Agenda

• Aruba Data Center Networking Portfolio
• AOS-CX
• VSX
• Network Analytics Engine
• NetEdit
• DCN Architectures and Use Cases
• Aruba DCN Reference Architecture
• HPE SimpliVity & Aruba In The DC
• HPE Synergy & Aruba In the DC
• Advanced Use Cases
What makes a Data Center Network?

Local Area Network (LAN) / Campus Networks
- Same geographical location, building, campus etc.
- Wired and wireless network connects users, IP phones and wireless APs
- Focus on North - South traffic from Clients to applications
- Typical features required: POE, 802.1X etc.

Data Center Networks
- Same geographical location
- Connects Servers/VMs/Containers, applications, storage, firewalls/ load balancers, etc. – wired connectivity
- Stable, low latency fabrics with high availability / high performance and throughput / density and scale
- Focus on improving East - West traffic between racks
- Advanced features required: VXLAN/EVPN, BGP, OSPF, DCB, etc..

Lines are blurring between Campus and DC
Aruba Data Center Networking Portfolio
Aruba Switching Portfolio: Campus and Data Center

- **Access**
  - Aruba 2540
  - Aruba 2530

- **Aggregation**
  - Aruba 2930F
  - Aruba 2930M

- **Core**
  - Aruba 3810

- **Data Center**
  - Aruba 8320
  - Aruba 5400R
  - Aruba 8325
  - Aruba 8400
Aruba Core & Datacenter Switching (AOS-CX) Portfolio

Aruba 8000 Series with AOS-CX

- Highest reliability, flexibility, performance, port density
- 19 Tbps system, 8-slot chassis
- Redundancy everywhere: Mgmt. Module, Fabric, Power, Fans
- Up to 512 10GbE, 128 40GbE, 96 100GbE in a 2-chassis pair

Aruba 8400
- Workhorse for mid-size core/aggregation use cases
- 2.5 Tbps system, 1RU
- N+1 redundant hot swappable power supplies, fans
- Three models: 48 x 10GbE, 48 x 10GBASE-T, 32 x 40GbE

Aruba 8325
- Mid-size core/aggregation use cases and DC ToR or EoR
- 6.4 Tbps system, 1RU
- N+1 redundant hot swappable power supplies, fans
- 32 ports of 40/100 GbE or
- 48 ports of 10/25 GbE and 8 ports of 40/100 GbE
- Front to back or back to front airflow
MARTKET VALIDATION FOR ARUBA 8000 Series

One Year Later: Aruba 8400 Grabbing Share From Cisco In Core Network Battle, Making IoT Gains

Aruba is doubling down on its 8400 core network switch with plans for new hardware and software releases after making US revenue share gains versus Cisco in the Ethernet switching market.

By Steven Burke
November 09, 2019, 12:45 PM EST

Golden State Warriors partner with Hewlett Packard Enterprise to drive connected experiences for Chase Center

HPE selected as Founding Partner to deliver connected experiences for Chase Center guests.

SAN FRANCISCO, Nov. 09, 2019 (GLOBE NEWSWIRE) -- At the core of the network lies Aruba's 8400 Core Aggregation Switch, which offers flexibility and innovation in dealing with modern applications, security, and scalability demands in today's mobile, cloud, and Internet of Things (IoT) era. Aruba offers the industry's most advanced, fully programmable operating system, carrier-grade performance, and an industry-first Network Analytics Engine that proactively monitors and troubleshoots network, system, application and security-related issues.

HPE Aruba And Its Secret Competitive Weapon

Fast Quality

The concept of “fast quality” seems like an oxymoron on the surface. Oftentimes, in the rush to bring technology to market, certain issues are overlooked and products are released in beta. It then falls to customers to help with the debugging process. That's not the case with HPE and the Aruba product development team, who utilize testing to not only bring products to market faster but also to deliver higher quality solutions. Aruba employs a rigorous testing framework and sophisticated tools, including a dynamic, drag-and-drop, software-based test bed that allows engineers across five locations in...
Aruba 8400/832x Success: 1,000 Customers & growing

North America
- School districts
- Defense research lab
- Manufacturing
- State government agency
- Universities
- Casino
- Transportation
- Grocery chain
- Electricity provider
- Technology company
- Media
- Health Center
- Apparel retailer
-...

EMEA
- Universities
- Manufacturing
- Diversified conglomerate
- Public prosecution service
- Boarding school
- City government
- Media
-...

APJ
- Transportation
- Universities
- Manufacturing
- Technology
- Financial services
- Media
- City government
- Aerospace
-...

Latin America
- Casino
- Airport concessions
- Oil & Gas
- Media
- Universities
-...

atmosphere
2019 APAC
Use Cases We’ve Been Asked to Solve

- How do we enable programmability?  
  AOS-CX: network as an operating system

- How do we automate troubleshooting?  
  Network Analytics Engine (NAE) with embedded analytics

- How do we automate and verify config?  
  Aruba NetEdit for config automation & verification

- How do we deliver always-on reliability?  
  Live Upgrades for the Data Center with Aruba VSX
HPE FlexFabric (Comware) Portfolio

Core/Spine

- Compact, cost effective, 100GbE (small core/spine)
  - 5950 32 * 100G
  - 12901E Series
  - 5980 advanced 10/100GbE
  - 12902E Series
- Highest density, 25/100GbE flexibility and features
  - 12900E Series: 4, 8, 16 slots

ToR/Leaf

- 1/10GbE ToR, price/perf
  - 5710 Series 1/10GbE
    - 40GbE up ToR / server iLO
- 1-100GbE fixed and modular ToR flexibility
  - 5980 advanced 10/100GbE
  - 594x fixed/modular 10/25/40GbE
  - 5950 fixed/modular 10/25/50/100GbE
  - 5950 32 * 100G

Storage/HPC ToR

- 5950 32 * 100G
- 5980 advanced 10/100GbE
- 12900E Series: 4, 8, 16 slots
AOS-CX
AOS-CX Database-Driven Architecture

Benefits
- High modularity – easy to extend and maintain
- Full visibility – everything is in one place
- Full programmability – 100% REST API
- Resiliency – resync failed processes from database
- HA – straightforward sync to standby
- Contains all persistent and ephemeral state
  - Running configuration
  - Hardware component state
  - L2/L3/L4 tables

Statistics
- Read and write information to and from the DB only
- Do not call each other
- Daemon crash does not cause a reboot
- Daemon can reboot and get its state from DB
Virtual Switching Extension (VSX)

- Based on Multi Chassis Link Aggregation
- Redundancy in both hardware and software
- High Availability during upgrades
- Flexibility for network designs
- Operational simplicity with VSX Sync
Switch Virtualization Comparison

(*) configurable levels of synchronization
Network Analytics Engine
NAE WITH EMBEDDED ANALYTICS

‘It’s like having a 24/7 network technician as part of the network’

- Relevant historical data correlated with configuration changes
- Automated service impact and root cause analysis
- Intelligent monitoring agents ‘always on’
- Complete telemetry for all system information
- Can capture info from neighbor infrastructure
- Notification with automatic diagnostics

REST API

Network Analytics Engine

NAE Agents

Configuration and State

Time Series Data
CUSTOMER FOCUS
BRINGS ANALYTICS TO LIFE

**IT Workflow Integrations**
- ITSM integrated change mgmt. with ServiceNow / TopDesk
- Proactive Email notifications for critical events and errors
- Auto-config archiving with TFTP config updates

**Network Health Reporting**
- Transceiver Diagnostics for Health and Failure Root Cause
- VSX Health Monitor to Highlight VSX Stability
- Monitor and Change Route when Failure Detected

**Proactive Monitoring**
- Predictive Fault Finder for General Network Health
- VoIP monitor based on IPSLA transactions
- MAC and ARP Count Analytics to Ensure Proper Device Load

**CUSTOMER USE CASE CO-DEVELOPMENT**
Deep R&D engagements with numerous customers, delivering customer focused solutions
NAE Scripts Published on Aruba Solutions Exchange (ASE)
Top 10 Causes of Outages

1. Faults, errors or discards in network devices
2. Device configuration changes
3. Operational human errors and mismanagement of devices
4. Link failure caused due to fiber cable cuts
5. Power outages
6. Server hardware failure
7. Security attacks such as denial of service (DoS)
8. Failed software and firmware upgrade or patches
9. Incompatibility between firmware and hardware device
10. Unprecedented natural disasters and ad hoc mishaps on the network such as a minor accidents, or even as unrelated as a rodent chewing through a network line, etc.
NetEdit for Configuration, Automation and Verification

- Search
- Edit
- Validate
- Deploy
- Audit

Anomaly Detection

Predictive Assistance

Auto-Change Verification

Continuous Validation

Repetitive Task Automation
Data Center Network Architectures and Use Cases
Enterprise Datacenter Network Architecture Evolution

- Traditional 3 layer
  STP

- Optimized L2/L3 Fabric
  IRF/VSX MLAG

- Spine & Leaf L2 ECMP
  TRILL/SPB

- VxLAN, EVPN & Network Virtualization

- Classic / Underlay
  - LACP
  - L2
  - L3

- VXLAN Overlay
  - SW VTEPs
  - SW & HW VTEPs
  - HW VTEPs

- Scalability, Agility, Orchestration
Aruba Data Center Network Reference Architecture
Data Center PODs / Availability Zones

• PODs/ Availability Zones are replicable networks to support different application domains or functions, e.g. Production POD11, QA POD12, Hadoop POD13, SAP POD14

• PODs create separate failure domains to support maximum high availability (HA) and network uptime, e.g. Network issue in POD11 should not impact POD12

• PODs provide optimized East/West traffic connectivity for applications within a POD

• Facilitates upgrades on a POD by POD basis (e.g. every 5-7 years)

• L2 and L3 PODs are possible to support different applications

• 1 tier POD (example below, could be physically MoR or EoR) and 2 tier PODs are common

• Customers can mix different POD types in their DC, e.g. 1 tier POD11, 2 tier POD12

![Diagram of Data Center PODs and Availability Zones](image-url)
Example of a 2 Tier L2 POD supporting 100 rack servers

• 2 core switches, 6 access switches within a POD
• L2 connectivity within a POD (star topology), L3 connectivity to L3 core network
• L2 VSX LACP LAGs to rack servers
• L3 VSX Active Gateways on L3 POD Core for default gateway redundancy
• EBGP recommended for POD connectivity to the existing L3 network
• Core switches could be physically MoR or EoR
• Access switches are typically ToR

![Network Diagram](image-url)
Example of a 2 Tier L3 POD supporting 100 rack servers

- 2 spine switches, 6 leaf switches within a POD
- L2 connectivity within a Leaf pair, L3 connectivity to Spines
- OSPF within a POD since there are only 6 switches (BGP an alternative option)
- L2 VSX LACP LAGs to rack servers
- L3 VSX Active Gateways on each Leaf pair for default gateway redundancy
- EBGP recommended for POD connectivity from Border leafs to the existing L3 network
- Spine switches could be physically MoR or EoR
- Leaf switches are typically ToR
Does Every DC Network Architecture require Spine/Leaf with VXLAN?

- No, as these are still valid based on customer requirements, they all support HA and network automation

**1-Tier Data Center**
- Supports L2 (e.g. vMotion) /L3 connectivity between racks/servers
- Modular/Fixed port core switches are possible, this will determine how many servers can be connected
- Link aggregation from core to servers provides traffic load sharing and link/switch redundancy

**2-Tier Data Center (Star Topology)**
- Supports L2 (e.g. vMotion) /L3 connectivity between racks/servers
- Modular/Fixed port core switches are possible, this will determine how many access switches can be used
- Loop free topology as link aggregation is used between Access/Core for traffic load sharing and link/switch redundancy
- STP enabled as a backup mechanism to prevent loops
- Link aggregation from access to servers provides traffic load sharing and link/switch redundancy

**L3 Spine/Leaf Data Center**
- Supports L3 connectivity between racks/leafs
- Removes STP since an L3 IP fabric is used
- Failure domain contained at L2 leafs
- Modular/Fixed port spines are possible, this will determine how large the fabric can grow
- Link aggregation from leafs to servers provides traffic load sharing and link/switch redundancy
Separate Out Of Band (OOB) network recommended

- Applicable to both blade/rack server environments
- Provides remote access to access/core, Leaf/Spine, server iLO etc
Separate OOB star topology network

- Star topology is recommended for the OOB network
- L2 EoR OOB switches within each POD
- Centralized L3 OOB default gateway connects to services leaf (leaf which provides connectivity to network services such as firewalls/load balancers etc)
- Firewalls can be added to provide additional network security
- Less concern of switch/link failure (if the OOB network goes offline, production network traffic is not impacted)
- OOB network provides the ideal location for NetEdit to manage the CX switches
HPE SimpliVity & Aruba In The DC
SimpliVity & Aruba In The DC – HPE SimpliVity 380 (2 + 1)

Link to: HPE-SimpliVity-Cluster-Interop-with-ArubaOS-CX-Switch

- Active/Standby DCs that require L3 network connectivity
HPE SimpliVity with Aruba Integration

- Deployment Manager (with new AIS) evaluates existing VLANs present on Aruba switches with certain filter criteria.
- It proposes new VLANs to configure for storage and federation ports connected to Simplivity DI (Deploy Installer) nodes.
- 8320 switchports towards Simplivity servers are detected via LLDP and configured with VLANs, trunk mode and MTU.

```plaintext
interface 1/1/1
  no shutdown
  mtu 9000
  no routing
  vlan trunk native 1
  vlan trunk allowed 5
```
HPE Synergy & Aruba In the DC
Synergy & AOS-CX In The DC

Link to: HPE Synergy & ArubaOS-CX VSX Cluster VRD

- Synergy or C7000 uplinks to MC-LAG VSX switches
- VSX switches provide network high availability and increased bandwidth
Advanced Use Cases
Intra-DC VXLAN/EVPN

Main drivers:
- Provides both L2/L3 network connectivity and multi-tenancy (beyond 4K VLANs) across racks
- Virtual network agility
- Remove STP from the DC fabric
Data Center Interconnect (DCI)

- **Layer 3 Extensions**: Provide routed connectivity between datacenters, and route users to the data center where the applications reside. This may be Layer 3 VPN-based connectivity, and may require bandwidth and QoS considerations.
- **Data Center Interconnect**: Server to server network connectivity + Layer 2 Extension provides a transparent mechanism to distribute the physical resources required by applications such as the virtual machine mobility.
- **SAN Extensions**: Backing up and replicating data for business continuity, disaster recovery, and/or regulatory compliance. Requires lossless infrastructure.
## AOS-CX 10.3

<table>
<thead>
<tr>
<th>Category</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Layer 1</strong></td>
<td>* 1/10/25/40/100G Transceivers, Bluetooth Dongle Support, Support for 1G SFP and 1G Base-T (limited to 32) Transceivers on the 8325</td>
</tr>
<tr>
<td><strong>Layer 2/Bridging</strong></td>
<td>STP, STP features – Root Guard, Loop Guard etc., MSTP, RSTP, RPVST+, Loop Protect, LAG/MC-LAG, LACP, MVRP, LLDP, support over OOBM, Unidirectional Link detection (UDLD), Ethernet Ring Protection Switching (ERPS), VLAN Translation, Data Center Bridging (DCB) – ETS, PFC, QCN, DCBx</td>
</tr>
<tr>
<td><strong>Layer 3/Routing</strong></td>
<td>OSPFv2/v3, MP-BGP, BGP EVPN, VRRPv3, Policy Based Routing (PBR), Bidirectional Forwarding Detection (BFD) for all routing protocols, IPv4 &amp; IPv6 Static Routing</td>
</tr>
<tr>
<td><strong>High Availability</strong></td>
<td>In-Chassis HA, VSX – Virtual Switching Extension (Chassis), VSX Live Upgrade, VSX Configuration Synchronization, OS Resiliency – Time-Series Database, VSX enhancements including interoperability with RPVST+, VSX graceful upgrade for routing features, LACP Fallback with VSX LAG, VSX Sync enhancements</td>
</tr>
<tr>
<td><strong>Multicast</strong></td>
<td>IGMPv3, MLDv2, PIM-SMv4 &amp; v6, Multicast Source Discovery Protocol - MSDP</td>
</tr>
<tr>
<td><strong>Security</strong></td>
<td>Local AAA, Remote AAA with TACACS+ &amp; RADIUS, PKI, IPv4/IPv6 ACL, VLAN ACL, Control Plane ACL, Object Group ACL, RBAC, IPv4/IPv6ACL, BPDU Filtering, BPDU Throttle, Time-Based ACL with NAE, AAA Channels, PIM-SM RP ACL</td>
</tr>
<tr>
<td><strong>QoS</strong></td>
<td>Strict Priority Scheduling, DWRR Scheduling, Map to output queue by 802.1p, DSCP, IP precedence, Classifier-based QoS, Committed Information Rate (CIR) – Ingress/Egress, CoPP, Traffic Policing, Port &amp; Remote Mirroring, Global Port Mirror (8400), Shaping, Egress Queue Shaping, Trust (802.1p, DSCP)</td>
</tr>
<tr>
<td><strong>Management &amp; Usability/Operator Experience</strong></td>
<td>DHCP v4/v6 Server, DHCP Relay, DNS v4/v6, Syslog v4/v6, NTP Server, RMON/SFTP/SSH, SNMP, Local/Remote Mirroring, IP SLA, Web GUI, sFlow, Analytics, Dynamic action/remediation, REST API programmability, NetEdit - Config automation, Config verification, Config validation, Airwave and Central Support, Network Analytics Engine (NAE), NAE Script Upgrade</td>
</tr>
<tr>
<td><strong>Segmentation</strong></td>
<td>L2 VXLAN, L3 VXLAN**, VRF-Lite, L3 GRE, v6-over-v4 Tunnels, BGP over GRE</td>
</tr>
</tbody>
</table>

**Supported only on 8325 in 10.3**

**Font Color =Orange = 10.3 features**

**Bold Orange = 10.3 DC features, Bold =10.2 and earlier Features applicable to DC**

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Software Value without Licensing Complexity
Intelligent Edge Related Sessions:

- AP215 Modern switches with Built-in Network Analytics (Sep 24, 12.30pm)
- AP221 Designing The New Edge - Building a Foundation for Intelligent Edge Networking (Sep 24, 12.30pm/3.15pm, Sep 25, 10am)
- AP222 Limiting your Network Blast Radius with Aruba’s HA Architecture (Sep 24, 3.15pm/5.15pm)
- AP231 EVPN & VXLAN (Sep 25, 2.45pm)
- AP218 Protect and Secure your IoT with Aruba’s Dynamic Segmentation (Sep 25, 3.45pm/5.30pm) and (Sep 26, 11am)
- AP219 Intelligent Wired Edge Solutions and Innovations with End-User Panel (Sep 25, 5.30pm)
- AP220 Embrace Network Automation with Ansible (Sep 26, 9am)
- AP216 Orchestrating Network Configuration with Aruba’s NetEdit (Sep 26, 10am)
Intelligent Edge Related Demos at Tech Playground

- SimpliVity/AOS-CX Integration
- NetEdit
- NAE

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- Click Survey
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Ask Aruba
- Session 1: Tuesday, 24 Sep, 2:00pm – 2:45pm
- Session 2: Wednesday, 25 Sep, 1:45pm – 2:30pm
- Location: Town Hall at Tech Playground

Submit your Ask Aruba questions using the mobile app now!

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