

Synchronous Ethernet based mobile backhaul – integrated transport and synchronization management

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Clock Synchronization Is Critical

■ Synchronization requirements:

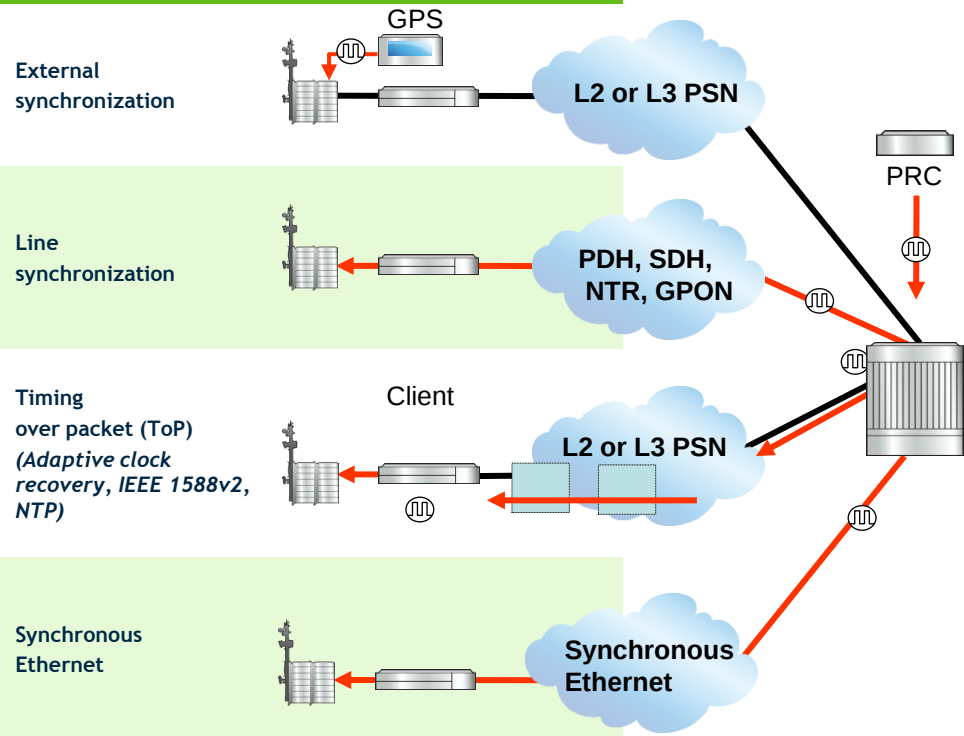
- Generally, 2G/3G networks require frequency sync, with exception of CDMA which also needs phase sync
- Now with LTE, two approaches:
 - FDD mode – requires frequency only with some exceptions (e.g., eMBMS)
 - TDD mode – requires both frequency and phase synchronization
 - Small Cells with Macro Cell Coordination - requires freq & phase synchronisation

■ Implementation solutions:

- Multiple proven sync options for different environments
- Migration to packet-based networks and instances where phase synchronization is required are leading to new approaches
- Optimal solution depends on mobile technology requirements and the available backhaul capabilities

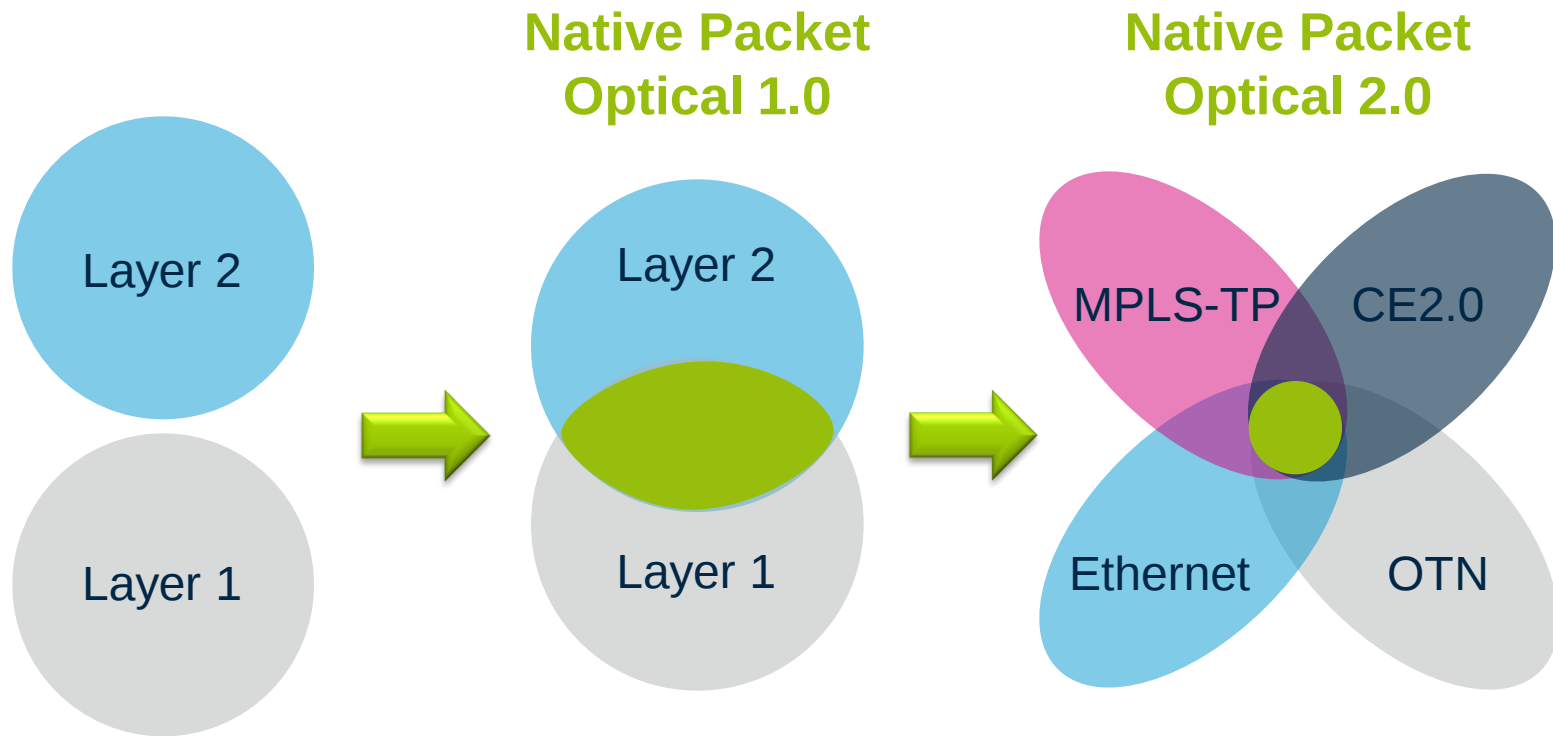
Multiple techniques available for the distribution and acquisition of synchronization.

Approach

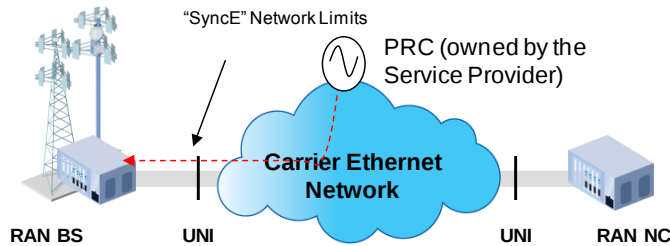


Converged Packet-Optical Solutions

How to integrate
WDM and Ethernet?



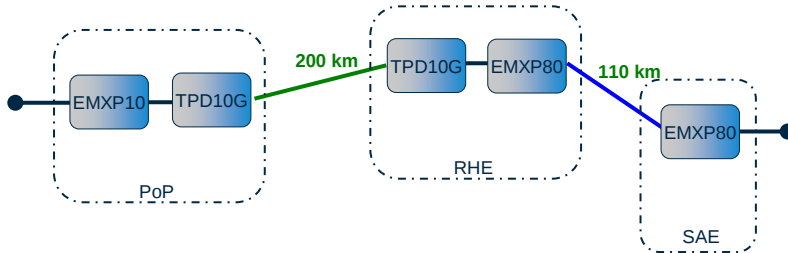
Native Packet Optical – Synchronous Mobile Backhaul



MEF 22.1 Mobile Backhaul Implementation Agreement Phase 2

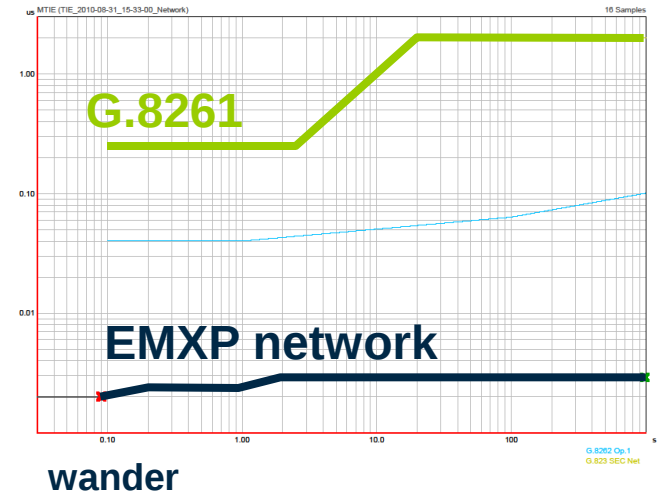
MEF 22.1
LTE Networks

~70x better



Measured EMXP performance in real mobile backhaul network

- Ethernet Muxponder (EMXP) built for the new Ethernet transport requirements:
 - Better than 1 ppb Holdover (15 min)
 - About 70 times better than MEF 22.1 for LTE networks
- Real networks require margins for air interface



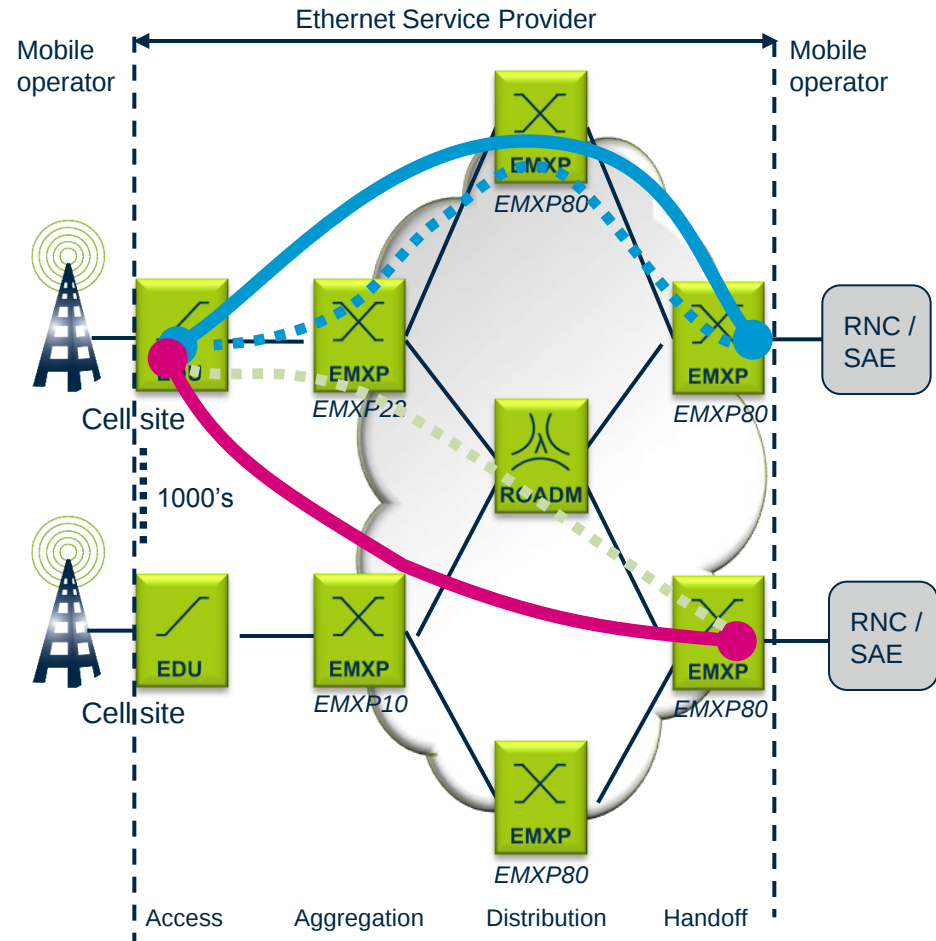
EMXP/EDU provides Layer 2 Packet Synchronization

SyncE

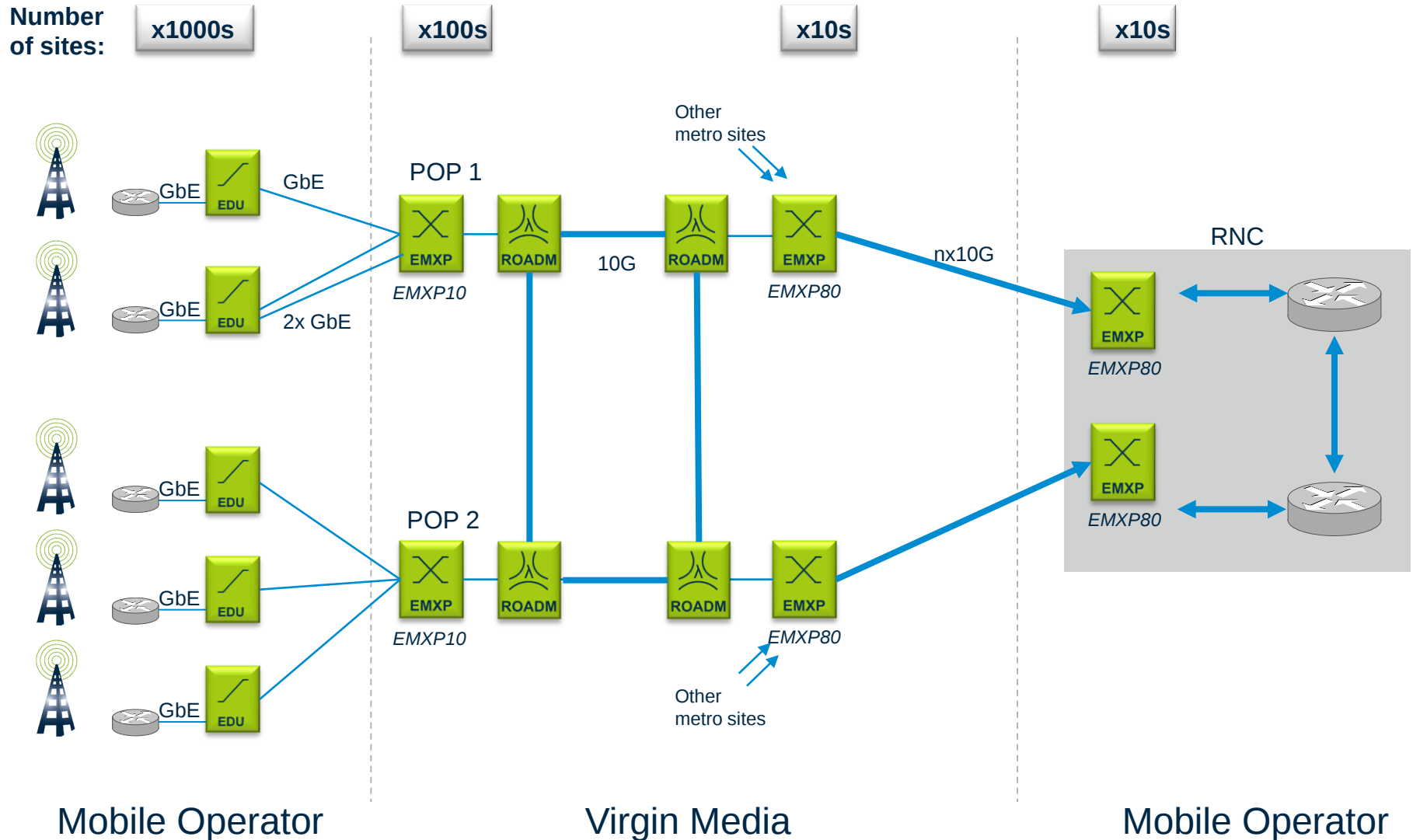
- **Transmode's unique patented sync circuitry revolutionises sync quality**
- Achieved through thorough analysis of all product design with respect to Sync.
- High level of Sync expertise that holds several patents in the area

1588v2 (required for LTE Time of Day)

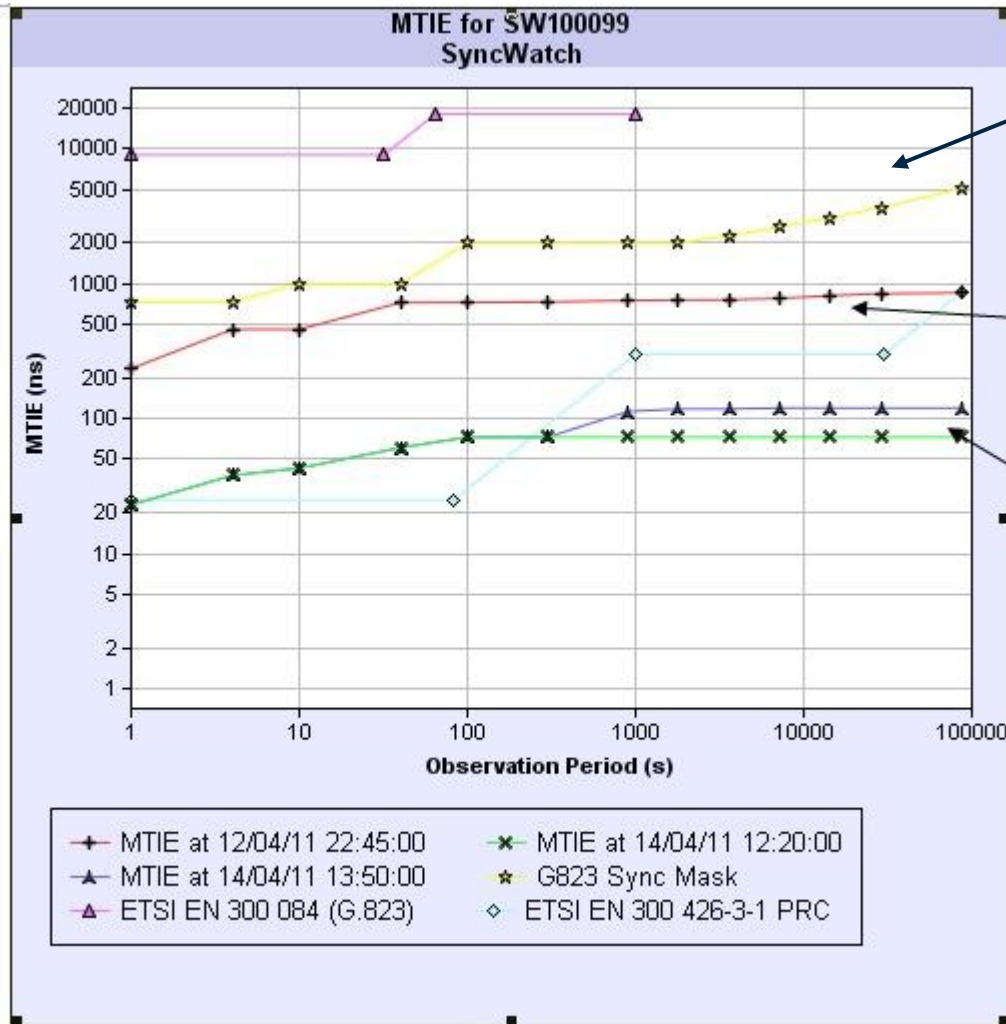
- Transmode's approach is transparent, treated as transport
- Best in class backhaul network supports 1588v2 scalability



Case Study – Virgin Media – Mobile Backhaul Wholesale



Real world example



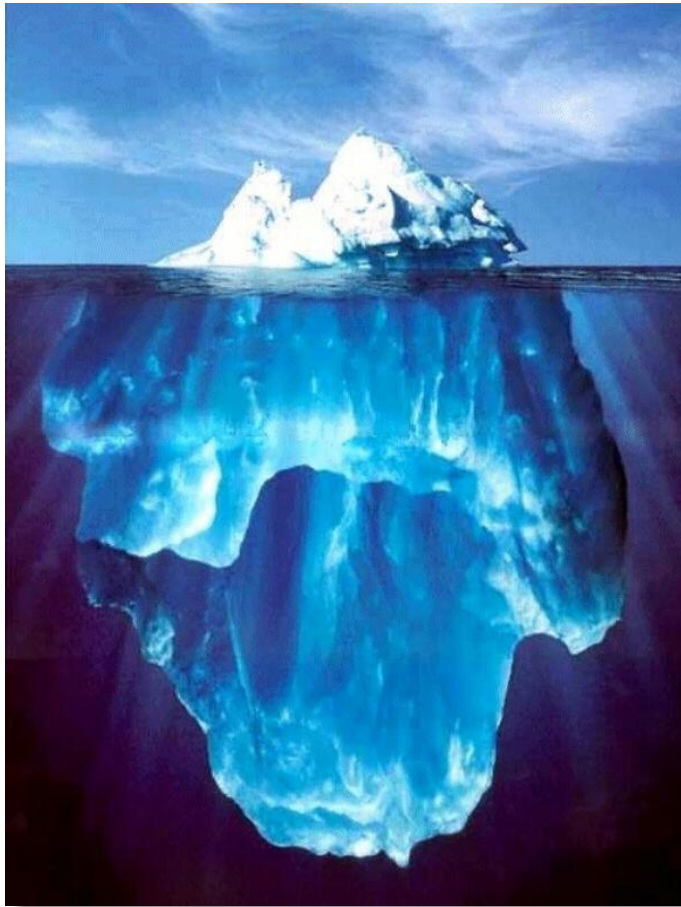
Yellow - The Sync mask.
Results must be below this line for all time periods.

Red - The performance of the E1 based sync in the existing network

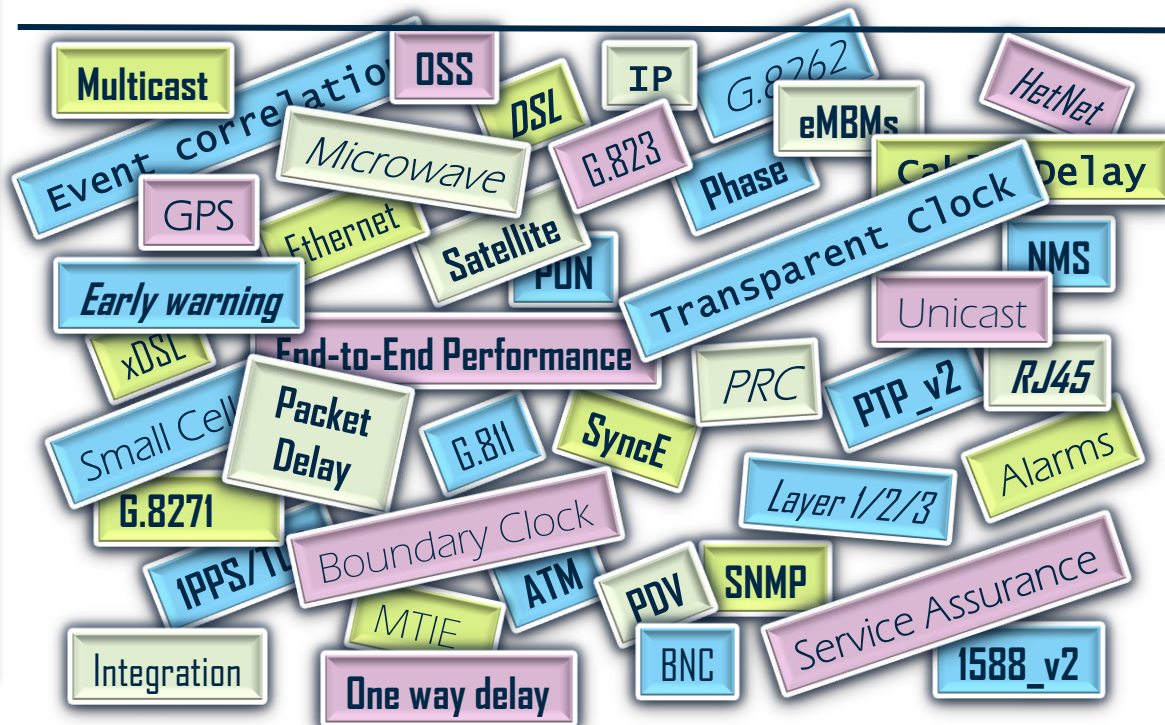
Green - The even better performance with SyncE over Transport Ethernet.

These measurements were performed over a period of a month in a live network using multiple EMXP-80, EMXP-10/22 and EDU units over a 200+ km live network with running at 100% throughput giving excellent synchronization performance and zero packet loss.

Simplifying the complexity that is Sync



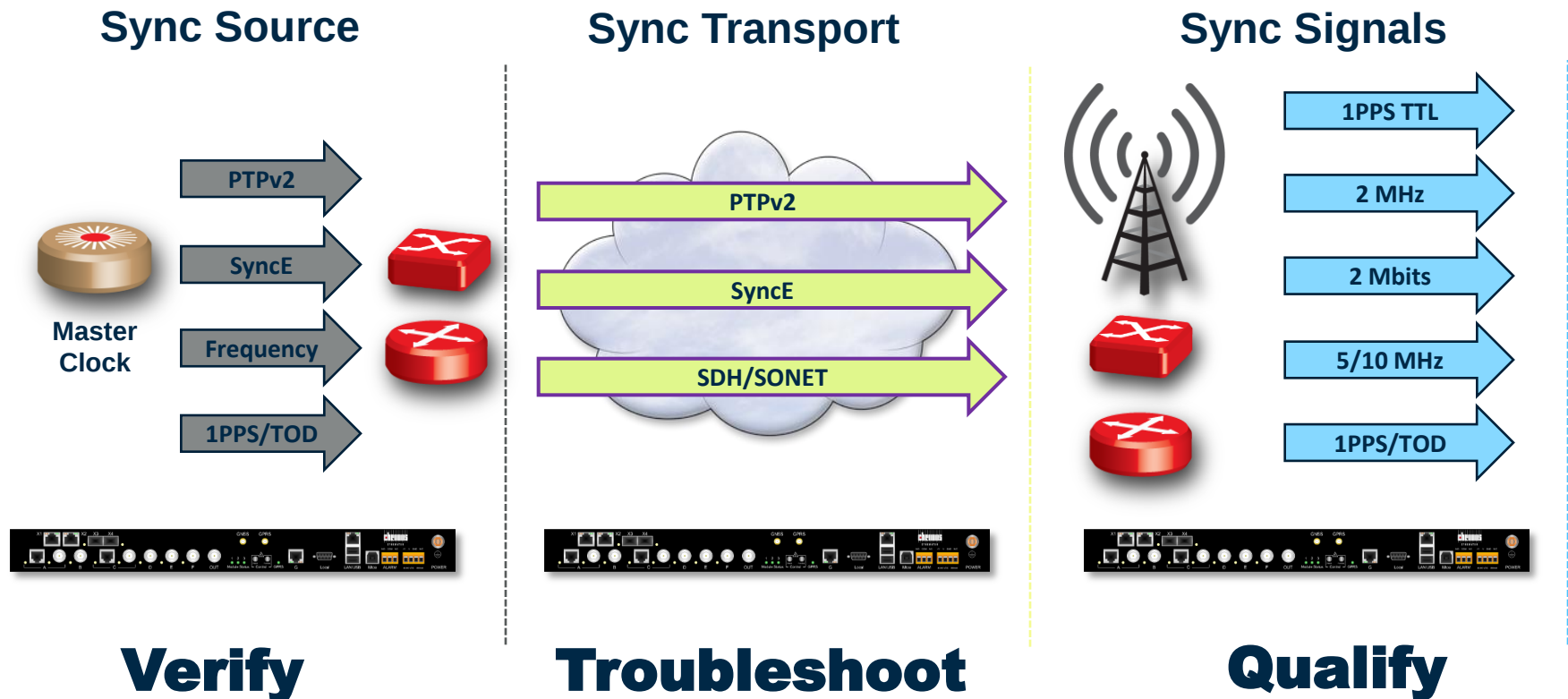
- Products ✓
- Standards ✓
- Device management / alarms ✓



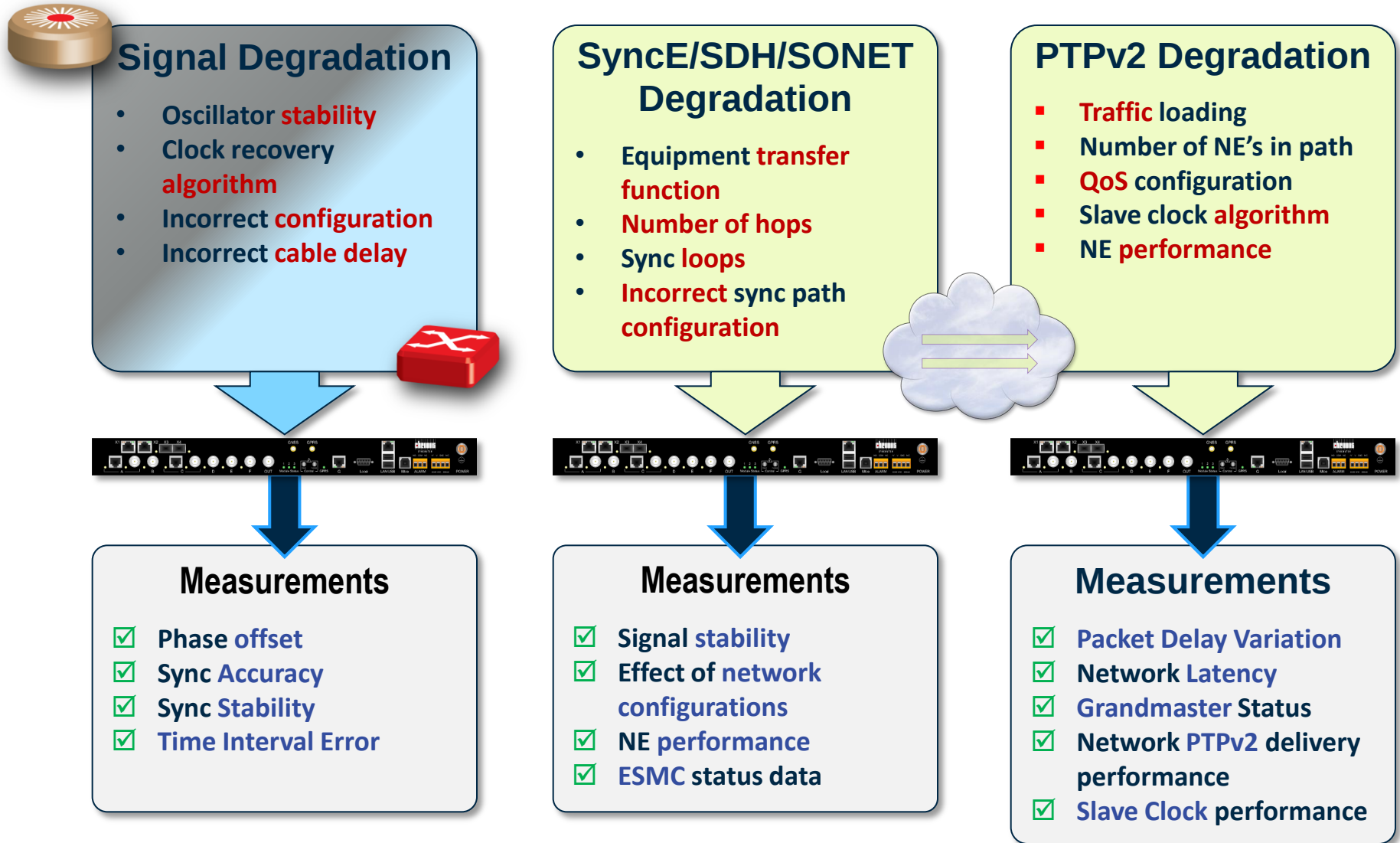
Synchronisation is a complex layer...

The building blocks

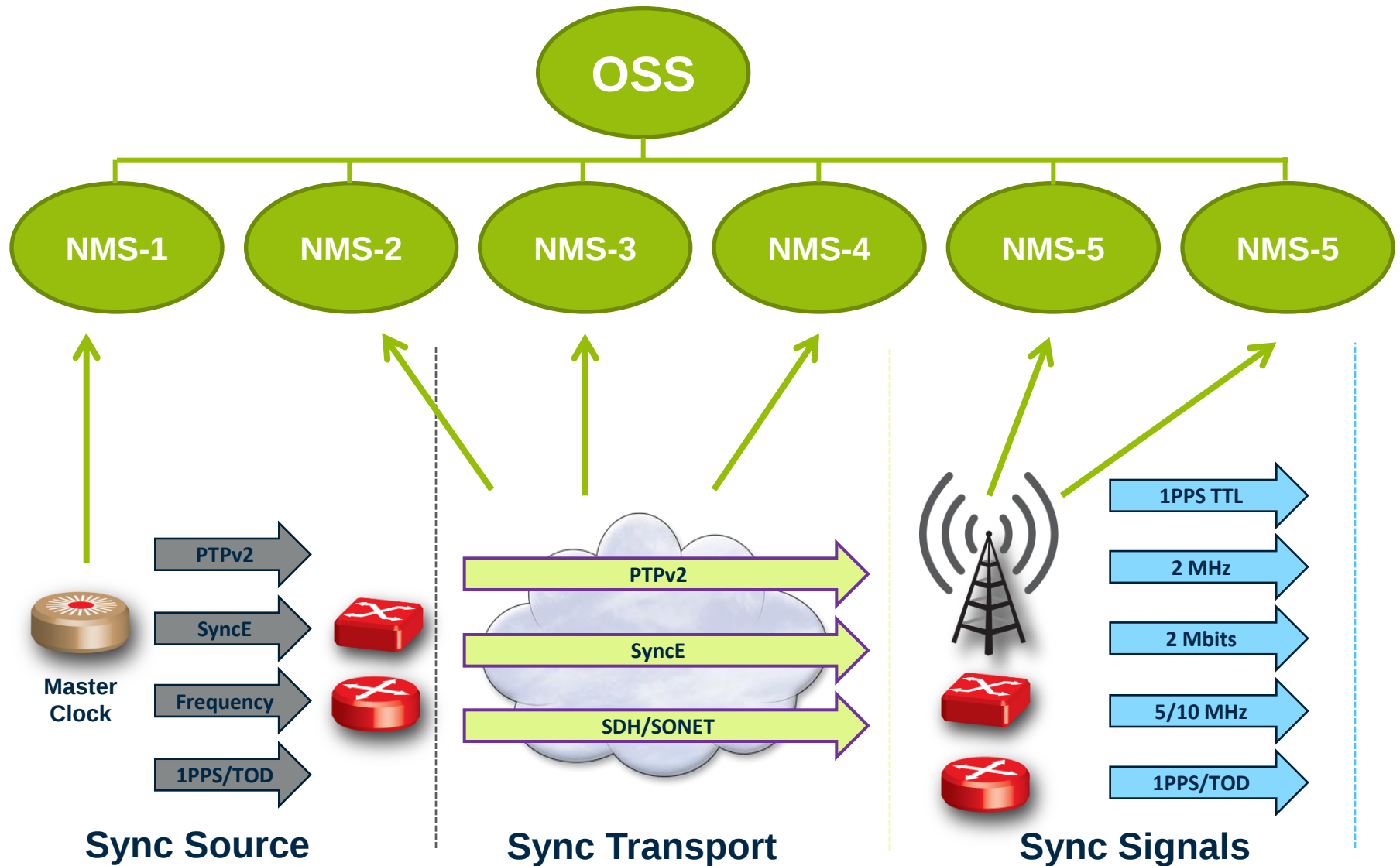
- **Monitoring of Sync signals;**
 - Most equipment provides test points to measure sync stability and accuracy
 - This applies to both sources, devices transporting sync and those terminating sync.



Measuring sync degradation

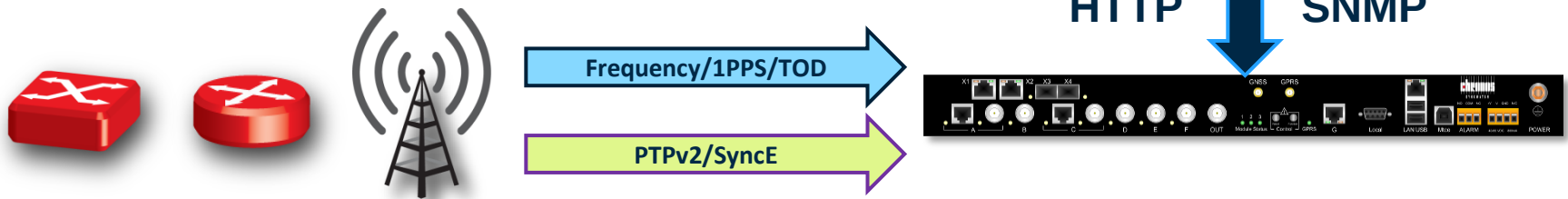


Visibility of end-to-end sync quality



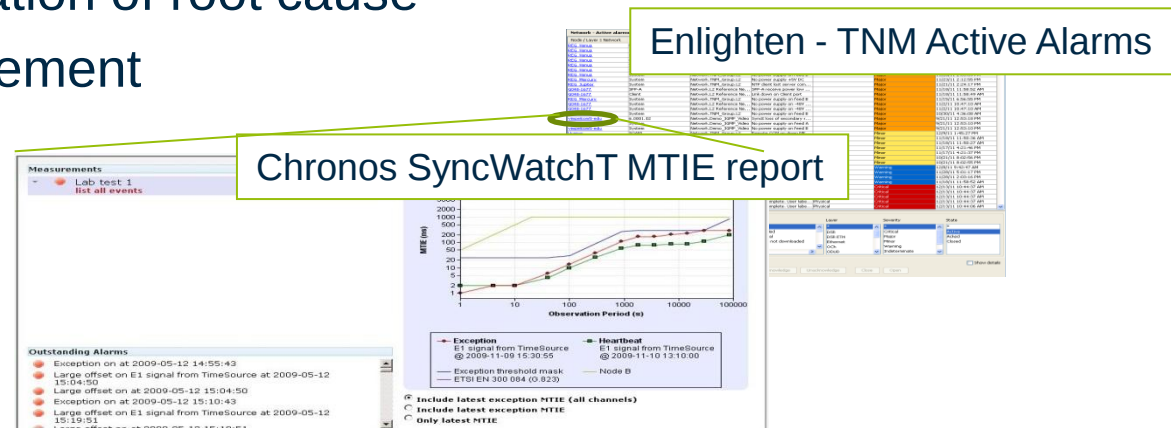
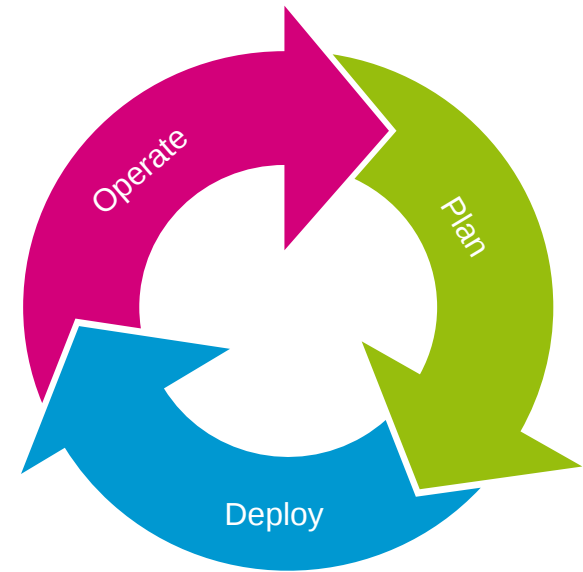
Sync service assurance

- **On-going sync confidence**
 - Deployment at targeted sites in a sync network
 - Pilot sites for new technology / equipment
 - Longest sync trail – most remote
 - Most revenue / highest priority
 - 24 x7 monitoring of sync quality
- **SLA definition & policing**
 - Threshold Crossing Alarms - TCA
 - Early warning of sync problems
- **Integration with NMS / OSS**
 - NOC visibility of network sync health
 - Correlation between sync and network health



Integrated packet-optical and synchronisation management

- Integrated packet-optical and sync management
 - Layers 0 to 2.5 with sync
 - Whole live-cycle management
 - Sync probes visible on transport manager
 - Detailed analysis via Sync Manager
 - Alarm correlation and root cause analysis
 - Sync maps
- Ensures swift identification of root cause
- Proactive sync management



Summary

- Native Packet Optical proves its competitive strengths within Mobile Backhaul:
 - ➡ “Transport Ethernet” functionality integrated in the optical layer
 - ➡ Cost efficient Ethernet aggregation
 - ➡ Flexible and scalable bandwidth
 - ➡ Ultra low latency and no jitter
 - ➡ Outstanding Synchronous Ethernet performance
- Sync Management is critical in service assurance
 - ➡ Correlation between network layer and sync layer events
 - ➡ Independent evidence of delivered performance
 - ➡ Reduced support costs through simplified fault processes

THANK YOU!

Making light make sense

