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Migration from Cisco to HP switches

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FOREWORD

The project's main job is to replace the switches; the most important part is the rational allocation of VAMK VLAN, and the exchange of information security. The working period is between Jan, 2010 and Apr, 2010.

I would like to express my appreciation to the supervisor Mr. Johan Dams, who has been concerned about this project, guiding the project and giving me lots of help and suggestions.

Then I would like to thank you to Dr. Smail Menani principal Lecturer to give me an opportunity for this project.

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In Vaasa, 10 MAY 2010

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ABSTRACT

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In today's society, information has become a key structure resource. Network technologies transmit accurate information, high-speed in all types of computers, terminals, telephones, and fax machines and communications devices.

In campus, LAN technology is a relatively small geographical areas covered by high-speed data network, which includes workstations, personal computers, printers and other devices. It provides the equipments and applications, including shared access, users to exchange files, e-mail and other communication applications. VLAN technologies emerge and LAN switching technology is inseparable. The project aim is to replace the switch, which VLAN conversion is a very important part to distribute VLAN for helping the operator to manage easily. On the other hand, VLAN considerably reduced the broadcasting field, and the bandwidth of the application to the network information transmission rate greatly increased, based on HP ProCurve switch 2910 series VLAN communication protocol is IEEE802.1Q, through a combination of authentication and encryption technology to ensure that the data in the whole network reliability and stability.

This paper is based on finding achieved by configuring layer 3 switch VLAN allocation, implementation, and the connection between different switches, ensuring information exchange, file transfer and telephone network, communicates well in VAMK network.

Keywords LAN, IEEE802.1Q, VLAN, Switch

ABBREVIATION

LAN: Local Area Network

VLAN: Virtual Local Area Network

WLAN: Wireless LAN

NIC: Network Interface Card

MAC: Media Access Control

IPv4: Internet Protocol Version 4

IPv6: Internet Protocol Version 6

GARP: Generic Attribute Registration Protocol

GVRP: GARP VLAN Registration Protocol

RIP: Routing Information Protocol

SNTP: Simple Network Time Protocol

SNMP: Simple Network Management Protocol

LLDP: Link Layer Discovery Protocol

CDP: Cisco Discovery Protocol

ISL: Inter Switch Link (Cisco)

PDU: Protocol

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1. INTRODUCTION

LAN technologies are maturing technology enabling the computer to the network, integration and rapid development of the direction of a growing number of local area network interconnection between the requirements to achieve a wider range of data communication and resource sharing. The interconnection technology is based on the network structure into a clear functional level.

In VAMK the LAN system has multiple servers and several workstations together to share the communication lines or through WLAN connection, they are in a limited geographical scope of resource sharing and information exchange. Study of its technical definition, it is through a specific type of transmission medium (such as cable, fiber and wireless media) and network adapter (also called NIC) connected to the computer and monitored by the network operating system network.

LAN has a higher data rate, error rate is relatively low, but the transmission distance is restricted. And in the same LAN can be connected to a certain number of nodes is also wanted.

Figure 1-1 shows a relatively common local area network, LAN has two parts of network hardware and network software. Network hardware is: servers, workstations, and network transmission medium and connecting components. Network software includes network operating systems, network protocols, transmission control information and the corresponding protocol software and a large number of network application software.

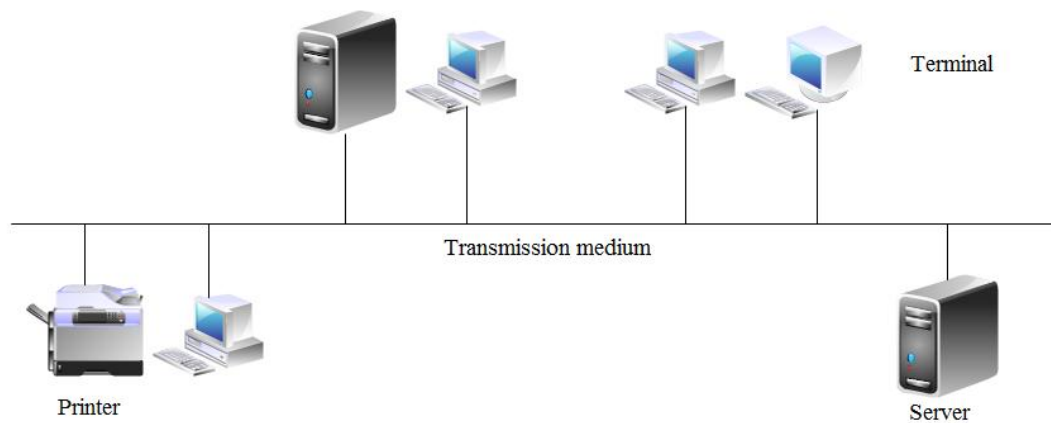


Figure 1-1: Common LAN

Various servers in VAMK such as file server, print server, communications server, database server and so on. File server is the most basic LAN server, for managing file resources within the LAN, print server providing print services shared in the network for users, communication server is mainly responsible for the local LAN and other LAN, the host system or a remote workstation communication and database server is to provide users with database retrieval, updates and other services.

Workstation (clients) generally is a user's computer also can be a dedicated computer. Workstation has its own operating system, independent work, by running network software can access the server shared resources in the workstations. VAMK workstations include Windows7/Vista and Linux. Network connection between the workstations and servers are achieved through the transmission medium components. Network connection components include network interface cards, hubs and switches etc. Here is our main target of this project: switch.

Switch is focus on the endpoint lines that connect and support the port number of simultaneous connections between the workstation and achieve multiple simultaneous data transfers between workstations, the bandwidth can be increased to improve the local area network LAN Performance and service quality.

1.1. Motivation of project

Remove the Cisco switches and replaced with HP ProCurve switch, because Cisco service ended, VAMK adopt the new network hardware of HP 2910al ProCurve Switch that need to converse VLANs on HP. For settings because Cisco switches have many useless VLANs, therefore using the new VLANs to manage, facilitate management. All the 2910 switches have four dual-personality Gig ports and four optional 10G port with one RJ-45 serial console port. The development of IPv6 has become a trend; 2910al series is support dual stack of IPv4/IPv6 which provides transition mechanism from IPv4 to IPv6; both protocols connectivity is supported, of course HP ProCurve can be managed and deployed at the edge of IPv6 networks, so far we still use IPv4 in VAMK, but Physical Devices are prepared for the future.

Summarized below are some of the advantages about HP ProCurve Switch:

- Connectivity
 - 10Gbps Ethernet connectivity – support four optional and flexible 10G-Gigbit ports.
 - Dual stack (IPv4/IPv6) – provides transition mechanism from IPv4 to IPv6, the switches also can be supported and managed IPv6 network.
- Manageability
 - RMON (Remote Network Monitoring) – provide advanced monitoring and reporting capabilities for history, status and events.
 - Command authorization – provide CLI (Command Line Interface) to individual network administrator's login.
- Layer 2 switching
 - VLAN support and tagging – supports the IEEE 802.1Q about 4,094 VLAN IDs and 256 VLANs simultaneously.
- Layer 3 routing
 - Static IP Routing – provides manually configured routing.
 - RIP – provides RIPv1 and RIPv2 routing.

-
- Security
 - IEEE 802.1X – support multiple user authentications with RADIUS server.
 - Warranty and support
 - ProCurve Warranty – for as long as you own the product, with next-business-day advance replacement

We need to refer the previous Cisco configuration, also need to understand the distribution of the switches in the VAMK. Focus on new VLANs conversion on HP ProCurve switches configuration and replace of the Cisco switches. Understand the HP switch description with functions that what the difference settings are between HP and CISCO.

HP ProCurve Identity Driven Manager is to manage the HP switches and other HP devices while the new devices are added, it automatically detects and manually assign switch to the specified group.

Upon completion of the switch assembly, assign wireless access point static DHCP address in ns2.puv.fi server.

1.2. How the switch works

Switch technology based on layer 2 (data link layer) technologies, is the data link equipment, data packets can be identified in the MAC address information, according to MAC address forwarding MAC address information, record MAC address and port corresponding to an address in the internal address table.

1. Switch receive a data packet from one port, first read the header of the source MAC address, MAC address it's know that the machine connect to which port.
2. Reads the header of the head to destination MAC address and find the appropriate

port in the address table.

3. If appropriate port can be found in destination MAC address then copy the data to this port.

4 If the table cannot found in the corresponding port put the data packet broadcast to all ports, when the destination machine respond to the source machine, the switch can learn which destination MAC address and port corresponding to transmit data, no longer need to carry out all ports broadcast t next time.

Layer 3 (network layer) switches is a part of the router functions of the switches, the most important objective is to accelerate the exchange of data within a large local area network, and the routing function has also the services for this purpose can be a route, forward many times. Such regularity for the data packet forwarding process to achieve high speed by the hardware, but as the routing information update, routing table maintenance, route calculation, routing and other functions determined by the software.

Consideration of security and convenience, mainly purpose to reduce the broadcast storm, such as large local area network (LAN) by function or geographical factors divided into a small local area network, making the VLAN in the network to a large number of applications, communication between different VLAN must be forwarded through the router to complete. Because network visits information is increase, simply use a router to achieve the access, for the limited number of ports and limiting the size of the network and access speed. Based on this situation come into being layer 3 switches - designed for the IP, simple interface type, with a strong layer 2 packet processing capabilities, is ideal for large LAN routing and switching of data, It can work on layer 3 protocol or part of the complete replacement of traditional router functions, while the rate of exchange has almost the same with layer 2 switch, and the price is relatively cheaper.

In campus, the general will use layer 3 switches in the network of core layer, with the gigabit ports or fast port connection different subnet or VLAN. The most important function of layer 3 switch is to speed up data exchange within a large local area network, the routing function has also many purposes around the launch, so its routing capabilities of professional grade is a little less than router. After all, security, protocol support has gaps, can not completely instead of routers.

In practical applications, the typical approach is: The LAN has the same subnet of the Internet and VLAN, use layer 3 switches instead of the routers, LAN and public network only to achieve inter-connectivity for area network accesses, that's we need professional router.

2. TECHNICAL BACKGROUNDS

2.1. Network Distribution

VAMK university network provides a comprehensive application environment for the school's teaching, management, office, and information exchange, communication network.

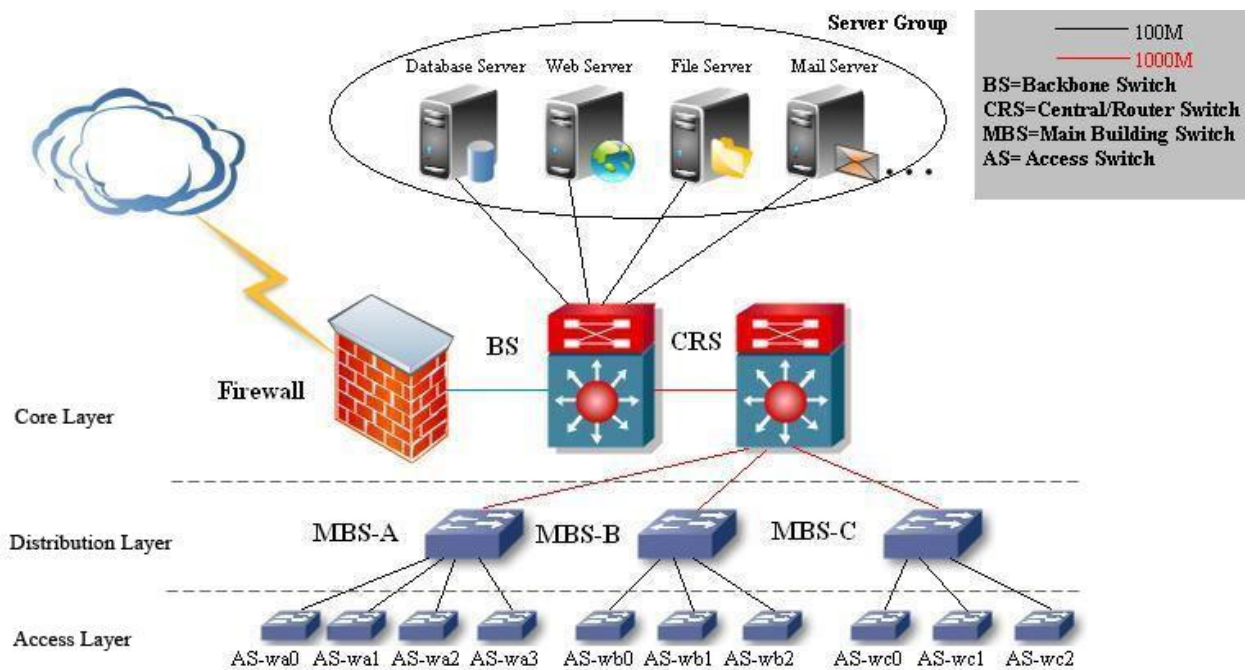


Figure 2-1: VAMK current network topology

Figure 2-1 shows VAMK current Network topology is star topology has three layers that consists of core layer, distribution layer and access layer. Core layer provides optimal transport between two locations, the distribution layer of the network service to connect to the access layer, and the realization of security, communications loading and routing strategy. Access layer provides users access to a switch or hub.

Software and hardware that contains operation system, various servers and backbone switch; central/router switch; main building switch and access switch.

Object of the project access switches are control network of the classrooms and staff offices. We focus on Access Layer in the project to remove Cisco replaced with HP.

2.2. Instruction of HP ProCurve Switch

In the project we use HP ProCurve 2910al Switch Series includes:

- a) HP ProCurve 2910al-24G Switch



- b) HP ProCurve 2910al-48G Switch



All 2910 switches have four dual-personality Gig ports and four optional 10G port with one RJ-45 serial console port. The development of IPv6 has become a trend; 2910al series is support dual stack of IPv4/IPv6 which provides transition mechanism from IPv4 to IPv6; both protocols connectivity is supported, of course HP ProCurve can be managed and deployed at the edge of IPv6 networks, so far we still use IPv4 in VAMK, but Physical Devices are prepared for the future.

2.3. Switch replacement procedure

2.3.1. Glossary

Figure 2-2 shows deals with what different command to set uplink port in VLAN between HP and Cisco, these are used to describe similar concept on both platforms.

Cisco	HP ProCurve	What is it?
Trunk	Tagged	A port that "carries" multiple VLANs using the 802.1q tag, for example an uplink, an IP phone port.
Access	Untagged	A port that belongs to a unique VLAN and is untagged
Native VLAN	-	Defines the untagged VLAN of a 802.1q - tagged port. Defaults to VLAN 1 on HP and Cisco

Figure 2-2: Difference commands between Cisco & HP

2.3.2. VLAN infrastructure

Virtual Local Area Network uses to segment the network into smaller broadcast domain or segments. When the device is actually located a number of different LAN segments, they can be as connected to the same physical media to communicate. VLAN is based on the logical connection rather than a physical connection, so it is very flexible.

VLAN classification has many ways - IP address-based VLANs, Port-based VLANs, MAC-based VLANs etc.; the specific classification can be selected according to the actual situation of the division of different ways. In our college VLAN conversion divided by Port-based. Here are some advantages of port-based VLANs.

Port-based VLANs is a common method of VLAN classification also called segment-based VLANs or static VLANs; a lot of switch products support this function. This method is based on the Ethernet switch ports division.

It divided into single-port VLANs switch port and multi-switch port VLANs classification, the former supports only a single switch port number specified on the composition of the VLAN, in a multi-division can make a VLAN spans multiple switches, and the same switch port can belong to different VLAN. Port-based VLANs

classification can be better for users to manage and reduce broadcast storms, and high security.

Advantage is simple to define VLAN membership as all the ports are defined for the same VLAN group. It's suitable for any network. If a user leaves the original port, to a new switch the port will be redefined.

In the project Cisco switches remove many kind of useless VLANs and the project provide new VLAN 316 in HP ProCurve Switches instead of VLAN 29(manage Cisco switch); therefore converse VLAN is an important part of this project.

Figure 2-3 shows VAMK Important VLANs

Name	Duty
VLAN 316	Manage HP ProCurve Switch
VLAN 329	Manage HP Access Point (MSM422 wireless device)
VLAN 306	Filter PCWN wireless
VLAN 332	VAMK Staff
VLAN 396	VAMK Student
VLAN 397	VAMK Mobile
VLAN 317	Telephone system and work time management
VLAN 305	PCWN (wireless network)
VLAN 29	Manage Cisco Switch

Figure 2-3: VAMK important VLAN List

2.3.3. GVRP introduction

GVRP is an application of GARP, based on the working mechanism of GARP, maintaining the switch in the VLAN dynamic registration information and disseminate this information to other switches. Support GVRP feature of the switch can receive the VLAN information from other switches, and dynamically update the local VLAN registration information, including the current VLAN membership, the members of these VLAN ports through which to reach and so on.

-
- GVRP is IEEE GARP-based protocol developed.
 - GVRP protocol is by attribute statement - a registration mechanism to the local VLAN information notice to the other switch.
 - GVRP protocol supported VLAN ID range of 1-4094.

2.3.4. Switch replacement procedure

Compared with other hardware, switch is not really particularly stable and reliable equipment. So there will be a variety of problems occur, we need to replace the switch. If there is no manual, we can change it down, and thereafter on demand, re-configure and use it. However, if based on reasonable steps that can save administrators a lot of time to achieve the multiplier effect. Now we're going to explore a set of replacement switches reasonable steps to.

1. Remove Cisco switch

- a) Archive backup before remove the Cisco switch we need to save its configuration;
- b) Mark the labels on the connect switch cables and record each corresponding switch port;
- c) Shutdown, power off and unplug all the connecting cables;
- d) Remove the switch out of Cabinet

2 Install HP ProCurve Switch

- a) Configure HP Switch;
- b) Put HP switch in cabinet;
- c) In accordance with the original line corresponds to the original plan plugged;
- d) Test connection

2.3.4.1. Sample topology

This network topology is a part of the Access Switch Group in VAMK. Because there are about 60 switches in VAMK and I could not show them all in the report so that show one part construction in the whole network topology as the demonstration.

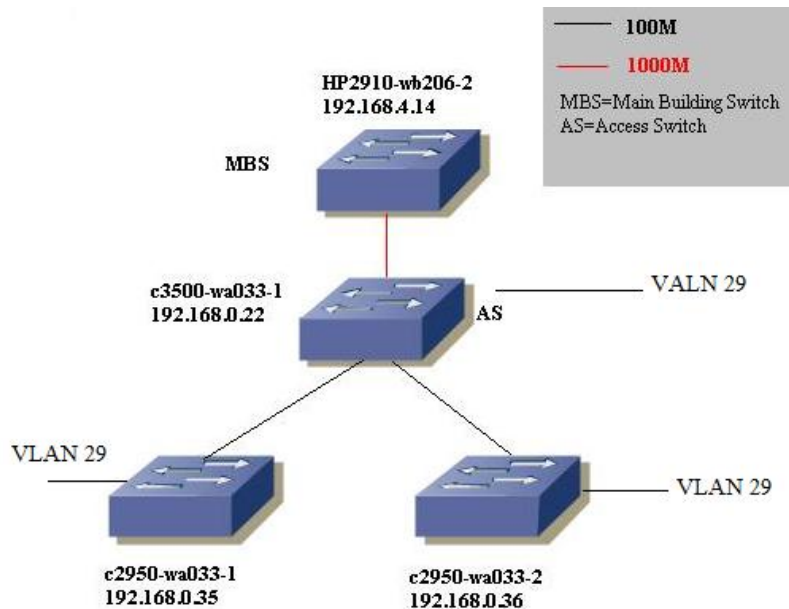


Figure 2-4: Previous Cisco switch network.

Figure 2-4 shows the access switch c3500 (48G) connect the HP2910 switch by VLAN 29 of the IP address 192.168.0.22/24 using IEEE802.1Q as the same protocol with hp2910-wb206-2 and manage two switches are c2950-wa033-1(24G) and c2950-wa033-2(24G), and now we will remove Cisco 3500 to one HP 2910al and combine two c2950 switch as one HP ProCurve 2910al Switch both are 48 Gigabit Ethernet ports. Adding new VLAN manager 316 of IP address is 192.168.4.x(x is increased of 1).

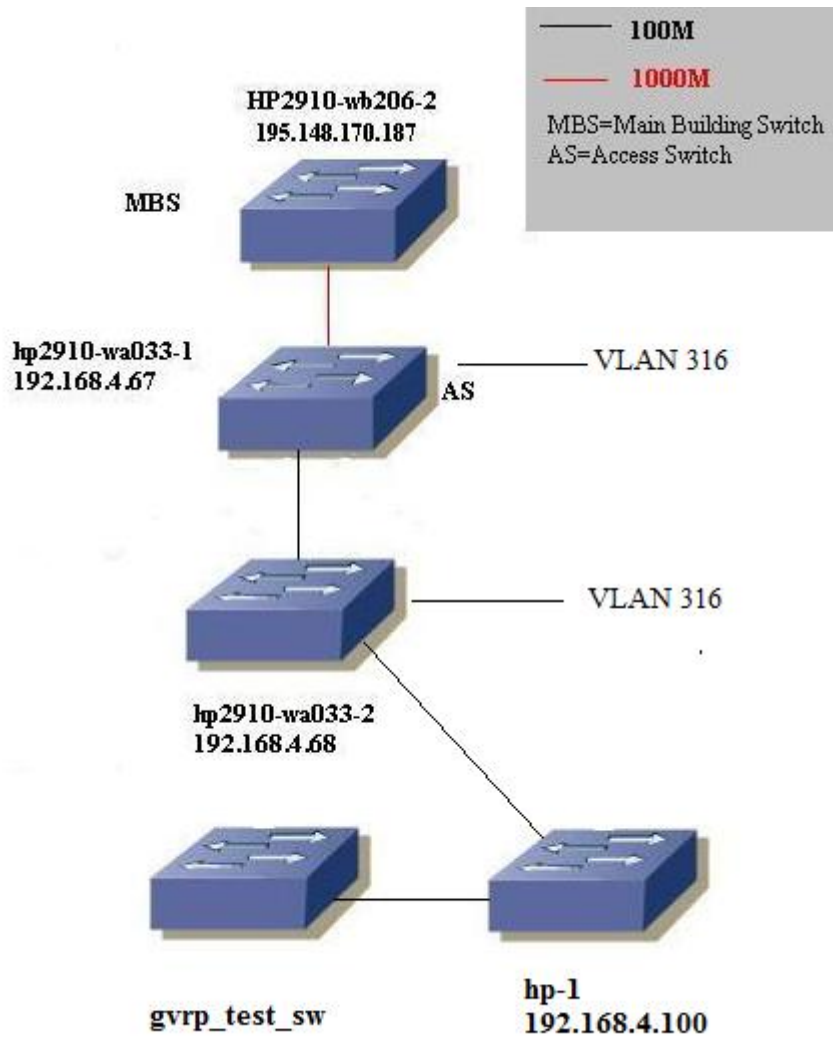


Figure 2-5: Current HP ProCurve Network

Figure 2-5 shows hp2910-wa033-1 instead of c3500-wa033-1 of the trunk port though by VLAN 316 which the IP address is 192.168.4.67/24, then combine two Cisco catalysts 2950 switches each one has 24 Gigabit Ethernet of total 48 to one hp2910-wa033-2 which has 48 Gigabit Ethernet with the uplink port IP address 192.168.4.68/24 .

For improve the configurations we use two HP switches to test. Hp-1 with IP address 192.168.4.100 the purpose is to support source of VLANs for GVRP testing. More details of these two HP ProCurve switches in next chapter.

2.3.4.2. Preparations

Before configuration on HP ProCurve Switch, there are various preparations we need to know that make sure all VLANs information such as status, name and the corresponding port and how many VLANs will be assigned etc. The preparation can affect the configuration so that make clear several forms to record the previous settings on Cisco and new settings on HP ProCurve. Refer to those forms,

- Discovery configuration

Regarding discovery protocol on Cisco configuration, CDP is enabled by default, ProCurve LLDP is also enabled in send and receive mode. Link Layer Discovery Protocol can directly display network devices for advertising of their identity, capabilities and interconnecting. Very useful protocol used in HP Switch.

- Checking Discovery info on Cisco Switch

On Cisco 3500-wa033-1:

Figure 2-6 shows c3500-wa033-1 Cisco Discovery Protocol result, configuration commands “show cdp neighbours “list CDP neighbour devices. As expected, it displays the two Catalysts 2950. Cisco 3500 local interface Gig0/48 is connect to c2950-wa033-1 port of Gig0/24, the other one Gig0/47 is connect to wa033-2 port of Gig0/24.

```
c3500-wa033-1#show cdp neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone,
                  D - Remote, C - CVTA, M - Two-port Mac Relay

Device ID         Local Intrfce   Holdtme    Capability   Platform   Port ID
c2950-wa033-1     Gig 0/48       131        S I         WS-C2950G  Gig 0/24
c2950-wa033-2     Gig 0/47       150        S I         WS-C2950G  Gig 0/24
```

Figure 2-6: Cisco Discovery Protocol

- Checking running-configuration

Take a cut out of the c3500 running/configuration, the Cisco Switch manage VLAN 29

IP address 192.168.0.22/24.

```
c3500-wa033-1#show running-config
interface VLAN29
 ip address 192.168.0.22 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
```

- Checking interface status

On Cisco 3500:

Firstly get trunk ports information of interface line status is required to pass VLAN information between switches. Cisco switch have two Ethernet trunk mechanisms: ISL and IEEE 802.1Q.

Both ISL and IEEE 802.1Q are supported on Cisco 3500, but Cisco 2950 only support 802.1Q. HP ProCurve 2910al series as the same with Cisco 2950 can support 802.1Q. ISL and IEEE802.1Q they belong to different protocol, cannot communicate each other.

How the two protocols additional VLAN information on the data frame?

ISL (Inter Switch Link):

ISL, Cisco product support the similar with IEEE802.1Q, used to link aggregation on the additional protocol VLAN.

After using the ISL, the head of each data frame of 26 bytes will be added "ISL header (ISL Header)", and bring the end of the frame header by including the ISL frame including the data calculated by 4 bytes CRC value. In other words, totally increase of 30 bytes of information.

Use ISL method, when the data frame leaves the link aggregation; simply remove the ISL header and the new CRC. As the original frame and CRC are intact, so do not need

to recalculate the CRC.

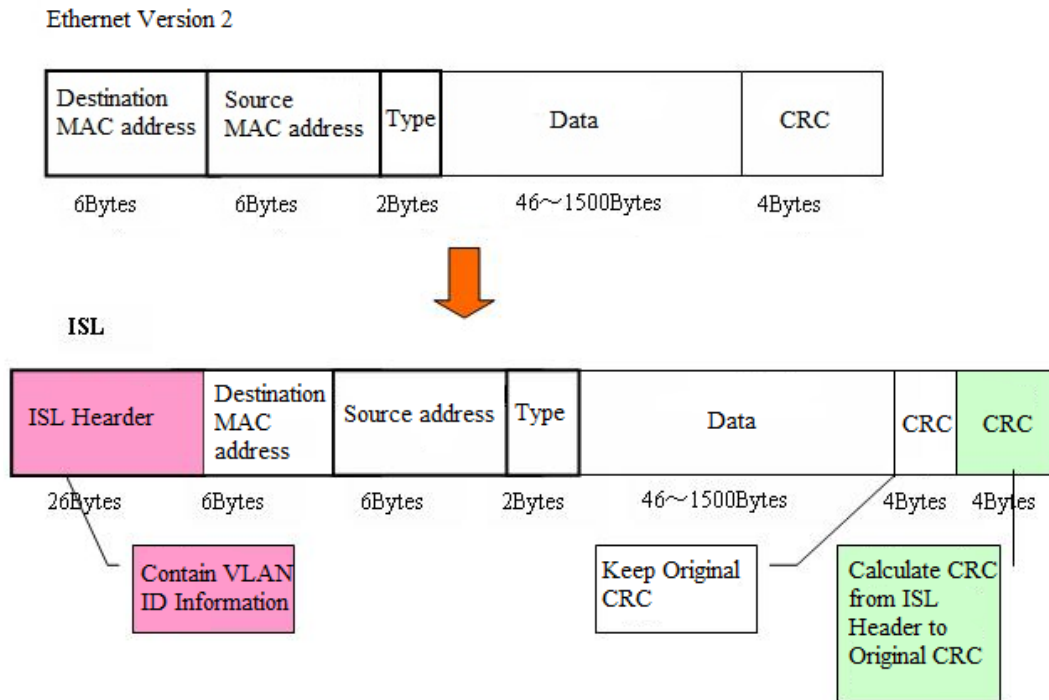


Figure 2-7: ISL Frame

Figure 2-7 shows ISL Frame, ISL header and new CRC package the original data frame, therefore it calls “Encapsulated VLAN”.

IEEE 802.1Q

IEEE802.1Q is certified through the IEEE additional VLAN on the data frame identification information of the agreement.

IEEE802.1Q attached to the VLAN identification information in the data frame “source MAC address” and “Category Domain (Type Field)” between. Include 2 bytes TPID and 2 bytes TCI, a total of 4 bytes.

Added in the data frame the content of 4 bytes, then the CRC value must change. Currently CRC frame value obtained is re-calculated the data frame after inserted TPID and TCI.

Ethernet Version 2

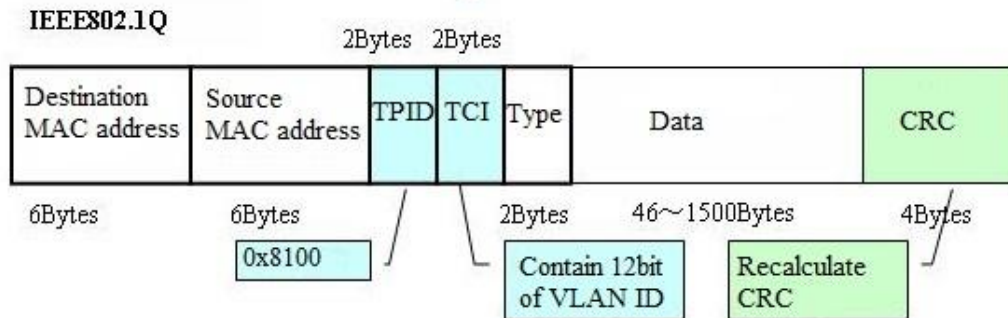
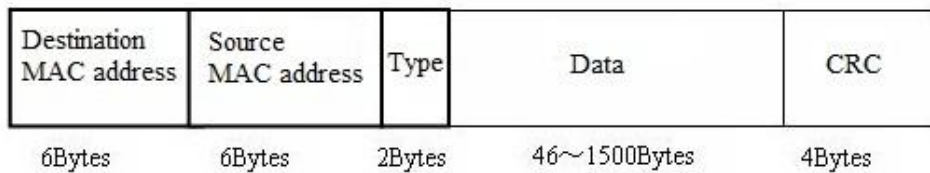


Figure 2-8: IEEE 802.1Q frame

Figure 2-8 shows IEEE802.1.Q frame, when the data frame leaves link aggregation, TPID and TCI will be removed, then will conduct a CRC re-calculation.

TPID value fixed at 0x8100. Switch by TPID, to determine the additional data frame's VLAN information based on IEEE802.1Q. The essence of the VLAN ID is TCI's 12-bit. So that up to $2^{12}=4096$ identified VLAN.

VLAN-based IEEE802.1Q additional information, as in the delivery label attached articles. Therefore, it is also known as "tag-based VLAN (Tagging VLAN)".

Figure 2-9 shows Cisco 3500 interface status, the command “show interface status” was captured (Appendix 1), according interfaces status we know.

Catalysts 3500		
Port	Name	VLAN 29
Fa0/42	alpha.cc.puv.fi	Trunk to alpha.cc.puv.fi
Fa0/47	c2950-wa033-1	Trunk to wa033-1 switch

Fa0/48	c2950-wa033-2	Trunk to wa033-2 swtich
Gi0/1	hp2910-wb206-2	Trunk to wb206-2 switch

Figure 2-9: Catalysts 3500 interface status

Figure 2-10 shows Cisco 2950 Switches interface status, use the same method get c2950-wa033-1 and wa033-2 interface status:

Catalysts 2950 wa033-1		
Port	Name	VLAN 29
Fa0/24	c3500-wa033-1	Trunk to c3500-wa033-1
Catalysts 2950 wa033-2		
Fa0/24	c3500-wa033-1	Trunk to c3500-wa033-1

Figure 2-10: Catalysts 2950 interface status

- Checking VLANs

The command “show vlan status” was captured (Appendix 2).Get the current VLANs information. Remove useless VLANs on Cisco 3500. Choose active VLANs and write in the form.

Figure 2-11 shows Cisco 3500 VLAN, for example, VLAN 320 has the name Printers which is active with a port number Fa0/37 but for VLAN 367 has the port number Fa0/1 to Fa0/16, Fa0/18 to Fa0/36, Fa0/38 to Fa0/41, Fa0/43 and Fa0/44, according VLAN status, current VLANs are used:

Catalysts 3500		
VLAN name	Status	Ports
VLAN320 Printer	Active	Fa0/37
VLAN363 Etaliittymat	Active	Fa0/45,46
VLAN367	Active	Fa0/1 – 16, 18–36, 38–41, 43 and 44

Figure 2-11: Catalysts 3500 VLAN

Figure 2-12 shows Catalysts 2950 switch VLAN.

Catalysts 2950-wa033-1

VLAN name	Status	Ports
VLAN367	Active	Fa0/1 – 19
VLAN317	Active	Fa0/20 – 23
Catalysts 2950-wa033-2		
VLAN367	Active	Fa0/1 – 9, 11 – 22
VLAN320	Active	Fa0/10
VLAN317	Active	Fa0/23

Figure 2-12: Catalysts 2950 VLAN

To sum up Catalysts 3500 and two Catalysts 2950 VLANs are keeping in the HP ProCurve that those VLANs information will be assigned in HP switch, therefore the interface also should be rearranged in HP Switch. Because reasonable distributions of ports help improve future management, administrators can easily view the switch port information.

- **Rearrange c3500-wa033-1 to hp2910-wa033-1**

Figure 2-13 and 2-14 shows rearrange trunk port and interfaces from Cisco 3500 to HP 2910, distribute the trunk port on hp 2910-wa33-1; replace VLAN 29 with VLAN 316 assign on Fa0/46, 47 and 48 ports. VLAN 320 on Fa0/1 port,

c3500-wa033-1 uplink port assign			hp2910-wa033-1 uplink port assign		
Trunk port	Name	VLAN	Trunk port	Nam	VLAN
Fa0/42	alpha.cc.puv.fi	VLAN 29	Fa0/46	alpha.cc.puv.fi	VLAN 316
Fa0/47	c2950-wa033-1	VLAN 29	Fa0/47	hp2910-wa033-2	VLAN 316
Fa0/48	c2950-wa033-2	VLAN 29			
Gi0/1	hp2910-wb206-2	VLAN 29	Gi0/48	Hp2910-wb206-2	VLAN 316

Figure 2-13: Rearrange trunk port on Catalysts 3500

c3500-wa033-1 interfaces assign			hp2910-wa033-1 interfaces assign		
Port	Name	VLAN	Port	Name	VLAN
Fa0/1 – 16, 18 – 36, 38 -		VLAN 367	Fa/4 - 44		VLAN 367

41					
Fa0/37	Printer	VLAN 320	Fa 0/1	Printer	VLAN 320
Fa0/45	Etayhteys Jakas/Kallio	VLAN 363	Fa0/2	Etayhteys Jakas/Kallio	VLAN 363
Fa0/46	Borje Harju	VLAN 363	Fa0/3	Borje Harju	VLAN 363

Figure 2-14: Rearrange interface on Catalysts 3500

- **Rearrange interfaces and combine two c2950 into one hp2910-wa033-2**

Figure 2-15 and 2-16 shows rearrange trunk port and interfaces on Cisco 2950.

c2950-wa033-1 uplink port assign			hp2910-wa033-2 uplink port assign		
Trunk Port	Name	VLAN	Trunk port	Name	VLAN
Fa0/24	c3500-wa033-1	VLAN 29	Fa0/48	hp2910-wa033-1	VLAN 316
c2950-wa033-2 uplink port assign					
Fa0/24	c3500-wa033-1	VLAN 29			

Figure 2-15: Rearrange trunk port on Catalysts 3500

c2950-wa033-1 interfaces assign		
Port	Name	VLAN
Fa0/1 – 19		VLAN 367
Fa0/20–23	Telephone system	VLAN 317
c2950-wa033-2 interfaces assign		
Fa0/1 – 9, 11 – 22		VLAN 367
Fa0/10	Printer	VLAN 320
Fa0/23	Telephone system	VLAN 317

hp2910-wa033-2 interfaces assign		
Port	Name	VLAN
Fa0/1 – 5	Telephone system	VLAN 317
Fa0/6	Printer	VLAN 320
Fa0/7– 47		VLAN 367

Figure 2-16: Rearrange interface on hp2910

3. CONFIGURATION ON HP PROCURVE SWITCH

3.1. Access HP ProCurve Switch

Switch without the keyboard and mouse, no monitor, the computer needs to initialize the switch and the switch console serial port to connect. Two most common approaches is to use the console cable (control cable) to connect PC and use telnet to access

Equipments and Hardware:

- HP ProCurve Switch
- RJ-45 to DB9 Adapter

Software:

- HyperTerminal
- Putty
- HP ProCurve RJ45-DB9 driver

Figure 3-1 shows use a RJ-45 to DB9 adapter to connect the switch console port and laptop COM 1 port.

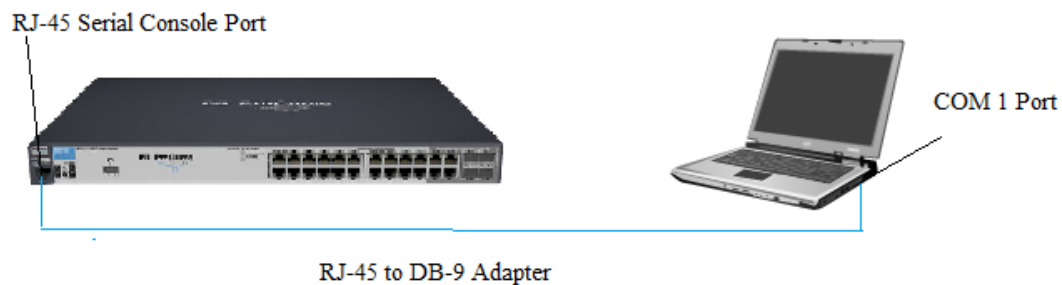


Figure 3-1: Connection Diagram

Normally switch of the default state is bps – bits per second is 96000bps, the COM port of properties is set to revert to the default value which you can choose to identify and press enter key, then the screen prompt appears on the router or other characters,

indicating the computer is connected to the switch, and wait for the switch begins to load IOS (Internet work Operating System) while loading IOS system you can see the IOS version, switch type and memory size are displayed, after the completion can be configured.

Setting communication parameters on HyperTerminal

- COM port COM1
- 9600bps
- Data bits: 8
- Parity: None
- Stop bits: 1
- Flow control: None

3.1.1. ProCurve Switch Command Prompts

In the default configuration, switch displays the following CLI prompts.

Figure 3-2 shows login flow chart of process model.

User Exec

Log in to start switch HP ProCurve Switch>

Privileged Exec

User mode “enable” command execution HP ProCurve Switch#

Global Configuration

Privileged mode “configuration” execution HP ProCurve Switch(config)#

Config-VLAN (Global Configuration VLAN mode)

Global mode “vlan-id” execution HP ProCurve Switch(vlan-id)#

Interface configuration level (Global Configuration interface level mode)

Global mode “interface-id” execution

HP ProCurve Switch(eth-id)#

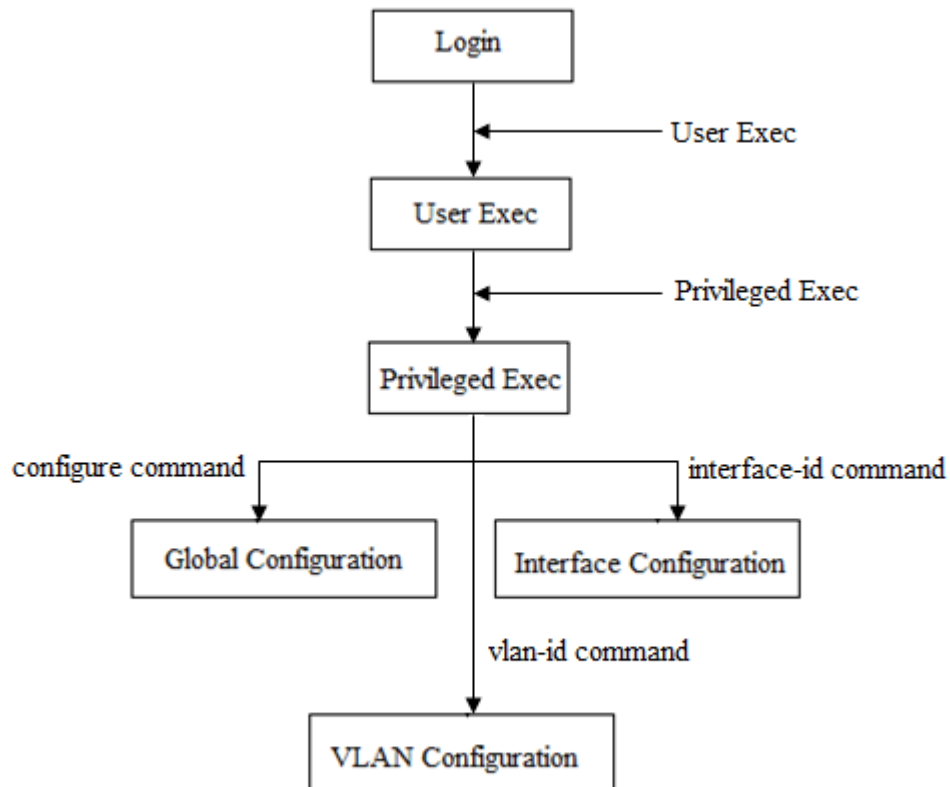


Figure 3-2: Login flow chart

Figure 3-3 shows logout flow chart of process model.

User Exec

HP ProCurve Switch>

Execution “exit” command

Privileged Exec

HP ProCurve Switch#

Execution “logout” or “exit” command

Global Configuration

HP ProCurve Switch(config)#

Execution “exit” or ctrl+Z command

Config-VLAN (Global Configuration VLAN mode)

HP ProCurve Switch(vlan-id)# Execution “exit” or ctrl+Z command

Interface configuration level (Global Configuration interface level mode)

HP ProCurve Switch(eth-id)# Execution “exit” or ctrl+Z command

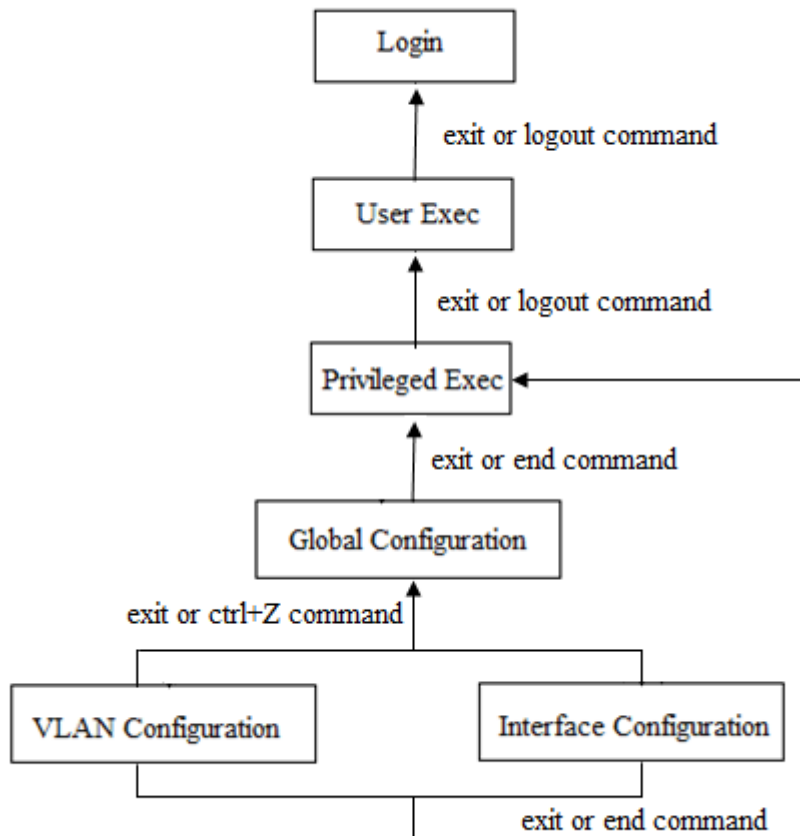


Figure 3-3: Logout flow chart

3.1.2. Getting help in the menu Interface

For information on specific parameters in the menu interface, help command conduce to configure the switch when you have no idea or forget the command, mention the information you need, and suggestion the processing in future.

Otherwise the command “help” in the CLI has the similar function with help in the menu interface, type “help” in the privilege execution while several commands are displayed on your switch. Get the help from the list that improve your configuration.

3.2. Basic Setting for the ProCurve Switch

All HP ProCurve Switches have the same basic settings, such as SNTP, SNMP and IP route parameters must be the same, because data transmission through these server and gateway. The theory of layer 3 switches sending data between different computers:

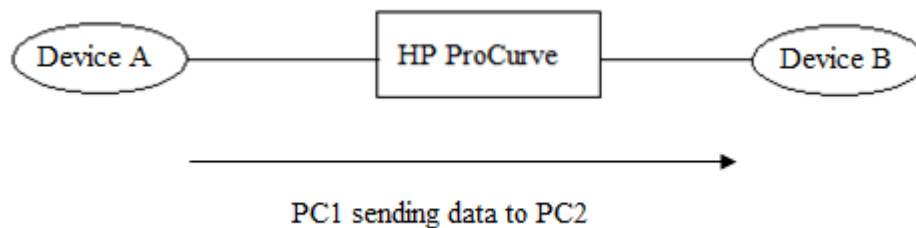


Figure 3-4: Switch sends data between two computers

Figure 3-4 shows switch send data between two computers, such as A send data to B, the requirement is known destination IP address of B, then A estimate and check destination IP address whether or not in the same subnet mask.

If A and B are in the same network segment, but do not know the MAC address required for forwarding of data, A will send an ARP (Address Resolution Protocol) request, B return to their MAC address, A package this MAC and send the packet switch, the switch use the layer 2 (data link layer) function, find the MAC address table, will forward the packet to the appropriate port.

If the destination IP address displayed is not in the same network segment, achieve the communication between A and B, no corresponding MAC address table entry in the flow cache, firstly to send a normal data packet to a default gateway, the default gateway in the operating system has been set up, corresponding to the routing module of layer 3 (network layer), we can see that the data which is not the same subnet, the first the default gateway of MAC address is kept in the MAC; then routing modules

receiving this packet, check the routing table to determine the route to reach B, it will construct a new frame header, in which the default gateway MAC address as the source MAC address, host B's MAC address for the destination of MAC addresses. Recognition by some trigger mechanism, the establishment of the host A and B's MAC address and corresponding port forwarding System, and record it in the flow cache, after the A to B data, directly referred to the layer 2 of the exchange module to complete.

Configuration include-credentials have to be given once by hand before copy paste this setting uses on every HP ProCurve Switch. The project requirements use the last port as uplink port (24G/48G).

include-credentials

```
time timezone 120
time daylight-time-rule Western-Europe
ip routing
timesync sntp
sntp unicast
sntp server priority 1 192.168.1.1 3
sntp server priority 2 192.168.1.2 3
ip ssh
ip ssh filetransfer
ip route 0.0.0.0 0.0.0.0 192.168.4.1
router rip
    no auto-summary
    exit
snmp-server community "public" unrestricted
snmp-server host 193.166.140.174 "public"
snmp-server host 193.166.140.44 "public"
```

Time zone 120: Europe time zone.

IP routing: access the path of the data travel across multiple networks.

SNTP server priority 1 192.168.1.1: switch achieves time synchronization with SNTP server.

IP authorized-managers: show IPv4 address allowed managing the switch.

IP route 0.0.0.0 0.0.0.0 192.168.4.1: configure default route which means 0.0.0.0 0.0.0.0 indicate all of the local IP address (first 0.0.0.0 is all IPs; second is all subnets), 192.168.4.1 indicate the next hop switch is 192.168.4.1.

SNMP server host 193.166.140.174 "public: SNMP agent sent trap to host 193.166.140.174 that can grantee communication of the switches.

The setup configuration steps:

Step 1: Access Global Configuration

[HP2910# configure terminal](#)

Step 2: Give include-credentials

[HP2910\(config\)# include-credentials](#)

Step 3: copy and paste the basic configuration before settings

3.3. Configuration on HP ProCurve

3.3.1. Configuration Steps on HP ProCurve Switch

Refer to figure from 2-10 to 2-13, the interface are assigned on HP ProCurve.

This configuration example applies to the following HP series 2910 switch products.

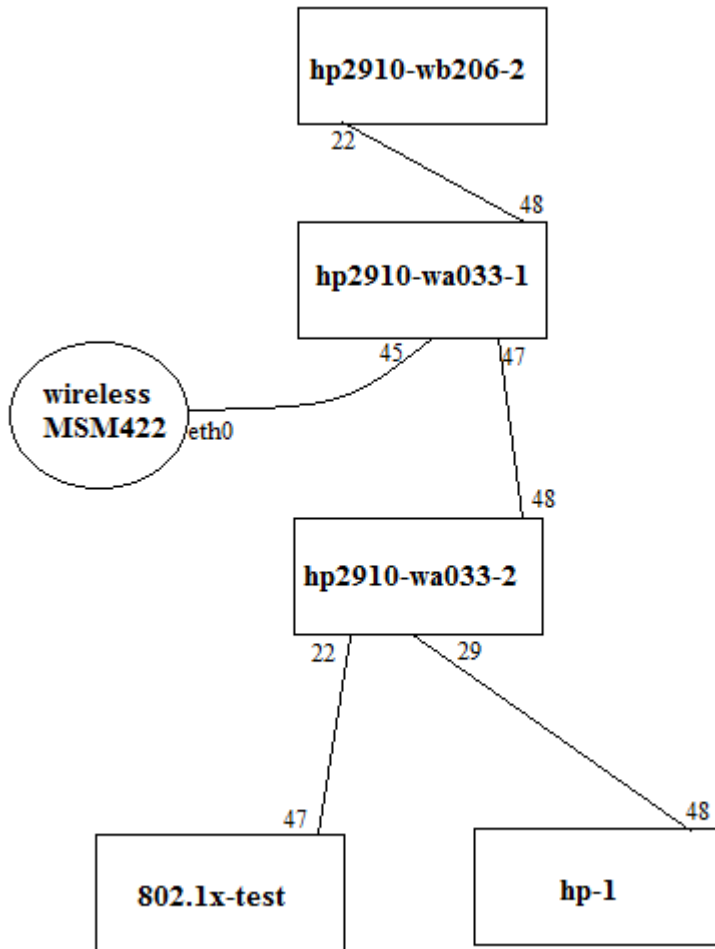


Figure 3-5: Network connection

Figure 3-5 shows the network connection according to Figure 2-5, trunk port 22 of hp2910-wb206-2 connects to wa033-1 Gigabit port 48, on wa033-1 port 45 is untagged for a wireless access point connect to Ethernet 0, besides port 45 need to be tagged on trunk port (47 and 48), then port 47 as the trunk port connect to the next one wa033-2 switch on port 48, hp-1 with port 48 trunk to port 29 on wa033-2, the other one 802.1x-test port 47 trunk to port 22 on wa033-2.

Now we get all trunk port information, configure VLAN 316 (192.168.4.47) on hp2910-wa033-1, VLAN 316 uses on uplink port, the duty is to carry multiple VLANs. The next steps all VLANs have to be tagged on VLAN 316, it decides VLANs where from and go.

hp2910-wa033-1

1. Configure Host Name

In VAMK, there are various switches, each switch in the network as a certain role; administrators face the problems when making management of the large number of different types of switches. Therefore, a meaningful name to the switch to show its type, function and location (wa033 classroom) is necessary.

```
HP ProCurve Switch(config)# hostname hp2910-wa033-1
```

2. Configure Password

Set user password when the user need remote login or directly connect to console port with switch, we can set the operator and manager password. In our situation we are using the same password on each ProCurve Switch.

```
hp2910-wa033-1(config)# password operator xxxx
```

```
hp2910-wa033-1(config)# password manager xxxx
```

3. VLAN creation

Access vlan-id execution in global configuration; create VLAN 316, give an IP address and subnet mask address to this VLAN, setting port 46 to 48 are trunk ports that 47 trunk to upper switch wa033-2 and 48 to wb206-2.

```
hp2910-wa033-1 (config)# VLAN 316
```

```
hp2910-wa033-1 (VLAN-316)# name KYTKIMET
```

```
hp2910-wa033-1 (VLAN-316)# ip address 192.168.4.67/24
```

```
hp2910-wa033-1 (VLAN-316)# tagged 46-48
```

```
hp2910-wa033-1 (VLAN-316)# exit
```

Printer VLAN 320 uses port 1 which is connecting to the printer in classroom wa033 as untagged status; port 2 and 3 are assigned to VLAN 363; ports 4 to 44 are assigned to VLAN 367 that manage all students computer in wa033. Uplink ports in each VLAN must be tagged on VLAN 316. All data communication exchanges though the main VLAN 316.

```
hp2910-wa033-1(config)# VLAN 320
hp2910-wa033-1(VLAN-320)# name PRINTERS
hp2910-wa033-1(VLAN-320)# untagged 1
hp2910-wa033-1(VLAN-320)# tagged 46-48
hp2910-wa033-1(VLAN-320)# exit
hp2910-wa033-1(config)# VLAN 363
hp2910-wa033-1(VLAN-363)# name SDSL-LIITTYM
hp2910-wa033-1(VLAN-363)# untagged 2-3
hp2910-wa033-1(VLAN-363)# tagged 46-48
hp2910-wa033-1(VLAN-363)# exit
hp2910-wa033-1(config)# VLAN 367
hp2910-wa033-1(VLAN-367)# name VLAN367
hp2910-wa033-1(VLAN-367)# untagged 4-44
hp2910-wa033-1(VLAN-367)# tagged 46-48
hp2910-wa033-1(VLAN-367)# exit
```

VLAN 320, 363 and 367 already tagged on VLAN 316 then follow the IP address of VLAN 316 (192.168.4.67); VLANs are recorded in NS (Name server) server which is used to specify the DNS server from the domain name for resolution, it will get the request from switch to and checks that VLAN information whether exist and offer an IP address to the computer. For example printer VLAN 320 will get the IP address 192.168.20.xxx.

VAMK internal telephone system VLAN is 317, it, and here we did not configure VLAN 317 in hp2910-wa033-1, this VLAN also has to be tagged in VLAN 316 for access VLAN 317 data transmission through by VLAN 316, the purpose is for wa033-2 switch can take the VLAN 317 information from the uplink port.

```
hp2910-wa033-1(config)# VLAN 317
hp2910-wa033-1(VLAN-317)# name VLAN317
hp2910-wa033-1(VLAN-317)# tagged 46-48
hp2910-wa033-1(VLAN-317)# exit
```

Assign wireless network VLAN 329 with another four VLANs 306, 332, 396 and 397 which I mentioned in the figure 2-3 VAMK important VLAN list. VLAN 329 is like VLAN 316, 329 control all wireless devices, and the duty of 316 is to manage wired devices.

```

hp2910-wa033-1(config)# VLAN 329
hp2910-wa033-1(VLAN-329)# name HP-WLAN
hp2910-wa033-1(VLAN-329)# untagged 45
hp2910-wa033-1(VLAN-329)# tagged 48
hp2910-wa033-1(VLAN-329)# exit
hp2910-wa033-1(config)# VLAN 306
hp2910-wa033-1(VLAN-306)# name PCWN
hp2910-wa033-1(VLAN-306)# tagged 48
hp2910-wa033-1(VLAN-306)# exit
hp2910-wa033-1(config)# VLAN 332
hp2910-wa033-1(VLAN-332)# name W30-STAFF
hp2910-wa033-1(VLAN-332)# tagged 45,48
hp2910-wa033-1(VLAN-332)# exit
hp2910-wa033-1(config)# VLAN 396
hp2910-wa033-1(VLAN-396)# name WL-Vamk-w30
hp2910-wa033-1(VLAN-396)# tagged 45,48
hp2910-wa033-1(VLAN-396)# exit
hp2910-wa033-1(config)# VLAN 397
hp2910-wa033-1(VLAN-397)# name WL-VamkMobile
hp2910-wa033-1(VLAN-397)# tagged 45,48
hp2910-wa033-1(VLAN-397)# exit

```

Assign VLAN 329 static DHCP address 192.168.29.21 in ns2 server (ns2.puv.fi), Hardware Ethernet is MAC address of MSM422 Access point. Switch loading VLAN 329 parameters in ns2 server and assign the static DHCP address to HP Access Point.

- 1) Login ns2.puv.fi by SSH in putty
- 2) Become root sudo -i
- 3) Find the location of dhcp3 folder; cd /etc/dhcp3/
- 4) Nano master.dhcp.conf and edit configuration as below:

```

host puv-wa033 {
    hardware ethernet 00:0f:61:0e:2b:b2;
    fixed-address 192.168.29.21;
}

```

4. Authorized IP manager

The security configuration by authorized IP Manages function used IP address and masks to determine which stations (PCs or workstations) can access the switch through

the network. The default IP Mask is 255.255.255.255 which means allow switch access only a station having an IP address, the Mask address specify ranges of the IP address. The function of authorized IP Manages include Telnet application, web browser interface and SNMP wile configured switch, IP managers through local password first, but if we assigned RADIUS server in switch, the authorized IP manager it is defined as one of the highest priority. The password will be followed in RADIUS server. Now focus the project, we have two workstations can be used, 193.166.140.44 and 193.166.140.174.

```
hp2910-wa033-1(config)#ip authorized-managers 193.166.140.44 255.255.255.255  
access manager
```

```
hp2910-wa033-1(config)#ip authorized-managers 193.166.140.174 255.255.255.255  
access manager
```

Thus far HP 2910-wa033-1 configuration is done; type the command in privilege execution “write memory” for saving the running-configuration of the switch to the flash memory; other switches configuration on the same theory. Refer VLAN forms preparation care of what VLAN-ID should be assigned and be careful of the management VLAN 316 IP address which is following the previous IP address and increase of 1. Here we took 192.168.4.67/24 for wa033-1 classroom, next switch wa033-2 is 192.168.4.68/24 and so on, subnet mask don’t need to change.

3.3.2. Verification Commands On HP2910-wa033-1

Complete HP ProCurve Switch configuration, while some commands can check the configuration. Verification commands displaying clearly configuration what you did.

Firstly, we check the running configuration of all the switches; the command “show running-configuration” is one of the best ways in verification commands, and was captured (Appendix 3). If the configuration is good, the other method “ping” and “telnet” command also can check the configuration; verify the connection in the network. Packet Internet Groper (ping) operates by sending ICMP echo request witch

data package to a host, if the host responds, then the host is the existence of this network. Even so ping command does not determine whether the host is working correctly. Login hp2910-wa033-1 and ping VAMK web server 193.166.140.15, the default gateway of VLAN 316 192.168.4.1.

```
hp2910-wa033-1# ping 193.166.140.15
193.166.140.15 is alive, time = 3 ms
hp2910-wa033-1# ping 192.168.4.1
192.168.4.1 is alive, time = 4 ms
hp2910-wa033-1# ping 192.168.4.68
192.168.4.68 is alive, time = 8 ms
hp2910-wa033-1#
```

Secondly another way to verify the configuration is to use “show interface brief”, the command was captured in Appendix 4, displays all the interfaces parameter and mode on the switch. The trunk port connection status the connection of all trunk ports is on.

Then checking the network identity devices, the command “show lldp info remote-device” advertise network devices on IEEE 802 LAN network. Output of the information was captured in Appendix 5, local port 45 connect MSM422 Ethernet 0, port 47 trunk to wa033-2, 48 trunk to wb206-2, the results as we expecting.

Finally verification command VLAN and IP authorized outputs in APPENDIX 6.

3.4. Dynamic VLANs Implementation

3.4.1. GVRP configuration on HP ProCurve

Dynamic VLANs information can be propagated by GVRP, switch in the network can dynamically create VLAN, and real-time to maintain VLAN configuration consistency.

Enable GVRP the switch can monitor each port of GVRP PDU (protocol data unit), to learn from the GVRP PDU connected to GVRP-aware devices in the VLAN information, accordingly the configuration accept VLAN membership on GVRP PDU port. The way by sending a GVRP PDU, switch advertises VLAN information on every

port. Notices of the VLAN information includes the level of static configuration and through GVRP learns the other devices information.

GVRP default settings of global state and dynamic creation VLANs are disabled, before configurations of GVRP, there are some proceeding need attention.

- Both ends of a link the switch should start GVRP, GVRP information advertise on the trunk ports, but dissemination of information including the current VLANs information to all switches, regardless of whether learning the dynamic VLAN, or manually.
- State of forwarding ports will participate in GVRP operation, such as receiving, sending GVRP PDU; only the forwarding ports of VLAN GVRP information will be spread.
- Add the VLAN port GVRP are tagged port.
- GVRP dynamic VLAN learning none of the configuration will be stored in the system, when the switch reset, these messages will be lost. Users can not save these dynamic learning to the VLAN information.
- Created by the GVRP dynamic VLAN cannot modify the parameters.

Make the connection of hp-1 and gvrp_test_sw switches (Figure 3-6) where refer to Figure 2-5 new HP ProCurve topology, hp-1 has to be considering as VLAN Source Provider.

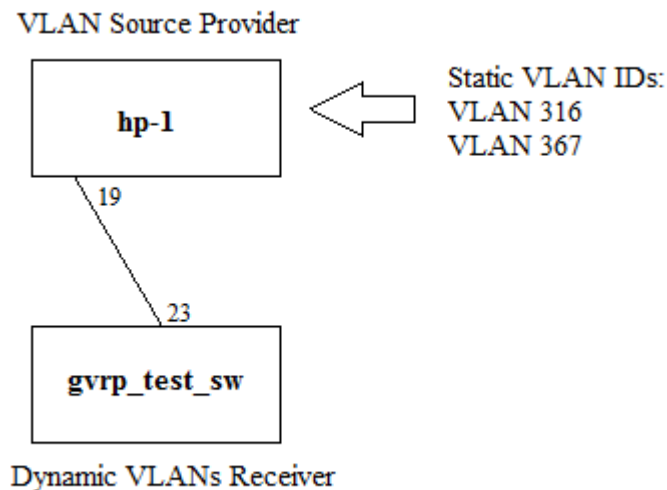


Figure 3-6: GVRP switches connection

Figure 3-6 shows GVRP Switches connection, its point out VLAN Source Provider supports two static VLAN of VLAN 316 and 367 which will be spread to the network, as the receiver of gvrp_test_sw when get the VLANs information from hp-1 and learn VLAN parameters from port 19 to port 23 based on both switches are enable GVRP Global settings, we have 2 VLANs learned on gvrp_test_sw switch in the network. Two static VLANs 316 and 367, it is configured to “block” the learning of any additional “unknown” VLANs which can be guaranteed hp-1 switch will only advertise the 2 statically-configured VLANs.

The syntax to enable GVRP

```
hp-1(config)#gvrp enable
```

Or disable by `no gvrp enable`

Determine VLAN 316 and 367 must be “Active” on hp-1, VLAN 316 is trunk link with IP address 192.168.4.100/24, interfaces 1 to 20 assigns to VLAN 367.

The configuration for GVRP

```
hp-1(config)# vlan 316
hp-1(vlan-316)# ip address 192.168.4.100/24
hp-1(vlan-316)# tagged 48
hp-1(vlan-316)# exit
```

```
hp-1(config)#vlan 367
hp-1(vlan-367)# untagged 1-20
hp-1(vlan-367)# tagged 48
hp-1(vlan-367)# exit
hp-1(config)#gvrp
hp-1(config)#interface 1-20
hp-1(eth-1-20)#unkown-valns block
hp-1(eth-1-20)#end
hp-1# write memory
```

Notice interface 1-20 block unknown VLANs, the reason is to reject other VLAN parameter access on the interface 1-20, only transmit VLAN 367 parameters on the network. The learning switch gvrp_test_sw will know what VLAN ID is advertised. From the configuration of VLAN 367 interface 1-20 is untagged, but its tagged on VLAN 316, as I mentioned GVRP only advertise on Tagged port, so VLAN 316 also spread to the learning switch.

3.4.2. Verify Command of GVRP

In order to verify the configuration, at the beginning we check the switches connection status, the command of "show lldp info remote-device" capture in APPENDIX 7 the result of gvrp_test_sw discover hp-1 switch on local port 23.

Then checking VLAN information on both switches that out of put "show vlans" in APPENDIX 8. As we expected, the result shows VLAN 316 and 367 in hp-1 is static, on gvrp_test_sw is dynamic status its successful get the advertising VLANs on the network.

GVRP status verification of "show gvrp" in APPENDIX 9, interface 1-20 of hp-1 blocked all unknown VLANs, and the other sides on gvrp_test_sw of all ports are learned from provider switch.

The GVRP is the future implementation in VAMK, within the network by automatically notice VLAN ID, GVRP configuration reduces the inconsistency because the

possibility of errors arising. And, when a device on the VLAN configuration is changed, GVRP can automatically change the VLAN configuration on the connected devices, thus reducing manual configuration.

4. CONCLUSION

The project focus on the implementation of the Migration from Cisco to HP switches for VAMK VLAN conversions. In the past three months, I realize the importance of teamwork during the project and strong capability of handling various problems; we support each other in studies and share practical experiences, and with my supervisor guiding us to achieve this project step by step, finally all the switches and wireless access points configured successfully.

From project preparation to completion, I did the following research and work (APPENDIX A and B).

Understand network distributed in VAMK;

Understand HP ProCurve Switch configuration;

Understand the difference configurations between Cisco and HP ProCurve Switch;

Incorporate fundamental studies and substantial network skills into the practical;

The paper is to explain one of the important access layers switches configurations steps, because replace switches is a large project, some part has to improve in the future of GVRP configuration and authentication implementation.

REFERENCES

HP ProCurve Network Technical Supports in Internet:

URL: <http://www.hp.com/rnd/support/manuals/2800.htm>

CCNA: Cisco Certified Network Associate Study Guide Sixth Edition 640-802

Technical Words Definitions:

URL: <http://www.webopedia.com/>

Data Communications and Networking Fourth Edition, Forouzan.

APPENDIX 1

Cisco 3500 interface status:

c3500-wa033-1#show interfaces status

Port	Name	Status	VLAN	Duplex	Speed	Type
Fa0/1		connected	367	A-Full	A-100	100BaseTX/FX
Fa0/2		connected	367	A-Full	A-10	100BaseTX/FX
.....						
Fa0/15		connected	367	A-Full	A-100	100BaseTX/FX
Fa0/16		notconnect	367	Auto	Auto	100BaseTX/FX
Fa0/17		notconnect	trunk	Auto	Auto	100BaseTX/FX
Fa0/18		notconnect	367	Auto	Auto	100BaseTX/FX
Fa0/19		notconnect	367	Auto	Auto	100BaseTX/FX
Fa0/20		notconnect	367	Auto	Auto	100BaseTX/FX
Fa0/21		notconnect	367	Auto	Auto	100BaseTX/FX
.....						
Fa0/39		notconnect	367	Auto	Auto	100BaseTX/FX
Fa0/40		notconnect	367	Auto	Auto	100BaseTX/FX
Fa0/41		notconnect	367	Auto	Auto	100BaseTX/FX
Fa0/42	alpha.cc.puv.fi	connected	trunk	A-Full	A-100	100BaseTX/FX
Fa0/43		notconnect	367	Auto	Auto	100BaseTX/FX
Fa0/44		notconnect	367	Auto	Auto	100BaseTX/FX
Fa0/45	EtayhteysBorj	connected	363	A-Half	A-10	100BaseTX/FX
Fa0/46	EtayhteysJaka	connected	363	A-Half	A-10	100BaseTX/FX
Fa0/47	c2950-wa033-2	connected	trunk	A-Full	A-100	100BaseTX/FX
Fa0/48	c2950-wa033-1	connected	trunk	A-Full	A-100	100BaseTX/FX
Gi0/1	hp2910-wb206-2	connected	trunk	A-Full	1000	1000BaseSX
Gi0/2		notconnect	trunk	Auto	1000	Missing

APPENDIX 2

Cisco 3500 VLAN status:

c3500-wa033-1#show VLAN

VLAN Name	Status	Ports
1 default	active	
320 Printers	active	Fa0/37
329 hp-wireless	active	
332 hal-332-W30	active	
333 hal-333-R29	active	
334 hal-334-R31-R33	active	
335 hal-335-TB	active	
336 hal-336-test	active	
337 VamkStaffWlan	active	
363 Etaliittymat	active	Fa0/45, Fa0/46
364 opp-364-W30	active	
365 VLAN365	active	
366 VLAN366	active	
367 VLAN367	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4, Fa0/5, Fa0/6, Fa0/7, Fa0/8, Fa0/9, Fa0/10, Fa0/11, Fa0/12, Fa0/13, Fa0/14, Fa0/15, Fa0/16, Fa0/18, Fa0/19, Fa0/20, Fa0/21, Fa0/22, Fa0/23, Fa0/24, Fa0/25, Fa0/26, Fa0/27, Fa0/28, Fa0/29, Fa0/30, Fa0/31, Fa0/32, Fa0/33, Fa0/34, Fa0/35, Fa0/36, Fa0/38, Fa0/39, Fa0/40, Fa0/41, Fa0/43, Fa0/44
368 VLAN368	active	

APPENDIX 3

Resulting Configuration of hp2910-wa033-1:

hp2910-wa033-1# show running-config

Running configuration:

; J9147A Configuration Editor; Created on release #W.14.38

```
hostname "hp2910-wa033-1"
time timezone 120
time daylight-time-rule Western-Europe
module 1 type J9147A
interface 2
    name "Etayhteys-Borje-Harju"
exit
interface 3
    name "Etahyteys-Jakas-Kallio"
exit
interface 46
    name "alpha.cc.puv.fi"
exit
interface 47
    name "hp2910-wa033-2"
exit
interface 48
    name "hp2910-wb206"
exit
ip routing
VLAN 1
    name "DEFAULT_VLAN"
    ip address dhcp-bootp
    no untagged 1-48
    exit
VLAN 316
    name "KYTKIMET"
    ip address 192.168.4.67 255.255.255.0
    tagged 46-48
    exit
VLAN 320
    name "PRINTERS"
    untagged 1
    tagged 46-48
```

```
no ip address
exit
VLAN 363
  name "SDSL-LIITTYM"
  untagged 2-3
  tagged 46-48
  no ip address
  exit
VLAN 367
  name "VLAN367"
  untagged 4-44
  tagged 46-48
  no ip address
  exit
VLAN 329
  name "HP-WLAN"
  untagged 45
  tagged 48
  no ip address
  exit
VLAN 306
  name "PCWN"
  tagged 45,48
  no ip address
  exit
VLAN 332
  name "W30-STAFF"
  tagged 45,48
  no ip address
  exit
VLAN 396
  name "WL-Vamk-w30"
  tagged 45,48
  no ip address
  exit
VLAN 397
  name "WL-VamkMobil"
  tagged 45,48
  no ip address
  exit
VLAN 317
  name "VLAN317"
  tagged 46-48
  no ip address
```

```
exit
VLAN 307
  name "Eduroam"
  tagged 45,47-48
  no ip address
  exit
include-credentials
password operator sha1 "446410a140d4e16355e0a38e4f924fa1a4c7790f"
password manager sha1 "446410a140d4e16355e0a38e4f924fa1a4c7790f"
timesync sntp
sntp unicast
sntp server priority 1 192.168.1.1 3
sntp server priority 2 192.168.1.2 3
ip authorized-managers 193.166.140.44 255.255.255.255 access manager
ip authorized-managers 193.166.140.174 255.255.255.255 access manager
ip ssh filetransfer
ip route 0.0.0.0 0.0.0.0 192.168.4.1
router rip
  no auto-summary
  exit
snmp-server community "public" unrestricted
snmp-server host 193.166.140.174 "public"
snmp-server host 193.166.140.44 "public"
snmpv3 engineid "00:00:00:0b:00:00:00:24:a8:dc:31:80"
no tftp client
no tftp server
no autorun
```

APPENDIX 4

HP ProCurve wa033-1 Verification command of Interface Brief

hp2910-wa033-1# show interfaces brief

Status and Counters - Port Status

Port	Type	Intrusion Alert	Enabled	Status	Mode	MDI Mode	Flow Ctrl	Bcast Limit
----- + -----								
1	100/1000T	No	Yes	Up	100FDx	MDIX	off	0
2	100/1000T	No	Yes	Up	10HDx	MDIX	off	0
3	100/1000T	No	Yes	Up	10HDx	MDIX	off	0
4	100/1000T	No	Yes	Up	1000FDx	MDI	off	0
5	100/1000T	No	Yes	Up	1000FDx	MDI	off	0
6	100/1000T	No	Yes	Up	1000FDx	MDI	off	0
7	100/1000T	No	Yes	Down	1000FDx	MDI	off	0
8	100/1000T	No	Yes	Up	1000FDx	MDI	off	0
9	100/1000T	No	Yes	Up	1000FDx	MDIX	off	0
10	100/1000T	No	Yes	Up	1000FDx	MDI	off	0
11	100/1000T	No	Yes	Up	1000FDx	MDIX	off	0
12	100/1000T	No	Yes	Up	1000FDx	MDI	off	0
13	100/1000T	No	Yes	Up	1000FDx	MDI	off	0
.....								
43	100/1000T	No	Yes	Up	1000FDx	MDIX	off	0
44	100/1000T	No	Yes	Down	1000FDx	Auto	off	0
45	100/1000T	No	Yes	Up	1000FDx	MDIX	off	0
46	100/1000T	No	Yes	Up	100FDx	MDIX	off	0
47	100/1000T	No	Yes	Up	1000FDx	MDI	off	0
48	1000SX	No	Yes	Up	1000FDx		off	0

APPENDIX 5

Output of “show lldp info remote-device”

hp2910-wa033-1:

LLDP Remote Devices Information

LocalPort	ChassisId	PortId	PortDescr	SysName
45	SG949ZVW45	eth0		
47	00 24 a8 dc 54 00	48	48	hp2910-wa033-2
48	00 24 a8 c6 c4 40	22	22	hp2910-wb206-2

APPENDIX 6

Output of “show vlans”

hp2910-wa033-1:

Status and Counters - VLAN Information

Maximum VLANs to support : 256

Primary VLAN : DEFAULT_VLAN

Management VLAN :

VLAN ID	Name	Status	ssVoice	Jumbo
1	DEFAULT_VLAN	Port-based	No	No
306	PCWN	Port-based	No	No
307	Eduroam	Port-based	No	No
316	KYTKIMET	Port-based	No	No
317	VLAN317	Port-based	No	No
320	PRINTERS	Port-based	No	No
329	HP-WLAN	Port-based	No	No
332	W30-STAFF	Port-based	No	No
363	SDSL-LIITTYM	Port-based	No	No
367	VLAN367	Port-based	No	No
396	WL-Vamk-w30	Port-based	No	No
397	WL-VamkMobil	Port-based	No	No

IP Authorized Managers:

IPV4 Authorized Managers

Address : 193.166.140.44
Mask : 255.255.255.255
Access : Manager

Address : 193.166.140.174
Mask : 255.255.255.255
Access : Manager

APPENDIX 7

Output of “show lldp info remote-device”

gvrp_test_sw

LLDP Remote Devices Information

LocalPort	ChassisId	PortId	PortDescr	SysName
23	00 24 a8 dc 20 80	19	19	hp-1

APPENDIX 8

Output of "show vlans" on hp-1 and gvrp_test_sw

hp-1:

Status and Counters - VLAN Information

Maximum VLANs to support : 256
Primary VLAN : DEFAULT_VLAN
Management VLAN :

VLAN ID	Name	Status	Voice	Jumbo
1	DEFAULT_VLAN	Port-based	No	No
316	VLAN316	Port-based	No	No
367	VLAN367	Port-based	No	No

gvrp_test_sw:

Status and Counters - VLAN Information

Maximum VLANs to support : 256
Primary VLAN : DEFAULT_VLAN
Management VLAN :

VLAN ID	Name	Status	Voice	Jumbo
1	DEFAULT_VLAN	Port-based	No	No
316	GVRP_316	Dynamic		No
367	GVRP_367	Dynamic		No

APPENDIX 9

Output of “show gvrp”

hp-1:

GVRP support

Maximum VLANs to support [256] : 256

Primary VLAN : DEFAULT_VLAN

GVRP Enabled [No] : Yes

Port Type	Unknown VLAN	Join	Leave	Leaveall
----- + -----				
1 100/1000T	Block	20	300	1000
2 100/1000T	Block	20	300	1000
.....				
18 100/1000T	Block	20	300	1000
19 100/1000T	Block	20	300	1000
20 100/1000T	Block	20	300	1000

gvrp_test_sw:

GVRP support

Maximum VLANs to support [256] : 256

Primary VLAN : DEFAULT_VLAN

GVRP Enabled [No] : Yes

Port Type	Unknown VLAN	Join	Leave	Leaveall
----- + -----				
1 100/1000T	Learn	20	300	1000
2 100/1000T	Learn	20	300	1000
.....				
18 100/1000T	Learn	20	300	1000
19 100/1000T	Learn	20	300	1000
20 100/1000T	Learn	20	300	1000
21 100/1000T	Learn	20	300	1000
22 100/1000T	Learn	20	300	1000
23 100/1000T	Learn	20	300	1000

APPENDIX A

List of configured HP ProCurve Switches

IP address	Switch name
192.168.4.40	hp2910-wb004
192.168.4.41	hp2910-wa117-1
192.168.4.42	hp2910-wa128-1
192.168.4.44	hp2910-wa333
192.168.4.47	hp2910-wa313-1
192.168.4.57	hp2910-wa339-1
192.168.4.67	hp2910-wa033-1
192.168.4.68	hp2910-wa033-2

APPENDIX B

List of configured MSM422 Access Points

IP address	Access Point	AP ID	MAC Address
192.168.29.26	puv-wa333	SG949ZVW1L	00:0f:61:0e:3f:88
192.168.29.27	puv-wa301	SG949ZVW05	00:0f:61:0e:3f:2e
192.168.29.28	puv-wa337	SG949ZVWMC	00:0f:61:0e:3f:b8
192.168.29.29	puv-wa242	SG951ZVWSP	00:0f:61:0e:5d:f8
192.168.29.30	puv-wa234	SG952ZVW02	00:0f:61:0e:7d:88
192.168.29.32	puv-wa202	SG951ZVWSJ	00:0f:61:0e:6d:14
192.168.29.36	puv-wa247	SG951ZVX8R	00:0f:61:0e:9d:f2
192.168.29.38	puv-wc017	SG951ZVWWD	00:0f:61:0e:2b:8e