



## Driving Ethernet Deeper

### Ethernet Business Services over DOCSIS COX New Orleans (NOLA) Case Study

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# Agenda

- Carrier Ethernet Business Services
- COX New Orleans Telecommuter Service
- Deployment Challenges and Service Evolution
- Summary and Q&A



# Carrier Ethernet Business Services



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# Business VPN Services

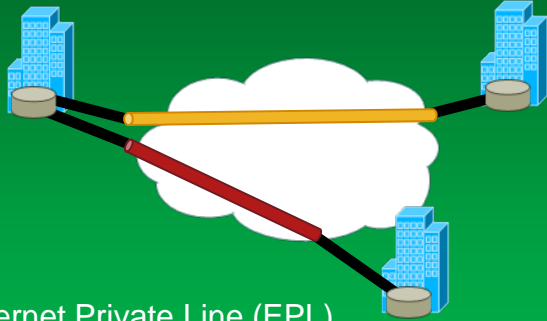
- Mass scale Carrier Ethernet Services adoption
- MPLS-based L3 VPN and L2 VPN services
- Advantages of L2 VPN services over L3 VPN:
  - Protocol Agnostic
  - No protocol sharing between SP and Customer
  - More customer control over their network
  - Simpler to deploy
- Standardized Carrier Ethernet L2VPN Services

# Carrier Ethernet L2VPN Services

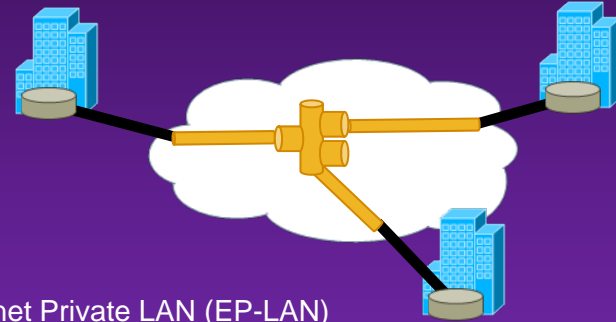
## E-LINE Services

## E-LAN Services

Port-based

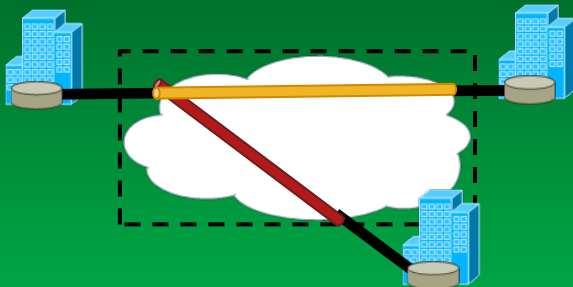


**Ethernet Private Line (EPL)**  
Replaces a TDM private line  
Dedicated UNIs for point-to-point connections  
Single Ethernet Virtual Connection (EVC) per UNI  
The most popular Ethernet service due to its simplicity

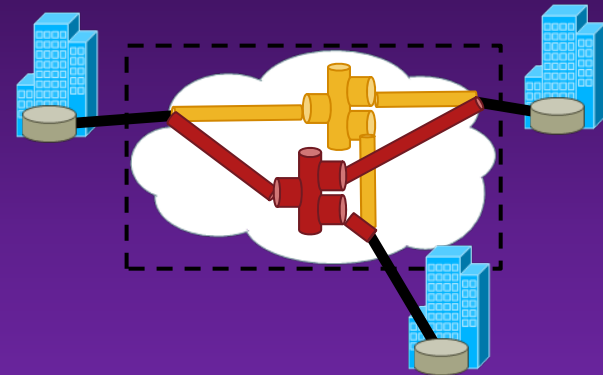


**Ethernet Private LAN (EP-LAN)**  
Supports dedicated UNIs  
Supports transparent LAN services  
Supports multipoint Layer 2 VPNs

VLAN-based



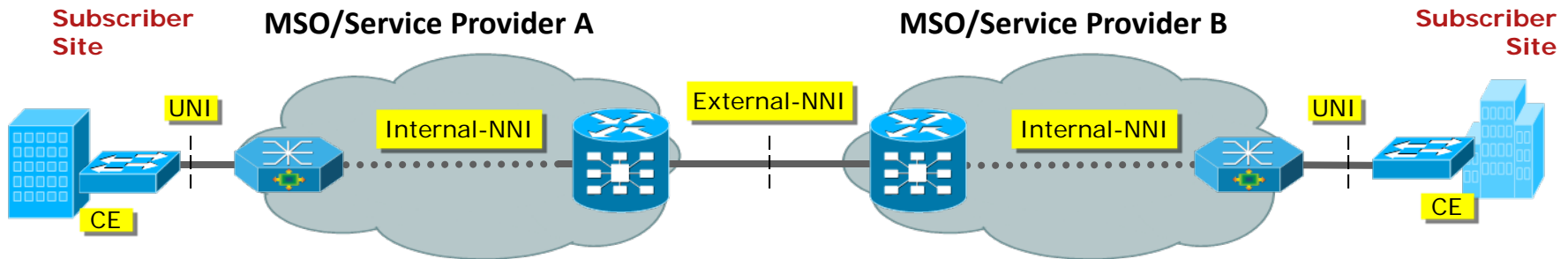
**Ethernet Virtual Private Line (EVPL)**  
Replaces Frame Relay or ATM services  
Supports service multiplexed UNIs (i.e., multiple EVCs per UNI)  
Allows single physical connection (UNI) to customer premise equipment for multiple virtual connections



**Ethernet Virtual Private LAN (EVP-LAN)**  
Supports service-multiplexed UNIs  
Supports multipoint Layer 2 VPNs

# Carrier Ethernet Components

- User-to-Network Interface (UNI)
  - Physical demarcation between Subscriber and MSO
- Network-to-Network Interface (NNI)
  - Physical demarcation between individual Carrier Ethernet networks
- Ethernet Virtual Circuit (EVC)
  - Logical end-to-end service representation



# Business Services Over DOCSIS

- Builds on standard defined by MEF
- Competitive advantage for Cable SPs due to HFC reach
- DOCSIS 3.0 offer new opportunities for BSOD
  - Higher speed with Channel bonding
  - Effective competition against T1, leased line and in some cases, fiber
- Multiple Deployment Options
  - Transparent LAN Services over DOCSIS
  - 802.1Q (Dot1Q) Based BSoD
  - MPLS based BSoD



# COX New Orleans Telecommuter Service

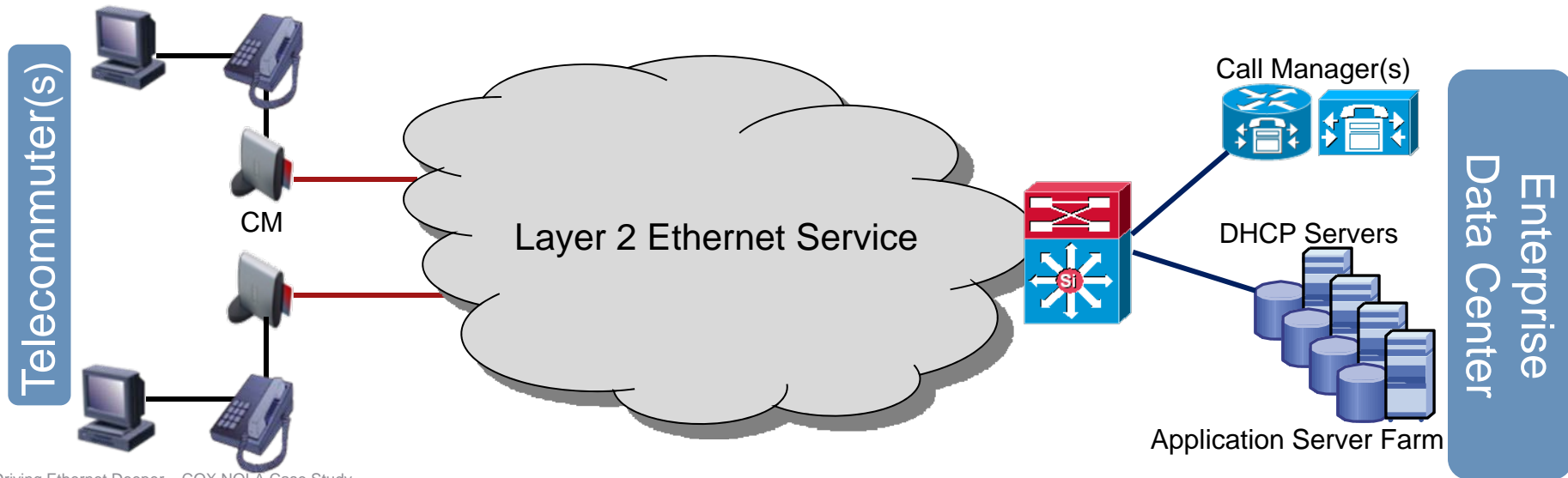




# COX New Orleans Telecommuter Application

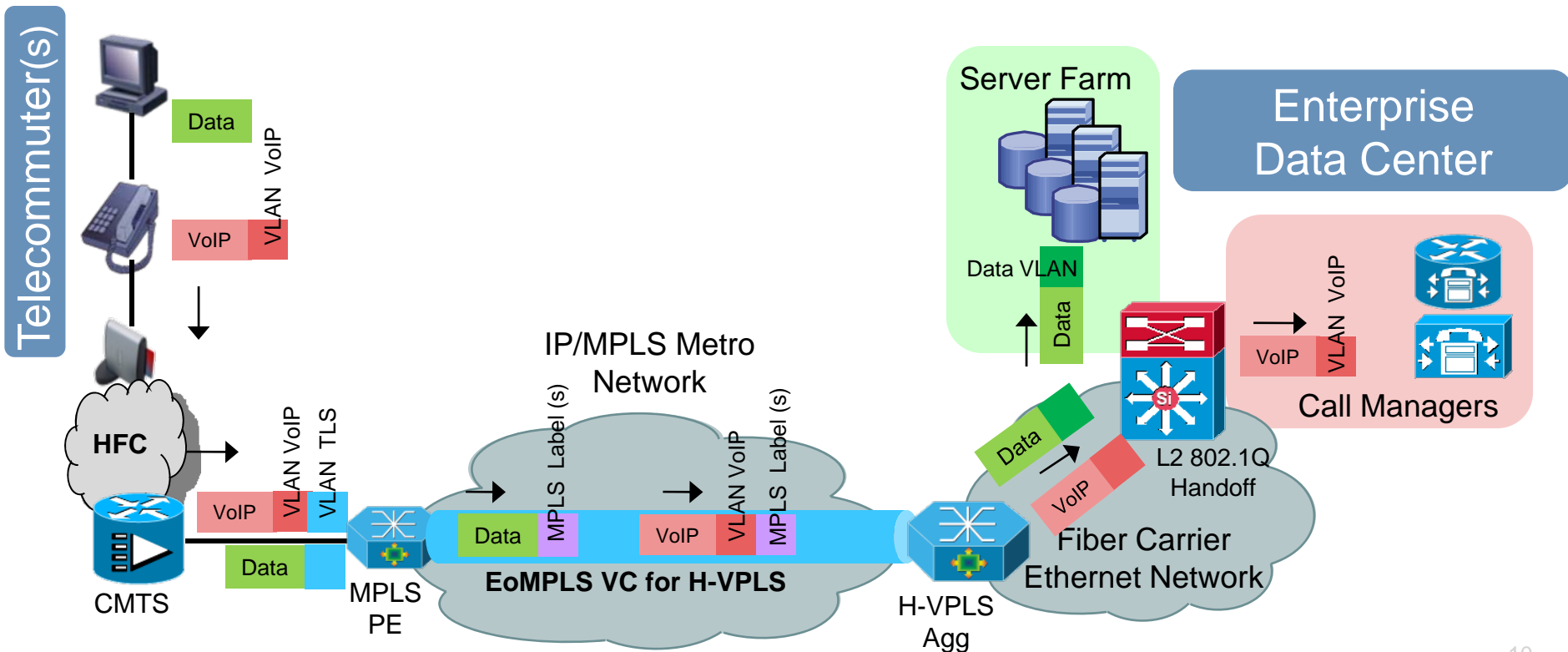
## Service Objectives and Requirements

- To provide telecommuters with Layer 2 Access to Central Office
- Use existing HFC access in Home Office
- Each Home Office contains:
  - IP Phone for Voice over IP traffic
  - PC for Data traffic
- VoIP and Data Traffic to use separate VLAN's in CO



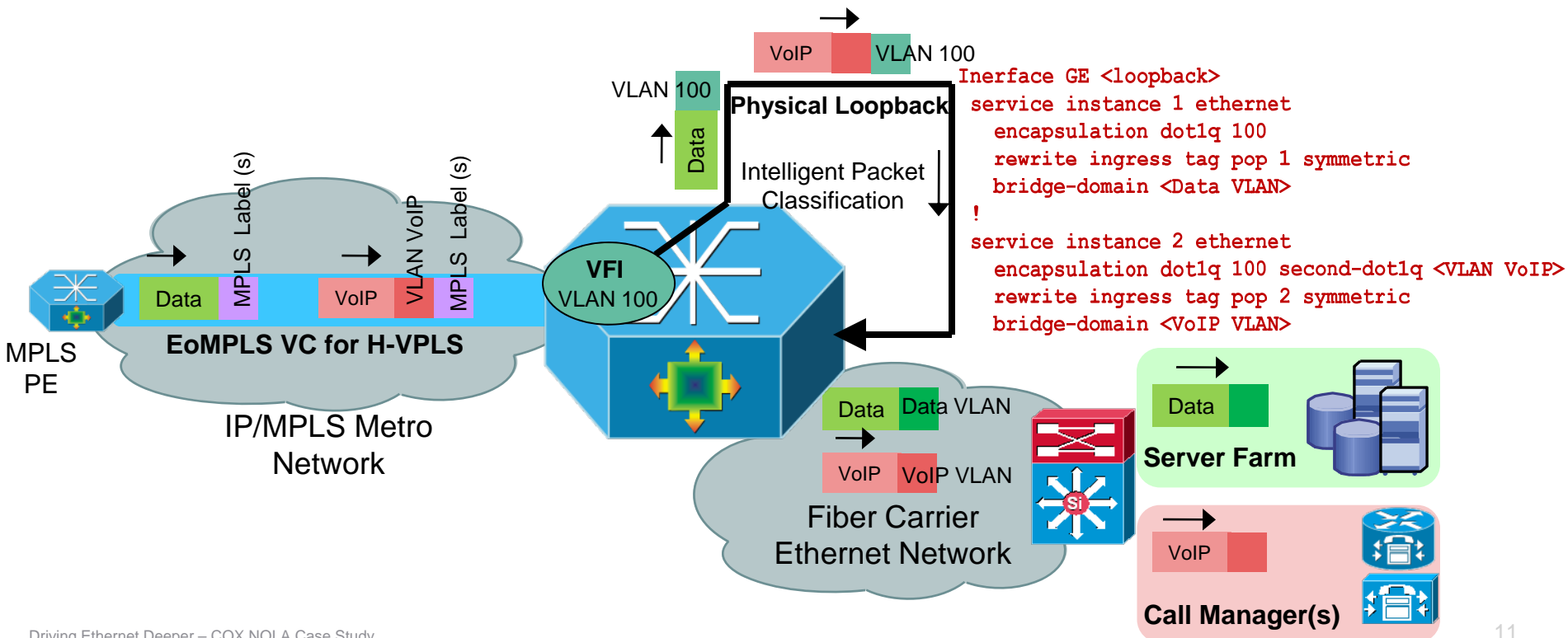
# COX New Orleans Telecommuter Application Service Architecture

- H-VPLS to provide MAC learning and bridging at Central Location
- Transparent LAN Services over DOCSIS used on CM and CMTS
  - CMTS encapsulate all traffic from CM in a 802.1Q VLAN Tag
- Data traffic is untagged; VoIP is Tagged for service separation



# COX New Orleans Telecommuter Application Service Traffic Separation

- CMTS adds a TLS over DOCSIS tag to all traffic
  - Data Traffic is single tagged
  - VoIP is double tagged, with same S-VLAN as Data
- Flexible frame matching needed on upstream router





# Deployment Challenges and Service Evolution



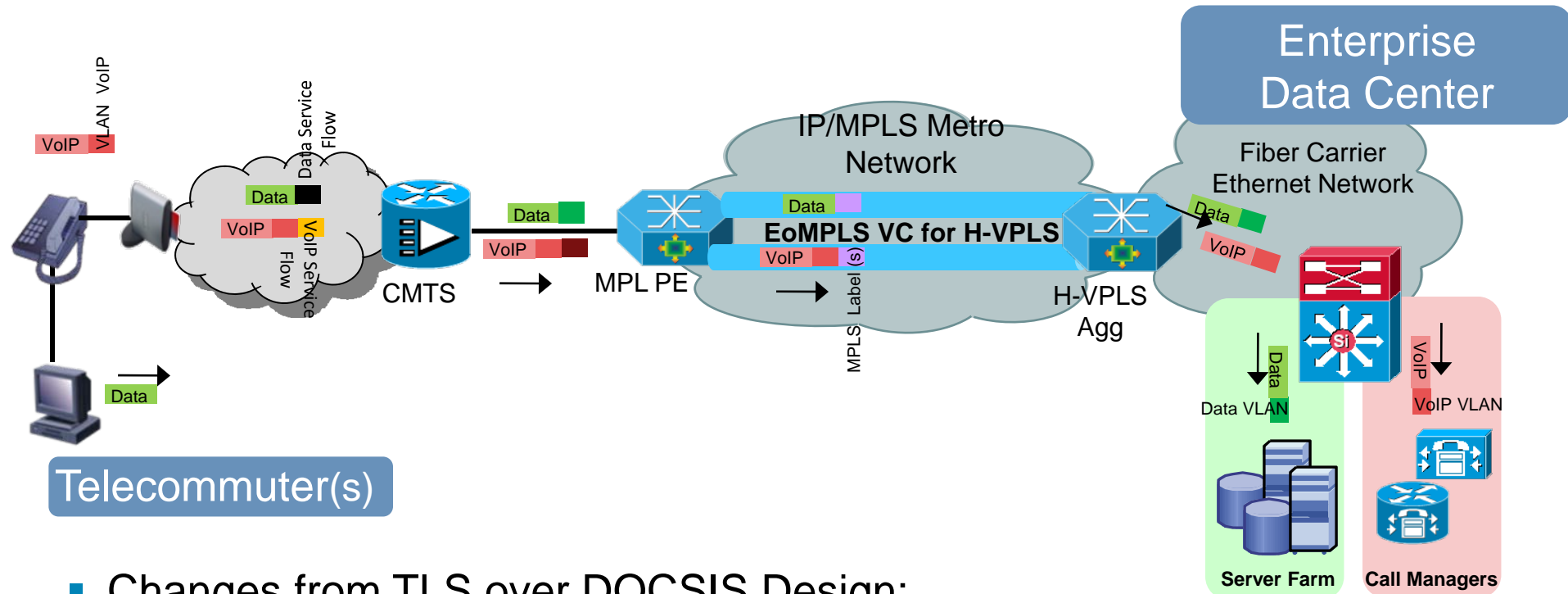
# Service Deployment Challenges

- End-to-End Traffic Isolation
  - Centralized solution difficult to troubleshoot
- Per Site CMTS Configuration
  - CMTS manually configured for each site
- L2 Problem Detection and Isolation
  - End-to-end troubleshooting tools are mainly Layer 3
  - Cable Modem down, but L2 circuit active
- High Availability and Load Balancing
  - Only one forwarding interface per CMTS
- Service Scale
  - 4000 services (VLANs) total

# Service Evolution

- Cable Labs compliant Business Services over DOCSIS (BSoD)
- 1) Dot1Q-based BSoD
  - Similar to TLS over DOCSIS but supports:
    - Multiple VLAN's for single CM
    - Provisioning through Cable Modem Config file
- 2) MPLS-based BSoD
  - Enables MPLS PE functionality on CMTS
  - Provisioning through CM Config file
  - MPLS-based load balancing and High Availability

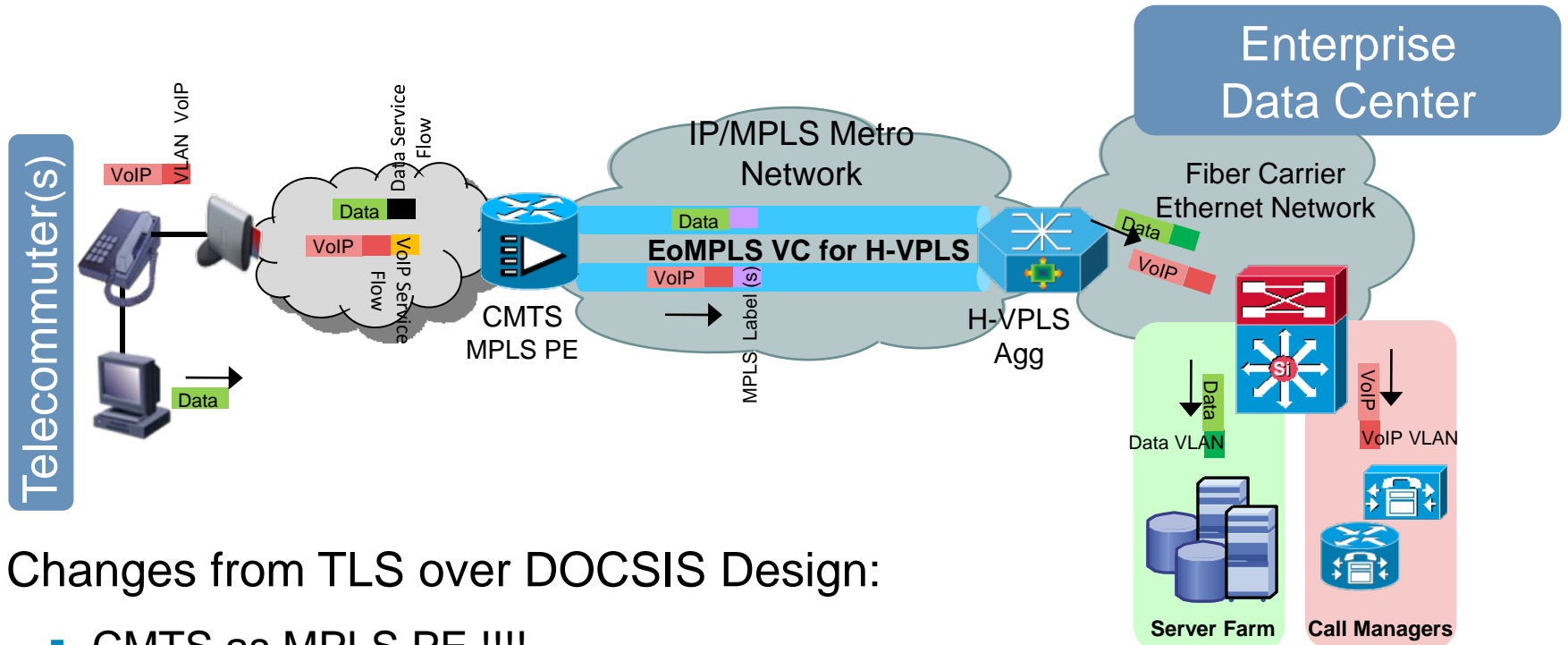
# Dot1Q Based BSoD for Telecommuter Service



- Changes from TLS over DOCSIS Design:
  - Use multiple services flow with VLAN based Classification
  - Assign per-traffic VLAN
  - Use Cable modem Configuration file for CMTS side processing

Challenge	Impact
Traffic Isolation	✓
Per site Configuration	✓
L2 Problem Detection	<b>Future</b>
CM Down Propagation	✗
High Availability and Load Balancing	✗
Service Scale (CMTS)	<b>4000</b>

# MPLS Based BSoD for Telecommuter Service



- Changes from TLS over DOCSIS Design:
  - CMTS as MPLS PE !!!!
  - Use multiple services flow with VLAN based Classification
  - Assign per-service flow EoMPLS PW
  - Use Cable modem Configuration file for CMTS side processing
- Simplest End-to-End Design !!

Challenge	Impact
Traffic Isolation	✓
Per site Configuration	✓
L2 Problem Detection	<b>Future</b>
CM Down Propagation	✓
High Availability and Load Balancing	✓
Service Scale (CMTS)	<b>upto16000</b>





# Summary



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# Summary

- Business Services over DOCSIS picking steam
- Leverage existing HFC infrastructure for MEF Services
- Multiple deployment option for Business Services over DOCSIS
- TLS over DOCSIS for COX Telecommuter application
- Metro network key for end-to-end Layer 2 transport
- Dot1Q- and MPLS-based BSoD offers enhanced functionality and flexibility

# Q & A

