ASSIGNMENT

NETWORK DESIGN AND SIMULATION FOR A CRITICAL LARGE HOSPITAL

OBJECTIVES

This assignment is about designing a topology of a network for a critical large company in which different departments have some computers in different buildings and setting up their network so that they can interact and communicate with each other by exchanging data. The network is designed and simulated using a Cisco Packet Tracer (or other alternatives). Cisco Packet Tracer (CPT) is a multitasking network simulation software that can be used to perform and analyze various network activities such as the implementation of different topologies, selection of optimum paths based on various routers, and analysis of different network configurations.

CASE STUDY

CCC (Computer & Construction Consultant) Agency was asked to design a computer network to be deployed in the Main Site (at Ho Chi Minh City) and two Auxiliary Sites (at DBP Street and BHTQ Street) of a Specialized Hospital under construction. The key characteristics of IT usage in this Hospital are as follows.

The main Site includes:

- 2 buildings A and B (5 floors with 10 rooms/floor) equipped with computers and medical devices.
- The data center, IT, and Cabling Central Local (using patch panels gathering wires) are located in a separate room, 50 meters from buildings A and B.
- Medium-scale: 600 workstations, 10 servers, 12 networking devices (or maybe more with security-specific devices).
- The wireless connection has to be covered for the whole Site.
- Using new technologies for network infrastructure including wired and wireless connections, fiber cabling (GPON), and GigaEthernet 1GbE/10GbE/40GbE. The network is organized according to the VLAN structure for different departments
- The main Site subnetwork connects two other Sites (Site DBP and Site BHTQ) subnetworks by 2 leased lines for WAN connection (possibly applying SD-WAN, MPLS).

- 2 xDSL for Internet access with a load-balancing mechanism. All traffic to the Internet passes through the main site subnet.
- For software acquisition, the Hospital uses a mix of licensed and open-source software, hospital software (HIS, RIS - PACS, LIS, CRM, etc.), office applications, client-server applications, multimedia, and databases.
- Requirements for capability of extension, high security (e.g., firewall, IPS/IDS, phishing detection), high availability (HA), robustness when problems occur, ease of upgrading the system
- Propose a VPN configuration for site-to-site and for a teleworker to connect to Company LAN
- Propose a surveillance camera system for the Company

Other Sites:

- The building has 2 floors, the first floor is equipped with 1 IT room and 1 Cabling Central Local.
- Small-scale: 60 workstations, 2 servers, 5 or more networking devices

Implementing the connection between the main Site and the two Auxiliary Sites through the WAN links, you can choose one of the technologies such as SD-WAN, MPLS, etc. used for this link according to the cost of the solution. List all available out.

- Suggest options with cost
- Analyze the advantages and disadvantages of the selected solution.

The dataflows and workload of the system (about 80% at peak hours 9g-11g and 15g-16g) can be shared for the main Site and the two Auxiliary Sites as follows:

- Servers for software updates, web access, and database access, ... The total download estimate is about 1000 MB/day and the upload estimate is 2000 MB/day.
- Each workstation is used for Web browsing, document downloads, and customer transactions, ... The total download estimate is about 500 MB/day and the upload estimate is 100 MB/day.
- WiFi-connected devices from customers' access for downloading are about 500 MB/day.

Hospital Network is estimated to have a growth rate of 20% in 5 years (in terms of the number of users, network load, site extensions, etc.).

REQUIREMENTS

Step 1 (1 point): Find out suitable network structures for buildings

- Analyze the network system requirements of the main Site and the two Auxiliary Sites
- **Make a checklist to be surveyed at the installation locations**
- Define areas with high load (network load) to select the appropriate device configuration (load balancers are placed in necessary locations)
- Choose a network structure that matches the building's architecture with convenience and aesthetics
- Design the network usage in a wireless environment, applying network security standards and setting up partitions for network servers and devices (e.g., Server farm, DMZ, Firewall, ...)

Step 2 (1 point): List of minimum equipment, IP plan, and wiring diagram (cabling)

- List of recommended equipment and typical specifications
- Schematic physical setup of the network
- WAN connection diagram between the main Site and the two Auxiliary Sites (using new WAN technology such as SD-WAN, MPLS, and OSPF routing protocol)

Step 3 (1 point): Calculate the required throughput, and expected bandwidth from ISP, then suggest the configuration for the hospital network

Step 4 (2 points): Design the network map using Packet Tracer or GNS3 simulation software

Step 5 (2 points): Test the system with popular tools such as ping, traceroute, etc. on the simulated system.

Step 6 (2 points): Re-evaluate the designed network system through the following features: reliability, ease of upgrade, diverse support software, safety, network security, etc.

- The remaining problems for the project
- Development orientation in the future

Step 7 (1 point): Upload the simulation file (using Packet Tracer or GNS-3) and the project report to BKeL before the deadline.

In the report and results demo of the Assignment, students are asked to test connectivity:

- Connect between PCs in the same VLAN
- Connect PCs between VLANs
- Connect PCs between the main Site and the two Auxiliary Sites
- Connect to servers in the DMZ
- No connections from Customers' devices to PCs on the LAN
- Connect to the Internet to a Web server.

For the **talented engineer program**, you are required to implement and test a security solution for the Hospital: apply a security plan, add firewalls and configure ACLs, implement IDS/ISP, and edit a security best practice guide.

REFERENCES

Information selectively comes from the Internet

The references for the subject of Computer Networking

TIMING

Deadline for reporting: 4 weeks after the assignment uploading.

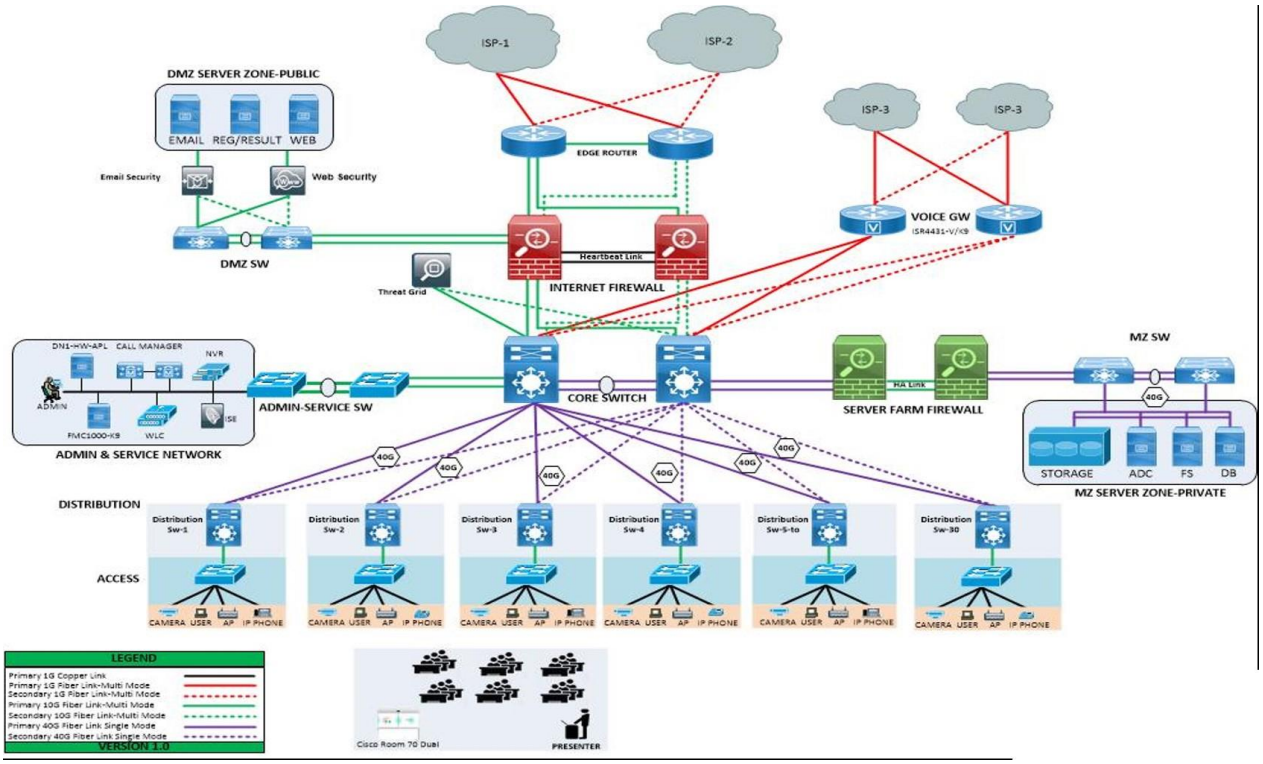
Softcopy (to be submitted to BKeL before the deadline) and hard copy (needed for presentation and demo session).

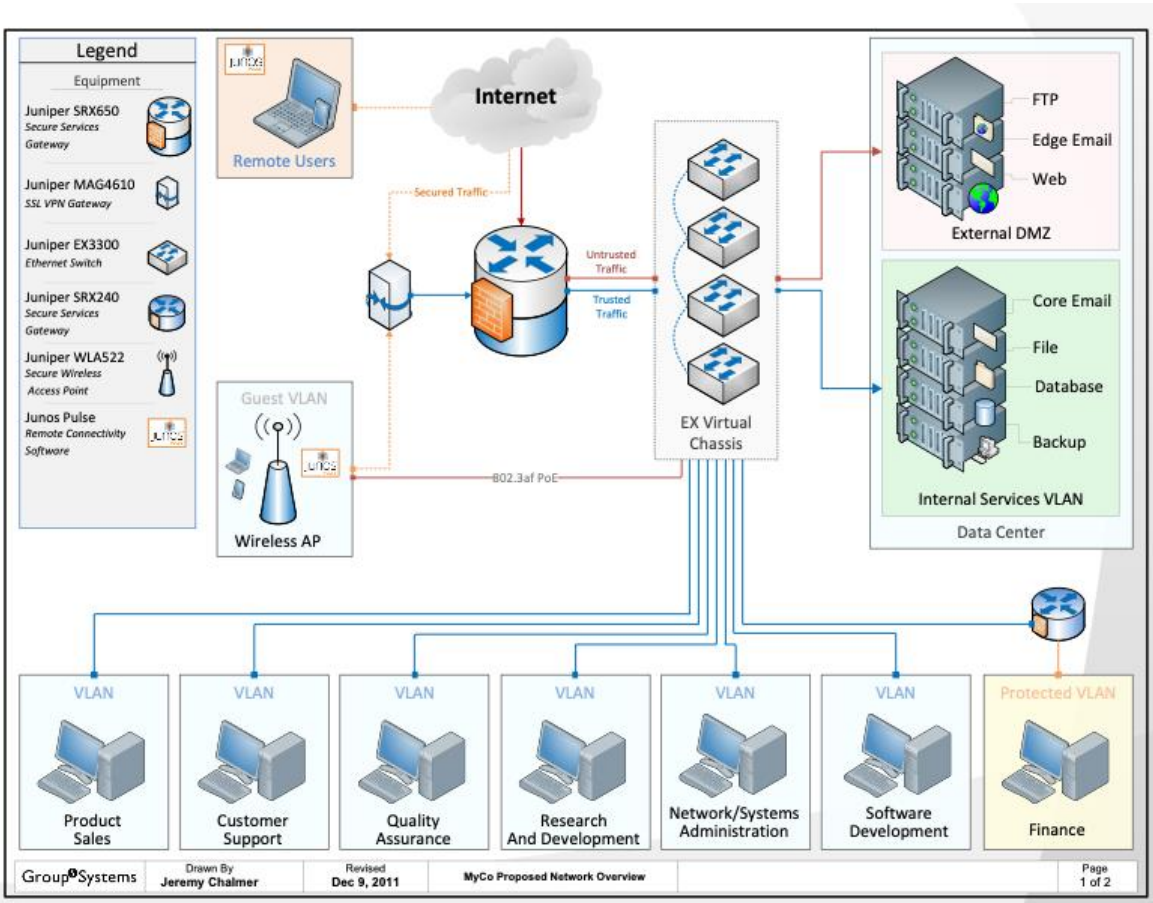
NUMBER OF STUDENTS

Get into a group of 2 or 3 students as indicated by the Instructor.

GUIDES

Some examples of network design diagram.


ISP-1
ISP-2
ISP-3
ISP-3
DMZ SERVER ZONE-PUBLIC
EMAIL
REG/RESULT
WEB
EDGE ROUTER
Email Security
Web Security
VOICE GW
DMZ SW
Heartbeat Link
INTERNET FIREWALL
Threat Grid
DN1-HW-APL
CALL MANAGER
NVR
ADMIN
ADMIN-SERVICE SW
CORE SWITCH
HA Link
SERVER FARM FIREWALL
MZ SW
STORAGE
ADC
FS
DB
MZ SERVER ZONE-PRIVATE
ADMIN & SERVICE NETWORK
DISTRIBUTION
ACCESS
Distribution Sw-1
Distribution Sw-2
Distribution Sw-3
Distribution Sw-4
Distribution Sw-5-to
Distribution Sw-30
CAMERA
USER
AP
IP PHONE
LEGEND
Primary 1G Copper Link
Primary 1G Fiber Link-Multi Mode
Secondary 1G Fiber Link-Multi Mode
Primary 10G Fiber Link-Multi Mode
Secondary 10G Fiber Link-Multi Mode
Primary 40G Fiber Link Single Mode
Secondary 40G Fiber Link Single Mode
VERSION 1.0
Cisco Room 70 Dual
PRESENTER


Legend
Equipment
Juniper SRX650
Secure Services Gateway
Juniper MAG4610
SSL VPN Gateway
Juniper EX3300
Ethernet Switch
Juniper SRX240
Secure Services Gateway
Juniper WLA522
Secure Wireless Access Point
Junos Pulse
Remote Connectivity Software
Remote Users
Internet
Secured Traffic
Untrusted Traffic
Trusted Traffic
Guest VLAN
Wireless AP
802.3af PoE
EX Virtual Chassis
FTP
Edge Email
Web
External DMZ
Core Email
File
Database
Backup
Internal Services VLAN
Data Center
VLAN
Product Sales
VLAN
Customer Support
VLAN
Quality Assurance
VLAN
Research And Development
VLAN
Network/Systems Administration
VLAN
Software Development
Protected VLAN
Finance
Group Systems
Drawn By
Jeremy Chalmer
Revised
Dec 9, 2011
MyCo Proposed Network Overview
Page
1 of 2