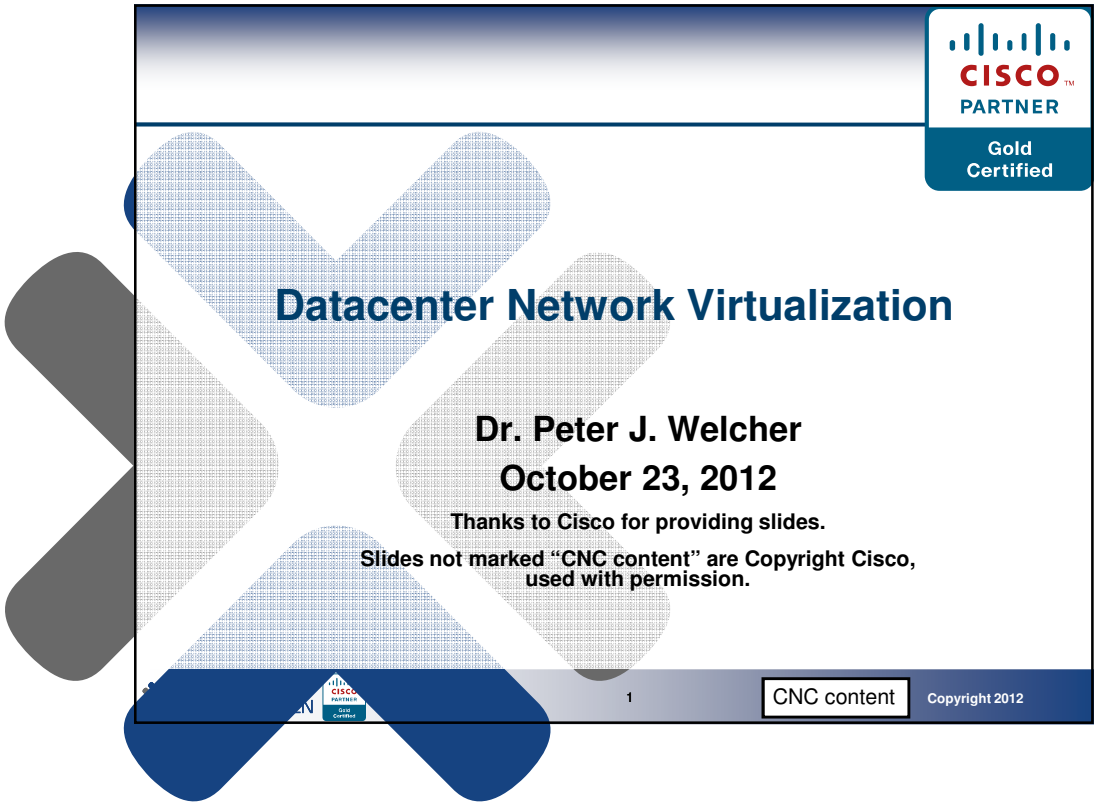


About the Speaker

- Dr. Pete Welcher
  - Cisco CCIE #1773, CCSI #94014, CCIP, CCDP
  - Specialties: Large datacenter and network design and assessment, IP multicast, QoS, MPLS, Large-Scale Routing & Switching, High Availability, Management of Networks and Applications
  - Customers include large enterprises and hospitals, federal agencies, universities, large banks and financial organizations, large web service provider
  - Taught many of the Cisco courses over the years, now teaching Nexus class about once a month
  - Reviewer for many Cisco Press books, book proposals; designed and reviewed 2.0 revisions to the Cisco DESGN and ARCH courseware; tech reviewer for 2.1 version of ARCH book
  - Presented lab session on MPLS VPN Configuration at CPN 2003-2004, and Networkers 2005-2007; presented BGP lab session at Cisco Live 2008-2010; presented lab sessions on Nexus in 2011-2012
- Over 170 articles plus 50+ recent blogs at http://www.netcraftsmen.net/welcher

Cool New Stuff!

- Cisco Nexus 3000 series can provide wire-rate L2/L3 for e.g. border L3 switches outside firewalls (vs. 3750 less than wire rate)
- New Cisco Nexus 3548
  - 48 L2/L3 wire rate 1/10 Gbps ports
  - 250 ns latency (Algo Boost)
  - 190 ns Warp mode
  - 50 ns Warp SPAN

New 1000v Licensing!

- Essential Edition free (SmartNet*)
  - Layer 2 switching, VLANs, PVLANs, VXLAN, loop prevention, Ipmc, vPC, LACP, ACLs
  - Management features: SPAN, ERSPAN, NetFlow 9, vTracker, vCenter Server plug-in
  - Enhanced QoS
  - Cisco vPath
- Advanced Edition
  - Security: DHCP snooping, IP source guard, Dynamic ARP inspection, TrustSec, SGACL support
  - VSG
- Separate products: ASA 1000v, vWAAS, etc.

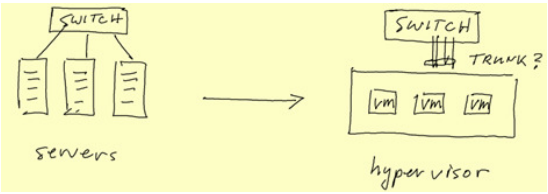
Today's Objective

- Discuss new virtual capabilities for the datacenter
  - Look at capabilities not details
  - Look at directions: where is this technology heading?
  - Look at what that might mean for us (positive or negative)
  - Understand design and control implications
- How do virtual appliances change the game?
  - Simplification
  - New capabilities
  - Mobility
  - Scale up versus out
- We'll start with components, then the bigger picture

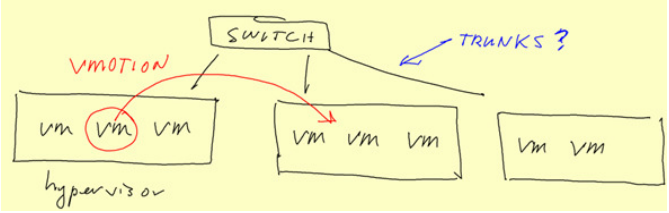
Agenda

- Server virtualization and Cisco 1000v
- Virtual Security: VSG, VNMC, vASA
- Other Virtual Appliances
- CSR 1000v Virtual Router
- VXLAN
- vPath 2.0
- Virtualization Design
- Automation
- Summary

Virtual Machines Change Things!



Server to VM to cabling ratio improving: cabling isn't cheap



New operational challenges with what is running, where

Some Questions

- **How many are experiencing operational issues around this sort of thing?**
- **What are some of the biggest problems?**
- **Other issues?**

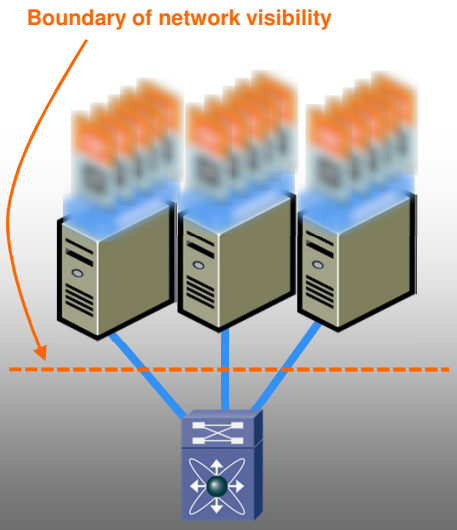
Possible Issues

- Control and visibility into:
  - Which physical ports a VM uses
  - VLAN creation
  - "Just give me trunk ports"
  - Teaming: which of 7+ flavors?
  - (NIC / driver validation?)
- How do we troubleshoot "the network" when it is virtual, running inside a set of hypervisor hosts?

Where the Network Meets the Server

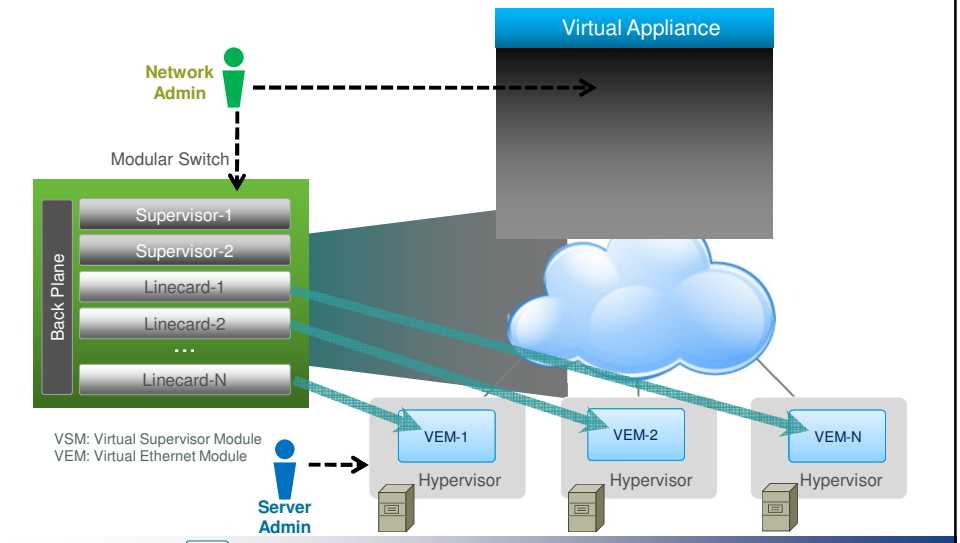
- Blade chassis with HP VirtualConnect/FlexConnect
- Hypervisors and VMs and simple virtual switches
- Generic (v)switch: how much functionality is enough?
  - Server side: all I need is VLANs (VMware port groups)
  - Network: BPDU Guard, STP controls, ACLs, VACLs, QoS, SPAN, NetFlow, …

Server virtualization creates a demand for VM-level visibility

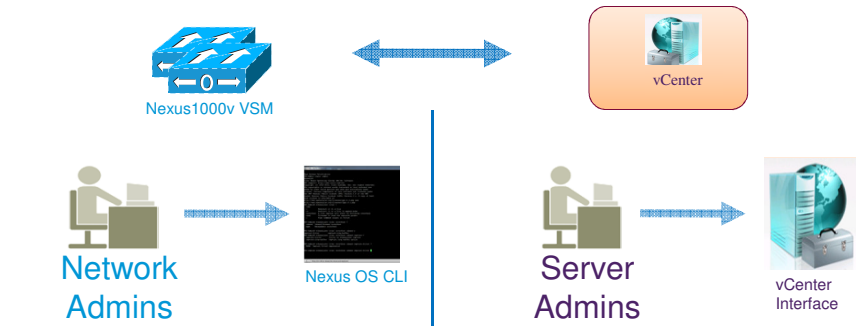


- Lack of visibility into network behavior at the VM level
- Lack of visibility into cross-VM interactions
- Need for operational consistency and continuity across physical and virtual network

Technologies Virtual Switching Nexus 1000 Architecture



Operational Segregation



Create or Update port-profiles

Install hypervisor on hosts with N1KV VEM
Create VM and assign Port profiles to VM

No hand-off required between Server and Network Admins for Virtualized environment

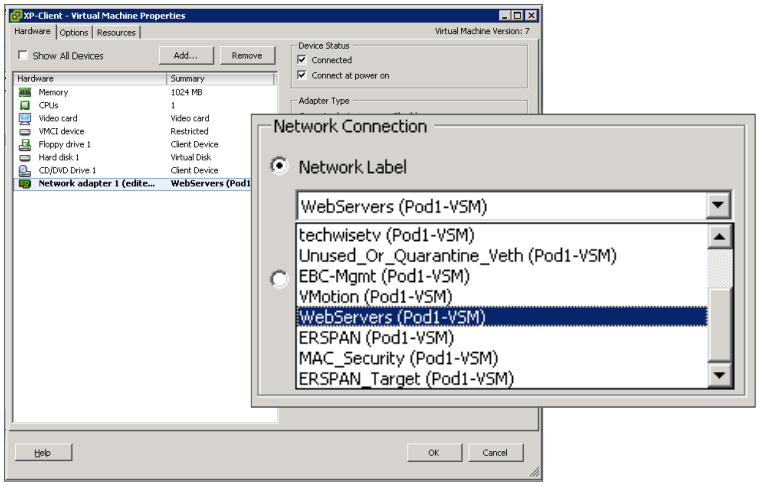
1000v Port Profile Configuration

```
n1000v# show port-profile name WebProfile
port-profile WebServers
  description:
  status: enabled
  capability uplink: no
  system vlans:
  port-group: WebServers
  config attributes:
    switchport mode access
    switchport access vlan 110
    no shutdown
  evaluated config attributes:
    switchport mode access
    switchport access vlan 110
    no shutdown
  assigned interfaces:
    Veth10
```

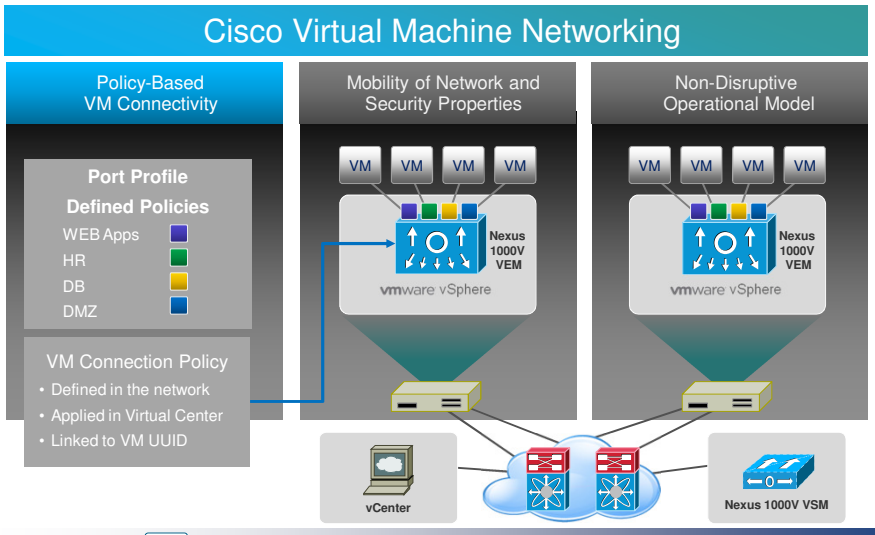
Supported:

- ✓ Port management
- ✓ VLAN
- ✓ PVLAN
- ✓ Port-Channel
- ✓ ACL
- ✓ Netflow
- ✓ Port security
- ✓ QoS
- ✓ Other commands

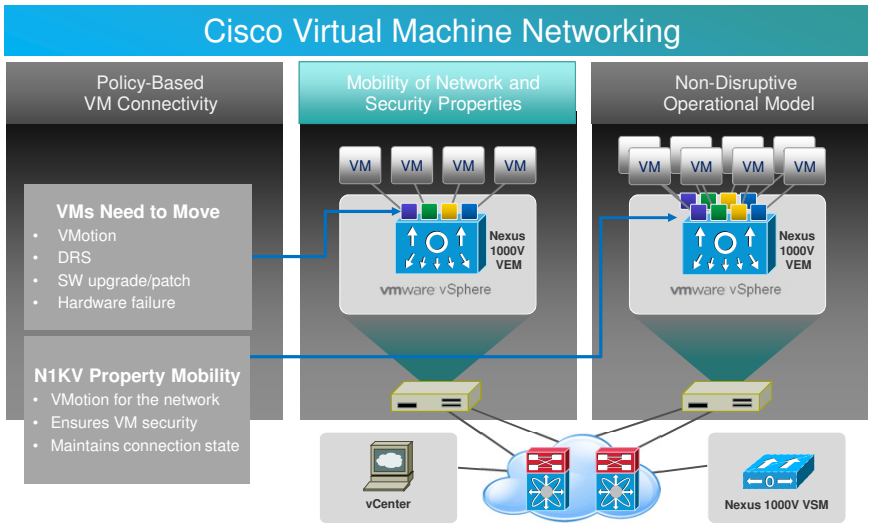
Port Groups: VI Admin View



Cisco Nexus 1000V
Faster VM Deployment



Cisco Nexus 1000V
Richer Network Services



Advanced Features of the Nexus 1000V

Switching	• L2 Switching, 802.1Q Tagging, VLAN Segmentation, Rate Limiting (TX) • IGMP Snooping, QoS Marking (COS & DSCP), Class-based WFQ
Security	• Policy Mobility, Private VLANs w/ local PVLAN Enforcement • Access Control Lists (L2–4 w/ Redirect), Port Security • Dynamic ARP inspection, IP Source Guard, DHCP Snooping
Network Services	• Virtual Services Datapath (vPath) support for traffic steering & fast-path off-load [leveraged by Virtual Security Gateway (VSG) and vWAAS]
Provisioning	• Automated vSwitch Config, Port Profiles, Virtual Center Integration • Optimized NIC Teaming with Virtual Port Channel – Host Mode
Visibility	• VMotion Tracking, NetFlow v.9 w/ NDE, CDP v.2 • VM-Level Interface Statistics • SPAN & ERSPAN (policy-based)
Management	• Virtual Center VM Provisioning, Cisco Network Provisioning, CiscoWorks • Cisco CLI, Radius, TACACs, Syslog, SNMP (v.1, 2, 3) • Hitless upgrade, SW Installer

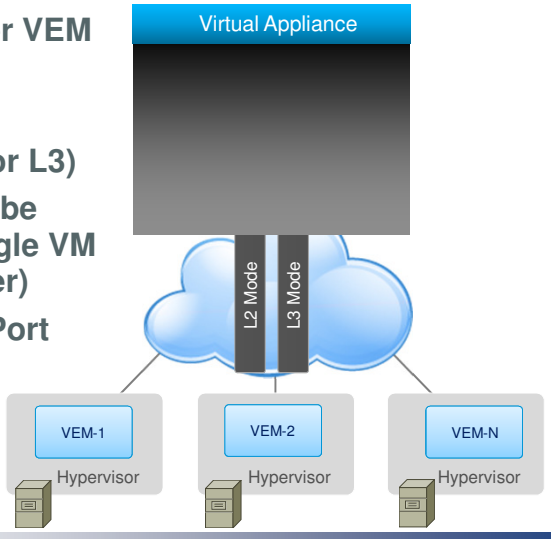
IPv6 Support: As a Layer-2 switch, Nexus 1000V supports forwarding of IPv6 packets as well as Layer-2 features such as PVLAN and Port Security. Also, management interface can be assigned an IPv6 address.

1000v and Hypervisors

- VMware: long-established support by 1000v
- Microsoft Hyper-V: recent announcements
- Citrix CloudPlatform CloudStack supports 1000v
- ~~Reportedly coming:~~Announced at CiscoLive Barcelona, ~ 1-2 weeks ago:
  - Citrix XenServer support
  - KVM
  - ~~** If politics and marketing don't intrude?~~

Technologies Virtual Switching Nexus 1000 Scale

- 200+ vEth ports per VEM
- 2K vEths per N1K
- 64 VEMs per N1K (connected by L2 or L3)
- Multiple N1Ks can be created (under single VM management center)
- Policy applied by Port Profile

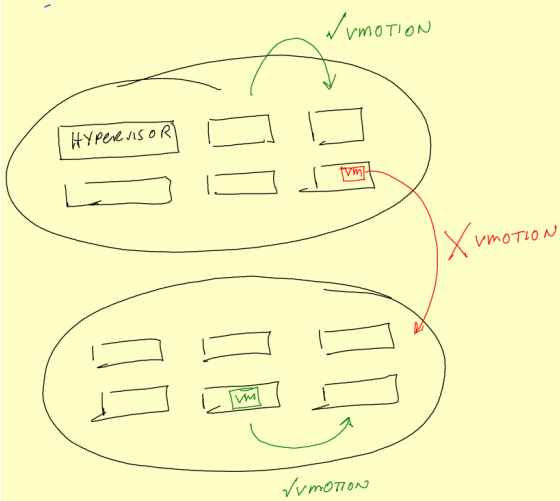


VSM: Virtual Supervisor Module
VEM: Virtual Ethernet Module
vEth: Virtual Ethernet port

Scaling 1000v

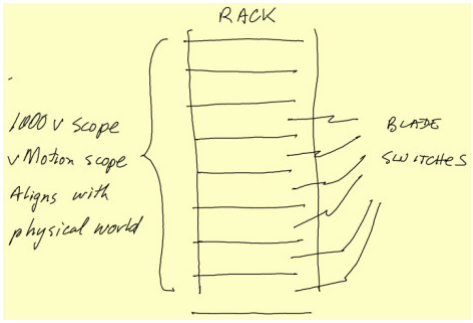
- 1000v per vCenter:
  - 12 when using vCloud Director
  - 32 Nexus 1000v when not using vCloud Director
- UCS: up to 8 servers per 6 RU
  - Say 6 per rack = 48 in a rack
  - Each 1000v can cover 1.25 racks
  - 32 x 1000v covers 40 racks! Or 32 if you do 1 rack per 1000v.
- About the 1000v scaling limits
  - Appears tied to a previous vSphere vDS limit, the present vDS limit in 5.1 is 128
  - vSphere 5.1 vDS ports max per vCenter is 60,000 …
  - Will 1000v limits be increased?

Scaling, Predictability, and 1000v



- Which range of hypervisor hosts can a VM do vMotion between?
- 1000v vDS provides an implicit grouping of hosts for vMotion
- What's good for server deployment, vs. operational management?

vMotion Scope



- Needed for vMotion:
  - Consistent portgroup definitions
  - vDS provides that
  - 1000v provides that
  - 1000v lets you participate in defining the boundaries
- Conclusion: natural boundary for vMotion
  - Unless server team likes winging it?

More Questions

- What is your organization's strategy about VM to physical server / network coordination?
- Do you have a standard for vDS deployment?
- Do you discuss / design with server team:
  - When to create new VLANs
  - What they're for
  - (Coming topic) VLANs coordinating with FW and SLB/ADC? (Firewall, Server Load Balancer)
- Pros / cons of 1000v from your Point of View?

Agenda

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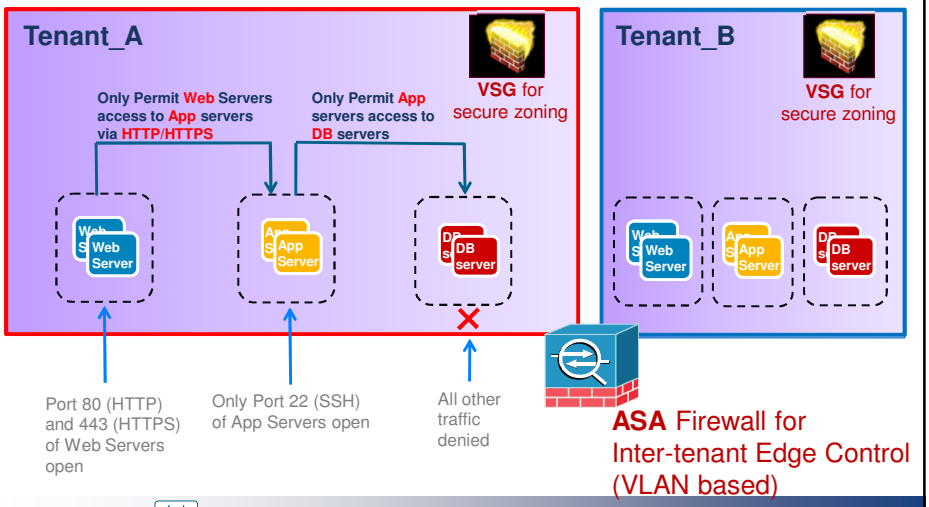
CNC content

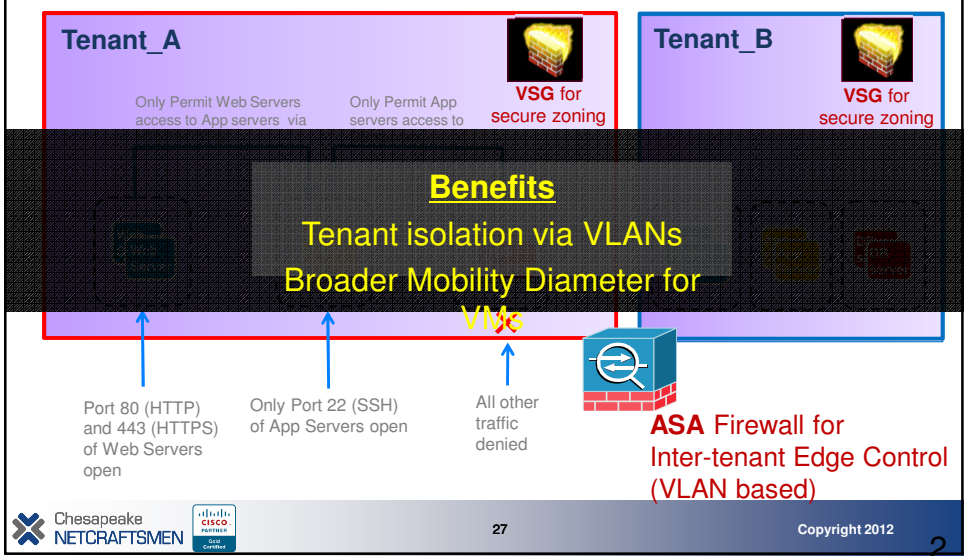
Use Case – Secure Multi-tenancy

Secure zoning of 3-Tier Application Workload

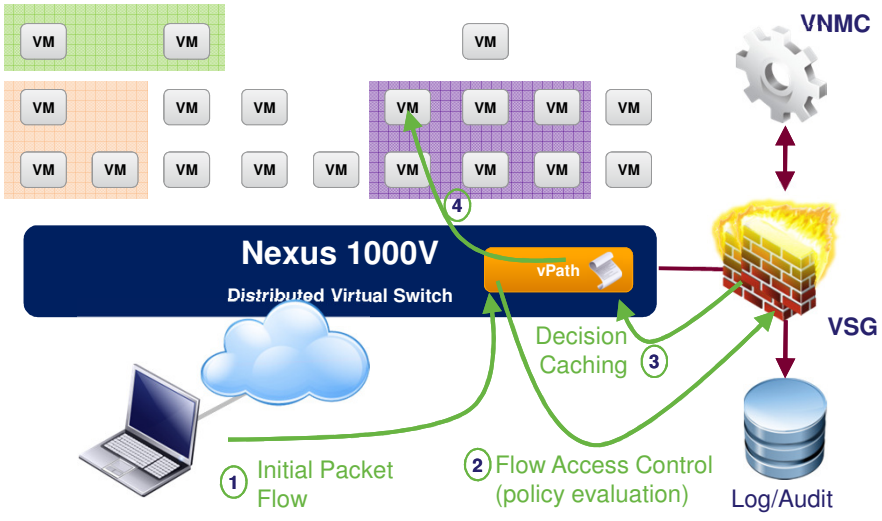


Use Case – Secure Multi-tenancy

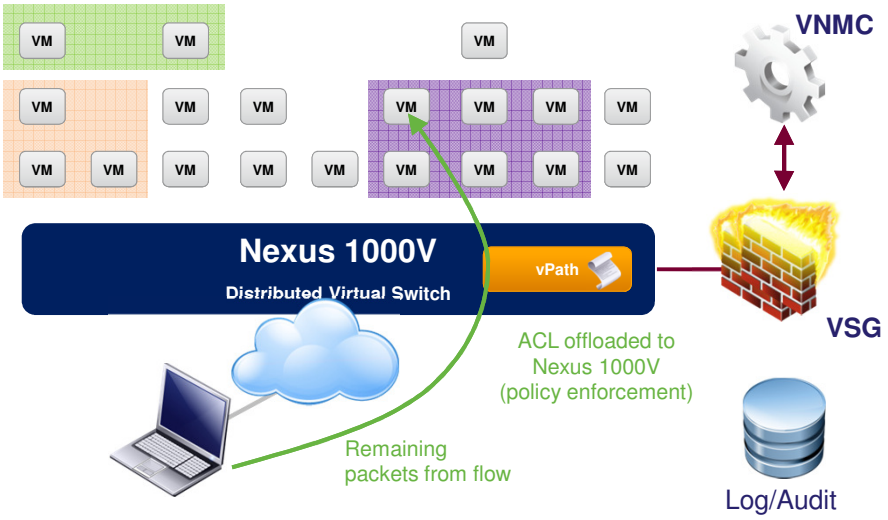
Secure zoning of 3-Tier Application Workload



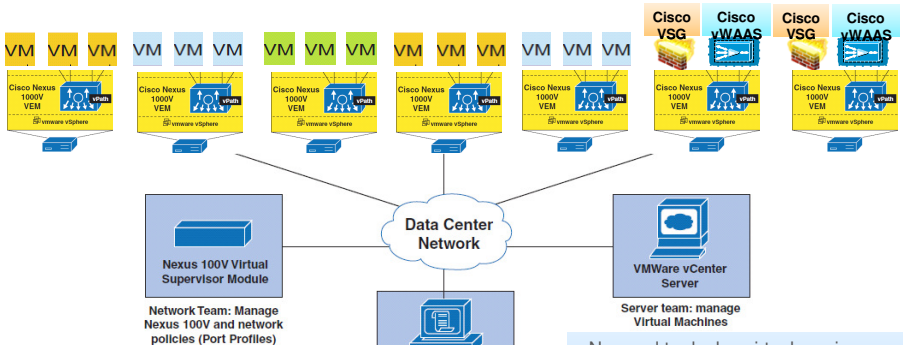
VSG: Performance Acceleration with vPath



VSG: Performance Acceleration with vPath – 2

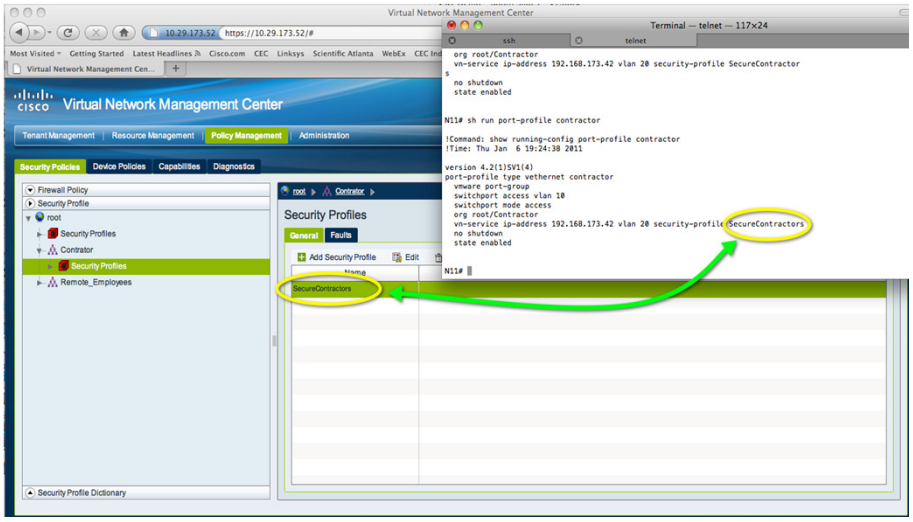


Decoupled Deployment of Virtual Services



- No need to deploy virtual services on every host
- Plan CPU capacity independently across application workloads & virtual services
- Simpler to deploy with multiple operations teams (server, network, security, etc.)

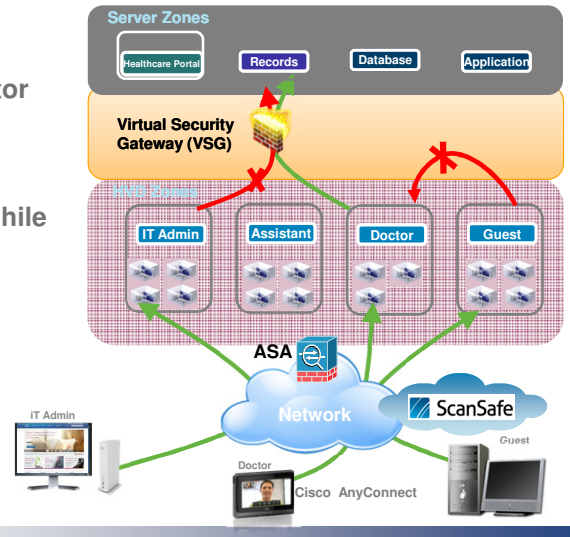
Binding VSG Security Profile with 1000V Port-Profile



Use Case: Securing VDI with Cisco VSG

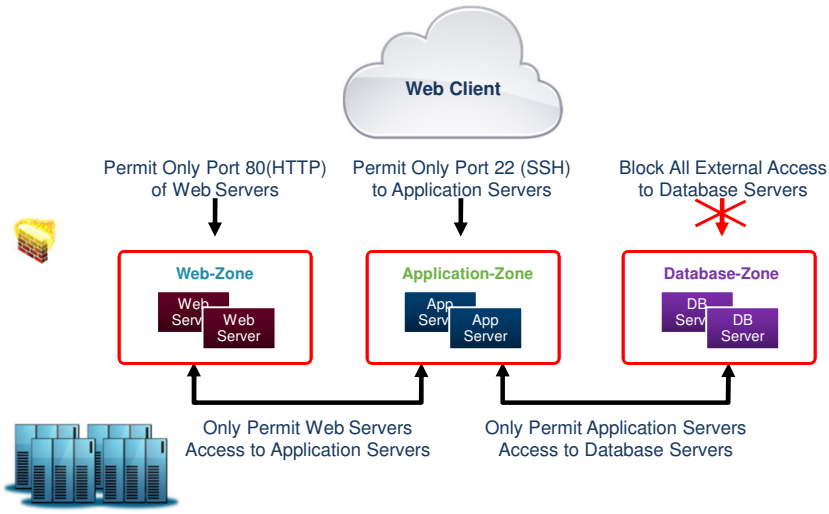
- Persistent virtual workspace for the doctor
- Flexible workspace for Doctor's assistant
- Maintain compliance while supporting IT consumerization

Leverage VM context (e.g. VM-name) to create VSG security policies



Reference Architecture: Cisco VXI Reference Architecture

Use Case 2: Securing a 3-tier Application Infrastructure

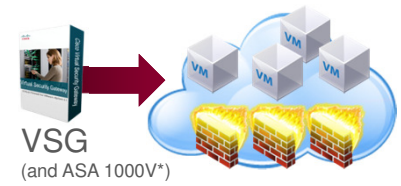


Cisco Virtual Security Products

Zone based intra-tenant segmentation of VMs

External / multi-tenant edge deployment

Defense in Depth Security Model



VSG
(and ASA 1000V*)

Virtual Security

- Policy applied to VM zones
- Dynamic, scale-out operation
- VM context based controls

FWSM
ASA-SM

ASA 55xx

Internal Security

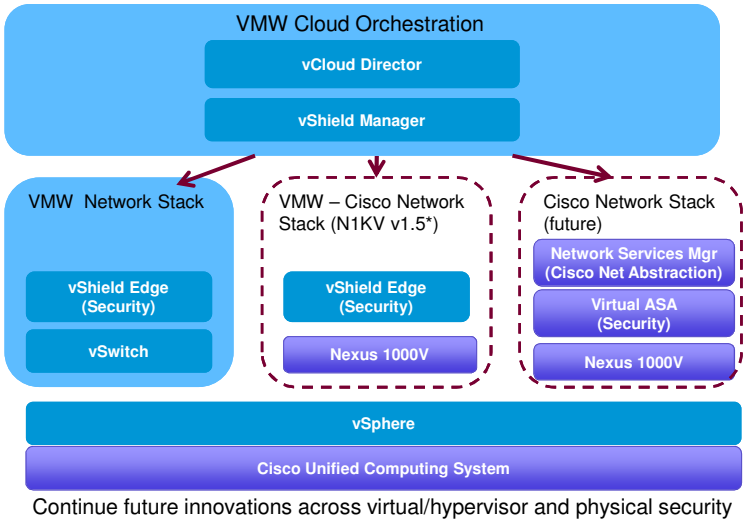
- Segment internal network
- Policy applied to VLANs
- Application protocol inspection
- Virtual Contexts

ASA 55xx

Internet Edge

- Filter external traffic
- Extensive app protocol support
- VPN access, Threat mitigation

vCD Technology Integration Roadmap



Continue future innovations across virtual/hypervisor and physical security

Agenda

- Server virtualization and Cisco 1000v
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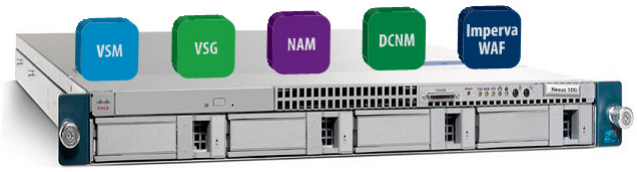
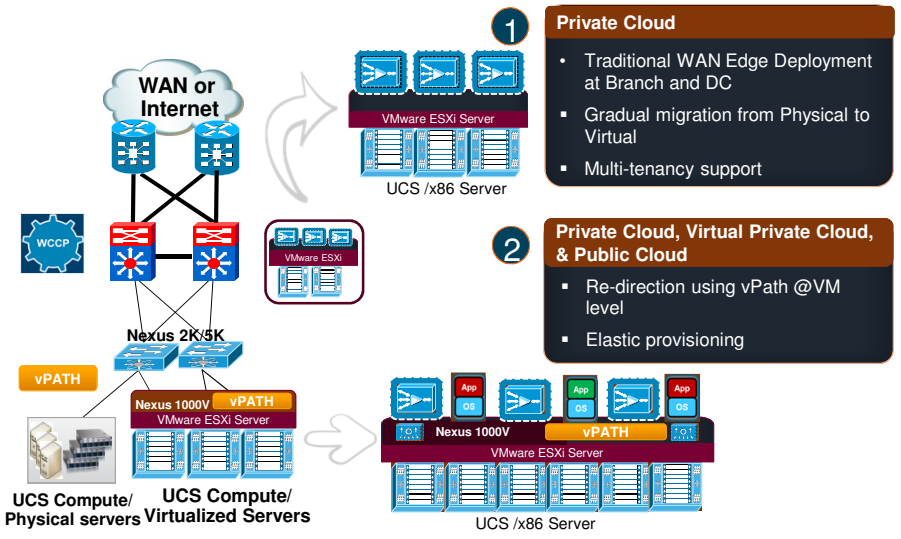
Imperva Web Application Firewall

- Imperva has a PCI 6.6 supporting Web Application Firewall. It is being ported to run as a Virtual Service Node on the Cisco 1010 / 1100
  - http://www.imperva.com/docs/SB_Imperva_Cisco.pdf



Cisco vWAAS Provides Flexible Cloud Deployment Options



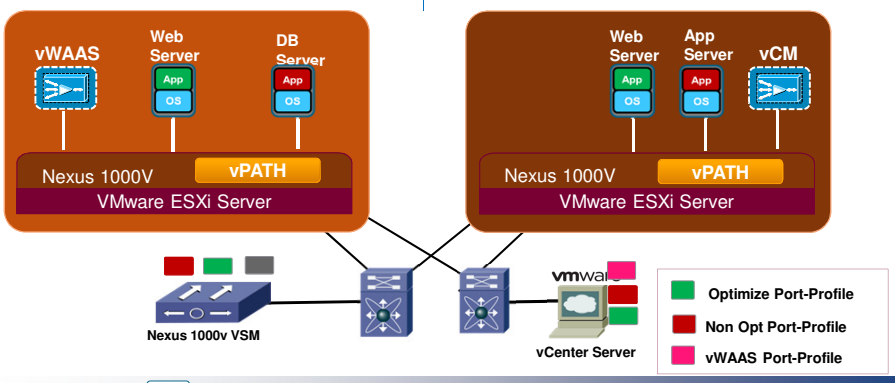
vWAAS Policy Based Configuration in N1000V

Feature

1. Optimization based on the port-profile policy configured in Nexus 1000V
2. Policy gets propagated to vCenter automatically

Benefit

1. Provide on-demand service orchestration in the cloud without network disruption



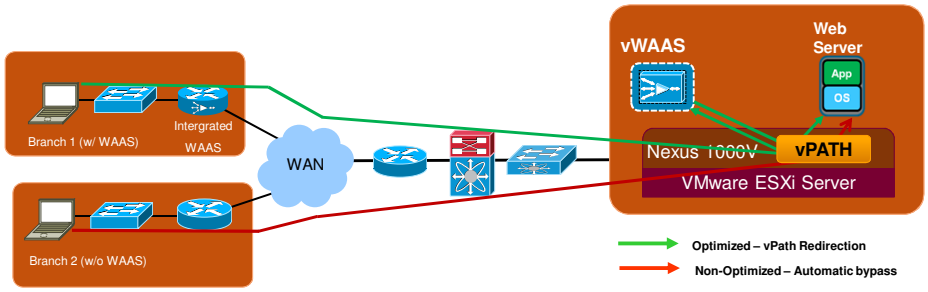
vWAAS – Optimized Performance with vPath

Feature

1. vWAAS sends "offload" to vPATH for non-intresting traffic (inter-server traffic or no-peer traffic)
2. vPATH provide automatic bypass of these traffic

Benefit

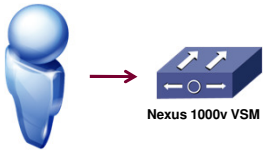
1. High scale with automatic application or port-profile based traffic filtering



vWAAS – Application based interception

Port-Profile ⟷ Port-group

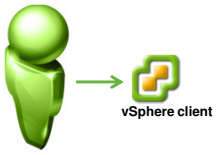
Network Admin view

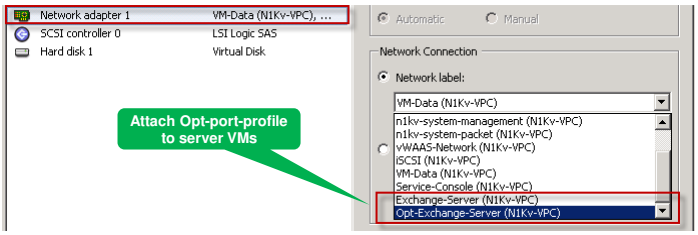



```
port-profile type vethernet Opt-Exchange-Server
  vmware port-group
  switchport mode access
  switchport access vlan 3185
  vn-service ip-address 2.8.2.90 vlan 3002 mgmt-ip-address 2.8.2.90 fail open
  no shutdown
  state enabled
```

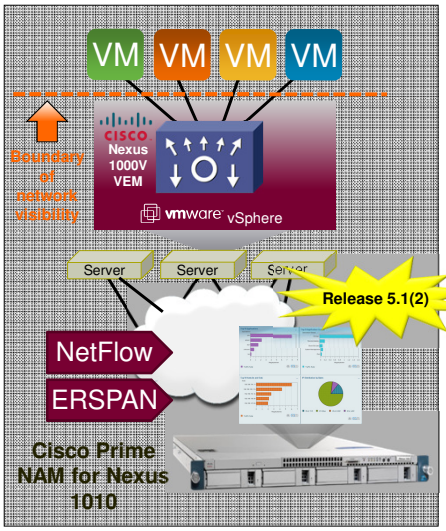
vPATH interception

Server Admin view





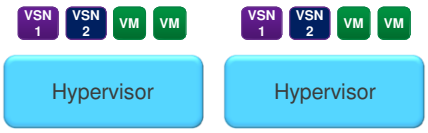
Cisco Prime NAM for Nexus 1010
Extends Visibility into Virtual Machine (VM) Network



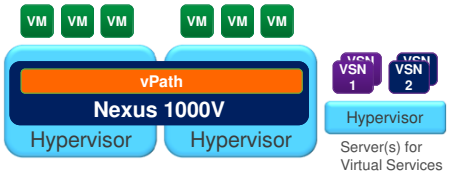
- Profile VM Network Traffic
- Analyze Application Reponses Time
- Examine Virtual Interface Statistics
- Assess impact on network behavior due to changes such as VM migration, port profile update, etc.
- Watch VMs while they migrate with VMotion

Virtual Services Options

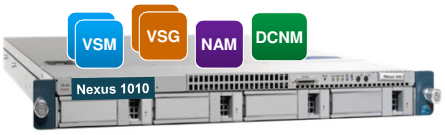
- **Stand-alone VSN**
  - Can be deployed with any virtual switch
  - Example: vWAAS



- **N1KV vPath integrated VSN**
  - Integrates with N1KV port profile and virtual service datapath (vPath)
  - Example: vWAAS, VSG, ASA 1000V



- **VSN hosted on Nexus 1010 appliance**
  - VSN can be stand-alone or vPath integrated. Examples: VSG, NAM



VSN: Virtual Service Node

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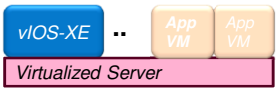
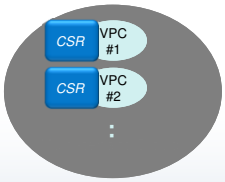
CNC content

What is CSR1000v?

Virtualized IOS-XE Features for the Cloud



Primarily intended for VPC (Virtual Private Cloud) deployment



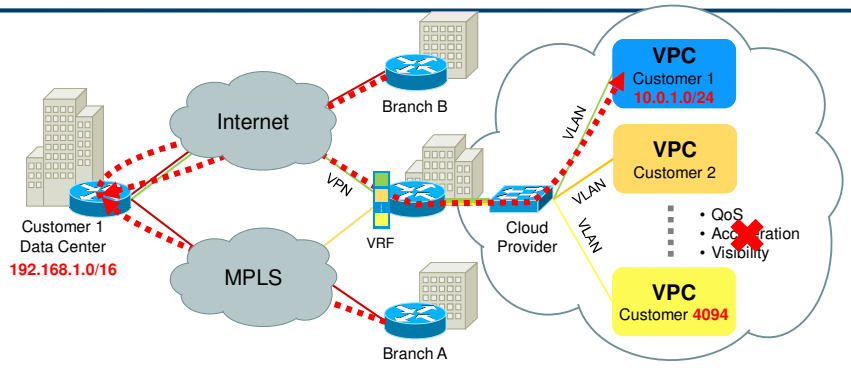
Target Customers are Cloud Providers and Enterprises

Enterprises: Network Extension to Cloud
Cloud Providers: Networking as a Service

General Availability: March 2013 (IOS-XE 3.9)

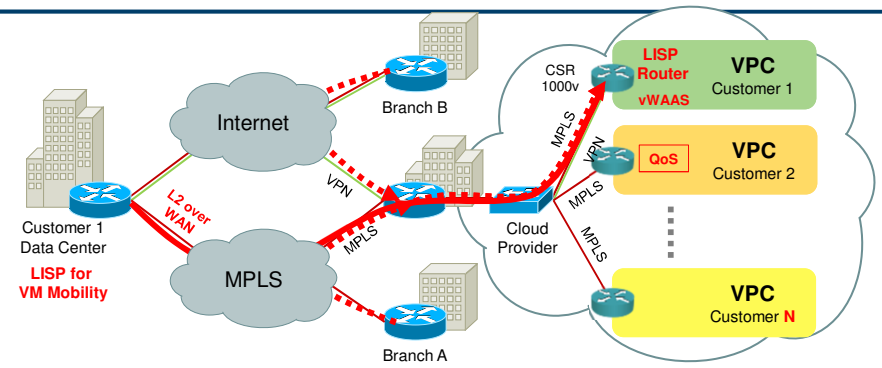
Pre-GA Release #1: May 2012 (IOS-XE 3.7)
Pre-GA Release #2: July 2012 (IOS-XE 3.8)

Virtual Private Cloud Challenges



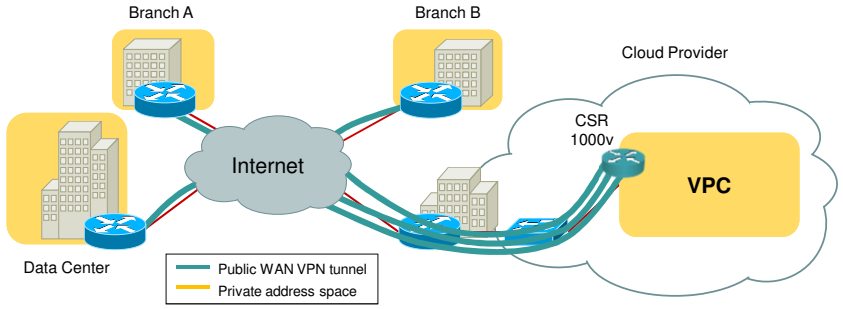
- Point-to-Point tunnel between DC and VPC adds network latency
- Terminating WAN at Cloud Provider's edge limits VPC scalability
- Disjoint local networks complicate application on-boarding to VPC
- Lack of traffic control in VPC restricts use of networking services

Cisco CSR1000v



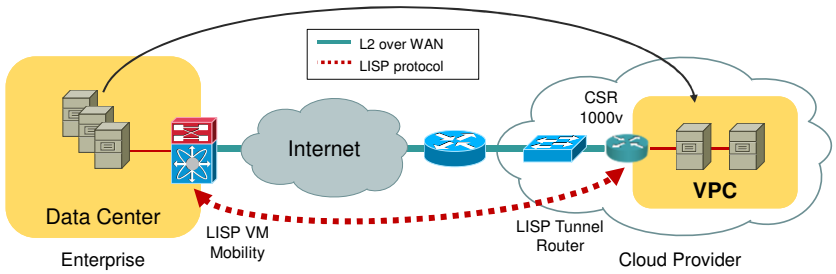
- Direct VPN connectivity to VPC reduces network latency
- Termination of MPLS at VPC eliminates dependence on VLANs
- Extending DC network to VPC simplifies application deployment
- Traffic control at VPC edge enables support of network services

VPN Gateway for VPC



- **Enterprise VPNs**
  - **S2S (IPSec) VPN**
  - **DMVPN**
  - **EZVPN**
  - **FlexVPN**
  - **SSLVPN (future)**
- **Routing**
  - **Static**
  - **EIGRP**
  - **OSPF**
  - **BGP**
- **Addressing**
  - **NAT/PAT**
  - **DHCP**
- **Firewall & ACLs**
- **AAA**
- **Apply services via CSR**

Extend DC Network to VPC



- **L2 connectivity and L3 address mobility between DC and VPC**
- **Transparent on-boarding of existing business applications to VPC**
  - L2 over WAN
  - EoMPLS over GRE
  - Addressing
    - NAT/PAT
    - VRF-Lite
  - Transport Services
    - LISP for VM Mobility
    - Multicast

Agenda

- Server virtualization and Cisco 1000v
- Virtual Security: VSG, VNMC, vASA
- Other Virtual Appliances
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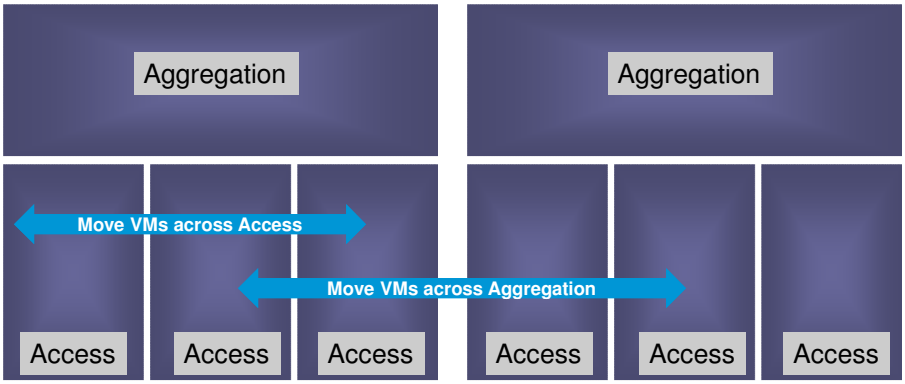
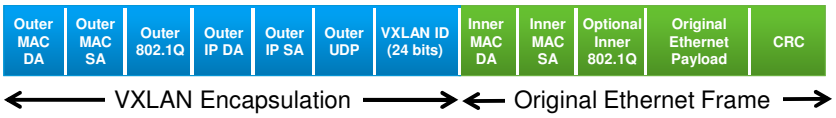
Moving Virtual Apps within DC



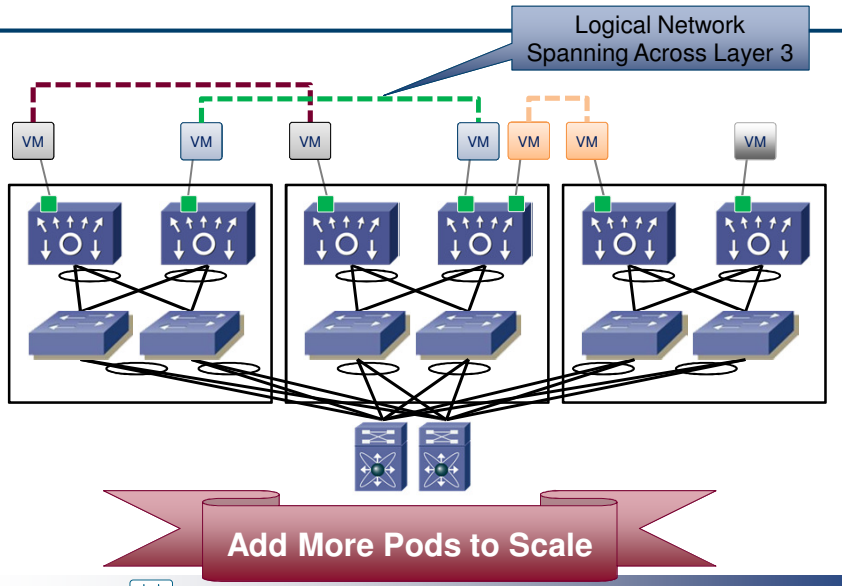
- **Horizontal scaling of infrastructure**
  Deploy PODs without worrying about VM scale per POD
- **Network services must continue to be applied**

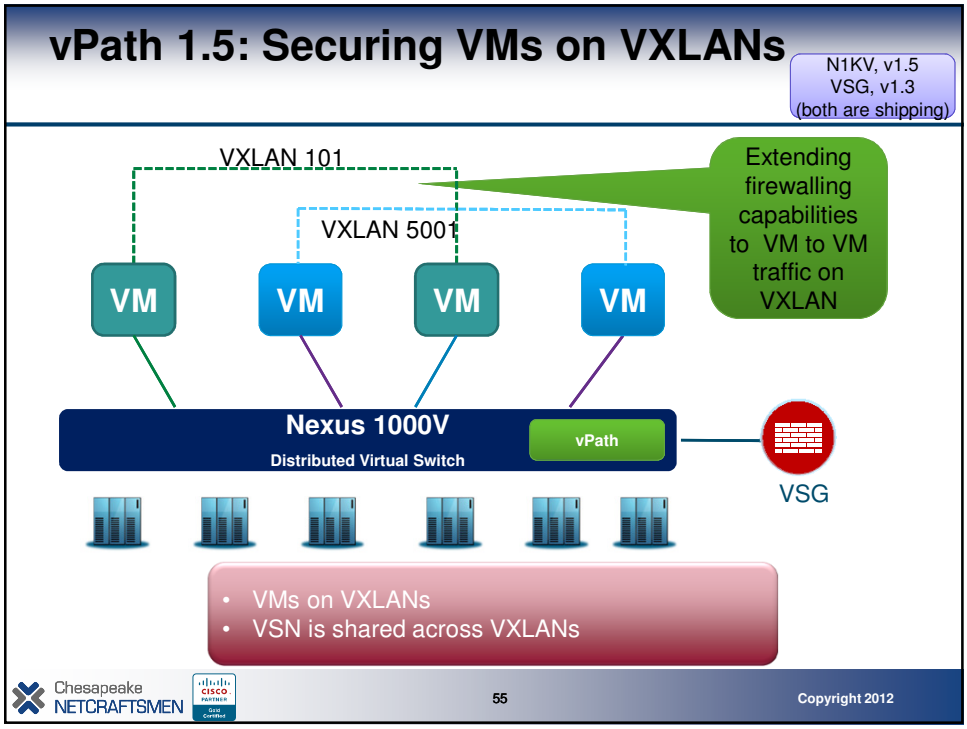
Virtual Extensible Local Area Network (VXLAN)

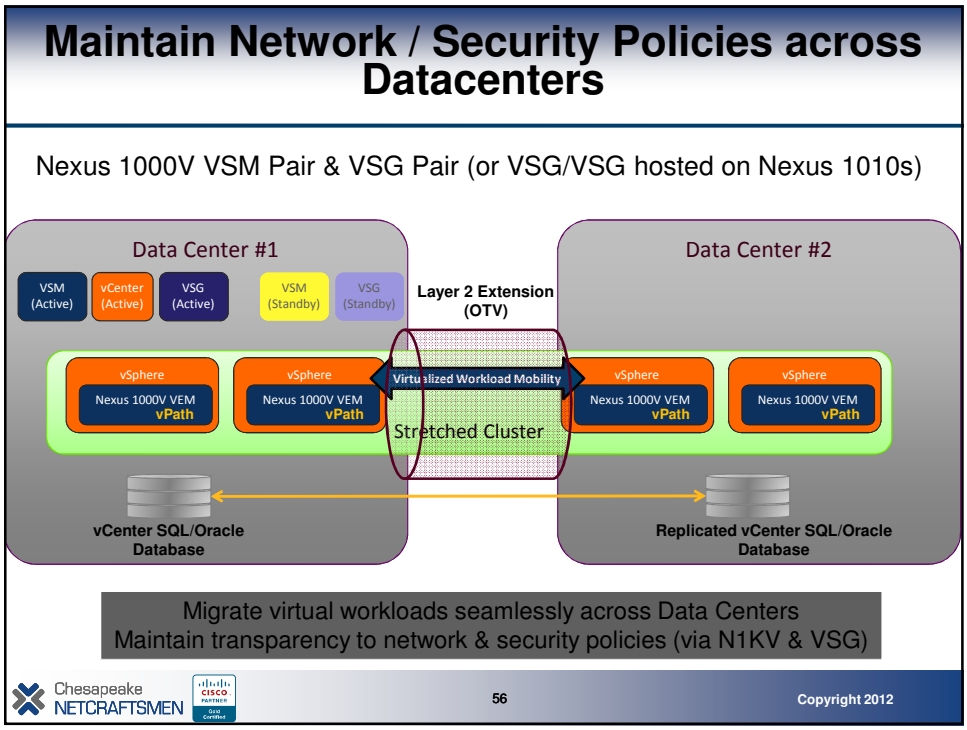
- Tunnel between Virtual Ethernet Modules (VEM)
  - VMs do NOT see VXLAN ID
- IP multicast used for L2 broadcast/multicast, unknown unicast
- Technology submitted to IETF for standardization
  - With VMware, Citrix, Red Hat and Others
- Ethernet in IP overlay network
  - Entire L2 frame encapsulated in UDP
  - 50 bytes of overhead
- Include 24 bit VXLAN Identifier
  - 16 M logical networks
  - Mapped into local bridge domains
- VXLAN can cross Layer 3



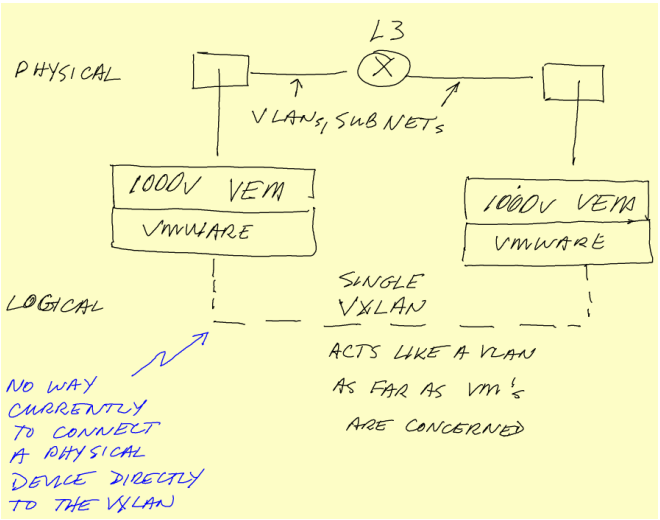
Scalable Pods with VXLAN







VXLAN Gateway



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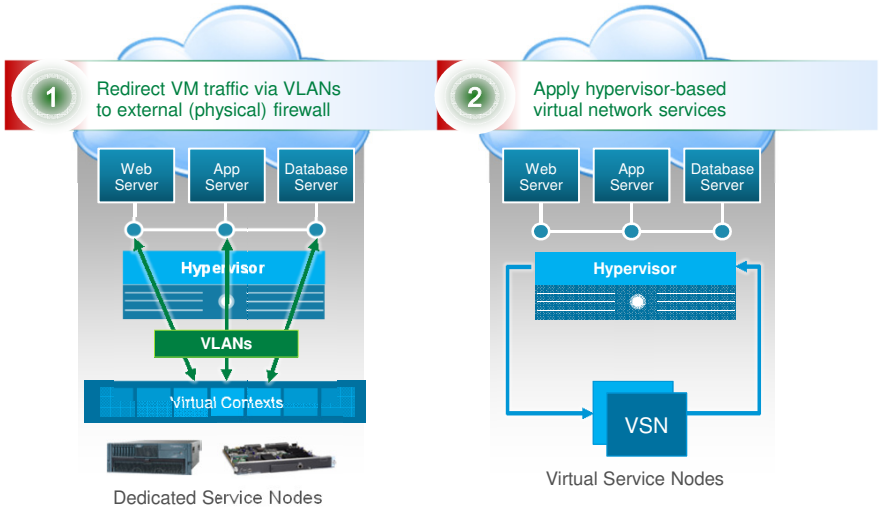
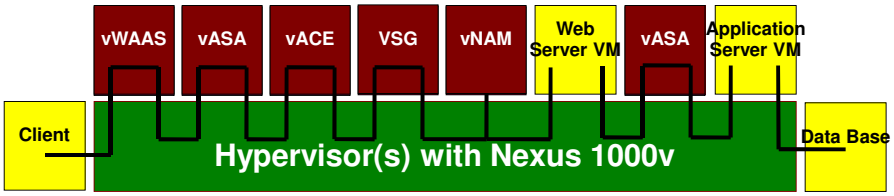
A Perception about SDN

- A lot of the popular discussion in general has had a Server and VM fixation (focus) to date
  - OpenFlow, SDN, and "dumb switches"?
  - Automating only part of the process
  - L3, L4, L7? Value add by the control (policy) software?
  - Services? Security, Load Balancing, …
- Cisco is looking further out…
  - Many virtualized appliances already available
  - How do you make it easier to use them?
  - Others may be doing so, less visible (to me)
- Multi-tenant can be zones w/in enterprise datacenter

Network Services for Virtualized/Cloud DC



Technologies Virtual Switching Virtual Network Service Data Path (vPath)



- All virtualized services are Off Path
- vPath 1.0
  - Redirecting to a single service
  - Fastpath
- vPath 2.0 supports
  - Chaining multiple services
  - Stateful return path
  - Clustering for scale
- Consider server overhead to redirect flows to multiple SNs

Deploy vASA and VSG Service Chaining

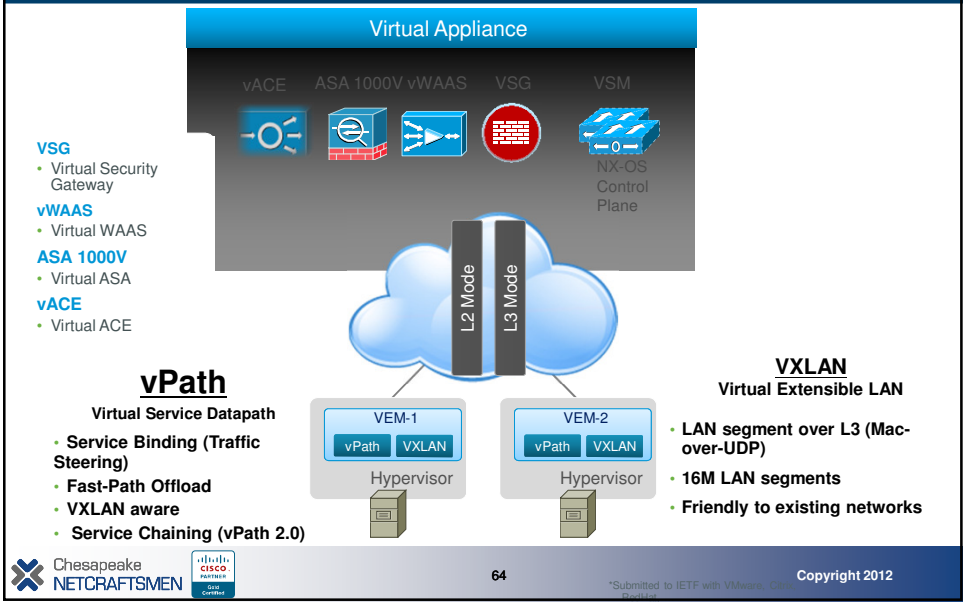
- vservice node ASA1 type asa
  - ip address 172.31.2.11
  - adjacency l2 vlan 3770
- vservice node VSG1 type vsg
  - ip address 10.10.11.202
  - adjacency l3
- vservice path chain-VSG-ASA
  - node VSG1 profile sp-web order 10
  - node ASA1 profile sp-edge order 20
- port-profile type vethernet Tenant-1
  - org root/Tenant-1
  - vservice path chain-VSG-ASA

Defining the Service Node on Nexus 1000V

Chain the Service Nodes Order is inside

Enable the Service Chain Per Port-Profile

Virtual Services on Virtual Extensible LAN (VXLAN)



Cisco Virtualized Network Services

- **Virtualized L4-7 services**
  - vWAAS
  - ASA 1000v (aka vASA)
  - VSG (Virtual Security Gateway)
  - vACE
  - vNAM
  - vWSA (Web Security Appliance)
  - veCDS
  - vGSS (planned)
  - Cloud Services Router 1000v (aka vIOS)
- **Insertion services**
  - Nexus 1000v vPath 2.0
  - Service Insertion Architecture (SIA)
  - WAAS AppNav
  - Hardware vPath offload
- **Cloud connect**
  - Routed – CSR 1000v
  - Bridged – Nexus 1000v Cloud Gateway

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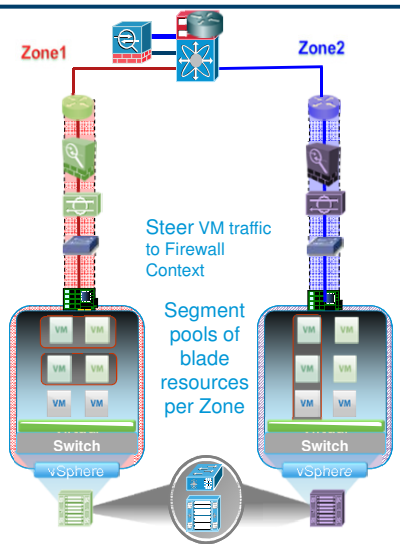
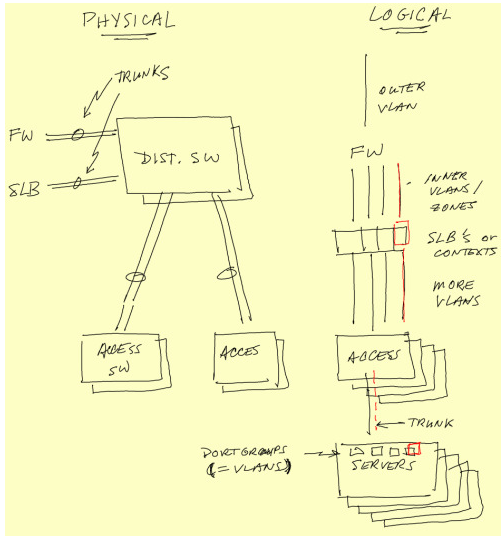
CNC content

Deploy ASA Physical to Virtual

- Zones used define policy enforcement
- Unique policies and traffic decisions applied to each zone
- Physical Infrastructure mapped per zone
  - VRF, Virtual Context
- Merging physical and virtual infrastructure



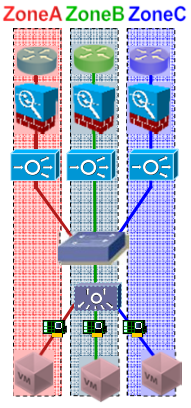
Service Plumbing



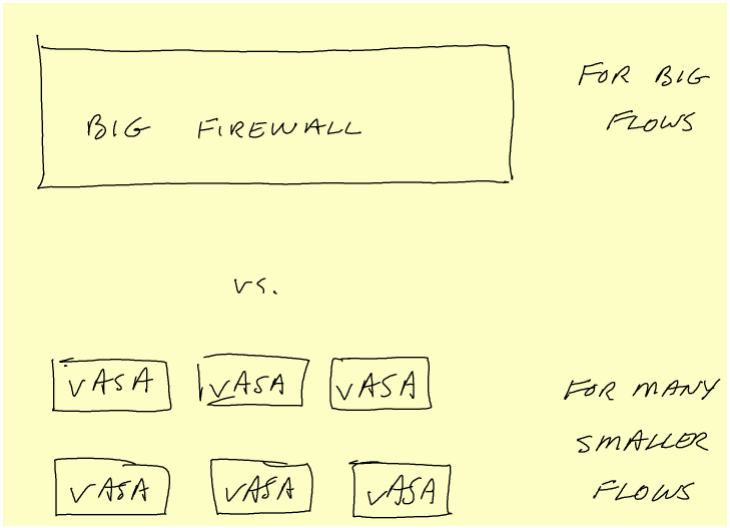
- Drilling down into what deploying a new app / server zone entails:
  - "VLAN plumbing"
  - Policy on FW
  - Policy on SLB
- It can be done for VMs
- Easier way?

Deploy ASA and ACE In Path

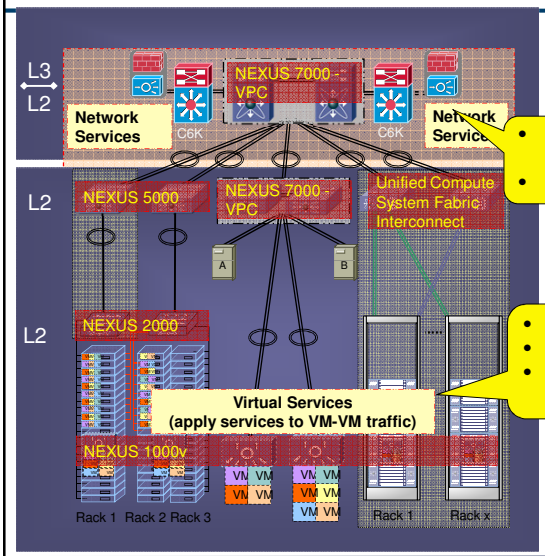
- **Services can be mapped and applied to both the physical and virtual DC networks**
- **VRFs and VLANs used to segment networks**
- **ACE/ASA Contexts in path routed/bridged perpetuate segmentation**
- **Segment network traffic within the Zone**
  - **System Traffic**
  - **VM Traffic**
  - **Management Traffic**
- **Lockdown elements within a Zone**
- **Unique policies and traffic decisions can be applied to each zone creating very flexible designs**
- **Foundation for secure private cloud**



Scale Up or Out?



Virtual Services in a Data Center POD



Aggregation
- Typical L3/L2 boundary.
- Physical network services

- Aggregated flows, need big performance (scale UP)
- Local vMotion no problem.

Unified Access
- Non-blocking paths to servers & IP storage devices

- Scale OUT
- How control policy on many?
- Move them with the application? (How?)

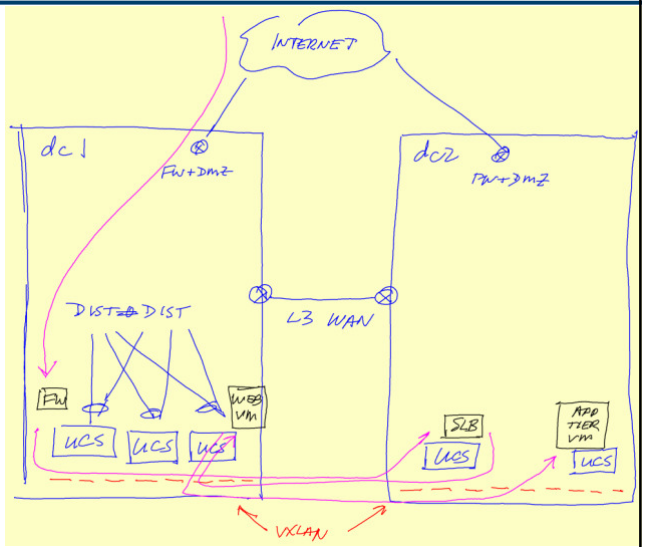
Virtual Access
- Virtual switches
- Virtual services with horizontal scaling

Design Alternatives for a Virtual World

- **Alternatives:**
  - **VLANs (STP or vPC)**
  - **FabricPath and VLANs**
  - **OTV**
  - **VXLAN and VXLAN gateways**
  - **Planned vs. unplanned**
  - **1000v?**
- **Where to put L3 boundaries in the physical world?**

Traffic Patterns

- **What do you think about:**



vAppPod

- vApp = VMware group of virtual machines, power on/off as a group, no provision for "group vMotion"
- Can use VMware DRS group for "group vMotion" to some degree
- Add virtual appliances and internal plumbing, maybe it becomes a "vAppPod" or virtual private datacenter or a ***what***?

Virtualization Design

- Topics requiring a lot more time and thought:
  - Do I use physical (centralized?) or virtual appliances?
  - What's best for failover, management, t'shooting?
  - What about vMotion with statefulness?
    - (Hint: centralized might have advantages, unless you move the app + the firewall etc.)
  - How does the virtual map to the physical?
  - Where is my traffic flowing?
  - As virtualization accelerates, might combined services (e.g. load balancer + firewall) become useful? One point of policy control?

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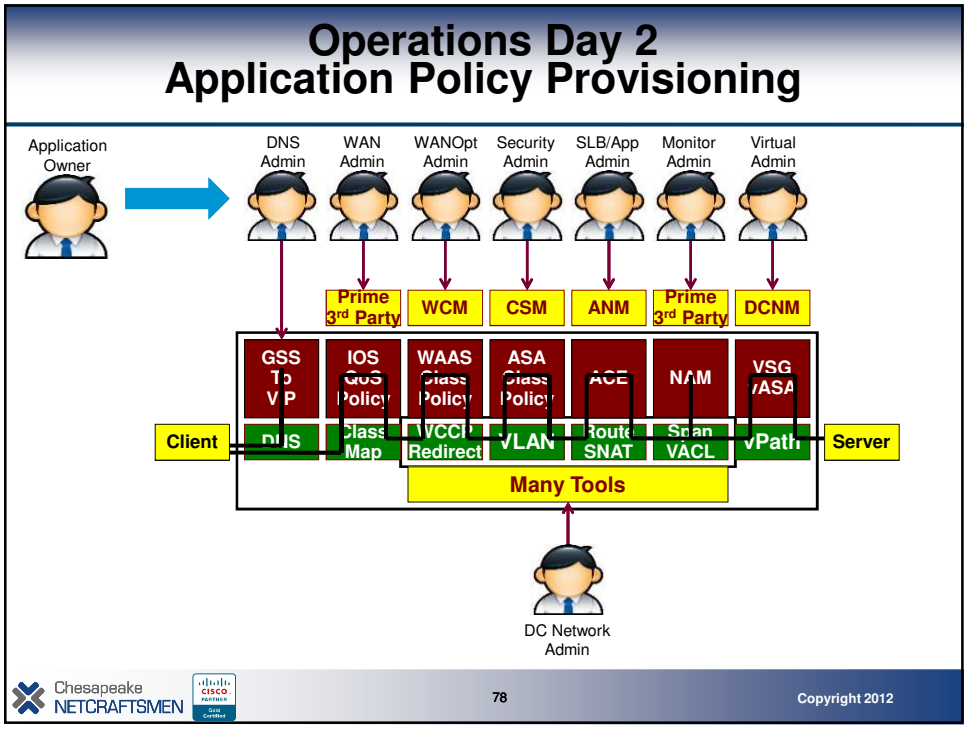
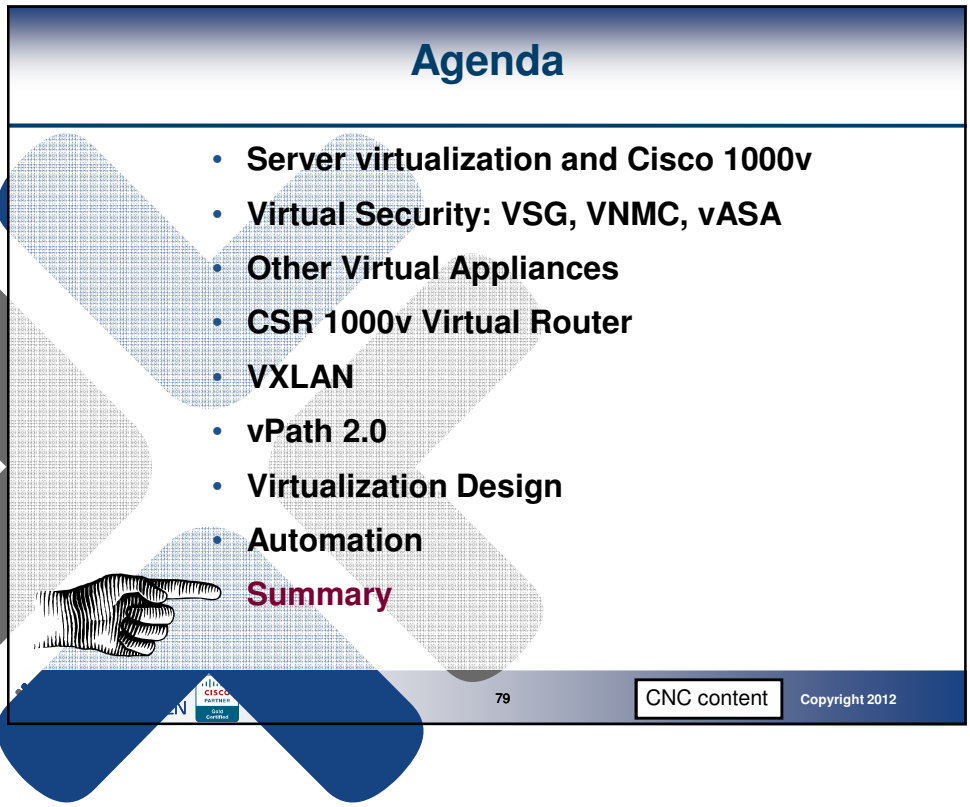
Datacenter Automation

- Goal: simpler, faster, better project deployment (calendar, people time)
  - Software Defined Network: SDN
  - Who says Cisco isn't in the SDN game? Who defines the right one? (Customer?)
- Virtualization expedites automation
  - If you have spare licenses, you can just fire up another v-appliance – saves the purchase cycle
  - With v-appliances, you can automate different templated virtual datacenters
  - Requires political / funding and cultural change of mindset
  - Various organizations at various points in moving towards higher automation: servers first, some sites still installing OS from CD versus VM cloning
- Still need to configure policy:
  - The hard part of SDN?
  - Focus on the real human value add?
  - Like Apple: focus on key functionality, lose some of the complexity?





Summary / Conclusions

- Virtual Services needs to be deployed with an architectural mind-set
  - Virtual Data Center, Private Cloud, Public Cloud
- Network intelligence for virtual services is critical for:
  - Simplified deployment
  - Optimized performance
  - Virtualization-aware operation
- Separation of duties and operational non-disruptiveness needs to be maintained

Cisco **virtual services** with **Nexus 1000V/vPath** provide an extensible architecture and an excellent platform for building out virtualized DC and private/public clouds

Conclusions – 2

- We need to have some idea of the alternatives
- The virtual network appliance world will be simpler and faster to deploy in many ways
  - In the near term, beware performance limits
  - Leverage scale out versus scale up
- VXLAN is very flexible, solves some problems, adds others
  - How does it fit your organization's needs?

References

- **Networkers 2012 presentations:**
  - **BRKVIR-2011**
  - **BRKVIR-2016**
  - **BRKAPP-2026**
- **1000v and vPath:**
  - **http://www.cisco.com/en/US/products/ps9902/index.html**
- **ASA 1000v:**
  - **http://www.cisco.com/en/US/products/ps12233/index.html**
- **CSR 1000v:**
  - **http://www.cisco.com/en/US/products/ps12559/index.html**

Any Questions?

- **For a copy of the presentation, email me at pjw@netcraftsmen.net**
- **About Chesapeake Netcraftsmen:**
  - **Cisco Gold Partner, 2nd in U.S. to meet 2012 broad certification requirements:**
    - **Data Center Architecture**
    - **Borderless Networks Architecture**
    - **Collaboration Architecture**
  - **Cisco Customer Satisfaction Excellence rating**
  - **We've done some large and very large data center assessments, designs, and deployments, large UC deployments, WLAN, etc.**
  - **Designed and assessed networks for several federal agencies, several well-known hospitals, large mortgage firms, stock firms, web commerce datacenters, law firms…**

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