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How the world shares ideas.

LAN and WAN Rate 10 GigE

IEEE 802.3
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Agenda

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- **A 2 PHYs Solution is the Way To Go**
- **LAN PHY compatible with LAN market**
- **LAN PHY provides connections up to 40 Km for extended campus networks**
- **WAN PHY needs short reach optics**
- **WAN PHY does not need a SONET clock**

LAN and WAN Rate Ethernet

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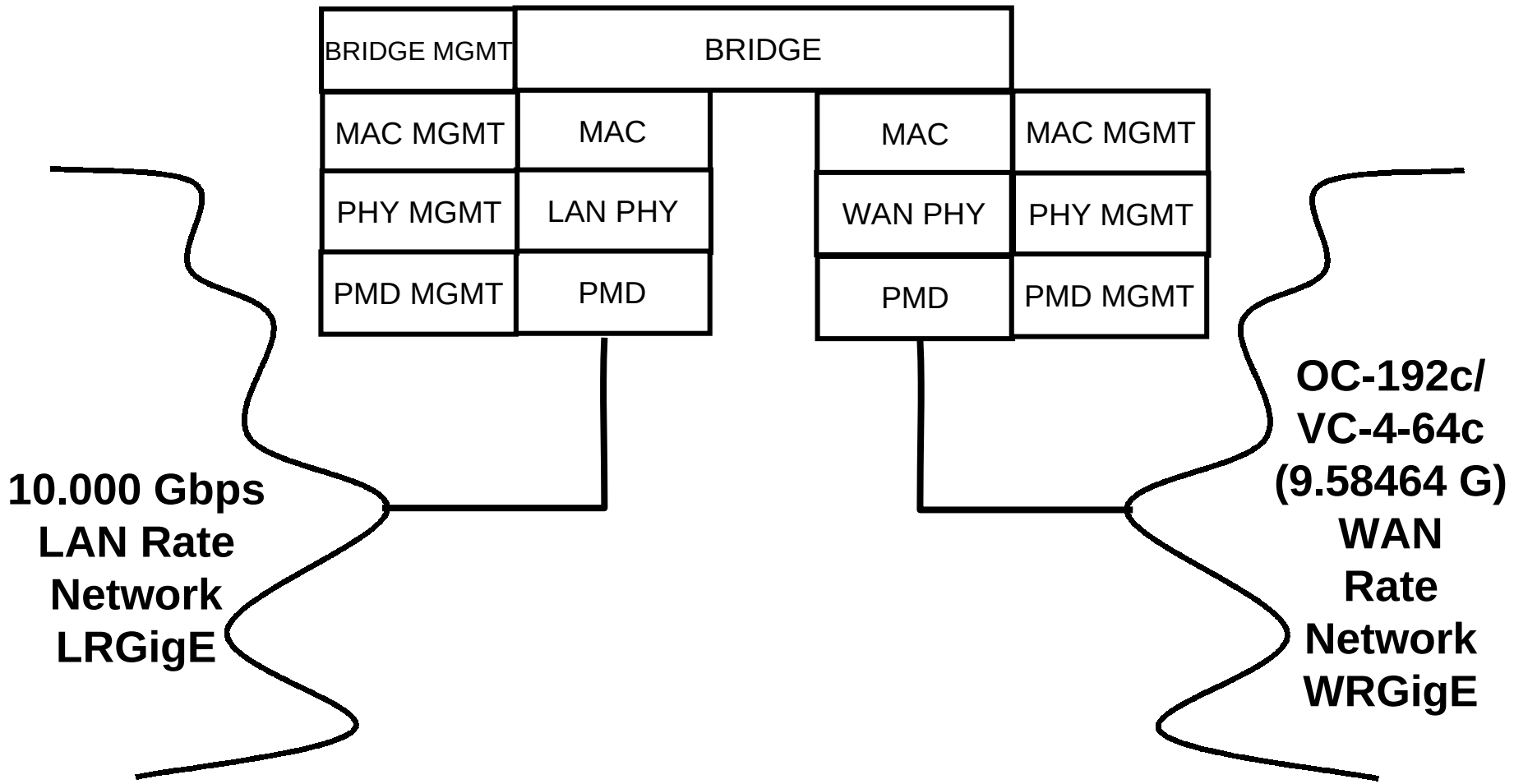
LAN Rate

- A 10.000 G MAC clock allows a single clock for selecting 1 GigE or 10 GigE
- Users, test labs, and sales people expect the performance metrics for 10 GigE to be exactly 10X 1 Gbps Ethernet
- LAN a simple management system
- Allow Ethernet TM multiplexer product to carry exactly 10 1 Gbps signals

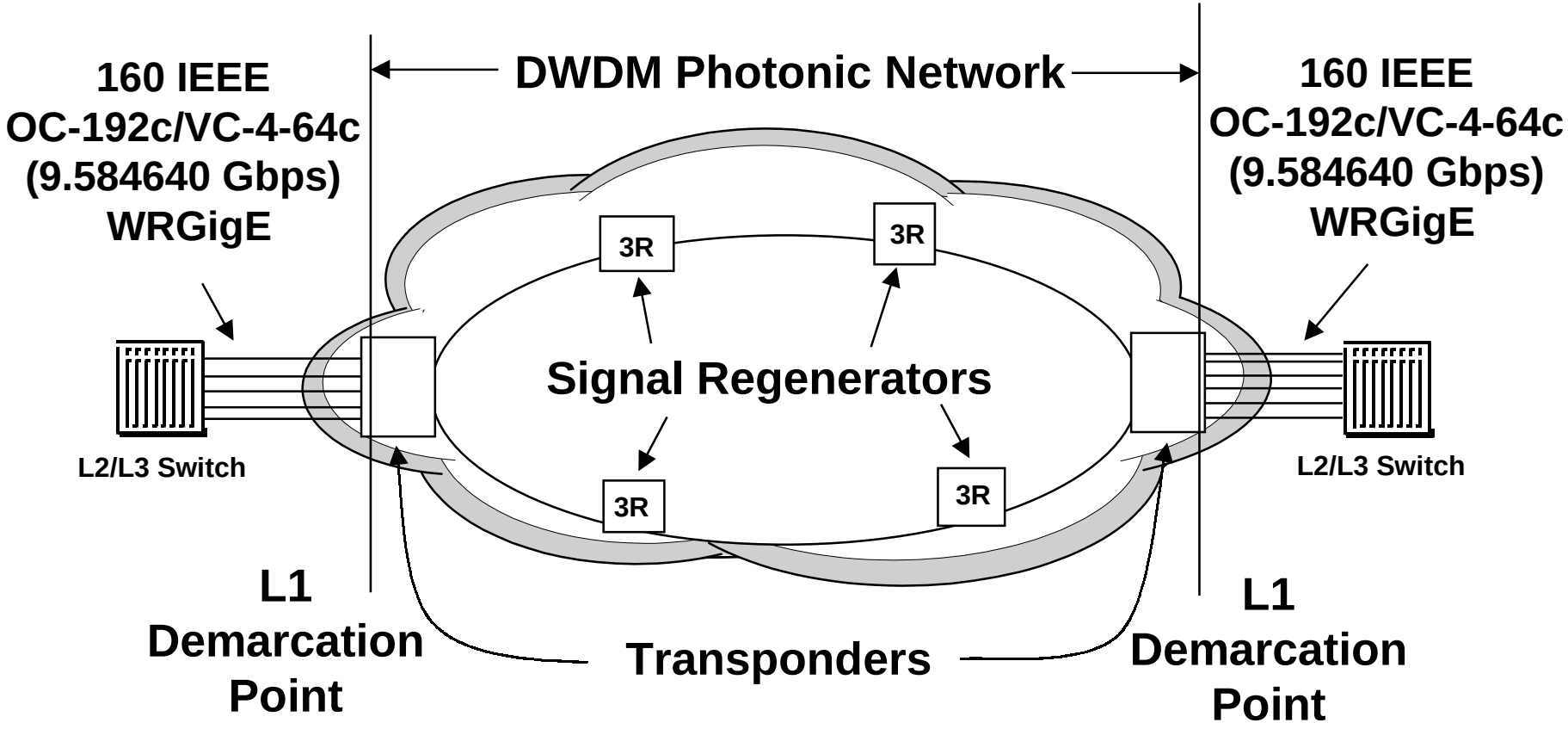
WAN Rate

- Carrying 10 GigE over existing WAN networks requires reducing the data rate to fit in the payload capacity of OC-192c/VC-4-64c (9.584640 Gbps)
- Carrying 10 GigE directly over DWDM networks requires matching the transmission technique, timing, and management requirements of the regenerator network
- Wide area networks demand enhanced management to support unmanned offices

A Bridge Connects 2 Rates

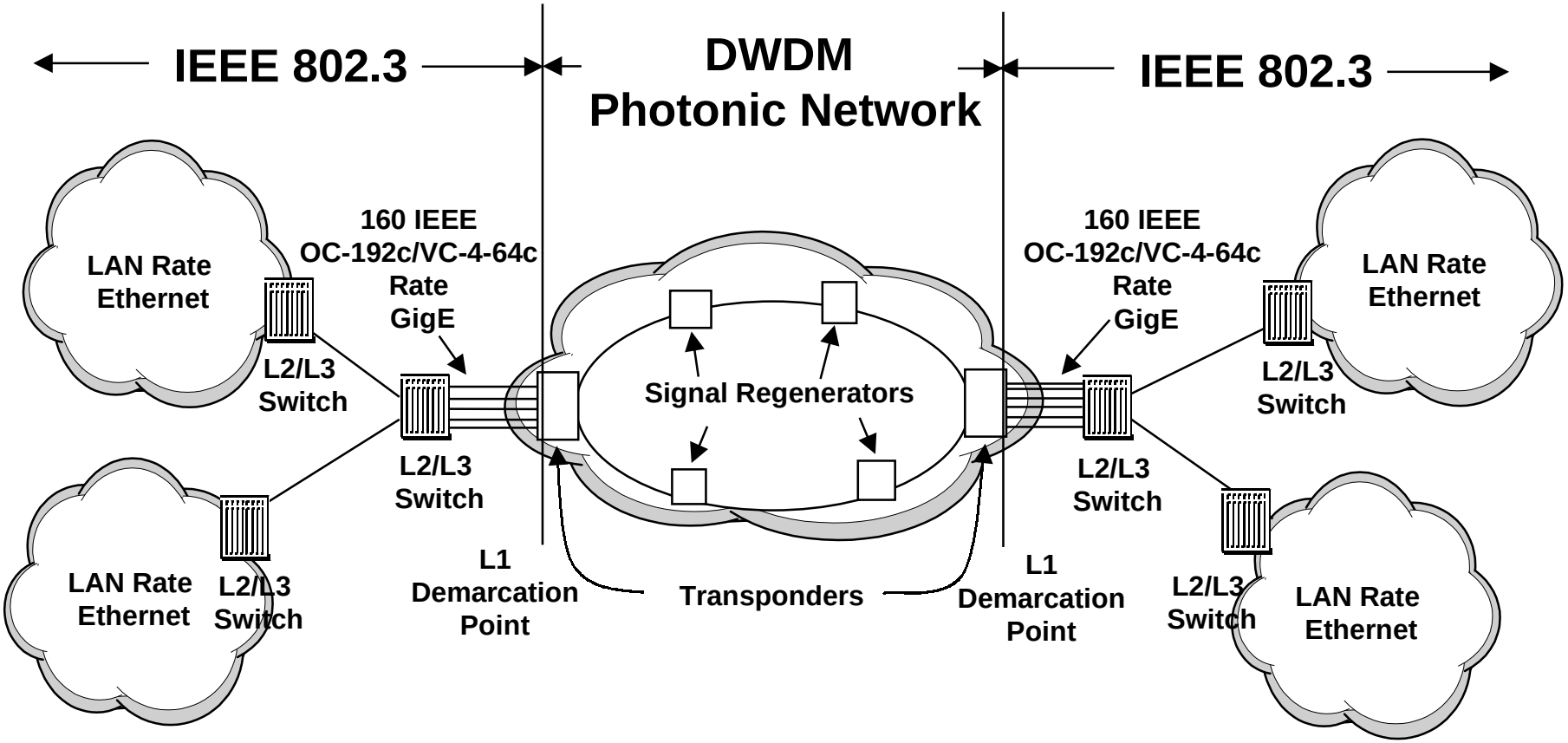


WAN Rate Network



- **Transponders serve as a demarcation point between the IEEE L1 and the DWDM photonic network**
- **Transponders perform mapping to DWDM wavelengths plus signal regeneration and retiming**

LAN/WAN Rate Matching



- **LAN Switches de-couple the LAN Rate and WAN Rate PHYs by buffering**

A Single MAC For Both Rates

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- **Use a clock rate of 10.000 Gbps on the MAC/PLS interface**
- **MAC pacing mechanism reduces data rate to fit in 9.584640 Gbps OC-192c/VC-4-64c**
  - Word-by-word HOLD over XGMII
  - IPG stretch system
- **Highly desirable to send frame length over the XGMII**
  - Supports bufferless length/type encode systems

Have Many MAC Pacing Methods

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- A word-by-word HOLD signal at the MAC/PLS boundary
- A MAC modification for IPG gap stretching
- IPG gap stretching based on the Deference signal at the MAC/PLS boundary
- An IPG HOLD signal at the MAC/PLS boundary
- An IPG stretching shim located between the MAC and the MAC-Control layers

WAN Rate Matches OC-192c/VC-4-64c

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- **WAN OC-192c/VC-4-64c Rates:**
  - Line Transmission Rate: 9.953280 Gbps
  - Synchronous Envelope Rate: 9.621504 Gbps
  - Payload Rate: 9.584640 Gbps
- **To operate in all WAN applications the MAC must pace the data to a rate which will fit in an encoded payload**
- **If the encode overhead is zero then the MAC data rate will equal the OC-192c/VC-4-64c payload rate**
  - the scrambled encode proposals provide zero overhead
  - byte stuffing used for delimiting in PoS results in a variable MAC rate depending on the data pattern
  - 8b/10b direct on OC-192c results in 25% data rate reduction
  - other encoding systems exist with higher and lower encode efficiencies

LAN/WAN Rate PMDs Same

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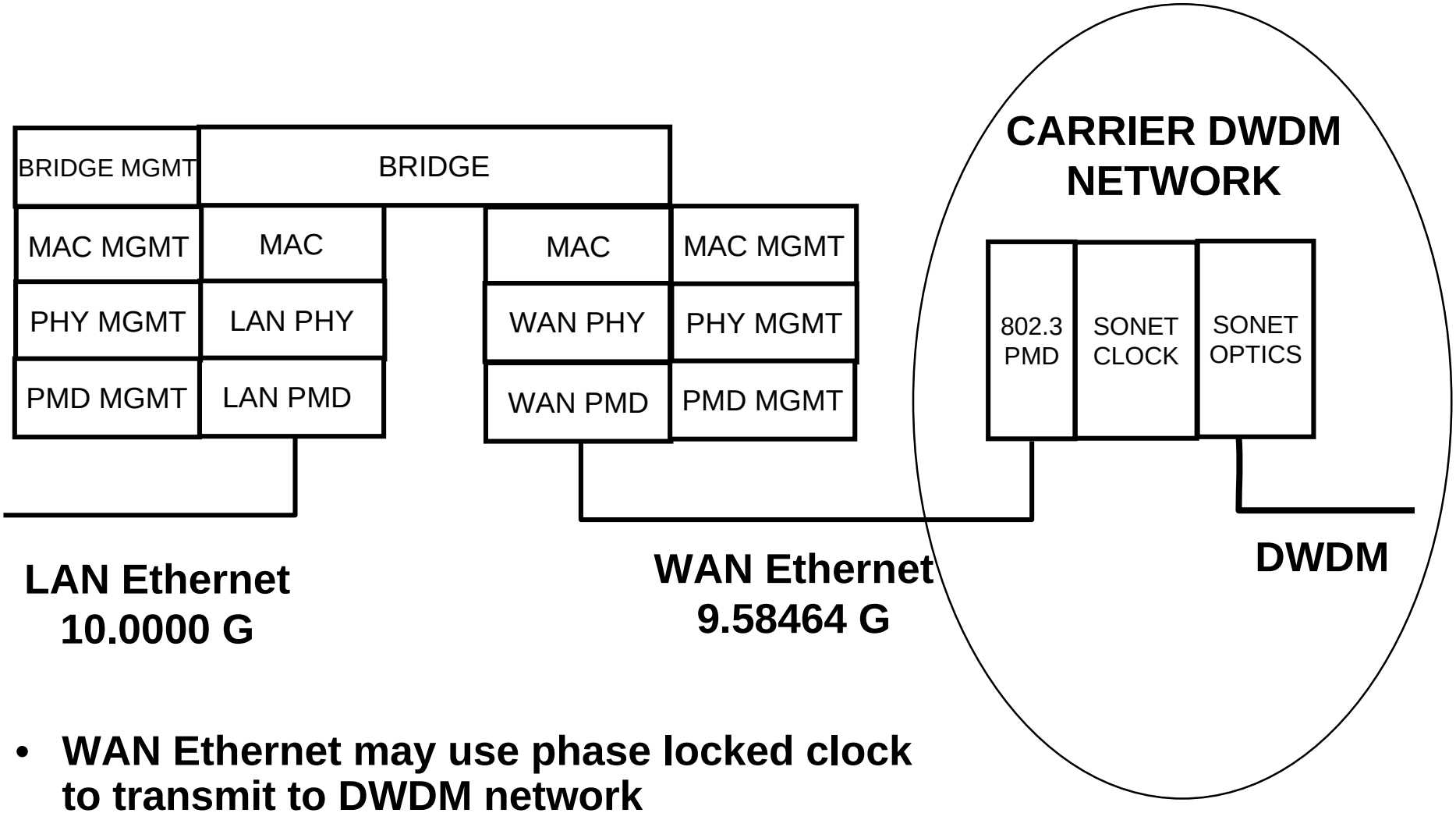
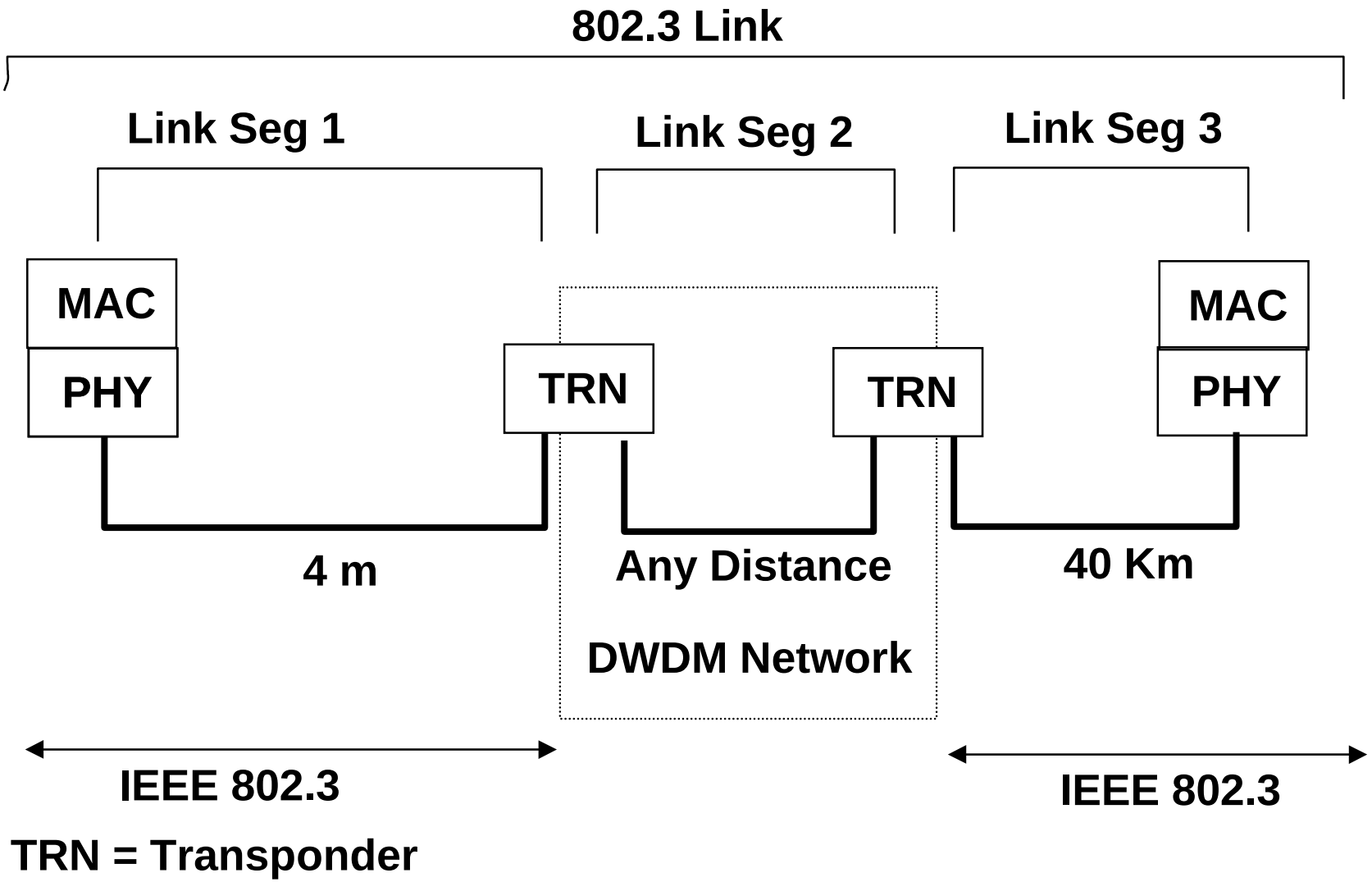
- Many WAN Rate GigE (WRGigE) links are used to connect switching equipment inside the Point-of-Presence (POP)
- Intra-POP links are typically confined to a single building and frequently connect between racks
- The applications for these links demand low cost short reach optics
- Intra-POP fibers carry a single 10 WRGigE signals
- Access to the DWDM transmission facility is through a transponder/translator
- Each DWDM wavelength is demultiplexed onto a single 10 WGigE fiber
- Access between MAN POPs may be carried on dark fibers supporting 10 WRGigE
- All 10 GigE distances are important for 10 WRGigE including MMF and SMF at 100 m, 300 m, 2 Km, 10 Km, and 40 Km
- 10 WRGigE links provide single hop transmission between buffered devices

LAN to WAN Ethernet to DWDM



- **WAN Ethernet may use phase locked clock to transmit to DWDM network**

WAN Rate Ethernet < 2 Km



Recommended Objectives

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- **Support both LAN and a WAN rate PHYs**
- **Same MAC supports LAN and WAN rates**
- **Add a pacing mechanism to the MAC**
- **Deliver frame length over the XGMII**
- **All PMD objectives should be the same for LAN and WAN rates**