

# TELECOM PROFILE FOR TIME/PHASE ITU-T G.8275.1

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WSTS 2014, San Jose

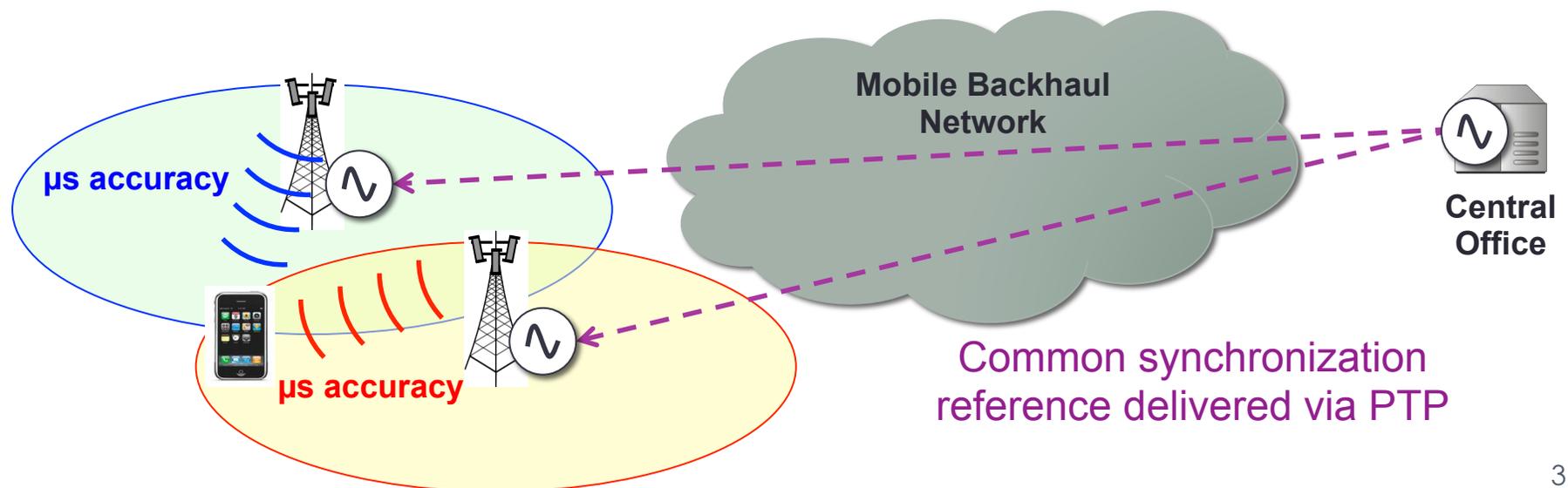
Sebastien Jobert  
Director of Engineering – Iometrix  
sebastien@iometrix.com  
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# Why defining time profiles in ITU-T?

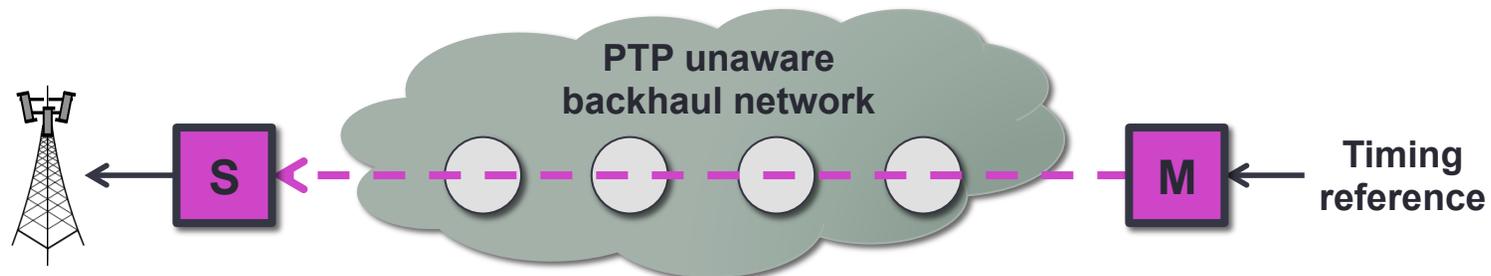
- New mobile applications requiring very accurate phase/time sync:
  - TDD, LTE-A CoMP, MBSFN, location-based services, ...
- Cost/vulnerabilities of GNSS systems
- Distribution of time synchronization by the network requested by the network operators
- Specific telecom requirements led to define PTP telecom profiles in ITU-T

# Time sync is critical for MBSFN & CoMP

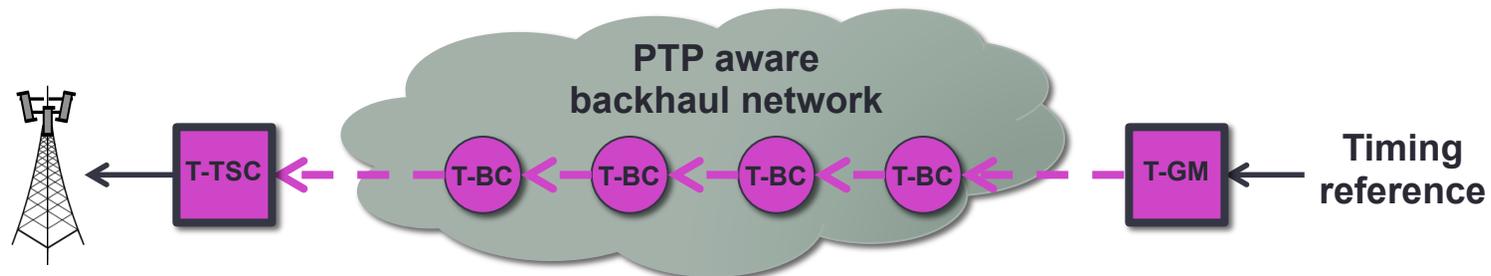
- MBSFN or LTE-A CoMP implies that the same content (or synchronized data) is delivered at the same moment by neighbor base stations
  - If the phase alignment is not good enough, the interferences cannot be handled by cyclic prefix
  - Poor synchronization results in poor user experience caused by dropped calls and erratic throughput



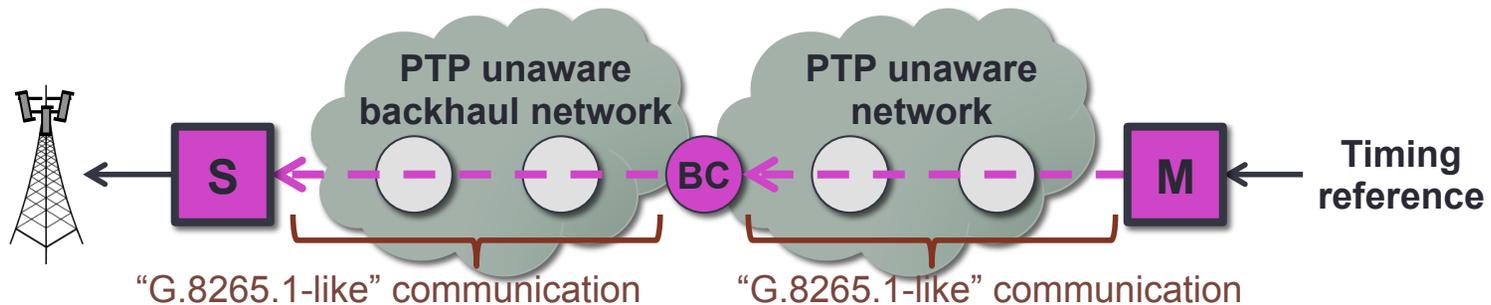
# IEEE 1588™ & PTP telecom profiles



PTP in end-to-end mode, ITU-T G.8265.1 telecom profile



PTP with full timing support from the network, ITU-T G.8275.1 telecom profile



PTP with partial timing support from the network, ITU-T G.8275.2 telecom profile, under study in ITU-T

# PTP messages and clocks

	G.8265.1	G.8275.1
PTP messages used in the profile	Sync, Follow_Up, Announce, Delay_Req, Delay_Resp, and Signaling; Management messages are FFS	Sync, Follow_Up, Announce, Delay_Req, and Delay_Resp; Signaling and Management messages are FFS
PTP types of clock used in the profile	Packet Master Clock: master-only Ordinary Clock  Packet Slave Clock: slave-only Ordinary Clock	T-GM: master-only Ordinary Clock or master-only Boundary Clock  T-BC: Boundary Clock  T-TSC: slave-only Ordinary Clock Transparent Clocks for future versions

# PTP modes

	G.8265.1	G.8275.1
One-way vs Two-way	One-way and Two-way mode authorized	Two-way mode only
One-step vs two-step clock	One-step clock and Two-step clock supported	One-step clock and Two-step clock supported
Mapping	IPv4/IPv6 unicast mapping (IEEE Std 1588™ Annexes D and E)	Ethernet multicast mapping (IEEE Std 1588™ Annex F), non-forwardable multicast address 01-80-C2-00-00-0E and forwardable multicast address 01-1B-19-00-00-00 can be used
Unicast negotiation	Used to establish unicast sessions (IEEE Std 1588™ Clause 16.1 + specific requirements from ITU-T)	Not used

# PTP message rates

	G.8265.1	G.8275.1
Announce message rate	Minimum rate: one packet every 16 seconds Maximum rate: 8 packets per second Default rate: one packet every 2 seconds	8 packets per seconds
Sync message rate	Minimum rate: one packet every 16 seconds Maximum rate: 128 packets per second	16 packets per seconds
Delay_Req/ Delay_Resp message rate	Minimum rate: one packet every 16 seconds Maximum rate: 128 packets per second	16 packets per seconds

# Alternate BMCA

	G.8265.1	G.8275.1
Type of Alternate Best Master Clock Algorithm	Static Alternate BMCA, master selection is done outside the scope of the PTP protocol	Alternate BMCA with 2 modes: - Fully automatic topology setup (similar to IEEE1588v1 BMCA) - Semi-automatic topology setup
Master selection	Based on G.781 principles: comparison of Quality Level / SSM first, then comparison of local priorities	Based on default BMCA with adaptations (if localPriorities unused), or based on G.781 principles (if localPriorities used)
Multiple active masters	Multiple masters active at the same time is allowed	Multiple masters active at the same time is allowed
PTP attributes used in master selection	clockClass (carries Quality Level information), local priority*	clockClass, clockAccuracy, offsetScaledLogVariance, GM priority2, localPriority*, GM clockId, stepsRemoved, portId, portNumber

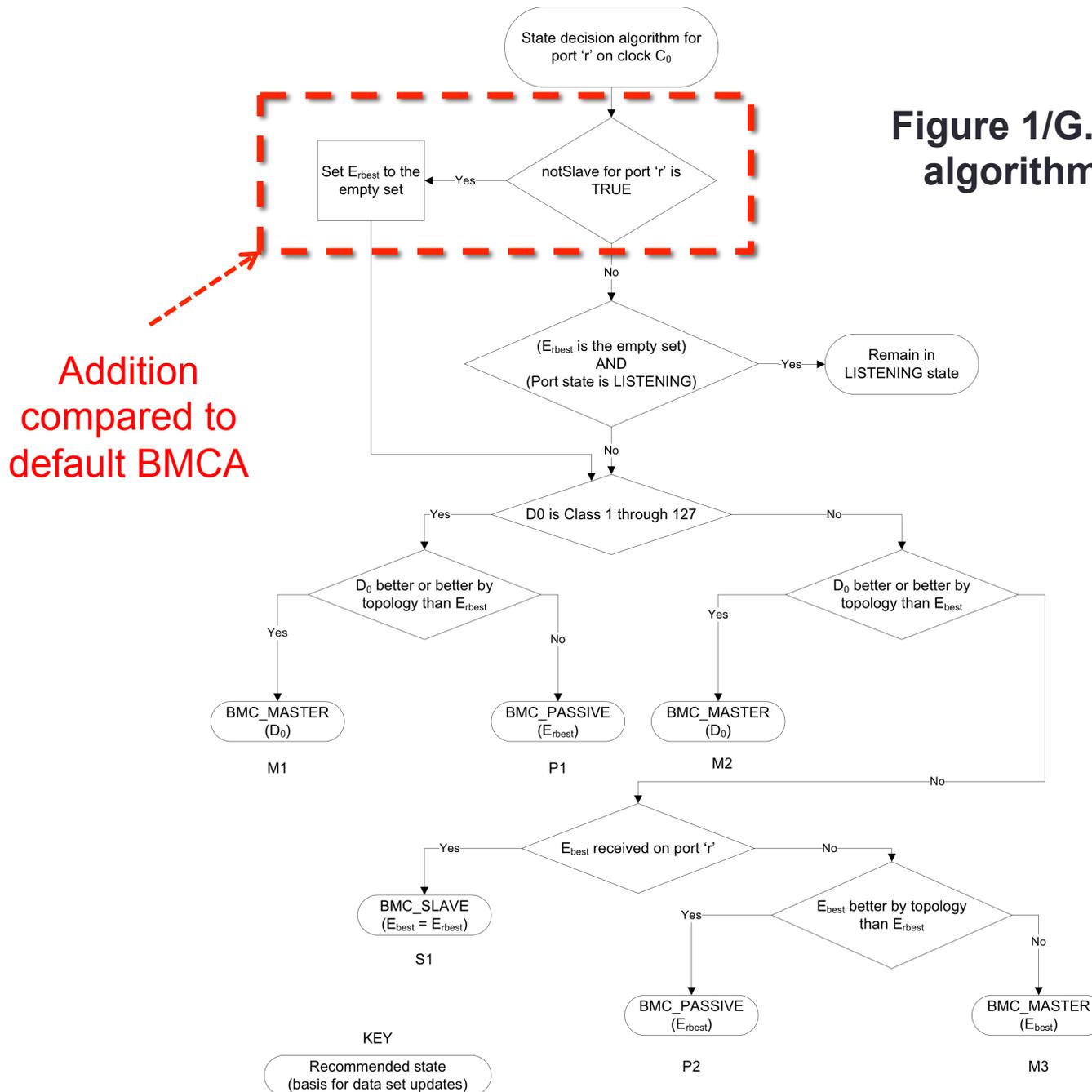
\* not an attribute carried in PTP Announce messages 8

# clockClass values

	G.8265.1	G.8275.1*
T-GM / Packet Master Clock	<u>G.781 Option 1</u> : 84 (PRC), 90 (SSU-A), 96 (SSU-B), 104 (EEC-1), 110 (DNU) <u>G.781 Option 2</u> : 80 (PRS), 82 (STU), 86 (ST2), 90 (TNC), 100 (ST3E), 102 (EEC-2), 106 (SMC), 108 (PROV), 110 (DUS) <u>G.781 Option 3</u> : 82 (UNK), 104 (SEC)	6 (ref from PRTC in locked mode), 7 (within holdover specification), 140 (out of holdover, Category 1), 150 (out of holdover, Category 2), 160 (out of holdover, Category 3), 248 (without time reference since start-up)
T-BC	Not Applicable	135 (within holdover specification), 165 (out of holdover specification), 248 (without time reference since start-up)
T-TSC / Packet Slave Clock	255 (slave does not send Announce messages)	255 (slave does not send Announce messages)

\* G.8275.1 also describes values for equipment deployed prior to this Recommendation

**Figure 1/G.8275.1: State decision algorithm for Alternate BMCA**



# Insight to future G.8275.2

- Many aspects expected to be similar to G.8265.1
- G.8275.2 first draft based on G.8265.1 text, with adaptations
- Assisted Partial Timing Support vs General Partial Timing Support, G.8275.2 telecom profile expected to support both architectures
- Focus on architecture with no BC and single master for the first version
- A-BMCA: expected to be static in first version
- IP unicast mapping has been agreed
- Packet selection will be performed in the slave PTP ports, in order to filter traffic load-related PDV and asymmetry

# Conclusion

- G.8275.x time PTP telecom profiles are designed to support the needs of current and future mobile technologies
- G.8275.1 (full timing support) has been finalized recently in ITU-T
- G.8275.2 (partial timing support) definition is now on-going, and will reuse many aspects specified in G.8265.1



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# Acronyms

- PTP: Precision Time Protocol
- M: Master
- S: Slave
- T-GM: Telecom-Grandmaster
- T-BC: Telecom-Boundary Clock
- T-TSC: Telecom-Time Slave Clock
- BC: Boundary Clock
- QL: Quality Level
- PRC: Primary Reference Clock
- PRS: Primary Reference Source