

# IEEE 1588™ TELECOMMUNICATIONS CONFORMANCE PROGRAM

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An IEEE Conformity Assessment Program

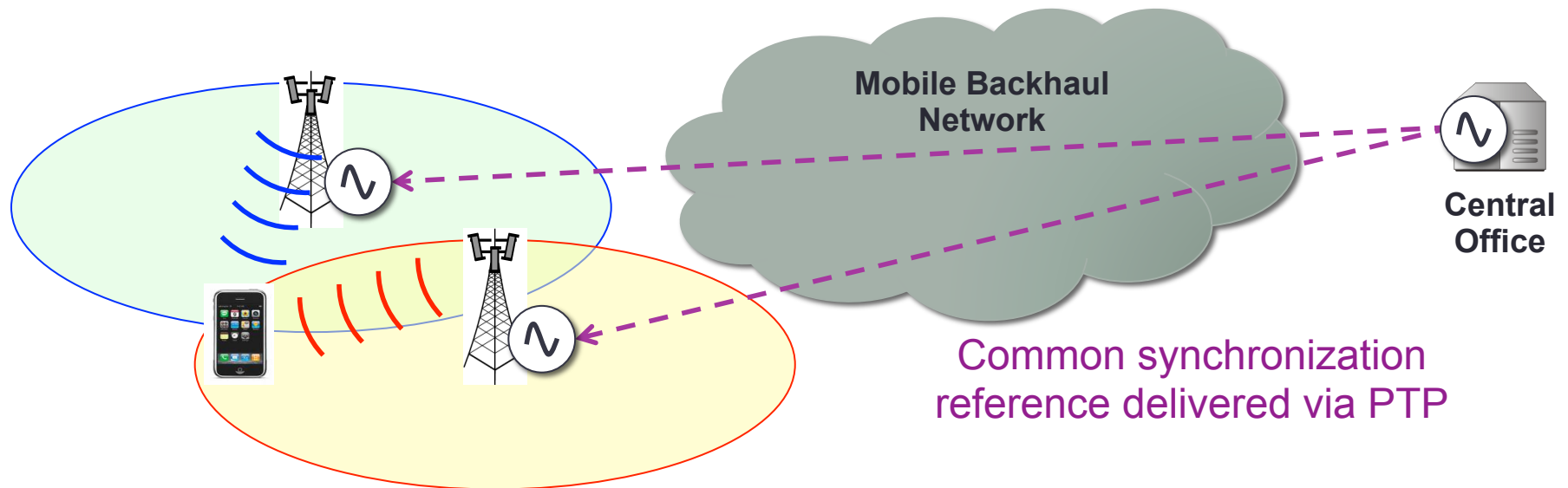
**IEEE-ISTO**

Industry Standards and Technology Organization  
*affiliated with the IEEE and the IEEE Standards Association*



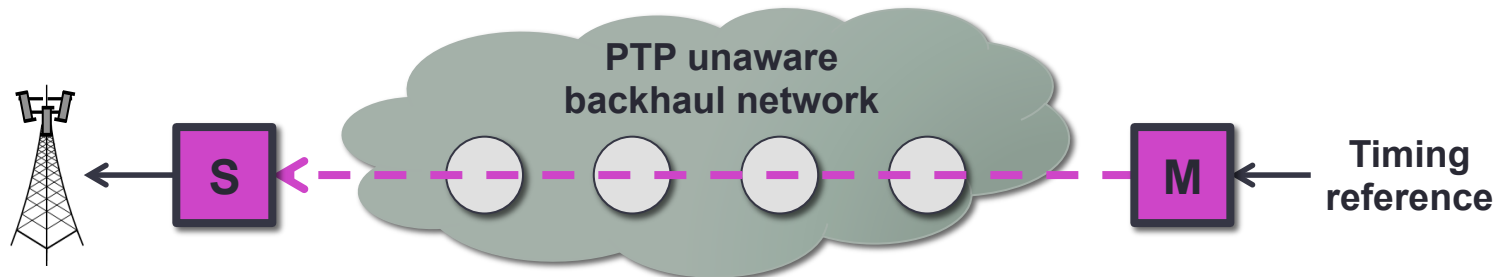
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June 11<sup>th</sup> 2014

# Synchronization for mobile networks

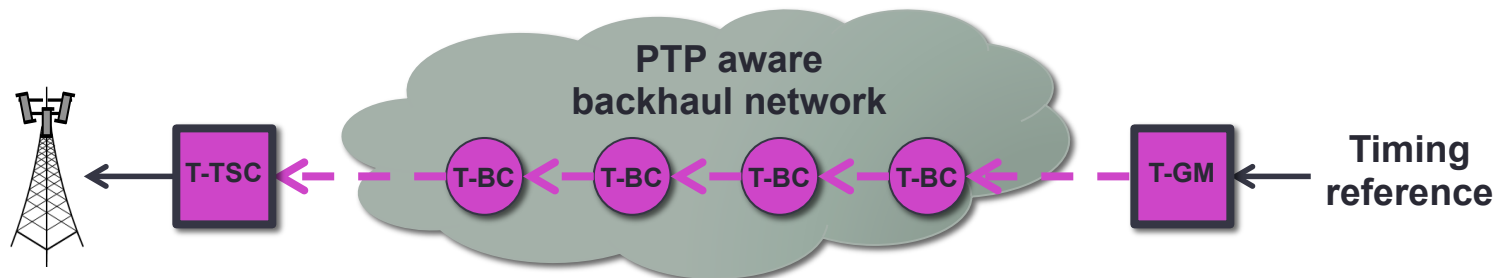


- 4G/LTE and 5G/LTE-A base stations require accurate synchronization to avoid interferences and ensure successful handovers and efficient radio spectrum usage
- Poor synchronization results in poor user experience caused by dropped calls and erratic throughput

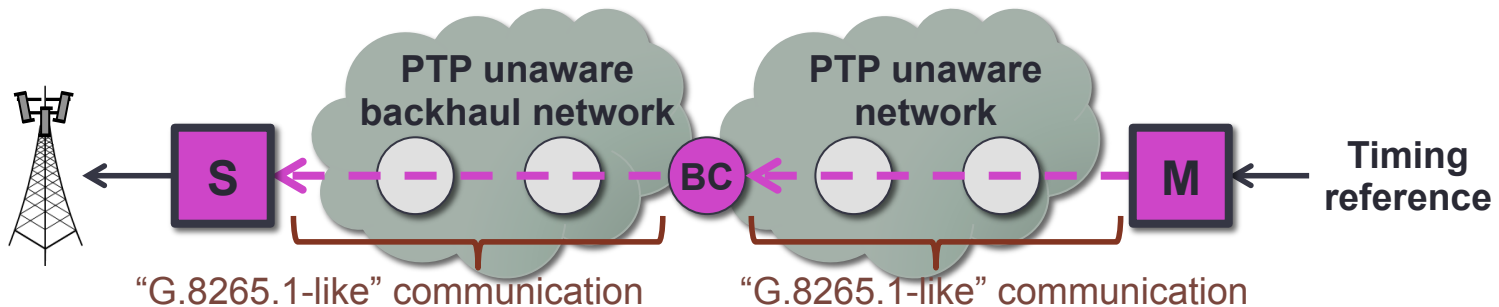
# IEEE 1588™ & PTP telecom profiles



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

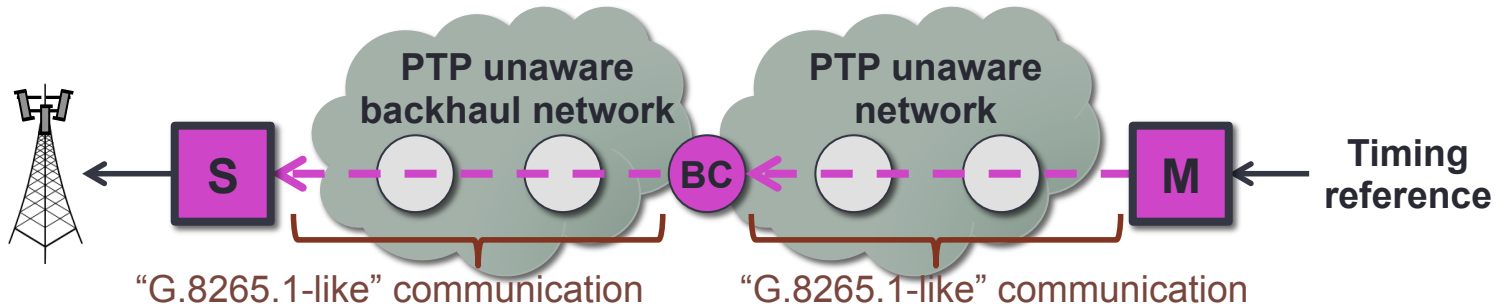
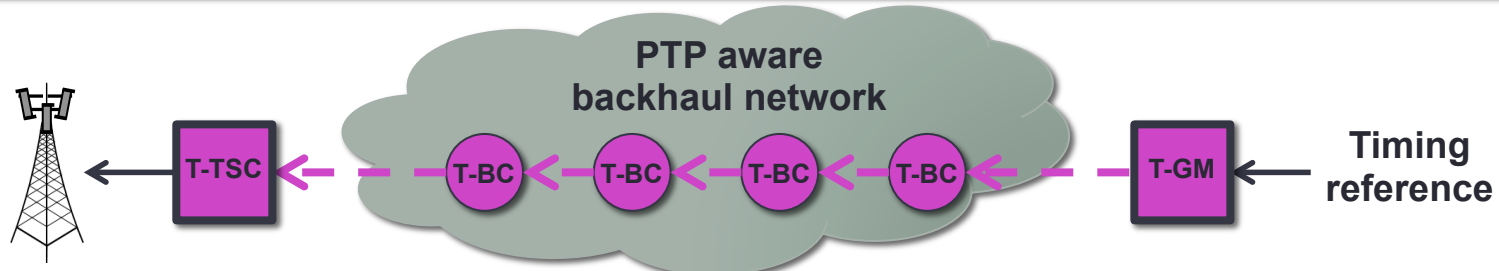
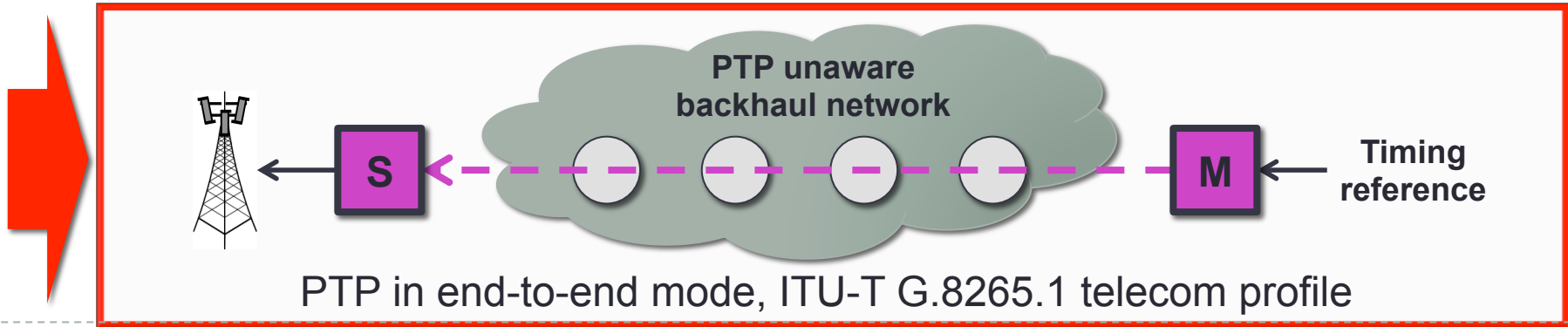


PTP with full timing support from the network, ITU-T G.8275.1 telecom profile



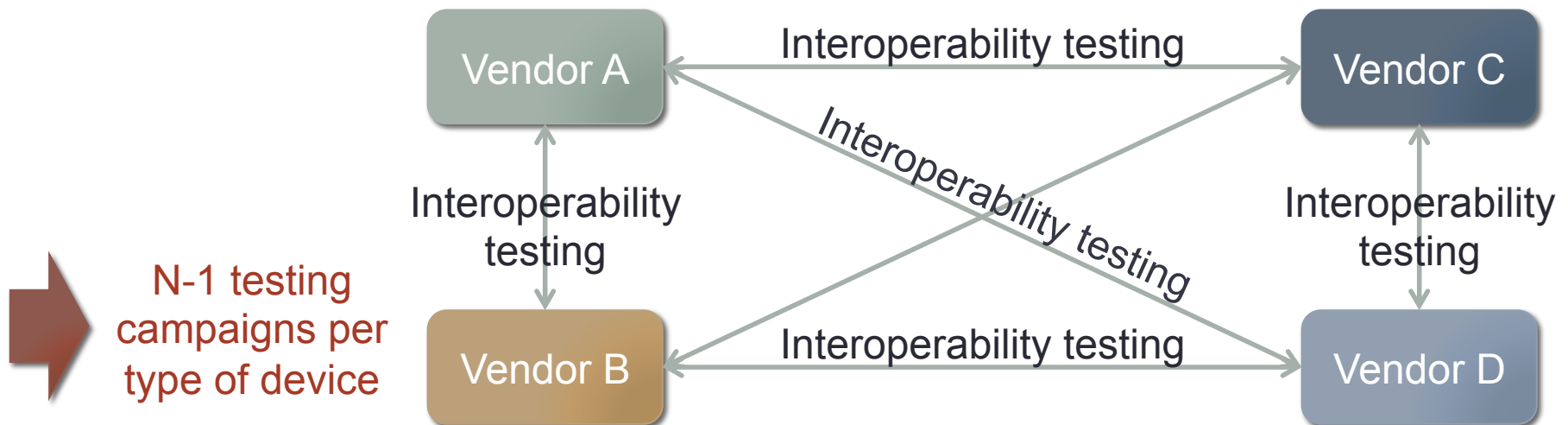
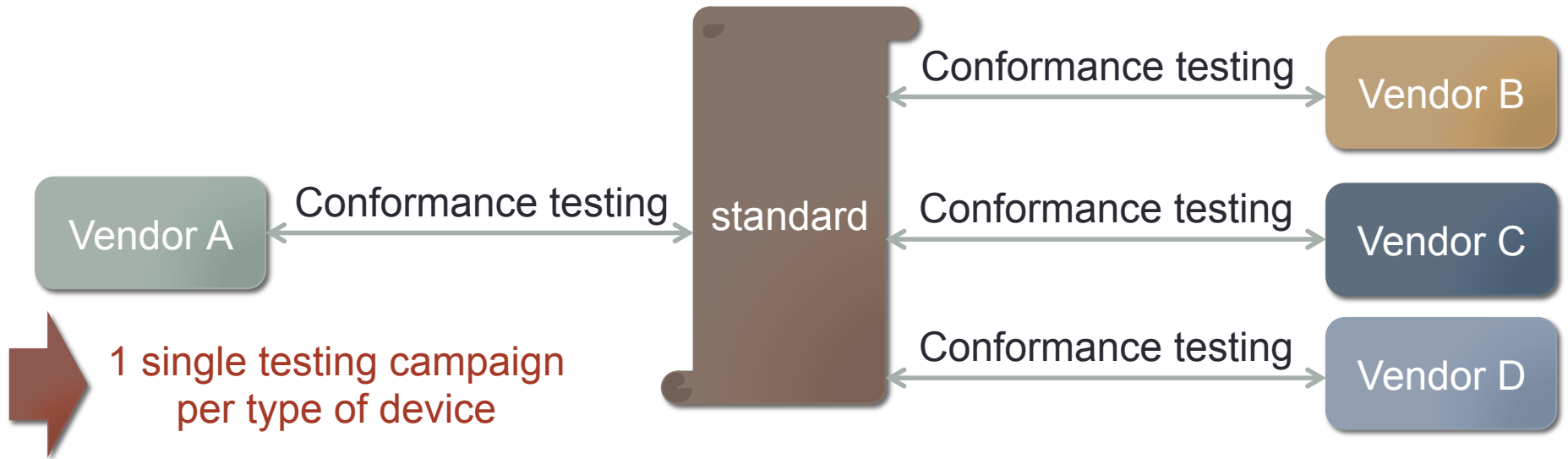
PTP with partial timing support from the network, ITU-T G.8275.2 telecom profile, under study in ITU-T

# IEEE 1588™ & PTP telecom profiles



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

# Importance of conformance testing





## ICAP IEEE 1588™ Program

- Joint initiative of IEEE-SA and IEEE-ISTO
- Industry's first IEEE 1588™ conformance program in telecom environments (IEEE Std 1588™-2008 and ITU-T G.8265.1 standards)
- Completes the standardization process with a single and universally recognized conformity assessment testing process based on an industry-approved test plan
- Focus on Packet Master Clocks and Packet Slave Clocks for high growth packet-based mobile backhaul networks
- Iometrix, officially authorized ICAP test lab

# Update on ICAP 1588™ Program

- First Conformity Assessment Program launched by IEEE reaching its regular phase
- Unique place where PTP protocol is tested in depth, essential for interoperability between vendors
- First vendors with compliant Packet Master Clock or Packet Slave Clock implementations have been announced
- Other vendors are currently under test

# Business Motives and Rationale

## For Service Providers

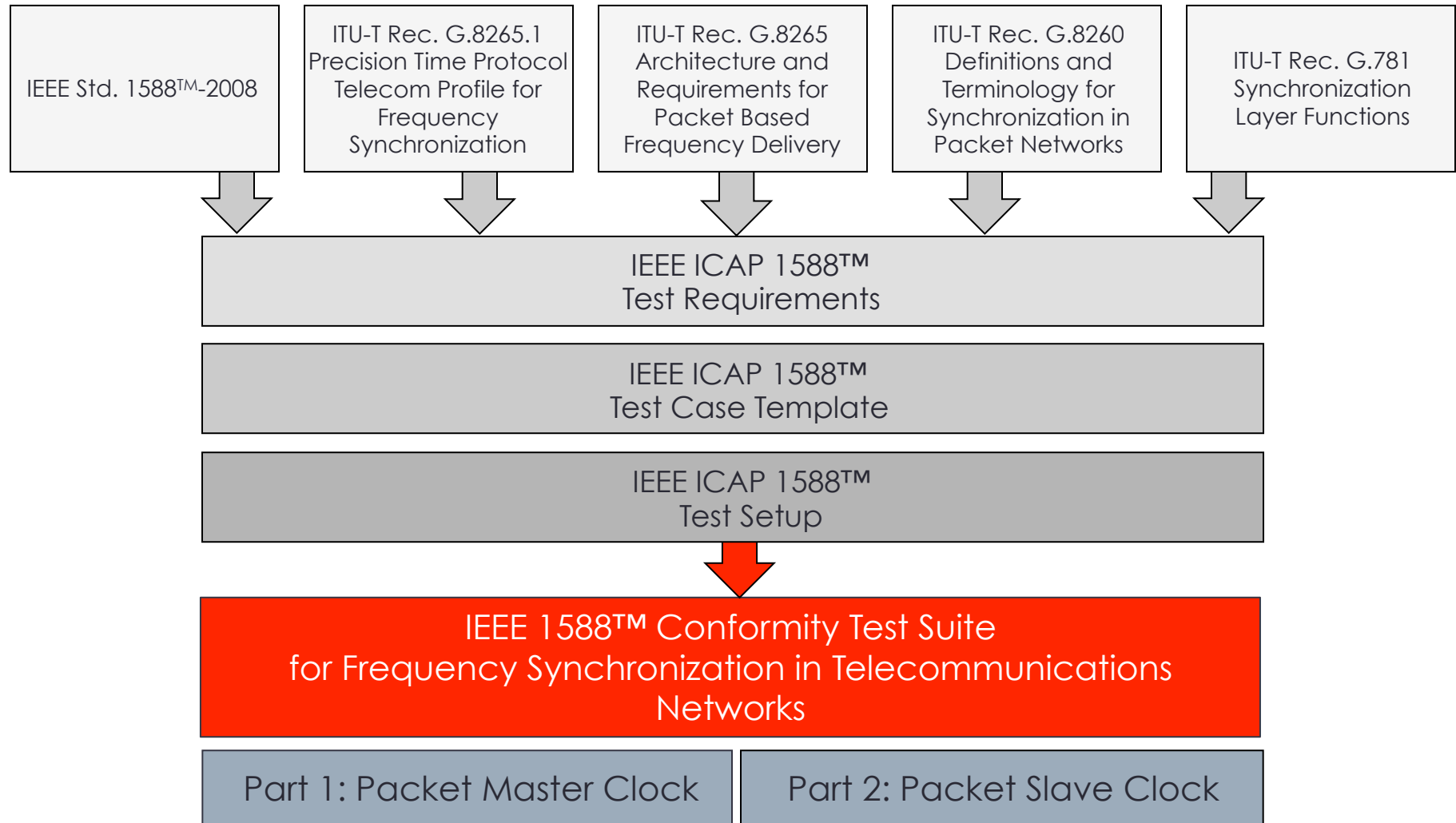
- Meets service provider requirements for compliant IEEE 1588™ telecom products
- Accelerates and eases equipment sourcing and selection process
- Requirement expected in service provider RFPs for mobile backhaul

## 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



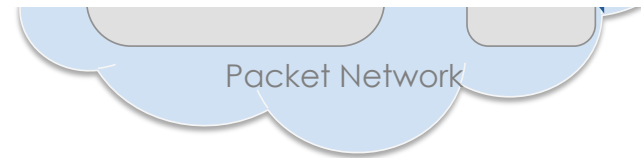
# IEEE 1588™ Test Case Scope

IEEE 1588™ Packet Master Clock Conformance 346 Test Cases	
ONE-STEP CLOCK	TWO-STEP CLOCK
<ul style="list-style-type: none"> <li>Grant, Cancellation &amp; Cancellation Ack. of Announce Messages - Signaling Message Format</li> <li>Unicast Session - Announce Messages</li> <li>Announce Message Format</li> </ul>	
<ul style="list-style-type: none"> <li>Grant, Cancellation &amp; Cancellation Ack. of Sync Messages - Signaling Message Format</li> <li>Unicast Session - Sync Messages</li> <li>Sync and Follow Up Message Format</li> </ul>	
<ul style="list-style-type: none"> <li>Grant, Cancellation &amp; Cancellation Ack. of Delay_Resp Messages - Signaling Message Format</li> <li>Unicast Session - Delay_Resp Messages</li> <li>Delay_Resp Message Format</li> </ul>	
<ul style="list-style-type: none"> <li>SSM Quality Levels &amp; PTP clockClass Values</li> </ul>	
<ul style="list-style-type: none"> <li>Specific Cases Involving Multiple Messages</li> </ul>	

IEEE 1588™ Packet Slave Clock Conformance 375 Test Cases	
ONE-WAY TIMING MODE	TWO-WAY TIMING MODE
<ul style="list-style-type: none"> <li>Request, Cancellation &amp; Cancellation Ack. of Announce Messages - Signaling Message Format</li> <li>Request of Announce Messages - Configurable Range</li> </ul>	
<ul style="list-style-type: none"> <li>Request, Cancellation &amp; Cancellation Ack. of Sync Messages - Signaling Message Format</li> <li>Request of Sync Messages - Configurable Range</li> </ul>	
<ul style="list-style-type: none"> <li>Request, Cancellation &amp; Cancellation Ack. of Delay_Resp Messages - Signaling Message Format</li> <li>Request of Delay_Resp Messages - Configurable Range</li> </ul>	
<ul style="list-style-type: none"> <li>Unicast Session of Delay_Req/Delay_Resp</li> <li>Delay_Req Message Format</li> </ul>	
<ul style="list-style-type: none"> <li>Alternate Best Master Clock Algorithm and Master Selection</li> <li>Protection Functions</li> </ul>	
<ul style="list-style-type: none"> <li>Denied Requests of Unicast Messages</li> <li>Specific Cases Involving Multiple Messages</li> </ul>	

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

# IEEE 1588™ Test Beds



Test bed for Packet  
Master Clock:



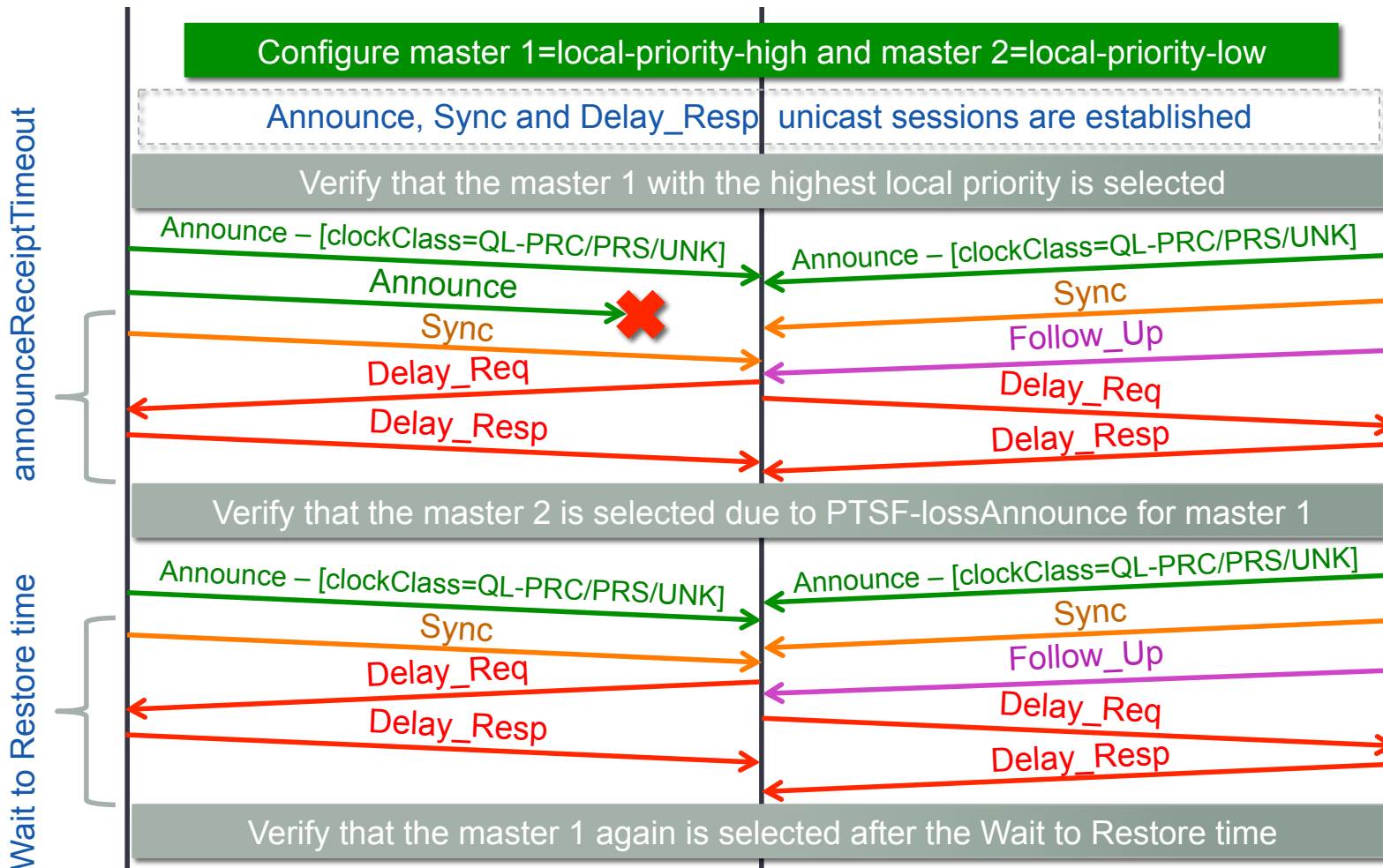
Test bed for Packet  
Slave Clock:

# Example of Slave testing scenario

Compliant packet  
master clock #1

Packet slave clock  
under test

Compliant packet  
master clock #2



\* G.781 Options 1, 2 and 3 are tested <sup>12</sup>



Official Testing Lab of:



**IEEE 1588 Testing**  
*IEEE Std. 1588™-2008 (v2)*



**Carrier Ethernet Testing**  
*Equipment & 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, BIF, IEEE, IETF 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