# 802.1 AVB Support for Coordinated Shared Network

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# Coordinated Shared Network

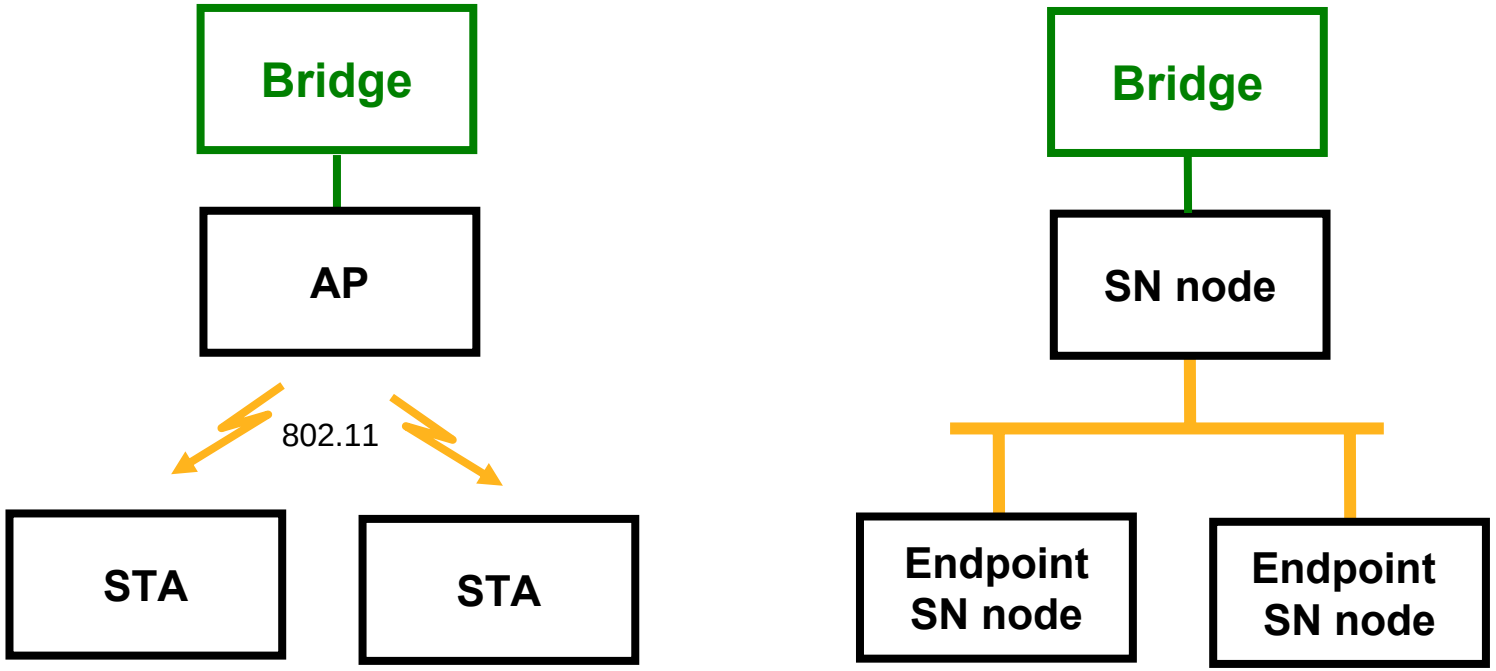
- Time domain multiple access (TDMA) network
- Coordinated contention free media access controlled by a single elected or designated network controller (NC)
- Interface for priority (& parameterized) QoS

- *CSN is the trend of the more recent (OFDM based) home networks :*
  - *Moca (coax)*
  - *Homeplug (powerline)*
  - *UWB, 802.15 (wireless)*
  - *HCCA 802.11*

# Shared Network Support in Current Draft IEEE 802.1 AVB

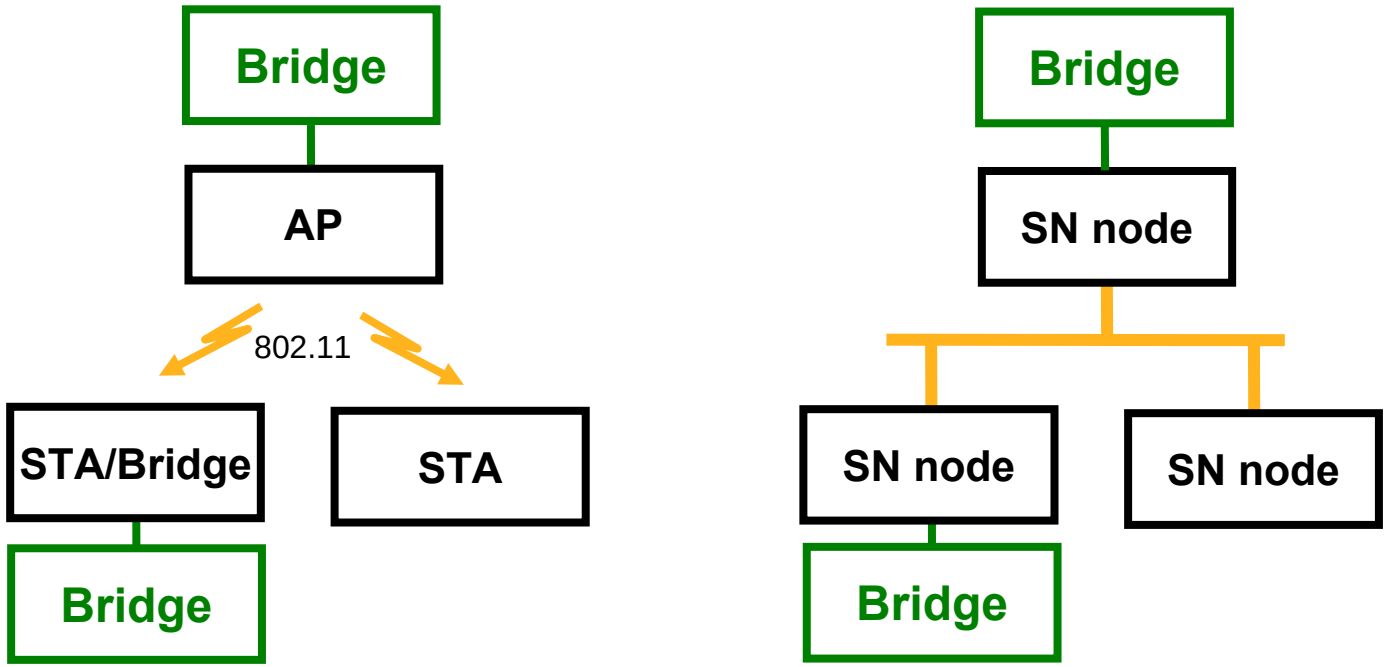
- IEEE 802.1as includes the current 802.11 AP/STA topology
- ”similar *” to the shared network topology if a single node only is connected to a bridge…

  *[*] SN supports node-to-node connections while 802.1 does not support STA-STA connections (if Direct Link Protocol is not supported)*



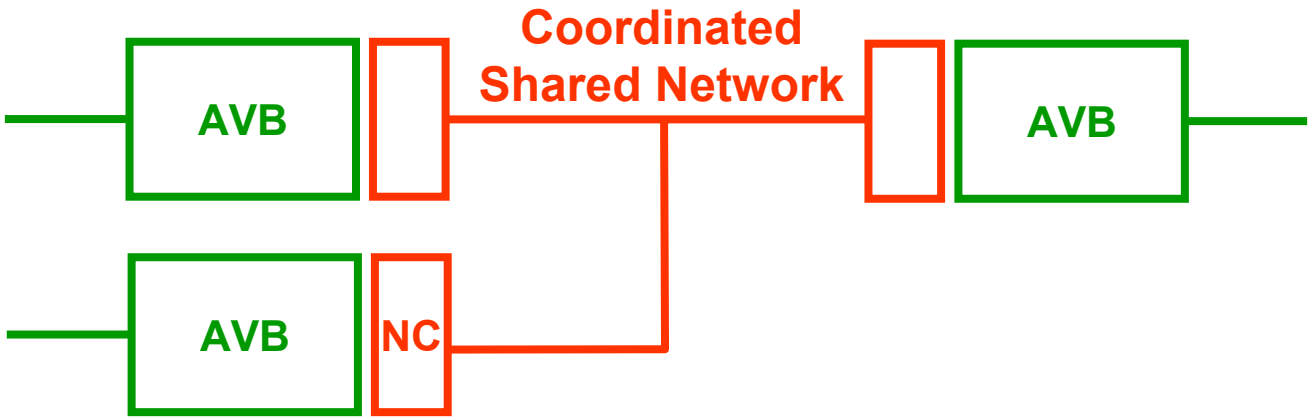
# Shared Network Backbone Support in IEEE 802.1 AVB

- Current draft model does not support SN backbone connecting multiple bridges
  - *No support in the current IEEE 802.1 AVB standard for AVB to AVB SN link*
  - *However, an 801.11 STA / Bridge discussion has being initiated in the joint AVB and Video Transport TG.*



# AVB Support for Coordinated Shared Network

- Proposal: AVB Standard layer interface for any Coordinated Shared Network (CSN)
  - MoCA
  - HomePlug
  - Future 802.11 with STA-Bridge support
  - …

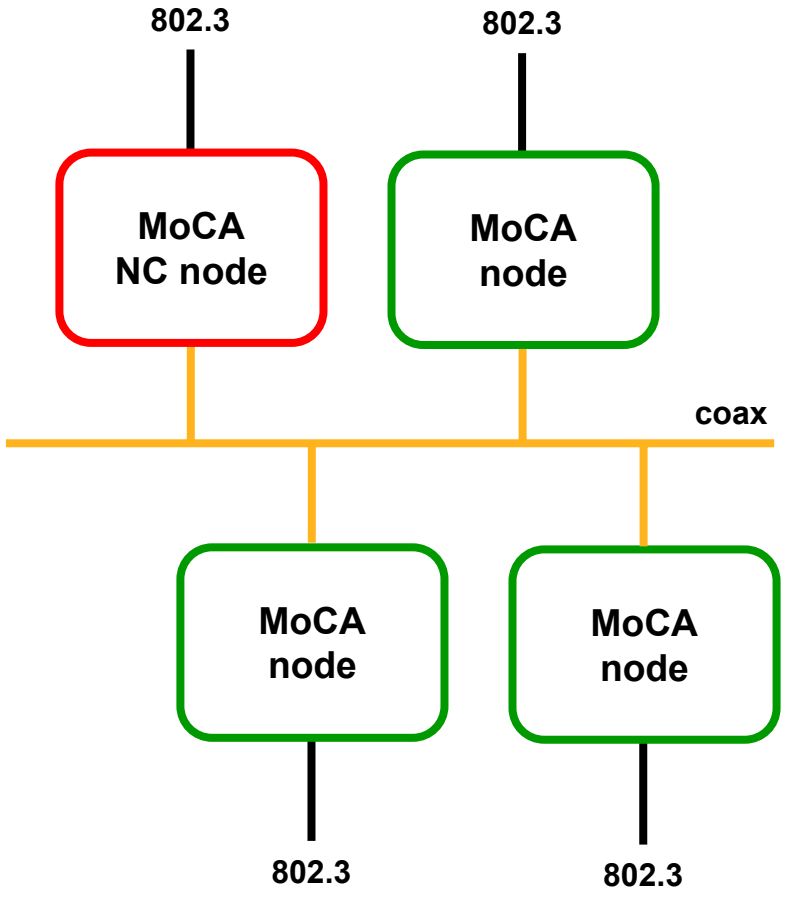



NC = Network Controller

# MoCA Network Characteristics

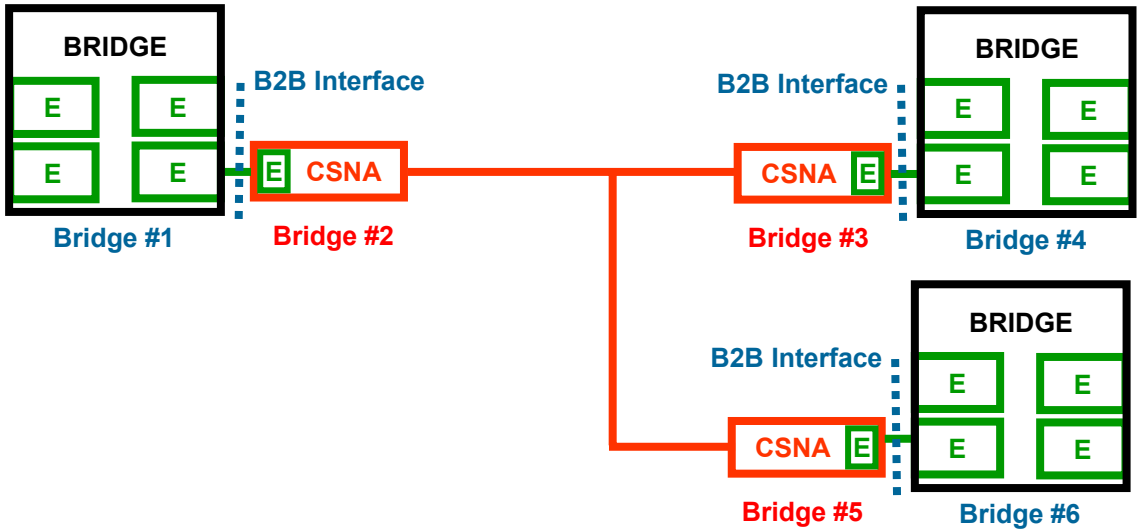
MULTIMEDIA over COAX ALLIANCE

- 802.3 Link emulation over coax
  - Bridge 802.3 packets over coax medium
- Synchronized access network
  - Network access is controlled by an single (self-selected or preferred) Network Coordinator (NC)
- Clock Services
  - NC periodically broadcasts clock references to all the nodes
  - Nodes maintain a local timer, resynchronized by the NC clock references
  - Max permissible jitter defined by the specs



# Topology Option #1

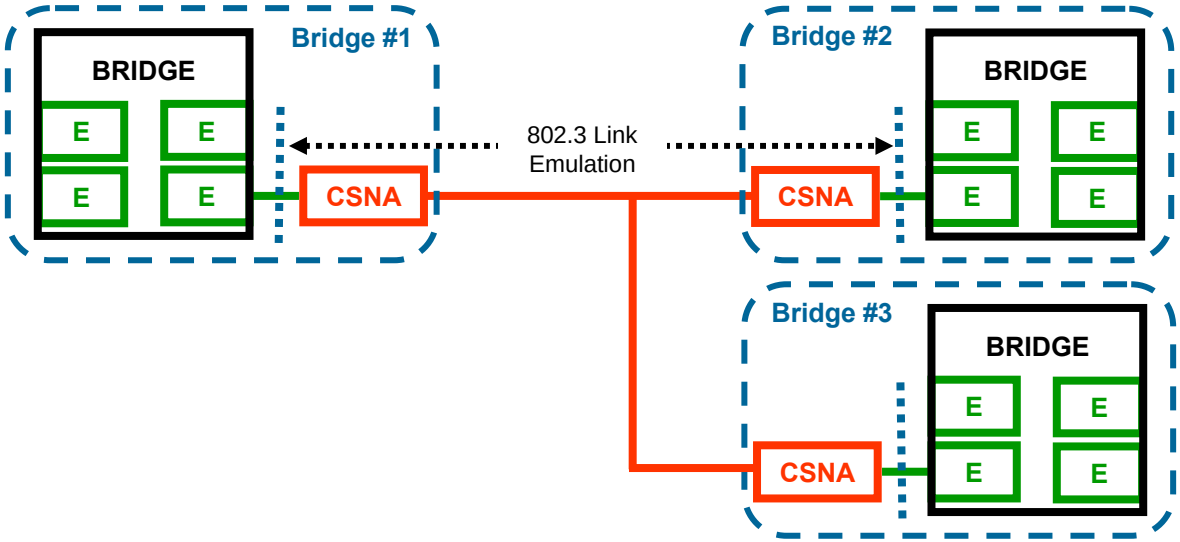
- CSN Adapter (CSNA) is a 802.3 / CSN bridge




| | |
|---|---|
| PRO | Natural decomposition – Cascaded bridges<br>Bridge 2 Bridge interface is well defined |
| CONS | Implementing a full bridge HW/SW functionality might be too expensive for low end adapters |

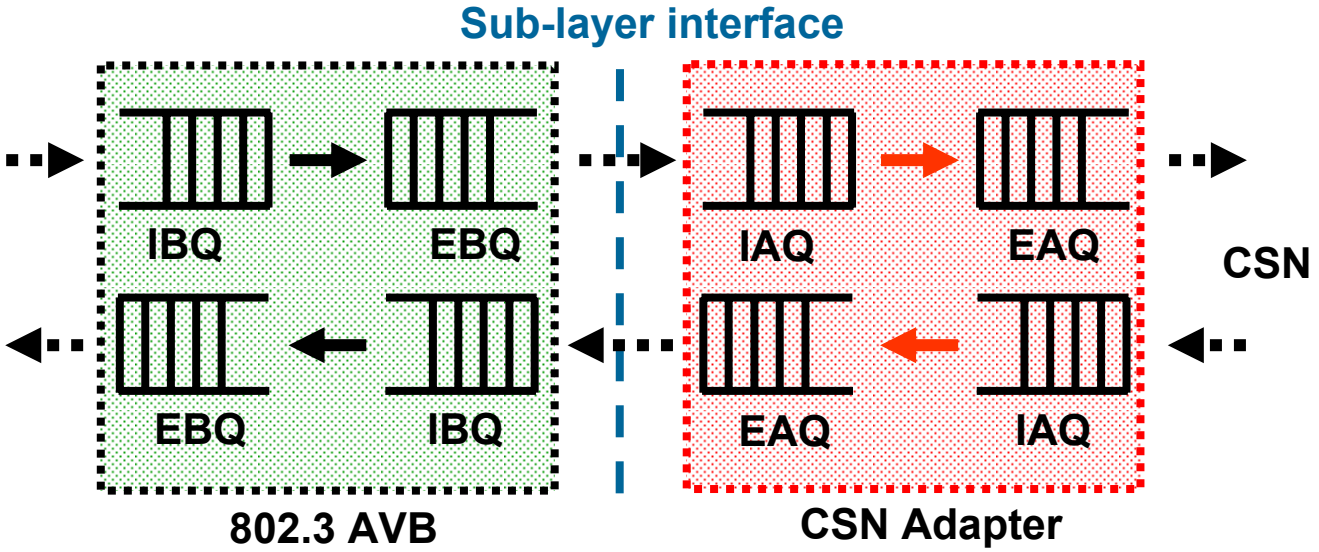
# Topology Option #2

- CSN Adapter emulates links (CSNA is seen as a PHY)




| | |
|---|---|
| PRO | Cheaper implementation<br>Transparent to AVB |
| CONS | Transparent to AVB (LLDP & RSP messages should be spoofed & modified)<br>SNA inner queue latencies<br>SN link latencies might change over time<br>No Bridge interface to export / import CSN characteristics / policies for 802.1Qav |

# Ingress / Egress Queue Latencies

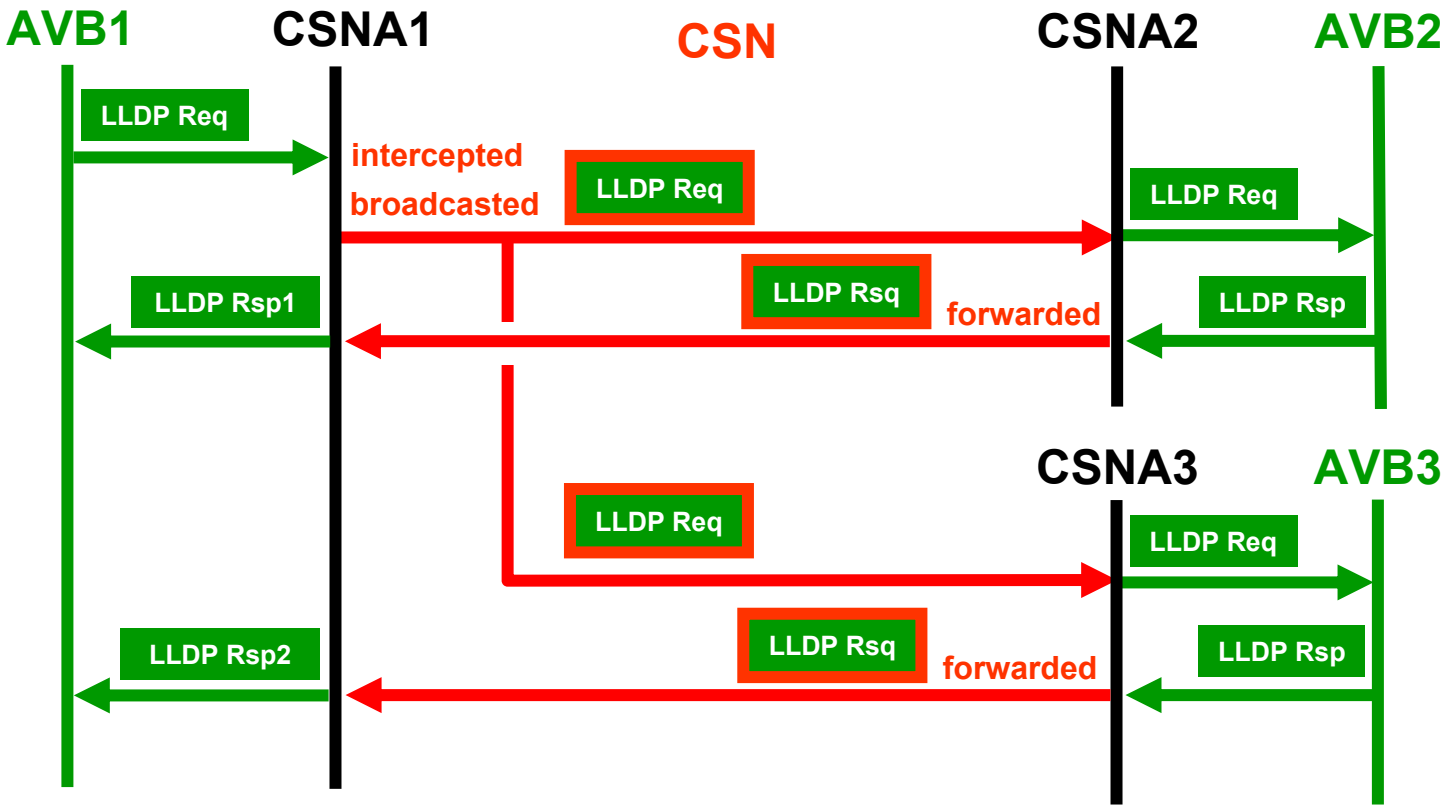



- IBQ-EBQ latencies and policies are covered by IEEE 802.1Qav
- CSNA's S&F inner queues cannot be transparent to AVB:
  - IAQ-EAQ max latencies should be queried and accounted for by the AVB
  - IAQ-EAQ policies should be exported by the AVB
- Could be done thru a AVB standardized sub-layer interface

# AVB Messages CSN Handling

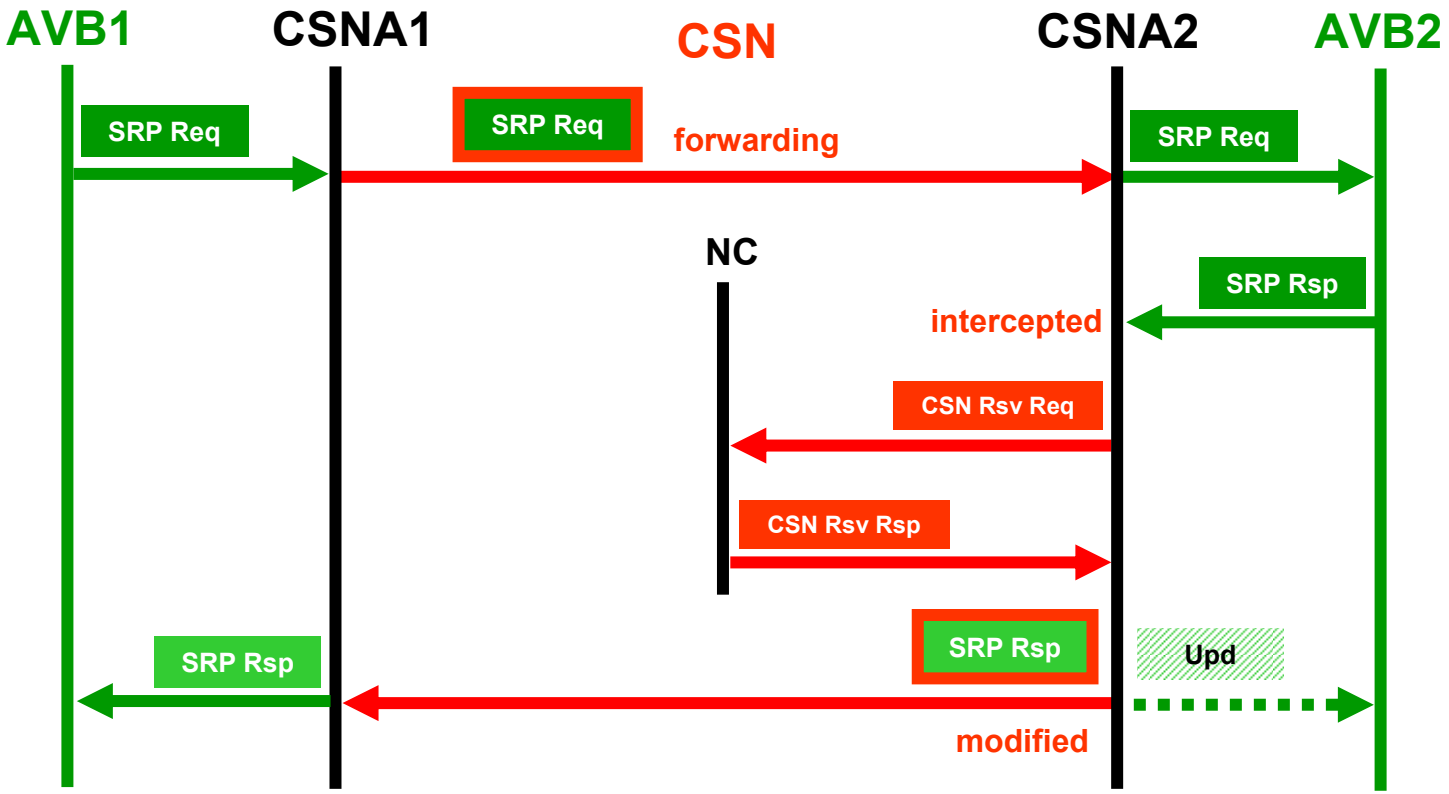
| Messages | CSN Handling | |
|---|---|---|
| 802.1 ab<br>Link Layer Discovery Protocol Msgs | Spoofed and broadcasted by CSN | • LLDP queries messages broadcasted to every CSNAs<br>• LLDP responses forwarded over the CSN |
| 802.1 at<br>Stream Reservation Protocol Msgs | Spoofed & intercepted by CSN | • Similar to non AVB intermediate bridge…<br>– Request are transparently forwarded from SN edge to edge<br>– Responses are intercepted and eventually modified (*if i.e. the SN capabilities are lower than the 802.3 capability for this link)* |
| 802.1 as<br>Clock Synchronization Msgs | Boundary Clock or Transparent Clock | • SN Native Sync handling |

# AVB LLDP Messages Broadcasting




- LLDP request messages are encapsulated in CSN containers and broadcasted over the CSN network
  - *AVB support to on to many links (multiple discovery responses to the same discovery request )?*

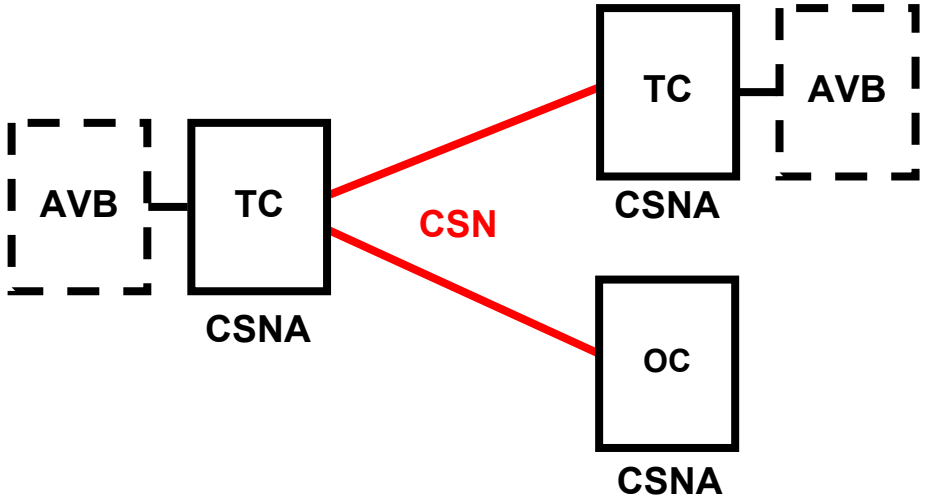
# AVB SRP Messages Interception



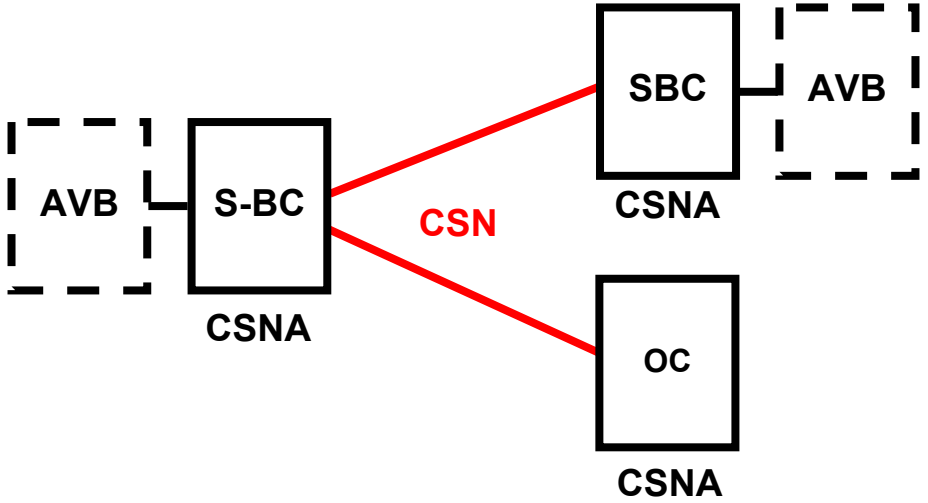

- Available bandwidth of the SN link might be lower that the bandwidth reservation acknowledged by AVB2
  - AVB reservation responses should be demoted by the SN
  - *do we need feedback msg to AVB2 to update AVB2 ?*

# SN 802.1as Clock Model

**Model #1**




**Model #2**




OC = Ordinary Clock

S-BC = Simple Boundary Clock

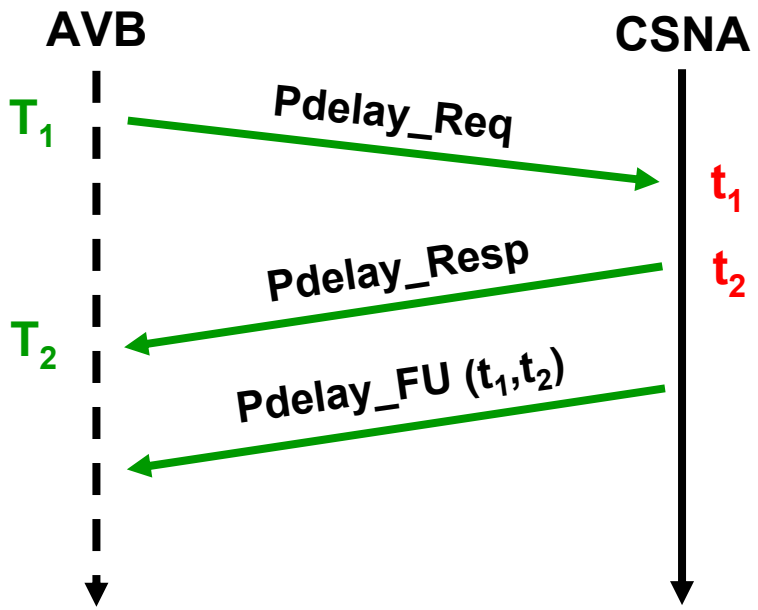
TC = Transparent Clock

# SN AVB Timing Services

- AVB  Timing Services
  - If the CSN clock is accurate enough,  the 802.1as CSN media dependant part could be provided by the CSN time services:
    - NC's master clock periodically broadcasted to all CSNAs
    - CSNAs local timer synchronized on NC's master clock references
    - Time-stamped Txm frames

- AVB  CSN Timing SAP:
  - Sync, Follow_Up,
  - Pdelay_Req, Pdelay_Resp, Pdelay_Resp_Follow_Up

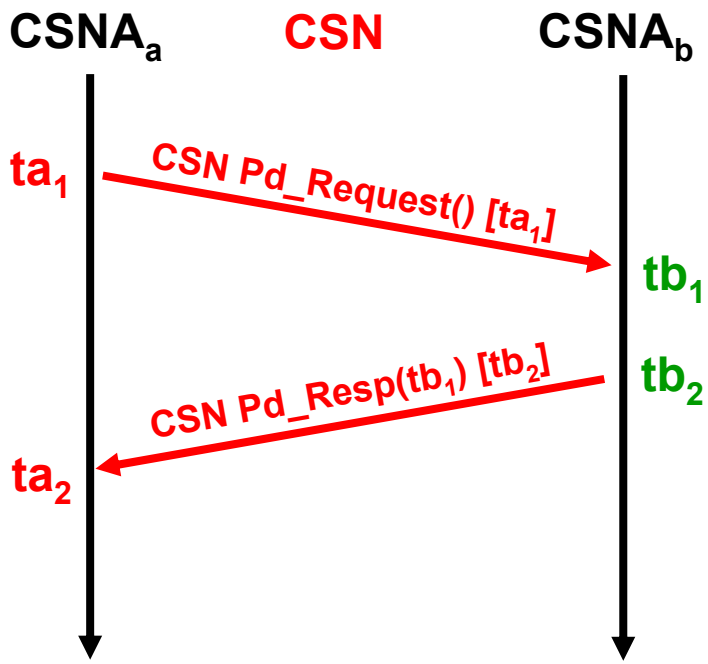
# Link Delay SAP



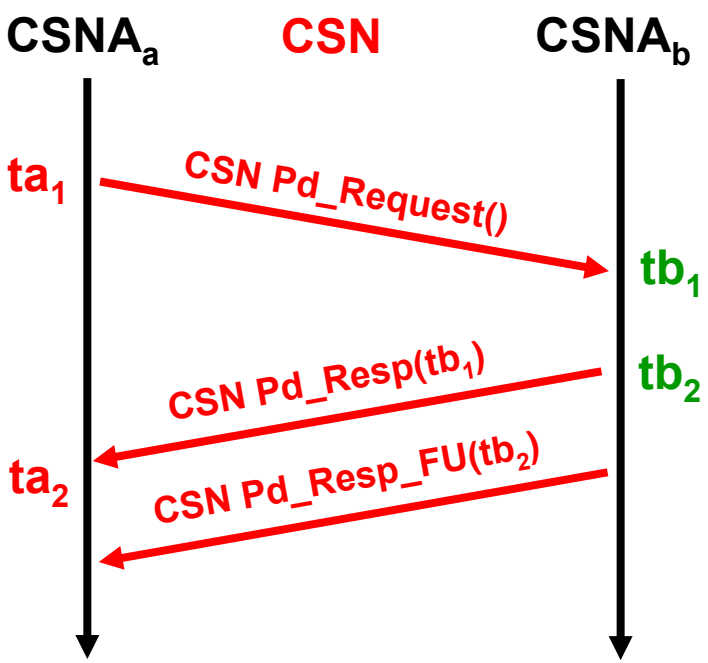

$$\text{LinkDelay}^* = ( (T_2 - T_1) - (t_2 - t_1) ) / 2$$

* In most cases ,CSNA will be co-located on the AVB board and LinkDelay should be neglectable

# CSN Propagation Delay Measurement between 2 CSNAs




w/i Txm packet timestamps



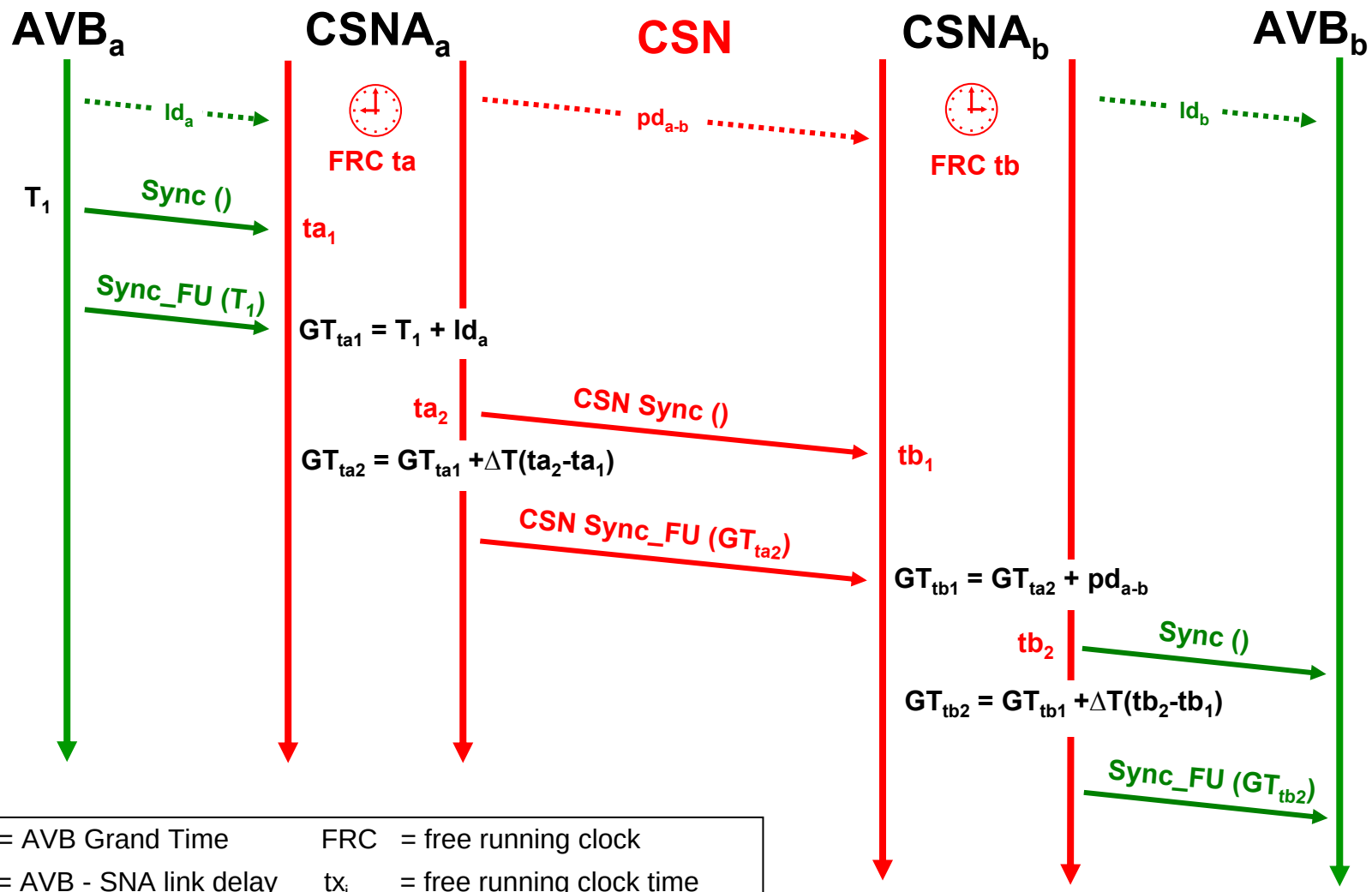

w/o Txm packet timestamps

**CSN_PropagationDelay = ( (ta$_2$-ta$_1$) - (tb$_2$-tb$_1$) ) / 2**

[t] Tx Packet Header ‘s Timestamp

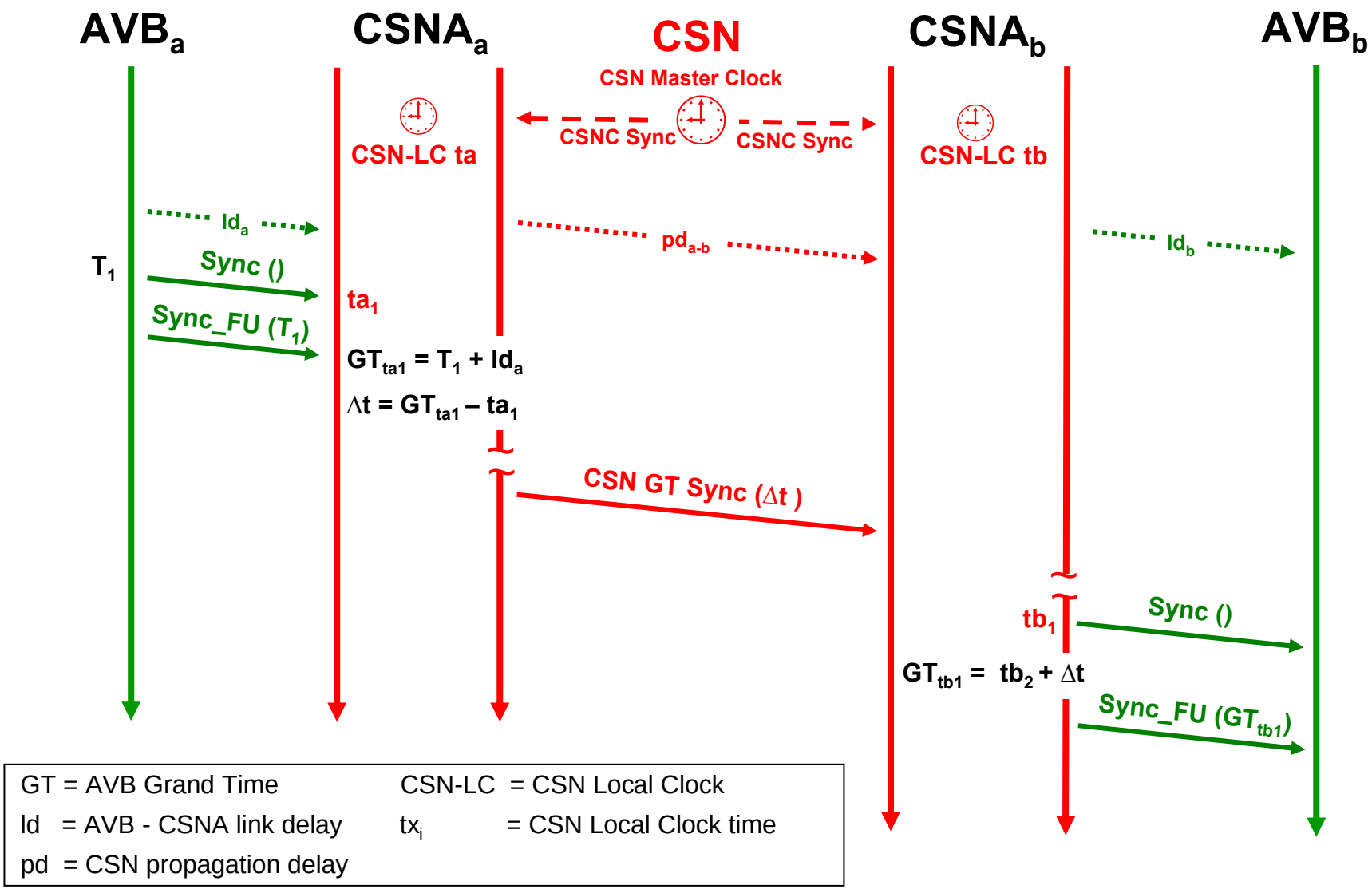
(t) API Parameters

# Transparent Clock Sync SAP




| | |
|---|---|
| GT = AVB Grand Time | FRC = free running clock |
| ld = AVB - SNA link delay | $tx_i$ = free running clock time |
| pd = SN propagation delay | |

# Boundary Clock Sync SAP




| | |
|---|---|
| GT = AVB Grand Time | CSN-LC = CSN Local Clock |
| ld = AVB - CSNA link delay | $tx_i$ = CSN Local Clock time |
| pd = CSN propagation delay | |

# Call to Action


# Thank you