aruba
a Hewlett Packard Enterprise company

TECHNOLOGY BRIEF

High Availability From Campus to Data Center

Aruba Virtual Switching Extension (VSX)

Enterprise networks face the challenge of delivering 24x7 always-on mobility, reliable access to collaboration and cloud-based services, and support for an increasing number of IoT devices. As a business and network grows, this non-stop availability becomes more critical due to simple economics. Downtime leads to a loss of productivity, user satisfaction and revenue.

Switches in the campus and data center sit at the heart of the network and are responsible for the delivery of a high availability (HA) solution that's capable of ensuring always-on access with robust performance.

To address this requirement, Aruba's Virtual Switching Extension (VSX) has been designed from the ground up to provide industry-leading performance and high availability with much-needed simplicity. This is accomplished through the resiliency of AOS-CX, a modern network operating system that performs continuous state synchronization (Figure 1).

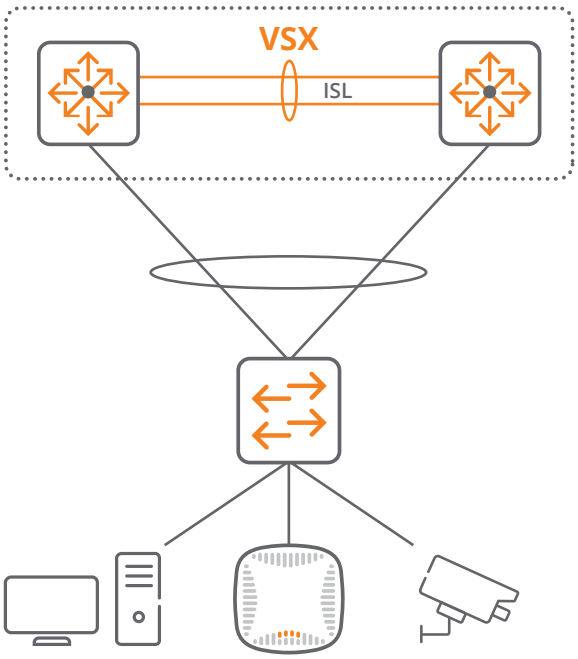

Figure 1: Aruba Virtual Switching Extension

NO DOWNTIME, EVEN DURING UPGRADES

High availability (HA) refers to a system or component that is continuously operational for extended periods of time. For organizations today, this translates to 24x7 uptime, without disruption to network access or performance.

Planning for high availability of campus and data center switches involves complex tasks for addressing backup and failover processing. This includes copying and accessing the real-time networking state, including routing and forwarding tables.

Aruba VSX takes a new and innovative approach to solving high availability challenges by combining the best aspects of existing HA technologies such as multi-chassis link aggregation (MC-LAG) and equal-cost multi-path (ECMP) routing. This combination provides a distributed and redundant architecture that is highly available, with minimal to zero traffic loss, even during software upgrades.

Aruba VSX Benefits

- **High availability** design with live upgrades and no downtime
- **Built for redundancy** across campus and data center networks
- **Continuous config synchronization** via AOS-CX
- **Flexible active-active network designs** at L2 and L3
- **Operational simplicity** for configuration and troubleshooting

Thanks to its design principles, VSX also supports live upgrades (figure 2), delivering on the promise of in-service software upgrades where no maintenance windows are required. Within an hour, core and aggregation switches in the campus and top of rack (ToR) switches in the data center can be successfully upgraded while continuously delivering high-performing network services, without compromise.

A BETTER WAY TO ACHIEVE HIGH AVAILABILITY

VSX is supported on Aruba CX 6400 and Aruba CX 8000 Switch Series. These core, aggregation, leaf, and spine switches are based on AOS-CX, a modern operating system created for both high performance and process resiliency. With a modular, database-driven design, processes can fail and restart (and continue processing) using their last known state. AOS-CX also features a microservice architecture which makes the Aruba VSX implementation possible and unique.

High availability and redundancy are delivered by enabling VSX on two switches. Each switch then maintains its independent control plane, yet stays synchronized with the other for important information like MAC and ARP addresses. This enables a redundant, loop-free topology that does not require spanning tree protocol (STP). VSX is also compatible with multi-spanning tree protocol (MSTP) and rapid per-VLAN spanning tree (RPVST+), offering flexible design options for organizations using traditional spanning tree.

By leveraging distributed intelligence – with each switch maintaining its independent control plane – the peer VSX will continue to operate and deliver services, regardless of the state of its peer. This highly available pair of switches leverages active-active packet forwarding and can utilize popular distributed routing protocols such as OSPF and BGP to provide industry-leading HA in both Layer 2 and Layer 3 network designs.

Compared to rigid, legacy operating systems, AOS-CX provides intelligent synchronization across the network to ensure that configurations are always applied identically to both members of the VSX pair. Moreover, the Aruba Network Analytics Engine (NAE) constantly gathers real-time data on the availability state of the switches to provide HA health information to the network operator. Using these analytics, operators can ensure that any anomalous events are quickly diagnosed and resolved.

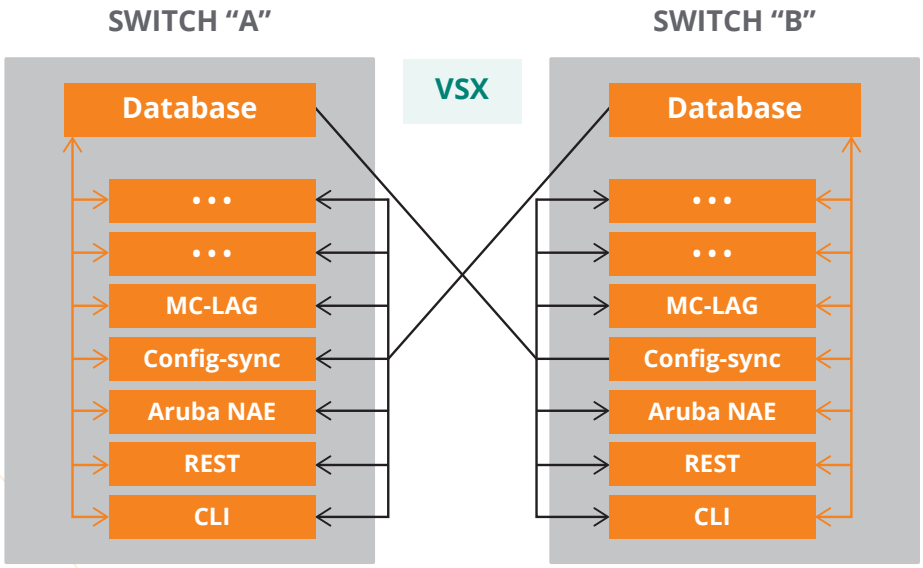

Figure 2: Live Upgrades with Aruba VSX

ALTERNATIVE APPROACHES

Traditional high availability and virtualization solutions can be separated into two major design approaches, each with limitations.

The first approach, referred to as "virtual stacking," uses a unified control plane with a single point of management. This virtualized stack of switches is simpler to configure and manage, but simplicity comes at a cost as any upgrade requires the stack to be taken offline during the operation. At the access layer, the simplicity of a virtual stack is often ideal and is frequently implemented. Aruba's virtual stacking solution is Aruba Virtual Stacking Framework (VSF). Figure 3 compares virtual stacking and VSX, and illustrates the continual state synchronization of VSX and typical network deployment of VSX and VSF.

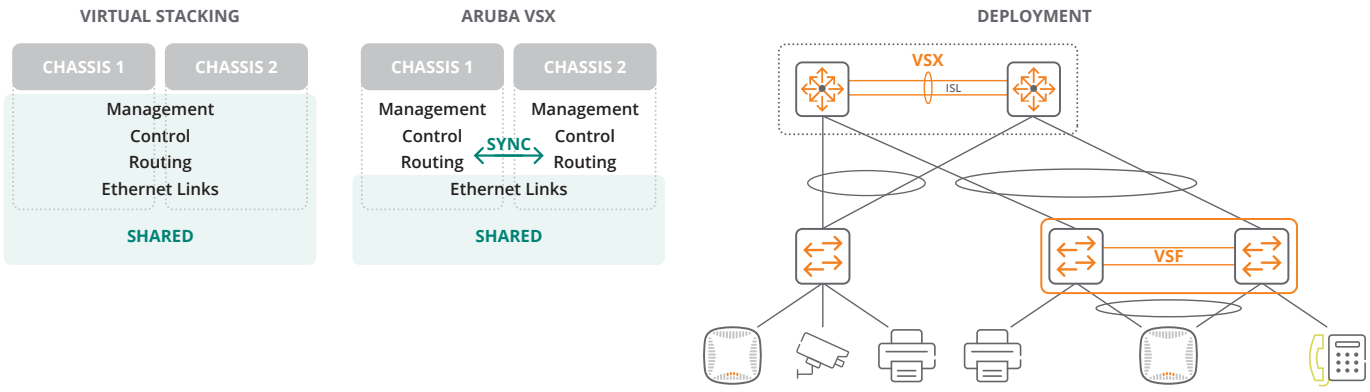

Figure 3: Comparison of Virtual Stacking and VSX

The second approach, typically implemented at the core or aggregation layer due to the larger failure domain, is an MC-LAG solution that has two distinct and separate chassis and control planes. This approach differs in its ability to support native HA during upgrades, which is especially important in the network core.

Implementations vary in their level of support of operational simplicity, configuration synchronization, and troubleshooting. Limitations include:

1. MC-LAG implementations restricted to Layer 2 support causes routed traffic to hairpin between the redundant chassis.
2. Layer 2 virtualization without Layer 3 support requires the chassis to use a first-hop redundancy protocol such as virtual routing redundancy protocol (VRRP).

FLEXIBLE DESIGN OPTIONS

Aruba VSX's benefits include the flexibility to support network designs offered by other high availability and virtualization approaches. Supported designs are discussed in Table 1.

TABLE 1: DESIGN OPTIONS FOR VSX HIGH AVAILABILITY

HA Design Option	Description
Dual Control Plane Architecture	Enables better resiliency during failover of a VSX node by providing L3 peer equal-cost multi-path (ECMP) routing.
Pseudo Single Management Plane	Helps keep key configuration settings of each VSX peer in sync as operational changes are made. This simplifies troubleshooting and management by providing: • A merged view of the VSX control and data path status in a single show command output. • A diff view for some of the data path tables that indicate how packets will be forwarded by each switch.
Active-Active Layer 2	VSX provides the ability to build networks without spanning tree, so there are no blocked links and the network quickly re-converges in the event of link or device failures. MSTP and RPVST+ are also supported, providing flexible design options for achieving desired load balancing schemes.
Active-Active Layer 3 (Unicast and Multi-Cast)	Each VSX node runs independent instances of OSPF, BGP and PIM routing protocols, guaranteeing ECMP routing on upstream peers. Aggregation and core switches can communicate on traditional point-to-point circuits using ECMP for HA, or over VSX LAG links using the VSX unified data-path with VSX active-forwarding, so that the first switch receiving a packet forwards it to the destination.
DHCP Redundancy	Both aggregation switches can be configured as DHCP forwarders. The primary device plays an active role in relaying DHCP requests between the clients and the DHCP server while the other is in stand-by mode. When the primary device goes down, the secondary one takes over, and all updates automatically synchronize back to the primary when it comes back online.
Native Active-Active Default Gateway (without the complexity of protocols such as VRRP)	If one of the devices fail, the other will simply take over and forward all traffic.

SUMMARY

High availability is a must-have requirement at the core and aggregation layers of campus networks, as well as within leaf-spine architectures in data centers. Aruba's Virtual Switching Extension (VSX) is designed from the ground up to deliver the availability, virtualization, and simplicity required at these mission-critical layers of the network. Our goal is to offer operators a better way to ensure business success with a network that is always available, even during upgrades.

TO LEARN MORE

Visit Aruba's website to find out more about VSX and other products in our switching portfolio.

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