



# Control Protocol and OAM in MPLS-TP Network

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COMMUNICATIONS

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- 2. Functions of Control Protocol and OAM**
- 3. Relationship of Control Protocol and OAM**
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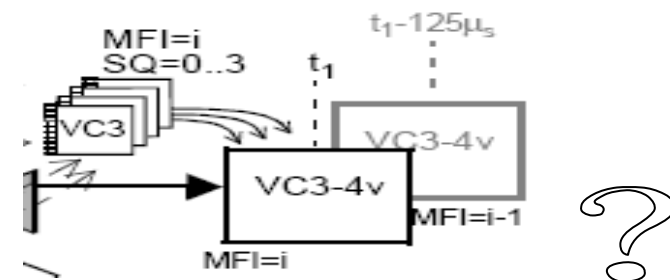
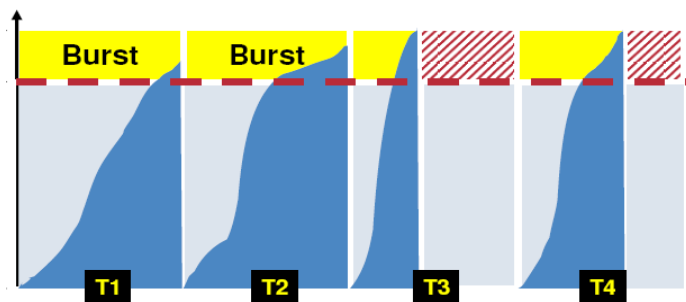
# MPLS-TP Based Metro Network



- **Evolution of current MSPP network**
  - VC, VCG, LCAS cannot solve the data bursting problem effectively in future All-IP services

Ethernet	10 Mbit/s	VC-3 (20%)	VC-11-7v (89%)
Fast Ethernet	100 Mbit/s	VC-4 (67%)	VC-3-2v (99%)
Gigabit Ethernet	1000 Mbit/s	VC-4-16c (42%)	VC-4-7v (95%)
Fibre Channel	1700 Mbit/s	VC-4-16c (42%)	VC-4-12v (90%)
ATM	25 Mbit/s	VC-3 (50%)	VC-11-16c (98%)
DVB	270 Mbit/s	VC-4-4c (37%)	VC-3-6v (93%)
ESCON	160 Mbit/s	VC-4-4c (26%)	VC-3-4v (83%)

VC-11	VT.15 SPE	1,600 Kbps	1 to 64	1,600 to 102,400 Kbps
VC-12	VT2 SPE	2,176 Kbps	1 to 64	2,176 to 139,264 Kbps
VC-2	VT6 SPE	6,784 Kbps	1 to 64	6,784 to 434,176 Kbps
VC-3	STS-1 SPE	48,384 Kbps	1 to 256	48,384 to 12,386 Kbps
VC-4	STS-3c SPE	149,760 Kbps	1 to 256	149,760 to 38,338,560 Kbps



# Why MPLS-TP?



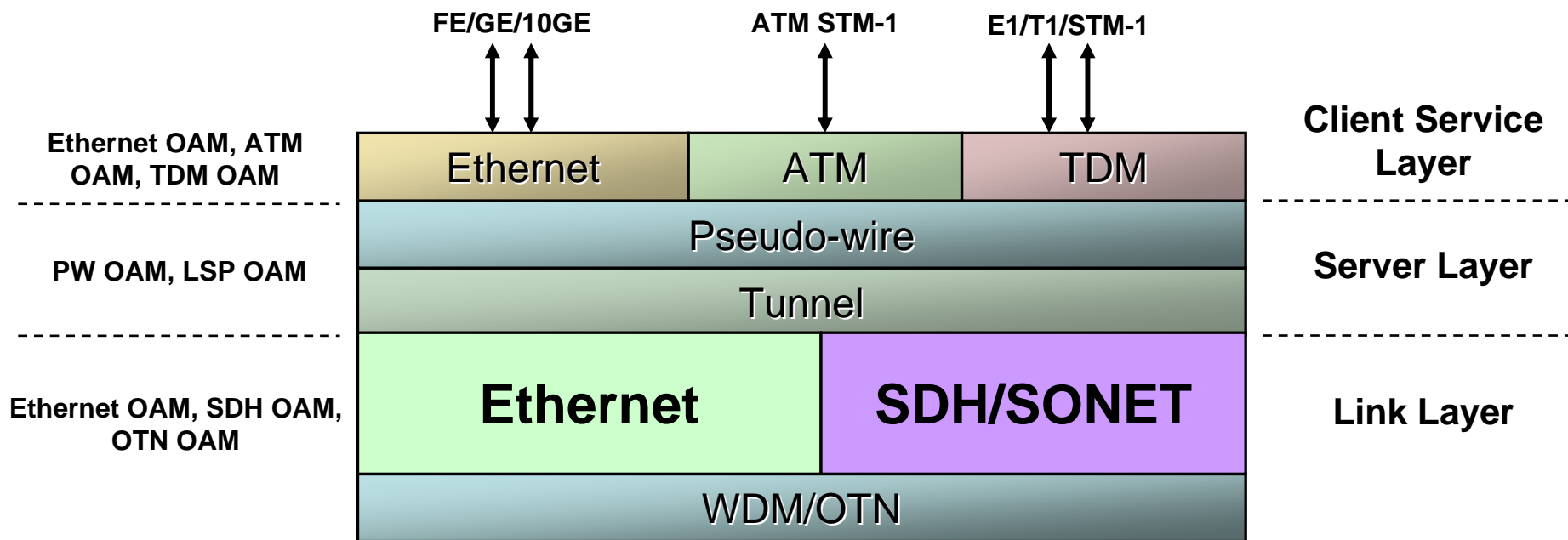
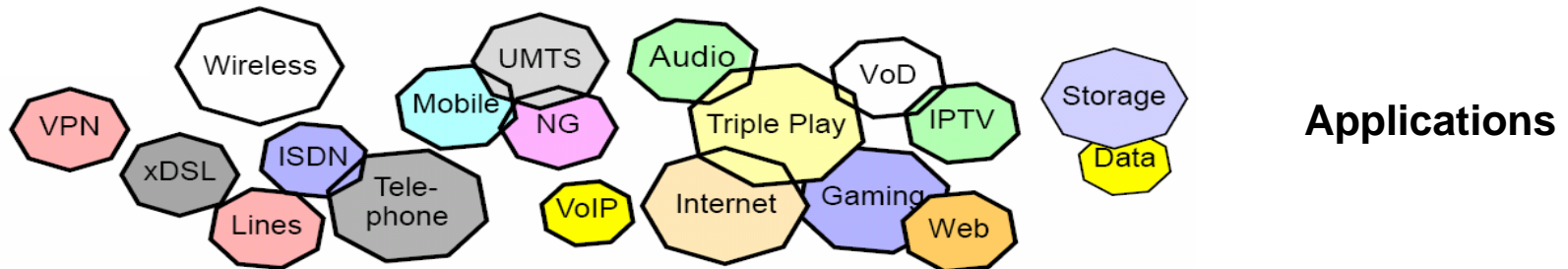
- **MPLS-TP network concentrates on**
  - Effectively transmission of bursting data
  - Uniform transmission platform for every kind of current network
  - MPLS-TP network element Inherits both the packet and telecommunication characteristics:
    - Label switching, QoS, Control Plane
    - OAM, less than 50ms protection, synchronization and high reliability

# MPLS-TP NE Benefits

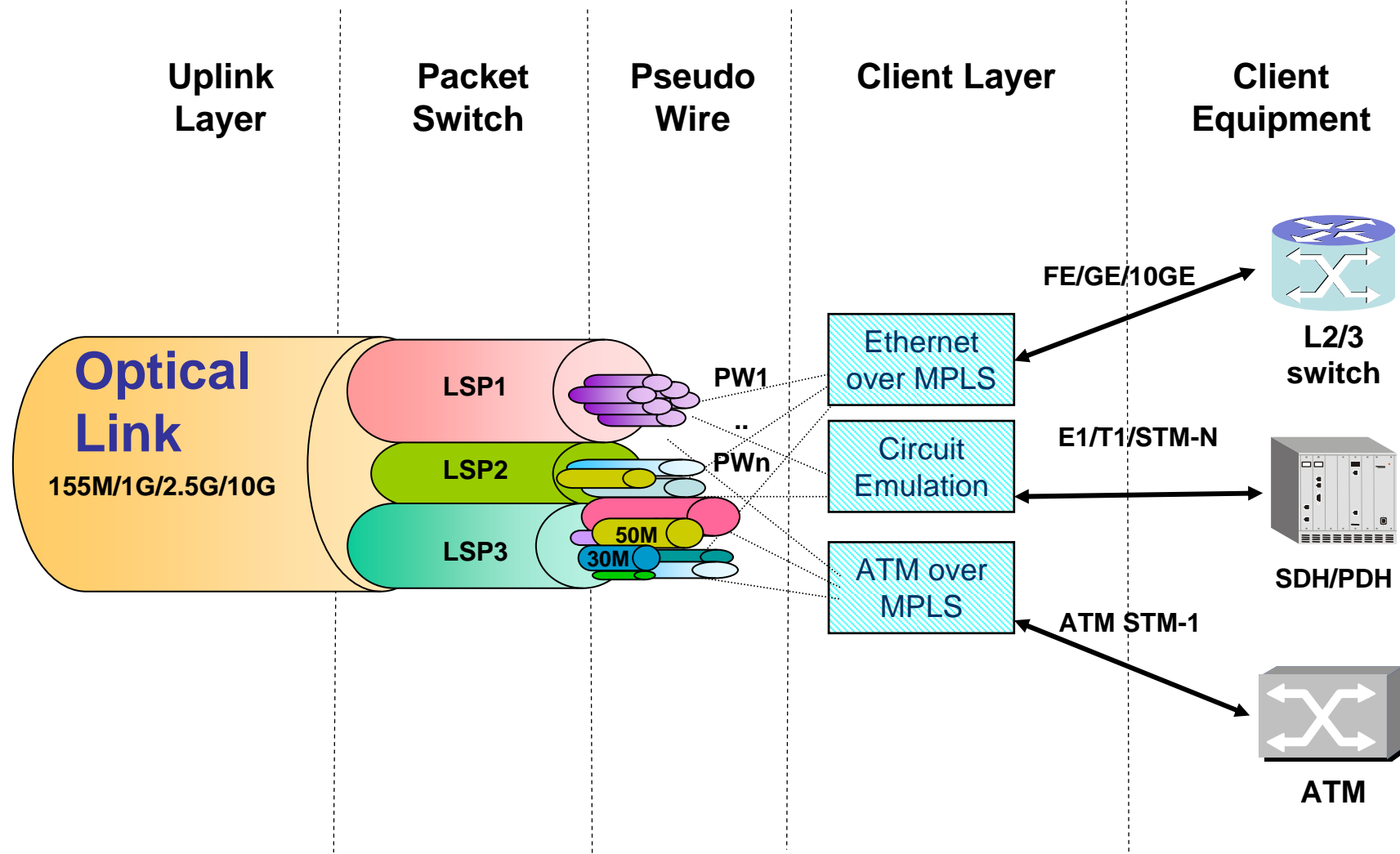


- **Based on label switching**
- **Support QoS-guaranteed Multi-Service by PWE3 and sophisticated QoS mechanism**
- **Layered rich OAM tools for operation and fault management**
- **Support high accuracy timing and clock**
- **High Reliability, equipment protection, network protection less than 50ms**
- **Low cost for dollars per kbps, dollars per port**

# MPLS-TP Equipment Layering Model



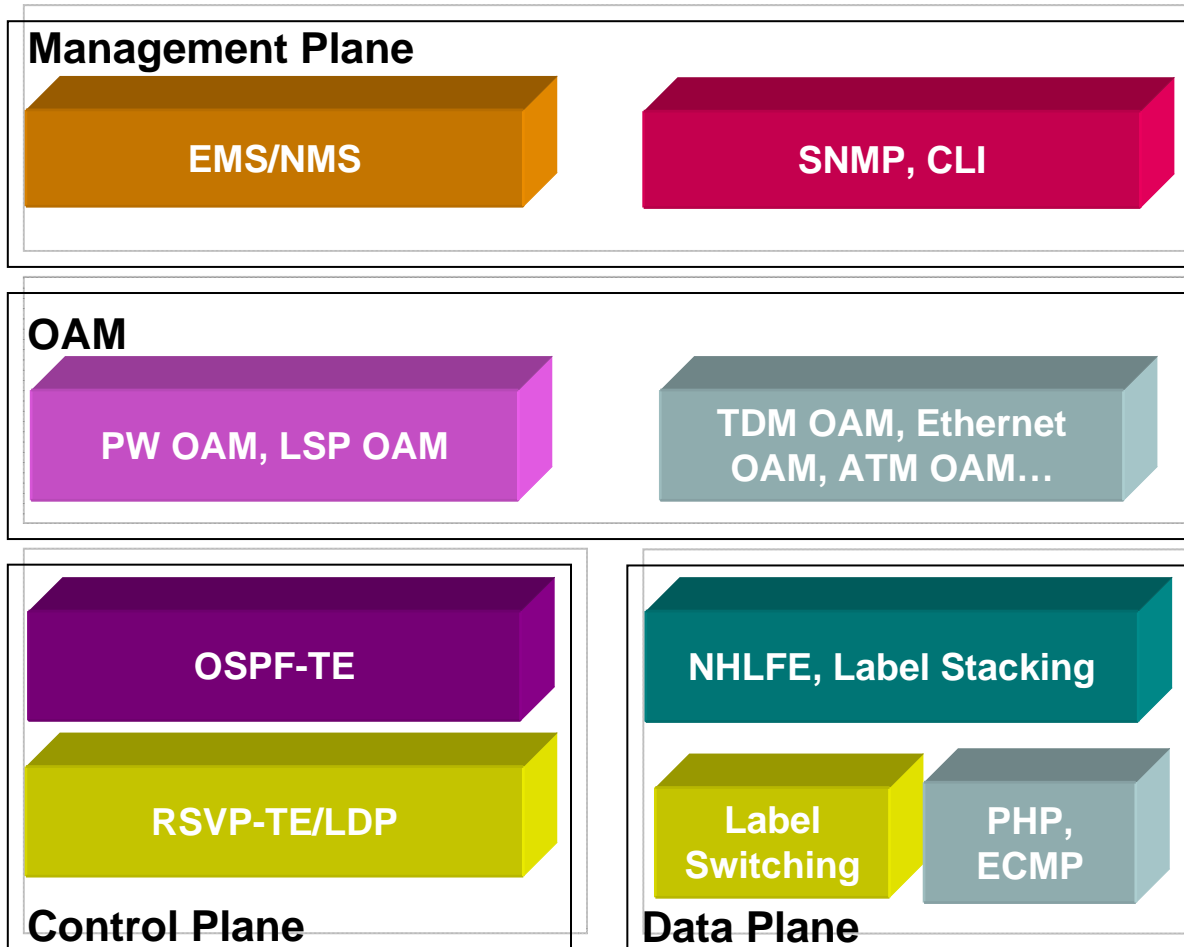
# Multi-Service Support



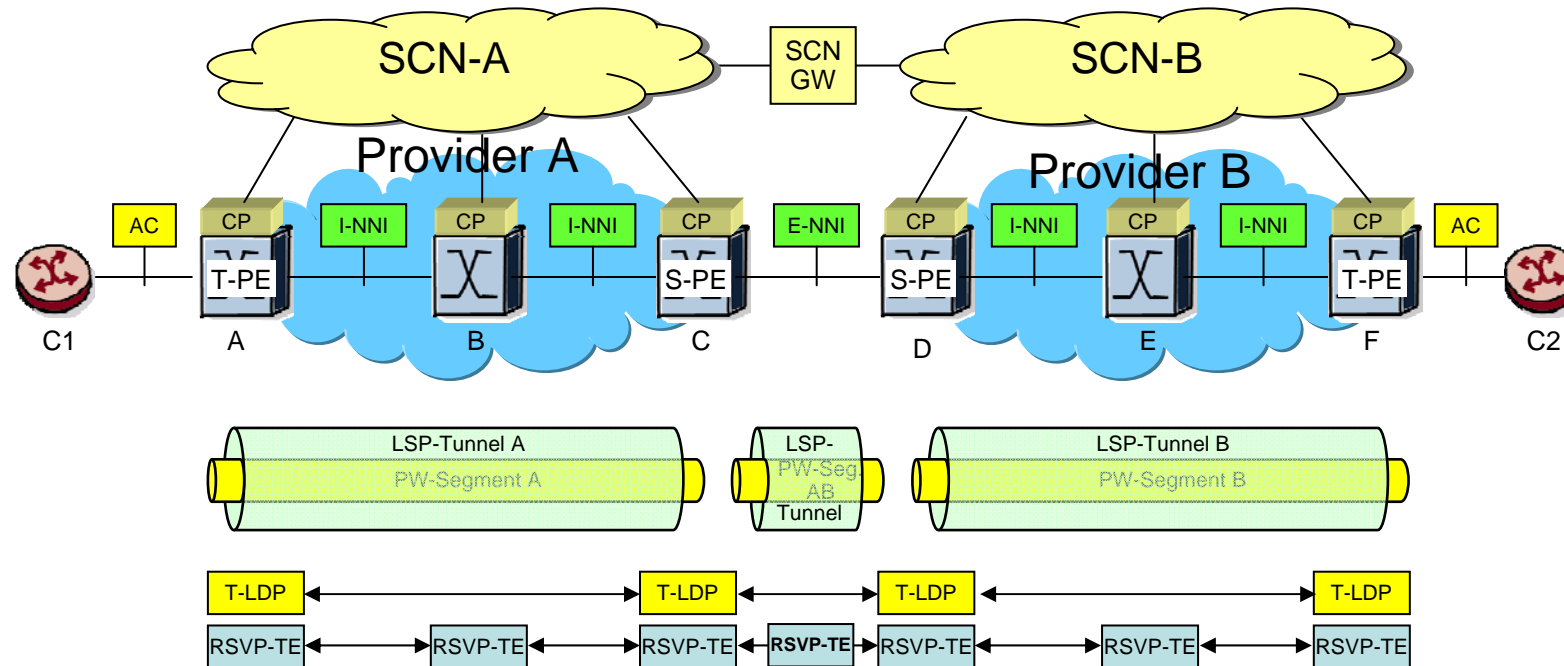
- **MPLS-TP needs considering both Control Plane and OAM**
- **Control Plane means**
  - Routing, Signaling protocols, mainly used in existing IP/MPLS network
- **OAM means**
  - Fault management, ex: APS; performance management, ex: B1/B2/B3, mainly used in telecommunication



# MPLS-TP NE Architecture

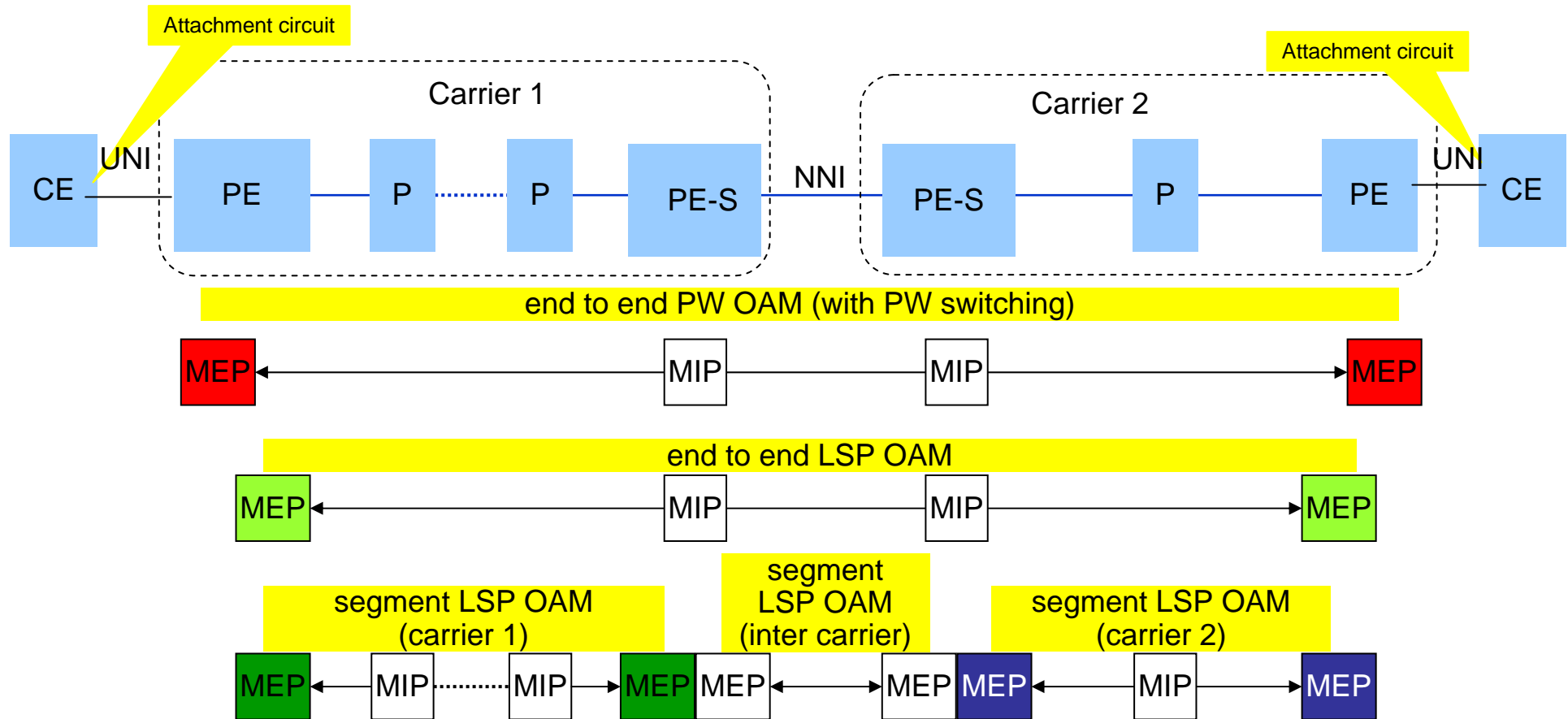


# What CP Does?



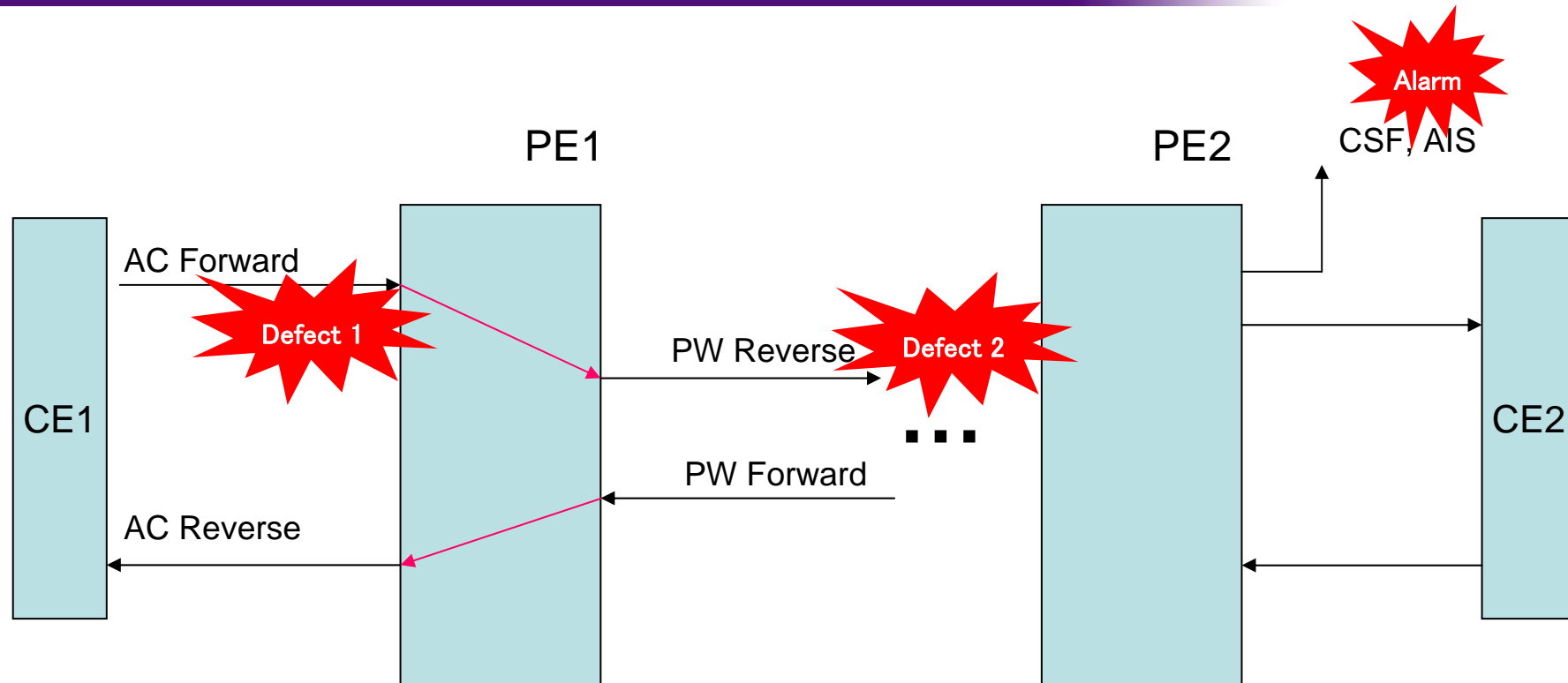
- AC – Attachment Circuit
- NNI – Network-Network Interface
- I-NNI – Internal NNI
- E-NNI – External NNI
- SCN – Signaling Communication Network
- SCN-GW Gateway
- T-LDP – Targeted LDP

# What OAM Does?



- **PW and LSP OAM Monitoring**

# PW OAM Mapping



- **AC defect can be notified to PW and vice versa, this is called PW OAM Mapping**
  - Currently trying to extend it to OAM mapping between PW
- **AC LOS can be reported to remote site as CSF**
- **LSP LOC can be reported to remote site as AIS**
- **Signaling protocol can also convey the above information**

- **MPLS-TP requirements**
  - Configuration of LSP and PW are not solely on CP
    - Static provisioning is desired
    - With Static provisioning, no dependency on routing or signaling
  - If there is CP, CP failure and recovery must not impact the data plane
  - Independent Transport OAM for LSP and PW, with full FCAPS capabilities
    - CV/CC, AIS, RDI, LB, LM, DM, APS, MCC, SCC, CSF, LCK, TST, EXP, VSM...
  - Consistent OAM capabilities for multi-layered network and inter-working of the different layers/technologies
- **OAM and CP are competing sometimes**
- **OAM and CP are placatory**

# Sometime OAM is Better

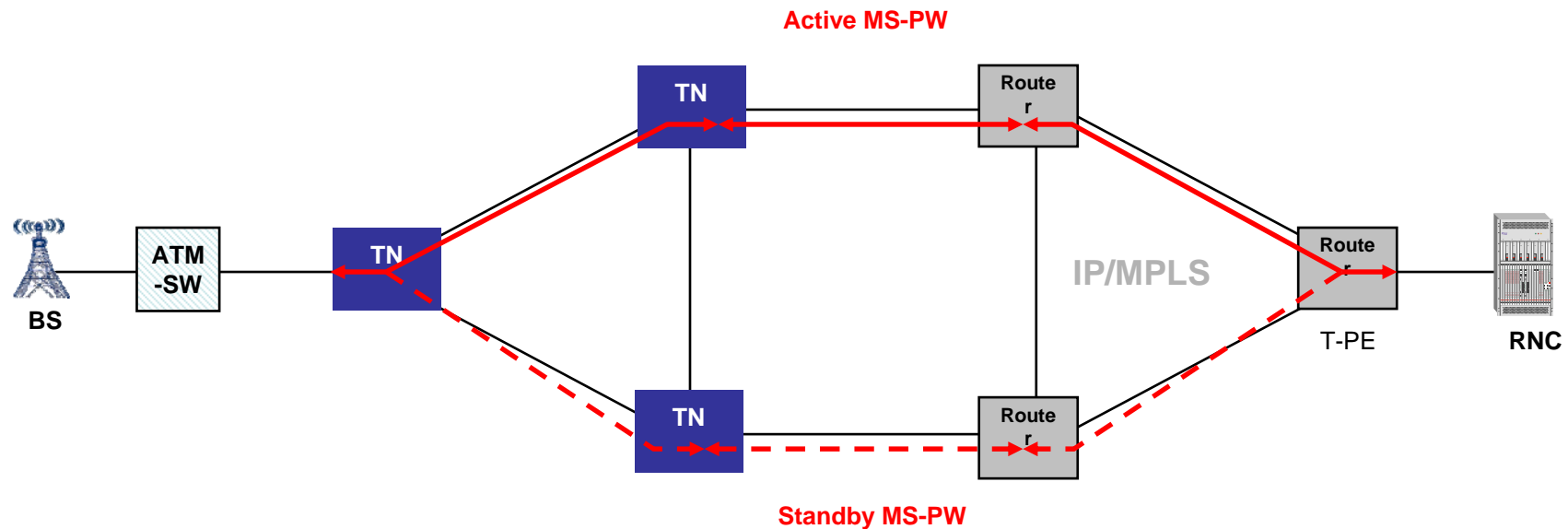


- **In some cases, OAM and CP are competing, both can be used**
  - AC status notification: LDP vs PW OAM mapping
  - Protection/restoration:
    - Linear: RSVP Protection Switching vs. OAM Linear 1:1
    - Ring: RSVP FRR vs TM-SPRING
- **The difference is:**
  - OAM is hardware based, fast and reliable, CP is not so fast and reliable

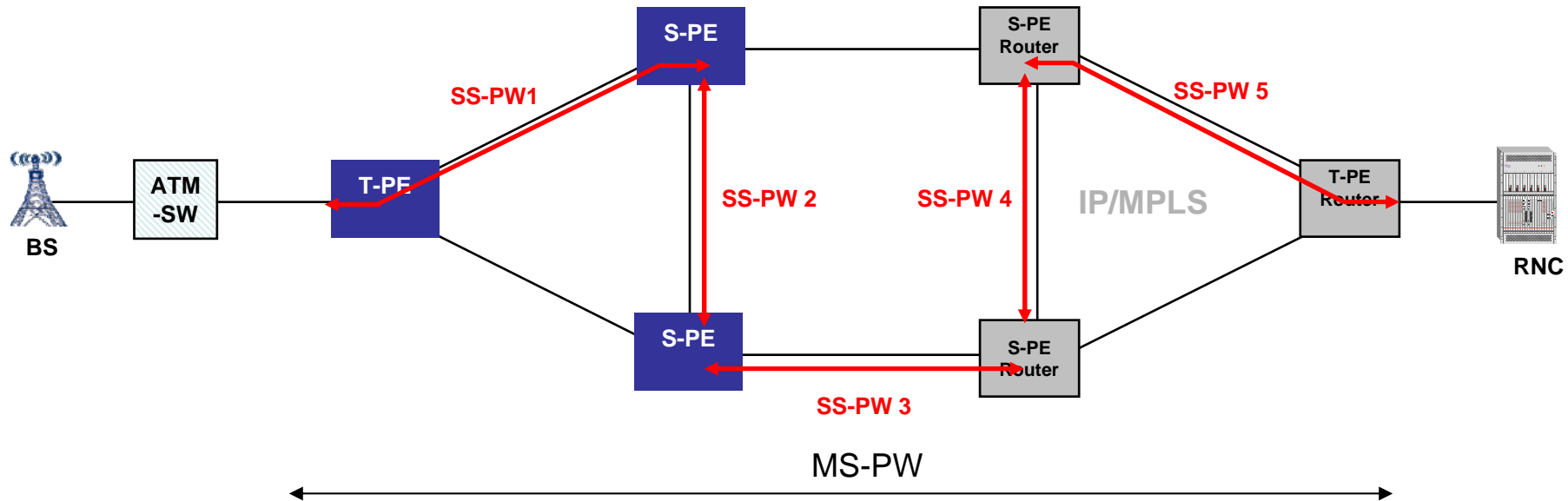
Common Knowledge!

# Sometimes CP is Better

- In some cases, CP has advantage, but OAM is also progressing
  - Multi-segment PW redundancy



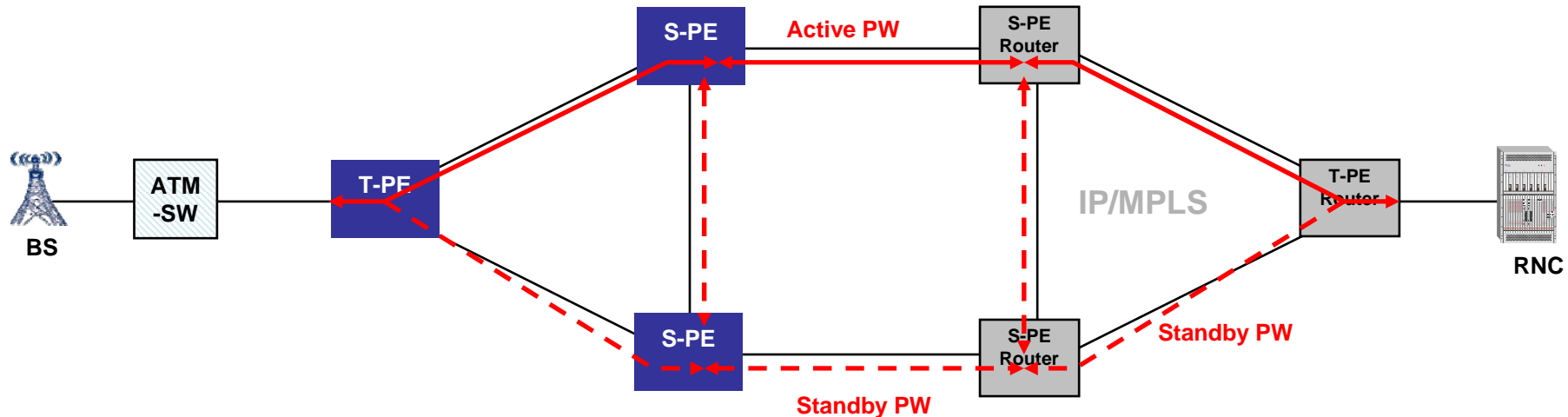
# Dynamic PW Method 1



- **Method 1: Using PW All routing table to find the next PE, so CP can dynamic selecting S-PE, to stitching multiple SS-PW into one MS-PW**

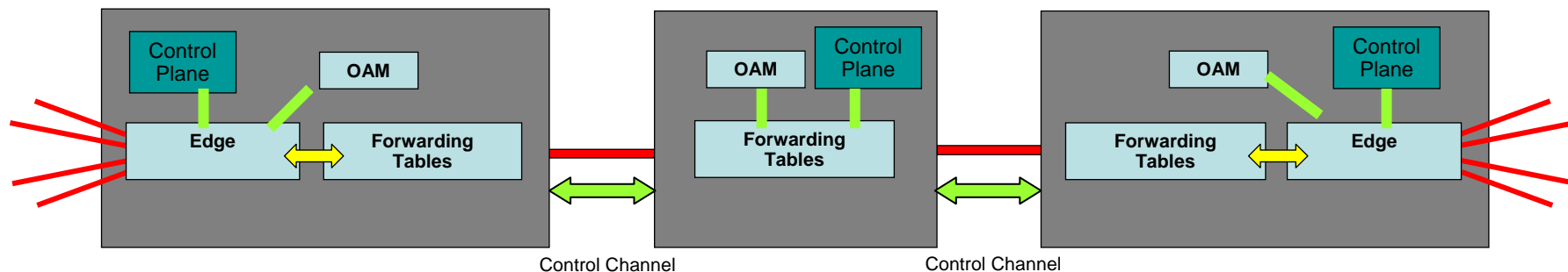


# Dynamic PW Method 2



- **Method 2: PW redundancy relies on extensions to PW signaling that use LDP status messages to indicate the active or standby state of a PW and let the T-PE synchronize the PW used.**
- **OAM can do protection on this special topology similarly as DNI, currently in exploring**

# Co-work of OAM and CP



- **In most cases, OAM and CP are placatory**
- **CP is responsible for:**
  - End to End, Segment LSPs and PWE-3 setup/teardown/modification
  - Determining and defining primary and backup paths
  - Configuring the OAM function along the path
  - Note: ALL these can be done by Management plane
- **OAM is responsible for:**
  - Monitoring and driving switches between primary and backup paths for the end to end path and path segments

# Conclusion



- **MPLS-TP network is uniform transmission network**
- **OAM is key component of MPLS-TP**
- **Control plane works better when inter-working with legacy IP/MPLS network and dynamic PW placement is needed**

# Thank You

