

Johannesburg Stock Exchange Colocation Network Configuration Guidance Note

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1. Introduction

This JSE Colocation Network Configuration Guidance Note document provides clients who will be making use of the JSE Colocation Services. It is intended to provide clients with high-level guidance and sample configurations to apply when configuring and connecting their Hosting Unit up in Colocation.

This guide follows commands and principles used on Cisco networking devices. Sample configurations need to be modified for each specific client environment as per their unique requirements as well as the Hosting Unit IP address ranges assigned by the JSE.

For detailed IP addresses per market or application, clients must request this information from the JSE Client Service Centre by sending email to customersupport@jse.co.za.

Please refer to the [JSE Colocation](#) website.

2. Hosting Unit Cabling

The JSE has pre-terminated multimode fibre in each Hosting Unit, providing access to the JSE's markets and services via network access interfaces or ports at the top of the Hosting Unit.

The following diagrams provide further clarification on the fibre drop cable termination layout, installed within and to each Hosting Unit. Note that the JSE's pre-terminated cabling handoffs require an LC connector.

Illustration of the Network Access Interface Presentation within a Hosting Unit

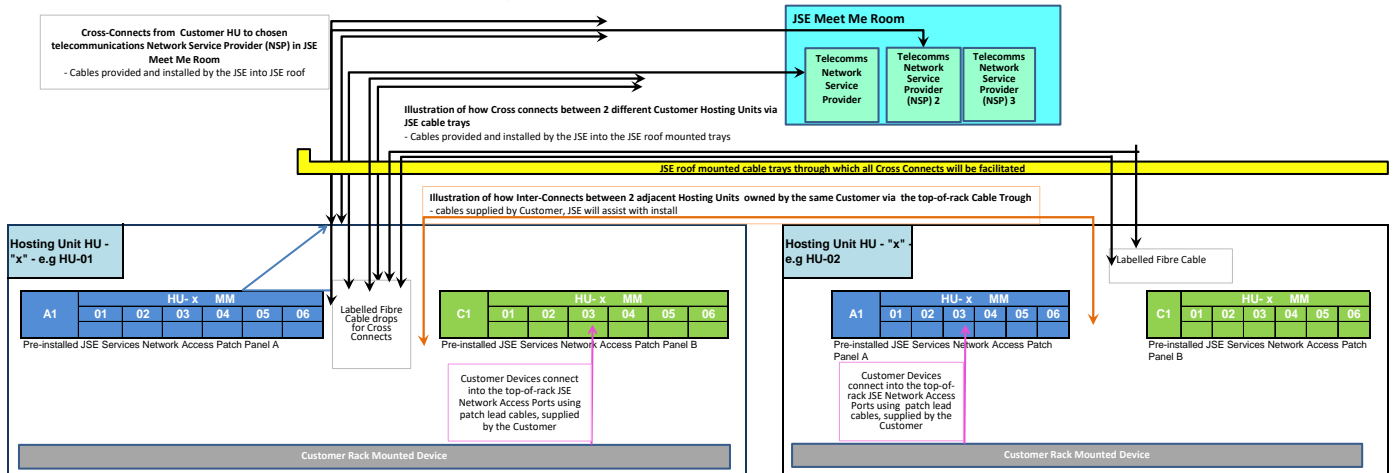


Illustration of the Network Access Interface Presentation within a Hosting Unit

Notes

- 1 Cross Connects** to Telecommunications Network Service Providers (NSPs) in the **JSE Meet Me Room** or to another Customer Hosting Unit in Colocation, are presented as **labelled fibre cable drops** in the Hosting Unit.
- Cross Connect cables are **supplied by the JSE and installed by the JSE** on behalf of Customers via the roof mounted cable trays.
- Customers requiring **6 or more Cross Connects** can request the installation of a **patch panel presentation** for Cross Connects of the Hosting Unit. Please request a quote for this from the JSE.
- All cables are multi-mode fibre cables** with LC connectors, JSE can support single-mode cables if required by Customer.
- Inter-Connects** are installed between **adjacent Hosting Units owned by the same Customer** via top-of-rack cable trays. **Inter-connect cables are supplied by the Customer** and the JSE will assist with the install.

Pre-Installed Patch Panel Fibre Port Access Legend

A1 - 01	Management Network Access Point - PRIMARY	Same VLAN	C1 - 01	Management Network Access Point - SECONDARY
A1 - 02	Equity Market Data - A Feed	Different VLANs	C1 - 02	Equity Market Data - B Feed
A1 - 03	Equity Trading Access - PRIMARY	Same VLAN	C1 - 03	Equity Trading Access - SECONDARY
A1 - 04	Derivatives Trading and Market Data Access -	Same VLAN	C1 - 04	Derivatives Trading and Market Data Access - SECONDARY
A1 - 05	Discretionary spare port for JSE Services	Same VLAN	C1 - 05	Discretionary spare port for JSE Services
A1 - 06	Discretionary spare port for JSE Services	Same VLAN	C1 - 06	Discretionary spare port for JSE Services

NOTE: As part of the CSOF that will be provided to clients once we receive a complete Order Form - following is an **EXAMPLE** of the "C" Class IP address Range that will be assigned to the **JSE Network Access Ports** of a Customer Hosting Unit i.e. Customer Source address for connecting to the JSE services

	NW Range	Default GW		NW Range	Default GW				
Remote Mgmt NW (optional)	A1 - 01	10.11.125.0/24	10.11.125.1/24	usable 2-252	Remote Mgmt NW (optional) C1 - 01	10.11.125.0/24	10.11.125.1/24	usable 2-252	
Millennium IT Market Data - A Feed - Applicable Markets (EDM,EQM,FXM)	A1 - 02	10.21.125.0/24	10.21.125.254/24	usable 2-252	Millennium IT Market Data - B Feed - Applicable Markets (EDM,EQM,FXM)	C1 - 02	10.22.125.0/24	10.22.125.254/24	usable 2-252
Millennium IT Trading - Primary - Applicable Markets (EDM,EQM,FXM)	A1 - 03	10.20.125.0/24	10.20.125.1/24	usable 2-252	Millennium IT Trading - Secondary - Applicable Markets (EDM,EQM,FXM)	C1 - 03	10.20.125.0/24	10.20.125.1/24	usable 2-252
Nutron Trading & Market Data (CDM ,Bonds & IRD) + RTC- Primary	A1 - 04	10.23.125.0/24	10.23.125.1/24	usable 2-252	Nutron Trading & Market Data (CDM ,Bonds & IRD) + RTC- Secondary	C1 - 04	10.23.125.0/24	10.23.125.1/24	usable 2-252
	A1 - 05	unused			C1 - 05	unused			
	A1 - 06	unused			C1 - 06	unused			

Please reference a glossary of terms which are referred to in the above diagram.

Millennium IT – The trading and market data platform used by the following markets :

- Equity Derivatives Market (EDM)
- Equity Market (EQM)
- Currency Derivatives (FXM)

Nutron – The trading and market data platform used by the following markets :

- Commodity Derivatives Market (CDM)
- Bonds – Spot and Corporate Bonds . Access to Government is not facilitated through this connection.
- Interest Rate and Bond Derivatives (IRD)

RTC (Real Time Clearing) – The post trade platform for the following markets :

- Equity Derivatives Market (EDM)
- Currency Derivatives Market (FXM)

3. Access to JSE Markets and Services

Clients can access the JSE markets by configuring and connecting their servers or switching infrastructure within their Hosting Unit to the pre-defined network access patch panel fibre ports installed by the JSE in the reserved section of the Hosting Unit. Clients can access the relevant JSE markets and services offered by the JSE as per the diagram in Section 2 of this document.

Clients can consider the below configurations for their network switches or routing capable devices when configuring their own connectivity to the relevant JSE services.

3.1 Millennium IT Configuration samples (EDM, EQM, FXM)

3.1.1 TCP services Links patched to JSE patch panel A1-03 and C1-03 from two separate switches/routers

TCP Services (A1-03 and C1-03)

Switch-A (primary path switch for TCP services (A1-03). Only path for Feed-A(A1-02))

(Setup static route for Equity TCP services to the JSE HU virtual IP (10.20.x.1 were x is the HU number)

```
ip route 10.10.22.12 255.255.255.255 next-hop-to-JSE interface 10.20.x.1
```

```
ip route 10.10.22.13 255.255.255.255 next-hop-to-JSE interface 10.20.x.1
```

```
ip route 10.12.10.10 255.255.255.255 next-hop-to-JSE
```

```
interface 10.20.x.1 ip route 10.13.10.11 255.255.255.255
```

```
next-hop-to-JSE interface 10.20.x.1
```

Switch-B (Secondary path switch for TCP services. Only path for Feed-B) routes are weighted to ensure that the primary path is used until an even where there is a failure.

(Setup static route for Equity TCP services to the JSE HU virtual IP (10.20.x.1 were x is the HU number)

```
ip route 10.10.22.12 255.255.255.255 next-hop-to-JSE interface
```

```
10.20.x.1 200 ip route 10.10.22.13 255.255.255.255 next-hop-
```

```
to-JSE interface 10.20.x.1 200
```

```
Ip route 10.12.10.10 255.255.255.255 next-hop-to-JSE interface
10.20.x.1 200 Ip route 10.13.10.11 255.255.255.255 next-hop-
to-JSE interface 10.20.x.1 200
```

UDP services links for Market data Services (A1-02 and C1-02)

No PIM/IGMP joins to be accepted for market data groups.

JSE to push down (igmp static-oif 224.0.112.x) market data to the client's HU on A1-02 and C1-02 as per the client enablement

Sample configuration on a Cisco Nexus - 3548 for a client:

JSE will supply clients with the VLAN ID's for TCP-Unicast (A1-03 and C1-03), Multicast "A"(A1-02) and "B"(C1-02) feeds that needs to be configured under their interfaces connecting to the JSE switch.

Switch-A (Primary switch path for TCP services (A1-03).Only path for Feed-A (A1-02))

```
TCP-Unicast (A1-03 and C1-
03) interface Ethernet X/X
switchport access vlan 4XX(JSE can supply if need be or client can use an VLAN ID of their
choice)
Spanning-tree port type edge
```

Multicast "A" feed

```
Interface Ethernet X/X
switchport access vlan 6XX(JSE can supply if need be or client can use an VLAN ID of their
choice)
Spanning-tree port type edge
```

```
ip route 10.10.22.12 255.255.255.255 next-hop-to-JSE interface 10.20.x.1
Ip route 10.10.22.13 255.255.255.255 next-hop-to-JSE interface 10.20.x.1
Ip route 10.12.10.10 255.255.255.255 next-hop-to-JSE interface 10.20.x.1
Ip route 10.13.10.11 255.255.255.255 next-hop-to-JSE interface 10.20.x.1
```

The JSE will configure below multicast groups on the clients HU's layer 3 for "A" feed multicast

```
Interface Vlan 6XX
ip igmp static-oif 224.0.112.30
ip igmp static-oif 224.0.112.32
ip igmp static-oif 224.0.112.34
ip igmp static-oif 224.0.112.36
ip igmp static-oif 224.0.112.38
ip igmp static-oif 224.0.112.40
ip igmp static-oif 224.0.112.42
ip igmp static-oif 224.0.112.44
ip igmp static-oif 224.0.112.46
```

Switch-B (Secondary path for TCP services (C1-03). Only path for Feed-B (C1-02))

Multicast "B" feed

Interface Ethernet X/X
switchport access vlan 8XX(JSE can supply if need be or client can use an VLAN ID of their choice)
Spanning-tree port type edge

```
ip route 10.10.22.12 255.255.255.255 next-hop-to-JSE interface 10.20.x.1 200  
ip route 10.10.22.13 255.255.255.255 next-hop-to-JSE interface 10.20.x.1 200  
ip route 10.12.10.10 255.255.255.255 next-hop-to-JSE interface 10.20.x.1 200  
ip route 10.13.10.11 255.255.255.255 next-hop-to-JSE interface 10.20.x.1 200
```

The JSE will configure below multicast groups on the clients HU's layer 3 for "B" feed multicast

```
Interface Vlan 8XX  
ip igmp static-oif 224.0.112.31  
ip igmp static-oif 224.0.112.33  
ip igmp static-oif 224.0.112.35  
ip igmp static-oif 224.0.112.37  
ip igmp static-oif 224.0.112.39  
ip igmp static-oif 224.0.112.41  
ip igmp static-oif 224.0.112.43  
ip igmp static-oif 224.0.112.45  
ip igmp static-oif 224.0.112.47
```

Note:

1. Client need to ensure that the VLAN used on the A1-03 and C1-03 is the same and trunked between the two switches/routers so the VRRP on their HU becomes operational
2. With the JSE pushing the market data down to the clients HU, clients need to ensure the market data reaches the intended destination servers if they are not located in the same VLAN as the A1-02 and C1-02 ports.

3.1.2 TCP services Links patched to JSE patch panel A1-03 and C1-03 from one switch/router.

TCP Services (A1-03 and C1-03)

Switch (Link 1(A1-03) for primary path and Link2 for secondary path (C1-03) for TCP services. path for both Feed-A and Feed-B)

(Setup static route for Equity TCP services to the JSE HU virtual IP via link 1(10.20.x.1 were x is the HU number))

```
ip route 10.10.22.12 255.255.255.255 next-hop-to-JSE interface 10.20.x.1  
ip route 10.10.22.13 255.255.255.255 next-hop-to-JSE interface 10.20.x.1
```

```
ip route 10.12.10.10 255.255.255.255 next-hop-to-JSE
interface 10.20.x.1
ip route 10.13.10.11 255.255.255.255 next-hop-to-JSE
interface 10.20.x.1
```

(Setup static route for Equity TCP services to the JSE HU virtual IP via link 2(10.20.x.1 were x is the HU number) routes are weighted to ensure that link 1 is used until an even where there is a failure.

```
ip route 10.10.22.12 255.255.255.255 next-hop-to-JSE interface 10.20.x.1 200
ip route 10.10.22.13 255.255.255.255 next-hop-to-JSE interface 10.20.x.1 200
ip route 10.12.10.10 255.255.255.255 next-hop-to-JSE interface 10.20.x.1 200
ip route 10.13.10.11 255.255.255.255 next-hop-to-JSE interface 10.20.x.1 200
```

UDP services links for Market data Services (A1-02 and C1-02)

No PIM/IGMP joins to be accepted for market data groups.

JSE to push down (igmp static-oif 224.0.112.x) market data to the client's HU on A1-02 and C1-02 as per the client enablement

Sample configuration on a Cisco Nexus - 3548 for a client:

JSE will supply clients with the VLAN ID's for TCP-Unicast (A1-03 and C1-03), Multicast "A"(A1-02) and "B"(C1-02) feeds that needs to be configured under their interfaces connecting to the JSE switch.

Switch (primary TCP services (A1-03) via link 1 and secondary TCP services via link 2.Only path for Feed-A (A1-02))

TCP-Unicast (A1-03 and C1-03)

Interface Ethernet X/X

switchport access vlan 4XX (JSE can supply if need be or client can use an VLAN ID of their choice) spanning-tree port type edge

Multicast "A" feed

interface Ethernet X/X

switchport access vlan 6XX(JSE can supply if need be or client can use an VLAN ID of their choice) spanning-tree port type edge

Multicast "B" feed

Interface Ethernet X/X

switchport access vlan 8XX(JSE can supply if need be or client can use an VLAN ID of their choice) spanning-tree port type edge

```
ip route 10.10.22.12 255.255.255.255 next-hop-to-JSE interface 10.20.x.1
ip route 10.10.22.13 255.255.255.255 next-hop-to-JSE interface 10.20.x.1
ip route 10.12.10.10 255.255.255.255 next-hop-to-JSE interface 10.20.x.1
ip route 10.13.10.11 255.255.255.255 next-hop-to-JSE interface 10.20.x.1
```

Note:

1. Client need to ensure that the VLAN used on the A1-03 and C1-03 ports is the same on the switch/router so the VRRP on their HU becomes operational

2. With the JSE pushing the market data down to the clients HU, client's needs to ensure the market data reaches the intended destination servers if they are not located in the same VLAN as the A1-02 and C1-02 ports.

3.2 Nutron & RTC configuration sample

Clients will be required to create static routing entries on their switches, allowing pre-defined network access patch panel fibre ports installed by the JSE in the reserved section of the Hosting Unit. Clients can access the relevant JSE Derivative markets as per the diagram in Section 2 of this document.

3.2.1. TCP Links patched to JSE patch panel A1-04 and C1-04 from two separate switches/routers

TCP Services (A1-03 and C1-03)

Switch-A (primary path switch for TCP services (A1-04)).

(Setup static route for Equity TCP services to the JSE HU virtual IP (10.23.x.1 were x is the HU number))

```
ip route 10.10.35.50 255.255.255.255 next-hop-to-JSE interface 10.23.x.1
ip route 10.10.35.51 255.255.255.255 next-hop-to-JSE interface 10.23.x.1
ip route 10.10.35.52 255.255.255.255 next-hop-to-JSE interface 10.23.x.1
ip route 10.10.35.53 255.255.255.255 next-hop-to-JSE interface 10.23.x.1
```

Switch-B (Secondary path switch for TCP services.) routes are weighted to ensure that the primary path is used until an even where there is a failure.

(Setup static route for Equity TCP services to the JSE HU virtual IP (10.23.x.1 were x is the HU number))

```
ip route 10.10.22.12 255.255.255.255 next-hop-to-JSE interface 10.23.x.1 200
ip route 10.10.22.13 255.255.255.255 next-hop-to-JSE interface 10.23.x.1 200
ip route 10.12.10.10 255.255.255.255 next-hop-to-JSE interface 10.23.x.1 200
ip route 10.13.10.11 255.255.255.255 next-hop-to-JSE interface 10.23.x.1 200
```

Note:

1. Client need to ensure that the VLAN used on the A1-04 and C1-04 is the same and trunked between the two switches/routers so the VRRP on their HU becomes operational

Sample configuration on a Cisco Nexus - 3548 for a client:

Switch-A

JSE will supply clients with the VLAN ID's for TCP-Unicast (A1-04 and C1-04), configured under their interfaces connecting to the JSE switch.

Switch (primary TCP services (A1-03) via link 1 and secondary TCP services via link 2.Only path for Feed-A (A1-02))

TCP-**Unicast** (A1-04 and C1-04)

Interface Ethernet X/X

switchport access vlan 24XX (JSE can supply if need be or client can use an VLAN ID of their choice) spanning-tree port type edge

```
ip route 10.10.35.50 255.255.255.255 next-hop-to-JSE interface 10.23.x.1
ip route 10.10.35.51 255.255.255.255 next-hop-to-JSE interface 10.23.x.1
ip route 10.10.35.52 255.255.255.255 next-hop-to-JSE interface 10.23.x.1
ip route 10.10.35.53 255.255.255.255 next-hop-to-JSE interface 10.23.x.1
```

Switch-B

JSE will supply clients with the VLAN ID's for TCP-Unicast (A1-04 and C1-04), configured under their interfaces connecting to the JSE switch.

Switch (primary TCP services (A1-03) via link 1 and secondary TCP services via link 2. Only path for Feed-A (A1-02))

TCP-Unicast (A1-04 and C1-04)

Interface Ethernet X/X

switchport access vlan 24XX (JSE can supply if need be or client can use an VLAN ID of their choice) spanning-tree port type edge

```
ip route 10.10.35.50 255.255.255.255 next-hop-to-JSE interface
10.23.x.1 200
ip route 10.10.35.51 255.255.255.255 next-hop-to-JSE interface
10.23.x.1 200
ip route 10.10.35.52 255.255.255.255 next-hop-to-JSE interface 10.23.x.1 200
ip route 10.10.35.53 255.255.255.255 next-hop-to-JSE interface 10.23.x.1 200
```

3.2.2. TCP Links patched to JSE patch panel A1-04 and C1-04 from one switch/router

TCP Services (A1-04 and C1-04)

Switch (Link 1(A1-04) for primary path and Link2 for secondary path (C1-04) for TCP services.)

(Setup static route for Equity TCP services to the JSE HU virtual IP via link 1(10.23.x.1 were x is the HU number)) ip route 10.10.22.12 255.255.255.255 next-hop-to-JSE interface 10.23.x.1

ip route 10.10.22.13 255.255.255.255 next-hop-to-JSE interface 10.23.x.1

ip route 10.12.10.10 255.255.255.255 next-hop-to-JSE interface 10.23.x.1

ip route 10.13.10.11 255.255.255.255 next-hop-to-JSE interface 10.23.x.1

(Setup static route for Equity TCP services to the JSE HU virtual IP via link 2(10.23.x.1 were x is the HU number) routes are weighted to ensure that link 1 is used until an even where there is a failure.

```
ip route 10.10.22.12 255.255.255.255 next-hop-to-JSE interface
10.23.x.1 200
```

```
ip route 10.10.22.13 255.255.255.255 next-hop-to-JSE interface  
10.23.x.1 200  
ip route 10.12.10.10 255.255.255.255 next-hop-to-JSE interface 10.23.x.1 200  
ip route 10.13.10.11 255.255.255.255 next-hop-to-JSE interface 10.23.x.1 200
```

4. Time Synchronisation Service

4.1 Precision Time Protocol (PTP) Service

The JSE's PTP service will be made available to client Hosting Units in Colocation via the following pre-defined network access patch panel ports:

- A-03 & C-03 Millennium IT Trading Access
- A-04 & C-04 Nutron Trading and Market Data Access

Clients must please ensure that their servers or switching infrastructure is PTP capable before attempting to configure their Hosting Unit infrastructure to connect to the JSE's PTP service.

4.1.1 PTP configuration sample on the nexus 3548

A-03 & C-03 Millennium IT Trading Access

Customer#xx#

feature ptp (enable the ptp feature)

ptp source 10.20.x.1 (source address that downstream devices will see when ptp multicast messages are sent)

interface Ethernetx/x

description Customerxx to JSEswitch-01 ey/y

ptp (enable ptp on the port)

ptp vlan xxx (used when the port is in trunk mode to distinguish which vlan should process ptp)

switchport access vlan xxx

Spanning-tree port type edge

A-04 & C-04 Nutron Trading and Market Data Access

Customer#xx#

feature ptp (enable ptp feature)

ptp source 10.23.x.1 (source address that downstream devices will see when ptp multicast messages are sent)

interface Ethernetx/x

description Customerxx to JSEswitch-01 ey/y

ptp (enable ptp on the port)

ptp vlan xxx (used when the port in in trunk mode to distinguish which vlan should process ptp)

switchport access vlan xxx

spanning-tree port type edge

5. Colocation Network Connectivity Test and Troubleshooting

5.1 Colocation Network Connectivity Test

As part of the Colocation Take-on and initial set-up of clients in Colocation, network connectivity tests will be conducted between the JSE infrastructure and the clients Hosting Unit or client infrastructure within their Hosting Unit e.g. from client switch to the Hosting Unit Network default gateways. These tests will confirm the Hosting Unit set-up is in accordance with the Colocation services they will subscribe to.

In addition, ICMP by default is not configured by the JSE; however, this can be temporarily permitted to a client's own Hosting Unit Network default gateways to assist clients with additional testing or troubleshooting that they may require.

Below is a sample script that clients can apply to their own switch infrastructure, allowing them to ping their Hosting Unit Network default gateways confirming connectivity to the JSE Colocation services.

Sample configurations:

```
Conf terminal
Interface VLAN 4xx
Description Test VLAN for Unicast Equity Trading
Ip address 10.20.x.2 255.255.255.0
No shutdown
```

```
Conf terminal
Interface VLAN 6xx
Description Test VLAN for Multicast A feed
Ip address 10.21.x.2 255.255.255.0255
No shutdown
```

```
Conf terminal
Interface VLAN 8xx
Description Test VLAN for Multicast B feed
Ip address 10.22.x.2 255.255.255.0
No shutdown
```

```
Conf terminal
Interface VLAN 24xx
Description Test VLAN for Derivatives Trading and Market Data
Ip address 10.23.x.2 255.255.255.0
No shutdown
```

```
Conf terminal
Interface VLAN 14xx
Description Test VLAN for Management
```

Ip address 10.11.x.2
255.255.255.0
No shutdown

NB: If it is a Cisco switch, which supports VTP, it must be in transparent mode to accept VLAN range above 1005, otherwise the client can use own VLAN.

6. Troubleshooting Multicast Data

There are a number of helpful tools and commands that can assist a client in troubleshooting multicast data on their routers and networks. The following is only a guide for troubleshooting multicast traffic on a client router / network.

**** The commands to be executed are in italics, with a sample output beneath****

In addition to the below, a strategically placed network sniffer (e.g. a PC with Wireshark installed, listening to a span port off the router or switch closest to the router), can assist greatly in troubleshooting:

- Confirm on the switch is multicast is flowing (if the VLAN were A1-02 and C1-02 is IGMP snooping enabled)

```
xxxxx# sh ip igmp
snooping vlan 601
IGMP Snooping
information for vlan
601 IGMP snooping
enabled
  Lookup mode: IP
  Optimised Multicast Flood (OMF) disabled
  IGMP querier present, address: 10.21.1.254,
version: 2, i/f E1/1
  Switch-querier disabled
  IGMPv3 Explicit tracking enabled
  IGMPv2 Fast leave disabled
  IGMPv1/v2 Report suppression enabled
  IGMPv3 Report suppression disabled
  Link Local Groups suppression enabled
  Router port detection using PIM Hellos, IGMP Queries
  Number of router-ports: 1
  Number of
groups: 3
  VLAN vPC
function
disabled
  Active
ports:
  E1/7
xxxx# sh ip igmp snooping groups vlan 601
Type: S - Static, D - Dynamic, R - Router port, F - Fabricpath core port

Vlan Group Address   Ver Type Port list
601 224.0.112.34 v2 D Eth1/7
```

- Confirm on the device(server/router/switch) that patch to A1-02 and C1-02 with a packet capture running on the device

Linux/Unix

Tcpdump -i eth0 udp 224.0.112.34

Microsoft

Start>run>Wireshark then filter messages incoming from port A1-02 and C1-02

Router/switch

SPAN traffic

*** For additional information on Cisco Multicast guidelines, please see link below***

<http://www.cisco.com/c/en/us/support/docs/ip/ip-multicast/16450-mcastguide0.html>