Distributed Network Function Virtualization

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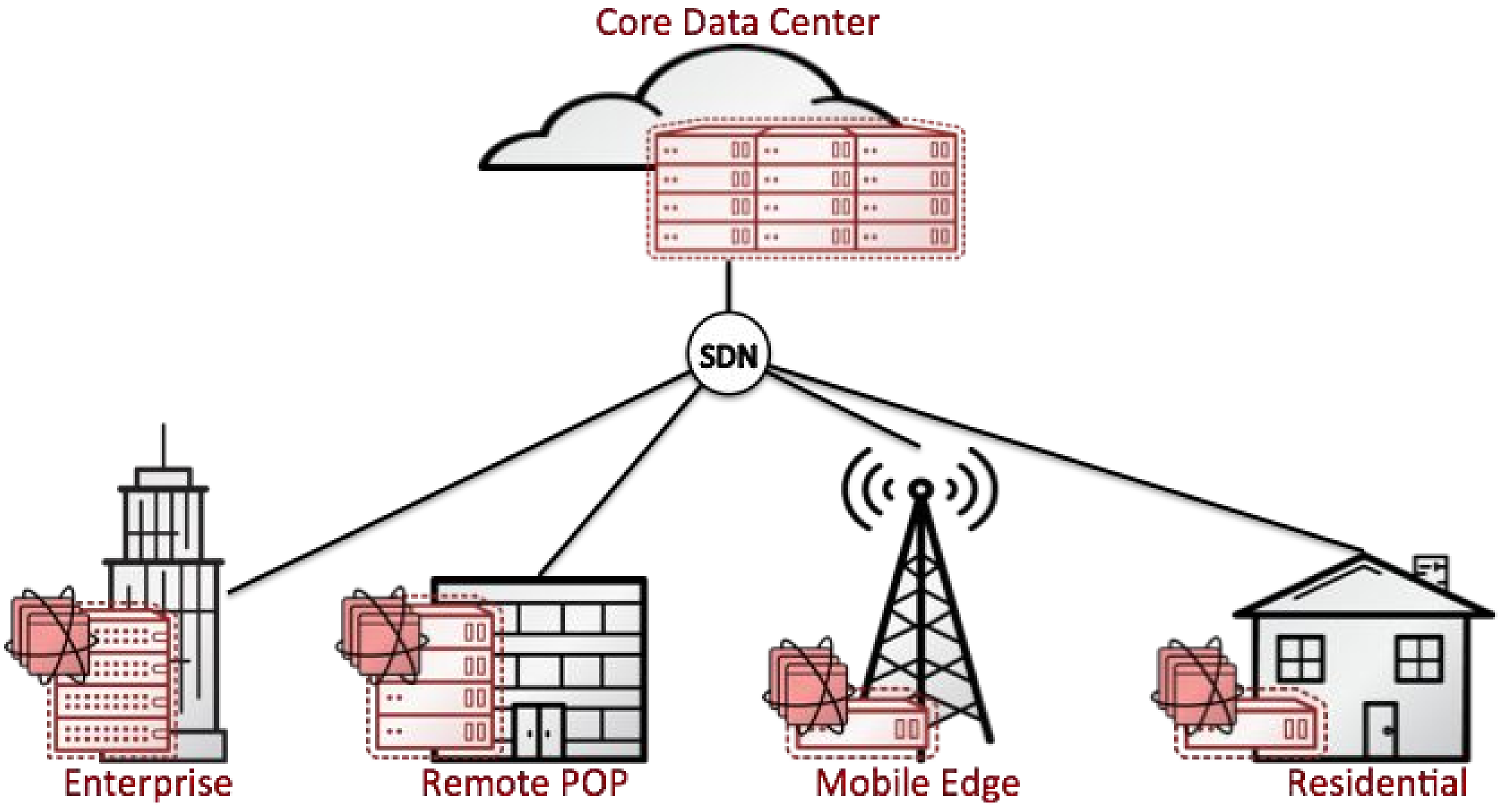
Outline

- What is Distributed NFV?
- Why do we need Distributed NFV?
  - Verizon Use Case
- How do we implement Distributed NFV?
  - Architecture
  - Pitfalls
- Verizon + BigSwitch + Red Hat joint solution
  - Lab setup
  - Findings
- Wrap Up
- Q & A

Distributed NFV Architecture



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Component Placement

- Distributed deployment of Network Functions at multiple sites with some level of remote control over those deployment models, traffic management for OpenStack and VNFs
  - Core Data Center
    - Deployment Tools
    - Network Controllers
    - Cloud Controllers
    - Orchestration
    - Monitoring, Troubleshooting and Analytics
    - Centralized Applications
  - Remote Sites
    - Compute Nodes running Edge Applications

Areas of Application

- Thick CPE (Customer Premise Equipment)

Enterprise

On-premise:

- VNFs
  - Ex: FW, LB, WAN Optimization, NAT
- Limited storage

In central DC:

- Policy management and enforcement
- Subscriber management
- IPSec termination
- Additional VNFs + SFC

Residential

On-premise:

- VNFs
  - Ex: FW, NAT
- Limited storage

In central DC:

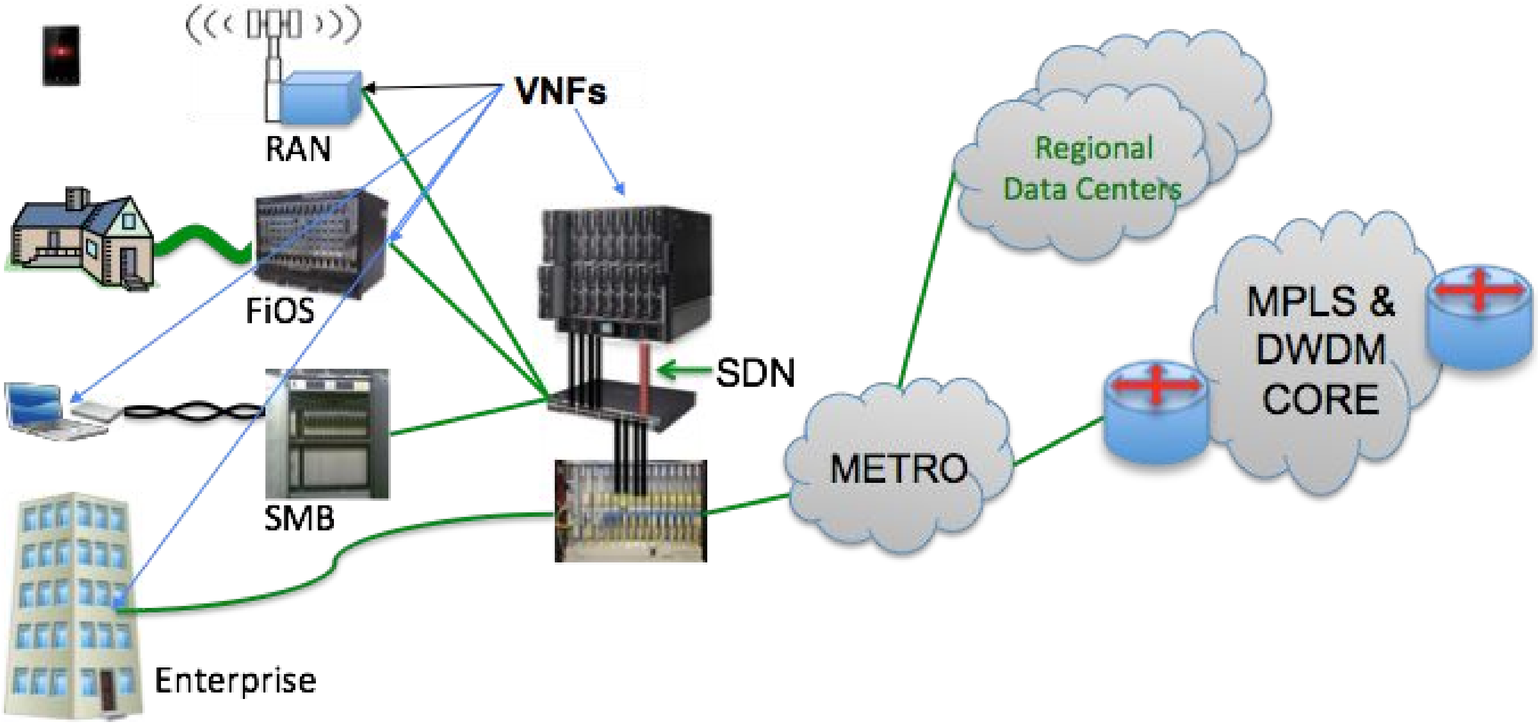
Additional VNFs

- Remote POP
  - Web Cache
  - Video Streamers
- Mobile Edge Computing

Verizon Use Case - Distributed Network Services

- Support for new NFV services requires large number of small deployments
  - Low latency for highly interactive applications (VR, AR)
  - High bandwidth video and graphics distribution
  - Edge-Datacenter support with 4-16 servers at each hundreds of locations
  - Potentially scale to a single (micro) server (CPE) at 10s of thousands of retail locations
- Improve customer experience by providing on-demand software services
- Reduce cost of service delivery
- Multiple classes of Reliability and Availability

Verizon Scenario



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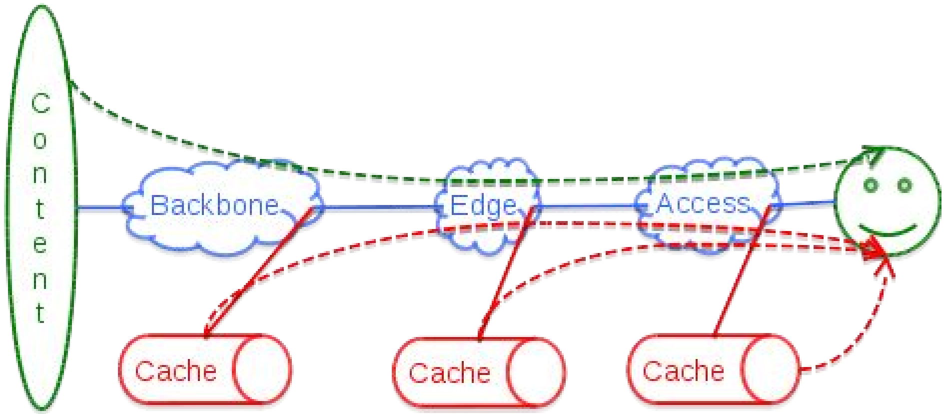
Evolving Economics of Networking and Computing

- Historical Processing/Storage unit costs decreasing faster than Routing/Transport
- These trends drive placing cache (CDN) closer to end users
- Continuation of these trends will make Distributed NFV more economically compelling for other network services

Content Delivery Cost *is a combination of*
Processing + Storage *and* *Routing + Transport* *Costs*



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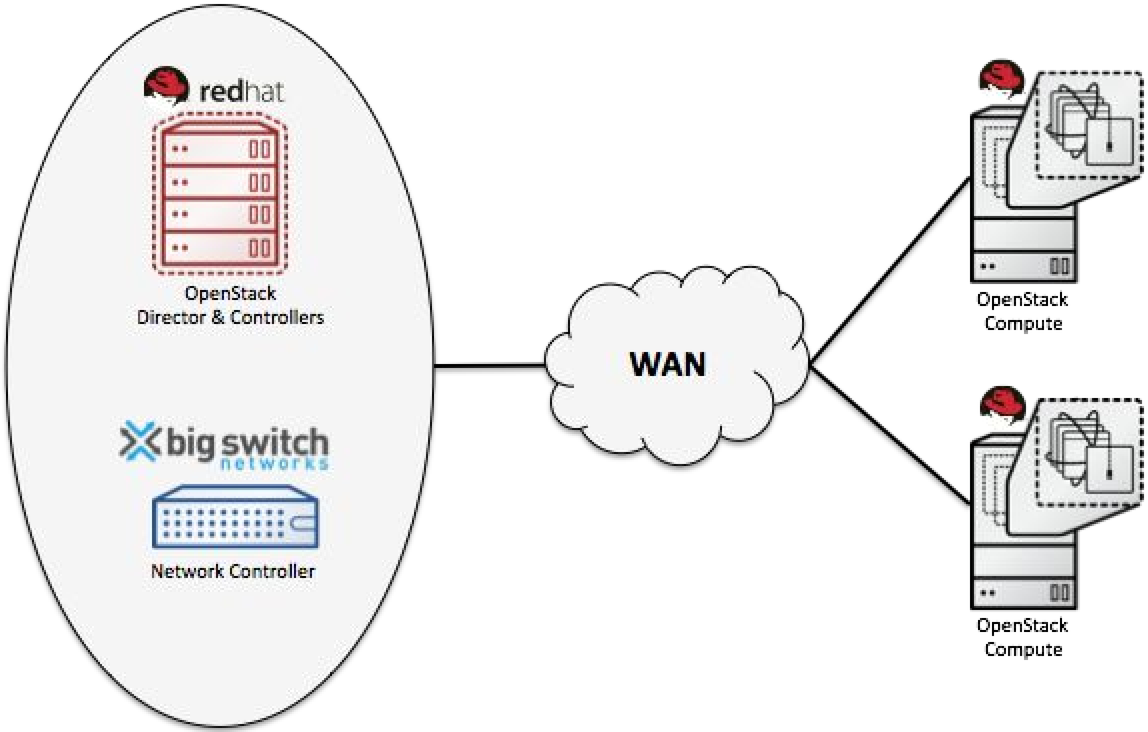
Goal: Customer Access to Distributed NFV Infrastructure

- Dynamic network services provided efficiently to customers
- Leverage most appropriate infrastructure to deliver the service
  - Efficient access to scalable services
  - Multiple reliability/availability classes of service
- Support for dynamic service graphs to enable distributed services
- Scalable highly-available service management

Lab Implementation Architecture



Challenges

- Deployment of Remote Compute Nodes across WAN
  - Extending L2 for provisioning
  - Network latency
- OpenStack Control Plane Communication
  - Network latency effect on the Message Bus and Database Access
  - Orchestration
  - Application deployment
  - Failure detection
- Service Resiliency
  - Headless operation
  - Service recovery
- Network Configuration, Maintenance and Troubleshooting

Lab Setup

Core Data Center

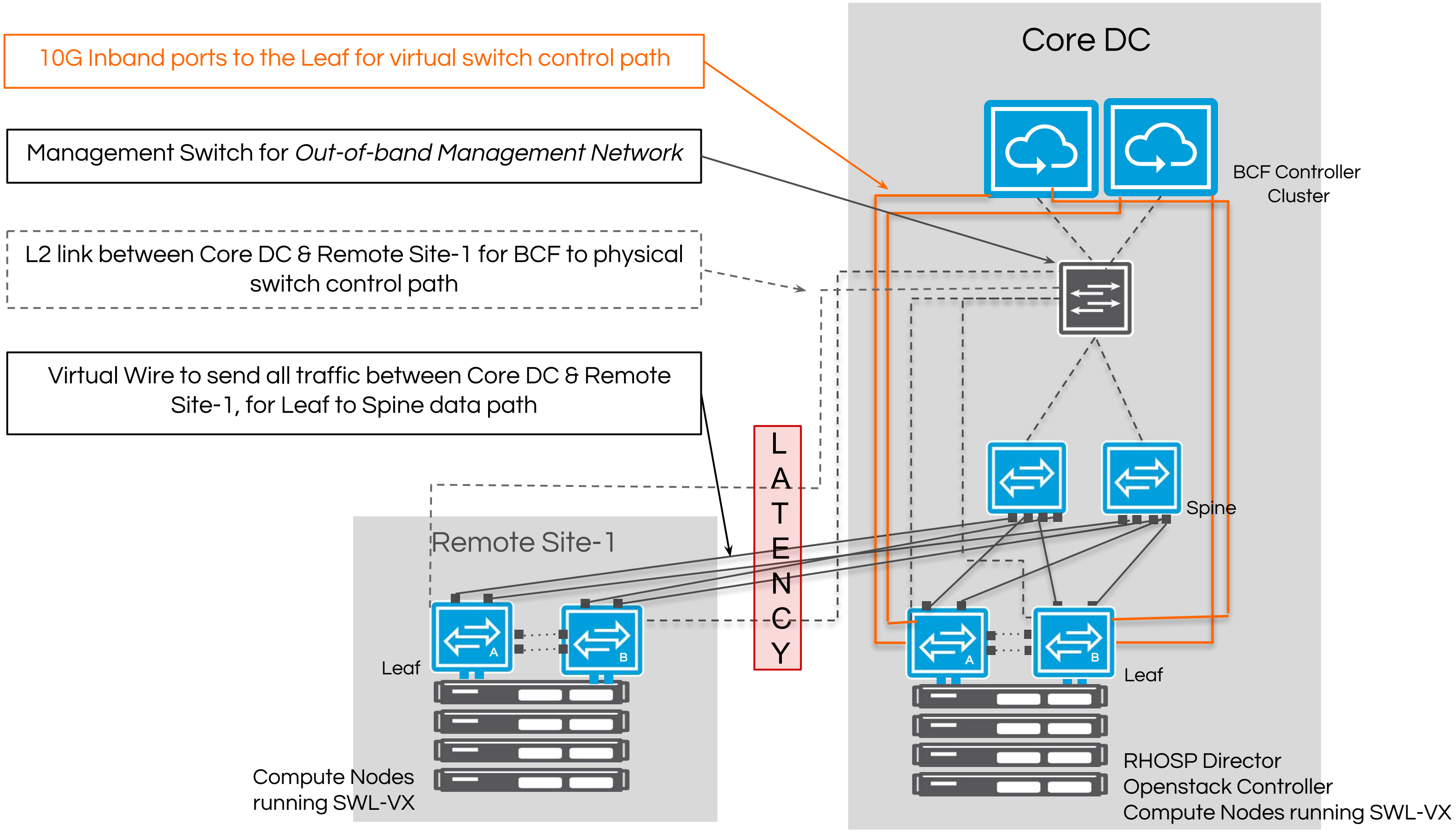
- Big Cloud Fabric Controller Cluster
- Spine switches
- TOR Leaf switches
- RHOSP Director (Undercloud)
- OpenStack Controllers (Overcloud)
- Compute nodes running Switch Light VX (virtual switch)

Remote Site-1

- TOR Leaf switches
- Compute nodes running Switch Light VX (virtual switch)

Latency Generator

Lab Setup: Physical Topology



Test Objective

Validate fabric resiliency with WAN latency [0-40ms]

Control path latency

- Big Cloud Fabric out-of-band management network for physical switches
- Big Cloud Fabric in-band management network for virtual switches
- OpenStack control plane communications

Tests Performed

Ping from a VM in the Core DC to a VM on the Remote Site-1

Success Criteria: No ping packets lost

- Controller failures
  - Failover
  - Headless mode
- Spine and leaf switch disconnects and reconnects
- Spine and leaf switch interface up/down
  - Spine to leaf connectivity
  - Leaf to compute connectivity
- Spine and leaf switch reboots

Wrap Up

- Telecom provider concerns
  - Distributed NFV architecture is essential for a variety of carrier use cases and needs to be supported across the layers of the stack, from networking to message bus to applications
  - Latency and network availability might potentially affect both initial deployment and day two operation
- Infrastructure providers' answers
  - Red Hat OpenStack Platform components are able to handle delays produced by deployment across the WAN
  - Big Switch Networks proved that the Big Cloud Fabric was resilient even across the WAN

Q & A

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