High Availability Architecture in Campus
Cisco Stackwise Virtual

Migrate Access layer switches from HSRP to Stackwise Virtual Distribution layer with 0 Downtime projection

Summary

In the following document I will present how to migrate Access layer switches from an existing HSRP Distribution layer environment to a new Cisco Stackwise virtual deployment with 0 Downtime projections in a mission-critical environment.

Scenario mission-critical environment explained

The existing HRSP deployment serves for redundancy in a Distribution layer, where 24/7 access must be available for business operation. Network resources, such as applications, critical devices, and wireless access are required to deliver an excellent customer service.

Objectives

The main objective is to improve HA with the environment by deploy a more robust and enhance technology provided by Cisco Stackwise virtual.

Benefits of deploying Stackwise Virtual

1. Simplify Operations by Eliminating STP, FHRP and Multiple Touch-Points
2. Double Bandwidth & Reduce Latency with Active-Active Multi-chassis EtherChannel (MEC)
3. Minimizes Convergence with Sub-second Stateful and Graceful Recovery (SSO/NSF)
4. Unified Control Plane: Manage, Configure and troubleshoot two switches as a single switch
5. Active-Active Data Plane: Both the switches are capable of forwarding the traffic locally

https://www.ciscolive.com/c/dam/r/ciscolive/emea/docs/2019/pdf/BRKCRS-2650.pdf
Page 58, and 63

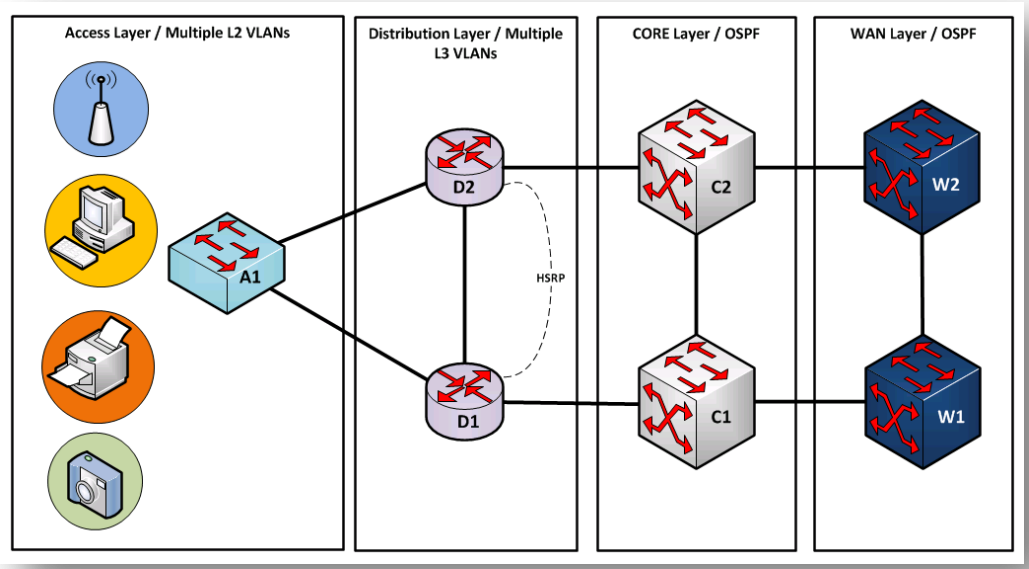
Network Scenario

For sake of argument let say that we have a building with 10 floors with multiple access switches per floor connected via dual-links to both HSRP Distribution switches with the following setup:

1. Layer 2 and Layer 3 VLANs (SVI) configured in Distribution layer
2. Layer 3 VLANs advertise via OSPF to CORE and WAN layer
3. Layer 2 VLANs configured and trunked in each Access layer switches
4. End point types reside in separate VLAN segments (i.e. security cameras, printers, PCs, wireless access points)

See HSRP – High Level image diagram L1-L4 below

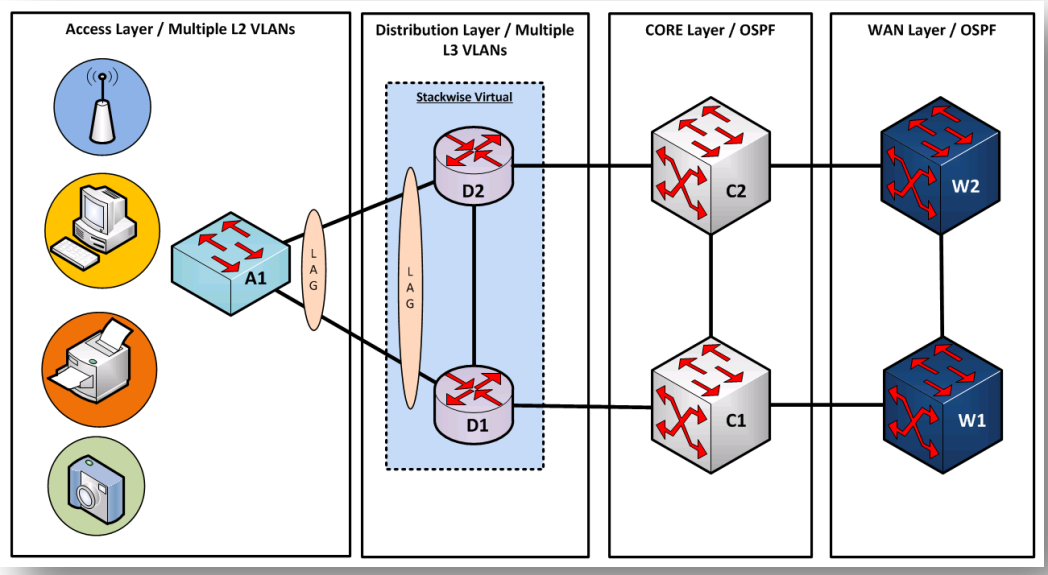
Image 1 - HSRP - High Level Network diagram L1-L4



Tasks Execution

Setup new Stackwise Virtual (SWV) Distribution layer switches (active/standby)
Connect new Distribution to the Core layer and verify reachability over the WAN/Core
Migrated dual-links from each Access layer switches to new Stackwise Virtual setup

Stackwise Virtual - High Level Network diagram below L1-L4



Logistics - Checks, Configurations and setups before migration

1. Verify and document from existing Access switches:
    a. Uplinks interfaces to Distribution switch
    b. SFP transceivers media type and speed
    c. Trunk interfaces configuration
    d. Verify Spanning tree priority
        i. Ensure that the Distribution layer is the Root for all VLANs
    e. L2/L3 port security such as DHCP snooping
    f. Rectify any discrepancies in configuration prior to migration
        i. L2 VLAN miss-configuration in trunk, spanning tree and DHCP snooping
    g. Look for any duplicate L2 VLANs
2. Verify and document from existing Distribution switch:
    a. Uplinks interfaces to Access switches
    b. Trunk interfaces configuration
    c. L2/L3 VLAN configuration
3. Fiber connections
    a. Label existing fiber connections
    b. Record LIU fiber panel connections to/from all switches to be used during migration

Configuring Stackwise Virtual switches

A. Configure Stackwise Virtual switches
    a. Look Stackwise Virtual step notes for details
    b. License, Active/Standby, Dual-Active Detection requirements
    c. Use HSRP standby's loop back IP address
    d. Keep all interfaces in disable state (shutdown)
        i. L3 VLANs and LAG ports
    e. Verify and configured OSPF settings
    f. Identify, configure and patch WAN uplinks

Mount Stackwise Virtual (SWV) switches in data closet

A. Mount SWV switch # 1, keep it power off
B. Mount SWV switch # 2, keep it power off

***Note**: At your discretion use any step to check fiber polarity*

C. Connect fiber Virtual Links between both SWV members
D. Connect fiber links for Dual Activate Detention (DAD)
E. Power up SWV switch # 1
F. Power up SWV switch # 2
G. Verify that both members are in up and in active/standby state

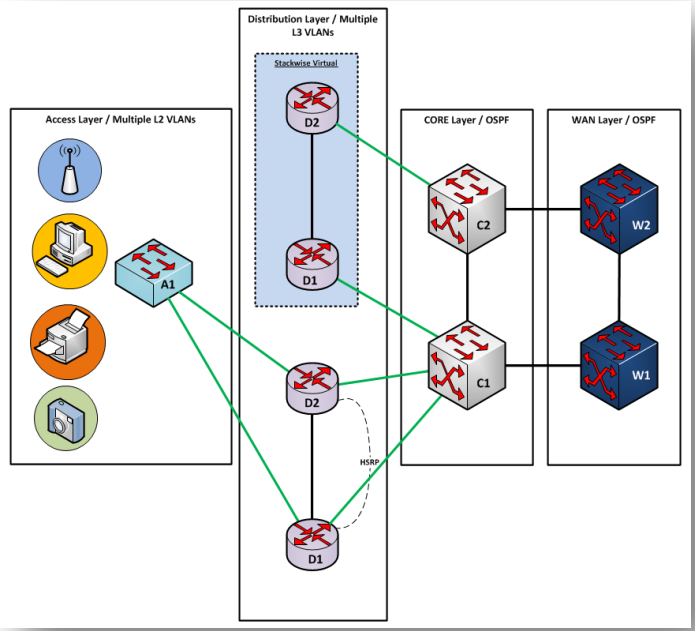
Connecting Core uplinks to new Distribution switches

1. Configure Core uplinks for the Distribution connections
2. Configure OSPF settings between Core and Distribution

***Note**: At your discretion use any step to check fiber polarity*

3. Connect SWV each member to each Core over a fiber single-mode connection
4. Verify OSPF neighbor State from Core and SWV Distribution
5. Verify network advertisement

At this time we have deploy a brand new Stackwise Virtual Distribution layer environment running simultaneously with the HSRP Distribution layer.



Migrating each Access switch

At this time will proceed migrate each Access switch to the new SWV Distribution switch. Up to this moment users have been no affect as the result of the logistic, design, deployment and connectivity of the new Distribution layer environment.

We want 0 or the minimum impact to the users while migrate each Access switches to the new Distribution. Keep in mind that in current scenario the OSPF convergence of the forwarding routing table may occur between 100ms and 400ms. In very large environment, synchronizing network forwarding tables could take more time and further arrangements will have to be in-place with other departments in the organization. In addition, consider to implement OSPF fast convergence techniques to improve its process [https://blog.ine.com/2010/06/02/ospf-fast-convergenc]

The following are the steps to migrate each Access switches to the new SWV Distribution while being connected to the existing HSRP Distribution.

Distribution data closet – Closet # 1

Select one of the Distribution closet to work from, preferably where SWV active switch is located.
Graphical representation in appendix for reference

Just as a word of advised to verify connectivity to end devices before, during, and after migration. I collect information of the MAC and ARP tables for the VLANs to be migrate. I test reachability using ICMP software such as '*PingInfoView*' and collect status of each IP address if needed in MS Excel file.

Moving redundancy link access switch to Stackwise Virtual

1. Remote access (SSH) to all Distribution switches, HSRP # D1 and # D2 and SWV
    a. For the SWV switch, another option is to console to it
2. Remote access (SSH) to A1 access switch to be migrate
3. In the HSRP # D1 shut down all L3 VLANs and Uplink to Access switch A1
    a. All traffic should be forward by the HSRP # D2 switch
4. Move A1 access switch's uplink from HSRP # D1 switch to SWV # D1 active switch
5. From SWV Distribution switch
    a. Enable Port Channel where the A1 access switch is connected to
6. From A1 access switch
    a. Configured Port Channel, add uplink facing the SWV # D1 to this PO
    b. Enable PO channel
        i. At this time, you might temperately lose remote connection to the access switch
        ii. If so, re-start the remote connection to access switch again

At this moment the Layer 1 and Layer 2 should be up between A1 access switch interface and SWV

7. Verify connectivity between A1 access switch and SWV active switch
    a. Verify Port Channel is up at both ends and interface members
    b. Verify trunk status at A1 access switch
    c. Verify CDP or LLDP neighbor

Reroute all network traffic thru the SWV active switch

NOTE:
This task required a little of collaboration since we want to enabling all L3 VLANs at the new Distribution switch while disabling them in the last HSRP member hot switch # D2. Remember the above note regard OSPF convergence. This is where it happens ☺

A single person can copy and paste the commands from a text file. The faster you copy/past the shorter OSPF convergence time. Otherwise, ask a co-worker to assist you during the migration. Thus, one can do the copy/paste in the existing Distribution #D2 and you can be in the new Distribution SWV. I have experience less than two seconds (single ping) to get the network L3 VLANs in operation while doing it myself.

8. From both switches HSRP hot # D2 and Stackwise Virtual, copy and paste the disable and enable commands respectively

At this time the A1 access switch is forward traffic thru the new Distribution using a single uplink

9. From the A1 access switch
    a. Add the disable second uplink connected to HSRP # D2 to the active PO
    b. Verify Port Channel is still up and interface members
        i. Second interface be remain Down state until cable from HSRP # D2 is move to the SWV # D2

Distribution data closet – Closet # 2

1. Move A1 access switch's uplink from HSRP # D2 switch to SWV # D2 active switch
    a. Verify Port Channel is still up and interface members

At this time both A1 access switch uplinks are connected and forward traffic via the new SWV Distribution switch.

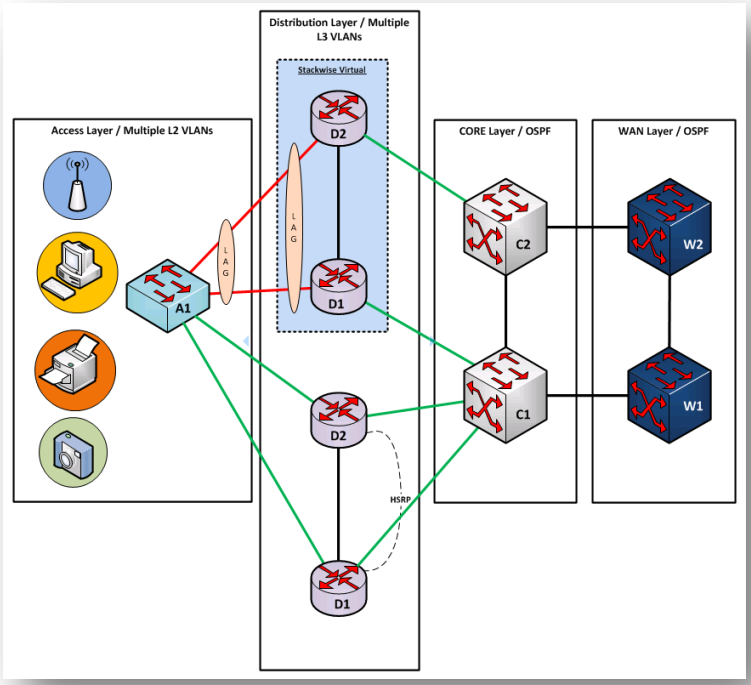
NOTE:
In case there are multiple Access switches on the same floor (i.e. A1, A2, and A3), repeat steps 3 thru 7 in session "**Moving redundancy link access switch to Stackwise Virtual**" for all access switches. Then, proceed with the remaining sessions.

After all uplinks from HSRP Distribution to the Core can be disabled, when all access switches are migrated to the new SWV Distribution. Proceed to power down and unmounts old Distribution switches.

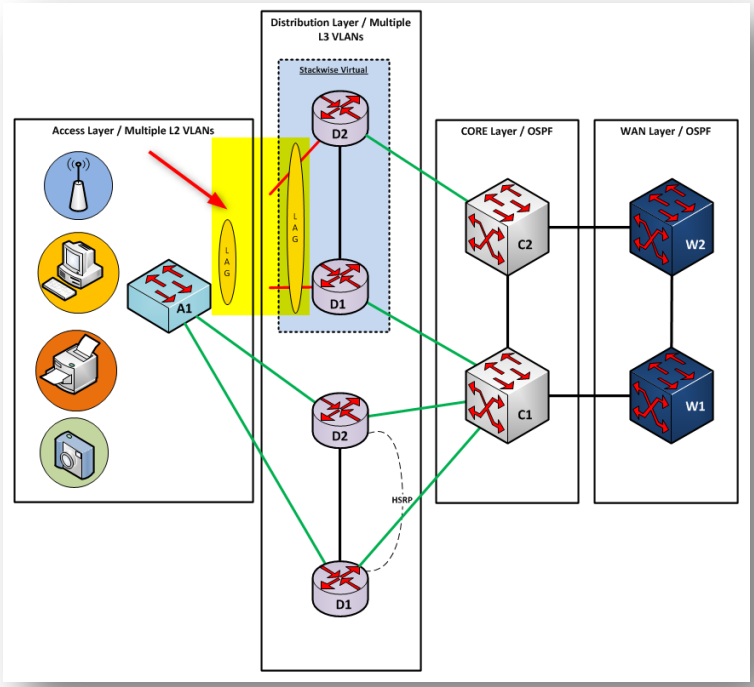
Appendix

Graphical representation of the "Moving redundancy link access switch to Stackwise Virtual" and "Reroute all network traffic thru the SWV active switch" sessions.

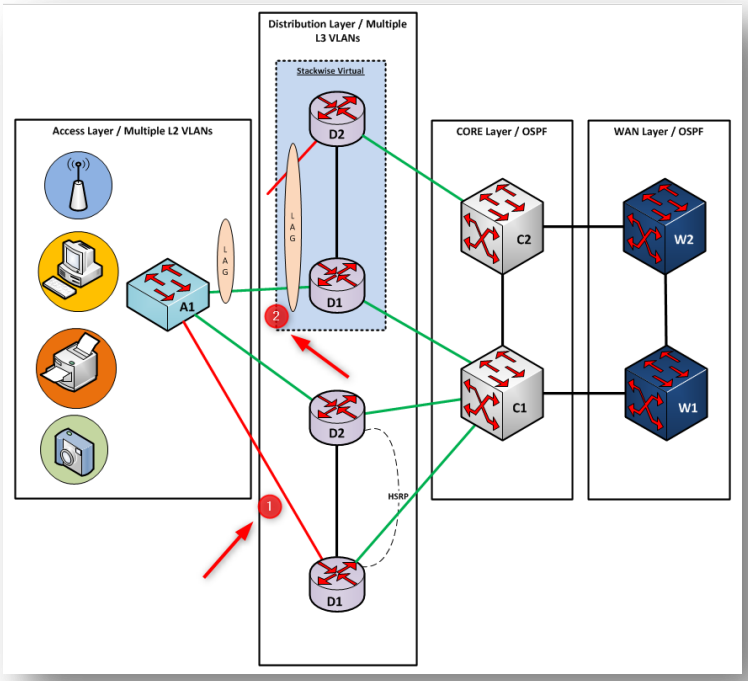
High Level Setup



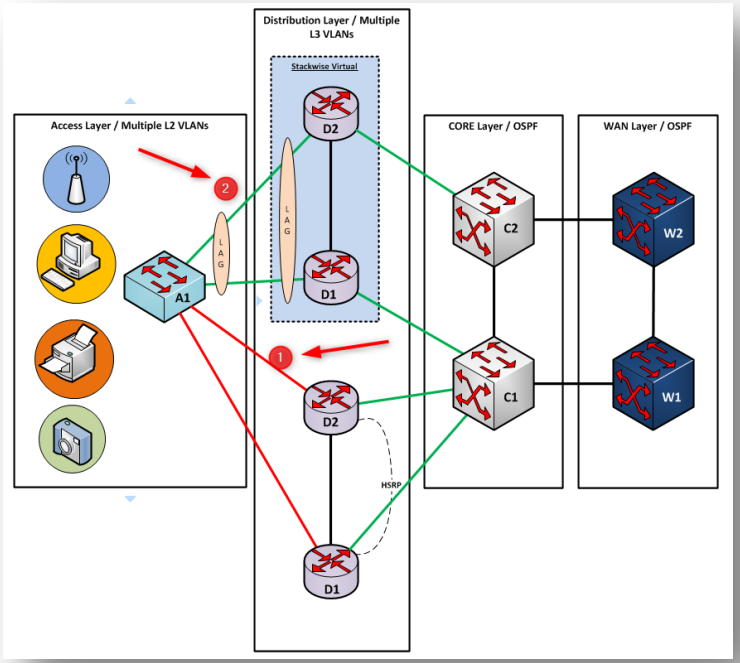
LAG configuration in SWV Distribution, follow by the LAG configuration in A1 access switch



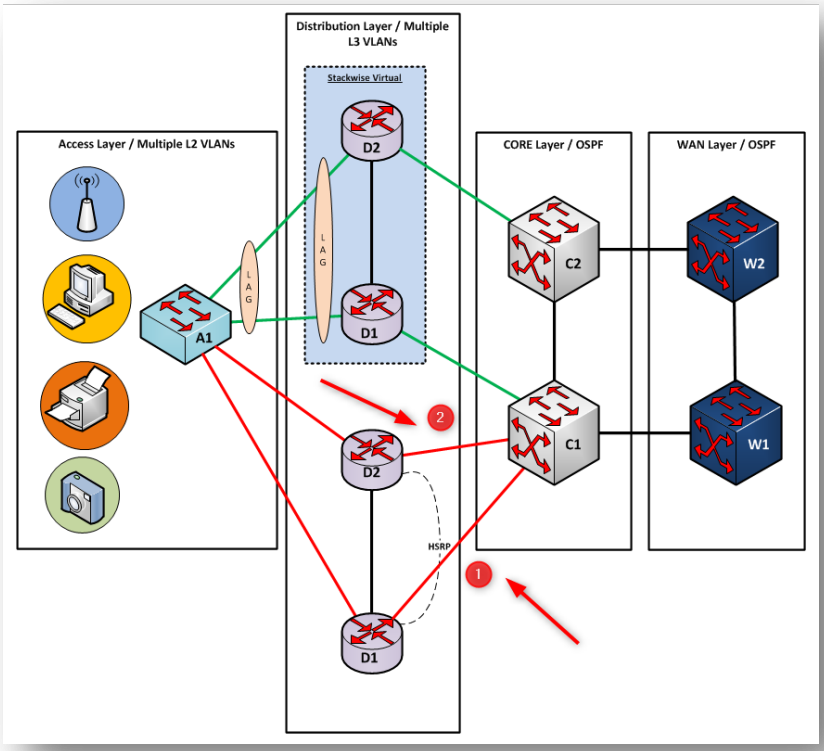
Disable L3 VLANs and Uplink - Move uplink from HSRP # D1 to SWV # D1



Disable L3 VLANs and Uplink HSRP # D2 - Move A1 access switch from HSRP # D2 uplink to SWV # D2



Disable uplinks from HSRP Distribution to Core



References

Links

Cisco Hot Standby Router Protocol (HSRP)
https://tools.ietf.org/html/rfc2281

Enterprise Network Next Generation High Availability
https://www.ciscolive.com/c/dam/r/ciscolive/emea/docs/2019/pdf/BRKCRS-2650.pdf

High Availability Configuration Guide, Cisco IOS XE Fuji 16.9.x (Catalyst 9500 Switches)
https://www.cisco.com/c/en/us/td/docs/switches/lan/catalyst9500/software/release/16-9/configuration_guide/ha/b_169_ha_9500_cg/configuring_cisco_stackwise_virtual.html

OSPF FAST CONVERGENCE
https://blog.ine.com/2010/06/02/ospf-fast-convergenc

PingInfoView – Ping multiple hosts and watch the result within a single pane.
https://www.nirsoft.net/utils/multiple_ping_tool.html

General Notes

Just as a way of reminder, I follow the OSI model approach when working on upgrading or deploying new network equipment or environment.

1. Layer 1
    a. Identify type of SFP transceivers requirements [media type and speed]
    b. Identify type, length and mode of fiber links [single-mode, multi-mode / LC-SC, LC-LC / 1, 2, 3 Meters, etc.]
2. Layer 2
    a. Identify switch port convention to use for Link Aggregation Group LAG [Port Channel]
    b. Defined and configured VLANs to be trunks in each LAG port
3. Layer 3
    a. Defined and configured Switch Virtual Interfaces (SVI) i.e VLAN Interfaces
4. Layer 4
    a. Identify and configured routing protocol to advertise the SVIs

Inventory

These are some of the items used during this project:

Some of the Network equipment:
Cisco Cat 4507rpluse switch | ACCESS layer
Cisco Cat38xxStack switch | ACCESS layer
HP ProCurve 5412zl switch | ACCESS layer
Cisco WS-C6506-E switch | Existing DISTRIBUTION layer
Cisco C9500-48Y4C switch | New DISTRIBUTION layer
Cisco WS-C6509-E switch | CORE layer
Arista DCS-7280SR-48C6-F switch | WAN layer

Fibers patch cables:

- Multi-Mode / LC-LC / 1Meter
- Multi-Mode / SC-LC / 1Meter
- Multi-Mode / LC-LC / 2Meters

SFP transceivers:

- SFP-10GBase-LR, for single-mode links
- SFP-10GBase-SR, for multi-mode links
- 1000BaseSX SFP, for access switches