We’re ready. Are you?
Cisco Catalyst 6500
Instant Access
- Design and Migration Case Studies

Roland Salinas
Technical Marketing Engineer

BRKARC-3465
Catalyst Instant Access

Key Benefits

**Managed Devices = 40+**

*ISE*  PRIME

- Satellite Device capable of Stacking & POE+
- Single Point of Management, Configuration and Troubleshooting
- Simplified Network Design for VLANs and Port-Channels
- Agile Infrastructure to add new features uniformly across Access Layer
- A Single Image to Deploy and Manage across Distribution Block

Up to 2,016 Port Campus Distribution Block

**REduced TCO!**
Agenda

- Instant Access Overview
  - Components
  - Control Plane and Data Plane
  - Operations
- Case Studies in Instant Access Deployments
  - Case Study #1
  - Case Study #2
  - Case Study #3
- High Availability Performance
  - Link failure
  - Parent line card failures
  - Client switch failure in a stack
  - Parent chassis failure
  - Planned software upgrade procedure
- Best Practices and Recommendations
What is Instant Access?
Catalyst Instant Access

Evolution of the Campus

**STANDALONE**

Access Switch  Access Stack

LACP or PAGP

**VSS**

Access Switch  Access Stack

LACP or PAGP

LACP or PAGP

**INSTANT ACCESS**

Instant Access Client  Instant Access Stack

SDP  SRP  SCP

Access Switch  Access Stack

VSL

Access Stack

VSL
Deployment Models

<table>
<thead>
<tr>
<th></th>
<th>Wireless</th>
<th>Centralised</th>
<th>Distributed</th>
<th>Centralised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wired</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CAPWAP Tunnel

L2/L3 Links

Sup7E/3750-X

Sup8E/3850-X

MA

Fabric Links

6800IA

6500/6800

WiSM2/5508

MA

PRIME

ISE

TRADITIONAL ACCESS

CONVERGED ACCESS

INSTANT ACCESS
Instant Access Parent Switch and Client Switch

Parent Switch
In VSS Mode
IEEE 802.3ae
10Gbps Interfaces
or
IEEE 802.3z
1Gbps Interfaces

Client Switch

=

C6500-E

or

C6807-XL

or

C6880-X

Data only
PoE +
PoE + with Dual PS

Compact Switch
## Catalyst 6800 10G Portfolio

### Throughput in 6807

<table>
<thead>
<tr>
<th></th>
<th>160G</th>
<th>80G</th>
<th>80G</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Throughput</strong></td>
<td>160G</td>
<td>80G</td>
<td>80G</td>
</tr>
<tr>
<td><strong>Optics:</strong></td>
<td>SFP/ SFP+</td>
<td>SFP/ SFP+</td>
<td>SFP/ SFP+</td>
</tr>
<tr>
<td><strong>Egress Buffer/port:</strong></td>
<td>250 MB</td>
<td>250 MB</td>
<td>500 MB</td>
</tr>
<tr>
<td><strong>Additional Hardware Features:</strong></td>
<td>Large Buffers, SGT, MACSec, LISP, Dual Priority Queues, Two Level Shaping, Instant Access</td>
<td>Large Buffers, SGT, MACSec, LISP, Dual Priority Queues, Two Level Shaping, Instant Access</td>
<td>Large Buffers, SGT, MACSec, LISP, Dual Priority Queues, Two Level Shaping, Instant Access</td>
</tr>
<tr>
<td><strong>Ideal for:</strong></td>
<td>Campus Aggregation and Core</td>
<td>Campus Aggregation and Core</td>
<td>Campus Aggregation Core</td>
</tr>
</tbody>
</table>
## Instant Access Supported Maximums

### 6880-X

<table>
<thead>
<tr>
<th>Feature</th>
<th>15.1(2)SY</th>
<th>15.2(1)SY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Scale</td>
<td>1,000</td>
<td>2,016</td>
</tr>
<tr>
<td>Fabric Link</td>
<td>12</td>
<td>42</td>
</tr>
<tr>
<td>Stacking</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

### Supervisor 2T

<table>
<thead>
<tr>
<th>Feature</th>
<th>15.1(2)SY</th>
<th>15.2(1)SY</th>
<th>15.2(1)SY1 (April 2015)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Scale</td>
<td>1,000</td>
<td>1,200</td>
<td>1,536</td>
</tr>
<tr>
<td>Fabric Link</td>
<td>12</td>
<td>25</td>
<td>32</td>
</tr>
<tr>
<td>Stacking</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>
## Catalyst Instant Access Client Portfolio (15.2(1)SY)

<table>
<thead>
<tr>
<th></th>
<th>C6800IA-48TD</th>
<th>C6800IA-48FPD</th>
<th>C6800IA-48FPDR</th>
<th>3560CX-12PD-S</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PoE/PoE+</strong></td>
<td>X</td>
<td>48 ports, 740W</td>
<td>48 ports, 740W</td>
<td>12 ports, 240W</td>
</tr>
<tr>
<td><strong>Down Link Ports</strong></td>
<td>48x1G Cu</td>
<td>48x1G Cu</td>
<td>48x1G Cu</td>
<td>12x1G</td>
</tr>
<tr>
<td><strong>Uplink Ports</strong></td>
<td>2x10G SFP+</td>
<td>2x10G SFP+</td>
<td>2x10G SFP+</td>
<td>2x10G SFP+</td>
</tr>
<tr>
<td><strong>FEX ID</strong></td>
<td>12→42/32*</td>
<td>12→42/32*</td>
<td>12→42/32*</td>
<td>42/32*</td>
</tr>
<tr>
<td><strong>Access Ports Scalability</strong></td>
<td>1000→2000/1500*</td>
<td>1000→2000/1500*</td>
<td>1000→2000/1500*</td>
<td>300-500**</td>
</tr>
<tr>
<td><strong>Stack</strong></td>
<td>3→5</td>
<td>3→5</td>
<td>3→5</td>
<td>0</td>
</tr>
<tr>
<td><strong>Dual Power Supply</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Standalone Mode</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*see previous slide as accurate reference for scalability

** Depending on the platform, 300 for sup2T, 500 for 6880
Parent to Client Span Distances

Copper Twin-Ax for internal rack connectivity
1m, 3m, 5m, 7m

10GBASE-LRM MMF & SMF for intra building connectivity using legacy fibre

10GBASE-SR MMF for rack to rack and intra-building connectivity

10GBASE-LR SMF, for inter-building, campus and metro connectivity

10GBASE-ER SMF, for inter-site connectivity

DWDM, for inter-site and long-haul connectivity

Diagram Not to Scale
## SFP+ Transceiver Types Supported on C6800-Series

<table>
<thead>
<tr>
<th>Cisco SFP+</th>
<th>Wavelength</th>
<th>Cable Type</th>
<th>Core Size (microns)</th>
<th>Modal Bandwidth</th>
<th>Cable Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cisco SFP-10G-SR</td>
<td>850</td>
<td>MMF</td>
<td>62.5</td>
<td>160 (FDDI)</td>
<td>26m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>62.5</td>
<td>200 (OM1)</td>
<td>33m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50.0</td>
<td>400</td>
<td>66m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50.0</td>
<td>500 (OM2)</td>
<td>82m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50.0</td>
<td>2000 (OM3)</td>
<td>300m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50.0</td>
<td>4700 (OM4)</td>
<td>400m</td>
</tr>
<tr>
<td>SFP-10G-LR</td>
<td>1310</td>
<td>SMF</td>
<td></td>
<td></td>
<td>10km</td>
</tr>
<tr>
<td>SFP-10G-LRM</td>
<td>1310</td>
<td>MMF</td>
<td>62.5</td>
<td>500</td>
<td>220m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50.0</td>
<td>400</td>
<td>100m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50.0</td>
<td>500</td>
<td>220m</td>
</tr>
<tr>
<td>SFP-10G-ER</td>
<td>1550</td>
<td>SMF</td>
<td>G.652</td>
<td>-</td>
<td>30Km, 40Km**</td>
</tr>
<tr>
<td>SFP-H10GB-CU1M</td>
<td>-</td>
<td>Twinax</td>
<td></td>
<td></td>
<td>1, 3m, 5M</td>
</tr>
<tr>
<td>SFP-H10GB-CU3M</td>
<td>-</td>
<td>cable,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFP-H10GB-CU5M</td>
<td>-</td>
<td>passive,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30AWG cable assembly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DWDM-SFP10G-xx.xx</td>
<td>40 non-tunable ITU</td>
<td>SMF</td>
<td></td>
<td></td>
<td>80Km+, DWDM transport network dependent</td>
</tr>
</tbody>
</table>

Always Check the The Release Notes for the Latest Hardware and Software Compatibility
# SFP Transceiver Types Supported on C6800-Series

<table>
<thead>
<tr>
<th>Cisco SFP+</th>
<th>Wavelength</th>
<th>Cable Type</th>
<th>Core Size (microns)</th>
<th>Modal Bandwidth</th>
<th>Cable Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000BASE-SX</td>
<td>850</td>
<td>MMF</td>
<td>62.5</td>
<td>160 (FDDI-grade)</td>
<td>220m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>62.5</td>
<td>200 (OM1)</td>
<td>275m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td>400 (400/400)</td>
<td>500m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td>500 (OM2)</td>
<td>550m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td>2000 (OM3)</td>
<td>1Km</td>
</tr>
<tr>
<td>1000BASE-LX/LH</td>
<td>1310</td>
<td>MMF*</td>
<td>62.5</td>
<td>500</td>
<td>550m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td>400</td>
<td>550m</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50</td>
<td>500</td>
<td>550m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SMF</td>
<td>-</td>
<td>-</td>
<td>10Km</td>
</tr>
</tbody>
</table>

Always Check the The Release Notes for the Latest Hardware and Software Compatibility
## SFP Transceiver Types Supported on C6800-Series

<table>
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<tr>
<th>Cisco SFP</th>
<th>Wavelength</th>
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<th>Core Size (microns)</th>
<th>Modal Bandwidth</th>
<th>Cable Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000BASE-ZX</td>
<td>1550</td>
<td>SMF</td>
<td>-</td>
<td>-</td>
<td>Approximately 70 km depending on link loss</td>
</tr>
<tr>
<td>1000BASE-EX</td>
<td>1310</td>
<td>SMF</td>
<td>-&quot;</td>
<td>-</td>
<td>40Km</td>
</tr>
<tr>
<td>1000BASE-BX-U</td>
<td>1310</td>
<td>SMF</td>
<td>-&quot;</td>
<td>-</td>
<td>10Km</td>
</tr>
<tr>
<td>1000BASE-BX-D</td>
<td>1490</td>
<td>SMF</td>
<td>-&quot;</td>
<td>-</td>
<td>10Km</td>
</tr>
<tr>
<td>GLC-T</td>
<td></td>
<td>Cat5 copper</td>
<td></td>
<td>-</td>
<td>100m</td>
</tr>
</tbody>
</table>

Using 10GbE interfaces between IA Parent and Client switch is the recommended design. However 1Gbe interfaces are supported and provide an option for specific use cases where anticipated traffic bandwidth will not exceed the 1Gbs uplinks.

Always Check the The Release Notes for the Latest Hardware and Software Compatibility
Instant Access Control Plane and Data Plane
Catalyst Instant Access
Control Plane

1. **Satellite Discovery Protocol (SDP)**
   - Fabric Link Discovery
     - `switchport mode fex-fabric`
   - IA Client Discovery
     - `fex associate <fex ID>`

2. **Satellite Registration Protocol (SRP)**
   - Compatibility Info
   - Client Registration
     - Image Management
     - Client ROIR

3. **Satellite Configuration Protocol (SCP)**
   - Configuration, Status, Statistics

4. **Inter Card Communication (ICC)**
   - Syslog, QoS, Remote Login, etc.
Catalyst Instant Access
Data Plane Components

**IA Parent**
- Virtual Interface (VIF) Mapping
- VNTAG Assignment
- MAC Learning
- L2 & L3 Features
- QoS Classification, Marking and Policing

**IA Client**
- VNTAG Encapsulation
- Quality of Service (QoS) host port queuing
Virtual Interface (VIF) Mapping

- **Automatically Assigned**
- IA Parent VIF = 0
- One VIF to each Host Port
- One VIF to each Ether Channel
- One VIF to FEX CPU for Control Channel
- Multicast/Broadcast: Pointer to Replication Table in IA Client
Packet Flow with VNTAG Assignment

Unicast Forwarding

VNTAG: Virtual NIC Tag

Host 1
MAC 1

VNTAG
SVIF = VIF1, DVIF = 0

SA=MAC1, DA=MAC2+ Payload

VNTAG
SVIF = VIF1, DVIF = 0

SA=MAC1, DA=MAC2+ Payload

SA=MAC1, DA=MAC2+ Payload

F101

IF1 (VIF1)

IF2 (VIF2)

Host 2
MAC 2

VNTAG
SVIF = 0, DVIF = VIF2

SA=MAC1, DA=MAC2+ Payload

VNTAG
SVIF = 0, DVIF = VIF2

SA=MAC1, DA=MAC2+ Payload

SA=MAC1, DA=MAC2+ Payload
VNTAG Frame Format + 802.1Q

- **DA[6]**
- **SA[6]**
- **VNTAG[6]**
- **802.1Q[4]**
- **Frame Payload**
- **CRC[4]**

**Unicast**
- D=1
- Unicast to FEX Host Port

**Multicast**
- P=1
- Pointer to Multicast Table on FEX Client

- **VNTAG ETHERTYPE (0x8926)**
- **D[1]**
- **P[1]**
- **DVIF [12]**
- **L[1]**
- **R[1]**
- **R[1]**
- **R[1]**
- **SVIF[12]**

- **Destination VIF**
- **Source VIF**
- **Destination bit**
- **Pointer bit (multicast)**
- **Loopback bit**
- **Reserved**
Packet Flow
Multicast & Broadcast

192.168.1.100, 224.0.255.1
Incoming Interface: FortyGig 5/1 RPF Neighbor 210.20.37.33
Outgoing interface list:
  Gigabitethernet 101/1/0/1, Forward/Dense, 0:57:31/0:02:52
  Gigabitethernet 101/1/0/2, Forward/Dense, 0:56:55/0:01:28

MAC + Payload

**VNTAG**
SVIF = VIF₁, DVIF = 0

MAC + Payload

Host 1

Host 2

**Outgoing Interface**

VIF₁

VIF₂

**Hosts**

MAC + Payload

**IA Parent**

**F101**

IF₁ (VIF₁)

IF₂ (VIF₂)
Case Studies For Deployment
Global Corporation with Diversified Business Group
Case Study #1 – Medium Campus, Factory Floor

Global Corporation with Diversified Business Groups

- Business and Technology Drivers
  - High Availability network designs
  - Highly secure environment
  - Future network segmentation options including VRF-lite, MPLS

- Instant Access domain size
  - 8 Instant Access domains over two locations
  - Near 1000 ports in each Instant Access domain

- Key applications
  - Engineering
  - Traditional enterprise applications including email, collaboration

- Key functionality enabled
  - Wired and wireless user authentication with IEEE 802.1x
Case Study #1 – IA Topology

- Migrating to Instant Access in phases
  - Traditional multi-layer deployment today
  - 2 x 10GbE and 4 X 10GbE fex uplink configurations

- Considering 1GbE uplinks in future manufacturing floor deployments

- Considering VRF-lite extensions to the Instant Access domains

6 IA Domains

21 Clients

21 Clients

21 Clients

21 Clients

Manufacturing Facility

Campus Network

C-Core

21 Clients

21 Clients
Global Financial Corporation
Case Study #2 – Global Enterprise

Financial Securities Company

• Business and Technology Drivers
  • Existing Cisco infrastructure needs to be refreshed world wide
  • HQ with over 500 employees
  • Over 200 remote sites medium (less than 100 users) and small (less than 20 users)
  • Desires deployment model that fits multiple locations
  • No Cisco certified IT staff onsite at remote locations

• New building deployment, future growth planned
  • Instant Access domain size 1000 – 1500 ports

• Already using Catalyst 6500 in core, distribution and access in many existing locations
Case Study #2 - Topology

HQ Hybrid Deployment – IA domain 1000 – 1500 ports

MPLS Backbone

C-1 Core DC

FEX 101

FEX 102

FEX 103

FEX 104

FEX 105

FEX 106

FEX 107

C45007+RE

Trader Access

User Access
Customer Proof of Concept Testing (CPOC)

London CPOC Testing Services

- Customer requested a formal CPOC test to compare versus competitive offers

- Test Plan dictated by customer
  - Over 250 individual test cases
  - Routing & Switching, Wireless, Network Management
  - High Availability, Performance, Routing Protocols, Multicast more…

- Two different deployment topologies verified
  - Instant Access Max Scale 1000 ports
  - Traditional Access with Catalyst 4500
## CPOC - Test Case Examples

<table>
<thead>
<tr>
<th>Test Section</th>
<th>Test Case</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Plane</td>
<td>OSPF - Core/Distribution - Inject 25,000 OSPF prefixes</td>
<td>Pass</td>
</tr>
<tr>
<td>Scalability</td>
<td>BGP - Core/Distribution - Inject 25,000 BGP prefixes</td>
<td>Pass</td>
</tr>
<tr>
<td>Control Plane</td>
<td>ECMP - Core/Distribution - Confirm traffic is load balanced when equal paths exist.</td>
<td>Pass</td>
</tr>
<tr>
<td>Scalability</td>
<td>MulticastInject10,000 S,G multicast groups from the DCI to the core/aggregation layer</td>
<td>Pass</td>
</tr>
<tr>
<td>Control Plane</td>
<td>Broadcast – Access, Distribution, Core Layer</td>
<td>Pass</td>
</tr>
<tr>
<td>Protection</td>
<td>TTL Expired Traffic – Core, Distribution</td>
<td>Pass</td>
</tr>
<tr>
<td>Control Plane</td>
<td>Malformed Packet - Core/Distribution/Access</td>
<td>Pass</td>
</tr>
<tr>
<td>Protection</td>
<td>SPAN/Monitor Port – Unicast/Multicast</td>
<td>Pass</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Section</th>
<th>Test Case</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network Convergence</td>
<td>Uplink Failure - Unicast Fail one uplink</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>Uplink Failure - Multicast Fail one uplink in a User Access switch.</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>Unicast - Core/Distribution Simulate a failure of an active Supervisor module.</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>Multicast - Core/Distribution Simulate a failure of an active Supervisor module.</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>Unicast - Core/Distribution Simulate a failure of a backup Supervisor module.</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>Multicast - Core/Distribution Simulate a failure of a backup Supervisor module.</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>Distribution/Core Failure – Unicast- Simulate a failure of a Core/Aggregation Switch.</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td>Distribution/Core Failure – Multicast- Simulate a failure of a Core/Aggregation Switch.</td>
<td>Pass</td>
</tr>
</tbody>
</table>
CPOC Test Topology

Legend:
- Layer 3
- Layer 2
- FEX-Fabric
- Host L2
- Spirent TG

Legend:
- VSL (VSS Link)
- Dual Active

DC-1

VSS-Core

Trader Access
C45007+RE

FEX 101

FEX 102

E
I
Q
R
S

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VSS Active Switch Fail Test

Each test stream transmitting at 1000 fps i.e. each dropped frame equals 1 millisecond of downtime
Each test stream transmitting at 1000 fps i.e. each dropped frame equals 1 millisecond of downtime.
Catalyst Instant Access

A = Active
S=Standby
LC=Line Card

issu load version
issu run version
issu run version fex 103
issu commit version
issu accept version
issu run version fex 103, 101
High Availability: Software upgrade

Upgrade of Distribution and Access

1. VSS-1# issu load version Version 1 → Version 2

VSS-1# issu load version Version 1 → Version 2

Unicast ~25-50ms
Multicast ~ 300ms

2. VSS-1# issu runversion [SSO VSS1↔ VSS2]

VSS-1# issu runversion [SSO VSS1↔ VSS2]

Unicast ~25-50ms
Multicast ~ 300ms
High Availability: Software Upgrade
Upgrade of Distribution and Access

3. VSS-1# issu runversion fex 106
   Cat6500-VSS# issu runversion fex 106
   % Successfully initiated 'runversion fex' for Fex IDs: 106.

- Image download w/ no disruption of traffic (4.5mts)
  Tel1/2/15 - Interface Up.  state: bound
  Tel1/2/16 - Interface Up.  state: bound
  Tel2/2/15 - Interface Up.  state: bound
  Tel2/2/16 - Interface Up.  state: bound

- Unicast: No Loss
- Multicast – No Loss

4. C6800IA reload’s with new image
   Traffic Loss during reboot of C6800IA ~ 5-6 mts

VSS-1# issu commitversion
CPOC - ISSU Upgrade Timeline with Instant Access Domain of 1008 Ports

Upgrade From 15.1(2)SY3 to 15.1(2)SY4

- ISSU Loadversion path:file
- ISSU runversion fex all
- ISSU runversion
- ISSU acceptversion
- ISSU commitversion

Upgrade includes 8 Total FEXs using 21 IA switches (Total upgrade time will vary per unique configuration)

Useful Commands:
- Show ISSU State Detail
- Show FEX
- Show Etherchannel Summary
CPOC - Problems Upgrading from 15.1(2)SY2

- Ran into a known problem/bug when upgrading some IA switches to 15.1(2)SY2
- Caused extended image download times or aborted downloads
- Needed to use the recovery method documented in Field Notice
- Once all switches were running 15.1(2)SY3 with IA image c6800ia-universalk9-mz.150-2.EX6.bin then no problems upgrading to 15.1(2)SY4

- Field Notice FN - 63838 - Catalyst 6800 Instant Access Client Switch Fails to Boot During Installation or Upgrade - Image Recovery Required
CPOC – Instant Access Switch Stacking

Recommended Stacking Configuration for max bandwidth and redundancy

- Minimal documentation available on how to connect the stacking cables
  - Initial CPOC testing experienced greater than 1 sec convergence time on certain test cases
- Once stacking cables connections were optimised all convergence test cases results in sub second convergence
- See 6800IA Hardware Installation Guide for additional reference
CPOC – Which Switch is SW1? SW2? SW3?

- From the CLI one can identify individual switches in the stack
- Physically all the IA switches look the same
  - can cause confusion when connecting cables, power supplies etc…
- Solution - Configure system LED to beacon for the desired switch

```
C6880-VSS#show module fex
Switch Number: 101 Role: FEX
---------------------- ----------------------
Mod Ports Card Type Model Serial No.
--- ----- ---------------------- ----------------------
1 48 C6800IA 48GE POE C6800IA-48FPD FOC1740Y359
2 48 C6800IA 48GE POE C6800IA-48FPD FOC1723X3KG
3 48 C6800IA 48GE POE C6800IA-48FPD FOC1723X3JR
```

```
Mod MAC addresses Hw Fw Sw Status
--- ---------------------- ------------------
1 34db.fdc9.3200 to 34db.fdc9.3233 0.0 Unknown 15.0(2)EX6 Ok
2 ecel.a959.6580 to ecel.a959.65b3 5.0 Unknown 15.0(2)EX6 Ok
3 ecel.a958.dd80 to ecel.a958.ddb3 5.0 Unknown 15.0(2)EX6 Ok
```

```
Mod Online Diag Status
--- -------------------
1 Pass
2 Pass
3 Pass
```

```
C6880-VSS(config)#hw-module fex 107 slot 1 led beacon
```
CPOC - Recommendations for large scale VSS or large scale IA domain

- Reduce impact to Active CPU when the Standby chassis is initializing many line cards/ports simultaneously (after a reload or switchover)

Reduce impact to Active CPU when initializing many IA clients simultaneously (bootup, software upgrades, etc…)

HQ-AGG-6807(config)#switch virtual domain 100
HQ-AGG-6807(config-vs-domain)#standby port delay 30
HQ-AGG-6807(config-vs-domain)#standby port bringup 20

HQ-AGG-6807(config)#fex stagger 120
Global Energy Corporation
Case Study #3 Global Energy Company – European Office Deployment

Looking for ways to drive costs lower

Security is top of mind

- PCs are locked down
- IEEE 802.1x port security
  - For wired and wireless
  - Certificate-based authentication for PCs
  - MAB for printers and other devices

Drive Efficiency with Automation

- BMC BladeLogic Network Automation (BBNA) tool for pushing config changes
- Reduce the number of CLIs that I have to manage
Key project for 2016

Two new buildings

- 12 story building and 6 story building

768 Access Ports per floor

Cisco AireOS Centralized Wireless solution
Deployment – Option 1
Catalyst 6800 IA

Twelve Story Building
Access - 6 x IA Domains
Core - 1 x 6800 VSS pair

Six Story Building
Access - 3 x IA Domains
Core - 1 x 6800 VSS Pair
Deployment – Option 2
Catalyst 6800 VSS with Cat4k Access

Twelve Story Building
Access – 24 x Cat 4k switches
Core - 1 x 6800 VSS pair

Six Story Building
Access – 12 x Cat 4k switches
Core - 1 x 6800 VSS pair
Why Instant Access

- Simplification, reduces the number of management nodes (automation)
- Cisco’s proven solution for 802.1x port security (security)
- More scalable than Juniper Virtual Chassis
- Refresh Distribution and Access at the same time with a single integrated solution (cost savings)
Project and Instant Access Release Timeline

Mid 2014
- Evaluate
- Proof of Concept begins

Dec 2014
- Release 15.2(1)SY
- C6880 scales to 2000 ports
- Interface templates
- Bug fixes

May 2015
- Release 15.2(1)SY1
- Improved logging
- Stack switch ID renumbering
- Bug fixes

Oct 2015
- Release 15.2(1)SYA
- Bug fixes

Deployment
Nov 2015
- Site 1
  - 1344 ports
- Site 2
  - 1776 ports
  - 1392 ports
  - 1900 ports

Deployment
Nov 2015
Critical Features that led to a successful deployment

• Catalyst 6880-X increased IA scalability to 2000 ports / 42 FEX id’s with 15.2(1)SY

• Switch renumbering in a stack 15.2(1)SY1

• Interface template support 15.2(1)SY

• Improved logging for IA clients as they come online 15.2(1)SY1
Provisioning Instant Access

Log messages when Instant Access client comes online

DIST-VSS#
*Apr 1 21:04:26.335: %FEXMGR-SW2-6-IMAGE_DNLD_STATUS: (FEX 103) Auto Image Download: In progress
*Apr 1 21:04:48.899: %FEXMGR-SW2-6-IMAGE_DNLD_STATUS: (FEX 103) Auto Image Download: Installing the images
*Apr 1 21:04:53.039: %FEXMGR-SW2-6-IMAGE_DNLD_STATUS: (FEX 103) Auto Image Download: Software Installation completed
*Apr 1 21:04:56.043: %FEXMGR-SW2-6-IMAGE_DNLD_STATUS: (FEX 103) Auto Image Download: Reloading the FEX

DIST-VSS# show fex

<table>
<thead>
<tr>
<th>FEX</th>
<th>FEX</th>
<th>FEX</th>
<th>FEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Description</td>
<td>State</td>
<td>Model</td>
</tr>
<tr>
<td>Serial</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>------------</td>
<td>-----------</td>
</tr>
<tr>
<td>101</td>
<td>FEX0101</td>
<td>online</td>
<td>C6800IA-48TD</td>
</tr>
<tr>
<td>FOC1741S1FD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>102</td>
<td>FEX0102</td>
<td>online</td>
<td>WS-C3560CX-12PD-S</td>
</tr>
<tr>
<td>FOC1906Y1HB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>103</td>
<td>FEX0103</td>
<td>online</td>
<td>WS-C3560CX-8XPD-S</td>
</tr>
<tr>
<td>FOC1852Z001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C3560-CX IA
C6800IA
C3560-CX IA
Interface Templates

Static Apply an Interface Template with

Statically apply interface template with

```
interface CLI
Full interface configuration use “show derived-config interface <intf>”
```

```
Template name appears in “show running interface <intf>”
```

```
By default, access vlan is 1.
```

**Easy to Use**

Statically apply interface template with “source template <templatename>”

interface CLI

Full interface configuration use “show derived-config interface <intf>”

```
Template name appears in “show running interface <intf>”
```

```
By default, access vlan is 1.
```
Interface Templates

Adding an Interface Template

Easy to Modify

Editing is easy; add or modify configuration, e.g., change access vlan for template

Create new or customize existing with command “template <name>”

Change propagates to templates in place!
- ASP has to re-apply macro after change

Changing built-in template, entire template appears in running and startup configuration
- Unchanged template not in config

Restore to original built-in with no command
- “no source template”

Switch# show derived-config int g101/1/0/1
interface GigabitEthernet101/1/0/1
switchport
switchport access vlan 100
switchport trunk allowed vlan 1
switchport mode access
switchport nonegotiate
switchport port-security
spanning-tree portfast edge

Switch(config)#template IA_TEMPLATE
Switch(config-template)#switchport access vlan 200
Switch(config-template)#end

Switch# show derived-config int g101/1/0/1
Derived configuration : 155 bytes
!
interface GigabitEthernet101/1/0/1
switchport
switchport access vlan 200
switchport trunk allowed vlan 1
switchport mode access
switchport nonegotiate
switchport port-security
spanning-tree portfast edge
Switch Renumbering in a Stack
Easy replacement during RMA

Switch 4
Switch 5

Change switch number of replaced switch, to derive the configuration of the previously failed stack member

Switch Renumbering in a Stack
Easy replacement during RMA

6880-VSS#show mod fex 109
Switch Number: 109 Role: FEX

<table>
<thead>
<tr>
<th>Mod</th>
<th>Ports</th>
<th>Card Type</th>
<th>Model</th>
<th>Serial No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>48</td>
<td>C6800IA 48GE POE</td>
<td>C6800IA-48FPDR</td>
<td>FDO1804B02N</td>
</tr>
<tr>
<td>2</td>
<td>48</td>
<td>C6800IA 48GE POE</td>
<td>C6800IA-48FPDR</td>
<td>FDO1804B02C</td>
</tr>
<tr>
<td>3</td>
<td>48</td>
<td>C6800IA 48GE POE</td>
<td>C6800IA-48FPDR</td>
<td>FDO1804B02W</td>
</tr>
<tr>
<td>4</td>
<td>48</td>
<td>C6800IA 48GE POE</td>
<td>C6800IA-48FPDR</td>
<td>FDO1804B025</td>
</tr>
<tr>
<td>5</td>
<td>48</td>
<td>C6800IA 48GE POE</td>
<td>C6800IA-48FPDR</td>
<td>FDO1804B01V</td>
</tr>
</tbody>
</table>

<snip>

6880-VSS#module provision update fex 109
6880-VSS(exec-fex-update)#renumber 5 to 4

%FEX 109 slot 5 will reload upon commit.
Are you sure you want to proceed? [no]: yes

6880-VSS(exec-fex-update)#renumber 4 to 5

%FEX 109 slot 4 will reload upon commit.
Are you sure you want to proceed? [no]: yes

6880-VSS(exec-fex-update)#show

Current module renumber mappings for FEX 109
renumber 4 to 5
renumber 5 to 4

Current module Priority mappings for FEX 109

Temp vslots allowed:NO

Current Temp vslot allowed FEXs:

6880-VSS(exec-fex-update)#commit

%FEX 109 renumbered modules will reload.
Are you sure you want to proceed? [no]: yes

6880-VSS(exec-fex-update)#end

6880-VSS#
<table>
<thead>
<tr>
<th>DDTS</th>
<th>Descr</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCut84834</td>
<td>6880IA System LED lit Amber</td>
</tr>
<tr>
<td>CSCut78924</td>
<td>Dot1x Crash @ dot1x_sp_platform_unrestrict_macs</td>
</tr>
<tr>
<td></td>
<td>Dot1x crash @ dot1x_switch_sb_from_swidb</td>
</tr>
<tr>
<td>CSCuv09462</td>
<td>Traffic dropped due to LTL fail for IAs getting online after switchover</td>
</tr>
<tr>
<td>CSCuv06404</td>
<td>Crash @ fexmgr_acfg_del_rslif</td>
</tr>
<tr>
<td>CSCuv18809</td>
<td>Unexpected reload seen @ipc_rcv_unaccount</td>
</tr>
<tr>
<td>CSCuu14497</td>
<td>TB@sisf_mac_fsm_clean upon triggering dot1x/mab authentication</td>
</tr>
<tr>
<td>CSCuq47073</td>
<td>fm_cm_set_port_mode_for_rtype: idb - mih mapping failed</td>
</tr>
<tr>
<td>CSCus92491</td>
<td>%QM-SW1-4-SET_MODE: Hardware mode programming on no shut of fex port</td>
</tr>
<tr>
<td>CSCuw09071</td>
<td>USB Enumeration fail causes MCL error due to tftp-server /exception cmd (This issue will not be seen since CSCuu86026 is fixed)</td>
</tr>
<tr>
<td>CSCuu86026</td>
<td>Internal USB Bootdisk is not initialized during bootup</td>
</tr>
<tr>
<td>CSCuu05714</td>
<td>Constant high cpu due to SNMP ENGINE when pooling MIB llpdXMEdMIB</td>
</tr>
<tr>
<td>CSCuw44036</td>
<td>6880x crashes when running &quot;sh monitor session egress replication-mode&quot;</td>
</tr>
<tr>
<td>CSCuw30287</td>
<td>Alignment fix for EHCI controller data structures (bcache_init: bootdisk corruption crash)</td>
</tr>
<tr>
<td>Identifier</td>
<td>Headline</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CSCus53298</td>
<td>Adding 5th member to the stack of 4 members reloads whole 6800IA stack</td>
</tr>
<tr>
<td>CSCus60440</td>
<td>C6880 crashes when dot1x device moved across a client stack</td>
</tr>
<tr>
<td>CSCuq04062</td>
<td>1Gig port- 64 byte Padding some ports pass 60 byte</td>
</tr>
<tr>
<td>CSCut14048</td>
<td>TB@sisf_mac_fsm_clean upon triggering dot1x/mab authentication</td>
</tr>
<tr>
<td>CSCup54643</td>
<td>Proposal for zero-touch replacement of Fex stack member</td>
</tr>
<tr>
<td>CSCus42147</td>
<td>FEX Switch number update</td>
</tr>
<tr>
<td>CSCus70085</td>
<td>Provision to modify the IA switch priority from Controller.</td>
</tr>
<tr>
<td>CSCus70091</td>
<td>Switch renumber of an RMAed IA of Stack in scaled setup (all vslots)</td>
</tr>
<tr>
<td>CSCus76144</td>
<td>MK1.5 Proposal for zero-touch replacement of Fex stack member</td>
</tr>
<tr>
<td>CSCus78167</td>
<td>Provision to modify the IA module priority from Contr (2k side changes)</td>
</tr>
</tbody>
</table>
Rack mounting kit – not flush

New and improved rack mounting kit shipping
March 2016

ISO View

Right View

Original rack mount kit
Successful Deployments ..more planned

• Production deployments in November 2015
  • Two buildings, four total IA domains deployed
  • C6800 software version 15.2.(1)SY1a
  • Multi VRF
  • 30 VLANs
  • ISIS, IPv4 and IPv6
  • Identity Based Management 2.0 (IEEE 802.1x port authentication)
  • Interface templates

• Third production deployment in December 2015
  • Four IA domains
Performance Characteristics High Availability
Catalyst Instant Access High Availability.

- VSS / VSS Quad-Sup SSO
- EtherChannel Load Balancing
- Up to 6 10G in MEC Bundle
- Load Sharing Ca6k Hash Algorithms
- Up to 3 Stack Members
- 80G stack bandwidth between stack members
- EtherChannel Across Stack Members
- Up to 6 10G into One EtherChannels
- Dual Active detection on fabric links
- Upto 8 Host Port Etherchannels
- Host Port EtherChannel Across Stack Members (Next release)
- Master Failure will not reset Etherchannel
Network Topology

- Bi-Directional Unicast Traffic
  - TrafficGen <-> Hosts
  - 100 Flows to each Host
  - MEC:Hash – Src-Dst-Port

- Multicast(Anycast, Sparse)
  - TrafficGen -> All Hosts
High Availability: Fabric-Link Failure

1\textsuperscript{st} Uplink failure
- Host A,B ~ 15ms
- Multicast - Hitless

2\textsuperscript{nd} Uplink failure
- Host A,B,C ~ 50ms
- Multicast ~ 612ms

3\textsuperscript{rd} Uplink failure
- Host A,C ~ 25ms
- Multicast - Hitless
High Availability: Fabric-Link Failure

Fabric Link Recovery
Host A, B, C ~ 25-50ms
Multicast ~ 0 – 90ms
High Availability: Supervisor Failure

Traffic Generator

Supervisor Failure
Host A, B, C, D, E, F ~ 15ms - 60 ms
Multicast ~ 800ms
High Availability: Stacking - Uplink Failover

1) Pulled Stack cable between SW1 and SW3:
   - Host A,B – Hitless,
   - Host C ~ 30ms
   - Multicast – Hitless

2) Pulled Stack cable between SW1 and SW2:
   - Host B ~ 30ms Loss
   - Multicast ~ 204 ms
   - Host A, C – Hitless
High Availability: Stackmaster Failure

Power removed from Stack master (SW1)

Host B, C ~ 96ms Loss
Multicast - Hitless
High Availability: VSL Link Failure

Traffic Generator

VSL Link Failure
Host A,B,C,D,E,F ~ 23 - 45 ms
Multicast ~ 500ms

Dual-Active Detection
High Availability: VSL Link Failure

Switch 1: Supervisor 1: Failure
Host A,B,C,D,E,F - Hitless
Multicast - Hitless

Switch 2: Supervisor 1: Failure
Host A,B,C,D,E,F - Hitless
Multicast - Hitless
Instant Access: VSS Dual Active Detection

Enhanced PAgP

- Requires ePagP capable neighbour:
  - 3750: 12.2(46)SE
  - 4500: 12.2(44)SE
  - 6500: 12.2(33)SXH1
- Sub-second convergence

Enhanced SDP (Fabric Link Discovery Protocol)

- Channel Group 16 (FEX 132)
  - Dual Active detection enabled: Yes
  - Dual Active detection capable: Yes
  - switch 1 member port state:
    - Te1/2/5 - Interface Up. state: bound
    - Te1/2/13 - Interface Up. state: bound
  - switch 2 member port state:
    - Te2/2/5 - Interface Up. state: bound
    - Te2/2/13 - Interface Up. state: bound
Recommendations and Best Practices
New Deployment of Instant Access

Simplicity of Provisioning

Automatic-Provisioning on Connection
• A Client gets automatically discovered and provisioned using IA Control Protocol when connected.
• Automatic Discovery and Stack Member by Parent via Stack Master

Pre-Provisioning
Provision IA Client and interface Configurations before even physically connecting the IA Client

```
mod provision create fex 111 type c6800IA-48fPD
mod provision create fex 111 type c6800IA-48fPD slot 2
```
Provisioning Client Switches

Use the `module provision create fex 188 type c6800iA-48FPD` command to create the logical interface representation within the system configuration without even connecting the physical client switch.

```
C6500-VSS-2# module provision create fex 188 type c6800iA-48FPD
FEX 188 slot 1 module provisioning entry added.
```

```
C6500-VSS-2# show interface summary | begin 188
GigabitEthernet188/1/0/1  0 0 0 0 0 0 0 0
GigabitEthernet188/1/0/2  0 0 0 0 0 0 0 0
GigabitEthernet188/1/0/3  0 0 0 0 0 0 0 0
GigabitEthernet188/1/0/4  0 0 0 0 0 0 0 0
GigabitEthernet188/1/0/5  0 0 0 0 0 0 0 0
GigabitEthernet188/1/0/6  0 0 0 0 0 0 0 0
GigabitEthernet188/1/0/7  0 0 0 0 0 0 0 0
```
Apply Configuration to Provisioned FEX Clients

C6500-VSS-2# show run fex 188
Building configuration...

Current configuration : 5900 bytes
!
interface GigabitEthernet188/1/0/1
  switchport
  switchport trunk allowed vlan 1
  switchport mode dynamic auto
  shutdown
!
interface GigabitEthernet188/1/0/2
  switchport
  switchport trunk allowed vlan 1
  switchport mode dynamic auto
  shutdown
!

C6500-VSS-2# conf t
Enter configuration commands, one per line. End with CNTL/Z.
C6500-VSS-2(config)# int gi 188/1/0/1
C6500-VSS-2(config-if)# switchport mode access
C6500-VSS-2(config-if)# switchport access vlan 100
C6500-VSS-2(config-if)#
Catalyst Instant Access
Fabric Link Connectivity Scenarios – Dual Homed to VSS Pair

**Recommended Design**

- **Dual Homed to VSS Pair**
- **Dual Homed across Stack Members**
- **Up to 6 uplinks (60G) MEC across Client to Parent**

Dual Homed to VSS Pair

Dual Homed across Stack Members

Up to 6 uplinks (60G) MEC across Client to Parent
Catalyst Instant Access
Fabric Link Connectivity Scenarios – Single Homed to VSS Pair

Possible but “Not Recommended”

Single homed to VSS pair

Single Homed upto 6 links in MEC Across Stack members
Catalyst Instant Access
Fabric Link Connectivity Scenarios – Single Switch VSS Mode

Possible but “Not Recommended”

Single Homed to Switch 1 in VSS mode

Dual Homed to Single Switch in VSS mode

Up to 6 links in MEC homed to Single Switch in VSS Mode
Key Recommendations

• Consider software release 15.2(1)SY1a or newer
• Follow VSS related topology recommendations
  • Dual attach to the VSS
  • Tune VSS port and FEX stagger timers for large scale deployments
• Stack IA client switches in full loop for optimal convergence
• Leverage FEX provisioning as needed
• Leverage Interface templates
Summary and Key Takeaways
Key Takeaways

• Instant Access is a deployment model with specific benefits
  • Simplified operations
    • Single point of management
    • Image management
    • Configuration management
    • Troubleshooting
  • Eliminates configuration complexity at the access uplink
    • VLAN trunks, VRF-Lite, MPLS and other segmentation protocols
  • Specific hardware and Software requirements
  • Centralised wired and wireless switching designs
• Instant Access is shipping and ready to deploy
  • Latest software release supports increased scalability up to 1200 ports with Sup2T and 2016 ports with the Catalyst 6880
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