Time Synch Unification: a possible approach

Michael Johas Teener

mikejt@broadcom.com

Introduction

It's NTP and IEEE Std 1588-2008 and IEEE Std 802.1AS-2011

- … so we are done, right?

Clearly we are not

- IP vs the other IP vs Layer 2, profile proliferation™, redundancy, shared media (e.g., WiFi, g.hn)
- "Every OS uses NTP"
- "802.1AS is higher performance and lower cost"
- "1588 is more compatible"

NTP

Advantages:

- Very mature

- Used by virtually every OS as the default source of "time"

- Demonstrably the big-I Internet standard

Issues:

- Takes a "while" to converge

- Variations in network traffic affect accuracy, requires substantial filtering

- No direct feedback from lower layers

IEEE 1588 advantages

Specifies how hardware timestamping can be done

- at the cost of layer violations and hacked specifications

Delay measurements can be dynamic

- compensate for IS delays using "transparent clocks"

1588 profiles for virtually any point-to-point L2 connection

- unfortunately, several Ethernet-based versions and all are incompatible and compete with each other

A 1588 PTP domain doesn't <u>require</u> time-aware switches (BC or TC)

- for existing networks with expensive infrastructure ... e.g., telecom, but at the cost of NTP-like sophisticated filtering to compensate for variable delays

802.1AS advantages

It's a proper 1588 profile with many fewer options

- two-step only, single domain, all devices BMCA-aware, all switches/bridges are "TC-equivalent" BC's

Higher guaranteed performance

- all switches/bridges are "time-aware" (802.1AS Ethernet switches are mathematically equivalent to a 1588 peer-to-peer transparent clock)

- fast phase convergence via explicit phase difference propagation

Support for many L2 networks

- Ethernet, EPON, WiFi, MoCA, powerline

Fully defined higher-layer service definition

- abstract interfaces suitable for HW and SW

Problems

What is "routable" PTP?

- a wide-area PTP requires a time-aware router ... what does that look like? ... how do we deal with the scalability issues?

Interaction with NTP

- unspecified

1588 breaks the 802.1 bridge model

- on-the-fly modification of data within packets without changing SA

1588 timestamping interface is a hack

- not coordinated with any other standard, doesn't interface with different L2 technologies

More problems

No explicit bridging model between:

- non-802.1AS 1588 systems and 802.1AS

- 1588 and NTP

- 1588 profile A and 1588 profile B

- ugh!

I believe (_very personal opinion_) the problem is bad layering and poor communication between standards efforts

Proposed new 1588 work

1588v3 should adopt the layering model used in 802.1AS

- keep L2-specific operation out of 1588
- provides a high-level abstract interface for PTP

1588v3 should work with the IETF on a new "wide area PTP"

- define the bridging between "local" and "routable" domains
- specific interface with NTP

Proposed new 802.1AS work

Provide L2 timing information for 1588v3

- update L2 abstract interface to support 1588v3

Allow 1-step timestamps

- define interoperability with 2-step-only systems

Work with 1588v3 to provide end-to-end quality information

- common service interface and information exchange

Some controversy?

Personal opinion again:

1588v3 should deprecate "TC's"

- allowed, but should encourage using 802.1AS for LANs
- IPv(x) 1588 should assume 802.1AS services for event propagation and path definition

802.1AS and 1588v3 should be merged and repartitioned

- "L2" spec defines PTP over a subnet, defined by 1588v3
- "IP" spec defines PTP over an internet, defined by 1588v3 and/or the IETF
  - What's the IETF position?

Organization?

New 1588v3 group at least partially colocated with 802.1AS meetings

- IEEE 802.1 meets 6 times per year
  - 1588 could use same venue

Define repartition

- update 802.1AS revision PAR (already approved)
- new 1588v3 PAR just being developed (first study group meetings 2013-04-02)
- TICTOC participation very desirable

Continue to colocate meetings

- PTP/TICTOC community will likely be interested in other 802.1 time-sensitive networking efforts such as ...

Other "time-sensitive" collaborations

Mapping between 1588 time and NTP time

- let's base it on TAI, please ... not UTC

- move toward 1588 timestamps in RTP

  - in process, hooray!

Bandwidth reservation for streams

- Interface to RSVP and/or SIP w/SDP

Latency/delay upper bounds for reserved streams

- how do we report these numbers to higher layers?

Multicast streaming

- multicast address correlation with IP address without collisions

Path redundancy

- multiple paths through L2 subnet

Thank you!