Multi-segment Pseudowires in Passive Optical Networks

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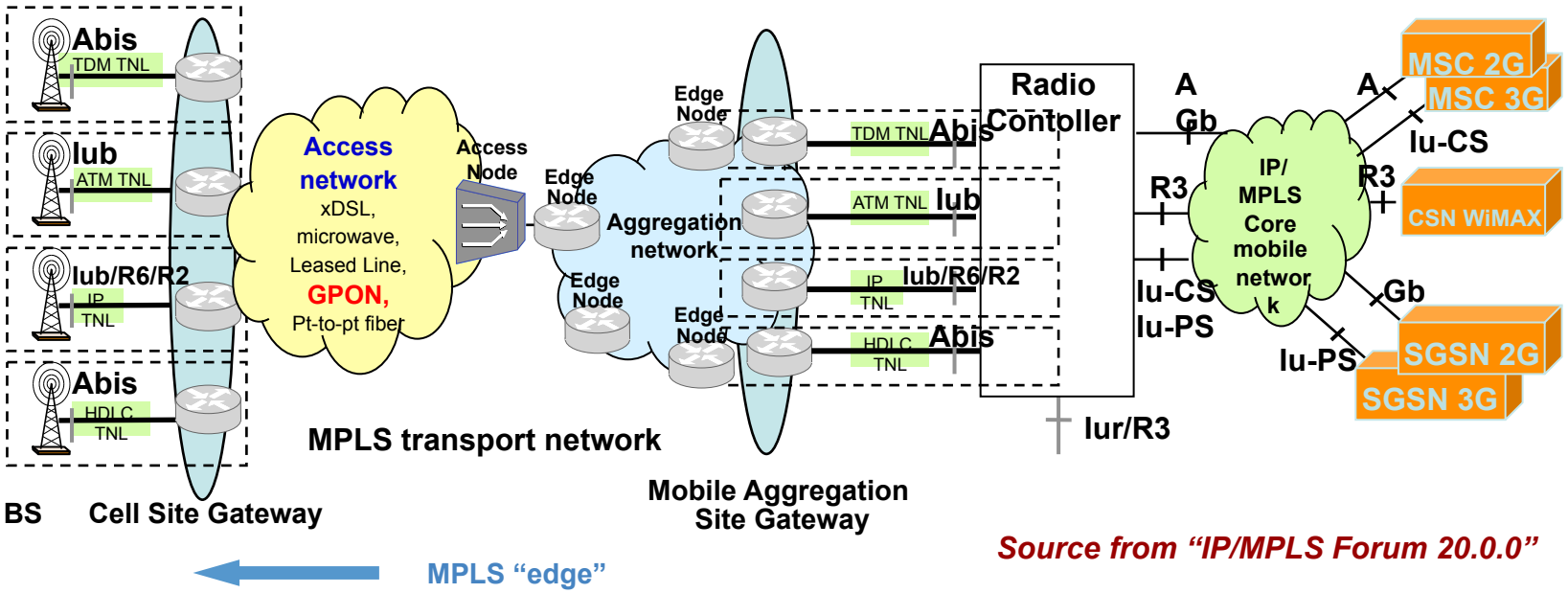
Objective

- **The objective of this draft is to provide the information of PW support in current GPON systems for mobile backhaul.**

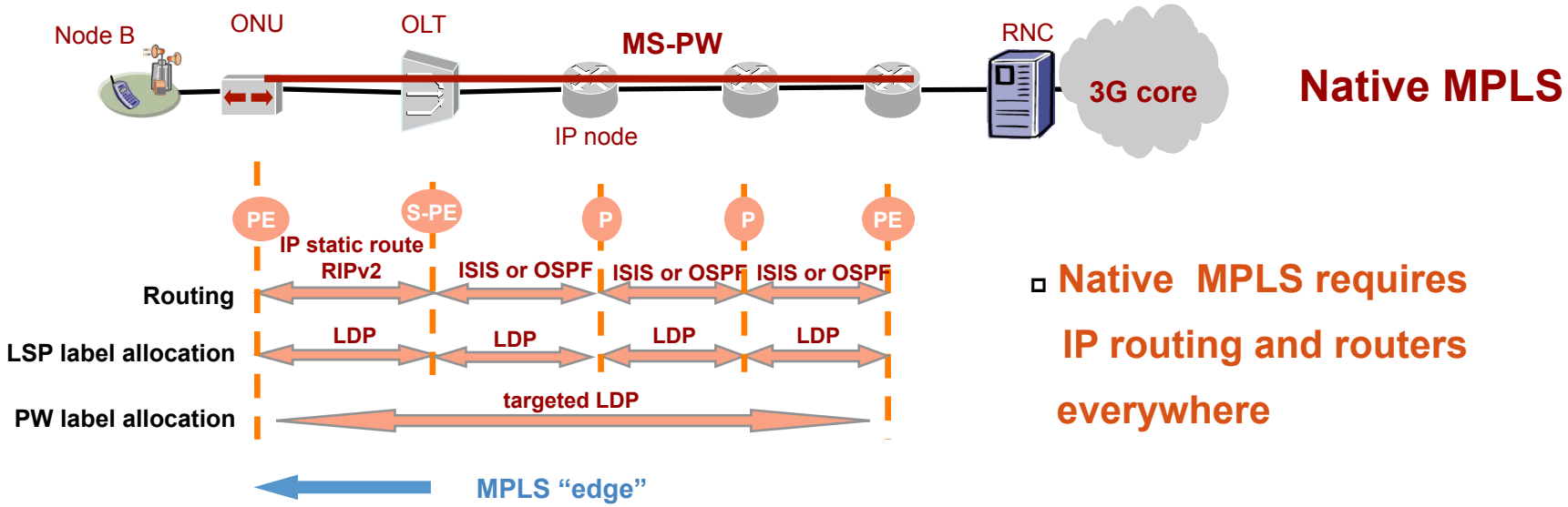
Scenario of GPON for 2G and 3G mobile backhaul



Source from "IP/MPLS Forum 20.0.0"

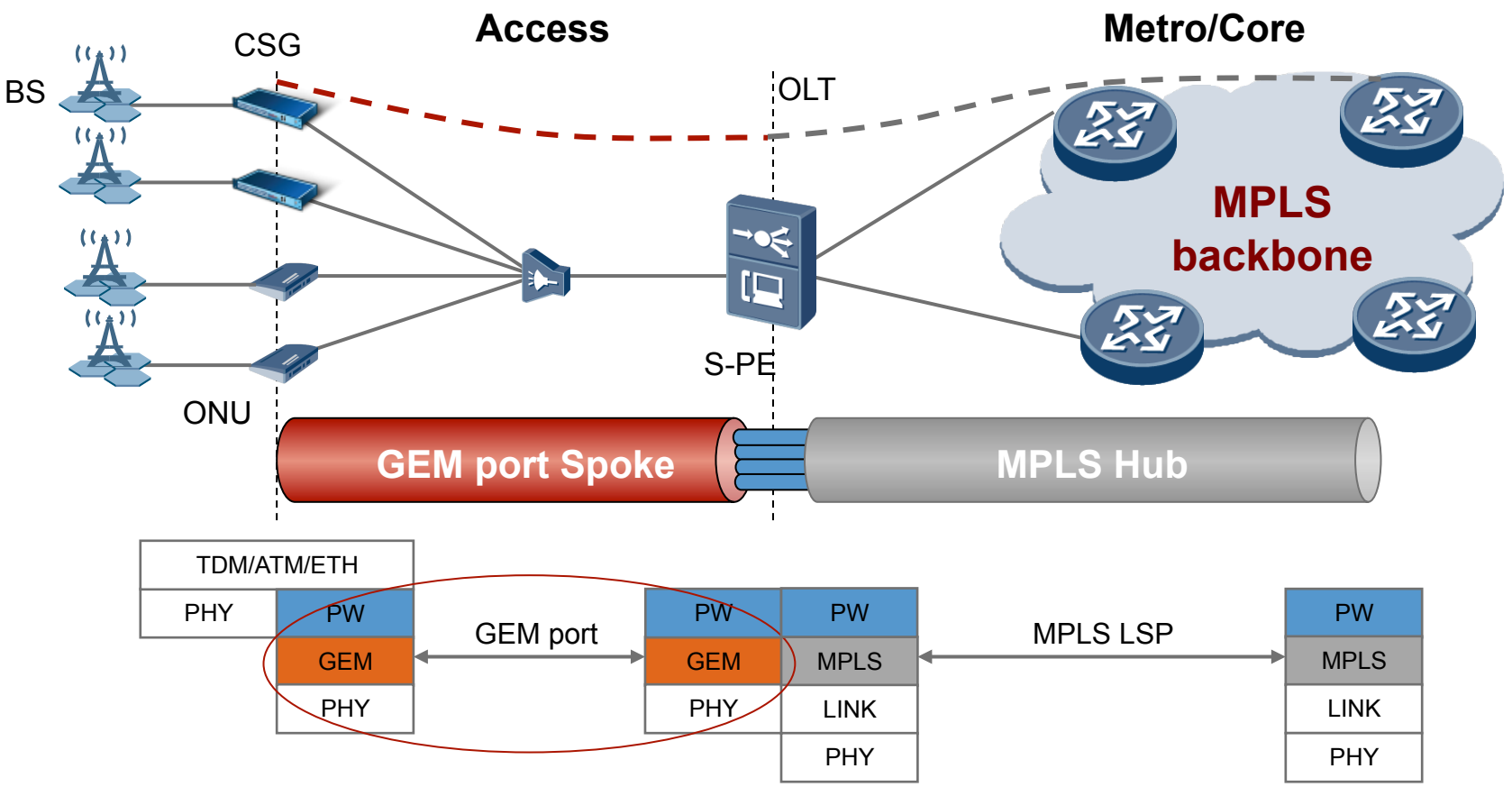
- According to the Technical Specification of "MPLS in Mobile Backhaul Networks Framework and Requirements" from IP/MPLS Forum 20.0.0, GPON is considered as a alternative for 2G and 3G mobile backhaul.
- With PW extension to ONU, e2e MPLS tunnel can be built between CSG and MASG for mobile backhaul.
- OLT don't need to be aware of TDM/ATM/SDH services and don't need to support physical interfaces of E1/T1, NxDS0, POS/SDH, ATM, …

Challenges for MPLS to GPON for mobile backhaul



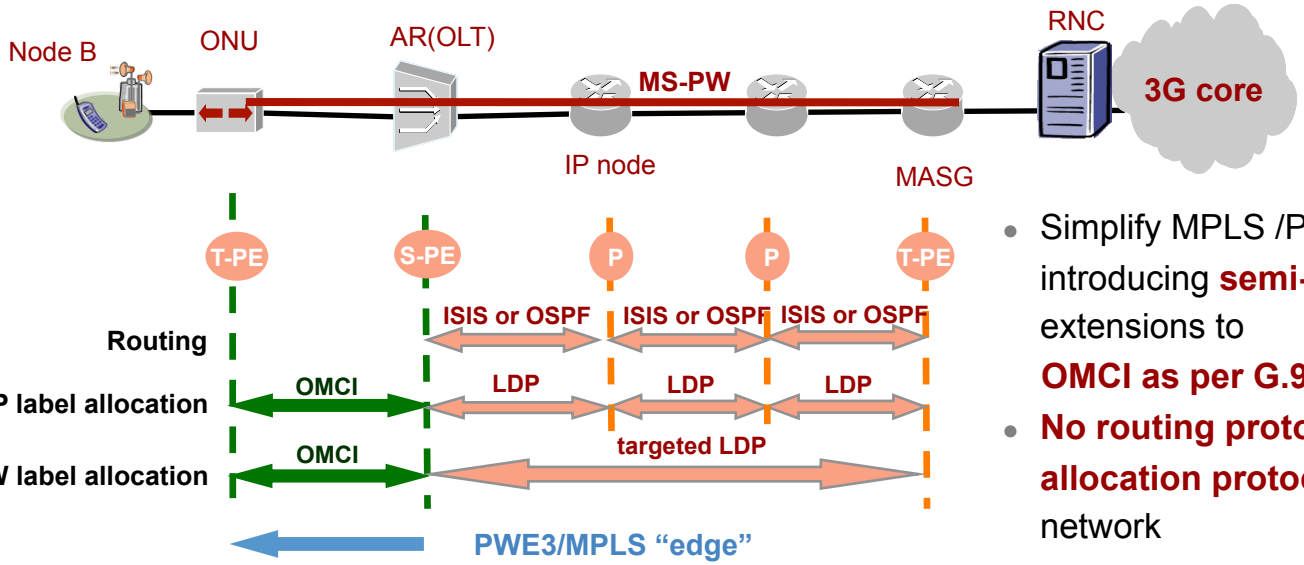
- **Complexity**
  - ONU is very cost-sensitive to routing protocols and dynamic label allocation
  - Is routing protocol necessary in GPON?
- **Provisioning difficulties**
  - When MS-PW is implemented in a PON, there may be a very large number of PW T-PEs. If PW labels on ONUs are provision d by NMS directly, it requires a network manager touching each ONU once for each PW, and there may be very many PWs. This makes provisioning a heavy burden for the network manager.
  - Additionally, there must be a concern that the configuration at the ONU and the OLT will be inconsistent because for any PW, both the ONU and the OLT must be configured.
  - ONTs may not be able to support SNMP.

Network reference model for MS-PW over GPON



- Network is partitioned into access segments and Metro/Core segments in a hub & spoke topology.
- The OLT is recommended as a S-PE so that PWs can be optimized within each segments. "PW over GEM" is recommended as per ITU-T G.984.3 in access segments providing generic transport of TDM/ATM/ETH traffic.
- All PW segments are of the same technology, which is packet encapsulated. It is only the tunneling technology that changes at the S-PE.

Label Provisioning for PW over GPON

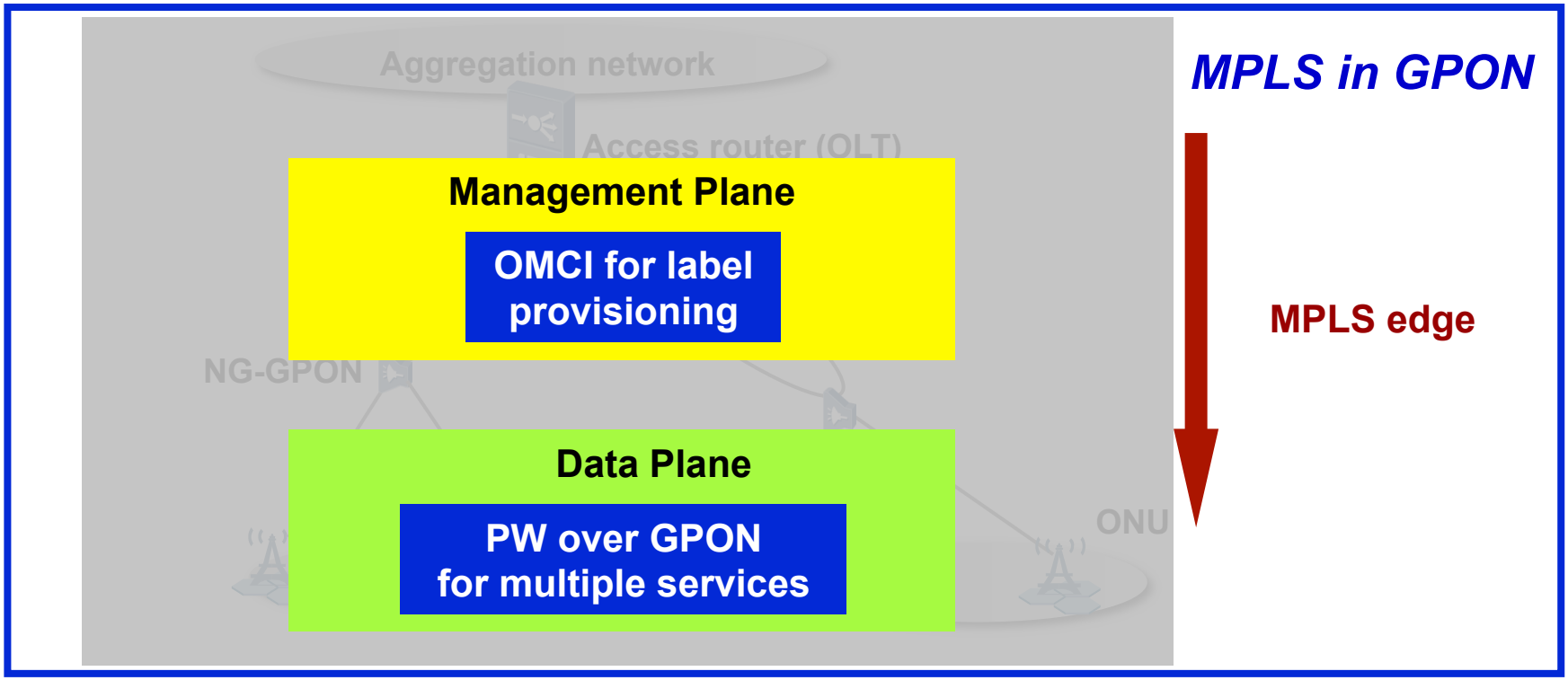


MS-PW over GPON

- Simplify MPLS /PW operation in GPON by introducing **semi-static** configuration using extensions to
  OMCI as per G.988
- **No routing protocol and dynamic label allocation protocol** needed in the access network

- The ONT management and control interface (OMCI) is a management channel between the OLT and the ONUs.
- G.984.4 and G.988 extends the functions that can be configured using OMCI to include MPLS and MPLS PW termination points at an ONT. This allows seamless integration of MPLS and MPLS PW services with a PON.
- Making use of a GPON management protocol (OMCI) helps to
  - reduce the labor of configuration
  - simplify and speed up the PW provision procedure to a great extent
  - avoid the potential inconsistence or mismatch between ONUs and OLT
  - notify to S-PE (which is the OLT) of the status of the AC at the T-PE (which is the ONU).
- It can be applied when SNMP is not support by ONTs.

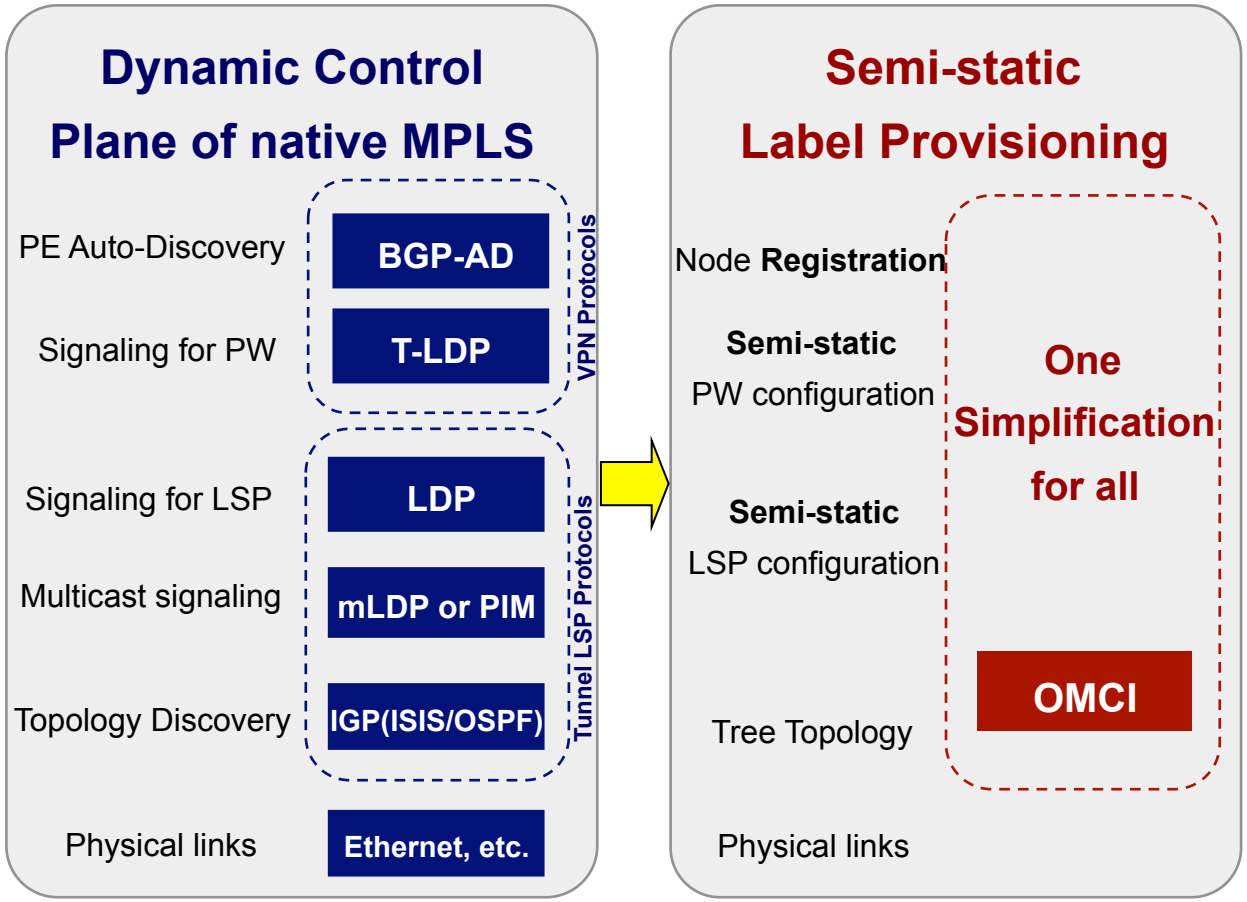
Summary



- There is a trend that operators are deploying MPLS and PWE3 in access networks, especially in an access network of G-PON or NG-GPON.
- However, IP routing and routing protocol challenge the scalability and complexity of the access network (e.g. PON).
- With OMCI for PW operation and PW over GPON, no need for full IP/MPLS stack in GPON ONUs. Thus keep PON simple and cost-effective.

Thank you

One Simplification for All



The ONT management and control interface (OMCI) is a management channel between the OLT and the ONUs that supports Ethernet, equipment, subscriber interface, and subscriber feature management.

OMCI specifies the managed entities of a protocol-independent management information base (MIB) module that models the resources and services in an ONU. Through standardized OMCI signalling, OLT builds up its management bonds with ONUs automatically.

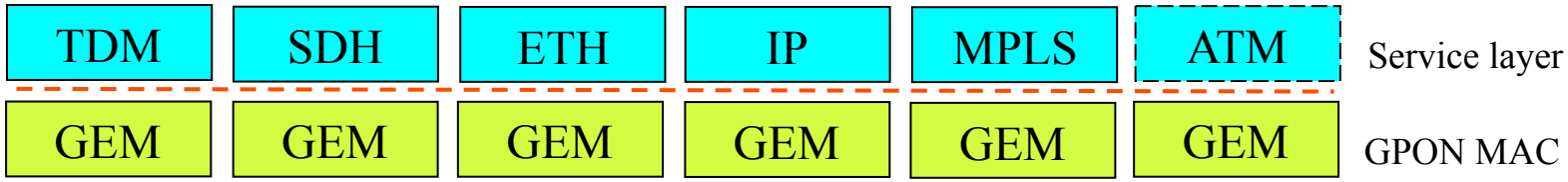
OMCI is standardized in G. 984.4 and G.988.

- **G.984.4 and G.988 extends the functions that can be configured using OMCI to include MPLS and MPLS PW termination points at an ONT. This allows seamless integration of MPLS and MPLS PW services with a PON.**

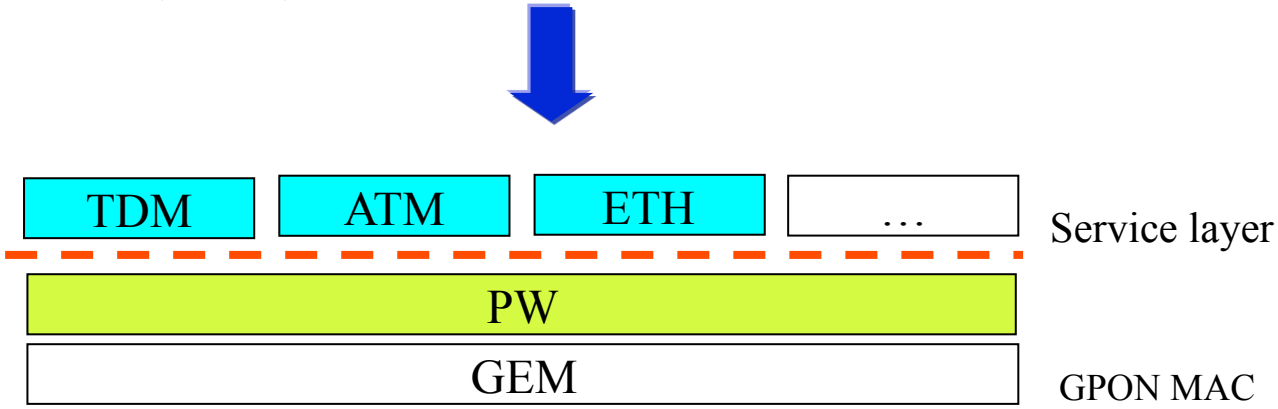
SNMP-based Provisioning vs. OMCI-based Provisioning

- **Problems of SNMP-based provisioning**
  - When MS-PW is implemented in a PON, there may be a very large number of PW T-PEs. If PW labels on ONUs are provision d by NMS directly, it requires a network manager touching each ONU once for each PW, and there may be very many PWs. This makes provisioning a heavy burden for the network manager.
  - Additionally, there must be a concern that the configuration at the ONU and the OLT will be inconsistent because for any PW, both the ONU and the OLT must be configured.
  - ONTs may not be able to support SNMP.
- **Benefit of OMCI-based provisioning**
  - reduce the labor of configuration
  - simplify and speed up the PW provision procedure to a great extent
    - When using OMCI to provision PWs on ONU, the network manager only needs to send all configurations to the OLT, which will send all parameters to ONUs automatically through OMCI. There is no need to touch each ONU.
  - avoid the potential inconsistence or mismatch between ONUs and OLT
    - Through standardized OMCI signalling, OLT builds up its management bonds with ONUs automatically.
  - OMCI can act as a signaling mechanism between ONU and OLT, which enables the ONU to notify AC status to OLT.
  - It can be applied when SNMP is not support by ONTs.

Multi-service support in GPON systems



• Multi-service support means multiple transport modes in current GPON system.
• high OPEX: operational difficulty and management complexity
• high cost of access router (NG-OLT) with a whole bunch of physical interfaces: E1/T1, NxDS0, POS/SDH, ATM, ETH …



• The trend is that PW layer functions as an uniform transport layer for multiple services.
• OMCI is extended for semi-static configuration of PWs.
• It can greatly reduce the operational difficulty and management complexity and keeps ONU simple and cost-effective.