802.1AVB
Media-dependent layer specification for CSN Networks

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V1.0

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Coordinated Shared Network Characteristics

- **Contention-free, QoS-able, time-division multiplexed-access, network**.
- One of the nodes of the network acts as the network coordinator node, granting transmission opportunities to the other nodes of the network
- The network coordinator node is the QoS Manager

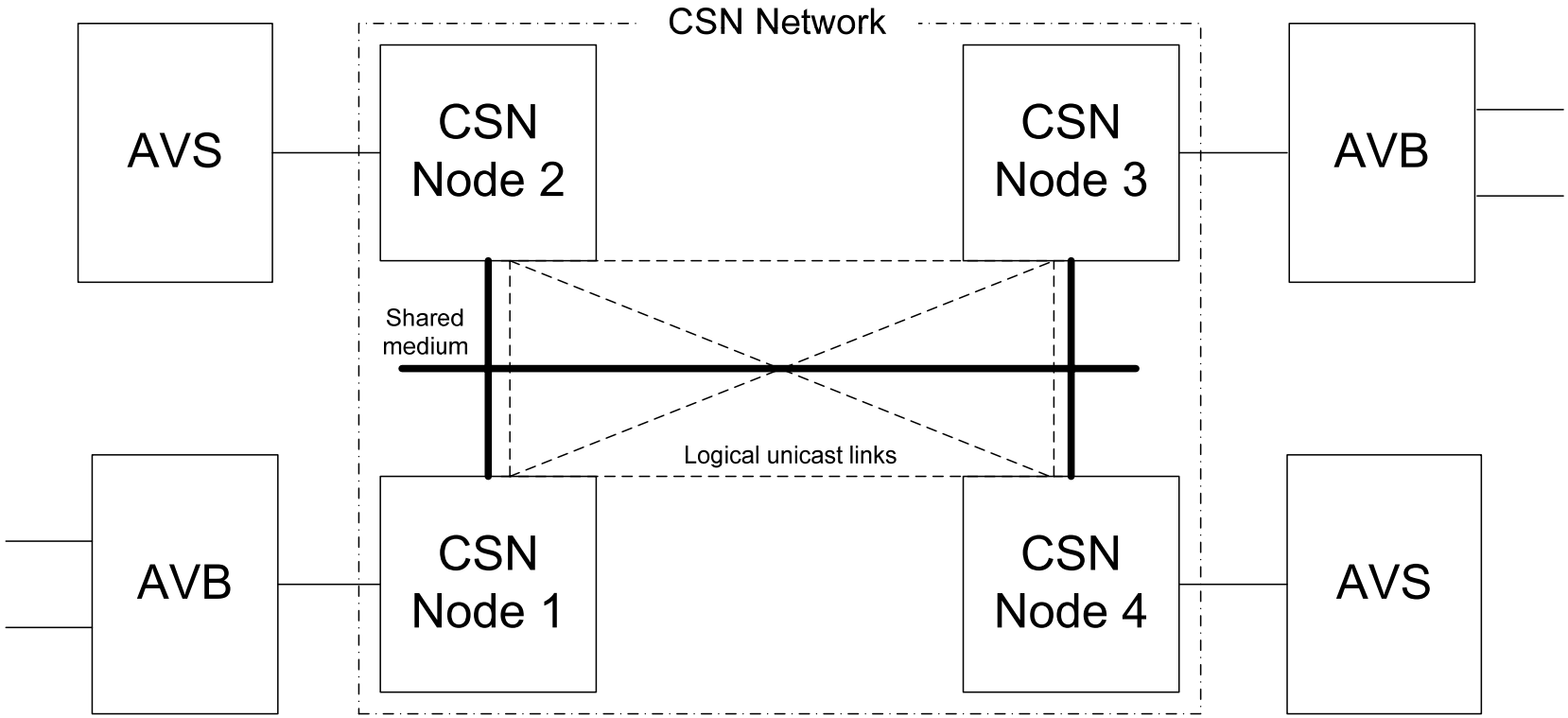
Coordinated Shared Network Characteristics

- CSNs support two types of transmission:
  1. **Unicast** transmission for point-to-point (node-to-node) transmission
     - Each node-to-node link has its own bandwidth characteristics, which could change over time as a result of the periodic ranging of the link
  2. **Broadcast** transmission for point-to-multipoint (node-to-all-other-nodes) transmission
     - The broadcast transmission characteristics are the lowest common characteristics of all the links of the network

Coordinated Shared Network Characteristics

- A CSN network is
  - **physically** a **shared** network, in that a CSN node has a single physical port connected to the half-duplex medium,
  - but is also a **logically** fully-connected **mesh network**, in that every node could transmits to every other node using its own profile over the shared medium

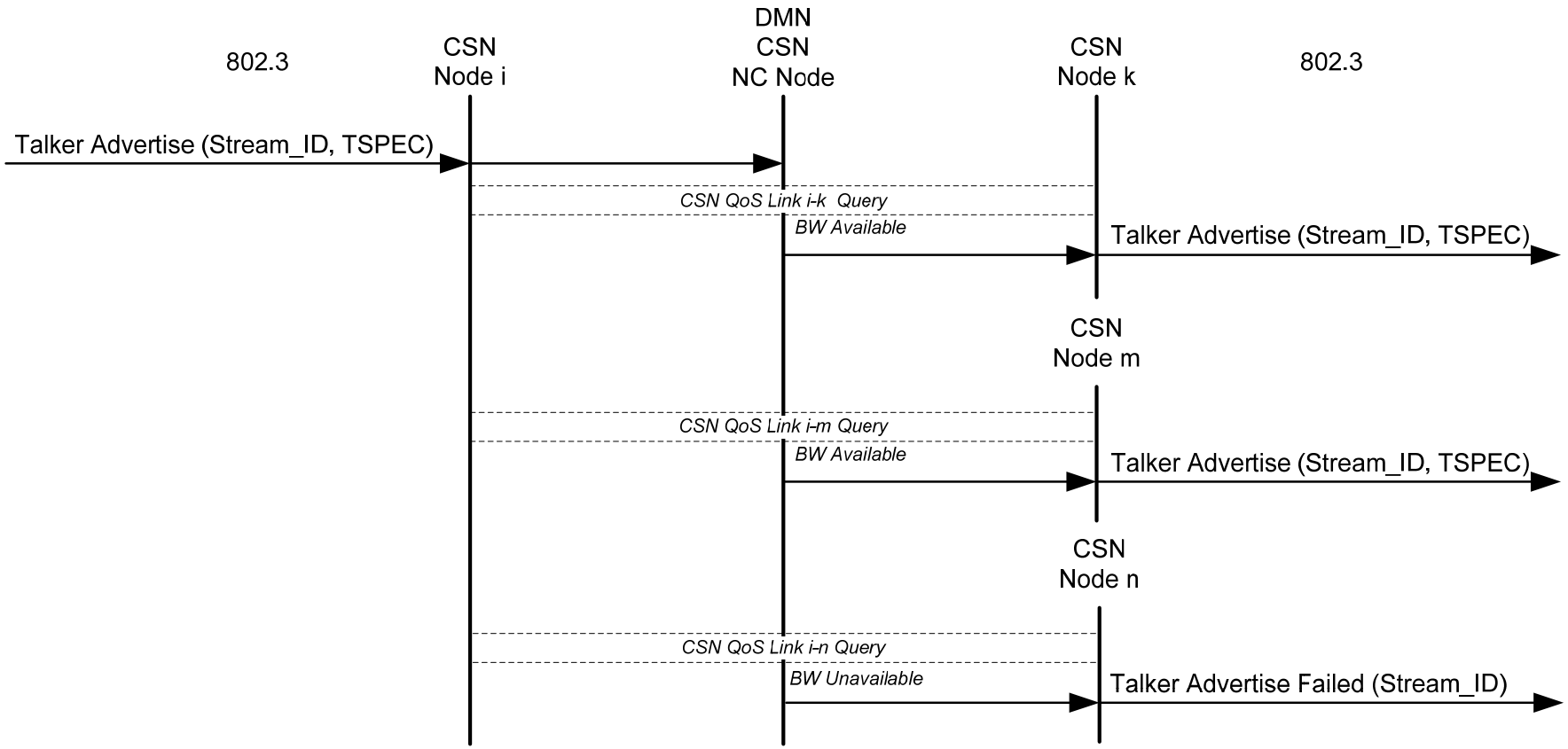
Example of CSN Backbone in an AVB LAN



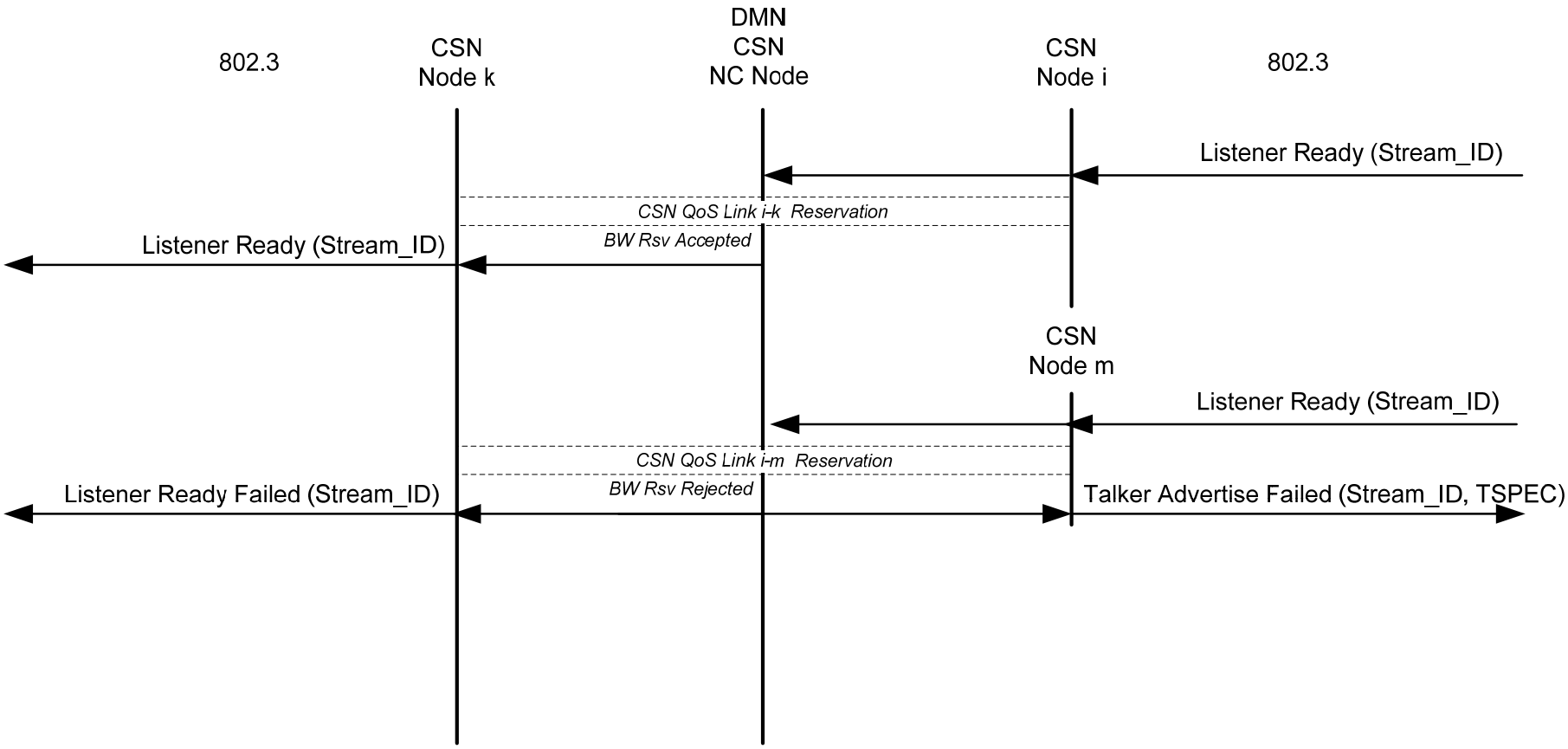
CSN integration to 802.1AVB

- 802.1AV: **no** CSN media-dependent
  - CSN Store & Forward MAC is equivalent to 802.3 Bridge Fan In
- 802.1AT: CSN media-dependent:
  - MSRP messages handling
- 802.1AS: CSN media-dependent:
  - Path Delay and Sync messages handling

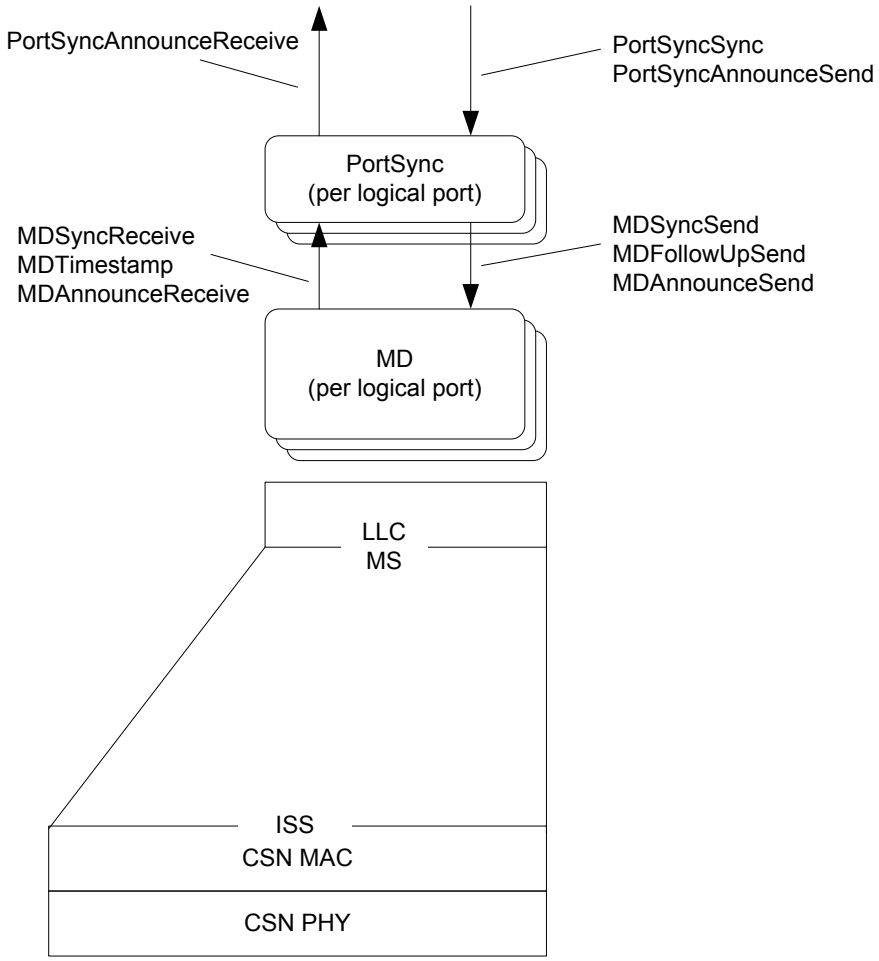
MSRP Talker Advertise Message over CSN



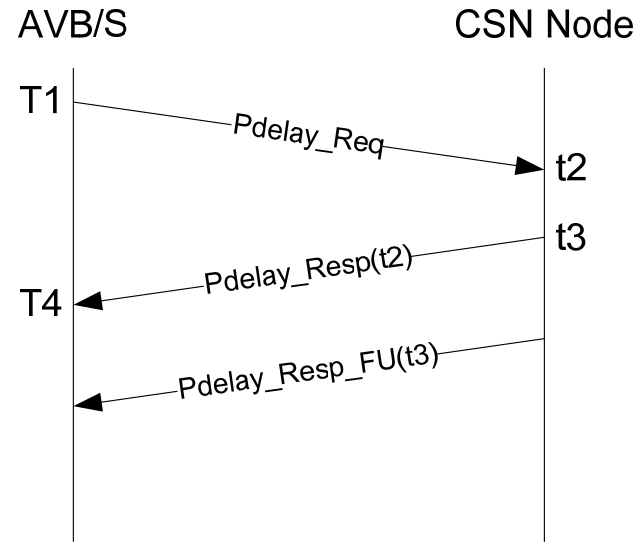
MSRP Listener Ready Message over CSN



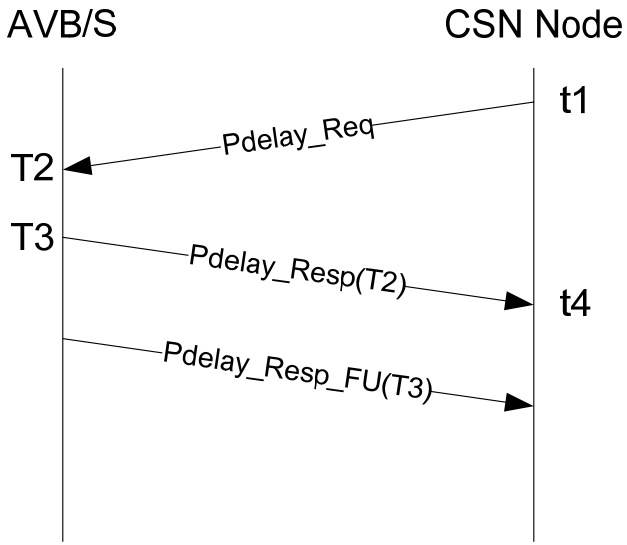
802.1as MAC dependent and lower entities in CSN nodes



Path Delay Measurements at the CSN Boundaries



CSN Node to AVB/S Path Delay Measurement



AVB/S to CSN Node Path Delay Measurement

- neighborRateRatio =
  (t3 - previous_t3) / (T4 - previous_T4)
- mean-propagation delay =
  ((T4-T1) – (t3-t2) * neighborRateRatio) / 2

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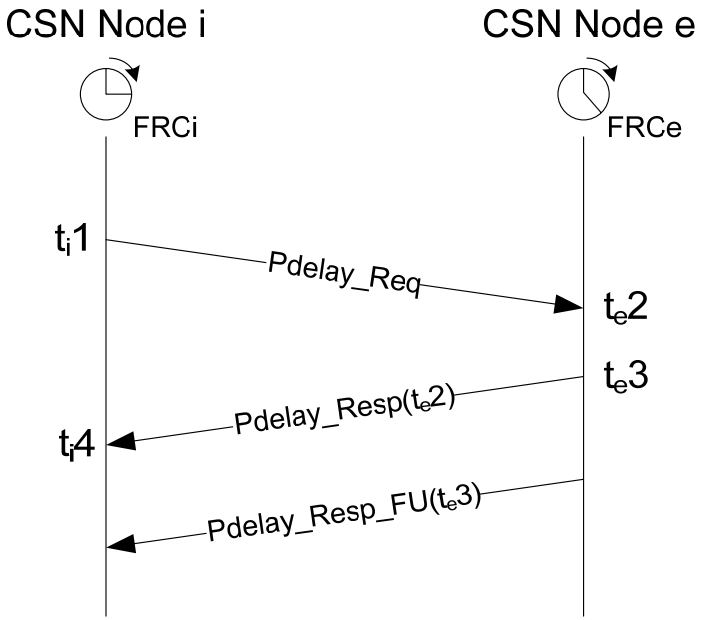
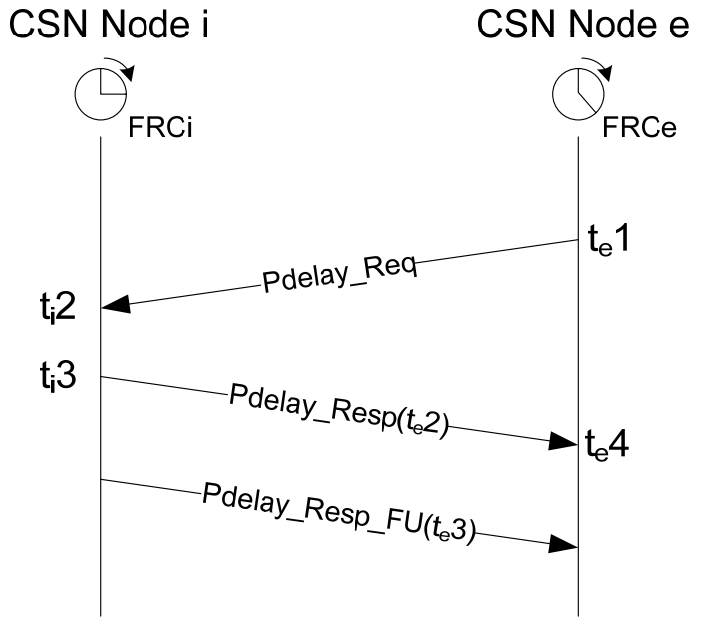
CSN Node to Node Path Delay Measurement without Network Clock reference





- neighborRateRatio =
  (t_e3 - previous_ t_e3) / (t_i4 - previous_ t_i4)
- mean-propagation delay =
  ((t_i4- t_i1) – (t_e3- t_e2) * neighborRateRatio) / 2

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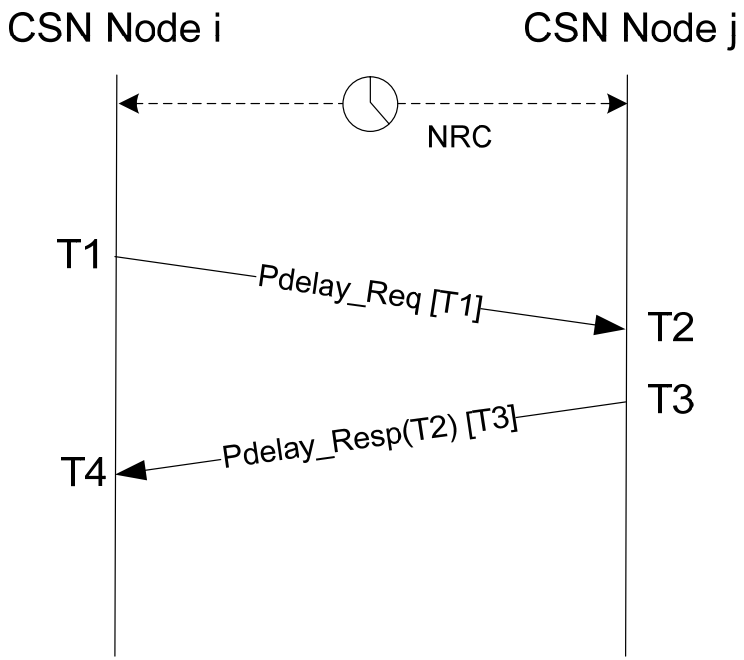
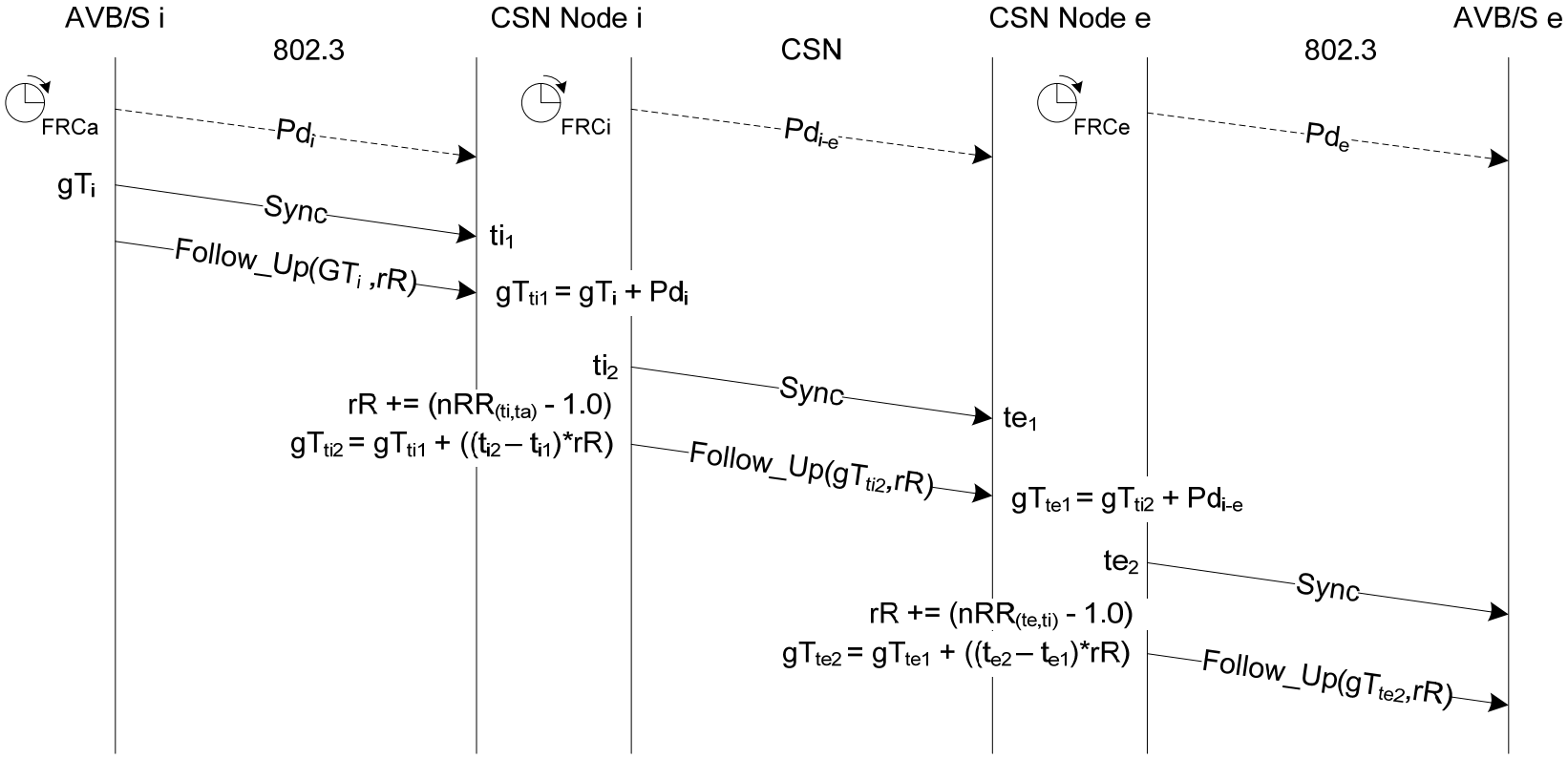
CSN Node to Node Path Delay Measurement with Network Clock reference



NRC = Network Reference Clock
[T] = TimeStamp

- neighborRateRatio = **1** (same clock reference)
- mean-propagation delay = **((T4- T1) – (T3- T2)) / 2**

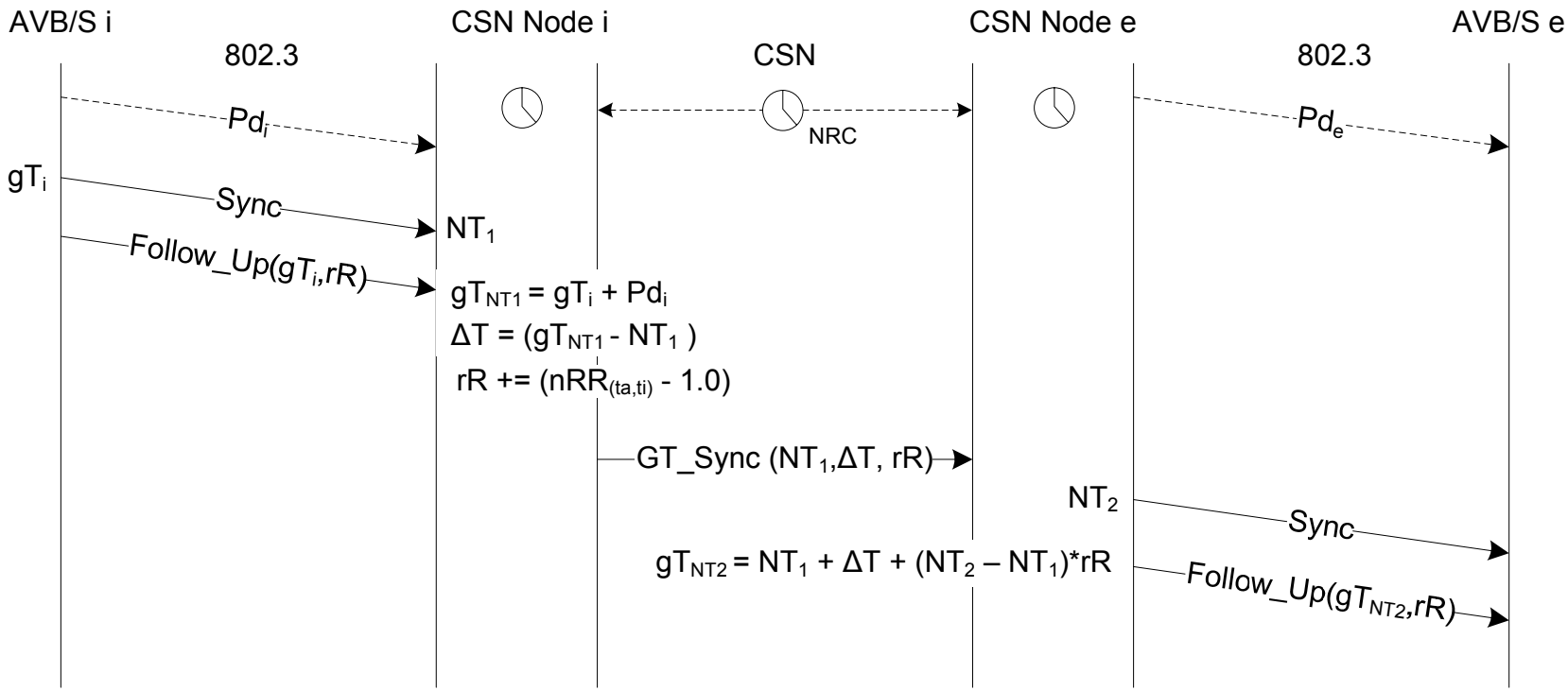
Sync Messages Propagation without CSN Network Clock



Pd = path delay
gT = grandmasterTime
nRR = neighborRateRatio
rR = rateRatio

FRC = free running clock
tx = free running clock time
gT_{tx} = grandTime @ free running clock tx

Sync Messages Propagation with CSN Network Reference Clock



Pd = path delay
GT = grandmasterTime
nRR = neighborRateRatio
rR = rateRatio

NRC = CSN Network Reference Clock
NT = Network time
ΔT = time difference between gT and NT

Questions ?

Thank you