MPCP Layering Considerations

Glen Kramer – UC Davis
Onn Haran, Ariel Maislos – Passave
Hiroshi Suzuki – Cisco Systems
Emulation in RS Layer

- Emulation layer must be able to multiplex data frames for downstream transmission
- Concurrent frames from multiple MAC ports
- Overall bandwidth may exceed line bandwidth
Issues with Emulation in RS Layer

- **Multiplexing requires:**
  - Buffering ⇒ delay is not constant
    - May affect MPCP synchronization
    - Buffers may overflow
    - Backpressure is required
  - Intelligent discarding ⇒
    - RS layer must be SLA-aware to drop frame based on user’s bandwidth usage (layer violation)
    - RS layer must look inside L2 header to drop lower-priority frame (layer violation)

- **Error Counters are in MAC ⇒**
  - Frame Discarding below MAC impacts BER
  - BER becomes load-dependant (higher load = drop more frames)
Emulation in MAC-Ctrl Layer

- Solves the problems with buffering and L2 lookup (OK to do above MAC)
- Can intelligently discard frames

But …
- MAC needs to be modified to pass PHY-ID through (MAC-address-based filtering does not work)
- Pause support is not possible
- Also link management functions don’t work (see next slide)
Issues with Emulation in MAC-Ctrl

- Frame is filtered below MAC
- Corrupted frame increments error counter in **only one** MAC at the receiving end of virtual PtP link
- Frame is filtered above MAC
- Corrupted frame increments error counter in **every** ONU’s MAC
- Invalidates link management
Neither Approach Works

<table>
<thead>
<tr>
<th></th>
<th>Layering</th>
<th>Link Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emulation in RS layer</td>
<td>Violation</td>
<td>OK</td>
</tr>
<tr>
<td>Emulation in MAC Ctrl Layer</td>
<td>OK</td>
<td>Violation</td>
</tr>
</tbody>
</table>

What is the solution? *Split functionality into two layers*
Solution

- Keep filtering (emulation) below MAC
- Reduce below-MAC multiplexing to simple OR function
- Guarantee that there is no concurrent frames in emulation layer

How?

- Currently MPCP controls access to the medium from tail end
- Extend MPCP to control access to the medium from the head end
• Intra-OLT messages need not be 802.3 frames
• MPCP Registers are set using an unspecified interface
Conclusion

1. Downstream multiplexing performed by gating (serializing) downstream transmissions from different ports

2. Same mechanisms used in OLT and ONU

3. Currently MPCP allows BE bandwidth control for upstream only. User paying for 10 Mbps may get almost 1 Gbps downstream

4. Gating OLT’s transmission will allow bandwidth control for downstream

5. Gating OLT’s transmission allows very simple emulation layer in RS