



Galina S. Antonova, October 6, 2010

NIST Interoperability Standards Testing and Verification for PC37.238

PC37.238 Draft Standard Status

Standard for Use of IEEE Std. 1588 Precision Time Protocol in Power System Applications

- IEEE PSRC H7 /Sub C7 development in coordination with IEC TC57 WG10
- Agreed to proceed with IEEE balloting and solicit comments from IEC TC57 WG 10, TC57 and SC65C
- Received 2 comments from IEC SC65C, none from IEC TC57 and WG10

- PC37.238 Draft D5.5 **approved** to go to Sponsor Ballot
 - Balloting pool formation ⇒ by October 21, 2010
 - Ballot comments ⇒ by November 21, 2010

- Comments resolution, recirculation, approval and publishing.

PC37.238 Testing

Proof-of-concept, interoperability and performance testing

=> 2 Plug-fests at IEEE PSRC, Sept 2009 and Jan 2010

=> IEEE 1588 Testbed project

=> ISPCS Plug-fest, Sept 2010

Conformance testing

=> Started discussions with IEEE Conformity Assessment Program

=> Started discussions on co-ordination with IEEE 1588 Alliance

Testing with applications !

=> IEC 61850 (sampled values, mapping time quality, local / global sync)

=> IEEE C37.118 (time accuracy, measurements, time quality nibble, locked bit)

PC37.238 Plug-fests

September 2009 Plug- fest

- => 6 vendors, 15 devices (GMs, TCs, OCs)
- => Star, chain and ring topologies
- => Achieved 200-400ns time accuracy over 4-5 hops
- => Suggested to reconsider 125us Sync Interval and Default VID=0

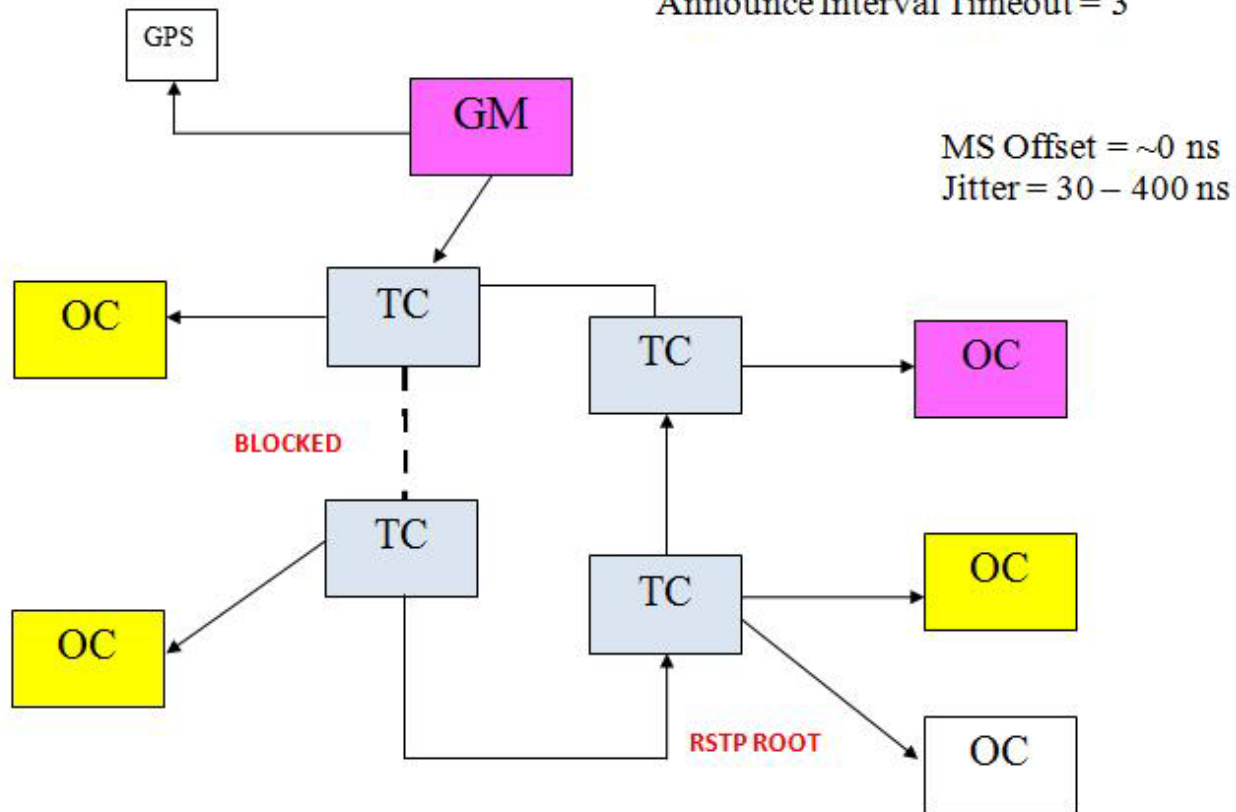
January 2010 Plug-fest

- => 5 vendors, 11 devices (GMs, TCs, OCs)
- => Ring and multi-layer star topologies
- => 1s Sync Interval, 1s Announce Interval, tagged frames with VID=0
- => Start-up and slave convergence time (~20s)
- => Master fail-over and recovery (~20s)
- => Achieved up to 400ns time accuracy in 4-hop ring
- => Suggested to include holdover requirements

PC37.238 January 2010 Plug-fest

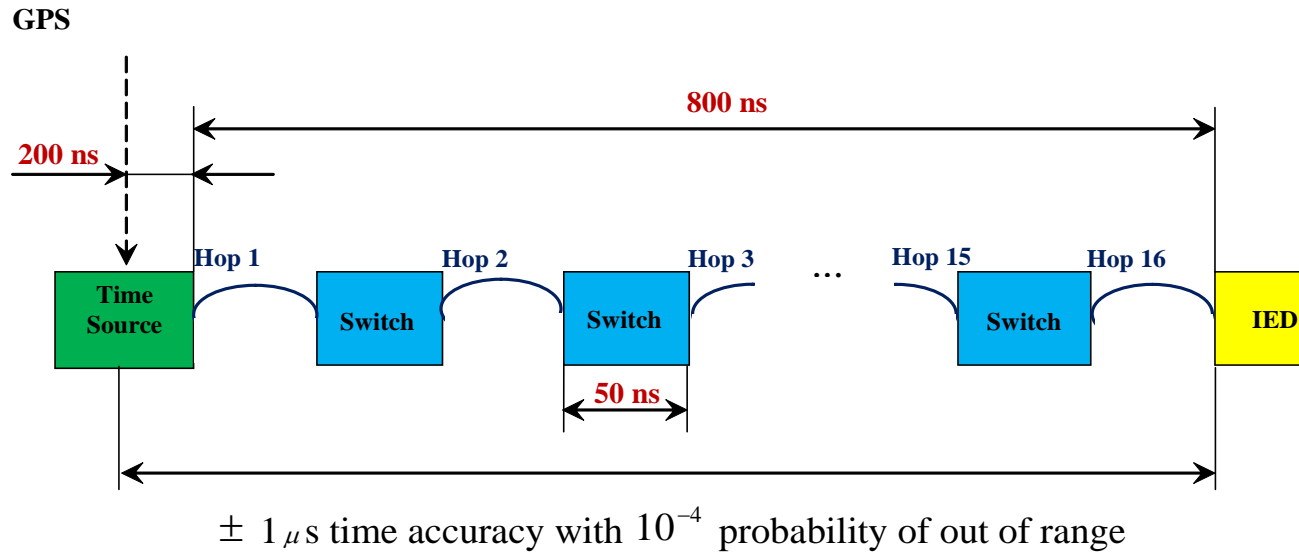
Demo Setup: Ring Topology

Configuration: Tagged frames, VID=0, Pri=4
Sync Interval = 1s, Announce Interval = 1s
Announce Interval Timeout = 3



Sampled Value Traffic of 1 Merging Unit was injected (IEC 61850-9-2)

PC37.238 Performance requirements



- Time distribution over 16 network hops
- 1us time accuracy at INPUT of the last device => special test fixture may be needed
- 10^{-4} probability of out-of-range
- Time accuracy and offset from Master relationship at slaves
- 200ns max error for time source => GPS receiver specs / performance
- 50ns max error for Ethernet switch (transparent clock)

PC37.238 Default VID = 0

- Challenges at ISPCS plug-fest on Sept 29, 2010 (again)
- Ethernet switches replace VID=0 with Port VLAN ID > 0

Per IEEE 802.1Q -2005 6.7.1, 8.1.4 each untagged or priority-only tagged frame has to be the Port VLAN ID of the port that this frame is received on.

Per Table 9-2 VLAN ID 0 is not allowed to be configured as a port VLAN ID.

- Devices see frames with VID field > 0
- These frames may be dropped, as receiving port VLAN ID can be different from received VID value

- Possible solutions
 - Change default VID to VID > 0 => not aligned with IEC 61850-9-2
 - Require devices to accept frames with ANY VID by default (no filtering)
 - Require devices to accept untagged frames by default

- Once VLAN ID is configured to non-default VID => no issue !

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