



Juniper J-series X-Over to JUNOS

Rajat Upadhyay- SANOG-15/ 28th January 2010

Course Goal

- **To equip participants with the confidence to discuss and install J-series products into enterprise style networks**
- **To become familiar with the basics of J-Series web interface and JUNOS operation and commands**

Agenda

- **J-series Hardware Platform**
- **Software Architecture, Services & Forwarding**
- **Initial Configuration (J-Web & JUNOS CLI)**
- **Licensing**
- **Interface configuration**
- **Static route / RIP configuration**
- **OSPF configuration**
- **BGP configuration**
- **Operations and Management**

Housekeeping

- **Sign-in sheet**
- **Break and lunch facilities**
- **Finish by 5:00pm**
- **Mobiles silent or off**
- **If your equipment doesn't work, ask for assistance immediately!**
- **No introductions**

Who are Juniper Networks?

- **Nasdaq: JNPR**
- **Founded 1996 by Pradeep Sindhu**
 - Left his job in 1996 at Computer Science Lab at Xerox PARC
 - Now vice chairman, and CTO
- **Was joined by Scott Kriens CEO (today)**
- **With the goal; to start up a high-end router company**
- **1999; was one of the most successful technology IPOs in history**

Juniper's Enterprise Portfolio

M-series Routers

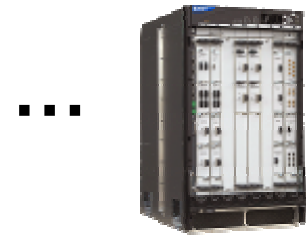
Head office, backbone,
and data centers



M7i



M10i



M320

J-series Routers

Remote, branch, and
regional offices



J2300



J4350



J6350

Firewalls & Secure Services Gateways

Advanced Security for
remote, branch, and
regional offices



SSG 5



SSG 20



SSG 140



SSG 500

WAN Acceleration

Increased application
performance in the
network



WX and WXC Family

J-Series Certification Program

JNCIA

JNCIS

**Juniper Networks Technical Certification Program (JNTCP)
Enterprise Routing Track**

Operating Juniper
Networks Routers in the
Enterprise
(OJRE)



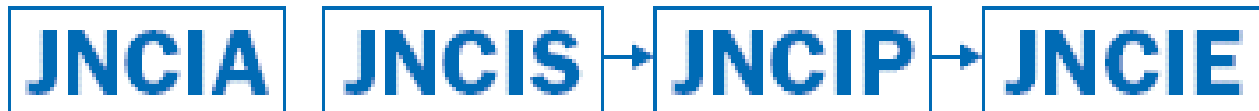
JNCIA-ER

Advanced Juniper
Networks Routers in the
Enterprise
(AJRE)



JNCIS-ER

Juniper M/T-Series Certification Track



**Juniper Networks Technical Certification Program (JNTCP)
M/T-series Routers Track**

- http://www.juniper.net/training/technical_education/
 - CJNR (5days) = JNCIA after passing Thompson Prometric test www.2test.com

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- OSPF configuration
- BGP configuration
- Operations and Management
- Test – 20 multiple guess questions

J-Series

- **Runs industry leading JUNOS software with integrated services**
 - Software-based control and forwarding
 - Departure from the ASIC-driven data paths in the M-series and T-series platforms
 - ASIC forwarding is overkill in all but the largest networks
 - A software-only design keeps costs low
- **Based on standard PC components; PCI-based interfaces with Intel IXP4xx Network Processors**

Bringing carrier class routing to the enterprise

J Series Product Family Overview



J2300



J4350

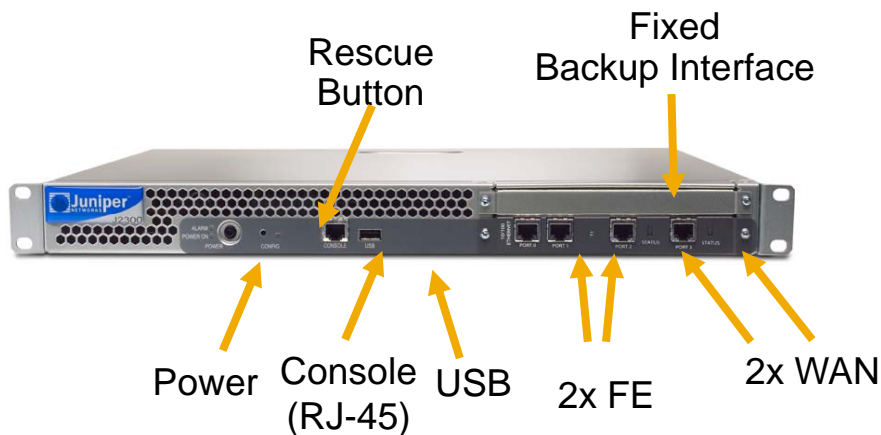


J6350

- **Unmatched Performance with Services**
 - Unmatched performance with services enabled
- **Extensive Connectivity**
 - Four on-board GigE ports on J4350 and J6350
 - Expandable WAN and LAN interfaces via modules
 - 16 J2300 models available
- **Best Price to Performance**
 - 30% lower price than similar products and more than 2x faster

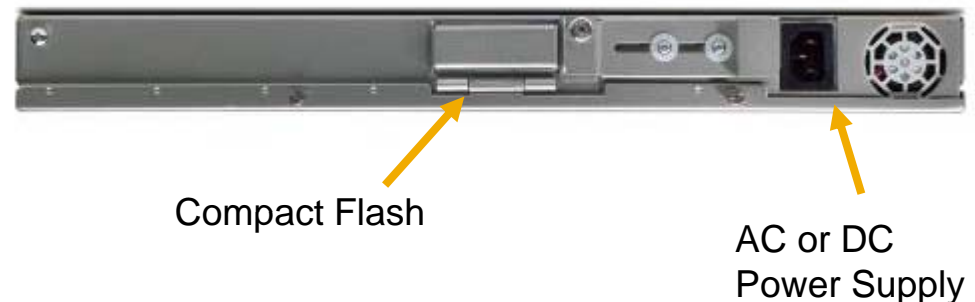
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J2300 Components

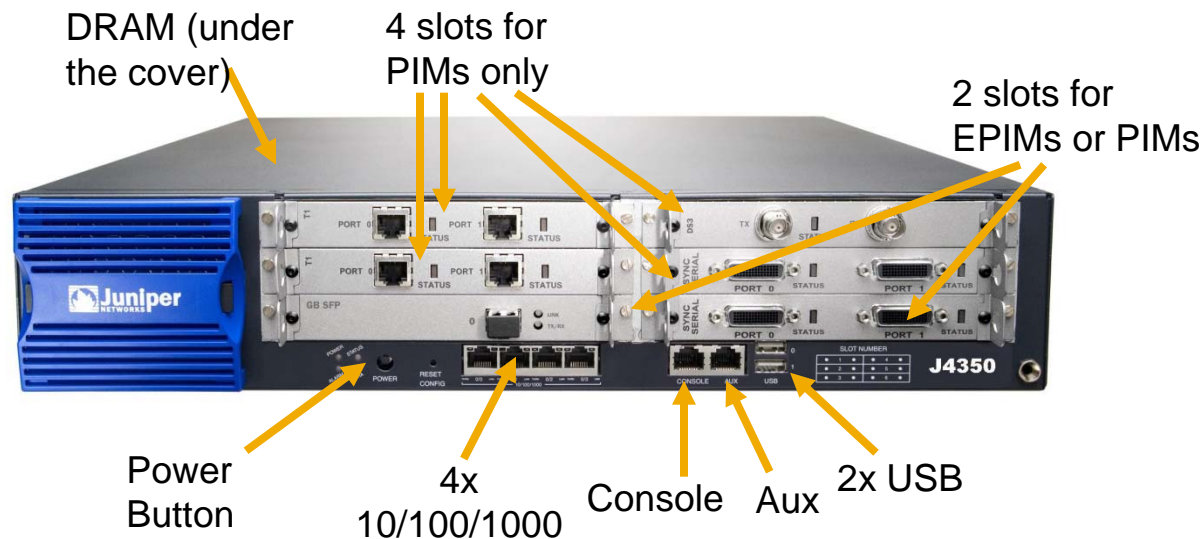


- 2xT1/E1 deployments with full services
- T1, E1, Serial, or G.SHDSL WAN Interfaces
- Two fixed FE LAN ports, and optional integrated ISDN BRI backup
- DC versions available

- 256 MB DRAM default, max 1 GB
- 256 MB compact flash default, max 1 GB



J4350 Components



- T1, E1, FE, Serial, ISDN BRI, ADSL/2/2+, G.SHDSL, DS3, E3, GE Interfaces
- 4 fixed GE LAN ports, 4 PIM slots and 2 EPIM/PIM slots
- Avaya media gateway capable
- DC version available

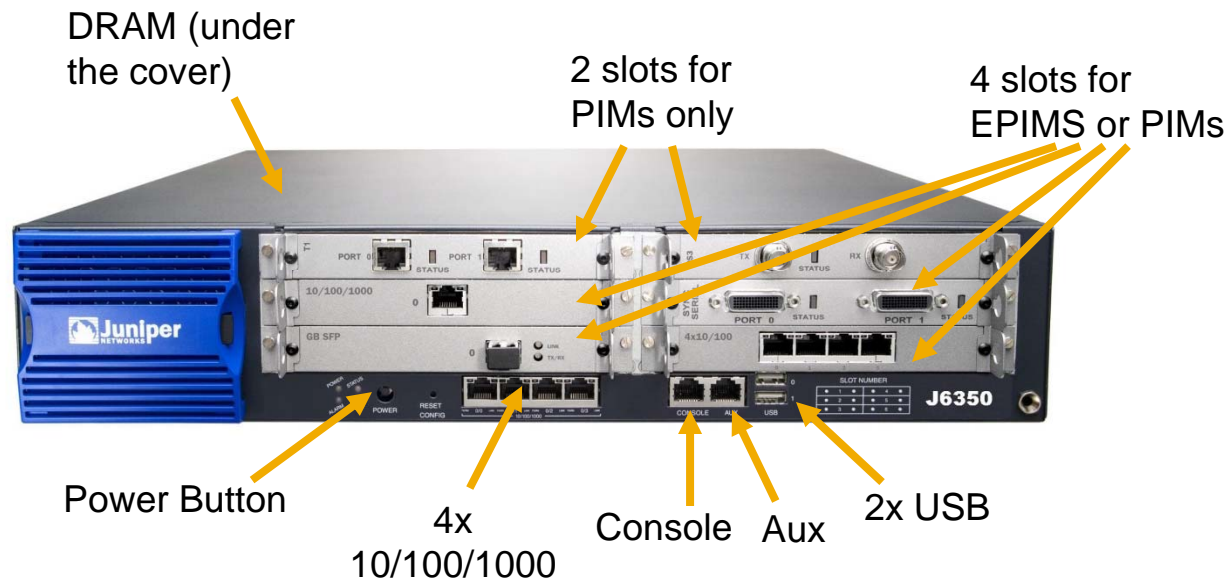
- 1 GB or 256 MB DRAM default, max 2 GB
- 256 MB compact flash default, max 1 GB
- Hardware encryption acceleration (optional)
- NEBS compliant models available



AC or DC power supply

Power Switch

J6350 Components



- T1, E1, FE, Serial, ISDN BRI, ADSL/2/2+, G.SHDSL, DS3, E3, GE Interfaces
- 4 fixed GE LAN ports, 2 PIM slots and 4 EPIM/PIM slots
- Avaya media gateway capable
- DC version available

- 1 GB DRAM default, max 2 GB
- 256 MB compact flash default, max 1 GB
- Hardware encryption acceleration standard
- NEBS compliant models available



Redundant AC or DC power supplies

J-Series Interface Summary

Platform	J2300	J4350	J6350
Size	1U	2U	2U
Fixed LAN Ports	2xFE	4xGE	4xGE
WAN Interface Slots	n/a	6 Open Slots	6 Open Slots
Fixed WAN Interfaces	2xT1, 2xE1, 2xSerial, or 2x2-wire or 1x4-wire G.SHDSL (Optional Integrated ISDN)	n/a	n/a
WAN Interface Modules	n/a	2xT1, 2xE1, 2xFE, 4xFE, 2xSerial, 1xADSL2+, 2x2-wire or 1x4-wire G.SHDSL, 4xISDN, 1xSFP GE, 1xCopper GE	2xT1, 2xE1, 2xFE, 4xFE, 2xSerial, 1xADSL2+, 2x2-wire or 1x4-wire G.SHDSL, 4xISDN, 1xSFP GE, 1xCopper GE
DRAM Memory (min/max)	256 MB/1 GB	256 MB/2 GB	1 GB/2 GB
Redundancy	No	No	Power (optional)
Additional Software Licenses	J-Flow Accounting, BGP Route Reflector, and DLSw	J-Flow Accounting, BGP Route Reflector, and DLSw	J-Flow Accounting, BGP Route Reflector, and DLSw

Agenda

- J-series Hardware Platform
- **Software Architecture, Services & Forwarding**
- Initial Configuration (J-Web & JUNOS CLI)
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- BGP configuration
- Operations and Management



Juniper Operating System

- **Specialised operating system**
 - Based on FreeBSD
 - Independent software processes
 - Protected memory, multi-tasking
- **Hardware based packet forwarding**
 - Implement key functions on ASICs
 - Separation of Internet control and high-performance packet forwarding

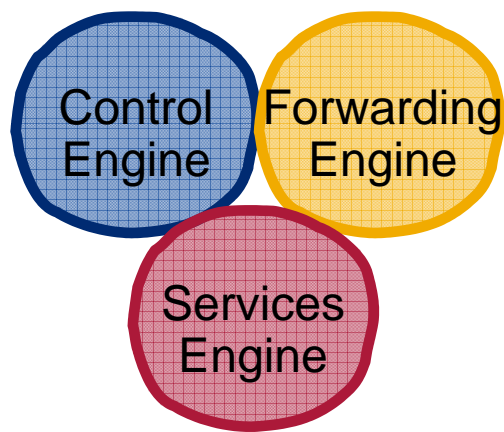
JUNOS Feature Set

- **IPv4 Unicast/IPv6 JUNOS 7.2**
- **Routing (OSPF, BGP, RIPv2, Static routes, IS-IS)**
- **Multicast (IGMPv3, PIM, SDP, DVRMRP, Source Specific)**
- **MPLS**
- **Encapsulations**
 - Ethernet (MAC and tagged)
 - PPP (Synch)
 - Frame relay
 - HDLC
 - Serial (RS232, RS449, X.21, V.35, EIA530)
 - MLPPP
 - MLFR
- **IP Address Management (Static, DHCP, DHCP Server, DHCP Relay)**
- **Advanced QOS**
 - Policing & shaping
 - Class-based queuing with prioritization
 - WRED
 - Queuing based on VLAN/DLCI/interface/bundles
- **Tunneling (GRE, IP in IP, IPSec)**
- **NAT/Stateful Firewall Filters**
- **DOS & DDOS protection**
- **J-Flow flow monitoring and accounting services**

Juniper System Architecture

A Fundamentally Different Approach

Dedicated Resources



- **Guaranteed processing, memory resources per function**
- **Clean separation of processes**

Unmatched Value

+

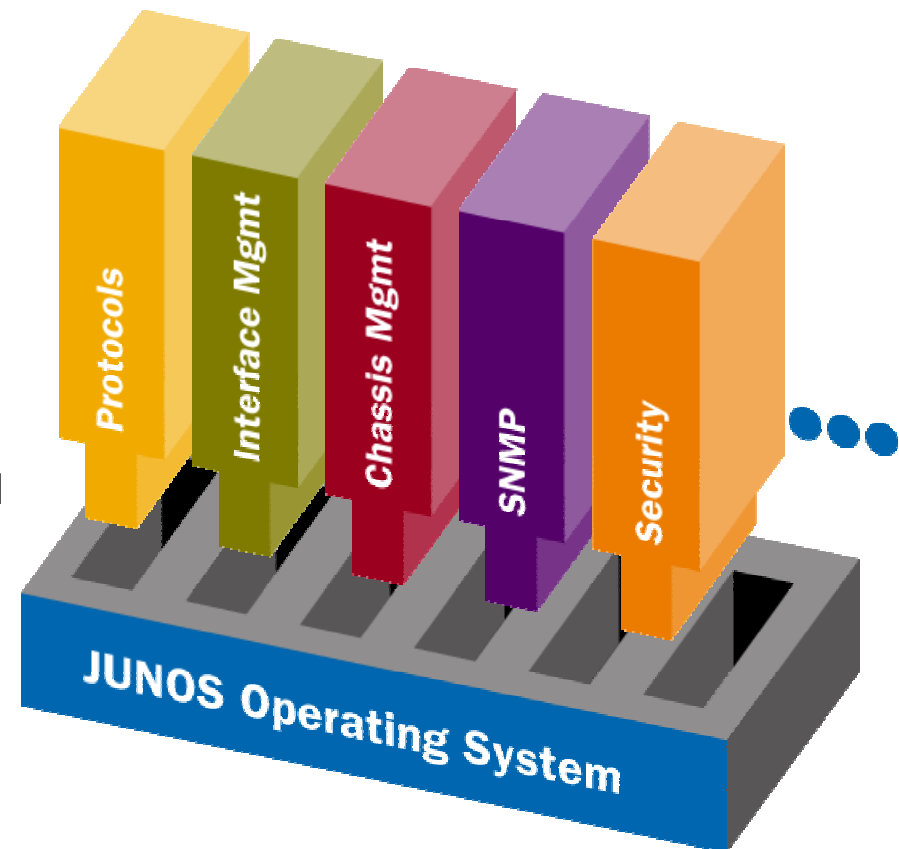


- **No licensing fees for advanced services such as IPv6, MPLS, IPSec, and stateful firewall**
- **No port licenses required to operate onboard or modular interfaces**

Modular Software Architecture

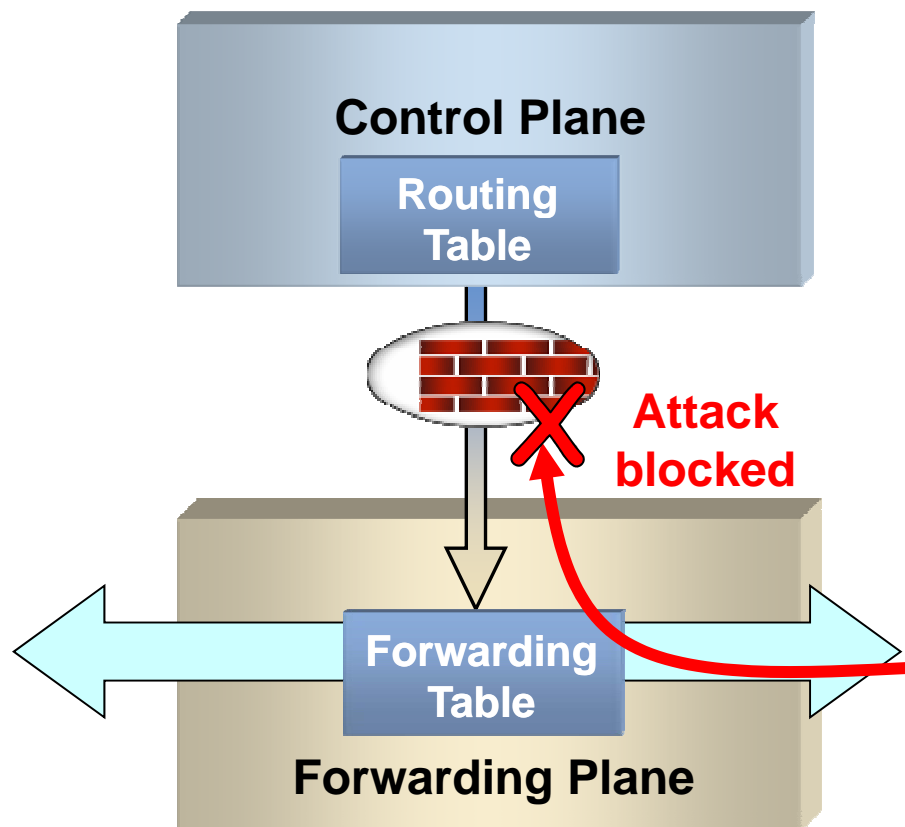
High Reliability, High Availability

- **High Reliability possible only with independent OS modules**
 - Processes run in their own protected memory and can't overwrite another's
 - Single failing component does not cause a full system crash
 - Changes localized to modules allow rapid software change and increased verification speed
 - Modules can be restarted independently
- **High Availability (Graceful Restart, NSF, GRES, NSR) possible only with clean separation of planes and individually running processes**



Dedicated Resources

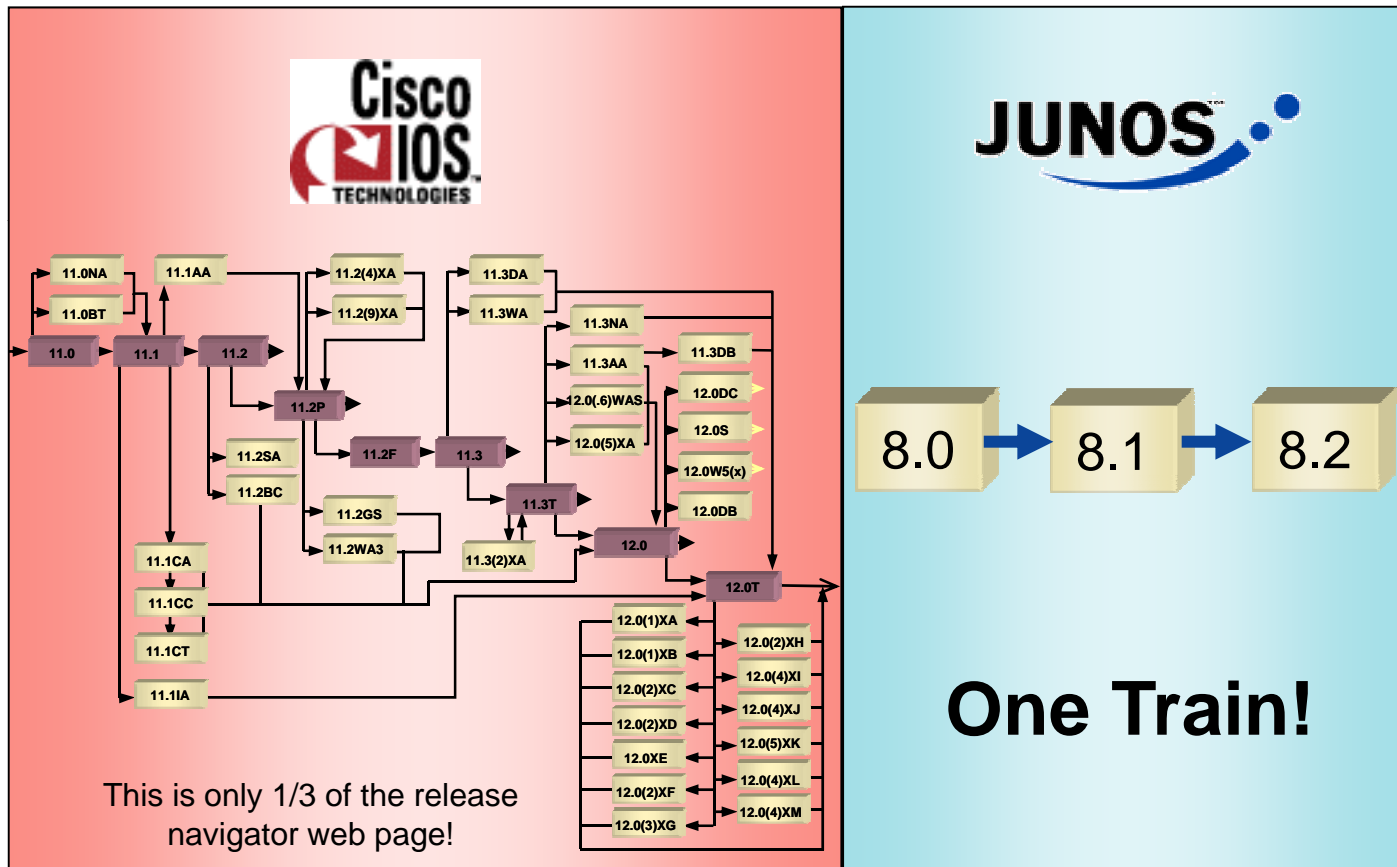
Industry's Most Secure Routers



- **Separate control and forwarding planes offer**
 - System resources reserved ensuring full router control while under attack (DoS)
 - Stateful firewall, rate limit protection for control plane
 - Critical filters can be added/changed dynamically while under attack; Thousands of filters at line rate
 - Forwarding engine free to forward traffic when routing engine is busy (topology changes, etc.)

Ease of Upgrade

Single JUNOS release train across all platforms



- Each new software version has all the features of the previous version and some more.
- Eliminates confusion about which version of software to upgrade to.
- Any given version runs on all J-routers. This simplifies staging, deployment.
- Lowers OPEX as fewer resources are needed to evaluate, test and deploy updates, upgrades

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- Software Architecture, Services & Forwarding
- **Initial Configuration (J-Web & JUNOS CLI)**
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Initial Startup

■ Boot Order

- Primary Internal Flash
- Removable external flash (4350 & 6350)
- Removable USB

Loaded Software Components

- **Routing Engine and Packet Forwarding Engine**
- **Kernel and MicroKernel**
- **Processes**
 - Management Process
 - Chassis Process
 - Routing Protocols Process
 - Interface Process
 - Forwarding Process

Juniper references - online

>Support > Software Documentation

- **JUNOS Software Release Notes**
- **JUNOS Configuration Guides**
- **Enterprise-Specific MIBs and Traps**
- **JUNOS References**
- **JUNOS API and Scripting Documentation**
- **J-Web Documentation**

Manual Configuration Recovery

■ Rollback with CONFIG Button

- Press for approx 5 seconds and release
 - Rescue Configuration loaded and committed
 - Note : You must have created a “Rescue Configuration” for this option to work and the LED will turn RED for a few seconds
- Press for approx 15 seconds and release
 - All configurations including “Rescue” are deleted – red LED Blinks, and command prompt returns you to root%
 - Factory configuration loaded and committed
 - Router hostname is persistent (it still stays – why?)
 - router> show config (to confirm)
autoinstallation appears in the config
- Can not be disabled (config button)

Rescue
Button



Factory Defaults

```
version 7.0R1.5;
system {
    services {
        web-management {
            http;
        }
    }
    syslog {
        file messages {
            any any;
        }
    }
}
```

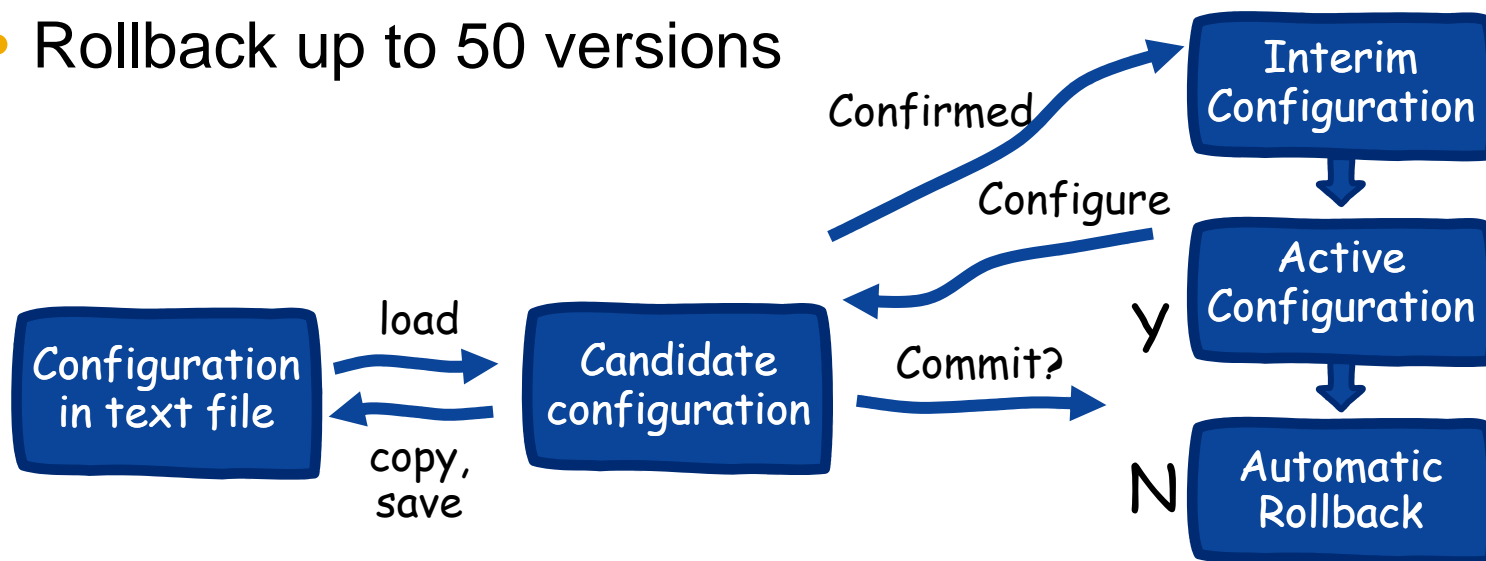
root> **show system autoinstallation status**

- Autoinstallation enabled
- fe-0/0/0
 - IP address 192.168.1.1/24 & DHCP server enabled
- fe-0/0/1
 - IP address 192.168.2.1/24 & DHCP server enabled
- **None of the above are viewable in the active configuration**
- **Note: If any configuration is made and committed, autoinstallation is disabled. If no IP address is configured on your fe interface you will lose connectivity**

Configuration Manipulation

■ Configuration changes:

- Made in candidate configuration
- When you select “Apply or OK” using JWEB; written to Active Configuration
- Rollback up to 50 versions



Configuration Methods

- **CLI... root#**
 - Full configuration access, monitoring, traceoptions...
 - Similar to other CLI interfaces but not!
 - CJNR 5 day course intro to JUNOS “not” networking – a must to get the most out of JUNOS
- **J-Web... <http://192.168.1.1> (factory default)**
 - Simple, quick and for the most part intuitive
 - More advanced configurations are sometimes easier through the web
 - Focus of this course is to use the J-Web interface

Connecting with the CLI

- **Connect to the RJ-45 port on the router**
- **Configure your terminal software**
 - Bits per second: 9600 - Data bits: 8, Parity: None, Stop bits: 1, Flow control: None
- **Apply power, wait for the prompt “root%”**
- **Log in as “root” with no password**
 - root% **cli**
 - root> **configure** (Operational Mode)
 - root# **set ?** (Configuration Mode)
 - root# **commit and-quit**
 - Make the Candidate Config > Active
 - Any time a commit is made it only copies across the changes not the complete config
 - Root> **show ?**
- **Before continuing to the next page ensure your system has been reset by holding in the config button for 15 seconds**

J-Web Quick Configuration

- **Connect Laptop or PC to fe-0/0/0**
- **Enable PC for DHCP**
- **http to 192.168.1.1/24**
 - HTTPS supported with user installable certificate (after initial configuration)
- **Access J-Web Set Up Quick Configuration Page**
- **After any configuration change click...**
 - **Apply** - commit
 - **OK** – commit and exit screen
 - If multiple users are editing the configuration when you commit the candidate configuration, all changes made by all users take effect

Configuration > View and Edit > View Configuration Text

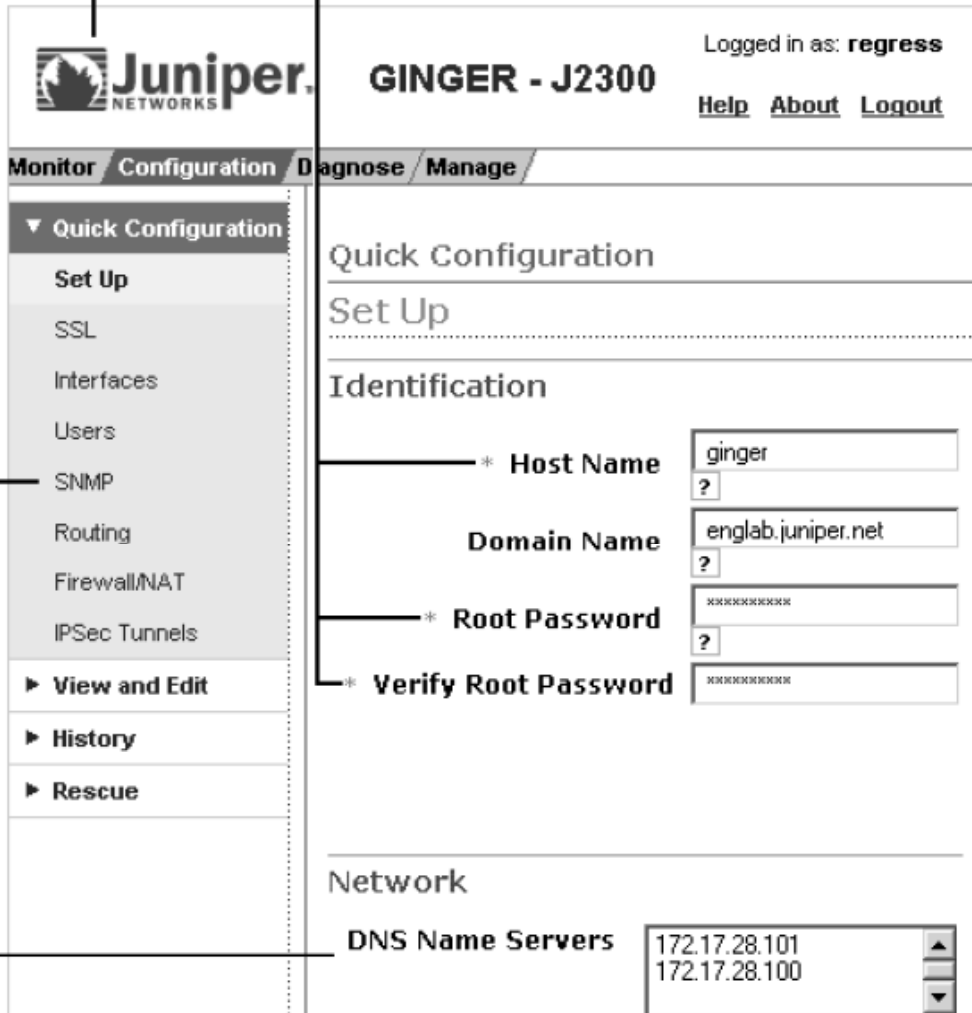
Main

Top pane

Red asterisk (required field)

Side pane

Main pane



Juniper NETWORKS

GINGER - J2300

Logged in as: regress

[Help](#) [About](#) [Logout](#)

Monitor Configuration Diagnose Manage

Quick Configuration

Set Up

SSL

Interfaces

Users

SNMP

Routing

Firewall/NAT

IPsec Tunnels

View and Edit

History

Rescue

Quick Configuration

Set Up

Identification

* Host Name

ginger

?

Domain Name

englab.juniper.net

?

* Root Password

XXXXXXXXXX

?

* Verify Root Password

XXXXXXXXXX

Network

DNS Name Servers

172.17.28.101

172.17.28.100

S001112

Specific / Advanced Configuration

Path to current task

Task bar

Configuration hierarchy

Icon legend

Juniper NETWORKS

GINGER - J2300

Logged in as: regress

[Help](#) [About](#) [Logout](#)

Monitor Configuration Diagnose Manage

Configuration > View and Edit > Edit Configuration > System > Radius server

Configuration

(Expand all | Hide all)

- + groups
- system
 - + radius-server
 - + tacplus-server
 - + services
 - + chassis
 - + interfaces
 - + protocols
 - + class-of-service
 - + services

System

Radius server

OK Cancel Refresh Commit... Discard...


Radius server Add new entry

Address	Port	Secret	Timeout	Retry
10.10.10.10				


OK Cancel Refresh Commit... Discard...

Icon Legend


Comment

 The configuration statement has been annotated with a comment. To display the comment, place the cursor over the statement icon.

Inactive

 The configuration statement is not active and does not affect the device.

Modified

 The configuration statement has been changed or added.

- ▶ Quick Configuration
- ▶ View and Edit
- ▶ **History**
- ▶ Rescue

History

Database Information

No users are editing the configuration database.

Configuration History

The following table shows the router's commit history.


To view a configuration, click the revision number.

To compare configurations, select two and click "Compare".

Compare

	Number	Date/Time	User	Client	Comment	Log Message	Action
<input type="checkbox"/>	Current	2005-01-04 19:27:26 EST	root	junoscript		Modified via Set Up Quick Configuration	Download
<input type="checkbox"/>	1	2005-01-04 19:22:59 EST	root	junoscript		Modified via Set Up Quick Configuration	Download Rollback
<input type="checkbox"/>	2	2005-01-04 19:21:23 EST	root	junoscript		Modified via Set Up Quick Configuration	Download Rollback

Editing Configuration Text using J-Web

**GINGER - J2300**

Logged in as: **regress**
[Help](#) [About](#) [Logout](#)

Monitor **Configuration** **Diagnose** **Manage**

► Quick Configuration

▼ View and Edit

View Configuration Text

Edit Configuration

Edit Configuration Text

Upload Configuration File

► History

► Rescue

View and Edit

Edit Configuration Text

Edit the configuration. When you click "Commit", the edited configuration is saved. If any errors occur when the configuration is loading or committed, the configuration is restored.

Configuration

```
version "7.0I0 [builder]";
groups {
  re0 {
    system {
      host-name ginger;
    }
    interfaces {
      fe-0/0/0 {
        unit 0 {
          family inet
            address
          }
        }
      }
    }
  }
}
global {
```

Uploading a Configuration File

**GINGER - J2300**

Logged in as: **regress**
[Help](#) [About](#) [Logout](#)

Monitor **Configuration** **Diagnose** **Manage**

► Quick Configuration

▼ View and Edit

View Configuration Text

Edit Configuration

Edit Configuration Text

Upload Configuration File

► History

► Rescue

[Configuration](#) > [View and Edit](#) > [Upload Configuration File](#)

View and Edit

Upload Configuration File

Type the name of a configuration file on the local hard drive. When you click "Upload and Commit", the configuration in the file replaces the existing configuration and takes effect. If any errors occur when the file is loading or committing, they are displayed and the previous configuration is restored.

* **File to Upload**

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Licensing < JUNOS 7.6

- **All features available from single software image**
- **Software feature licenses**
 - J-Flow
 - IPSec VPN
 - Stateful firewall filters
 - BGP route reflector (advanced BGP)
- **Port licenses**
 - No license required for the first 2 x FE
 - 2nd port on 2-port interface cards
 - T1, E1, Serial, FE
- **JUNOS 7.6 and above licenses...**
 - BGP route reflector (advanced BGP)
 - Flow sampling

One Software Image

- All software “features” available in all platforms
 - Images are not the same for J-Series and M/T series
- Licenses unlock new features without software upgrades or truck rolls
- Fewer resources to evaluate, test and deploy updates and upgrades



Agenda

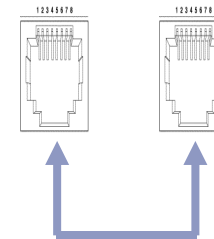
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T1/E1 Interfaces

- 2xT1 or 2x E1 ports
- Support for fractional T1/E1
- No support for channelization
- Support for 56 & 64k modes
- Independent Clock
- Integrated CSU/DSU
- Support for G.703, G.704 & G.706
- Diagnostic feature similar to Q PIC's
 - FDL
 - BERT
 - Loopbacks
 - Long Buildout

white/blue
blue ,
white/orange
orange , , ,
white/orange
orange ,
white/blue
blue , , ,



The cross over cables pin outs for labs etc.

Ethernet Interfaces

- **2x10/100 ports**
- **Auto sensing MDI & MDX support**
- **Support for Full & Half Duplex**
- **Support for MAC filtering (SA & DA)**
- **Support for 128 VLAN's per port**
- **Not Line Rate at small packet sizes**

Serial Ports

- **2xSerial Interfaces**
- **Single Serial Interface which supports**
 - RS232, V.35, X.21, RS449 & EIA 530
- **Auto-detection based on cable**
- **Juniper Proprietary cables**
- **Maximum Bandwidth of 8MB**
- **Auto-Detection for DTE/DCE modes**
- **Clock Rate configurable**
- **Crypto Re-syncnch support**

DS-3

- **Integrated CSU & DSU**
- **Subrate & Scrambling option support**
 - Support for Verilink, Kentrox, Digital Link, Larscom & Adtran
- **Loopback support**
- **BERT & FEAC Support**
- **Counter, Alarms & Clocks**

Your 2300 Interfaces

Monitor

Configuration

Diagnose

Manage

Quick Configuration

Set Up

SSL

Interfaces

Users

SNMP

Routing

Firewall/NAT

IPSec Tunnels

View and Edit

History

Rescue

Quick Configuration

Interfaces

Interface Name	Link State	Configured	Description
fe-0/0/0	Up	Yes	Fast Ethernet Interface 'fe-0/0/0'
fe-0/0/0.0	Up	Yes	Logical Unit 0 on Fast Ethernet Interface 'fe-0/0/0'
fe-0/0/1	Down	No	Fast Ethernet Interface 'fe-0/0/1'
e1-0/0/2	Down	No	E1 Interface 'e1-0/0/2'
e1-0/0/3	Down	No	E1 Interface 'e1-0/0/3'
lo0	Up	Yes	Loopback Interface 'lo0'
lo0.0	Up	Yes	Logical Unit 0 on Loopback Interface 'lo0'
lo0.32768	Up	No	Logical Unit 32768 on Loopback Interface 'lo0'

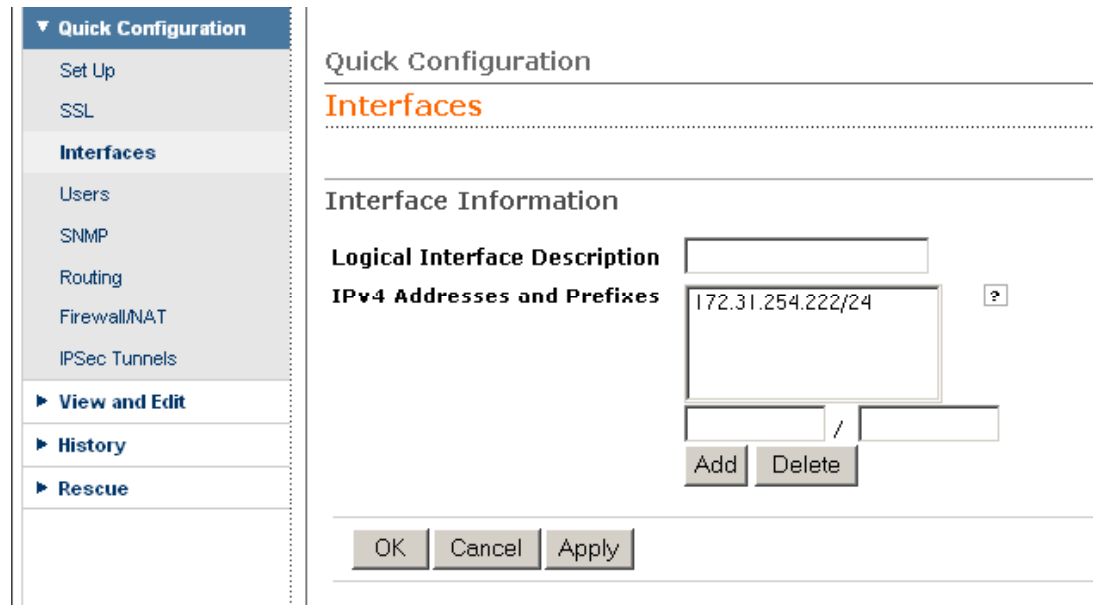
Interface Construction

■ Fast Ethernet Example

- FE-0/0/0.0
- MediaType - FPC Slot / PIC Slot / Port Number . Logical Interface
 - Media Type = FE,E1,T1,etc
 - FPC slot = Flexible PIC Concentrator
 - PIC = Physical Interface Card
 - Port Number = Port on card starting
- All the above begin with "0"

Interface Configuration

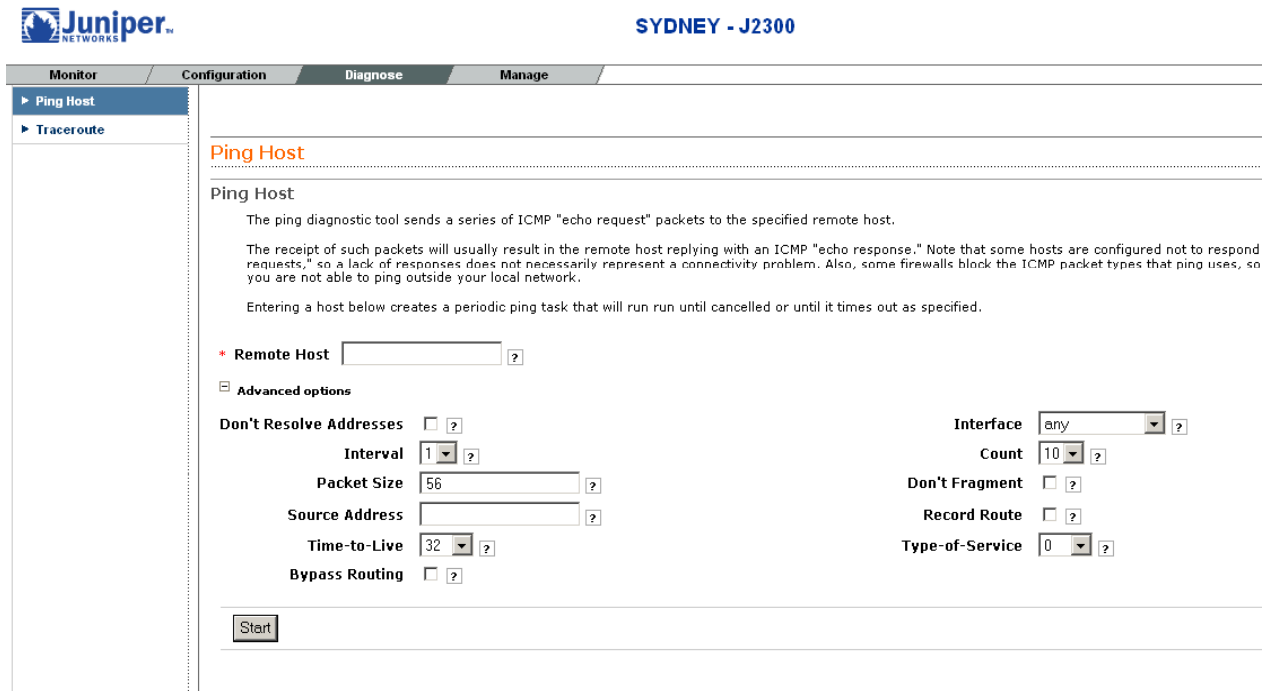
- **Physical Information contained on**
 - FE-0/0/0
 - IE full duplex, vlan tagging
- **Logical Information configured on**
 - FE-0/0/0.0
 - IE: Version 4 IP
 - Address



The screenshot displays the Juniper configuration interface. On the left is a sidebar titled 'Quick Configuration' with a tree view containing: Set Up, SSL, Interfaces (highlighted), Users, SNMP, Routing, Firewall/NAT, and IPsec Tunnels. Below this are expandable sections for 'View and Edit', 'History', and 'Rescue'. The main content area is titled 'Quick Configuration' and 'Interfaces'. It includes an 'Interface Information' section with a 'Logical Interface Description' field and an 'IPv4 Addresses and Prefixes' field containing '172.31.254.222/24'. There are 'Add' and 'Delete' buttons below the address field. At the bottom are 'OK', 'Cancel', and 'Apply' buttons.

Verifying the Link using Ping

- Select Diagnose > Ping Host
- In the Remote Host box, type the address
- Click Start



Juniper NETWORKS SYDNEY - J2300

Monitor Configuration **Diagnose** Manage

► Ping Host
► Traceroute

Ping Host

The ping diagnostic tool sends a series of ICMP "echo request" packets to the specified remote host.

The receipt of such packets will usually result in the remote host replying with an ICMP "echo response." Note that some hosts are configured not to respond requests,* so a lack of responses does not necessarily represent a connectivity problem. Also, some firewalls block the ICMP packet types that ping uses, so you are not able to ping outside your local network.

Entering a host below creates a periodic ping task that will run until cancelled or until it times out as specified.

* Remote Host

☐ Advanced options

Don't Resolve Addresses ☐

Interval

Packet Size

Source Address

Time-to-Live

Bypass Routing ☐

Interface

Count

Don't Fragment ☐

Record Route ☐

Type-of-Service

```
user@host> show interfaces detail
```

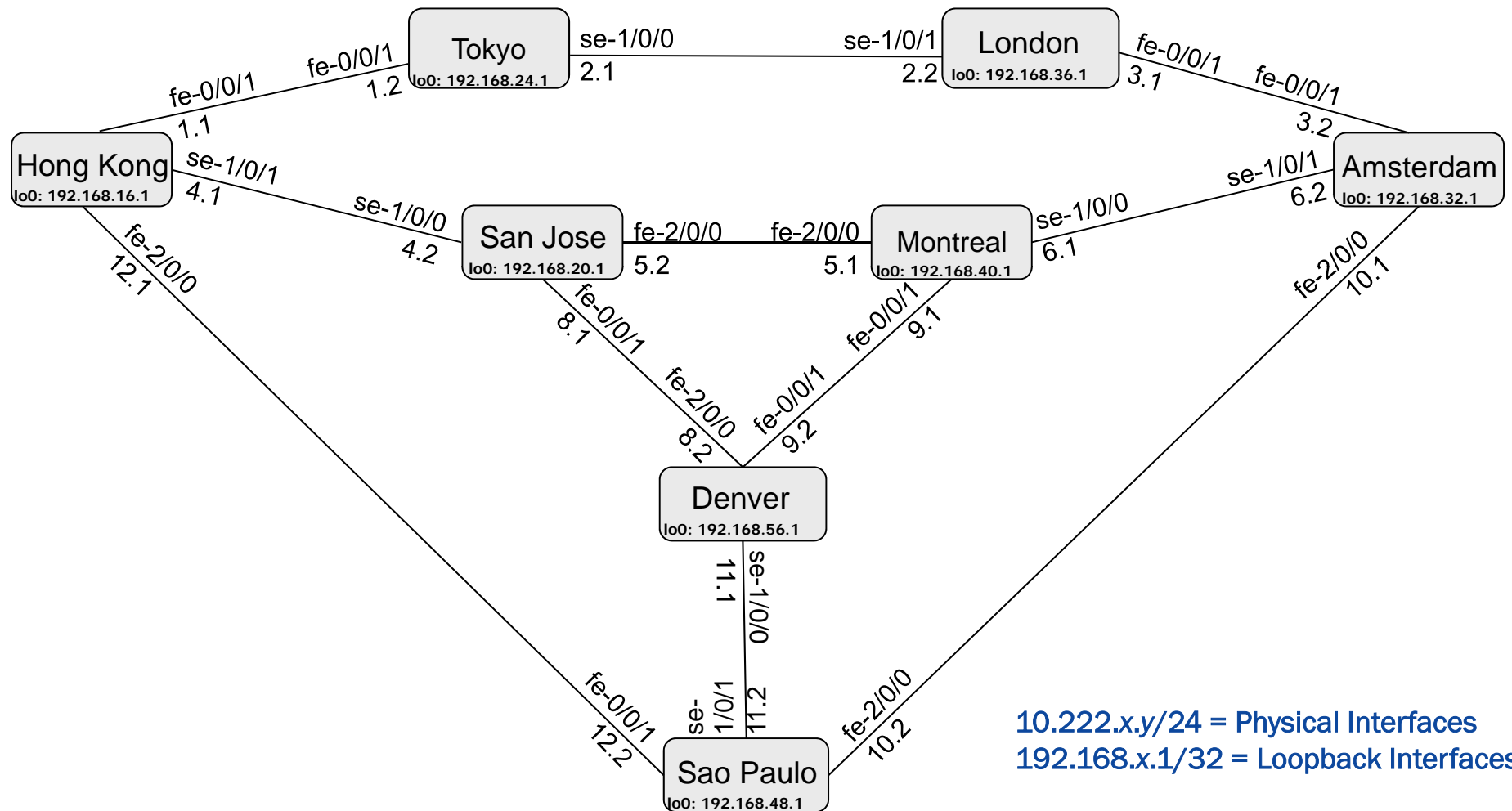
```
Physical interface: fe-1/0/0, Enabled, Physical link is Up
Interface index: 134, SNMP ifIndex: 27, Generation: 17
Link-level type: Ethernet, MTU: 1514, Speed: 100mbps, Loopback: Disabled,
Source filtering: Disabled, Flow control: Enabled
Device flags      : Present Running
Interface flags: SNMP-Traps 16384
Link flags        : None
CoS queues        : 4 supported
Hold-times        : Up 0 ms, Down 0 ms
Current address: 00:90:69:87:44:9d, Hardware address: 00:90:69:87:44:9d
Last flapped      : 2004-08-25 15:42:30 PDT (4w5d 22:49 ago)
Statistics last cleared: Never
Traffic statistics:
  Input  bytes   :                0                0 bps
  Output bytes   :                0                0 bps
  Input  packets :                0                0 pps
  Output packets :                0                0 pps
Queue counters:      Queued packets  Transmitted packets  Dropped packets
  0 best-effort      0                0                0
  1 expedited-fo     0                0                0
```

Lab 1 – Topology & Initial Configuration

■ Using the Web tool

- Configure IP Addressing on all interfaces
- Configure IP Addressing on PC's
- set hostname "rn" [n-router number]
- Configure E1 interfaces
- Confirm connectivity testing with directly connected interfaces
 - Using both the JWEB and CLI
- Backup the router configuration to your PC

Lab Topology



Don't Forget – SE Configuration if req'd

■ DTE

- ppp
- Clocking - loop

■ DCE

- ppp
- Clocking internal
- rate - xxx

Note

- **Autoinstallation is used to provide the fe-0/0/0 interface with IP address 192.168.1.1 and a matching DHCP server**
 - Making and saving “any” configuration using the JWeb will disable autoinstallation
 - Resulting in your fe-0/0/0 interface to accept the new settings this may include no address configuration

Monitor

Configuration

Diagnose

Manage

► System

► Chassis

► Interfaces

▼ Routing

Route Information

BGP Information

OSPF Information

RIP Information

► Firewall

► IPsec

► NAT

Routing

Route Information

10 destinations, 10 routes (9 active, 0 hold down, 1 hidden)

Showing 9 of 10 routes (Page 1 of 1)

inet.0

Destination	Protocol/Preference	Next-Hop	Age
⊕ 0.0.0.0/0	*Static/5	to 172.31.254.129 via fe-0/0/0.0, selected	1:12:52
⊕ 10.100.1.0/24	*Direct/0	Interface	21:45
⊕ 10.100.1.1/32	*Local/0	Local	21:47
⊕ 10.100.3.0/24	*Direct/0	Interface	15:29
⊕ 10.100.3.1/32	*Local/0	Local	16:58
⊕ 10.200.1.0/24	*Direct/0	Interface	26:49
⊕ 10.200.1.1/32	*Local/0	Local	26:49
⊕ 172.31.254.0/24	*Direct/0	Interface	1:12:52
⊕ 172.31.254.222/32	*Local/0	Local	1:12:54

Narrow Search

Agenda

- J-series Hardware Platform
- Software Architecture, Services & Forwarding
- Initial Configuration (J-Web & JUNOS CLI)
- Licensing
- Interface configuration
- **Static route / RIP configuration**
- OSPF configuration
- BGP configuration
- Operations and Management



JUNOS Routing Introduction

■ Adding Routing Protocols

- Routing Tables
- Routing Preferences
- RIP refresher

■ LAB Two

- RIP Routing Configuration
- Static Route Configuration

JUNOS Route Tables

■ Routing Tables

- inet.0 - UniCast Routes *
- inet.1 – Multicast forwarding cache
- inet.2 - MBGP RPF
- inet.3 - MPLS Path
- inet.6 - IPv6 Routes
- mpls.0 – MPLS next hops

* We are only covering unicast routes

JUNOS Route Preference (Administrative Distance)

Protocol	JUNOS	IOS
Direct/Local	0	0
Static	5	1
OSPF internal	10	110 (all types)
RIP	100	120
OSPF external	150	110 (all types)
EBGP	170	20
IBGP	170	200

JUNOS Equal Cost Paths

- **Load Sharing, 2 choices.**
 - Randomly choose ECMP on a per prefix (default)
 - ECMP on a per flow basis (configurable option)
- **Traffic shared over up to 16 next hops**

RIP Review

- Interior; distance vector routing protocol
- Maximum of 15 hops
- RIPv2 is the default – RFC 2453
- Multicast address used to update on broadcast media – 224.0.0.9
- Password or MD5 Authentication for updates
- Backward compatible with RIPv1 – RFC1058

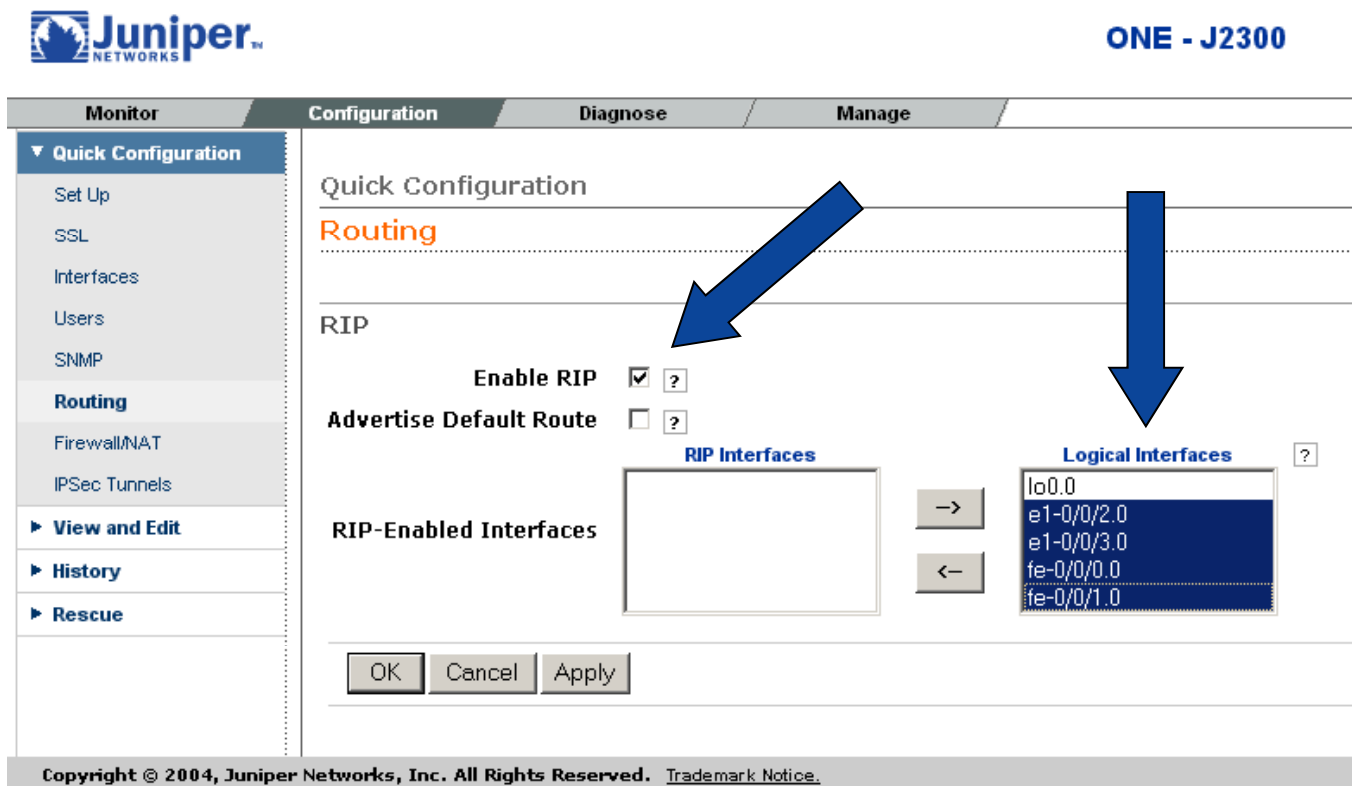
RIP Issues

■ RIP Limitations

- Slow convergence
- Metric is Hop Count
 - Does not consider speed, latency, load or jitter
- Maximum Hop Count is 15

Starting the RIP Process

- Enable RIP
- Select RIP Interfaces
- Apply



ONE - J2300

Monitor Configuration Diagnose Manage

Quick Configuration

Set Up

SSL

Interfaces

Users

SNMP

Routing

Firewall/NAT

IPSec Tunnels

View and Edit

History

Rescue

Quick Configuration

Routing

RIP

Enable RIP ☒ ?

Advertise Default Route ☐ ?

RIP Interfaces

Logical Interfaces ?

lo0.0

e1-0/0/2.0

e1-0/0/3.0

fe-0/0/0.0

fe-0/0/1.0

OK Cancel Apply

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JUNOS RIP Default Specifics

- **Receive and process RIP updates**
- **Not to re-advertise RIP updates**
 - Directly connected networks can be redistributed into RIP “via policy”
 - Static and other protocol routes can also be redistributed into RIP “via policy”
- **Create a RIP group and nominate interfaces which will select their networks – automatically done using the JWeb**

Verifying the routing table – RIP entries

■ inet.0 route table

Monitor	Configuration	Diagnose	Manage																																																								
<ul style="list-style-type: none"> System Chassis Interfaces Routing <ul style="list-style-type: none"> Route Information BGP Information OSPF Information RIP Information Firewall IPSec IAT 	<div>Routing</div> <div>Route Information</div> <div>16 destinations, 17 routes (16 active, 0 hold down, 0 hidden)</div> <div>Showing 17 of 17 routes (Page 1 of 1)</div> <div>inet.0</div> <table> <tr> <th>Destination</th><th>Protocol/Preference</th><th>Next-Hop</th><th>Age</th></tr> <tr> <td>⊕ 0.0.0.0/0</td><td>*Static/5</td><td>to 172.31.254.129 via fe-0/0/0.0, selected</td><td>4:07:30</td></tr> <tr> <td>⊕ 10.2.0.0/24</td><td>*RIP/100</td><td>to 10.100.1.2 via e1-0/0/2.0, selected</td><td>3:50:54</td></tr> <tr> <td>⊕ 10.2.10.0/24</td><td>*RIP/100</td><td>to 10.100.1.2 via e1-0/0/2.0, selected</td><td>3:41:55</td></tr> <tr> <td>⊕ 10.3.0.0/24</td><td>*RIP/100</td><td>to 10.100.3.2 via e1-0/0/3.0, selected</td><td>3:46:27</td></tr> <tr> <td>⊕ 10.3.10.0/24</td><td>*RIP/100</td><td>to 10.100.3.2 via e1-0/0/3.0, selected</td><td>4:07:09</td></tr> <tr> <td>⊕ 10.50.1.1/32</td><td>*Direct/0</td><td>Interface</td><td>1d 4:54:54</td></tr> <tr> <td>⊕ 10.100.1.0/24</td><td>*Direct/0</td><td>Interface</td><td>1d 22:09:25</td></tr> <tr> <td>⊕ 10.100.1.1/32</td><td>*Local/0</td><td>Local</td><td>1d 22:09:27</td></tr> <tr> <td>⊕ 10.100.2.0/24</td><td>*RIP/100</td><td>to 10.100.1.2 via e1-0/0/2.0, selected to 10.100.3.2 via e1-0/0/3.0</td><td>4:31:21</td></tr> <tr> <td>⊕ 10.100.3.0/24</td><td>*Direct/0</td><td>Interface</td><td>1d 22:03:09</td></tr> <tr> <td>⊕ 10.100.3.1/32</td><td>*Local/0</td><td>Local</td><td>1d 22:04:38</td></tr> <tr> <td>⊕ 10.200.1.0/24</td><td>*Direct/0</td><td>Interface</td><td>4:07:30</td></tr> <tr> <td>⊕ 10.200.1.1/32</td><td>*Local/0</td><td>Local</td><td>4:34:03</td></tr> </table>			Destination	Protocol/Preference	Next-Hop	Age	⊕ 0.0.0.0/0	*Static/5	to 172.31.254.129 via fe-0/0/0.0, selected	4:07:30	⊕ 10.2.0.0/24	*RIP/100	to 10.100.1.2 via e1-0/0/2.0, selected	3:50:54	⊕ 10.2.10.0/24	*RIP/100	to 10.100.1.2 via e1-0/0/2.0, selected	3:41:55	⊕ 10.3.0.0/24	*RIP/100	to 10.100.3.2 via e1-0/0/3.0, selected	3:46:27	⊕ 10.3.10.0/24	*RIP/100	to 10.100.3.2 via e1-0/0/3.0, selected	4:07:09	⊕ 10.50.1.1/32	*Direct/0	Interface	1d 4:54:54	⊕ 10.100.1.0/24	*Direct/0	Interface	1d 22:09:25	⊕ 10.100.1.1/32	*Local/0	Local	1d 22:09:27	⊕ 10.100.2.0/24	*RIP/100	to 10.100.1.2 via e1-0/0/2.0, selected to 10.100.3.2 via e1-0/0/3.0	4:31:21	⊕ 10.100.3.0/24	*Direct/0	Interface	1d 22:03:09	⊕ 10.100.3.1/32	*Local/0	Local	1d 22:04:38	⊕ 10.200.1.0/24	*Direct/0	Interface	4:07:30	⊕ 10.200.1.1/32	*Local/0	Local	4:34:03
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Displaying RIP Only Routes – inet.0

Monitor

Configuration

Diagnose

Manage

► System

► Chassis

► Interfaces

▼ Routing

Route Information

BGP Information

OSPF Information

RIP Information

► Firewall

► IPsec

► NAT

Routing

Route Information

16 destinations, 17 routes (16 active, 0 hold down, 0 hidden)

Showing 7 of 17 routes (Page 1 of 2)

inet.0

Destination	Protocol/Preference	Next-Hop	Age
10.2.0.0/24	*RIP/100	to 10.100.1.2 via e1-0/0/2.0, selected	3:53:28
10.2.10.0/24	*RIP/100	to 10.100.1.2 via e1-0/0/2.0, selected	3:44:29
10.3.0.0/24	*RIP/100	to 10.100.3.2 via e1-0/0/3.0, selected	3:49:01
10.3.10.0/24	*RIP/100	to 10.100.3.2 via e1-0/0/3.0, selected	4:09:43
10.100.2.0/24	*RIP/100	to 10.100.1.2 via e1-0/0/2.0, selected to 10.100.3.2 via e1-0/0/3.0	4:33:55

Narrow Search

Destination Address

Next Hop Address

Best Route ☐

Exact Route ☐

Number of Routes to Display 25


OK

Protocol rip

Receive Protocol

Inactive Routes ☐

Hidden Routes ☐



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66

RIP Summary

Monitor	Configuration	Diagnose	Manage																																																					
<ul style="list-style-type: none"> ▶ System ▶ Chassis ▶ Interfaces ▼ Routing <ul style="list-style-type: none"> Route Information BGP Information OSPF Information RIP Information ▶ Firewall ▶ IPSec ▶ NAT 	<p>Routing</p> <p>RIP Information</p> <hr/> <p>RIP Statistics</p> <table border="1"> <tr> <td>RIP Protocol Name</td> <td>RIPv2</td> </tr> <tr> <td>RIP Port</td> <td>520</td> </tr> <tr> <td>RIP Update Interval</td> <td>30s</td> </tr> <tr> <td>Hold Down</td> <td>180s</td> </tr> <tr> <td>Timeout</td> <td>120s</td> </tr> </table> <table border="1"> <tr> <td>Routes Learned</td> <td>Routes Held Down</td> <td>Requests Dropped</td> <td>Responses Dropped</td> </tr> <tr> <td>6</td> <td>5</td> <td>0</td> <td>0</td> </tr> </table> <p>RIP Neighbors</p> <table border="1"> <thead> <tr> <th>Neighbor</th> <th>State</th> <th>Source Address</th> <th>Destination Address</th> <th>Send Mode</th> <th>Receive Mode</th> <th>In Metric</th> </tr> </thead> <tbody> <tr> <td>e1-0/0/2.0</td> <td>Up</td> <td>10.100.1.1</td> <td>224.0.0.9</td> <td>mcast</td> <td>both</td> <td>1</td> </tr> <tr> <td>e1-0/0/3.0</td> <td>Up</td> <td>10.100.3.1</td> <td>224.0.0.9</td> <td>mcast</td> <td>both</td> <td>1</td> </tr> <tr> <td>fe-0/0/0.0</td> <td>Up</td> <td>10.200.1.1</td> <td>224.0.0.9</td> <td>mcast</td> <td>both</td> <td>1</td> </tr> <tr> <td>fe-0/0/1.0</td> <td>Dn</td> <td>(null)</td> <td>(null)</td> <td>mcast</td> <td>both</td> <td>1</td> </tr> </tbody> </table>			RIP Protocol Name	RIPv2	RIP Port	520	RIP Update Interval	30s	Hold Down	180s	Timeout	120s	Routes Learned	Routes Held Down	Requests Dropped	Responses Dropped	6	5	0	0	Neighbor	State	Source Address	Destination Address	Send Mode	Receive Mode	In Metric	e1-0/0/2.0	Up	10.100.1.1	224.0.0.9	mcast	both	1	e1-0/0/3.0	Up	10.100.3.1	224.0.0.9	mcast	both	1	fe-0/0/0.0	Up	10.200.1.1	224.0.0.9	mcast	both	1	fe-0/0/1.0	Dn	(null)	(null)	mcast	both	1
RIP Protocol Name	RIPv2																																																							
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Lab 2 - Configuring RIP

■ Objectives

- Using the same LAB topology and addressing from LAB 1
- Configure RIP on
 - All ports
 - Ensure version is RIPv2 – How do you know ?
- Confirm routes from all neighbours in routing table
- Ping and FTP to the instructor PC on the backbone network

Lab 2 - Configuring RIP

■ Completion of Lab Two

- Confirm connectivity to all networks
 - Ping both neighbours FastEthernet interfaces
- Traceroute
 - Are the paths being followed deterministic and preferable ? If not, why ?

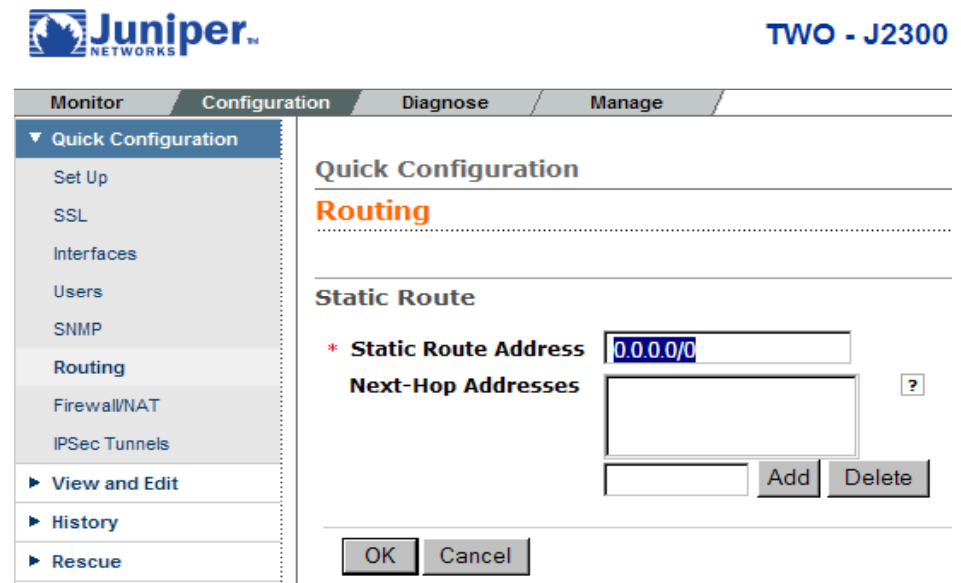
■ View the JUNOS configuration file created using the JWeb interface

■ QUESTIONS ?

Lab Two - Configuring Static / Default Routes

■ Routing > Static Routing > Add

- To network 20.50.x.0/24
 - X = router number
- With a next hop pointing out of your POD
 - Neighbour router or 10.200.1.254
 - Don't redistribute into RIP



The image shows the Juniper J2300 configuration interface. The top navigation bar includes 'Monitor', 'Configuration', 'Diagnose', and 'Manage'. The 'Configuration' tab is active, and the left sidebar shows a tree view with 'Quick Configuration' expanded, listing 'Set Up', 'SSL', 'Interfaces', 'Users', 'SNMP', 'Routing', 'Firewall/NAT', and 'IPSec Tunnels'. The 'Routing' option is selected. The main panel is titled 'Quick Configuration' and 'Routing'. Under 'Static Route', there is a field for '* Static Route Address' with the value '0.0.0.0' and a 'Next-Hop Addresses' field. Below these fields are 'Add' and 'Delete' buttons. At the bottom of the panel are 'OK' and 'Cancel' buttons. The top right corner of the interface displays 'TWO - J2300'.

Agenda

- J-series Hardware Platform
- Software Architecture, Services & Forwarding
- Initial Configuration (J-Web & JUNOS CLI)
- Licensing
- Interface configuration
- Static route / RIP configuration
- **OSPF configuration**
- BGP configuration
- Operations and Management



OSPF Review

- **Open Shortest Path First – OSPF**
 - RFC-2328 OSPFv2
 - RFC-1587 NSSA
- **Interior routing protocol that uses “Link State Advertisements (LSA)” to update neighbours**
- **Shortest Path First Algorithm – Dyjkstra**
- **Maintains a database of the whole area**

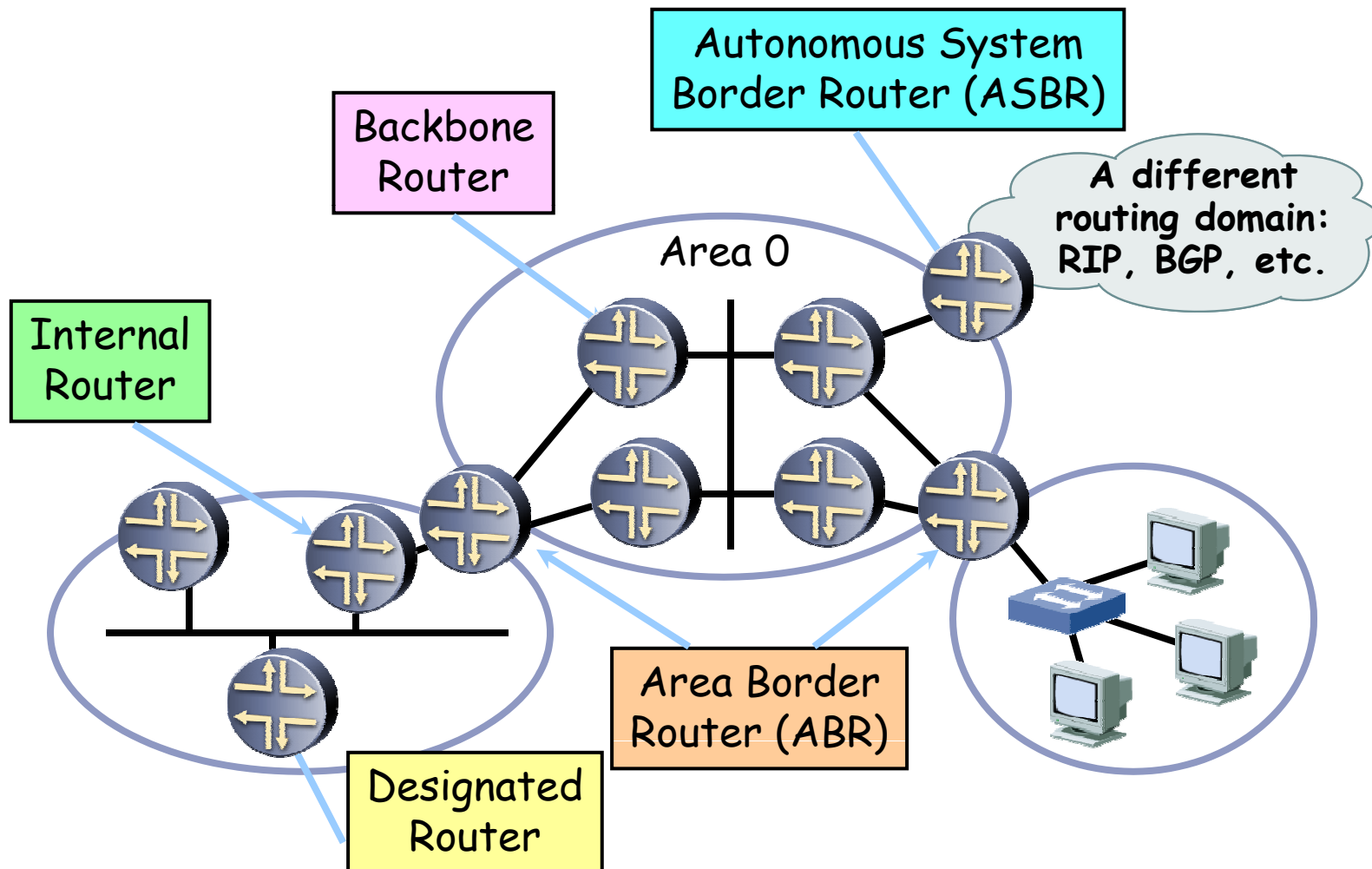
OSPF Details

- **5 types of OSPF packets**
 - Hello, Database, Request, Update, Ack.
- **Multicast used on Broadcast media**
 - 224.0.0.5 – All OSPF Routers
 - 224.0.0.6 – All Designated Routers

OSPF Topology

- **Areas are used to contain LSA's to a region within the network**
- **Area 0 (0.0.0.0) is called the BackBone and all traffic from other areas must transit Area 0**
- **Router types**
 - Internal – All interfaces in same the Area
 - Backbone – All interfaces in Area 0
 - Area Border – Interfaces in more than one area, one of which must be Area 0
 - AS Boundary – Inject routes from other domains into OSPF

OSPF Device by Function



OSPF Fast Ethernet Devices

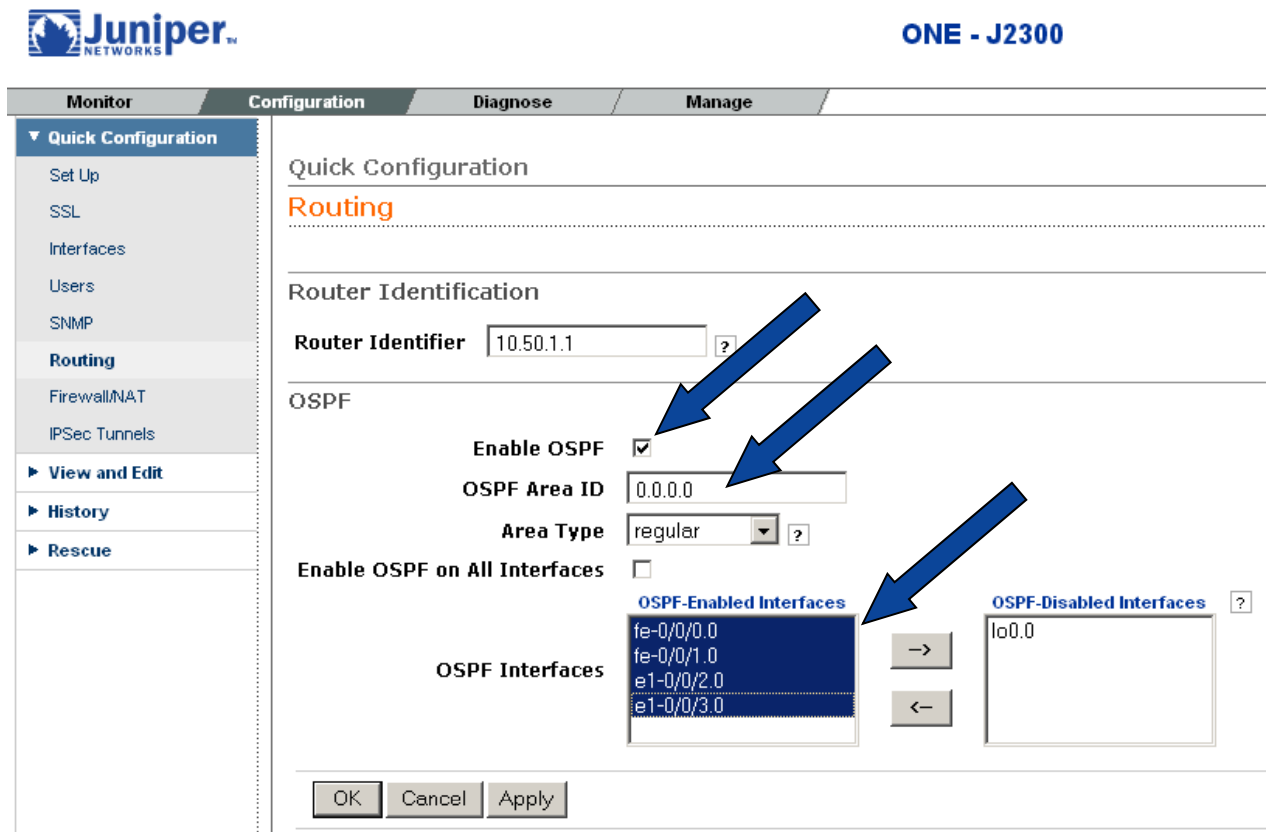
- **Designated Router**
 - Advertises type-2 Network LSAs
- **Backup Designated Router**
 - Backup for the Designated router
- **Adjacencies are formed between all routers on the same Ethernet**
 - Full state indicates adjacency has correctly formed
 - root> show ospf neighbor

OSPF Router ID

- **Router ID – How a device is known to the OSPF network**
 - Selected from Loopback0 if active
- OR
- The first active interface after Loopback0
 - Neither of the above area candidates if they have 127.0.0.0/8 (Martian) addresses

Enable the OSPF Process

- Enable OSPF
- Apply Area 0
- Select Interfaces
- Apply



The image shows the Juniper ONE - J2300 configuration interface. The left sidebar contains a navigation menu with options: Quick Configuration, Set Up, SSL, Interfaces, Users, SNMP, Routing (selected), Firewall/NAT, and IPsec Tunnels. Below this are View and Edit, History, and Rescue buttons. The main content area is titled 'Quick Configuration' and 'Routing'. It includes sections for Router Identification (Router Identifier: 10.50.1.1) and OSPF settings. In the OSPF section, 'Enable OSPF' is checked, 'OSPF Area ID' is 0.0.0.0, and 'Area Type' is regular. 'Enable OSPF on All Interfaces' is unchecked. There are two lists: 'OSPF-Enabled Interfaces' (fe-0/0/0.0, fe-0/0/1.0, e1-0/0/2.0, e1-0/0/3.0) and 'OSPF-Disabled Interfaces' (lo0.0). Blue arrows point to the 'Enable OSPF' checkbox, the 'OSPF Area ID' field, and the 'OSPF-Enabled Interfaces' list. At the bottom are OK, Cancel, and Apply buttons.

Verify OSPF Communication

■ inet.0 route table

Monitor	Configuration	Diagnose	Manage																																																																																								
<ul style="list-style-type: none"> System Chassis Interfaces Routing <ul style="list-style-type: none"> Route Information BGP Information OSPF Information RIP Information Firewall IPSec HAAT 	<div>Routing</div> <div>Route Information</div> <div>14 destinations, 21 routes (14 active, 0 hold down, 0 hidden) Showing 21 of 21 routes (Page 1 of 1)</div> <div>inet.0</div> <table> <tr> <th>Destination</th><th>Protocol/Preference</th><th>Next-Hop</th><th>Age</th></tr> <tr> <td>10.2.0.0/24</td><td>*OSPF/10</td><td>via e1-0/0/2.0, selected</td><td>36:48</td></tr> <tr> <td>10.2.10.0/24</td><td>RIP/100</td><td>to 10.100.1.2 via e1-0/0/2.0, selected</td><td>36:45</td></tr> <tr> <td>10.2.10.0/24</td><td>*OSPF/10</td><td>via e1-0/0/2.0, selected</td><td>13:52:38</td></tr> <tr> <td>10.2.10.0/24</td><td>RIP/100</td><td>to 10.100.1.2 via e1-0/0/2.0, selected</td><td>18:32:05</td></tr> <tr> <td>10.3.0.0/24</td><td>*OSPF/10</td><td>via e1-0/0/3.0, selected</td><td>15:55</td></tr> <tr> <td>10.3.10.0/24</td><td>RIP/100</td><td>to 10.100.3.2 via e1-0/0/3.0, selected</td><td>15:51</td></tr> <tr> <td>10.3.10.0/24</td><td>*OSPF/10</td><td>via e1-0/0/3.0, selected</td><td>13:52:38</td></tr> <tr> <td>10.3.10.0/24</td><td>RIP/100</td><td>to 10.100.3.2 via e1-0/0/3.0, selected</td><td>18:57:19</td></tr> <tr> <td>10.50.1.1/32</td><td>*Direct/0</td><td>Interface</td><td>1d 19:45:04</td></tr> <tr> <td>10.100.1.0/24</td><td>*Direct/0</td><td>Interface</td><td>2d 12:59:35</td></tr> <tr> <td>10.100.1.1/32</td><td>OSPF/10</td><td>via e1-0/0/2.0, selected</td><td>13:52:38</td></tr> <tr> <td>10.100.1.1/32</td><td>*Local/0</td><td>Local</td><td>2d 12:59:37</td></tr> <tr> <td>10.100.2.0/24</td><td>*OSPF/10</td><td>via e1-0/0/2.0 via e1-0/0/3.0, selected</td><td>13:52:38</td></tr> <tr> <td>10.100.2.0/24</td><td>RIP/100</td><td>to 10.100.1.2 via e1-0/0/2.0, selected to 10.100.3.2 via e1-0/0/3.0</td><td>19:21:31</td></tr> <tr> <td>10.100.3.0/24</td><td>*Direct/0</td><td>Interface</td><td>2d 12:53:19</td></tr> <tr> <td>10.100.3.0/24</td><td>OSPF/10</td><td>via e1-0/0/3.0, selected</td><td>13:52:38</td></tr> <tr> <td>10.100.3.1/32</td><td>*Local/0</td><td>Local</td><td>2d 12:54:48</td></tr> <tr> <td>10.200.1.0/24</td><td>*Direct/0</td><td>Interface</td><td>18:57:40</td></tr> <tr> <td>10.200.1.1/32</td><td>*Local/0</td><td>Local</td><td>19:24:13</td></tr> <tr> <td>224.0.0.5/32</td><td>*OSPF/10</td><td></td><td>14:19:27</td></tr> <tr> <td>224.0.0.9/32</td><td>*RIP/100</td><td></td><td>13:52:39</td></tr> </table>			Destination	Protocol/Preference	Next-Hop	Age	10.2.0.0/24	*OSPF/10	via e1-0/0/2.0, selected	36:48	10.2.10.0/24	RIP/100	to 10.100.1.2 via e1-0/0/2.0, selected	36:45	10.2.10.0/24	*OSPF/10	via e1-0/0/2.0, selected	13:52:38	10.2.10.0/24	RIP/100	to 10.100.1.2 via e1-0/0/2.0, selected	18:32:05	10.3.0.0/24	*OSPF/10	via e1-0/0/3.0, selected	15:55	10.3.10.0/24	RIP/100	to 10.100.3.2 via e1-0/0/3.0, selected	15:51	10.3.10.0/24	*OSPF/10	via e1-0/0/3.0, selected	13:52:38	10.3.10.0/24	RIP/100	to 10.100.3.2 via e1-0/0/3.0, selected	18:57:19	10.50.1.1/32	*Direct/0	Interface	1d 19:45:04	10.100.1.0/24	*Direct/0	Interface	2d 12:59:35	10.100.1.1/32	OSPF/10	via e1-0/0/2.0, selected	13:52:38	10.100.1.1/32	*Local/0	Local	2d 12:59:37	10.100.2.0/24	*OSPF/10	via e1-0/0/2.0 via e1-0/0/3.0, selected	13:52:38	10.100.2.0/24	RIP/100	to 10.100.1.2 via e1-0/0/2.0, selected to 10.100.3.2 via e1-0/0/3.0	19:21:31	10.100.3.0/24	*Direct/0	Interface	2d 12:53:19	10.100.3.0/24	OSPF/10	via e1-0/0/3.0, selected	13:52:38	10.100.3.1/32	*Local/0	Local	2d 12:54:48	10.200.1.0/24	*Direct/0	Interface	18:57:40	10.200.1.1/32	*Local/0	Local	19:24:13	224.0.0.5/32	*OSPF/10		14:19:27	224.0.0.9/32	*RIP/100		13:52:39
Destination	Protocol/Preference	Next-Hop	Age																																																																																								
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224.0.0.9/32	*RIP/100		13:52:39																																																																																								

Show OSPF Only Routes

- inet.0 route
- Remember this may not be the active forwarding table
- * indicates active



ONE - J2300

Monitor Configuration Diagnose Manage

- System
- Chassis
- Interfaces
- Routing**
 - Route Information
 - BGP Information
 - OSPF Information
 - RIP Information
- Firewall
- IPSec
- HAAT

Routing

Route Information

14 destinations, 21 routes (14 active, 0 hold down, 0 hidden) Showing 8 of 21 routes (Page 1 of 3)

inet.0

Destination	Protocol/Preference	Next-Hop	Age
10.2.0.0/24	*OSPF/10	via e1-0/0/2.0, selected	38:07
10.2.10.0/24	*OSPF/10	via e1-0/0/2.0, selected	13:53:57
10.3.0.0/24	*OSPF/10	via e1-0/0/3.0, selected	17:14
10.3.10.0/24	*OSPF/10	via e1-0/0/3.0, selected	13:53:57
10.100.1.0/24	OSPF/10	via e1-0/0/2.0, selected	13:53:57
10.100.2.0/24	*OSPF/10	via e1-0/0/2.0 via e1-0/0/3.0, selected	13:53:57
10.100.3.0/24	OSPF/10	via e1-0/0/3.0, selected	13:53:57
224.0.0.5/32	*OSPF/10		14:20:46

Narrow Search

Destination Address
Next Hop Address
Best Route
Exact Route
Number of Routes to Display
25

Protocol
ospf
Receive Protocol
Inactive Routes
Hidden Routes

OK

Viewing the OSPF process

■ OSPF Information



ONE - J2300

Logge

[Help](#) [Abo](#)

Monitor

Configuration

Diagnose

Manage

► System

► Chassis

► Interfaces

▼ Routing

Route Information

BGP Information

OSPF Information

RIP Information

► Firewall

► IPsec

► NAT

Routing

OSPF Information

OSPF Neighbors

OSPF Interfaces

OSPF Statistics

Monitor > Routing > OSPF

Routing

OSPF Information

OSPF Neighbors

OSPF Interfaces

OSPF Statistics

Address	Interface Name	State	ID	Priority	Activity Timer	Area	Options	DR Address	BDR Address	Up Time	Adjacency Time
10.100.1.2	e1-0/0/2.0	Full	10.50.2.1	128	34	0.0.0.0	0x42	0.0.0.0	0.0.0.0	14:10:29	14:10:29
10.100.3.2	e1-0/0/3.0	Full	10.50.3.1	128	37	0.0.0.0	0x42	0.0.0.0	0.0.0.0	14:10:48	14:10:48

Interface	State	Area	DR ID	BDR ID	Neighbors
e1-0/0/2.0	PtToPt	0.0.0.0	0.0.0.0	0.0.0.0	1
e1-0/0/3.0	PtToPt	0.0.0.0	0.0.0.0	0.0.0.0	1
fe-0/0/0.0	DR	0.0.0.0	10.50.1.1	0.0.0.0	0

Packet Type	Packets Sent	Packets Received
Hello	26	15324
DbD	16	13
LSReq	3	1
LSUpdate	114	123
LSAck	51	56

Depth of flood Queue	Total Retransmits	Total Database Summaries
0	0	0

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Lab 3 - Configuring OSPF

■ Objectives

- Configure OSPF :
 - On all ports except lo0 (passive)
 - Set to Area 0.0.0.0
- Confirm that you can see all neighbours
- Confirm that you can see all routes and they are preferred to other routes

■ QUESTIONS ?

Agenda

- J-series Hardware Platform
- Software Architecture, Services & Forwarding
- Initial Configuration (J-Web & JUNOS CLI)
- Licensing
- Interface configuration
- Static route / RIP configuration
- OSPF configuration
- **BGP configuration**
- Operations and Management



BGP Review

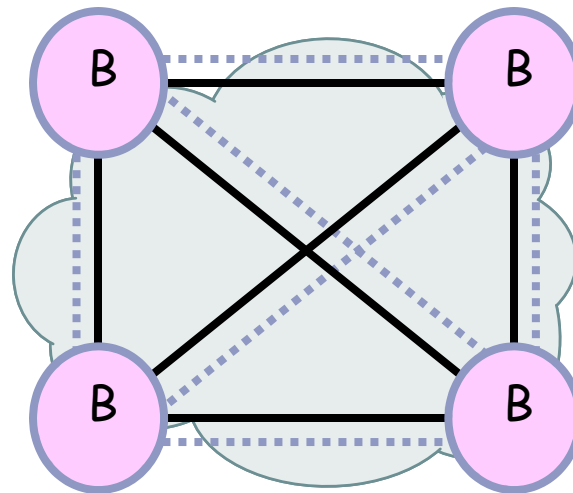
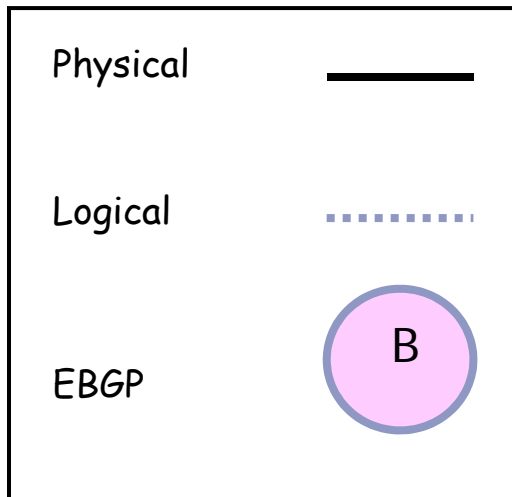
- **Border Gateway Protocol BGP – RFC 1771**
- **Exterior (EBGP) and Interior (IBGP) routing protocol**
 - EBGP – Used to communicate between AS's
 - IBGP - Used to communicate within an AS
 - Must be fully meshed between each router
 - Uses IGP to resolve next hop and routing path
 - AS – Autonomous System (Routers under the same administrative domain)

BGP Review Continued...

- **Uses TCP port 179**
- **Exterior (EBGP) BGP devices**
 - Normally share a common network
 - Belong to different Autonomous Systems
- **Interior (IBGP) BGP devices**
 - Must be fully meshed logically
 - Belong to the same Autonomous System

EBGP

- **EBGP Peers must belong to different AS's**
- **Are normally on the same physical network**

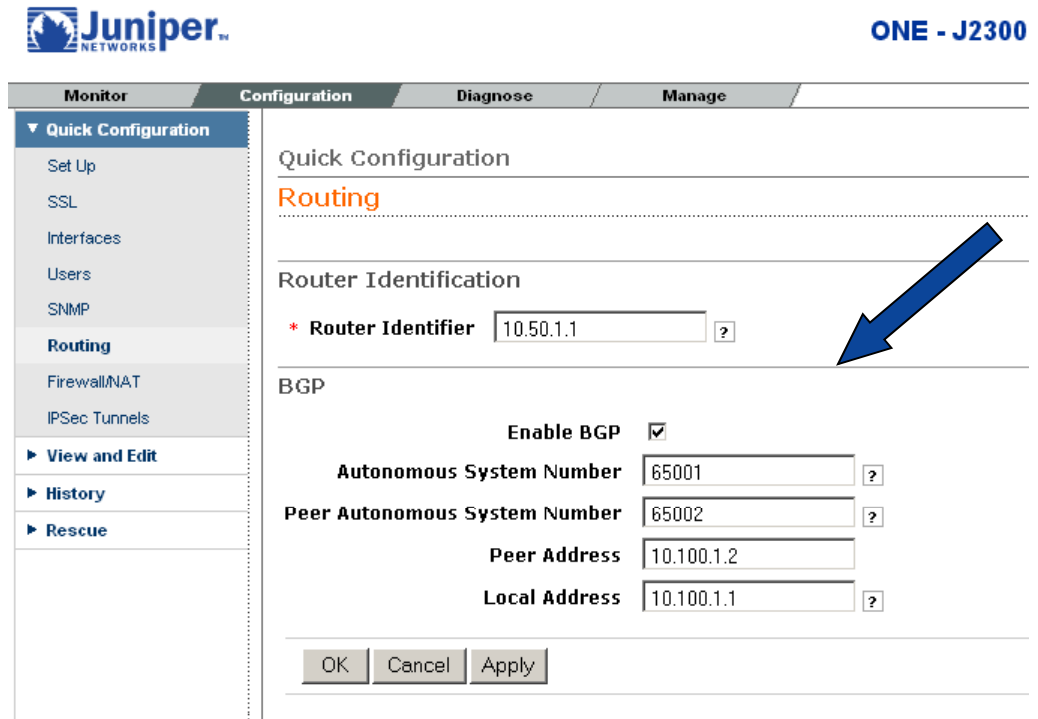


JUNOS BGP Path Selection

- **Path selection for multiple routes to the same destination**
 - Can the BGP next hop be resolved
 - Highest local preference value
 - Shortest AS-Path length
 - Lowest origin value (IGP, EGP, unknown)
 - Lowest MED value
 - EBGP over IBGP
 - Route with the lowest IGP metric
 - Path with the shortest cluster length
 - Peer with the lowest RID
 - Peer with the lowest interface

Configuring BGP

- **Enable BGP**
- **Enter**
 - local AS
 - remote AS
 - local Peer address
 - remote Peer address



The image shows the Juniper ONE - J2300 configuration interface. The top navigation bar includes 'Monitor', 'Configuration', 'Diagnose', and 'Manage'. The left sidebar lists various configuration options under 'Quick Configuration', with 'Routing' selected. The main content area is titled 'Quick Configuration' and 'Routing'. Under 'Router Identification', the 'Router Identifier' is set to '10.50.1.1'. A blue arrow points to this field. Below this, the 'BGP' section is visible, with 'Enable BGP' checked. The 'Autonomous System Number' is set to '65001', the 'Peer Autonomous System Number' is '65002', the 'Peer Address' is '10.100.1.2', and the 'Local Address' is '10.100.1.1'. At the bottom, there are 'OK', 'Cancel', and 'Apply' buttons.

ONE - J2300

Monitor Configuration Diagnose Manage

Quick Configuration

Routing

Router Identification

* Router Identifier 10.50.1.1 ?

BGP

Enable BGP ☒

Autonomous System Number 65001 ?

Peer Autonomous System Number 65002 ?

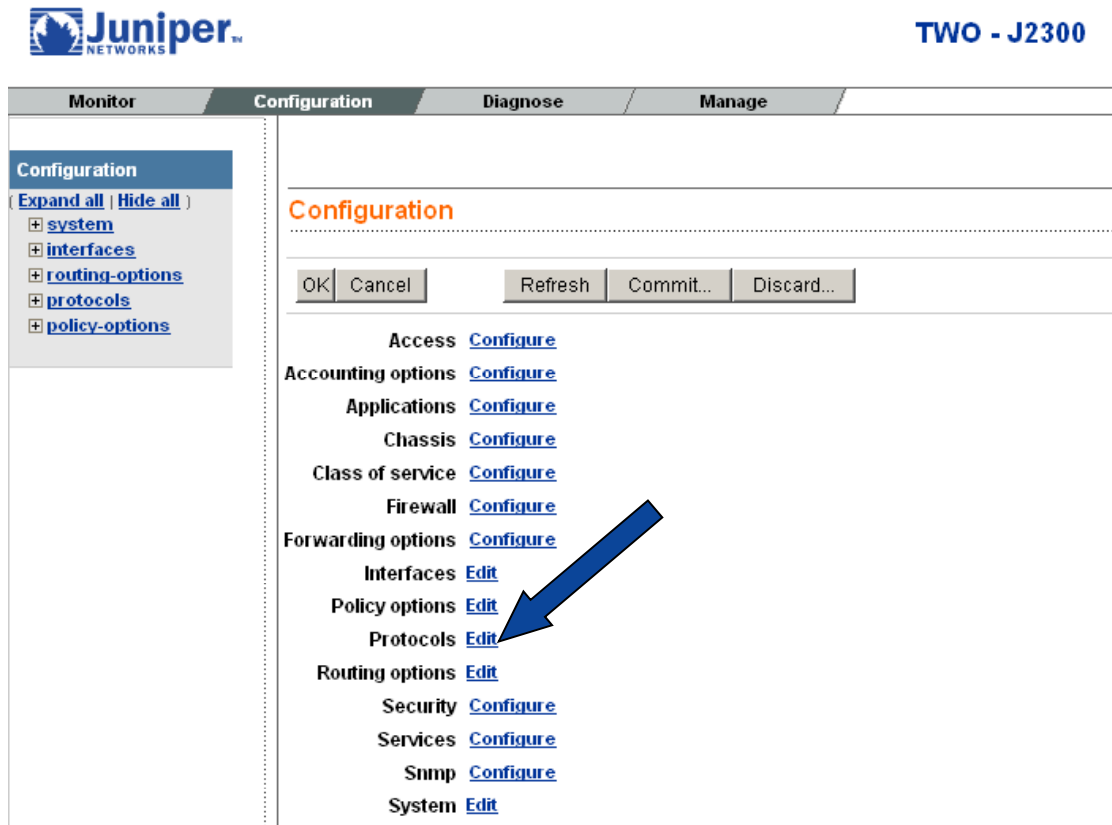
Peer Address 10.100.1.2

Local Address 10.100.1.1 ?

OK Cancel Apply

Adding Neighbours (Adv Config) – Step 1

■ Edit Protocol



Juniper NETWORKS TWO - J2300

Monitor Configuration Diagnose Manage

Configuration

Expand all | Hide all |

- + system
- + interfaces
- + routing-options
- + protocols
- + policy-options

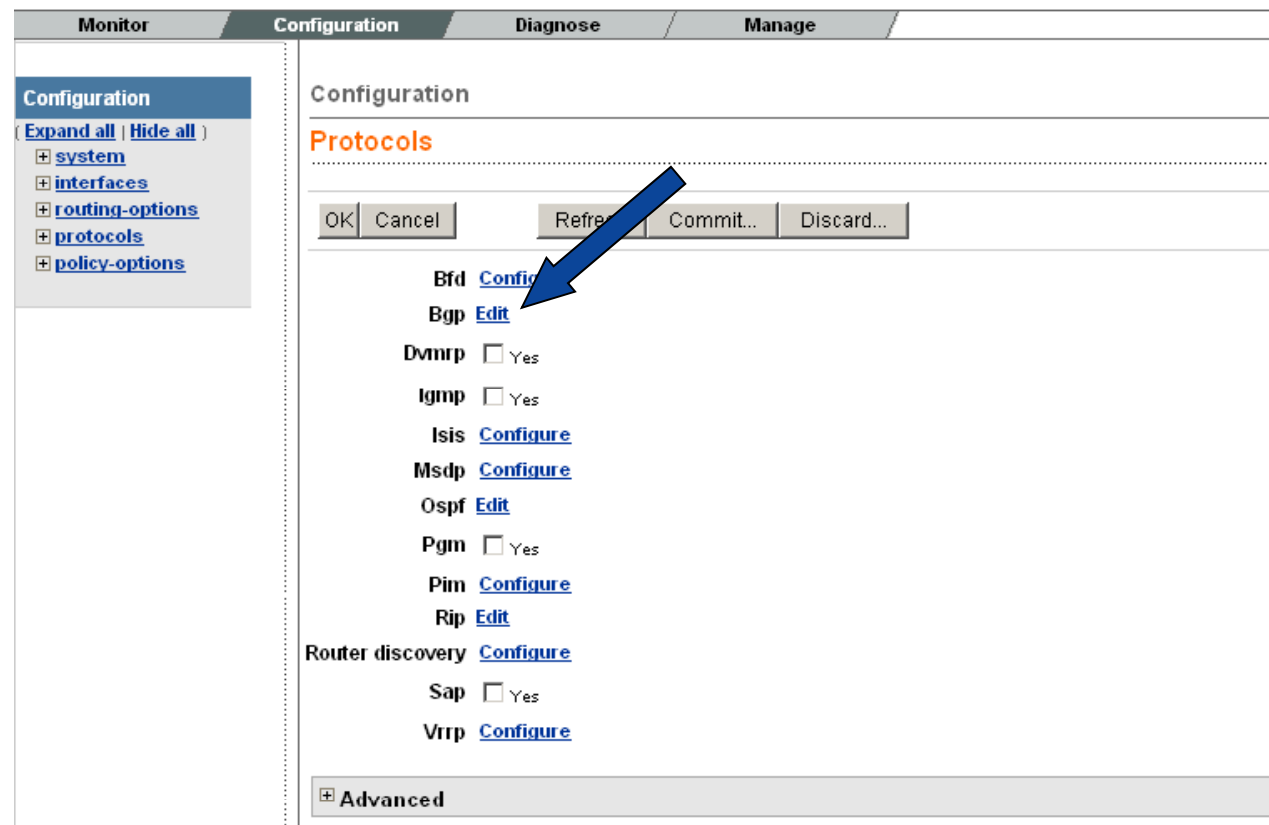
Configuration

OK Cancel Refresh Commit... Discard...

- Access [Configure](#)
- Accounting options [Configure](#)
- Applications [Configure](#)
- Chassis [Configure](#)
- Class of service [Configure](#)
- Firewall [Configure](#)
- Forwarding options [Configure](#)
- Interfaces [Edit](#)
- Policy options [Edit](#)
- Protocols [Edit](#)
- Routing options [Edit](#)
- Security [Configure](#)
- Services [Configure](#)
- Snmp [Configure](#)
- System [Edit](#)

Adding Neighbours – Step 2

■ Edit BGP



The screenshot shows the Juniper Configuration page with the following elements:

- Navigation tabs:** Monitor, Configuration (selected), Diagnose, Manage.
- Left sidebar:** Configuration section with links for [Expand all](#), [Hide all](#), [system](#), [interfaces](#), [routing-options](#), [protocols](#), and [policy-options](#).
- Main content area:**
 - Configuration** header.
 - Protocols** section with buttons: OK, Cancel, Refresh, Commit..., Discard...
 - Protocol list with links:
 - Bfd [Configure](#)
 - Bgp [Edit](#) (highlighted by a blue arrow)
 - Dvmrp ☐ Yes
 - Igmp ☐ Yes
 - Isis [Configure](#)
 - Msdp [Configure](#)
 - Ospf [Edit](#)
 - Pgm ☐ Yes
 - Pim [Configure](#)
 - Rip [Edit](#)
 - Router discovery [Configure](#)
 - Sap ☐ Yes
 - Vrrp [Configure](#)
 - [Advanced](#) (expandable section)

Adding Neighbours – Step 3

■ Edit jweb-bgp Group

Passive ☐ Yes
 Path selection
 Peer as ?
 Preference ?
 Remove private ☐ Yes
 Traceoptions [Configure](#)

Family

Inet [Configure](#)

Local as

As number ?
 Loops ?
 Private ☐ Yes

Export (None configured) [Add new entry](#)

Group [Add new entry](#)

Group name	Type	Description	Preference	Local preference	Nested Configuration
jweb-bgp					Neighbor

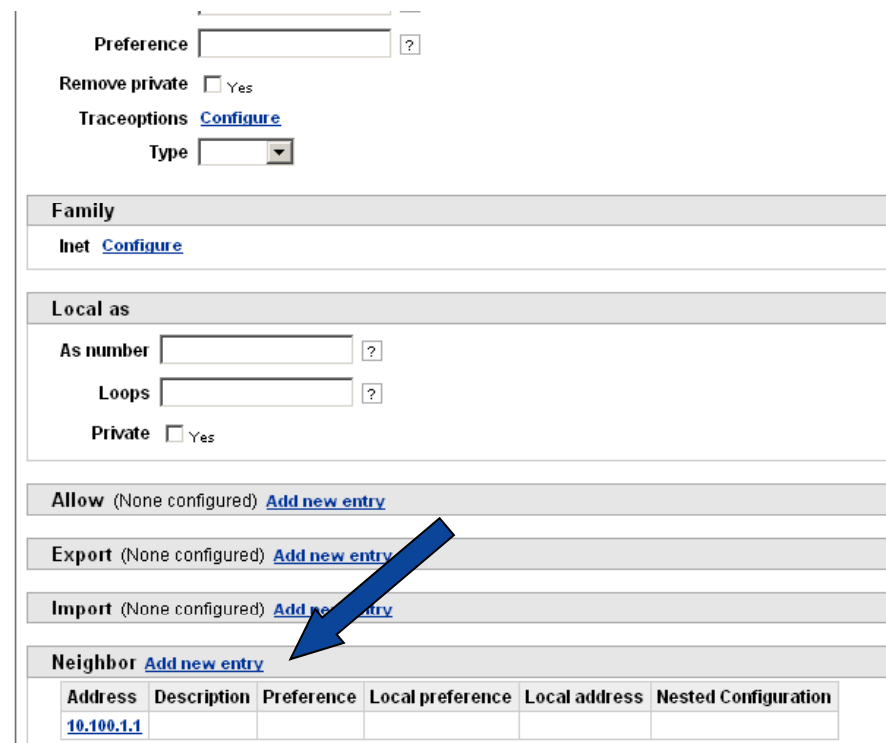
Import (None configured) [Add new entry](#)

Advanced

Adding Neighbours – Step 4

■ Add new neighbour

- Complete the following fields
 - Address (neighbour physical address)
 - Peer AS (neighbour)
 - Leave the rest blank
 - Commit



Preference ?

Remove private ☐ Yes

Traceoptions [Configure](#)

Type

Family

Inet [Configure](#)

Local as

As number ?

Loops ?

Private ☐ Yes

Allow (None configured) [Add new entry](#)

Export (None configured) [Add new entry](#)

Import (None configured) [Add new entry](#)

Neighbor [Add new entry](#)

Address	Description	Preference	Local preference	Local address	Nested Configuration
10.100.1.1					

Lab 4 - Configuring EBGP

■ Objectives

- Configure BGP :
 - To other neighbours in your Pod
 - Assign AS number 6500x; where x = router number
- Stop here! → • Confirm that you can see all BGP neighbours
- Create a static route, policy and redistribute into BGP (see next slide for syntax)

■ QUESTIONS ?

Lab 4 – static to ebgp

- Delete your static route from Lab 1 first
- root> configure
- root# set routing-options static route x.x.x.x/32 reject
 - where x = router number
 - reject = drop packet and send ICMP error
- root# set policy-options policy-statement static-ebgp from protocol static
- root# set policy-options policy-statement static-ebgp then accept
- root# set protocols bgp export static-ebgp
- root# commit

Agenda

- J-series Hardware Platform
- Software Architecture, Services & Forwarding
- Initial Configuration (J-Web & JUNOS CLI)
- Licensing
- Interface configuration
- Static route / RIP configuration
- OSPF configuration
- BGP configuration
- **Operations and Management**



User Accounts

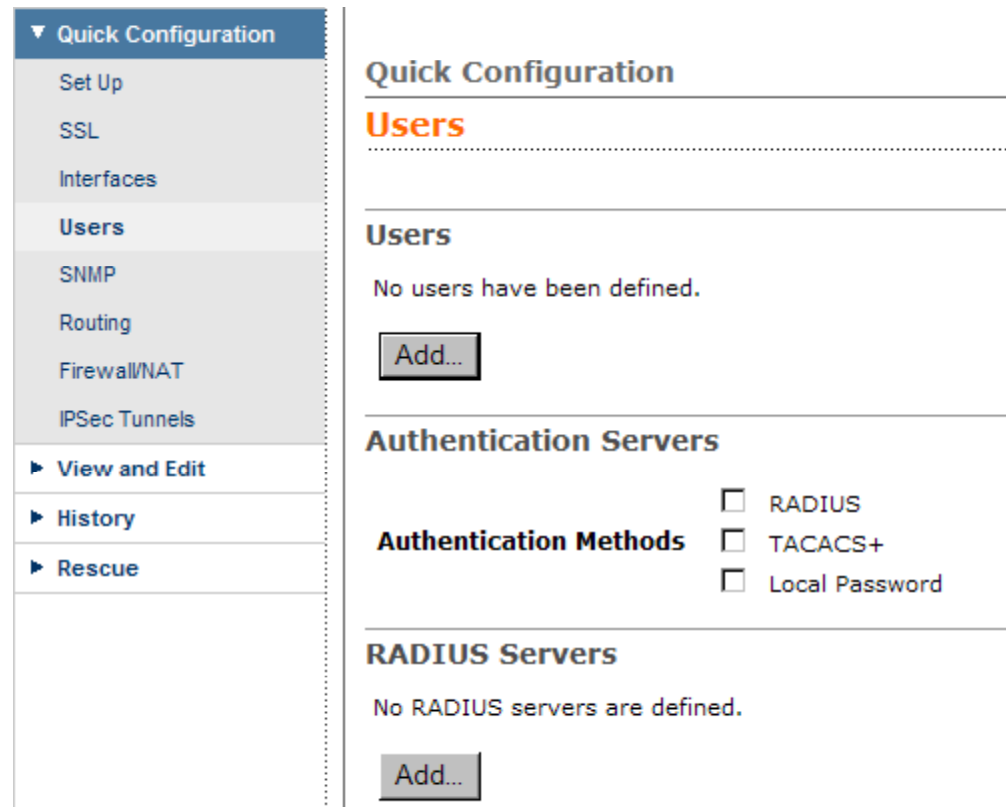
- **Authentication local, RADIUS, TACACS+ Login Class (pre-defined or user defined)**
- **Access privileges (Permission Bits) users have when they are logged into the router**
- **Commands and statements that users can and cannot specify**
- **How long a login session can be idle before it times out and the user is logged off**

Pre-Defined Login Classes

Login Class	Permission Bits Set
Operator	Clear, network, reset trace, view
Read-only	View
Super-user	all
Unauthorized	none

Creating New Users

- **Quick Configuration > Users > Add**
 - Type the name of the user and select a configuration class



The screenshot displays the Juniper Quick Configuration web interface. On the left is a navigation pane with a tree structure. The 'Quick Configuration' section is expanded, and 'Users' is selected. Below it are links for 'View and Edit', 'History', and 'Rescue'. The main content area on the right is titled 'Quick Configuration' and 'Users'. It states 'No users have been defined.' and includes an 'Add...' button. Below this is the 'Authentication Servers' section, which includes 'Authentication Methods' with checkboxes for 'RADIUS', 'TACACS+', and 'Local Password'. The 'RADIUS Servers' section follows, stating 'No RADIUS servers are defined.' and also featuring an 'Add...' button.

▼ Quick Configuration

- Set Up
- SSL
- Interfaces
- Users**
- SNMP
- Routing
- Firewall/NAT
- IPSec Tunnels

► View and Edit

► History

► Rescue

Quick Configuration

Users

No users have been defined.

[Add...](#)

Authentication Servers

Authentication Methods

- ☐ RADIUS
- ☐ TACACS+
- ☐ Local Password

RADIUS Servers

No RADIUS servers are defined.

[Add...](#)

Customised “Login Class” profile options

■ Created from the CLI

- root# set system login class [] permissions ?

Permission Bit	Access
security-control	Can view and configure security information (at the [edit security] hierarchy level).
shell	Can start a local shell on the router by entering the start shell command.
snmp	Can view SNMP configuration information in configuration and operational modes.
snmp-control	Can view SNMP configuration information and configure SNMP (at the [edit snmp] hierarchy level).
system	Can view system-level information in configuration and operational modes.
system-control	Can view system-level configuration information and configure it (at the [edit system] hierarchy level).
trace	Can view trace file settings in configuration and operational modes.
trace-control	Can view trace file settings and configure trace file properties.
view	Can use various commands to display current systemwide, routing table, and protocol-specific values and statistics.

Software Upgrade Overview

- All junos-jseries software is delivered in signed packages that contain Secure Hash Algorithm 1 (SHA-1) checksum
- The junos-jseries package completely reinstalls the software. This package rebuilds the file system but retains configuration files, log files, and similar information from the previous version.

Before you begin

- **To download software upgrades, you must have a Web account with Juniper Networks. To obtain an account, complete the registration form at the Juniper Networks Web site:**
 - <https://www.juniper.net/registration/Register.jsp>
- **Find software you need at:**
 - <https://www.juniper.net/support/csc/swdist-ww/>
- **To back up the file system to the removable compact flash drive, issue the following command (j4300, j6300):**
 - `user@host> request system snapshot media removable-compact-flash`
- **To back up the file system to the removable USB drive, issue the following command (j2300):**
 - `user@host> request system snapshot media usb`

Installing from a remote FTP server

**GINGER - J2300**

Logged in as: **regress**
[Help](#) [About](#) [Logout](#)

Monitor / **Configuration** / **Diagnose** / **Manage**

[Manage](#) > [Software](#) > [Install Remote](#)

► Files

▼ Software

Install Remote

Upload Package

Downgrade

► Licenses

► Reboot

Software

Install Remote

You can instruct the router to retrieve a software package from a remote server by specifying the location below.

* Package Location

User

Password

Reboot If Required


☐

Fetch and Install Package

Cancel

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Uploading Software from PC

**GINGER - J2300**

Logged in as: **regress**
[Help](#) [About](#) [Logout](#)

Monitor / Configuration / Diagnose / **Manage**

Manage > Software > Upload Package

Software

Upload Package

The software package file specified below will be uploaded to the router for installation.

* **File to Upload**

Reboot If Required ☐

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JUNOS Logging

- Top Menu
“MANAGE”
“Files”
- Log Files
- Download file for viewing
- `root> show log ?`

Monitor
Configuration
Diagnose
Manage

Files
Software
Licenses
Reboot

Files

Clean Up Files

If you are running low on storage space on your router, you can c perform the following:

- Rotate your log files
- Delete log files in /var/log that are not currently being writt
- Delete temporary files in /var/tmp that have not been toucl
- Delete all crash files in /var/crash

Alternatively, you can click on the "File Type" group name below to

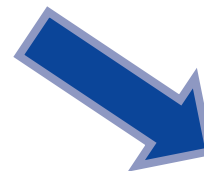
[Clean Up Files](#)

Download and Delete Files

File Type	Directory	Usage
Log Files	/cf/var/log	767K
Temporary Files	/cf/var/tmp	9.0K
Crash (Core) Files	/cf/var/crash	2.0K

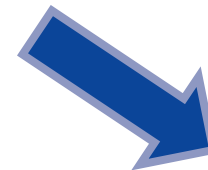
Delete Backup JUNOS Package

There is no backup JUNOS package.



Specific Logging (like debug)

- **root> monitor interface traffic**
- **root> monitor interface fe-0/0/0**
 - Realtime ins and outs...
- **Traceoptions – configured under most configuration stanzas**
 - e.g. (web) [Configuration > View and Edit > Edit Configuration > Protocols > Bgp](#)
- **Set file name, # files, size, flags (what to look out for)**



Peer as ?

Preference ?

Remove private ☐ Yes


Traceoptions [Configure](#)

Family

Inet [Configure](#)

Rebooting or Halting the Router

- **root> request system halt**
 - or push the power on button
- **root> request system reboot**



GINGER - J2300

Logged in as: **regress**
[Help](#) [About](#) [Logout](#)

[Monitor](#) / [Configuration](#) / [Diagnose](#) / [Manage](#)

[Manage > Reboot](#)

- ▶ Files
- ▶ Software
- ▶ Licenses
- ▶ Reboot

Reboot

Schedule Reboot Or Halt

To reboot or halt the system, please select a time below.

Note that a halted system can only be accessed from the system console port.

The current system time is 15:14 (3:14 PM). Reboots scheduled to occur in the future will occur regardless of whether you log out of web management.

☐ Reboot Immediately

☒ Reboot in 5 minutes

☐ Reboot when the system time is 15 : 15

☐ Halt Immediately

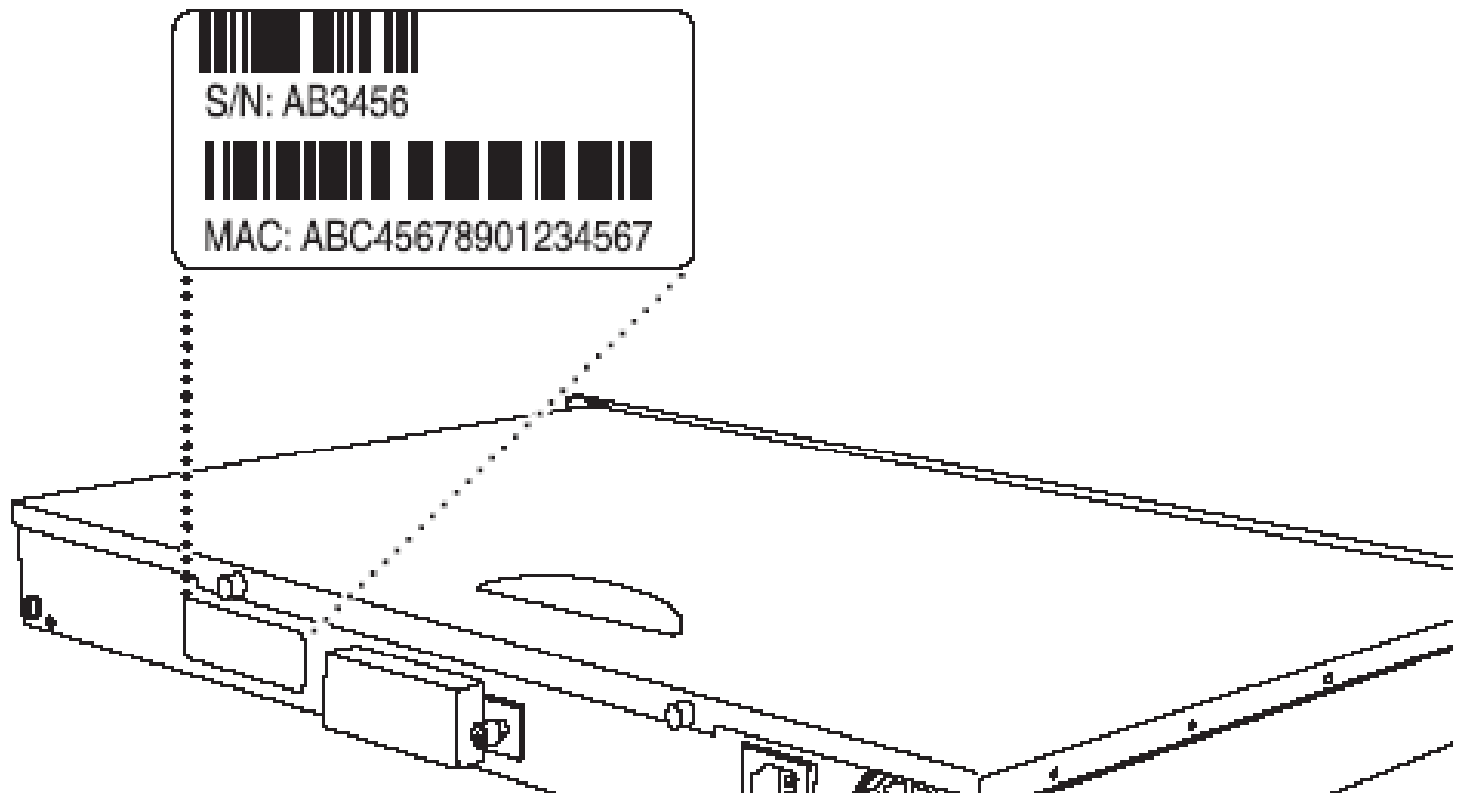
Reboot From Media compact-flash

Message

Customer Support: Locating Serial Numbers

- **router> show chassis hardware**

Serial number ID label

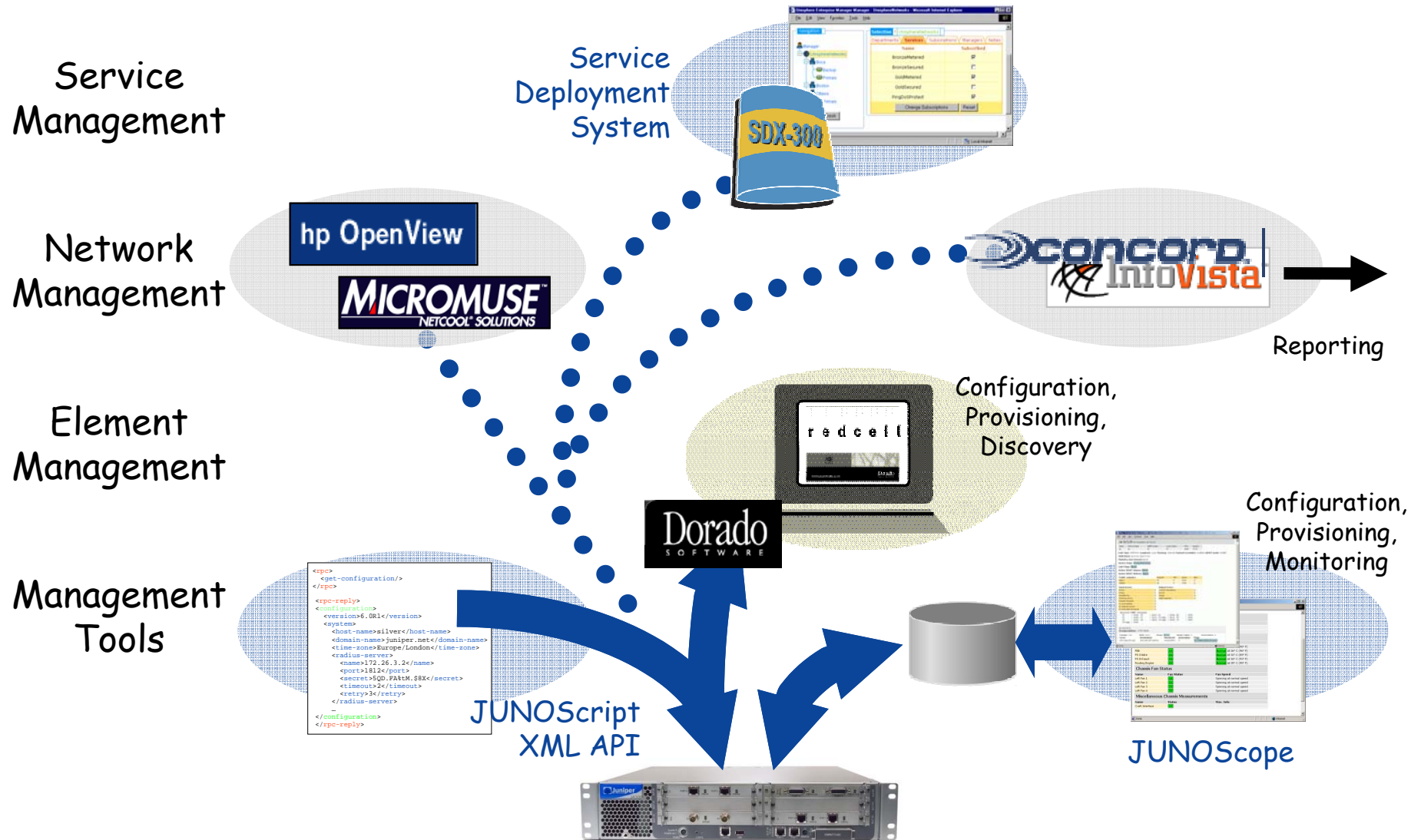




- 11 JTAC centers worldwide
- 24 x 7 x 365 operation
- 200+ JTAC Engineers WW

Contacting Customer Support

- **If you need assistance while troubleshooting a Services Router, open a support case using the Case Manager link at**
 - <http://www.juniper.net/support/>
- **Telephone Contacts**
 - http://www.juniper.net/support/support_contacts.html
 - Australia 1 800-008-792
 - New Zealand 800-44-3774
- **root> request support information | save filename []**
 - Default directory /var/home/[username]



J-Series Management Applications

- **Router Instrumentation**
 - SNMP MIBs, traps, syslog
 - JUNOScript - XML API
 - Configuration modifications
 - RPM – Realtime Performance Management
 - QoS level performance monitoring
 - Built into JWeb JUNOS 7.1
- **Licensed Features**
 - J-Flow – flow statistics
- **Network Management Products**
 - SDX – Service Deployment System
 - Managed services, realtime user service deployment and modifications
 - JUNOScope – web based element configuration manager

Monitoring and Diagnosing a Services Router



Monitor	Configuration	Diagnose	Manage										
<ul style="list-style-type: none"> ▶ System ▶ Chassis ▶ Interfaces ▶ Routing ▶ Firewall ▶ IPsec ▶ NAT 	<h2>System</h2> <hr/> <h3>System Identification</h3> <table border="1"> <tbody> <tr> <td>Serial Number</td> <td>JN001692AA</td> </tr> <tr> <td>JUNOS Software Version</td> <td>7.0R1.5</td> </tr> <tr> <td>Router Hostname</td> <td>two</td> </tr> <tr> <td>Router IP Address</td> <td>Could not resc</td> </tr> <tr> <td>Loopback Addresses</td> <td></td> </tr> </tbody> </table>			Serial Number	JN001692AA	JUNOS Software Version	7.0R1.5	Router Hostname	two	Router IP Address	Could not resc	Loopback Addresses	
Serial Number	JN001692AA												
JUNOS Software Version	7.0R1.5												
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Router IP Address	Could not resc												
Loopback Addresses													

Agenda

- J-series Hardware Platform
- Software Architecture, Services & Forwarding
- Initial Configuration (J-Web & JUNOS CLI)
- Licensing
- Interface configuration
- Static route / RIP configuration
- OSPF configuration
- BGP configuration
- Operations and Management





JUNOS Sealed Section

Cool things about the CLI

- CLI is hierarchical, modular
- Able to define “configuration groups” and apply them to different sections of your configuration – saving time allowing scalability and quick changes effecting many configurations
- Capability to rename parts of your configuration
- Deactivate / disable parts of your configuration
- Insert identifiers (i.e. statement in the middle of an access list).
- Annotate configuration statements
- Commit check (configuration verification with out having to make active; syntax checking)
- Scheduled commits
- Extremely flexible configuration options, which can also be confusing
 - there are many ways to configure JUNOS to achieve specific outcomes

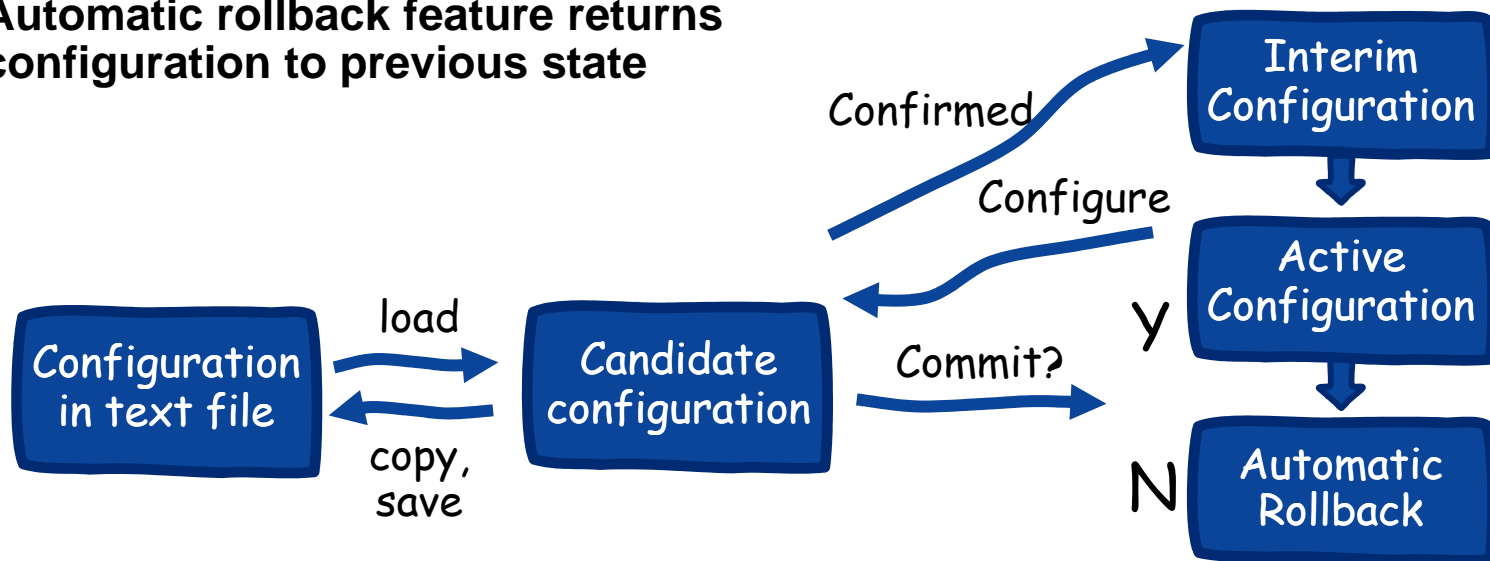
Configuration Mode

Configuration Mode of CLI

- Create candidate configuration
- Commit check verifies the candidate
- Changes require separate commit
- Automatic rollback feature returns configuration to previous state

Advantages

- Prevents accidental router isolation
- Changes accumulate and are applied only when confirmed
- Previous configurations are recovered easily

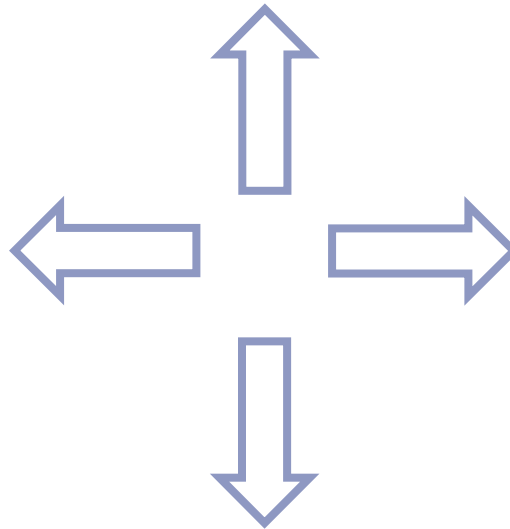


Key Configuration Concepts

candidate configuration	A working copy of the configuration that can be edited without affecting the Services Router until it is committed.
configuration group	Group of configuration statements that can be inherited by the rest of the configuration.
commit a configuration	Have the candidate configuration checked for proper syntax, activated, and marked as the current configuration file running on the Services Router.
configuration hierarchy	The JUNOS software configuration consists of a hierarchy of statements. There are two types of statements: container statements, which contain other statements, and leaf statements, which do not contain other statements. All the container and leaf statements together form the configuration hierarchy.
rescue configuration	Configuration that recovers a Services Router from a configuration that denies management access. You set a current committed configuration through the J-Web interface or CLI for emergency use. To load and commit the rescue configuration, you press and release the CONFIG button.
rollback a configuration	Return to a previously committed configuration.

Editing Commands – standard stuff

- **Ctrl-U** **deletes all characters**
- **Ctrl-A** **moves to the beginning on the line**
- **Ctrl-E** **moves to the end of the line**
- **Ctrl-L** **redraws the current line**
- **Keyboard**



Stepping through...

- **root% cli**
- **root> configure**
- **root# set ?**
- **root# edit interfaces fe-0/0/0**
 - parks you in that mode shortening required commands
- **root# deactivate interfaces fe-0/0/0**
- **root# show**
 - displays the candidate configuration
- **root# run show configuration**
 - displays the current active configuration
- **root# commit and-quit**
 - makes the candidate configuration > active
- **Root> show ?**

Handy tips – try them out...

- **root> help topic ? ...conceptual**
- **root> help reference ? ...config related**
- **root> show configuration | match “xxx xx”**
- **root> show configuration | display set**
- **root> configure [exclusive | private]**
 - These options only available from the CLI no JWeb capability
- **Root> show configuration | find interfaces**
- **“run” allows any command from the root> to be executed**
- **root# run show route | match 10/8**
- **root# run show route | match 10/8 | count**
- **Scrolling up and down through output from a show command**
 - U – up, D- down, Ctrl - E
- **Moving up and down the configuration hierarchy**
 - up | exit – up one level / top – to the top of the configuration

Handy tips – continued...

- **root# commit confirmed 10minutes**
- **root# commit at hh:mm:ss**
- **root# rollback [0-49]**
- **root# load merge terminal**
- **root# load replace terminal**
- **root# delete interfaces fe-0/0/0**
- **root# save [filename] from where you are**
- **root> request system halt**
- **root> request system reboot**

Handy tips – last page...

- **root# edit interfaces fe-0/0/0**
- **[edit interfaces fe-0/0/0]**
- **root# set traceoptions flag [all | event | ...]**
 - no filename allowed > messages default
- **root# run show log messages**

- **root# edit protocols ospf**
- **[edit protocols ospf]**
- **root# set traceoptions file ospf-trace**
- **root# set traceoptions flag ? (repeat lines for options)**
- **root# run show log ospf-trace**

Aggregate Route Configuration

- Combining multiple routing entries into one (summarisation)
- In order for the router to be active and advertised (if redistributed) only one candidate route need be active
- root# **set routing-options aggregate route 10/8**
- Remember static route configuration
- root# **set routing-options static route route 10.1/16 next-hop [x.x.x.x | reject | discard]**

Policy Overview

- **Controls routing information transferred into and out of the routing table**
 - Ignore, change, suppress incoming / outgoing routing information
- **root# set policy-options policy statement [name] from [match-conditions]**
- **root# set policy-options policy statement then [action]**
- **Be careful of default actions (unfortunately we don't have time in this course – even if we get this far!)**

Configuring Filters & NAT

- **Packet Filter (non-stateful)**
 - Or
- **Stateful firewall filter as a basis for performing Network Address Translation (NAT)**
 - Requires license



Packet Filter example – JUNOS CLI

CREATE THE POLICY

```
firewall {  
  filter LOCAL-ACCESS-CONTROL {  
    term LOGIN-PERMIT {  
      from {  
        source-address {  
          192.168.1.0/24;  
        }  
        protocol tcp;  
        destination-port telnet;  
      }  
      then accept;  
    }  
    term LOGIN-DENY {  
      from {  
        protocol tcp;  
        destination-port telnet;  
      }  
      then {  
        discard;  
      }  
    }  
  }  
}
```


APPLY THE POLICY TO YOUR LOOPBACK INTERFACE

```
interfaces {  
  lo0 {  
    unit 0 {  
      family inet {  
        no-redirects;  
        filter {  
          input LOCAL-ACCESS-CONTROL;  
        }  
        address 10.10.10.10/32  
      }  
    }  
  }  
}
```


Unix File System

- **root> file show ?**
 - /var/home/username (default)
- **root> file show /**
- **root> exit**
- **root%** (unix kernel)
- **ls**
- **cd**
- **pwd**

IOS to JUNOS Converter



Home Solutions Products & Services J-Security Center **Support** Education Partners Company How to Buy



I2J Home
Feature Status
Known Issues
Change Log
Terms of Use
FAQ
Help

Support

IOS TO JUNOS TRANSLATOR

IOS INPUT

The IOS to JUNOS Translator (I2J) converts FULL IOS Configuration files for both 75xx and 12xx platforms into Juniper Networks JUNOS format.

Not all IOS commands are translated and some may be translated incorrectly. Hand reviewing the output is ABSOLUTELY NECESSARY.

Although most IOS commands can be input singularly, this is NOT recommended or supported.

Paste a complete IOS config file

- OR -

Upload an IOS config file

Select option(s)

☒ Output IOS lines that converted properly

☒ Output verbose IOS comments

IOS to JUNOS comparisons

- `router> enable`
- `router# configure terminal`
- `router(config)# ...`

- `root> configure`
- `root# set ...`
- `root# commit`

- `router(config)# interface fe0/1 shutdown`
- `root# disable interfaces fe-0/0/0`
- `root# commit`

IOS to JUNOS comparisons cont...

- `router(config)# interface fe0/1 ip address 1.1.1.1 255.255.255.0`
- `root# set interface fe-0/0/0 unit 0 family inet address 1.1.1.1/24`
- `root# commit`
- `router# debug ?`
- `root# set protocols bgp traceoptions file []`
- `root# set protocols bgp traceoptions flag ?`

IOS to JUNOS comparisons cont...

- `router(config)# router rip`
- `router(config)# network 1.1.1.0`

- `root# set protocols rip group rip-interfaces interface fe-0/0/0`
- `root# commit`

- `router(config)# access list 101 permit 1.1.1.0 255.255.255.255 eq 80`
- `root#`

Instructor Demonstration

- **Delete entire config**
- **Load demo config**
- **Rename interface fe-0/0/0 to fe-0/0/1**
- **Rename ip address on fe-0/0/1**
- **Disable interface fe-0/0/0**
 - removed from active config
- **Deactivate interface fe-0/0/1**
 - remains in active config
- **Rename policy**
- **Insert comments - #whole line or #after a command**

Juniper *your* Net™