SOFTWARE DEFINED NETWORKING FOR SERVICE PROVIDERS – USE CASES

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May 23rd 2013

What if you could …

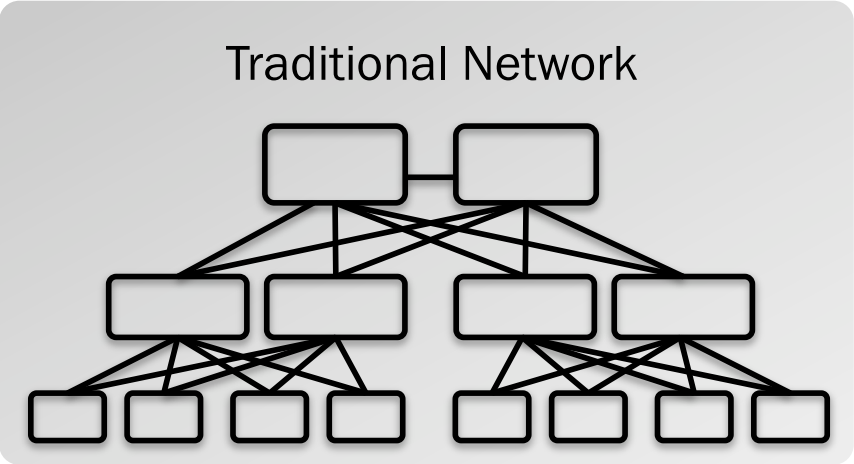
Build your next data center optimized for **highest demands** in flexibility, reliability, and scale

Virtualize your network **starting now** for greater responsiveness and increased asset utilization

Create and deliver **customized services and new offerings** at the speed of customer need

Unlock the intelligence from your network for **real-time orchestration and analytics**

Why can’t you do these things today?



- Network changes are difficult, slow, and risky
- Can’t handle rapid swings in traffic demands
- New services requires too new specialized skills

What is Software-Defined Networking (SDN)?

- Software abstraction layer on top of networking infrastructure
- Allows external “controller” to control how packets are forwarded by routers and switches
- Key customer benefits:
  - Decouple network application innovation from dependency on new router OS releases
  - Accelerate automation of network changes to increase service velocity

Brocade Cloud-Optimized Networking

Architecture for building the software-defined network

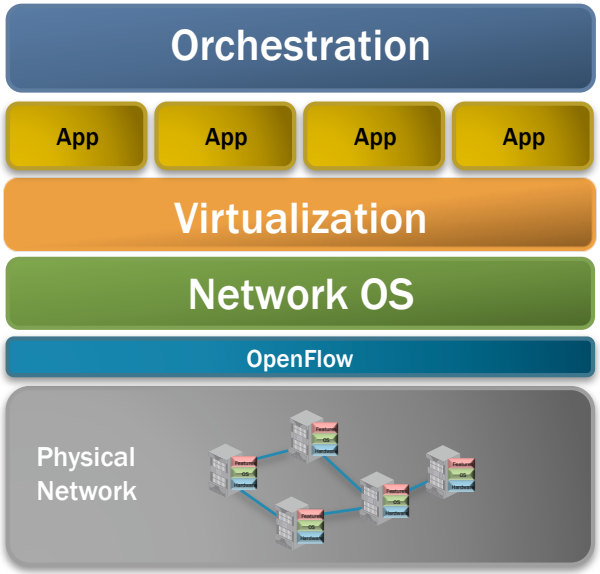
Cloud-Optimized Network Stack	Enabling Technologiesn	Key Benefits
Cloud Management Layer	Cloud APIs: OpenStack, VMware, Microsoft, CloudStack, etc.	Automation and orchestration
Services Layer	Programmatic Control: OpenFlow; OpenScript	Personalization and monetization
Network Virtualization Layer	Overlay Networking: VXLAN, NVGRE, STT; MPLS	Flexibility and efficient asset utilization
Network Fabric Layer	Any-to-any connectivity: Ethernet Fabrics; TRILL; IP routing	Reliability and simplicity

Who is behind Software Defined Networking?

Open Networking Foundation (ONF)

- ONF launched publicly in March, 2011
- Support from more than 70 major companies
- The ONF defines OpenFlow and API specifications
- Founding members of ONF:

Deutsche Telekom · Microsoft · facebook · verizon wireless · Google · YAHOO!

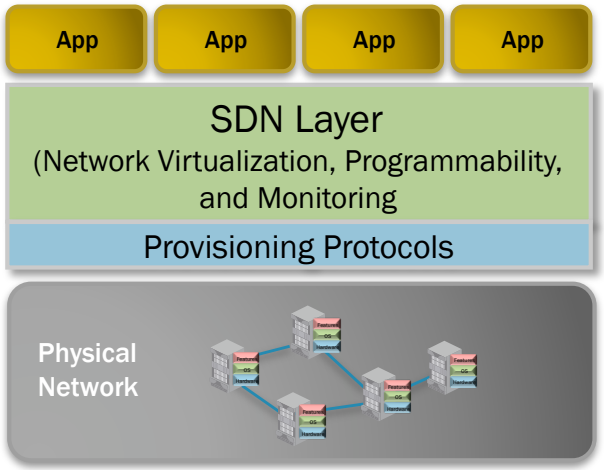


ONF SDN Model
(simplified)

Software Defined Networking and IETF

Similar Goals, Similar Architecture

- "SDN Problem Statement and Use Cases for Data Center Applications"
  - draft-pan-sdn-dc-problem-statement-and-use-cases-02.txt
- Flexible in terms of provisioning protocols
  - OpenFlow, NetConf, PCE

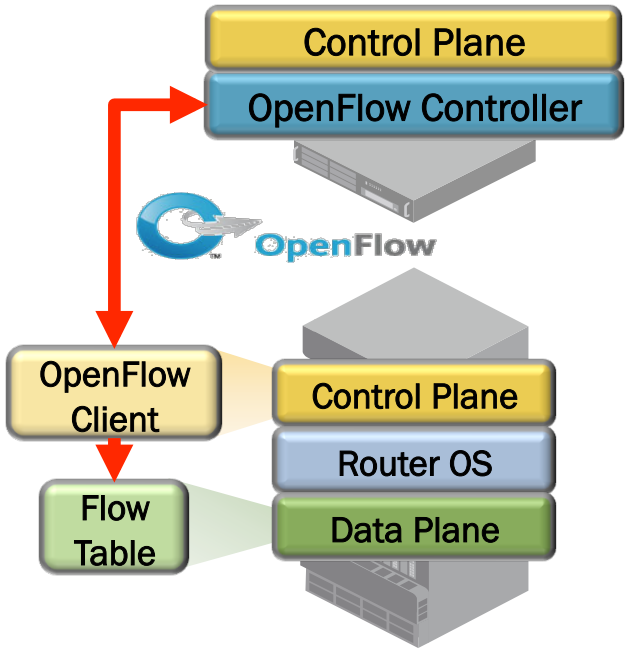


SDN-enabled Network

OpenFlow Basics

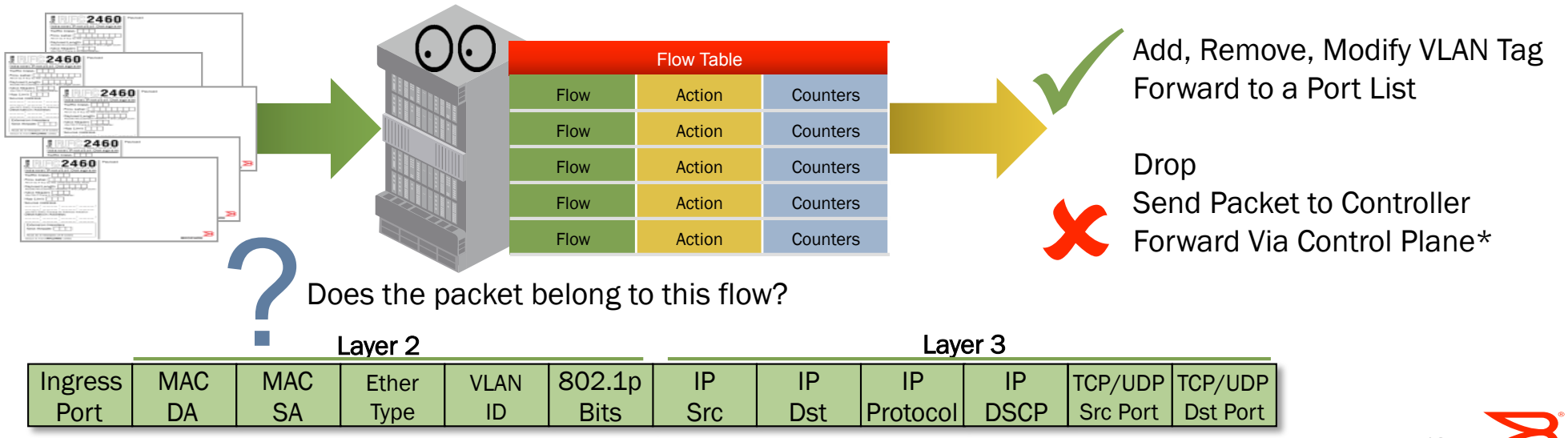
OpenFlow Overview

- Protocol that enables communication between an OpenFlow controller and an OpenFlow router
  - Control plane routing decisions are made by the controller, which typically runs on a server
  - Data plane forwarding is still done by the router
- Router and controller communicate via the OpenFlow protocol, which defines messages
- Router maintains flow tables, which are maintained by the controller using APIs



OpenFlow Router Operation

- Flow table contains entries that define a flow based on the packet header
- Flows are sorted by priority as defined by the controller, highest priority flows match first



OpenFlow Applications: What can you do with OpenFlow?

- OpenFlow itself does not define or mandate any specific application, it's just an interface into the control plane
- Enables a large set of applications due to its flexibility to program the network based on any external criteria
  - Cost
  - Time of day
  - Latency
  - Security
  - Traffic policy
  - Load
- Ideal for automation in highly orchestrated environments where you want to precisely control network behavior

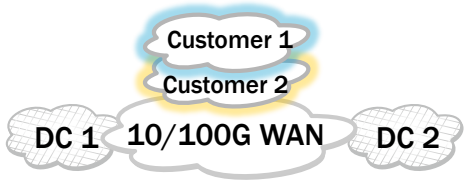
OpenFlow Use Cases

OpenFlow Will Evolve Through Value-Added Applications

Brocade SDN Target Use Cases

WAN Network Virtualization

WAN Virtualization
App & SDN Controller



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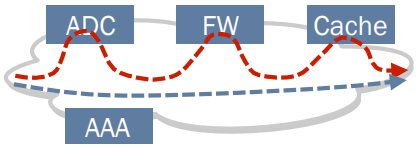
Services Creation & Insertion

Services Insertion
App & SDN Controller



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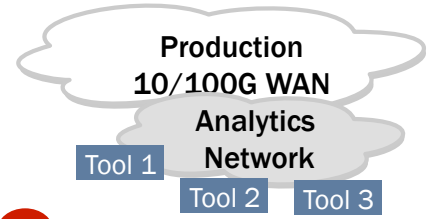
Network Analytics

Network Analytics
App & SDN Controller



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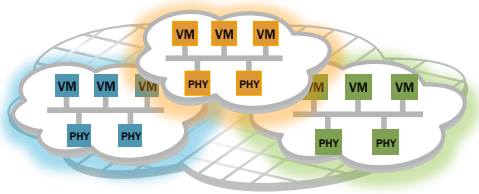
DC Network Virtualization

DC Virtualization
App & SDN Controller



DC Network Fabric

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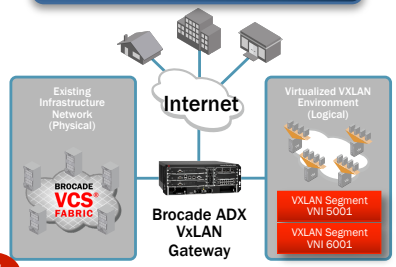
Application Delivery

ADP APP & SDN Controller



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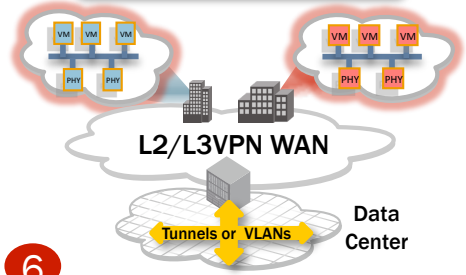
SDN Cloud Gateway

SDN Orchestration &
SDN Controller



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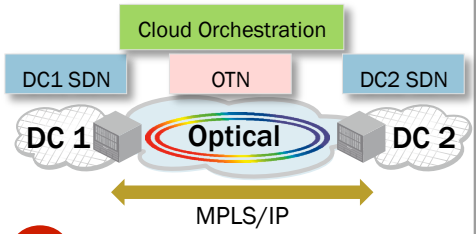
SDN Packet-Optical Integration

Packet-Optical Integration
APP & SDN Controller



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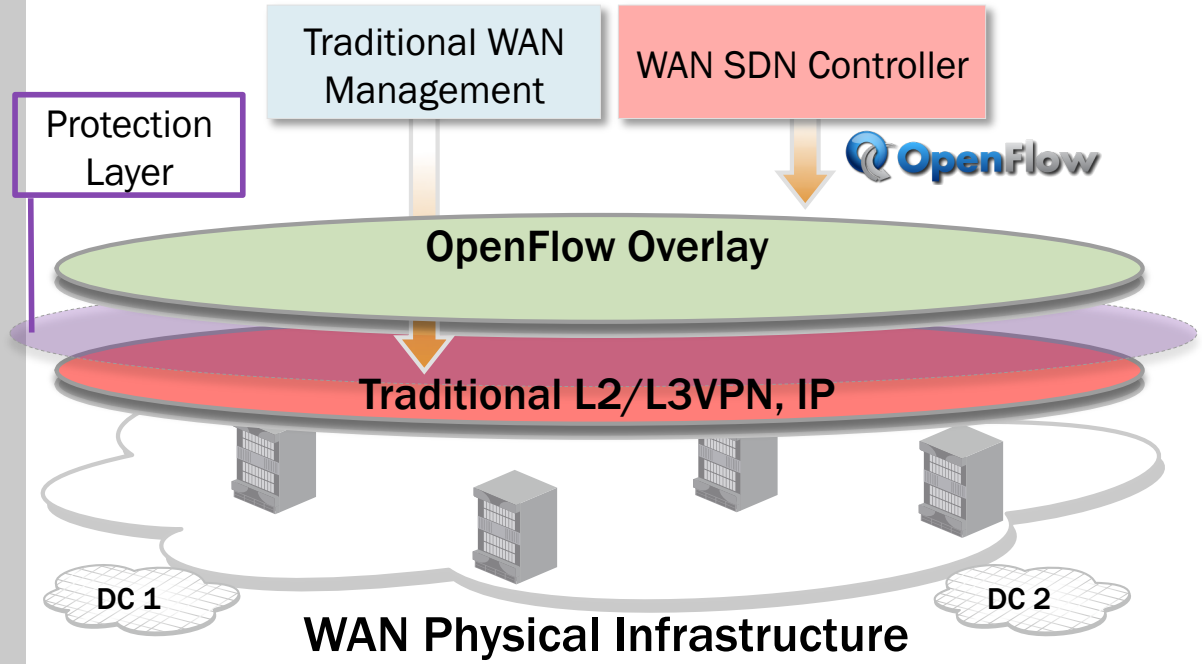
Use Case 1

WAN Network Virtualization

Traditional L2/L3VPN-IP Network with OpenFlow Overlay



- OpenFlow as an overlay to existing network
  - Allows for new revenue-generating features on top of existing production network
- Enabled by Brocade's "Hybrid port mode"
  - OpenFlow and traditional features enabled concurrently on same router ports
- Protected Hybrid Port Mode
  - OpenFlow does not affect Traditional traffic
  - Protection in hardware
  - Allows for initial OpenFlow overlay service development without risk

Use Case 1

BROCADE OPENFLOW ENABLED 100G NATIONWIDE BACKBONE

INTERNET 2

IN SUPPORT OF U.S.UCAN

manLan Exchange Point

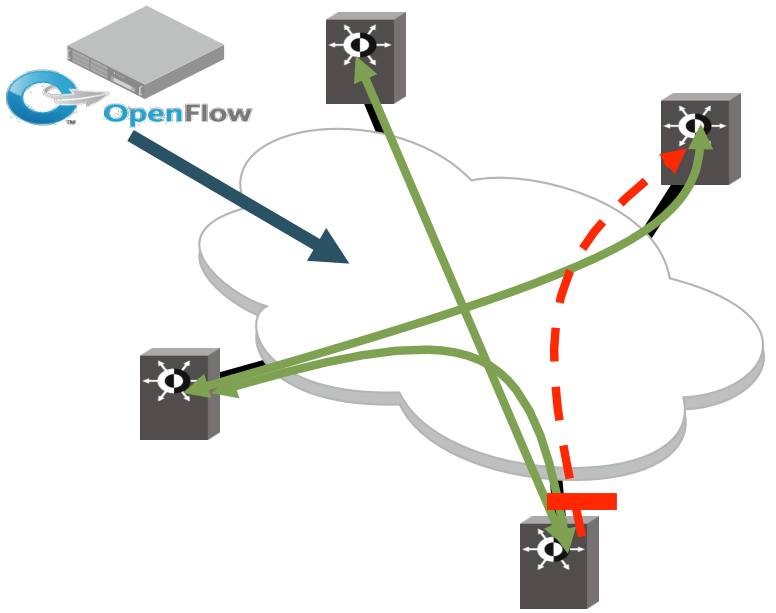
Internet 2

- 49 Custom Location Facilities
- 15,500 miles of dark Fiber
- 8.8 Tbps of Optical Capacity
- Hybrid Mode with protected OpenFlow traffic

Use Case 1

Policy-Based IXP with SDN

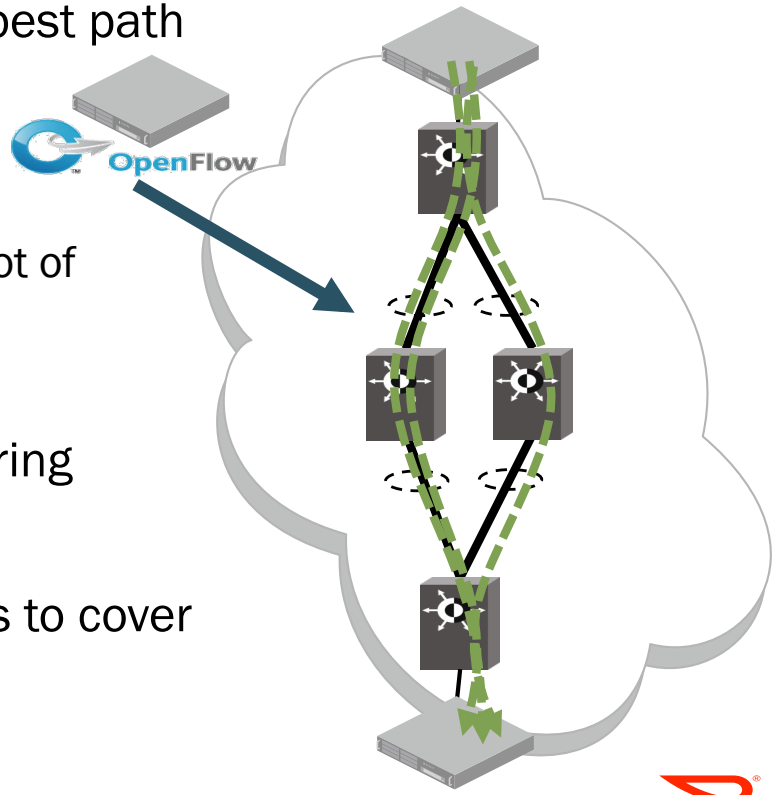
- IXP peering flows could be programmed entirely with OpenFlow
  - MAC addresses already have to be registered
- Offers much greater port security and traffic control
  - Solves problem of receiving unwanted traffic/ default routing
  - Intercept all ARP/ND and punt to server for validation
- Could offer member-provisioned public peering or VLAN PNIs through portal



Use Case 1

Monitoring All Paths in the IXP Network

- Need to monitor all links in a network, not just the best path
- Complicated by multipath and LAG
  - Test packets take the best path
  - Google does this with RSVP-TE LSPs which creates a lot of state(*)
  - LINX does this with SNMP/UDP
  - Use existing network topology for production peering traffic
- Overlay to match crafted test flows on specific ports to cover all links in the network

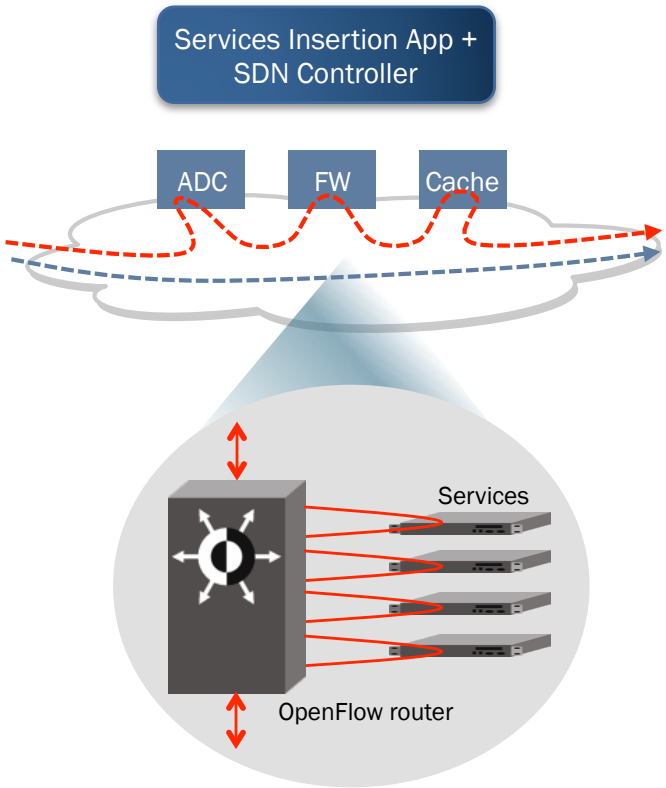


(*) https://ripe65.ripe.net/presentations/828-RIPE65.Talk29.Google_Blackbox_Monitoring.pdf

Use Case 2

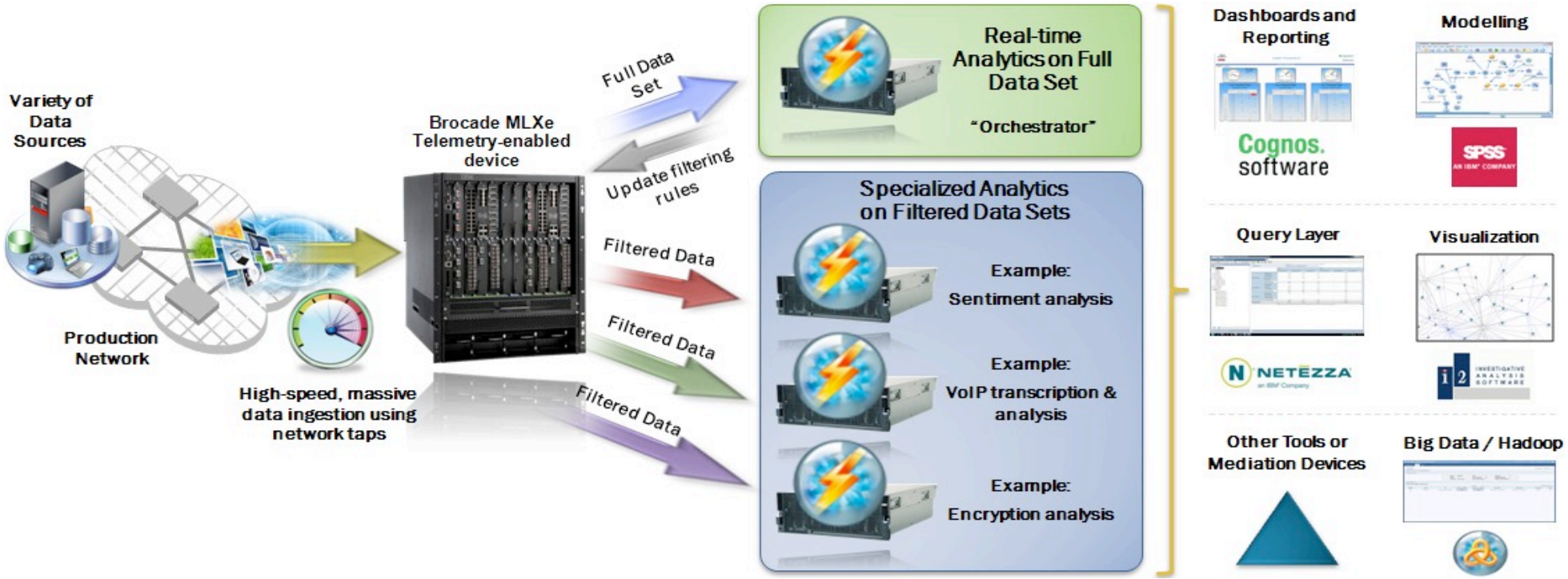
Services Creation & Insertion

- SDN automates
  - Traffic steering to achieve desired pipeline of services
  - Customization of services according to customer needs
- Optimizes use of network resources
  - No need to steer traffic through traffic steering appliances



Use Case 3

Network Analytics Architecture

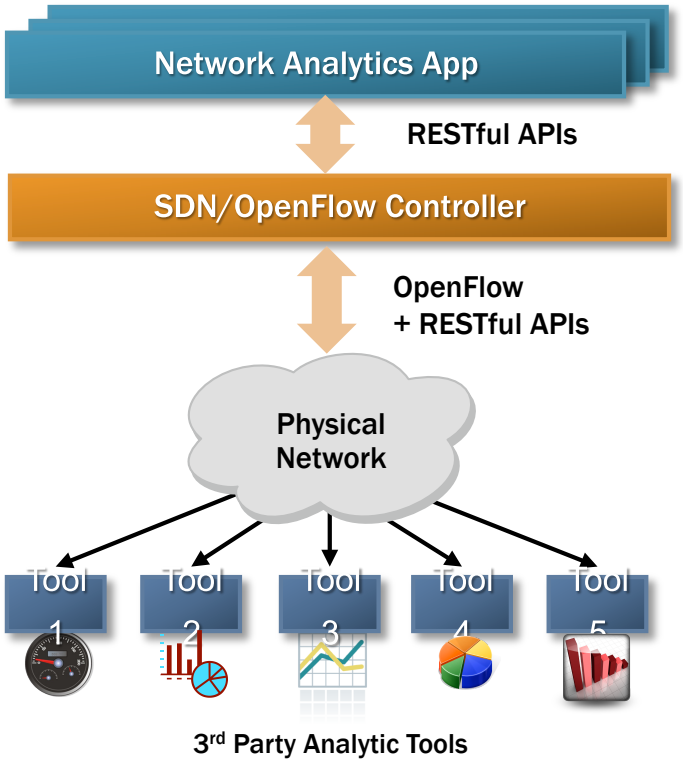


Use Case 3

SDN Approach to Network Analytics

Unlocking Advanced Operational Intelligence

- Why network analytics is important
  - Real-time network statistics collection & alerting
  - Summarization of normal and abnormal traffic
  - Detect network performance issues in advance of customer complaints
- Use cases
  - Internet/Mobile traffic analysis: Facebook, Youtube, Email, …
  - Big Data analysis
  - Detection of unlawful content
  - …



Conclusion

SDN is a vehicle for reducing service delivery costs and increasing service velocity with key benefits

TCO Category	SDN Percentage Savings Compared to PMO		
	Service Creation & Insertion	WAN Virtualization	Network Analytics
Network CapEx	39%	49%	13%
Network OpEx	31%	38%	17%
Labour Cost for Order Processing Setup	77%	77%	77%
Labour Cost for Order Processing	86%	86%	86%
TCO	**83%**	**61%**	**48%**

Service velocity is increased by reducing order processing setup time from one year to four months and by a 7:1 reduction in order processing time.

- Operational Savings
- Flexibility
- Improved Uptime
- Better Management
- Planning
- Infrastructure Savings

Thank You