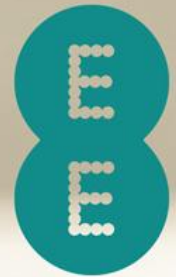


# Experiences in migrating an established synchronisation network to use new synchronisation technologies

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# Agenda

1. **EE, H3G, and the shared RAN and backhaul**
2. **Synchronisation current state**
3. **Synchronisation objectives**
4. **Introducing 1588v2**
5. **Test Results**
6. **Introducing Synchronous Ethernet**
7. **Trial Results**
8. **Conclusion and Next Steps**

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# EE, H3G, and the shared RAN and backhaul

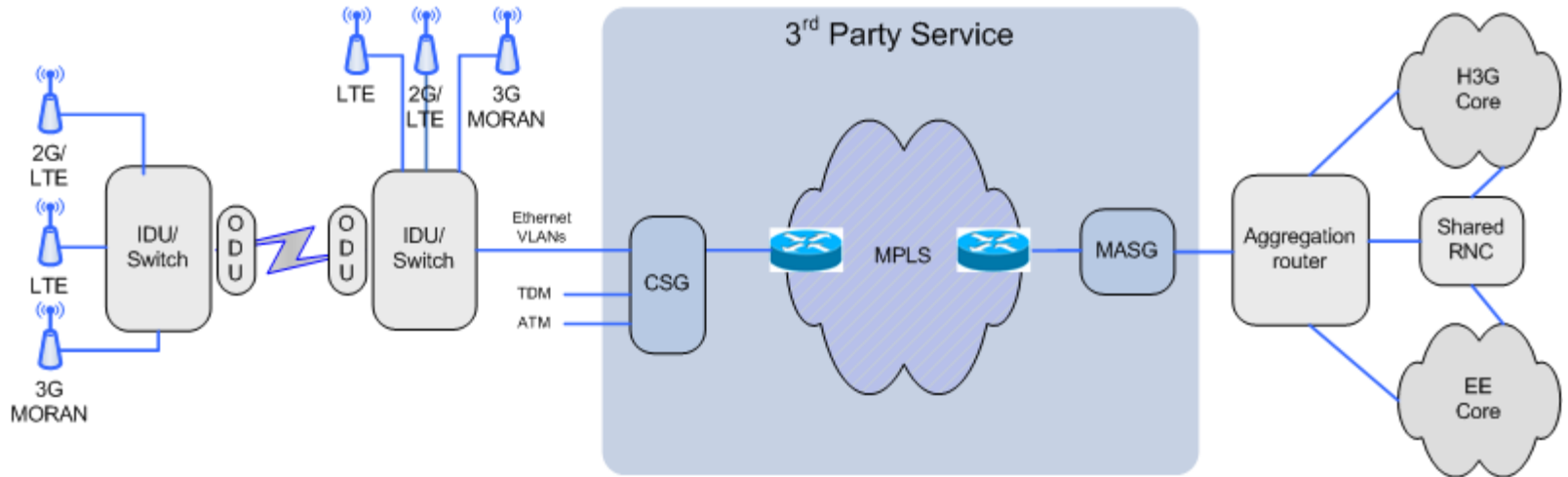
**Through MBNL, EE and H3G share a 3G RAN and a backhaul transport network:**

- EE and H3G Multi Operator RAN 3G infrastructure
- Backhaul for MORAN 3G
- Backhaul for EE 2G (Legacy TDM migrating to IP / Ethernet)
- Backhaul for EE LTE
- Backhaul for H3G LTE
- Synchronisation for all radio technologies

**MBNL builds and operates networks according to requirements of EE and H3G, directed by technical strategy of EE and H3G.**

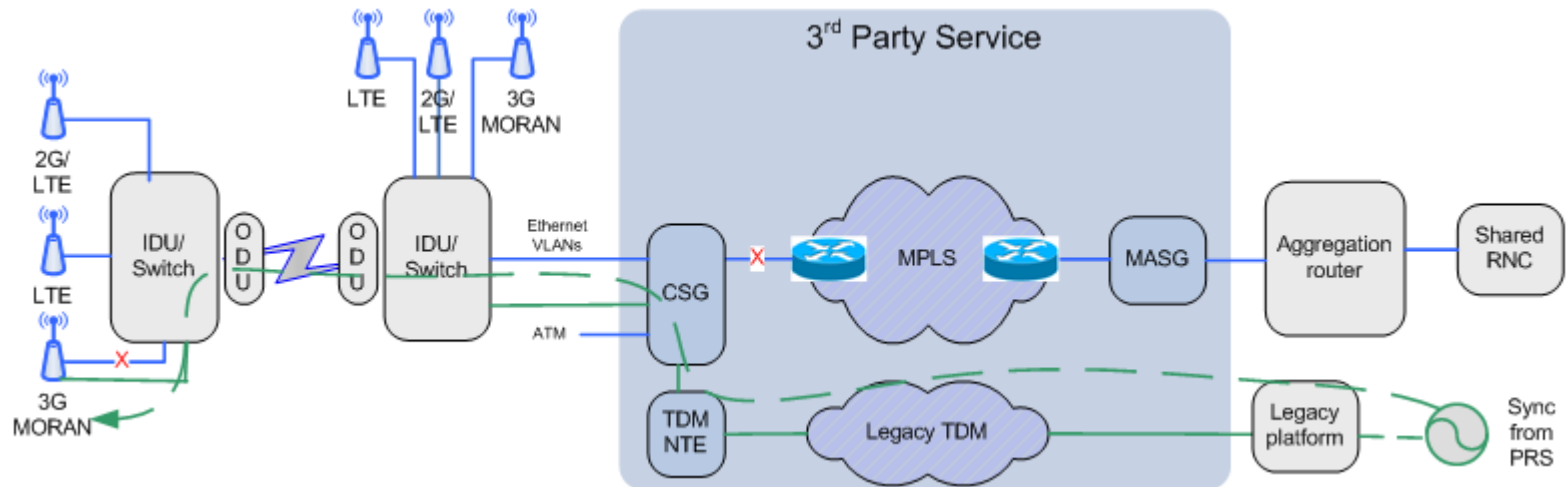
# EE, H3G, and the shared RAN and backhaul

- Shared 3G NodeB and RNC for EE and H3G
- About 1/3 of sites have backhaul to RNC sites via 3<sup>rd</sup> party pseudowire based service delivering TDM, ATM and Ethernet VLANs
- Most of the rest are subtended via (hybrid) microwave radio



# Synchronisation current state

- Existing legacy TDM circuits used to synchronise CSG, TDM from CSG used to synchronise NodeB.
- 3<sup>rd</sup> party tails to CSG do not support Sync E
- 3G NodeB did not (at the time) support Sync E reception
- Some microwave radios did not support Sync E



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# Objectives

## Immediate

- Stop using legacy TDM sync while maintaining quality (15ppb, G.823 sync)
  - Enable new sites to be provisioned where there is no legacy TDM
  - Enable retirement of legacy TDM networks and platforms

## Soon

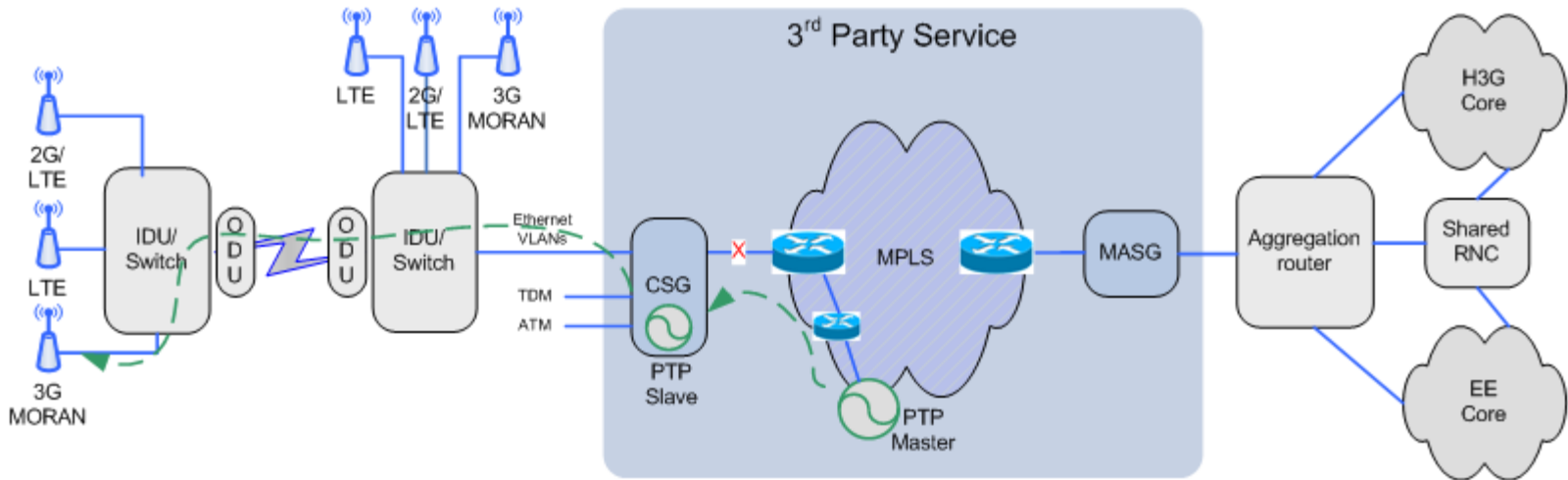
- Enable phase sync for LTE-TDD, LTE-A etc. (500nS?)
  - Enable PTP
  - Enhance frequency sync quality for PTP assist

## Target architecture

- Physical layer sync (Sync E) from PRS to edge
- PTP with physical assist at edge, master as “close” to edge as practical.

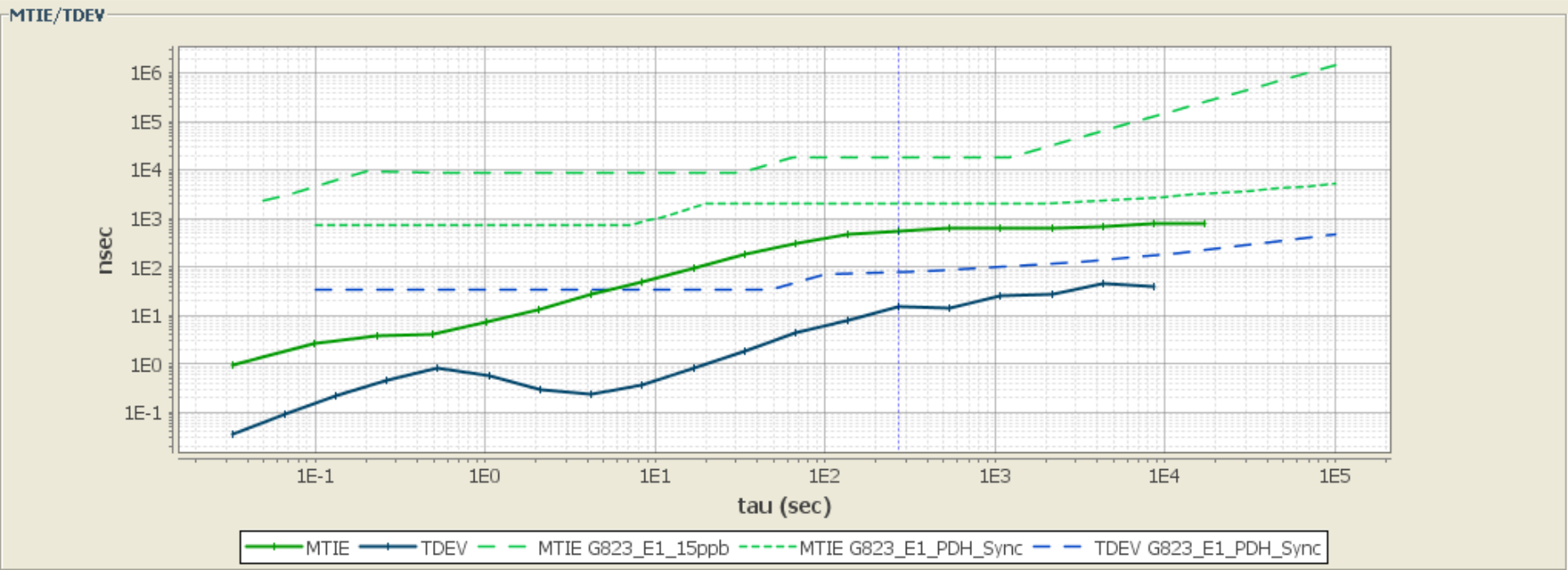
# Introducing 1588v2

- Circumvents non- Sync E tail to CSG
- PTP Master within two hops of edge
- PTP slave on CSG which then propagates Sync E
- Sync E support now on NodeB and microwave radio



# 1588v2 test results 1

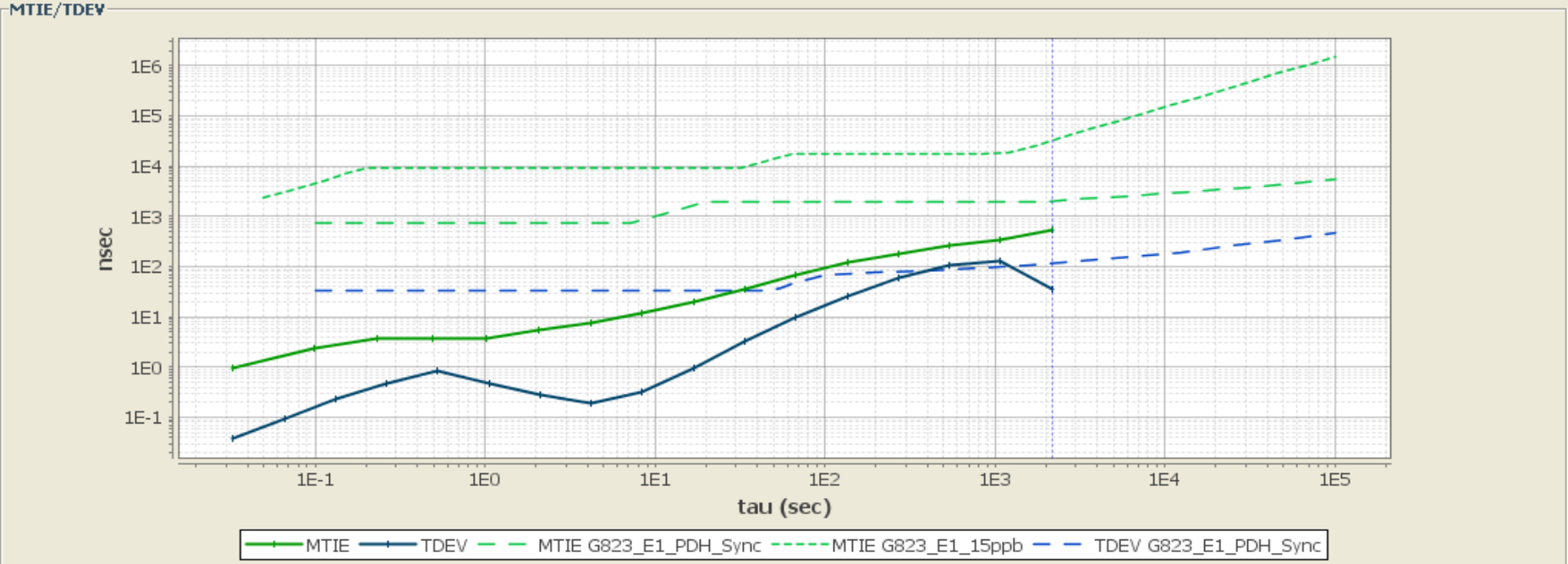
- Single hop test network
- Ramping load case





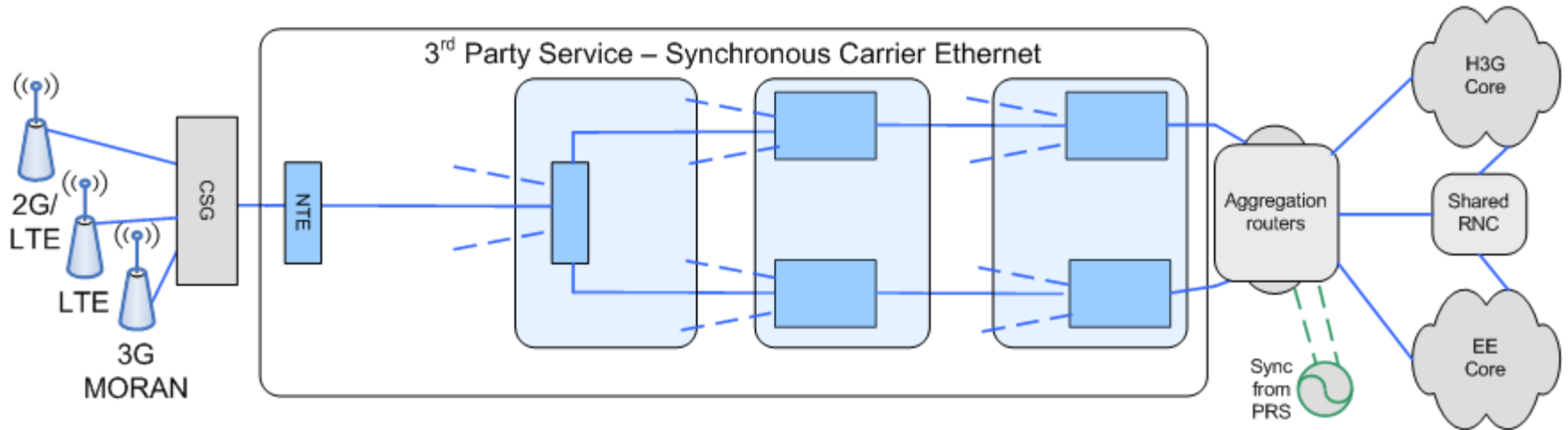
# 1588v2 test results 2

- Single hop test network
- Short congestion case



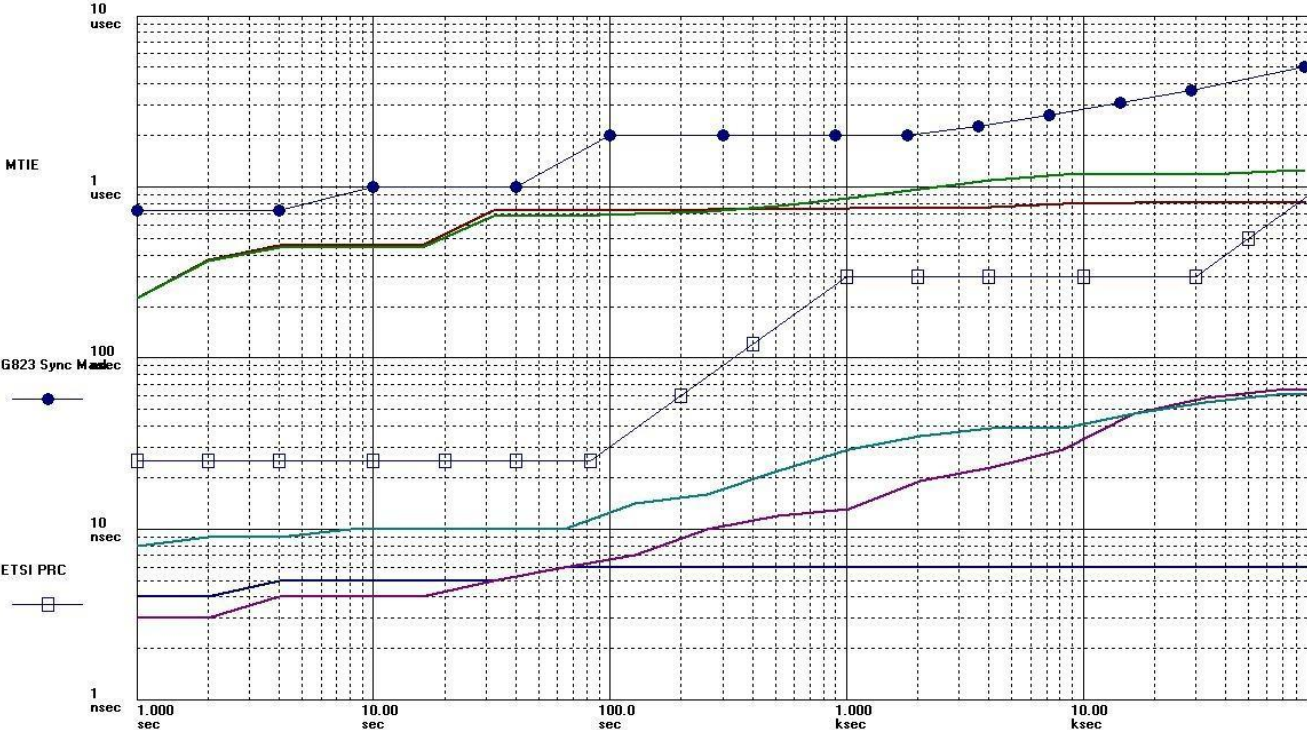
# Introducing Synchronous Ethernet

- New 3<sup>rd</sup> Party service, provides un-contended 1G aggregated into 10G interfaces, MBNL managed CSG and routers provide services over this.
- 3<sup>rd</sup> party infrastructure takes synchronous Ethernet interface at head end and propagates to cell site, ESMC used for resilience and notification.



# Synchronous Ethernet trial results

- Cyan and mauve Sync E plots up to 100x better than green and brown PDH!



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## Conclusion and next steps

**Immediate objectives have been met - current synchronisation quality can be maintained for new sites without legacy TDM, legacy TDM networks and platforms can be retired.**

**Target architecture can be realised subject to further development, level of which differs between the 3<sup>rd</sup> party solutions:**

- For MPLS based 3<sup>rd</sup> party backhaul service, further development required on frequency sync solution, then it is expected phase sync can be implemented with PTP.
- For synchronous carrier Ethernet 3<sup>rd</sup> party backhaul service, it is expected phase sync can be implemented with PTP.

**ITSF 2013 – Experiences in implementing network based phase sync for mobile backhaul?**

# Thank you

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