ABSTRACT

A network has to be designed for a small business organization which has 100 users. The organization hosts an e-commerce application on a server which is accessible to internet users using https and with a public IP address.

A network for the same was designed using Cisco Packet Tracer version 8.0.0. The requirements were emulated and tested for connectivity. A server was setup, which is accessible only on port 443 with HTTPS connectivity. Internally, department routers are interconnected for unfiltered access to the server.

The company router has NAT to translate public IP address to private device IP addresses. Switches are used to ensure optimal number of devices can be used with both the company network as well as the broadband network.

Pings were used to check the connectivity and the reachability of the systems from all the network.

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1. INTRODUCTION

1.1 Scenario Description

This report aims to cover a network installation for a new three-floor building at SRM College - School of Computing. The main plan involves a LAN design that will be able to endure for the next five to seven years but will also be able to provide the means for any future upgrades. The hardware of the network will consist of a number of dedicated servers and will also provide directory services and database services. The LAN will be resilient and secure with the ability to handle high traffic loads and support voice and video communications. Moreover, it will be cost effective and upgradable to cater for more users. The school consists of 4 departments: The staff, general and administrative, where each member of both departments will have their own computer and connection to a printer and the servers, but the admin staff will be using a shared printer; The technicians, where all of its members will have their own computer and access to all networks but also access to a large and secure storeroom that exist in their area; And 6 Computing Laboratories. Each department will be logically separated with the use of different subnets that will also provide the necessary isolation so that some departments will have limited access to others. A wireless network will also be available to provide access to the Internet to anyone from anywhere within the campus but will separate access from guests to lecturers and students by using proper security. Remaining Sections • Proposed Design 1. Cabling and connectivity 2. Logical Topology 3. Device selection and placement • IP Addressing 1. IP addressing scheme 2. Subnetting benefits 3. IP address LAN allocation • Summary • References 2. Proposed Design For the current plan, a two-tier collapsed core hierarchical network model is proposed because it offers the same benefits as a three-tier design such as modularity, which facilitates scalability, isolation through subnetting, which improves resiliency and reduced cost, as it provides the functions of the core and distribution layer in single device. 2.1 Cabling and connectivity The whole network utilizes wired connectivity and offers restricted wireless connectivity for those who want to bring their own devices. While wireless connectivity is easier to setup, manage and maintain, it is not suggested in the enterprise area due to the many disadvantages that comes with it, such as high security risks and much slower speeds from wired ones due to wireless signals being affected from walls, floors or other electronics(Evans 2013). In order to keep an organized and well-planned cabling system at the main distribution core, the network follows a structural cabling standard such as the EIA/TIA-568, where it suggests colored cables with appropriate labeling and patch panels for easy management. The cables travel from rack to rack via overhead cable pathways and with the use of vertical and horizontal cable managers at the sides of the racks end up to their corresponding device while keeping an organized cabling environment. This structured approach offers a reliable, scalable and manageable cabling infrastructure . The types of cables for the network

are chosen based on the types of the devices that will be used for, as well as the layer that those devices exist in the hierarchical model. At the core layer, the cable of choice is the CAT6 STP straight-through that is made of copper, is shielded to protect from various interferences and supports 10GBase gigabit speeds within distances of 55 meters. For intermediary devices and hosts the cable of choice is the CAT5e UTP crossover which is widely used with fast ethernet connections but it also supports 1gigabit connections. Other alternatives are the CAT7 copper cable that supports 10GBase connections up to 100 meters and fiber optic cable that support various standards with different modes based on its wavelength, and distances up 40 kilometers. However, for the current plan these alternatives are cost-inefficient and redundant since that the chosen cables can already provide the required resiliency and scalability

2. REQUIREMENTS

2.1 Requirement Analysis

From the given scenario, we draw the following requirements:

1. Identifying the appropriate hardware which would be used (Cisco Packet Tracer)
2. Users on the internet should be able to access only https on the e-commerce server.
3. Users on the internet should have access only to the public IP address of the server and not the private IP address.
4. The users in the organization should have full access to the server.
5. TCP/IP Network design with IP addressing
6. Features and configuration required on the hardware with explanation

We need to configure a network design keeping the following requirements in mind.

2.2 Hardware Requirement:

8x VLAN

2x L3 Switch

1x Router

1x Cable Modem

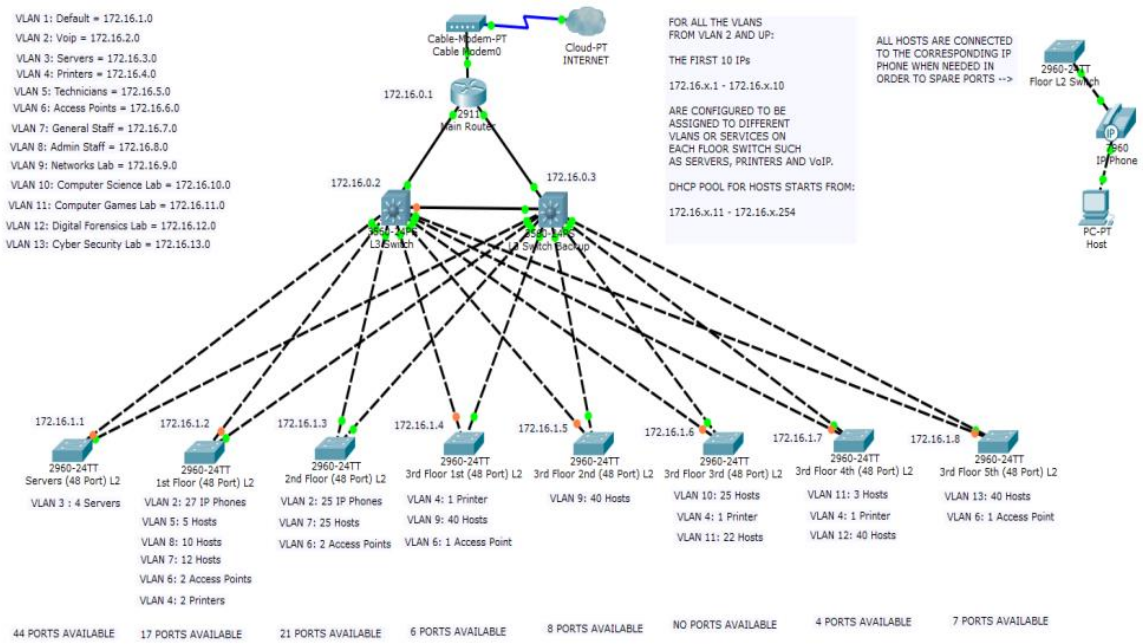
CAT Cable

CABLE	DATA RATE	DISTANCE	APPLICATION
CAT5e	Up to 1Gbps	100 meters	Fast Ethernet (Hosts, Intermediary devices)
CAT6	Up to 10Gbps	55 meters	10Gigabit Ethernet Backbone - medium-sized campuses
CAT7	Up to 10Gbps	100 meters	10Gigabit Ethernet Backbone -large-sized campuses
Fiber Optic	Up to 10Gbps	40 kilometers (single mode)	10Gigabit Ethernet Large enterprises – industrial

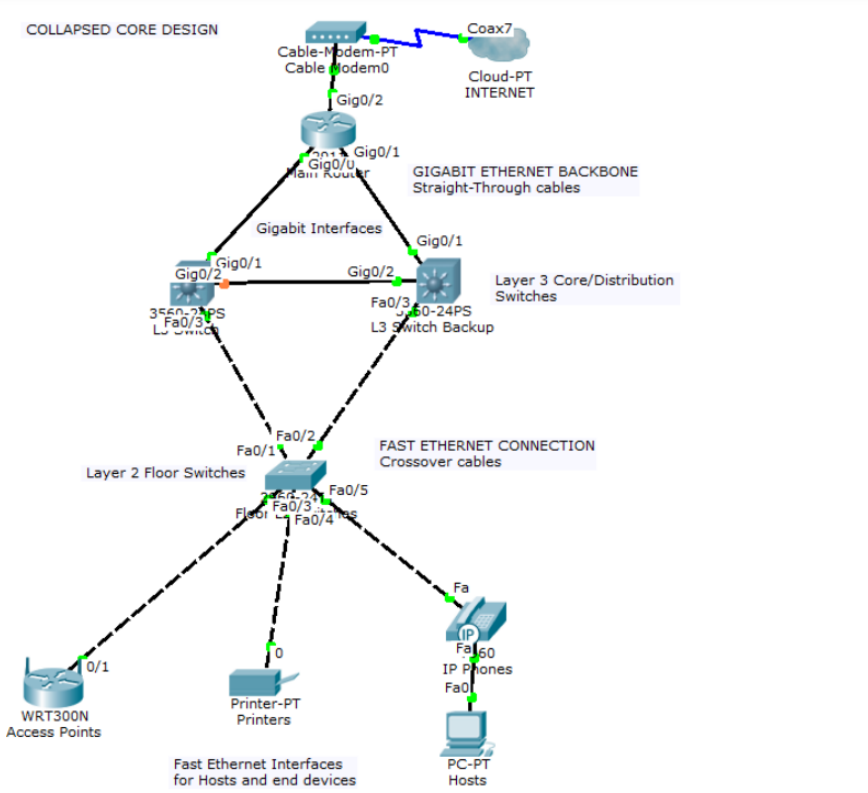
3. ARCHITECTURE AND DESIGN

3.1 Logical topology Diagram

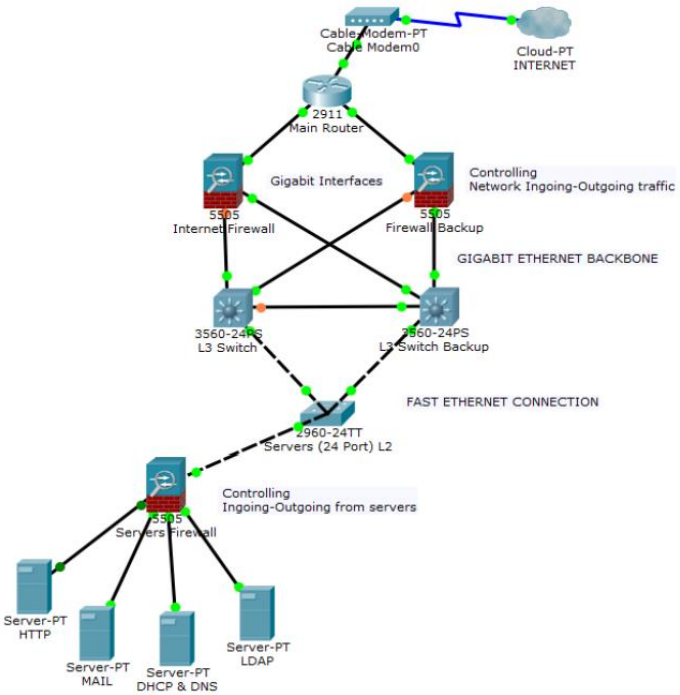
The network architecture is as follows:



3.2 Physical topology Diagram



3.3 Physical Topology – Firewalls



4. IMPLEMENTATION

4.1 Address Table

The address table is as follows:

Department	Number of hosts	Network Address	Broadcast address	First Usable Address	Last Usable Address	Subnet mask
Guest wireless access	200	172.16.6.0	172.16.6.255	172.16.6.1	172.16.6.254	255.255.255.0
Networks labs	200	172.16.9.0	172.16.9.255	172.16.9.1	172.16.9.254	255.255.255.0
General staff offices	200	172.16.7.0	172.16.7.255	172.16.7.1	172.16.7.254	255.255.255.0
Digital forensics lab	180	172.16.13.0	172.16.13.255	172.16.13.1	172.16.13.254	255.255.255.0
Cyber security lab	220	172.16.12.0	172.16.12.255	172.16.12.1	172.16.12.254	255.255.255.0
Admin	150	172.16.8.0	172.16.8.255	172.16.8.1	172.16.8.254	255.255.255.0
Computer games lab	170	172.16.11.0	172.16.11.255	172.16.11.1	172.16.11.254	255.255.255.0
Computer science lab	190	172.16.10.0	172.16.10.255	172.16.10.1	172.16.10.254	255.255.255.0
Technicians	130	172.16.5.0	172.16.5.255	172.16.5.1	172.16.5.254	255.255.255.0

5. RESULTS AND DISCUSSION

5.1 Connection Check

The proposed design analyzed in this report provides the necessary means to cover for the requirements of the campus. The collapsed core design, combined with the appropriate structural cabling and connectivity, provides a Gigabit network that is cost-effective and resilient for the next five to seven years but also easily upgradable with the use of stackable L3 switches. Moreover, the LAN is secure logically, as a combination of firewalls, vlans and secure wireless access points is implemented but also physically with the backbone installed in a secured area. Finally, with the chosen IP addressing scheme and the wireless availability on each floor, scalability and availability is also ensured.

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