# Software-Defined Networking: Where Are We Today?

Guido Appenzeller

Chief Technology Strategy Officer
Networking & Security
VMware

Networking is going through it's biggest revolution of the past 20 years.

# Agenda

**Why SDN?**

Where are we today?

The future of SDN.

**vm**ware®

# Networking Hardware is a Commodity

All of these switches have the same networking chip


Arista 7050S-64


IBM BNT Rackswitch G8264


Alcatel Lucent 6900


Juniper QFX 3500


Cisco Nexus 3064


Quanta T3048-LY2


Dell Force 10 S4810


HP5900af 48xg


Edge Core AS5600-52X
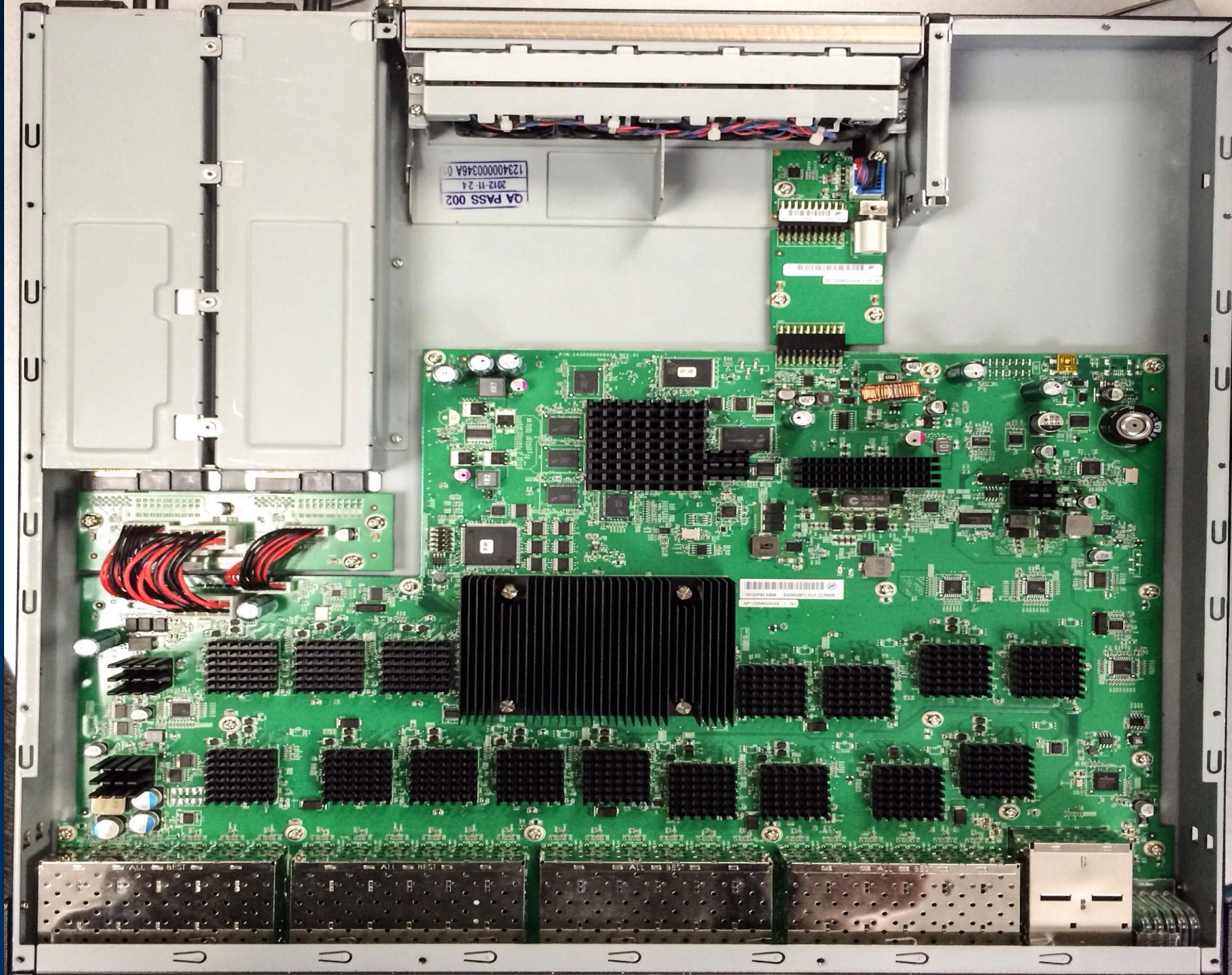
# Networking Hardware is a Commodity

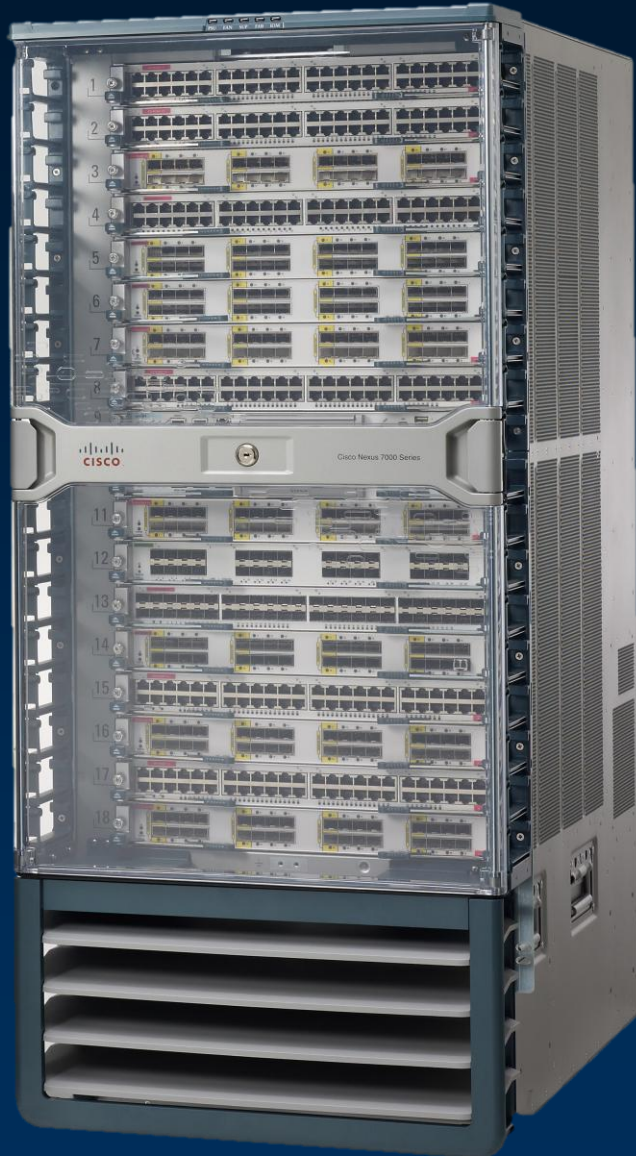Broadcom dominates the silicon market (think Intel x86)

- Currently used by all major ToR switches

OEM Manufacturers build systems based on Broadcom design

- OEMs have a roadmap of upcoming systems

- In many cases, Brand vendors pick existing design and only add their software

- Switches are internally virtually identical
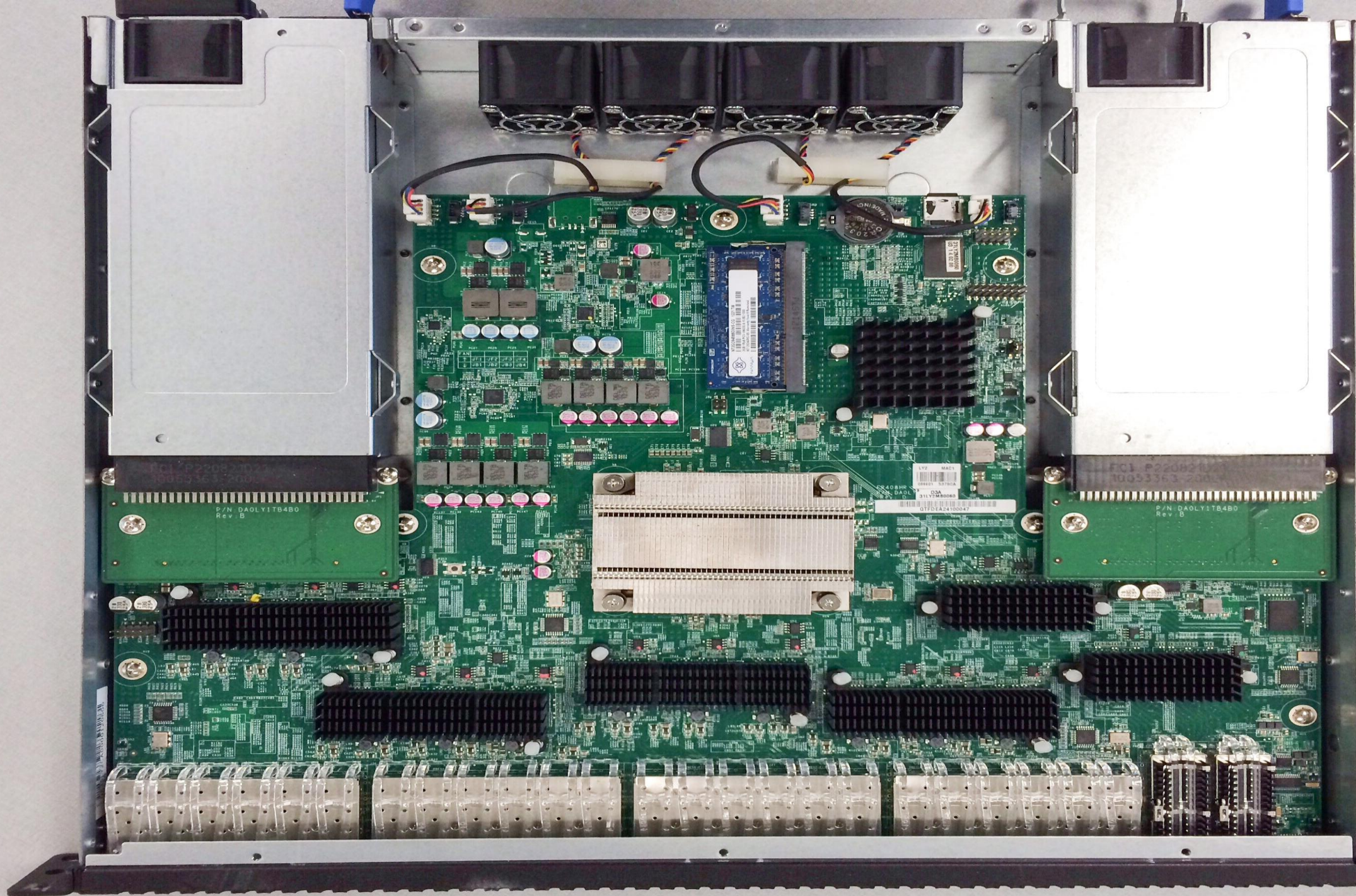
| Protocols | Features |
| --- | --- |
| Network OS | |
| System | |
| Silicon | |

VM #1 | VM #2

Hypervisor

System

Silicon

vmware®

# Software-Defined Data Center

Software

Data Center Virtualization Layer

Hardware

Intelligence, Networks Software Storage Capacity

# Proven approach, now being consumed by enterprise

Custom Application Software Including routing, load balancing, security, location independence, hardware independence.
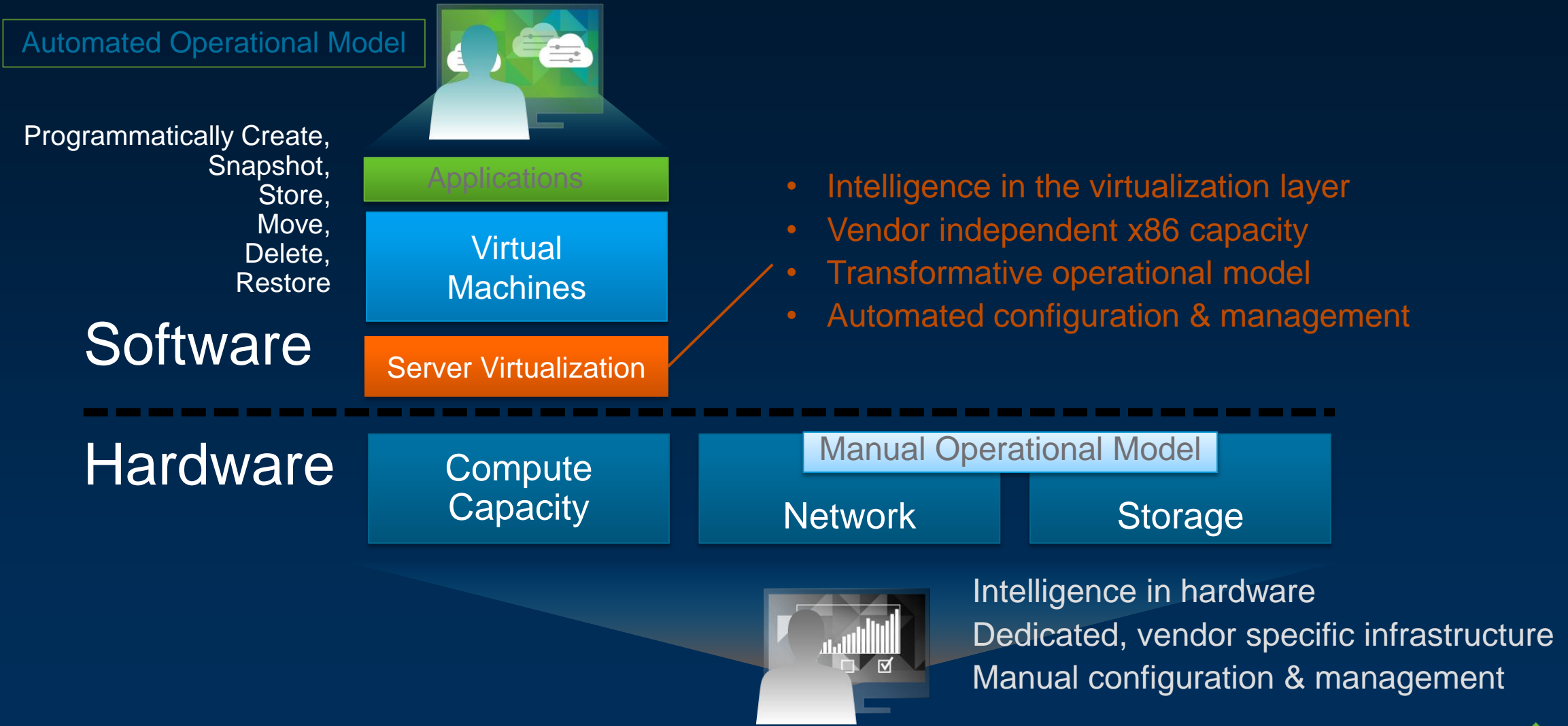
Custom Software with Abstraction Layer

Software Defined Data Center

Any Enterprise Application

Abstraction in Virtualization Layer
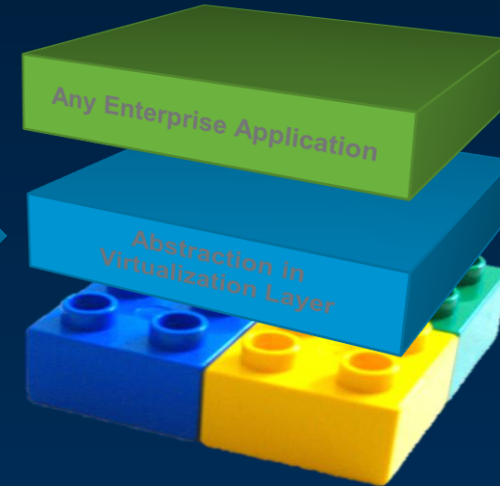
Simple "Lego Block" Style Modular Capacity

# Taking what we have learned….

Automated Operational Model

Programmatically Create,
Snapshot,
Store,
Move,
Delete,
Restore

## Software

Applications

Virtual
Machines

Server Virtualization

- Intelligence in the virtualization layer
- Vendor independent x86 capacity
- Transformative operational model
- Automated configuration & management

## Hardware

Compute
Capacity

Manual Operational Model

Network

Storage

Intelligence in hardware
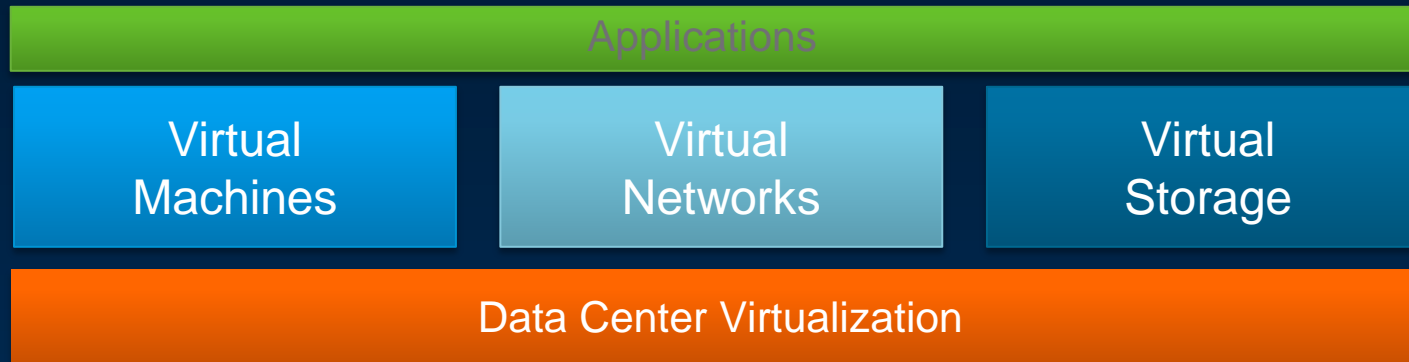Dedicated, vendor specific infrastructure
Manual configuration & management

**vm**ware®

# To deliver a Software Defined Data Center approach

Programmatically Create,
Snapshot,
Store,
Move,
Delete,
Restore

**Applications**

| Virtual Machines | Virtual Networks | Virtual Storage |

**Software**

Data Center Virtualization

**Hardware**

| Compute Capacity | Network Capacity | Storage Capacity |

Pooled compute, network and storage capacity
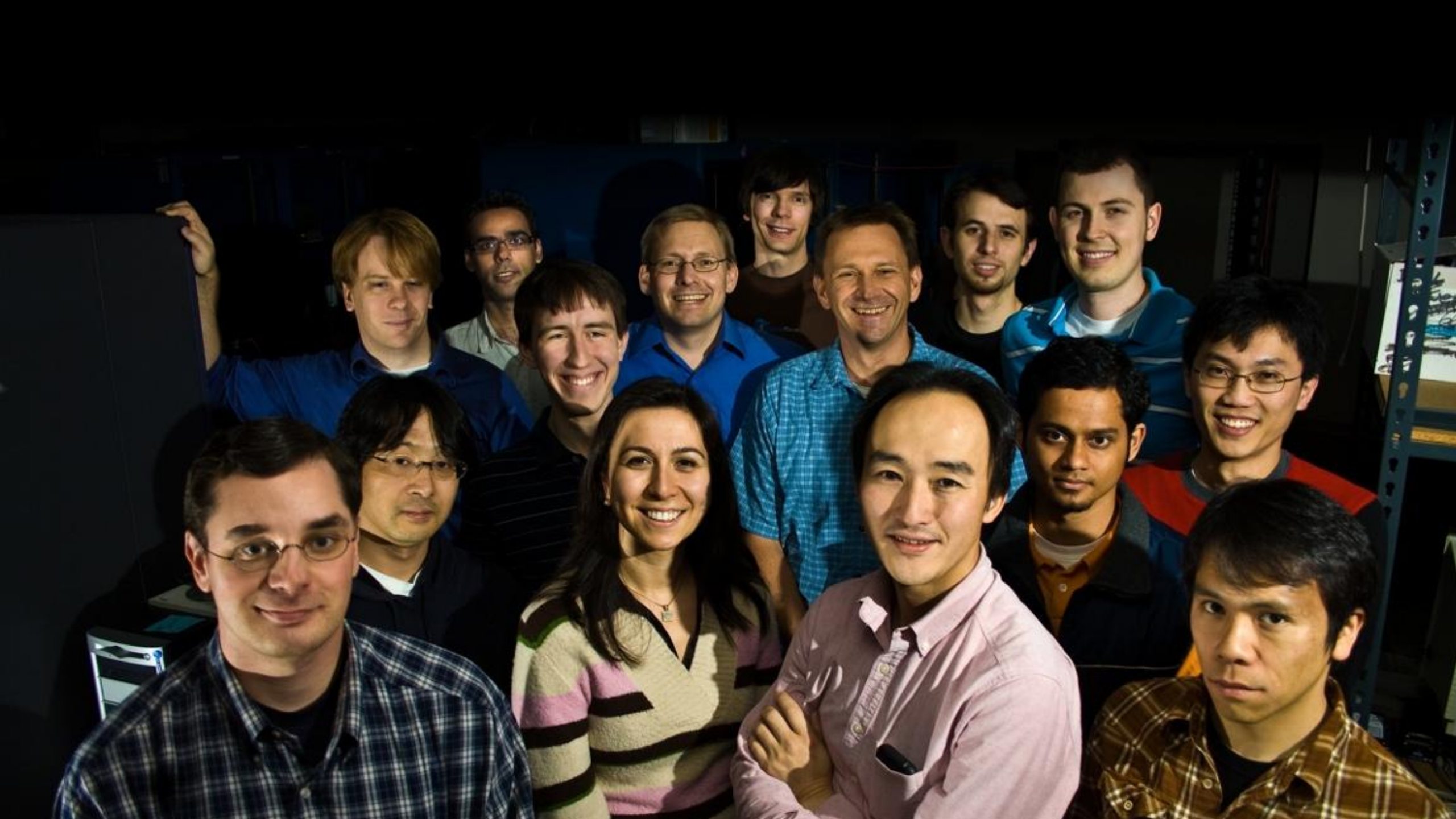Vendor independent, best price/performance
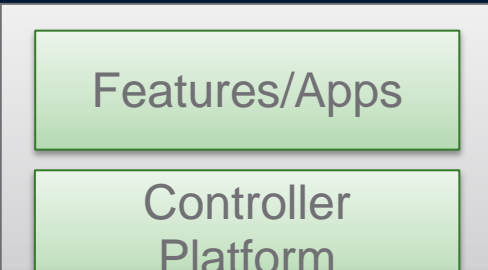Simplified configuration & management

Location Independence

**vmware**®

# Agenda

Why SDN?

Where are we today?

The future of SDN.

**vm**ware®

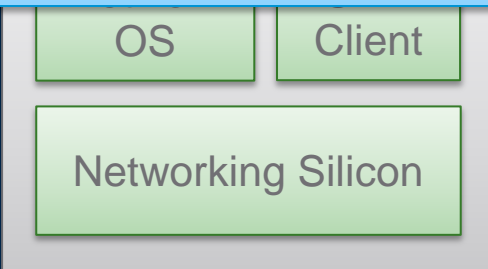# OpenFlow Model

SDN Controller

Features/Apps

Controller
Platform

**Vendor B**
- Controller Platform
- Applications on Top

Who can name an example of a production deployment that follows this model?

OS    Client

Networking Silicon

- Build Feature Switch
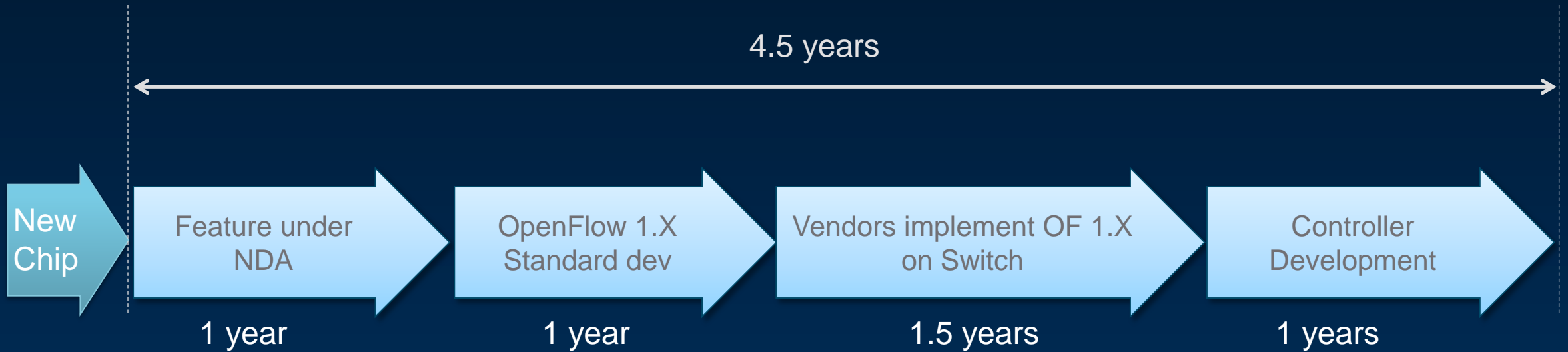- Adds OpenFlow Client

SDN Enabled Switch

**vm**ware®

# OpenFlow Deployments Today

- SDN is doing extremely well
  - ONS with 1,600 attendees
  - NSX at $200m run rate, 400 customers
  - BSN had $1m in pre-orders for it's Cloud Fabric
  - Analyst predictions are going up…

- Why is no one following the original model?

**vm**ware®

# OpenFlow Development

The original model constrains innovation

4.5 years

| New Chip | Feature under NDA | OpenFlow 1.X Standard dev | Vendors implement OF 1.X on Switch | Controller Development |
|---|---|---|---|---|
| | 1 year | 1 year | 1.5 years | 1 years |

**Networking industry is moving very quickly
Standards-based development model slows down innovation.**

**vm**ware®

# Evolution of Software Defined Networking

**Research**
- OpenFlow
- Mostly in Academia
- Experimental

**Products & Architecture**
- Overlay Networks
- Centralized Control Planes
- Service Providers & Enterprise

START
Data Center

**Mainstream Deployments**
- Operational Readiness
- Easy Deployment
- Operational Tools

| 2008 | 2010 | 2012 | 2014 | 2015 | 2016 |

Existing Hardware (Extend Life)

New Fabric Designs (L3, ECMP)

Bare Metal Switches

**vmware®**

# Networking is a Software Industry

# Agenda

Why SDN?

Where are we today?

The future of SDN.

# Recent Data Breaches

**Home Depot**
56,000,000

**JP Morgan Chase**
76,000,000

Sony Pictures

Staples

Dominios Pizzas (France)

Community Health Services

**Target**
70,000,000

**AOL**
2,400,000

Japan Airlines

Mozilla

NASDAQ

New York Taxis

TerraCom & YourTel

**UPS**

**Ebay**
145,000,000

Korea Credit Bureau

Yahoo Japan

Crescent Health Inc., Walgreens

D&B, Altegrit

MacRumours.com

Neiman Marcus

SnapChat

European Central Bank

Nintendo

Ubuntu

Florida Department of Juvenile Justice

**Adobe**
36,000,000

Drupal

Florida

**Living Social**

Vodafone
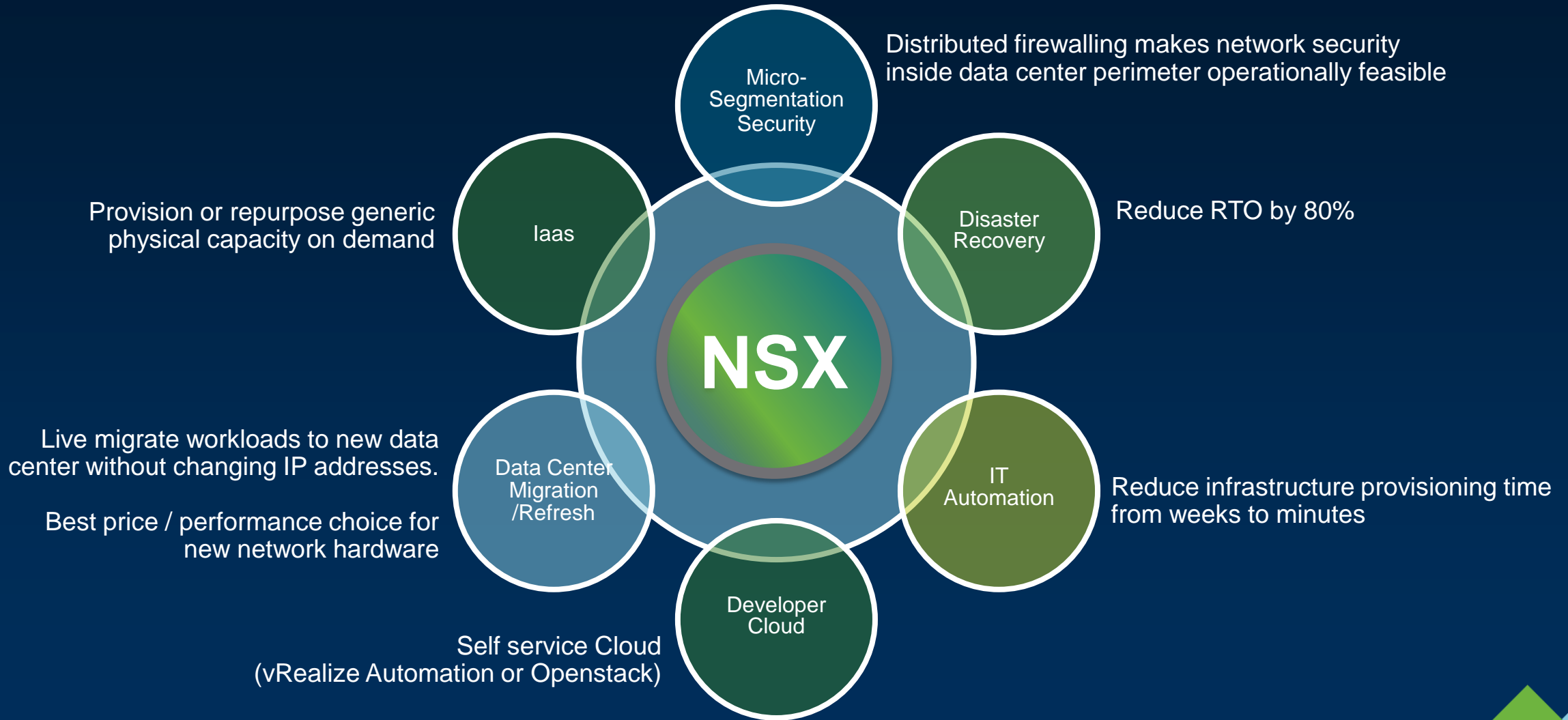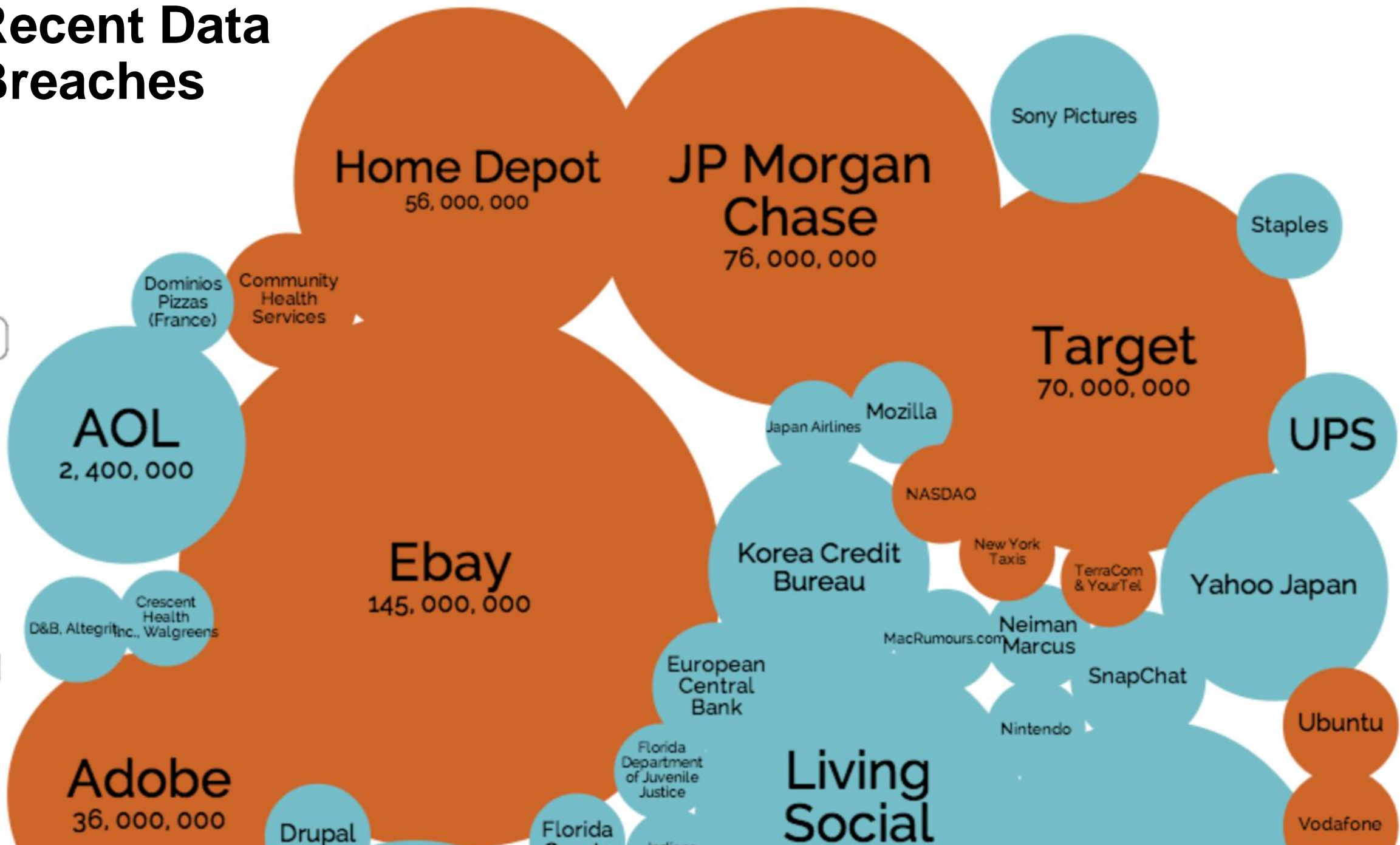
# Secure Micro-Segmentation in the Data Center
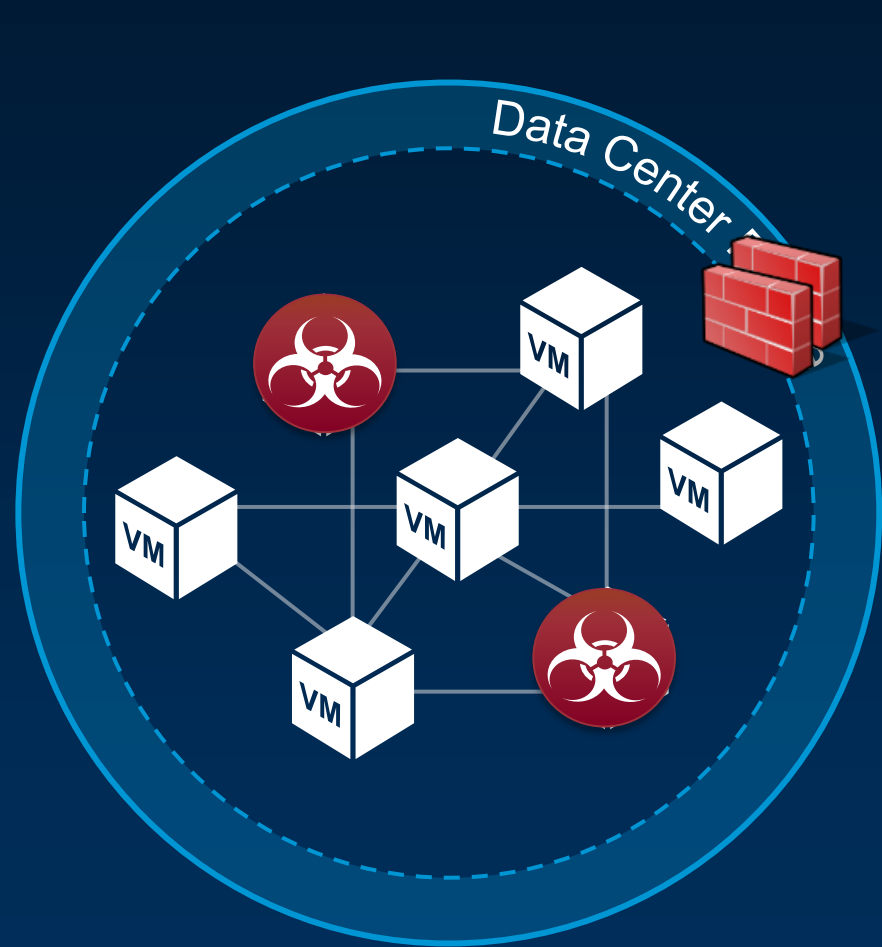
Data Center

Uncontrolled
Communication

**vm**ware®

# Secure Micro-Segmentation in the Data Center

# Isolation

**Dev**

**Test**
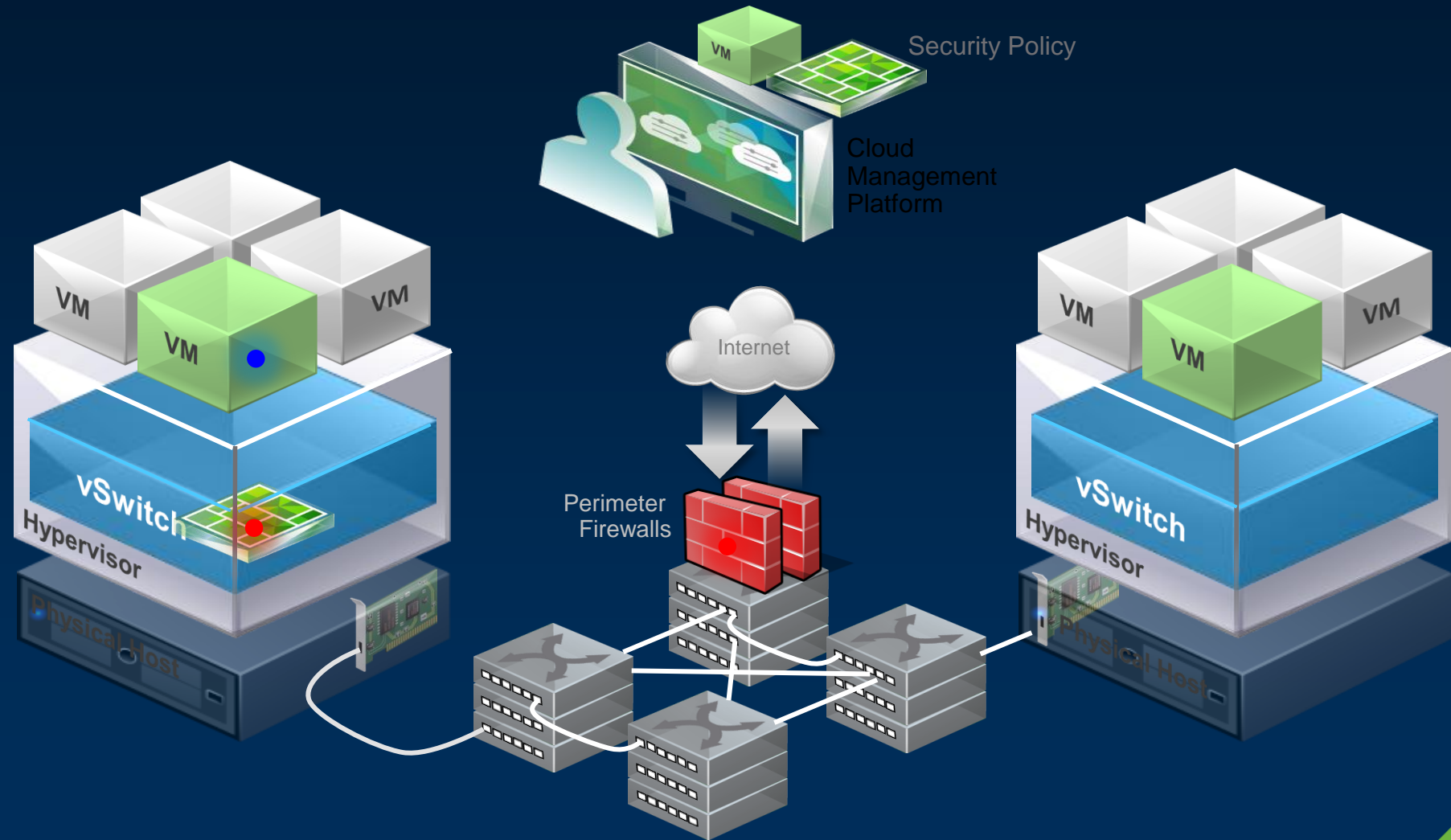
**Production**
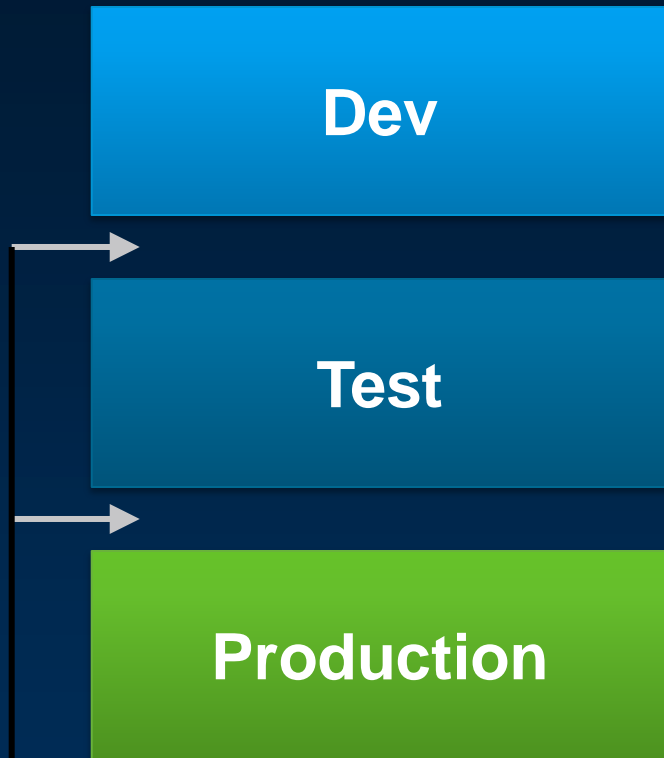
No Communication Path

# Segmentation

**Web**

**App**

**DB**
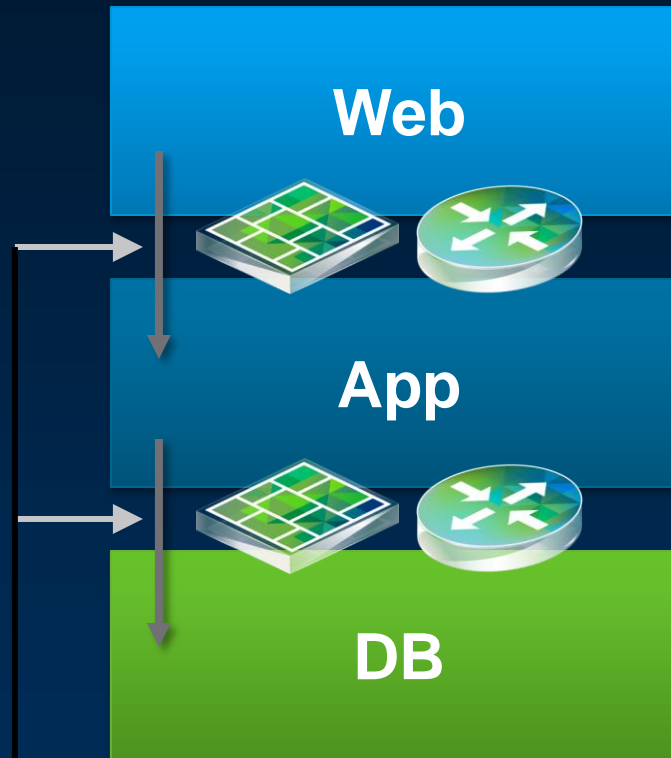
Controlled Communication Path

# Segmentation with Advanced Services

**Web**

**App**

**DB**
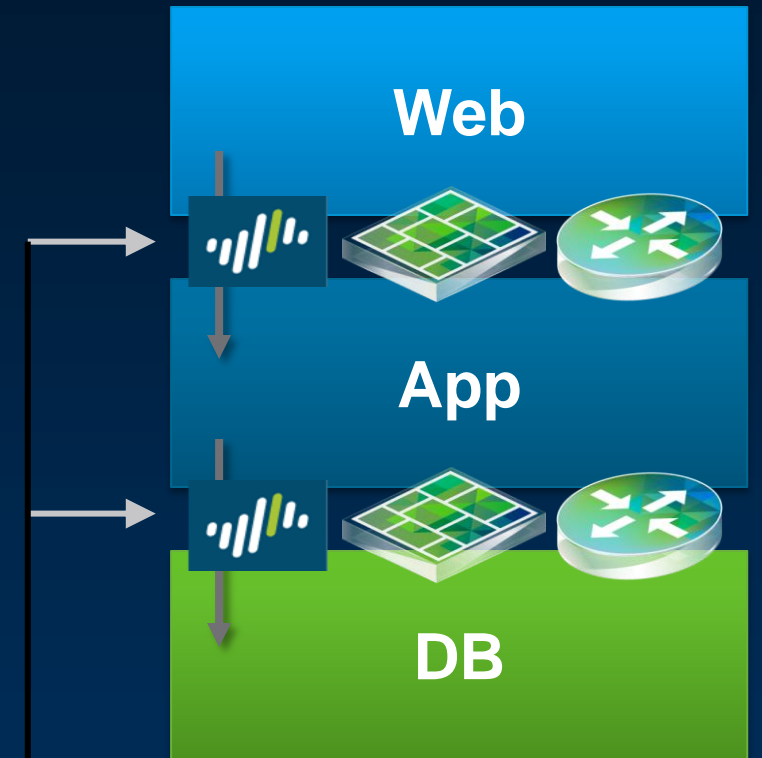
Advanced Services Controlled Communication Path

**vm**ware®

29

# Advanced Services Insertion – Example: Palo Alto Networks NGFW



NSX Controller

Security Admin

Panorama

Security Policy

Traffic Steering

VM

VM

VM

VM

vSwitch

vSwitch

Hypervisor

Hypervisor

Physical Host

Physical Host

Internet

**vm**ware®
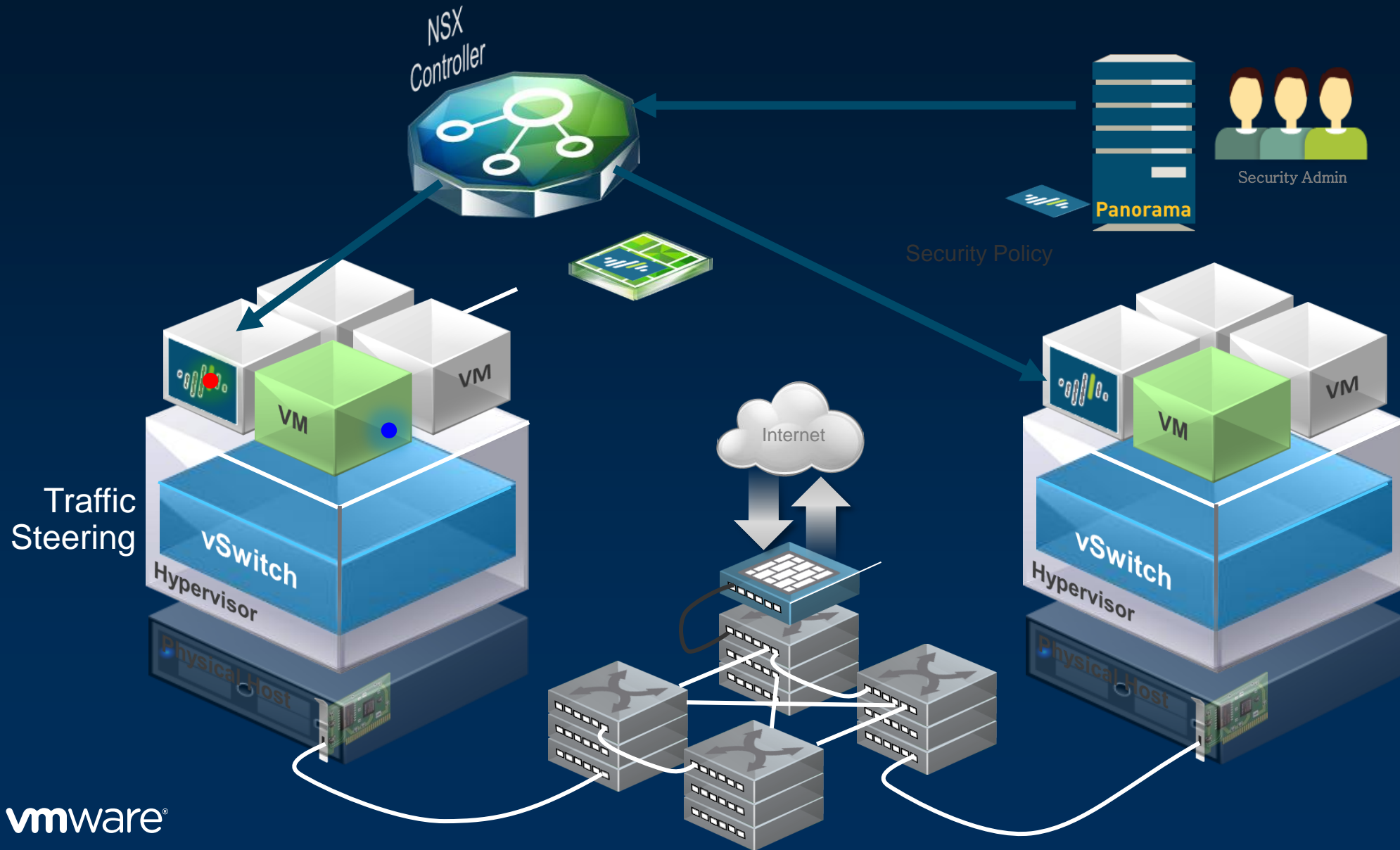
# Software Defined Data Center Deployed



All Software Construct

L3 Subnet

L3 Subnet

L3 Subnet

VM

VM

VM

VM

NAT

Internet

Physical Network
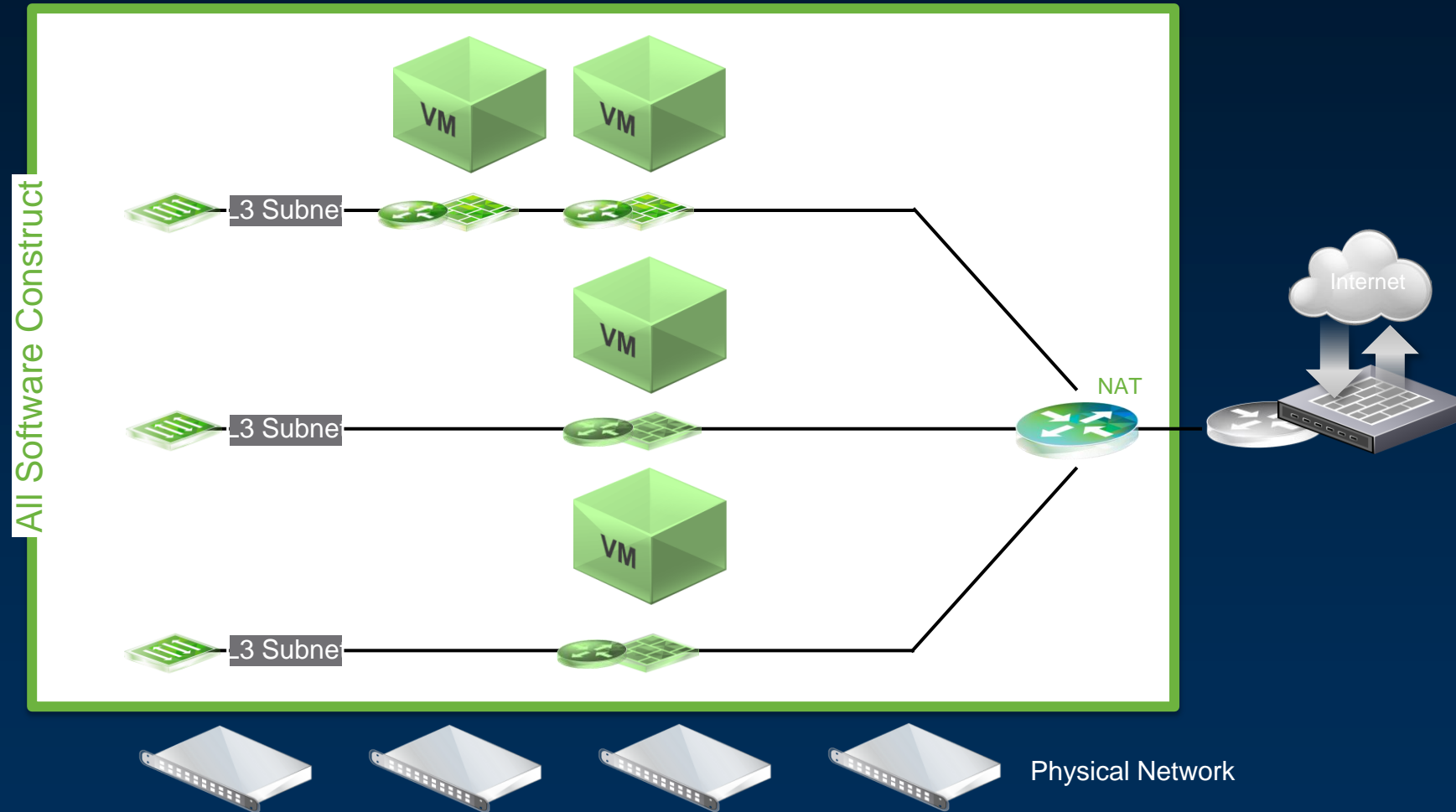
vmware®

# Use case 3: VDI

**Traditional Data Center**

**NSX Data Center**

| | | | |
|---|---|---|---|
| Eng | ➔ | Web 1 | |
| Eng | ➔ | App 1 | |
| Eng | ➔ | Web 2 | |
| Eng | ➔ | App 2 | |
| Ext1 | ➔ | Web 1 | |
| Ext1 | ➔ | App 1 | |
| Ext2 | ➔ | Web 2 | |
| Ext2 | ➔ | App 2 | |
| | | ... | |

| | | | |
|---|---|---|---|
| Eng | ➔ | Eng net | |
| "External 1*" | ➔ | Web 1 | |
| "External 2*" | ➔ | Web 2 | |

**APP1**

VM Web 1   VM App 1

**APP2**

VM Web 2   VM App 2

**APP1**

Web 1   App 1

**APP2**

Web 2   App 2

**VLANs**

| |
|---|
| Engineering |
| External Contractor 1 |
| External Contractor 2 |

Engineering

External Contractor 1

External Contractor 2

Engineering

External Contractor 1

External Contractor 2
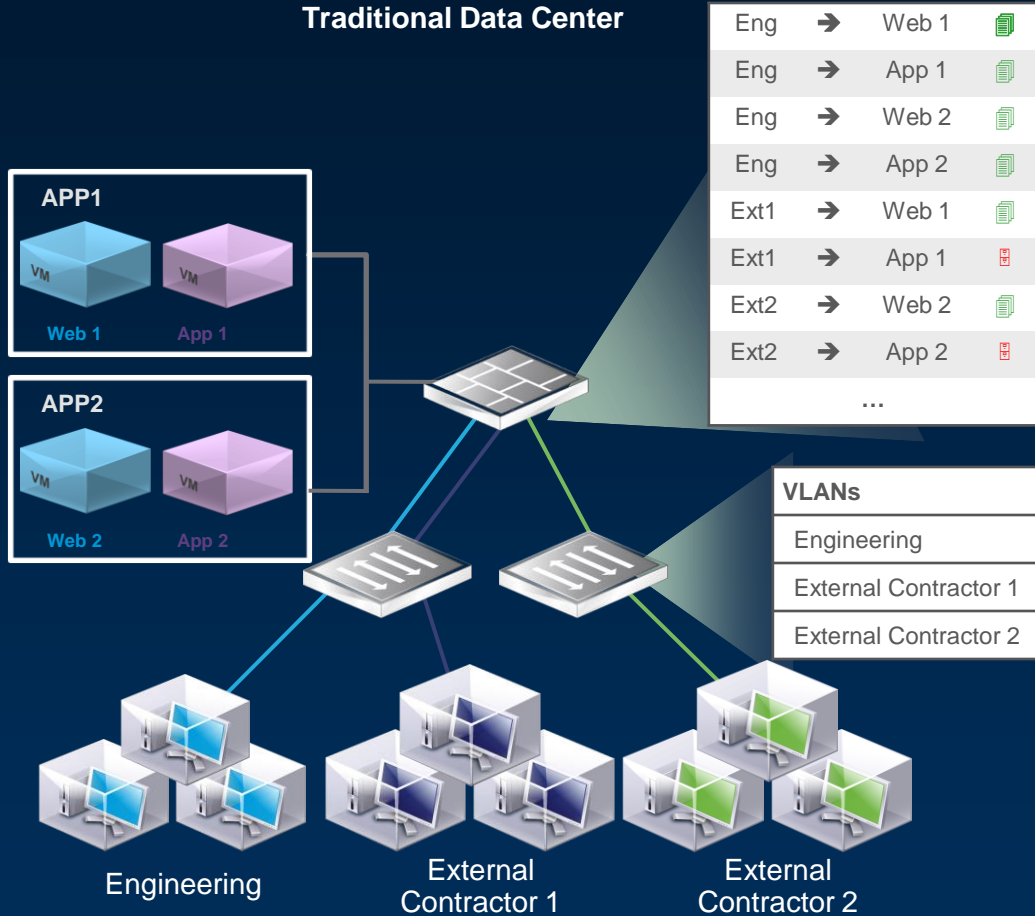
## Simplify VDI deployments

- Eliminate complex policy sets and topologies for different VDI users
- Align policies to logical grouping
- Decouple network topology from VDI security

**vm**ware®

33

# VMware NSX Momentum: Customers
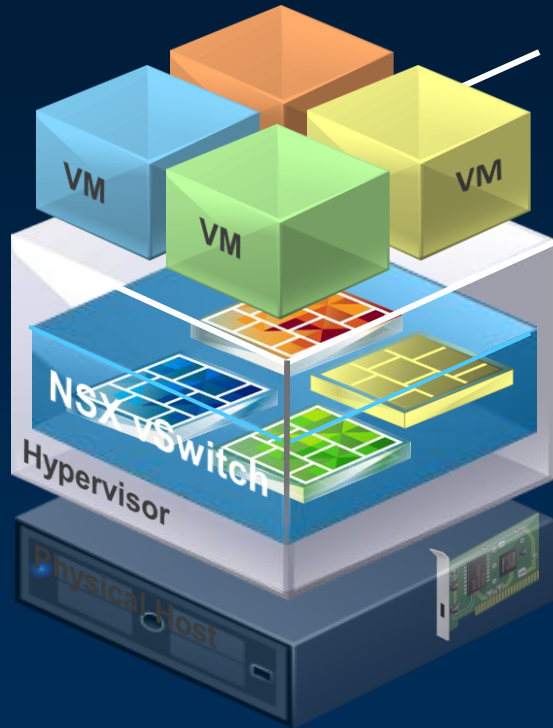
## 4 of 5
**top investment banks**

## Over 400 Customers
**Leading enterprises & service providers**

# Networking is a Software Industry



**Software Defined Networking is here Today!**

Use cases are driving adoption:
- Security + Micro-Segmentation
- IT Automation
- Disaster Recovery
- IaaS