



# Options for Monitoring PTP Network Performance

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1. Need for monitoring in PTP networks
2. Self Reporting
3. Monitoring Nodes
4. Network Asymmetry Monitoring
5. Slave Port Measurement
6. Comparison

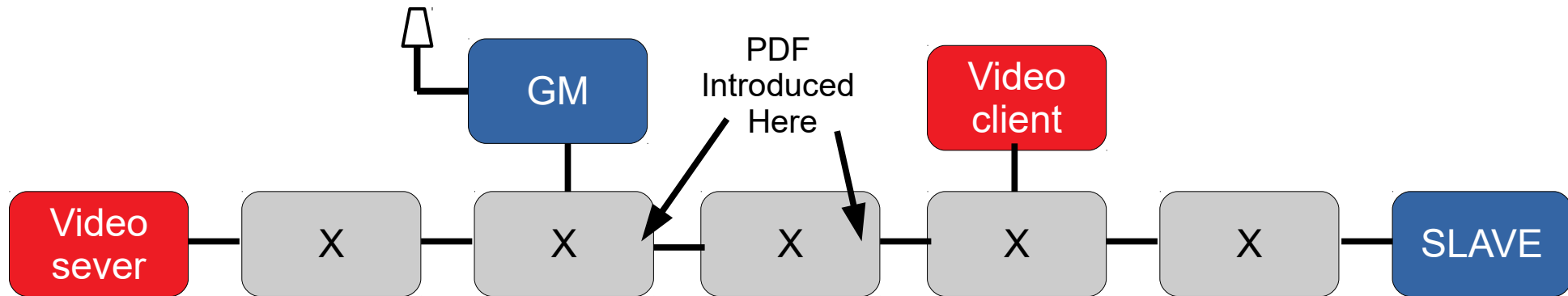
- Shared Data/timing network
  - Timing sent over network designed for data
  - Data traffic patterns change over time as applications change
  - Timing system which once worked can degrade due changes to non-timing data
  - Especially true without full on-path support
  - Experts who initially set up timing network now busy with something else
- Regulatory compliance
  - For example MiFID II
  - Create and archive evidence of compliance

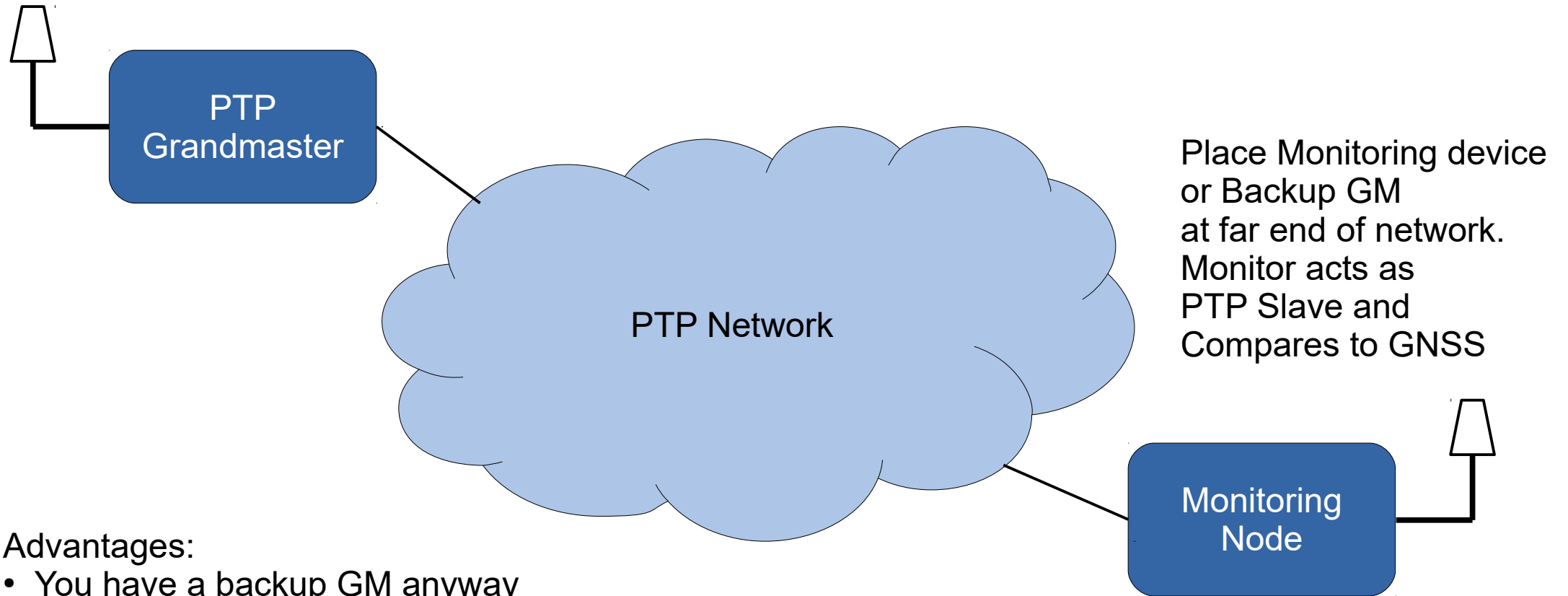


- **Self reporting by network nodes**
  - Everything has a management interface
  - SNMP, https, etc
  - Or PTP native management messages (if you must)
- **Advantages**
  - Easy, no additional equipment
  - Gives detailed picture of node status

- Optional self reporting feature in next edition of IEEE 1588
- Based on fundamental statistics for each quantity
  - Average, minimum, maximum, standard deviation
  - Or counters of events
- Examples
  - Average offset from master
  - Number of Sync messages received
- Complete implementation
  - 24 our average of each metric
  - 24 hours worth of 15 minute averages of each metric
  - 37 metrics defined
  - Partial or no implementation allowed

- Don't trust the slave's time accuracy estimate
  - Forward/reverse path asymmetry indistinguishable from master-slave time offset
- Asymmetry sources
  - Queuing noise
  - Ethernet PHYs
  - Accumulated TC/BC error contributions
  - Cable skew, important for longer cables



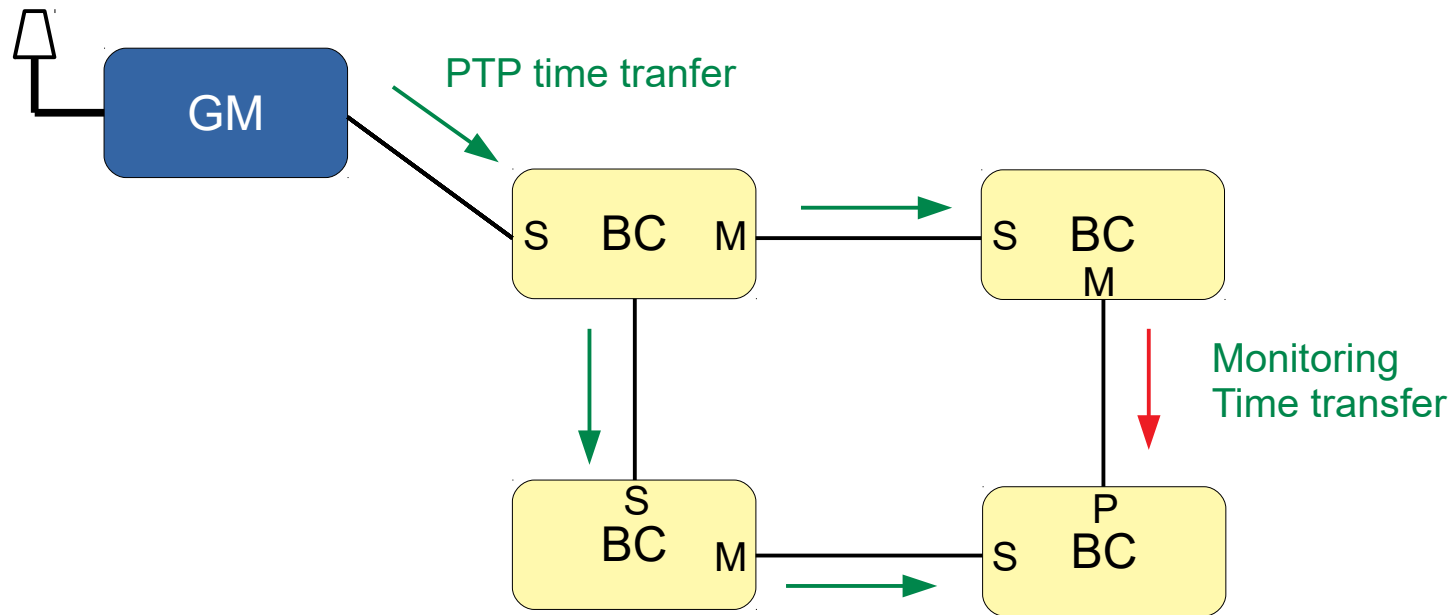


### Advantages:

- You have a backup GM anyway
- Timing performance based on accurate GNSS timing

### Disadvantage:

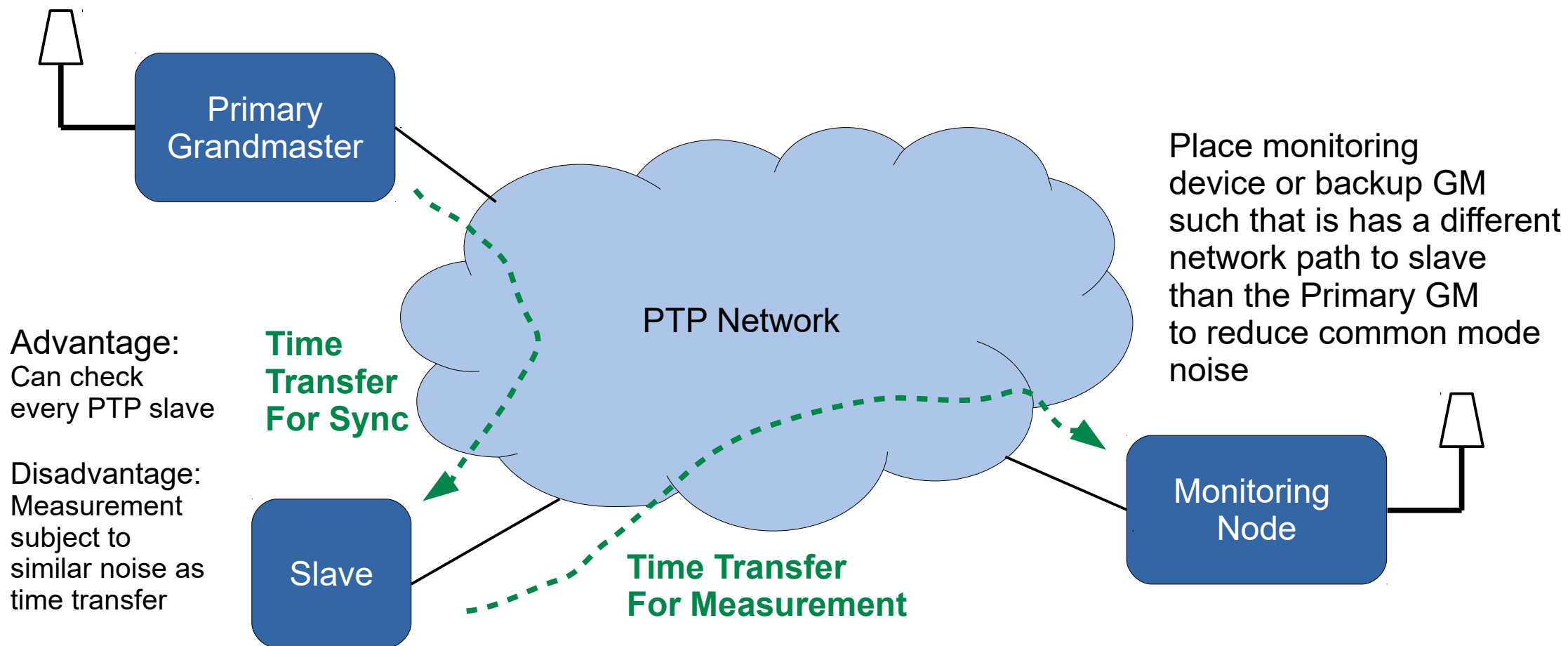
- Only checking one position in the network



Time transferred to PASSIVE Port for comparison to standard PTP time using.  
Any difference in PTP time and monitor indicates asymmetry.

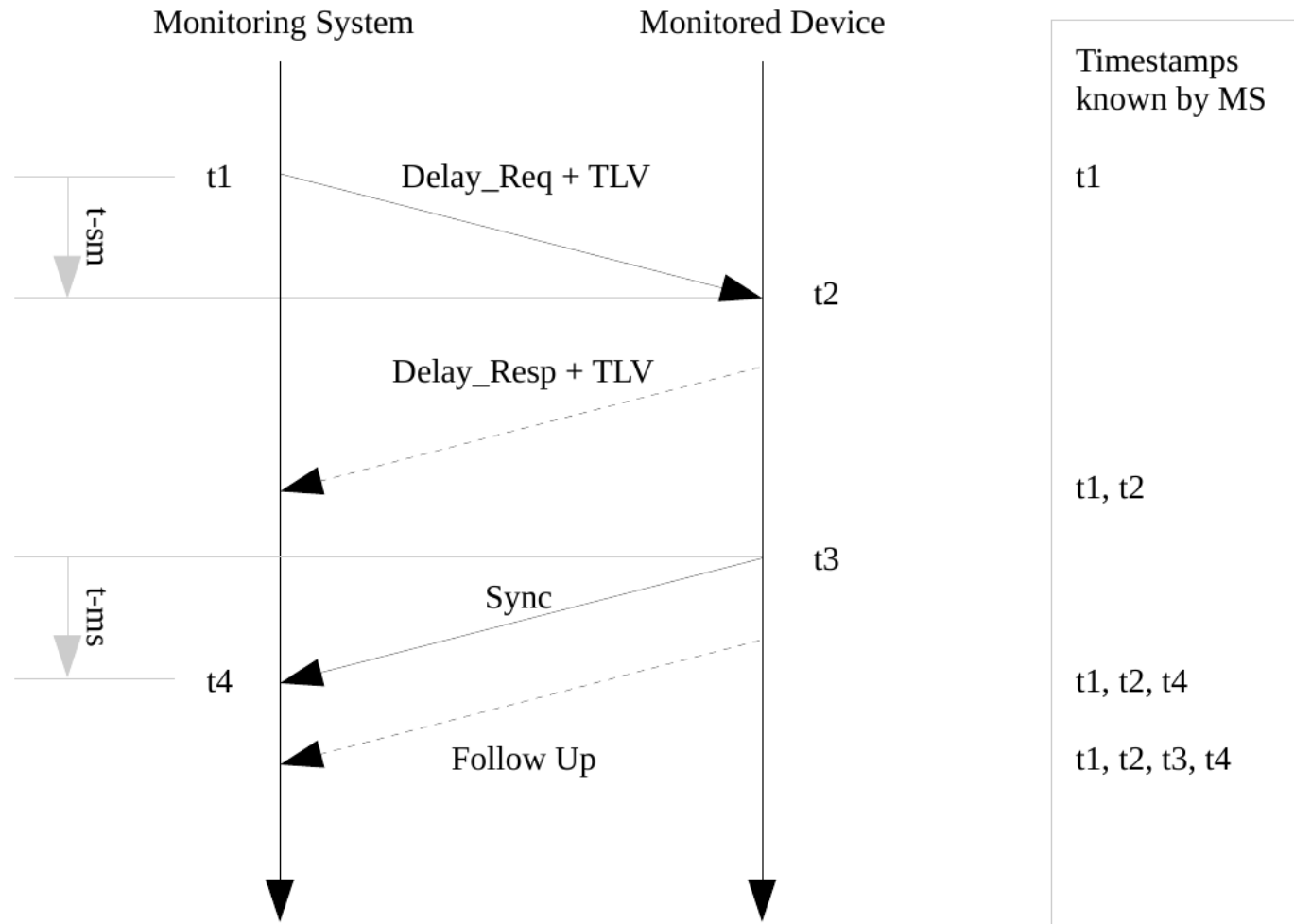
Note: time could also be transferred from PASSIVE PORT acting as an alternate master,  
to the MASTER PORT also acting as a SLAVE.





- Slave Event Monitoring
- TLVs sent from monitored PTP slave in signaling messages
  - Other means of transporting TLVs allowed but not specified
  - Multiple data sets can be sent in one message
- TLVs defined
  - Slave Rx Sync Timing
  - Slave Rx Sync Computed Data
  - Slave Tx Event Timestamps
- Measurement details unspecified
  - Up to Profile or implementation
  - i.e.. measurement interval, record structure, visualization, logging.

# Network Measurement example: NetSync Monitor



### Monitored Time Node with ID1:

Alias : Slave\_TLV  
Address : 172.75.75.1  
Location : training\_rack  
Group ID : 0  
Time Range: 16.07.2017 - 17.07.2017  
Amount : 1962/2700

### Monitor Configuration:

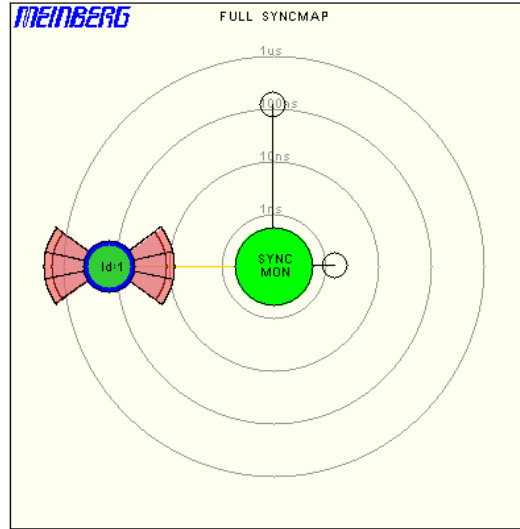
Offset Limit : +1.000us  
Protokoll : PTP/TLV  
Module : HPS in IO5

### Monitor current Status:

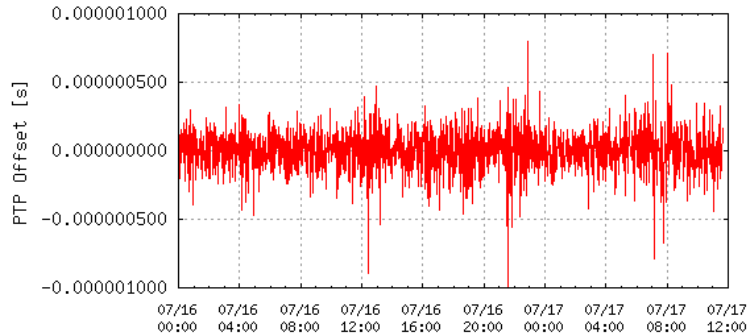
Current Time : 20170717/11:38:46/UTC  
Last Error found : No Error  
Last Measured Offset: -182.0ns  
Last Reported Offset: +166.0ns  
Last PTP Domain:7  
Last Delay : +2.993us

### Monitor Statistic:

MAX Measured Offset : +569.0ns  
MIN Measured Offset : -902.0ns  
Mean Measured Offset : -196.0ns  
StdDev. Measured Offset : +0.0ns  
MAX Reported Offset : +799.0ns  
MIN Reported Offset : -1.084us  
Mean Reported Offset : +0.0ns  
StdDev. Reported Offset : +0.0ns

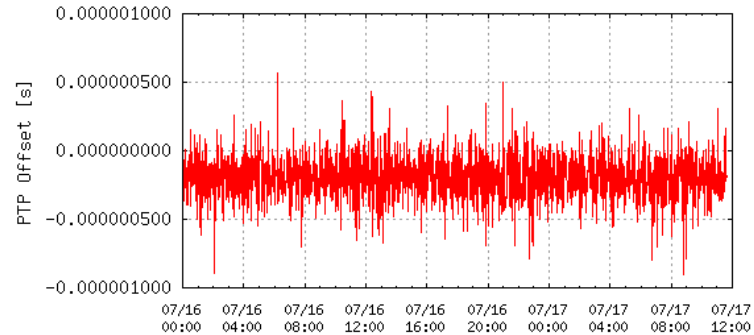


Time Monitoring Stats Plot of Slave\_TLV



Timescale from 16.07.2017 (1962 records Reported Offset)

Time Monitoring Stats Plot of Slave\_TLV



Timescale from 16.07.2017 (1962 records Measured Offset)

	Advantages	Limitations
Self Reporting	<ul style="list-style-type: none"><li>• Can use standard management interfaces</li><li>• Much information available</li></ul>	Timing accuracy unknown
Monitoring Node	Most accurate measurement of time error in network	Can only measure time error at where there is a monitoring node
Alternate master function	Can detect asymmetry in BC mesh networks	More information needed to pinpoint cause of asymmetry
Network measurements	Can measure every slave port	Measurement error similar to time transfer error

- Monitoring needed in live timing networks
  - Due to changes in network after timing system installation
  - To prove timing accuracy for compliance
- Self reporting by timing nodes gives rich set of information
  - But time accuracy unreliable
  - Implementation of PTPv2.1 standard metrics would enable timing analysis tools
- Monitoring nodes are most accurate measurement of network time error
  - Could be dual purpose as backup master
- Alternate master function can be used to detect asymmetry in mesh networks
- Network measurements schemes can measure every slave port accuracy
  - May be used to build compliance archive
  - Measurement node needs to be on different path than Grandmaster clock



**Thank you for your attention**

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