

Summary of the IrDA specifications

by

Henk Blik / White Bream

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Summary of the IrDA specifications

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1 IrDA overview

The Infrared Data Association (IrDA), which is founded in June 1993, has defined standards for infrared communication between devices. The basic two standards are IrDA Data and IrDA Control. The first, IrDA Data, is intended for communication over a relatively short distance, typically up to two meters, and provides speeds up to 4Mbps. Applications that could benefit from IrDA Data are notebook computers, Handheld PCs, digital cameras, mobile telephones, printers, computer peripherals and, of course, barcode scanners.

IrDA Control on the other hand is defined to provide a way of communicating over a relatively long distance at slow speeds. Typical applications that could depend on the IrDA Control specification are keyboards and mice.

2 IrDA Data

One year after the foundation published IrDA the IrDA Data standard. The IrDA Data specification consists of set of protocols that make it possible for devices to communicate with each other with the protocol that is most suitable for the application.

Application protocols that are defined by IrDA are:

- IrCOMM, this protocol exists from the very beginning of the IrDA Data specifications. By using IrCOMM can an IrDA Data connection be used to replace existing serial and parallel cables.
- IrLAN, this specification describes a protocol that enables networking over an IrDA Data connection. With the currently available speeds of 4Mbps can this provide a very acceptable network connection.
- IrTran-P, intended for digital cameras provides this specification a protocol that can be used for exchanging digital images between devices.
- IrOBEX, this specification defines 'HTTP over IrDA', targeted at Handheld PCs and other portable information devices gives this specification the possibility to exchange objects between devices. These objects can be almost anything that can be held in a file such as web pages, notes, games and emails.
- IrMC, infrared mobile communications, specifies how mobile telephony and communication devices can communicate.

All these protocols rely on the core protocols that are mandatory for operation of IrDA Data. These protocols provide the infrastructure for infrared communication like TCP/IP provides a basis for network communication. The mandatory protocols are:

-
- IrPHY, the physical signaling layer
 - IrLAP, the Link Access Protocol
 - IrLMP, the Link Management Protocol
 - TinyTP, a Tiny Transport Protocol control mechanism for use with IrLMP
-

Table 1: IrDA mandatory protocols

IrDA has also defined recommendations for reducing these core protocols to the most essential parts, making it easier to implement IrDA Data into small electronic devices that do not have much memory available. These recommendations are specified in the IrDA Lite document.

All these protocols are grouped together to form a protocol stack.

IrCOMM	IrOBEX	IrMC	IrKBD
	LM-IAS	Tiny Transport Protocol - Tiny TP	
Infrared Link Management and Multiplexer - IrLMP			
Infrared Link Access Protocol - IrLAP			
SIR	FIR		VFIR

Table 2: IrDA protocol stack

2.1 IrPHY

The physical layer of IrDA can run over two different connection types. The first and oldest is SIR, which stands for Serial Infrared. This standard is used for speeds up to 115.200 baud and uses a standard Universal Asynchronous Receiver / Transmitter (UART) The second standard covers in fact two different connection types. The first type is used for 576 and 1152 kbps and the second for 4 Mbps. IrDA has recently published the drafts for a new standard called VFIR. This proposal specifies communication at 16 Mbps.

2.1.1 SIR

The frame format of SIR is as follows:

XBOFs	BOF	Payload	FCS(CRC-16)	EOF
-------	-----	---------	-------------	-----

Table 3: SIR frame format

The XBOFs are transmitted before each frame and are used as a preamble. The Begin Of Frame (BOF) indicates the beginning of the frame and the End Of Frame (EOF) denotes the end of the frame.

The payload is formed by the IrLAP frame over which the checksum in the Frame Check Sequence (FCS) is calculated.

Because the XBOF, BOF and EOF are fixed characters that determine the frame it is not allowed that these characters occur in the payload or the FCS of the frame. In order to prevent that has a character transparency mode been defined.

2.1.1.1 Checksum

The checksum that is used is the 16 bit CRC-CCITT cyclic redundancy check, which is based on the polynomial $x^{16} + x^{12} + x^5 + 1$.

2.1.1.2 Character transparency mode

Because the control character may not occur in the payload or the FCS of the frame must data characters that are the same be masqueraded. This is done with the Control Escape (CE) character. After the CE is the illegal character transmitted, but not before it has been XORed with 0x20, i.e. bit 5 has been inverted.

The CE character is in conjunction with the EOF character also used to indicate a frame abort. When this sequence is received by a device will the already received data be discarded.

2.1.2 FIR

As mentioned above covers the FIR specification in fact two communication types. The first type is sometimes also referred to as MIR, which should stand for medium infrared. It is used for communication at speeds of 576 kbps and 1.152 Mbps.

A feature that FIR has to support is the serial infrared interaction pulse. This is a null character that has to be transmitted every 500 ms. This causes SIR-only devices to listen for the next 500 ms and not to initiate any transmissions, which could interfere with the FIR connection.

2.1.2.1 576 kbps & 1.152 Mbps (MIR)

The frame format for these speeds is the same as for SIR. The difference is that the infrared pulses are 1/4th of the bit time and that it uses bit stuffing instead of character transparency mode. Just like SIR uses it also 16 bit CRC.

The characters that are used for beginning of frame and end of frame indications are also different and are both defined as '0111.1110' (note that this is a violation of the bit stuffing, which is explained below).

2.1.2.1.1 Bit stuffing

A '0' is inserted into the bit stream after five '1's have been sent. A frame is considered invalid when more than five '1's are received. This is also used to indicate that a frame is aborted. The bit stuffing is illustrated below.

```
Raw data:      00110011.10101111.10001111.11100101
Stuffed data:  00110011.10101111.10000111.11011001.01
```

Note that the length of the data that is transmitted does not have to be a multiple of eight bits.

2.1.2.2 4 Mbps

This speed, which is nowadays commonly implemented on most IrDA hardware such as notebooks, PDAs and digital cameras, uses yet another encoding. This encoding is called PPM. PPM stands for Pulse Position Modulation. The CRC that is used for 4 Mbps FIR is CRC-32. This CRC algorithm is specified by IEEE in standard 802.

A frame for 4 Mbps infrared consists of five fields:

Preamble	Start Flag	Data	CRC-32	Stop flag
16x4	8	Nx4	16	8

Table 4: 4 Mbps FIR frame format

2.1.2.2.0.1 Preamble

4 Mbps data frames are commence with a preamble. A preamble is formed by four symbols, containing the next chip sequence.

1000	0000	1010	1000
------	------	------	------

This preamble must be transmitted sixteen times in front of each packet.

2.1.2.2.1 Start flag

The beginning of the data is indicated with the start flag.

0000	1100	0000	1100	0110	0000	0110	0000
------	------	------	------	------	------	------	------

2.1.2.2.2 Stop flag

A frame is ended with the stop flag.

0000	1100	0000	1100	0000	0110	0000	0110
------	------	------	------	------	------	------	------

2.1.2.2.3 Pulse Position Modulation

With the PPM that is used for 4 Mbps infrared are two data bits transmitted in four so called chips. One pulse position modulated symbol contains four chips and thus represents two bits, also called a data bit pair. The encoding is done according to the following table.

<i>Data Bit Pair</i>	<i>4PPM Data Symbol</i>
00	1000
01	0100
10	0010
11	0001

Table 5: Pulse position modulation scheme

Note that the preamble, the start and the stop flag are violations to this encoding and are therefore clearly identifiable.

2.1.3 VFIR

The frame format of VFIR will become as follows:

Preamble	Start	Payload	CRC	Flush byte	Stop	Null
----------	-------	---------	-----	------------	------	------

Table 6: VFIR frame format

The data will be transmitted using a new modulation type, called HHH(1,13).

Refer to the most recent version of the specification for exact description of the fields of the VFIR frame. At this moment are these descriptions still proposals.

2.2 IrLAP

The key functions of the IrLAP layer are performing or responding to discovery procedures and providing a reliable device-to-device connection.

The initiator of the connection is called the primary device and the responder is called the secondary device.

2.2.1 Discovery

The discovery procedure is a method that is used to find other IrDA devices in the area. The procedure is split up in a number of time slots. The host performing the discovery will send an Exchange Station Identification

(XID) frame in every time slot. Devices who 'see' the discovery will generate a slot number that they will use to respond to the discovery. This slot number is a random number that lies between the current slot number and the total number of slots. The responding device will then wait until the random chosen slot is transmitted by the host and respond after that with an XID response frame.

This frame contains the address of the responder, its nickname and the hints byte(s).

The address is a random generated 32-bit value that will be used during the rest of the communication. The nickname is not required, but can be used to inform the user which devices have been found. It is the value that is displayed in the infrared monitor of Windows 95 and 98.

The most important items in the XID response frame are the hints. These byte or bytes inform the host about the capabilities of the responding device. The hints that are available at the moment are:

<input type="checkbox"/> PnP compatible	<input type="checkbox"/> Telephony
<input type="checkbox"/> PDA/Palmtop	<input type="checkbox"/> File Server
<input type="checkbox"/> Computer	<input type="checkbox"/> IrCOMM
<input type="checkbox"/> Printer	<input type="checkbox"/> Message
<input type="checkbox"/> Modem	<input type="checkbox"/> HTTP
<input type="checkbox"/> Fax	<input type="checkbox"/> JetSend
<input type="checkbox"/> LAN Access	<input type="checkbox"/> reserved

Table 7: Available hint bits

Every hint byte has an extension bit, which indicates that more hint bytes follow. This makes it possible to give almost any imaginable application its own hint bit because every byte can be followed by a next byte.

By using these bits is it very easy to see what the capabilities are of the device. A printer/fax combination equipped with IrDA could for example set flags 4, 6 and 13 in the hints bytes, indicating that it supports printing, faxing and JetSend over IrDA.

2.2.2 Device to device connection

A connection is requested by sending a SNRM frame. SNRM stands for Set Normal Response Mode. This frame is addressed to one of the devices that is discovered in the discover procedure. When the addressed device accepts the connection will it send an Unnumbered Acknowledgement (UA) frame back. After that is the connection established. In most applications will the device always accept the connection request, but it is possible for an application to reject the request, in which case a Disconnect Mode (DM) frame is replied to the host

2.2.3 Frame format

The basic IrLAP frame format is as follows:

Address	Control	Information ...
8 bits	8 bits	Nx8 bits

Table 8: IrLAP frame format

The Address field contains the connection address of the destination and the Command/Response flag. The address 0x00 is reserved and the address 0xFE (all ones) is the broadcast address that is used in the discovery procedure. The connection address of a secondary device is assigned by the primary device in the SNRM frame. The Control field indicates the type of the packet. Depending on the type of the packet may the Information field contain zero or more bytes of additional fields and / or payload data.

2.2.4 Packet types

The following packet types can be indicated in the control field of the IrLAP frame:

<input type="checkbox"/> U (Unnumbered) frames
<input type="checkbox"/> S (Supervisory) frames
<input type="checkbox"/> I (Information) frame

Table 9: IrLAP frame types

2.2.4.1 Unnumbered frame

The unnumbered frames are used to control the connection. They can be sent at any time and have no influence on the sequence counters. The following control commands (c) and responses (r) are available:

○ XID (Exchange Identification) c/r	○ TEST c/r
○ SNRM (Set Normal Response Mode) c	○ UI (Unnumbered Information) c/r
○ UA (Unnumbered Acknowledgement) r	○ FRMR (Frame Reject) r
○ RNRM (Request Normal Response Mode) r	○ DISC (Disconnect) c
○ DM (Disconnect Mode) r	○ RD (Request Disconnect) r

Table 10: Unnumbered frame commands and responses

The SNRM, UA and DM command frame are handled already in paragraph 2.2.2 Device to device connection.

DISC indicates that the primary wants to disconnect.

RD indicates that the secondary want to disconnect. This command is accompanied with a reason so the receiver can inform the user or the application why the link got disconnected.

UI is used for connectionless data and is optional. It is not used in optIr because a reliable connection is required. The installation base of systems supporting connectionless data exchange is also very small too, so it would not be very useful.

FRMR is sent when a primary has sent an invalid or unsupported frame to the secondary. It is accompanied by a reason that indicates why the frame is rejected. This can be used by a primary to find out the capabilities of a station.

The TEST command is used to test a connection. A station that receives a test frame will send one back. If data was included in the information field of the source test and the station can handle the amount of data than will the same data be included in the test frame to be send.

2.2.4.2 Supervisory frame

The supervisory frames manage the information frames or extend their function. These frames use the sequence number that is also used by information frames so they can be used to acknowledge received frames.

The table below gives an overview of the commands and responses that are available.

○ RR (Receive Ready) c/r
○ RNR (Receive Not Ready) c/r
○ REJ (Reject) c/r
○ SREJ (Selective Reject) c/r

Table 11: Supervisory frame commands and responses

When a station has nothing to send, then it sends a RR frame instead of an information frame. When the station has nothing to send but is also not ready to receive new data by one or another reason than is replies with the RNR frame.

The frames REJ and SREJ are used to request retransmission of information frames. Hereby requests REJ retransmission of all frames following the frame number of the current supervisory frame while SREJ only request retransmission of that particular frame.

2.2.4.3 Information frame

Information frames for exchanging data. Depending on the negotiated window size can up to eight of these frames be sent and received before a link turn around is required. The payload of an information frame is formed by an IrLMP packet.

2.2.4.4 Poll/Final flag

The control field contains also the poll/final flag. This flag, when cleared, indicates that more frames will follow. This flag is called the poll flag when transmitted by a primary station and called the final flag when transmitted by a secondary. There is no functional difference between the two flags. After exchange of a frame with the poll/final flag set turns the link around and can the other device transmit.

2.2.4.5 Sequencing

IrLAP has a construction that, depending on the connection parameters, permits a station to send up to eight packets before an acknowledgement is required. This can significantly increase the throughput of the connection.

The 'sequencer' uses four variables; Vr, Vs, Nr and Ns. Vr and Vs are variables that are used by IrLAP to test the validity of the Nr and Ns variables, which are fields in the packet header. Ns represents the sequence number of the transmitted frame and Nr represents the sequence number of the next expected frame.

The Vs counter values is placed in the Ns field of every packet that is transmitted, and incremented after transmission of an information frame.

The Vr counter is increased when an error free information frame is received.

This construction allows a system to detect that frames are not received and to know which frames are acknowledged by the remote station.

2.2.5 Negotiation

The IrLAP connection has a lot of parameters, which control the performance of the connection. The parameters that will be used are negotiated when the connection is build up. The procedure for that is as follows:

When the initiating host sends the SNRM frame to the target device does it include all the parameters that it supports in the frame. The target maps these parameters over its own parameters and finds the best commonly supported value for each parameter. In the UA response frame are these values included after which both devices know the settings that will apply for the connection. When the device does not have values in common then no connection is possible and will the connection setup be aborted with the DM response frame.

The parameters that can be negotiated about are:

<input type="radio"/> Baud Rate	<input type="radio"/> Additional BOFs
<input type="radio"/> Maximum TAT (Turn Around Time)	<input type="radio"/> Minimum TAT
<input type="radio"/> Data Size	<input type="radio"/> Threshold time
<input type="radio"/> Window Size	

Table 12: Negotiated parameters

Because the devices need to be able to communicate with any other device is the connection setup performed at predefined communication parameters. The parameters are 9600 baud, 500ms max. TAT, 64 byte data size, window size of 1, 0 additional BOFs, 50ms min. TAT and 40 seconds threshold. Every device that supports IrDA must support these parameters, it is however not required that the device supports these parameters for data communication, i.e. a device may negotiate that it only supports 4 Mbps. The negotiation itself occurs than however still at 9600 bps.

The parameters baud rate, data size and window size are directly related to the performance of a link, it is evident that a connection at 4 Mbps, a packet size of 2048 byte and a window size of 8 can transport much more data than a connection at 9600 bps, a packet size of 64 and a window size of 1. It depends on the application whether or not that is relevant.

A more or less time critical application may use a maximum TAT of less than 500 ms to reduce latencies. Other applications that have limited processing power can make use of the minimum TAT value to prevent frames from coming in too fast. The additional BOFs parameter can be used for battery powered applications that suspend between transmissions and need some time to wake up. An example of such an application is the Comtec RP3 printer, which requests 48 additional BOFs.

The threshold time is mainly intended for user friendliness. It controls how long two stations will try to reestablish a connection that has been broken. Its value can range from 3 to 40 seconds.

2.3 IrLMP

IrLMP is the link management protocol and multiplexer.

With this protocol it is possible to run multiple connections over a single IrLAP connection.

2.3.1 Frame format

IrLMP uses two types of frames, the first is a data frame and the second is a link control frame. The frame type is distinguished by the C flag, which is the first bit of the header.

C=0	DLSAP	r=0	SLSAP	Data ...		
C=1	DLSAP	r=0	SLSAP	A	Opcode	Parameters

Table 13: IrLMP frame formats

The r flag before the SLSAP is reserved and must always be '0'.

Both LSAPs and the opcode are seven bit long because the first bits of those bytes are used for the flags C, r and A.

2.3.1.1 LSAP

The LMP connections are identified by Link Service Access Points (LSAPs). Both sides of a connection have their own LSAP, which are included in the packed as the DLSAP for the destination LSAP and the SLSAP for the source LSAP.

The source LSAPs can be retrieved from a table or generated during runtime. The last option is mainly intended for applications where protocols can be removed or added all the time, e.g. the IrDA implementation of Windows 98 or Linux. Only one LSAP is mandatory, this is the root LSAP with number 0, which is used to access the IAS database.

2.3.1.2 Command frame

The A flag indicates, when set, that the frame is a command frame. Commands can go in both directions of the link, and not like with IrLAP only from the primary to the secondary station.

The following commands can be sent over the link control connection. Some of them can also be a response. This is also stated in the table. These commands become responses when the A flag is cleared.

<i>Opcode</i>	<i>Command</i>	<i>Mode</i>
1	Connect	command/response
2	Disconnect	command
3	AccessMode	command/response

Table 14: IrLMP opcodes

The disconnect command must be accompanied by a reason. 11 different reasons are specified, but the most commonly used reasons are 'User Request' and 'Unspecified Disconnect Reason' with values respectively 0x01 and 0xFF.

2.4 LM-IAS

LM-IAS stands for Link Management – Information Access Service. This service keeps a database with the service that the IrDA implementation supports. Every protocol or service has its own entry in this database. Every entry or object has a more or less attributes. The attributes that are mandatory are classname and LsapSel

When a host wants to contact a device then it first queries the IAS. The response from the device will than show if the requested service is available in the device and (if available) which LSAP it wants to use for that service.

2.4.1 Device object

The basic IrDA stack without application protocols has also an entry in the IAS. The name of this mandatory object is "Device". It has at least the attribute "DeviceName". This attribute is used for example by Windows 9x to retrieve the name that is displayed in the device description of the infrared monitor.

2.4.2 Attributes

The attributes of an object can be any of the following types:

- | |
|---|
| <ul style="list-style-type: none"> ○ Missing ○ Integer ○ Octet sequence ○ User string |
|---|

Table 15: IAS attributes

2.4.2.1 Missing

This attribute is not stored, but send when a specified attribute does not exist.

Type=0
1 byte

2.4.2.2 Integer

The integer type can represent a value of 32 bits signed, which is ~ -2 billion to +2 billion
The attribute is organized as follows.

Type=1	Integer
1 byte	4 bytes

The LsapSel for example, which is available in every object (except the main object Device), is of this type.

2.4.2.3 Octet sequence

This type is more or less equivalent to an array. It represents up to 1024 bytes that have no relation to each other like in a string.

Type=2	Length	Sequence
1 byte	2 bytes	'Length' bytes

2.4.2.4 User string

This attribute type allows including a textual string in the database. An example of this is "Device.DeviceName".
The maximum length is 256 characters.

Type=3	Char. set	Length	Characters
1 byte	1 byte	1 byte	'Length' bytes

The character set selected in the second field can represent standard ASCII (0x00), Unicode (0xFF) or one of the ISO-8859-x standards (0x01 - 0x09). It is the responsibility of the application to know that when using Unicode only 128 characters will fit in the string (because an Unicode character is 16 bits long).

2.4.3 Information Access Protocol

This protocol describes how the data in the IAS has to be retrieved by a device.

2.4.3.1 Frame format

LMP header	Lst	Ack	Opcode	Data ...
------------	-----	-----	--------	----------

Table 16: IAP frame format

The Lst flag indicates that the frame is the last or the only frame.

The Ack flag can be used to acknowledge a command. This is normally not necessary because the response is an acknowledge anyway.

The following commands are available for the IAP. Only the first is required for every station.

o LM_GetValueByClass	o LM_GetObjects
o LM_GetInfoBaseDetail	o LM_GetObjectInfo
o LM_GetValue	o LM_GetAttributeNames

Table 17: IAP services

Only the first service is explained here, it is also mandatory. Refer to chapter 4 of the IrLMP specification for information on the other services, which are all optional.

2.4.3.2 GetValueByClass

This service is called object name and the attribute name, both names are octet sequences.

Opcode=4	Class len.	Class name	Attr. Len.	Attr. name
6 bit	1 byte	'C.Len' byte(s)	1 byte	'A.Len' byte(s)

So when the GetValueByClass service is called on Device.DeviceName, than the frame contents will be:
 < 0x04, 6, 'D', 'e', 'v', 'i', 'c', 'e', 10, 'D', 'e', 'v', 'i', 'c', 'e', 'N', 'a', 'm', 'e' >

The response of this service is uses the same opcode (0x04), always followed by at least one byte. This byte can the value 0, 1 and 2. When the value is 0, then the request completed successfully and the response data follows. A value of 1 indicated that the requested class was not available and 2 indicates that the attribute was not available.

The data that follows the '0-response' is as follows:

List length	List
Object identifier	Attribute

Table 18

2.5 Tiny TP

Tiny TP is an extension to IrLMP. It provides a flow control mechanism for each IrLMP connection, just like IrLAP does for the device to device connection. This is done by providing the remote peer with a delta credit value, which represents the amount of data that can currently be received.

It also adds segmentation and reassembly (SAR) features to IrDA, which makes the protocol suite more universal.

2.5.1 Frame format:

The header of Tiny TP is only one byte large, The first bit is used for the SAR feature and indicates that more packets follow. The next seven bits represent the deltacredit value.

M	DeltaCredit	Userdata ...
---	-------------	--------------

Table 19: Tiny TP frame format

2.6 IrCOMM

IrCOMM provides serial and parallel port emulator over IrDA. It can be used for any wireless IrDA connection that can also exist with a serial or parallel cable

2.6.1 History

IrCOMM was introduced shortly after IrDA Data was specified. It is specified with the intention to provide legacy applications the ability to communicate over infrared. Implementation recommendations discourage the use of IrCOMM in applications that can benefit from a more solid and integrated infrared implementation. Despite those recommendations have most manufacturers of IrDA equipped devices used IrCOMM. This is probably caused by the fact that in the early days of IrDA only IrCOMM was supported under Windows 95, this windows implementation did also not allow for application specific protocols to be hooked to the stack. As a result of that most applications were designed to use IrCOMM.

2.6.2 Frame format

For the 3 wire, 9 wire and centronics service types are the control parameters sent before the data:

TinyTP	Control	Data
Clen	Cvalue	
PI	PL	PV

Table 20: IrCOMM frame format

The CLen field indicated how many bytes are contained in the Cvalue field. This means that if the frame contains no control data, the CLen value will be 0. The Cvalue contains sets of a Parameter Index (PI), a Parameter Length (PL) and a Parameter Value (PV).

The Parameter Index identifies the parameter, such as the baud rate and is 1 byte long. The Parameter Length field contains the length of the Parameter Value field.

Using this construction it is possible to send a random number of parameters, without always reserving parameter field in the frame.

2.6.2.1 IrCOMM services

The serial and parallel port types that can be emulated by IrCOMM are 3 wire raw, 3 wire, 9 wire and centronics. 3 Wire raw is also known as IrLPT because it has been used by some printer applications that only need one connection.

2.6.2.2 3 Wire raw / IrLPT

This is a service of IrCOMM that does not make use of Tiny TP. The data of 3 wire raw is put directly into the IrLMP frames. IrCOMM does not add additional control data or headers. This behavior can also be seen in the IAS definition below.

Printers do also use 3 wire raw, but they call it IrLPT. It differs only from 3 wire raw with the name of the IAS entry, which is "IrLPT.IrDA:IrLMP:LsapSel" instead of "IrDA:COMM.IrDA:IrLMP:LsapSel".

3 Wire raw and IrLPT do not use the frame construction that is described above. They just dump the raw data into the payload field of the IrLMP frame.

2.6.2.3 3 Wire

3 Wire raw has provisions for selecting a baud rate, flow control and sending a break.

The definition of the entry in the IAS is the same for all the following services and is

"IrDA:IrCOMM.IrDA:TinyTP:LsapSel" the Parameters attribute of the IAS entry identifies the service type, that is 3 wire, 9 wire or centronics.

2.6.2.4 9 Wire

This service functions in the same manner as 3 wire except that the parameter attribute in the IAS has the 9 wire bit set and that it has more control parameters.

Added parameters are used for transferring the status of the serial handshake lines.

2.6.2.5 Centronics

The control parameters of the centronics service are used for setting the centronics type (normal, ECP, EPP), timeout and status. It has the centronics bit set in the parameter attribute of the IAS.

2.7 IrMC

This is a set of specifications suitable for mobile communication devices like mobile telephones and PDAs. This set contains IrOBEX, Ultra and RTCON.

Ultra makes use of the UI unnumbered frame of IrLAP to send small pieces of data to other hosts. This can be combined with IrOBEX to create a connectionless object exchange service.

2.8 IrLPT

IrLPT is in fact based on IrCOMM 3-wire raw, or better-said IrCOMM 3 wire raw is based on IrLPT, since IrLPT existed before IrCOMM. It is only intended for use with in printer applications and differs only from IrCOMM 3 wire raw in that it has another name for the IAS entry.

3 IrDA Control

The specifications for IrDA Control were published in February 1998. The intention of IrDA and the contributors to this specification was that IrDA Control product would be available in 1998. Until now has however not a single known product been equipped with IrDA Control.

This standard is intended for use in Human Input Devices such as keyboards, mice and game pads. It provides a speed of 75 kbps, a response time of 13.8 ms, up to 8 simultaneous connected devices and a range of 5 or more meters.

IrDA Control has three mandatory protocol layers:

-
- PHY (Physical layer)
 - MAC (Media access control)
 - LLC (Logical link control)
-

Table 21: IrDA Control protocol layers

3.1 Physical layer

The physical layer takes care of protecting the data and to convert it from memory content to an infrared signal. The data is first protected with a packet size dependent Cyclic Redundancy Check (CRC). This is CRC-8 for small packets with a payload up to 9 bytes. For large packets up to maximal 97 bytes CRC-16 is used. After that is the data encoded into a 16-pulse sequence. This bit stream is multiplied with a 1.5 MHz sub carrier frequency.

The resulting modulated signal is sent to the infrared transceiver. This transceiver must be capable of sending and receiving high frequency modulated signals. Suitable transceivers are the range of Sharp and the TDFU6101 from Vishay. Ordinary FIR transceivers are not usable because the signal range of these transceivers is only one meter, while IrDA Control requires a range of five meters and they are not usable. The maximum data speed that can be reached is 75 kbps.

3.2 Media access layer

IrDA Control has the same construction as its wired equivalent; USB. This means that all communication takes place under control of the host. The host continually polls all the devices within range and the devices may respond when they are polled.

Two kinds of devices can be differentiated; Non-critical Latency (NCL) peripherals and Critical Latency (CL) peripherals. The difference between those two is that the CL devices are polled at least every 13.8 ms, while NCL devices may be skipped if necessary.

The MAC contains also a special operating mode, which makes it possible to let IrDA Control coexists with IrDA Data. The consequence of this is that the performance of IrDA Control reduces significantly; the maximum number of devices is reduced from 8 to 2 and CL devices cannot always be served within the required time of 13.8 ms.

3.3 Logical link control

This layer provides a bridge between the USB HID class and the lower protocol layers of IrDA Control. Things like error correction are not available in the LLC layer because that is already handled by the USB protocols.