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White Paper

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CIPA DC-005-2005

“Picture Transfer Protocol” over TCP/IP networks

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1. Overview and Scope

This document explains the background, the objective, the features, the technical outline, and the basic operation of a communication protocol specified by CIPA standard “CIPA DC-005-2005”, “Picture Transfer Protocol” over TCP/IP networks (Hereafter “PTP-IP”).

The goal of PTP-IP is to define a standard transport layer for devices and applications that would achieve interoperability of the transport layer for “Picture Transfer Protocol” [1] (Hereafter “PTP”) in networking environments based on TCP/IP. The scope of PTP-IP does not specify such aspects of networking applications as network configuration, device discovery, device bonding, user authentication etc. Additional methods and conventions shall need to be specified in order to achieve interoperability of products utilizing PTP in networking environments.

2. Outline of PTP

PTP was primarily standardized by PIMA (currently I3A[2]) and is now an ISO standard. It is a standard protocol for bi-directional image communications. It defines communication mechanism to ensure the interoperability between imaging devices, such as digital still cameras (Hereafter “DSC”), printers, desktop computers, and hand held devices.

PTP is supported by major OS-es and applications for PC and provides uniform mechanisms for direct transfer for images between DSCs and PCs without a need for vendor-specific drivers. Furthermore, it is adopted by PictBridge[3] standardized by CIPA in 2003 as its underlying transport protocol and most of modern DSCs and photo printers have implemented it with the spread of PictBridge in recent years.

One of the most important features of PTP is that it is a transport-independent protocol. Although presently only a USB[4] transport layer for PTP is standardized, other solutions are available for PTP over different transport layers.

3. Background and Objective

As more and more devices in home and office environments become networked and wireless, there is a growing need to support this trend in the digital imaging domain, in particular DSCs and Photo printers. Currently, the most popular way of connecting such devices with PCs is by using USB.

In order to fulfill this need, PTP-IP has been specified as a new layer in the PTP communication stack to map PTP onto TCP/IP which is a standard network protocol. PTP-IP enables PTP-based applications over the IP-based networks with minimal changes in the application code and does not impose a heavy implementation burden on a device. Therefore, PTP-based applications on PC and PictBridge devices can become networked or wireless with minimal implementation burden of PTP-IP.

4. Features

The main features of PTP-IP are:

- It is able to work over any network running TCP/IP, both wireless and wired.
- It preserves all of PTP features such as picture transfer, camera control and manufacturer specific extensions.
- It does not affect any higher application-level protocols over PTP (e.g. PictBridge).
- It can support multiple concurrent sessions (multiple Initiators can connect to same Responder simultaneously), which is impossible in case of USB connections.

5. Outline of PTP-IP

5.1. PTP-IP layer model

The communication between PTP and PTP-IP is based on PTP transactions model, as follows.

- The Responder responds with Response to Operation Request from the Initiator.
- In Data-In, data is transferred from the Responder to the Initiator.
- In Data-Out, data is transferred from the Initiator to the Responder.
- In Event, PTP event is transferred from the Responder to the Initiator.

The PTP-IP layer model is shown in Figure 1.

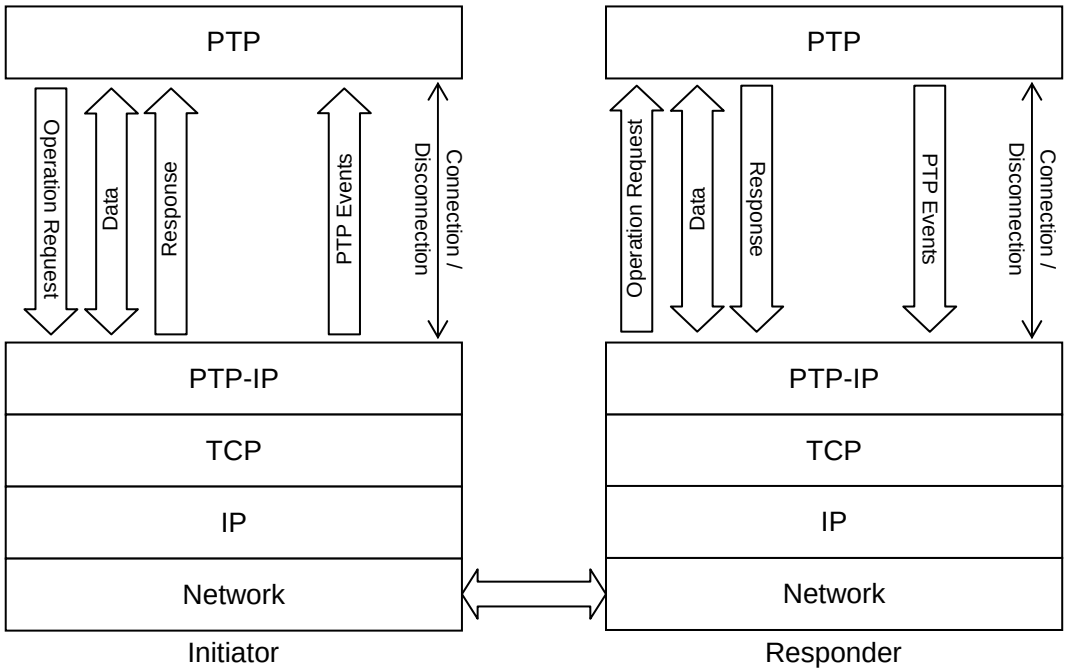

Figure 1

5.2. PTP-IP as a part of the Communication Stack

PTP-IP uses TCP as its transport layer. Mapping PTP onto TCP provides a suitable means of communication between two PTP devices (i.e. the Initiator and Responder of PTP). The place of the PTP-IP in the communication stack is presented in Figure 2.

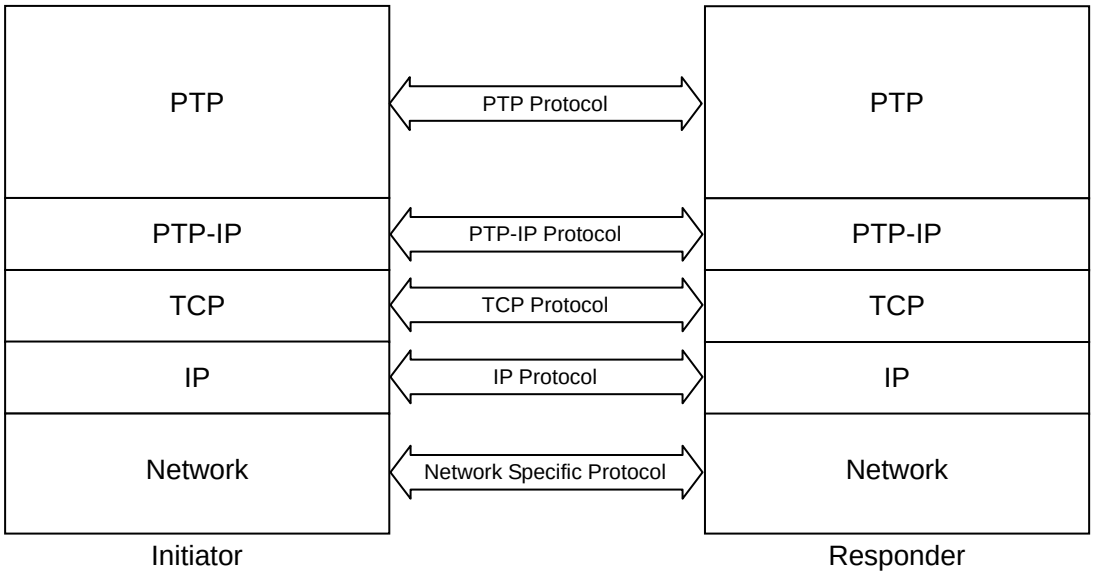

Figure 2

TCP (in the TCP/IP protocol stack) is the natural transport layer to provide reliable, error free data communication services to PTP-IP. Furthermore, TCP is a stream based transport layer that provides multiple communication channels (TCP connections).

5.3. PTP-IP Connection

In order for the PTP layer on the Initiator to be able to establish a session with the remote PTP layer on the Responder device, a PTP-IP connection needs to be first established. This consists of two TCP/IP connections, as shown in Figure 3, one for Command/Data Connection and one for Event Connection. The former carries PTP commands, data and responses while the latter carries PTP events related to Command/Data Connection asynchronously.

If an Initiator requires multiple PTP sessions to the same Responder device, then multiple PTP-IP connections need to be established. In a networking environment, multiple Initiators may attempt to open connections with the same Responder. Thus special care using Connection Number needs to be taken in order for the Responder to make sure that dual TCP connections are associated with the same PTP-IP connection. (See 5.4)

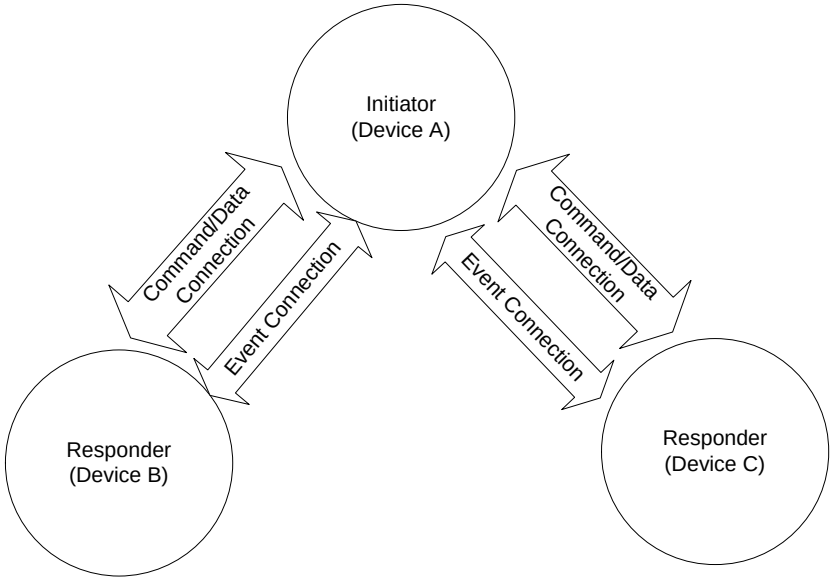

Figure 3

5.4. Establishment of PTP-IP Connection

The sequence of the PTP-IP connections establishment is shown in Figure 4.

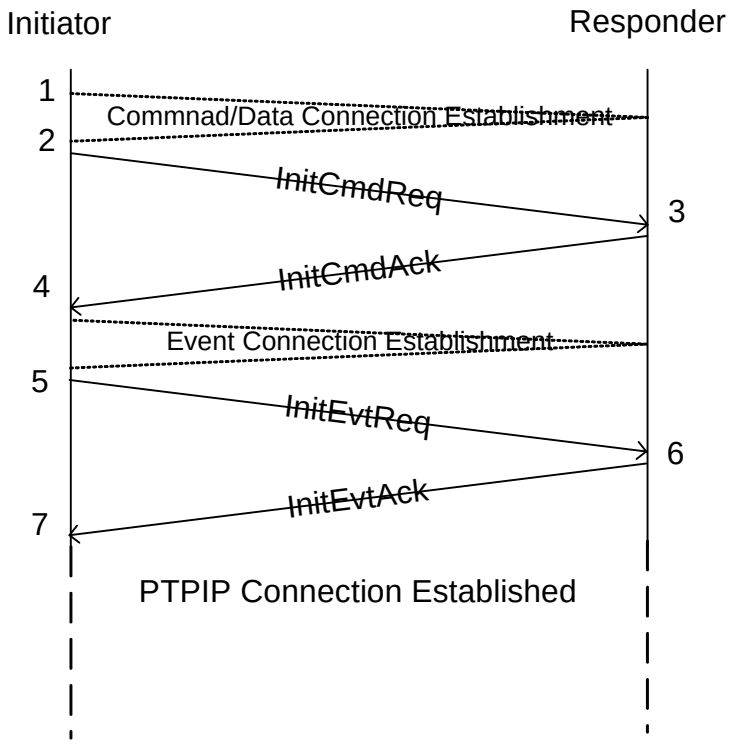

Figure 4

1 The Initiator initiates the establishment of the underlying Command/Data TCP connection with the Responder (TCP port number 15740).

2 Immediately after this TCP connection is established, the Initiator sends the ***Init Command Request*** PTP-IP packet that contains its identity (GUID and Friendly Name).

3 The Responder answers with ***Init Command Ack*** PTP-IP Packet.

4 After the Initiator receives ***Init Command Ack*** packet in the previous phase, it initiates the Event TCP connection with the Responder (TCP port number 15740).

5 Immediately after this TCP connection is established, the Initiator sends the Responder the ***Init Event Request*** PTP-IP Packet that carries the previously assigned Connection Number. The Responder uses this number to associate the two TCP connections (Command/Data and Event) as belonging to same PTP-IP connection and to the same PTP session.

6 In response, the Responder sends an ***Init Event Ack*** packet on the Event TCP connection.

7 Once the Initiator receives the ***Init Event Ack*** packet, the PTP-IP connection is considered established and further data communication can take place.

6. The relationship with PictBridge

As defined in specifications CIPA DC-001, Implementer's Guidelines and Logo Certification Guidelines, a PictBridge compliant product is required to use PTP as an underlying transport protocol and USB as a physical interface. If a product satisfies these requirements and passes the logo certification test, the product is authorized to use the PictBridge logo.

If any other transport protocol or physical interface is used for a PictBridge product, new implementer's guidelines and logo certification guidelines should be defined in order to achieve the interoperability between the new PictBridge products. However, any concrete definitions of these guidelines do not exist at this moment.

Therefore, if a vendor implements PictBridge equivalent functionality over TCP transport protocol by using PTP-IP, the vendor should consider some methods so that customers may not misunderstand that the functionality of the product is compliant with PictBridge in terms of interoperability. The examples of the methods are shown below:

- It is stated in a datasheet and a manual of the product that its connectivity specification is the vendor proprietary.
- A vendor original name or logo different from PictBridge is used in order to clarify that the product is using the vendor original connectivity specification.

7. References

[1] ISO, ISO 15740:2005, "Picture transfer protocol (PTP) for digital still photography devices", http://www.iso.org/

[2] I3A, International Imaging Industry Association, http://www.i3a.org/

[3] CIPA, CIPA DC-001-2003, "Digital Photo Solutions for Imaging Devices", http://www.cipa.jp/pictbridge/contents_e/03overview_e.html

[4] USB Implementers Forum, Inc., Universal Serial Bus Specification Revision 2.0, http://www.usb.org/developers/docs/