Common Configuration Tasks for Layer3 ICX Running Fastiron8.X

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Target Path

- Current Target Path can be found in the following documentation:
  - http://www.brocade.com/en/backend-content/pdf-page.html?/content/dam/common/documents/content-types/target-path-selection-guide/brocade-fi-target-path.pdf
- Ensure switches are upgraded BEFORE deployment

ICX 6610 Port Numbering Scheme

Module 3
ETH x/3/y

Module 1
ETH x/1/y

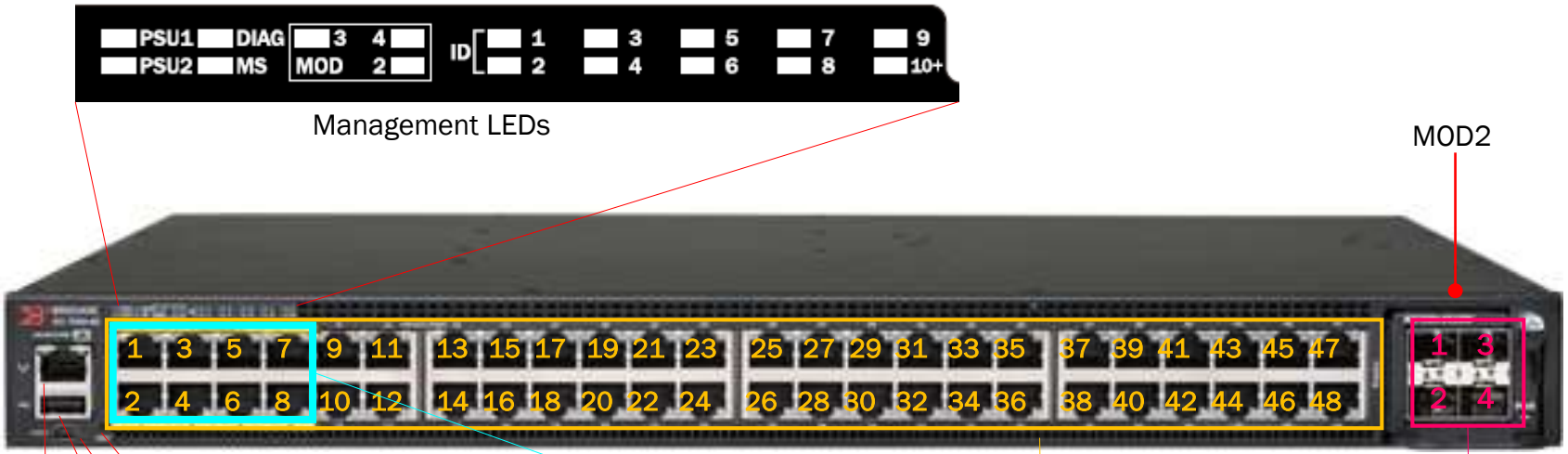
Console
9600 8/N/1

Out of Band
Ethernet
Management

Module 2
ETH x/2/y

X = Unit ID
Y = Port number

ICX 7450 Front Port Numbering Scheme



ICX 7450 Rear Port Numbering Scheme

ICX L3 Switch Steps

- Build Stack
- Temporarily assign IP address for Code Upgrade
- Upgrade Code
- Edge Ports
- Uplink Pots
- Link Aggregation
- VLANs
- Per VLAN Rapid Spanning Tree

ICX L3 Switch Steps

- Configure Assign IP Parameters
- Configure Administrative Parameters
- Copy Configuration to TFTP Server
- RELOAD and Verify Working System
- Utilizing Templates

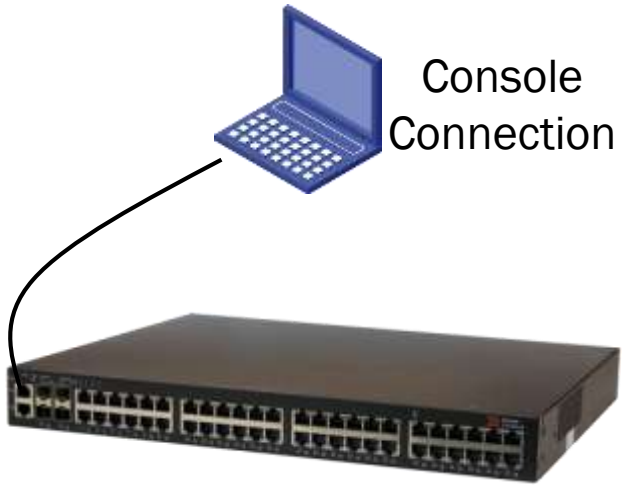
Building ICX Stack

Erase Configuration

Erase Existing Configuration on Individual Switches

- Console to Individual Units
- Power On Units
- Perform the following steps:

```
ICX6610-24P Router>enable
No password has been assigned yet...
ICX6610-24P Router#erase startup-config
ICX6610-24P Router#reload
```



Stacking Cables

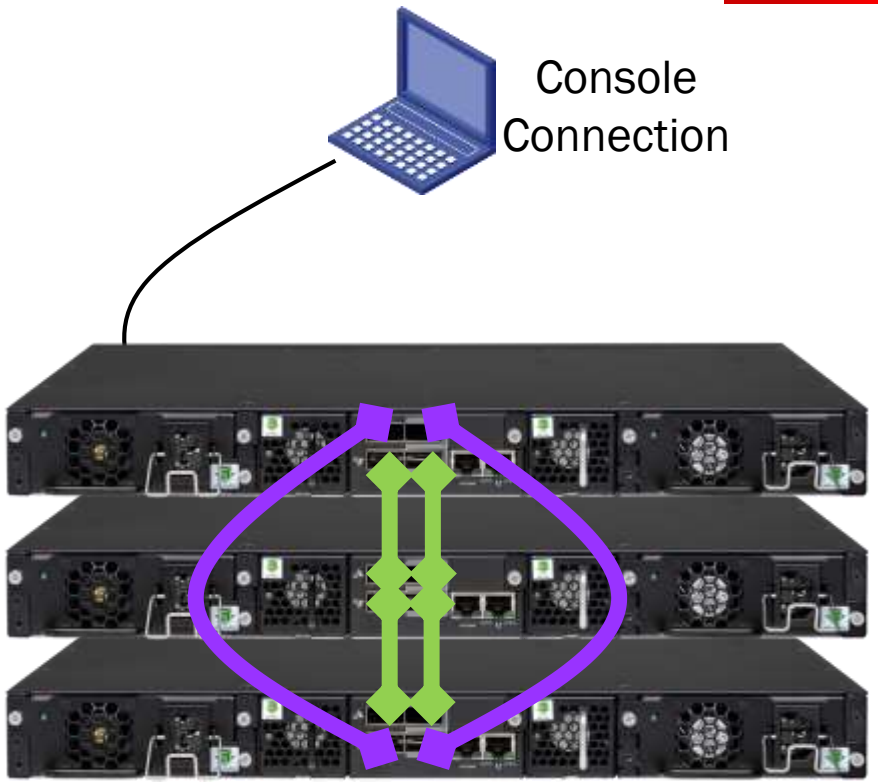
- 40G Twinax Cables
- (2) 1M Cables Included with Order
- 1M-5M Options
  - 40G-QSFP-C-0101
  - 40G-QSFP-C-0501

ICX 6610 Stacking Steps

Stack Secure Setup

- Connect Console to Top Unit
- Power On All Units
- Perform on Top Unit Only

```
ICX66610-24P(config)#stack enable
Enable stacking. This unit actively
participates in stacking
stacking is enable. optical monitoring for
stacking ports 1/2/1, 1/2/6 is not
available.

ICX66610-24P Switch(config)#exit
ICX66610-24P Switch#stack secure-setup
```

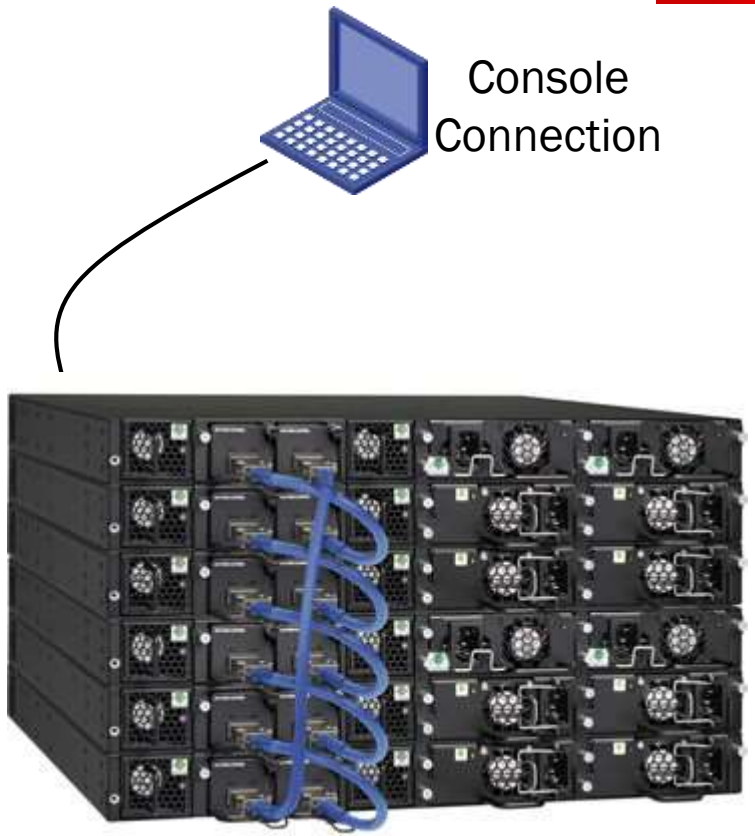


ICX 7450 Stacking Steps

Stack Secure Setup

- Connect Console to Top Unit
- Power On All Units
- Perform on Top Unit Only

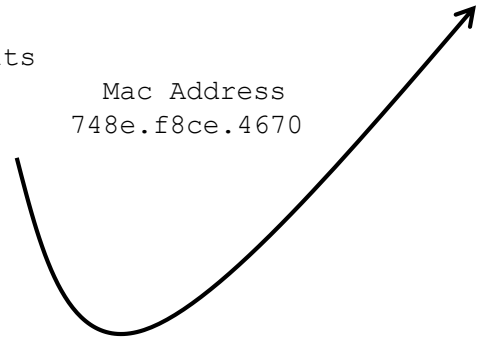
```
ICX7450-24P(config)#stack enable

ICX7450-24P Switch(config)#exit
ICX7450-24P Switch#stack secure-setup
```



ICX Stacking Steps

Verify Stack Secure-Setup Discovers Ring Topology

```
ICX6610-48 Switch#stack secure-setup
ICX6610-48 Switch#Discovering the stack topology...

Current Discovered Topology - RING
Available UPSTREAM units
Hop(s)   Id      Type          Mac Address
1        new   ICX6610-48     748e.f8ce.4670

Available DOWNSTREAM units
Hop(s)   Id      Type          Mac Address
1        new   ICX6610-48     748e.f8ce.4670
```



Continued

```
Do you accept the topology (RING) (y/n)?: y

Selected Topology:
Active   Id      Type          Mac Address
         1     ICX6610-48     748e.f895.3aae

Selected UPSTREAM units
Hop(s)   Id      Type          Mac Address
1        2     ICX6610-48     748e.f8ce.4670

Selected DOWNSTREAM units
Hop(s)   Id      Type          Mac Address
1        2     ICX6610-48     748e.f8ce.4670

Do you accept the unit id's (y/n)?: y
```

ICX Stack Steps

Verify Stack Secure-Setup Renumbers Units

```
Do you accept the unit id's (y/n)?: y
ICX6610-48 Switch#

T=4m1.0: Election, was alone --> active, ID=1, pri=128, 2U(1-2), A=u1, nbr#=1 1,
reset unit 2: u2 diff bootup id=1
Unit 1 loses all neighbors.
Active unit 1 deletes u2 and its config because it is learned.

Config changed due to add/del units. Do write mem if you want to keep it
```

ICX Stacking Steps

CLI Feedback

```
Do you accept the unit id's (y/n)?: y
ICX6610-48 Switch#

T=4m1.0: Election, was alone --> active, ID=1, pri=128, 2U(1-2), A=u1, nbr#=1 1,
reset unit 2: u2 diff bootup id=1
Unit 1 loses all neighbors.
Active unit 1 deletes u2 and its config because it is learned.

Config changed due to add/del units. Do write mem if you want to keep it
```

Unit 1 Becomes Master
With Priority 128
Automatically Assigned

Assign Next Switch Unit 2
Reloads Unit 2 Automatically

Save Running Config to Startup

ICX Stacking Steps

Verify Configuration

```
ICX6450-24P Switch#show run
Current configuration:
!
ver 07.4.00cT311
!
stack unit 1
  module 1 icx6450-24p-poe-port-management-module
  module 2 icx6450-sfp-plus-4port-40g-module
  priority 128
  stack-port 1/2/1 1/2/3
stack unit 2
  module 1 icx6450-24p-poe-port-management-module
  module 2 icx6450-sfp-plus-4port-40g-module
  stack-port 2/2/1 2/2/3
stack enable
```

ICX Stacking Steps

Verify Stack

```
ICX6610-48 Switch#show stack
alone: standalone, D: dynamic config, S: static config
ID   Type          Role    Mac Address    Pri State   Comment
1  S ICX6610-48    active  748e.f895.3aae 128 local   Ready
2  D ICX6610-48    standby 748e.f8ce.4670   0 remote  Ready

    active       standby
     +---+        +---+
 =2/1| 1 |2/6==2/1| 2 |2/6=
  |   +---+        +---+   |
  |                        |
  |------------------------|

Standby u2 - No hitless failover. Reason: hitless-failover not configured
Current stack management MAC is 748e.f895.3aae
Note: no "stack mac" config. My MAC will change after failover.
```

ICX Stacking Steps

Verify Flash

```
ICX6610-48 Switch#show flash
Stack unit 1:
  Stack unit 1:
  Compressed Pri Code size = 6958108, Version:07.3.00gT7f3 (FCXS07300c.bin)
  Compressed Sec Code size = 6958108, Version:07.3.00gT7f3 (FCXR07300c.bin)
  Compressed Boot-Monitor Image size = 370555, Version:07.3.02T7f5
  Code Flash Free Space = 50855936
Stack unit 2:
  Stack unit 1:
  Compressed Pri Code size = 6958108, Version:07.3.00gT7f3 (FCXS07300c.bin)
  Compressed Sec Code size = 6958108, Version:07.3.00gT7f3 (FCXR07300c.bin)
  Compressed Boot-Monitor Image size = 370555, Version:07.3.02T7f5
  Code Flash Free Space = 50855936
```

ICX Stacking Steps

Additional Steps

- Enable Hitless Failover
- Disable Stack MAC Timer
- Enable Per VLAN Per Port ACL

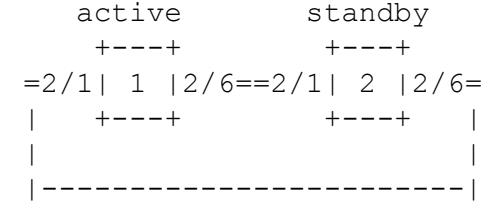
```
ICX6610-24P Router#config t
ICX6610-24P Router(config)#hitless-failover enable
ICX6610-24P Router(config)#stack persistent-mac-timer 0
ICX6610-24P Router(config)#enable acl-per-port-per-vlan

Reload required.  Please write memory and then reload or power cycle.

ICX6610-24P Router(config)#exit
ICX6610-24P Router#wri mem
```

WAIT UNTIL STACK HITLESS FAILOVER IS OPERATIONAL BEFORE RELOAD PERFORM **'SHOW STACK'** TO VERIFY

ICX Stacking Steps

Verify Hitless Failover and Reload

```
ICX6610-48 Switch#show stack
alone: standalone, D: dynamic config, S: static config
ID   Type         Role    Mac Address    Pri State   Comment
1  S ICX6610-48   active  748e.f895.3aae 128 local   Ready
2  D ICX6610-48   standby 748e.f8ce.4670   0 remote  Ready
```




```
Standby u2 - protocols ready, can failover
Current persistent MAC is 748e.f883.d560
Current stack management MAC is 748e.f883.d560

ICX6610-48 Switch#reload
Are you sure? (enter 'y' or 'n'): y
Reload request sent to attached stack member(s)...
```

Upgrade Stack Code

Assign IP Address

- Assign IP address to Management 1
- IP address can be learned from DHCP server as well – Default Behavior

```
Router(config)#interface management 1
Router(config-if-mgmt-1)#no ip dhcp-client enable
Router(config-if-mgmt-1)#ip address 192.168.13.70/24
Router(config-if-mgmt-1)#exit
Router(config)#ip route 0.0.0.0 0.0.0.0 192.168.13.1
Router(config)#ip dns server-address 4.2.2.2
Router(config)#ip dns domain-name brocode.com
```

Upgrade Software

Upgrade Bootrom Always

```
Router#copy tftp flash 192.168.13.30 grz07302.bin bo
  bootrom              Boot ROM image
Router#copy tftp flash 192.168.13.30 grz07302.bin bootrom
Router#Load to buffer (8192 bytes per dot)
.............................................................Write to boot flash..
TFTP to Flash Done.

Router#show flash
Stack unit 1:
  Compressed Pri Code size = 6905002, Version:07.3.00fT7f3 (FCXR07300f.bin)
  Compressed Sec Code size = 6905002, Version:07.3.00fT7f3 (FCXR07300f.bin)
  Compressed Boot-Monitor Image size = 370555, Version:07.3.02T7f5
  Code Flash Free Space = 51380224
Stack unit 2:
  Compressed Pri Code size = 6905002, Version:07.3.00fT7f3 (FCXR07300f.bin)
  Compressed Sec Code size = 6905002, Version:07.3.00fT7f3 (FCXR07300f.bin)
  Compressed Boot-Monitor Image size = 370555, Version:07.3.02T7f5
  Code Flash Free Space = 51380224

Router#
```

Command copies Image to all units

Upgrade Software

Upgrade Image Always

- 2 images of Fastiron Code may be used
- Best Practice to copy image to Primary and Secondary
- Switch Image (fcx**s**0xxxxx.bin)
  - Performs Layer 2 functions only
  - Single IP address/default gateway for management
- Router Image (fcx**r**0xxxxx.bin)
  - Performs Base Layer 3 functions
  - Performs Dynamic Layer 3 functions with License
  - IP address assign per VE and IP routes configured/learned

Upgrade Software

Upgrade Image Always

Command copies Image to all units

```
Router#copy tftp flash 192.168.13.30 FCXR07300g1.bin primary
Router#Flash Memory Write (8192 bytes per dot)
.....................................................................................
.....................................................................................
.....................................................................................
.....................................................................................
.....................................................................................
.....................................................................................
.....................................................................................
.....................................................................................
.....................................................................
TFTP to Flash Done.
Router#show flash
Stack unit 1:
  Compressed Pri Code size = 6958108, Version:07.3.00gT7f3 (FCXR07300g1.bin)
  Compressed Sec Code size = 6958108, Version:07.3.00gT7f3 (FCXR07300g1.bin)
  Compressed Boot-Monitor Image size = 370555, Version:07.3.02T7f5
  Code Flash Free Space = 51118080
Router#
```

Best Practice to copy to Primary and Secondary

Upgrade Software

Upgrade POE Firmware (if necessary)

```
Router#show inline power detail

Firmware
Version
--------
02.1.0
```

Check Firmware Version for each Unit

```
Router#inline power install-firmware stack-unit 1 tftp 192.168.13.30 fcx_poeplus_02.1.0.fw
Router#Flash Memory Write (8192 bytes per dot)
.....................
 tftp download successful stackId = 1 file name = poe-fw
```

Perform for each unit in stack

See CLI output below

Upgrade Software

Reload Stack

- Reload after bootrom and images are copied to Flash

```
Router#reload
Are you sure? (enter 'y' or 'n'): y
Halt and reboot
Rebooting(0)...
```

Upgrade Software

Verify Running Software and Flash

```
Router#show ver
  Copyright (c) 1996-2013 Brocade Communications Systems, Inc.
    UNIT 1: compiled on Oct 16 2013 at 20:19:11 labeled as FCXR07300g1
                (6958108 bytes) from Primary FCXR07300g1.bin
         SW: Version 07.3.00g1T7f3
  Boot-Monitor Image size = 370555, Version:07.3.02T7f5 (grz07302)
  HW: Stackable ICX6610-24-HPOE

Router#show flash
Stack unit 1:
  Compressed Pri Code size = 6958108, Version:07.3.00gT7f3 (FCXR07300g1.bin)
  Compressed Sec Code size = 6958108, Version:07.3.00gT7f3 (FCXR07300g1.bin)
  Compressed Boot-Monitor Image size = 370555, Version:07.3.02T7f5
  Code Flash Free Space = 50855936
Stack unit 2:
  Compressed Pri Code size = 6958108, Version:07.3.00gT7f3 (FCXR07300g1.bin)
  Compressed Sec Code size = 6958108, Version:07.3.00gT7f3 (FCXR07300g1.bin)
  Compressed Boot-Monitor Image size = 370555, Version:07.3.02T7f5
  Code Flash Free Space = 50855936

Router#
```

Edge Port Configuration

ICX 6610 Edge Port POE Configuration

- POE Models do not enable inline power by default on ports
- Ports must be configured to provide inline power

```
hendrix(config)#interface e 1/1/1 to 1/1/24
hendrix(config-mif-1/1/1-1/1/24)#inline power
```

ICX 6610 Model	POE Class 3 Ports	POE+ Ports
6610-24P, Single PS	24	24
6610-24P, Dual PS	24 redundant	24 redundant
6610-48P, Single PS	48	25
6610-48P, Dual PS	48 redundant	48

ICX 7450 Edge Port POE Configuration

- POE Models do not enable inline power by default on ports
- Ports must be configured to provide inline power

```
hendrix(config)#interface e 1/1/1 to 1/1/24
hendrix(config-mif-1/1/1-1/1/24)#inline power
```

SKU	Power Supply Combination		Supported Class of PD				Redundancy
	PS1	PS2	Classic Class 4 PD (PoE+)	Class 3 PD	uPoE PD (60 W)	PoH PD (95 W)	
ICX7450 24P	748	-	24	24	8	7	No
	748	748	24	24	8	8	24 class 4 PD
	256	-	8	16	4	2	No
	256	256	17	24	8	5	8 Class 4 PDs
ICX7450 48P	748	-	24	48	8	7	No
	748	748	48	48	8	8	24 class 4 PD
	256	-	8	16	4	2	No
	256	256	17	33	8	5	8 Class 4 PDs

Edge Port POE Verification

```
hendrix#show inline power

Power Capacity:          Total is 748000 mWatts. Current Free is 748000 mWatts.

Power Allocations:       Requests Honored 25 times

 Port    Admin    Oper     ---Power(mWatts)---  PD Type   PD Class   Pri  Fault/
         State    State    Consumed  Allocated                          Error
-------------------------------------------------------------------------------
 1/1/1   On       Off             0          0  n/a       n/a          3  n/a
 1/1/2   On       On          11925      30000  802.3at   Class 4      3  n/a
 1/1/3   On       Off             0          0  n/a       n/a          3  n/a
 1/1/4   On       Off             0          0  n/a       n/a          3  n/a
 1/1/5   On       Off             0          0  n/a       n/a          3  n/a
 1/1/6   On       Off             0          0  n/a       n/a          3  n/a
```

Edge Port Loop Detection Config

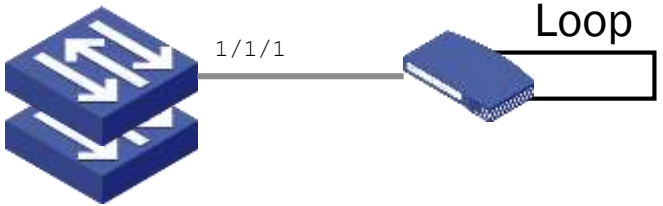
- Spanning tree provides a loop-free topology in a Layer 2 network between ports
- Loops can occur downstream on a single port with unknown network equipment connected to edge ports
- Strict Loop Detection detects loop on an individual port
- Port will be placed into ERR-DISABLED state with active loop

```
hendrix(config-if-e1000-1/1/1)#lo
hendrix(config-if-e1000-1/1/1)#loop-detection
hendrix(config-if-e1000-1/1/1)#exit

hendrix(config)#show run | incl errdisable
errdisable recovery cause all
errdisable recovery interval 30
```

Port will remove itself from ERR-DISABLE state after 30 seconds.
If loop detected again, port placed into ERR-DISABLE state.

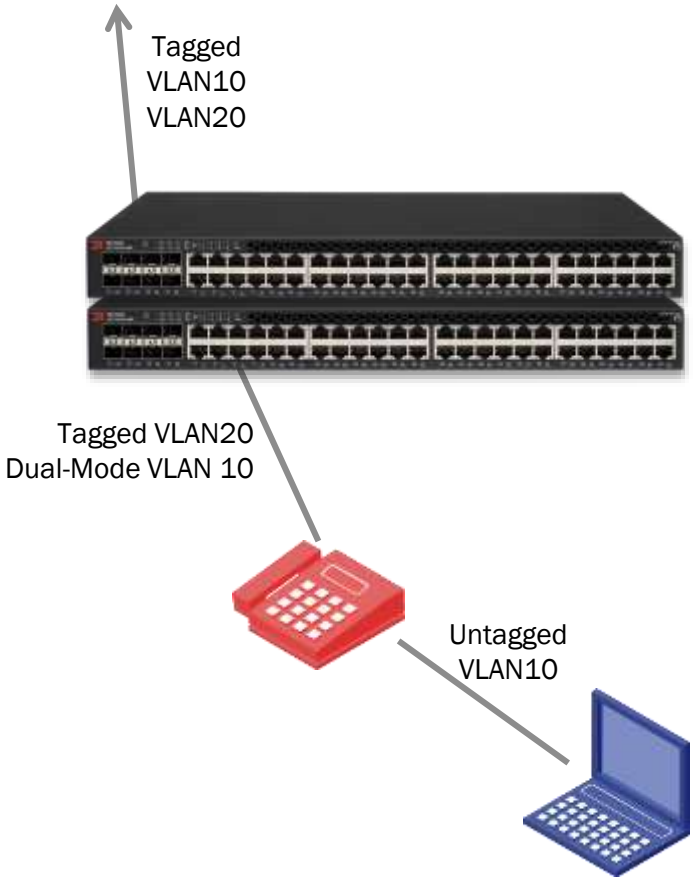
Edge Port Loop Detection Verification

```
hendrix#Loop-detection: port 1/1/1 (vlan=10), put into errdisable state
hendrix#show errdisable recovery
ErrDisable Reason                                                    Timer Status
-------------------------------------------------------------------------------
all reason                                                           Enabled
bpduguard                                                            Disabled
loopDetection                                                        Disabled
invalid license                                                      Disabled
Reload the switch or stack to enable this port in 10G speed          Disabled

Timeout Value: 30 seconds

Interface that will be enabled at the next timeout:

Interface         Errdisable reason   Time left (sec)

--------------    -----------------   ---------------
Port 1/1/1        loopDetection     27

hendrix#show errdisable sum
Port 1/1/1   ERR_DISABLED for loopDetection (vlan 10)
```



Dual Mode Ports

- Some ports need to accept Tagged and Untagged Traffic
- Common deployment scenario in VoIP and WLAN
- Dual Mode Port accepts tagged/untagged traffic
- Configure ‘Dual-Mode’ at port level
- Untagged traffic assigned to Dual-Mode VLAN configured on port



Dual Mode Ports

```
hendrix(config)#vlan 10 20
hendrix(config-mvlan-10*20)#tagged e 1/1/20 to 1/1/22 e 2/1/20 to 2/1/22
hendrix(config-mvlan-10*20)#
Added tagged port(s) ethe 1/1/20 to 1/1/22 ethe 2/1/20 to 2/1/22 to port-vlan 10.
Added tagged port(s) ethe 1/1/20 to 1/1/22 ethe 2/1/20 to 2/1/22 to port-vlan 20.

hendrix(config-mvlan-10*20)#exit
hendrix(config)#interface e 1/1/20 to 1/1/22
hendrix(config-mif-1/1/20-1/1/22)#dual-mode 10
hendrix(config-mif-1/1/20-1/1/22)#exit
hendrix(config)#interface e 2/1/20 to 2/1/22
hendrix(config-mif-2/1/20-2/1/22)#dual-mode 10
hendrix(config-mif-2/1/20-2/1/22)#
```

Port will accept Tagged Traffic Only for VLAN20

Port will accept Tagged and Untagged traffic for VLAN10

Dual Mode Ports

```
hendrix#show vlan
Total PORT-VLAN entries: 4
Maximum PORT-VLAN entries: 64

Legend: [Stk=Stack-Id, S=Slot]

PORT-VLAN 10, Name DATA, Priority level0, Spanning tree Off
 Untagged Ports: None
   Tagged Ports: (U1/M3)    1    2
   Uplink Ports: None
 DualMode Ports: (U1/M1)   20   21   22
 Mac-Vlan Ports: None
     Monitoring: Disabled

PORT-VLAN 20, Name VOICE, Priority level0, Spanning tree Off
 Untagged Ports: None
   Tagged Ports: (U1/M1)   20   21   22
   Tagged Ports: (U1/M3)    1    2
   Uplink Ports: None
 DualMode Ports: None
 Mac-Vlan Ports: None
     Monitoring: Disabled
```

QoS Configuration

Edge Ports Can Be Configured to Honor DSCP If Needed

- 6610 provides 8 queues per interface for scheduling and prioritization
- 802.1p bits automatically honored placing frames in the appropriate queues
- IP DSCP can be honored in deployments where 802.1p bits are not implemented OR at Routed Aggregation Points

```
hendrix(config)#interface ethernet 1/1/20
hendrix(config-if-e10000-1/1/20)#trust dscp
```

Uplink Configuration

ICX 6610 10G SFP Uplinks

- ICX6610-10G-LIC-POD upgrades 4 Ports on Module 3 to 10G
- Configure 10G speed duplex
- Ports 1G by default

```
hendrix#show license
Index      License Name              Lid          License Type    Status     License Period
Stack unit 1:
1          ICX6610-PREM-LIC-SW       dzoHKFIlFMg  Normal          Active     Unlimited
2          ICX6610-10G-LIC-POD       dzoHKFIlFMg  Normal          Active     Unlimited
3          ICX6610-ADV-LIC-SW        dzoHKFIlFMg  Normal          Active     Unlimited


hendrix(config)#interface e 1/3/1 to 1/3/4
hendrix(config-mif-1/3/1-1/3/4)#speed-duplex 10g-full
```

ICX 6610 1G SFP Uplinks

- By Default, Module 3 ports on 6610 enabled for 1G
- License required for 10G upgrade

```
hendrix#show int e 1/3/1
10GigabitEthernet1/3/1 is down, line protocol is down
  Hardware is 10GigabitEthernet, address is 748e.f8e8.7527 (bia 748e.f8e8.7527)
  Interface type is unknown
  Configured speed 1Gbit, actual unknown, configured duplex fdx, actual unknown
```

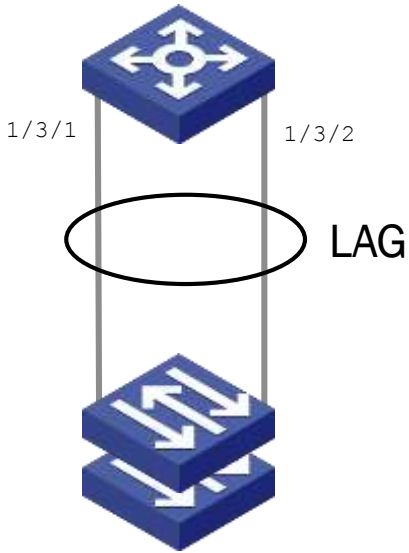
ICX 7450 10G SFP Uplinks

- ICX7450 1/10G Module can be copper or fiber
- Configure speed duplex

Link Aggregation Configuration

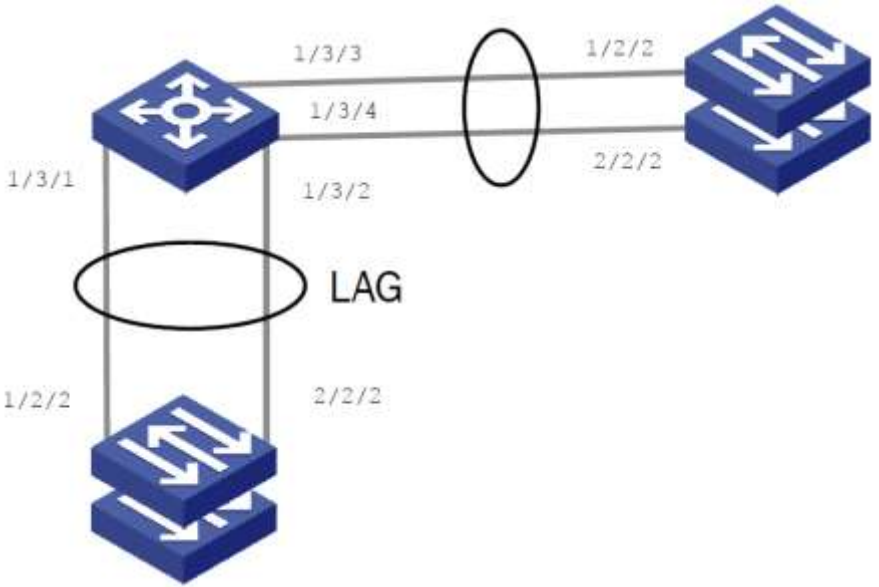
Dynamic Link Aggregation

- Link Aggregation provides resilient paths between two network elements
- Port links can be used to forward packets
- Spanning Tree does not block links in Link Agg Group
- LACP (protocol) provides dynamic formation and consistency check for LAG to form - RECOMMENDED



Dynamic Link Aggregation

- <= 8 Links can form a single LAG
- Configuration Key defines which LAG group a port belongs – Locally significant value only
- Active LAG configuration will initiate LACP protocol
- VLANs must be consistent between port members before LAG created
- Speed/Duplex must be consistent between member ports



Link Aggregation Configuration

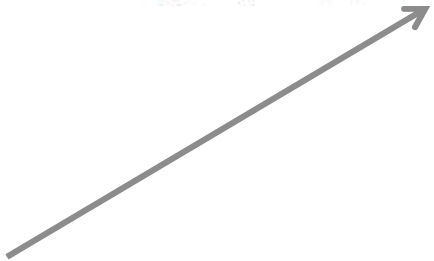
- Ensure Speed/Duplex consistency
- Ensure VLAN consistency
- Configure same Configuration Key on each Port in LAG
- Configure Active LACP on each port
- Any port configuration from this point will be done on 1st port in LAG group

```
hendrix#show vlan e 1/3/1
Total PORT-VLAN entries: 1
Maximum PORT-VLAN entries: 64

Legend: [Stk=Stack-Id, S=Slot]

hendrix#show vlan e 1/3/2
Total PORT-VLAN entries: 1
Maximum PORT-VLAN entries: 64

Legend: [Stk=Stack-Id, S=Slot]

hendrix#show interfaces brief | incl /3/
1/3/1   Up      Forward Full 1G    None  No  1     0
1/3/2   Up      Forward Full 1G    None  No  1     0
```

Link Aggregation Configuration

- Ensure Speed/Duplex consistency
- Ensure VLAN consistency
- Give LAG a Name
- Dynamic = LACP
- Any port configuration from this point will be done on 1st port in LAG group

```
zappa(config)#lag TO6450 dynamic
zappa(config-lag-TO6450)#ports e 1/3/1 e 2/3/1
zappa(config-lag-TO6450)#primary-port 1/3/1
zappa(config-lag-TO6450)#deploy
LAG TO6450 deployed successfully!

zappa(config)#vlan 50
zappa(config-vlan-50)#tagged e 1/3/1

Added tagged port(s) ethe 1/3/1 ethe 2/3/1 to port-vlan 50.
```



Link Aggregation Verification

```
zappa#show lag
Total number of LAGs:           1
Total number of deployed LAGs: 1
Total number of trunks created:1 (119 available)
LACP System Priority / ID:      1 / 748e.f8e8.750a
LACP Long timeout:              90, default: 90
LACP Short timeout:             3, default: 3
=== LAG "TO6450" ID 1 (dynamic Deployed) ===
LAG Configuration:
   Ports:          e 1/3/1 e 2/3/1
   Port Count:     2
   Primary Port:   1/3/1
   Trunk Type:     hash-based
   LACP Key:       20001
Deployment: HW Trunk ID 1
Port    Link    State   Dupl Speed Trunk Tag Pvid Pri MAC             Name
1/3/1   Up      Forward Full 1G    1     Yes N/A  0   748e.f8e8.752d
2/3/1   Up      Forward Full 1G    1     Yes N/A  0   748e.f8e8.752d

Port    [Sys P] [Port P] [ Key ] [Act][Tio][Agg][Syn][Col][Dis][Def][Exp][Ope]
1/3/1         1        1   20001   Yes   L   Agg  Syn  Col  Dis  No   No   Ope
2/3/1         1        1   20001   Yes   L   Agg  Syn  Col  Dis  No   No   Ope
```

Make Sure Link Aggregation is Operational for all Ports

VLAN Configuration

Change Default VLAN

- All Ports belong to single port-based VLAN called Default VLAN
- Initially, DEFAULT VLAN = 1
- DEFAULT VLAN provide Untagged Port Membership ONLY
- Recommended to change DEFAULT VLAN to another unused VLAN value

```
hendrix(config)#default-vlan-id 299
hendrix(config)#show vlan 299
Total PORT-VLAN entries: 4

Maximum PORT-VLAN entries: 64


Legend: [Stk=Stack-Id, S=Slot]

PORT-VLAN 299, Name DEFAULT-VLAN, Priority level0, Spanning tree Off
 Untagged Ports: (U1/M1)   2   3   4   5   6   7   8   9  10  11  12  13
 Untagged Ports: (U1/M1)  14  15  16  17  18  19  23  24
 Untagged Ports: (U1/M3)   3   4   5   6   7   8
   Tagged Ports: None
   Uplink Ports: None
 DualMode Ports: None
 Mac-Vlan Ports: None
     Monitoring: Disabled
```

Create VLANs

- By default, all ports belong to DEFAULT VLAN which was modified earlier
- Ports associated with newly created VLAN are removed from DEFAULT VLAN
- User friendly names can be configured with each VLAN
- VLAN 4087, 4090, 4093 and 4094 are reserved

```
hendrix(config)#vlan 10 name DATA
hendrix(config-vlan-10)#exit
hendrix(config)#vlan 20 name VOICE
hendrix(config-vlan-20)#exit
```

Assign Ports to VLANs

- Ports are assigned to VLAN
- Ports support Tagged and Untagged traffic
- Tagged traffic will carry 802.1q tag with data traffic
- Unknown tagged traffic will be dropped
- Ranges can be used for ports and VLANs to speed configuration

Ports to VLANs

```
hendrix(config)#vlan 10
hendrix(config-vlan-10)#untagged e 1/1/1 to 1/1/10
Added untagged port(s) ethe 1/1/1 to 1/1/10 to port-vlan 10.
hendrix(config-vlan-10)#exit

hendrix(config)#vlan 20
hendrix(config-vlan-20)#untagged e 1/1/11 to 1/1/13 e 2/1/1 to 2/1/10
Added untagged port(s) ethe 2/1/1 to 2/1/10 to port-vlan 20.
hendrix(config-vlan-20)#exit

hendrix(config)#vlan 10 20
hendrix(config-mvlan-10*20)#tagged e 1/3/1 e 1/3/4
hendrix(config-mvlan-10*20)#Added tagged port(s) ethe 1/3/1 ethe 1/3/4 to port-vlan 10.
Added tagged port(s) ethe 1//3/1 ethe 1/3/4 to port-vlan 20.
```

Ranges can be used to speed configuration

Verify VLANs

```
hendrix#show vlan
Total PORT-VLAN entries: 3
Maximum PORT-VLAN entries: 64

Legend: [Stk=Stack-Id, S=Slot]

PORT-VLAN 10, Name DATA, Priority level0, Spanning tree Off
 Untagged Ports: None
   Tagged Ports: (U1/M3)    1    2
   Uplink Ports: None
 DualMode Ports: None
 Mac-Vlan Ports: None
     Monitoring: Disabled
PORT-VLAN 20, Name VOICE, Priority level0, Spanning tree Off
 Untagged Ports: None
   Tagged Ports: (U1/M3)    1    2
   Uplink Ports: None
 DualMode Ports: None
 Mac-Vlan Ports: None
     Monitoring: Disabled
```

DEFAULT VLAN NOT SHOWN FOR BREVITY

Specifying Management VLAN

- A single VLAN can be configured to accept management traffic
- Other VLANs will drop management traffic
- Reduces scope of management engagement from security perspective

```
hendrix(config)#vlan 99 name Management
hendrix(config-vlan-99)#tagged e 1/2/2 e 2/2/2
Added tagged port(s) ethe 1/2/2 ethe 2/2/2 to
port-vlan 99.
hendrix(config-vlan-99)#management-vlan
hendrix(config-vlan-99)#
```

Spanning Tree Configuration

Enable Spanning Tree

Per VLAN Rapid Spanning Tree

- Best practice to enable spanning tree to prevent loops in network
- MDF locations need to be Root through priority assignment (lower number wins Root election)
- IDF locations typically do not require priority assignment if there is only a 2 layer network
- Spanning-tree is disabled by default on the Layer 3 (Routing) image.

```
hendrix(config)#vlan 10 20 99
hendrix(config-mvlan-10*99)#span 8
 Enable Rapid Spanning Tree IEEE 802.1w
hendrix(config-mvlan-10*99)#span 802-1w
hendrix(config-mvlan-10*99)#span 802-1w priority 1024
```

Spanning Tree Configuration

MDF Configuration

```
vlan 10 name DATA by port
 tagged ethe 1/1/20 to 1/1/22 ethe 1/2/2 ethe 2/1/20 to 2/1/22 ethe 2/2/2
 untagged ethe 1/1/1 to 1/1/10
 spanning-tree 802-1w
 spanning-tree 802-1w priority 1024
vlan 20 name VOICE by port
 tagged ethe 1/1/20 to 1/1/22 ethe 1/2/2 ethe 2/1/20 to 2/1/22 ethe 2/2/2
 untagged ethe 1/1/11 to 1/1/13 ethe 2/1/1 to 2/1/10
 spanning-tree 802-1w
 spanning-tree 802-1w priority 1024
vlan 99 name Management by port
 tagged ethe 1/2/2 ethe 2/2/2
 spanning-tree 802-1w
 spanning-tree 802-1w priority 1024
 management-vlan
 default-gateway  192.168.13.1 1

interface ethernet 1/2/2
 spanning-tree 802-1w admin-pt2pt-mac
interface ethernet 2/2/2
 spanning-tree 802-1w admin-pt2pt-mac
```

Spanning Tree Configuration

IDF Configuration

```
vlan 10 name DATA by port
 tagged ethe 1/1/20 to 1/1/22 ethe 1/2/2 ethe 2/1/20 to 2/1/22 ethe 2/2/2
 untagged ethe 1/1/1 to 1/1/10
 spanning-tree 802-1w
vlan 20 name VOICE by port
 tagged ethe 1/1/20 to 1/1/22 ethe 1/2/2 ethe 2/1/20 to 2/1/22 ethe 2/2/2
 untagged ethe 1/1/11 to 1/1/13 ethe 2/1/1 to 2/1/10
 spanning-tree 802-1w
vlan 99 name Management by port
 tagged ethe 1/2/2 ethe 2/2/2
 spanning-tree 802-1w
 management-vlan
 default-gateway  192.168.13.1 1

interface ethernet 1/1/1
 spanning-tree 802-1w admin-edge-port
 stp-bpdu-guard
interface ethernet 1/2/2
 spanning-tree 802-1w admin-pt2pt-mac
interface ethernet 2/2/2
 spanning-tree 802-1w admin-pt2pt-mac
```

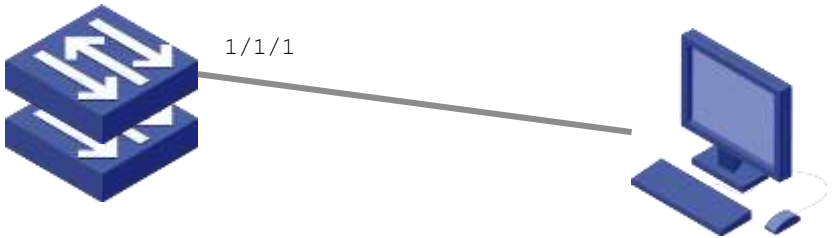
Enable Spanning Tree

Spanning Tree Edge Port Parameter

- Edge Ports end devices
- Edge Ports transition directly to forwarding state
- No topology change notification generated for edge port transition
- Receiving a BPDU will change edge port to non-edge port
- Recommend BPDU Guard to prevent unexpected Spanning Tree Participation

```
hendrix(config)#interface ethernet 1/1/1
hendrix(config-if-e1000-1/1/1)#span 8 admin-edge-port
hendrix(config-if-e1000-1/1/1)#stp-bpdu-guard

hendrix#show run interface e 1/1/1

interface ethernet 1/1/1
 spanning-tree 802-1w admin-edge-port
 stp-bpdu-guard
```

IF PORT RECEIVES BPDU, TRANSITIONS TO ERR-DISABLE

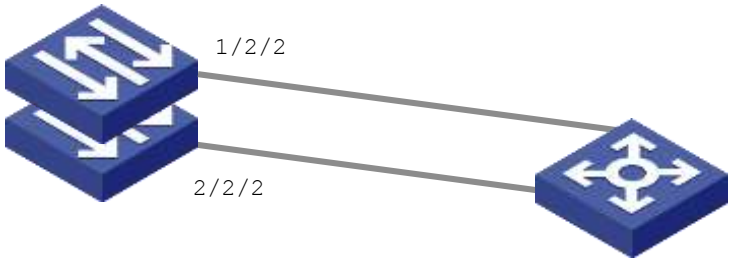


Enable Spanning Tree

Spanning Tree Uplink Port Parameter

- RSTP takes advantage of Point-to-Point links between network elements
- Point-to-Point configuration speeds convergence
- Switch negotiates rapid transition to other port in loop-free manner

```
hendrix(config)#interface e 1/2/2
hendrix(config-if-e10000-1/2/2)#span 8 admin-pt2pt-mac
hendrix(config-if-e10000-1/2/2)#exit
hendrix(config)#interface e 2/2/2
hendrix(config-if-e10000-2/2/2)#span 8 admin-pt2pt-mac
```



Spanning Tree Verification

Make Sure Root and Root Port Correctly Chosen

```
hendrix#show 8 vlan 10
--- VLAN 10 [ STP Instance owned by VLAN 10 ] ----------------------------
Bridge IEEE 802.1W Parameters:

Bridge           Bridge Bridge Bridge Force    tx
Identifier       MaxAge Hello  FwdDly Version  Hold
hex              sec    sec    sec             cnt
8000748ef883d560 20     2      15     Default  3

RootBridge       RootPath  DesignatedBri-   Root   Max Fwd Hel
Identifier       Cost      dge Identifier   Port   Age Dly lo
hex                        hex              sec sec sec sec
0400748ef8e8750a 20000     0400748ef8e8750a 1/2/2  20  15  2

Port IEEE 802.1W Parameters:

        <--- Config Params --><-------------- Current state ----------------->
Port    Pri PortPath P2P Edge Role       State       Designa-  Designated
Num         Cost     Mac Port                       ted cost  bridge
1/1/1   128 200000   F   F    DESIGNATED FORWARDING  20000     8000748ef883d560
1/2/2   128 20000    F   F    ROOT       FORWARDING  0         0400748ef8e8750a
2/2/2   128 20000    F   F    ALTERNATE  DISCARDING  0         0400748ef8e8750a
```

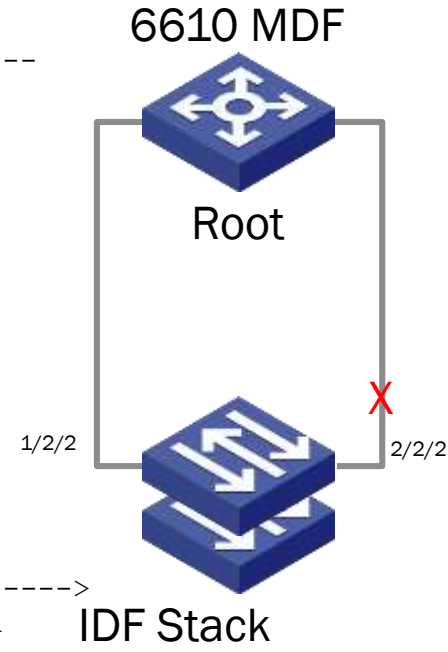
Priority 8000 Hex 32768 Dec

Priority 0400 Hex 1024 Dec

EdgePort FWD

Uplink ROOT

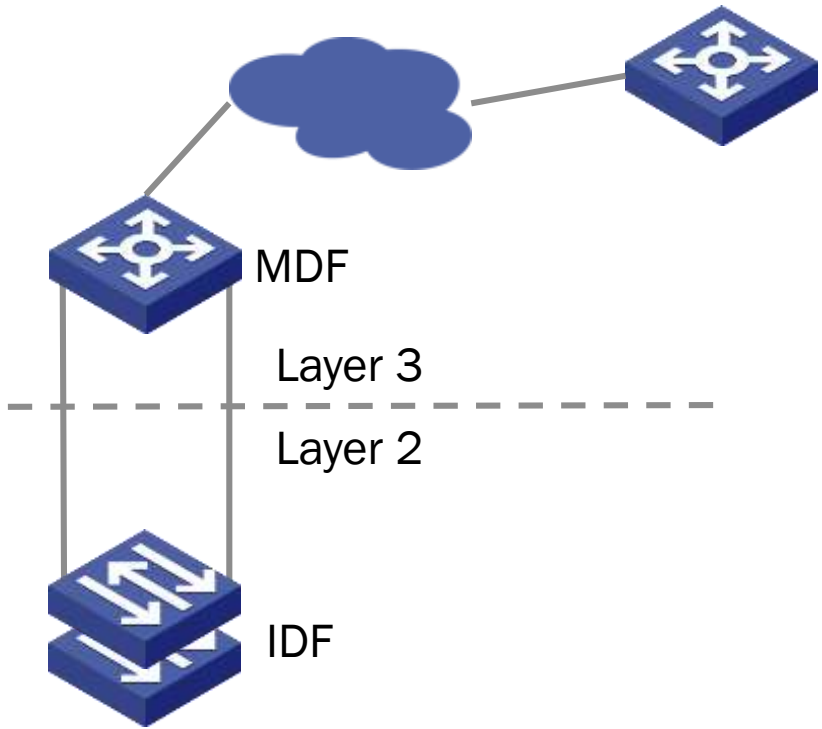
Uplink BLK



Layer 3 Unicast Functions

MDF Routing

- Provides routing function in typical deployment
- Provides default gateway functionality for subnets
- Provides inter-vlan and disparate routing functions (static or dynamic)
- IP enabled by default



ICX 6610 Routing Options

- Base Routing Option (Direct/Static)
  - Included with ICX6610-xx-E
  - Included with ICX6610-xx-PI
- Premium Routing (RIP/OSPF/VRRP/PIM/PBR)
  - Included with ICX6610-xx-PE
  - Included with ICX6610-xx-PI
  - Base to Premium Upgrade
    - ICX6610-PREM-LIC
- Advanced Routing (BGP/VRF)
  - Base to Advanced Upgrade
    - ICX6610-ADV-LIC
  - Premium to Advanced Upgrade
    - ICX6610-ADV-UPG-LIC

ICX 7450 Routing Options

Base Layer 3 IP routing	• IPv4 and IPv6 static routes • ECMP • Port-based Access Control Lists • L3/L4 ACLs • Host routes • Virtual Interfaces • Routed Interfaces • Route-only Support • Routing Between Directly Connected Subnets
Premium Layer 3 IP routing (with software license)	• IPv4 and IPv6 dynamic routes • RIP v1/v2, RIPng (IPv6) • OSPF v2, OSPF v3 (IPv6) • PIM-SM, PIM-SSM, PIM-DM, PIM passive (IPv4/IPv6 multicast routing functionality) • PBR • Virtual Route Redundancy Protocol (VRRP) • VRRP-E, VRRP-E (IPv6) • VRRPv3 (IPv6) • BGP4, BGP4+(IPv6) • GRE • IPv6 over IPv4 tunnels • VRF (IPv4 and IPv6)

Layer 3 Software

- Best Practice to copy image to Primary and Secondary
- Router Image (FCXR0xxxxx.bin)
  - Performs Base Layer 3 functions
  - Performs Dynamic Layer 3 functions with License
  - IP address assign per VE and IP routes configured/learned

Layer 3 Interfaces

- Supported L3 Interfaces
  - Ethernet
  - Virtual Routing Interface (VE)
  - Loopback
- VE typical deployment choice
- Loopback IP address recommended best practice

Layer 3 Ethernet Interface

- Ethernet interfaces can be configured as routing interface
- Routed interface does not participate in L2 functions as SPT
- Physical L3 Interfaces share same MAC address
- Not recommended to connect two or more physical IP interfaces between two routers

```
hendrix(config-if-e1000-1/1/7)#route-only
hendrix(config-if-e1000-1/1/7)#ip address 172.17.1.1/24

hendrix#show ip interface e 1/1/7
Interface Ethernet 1/1/7
  port enabled
  port state: DOWN
  ip address: 172.17.1.1    subnet mask: 255.255.255.0
  encapsulation: ETHERNET, mtu: 1500, metric: 1
  directed-broadcast-forwarding: disabled
  proxy-arp: disabled
  ip arp-age:  10 minutes
  No Helper Addresses are configured.
  No inbound ip access-list is set
  No outgoing ip access-list is set
```

Layer 3 Virtual Routing Interface

- Virtual Routing Inteface = VE
- Virtual L3 Interface associated with a VLAN
- VE interfaces can route traffic between VLANs
- Best to match VLAN and VE number
- IP protocol parameters can be configured on VE interfaces

```
hendrix(config)#vlan 20
hendrix(config-vlan-20)#router-interface ve 20
hendrix(config-vlan-20)#exit

hendrix(config)#interface ve 20
hendrix(config-vif-20)#ip address 10.0.2.1/24

hendrix(config-vif-20)#show int ve 20
ve20 is up, line protocol is up
  Hardware is Virtual Ethernet, address is 748e.f8e8.750a
(bia 748e.f8e8.750a)
  No port name
  Internet address is 10.0.2.1/24, IP MTU 1500 bytes,
encapsulation ethernet
```

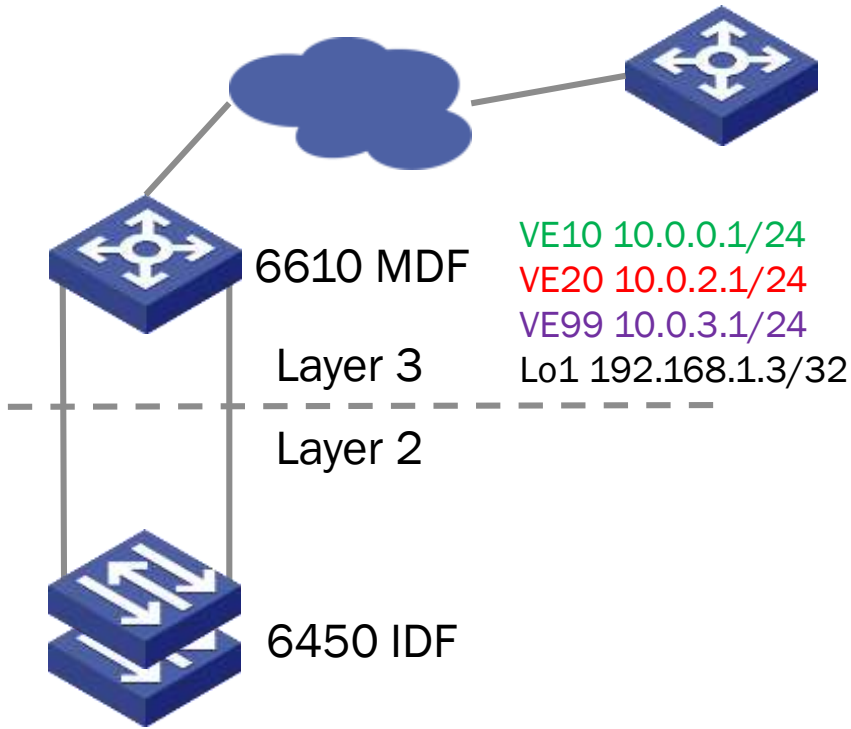
Layer 3 Loopback Interface

- Loopback interfaces are always up, regardless of the states of physical interfaces
- Adds stability to network not subject to route flaps
- Typically a host IP address
- Chosen as router-id by many routing protocols

```
hendrix(config)#int loopback 1
hendrix(config-lbif-1)#ip add 192.168.1.3/32

hendrix#show ip int loopback 1
Interface Loopback 1
  port enabled
  port state: UP
  ip address: 192.168.1.3  subnet mask: 255.255.255.255
  encapsulation: ETHERNET, mtu: 1500, metric: 1
  directed-broadcast-forwarding: disabled
  proxy-arp: disabled
  ip arp-age:  10 minutes
  No Helper Addresses are configured.
  No inbound ip access-list is set
  No outgoing ip access-list is set
```

VE IP Addressing

```
interface ve 10
 ip address 10.0.0.1 255.255.255.0
!
interface ve 20
 ip address 10.0.2.1 255.255.255.0
!
interface ve 99
 ip address 10.0.3.1 255.255.255.0
!
interface loopback 1
 ip address 192.168.1.3 255.255.255.255
```



Inter-VLAN Routing

- Will route between VE interface without configuration
- VE subnets called Connected Subnets
- Identified with ‘D’ in routing table

```
hendrix#show ip route
Total number of IP routes: 5, avail: 11995 (out of max 12000)
B:BGP D:Connected  R:RIP  S:Static  O:OSPF *:Candidate default
        Destination     NetMask         Gateway         Port       Cost    Type
1       10.0.0.0        255.255.255.0   0.0.0.0         v10        1       D
2       10.0.2.0        255.255.255.0   0.0.0.0         v20        1       D
3       10.0.3.0        255.255.255.0   0.0.0.0         v99        1       D
4       172.16.16.0     255.255.255.0   0.0.0.0         v2         1       D
5       192.168.1.3     255.255.255.255 0.0.0.0         lb1        1       D
```

Static Routing

- Static routes can be configured
- Mask can be dotted decimal or /n notation
- Identified with ‘S’ in routing table
- Cannot specify null0 or another interface as the next hop in the base Layer 3 image

```
hendrix(config)#ip route 209.157.2.0 255.255.255.0 172.16.16.1
hendrix(config)#ip route 209.157.2.0/24 172.16.16.1

hendrix#show ip route static
Start index: 1  B:BGP D:Connected  R:RIP  S:Static  O:OSPF *:Candidate default
        Destination     NetMask         Gateway         Port        Cost    Type
        209.157.2.0     255.255.255.0   172.16.16.1     v2          1
```

Static Default Route

- Static default route can be configured
- Mask can be dotted decimal or /n notation
- Identified with ‘S’ in routing table
- Cannot specify null0 or another interface as the next hop in the base Layer 3 image

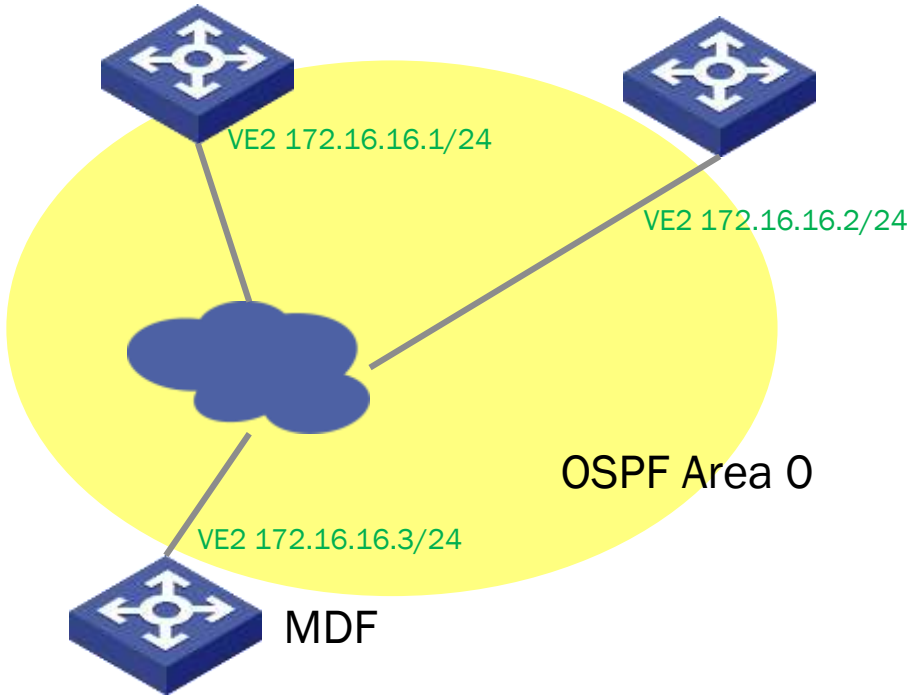
```
hendrix(config)#ip route 0.0.0.0 0.0.0.0 172.16.16.1
hendrix(config)#ip route 0.0.0.0/0 172.16.16.1

hendrix(config)#show ip route static
Start index: 1  B:BGP D:Connected  R:RIP  S:Static  O:OSPF *:Candidate default
        Destination        Gateway         Port       Cost   Type
        209.157.2.0/24     172.16.16.1     v2         1
        0.0.0.0/0          172.16.16.1     v2         1
```

OSPF Routing

- Link state protocol used in modern network
- Dynamically creates link state database on each router
- IP routes derived from LSDB and inserted into routing table
- Discussion on Areas / Area Type / LSA Type / etc beyond scope of document
- Single Backbone Area assumed for Wide Area deployment

OSPF Routing

- Single Backbone Area in WAN
- Dedicated VLAN/Subnet for WAN
- Tagged/Untagged depending on WAN service
- OSPF enabled on WAN VE and Loopback
- Router-id configured as Lo1

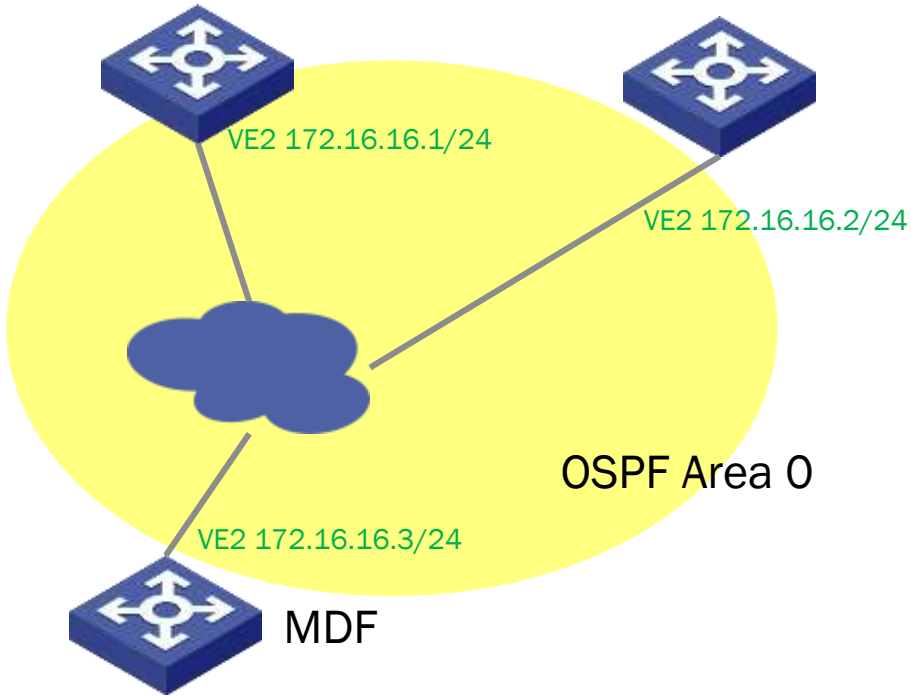


OSPF Routing

Loopback / Router ID / VE

- Configure Loopback 1
- Configure Router ID

```
hendrix(config)#interface loopback 1
hendrix(config-lbif-1)#ip address 192.168.1.3/32
hendrix(config-lbif-1)#exit

hendrix(config)#ip router-id 192.168.1.3
hendrix(config)#

hendrix(config)#vlan 2
hendrix(config-vlan-2)#untagged e 1/1/1
hendrix(config-vlan-2)#router-interface ve 2
hendrix(config-vlan-2)#exit
hendrix(config)#interface ve 2
hendrix(config-vif-2)#ip address 172.16.16.3/24
hendrix(config-vif-2)#
```

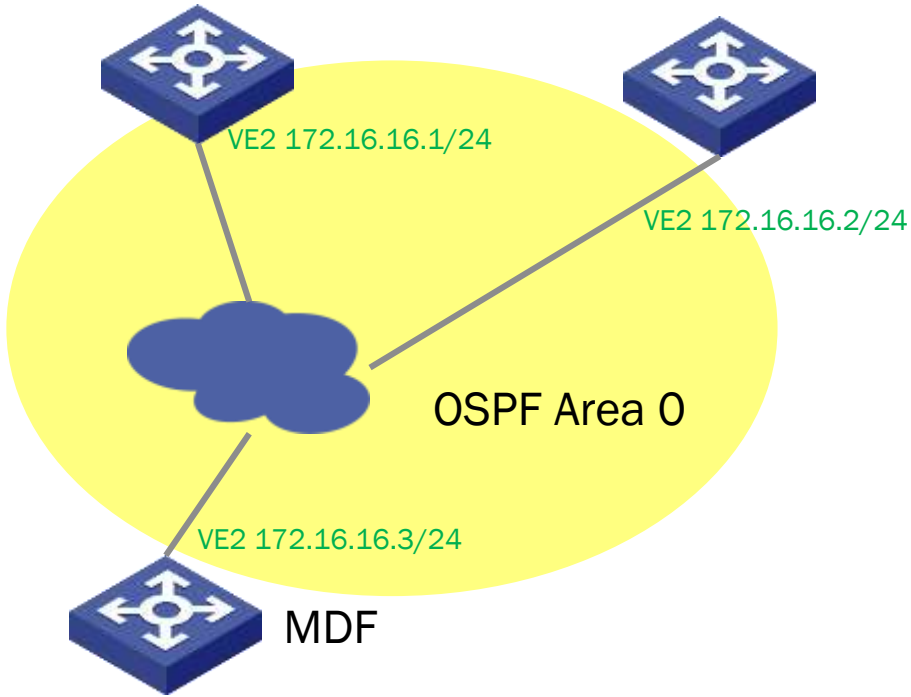


OSPF Routing

OSPF and Area Configuration

- Enable OSPF
- Configure Area 0

```
hendrix(config)#router ospf
hendrix(config-ospf-router)#area 0

hendrix#show ip ospf
OSPF Version                    Version 2
Router Id                       192.168.1.3
ASBR Status                     No
Redistribute Ext Routes from
External LSA Counter            0
External LSA Checksum Sum       0
Originate New LSA Counter       0
Rx New LSA Counter              0
External LSA Limit              14447047
Database Overflow Interval      0
Database Overflow State :       NOT OVERFLOWED
RFC 1583 Compatibility :        Enabled
Graceful Restart :              Enabled
```

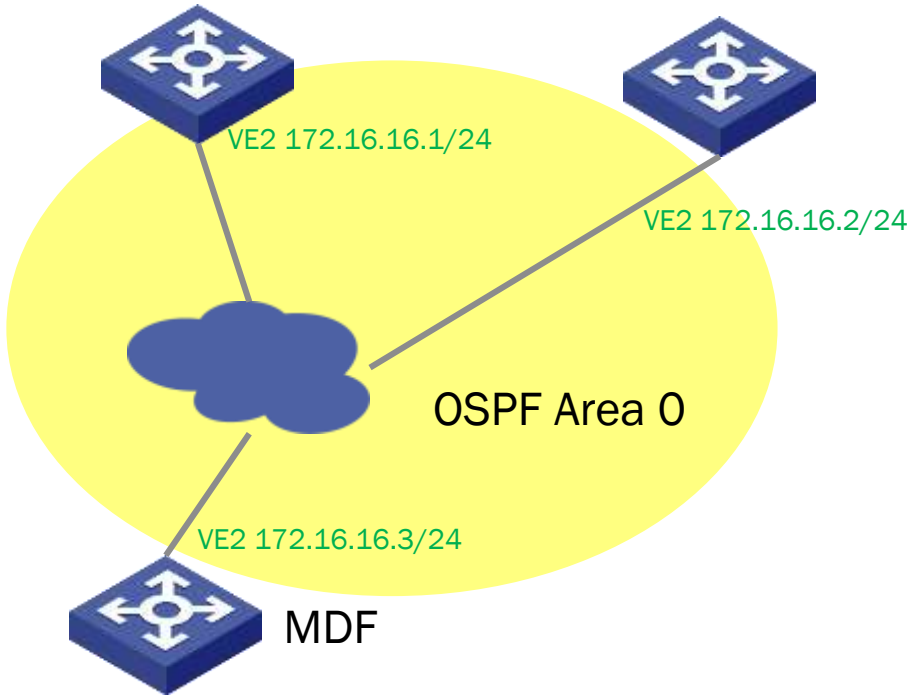


OSPF Routing

Activate OSPF Per Interface / Set DR Priority

- Activate OSPF per interface
- Set Lo1 OSPF Passive
- Set DR Priority 0 for Remote sites

```
hendrix(config)#interface ve 2
hendrix(config-vif-2)#ip ospf area 0
hendrix(config-vif-2)#ip ospf priority 0
hendrix(config-vif-2)#exit
hendrix(config)#interface loopback 1
hendrix(config-lbif-1)#ip ospf area 0
hendrix(config-lbif-1)#ip ospf pass
hendrix(config-lbif-1)#end
hendrix#show ip ospf interface

v2,OSPF enabled
     IP Address 172.16.16.3, Area 0

lb1,OSPF enabled
     IP Address 192.168.1.3, Area 0
     OSPF state Passive
```



OSPF Routing

Validate OSPF Adjacency

- After configuration, verify adjacency

```
hendrix#show ip ospf neighbor

Port            Address          Pri State      Neigh Address    Neigh ID         Ev
v2              172.16.16.3      250 FULL/DR    172.16.16.1      192.168.1.1      6
```

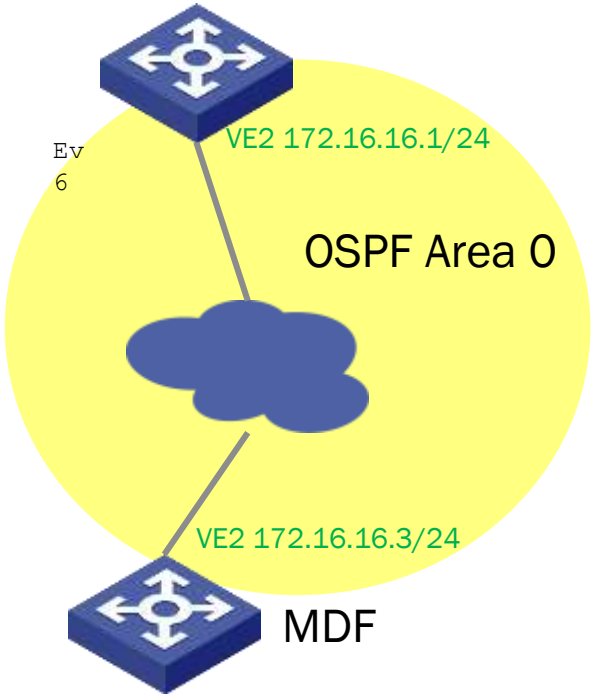
Adj Interface

Local Router Address

Neighbor State Full & Neighbor Elected as DR for Broadcast Network

Neighbor Interface Address

Neighbor RouterID

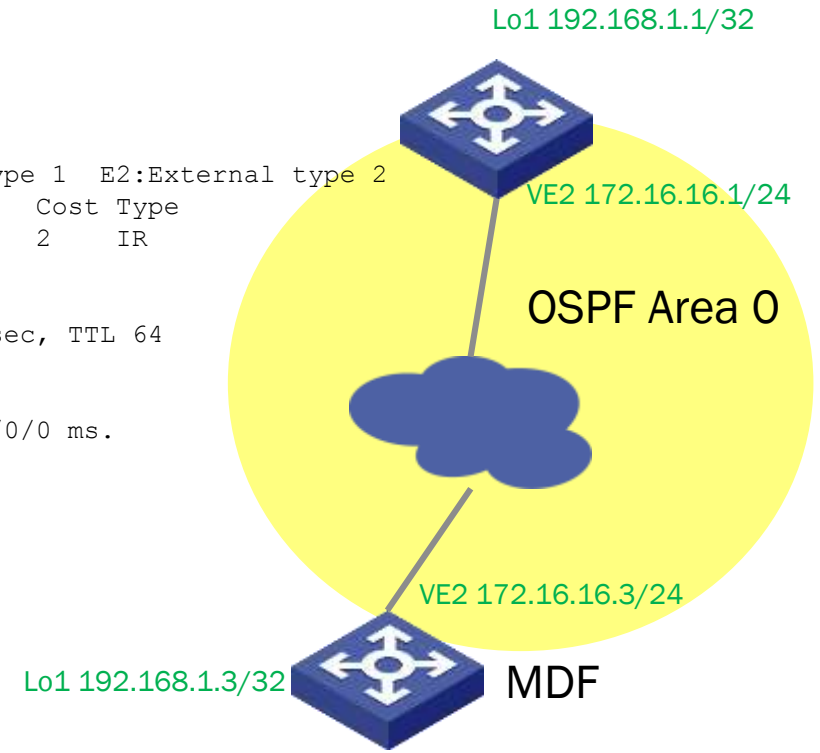


OSPF Routing

Validate Routing Table

- After configuration, verify OSPF routes

```
hendrix#show ip route ospf
Start index: 1  IA:Inter area  IR:Intra area  E1:External type 1  E2:External type 2
Destination        Gateway         RouterID        Port       Cost Type
192.168.1.1/32     172.16.16.1     192.168.1.1     v2         2    IR

hendrix#ping 192.168.1.1 source 192.168.1.3
Sending 1, 16-byte ICMP Echo to 192.168.1.1, timeout 5000 msec, TTL 64
Type Control-c to abort
Reply from 192.168.1.1      : bytes=16 time<1ms TTL=64
Success rate is 100 percent (1/1), round-trip min/avg/max=0/0/0 ms.
```

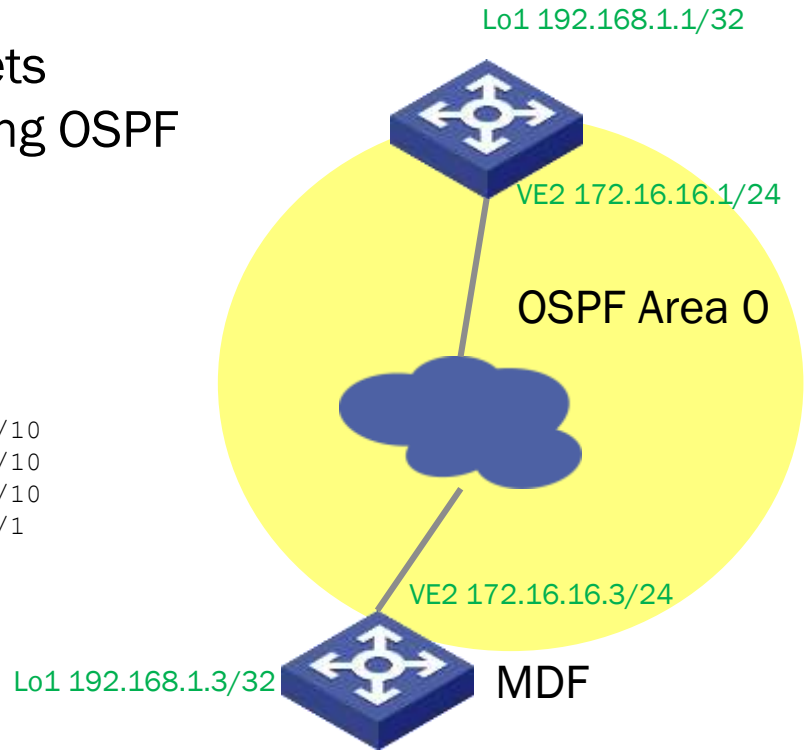


OSPF Routing

OSPF Route Advertisement

- 6610 MDF must advertise multiple subnets
- Subnets typically do not warrant processing OSPF
- Redistribute connected subnets

```
hendrix(config)#router ospf
hendrix(config-ospf-router)#redistribution connected

central#show ip route ospf
Destination        Gateway          Port          Cost
1       10.0.0.0/24        172.16.16.3     ve 2          110/10
2       10.0.2.0/24        172.16.16.3     ve 2          110/10
3       10.0.3.0/24        172.16.16.3     ve 2          110/10
4       192.168.1.3/32     172.16.16.3     ve 2          110/1
```

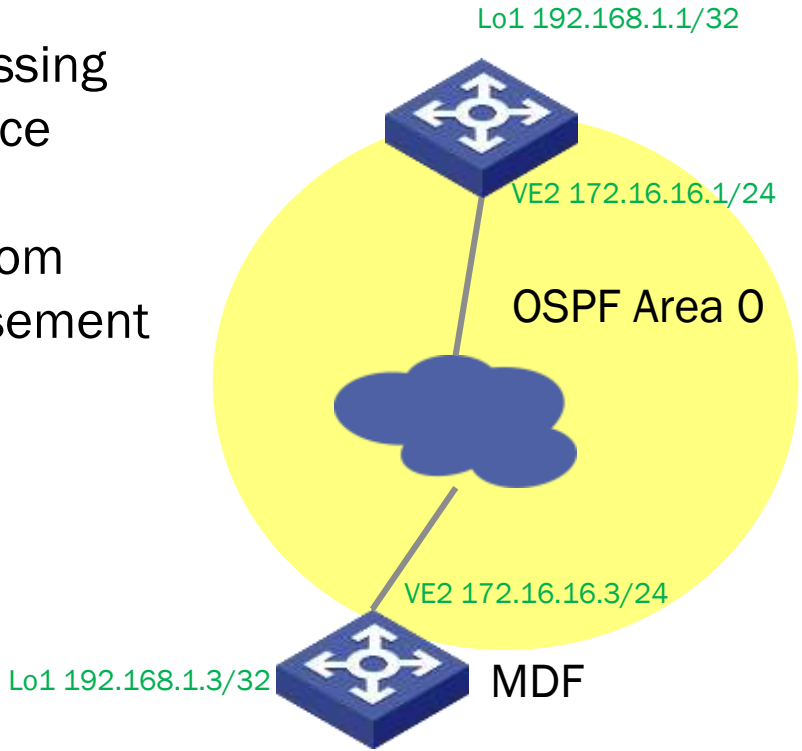


OSPF Routing

OSPF Route Summary

- 6610 MDF can advertise summary addressing
- Well planned subnet addressing can reduce route table size dramatically
- Example below summarizes all subnets from 10.0.0.0-10.0.31.254 with single advertisement

```
hendrix(config)#router ospf
hendrix(config-ospf-router)#summary-address 10.0.0.0/19

central#show ip route ospf
        Destination         Gateway          Port
1       10.0.0.0/19         172.16.16.3      ve 2
2       192.168.1.3/32      172.16.16.3      ve 2
```

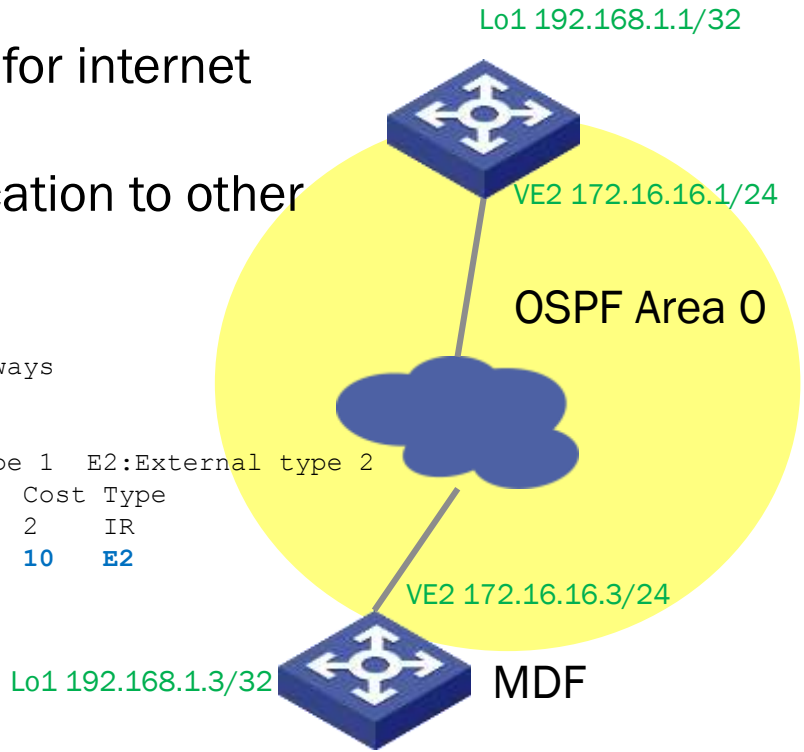


OSPF Routing

OSPF Default Route

- Most networks will utilize central location for internet access
- Default route can be sent from central location to other locations

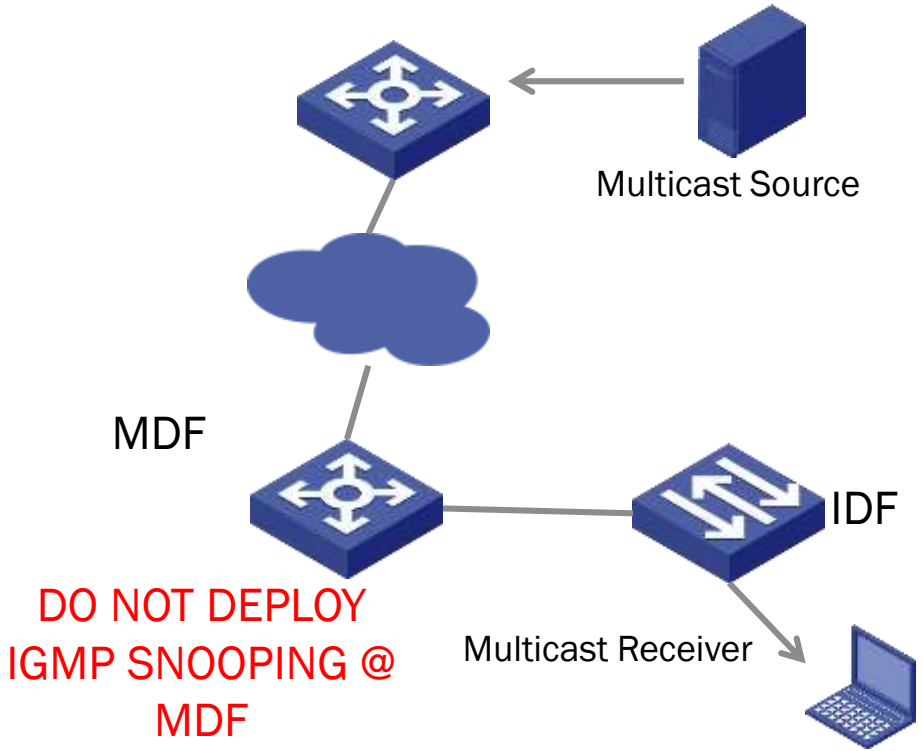
```
central(config)#router ospf
central(config-ospf-router)#default-information-originate always

hendrix#show ip route ospf
Start index: 1  IA:Inter area  IR:Intra area  E1:External type 1  E2:External type 2
Destination        Gateway         RouterID        Port       Cost Type
192.168.1.1/32     172.16.16.1     192.168.1.1     v2         2    IR
0.0.0.0/0          172.16.16.1     192.168.1.1     v2         10   E2
```



Layer 3 Multicast Functions

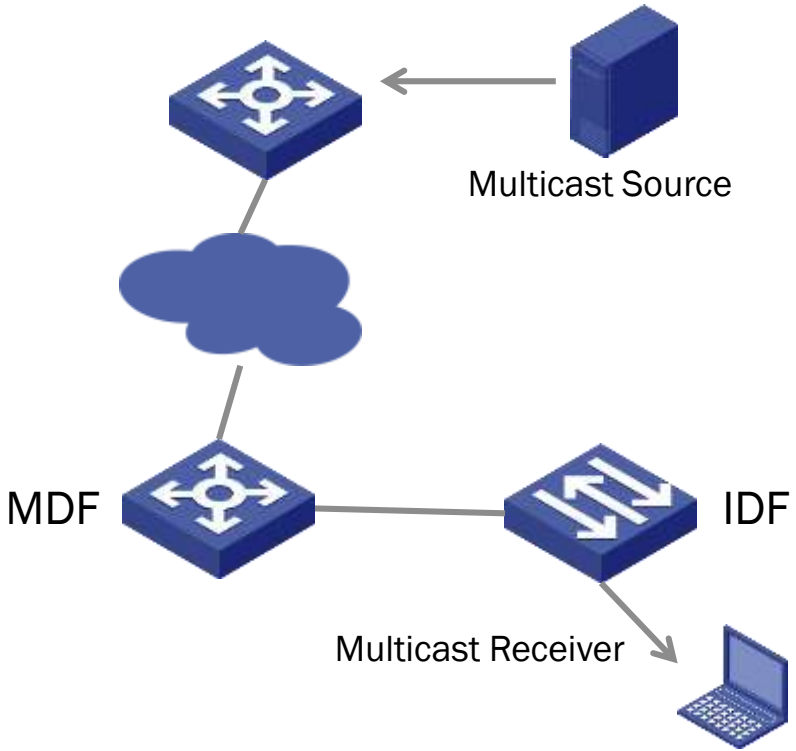
Multicast Routing

- MDF needs to support Multicast routing between subnets
- Local/Remote Multicast depends on implementation
- IDF support IGMP snooping with ‘ip multicast passive’
- MDF IGMP querier function enabled by activating multicast routing on VE interface
- PIM-DM or PIM-SM can be deployed



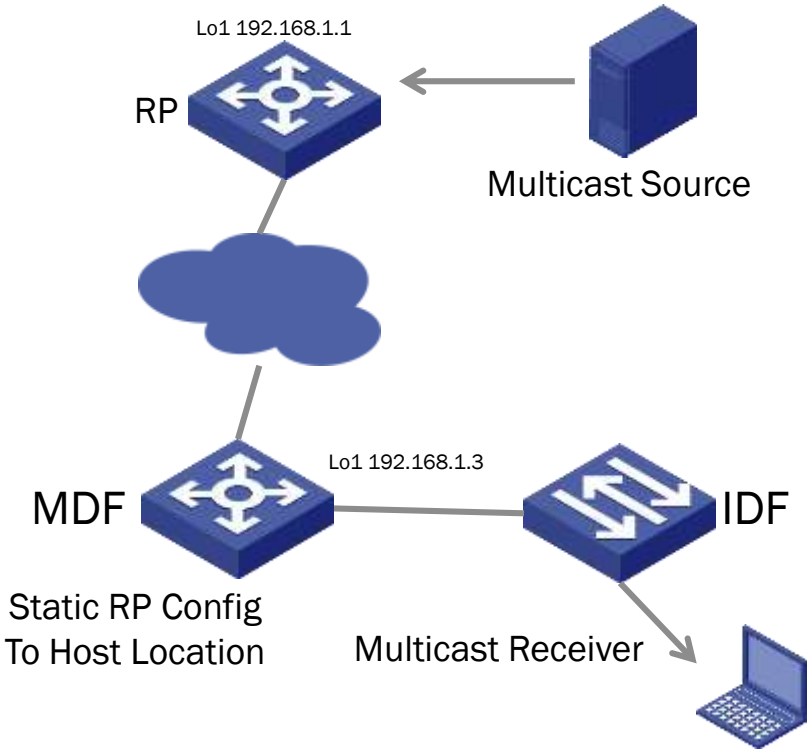
Multicast Routing

- MDF receives IGMP ‘join’ messages from receiver
- MDF requests multicast stream across metro via PIM
- Following configuration example will deploy PIM-SM multicast routing
- Other deployment scenarios beyond scope of presentation



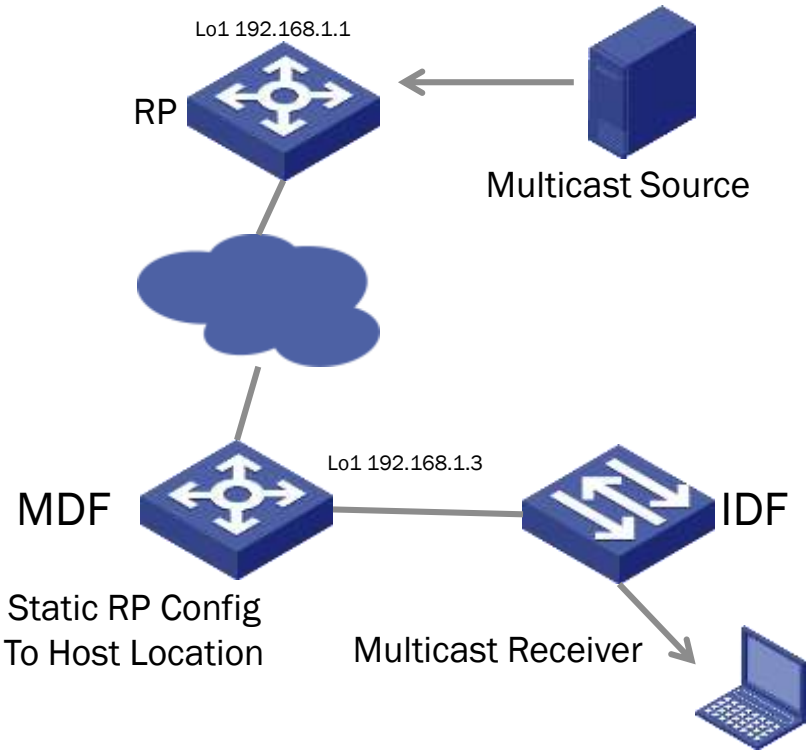
PIM-SM Static Rendezvous Point

- Configure central router as RP
- MDF configure Central Router as Static RP
- Use Loopback addresses for stability
- PIM-SM enabled on all L3 interfaces (Enables IGMP querier function)



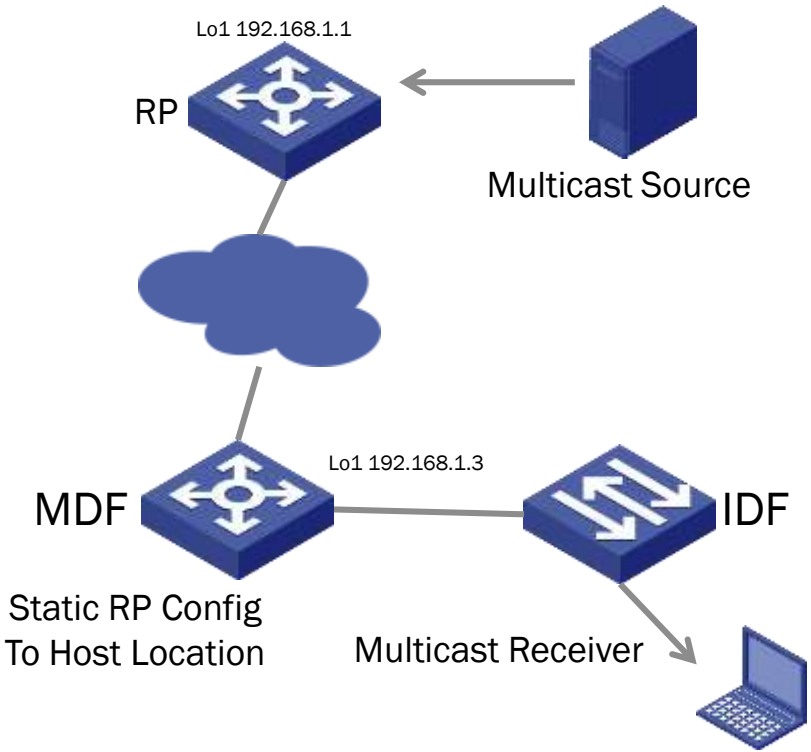
PIM-SM Static Rendezvous Point Configuration

```
interface loopback 1
 ip address 192.168.1.3/32
 ip pim-sparse
 ip ospf area 0
 ip ospf passive

interface ve 2
 ip address 172.16.16.3/24
 ip pim-sparse
 ip ospf area 0
 ip ospf priority 0
!
interface ve 10
 ip address 10.0.0.1/24
 ip pim-sparse
 ip helper-address 1 10.100.100.5
!
interface ve 20
 ip address 10.0.2.1/24
 ip pim-sparse
!

router pim
 rp-address 192.168.1.1 0
```



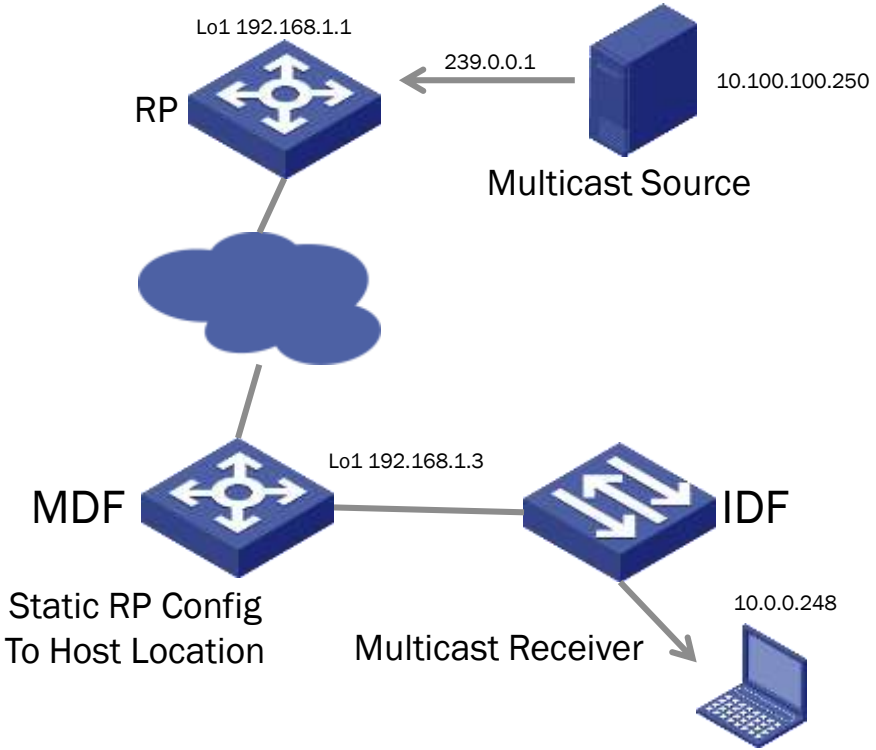
PIM-SM Static Rendezvous Verification

```
hendrix#show ip pim int
  interface      PIM interface
hendrix#show ip pim interface
Interface v2
PIM Sparse
TTL Threshold: 1, Enabled, DR: itself
Local Address: 172.16.16.3
Neighbor:
  172.16.16.1

Interface v10
PIM Sparse
TTL Threshold: 1, Enabled, DR: itself
Local Address: 10.0.0.1

Interface v20
PIM Sparse
TTL Threshold: 1, Enabled, DR: itself
Local Address: 10.0.2.1

Interface l1
PIM Sparse
TTL Threshold: 1, Enabled, DR: itself
Local Address: 192.168.1.3

hendrix#show ip pim neigh
Total number of neighbors: 1 on 1 ports
Port    Phy_p      Neighbor        Holdtime Age    UpTime  GenID
v2      1/1/1      172.16.16.1     105      0      2820    0x00005F35
```



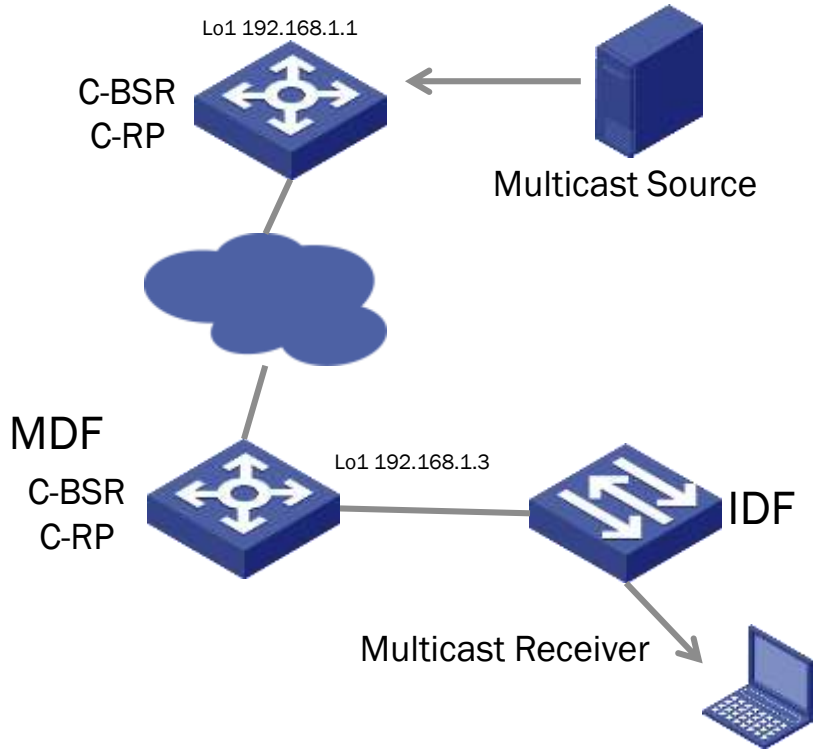
PIM-SM Static Rendezvous Verification

```
hendrix#show ip pim rp-set
Group address        Static-RP-address  Override
-------------------------------------------------
224.0.0.0/4          192.168.1.1               Off

BSR state=ACCEPT-ANY, # of group prefixes Learnt from BSR: 0
No RP-Set present.
hendrix#show ip pim mcache
Total 2 entries


1     (10.100.100.250 239.0.0.1) in v2 (1/1/1), cnt=4
      upstream neighbor=172.16.16.1 on v2 using ip route
      Sparse Mode, RPT=0 SPT=1 SSM=0 REG=0 MSDP Adv=0 MSDP Create=0
      L3 (HW) 1: tag TR(1/3/1,1/3/1)(VL10)
      fast=1 slow=0 pru=0 graft age
      age=120s up-time=20m HW=1 L2-vidx=4131 has mll
2     (* 239.0.0.1) RP 192.168.1.1, in v2 (1/1/1), cnt=2
      upstream neighbor=172.16.16.1 on v2 using ip route
      Sparse Mode, RPT=1 SPT=0 SSM=0 REG=0 MSDP Adv=0 MSDP Create=0
      L3 (SW) 1: tag TR(1/3/1,1/3/1)(VL10)
      fast=1 slow=0 pru=1 graft
      age=0s up-time=20m HW=0
```



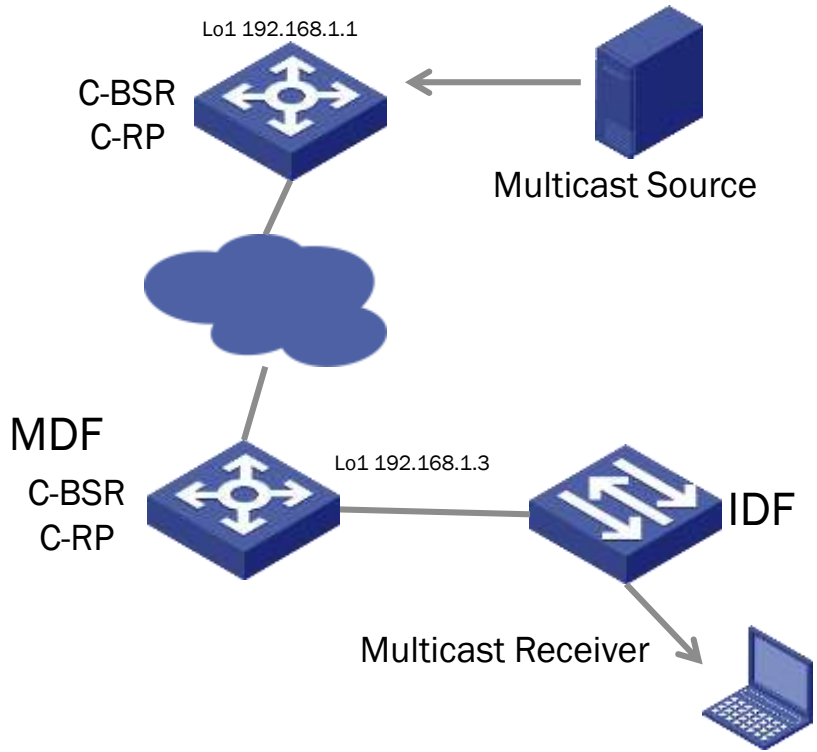
PIM-SM Rendezvous Point Bootstrap Routing

- Dynamic selection method for RP in PIM-SM network
- Standards based method
- Used for redundancy and failover
- Can be used a form of load balancing
- BSR collects and distribute RP information
- Best practice to make each Candidate RP a Candidate BSR



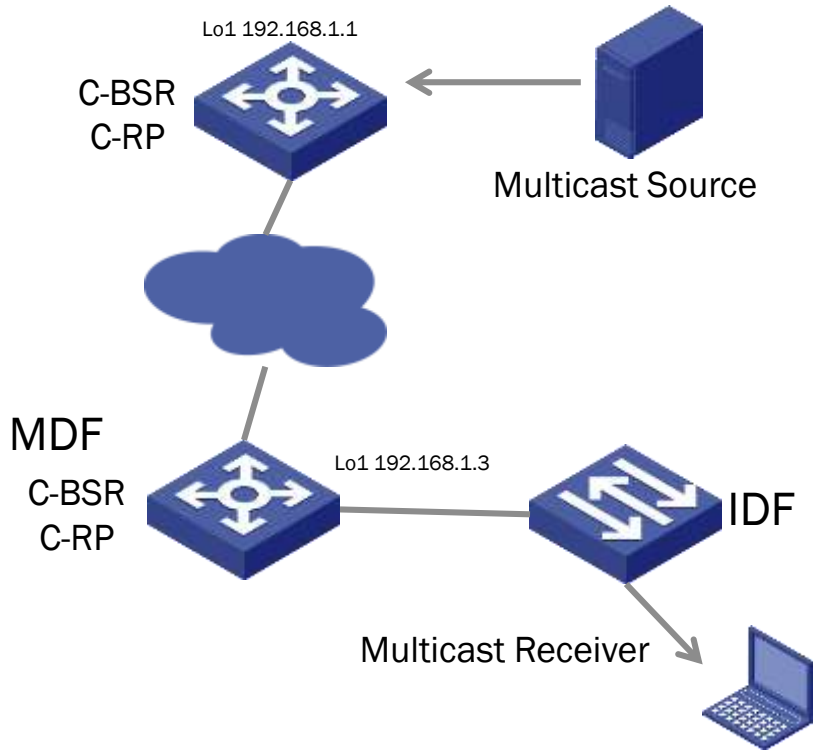
PIM-SM BSR Configuration

```
hendrix(config)#router pim
hendrix(config-pim-router)#bsr-candidate loopback 1 30
hendrix(config-pim-router)#rp-candidate loopback 1

interface loopback 1
 ip address 192.168.1.3/32
 ip pim-sparse
 ip ospf area 0
 ip ospf passive

interface ve 2
 ip address 172.16.16.3/24
 ip pim-sparse
 ip ospf area 0
 ip ospf priority 0
!
interface ve 10
 ip address 10.0.0.1/24
 ip pim-sparse
 ip helper-address 1 10.100.100.5
!
interface ve 20
 ip address 10.0.2.1/24
 ip pim-sparse
```



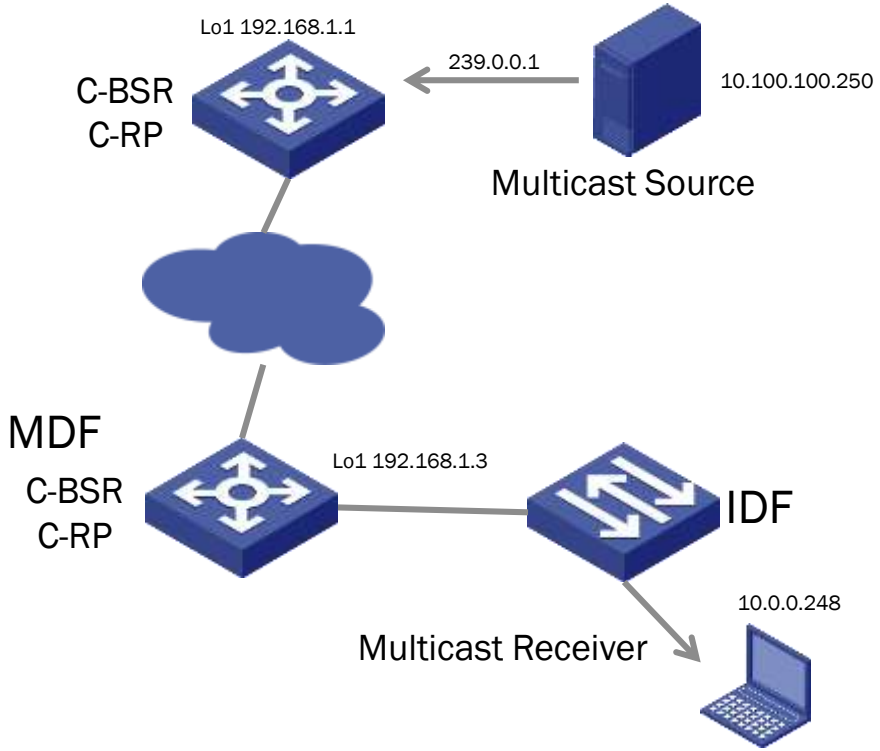
PIM-SM BSR Verification

```
hendrix#show ip pim neighbor
Total number of neighbors: 1 on 1 ports
Port    Phy_p      Neighbor        Holdtime Age    UpTime   GenID
v2      1/1/1      172.16.16.1     105      0      3300     0x00005F35

hendrix#show ip pim bsr
PIMv2 Bootstrap information, state=CAND-BSR
  BSR address: 192.168.1.1
  BSR priority: 255, Hash mask length: 30

This system is a candidate BSR
  Candidate BSR address: 192.168.1.3
  Priority: 0, hash mask length: 30

Next Candidate-RP-advertisment in 00:00:40
  RP: 192.168.1.3
    group prefixes:
    224.0.0.0 / 4

  Candidate-RP-advertisement period: 60
hendrix#show ip pim rp-candidate
Next Candidate-RP-advertisment in 00:00:10
  RP: 192.168.1.3
    group prefixes:
    224.0.0.0 / 4

  Candidate-RP-advertisement period: 60
```



PIM-SM BSR Verification

```
hendrix#show ip pim rp-map
Number of group-to-RP mappings: 1

         Group address         RP address  age
-------------------------------------------------
   1         239.0.0.1        192.168.1.1    0

hendrix#show ip pim rp-set
No static-RP configured

BSR state=CAND-BSR, # of group prefixes Learnt from BSR: 1

Group prefix = 224.0.0.0/4      # RPs expected: 1
      # RPs received: 1
      RP 1: 192.168.1.1    priority=0,
hendrix#show ip pim mcache
Total 2 entries

1     (10.100.100.250 239.0.0.1) in v2 (1/1/1), cnt=2
      upstream neighbor=172.16.16.1 on v2 using ip route
      Sparse Mode, RPT=0 SPT=1 SSM=0 REG=0 MSDP Adv=0 MSDP Create=0
      L3 (HW) 1: tag TR(1/3/1,1/3/2)(VL10)
      fast=1 slow=0 pru=0 graft
      age=120s up-time=2m HW=1 L2-vidx=4131 has mll
2     (* 239.0.0.1) RP 192.168.1.1, in v2 (1/1/1), cnt=2
      upstream neighbor=172.16.16.1 on v2 using ip route
      Sparse Mode, RPT=1 SPT=0 SSM=0 REG=0 MSDP Adv=0 MSDP Create=0
      L3 (SW) 1: tag TR(1/3/1,1/3/2)(VL10)
      fast=1 slow=0 pru=1 graft
      age=0s up-time=6m HW=0
```



IP Parameter Configuration

Assign IP DNS Parameters

- DNS parameters configured same as switch code

```
hendrix(config)#ip dns server-address 4.2.2.2
hendrix(config)#ip dns domain-name brocade.com
```

Sflow Configuration

SFLOW Configuration

- SFLOW is a standards-based protocol that allows network traffic to be sampled at a user-defined rate for the purpose of monitoring traffic flow patterns and identifying packet transfer rates on user-specified interfaces.
- Enable SFLOW globally
- Enable SFLOW per interface
- Specify SFLOW collector(s)

```
hendrix(config)#interface e 1/1/1
hendrix(config-if-e1000-1/1/1)#sflow forwarding
hendrix(config-if-e1000-1/1/1)#sflow sample 1024
hendrix(config-if-e1000-1/1/1)#exit
hendrix(config)#sflow destination 192.168.1.100
sFlow collector added; 1 collectors configured.
hendrix(config)#sflow enable
```

Sampling Recommendations:

100M interface -> 512

1G interface -> 1024

10G interface -> 2048

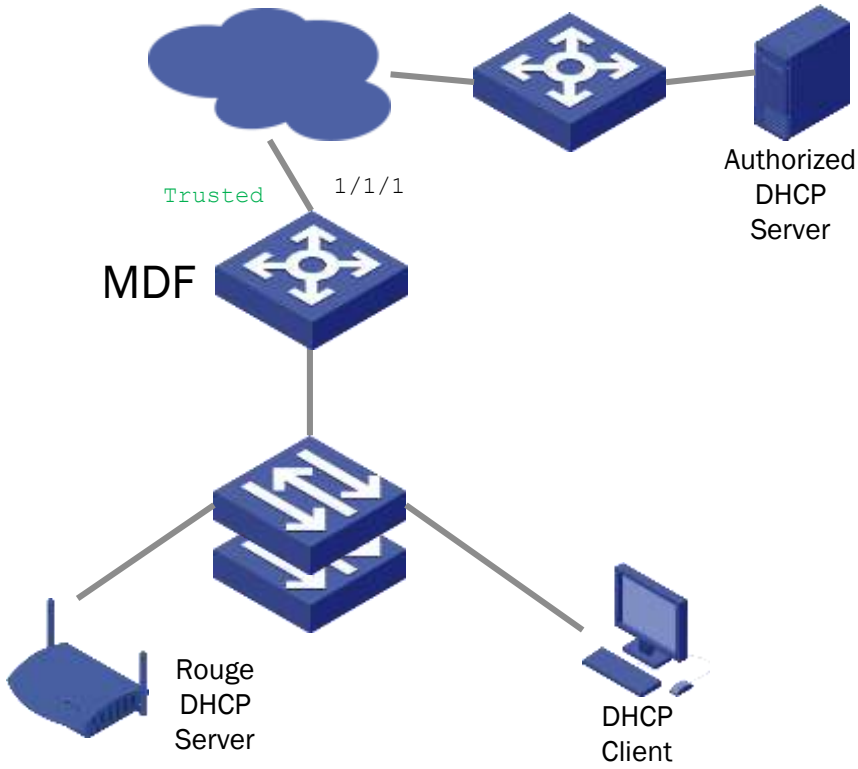
SFLOW Verification

```
hendrix#show sflow
sFlow version: 5
sFlow services are enabled.
sFlow agent IP address: 192.168.13.60
Collector IP 192.168.1.100, UDP 6343
UDP source port: 8888 (Default)
Polling interval is 20 seconds.
Configured default sampling rate: 1 per 4096 packets.
Actual default sampling rate: 1 per 4096 packets.
The maximum sFlow sample size: 128.
sFlow exporting cpu-traffic is disabled.
47 UDP packets exported
0 sFlow flow samples collected.
sFlow ports: ethe 1/1/1
Module Sampling Rates
---------------------
Port Sampling Rates
-------------------
Port=1/1/1, configured rate=1024, actual rate=1024
```

DHCP Snooping and Relay

DHCP Snooping

- Rouge DHCP Servers disrupt network connectivity and present security risk
- DHCP Snooping blocks DHCP replies on Untrusted Ports
- DHCP Snooping configured on Per VLAN Bassis
- Ports must be configured to trust DHCP replies



DHCP Snooping Configuration

- Rouge DHCP Servers disrupt network connectivity and present security risk
- DHCP Snooping blocks DHCP replies on Untrusted Ports
- DHCP Snooping configured on Per VLAN Basis
- Ports must be configured to trust DHCP replies

```
hendrix(config)#ip dhcp snooping vlan 10
hendrix#show ip dhcp snooping vlan 10
IP DHCP snooping VLAN 10: Enabled
  Untrusted Ports : ethe 1/1/20 to 1/1/22 ethe
1/3/1 to 1/3/2
  Relay Agent Information disabled on Ports : None
```

DHCP Relay

- Many organizations use a central DHCP server to service requests
- DHCP request need to be relay to appropriate server
- Relay enabled using IP Helper function on VE interface

```
hendrix#show run interface ve 10
interface ve 10
 ip address 10.0.0.1/24
 ip helper-address 1 10.100.100.5
```

Administrative Parameters Configuration

System Administration Information

- Enter the following from CLI:
  - System Name
  - Contact Information
  - Location

```
ICX6610-24P Switch(config)#hostname hendrix
hendrix(config)#snmp-server location Centerville
hendrix(config)#snmp-server contact Support Services
hendrix(config)#exit
hendrix#wri mem
```

Enable Telnet and Set Password

- Telnet server can be enabled on system for management
- Unique password can also be setup locally on the system
- Example to right shows straight forward example to set password
- System also supports Radius and TACACS

```
hendrix(config)#telnet server
hendrix(config)#enable telnet password brocade
```

Set Enable Password

- Fastiron code can set password to limit access to ‘enable’ mode
- Regardless if other authentication methods are deployed, set an enable password local on the system for emergency access
- Password encrypted and not readable from configuration

```
hendrix(config)#enable super-user-password brocade
hendrix(config)#exit
hendrix#exit
hendrix>en
Password:
hendrix#
```

NTP and Clock Configuration

- Providing consistent time among network elements proves invaluable in troubleshooting activities
- NTP enables synchronization across the enterprise

```
zappa(config)#ntp
zappa(config-ntp)#server 192.168.13.42
zappa(config-ntp)#exit
zappa(config)#clock timezone us central
zappa(config)#clock summer-time

zappa#show clock
15:51:48.105 Central Wed May 27 2015

zappa#show ntp status
 Clock is synchronized, stratum 7, reference clock is
192.168.13.42
 precision is 2**-16
 reference time is 3641748597.1462168574 (14:49:57.1462168574
Central Wed May 27 2015)
 clock offset is -33.2244 msec, root delay is 1.5514 msec
 root dispersion is 49.0082 msec,  peer dispersion is 11.8871
msec
 system poll interval is 64,  last clock update was 91 sec ago
 NTP server mode is enabled, NTP client mode is enabled
 NTP master mode is disabled, NTP master stratum is 8
```

SNMP and Syslog Configuration

- Setup community strings for RW and RO
- Specify SNMP Trap destination
- ACLs can be utilized to restrict SNMP access

```
hendrix(config)#snmp-server community brocade ro
hendrix(config)#snmp-server community brocade rw
hendrix(config)#snmp-server host 192.168.1.100
hendrix(config)#logging host 192.168.1.100
```

Secure Shell Configuration

- SSH allows secure remote access to management functions on a Brocade device
- SSH2 supported
- Key generation can take several minutes – BE PATIENT
- CPU Priority can be given to key generation during maintenance window

zappa(config)#crypto key generate rsa mod 1024

Creating DSA key pair, please wait...

DSA Key pair is successfully created

TO DELETE KEY

```
hendrix(config)#crypto key zeroize
```

Enable Discovery Protocols

- Link layer discover protocols can be enabled on the system
- Fastiron supports the following:
  - FDP (Foundry Discovery Protocol)
  - CDP (Cisco Discovery Protocol)
  - LLDP (Link Layer Discovery Protocol)

```
hendrix#config t
hendrix(config)#lldp run
hendrix(config)#fdp run
hendrix(config)#show fdp
Global FDP information:
  Sending FDP packets every 60 seconds
  Sending a holdtime value of 180 seconds
hendrix(config)#show lldp
LLDP transmit interval            : 30 seconds
LLDP transmit hold multiplier     : 4   (transmit TTL:
120 seconds)
LLDP transmit delay               : 2 seconds
LLDP SNMP notification interval   : 5 seconds
LLDP reinitialize delay           : 2 seconds
LLDP-MED fast start repeat count : 3

LLDP maximum neighbors            : 392
LLDP maximum neighbors per port   : 4
hendrix(config)#
```

Configuration Snippets

Edge Port Config Snippet

```
interface ethernet 1/1/1
 loop-detection
 dual-mode 10
 spanning-tree 802-1w admin-edge-port
 inline power
 voice-vlan 20
 trust dscp
 stp-bpdu-guard
 sflow forwarding
```

1G Uplink Port Config Snippet

```
interface ethernet 1/3/1
 dhcp snooping trust
 spanning-tree 802-1w admin-pt2pt-mac
 trust dscp
```

10G Uplink Port Config Snippet

```
interface ethernet 1/2/2
 dhcp snooping trust
 speed-duplex 10g-full
 spanning-tree 802-1w admin-pt2pt-mac
 trust dscp
```

VLAN/802.1w Configuration Snippet

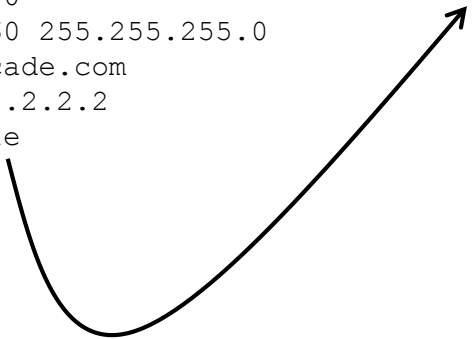
```
vlan 10 name DATA by port
 tagged ethe 1/1/1 to 1/1/24 ethe 1/3/2 ethe 2/1/1 to 2/1/24 ethe 2/3/2
 spanning-tree 802-1w
 spanning-tree 802-1w ethe 2/3/2 admin-pt2pt-mac
!
vlan 20 name VOICE by port
 tagged ethe 1/1/1 to 1/1/24 ethe 1/3/2 ethe 2/1/1 to 2/1/24 ethe 2/3/2
 spanning-tree 802-1w
 spanning-tree 802-1w ethe 2/3/2 admin-pt2pt-mac
!
vlan 99 name Management by port
 tagged ethe 1/3/2 ethe 2/3/2
 spanning-tree 802-1w
 spanning-tree 802-1w ethe 2/2/2 admin-pt2pt-mac
 management-vlan
 default-gateway  192.168.13.1 1
!
vlan 299 name DEFAULT-VLAN by port
```

DHCP Snooping Config Snippet

```
ip dhcp snooping vlan 10
ip dhcp snooping vlan 20

interface ethernet 1/3/2
 dhcp snooping trust
 speed-duplex 1000-full-master
 long-preamble
 spanning-tree 802-1w admin-pt2pt-mac
 trust dscp

interface ethernet 2/3/2
 dhcp snooping trust
 speed-duplex 1000-full-master
 long-preamble
 spanning-tree 802-1w admin-pt2pt-mac
 trust dscp
```

Misc Config Snippet

```
stack enable
stack persistent-mac-timer 0
errdisable recovery cause all
errdisable recovery interval 30
default-vlan-id 299
enable telnet password .....
enable acl-per-port-per-vlan
enable super-user-password .....
hostname hendrix
ip dhcp snooping vlan 10
ip dhcp snooping vlan 20
ip address 192.168.13.60 255.255.255.0
ip dns domain-name brocade.com
ip dns server-address 4.2.2.2
no ip dhcp-client enable
fdp run
```



Continued

```
snmp-server community ..... ro
snmp-server community ..... rw
snmp-server contact Support Services
snmp-server location Centerville
snmp-server host 192.168.1.100 version v1
.....
clock summer-time
clock timezone us Central
ntp
  server 192.168.1.100

hitless-failover enable
```

Utilizing Deployment Templates

Why Create Templates

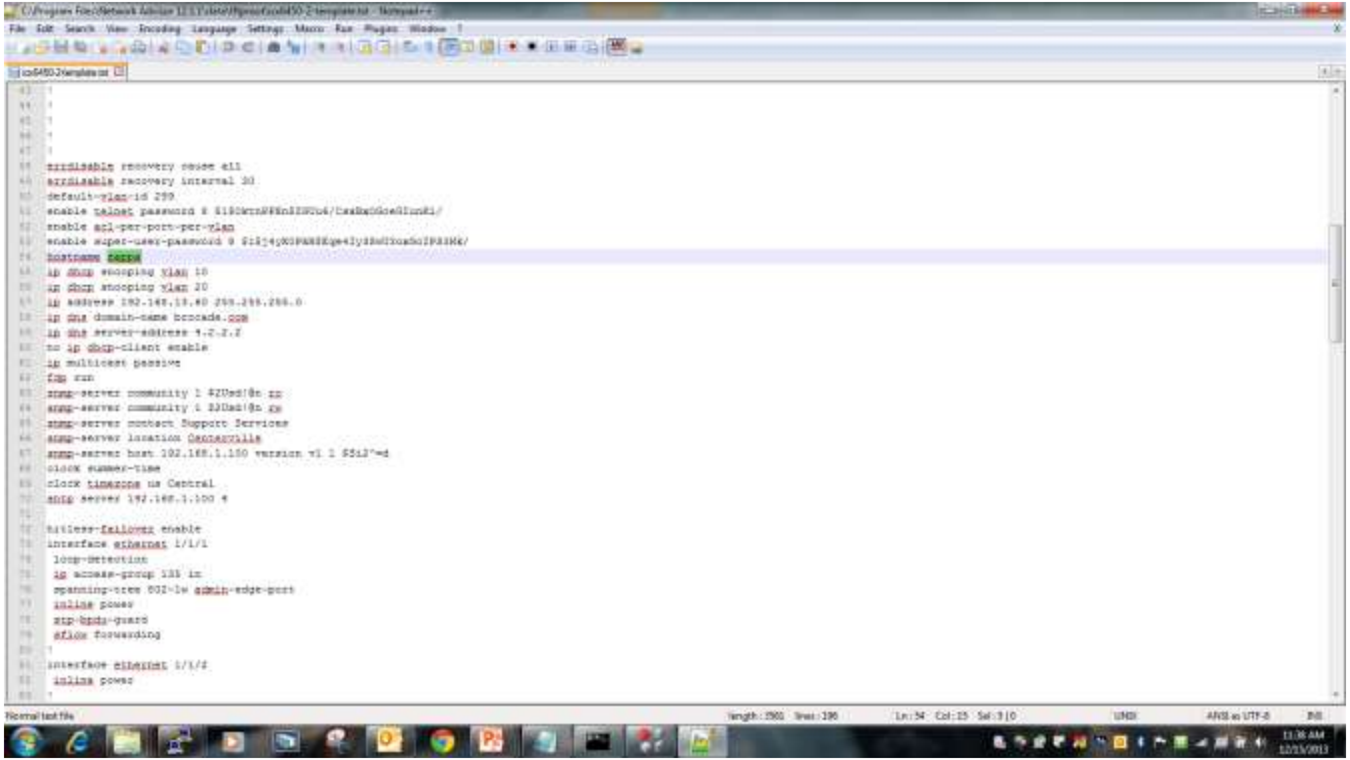
- Most configuration parameters will be consistent across ICX Stack Deployments
- Creating a template will enforce consistency across enterprise
- Template reduce error and increase deployment efficiency

Create Template

- Develop “Gold” Config on ICX Stack
- Copy startup config from ICX Stack to TFTP server
- Creates most accurate duplicate of configuration including passwords

```
hendrix#copy startup-config tftp 192.168.13.30 icx6610-2-template.txt
hendrix#Upload startup-config to TFTP server done.
```

Edit Template and Save As New File



Deploy Stack

- Build New Stack
- Upgrade Code
- Reload
- Assign Temporary IP parameters
- Copy Config File from TFTP Server to Startup Config
- Reload

```
ICX6610-24P Switch#copy tftp startup-
config 192.168.13.30 icx6450-reform.txt
ICX6450-24P Switch#
Automatic copy to member units:  2
Download startup-config from TFTP server
done.

ICX6610-24P Switch#reload
Are you sure? (enter 'y' or 'n'): y
Running Config data has been changed.   Do
you want to continue
the reload without saving the running
config? (enter 'y' or 'n'): y
Reload request sent to attached stack
member(s)...
ICX6610-24P Switch#Halt and reboot
Sent SIGTERM to all processes
Sent SIGKILL to all processes
Requesting system reboot
Restarting system.
```

Confirm New Stack Config

- Confirm hostname change
- Confirm login password
- Connect to network
- Confirm operation

```
hendrix>
hendrix>en
Password:
hendrix#show link-ag
System ID: 748e.f883.d560
Long  timeout: 90, default: 90
Short timeout: 3, default: 3
Port   [Sys P] [Port P] [  Key ] [Act][Tio][Agg][Syn][Col][Dis][Def][Exp][Ope]
1/3/2        1         1    10001   Yes   L   Agg  Syn  Col  Dis  No   No   Ope
2/3/2        1         1    10001   Yes   L   Agg  Syn  Col  Dis  No   No   Ope
```

The End

- Questions?