

Network Virtualization Problem Definition

Answer to multiple business problems

- Employee / Partner / Guest Access
- 802.1x / NAC Remediation
- Merges / Acquisitions
- etc.

Closed user groups

- Private
- Secure
- Independent policies

End-to-end Shared infrastructure

Employee Servers, Remediation Servers, Internet, Unhealthy Posture, Employee, Partner, Guest

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Network Virtualization Creation of logical Partitions

- Virtualization: 1 to Many (one network supports many virtual networks)
- End-user perspective is that of being connected to a dedicated network (security, independent set of policies, routing decisions...)
- It is critical to have a rock-solid Campus design in place before adding virtualization to the network

Outsourced IT Department, Merged New Company, Segregated Department (Regulatory Compliance), Virtual Network, Actual Physical Infrastructure

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Agenda

- What is Network Virtualization?
- **Network Virtualization Components**
- Deploying Network Virtualization in the Campus
- Network Virtualization of the Distribution block
- VRF-Lite End-to-End
- VRF-Lite with GRE tunnels
- MPLS-VPN
- Overview
- Questions

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Network Virtualization Components Functional Architecture

	Access Control	Path Isolation	Services Edge
	<p>Branch - Campus</p>	<p>WAN - MAN - Campus</p>	<p>Data Center - Internet Edge - Campus</p>
Functions	Authenticate client (user, device, app) attempting to gain network access Authorize client into a Partition (VLAN, ACL) Deny access to unauthenticated clients	Maintain traffic partitioned over Layer 3 infrastructure Transport traffic over isolated Layer 3 partitions Map Layer 3 Isolated Path to VLANs in Access and Services Edge	Provide access to services: Shared Dedicated Apply policy per partition Isolate Application environments if necessary

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Network Virtualization Components Access Control

- **Authentication – Who/what is requesting access?**
 - Client based – 802.1x
 - Clientless – Web-authentication
 - Device specific control – MAC-address based
- **Authorization – Where/how is the access granted?**
 - Allow access to the network
 - Allow access to a particular VLAN

Edge Access Control

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Network Virtualization Components Path Isolation

- **Device virtualization L3**
 - Control plane virtualization
 - Data plane virtualization
- **Data path virtualization**
 - Single-hop – layer 2 based via trunk 802.1q
 - Multi-hop –layer 3 based via tunnel technique (GRE)

VRF - Virtual Routing and Forwarding
GRE - Generic Routing Encapsulation

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Network Virtualization Components Services Edge

- Efficient and manageable
- Policies centrally deployed
- Economical

Shared for All Groups:

- Internet Gateway
- Video Server
- Firewall and NAT
- Hosted Content
- DHCP
- IPSec Gateway

Internet/Shared, Campus Core, Resource, Partner, Employee, Guest

Employees, Contractors, Resources, Guests/NAC Quarantine

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Deploying Network Virtualization in the Campus Path Isolation

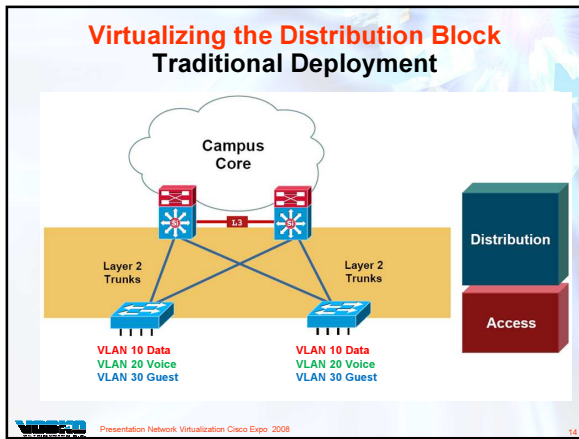
- Path isolation techniques allow to build a logical overlay over the physical infrastructure
- First step is the virtualization of first-hop L3 devices
 - Virtualization of the campus distribution block
- Second step is the end-to-end extension of the logical isolation using different techniques
 - VRF-Lite End-to-End (Single-hop)
 - VRF-Lite and GRE (Multi-hop)
 - MPLS VPN (Multi-hop)

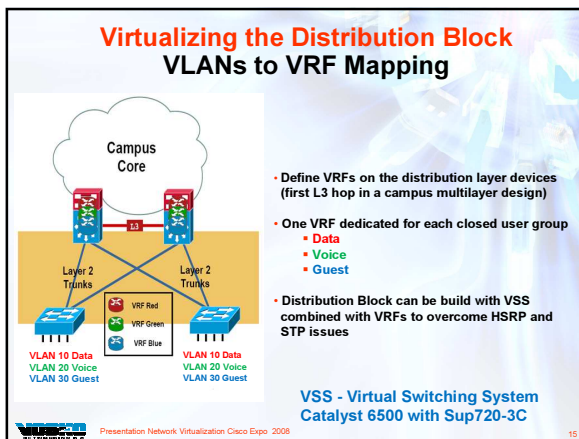
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VRF-Lite End-to-End Path Isolation

Each L3 Hop Device

Note: Single-hop virtualization

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VRF-Lite End-to-End Path Isolation

- VRF-Lite End-to-End on all routed hops:
 - Distribution layer
 - Core layer
- Every link between Acces, Distribution and Core layers are 802.1q trunks
- 802.1q tags of the trunks provide single hop routed data path virtualization
- Every physical link carries multiple logical routed links with the use of 802.1q trunks
- Number of logical routed links depends on the number of VRFs

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VRF-Lite End-to-End Trunks 802.1q

PROs

- Data path virtualization also segmentation true routing and forwarding

CONs

- Limited scalability: recommended for a low number of VRFs per device
- Separated routing domain for each closed user group

(Two OSPF processes needed for this example)

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VRF-Lite with GRE Tunnels Path Isolation

Note: Multi-hop virtualization

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VRF-Lite with GRE Tunnels Path Isolation

- Point-to-point overlay network
- Hub-and-spoke overlay network
- VRFs connected through the use of tunnels (GRE)

Green User

Internet

Green VRF

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VRF-Lite with GRE Tunnels

PROs

- Data path virtualization also segmentation true routing and forwarding

CONs

- Limited Hardware GRE support for Wire Speed performance
- Limited scalability: recommended for point-to-point and hub-and-spoke deployments

Green User

Internet

Green VRF

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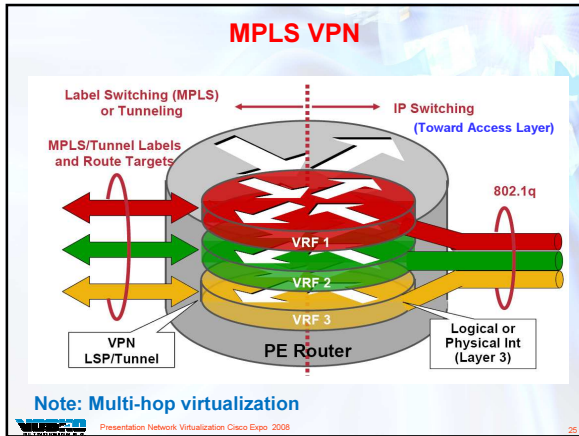
Green User

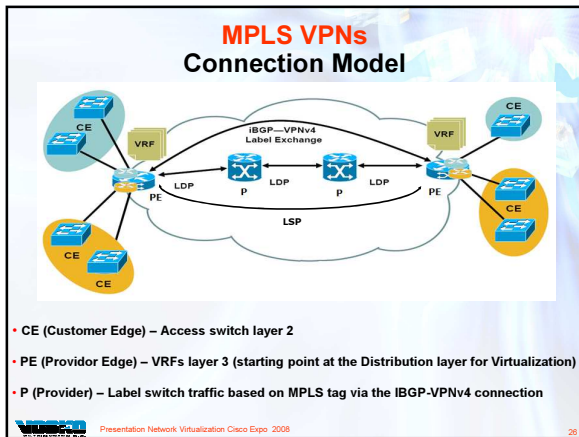
Internet

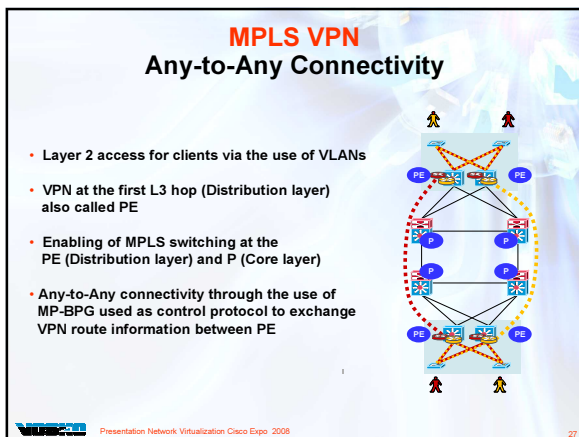
Green VRF

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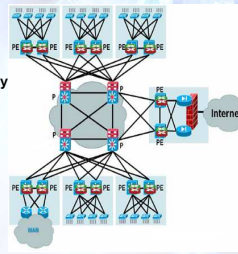
MPLS VPN Any-to-Any Connectivity

PROs

- Data path virtualization also segmentation true routing and forwarding
- Most scalable solution to provide Any-to-Any connectivity for each closed user group

CONs


- Requires enabling MPLS in the core of the network
- MP-BGP used as control protocol to exchange VPN route information
- Platform support currently restricted to Catalyst 6500



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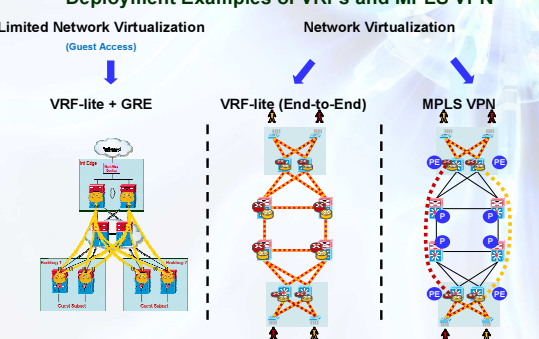


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Overview Deployment Examples of VRFs and MPLS VPN

Limited Network Virtualization (Guest Access)

Network Virtualization



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