TRANFERJET TECNOLOGY

ELDHO PETER
Assistant Professor, Department of Computer Application
Nirmala Arts and Science College, Mulanthuruthy,
(Affiliated to Mahatma Gandhi University)
Ernakulam, Kerala- 682314

Abstract- *TransferJet is a new type of close proximity wireless transfer technology developed by Sony. Touching (or bringing very close together) two electronic devices, TransferJet allows high speed exchange of data. The concept of TransferJet consists of a touch-activated interface which can be applied for applications requiring high-speed data transfer between two devices in a peer-to-peer mode without the need for external physical connectors. TransferJet's maximum physical layer transmission rate is 560 Mbit/s. After allowing for error correction and other protocol overhead, the effective maximum throughput is 375 Mbit/s. TransferJet will adjust the data rate downward according to the wireless environment, thereby maintaining a robust link even when the surrounding wireless condition fluctuates.*

Keywords – ***TransferJet , electronic devices***

INTRODUCTION

Two worlds exist for today’s consumer: content creation and content playback. The traditional end user still consumes multimedia content by watching TV, listening to music, and viewing family photos. But many end users spend almost as much time producing content. They produce video, music, and photos using cameras, camcorders, cell phones, and digital video recorders (DVRs) to shoot, snap, and record events whenever and wherever they happen. The reason this has become so popular is simple: it is very easy to create content with modern equipment. But there is a problem. Content is easier to create than to transfer. This limits the potential for playback and sharing and creates a kind of bottleneck between content production and content consumption. For example, end users want to view digital family photos on their big screen TV. It is possible today using cables and menus. But is that the best way? Does the complexity allow people to fully enjoy photos at their convenience? Is every member of the family able to view photos in this way? What about the end user that wants to transfer digital photos to their PC? That is also possible using a memory card or a USB cable. And many people successfully navigate that existing procedure. But is there a better way? Or does this procedure also limit the enjoyment factor? Many other opportunities exist for sharing content between devices. Every device has some advantage. Some, like camcorders and digital cameras, are better at creating content. Others, like TVs and notebook computers, are better at playing back content. Still others, like cell phones, fulfill both roles in a portable platform. Clearly, the ability to share content between devices is necessary to bridge the two worlds thus enhancing the enjoyment and value of individual devices. This technical overview presents a solution – TransferJet™ – which solves the content sharing problem in a way that also achieves high performance, low cost, high security, and most importantly, extreme ease of use.

Technology Development

TransferJet™ is a new wireless technology that combines the speed of UWB (Ultra-Wide Band) with the ease of NFC (Near Field Communications). By doing so, TransferJet™ delivers a transfer speed of 560 Mbps available.

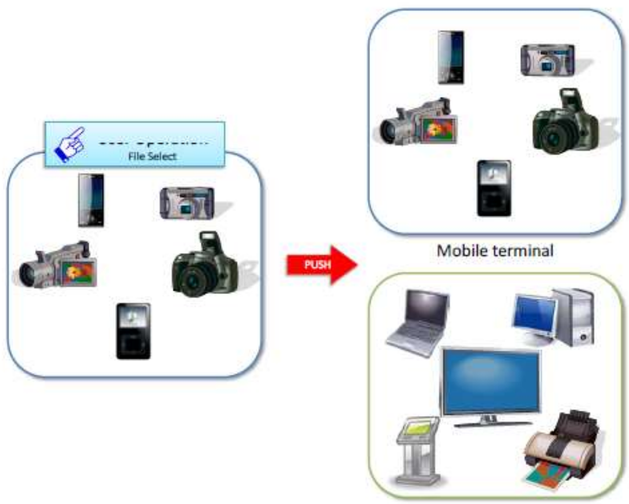
The key concept of TransferJet™ is this “touch” model of user operation. This model requires only a simple touch motion from the user to make things happen. Touch is such a natural motion that people tend to “get it” very quickly. Clearly, touch is a very natural and intuitive motion. From a user standpoint, TransferJet™ can be thought of as a universal touch-activated interface which instantly connects a wide variety of consumer (and non-consumer) electronic products. The TransferJet™ technical specifications have been developed in order to realize simplicity of use based on the “touch” model.

1.1. Initial Reference Use Case

The TransferJet Consortium has studied various usage scenarios that are suitable for this “touch” model and prioritized them according to consumer/commercial needs. The TransferJet Consortium ultimately selected the following three use cases as the initial reference use cases. The TransferJet™ 1.0 technical specifications were developed to implement these initial reference use cases.

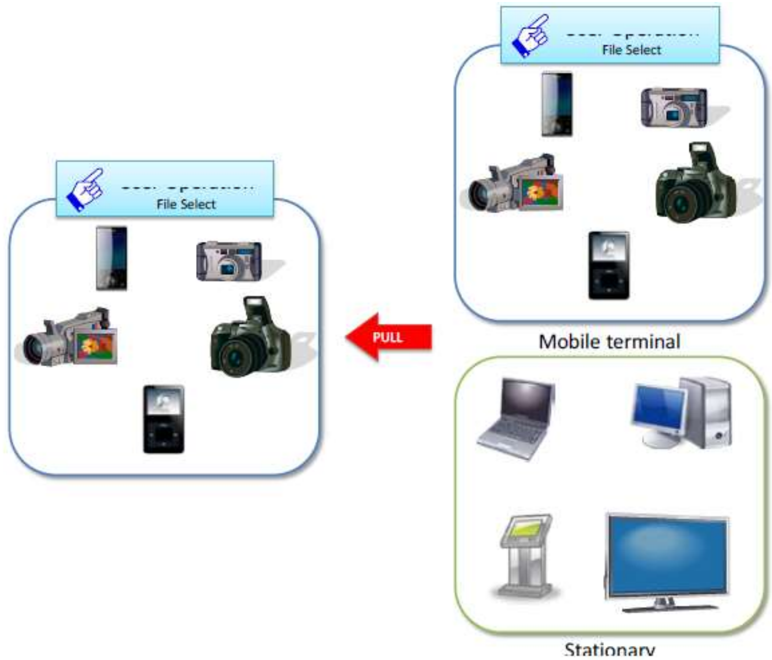
1.1.1. File Exchange

TransferJet™ enables high speed transfer of large data files (photos, video, images, etc) between two electronic products such as mobile phones, digital cameras, camcorders, computers, TVs, game products, and printers. Using this technology in its simplest form, data can be sent at high speed with just a single touch.



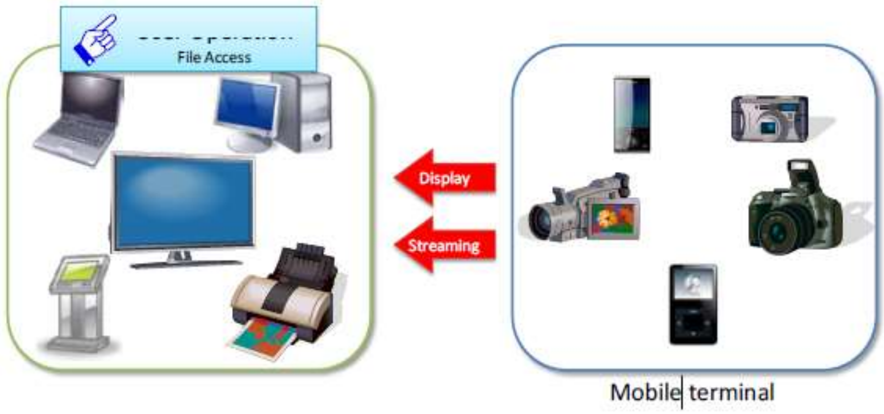
In this use case, a user can push any data file from her/his mobile terminal to another mobile/stationary terminal just by touching. In certain cases, the user may select the specific data to send as well as the location to store (or method to process) the received data before the actual touch operation. For example, students can share music with friends merely by touching the cell phone to the music player. A tourist can store and archive digital video simply by placing the camcorder close to the PC.

Alternatively, the user can get any data file from another mobile/stationary terminal with a similar touch operation. In most cases, the data to transfer has been selected by the sender and, therefore, the receiver does not have to select the file but just touch and receive it.



1.1.2. File access and real time content consumption

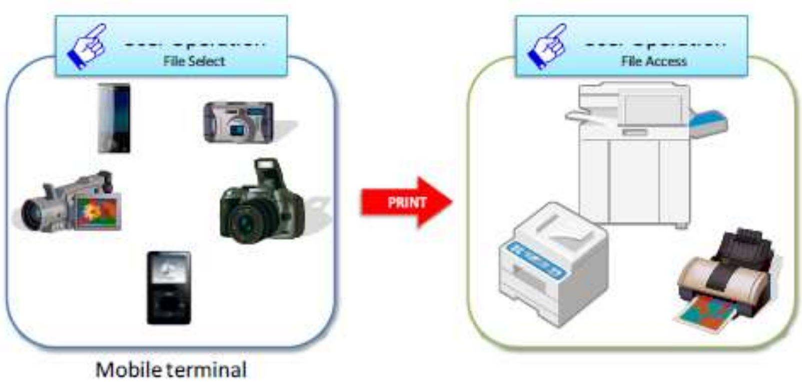
A user might access a file system on her/his mobile terminal (such as cell phone, digital camera, or camcorder) by placing it on a TransferJet™ target point connected to a host terminal such as a computer, digital TV, projector or other device. Once connected, one can access, retrieve, manage, and execute any files on the mobile terminal in the same way as local files. The user can play back and enjoy streamed contents on the host terminal having a high resolution display and a high quality surround sound, without any physical cable connection.



1.1.3. Print Services

The last use case is a special case of the previous two. If a file is transferred to a printer, it should be printed in an appropriate manner. In general, there are two possible ways of printing. A user may operate her/his mobile terminal to select the specific file to print and then touch the printer, which will then print in its default mode.

Alternatively, a user may put the mobile terminal on a TransferJet™ pad of the printer, and then select a file to print by operating the printer. In the latter case, the user can specify various print configurations supported by the printer, such as paper size, layout, color.



Technical Implementation

In order to realize the initial reference use cases, the TransferJet Consortium decided to support two major existing protocols: OBEX (abbreviation of OBjectEXchange, also termed IrOBEX) and SCSI (abbreviation of Small Computer System Interface). By adopting these two well-defined and mature protocols, it is possible to incorporate TransferJet™ into a variety of commercial products, services, and applications.

After technical review, the consortium concluded that all initial reference use cases can be implemented by leveraging these two protocols. The file exchange is realized by utilizing the OBEX Inbox Service. The OBEX Folder Browsing Service and SCSI support the file access functions. SCSI is suitable for implementing the real time content consumption services. Print services can be achieved by using either OBEX or SCSI.

In conclusion, TransferJet™ 1.0 supports specific profiles of OBEX and SCSI. The details will be described in Section 4 “Protocol Conversion Layer”.

TransferJet™Technology Overview

The unique qualities of TransferJet™ make it useful for many applications. TransferJet™ can transfer data at a peak speed of 560 Mbps, with an effective throughput up to 375 Mbps. The maximum range of operation is on the order of a few centimeters and the network topology is always point-to-point between two active (powered) devices. These last two features greatly enhance the simplicity of the system. The short range makes it possible to operate in the near field of the radio signal using very little transmit power – at or below -70 dBm/MHz. The point-to-point topology simplifies the network setup and management procedures. And since the near field is a non-polarized field, the two devices do not have to be precisely oriented to achieve a good connection. The spectrum is centered at 4.48 GHz, and occupies a bandwidth of 560 MHz. The choice of this spectrum, coupled with the extremely low transmit power, enables unlicensed operation in Japan, US, the EU, South Korea and other regulatory domains. In addition, TransferJet™ contains a robust protocol which includes error detection and correction, packet acknowledgement, and packet resend. All of these details work together to minimize complexity and interference. The low transmit power and point-to-point topology help to minimize power consumption. Finally, each TransferJet™ device can detect the presence of another device as it comes within range. Therefore, it is possible to save power by transmitting only when another device is detected. This is another advantage of the touch model.

2.1. TransferJet™ Basics

Since TransferJet™ communicates using a radio signal, it must comply with government regulations in any geographic region in which it operates. In the regions that have clearly established regulations, including Japan, South Korea, the EU, and the US, TransferJet™ is compliant for operation indoors or outdoors. The regulatory situation at the time of writing is shown below.TransferJet™Technology Overview

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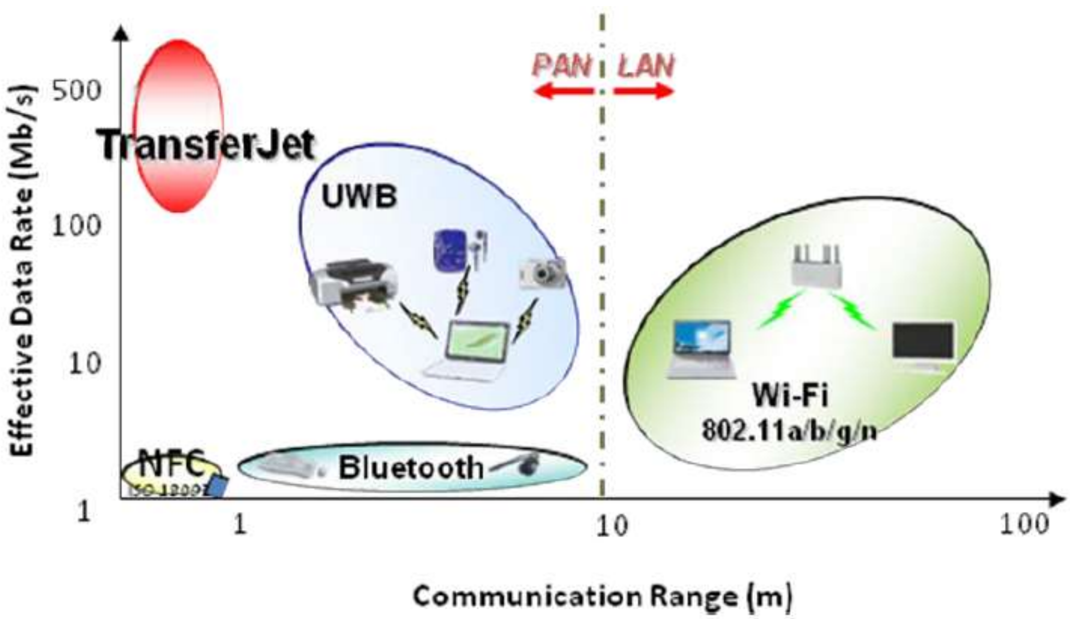


Center Frequency	4.48 GHz
Transmission Power	At or below -70 dBm/MHz (average) Corresponds to low-intensity radio wave regulation in Japan, and with local regulations in other countries and regions.
Transmission Rate	560 Mbps (max) / 375 Mbps (effective throughput) System can adjust the transmission rate depending on the wireless environment.
Connection Distance	A few centimeters
Topology	1-to-1, Point-to-point
Antenna Element	Electric induction field coupler

TransferJet™ Security

Although TransferJet™ is a near field, point-to-point technology, it is still a wireless connection. So security is a key question. Wireless connections such as 802.11 and Bluetooth have extensive and complex encryption technology built in to the link layer to make sure that an unauthorized receiver cannot access private information. Such link layer encryption is necessary for long range networks because it is impossible to physically restrict access to thenetwork as would be possible with a cabled solution such as Ethernet or USB. For security purposes, TransferJet™ is more like a physical cable. Therefore, it intentionally has no encryption built into the link layer. It would be very difficult for an attacker to gain access to a TransferJet™ connection from some distant location. The attacker would have to be physically a few centimeters away in order to access the connection, in which case it is easier to simply intercept the USB cable. Everything about TransferJet™ is designed to restrict both the signal level and range of the radiated signal. By eliminating link layer security, TransferJet™ saves power and cost, and further reduces complexity for the user. But it is possible to add encryption at the application layer. Some applications must protect a file’s integrity during file transfer regardless of the connection type. TransferJet™ is perfectly compatible with these application-level security measures. Since each device has a unique ID, it is also possible to uniquely identify any device that attempts to establish a connection. So TransferJet™ achieves the best of both worlds, the simplicity of touch, with the security of a cable.

2.3. TransferJet™ Connection

At first glance, the short range of a few centimeters might be considered a disadvantage. But when combined with the touch usage model, it actually offers tremendous advantages. In addition to the low power consumption, the short range virtually eliminates multipath fading or shadowing that occurs in longer range solutions such as 802.11 or Bluetooth. Thus the connection is very reliable without the need for complex equalizers or advanced signal processing such as OFDM. This also helps to minimize cost and power consumption. But the biggest advantage is the ability for each TransferJet™ device to discover another TransferJet™ device that comes within range. Since the range is so short, the protocol can reach a key conclusion upon making this discovery: the user has just authorized a connection with the discovered device. Therefore, the protocol can connect the two devices with no further action required from the user. Once this connection is made, the application can take further steps such as transfer a file, query the user, display a file menu, etc. In this sense, the touch motion in the TransferJet™ world is similar to the cable plug-in action in the USB world. One might say that TransferJet™ provides the ease of a USB cable – without the cable. As with every other wireless protocol, devices must proceed through the necessary stages – search, discovery, selection, authentication, connection, and transfer – in order to complete a desired activity. But TransferJet™ is unique because all these steps are collapsed into a single motion: the “touch”.

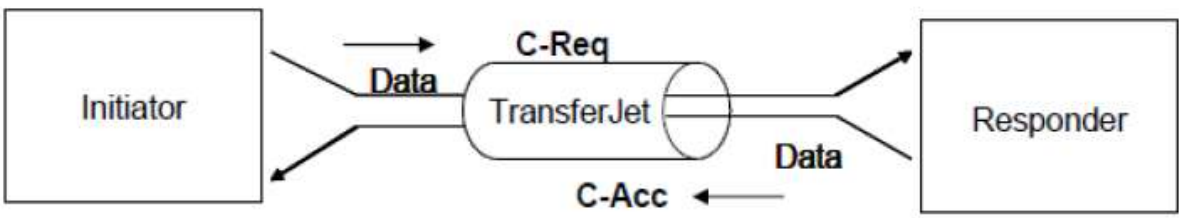
2.4. Unique Coupler Element

Surprisingly, it is not so easy to restrict operation to such a short range. If two TransferJet™ devices are separated by *more* than a few centimeters, they should do nothing – not even detect each other. That is a very difficult task for a conventional antenna. A typical antenna is designed to radiate a signal as far as possible. To better understand this behavior, consider the field equationsshown below for an ideal dipole excited by a sinusoidal current.

Connection and Sequence

The two TransferJet™ devices that enable data transmission and reception serve as “Responder” and “Initiator” respectively, and they can establish a link only in this combination. Communications cannot take place between two Responders or two Initiators.

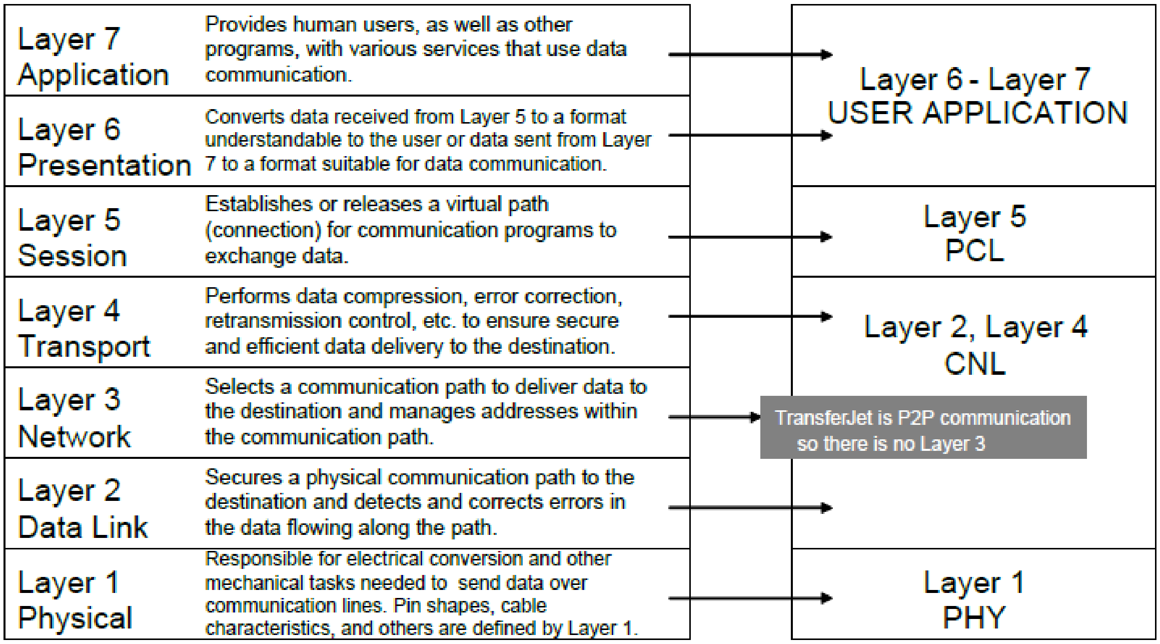
The two roles have no relation to the actual direction of data transfer



Specification Details

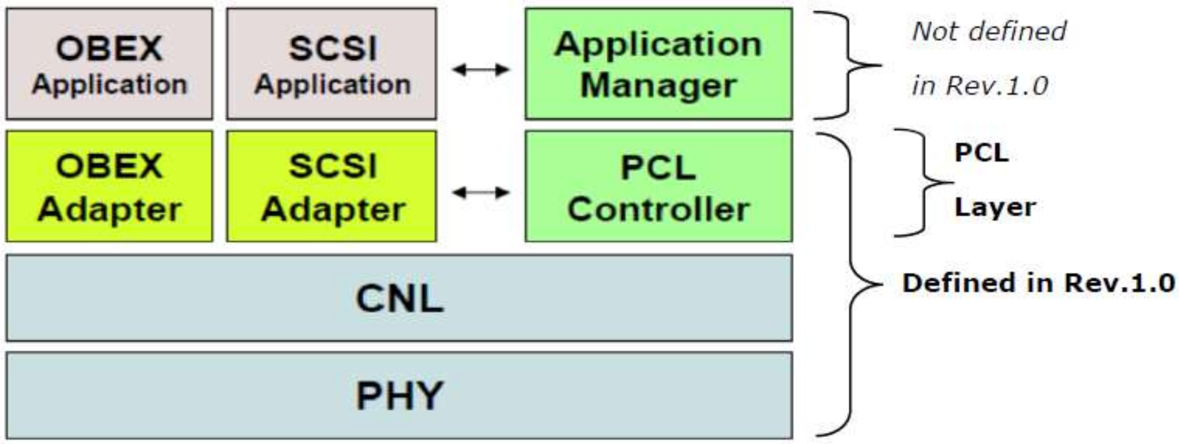
TransferJet™ Specifications consist of the following three Layers.

- Physical Layer （PHY）
- Connection Layer (CNL)
- Protocol Conversion Layer (PCL)



Architecture and Hierarchy

The Physical layer, or PHY, defines the actual radio. This layer converts the digital information into an RF signal suitable for transmission across the TransferJet™ couplers. The Connection Layer, or CNL, manages the connection and data delivery. For connection management the CNL is responsible for establishing and releasing the connection to a peer TransferJet™ device. For data delivery, the CNL provides packets to carry the data payload and confirm successful delivery of those packets to the peer device. The Protocol Conversion Layer, or PCL, is responsible for converting from an Application's existing interface standards (such as SCSI or OBEX), and the TransferJet™ native protocol. In this way, for example, a stationary device can access data on a mobile device without modification to the application layer software. There is also a separate Application Management Layer (not defined in Rev. 1.0) that coordinates and manages the applications, as well as guidelines that define how devices should provide feedback to inform the user of the progress of a transfer operation.



Physical Layer Overview

During transmission, the Physical Layer (PHY) receives the digital data stream from the upper Connection Layer (CNL) and converts to an analog RF signal centered at 4.48 GHz, which feeds the induction coupler element. The PHY data packets are structured in the form of Service Data Units (PSDU) separated by inter-frame spaces (IFS). The PSDU starts with a preamble, sync and header followed by a variable-length payload that can typically last about 2 msec. The PSDU applies forward error correction (FEC), spreading, scrambling and modulation together with multirate support capability. The modulation used is direct sequence spread spectrum (DS-SS). Complicated schemes such as OFDM are not needed since, unlike traditional wireless systems, the point-to-point proximity connection does not suffer from instabilities arising from reflections or interference. The transmitted RF power level is controlled such that it will not exceed -70 dBm. During reception, the PHY performs the reverse operations to convert the RF signal from the coupler into a digital data stream that can be handled by the upper CNL.

In conjunction with the special coupler optimized for the transmission and reception of longitudinal electric induction waves and having a sharp spatial attenuation characteristic, the PHY is designed to achieve excellent close proximity data transfer operating at a separation distance that is well below 1/2 wavelength at the carrier frequency.

Connection Layer Overview

The main functions of the Connection Layer (CNL) consist of establishing, maintaining and releasing the connection, or data link, between the two devices, as well as ensuring the integrity of the data transfer. One CNL Protocol Data Unit (CPDU) contains headers, subheaders, CRC bits and either one or two payload, each having 1-4096 Bytes of data. In terms of functionality, the device that transmits the initial connection request is defined as the "initiator" while the device that responds and accepts the request is called the "responder". These terms refer to the initial handshaking sequence and have no relation to the actual direction of user application data (which is bi-directional). The initiator may send out the request signals continuously or in specific moments. The responder search state can minimize power consumption by means of intermittent operation.

In the rare event that there exists more than one device trying to establish a connection, the CNL will arbitrate the media access and select just one by means of random back-off.

Since all connections are point-to-point, there is no network or IP layer in the protocol stack and the CNL exchanges data directly with the upper PCL (Layers 4 and 5).

Protocol Conversion Layer Overview

The Protocol Conversion Layer provides the necessary control functions to enable basic communications with the upper layer as well as the adapter functions to map the lower CNL layer to the upper applications and system interfaces.

4.1. Protocol Conversion Layer Controller

The PCL Controller offers common services, such as initialization and basic communications (connection setup, connection release, and device authentication) to the Upper Layer.

4.1.1. Services

The PCL Controller provides the services (hereinafter called “PCLC Services”) described below, using the mechanisms provided by the CNL. Also the services composed of the PCLC Services and the services provided by PCL Adapter are hereinafter called “PCL Services”.

1. Connection Management service

The PCL Controller provides a service that manages the establishment and release of a connection between two TransferJet™ devices. When two TransferJet™ devices enter the communication range, the service establishes a CNL connection, unless the Device Modes (see 4.1.2) of both devices are Reactive Mode.

2. Device Authentication service

The PCL Controller provides a service for authenticating CNL-connected TransferJet™ devices. This device authentication is mutual.

3. Application-Service Control service

This service provides a framework for CNL-connected TransferJet™ devices to determine the desired Application-Service (this is defined as a service provided by a pair of applications that each is executed on the TransferJet™ device).

See 4.1.3 about Application-Service Parameter which is a combination of components necessary to determine the Application-Service.

Transferjetvs Bluetooth

Transfer Jet system has the advantage of operating at a much higher throughput rate while not having the security concerns that can be found in a Bluetooth connection.For example, with Bluetooth, transfer of data takes place over a range of several feet. Since the signal is not encrypted, it can be intercepted by other Bluetooth devices. A short 3cm transmission distance minimizes any risks of data theft. Unlike Bluetooth and other wireless data transfer protocols, there is no risk of unauthorized access because Transfer Jet can recognize and connect to specific devices only.n addition, the short transmission distance minimizes data leakage without the need for complex security measures or setup procedures. Users can specify and determine restricted access to Transfer Jet capable devices

FUTURE OF TRANSFERJET

The TransferJet Consortium consists of Sony, Canon, Eastman Kodak, Hitachi, Victor Company of Japan, KDDI, Kenwood, Matsushita Electric Industrial (Panasonic), Nikon, Olympus, Pioneer, Samsung, Seiko Epson, Sony Ericsson Mobile Communications, and Toshiba.

The group will develop specifications and guidelines to ensure interoperability between products that incorporate the technology. The consortium will also promote the advantages of this new technology across industries and directly to consumers, hoping, ultimately, to create and expand the market for TransferJet products

CONCLUSION

Transferjet is a technology, still in the works by Sony and few other Japanese firms, which was recently unveiled to great awe. Transferjet have a data throughput of 375 Mbps which is far higher than existing technologies such as Bluetooth or even NFC. “This is definitely a huge advantage but Transferjet still has a long way to go in convincing the market of its commerical viability, security and regulatory restrictions. Currently, even the costs associated with transferjet are not known

- **REFERENCE**

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