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Routing Issues: QoS/CoS

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Agenda: QoS/CoS Workshop

- Module 1: Overview of QoS/CoS
- Module 2: JUNOS QoS implementation (J/M/T-Series)
- Module 3: Introduction to JUNOS CLI
- Module 4: GEANT2 QoS services Implementation
Module 3: JUNOS CLI Outline

- Overview and objectives
- Connecting to a Juniper Networks M-Series router
- JUNOS CLI Overview
- JUNOS Operational Mode
- JUNOS Configuration Mode
- System Debugging and Troubleshooting
- Additional Information
Overview and objectives

- This presentation is meant to establish a basic understanding of the JUNOS operating system Command Line Interface (CLI)
- Similarities exist between JUNOS and Cisco’s IOS
- Modular structure takes JUNOS to the next level for ease of configuration
- Additional features have been implemented for configuration verification
Overview and Objectives

- This overview is not intended as a substitute for Juniper Networks’ Technical Education Courses. These courses are recommended for anyone that has responsibility for configuration and management of Juniper Networks routers.

- For complete course information, please refer to Juniper Networks website: www.juniper.net/support/training/
Assumptions and Prerequisites

- Experience managing and configuring routers
- Understanding of IP addressing and subnetting
- Understanding of IP routing protocols
  - Ex. OSPF, IS-IS, BGP4
- Physical access to the router console port
- JUNOS version 5.1 or later
- Access to JUNOS documentation and Quick Reference Guides
- New, non-configured Juniper Network router
JUNOS CLI Outline

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Accessing the Juniper Networks Router

- **Command Line Interface (CLI) access**
  - Console port
  - Auxiliary port
  - Out-of-band Ethernet port

- **Console cable (9-pin male to 9-pin female) shipped with router**

- **Communications application (ex Hyperterminal)**
  - Settings are 9600, 8, N, 1 with VT100 terminal emulation

- **Initial boot-up basic configuration**

- **Initiate the Command Line Interface**
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CLI Overview

- Command Line Interface access
  - Router console port
  - Network access via SSH or Telnet
- Simple to use, text-based command interface
- Various commands for configuring JUNOS and Monitoring/Troubleshooting software, hardware, and network connectivity
- JUNOS supports two modes
  - Operational Mode
  - Configuration Mode
- CLI Command Hierarchy
CLI Overview – Help

- Provides context sensitive (Operational or Configuration mode) help at any level of the hierarchy

```
juniper@host> ?
  juniper@host > show ?
  juniper@host > show system ?

[edit]
  juniper@host#> set protocols bgp ?
```
CLI Overview – Command Completion

- Allows completion of commands without requiring user to recall entire syntax

- Applies to filenames, usernames, configuration dependant policies, firewall filters, etc.

- Use Space or tab
  - show version
  - show ver [press space or tab]  =>  show version
Juniper Networks Documentation Set is Online

- Help topic ?
- Help reference ?
CLI Overview – CLI Messages

- Messages appear when you:
  - Enter or exit from configuration mode
  - Commit a configuration
  - Type a string or value that is not valid

- Invalid string a message "syntax error" or "unknown command" appears with a caret (^) indicating error location

```
user@host> clear route
^ syntax error, expecting <command>.
```

- CLI may display commands available to correct the syntax error

```
[edit]
user@host# load myconfig-file <Enter>
`override', or `replace'.
^ syntax error, expecting `merge',
```
CLI Overview – Hierarchy Movement

- Keyboard command sequences (Unix Emacs) for line commands and viewing recently used commands

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ctrl-U</td>
<td>Erase Line</td>
</tr>
<tr>
<td>Ctrl-W</td>
<td>Erase word</td>
</tr>
<tr>
<td>Ctrl-A / Ctrl-E</td>
<td>Goto Beginning/ End of line</td>
</tr>
<tr>
<td>Crtl-L</td>
<td>Redraw line</td>
</tr>
<tr>
<td>Ctrl-F</td>
<td>Forward</td>
</tr>
<tr>
<td>Ctrl-B</td>
<td>Backwards</td>
</tr>
<tr>
<td>delete/ backspace</td>
<td>Delete char before cursor</td>
</tr>
</tbody>
</table>
CLI Overview – Command output

- All output in Junos is Unix “less”
  - just like “more” but with additional options
- Output does not scroll off the screen

<table>
<thead>
<tr>
<th>/ string – search</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>n - repeat search</td>
<td>Enter - line</td>
</tr>
<tr>
<td>q - quit</td>
<td>h - help</td>
</tr>
<tr>
<td>b - previous screen</td>
<td>N - full listing</td>
</tr>
<tr>
<td>space - next screen</td>
<td>G - End of file</td>
</tr>
<tr>
<td>s - filename</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(saves in user default directory / var/ home/ user)</td>
</tr>
</tbody>
</table>

Example:
```
show interfaces / lo0
```
CLI Overview – Command History

- Command history for CLI and configure mode
  - Up / Down arrow (VT100)
  - (Ctrl-P / Ctrl-N)

- show cli history (CLI mode only)
  - Default is to show last 100 commands
  - <count> Maximum number of commands to display
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Operational Mode – Overview

- Initial mode following successful login

<table>
<thead>
<tr>
<th>Various Commands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlling the CLI</td>
</tr>
<tr>
<td>Monitoring and Troubleshooting</td>
</tr>
<tr>
<td>Connecting to other systems</td>
</tr>
<tr>
<td>File management</td>
</tr>
<tr>
<td>Controlling the system</td>
</tr>
<tr>
<td>Initiating Configuration mode</td>
</tr>
<tr>
<td>Exiting the CLI</td>
</tr>
</tbody>
</table>

- Primarily used for viewing the operation of system status
Operational Mode – CLI Environment

- Setting the CLI environment
  - show cli
    - user@host> show cli
      - CLI complete-on-space set to on
      - CLI idle-timeout disabled
      - CLI restart-on-upgrade set to on
      - CLI screen-length set to 24
      - CLI screen-width set to 80
      - CLI terminal is 'unknown'
      - CLI is operating in enhanced mode
  - set cli
    - Change any of the CLI parameters
Operational Mode – A Few Commands

- show version
- show system ?
- file ?
- show interface
- show interface terse
- show interface extensive
- request support information
- show chassis ?
Operational Mode – Command Pipes

- `show interfaces | ?`
- `show interfaces | count`
- `show interfaces | match fxp1`
- `show interfaces | find fxp1`
- `show interfaces | save filename`
- `show configuration | compare rollback 1`
- `request support information | save filename`
- `show configuration | compare (filename | rollback n)`
  - Like Unix diff
Operational Mode – File Directory Structure

- **/config (flash)**
  - `juniper.conf`, `juniper.conf.1`, `juniper.conf.2`, and `juniper.conf.3`

- **/var (disk)**
  - `/var/home` - users’ home directories
  - `/var/db/config` - `juniper.conf.4` through `juniper.conf.9`
  - `/var/log` - Contains system log and tracing files
  - `/var/tmp` — core files, temp directory for new software

- **/altroot (disk)**
  - request system snapshot command
  - the root file system (/) is backed up to /altroot

- **/altconfig (disk)**
  - request system snapshot command
  - `/config` directory is backed up to /altconfig.
Operational Mode – Log Files

- Log files kept in /var/log

- **show log**
  - list of log files in /var/log

- **show log filename**
  - more filename

- **monitor start filename**
  - like Unix tail –f
  - multiple people can view log files at same time
Operational Mode – JUNOS Software

- Each JUNOS software release consists of the base operating system (jbase) and six software packages:
  - jbase - Contains additions to the operating system
  - jkernel - Operating system package
  - jroute - Software that runs on the Routing Engine
  - jcrypto - Security software (Domestic version only)
  - jpfe - Software that runs on the router’s Packet Forwarding Engine
  - jdocs - Documentation for the software

- These six packages, when grouped together, are known as a jbundle

- Download software packages from: www.juniper.net/support/

- The same binary image of JUNOS runs across all Juniper platforms!
Operational Mode – Software Naming Convention

- Package-m.nZnumber.tgz
- m.n is the major version

- Z is a single uppercase letter
  - A – Alpha
  - B – Beta
  - R – Release
  - I – Internal Test or Experimental

- Number is the release number
Operational Mode –
Software Naming Convention (continued)

- jbundle-5.2R1.3-domestic.tgz
- Software version 5.2
- Released software
- Release 1
- Build 3
- Domestic export restricted version
Operational Mode – System Shutdown

- Two methods to gracefully shutdown and restart the router and JUNOS
  - `request system halt`
  - `request system reboot`
Request System Snapshot

- Back up the currently running and active file system so that you can recover to a known, stable environment in case something goes wrong with an upgrade

  - /altroot
    - the root file system (/) is backed up to /altroot
  - /altconfig
    - /config directory is backed up to /altconfig.

- Use *request system software rollback* to recover
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Configuration Mode – Overview

- Initiated by entering “configure” in Operational Mode
- Prompt changes
- Banner appears indicating hierarchy level
- Hierarchy of statements

<table>
<thead>
<tr>
<th>Trunk of Hierarchy Tree (Top-level Statements)</th>
<th>Branches of Hierarchy Tree (Container Statements)</th>
<th>Tree Leaves (Leaf Statements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocols: bgp, dvmrp, icmp, igmp, isis, mpls, ospf, rip, router-discovery, rsvp, sap</td>
<td>area range, interface stub, virtual-link</td>
<td>dead-interval, hello-interval, interface-type, metric, passive, poll-interval, priority, retransmit-interval, transit-delay, transmit-interval</td>
</tr>
</tbody>
</table>
Configuration Mode – Prompt Changes

- Prompt changes from “>” to “#”

- Banner appears indicating Hierarchy level

```
user@host#
[edit interfaces]
user@host#
```
Configuration Mode – Candidate Configuration

- Initially a **copy** of the active configuration
- Changes to candidate configuration do not take effect until successful commit or commit confirmed
  - Container and Leaf statements

```
/ config/juniper.conf.n (n=0-3)
/ var/db/config/juniper.conf.n (n=4-9)
```
Configuration Mode – Set Command

- Add or change configuration
  - `set system host-name Denver`
  - `set interface fxp0 unit 0 family inet address 1.1.1.1/24`
  - `set routing-options router-id 2.2.2.2/32`
Configuration Mode – Edit Command

- Example:
  - `top`
  - `?`
  - `show`
  - `edit interfaces`
  - `?`
  - `show`
  - `top`
Configuration Mode – Top Command

- top level – moves to top of edit hierarchy
  - edit interfaces
  - show
  - top
  - show
Configuration Mode – Up Command

- move up one level in edit hierarchy

Example:
- edit system login
- show
- up
- show
- up
- show
Configuration Mode – Exit Command

- Exit configuration mode
- Move to previous edit level in hierarchy
Configuration Mode – Show Command

- View the candidate configuration
- Pipe the show command to compare existing Candidate configuration with previous configurations or files
Configuration Mode – Status Command

- Display other users configuring router

- Multiple users can edit the same candidate configuration, and the configuration changes are visible to everyone.

- If another user is in the configuration mode at the same time, this information is displayed when you enter the configuration mode

- configure exclusive in 4.3
Configuration Mode – Delete Command

- **Remove configuration statements**
  - `edit interfaces fxp1 unit 0`
  - `show`
  - `set family inet address 1.1.1.1/24`
  - `show`
  - `delete family inet address 1.1.1.1/24`
  - `show`
  - `delete protocol ospf`
  - `delete protocol bgp`
  - `top`
  - `delete`
Configuration Mode – Run Command

- Execute CLI commands from configuration mode with the run command
  
  `- run show interface fxp0`
  `- run show bgp sum`
Configuration Mode – Commit Command

- Save changes and activate

- **commit** - checks configuration before activating it

- **commit check** - Check only, do not apply changes

- **commit and-quit** - Quit configuration mode if commit succeeds

- **commit confirmed** – next page…
Configuration Mode – Commit Confirmed Command

- **commit confirmed** - Automatically rollback if not confirmed.

- By default, the configuration runs for 10 minutes before the rollback.

- You can change the time by specifying the number of minutes at the end of the command.

- If you do not want the rollback to occur, issue a second commit command before the rollback occurs.

- Current config is juniper.conf (/config on flash)

- Saved configs are juniper.conf.1, juniper.conf.2, ...,juniper.conf.9
**Configuration Mode – Save Command**

- `save filename`
- saves the configuration to an ASCII file on hard drive, floppy drive, ftp site, ...
  - Default directory is your user directory
  - `/var/home/username`
- saves from current level and below
  - `top`
  - `save filename`

- **Note:** only commit activates and saves all your changes to flash (`/config`).
Configuration Mode – Load a Configuration File

- Configuration information can come from an ASCII file prepared offline

- Use the load command to
  - **override** an existing configuration
  - **merge** new statements into existing configuration
  - **replace** existing statement in current configuration
Configuration Mode – Filenames

- In some CLI commands and configuration statements you can include a filename.
  - Including: file copy, load, save, set system login user user-name authentication load-key-file, and request system software add.
Configuration Mode – Filenames

You can specify a filename in one of the following ways:

- **filename**
  - File in the user’s home directory on the local flash disk.
- **path/filename**
  - File on the local flash disk.
- **/var/filename** or **/var/path/filename**
  - File on the local hard disk.
- **a:filename** or **a:path/filename**
  - File on local removable media. Can be in MS-DOS or UNIX (UFS) format.
- **hostname/path/filename** or **scp://hostname/path/filename**
  - File on an scp/ssh client. You can also specify hostname as username@hostname or username:password@hostname.
- **ftp://hostname/path/filename**
  - File on an FTP server. You can also specify hostname as username@hostname or username:password@hostname.
- **http://hostname/path/filename**
  - File on an HTTP server.
Configuration Mode – Rollback Command

- Restore previously committed config

- Stores last 9 committed – 0 is current running config and 9 is oldest saved config

  - set system host-name
  - commit
  - show
  - rollback 1
  - show
Delete Entire Candidate Config.

- configure
- save demo
- delete
- show
- load replace demo
- show

OR

- configure
- delete
- show
- rollback
- show
Basic System Configuration

- `set system host-name Denver`
- `set system domain name juniper.net`
- `set system services telnet`
- `set system services ftp`
- `set system login user juniper authentication plain-text-password`
- `set system login user juniper class fullaccess`
- `set system login class fullaccess permissions all`
- `set syslog file filename interactive-commands info`
- `set interfaces fxp0 unit 0 family inet 1.1.1.1/24`
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Trace Options

- `set traceoptions file filename`
  - files (default 10)
  - size (default 128k)
  - world-readable

- `set traceoptions flag`
  - What do you want to look at?
  - Various options

- `monitor start filename`
  - like Unix tail –f
  - multiple people can view log files at same time
Trace Options

Example:
• edit protocols bgp
• set traceoptions file bgp.log
• set traceoptions flag ?
  • all Trace everything
  • aspath
  • damping
  • General Trace general events
  • keepalive
  • Normal Trace normal events
  • open Trace BGP open packets
  • Packets Trace all BGP protocol packets
Trace Options (continued)

- **policy** - Trace policy processing
- **route** - Trace routing information
- **state** - Trace state transitions
- **task** - Trace routing protocol task processing
- **timer** - Trace routing protocol timer processing
- **update** - Trace BGP update packets

- Commit and-exit
- Monitor start bgp.log
Troubleshooting – Real-time Monitoring

- `monitor interface <interface>`
- `monitor interface traffic`

- May need to set terminal type
  - `set cli terminal vt100`
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Additional Information

- **JUNOS Documentation**
  - CD-ROM (included with every new router)
  - Website – [www.juniper.net/support/techpubs/](http://www.juniper.net/support/techpubs/)
  - Hardcopy manuals (orderable item)

- **Online Video of the material covered in this presentation**
  - [http://www.juniper.net/training/elearning/junos_cli/](http://www.juniper.net/training/elearning/junos_cli/)
Thank you

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