IEEE 1588™ TELECOMMUNICATIONS CONFORMANCE PROGRAM

An IEEE-SA Conformity Assessment Program

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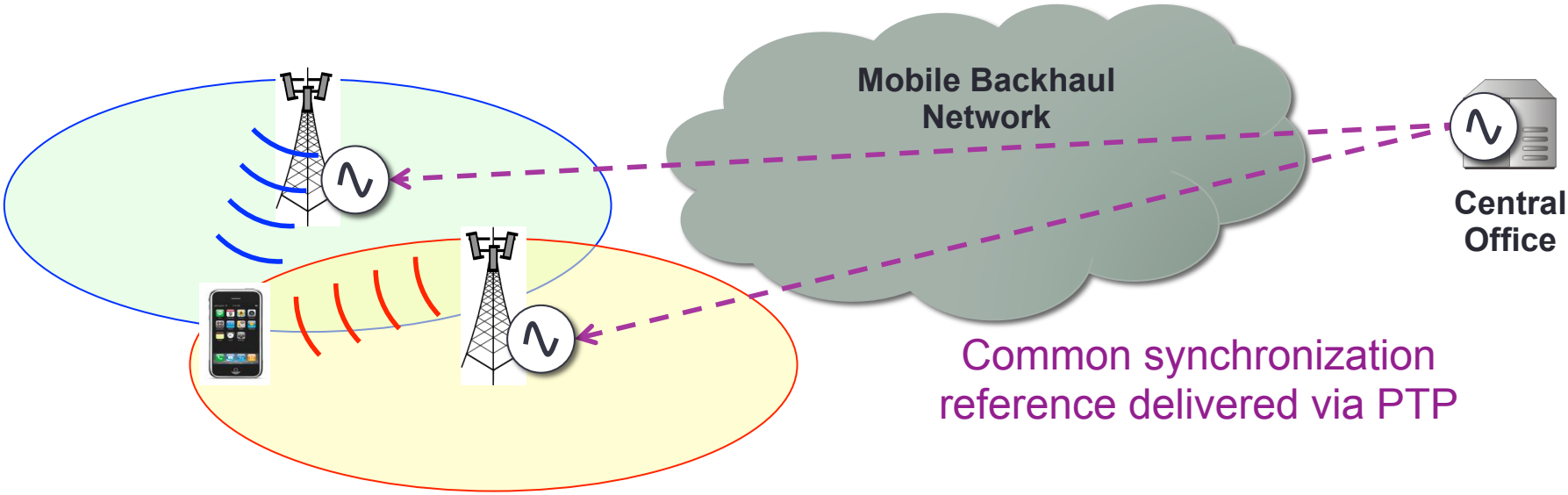
IEEE-SA Conformity Assessment Program for IEEE 1588™

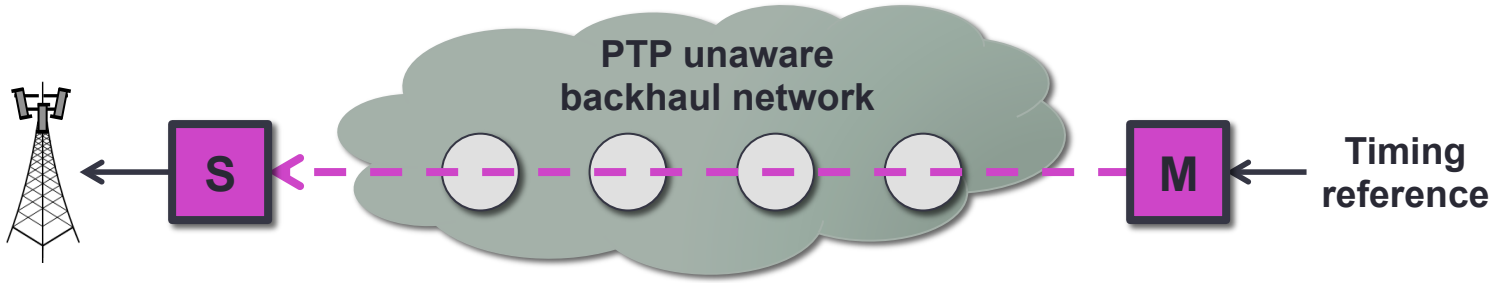
- IEEE-SA initiative (transitioned recently from IEEE-ISTO, see Press Release)
- First Conformity Assessment Program launched by IEEE-SA reaching its regular phase
- First vendors with compliant Packet Master Clock or Packet Slave Clock implementations have been announced in June 2014
- Unique place where PTP protocol is tested in depth, essential for interoperability between vendors
- Next steps are in preparation: G.8275.1 Program
- Iometrix, officially authorized ICAP test lab

Synchronization for mobile networks

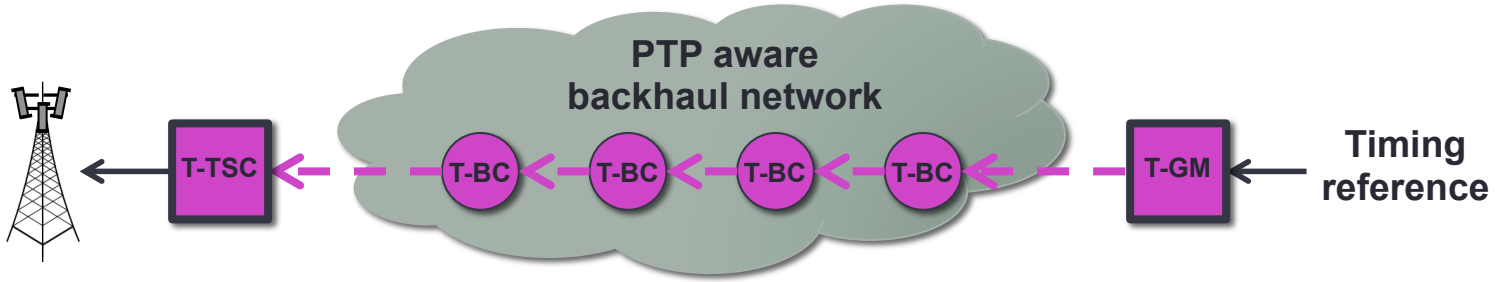


- 4G/LTE and 5G/LTE-A base stations require accurate synchronization to avoid interferences and ensure successful handovers and efficient radio spectrum usage
- Poor synchronization results in poor user experience caused by dropped calls and erratic throughput

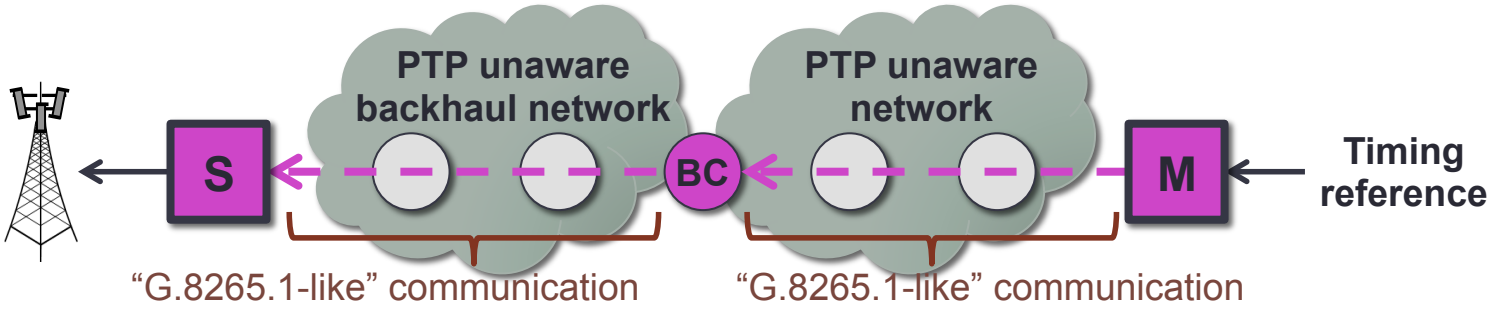
IEEE 1588™ & PTP telecom profiles



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

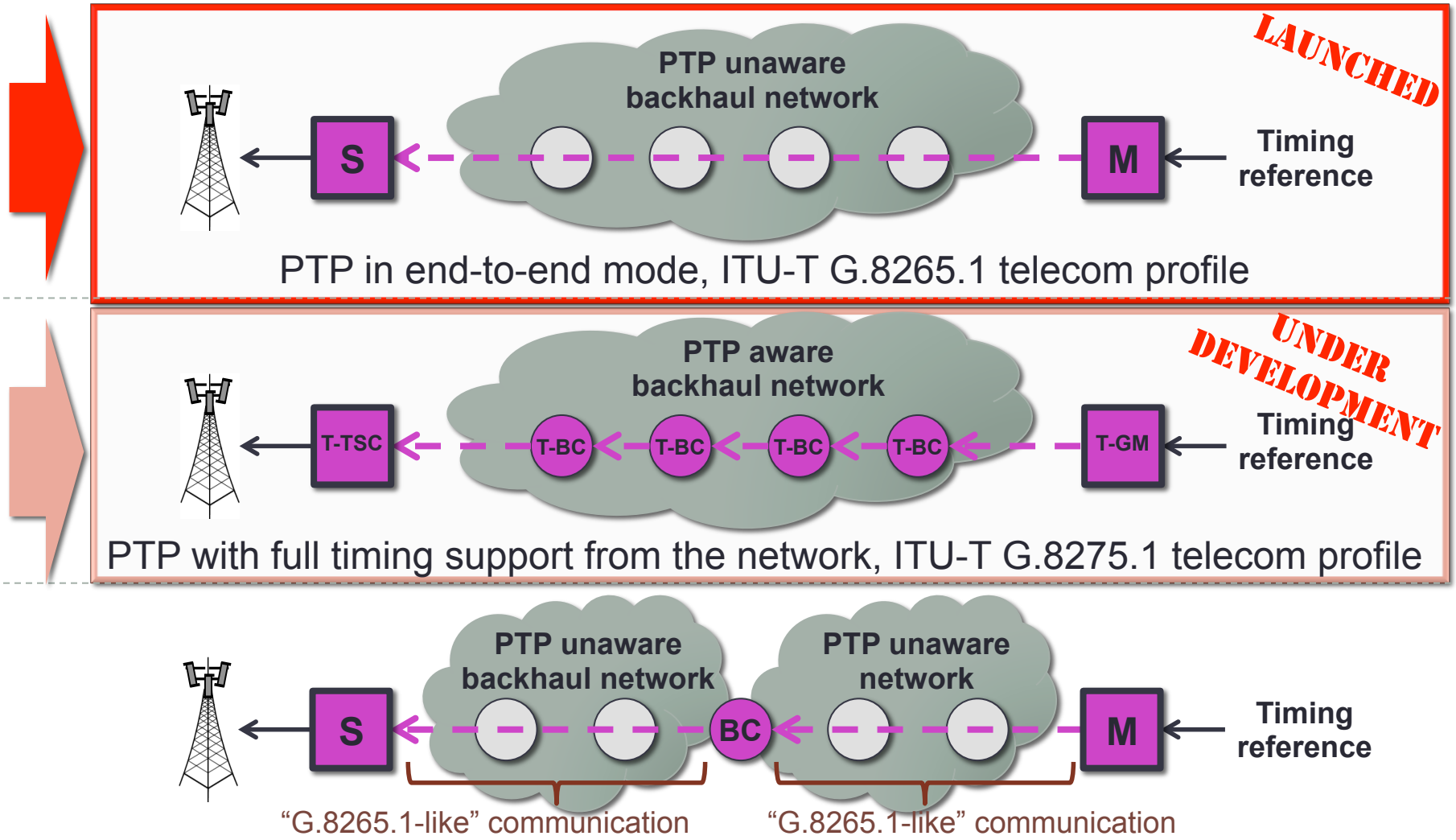


PTP with full timing support from the network, ITU-T G.8275.1 telecom profile

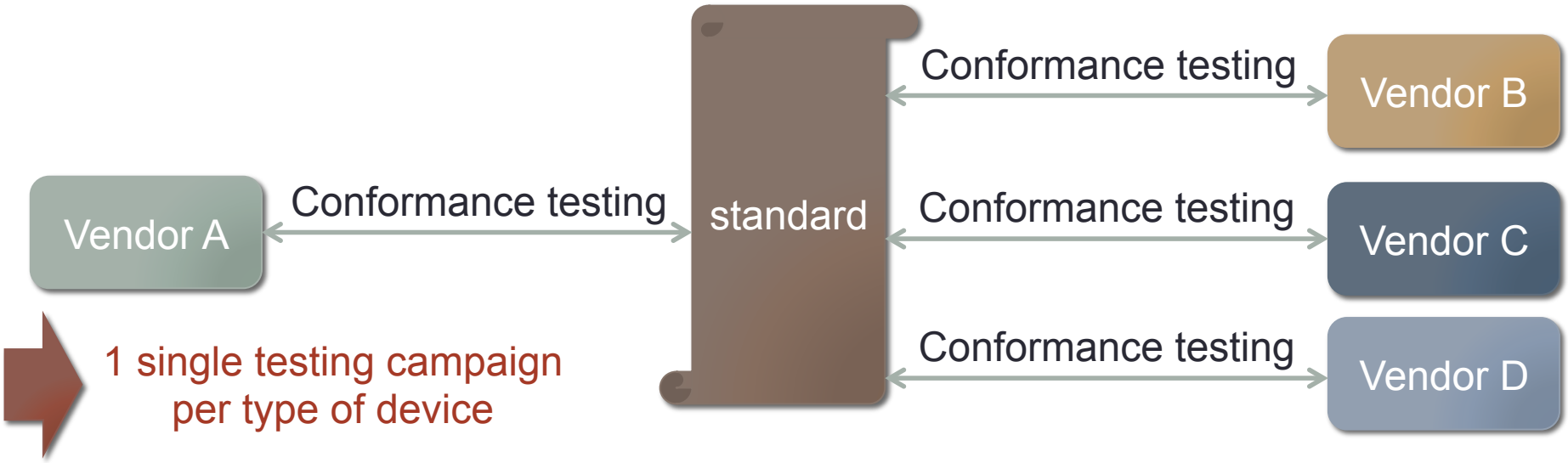


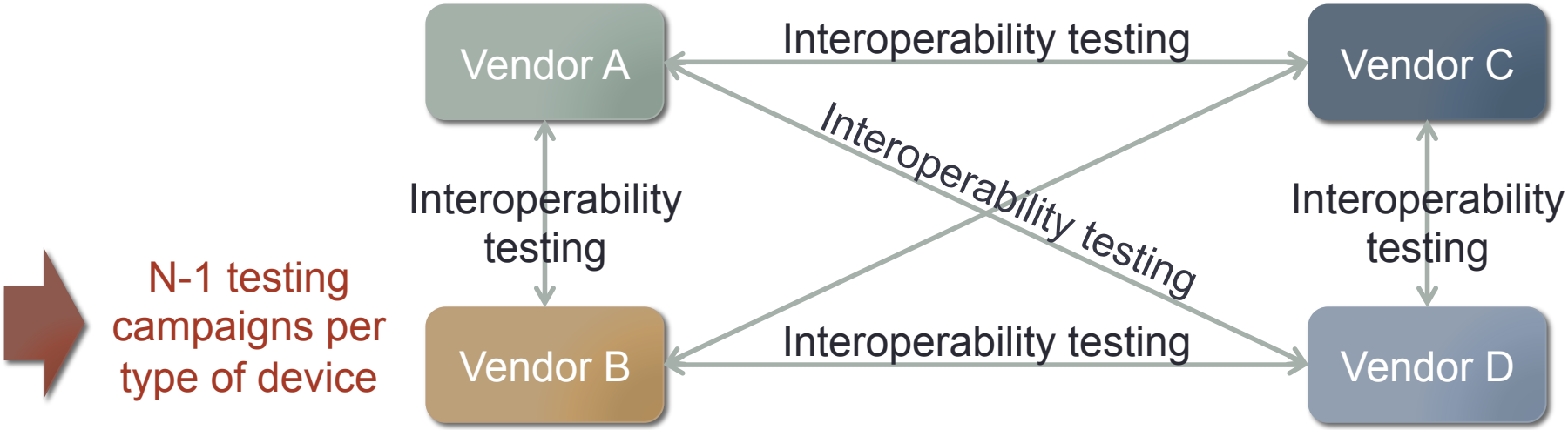
PTP with partial timing support from the network, ITU-T G.8275.2 telecom profile, under study in ITU-T

Status of IEEE 1588™ Certification Programs



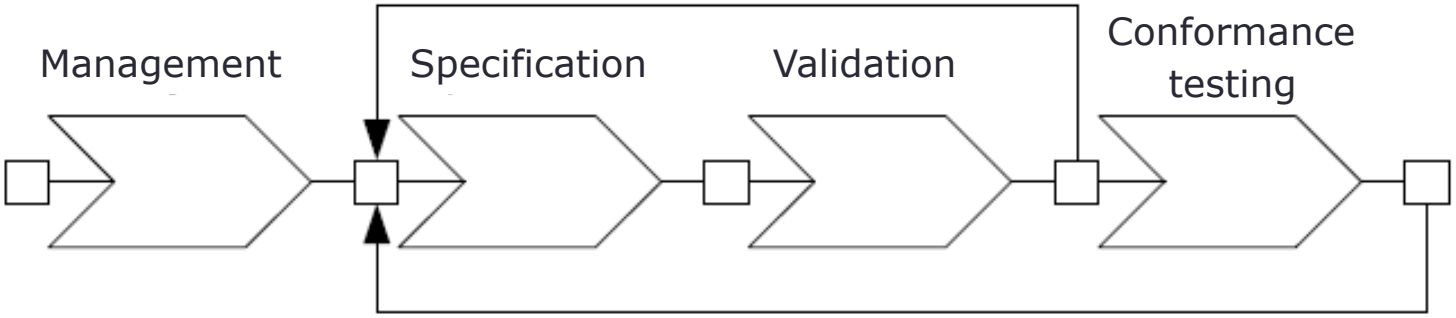
Importance of conformance testing





ICAP 1588™ Program

- Industry's first IEEE 1588™ conformance program in telecom environments (IEEE Std 1588™-2008 and ITU-T G.8265.1 / G.8275.1 standards)
- Completes the standardization process with a single and universally recognized conformity assessment testing process based on industry-approved test plan



Feedback from validation and testing to base standards

(Credits: Martin Brand, vice-chairman SG11, ETSI presentation "Achieving Interoperable Standards")

Business Motives and Rationale

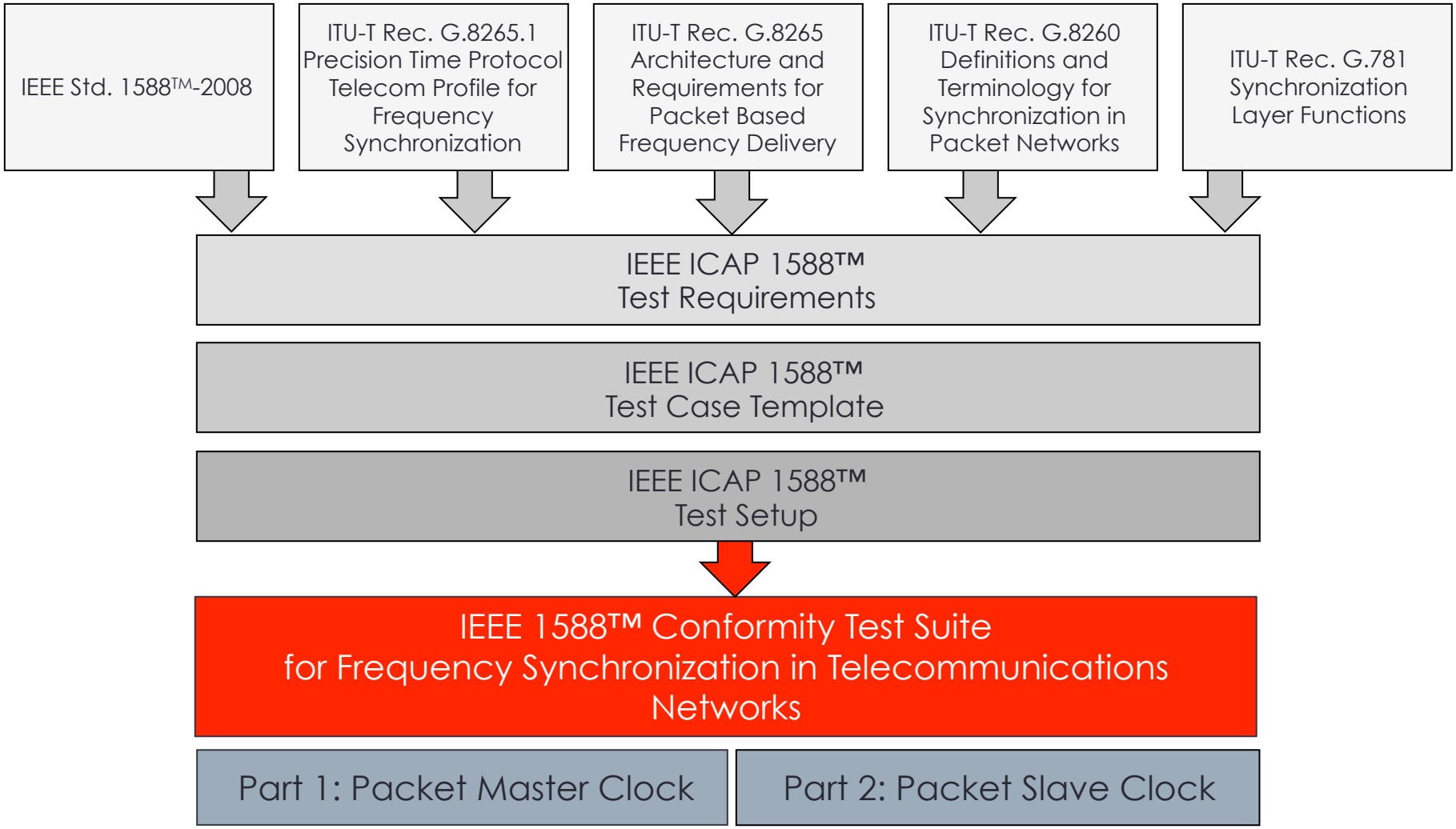
For Service Providers

- Meets service provider requirements for compliant IEEE 1588™ telecom products
- Accelerates and eases equipment sourcing and selection process
- Requirement expected in service provider RFPs for mobile backhaul

For Vendors

- Replaces vendor need to undergo multiple service providers' internal test programs
- Demonstrates commitment to latest industry timing and synchronization standards
- High-level of interoperability once equipment is deployed, reduces issues in the field

IEEE 1588™ Conformity Test Suite



IEEE 1588™ Test Case Scope

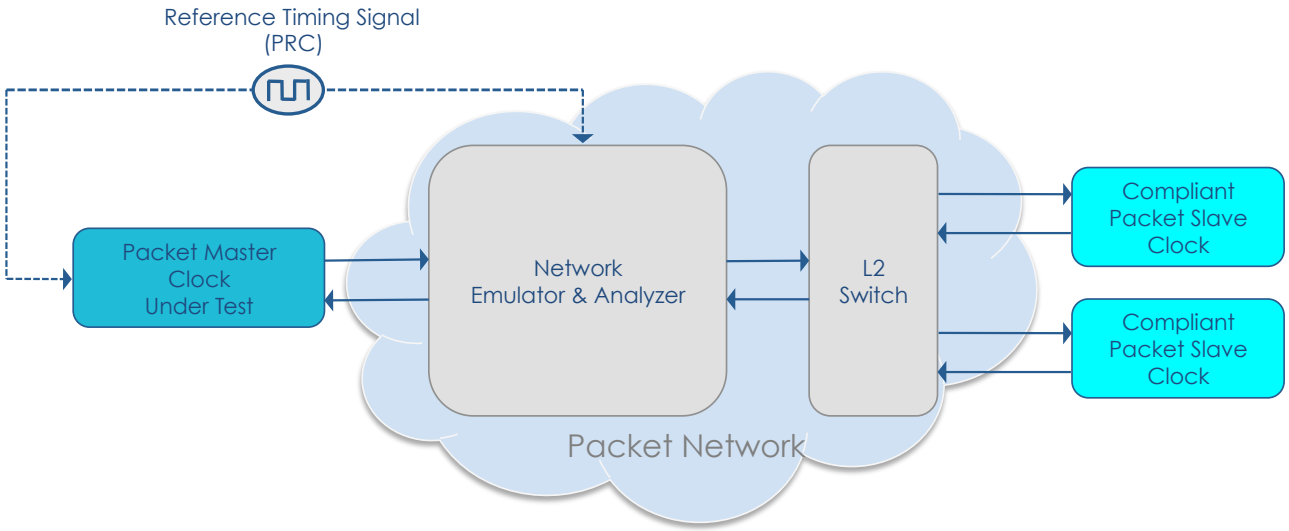
IEEE 1588™ Packet Master Clock Conformance 346 Test Cases	
ONE-STEP CLOCK	TWO-STEP CLOCK
○ Grant, Cancellation & Cancellation Ack. of Announce Messages - Signaling Message Format ○ Unicast Session - Announce Messages ○ Announce Message Format	
○ Grant, Cancellation & Cancellation Ack. of Sync Messages - Signaling Message Format ○ Unicast Session - Sync Messages ○ Sync and Follow Up Message Format	
○ Grant, Cancellation & Cancellation Ack. of Delay_Resp Messages - Signaling Message Format ○ Unicast Session - Delay_Resp Messages ○ Delay_Resp Message Format	
○ SSM Quality Levels & PTP clockClass Values	
○ Specific Cases Involving Multiple Messages	

IEEE 1588™ Packet Slave Clock Conformance 375 Test Cases	
ONE-WAY TIMING MODE	TWO-WAY TIMING MODE
○ Request, Cancellation & Cancellation Ack. of Announce Messages - Signaling Message Format ○ Request of Announce Messages - Configurable Range	
○ Request, Cancellation & Cancellation Ack. of Sync Messages - Signaling Message Format ○ Request of Sync Messages - Configurable Range	
○ Request, Cancellation & Cancellation Ack. of Delay_Resp Messages - Signaling Message Format ○ Request of Delay_Resp Messages - Configurable Range	
○ Unicast Session of Delay_Req/Delay_Resp ○ Delay_Req Message Format	
○ Alternate Best Master Clock Algorithm and Master Selection ○ Protection Functions	
○ Denied Requests of Unicast Messages ○ Specific Cases Involving Multiple Messages	

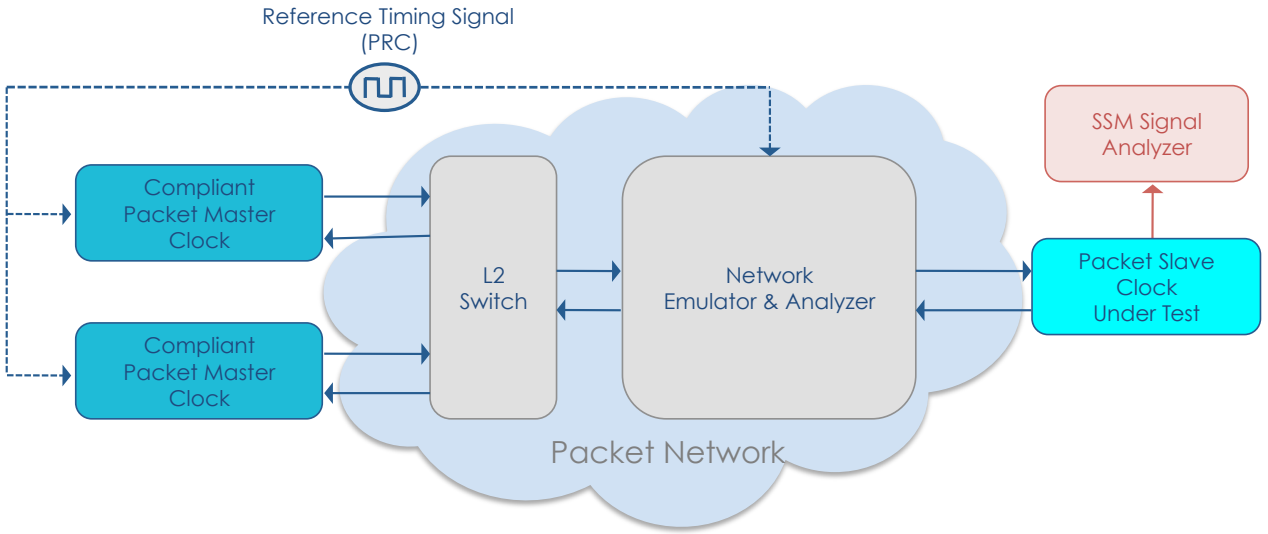
Scope of the conformance program: PTP protocol communication between master and slave

IEEE 1588™ Test Beds

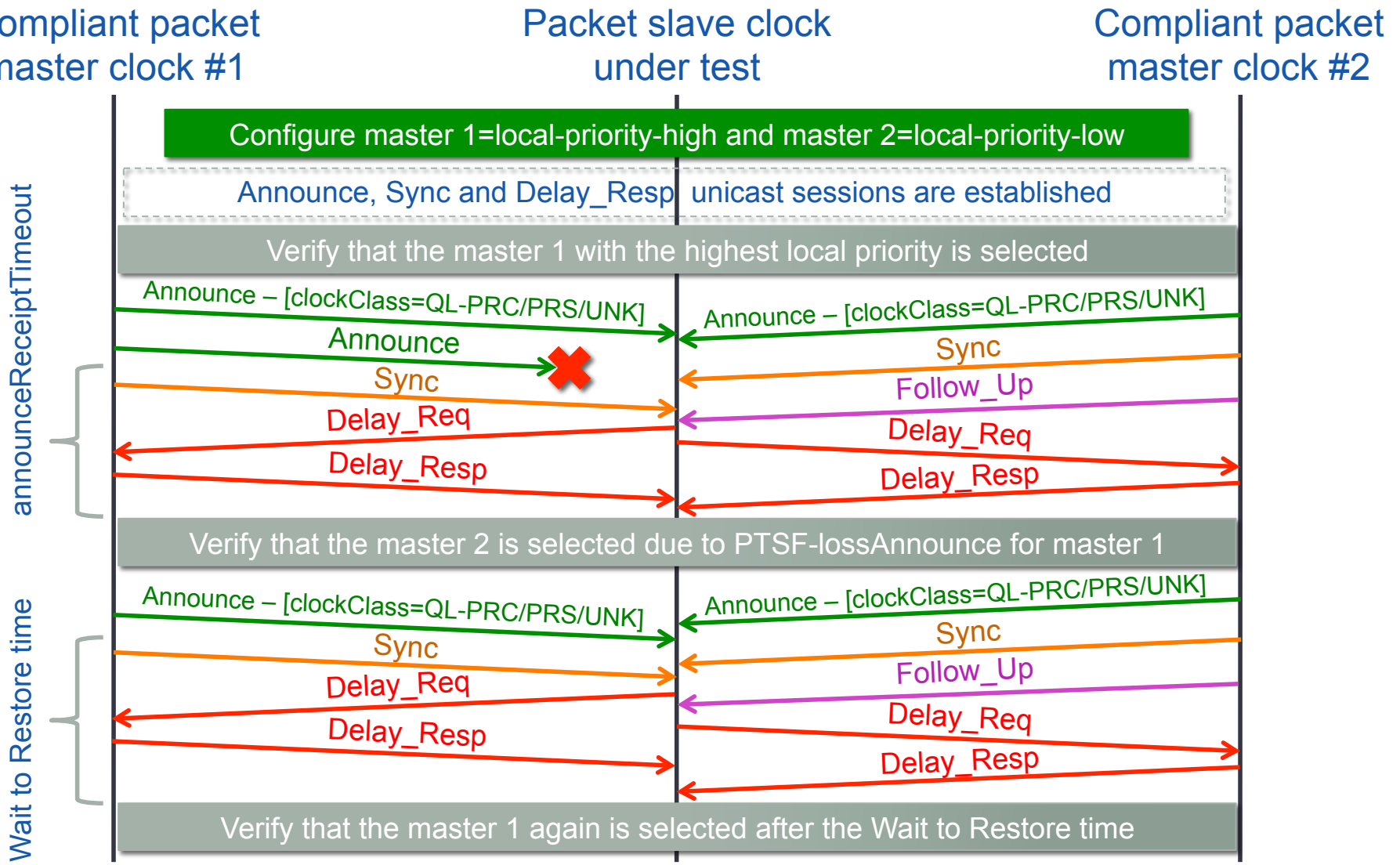
Test bed for Packet Master Clock:



Test bed for Packet Slave Clock:

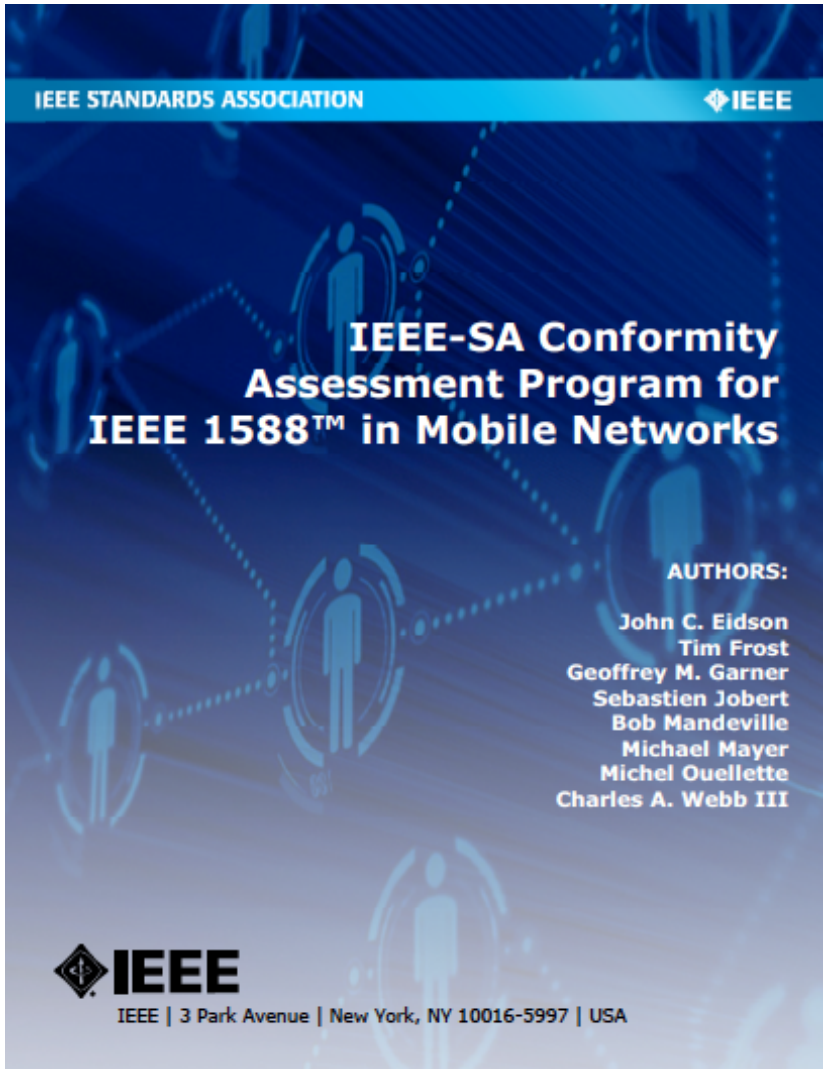


Example of Slave testing scenario



* G.781 Options 1, 2 and 3 are tested

ICAP White Paper published



http://standards.ieee.org/about/icap/active-programs.html

iometrix
THE STANDARD FOR TESTING

Official Testing Lab of:

IEEE STANDARDS ASSOCIATION
IEEE

IEEE 1588 Testing
First IEEE-sanctioned program for timing and synchronization in mobile networks

MEF

Carrier Ethernet Testing
Equipment & Services

CloudEthernet.org

OpenCloud Project
Reference test bed for Cloud Networks & Services

Iometrix: The Standard for Testing

- The networking industry's preeminent testing authority
- Official testing lab of major Standards Development Organizations
- Iometrix is an A2LA accredited ISO/IEC 17025 CAB (Conformity Assessment Body)
- Delivers conformance testing to a broad spectrum of telecom equipment manufacturers and service providers worldwide
- Focus on packet network protocols, technologies and services
- Editor of numerous test specifications in leading standards bodies including the ITU, BBF, IEEE, IETF, CEF and MEF
- Headquartered in Silicon Valley, California with operations and activities around the globe

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
- PTSF: Packet Timing Signal Fail