

City of Mesa

Backbone Network

Operations Guide

Version 0.22 • March 1, 2010

Prepared by:



City of Mesa, Arizona

PO Box 1466

Mesa AZ 85211-1466

Tel: +xxx-x-xxx-xxxx Fax: + xxx-x-xxx-xxxx

Last edited: 01 March 2010

Copyright © 2010 Torrey Point Group, LLC. All rights reserved.

No part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from [Company].

All copyright, confidential information, patents, design rights and all other intellectual property rights of whatsoever nature contained herein are and shall remain the sole and exclusive property of [Company]. The information furnished herein is believed to be accurate and reliable.

However, no responsibility is assumed by [Company] for its use, or for any infringements of patents or other rights of third parties resulting from its use.

The Torrey Point] name and Torrey Point logo are trademarks or registered trademarks of Torrey Point Group, LLC.

All other trademarks are the property of their respective owners

Contents

1	GENERAL INFORMATION.....	6
1.1	RISK LEVELS	6
1.2	ALLOCATING RESOURCES: BEST PRACTICES	6
1.3	MODIFYING ROUTER FILES: BEST PRACTICES	6
2	SYSTEM OPERATIONS.....	7
2.1	INSTALL ROUTER SOFTWARE UPDATES.....	7
2.2	RESTART ROUTER	7
2.3	RECOVER PASSWORD.....	7
3	PROVISIONING.....	8
3.1	PROVISION NEW CE SITE (SINGLE PHYSICAL INTERFACE, STATIC ROUTING).....	8
3.2	PROVISION NEW CE SITE (SINGLE PHYSICAL INTERFACE, OSPF ROUTING).....	12
3.3	PROVISION NEW CE SITE (MULTIPLE PHYSICAL INTERFACES, STATIC ROUTING)	17
3.4	PROVISION NEW CE SITE (MULTIPLE PHYSICAL INTERFACES, OSPF ROUTING)	24
3.5	PROVISION NEW VPN	32
4	NETWORK MONITORING.....	33
4.1	CHECK NETWORK NODE ALARMS	33
4.2	MONITOR ROUTER CPU UTILIZATION.....	34
4.3	MONITOR ROUTER MEMORY CONSUMPTION	35
4.4	MONITOR PIC CPU UTILIZATION AND MEMORY CONSUMPTION	36
4.5	MONITOR ROUTER ENVIRONMENTAL STATISTICS	37
4.6	DISPLAY ROUTER HARDWARE INVENTORY AND SERIAL NUMBERS.....	38
4.7	DISPLAY ROUTER SOFTWARE VERSION.....	39
5	TROUBLESHOOTING.....	41
5.1	PROBLEM: INTERMITTENT/NO CONNECTIVITY BETWEEN CORE ROUTERS	41
5.2	PROBLEM: INTERMITTENT/NO CONNECTIVITY BETWEEN SITES	41

About This Document

This operations guide is intended for network administrators responsible for routine operation of the microwave backbone network designed and deployed by Torrey Point. For information about network operations not described here, contact Torrey Point at (888) 700-5747.

Revision History

Revision Number	Revision Date	Summary of Changes	Author
0.22	03/01/2010	a. Update Network Monitoring chapter. b. Added System Operations chapter topics. c. Added placeholder for Provision New VPN site d. Added placeholders for Troubleshooting	Ed Morgan
1.0		Initial release to City of Mesa	Torrey Point

Network Reference Documents

These documents contain more detailed information about the City of Mesa network. Documents identified with an asterisk (*) are working documents and should be used only in electronic form as posted to master location. vv = version number

Document Name	File Name	Formats	Author
City of Mesa: Backbone Modernization Architecture Document	TPG-Arch-P2-vv	Word	Torrey Point
Technical Specifications Master*	Mesa-Technical-Specifications-vv	Excel	Torrey Point
Network Diagrams*	ACCOUNT-North-vv ACCOUNT-South-vv GILBERT-South-vv library-South-vv PHOENIX-South-vv SCADA-North-vv SCADA-South-vv	OmniGraffle (editable) and PDF	Torrey Point

Other Useful Documents

These documents provide additional information for network administrators.

Document Name	Source	Publisher	Authors
Exploring the Junos CLI	www.juniper.net/dayone	Juniper Networks	Cathy Gadecki, Michael Scruggs
Configuring Junos Basics	www.juniper.net/dayone	Juniper Networks	Ian Jarrett, Sean Clarke

1 General Information

The information in this chapter applies to all chapters in the Operations Guide.

1.1 Risk Levels

Any change to the core network involves some risk of disrupting normal network operations. In this document, procedures are categorized by risk level as defined in the table below. As a network best practice, always understand how you will recover from a network outage before starting any of the procedures in this section.

Risk Level	Description	Scheduling
Low	Unlikely to disrupt network operations.	Can be performed at any convenient time
Moderate	Usually will not disrupt network operations, but be prepared for localized outage.	Recommended for maintenance window, but can be performed during normal operations.
High	Likely to involve some local outage, and could affect overall network operations	Perform during maintenance window only

1.2 Allocating Resources: Best Practices

- These procedures require allocating available interfaces and other network resources. Resource allocations are documented in the Technical Specifications Master and Network Diagrams.
- When allocating resources, always update these documents before beginning the step-by-step procedures. This precaution prevents another network administrator from allocating the same resources and ensures accurate network documentation.
- To view the unused interfaces on a PE router, click on the corresponding tab in the Technical Specifications document, for example, CRS-01. Unassigned interfaces are designated “available” in the Description column.
- Even if an interface is marked “available,” double-check the configuration file on the PE router to verify that the interface is not in use.

1.3 Modifying Router Files: Best Practices

- When you have finished editing a router configuration file, use the Junos command `commit check` to check for syntax or logical errors. The command returns `configuration check succeeds` when the file contains no errors.
- To see details of the errors, use the command `commit check | display xml`.
- When the file is error-free, you can issue the command `commit` to start running the modified configuration file on the router.
- To return to the previous configuration of the router (before the most recent `commit` command), use the command `rollback 1`. This command must be issued at the top of the configuration tree.

2 System Operations

This chapter gives instructions for a number of basic system operations that can be performed by City of Mesa IT staff.

2.1 Install Router Software Updates

2.2 Restart Router

2.3 Recover Password

3 Provisioning

The section describes the procedures used for provisioning and configuration tasks that can be performed by City of Mesa network administrators.

3.1 Provision New CE Site (Single Physical Interface, Static Routing)

Overview	
Purpose	Use this procedure to provision a new CE site that is connected to the PE via a single physical interface, for example, a T1 line or Gigabit Ethernet, using static routing.
Related files	• Technical Specifications Master • Network Diagram (for specific VPN) • Router configuration file (resident on PE router)
Skills/Software	• Edit router configuration file using Junos CLI and basic Junos commands • Edit OmniGraffle file (to update the Network Diagram) • Edit Excel file (to update the Technical Specifications Master)
Procedure time	60 minutes
Risk Level	Low

Needed Information (Obtain from System Administrator at CE Site)		
Parameter	Value	Description
VPN name	SCADA, ACCOUNT, LIBRARY, GILBERT, PHOENIX or new VPN	The VPN associated with the site where the new CE is being provisioned, for example, SCADA.
Subnet address	IP address	The IP address for the PE-CE subnet, for example, 192.168.200.1/24
Routes	IP address	IP addresses of subnets that require static routes on PE router

A. Allocate PE Router Resources									
Step	Procedure								
1	Allocate an unused interface on the PE router and update the Technical Specifications Master. ***** EXAMPLE ***** <table> <tr> <th>Interface</th><th>Description</th></tr> <tr> <td>t1-1/0/0</td><td>Lab</td></tr> <tr> <td>t1-1/0/1</td><td>Lab</td></tr> <tr> <td>t1-1/0/2</td><td>"LAB-SCADA: jnpr.m10i.crs-01 -to- jnpr.m10i.com-03"</td></tr> </table>	Interface	Description	t1-1/0/0	Lab	t1-1/0/1	Lab	t1-1/0/2	"LAB-SCADA: jnpr.m10i.crs-01 -to- jnpr.m10i.com-03"
Interface	Description								
t1-1/0/0	Lab								
t1-1/0/1	Lab								
t1-1/0/2	"LAB-SCADA: jnpr.m10i.crs-01 -to- jnpr.m10i.com-03"								
2	Add the new interface assignment to the Network Diagram corresponding to the VPN, for example, SCADA-North.								

B: Edit the PE Router Configuration File	
Step	Procedure
1	Update the interface description. ***** EXAMPLE ***** <pre> interfaces { : t1-1/0/2 { description "LAB-SCADA: jnpr.m10i.crs-01 -to- jnpr.m10i.com-03 interface: t1-1/0/2.0"; </pre>
2	Add the IP subnet assignment. ***** EXAMPLE ***** <pre> interfaces { : t1-1/0/2 { description "LAB-SCADA: jnpr.m10i.crs-01 -to- jnpr.m10i.com-03 interface: t1-1/0/2.0"; unit 0 { family inet { address 192.168.200.1/24; </pre>

B: Edit the PE Router Configuration File	
3	Add the PE router interface to the appropriate VRF (Virtual Routing and Forwarding) template. <pre>***** EXAMPLE ***** routing-instances { . . VRF-SCADA { instance-type vrf; interface t1-1/0/2.0;</pre>
4	Configure the static routes. <pre>***** EXAMPLE ***** routing-instances { . . VRF-SCADA { . . routing-options { static { route 172.16.20.0/24 next-hop t1-1/0/2.0; route 172.16.19.0/24 next-hop t1-1/0/2.0;</pre>

C: Check and Commit Configuration	
Step	Procedure
1	Check the configuration file with the Junos command <i>commit check</i>. <pre>***** EXAMPLE ***** pschmalz@jnpr.m10i.crs-01.mesaaz.gov# commit check configuration check succeeds</pre>
2	If the check succeeds, apply configuration with the Junos command <i>commit</i>. (If errors were reported, find and fix, then repeat step 1.) <pre>***** EXAMPLE ***** pschmalz@jnpr.m10i.crs-01.mesaaz.gov# commit commit complete</pre>

D: Validate the Configuration	
Step	Procedure
1	Verify the physical interface using the Junos command <i>run show interfaces</i>. (See Notes in example below): A. Interface status: Enabled, Physical link is Up B. Link type: PPP C. Link speed: Matches speed of physical interface (T1) D. LCP state: Opened E. NCP state: inet: Opened F. Link encapsulation: PPP ***** EXAMPLE ***** <pre>pschmalz@jnpr.m10i.crs-01.mesaaz.gov# run show interfaces t1-1/0/2 Physical interface: t1-1/0/2, Enabled, Note A Physical link is Up . . Note B Link-level type: PPP, MTU: 1504, Note C Speed: T1 . . Note D LCP state: Opened Note E NCP state: inet: Opened, . . Flags: Point-To-Point SNMP-Traps 0x4000 Note F Encapsulation: PPP</pre>
2	Verify next-hops using the Junos command <i>run show route</i> for <u>each</u> static route. ***** EXAMPLE ***** <pre>pschmalz@jnpr.m10i.crs-01.mesaaz.gov# run show route 172.16.20.0/24 VRF-ACCOUNT.inet.0: 3 destinations, 4 routes (3 active, 0 holddown, 0 hidden) + = Active Route, - = Last Active, * = Both 172.16.20.0/24 * [Static/5] 1w2d 21:09:19 > via t1-1/0/2.0</pre>

PETER, WE NEED TO ADD CLASS OF SERVICE CONFIGURATION, EITHER HERE OR AS A SEPARATE PROCEDURE.

3.2 Provision New CE Site (Single Physical Interface, OSPF Routing)

Overview	
Purpose	Use this procedure to provision a new CE site that is connected to the PE via a single physical interface, for example, a T1 line or Gigabit Ethernet, using the OSPF routing protocol.
Related files	• Technical Specifications Master • Network Diagram (for specific VPN) • Router configuration file (resident on PE router)
Skills/Software	• Edit router configuration file using Junos CLI and basic Junos commands • Edit OmniGraffle file (to update the Network Diagram) • Edit Excel file (to update the Technical Specifications Master)
Procedure time	60 minutes
Risk Level	Moderate

Needed Information (Obtain from System Administrator at CE Site)		
Parameter	Value	Description
VPN name	SCADA, ACCOUNT, LIBRARY, GILBERT, PHOENIX or new VPN	The VPN associated with the site where the new CE is being provisioned, for example, SCADA.
Subnet address	IP address	The IP address for the PE-CE subnet, for example, 192.168.200.1/24
OSPF area ID	Area ID	OSPF area ID value for new link

A. Allocate PE Router Resources									
Step	Procedure								
1	Allocate an interface on the PE router and update the Technical Specifications Master. ***** EXAMPLE ***** <table> <tr> <th>Interface</th><th>Description</th></tr> <tr> <td>t1-1/0/0</td><td>Lab</td></tr> <tr> <td>t1-1/0/1</td><td>Lab</td></tr> <tr> <td>t1-1/0/2</td><td>"LAB-SCADA: jnpr.m10i.crs-01 -to- jnpr.m10i.com-03"</td></tr> </table>	Interface	Description	t1-1/0/0	Lab	t1-1/0/1	Lab	t1-1/0/2	"LAB-SCADA: jnpr.m10i.crs-01 -to- jnpr.m10i.com-03"
Interface	Description								
t1-1/0/0	Lab								
t1-1/0/1	Lab								
t1-1/0/2	"LAB-SCADA: jnpr.m10i.crs-01 -to- jnpr.m10i.com-03"								
2	Add the new interface assignment to the Network Diagram corresponding to the VPN, for example, SCADA-North.								

B: Edit the PE Router Configuration File	
Step	Procedure
1	Update the interface description. ***** EXAMPLE ***** <pre> interfaces { : : t1-1/0/0 { description "LAB-SCADA: jnpr.m10i.crs-01 -to- jnpr.m10i.com-03 interface: t1-1/0/2.0"; } </pre>
2	Add the IP subnet assignment. ***** EXAMPLE ***** <pre> interfaces { : : t1-1/0/2 { description "LAB-SCADA: jnpr.m10i.crs-01 -to- jnpr.m10i.com-03 interface: t1-1/0/2.0"; unit 0 { family inet { address 192.168.200.1/24; } } } </pre>

B: Edit the PE Router Configuration File	
3	Add the PE router interface to the appropriate VRF (Virtual Routing and Forwarding) template. <pre>***** EXAMPLE ***** routing-instances { . . VRF-SCADA { instance-type vrf; interface t1-1/0/2.0;</pre>
4	Add the OSPF area ID. <pre>***** EXAMPLE ***** routing-instances { . . VRF-SCADA { . . protocols { ospf { export bgp-to-ospf; area 0.0.0.0 { interface t1-1/0/2.0;</pre>

C: Check and Commit Configuration	
Step	Procedure
1	Check the configuration file with the Junos command <i>commit check</i>. <pre>***** EXAMPLE ***** pschmalz@jnpr.m10i.crs-01.mesaaz.gov# commit check configuration check succeeds</pre>
2	If the check succeeds, apply configuration with the Junos command <i>commit</i>. (If errors were reported, find and fix, then repeat step 1.) <pre>***** EXAMPLE ***** pschmalz@jnpr.m10i.crs-01.mesaaz.gov# commit commit complete</pre>

D: Validate the Configuration													
Step	Procedure												
1	Verify the physical interface using the Junos command <i>run show interfaces</i>. (See Notes in example below): A. Interface status: Enabled, Physical link is Up B. Link type: PPP C. Link speed: Matches speed of physical interface (T1) D. LCP state: Opened E. NCP state: inet: Opened F. Link encapsulation: PPP ***** EXAMPLE ***** <pre>pschmalz@jnpr.m10i.crs-01.mesaaz.gov# run show interfaces t1-1/0/2</pre> Physical interface: t1-1/0/2, Enabled, Note A Physical link is Up : : Note B Link-level type: PPP, MTU: 1504, Note C Speed: T1 : : Note D LCP state: Opened Note E NCP state: inet: Opened, : : Flags: Point-To-Point SNMP-Traps 0x4000 Note F Encapsulation: PPP												
2	Verify OSPF neighbor state is Full using the Junos command <i>run show ospf</i>. ***** EXAMPLE ***** <pre>pschmalz@jnpr.m10i.crs-01.mesaaz.gov# run show ospf neighbor</pre> instance VRF-SCADA <table><tr><th>Address</th><th>Interface</th><th>State</th><th>ID</th><th>Pri</th><th>Dead</th></tr><tr><td>192.168.200.2</td><td>t1-1/0/2.0</td><td>Full</td><td>192.168.201.1</td><td>128</td><td>31</td></tr></table>	Address	Interface	State	ID	Pri	Dead	192.168.200.2	t1-1/0/2.0	Full	192.168.201.1	128	31
Address	Interface	State	ID	Pri	Dead								
192.168.200.2	t1-1/0/2.0	Full	192.168.201.1	128	31								

D: Validate the Configuration

3

Verify routes are being added to the VRF routing table using the Junos command *run show route table*.

***** EXAMPLE *****

pschmalz@jnpr.m10i.crs-01.mesaaz.gov# **run show route table VRF-SCADA**

VRF-SCADA.inet.0: 5 destinations, 6 routes (5 active, 0 holddown, 0 hidden)

+ = Active Route, - = Last Active, * = Both

```
192.168.200.0/24  *[Direct/0] 1w2d 21:03:55
                  > via t1-1/0/2.0
                  [OSPF/10] 1w2d 21:03:52, metric 65
                  > via t1-1/0/2.0
192.168.200.1/32  *[Local/0] 1w2d 21:04:01
                  Local via t1-1/0/2.0
192.168.201.0/24  *[OSPF/10] 1w2d 21:03:42, metric 65
                  > via t1-1/0/2.0
192.168.201.1/32  *[OSPF/10] 1w2d 21:03:42, metric 65
                  > via t1-1/0/2.0
224.0.0.5/32     *[OSPF/10] 1w2d 21:04:02, metric 1
                  MultiRecv
```

PETER, WE NEED TO ADD CLASS OF SERVICE CONFIGURATION, EITHER HERE OR AS A SEPARATE PROCEDURE.

3.3 Provision New CE Site (Multiple Physical Interfaces, Static Routing)

Overview	
Purpose	Use this procedure to provision a new CE site that is connected to the PE via a multilink bundle and MLPPP using static routing.
Related files	• Technical Specifications Master • Network Diagram (for specific VPN) • Router configuration file (resident on PE router)
Skills/Software	• Edit router configuration file using Junos CLI and basic Junos commands • Edit OmniGraffle file (to update the Network Diagram) • Edit Excel file (to update the Technical Specifications Master)
Procedure time	90 minutes
Risk Level	Low

Needed Information (Obtain from System Administrator at CE Site)		
Parameter	Value	Description
VPN name	SCADA, ACCOUNT, LIBRARY, GILBERT, PHOENIX or new VPN	The VPN associated with the site where the new CE is being provisioned, for example, SCADA.
T1 count	Integer	The number of T1 lines to be bundled into a single logical multilink interface
Subnet address	IP address	The IP address for the PE-CE subnet, for example, 192.168.200.1/24
Routes	IP address	IP addresses of subnets that require static routes on PE router

A. Allocate PE Router Resources				
Step	Procedure			
1	Allocate the logical multilink interface and update the Technical Specifications Master.			
	***** EXAMPLE *****			
	Interface	Description	Local Addr.	Remote Addr.
	.	.	.	.
	Isq-0/0/0.2	"SCADA: jnpr.m10i.crs-01 -to- Scada-NWP"	10.6.11.182/30	10.6.11.181
	Isq-0/0/0.3	"SCADA: jnpr.m10i.crs-01 -to- NWP"	10.6.11.182/30	10.6.11.181
2	Allocate physical interfaces on the PE router and update the Technical Specifications Master.			
	***** EXAMPLE *****			
	Interface	Description		
	t1-1/0/0	Lab		
	t1-1/0/1	Lab		
	t1-1/0/2	"SCADA: jnpr.m10i.crs-01 -to- NWP (1 of 2 MLPPP) Bundle Isq-0/0/0.3"		
	t1-1/0/3	"SCADA: jnpr.m10i.crs-01 -to- NWP (2 of 2 MLPPP) Bundle Isq-0/0/0.3"		
3	Add the new interface assignment to the Network Diagram corresponding to the VPN, for example, SCADA-North.			

B: Edit the PE Router Configuration File	
Step	Procedure
1	Update the interface description. Format is: VPN: local router name –to- remote router name, physical number in multilink bundle, remote router interface.
2	Assign each physical interface to a logical MLPPP bundle.
	***** EXAMPLE (STEPS 1 & 2) ***** <pre> interfaces { . . ct1-1/0/2 { no-partition interface-type t1; } t1-1/0/2 { description "SCADA: jnpr.m10i.crs-01 -to- NWP (1 of 2 MLPPP) Bundle lsq-0/0/0.3"; unit 0 { family mlppp { bundle lsq-0/0/0.3; } } } ct1-1/0/3 { no-partition interface-type t1; } t1-1/0/3 { description "SCADA: jnpr.m10i.crs-01 -to- NWP (2 of 2 MLPPP) Bundle lsq-0/0/0.3"; unit 0 { family mlppp { bundle lsq-0/0/0.3; } } } } </pre>

B: Edit the PE Router Configuration File	
3	Configure the multilink bundle interface by adding the description tag for the link connection (VPN: local router name –to- remote router name) and the IP address. Be sure to use the correct unit number allocated earlier. ***** EXAMPLE ***** <pre>lsq-0/0/0 { unit 2 { description "CORE: jnpr.m10i.crs-01 -to- jnpr.m10i.fal-01 interface lsq-0/0/0.2"; family inet { address 10.200.2.5/30; } family mpls; } unit 3 { description "SCADA: jnpr.m10i.crs-01 -to- NWP"; family inet { address 10.6.11.182/30; } } }</pre>
4	Add the PE logical interface to the appropriate VRF template. ***** EXAMPLE ***** <pre>routing-instances { : : VRF-SCADA { instance-type vrf; interface lsq-0/0/0.3;</pre>
5	Configure the static routes. ***** EXAMPLE ***** <pre>routing-instances { : : VRF-SCADA { : : routing-options { static { route 172.16.20.0/24 next-hop lsq-0/0/0.3; route 172.16.19.0/24 next-hop lsq-0/0/0.3;</pre>

C: Check and Commit Configuration	
Step	Procedure
1	Check the configuration file with the Junos command <i>commit check</i>. ***** EXAMPLE ***** pschmalz@jnpr.m10i.crs-01.mesaaz.gov# commit check configuration check succeeds
2	If the check succeeds, apply configuration with the Junos command <i>commit</i>. (If errors were reported, find and fix, then repeat step 1.) ***** EXAMPLE ***** pschmalz@jnpr.m10i.crs-01.mesaaz.gov# commit commit complete

D: Validate the Configuration	
Step	Procedure
1	Verify <u>each</u> physical interface in the multilink bundle using the Junos command <code>run show interfaces extensive</code>. (See Notes in example below): A. Interface status: Enabled, Physical link is UP B. Link type: Multilink-PPP C. Link speed: Matches speed of physical interface (T1) D. LCP state: Opened E. Traffic statistics: Should be input and output activity F. Input errors: Should be 0 errors G. Link protocol: Mlppp protocol, check lsq assignment, mlppp protocol ***** EXAMPLE ***** <pre>pschmalz@jnpr.m10i.crs-01.mesaaz.gov# run show interfaces t1-1/0/2 extensive Physical interface: t1-0/0/2, Note A Enabled, Physical link is Up : Note B Link-level type: Multilink-PPP, MTU: 4474, Clocking: Internal, Note C Speed: T1, Loopback: None, FCS: 16, Mode: C/Bit parity, : Note D LCP state: Opened : Note E Traffic statistics: Input bytes : 693362419 24 bps Output bytes : 720007682 0 bps Input packets: 8503859 0 pps Output packets: 8570414 0 pps : Note F Input errors: Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Bucket drops: 0, Policed discards: 0, L3 incompletes: 0, L2 channel errors: 1, : Note G Protocol mlppp, Multilink bundle: lsq-0/0/0.3, MTU: 4470, Generation: 201, Route table: 0</pre>

D: Validate the Configuration

2

Verify the logical interface using the Junos command *run show interfaces statistics*. (See **Notes** in example below):

A. Links active: Active links should equal total in bundle

B. Link balance: Total frames evenly divided among all active links

***** EXAMPLE *****

pschmalz@jnpr.m10i.crs-01.mesaaz.gov# **run show interfaces lsq-0/0/0.3 statistics**

Logical interface lsq-0/0/0.3 (Index 70) (SNMP ifIndex 187)

:

Bundle links information:

Note A Active bundle links 2

Removed bundle links 0

Disabled bundle links 0

Statistics	Frames	fps	Bytes	bps
------------	--------	-----	-------	-----

Bundle:

Multilink:

Input :	Note B	20	0	1716	0
---------	---------------	----	---	------	---

Output:		20	0	1768	0
---------	--	----	---	------	---

Network:

Input :	20	0	1596	0
---------	----	---	------	---

Output:	20	0	1708	0
---------	----	---	------	---

Link:

T1-1/0/2.0

Up time: 2w3d 20:17

Input :	Note B	10	0	844	0
---------	---------------	----	---	-----	---

Output:		10	0	862	0
---------	--	----	---	-----	---

T1-1/0/3.0

Up time: 2w3d 20:17

Input :	Note B	10	0	872	0
---------	---------------	----	---	-----	---

Output:		10	0	906	0
---------	--	----	---	-----	---

3

Verify next-hops assigned to logical link using the Junos command *run show route* for each static route.

***** EXAMPLE *****

pschmalz@jnpr.m10i.crs-01.mesaaz.gov# **run show route 172.16.20.0/24 VRF-ACCOUNT.inet.0**: 3 destinations, 4 routes (3 active, 0 holddown, 0 hidden)

+ = Active Route, - = Last Active, * = Both

172.16.20.0/24 ***[Static/5]** 1w2d 21:09:19

> **via lsq-0/0/0.3**

3.4 Provision New CE Site (Multiple Physical Interfaces, OSPF Routing)

Overview	
Purpose	Use this procedure to provision a new CE site that is connected to the PE via a multilink bundle and MLPPP using OSPF routing.
Related files	• Technical Specifications Master • Network Diagram (for specific VPN) • Router configuration file (resident on PE router)
Skills/Software	• Edit router configuration file using Junos CLI and basic Junos commands • Edit OmniGraffle file (to update the Network Diagram) • Edit Excel file (to update the Technical Specifications Master)
Procedure time	90 minutes
Risk Level	Moderate

Needed Information (Obtain from System Administrator at CE Site)		
Parameter	Value	Description
VPN name	SCADA, ACCOUNT, LIBRARY, GILBERT, PHOENIX or new VPN	The VPN associated with the site where the new CE is being provisioned, for example, SCADA.
T1 count	Integer	The number of T1 lines to be bundled into a single logical multilink interface
Subnet address	IP address	The IP address for the PE-CE subnet, for example, 192.168.200.1/24
OSPF area ID	Area ID	OSPF area ID value for new link

A. Allocate PE Router Resources																				
Step	Procedure																			
1	Allocate the logical multilink interface and update the Technical Specifications Master.																			
	***** EXAMPLE *****																			
	<table><tr><th>Interface</th><th>Description</th><th>Local Addr.</th><th>Remote Addr.</th></tr><tr><td>.</td><td>.</td><td>.</td><td>.</td></tr><tr><td>Isq-0/0/0.2</td><td>"SCADA: jnpr.m10i.crs-01 -to- Scada-NWP"</td><td>10.6.11.182/30</td><td>10.6.11.181</td></tr><tr><td>Isq-0/0/0.3</td><td>"SCADA: jnpr.m10i.crs-01 -to- NWP"</td><td>10.6.11.182/30</td><td>10.6.11.181</td></tr></table>				Interface	Description	Local Addr.	Remote Addr.	.	.	.	.	Isq-0/0/0.2	"SCADA: jnpr.m10i.crs-01 -to- Scada-NWP"	10.6.11.182/30	10.6.11.181	Isq-0/0/0.3	"SCADA: jnpr.m10i.crs-01 -to- NWP"	10.6.11.182/30	10.6.11.181
	Interface	Description	Local Addr.	Remote Addr.																
	.	.	.	.																
Isq-0/0/0.2	"SCADA: jnpr.m10i.crs-01 -to- Scada-NWP"	10.6.11.182/30	10.6.11.181																	
Isq-0/0/0.3	"SCADA: jnpr.m10i.crs-01 -to- NWP"	10.6.11.182/30	10.6.11.181																	
2	Allocate physical interfaces on the PE router and update the Technical Specifications Master.																			
	***** EXAMPLE *****																			
	<table><tr><th>Interface</th><th>Description</th></tr><tr><td>t1-1/0/0</td><td>Lab</td></tr><tr><td>t1-1/0/1</td><td>Lab</td></tr><tr><td>t1-1/0/2</td><td>"SCADA: jnpr.m10i.crs-01 -to- NWP (1 of 2 MLPPP) Bundle Isq-0/0/0.3"</td></tr><tr><td>t1-1/0/3</td><td>"SCADA: jnpr.m10i.crs-01 -to- NWP (2 of 2 MLPPP) Bundle Isq-0/0/0.3"</td></tr></table>				Interface	Description	t1-1/0/0	Lab	t1-1/0/1	Lab	t1-1/0/2	"SCADA: jnpr.m10i.crs-01 -to- NWP (1 of 2 MLPPP) Bundle Isq-0/0/0.3"	t1-1/0/3	"SCADA: jnpr.m10i.crs-01 -to- NWP (2 of 2 MLPPP) Bundle Isq-0/0/0.3"						
	Interface	Description																		
	t1-1/0/0	Lab																		
t1-1/0/1	Lab																			
t1-1/0/2	"SCADA: jnpr.m10i.crs-01 -to- NWP (1 of 2 MLPPP) Bundle Isq-0/0/0.3"																			
t1-1/0/3	"SCADA: jnpr.m10i.crs-01 -to- NWP (2 of 2 MLPPP) Bundle Isq-0/0/0.3"																			
3	Add the new interface assignment to the Network Diagram corresponding to the VPN, for example, SCADA-North.																			

B: Edit the PE Router Configuration File	
Step	Procedure
1	Update the interface description. Format is: VPN: local router name –to- remote router name, physical number in multilink bundle, remote router interface.
2	Assign each physical interface to a logical MLPPP bundle.
	***** EXAMPLE (STEPS 1 & 2) ***** <pre> interfaces { . . ct1-1/0/2 { no-partition interface-type t1; } t1-1/0/2 { description "SCADA: jnpr.m10i.crs-01 -to- NWP (1 of 2 MLPPP) Bundle lsq-0/0/0.3"; unit 0 { family mlppp { bundle lsq-0/0/0.3; } } } ct1-1/0/3 { no-partition interface-type t1; } t1-1/0/3 { description "SCADA: jnpr.m10i.crs-01 -to- NWP (2 of 2 MLPPP) Bundle lsq-0/0/0.3"; unit 0 { family mlppp { bundle lsq-0/0/0.3; } } } } </pre>

B: Edit the PE Router Configuration File	
3	Configure the multilink bundle interface by adding the description tag for the link connection (VPN: local router name –to- remote router name) and the IP address. Be sure to use the correct unit number allocated earlier. ***** EXAMPLE ***** <pre> lsq-0/0/0 { unit 2 { description "CORE: jnpr.m10i.crs-01 -to- jnpr.m10i.fal-01 interface lsq-0/0/0.2"; family inet { address 10.200.2.5/30; } family mpls; } unit 3 { description "SCADA: jnpr.m10i.crs-01 -to- NWP"; family inet { address 10.6.11.182/30; } } } </pre>
4	Add the PE logical interface to the appropriate VRF template. ***** EXAMPLE ***** <pre> routing-instances { : : VRF-SCADA { instance-type vrf; interface lsq-0/0/0.3; } } </pre>
5	Add the OSPF area ID. ***** EXAMPLE ***** <pre> routing-instances { : : VRF-SCADA { : protocols { ospf { export bgp-to-ospf; area 0.0.0.0 { interface lsq-0/0/0.3; } } } } } </pre>

C: Check and Commit Configuration	
Step	Procedure
1	Check the configuration file with the Junos command <i>commit check</i>. ***** EXAMPLE ***** pschmalz@jnpr.m10i.crs-01.mesaaz.gov# commit check configuration check succeeds
2	If the check succeeds, apply configuration with the Junos command <i>commit</i>. (If errors were reported, find and fix, then repeat step 1.) ***** EXAMPLE ***** pschmalz@jnpr.m10i.crs-01.mesaaz.gov# commit commit complete

D: Validate the Configuration	
Step	Procedure
1	Verify <u>each</u> physical interface in the multilink bundle using the Junos command <code>run show interfaces extensive</code>. (See Notes in example below): A. Interface status: Enabled, Physical link is UP B. Link type: Multilink-PPP C. Link speed: Matches speed of physical interface (T1) D. LCP state: Opened E. Traffic statistics: Should be input and output activity F. Input errors: Should be 0 errors G. Link protocol: mlppp protocol, check lsq assignment ***** EXAMPLE ***** <pre>pschmalz@jnpr.m10i.crs-01.mesaaz.gov# run show interfaces t1-1/0/2 extensive Physical interface: t1-0/0/2, Note A Enabled, Physical link is Up : Note B Link-level type: Multilink-PPP, MTU: 4474, Clocking: Internal, Note C Speed: T1, Loopback: None, FCS: 16, Mode: C/Bit parity, : Note D LCP state: Opened : Note E Traffic statistics: Input bytes : 693362419 24 bps Output bytes : 720007682 0 bps Input packets: 8503859 0 pps Output packets: 8570414 0 pps : Note F Input errors: Errors: 0, Drops: 0, Framing errors: 0, Runts: 0, Giants: 0, Bucket drops: 0, Policed discards: 0, L3 incompletes: 0, L2 channel errors: 1, : Note G Protocol mlppp, Multilink bundle: lsq-0/0/0.3, MTU: 4470, Generation: 201, Route table: 0</pre>

D: Validate the Configuration

- 2 Verify the logical interface using the Junos command *run show interfaces statistics*. (See **Notes** in example below):
- A. Links active: Active links should equal total in bundle
 - B. Link balance: Total frames evenly divided among all active links
- ***** EXAMPLE *****
- pschmalz@jnpr.m10i.crs-01.mesaaz.gov# **run show interfaces lsq-0/0/0.3 statistics**
- Logical interface lsq-0/0/0.3 (Index 70) (SNMP ifIndex 187)
- :
- Bundle links information:
- Note A** **Active bundle links** **2**
- Removed bundle links 0
- Disabled bundle links 0
- | Statistics | Frames | fps | Bytes | bps |
|---------------------|-------------------------|----------|-------------|----------|
| Bundle: | | | | |
| Multilink: | | | | |
| Input : | Note B 20 | 0 | 1716 | 0 |
| Output: | 20 | 0 | 1768 | 0 |
| Network: | | | | |
| Input : | 20 | 0 | 1596 | 0 |
| Output: | 20 | 0 | 1708 | 0 |
| Link: | | | | |
| T1-1/0/2.0 | | | | |
| Up time: 2w3d 20:17 | | | | |
| Input : | Note B 10 | 0 | 844 | 0 |
| Output: | 10 | 0 | 862 | 0 |
| T1-1/0/3.0 | | | | |
| Up time: 2w3d 20:17 | | | | |
| Input : | Note B 10 | 0 | 872 | 0 |
| Output: | 10 | 0 | 906 | 0 |
- 3 Verify OSPF neighbor state is Full using the Junos command *run show ospf*.
- ***** EXAMPLE *****
- pschmalz@jnpr.m10i.crs-01.mesaaz.gov# **run show ospf neighbor instance VRF-SCADA**
- | Address | Interface | State | ID | Pri | Dead |
|---------------|-------------|-------------|---------------|-----|------|
| 192.168.200.2 | lsq-0/0/0.3 | Full | 192.168.201.1 | 128 | 31 |

D: Validate the Configuration

4

Verify routes are being added to the VRF routing table using the Junos command *run show route table*.

***** EXAMPLE *****

pschmalz@jnpr.m10i.crs-01.mesaaz.gov# **run show route table VRF-SCADA**

VRF-SCADA.inet.0: 5 destinations, 6 routes (5 active, 0 holddown, 0 hidden)

+ = Active Route, - = Last Active, * = Both

```
192.168.200.0/24  *[Direct/0] 1w2d 21:03:55
                  > via lsq-0/0/0.3
                  [OSPF/10] 1w2d 21:03:52, metric 65
                  > via lsq-0/0/0.3
192.168.200.1/32  *[Local/0] 1w2d 21:04:01
                  Local via lsq-0/0/0.3
192.168.201.0/24  *[OSPF/10] 1w2d 21:03:42, metric 65
                  > via lsq-0/0/0.3
192.168.201.1/32  *[OSPF/10] 1w2d 21:03:42, metric 65
                  > via lsq-0/0/0.3
224.0.0.5/32     *[OSPF/10] 1w2d 21:04:02, metric 1
                  MultiRecv
```

3.5 Provision New VPN

Peter to provide source information

Overview	
Purpose	.
Related files	
Skills/Software	
Procedure time	
Risk level	

4 Network Monitoring

This section describes procedures for monitoring the state of the core network during normal operations. These procedures can also be useful during troubleshooting, as described in Chapter 5.

4.1 Check Network Node Alarms

Purpose	Use this procedure to check alarms on the local network node.
Related files	Juniper JUNOS documentation @ www.juniper.net
Skills/Software	Edit router configuration file using Junos CLI and basic Junos commands
Procedure time	10 minutes
Risk level	Low
Procedure	Use Junos <i>run show chassis alarms</i> command to check alarms on the local network node. Alarms are time stamped, organized by class, with brief descriptions. ***** EXAMPLE ***** <pre>pschmalz@jnpr.m10i.swp-01.mesaaz.gov# run show chassis alarms 1 alarms currently active Alarm time Class Description 2009-11-30 22:28:32 UTC Major Host 1 fxp0:Ethernet Link Down</pre>

4.2 Monitor Router CPU Utilization

Purpose	Use this procedure to monitor CPU utilization on a specific network node when troubleshooting scaling and node alarm issues.
Related files	Juniper JUNOS documentation @ www.juniper.net
Skills/Software	Edit router configuration file using Junos CLI and basic Junos commands
Procedure time	10 minutes
Risk level	Low
Procedure	Use the <i>run show chassis routing-engine</i> command to gather CPU utilization statistics. ***** EXAMPLE ***** <pre> pschmalz@jnpr.m10i.swp-01.mesaaz.gov# run show chassis routing-engine Routing Engine status: Slot 0: Current state Master Election priority Master (default) Temperature 26 degrees C / 78 degrees F CPU temperature 23 degrees C / 73 degrees F DRAM 768 MB Memory utilization 45 percent CPU utilization: User 0 percent Background 0 percent Kernel 3 percent Interrupt 0 percent Idle 96 percent </pre>

4.3 Monitor Router Memory Consumption

Purpose	Use this procedure to monitor memory consumption on a specific network node when troubleshooting scaling or node alarm issues.
Related files	Juniper JUNOS documentation @ www.juniper.net
Skills/Software	Edit router configuration file using Junos CLI and basic Junos commands
Procedure time	10 minutes
Risk level	Low
Procedure	Use the <code>run show chassis routing-engine</code> command to gather memory consumption statistics. ***** EXAMPLE ***** <pre> pschmalz@jnpr.m10i.swp-01.mesaaz.gov# run show chassis routing-engine Routing Engine status: Slot 0: Current state Master Election priority Master (default) Temperature 26 degrees C / 78 degrees F CPU temperature 23 degrees C / 73 degrees F DRAM 768 MB Memory utilization 45 percent CPU utilization: User 0 percent Background 0 percent Kernel 3 percent Interrupt 0 percent Idle 96 percent Model RE-5.0 Serial ID 9009034804 Start time 2009-11-30 22:26:28 UTC Uptime 83 days, 22 hours, 47 minutes, 24 seconds Last reboot reason Router rebooted after a normal shutdown. Load averages: 1 minute 5 minute 15 minute 0.00 0.02 0.00 </pre>

4.4 Monitor PIC CPU Utilization and Memory Consumption

Purpose	Use this procedure to monitor CPU utilization and memory consumption for a specific PIC card within a network node.
Related files	Juniper JUNOS documentation @ www.juniper.net
Skills/Software	Edit router configuration file using Junos CLI and basic Junos commands
Procedure time	10 minutes
Risk level	Low
Procedure	Use the run <i>show chassis pic pic-slot fpc-slot</i> command to gather CPU utilization and memory consumption statistics for a specific PIC card. ***** EXAMPLE ***** <pre> pschmalz@jnpr.m10i.swp-01.mesaaz.gov# run show chassis pic pic- slot 1 fpc-slot 1 FPC slot 1, PIC slot 1 information: Type 4x 1GE(LAN), IQ2E State Online PIC version 0.6 CPU load average 1 percent Interrupt load average 0 percent Total DRAM size 128 MB Memory buffer utilization 48 percent Memory heap utilization 25 percent Uptime 83 days, 22 hours, 46 minutes, 12 seconds </pre>

4.5 Monitor Router Environmental Statistics

Purpose	Use this procedure to monitor environmental node alarms. This command will display the power, temperature, and fan status of the system.																																																																																												
Related files	Juniper JUNOS documentation @ www.juniper.net																																																																																												
Skills/Software	Edit router configuration file using Junos CLI and basic Junos commands																																																																																												
Procedure time	10 minutes																																																																																												
Risk level	Low																																																																																												
Procedure	Use the <i>run show chassis environment</i> command to gather routing engine environmental statistics such as routing engine temperature, power supply, and fan status. ***** EXAMPLE ***** <pre>pschmalz@jnpr.m10i.swp-01.mesaaz.gov# run show chassis environment</pre> <table><thead><tr><th>Class</th><th>Item</th><th>Status</th><th>Measurement</th></tr></thead><tbody><tr><td>Power</td><td>Power Supply 0</td><td>OK</td><td></td></tr><tr><td></td><td>Power Supply 1</td><td>OK</td><td></td></tr><tr><td></td><td>Power Supply 2</td><td>OK</td><td></td></tr><tr><td></td><td>Power Supply 3</td><td>Absent</td><td></td></tr><tr><td>Temp</td><td>Intake</td><td>OK</td><td>22 degrees C / 71 degrees F</td></tr><tr><td></td><td>FPC 0</td><td>OK</td><td>27 degrees C / 80 degrees F</td></tr><tr><td></td><td>FPC 1</td><td>OK</td><td>28 degrees C / 82 degrees F</td></tr><tr><td></td><td>Lower Power Supplies</td><td>OK</td><td>27 degrees C / 80 degrees F</td></tr><tr><td></td><td>Upper Power Supplies</td><td>OK</td><td>28 degrees C / 82 degrees F</td></tr><tr><td></td><td>CFEB Intake</td><td>OK</td><td>33 degrees C / 91 degrees F</td></tr><tr><td></td><td>CFEB Exhaust</td><td>OK</td><td>33 degrees C / 91 degrees F</td></tr><tr><td></td><td>Routing Engine 0</td><td>OK</td><td>26 degrees C / 78 degrees F</td></tr><tr><td></td><td>Routing Engine 1</td><td>OK</td><td>26 degrees C / 78 degrees F</td></tr><tr><td>Fans</td><td>Fan Tray 0</td><td>Absent</td><td></td></tr><tr><td></td><td>Fan Tray 1 Fan 1</td><td>OK</td><td>Spinning at normal speed</td></tr><tr><td></td><td>Fan Tray 1 Fan 2</td><td>OK</td><td>Spinning at normal speed</td></tr><tr><td></td><td>Fan Tray 1 Fan 3</td><td>OK</td><td>Spinning at normal speed</td></tr><tr><td></td><td>Fan Tray 1 Fan 4</td><td>OK</td><td>Spinning at normal speed</td></tr><tr><td></td><td>Fan Tray 1 Fan 5</td><td>OK</td><td>Spinning at normal speed</td></tr><tr><td></td><td>Fan Tray 1 Fan 6</td><td>OK</td><td>Spinning at normal speed</td></tr><tr><td></td><td>Fan Tray 1 Fan 7</td><td>OK</td><td>Spinning at normal speed</td></tr><tr><td></td><td>Fan Tray 1 Fan 8</td><td>OK</td><td>Spinning at normal speed</td></tr></tbody></table>	Class	Item	Status	Measurement	Power	Power Supply 0	OK			Power Supply 1	OK			Power Supply 2	OK			Power Supply 3	Absent		Temp	Intake	OK	22 degrees C / 71 degrees F		FPC 0	OK	27 degrees C / 80 degrees F		FPC 1	OK	28 degrees C / 82 degrees F		Lower Power Supplies	OK	27 degrees C / 80 degrees F		Upper Power Supplies	OK	28 degrees C / 82 degrees F		CFEB Intake	OK	33 degrees C / 91 degrees F		CFEB Exhaust	OK	33 degrees C / 91 degrees F		Routing Engine 0	OK	26 degrees C / 78 degrees F		Routing Engine 1	OK	26 degrees C / 78 degrees F	Fans	Fan Tray 0	Absent			Fan Tray 1 Fan 1	OK	Spinning at normal speed		Fan Tray 1 Fan 2	OK	Spinning at normal speed		Fan Tray 1 Fan 3	OK	Spinning at normal speed		Fan Tray 1 Fan 4	OK	Spinning at normal speed		Fan Tray 1 Fan 5	OK	Spinning at normal speed		Fan Tray 1 Fan 6	OK	Spinning at normal speed		Fan Tray 1 Fan 7	OK	Spinning at normal speed		Fan Tray 1 Fan 8	OK	Spinning at normal speed
Class	Item	Status	Measurement																																																																																										
Power	Power Supply 0	OK																																																																																											
	Power Supply 1	OK																																																																																											
	Power Supply 2	OK																																																																																											
	Power Supply 3	Absent																																																																																											
Temp	Intake	OK	22 degrees C / 71 degrees F																																																																																										
	FPC 0	OK	27 degrees C / 80 degrees F																																																																																										
	FPC 1	OK	28 degrees C / 82 degrees F																																																																																										
	Lower Power Supplies	OK	27 degrees C / 80 degrees F																																																																																										
	Upper Power Supplies	OK	28 degrees C / 82 degrees F																																																																																										
	CFEB Intake	OK	33 degrees C / 91 degrees F																																																																																										
	CFEB Exhaust	OK	33 degrees C / 91 degrees F																																																																																										
	Routing Engine 0	OK	26 degrees C / 78 degrees F																																																																																										
	Routing Engine 1	OK	26 degrees C / 78 degrees F																																																																																										
Fans	Fan Tray 0	Absent																																																																																											
	Fan Tray 1 Fan 1	OK	Spinning at normal speed																																																																																										
	Fan Tray 1 Fan 2	OK	Spinning at normal speed																																																																																										
	Fan Tray 1 Fan 3	OK	Spinning at normal speed																																																																																										
	Fan Tray 1 Fan 4	OK	Spinning at normal speed																																																																																										
	Fan Tray 1 Fan 5	OK	Spinning at normal speed																																																																																										
	Fan Tray 1 Fan 6	OK	Spinning at normal speed																																																																																										
	Fan Tray 1 Fan 7	OK	Spinning at normal speed																																																																																										
	Fan Tray 1 Fan 8	OK	Spinning at normal speed																																																																																										

4.6 Display Router Hardware Inventory and Serial Numbers

Purpose	Use this procedure to get inventory and serial number information of the chassis, and all PIC cards installed in the chassis.
Related files	Juniper JUNOS documentation @ www.juniper.net
Skills/Software	Edit router configuration file using Junos CLI and basic Junos commands
Procedure time	10 minutes
Risk level	Low
Procedure	Use the <i>run show chassis hardware</i> command to get inventory and serial number information of the chassis, and all PIC cards installed in the chassis. ***** EXAMPLE ***** <pre>pschmalz@jnpr.m10i.swp-01.mesaaz.gov# run show chassis hardware Hardware inventory: Item Version Part number Serial number Description Chassis J6900 Midplane REV 08 710-008920 AAAS7064 M10i Midplane Power Supply 0 Rev 06 740-008985 VJ55282 DC Power Supply Power Supply 1 Rev 06 740-008985 VJ55337 DC Power Supply Power Supply 2 Rev 06 740-008985 VH52605 DC Power Supply HCM 0 REV 06 710-010580 AAAS7153 M10i HCM HCM 1 REV 06 710-010580 AAAS7186 M10i HCM Routing Engine 0 REV 02 740-021833 9009034804 RE-5.0 Routing Engine 1 REV 02 740-021833 9009034862 RE-5.0 CFEB 0 REV 12 750-023594 AAAT1366 Enhanced CFEB CFEB 1 N/A N/A N/A Backup FPC 0 E-FPC PIC 0 REV 16 750-014895 AAASV0650 MultiServices 100 PIC 2 REV 11 750-002963 AAASK0362 4x T3 FPC 1 E-FPC PIC 0 REV 06 750-012501 AAAT6771 10x CHT1 IQ PIC 1 REV 06 750-024781 AAAP4284 4x 1GE(LAN), IQ2E PIC 2 REV 11 750-002963 AAASV0034 4x T3 Fan Tray 1 Rear Right Fan Tray</pre>

4.7 Display Router Software Version

Purpose	Use this procedure to check the current software revision running on a network node.
Related files	Juniper JUNOS documentation @ www.juniper.net
Skills/Software	Edit router configuration file using Junos CLI and basic Junos commands
Procedure time	10 minutes
Risk level	Low
Procedure	Use the <i>run system software</i> command to get the current software revision on the network node. ***** EXAMPLE ***** <pre>pschmalz@jnpr.m10i.swp-01.mesaaz.gov# run show system software Information for jbase: Comment: JUNOS Base OS Software Suite [9.6R1.13] Information for jcrypto: Comment: JUNOS Crypto Software Suite [9.6R1.13] Information for jdocs: Comment: JUNOS Online Documentation [9.6R1.13] Information for jkernel: Comment: JUNOS Kernel Software Suite [9.6R1.13] Information for jpfe: Comment: JUNOS Packet Forwarding Engine Support (M7i/M10i) [9.6R1.13]</pre> <i>Display listing continued next page</i> <pre>Information for jpfe-common: Comment: JUNOS Packet Forwarding Engine Support (M/T Common) [9.6R1.13]</pre>

	Information for jroute: Comment: JUNOS Routing Software Suite [9.6R1.13] Information for jservices-aacl: Comment: JUNOS Services AAACL Container package [9.6R1.13] Information for jservices-appid: Comment: JUNOS AppId Services [9.6R1.13] Information for jservices-bgf: Comment: JUNOS Border Gateway Function package [9.6R1.13] Information for jservices-idp: JUNOS IDP Services [9.6R1.13] Information for jservices-llpdf: Comment: JUNOS Services LL-PDF Container package [9.6R1.13] Information for jservices-sfw: Comment: JUNOS Services Stateful Firewall [9.6R1.13] Information for jservices-voice: Comment: JUNOS Voice Services Container package [9.6R1.13] Information for junos: Comment: JUNOS Base OS boot [9.6R1.13]
--	--

5 Troubleshooting

This section provides basic troubleshooting information for common connectivity and network problems. When using these procedures, always document your findings to help in case of escalation to Torrey Point.

5.1 Problem: Intermittent/No Connectivity between Core Routers

Peter provided source information, Ed will write up

5.2 Problem: Intermittent/No Connectivity between Sites

Peter to provide source information