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MODERN INFRASTRUCTURE DECISIONS
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Practical Software-defined Networking

How It Can Make Your Virtualized Data Center More Efficient



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Welcome

- Who am I?
 - Ethan Banks, CCIE #20655 (Routing and Switching)
 - Day to day network architect, who has worked with education, government, financial and technology verticals.
 - Co-host of the Packet Pushers Podcast, with over 10K listeners and 1.5 million downloads from our content library.
 - Regularly researching emerging technology and interviewing the people that make it and use it.
 - Writer and blogger for online publications like TechTarget and Network Computing.
 - Follow @ecbanks and connect with me on LinkedIn.

Agenda

- **Architectural and process challenges** in the modern data center.
- **SDN's early years:** OpenFlow, the ONF and the silicon problem, centralized controllers, APIs, hybrid switching, overlays.
- **The current SDN product landscape:** who's selling what, what does it do for your data center and how do you add it to what you've already got?
- How to make an **SDN technology buying decision.**

Virtualized Data Center Challenges:

1 – Conversations Anywhere

- Fat tree to fabric mesh: the data center topology is changing. Why?
 - Virtual machines and their storage can live anywhere in the data center unpredictably, based on load or availability requirements.
 - Fast transport and predictable latency can't be limited by the physical location of services.
 - Building isolated pods where compute resources are always close at hand isn't possible when a VM can be moved on a whim.
- Q: *How many of you have deployed fabric (TRILL, SPB, leaf/spine)?*

Virtualized Data Center Challenges:

2 – Slow Provisioning & Human Error

- Operational challenges
 - Provisioning network services is often not automated.
 - Time to provision networking is a bottleneck for bringing new services online. VMs can get spun up with a script and moved to new metal with a click, but the network requires a lot of hands-on to support this.
 - A lot of hands-on means opportunity for errors.
- *Q: How many of you run orchestration software that provisions the network in lock-step with application provisioning or a new tenant space?*

Virtualized Data Center Challenges:

3 – Hard To Deploy Policies Globally

- Flexibility challenges
 - The middlebox problem – exiting the fabric for services like load-balancing and firewall inspection.
 - Difficult to build and deploy policies throughout the data center or campus. Lots of individual device configuration.
 - Custom routing based on non-traditional metrics (think dollar cost or real-time load).
 - Forwarding based on latency, hop count, or QoS parameters.
 - Security policies for “trust or not”, DPI, state tracking.
 - Multitenant deployments are complex.
- *Q: How many create central policies, but deploy via individual device configuration?*

The Early Years of SDN:

1 – What is SDN, Anyway?

- What is software defined networking?
 - The idea that a central controller can program the network as a whole to forward traffic in a way that is unlike what traditional forwarding protocols can do.
 - An abstraction of the network, such that individual network elements (routers, switches, firewalls, application delivery controllers) do not require manual, individual configuration to support a business requirement.
 - Not just OpenFlow.

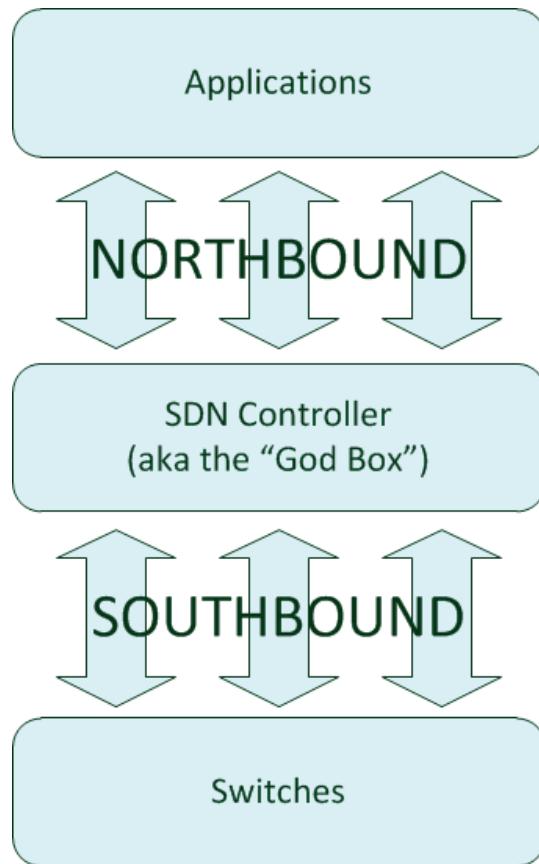
The Early Years of SDN: 2 – OpenFlow & the ONF

- The Open Networking Foundation is the force behind SDN's biggest buzzword: OpenFlow.
 - Who is the ONF?
 - What's this OpenFlow they've created?
 - A rapidly evolving southbound protocol that describes the programming of flow tables between a centralized controller and a topology of switches.
 - Why aren't all major networking vendors on board with OpenFlow?
 - Well, most **are**, but commitment levels vary.
 - It's a silicon problem. ("A bit like strapping rockets to a camel.")
- Q: *Is OpenFlow important, or just a curiosity so far?*



The Early Years of SDN: 3 – A Simple OpenFlow Diagram.

- What's an OpenFlow network look like?



| Field | Description |
|-----------------|--|
| OXM_OF_IN_PORT | Required Ingress port. This may be a physical or switch-defined logical port. |
| OXM_OF_ETH_DST | Required Ethernet source address. Can use arbitrary bitmask |
| OXM_OF_ETH_SRC | Required Ethernet destination address. Can use arbitrary bitmask |
| OXM_OF_ETH_TYPE | Required Ethernet type of the OpenFlow packet payload, after VLAN tags. |
| OXM_OF_IP_PROTO | Required IPv4 or IPv6 protocol number |
| OXM_OF_IPV4_SRC | Required IPv4 source address. Can use subnet mask or arbitrary bitmask |
| OXM_OF_IPV4_DST | Required IPv4 destination address. Can use subnet mask or arbitrary bitmask |
| OXM_OF_IPV6_SRC | Required IPv6 source address. Can use subnet mask or arbitrary bitmask |
| OXM_OF_IPV6_DST | Required IPv6 destination address. Can use subnet mask or arbitrary bitmask |
| OXM_OF_TCP_SRC | Required TCP source port |
| OXM_OF_TCP_DST | Required TCP destination port |
| OXM_OF_UDP_SRC | Required UDP source port |
| OXM_OF_UDP_DST | Required UDP destination port |

The Early Years of SDN: 4 – SDN Approaches That Don’t Use OpenFlow

- What other approaches are vendors taking?
 - Keep the controller model the same, but don't rely just on OpenFlow. Lots of controllers out there.
 - Speaking of a plethora of controllers...let's mention the northbound API problem.
 - There is no standard.
 - There won't be a standard soon.
 - When there is a standard, it will most likely be a common baseline with vendor-specific extensions.

The Early Years of SDN: 5 – APIs, Hybrid Switching and Overlays

- Alternative approaches, continued
 - Build vendor-specific APIs that take advantage of vendor silicon. ASICs = differentiation.
 - Hybrid switching allows an “either/both” approach.
 - Run some sections of the network as software-defined and some as traditional/distributed.
 - In some cases, even split up ports in the same switch.
 - “Patches of green in the brownfield data center.”
 - Overlay networks
 - Multitenancy at scale.
 - An intelligent “soft edge” allows for a simple, fast core.
 - VXLAN, NVGRE, STT

The SDN Landscape: Who's Selling What?

1 – Established Vendors | Cisco

Cisco Systems

- Focusing on network programmability.
- The “ONE” initiative.
- onePK – API set, to be standardized across multiple Cisco product lines.
- ONE Controller coming.
- SDN applications? Hmm. Let’s see what the controller brings.
- Cisco has a hardware business to protect. Their SDN strategy is aimed at preserving that.

The SDN Landscape: Who's Selling What?

2 – Established Vendors | HP

Hewlett Packard (HP Networking)

- OpenFlow supporter/implementor since OpenFlow's earliest experimental days at Stanford.
- OpenFlow supported across many of their switches.
- Modular controller.
- Sentinel security app demonstrates SDN capability.

The SDN Landscape: Who's Selling What?

3 – Established Vendors | Juniper

Juniper Networks

- Junos platform has been XML under the hood for years, so lends itself well to SDN architecture.
- Recently acquired Contrail.
- Contrail technology includes a virtual switch allowing for a smart soft edge.
- Making in-roads into provisioning automation with Puppet.
- Announced product availability in 2014.

The SDN Landscape: Who's Selling What?

4 – Established Vendors | Brocade

Brocade

- Up-and-comer in Ethernet fabric space.
- Recently purchases Vyatta, a software router/switch platform.
- Recently hired new CEO, Lloyd Carney.
- Unclear exactly how Vyatta & Brocade will merge technology, but smart soft edge seems obvious.

The SDN Landscape: Who's Selling What?

5 – Established Vendors | VMware/Nicira

VMware

- Bought Nicira in 2012 for \$1.2B.
- Nicira's "Network Virtualization Platform" includes:
 - Controller
 - Overlay
 - Software to manage multi-tenant clouds.

The SDN Landscape: Who's Selling What?

6 – Established Vendors | Microsoft

Microsoft

- Not a traditional networking vendor.
- Closing the functionality gap with VMware.
- Rich networking functionality embedded in Hyper-V, leveraging NVGRE as an overlay.
- Again, the notion of a smart, soft edge.

The SDN Landscape: Who's Selling What?

7 – Established Vendors | Others

- NEC ProgrammableFlow (controller, hardware switches, policy management software)
- IBM DOVE (new announcement)
- Alcatel-Lucent / Nuage Networks (controller, soft switch, policy management software)

The SDN Landscape: Who's Selling What?

1 – Startups | Plexxi



- An SDN controller & Ethernet switch with optical interconnect built in a ring topology.
- Well-funded, Boston-area startup attracting MIT talent as well as talent from established vendors.
- Algorithm that optimizes traffic flows using lambdas with minimal cabling requirement.
- In the ONF, but not OpenFlow-centric.
- Interest from the financial sector.

The SDN Landscape: Who's Selling What?

2 – Startups | Big Switch



- OpenFlow-oriented controller.
- Applications like “Big Tap.”
- Many industry partnerships for northbound API.
- Does not manufacture an OF switch; switch agnostic.
- Open-sourced the “FloodLight” controller.

The SDN Landscape: Who's Selling What?

3 – Startups | Anuta Networks



- Full provisioning & resource management system for cloud providers, with probable enterprise applications.
- Delivered as a controller.
- Leverages network hardware commonly deployed today. (Cisco Nexus/ACE/ASA, F5 ADCs, other, many more roadmapped.)
- Not an overlay or smart soft edge.
- OpenFlow support coming via Big Switch.

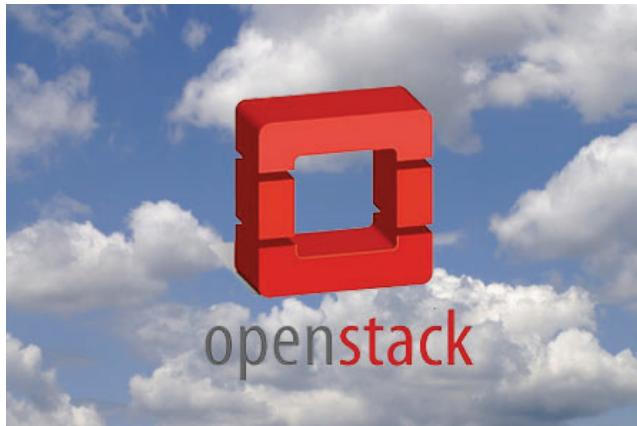
The SDN Landscape: Who's Selling What?

4 – Startups | Embrane



- Creates common L4-L7 network resources on demand in software.
- Heleos product aimed at the IaaS space.
- Creates firewalls, load balancers – application level network elements – by abstracting compute blocks and assigning them to virtual network elements.

The SDN Landscape: Who's Selling What? Don't Forget About Open Source!



- Open vSwitch is a fully-featured software switch.
- Quantum is an abstraction layer presenting a networking API northbound, hiding the southbound implementation.
- Lots of SDN & virtualization products tie into these.

The SDN Landscape: Who's Selling What? Looking Ahead – The Daylight Consortium

- Keep up with news about the rumored Daylight Consortium.
- “Daylight” is expected to result in an SDN controller architecture that is unified across member vendors.
- Presumably modular, allowing for common baseline functionality, with vendor-specific extensions.
- Reported members include Cisco, IBM, HP, Citrix, and NEC.

How to Make an SDN Buying Decision:

1 – Shiny vs. Necessary

- Understand that SDN isn't a must.
 - You have a network that works today.
 - SDN is not taking over tomorrow.
 - Your existing vendor will probably have an incremental solution for you.
- Understand the problem you are trying to solve.
 - Scale multitenancy?
 - Smooth operations?
 - Forward flexibly or unconventionally?

How to Make an SDN Buying Decision:

2 – The Target is Moving

- Understand that SDN is not mature.
 - OpenFlow is *not* yet the standard all vendors are rallying around, and implementing OpenFlow in silicon is hard (so far).
 - Other standards are fledgling or only slowly maturing.
 - Many products under the heading of “SDN” are use-case specific, not holistic reimaginings of how to do networking.
 - Vendor interoperability doesn’t exist as yet. Even with OpenFlow as a common denominator, implementations vary widely.
 - Matching controllers with switches requires careful evaluation aligned with a deep understanding of what you’re trying to accomplish.

How to Make an SDN Buying Decision:

3 – Determining Value

- Understand the value proposition for your business.
 - SDN is as much about process transformation as it is about physical network transformation. SDN changes *how* you provision network services. This impacts your team, what they do and what they are freed up to focus on.
 - How do you quantify an ROI? Things like...
 - Time saved – automate provisioning.
 - Errors reduced – fewer human touches should = fewer errors.
 - Faster product enablement – bring to market more quickly.
 - Reduction in project timelines – faster rollouts.
 - Reduction in physical infrastructure – less gear required to meet regulatory requirements or enable experimental services.

Thank You! Questions?

Keep in Touch

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Where serious technology buyers decide