Programmable Networking is SFW

David Ward
CTO & Chief Architect
Platform Systems Division, Juniper Networks
The Developer and The Network

Improving user experience by programming the network

Real Problems. Real Revenue. Real Attention. Not an Armadillo

Programmable Networking is SFW

Copyright © 2011 Juniper Networks, Inc. www.juniper.net
Beyond ferreting the information
Current approximation techniques are barely sufficient and inefficient

<table>
<thead>
<tr>
<th>APPLICATION WORLD: GUESSING</th>
<th>NETWORK WORLD: DERIVING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applications blindly probe the network to understand what it can deliver</td>
<td>Networks spy on traffic to try to understand applications</td>
</tr>
</tbody>
</table>

**APPLICATION WORLD: GUESSING**
- Game ping-stats, doppler, geo-location, whois
- Proprietary codecs
- Approximate topology/location

**NETWORK WORLD: DERIVING**
- Deep Packet Inspection
- Stateful flow analysis
- Application fingerprinting
- Service specific overlay topologies

Programmable Networking is SFW

Copyright © 2011 Juniper Networks, Inc., www.juniper.net
What brings the two together?

Bi-directional interaction and programmability
Interaction at multiple touch points

Inform network of desired behavior

Inform application of data intrinsically in the network

Programmable Touch points

User service profile
Enterprise edge
Hypervisor stack
CDN

Billing profile
Business edge service profile
VPN/mobile/security gateways

Extract information or program desired behavior
What is possible in this new world?

**Applications made better by information from network**
- Understanding of end-device capabilities
- Real location / topology
- Adjust behavior to real-time usage
- Billing granularity

**Networks made better by information from application**
- Bandwidth and resource optimization
- New service topologies
- Security identification
- Service-specific packet treatment

**Flexibility of service placement**

**Control of resources from applications**
There’s more than what you are hearing

Software Defined Networks
- Separation of existing protocols from forwarding plane for network devices
- Programming of forwarding plane via centralized orchestration platforms

No interaction with existing routing/signaling protocols of the Internet

- Augment what’s already on the internet
- Integration with routing, signaling and policy logic
- Modular, programmable touchpoints
- Seamless service model via collaborative inputs
- Standards-based approach
Router: Control and Data Planes

Augment Control Plane, Control Pkt. Fwdg

Abstraction level:
data plane (low), control plane (high)

Programmable Networking is SFW
How do we make this happen?

Without breaking everything …

**Programmable Networking**

- Real-time topology understanding (ALTO, BGP-TE)
- Steering traffic through optimal paths (PCE)
- Selecting specific traffic (OpenFlow)
- New touch points: gateways, billing collectors, service appliances, CDN, DPI

**The Application World**

- Web Services API
- Orchestration Across Networks
- Network APIs

**The Network World**

Programmable Networking is SFW
Network Operators Building Development Platforms

Network operator innovation centers around the world

Platform potential: Reaching ~53% of world population; Equals ~64% of world GDP

Programmable Networking is SFW
What is a Service Engineered Path?

- Tunneling/switching technology that provides a path to specific service functions
- Enables selective traffic redirection based upon ephemeral classifiers
- Signaled paths requested via PCE – Path Computation Element
  - Standardized API
Example:
Content Request Routing

From where the user is connected…

... to where the content is best served

Based on:
- Network proximity
- Network availability
- Network congestion
- Content availability
- Content load
- Content capacity

This is new because:
- Uses information of the network infrastructure
- Runs across multiple service providers
- Mobile & broadband subscribers

Programmable Networking is SFW
Example: Bandwidth Calendaring

Schedule a reserved path for your session…

… without having to know the network

Technology used:
- Real-time topology understanding (ALTO, BGP-TE)
- Steering traffic through optimal paths (PCE)
- Reservation transaction (WebServices API)
- Selecting specific traffic (OpenFlow)

What would I use this for?
- Flexibility of service placement
- Scheduled data center backups
- Managed content distribution
- Cloud orchestration

Programmable Networking is SFW

Copyright © 2011 Juniper Networks, Inc.  www.juniper.net
Example: Social Networking

**Today’s wheel of missed fortune**

- Collected End User Information
- Content/Gaming
- Analytics Platforms
- Pure Social
- SN topology platform types
- Advertising
- Commerce
- Communication
- Network

**Untapped mine of information**

- Access technology and capability
  - Mobility events
  - Bandwidth, utilization
- Capabilities of device and network
- Network location
- Proximity to caches / servers
- Bandwidth / billing / usage caps
- Security profile

Programmable Networking is SFW

Copyright © 2011 Juniper Networks, Inc. www.juniper.net
Tune in - turn on: Be “in the topology”

Weak architecture = one-legged tap dancing

Continuous, real-time streaming of surrounding content, resources, places, people

Low value in navigational coordinates

—

Where am I?

I am here!

Active broadcast
Game broadcast
Passive derivation

“You’re here!”
<access>
<capability>
<BW>
<profile>

And this is around you:
<content>
<resources>
<places>
<people>
...

“Above the topology”
“Visualize the topology”
“Below the topology”
What did he just say?

**UNLEASH THE POTENTIAL!**
Today the two worlds are not interlocked

**PROGRAMMABLE NETWORKING**

**DEVELOPMENT PLATFORMS EMERGING AND GETTING A LOT OF VC**

Enables:
- Flexibility of service placement
- Fungibility of assets
- Control of resources
- Derivation of telemetry and proximity

Decisions that impact your applications are being made by:
- IT departments
- Network equipment vendors
- Providers delivering your application
- Application developers

Programmable Networking is SFW