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DevOps 4 Networks

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About Nathan

- Lives in Madrid, habla Castellano
- Freelance Full Stack Developer - <https://www.linkedin.com/in/nathandevops>
- 15 years Cisco
 - Software Defined Networking (SDN)
 - Programmable infrastructure and DevOps strategy and development
 - Cloud, virtualisation, NFV
- Over 28 years of solution and systems engineering experience with leading fortune 100 companies and startups in telecommunications and finance
- Started coding with ZX-81 and Spectrum

Agenda

- Who are you?
- Why do we need DevOps for Networking?
- What does that look like?
- Technology deep dive
- What does this do for teams?

Who Are You?

- Developer
- IT Operations
- Network Architect/Design/Operations



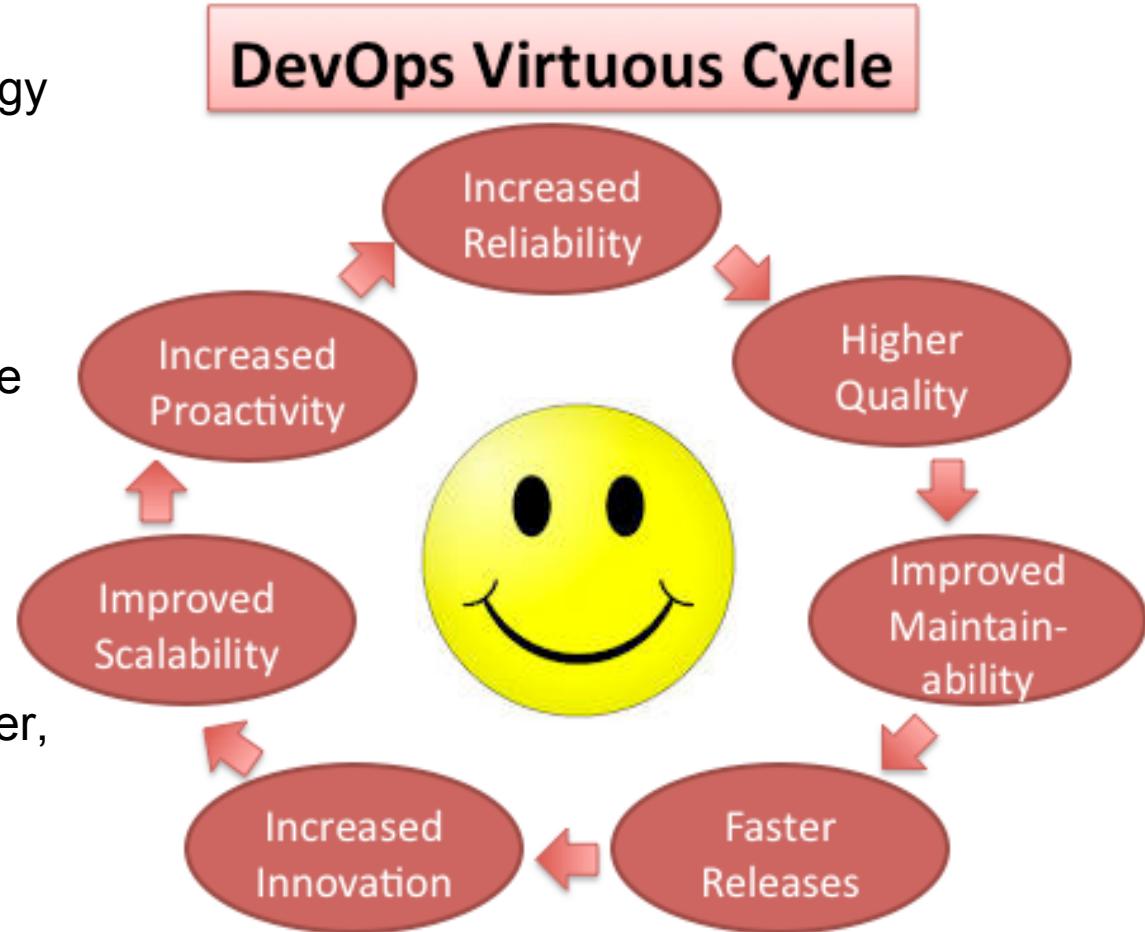
Why Does This Matter?

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- DevOps is a cultural change enabled by automation technology
- Automation technology replaces manual efforts
- Doers become planners, reactive changes to proactive
- Greater efficiency, ease and responsiveness
- More business gets done, quicker, at lower cost
- People are happy!

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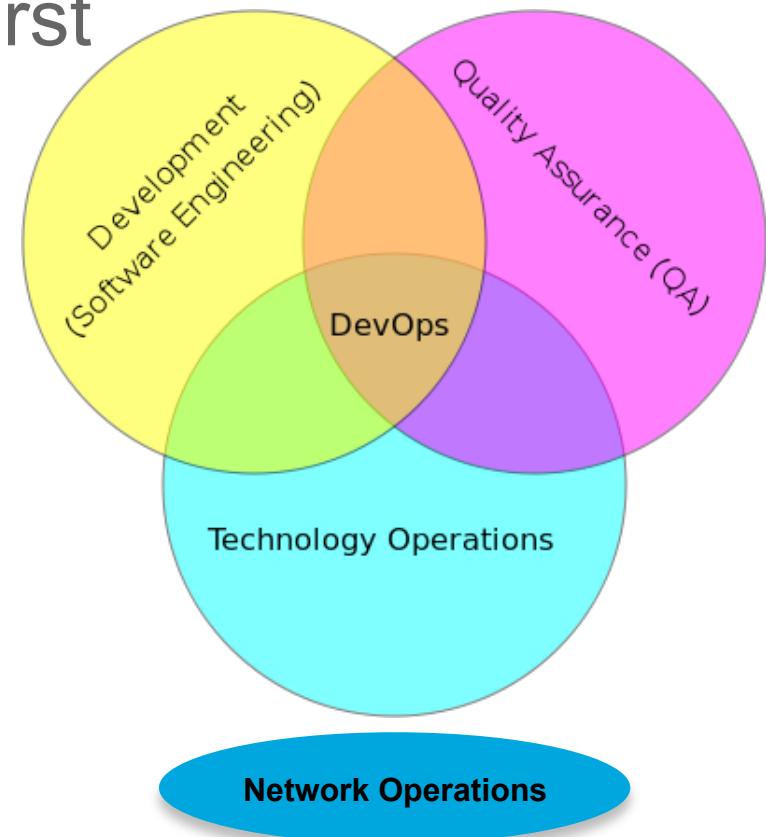


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OS and Sys Admins Did It First

- Manually configuring servers, OSs, and VMs ->
- Operating **automated** infrastructure at scale
- 1 Server Admin : 100-200 Servers ->
- 1 Server Admin : 5,000 – 10,000 Servers
- CLI + Bash scripts + Reactive configuration ->
- DevOps - Orchestrated configuration and integration

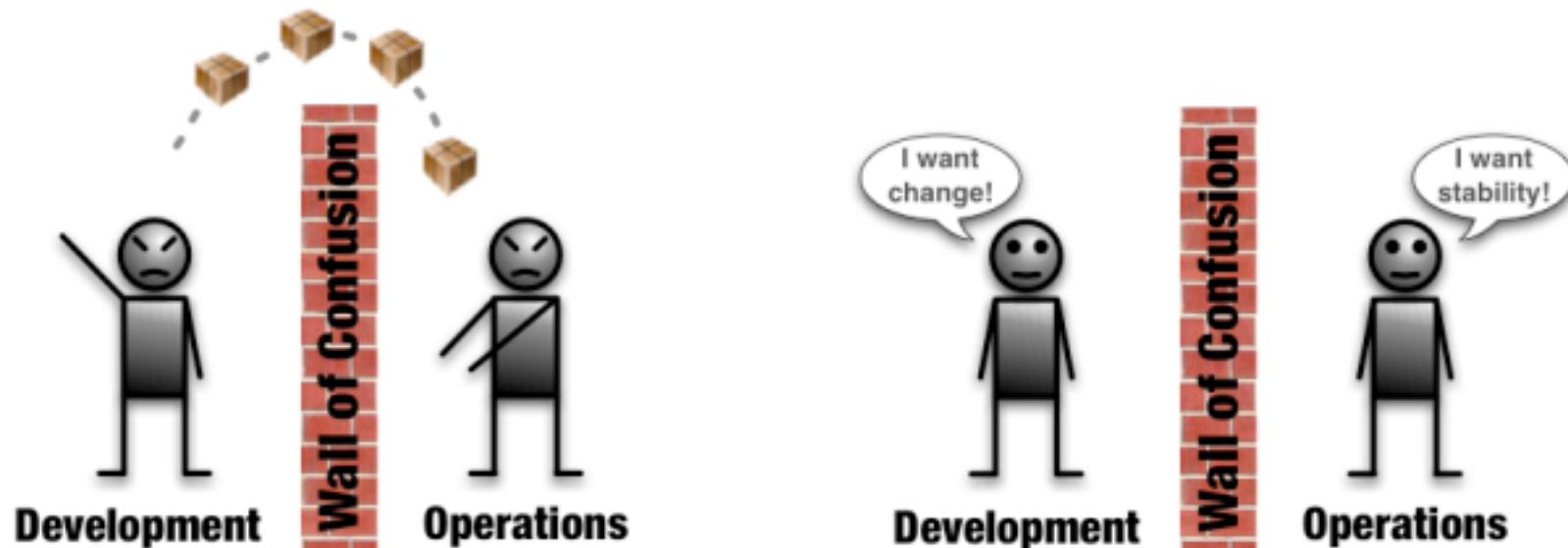
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Culture - The Wall of Confusion

Or, why can't we all just get on together?



Technology - VM Creation, Configuration and Deployment

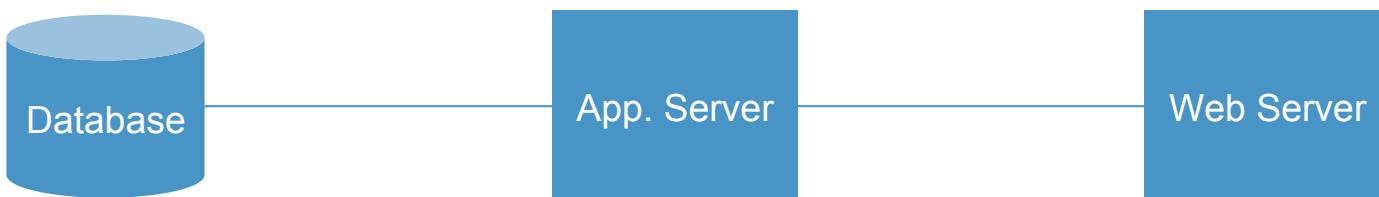


Create VMs

Configuration Management

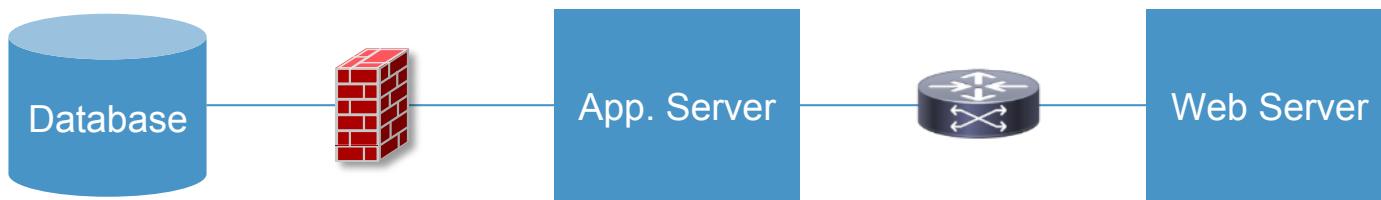
Deploy VMs

A Typical Enterprise Deployment



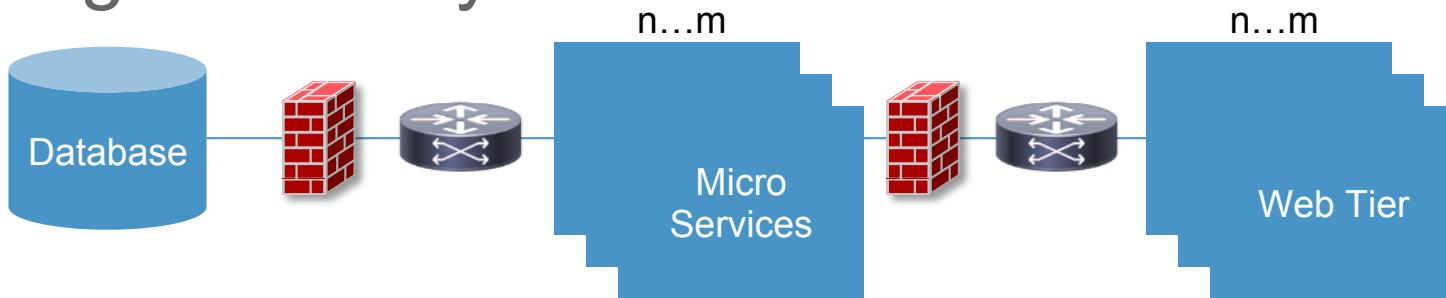
- Boxes can be VMs
- Database can be copy of production
- Automated testing in a clone of the production environment
- If the tests pass in the clone of the production environment
- Then the system can be deployed automatically

A Typical Enterprise Network



- The lines between the boxes represent network functions
- vLANs, ACLs, QoS, WAN connectivity, VPNs ...
- How do we automate testing and deployment for those?

Scaling to the “Hybrid” Cloud



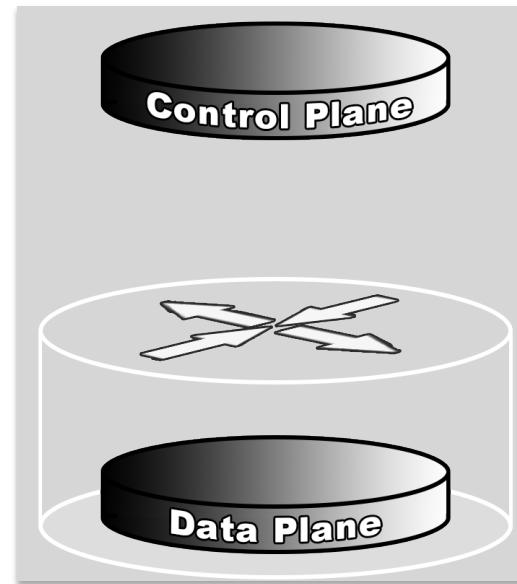
- Dynamic scaling – any number of ...
- SOA “micro services” on premises/cloud
- Web tier on premises/cloud
- Requires automated “hybrid cloud” deployment

What Does This Look Like?

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Software Define Networking (SDN)



Software defined networking (SDN) is an approach to building computer networks that separates and abstracts elements of these systems

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Origins of Software Defined Networking (SDN)

- “*...In the SDN architecture, the control and data planes are decoupled, network intelligence and state are logically centralized, and the underlying network infrastructure is abstracted from the applications...*”
- “*...open standard that enables researchers to run experimental protocols in campus networks. Provides standard hook for researchers to run experiments, without exposing internal working of vendor devices.....*”



OPEN NETWORKING
FOUNDATION

<https://www.opennetworking.org/images/stories/downloads/white-papers/wp-sdn-newnorm.pdf>

<http://www.openflow.org/wp/learnmore/>

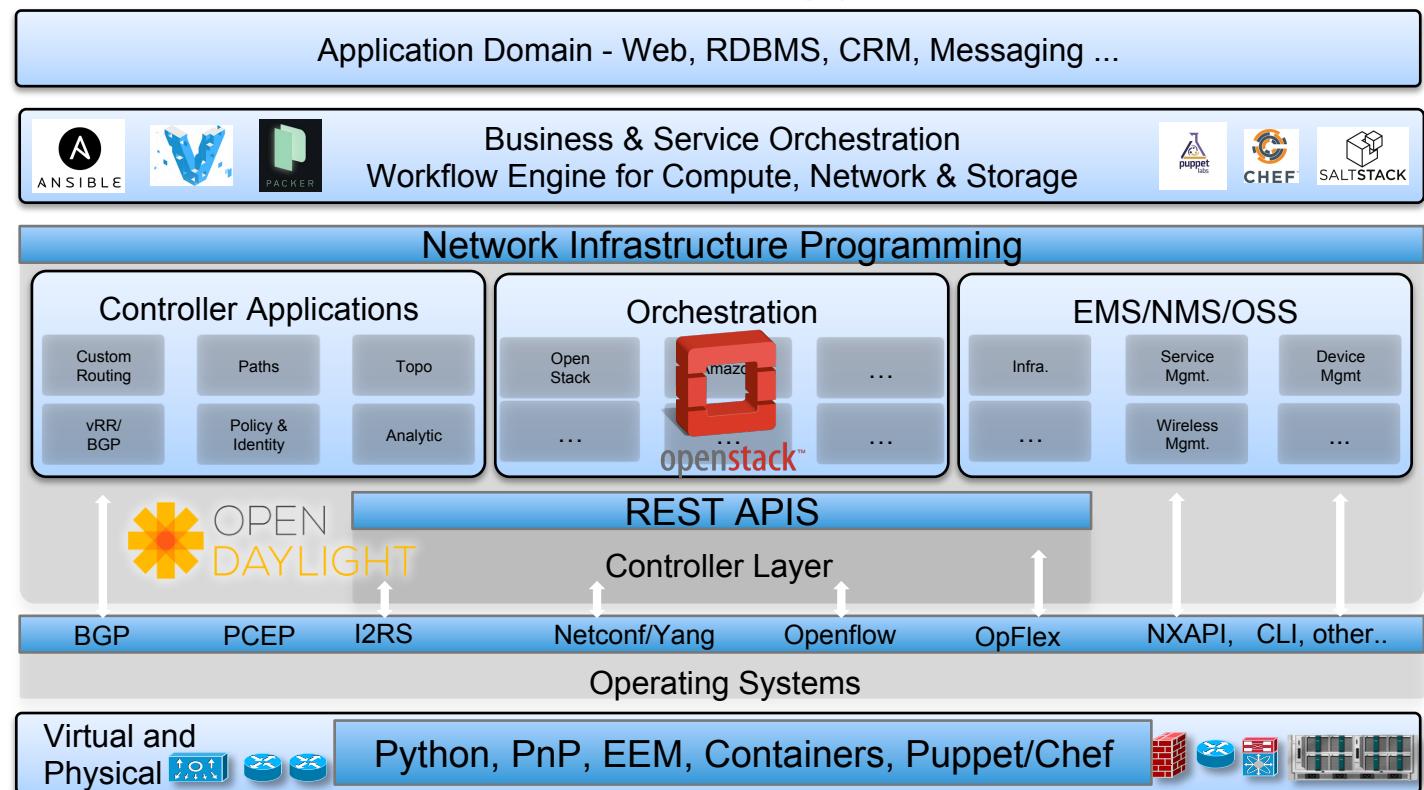
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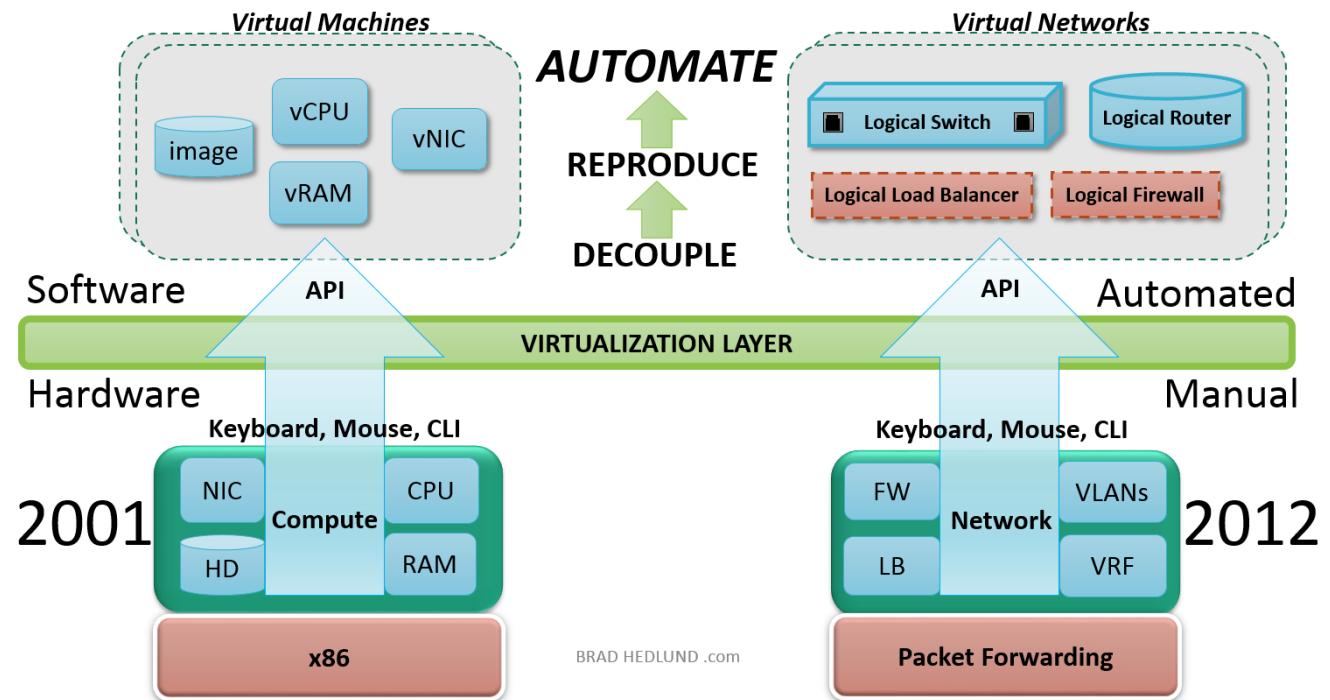
The SDN and DevOps Technology Landscape

- APIs so that the network infrastructure can be *programmed*
- Program the network infrastructure to support *automation*
- To make automation work across the organization, you need DevOps
- To get DevOps to work, you need virtualisation
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The Evolution of Virtualisation

Server Virtualization



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Network Function Virtualisation (NFV)

Nexus/Catalyst	ASR/ISR/CRS	Identity/Policy - ISE	Firewall - ASA
<i>vSwitch</i> (Nexus 1Kv/9Kv)	<i>vRouter</i> (CSR1Kv)	<i>vISE</i>	<i>vFW</i> (ASA 1000v)
WAAS	Email Security - ESA	Wireless LAN Controller	<i>Security Gateway</i> - VSG
<i>vWAAS</i>	<i>vESA</i>	<i>vWLC</i>	
Video Cache	Web Security - WSA	Network Analysis - NAM	IOS/XR RR
<i>vVideoCache</i>	<i>vWSA</i>	<i>vNAM</i>	<i>vRouteReflector</i>

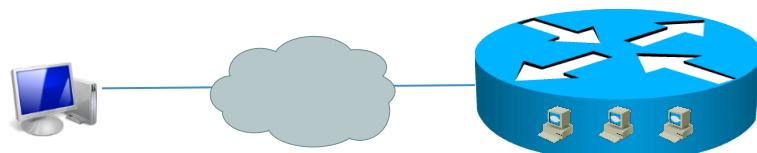
Technology Deep Dive

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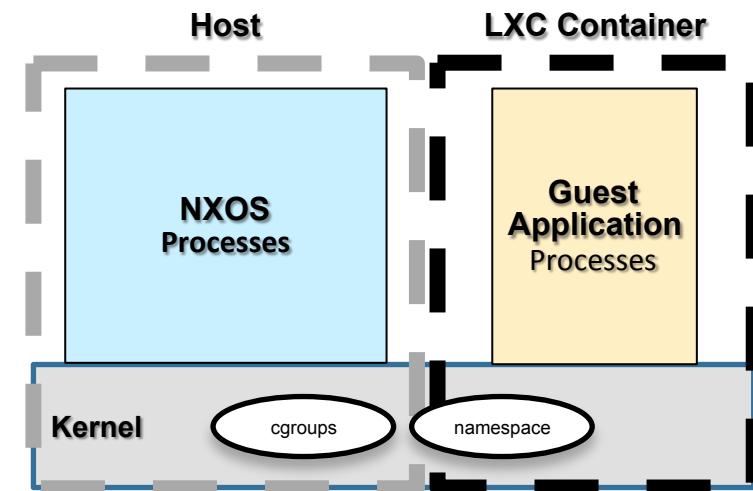
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Linux Container (LXC)

- Linux Containers (LXC) - a lightweight virtualization technology
 - No hypervisor
 - LXC shares the host kernel
- Namespace separation
 - Process namespace
 - File namespace
 - Network namespace
- Cgroup – resource allocation and control
 - CPU
 - Memory
 - Storage



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Networking Model: Shared Host Stack

- Services appear as applications running natively on the host
- Port addressable

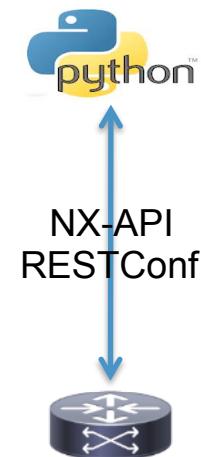
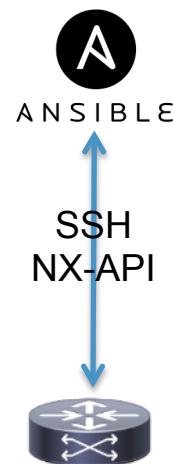
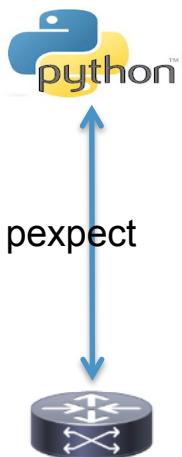
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On the Devices

```
Linux Bash, LXC Guest Shell, NXOS-CLI, TCL/EEM, Python
guestshell:~$ dohost "conf t" "cdp timer 20"
{0} {}
{0} {}
guestshell:~$ dohost "show run | inc cdp"
{0}{cdp timer 20}
guestshell:~$ python
Python 2.7.3 (default, Aug 22 2014, 12:09:58)
[GCC 4.8.1] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>> quit()
guestshell:~$ tclsh
switch-tcl#
```

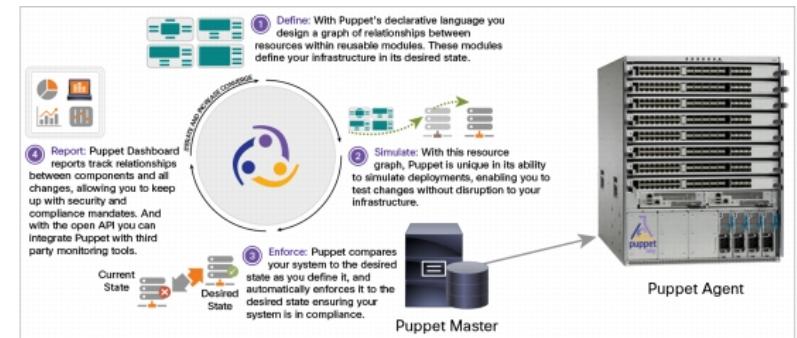


Direct to Network

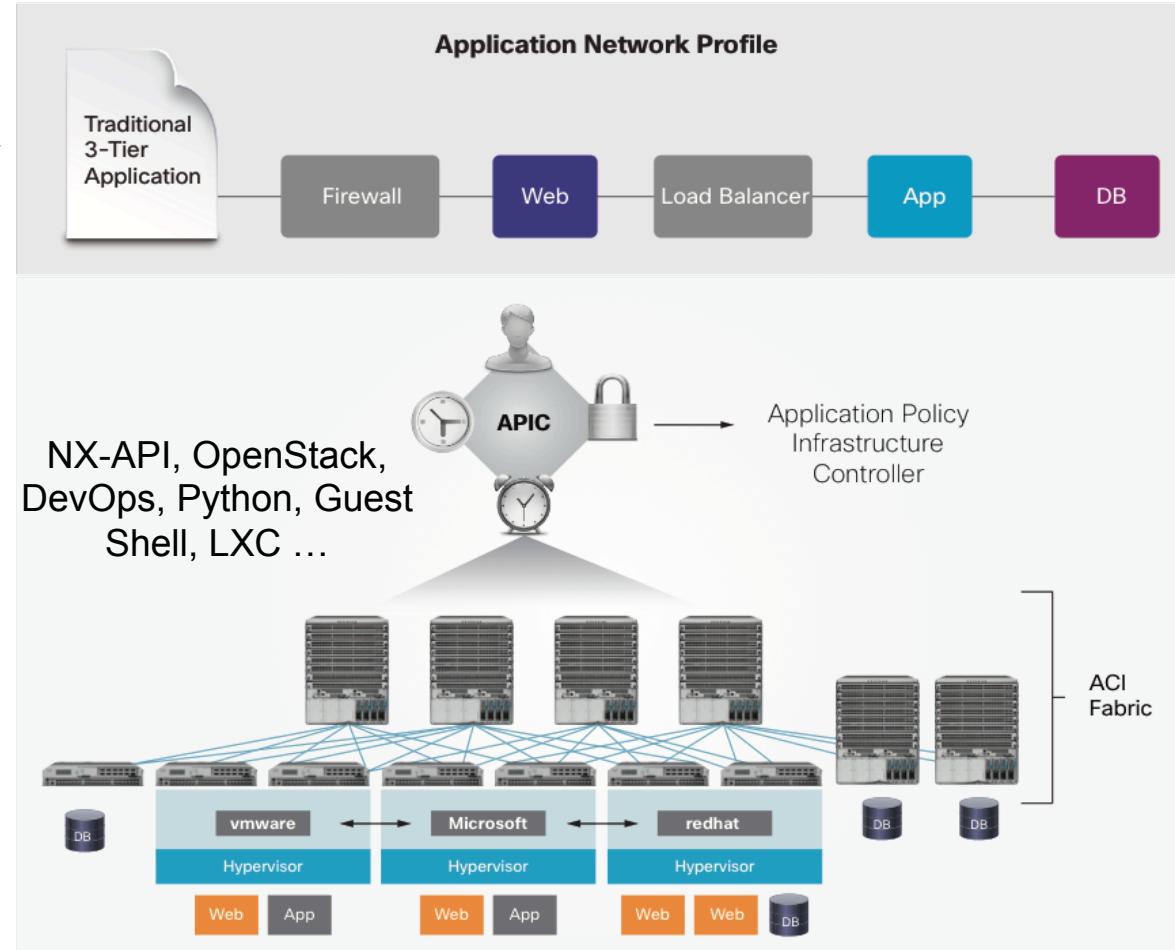


Puppet and Chef Agents

Chef and Puppet servers communicate with agents to maintain Configuration state



Cisco Nexus 9K

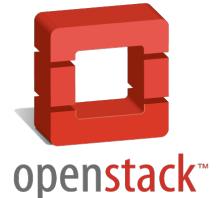


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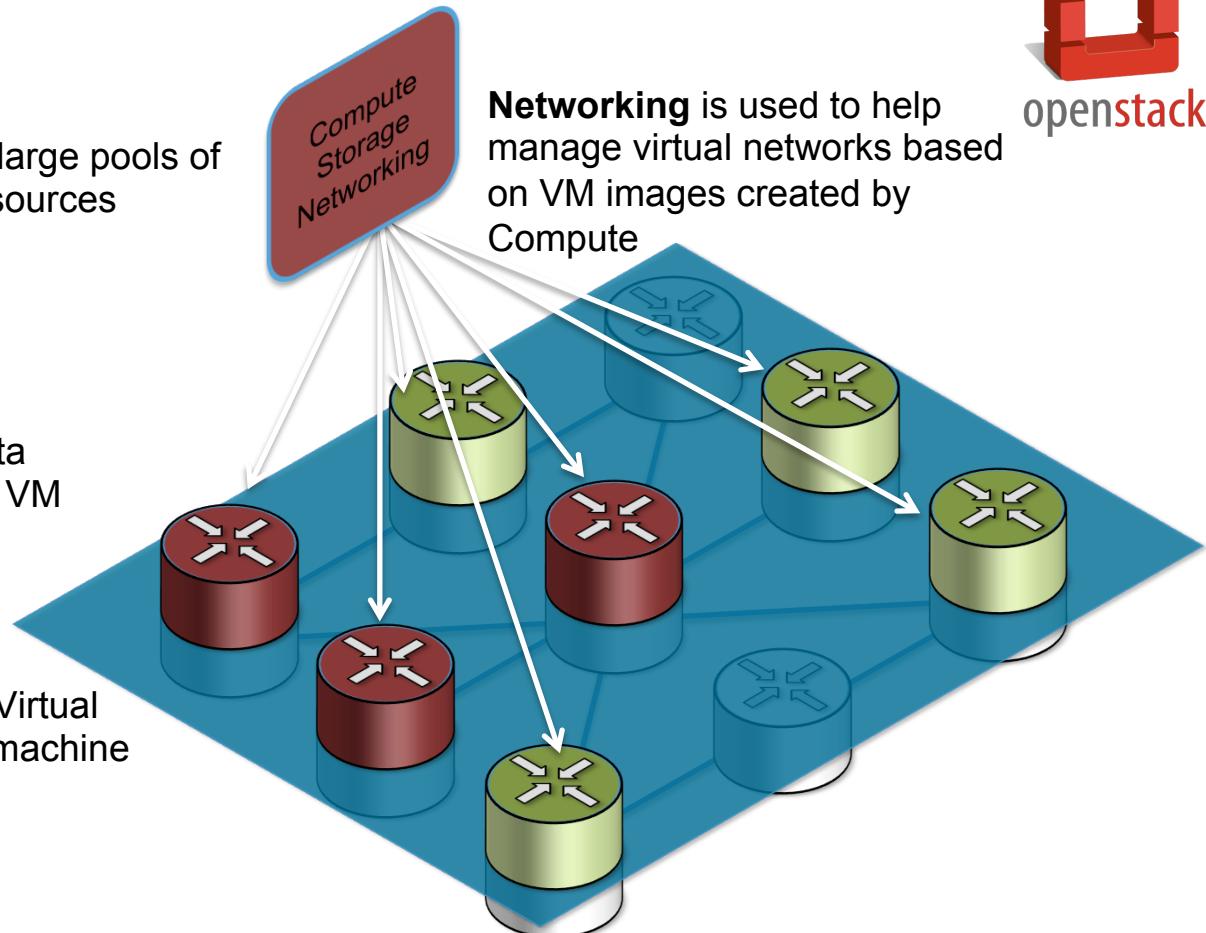
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OpenStack

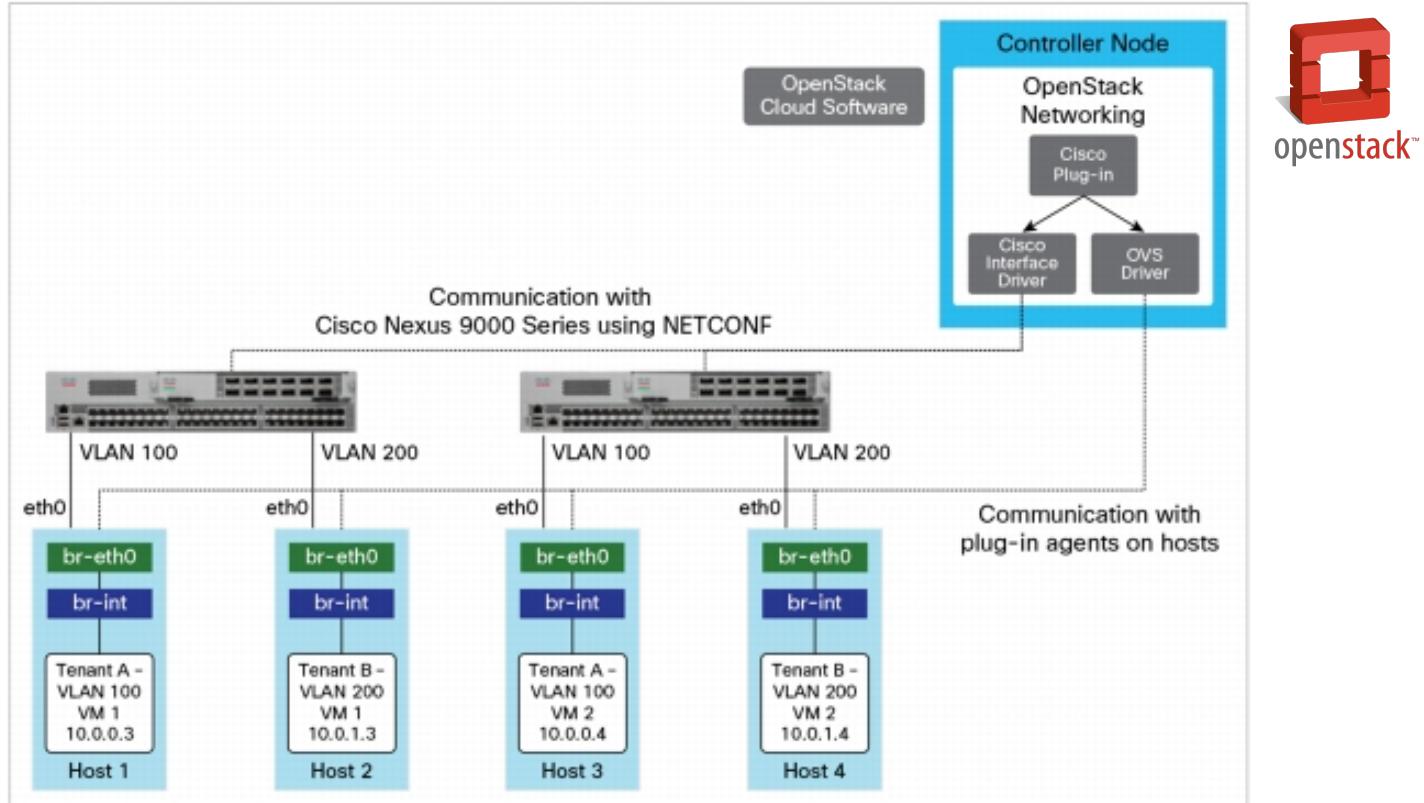
Cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacenter



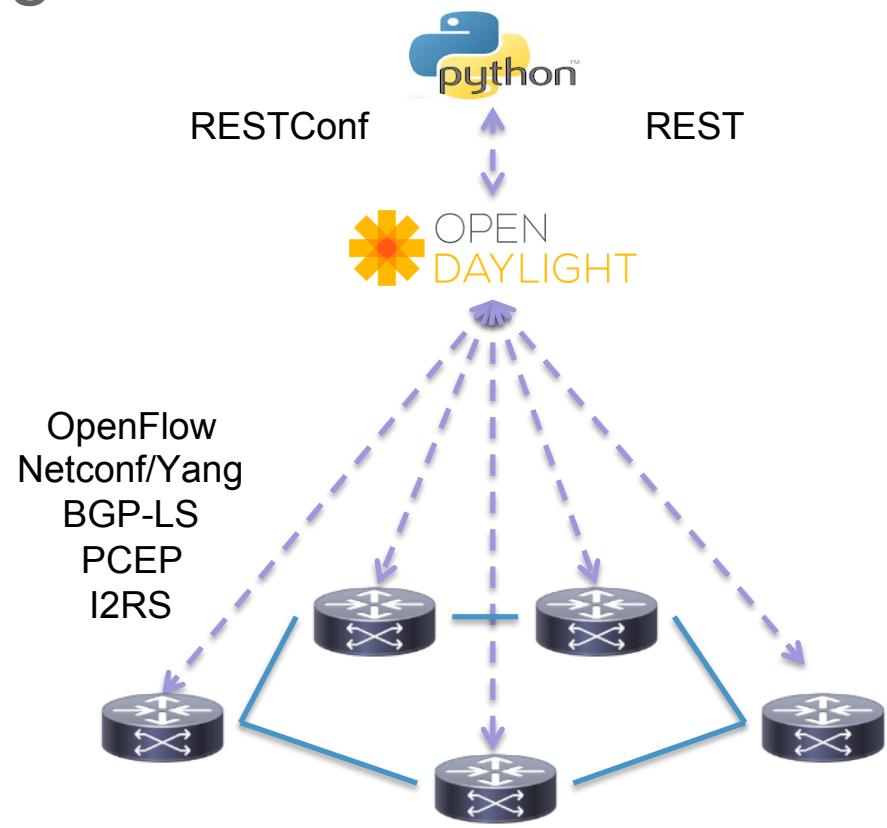
- Storage** supports object data and block devices including VM images
- Compute** creates and manage Virtual Machines (VM's) using various machine images from Storage



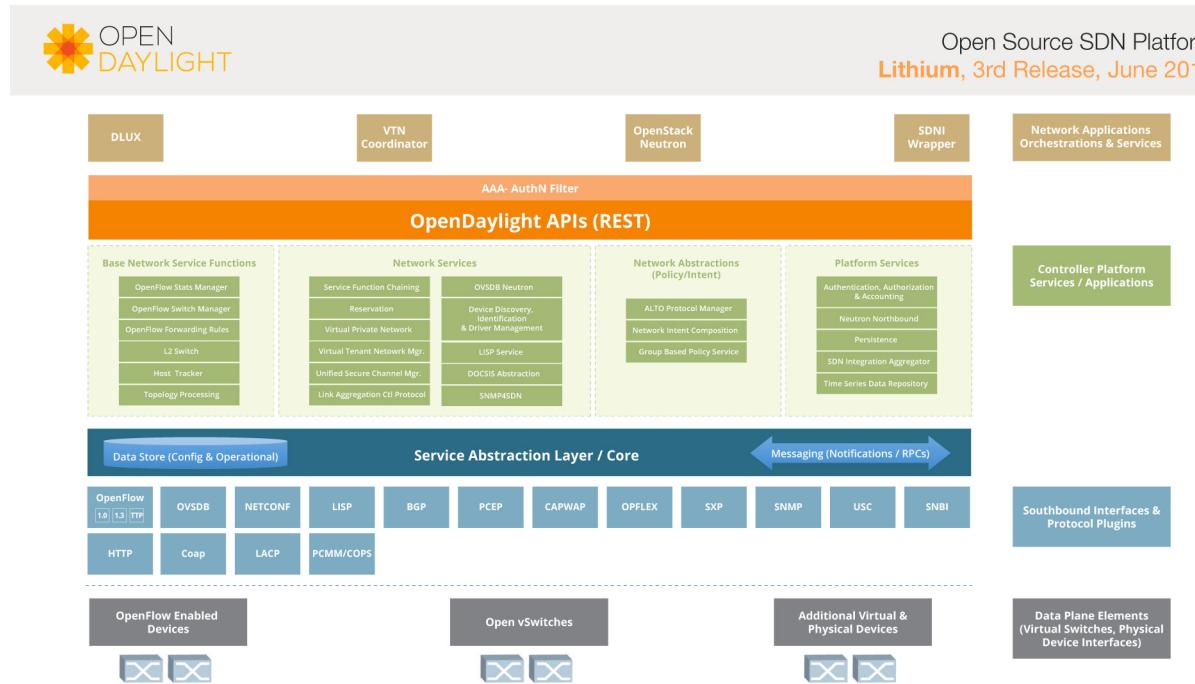
OpenStack



Controllers



OpenDaylight Platform – www.opendaylight.org



Hydrogen

- Released February 2014
- Based on Cisco's XNC

Helium

- Released October 2014
- 1.87M+ lines of code
- 28 Projects
- 256 Contributors

Lithium

- June 2015 release

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What Does This do for Teams?

VIRL - Virtual Networks on Your Laptop

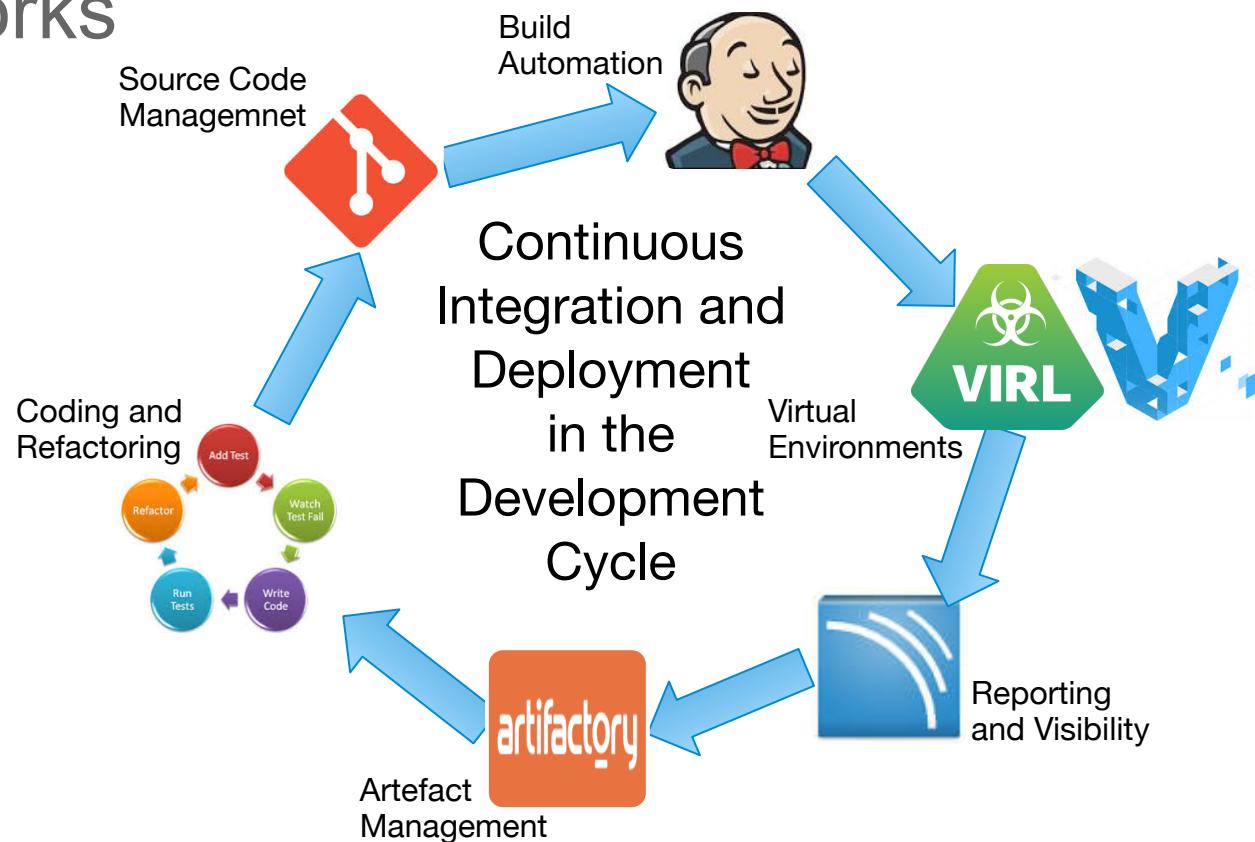
VIRL.cisco.com - A CCNA running on your laptop for \$150

A network orchestration and virtualization platform that enables:

- Point-and-click network design
- Painless configuration
- Integration of platform-sync'd code
- Rapid setup and tear-down
- Seamless connectivity with 'real' networks
- Portability and repeatability



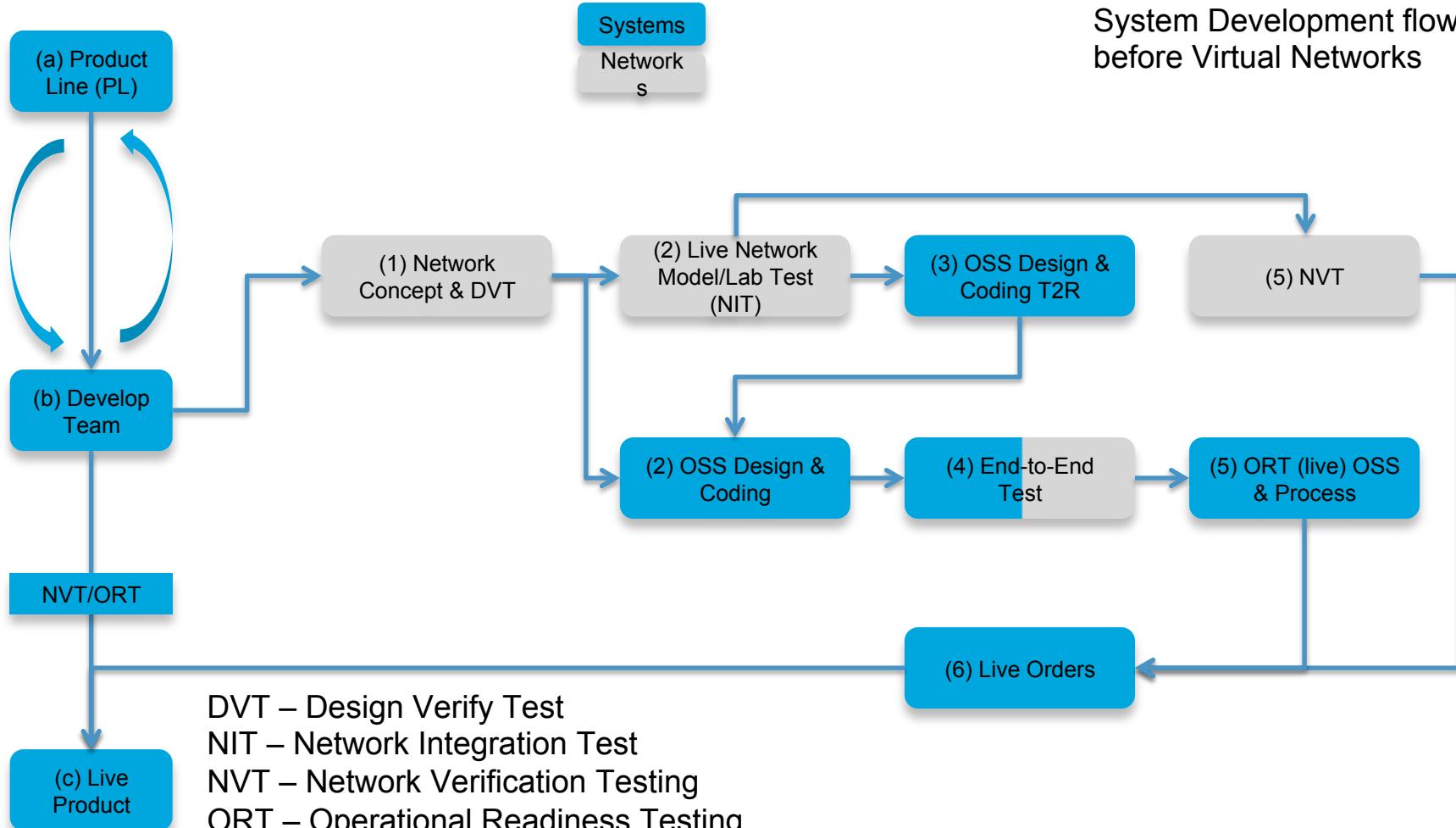
Agile Development and CI/CD with Virtual Networks



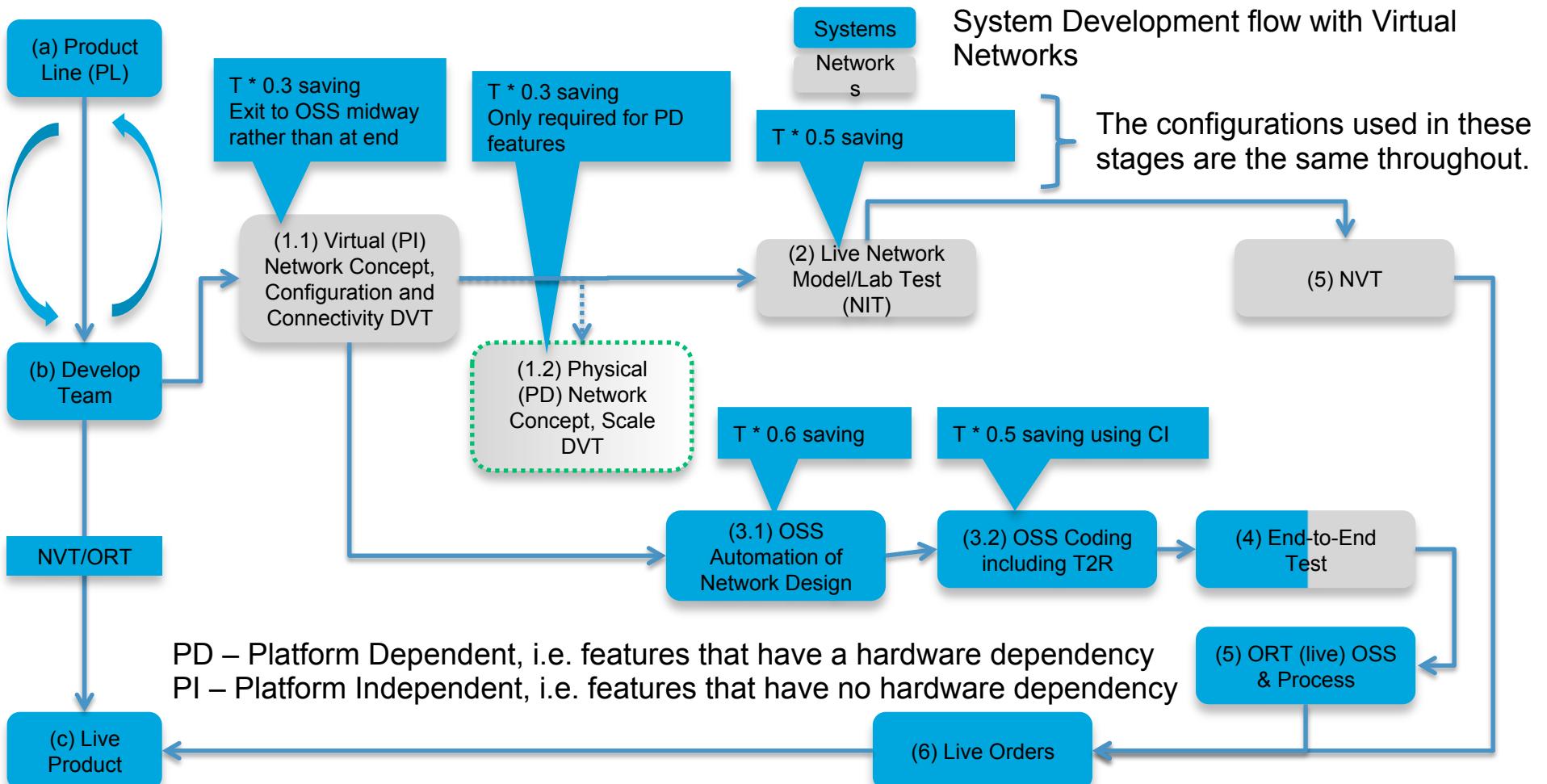
Bridging the Gap Between Network and System Architects

- Virtual network functions allow for whole systems modelling
 - All of the system functions can be represented as VMs
 - The virtual network components have high fidelity with respect to their physical instantiations (Nexus 9K and the 9Kv, ASR9K and XRv ...) - See VIRL
- Modelling the system provides a common framework
 - The interactions of network and other system functions can be designed, developed and tested in virtual environments
 - Virtual environments support automation, and removes bottlenecks
 - Automation speeds up system design, development and test

System Development flow before Virtual Networks



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All phases using virtual networks trending to 100% Right First Time (RFT)
 (Significantly reduced feedback loop for corrections)

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Conclusions

- DevOp automation has to include network functions
- This must be based on the tools that the IT DevOps world uses
- Automation works best with virtualisation
- Many network functions are virtualised
- SDN development requires virtual tooling
- Virtualisation changes how teams function

Thank you

<https://github.com/DevOps4Networks>

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