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INTERNATIONAL STANDARD

colour inside

Power systems management and associated information exchange – Data and communications security –
Part 7: Network and System Management (NSM) data object models

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CONTENTS

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POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE – DATA AND COMMUNICATIONS SECURITY –

Part 7: Network and System Management (NSM) data object models

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International Standard IEC 62351-7 has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

This edition of IEC 62351-7 cancels and replaces IEC TS 62351-7 Ed. 1 published in 2010. This new edition constitutes a technical revision and includes the following significant technical changes with respect to IEC TS 62351-7 (2010):

a) NSM object data model reviewed and enriched;

b) UML model adopted for NSM objects description;

c) SNMP protocol MIBs translation included as Code Components.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
57/1857/FDIS	57/1885/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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POWER SYSTEMS MANAGEMENT AND ASSOCIATED INFORMATION EXCHANGE – DATA AND COMMUNICATIONS SECURITY –

Part 7: Network and System Management (NSM) data object models

1 Scope

This part of IEC 62351 defines network and system management (NSM) data object models that are specific to power system operations. These NSM data objects will be used to monitor the health of networks and systems, to detect possible security intrusions, and to manage the performance and reliability of the information infrastructure. The goal is to define a set of abstract objects that will allow the remote monitoring of the health and condition of IEDs (Intelligent Electronic Devices), RTUs (Remote Terminal Units), DERs (Distributed Energy Resources) systems and other systems that are important to power system operations.

Power systems operations are increasingly reliant on information infrastructures, including communication networks, IEDs, and self-defining communication protocols. Therefore, management of the information infrastructure has become crucial to providing the necessary high levels of security and reliability in power system operations.

The telecommunication infrastructure that is in use for the transport of telecontrol and automation protocols is already subject to health and condition monitoring control, using the concepts developed in the IETF Simple Network Management Protocol (SNMP) standards for network management. However, power system specific devices (like teleprotection, telecontrol, substation automation, synchrophasors, inverters and protections) need instead a specific solution for monitoring their health.

The NSM objects provide monitoring data for IEC protocols used for power systems (IEC 61850, IEC 60870-5-104) and device specific environmental and security status. As a derivative of IEC 60870-5-104, IEEE 1815 DNP3 is also included in the list of monitored protocols. The NSM data objects use the naming conventions developed for IEC 61850, expanded to address NSM issues. For the sake of generality these data objects, and the data types of which they are comprised, are defined as abstract models of data objects.

In addition to the abstract model, in order to allow the integration of the monitoring of power system devices within the NSM environment in this part of IEC 62351, a mapping of objects to the SNMP protocol of Management Information Base (MIBs) is provided.

The objects that are already covered by existing MIBs are not defined here but are expected to be compliant with existing MIB standards.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TS 62351-1, *Power systems management and associated information exchange – Data and communications security – Part 1: Communication network and system security – Introduction to security issues*

IEC TS 62351-2, *Power systems management and associated information exchange – Data and communications security – Part 2: Glossary of terms*

IEC 62351-3, *Power systems management and associated information exchange – Data and communications security – Part 3: Communication network and system security – Profiles including TCP/IP*

IEC 62351-4, *Power systems management and associated information exchange – Data and communications security – Part 4: Profiles including MMS*[1]

IEC TS 62351-5, *Power systems management and associated information exchange – Data and communications security – Part 5: Security for IEC 60870-5 and derivatives*

IEC TS 62351-8, *Power systems management and associated information exchange – Data and communications security – Part 8: Role-based access control*

IEC 62351-9, *Power systems management and associated information exchange – Data and communications security – Part 9: Cyber security key management for power system equipment*

IEEE 754:2008, *IEEE Standard for Floating-Point Arithmetic*

IETF RFC 2578, *Structure of Management Information Version 2 (SMIv2),* April 1999, http://tools.ietf.org/html/rfc2578

IETF RFC 3410, *Introduction and Applicability Statements for Internet-Standard Management Framework,* December 2002, http://tools.ietf.org/rfc/rfc3410

IETF RFC 3414, *User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3),* December 2002, http://tools.ietf.org/rfc/rfc3414

IETF RFC 3826, *The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model,* June 2004, http://www.rfc-editor.org/rfc/rfc3826

IETF RFC 4022, *Management Information Base for the Transmission Control Protocol (TCP)*, March 2005, http://tools.ietf.org/html/rfc4022

IETF RFC 4113, *Management Information Base for the User Datagram Protocol (UDP)*, June 2005, http://tools.ietf.org/html/rfc4113

IETF RFC 4292, *IP Forwarding Table MIB*, April 2006, http://www.rfc-editor.org/rfc/rfc4292

IETF RFC 4293, *Management Information Base for the Internet Protocol (IP)*, April 2006, http://tools.ietf.org/rfc/rfc4293

IETF RFC 4898, *TCP Extended Statistics MIB*, May 2007, http://tools.ietf.org/rfc/rfc4898

IETF RFC 5132, *IP Multicast MIB*, December 2007, http://tools.ietf.org/rfc/rfc5132

IETF RFC 5905, *Network Time Protocol Version 4: Protocol and Algorithms Specification*, June 2010, http://tools.ietf.org/rfc/rfc5905

IETF RFC 5590, *Transport Subsystem for the Simple Network Management Protocol (SNMP*), June 2009, http://tools.ietf.org/rfc/rfc5590

1 Under preparation. Stage at the time of publication: IEC CDV 62351-4:2017

IETF RFC 5591, *Transport Security Model for the Simple Network Management Protocol (SNMP)*, June 2009, *http://tools.ietf.org/rfc/rfc5591*

IETF RFC 5592, *Secure Shell Transport Model for the Simple Network Management Protocol (SNMP)*, June 2009, http://www.rfc-editor.org/rfc/rfc5592

IETF RFC 5953, *Transport Layer Security (TLS) Transport Model for the Simple Network Management Protocol (SNMP)*, August 2010, http://www.rfc-editor.org/rfc/rfc5953

IETF RFC 6347, *Datagram Transport Layer Security Version 1.2*, January 2012, *http://tools.ietf.org/rfc/rfc6347*

IETF RFC 6353, *Transport Layer Security (TLS) Transport Model for the Simple Network Management Protocol (SNMP)*, July 2011, *http://tools.ietf.org/rfc/rfc6353*

IETF RFC 7860, HMAC-SHA-2, *Authentication Protocols in User-Based Security Model (USM) for SNMPv3*, April 2016, http://tools.ietf.org/rfc/rfc7860

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 62351-2 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
Unified Modelling Language
UML
general-purpose modeling language with a semantic specification, a graphical notation, an interchange format, and a repository query interface, designed for use in object-oriented software applications, including those based on technologies recommended by the Object Management Group (OMG)

[SOURCE: ISO/IEC 19501:2005, Introduction]

3.2
Structure of Management Information
SMIv2
adapted subset of OSI's Abstract Syntax Notation One, ASN.1 used to write Management Information Base (MIB) modules (RFC 2578), which defines fundamental data types, an object model, and the rules for writing and revising MIB modules

[SOURCE: adapted from IETF RFC 3410, 7.1]

3.3
Transport Security Model
Security Model for the Simple Network Management Protocol for use with secure Transport Models in the Transport Subsystem

[SOURCE: adapted from IETF RFC 5590, 3.2.1]

3.4
Datagram Transport Layer Security
protocol that provides communications privacy for datagram protocols, which allows client/server applications to communicate in a way that is designed to prevent eavesdropping, tampering, or message forgery

Note 1 to entry: The DTLS protocol is based on the Transport Layer Security (TLS) protocol and provides equivalent security guarantees.

[SOURCE: adapted from IETF RFC 6347, abstract]

3.5
Protocol Data Unit
PDU
data object exchanged by protocol machines (entities) within a given layer, which consists of both Protocol Control Information (PCI) and user data

Note 1 to entry: This is OSI terminology for "packet".

[SOURCE: IETF RFC 1208, *A glossary of networking terms*]

3.6
Protocol Control Information
protocol information added by an OSI entity to the service data unit passed down from the layer above, all together forming a Protocol Data Unit (PDU)

[SOURCE: IETF RFC 1208, *A glossary of networking terms*]

4 Abbreviated terms and acronyms

Additional abbreviated terms and acronyms are given in IEC 62351-2.

Term	Definition
ASN.1	Abstract Syntax Notation One
DER	Distributed Energy Resource
DTLS	Datagram Transport Layer Security
GIS	Geographical Information System
IED	Intelligent Electronic Device
MIB	Management Information Base
MMS	Manufacturing Message Specification
NSM	Network and System Management
PCI	Protocol Control Information
PDU	Protocol Data Unit
RTU	Remote Terminal Unit
SMI	Structure of Management Information
TLS	Transport Layer Security
TSM	Transport Security Model
UML	Unified Modelling Language

5 Overview of Network and System Management (NSM)

5.1 Objectives

The information infrastructure in power operations consists not only of the communication networks, but also of the data that is exchanged between systems, stored in databases, and used by applications in power system operations. This information infrastructure is not typically treated as a coherent infrastructure, but is viewed as a disparate collection of communication channels, group of distinct network segments, separate devices, various databases, and different protocols. Often SCADA (Supervisory Control and Data Acquisition) systems perform some communications monitoring, such as whether connections are available to their remote terminal units (RTUs), and they flag the event as connection lost when connections fail. However, real-time coherent, complete and homogeneous health status of the overall information infrastructure has been missing. Such real-time information infrastructure health status can support operators to detect and mitigate potential problems in the power system.

Traditionally, the information infrastructure supporting the power system has not been adequately monitored, and some corrective control actions are not possible. The analysis of past major blackouts showed that the primary reason behind the propagation of such blackouts after an initial equipment failure was the lack of critical information made available to the right user at the right time.

In the case of a communication network or system failure, possible cyber security attack, or other anomalous situation, maintenance personnel must be able to identify and diagnose the cause of the problems quickly: which equipment is affected, where the equipment is located, and what should be done to fix the problem. Power operators should be rapidly informed of such an anomalous occurrence in the information infrastructure.

Different organizations and utilities have different needs in what information is important for their information networks and which data should be available to their service and maintenance staff. For example, telecommunication technicians are generally responsible for tracking down any microwave or fibre cable problems; telecommunication service providers must track their networks; database administrators must determine if data is being retrieved correctly from substation automation systems or from geographical information system (GIS) databases; protocol engineers must correct configuration errors; application engineers must determine if applications have crashed, have not converged or are in an endless loop; cyber security staff need to know where and which cyber-attack is affecting the network; and operators must filter out through large amounts of log data to determine if a possible “power system problem” is about to occur.

Network system management (NSM) data objects defined in this specification are specific and meaningful for the power industry and will provide end devices health information. These NSM data objects support communication network integrity, system, network and IED’s health, Intrusion Detection Systems (IDS) and firewalls events, and other security/network management relevant information. An example high level architecture extending a typical SCADA infrastructure of a power system with firewalls, intrusion detection systems and security monitoring objects is shown in Figure 1.

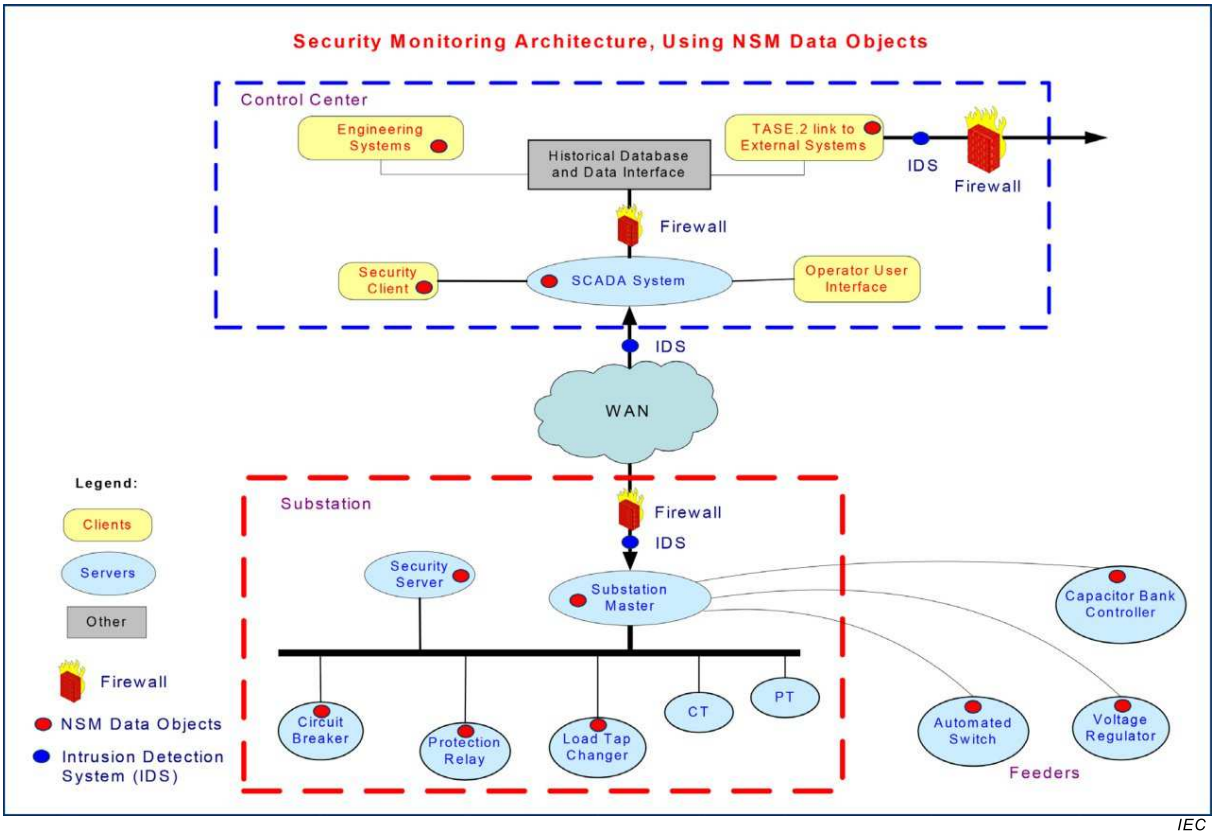


Figure 1 – Example of a power system SCADA architecture extended with NSM Data Objects

5.2 NSM concepts

5.2.1 Simple Network Management Protocol (SNMP)

The simple network management protocol (SNMP) was developed by the IETF as the protocol for transmitting Management Information Base (MIB) objects over the Internet. A MIB is a database defining hierarchical data objects, with each object identified by an object identifier (OID). These data objects are used to define which information may be used to monitor and manage a network infrastructure. MIB objects are specified in a way to indicate the state of different equipment, applications, and systems.

Many systems use SNMP over internal communication networks as well. Due to its popularity SNMP is the preferred protocol to transmit MIBs. However, other protocols may be used as well.

The IETF and many mainstream vendors of network and system products have developed specific MIBs for their products, with the basic assumption that these products will be used over the Internet or an Intranet based on IETF technologies.

Although some existing MIB objects are generic enough for typical network equipment and should be used by the power industry, many specialized MIB objects are needed to represent some of the very specialized equipment and special environments deployed in power system operations.

5.2.2 ISO NSM categories

Network management aspects have been organized by the ISO 7498-4 standard into five areas:

- Performance management;
- Configuration management;
- Accounting management;
- Fault management;
- Security management.

Of these five areas, only accounting management is not relevant to this standard. The other four areas are either directly or indirectly involved in power operation security. For instance, if an equipment failure or a careless parameter change causes a degradation of performance, then the reliability of the power system operations may be affected; or a change in the network configuration could result in a single point of failure that is not recognized until that failure occurs; or an undetected intrusion may cause the violation of transmission time constraints required by time-sensitive data exchanges.

5.2.3 NSM “data objects” for power system operations

The NSM “data objects” identified in this document fill the gap between the existing SCADA communications monitoring and the desired secure and reliable information infrastructure for power system operations. “Data objects” are abstract data elements that can be subsequently mapped to different protocols, including IEC 61850, IEC 60870-5, IEC 60870-6 (TASE.2) as well as SNMP.

This document also does not specify the actions that could or should be taken upon receiving an NSM alarm or warning: those actions are considered to be device and system implementation-specific and are outside the scope of this document.

5.2.4 Other NSM protocols

The NSM abstract objects defined in this document can be mapped in the future toward other protocols. This additional mapping man be defined as a specific standard addendum.

The IEC 61850 protocol can be an example of future mapping, but also Constrained Application Protocol (CoAP) can be considerd for future mappings.

The basic requirement for a possible mapping is that the protocol must support the mapping of the abstract object semantics into the data object semantics of protocol itself. In addition, it is important that any mapping into another protocol should also be supported by appropriate Network Management tools and technologies.

5.3 Communication network management

5.3.1 Network configuration

Typical network management involves monitoring and controlling the communication network and its configuration. Most vendors of enterprise-level network equipment provide some degree of control. Wherever these control capabilities are available in power system operations, these capabilities should be used. The following are the NSM requirements related to monitoring and controlling the configuration of a network. Conceptually, each entity in the network (either a “network node” or an “end device” or a nested “sub network”) will contain this information. Depending on the implementation and configuration, this information can be “downloaded” from another node or can be “automatically acquired”; however, it is available for viewing, uploading, etc.

The following items are examples of data to be monitored for network configuration monitoring and controlling.

- Network configuration information, including what end systems are connected on what network paths. Backup and alternative paths should also be included. Although some

implementations could pre-load the configuration data objects, they should be visible to authorized users.

- Power cycle (on/off) commands to network equipment.
- Reset command to network equipment.
- Establishing primary and, optionally, secondary paths to each end device.
- Switching commands to network equipment for changing paths to devices.
- Setting or updating the access control list and Role Based Access Control (RBAC) rules.
- Setting parameters and sequences for automated network actions in response to event, such as reconfiguration of the communications network upon equipment failure.
- Specific mappings towards monitoring and control protocol may not include some of the above data in order to avoid duplicated and possibly conflicting configurations.

5.3.2 Network backup

In addition to monitoring the network equipment, it is crucial to determine if the network can provide the performance it is designed for. Specifically, the status of alternate paths and backup equipment needs to be monitored to ensure that they are available to handle failures, degraded communication links, and deliberate removal of the primary routes for maintenance or other purposes.

The network backup monitoring requirements include:

- Determining the status of backup equipment, including the ability to be automatically switched to it;
- Determining the status of alternate communication links, including the available bandwidth if they were switched to them;
- Detecting network equipment failovers to backup equipment;
- Detecting switching to alternate or backup communication links;
- Logging of status and times of all failovers and use of backup equipment.

5.3.3 Communications failures and degradation

Network management involves monitoring the state of the communications networks, primarily for equipment and communication failures. Most enterprise-level network equipment from mainstream vendors already includes SNMP MIBs for monitoring these networks. However, most communication networks used in power system operations do not use these types of mainstream networking equipment since often there is no “network” involved – only point-to-point low-speed links between the control centre and each substation. Even where networks are involved, they are often handled more as sets of fixed links rather than true networks.

Therefore, if a specific implementation includes mainstream networking equipment with SNMP MIBs that covers some of the following items, these should be used if possible. For other implementations and for items not covered by mainstream vendor MIBs, data objects need to be developed. These data objects can then be implemented where appropriate.

The communication failure and degradation monitoring requirements include:

- Detecting network equipment permanent failures;
- Detecting network equipment temporary failures and/or resets;
- Detecting communication link failures;
- Detecting communication link degradation or lower than expected throughput;
- Detecting network routing degradation or lower than expected throughput;
- Logging equipment and communication link failures and degraded conditions.

5.4 Communication protocols

Monitoring of the communication protocols that are being used over the network is also critical. Some of this monitoring can be performed by routers, gateways, firewalls and other systems through which the protocols are passed. However, some of the more detailed information must be collected by the protocol stacks, since that is where the knowledge of correct and incorrect protocol formation resides.

The communication protocol monitoring requirements include:

- Detecting communication protocol version and status;
- Detecting mismatches of differing protocol versions and capabilities;
- Detecting tampered/malformed protocol messages;
- Detecting inadequately synchronized time clocks across networks;
- Detecting resource exhaustion forms of Denial of Service (DoS) attacks;
- Detecting buffer overflow DoS attacks;
- Detecting physical access disruptions such as loss or degradation of connectivity;
- Detecting invalid network accesses;
- Detecting invalid application object accesses/operations;
- Supporting broader ability to detect coordinated attacks across multiple systems;
- Collecting statistical information from network equipment:
  - determining average message delivery times, slowest, fastest, etc.
  - counting number of messages, size of messages;
  - counting number of lost messages;
- Providing audit logs and records;
- Detecting application protocol timeouts;
- Detecting invalid sequence numbers of application messages.

5.5 End systems management

Monitoring of IEDs involves a combination of internal and external assessments of their health. Internal assessments can be more precise in detecting anomalies, while external assessments can determine their state in situations in which the application or end system is not capable of assessing itself. Internal assessments can be performed by applications which directly handle the data being exchanged. Some other internal assessments can be performed by a system watchdog which can assess the state of applications. External assessments must be performed by separate systems, such as gateways, proxy servers, and routers.

Since the IEDs can be very different in their applications and in their validity checking of the data exchanges, the actual meaning or causes of “invalid data” must be considered a local issue.

The following is a list of monitored data from end systems:

- Invalid data detected by end device application;
- Invalid requests for data detected by end device application;
- Invalid control commands detected by end device application;
- Valid control commands out of sequence as detected by the end device application;
- Status of each application and/or software module: stopped, suspended, running, not responding, inadequate or inconsistent input, errors in outputs, error state, etc.;
- Status of all network connections to an end device, including availability, overloads;

- Status of any “keep-alive” heartbeats, including any missed heartbeats;
- Status of backup or failover mechanisms, such as numbers and times these mechanisms were unavailable;
- Status of data reporting: normal, not able to keep up with requests, missing data, etc.;
- Status of access: numbers, times, and types of unauthorized attempts to access data or issue controls;
- Anomalies in data access (e.g. individual request when normally reported periodically);
- Numbers and times of all stops and starts of systems, controllers, and applications;
- Log of all events, including type of event, timestamp, relevant status or situation, equipment or message identification, etc.;
- Return-to-normal indications after all failures, stops, unavailability, etc.

5.6 Intrusion detection systems (IDS)

5.6.1 IDS guidelines

Intrusion detection systems monitor network communication packets and detect any packet that is foreign in a particular network. IDS should warn operators as soon as an intrusion is detected and should inform what kind of vulnerability is being exploited.

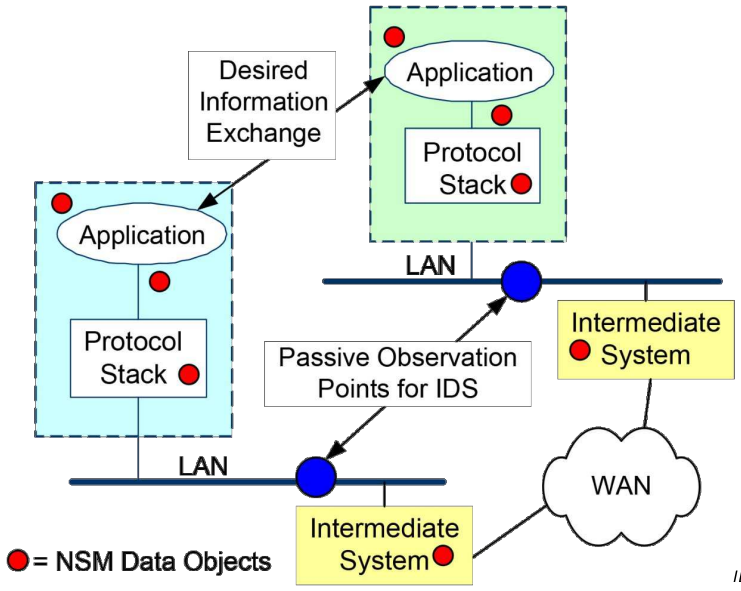


Figure 2 – IDS Information exchange between applications: generic communication topology

Figure 2 depicts two applications attempting to exchange information. In this diagram, in order to exchange information, the information needs to be:

- Transmitted through a local communication stack;
- Transmitted from the local communication stack onto a local area network (LAN);
- Routed/bridged into a wide area network (WAN) via an intermediate system (IS);
- Received by a remote IS;
- Transmitted by the remote IS onto the remote application’s LAN;
- Received by the remote application’s communication stack;
- Delivered to the remote application for processing.

Each of these locations could provide information on possible intrusion detections, including the following types of integrity, confidentiality, availability and non-repudiation security threats:

- Resource exhaustion or “significant” performance impacts due to unexpectedly large number of messages being sent, inadvertently or deliberately, which prevent or delay legitimate messages from being received;
- Buffer overflows, caused either by “mistakes” in forming messages or by malicious attacks to disrupt system operations;
- PDUs (packets) that are (inadvertently) malformed or have been (deliberately) tampered with;
- Invalid network access attempts by messages with unauthorized IP addresses or port requests;
- Invalid application access attempts.

Two basic methods exist for IDSs: passive observation techniques and active security monitoring. These are discussed in the following sub clauses.

It must be noted that both IDS techiques rely on the communication availability toward a central management system, that shall be considered in the design of monitoring systems.

5.6.2 IDS: Passive observation techniques

Passive observation techniques (i.e. requiring no modifications to the system, communication stack, or application) require only the addition of “network based IDS” monitors – existing equipment and networks do not need to be modified, thus making these security upgrades easier and less expensive to implement. For this reason, passive IDSs are the preferred approach when considering systems and equipment which are already installed or will use “non-IDS” end equipment.

Figure 2 illustrates two passive observation points in the local and remote networks, shown as two blue circles.

Purely passive IDSs have limited ability to detect intrusions since they may not be “aware” of what normal traffic might be in typical power system operations. However, in addition to these passive IDSs, NSM data objects can be implemented in systems which house the applications and communication stacks, as well as in the intermediate systems (IS) (see the many red dots in Figure 2). These NSM data objects would provide additional intelligence to determine if an attack is underway, what type of attack is taking place, and the time of the critical events.

The NSM data objects in a legacy system would simply include available information that could be sent as additional data using the existing protocols. Often this data is available but either ignored or stored in a local log as an “error”. The key is to identify the important, but available data, and provide it to the IDS or to a security system.

5.6.3 IDS: Active security monitoring architecture with NSM data objects

Active security monitoring involves designing the networks and the end systems with security monitoring as part of the design criteria. Rather than relying on what error checking is available in legacy systems, these systems include in their design the ability to identify and provide additional security information to a “security manager”, including information on anomalous events, unauthorized messages, data possibly related to DoS attacks, etc.

Active security monitoring allows the collection of information that a passive probe could not be able to collect like high cpu usage, buffer overflow, certificate close to expire or invalid local access.

The collection of this information is in charge of a specific process running within the IED. This process collects internal measures and events and publishes the related values as related objects.

In this active security monitoring architecture, each layer in the protocol stack (depicted in Figure 3 with reference to ISO/OSI levels) would monitor for possible security attacks, and many applications would provide key error and failure data. A security provider would manage the NSM data objects, possibly setting appropriate thresholds, limits, and other parameters in order to fine-tune the response to more closely fit each power system operational environment. Upon the detection of an anomaly, the NSM data would be sent to the security manager for additional analysis. The target of these information are central Network Management Systems and all systems that need to collect the status and events. Operators have different responsibility and are not supposed to be the first endup.

This architecture is similar to the SNMP architecture. However, this does not imply that the SNMP formats will necessarily be used to transmit the NSM data: the NSM data objects would be implemented using whatever protocol is being used for other types of communications, as defined in 5.2.4.

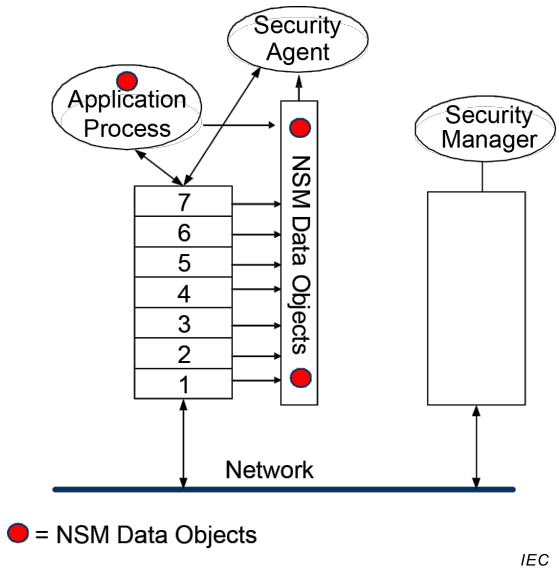


Figure 3 – Active security monitoring architecture with NSM data objects

5.7 End-to-end security

5.7.1 End-to-end security concepts

End-to-end security encompasses not only deliberate attacks but also inadvertent actions.

This statement is crucial to understanding the scope of this standard. Although some definitions of “security” just include the protection of systems against the deliberate attacks of terrorists or cyber hackers, often more damage is done by carelessness, equipment failures and natural disasters than by those deliberate attacks. Therefore, in this standard, “security” covers all hazards, including deliberate attacks, inadvertent mistakes, equipment failures, software problems and natural disasters. For the security and reliability of power system operations, it does not matter whether a problem was caused by a deliberate attack or by an inadvertent action.

In addition, many of the same measures that could be used against deliberate attacks can be used against inadvertent actions. Therefore, it is useful and cost-effective to address both types of security threats with the same types of security measures.

End-to-end security entails a much larger scope than just the authentication of users and the securing of the protocols. End-to-end security involves security policies, access control mechanisms, key management, audit logs, and other critical infrastructure protection issues. It also entails securing the information infrastructure itself.

As discussed in IEC TS 62351-1, security threat agents include:

a) Inadvertent: Threat agents which may cause inadvertent “attacks” on systems:
   - Careless users;
   - Employees who bypass security;
   - Safety system failures;
   - Equipment failures;
   - Natural disasters.
b) Deliberate: Threat agents which undertake deliberate attacks:
   - Disgruntled employee;
   - Industrial espionage agents;
   - Vandals;
   - Cyber hackers;
   - Viruses and worms;
   - Thieves;
   - Terrorists.

The key point is that the overall security of power system operations is threatened not only by deliberate acts of terrorism but by many other, sometimes deliberate, sometimes inadvertent threats that can ultimately have more devastating consequences than direct espionage.

As noted in IEC TS 62351-1, securing protocols using IEC 62351 essentially provides authentication and (for some protocols) encryption over the communications link, covering three of the four security requirements: availability, integrity, confidentiality and non-repudiation. These very important security measures still, however, leave serious gaps:

- First, they cover only the protocols over the communications link, and do not address the end users and end equipment. Masquerading users, equipment failures or undetected intrusions can disrupt operations even if the data exchanges are continuing correctly.
- Second, they do not address denial of service. Denial of service can take many forms, from slowed data exchanges, failures of equipment, faults in communication paths, sporadic or decreased availability, interference and theft.

Although the main objective of security measures may be to prevent security attacks, security measures cannot be entirely preventative. If only prevention were attempted, then when an attacker does manage to penetrate a periphery, they would have complete freedom to do whatever damage they wanted to. Therefore, “prevention” of attacks should be viewed as both deterrence and delay of attacks. In addition, security protection needs to be provided to counter attacks that were not deterred.

5.7.2 Role of NSM in end-to-end security

End-to-end security involves far more than encryption or authentication, which are the primary security methods. As discussed in IEC TS 62351-1 and shown in Figure 4, the entire information infrastructure must be made secure and reliable in order to provide security and reliability of power system operations. Figure 5 shows the management of both the power system infrastructure and the information infrastructure.

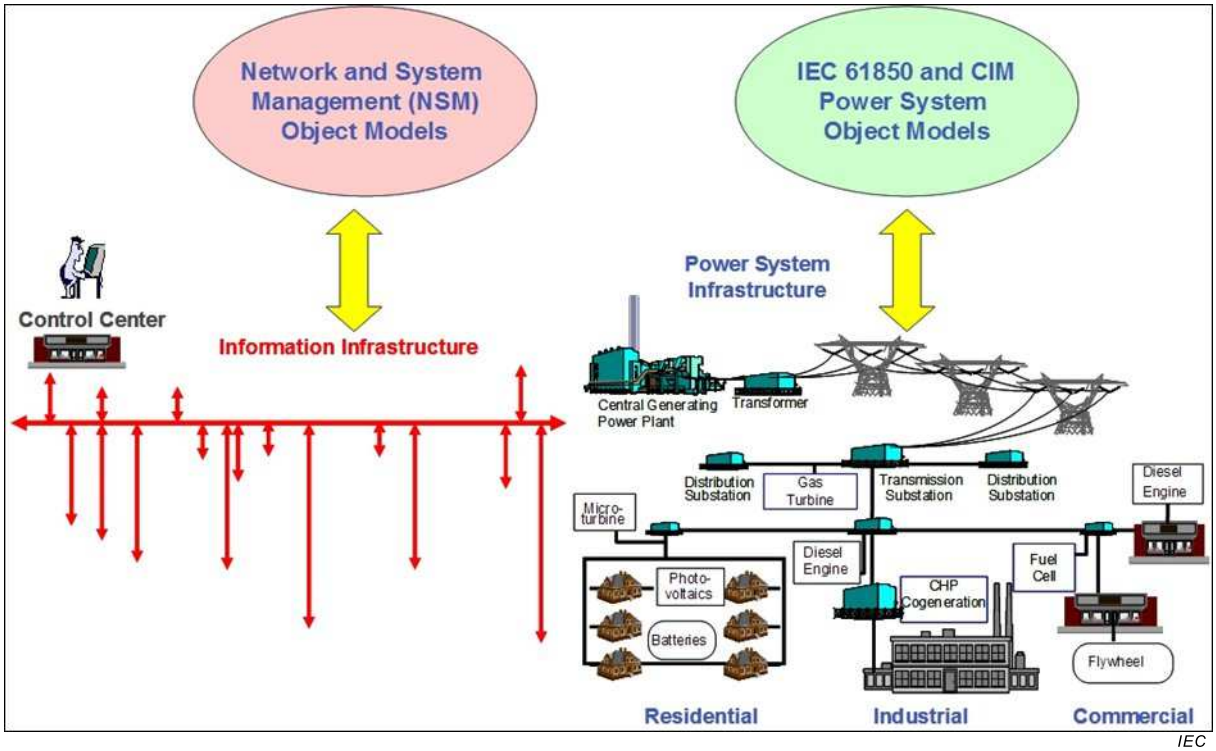


Figure 4 – Comparison of NSM data objects with IEC 61850 objects

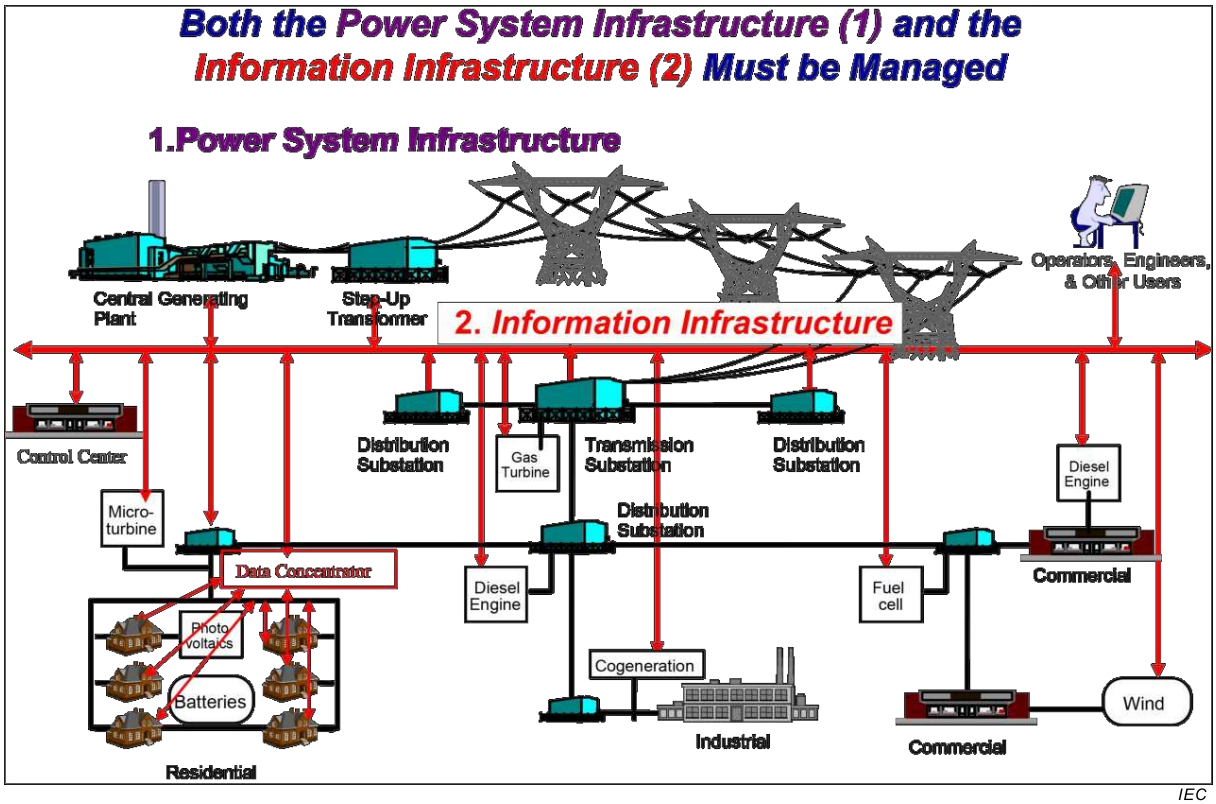


Figure 5 – Management of both the power system infrastructure and the information infrastructure

Not all of these security and reliability requirements can be filled by NSM, but many of them can be improved. Specifically, the following functions can be provided by NSM:

- Monitoring the status of software applications, hardware equipment, and communications. This status monitoring can provide notification of changes, such as equipment failures, abnormal configuration changes, software “crashes” or failures, temporary communication disruptions, and permanent communication failures.
- Monitoring the performance of systems and communications. This performance monitoring can record data traffic conditions, software application performance changes, data throughput changes, performance results from communication configuration changes, etc.
- Intrusion detection. In addition to obvious intrusions, this detection must be sensitive to “normal” conditions in order to attempt to detect subtle changes in conditions which might signal an intrusion. This intrusion detection would utilize the information from the status and performance monitoring.
- Configuration management. The configuration of communications networks and equipment can be managed, either by establishing automatic changes based on events (e.g. move to backup channel if the primary channel fails), or by manually changing the configuration, such as taking one piece of equipment out of service and replacing it with another.

5.8 NSM requirements: detection functions

5.8.1 Detecting unauthorized access

The most basic intrusion detection requirement is to determine if an unauthorized entity is trying to access the system. This requirement thus relies on establishing which entities are authorized, and thereby indicating which entities are not authorized.

The NSM data objects required to detect unauthorized access include determination that unauthorized user is attempting a connection or transmission of a message, based on a list of authorized users of the connections.

5.8.2 Detecting resource exhaustion as a denial of service (DoS) attack

Typically, the passive IDS can detect resource flooding based upon time and/or bandwidth consumption (e.g. similar to a SYN flood attack). This works well for resource “unconstrained” devices, but not well within the IEC domain where communication resources are limited. The reasons are as follows:

- In typical networks, an IDS may be able to detect a SYN flood attack where hundreds or thousands of rapid SYNs are issued (e.g. an attack designed to consume available TCP connections). However, in IEC domain networks, IEC 60870-5-104, IEC 60870-6, and IEC 61850 devices do not support hundreds or thousands of connections.
- Due to the lower number of possible connections, the timeframe required for the equivalent of the SYN flood attack has to be shorter, and probably most passive IDSs would not be able to detect such an attack. A possible solution could be to configure these passive IDSs based on the expected resource capacity, but this complicates the configuration and maintenance of the communication networks, since each time they are reconfigured, the IDSs would also have to be updated.
- An alternative solution is to let the network itself dynamically reconfigure what might constitute an SYN flood attack. The communication stack and applications do have an explicit knowledge of the resources, and this explicit knowledge of resources can be accessed through standardized NSM data objects.

The NSM data objects required to detect resource exhaustion attacks include:

- Exceeding the maximum number of connections permitted over the network;
- Count of number of connections actually in place over the network;
- Exceeding the maximum number of connections which can be in use simultaneously;
- Count of the number of connections in use simultaneously;
- Exceeding CPU load limits;

- Exceeding memory usage limits.

This information must be collected from each device along the entire communication path between applications, since different communication segments between nodes could be affected and cause a bottleneck.

5.8.3 Detecting invalid buffer access DoS attacks

Passive IDSs are not intrinsically able to determine whether a buffer overflow attack is underway. This is especially true for IEC 61850 and IEC 60870-6 TASE.2, where the application buffer size is negotiated at runtime. However, the application/communication stack might be aware of such overruns. This even applies to Ethernet buffer issues internal to the communication stacks.

The NSM data objects required to detect buffer overflow/underflow attacks include:

- Number of buffer overruns;
- Number of buffer under runs;
- Audit ability to detect which source caused the buffer overflow/underflow.

5.8.4 Detecting tampered/malformed PDUs

Passive IDSs can have an ability to detect some malformed packets. However, it is almost impossible for passive IDSs to detect a packet that has been tampered with (e.g. man-in-the-middle). Additionally, for more complex application level protocols (e.g. IEC 60870-5, IEC 61850, and IEC 60870-6 TASE.2), passive IDSs may not have the ability to detect all of the possible malformations that could cause processing issues. However, the communication stack, application, and/or IS does have this knowledge, since they must interpret each packet.

The NSM data objects in this category include:

- Number of malformed PDUs detected;
- Number of PDUs which have been tampered with;
- Audit ability to detect which source is causing the tampered/malformed PDU.

5.8.5 Detecting physical access disruption

If a resource is powered-off or disconnected from the communication network, this represents the ultimate DoS attack, since physical restoration may be required. Especially if the equipment cannot be turned back on remotely, it is vital to be able to accurately log the time of the power-off/disconnect event and to correlate it with other events.

The NSM data objects required to detect physical access disruptions include:

- Loss of power to equipment and time of loss;
- Media disconnected and time of disconnect;
- Power restored to equipment and time of restoration;
- Media re-connected and time of reconnection.

5.8.6 Detecting invalid network access

Firewalls are designed to prevent invalid access to networks, particularly through the use of access control lists which permit only authorized IP addresses to pass through the firewall. Other firewall capabilities include port restrictions, stateful filtering and session management.

However, internal (e.g. behind a firewall) resources can be converted into (inadvertent or deliberate) attackers. In many situations, this type of “conversion” is detectable by passive IDSs. However, IDSs within a network may not be able to recognize invalid data exchanges

which take place. For example, any protocols used both internally and externally, such as IEC 60870-6 (TASE.2) and IEC 61850-7-420 between control centres and other locations, could pass malicious data from an external source (which is trusted only for certain types of data) to an internal resource, where it might be sent as fully trusted data to other internal resources.

Much of the protection for this type of attack would have to be within the actual applications which handle the exchange of data between external resources and internal resources. These applications should have the knowledge of what data is valid and/or not valid. However, some NSM data objects that monitor the traffic between applications/systems could assist in this effort.

The NSM data objects required to help detect invalid network access include:

- Unexpected frequency of traffic between specific applications/systems on the network;
- Unexpected volume of traffic between specific applications/systems on the network;
- Suspicious data detected (virus, worm, or malformed data).

5.8.7 Detecting coordinated attacks

Coordinated attacks across many substations, between control centres and to the dispersed facilities with DERs could inflict more damage than these same attacks might cause if they were executed at different times or places. If sequential attacks are underway, then it could be vital to respond appropriately and in a timely manner to the first attacks to mitigate the impact of the remaining attacks.

Whether or not specific attacks are successful, the knowledge that they were coordinated can provide significant clues on who caused them, how they were executed, and why they took place.

Therefore, a mechanism for the correlation of information needs to be standardized. Conceptually, this mechanism is simple: a complete log of all significant alarms and events (including events that should have taken place and did not occur or failed) with synchronized and precise timestamps.

The NSM data objects required to help detect coordinated attacks include:

- Identification of all communication failures;
- Identification of all end-system failures;
- Identification of all DoS attacks;
- Timestamps with millisecond precision on all data objects;
- Time synchronization across all communications and end systems.

5.9 Abstract object and agent UML descriptions

5.9.1 Purpose of UML

The NSM object definitions in this standard are intended to be defined as “abstract” with the goal of allowing the mapping of the objects to different protocols. For this reason the objects are defined using UML (Unified Modelling Language).

UML is a flexible and powerful tool for object modelling and it is already widely used within the IEC for the development of several standards (e.g. CIM and IEC 61850).

UML supports the abstract description of objects and at the same time provides a complete collection of the information needed for the mapping to specific protocols. In other words the

semantics of abstract objects can be defined using UML description tools, where each object is described as a UML class or class attribute.

UML can be translated then into different real protocols notations (e.g. SNMP MIBs) through the adoption of an appropriate semantics translator that produces the specific protocol objects semantics according with the original UML description.

This standard introduces the IEC 62351-7 UML abstract objects model that includes:

- The description of the abstract types as a common list of objects (UML classes) that can be reused inside different monitoring agents.
- The description of the base types associated with SNMP mapping.
- The description of abstract classes providing attributes which are common to several agent definition classes.
- Specific monitoring agents/subagents which are described as packages of classes each containing a set of attributes that can be specific to the agent or inherited from other abstract classes.

5.9.2 Abstract types and base types

The primary objective of this standard is to define and describe the NSM objects using an abstract notation that can allow the translation of those objects and their semantics into specific NSM protocol objects. A further objective is the translation of those objects into SNMP MIB objects. This standard needs therefore the description of abstract types not constrained by the limits and notation of SNMP while still providing a set of base types that are compatible with the SNMP standard types.

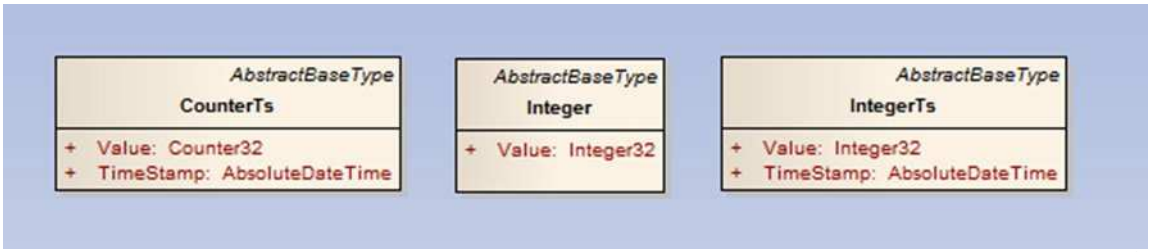


Figure 6 – Abstract types

Figure 6 depicts an example of some abstract types showing the difference between the abstract object name and the semantics of the base types that are referenced as class attribute types.

The BaseTypes package includes a set of classes that respect the same naming convention of SNMP types, in order to allow the automated translation of UML attributes types into SNMP types. However, the attribute type that is used inside the model classes that describe the monitoring agents does not reference the base type directly. Instead, the agent classes attributes reference the abstract types. Each abstract type refers to base types indirectly. This allows a decoupling between the abstract agent classes and the SNMP translation, thus permitting future translations to different native types of other different protocols.

Each abstract type is represented in the UML model through a specific class declaration. The name of the class is intended to be almost self-explanatory but the class description also includes an explanation of the type semantics. For instance, when an abstract type class has the “Ts” suffix this mean that the abstract object will actually provide a “value” of the object and a “timestamp” to be set simultaneously with the related value. For instance a counter object value makes more sense when the last time when the counter has been incremented is also well-known. This can be considered as implicit but the choice was instead to make it explicit in the class semantics.

The package “BaseTypes“ contains the definition of the type used in the definition of the abstract type UML classes attributes.

5.9.3 Enumerated Types

The package “EnumeratedTypes” provides the definition of enumerated values used for the abstract agent object attributes. Figure 7 depicts an example of the EnumeratedType declaration with the two types of “value only” and “value and timestamp” declaration.

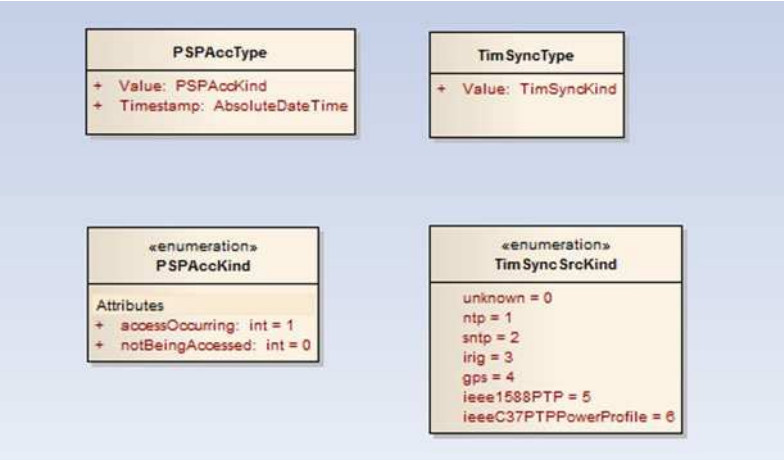


Figure 7 – Enumerated types

The concept of enumerated types declaration is almost the same as the one adopted for abstract objects, although not all enumerated types require a timestamp. Therefore the attribute of an enumerated type may include both a value and a timestamp or may include only a value. In both cases, the type is declared as an “enumeration” stereotype class.

5.9.4 Abstract agents

The concept of an agent is related to the procedure of abstract types deployment within a real IED, and is connected also to the architecture of the NSM software that actually runs on this device. The type of agent depends on the adopted NSM protocol.

The concept of agent/subagent architecture (and the “agent/subagent” terminology) arises from the terminology of the SNMP NSM protocol. This standard uses this agent/subagent concept and the related architecture as an abstract idea.

An agent/subagent for the purposes of this standard can be summarized with the concept of a set of abstract objects that are related to a homogeneous environment of NSM objects inside the IED. Each of those homogenous objects values sets are expected to be populated by an independent software component, called the subagent, even if for some NSM protocols (like SNMP) only one of these agents could be in charge of the communication with central NSM system.

This architecture thus allows the activation of specific subagents of an NSM object set only when those subagents are actually useful.

The homogenous set of objects include the following:

- Environmental Agent: device Physical and power security and health
- IED Agent: general device status (e.g. CPU, Storage, Certificate status)
- Application Protocol Agents: application protocols Statistics, status and alarms

- Interfaces Agent: The interfaces that need to be monitored are keyboards, USB, Serial, and Ethernet
- Clocks Agent: Status and health of clock synch system.

Each agent/subagent is responsible for updating values and related timestamps of its own instances of each abstract object.

Depending on the translation to a specific NSM protocol, the communication with the central NMS is delegated to one particular agent that acts as a communication mediator for the other agents which in this case act as subagents (this is the case of SNMP). Figure 8 provides a view of the agent/subagent hierarchy.

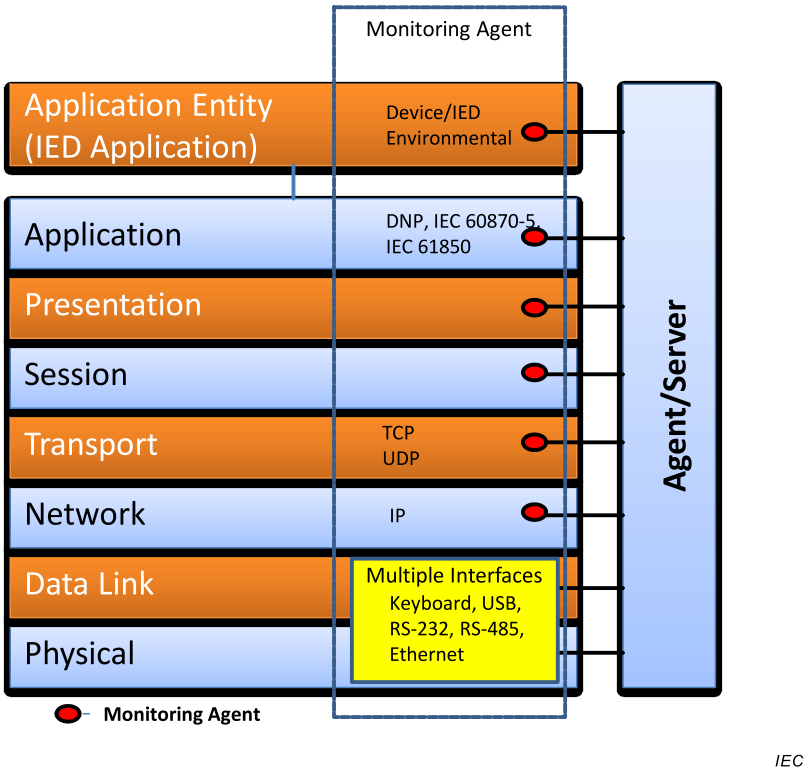


Figure 8 – Subagents

The agent/subagent structure is implemented using UML packages. Within each package the classes describe the following basic entities:

- UML classes having “nsmAgent” stereotype: these are the classes which contain as attributes the NSM abstract object
- UML classes having “nsmEntry” stereotype: these are the classes which contain subsidiary class.
- The attributes of nsmAgent classes, defined with a set of possible stereotypes which express the conceptual role of the attribute
- UML classes having “nsmEvent” stereotype: these are the classes which contain, as attributes, the object to be notified in case of event.

Each package can also host special common classes that contain the attributes commonly used by multiple agents. An agent can therefore inherit attributes from these common classes, avoiding attribute declaration duplication.

In Figure 9, the main Environmental agent is presented. Note that a subsidiary nsmAgent PSUPEntry class is represented next to Environmental class, and PSUPEntry is also the attribute Type of PSUP attribute. PSUP attribute also show 1..* multiplicity.

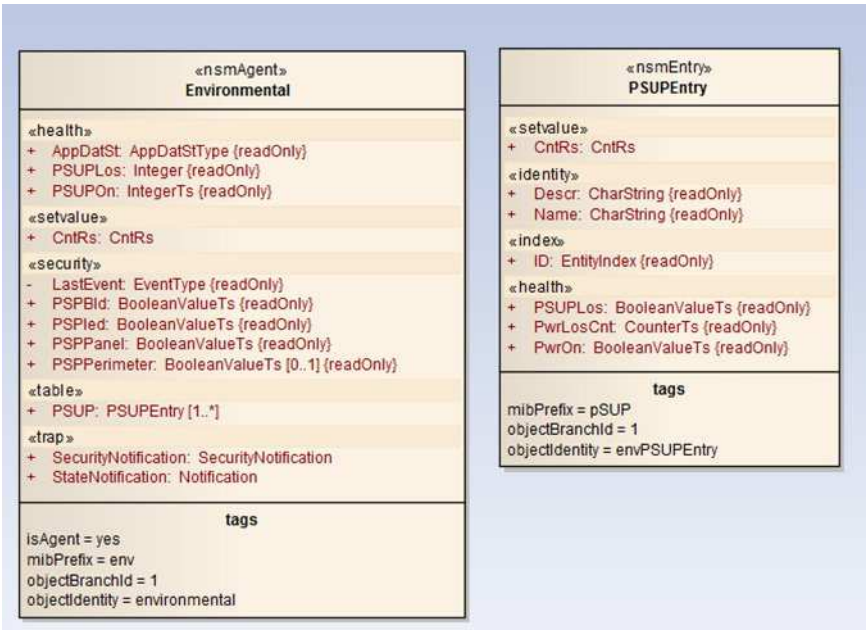


Figure 9 – Environmental agent

This kind of notation is always used in this UML model when a set of attributes must be supported in multiple instances (such as in this case the power supply) and each instance must have its own set of values.

As depicted in Figure 10, an “nsmEvent” stereotype is declared which allows the declaration of a special class that includes the objects to be notified when a predefined event occurs.

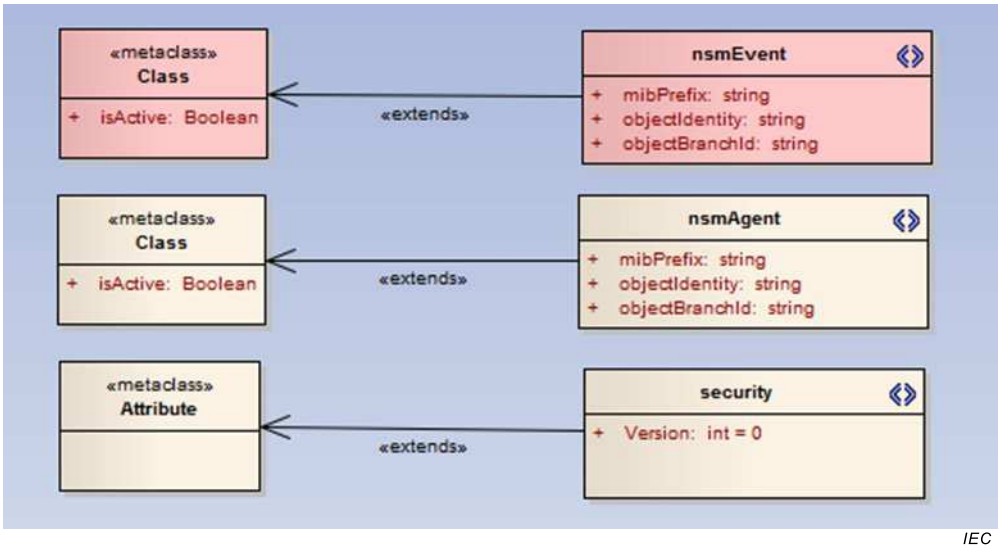


Figure 10 – Model stereotypes

The nsmAgent stereotype declaration allows the use of an additional tool that includes some additional information for each class or attribute that is not strictly related to the abstract

model but is instead necessary for translating the model objects into SNMP MIBs (or also in the future to different protocols).

Therefore some stereotypes attributes are included and are represented as “tags” for nsmAgent classes and for the related attributes.

5.9.5 Unsolicited Event Notification

A model for spontaneous NSM Event notification is included in the design of this standard UML model. The event recognition is a local function of the IED. One or more NSM abstract classes declare the object to be notified in an attribute list. This set of objects is defined in UML model in the “nsmEvent” classes.

5.9.6 UML Model extension

The UML model structure based upon the abstract agent concept allows several possible extension mechanisms of the structure and the related translations to specific protocols. Specifically, the following techniques can extend the current abstract object set:

- New abstract agent descriptions, for instance to define the abstract object related to a new protocol
- Additional classes included within existing abstract agents. For example these new classes can contain specific abstract objects for the monitoring of a new feature of an existing protocol
- New abstract objects can be added to existing abstract agent classes. The UML structure includes a version tagging mechanism to maintain the correct ordering of the new objects to come after existing objects.

Any new abstract agent or class can use UML inheritance to include any existing attributes.

5.10 Abstract Object UML translation to SNMP

5.10.1 Simple Network Management Protocol (SNMP)

The Simple Network Management Protocol (SNMP) was developed by the IETF as a protocol of level 7 OSI (IETF RFC 1157), in order to support the activity of configuration, monitoring and management of devices connected over a network.

The SNMP-management infrastructure includes three main components: managed devices, agents, and network-management systems (NMSs).

A managed device is a node inside the network that incorporates an SNMP agent and is part of a managed network. Inside a managed device, information is collected, stored and accessed by central NMSs using the SNMP protocol. Managed devices (or network elements) can be, for instance, routers, switches and bridges, but also IEDs and local and remote SCADA systems.

An agent is a software module that resides inside a managed device. This module is in charge of the exposure of NSM information via the SNMP protocol using a structured data format that is called a MIB (Management Information Base) (see next clause). The agent has local knowledge of management information and exposes that information in a form compatible with SNMP.

An SNMP agent can be present in a single managed device as multiple instances, for instance, being implemented as an agent-subagent architecture, with a main agent that is in charge of the communication with NMSs (many NMS can exist inside the managed network) and the subagents that are specialized in the collection of specific part of information. This approach allows an SNMP agent modular implementation with subagents also provided by independent manufacturer.

The protocol allows not only access to information but also permits active management tasks, for instance the modification of the variables exposed by the agent.

5.10.2 Management information bases (MIBs)

The variables accessible via SNMP are organized in hierarchies. The Management Information Bases (MIBs) are the entities that describe such hierarchies, together with the metadata such as type and description of the variable.

Inside a MIB there is the description of the structure of the management data of a device subsystem, organized in a hierarchical namespace and named object identifiers (OID), as shown in Figure 11. Each OID identifies a variable that can be read or set via SNMP.

MIBs use the notation defined by Structure of Management Information Version 2 (SMIv2, RFC 2578), that is a subset of ASN.1. Note that SMIv2 is only a subset and not a full ASN.1 notation. Therefore some constraints in the naming and structuring of the hierarchy and object reuse apply.

In SMIv2 an OID uniquely identifies a managed object in the MIB hierarchy. The top-level MIB object IDs belong to different standard organizations, while lower-level object IDs are allocated by associated organizations.

The Internet Assigned Numbers Authority (IANA), among the other coordination activity, is responsible also for the assignment of the Private Enterprise Numbers.

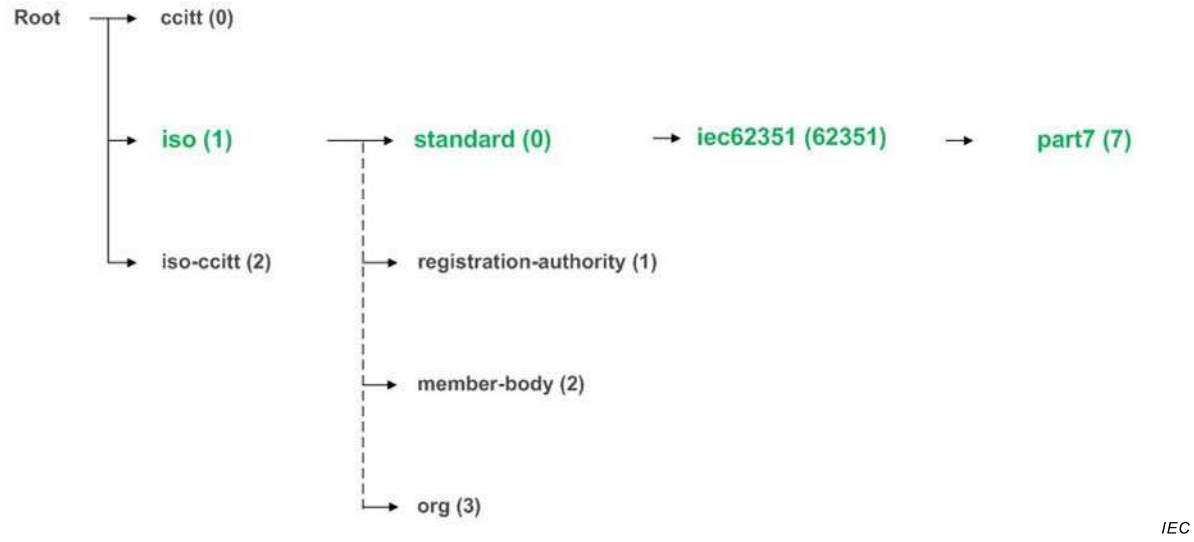


Figure 11 – Object identifier structure

Vendors can define private branches that include managed objects for their own products. MIBs that have not been standardized typically are positioned in the experimental branch.

The IANA Private Enterprise Number (PEN) for IEC 62351-7 is located under the iso branch. The full path is: iso.standard.iec62351.part7 (1.0.62351.7).

Management information bases (MIBs) are used to define what information is needed to manage the information infrastructure as securely and reliably as the power system infrastructure is managed.

The IETF and many mainstream vendors of network and system products have developed specific MIBs for their products, with the basic assumption that these products will be used

over the Internet or an Intranet based on IETF technologies. These should be used where they exist.

This document covers the definition of the MIBs needed to manage the specific information related to IEDs not already covered by an RFC defined MIBs..

5.11 SNMP mapping of UML model Objects

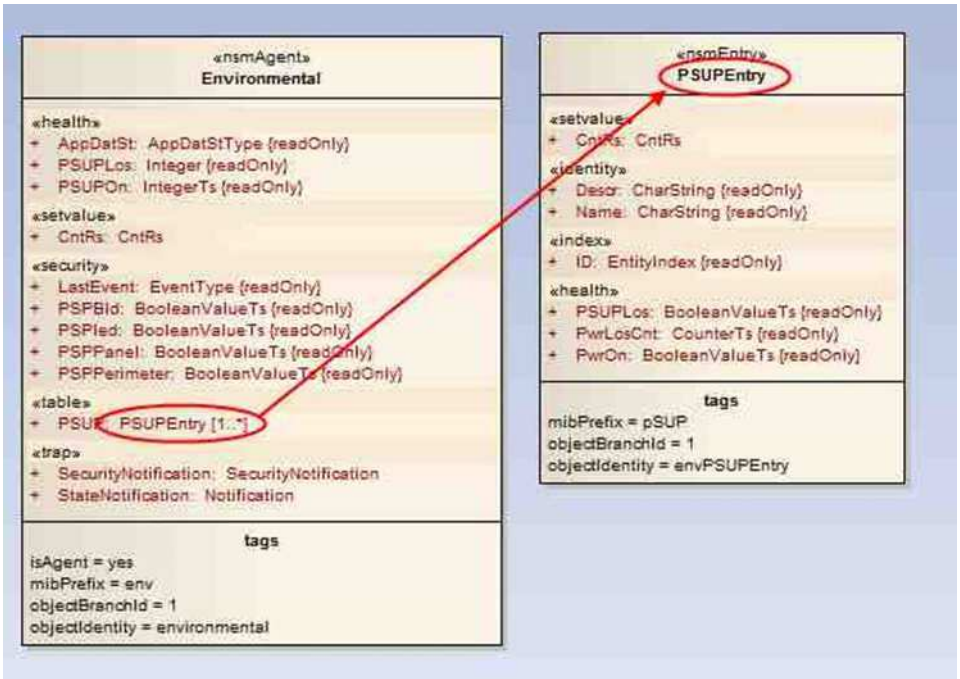
The translation of the objects defined in this standard and their semantics into SNMP object and semantics is carried out by adopting the following translation rules:

- The UML model package hierarchy starts from the IEC root, and each nested package maps into a new level of SNMP OID hierarchy. This produces an OIDs structure that is “parallel” to the UML module package structure. Only the packages that provide the “objectIdentity” and “objectBranchId” tags are considered for the structure generation process:
  1) “objectIdentity” tag is the symbolic name of the branch.
  2) “objectBranchId” tag is the OID branch number.
- The EnumeratedTypes package is used for the production of the corresponding SNMP MIB enumerations. In order to be recognized by an automatic translator this package includes a tag named “isEnumeration” set to “yes”
- The Abstract Types package includes a set of classes. Each class provides one or both the attributes:
  1) “Value”: the actual abstract object value referring to the actual type, selected among the base types and used for SNMP object type assignment.
  2) “TimeStamp”: the object that is generated together with the “value” object, that refers to the timestamp of the last value set.
- The packages exposing the “isAgent” tag set to “yes” are to be considered within the SNMP objects production process.
- “nsmAgent” stereotype class are intended to be selected for SNMP object generation process. Each class attribute automatically translates into one or more SNMP objects depending on the abstract type declaration. Attributes that are defined as constant are translated into a read-only SNMP object.
- “nsmEvent” stereotype class are selected for SNMP trap object generation process. Each class attribute is automatically translated into one or more SNMP trap objects depending on the abstract type declaration.

The following rules apply to the translation of each agent class into MIB objects:

- Multiplicity of class attribute higher than “x..1” (i.e. 0..*) produces a SNMP table reference. As depicted in Figure 12, the UML type of this attribute is actually the class name which provides the attributes to be included in SNMP table sequence as tabular objects.
- Class attribute names are translated into SNMP object names using the mibPrefix tag value as a prefix. This avoids the SNMP MIB SMIv2 constraint that does not allow replication of the same SNMP object name in several object descriptions.
- The SNMP object is generated, including all the inherited attributes.
- The SNMP object OID is automatically generated in sequence within the same agent class.
- Each attribute owns a “Version” tag. This version tag is provided in order to allow the future extension of this UML model to add new attributes, thus declaring that the additional attributes belong to a more recent version. This allows the automatic translation of the additional attributes as objects at the end of the existing list of SNMP MIB object of the same branch without affecting the SNMP OIDs mapping of existing MIB objects.

- The UML Model is translated into several SNMP MIBs. When a UML package include the “mibName” tag, the tag value is used as SNMP MIB name. Each MIB oid branch is produced according to the overall oid structure defined within the UML model.



IEC

Figure 12 – SNMP table

5.12 SNMP Security

SNMP Versions 1 and 2 do not implement a real authentication mechanism because they rely on a shared password (community string) that is sent in clear text between a manager and an agent.

SNMP versions 1 and 2c are subject to packet sniffing of the clear text community string from the network traffic, because they do not implement encryption.

SNMPv3 introduced the authentication feature that requires messages to include security parameters which are encoded as an octet string. SNMPv3 provides the following security features, as shown in Figure 13:

- Confidentiality using encryption of packets.
- Integrity of messages in transit including an optional packet replay protection.
- Authentication to verify that the message is from a known and authorized source.
- Confidentiality can both be provided through the use of SNMPv3 or trusted networks established through the use of VPNs.

Figure 13 depicts the map of SNMP RFCs including SNMPv1, SNMPv2 and SNMPv3 protocol versions. The green marked RFCs are the relevant ones from the security perspective, while the yellow marked are related to SNMP transport and contain references to possible security countermeasures.

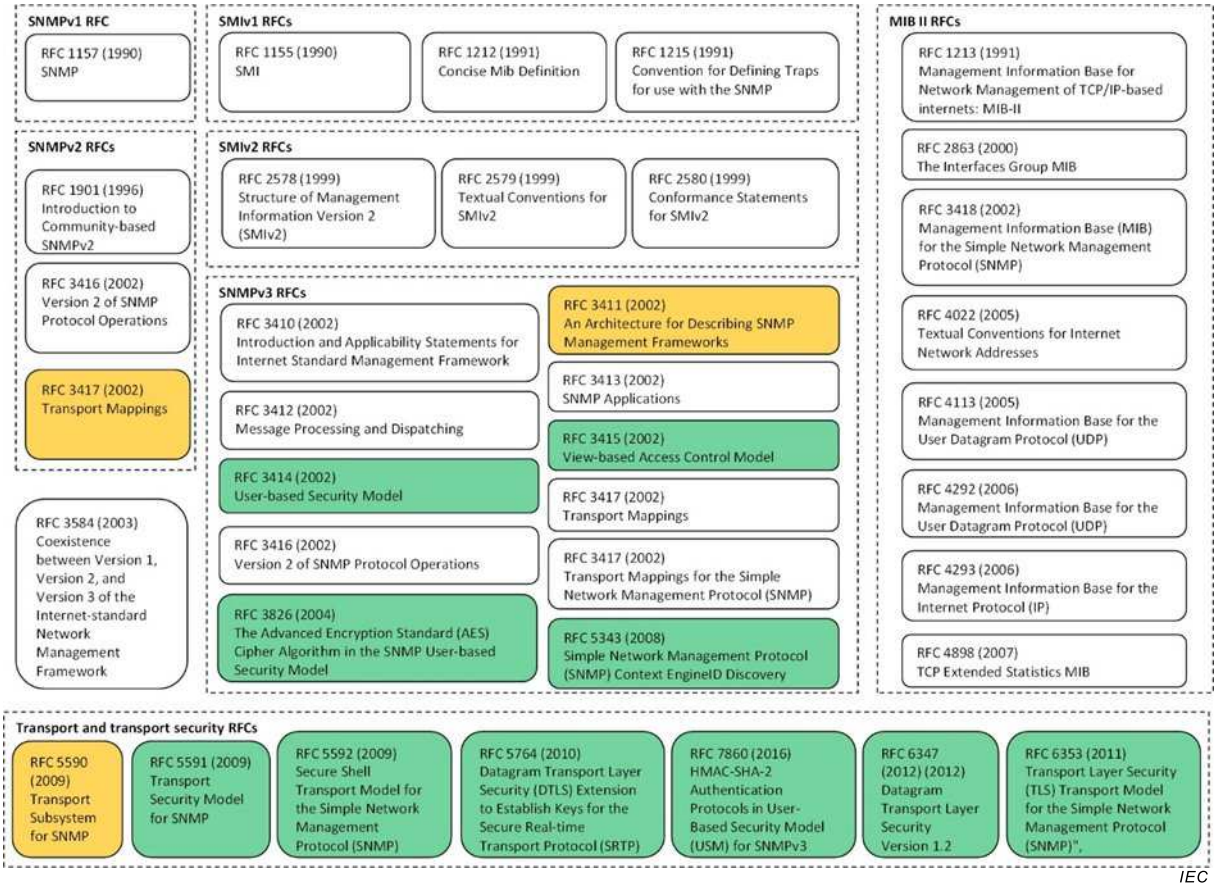


Figure 13 – SNMP RFCs map and security

All versions of SNMP are subject to brute force and dictionary attacks for guessing the community strings, authentication strings, authentication keys, encryption strings, or encryption keys, because they do not implement a challenge-response handshake.

Although SNMP works over TCP and other protocols, it is most commonly used over UDP that is connectionless and vulnerable to IP spoofing attacks. Thus, all versions are subject to bypassing device access lists that might have been implemented to restrict SNMP access, though SNMPv3's other security mechanisms should prevent a successful attack.

SNMP's powerful configuration (write) capabilities are not being fully utilized by many vendors, partly because of a lack of security in SNMP versions before SNMPv3 and partly because many devices simply are not capable of being configured via individual MIB object changes.

RFC 3414 also includes a MIB document for remotely monitoring and managing the configuration parameters for the USM, the first and default SNMPv3 security model, including key distribution and key management. The User Security Model provides mechanisms for the following security features:

- Symmetric or private-key cryptography (username/passwords)
- Digest computation with keyed hashing algorithms (message integrity)
- Time indicators and automatic clock synchronization
- Data encryption

RFC 5590 includes the overall picture of SNMP transport, depicted in Figure 14. As shown in Figure 14, two end-to-end Security Models are available for SNMP: USM and Transport Security Model (TSM).

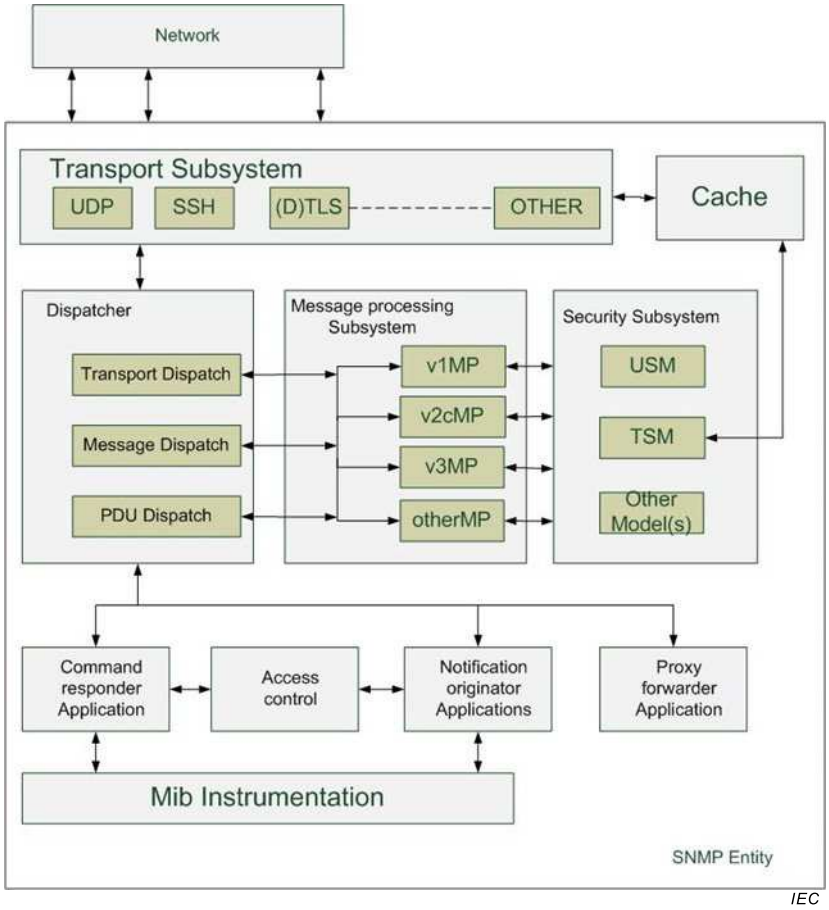


Figure 14 – SNMP Entity

RFC 5591, *Transport Security Model (TSM) for the Simple Network Management Protocol (SNMP)*, adds the TSM for SNMP. TSM defines a framework that allows the use of TLS and DTLS in order to provide a secure communication channel for SNMP messages.

Even if SNMP can be carried by several protocols, normally SNMP implementations are UDP based and therefore DTLS protocol support is included and actually suggested in TSM framework (RFC 5591, RFC 5592, RFC 5764, RFC 6347, RFC 6353).

According to RFC 5591 (chapter 8.1, “MIB Module Security”) SNMP versions prior to SNMPv3 did not include adequate security.

6 Abstract objects

6.1 General

This clause provides the higher level abstract object definitions that are reused inside the specific agents packages classes. In each diagram it should be noted that the arrow direction depicts the generalization of the class.

For implementations claiming conformance to this standard, the abstract objects defined in each agent section shall be implemented only when the related protocol or feature is provided by the device.

The mult column of the attributes table defines the multiplicity of each attribute. If the first number of multiplicity equals 0 then the attribute implementation is optional.

The authorization for resetting counters is a matter of Role Base Access Control that is defined in IEC TS 62351-8 and therefore is outside the scope of IEC 62351-7. The handling of authorization for resetting counters will be defined in specific future profiles of IEC 62351-7.

6.2 Package Abstract Types

6.2.1 General

The abstract objects used within each agent are mapped to the following object types, except for the objects that refer to special enumerated data types which are defined by their own dedicated types.

Abstract objects are classified by the following attributes:

– Type of data (Boolean, Counter, Integer, Float)
– Timestamp required for each status value change

The type object naming actually reflects this classification, as provided in the description of each abstract type.

It should be noted that the attribute defined in this package class exposes 1..1 multiplicity. The multiplicity is handled when these classes are used as attributes within the agents classes definition.

6.2.2 BooleanValue

BooleanValue is an abstract object reporting only a boolean variable.

Table 1 shows all attributes of BooleanValue.

Table 1 – Attributes of Abstract Types::BooleanValue

name	mult	type	Description
Value	1..1	TruthValue	Represents a boolean value.

6.2.3 BooleanValueTs

BooleanValueTs is an abstract object reporting a boolean value variable with a timestamp. The timestamp of the value change is stored into an auxiliary variable.

Table 2 shows all attributes of BooleanValueTs.

Table 2 – Attributes of Abstract Types::BooleanValueTs

name	mult	type	description
TimeStamp	1..1	DateAndTime	Timestamp. The value of year is in network-byte order fractions of second is as defined in RFC 5905 epoch is defined as Midnight January 1, 1970.
Value	1..1	TruthValue	Represents a boolean value.

6.2.4 CounterTs

CounterTs is an abstract object reporting an integer 32 value variable. A timestamp of value change is stored into an auxiliary variable.

Table 3 shows all attributes of CounterTs.

Table 3 – Attributes of Abstract Types::CounterTs

name	mult	type	description
TimeStamp	1..1	DateAndTime	Timestamp. The value of year is in network-byte order fractions of second is as defined in RFC 5905 epoch is defined as Midnight January 1, 1970.
Value	1..1	Counter32	According to SMI v2, used to specify a value which represents a count. The range is 0 to 4294967295.

6.2.5 CntRs

CntRs is an abstract object that allows a reset of the counters.

Table 4 shows all attributes of CntRs.

Table 4 – Attributes of Abstract Types::CntRs

name	mult	type	description
TimeStamp	1..1	DateAndTime	Timestamp. The value of year is in network-byte order fractions of second is as defined in RFC 5905 epoch is defined as Midnight January 1, 1970.
Value	1..1	TruthValue	Boolean

6.2.6 Floating

Floating is an abstract object reporting a Float32 value variable. IEEE Standard 754-2008 for Floating-Point Arithmetic.

Table 5 shows all attributes of Floating.

Table 5 – Attributes of Abstract Types::Floating

name	mult	type	description
Value	1..1	Float32TC	IEEE Standard 754-2008 for Floating-Point Arithmetic

6.2.7 FloatingTs

FloatingTs is an abstract object reporting a Float32 value variable and a timestamp. IEEE Standard 754-2008 for Floating-Point Arithmetic.

Table 6 shows all attributes of FloatingTs.

Table 6 – Attributes of Abstract Types::FloatingTs

name	mult	type	description
TimeStamp	1..1	DateAndTime	Timestamp. The value of year is in network-byte order fractions of second is as defined in RFC 5905 epoch is defined as Midnight January 1, 1970.
Value	1..1	Float32TC	IEEE Standard 754-2008 for Floating-Point Arithmetic

6.2.8 EntityIndex

EntityIndex is an abstract object reporting an unsigned Integer32 value variable used as Index entry to multiple instances of Class.

Table 7 shows all attributes of EntityIndex.

Table 7 – Attributes of Abstract Types::EntityIndex

name	mult	type	description
Value	1..1	Unsigned32	Integer value 1..2147483647 index

6.2.9 Integer

Integer is an abstract object reporting an Integer32 value variable.

Table 8 shows all attributes of Integer.

Table 8 – Attributes of Abstract Types::Integer

name	mult	type	description
Value	1..1	Integer32	Integer value 0 to Integer value -2147483648..2147483647 (inclusive) according to SMI v2 according to SMI v2

6.2.10 IntegerTs

IntegerTs is an abstract object reporting an integer value variable and a timestamp. A timestamp of value change is stored into an auxiliary variable.

Table 9 shows all attributes of IntegerTs.

Table 9 – Attributes of Abstract Types::IntegerTs

name	mult	type	description
TimeStamp	1..1	DateAndTime	Timestamp. The value of year is in network-byte order fractions of second is as defined in RFC 5905 epoch is defined as Midnight January 1, 1970.
Value	1..1	Integer32	Integer value 0 to 4,294,967, 295 according to SMI v2

6.2.11 InetAddress

InetAddress denotes a generic Internet address. An InetAddress value is always interpreted within the context of an InetAddressType value. Every usage of the InetAddress textual convention is required to specify the InetAddressType object that provides the context. It is suggested that the InetAddressType object be logically registered before the object(s) that use the InetAddress textual convention, if they appear in the same logical row.

The value of an InetAddress object shall always be consistent with the value of the associated InetAddressType object. Attempts to set an InetAddress object to a value inconsistent with the associated InetAddressType shall fail with an inconsistent Value error.

Table 10 shows all attributes of InetAddress.

Table 10 – Attributes of Abstract Types::InetAddress

name	mult	type	description
Value	1..1	InetAddress	A value that represents an Internet address according to IETF RFC 4001.

6.2.12 InetAddressType

InetAddressType is an abstract object that represents a type of Internet address according to IETF RFC 4001.

Table 11 shows all attributes of InetAddressType.

Table 11 – Attributes of Abstract Types::InetAddressType

name	mult	type	description
Value	1..1	InetAddressType	Address Type

6.2.13 MacAddress

MacAddress is an abstract object that represents an 802 MAC address represented in the `canonical' order defined by IEEE 802.1a, i.e., as if it were transmitted least significant bit first, even though 802.5 (in contrast to other 802.x protocols) requires MAC addresses to be transmitted most significant bit first.

Table 12 shows all attributes of MacAddress.

Table 12 – Attributes of Abstract Types::MacAddress

name	mult	type	description
Value	1..1	MacAddress	OCTET STRING (SIZE (6)), DISPLAY-HINT "1x:"

6.2.14 Selector

Selector is an abstract object used for T, S and P SELECTORS of a specific MMS association. It is a string formed using digits and letters from A to F. For Transport Selector, max length is 8. For Session and Presentation Selector, the max length is 16.

Table 13 shows all attributes of Selector.

Table 13 – Attributes of Abstract Types::Selector

name	mult	type	description
Value	1..1	DisplayString	For Transport Selector, max length is 8. For Session and Presentation Selector max length is 16.

6.2.15 Timestamp

Timestamp is an abstract object object reporting a boolean value variable. A timestamp of the value change is stored in a related variable.

Table 14 shows all attributes of Timestamp.

Table 14 – Attributes of Abstract Types::Timestamp

name	mult	type	description
TimeStamp	1..1	DateAndTime	Timestamp. The value of year is in network-byte order fractions of second is as defined in RFC 5905 epoch is defined as Midnight January 1, 1970.

6.2.16 CharString

CharString is an abstract object reporting a String variable.

Table 15 shows all attributes of CharString.

Table 15 – Attributes of Abstract Types::CharString

name	mult	type	description
Value	1..1	DisplayString	Represents a String.

6.2.17 CharStringTs

CharStringTs is an abstract object reporting a String variable and a timestamp. A timestamp of value change is stored into an auxiliary variable.

Table 16 shows all attributes of CharStringTs.

Table 16 – Attributes of Abstract Types::CharStringTs

name	mult	type	description
TimeStamp	1..1	DateAndTime	Timestamp. The value of year is in network-byte order fractions of second is as defined in RFC 5905 epoch is defined as Midnight January 1, 1970.
Value	1..1	DisplayString	Represents a String.

6.2.18 AbstractBaseType root class

AbstractBaseType is the root UML class for abstract objects type UML classes.

6.2.19 AbstractAgent root class

AbstractAgent is the UML root class for agents UML classes.

6.3 Package EnumeratedTypes

6.3.1 General

The abstract objects defined as enumerated types refer to special enumerated data types.

The type object naming actually reflects this classification, as explained explicitly within this section in the description of each abstract type.

Please note that the attributes defined in this package classes have 1..1 multiplicity. The multiplicity is handled when these classes are used as attributes within the agents classes definition.

6.3.2 AppDatStKind enumeration

AppDatStKind is an enumeration of status for the environment where the device is operated (e.g. Power Supply, Physical Access).

Table 17 shows all literals of AppDatStKind.

Table 17 – Literals of EnumeratedTypes::AppDatStKind

literal	value	description
unknown	0	No information available about the environment.
good	1	Good environment status.
bad	2	Environmental problems detected.

6.3.3 PhyHealthKind enumeration

PhyHealthKind is an enumeration of general health status of IED.

Table 18 shows all literals of PhyHealthKind.

Table 18 – Literals of EnumeratedTypes::PhyHealthKind

literal	value	description
ok	0	No problems, normal operation.
warning	1	Minor problems, but in safe operation mode.
alarm	2	Severe problem, no operation possible.

6.3.4 ExtKind enumeration

ExtKind is an enumeration of possible IED extension types.

Table 19 shows all literals of ExtKind.

Table 19 – Literals of EnumeratedTypes::ExtKind

literal	value	description
unknown	0	unknown module
ioModule	1	I/O module
softwarePLC	2	Software PLC module

6.3.5 IntKind enumeration

IntKind is an enumeration of type of interface being utilized.

Table 20 shows all literals of IntKind.

Table 20 – Literals of EnumeratedTypes::IntKind

literal	value	description
wired	0	Wired interface
wireless	1	Wireless interface

6.3.6 LnkKind enumeration

LnkKind is an enumeration of LnkType.

Table 21 shows all literals of LnkKind.

Table 21 – Literals of EnumeratedTypes::LnkKind

literal	value	description
unknown	0	unknown
serial	1	serial
tcp	2	tcp
udp	3	udp
eth	4	Ethernet

6.3.7 PSPAccKind enumeration

PSPAccKind indicates that panel access is occurring at the IED.

Table 22 shows all literals of PSPAccKind.

Table 22 – Literals of EnumeratedTypes::PSPAccKind

literal	value	description
notBeingAccessed	0	No access to IED control panel is taking place.
accessOccurring	1	An access to IED control panel is taking place.

6.3.8 ProtIdKind enumeration

ProtIdKind is an enumeration used to identify the target protocol.

Table 23 shows all literals of ProtIdKind.

Table 23 – Literals of EnumeratedTypes::ProtIdKind

literal	value	description
unknown	0	Unknown protocol
iEC6185081	1	MMS
iEC6185081GOOSE	2	GOOSE
iEC6185092SV	3	SV
ieee1815DNP	4	DNP
iec608705	5	IEC 60870-5 (Valid for 101 and 104 companion standards)

6.3.9 EventKind enumeration

EventKind is an enumeration of the last known attack vector that was encountered.

Table 24 shows all literals of EventKind.

Table 24 – Literals of EnumeratedTypes::EventKind

literal	value	description
none	0	Indicates that the application does not exist.
unKnown	1	unclassified type
denialOfService	2	Denial of Service attack
malware	3	Malware detected
bufferOverRun	4	Buffer Over Run
bufferUnderRun	5	Buffer Under Run
badCredential	6	Bad Credential
badKey	7	Bad Key
malformedPDU	8	Detected some tampered/malformed packets.
physicalDisruption	9	Power failure detection or media disconnection.
invalidNetworkAccess	10	Access to the device form unexpected/banned networks.

6.3.10 TimSyncIssueKind enumeration

TimSyncIssueKind is an enumeration of possible problems with time synchronization.

Table 25 shows all literals of TimSyncIssueKind.

Table 25 – Literals of EnumeratedTypes::TimSyncIssueKind

literal	value	description
synced	0	Indicates time sync is active and correctly operating.
degradated	1	Indicates time sync is active but not operating correctly (for example because time source is not correctly operating or because of network degradation).
failed	2	Indicates that sync has failed.

6.3.11 SecurityProfileKind enumeration

SecurityProfileKind is an enumeration of SecurityProfile alternatives.

NOTE These are the enumerated values expected to be normative in IEC 62351-4. If there is a discrepancy when that standard is finally released, the values in that standard will take precedence.

Table 26 shows all literals of SecurityProfileKind.

Table 26 – Literals of EnumeratedTypes::SecurityProfileKind

literal	value	description
noSecurity	0	Indicate that no security profile is in use
aProfile	1	Indicates that authentication A Profile is in use.
aPlusProfile	2	Indicates that integrity A+ Profile is in use.
aePlusProfile	3	Indicates that AE+ Profile is in use

6.3.12 TimSyncSrcKind enumeration

TimSyncSrcKind is an enumeration of source of time synchronization alternatives.

Table 27 shows all literals of TimSyncSrcKind.

Table 27 – Literals of EnumeratedTypes::TimSyncSrcKind

literal	value	description
unknown	0	Indicates that the type of the current time sync source is unknown.
ntp	1	Indicates that time sync is being performed via NTP protocol.
sntp	2	Indicates that time sync is being performed via SNTP protocol.
irig	3	Indicates that time sync is being performed via IRIG input.
gps	4	Indicates that time sync is being performed via GPS input.
ieee1588PTP	5	Indicates that time sync is being performed via PTP protocol.
ieee1588PTPC37238Profile2011	6	Indicates that time sync is being performed via PTP protocol using C37.238-2011 power profile.
ieee1588PTPIEC6185093	7	Indicates that time sync is being performed via PTP protocol using IEC61850-9-3 profile.

6.3.13 AppDatStType

AppDatStType is the abstract object for the status for the environment where the device is operated (e.g. Power Supply, Physical Access).

Table 28 shows all attributes of AppDatStType.

Table 28 – Attributes of EnumeratedTypes::AppDatStType

name	mult	type	description
TimeStamp	1..1	DateAndTime	Timestamp.
Value	1..1	AppDatStKind	AppDatStKind enumeration.

6.3.14 PhyHealthType

PhyHealthType is the abstract object for the general health status of IED.

Table 29 shows all attributes of PhyHealthType.

Table 29 – Attributes of EnumeratedTypes::PhyHealthType

name	mult	type	description
TimeStamp	1..1	DateAndTime	Timestamp.
Value	1..1	PhyHealthKind	PhyHealthKind enumeration.

6.3.15 ExtType

ExtType is the abstract object that provides the type of the IED extension module.

Table 30 shows all attributes of ExtType.

Table 30 – Attributes of EnumeratedTypes::ExtType

name	mult	type	description
Value	1..1	ExtKind	ExtKind enumeration.

6.3.16 IntType

IntType is the abstract object for the type of interface being utilized. IntType {wired(0), wireless(1)}.

Table 31 shows all attributes of IntType.

Table 31 – Attributes of EnumeratedTypes::IntType

name	mult	type	description
Value	1..1	IntKind	IntKind enumeration

6.3.17 EventType

EventType is the abstract object that provides the last known attack vector that was encountered.

Table 32 shows all attributes of EventType.

Table 32 – Attributes of EnumeratedTypes::EventType

name	mult	type	description
TimeStamp	1..1	DateAndTime	Timestamp.
Value	1..1	EventKind	EventKind enumeration.

6.3.18 PSPAccType

PSPAccType is the abstract object that indicates if panel access is occurring at the IED.

Table 33 shows all attributes of PSPAccType.

Table 33 – Attributes of EnumeratedTypes::PSPAccType

name	mult	type	description
Timestamp	1..1	DateAndTime	Timestamp.
Value	1..1	PSPAccKind	PSPAccKind Enumeration.

6.3.19 ProtIdType

ProtIdType is the abstract object for the attribute that provides the protocol identification. A standardized enumeration that represents the protocol that is in use.

Table 34 shows all attributes of ProtIdType.

Table 34 – Attributes of EnumeratedTypes::ProtIdType

name	mult	type	description
Value	1..1	ProtIdKind	ProtIdKind Enumeration.

6.3.20 TimSyncIssueType

TimSyncIssueType is the abstract object that provides an indication if there is a problem with time synchronization.

Table 35 shows all attributes of TimSyncIssueType.

Table 35 – Attributes of EnumeratedTypes::TimSyncIssueType

name	mult	type	description
Value	1..1	TimSyncIssueKind	TimSyncIssueKind Enumeration.

6.3.21 SecurityProfileType

SecurityProfileType is the abstract object that provides an attribute that indicates which Security Profile is in use.

Note: These are the enumerated values expected to be normative in IEC 62351-4. If there is a discrepancy when that standard is finally released, the values in that standard will take precedence.

Table 36 shows all attributes of SecurityProfileType.

Table 36 – Attributes of EnumeratedTypes::SecurityProfileType

name	mult	type	description
Value	1..1	SecurityProfileKind	SecurityProfile Enumeration

6.3.22 TimSyncSrcType

TimSyncSrcType is the abstract object that provides an attribute that indicates the source of time synchronization that is in use.

Table 37 shows all attributes of TimSyncSrcType.

Table 37 – Attributes of EnumeratedTypes::TimSyncSrcType

name	mult	type	description
Value	1..1	TimSyncSrcKind	TimSyncSrcKind Enumeration

6.3.23 LnkType

LnkType is the abstract object that identifies the type of transport being utilized. LnkType (Integer) {unknown(0), serial (1), tcp(2), udp(3), eth(4)}.

Table 38 shows all attributes of LnkType.

Table 38 – Attributes of EnumeratedTypes::LnkType

name	mult	type	description
Value	1..1	LnkKind	LnkType Enumeration.

7 Agents

7.1 Package Overview

The NSM agent objects are organized in a UML package hierarchy that is shown in Figure 15. The application protocol branch is organized into further substructures that include the specific protocols agents.

The tree of packages is reflected in the translation to the SNMP MIB structure. This MIB structure shall respect additional constraints. For instance the reuse of attribute names in different MIB branches is not allowed. Additional MIB constraints are related to naming conventions and the OID specification.

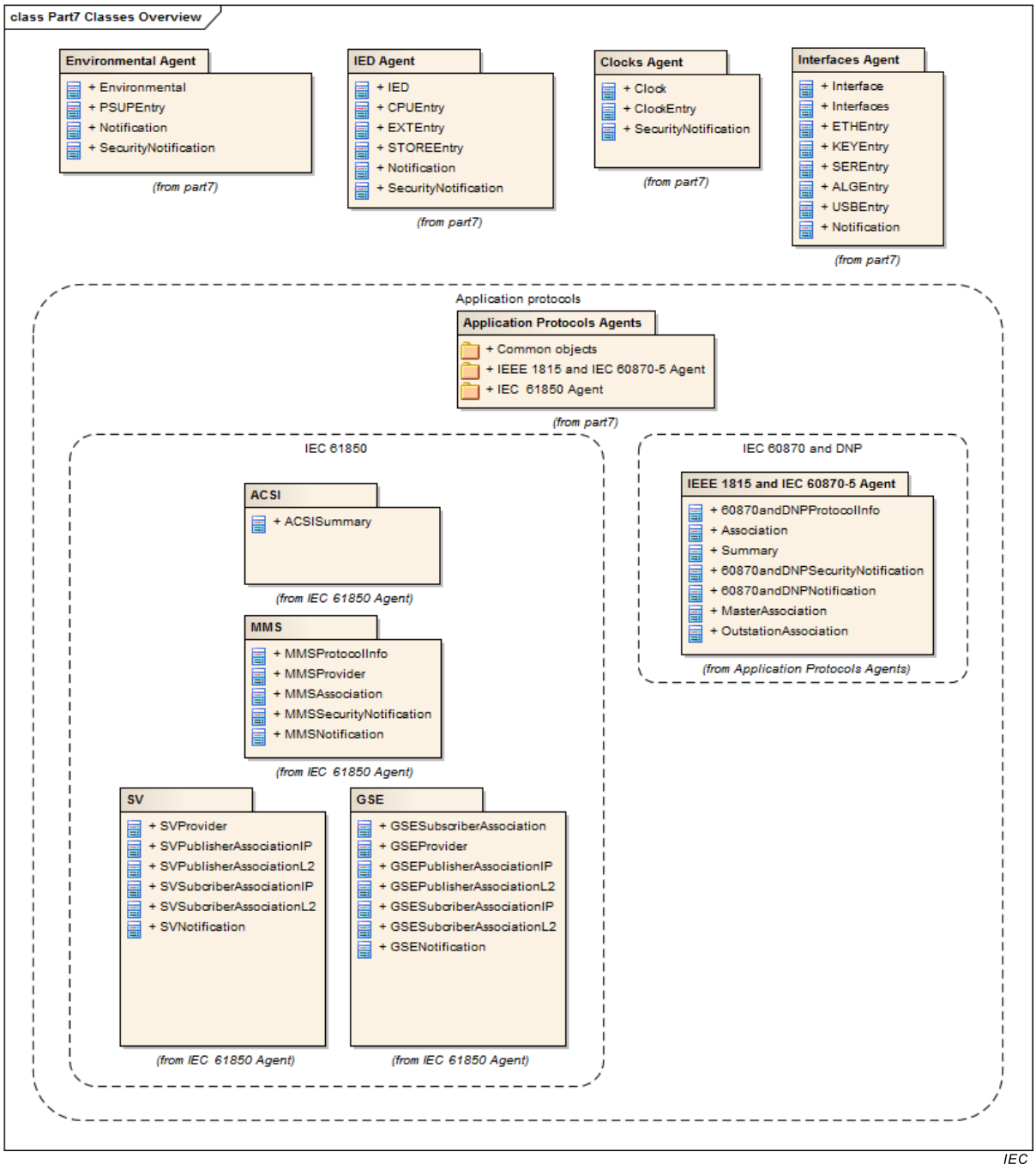


Figure 15 – Class diagram Overview::Part7 Classes Overview

7.2 Package Environmental Agent

7.2.1 General

As shown in Figure 16 this package contains the object descriptions for the environmental information to be provided for the Network and System Monitoring of environmental conditions where the device is operating.

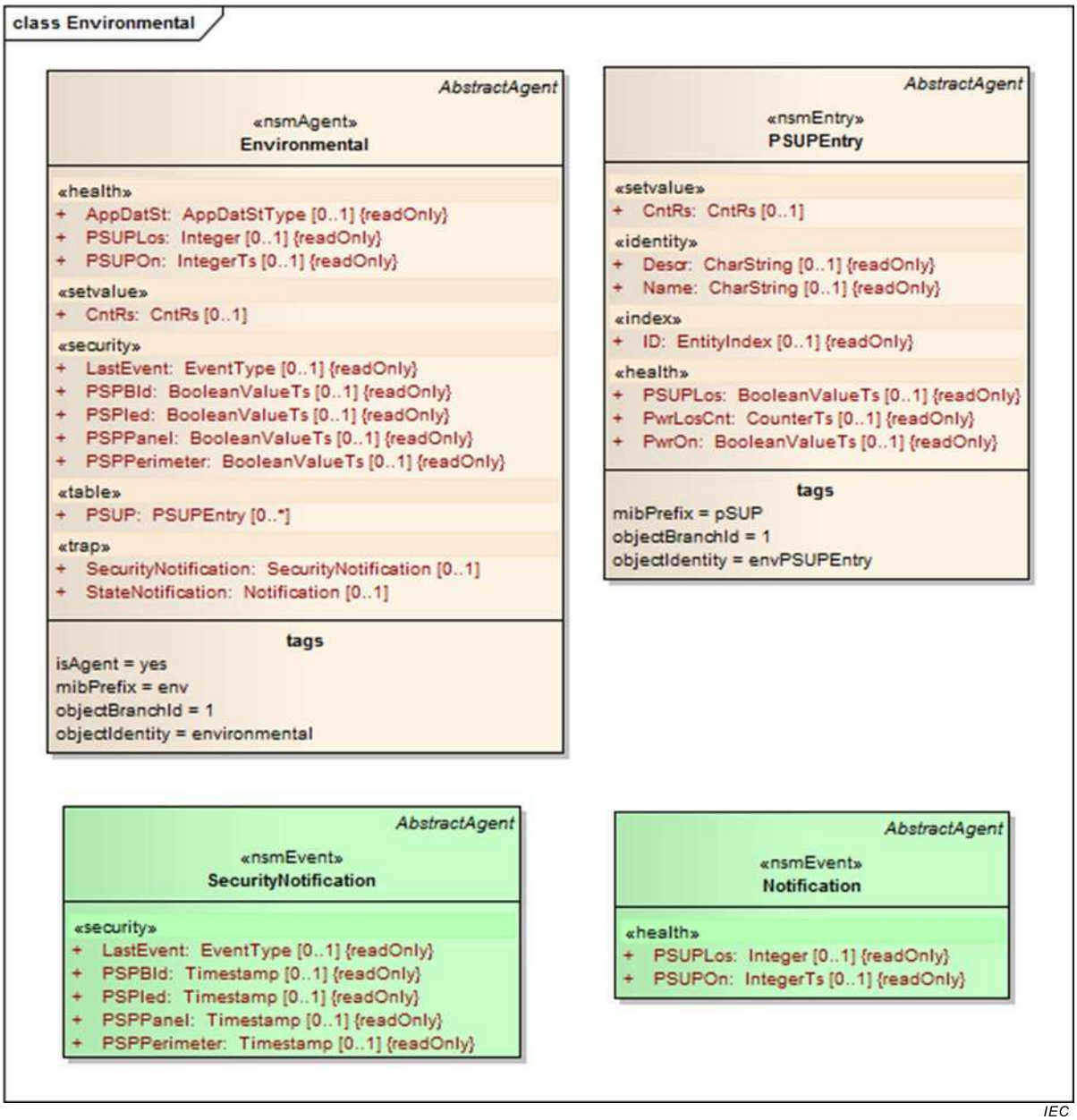


Figure 16 – Class diagram Environmental Agent::Environmental

7.2.2 Environmental

The Environmental class is a set of objects that includes the physical access to the device, the power supply conditions, and other environmental conditions. This information is collected by the device itself whenever possible and is used to report the physical device security and health.

Table 39 shows all attributes of Environmental.

Table 39 – Attributes of Environmental Agent::Environmental

name	mult	type	description
AppDatSt	0..1	AppDatStType	Status of the environment where the device is operated (e.g. Power Supply, Physical Access)
CntRs	0..1	CntRs	Attribute that allows a reset of the statistical information.
LastEvent	0..1	EventType	Provides the last known event encountered.
PSPBld	0..1	BooleanValueTs	Building access occurred.
PSPIed	0..1	BooleanValueTs	Indicates that direct access to the IED is in process.
PSPPanel	0..1	BooleanValueTs	Indicates that panel access is occurring to the IED.
PSPPerimeter	0..1	BooleanValueTs	Physical perimeter access occurred (e.g. door open), where available.
PSUP	0..*	PSUPEntry	A list of power supply entries.
PSUPLos	0..1	Integer	Power supply table entry index of the last power supply that was detected as lost.
PSUPOn	0..1	IntegerTs	Index of the power supply that was the last to come on.
SecurityNotification	0..1	SecurityNotification	Security events notification object.
StateNotification	0..1	Notification	State events notification object.

7.2.3 PSUPEntry

The PSUPEntry class contains the information regarding the power supply for the device status.

Table 40 shows all attributes of PSUPEntry.

Table 40 – Attributes of Environmental Agent::PSUPEntry

name	mult	type	description
CntRs	0..1	CntRs	Counters reset control object.
Descr	0..1	CharString	Description of the power supply.
ID	0..1	EntityIndex	Id of the power supply.
Name	0..1	CharString	Name of the power supply.
PSUPLos	0..1	BooleanValueTs	Timestamp of the last detected power loss.
PwrLosCnt	0..1	CounterTs	Attribute that provides a count of number power losses. Power loss indicates primary supply power loss not shutdown.
PwrOn	0..1	BooleanValueTs	Indicates if the power supply state is currently on and operating appropriately.

7.2.4 Notification

The Notification class defines the content of the notification message to be sent on event related with the specified objects.

Table 41 shows all attributes of Notification.

Table 41 – Attributes of Environmental Agent::Notification

name	mult	type	description
PSUPLos	0..1	Integer	Power supply Table Entry Index of the last power supply that was detected as lost.
PSUPOn	0..1	IntegerTs	Index of the power supply that was the last to come on.

7.2.5 SecurityNotification

The SecurityNotification class defines the content of the notification message to be sent on event related with the specified objects.

Table 42 shows all attributes of SecurityNotification.

Table 42 – Attributes of Environmental Agent::SecurityNotification

name	mult	type	description
LastEvent	0..1	EventType	Provides the last known event encountered.
PSPBld	0..1	Timestamp	Building Access occurred.
PSPIed	0..1	Timestamp	Indicates that direct access to the IED is in process.
PSPPanel	0..1	Timestamp	Indicates that panel access is occurring to the IED.
PSPPerimeter	0..1	Timestamp	Perimeter Access occurred.

7.3 Package IED Agent

7.3.1 General

As shown in Figure 17, the IED Agent package contains the object descriptions for the environmental information to be provided for the network and system monitoring of environmental conditions where the device is operating.

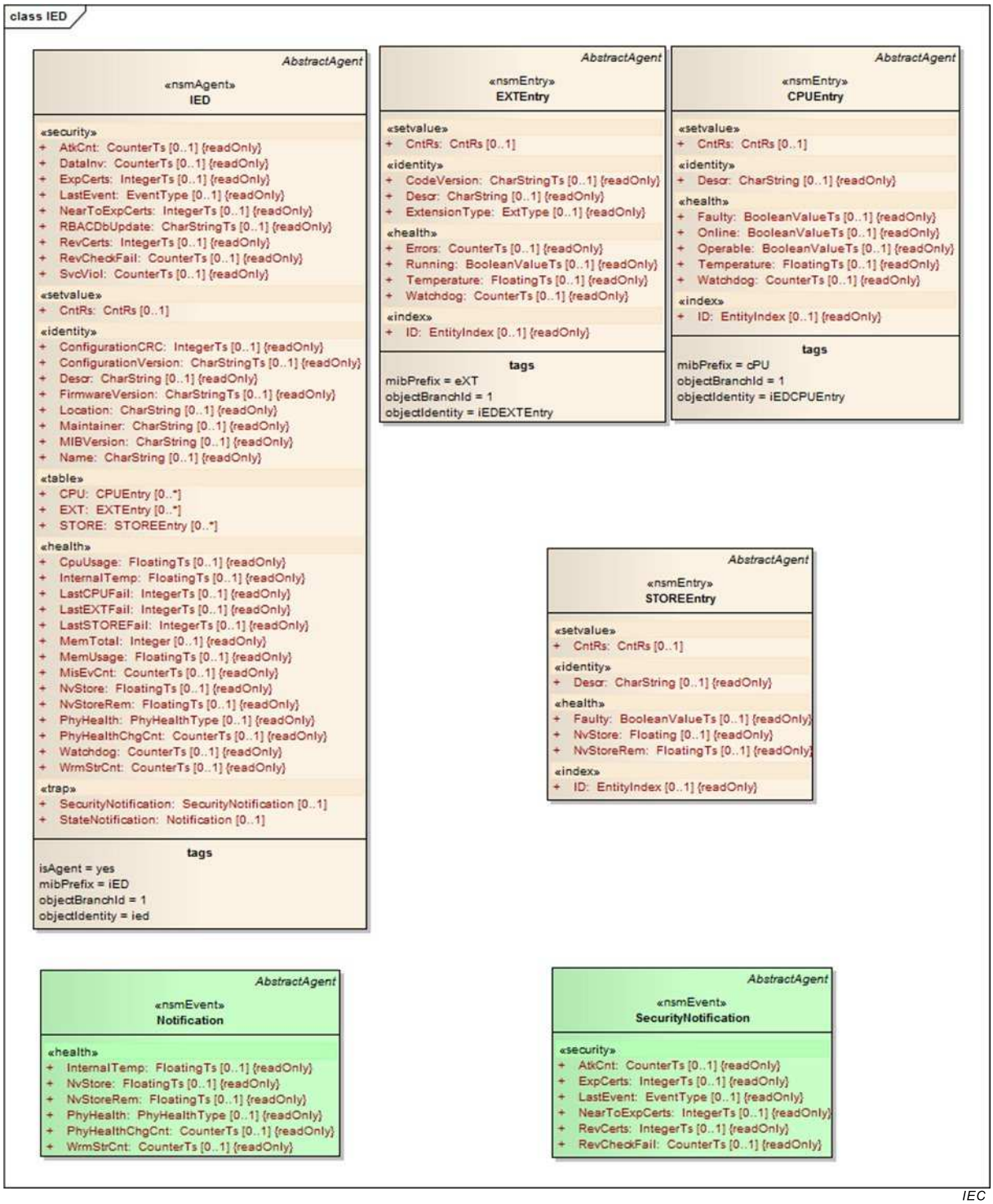


Figure 17 – Class diagram IED Agent::IED

7.3.2 IED

The IED class is a set of objects that includes the hardware (CPU, storage), software (e.g. buffer overflow) health information, and security information regarding possible attacks. Information on device security credentials (certificates and more in general encryption keys) is provided.

Table 43 shows all attributes of IED.

Table 43 – Attributes of IED Agent::IED

name	mult	type	description
AtkCnt	0..1	CounterTs	Attribute that provides the number of cyber-attacks that have been detected.
CntRs	0..1	CntRs	Counters reset control object.
ConfigurationCRC	0..1	IntegerTs	CRC of the last update.
ConfigurationVersion	0..1	CharStringTs	Version of the last uploaded configuration.
CPU	0..*	CPUEntry	This entry defer to possible multiple instances of CPU inside the IED.
CpuUsage	0..1	FloatingTs	Provides an attribute that indicates the percentage of processing resources that is in use. Range is 0 to 100.
DataInv	0..1	CounterTs	Provides a count of the number of attempts to write invalid data, for instance out-of-range data.
Descr	0..1	CharString	This entry provides a textual description of the IED.
ExpCerts	0..1	IntegerTs	Indicates the number of expired certificates that are in the certificate storage configured for local use.
EXT	0..*	EXTEntry	This entry defer to possible multiple instances of extension modules inside the IED.
FirmwareVersion	0..1	CharStringTs	Version of the last uploaded Firmware. Timestamp refers to upload time.
InternalTemp	0..1	FloatingTs	Degree Centigrade measurement of the internal IED Temperature.
LastCPUFail	0..1	IntegerTs	Index of last failing CPU.
LastEvent	0..1	EventType	Provides the last known event encountered.
LastEXTFail	0..1	IntegerTs	Index of last failing Extension.
LastSTOREFail	0..1	IntegerTs	Index of last failing Storage.
Location	0..1	CharString	Physical Installation coordinates (geographical and plant location).
Maintainer	0..1	CharString	Organizational reference for device maintenance.
MemTotal	0..1	Integer	Provides an attribute that report the total RAM available in KBytes.
MemUsage	0..1	FloatingTs	Provides an attribute that indicates the percentage of memory that is in use.Range is 0 to 100.
MIBVersion	0..1	CharString	Version of the Management Information Base.
MisEvCnt	0..1	CounterTs	Provides an attribute that represents the count of missed events or data.
Name	0..1	CharString	Name of IED.
NearToExpCerts	0..1	IntegerTs	Indicates the number of certificates in the certificate storage configured for local use that have exceeded the 70% of validity period.
NvStore	0..1	FloatingTs	Indicates the global number of kilobytes of

name	mult	type	description
			storage allocated for local use in all storage areas.
NvStoreRem	0..1	FloatingTs	Indicates the percentage of NvStore available for storage.
PhyHealth	0..1	PhyHealthType	General health status of IED hardware and software.
PhyHealthChgCnt	0..1	CounterTs	Provides a count of the number of transitions state of PhyHealth Attribute.
RBACDbUpdate	0..1	CharStringTs	Version of the last uploaded RBAC Database.
RevCerts	0..1	IntegerTs	Indicates the number of revoked certificates that are still configured for local use.
RevCheckFail	0..1	CounterTs	Indicates the number revocation check failures.
SecurityNotification	0..1	SecurityNotification	Security events notification object.
StateNotification	0..1	Notification	State events notification object.
STORE	0..*	STOREEntry	This entry defer to possible multiple instances of storage modules inside the IED.
SvcViol	0..1	CounterTs	Number of service privilege violations (i.e., when the data object that the client wanted to access exists in the access view for the association with that client, but the requested service is not allowed).
Watchdog	0..1	CounterTs	This attribute report the count of Watchdog intervention on any component of the IED.
WrmStrCnt	0..1	CounterTs	Number of warm starts detected.

7.3.3 CPUEntry

The CPUEntry class contains the information regarding the status of a CPU instance.

Table 44 shows all attributes of CPUEntry.

Table 44 – Attributes of IED Agent::CPUEntry

name	mult	type	description
CntRs	0..1	CntRs	Counters reset control object.
Descr	0..1	CharString	Description of the CPU.
Faulty	0..1	BooleanValueTs	CPU generated errors.
ID	0..1	EntityIndex	CPU number.
Online	0..1	BooleanValueTs	Indicate that CPU is online and active.
Operable	0..1	BooleanValueTs	Indicates that CPU is operable (it can be either online or offline).
Temperature	0..1	FloatingTs	Temperature of this CPU.
Watchdog	0..1	CounterTs	This attribute report the count of Watchdog intervention on this CPU.

7.3.4 EXTEntry

The EXTEntry class contains the information regarding the status of the internal HW/SW additional modules (e.g. IO/PLC).

Table 45 shows all attributes of EXTEntry.

Table 45 – Attributes of IED Agent::EXTEntry

name	mult	type	description
ID	0..1	EntityIndex	Software PLC ID.
Descr	0..1	CharString	Description of the Software PLC.
ExtensionType	0..1	ExtType	This attribute defines the type of the extension module.
CodeVersion	0..1	CharStringTs	Version of the last uploaded code.
Running	0..1	BooleanValueTs	Indicates that CPU is operable (it can be either online or offline).
Temperature	0..1	FloatingTs	Temperature of this extension.
Watchdog	0..1	CounterTs	This attribute report the count of Watchdog intervention on this IED extension (e.g. software PLC).
Errors	0..1	CounterTs	This attribute reports the PLC software detected errors.
CntRs	0..1	CntRs	Counters reset control object.

7.3.5 STOREEntry

The STOREEntry class contains the information regarding the status of a CPU instance.

Table 46 shows all attributes of STOREEntry.

Table 46 – Attributes of IED Agent::STOREEntry

name	mult	type	description
ID	0..1	EntityIndex	Storage area ID number.
Descr	0..1	CharString	Description of the storage area.
NvStore	0..1	Floating	Indicates the amount of storage.
NvStoreRem	0..1	FloatingTs	Indicate remaining storage in this area.
Faulty	0..1	BooleanValueTs	Storage area fault generated errors.
CntRs	0..1	CntRs	Counters reset control object.

7.3.6 Notification

The Notification class defines the content of the notification message to be sent on event related with the specified objects.

Table 47 shows all attributes of Notification.

Table 47 – Attributes of IED Agent::Notification

name	mult	type	description
PhyHealthChgCnt	0..1	CounterTs	Provides a count of the number of transitions state of PhyHealth Attribute.
InternalTemp	0..1	FloatingTs	Degree Centigrade measurement of the internal IED Temperature.
NvStore	0..1	FloatingTs	Indicates the global number of kilobytes of storage allocated for local use in all storage areas.
NvStoreRem	0..1	FloatingTs	Indicates the percentage of NvStore available for storage.
PhyHealth	0..1	PhyHealthType	General health status of IED hardware and software.
WrmStrCnt	0..1	CounterTs	Number of warm starts detected.

7.3.7 SecurityNotification

The SecurityNotification class defines the content of the notification message to be sent on event related with the specified objects.

Table 48 shows all attributes of SecurityNotification.

Table 48 – Attributes of IED Agent::SecurityNotification

name	mult	type	description
AtkCnt	0..1	CounterTs	Attribute that provides the number of cyber-attacks that have been detected.
ExpCerts	0..1	IntegerTs	Indicates the number of expired certificates that are in the certificate storage configured for local use.
LastEvent	0..1	EventType	Provides the last known event encountered.
NearToExpCerts	0..1	IntegerTs	Indicates the number of certificates in the certificate storage configured for local use that have exceeded the 70% of validity period.
RevCerts	0..1	IntegerTs	Indicates the number of revoked certificates that are still configured for local use.
RevCheckFail	0..1	CounterTs	Indicates the number revocation check failures.

7.4 Package Application Protocols Agents

7.4.1 General

This Application Protocols Agents package contains the object descriptions to be provided in order to monitor the behaviour of the application protocols and any possible security information related to application communication layer.

Each protocol package is structured with the goal of exposing summary information on the overall application stack protocol statistics and information, but also of providing specialized

statistics and information for each association with remote entities (the application level connections). This is done by reusing the same common or protocol-related objects with the goal of obtaining more coherent structure and semantics of variables.

7.4.2 Package Common objects

7.4.2.1 General

As shown in Figure 18, this package includes the common class for the application protocols.

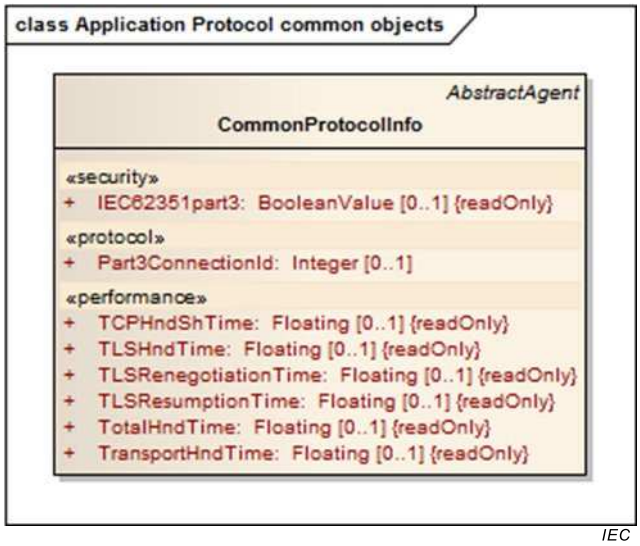


Figure 18 – Class diagram Common objects::Application Protocol common objects

7.4.2.2 CommonProtocolInfo

The CommonProtocolInfo class contains the specific attributes for IEC 60870-5-104, IEEE 1815 DNP3 and IEC 61850 application protocol health information collection and inherits the more general class attributes as well.

Table 49 shows all attributes of CommonProtocolInfo.

Table 49 – Attributes of Common objects::CommonProtocolInfo

name	mult	type	description
IEC62351part3	0..1	BooleanValue	True is security profile in use for this association (IEC 62351-3).
Part3ConnectionId	0..1	Integer	IEC 62351-3 Transport layer connection id in use for this Association. Meaningful only if IEC62351Part3 is true.
TCPHndShTime	0..1	Floating	Duration of the TCP handshake.
TLSHndTime	0..1	Floating	TLS Handshake time
TLSRenegotiationTime	0..1	Floating	TLS Renegotiation time
TLSResumptionTime	0..1	Floating	TLS Resumption time
TotalHndTime	0..1	Floating	Transport + Application Handshake time
TransportHndTime	0..1	Floating	Transport layer handshake time. It is equal to TCPHndTime if IEC62351part3 is false, it is equal to TCPHndTime + TLSHndTime if IEC62351part3 is true.

7.4.3 Package IEEE 1815 and IEC 60870-5 Agent

7.4.3.1 General

As shown in Figure 19, this package includes the IEEE 1815 DNP and IEC 60870-5-104 protocols classes. This high level class named "summary" includes two objects related to the application stack and "association" class that reports the object related to the possible communication sessions between masters and outstations.

The two class "Master Association" and "Outstation Association" Inherits the Associations class attributes.

For each IEEE 1815 DNP or IEC 60870-5-104 application stack a single instance of "summary" class is provided. This instance of "summary" class can be related to several instances of "OutstationAssociation" and "MasterAssociation" classes which inherit the attributes from the "Association" class. Each instance "Association" is the container of the attributes of a specific application session between an Outstation and a Master.

Summary and Association class inherits the specific IEEE 1815 DNP and IEC 60870-5-104 Protocol Infoand Security objects, and therefore the more general class as well.

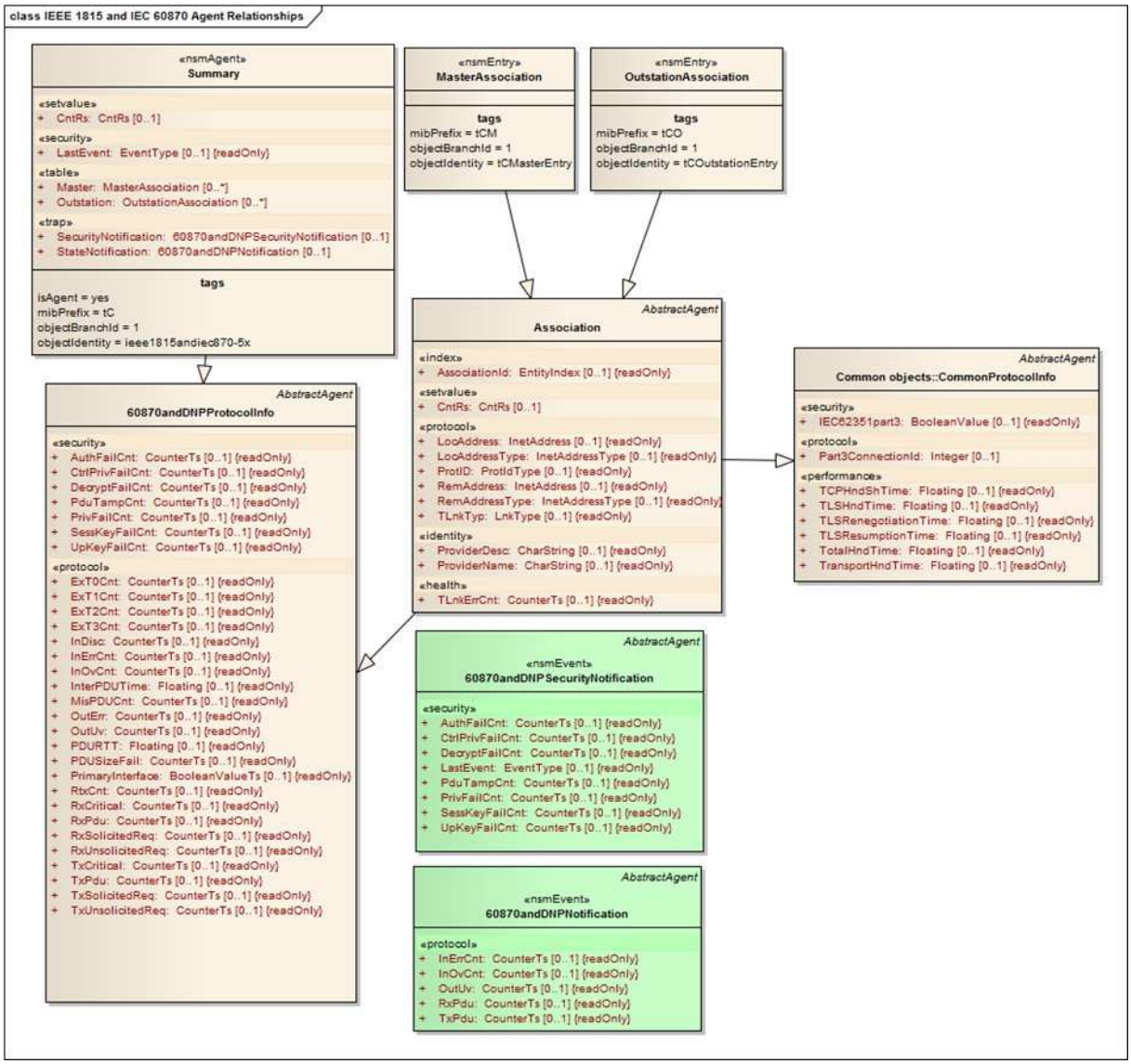


Figure 19 – Class diagram IEEE 1815 and IEC 60870-5 Agent::IEEE 1815 and IEC 60870 Agent Relationships

Summary and Association class inherits the specific IEEE 1815 DNP and IEC 60870-5-104 Protocol Info and Protocol Info and Security objects, and therefore the more general class as well.

7.4.3.2 60870andDNPProtocolInfo

The 60870andDNPProtocolInfo class contains the specific attributes for IEC 60870-5-104 and IEEE 1815 DNP3 application protocol health information collection and inherits the more general class attributes as well.

Table 50 shows all attributes of 60870andDNPProtocolInfo.

Table 50 – Attributes of IEEE 1815 and IEC 60870-5 Agent::60870andDNPProtocolInfo

name	mult	type	description
AuthFailCnt	0..1	CounterTs	Count of the number of authorization failures.
CtrlPrivFailCnt	0..1	CounterTs	Number of control actions attempted that did not have the correct privilege.
DecryptFailCnt	0..1	CounterTs	Number PDUs received that could not be decrypted.
ExT0Cnt	0..1	CounterTs	Count the expirations of the 104 time-out T0 (connection establishment).
ExT1Cnt	0..1	CounterTs	Count the expirations of the 104 time-out T1 (PDU).
ExT2Cnt	0..1	CounterTs	Count the expirations of the 104 time-out T2 (ACK).
ExT3Cnt	0..1	CounterTs	Count the expirations of the 104 time-out T3 (TEST).
InDisc	0..1	CounterTs	Number of received PDUs that were discarded.
InErrCnt	0..1	CounterTs	Number of PDUs received that were in error.
InOvCnt	0..1	CounterTs	Number of buffer overflows detected due to incoming communication.
InterPDUTime	0..1	Floating	Time between two consecutives PDUs.
MisPDUCnt	0..1	CounterTs	Provides an attribute that represents the count of missed PDU.
OutErr	0..1	CounterTs	Number of transmission errors.
OutUv	0..1	CounterTs	Number of buffer underflows detected due to outgoing serial communication.
PDURTT	0..1	Floating	PDU round trip time.
PDUSizeFail	0..1	CounterTs	Number of received PDU with wrong size.
PduTampCnt	0..1	CounterTs	Provides an attribute that indicates the count of the number of PDUs that have been detected to be tampered with.
PrimaryInterface	0..1	BooleanValueTs	True if the Protocol is running on primary interface (false when backup interface is in use).
PrivFailCnt	0..1	CounterTs	Number of received PDUs for which action was not taken due to insufficient privilege.
RtxCnt	0..1	CounterTs	Count the number of retransmissions.
RxCritical	0..1	CounterTs	Number of critical requests received (according to IEC TS 62351-5).
RxPdu	0..1	CounterTs	Number of received PDUs (including in error PDUs).
RxSolicitedReq	0..1	CounterTs	Number of solicited requests received. Only for DNP.
RxUnsolicitedReq	0..1	CounterTs	Contains the count of number of unsolicited requests that have been transmitted since the last reset.
SessKeyFailCnt	0..1	CounterTs	Number of session key negotiations that failed.
TxCritical	0..1	CounterTs	Number of critical requests transmitted (according to IEC TS 62351-5)
TxPdu	0..1	CounterTs	Number of transmitted PDUs.
TxSolicitedReq	0..1	CounterTs	Number of solicited requests transmitted. Only for DNP.
TxUnsolicitedReq	0..1	CounterTs	Contains the count of number of unsolicited requests that have been transmitted since the last reset.
UpKeyFailCnt	0..1	CounterTs	Number of update key negotiations that failed.

7.4.3.3 Association

The Association class includes the attributes which define the information about the association between the local device application stack and a remote device application stack. This association can be either a Master or Outstation slave remote device.

Table 51 shows all attributes of Association.

Table 51 – Attributes of IEEE 1815 and IEC 60870-5 Agent::Association

name	mult	type	description
AssociationId	0..1	EntityIndex	Id of the association.
CntRs	0..1	CntRs	Counters reset control object.
LocAddress	0..1	InetAddress	Local address.
LocAddressType	0..1	InetAddressType	Local address type.
ProtID	0..1	ProtIdType	Protocol ID in use.
ProviderDesc	0..1	CharString	Textual description of the provider that is in use.
ProviderName	0..1	CharString	Identity of the provider responding as the outstation for this association.
RemAddress	0..1	InetAddress	Remote address.
RemAddressType	0..1	InetAddressType	Remote address type.
TLnkErrCnt	0..1	CounterTs	Count of communication link errors detected.
TLnkTyp	0..1	LnkType	Type of transport being utilized.
AuthFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
CtrlPrivFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
DecryptFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT0Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT1Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT2Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT3Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InDisc	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InErrCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InOvCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InterPDUTime	0..1	Floating	inherited from: 60870andDNPProtocolInfo
MisPDUCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
OutErr	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
OutUv	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
PDURTT	0..1	Floating	inherited from: 60870andDNPProtocolInfo
PDUSizeFail	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
PduTampCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
PrimaryInterface	0..1	BooleanValueTs	inherited from: 60870andDNPProtocolInfo
PrivFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RtxCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxCritical	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxPdu	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxSolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxUnsolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
SessKeyFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo

name	mult	type	description
TxCritical	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxPdu	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxSolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxUnsolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
UpKeyFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
IEC62351part3	0..1	BooleanValue	inherited from: CommonProtocolInfo
Part3ConnectionId	0..1	Integer	inherited from: CommonProtocolInfo
TCPHndShTime	0..1	Floating	inherited from: CommonProtocolInfo
TLSHndTime	0..1	Floating	inherited from: CommonProtocolInfo
TLSRenegotiationTime	0..1	Floating	inherited from: CommonProtocolInfo
TLSResumptionTime	0..1	Floating	inherited from: CommonProtocolInfo
TotalHndTime	0..1	Floating	inherited from: CommonProtocolInfo
TransportHndTime	0..1	Floating	inherited from: CommonProtocolInfo

7.4.3.4 Summary

The Summary class includes the attributes which define the information about the overall IEC 60870-5-104 or IEEE 1815 DNP application stack running on the device.

Table 52 shows all attributes of Summary.

Table 52 – Attributes of IEEE 1815 and IEC 60870-5 Agent::Summary

name	mult	type	description
CntRs	0..1	CntRs	Counters reset control object.
LastEvent	0..1	EventType	Provides the last known event encountered (security or health).
Master	0..*	MasterAssociation	Client association (when applicable)
Outstation	0..*	OutstationAssociation	Server association (when applicable)
SecurityNotification	0..1	60870andDNPSecurityNotification	Security events notification object
StateNotification	0..1	60870andDNPNotification	State events notification object
AuthFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
CtrlPrivFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
DecryptFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT0Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT1Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT2Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT3Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InDisc	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InErrCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InOvCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InterPDUTime	0..1	Floating	inherited from: 60870andDNPProtocolInfo
MisPDUCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
OutErr	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
OutUv	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
PDURTT	0..1	Floating	inherited from: 60870andDNPProtocolInfo
PDUSizeFail	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
PduTampCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
PrimaryInterface	0..1	BooleanValueTs	inherited from: 60870andDNPProtocolInfo
PrivFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RtxCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxCritical	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxPdu	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxSolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxUnsolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
SessKeyFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxCritical	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxPdu	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxSolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxUnsolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
UpKeyFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo

7.4.3.5 60870andDNPSecurityNotification

The 60870andDNPSecurityNotification class defines the content of the notification message to be sent on event related with the specified objects.

Table 53 shows all attributes of 60870andDNPSecurityNotification.

Table 53 – Attributes of IEEE 1815 and IEC 60870-5 Agent::60870andDNPSecurityNotification

name	mult	type	description
AuthFailCnt	0..1	CounterTs	Count of the number of authorization failures.
CtrlPrivFailCnt	0..1	CounterTs	Number of control actions attempted that did not have the correct privilege.
DecryptFailCnt	0..1	CounterTs	Number PDUs received that could not be decrypted.
LastEvent	0..1	EventType	Provides the last known event encountered (security or health).
PduTampCnt	0..1	CounterTs	Provides an attribute that indicates the count of the number of PDUs that have been detected to be tampered with.
PrivFailCnt	0..1	CounterTs	Number of received PDUs for which action was not taken due to insufficient privilege.
SessKeyFailCnt	0..1	CounterTs	Number of session key negotiations that failed.
UpKeyFailCnt	0..1	CounterTs	Number of update key negotiations that failed.

7.4.3.6 60870andDNPNotification

The 60870andDNPNotification class defines the content of the notification message to be sent on event related with the specified objects.

Table 54 shows all attributes of 60870andDNPNotification.

Table 54 – Attributes of IEEE 1815 and IEC 60870-5 Agent::60870andDNPNotification

name	mult	type	description
InErrCnt	0..1	CounterTs	Number of PDUs received that were in error.
InOvCnt	0..1	CounterTs	Number of buffer overflows detected due to incoming communication.
OutUv	0..1	CounterTs	Number of buffer underflows detected due to outgoing serial communication.
RxPdu	0..1	CounterTs	Number of received PDUs.
TxPdu	0..1	CounterTs	Number of transmitted PDUs.

7.4.3.7 MasterAssociation

The MasterAssociation class defines the contents of the master association.

Table 55 shows all attributes of MasterAssociation.

Table 55 – Attributes of IEEE 1815 and IEC 60870-5 Agent::MasterAssociation

name	mult	type	description
AssociationId	0..1	EntityIndex	inherited from: Association
CntRs	0..1	CntRs	inherited from: Association
LocAddress	0..1	InetAddress	inherited from: Association
LocAddressType	0..1	InetAddressType	inherited from: Association
ProtID	0..1	ProtIdType	inherited from: Association
ProviderDesc	0..1	CharString	inherited from: Association
ProviderName	0..1	CharString	inherited from: Association
RemAddress	0..1	InetAddress	inherited from: Association
RemAddressType	0..1	InetAddressType	inherited from: Association
TLnkErrCnt	0..1	CounterTs	inherited from: Association
TLnkTyp	0..1	LnkType	inherited from: Association
AuthFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
CtrlPrivFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
DecryptFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT0Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT1Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT2Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT3Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InDisc	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InErrCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InOvCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InterPDUTime	0..1	Floating	inherited from: 60870andDNPProtocolInfo
MisPDUCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
OutErr	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
OutUv	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
PDURTT	0..1	Floating	inherited from: 60870andDNPProtocolInfo
PDUSizeFail	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
PduTampCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
PrimaryInterface	0..1	BooleanValueTs	inherited from: 60870andDNPProtocolInfo
PrivFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RtxCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxCritical	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxPdu	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxSolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxUnsolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
SessKeyFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxCritical	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxPdu	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxSolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxUnsolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
UpKeyFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
IEC62351part3	0..1	BooleanValue	inherited from: CommonProtocolInfo

name	mult	type	description
Part3ConnectionId	0..1	Integer	inherited from: CommonProtocolInfo
TCPHndShTime	0..1	Floating	inherited from: CommonProtocolInfo
TLSHndTime	0..1	Floating	inherited from: CommonProtocolInfo
TLSRenegotiationTime	0..1	Floating	inherited from: CommonProtocolInfo
TLSResumptionTime	0..1	Floating	inherited from: CommonProtocolInfo
TotalHndTime	0..1	Floating	inherited from: CommonProtocolInfo
TransportHndTime	0..1	Floating	inherited from: CommonProtocolInfo

7.4.3.8 OutstationAssociation

The OutstationAssociation class defines the contents of the outstation association.

Table 56 shows all attributes of OutstationAssociation.

Table 56 – Attributes of IEEE 1815 and IEC 60870-5 Agent::OutstationAssociation

name	mult	type	description
AssociationId	0..1	EntityIndex	inherited from: Association
CntRs	0..1	CntRs	inherited from: Association
LocAddress	0..1	InetAddress	inherited from: Association
LocAddressType	0..1	InetAddressType	inherited from: Association
ProtID	0..1	ProtIdType	inherited from: Association
ProviderDesc	0..1	CharString	inherited from: Association
ProviderName	0..1	CharString	inherited from: Association
RemAddress	0..1	InetAddress	inherited from: Association
RemAddressType	0..1	InetAddressType	inherited from: Association
TLnkErrCnt	0..1	CounterTs	inherited from: Association
TLnkTyp	0..1	LnkType	inherited from: Association
AuthFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
CtrlPrivFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
DecryptFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT0Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT1Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT2Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
ExT3Cnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InDisc	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InErrCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InOvCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
InterPDUTime	0..1	Floating	inherited from: 60870andDNPProtocolInfo
MisPDUCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
OutErr	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
OutUv	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
PDURTT	0..1	Floating	inherited from: 60870andDNPProtocolInfo
PDUSizeFail	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
PduTampCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo

name	mult	type	description
PrimaryInterface	0..1	BooleanValueTs	inherited from: 60870andDNPProtocolInfo
PrivFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RtxCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxCritical	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxPdu	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxSolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
RxUnsolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
SessKeyFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxCritical	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxPdu	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxSolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
TxUnsolicitedReq	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
UpKeyFailCnt	0..1	CounterTs	inherited from: 60870andDNPProtocolInfo
IEC62351part3	0..1	BooleanValue	inherited from: CommonProtocolInfo
Part3ConnectionId	0..1	Integer	inherited from: CommonProtocolInfo
TCPHndShTime	0..1	Floating	inherited from: CommonProtocolInfo
TLSHndTime	0..1	Floating	inherited from: CommonProtocolInfo
TLSRenegotiationTime	0..1	Floating	inherited from: CommonProtocolInfo
TLSResumptionTime	0..1	Floating	inherited from: CommonProtocolInfo
TotalHndTime	0..1	Floating	inherited from: CommonProtocolInfo
TransportHndTime	0..1	Floating	inherited from: CommonProtocolInfo

7.4.4 Package IEC61850 Agent

7.4.4.1 General

The IEC 61850 Agent package includes the collection of IEC 61850 protocols monitoring information. It is structured into the following sub-packages:

– ACSI (Abstract communication service interface)
– MMS (Manufacturing Message Specification)
– SV (Sampled Value)
– GSE (Generic Substation Events).

7.4.4.2 Package ACSI

7.4.4.2.1 General

As shown in Figure 20, the ACSI package includes the IEC 61850 Abstract Communication Service Interface (ACSI) classes.

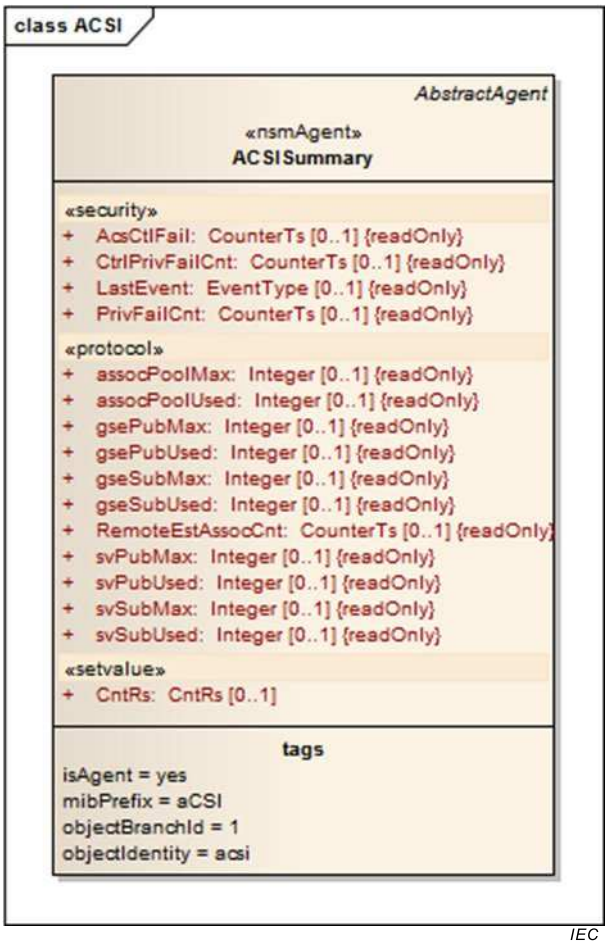


Figure 20 – Class diagram ACSI::ACSI

7.4.4.2.2 ACSISummary

The ACSISummary class includes the attributes which define the information about the overall IEC 61850 stack running on the device ACSI.

Table 57 shows all attributes of ACSISummary.

Table 57 – Attributes of ACSI::ACSISummary

name	mult	type	description
assocPoolMax	0..1	Integer	Maximum number of client/server associations.
assocPoolUsed	0..1	Integer	Number of client/server associations active.
CntRs	0..1	CntRs	Counters reset control object.
CtrlPrivFailCnt	0..1	CounterTs	Number of control actions attempted that did not have the correct privilege.
gsePubMax	0..1	Integer	Maximum number GSE Publications supported.
gsePubUsed	0..1	Integer	Number of active GSE Publications.
gseSubMax	0..1	Integer	Maximum number of GSE Subscriptions.
gseSubUsed	0..1	Integer	Number of active GSE Subscriptions.
LastEvent	0..1	EventType	Provides the last known event encountered.
PrivFailCnt	0..1	CounterTs	Number of received PDUs for which action was not taken due to insufficient privilege.
RemoteEstAssocCnt	0..1	CounterTs	Count of the number of currently active associations that were established through the ACSI associate response.
AcsCtlFail	0..1	CounterTs	Number of access control failures detected (i.e., when a data object that the client wanted to access exists in the server, but based on the access view of the association with that client, an access to the data object was refused).
svPubMax	0..1	Integer	Maximum number SV publications supported.
svPubUsed	0..1	Integer	Number of active SV publications.
svSubMax	0..1	Integer	Maximum number SV subscriptions supported.
svSubUsed	0..1	Integer	Number of active SV subscriptions.

7.4.4.3 Package MMS

7.4.4.3.1 General

As shown in Figure 21, the MMS package includes the IEC 61850 Manufacturing Message Specification (MMS) classes. MMS Provider and MMS Association inherit both Security and Protocol Info attributes from the more general classes.

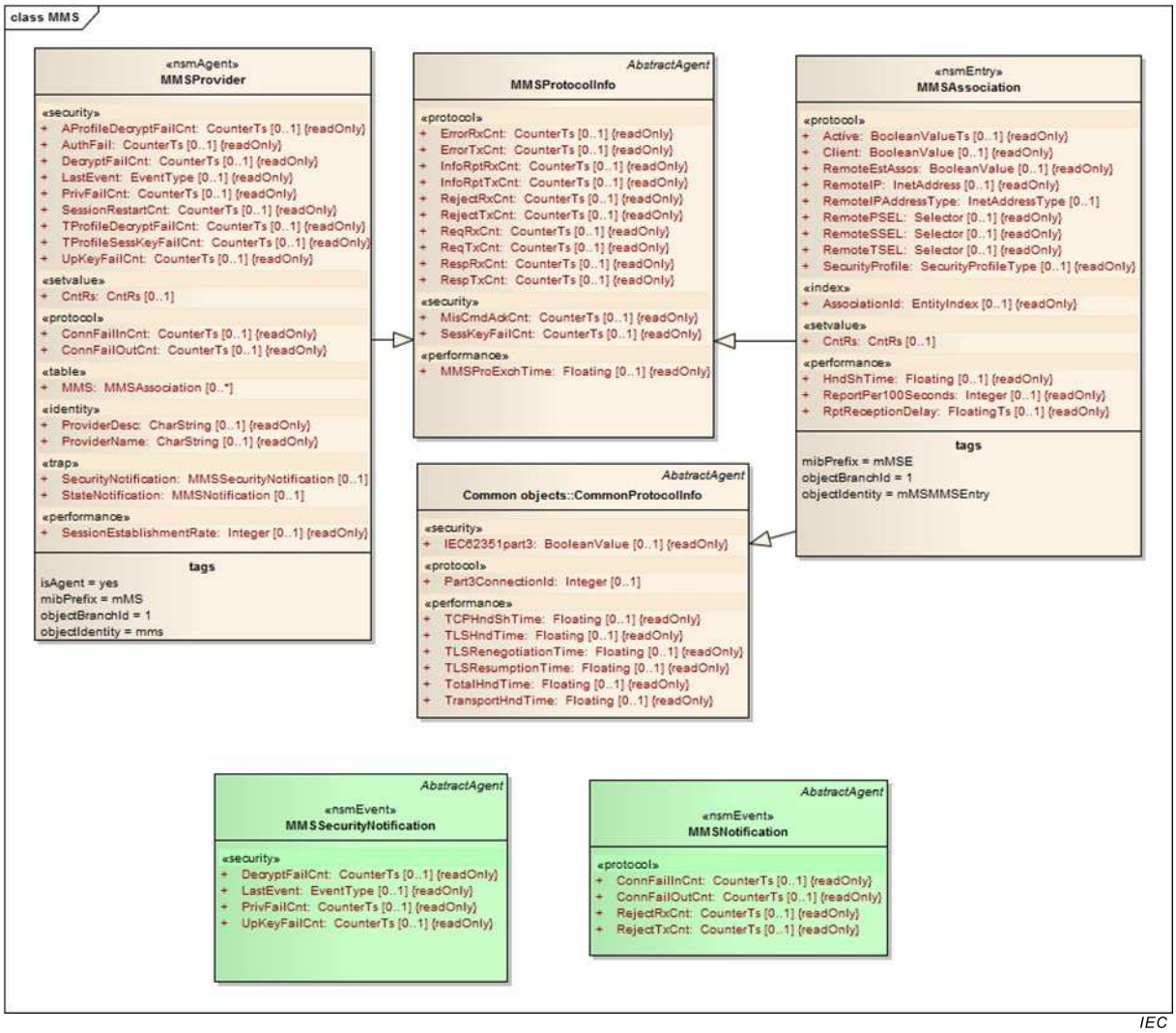


Figure 21 – Class diagram MMS::MMS

7.4.4.3.2 MMSProtocolInfo

The MMSProtocolInfo class contains the specific IEC 61850 MMS Provider attributes for application protocol health information collection.

Table 58 shows all attributes of MMSProtocolInfo.

Table 58 – Attributes of MMS::MMSProtocolInfo

name	mult	type	description
ErrorRxCnt	0..1	CounterTs	Number of error PDUs that have been received including: – Confirmed-ErrorPDU (only for client) – Cancel-ErrorPDU (only for client) – Initiate-ErrorPDU – Conclude-ErrorPDU.
ErrorTxCnt	0..1	CounterTs	Number of error PDUs that have been sent including: – Confirmed-ErrorPDU (only for server) – Cancel-ErrorPDU (only for server) – Initiate-ErrorPDU – Conclude-ErrorPDU.
InfoRptRxCnt	0..1	CounterTs	Number of MMS Information Reports that have been received.
InfoRptTxCnt	0..1	CounterTs	Number of MMS Information Reports that have been sent.
MisCmdAckCnt	0..1	CounterTs	Provides an attribute that indicates the count of the number of MMS request that have not been acknowledged.
MMSProExchTime	0..1	Floating	MMS Profile exchange duration (seconds). MMS profile is meant as Logical Devices, Logical Nodes and Dataset definition are exchanged.
RejectRxCnt	0..1	CounterTs	Number of RejectPDUs received.
RejectTxCnt	0..1	CounterTs	Number of RejectPDUs sent.
ReqRxCnt	0..1	CounterTs	Number of request PDUs that have been received including: – Confirmed-RequestPDU (only for server) – Cancel-RequestPDU (only for server) – Initiate-RequestPDU – Conclude-RequestPDU.
ReqTxCnt	0..1	CounterTs	Number of request PDUs that have been sent including: – Confirmed-RequestPDU (only for client) – Cancel-RequestPDU (only for client) – Initiate-RequestPDU – Conclude-RequestPDU.
RespRxCnt	0..1	CounterTs	Number of response PDUs that have been received including: – Confirmed-ResponsePDU (only for client) – Cancel-ResponsePDU (only for client) – Initiate-ResponsePDU – Conclude-ResponsePDU.
RespTxCnt	0..1	CounterTs	Number of response PDUs that have been sent including: – Confirmed-ResponsePDU (only for server) – Cancel-ResponsePDU (only for server) – Initiate-ResponsePDU – Conclude-ResponsePDU..
SessKeyFailCnt	0..1	CounterTs	Number of session key negotiations that failed.

7.4.4.3.3 MMSProvider

The MMSProvider class includes the attributes which define the information about the overall IEC 61850 stack MMS provider running on the device.

Table 59 shows all attributes of MMSProvider.

Table 59 – Attributes of MMS::MMSProvider

name	mult	type	description
AProfileDecryptFailCnt	0..1	CounterTs	Number of PDUs received that could not be decrypted within A-Profile session.
AuthFail	0..1	CounterTs	Count of the number of authorization failures.
CntRs	0..1	CntRs	Counters reset control object.
ConnFailInCnt	0..1	CounterTs	Number of incoming Initiate-requests that have been refused.
ConnFailOutCnt	0..1	CounterTs	Number of outgoing Initiate-requests that have been refused.
DecryptFailCnt	0..1	CounterTs	Number PDUs received that could not be decrypted.
LastEvent	0..1	EventType	Provides the last known event encountered.
MMS	0..*	MMSAssociation	Provides a table through which more detailed MMS information can be obtained for each connection.
PrivFailCnt	0..1	CounterTs	Number of received PDUs for which action was not taken due to insufficient privilege.
ProviderDesc	0..1	CharString	Description of provider.
ProviderName	0..1	CharString	Name of the provider.
SecurityNotification	0..1	MMSSecurityNotification	Security events notification object.
SessionEstablishmentRate	0..1	Integer	The number of times any Association has been restablished after a disconnection within 15 minutes.
SessionRestartCnt	0..1	CounterTs	Provides an attribute that indicates the count of the number of times the session has been restablished.
StateNotification	0..1	MMSNotification	State events notification object.
TProfileDecryptFailCnt	0..1	CounterTs	Number PDUs received that could not be decrypted within T-Profile session.
TProfileSessKeyFailCnt	0..1	CounterTs	Number of session key negotiations that failed. This applies only to T-Profile.
UpKeyFailCnt	0..1	CounterTs	Number of update key negotiations that failed.
ErrorRxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
ErrorTxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
InfoRptRxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
InfoRptTxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
MisCmdAckCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
MMSProExchTime	0..1	Floating	inherited from: MMSProtocolInfo
RejectRxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
RejectTxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
ReqRxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
ReqTxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
RespRxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
RespTxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
SessKeyFailCnt	0..1	CounterTs	inherited from: MMSProtocolInfo

7.4.4.3.4 MMSAssociation

The MMSAssociation class includes the attributes which define the information about the MMS association between the local device application stack and a remote device application stack.

Table 60 shows all attributes of MMSAssociation.

Table 60 – Attributes of MMS::MMSAssociation

name	mult	type	description
Active	0..1	BooleanValueTs	True if association is in use.
AssociationId	0..1	EntityIndex	Id of the association.
Client	0..1	BooleanValue	True if role is client, false if role is server
CntRs	0..1	CntRs	Counters reset control object.
HndShTime	0..1	Floating	Duration of the MMS session handshake.
RemoteEstAssos	0..1	BooleanValue	True if the association was established due to an incoming Initiate-Request.
RemoteIP	0..1	InetAddress	Remote entity network address.
RemoteIPAddressType	0..1	InetAddressType	Type of IP address in use.
RemotePSEL	0..1	Selector	Remote entity presentation selector.
RemoteSSEL	0..1	Selector	Remote entity session selector.
RemoteTSEL	0..1	Selector	Remote entity transport selector.
ReportPer100Seconds	0..1	Integer	Number of Reports received/transmitted during the last 100 seconds.
RptReceptionDelay	0..1	FloatingTs	The time required to receive the last Report. This time is the difference between the reception time and the emission timestamp stored inside the report. If not synchronized this value shall be set to -1.
SecurityProfile	0..1	SecurityProfileType	This is the security profile in use for this association (no security, integrity A profile, A+, AE+).
ErrorRxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
ErrorTxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
InfoRptRxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
InfoRptTxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
MisCmdAckCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
MMSProExchTime	0..1	Floating	inherited from: MMSProtocolInfo
RejectRxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
RejectTxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
ReqRxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
ReqTxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
RespRxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
RespTxCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
SessKeyFailCnt	0..1	CounterTs	inherited from: MMSProtocolInfo
IEC62351part3	0..1	BooleanValue	inherited from: CommonProtocolInfo
Part3ConnectionId	0..1	Integer	inherited from: CommonProtocolInfo
TCPHndShTime	0..1	Floating	inherited from: CommonProtocolInfo
TLSHndTime	0..1	Floating	inherited from: CommonProtocolInfo
TLSRenegotiationTime	0..1	Floating	inherited from: CommonProtocolInfo

name	mult	type	description
TLSResumptionTime	0..1	Floating	inherited from: CommonProtocolInfo
TotalHndTime	0..1	Floating	inherited from: CommonProtocolInfo
TransportHndTime	0..1	Floating	inherited from: CommonProtocolInfo

7.4.4.3.5 MMSSecurityNotification

The MMSSecurityNotification class defines the content of the notification message to be sent on event related with the specified objects.

Table 61 shows all attributes of MMSSecurityNotification.

Table 61 – Attributes of MMS::MMSSecurityNotification

name	mult	type	description
DecryptFailCnt	0..1	CounterTs	Number of PDUs received that could not be decrypted.
LastEvent	0..1	EventType	Provides the last known event encountered.
PrivFailCnt	0..1	CounterTs	Number of received PDUs for which action was not taken due to insufficient privilege.
UpKeyFailCnt	0..1	CounterTs	Number of update key negotiations that failed.

7.4.4.3.6 MMSNotification

The MMSNotification class defines the content of the notification message to be sent on event related with the specified objects.

Table 62 shows all attributes of MMSNotification.

Table 62 – Attributes of MMS::MMSNotification

name	mult	type	description
ConnFailInCnt	0..1	CounterTs	Number of incoming Initiate-requests that have been refused.
ConnFailOutCnt	0..1	CounterTs	Number of outgoing Initiate-requests that have been refused.
RejectRxCnt	0..1	CounterTs	Number of reject issued in reception.
RejectTxCnt	0..1	CounterTs	Number of received Reject on transmission.

7.4.4.4 Package SV and GSE common objects

7.4.4.4.1 General

As shown in Figure 22, the SV and GSE common objects package includes the IEC 61850 Sampled Value (SV) and Generic Substation Events (GSE) common classes.

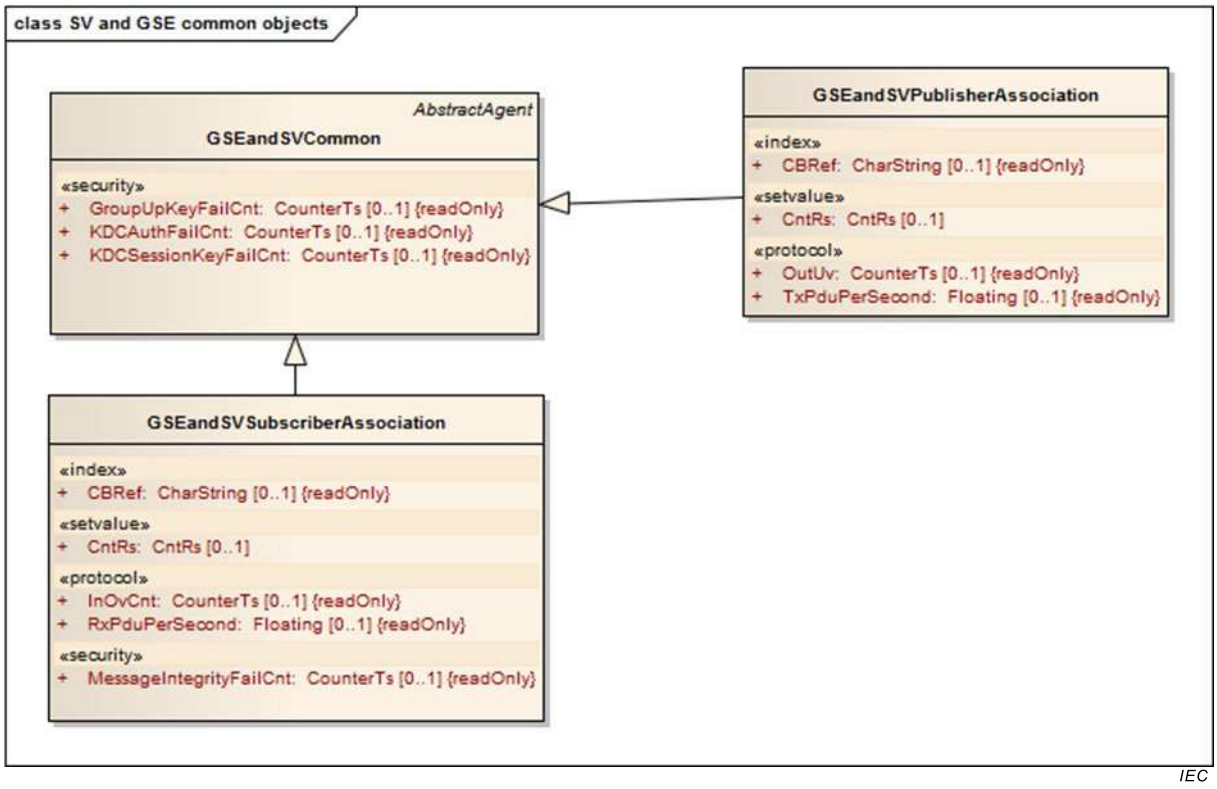


Figure 22 – Class diagram SV and GSE common objects::SV and GSE common objects

7.4.4.4.2 GSEandSVCommon

The GSEandSVCommon class includes the attributes which define the common information about the GSE and SV association.

Table 63 shows all attributes of GSEandSVCommon.

Table 63 – Attributes of SV and GSE common objects::GSEandSVCommon

name	mult	type	description
GroupUpKeyFailCnt	0..1	CounterTs	Number of update key negotiations at KDC that failed.
KDCAuthFailCnt	0..1	CounterTs	Count of the number of authorization failures against KDC.
KDCSessionKeyFailCnt	0..1	CounterTs	Session Key establishment between peer and KDC failed.

7.4.4.4.3 GSEandSVPublisherAssociation

The GSEandSVPublisherAssociation class includes the common attributes which define the common information about the GSE and SV publisher association.

Table 64 shows all attributes of GSEandSVPublisherAssociation.

Table 64 – Attributes of SV and GSE common objects::GSEandSVPublisherAssociation

name	mult	type	description
CBRef	0..1	CharString	Reference of the GSE/SV Control block being supervised.
CntRs	0..1	CntRs	Counters reset control object.
OutUv	0..1	CounterTs	Number of buffer underflows detected due to outgoing serial communication.
TxPduPerSecond	0..1	Floating	Count of the number of SV telegrams sent within a second on the association.
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.4.4 GSEandSVSubscriberAssociation

The GSEandSVSubscriberAssociation class includes the attributes which define the common information about the GSE and SV subscriber association.

Table 65 shows all attributes of GSEandSVSubscriberAssociation.

Table 65 – Attributes of SV and GSE common objects::GSEandSVSubscriberAssociation

name	mult	type	description
CBRef	0..1	CharString	Reference of the GSE/SV Control block being supervised.
CntRs	0..1	CntRs	Counters reset control object.
InOvCnt	0..1	CounterTs	Number of buffer overflows detected due to incoming communication. This counter is incremented each time the buffer space is insufficient to receive an incoming message.
MessageIntegrityFailCnt	0..1	CounterTs	Number messages that were not using the proper Group Key.
RxPduPerSecond	0..1	Floating	Count of the number of SV telegrams received within a second on the association.
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.5 Package SV

7.4.4.5.1 General

As shown in Figure 23, the SV package includes the IEC 61850 Sampled Value (SV) classes. SVProvider and SVAssociation inherit both Security and Protocol Info attributes from the more general classes.

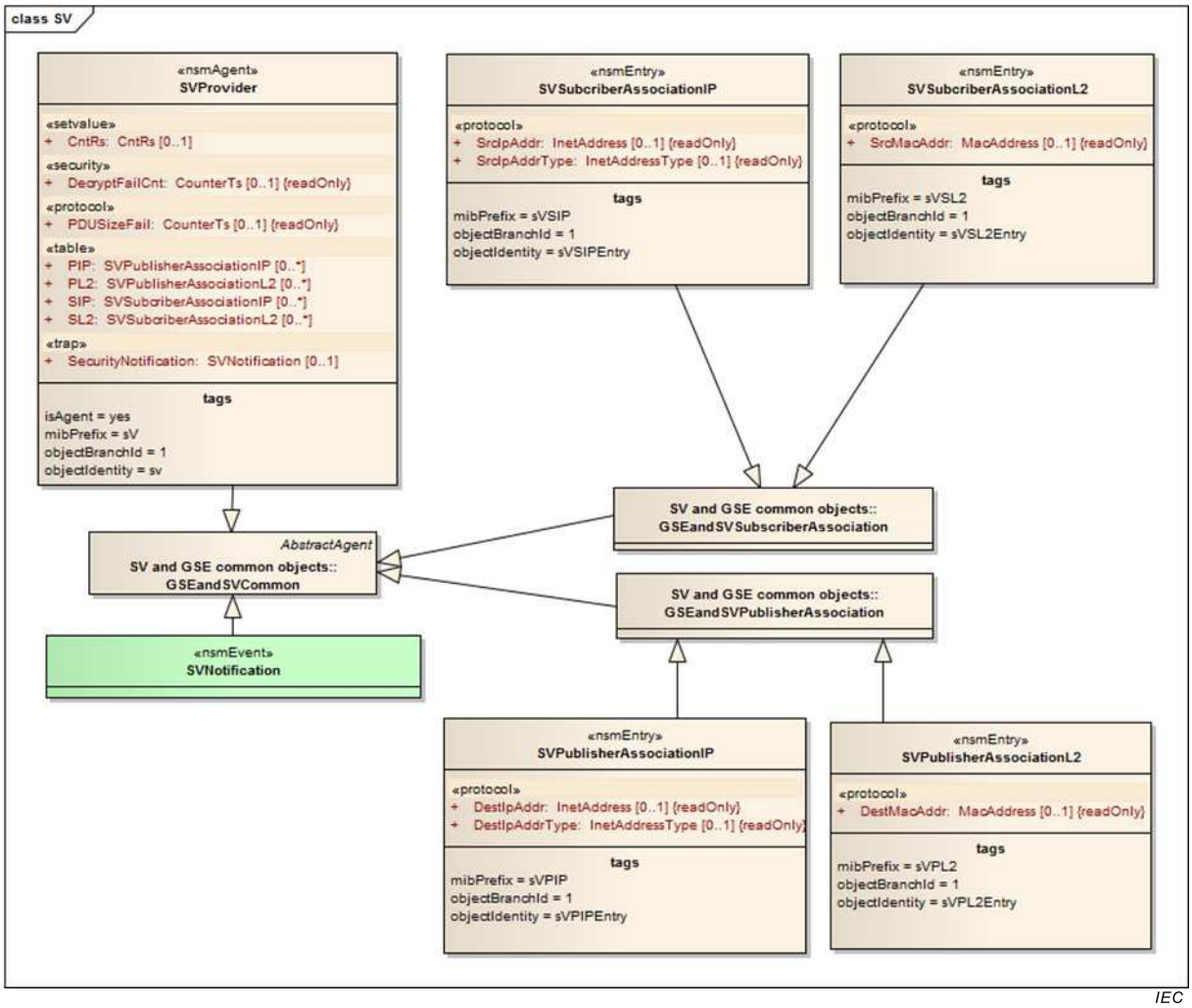


Figure 23 – Class diagram SV::SV

7.4.4.5.2 SVProvider

The SVProvider class includes the attributes which define the information about the overall IEC 61850 stack SV provider running on the device.

Table 66 shows all attributes of SVProvider.

Table 66 – Attributes of SV::SVProvider

name	mult	type	description
CntRs	0..1	CntRs	Counters reset control object.
DecryptFailCnt	0..1	CounterTs	Number of PDUs received that could not be decrypted
PDUSizeFail	0..1	CounterTs	Number of received PDU with wrong size. This is meaningful only for IP telegrams.
PIP	0..*	SVPublisherAssociationIP	Provides a table through which more detailed SV information can be obtained for each IP publisher connection.
PL2	0..*	SVPublisherAssociationL2	Provides a table through which more detailed SV information can be obtained for each L2 (Ethernet) publisher connection.
SecurityNotification	0..1	SVNotification	Security events notification object.
SIP	0..*	SVSubcriberAssociationIP	Provides a table through which more detailed SV information can be obtained for each IP subscriber connection.
SL2	0..*	SVSubcriberAssociationL2	Provides a table through which more detailed SV information can be obtained for each L2 (Ethernet) subscriber connection.
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.5.3 SVPublisherAssociationIP

The SVPublisherAssociationIP class includes the attributes which define the information about the association between the local device application stack and a remote device application stack. This class is used for the IP associations with publisher role.

Table 67 shows all attributes of SVPublisherAssociationIP.

Table 67 – Attributes of SV::SVPublisherAssociationIP

name	mult	type	description
DestIpAddr	0..1	InetAddress	Destination IP address.
DestIpAddrType	0..1	InetAddressType	Type of IP address in use.
CBRef	0..1	CharString	inherited from: GSEandSVPublisherAssociation
CntRs	0..1	CntRs	inherited from: GSEandSVPublisherAssociation
OutUv	0..1	CounterTs	inherited from: GSEandSVPublisherAssociation
TxPduPerSecond	0..1	Floating	inherited from: GSEandSVPublisherAssociation
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.5.4 SVPublisherAssociationL2

The SVPublisherAssociationL2 class includes the attributes which define the information about the association between the local device application stack and a remote device application stack. This class is used for L2 (ethernet) associations with publisher role.

Table 68 shows all attributes of SVPublisherAssociationL2.

Table 68 – Attributes of SV::SVPublisherAssociationL2

name	mult	type	description
DestMacAddr	0..1	MacAddress	MAC Address. Will be a zero value if IP profile is in use for the association.
CBRef	0..1	CharString	inherited from: GSEandSVPublisherAssociation
CntRs	0..1	CntRs	inherited from: GSEandSVPublisherAssociation
OutUv	0..1	CounterTs	inherited from: GSEandSVPublisherAssociation
TxPduPerSecond	0..1	Floating	inherited from: GSEandSVPublisherAssociation
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.5.5 SVSubcriberAssociationIP

The SVSubcriberAssociationIP class includes the attributes which define the information about the association between the local device application stack and a remote device application stack. This class is used for the IP associations with subscriber role.

Table 69 shows all attributes of SVSubcriberAssociationIP.

Table 69 – Attributes of SV::SVSubcriberAssociationIP

name	mult	type	description
SrcIpAddr	0..1	InetAddress	Source IP address.
SrcIpAddrType	0..1	InetAddressType	Type of IP address in use.
CBRef	0..1	CharString	inherited from: GSEandSVSubscriberAssociation
CntRs	0..1	CntRs	inherited from: GSEandSVSubscriberAssociation
InOvCnt	0..1	CounterTs	inherited from: GSEandSVSubscriberAssociation
MessageIntegrityFailCnt	0..1	CounterTs	inherited from: GSEandSVSubscriberAssociation
RxPduPerSecond	0..1	Floating	inherited from: GSEandSVSubscriberAssociation
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.5.6 SVSubcriberAssociationL2

The SVSubcriberAssociationL2 class includes the attributes which define the information about the association between the local device application stack and a remote device application stack. This class is used for L2 (Ethernet) associations with subscriber role.

Table 70 shows all attributes of SVSubcriberAssociationL2.

Table 70 – Attributes of SV::SVSubcriberAssociationL2

name	mult	type	description
SrcMacAddr	0..1	MacAddress	MAC Address. Will be a zero value if IP profile is in use for the association.
CBRef	0..1	CharString	inherited from: GSEandSVSubscriberAssociation
CntRs	0..1	CntRs	inherited from: GSEandSVSubscriberAssociation
InOvCnt	0..1	CounterTs	inherited from: GSEandSVSubscriberAssociation
MessageIntegrityFailCnt	0..1	CounterTs	inherited from: GSEandSVSubscriberAssociation
RxPduPerSecond	0..1	Floating	inherited from: GSEandSVSubscriberAssociation
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.5.7 SVNotification

The SVNotification class defines the content of the notification message to be sent on event related with the specified objects.

Table 71 shows all attributes of SVNotification.

Table 71 – Attributes of SV::SVNotification

name	mult	type	description
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.6 Package GSE

7.4.4.6.1 General

As shown in Figure 24, the GSE package includes the IEC 61850 Generic Substation Events (GSE) classes. GSEprovider and GSEAssociation inherit both Security and Protocol Info attributes from the more general classes.

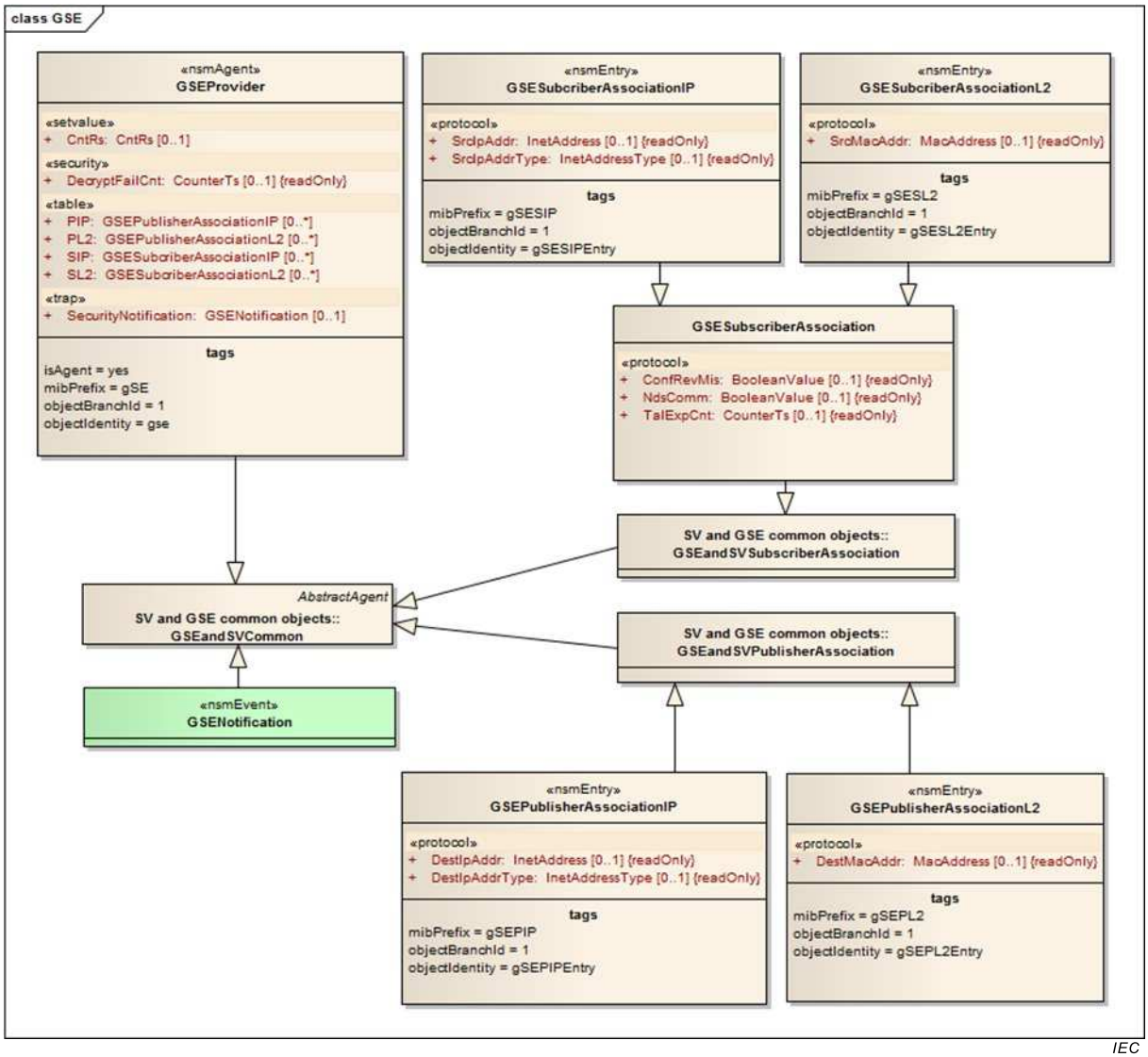


Figure 24 – Class diagram GSE::GSE

7.4.4.6.2 GSESubscriberAssociation

The GSESubscriberAssociation class includes the attributes which define the information about the GSE subscriber association.

Table 72 shows all attributes of GSESubscriberAssociation.

Table 72 – Attributes of GSE::GSESubscriberAssociation

name	mult	type	description
ConfRevMis	0..1	BooleanValue	True indicates that the expected configuration revision did not match the received number.
NdsComm	0..1	BooleanValue	If true, the subscription needs commissioning, i.e., the received message does not conform to the current subscription configuration (either the 'dataSetRef' is wrong, the data set members, the configuration revision number, or no subscription is configured at all).
TalExpCnt	0..1	CounterTs	Count of the received TAL expirations that have been detected.
CBRef	0..1	CharString	inherited from: GSEandSVSubscriberAssociation
CntRs	0..1	CntRs	inherited from: GSEandSVSubscriberAssociation
InOvCnt	0..1	CounterTs	inherited from: GSEandSVSubscriberAssociation
MessageIntegrityFailCnt	0..1	CounterTs	inherited from: GSEandSVSubscriberAssociation
RxPduPerSecond	0..1	Floating	inherited from: GSEandSVSubscriberAssociation
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.6.3 GSEProvider

The GSEProvider class includes the attributes which define the information about the overall IEC 61850 stack GSE provider running on the device.

Table 73 shows all attributes of GSEProvider.

Table 73 – Attributes of GSE::GSEProvider

name	mult	type	description
CntRs	0..1	CntRs	Counters reset control object.
DecryptFailCnt	0..1	CounterTs	Number of PDUs received that could not be decrypted
InErrCnt	0..1	CounterTs	Number of PDUs received that were in error due to malformed content, parity errors or configuration mismatch.
InUnexpectedMulticast	0..1	CounterTs	Count of unexpected multicast received PDUs.
PIP	0..*	GSEPublisherAssociationIP	Provides a table through which more detailed GSE information can be obtained for each IP publisher connection.
PL2	0..*	GSEPublisherAssociationL2	Provides a table through which more detailed GSE information can be obtained for each L2 (Ethernet) publisher connection.
SecurityNotification	0..1	GSENotification	Security events notification object.
SIP	0..*	GSESubcriberAssociationIP	Provides a table through which more detailed GSE information can be obtained for each IP

name	mult	type	description
			subscriber connection.
SL2	0..*	GSESubcriberAssociationL2	Provides a table through which more detailed GSE information can be obtained for each L2 (Ethernet) subscriber connection.
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.6.4 GSEPublisherAssociationIP

The GSEPublisherAssociationIP class includes the attributes which define the information about the association between the local device application stack and a remote device application stack. This class is used for the IP associations with publisher role.

Table 74 shows all attributes of GSEPublisherAssociationIP.

Table 74 – Attributes of GSE::GSEPublisherAssociationIP

name	mult	type	description
DestIpAddr	0..1	InetAddress	Destination IP address.
DestIpAddrType	0..1	InetAddressType	Type of IP address in use.
CBRef	0..1	CharString	inherited from: GSEandSVPublisherAssociation
CntRs	0..1	CntRs	inherited from: GSEandSVPublisherAssociation
OutUv	0..1	CounterTs	inherited from: GSEandSVPublisherAssociation
TxPduPerSecond	0..1	Floating	inherited from: GSEandSVPublisherAssociation
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.6.5 GSEPublisherAssociationL2

The GSEPublisherAssociationL2 class includes the attributes which define the information about the association between the local device application stack and a remote device application stack. This class is used for L2 (ethernet) associations with publisher role.

Table 75 shows all attributes of GSEPublisherAssociationL2.

Table 75 – Attributes of GSE::GSEPublisherAssociationL2

name	mult	type	description
DestMacAddr	0..1	MacAddress	MAC Address. Will be a zero value if IP profile is in use for the association.
CBRef	0..1	CharString	inherited from: GSEandSVPublisherAssociation
CntRs	0..1	CntRs	inherited from: GSEandSVPublisherAssociation
OutUv	0..1	CounterTs	inherited from: GSEandSVPublisherAssociation
TxPduPerSecond	0..1	Floating	inherited from: GSEandSVPublisherAssociation
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.6.6 GSESubscriberAssociationIP

The GSESubcriberAssociationIP class includes the attributes which define the information about the association between the local device application stack and a remote device application stack. This class is used for the IP associations with subscriber role.

Table 76 shows all attributes of GSESubcriberAssociationIP.

Table 76 – Attributes of GSE::GSESubcriberAssociationIP

name	mult	type	description
SrcIpAddr	0..1	InetAddress	Source IP address. .
SrcIpAddrType	0..1	InetAddressType	Type of IP address in use.
ConfRevMis	0..1	BooleanValue	inherited from: GSESubscriberAssociation
NdsComm	0..1	BooleanValue	inherited from: GSESubscriberAssociation
TalExpCnt	0..1	CounterTs	inherited from: GSESubscriberAssociation
CBRef	0..1	CharString	inherited from: GSEandSVSubscriberAssociation
CntRs	0..1	CntRs	inherited from: GSEandSVSubscriberAssociation
InOvCnt	0..1	CounterTs	inherited from: GSEandSVSubscriberAssociation
MessageIntegrityFailCnt	0..1	CounterTs	inherited from: GSEandSVSubscriberAssociation
RxPduPerSecond	0..1	Floating	inherited from: GSEandSVSubscriberAssociation
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.6.7 GSESubcriberAssociationL2

The GSESubcriberAssociationL2 class includes the attributes which define the information about the association between the local device application stack and a remote device application stack. This class is used for L2 (Ethernet) associations with subscriber role.

Table 77 shows all attributes of GSESubcriberAssociationL2.

Table 77 – Attributes of GSE::GSESubscriberAssociationL2

name	mult	type	description
SrcMacAddr	0..1	MacAddress	MAC Address. Will be a zero value if IP Profile is in use for the association.
ConfRevMis	0..1	BooleanValue	inherited from: GSESubscriberAssociation
NdsComm	0..1	BooleanValue	inherited from: GSESubscriberAssociation
TalExpCnt	0..1	CounterTs	inherited from: GSESubscriberAssociation
CBRef	0..1	CharString	inherited from: GSEandSVSubscriberAssociation
CntRs	0..1	CntRs	inherited from: GSEandSVSubscriberAssociation
InOvCnt	0..1	CounterTs	inherited from: GSEandSVSubscriberAssociation
MessageIntegrityFailCnt	0..1	CounterTs	inherited from: GSEandSVSubscriberAssociation
RxPduPerSecond	0..1	Floating	inherited from: GSEandSVSubscriberAssociation
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.4.4.6.8 GSENotification

The GSENotification class defines the content of the notification message to be sent on event related with the specified objects.

Table 78 shows all attributes of GSENotification.

Table 78 – Attributes of GSE::GSENotification

name	mult	type	description
GroupUpKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCAuthFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon
KDCSessionKeyFailCnt	0..1	CounterTs	inherited from: GSEandSVCommon

7.5 Package Interfaces Agent

7.5.1 General

As shown in Figure 25, the Interfaces Agent package contains the object descriptions to be provided in order to monitor the IED Interfaces state and behaviour.

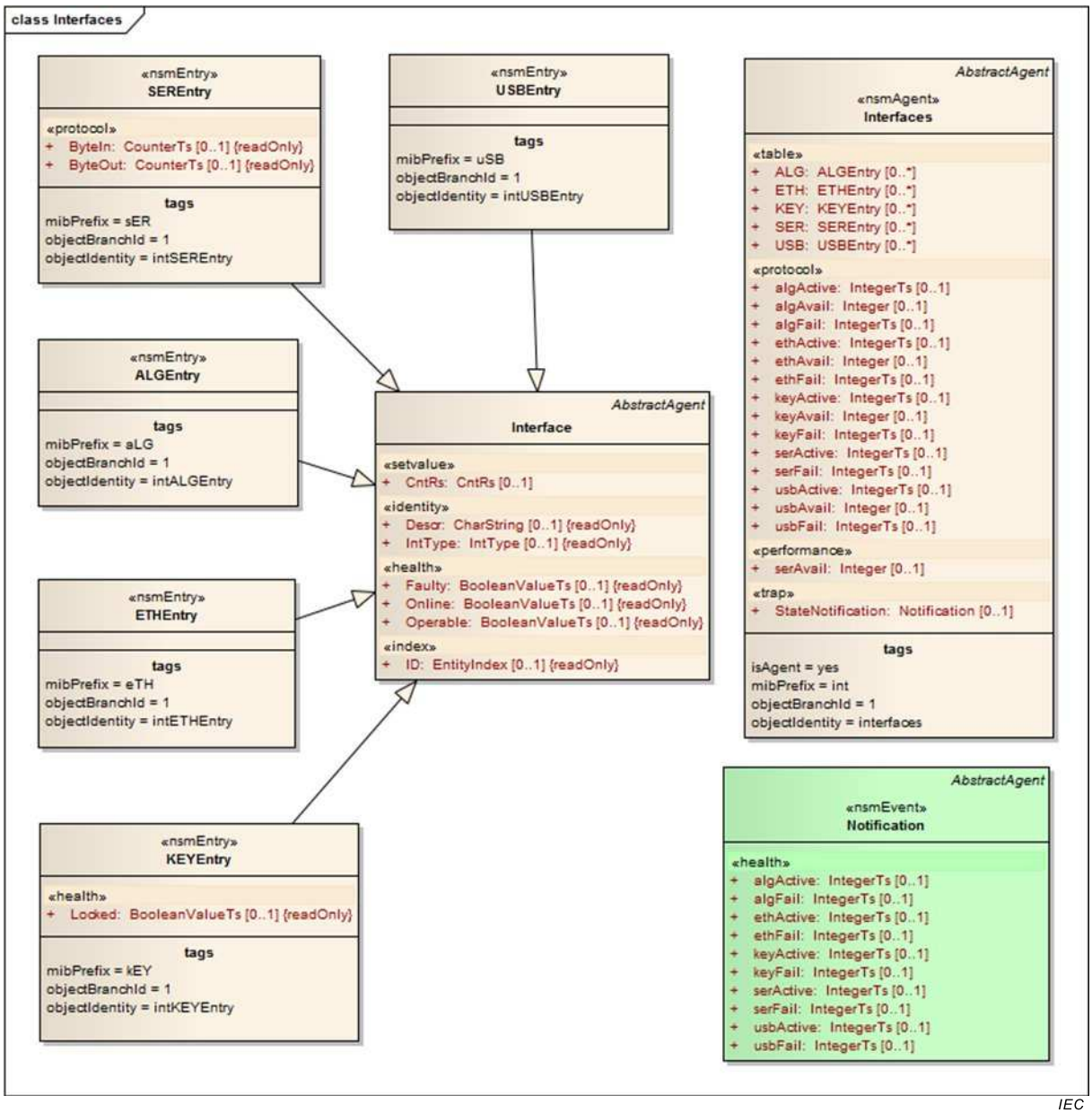


Figure 25 – Class diagram Interfaces Agent::Interfaces

7.5.2 Interface

The Interface class contains the information regarding the common attributes for the device interfaces.

Table 79 shows all attributes of Interface.

Table 79 – Attributes of Interfaces Agent::Interface

name	mult	type	description
ID	0..1	EntityIndex	Interface number
Descr	0..1	CharString	Description of the CPU.
IntType	0..1	IntType	Interface type (Wired or Wireless)
Operable	0..1	BooleanValueTs	Indicates that CPU is operable (it can be either online or offline)
Online	0..1	BooleanValueTs	Indicate that CPU is online and active
Faulty	0..1	BooleanValueTs	CPU generated errors
CntRs	0..1	CntRs	Counters reset control object.

7.5.3 Interfaces

The Interfaces class is a set of objects that includes the hardware interfaces of the device.

Table 80 shows all attributes of Interfaces.

Table 80 – Attributes of Interfaces Agent::Interfaces

name	mult	type	description
serAvail	0..1	Integer	Number of serial interfaces installed on the device
serActive	0..1	IntegerTs	Number of serial interfaces active on the device
serFail	0..1	IntegerTs	Number of failing serial Interfaces on the device
ethAvail	0..1	Integer	Number of ethernet Interfaces installed on the device
ethActive	0..1	IntegerTs	Number of ethernet interfaces active on the device
ethFail	0..1	IntegerTs	Number of failing ethernet interfaces on the device
algAvail	0..1	Integer	Number of analogue Interfaces installed on the device
algActive	0..1	IntegerTs	Number of analogue interfaces Active on the device
algFail	0..1	IntegerTs	Number of failing analogue interfaces on the device
keyAvail	0..1	Integer	Number of keyboard Interface installed on the device
keyActive	0..1	IntegerTs	Number of keyboard interface active on the device
keyFail	0..1	IntegerTs	Number of failing keyboard interface on the device
usbAvail	0..1	Integer	Number of Universal Serial Bus Interface installed on the device
usbActive	0..1	IntegerTs	Number of Universal Serial Bus interface active on the device
usbFail	0..1	IntegerTs	Number of failing Universal Serial Bus interface on the device
SER	0..*	SEREntry	This entry defer to possible multiple instances of serial interfaces inside the IED
ETH	0..*	ETHEntry	This entry defer to possible multiple instances of Ethernet interfaces inside the IED
USB	0..*	USBEntry	This entry defer to possible multiple instances of USB interfaces inside the IED
KEY	0..*	KEYEntry	This entry defer to possible multiple instances of keyboard interfaces inside the IED
ALG	0..*	ALGEntry	This entry defer to possible multiple instances of analogue interfaces inside the IED
StateNotification	0..1	Notification	State events notification object

7.5.4 ETHEntry

The ETHEntry class contains the information regarding the Ethernet interface instance.

Table 81 shows all attributes of ETHEntry.

Table 81 – Attributes of Interfaces Agent::ETHEntry

name	mult	type	description
ID	0..1	EntityIndex	inherited from: Interface
Descr	0..1	CharString	inherited from: Interface
IntType	0..1	IntType	inherited from: Interface
Operable	0..1	BooleanValueTs	inherited from: Interface
Online	0..1	BooleanValueTs	inherited from: Interface
Faulty	0..1	BooleanValueTs	inherited from: Interface
CntRs	0..1	CntRs	inherited from: Interface

7.5.5 KEYEntry

The KEYEntry class contains the information regarding the specific keyboard entry status.

Table 82 shows all attributes of KEYEntry.

Table 82 – Attributes of Interfaces Agent::KEYEntry

name	mult	type	description
Locked	0..1	BooleanValueTs	Indicate a locked status for the device keyboard
ID	0..1	EntityIndex	inherited from: Interface
Descr	0..1	CharString	inherited from: Interface
IntType	0..1	IntType	inherited from: Interface
Operable	0..1	BooleanValueTs	inherited from: Interface
Online	0..1	BooleanValueTs	inherited from: Interface
Faulty	0..1	BooleanValueTs	inherited from: Interface
CntRs	0..1	CntRs	inherited from: Interface

7.5.6 SEREntry

The SEREntry class contains the information regarding the serial interface entry.

Table 83 shows all attributes of SEREntry.

Table 83 – Attributes of Interfaces Agent::SEREntry

name	mult	type	description
ByteIn	0..1	CounterTs	Inbound Byte counter
ByteOut	0..1	CounterTs	Outbound Byte counter
ID	0..1	EntityIndex	inherited from: Interface
Descr	0..1	CharString	inherited from: Interface
IntType	0..1	IntType	inherited from: Interface
Operable	0..1	BooleanValueTs	inherited from: Interface
Online	0..1	BooleanValueTs	inherited from: Interface
Faulty	0..1	BooleanValueTs	inherited from: Interface
CntRs	0..1	CntRs	inherited from: Interface

7.5.7 ALGEntry

The ALGEntry class contains the information regarding the analogue interface instance

Table 84 shows all attributes of ALGEntry.

Table 84 – Attributes of Interfaces Agent::ALGEntry

name	mult	type	description
ID	0..1	EntityIndex	inherited from: Interface
Descr	0..1	CharString	inherited from: Interface
IntType	0..1	IntType	inherited from: Interface
Operable	0..1	BooleanValueTs	inherited from: Interface
Online	0..1	BooleanValueTs	inherited from: Interface
Faulty	0..1	BooleanValueTs	inherited from: Interface
CntRs	0..1	CntRs	inherited from: Interface

7.5.8 USBEntry

The USBEntry class contains the information regarding the USB interface instance.

Table 85 shows all attributes of USBEntry.

Table 85 – Attributes of Interfaces Agent::USBEntry

name	mult	type	description
ID	0..1	EntityIndex	inherited from: Interface
Descr	0..1	CharString	inherited from: Interface
IntType	0..1	IntType	inherited from: Interface
Operable	0..1	BooleanValueTs	inherited from: Interface
Online	0..1	BooleanValueTs	inherited from: Interface
Faulty	0..1	BooleanValueTs	inherited from: Interface
CntRs	0..1	CntRs	inherited from: Interface

7.5.9 Notification

The Notification class defines the content of the notification message to be sent on event related with the specified objects.

Table 86 shows all attributes of Notification.

Table 86 – Attributes of Interfaces Agent::Notification

name	mult	type	description
serActive	0..1	IntegerTs	Number of serial Interfaces active on the device
serFail	0..1	IntegerTs	Number of failing serial Interfaces on the device
ethActive	0..1	IntegerTs	Number of ethernet interfaces active on the device
ethFail	0..1	IntegerTs	Number of failing ethernet interfaces on the device
algActive	0..1	IntegerTs	Number of analogue interfaces active on the device
algFail	0..1	IntegerTs	Number of failing analogue interfaces on the device
keyActive	0..1	IntegerTs	Number of keyboard interfaces active on the device
keyFail	0..1	IntegerTs	Number of failing keyboard interfaces on the device
usbActive	0..1	IntegerTs	Number of Universal Serial Bus interfaces active on the device
usbFail	0..1	IntegerTs	Number of failing Universal Serial Bus interfaces on the device

7.6 Package Clocks Agent

7.6.1 General

As shown in Figure 26, the Clocks Agent package includes the clock monitoring classes.

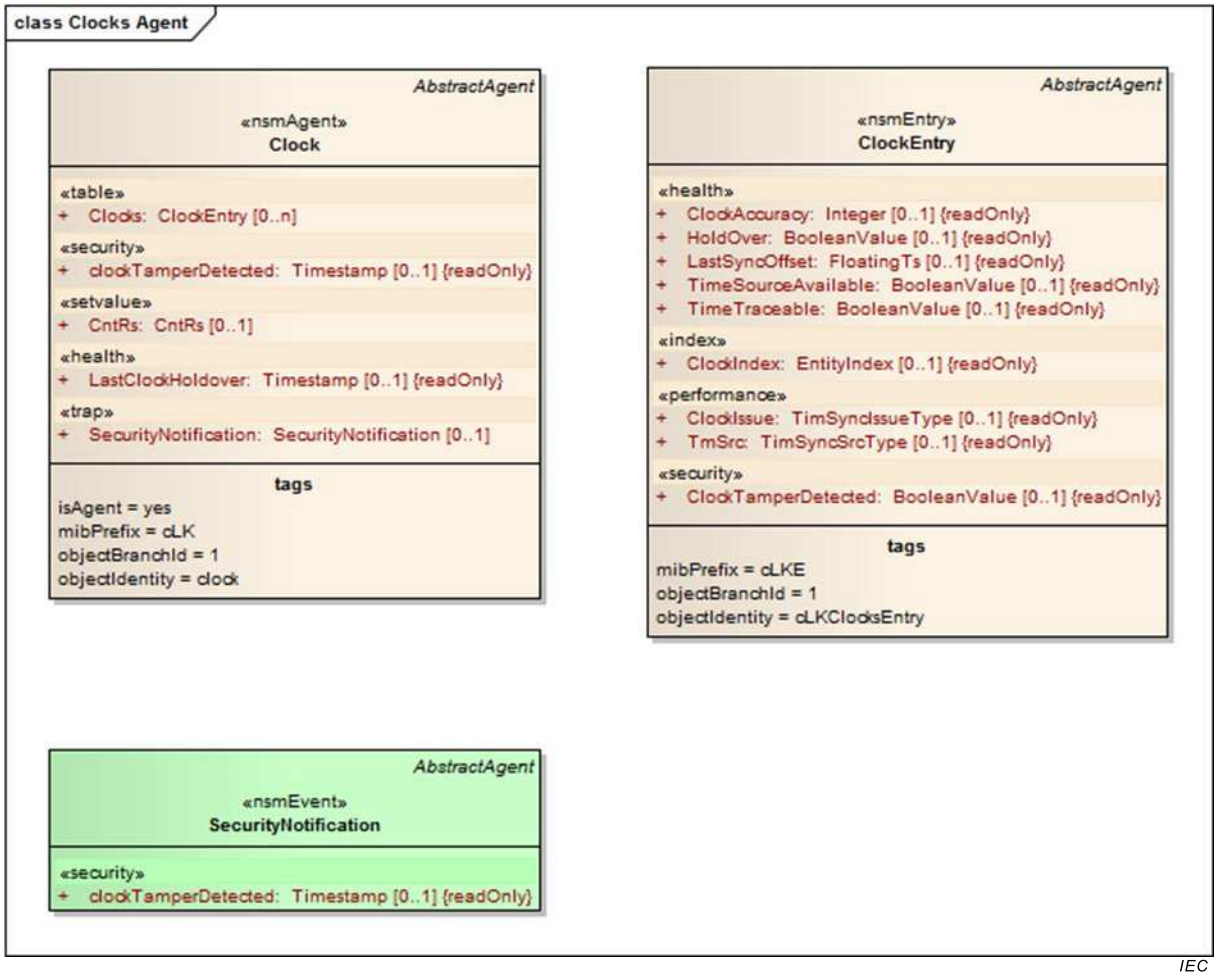


Figure 26 – Class diagram Clocks Agent::Clocks Agent

7.6.2 Clock

The Clock class contains the information regarding clocks.

Table 87 shows all attributes of Clock.

Table 87 – Attributes of Clocks Agent::Clock

name	mult	type	description
clockTamperDetected	0..1	Timestamp	Timestamp of when a tamper of a clock has been detected
LastClockHoldover	0..1	Timestamp	Indicates the timestamp at which the last Holdover was detected.
CntRs	0..1	CntRs	When written True, the statistics of clockTamperDetected and LastClockHoldover are set back to a value of zero. The values in the clocks table are not impacted by this reset.
Clocks	0..n	ClockEntry	Table of information regarding the clock sources that are in use.
SecurityNotification	0..1	SecurityNotification	Security events notification object.

7.6.3 ClockEntry

The ClockEntry class contains the information regarding clock entries.

Table 88 shows all attributes of ClockEntry.

Table 88 – Attributes of Clocks Agent::ClockEntry

name	mult	type	description
ClockAccuracy	0..1	Integer	Reports the current expected accuracy of this clock in nanoseconds. A value of -1 indicates that the accuracy is unknown or estimated to be larger than 2147483647 ns.
ClockIndex	0..1	EntityIndex	Clock Index
ClockIssue	0..1	TimSyncIssueType	Reports the presence of any clock issue.
ClockTamperDetected	0..1	BooleanValue	Clock tamper have been detected.
TmSrc	0..1	TimSyncSrcType	Reports the clock sync method.
HoldOver	0..1	BooleanValue	The Holdover flag shall be set True whenever the Time Traceable flag is True and the IED is not receiving a qualified signal from a recognized standard time source. It shall be set False otherwise. Therefore, this flag gives an immediate indication of loss of the time reference signal.
LastSyncOffset	0..1	FloatingTs	Reports the time offset (in seconds) computed from the last qualified synchronization signal received by this clock. This value is used by the clock servo to gradually adjust the clock.
TimeSourceAvailable	0..1	BooleanValue	The Time Source Available flag shall be set True whenever the IED is receiving a qualified signal from a recognized standard time source. If it loses this signal, then after an appropriate period (during which the additional holdover uncertainty is not a significant impairment to performance), the Time Source Available flag shall be set False. The duration of the period after loss of the time signal and negation of the Time Source Available flag depends on the quality of the holdover oscillator and the required time quality, and may be a configurable IED parameter. This flag may not immediately be set False, because momentary loss of the time signal may not adversely affect IED time quality. The Holdover flag provides an immediate indication of this condition.
TimeTraceable	0..1	BooleanValue	The Time Traceable flag shall be set False before the IED has received and qualified a signal from a recognized standard time source. Once it has locked to the recognized standard time source and stabilized, the Time Traceable flag shall be set True. The Time Traceable flag shall not be set False again, so long as the IED can estimate its holdover uncertainty. If at some point, perhaps due to an extended holdover interval, the IED no longer can estimate its holdover uncertainty, then the Time Traceable flag shall be set False.

7.6.4 SecurityNotification

The SecurityNotification class defines the content of the notification message to be sent on event related with the specified objects.

Table 89 shows all attributes of SecurityNotification.

Table 89 – Attributes of Clocks Agent::SecurityNotification

name	mult	type	description
clockTamperDetected	0..1	Timestamp	Timestamp of when a tamper of a clock has been detected

7.7 Network and Transport Agents

7.7.1 TCP

The Transmission Control Protocol (TCP) is a connection-oriented protocol that has several RFCs already specifing MIB definitions for its monitoring.

For implementation claiming conformance to this standard, the following RFCs shall be used to expose TCP information:

- RFC 4022: Management Information Base for the Transmission Control Protocol (TCP)
- RFC 4898: TCP Extended Statistics MIB
- RFC 5953: Transport Layer Security (TLS) Transport Model for the Simple Network Management Protocol

The granularity of the information available within these RFCs is detailed enough to provide the sematic information required by this standard. Therefore, it is required to adopt those RFCs.

7.7.2 User Datagram Protocol (UDP)

The User Datagram Protocol is a connectionless transport protocol that can support unicast or multicast addressing.

For implementation claiming conformance to this standard, the following RFCs shall be used to expose UDP information:

- RFC 4113 specifies the structure of the MIBs for UDP.

The SNMP structure for UDP has two key OBJECT-TYPES: the UDP MIB which contains an udpEndPointTable consisting of multiple udpEndPointEntry OBJECT-TYPEs.

The granularity of the information available within these RFCs is detailed enough to provide the sematic information required by this standard. Therefore, it is required to adopt this RFC in order to provide the UDP protocol objects.

7.7.3 IP

The Internet Protocol (IP) is a connectionless protocol that has several RFCs already defining MIB definitions for its monitoring.

For implementation claiming conformance to this standard, the following RFCs shall be used to expose IP information:

- RFC 4292: IP Forwarding MIBs

- RFC 4293: IP Base MIBs
- RFC 5132: IP Multicast MIBs

8 SNMP security

The adoption of SNMPv3 protocol is mandatory in order to protect SNMP against possible security threats.

For implementation claiming conformance to this standard the User Security Model (3) *securityModel* option defined in RFC 3411, section 6.1, shall be implemented according to the following RFCs specifications:

- RFC 3414: User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)
- RFC 5590: Transport Subsystem for the Simple Network Management Protocol (SNMP)
- RFC 7860: HMAC-SHA-2 Authentication Protocols in User-Based Security Model (USM) for SNMPv3
- RFC 3826: The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model

The following *securityLevel* options defined in RFC 3411 section 3.4.3 shall be supported:

- noAuthNoPriv: Communication without Authentication and Privacy
- authNoPriv: Communication with authentication and without privacy. HMAC-SHA-2 algorithm shall be supported according to RFC 7860
- authPriv: Communication with Authentication and Privacy. HMAC-SHA-2 algorithm shall be supported according to RFC 7860.

The *securityLevel* noAuthNoPriv usage is deprecated in operation environment and can be supported by implemementation for SNMPv3.

The Transport Security Model (4) *securityModel* option defined in RFC 5591 can be optionally implemented and in this case the following RFC specifications shall be implemented:

- RFC 5591: Transport Security Model for the Simple Network Management Protocol (SNMP)
- RFC 6353: Transport Layer Security (TLS) Transport Model for the Simple Network Management Protocol (SNMP).

The authentication process for the optional Transport Security Model shall be based on PKI Certificates according with RFC 5953, section 9, and the revocation check of certificates shall be implemented according to IEC 62351-9 requirements. The lifecycle of Private/Public keys shall be implemented as well according to IEC 62351-9.

The Transport Security Model implementation is recommended and will be set mandatory in new revision of this standard

9 Secured time synchronization

Clock accuracy shall be ensured. Time synchronization shall be carried out using secure communications and using a protocol such as IEEE 1588 or IETF’s NTS.

Annex A
(normative)

SNMP MIB Mapping

The following MIBs are automatically produced from the UML model.

Enumeration agent MIB

<CODE BEGINS>

```
IEC-62351-ENUM-MIB DEFINITIONS::= BEGIN
    IMPORTS
    MODULE-IDENTITY,  OBJECT-IDENTITY,
    OBJECT-TYPE, Counter32, Integer32, Unsigned32,
    Gauge32, TimeTicks, NOTIFICATION-TYPE
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, DisplayString, TruthValue,
    MacAddress, PhysAddress, DateAndTime
        FROM SNMPv2-TC
    OBJECT-GROUP, NOTIFICATION-GROUP, MODULE-COMPLIANCE
        FROM SNMPv2-CONF
    Float32TC
              FROM FLOAT-TC-MIB

    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB;

    enumeration MODULE-IDENTITY
        LAST-UPDATED        "2017060610000Z"
        ORGANIZATION        "IEC"
        CONTACT-INFO        "IEC TC57 WG15"
        DESCRIPTION         "Copyright (C) IEC. This version of this MIB module is part
                             of IEC 57-62351-7-Ed1.
                             See the IEC 57-62351-7-Ed1 for full legal notices.
                             The abstract objects defined as enumerated
                             types refer to special enumerated data types. The
                             type object naming actually reflects this
                             classification, as explained explicitly
                             within this section in
                             the description of each abstract type. Please note
                             that the attributes defined in this package classes
                             have 1..1 multiplicity. The multiplicity is
                             handled when these classes are used as attributes
                             within the agents classes definition."

        REVISION            "2017060610000Z"
        DESCRIPTION         "IEC 57-62351-7-Ed1"

       ::= { part7 1 }

       standard  OBJECT IDENTIFIER::= { iso 0 }

       iec62351  OBJECT IDENTIFIER::= { standard 62351 }

       part7  OBJECT IDENTIFIER::= { iec62351 7 }
```

```
AppDatStKind::= TEXTUAL-CONVENTION
    STATUS              current
    DESCRIPTION         "AppDatStKind is an enumeration of status for
                         the environment where the device is operated (e.g.
                         Power Supply, Physical Access)."
    SYNTAX  INTEGER
          {
           unknown( 0 ),
           good( 1 ),
           bad( 2 )
          }
PhyHealthKind::= TEXTUAL-CONVENTION
    STATUS              current
    DESCRIPTION         "PhyHealthKind is an enumeration of general
                         health status of IED."
    SYNTAX  INTEGER
          {
           ok( 0 ),
           warning( 1 ),
           alarm( 2 )
          }
ExtKind::= TEXTUAL-CONVENTION
    STATUS              current
    DESCRIPTION         "ExtKind is an enumeration of possible IED
                         extension types."
    SYNTAX  INTEGER
          {
           unknown( 0 ),
           ioModule( 1 ),
           softwarePLC( 2 )
          }
IntKind::= TEXTUAL-CONVENTION
    STATUS              current
    DESCRIPTION         "IntKind is an enumeration of type of interface
                         being utilized."
    SYNTAX  INTEGER
          {
           wired( 0 ),
           wireless( 1 )
          }
LnkKind::= TEXTUAL-CONVENTION
    STATUS              current
    DESCRIPTION         "LnkKind is an enumeration of LnkType."
    SYNTAX  INTEGER
          {
           unknown( 0 ),
           serial( 1 ),
           tcp( 2 ),
           udp( 3 ),
           eth( 4 )
          }
PSPAccKind::= TEXTUAL-CONVENTION
    STATUS              current
    DESCRIPTION         "PSPAccKind indicates that panel access is
                         occurring at the IED."
    SYNTAX  INTEGER
          {
           notBeingAccessed( 0 ),
           accessOccurring( 1 )
          }
```

```
    ProtIdKind::= TEXTUAL-CONVENTION
        STATUS              current
        DESCRIPTION         "ProtIdKind is an enumeration used to identify
                             the target protocol."
        SYNTAX  INTEGER
              {
               unknown( 0 ),
               iEC6185081( 1 ),
               iEC6185081GOOSE( 2 ),
               iEC6185092SV( 3 ),
               ieee1815DNP( 4 ),
               iec608705( 5 )
              }
    EventKind::= TEXTUAL-CONVENTION
        STATUS              current
        DESCRIPTION         "EventKind is an enumeration of the last known
                             attack vector that was encountered."
        SYNTAX  INTEGER
              {
               none( 0 ),
               unKnown( 1 ),
               denialOfService( 2 ),
               malware( 3 ),
               bufferOverRun( 4 ),
               bufferUnderRun( 5 ),
               badCredential( 6 ),
               badKey( 7 ),
               malformedPDU( 8 ),
               physicalDisruption( 9 ),
               invalidNetworkAccess( 10 )
              }
    TimSyncIssueKind::= TEXTUAL-CONVENTION
        STATUS              current
        DESCRIPTION         "TimSyncIssueKind is an enumeration of
                             possible problems with time synchronization."
        SYNTAX  INTEGER
              {
               synced( 0 ),
               degradated( 1 ),
               failed( 2 )
              }
    SecurityProfileKind::= TEXTUAL-CONVENTION
        STATUS              current
        DESCRIPTION         "SecurityProfileKind is an enumeration of
                             SecurityProfile   alternatives.   Note:   These   are   the
enumerated
                             values expected to be normative in IEC 62351-4. If
                             there is a discrepancy when that standard is finally
                             released, the values in that standard will take
                             precedence."
        SYNTAX  INTEGER
              {
               noSecurity( 0 ),
               aProfile( 1 ),
               aPlusProfile( 2 ),
               aePlusProfile( 3 )
              }
    TimSyncSrcKind::= TEXTUAL-CONVENTION
        STATUS              current
        DESCRIPTION         "TimSyncSrcKind is an enumeration of source of
                             time synchronization alternatives."
        SYNTAX  INTEGER
              {
               unknown( 0 ),
```

```
                ntp( 1 ),
                sntp( 2 ),
                irig( 3 ),
                gps( 4 ),
                ieee1588PTP( 5 ),
                ieee1588PTPC37238Profile2011( 6 ),
                ieee1588PTPIEC6185093( 7 )
               }
    enumerationCompliance MODULE-COMPLIANCE
        STATUS              current
        DESCRIPTION         "enumeration Compliance"
       MODULE

       ::= { enumeration 2 }


END
```

<CODE ENDS>

IED agent MIB

<CODE BEGINS>

```
IEC-62351-DEV-MIB DEFINITIONS::= BEGIN
    IMPORTS
    MODULE-IDENTITY,  OBJECT-IDENTITY,
    OBJECT-TYPE, Counter32, Integer32, Unsigned32,
    Gauge32, TimeTicks, NOTIFICATION-TYPE
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, DisplayString, TruthValue,
    MacAddress, PhysAddress, DateAndTime
        FROM SNMPv2-TC
    OBJECT-GROUP, NOTIFICATION-GROUP, MODULE-COMPLIANCE
        FROM SNMPv2-CONF
    Float32TC
              FROM FLOAT-TC-MIB
       AppDatStKind, PhyHealthKind, ExtKind,
    IntKind, LnkKind, PSPAccKind, ProtIdKind, EventKind,
    TimSyncIssueKind, SecurityProfileKind, TimSyncSrcKind FROM
    IEC-62351-ENUM-MIB
    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB;

    ied-agent MODULE-IDENTITY
        LAST-UPDATED        "201706061000Z"
        ORGANIZATION        "IEC"
        CONTACT-INFO        "IEC TC57 WG15"
        DESCRIPTION         "Copyright (C) IEC. This version of this MIB module is part
                             of IEC 57-62351-7-Ed1.
                             See the IEC 57-62351-7-Ed1 for full legal notices.
                             As shown in Figure 17, the IED Agent package
                             contains the object descriptions for the environmental
                             information to be provided for the network and system
                             monitoring of environmental conditions where the device
                             is operating."

        REVISION            "201706061000Z"
        DESCRIPTION         "IEC 57-62351-7-Ed1"

       ::= { part7 2 }

       standard  OBJECT IDENTIFIER::= { iso 0 }

       iec62351  OBJECT IDENTIFIER::= { standard 62351 }
```

```
   part7  OBJECT IDENTIFIER::= { iec62351 7 }




ied OBJECT-IDENTITY
    STATUS              current
    DESCRIPTION         "The IED class is a set of objects that includes
                         the hardware (CPU, storage), software (e.g.
                         buffer overflow) health information, and security
                         information regarding possible attacks. Information on
                         device security credentials (certificates and more
                         in general encryption keys) is provided."
   ::= { ied-agent 1 }

iEDAtkCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.AtkCnt - timestamp"
   ::= { ied 1 }

iEDAtkCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.AtkCnt"
   ::= { ied 2 }

iEDCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.CntRs - timestamp"
   ::= { ied 3 }

iEDCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "IED Agent::IED.CntRs"
   ::= { ied 4 }

iEDConfigurationCRCTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.ConfigurationCRC - timestamp"
   ::= { ied 5 }

iEDConfigurationCRC OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.ConfigurationCRC"
   ::= { ied 6 }

iEDConfigurationVersionTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
```

```
    DESCRIPTION         "IED Agent::IED.ConfigurationVersion -
                         timestamp"
   ::= { ied 7 }

iEDConfigurationVersion OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.ConfigurationVersion"
   ::= { ied 8 }

iEDCPUTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF CPUEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "IED Agent::IED.CPU"
   ::= { ied 9 }

iEDCPUEntry OBJECT-TYPE
    SYNTAX  CPUEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "IED Agent::IED.CPU"
    INDEX   {
           cPUID

   }
   ::= { iEDCPUTable 1 }

CPUEntry::=
    SEQUENCE {
           cPUCntRsTs DateAndTime,
           cPUCntRs TruthValue,
           cPUDescr DisplayString,
           cPUFaultyTs DateAndTime,
           cPUFaulty TruthValue,
           cPUID Unsigned32,
           cPUOnlineTs DateAndTime,
           cPUOnline TruthValue,
           cPUOperableTs DateAndTime,
           cPUOperable TruthValue,
           cPUTemperatureTs DateAndTime,
           cPUTemperature Float32TC,
           cPUWatchdogTs DateAndTime,
           cPUWatchdog Counter32
    }

iEDCpuUsageTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.CpuUsage - timestamp"
   ::= { ied 10 }

iEDCpuUsage OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.CpuUsage"
   ::= { ied 11 }

iEDDataInvTs OBJECT-TYPE
```

```
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.DataInv - timestamp"
       ::= { ied 12 }

    iEDDataInv OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.DataInv"
       ::= { ied 13 }

    iEDDescr OBJECT-TYPE
        SYNTAX              DisplayString
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.Descr"
       ::= { ied 14 }

    iEDExpCertsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.ExpCerts - timestamp"
       ::= { ied 15 }

    iEDExpCerts OBJECT-TYPE
        SYNTAX              Integer32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.ExpCerts"
       ::= { ied 16 }

    iEDEXTTable OBJECT-TYPE
        SYNTAX  SEQUENCE OF EXTEntry
        MAX-ACCESS  not-accessible
        STATUS  current
        DESCRIPTION
                "IED Agent::IED.EXT"
       ::= { ied 17 }

    iEDEXTEntry OBJECT-TYPE
        SYNTAX  EXTEntry
        MAX-ACCESS  not-accessible
        STATUS  current
        DESCRIPTION
                "IED Agent::IED.EXT"
        INDEX   {
               eXTID

       }
       ::= { iEDEXTTable 1 }

    EXTEntry::=
        SEQUENCE {
               eXTID Unsigned32,
               eXTDescr DisplayString,
               eXTExtensionType ExtKind,
               eXTCodeVersionTs DateAndTime,
               eXTCodeVersion DisplayString,
               eXTRunningTs DateAndTime,
               eXTRunning TruthValue,
               eXTTemperatureTs DateAndTime,
```

```
            eXTTemperature Float32TC,
            eXTWatchdogTs DateAndTime,
            eXTWatchdog Counter32 ,
            eXTErrorsTs DateAndTime,
            eXTErrors Counter32 ,
            eXTCntRsTs DateAndTime,
            eXTCntRs TruthValue
    }

iEDFirmwareVersionTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.FirmwareVersion - timestamp"
   ::= { ied 18 }

iEDFirmwareVersion OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.FirmwareVersion"
   ::= { ied 19 }

iEDInternalTempTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.InternalTemp - timestamp"
   ::= { ied 20 }

iEDInternalTemp OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.InternalTemp"
   ::= { ied 21 }

iEDLastCPUFailTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.LastCPUFail - timestamp"
   ::= { ied 22 }

iEDLastCPUFail OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.LastCPUFail"
   ::= { ied 23 }

iEDLastEventTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.LastEvent - timestamp"
   ::= { ied 24 }

iEDLastEvent OBJECT-TYPE
    SYNTAX              EventKind
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.LastEvent"
   ::= { ied 25 }
```

```
iEDLastEXTFailTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.LastEXTFail - timestamp"
   ::= { ied 26 }

iEDLastEXTFail OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.LastEXTFail"
   ::= { ied 27 }

iEDLastSTOREFailTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.LastSTOREFail - timestamp"
   ::= { ied 28 }

iEDLastSTOREFail OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.LastSTOREFail"
   ::= { ied 29 }

iEDLocation OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.Location"
   ::= { ied 30 }

iEDMaintainer OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.Maintainer"
   ::= { ied 31 }

iEDMemTotal OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.MemTotal"
   ::= { ied 32 }

iEDMemUsageTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.MemUsage - timestamp"
   ::= { ied 33 }

iEDMemUsage OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.MemUsage"
   ::= { ied 34 }
```

```
iEDMIBVersion OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.MIBVersion"
   ::= { ied 35 }

iEDMisEvCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.MisEvCnt - timestamp"
   ::= { ied 36 }

iEDMisEvCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.MisEvCnt"
   ::= { ied 37 }

iEDName OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.Name"
   ::= { ied 38 }

iEDNearToExpCertsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.NearToExpCerts - timestamp"
   ::= { ied 39 }

iEDNearToExpCerts OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.NearToExpCerts"
   ::= { ied 40 }

iEDNvStoreTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.NvStore - timestamp"
   ::= { ied 41 }

iEDNvStore OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.NvStore"
   ::= { ied 42 }

iEDNvStoreRemTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.NvStoreRem - timestamp"
   ::= { ied 43 }

iEDNvStoreRem OBJECT-TYPE
```

```
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.NvStoreRem"
       ::= { ied 44 }

    iEDPhyHealthTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.PhyHealth - timestamp"
       ::= { ied 45 }

    iEDPhyHealth OBJECT-TYPE
        SYNTAX              PhyHealthKind
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.PhyHealth"
       ::= { ied 46 }

    iEDPhyHealthChgCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.PhyHealthChgCnt - timestamp"
       ::= { ied 47 }

    iEDPhyHealthChgCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.PhyHealthChgCnt"
       ::= { ied 48 }

    iEDRBACDbUpdateTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.RBACDbUpdate - timestamp"
       ::= { ied 49 }

    iEDRBACDbUpdate OBJECT-TYPE
        SYNTAX              DisplayString
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.RBACDbUpdate"
       ::= { ied 50 }

    iEDRevCertsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.RevCerts - timestamp"
       ::= { ied 51 }

    iEDRevCerts OBJECT-TYPE
        SYNTAX              Integer32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::IED.RevCerts"
       ::= { ied 52 }

    iEDRevCheckFailTs OBJECT-TYPE
        SYNTAX              DateAndTime
```

```
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.RevCheckFail - timestamp"
   ::= { ied 53 }

iEDRevCheckFail OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.RevCheckFail"
   ::= { ied 54 }


iEDSecurityNotificationType NOTIFICATION-TYPE
    OBJECTS {

            iEDAtkCntTs,
            iEDAtkCnt,
            iEDExpCertsTs,
            iEDExpCerts,
            iEDLastEventTs,
            iEDLastEvent,
            iEDNearToExpCertsTs,
            iEDNearToExpCerts,
            iEDRevCertsTs,
            iEDRevCerts,
            iEDRevCheckFailTs,
            iEDRevCheckFail
             }
    STATUS              current
    DESCRIPTION         "The SecurityNotification class defines the
                         content of the notification message to be sent on event
                         related with the specified objects."
   ::= { ied 55 }

iEDSecurityNotification NOTIFICATION-GROUP
    NOTIFICATIONS       {
                            iEDSecurityNotificationType
                        }
    STATUS              current
    DESCRIPTION         "The SecurityNotification class defines the
                         content of the notification message to be sent on event
                         related with the specified objects."
   ::= { ied 56 }


iEDNotificationType NOTIFICATION-TYPE
    OBJECTS {

            iEDPhyHealthChgCntTs,
            iEDPhyHealthChgCnt,
            iEDInternalTempTs,
            iEDInternalTemp,
            iEDNvStoreTs,
            iEDNvStore,
            iEDNvStoreRemTs,
            iEDNvStoreRem,
            iEDPhyHealthTs,
            iEDPhyHealth,
            iEDWrmStrCntTs,
            iEDWrmStrCnt
             }
    STATUS              current
    DESCRIPTION         "The Notification class defines the content of
```

```
                        the notification message to be sent on event
                        related with the specified objects."
    ::= { ied 57 }

iEDNotification NOTIFICATION-GROUP
    NOTIFICATIONS       {
                            iEDNotificationType
                        }
    STATUS              current
    DESCRIPTION         "The Notification class defines the content of
                         the notification message to be sent on event
                         related with the specified objects."
    ::= { ied 58 }

iEDSTORETable OBJECT-TYPE
    SYNTAX  SEQUENCE OF STOREEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "IED Agent::IED.STORE"
    ::= { ied 59 }

iEDSTOREEntry OBJECT-TYPE
    SYNTAX  STOREEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "IED Agent::IED.STORE"
    INDEX   {
           sTOREID

   }
   ::= { iEDSTORETable 1 }

STOREEntry::=
    SEQUENCE {
           sTOREID Unsigned32,
           sTORENvStore Float32TC,
           sTORENvStoreRemTs DateAndTime,
           sTORENvStoreRem Float32TC,
           sTOREFaultyTs DateAndTime,
           sTOREFaulty TruthValue,
           sTORECntRsTs DateAndTime,
           sTORECntRs TruthValue
    }

iEDSvcViolTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.SvcViol - timestamp"
    ::= { ied 60 }

iEDSvcViol OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.SvcViol"
    ::= { ied 61 }

iEDWatchdogTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
```

```
    STATUS              current
    DESCRIPTION         "IED Agent::IED.Watchdog - timestamp"
   ::= { ied 62 }

iEDWatchdog OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.Watchdog"
   ::= { ied 63 }

iEDWrmStrCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.WrmStrCnt - timestamp"
   ::= { ied 64 }

iEDWrmStrCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::IED.WrmStrCnt"
   ::= { ied 65 }

cPUCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::CPUEntry.CntRs - timestamp"
   ::= { iEDCPUEntry 1 }

cPUCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "IED Agent::CPUEntry.CntRs"
   ::= { iEDCPUEntry 2 }

cPUDescr OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::CPUEntry.Descr"
   ::= { iEDCPUEntry 3 }

cPUFaultyTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::CPUEntry.Faulty - timestamp"
   ::= { iEDCPUEntry 4 }

cPUFaulty OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::CPUEntry.Faulty"
   ::= { iEDCPUEntry 5 }

cPUID OBJECT-TYPE
    SYNTAX              Unsigned32
    MAX-ACCESS          not-accessible
    STATUS              current
```

```
        DESCRIPTION         "IED Agent::CPUEntry.ID"
       ::= { iEDCPUEntry 6 }

    cPUOnlineTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::CPUEntry.Online - timestamp"
       ::= { iEDCPUEntry 7 }

    cPUOnline OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::CPUEntry.Online"
       ::= { iEDCPUEntry 8 }

    cPUOperableTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::CPUEntry.Operable - timestamp"
       ::= { iEDCPUEntry 9 }

    cPUOperable OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::CPUEntry.Operable"
       ::= { iEDCPUEntry 10 }

    cPUTemperatureTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::CPUEntry.Temperature - timestamp"
       ::= { iEDCPUEntry 11 }

    cPUTemperature OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::CPUEntry.Temperature"
       ::= { iEDCPUEntry 12 }

    cPUWatchdogTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::CPUEntry.Watchdog - timestamp"
       ::= { iEDCPUEntry 13 }

    cPUWatchdog OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::CPUEntry.Watchdog"
       ::= { iEDCPUEntry 14 }

    eXTID OBJECT-TYPE
        SYNTAX              Unsigned32
        MAX-ACCESS          not-accessible
        STATUS              current
        DESCRIPTION         "IED Agent::EXTEntry.ID"
```

```
   ::= { iEDEXTEntry 1 }

eXTDescr OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::EXTEntry.Descr"
   ::= { iEDEXTEntry 2 }

eXTExtensionType OBJECT-TYPE
    SYNTAX              ExtKind
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::EXTEntry.ExtensionType"
   ::= { iEDEXTEntry 3 }

eXTCodeVersionTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::EXTEntry.CodeVersion - timestamp"
   ::= { iEDEXTEntry 4 }

eXTCodeVersion OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::EXTEntry.CodeVersion"
   ::= { iEDEXTEntry 5 }

eXTRunningTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::EXTEntry.Running - timestamp"
   ::= { iEDEXTEntry 6 }

eXTRunning OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::EXTEntry.Running"
   ::= { iEDEXTEntry 7 }

eXTTemperatureTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::EXTEntry.Temperature - timestamp"
   ::= { iEDEXTEntry 8 }

eXTTemperature OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::EXTEntry.Temperature"
   ::= { iEDEXTEntry 9 }

eXTWatchdogTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::EXTEntry.Watchdog - timestamp"
   ::= { iEDEXTEntry 10 }
```

```
    eXTWatchdog OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::EXTEntry.Watchdog"
       ::= { iEDEXTEntry 11 }

    eXTErrorsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::EXTEntry.Errors - timestamp"
       ::= { iEDEXTEntry 12 }

    eXTErrors OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::EXTEntry.Errors"
       ::= { iEDEXTEntry 13 }

    eXTCntRsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::EXTEntry.CntRs - timestamp"
       ::= { iEDEXTEntry 14 }

    eXTCntRs OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "IED Agent::EXTEntry.CntRs"
       ::= { iEDEXTEntry 15 }

    sTOREID OBJECT-TYPE
        SYNTAX              Unsigned32
        MAX-ACCESS          not-accessible
        STATUS              current
        DESCRIPTION         "IED Agent::STOREEntry.ID"
       ::= { iEDSTOREEntry 1 }

    sTORENvStore OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::STOREEntry.NvStore"
       ::= { iEDSTOREEntry 3 }

    sTORENvStoreRemTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IED Agent::STOREEntry.NvStoreRem -
                             timestamp"
       ::= { iEDSTOREEntry 4 }
```

```
sTORENvStoreRem OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::STOREEntry.NvStoreRem"
   ::= { iEDSTOREEntry 5 }

sTOREFaultyTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::STOREEntry.Faulty - timestamp"
   ::= { iEDSTOREEntry 6 }

sTOREFaulty OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::STOREEntry.Faulty"
   ::= { iEDSTOREEntry 7 }

sTORECntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IED Agent::STOREEntry.CntRs - timestamp"
   ::= { iEDSTOREEntry 8 }

sTORECntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "IED Agent::STOREEntry.CntRs"
   ::= { iEDSTOREEntry 9 }

ied-agentGroupOptional OBJECT-GROUP
   OBJECTS {
                  iEDAtkCntTs,
           iEDAtkCnt,
           iEDCntRsTs,
           iEDCntRs,
           iEDConfigurationCRCTs,
           iEDConfigurationCRC,
           iEDConfigurationVersionTs,
           iEDConfigurationVersion,
           iEDCpuUsageTs,
           iEDCpuUsage,
           iEDDataInvTs,
           iEDDataInv,
           iEDDescr,
           iEDExpCertsTs,
           iEDExpCerts,
           iEDFirmwareVersionTs,
           iEDFirmwareVersion,
           iEDInternalTempTs,
           iEDInternalTemp,
           iEDLastCPUFailTs,
           iEDLastCPUFail,
           iEDLastEventTs,
           iEDLastEvent,
           iEDLastEXTFailTs,
           iEDLastEXTFail,
           iEDLastSTOREFailTs,
```

```
                iEDLastSTOREFail,
                iEDLocation,
                iEDMaintainer,
                iEDMemTotal,
                iEDMemUsageTs,
                iEDMemUsage,
                iEDMIBVersion,
                iEDMisEvCntTs,
                iEDMisEvCnt,
                iEDName,
                iEDNearToExpCertsTs,
                iEDNearToExpCerts,
                iEDNvStoreTs,
                iEDNvStore,
                iEDNvStoreRemTs,
                iEDNvStoreRem,
                iEDPhyHealthTs,
                iEDPhyHealth,
                iEDPhyHealthChgCntTs,
                iEDPhyHealthChgCnt,
                iEDRBACDbUpdateTs,
                iEDRBACDbUpdate,
                iEDRevCertsTs,
                iEDRevCerts,
                iEDRevCheckFailTs,
                iEDRevCheckFail,
                iEDSvcViolTs,
                iEDSvcViol,
                iEDWatchdogTs,
                iEDWatchdog,
                iEDWrmStrCntTs,
                iEDWrmStrCnt,
                cPUCntRsTs,
                cPUCntRs,
                cPUDescr,
                cPUFaultyTs,
                cPUFaulty,
                cPUOnlineTs,
                cPUOnline,
                cPUOperableTs,
                cPUOperable,
                cPUTemperatureTs,
                cPUTemperature,
                cPUWatchdogTs,
                cPUWatchdog,
                eXTDescr,
                eXTExtensionType,
                eXTCodeVersionTs,
                eXTCodeVersion,
                eXTRunningTs,
                eXTRunning,
                eXTTemperatureTs,
                eXTTemperature,
                eXTWatchdogTs,
                eXTWatchdog,
                eXTErrorsTs,
                eXTErrors,
                eXTCntRsTs,
                eXTCntRs,
                sTORENvStore,
                sTORENvStoreRemTs,
                sTORENvStoreRem,
                sTOREFaultyTs,
```

```
                sTOREFaulty,
                sTORECntRsTs,
                sTORECntRs
        }
         STATUS              current
        DESCRIPTION         "ied-agent optional objects group"
        ::= { ied-agent 2 }

    ied-agentCompliance MODULE-COMPLIANCE
         STATUS              current
         DESCRIPTION         "ied-agent Compliance"
        MODULE

        ::= { ied-agent 3 }


END
```

<CODE ENDS>

Environmental agent MIB

<CODE BEGINS>

```
IEC-62351-ENV-MIB DEFINITIONS::= BEGIN
    IMPORTS
    MODULE-IDENTITY,  OBJECT-IDENTITY,
    OBJECT-TYPE, Counter32, Integer32, Unsigned32,
    Gauge32, TimeTicks, NOTIFICATION-TYPE
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, DisplayString, TruthValue,
    MacAddress, PhysAddress, DateAndTime
        FROM SNMPv2-TC
    OBJECT-GROUP, NOTIFICATION-GROUP, MODULE-COMPLIANCE
        FROM SNMPv2-CONF
    Float32TC
              FROM FLOAT-TC-MIB
       AppDatStKind, PhyHealthKind, ExtKind,
    IntKind, LnkKind, PSPAccKind, ProtIdKind, EventKind,
    TimSyncIssueKind, SecurityProfileKind, TimSyncSrcKind FROM
    IEC-62351-ENUM-MIB
    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB;

    environmental-agent MODULE-IDENTITY
        LAST-UPDATED        "201706061000Z"
        ORGANIZATION        "IEC"
        CONTACT-INFO        "IEC TC57 WG15"
        DESCRIPTION         "Copyright (C) IEC. This version of this MIB module is part
                             of IEC 57-62351-7-Ed1.
                             See the IEC 57-62351-7-Ed1 for full legal notices.
                             As shown in Figure 16 this package contains the
                             object descriptions for the environmental
                             information to be provided for the Network and System
                             Monitoring of environmental conditions where the device
                             is operating."

        REVISION            "201706061000Z"
        DESCRIPTION         "IEC 57-62351-7-Ed1"

       ::= { part7 1 }

       standard  OBJECT IDENTIFIER::= { iso 0 }

       iec62351  OBJECT IDENTIFIER::= { standard 62351 }
```

```
   part7  OBJECT IDENTIFIER::= { iec62351 7 }




environmental OBJECT-IDENTITY
    STATUS              current
    DESCRIPTION         "The Environmental class is a set of objects that
                         includes the physical access to the device, the power
                         supply conditions, and other environmental
                         conditions. This information is collected by the device
                         itself whenever possible and is used to report the
                         physical device security and health."
   ::= { environmental-agent 1 }

envAppDatStTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental
                         Agent::Environmental.AppDatSt - timestamp"
   ::= { environmental 1 }

envAppDatSt OBJECT-TYPE
    SYNTAX              AppDatStKind
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental
                         Agent::Environmental.AppDatSt"
   ::= { environmental 2 }

envCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::Environmental.CntRs -
                         timestamp"
   ::= { environmental 3 }

envCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Environmental Agent::Environmental.CntRs"
   ::= { environmental 4 }

envLastEventTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental
                         Agent::Environmental.LastEvent - timestamp"
   ::= { environmental 5 }

envLastEvent OBJECT-TYPE
    SYNTAX              EventKind
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental
                         Agent::Environmental.LastEvent"
   ::= { environmental 6 }
```

```
envPSPBldTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::Environmental.PSPBld
                         - timestamp"
   ::= { environmental 7 }

envPSPBld OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::Environmental.PSPBld"
   ::= { environmental 8 }

envPSPIedTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::Environmental.PSPIed
                         - timestamp"
   ::= { environmental 9 }

envPSPIed OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::Environmental.PSPIed"
   ::= { environmental 10 }

envPSPPanelTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental
                         Agent::Environmental.PSPPanel - timestamp"
   ::= { environmental 11 }

envPSPPanel OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental
                         Agent::Environmental.PSPPanel"
   ::= { environmental 12 }

envPSPPerimeterTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental
                         Agent::Environmental.PSPPerimeter - timestamp"
   ::= { environmental 13 }

envPSPPerimeter OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental
                         Agent::Environmental.PSPPerimeter"
   ::= { environmental 14 }

envPSUPTable OBJECT-TYPE
```

```
        SYNTAX  SEQUENCE OF PSUPEntry
        MAX-ACCESS  not-accessible
        STATUS  current
        DESCRIPTION
                "Environmental Agent::Environmental.PSUP"
       ::= { environmental 15 }

    envPSUPEntry OBJECT-TYPE
        SYNTAX  PSUPEntry
        MAX-ACCESS  not-accessible
        STATUS  current
        DESCRIPTION
                "Environmental Agent::Environmental.PSUP"
        INDEX   {
               pSUPID

       }
       ::= { envPSUPTable 1 }

    PSUPEntry::=
        SEQUENCE {
               pSUPCntRsTs DateAndTime,
               pSUPCntRs TruthValue,
               pSUPDescr DisplayString,
               pSUPID Unsigned32,
               pSUPName DisplayString,
               pSUPPSUPLosTs DateAndTime,
               pSUPPSUPLos TruthValue,
               pSUPPwrLosCntTs DateAndTime,
               pSUPPwrLosCnt Counter32 ,
               pSUPPwrOnTs DateAndTime,
               pSUPPwrOn TruthValue
        }

    envPSUPLos OBJECT-TYPE
        SYNTAX              Integer32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Environmental
                             Agent::Environmental.PSUPLos"
       ::= { environmental 16 }

    envPSUPOnTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Environmental Agent::Environmental.PSUPOn
                             - timestamp"
       ::= { environmental 17 }

    envPSUPOn OBJECT-TYPE
        SYNTAX              Integer32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Environmental Agent::Environmental.PSUPOn"
       ::= { environmental 18 }


    envSecurityNotificationType NOTIFICATION-TYPE
        OBJECTS {

               envLastEventTs,
               envLastEvent,
               envPSPBldTs,
```

```
            envPSPIedTs,
            envPSPPanelTs,
            envPSPPerimeterTs
             }
    STATUS              current
    DESCRIPTION         "The SecurityNotification class defines the
                         content of the notification message to be sent on event
                         related with the specified objects. ."
   ::= { environmental 19 }

envSecurityNotification NOTIFICATION-GROUP
    NOTIFICATIONS       {
                            envSecurityNotificationType
                        }
    STATUS              current
    DESCRIPTION         "The SecurityNotification class defines the
                         content of the notification message to be sent on event
                         related with the specified objects. ."
   ::= { environmental 20 }


envNotificationType NOTIFICATION-TYPE
    OBJECTS {

            envPSUPLos,
            envPSUPOnTs,
            envPSUPOn
             }
    STATUS              current
    DESCRIPTION         "The Notification class defines the content of
                         the notification message to be sent on event
                         related with the specified objects."
   ::= { environmental 21 }

envNotification NOTIFICATION-GROUP
    NOTIFICATIONS       {
                            envNotificationType
                        }
    STATUS              current
    DESCRIPTION         "The Notification class defines the content of
                         the notification message to be sent on event
                         related with the specified objects."
   ::= { environmental 22 }

pSUPCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::PSUPEntry.CntRs -
                         timestamp"
   ::= { envPSUPEntry 1 }

pSUPCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Environmental Agent::PSUPEntry.CntRs"
   ::= { envPSUPEntry 2 }

pSUPDescr OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::PSUPEntry.Descr"
```

```
    ::= { envPSUPEntry 3 }

pSUPID OBJECT-TYPE
    SYNTAX              Unsigned32
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION         "Environmental Agent::PSUPEntry.ID"
    ::= { envPSUPEntry 4 }

pSUPName OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::PSUPEntry.Name"
    ::= { envPSUPEntry 5 }

pSUPPSUPLosTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::PSUPEntry.PSUPLos -
                         timestamp"
    ::= { envPSUPEntry 6 }

pSUPPSUPLos OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::PSUPEntry.PSUPLos"
    ::= { envPSUPEntry 7 }

pSUPPwrLosCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::PSUPEntry.PwrLosCnt -
                         timestamp"
    ::= { envPSUPEntry 8 }

pSUPPwrLosCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::PSUPEntry.PwrLosCnt"
    ::= { envPSUPEntry 9 }

pSUPPwrOnTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::PSUPEntry.PwrOn -
                         timestamp"
    ::= { envPSUPEntry 10 }

pSUPPwrOn OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Environmental Agent::PSUPEntry.PwrOn"
    ::= { envPSUPEntry 11 }

environmental-agentGroupOptional OBJECT-GROUP
   OBJECTS {
                envAppDatStTs,
```

```
                envAppDatSt,
                envCntRsTs,
                envCntRs,
                envLastEventTs,
                envLastEvent,
                envPSPBldTs,
                envPSPBld,
                envPSPIedTs,
                envPSPIed,
                envPSPPanelTs,
                envPSPPanel,
                envPSPPerimeterTs,
                envPSPPerimeter,
                envPSUPLos,
                envPSUPOnTs,
                envPSUPOn,
                pSUPCntRsTs,
                pSUPCntRs,
                pSUPDescr,
                pSUPName,
                pSUPPSUPLosTs,
                pSUPPSUPLos,
                pSUPPwrLosCntTs,
                pSUPPwrLosCnt,
                pSUPPwrOnTs,
                pSUPPwrOn
        }
         STATUS              current
        DESCRIPTION         "environmental-agent optional objects group"
        ::= { environmental-agent 2 }

    environmental-agentCompliance MODULE-COMPLIANCE
         STATUS              current
         DESCRIPTION         "environmental-agent Compliance"
        MODULE

        ::= { environmental-agent 3 }


END
<CODE ENDS>

IEEE 1815 and IEC 60870-5 agent MIB

<CODE BEGINS>

IEC-62351-IEC60870-5-IEEE1815-MIB DEFINITIONS::= BEGIN
    IMPORTS
    MODULE-IDENTITY,  OBJECT-IDENTITY,
    OBJECT-TYPE, Counter32, Integer32, Unsigned32,
    Gauge32, TimeTicks, NOTIFICATION-TYPE
         FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, DisplayString, TruthValue,
    MacAddress, PhysAddress, DateAndTime
         FROM SNMPv2-TC
    OBJECT-GROUP, NOTIFICATION-GROUP, MODULE-COMPLIANCE
         FROM SNMPv2-CONF
    Float32TC
              FROM FLOAT-TC-MIB
        AppDatStKind, PhyHealthKind, ExtKind,
    IntKind, LnkKind, PSPAccKind, ProtIdKind, EventKind,
    TimSyncIssueKind, SecurityProfileKind, TimSyncSrcKind FROM
    IEC-62351-ENUM-MIB
    InetAddressType, InetAddress
```

```
        FROM INET-ADDRESS-MIB;

    ieee1815andiec60870-5-agent MODULE-IDENTITY
        LAST-UPDATED        "201706061000Z"
        ORGANIZATION        "IEC"
        CONTACT-INFO        "IEC TC57 WG15"
        DESCRIPTION         "Copyright (C) IEC. This version of this MIB module is part
                             of IEC 57-62351-7-Ed1.
                             See the IEC 57-62351-7-Ed1 for full legal notices.
                             As shown in Figure 19, this package includes the
                             IEEE 1815 DNP and IEC 60870-5-104 protocols
                             classes. This high level class named summary includes
                             two objects related to the application stack and
                             association class that reports the object related to the
                             possible communication sessions between masters and
                             outstations. The two class Master Association and
                             Outstation Association Inherits the Associations class
                             attributes. For each IEEE 1815 DNP or IEC 60870-5-104
                             application stack a single instance of summary class is
                             provided. This instance of summary class can be related to
                             several instances of OutstationAssociation and
                             MasterAssociation  classes  which  inherit  the  attributes
from the
                             Association class. Each instance Association is the
                             container of the attributes of a specific application
                             session between an Outstation and a Master. Summary and
                             Association class inherits the specific IEEE 1815 DNP and
                             IEC 60870-5-104 Protocol Infoand Security
                             objects, and therefore the more general class as well."

        REVISION            "201706061000Z"
        DESCRIPTION         "IEC 57-62351-7-Ed1"

       ::= { application 1 }

       standard  OBJECT IDENTIFIER::= { iso 0 }

       iec62351  OBJECT IDENTIFIER::= { standard 62351 }

       part7  OBJECT IDENTIFIER::= { iec62351 7 }

       application  OBJECT IDENTIFIER::= { part7 3 }


    ieee1815andiec870-5x OBJECT-IDENTITY
        STATUS              current
        DESCRIPTION         "The Summary class includes the attributes
                             which define the information about the overall IEC
                             60870-5-104 or IEEE 1815 DNP application stack running on
                             the device."
       ::= { ieee1815andiec60870-5-agent 1 }

    tCCntRsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::Summary.CntRs - timestamp"
       ::= { ieee1815andiec870-5x 1 }

    tCCntRs OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-write
        STATUS              current
```

```
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Summary.CntRs"
   ::= { ieee1815andiec870-5x 2 }

tCLastEventTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Summary.LastEvent - timestamp"
   ::= { ieee1815andiec870-5x 3 }

tCLastEvent OBJECT-TYPE
    SYNTAX              EventKind
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Summary.LastEvent"
   ::= { ieee1815andiec870-5x 4 }

tCMasterTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF MasterAssociation
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "IEEE 1815 and IEC 60870-5
                         Agent::Summary.Master"
   ::= { ieee1815andiec870-5x 5 }

tCMasterEntry OBJECT-TYPE
    SYNTAX  MasterAssociation
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "IEEE 1815 and IEC 60870-5
                         Agent::Summary.Master"
    INDEX   {
           tCMAssociationId

   }
   ::= { tCMasterTable 1 }

MasterAssociation::=
    SEQUENCE {
           tCMAssociationId Unsigned32,
           tCMCntRsTs DateAndTime,
           tCMCntRs TruthValue,
           tCMLocAddress InetAddress,
           tCMLocAddressType InetAddressType,
           tCMProtID ProtIdKind,
           tCMProviderDesc DisplayString,
           tCMProviderName DisplayString,
           tCMRemAddress InetAddress,
           tCMRemAddressType InetAddressType,
           tCMTLnkErrCntTs DateAndTime,
           tCMTLnkErrCnt Counter32 ,
           tCMTLnkTyp LnkKind,
           tCMAuthFailCntTs DateAndTime,
           tCMAuthFailCnt Counter32 ,
           tCMCtrlPrivFailCntTs DateAndTime,
           tCMCtrlPrivFailCnt Counter32 ,
           tCMDecryptFailCntTs DateAndTime,
           tCMDecryptFailCnt Counter32 ,
           tCMExT0CntTs DateAndTime,
```

```
            tCMExT0Cnt Counter32 ,
            tCMExT1CntTs DateAndTime,
            tCMExT1Cnt Counter32 ,
            tCMExT2CntTs DateAndTime,
            tCMExT2Cnt Counter32 ,
            tCMExT3CntTs DateAndTime,
            tCMExT3Cnt Counter32 ,
            tCMInDiscTs DateAndTime,
            tCMInDisc Counter32 ,
            tCMInErrCntTs DateAndTime,
            tCMInErrCnt Counter32 ,
            tCMInOvCntTs DateAndTime,
            tCMInOvCnt Counter32 ,
            tCMInterPDUTime Float32TC,
            tCMMisPDUCntTs DateAndTime,
            tCMMisPDUCnt Counter32 ,
            tCMOutErrTs DateAndTime,
            tCMOutErr Counter32 ,
            tCMOutUvTs DateAndTime,
            tCMOutUv Counter32 ,
            tCMPDURTT Float32TC,
            tCMPDUSizeFailTs DateAndTime,
            tCMPDUSizeFail Counter32 ,
            tCMPduTampCntTs DateAndTime,
            tCMPduTampCnt Counter32 ,
            tCMPrimaryInterfaceTs DateAndTime,
            tCMPrimaryInterface TruthValue,
            tCMPrivFailCntTs DateAndTime,
            tCMPrivFailCnt Counter32 ,
            tCMRtxCntTs DateAndTime,
            tCMRtxCnt Counter32 ,
            tCMRxCriticalTs DateAndTime,
            tCMRxCritical Counter32 ,
            tCMRxPduTs DateAndTime,
            tCMRxPdu Counter32 ,
            tCMRxSolicitedReqTs DateAndTime,
            tCMRxSolicitedReq Counter32 ,
            tCMRxUnsolicitedReqTs DateAndTime,
            tCMRxUnsolicitedReq Counter32 ,
            tCMSessKeyFailCntTs DateAndTime,
            tCMSessKeyFailCnt Counter32 ,
            tCMTxCriticalTs DateAndTime,
            tCMTxCritical Counter32 ,
            tCMTxPduTs DateAndTime,
            tCMTxPdu Counter32 ,
            tCMTxSolicitedReqTs DateAndTime,
            tCMTxSolicitedReq Counter32 ,
            tCMTxUnsolicitedReqTs DateAndTime,
            tCMTxUnsolicitedReq Counter32 ,
            tCMUpKeyFailCntTs DateAndTime,
            tCMUpKeyFailCnt Counter32 ,
            tCMIEC62351part3 TruthValue,
            tCMPart3ConnectionId Integer32,
            tCMTCPHndShTime Float32TC,
            tCMTLSHndTime Float32TC,
            tCMTLSRenegotiationTime Float32TC,
            tCMTLSResumptionTime Float32TC,
            tCMTotalHndTime Float32TC,
            tCMTransportHndTime Float32TC
        }

    tCOutstationTable OBJECT-TYPE
        SYNTAX  SEQUENCE OF OutstationAssociation
        MAX-ACCESS  not-accessible
```

```
    STATUS  current
    DESCRIPTION
            "IEEE 1815 and IEC 60870-5
                        Agent::Summary.Outstation"
   ::= { ieee1815andiec870-5x 6 }

tCOutstationEntry OBJECT-TYPE
    SYNTAX  OutstationAssociation
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "IEEE 1815 and IEC 60870-5
                        Agent::Summary.Outstation"
    INDEX   {
           tCOAssociationId

   }
   ::= { tCOutstationTable 1 }

OutstationAssociation::=
    SEQUENCE {
           tCOAssociationId Unsigned32,
           tCOCntRsTs DateAndTime,
           tCOCntRs TruthValue,
           tCOLocAddress InetAddress,
           tCOLocAddressType InetAddressType,
           tCOProtID ProtIdKind,
           tCOProviderDesc DisplayString,
           tCOProviderName DisplayString,
           tCORemAddress InetAddress,
           tCORemAddressType InetAddressType,
           tCOTLnkErrCntTs DateAndTime,
           tCOTLnkErrCnt Counter32 ,
           tCOTLnkTyp LnkKind,
           tCOAuthFailCntTs DateAndTime,
           tCOAuthFailCnt Counter32 ,
           tCOCtrlPrivFailCntTs DateAndTime,
           tCOCtrlPrivFailCnt Counter32 ,
           tCODecryptFailCntTs DateAndTime,
           tCODecryptFailCnt Counter32 ,
           tCOExT0CntTs DateAndTime,
           tCOExT0Cnt Counter32 ,
           tCOExT1CntTs DateAndTime,
           tCOExT1Cnt Counter32 ,
           tCOExT2CntTs DateAndTime,
           tCOExT2Cnt Counter32 ,
           tCOExT3CntTs DateAndTime,
           tCOExT3Cnt Counter32 ,
           tCOInDiscTs DateAndTime,
           tCOInDisc Counter32 ,
           tCOInErrCntTs DateAndTime,
           tCOInErrCnt Counter32 ,
           tCOInOvCntTs DateAndTime,
           tCOInOvCnt Counter32 ,
           tCOInterPDUTime Float32TC,
           tCOMisPDUCntTs DateAndTime,
           tCOMisPDUCnt Counter32 ,
           tCOOutErrTs DateAndTime,
           tCOOutErr Counter32 ,
           tCOOutUvTs DateAndTime,
           tCOOutUv Counter32 ,
           tCOPDURTT Float32TC,
           tCOPDUSizeFailTs DateAndTime,
           tCOPDUSizeFail Counter32 ,
```

```
            tCOPduTampCntTs DateAndTime,
            tCOPduTampCnt Counter32 ,
            tCOPrimaryInterfaceTs DateAndTime,
            tCOPrimaryInterface TruthValue,
            tCOPrivFailCntTs DateAndTime,
            tCOPrivFailCnt Counter32 ,
            tCORtxCntTs DateAndTime,
            tCORtxCnt Counter32 ,
            tCORxCriticalTs DateAndTime,
            tCORxCritical Counter32 ,
            tCORxPduTs DateAndTime,
            tCORxPdu Counter32 ,
            tCORxSolicitedReqTs DateAndTime,
            tCORxSolicitedReq Counter32 ,
            tCORxUnsolicitedReqTs DateAndTime,
            tCORxUnsolicitedReq Counter32 ,
            tCOSessKeyFailCntTs DateAndTime,
            tCOSessKeyFailCnt Counter32 ,
            tCOTxCriticalTs DateAndTime,
            tCOTxCritical Counter32 ,
            tCOTxPduTs DateAndTime,
            tCOTxPdu Counter32 ,
            tCOTxSolicitedReqTs DateAndTime,
            tCOTxSolicitedReq Counter32 ,
            tCOTxUnsolicitedReqTs DateAndTime,
            tCOTxUnsolicitedReq Counter32 ,
            tCOUpKeyFailCntTs DateAndTime,
            tCOUpKeyFailCnt Counter32 ,
            tCOIEC62351part3 TruthValue,
            tCOPart3ConnectionId Integer32,
            tCOTCPHndShTime Float32TC,
            tCOTLSHndTime Float32TC,
            tCOTLSRenegotiationTime Float32TC,
            tCOTLSResumptionTime Float32TC,
            tCOTotalHndTime Float32TC,
            tCOTransportHndTime Float32TC
        }


    tC60870andDNPSecurityNotificationType NOTIFICATION-TYPE
        OBJECTS {

            tCAuthFailCntTs,
            tCAuthFailCnt,
            tCCtrlPrivFailCntTs,
            tCCtrlPrivFailCnt,
            tCDecryptFailCntTs,
            tCDecryptFailCnt,
            tCLastEventTs,
            tCLastEvent,
            tCPduTampCntTs,
            tCPduTampCnt,
            tCPrivFailCntTs,
            tCPrivFailCnt,
            tCSessKeyFailCntTs,
            tCSessKeyFailCnt,
            tCUpKeyFailCntTs,
            tCUpKeyFailCnt
             }
        STATUS              current
        DESCRIPTION         "The 60870andDNPSecurityNotification class
                             defines the content of the notification message to be
                             sent on event related with the specified objects."
       ::= { ieee1815andiec870-5x 7 }
```

```
tC60870andDNPSecurityNotification NOTIFICATION-GROUP
    NOTIFICATIONS       {
                            tC60870andDNPSecurityNotificationType
                        }
    STATUS              current
    DESCRIPTION         "The 60870andDNPSecurityNotification class
                         defines the content of the notification message to be
                         sent on event related with the specified objects."
   ::= { ieee1815andiec870-5x 8 }


tC60870andDNPNotificationType NOTIFICATION-TYPE
    OBJECTS {

           tCInErrCntTs,
           tCInErrCnt,
           tCInOvCntTs,
           tCInOvCnt,
           tCOutUvTs,
           tCOutUv,
           tCRxPduTs,
           tCRxPdu,
           tCTxPduTs,
           tCTxPdu
            }
    STATUS              current
    DESCRIPTION         "The 60870andDNPNotification class defines
                         the content of the notification message to be sent
                         on event related with the specified objects."
   ::= { ieee1815andiec870-5x 9 }

tC60870andDNPNotification NOTIFICATION-GROUP
    NOTIFICATIONS       {
                            tC60870andDNPNotificationType
                        }
    STATUS              current
    DESCRIPTION         "The 60870andDNPNotification class defines
                         the content of the notification message to be sent
                         on event related with the specified objects."
   ::= { ieee1815andiec870-5x 10 }

tCAuthFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.AuthFailCnt - timestamp"
   ::= { ieee1815andiec870-5x 11 }

tCAuthFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.AuthFailCnt"
   ::= { ieee1815andiec870-5x 12 }

tCCtrlPrivFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
```

```
                            Agent::60870andDNPProtocolInfo.CtrlPrivFailCnt          -
timestamp"
       ::= { ieee1815andiec870-5x 13 }

    tCCtrlPrivFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.CtrlPrivFailCnt"
       ::= { ieee1815andiec870-5x 14 }

    tCDecryptFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.DecryptFailCnt - timestamp"
       ::= { ieee1815andiec870-5x 15 }

    tCDecryptFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.DecryptFailCnt"
       ::= { ieee1815andiec870-5x 16 }

    tCExT0CntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.ExT0Cnt - timestamp"
       ::= { ieee1815andiec870-5x 17 }

    tCExT0Cnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.ExT0Cnt"
       ::= { ieee1815andiec870-5x 18 }

    tCExT1CntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.ExT1Cnt - timestamp"
       ::= { ieee1815andiec870-5x 19 }

    tCExT1Cnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.ExT1Cnt"
       ::= { ieee1815andiec870-5x 20 }

    tCExT2CntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
```

```
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT2Cnt - timestamp"
   ::= { ieee1815andiec870-5x 21 }

tCExT2Cnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT2Cnt"
   ::= { ieee1815andiec870-5x 22 }

tCExT3CntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT3Cnt - timestamp"
   ::= { ieee1815andiec870-5x 23 }

tCExT3Cnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT3Cnt"
   ::= { ieee1815andiec870-5x 24 }

tCInDiscTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InDisc - timestamp"
   ::= { ieee1815andiec870-5x 25 }

tCInDisc OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InDisc"
   ::= { ieee1815andiec870-5x 26 }

tCInErrCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InErrCnt - timestamp"
   ::= { ieee1815andiec870-5x 27 }

tCInErrCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InErrCnt"
   ::= { ieee1815andiec870-5x 28 }

tCInOvCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
```

```
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.InOvCnt - timestamp"
       ::= { ieee1815andiec870-5x 29 }

    tCInOvCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.InOvCnt"
       ::= { ieee1815andiec870-5x 30 }

    tCInterPDUTime OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.InterPDUTime"
       ::= { ieee1815andiec870-5x 31 }

    tCMisPDUCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.MisPDUCnt - timestamp"
       ::= { ieee1815andiec870-5x 32 }

    tCMisPDUCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.MisPDUCnt"
       ::= { ieee1815andiec870-5x 33 }

    tCOutErrTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.OutErr - timestamp"
       ::= { ieee1815andiec870-5x 34 }

    tCOutErr OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.OutErr"
       ::= { ieee1815andiec870-5x 35 }

    tCOutUvTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.OutUv - timestamp"
       ::= { ieee1815andiec870-5x 36 }

    tCOutUv OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
```

```
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.OutUv"
       ::= { ieee1815andiec870-5x 37 }

    tCPDURTT OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PDURTT"
       ::= { ieee1815andiec870-5x 38 }

    tCPDUSizeFailTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PDUSizeFail - timestamp"
       ::= { ieee1815andiec870-5x 39 }

    tCPDUSizeFail OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PDUSizeFail"
       ::= { ieee1815andiec870-5x 40 }

    tCPduTampCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PduTampCnt - timestamp"
       ::= { ieee1815andiec870-5x 41 }

    tCPduTampCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PduTampCnt"
       ::= { ieee1815andiec870-5x 42 }

    tCPrimaryInterfaceTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PrimaryInterface          -
timestamp"
       ::= { ieee1815andiec870-5x 43 }

    tCPrimaryInterface OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PrimaryInterface"
       ::= { ieee1815andiec870-5x 44 }

    tCPrivFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
```

```
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PrivFailCnt - timestamp"
       ::= { ieee1815andiec870-5x 45 }

    tCPrivFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PrivFailCnt"
       ::= { ieee1815andiec870-5x 46 }

    tCRtxCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RtxCnt - timestamp"
       ::= { ieee1815andiec870-5x 47 }

    tCRtxCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RtxCnt"
       ::= { ieee1815andiec870-5x 48 }

    tCRxCriticalTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxCritical - timestamp"
       ::= { ieee1815andiec870-5x 49 }

    tCRxCritical OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxCritical"
       ::= { ieee1815andiec870-5x 50 }

    tCRxPduTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxPdu - timestamp"
       ::= { ieee1815andiec870-5x 51 }

    tCRxPdu OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxPdu"
       ::= { ieee1815andiec870-5x 52 }

    tCRxSolicitedReqTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
```

```
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxSolicitedReq - timestamp"
       ::= { ieee1815andiec870-5x 53 }

    tCRxSolicitedReq OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxSolicitedReq"
       ::= { ieee1815andiec870-5x 54 }

    tCRxUnsolicitedReqTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxUnsolicitedReq          -
timestamp"
       ::= { ieee1815andiec870-5x 55 }

    tCRxUnsolicitedReq OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxUnsolicitedReq"
       ::= { ieee1815andiec870-5x 56 }

    tCSessKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.SessKeyFailCnt - timestamp"
       ::= { ieee1815andiec870-5x 57 }

    tCSessKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.SessKeyFailCnt"
       ::= { ieee1815andiec870-5x 58 }

    tCTxCriticalTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxCritical - timestamp"
       ::= { ieee1815andiec870-5x 59 }

    tCTxCritical OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxCritical"
       ::= { ieee1815andiec870-5x 60 }

    tCTxPduTs OBJECT-TYPE
        SYNTAX              DateAndTime
```

```
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxPdu - timestamp"
       ::= { ieee1815andiec870-5x 61 }

    tCTxPdu OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxPdu"
       ::= { ieee1815andiec870-5x 62 }

    tCTxSolicitedReqTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxSolicitedReq - timestamp"
       ::= { ieee1815andiec870-5x 63 }

    tCTxSolicitedReq OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxSolicitedReq"
       ::= { ieee1815andiec870-5x 64 }

    tCTxUnsolicitedReqTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxUnsolicitedReq          -
timestamp"
       ::= { ieee1815andiec870-5x 65 }

    tCTxUnsolicitedReq OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxUnsolicitedReq"
       ::= { ieee1815andiec870-5x 66 }

    tCUpKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.UpKeyFailCnt - timestamp"
       ::= { ieee1815andiec870-5x 67 }

    tCUpKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.UpKeyFailCnt"
       ::= { ieee1815andiec870-5x 68 }

    tCMAssociationId OBJECT-TYPE
```

```
    SYNTAX              Unsigned32
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.AssociationId"
   ::= { tCMasterEntry 1 }

tCMCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.CntRs - timestamp"
   ::= { tCMasterEntry 2 }

tCMCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.CntRs"
   ::= { tCMasterEntry 3 }

tCMLocAddress OBJECT-TYPE
    SYNTAX              InetAddress
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.LocAddress"
   ::= { tCMasterEntry 4 }

tCMLocAddressType OBJECT-TYPE
    SYNTAX              InetAddressType
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.LocAddressType"
   ::= { tCMasterEntry 5 }

tCMProtID OBJECT-TYPE
    SYNTAX              ProtIdKind
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.ProtID"
   ::= { tCMasterEntry 6 }

tCMProviderDesc OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.ProviderDesc"
   ::= { tCMasterEntry 7 }

tCMProviderName OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.ProviderName"
   ::= { tCMasterEntry 8 }

tCMRemAddress OBJECT-TYPE
```

```
        SYNTAX              InetAddress
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::Association.RemAddress"
       ::= { tCMasterEntry 9 }

    tCMRemAddressType OBJECT-TYPE
        SYNTAX              InetAddressType
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::Association.RemAddressType"
       ::= { tCMasterEntry 10 }

    tCMTLnkErrCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::Association.TLnkErrCnt - timestamp"
       ::= { tCMasterEntry 11 }

    tCMTLnkErrCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::Association.TLnkErrCnt"
       ::= { tCMasterEntry 12 }

    tCMTLnkTyp OBJECT-TYPE
        SYNTAX              LnkKind
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::Association.TLnkTyp"
       ::= { tCMasterEntry 13 }

    tCMAuthFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.AuthFailCnt - timestamp"
       ::= { tCMasterEntry 14 }

    tCMAuthFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.AuthFailCnt"
       ::= { tCMasterEntry 15 }

    tCMCtrlPrivFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.CtrlPrivFailCnt          -
timestamp"
       ::= { tCMasterEntry 16 }
```

```
tCMCtrlPrivFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.CtrlPrivFailCnt"
   ::= { tCMasterEntry 17 }

tCMDecryptFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.DecryptFailCnt - timestamp"
   ::= { tCMasterEntry 18 }

tCMDecryptFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.DecryptFailCnt"
   ::= { tCMasterEntry 19 }

tCMExT0CntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT0Cnt - timestamp"
   ::= { tCMasterEntry 20 }

tCMExT0Cnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT0Cnt"
   ::= { tCMasterEntry 21 }

tCMExT1CntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT1Cnt - timestamp"
   ::= { tCMasterEntry 22 }

tCMExT1Cnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT1Cnt"
   ::= { tCMasterEntry 23 }

tCMExT2CntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT2Cnt - timestamp"
   ::= { tCMasterEntry 24 }
```

```
tCMExT2Cnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT2Cnt"
   ::= { tCMasterEntry 25 }

tCMExT3CntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT3Cnt - timestamp"
   ::= { tCMasterEntry 26 }

tCMExT3Cnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT3Cnt"
   ::= { tCMasterEntry 27 }

tCMInDiscTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InDisc - timestamp"
   ::= { tCMasterEntry 28 }

tCMInDisc OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InDisc"
   ::= { tCMasterEntry 29 }

tCMInErrCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InErrCnt - timestamp"
   ::= { tCMasterEntry 30 }

tCMInErrCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InErrCnt"
   ::= { tCMasterEntry 31 }

tCMInOvCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InOvCnt - timestamp"
   ::= { tCMasterEntry 32 }
```

```
tCMInOvCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InOvCnt"
   ::= { tCMasterEntry 33 }

tCMInterPDUTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InterPDUTime"
   ::= { tCMasterEntry 34 }

tCMMisPDUCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.MisPDUCnt - timestamp"
   ::= { tCMasterEntry 35 }

tCMMisPDUCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.MisPDUCnt"
   ::= { tCMasterEntry 36 }

tCMOutErrTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.OutErr - timestamp"
   ::= { tCMasterEntry 37 }

tCMOutErr OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.OutErr"
   ::= { tCMasterEntry 38 }

tCMOutUvTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.OutUv - timestamp"
   ::= { tCMasterEntry 39 }

tCMOutUv OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.OutUv"
   ::= { tCMasterEntry 40 }
```

```
    tCMPDURTT OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PDURTT"
       ::= { tCMasterEntry 41 }

    tCMPDUSizeFailTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PDUSizeFail - timestamp"
       ::= { tCMasterEntry 42 }

    tCMPDUSizeFail OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PDUSizeFail"
       ::= { tCMasterEntry 43 }

    tCMPduTampCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PduTampCnt - timestamp"
       ::= { tCMasterEntry 44 }

    tCMPduTampCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PduTampCnt"
       ::= { tCMasterEntry 45 }

    tCMPrimaryInterfaceTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PrimaryInterface          -
timestamp"
       ::= { tCMasterEntry 46 }

    tCMPrimaryInterface OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PrimaryInterface"
       ::= { tCMasterEntry 47 }

    tCMPrivFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PrivFailCnt - timestamp"
       ::= { tCMasterEntry 48 }
```

```
tCMPrivFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.PrivFailCnt"
   ::= { tCMasterEntry 49 }

tCMRtxCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RtxCnt - timestamp"
   ::= { tCMasterEntry 50 }

tCMRtxCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RtxCnt"
   ::= { tCMasterEntry 51 }

tCMRxCriticalTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RxCritical - timestamp"
   ::= { tCMasterEntry 52 }

tCMRxCritical OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RxCritical"
   ::= { tCMasterEntry 53 }

tCMRxPduTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RxPdu - timestamp"
   ::= { tCMasterEntry 54 }

tCMRxPdu OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RxPdu"
   ::= { tCMasterEntry 55 }

tCMRxSolicitedReqTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RxSolicitedReq - timestamp"
   ::= { tCMasterEntry 56 }
```

```
    tCMRxSolicitedReq OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxSolicitedReq"
       ::= { tCMasterEntry 57 }

    tCMRxUnsolicitedReqTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxUnsolicitedReq          -
timestamp"
       ::= { tCMasterEntry 58 }

    tCMRxUnsolicitedReq OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxUnsolicitedReq"
       ::= { tCMasterEntry 59 }

    tCMSessKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.SessKeyFailCnt - timestamp"
       ::= { tCMasterEntry 60 }

    tCMSessKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.SessKeyFailCnt"
       ::= { tCMasterEntry 61 }

    tCMTxCriticalTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxCritical - timestamp"
       ::= { tCMasterEntry 62 }

    tCMTxCritical OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxCritical"
       ::= { tCMasterEntry 63 }

    tCMTxPduTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxPdu - timestamp"
```

```
        ::= { tCMasterEntry 64 }

    tCMTxPdu OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxPdu"
        ::= { tCMasterEntry 65 }

    tCMTxSolicitedReqTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxSolicitedReq - timestamp"
        ::= { tCMasterEntry 66 }

    tCMTxSolicitedReq OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxSolicitedReq"
        ::= { tCMasterEntry 67 }

    tCMTxUnsolicitedReqTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxUnsolicitedReq          -
timestamp"
        ::= { tCMasterEntry 68 }

    tCMTxUnsolicitedReq OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxUnsolicitedReq"
        ::= { tCMasterEntry 69 }

    tCMUpKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.UpKeyFailCnt - timestamp"
        ::= { tCMasterEntry 70 }

    tCMUpKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.UpKeyFailCnt"
        ::= { tCMasterEntry 71 }

    tCMIEC62351part3 OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Common
```

```
                        objects::CommonProtocolInfo.IEC62351part3"
    ::= { tCMasterEntry 72 }

tCMPart3ConnectionId OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.Part3ConnectionId"
    ::= { tCMasterEntry 73 }

tCMTCPHndShTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.TCPHndShTime"
    ::= { tCMasterEntry 74 }

tCMTLSHndTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.TLSHndTime"
    ::= { tCMasterEntry 75 }

tCMTLSRenegotiationTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.TLSRenegotiationTime"
    ::= { tCMasterEntry 76 }

tCMTLSResumptionTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.TLSResumptionTime"
    ::= { tCMasterEntry 77 }

tCMTotalHndTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.TotalHndTime"
    ::= { tCMasterEntry 78 }

tCMTransportHndTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.TransportHndTime"
    ::= { tCMasterEntry 79 }

tCOAssociationId OBJECT-TYPE
    SYNTAX              Unsigned32
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
```

```
                        Agent::Association.AssociationId"
   ::= { tCOutstationEntry 1 }

tCOCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.CntRs - timestamp"
   ::= { tCOutstationEntry 2 }

tCOCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.CntRs"
   ::= { tCOutstationEntry 3 }

tCOLocAddress OBJECT-TYPE
    SYNTAX              InetAddress
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.LocAddress"
   ::= { tCOutstationEntry 4 }

tCOLocAddressType OBJECT-TYPE
    SYNTAX              InetAddressType
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.LocAddressType"
   ::= { tCOutstationEntry 5 }

tCOProtID OBJECT-TYPE
    SYNTAX              ProtIdKind
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.ProtID"
   ::= { tCOutstationEntry 6 }

tCOProviderDesc OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.ProviderDesc"
   ::= { tCOutstationEntry 7 }

tCOProviderName OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::Association.ProviderName"
   ::= { tCOutstationEntry 8 }

tCORemAddress OBJECT-TYPE
    SYNTAX              InetAddress
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
```

```
                            Agent::Association.RemAddress"
       ::= { tCOutstationEntry 9 }

    tCORemAddressType OBJECT-TYPE
        SYNTAX              InetAddressType
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::Association.RemAddressType"
       ::= { tCOutstationEntry 10 }

    tCOTLnkErrCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::Association.TLnkErrCnt - timestamp"
       ::= { tCOutstationEntry 11 }

    tCOTLnkErrCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::Association.TLnkErrCnt"
       ::= { tCOutstationEntry 12 }

    tCOTLnkTyp OBJECT-TYPE
        SYNTAX              LnkKind
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::Association.TLnkTyp"
       ::= { tCOutstationEntry 13 }

    tCOAuthFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.AuthFailCnt - timestamp"
       ::= { tCOutstationEntry 14 }

    tCOAuthFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.AuthFailCnt"
       ::= { tCOutstationEntry 15 }

    tCOCtrlPrivFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.CtrlPrivFailCnt          -
timestamp"
       ::= { tCOutstationEntry 16 }

    tCOCtrlPrivFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
```

```
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.CtrlPrivFailCnt"
   ::= { tCOutstationEntry 17 }

tCODecryptFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.DecryptFailCnt - timestamp"
   ::= { tCOutstationEntry 18 }

tCODecryptFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.DecryptFailCnt"
   ::= { tCOutstationEntry 19 }

tCOExT0CntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT0Cnt - timestamp"
   ::= { tCOutstationEntry 20 }

tCOExT0Cnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT0Cnt"
   ::= { tCOutstationEntry 21 }

tCOExT1CntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT1Cnt - timestamp"
   ::= { tCOutstationEntry 22 }

tCOExT1Cnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT1Cnt"
   ::= { tCOutstationEntry 23 }

tCOExT2CntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.ExT2Cnt - timestamp"
   ::= { tCOutstationEntry 24 }

tCOExT2Cnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
```

```
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.ExT2Cnt"
       ::= { tCOutstationEntry 25 }

    tCOExT3CntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.ExT3Cnt - timestamp"
       ::= { tCOutstationEntry 26 }

    tCOExT3Cnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.ExT3Cnt"
       ::= { tCOutstationEntry 27 }

    tCOInDiscTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.InDisc - timestamp"
       ::= { tCOutstationEntry 28 }

    tCOInDisc OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.InDisc"
       ::= { tCOutstationEntry 29 }

    tCOInErrCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.InErrCnt - timestamp"
       ::= { tCOutstationEntry 30 }

    tCOInErrCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.InErrCnt"
       ::= { tCOutstationEntry 31 }

    tCOInOvCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.InOvCnt - timestamp"
       ::= { tCOutstationEntry 32 }

    tCOInOvCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
```

```
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InOvCnt"
   ::= { tCOutstationEntry 33 }

tCOInterPDUTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.InterPDUTime"
   ::= { tCOutstationEntry 34 }

tCOMisPDUCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.MisPDUCnt - timestamp"
   ::= { tCOutstationEntry 35 }

tCOMisPDUCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.MisPDUCnt"
   ::= { tCOutstationEntry 36 }

tCOOutErrTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.OutErr - timestamp"
   ::= { tCOutstationEntry 37 }

tCOOutErr OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.OutErr"
   ::= { tCOutstationEntry 38 }

tCOOutUvTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.OutUv - timestamp"
   ::= { tCOutstationEntry 39 }

tCOOutUv OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.OutUv"
   ::= { tCOutstationEntry 40 }

tCOPDURTT OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
```

```
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PDURTT"
       ::= { tCOutstationEntry 41 }

    tCOPDUSizeFailTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PDUSizeFail - timestamp"
       ::= { tCOutstationEntry 42 }

    tCOPDUSizeFail OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PDUSizeFail"
       ::= { tCOutstationEntry 43 }

    tCOPduTampCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PduTampCnt - timestamp"
       ::= { tCOutstationEntry 44 }

    tCOPduTampCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PduTampCnt"
       ::= { tCOutstationEntry 45 }

    tCOPrimaryInterfaceTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PrimaryInterface          -
timestamp"
       ::= { tCOutstationEntry 46 }

    tCOPrimaryInterface OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PrimaryInterface"
       ::= { tCOutstationEntry 47 }

    tCOPrivFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.PrivFailCnt - timestamp"
       ::= { tCOutstationEntry 48 }

    tCOPrivFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
```

```
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.PrivFailCnt"
   ::= { tCOutstationEntry 49 }

tCORtxCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RtxCnt - timestamp"
   ::= { tCOutstationEntry 50 }

tCORtxCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RtxCnt"
   ::= { tCOutstationEntry 51 }

tCORxCriticalTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RxCritical - timestamp"
   ::= { tCOutstationEntry 52 }

tCORxCritical OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RxCritical"
   ::= { tCOutstationEntry 53 }

tCORxPduTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RxPdu - timestamp"
   ::= { tCOutstationEntry 54 }

tCORxPdu OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RxPdu"
   ::= { tCOutstationEntry 55 }

tCORxSolicitedReqTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "IEEE 1815 and IEC 60870-5
                         Agent::60870andDNPProtocolInfo.RxSolicitedReq - timestamp"
   ::= { tCOutstationEntry 56 }

tCORxSolicitedReq OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
```

```
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxSolicitedReq"
       ::= { tCOutstationEntry 57 }

    tCORxUnsolicitedReqTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxUnsolicitedReq          -
timestamp"
       ::= { tCOutstationEntry 58 }

    tCORxUnsolicitedReq OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.RxUnsolicitedReq"
       ::= { tCOutstationEntry 59 }

    tCOSessKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.SessKeyFailCnt - timestamp"
       ::= { tCOutstationEntry 60 }

    tCOSessKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.SessKeyFailCnt"
       ::= { tCOutstationEntry 61 }

    tCOTxCriticalTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxCritical - timestamp"
       ::= { tCOutstationEntry 62 }

    tCOTxCritical OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxCritical"
       ::= { tCOutstationEntry 63 }

    tCOTxPduTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxPdu - timestamp"
       ::= { tCOutstationEntry 64 }

    tCOTxPdu OBJECT-TYPE
        SYNTAX              Counter32
```

```
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxPdu"
       ::= { tCOutstationEntry 65 }

    tCOTxSolicitedReqTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxSolicitedReq - timestamp"
       ::= { tCOutstationEntry 66 }

    tCOTxSolicitedReq OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxSolicitedReq"
       ::= { tCOutstationEntry 67 }

    tCOTxUnsolicitedReqTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxUnsolicitedReq          -
timestamp"
       ::= { tCOutstationEntry 68 }

    tCOTxUnsolicitedReq OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.TxUnsolicitedReq"
       ::= { tCOutstationEntry 69 }

    tCOUpKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.UpKeyFailCnt - timestamp"
       ::= { tCOutstationEntry 70 }

    tCOUpKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "IEEE 1815 and IEC 60870-5
                             Agent::60870andDNPProtocolInfo.UpKeyFailCnt"
       ::= { tCOutstationEntry 71 }

    tCOIEC62351part3 OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Common
                             objects::CommonProtocolInfo.IEC62351part3"
       ::= { tCOutstationEntry 72 }

    tCOPart3ConnectionId OBJECT-TYPE
```

```
        SYNTAX              Integer32
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "Common
                             objects::CommonProtocolInfo.Part3ConnectionId"
      ::= { tCOutstationEntry 73 }

    tCOTCPHndShTime OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Common
                             objects::CommonProtocolInfo.TCPHndShTime"
      ::= { tCOutstationEntry 74 }

    tCOTLSHndTime OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Common
                             objects::CommonProtocolInfo.TLSHndTime"
      ::= { tCOutstationEntry 75 }

    tCOTLSRenegotiationTime OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Common
                             objects::CommonProtocolInfo.TLSRenegotiationTime"
      ::= { tCOutstationEntry 76 }

    tCOTLSResumptionTime OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Common
                             objects::CommonProtocolInfo.TLSResumptionTime"
      ::= { tCOutstationEntry 77 }

    tCOTotalHndTime OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Common
                             objects::CommonProtocolInfo.TotalHndTime"
      ::= { tCOutstationEntry 78 }

    tCOTransportHndTime OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Common
                             objects::CommonProtocolInfo.TransportHndTime"
      ::= { tCOutstationEntry 79 }

    ieee1815andiec60870-5-agentGroupOptional OBJECT-GROUP
      OBJECTS {
                    tCCntRsTs,
              tCCntRs,
              tCLastEventTs,
              tCLastEvent,
              tCAuthFailCntTs,
              tCAuthFailCnt,
              tCCtrlPrivFailCntTs,
```

```
tCCtrlPrivFailCnt,
tCDecryptFailCntTs,
tCDecryptFailCnt,
tCExT0CntTs,
tCExT0Cnt,
tCExT1CntTs,
tCExT1Cnt,
tCExT2CntTs,
tCExT2Cnt,
tCExT3CntTs,
tCExT3Cnt,
tCInDiscTs,
tCInDisc,
tCInErrCntTs,
tCInErrCnt,
tCInOvCntTs,
tCInOvCnt,
tCInterPDUTime,
tCMisPDUCntTs,
tCMisPDUCnt,
tCOutErrTs,
tCOutErr,
tCOutUvTs,
tCOutUv,
tCPDURTT,
tCPDUSizeFailTs,
tCPDUSizeFail,
tCPduTampCntTs,
tCPduTampCnt,
tCPrimaryInterfaceTs,
tCPrimaryInterface,
tCPrivFailCntTs,
tCPrivFailCnt,
tCRtxCntTs,
tCRtxCnt,
tCRxCriticalTs,
tCRxCritical,
tCRxPduTs,
tCRxPdu,
tCRxSolicitedReqTs,
tCRxSolicitedReq,
tCRxUnsolicitedReqTs,
tCRxUnsolicitedReq,
tCSessKeyFailCntTs,
tCSessKeyFailCnt,
tCTxCriticalTs,
tCTxCritical,
tCTxPduTs,
tCTxPdu,
tCTxSolicitedReqTs,
tCTxSolicitedReq,
tCTxUnsolicitedReqTs,
tCTxUnsolicitedReq,
tCUpKeyFailCntTs,
tCUpKeyFailCnt,
tCMCntRsTs,
tCMCntRs,
tCMLocAddress,
tCMLocAddressType,
tCMProtID,
tCMProviderDesc,
tCMProviderName,
tCMRemAddress,
tCMRemAddressType,
```

```
                tCMTLnkErrCntTs,
                tCMTLnkErrCnt,
                tCMTLnkTyp,
                tCMAuthFailCntTs,
                tCMAuthFailCnt,
                tCMCtrlPrivFailCntTs,
                tCMCtrlPrivFailCnt,
                tCMDecryptFailCntTs,
                tCMDecryptFailCnt,
                tCMExT0CntTs,
                tCMExT0Cnt,
                tCMExT1CntTs,
                tCMExT1Cnt,
                tCMExT2CntTs,
                tCMExT2Cnt,
                tCMExT3CntTs,
                tCMExT3Cnt,
                tCMInDiscTs,
                tCMInDisc,
                tCMInErrCntTs,
                tCMInErrCnt,
                tCMInOvCntTs,
                tCMInOvCnt,
                tCMInterPDUTime,
                tCMMisPDUCntTs,
                tCMMisPDUCnt,
                tCMOutErrTs,
                tCMOutErr,
                tCMOutUvTs,
                tCMOutUv,
                tCMPDURTT,
                tCMPDUSizeFailTs,
                tCMPDUSizeFail,
                tCMPduTampCntTs,
                tCMPduTampCnt,
                tCMPrimaryInterfaceTs,
                tCMPrimaryInterface,
                tCMPrivFailCntTs,
                tCMPrivFailCnt,
                tCMRtxCntTs,
                tCMRtxCnt,
                tCMRxCriticalTs,
                tCMRxCritical,
                tCMRxPduTs,
                tCMRxPdu,
                tCMRxSolicitedReqTs,
                tCMRxSolicitedReq,
                tCMRxUnsolicitedReqTs,
                tCMRxUnsolicitedReq,
                tCMSessKeyFailCntTs,
                tCMSessKeyFailCnt,
                tCMTxCriticalTs,
                tCMTxCritical,
                tCMTxPduTs,
                tCMTxPdu,
                tCMTxSolicitedReqTs,
                tCMTxSolicitedReq,
                tCMTxUnsolicitedReqTs,
                tCMTxUnsolicitedReq,
                tCMUpKeyFailCntTs,
                tCMUpKeyFailCnt,
                tCMIEC62351part3,
                tCMPart3ConnectionId,
                tCMTCPHndShTime,
```

```
tCMTLSHndTime,
tCMTLSRenegotiationTime,
tCMTLSResumptionTime,
tCMTotalHndTime,
tCMTransportHndTime,
tCOCntRsTs,
tCOCntRs,
tCOLocAddress,
tCOLocAddressType,
tCOProtID,
tCOProviderDesc,
tCOProviderName,
tCORemAddress,
tCORemAddressType,
tCOTLnkErrCntTs,
tCOTLnkErrCnt,
tCOTLnkTyp,
tCOAuthFailCntTs,
tCOAuthFailCnt,
tCOCtrlPrivFailCntTs,
tCOCtrlPrivFailCnt,
tCODecryptFailCntTs,
tCODecryptFailCnt,
tCOExT0CntTs,
tCOExT0Cnt,
tCOExT1CntTs,
tCOExT1Cnt,
tCOExT2CntTs,
tCOExT2Cnt,
tCOExT3CntTs,
tCOExT3Cnt,
tCOInDiscTs,
tCOInDisc,
tCOInErrCntTs,
tCOInErrCnt,
tCOInOvCntTs,
tCOInOvCnt,
tCOInterPDUTime,
tCOMisPDUCntTs,
tCOMisPDUCnt,
tCOOutErrTs,
tCOOutErr,
tCOOutUvTs,
tCOOutUv,
tCOPDURTT,
tCOPDUSizeFailTs,
tCOPDUSizeFail,
tCOPduTampCntTs,
tCOPduTampCnt,
tCOPrimaryInterfaceTs,
tCOPrimaryInterface,
tCOPrivFailCntTs,
tCOPrivFailCnt,
tCORtxCntTs,
tCORtxCnt,
tCORxCriticalTs,
tCORxCritical,
tCORxPduTs,
tCORxPdu,
tCORxSolicitedReqTs,
tCORxSolicitedReq,
tCORxUnsolicitedReqTs,
tCORxUnsolicitedReq,
tCOSessKeyFailCntTs,
```

```
                tCOSessKeyFailCnt,
                tCOTxCriticalTs,
                tCOTxCritical,
                tCOTxPduTs,
                tCOTxPdu,
                tCOTxSolicitedReqTs,
                tCOTxSolicitedReq,
                tCOTxUnsolicitedReqTs,
                tCOTxUnsolicitedReq,
                tCOUpKeyFailCntTs,
                tCOUpKeyFailCnt,
                tCOIEC62351part3,
                tCOPart3ConnectionId,
                tCOTCPHndShTime,
                tCOTLSHndTime,
                tCOTLSRenegotiationTime,
                tCOTLSResumptionTime,
                tCOTotalHndTime,
                tCOTransportHndTime
        }
         STATUS              current
        DESCRIPTION         "ieee1815andiec60870-5-agent optional
                              objects group"
        ::= { ieee1815andiec60870-5-agent 2 }

    ieee1815andiec60870-5-agentCompliance MODULE-COMPLIANCE
         STATUS              current
         DESCRIPTION         "ieee1815andiec60870-5-agent Compliance"
        MODULE

        ::= { ieee1815andiec60870-5-agent 3 }


END
```

<CODE ENDS>

IEC 61850 ACSI agent MIB

<CODE BEGINS>

```
IEC-62351-IEC61850-ACSI-MIB DEFINITIONS::= BEGIN
    IMPORTS
    MODULE-IDENTITY,  OBJECT-IDENTITY,
    OBJECT-TYPE, Counter32, Integer32, Unsigned32,
    Gauge32, TimeTicks, NOTIFICATION-TYPE
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, DisplayString, TruthValue,
    MacAddress, PhysAddress, DateAndTime
        FROM SNMPv2-TC
    OBJECT-GROUP, NOTIFICATION-GROUP, MODULE-COMPLIANCE
        FROM SNMPv2-CONF
    Float32TC
              FROM FLOAT-TC-MIB
       AppDatStKind, PhyHealthKind, ExtKind,
    IntKind, LnkKind, PSPAccKind, ProtIdKind, EventKind,
    TimSyncIssueKind, SecurityProfileKind, TimSyncSrcKind FROM
    IEC-62351-ENUM-MIB
    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB;

    acsi-agent MODULE-IDENTITY
        LAST-UPDATED        "201706061000Z"
        ORGANIZATION        "IEC"
        CONTACT-INFO        "IEC TC57 WG15"
```

```
    DESCRIPTION         "Copyright (C) IEC. This version of this MIB module is part
                         of IEC 57-62351-7-Ed1.
                         See the IEC 57-62351-7-Ed1 for full legal notices.
                         As shown in Figure 20, the ACSI package includes
                         the IEC 61850 Abstract Communication Service
                         Interface (ACSI) classes."

    REVISION            "201706061000Z"
    DESCRIPTION         "IEC 57-62351-7-Ed1"

   ::= { iec61850 1 }

   standard  OBJECT IDENTIFIER::= { iso 0 }

   iec62351  OBJECT IDENTIFIER::= { standard 62351 }

   part7  OBJECT IDENTIFIER::= { iec62351 7 }

   application  OBJECT IDENTIFIER::= { part7 3 }

   iec61850  OBJECT IDENTIFIER::= { application 2 }


acsi OBJECT-IDENTITY
    STATUS              current
    DESCRIPTION         "The ACSISummary class includes the attributes
                         which define the information about the overall IEC
                         61850 stack running on the device ACSI."
   ::= { acsi-agent 1 }

aCSIassocPoolMax OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.assocPoolMax"
   ::= { acsi 1 }

aCSIassocPoolUsed OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.assocPoolUsed"
   ::= { acsi 2 }

aCSICntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.CntRs - timestamp"
   ::= { acsi 3 }

aCSICntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.CntRs"
   ::= { acsi 4 }

aCSICtrlPrivFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.CtrlPrivFailCnt -
                         timestamp"
```

```
    ::= { acsi 5 }

aCSICtrlPrivFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.CtrlPrivFailCnt"
   ::= { acsi 6 }

aCSIgsePubMax OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.gsePubMax"
   ::= { acsi 7 }

aCSIgsePubUsed OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.gsePubUsed"
   ::= { acsi 8 }

aCSIgseSubMax OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.gseSubMax"
   ::= { acsi 9 }

aCSIgseSubUsed OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.gseSubUsed"
   ::= { acsi 10 }

aCSILastEventTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.LastEvent - timestamp"
   ::= { acsi 11 }

aCSILastEvent OBJECT-TYPE
    SYNTAX              EventKind
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.LastEvent"
   ::= { acsi 12 }

aCSIPrivFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.PrivFailCnt - timestamp"
   ::= { acsi 13 }

aCSIPrivFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.PrivFailCnt"
   ::= { acsi 14 }
```

```
aCSIRemoteEstAssocCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.RemoteEstAssocCnt -
                         timestamp"
   ::= { acsi 15 }

aCSIRemoteEstAssocCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.RemoteEstAssocCnt"
   ::= { acsi 16 }

aCSIAcsCtlFailTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.AcsCtlFail - timestamp"
   ::= { acsi 17 }

aCSIAcsCtlFail OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.AcsCtlFail"
   ::= { acsi 18 }

aCSIsvPubMax OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.svPubMax"
   ::= { acsi 19 }

aCSIsvPubUsed OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.svPubUsed"
   ::= { acsi 20 }

aCSIsvSubMax OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.svSubMax"
   ::= { acsi 21 }

aCSIsvSubUsed OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "ACSI::ACSISummary.svSubUsed"
   ::= { acsi 22 }

acsi-agentGroupOptional OBJECT-GROUP
   OBJECTS {
                  aCSIassocPoolMax,
           aCSIassocPoolUsed,
           aCSICntRsTs,
           aCSICntRs,
```

```
                aCSICtrlPrivFailCntTs,
                aCSICtrlPrivFailCnt,
                aCSIgsePubMax,
                aCSIgsePubUsed,
                aCSIgseSubMax,
                aCSIgseSubUsed,
                aCSILastEventTs,
                aCSILastEvent,
                aCSIPrivFailCntTs,
                aCSIPrivFailCnt,
                aCSIRemoteEstAssocCntTs,
                aCSIRemoteEstAssocCnt,
                aCSIAcsCtlFailTs,
                aCSIAcsCtlFail,
                aCSIsvPubMax,
                aCSIsvPubUsed,
                aCSIsvSubMax,
                aCSIsvSubUsed
        }
         STATUS              current
        DESCRIPTION         "acsi-agent optional objects group"
        ::= { acsi-agent 2 }

    acsi-agentCompliance MODULE-COMPLIANCE
         STATUS              current
         DESCRIPTION         "acsi-agent Compliance"
        MODULE

        ::= { acsi-agent 3 }


END
```

<CODE ENDS>

IEC 61850 GSE agent MIB

<CODE BEGINS>

```
IEC-62351-IEC61850-GSE-MIB DEFINITIONS::= BEGIN
    IMPORTS
    MODULE-IDENTITY,  OBJECT-IDENTITY,
    OBJECT-TYPE, Counter32, Integer32, Unsigned32,
    Gauge32, TimeTicks, NOTIFICATION-TYPE
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, DisplayString, TruthValue,
    MacAddress, PhysAddress, DateAndTime
        FROM SNMPv2-TC
    OBJECT-GROUP, NOTIFICATION-GROUP, MODULE-COMPLIANCE
        FROM SNMPv2-CONF
    Float32TC
              FROM FLOAT-TC-MIB
       AppDatStKind, PhyHealthKind, ExtKind,
    IntKind, LnkKind, PSPAccKind, ProtIdKind, EventKind,
    TimSyncIssueKind, SecurityProfileKind, TimSyncSrcKind FROM
    IEC-62351-ENUM-MIB
    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB;

    gse-agent MODULE-IDENTITY
        LAST-UPDATED        "201706061000Z"
        ORGANIZATION        "IEC"
        CONTACT-INFO        "IEC TC57 WG15"
        DESCRIPTION         "Copyright (C) IEC. This version of this MIB module is part
                             of IEC 57-62351-7-Ed1.
```

```
                        See the IEC 57-62351-7-Ed1 for full legal notices.
                        As shown in Figure 24, the GSE package includes
                        the IEC 61850 Generic Substation Events (GSE)
                        classes. GSEprovider and GSEAssociation inherit both
                        Security and Protocol Info attributes from the more
                        general classes."

    REVISION            "201706061000Z"
    DESCRIPTION         "IEC 57-62351-7-Ed1"

   ::= { iec61850 4 }

   standard  OBJECT IDENTIFIER::= { iso 0 }

   iec62351  OBJECT IDENTIFIER::= { standard 62351 }

   part7  OBJECT IDENTIFIER::= { iec62351 7 }

   application  OBJECT IDENTIFIER::= { part7 3 }

   iec61850  OBJECT IDENTIFIER::= { application 2 }


gse OBJECT-IDENTITY
    STATUS              current
    DESCRIPTION         "The GSEProvider class includes the attributes
                         which define the information about the overall IEC
                         61850 stack GSE provider running on the device."
   ::= { gse-agent 1 }

gSECntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "GSE::GSEProvider.CntRs - timestamp"
   ::= { gse 1 }

gSECntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "GSE::GSEProvider.CntRs"
   ::= { gse 2 }

gSEDecryptFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "GSE::GSEProvider.DecryptFailCnt -
                         timestamp"
   ::= { gse 3 }

gSEDecryptFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "GSE::GSEProvider.DecryptFailCnt"
   ::= { gse 4 }

gSEInErrCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "GSE::GSEProvider.InErrCnt - timestamp"
```

```
    ::= { gse 5 }

gSEInErrCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "GSE::GSEProvider.InErrCnt"
   ::= { gse 6 }

gSEInUnexpectedMulticastTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "GSE::GSEProvider.InUnexpectedMulticast -
                         timestamp"
   ::= { gse 7 }

gSEInUnexpectedMulticast OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "GSE::GSEProvider.InUnexpectedMulticast"
   ::= { gse 8 }

gSEGroupUpKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.GroupUpKeyFailCnt - timestamp"
   ::= { gse 9 }

gSEGroupUpKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.GroupUpKeyFailCnt"
   ::= { gse 10 }

gSEKDCAuthFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt - timestamp"
   ::= { gse 11 }

gSEKDCAuthFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt"
   ::= { gse 12 }

gSEKDCSessionKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt - timestamp"
   ::= { gse 13 }
```

```
gSEKDCSessionKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt"
   ::= { gse 14 }

gSEPIPTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF GSEPublisherAssociationIP
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "GSE::GSEProvider.PIP"
   ::= { gse 15 }

gSEPIPEntry OBJECT-TYPE
    SYNTAX  GSEPublisherAssociationIP
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "GSE::GSEProvider.PIP"
    INDEX   {
           gSEPIPCBRef

   }
   ::= { gSEPIPTable 1 }

GSEPublisherAssociationIP::=
    SEQUENCE {
           gSEPIPDestIpAddr InetAddress,
           gSEPIPDestIpAddrType InetAddressType,
           gSEPIPCBRef DisplayString,
           gSEPIPCntRsTs DateAndTime,
           gSEPIPCntRs TruthValue,
           gSEPIPOutUvTs DateAndTime,
           gSEPIPOutUv Counter32 ,
           gSEPIPTxPduPerSecond Float32TC,
           gSEPIPGroupUpKeyFailCntTs DateAndTime,
           gSEPIPGroupUpKeyFailCnt Counter32 ,
           gSEPIPKDCAuthFailCntTs DateAndTime,
           gSEPIPKDCAuthFailCnt Counter32 ,
           gSEPIPKDCSessionKeyFailCntTs DateAndTime,
           gSEPIPKDCSessionKeyFailCnt Counter32
    }

gSEPL2Table OBJECT-TYPE
    SYNTAX  SEQUENCE OF GSEPublisherAssociationL2
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "GSE::GSEProvider.PL2"
   ::= { gse 16 }

gSEPL2Entry OBJECT-TYPE
    SYNTAX  GSEPublisherAssociationL2
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "GSE::GSEProvider.PL2"
    INDEX   {
           gSEPL2CBRef

   }
```

```
   ::= { gSEPL2Table 1 }

GSEPublisherAssociationL2::=
    SEQUENCE {
           gSEPL2DestMacAddr MacAddress,
           gSEPL2CBRef DisplayString,
           gSEPL2CntRsTs DateAndTime,
           gSEPL2CntRs TruthValue,
           gSEPL2OutUvTs DateAndTime,
           gSEPL2OutUv Counter32 ,
           gSEPL2TxPduPerSecond Float32TC,
           gSEPL2GroupUpKeyFailCntTs DateAndTime,
           gSEPL2GroupUpKeyFailCnt Counter32 ,
           gSEPL2KDCAuthFailCntTs DateAndTime,
           gSEPL2KDCAuthFailCnt Counter32 ,
           gSEPL2KDCSessionKeyFailCntTs DateAndTime,
           gSEPL2KDCSessionKeyFailCnt Counter32
    }


gSEGSENotificationType NOTIFICATION-TYPE
    OBJECTS {

           gSEGroupUpKeyFailCntTs,
           gSEGroupUpKeyFailCnt,
           gSEKDCAuthFailCntTs,
           gSEKDCAuthFailCnt,
           gSEKDCSessionKeyFailCntTs,
           gSEKDCSessionKeyFailCnt
            }
    STATUS              current
    DESCRIPTION         "The GSENotification class defines the content
                         of the notification message to be sent on event
                         related with the specified objects."
   ::= { gse 17 }

gSEGSENotification NOTIFICATION-GROUP
    NOTIFICATIONS       {
                            gSEGSENotificationType
                        }
    STATUS              current
    DESCRIPTION         "The GSENotification class defines the content
                         of the notification message to be sent on event
                         related with the specified objects."
   ::= { gse 18 }

gSESIPTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF GSESubcriberAssociationIP
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
           "GSE::GSEProvider.SIP"
   ::= { gse 19 }

gSESIPEntry OBJECT-TYPE
    SYNTAX  GSESubcriberAssociationIP
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
           "GSE::GSEProvider.SIP"
    INDEX   {
           gSESIPCBRef

   }
```

```
   ::= { gSESIPTable 1 }

GSESubcriberAssociationIP::=
    SEQUENCE {
           gSESIPSrcIpAddr InetAddress,
           gSESIPSrcIpAddrType InetAddressType,
           gSESIPConfRevMis TruthValue,
           gSESIPNdsComm TruthValue,
           gSESIPTalExpCntTs DateAndTime,
           gSESIPTalExpCnt Counter32 ,
           gSESIPCBRef DisplayString,
           gSESIPCntRsTs DateAndTime,
           gSESIPCntRs TruthValue,
           gSESIPInOvCntTs DateAndTime,
           gSESIPInOvCnt Counter32 ,
           gSESIPMessageIntegrityFailCntTs DateAndTime,
           gSESIPMessageIntegrityFailCnt Counter32 ,
           gSESIPRxPduPerSecond Float32TC,
           gSESIPGroupUpKeyFailCntTs DateAndTime,
           gSESIPGroupUpKeyFailCnt Counter32 ,
           gSESIPKDCAuthFailCntTs DateAndTime,
           gSESIPKDCAuthFailCnt Counter32 ,
           gSESIPKDCSessionKeyFailCntTs DateAndTime,
           gSESIPKDCSessionKeyFailCnt Counter32
    }

gSESL2Table OBJECT-TYPE
    SYNTAX  SEQUENCE OF GSESubcriberAssociationL2
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "GSE::GSEProvider.SL2"
   ::= { gse 20 }

gSESL2Entry OBJECT-TYPE
    SYNTAX  GSESubcriberAssociationL2
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "GSE::GSEProvider.SL2"
    INDEX   {
           gSESL2CBRef

   }
   ::= { gSESL2Table 1 }

GSESubcriberAssociationL2::=
    SEQUENCE {
           gSESL2SrcMacAddr MacAddress,
           gSESL2ConfRevMis TruthValue,
           gSESL2NdsComm TruthValue,
           gSESL2TalExpCntTs DateAndTime,
           gSESL2TalExpCnt Counter32 ,
           gSESL2CBRef DisplayString,
           gSESL2CntRsTs DateAndTime,
           gSESL2CntRs TruthValue,
           gSESL2InOvCntTs DateAndTime,
           gSESL2InOvCnt Counter32 ,
           gSESL2MessageIntegrityFailCntTs DateAndTime,
           gSESL2MessageIntegrityFailCnt Counter32 ,
           gSESL2RxPduPerSecond Float32TC,
           gSESL2GroupUpKeyFailCntTs DateAndTime,
           gSESL2GroupUpKeyFailCnt Counter32 ,
           gSESL2KDCAuthFailCntTs DateAndTime,
```

```
            gSESL2KDCAuthFailCnt Counter32 ,
            gSESL2KDCSessionKeyFailCntTs DateAndTime,
            gSESL2KDCSessionKeyFailCnt Counter32
    }

gSEPIPDestIpAddr OBJECT-TYPE
    SYNTAX              InetAddress
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "
                         GSE::GSEPublisherAssociationIP.DestIpAddr"
   ::= { gSEPIPEntry 1 }

gSEPIPDestIpAddrType OBJECT-TYPE
    SYNTAX              InetAddressType
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "
                         GSE::GSEPublisherAssociationIP.DestIpAddrType"
   ::= { gSEPIPEntry 2 }

gSEPIPCBRef OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.CBRef"
   ::= { gSEPIPEntry 3 }

gSEPIPCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.CntRs - timestamp"
   ::= { gSEPIPEntry 4 }

gSEPIPCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.CntRs"
   ::= { gSEPIPEntry 5 }

gSEPIPOutUvTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.OutUv - timestamp"
   ::= { gSEPIPEntry 6 }

gSEPIPOutUv OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.OutUv"
   ::= { gSEPIPEntry 7 }

gSEPIPTxPduPerSecond OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
```

```
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.TxPduPerSecond"
   ::= { gSEPIPEntry 8 }

gSEPIPGroupUpKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.GroupUpKeyFailCnt - timestamp"
   ::= { gSEPIPEntry 9 }

gSEPIPGroupUpKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.GroupUpKeyFailCnt"
   ::= { gSEPIPEntry 10 }

gSEPIPKDCAuthFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt - timestamp"
   ::= { gSEPIPEntry 11 }

gSEPIPKDCAuthFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt"
   ::= { gSEPIPEntry 12 }

gSEPIPKDCSessionKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt - timestamp"
   ::= { gSEPIPEntry 13 }

gSEPIPKDCSessionKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt"
   ::= { gSEPIPEntry 14 }

gSEPL2DestMacAddr OBJECT-TYPE
    SYNTAX              MacAddress
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "
                         GSE::GSEPublisherAssociationL2.DestMacAddr"
   ::= { gSEPL2Entry 1 }

gSEPL2CBRef OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          not-accessible
```

```
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVPublisherAssociation.CBRef"
       ::= { gSEPL2Entry 2 }

    gSEPL2CntRsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVPublisherAssociation.CntRs - timestamp"
       ::= { gSEPL2Entry 3 }

    gSEPL2CntRs OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVPublisherAssociation.CntRs"
       ::= { gSEPL2Entry 4 }

    gSEPL2OutUvTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVPublisherAssociation.OutUv - timestamp"
       ::= { gSEPL2Entry 5 }

    gSEPL2OutUv OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVPublisherAssociation.OutUv"
       ::= { gSEPL2Entry 6 }

    gSEPL2TxPduPerSecond OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVPublisherAssociation.TxPduPerSecond"
       ::= { gSEPL2Entry 7 }

    gSEPL2GroupUpKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.GroupUpKeyFailCnt - timestamp"
       ::= { gSEPL2Entry 8 }

    gSEPL2GroupUpKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.GroupUpKeyFailCnt"
       ::= { gSEPL2Entry 9 }

    gSEPL2KDCAuthFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
```

```
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt - timestamp"
   ::= { gSEPL2Entry 10 }

gSEPL2KDCAuthFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt"
   ::= { gSEPL2Entry 11 }

gSEPL2KDCSessionKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt - timestamp"
   ::= { gSEPL2Entry 12 }

gSEPL2KDCSessionKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt"
   ::= { gSEPL2Entry 13 }

gSESIPSrcIpAddr OBJECT-TYPE
    SYNTAX              InetAddress
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "GSE::GSESubcriberAssociationIP.SrcIpAddr"
   ::= { gSESIPEntry 1 }

gSESIPSrcIpAddrType OBJECT-TYPE
    SYNTAX              InetAddressType
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "
                         GSE::GSESubcriberAssociationIP.SrcIpAddrType"
   ::= { gSESIPEntry 2 }

gSESIPConfRevMis OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "GSE::GSESubscriberAssociation.ConfRevMis"
   ::= { gSESIPEntry 3 }

gSESIPNdsComm OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "GSE::GSESubscriberAssociation.NdsComm"
   ::= { gSESIPEntry 4 }

gSESIPTalExpCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "GSE::GSESubscriberAssociation.TalExpCnt -
                         timestamp"
```

```
       ::= { gSESIPEntry 5 }

    gSESIPTalExpCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "GSE::GSESubscriberAssociation.TalExpCnt"
       ::= { gSESIPEntry 6 }

    gSESIPCBRef OBJECT-TYPE
        SYNTAX              DisplayString
        MAX-ACCESS          not-accessible
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.CBRef"
       ::= { gSESIPEntry 7 }

    gSESIPCntRsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.CntRs - timestamp"
       ::= { gSESIPEntry 8 }

    gSESIPCntRs OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.CntRs"
       ::= { gSESIPEntry 9 }

    gSESIPInOvCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.InOvCnt          -
timestamp"
       ::= { gSESIPEntry 10 }

    gSESIPInOvCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.InOvCnt"
       ::= { gSESIPEntry 11 }

    gSESIPMessageIntegrityFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common

objects::GSEandSVSubscriberAssociation.MessageIntegrityFailCnt - timestamp"
       ::= { gSESIPEntry 12 }

    gSESIPMessageIntegrityFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
```

```
objects::GSEandSVSubscriberAssociation.MessageIntegrityFailCnt"
       ::= { gSESIPEntry 13 }

    gSESIPRxPduPerSecond OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.RxPduPerSecond"
       ::= { gSESIPEntry 14 }

    gSESIPGroupUpKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.GroupUpKeyFailCnt - timestamp"
       ::= { gSESIPEntry 15 }

    gSESIPGroupUpKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.GroupUpKeyFailCnt"
       ::= { gSESIPEntry 16 }

    gSESIPKDCAuthFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCAuthFailCnt - timestamp"
       ::= { gSESIPEntry 17 }

    gSESIPKDCAuthFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCAuthFailCnt"
       ::= { gSESIPEntry 18 }

    gSESIPKDCSessionKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCSessionKeyFailCnt - timestamp"
       ::= { gSESIPEntry 19 }

    gSESIPKDCSessionKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCSessionKeyFailCnt"
       ::= { gSESIPEntry 20 }

    gSESL2SrcMacAddr OBJECT-TYPE
        SYNTAX              MacAddress
        MAX-ACCESS          read-only
        STATUS              current
```

```
        DESCRIPTION         "
                             GSE::GSESubcriberAssociationL2.SrcMacAddr"
       ::= { gSESL2Entry 1 }

    gSESL2ConfRevMis OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "GSE::GSESubscriberAssociation.ConfRevMis"
       ::= { gSESL2Entry 2 }

    gSESL2NdsComm OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "GSE::GSESubscriberAssociation.NdsComm"
       ::= { gSESL2Entry 3 }

    gSESL2TalExpCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "GSE::GSESubscriberAssociation.TalExpCnt -
                             timestamp"
       ::= { gSESL2Entry 4 }

    gSESL2TalExpCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "GSE::GSESubscriberAssociation.TalExpCnt"
       ::= { gSESL2Entry 5 }

    gSESL2CBRef OBJECT-TYPE
        SYNTAX              DisplayString
        MAX-ACCESS          not-accessible
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.CBRef"
       ::= { gSESL2Entry 6 }

    gSESL2CntRsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.CntRs - timestamp"
       ::= { gSESL2Entry 7 }

    gSESL2CntRs OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.CntRs"
       ::= { gSESL2Entry 8 }

    gSESL2InOvCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.InOvCnt          -
timestamp"
```

```
        ::= { gSESL2Entry 9 }

    gSESL2InOvCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.InOvCnt"
        ::= { gSESL2Entry 10 }

    gSESL2MessageIntegrityFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common

objects::GSEandSVSubscriberAssociation.MessageIntegrityFailCnt - timestamp"
        ::= { gSESL2Entry 11 }

    gSESL2MessageIntegrityFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common

objects::GSEandSVSubscriberAssociation.MessageIntegrityFailCnt"
        ::= { gSESL2Entry 12 }

    gSESL2RxPduPerSecond OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.RxPduPerSecond"
        ::= { gSESL2Entry 13 }

    gSESL2GroupUpKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.GroupUpKeyFailCnt - timestamp"
        ::= { gSESL2Entry 14 }

    gSESL2GroupUpKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.GroupUpKeyFailCnt"
        ::= { gSESL2Entry 15 }

    gSESL2KDCAuthFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCAuthFailCnt - timestamp"
        ::= { gSESL2Entry 16 }

    gSESL2KDCAuthFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
```

```
                        objects::GSEandSVCommon.KDCAuthFailCnt"
    ::= { gSESL2Entry 17 }

gSESL2KDCSessionKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt - timestamp"
    ::= { gSESL2Entry 18 }

gSESL2KDCSessionKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt"
    ::= { gSESL2Entry 19 }

gse-agentGroupOptional OBJECT-GROUP
   OBJECTS {
                  gSECntRsTs,
           gSECntRs,
           gSEDecryptFailCntTs,
           gSEDecryptFailCnt,
           gSEInErrCntTs,
           gSEInErrCnt,
           gSEInUnexpectedMulticastTs,
           gSEInUnexpectedMulticast,
           gSEGroupUpKeyFailCntTs,
           gSEGroupUpKeyFailCnt,
           gSEKDCAuthFailCntTs,
           gSEKDCAuthFailCnt,
           gSEKDCSessionKeyFailCntTs,
           gSEKDCSessionKeyFailCnt,
           gSEPIPDestIpAddr,
           gSEPIPDestIpAddrType,
           gSEPIPCntRsTs,
           gSEPIPCntRs,
           gSEPIPOutUvTs,
           gSEPIPOutUv,
           gSEPIPTxPduPerSecond,
           gSEPIPGroupUpKeyFailCntTs,
           gSEPIPGroupUpKeyFailCnt,
           gSEPIPKDCAuthFailCntTs,
           gSEPIPKDCAuthFailCnt,
           gSEPIPKDCSessionKeyFailCntTs,
           gSEPIPKDCSessionKeyFailCnt,
           gSEPL2DestMacAddr,
           gSEPL2CntRsTs,
           gSEPL2CntRs,
           gSEPL2OutUvTs,
           gSEPL2OutUv,
           gSEPL2TxPduPerSecond,
           gSEPL2GroupUpKeyFailCntTs,
           gSEPL2GroupUpKeyFailCnt,
           gSEPL2KDCAuthFailCntTs,
           gSEPL2KDCAuthFailCnt,
           gSEPL2KDCSessionKeyFailCntTs,
           gSEPL2KDCSessionKeyFailCnt,
           gSESIPSrcIpAddr,
           gSESIPSrcIpAddrType,
           gSESIPConfRevMis,
           gSESIPNdsComm,
```

```
                gSESIPTalExpCntTs,
                gSESIPTalExpCnt,
                gSESIPCntRsTs,
                gSESIPCntRs,
                gSESIPInOvCntTs,
                gSESIPInOvCnt,
                gSESIPMessageIntegrityFailCntTs,
                gSESIPMessageIntegrityFailCnt,
                gSESIPRxPduPerSecond,
                gSESIPGroupUpKeyFailCntTs,
                gSESIPGroupUpKeyFailCnt,
                gSESIPKDCAuthFailCntTs,
                gSESIPKDCAuthFailCnt,
                gSESIPKDCSessionKeyFailCntTs,
                gSESIPKDCSessionKeyFailCnt,
                gSESL2SrcMacAddr,
                gSESL2ConfRevMis,
                gSESL2NdsComm,
                gSESL2TalExpCntTs,
                gSESL2TalExpCnt,
                gSESL2CntRsTs,
                gSESL2CntRs,
                gSESL2InOvCntTs,
                gSESL2InOvCnt,
                gSESL2MessageIntegrityFailCntTs,
                gSESL2MessageIntegrityFailCnt,
                gSESL2RxPduPerSecond,
                gSESL2GroupUpKeyFailCntTs,
                gSESL2GroupUpKeyFailCnt,
                gSESL2KDCAuthFailCntTs,
                gSESL2KDCAuthFailCnt,
                gSESL2KDCSessionKeyFailCntTs,
                gSESL2KDCSessionKeyFailCnt
        }
         STATUS              current
        DESCRIPTION         "gse-agent optional objects group"
        ::= { gse-agent 2 }

    gse-agentCompliance MODULE-COMPLIANCE
         STATUS              current
         DESCRIPTION         "gse-agent Compliance"
        MODULE

        ::= { gse-agent 3 }


END
```

<CODE ENDS>

IEC 61850 MMS agent MIB

<CODE BEGINS>

```
IEC-62351-IEC61850-MMS-MIB DEFINITIONS::= BEGIN
    IMPORTS
    MODULE-IDENTITY,  OBJECT-IDENTITY,
    OBJECT-TYPE, Counter32, Integer32, Unsigned32,
    Gauge32, TimeTicks, NOTIFICATION-TYPE
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, DisplayString, TruthValue,
    MacAddress, PhysAddress, DateAndTime
        FROM SNMPv2-TC
    OBJECT-GROUP, NOTIFICATION-GROUP, MODULE-COMPLIANCE
        FROM SNMPv2-CONF
```

```
Float32TC
          FROM FLOAT-TC-MIB
   AppDatStKind, PhyHealthKind, ExtKind,
IntKind, LnkKind, PSPAccKind, ProtIdKind, EventKind,
TimSyncIssueKind, SecurityProfileKind, TimSyncSrcKind FROM
IEC-62351-ENUM-MIB
InetAddressType, InetAddress
    FROM INET-ADDRESS-MIB;

mms-agent MODULE-IDENTITY
    LAST-UPDATED        "201706061000Z"
    ORGANIZATION        "IEC"
    CONTACT-INFO        "IEC TC57 WG15"
    DESCRIPTION         "Copyright (C) IEC. This version of this MIB module is part
                         of IEC 57-62351-7-Ed1.
                         See the IEC 57-62351-7-Ed1 for full legal notices.
                         As shown in Figure 21, the MMS package includes
                         the IEC 61850 Manufacturing Message
                         Specification (MMS) classes. MMS Provider and MMS
                         Association inherit both Security and Protocol Info
                         attributes from the more general classes."

    REVISION            "201706061000Z"
    DESCRIPTION         "IEC 57-62351-7-Ed1"

   ::= { iec61850 2 }

   standard  OBJECT IDENTIFIER::= { iso 0 }

   iec62351  OBJECT IDENTIFIER::= { standard 62351 }

   part7  OBJECT IDENTIFIER::= { iec62351 7 }

   application  OBJECT IDENTIFIER::= { part7 3 }

   iec61850  OBJECT IDENTIFIER::= { application 2 }


mms OBJECT-IDENTITY
    STATUS              current
    DESCRIPTION         "The MMSProvider class includes the attributes
                         which define the information about the overall IEC
                         61850 stack MMS provider running on the device."
   ::= { mms-agent 1 }

mMSAProfileDecryptFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.AProfileDecryptFailCnt -
                         timestamp"
   ::= { mms 1 }

mMSAProfileDecryptFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.AProfileDecryptFailCnt"
   ::= { mms 2 }

mMSAuthFailTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
```

```
    DESCRIPTION         "MMS::MMSProvider.AuthFail - timestamp"
   ::= { mms 3 }

mMSAuthFail OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.AuthFail"
   ::= { mms 4 }

mMSCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.CntRs - timestamp"
   ::= { mms 5 }

mMSCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.CntRs"
   ::= { mms 6 }

mMSConnFailInCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.ConnFailInCnt - timestamp"
   ::= { mms 7 }

mMSConnFailInCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.ConnFailInCnt"
   ::= { mms 8 }

mMSConnFailOutCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.ConnFailOutCnt -
                         timestamp"
   ::= { mms 9 }

mMSConnFailOutCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.ConnFailOutCnt"
   ::= { mms 10 }

mMSDecryptFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.DecryptFailCnt -
                         timestamp"
   ::= { mms 11 }

mMSDecryptFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
```

```
        STATUS              current
        DESCRIPTION         "MMS::MMSProvider.DecryptFailCnt"
       ::= { mms 12 }

    mMSLastEventTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProvider.LastEvent - timestamp"
       ::= { mms 13 }

    mMSLastEvent OBJECT-TYPE
        SYNTAX              EventKind
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProvider.LastEvent"
       ::= { mms 14 }

    mMSMMSTable OBJECT-TYPE
        SYNTAX  SEQUENCE OF MMSAssociation
        MAX-ACCESS  not-accessible
        STATUS  current
        DESCRIPTION
                "MMS::MMSProvider.MMS"
       ::= { mms 15 }

    mMSMMSEntry OBJECT-TYPE
        SYNTAX  MMSAssociation
        MAX-ACCESS  not-accessible
        STATUS  current
        DESCRIPTION
                "MMS::MMSProvider.MMS"
        INDEX   {
               mMSEAssociationId

       }
       ::= { mMSMMSTable 1 }

    MMSAssociation::=
        SEQUENCE {
               mMSEActiveTs DateAndTime,
               mMSEActive TruthValue,
               mMSEAssociationId Unsigned32,
               mMSEClient TruthValue,
               mMSECntRsTs DateAndTime,
               mMSECntRs TruthValue,
               mMSEHndShTime Float32TC,
               mMSERemoteEstAssos TruthValue,
               mMSERemoteIP InetAddress,
               mMSERemoteIPAddressType InetAddressType,
               mMSERemotePSEL DisplayString,
               mMSERemoteSSEL DisplayString,
               mMSERemoteTSEL DisplayString,
               mMSEReportPer100Seconds Integer32,
               mMSERptReceptionDelayTs DateAndTime,
               mMSERptReceptionDelay Float32TC,
               mMSESecurityProfile SecurityProfileKind,
               mMSEErrorRxCntTs DateAndTime,
               mMSEErrorRxCnt Counter32 ,
               mMSEErrorTxCntTs DateAndTime,
               mMSEErrorTxCnt Counter32 ,
               mMSEInfoRptRxCntTs DateAndTime,
               mMSEInfoRptRxCnt Counter32 ,
               mMSEInfoRptTxCntTs DateAndTime,
```

```
            mMSEInfoRptTxCnt Counter32 ,
            mMSEMisCmdAckCntTs DateAndTime,
            mMSEMisCmdAckCnt Counter32 ,
            mMSEMMSProExchTime Float32TC,
            mMSERejectRxCntTs DateAndTime,
            mMSERejectRxCnt Counter32 ,
            mMSERejectTxCntTs DateAndTime,
            mMSERejectTxCnt Counter32 ,
            mMSEReqRxCntTs DateAndTime,
            mMSEReqRxCnt Counter32 ,
            mMSEReqTxCntTs DateAndTime,
            mMSEReqTxCnt Counter32 ,
            mMSERespRxCntTs DateAndTime,
            mMSERespRxCnt Counter32 ,
            mMSERespTxCntTs DateAndTime,
            mMSERespTxCnt Counter32 ,
            mMSESessKeyFailCntTs DateAndTime,
            mMSESessKeyFailCnt Counter32 ,
            mMSEIEC62351part3 TruthValue,
            mMSEPart3ConnectionId Integer32,
            mMSETCPHndShTime Float32TC,
            mMSETLSHndTime Float32TC,
            mMSETLSRenegotiationTime Float32TC,
            mMSETLSResumptionTime Float32TC,
            mMSETotalHndTime Float32TC,
            mMSETransportHndTime Float32TC
    }

mMSPrivFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.PrivFailCnt - timestamp"
   ::= { mms 16 }

mMSPrivFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.PrivFailCnt"
   ::= { mms 17 }

mMSProviderDesc OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.ProviderDesc"
   ::= { mms 18 }

mMSProviderName OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.ProviderName"
   ::= { mms 19 }


mMSMMSSecurityNotificationType NOTIFICATION-TYPE
    OBJECTS {

            mMSDecryptFailCntTs,
            mMSDecryptFailCnt,
            mMSLastEventTs,
            mMSLastEvent,
```

```
            mMSPrivFailCntTs,
            mMSPrivFailCnt,
            mMSUpKeyFailCntTs,
            mMSUpKeyFailCnt
             }
    STATUS              current
    DESCRIPTION         "The MMSSecurityNotification class defines
                         the content of the notification message to be sent
                         on event related with the specified objects."
   ::= { mms 20 }

mMSMMSSecurityNotification NOTIFICATION-GROUP
    NOTIFICATIONS       {
                            mMSMMSSecurityNotificationType
                        }
    STATUS              current
    DESCRIPTION         "The MMSSecurityNotification class defines
                         the content of the notification message to be sent
                         on event related with the specified objects."
   ::= { mms 21 }

mMSSessionEstablishmentRate OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "
                         MMS::MMSProvider.SessionEstablishmentRate"
   ::= { mms 22 }

mMSSessionRestartCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.SessionRestartCnt -
                         timestamp"
   ::= { mms 23 }

mMSSessionRestartCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.SessionRestartCnt"
   ::= { mms 24 }


mMSMMSNotificationType NOTIFICATION-TYPE
    OBJECTS {

            mMSConnFailInCntTs,
            mMSConnFailInCnt,
            mMSConnFailOutCntTs,
            mMSConnFailOutCnt,
            mMSRejectRxCntTs,
            mMSRejectRxCnt,
            mMSRejectTxCntTs,
            mMSRejectTxCnt
             }
    STATUS              current
    DESCRIPTION         "The MMSNotification class defines the content
                         of the notification message to be sent on event
                         related with the specified objects."
   ::= { mms 25 }

mMSMMSNotification NOTIFICATION-GROUP
```

```
    NOTIFICATIONS       {
                            mMSMMSNotificationType
                        }
    STATUS              current
    DESCRIPTION         "The MMSNotification class defines the content
                         of the notification message to be sent on event
                         related with the specified objects."
   ::= { mms 26 }

mMSTProfileDecryptFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.TProfileDecryptFailCnt -
                         timestamp"
   ::= { mms 27 }

mMSTProfileDecryptFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.TProfileDecryptFailCnt"
   ::= { mms 28 }

mMSTProfileSessKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.TProfileSessKeyFailCnt -
                         timestamp"
   ::= { mms 29 }

mMSTProfileSessKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.TProfileSessKeyFailCnt"
   ::= { mms 30 }

mMSUpKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.UpKeyFailCnt - timestamp"
   ::= { mms 31 }

mMSUpKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProvider.UpKeyFailCnt"
   ::= { mms 32 }

mMSErrorRxCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.ErrorRxCnt -
                         timestamp"
   ::= { mms 33 }

mMSErrorRxCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
```

```
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.ErrorRxCnt"
       ::= { mms 34 }

    mMSErrorTxCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.ErrorTxCnt -
                             timestamp"
       ::= { mms 35 }

    mMSErrorTxCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.ErrorTxCnt"
       ::= { mms 36 }

    mMSInfoRptRxCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.InfoRptRxCnt -
                             timestamp"
       ::= { mms 37 }

    mMSInfoRptRxCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.InfoRptRxCnt"
       ::= { mms 38 }

    mMSInfoRptTxCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.InfoRptTxCnt -
                             timestamp"
       ::= { mms 39 }

    mMSInfoRptTxCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.InfoRptTxCnt"
       ::= { mms 40 }

    mMSMisCmdAckCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.MisCmdAckCnt -
                             timestamp"
       ::= { mms 41 }

    mMSMisCmdAckCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.MisCmdAckCnt"
       ::= { mms 42 }
```

```
mMSMMSProExchTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.MMSProExchTime"
   ::= { mms 43 }

mMSRejectRxCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.RejectRxCnt -
                         timestamp"
   ::= { mms 44 }

mMSRejectRxCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.RejectRxCnt"
   ::= { mms 45 }

mMSRejectTxCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.RejectTxCnt -
                         timestamp"
   ::= { mms 46 }

mMSRejectTxCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.RejectTxCnt"
   ::= { mms 47 }

mMSReqRxCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.ReqRxCnt - timestamp"
   ::= { mms 48 }

mMSReqRxCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.ReqRxCnt"
   ::= { mms 49 }

mMSReqTxCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.ReqTxCnt - timestamp"
   ::= { mms 50 }

mMSReqTxCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.ReqTxCnt"
   ::= { mms 51 }
```

```
mMSRespRxCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.RespRxCnt - timestamp"
   ::= { mms 52 }

mMSRespRxCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.RespRxCnt"
   ::= { mms 53 }

mMSRespTxCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.RespTxCnt - timestamp"
   ::= { mms 54 }

mMSRespTxCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.RespTxCnt"
   ::= { mms 55 }

mMSSessKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.SessKeyFailCnt -
                         timestamp"
   ::= { mms 56 }

mMSSessKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.SessKeyFailCnt"
   ::= { mms 57 }

mMSEActiveTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSAssociation.Active - timestamp"
   ::= { mMSMMSEntry 1 }

mMSEActive OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSAssociation.Active"
   ::= { mMSMMSEntry 2 }

mMSEAssociationId OBJECT-TYPE
    SYNTAX              Unsigned32
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION         "MMS::MMSAssociation.AssociationId"
   ::= { mMSMMSEntry 3 }
```

```
mMSEClient OBJECT-TYPE
     SYNTAX              TruthValue
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSAssociation.Client"
    ::= { mMSMMSEntry 4 }

mMSECntRsTs OBJECT-TYPE
     SYNTAX              DateAndTime
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSAssociation.CntRs - timestamp"
    ::= { mMSMMSEntry 5 }

mMSECntRs OBJECT-TYPE
     SYNTAX              TruthValue
     MAX-ACCESS          read-write
     STATUS              current
     DESCRIPTION         "MMS::MMSAssociation.CntRs"
    ::= { mMSMMSEntry 6 }

mMSEHndShTime OBJECT-TYPE
     SYNTAX              Float32TC
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSAssociation.HndShTime"
    ::= { mMSMMSEntry 7 }

mMSERemoteEstAssos OBJECT-TYPE
     SYNTAX              TruthValue
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSAssociation.RemoteEstAssos"
    ::= { mMSMMSEntry 8 }

mMSERemoteIP OBJECT-TYPE
     SYNTAX              InetAddress
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSAssociation.RemoteIP"
    ::= { mMSMMSEntry 9 }

mMSERemoteIPAddressType OBJECT-TYPE
     SYNTAX              InetAddressType
     MAX-ACCESS          read-write
     STATUS              current
     DESCRIPTION         "MMS::MMSAssociation.RemoteIPAddressType"
    ::= { mMSMMSEntry 10 }

mMSERemotePSEL OBJECT-TYPE
     SYNTAX              DisplayString
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSAssociation.RemotePSEL"
    ::= { mMSMMSEntry 11 }

mMSERemoteSSEL OBJECT-TYPE
     SYNTAX              DisplayString
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSAssociation.RemoteSSEL"
    ::= { mMSMMSEntry 12 }
```

```
    mMSERemoteTSEL OBJECT-TYPE
        SYNTAX              DisplayString
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSAssociation.RemoteTSEL"
       ::= { mMSMMSEntry 13 }

    mMSEReportPer100Seconds OBJECT-TYPE
        SYNTAX              Integer32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSAssociation.ReportPer100Seconds"
       ::= { mMSMMSEntry 14 }

    mMSERptReceptionDelayTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSAssociation.RptReceptionDelay -
                             timestamp"
       ::= { mMSMMSEntry 15 }

    mMSERptReceptionDelay OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSAssociation.RptReceptionDelay"
       ::= { mMSMMSEntry 16 }

    mMSESecurityProfile OBJECT-TYPE
        SYNTAX              SecurityProfileKind
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSAssociation.SecurityProfile"
       ::= { mMSMMSEntry 17 }

    mMSEErrorRxCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.ErrorRxCnt -
                             timestamp"
       ::= { mMSMMSEntry 18 }

    mMSEErrorRxCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.ErrorRxCnt"
       ::= { mMSMMSEntry 19 }

    mMSEErrorTxCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.ErrorTxCnt -
                             timestamp"
       ::= { mMSMMSEntry 20 }

    mMSEErrorTxCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.ErrorTxCnt"
```

```
   ::= { mMSMMSEntry 21 }

mMSEInfoRptRxCntTs OBJECT-TYPE
     SYNTAX              DateAndTime
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSProtocolInfo.InfoRptRxCnt -
                          timestamp"
   ::= { mMSMMSEntry 22 }

mMSEInfoRptRxCnt OBJECT-TYPE
     SYNTAX              Counter32
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSProtocolInfo.InfoRptRxCnt"
   ::= { mMSMMSEntry 23 }

mMSEInfoRptTxCntTs OBJECT-TYPE
     SYNTAX              DateAndTime
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSProtocolInfo.InfoRptTxCnt -
                          timestamp"
   ::= { mMSMMSEntry 24 }

mMSEInfoRptTxCnt OBJECT-TYPE
     SYNTAX              Counter32
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSProtocolInfo.InfoRptTxCnt"
   ::= { mMSMMSEntry 25 }

mMSEMisCmdAckCntTs OBJECT-TYPE
     SYNTAX              DateAndTime
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSProtocolInfo.MisCmdAckCnt -
                          timestamp"
   ::= { mMSMMSEntry 26 }

mMSEMisCmdAckCnt OBJECT-TYPE
     SYNTAX              Counter32
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSProtocolInfo.MisCmdAckCnt"
   ::= { mMSMMSEntry 27 }

mMSEMMSProExchTime OBJECT-TYPE
     SYNTAX              Float32TC
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSProtocolInfo.MMSProExchTime"
   ::= { mMSMMSEntry 28 }

mMSERejectRxCntTs OBJECT-TYPE
     SYNTAX              DateAndTime
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "MMS::MMSProtocolInfo.RejectRxCnt -
                          timestamp"
   ::= { mMSMMSEntry 29 }

mMSERejectRxCnt OBJECT-TYPE
     SYNTAX              Counter32
```

```
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.RejectRxCnt"
       ::= { mMSMMSEntry 30 }

    mMSERejectTxCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.RejectTxCnt -
                             timestamp"
       ::= { mMSMMSEntry 31 }

    mMSERejectTxCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.RejectTxCnt"
       ::= { mMSMMSEntry 32 }

    mMSEReqRxCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.ReqRxCnt - timestamp"
       ::= { mMSMMSEntry 33 }

    mMSEReqRxCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.ReqRxCnt"
       ::= { mMSMMSEntry 34 }

    mMSEReqTxCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.ReqTxCnt - timestamp"
       ::= { mMSMMSEntry 35 }

    mMSEReqTxCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.ReqTxCnt"
       ::= { mMSMMSEntry 36 }

    mMSERespRxCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.RespRxCnt - timestamp"
       ::= { mMSMMSEntry 37 }

    mMSERespRxCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "MMS::MMSProtocolInfo.RespRxCnt"
       ::= { mMSMMSEntry 38 }

    mMSERespTxCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
```

```
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.RespTxCnt - timestamp"
   ::= { mMSMMSEntry 39 }

mMSERespTxCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.RespTxCnt"
   ::= { mMSMMSEntry 40 }

mMSESessKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.SessKeyFailCnt -
                         timestamp"
   ::= { mMSMMSEntry 41 }

mMSESessKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "MMS::MMSProtocolInfo.SessKeyFailCnt"
   ::= { mMSMMSEntry 42 }

mMSEIEC62351part3 OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.IEC62351part3"
   ::= { mMSMMSEntry 43 }

mMSEPart3ConnectionId OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.Part3ConnectionId"
   ::= { mMSMMSEntry 44 }

mMSETCPHndShTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.TCPHndShTime"
   ::= { mMSMMSEntry 45 }

mMSETLSHndTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.TLSHndTime"
   ::= { mMSMMSEntry 46 }

mMSETLSRenegotiationTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
```

```
                        objects::CommonProtocolInfo.TLSRenegotiationTime"
    ::= { mMSMMSEntry 47 }

mMSETLSResumptionTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.TLSResumptionTime"
    ::= { mMSMMSEntry 48 }

mMSETotalHndTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.TotalHndTime"
    ::= { mMSMMSEntry 49 }

mMSETransportHndTime OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Common
                         objects::CommonProtocolInfo.TransportHndTime"
    ::= { mMSMMSEntry 50 }

mms-agentGroupOptional OBJECT-GROUP
   OBJECTS {
                  mMSAProfileDecryptFailCntTs,
           mMSAProfileDecryptFailCnt,
           mMSAuthFailTs,
           mMSAuthFail,
           mMSCntRsTs,
           mMSCntRs,
           mMSConnFailInCntTs,
           mMSConnFailInCnt,
           mMSConnFailOutCntTs,
           mMSConnFailOutCnt,
           mMSDecryptFailCntTs,
           mMSDecryptFailCnt,
           mMSLastEventTs,
           mMSLastEvent,
           mMSPrivFailCntTs,
           mMSPrivFailCnt,
           mMSProviderDesc,
           mMSProviderName,
           mMSSessionEstablishmentRate,
           mMSSessionRestartCntTs,
           mMSSessionRestartCnt,
           mMSTProfileDecryptFailCntTs,
           mMSTProfileDecryptFailCnt,
           mMSTProfileSessKeyFailCntTs,
           mMSTProfileSessKeyFailCnt,
           mMSUpKeyFailCntTs,
           mMSUpKeyFailCnt,
           mMSErrorRxCntTs,
           mMSErrorRxCnt,
           mMSErrorTxCntTs,
           mMSErrorTxCnt,
           mMSInfoRptRxCntTs,
           mMSInfoRptRxCnt,
           mMSInfoRptTxCntTs,
           mMSInfoRptTxCnt,
```

```
mMSMisCmdAckCntTs,
mMSMisCmdAckCnt,
mMSMMSProExchTime,
mMSRejectRxCntTs,
mMSRejectRxCnt,
mMSRejectTxCntTs,
mMSRejectTxCnt,
mMSReqRxCntTs,
mMSReqRxCnt,
mMSReqTxCntTs,
mMSReqTxCnt,
mMSRespRxCntTs,
mMSRespRxCnt,
mMSRespTxCntTs,
mMSRespTxCnt,
mMSSessKeyFailCntTs,
mMSSessKeyFailCnt,
mMSEActiveTs,
mMSEActive,
mMSEClient,
mMSECntRsTs,
mMSECntRs,
mMSEHndShTime,
mMSERemoteEstAssos,
mMSERemoteIP,
mMSERemoteIPAddressType,
mMSERemotePSEL,
mMSERemoteSSEL,
mMSERemoteTSEL,
mMSEReportPer100Seconds,
mMSERptReceptionDelayTs,
mMSERptReceptionDelay,
mMSESecurityProfile,
mMSEErrorRxCntTs,
mMSEErrorRxCnt,
mMSEErrorTxCntTs,
mMSEErrorTxCnt,
mMSEInfoRptRxCntTs,
mMSEInfoRptRxCnt,
mMSEInfoRptTxCntTs,
mMSEInfoRptTxCnt,
mMSEMisCmdAckCntTs,
mMSEMisCmdAckCnt,
mMSEMMSProExchTime,
mMSERejectRxCntTs,
mMSERejectRxCnt,
mMSERejectTxCntTs,
mMSERejectTxCnt,
mMSEReqRxCntTs,
mMSEReqRxCnt,
mMSEReqTxCntTs,
mMSEReqTxCnt,
mMSERespRxCntTs,
mMSERespRxCnt,
mMSERespTxCntTs,
mMSERespTxCnt,
mMSESessKeyFailCntTs,
mMSESessKeyFailCnt,
mMSEIEC62351part3,
mMSEPart3ConnectionId,
mMSETCPHndShTime,
mMSETLSHndTime,
mMSETLSRenegotiationTime,
mMSETLSResumptionTime,
```

```
                mMSETotalHndTime,
                mMSETransportHndTime
        }
         STATUS              current
        DESCRIPTION         "mms-agent optional objects group"
        ::= { mms-agent 2 }

    mms-agentCompliance MODULE-COMPLIANCE
         STATUS              current
         DESCRIPTION         "mms-agent Compliance"
        MODULE

        ::= { mms-agent 3 }


END
```

<CODE ENDS>

IEC 61850 SV agent MIB

<CODE BEGINS>

```
IEC-62351-IEC61850-SV-MIB DEFINITIONS::= BEGIN
    IMPORTS
    MODULE-IDENTITY,  OBJECT-IDENTITY,
    OBJECT-TYPE, Counter32, Integer32, Unsigned32,
    Gauge32, TimeTicks, NOTIFICATION-TYPE
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, DisplayString, TruthValue,
    MacAddress, PhysAddress, DateAndTime
        FROM SNMPv2-TC
    OBJECT-GROUP, NOTIFICATION-GROUP, MODULE-COMPLIANCE
        FROM SNMPv2-CONF
    Float32TC
              FROM FLOAT-TC-MIB
       AppDatStKind, PhyHealthKind, ExtKind,
    IntKind, LnkKind, PSPAccKind, ProtIdKind, EventKind,
    TimSyncIssueKind, SecurityProfileKind, TimSyncSrcKind FROM
    IEC-62351-ENUM-MIB
    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB;

    sv-agent MODULE-IDENTITY
        LAST-UPDATED        "201706061000Z"
        ORGANIZATION        "IEC"
        CONTACT-INFO        "IEC TC57 WG15"
        DESCRIPTION         "Copyright (C) IEC. This version of this MIB module is part
                             of IEC 57-62351-7-Ed1.
                             See the IEC 57-62351-7-Ed1 for full legal notices.
                             As shown in Figure 23, the SV package includes
                             the IEC 61850 Sampled Value (SV) classes.
                             SVProvider and SVAssociation inherit both Security and
                             Protocol Info attributes from the more general classes."

        REVISION            "201706061000Z"
        DESCRIPTION         "IEC 57-62351-7-Ed1"

       ::= { iec61850 3 }

       standard  OBJECT IDENTIFIER::= { iso 0 }

       iec62351  OBJECT IDENTIFIER::= { standard 62351 }

       part7  OBJECT IDENTIFIER::= { iec62351 7 }
```

```
   application  OBJECT IDENTIFIER::= { part7 3 }

   iec61850  OBJECT IDENTIFIER::= { application 2 }


sv OBJECT-IDENTITY
     STATUS              current
     DESCRIPTION         "The SVProvider class includes the attributes
                          which define the information about the overall IEC
                          61850 stack SV provider running on the device."
   ::= { sv-agent 1 }

sVCntRsTs OBJECT-TYPE
     SYNTAX              DateAndTime
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "SV::SVProvider.CntRs - timestamp"
    ::= { sv 1 }

sVCntRs OBJECT-TYPE
     SYNTAX              TruthValue
     MAX-ACCESS          read-write
     STATUS              current
     DESCRIPTION         "SV::SVProvider.CntRs"
    ::= { sv 2 }

sVDecryptFailCntTs OBJECT-TYPE
     SYNTAX              DateAndTime
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "SV::SVProvider.DecryptFailCnt - timestamp"
    ::= { sv 3 }

sVDecryptFailCnt OBJECT-TYPE
     SYNTAX              Counter32
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "SV::SVProvider.DecryptFailCnt"
    ::= { sv 4 }

sVPDUSizeFailTs OBJECT-TYPE
     SYNTAX              DateAndTime
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "SV::SVProvider.PDUSizeFail - timestamp"
    ::= { sv 5 }

sVPDUSizeFail OBJECT-TYPE
     SYNTAX              Counter32
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "SV::SVProvider.PDUSizeFail"
    ::= { sv 6 }

sVGroupUpKeyFailCntTs OBJECT-TYPE
     SYNTAX              DateAndTime
     MAX-ACCESS          read-only
     STATUS              current
     DESCRIPTION         "SV and GSE common
                          objects::GSEandSVCommon.GroupUpKeyFailCnt - timestamp"
    ::= { sv 7 }

sVGroupUpKeyFailCnt OBJECT-TYPE
```

```
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.GroupUpKeyFailCnt"
       ::= { sv 8 }

    sVKDCAuthFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCAuthFailCnt - timestamp"
       ::= { sv 9 }

    sVKDCAuthFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCAuthFailCnt"
       ::= { sv 10 }

    sVKDCSessionKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCSessionKeyFailCnt - timestamp"
       ::= { sv 11 }

    sVKDCSessionKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCSessionKeyFailCnt"
       ::= { sv 12 }

    sVPIPTable OBJECT-TYPE
        SYNTAX  SEQUENCE OF SVPublisherAssociationIP
        MAX-ACCESS  not-accessible
        STATUS  current
        DESCRIPTION
                "SV::SVProvider.PIP"
       ::= { sv 13 }

    sVPIPEntry OBJECT-TYPE
        SYNTAX  SVPublisherAssociationIP
        MAX-ACCESS  not-accessible
        STATUS  current
        DESCRIPTION
                "SV::SVProvider.PIP"
        INDEX   {
               sVPIPCBRef

       }
       ::= { sVPIPTable 1 }

    SVPublisherAssociationIP::=
        SEQUENCE {
               sVPIPDestIpAddr InetAddress,
               sVPIPDestIpAddrType InetAddressType,
               sVPIPCBRef DisplayString,
```

```
            sVPIPCntRsTs DateAndTime,
            sVPIPCntRs TruthValue,
            sVPIPOutUvTs DateAndTime,
            sVPIPOutUv Counter32 ,
            sVPIPTxPduPerSecond Float32TC,
            sVPIPGroupUpKeyFailCntTs DateAndTime,
            sVPIPGroupUpKeyFailCnt Counter32 ,
            sVPIPKDCAuthFailCntTs DateAndTime,
            sVPIPKDCAuthFailCnt Counter32 ,
            sVPIPKDCSessionKeyFailCntTs DateAndTime,
            sVPIPKDCSessionKeyFailCnt Counter32
    }

sVPL2Table OBJECT-TYPE
    SYNTAX  SEQUENCE OF SVPublisherAssociationL2
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "SV::SVProvider.PL2"
   ::= { sv 14 }

sVPL2Entry OBJECT-TYPE
    SYNTAX  SVPublisherAssociationL2
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "SV::SVProvider.PL2"
    INDEX   {
           sVPL2CBRef

   }
   ::= { sVPL2Table 1 }

SVPublisherAssociationL2::=
    SEQUENCE {
            sVPL2DestMacAddr MacAddress,
            sVPL2CBRef DisplayString,
            sVPL2CntRsTs DateAndTime,
            sVPL2CntRs TruthValue,
            sVPL2OutUvTs DateAndTime,
            sVPL2OutUv Counter32 ,
            sVPL2TxPduPerSecond Float32TC,
            sVPL2GroupUpKeyFailCntTs DateAndTime,
            sVPL2GroupUpKeyFailCnt Counter32 ,
            sVPL2KDCAuthFailCntTs DateAndTime,
            sVPL2KDCAuthFailCnt Counter32 ,
            sVPL2KDCSessionKeyFailCntTs DateAndTime,
            sVPL2KDCSessionKeyFailCnt Counter32
    }


sVSVNotificationType NOTIFICATION-TYPE
    OBJECTS {

            sVGroupUpKeyFailCntTs,
            sVGroupUpKeyFailCnt,
            sVKDCAuthFailCntTs,
            sVKDCAuthFailCnt,
            sVKDCSessionKeyFailCntTs,
            sVKDCSessionKeyFailCnt
             }
    STATUS              current
    DESCRIPTION         "The SVNotification class defines the content
                         of the notification message to be sent on event
```

```
                        related with the specified objects."
    ::= { sv 15 }

sVSVNotification NOTIFICATION-GROUP
    NOTIFICATIONS       {
                            sVSVNotificationType
                        }
    STATUS              current
    DESCRIPTION         "The SVNotification class defines the content
                         of the notification message to be sent on event
                         related with the specified objects."
    ::= { sv 16 }

sVSIPTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF SVSubcriberAssociationIP
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "SV::SVProvider.SIP"
    ::= { sv 17 }

sVSIPEntry OBJECT-TYPE
    SYNTAX  SVSubcriberAssociationIP
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "SV::SVProvider.SIP"
    INDEX   {
           sVSIPCBRef

   }
   ::= { sVSIPTable 1 }

SVSubcriberAssociationIP::=
    SEQUENCE {
           sVSIPSrcIpAddr InetAddress,
           sVSIPSrcIpAddrType InetAddressType,
           sVSIPCBRef DisplayString,
           sVSIPCntRsTs DateAndTime,
           sVSIPCntRs TruthValue,
           sVSIPInOvCntTs DateAndTime,
           sVSIPInOvCnt Counter32 ,
           sVSIPMessageIntegrityFailCntTs DateAndTime,
           sVSIPMessageIntegrityFailCnt Counter32 ,
           sVSIPRxPduPerSecond Float32TC,
           sVSIPGroupUpKeyFailCntTs DateAndTime,
           sVSIPGroupUpKeyFailCnt Counter32 ,
           sVSIPKDCAuthFailCntTs DateAndTime,
           sVSIPKDCAuthFailCnt Counter32 ,
           sVSIPKDCSessionKeyFailCntTs DateAndTime,
           sVSIPKDCSessionKeyFailCnt Counter32
    }

sVSL2Table OBJECT-TYPE
    SYNTAX  SEQUENCE OF SVSubcriberAssociationL2
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "SV::SVProvider.SL2"
    ::= { sv 18 }

sVSL2Entry OBJECT-TYPE
    SYNTAX  SVSubcriberAssociationL2
    MAX-ACCESS  not-accessible
```

```
    STATUS  current
    DESCRIPTION
            "SV::SVProvider.SL2"
    INDEX   {
           sVSL2CBRef

   }
   ::= { sVSL2Table 1 }

SVSubcriberAssociationL2::=
    SEQUENCE {
           sVSL2SrcMacAddr MacAddress,
           sVSL2CBRef DisplayString,
           sVSL2CntRsTs DateAndTime,
           sVSL2CntRs TruthValue,
           sVSL2InOvCntTs DateAndTime,
           sVSL2InOvCnt Counter32 ,
           sVSL2MessageIntegrityFailCntTs DateAndTime,
           sVSL2MessageIntegrityFailCnt Counter32 ,
           sVSL2RxPduPerSecond Float32TC,
           sVSL2GroupUpKeyFailCntTs DateAndTime,
           sVSL2GroupUpKeyFailCnt Counter32 ,
           sVSL2KDCAuthFailCntTs DateAndTime,
           sVSL2KDCAuthFailCnt Counter32 ,
           sVSL2KDCSessionKeyFailCntTs DateAndTime,
           sVSL2KDCSessionKeyFailCnt Counter32
    }

sVPIPDestIpAddr OBJECT-TYPE
    SYNTAX              InetAddress
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV::SVPublisherAssociationIP.DestIpAddr"
   ::= { sVPIPEntry 1 }

sVPIPDestIpAddrType OBJECT-TYPE
    SYNTAX              InetAddressType
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "
                         SV::SVPublisherAssociationIP.DestIpAddrType"
   ::= { sVPIPEntry 2 }

sVPIPCBRef OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.CBRef"
   ::= { sVPIPEntry 3 }

sVPIPCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.CntRs - timestamp"
   ::= { sVPIPEntry 4 }

sVPIPCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "SV and GSE common
```

```
                        objects::GSEandSVPublisherAssociation.CntRs"
    ::= { sVPIPEntry 5 }

sVPIPOutUvTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.OutUv - timestamp"
    ::= { sVPIPEntry 6 }

sVPIPOutUv OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.OutUv"
    ::= { sVPIPEntry 7 }

sVPIPTxPduPerSecond OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.TxPduPerSecond"
    ::= { sVPIPEntry 8 }

sVPIPGroupUpKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.GroupUpKeyFailCnt - timestamp"
    ::= { sVPIPEntry 9 }

sVPIPGroupUpKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.GroupUpKeyFailCnt"
    ::= { sVPIPEntry 10 }

sVPIPKDCAuthFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt - timestamp"
    ::= { sVPIPEntry 11 }

sVPIPKDCAuthFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt"
    ::= { sVPIPEntry 12 }

sVPIPKDCSessionKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
```

```
                        objects::GSEandSVCommon.KDCSessionKeyFailCnt - timestamp"
   ::= { sVPIPEntry 13 }

sVPIPKDCSessionKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt"
   ::= { sVPIPEntry 14 }

sVPL2DestMacAddr OBJECT-TYPE
    SYNTAX              MacAddress
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV::SVPublisherAssociationL2.DestMacAddr"
   ::= { sVPL2Entry 1 }

sVPL2CBRef OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.CBRef"
   ::= { sVPL2Entry 2 }

sVPL2CntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.CntRs - timestamp"
   ::= { sVPL2Entry 3 }

sVPL2CntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.CntRs"
   ::= { sVPL2Entry 4 }

sVPL2OutUvTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.OutUv - timestamp"
   ::= { sVPL2Entry 5 }

sVPL2OutUv OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.OutUv"
   ::= { sVPL2Entry 6 }

sVPL2TxPduPerSecond OBJECT-TYPE
    SYNTAX              Float32TC
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVPublisherAssociation.TxPduPerSecond"
```

```
    ::= { sVPL2Entry 7 }

sVPL2GroupUpKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.GroupUpKeyFailCnt - timestamp"
    ::= { sVPL2Entry 8 }

sVPL2GroupUpKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.GroupUpKeyFailCnt"
    ::= { sVPL2Entry 9 }

sVPL2KDCAuthFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt - timestamp"
    ::= { sVPL2Entry 10 }

sVPL2KDCAuthFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt"
    ::= { sVPL2Entry 11 }

sVPL2KDCSessionKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt - timestamp"
    ::= { sVPL2Entry 12 }

sVPL2KDCSessionKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt"
    ::= { sVPL2Entry 13 }

sVSIPSrcIpAddr OBJECT-TYPE
    SYNTAX              InetAddress
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV::SVSubcriberAssociationIP.SrcIpAddr"
    ::= { sVSIPEntry 1 }

sVSIPSrcIpAddrType OBJECT-TYPE
    SYNTAX              InetAddressType
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "
                         SV::SVSubcriberAssociationIP.SrcIpAddrType"
    ::= { sVSIPEntry 2 }
```

```
    sVSIPCBRef OBJECT-TYPE
        SYNTAX              DisplayString
        MAX-ACCESS          not-accessible
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.CBRef"
       ::= { sVSIPEntry 3 }

    sVSIPCntRsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.CntRs - timestamp"
       ::= { sVSIPEntry 4 }

    sVSIPCntRs OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.CntRs"
       ::= { sVSIPEntry 5 }

    sVSIPInOvCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.InOvCnt          -
timestamp"
       ::= { sVSIPEntry 6 }

    sVSIPInOvCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.InOvCnt"
       ::= { sVSIPEntry 7 }

    sVSIPMessageIntegrityFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common

objects::GSEandSVSubscriberAssociation.MessageIntegrityFailCnt - timestamp"
       ::= { sVSIPEntry 8 }

    sVSIPMessageIntegrityFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common

objects::GSEandSVSubscriberAssociation.MessageIntegrityFailCnt"
       ::= { sVSIPEntry 9 }

    sVSIPRxPduPerSecond OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
```

```
                        objects::GSEandSVSubscriberAssociation.RxPduPerSecond"
    ::= { sVSIPEntry 10 }

sVSIPGroupUpKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.GroupUpKeyFailCnt - timestamp"
    ::= { sVSIPEntry 11 }

sVSIPGroupUpKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.GroupUpKeyFailCnt"
    ::= { sVSIPEntry 12 }

sVSIPKDCAuthFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt - timestamp"
    ::= { sVSIPEntry 13 }

sVSIPKDCAuthFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCAuthFailCnt"
    ::= { sVSIPEntry 14 }

sVSIPKDCSessionKeyFailCntTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt - timestamp"
    ::= { sVSIPEntry 15 }

sVSIPKDCSessionKeyFailCnt OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVCommon.KDCSessionKeyFailCnt"
    ::= { sVSIPEntry 16 }

sVSL2SrcMacAddr OBJECT-TYPE
    SYNTAX              MacAddress
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "SV::SVSubcriberAssociationL2.SrcMacAddr"
    ::= { sVSL2Entry 1 }

sVSL2CBRef OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION         "SV and GSE common
                         objects::GSEandSVSubscriberAssociation.CBRef"
```

```
       ::= { sVSL2Entry 2 }

    sVSL2CntRsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.CntRs - timestamp"
       ::= { sVSL2Entry 3 }

    sVSL2CntRs OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.CntRs"
       ::= { sVSL2Entry 4 }

    sVSL2InOvCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.InOvCnt          -
timestamp"
       ::= { sVSL2Entry 5 }

    sVSL2InOvCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.InOvCnt"
       ::= { sVSL2Entry 6 }

    sVSL2MessageIntegrityFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common

objects::GSEandSVSubscriberAssociation.MessageIntegrityFailCnt - timestamp"
       ::= { sVSL2Entry 7 }

    sVSL2MessageIntegrityFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common

objects::GSEandSVSubscriberAssociation.MessageIntegrityFailCnt"
       ::= { sVSL2Entry 8 }

    sVSL2RxPduPerSecond OBJECT-TYPE
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVSubscriberAssociation.RxPduPerSecond"
       ::= { sVSL2Entry 9 }

    sVSL2GroupUpKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
```

```
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.GroupUpKeyFailCnt - timestamp"
       ::= { sVSL2Entry 10 }

    sVSL2GroupUpKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.GroupUpKeyFailCnt"
       ::= { sVSL2Entry 11 }

    sVSL2KDCAuthFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCAuthFailCnt - timestamp"
       ::= { sVSL2Entry 12 }

    sVSL2KDCAuthFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCAuthFailCnt"
       ::= { sVSL2Entry 13 }

    sVSL2KDCSessionKeyFailCntTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCSessionKeyFailCnt - timestamp"
       ::= { sVSL2Entry 14 }

    sVSL2KDCSessionKeyFailCnt OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "SV and GSE common
                             objects::GSEandSVCommon.KDCSessionKeyFailCnt"
       ::= { sVSL2Entry 15 }

    sv-agentGroupOptional OBJECT-GROUP
       OBJECTS {
                      sVCntRsTs,
                sVCntRs,
                sVDecryptFailCntTs,
                sVDecryptFailCnt,
                sVPDUSizeFailTs,
                sVPDUSizeFail,
                sVGroupUpKeyFailCntTs,
                sVGroupUpKeyFailCnt,
                sVKDCAuthFailCntTs,
                sVKDCAuthFailCnt,
                sVKDCSessionKeyFailCntTs,
                sVKDCSessionKeyFailCnt,
                sVPIPDestIpAddr,
                sVPIPDestIpAddrType,
                sVPIPCntRsTs,
                sVPIPCntRs,
                sVPIPOutUvTs,
                sVPIPOutUv,
```

```
                sVPIPTxPduPerSecond,
                sVPIPGroupUpKeyFailCntTs,
                sVPIPGroupUpKeyFailCnt,
                sVPIPKDCAuthFailCntTs,
                sVPIPKDCAuthFailCnt,
                sVPIPKDCSessionKeyFailCntTs,
                sVPIPKDCSessionKeyFailCnt,
                sVPL2DestMacAddr,
                sVPL2CntRsTs,
                sVPL2CntRs,
                sVPL2OutUvTs,
                sVPL2OutUv,
                sVPL2TxPduPerSecond,
                sVPL2GroupUpKeyFailCntTs,
                sVPL2GroupUpKeyFailCnt,
                sVPL2KDCAuthFailCntTs,
                sVPL2KDCAuthFailCnt,
                sVPL2KDCSessionKeyFailCntTs,
                sVPL2KDCSessionKeyFailCnt,
                sVSIPSrcIpAddr,
                sVSIPSrcIpAddrType,
                sVSIPCntRsTs,
                sVSIPCntRs,
                sVSIPInOvCntTs,
                sVSIPInOvCnt,
                sVSIPMessageIntegrityFailCntTs,
                sVSIPMessageIntegrityFailCnt,
                sVSIPRxPduPerSecond,
                sVSIPGroupUpKeyFailCntTs,
                sVSIPGroupUpKeyFailCnt,
                sVSIPKDCAuthFailCntTs,
                sVSIPKDCAuthFailCnt,
                sVSIPKDCSessionKeyFailCntTs,
                sVSIPKDCSessionKeyFailCnt,
                sVSL2SrcMacAddr,
                sVSL2CntRsTs,
                sVSL2CntRs,
                sVSL2InOvCntTs,
                sVSL2InOvCnt,
                sVSL2MessageIntegrityFailCntTs,
                sVSL2MessageIntegrityFailCnt,
                sVSL2RxPduPerSecond,
                sVSL2GroupUpKeyFailCntTs,
                sVSL2GroupUpKeyFailCnt,
                sVSL2KDCAuthFailCntTs,
                sVSL2KDCAuthFailCnt,
                sVSL2KDCSessionKeyFailCntTs,
                sVSL2KDCSessionKeyFailCnt
        }
         STATUS              current
        DESCRIPTION         "sv-agent optional objects group"
        ::= { sv-agent 2 }

    sv-agentCompliance MODULE-COMPLIANCE
         STATUS              current
         DESCRIPTION         "sv-agent Compliance"
        MODULE

        ::= { sv-agent 3 }


END
<CODE ENDS>
```

Clock agent MIB

<CODE BEGINS>

```
IEC-62351-CLK-MIB DEFINITIONS::= BEGIN
    IMPORTS
    MODULE-IDENTITY,  OBJECT-IDENTITY,
    OBJECT-TYPE, Counter32, Integer32, Unsigned32,
    Gauge32, TimeTicks, NOTIFICATION-TYPE
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, DisplayString, TruthValue,
    MacAddress, PhysAddress, DateAndTime
        FROM SNMPv2-TC
    OBJECT-GROUP, NOTIFICATION-GROUP, MODULE-COMPLIANCE
        FROM SNMPv2-CONF
    Float32TC
             FROM FLOAT-TC-MIB
       AppDatStKind, PhyHealthKind, ExtKind,
    IntKind, LnkKind, PSPAccKind, ProtIdKind, EventKind,
    TimSyncIssueKind, SecurityProfileKind, TimSyncSrcKind FROM
    IEC-62351-ENUM-MIB
    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB;

    clock-agent MODULE-IDENTITY
        LAST-UPDATED        "201706061000Z"
        ORGANIZATION        "IEC"
        CONTACT-INFO        "IEC TC57 WG15"
        DESCRIPTION         "Copyright (C) IEC. This version of this MIB module is part
                             of IEC 57-62351-7-Ed1.
                             See the IEC 57-62351-7-Ed1 for full legal notices.
                             As shown in Figure 26, the Clocks Agent package
                             includes the clock monitoring classes."

        REVISION            "201706061000Z"
        DESCRIPTION         "IEC 57-62351-7-Ed1"

       ::= { part7 4 }

       standard  OBJECT IDENTIFIER::= { iso 0 }

       iec62351  OBJECT IDENTIFIER::= { standard 62351 }

       part7  OBJECT IDENTIFIER::= { iec62351 7 }

       application  OBJECT IDENTIFIER::= { part7 3 }


    clock OBJECT-IDENTITY
        STATUS              current
        DESCRIPTION         "The Clock class contains the information
                             regarding clocks."
       ::= { clock-agent 1 }

    cLKclockTamperDetectedTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Clocks Agent::Clock.clockTamperDetected -
                             timestamp"
       ::= { clock 1 }

    cLKLastClockHoldoverTs OBJECT-TYPE
        SYNTAX              DateAndTime
```

```
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Clocks Agent::Clock.LastClockHoldover -
                         timestamp"
   ::= { clock 2 }

cLKCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Clocks Agent::Clock.CntRs - timestamp"
   ::= { clock 3 }

cLKCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Clocks Agent::Clock.CntRs"
   ::= { clock 4 }

cLKClocksTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF ClockEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "Clocks Agent::Clock.Clocks"
   ::= { clock 5 }

cLKClocksEntry OBJECT-TYPE
    SYNTAX  ClockEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "Clocks Agent::Clock.Clocks"
    INDEX   {
           cLKEClockIndex

   }
   ::= { cLKClocksTable 1 }

ClockEntry::=
    SEQUENCE {
           cLKEClockAccuracy Integer32,
           cLKEClockIndex Unsigned32,
           cLKEClockIssue TimSyncIssueKind,
           cLKEClockTamperDetected TruthValue,
           cLKETmSrc TimSyncSrcKind,
           cLKEHoldOver TruthValue,
           cLKELastSyncOffsetTs DateAndTime,
           cLKELastSyncOffset Float32TC,
           cLKETimeSourceAvailable TruthValue,
           cLKETimeTraceable TruthValue
    }


cLKSecurityNotificationType NOTIFICATION-TYPE
    OBJECTS {

           cLKclockTamperDetectedTs
            }
    STATUS              current
    DESCRIPTION         "The SecurityNotification class defines the
                         content of the notification message to be sent on event
                         related with the specified objects."
```

```
       ::= { clock 6 }

    cLKSecurityNotification NOTIFICATION-GROUP
        NOTIFICATIONS       {
                                cLKSecurityNotificationType
                            }
        STATUS              current
        DESCRIPTION         "The SecurityNotification class defines the
                             content of the notification message to be sent on event
                             related with the specified objects."
       ::= { clock 7 }

    cLKEClockAccuracy OBJECT-TYPE
        SYNTAX              Integer32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Clocks Agent::ClockEntry.ClockAccuracy"
       ::= { cLKClocksEntry 1 }

    cLKEClockIndex OBJECT-TYPE
        SYNTAX              Unsigned32
        MAX-ACCESS          not-accessible
        STATUS              current
        DESCRIPTION         "Clocks Agent::ClockEntry.ClockIndex"
       ::= { cLKClocksEntry 2 }

    cLKEClockIssue OBJECT-TYPE
        SYNTAX              TimSyncIssueKind
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Clocks Agent::ClockEntry.ClockIssue"
       ::= { cLKClocksEntry 3 }

    cLKEClockTamperDetected OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Clocks
                             Agent::ClockEntry.ClockTamperDetected"
       ::= { cLKClocksEntry 4 }

    cLKETmSrc OBJECT-TYPE
        SYNTAX              TimSyncSrcKind
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Clocks Agent::ClockEntry.TmSrc"
       ::= { cLKClocksEntry 5 }

    cLKEHoldOver OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Clocks Agent::ClockEntry.HoldOver"
       ::= { cLKClocksEntry 6 }

    cLKELastSyncOffsetTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Clocks Agent::ClockEntry.LastSyncOffset -
                             timestamp"
       ::= { cLKClocksEntry 7 }

    cLKELastSyncOffset OBJECT-TYPE
```

```
        SYNTAX              Float32TC
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Clocks Agent::ClockEntry.LastSyncOffset"
       ::= { cLKClocksEntry 8 }

    cLKETimeSourceAvailable OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Clocks
                             Agent::ClockEntry.TimeSourceAvailable"
       ::= { cLKClocksEntry 9 }

    cLKETimeTraceable OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Clocks Agent::ClockEntry.TimeTraceable"
       ::= { cLKClocksEntry 10 }

    clock-agentGroupOptional OBJECT-GROUP
       OBJECTS {
                      cLKclockTamperDetectedTs,
                cLKLastClockHoldoverTs,
                cLKCntRsTs,
                cLKCntRs,
                cLKEClockAccuracy,
                cLKEClockIssue,
                cLKEClockTamperDetected,
                cLKETmSrc,
                cLKEHoldOver,
                cLKELastSyncOffsetTs,
                cLKELastSyncOffset,
                cLKETimeSourceAvailable,
                cLKETimeTraceable
       }
        STATUS              current
       DESCRIPTION         "clock-agent optional objects group"
       ::= { clock-agent 2 }

    clock-agentCompliance MODULE-COMPLIANCE
        STATUS              current
        DESCRIPTION         "clock-agent Compliance"
       MODULE

       ::= { clock-agent 3 }


END
```

<CODE ENDS>

Interfaces agent MIB

<CODE BEGINS>

```
IEC-62351-INT-MIB DEFINITIONS::= BEGIN
    IMPORTS
    MODULE-IDENTITY,  OBJECT-IDENTITY,
    OBJECT-TYPE, Counter32, Integer32, Unsigned32,
    Gauge32, TimeTicks, NOTIFICATION-TYPE
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, DisplayString, TruthValue,
    MacAddress, PhysAddress, DateAndTime
```

```
    FROM SNMPv2-TC
OBJECT-GROUP, NOTIFICATION-GROUP, MODULE-COMPLIANCE
    FROM SNMPv2-CONF
Float32TC
          FROM FLOAT-TC-MIB
   AppDatStKind, PhyHealthKind, ExtKind,
IntKind, LnkKind, PSPAccKind, ProtIdKind, EventKind,
TimSyncIssueKind, SecurityProfileKind, TimSyncSrcKind FROM
IEC-62351-ENUM-MIB
InetAddressType, InetAddress
    FROM INET-ADDRESS-MIB;

interfaces-agent MODULE-IDENTITY
    LAST-UPDATED        "201706061000Z"
    ORGANIZATION        "IEC"
    CONTACT-INFO        "IEC TC57 WG15"
    DESCRIPTION         "Copyright (C) IEC. This version of this MIB module is part
                         of IEC 57-62351-7-Ed1.
                         See the IEC 57-62351-7-Ed1 for full legal notices.
                         As shown in Figure 25, the Interfaces Agent
                         package contains the object descriptions to be
                         provided in order to monitor the IED Interfaces state and
                         behaviour."

    REVISION            "201706061000Z"
    DESCRIPTION         "IEC 57-62351-7-Ed1"

   ::= { part7 5 }

   standard  OBJECT IDENTIFIER::= { iso 0 }

   iec62351  OBJECT IDENTIFIER::= { standard 62351 }

   part7  OBJECT IDENTIFIER::= { iec62351 7 }

   application  OBJECT IDENTIFIER::= { part7 3 }


interfaces OBJECT-IDENTITY
    STATUS              current
    DESCRIPTION         "The Interfaces class is a set of objects that
                         includes the hardware interfaces of the device."
   ::= { interfaces-agent 1 }

intserAvail OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.serAvail"
   ::= { interfaces 1 }

intserActiveTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.serActive -
                         timestamp"
   ::= { interfaces 2 }

intserActive OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.serActive"
```

```
   ::= { interfaces 3 }

intserFailTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.serFail -
                         timestamp"
   ::= { interfaces 4 }

intserFail OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.serFail"
   ::= { interfaces 5 }

intethAvail OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.ethAvail"
   ::= { interfaces 6 }

intethActiveTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.ethActive -
                         timestamp"
   ::= { interfaces 7 }

intethActive OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.ethActive"
   ::= { interfaces 8 }

intethFailTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.ethFail -
                         timestamp"
   ::= { interfaces 9 }

intethFail OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.ethFail"
   ::= { interfaces 10 }

intalgAvail OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.algAvail"
   ::= { interfaces 11 }

intalgActiveTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
```

```
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interfaces.algActive -
                             timestamp"
       ::= { interfaces 12 }

    intalgActive OBJECT-TYPE
        SYNTAX              Integer32
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interfaces.algActive"
       ::= { interfaces 13 }

    intalgFailTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interfaces.algFail -
                             timestamp"
       ::= { interfaces 14 }

    intalgFail OBJECT-TYPE
        SYNTAX              Integer32
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interfaces.algFail"
       ::= { interfaces 15 }

    intkeyAvail OBJECT-TYPE
        SYNTAX              Integer32
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interfaces.keyAvail"
       ::= { interfaces 16 }

    intkeyActiveTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interfaces.keyActive -
                             timestamp"
       ::= { interfaces 17 }

    intkeyActive OBJECT-TYPE
        SYNTAX              Integer32
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interfaces.keyActive"
       ::= { interfaces 18 }

    intkeyFailTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interfaces.keyFail -
                             timestamp"
       ::= { interfaces 19 }

    intkeyFail OBJECT-TYPE
        SYNTAX              Integer32
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interfaces.keyFail"
       ::= { interfaces 20 }
```

```
intusbAvail OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.usbAvail"
   ::= { interfaces 21 }

intusbActiveTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.usbActive -
                         timestamp"
   ::= { interfaces 22 }

intusbActive OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.usbActive"
   ::= { interfaces 23 }

intusbFailTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.usbFail -
                         timestamp"
   ::= { interfaces 24 }

intusbFail OBJECT-TYPE
    SYNTAX              Integer32
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interfaces.usbFail"
   ::= { interfaces 25 }

intSERTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF SEREntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "Interfaces Agent::Interfaces.SER"
   ::= { interfaces 26 }

intSEREntry OBJECT-TYPE
    SYNTAX  SEREntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "Interfaces Agent::Interfaces.SER"
    INDEX   {
           sERID

   }
   ::= { intSERTable 1 }

SEREntry::=
    SEQUENCE {
           sERByteInTs DateAndTime,
           sERByteIn Counter32 ,
           sERByteOutTs DateAndTime,
           sERByteOut Counter32 ,
           sERID Unsigned32,
```

```
            sERDescr DisplayString,
            sERIntType IntKind,
            sEROperableTs DateAndTime,
            sEROperable TruthValue,
            sEROnlineTs DateAndTime,
            sEROnline TruthValue,
            sERFaultyTs DateAndTime,
            sERFaulty TruthValue,
            sERCntRsTs DateAndTime,
            sERCntRs TruthValue
    }

intETHTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF ETHEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "Interfaces Agent::Interfaces.ETH"
   ::= { interfaces 27 }

intETHEntry OBJECT-TYPE
    SYNTAX  ETHEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "Interfaces Agent::Interfaces.ETH"
    INDEX   {
           eTHID

   }
   ::= { intETHTable 1 }

ETHEntry::=
    SEQUENCE {
           eTHID Unsigned32,
           eTHDescr DisplayString,
           eTHIntType IntKind,
           eTHOperableTs DateAndTime,
           eTHOperable TruthValue,
           eTHOnlineTs DateAndTime,
           eTHOnline TruthValue,
           eTHFaultyTs DateAndTime,
           eTHFaulty TruthValue,
           eTHCntRsTs DateAndTime,
           eTHCntRs TruthValue
    }

intUSBTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF USBEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "Interfaces Agent::Interfaces.USB"
   ::= { interfaces 28 }

intUSBEntry OBJECT-TYPE
    SYNTAX  USBEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "Interfaces Agent::Interfaces.USB"
    INDEX   {
           uSBID
```

```
   }
   ::= { intUSBTable 1 }

USBEntry::=
    SEQUENCE {
           uSBID Unsigned32,
           uSBDescr DisplayString,
           uSBIntType IntKind,
           uSBOperableTs DateAndTime,
           uSBOperable TruthValue,
           uSBOnlineTs DateAndTime,
           uSBOnline TruthValue,
           uSBFaultyTs DateAndTime,
           uSBFaulty TruthValue,
           uSBCntRsTs DateAndTime,
           uSBCntRs TruthValue
    }

intKEYTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF KEYEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "Interfaces Agent::Interfaces.KEY"
   ::= { interfaces 29 }

intKEYEntry OBJECT-TYPE
    SYNTAX  KEYEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "Interfaces Agent::Interfaces.KEY"
    INDEX   {
           kEYID

   }
   ::= { intKEYTable 1 }

KEYEntry::=
    SEQUENCE {
           kEYLockedTs DateAndTime,
           kEYLocked TruthValue,
           kEYID Unsigned32,
           kEYDescr DisplayString,
           kEYIntType IntKind,
           kEYOperableTs DateAndTime,
           kEYOperable TruthValue,
           kEYOnlineTs DateAndTime,
           kEYOnline TruthValue,
           kEYFaultyTs DateAndTime,
           kEYFaulty TruthValue,
           kEYCntRsTs DateAndTime,
           kEYCntRs TruthValue
    }

intALGTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF ALGEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
            "Interfaces Agent::Interfaces.ALG"
   ::= { interfaces 30 }

intALGEntry OBJECT-TYPE
```

```
        SYNTAX  ALGEntry
        MAX-ACCESS  not-accessible
        STATUS  current
        DESCRIPTION
                "Interfaces Agent::Interfaces.ALG"
        INDEX   {
               aLGID

       }
       ::= { intALGTable 1 }

    ALGEntry::=
        SEQUENCE {
               aLGID Unsigned32,
               aLGDescr DisplayString,
               aLGIntType IntKind,
               aLGOperableTs DateAndTime,
               aLGOperable TruthValue,
               aLGOnlineTs DateAndTime,
               aLGOnline TruthValue,
               aLGFaultyTs DateAndTime,
               aLGFaulty TruthValue,
               aLGCntRsTs DateAndTime,
               aLGCntRs TruthValue
        }


    intNotificationType NOTIFICATION-TYPE
        OBJECTS {

               intserActiveTs,
               intserActive,
               intserFailTs,
               intserFail,
               intethActiveTs,
               intethActive,
               intethFailTs,
               intethFail,
               intalgActiveTs,
               intalgActive,
               intalgFailTs,
               intalgFail,
               intkeyActiveTs,
               intkeyActive,
               intkeyFailTs,
               intkeyFail,
               intusbActiveTs,
               intusbActive,
               intusbFailTs,
               intusbFail
                }
        STATUS              current
        DESCRIPTION         "The Notification class defines the content of
                             the notification message to be sent on event
                             related with the specified objects."
       ::= { interfaces 31 }

    intNotification NOTIFICATION-GROUP
        NOTIFICATIONS       {
                                intNotificationType
                            }
        STATUS              current
        DESCRIPTION         "The Notification class defines the content of
                             the notification message to be sent on event
```

```
                        related with the specified objects."
   ::= { interfaces 32 }

eTHID OBJECT-TYPE
    SYNTAX              Unsigned32
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.ID"
   ::= { intETHEntry 1 }

eTHDescr OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Descr"
   ::= { intETHEntry 2 }

eTHIntType OBJECT-TYPE
    SYNTAX              IntKind
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.IntType"
   ::= { intETHEntry 3 }

eTHOperableTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Operable -
                         timestamp"
   ::= { intETHEntry 4 }

eTHOperable OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Operable"
   ::= { intETHEntry 5 }

eTHOnlineTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Online -
                         timestamp"
   ::= { intETHEntry 6 }

eTHOnline OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Online"
   ::= { intETHEntry 7 }

eTHFaultyTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Faulty -
                         timestamp"
   ::= { intETHEntry 8 }

eTHFaulty OBJECT-TYPE
    SYNTAX              TruthValue
```

```
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Faulty"
       ::= { intETHEntry 9 }

    eTHCntRsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.CntRs -
                             timestamp"
       ::= { intETHEntry 10 }

    eTHCntRs OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.CntRs"
       ::= { intETHEntry 11 }

    kEYLockedTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::KEYEntry.Locked -
                             timestamp"
       ::= { intKEYEntry 1 }

    kEYLocked OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::KEYEntry.Locked"
       ::= { intKEYEntry 2 }

    kEYID OBJECT-TYPE
        SYNTAX              Unsigned32
        MAX-ACCESS          not-accessible
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.ID"
       ::= { intKEYEntry 3 }

    kEYDescr OBJECT-TYPE
        SYNTAX              DisplayString
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Descr"
       ::= { intKEYEntry 4 }

    kEYIntType OBJECT-TYPE
        SYNTAX              IntKind
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.IntType"
       ::= { intKEYEntry 5 }

    kEYOperableTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Operable -
                             timestamp"
       ::= { intKEYEntry 6 }
```

```
kEYOperable OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Operable"
   ::= { intKEYEntry 7 }

kEYOnlineTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Online -
                         timestamp"
   ::= { intKEYEntry 8 }

kEYOnline OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Online"
   ::= { intKEYEntry 9 }

kEYFaultyTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Faulty -
                         timestamp"
   ::= { intKEYEntry 10 }

kEYFaulty OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Faulty"
   ::= { intKEYEntry 11 }

kEYCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.CntRs -
                         timestamp"
   ::= { intKEYEntry 12 }

kEYCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.CntRs"
   ::= { intKEYEntry 13 }

sERByteInTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::SEREntry.ByteIn -
                         timestamp"
   ::= { intSEREntry 1 }

sERByteIn OBJECT-TYPE
    SYNTAX              Counter32
    MAX-ACCESS          read-only
    STATUS              current
```

```
        DESCRIPTION         "Interfaces Agent::SEREntry.ByteIn"
       ::= { intSEREntry 2 }

    sERByteOutTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::SEREntry.ByteOut -
                             timestamp"
       ::= { intSEREntry 3 }

    sERByteOut OBJECT-TYPE
        SYNTAX              Counter32
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::SEREntry.ByteOut"
       ::= { intSEREntry 4 }

    sERID OBJECT-TYPE
        SYNTAX              Unsigned32
        MAX-ACCESS          not-accessible
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.ID"
       ::= { intSEREntry 5 }

    sERDescr OBJECT-TYPE
        SYNTAX              DisplayString
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Descr"
       ::= { intSEREntry 6 }

    sERIntType OBJECT-TYPE
        SYNTAX              IntKind
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.IntType"
       ::= { intSEREntry 7 }

    sEROperableTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Operable -
                             timestamp"
       ::= { intSEREntry 8 }

    sEROperable OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Operable"
       ::= { intSEREntry 9 }

    sEROnlineTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Online -
                             timestamp"
       ::= { intSEREntry 10 }

    sEROnline OBJECT-TYPE
        SYNTAX              TruthValue
```

```
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Online"
   ::= { intSEREntry 11 }

sERFaultyTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Faulty -
                         timestamp"
   ::= { intSEREntry 12 }

sERFaulty OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Faulty"
   ::= { intSEREntry 13 }

sERCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.CntRs -
                         timestamp"
   ::= { intSEREntry 14 }

sERCntRs OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-write
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.CntRs"
   ::= { intSEREntry 15 }

aLGID OBJECT-TYPE
    SYNTAX              Unsigned32
    MAX-ACCESS          not-accessible
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.ID"
   ::= { intALGEntry 1 }

aLGDescr OBJECT-TYPE
    SYNTAX              DisplayString
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Descr"
   ::= { intALGEntry 2 }

aLGIntType OBJECT-TYPE
    SYNTAX              IntKind
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.IntType"
   ::= { intALGEntry 3 }

aLGOperableTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Operable -
                         timestamp"
   ::= { intALGEntry 4 }
```

```
    aLGOperable OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Operable"
       ::= { intALGEntry 5 }

    aLGOnlineTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Online -
                             timestamp"
       ::= { intALGEntry 6 }

    aLGOnline OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Online"
       ::= { intALGEntry 7 }

    aLGFaultyTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Faulty -
                             timestamp"
       ::= { intALGEntry 8 }

    aLGFaulty OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Faulty"
       ::= { intALGEntry 9 }

    aLGCntRsTs OBJECT-TYPE
        SYNTAX              DateAndTime
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.CntRs -
                             timestamp"
       ::= { intALGEntry 10 }

    aLGCntRs OBJECT-TYPE
        SYNTAX              TruthValue
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.CntRs"
       ::= { intALGEntry 11 }

    uSBID OBJECT-TYPE
        SYNTAX              Unsigned32
        MAX-ACCESS          not-accessible
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.ID"
       ::= { intUSBEntry 1 }

    uSBDescr OBJECT-TYPE
        SYNTAX              DisplayString
        MAX-ACCESS          read-only
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.Descr"
```

```
   ::= { intUSBEntry 2 }

uSBIntType OBJECT-TYPE
    SYNTAX              IntKind
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.IntType"
   ::= { intUSBEntry 3 }

uSBOperableTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Operable -
                         timestamp"
   ::= { intUSBEntry 4 }

uSBOperable OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Operable"
   ::= { intUSBEntry 5 }

uSBOnlineTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Online -
                         timestamp"
   ::= { intUSBEntry 6 }

uSBOnline OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Online"
   ::= { intUSBEntry 7 }

uSBFaultyTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Faulty -
                         timestamp"
   ::= { intUSBEntry 8 }

uSBFaulty OBJECT-TYPE
    SYNTAX              TruthValue
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.Faulty"
   ::= { intUSBEntry 9 }

uSBCntRsTs OBJECT-TYPE
    SYNTAX              DateAndTime
    MAX-ACCESS          read-only
    STATUS              current
    DESCRIPTION         "Interfaces Agent::Interface.CntRs -
                         timestamp"
   ::= { intUSBEntry 10 }

uSBCntRs OBJECT-TYPE
    SYNTAX              TruthValue
```

```
        MAX-ACCESS          read-write
        STATUS              current
        DESCRIPTION         "Interfaces Agent::Interface.CntRs"
       ::= { intUSBEntry 11 }

    interfaces-agentGroupOptional OBJECT-GROUP
       OBJECTS {
                      intserAvail,
                intserActiveTs,
                intserActive,
                intserFailTs,
                intserFail,
                intethAvail,
                intethActiveTs,
                intethActive,
                intethFailTs,
                intethFail,
                intalgAvail,
                intalgActiveTs,
                intalgActive,
                intalgFailTs,
                intalgFail,
                intkeyAvail,
                intkeyActiveTs,
                intkeyActive,
                intkeyFailTs,
                intkeyFail,
                intusbAvail,
                intusbActiveTs,
                intusbActive,
                intusbFailTs,
                intusbFail,
                eTHDescr,
                eTHIntType,
                eTHOperableTs,
                eTHOperable,
                eTHOnlineTs,
                eTHOnline,
                eTHFaultyTs,
                eTHFaulty,
                eTHCntRsTs,
                eTHCntRs,
                kEYLockedTs,
                kEYLocked,
                kEYDescr,
                kEYIntType,
                kEYOperableTs,
                kEYOperable,
                kEYOnlineTs,
                kEYOnline,
                kEYFaultyTs,
                kEYFaulty,
                kEYCntRsTs,
                kEYCntRs,
                sERByteInTs,
                sERByteIn,
                sERByteOutTs,
                sERByteOut,
                sERDescr,
                sERIntType,
                sEROperableTs,
                sEROperable,
                sEROnlineTs,
                sEROnline,
```

```
                sERFaultyTs,
                sERFaulty,
                sERCntRsTs,
                sERCntRs,
                aLGDescr,
                aLGIntType,
                aLGOperableTs,
                aLGOperable,
                aLGOnlineTs,
                aLGOnline,
                aLGFaultyTs,
                aLGFaulty,
                aLGCntRsTs,
                aLGCntRs,
                uSBDescr,
                uSBIntType,
                uSBOperableTs,
                uSBOperable,
                uSBOnlineTs,
                uSBOnline,
                uSBFaultyTs,
                uSBFaulty,
                uSBCntRsTs,
                uSBCntRs
        }
         STATUS              current
        DESCRIPTION         "interfaces-agent optional objects group"
        ::= { interfaces-agent 2 }

    interfaces-agentCompliance MODULE-COMPLIANCE
         STATUS              current
         DESCRIPTION         "interfaces-agent Compliance"
        MODULE

        ::= { interfaces-agent 3 }


END


<CODE ENDS>
```

Annex B
(informative)

Mapping of relevant IEC 61850 Objects

IEC 61850-7-4 standard objects have been reviewed and relevant IEC 62351-7 objects have been compared considering however that IEC 62351-7 monitoring objects will also apply to devices and protocols that will not implement IEC 61850-7-4.

Table B.1 reports the objects that have been identified in IEC 61850-7-4 for a mapping or a relationship definition with IEC 62351-7 objects.

Table B.1 – IEC 61850-7-4 objects mapping

IEC 61850-7-4 object	IEC 62351-7 object	Comparison and action
LPHD.PhyNam	IED.Location	IED.Location gives the physical installation coordinates (geographical and plant location). The Location attribute may be correlated with the latitude and longitude attributes of PhyNam, that is the name plate of the physical device. These two objects can have different semantics if IEC 61850-7-4 is not implemented.
LPHD.PhyHealth	IED.PhyHealth	These two objects share a similar semantics. Object name has been aligned.
GSAL.SvcViol	IED.SvcViol	Both objects are counters of the number of attempts to write invalid data, including out-of-range and access role violation. The name and the descriptions have been aligned.
GSAL.AcsCtlFail	ACSI.AcsCtlFail	The semantics of the IEC 62351-7 agent is a counter of the number of incoming setting group requests for which a privilege error/access control error has been detected. The name and the descriptions have been aligned to the IEC 61850-7-4 name and desccription.
GSAL.AuthFail	ACSI.AuthFail	The two objects share the same semantics. The object name has been aligned to the IEC 61850-7-4 name.
LCCH.InOv	IED.InOvCnt	Both objects refer to input overflows. However the common data class of LCCH.InOv has a Boolean value, while the abstract type of IED.InOv is a time stamped counter. This is reasonable and due to the different purposes of the two standards. The “Cnt” suffix has been introduced in the IEC 62351 agent in order to avoid possible confusion.
LTMS.TmSrc	ClockEntry.TmSrc	The two objects share the same semantics. The object name has been aligned to the IEC 61850-7-4 name.

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