Cisco Catalyst 4500-E and 4500-X Series Network Virtualization Solutions

Why Network Virtualization?

With network virtualization, users can:

- Lower total cost of ownership.
- Achieve regulatory compliance for network segmentation.
- Reduce application recovery times and business disruption as well as network complexity, to increase operational efficiency and return on investment while lowering OpEx and CapEx.

Types of Network Virtualization

Two types of network virtualization are: device pooling with the Virtual Switching System (VSS) technology, and Layer 3 network segmentation using Virtual Route Forwarding (VRF)-Lite, Cisco Easy Virtual Network (EVN), and Multiprotocol Label Switching (MPLS).

- The VSS technology on the Cisco® Catalyst® 4500-E and 4500-X Series Switches will add a new, powerful tool for IT managers to build resilient, highly available networks while optimizing traffic load balancing. *It will be enabled in a future software release*.
- With the VRF-Lite feature, Catalyst 4500-E and 4500-X Series Switches support multiple VPN routing and forwarding (VRF) instances for network segmentation. (VRF-Lite is also referred to as multi-VRF Customer Edge). This technology does not need to use MPLS to support such instances; it relies instead on the configuration of Layer 3 interfaces on the interswitch links.
- EVN is an enhancement of the existing VRF-Lite technology that improves Layer 3 traffic separation and path isolation on a shared network infrastructure. EVN reduces the user configuration burden and:
  - Simplifies Layer 3 network virtualization without requiring MPLS end-to-end capabilities.
  - Enhances shared services support, management, troubleshooting, and usability.

What Problems Do Network Virtualization Solutions Help Solve?

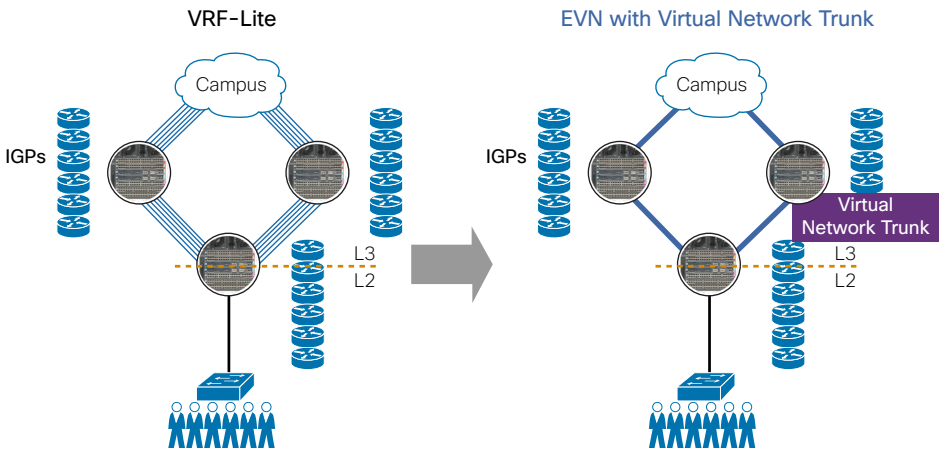
EVN is a Cisco innovation meant to overcome the overhead issues of the traditional VRF-Lite solution. With the VSS technology on Cisco Catalyst 6500 Series and now also on the Catalyst 4500-E and 4500-X Series Switches, campus networks can be designed in a way that eliminates the traditional drawbacks of multilayer network topologies, such as stateless network-level failovers resulting in increased application recovery times and business disruption; network complexity leading to lower operational efficiency and higher OpEx; and underutilized resources leading to lower return on investment and higher CapEx.

Cisco Easy Virtual Network

Cisco EVN technology uses the Virtual Network Trunk to significantly reduce the configuration required to implement network virtualization across the entire network infrastructure. The traditional VRF-Lite solution requires creating one interface per VRF on all switches and routers involved in the data path, a time-consuming process that can become a configuration management burden (Figure 1).

EVN also uses route replication technology to improve shared services support. Route replication technology makes it possible to link routes from a shared VRF to several segmented VRFs, simplify the configuration of importing and exporting routes, remove duplicate routing tables or routes, saving memory and CPU cycles.

Figure 1. VRF-Lite vs EVN Configuration with multiple Interior Gateway Protocol Instances (IGPs)



Virtual Switching System on 4500-E and 4500-X Series

The Cisco Virtual Switching System (to be enabled in a future software release) is a clustering technology that pools two Cisco Catalyst 4500-E Series Switches with Cisco Catalyst Supervisor Engine 7-E or 7-LE or two Catalyst 4500-X Series Switches into a single virtual switch. In a VSS, the data plane of both clustered switches is active at the same time in both chassis. VSS members are connected by virtual switch links (VSLs) using standard Gigabit or 10 Gigabit Ethernet connections between the VSS members. VSLs can carry regular user traffic in addition to the control plane communication between the VSS members.

Table 1 summarizes the planned configurations and capabilities for VSS (may be subject to change).

Table 1. Cisco Virtual Switching System on 4500-E and 4500-X Series Switches

Configuration/Capability	Catalyst 4500-E and 4500-X
Supported supervisors on Catalyst 4500-E	Supervisor Engine 7-E or 7-LE (identical pairs)
Minimum license	IP Base or higher (7-E) or special license (7-LE and Catalyst 4500-X)
Single-sup cross-chassis VSS support	Yes
Quad-sup VSS configuration with in-chassis redundant sups	In-chassis redundant sups in rommon mode with active uplinks
10 Gigabit Ethernet Virtual Switch Link (VSL)	Yes
1 Gigabit Ethernet VSL	Yes
Layer 2 Multichassis EtherChannel	Yes, plus regular EtherChannel and equal-cost multipath (ECMP) routing
Layer 3 Multichassis EtherChannel	No (planned for the future)
Standard and Power over Ethernet linecard support in VSS	Yes
Split Brain Detection mechanisms	Enhanced Port Aggregation Protocol (ePAgP), VSS fast hellos (to be added in a subsequent phase)

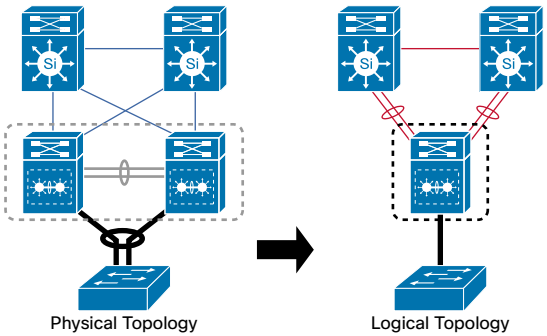
What Are the Benefits of Virtualization Solutions?

Virtualization solutions offer improved management capabilities, advanced security, and optimized network resource usage.

Device Pooling: Virtual Switching System reduces network complexity by combining two separate physical chassis into a single control plane. VSS offers the following advantages:

- Enables multipathing with Layer 2 Multichassis EtherChannel (MEC) between access and distribution (increase in link utilization).
- Business continuity with improved resiliency (~200 ms) in case of a link or network device failure, with no impact to voice or video applications.
- Reduces touch points with a single management and control plane between two physical switches (optimized for core and distribution deployments).
- Eliminates the need for spanning tree and offers a loop-free topology between the access and distribution with Layer 2 MEC.
- Simplifies and reduces network topology complexity by eliminating the need for first-hop redundancy protocols like Hot Standby Router Protocol (HSRP), Gateway Load Balancing Protocol (GLBP), or Virtual Router Redundancy Protocol (VRRP).

Figure 2. Physical vs Logical Topology in a VSS Configuration



Layer 3 Network Segmentation: The traditional VRF-Lite solution usually requires a lot of configuration management. EVN reduces configuration time significantly across the entire network infrastructure without requiring the use of MPLS. Advantages include:

- Uses the **vnet trunk** command to propagate segmentation information between devices.
- Does not require the MPLS infrastructure to propagate a segmentation tag.

Why Cisco?

Cisco provides comprehensive, single-vendor network virtualization technologies such as EVN and VSS, which enhance existing multilayer switching architectures by simplifying architecture and making technology easier to adopt. The Cisco Catalyst 4500-E and 4500-X Series Switches support these advanced features and provide the scalability and investment protection for today's evolving networks.

For More Information

www.cisco.com/go/vss

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