IBM System Networking

IBM

SDN (Software Defined Network)

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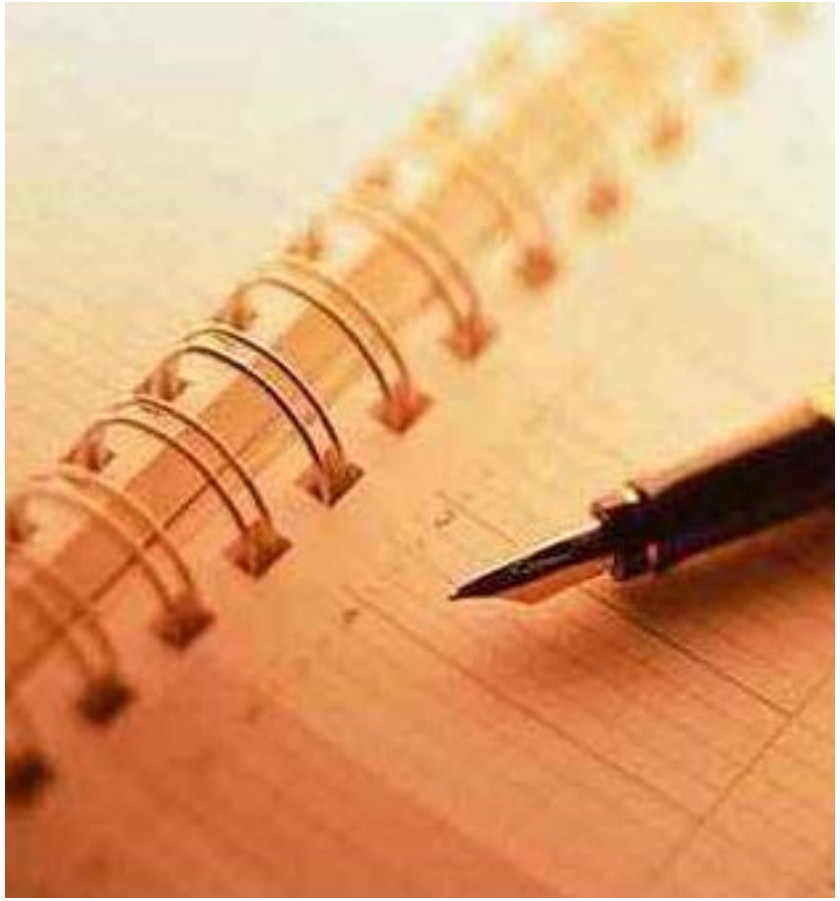
Agenda

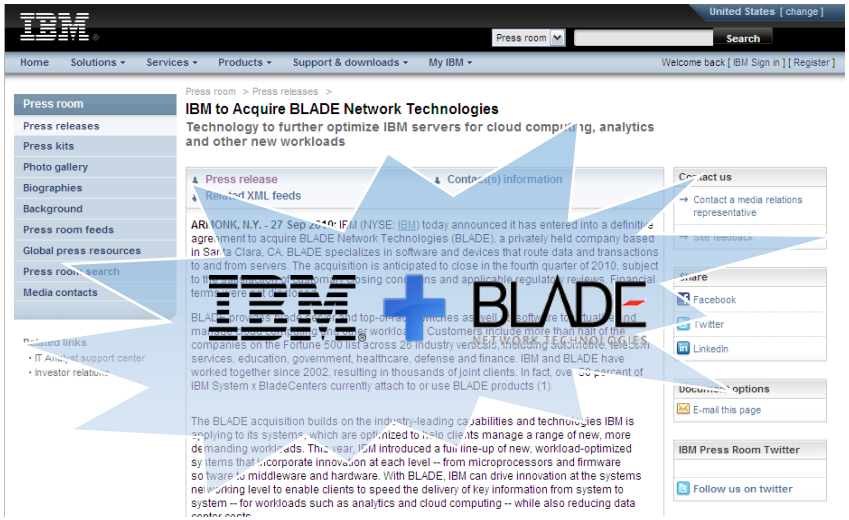
1. IT Market Trend
2. SDN (Software Defined Network)
   - What is SDN?
   - History of SDN
   - ONF (Open Networking Foundation)
   - OpenDayLight
3. IBM SDN Solution
   - 3.1 OpenFlow Solution
     - 3.1.1 OpenFlow Switch Products
     - 3.1.2 Controller product
   - 3.2 Overlayer Solution
     - 3.2.1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

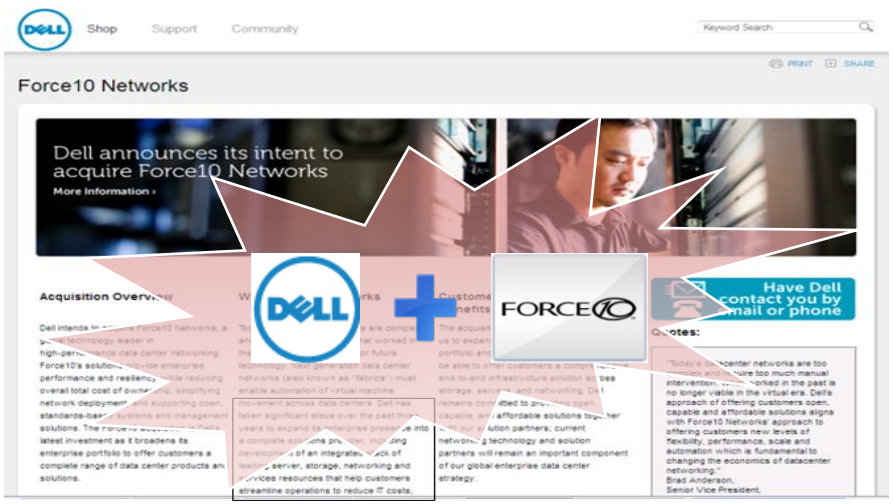


IT Market Trend

1. IT Market Trend > Total Solution

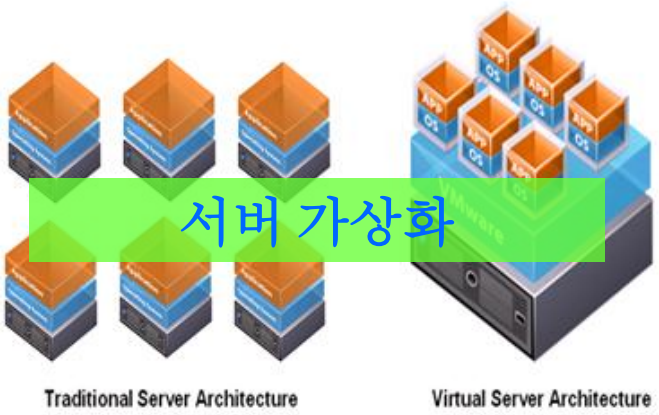
- 대형 Hardware Vendor들이 Server+Network+Storage를 통합된 Solution 제공

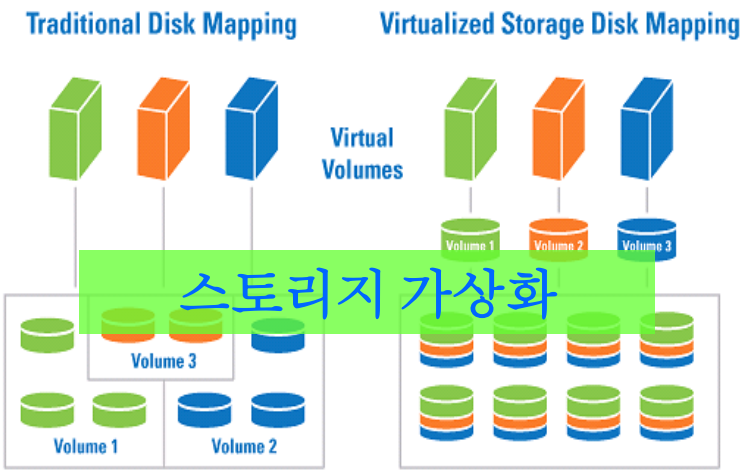


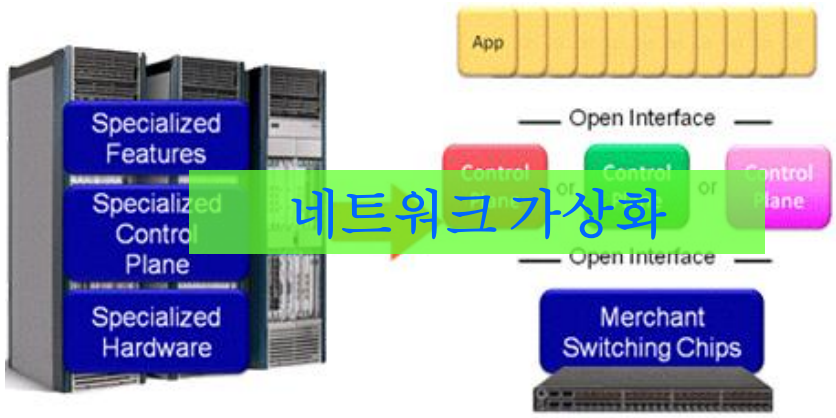


1. IT Market Trend > 가상화 영역 확대

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





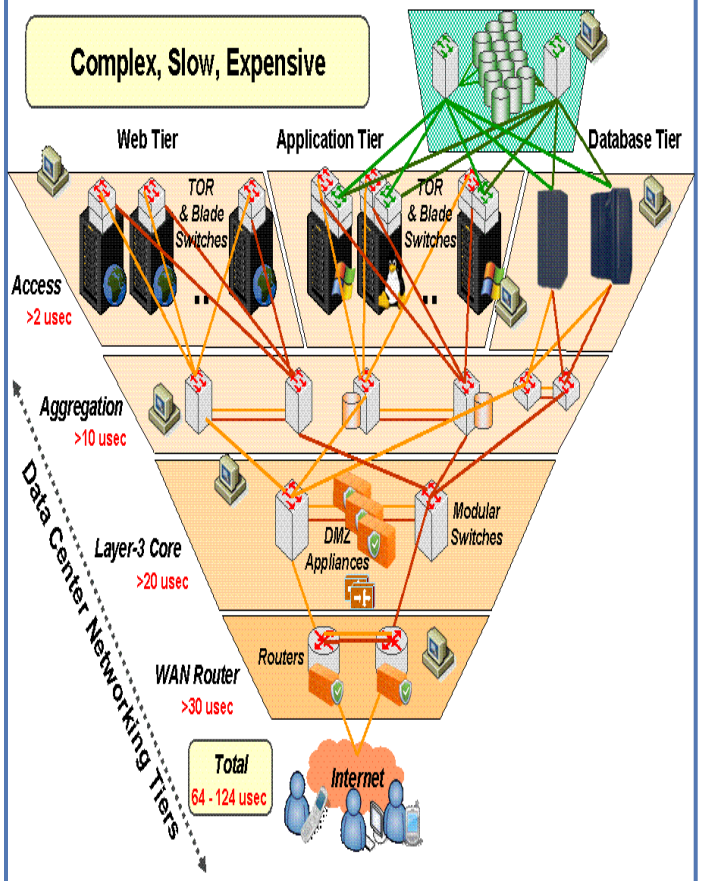


1. IT Market Trend > 가상화 영역 확대

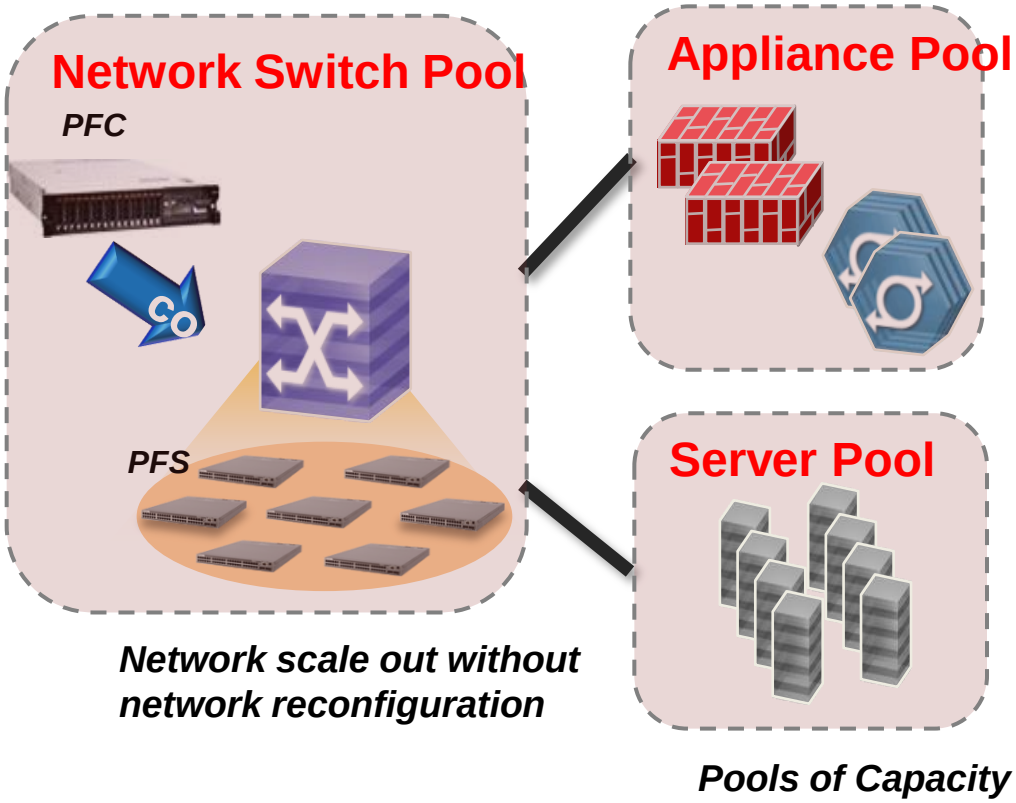
➢ 서버, 스토리지 가상화 뿐만 아니라 Network 가상화로 Technical Trend 변화

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

Legacy Topology

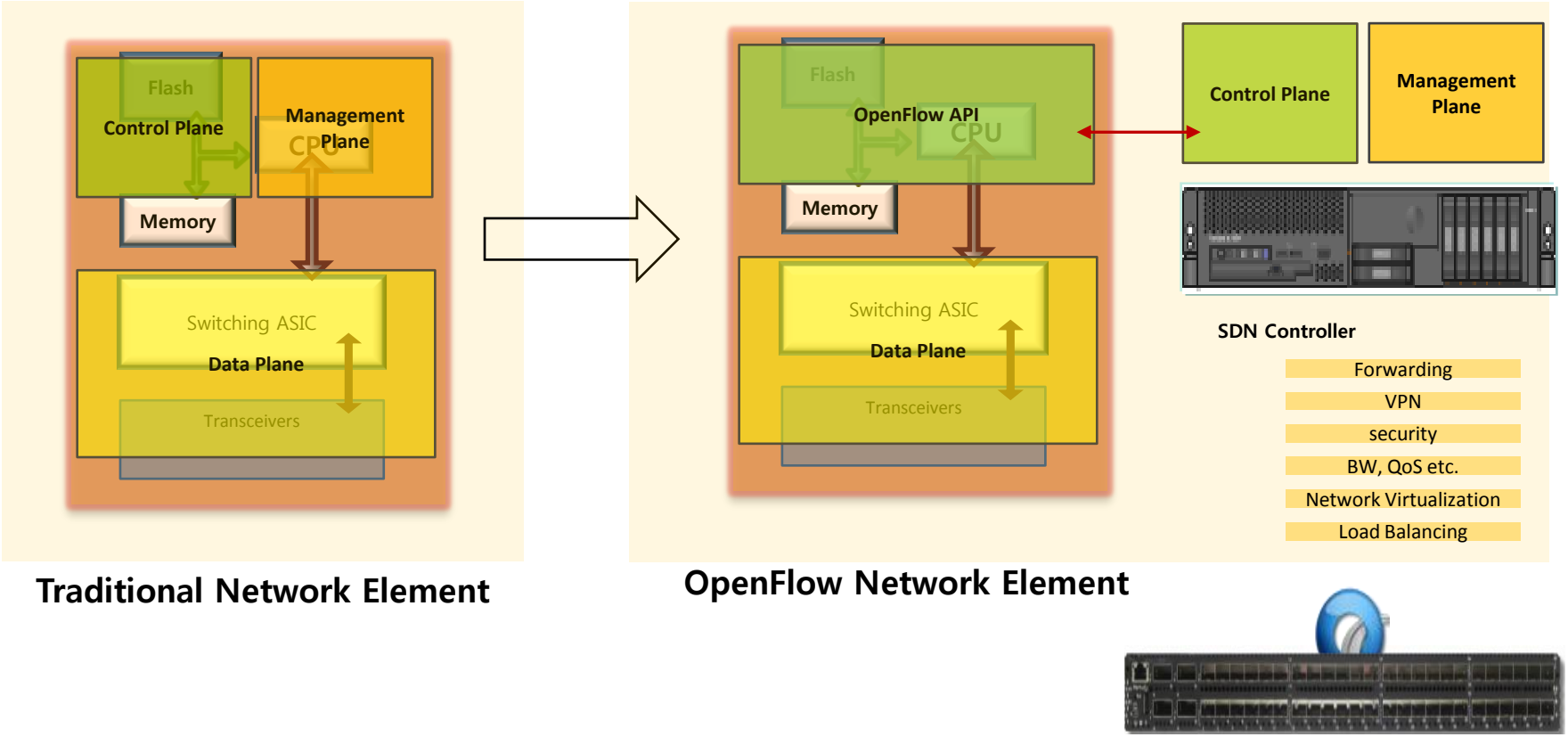


SDN Topology



1. IT Market Trend > SDN의 기본 설명

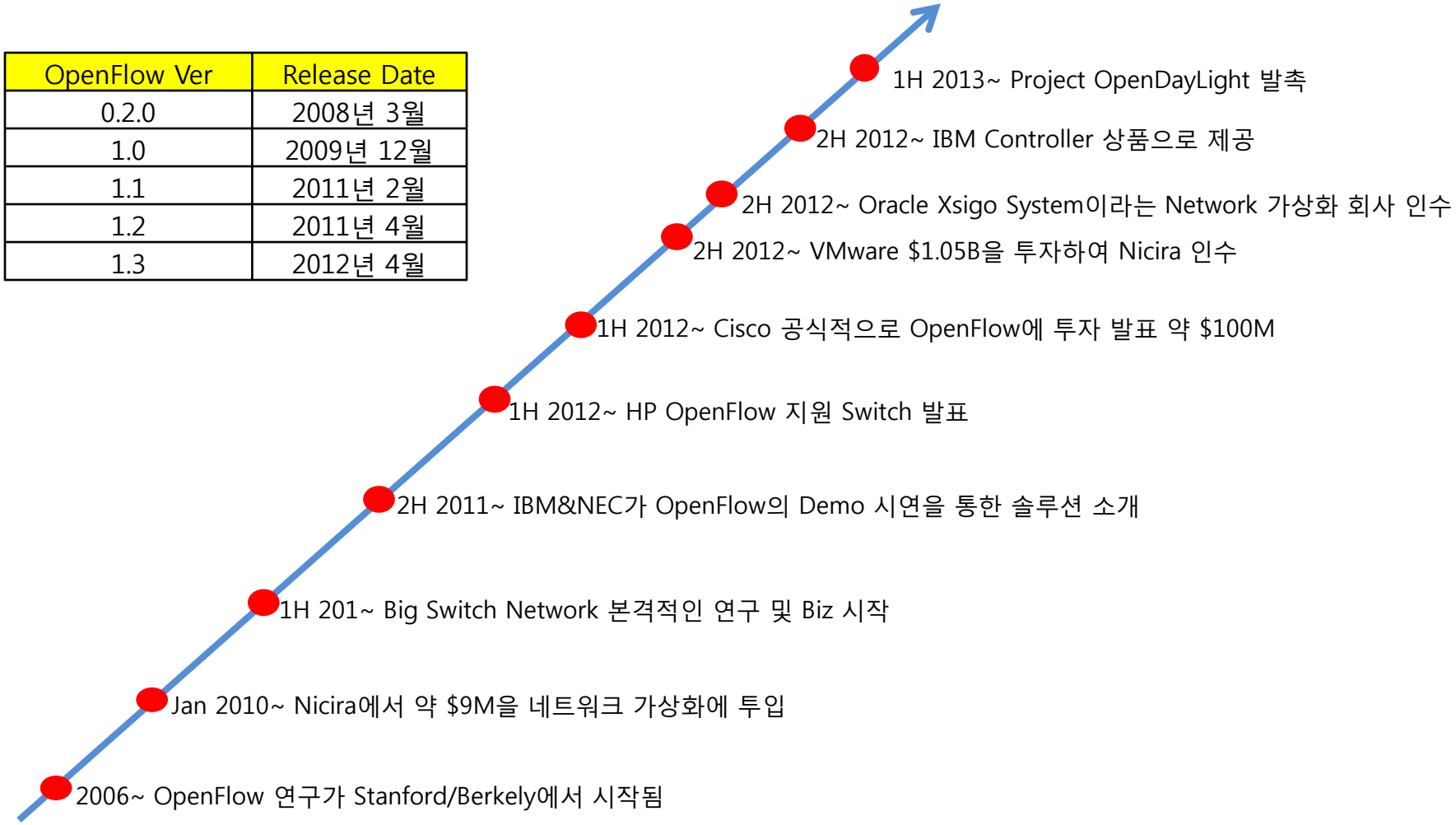
- Control Plane과 Data Plane이 **완전히 물리적으로 분리**된 형태의 Architecture
- SDN은 **네트워크 전체 영역에 초점**을 두고 있음
- 현재 SDN은 Datacenter에 초점을 두고 있으며 **Google, NTT 등의 대규모 데이터센터에서 도입**하고 있음



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

OPEN NETWORKING FOUNDATION

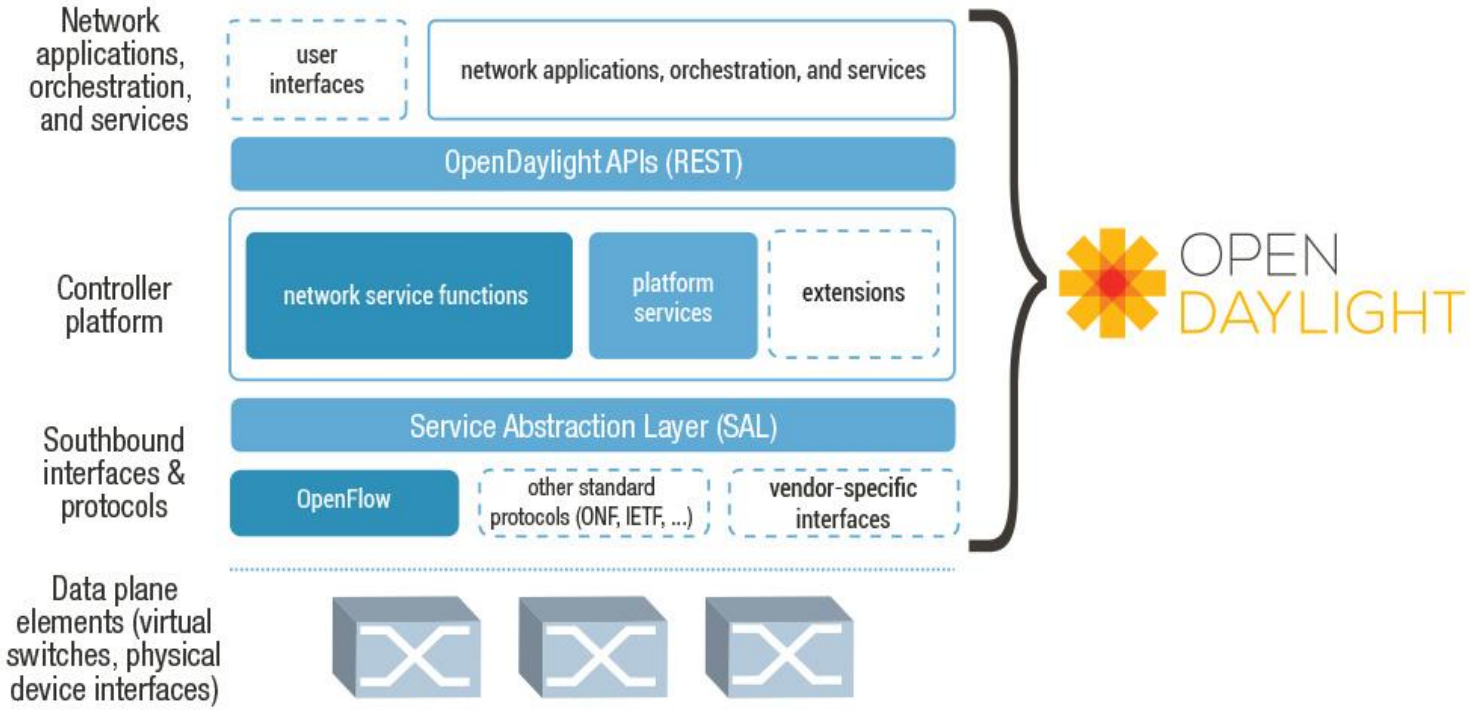
Deutsche Telekom, facebook, Google, Microsoft, NTT Communications, verizon, YAHOO!

ONF Board

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

A10 Networks, Alcatel·Lucent, ARGELA it's the passion, orange, FUJITSU, Gigamon, midokura, NCLC, NEC, big switch networks, BROADCOM, BROCADE, Goldman Sachs, HITACHI Inspire the Next, hp, NETGEAR Connect with Innovation, NETRONOME, nicira, ciena, cisco, CITRIX, HUAWEI, IBM, infinera what THE NETWORK will be, Nokia Siemens Networks, ORACLE, PICA, colt smarter / faster / further, comcast, CompTIA, Infoblox, intel, ipinfusion, PLEXXI, radware, riverbed Think fast., CYAN, DELL, Elbrys, IXIA, JUNIPER NETWORKS, kt, SAMSUNG, SK telecom, SPIRENT, ERICSSON, ETRI, extreme networks, linerate SYSTEMS, LSI, LUXOFT, TELECOM ITALIA, Tencent, TEXAS INSTRUMENTS, EZCHIP, f5, FORCE10, MARVELL, Mellanox TECHNOLOGIES, Metaswitch Networks, vello SYSTEMS, vmware, ZTE中兴

2. SDN> Project OpenDayLight



Platinum

ERICSSON, BROCADE, CISCO, IBM, JUNIPER NETWORKS, redhat, Microsoft, CITRIX

Gold

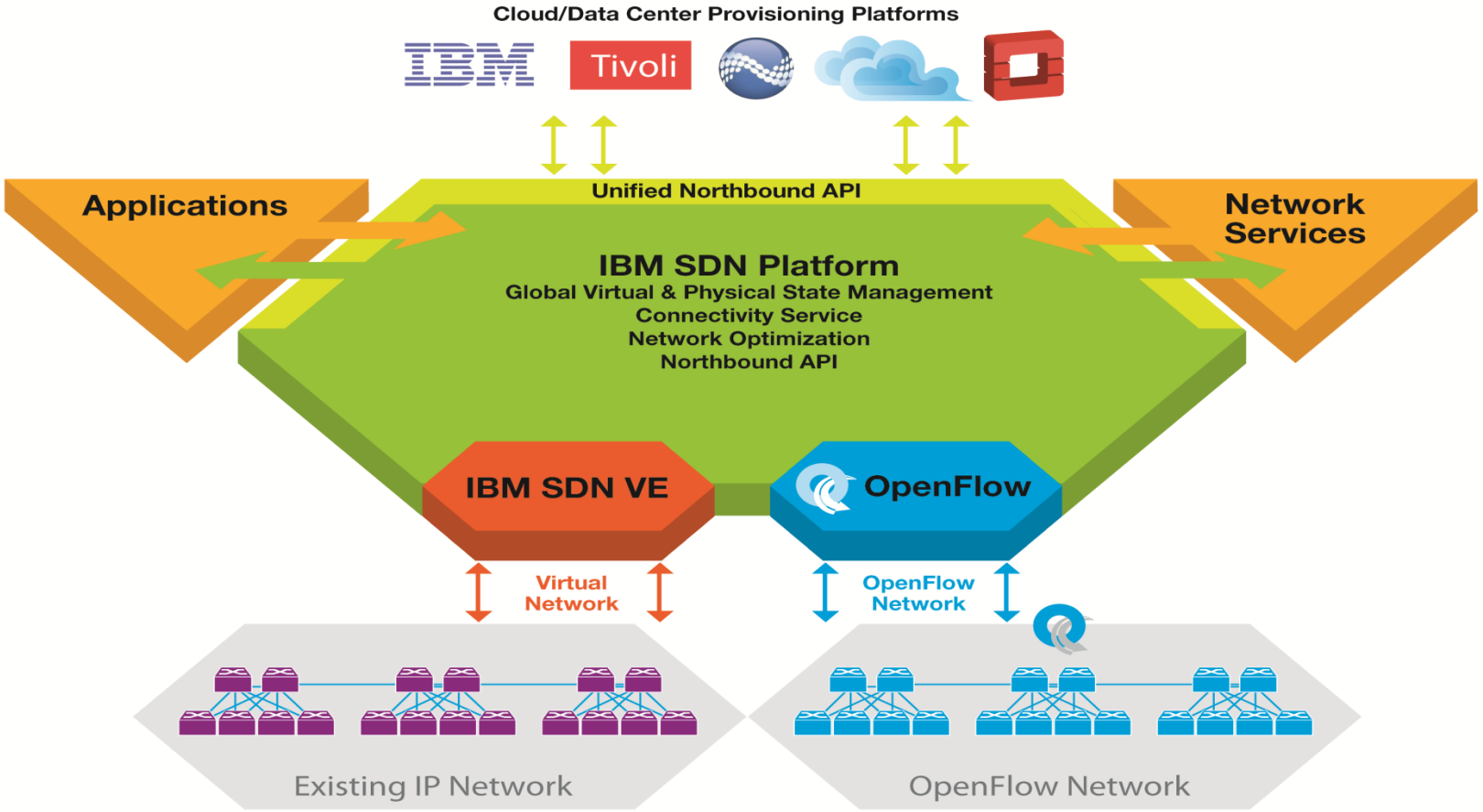
vmware, NEC

Silver

PLEXXI, big switch networks, ARISTA, DELL, intel, hp, INOCYBE TECHNOLOGIES, HUAWEI, nuagenetworks, PLUMgrid, FUJITSU

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

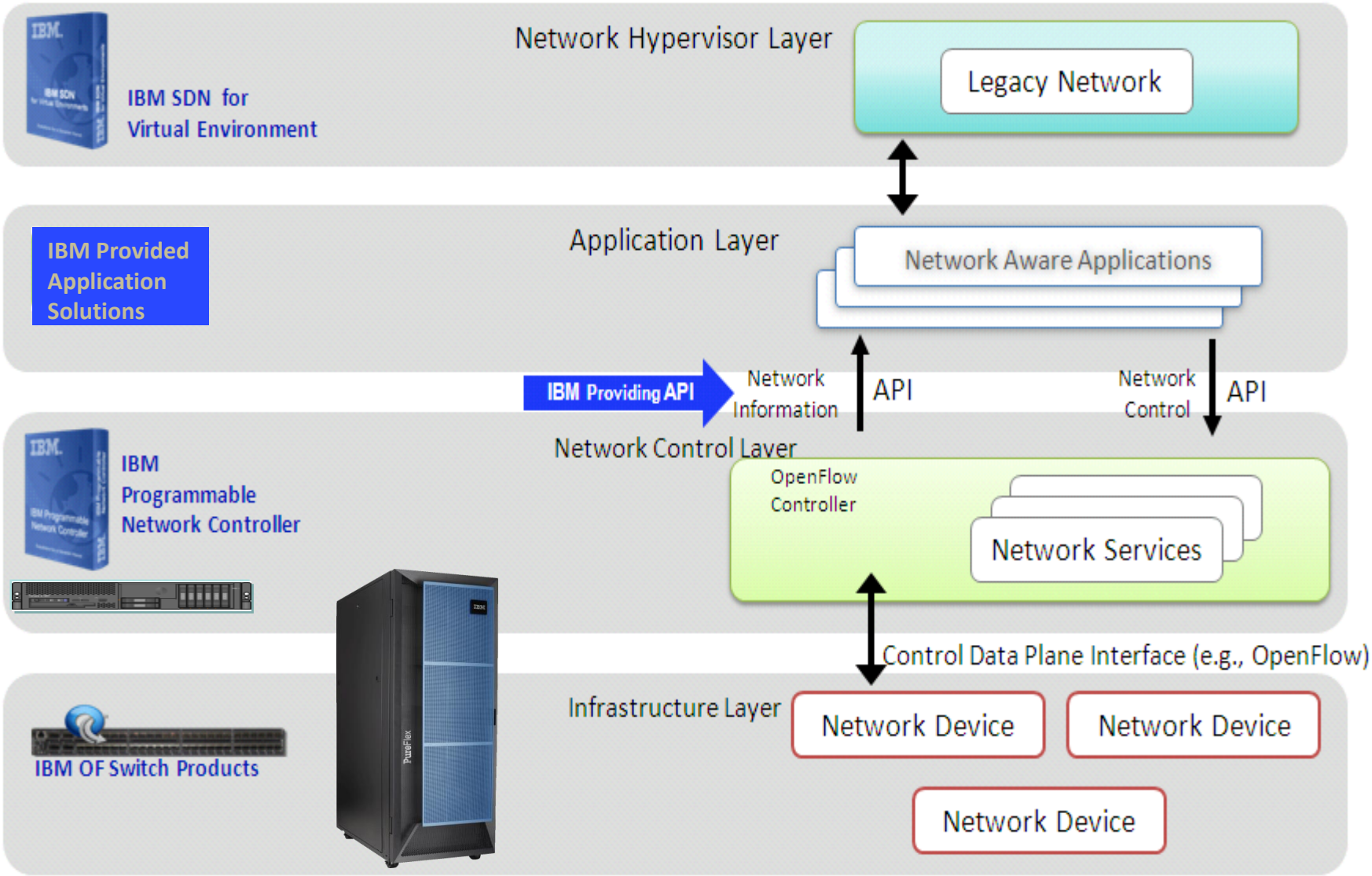


3. IBM SDN Solution> IBM의 SDN에 대한 전략

Now delivering…

…the future of networking

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
Treama	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

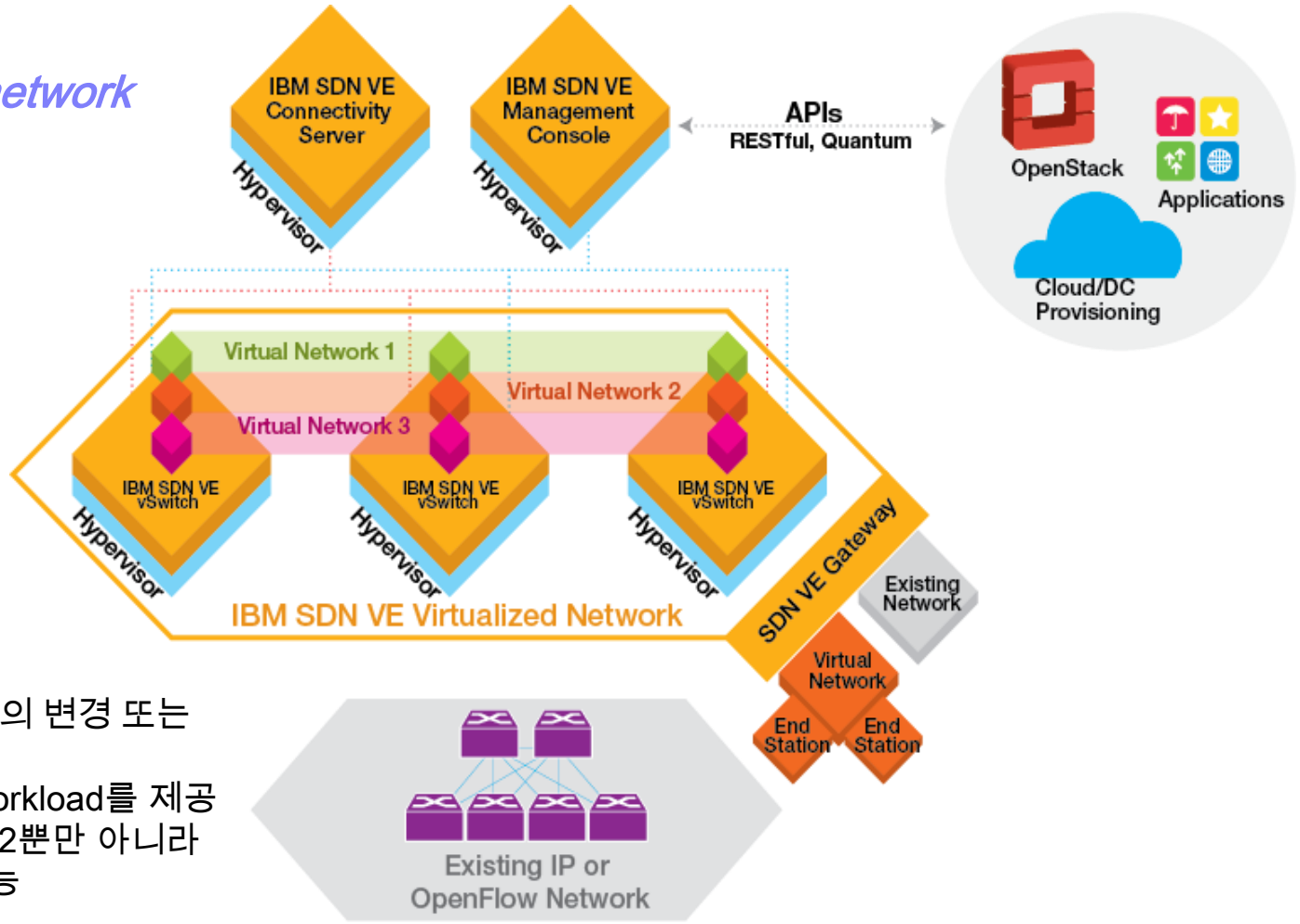
IBM System Networking G8316

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

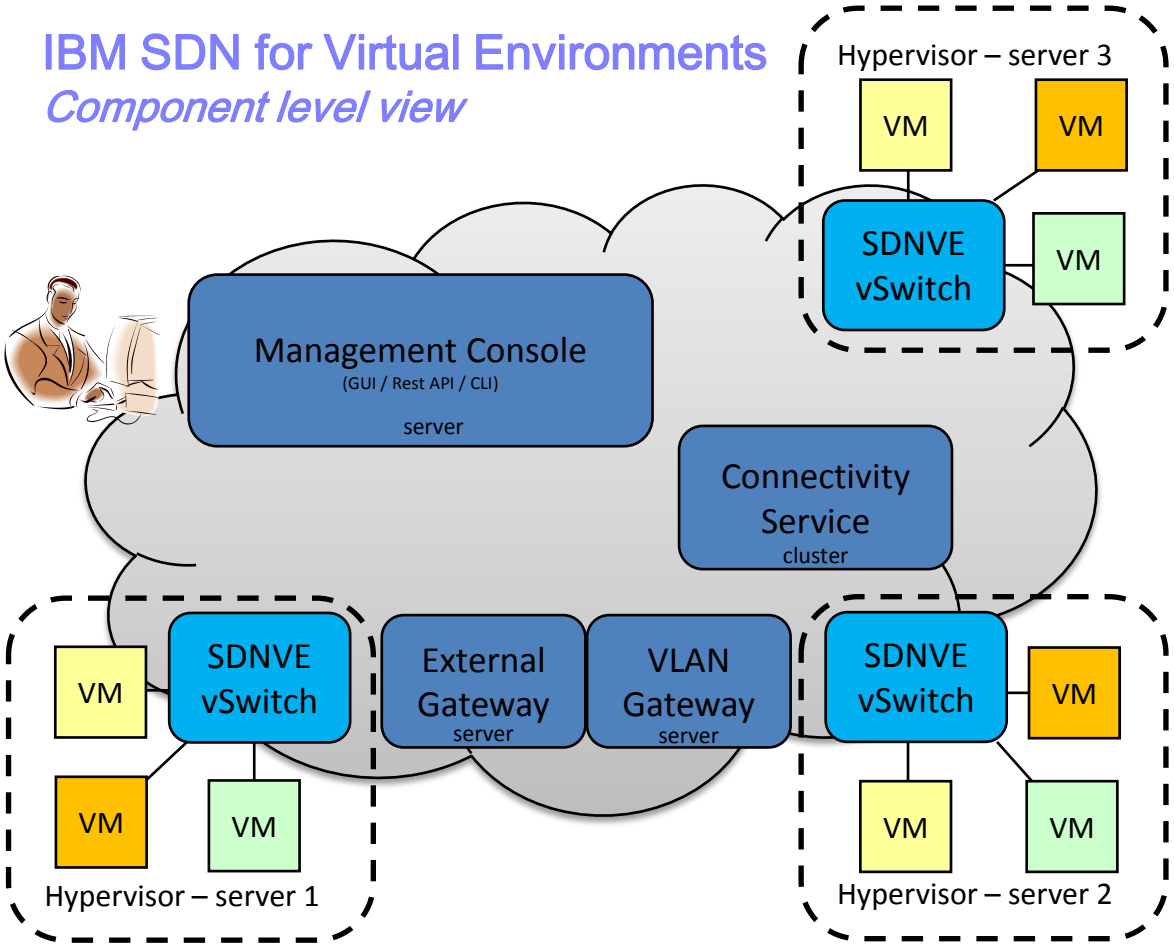


- 사용중인 Network Infra의 변경 또는 추가 작업이 필요 없음
- Server Base의 가상 Workload를 제공
- VM의 mobility가 Layer 2뿐만 아니라 Layer 3에서도 제공 가능

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

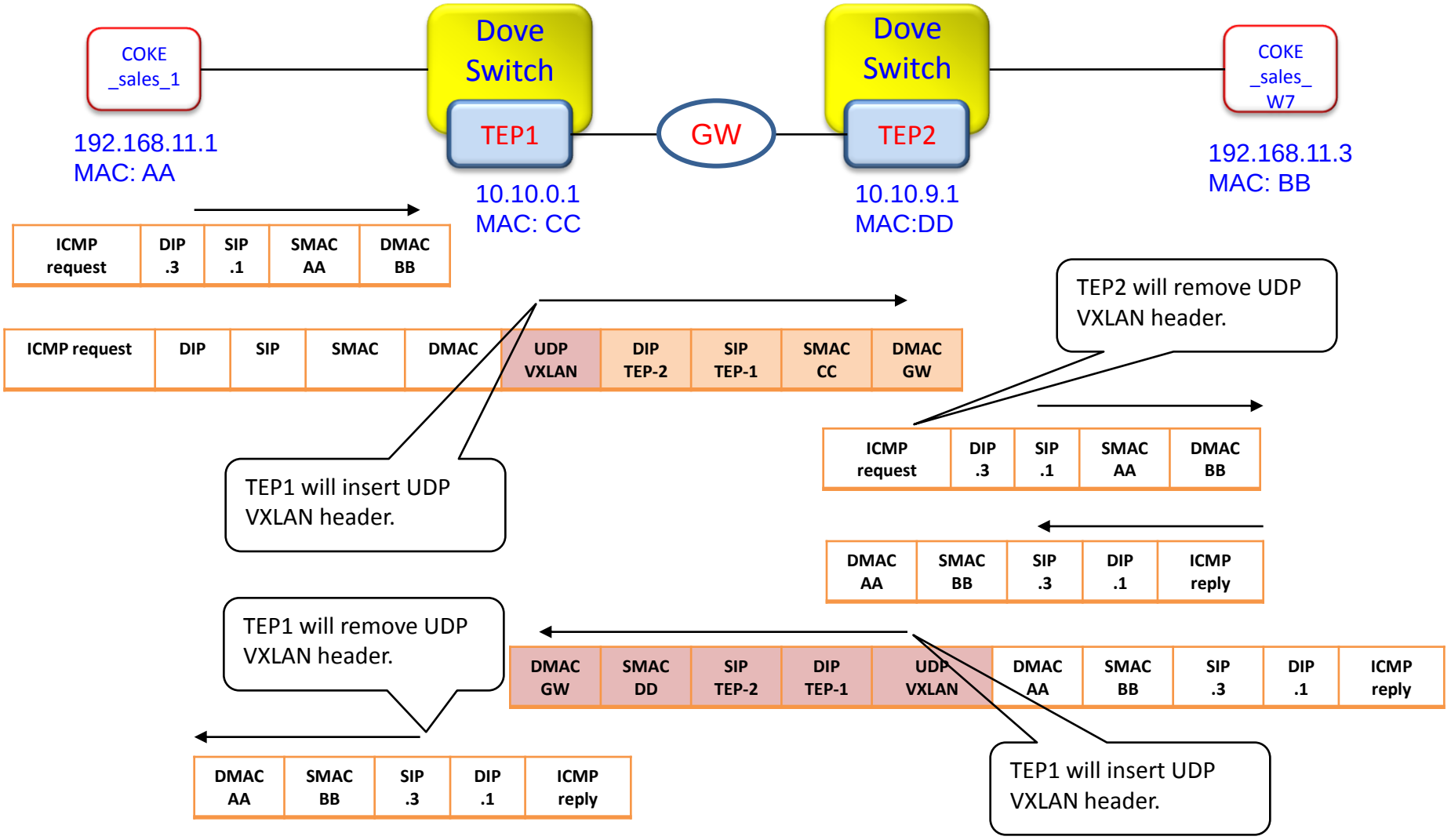
- Connects legacy machines to an SDNVE network, for example VMs in a 5000V deployment

External Gateway

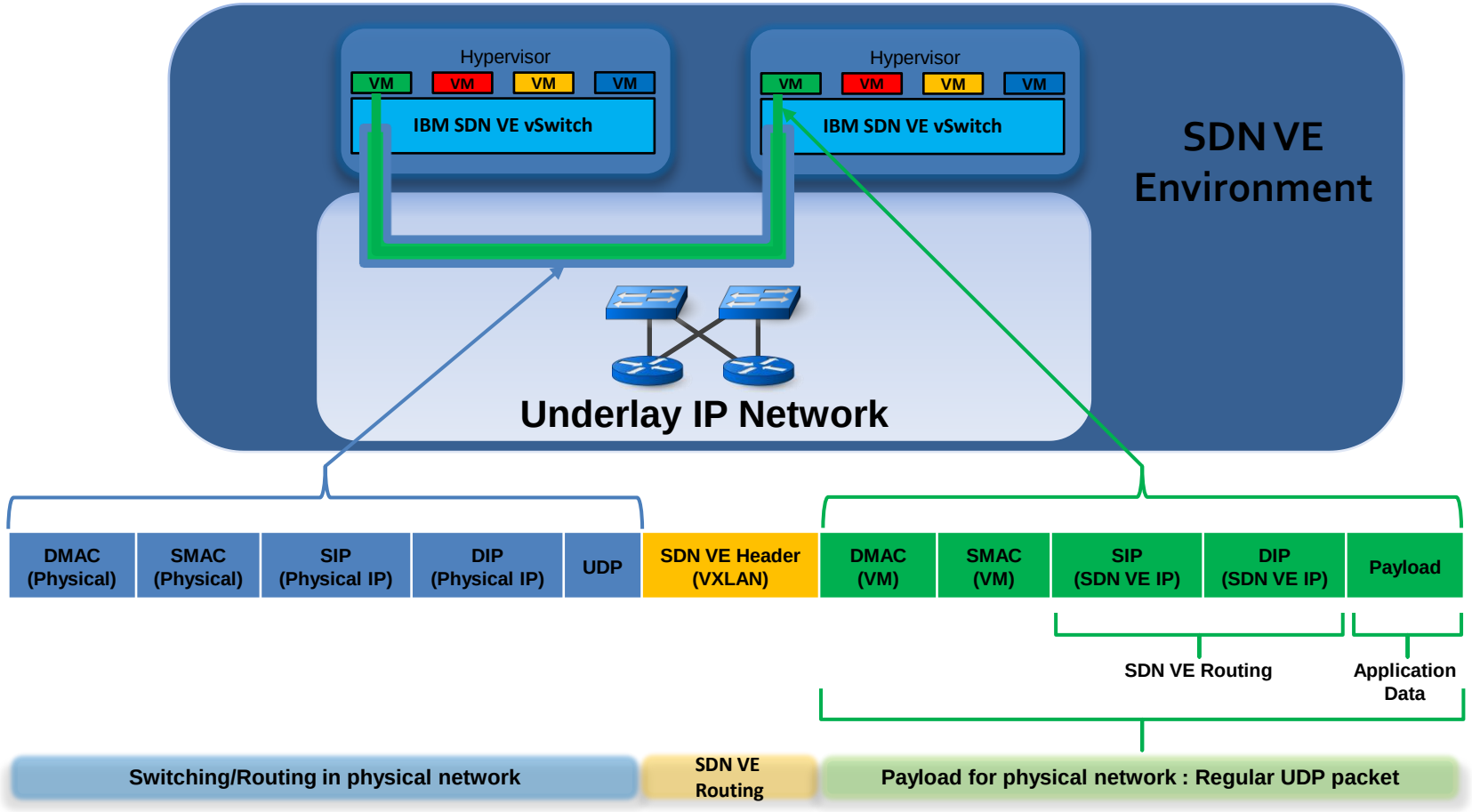
- Connects the virtual network to non-SDNVE networks
- Connects two SDNVE network domains

Virtual Networking: IBM SDN VE Traffic

- SDN VE Packet Flow Diagram



IBM SDN VE Traffic is Encapsulated within Existing IP Network

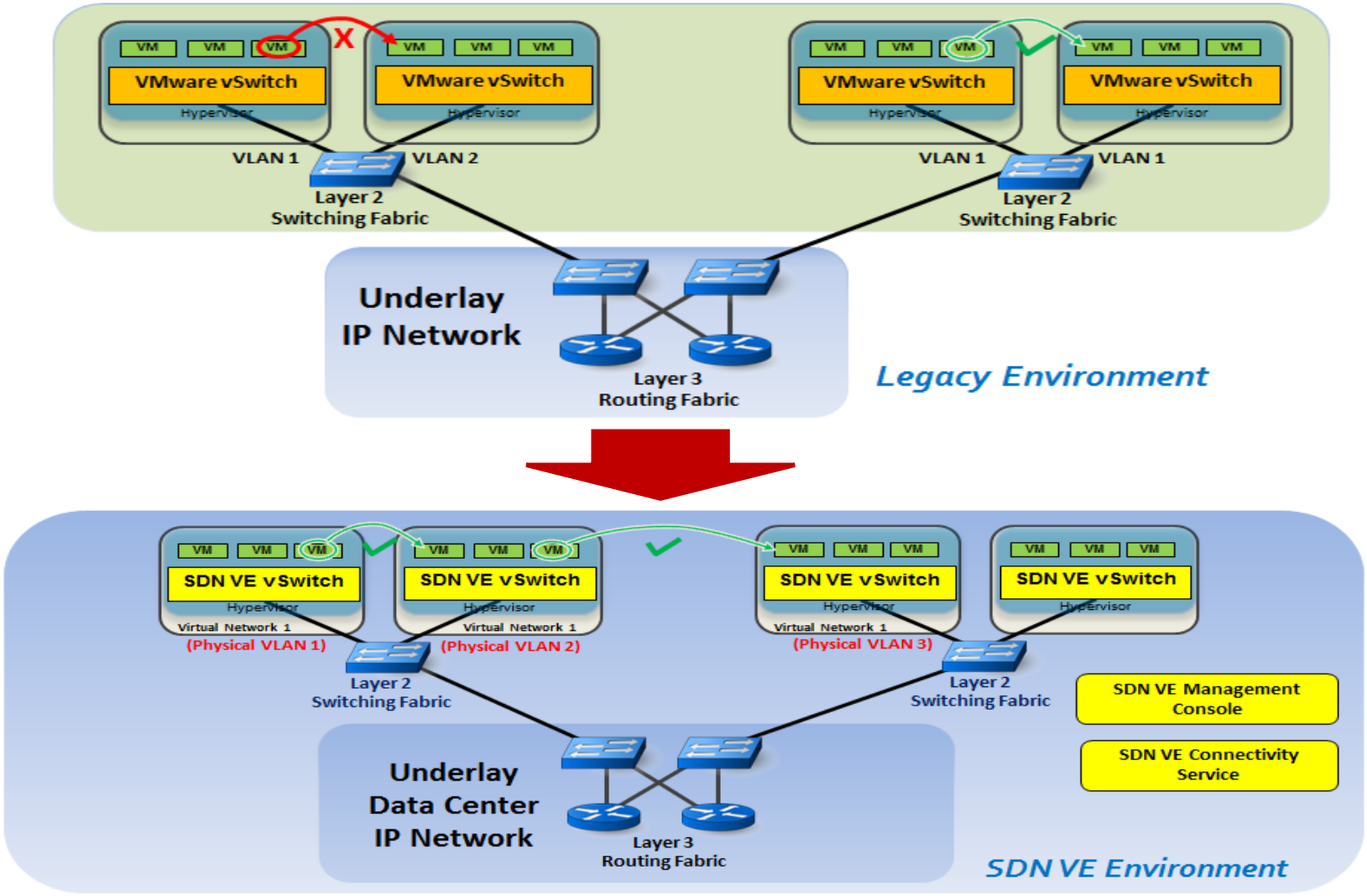


All VMs and vSwitches within an SDN VE environment are associated with an overlay IP topology

- 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

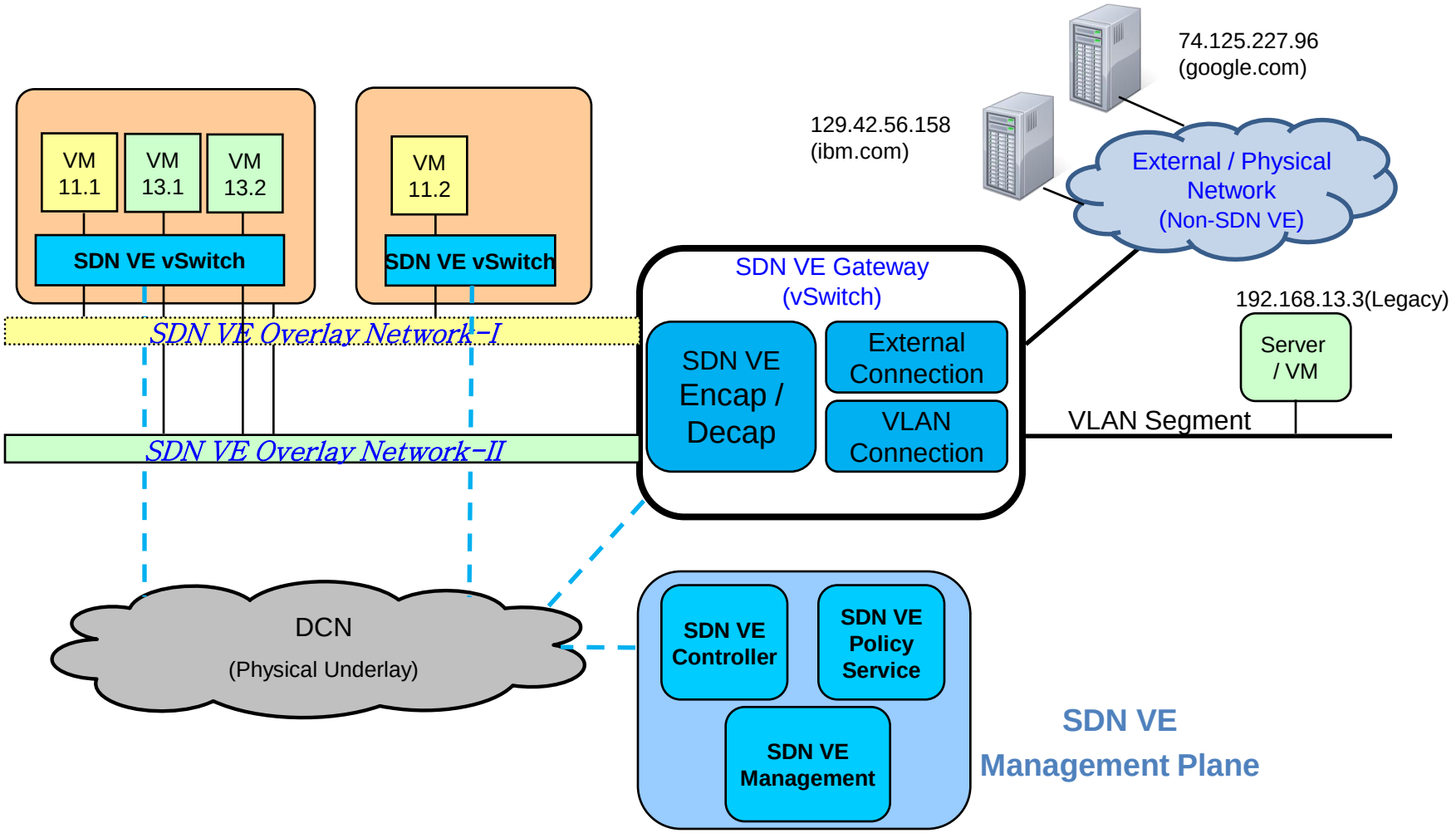
3. IBM SDN Solution> SDN VE (Virtual Environment)

- Layer 3 상에서의 VM Mobility 지원



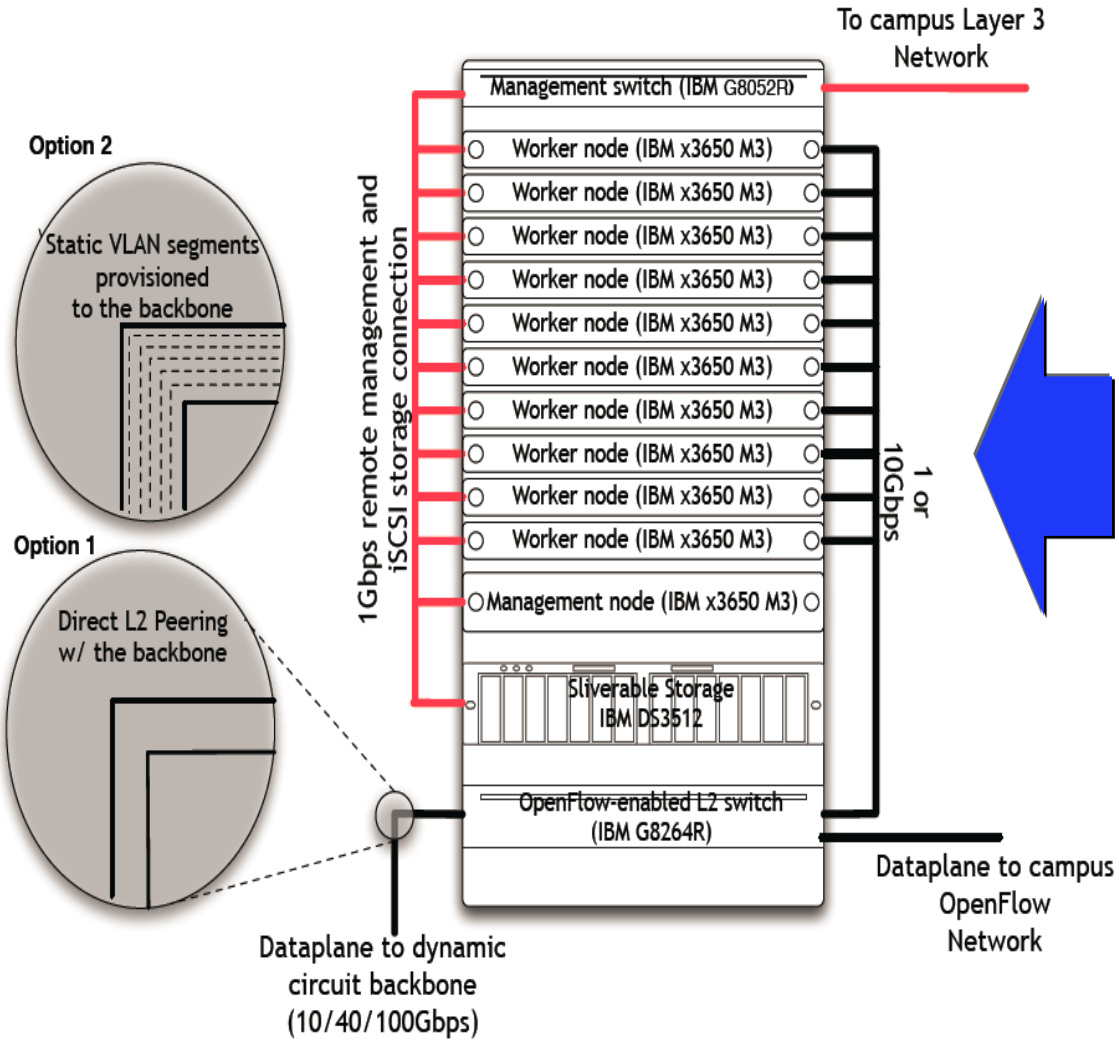
3. IBM SDN Solution> SDN VE (Virtual Environment)

- Non UnderLayer와의 통신 가능



Appendix

❖ SDN OpenFlow Reference Information

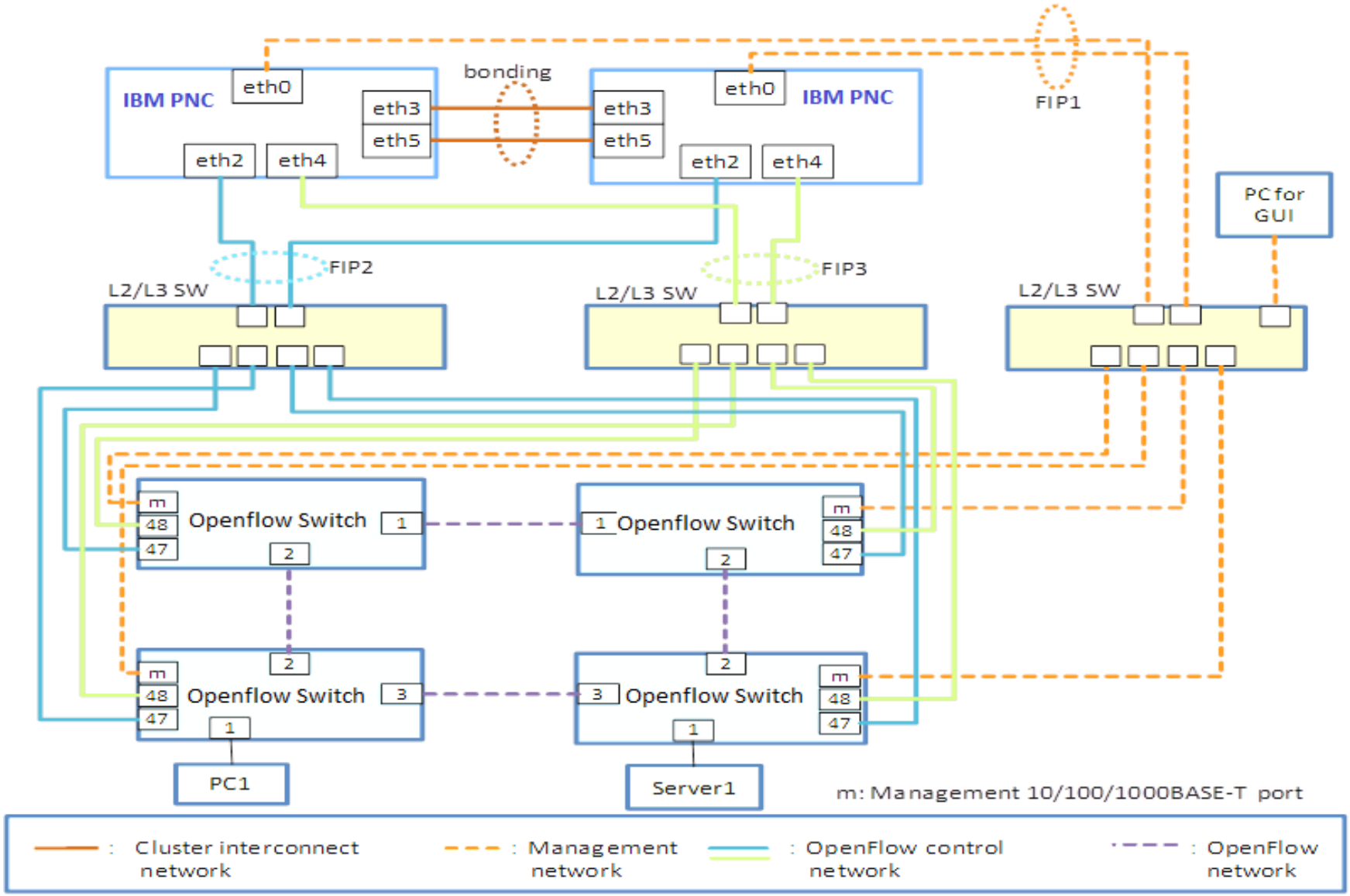


- 100 Virtual Machines
  - ➔ it is based on a standard cloud cluster stack **(Linux/KVM/Eucalyptus)**
- 6TB local iSCSI Strage
  - ➔ Image storage, measurement data storage and other experimental needs **(IBM DS3512)**
- 10/40GbE OF Switch
  - ➔ OpenFlow enabled Layer2 dataplane switch with VLAN capabilities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

<ExoGENI Rack Overview>

Appendix

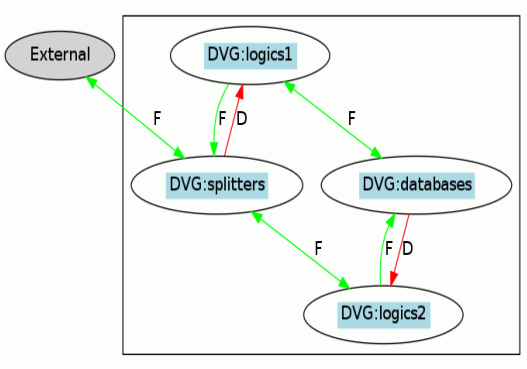
❖ IBM OpenFlow Sample Topology

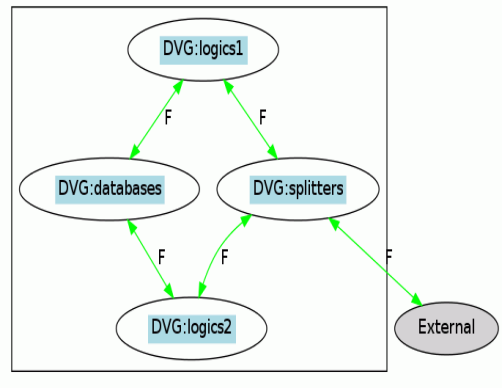


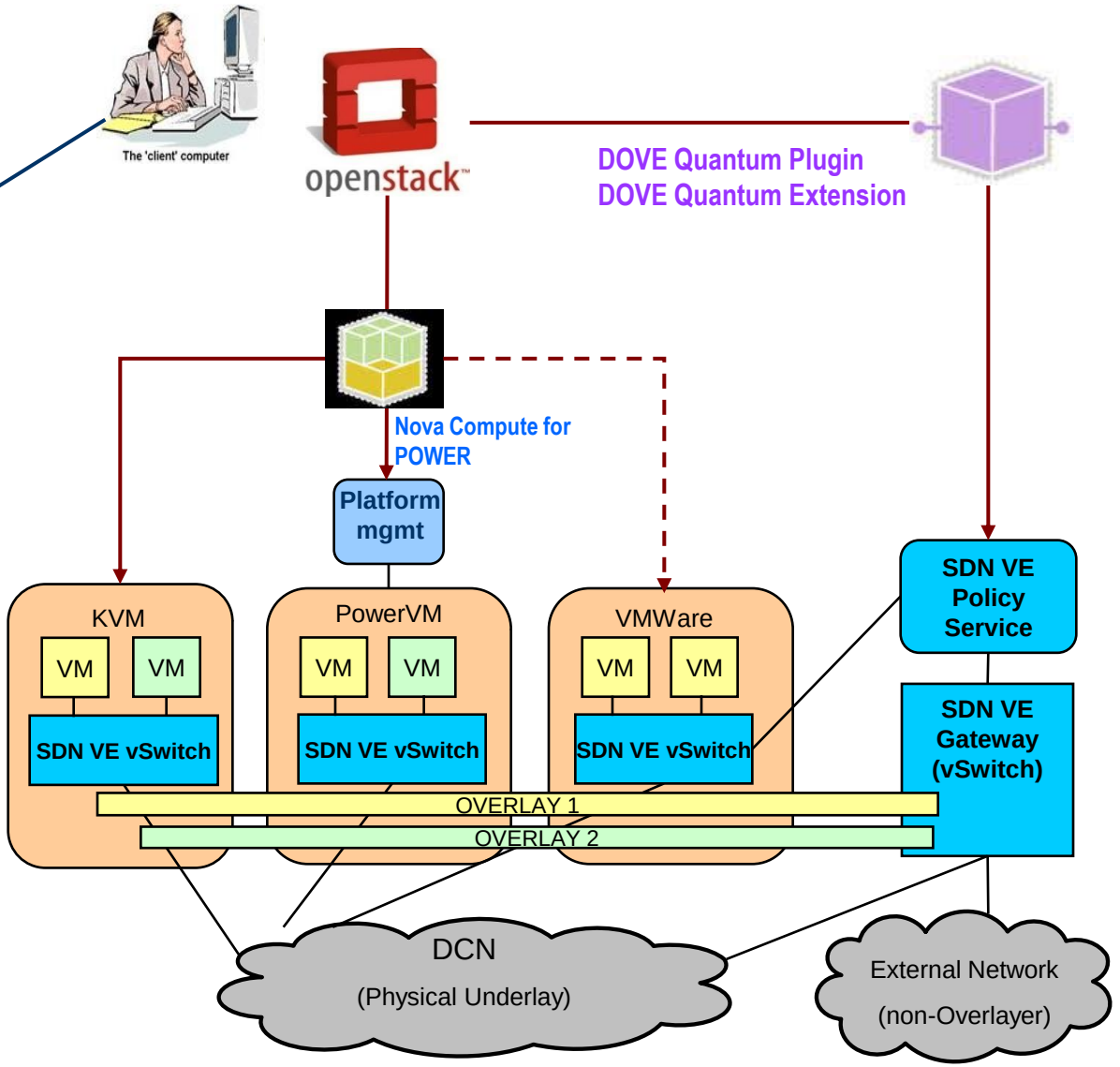
Appendix

❖ IBM SDN VE Sample Topology

SDN VE Network Blueprints In Horizon







<SDN VE+Openstack+Quantum>

Appendix

❖ 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

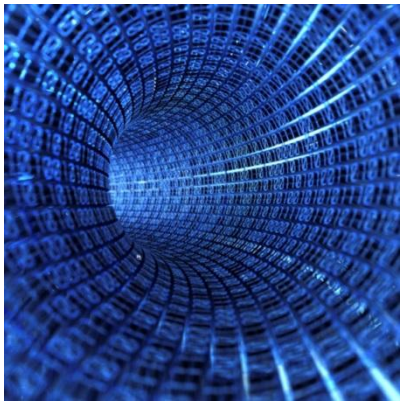
- Hybrid Networking (SDN or Legacy Networking): across multiple protocols
- Industry standard OpenFlow, 802.1 Qbg
- Uncompromised I/O: 40Gb Ethernet, 16Gb Fibre Channel, and 56Gb Infiniband

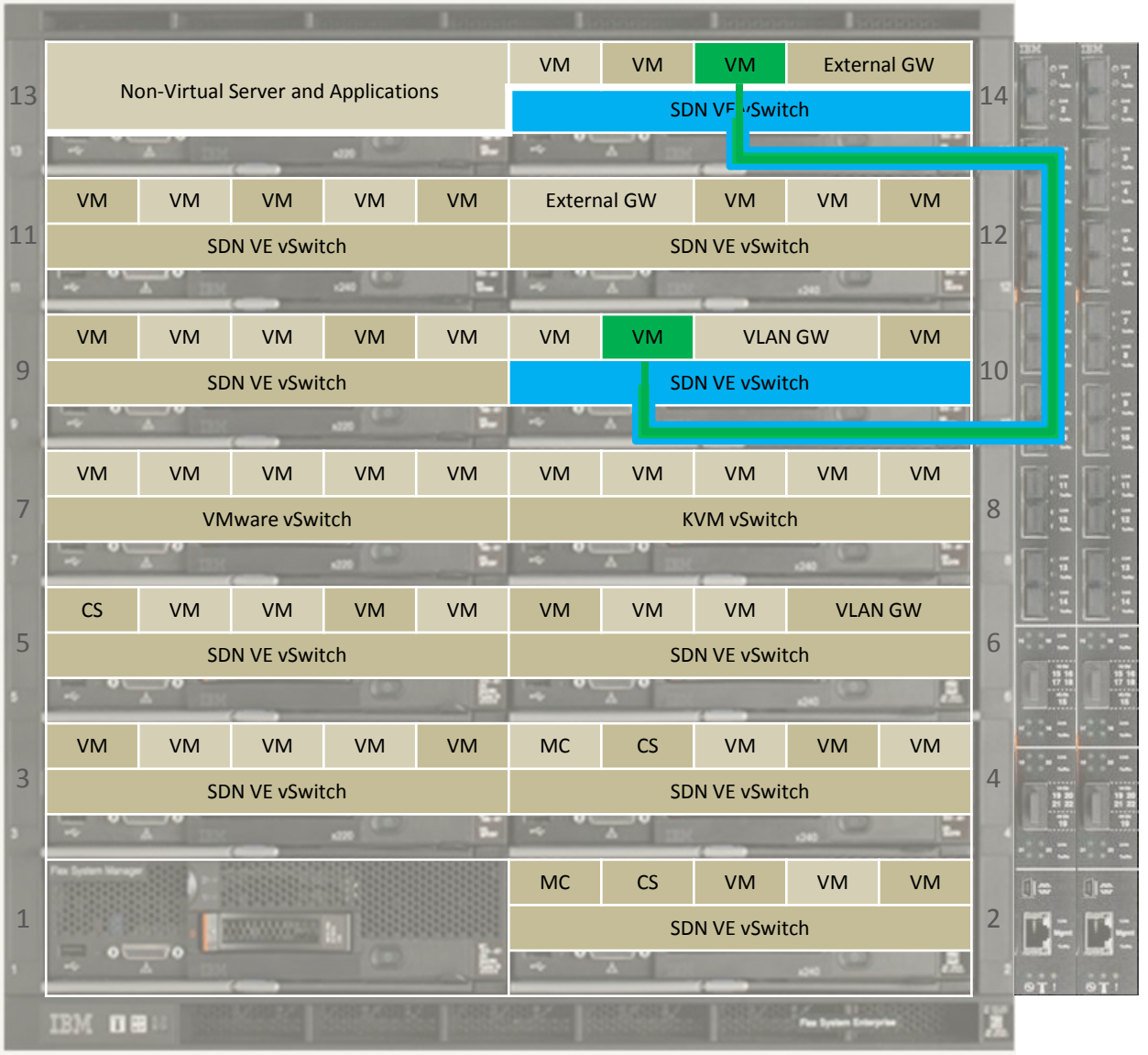
- Open Choice for compute, network, storage, OS and Hypervisors
- Desktop Virtualization: VirtualBridges, Citrix, VMware and ISV solutions

Appendix

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

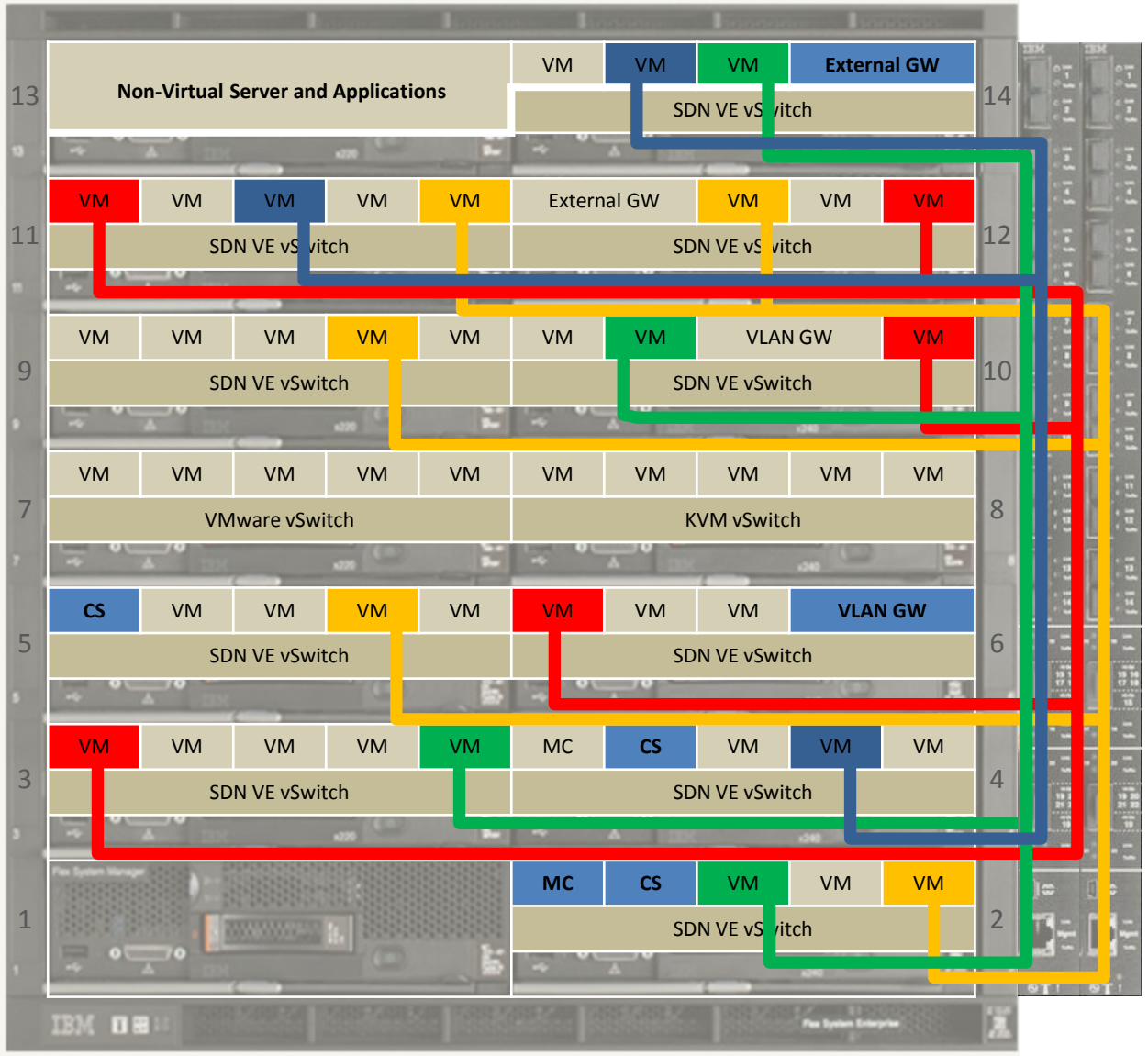




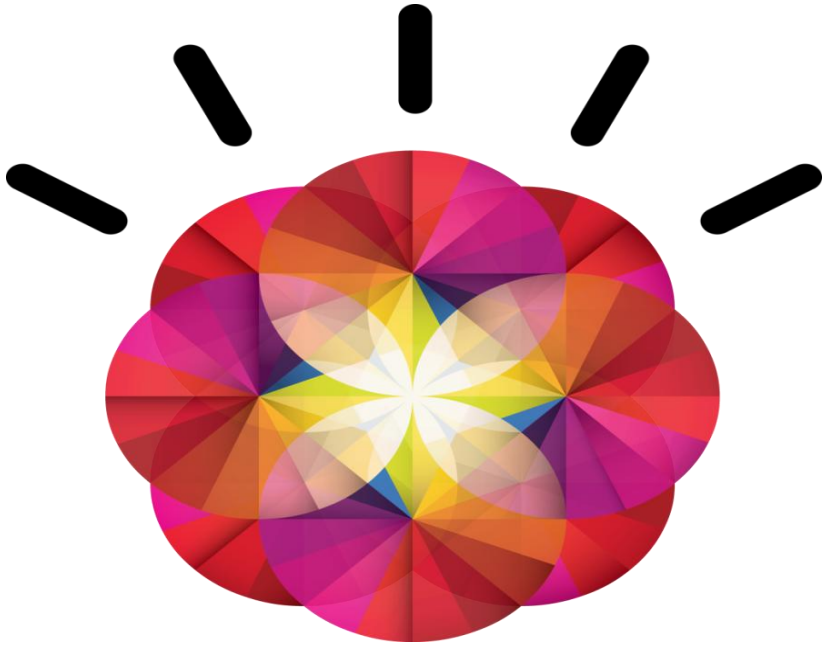
Appendix

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

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