

# **MPCP Baseline Proposal Architecture and Layering Model**

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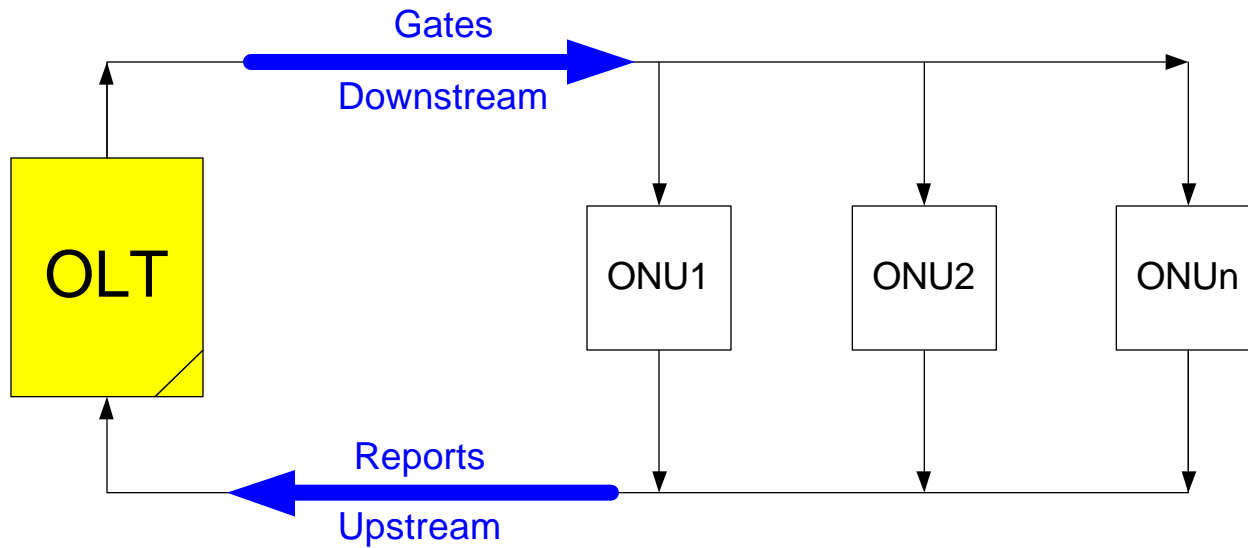
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# Overview

- ❑ **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 if needed
- 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**

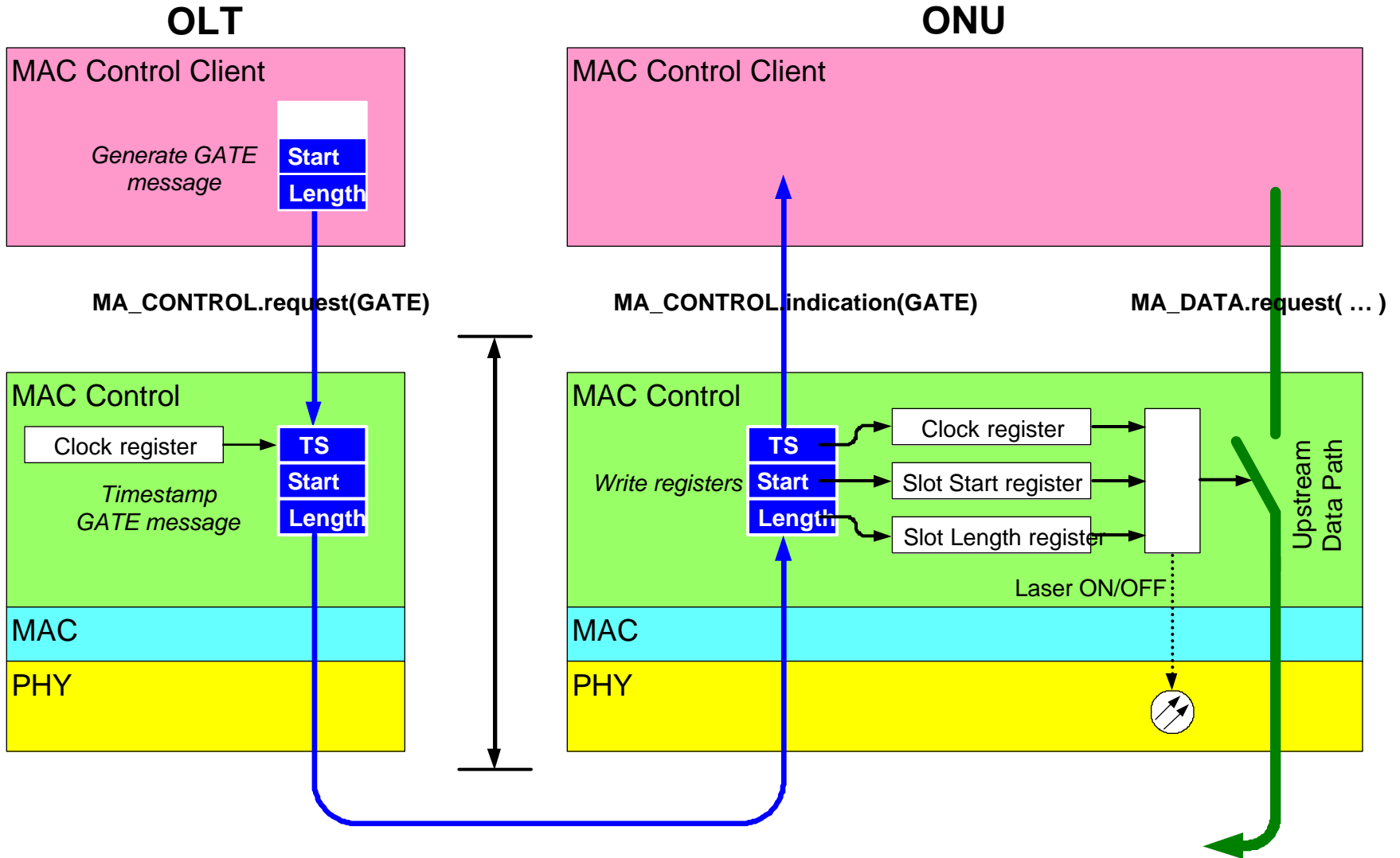
# OLT Operation

- ❑ **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

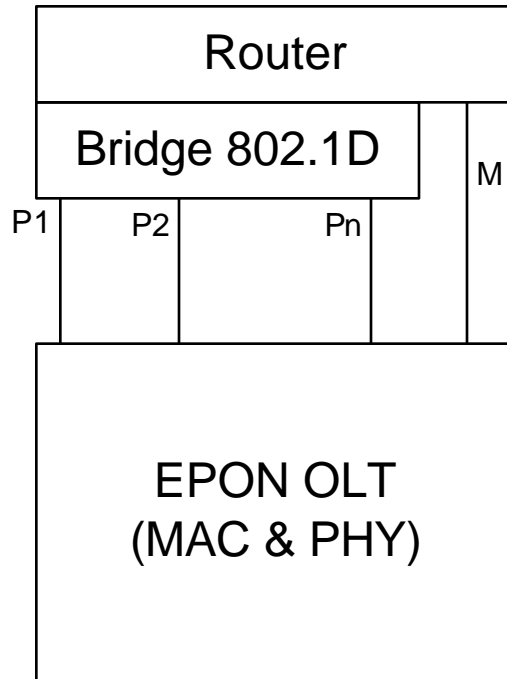
- ❑ Collisions can occur only during discovery
- ❑ The OLT must guarantee a minimum amount of bandwidth to each registered ONU
- ❑ Mechanism to support flexible assignment of bandwidth

# General Layering Overview



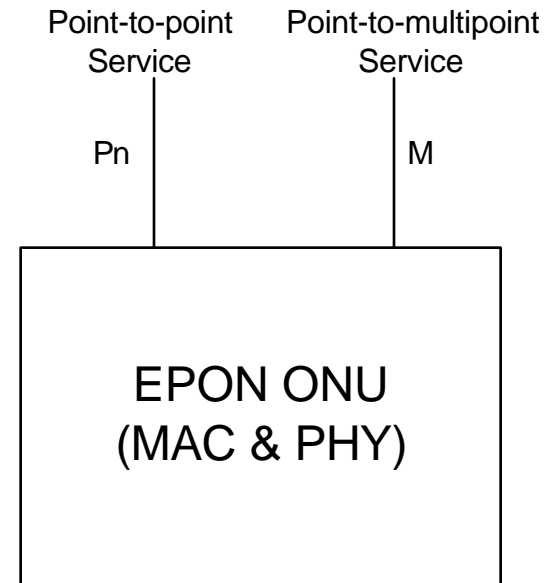
# External Interface

## OLT



Pi: Point-to-point link to ONU<sub>i</sub>  
M: Point-to-multipoint link

## ONU





# 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

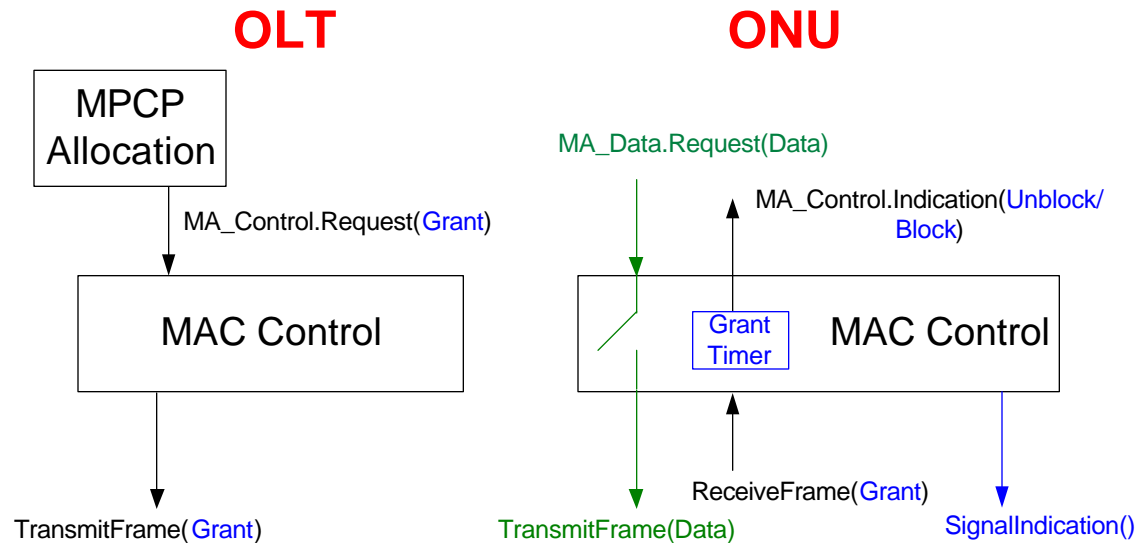
# Internal Layering Specification

- ❑ **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**

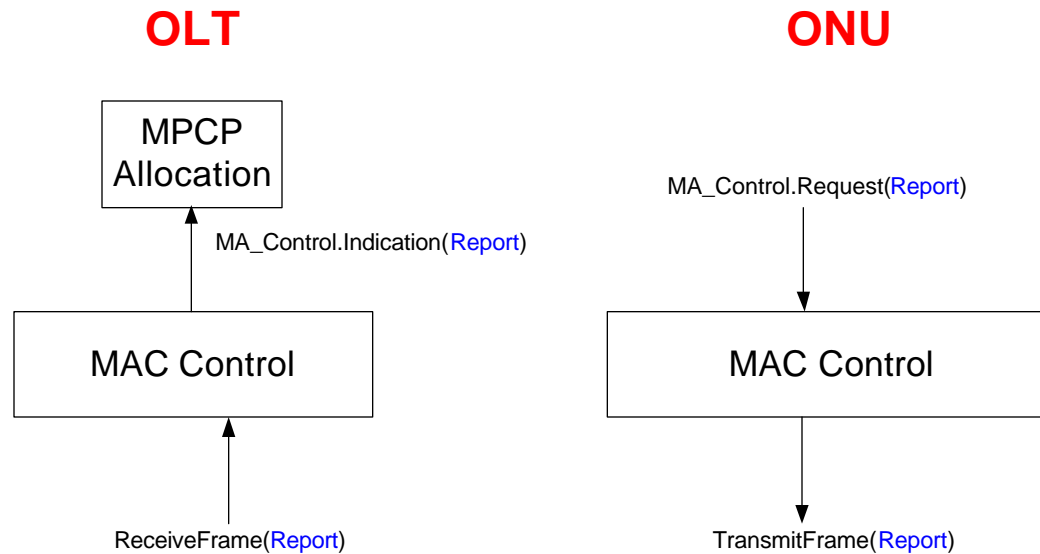
# Grant Operation



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)



# 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