Multi-Channel Control Protocol for 100Gb/s EPON

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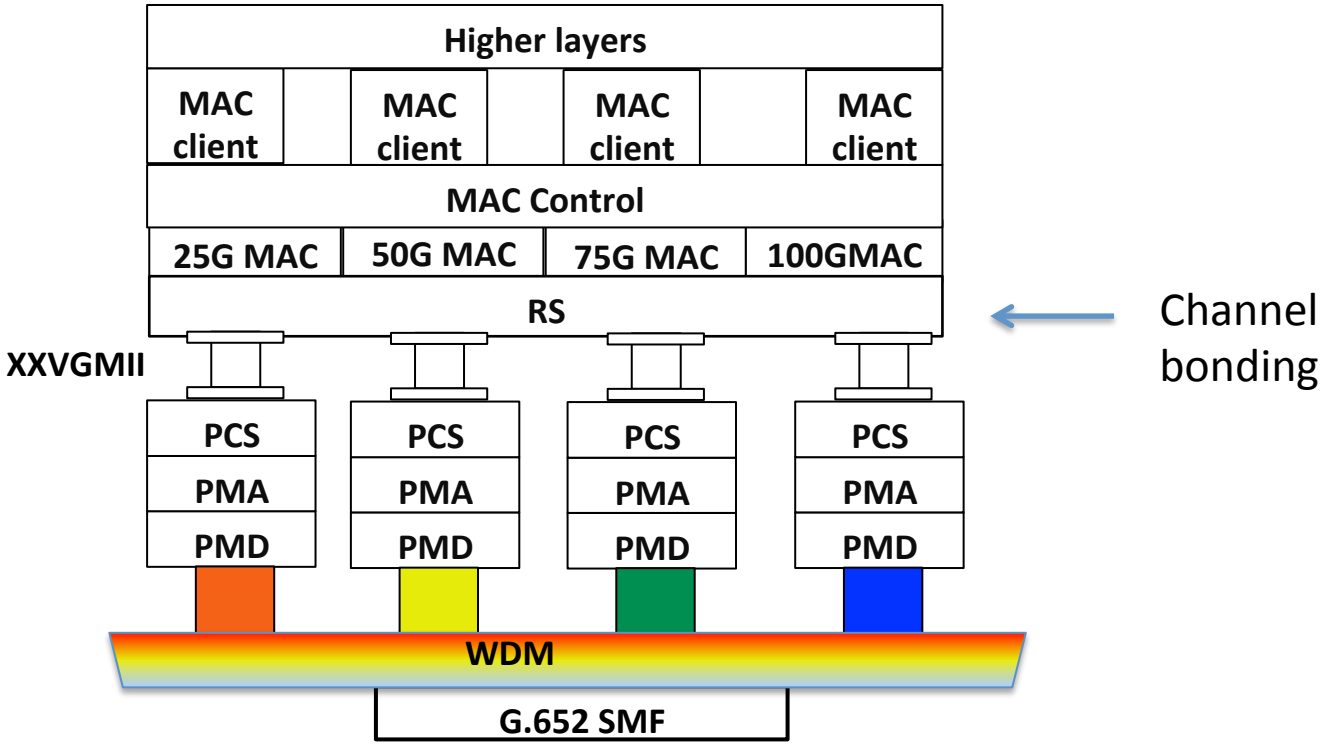
Outline

- Channel bonding choices
- Multi-Channel Control Protocol

100G EPON Reference Model I – RS layer bonding

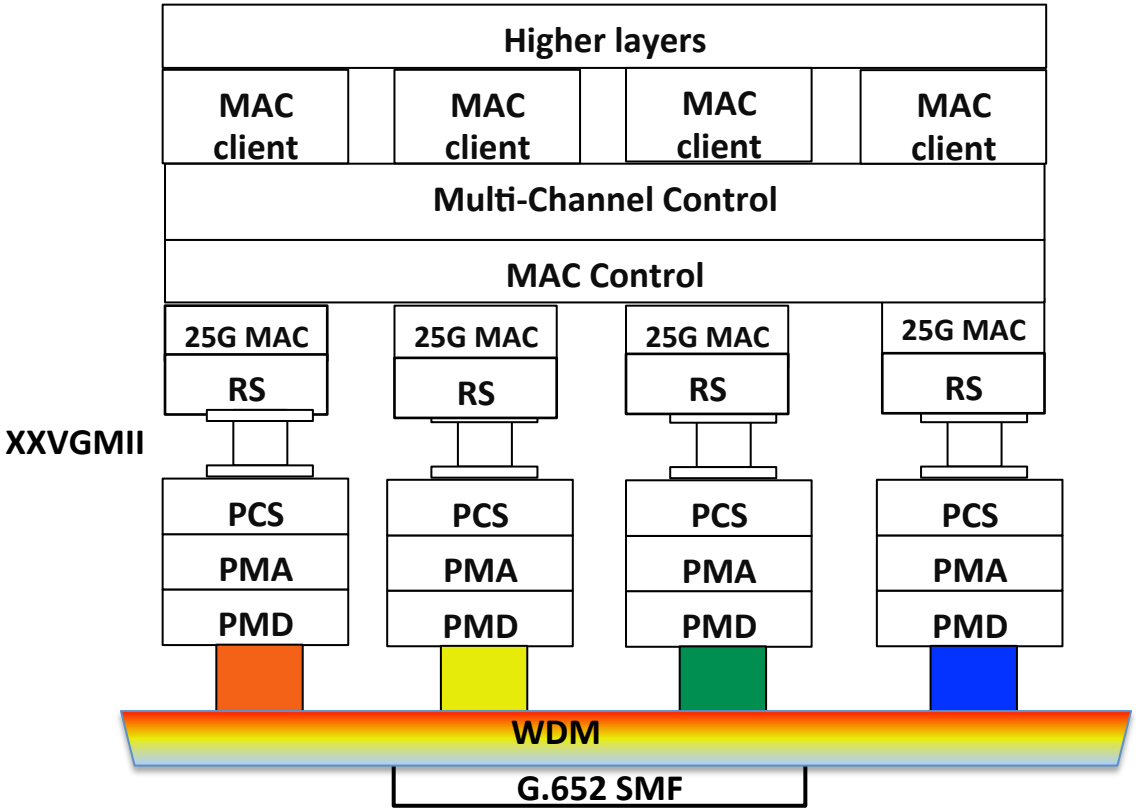


- 25G, 50G 75G and 100G have their own MACs
- Channel bonding occurs at a common RS layer

RS layer bonding

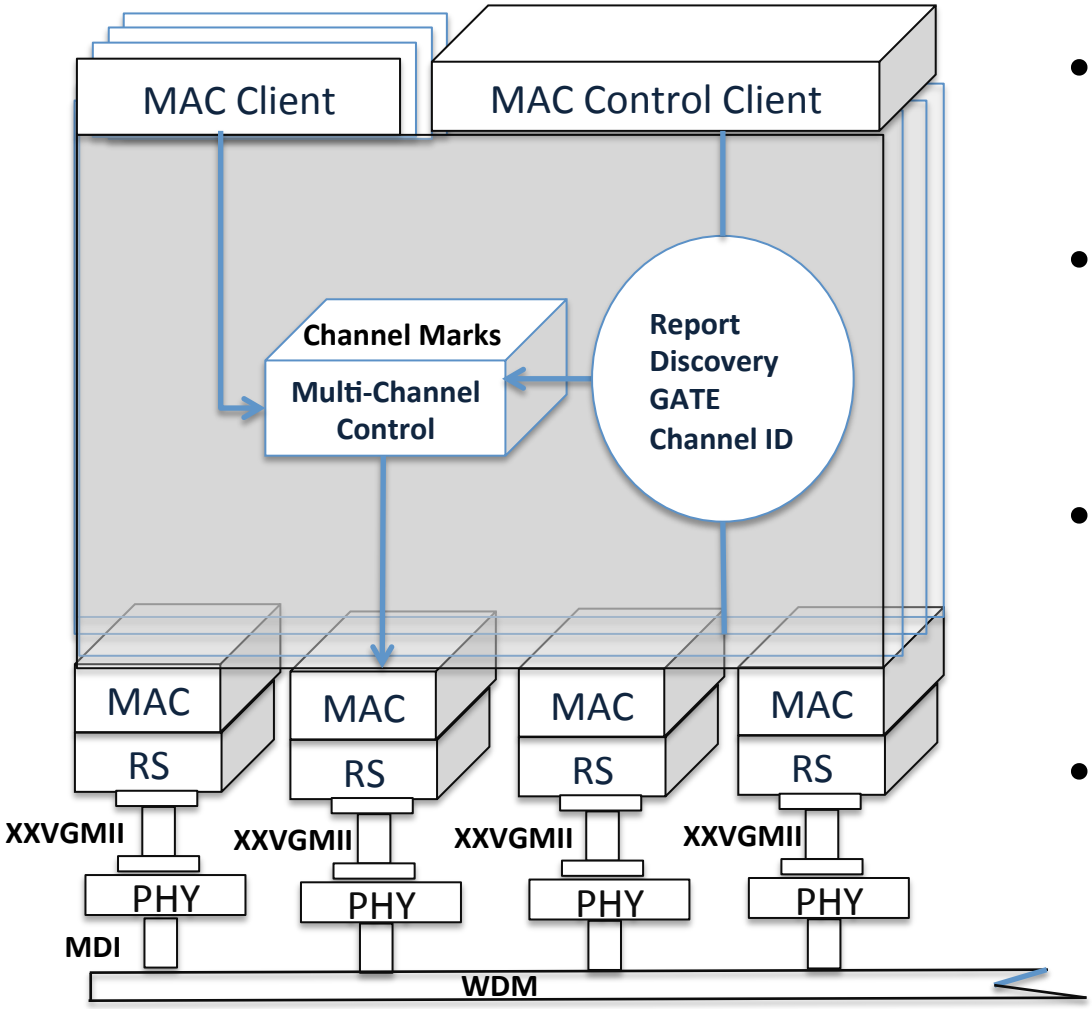
- RS layer, although it is between MAC and PHY layers, RS layer bonding is essentially PHY layer bonding
  - Inflexible, fixed bonding
- Efficiently scheduled upstream transmissions in mixed bonding channels/mixed generations is problematic
  - TDM only scheduling is simple, but not efficient
  - 2D scheduling is needed in order to be efficient, but is more complex (DOCSIS type of scheduling)
- Complication at OLT, i.e. OLT needs to have 25G, 50G and 100G MACs initially in order to support growth
- Traffic balancing among the lanes may be a problem without 2D scheduling
- Having fixed delay, rate adaptions may be challenging

100G EPON Reference Model II – bonding with MCCP



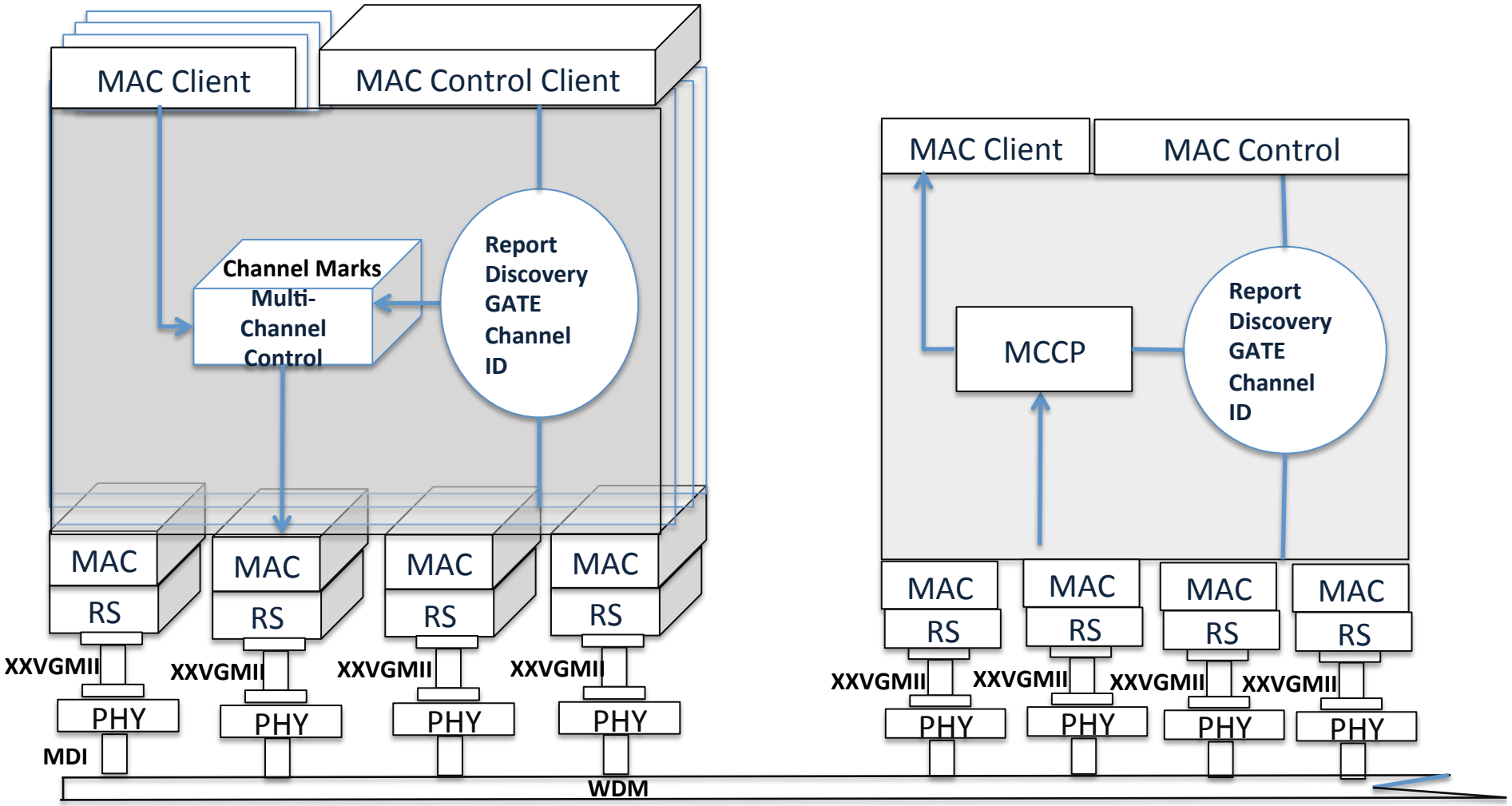
- Channel bonding is achieved with Multi-Channel Control Protocol
- MCCP works with MPCP to achieve channel bonding
- Using four identical 25G lanes

Multi-Channel Control Protocol



- An ONU reports its channel/ lane configuration in a new MPCP message – Channel ID
- MCCP uses “C_ID” to mark the packages to the ONU so they are assigned to the correct channels
- The packts are then sent to the transmission buffers of the lanes to be scheduled for transmission
- Each of the 25G MAC and PHY behaves similarly to 10G EPON (scheduling, rate adaption, etc.)

MCCP in an 100G EPON system



Channel Mark and Channel ID

Channel Mark

The possible channel combinations for 25G ONU, 50G ONU and 100G ONU:

$$\binom{4}{1} + \binom{4}{2} + \binom{4}{4} = 11$$

- A 4 bit C_Mark field is enough
- If considering to limit choices of channel combinations for 50G ONU, the1st channel must be on lane one, and a 3 bit C_Mark field will be enough

Channel ID

- Channel ID represents possible channels for the ONUs
- The bits needed for C_ID is the same as that for Channel Mark
- C_ID can be carried in MPCP message

- **Explicitly introduce C_ID for ONUs configuration identification and C-Mark for bonding**
- **Channel bonding does not have to be associated with LLIC as in RS layer bonding**

Conclusions

- RS layer channel bonding is essentially PHY layer bonding
  - Inflexible, fixed bonding
- Channel bonding with Multi-Channel Control Protocol has the flexibility similar to MAC layer bonding, but works with MPCP.
- MCCP can be considered as a new MAC control function in multi-channel P2MP environments

Thanks

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