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ITU-T

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STANDARDIZATION SECTOR
OF ITU

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SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE

General

General overview of the Global Information Infrastructure standards development

ITU-T Recommendation Y.100

(Previously CCITT Recommendation)

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GLOBAL INFORMATION INFRASTRUCTURE

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ITU-T RECOMMENDATION Y.100

GENERAL OVERVIEW OF THE GLOBAL INFORMATION INFRASTRUCTURE STANDARDS DEVELOPMENT

Summary

This Recommendation provides an overview of the nature of the Global Information Infrastructure (GII). It outlines the environment and the related factors which need to be taken into account in progressing the GII standardization work.

Source

ITU-T Recommendation Y.100 was prepared by ITU-T Study Group 13 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on the 1st of June 1998.

Keywords

Global Information Infrastructure, GII, standards, standardization, overview.

FOREWORD

ITU (International Telecommunication Union) is the United Nations Specialized Agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the ITU. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

INTELLECTUAL PROPERTY RIGHTS

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As of the date of approval of this Recommendation, the ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

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Recommendation Y.100

GENERAL OVERVIEW OF THE GLOBAL INFORMATION INFRASTRUCTURE STANDARDS DEVELOPMENT

(Geneva, 1998)

1 Introduction

This Recommendation provides an overview of the Global Information Infrastructure standards developments. It is intended to be a practical, educational and insightful guide for leaders and participants in GII-related standardization.

1.1 Purpose

This Recommendation is intended to be used as a planning tool by everyone considering the development or adoption of standards for use in the GII. Its use is not restricted solely to the ITU organizations.

1.2 Global collaboration

The word "global" is of critical importance. It is not desirable, or logical, to speak of more than one global infrastructure since, by definition, everything lies within a singular global infrastructure.

It follows that the respective roles of the various participants in the GII have to be described in common documents that all participating parties understand. Collaboration between the various participants can best be achieved on the basis of consistent programme documents, common positioning documents, and agreed or non-conflicting basic GII terms and definitions.

1.3 The goals of the Global Information Infrastructure (GII)

The ITU-T is seeking to ensure that the GII will be an infrastructure which facilitates the development, implementation and interoperability of existing and future information services and applications within and across the telecommunications, information technology, consumer electronics and content provision industries. This infrastructure will consist of interactive, broadcast and other multimedia delivery mechanisms coupled with capabilities for individuals to securely share, use and manage information, anytime and anywhere, with security and privacy protection, and with levels of acceptable cost and quality.

The GII will provide for interoperability between a multiplicity of applications and different platforms through a seamless federation of interconnected computers and communications capabilities incorporating line-fed (e.g. copper pair, fibre, coax) and wireless (e.g. satellite and fixed/mobile terrestrial radio) connectionless or connection-oriented technologies. The areas of application must remain unrestricted and are practically unlimited. Current areas of application are expected to include electronic commerce, telemedicine, city information services, intelligent transportation systems, distance learning, electronic libraries and museums, nomadicity (continuity of access in space and time) etc.

The GII must be designed to:

- enable information providers and users (e.g. individuals, information users, information providers, and information service providers) to communicate securely with each other any time and anywhere at acceptable cost and with acceptable quality;
- provide a set of communication services;
- support a multitude of open applications;

- embrace all forms of information (audio, text, data, image, video, etc.), and of information generation, use and transportation;
- operate in a transparent, user-friendly and straightforward way;
- provide seamless, interconnected and interoperable communication networks, information processing equipment, databases and terminals (including TV sets);
- enable competition between the players in the information and telecommunications (including broadcasting) sectors.

2 Abbreviations

This Recommendation uses the following abbreviations:

ATM	Asynchronous Transfer Mode
CL	Connectionless
CLNP	Connectionless Network Protocol
CO	Connection Oriented
CORBA	Common Object Request Broker Architecture
DCE	Distributed Computing Environment
DVD	Digital Video Disk, Digital Versatile Disk
GII	Global Information Infrastructure
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ITU-T	International Telecommunication Union – Telecommunication Standardization Sector
ODP	Open Distributed Processing
OSI	Open Systems Interconnection
PSTN	Public Switched Telephone Network
QOS	Quality of Service
SDH	Synchronous Digital Hierarchy
SDO	Standards Development Organization
SG	Study Group
WP	Working Party

3 Driving forces

This clause outlines some of the key forces driving the evolution of the GII.

3.1 The new environment

Two predominant factors distinguish a situation for the GII which is likely to be radically different from previous information infrastructures. These two factors are:

a) the convergence of technologies in use within telecommunications, computers, consumer electronics and the move of content provision industries towards digital technology; and

b) the new business opportunities, created by the unbundling of services made possible or necessary by deregulation, and other commercial and/or open market pressures.

3.2 Digitalization

Traditionally, networks have been designed with specific payloads in mind, e.g. voice, video or data. It is expected that digital networks will become general purpose carriers of streams of bits. In theory, this will enable any type of digital network to carry any and all types of information in digital format, such as voice, video or computer data. Moreover, the interconnection of different networks will be simplified. This will sweep away the restriction of video being carried on special purpose cable-TV networks, and the tradition of only carrying telephone service over traditional telecommunication networks. All forms of information, including voice, data or video/image, are simply reduced to streams of digital bits for transfer over a bit-way (or digital network). This represents a possible decoupling between networks and their payloads.

Thus, any network that is capable of carrying digital data is also capable of carrying any kind of digitized information. Conversely, any information that is captured in digital form is capable of being carried over any digital network. From this, one can envisage a good deal of role reversal amongst the traditional carriers and suppliers of voice, data and video/image based services.

This role reversal represents an industry-wide paradigm shift and thus requires new ways of doing business, including the business of Standards Development Organizations (SDOs). The convergence and new mix of players potentially created by this situation has enormous implications for the operation of, and relationships between, the standards development organizations representing the traditional players.

3.3 Value chain models and business opportunities

The technological unbundling, created by the new environment briefly outlined in 3.1 above, establishes many opportunities for new business(es) and standards-related developments.

De-regulation in the telecommunications and broadcasting areas also plays a part in this scenario. De-regulation in many cases permits, or even forces, an unbundling of components and services.

The main point to be illustrated is that any link in a value chain model represents both a business opportunity and a requirement for standards-based interface. It follows, therefore, that the ITU-T in conjunction with other Standards Development Organizations (SDOs) must become closely involved in business developments, to better understand their roles in the market place and its relationship to the other market players.

Figure 1 shows a simple added-value chain model. In this model, a given product or service is progressively enhanced as it progresses from the initial supplier, through intermediate suppliers, to the end user.

The following properties of an added-value chain are relevant to ITU-T standardization work:

a) Every link and item in an added-value chain, from content to user or user to user, potentially represents a possible business opportunity.

b) Every link in the chain establishes sufficient demarcation points to facilitate potential separate ownership and operation to be realized within the context of the entire chain.

c) a) and b) are sources of requirements for the definition of standards-based functions and/or interfaces.

This model can be used to represent a competitive telecommunications and information provision environment, involving the interconnection of networks in parallel or in series, as well as systems which enhance or modify information content.

NOTE – More substantial, formal and detailed material on the subject of value chains and Enterprise Models subject can be found in Recommendation Y.110, GII principles and framework architecture.

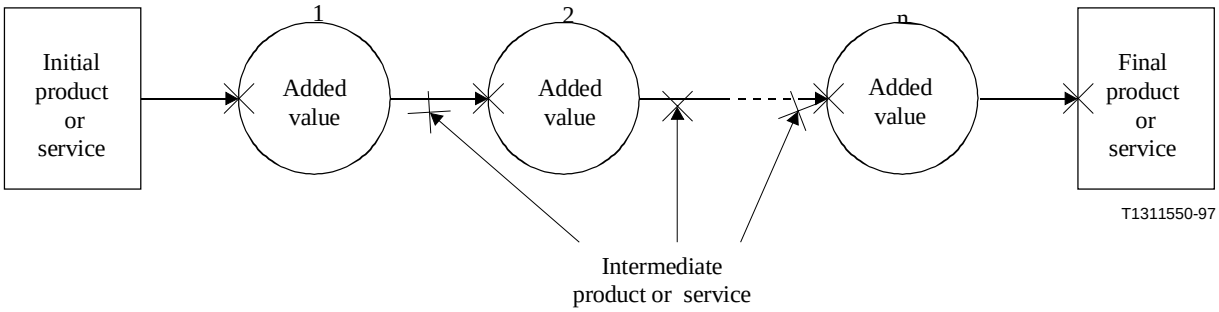

Figure 1/Y.100 – Added-value chain model

4 General considerations

The following general aspects need to be considered.

4.1 Integration and convergence

The GII must provide an evolutionary approach which allows the integration of current networks and technologies into an overall infrastructure as well as providing a direction for future network evolution.

4.2 Accommodation of existing and future technologies

The GII standards must support existing and future telecommunications, information technologies and entertainment services and applications including interactive, broadcast and multimedia capabilities, and will incorporate wire-based and radio-based technologies such as copper pair, fibre, coax, satellite and terrestrial (fixed and mobile) radio.

4.3 Accommodation of applications

The GII standards must provide for interoperability and interconnection (both connectionless and connection oriented), between a multiplicity of applications and different platforms (both software and hardware). The degree of interoperability and interconnection required is dependent on the individual business application areas.

Typical areas include, for example:

- distance learning/electronic libraries;
- telemedicine;
- teleworking (e.g. home office and "on-the-road" applications);
- electronic commerce;
- electronic Publishing;
- gaming.

Different types of application may have significantly different Quality of Service requirements. To illustrate this point the following rough guide to QOS categories is provided. The descriptions are not intended to be definitions and are only provided to show the need to consider various QOS

aspects. Some applications may require a mixture or combination of these categories, or some other category entirely not yet described herein.

Block Transfer

As a response to a "click" on a home page at a terminal computer, a data block that contains information data and a program file, such as a JAVA applet for full-motion video, may need to be sent all at once. An Application Data Unit (ADU) is sent by several packets. Block delay is the main concern from the QOS viewpoint.

Stream

Audio and video communications require end-to-end bandwidths in the network (these bandwidths are related to the communications quality). This type of traffic is characterized as a continuous data-transmission stream. In multicasting, stream data traffic may be sent simultaneously from one site to many destinations. An ADU is generated constantly or at a certain time interval. End-to-end bandwidth and constancy of propagation time are the main concerns.

Transaction

A transaction type of communication, such as that used for electronic commerce, electronic banking, electronic ordering, etc., generates bi-directional data transmission with small-sized data packets (a few kilobits), and requires low data-transmission latency in the network. An ADU is sent in a single packet. Packet latency is the main concern.

Best-effort

As with the Internet, an ADU is sent without any guarantee of QOS. For example, E-mail is a non-interactive application and mail may reach the destination in a few seconds or even in a few minutes.

Network control is not a user application, but it warrants mention. This information, which is accumulated in a single packet, may be categorized as a Transaction type.

Thus, each type of traffic needs a different level of network performance and QOS. It follows that appropriate performance parameters need to be defined to reflect the characteristics of each category of QOS. For example, the parameter Block Throughput/Delay might be appropriate for the Block category, Latency for the Transaction category and so on.

5 GII trends and directions

This clause identifies a number of trends and directions which need to be taken into account by both the ITU-T and other SDOs when establishing their respective programs, program priorities, and liaison or partnership arrangements.

5.1 Networking considerations

The GII will not, initially, require or employ new network capabilities, but will define how a multiplicity of existing capabilities will interwork in the context of a "federation of networks". However, standardization activities related to the GII must permit new network capabilities and technologies to be introduced.

Telecommunications networks are currently providing voice and data services worldwide with a high level of reliability and defined QOS and are based on different network technologies (PSTN, ISDN, Mobile, ATM, SDH, etc.) with interworking between them. Extension of the networks to include broadband capabilities is based on the ATM technology. ATM is also being enhanced to provide not

only for connection-oriented network services but also to meet the requirements of connectionless network capabilities and services supported by these capabilities.

IP-based networks provide a platform that allows users connected to different network infrastructures to have a common set of applications and to exchange data with an undefined QOS. The IP protocol suite is evolving to include voice, data and video applications with defined QOS.

These convergence trends in networking technology are illustrated in Figure 2.

Additionally, terrestrial radio, cable and satellite networks are providing local broadcast entertainment services and are also evolving to provide interactive voice, data and video services.

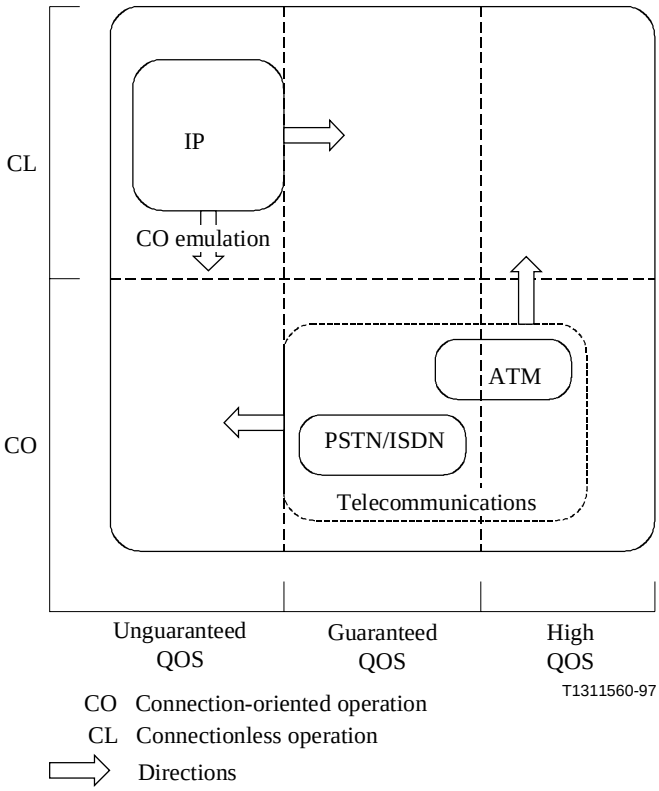

Figure 2/Y.100 – Networking directions

5.2 Information technology considerations

The availability of core technology (IP communications networks, web user interfaces and information representation, compression and retrieval technologies etc.) together with extensive information user and provider uptake and interest has led to rapid successes and growth in the application of internet/intranets (i.e. IP-based) and World Wide Web browsers/communicators for business and entertainment use. The future information and telecommunications technology landscape will provide user capabilities and network/management systems and services which are likely to involve the co-existence of many of these web technologies together with associated distributed technologies and architectures (e.g. OSI/ODP, DCE, JAVA, DCOM, ActiveX, CORBA). No one technology is expected to dominate in the immediate term. Examples of current identified key driver technologies are multicast push technology, security/electronic commerce, internet telephony/audio/video, "internet" management, network computers, intelligent agents, High Definition Television, nomadicity/mobility, and distributed databases.

The convergence of computing and networking requires tight cooperation and integration between computer systems and networking technologies. The scope of the required levels of cooperation will extend across the entire OSI stack but will be especially important in the mid-to-higher layers. Examples of specific areas of interest include data link protocol for satellite links, closer collaboration between physical layer and cabling standards, reliable multicast QOS negotiation, co-existence between OSI/CLNP and the IP protocols (IPv4 and IPv6) and migration to IPv6 in the longer term if IPv6 is commercially successful.

Key areas of interest to information and communications technologies are expected to include Data Capture and Identification systems, Data Management Services, Distributed Application Services, Information Interchange Media, Terminology, Multimedia and Representation, Networking and Interconnects, Office Equipment, Programming Languages and Software Interfaces, Security, Software Engineering, User Interfaces, Document Description languages, and coded Character sets.

5.3 Common generic capabilities

A number of fundamental common capabilities have been identified. These must be inherent in the GII to meet the needs of the user. The idea of common and reusable services/components is identified in order that the user will receive adequate value from the total of the parts, in a consistent manner.

The following list is provided as a starting point. Standards developers and others are encouraged to supplement or improve this list as they see appropriate.

- Access Methods – for requesting and reserving system resources/services;
- Addressing – for identifying entities to receive or provide information, including group directories, directory navigation and dynamic routing;
- Compression – for specifying the level and method of compression to be applied to data being transmitted between heterogeneous networks and applications;
- Cost Quotation – for informing users of the costs associated with services requested, and methods by which payment can be made;
- Data Navigation – for moving from one source of information to other, related, sources of information;
- Data Portability through conversion – for requesting translation of data from the format it is currently in to a form that can be accepted by the requester;
- Data Portability without conversion – for moving data from platform to platform in a neutral format;
- Identification – for identifying objects and data entities to be transmitted via GII as belonging to a specific type, set or sequence of information;
- Internationalization – for customizing applications for the generation of text in specific languages, for identifying the language of data and the sources of alternative versions of the same information for users who cannot understand the proffered language;
- Interoperability Testing – for testing service interoperability;
- Latency Control – for controlling the maximum length of time it may take a message to travel from source to destination[1];

[1] Users must have a common way to specify the maximum acceptable delay in transmission, the "immediate" versus "as available" request for retrieval/supply of information, and how deterministic the delivery mechanism must be.

- Nomadicity/Mobility – for retaining access to services that are not available in the local environment due to user mobility in time or space;
- Priority Management – for prioritizing a request with respect to all other requests;
- Privacy/Ownership – for ensuring that data transmitted via GII cannot be read or copied by those not intended to receive the data, including facilities for encryption, watermarking, copyright and IPR protection;
- Quality of Service – for the identification of levels of functionality acceptable to the user;
- Route Selection – for user control of networks/routes used to reach the destination;
- Search – for requesting and defining ways of looking for information via the GII;
- Security – for defining, in a graded fashion, the levels of security to be used, across all networks, applications and content, during transmission via the GII[2];
- Integrity – For ensuring that information content is not altered without authorization.

5.4 General considerations

A number of other factors need to be borne in mind when designing standards for GII services and components.

The following list is provided as a starting point. Standards developers and others are encouraged to supplement or improve this list as they see appropriate.

- affordability – the cost effectiveness of the resources utilized by an enterprise/organization or user over a specified period of time;
- availability – the measure of the degree of access to a particular resource or set of resources;
- cultural elements – the special characteristics of languages and the commonly accepted rules for their use (especially in written form) which are particular to a society or geographic area. Examples are: national characters and associated elements (such as hyphens, dashes, and punctuation marks), correct transformation of characters, dates and measures, sorting and searching rules, coding of national items (such as country and currency codes), and keyboard layouts;
- interoperability – the ability of two or more systems or applications to exchange information and to mutually use the information that has been exchanged;
- manageability – the ability for any enterprise/organization or user to control how its resources are deployed and utilized;
- minimalism – a methodology or approach which emphasizes the need to enable a resource to function with a minimum set of options;
- performance – the measure of a system or subsystem to execute its functions, e.g. response time, throughput, number of transactions per second, or speed of video playback;
- portability – the ease with which software and data can be transferred from one system to another;
- quality – the provision of a level of service consistent with the expectations of the receiver of that service;

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[2] Basic security services (authentication, non-repudiation, etc.) will be provided at each level in a graded fashion. The actual implementation of security levels is transparent to the user, and may differ across networks.

- reliability – the probability that a product or system will perform as required for a specified period of time;
- scalability – the ability to provide functionality up and down a graduated series of application platforms/environments that differ in speed, capacity, and cost.

6 Standards objectives

The GII is seen as a means to economic growth, competitiveness and socio-cultural development. Jobs, prosperity and cultural developments traditionally follow advances in support infrastructures such as transportation facilities, communications, and higher levels of general and professional education. In the same way, the development of the GII is expected to lead to increased and improved person-to-person communications and to future, and as yet unknown, businesses and interpersonal applications. This move to an Information Society in which individuals have secure global access to all kinds of information and services and which recognizes and meets cultural diversities and sensitivities is expected to be as far reaching in its social and economic impact as the move from the agrarian society to the industrial age.

While the convergence of telecommunications and computing is a prerequisite for the global information infrastructure to emerge, the essence of the information future is considered by some to be the mixing of previously separate types of information (e.g. text, video, audio) into a totally new paradigm. In fact, real and very significant standardization challenges are posed by each of the three component terms encompassed in the GII.

- Global – Global standards are required for the information and infrastructure components of the GII. The globalization of business, the ease of information access and the ease of personal mobility require removal of restrictive national or regional ways of doing business.
- Information – The purpose of the global infrastructure is to enable users to globally manage the creation, storage, delivery and use of information. Adequate global standards for the representation and secure context specific access to or exchange of information independently of the location of the information provider and information user are needed to realize the benefits of the GII.
- Infrastructure – The technological convergence and interconnection of telecommunications equipment, computers and much of consumer electronics has lead to new demands on the communications infrastructure by information providers and information users.

The precise requirements for all global information and infrastructure standards are not known. Nonetheless, it is generally accepted that the essential global standards must address market needs, must not impair or restrict the creativity of equipment manufacturers, information providers or service providers, and must provide a realistic and stable base for the envisioned information infrastructure. Global specifications are universally seen as necessary for a timely and successful GII. Such standards can achieve application-application, application-user and user-user interoperability and meet the market requirements for cost effectiveness, quality of service and support for cultural diversity. They must also address the needs generated by new technologies (such as DVD) and the impact of new operating paradigms (such as increased nomadicity and teleworking).

In addition to the global developments underway in some consortia and industry forums relating to the GII, various national and regional organizations are concentrating on developing their own particular national and regional information infrastructures. While these efforts may be localized in particular geographic areas, it is very evident that all regions and consortia need and want global standards. The challenge for the international standards bodies is the development of the essential standards in a timely manner, while recognizing and building on existing efforts.

It is proposed that GII work programmes be based on the sub-objectives outlined below.

6.1 Business coupling

It will be necessary to ensure that ITU-T, in conjunction with other SDOs, will develop the standards necessary to meet or match a value chain model consistent with business requirements. Approaches to ensuring this match include the use of scenario analysis and business value chain modelling.

NOTE – Business coupling is another way of expressing "meets market requirements" and represents strong added-value and market relevancy aspects to standardization programmes. It complements the growing solutions to the convergence objective. The value for users, developers and service providers would be measurable in real terms supportive of GII interoperability, portability, and connectivity needs.

6.2 Seamless operation

It will be necessary to facilitate a seamless linkage between telecommunications, information technology and entertainment (consumer electronics) through joint agreements on use of appropriate standards (or their development as necessary).

NOTE – The ITU-T and SDOs, by acting as project/programme managers, could offer their skills, procedures, collaborative agreements and liaison to manage and forward standards development and or importation of existing standards and/or specifications from outside bodies/groups.

6.3 Partnerships

It will be necessary to ensure that ITU-T has sufficient working links to other SDOs which will be partners in the value chain.

6.4 Joint work

Procedures to enable joint meetings, joint text, deferred ownership, etc., will need to be resolved amongst a set of collaborating SDOs for areas of joint interest.

6.5 Cross-industry interfaces

The identification of critical cross-industry interfaces is a vital aspect of the convergence process.

NOTE – Focused attention to cross-industry interfaces in light of GII and convergence is required at all levels.

6.6 Common GII models

It will be necessary to establish, jointly with appropriate partners, a common set of models to be used as a framework for progression of GII related activities.

7 Role of ITU-T

The strength of the ITU-T (and other SDOs) lies in their processes, their international membership, collaborative agreements and facilitation of global trade and commerce. The ITU-T can jointly create, implement and manage to a model based on GII standardization needs with its partner SDOs. The ITU is a strong vital organization equipped and organized to manage convergence and broker supportive Standards Development to benefit all parties. It can use its experts and processes to benefit from collaboration with experts from other groups via both formal and informal methods. The ITU can manage the puzzle, bring the players together, seek out agreement on work flow complete with mapping to each others, groups and cross-referenced standards and specifications, all geared towards solving the bigger/macro goal of standards for the GII.

ITU-T SG 13 has been identified by WTSC-96 as the Lead Study Group within the ITU-T for the Global Information Infrastructure. The responsibilities of a Lead Study Group are defined in the following extract from Resolution 1:

"A Study Group may be designated by the WTSC or TSAG as the "Lead Study Group" for ITU-T studies forming a defined programme of work involving a number of Study Groups. This Lead Study Group should be responsible for the study of the appropriate core questions. In addition, in consultation with the relevant Study Groups and in collaboration, where appropriate, with other standards bodies, the Lead Study Group has the responsibility to define and to maintain the overall framework and to coordinate, to assign (recognizing the mandates of the Study Groups) and to prioritize the studies to be done by the Study Groups and to ensure the preparation of consistent, complete and timely Recommendations."

The work of SG 13 as the Lead Study Group for the GII in the ITU-T will include:

- developing an overall view, in broad terms, of GII standardization needs within the ITU-T;
- providing the primary point of contact on GII to other standards development organizations and industry groups (while the other Study Groups will interact with external organizations, as required, in their own areas of interest);
- ensuring development of Recommendations if an activity is deemed to be important and if there was no existing work programme in any SG;
- ensuring development of Recommendations if an activity was deemed to be important and if the work programme for that activity in the ITU does not meet the needs of the GII (e.g. in terms of features or scheduling);
- taking the initiative for establishing an appropriate meeting schedule to progress its work expeditiously and take advantage of known meetings of relevant SGs by, for example, scheduling appropriate meetings to take place simultaneously with other SGs or WPs meetings;
- encouraging electronic means of working such as audio teleconferencing and electronic mail;
- being proactive in collaborating with other standards organizations and other industry organizations.

To perform its work SG 13 will create a work programme, including:

- a work plan, which will constitute an internal management tool covering project descriptions, detailed work items and schedules;
- a project plan, which will provide information about milestones of the projects including dates, deliverables and required inputs
- assign project coordinators for each individual projects.

8 Framework of Recommendations

One of the major activities to be undertaken in the early stages of the ITU-T GII activities clearly has to be work on the three key elements mentioned above:

a) a common programme document, outlining areas of collaboration;

b) a common positioning document, describing the principles, frameworks and architectures with, and within which, the appropriate organizations are operating;

c) common terms and definitions.

This overview Recommendation acts both as an overview and umbrella document for a family of subtending Recommendations.

Currently, the framework for the Y series of Recommendations is shown below.

Y.100	General
Y.200	Services, applications and middleware
Y.300	Network aspects
Y.400	Interfaces and protocols
Y.500	Numbering, addressing and naming
Y.600	Operation, administration and maintenance
Y.700	Security

The following Recommendations have been approved:

Y.100	General overview of the Global Information Infrastructure standards development
Y.110	Global Information Infrastructure principles and framework architecture
Y.120	Global Information Infrastructure scenario methodology

ITU-T RECOMMENDATIONS SERIES

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