THE POWER OF A CONNECTED WORLD

Javier Grizzuti System Engineer Juniper Networks Noviembre 2016

JUNPER. NETWORKS



Vision: To Be the Worldwide Leader of Network Innovation

Go to Market Vertical Focus

Alliance, Channel and Commercial Engines







Innovation Matters Across the Network





Edge/ Access & Aggregation





Core





WHY JUNIPER?



PERFORMANCE

- Line-rate performance
- Wire-speed security
- Scale
- Density
- **Rich service provider** feature set

HIGH AVAILABILITY

- Carrier-class platform
- Redundant hardware and software options
- **Virtual Chassis** technology
- In-service software upgrades



- **Automation**

SIMPLICITY

Collapsed architectures One Junos OS across routing portfolio **Platform for innovation** Service Now/Service

ARCHITECTING NETWORKS



FOCUS ON ROUTING, SWITCHING AND SECURITY



JUNOS: THE POWER OF ONE

Deployed since 1998

- First high-performance network operating system
- 18 years of innovation and development
 - Spans routing, switching, and security platforms
 - Simplify operations and deliver operational excellence
 - **Evolutionary architecture expands and extends to** tomorrow
- Serving the most demanding customers
 - Top 100+ service providers
 - High-performance enterprise and public sector custor es



JUNOS SOFTWARE ARCHITECTURE Separation of Control & Data **Open Management**



- Plane
- Independent modules
 - Protected memory for stability
- Well-defined interfaces for expansion of functions/platforms
- Scales performance, enhances resiliency, enables redundancy
- Open Management & **Development Interfaces**
 - NETCONF/XML/DMI
 - Junos API
 - Automation

Separation of Control and Forwarding



- All platforms running JUNOS Software share a common design goal:
 - Clean separation of control and forwarding
- RE maintains routing table, bridging table, and primary forwarding table
- PFE simply does what it is told—really fast

Operating Junos



CLI Modes

- **Operational mode:**
 - Monitor and troubleshoot the software, network connectivity, and switch The > character hardware user@switch> identifies operational mode

- **Configuration mode:**
 - Configure the switch, including interfaces, general bridging information, routing protocols, user access, and system hardware properties
 - [edit] user@switch#~

The *#* character identifies configuration mode

Command and Variable Completion Spacebar completes a command

user@switch> sh <space> 'i' is ambiguous.</space>	ow i <s< th=""><th>space> Enter a space complete</th></s<>	space> Enter a space complete
Possible completions:		command
igmp	Show	Internet Group Management Protocol
igmp-snooping	Show	IGMP snooping information
ike	Show	Internet Key Exchange information
interfaces	Show	interface information
ipsec	Show	IP Security information
isis	Show	Intermediate System-to-Intermediate

user@switch> show i •Use the Tab key to complete an assigned variable

[edit policy-options] user@switch# show policy-statement t<tab>his-is-my-policy then accept;

[edit policy-options] user@switch#

Use a tab to complete assigned variables

e to



Configuration File Differences (1 of 2)

Change the candidate configuration:

[edit system] user@switch# set services telnet [edit system] user@switch# delete services web-management [edit system] user@switch# delete services ssh

Display differences between the candidate and active configurations:

user@switch# show | compare [edit system services]

- ssh;
- + telnet;
- web-management {
- http { _
- port 8080;
- 13



Configuration File Differences (2 of 2)

Compare active and historical configurations:

user@switch> show configuration | compare rollback <u>number</u> user@switch> show configuration | compare filename

Compare arbitrary files: user@switch> file compare files <u>filename 1</u> filename 2



Helpful Configuration-Mode Commands

- Commands to aid in configuration:
 - rename a configuration statement
 - user@switch# rename interfaces ge-0/0/10 to ge-0/0/11
 - replace a pattern of configuration statements user@switch# replace pattern ge-0/0/10 with ge-0/0/11
 - **copy a configuration statement to another statement** user@switch# **copy interfaces ge-0/0/10 to ge-0/0/11**
 - deactivate or ignore a configuration statement

user@switch# deactivate interfaces ge-0/0/10

- insert a configuration statement in another location [edit policy-options policy-statement test] user@switch# insert term three before term two
- Remember to commit!

COMMIT MODEL



Separation of configuration, edit and activation Validation checks, version control, automated rollback

Benefits

Avert downtime caused by configuration errors **Reduce time for configuration and changes Enforce compliance to policies** Avoid risks of transient configuration state **Compare configurations** Easily roll back to past configurations

Active configuration stored in

/config/juniper.conf.gz **Rollback files stored in** /config/juniper.conf.n.gz (n=1-3) config/db/config/juniper.conf.n.gz (n=4-49)





Committing a Configuration

You must commit configuration changes for them to take effect:

[edit] user@switch# commit commit complete [edit] user@switch#

•Use commit check to confirm syntax:

[edit]

root@switch# commit check [edit interfaces ge-0/0/10 unit 0]

'family'

When ethernet-switching family is configured on an interface, no other family type can be configured on the same interface.

error: configuration check-out failed

•Use commit confirmed to temporarily activate:

user@switch# commit confirmed commit confirmed will be automatically rolled back in 10 minutes unless confirmed commit complete



run Is Cool

•Use the run command to execute operational mode CLI commands from within the configuration

- A real time-saver when testing the effect of a recent change
- Context-sensitive help is fully supported

[edit interfaces ge-0/0/12] user@switch# set unit 0 family inet address 10.250.0.141/16

[edit interfaces ge-0/0/12] user@switch# commit commit complete

Test configuration changes without leaving configuration mode with run

[edit interfaces ge-0/0/12] user@switch# run ping 10.250.0.149 count 1 PING 10.250.0.149 (10.250.0.149): 56 data bytes 64 bytes from 10.250.0.149: icmp seq=0 ttl=255 time=0.967 ms

--- 10.250.0.149 ping statistics ---1 packets transmitted, 1 packets received, 0% packet loss round-trip min/avg/max/stddev = 0.967/0.967/0.967/0.000 ms

JUNOS Power Tools: Configuration Groups

- Groups of statements that you can apply to different sections of a configuration
 - Shortcut method of applying the same parameters to many parts of a configuration
 - Required for redundant RE support
- Target area of configuration inherits information from source of configuration data

groups {

```
group-name {
```

```
configuration-data;
```



JUNOS Power Tools: Interface Group Example

[edit]					
[edit interfaces]					
lab@s1# show interfaces					
ge-0/0/0 {					
unit 0 {					
<pre>family ethernet-switching {</pre>					
port-mode access;					
vlan {					
members v100;					
}					
}					
}					
}					

[edit]
lab@s1# show groups
all-ge {
interfaces {
<ge-*> {</ge-*>
ether-options {
no-auto-negotiation;
flow-control;
link-mode full-o
speed {
100m;
}
[edit]
lab@SanJose# set interfaces appl



JUNOS SCRIPTS



Junos Infrastructure

Commit **Scripts**

Output Instructions on actions to take (m<mark>ake chan</mark>ges, issu<mark>e warn</mark>ings, errors, etc.)

NETCONF/DMI



- User-class privilege aware

JUNOS Router Telemetry

Scalable Telemetry Framework for external and internal usage

Virtual Network Functions (VNF) acceleration

Target Use cases

Goals

Performance Management Telemetry for PCE Controller and other **SDN/NFV** Application Burstable billing

Key Distributed export closer to the source Advantages Simplifies collector infrastructure, no polling

More information: <u>http</u> ://easylink.juniper.net/vision







JUNIPE

MX ASIC Evolution – MPC Per Slot Capacity







Introducing EA (Ea 3rd generation Trio ASIC

Physical Characteristics

- 28nm process
- 23.44mm x 23.15 mm die size
- More than 60% power consumption reduction, enabling 0.5W per gigabit at the system level

Capabilities

- All Trio forwarding features •
 - High scale flow export, video monitoring
 - Ethernet OAM and BFD
 - Performance monitoring
 - Sophisticated packet parsing, lookup and encapsulation
- Integrated rich queueing
- Improved tunnel performance
- Chip level telemetry and analytics support



Industry's first 400GE capable network processor

JUNIPE

4th Generation Silicon (ZT-C MX960 & MX2K Multi-



Goals

MX960 MPC

- 1.5T target per slot
- 100GE optimized
- Backward compatible with all Trio MPCs

MX2010, MX2020 MPC

- Targeting 4T per slot
- Less than 0.25W/G
- Fully backward compatible

Packet Forwarding Engine

- 4th Generation of Trio Architecture
- Very high capacity security with inline encryption/decryption
- Full HQoS and inline services

Upgrade

- No change to existing fans and power supply
- Upgrade using JAM
- New Fabric and Line Card only

Key Breakthroughs

- Less than 0.25W/G
- High Speed Inline Crypto



Planned for 2017/2018

100GE and 400GE optimized 16nm process – 500G Chip

JUNIPE

MX Roadmap Over

CENTRAL OFFICE OPTIMIZED



MX SERIES 3D FAMILY

•MX Family - Metro Ethernet Forum Compliant

- MX960
- MX480
- MX240
- Multi Port Concentrator (MPC)
- Host Common Equipment (redundant)
 - Routing Engine (RE)
 - Switch Control Board (SCB)
 - Power
 - Fans
- **•Craft Interface**



JUNIPER MX SERIES MID RANGE SOLUTION

- Family of high performance Mid-Range Routers •
- MX5: 5G MR Router
 - 20x1G
- MX10: 10G MR Router
 - 20x1G & 1 Modular Slot
- MX40: 40G MR Router
 - 2 Modular Slots & 2x10G
- **MX80**:
 - 2 Modular Slots & 4x10G
- Support for WAN (TDM) Interfaces in Modular slots
- **Option to upgrade from MX5 to MX10 to MX40 to** 80
- Service MIC support in rear slot







MX80: modular chassis

MX80 Modular

- 4x10G XFP (slot-0)
- Service MIC (slot-0)
- 2x MIC (slot-1)
- •Upto 8x10G in 2RU !





• MCS supported: Has VLAN Q / HQoS for MIC slots

6-15 us latency

- MIC-3D-20x1GE-SFP
- MIC-3D-2XGE-XFP
- MIC-3D-40x1GE-RJ45

- Hardware support for Timing
- Sync-E
- BITS, UART, 1pps /10Mhz
- **PEM redundancy (shipped with 1 PEM default)**

MX80: system architecture



Mx80: Routing engine

- **PowerQUICC III**
 - 1.3Ghz dual-core processor DDR2 at 266Mhz
 - 2GB of physical memory for
- control-plane
- 8MB of NOR flash 4GB of NAND storage (instead of
- hard-disk)
- 1x RJ45 console
- 1x RJ45 aux/modem 10/100/1000Base-TX
- management
- USB for install media
- About 1/3 performance of MX's **RE-1300**

MX104 – Universal Aggregation Router

Compact, Redundant & Future proof

- Trio based PFE 80G
- 17.5 in (W) x 3.5RU (H) x 9.5 in (D)
- ETSI-300 compliant
- Dual redundant hot-pluggable REs for **Control Plane redundancy**
- Dual redundant 1RU 600 Watt PSUs; AC and DC input variants
- Wide operating temp range -40C to +65C
- Forced cooling with side-to-side airflow; FRU'able fan tray
- Alarm extension ports



Modular Design

- 4x10GE SFP+ LAN/WAN uplink ports (built-in)
- 4 MIC Slots; ~20G BW per slot
- Max of 2 Services MIC per chassis
- BITS (TI/E1), 10MHz &1PPS and ToD timing I/O interfaces
- SyncE, SONET, PTP (Brilliant IP) integration) timing features

MX104 Architecture



MX Compact Router: Summit-1





Compact edge and aggregation router Universal 10GE/40GE/100GE ports, SFP+ support **Powerful** multi-core routing engine **Redundant** power supplies

MAIN FEATURES

BEST FOR 400GBPS AND BELOW

COMPACT

POWERFUL CONTROL PLANE

NEBS COMPLIANT

Planned for 1H 2017

MX Compact Route Summit-3





1.2T Line Card with a MIC Slot, Trio 3rd GEN



Compact edge, aggregation and peering router **Upgradable** control and forwarding planes Universal 10GE/40GE/100GE QSFP ports **Powerful** multi-core routing engine **Redundant** components Flexible L4-L7 services in the future **MAIN FEATURES**

2.4T PER SYSTEM NOW, 6T IN THE FUTURE

REDUNDANCY AND UPGRADEABILITY

10GE / 40GE / 100GE MACSEC VIA MIC

NEBS COMPLIANT

Planned for 1H 2017

Access Layer Update

Juniper's Innovation in Enterprise Networks





EX2300 Access Switch

EX2300 and EX2300-C

Compact & High Performance 1GbE density 10GbE uplinks in 1RU

Standard Compliance IEEE 802.3at (POE +)

Management Simplification Junos Virtual Chassis (4 devices - 10G support)

Operational Simplicity and Automated Config Juniper Fusion Enterprise (IEEE 802.1BR support)



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Juniper EX3400 Access Switch



EX4300 OVERVIEW







1U 24/48 Port 1GbE Switch Wire-rate performance on all ports

- 4 x 10GbE uplink module
- 4x40GbE QSFP+ fixed ports
- MacSec and EEE capable
- Front-back and back-front airflow
- Extensive Layer 3 (requires license)

Virtual Chassis Technology

- Enhanced 320 Gbps backplane
- Manage up to 10 as a single device
- Standard 10GbE/40GbE cables
- Mix 1GbE and 10GbE with QFX3500 ···
- Industry-only cross-platform Virtual Chassis
- Geographically distributed

Automation & Orchestration Automation with Puppet and Chef

- Openstack integration
- Openflow support

SRX300 Series and SRX550 Services Gateways

For Branch Firewall and Secure Router





SRX Series Services Gateways for Branch





All in one routing, switching and security in a single platform



Security at a every layer with MAC-sec, IPSec and application security



Best end-user application experience and operational efficiency



Portfolio Summary

	Retail Office Up to 50 Users	Small Branch Up to 50 Users	Mid Branch Up to 100 Users	Mid-Large Branch Up to 200 Users
	SRX300	SRX320	SRX340	SRX345
Routing*	500	lbps	1 Gbps	2 Gbps
App Firewall* 500 Mbps		1 Gbps	1.7 Gbps	
IPSec VPN	l* 100 I	lbps	200 Mbps	300 Mbps
NGFW**	100	Mbps	200 Mbps	300 Mbps

*Performance numbers for the IMIX packet size **NGFW = IPS + AppFW + External Logging

Large Branch Up to 500 Users

SRX550

3 Gbps

2.5 Gbps

350 Mbps

350 Mbps

Juniper Security Services Overview



Advanced Threat Prevention (Zero Day)

Sandboxing

Evasive Malware

Rich Reporting & Analytics

Routing

Automation

Preguntas?

Contact: Javier Grizzuti

jgrizzuti@juniper.net

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