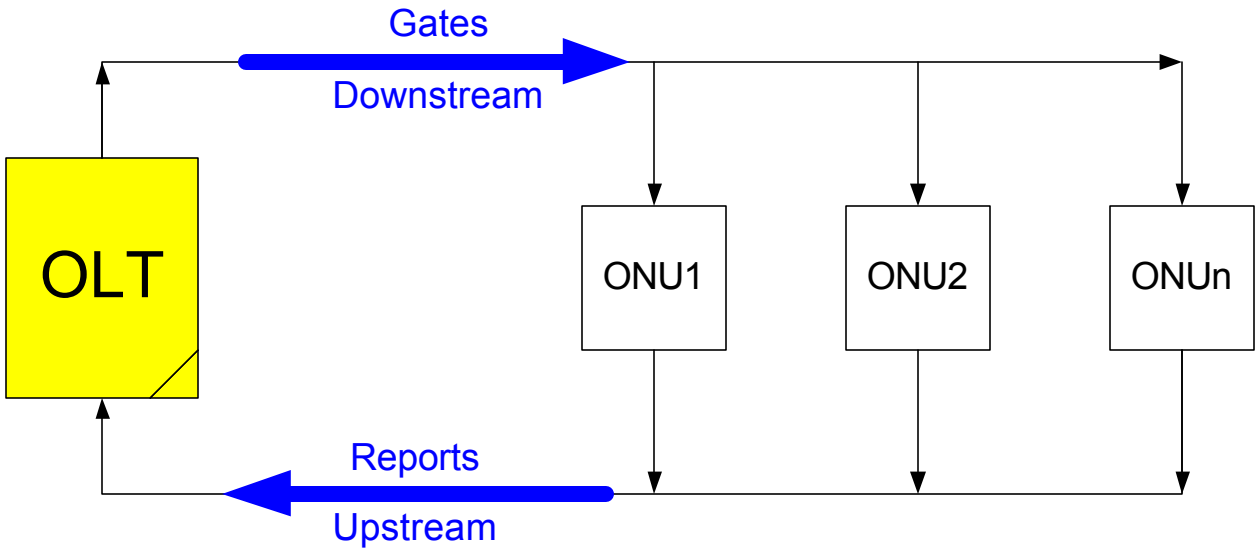
MPCP Baseline Proposal
Architecture and Layering Model

Glenn Algie
Vicent Bemmel
Richard Brand
Bob Gaglianello
Ajay Gummalla
Onn Haran
Ryan Hirth
David Horne
Lior Khermosh
Hiroshi Suzuki
John Limb
Ariel Maislos
Dolors Sala
Jian Song
Osamu Yoshihara

Overview

- **Protocol Overview**
- **Layering Model**
  - External Interface
  - Internal Layering and Interface
    - ONU Arbitration
    - Laser Control
    - Multiplexing Function
- **Summary**

PON System Operation



ONU Operation

1. **ONU synchronization**
   - ONU synchronizes to OLT timing through timestamps on the downstream MAC-control frames
2. **ONU waits for discovery gate**
3. **ONU performs discovery process which includes**
   - Ranging
   - Assignment of PHY_IDs
   - Assignment of bandwidth for the ONU to operate
     - This bandwidth must be large enough to at least be able to manage the ONU, and for the ONU to request more bandwidth when needed
4. **ONU waits for its grants**
   - ONU transmits frames in these grants
   - Request for additional bandwidth can be sent in report frames

***Timing and ranging and ONU discovery mechanisms described in separate presentations**

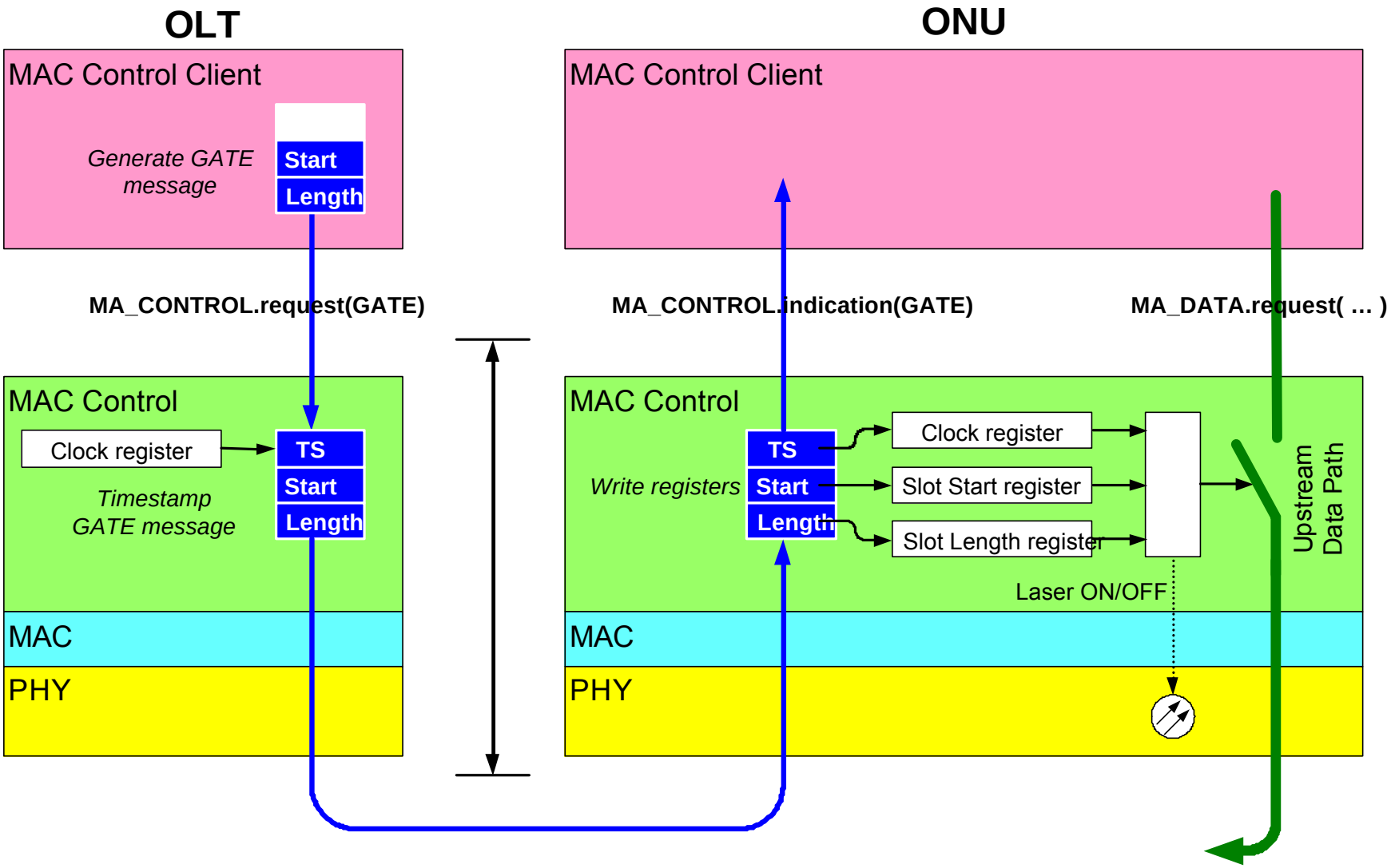
OLT Operation

- **Generates time stamped messages to be used as global time reference**
- **Assigns bandwidth (MPCP allocation)**
  - Generates discovery windows for new ONUs
  - Assigns individual grant windows to registered ONUs
- **Performs ranging operation**
- **Controls ONU registration process**

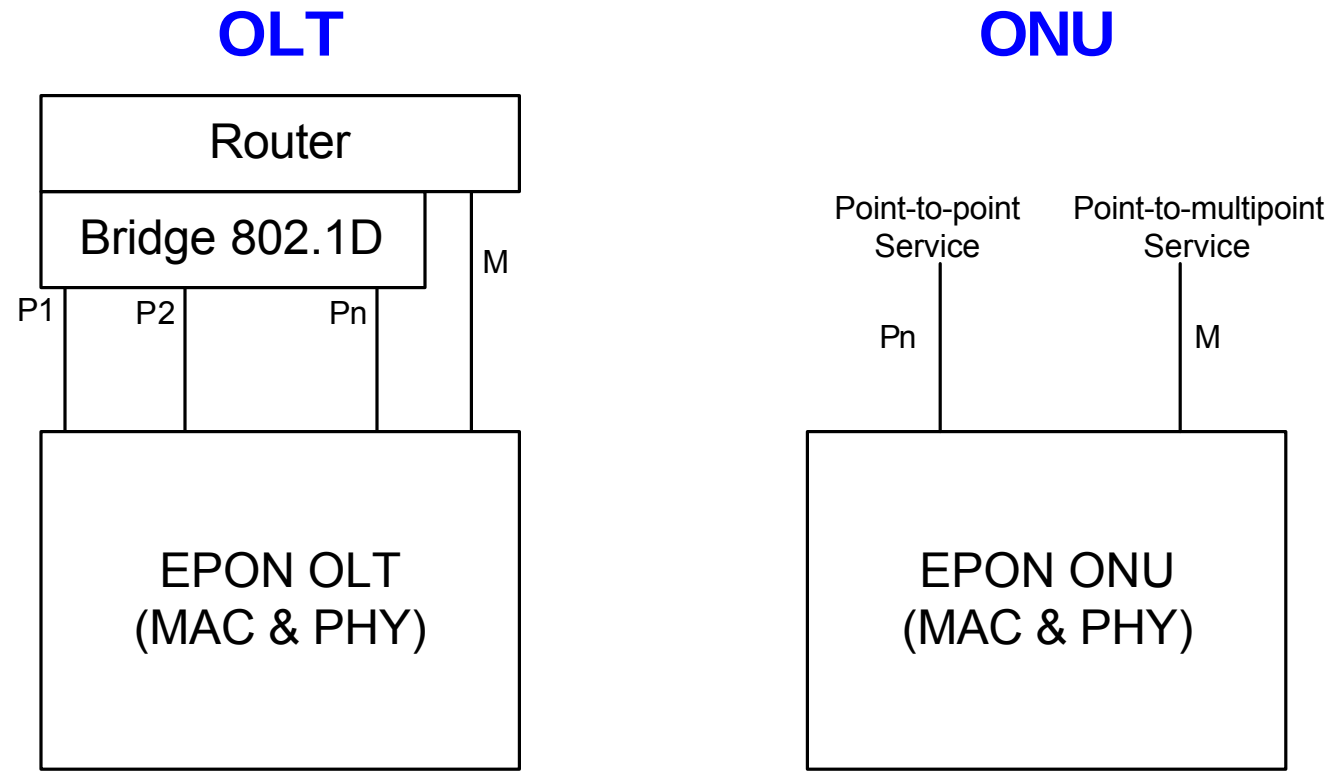
Protocol Highlights

- Collisions can occur only during discovery
- The OLT must guarantee a minimum amount of bandwidth to each registered ONU
- Mechanism to support flexible assignment of bandwidth

General Layering Overview



External Interface



Pi: Point-to-point link to ONUi
M: Point-to-multipoint link

External Interface: Details

- **Compliance is achieved with P2P emulation**
  - Defines a virtual P2P link between ONU and OLT. Each individual virtual link interfaces separately to the bridge.
- **Single copy broadcast is achieved with a special port**
  - This port supports a “native” mode of operation with a point-to-point upstream and a point-to-multipoint downstream
  - This port cannot be attached to a bridge because it is not compliant with 802.1 (requires special routing capabilities)
- **Shared emulation is not specified**
  - No need to specify how to reflect frames from upstream to downstream
- **Multiplexing function is used to map these interfaces to a single PHY**
- **Clean architecture for start process**
  - Autodiscovery can start in “native” mode and establish additional vMACs for P2PE during registration

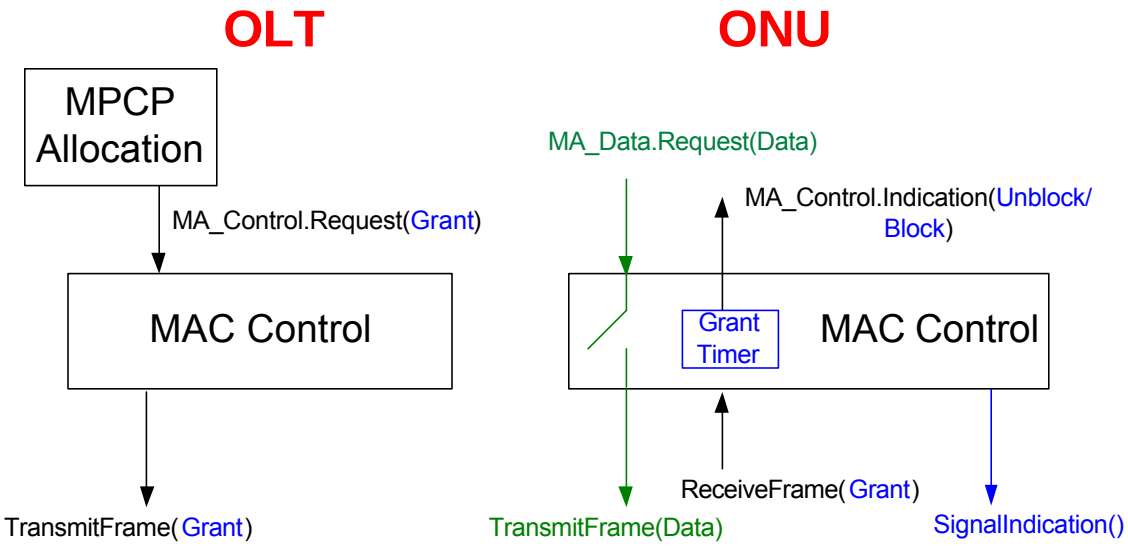
Internal Layering Specification

- ONU Arbitration
- Multiplexing Function
- ONU Laser Control

ONU Arbitration in MAC-control

- **Defined in MAC-control layer as it requires real time control**
  - Operates with standard MAC-control interface but new messages are required
- **Control layering assumes traditional Ethernet layering**
  - MAC-control entity connects to a single MAC entity
  - MAC-control entity can connect to several MAC-clients
- **MPCP allocation is performed by a centralized scheduler**
  - Scheduler transmits and receives control frames using MAC-control primitives
  - Scheduler behavior is considered out of scope
- **Gate and report messages are defined for arbitration**

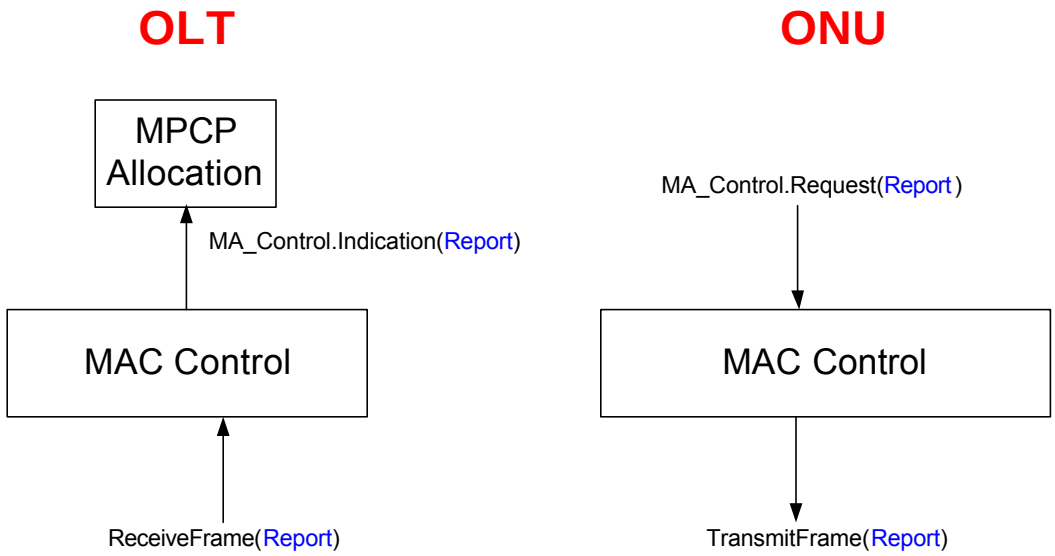
Grant Operation



Note: Modifications of existing operation marked in blue
Data path marked in green

- **Grant gates MAC-client delivery of frames.**
- **Grant operates exactly like PAUSE mechanism (generated in client and interpreted in MAC-control with indication of client at timeout time)**
- **ONU transmits only during the time indicated in the grant**
- **ONU MAC-control enables Phy transmission at the start of a grant duration and disables it at the end of the grant duration**

Report Operation



Note: Modifications of existing operation marked in blue

- **Reports are used to send ONU state to OLT**
  - Timestamps for synchronization and ranging
  - Requests for additional bandwidth

ONU Synchronization

- **Time stamps are added to MAC-control frames**
- **Specification must guarantee bounded jitter across MAC and lower layer**
  - Any jitter is accounted for in the guard band

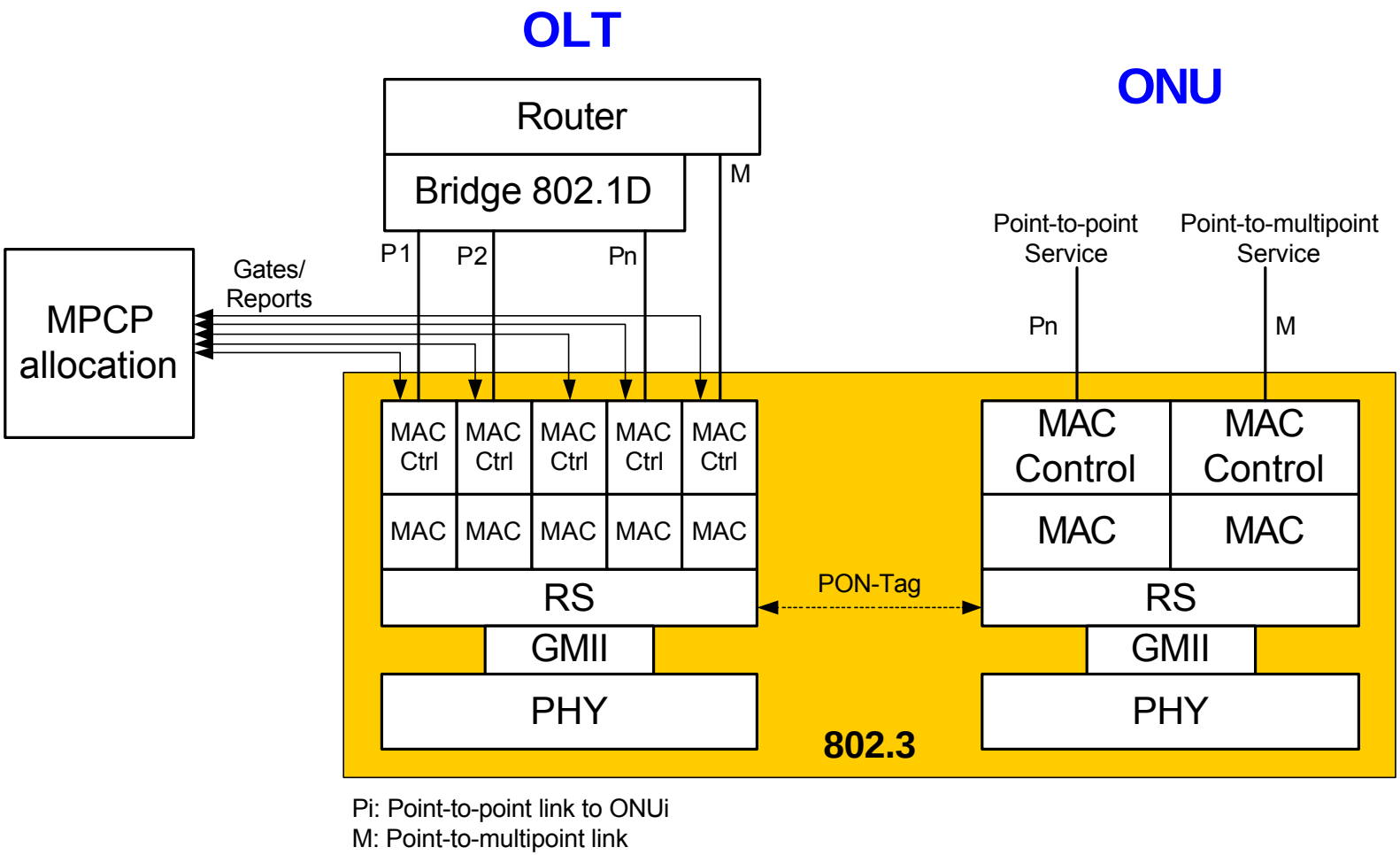
ONU Laser Control

- **MAC-control indicates PHY when to turn on/off laser**
- **Need to provide a real-time unidirectional signal from MAC-control to PHY**
  - It is a simple one-way indication to change state
- **Signal provided through a direct side path from MAC-control to PHY**
  - MAC-control generates (or writes) the signal
  - PHY receives (or reads) the signal
- **Details of signal specification to be worked out**

Multiplexing Function

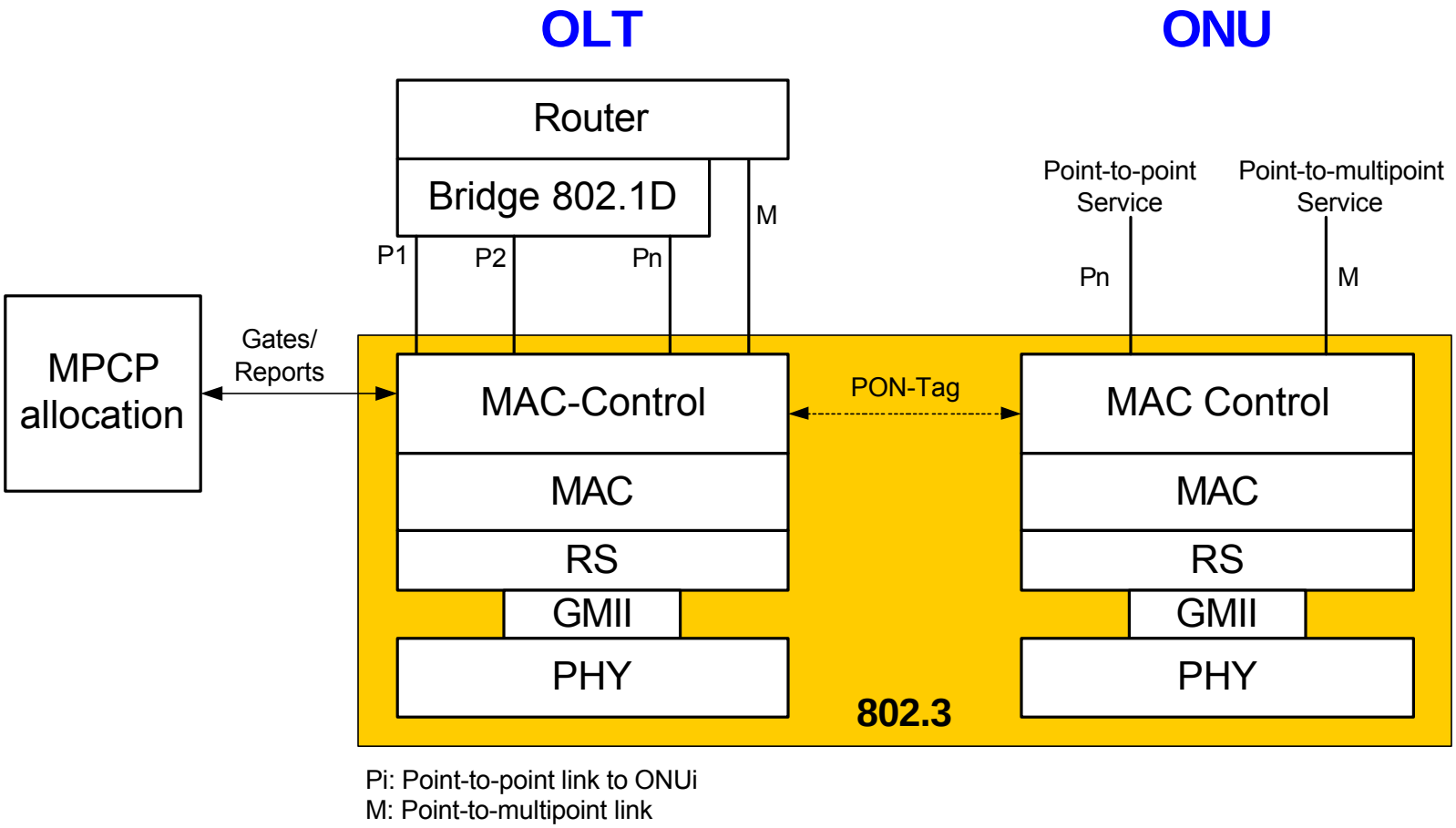
- **Multiplexing function**
  - Multiplexes frames coming from several bridge ports to a single interface to the PHY (and vice versa)
- **Two layering architectures are being considered for the multiplexing function:**
  - Reconciliation sublayer multiplexing (RSM)
  - MAC-control multiplexing (MCM)

RS Multiplexing : Architecture



Pi: Point-to-point link to ONUi
M: Point-to-multipoint link

MAC-Control Multiplexing: Architecture



Pi: Point-to-point link to ONUi
M: Point-to-multipoint link

Summary

- **Important layering decisions**
  - "Native" port that cannot be attached to bridge for single-copy broadcast service
  - A requirement of "router" functionality at OLT and ONU for single-copy broadcast service
  - MPCP at MAC-control layer
  - MPCP allocation a separate block with MAC-control interface
  - Protocol timing at MAC-control
  - Laser control signal direct from MAC-control to PHY
- **Need to decide**
  - Layer of Multiplexing function
- **Additional presentations give more details**

P2MP Motion: MPCP Architecture

P2MP Track Motion:

Use proposal <sala_1_0302.pdf> as a basis for the first P2MP draft, with the exception of

- removal of slides 17, 18
- page 4, change to “Assignment of PHY_IDs if needed”

Motion: Dolors Sala

Second: Tom Dineen

Y: __33

N: __0

A: __8