MPCP model for ResE

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ResE procedures

- The following procedures are required for ResE transport
  - Channel establishment
  - Timely transmission control
  - Derived requirement: network clock synchronization

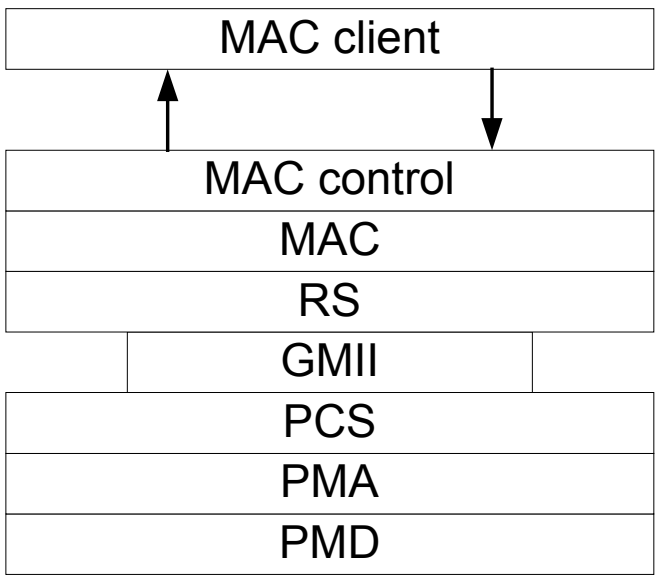
- The following procedures are assumed to be out of IEEE802.3 scope
  - Network wide bandwidth reservation
  - Network wide transmission timing control

MAC control content

- 2 functions currently implemented in MAC control
  1. Flow-control (pause)
  2. MPCP, which includes:
     - Stations discovery and registration
     - Transmission control
     - Status report
     - Timebase maintenance
- 16-bits are reserved for MAC control opcodes, of them only 6 are used
  - New opcodes can be added

Layering model

- If the project is part of Ethernet then functionality should be specified in MAC control
- Ground assumption:
  Anything below MAC control must not be changed



Placing timebase above MAC control

- Ethernet is not aware of any timebase above it
- Ethernet can't gate packet transmission based on external timing

- Upper layers traffic is susceptible to queuing delay
  - Delay and jitter in switch(es) can't be guaranteed
  - Delay and jitter between MAC and upper layer can't be guaranteed

Principles of MPCP operation

- The essence of MPCP is scheduling future transmission opportunities to avoid collisions
- Distributed events are synchronized to a central counter
- Synchronization is performed at MAC control sublayer

MPCP timing model

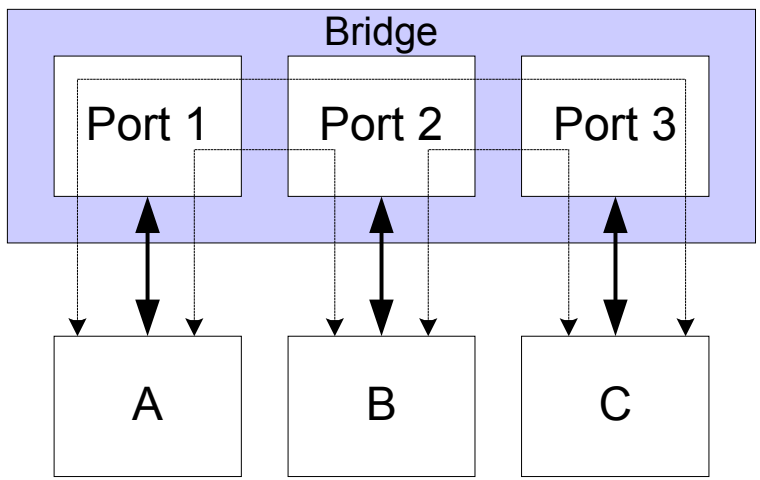
- A global counter exists in the OLT
- Events are synchronized to arrive at the OLT

- ONU updates its local counter based on arriving timestamp

- Every MPCP message includes the local clock value sent as a timestamp

Channel establishment

- Application layer channel establishment is required
- Low layer channel establishment is also required
  - RE aware detection: must be known to Ethernet
  - Enables guaranteed SLA end-to-end channels



Lower-layer channel establishment

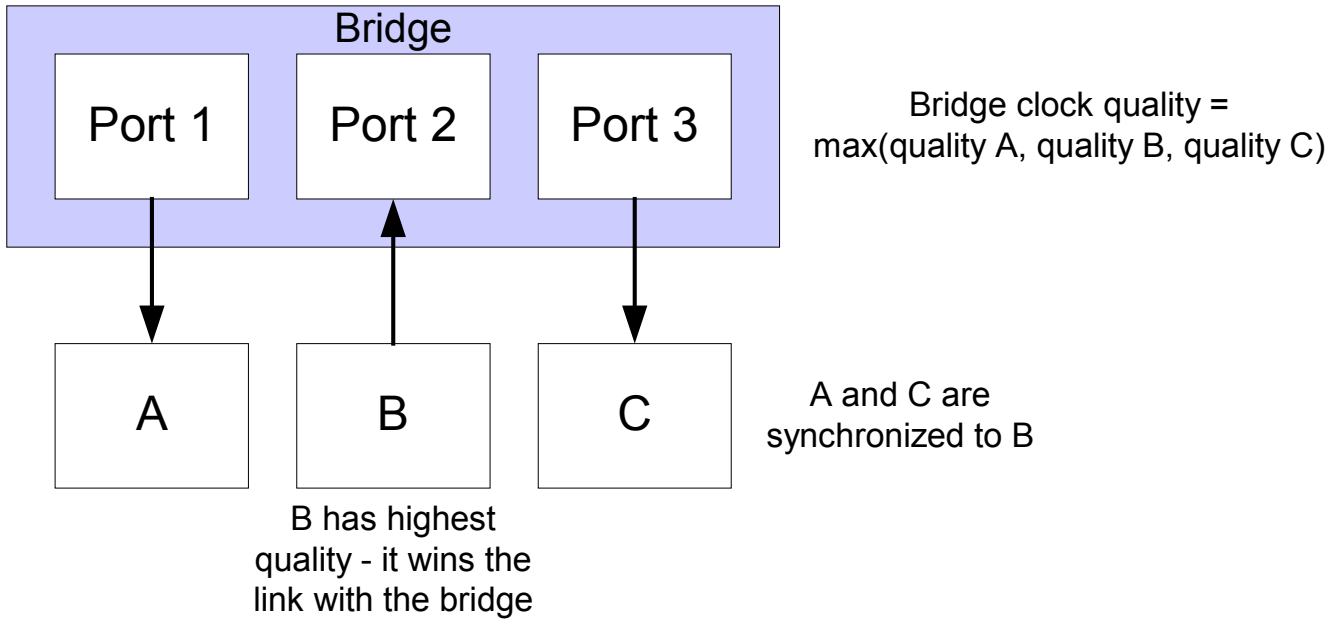
- In EPON, ONUs are attempting to register to OLT
  - Unique identity is assigned to each
- In ResE, no pre-defined partition to master and slave role
  - Concurrent discovery might be resulted

- Required extensions to MPCP
  - State machine modifications for concurrent discovery

Network wide timing (1/2)

- Timebase can be propagated in the network
  - In each link, the clock with better quality amongst the two is used
  - In a bridge, the port with better clock quality is sharing its clock with remaining ports
    - Out of scope
- End result: all links are synchronized on best available clock

Network wide timing (2/2)



- Required extensions to MPCP
  - Addition of link clock selection mechanism
    - New OPCODE and state-machine are suggested

Transmission control (1/2)

- In EPON
  - OLT's transmission is continuous
  - ONU's transmission is controlled by messages from OLT
- In ResE, both ends should gate transmission
  - Three options:
    1. Each end station schedules the transmission of the other end station
    2. Each end station schedules transmission locally
    3. Combination of the above

Transmission control (2/2)

- Required extensions to MPCP
  - Local transmission control should be added to the gating mechanism
  - Potentially, selection mechanism between local and remote based gating should be added

Timing of transmission control

- In EPON, each vendor designs its own dynamic bandwidth allocation (DBA) for controlling ONUs transmission
  - Network is typically over-subscribed
- In ResE, scheduling is similar, if not simpler, and can be adjusted to any network timing model
  - Network wide synchronization of transmission from all devices is possible, though out of scope

Redundant functionality

- Some of EPON functionality is redundant in ResE
  - Turning PHY on and off
  - Negotiating PHY timing capabilities during discovery
  - Contention based discovery
- Those points have no significant burden on the protocol
- Beside that, MPCP is a great start point for extensions enabling ResE

Summary

- The location for ResE should be MAC control
- Timebase maintenance, transmission control and link establishment already exist in Ethernet: MPCP
- The existing mechanisms can be enhanced to support ResE