Ethernet deployments towards Service providers

- In Campus: 10/100, GbE, 10GE
- In Metro: GbE, 10GE
  - 10Km, 40Km and beyond
- In Access: EFM
  - Up to 10Km
    - Ethernet over Copper
    - P-P GbE
    - Ethernet PON
Why we need OAM for Ethernet?

- “I want Low Cost Ethernet for my networks. But you do not have what Service Providers really need: OAM”: Mr. Roy Bynum, MCI Worldcom

OAM: Operation, Administration & Maintenance

- Low cost, service provider / customer demarcation, CPE
- Reduced network complexity
- Common protocol across LAN / MAN / Access
- While keeping the comparable level of OAM capability with existing transport / access networks (ADSL, T1/T3, OC-N, ATM etc.).
Operation Model: Head End to manage CPE

- CPE local stats/status is read/written by Head End
EFM OAM Objectives Agreed

• Support Far-end OAM in EFM, which includes:
  - Link Monitoring
  - Remote Failure Indication
  - Remote Loop back
Non-Goals

- Provisioning is excluded.
  - OAM at MAC/PHY level only.
  - Provisioning is for services.
Common OAM for all EFM PHYs

- What OAM (Link monitor, Failure Indication, Remote Loopback) means for each EFM PHY?
- Preferable to have a common OAM capability for all EFM PHYs.
## Link Monitoring

### Examples for each EFM-PHY

<table>
<thead>
<tr>
<th></th>
<th>P-P Copper</th>
<th>P-P GbE</th>
<th>EPON</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAC</strong></td>
<td></td>
<td></td>
<td><strong>Tx/Rx PKT</strong></td>
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<td></td>
<td><strong>CRC Error</strong></td>
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<tr>
<td><strong>PCS / PMA</strong></td>
<td><strong>SNR ( Inter Symbol Error )</strong></td>
<td><strong>8B10B Code Violation</strong></td>
<td><strong>8B10B Code Violation</strong></td>
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<td></td>
<td><strong>Corrected Error</strong></td>
<td></td>
<td><strong>Upstream Access Control Monitor</strong></td>
</tr>
<tr>
<td><strong>PMD ( Optical / Analog )</strong></td>
<td><strong>Tx Power</strong></td>
<td><strong>Loss of Signal (Rx Power)</strong></td>
<td><strong>Loss of Signal (Tx/RX Power)</strong></td>
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<td><strong>AGC gain (Rx)</strong></td>
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</tbody>
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**IEEE802.3 EFM SG**  
**July 2001**
## Remote Defect Indication
### Examples for each EFM-PHY

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<tr>
<td><strong>MAC</strong></td>
<td></td>
<td>MAC Control PKT option</td>
<td></td>
</tr>
<tr>
<td><strong>PCS / PMA</strong></td>
<td></td>
<td><em>Local/Remote Fault Indication</em></td>
<td><strong>Dying Gasp</strong></td>
</tr>
<tr>
<td><strong>PMD (Optical / Analog)</strong></td>
<td></td>
<td>n/a</td>
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</tr>
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Remote Loop Back

- Reduce / Eliminate “truck rolls”

- Loop back is important for
  - Failure Isolation
  - Remote problem resolution

- Per subscriber unit
OAM for EFM: Summary

• OAM is mandatory requirement for Ethernet in the First Mile
• OAM operations
  - Link Monitoring at MAC/PHY/PMD
  - Failure Indication at MAC/PHY
  - Remote Loop-back at MAC/PHY
  - EPON needs Upstream Access Control Monitoring
  - Failure Isolation by combination of these operations
• OAM Mechanism will be built in PHY and/or MAC layer
  - New attributes to be added to 802.3 Clause 30