

802.1 AVB Support for Coordinated Shared Network

IEEE 802.1 AV WG
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avb-phkl_avb_support_sn_1107-v4.pdf



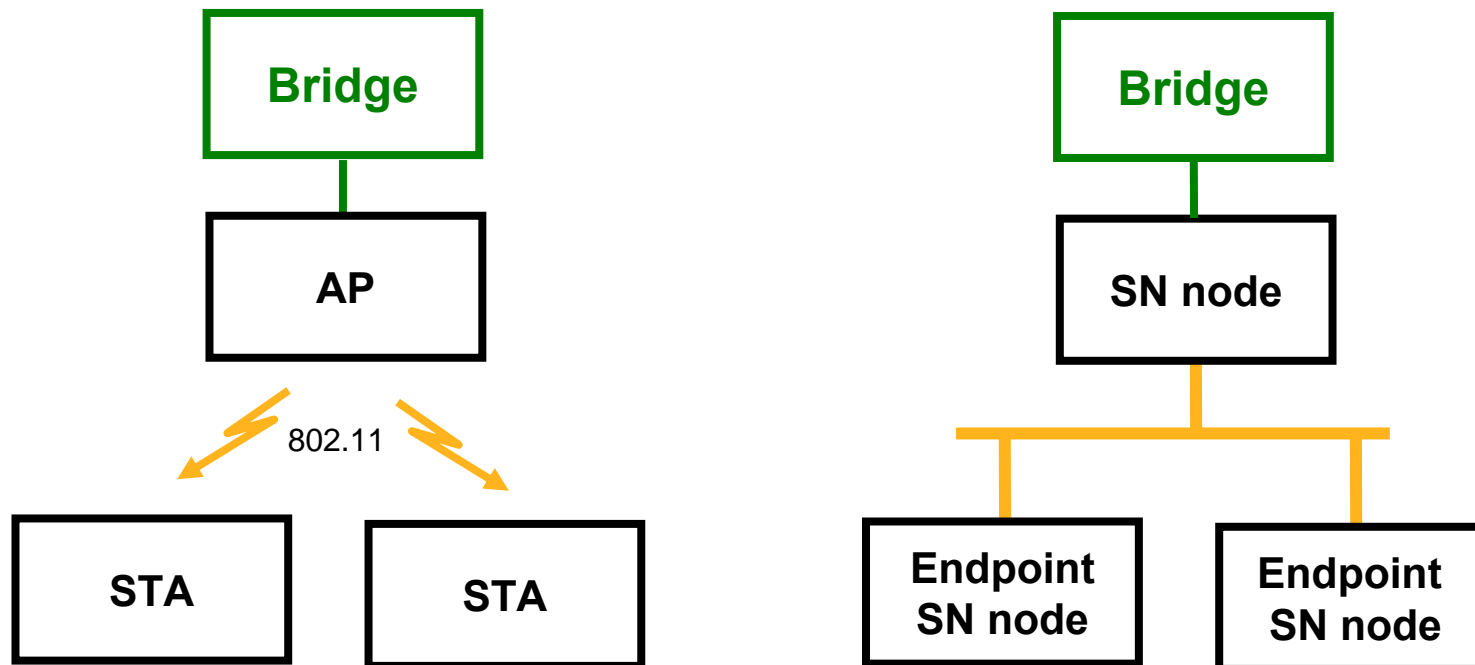
Coordinated Shared Network

- 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

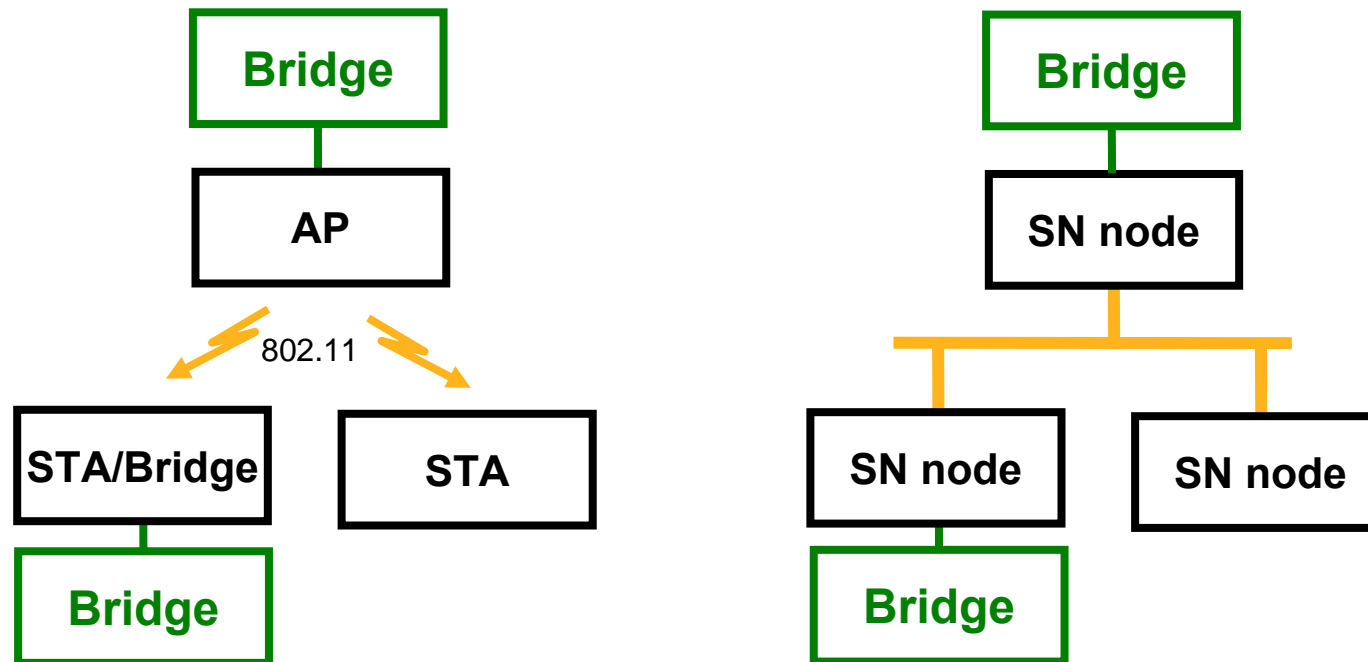
- IEEE 802.1as includes the current 802.11 AP/STA topology
- "similar *" to the shared network topology if a single node only is connected to a bridge...

[] 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

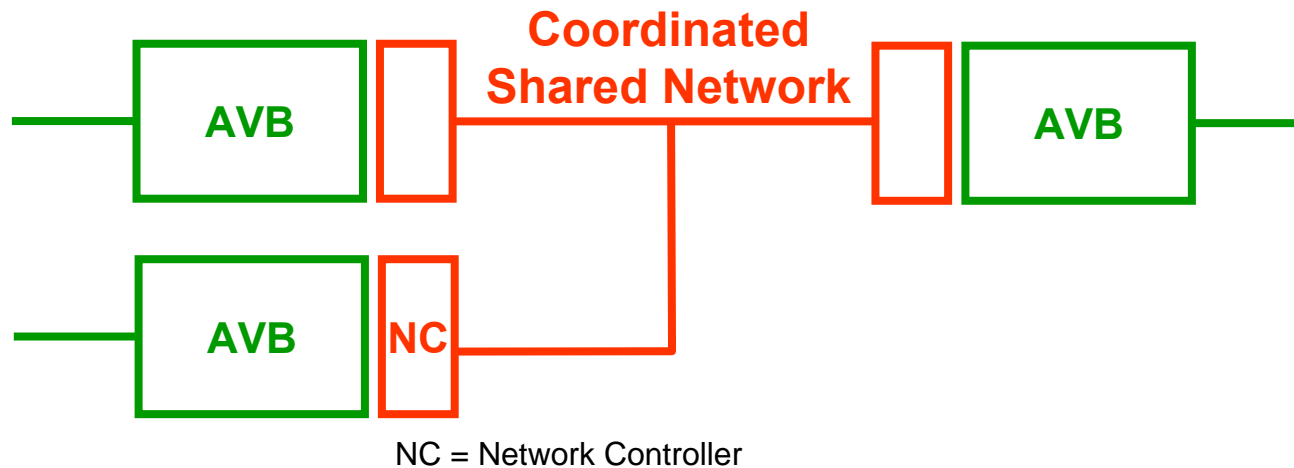
- Current draft model does not support SN backbone connecting multiple bridges
 - No support in the current IEEE 802.1 AVB standard for AVB to AVB SN link
 - However, an 801.11 STA / Bridge discussion has been initiated in the joint AVB and Video Transport TG.



AVB Support for Coordinated Shared Network

- **Proposal:** AVB Standard layer interface for any Coordinated Shared Network (CSN)

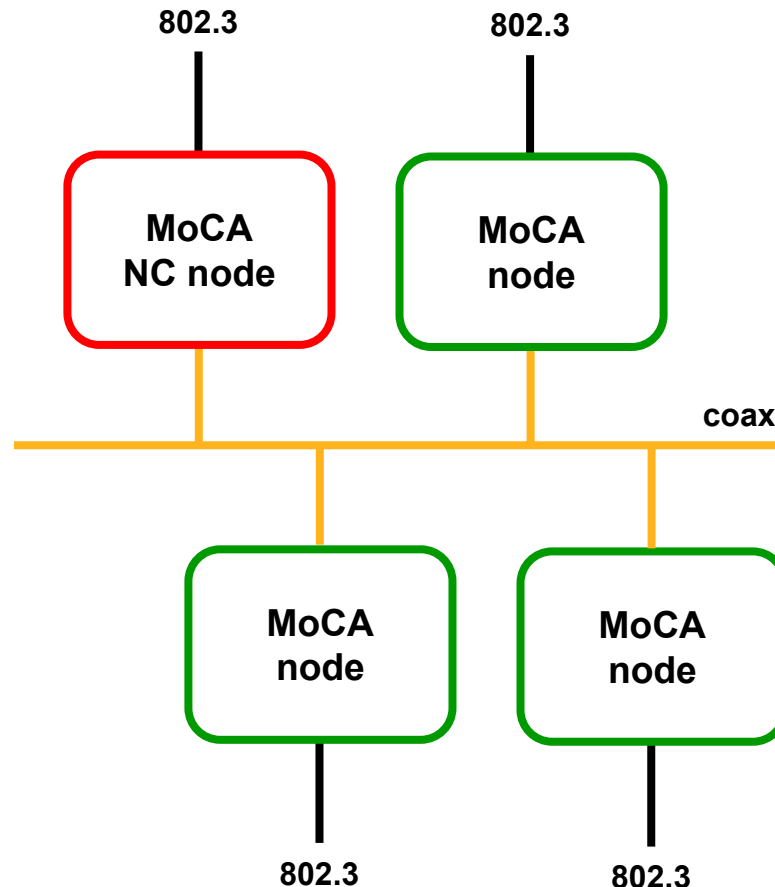
- MoCA
- HomePlug
- Future 802.11 with STA-Bridge support
- ...



MoCA Network Characteristics

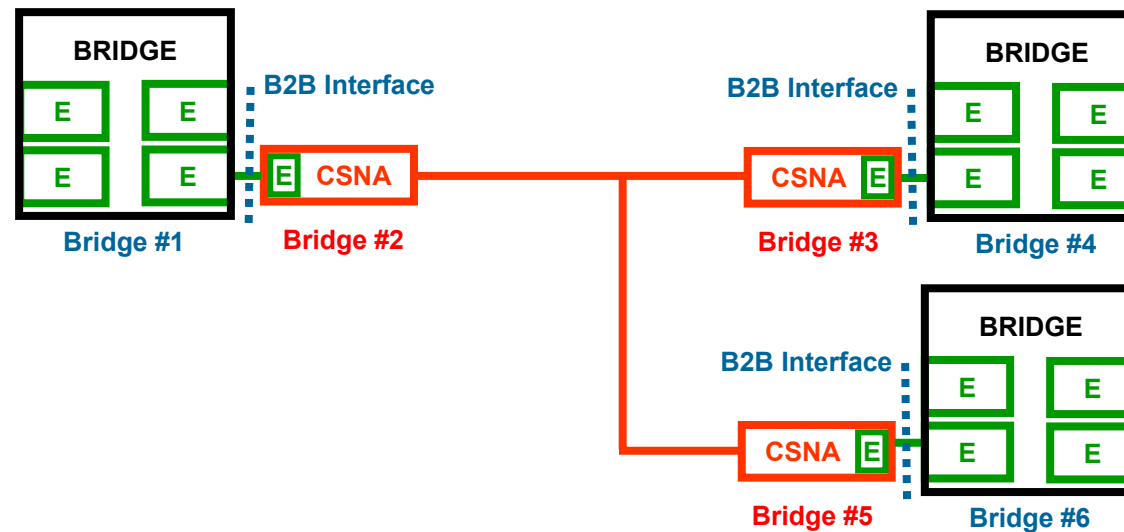


- 802.3 Link emulation over coax
 - Bridge 802.3 packets over coax medium
- Synchronized access network
 - Network access is controlled by an single (self-selected or preferred) Network Coordinator (NC)
- Clock Services
 - NC periodically broadcasts clock references to all the nodes
 - Nodes maintain 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

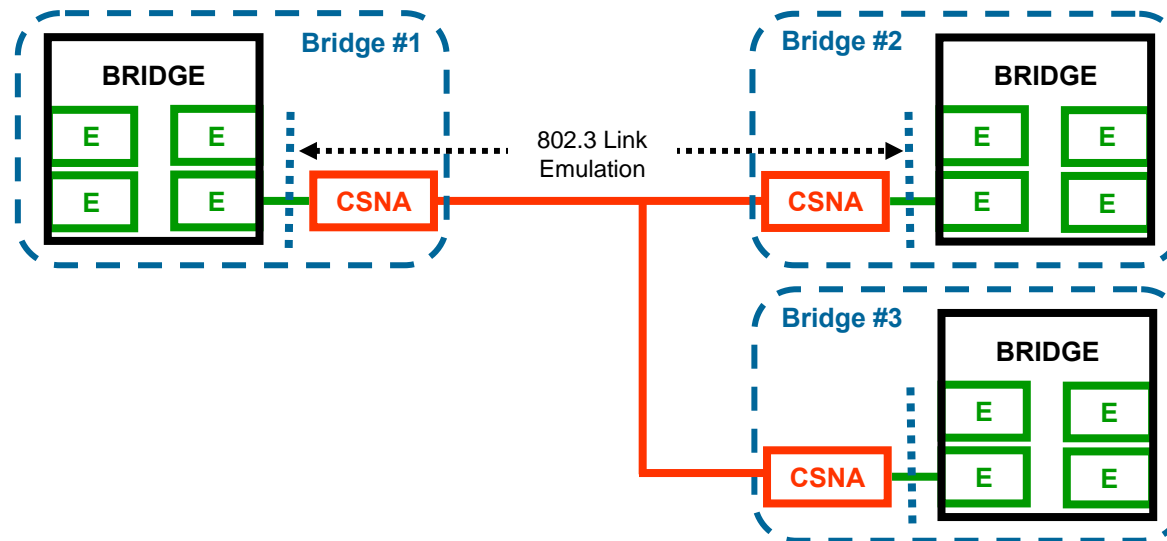


PRO Natural decomposition – Cascaded bridges
Bridge 2 Bridge interface is well defined

CONS Implementing a full bridge HW/SW functionality might be too expensive for low end adapters

Topology Option #2

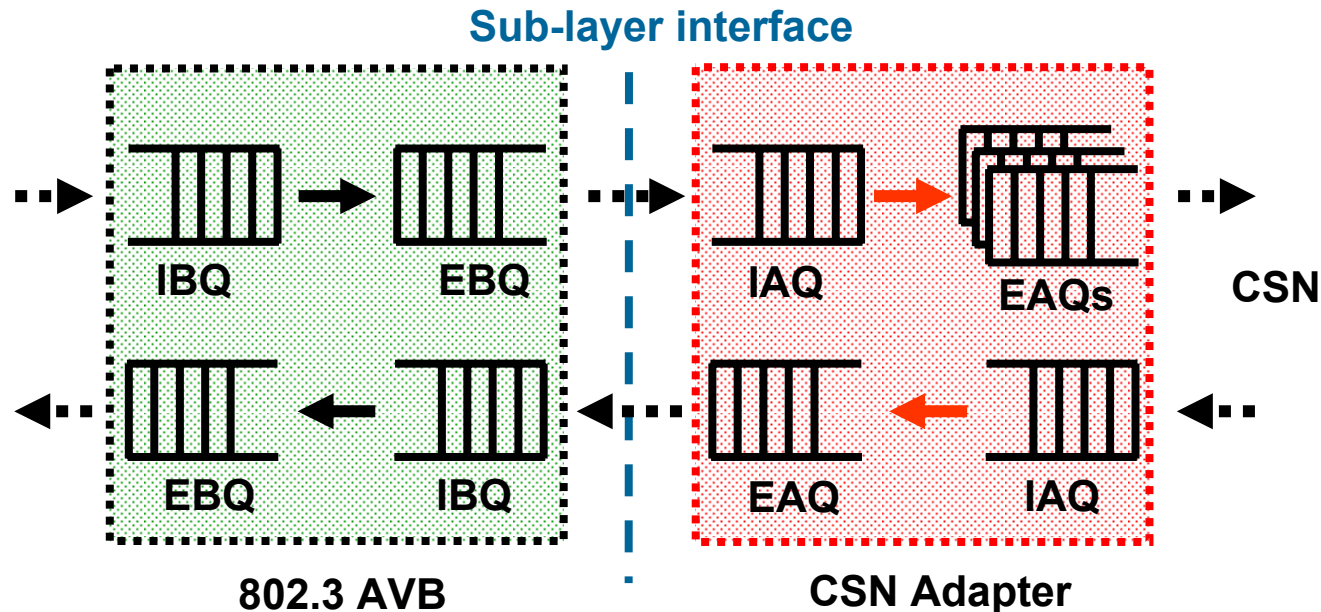
- CSN Adapter emulates links (CSNA is seen as a PHY)



PRO Cheaper implementation
Transparent to AVB

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

Ingress / Egress Queue Latencies

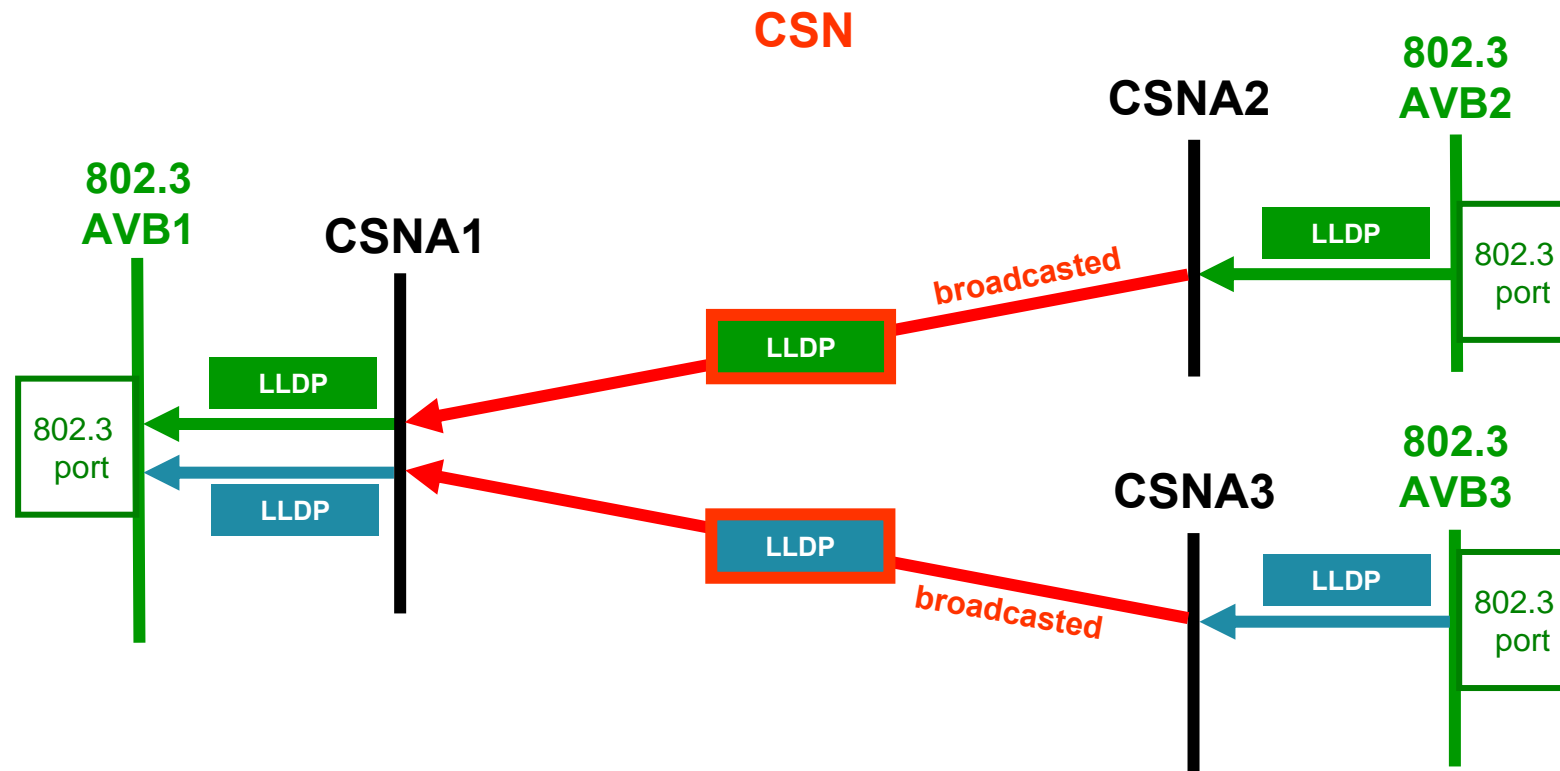


- IBQ-EBQ latencies and policies are covered by IEEE 802.1Qav
- CSNA's S&F inner queues cannot be transparent to AVB:
 - IAQ-EAQ max latencies should be queried and accounted for by the AVB
 - IAQ-EAQ policies should be exported by the AVB
- **Could be done thru a AVB standardized sub-layer interface**

AVB Messages CSN Handling

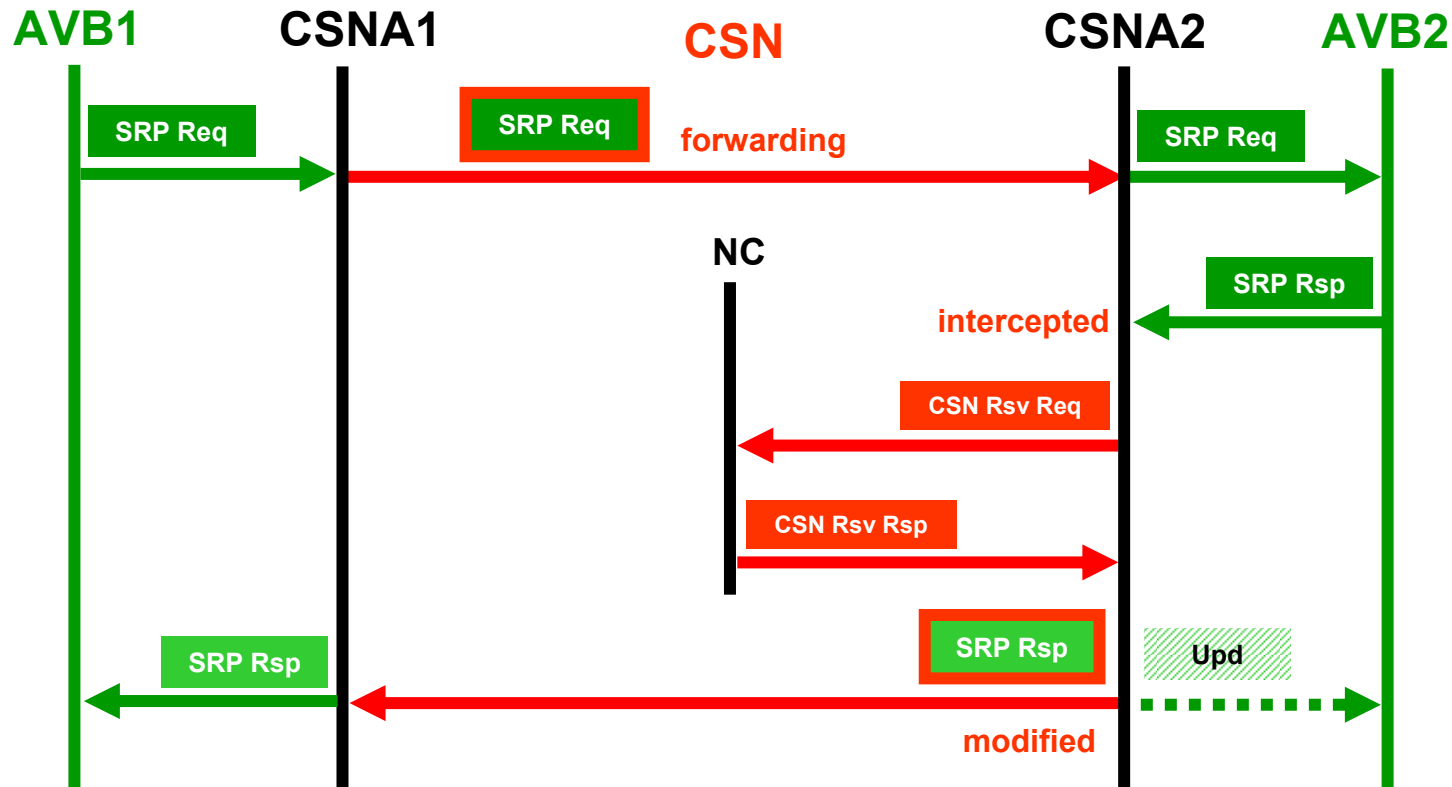
Messages	CSN Handling	
802.1 ab Link Layer Discovery Protocol Msgs	Spoofed and broadcasted by CSN	<ul style="list-style-type: none"> • LLDP queries messages broadcasted to every CSNAs • LLDP responses forwarded over the CSN
802.1 at Stream Reservation Protocol Msgs	Spoofed & intercepted by CSN	<ul style="list-style-type: none"> • Similar to non AVB intermediate bridge... <ul style="list-style-type: none"> – Request are transparently forwarded from SN edge to edge – Responses are intercepted and eventually modified (<i>if i.e. the SN capabilities are lower than the 802.3 capability for this link</i>)
802.1 as Clock Synchronization Msgs	Boundary Clock or Transparent Clock	<ul style="list-style-type: none"> • SN Native Sync handling

AVB LLDP Messages Broadcasting



- LLDP messages are encapsulated in CSN containers and broadcasted over the CSN network
 - *802.3 AVB port supposedly connected to a (P2P FD) 802.3 link now could receive LLDP message from multiple links...*

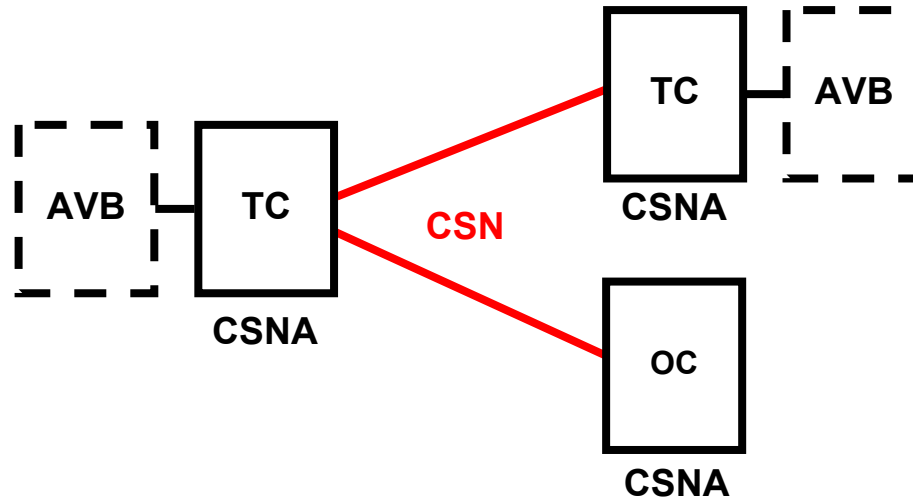
AVB SRP Messages Interception



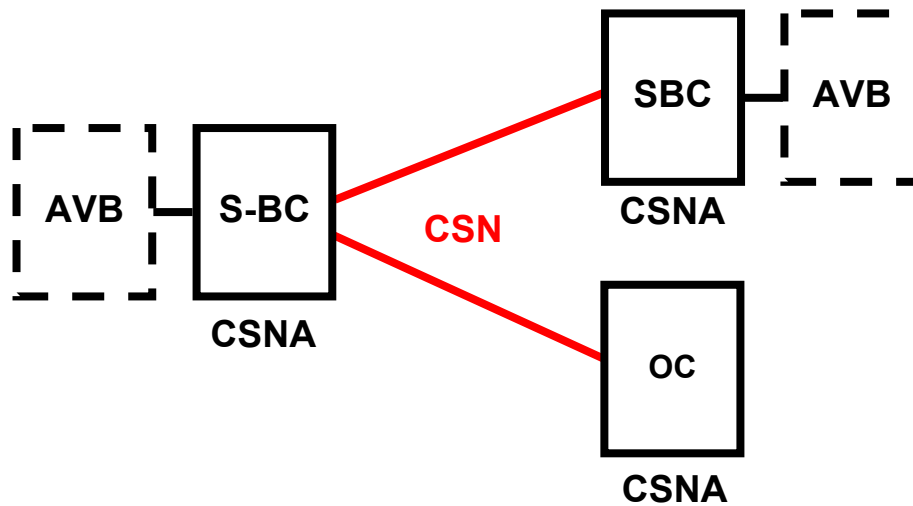
- Available bandwidth of the SN link might be lower than the bandwidth reservation acknowledged by AVB2
 - AVB reservation responses should be demoted by the SN
 - *do we need feedback msg to AVB2 to update AVB2 ?*

SN 802.1as Clock Model

Model #1



Model #2



OC = Ordinary Clock

S-BC = Simple Boundary Clock

TC = Transparent Clock

SN AVB Timing Services

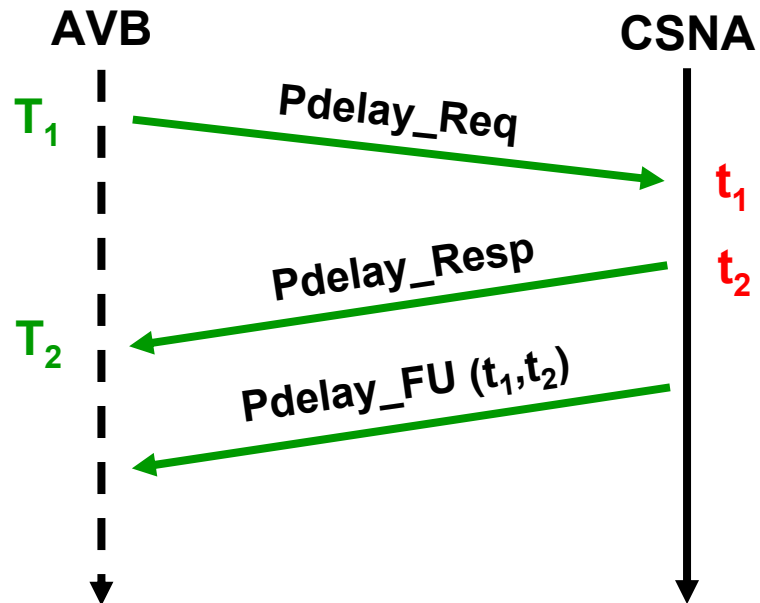
- **AVB Timing Services**

- 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

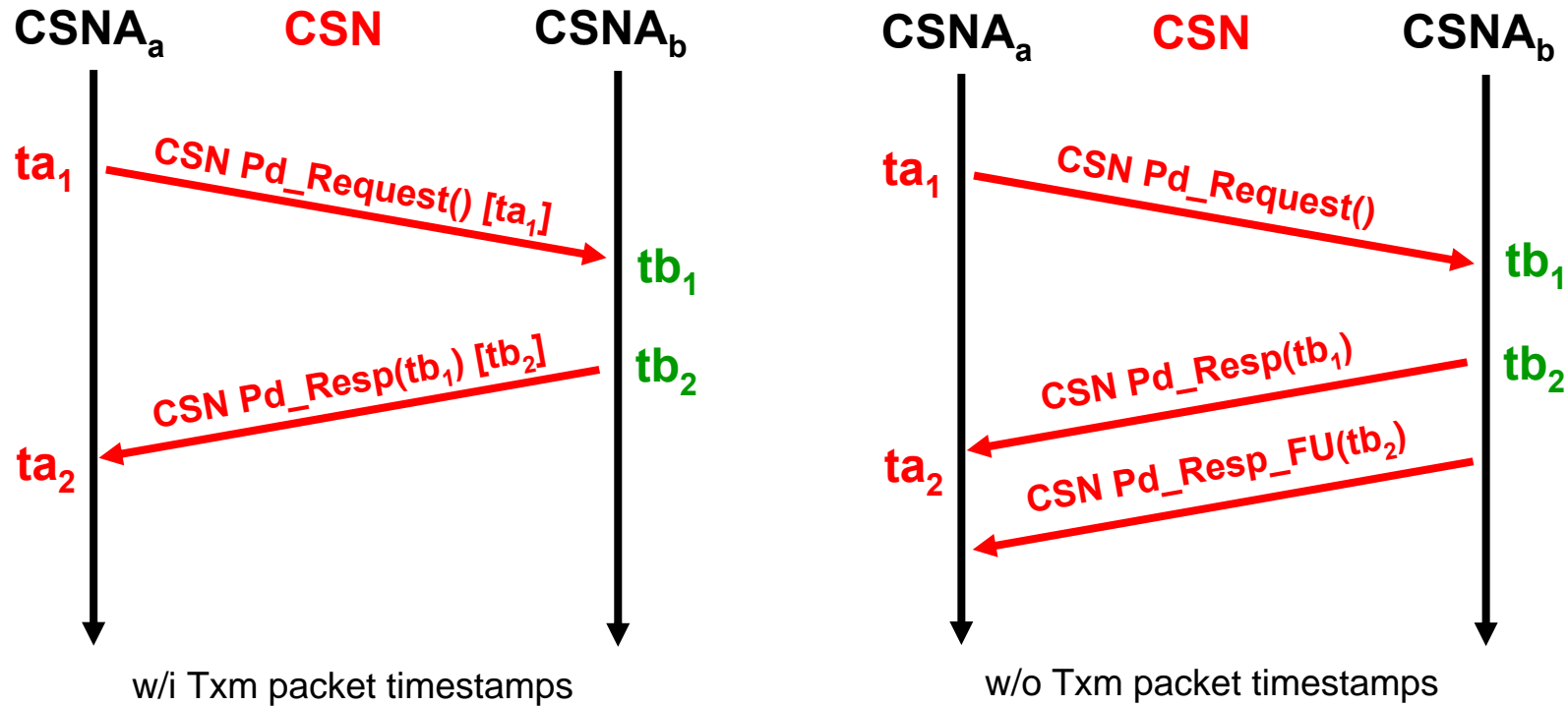
Link Delay SAP



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

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

CSN Propagation Delay Measurement between 2 CSNAs

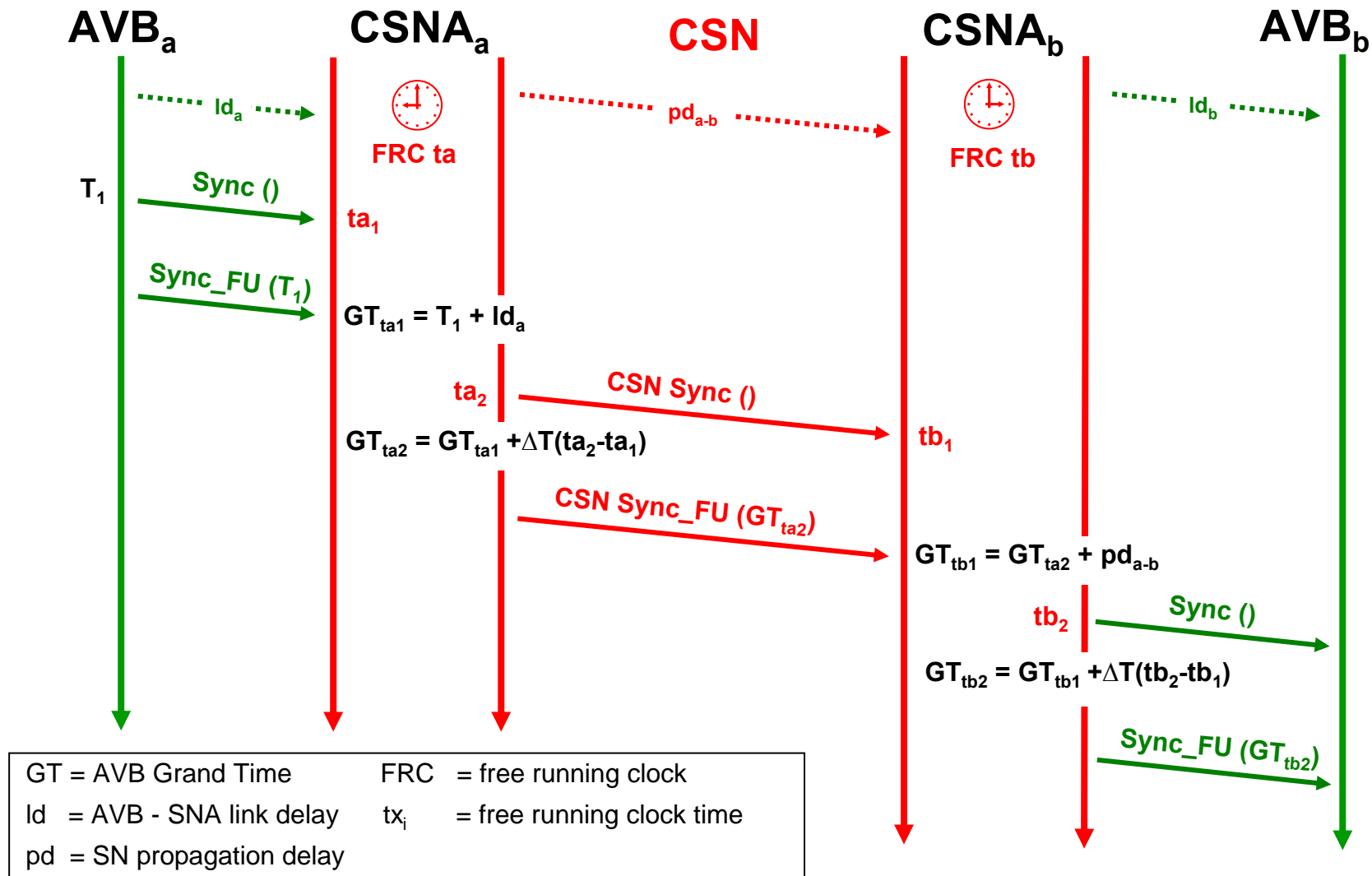


$$\text{CSN_PropagationDelay} = ((ta_2 - ta_1) - (tb_2 - tb_1)) / 2$$

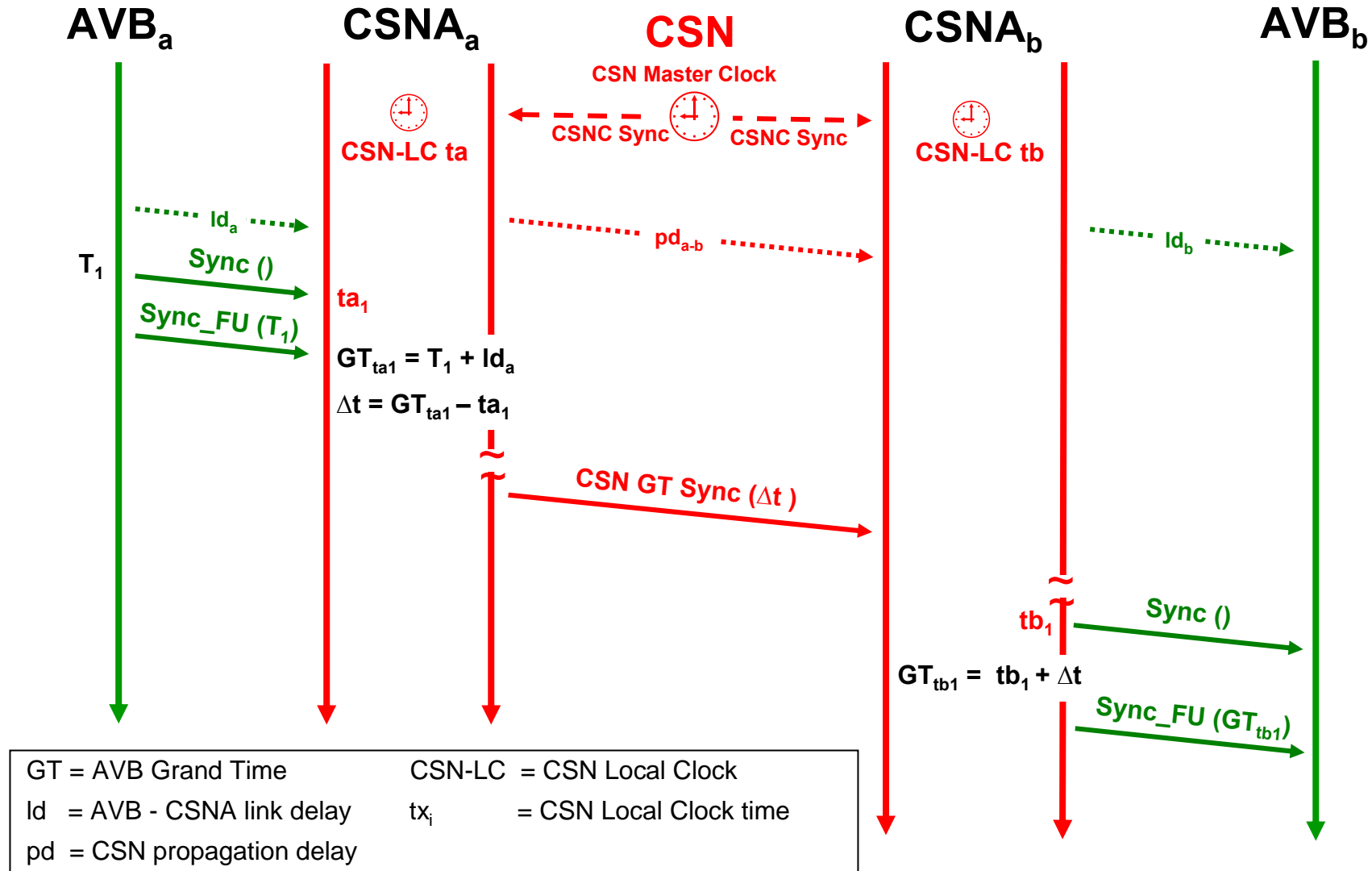
[t] Tx Packet Header 's Timestamp

(t) API Parameters

Transparent Clock Sync SAP



Boundary Clock Sync SAP



Call to Action



Thank you

