Infrared Data Association

Guidelines for *Ultra* Protocols

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1. Introduction

1.1 Purpose

The purpose of this document is to present the rules that apply any *Ultra* protocols that utilize IrDA data link layer framing. *Ultra* protocols in the context of this document refer to all protocols implemented on top of the connectionless data service of the IrLAP specification.

1.2 Scope

This document is intended to be a companion document to the IrDA IrLAP, IrLMP, and OBEX specifications (see section 1.3 References). For most part the aforementioned specifications provide the complete description of the respective protocols. Where exceptions are made, they are clearly marked with **`Exception`** text next to the exception. Reader should be familiar with the aspects of the connectionless data service described in IrLAP and IrLMP specifications.

1.3 References

IRDALAP	Serial Infrared Link Access Protocol, IrLAP, Version 1.1, Infrared Data Association
IRDALMP	Link Management Protocol, IrLMP, Version 1.1, Infrared Data Association
IRDAOBEX	IrDA Object Exchange Protocol, IrOBEX, Version 1.0, Infrared Data Association

2. Minimum Capabilities

This section describes the minimum IrLAP and IrLMP capabilities that are required in every device that supports *Ultra*. Every station that supports receiving and/or transmitting *Ultra* frames shall implement the IrLAP framing as specified in the IrLAP specification. Every station shall follow the IrLAP Media Access Control (MAC) rules. The following sections further explain the requirements.

Ultra devices are not required to support device discovery, sniffing, or connection-oriented services. All communication takes place on 9600 BPS, with optional support for 2400 BPS. *Ultra* protocol alone does not support reliable data service, nor does it support device selection based on addressing.

Nothing prevents the data packets from including additional information that is interpreted by the set of cooperating devices as address information.

Higher level software can be layered on top of *Ultra* to achieve reliable data transport, on a frame-by-frame basis, or, indeed, file transfer.

2.1 Framing

The IrDA-SIR framing requirements described in IrLAP 1.1 specification, appendix D (IrLAP Frame Wrappers) apply to all *Ultra* protocols. In Figure 1 is shown the framing, and the IrLAP and IrLMP layer specific headers.

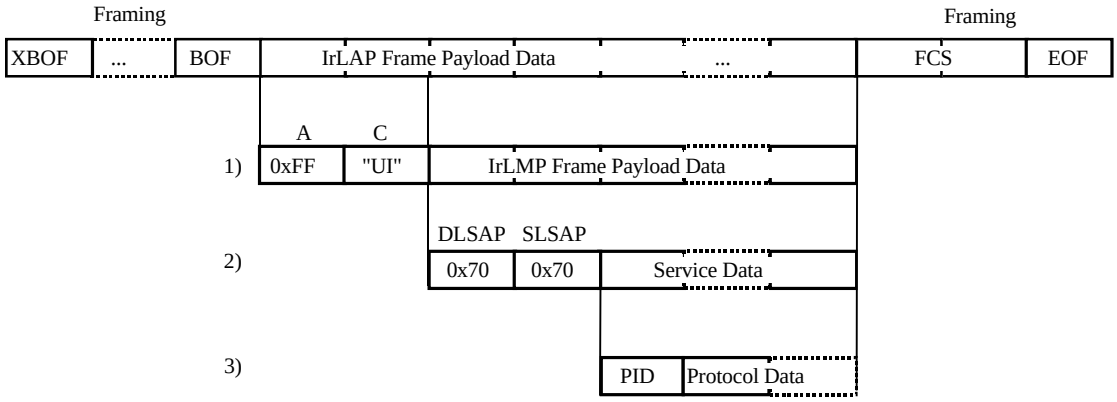

Figure 1. The framing and headers

This Figure shows three levels of definition for the connectionless UI frames. Level 1 headers are defined in the IrLAP specification, level 2 headers are defined in IrLMP, and this document defines the headers specific to level 3.

When the connectionless UI frames are utilized, the following restrictions apply:

The service data payload is required to start with a protocol identifier octet (PID). This octet is used to indicate what protocol is used in the payload. The eight bit of the PID octet is an extension bit and indicates whether or not an additional PID octet follows. PID information must always be presented with minimum possible number of PID octets. See Table 1 for the PID bit definitions. The definition of the extension capability follows closely the extension capability defined in section 3.4.1.1 Service Hints of IrLMP.

For more information on the requirements for connectionless UI frames, please refer to section 3.2.2 Receive Demultiplexer in IrLMP specification, cases (f), and (g). Note, that the Poll bit is required to be set in all connectionless UI frames.

The service data field including the protocol identifier(s), prior to transparency byte-stuffing, shall not exceed 382 octets in length.

It is highly recommended that the service data field including the protocol identifier(s), prior to transparency byte-stuffing, shall be limited to 62 octets in length. Resource restrained systems may not be able to send or to receive frames that exceed this value.

Table 1. The PID Octet Encoding

PID Octet	
Bit	Function
0	Protocol ID bit 0
1	Protocol ID bit 1
2	Protocol ID bit 2
3	Protocol ID bit 3
4	Protocol ID bit 4
5	Protocol ID bit 5
6	Protocol ID bit 6
7	Extension

All PID values are reserved and assigned by IrDA.

Protocol Identifier: 0x01 - Ultra OBEX

The service data payload following the Ultra OBEX protocol identifier shall follow the conventions set forth in the IrDA OBEX specification for utilization of OBEX in *Ultra* protocols. This means that only PUT and GET primitives defined in the OBEX specification may be placed in the service data field when the protocol identifier has a value of 01h. Furthermore, Ultra OBEX utilizes SAR functionality, which is implemented by placing SAR header in front of the OBEX command primitive. Refer to section 3.2. Segmentation and Re-assembly (SAR) for more information on the SAR functionality.

The Ultra OBEX frame structure is shown in Figure 2.

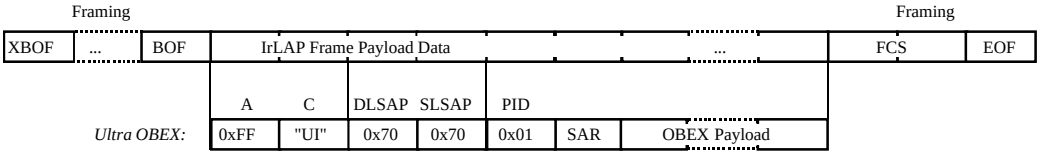

Figure 2. Ultra OBEX frame structure

2.2 Media Access Control Procedures

The MAC procedures described in IrLAP 1.1 specification, section 6.13 generally apply to all *Ultra* protocols.

2.2.1 Unidirectional Devices

No exceptions.

2.2.2 Bi-directional Devices

`Exception`: When any *Ultra* protocol provides device selection capability to ensure that only one station will try to reply to initiated requests, the replying station may generate a frame reply to incoming frame without media sense period, provided that it initiated the reply before 500 ms passes.

In other words, when it is clear that the request is directed to the local station, the local station may initiate reply as soon as possible. If 500 ms passes before the reply is initiated, then a media sense period is required. Care should be taken to always use the number of XBOFs required in the IrLAP specification when sending the reply frames, or problems with minimum turn-around time are inevitable.

3. Optional Capabilities

This section describes the optional capabilities that can be utilized by *Ultra* protocols.

3.1 Optional operation to support 2400 BPS-only stations

Devices supporting *Ultra* protocols may be implemented in such a way that they support operation only on 2400 BPS, and not on 9600 BPS as the IrLAP specification states. Refer to IrLAP specification, appendix A (2400 BPS devices) for full list of requirements. The following additional requirements apply:

> The IrLMP frame payload data field, prior to transparency byte-stuffing, shall not exceed 92 octets in length.
>
> The Service data field, prior to transparency byte-stuffing, shall not exceed 90 octets in length.

3.2 Segmentation and Re-assembly (SAR)

The SAR functionality means the capability to segmentate transmitted data to several smaller frames, and on the receiving side to re-assemble the received data back to the original size. This functionality may be implemented for an Ultra service in order to enable devices that can handle only minimum size frames while still being capable of sending/receiving larger information content.

All MAC rules apply to devices implementing SAR. This means that after each data fragment, the device must initiate a new 500+ ms media sense period. If the medium is free after the media sense period, then sending of the rest of the fragments can continue.

The SAR functionality specified here does not contain transaction id or any similar facility. It is prone to errors if used for extensive data exchange. Errors can happen for example in a situation where two messages contain the same amount of fragments, and the end first message is lost and the start of the second message is lost, while messages are being sent back-to-back.

The receiving station does not have any facility to indicate back to the sending station that a fragment was not received. Thus this SAR facility is only applicable to situations in which information is offered by one station to another unidirectionally. Receiving station is always required to discard all the fragments it receives if any of the fragments belonging to the message is lost, or any fragment is received out of sequence.

If no fragments of a message are received for 2 seconds while the current index is not equal to the final index, the receiving station is allowed to discard all the fragments. In practice this means that if the transmission medium is lost while sending a long sequence, then the sending must be started again.

In Figure 3 is shown an example in which three frames are sent using the SAR facility, while following the MAC procedures set forth in the IrLAP 1.1 specification.

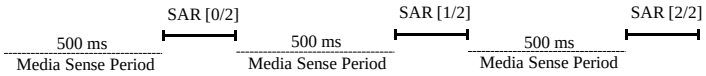

Figure 3. SAR and MAC timing

Table 2. The PID Octet Encoding

SAR Octet	
Bit	Function
0	Bit 0 of current segment index
1	Bit 1 of current segment index
2	Bit 2 of current segment index
3	Bit 3 of current segment index
4	Bit 0 of final segment index
5	Bit 1 of final segment index
6	Bit 2 of final segment index
7	Bit 3 of final segment index

The segment index may be any value from 0 to 14 decimal. Value 15 is reserved. The final segment index may be any value from 0 to 14. Value 15 is reserved.

When SAR is defined to be a part of the payload for a service but the functionality is not needed, then this can be indicated by setting both current segment index and the final segment index to 0, i.e., only one segment in the sequence.