IEEE 1394 PWG

Parallel Port Replacement Protocol Requirements

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Objective

The purpose of this document is to outline requirements for an IEEE 1394 transport layer protocol which is a suitable replacement for generic services required across the parallel-port.

IEEE 1394 PWG Transport Protocol Requirements (Musts)

The IEEE 1394 PWG has identified the following requirements for any data transport solution between a computer application (e.g. print driver, printer spooler) and a printing service.

Connection-Oriented

Access Control

Controlled access to 1394 CSR interface for the transport protocol command set and associated service.

Reliable

Guaranteed Data Delivery

Reliable data transfer must be provided to the layers above this protocol layer.

Flow Control

Data transfer must have flow control in order to keep the physical medium from being sharable and to keep the data transfer from overrunning buffers.

I think this an implementation issue rather than a service requirement and it really depends on the nature of the physical medium. 1394 guarantees arbitration between nodes for access to the bus. I'm not sure anything else is required at this protocol layer.

Error Detection

This is really part of providing guaranteed data delivery.

Error Correction/Recovery

This is really part of providing guaranteed data delivery.

In Order Data Delivery

Data must be transferred in-order to the service.

In TCP-speak, this is referred to as byte stream.
Question: Do we want to use the same description?
Question: Is the required data service independent of the "message" boundaries?

Multiple Instance Support (was Support for Multiple Channels)

This protocol layer cannot preclude having multiple instances of the same protocol simultaneously running between any two specific nodes.

Question: Does this instead mean that it must support any multiplexing protocol on top of this layer?

Transport Protocol is Bi-directional (was Single Channel is Bi-directional)

The protocol layer must provide for information transport in either direction.

Question: Is this requirement master/slave or peer-to-peer?

Master/slave is being defined as one end schedules when the data transfers take place in each direction. Master/slave requires:

> *The slave end must indicate out-of-data-band that data is available for the master. One of the following options must be chosen.*

>> *The slave must indicate the amount of data immediately available for the master so that the transfer is guaranteed to complete. This requires that the amount of data available be updated synchronously with the completion of each transfer request to the master.*

>> *The master must be able to ask for as much data as is immediately available up to a maximum amount. This requires that the amount of valid data be indicated in the result of the transfer request to the master. This also requires that the general Data Available indication be updated synchronously with the completion of each transfer request to the master.*

Peer-to-peer is being defined as each end of the transport knows how much information it can transfer and can spontaneously transfer information under it's own control. Peer-to-peer requires:

> *Some sort of transfer pacing/synchronization mechanism is required.*

Notes:
> If the transfer mechanism uses 1394 Write Transactions, then a buffer space credit notification mechanism and algorithm is needed.

> If the transfer mechanism uses 1394 Read Transactions then a buffer completion notification mechanism and algorithm is needed.

PDL, Application, OS Independent

This protocol layer should be independent of the contents of the information being transferred from the layer above. No transformation of the data should take place (e.g. no CR -> CR/LF). The protocol should be easily implementable on at least all variants of UNIX, OS/2, Mac OS, Microsoft Windows, commercial embedded RTOS)

Does Not Preclude Concurrent Operation of Other Protocols

IEEE 1394 PWG Peripheral Communications Desires (Wants)

Fair Access

Standard policy for guaranteeing fair access to access-controlled interfaces across all requesting nodes on the bus.

Pending/Active Access Control Status Query

Ability to query the status of who is interacting with the interface(s) of the device.

Question: is this on a per-interface basis or per-node basis? Does this just become a standardized service, especially since multiple protocol stacks may be executing within the device?

Use Existing Protocols

Low Protocol Overhead

Question: what measurement constitutes "low overhead"?

IEEE 1284 Service Characteristics

Point-to-point communication

Provides direct communication between one host application and one peripheral application. This is provided in each of the 1284 handshaking modes.

Half duplex operation

By it's nature, 1284 hosts are in control of data movement.

Bi-directional

Provided directly by ECP and EPP Modes, and indirectly by the combination of Compatibility and Nibble Modes.

Byte-level granularity of data transport

Non-isochronous bulk data transport

Peripheral to Host Data Available Indication

negated synchronous with the reverse transfer
asserted independent of the reverse transfer
ability to cause an interrupt on the host when asserted

Out-of-band re-initialization

Provides ability re-synch of communication pipe (e.g. nInit pulse)

Indication of target readiness to communicate

(i.e. Select signal)

Defined "Device ID" string service

defined availability (always available upon request, premature termination supported)
well-known format
minimum set of defined contents

Multiplexed Communication Channels

Provided by ECP Channel Address Command, EPP Read/Write Address handshakes, and other 1284 Mode Negotiation/terminations.

Rudimentary Out-of-data-band Device Status

Select, nFault, PError, Busy

Device-specific Device Status

EPP Mode User-Defined-1, -2, and -3 signals.

Proposed Parallel-Port Replacement Protocol

Requirements (Musts)

1. All of the IEEE 1394 PWG Peripheral Communications Requirements with the following assumptions:
   byte-stream data delivery is required (since provided by 1284)
   master/slave bi-directional communication is sufficient (limitation of 1284)

2. Byte-level granularity of data transport is supported.
3. Data Available for Master Indication is:
   negated synchronous with the reverse transfer
   asserted independent of the reverse transfer
4. Provide generic unsolicited status mechanism w/ vendor-dependent status definitions.

Beyond Scope (Not going to define)

1. Fair Access
2. Pending/Active Access Control Status Query
3. 1284 Rudimentary Out-of-data-band Device Status definitions
4. 1284 Mode Emulation
5. 1284 Multiplexed Communication Channel Support
6. Isochronous data transport service.