Cisco Aggregation update

Brian Kvisgaard
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Customer Evolution
Mobile Access (RAN) & Carrier Ethernet Converging

Converged Scenarios:
Fixed/Mobile Infrastructure
Wholesale Ethernet / RAN Backhaul
Mobile Operator with Business Services

Typical Services:
- Security
- Business Ethernet
- Mobile Internet
- Triple Play
- Internet Access
- RAN Backhaul

Mobile Operators

Typical Services:
- Mobile Internet
- RAN Backhaul
- TDM/ATM

Expand into CE services
Leveraging Unified RAN

Intelligent Converged Network

Expand into RAN services
Leveraging Carrier Ethernet

Telcos (+ MSOs)

Value

Unified RAN

Converged CE + Unified RAN

Carrier Ethernet

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Leveraging Carrier Ethernet

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Cisco PABU Evolution
Mobile RAN Backhaul & Carrier Ethernet Converging

Converged Scenarios:
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Wholesale Ethernet / RAN Backhaul
Mobile Operator with Business Services

Expand into CE services
Leveraging Unified RAN

Expand into RAN services
Leveraging Carrier Ethernet

Inherited products
• ME3400(E)
• ME3750
• ME3600X
• ME3800X
• CPT

New products
• ASR 901
• ASR 903

Mobile BU

CE BU (+part of optical)

Inherited products
• MWR 2941

Deliver world’s most innovative and cost effective solutions for SP Access.

architecture & linkages across mobile, access and Edge

Innovation with common building blocks in Silicon, Systems and Software

Operational Excellence and strong collaboration with key customers & partners
Portfolio evolution

IOS / ASIC

ASIC

OAM
TDM
Timing
I-temp
Cisco ME 3600/3800X Product Family
Portfolio Expansion to Multi-Service

ME-3800X series

ME-3800X-24FS
✓ 1GE Ethernet Aggregation

ME-3600X-24TS
ME-3600X-24FS
✓ 1GE Ethernet Services

ME-3600X-24CX-M
✓ 10GE Services
✓ Multi Services Access

ME-3600X-24CX-M
NEW
ME-3600X-24CX Overview

Carrier Class Chassis
2RU x 15”D
I-TEMP: -40 ~ 65C
Modular Redundant PSUs, FANs
All Interfaces built-in (Usage license)

Flexible Interface Options
8GE + 4 10GE
16GE + 3 10GE
24GE + 2 10GE

Advanced Features
L2: EVC, EoMPLS
L3: IP Routing, IPv6
MPLS: MPLS VPN, VPLS,
OAM: Y.1731 PM, 802.1ag, 802.3ah
CESoPSN, SAToP
Clocking: Sync. E., 1588-2008 BC/OC

24xGE ports(8xCombo + 16xSFP)  16xT1/E1 (ATM)
4x10GE XFP ports  4xOC3/STM1

Carrier Class Chassis
2RU x 15”D I-TEMP: -40 ~ 65C
Modular Redundant PSUs, FANs
All Interfaces built-in (Usage license)
Cisco ME-3600X-24CX-M Rear View

Fan Tray

Power Supply

Power Supply
Differences between ME3600X and ME3600X-24CX

1. ME3600-24CX:
   - 2 RU box
   - -40 to 65C (I-Temp)
   - 15 inches (5 inches less deep than ME3600X)

2. ME3600X-24CX:
   - BFD offload
   - CCM/OAM offload

3. ME3600X-24CX:
   - XFP
   - Four Ten Gig
   - Three Ten Gig

4. ME3600X-24CX:
   - 1588
   - T1/E1
   - STM-1/OC3
   - 10Mhz
   - 1PPS
   - ToD
ME-3600X-24CX-M (1/2)
Features available at FCS

Enhanced L2 Services
- EVC Architecture
- L2 VPN support
- EoMPLS with Pseudowire Redundancy
- EoMPLS with TE/FRR
- EoMPLS EVC xconnect
- VPLS
- REP with Edge No Neighbor, Flexlink
- E-OAM (CFM8.1, E-LMI, 802.3ah)
- Y.1731 PM
- CFM over EVC
- L2 Multicast:
  - IGMP snooping over switchport/EVC/PW
  - PIM Snooping

L3 Services
- OSPF/ISIS/BGP
- MPLS on all Ports
- MPLS L3VPN
- MVPN
- IPv6oEoMPLS
- VRF-Lite
- Traffic Engineering /Fast Reroute
- L3 IPv4 Multicast (PIM SSM & SM)
- EVC iRB
- BGP label distribution
- Routed PW
- BFD for static, ospf, isis, bgp including
  - SVI BFD
- IPv6:
  - Unicast routing (ospf, isis, bgp)
  - Host Connectivity
- DHCPv6
ME-3600X-24CX-M (2/2)
Features available at FCS

QoS
• 3-Levels H-QoS
• Ingress Policing (2R3C/1R2C)
• Egress :Strict PQ/Shaping/CIR/EIR/Tail
• Egress policing/marking
• WRED
• IPv6 DSCP classification

Timing
• SynchE with ESMC
• BITS

SLA and Management
• IP-SLA
• SNMP MIB
• ANA/ISC/LMS

Hardware Assist
• BFD offload

Circuit Emulation
• CE over PSN
• SATOP over MPLS

Security
• ACL on Switchport/EVC
• DHCP Snooping
  Option 82, DAI
# ME3600X-24CX Feature sets/Licenses

## Metro IP Access

<table>
<thead>
<tr>
<th>Feature</th>
<th>Advanced Metro IP Access</th>
<th>IEEE 1588-2008 BC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer 2: Ethernet virtual circuit (EVC) and 802.1Q</td>
<td>All features in Metro IP Access</td>
<td>IEEE 1588-2008 Boundary Clock</td>
</tr>
<tr>
<td>IP routing: Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Enhanced IGRP (EIGRP), Intermediate System to Intermediate System (IS-IS), Border Gateway Protocol (BGP), and Bidirectional Forwarding Detection (BFD)</td>
<td>MPLS</td>
<td></td>
</tr>
<tr>
<td>PIM (SM, DM, and SSM), SSM mapping</td>
<td>MPLS OAM</td>
<td></td>
</tr>
<tr>
<td>Ethernet OAM (802.1ag, 802.3ah, E-LMI, 1731 FM and PM)</td>
<td>MPLS VPN (MVPN)</td>
<td></td>
</tr>
<tr>
<td>MST, REP, Flexlink, G.8032</td>
<td>EoMPLS</td>
<td></td>
</tr>
<tr>
<td>SyncE, ESMC, SSM, T1/E1 line timing, BITS and IEEE 1588v2</td>
<td>Pseudowire redundancy</td>
<td></td>
</tr>
<tr>
<td>Switch Database Management (SDM) templates</td>
<td>VPLS and HVPLS</td>
<td></td>
</tr>
<tr>
<td>Multi-VRF CE (VRF-lite) with service awareness: Address Resolution Protocol (ARP), ping, Simple Network Management Protocol (SNMP), syslog, traceroute, FTP, and Trivial FTP (TFTP)</td>
<td>MPLS Transport (TP)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TDM pseudowire</td>
<td></td>
</tr>
</tbody>
</table>

## Table 4: Cisco ME 3600X-24CX Switch Modes of Operation

<table>
<thead>
<tr>
<th></th>
<th>Mode of Operation 1: 24GE + 2 10GE Interfaces</th>
<th>Mode of Operation 2: 8GE + 4 10GE Interfaces</th>
<th>Mode of Operation 3: 16GE + 3 10GE Interfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 port 10GE Upgrade license</td>
<td>Not required</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>GE Interfaces</td>
<td>24</td>
<td>8</td>
<td>16</td>
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<tr>
<td>10GE Interfaces</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>T1/E1 Interfaces</td>
<td>Supported; Require T1/E1 license</td>
<td>Supported; Require T1/E1 license</td>
<td>Supported; Require T1/E1 license</td>
</tr>
<tr>
<td>15.2(2)S Delivered</td>
<td>15.2(2)S1 Delivered</td>
<td>15.2(4)S Delivered 7/30/2012</td>
<td>15.2(4)S1 Delivered Oct 2012</td>
</tr>
<tr>
<td>-------------------</td>
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</tr>
<tr>
<td><strong>Enhanced L2 Services</strong></td>
<td><strong>Enhanced L2 Services</strong></td>
<td><strong>L3 Services</strong></td>
<td><strong>L3 Services</strong></td>
</tr>
<tr>
<td>Mac limit per VFI</td>
<td>MPLS-TP (24CX)</td>
<td>mVPN (Rosen)</td>
<td>6PE, 6VPE</td>
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<tr>
<td>Y.1731 PM (DMM/DMR)</td>
<td>1731 PM ETH-SLM</td>
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<td>BGP 4 bytes AS</td>
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<td>IGMP snooping over LAG</td>
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<td></td>
<td>PBR (3800)</td>
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<tr>
<td>L3 Services</td>
<td></td>
<td></td>
<td>OSPF TTL Security</td>
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<td>IPv6 DHCP</td>
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<td>IPv4 multicast per VRF lite</td>
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<tr>
<td>PIM Snooping</td>
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<tr>
<td><strong>HA</strong></td>
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<tr>
<td>Port Channel Min link</td>
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<td><strong>QoS</strong></td>
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<td>QoS ACL L4 port #</td>
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<td>Table Map</td>
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<td><strong>Security</strong></td>
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<td>CoPP</td>
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<td>IPv6 ACL</td>
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<tr>
<td>DHCP Snooping</td>
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<td>Option 82</td>
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<tr>
<td>ACL on EVC</td>
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<tr>
<td><strong>Management</strong></td>
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<td>EEM</td>
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<tr>
<td>Emergency License</td>
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</tbody>
</table>

Available Today
Overview

- **Standards-based protection** switching for Ethernet ring topologies
  - Defined by ITU-T Study Group 15 [G.8032/Y.1344] (v1 – 06/08; v2 – 03/10)
- **Protection against single failures** (link / node)
- **Loop avoidance** by blocking of designated ring link under normal conditions
- **Ring traffic forwarding** based on Ethernet bridging rules
- **Single Ring or Multi-Ring network** topologies
- **Leverages Ethernet CFM / ITU-T Y.1731** for Fault Detection (CCM) and a ring Control Channel (Ring APS)
- **Supports** MAC flushing, load-balancing, revertive / non-revertive switching and administrative switching commands
Ethernet Ring Protection Switching

The Basics

- **Ring Protection Link (RPL)** – ring link that under normal operation is blocked (at one or both ends) to prevent loops

- **RPL Owner node** – node adjacent to RPL responsible for blocking it under normal operation. Also responsible for activating reversion from protected or MS/FS conditions

- **RPL Neighbor node** – (optional) node adjacent to RPL responsible for blocking it under normal conditions in addition to block by RPL owner. Not responsible for activating reversion behavior
Ethernet Ring Protection Switching

The Basics (cont.)

- G.8032 supports multiple ERP instances over a ring
- ERP instance – entity responsible for the protection of subset of VLANs carried over the physical ring
- Each ERP instance is independent of other ring instances that may be configured on the ring
- Each ring instance should configure its own R-APS channel, RPL, RPL Owner Node and RPL Neighbor Node
  - Enables load-balancing over the ring
Ethernet Ring Protection Switching

Interconnected Rings

- G.8032v2 specifies support for a network of interconnected rings
  - One Major ring (closed) / multiple Sub-rings (open)
  - A given link must belong to a single ring
- Interconnection node – node common to two or more rings (e.g. Nodes D & E)
- Major Ring – Ethernet ring that is connected on two ports to Interconnection nodes (e.g. Ring A-B-C-E-D-A)
- Sub-Ring – An Ethernet ring that is connected to other rings through Interconnection Nodes. A Sub-Ring does not constitute a closed ring (e.g. Ring D-F-G-H-E)
Ethernet Ring Protection Switching

Normal Operation

- When no faults, RPL Owner (& neighbor) are blocked
- RPL Owner sends R-APS message advertising No Request (NR) state and RPL Blocked status (RB) every 5 sec
Ethernet Ring Protection Switching

Failure Handling

- [1] Ring Nodes detect link failure via
  - Link Down Event (PHY based Loss of Signal) or timeout of CFM CCMs
- [2] Nodes adjacent to failed link block their ports and flush MAC tables
- [3] Nodes adjacent to failed link send R-APS messages with Signal Fail (SF) state onto ring
- [4] Remaining Ring Nodes receiving R-APS SF messages flush MAC forwarding tables
- [5] Upon reception of R-APS SF, RPL Owner (and RPL neighbor if present) unblock RPL
Example – G.8032 Open Ring to VPLS

Configuration Steps

Step 1
Ring Ports configuration

Step 2 (opt)
CFM configuration

Step 3 (opt)
ERP Profile configuration

Step 4
ERP Ring configuration
Example – G.8032 Open Ring to VPLS

Ring Ports Configuration

```
hostname ASR903-11
!
interface GigabitEthernet0/0/6
  service instance 1 ethernet
    encapsulation dot1q 10
    bridge-domain 10
  !
  service instance 2 ethernet
    encapsulation dot1q 20
    bridge-domain 20
  !
  service instance trunk 30 ethernet
    encapsulation dot1q 1000-2999
    rewrite ingress tag pop 1 symmetric
    bridge-domain from-encapsulation

interface GigabitEthernet0/0/7
  service instance 1 ethernet
    encapsulation dot1q 10
    bridge-domain 10
  !
  service instance 2 ethernet
    encapsulation dot1q 20
    bridge-domain 20
  !
  service instance trunk 30 ethernet
    encapsulation dot1q 1000-2999
    rewrite ingress tag pop 1 symmetric
    bridge-domain from-encapsulation
```
Example – G.8032 Open Ring to VPLS

CFM Configuration

```
hostname ASR903-11
!
ethernet cfm ieee
ethernet cfm global
ethernet cfm logging
ethernet cfm domain MD-ERPS-100msec level 1
  service MA-link port
  continuity-check
  continuity-check interval 100ms
  efd notify g8032
!
ethernet cfm domain MD-ERPS-3msec level 1
  service MA-link port
  continuity-check
  continuity-check interval 3.3ms
  efd notify g8032

interface GigabitEthernet0/0/6
  ethernet cfm mep domain MD-ERPS-100msec mpid 1
  service MA-link
    continuity-check static r MEP
    r MEP mpid 2

interface GigabitEthernet0/0/7
  ethernet cfm mep domain MD-ERPS-3msec mpid 2
  service MA-link
    continuity-check static r MEP
    r MEP mpid 1
```
Example – G.8032 Open Ring to VPLS

ERP Profile Configuration

```
hostname ASR903-11
!

ASR903-11(config-erp-profile)#timer ?
  guard  Guard timer
  hold-off  Hold off timer
  wtr  Wait-to-Restore timer

ASR903-11(config-erp-profile)#timer guard ?
  <10-2000>  milliseconds

ASR903-11(config-erp-profile)#timer hold-off ?
  <0-10>  seconds

ASR903-11(config-erp-profile)#timer wtr ?
  <1-12>  minutes

ASR903-11(config-erp-profile)#non-revertive

Default 500 msec
Default 0 sec
Default 5 min
Default revertive

ethernet ring g8032 profile sample-profile
timer wtr 1
!```
Example – G.8032 Open Ring to VPLS

ERP Ring Configuration

```
hostname ASR903-11
!
ethernet ring g8032 RING
  open-ring
  port0 interface GigabitEthernet0/0/6
  port1 interface GigabitEthernet0/0/7
instance 1
  profile sample-profile
  rpl port1 owner
  inclusion-list vlan-ids 10,1000-1999
  aps-channel
    level 1
  port0 service instance 1
  port1 service instance 1
!
instance 2
  profile sample-profile
  inclusion-list vlan-ids 20,2000-2999
  aps-channel
    level 1
  port0 service instance 2
  port1 service instance 2
!
```

```
Ring Configuration
Open-Ring mode
Port 0 – Gig0/0/6
Port 1 – Gig0/0/7

Instance 1
Configuration
Port 1 RPL owner
Vlan 10, 1000-1999
APS Channel:
  R-APS CFM level 1
  EFP 1 port 0
  EFP 1 port 1

Instance 2
Configuration
Vlan 20, 2000-2999
APS Channel:
  R-APS CFM level 1
  EFP 2 port 0
  EFP 2 port 1
```
REP Segment 1 Basic Configuration

```
interface GigabitEthernet0/1
switchport mode trunk
rep segment 1 edge
rep preempt delay 15
rep block port 3 vlan 1-4094
```

Diagram:
- Edge Port
- REP Port

Network diagram with labels:
- Int giga 0/1
- Int giga 0/2
- Int giga 0/2 rep segment 1
- Int giga 0/1
- Int giga 0/2 rep segment 1
- Int giga 0/2 rep segment 1 edge
- Int giga 0/2 rep segment 1
- Int giga 0/2 rep segment 1
- Int giga 0/2 rep segment 1
- Int giga 0/2 rep segment 1
- Int giga 0/2 rep segment 1
- Int giga 0/2 rep segment 1
- Int giga 0/2 rep segment 1
- Int giga 0/2 rep segment 1
## ITU-T G.8032 and REP Comparison

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<tr>
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<th>REP</th>
<th>G.8032</th>
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<td>Multi-vendor support</td>
<td>Proprietary</td>
<td>Standard</td>
</tr>
<tr>
<td>Load-balancing</td>
<td>Per VLAN Range- VLAN groups in instance, Configuration at the edge ports of the domain</td>
<td>Per VLAN Range, configured via ERP instance</td>
</tr>
<tr>
<td>Provisioning Type</td>
<td>Manual</td>
<td>Manual</td>
</tr>
<tr>
<td>Fault Detection mechanism</td>
<td>• Link integrity based on hellos PDUs</td>
<td>• Loss of signal (local fault detection)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Eth CC OAM (remote fault detection)</td>
</tr>
<tr>
<td>Operational commands</td>
<td>• Preemption command</td>
<td>• Forced Switch (FS) –block a particular ring-port</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Manual Switch (MS) –block particular ring-port</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Clear –cancels FS or MS</td>
</tr>
<tr>
<td>Topology Discovery/Display</td>
<td>• Ring topology</td>
<td>• None</td>
</tr>
<tr>
<td>Open / Close Ring support</td>
<td>Segment support: open and close ring</td>
<td>Allow support for open and close ring</td>
</tr>
<tr>
<td>Multi-Ring support</td>
<td>Multi-segments support</td>
<td>Support for inter-connected rings, notion of major and minor rings</td>
</tr>
</tbody>
</table>
Definition and usage.

SPAN (Mirror) is a mechanism to monitor traffic on modern switches and routers. This is needed for debugging network problems by analyzing traffic on ports/VLANs. SPAN is implemented in data path hardware/asics as almost all of the switching today happens in hardware.

There is a requirement to implement SPAN feature on the Cisco Carrier ASIC based platforms. As on today there are two platforms which are based of Cisco Carrier Ethernet ASIC- ASR903 and ME3600. This document is for ME3600/3800/24CX platforms

There are Two flavors of the SPAN:

Local SPAN
Remote SPAN (Roadmap)

For this release (15.3(1)S) only a port based Local SPAN would be supported
Local Span Configuration

In the local SPAN both Source and Destination are on the same box. Source should be a port, destination is always a port on the box.

Today we support span for source sessions only at port level and not at service instance level.

Configuration Example

```plaintext
monitor session 1 type local
source interface GigabitEthernet0/11
destination interface GigabitEthernet0/13

interface GigabitEthernet0/11
switchport trunk allowed vlan 11
switchport mode trunk

interface GigabitEthernet0/13
switchport trunk allowed vlan 11
switchport mode trunk
```
<table>
<thead>
<tr>
<th>Layer</th>
<th>Q1 CY13 Committed</th>
<th>Q1 CY13 Committed</th>
<th>Q3 CY13 Committed</th>
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<tbody>
<tr>
<td>L2</td>
<td>Ethernet Loopback QoS</td>
<td>EVC local connect VPLS BGP signaling</td>
<td>Service Activation (36/38) Service Activation (24CX) 1731 PM 1DM</td>
</tr>
<tr>
<td>L3</td>
<td>MPLS TE counters IP FRR Remote LFA FRR</td>
<td></td>
<td>MPLS load balancing</td>
</tr>
<tr>
<td>QoS</td>
<td>Dual priority Queue</td>
<td>QoS TCAM optimization</td>
<td>QoS match EFP H-policer Color Aware Policing</td>
</tr>
<tr>
<td>HA</td>
<td>PW to ELMI RMON SD Flash card</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDM</td>
<td>1588 over MPLS</td>
<td>OC3, chOC3, HDLC OC3 SFP OC3 CEM PPP</td>
<td></td>
</tr>
</tbody>
</table>
Carrier Ethernet 2.0 Equipment Certification
# Carrier Ethernet Certifications at a Glance

<table>
<thead>
<tr>
<th>Service Standardization</th>
<th>CE 1.0 Certification</th>
<th>CE 2.0 Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-Line (EPL, EVPL)</td>
<td></td>
<td>E-Line (EPL, EVPL)</td>
</tr>
<tr>
<td>E-LAN</td>
<td></td>
<td>E-LAN (EP-LAN, EVP-LAN)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multi-CoS</th>
<th>Manageability</th>
<th>Interconnect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on MEF Technical Specifications</td>
<td>Based on MEF Technical Specifications</td>
<td></td>
</tr>
<tr>
<td>MEF 6, MEF 10</td>
<td>MEF 6.1, MEF 10.2, MEF 23.1, MEF 26.1, MEF 33</td>
<td></td>
</tr>
</tbody>
</table>

CE 1.0 Certification is the new branding for MEF 9 and MEF 14 certifications.
## Carrier Ethernet 2.0 Certifiable Services

<table>
<thead>
<tr>
<th>Service Type</th>
<th>Port Based Service</th>
<th>VLAN Based Service</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E-Line</strong></td>
<td>EPL Ethernet Private Line</td>
<td>EVPL Ethernet Virtual Private Line</td>
</tr>
<tr>
<td>Point-to-point EVC UNI to UNI</td>
<td>Enhanced</td>
<td>Enhanced</td>
</tr>
<tr>
<td><strong>E-LAN</strong></td>
<td>EP-LAN Ethernet Private LAN</td>
<td>EVP-LAN Ethernet Virtual Private LAN</td>
</tr>
<tr>
<td>Multipoint-to-multipoint EVC UNI to UNI</td>
<td>Enhanced</td>
<td>Enhanced</td>
</tr>
<tr>
<td><strong>E-Tree</strong></td>
<td>EP-Tree Ethernet Private Tree</td>
<td>EVP-Tree Ethernet Virtual Private Tree</td>
</tr>
<tr>
<td>Rooted-multipoint EVC UNI to UNI</td>
<td>New</td>
<td>New</td>
</tr>
<tr>
<td><strong>E-Access</strong></td>
<td>Access EPL Access Ethernet Private Line</td>
<td>Access EVPL Access Ethernet Virtual Private Line</td>
</tr>
<tr>
<td>Point-to-point OVC UNI to ENNI</td>
<td>New</td>
<td>New</td>
</tr>
</tbody>
</table>

Enhanced services are marked with Enhanced. New services are marked with New.
# New Carrier Ethernet 2.0 Services Features

<table>
<thead>
<tr>
<th>Multi-CoS</th>
<th>Manageability</th>
<th>Interconnect</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ MULTIPLE CLASSES OF SERVICE</td>
<td>➢ END-TO-END FAULT MANAGEMENT</td>
<td>➢ STANDARDIZED WHOLESALE INTERCONNECT SERVICE</td>
</tr>
<tr>
<td>➢ STANDARDIZED PERFORMANCE OBJECTIVES</td>
<td>➢ STANDARDIZED GRANULARITIES FOR TRAFFIC MANAGEMENT</td>
<td>➢ EXTENDS SERVICES COVERAGE</td>
</tr>
</tbody>
</table>

## Standardized CoS Labels
- High
- Medium
- Low

## Standardized Color Identifiers
- S-Tag PCP bits without DEI support
- S-Tag PCP bits with DEI support
- C-Tag PCP bits
- DSCP

## Standardized Performance Tiers
- PT1 - Metro
- PT2 - Regional
- PT3 - Continental
- PT4 - Global

## Standardized Performance Metrics & Objectives
- Frame Delay FD
- Mean Frame Delay MFD
- Inter-Frame Delay Variation IFDV
- Frame Delay Range FDR
- Frame Loss Ratio FLR

## Service OAM
- Subscriber and Test MEGs
- Continuity Check - CCM
- Linktrace - LTM & LTR
- Loopback - LBM & LBR

## BWP Granularity UNI to UNI
- Up to 10M in steps of 1M
- From 10M to 100Ms in steps of 5M
- From 100M to 1G in steps of 50M
- From 1G to 10G in steps of 500M

## BWP Granularity UNI to ENNI
- Up to 10M in steps of 1M
- From 10M to 100Ms in steps of 10M
- From 100M to 1G in steps of 100M
- From 1G to 10G in steps of 1G

## Maximum Transmission Unit
- UNI MTU, EVC MTU
- ENNI MTU, OVC MTU

## L2CP Handling
- Must Tunnel
- Must Not Tunnel

## UNI to ENNI Services
- Access EPL
- Access EVPL

## Standardized ENNI
- ENNI Frame format – 802.1ad-2005
- Single tagging option - S-tag
- Double tagging option - C-Tag + S-Tag
- ENNI MTU Size ≥ 1526 Bytes
- ENNI End Point map

## Standardized OVC End Points
- Color-Aware BWP at ENNI
- CoS ID for ENNI Frames
- Color-Blind BWP at UNI
- CoS ID for Service Frames
- OVC End Point Maps

## Standardized OVC
- Point-to-Point OVC
- Color Forwarding = Yes
- CE-VLAN ID & CoS Preservation
- Service Level Specification
# ASR9K & SPAG Certification Status

<table>
<thead>
<tr>
<th>Platforms</th>
<th>CE2.0 Certification Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME3600X-24CX</td>
<td>Certified – ELINE, ELAN &amp; E-TREE&lt;br&gt;First platform in Cisco to be CE2.0 certified.&lt;br&gt;Pending – E-Access (CY14)</td>
</tr>
<tr>
<td>ME3800X</td>
<td>Certified – ELINE, ELAN &amp; E-TREE&lt;br&gt;Pending – E-Access (CY14)</td>
</tr>
<tr>
<td>ME3600X</td>
<td>Certified – ELINE, ELAN &amp; E-TREE&lt;br&gt;Pending – E-Access (CY14)</td>
</tr>
<tr>
<td>ASR903</td>
<td>Certified – ELINE, ELAN &amp; E-TREE&lt;br&gt;Pending – E-Access (CY14)</td>
</tr>
<tr>
<td>ASR9K</td>
<td>Certified – ELINE, ELAN, E-TREE &amp; E-ACCESS</td>
</tr>
<tr>
<td>ASR901</td>
<td>Q1CY13</td>
</tr>
<tr>
<td>CPT</td>
<td>Q1CY13</td>
</tr>
</tbody>
</table>
Cisco ME 2600X Overview
ME 2600X
Next Generation Active E Fiber To The Home Solution

Feature Rich, Carrier Class and Manageability
- Advanced Standard Based Cisco EVC Model
- Innovative Interface Density with ANSI / ETSI Footprint
- Full Layer 2 IPv4 Security Supported (IPv6 FCS +1)

Based on over 6 years of Cisco Residential Ethernet Access Experience

Green P2P Active Ethernet
- Space & Power Optimized (1RU)
- 44 FE/GE with 4x10GE
- 2.7watts GE ie customer

High Availability
- Redundant Power Architecture ANSI/ETSI
- Redundant Fan Architecture

High Performance
- Wire-Rate Processing
- Line Rate IPv4 L2, QoS, Multicast
- Line Rate IPv6 L2, QoS, Multicast

End-to-End Manageability
- Cisco Prime Provisioning
- Industry standard CLI
ME 2600X
Active E FTTH Deployment Scenario

ME 2600X Supports Three Proven Deployment Models

- **Triple Play Services: Voice, Video & Data**
  - Each service (HSI, Voice, Video) deployed on a separate VLAN
  - All users share the service VLAN

- **Res-Model-1: Trunk UNI N:1**
  - One user per VLAN for Internet, shared VLAN for voice/video

- **Res-Model-2: Trunk UNI 1:1**
  - All subscriber services in one VLAN, priority tagged frames for service identification

- **Res-Model-3: Non-Trunk UNI N:1**
  - Port Density (44GE with 4x10GE)
  - Low OPEX (2.72 Watts Per User)
  - Compact Form Factor (1 Rack Unit)
  - Industrial Temperature Rated for Outside Plant Environment
  - ANSI and ETSI Compliant
  - Architecture Flexibility (Support for both Distributed and Centralized)
ME 2600X
Product Overview Front View

Redundant Power Feeds
• AC, or -48vDC Power Options

1 RU ANSI & ETSI Compliant

Field Replaceable Fan Tray
• Redundant Fans
• ToD/PSS Output
• Bits Out

LEDs

44xGE UNI
• Full Line Rate Packet Processing and Traffic Management

4x10GE UNI/NNI
• Full Line Rate Packet Processing and Traffic Management

Traffic management
• 8K policers 2 level hierarchical
• Egress queuing (8 queues per port)

Power
• Maximum Power 170 Watts, Nominal Power 120 Watts.
• Typical 2.72 W Watts Per User

Industrial Temp Rated
• -40C to +65C Operational Temperature
• -40C to +70C Storage Temperature

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ME 2600X FTTH Features

- DHCP Snooping Option 82
- IP Source Guard
- MAC Security
- Layer 2 (MAC) ACL on EVC
- Layer 3 ACL on EVC
- Dynamic ARP Inspection (DAI)
- Storm Control
ME 2600X

- Fully Standalone, IOS CLI
- Carrier Ethernet 802.1Q, 802.1ad Provider Bridges
- Services (EPL, EVPL, E-LAN, EV-PLAN, E-Tree, EVP-Tree)
- Resilient Ethernet Protocol (REP)
- Layer 2 Protocol Tunneling
- Link Aggregation (802.3ad)
- Quality of Service – QoS
- Multicast VLAN Registration (MVR)
- IGMP Snooping (v1,v2,v3)
Carrier Ethernet
Layer 2 Bridging

- Native Ethernet Bridging
- REP Protected Trunks
- Multiplexed Service Interface (e.g. UNI)
- Port, VLAN or LAG EFP
- P2MP with Optional Split Horizon
- Different flavors of L2 services on same port
  - Point-to-Point – P2P, Local Connect
  - Multipoint – P2MP, MP2MP
ME 2600X Roadmap

FCS
Feb ‘13
- DHCPv4 Snooping with option-82 and DHCP Relay
- DHCPv4 Rate Limiting
- Dynamic ARP Inspection
- IP Source Guard
- Mac Security
- Support Access Control List per EFP
- Support Storm Control
- Control Plane Security
- Console/Terminal AAA authentication through RADIUS and TACACS+
- ICMP Rate Limiting
- ARP Rate Limiting per port
- All L2 EVC/EFP/QoS

FCS + 1 (XE 3.11)
Q4CY13
- IPv6 Router Advertisement Guard
- Host Mode IPv6 Router Advertisement Guard
- DHCPv6 snooping LDRA
- IPv6 Neighbor Discovery Inspection
- IPv6 Prefix Guard
- IPv6 Source Guard
- IPv6 Binding Table Recovery Lease Query
- MLD Snooping
- DHCPv6 Rate Limiting

FCS.1
Q2 CY13
- Bug Fixes
- PPPoE Intermediate Agent

CY 2013

CY 2014

CY 2015

Many of the products and features described herein remain in varying stages of development and will be offered on a when-and-if-available basis. This roadmap is subject to change at the sole discretion of Cisco, and Cisco will have no liability for delay in the delivery or failure to deliver any of the products or features set forth in this document.
Thank you.