Welcome – Tom Ray, Juniper Networks

Door Prize #1 Drawing (iPAD Mini) – Todd Janssen, Juniper Networks

Keynote: Software Defined Networks – James Kelly, Juniper Networks

Closing Remarks – Tom Ray, Juniper Networks
  o Future User Group Topics?
  o Door Prize #2 Drawing (EX2200C)

Stay Connected via J-Net:
http://forums.juniper.net/t5/Sacramento-Area-Juniper-Users/bd-p/SAJUG

Feeling Social?
Be sure to include the hashtag #sajug in your tweets!
THE SDN OPPORTUNITY

James Kelly
SDN PORTFOLIO & PARTNER MANAGEMENT
SSD STRATEGY & MARKETING
WHY SDN NOW?
SOFTWARE TRENDS AND TECHNOLOGY DEMANDS

Software Unification
Unification of the IT organizational silos
- Devops unification of SW dev & IT ops
- IT tools defragmentation
  - Collected intelligence
  - SW synergies
  - Lower OPEX
  - Better op. experience

Software Evolution
Software lifecycle mgmt (virtualization)
- Computing (cloud) to process Big Data
- Software Design and Architecture Patterns
- Programmability
  - Integrations
  - Customizations
  - Automations

Tech Proliferation
Mobile Device Connectivity
- VM Network Connectivity
- Machine-to-Machine Connectivity
  - Complex Systems
  - High Network Usage
  - Better Traffic Engineering
IT DRIVERS: AGILITY AND ECONOMICS

- Consolidation
- Clouds
- Big Data

Driving IT Transformation

- Virtualization
- Fabric Technologies
- SDN
THE NETWORK NEEDS TO EVOLVE

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
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<tbody>
<tr>
<td>Client-Server</td>
<td>Distributed</td>
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<tr>
<td>Physical</td>
<td>Virtual</td>
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<tr>
<td>Dedicated</td>
<td>Shared</td>
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<td>Closed</td>
<td>Open</td>
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The network needs to evolve from a rigid, legacy model to a flexible, agile model. This evolution can be seen across various dimensions:

- **Applications**: From Client-Server to Distributed.
- **Compute**: From Physical to Virtual.
- **Storage**: From Dedicated to Shared.
- **Network**: From Fixed to Agile.

The diagram illustrates the transition from rigid, legacy models to more flexible and agile ones, emphasizing the need for evolution in network architecture and management.
THE NETWORK NEEDS TO EVOLVE

From

<table>
<thead>
<tr>
<th>Rigid, legacy model</th>
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<tr>
<td>Network</td>
<td>“In The Way”</td>
<td>Transparent</td>
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Flexible, agile model
## The Network Needs to Evolve

### From Rigid, Legacy Model to Flexible, Agile Model

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<tr>
<td>Security Silos</td>
<td>Dynamic Policy</td>
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### Key Concepts

- **Applications**
- **Compute**
- **Storage**
- **Network**
COMPARING CHALLENGES

- Spinning up an Application
- Provisioning a Virtual Machine
- Provisioning the Network

The legacy network approach hinders dynamic workflows.
# Networking Business Challenges

## OPEX

### Complex
- Overly complex to manage
- Difficult to scale
- Difficult to design
- Difficult to understand and analyze

### Slow
- Too static
- Manual provisioning
- Slow to respond to business requests
- Slow to validate

### Uneconomical
- Rising IT costs with rising complexity
- Declining revenue growth: Difficult to differentiate, monetize and optimize
- SP vs. OTT competition
- New Features = New Boxes

### Closed
- Inflexible
- Monolithic
- Not programmable
- Difficult to integrate

### Unreliable
- Difficult to secure
- Prone to human error
- Difficult to update while in service

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**Cloud**

**Mobile**

**Video**
ADDRESSING COMPLEXITY BOTTOM UP & TOP DOWN

SDN-Ready Platforms
Simplified architectures and broad protocol & orchestration support designed for dynamic workloads

SDN-Optimized Operations
Change from element management to workflows
OUR MISSION AND COMMITMENT

CONNECT EVERYTHING
from Client, through the Network, to the Device

SILICON

SYSTEMS

SOFTWARE

EMPOWER EVERYONE
IT DRIVERS: AGILITY AND ECONOMICS

- One Junos Network OS: 1996
- Junos Script Automation: 2005
- Junos SDK: 2006
- OpenFlow on Junos: 2008
- Space SDK & New Network: 2010
- Jnpr App GTM JVAS repository: 2011
- JunosV App Engine: 2012
- SDN Launch: 2013

INNOVATION LEADERSHIP
JUNIPER’S SDN STRATEGY: 6-4-1

6 – General Principles
- Separate Layers
- Centralize
- Virtualize
- Open Platforms
- Open Standards
- Apply Broadly

4 – Juniper Steps
- Centralize Management
- Extract Services
- Centralize Controller
- Optimize the Hardware

1 – Licensing Model
- Full Use and Elastic
- Transferable
- Software Lifetime Assurance

JUNIPER SOFTWARE ADVANTAGE
WHAT WE’RE WORKING ON

SDN Building Blocks
- OpenFlow
- PCEP
- BGP
- VXLAN
- Service Chaining
- NFV

SDN Platforms
- JunosV App Engine
- Junos Space
- Contrail

SDN Solutions
- Network Virtualization
- Centralized TE
- Service Automation
- IT Workflow Automation
- Scale Out
- ZTP

Projects & Partners
- OpenDaylight
- OpenStack
- VMware
- ONF
- OpenLab
- CloudStack
**USE CASE: OPTIMIZED TRAFFIC ENGINEERING**

- **Goal:** Maximize the utilization of network infrastructure bounded by certain SLA / QoS metrics.
- Multiple sources of information go into (i) offline capacity planning and what-if scenario simulation exercises with periodic network updates or (ii) real-time event driven resource optimization.
- Infrastructure team is typically the business / buying decision maker (customer cost center – but revenue source for Juniper as they buy large core/edge routers).

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**Workflow:**

1. **Business applications define policy constraints and optimization schedules.**
2. **Real time topology and link state discovered from the network elements using BGP-TE.**
3. **Centralized SDN System calculates pan network optimal paths based on defined policy constraints, static topology and real-time network data.**
4. **Explicit path or route objects pushed to the end point network elements using PCEP.**
5. **L2 / L3 PACKET CORE / OPTICAL NETWORK.**

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**Network Elements:**

- **DC (Data Center)**
- **P (Provider)**
- **PE (Provider Edge)**
- **L2 / L3 BACKBONE**
- **DWDM / OPTICAL NETWORK**
USE CASE: RAPID SERVICE DEPLOYMENT

Traditional Mobile Control Gateway

- MCG ATCA chassis
- 10M active users
- 32 ATCA chassis
- 3 zones (11 ATCA per zone)
- 300K subscribers per chassis

Virtual Mobile Control Gateway

- JunosV App Engine
- MX3D
- X86 appliances
- 10M active users
- 54 VSE appliances (27+27 backup)
- 3 zones (1 MX 3D/zone)
- 3.3M users per MX 3D, 400K users per VSE

Financial Benefits
- 54% lower TCO
- 65% lower OpEx
- 53% lower CapEx

Development Time & Cost
- 46% faster initial deployment
- 61% less initial deployment cost
- 87% faster capacity additions
- 92% less capacity addition cost

Operational Benefits
- 73% less environmental cost
- 72% less operator training cost
- 63% OA&M cost
USE CASE: VIRTUALIZED DATA CENTER

- Silo’ed Resource Allocation
- Manual Configuration
- Static Service Chains

- Dynamic Resource Allocation
- Automatic Configuration
- Dynamic Service Chains

TCO Reduction
Faster Time-to-Revenue

TRADITIONAL DATACENTERS

VIRTUALIZED DATACENTERS

Virtual-Network based Orchestration (Compute, Storage, Apps)
INITIAL APPROACH TO SDN VIRTUALIZATION

REACTIVE END-TO-END NETWORK

- Separates the data plane from the control plane
- Completely centralizes the control plane
- First packet of every flow is punt to the controller - reactive
- Uniform flat network
- Very large forwarding table in switches
- Tenant changes affects all switches in path
- Replaces existing network and protocols
**REACTIVE END-TO-END NETWORKS**

First packet of every flow is punted to controller. Controller reactively programs every flow on every switch on path.

Per-tenant state in physical network: Switches contain many flows.

Better Approach to SDN Virtualization

**Proactive Overlay Network**

- Underlay physical network provides industry standard L2 & L3 forwarding
- Tenant state only at the network edge – server hypervisors & gateways
- Controller proactively installs forwarding state
- Much smaller forwarding table in switches
- Tenant changes don’t affect physical network
- Incremental evolution of existing network and protocols
PROACTIVE OVERLAY NETWORKS

Packets are not punted to controller

Controller proactively programs virtual overlay switches & gateways only

No per-tenant state in physical network: Switches only know physical servers

Existing protocols establish IP fabric underlay

Low latency. High scalability. Robust. Evolutionary.
OVERLAY ARCHITECTURE

BUILT FROM THE GROUND-UP FOR:

**Always-On, Carrier-Class Cloud**
- No five or seven nines, it’s always available!
- In-service upgrade without any downtime
- Scale out without the management burden

**Multi-Cloud Federation & Scalability**
- Seamless interoperability with existing physical equipment
- Federation within clusters, across autonomous systems (hybrid clouds) over large scale

**Agility and Innovation**
- Preserves existing investment in networking
- Enables abstraction and programmatic APIs required for the dynamism of new applications
**CONTRAIL CONTROLLER**

- SDN Controller
  - Configuration
  - Analytics
  - Control

- IP fabric (underlay network)

- Server
  - VM

- Tenant VMs
  - KVM, Xen or HyperV Hypervisor + Contrail vRouter (L2 & L3)
  - Juniper Qfabric/QFX/EX or 3rd party underlay switches
  - Juniper MX or 3rd party gateway routers

- Contrail Controller
  - openstack
  - Citrix
  - Mirantis
  - Cloudscaling
**Contrail Controller**

- **SDN Controller**
  - Configuration
  - Analytics
  - Control

- **Orchestrator**
  - REST

- **IP fabric** (underlay network)
  - BGP Federation
  - BGP + Netconf
  - XMPP

- **KVM, Xen or HyperV Hypervisor + Contrail vRouter (L2 & L3)**

- **Juniper Qfabric/QFX/EX**
  - or 3rd party underlay switches

- **Juniper MX**
  - or 3rd party gateway routers

- **Tenant VMs**

- **Contrail Controller**
  - BGP Federation
  - BGP Clustering

- **Remote Access**
  - MPLS over GRE or VXLAN

- **Red Hat**
  - CloudStack
  - Citrix
  - Mirantis
STANDARDS

Overlay control plane protocols:
- XMPP: RFC 6120, draft-marques-l3vpn-end-system
- BGP L3VPN: RFC 4364
- BGP EVPN: draft-ietf-l2vpn-evpn
- NetConf: RFC 6241
- Multicast: draft-marques-l3vpn-mcast-edge

Overlay data plane encapsulation:
- MPLS over GRE: RFC 4797
- VXLAN (encapsulation only): draft-mahalingam-dutt-dcops-vxlan

Underlay control plane protocols:
Existing layer-2 or layer-3 protocols

Overall architecture
- IETF NVO3 WG
- ETSI NFV ISG
SERVICE CHAINING

Overlay establishes a serial, “chain” through multiple virtualized services
SERVICE CHAINING
Customer Deployment Advantages

- Cloud agility and economics for network services (NFV)
- Uniform templates for deploying any in-network services
- Decouple service from routing infrastructure
- Carrier-grade routing without the complexity of the routing protocols or manual configurations
- Meet dynamic systems requirements with RESTful APIs for chains creation, service sequencing, and service scaling for customized integrations with

Overlay establishes a serial “chain” through multiple virtualized services
- vNetwork to vNetwork, VM to VM, or combinations thereof