.1AS Transparent Clock / Sync Path Calculation

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Overview

- Proposal for a new type of time-aware systems: **Time-Aware Relay – Transparent Clock (TAR-TC)**
  - process sync like 1588 P2P-TC
  - participate in best master selection and sync tree establishment

- Grandmaster (best master) selection and spanning tree establishment
  - For time-aware network without redundant GM / sync Tree
    - use current BMCA to select GM per domain
    - use current BMCA to establish spanning tree for forwarding both Announce and Sync msgs

  - For time-aware network with redundant GM / sync tree
    - use a modified lightBMCA to select GM per domain and establish spanning tree only for forwarding Announce (Announce tree)
    - use PCE or BLCEs to establish redundant sync trees

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Recap

- 802.1AS defines two types of time-aware systems:
  - Time-aware end station (**TAES**) => IEEE 1588 ordinary clock
  - Time-aware relay (**TAR**) => IEEE 1588 boundary clock
    - renamed as *Time-Aware Relay Boundary Clock (**TAR-BC**)?*

- The group is currently working on a proposal for one-step/TCs*
  - The focus is on one-step, but also relating to TC (a TC-like operation)
  - TC-mode can be activated only under some constraints when
    - both slave and master ports are operating in one-step mode
    - sync rate is the same
  - This implies that such a TC-like operation is
    - not a real TC-implementation, but as a optional operating mode of a BC
    - strictly bound to one-step

* *http://www.ieee802.org/1/files/public/docs2015/asrev-mjt-one-step-details-0407-v04.pdf*

Proposal for A New Type of Time-Aware Systems: 802.1AS Time-Aware Relay Transparent Clock

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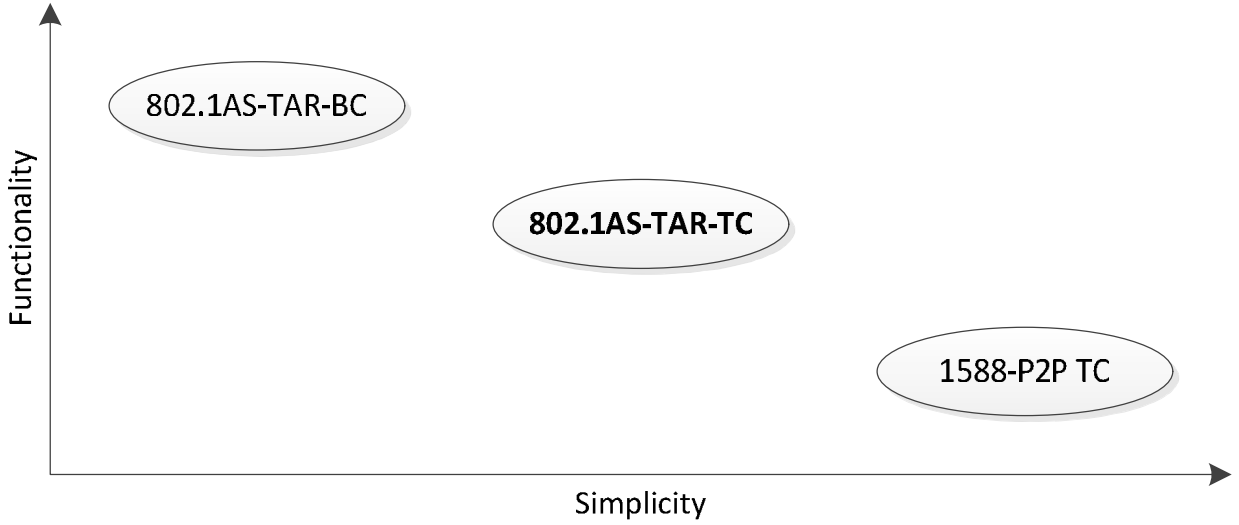
- We propose a third type of time-aware systems: **TAR-TC**
  - is independent of one-step/two-step operations
    - TC is a system feature, while one/two-step is a port or link feature
  - processes sync like a 1588-P2P-TC *(see next slide)*
    - TC simply forwards sync msgs with minor processing, thus largely reducing the implementation complexity of sync pipeline in contrast to a BC
  - but participates in best master selection and sync tree establishment
    - for ease of management as an improvement from 1588-P2P-TC
  - executes peer delay measurement



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Sync Processing in 802.1AS-TAR-TC

- TCs differ from BCs primarily in sync processing, while TCs simply “forward” received sync msgs with minor modification.

Sync Processing	TAR-BC	TAR-TC	1588 P2P-TC
sourcePortIdentity	changed	unchanged	unchanged
sequenceId	changed	unchanged	unchanged
correctionField	changed	changed	changed
cumulativeScaledRateOffset*	updated	updated	n/a
support of different sync rate	yes	no, only forwarding upon receiving	no, only forwarding upon receiving

- A TAR-TC needs also be involved in logical syntonization by calculating and updating rateRatio, in order to avoid error propagation to downstream nodes (see as-boiger-TC-cumulativeScaledRateOffset-issue-0515-v01.pdf)

Grandmaster (Best Master) Selection and Spanning Tree Establishment – Current Situation

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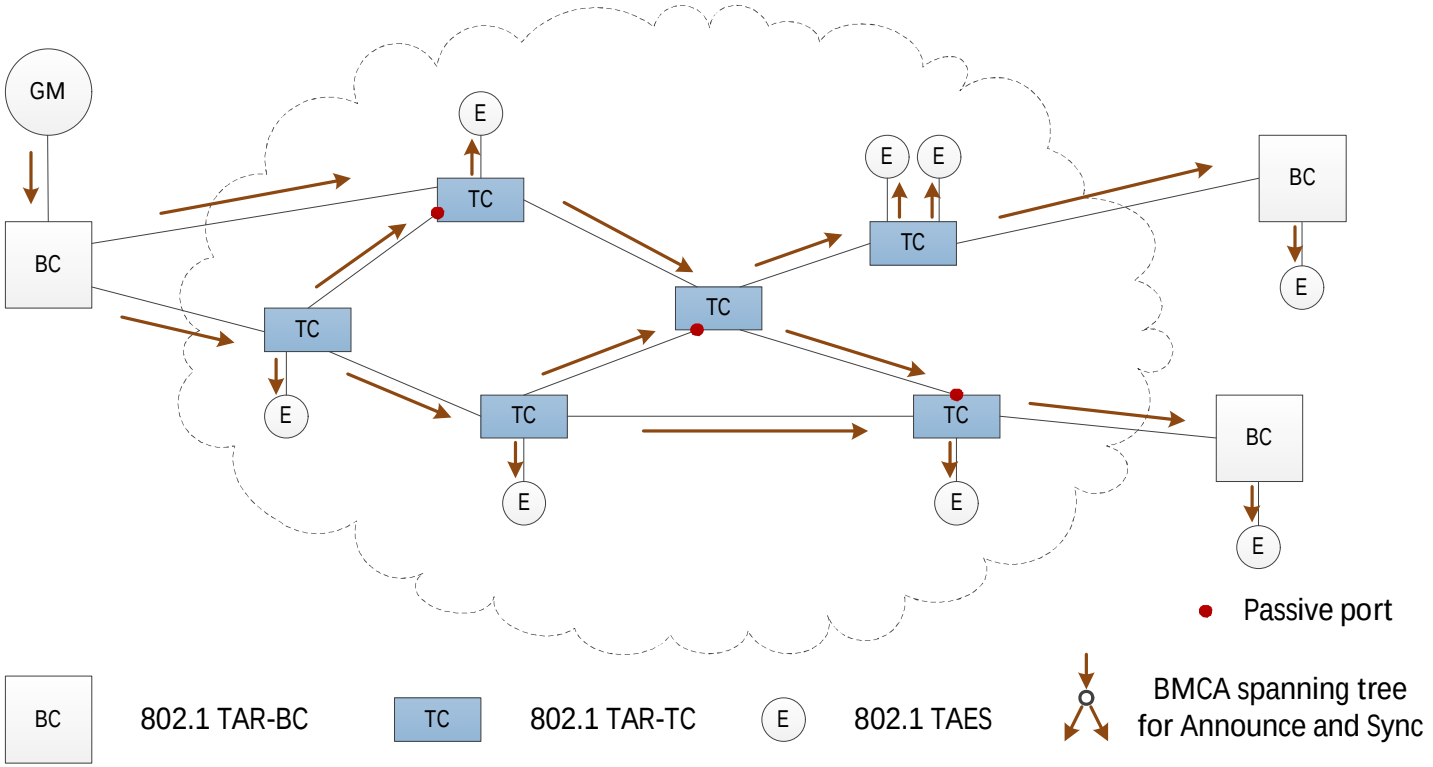
- The current BMCA runs within a single gPTP domain to
  - select a single GM
  - establish a spanning tree and set port roles
  - forward sync msgs along the established tree
    - receive from slave port and send over master port
  - transmit announce msgs also based on this tree
    - periodic announcing via master ports

- The current BMCA in gPTP works for time-aware network without redundancy
  - we propose that TAR-TC should also participate in BMCA

  => make management much easier (in comparison to 1588 P2P-TC not involved in BMCA)
  - with BMCA, TAR-TCs will have no interoperation issues with existing time-aware systems using already defined mechanisms in AS.

BMCA for Time-Aware Network without Redundancy

One GM with one spanning tree for both Announce and Sync



- Run the BMCA at all nodes in the same domain to select the Grandmaster and to establish the spanning tree.
- Forward Annouce and Sync msgs on the same spanning tree established by BMCA
  - If TAR-TCs exist, they can only participate in BMCA as not-GM-capable nodes

Grandmaster (Best Master) Selection and Spanning Tree Establishment for Redundant Synchronization

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- Problem: The current BMCA does not support redundancy
  - no support for redundant sync trees, e.g. MRT

- **Proposals**: use separate spanning trees for announce and sync
  - run BMCA per domain to select the GM and to establish a spanning tree like today, except that

    - only announce msgs are transmitted based on this tree (may call it *Announce Tree*)

    - no port roles are determined by BMCA for sync forwarding (i.e. BMCA spanning tree not used as sync tree)

    => *call it lightBMCA*

  - perform path calculation for (redundant) sync trees (may be defined outside of AS-Rev)
    - with either a centralized model with PCE
    - or a decentralized model with BLCEs

Centralized Sync Path Calculation with PCE for Time-Aware Network with Redundancy

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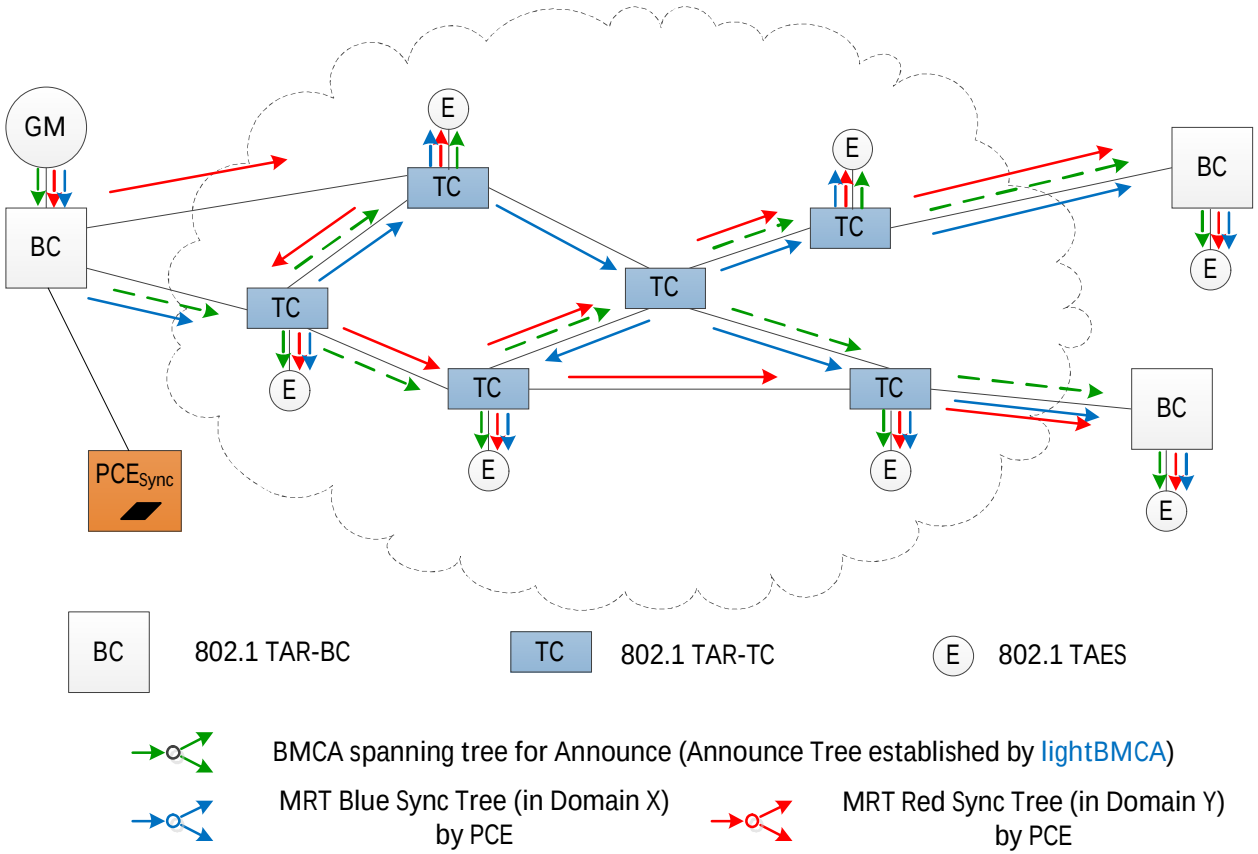
One GM with two redundant Sync trees in two gPTP domains (Media Redundancy)



Use PCE for computing redundant sync trees

Decentralized Sync Path Calculation with BLCEs for Time-Aware Network with Redundancy

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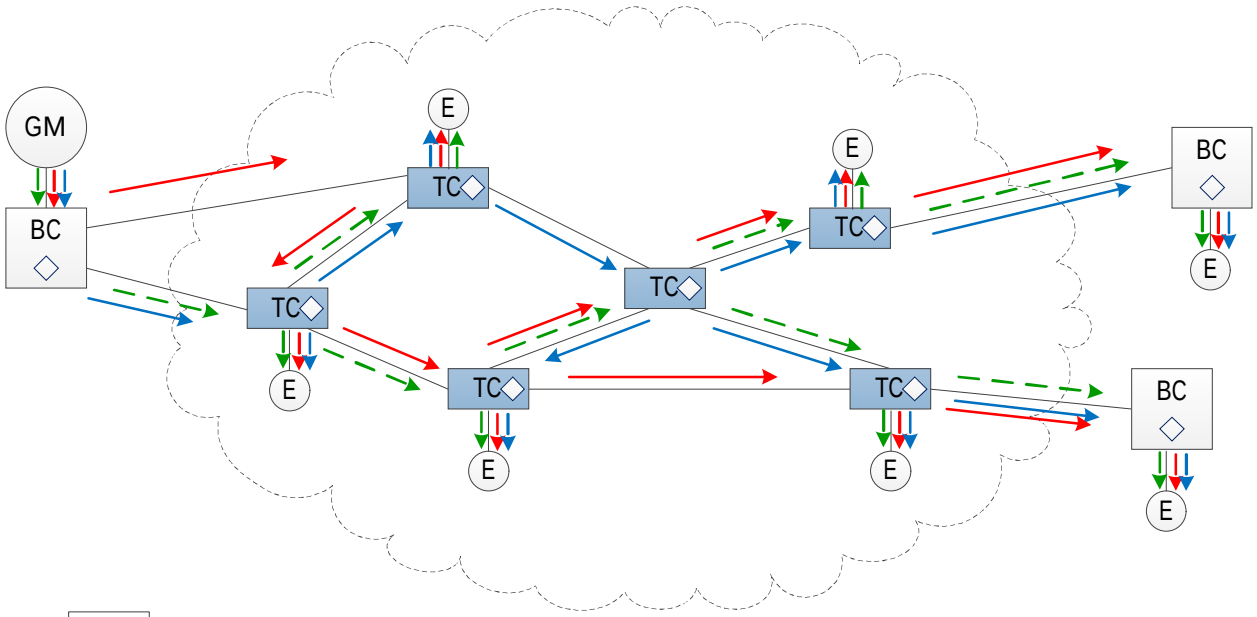
One GM with two redundant Sync trees in two gPTP domains (Media Redundancy)



Use BLCEs for computing redundant sync trees

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Summary

- Proposal to define transparent clock in 802.1 AS-Rev: TAR-TCs
  - allow a simplified sync processing (sync forwarding with time-correction)
  - have no requirements on performing local time synchronization
    - most functions defined in ClockMaster and ClockSlave can be eliminated
  - support logical syntonization (updating rateRatio)
  - perform peer delay measurement
  - participate in best master selection and sync tree establishment (BMCA)

- GM selection and spanning tree establishment for time-aware systems (incl. TAR-TC)
  - if not requiring redundancy, run existing BMCA (no changes needed)
  - If requiring redundancy:
    - run a lightBMCA to selects GM and to establish a spanning tree only for announcing process
    - perform sync path calculation for redundant sync trees in either a centralized way with PCE (for Sync) or a decentralized way with BLCEs (for Sync)

Thank you for your attention!

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