NETWORK PLUS: FINAL PROJECT

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Project Scope

A major automotive parts / supplier company is relocating to Tennessee. My job as a network consultant is to design a network and describe its configuration as per the requirements below for a corporate headquarters with multiple departments: Accounting & Finance, Human Resources, Marketing, Operations, Purchasing and IT. Each of the departments has 20, 10, 30, 50, 20 & 15 users respectively. Each department uses a separate VLAN. The organization obtains access to Internet through an ISP. The organization has offices and facilities at other geographical locations, but this task is to design a network for this location only. I (the network technician) will make appropriate assumptions about equipment, physical layout (one building or several buildings) and bandwidth requirements.

The company is concerned about industrial espionage / cybersecurity. I will research and include in the network design how the company can ensure its stored and transmitted data are secure.

Project Requirements

-Design the respective VLANs for each of the departments.

-Describe the addressing scheme that you will use to assign addresses to users in different VLANs.

-Identify the equipment and describe how they will be configured to create VLANs and inter VLAN routing.

-Describe how the DHCP server will be configured to assign IP addresses to users directly. Also describe how the router(s) will be configured.

-Create a network topology diagram.

-Describe how the network will be tested.

-Describe how the company can ensure its stored and transmitted data are secure.

Hardware and Software

Hardware:

-This network will require 4 – 48 port, Layer 2 switches. The switch model in the link below is from Cisco, and it is called the Cisco Catalyst 9300 Series Switch.

(See the link below.)

https://www.cisco.com/c/en/us/products/switches/catalyst-9300-series-switches/index.html

-The network will also require 1 router to filter and direct traffic. Below is the link to the Cisco 4000 Series Integrated Service Routers. (See the link below.)

https://www.cisco.com/c/en/us/products/routers/4000-series-integrated-services-routers-isr/index.html

-The network will require a DHCP server. A router will be used to fulfill this purpose.

-A firewall will be used in this network as well to provide security. Below is the link to the Cisco ASA 5505 Firewall. (See the link below.)

https://www.cisco.com/c/en/us/support/security/asa-5505-adaptive-security-appliance/model.html

-The computers will be Dell Inspiron Desktops, with an Intel Core Processor. (See the link below) http://www.dell.com/en-us/shop/dell-desktop-computers/inspiron-desktop/spd/inspiron-3668-desktop/fdcwgam201

-The monitors will be the Dell 22" Monitor: S2218H. (See the link below)

http://www.dell.com/en-us/shop/dell-22-monitor-s2218h/apd/210-alff/monitors-monitor-accessories

Software:

-The Network Management Software that the network technician will use is called Solar Winds. The website for this software is listed below.

(See the link below.)

https://www.solarwinds.com/

-Each desktop computer will run Windows 10 as the operating system.

-The network will use Avast as the antivirus software and a cybersecurity protection measure. (See the link below)

https://www.avast.com/en-us/managed-antivirus?quantity=145&id=BMP-00

Network Design Strategy

Network Design Overview:

This network uses subnetting to create 7 different VLANs, which is one for each of the six departments and one for the DHCP Server. Physically, this network is connected by 4 different switches. The total network hardware will include 4 - switches, 1 - router, 1 - firewall, 1 - DHCP Server (Router), and 145 - Computers.

As far as software goes, each computer will run Windows 10 and the network will use Solar Winds as its management software.

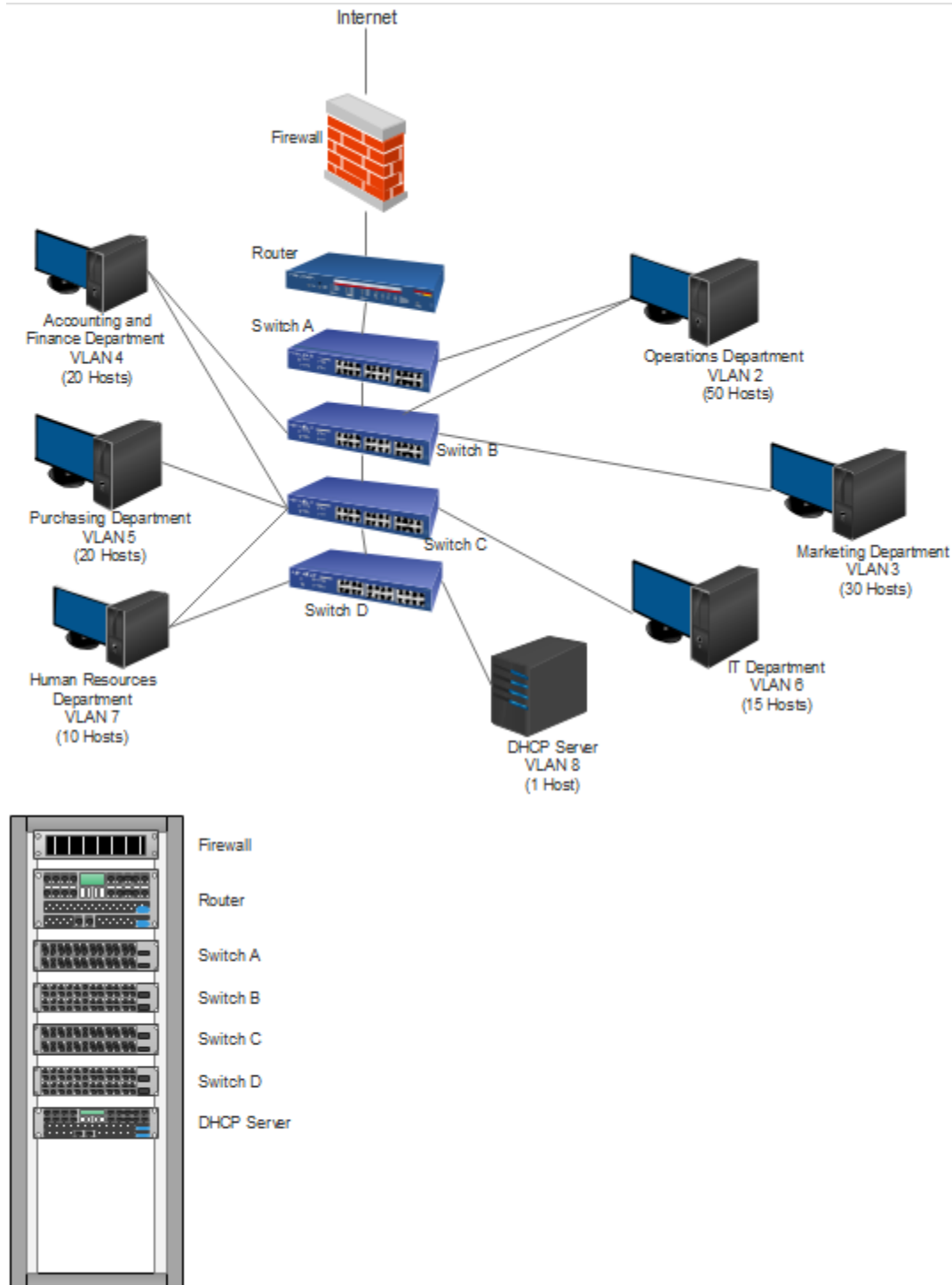It is estimated that the network will use between 143 and 168 Mbps of bandwidth.

This network will be confined to one building, which will house the network hardware for all six departments: Accounting & Finance, Human Resources, Marketing, Operations, Purchasing and IT. Each of the departments has 20, 10, 30, 50, 20 & 15 users respectively, which brings the total number of users on the network to 145.

Security:

This network will require security to protect against general threats, as well as industrial espionage. Therefore, as a protection against industrial espionage and a measure to increase cybersecurity, the network design will include a firewall to filter all traffic on the network, and Avast antivirus software will be installed on all devices. An additional protection measure implemented will be for the company to limit access to important data on the network, allowing access to sensitive data only to those with the most essential need for it when setting up the hosts.

Network Topology Diagram

The following are diagrams of the network topology and the physical layout of the rack, which includes the Firewall, Router, Switches, and DHCP Server:

Internet

Firewall

Router

Switch A

Accounting and
Finance Department
VLAN 4
(20 Hosts)

Operations Department
VLAN 2
(50 Hosts)

Switch B

Purchasing Department
VLAN 5
(20 Hosts)

Switch C

Marketing Department
VLAN 3
(30 Hosts)

Switch D

Human Resources
Department
VLAN 7
(10 Hosts)

DHCP Server
VLAN 8
(1 Host)

IT Department
VLAN 6
(15 Hosts)

Firewall

Router

Switch A

Switch B

Switch C

Switch D

DHCP Server

IP and VLAN Mapping

The IP addressing scheme used for this network is designed to conserve IP addresses, while still leaving room for growth in the network.

The VLANS are identified in chart 1 (see below), in the "VLAN number" column. The Subnet Mask, Subnet ID, IP Address Range, and Broadcast numbers are also identified in the chart below, and these details make up the IP and VLAN mapping for this network.

The "Servers" department is a VLAN configured for the DHCP server.

The following chart, which should be read by row, details the information needed to create the VLANs for this network and it explains the addressing scheme that will be used to assign IP addresses to users in each of the VLANs.

Department:	Subnet Mask:	Subnet ID:	IP Address Range:	Broadcast:	VLAN Number:
Operations	255.255.255.192/26	10.0.0.0	10.0.0.1-10.0.0.62	10.0.0.63	VLAN 2
Marketing	255.255.255.192/26	10.0.0.64	10.0.0.65-10.0.0.126	10.0.0.127	VLAN 3
Accounting and Finance	255.255.255.224/27	10.0.0.128	10.0.0.129-10.0.0.158	10.0.0.159	VLAN 4
Purchasing	255.255.255.224/27	10.0.0.160	10.0.0.161-10.0.0.190	10.0.0.191	VLAN 5
IT	255.255.255.224/27	10.0.0.192	10.0.0.193-10.0.0.222	10.0.0.223	VLAN 6
Human Resources	255.255.255.240/28	10.0.0.224	10.0.0.225-10.0.0.238	10.0.0.239	VLAN 7
Servers	255.255.255.252/30	10.0.0.240	10.0.0.241-10.0.0.242	10.0.0.243	VLAN 8

Chart 1

See the next page for a breakdown of the switch configuration used for each VLAN, which will help to create the VLANs and the inter VLAN routing.

IP and VLAN Mapping

Switch Configuration: The VLANS will be assigned to ports on the four - 48 port switches mentioned previously in the hardware section. These switches are part of the equipment which will help to create the VLANs and inter VLAN routing. In the chart below, the switches are referred to as Switches A, B, C, and D. The physical layout of these switches can be seen in the diagrams that are presented in the "Network Topology Diagram" section of this report. The "Port Numbers" column, in chart 2 below, shows what ports are being used, and the corresponding "Assigned VLAN" column shows which VLAN those port numbers are assigned to. This table should be read by row.

Switch A	
Port Numbers:	**Assigned VLAN:**
Ports 1-48	VLAN 2

Switch B	
Port Numbers:	**Assigned VLAN:**
Ports 1-2	VLAN 2
Ports 3-32	VLAN 3
Ports 33-48	VLAN 4

Switch C	
Port Numbers:	**Assigned VLAN:**
Ports 1-4	VLAN 4
Ports 5-24	VLAN 5
Ports 25-39	VLAN 6
Ports 40-48	VLAN 7

Switch D	
Port Numbers:	**Assigned VLAN:**
Port 1	VLAN 7
Port 2	VLAN 8

Chart 2

DHCP Server Configuration

The DHCP Scope is the IP address range that the DHCP server can pull from for each VLAN when a host requests an IP address. This will be combined with the subnet masks of each VLAN to configure the DCHP server to assign the IP addresses to hosts on the network. The DHCP Server will be configured to assign IP addresses based on the information provided in the following chart, which details the Department, DHCP Scope, Subnet Masks, and VLAN numbers. This chart should be read by row.

Department:	DHCP SCOPE:	Subnet Mask:	VLAN Number:
Operations	10.0.0.1-10.0.0.62	255.255.255.192/26	VLAN 2
Marketing	10.0.0.65-10.0.0.126	255.255.255.192/26	VLAN 3
Accounting and Finance	10.0.0.129-10.0.0.158	255.255.255.224/27	VLAN 4
Purchasing	10.0.0.161-10.0.0.190	255.255.255.224/27	VLAN 5
IT	10.0.0.193-10.0.0.222	255.255.255.224/27	VLAN 6
Human Resources	10.0.0.225-10.0.0.238	255.255.255.240/28	VLAN 7
Servers	10.0.0.241-10.0.0.242	255.255.255.252/30	VLAN 8

Chart 3

Router Configuration

While the method of using a layer 3 switch to perform inter VLAN routing could be used in this network, the routing method that has been chosen for this network is known by the term of Router on a Stick. When a VLAN sends out a package, it will travel to the router. Then, the router will strip the package of its current VLAN tag and replace that tag with one specifying the destination VLAN, before sending the package on its way. With the router on a stick method, there will be one router that is configured to manage traffic for all 7 VLANs. This router will be connected and configured as a trunk port on switch D. The Default Gateways and Subnet Masks of each VLAN will be used to configure the router to filter traffic. See Chart 4 below for the specified default gateways and subnet masks of each VLAN. The chart should be read by row.

Department:	Default Gateway:	Subnet Mask:	VLAN Number:
Operations	10.0.0.1	255.255.255.192/26	VLAN 2
Marketing	10.0.0.65	255.255.255.192/26	VLAN 3
Accounting and Finance	10.0.0.129	255.255.255.224/27	VLAN 4
Purchasing	10.0.0.161	255.255.255.224/27	VLAN 5
IT	10.0.0.193	255.255.255.224/27	VLAN 6
Human Resources	10.0.0.225	255.255.255.240/28	VLAN 7
Servers	10.0.0.241	255.255.255.252/30	VLAN 8

Chart 4

Network Testing

To test this network, the **ping** and **traceroute** commands will be used to test the connections to different parts of the network.
Also, by plugging into different switch ports, we can test whether or not we can get an IP address.