Link Layer Discovery Protocol

Traffic Pattern Overview for 802.3da Single Pair Multidrop

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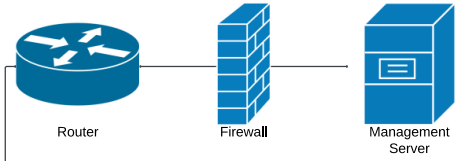
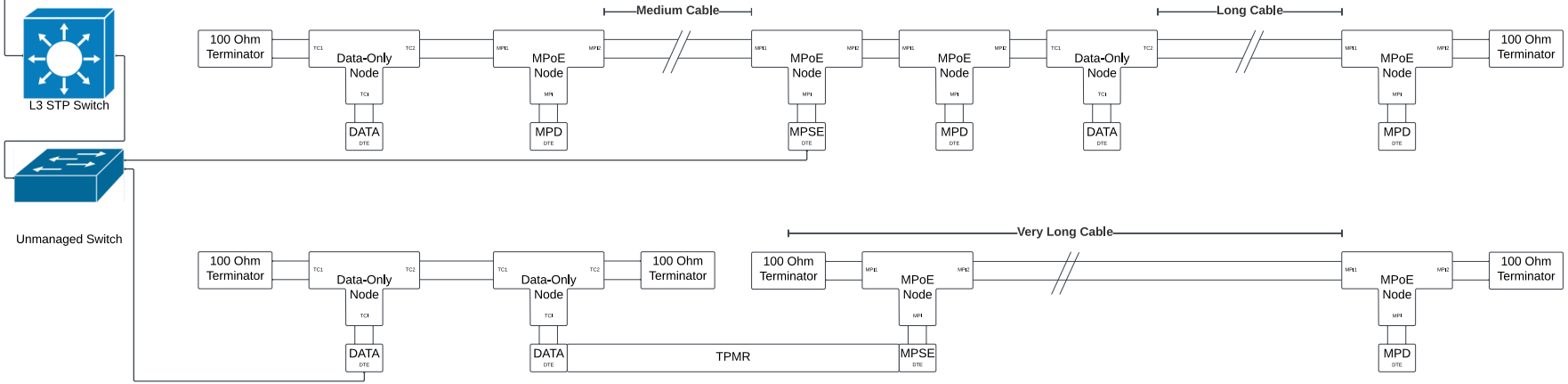
Cisco
2025-01-22

Sample Network Topology



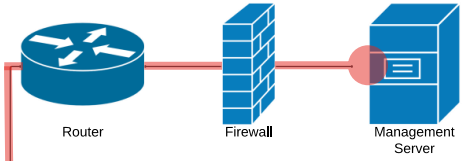
Network Management Applications in Datacenter

Deployed Network in the Field



Layer 3 Packet Forwarding

L3 Unicast



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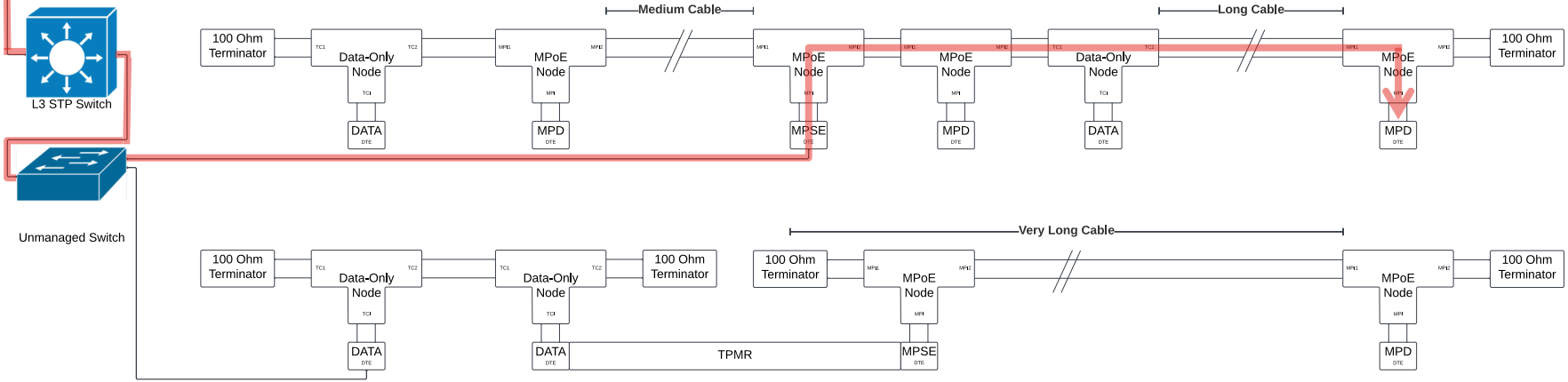
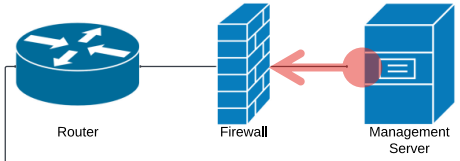
Deployed Network in the Field



Tx → Rx

L3 Broadcast from a Distant Server



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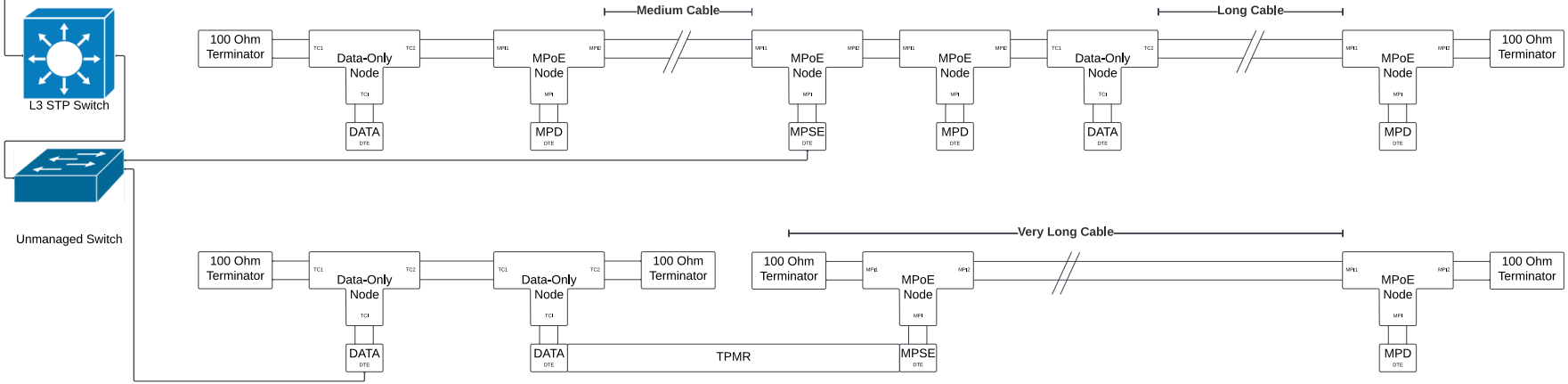
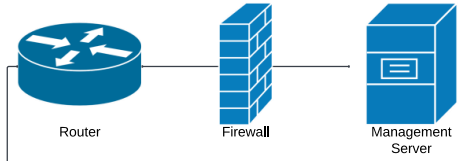
Deployed Network in the Field



Tx → Rx

L3 Broadcast from a Local Node



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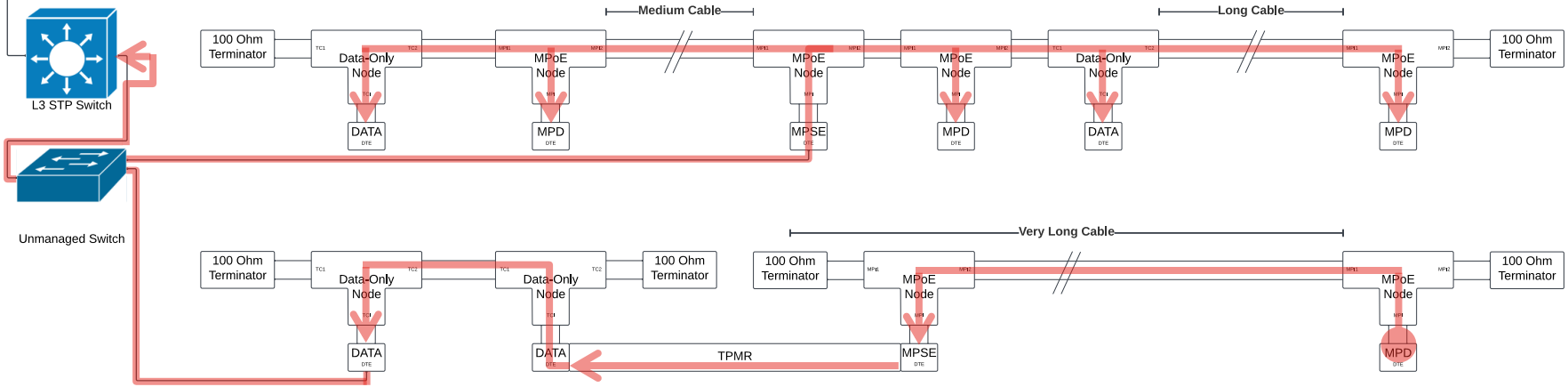
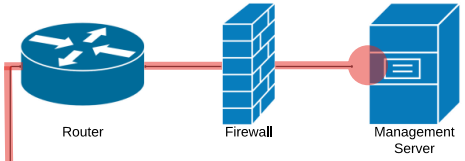
Deployed Network in the Field



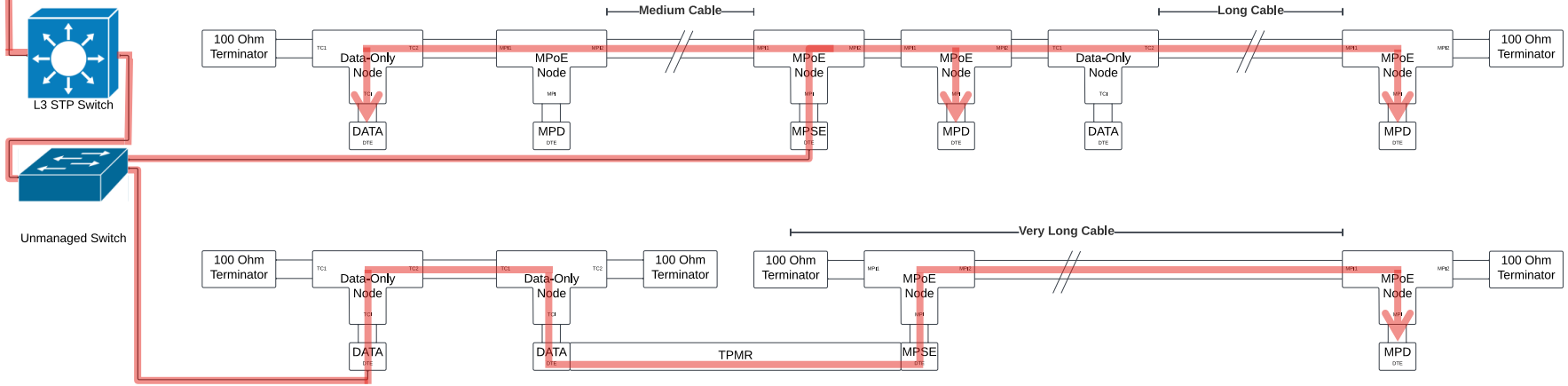
Tx → Rx

L3 Multicast in a Routed Multicast IP Environment



Network Management Applications in Datacenter

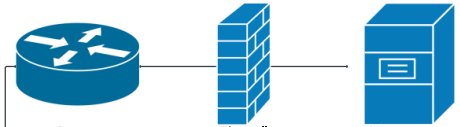
Deployed Network in the Field



Tx → Rx

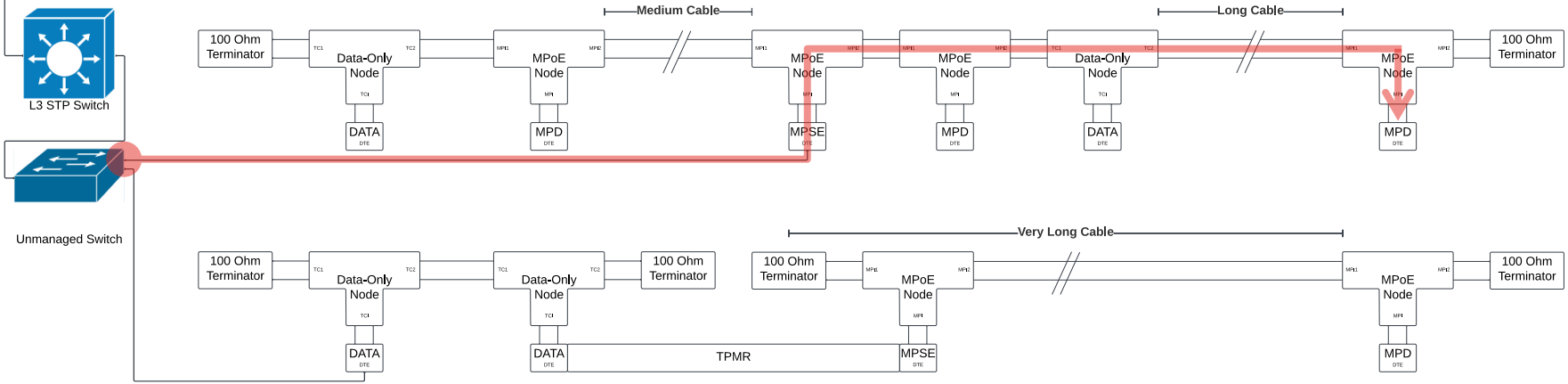
Layer 2 Frame Forwarding

L2 Unicast



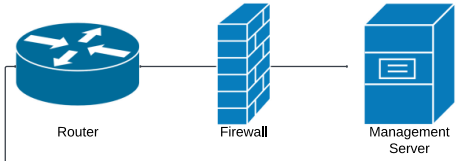
Network Management Applications in Datacenter

Deployed Network in the Field



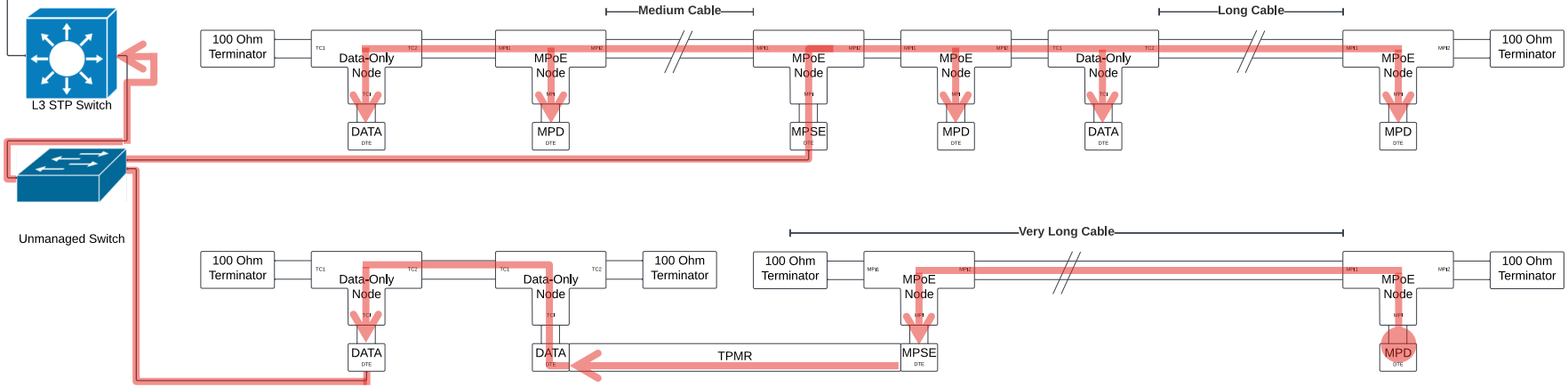
Tx → Rx

L2 Broadcast



Network Management Applications in Datacenter

Deployed Network in the Field



Tx → Rx

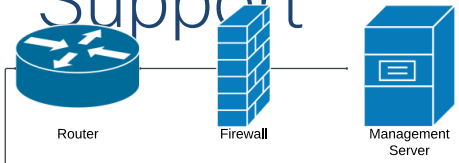
IEEE Std 802.1D and IEEE Std 802.1Q Reserved Addresses

Source:
https://standards.ieee.org/products-programs/regauth/grpmac/public/

Group MAC Address Value	IEEE Standard Using the Address Value	Notes
01-80-C2-00-00-00*	IEEE Std 802.1Q IEEE Std 802.1X IEEE Std 802.1AE IEEE Std 802.1AX	**Bridge Group address** **Nearest Customer Bridge group address**
01-80-C2-00-00-01	IEEE Std 802.1Q	IEEE MAC-specific Control Protocols group address
01-80-C2-00-00-02	IEEE Std 802.1Q IEEE Std 802.1AX	IEEE 802.3 Slow_Protocols_Multicast address
01-80-C2-00-00-03*	IEEE Std 802.1Q IEEE Std 802.1X IEEE Std 802.1AE IEEE Std 802.1AX IEEE Std 802.1BR	**Nearest non-TPMR Bridge group address** **IEEE Std 802.1X PAE address**
01-80-C2-00-00-04	IEEE Std 802.1Q	IEEE MAC-specific Control Protocols group address
01-80-C2-00-00-05	IEEE Std 802.1Q	Reserved for future standardization
01-80-C2-00-00-06	IEEE Std 802.1Q	Reserved for future standardization
01-80-C2-00-00-07	IEEE Std 802.1Q	MEF Forum ELMI protocol group address[a]
01-80-C2-00-00-08	IEEE Std 802.1Q	Provider Bridge group address
01-80-C2-00-00-09	IEEE Std 802.1Q	Reserved for future standardization
01-80-C2-00-00-0A	IEEE Std 802.1Q	Reserved for future standardization
01-80-C2-00-00-0B	IEEE Std 802.1Q IEEE Std 802.1X IEEE Std 802.1AE	EDE-SS PEP Address
01-80-C2-00-00-0C	IEEE Std 802.1Q	Reserved for future standardization
01-80-C2-00-00-0D	IEEE Std 802.1Q	Provider Bridge MVRP address
01-80-C2-00-00-0E*	IEEE Std 802.1Q IEEE Std 802.1X IEEE Std 802.1AE IEEE Std 802.1AS	**Individual LAN Scope group address**[b] **Nearest Bridge group address**
01-80-C2-00-00-0F	IEEE Std 802.1Q	Reserved for future standardization

*** Addresses Used by LLDP**

L2 Multicast – Local LAN Segment– Stops at First Switch with Spanning Tree Protocol Support



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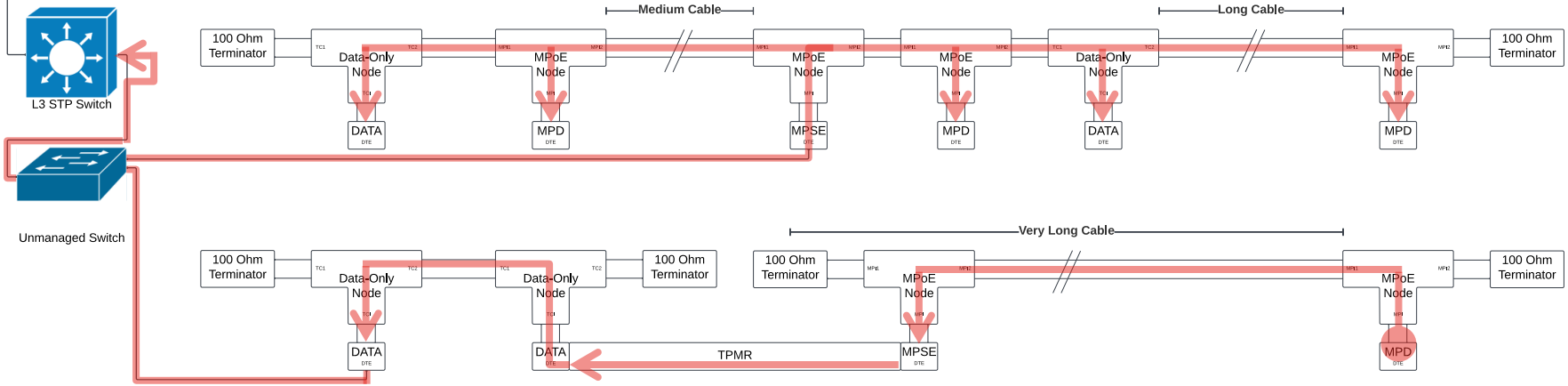
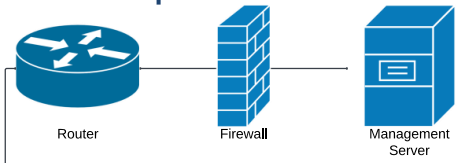
01-80-C2-00-00-00*	IEEE Std 802.1Q IEEE Std 802.1X IEEE Std 802.1AE IEEE Std 802.1AX	Bridge Group address Nearest Customer Bridge group address

Deployed Network in the Field



Tx → Rx

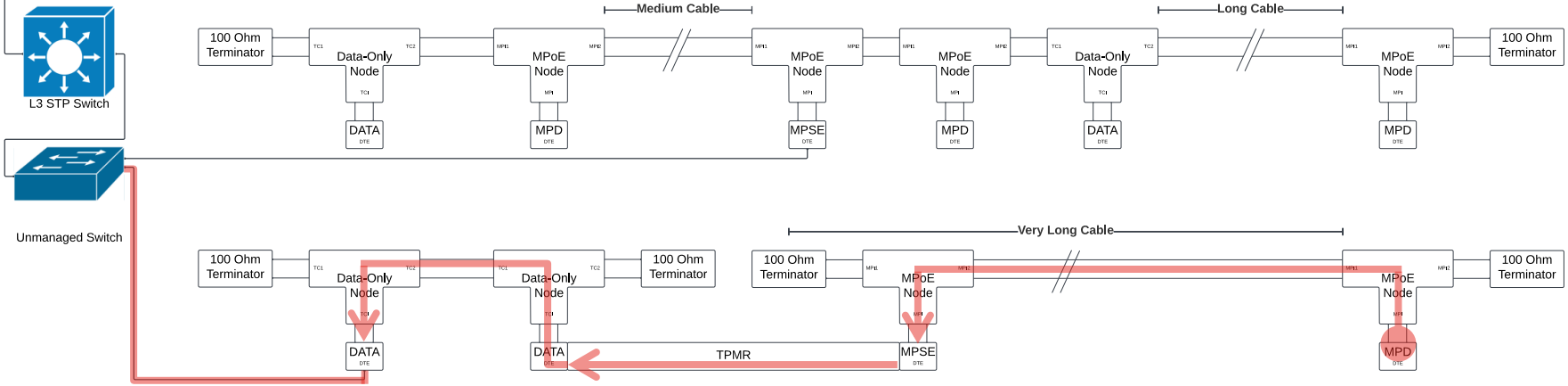
L2 Multicast – Local LAN Segment– Stops at First Multi-Port (Non-TPMR) Switch



Network Management Applications in Datacenter

01-80-C2-00-00-03*	IEEE Std 802.1Q IEEE Std 802.1X IEEE Std 802.1AE IEEE Std 802.1AX IEEE Std 802.1BR	Nearest non-TPMR Bridge group address IEEE Std 802.1X PAE address

Deployed Network in the Field

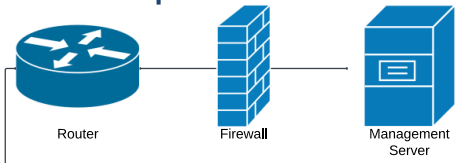


Tx → Rx

L2 Multicast – Local LAN Segment – Stops at Next Device

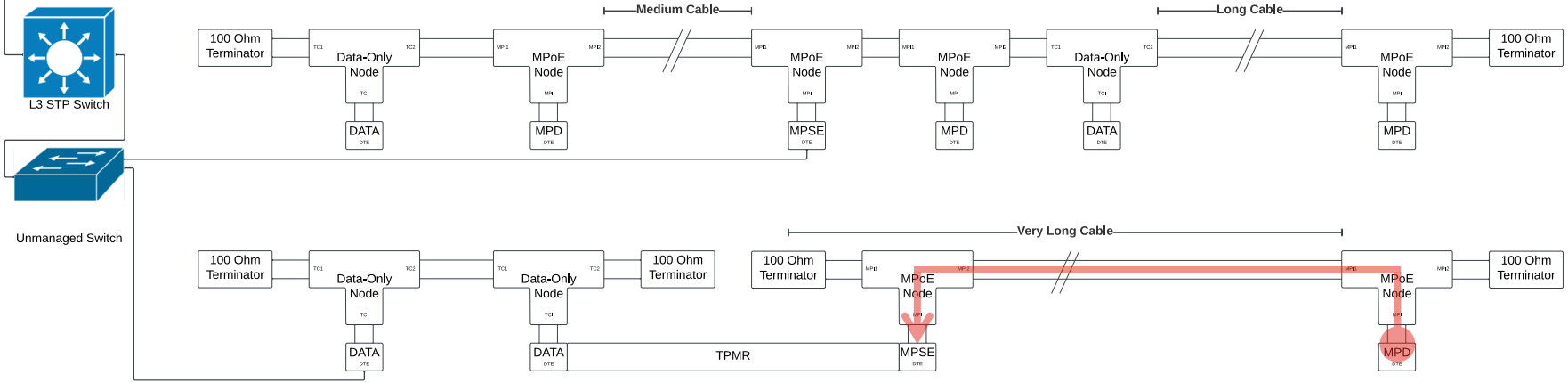
This is the only way to communicate with JUST the nodes on a mixing segment!

01-80-C2-00-00-0E*	IEEE Std 802.1Q IEEE Std 802.1X IEEE Std 802.1AE IEEE Std 802.1AS	Individual LAN Scope group address[b] Nearest Bridge group address



Network Management Applications in Datacenter

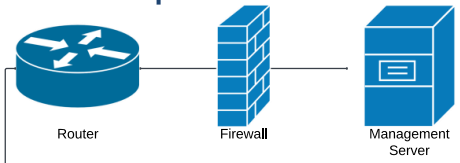
Deployed Network in the Field



L2 Multicast – Local LAN Segment – Stops at Next Device

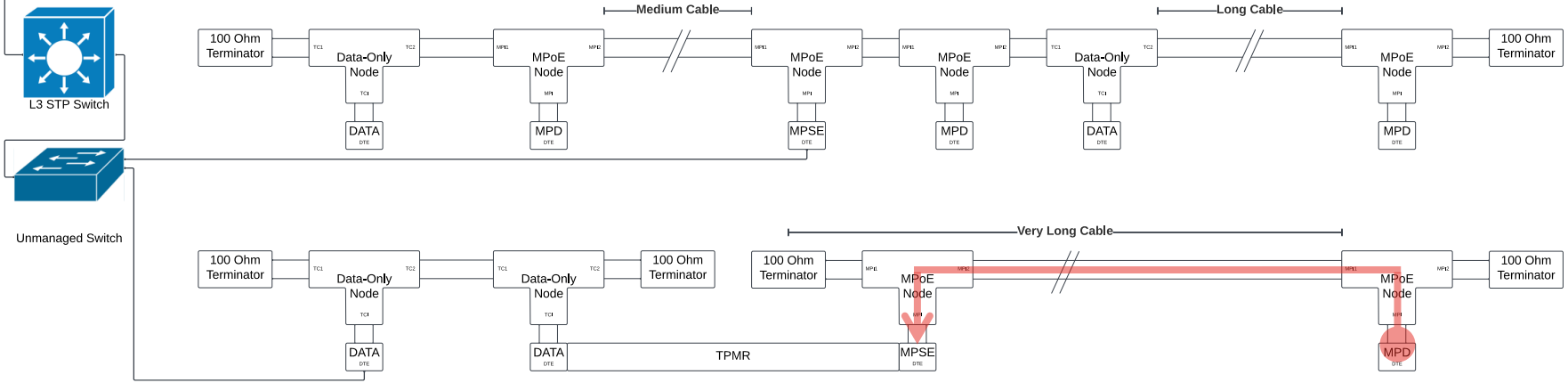
This is the only way to communicate with JUST the nodes on a mixing segment!

01-80-C2-00-00-0E*	IEEE Std 802.1Q IEEE Std 802.1X IEEE Std 802.1AE IEEE Std 802.1AS	Individual LAN Scope group address[b] Nearest Bridge group address



Network Management Applications in Datacenter

Deployed Network in the Field



Tx → Rx

Individual LAN Scope group Address: Nearest Bridge Group Address – 01-80-C2-00-00-**0E**

- Only way to communicate with just the nodes on a mixing segment
- Frame must originate from a node on the mixing segment
- Protocols that use this L2 multicast address include:
  - IEEE 802.1ab Link Layer Discovery Protocol (LLDP)
  - IEEE 802.1AS Precision Time Protocol v2
- There may be others, but we need a protocol that is widely implemented by switches to reliably not forward beyond a single mixing segment
- Link Layer Discovery Protocol (LLDP) is the right answer

Intra-Mixing-Segment Messaging

What functions require intra-mixing-segment messages?

- PLCA ID Station Discovery
  - No other way to establish which MACs are using which PLCA IDs within the context of a particular mixing segment
- Power Allocation Checking
  - No way to know which nodes are on a particular mixing segment, much less to collect their Unit Load characteristics
- Wake Tone
  - A remote management system needs an agent on the local mixing segment to emit the wake tone, and the ability to indicate to mixing segment members which nodes should wake up
- Topology Discovery
  - In order to perform topology discovery, it is essential that a method be present to silence all but one responding node, and this method must be implemented by all nodes, not just nodes that are capable of participating in a particular topology discovery scheme

More on Topology Discovery

Three possible methods for silencing the mixing segment:

1. Leverage Carrier Sense
   - This is a non-starter as the maximum mixing segment length's round trip time exceeds the time that a station is required to wait after carrier is sensed
2. Pause Frames
   - This approach is sub-optimal as Pause Frames are sent to the Local Lan Segment, up to the first STP-enabled switch, which will severely extend the duration of discovery as multiple interconnected mixing segments will all be silenced when a single mixing segment attempts topology discovery
3. LLDP TLV
   - This is the most feasible approach

Backup

Adapted from a 2006 Slide Deck by Devadas Patil, Cisco