A Final Project Report on

University Network Scenario

Submitted in partial fulfillment of the requirements of the
Semester II Subject of

Computer Networks

in

Computer Science

by

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Certificate

This is to certify that Computer Networks Final project entitled “University Network Scenario” submitted by Yrysbaev Maksatbek for the partial fulfillment of the requirement of the Semester II Subject of Computer Networks in Computer Science to the North American University, is a Houston work carried out during Semester II in Academic Year 2019-2020

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Place: North American University
Date: 04.28.2024

Declaration

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. Although I may not have a thorough knowledge of all academic principles at this stage, I promise to approach my work with sincerity, humility, and a desire to learn.

Signature: Yrysbaev Maksatbek
Date: 04.28.2024

Abbreviations:

- **MSE** Mobility Service Engine
- **UCS** Unified Computing System
- **RFP** Request For Proposal
- **CLI** Command Line Interface
- **IP** Internet Protocol
- **RIP** Routing Information Protocol
- **RPP** Routing Protocol Plan
- **OS** Operating System
- **OSI** Open Systems Interconnection
- **URL** Uniform Resource Locator
- **FTP** File Transfer Protocol
- **DNS** Domain Name System
- **LAN** Local Area Network
- **WAN** Wide Area Network
- **VLAN** Virtual Local Area Network

Contents

Introduction

This University Network Scenario is about designing a topology of a network that is a LAN(Local Area Network) for a University in which various computers of different departments are set up so that they can interact and communicate with each other by interchanging data. To design a networking scenario for a university which connects various departments to each other, it puts forward communication among different departments. CNS is used to design a systematic and well-planned topology, satisfying all the necessities of the university (i.e. client). CNS came up with a network with good performance.

Objectives

The main objective of the proposed network is to upgrade the existing network and also to improve its capacity and increase the flexibility of the network which ultimately provides good protection.

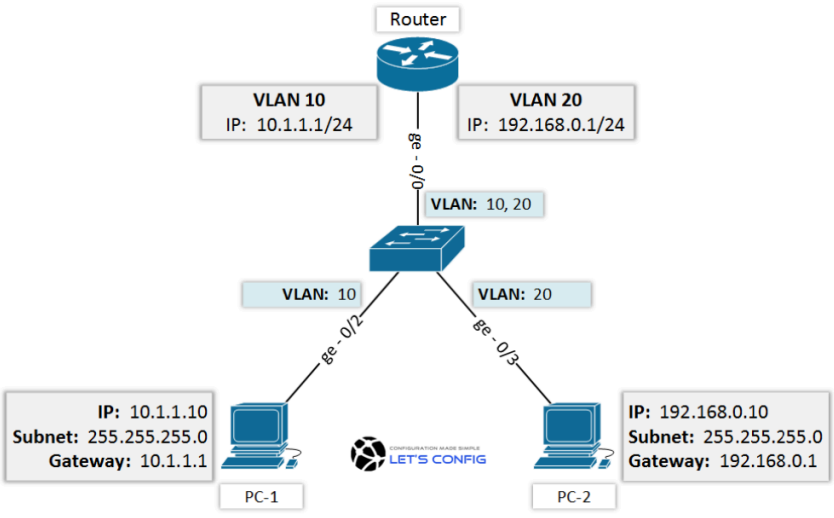
Network Requirements

1. The new system should be able to reduce internet outages. Upload and download links must maintain a speed condition above 5 Mbps.
2. The network should be scalable.
3. The system should support remote access.
4. Should include data centers with the necessary security features and support.

Major Design Area and Functional Areas

The proposed new system consists of IP-based switches that remain the base station for LAN-based (ethernet) as and Wi-Fi-based connections. These switches also provide SNMP support for easy traffic monitoring. IP-based switches is mainly used because:

- The inter VLAN routing feature is supported on both IP base or SMI and IP services or EMI image Layer 3 switches. For Layer 2-only switches, you require a Layer 3 routing device with any of the previous images.



VLAN Config

- The IP Base feature set includes advanced quality of service (QoS), rate limiting, access control lists (ACLs), and basic static and Routing Information Protocol (RIP) functions. Dynamic IP routing protocols (Open Shortest Path First (OSPF), BGPv4, Enhanced Interior Gateway Routing Protocol (EIGRP) are available only on the IP services image.
- The IP Services image provides a richer set of enterprise-class features, which includes advanced hardware-based IP unicast and IP Multicast routing. Support for IPv6 Layer 3 switching in hardware is also available with the addition of the Advanced IP Services license to either the IP Base or the IP Services images. Both the IP base Image and the IP services image allow for Layer 3 and Layer 4 lookups for QoS and security.

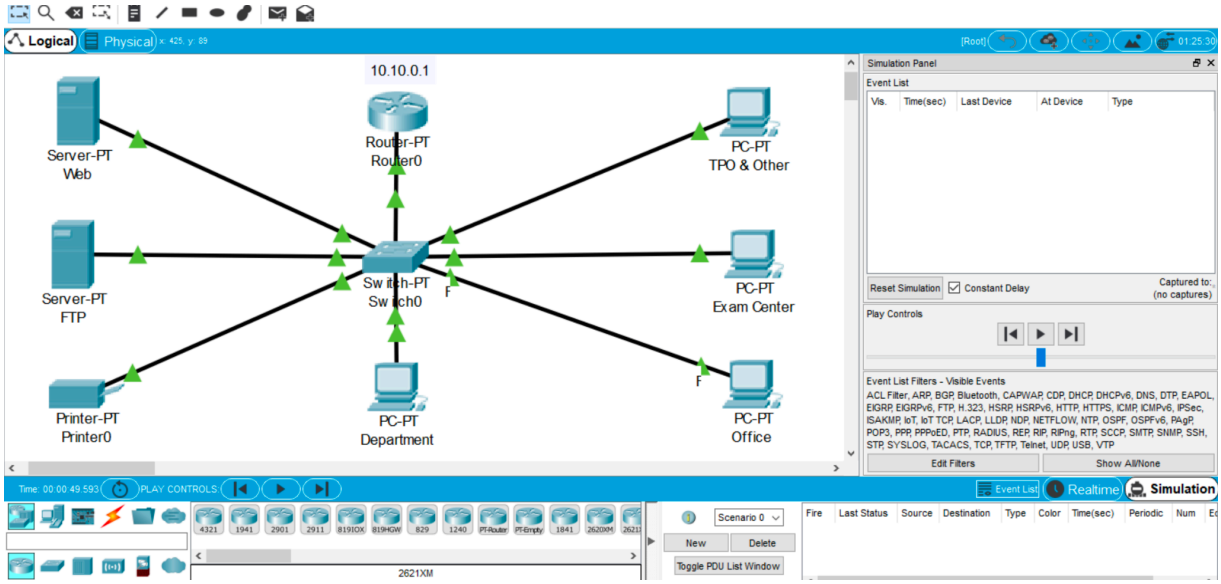
Existing Infrastructure

The existing system is a very basic system. University mainly comprises of three main sections as:

1. TPO & Other
2. Exam Center
3. Office

All hosts are assigned static IP addresses and assigned in the order in which they are assigned. There is no support for dynamic IP assignment. Although the work is divided into three main sectors, all host multimedia devices are connected to one network. Therefore, network security and maintenance is

difficult. Another problem found was that the current switches were outdated and therefore could not be useful for a network administrator to control and process network traffic because the system does not have access to the network. The lack of a basic firewall for small businesses was also noted. So security is also at risk. Three server rooms were used to create an independent network, which however caused a waste of effort and money.



The above design is the existing network traced on cisco packet tracer.

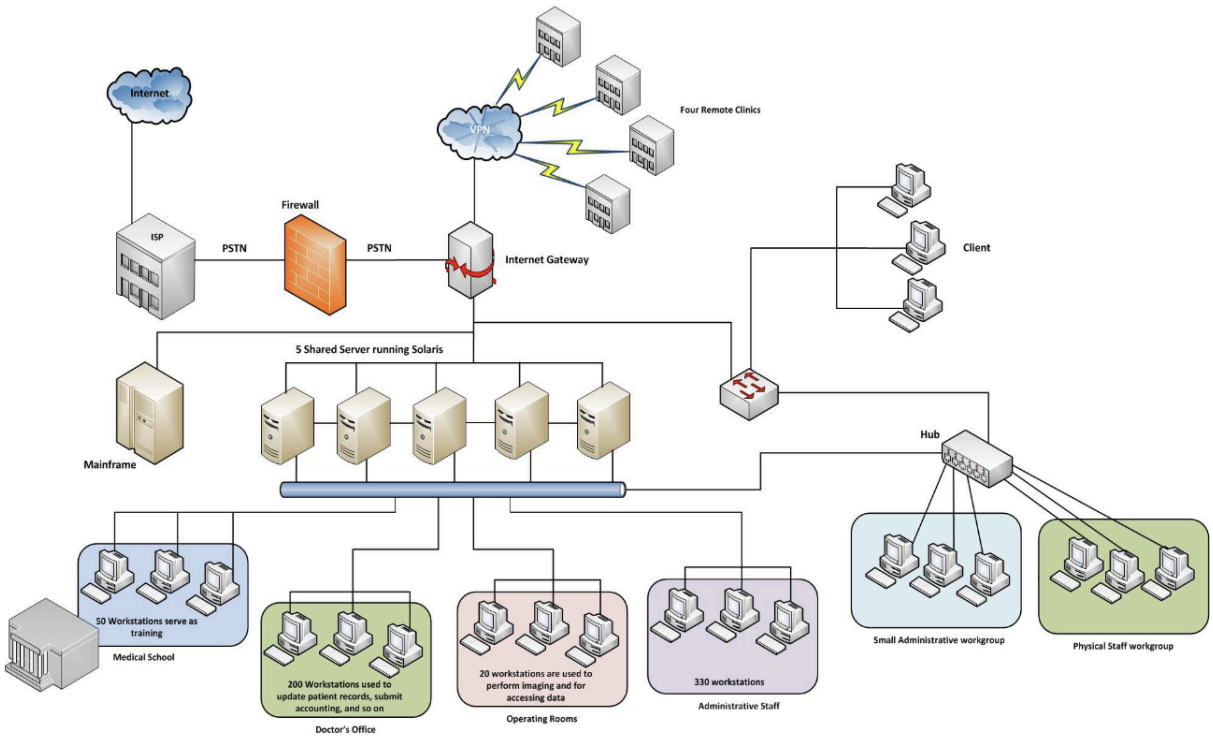
Network Devices

Developing the Existing LAN system:

- The basis of the LAN core is Cisco Catalyst 6509 switches equipped with Cisco 720 supervisors and Virtual Switching System (VSS), as well as Cisco 4500 switches, combined in a stack with the data transmission ports at 10 Gb/s bandwidth capacity. Switches create a platform for additional services, such as content processing, firewall (the project uses the Cisco firewall), intrusion prevention system, application of IPsec security tools, the arrangement of protected VPN channels, network analysis and acceleration of Secure Sockets Layer (SSL) connections.

Mobility Services Engine (MSE) solution and 300 Cisco Aironet 1140 access points were used.

- The Cisco Aironet 1140 Series is a component of the Cisco Unified Wireless Network, which can scale up to 18,000 access points with full Layer 3 mobility across central or remote locations on the enterprise campus, in branch offices, and at remote sites.
- The Cisco Unified Wireless Network is the industry's most flexible, resilient, and scalable architecture, delivering secure access to mobility services and applications and offering the lowest total cost of ownership and investment protection by integrating seamlessly with the existing wired network.



Above is the pictorial representation of the proposed network

- Cisco Unified Computing System (UCS) solution allowed the integration of computer and network resources as well as storage and virtualization systems as part of an energy efficiency system. Cisco Unified Computing System platform notably simplifies traditional architecture and significantly reduces the number of devices to be purchased, to connect by wires, to

supply with electricity and cooling, to protect and maintain. This solution is the foundation of complex optimization of the virtualized medium while maintaining the ability to support traditional operating systems and applications stacks in physical medium. This overall infrastructure developed allowed integration of several functionally different physical networks into one, such as guest network, hotel management network, telephone network and IP-Television network. The convergence within single network reduced hotel expenses for constructing and managing several dedicated networks which traditionally remain separate in hotels. The term unified computing system is often associated with Cisco. Cisco UCS products have the ability to support traditional operating system (OS) and application stacks in physical environments, but are optimized for virtualized environments. Everything is managed through Cisco UCS Manager, a software application that allows administrators to provision the server, storage and network resources all at once from a single pane of glass. Similar offerings to Cisco UCS include HP BladeSystem Matrix, Liquid Computing's LiquidIQ, Sun Modular Datacenter and InteliCloud 360.

Request for proposal

Serial no	Network Devices	Price per unit (Approx..)	Quantity	Total cost (INR)
1	The Cisco System Business switches	17,999	7	126, 000
2	Cisco RV042G	8000	4	32,000
3	Wires	25000	2	50000
			Total	208,000

IP Addressing Plan

BUSINESS MANAGEMENT DEPARTMENT(192.168.1.0)	
BIZ HOD CABIN	192.168.1.1
BIZ LAB 1	192.168.1.2
BIZ LAB 2	192.168.1.3
BIZ LAB 3	192.168.1.4
BIZ LAB 4	192.168.1.5
Printer 0	192.168.1.6

COMPUTER SCIENCE DEPARTMENT(192.168.2.0)	
CS HOD CABIN	192.168.2.1
CS LAB 1	192.168.2.2
CS LAB 2	192.168.2.3
CS LAB 3	192.168.2.4
CS LAB 4	192.168.2.5
Printer 0	192.168.2.6

Other(192.168.3.0)	
Office	192.168.3.2
Exam Cell	192.168.1.3
Printer 2	192.168.1.6
Printer 3	192.168.3.7
Enquiry	192.168.3.4
Printer 4	192.168.3.8
TPO	192.168.3.5

SERVER ROOM(1.0.0.0)	
FTP SERVER	1.0.0.4
PC1	1.0.0.5
DNS SERVER	1.0.0.2
WEB SERVER	1.0.0.3

Library(192.168.0.0)	
PC2	192.168.0.2
PC3	192.168.0.3
PC4	192.168.0.4
PC5	192.168.0.5
Printer 5	192.168.0.6

PRINCIPLE ROOM(192.168.4.0)	
PC0	192.168.4.2
LAPTOP 0	192.168.4.3

ADMINISTRATION(192.168.5.0)	
ADM HOD CABIN(1)	192.168.5.2
ADM LAB 1	192.168.5.3
ADM LAB 2	192.168.5.4
ADM LAB 3	192.168.5.5
ADM LAB 4	192.168.5.6
Printer 7	192.168.1.1

Routing Protocol Plan

Routing Information Protocol (RIP) is a dynamic routing protocol which uses hop count asa routing metric to find the best path between the source and the destination network. It is a distance vector routing protocol which has AD value 120 and works on the application layer of OSI model.

```
Router>
Router>enable
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/2] via 10.10.0.2, 00:00:19, Serial2/0
C    10.0.0.0/8 is directly connected, Serial2/0
R    20.0.0.0/8 [120/1] via 10.10.0.2, 00:00:19, Serial2/0
C    30.0.0.0/8 is directly connected, Serial3/0
R    128.168.0.0/16 [120/2] via 10.10.0.2, 00:00:19, Serial2/0
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet1/0
R    192.168.3.0/24 [120/1] via 10.10.0.2, 00:00:19, Serial2/0
R    192.168.4.0/24 [120/1] via 10.10.0.2, 00:00:19, Serial2/0

Router#
```

Routing Protocol Plan for Router0

```
Router>enable
Router#Show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/1] via 20.20.0.2, 00:00:00, Serial3/0
C    10.0.0.0/8 is directly connected, Serial2/0
C    20.0.0.0/8 is directly connected, Serial3/0
R    128.168.0.0/16 [120/1] via 20.20.0.2, 00:00:00, Serial3/0
R    192.168.1.0/24 [120/1] via 10.10.0.1, 00:00:05, Serial2/0
R    192.168.2.0/24 [120/1] via 10.10.0.1, 00:00:05, Serial2/0
C    192.168.3.0/24 is directly connected, FastEthernet0/0
C    192.168.4.0/24 is directly connected, FastEthernet1/0

Router#
```

Routing Protocol Plan for Router 1

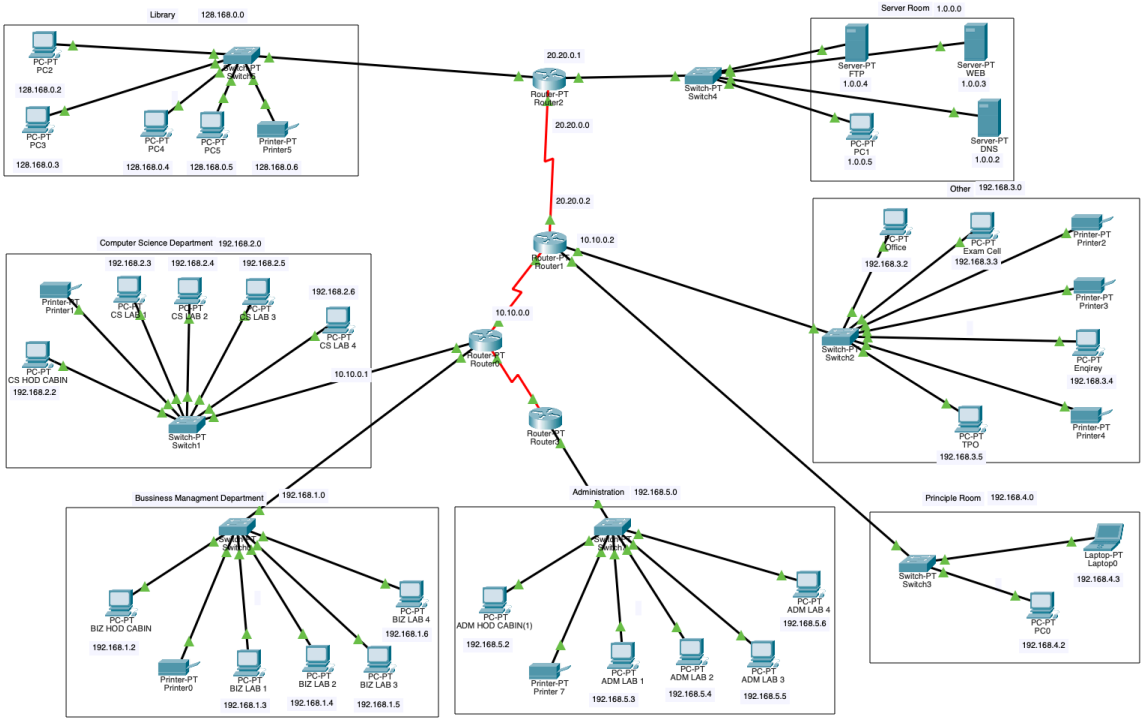
```
Router>enable
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

C    1.0.0.0/8 is directly connected, FastEthernet0/0
R    10.0.0.0/8 [120/1] via 20.20.0.1, 00:00:25, Serial2/0
C    20.0.0.0/8 is directly connected, Serial2/0
C    128.168.0.0/16 is directly connected, FastEthernet1/0
R    192.168.1.0/24 [120/2] via 20.20.0.1, 00:00:25, Serial2/0
R    192.168.2.0/24 [120/2] via 20.20.0.1, 00:00:25, Serial2/0
R    192.168.3.0/24 [120/1] via 20.20.0.1, 00:00:25, Serial2/0
R    192.168.4.0/24 [120/1] via 20.20.0.1, 00:00:25, Serial2/0

Router#
```

Routing Protocol Plan for Router 2

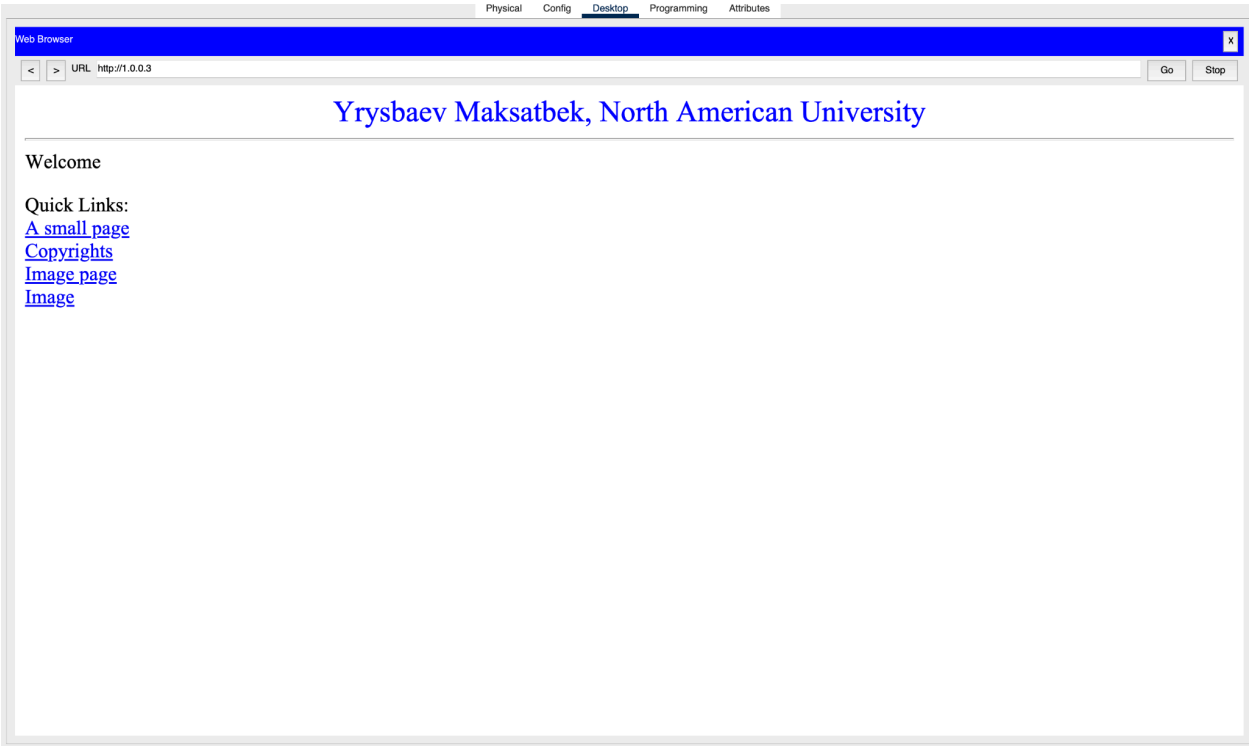
```
Router>enable
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

R    1.0.0.0/8 [120/2] via 10.10.0.2, 00:00:19, Serial2/0
C    10.0.0.0/8 is directly connected, Serial2/0
R    20.0.0.0/8 [120/1] via 10.10.0.2, 00:00:19, Serial2/0
C    30.0.0.0/8 is directly connected, Serial3/0
R    128.168.0.0/16 [120/2] via 10.10.0.2, 00:00:19, Serial2/0
C    192.168.1.0/24 is directly connected, FastEthernet0/0
C    192.168.2.0/24 is directly connected, FastEthernet1/0
R    192.168.3.0/24 [120/1] via 10.10.0.2, 00:00:19, Serial2/0
R    192.168.4.0/24 [120/1] via 10.10.0.2, 00:00:19, Serial2/0

Router#
```

Routing Protocol Plan for Router 3

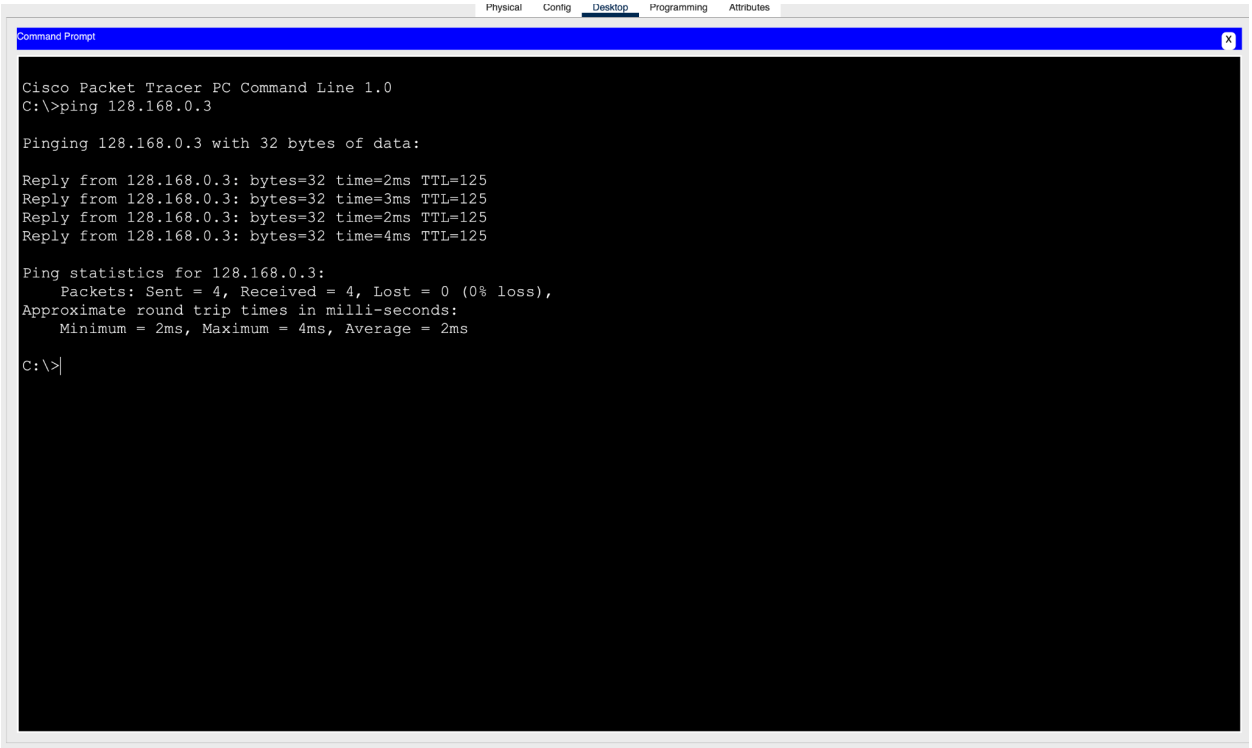
Networking Design



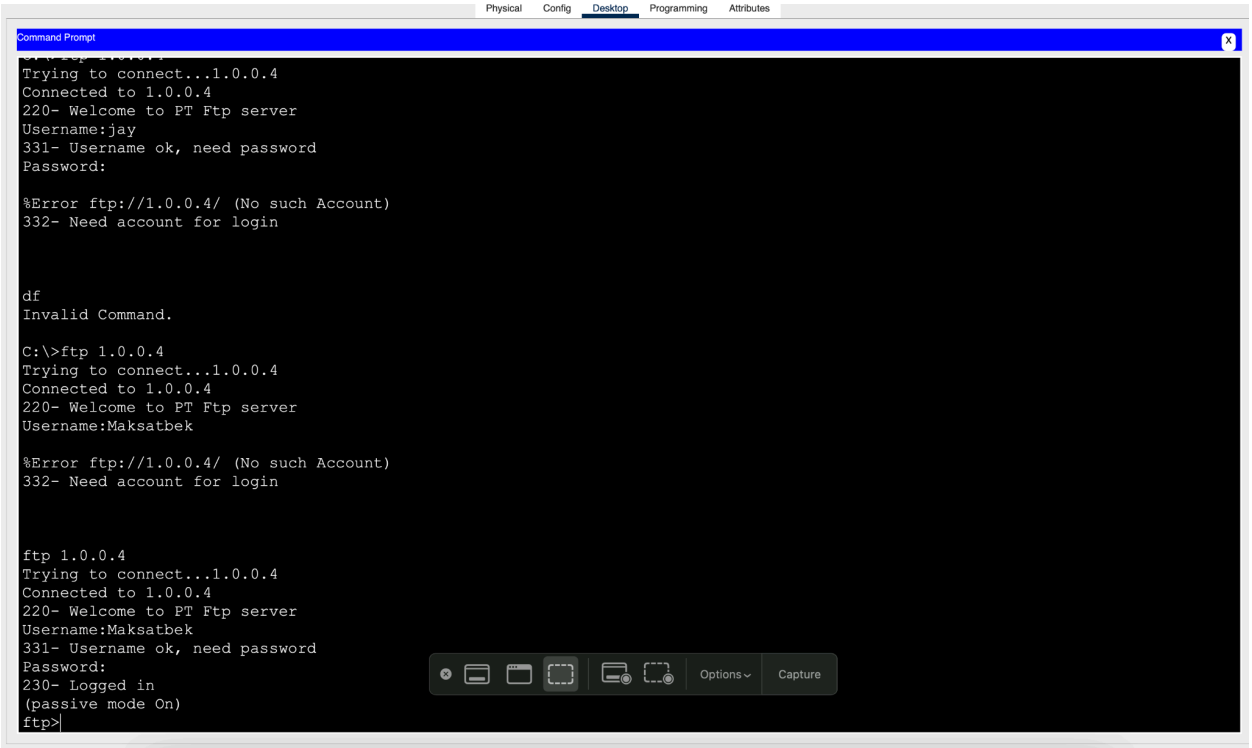
The prototype of the proposed network is implemented on cisco packet tracer



Testing WEB Hosting



Testing VLAN communications from HOD Cabin to Internet Lab



Testing FTP Server

Summary

The final result of the proposed system is a fail-safe core network infrastructure that fulfills the requirements of\easily available information and private network security, and also ensures optimal productivity when using telecommunications services. The installed devices made it possible to organize a high-speed cable and wireless Internet connection throughout the complex of hospital buildings, as well as the transmission of all types of data in one optimized network.

References

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