

SDN (Software Defined Network)

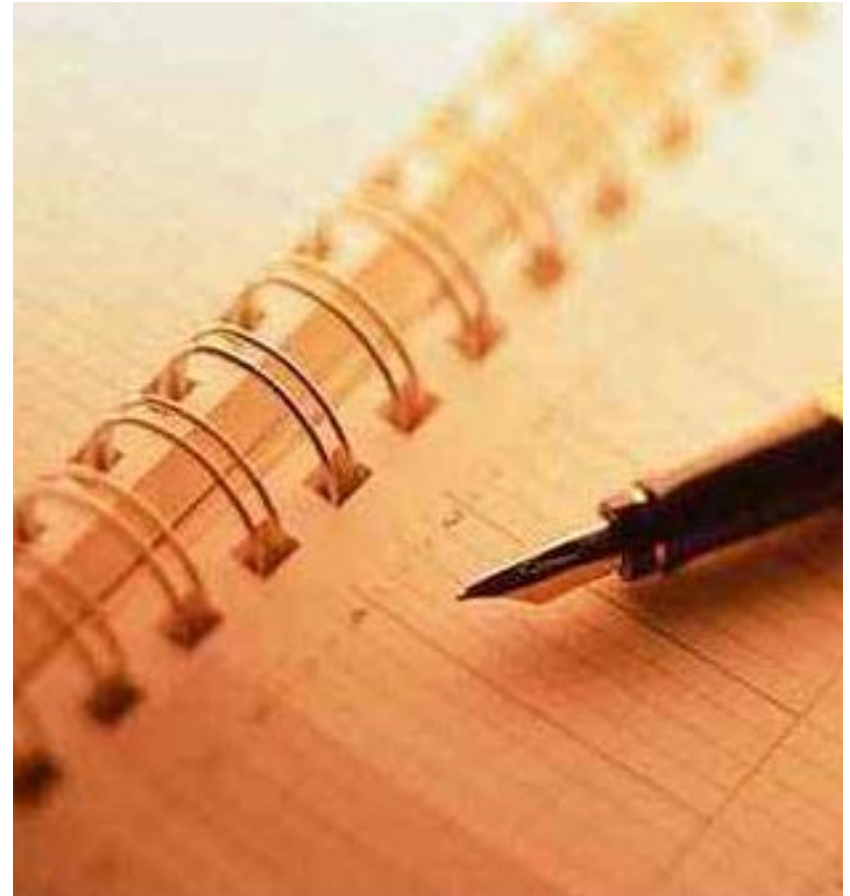
Sales Network Architect: KIM, Hak Yeul

mickykim@kr.ibm.com

Date: 10/14/2013



1. IT Market Trend
2. SDN (Software Defined Network)
 - What is SDN?
 - History of SDN
 - ONF (Open Networking Foundation)
 - OpenDayLight
3. IBM SDN Solution
 - 3.1 OpenFlow Solution
 - 3.1.1 OpenFlow Switch Products
 - 3.1.2 Controller product
 - 3.2 Overlayer Solution
 - 3.2.1 SDN VE (Virtual Environment)
4. Appendix



1. IT Market Trend > Total Solution

- 대형 Hardware Vendor들이 Server+Network+Storage를 통합된 Solution 제공

IBM to Acquire BLADE Networks Technologies
Technology to further optimize IBM servers for cloud computing, analytics and other new workloads

ARMONK, N.Y. - 27 Sep 2011 - IBM (NYSE: IBM) today announced it has entered into a definitive agreement to acquire BLADE Networks Technologies (BLADE), a privately held company based in Santa Clara, CA. BLADE specializes in software and devices that route data and transactions to and from servers. The acquisition is anticipated to close in the fourth quarter of 2011, subject to regulatory review and other customary closing conditions and applicable regulatory reviews. Financial terms of the transaction are not being disclosed.

BLADE provides a range of top-driven services as well as software to help build and manage a private cloud environment. Customers include many of the world's leading companies in the Fortune 500 in a variety of industries, including financial services, services, education, government, healthcare, defense and finance. IBM and BLADE have worked together since 2002, resulting in thousands of joint clients. In fact, over 90 percent of IBM System x BladeCenters currently attach to or use BLADE products (1).

The BLADE acquisition builds on the industry-leading capabilities and technologies IBM is applying to its systems, which are optimized to help clients manage a range of new, more demanding workloads. This year, IBM introduced a line-up of new, workload-optimized systems that incorporate innovation at each layer – from microprocessors and firmware software to middleware and hardware. With BLADE, IBM can drive innovation at the systems networking level to enable clients to speed the delivery of key information from system to system – for workloads such as analytics and cloud computing – while also reducing data center costs.

Dell announces its intent to acquire Force10 Networks
More information >

Acquisition Overview
Dell intends to acquire Force10 Networks, a technology leader in high-performance data center networking. Force10's software-based enterprise network architecture enables customers to achieve performance and resilience while reducing overall total cost of ownership, simplifying network deployment and supporting open standards-based management solutions. The transaction represents Dell's latest investment as it broadens its enterprise portfolio to offer customers a complete range of data center products and solutions.

Customer Benefits
Dell's acquisition of Force10 Networks is a complete end-to-end solution for customers to expand their portfolio and achieve infrastructure solutions across storage, server, and networking. Dell remains committed to providing open, scalable, and affordable solutions to help their customers achieve their goals. Dell's acquisition of Force10 Networks aligns with its strategy to provide a complete range of data center products and solutions.

Quotes:
"Today's enterprise networks are too complex and require too much manual intervention. The approach in the past is no longer viable in the virtual era. Dell's approach of offering customers open, scalable and affordable solutions aligns with Force10 Networks' approach to offering customers new levels of flexibility, performance, scale and automation which is fundamental to changing the economics of datacenter networking."
Brad Anderson, Senior Vice President

HP Completes Acquisition of 3Com Corporation, Accelerates Converged Infrastructure Strategy
PALO ALTO, Calif., April 12, 2011

HP today announced it has completed its acquisition of 3Com Corporation, a leading provider of network and security solutions. The acquisition is valued at approximately \$7.90 per share. HP will combine 3Com's ProCurve and Aruba networks with its existing HP network portfolio to create a unified, end-to-end solution for customers. This integration will enable HP to deliver a complete range of network and security solutions, simplifying the network and improving IT service delivery capabilities.

The acquisition of 3Com expands HP's Ethernet switching offerings, adds routing capabilities and significantly strengthens the company's position in China. 3Com also brings to HP network security capabilities through its TippingPoint portfolio. Together, the companies are able to deliver one of the broadest network technology capabilities in the market to meet customers' needs well into the future.

Further details on product integration will be announced at a later date.

HP creates new possibilities for technology to have a meaningful impact on people, businesses, governments and society. The world's largest technology company, HP brings together a portfolio that spans printing, personal computing, software, services and IT infrastructure to solve customer problems. More information about HP (NYSE: HPQ) is available at <http://www.hp.com/>.

Cisco Finally Releases UCS Market Share Numbers
97 Comments

MAY 24, 2011 - IDC came out with their 1Q 2011 worldwide server market revenue report today showing that Cisco has finally entered the market standings with a 3rd place standing at 9.4% factory revenue share. IDC's findings also showed that both HP and IBM decreased their blade server market share from Q4 2010.

According to IDC, worldwide server sales (all servers, not just blade servers) for 1Q 2011 increased 12.1% year over year to \$11.9 billion in factory revenues. IDC also reported the blade server market accelerated and continued its strong growth in 1Q with revenue increasing 23.9% year over year with shipments increasing to 5.4% compared to 1Q 2010. Overall, blade servers represent 15.2% of the quarterly worldwide server revenues. Interestingly enough, 90% of all blade revenue is driven by x86 systems, a segment in which HP and IBM now represent 20.2% and 20.2% of the market, respectively.

Here's a summary of the 4 blade server market share numbers (factory revenue share):

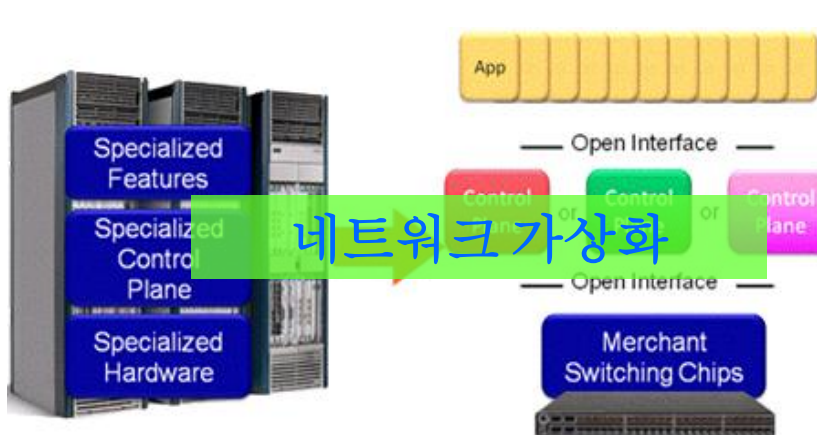
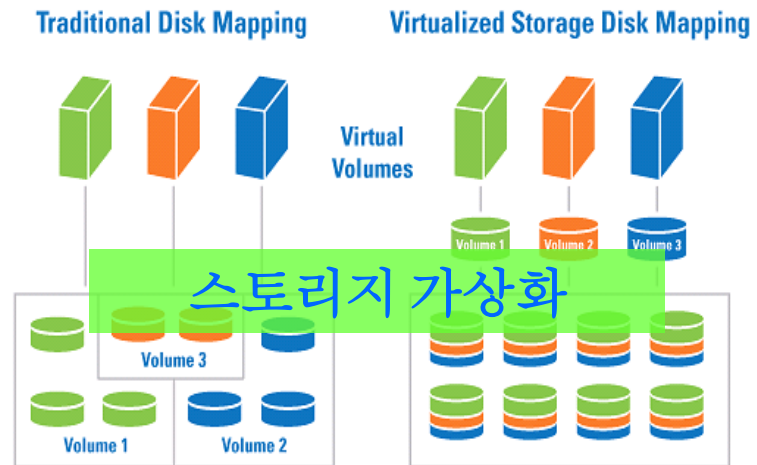
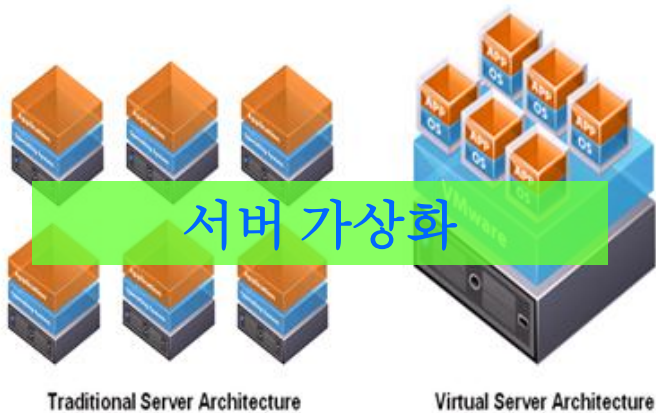
- #1 market share: HP at 50.00% in Q1 2011
- #2 market share: IBM at 20.20% in Q1 2011
- #3 market share: Cisco at 9.4% in Q1 2011
- #4 market share: Dell at 8.2% in Q1 2011

IDC 1Q 2011 Worldwide Blade Server Market Share

Vendor	Market Share (%)
HP	50.00%
IBM	20.20%
Cisco	9.40%
Dell	8.20%
All Other Vendors	12.20%

1. IT Market Trend > 가상화 영역 확대

- 서버, 스토리지 가상화 뿐만 아니라 Network 가상화로 Technical Trend 변화
 - ✓ 기존 네트워크 구성의 복잡성 탈피와 인프라 투자 및 관리 비용 절감

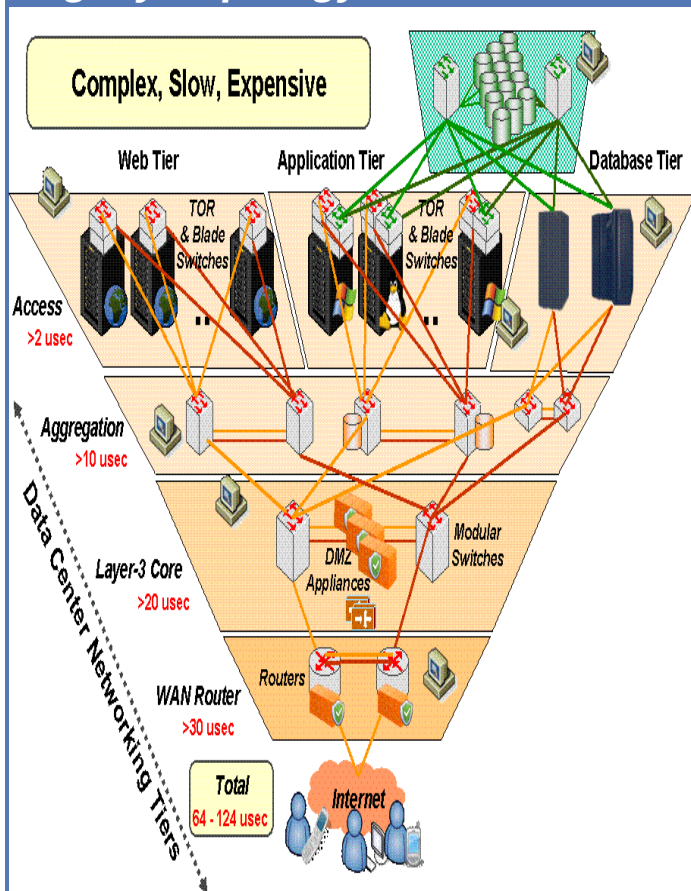


1. IT Market Trend > 가상화 영역 확대

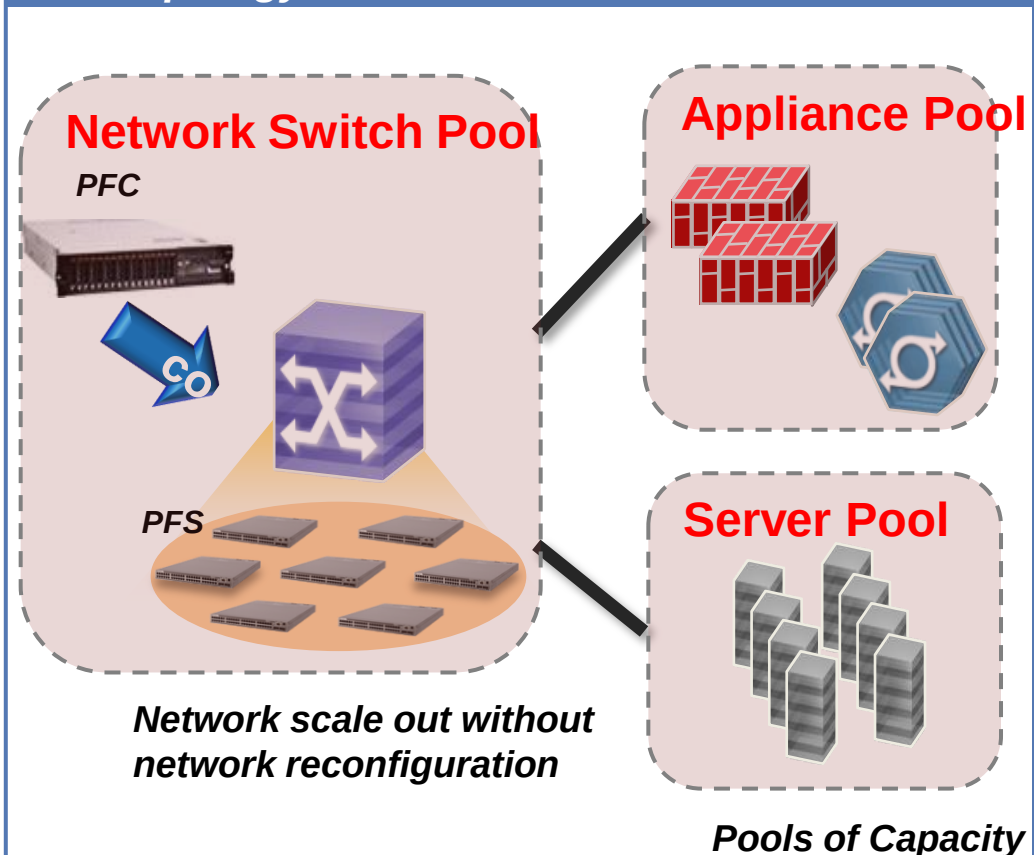
➤ 서버, 스토리지 가상화 뿐만 아니라 Network 가상화로 Technical Trend 변화

- SDN을 통해 네트워크 영역 또한 하나의 Device Pool로 만들어 간편함 및 확장성의 원할함 제공 네트워크 구성개선을 통한 TCO 절감 및 운영효율제공
- 네트워크 영역의 복잡성과 Vendor의 구속에서 벗어나기 위한 사용자들의 욕구

Legacy Topology

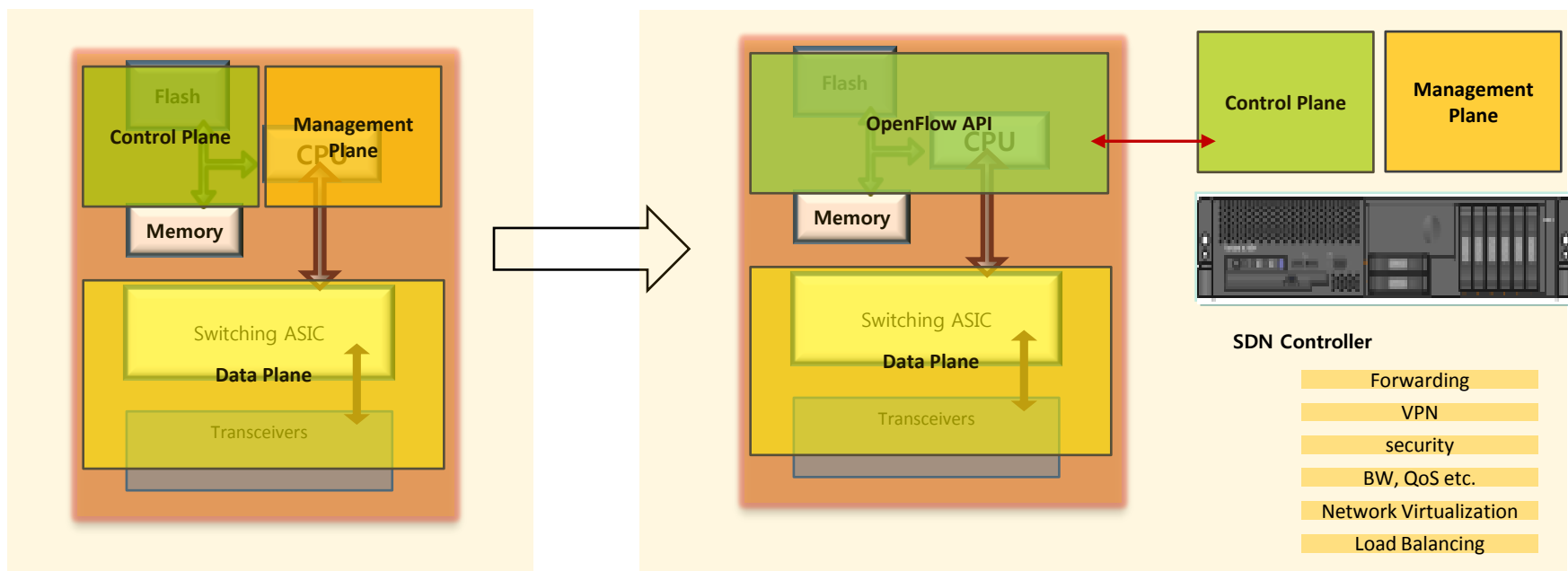


SDN Topology



1. IT Market Trend > SDN의 기본 설명

- Control Plane과 Data Plane이 **완전히 물리적으로 분리**된 형태의 Architecture
- SDN은 **네트워크 전체 영역에 초점**을 두고 있음
- 현재 SDN은 Datacenter에 초점을 두고 있으며 **Google, NTT 등의 대규모 데이터센터에서 도입**하고 있음



Traditional Network Element

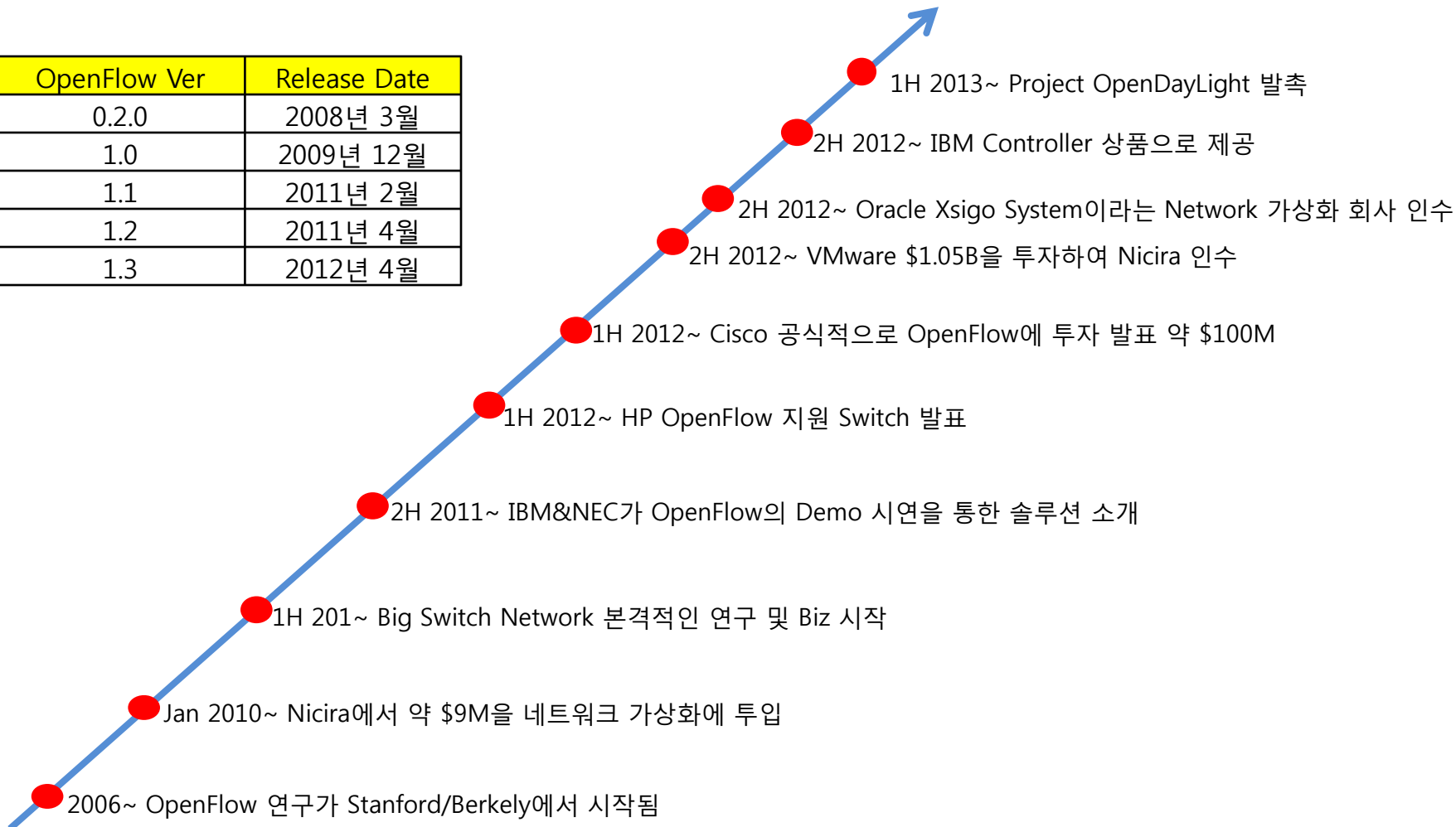
OpenFlow Network Element



2. SDN> SDN OpenFlow의 역사

- SDN OpenFlow는 시작은 학술적인 목적으로 시작 하였음
- 소규모 가상 네트워크 벤더에서부터 대형 IT Vendor까지 새로운 개념의 Architecture로 인지
- 고객이 leading하는 ONF와 Vendor가 leading하는 OpenDayLight 조직

OpenFlow Ver	Release Date
0.2.0	2008년 3월
1.0	2009년 12월
1.1	2011년 2월
1.2	2011년 4월
1.3	2012년 4월



2. SDN > ONF (Open Networking Foundation)

- Main Border Member가 고객 으로 부터 시작
- 각 Vendor들은 고객의 요건에 따라가는 그림
- 기존 Network Vendor들과 None Network Vendor들의 접근법의 차이

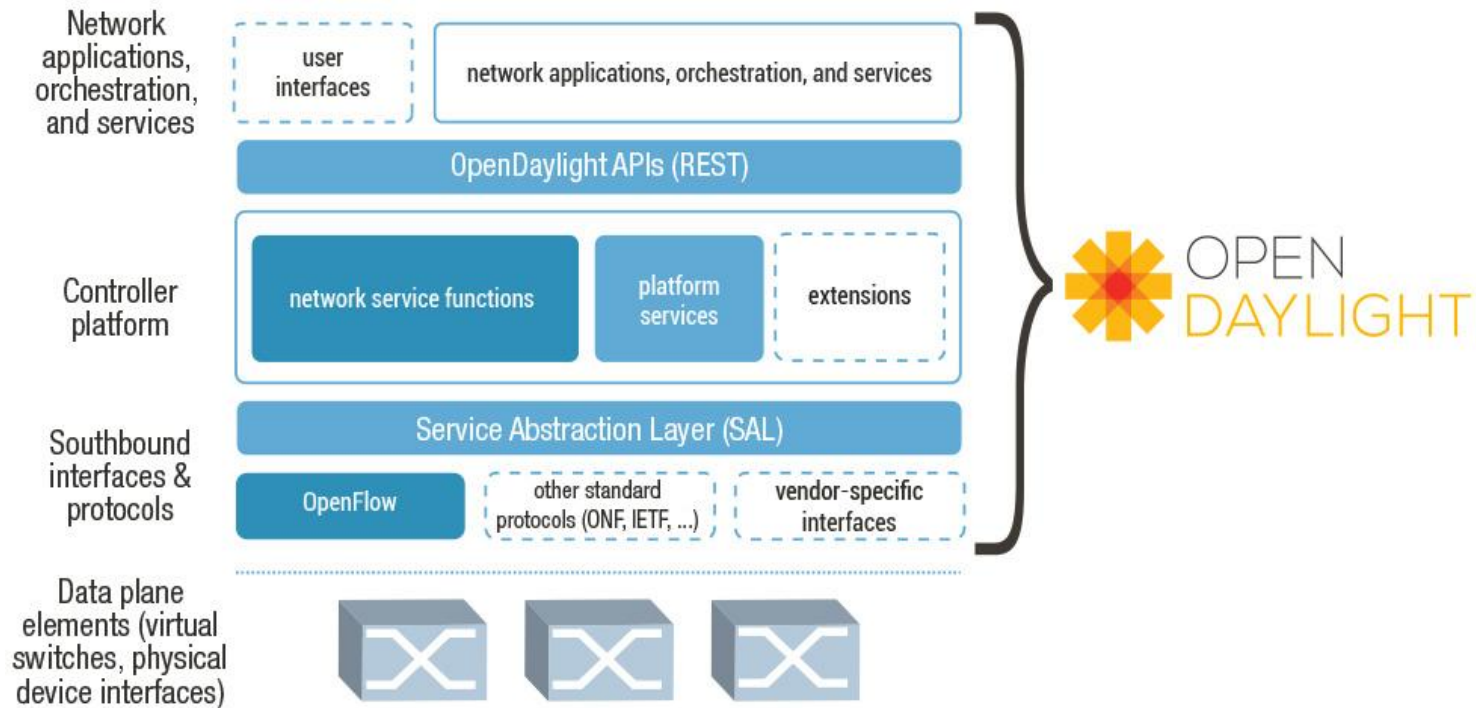


ONF Board

ONF board members are the largest network operators (not networking vendors)



2. SDN > Project OpenDayLight



Platinum



Gold

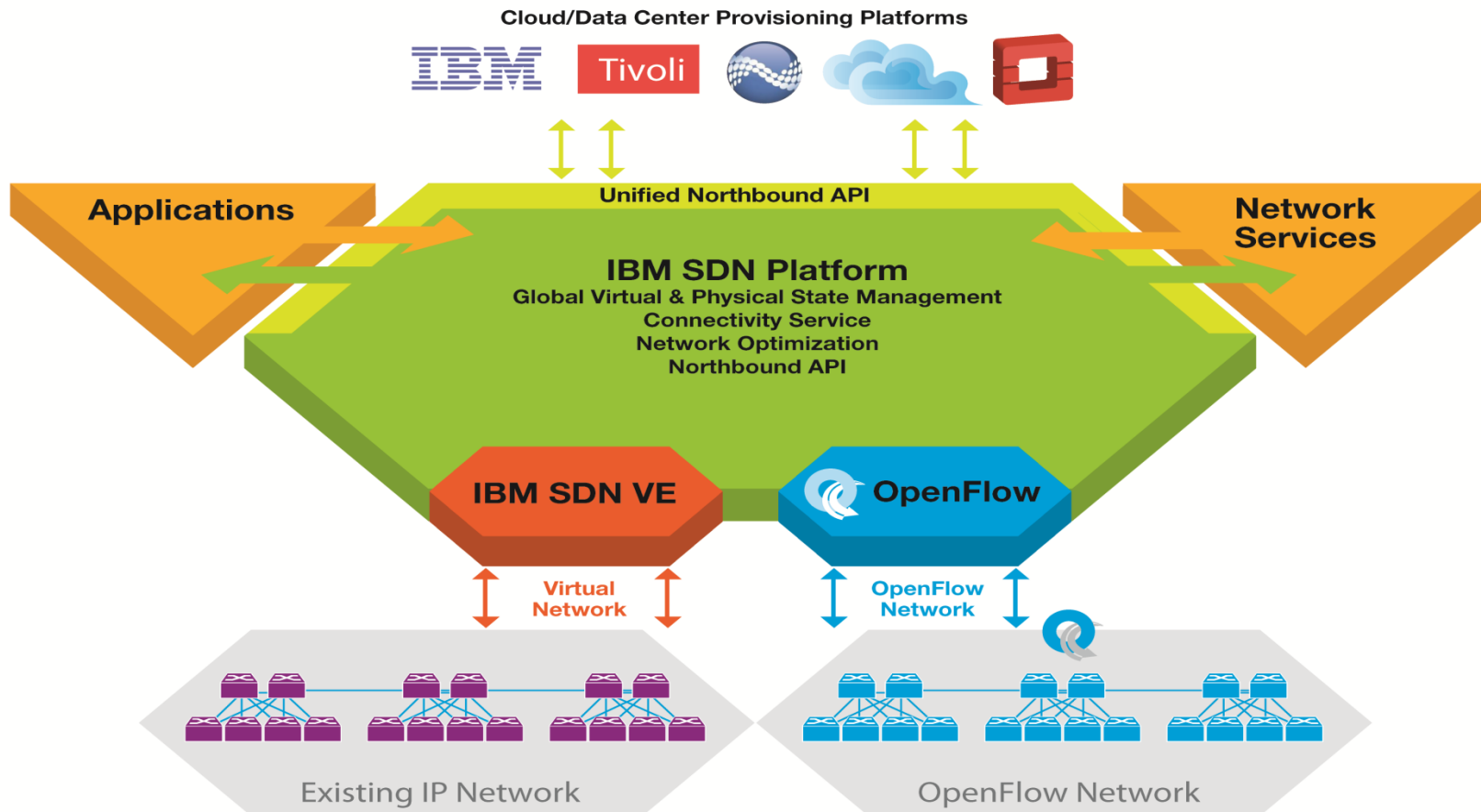


Silver



3. IBM SDN Solution > IBM SDN Technical Overview

- SDN Controller — Automates connectivity service, optimizes network
- IBM Software Defined Networking for Virtual Environments: a network hypervisor
- Optimized Fabric — Converged Ethernet and OpenFlow



3. IBM SDN Solution > IBM의 SDN에 대한 전략

Now delivering...

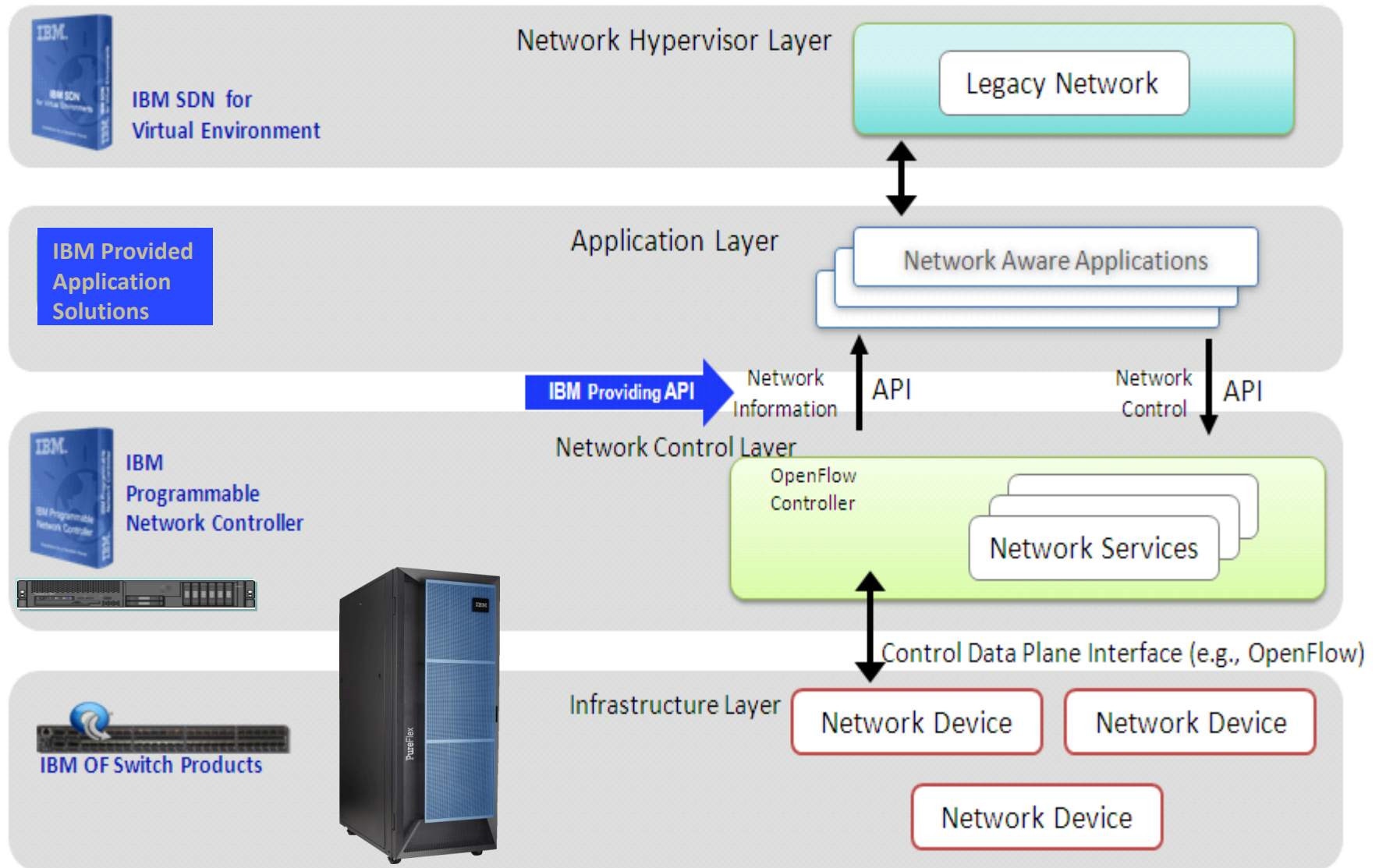
...the future of networking



Shipping product

Technology investment

3. IBM SDN Solution > SDN Products



3. IBM SDN Solution > OpenFlow Controller

Controller	Platform	Language	Author
NOX	Linux	C++/Python	Vmware(Nicira)
POX	Any	Python	
BEACON	Window/Linux/MAC/Android	Java	Standford
Trema	Linux	Ruby/C	IBM/NEC
Floodlight	Any	Java	Big Switch
Maestro	Window/Linux/MAC	Java	Rice
RoutFloor	Linux	C++/Python	CPQD (Brazil)



IBM Programmable Network Controller at a glance

OpenFlow standard	• OpenFlow 1.0 compliant
Verified OpenFlow Switches	• Aggregation Switch: IBM RackSwitch G8264, NEC PF5240 • Edge Switch (Edge of OpenFlow domain): IBM RackSwitch G8264, NEC PF5240
OpenFlow Vendor Extensions	• Bit masking • In band Broadcast/Multicast for wire speed forwarding
Virtual Tenant Network (VTN)	• vRouter (L3) • vBridge (L2) • vFilter
North bound API	• Web API
Number of VTN	• 1,000 (Extended VLAN mode: 10,000 VLANs)
Number of Flows	• 300,000
Redundancy Features	• IBM PNC Active/Standby
Switch and Link Discovery	• Topology discovery
IP	• IPv4 • IPv6 (L2 forwarding)
ARP	• ProxyARP
Routing options	• Shortest Hop • ECMP (L2/L3) • Avoid switch routing

3. IBM SDN Solution> OpenFlow Switch



IBM System Networking G8052



IBM System Networking G8264T



IBM System Networking G8264



IBM System Networking G8316

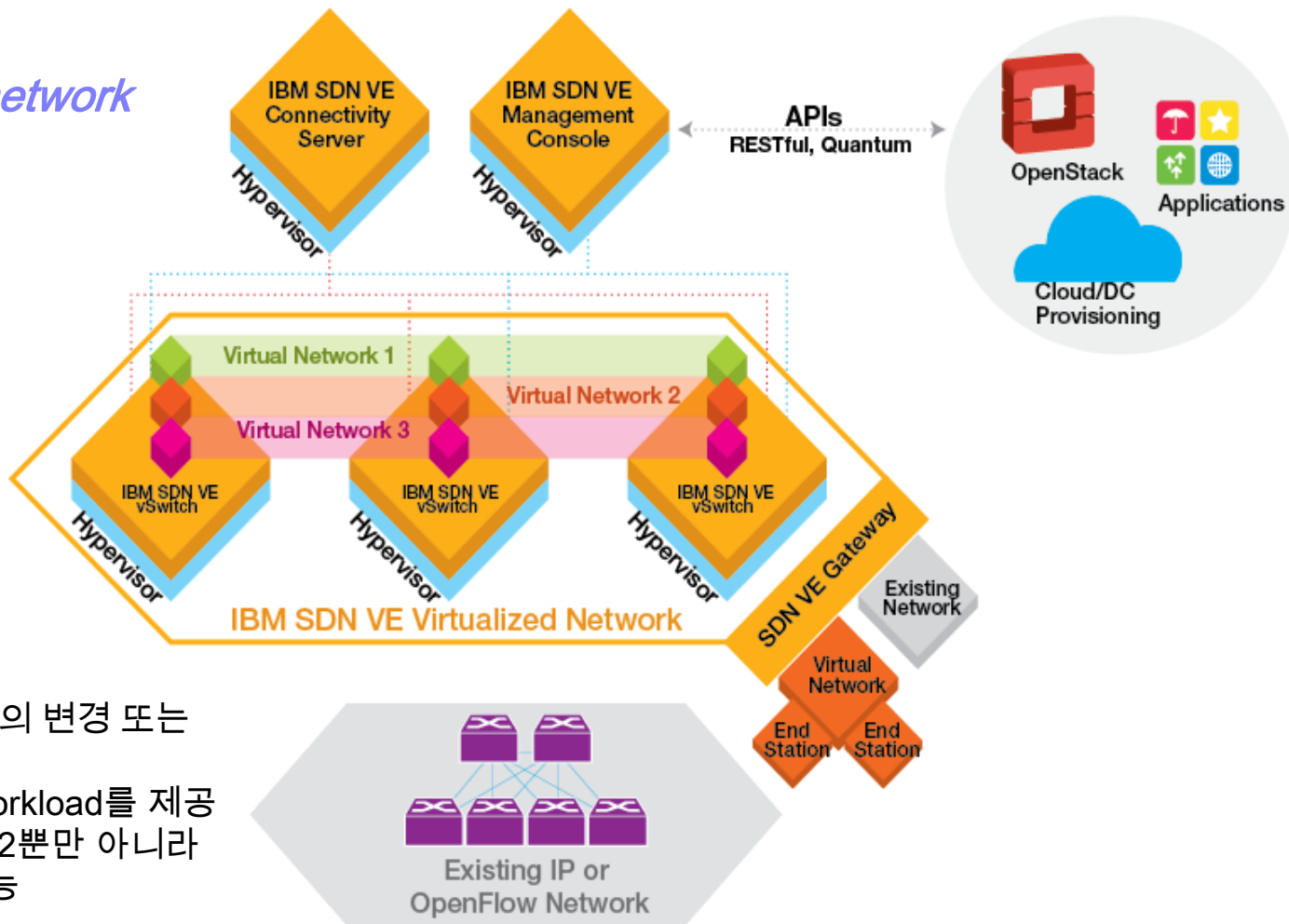


IBM System Networking EN4093R

Specifications	
Forwarding	- Delay less than 1us 1.28Tbps; 960Mpps
Number of ports	48 x 1 Gb/10 Gb SFP+ ports; 4 x 40 Gb QSFP+ ports - Up to 64 x 1 Gb/10 Gb SFP+ ports with optional breakout cables
Model	- Airflow-type rear to front - Airflow-type front to rear
Dimensions	17.3" wide; 19.0" deep; 1U high
Weight	9.98 kg
Power/consumption	50–60 Hz; 100–240 V; 330 watts
Temperature	0–40 degrees C
Humidity	10–90% non-condensing
Altitude	3,050 meters (10,000 feet)
MTBF	165,990 hours at 40 degrees C
Transceivers/cables	- QSFP+ 40GBASE-SR, 1M/3M/5M - QSFP+ DAC Breakout Cable, 1M - QSFP+ to QSFP+ cable - SFP+, 0.5M/1M/3M/7M DAC - SFP+, 1000Base-T (RJ-45) - SFP+, 1000Base-SX SFP
Protocol version	OpenFlow 1.0.0
Number of OpenFlow table entries	80–128K (Layer 2 MAC table for OpenFlow) 1,000 (12 tuple table)
Number of instances	1
Protocols	No legacy protocols running in OpenFlow switch mode
Management	Telnet, SSH, SNMP, sFlow
Redundancy	Power/fan

3. IBM SDN Solution > SDN VE (Virtual Environment)

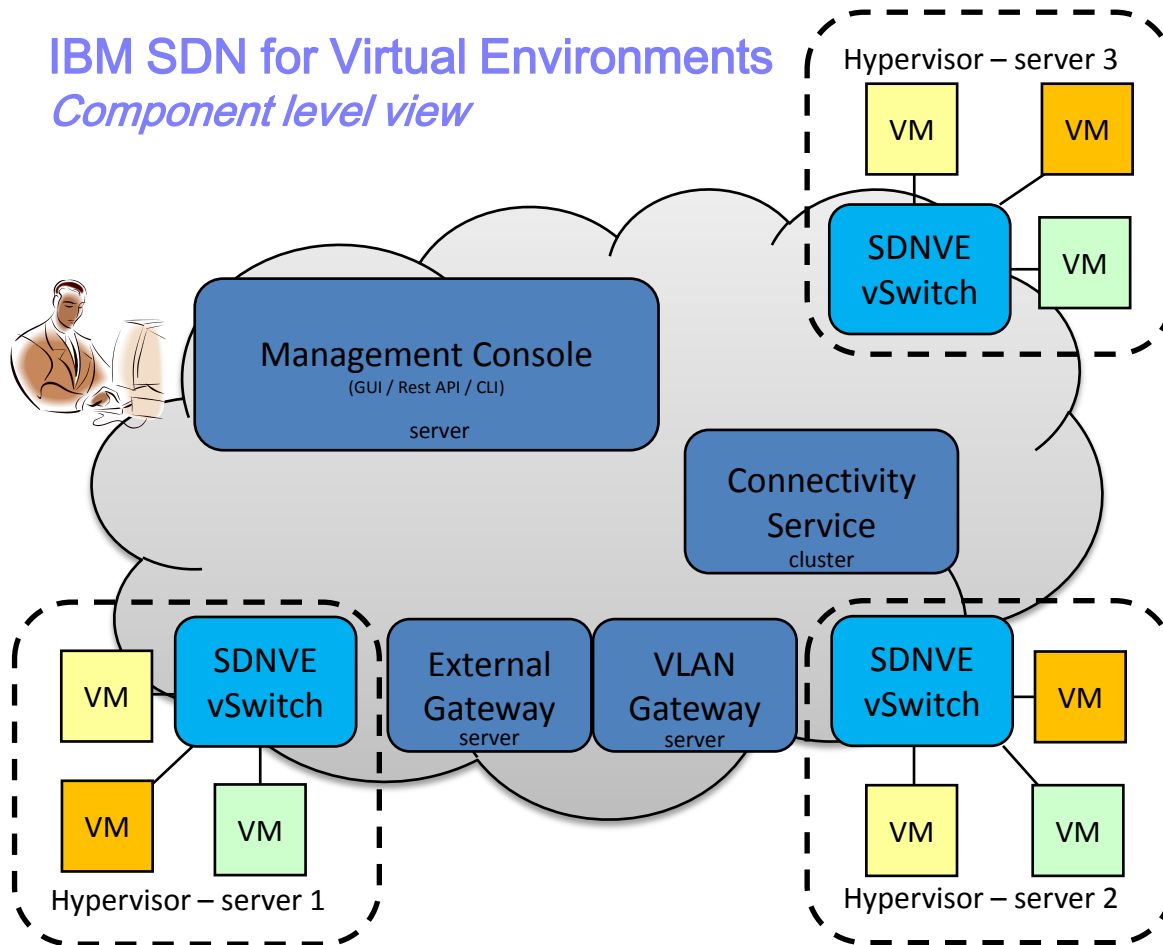
A hypervisor for the network



- 사용중인 Network Infra의 변경 또는 추가 작업이 필요 없음
- Server Base의 가상 Workload를 제공
- VM의 mobility가 Layer 2뿐만 아니라 Layer 3에서도 제공 가능

3. IBM SDN Solution> SDN VE (Virtual Environment)

IBM SDN for Virtual Environments *Component level view*



Management Console

- Provisions and configures virtual networks, Port group profile, Virtual Network (VNID) and subnets within those networks
- Assigns VMs to networks and defines policies between the VNIDs.

SDNVE vSwitch

- Enhanced hypervisor switch providing connectivity to VMs (replaces standard vSwitch)
- Provides connectivity to multiple network instances

Connectivity Service

- Registration, address lookup and policy lookup
- Multiple nodes for redundancy and load balancing

VLAN Gateway

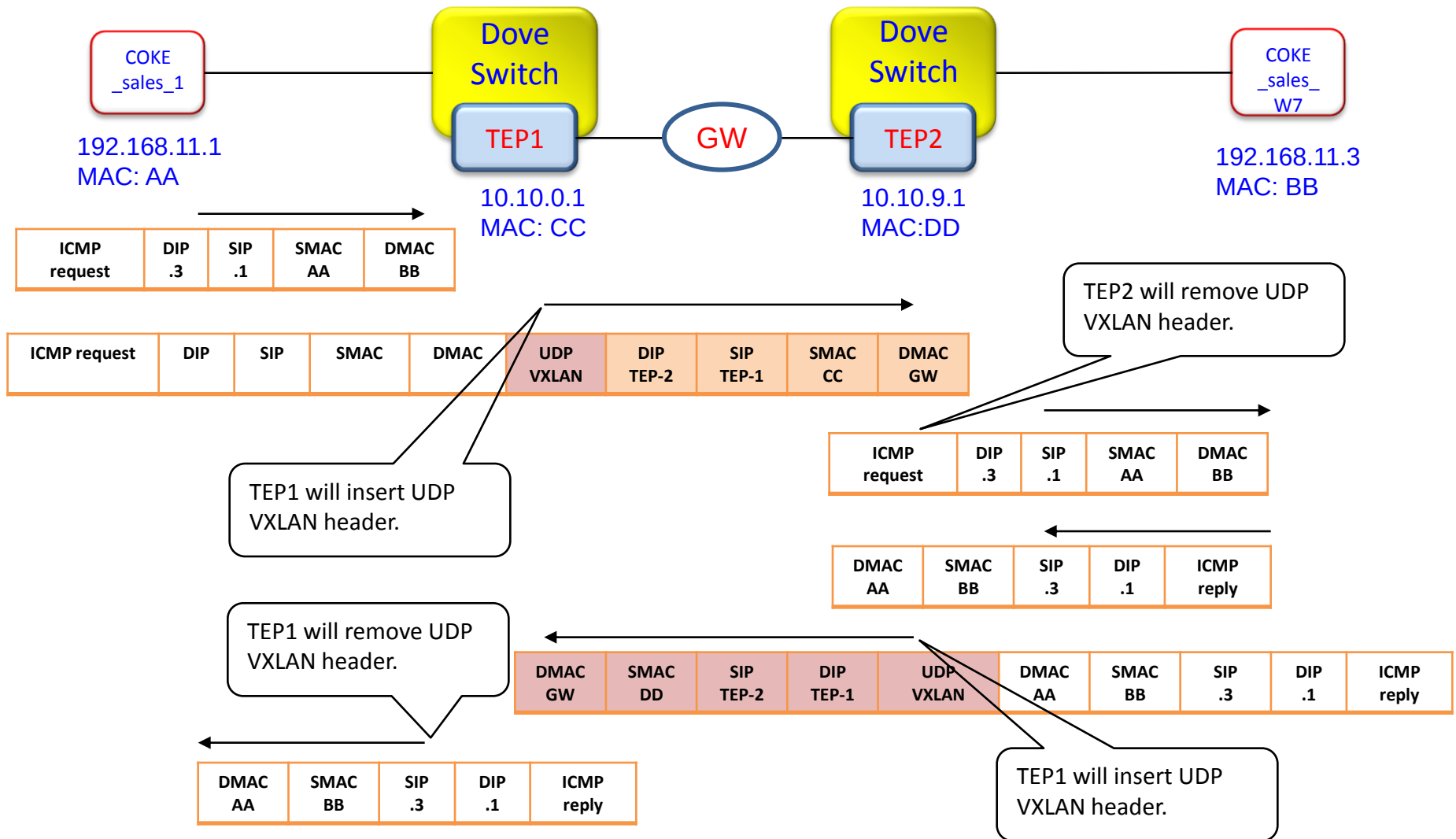
- Connects legacy machines to an SDNVE network, for example VMs in a 5000V deployment

External Gateway

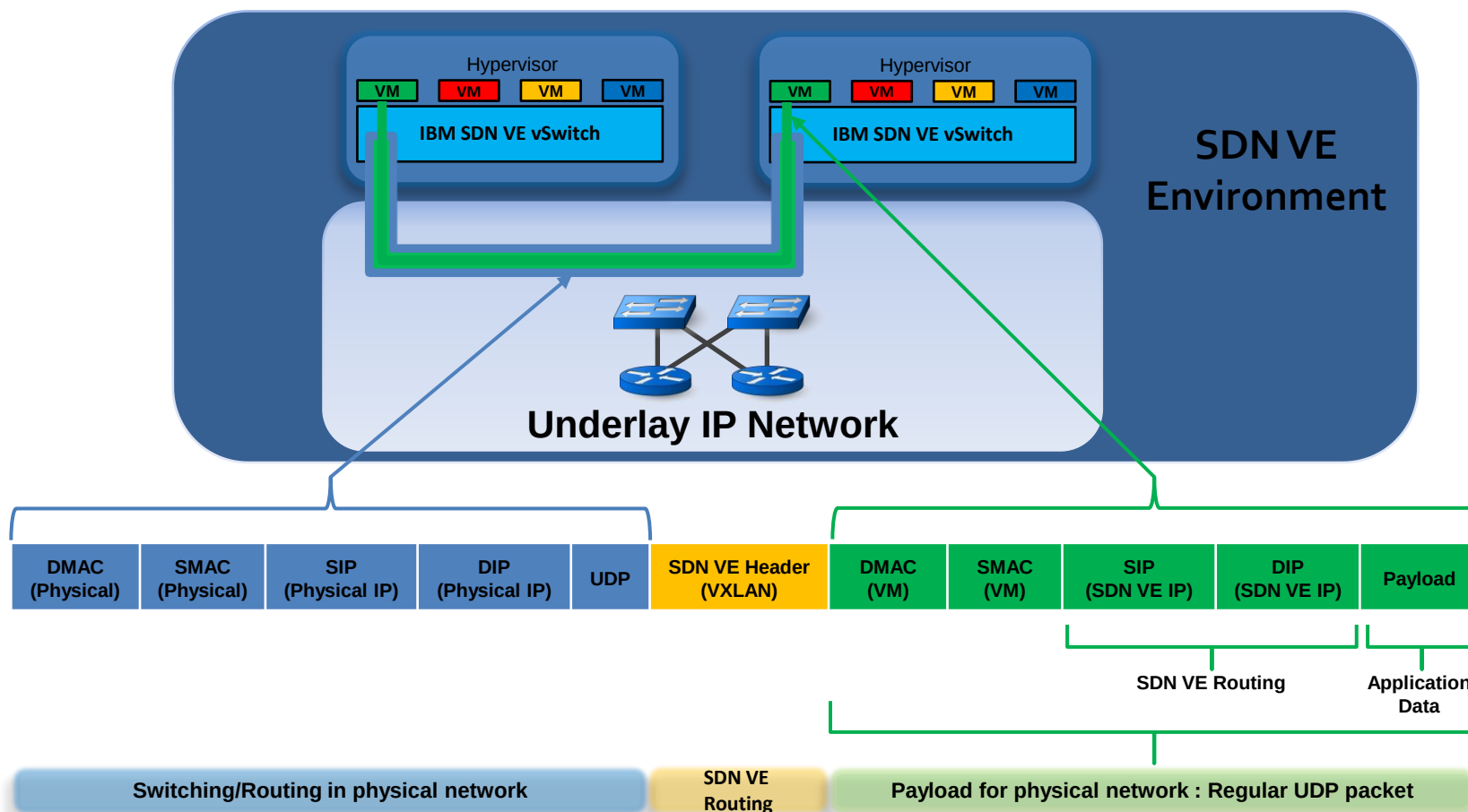
- Connects the virtual network to non-SDNVE networks
- Connects two SDNVE network domains

Virtual Networking: IBM SDN VE Traffic

- SDN VE Packet Flow Diagram



IBM SDN VE Traffic is Encapsulated within Existing IP Network

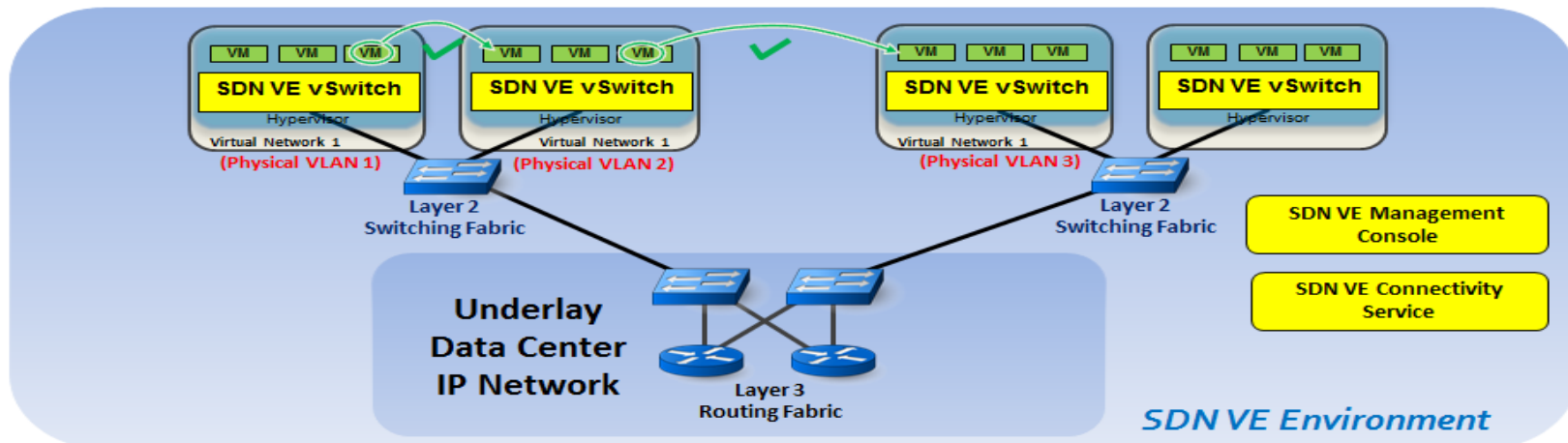
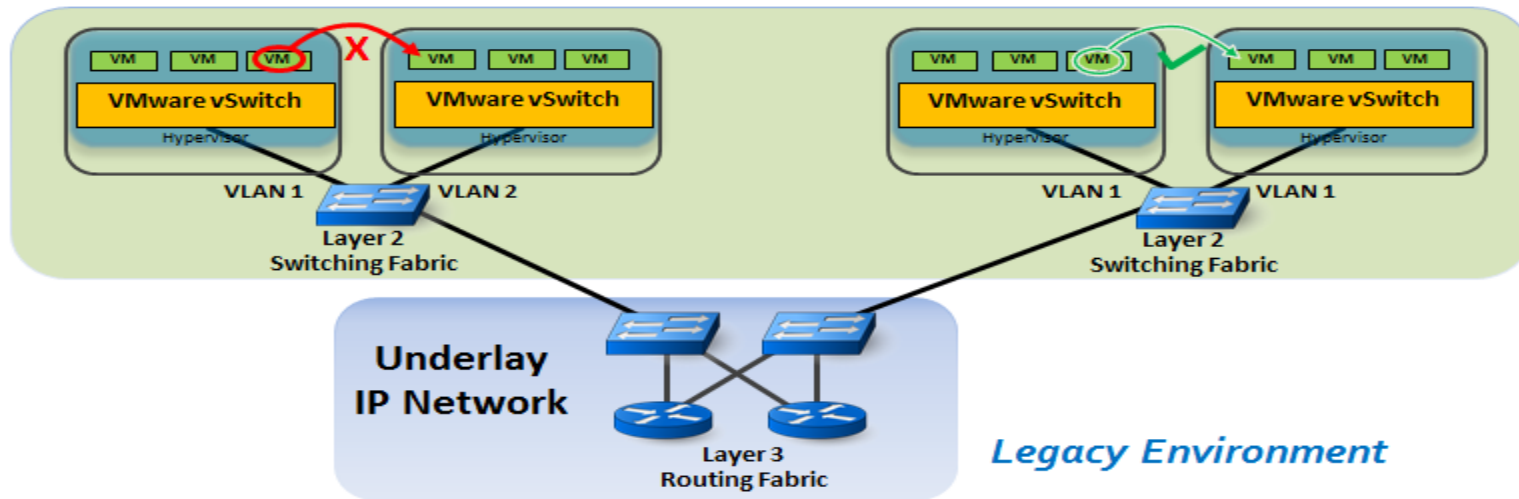


All VMs and vSwitches within an SDN VE environment are associated with an overlay IP topology

- SDN VE virtual network IP packets are encapsulated within IP packets of the existing underlay IP network
- IP packet encapsulation is added/removed as traffic passes through an SDN VE vSwitch at each end
- The SDN VE Header is used to transport IP packets across assigned Virtual Networks within Virtual Domains

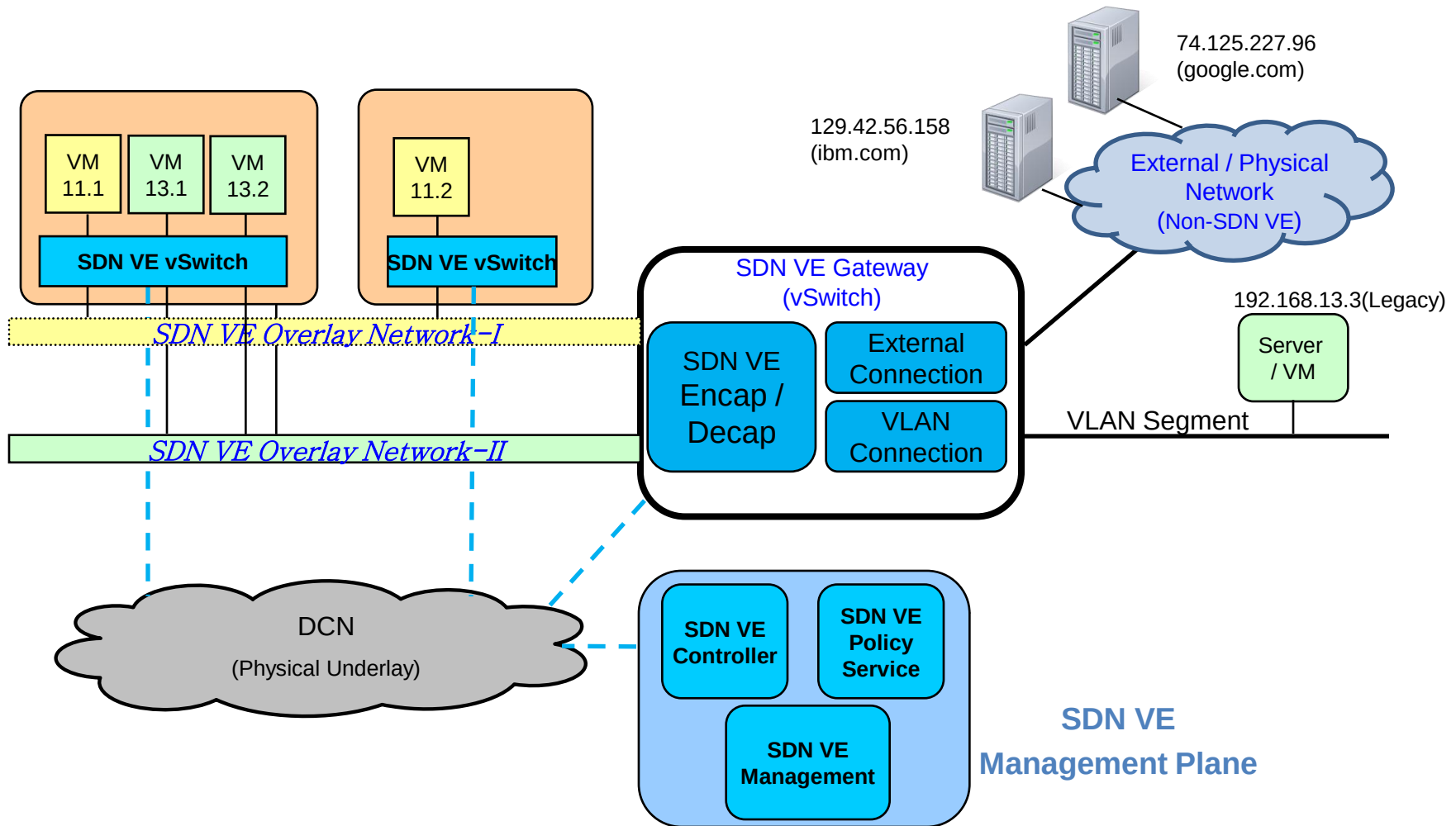
3. IBM SDN Solution> SDN VE (Virtual Environment)

- Layer 3 상에서의 VM Mobility 지원

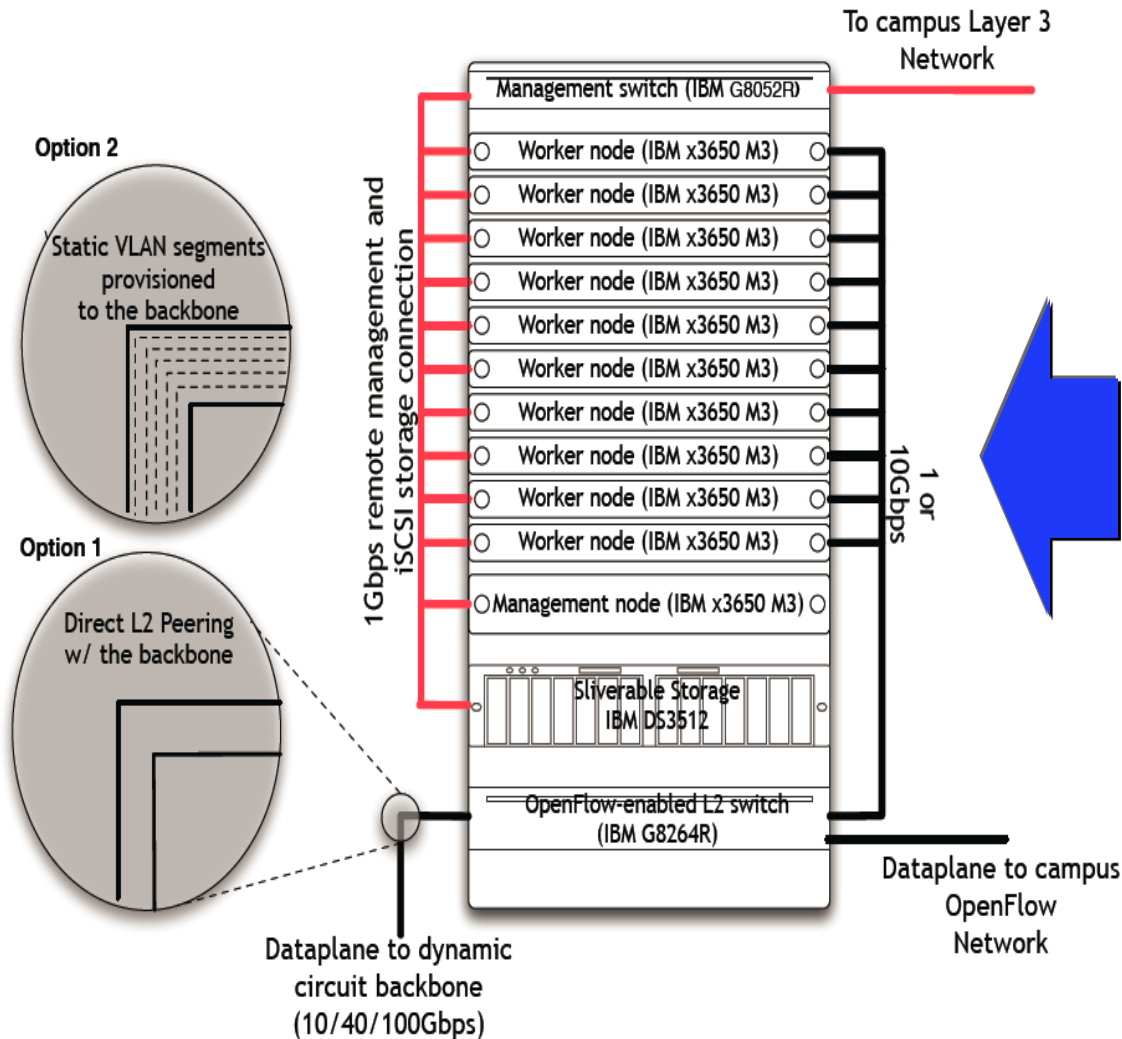


3. IBM SDN Solution > SDN VE (Virtual Environment)

- Non UnderLayer와의 통신 가능



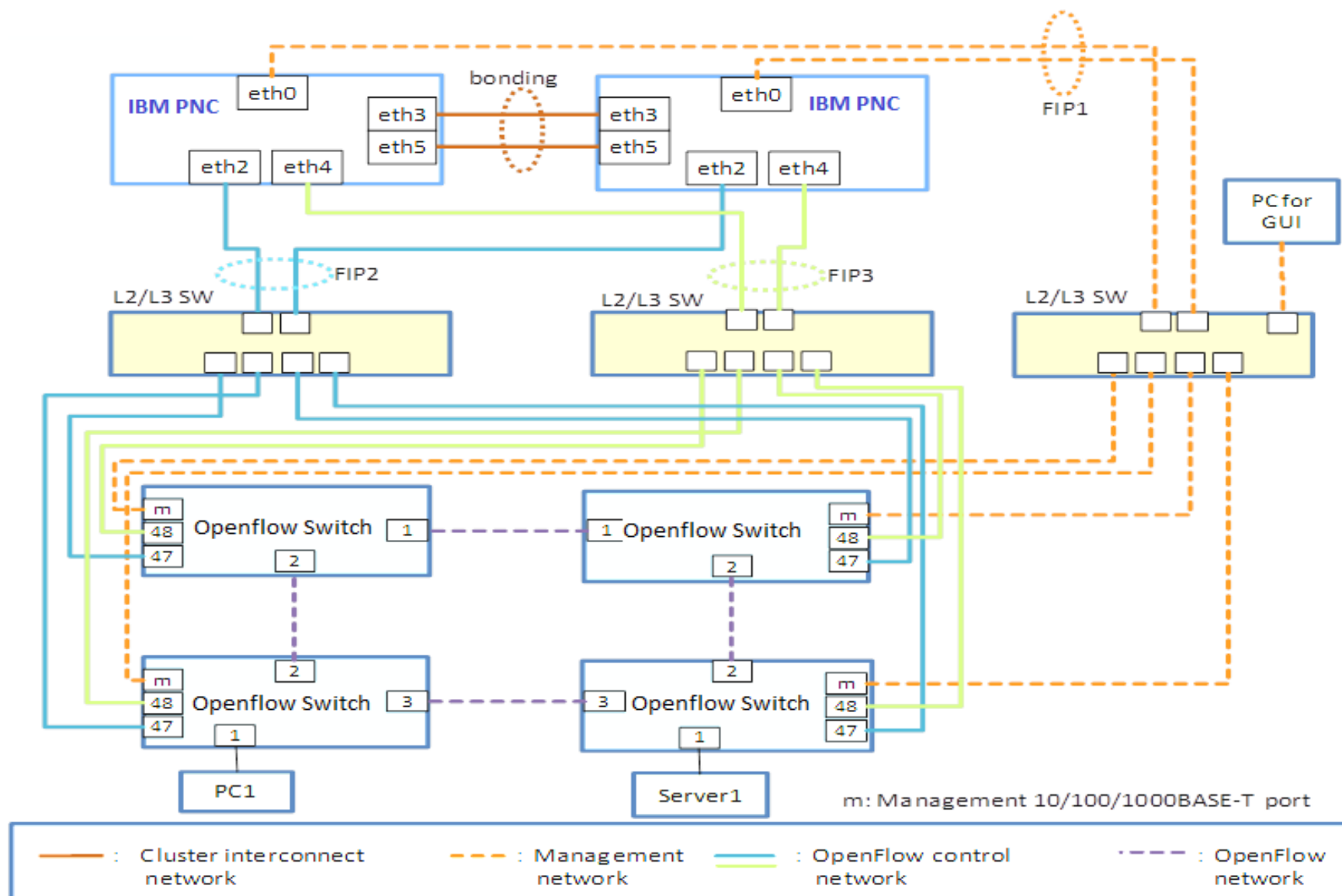
❖ SDN OpenFlow Reference Information



- 100 Virtual Machines
 - ➔ it is based on a standard cloud cluster stack ([Linux/KVM/Eucalyptus](#))
- 6TB local iSCSI Storage
 - ➔ Image storage, measurement data storage and other experimental needs ([IBM DS3512](#))
- 10/40GbE OF Switch
 - ➔ OpenFlow enabled Layer2 dataplane switch with VLAN capabilities connects the nodes to the backbone ([IBM G8264R](#))
- Management switch
 - ➔ [IBM G8052](#)
- Management/Head Node
 - ➔ [IBM 3650M3](#)

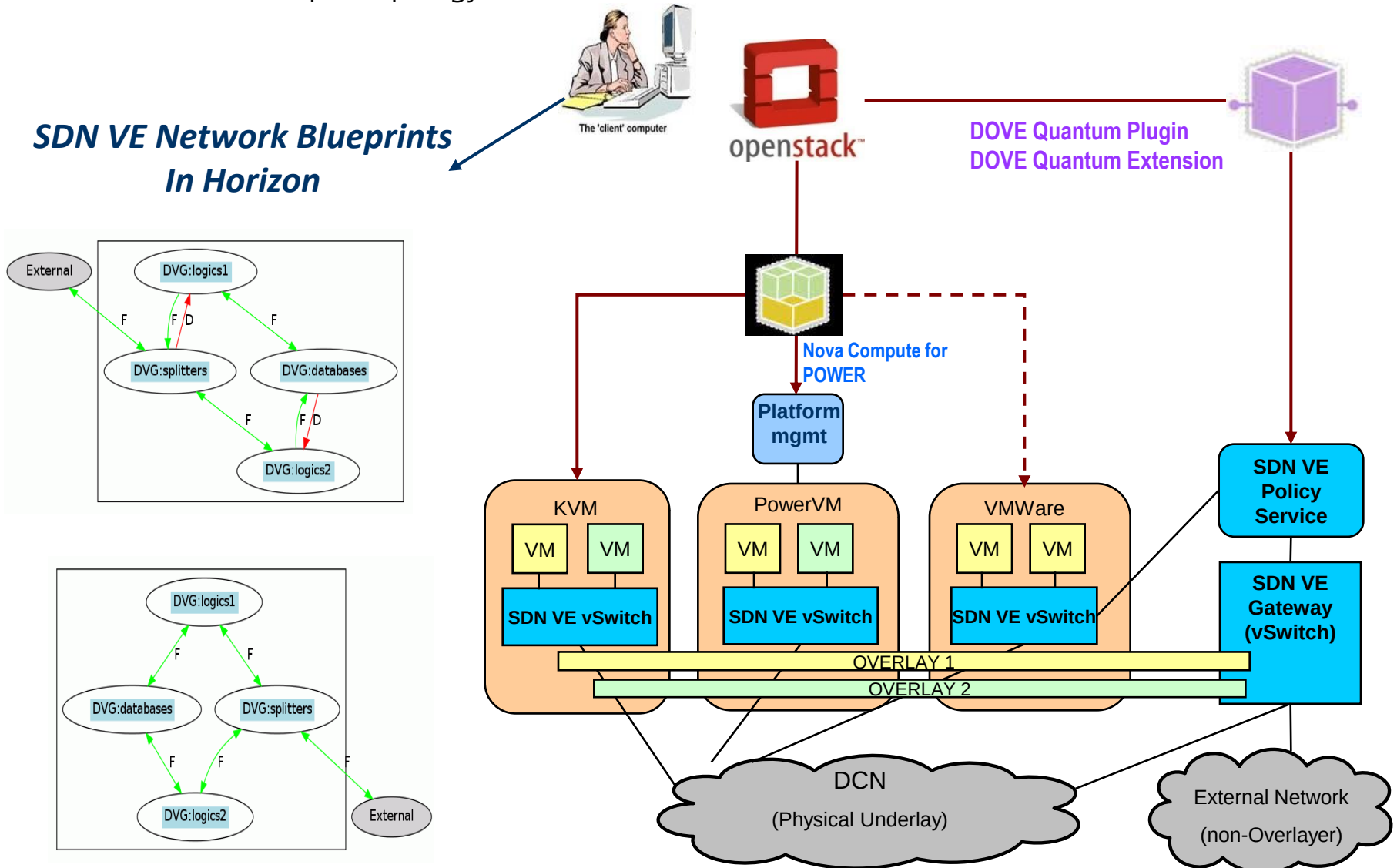
<ExoGENI Rack Overview>

❖ IBM OpenFlow Sample Topology



❖ IBM SDN VE Sample Topology

SDN VE Network Blueprints In Horizon



<SDN VE+Openstack+Quantum>

❖ The Best Suited SDN Solution

PureFlex

Only IBM can pull together all aspects of convergence



- Single point control for resource virtualization/systems management
- Infrastructure-as-a-Service (IaaS)
 - SmartCloud entry (private cloud)

- End-to-End Life-Cycle Support
- Single point of Contact
- Advanced industry services organization and Certified BP Network

- Higher VM density, more Memory
- Designed to support the growth of future generations

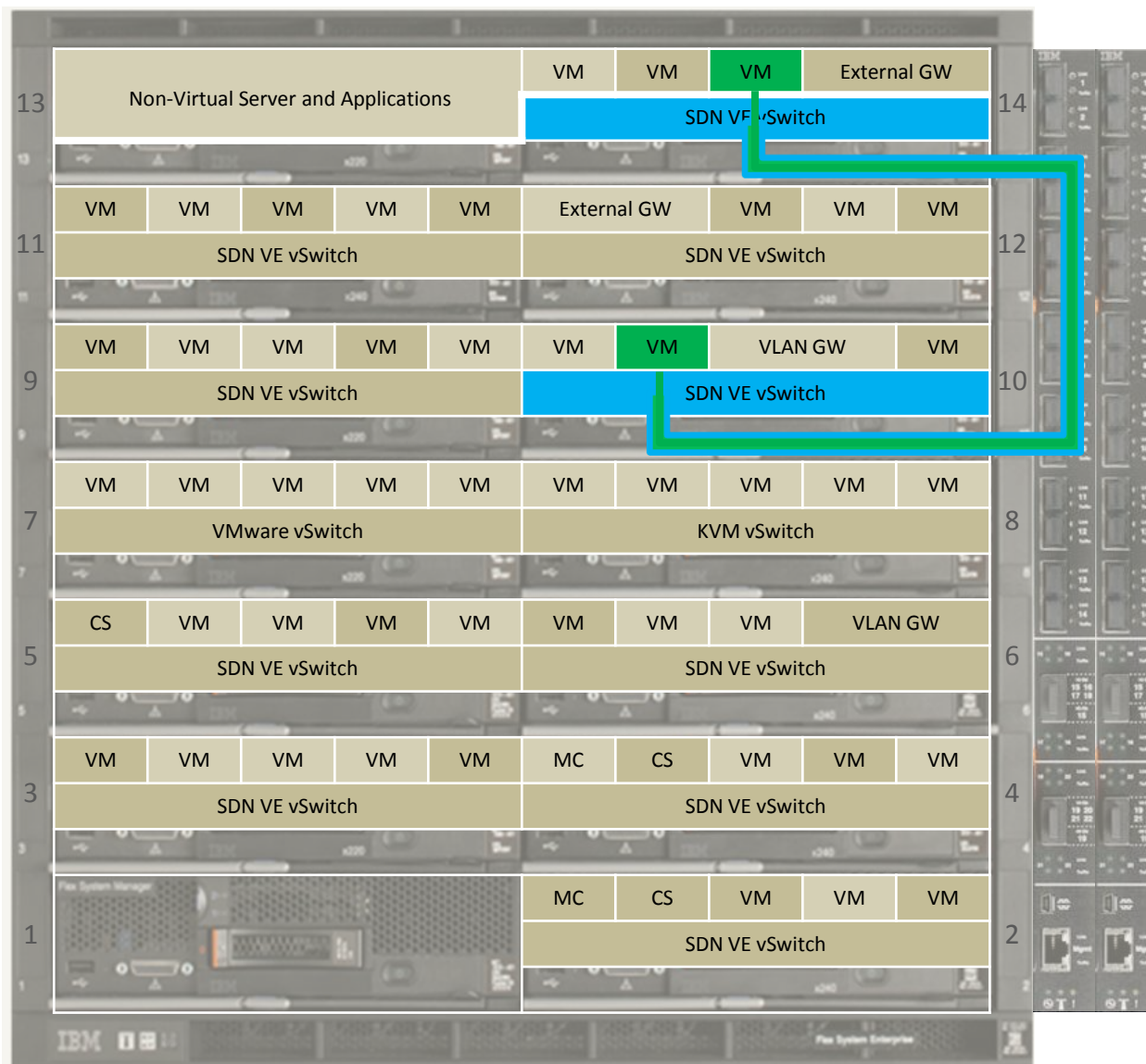
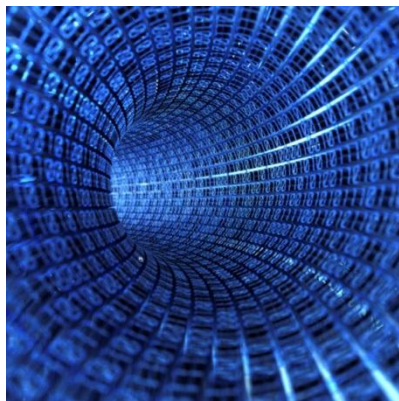
- Integrated, scalable, 3rd party storage virtualization
- Real-time Compression, Tiering, Pooling

- Hybrid Networking (SDN or Legacy Networking): across multiple protocols
- Industry standard OpenFlow, 802.1 Qbg
- Uncompromised I/O: 40Gb Ethernet, 16Gb Fibre Channel, and 56Gb Infiniband

- Open Choice for compute, network, storage, OS and Hypervisors
- Desktop Virtualization: VirtualBridges, Citrix, VMware and ISV solutions

IBM SDN VE Traffic Shown on a Flex Chassis

- With an SDN VE Architecture deployed into a VMware vSphere ecosystem, the VMware vSwitches are replaced with SDN VE vSwitches
- IP packets for SDN VE virtual networks are encapsulated within a standard IP packet for transit across the existing underlay IP network
- IP packet encapsulation is added/removed as traffic passes through an SDN VE vSwitch at each end



IBM SDN VE Architecture Mapped to Flex System

Virtual Domain 1

- Virtual Network 1

- Virtual Network 2

Virtual Domain 2

- Virtual Network 3

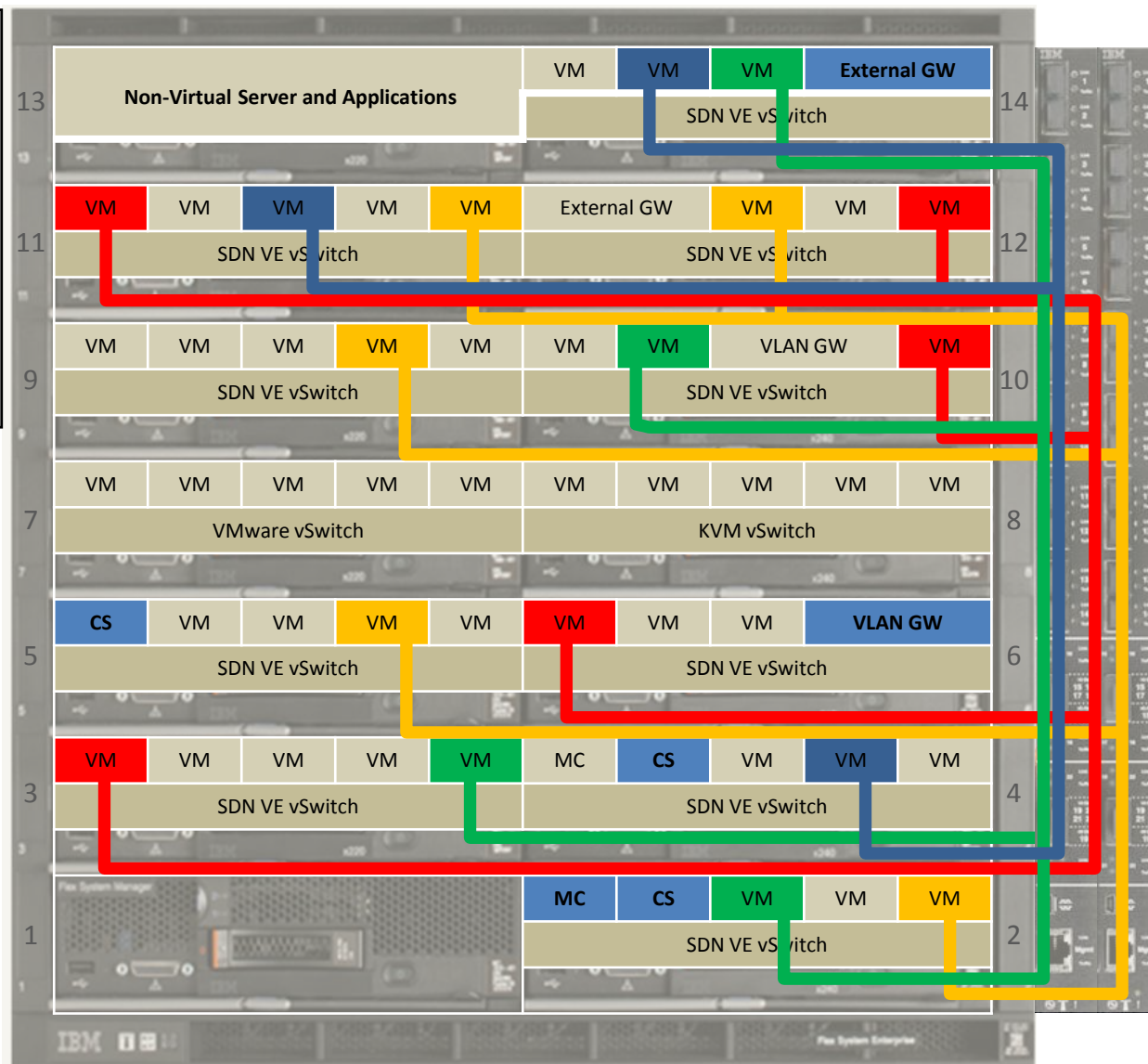
- Virtual Network 4

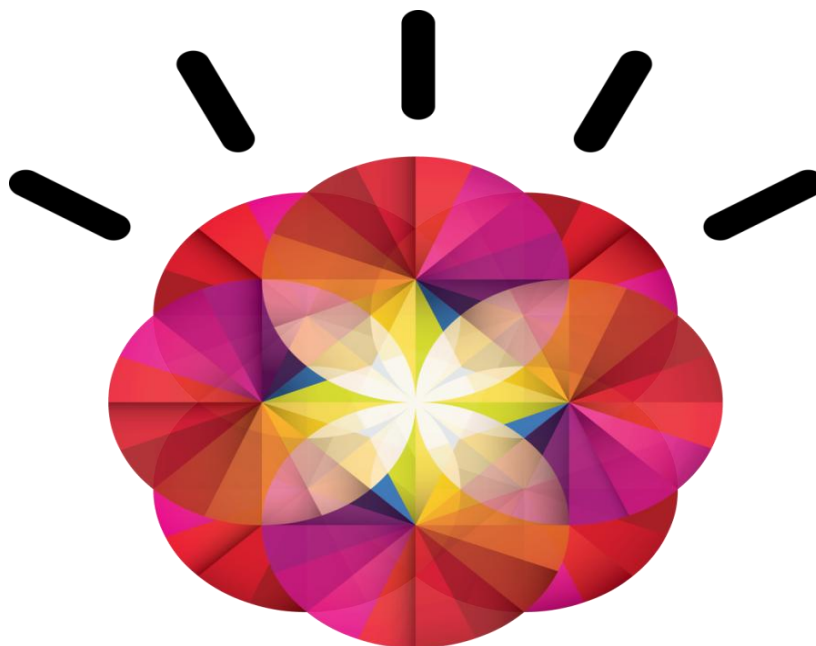
Virtual Domain Highlights

- Virtual domains are a collection of virtual networks
- In a multi-tenant environment individual tenants are fully secured from each other
- Up to 4000 virtual domains may exist in a single SDN VE environment

Virtual Network Highlights

- Virtual domains are a collection of virtual network subnets
- Policies define routing permissions between virtual networks.
- Up to 16000 virtual networks may exist in a single SDN VE environment





Thank You

IBM System Networking
www.ibm.com/networking