

Logistics for ResB Timing/Synchronization Work

Rev. 2

December 14, 2005

Outline

- Introduction
 - Note that the current name of the group is Residential Bridges (ResB), i.e., no longer Residential Ethernet; however, discussions of a new name are underway
- Items needed for ResB timing/synchronization specifications
 - Protocol related
 - Profile related
- Items in IEEE 1588
 - Current version (version 1)
 - New version (version 2)
- Possible division of ResB work
- Current view on possible solution

Introduction

- The current draft Residential Bridging (ResB) Timing/Synch PAR indicates that the standard will specify the use of IEEE 1588 in the context of IEEE Stds 802.1D and 802.1Q with the purpose of meeting the synch requirements for time sensitive applications such as audio and video across Bridged and Virtual Bridged LANs (both protocols and procedures will be specified)
- The draft PAR also indicates that the standard will leverage the emerging version of IEEE 1588 to develop the additional specs required to address these requirements

Introduction (Cont.)

- In a recent ResB call, 2 possible sets of logistics for working with IEEE 1588 were discussed
 - 1) Individuals would submit work directly to IEEE 1588, and the work would essentially be done there
 - 2) Individuals would submit work to the ResB group; the work would be done there and then liaised to IEEE 1588
- The ResB group preferred approach 1); the author was asked to communicate this to the IEEE 1588 committee in their next regular call

Introduction (Cont.)

- The IEEE 1588 Committee indicated it needed more detail on the needs of ResB, e.g., what does “leverage the new version of 1588 to the fullest extent possible” mean?
 - The 1588 Committee said that its PAR for version 2 is already approved, and it needs to understand how the ResB work would fit into this PAR (or if a new or modified PAR would be needed)
 - Once the work is better understood, it can be determined which subcommittee the work would proceed in
- The 1588 Committee asked for a presentation from the ResB group addressing these issues

Items Needed for ResB Timing/Synch Specifications

- The list of items needed is divided into two categories
 - Protocol-related items
 - Profile-related items
- This is done mainly for convenience, as traditionally IEEE 1588 has specified protocol-related items, while each application area of 1588 has specified profiles in other documents (usually in other standards bodies)

Items Needed for ResB Timing/Synch Specifications (Cont.)

- Protocol-related items
 - Layer 2 message definitions and formats
 - Definition of each field in each message type
 - Format for representing time would be included here
 - This would address whether every message carries full information or whether multiple message types are used
 - Definitions of communication path, sub-domain, domain
 - Message exchange procedure/sequence
 - Two-way versus one-way with less frequent two-way messages
 - Nominal inter-message time
 - Algorithm for selecting grandmaster and synch paths

Items Needed for ResB Timing/Synch Specifications (Cont.)

- Protocol-related items (Cont.)
 - Clock type(s) (but only high-level indication; detailed clock requirements are part of profile)

Items Needed for ResB Timing/Synch Specifications (Cont.)

- Profile-related items (see backup slides for more detail)
 - Phase and frequency compensation algorithms
 - Filter requirements
 - Eventual solution must allow any expensive filtering needed by stringent applications (e.g., uncompressed digital video) to be done at the endpoint demapper (so that the expense can be limited to the stringent application and not be borne by the entire network)
 - Time-stamp measurement accuracy
 - Clock requirements

Items in IEEE 1588

- Current version (list is not all-inclusive, and level of detail is limited)
 - Message types and formats
 - Definitions of PTP communication path, PTP sub-domain, PTP domain
 - Clock types (boundary clock, ordinary clock)
 - Message exchange procedure/sequence
 - Best master clock algorithm
 - Detailed state machines for clocks for various message exchanges, and data maintained by each clock
 - Synch interval limited to 1, 2, 8, 16, and 64 s

Items in IEEE 1588 (Cont.)

- New version (this information is taken from v2 PAR)
 - Layer 2 mappings (i.e., the case where no layer 3 is present)
 - Higher sampling rates (synch interval less than 1 s), with shorter messages defined
 - Transparent clock (to limit errors in long chains)
 - Fault tolerance
 - Security

Possible Division of ResB Work

- Protocol-related items on slides 7 and 8 fall within current and/or new versions of IEEE 1588
 - ResB will operate at Layer 2; message definitions and formats could be done under layer 2 work for version 2
 - ResB would use simplified version of 1588 PTP communication path, PTP sub-domain, and PTP domain
 - Essentially, a single ResB would be one PTP sub-domain with one grandmaster
 - All ResB links will be point-to-point full-duplex (in current PARs; ResB over wireless will be covered in future work); each link is a PTP communication path

Possible Division of ResB Work (Cont.)

- Protocol-related items (Cont.)
 - Message exchange procedure could be a simplified version of 1588 version 1 message exchanges
 - E.g., No explicit followup message; instead the time placed in sync could be the time of the previous sync message
 - Algorithm for selecting grandmaster and synch paths could be simplified version of Best Master Clock Algorithm
 - ResB does not need multiple clock stratum definitions; expected that there will be a single clock quality

Possible Division of ResB Work (Cont.)

- Protocol-related items (Cont.)
 - ResB will need short synch interval to achieve desired jitter and wander performance
 - Likely no more than 10 ms, and possibly less than 1 ms (though not less than 0.1 ms)
 - Consequently, layer 2 messages used by ResB should be as short as possible (e.g., 64 bytes for Ethernet)
 - Processing per message should be minimized

Possible Division of ResB Work (Cont.)

- Profile-related items on slides 9 – 11 fall within draft ResB Timing/Synch PAR, but not within IEEE 1588 v1 nor v2 PAR
- Profile related items could therefore easily go in a new 802.1 document
 - If they were included directly in 1588, a new or revised 1588 PAR would likely be needed

Possible Division of ResB Work (Cont.)

- Possible division of work
 - Include protocol-related items in IEEE 1588
 - Development of short messages at layer 2, simplified message exchange, plus simplified version of best master clock algorithm
 - Include profile-related items in new IEEE 802.1 document

Possible Division of ResB Work (Cont.)

- The carrying out of the work would be greatly facilitated if it could be done in a single thread of phone calls
 - If all the work in 1588 were under a single subcommittee, it might be possible to coordinate the calls
 - E.g., 802.1 ResB call for profile related work could immediately follow the respective 1588 subcommittee call
 - May be difficult, though, if the work in 1588 falls under multiple subcommittees

Possible Rough View of Solution

- Single PTP sub-domain with one grandmaster (for one ResB)
- Single clock quality
- Short messages, defined at layer 2
- Message exchange procedure is simplified version of current 1588 procedure

Possible Rough View of Solution (Cont.)

- Algorithm for selecting grandmaster and sync paths is simplified version of best master clock algorithm
- Phase and frequency compensation algorithm will be one of several algorithms considered so far (see backup slides for possible compensation algorithms)
- Filter and clock requirements TBD (except it is known now that clock frequency accuracy will be ± 100 ppm)
 - No or inexpensive filtering at intermediate nodes
 - Any expensive filtering will be limited to end nodes

Possible Rough View of Solution (Cont.)

- Time stamp measurement accuracy TBD
 - Very likely that measurement will be at least (i.e., at a layer no higher than) between the PHY and MAC

Backup Slides for Logistics for ResB Timing/Synchronization Work

Draft Rev. 2
December 14, 2005

Items Needed for ResB Timing/Synch Specifications – Additional Detail

- Protocol-related items
 - Layer 2 message definitions and formats
 - Definition of each field in each message type
 - Format for representing time would be included here
 - This would address whether every message carries full information needed for both phase/frequency compensation and Grandmaster selection (or whether the two aspects could be in separate messages)
 - Definitions of communication path, sub-domain, domain
 - Message exchange procedure/sequence
 - Two-way versus one-way with less frequent two-way messages
 - Nominal inter-message time
 - Algorithm for selecting grandmaster and synch paths

Items Needed for ResB Timing/Synch Specifications – Additional Detail

- Protocol-related items (Cont.)
 - Clock type(s) (but only high-level indication; detailed clock requirements are part of profile)

Items Needed for ResB Timing/Synch Specifications – Additional Detail

- Profile-related items
 - Phase and frequency compensation algorithms, e.g.
 - Filtered phase adjustments with less frequent instantaneous frequency adjustments, possibly with synch intervals between successive pairs of clocks syntonized or synchronized
 - Frequency compensated clock (FCC), possibly with synch intervals between successive pairs of clocks syntonized or synchronized
 - Offset and frequency compensated clock (OFCC), possibly with synch intervals between successive pairs of clocks synchronized
 - Etc.

Items Needed for ResB Timing/Synch Specifications – Additional Detail

- Profile-related items (Cont.)
 - Filter requirements
 - Where filtering is done (e.g., end nodes only, end nodes and intermediate nodes with possibly different requirements for each)
 - Equivalent bandwidth and gain peaking (or other equivalent parameters) for each filter location (application dependent for end node; essentially is demapper filter)
 - Eventual solution must allow any expensive filtering needed by stringent applications (e.g., uncompressed digital video) to be done at the endpoint demapper (so that the expense can be limited to the stringent application and not be borne by the entire network)
 - Does not preclude filtering at intermediate nodes, but requires that cost of such filtering be acceptable for network

Items Needed for ResB Timing/Synch Specifications – Additional Detail

- Profile-related items (Cont.)
 - Time-stamp measurement accuracy
 - Eventually must specify layer for time-stamp measurement; this spec may be in IEEE 802.3
 - Clock requirements
 - Frequency accuracy, possibly jitter and wander generation