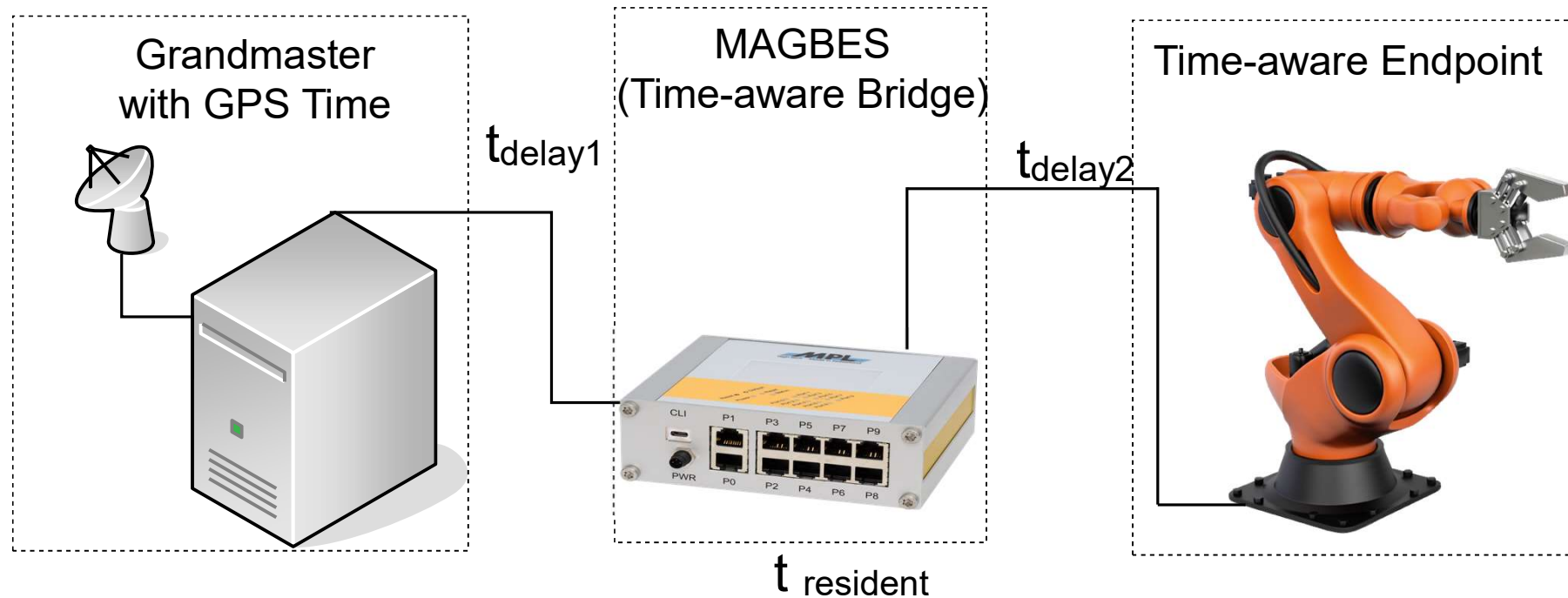


# Precision Time Protocol (PTP) in MPL Network Products

# What is IEEE 802.1AS gPTP

- gPTP generalized precision time protocol.
- Standard from the IEEE TSN (Time-Sensitive Networking) task group.
- Profile of the IEEE 1588 PTP standard.
- 2 step hardware stamping, peer-to-peer path delay algorithm as defined in IEEE Std 1588.
- All messages transported with the IEEE reserved multicast MAC address 01:80:C2:00:00:0E.
- Sub  $\mu$ Sec accuracy over 7 hops  
(two time-aware systems separated by six time-aware systems).

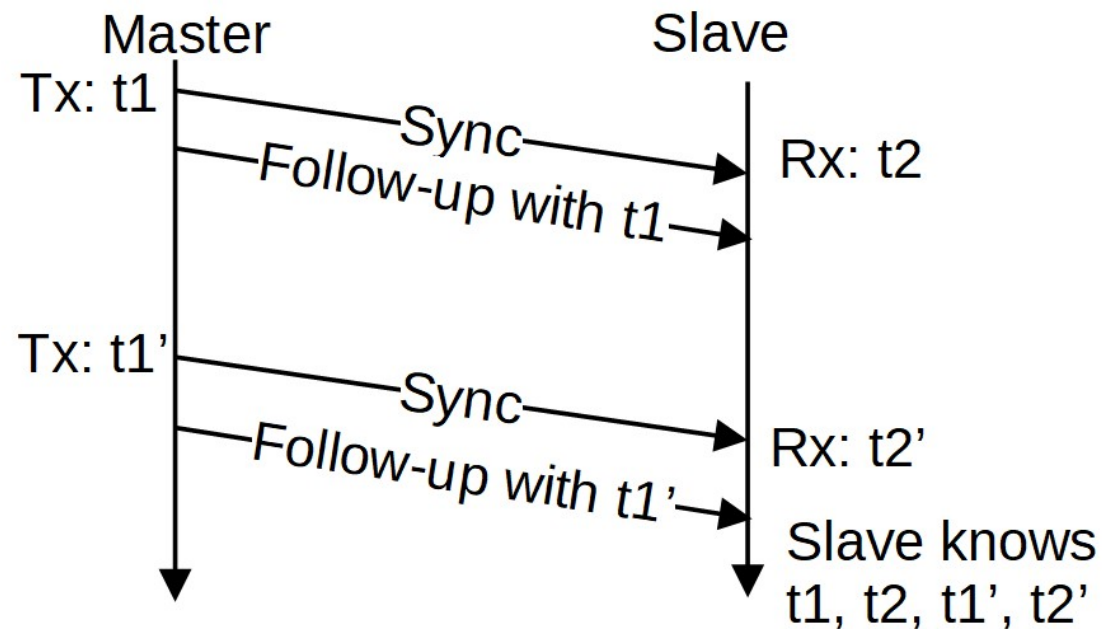
# Technical Background



Time-aware Endpoint Time = Grandmaster time +  $t_{\text{delay1}}$  +  $t_{\text{resident}}$  +  $t_{\text{delay2}}$

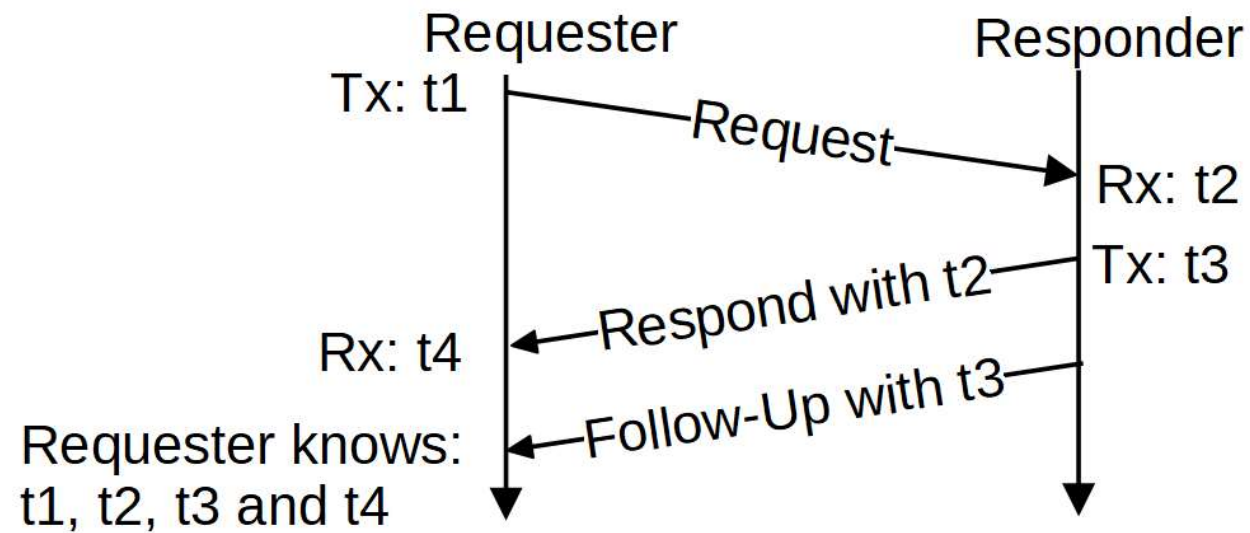
To calculate the  $t_{\text{resident}}$  the ratio of "Time-aware Bridge local clock" to "Grandmaster clock" needs to be known.

# MAGBES Firmware Ratio Calculation



$$Ratio = \frac{t_2' - t_2}{t_1' - t_1}$$

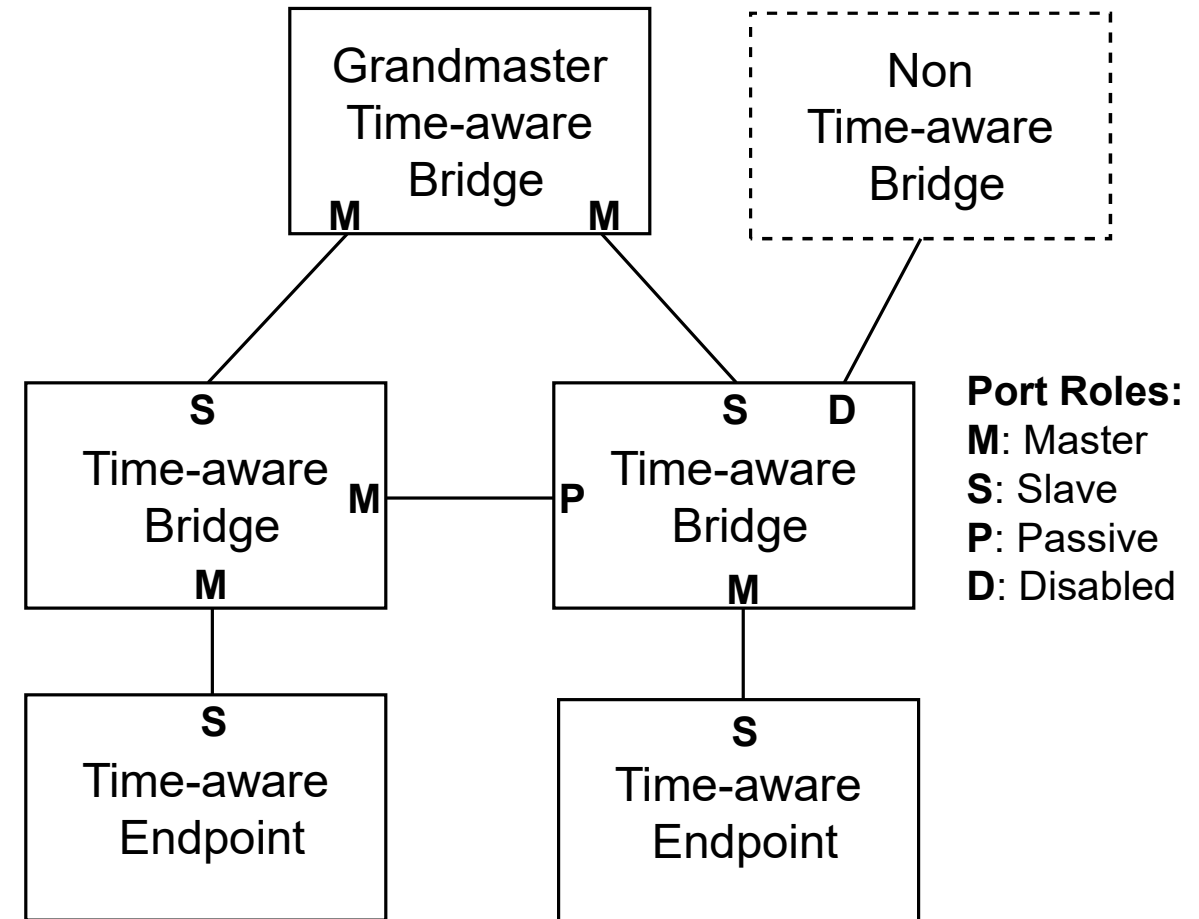
# MAGBES Firmware Delay Calculation



$$Delay = \frac{(t_2 - t_1) + (t_4 - t_3)}{2}$$

# Best Master Clock Algorithm (BMCA)

- Similar to the RSTP a Spanning Tree will be formed with the shortest path to the best Grandmaster clock.
- The priority vector (system identity) on which this Spanning tree is formed, consist of priority, clock class and MAC address.
- The use of the MAC address for this guarantee that every system identity is unique.



# IEEE 1588 vs IEEE 802.1AS

- IEEE 1588 allows the use of non time-aware bridges, although they may introduce considerable timing jitter and path asymmetry.
- If the IEEE802.1AS protocol measures a peer-delay of more than 800ns, the peer is considered as non-AS capable and no sync message (message containing the Grandmaster time) will be sent to this device.
- Message transport:

	IEEE 1588			IEEE 802.1AS
Messages	IPv4	IPv6	IEEE802.3	
Peer delay msg	224.0.1.129	FF0x::181	01-1B-19-00-00-00	01-80-C2-00-00-0E
All others	224.0.0.107	FF02::6B	01-80-C2-00-00-0E	

# MPL Implementation of gPTP in our Network Products

- The MAGBES Switch family has neither a timekeeping device nor an oscillator with a special low tolerance implemented, therefore the family is not grandmaster-capable (priority1 = 255).
- MPL Device Support:

<b>Devices</b>	<b>Support</b>
MAGBES-1x	Not supported
MAGBES-2x	All ports supported (SFP and Copper)
MAXBES	All ports supported except 10GBit SFP+ ports
μMAGBES	All ports of the master switch supported
μGUARD	supported with PTP4 Linux
μTX2FX	PHY based Media Converter