JetSend™ Protocol on IrDA

Application Note

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1. Introduction

One of the most basic and desirable features of the IrDA infrared communication protocols is the simple “point and shoot” usage model of the transport. IrDA has done an excellent job of defining a transport that meets these ease-of-use requirements. JetSend extends this usage model above the IrDA transport layer up into the application space.

JetSend is a device-to-device communications protocol that allows devices to intelligently negotiate information exchange. The protocol allows two devices to connect, negotiate the best possible data type, provide device status, and exchange information, without user intervention. JetSend acts as on-board intelligence allowing devices to communicate directly with one another without the need for a server or detailed information (such as a device driver) to communicate with another JetSend device. Each device knows its own capabilities and is able to communicate that information to other devices.

Traditionally, communication between devices requires both the sending and the receiving device to understand each other's device-type and device-specific capabilities. Once device type and capabilities are determined, the correct device driver software must be loaded on a network server or PC. The device driver translates data from the sending device into something the receiving device can understand. Basically, there is an intermediary that allows communication to occur between the two devices. As the number and types of network-connected devices multiply - especially those intended for ad hoc, distributed and mobile communications - the complexities of the traditional model are greatly amplified.

JetSend-enabled devices interact directly with one another. Once communication is established, the devices automatically produce a negotiated information exchange at the highest level outcome possible. In essence, the devices negotiate, so users don't have to.

JetSend devices communicate with one another through a series of electronic exchanges. Through these exchanges, devices share electronic material, or e-material, with each other. The following conversational metaphor illustrates an imaginary negotiation between two JetSend-enabled devices. To illustrate, we've used a scanner and a printer in this example, but the strength of the JetSend communications protocol is that it works across many different device types. PCs, pagers, PDAs, phones, auto-tellers, information kiosks, calculators, data collection devices, watches, home electronics, industrial machinery, medical instruments, automobiles, pizza ovens, and office equipment are all candidates for using JetSend.

Step 1: The scanner sends information about its capabilities to a printer. "I am a JetSend device. I can send you images in grayscale or color with up to 24 bits of color depth and in resolutions from 150 to 1200 dots-per-inch."

Step 2: The printer receives this information and returns the following. "I'm a JetSend device. Send me 24-bit color at 600 dpi."

Step 3: The information is rendered as requested and sent directly to the printer.

This negotiation happens automatically. If two JetSend-enabled devices can connect, they can exchange meaningful data. They can do this without drivers, without a lot of intermediary networking complexity, and most importantly - without user intervention.

JetSend uses an Information Appliance model. An information appliance, like a household appliance, is optimized for a specific purpose, very simple to use, and highly reliable. It may serve a single purpose like a small, household appliance, such as a toaster, iron, or blender. Or like a microwave or VCR, it may have advanced features and functionality built on top of that specific purpose, but the user experience with the basic operation of an information appliance is very simple, and the device is highly reliable.

JetSend enables an intelligently negotiated communication between two information appliances. Each is embedded with device firmware or software that contains information about how it works. This firmware

includes the JetSend technology and a small amount of device-specific integration code. Because each device knows its own capabilities and can communicate these via JetSend, they can interact directly to accomplish a specific communications task. This eliminates the need for external device drivers to enable communications.

Does this mean device drivers will disappear entirely? Probably not. People who want to use the advanced features and functionality of a device will probably use a device-specific driver to access those features. But if they simply want to communicate, JetSend allows them to do.

This document provides the necessary information for implementing JetSend using IrDA protocols. For more detailed information about JetSend protocol, refer to [HPJETSEND] Section I: Architectural Overview. For information about JetSend protocol extensions for digital photography, please refer to the [JSDIGPHOTO] document. Further information about many other JetSend topics can also be found at http://www.jetsend.hp.com/.

2. JetSend Overview

2.1 JetSend components

JetSend is a protocol for devices to communicate and exchange information. In its simplest form, it is quite compact and requires a small amount of code to implement. It can reside on top of any reliable transport, such as that provided by [IRDATTP]. JetSend consists of the following pieces:

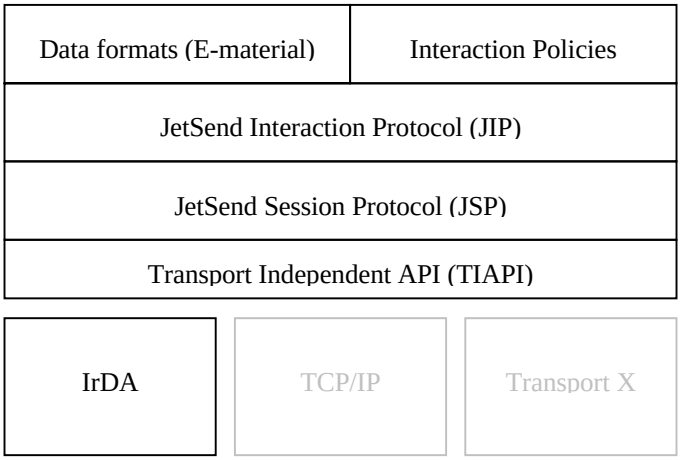

Figure 1. JetSend architectural components

- an e-material specification, which defines data types and structures which are used to communicate information. The e-material is hierarchical and is used for data, status, control, and contact information.
- an interaction policy specification, which determines the methods that are used to exchange data, status, control, and contact information.
- an interaction protocol, which is used to exchange information surfaces between devices. The interaction protocol uses an information appliance surface exchange model.
- a session protocol, which structures the dialogue between two devices. The session protocol uses a binary packet-based request/response model.
- a transport-independent API, which simplifies interaction with many different transport layers.
- an IAS definition and hint bits for the service for using JetSend on IrDA.

2.1.1 JetSend Protocol Versions

The JetSend Protocol Specification requires that devices support version 0 of all of the protocol layers (e.g. JetSend Session Protocol, JetSend Interaction Protocol, etc.). As an additional requirement, implementations of JetSend on IrDA are also required to implement JetSend Session Protocol (JSP) version 1. For information on the JetSend Protocol Specification, see http://www.jetsend.hp.com/.

2.2 Relation to other IrDA protocols

The following diagram illustrates where JetSend fits into the overall scheme of IrDA software.

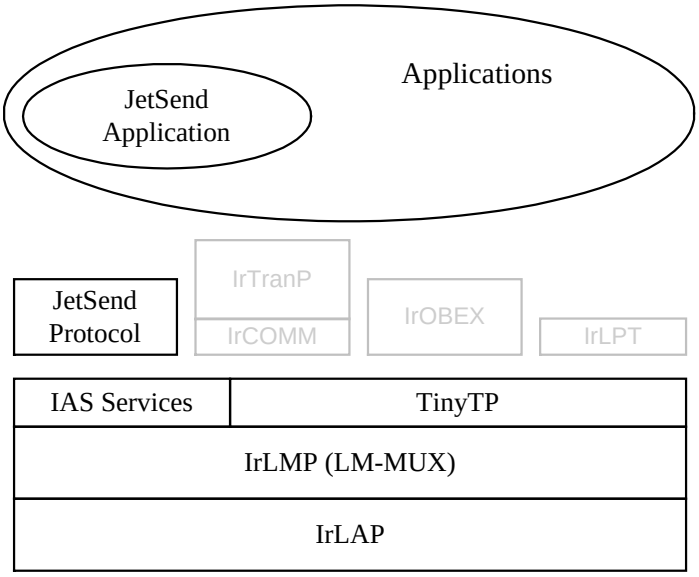

Figure 2. JetSend in the IrDA architecture

The above diagram places JetSend within the IrDA protocol hierarchy, but it could just as well appear above some other transport layer that provides reliable flow-controlled connections. Connection oriented operation over IrDA protocol uses TinyTP flow control to allow for multiple logical connections, including simultaneous JetSend sessions in both directions.

When JetSend is used over TinyTP, the TinyTP MaxSDUSize parameter is not permitted, and the TinyTP layer does not perform segmentation and re-assembly.

2.3 Specification versus Implementation

This description does not specify any implementation of the protocol; it only defines how the protocol is to be implemented on the IrDA transport. The JetSend protocol assumes that a lower protocol layer supports reliable data interchange with other devices (as provided by [IRDATTP]). An appendix discussing the use of JetSend over connectionless transports is under consideration.

3. Session Protocol

JetSend first establishes communications with another JetSend device by issuing an open request, which can be either active or passive. An active open initiates a connection and a passive open starts a listen mode. Appliances will typically listen for sessions on all the networks to which they are connected. The session will be initiated by one of the devices performing an active open request.

An open request will initiate a process to start a Tiny TP connection. This process includes performing a discovery, starting an IrLAP connection, querying the IAS for the JetSend LSAP, starting a Tiny TP connection, and then notifying JetSend of the connection and the Data TTPPDU size which is determined by IrLAP negotiation. Only one Tiny TP connection is required for JetSend to function.

If the JetSend connection is successful a session will be started. This first session opens a message connection by default. JetSend will multiplex all other message channels through this message channel.

Refer to [JETSEND] for more details.

4. JetSend IrDA IAS entries and service hint bit

In normal wired communications, the first step is attaching the cable to the two devices. When using JetSend, a three-step process of discovery, characterisation, and connection, thereby attaching the "infrared cable" replaces this. These steps are explained in [IRDALMP], but the JetSend unique parts are discussed here. There are two such parts: a new discovery hint bit, and new IAS entries.

4.1 JetSend hint bit

The JetSend hint bit is defined as bit 13. Hint bit 13 is overloaded with all object exchange protocols, such as JetSend, IrOBEX, IrTranP.

	Byte 2
Bit	Function
8	Telephony
9	File Server
10	IrCOMM
11	MESSAGE
12	HTTP
13	**JetSend**
14	(?)
15	Extension

The JetSend hint bit must be set for any device that has an IAS object with classname JetSend. To find out more, a prospective client must query the IAS.

4.2 JetSend IAS entry

The IAS is a database of infrared services, a sort of yellow pages listing what a device can provide. An IAS Object consists of a classname and one or more attributes that serve to advertise a service or group of related services on a device (see [IRDALMP] for details). The classname for JetSend services is "JetSend".

The JetSend IAS entry has at least the LsapSel attributes. The LsapSel attribute is needed in order to make a connection (see [IRDALMP] specification). A device should not allow multiple services with identical IAS entries, or the client must in effect toss a coin to decide among them.

The following section shows the detailed format of the attribute for a JetSend IAS entry.

4.2.1 LsapSel Attribute

LsapSel (Link Service Access Point Selector) is the unique "address" or id of the service within the context of one device, and is needed to connect to that service. Use of this attribute is mandatory.

To query for the LsapSel of a JetSend IAS entry, use the following format.

Class Name	Attribute Name	Value Type	Description
JetSend	IrDA:TinyTP:LsapSel	Integer (0x01)	The IrLMP LSAP/TTPSAP of the Tiny TP entity that provides access to the service being advertised Legal values are restricted to the range 0x01-0x6F.

5. Appendices

5.1 Appendix 1: Using JetSend over IrDA Ultra-Lite (Connectionless use)

JetSend has been designed to operate in a connectionless environment. The JetSend Session Protocol can provide connection services and JetSend has been successfully implemented in at least one connectionless environment (e.g. UDP/IP). However, the IrDA UltraLite proposals will have to be examined in further detail to make an exact determination of whether it provides all of the transport features required by JetSend (e.g. reliable delivery).

5.2 Appendix 2: 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
IRDATTP	Tiny Transport Protocol, TinyTP, Version 1.0, Infrared Data Association
IRDAIAS	IrLMP Hint Bit Assignments and Known IAS Definitions, Version 1.0, IrDA
JETSEND	HP JetSend™ Communications Technology Protocol Specification, Version 1.5
JSDIGPHOTO	JetSend Digital Photography Application Note, Infrared Data Association

5.3 Appendix 3: Further Information

Please refer to our web site for updates to the specification:

`http://www.jetsend.hp.com`

The web site also contains information on licensing the HP JetSend Developer's Kit, our certification program, logo and brand name information and more. The developer's kit contains source code that implements the protocols specified in this document.