

# Resolving 802.1AS-rev

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# Agenda

- IEEE 1588 non-conformance
- Disadvantages of one step transmit
- Better approach to same goal

# History

- 802.1ASbt: PAR excluded 1-step transmit and Transparent Clock (TC)
- 802.1AS-rev: consensus to allow 1-step tx, but not TC
  - From <http://www.ieee802.org/1/files/public/docs2015/asrev-mjt-one-step-details-0407-v06.pdf>

## Review



no TC mode!

- Most changes in Clause 11 (full-duplex point-to-point) media dependent layer
  - port can be “oneStepTransmit” (capable of one step Sync transmit) and “oneStepReceive” (capable of correctly receiving one step Sync) (per port global variable array)
  - if so capable, a master port can be in “oneStepTXOper” (port global)
    - slave port operation updated to support 1step, but no mode change.
- Intention is that media independent layer is almost the same
  - existing path unchanged
  - ***remove time filtering of Syncs in PortSyncSyncSend in “syncLocked” mode***
    - *do not drop \*early\* Syncs or synthesizing late Syncs ... that’s a media dependent thing*
    - *timeout still runs*

# If it walks/quacks like a duck, it's a TC

- Green is conformant to 1588; Red is non-conformant

802.1AS-2011 BC Sync	1588 TC Sync	802.1AS-rev 3.0 BC Sync
sourcePortId is parent port (i.e. link neighbor)	sourcePortId is grandmaster	sourcePortId is grandmaster
sequenceId per transmit port	transmit same sequenceId as received	transmit same sequenceId as received
“lock” when parent interval same as this port’s interval; implementation decides	Parent and this port implicitly locked	“lock” when parent interval same as this port’s interval; mandatory
all ports are BC	all ports are TC	some ports BC (AS-2011 neighbor), some ports “locked” (AS-rev neighbor)
all domains are BC	In some interpretations, TC is domain-independent (all domains TC)	some domains can be BC, and other domains “locked”

# Conclusions

- 802.1AS-rev “SyncLocked” is TC behavior
  - Mandated for all 802.1AS-rev products
- Mixed BC/TC is non-conformant to 1588
  - In presenter’s opinion, this is unlikely to change
- Some 802.1 voters will insist on 1588 conformance
  - 1588 is foundation of 802.1AS, so we cannot break its rules

# One step transmit

# More History

- Rationale for 1-step transmit from
  - <http://www.ieee802.org/1/files/public/docs2015/asbt-mjt-one-step-0115-v01.pdf>
  - <http://www.ieee802.org/1/files/public/docs2015/asrev-mjt-one-step-details-0407-v06.pdf>
- Perceived to be more accurate
  - Proven false for typical implementations
  - [Sub-nanosec 802.1AS on GE copper](#) currently requires 2-step
- Perceived to use less processing
  - Not true with 2-step implemented in hardware
  - <http://www.ieee802.org/1/files/public/docs2015/ASRev-pannell-To-1-step-or-not-0315-v1.pdf>
- Perceived to have smaller residence time
  - Relates more to TC (often assumed by 1-step advocates)
- Implemented by other 1588 profiles
  - Real problem (see approach in subsequent slides)

# Disadvantages Real (not Perceived)

- Hardware compute of correctionField as Sync transmits
  - 1-step advocates use 100M
  - 1-step not viable at 10G and higher
    - Adding latency is not acceptable for TSN
  - Disadvantage: Cannot be applied to every network
- 1-step hardware handles one domain only
  - Redundancy requires at least four domains
  - My survey of all known TSN-capable NICs and switches: one part supports 1-step tx on >1 domain, and it is expensive
    - In presenter's opinion, this is unlikely to change
  - Disadvantage: Not cost-effective with redundancy



# Fix Needed in AS-rev draft

- Assuming we keep 1-step tx in AS-rev, we need a fix
- Current draft states:

```
oneStepTXOper = rcvdSignalingPtr->flags.oneStepReceiveCapable &&  
oneStepTransmit;
```

- If neighbor capable, and I am capable, use 1-step always
- Assumes that 1-step is always best, which is not true
- Add new oneStepTxAdmin, writable by management
- Default? True or False raises problems
  - Each profile wants a different default

# Better approach

# Goal: Multiple Profiles using TSN

- Technical arguments for TC and 1-step tx are debatable
- Real problem: TSN appeals to a wide range of products
  - Some products are willing to use 802.1AS
  - Some products already use a different 1588 profile
  - These products will exist in the same network
    - Shared time is desired
- I think we all agree that we want to solve this problem

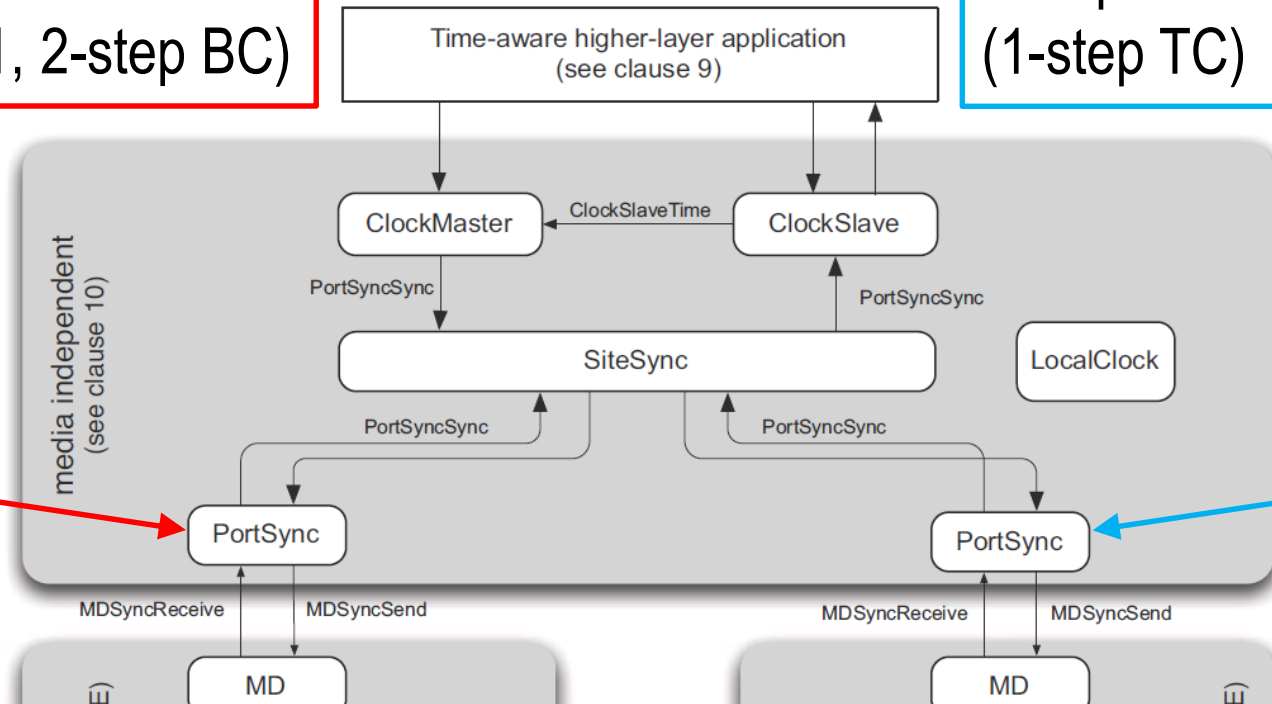
# Current Approach: Port Based

## 7.4 Time-aware system architecture

The model of a time-aware system is shown in Figure 7-8.

This port runs Profile A  
(.1AS-2011, 2-step BC)

This port runs Profile B  
(1-step TC)



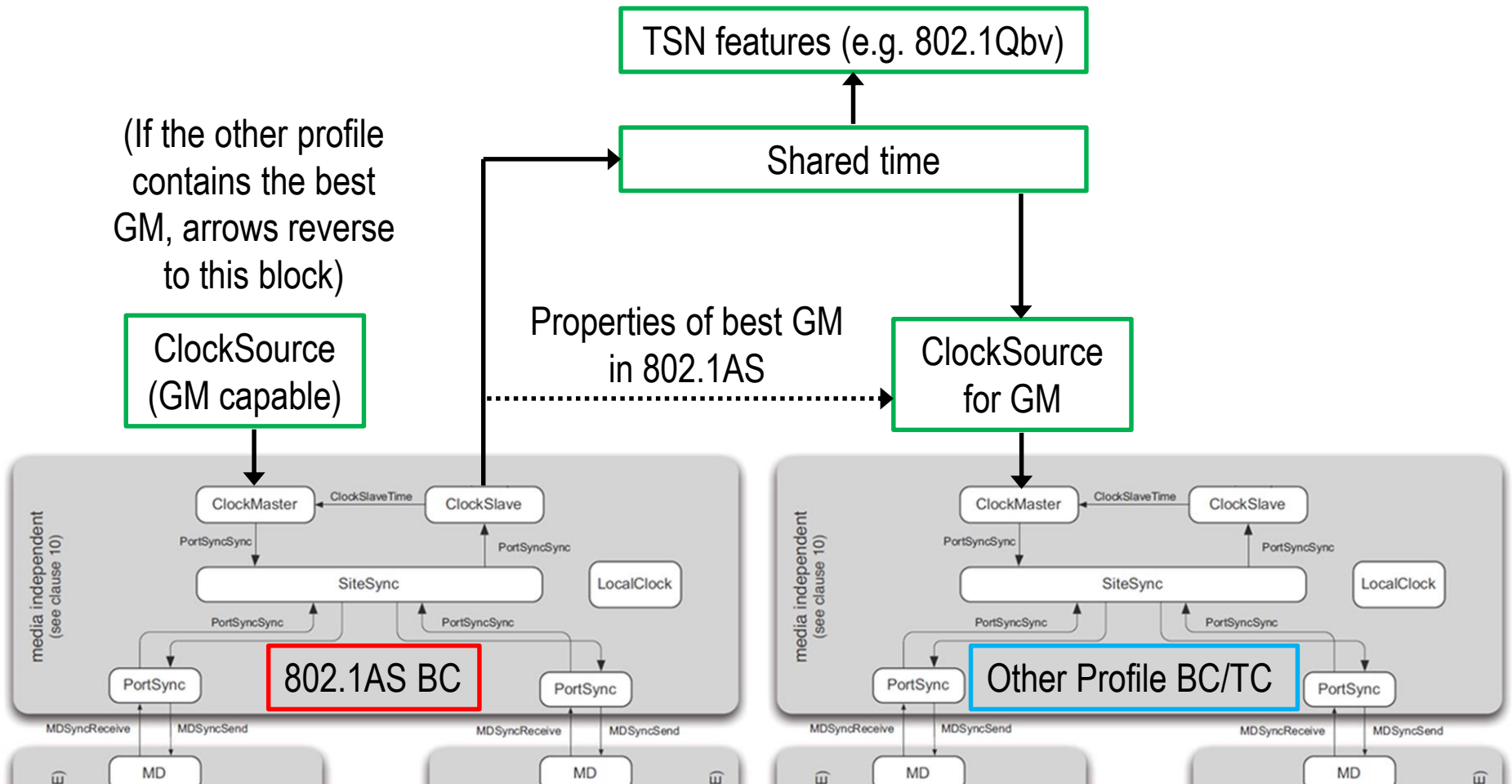
# Disadvantages of Current Approach

- Some 1588 features are not port-based
  - Creates non-conformance problems (e.g. TC)
- Forces Profile A to support everything in Profile B
  - Some 1588 features not universally applicable (e.g. 1-step tx)
- Assumes that all profiles will merge into 802.1AS
  - Not practical in SDOs (e.g. 1588, IEC 62439-3, ODVA)
- If profile doesn't merge, not practical in same domain(s)
  - Isolation, BMCA, profile-specific TLVs, etc

# Requirements for Better Approach

- Respect 1588 standard
- Respect existing profile standards
  - Large number of products in the field
- Interoperate with non-AS profiles as-is
  - Including isolation, BMCA, profile-specific TLVs
- Don't force non-AS profile features into 802.1AS profile
- Normative specs for conformance testing

# New Approach: Profile Gateway



# More on Profile Gateway

- Model in standard is different than port-based, but implementation is effectively the same
  - Primary difference is GM capability per profile
- Configure each port's profile using management
- Each profile controls its own BC/TC and ports
  - Mix of BC/TC in the gateway is conformant to 1588
- Nothing changes in profile specs
  - Profile can be isolated, run its own BMCA, run its own redundancy algorithm, etc



# Proposed Next Steps

- Remove 1-step TC features from 802.1AS profile
  - TC not conformant as is
  - 1-step does not meet our goal without TC
- Create new normative clause for Profile Gateway
  - Formalize the architecture
  - Create a subclause for each non-AS profile
    - Start with 1588 default profiles
    - Liaison with other SDOs to ask if they want to include their profile
- Conformance: Profile Gateway is a Major Capability
  - Optional at top level, but mandates if you support it
  - Work with AVnu on conformance testing

**Thank you**