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Design of an Enterprise Network Infrastructure of a City

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Abstract: A basic Network infrastructure allude to the resources like hardware and software of an entire network that let network connectivity, communication, operations and control of an enterprise network of a city, industries or home. Enterprise network infrastructure provides the communication path and services between users, processes, applications, services and external networks. The main objective of this research paper is to design a hierarchal enterprise network design of a city with consideration network enterprise edge. Cisco packet Tracer latest version was used to design & simulate this design. Using Cisco packet tracer we can simulate application layer protocols, basic routing with RIP, OSPF and EIGRP. Our design consist three locations in Dhaka, Bangladesh: Data center, Banani Branch & Motijheel Branch.

Keywords: LAN/WAN, OSI Model, Network Switch, Cisco Packet Tracer, Internet Cloud.

I. INTRODUCTION- ENTERPRISE NETWORK

The main purpose of an enterprise network is to reduce isolated users and workgroups. All systems should be capable of communicate and provide and desired information. Additionally, physical systems and devices should be able to maintain and provide satisfactory performance, reliability and security. Enterprise computing models are developed for this purpose, facilitating the exploration and improvement of established enterprise communication protocols and strategies. In scope, an enterprise network may include local and wide area networks (LAN/WAN), depending on operational and departmental requirements [1]. An enterprise network can integrate all systems, including Windows and Apple computers and operating systems (OS), UNIX systems, mainframes and related devices like smart phones and tablets. A tightly integrated enterprise network effectively combines and uses different device and system communication protocols.

Enterprise network consists of various network segments and configurations that enable the enterprise to generate revenue in today's highly connected, dynamic environment. The enterprise network itself consists of various business site types that must be interconnected in order to enable business and revenues. The corporate LAN and data centre are at the core of the enterprise network. These sites provide a bulk of the enterprise support, applications, and business enablers. The enterprise network is the sum of the configurations and design of the interconnections between the data centre and corporate headquarters and the rest of the enterprise. The enterprise remote sites can consist of various campus environments as well as small offices, revenue gateways, and other remote locations. The enterprise network is often designed to provide dedicated interconnection with partners, home-based workers, and other support resources. This is the key to the solution as it provides the backbone over which most enterprise traffic travels.

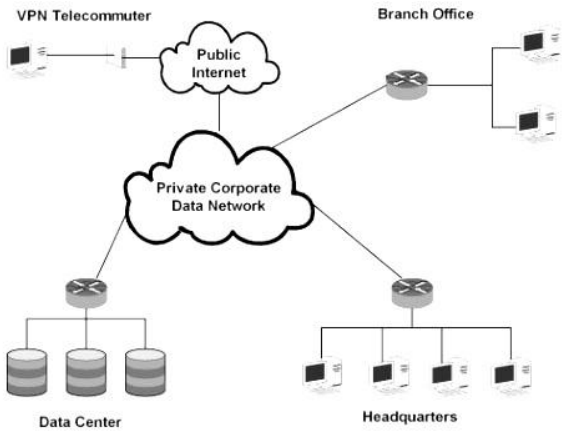

Figure 1: Basic Diagram of an Enterprise Network

A typical Enterprise network includes:

- Networking Hardware:
  - Routers
  - Switches
  - LAN cards
  - Wireless routers
  - Cables
- Networking Software:
  - Network operations and management
  - Operating systems
  - Firewall
  - Network security applications
- Network services:
  - T-1 Line
  - DSL
  - Satellite
  - Wireless protocols
  - IP addressing

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II. DATA CENTRE

A data centre is a facility used to house computer systems and associated components, such as telecommunications and storage systems. It generally includes redundant or backup power supplies, redundant data communications connections, environmental controls and various security devices. Large data centres are industrial scale operations using as much electricity as a small town. Data centres have their roots in the huge computer rooms of the early ages of the computing industry [2]. Early computer systems were complex to operate and maintain, and required a special environment in which to operate. Many cables were necessary to connect all the components and methods to accommodate and organize these were devised, such as standard racks to mount equipment, raised floors, and cable trays. Also, a single mainframe required a great deal of power, and had to be cooled to avoid overheating. Security was important because computers were expensive, and were often used for military purposes.

The main purpose of a data center is running the IT systems applications that handle the core business and operational data of the organization. Such systems may be proprietary and developed internally by the organization, or bought from enterprise software vendors. Such common applications are ERP and CRM systems [3]. A data center may be concerned with just operations architecture or it may provide other services as well. Data centers are also used for offsite backups. Companies may subscribe to backup services provided by a data center. This is often used in conjunction with backup tapes. Backups can be taken off servers locally on to tapes. However, tapes stored on site pose a security threat and are also susceptible to fire and flooding. Larger companies may also send their backups off site for added security. This can be done by backing up to a data center. Encrypted backups can be sent over the Internet to another data center where they can be stored securely.

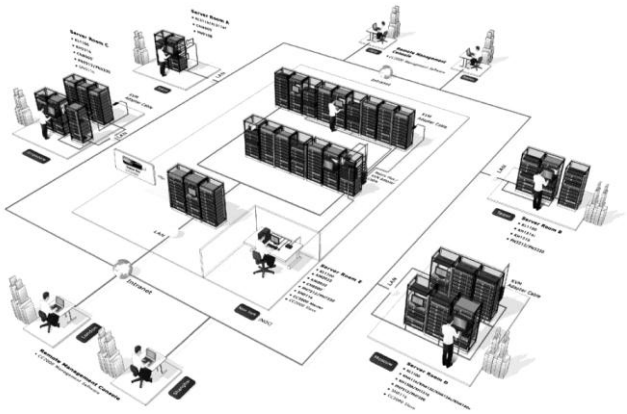

Figure 2: Data Center

III. SWITCHES: IP ADDRESSES

A network switch is a computer networking device that connects devices together on a computer network, by using packet switching to receive, process and forward data to the destination device. Unlike less advanced network hubs, a network switch forwards data only to one or multiple devices that need to receive it, rather than broadcasting the same data out of each of its ports. A network switch is a multiport network bridge that uses hardware addresses to process and forward data at the data link layer (layer 2) of the OSI model [4]. Switches can also process data at the network layer (layer 3) by additionally incorporating routing functionality that most commonly uses IP addresses to perform packet forwarding; such switches are commonly known as layer-3 switches or multilayer switches. Beside most commonly used Ethernet switches, they exist for various types of networks, including Fiber Channel, Asynchronous Transfer Mode.

The network switch plays an integral part in most modern Ethernet local area networks (LANs). Mid-to-large sized LANs contain a number of linked managed switches [5]. Small office/home office applications typically use a single switch, or an all-purpose converged device such as a residential gateway to access small office/home broadband services such as DSL or cable Internet. In most of these cases, the end-user device contains a router and components that interface to the particular physical broadband technology [6]. User devices may also include a telephone interface for Voice over IP (VoIP) protocol.

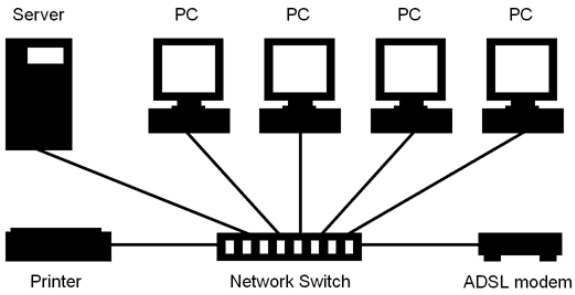

Figure 3: Network Switch

An Internet Protocol address (IP address) is a numerical label assigned to each device participating in a computer network that uses the Internet Protocol for communication. An IP address serves two principal functions: host or network interface identification and location addressing. The designers of the Internet Protocol defined an IP address as a 32-bit number and this system, known as Internet Protocol Version 4 (IPv4), is still in use today. However, because of the growth of the Internet and the predicted depletion of available addresses, a new version of IP , using 128 bits for the address, was developed in 1995.IPv6 was standardized as RFC 2460 in 1998, and its deployment has been ongoing since the mid-2000s .

IV. DESIGN & SIMULATION PROTOTYPE

Our Design fully demonstrated by cisco packet tracer. Packet tracer is a program used to illustrate at a basic level how network work. Packet tracer has two different views- Logical workspace & Physical workspace. It has two modes of operation-Real time mode & Simulation mode.

Figure 4 describe Data centre model. In this model two pc, three server-HTTP server, TFTP server & NTP server.

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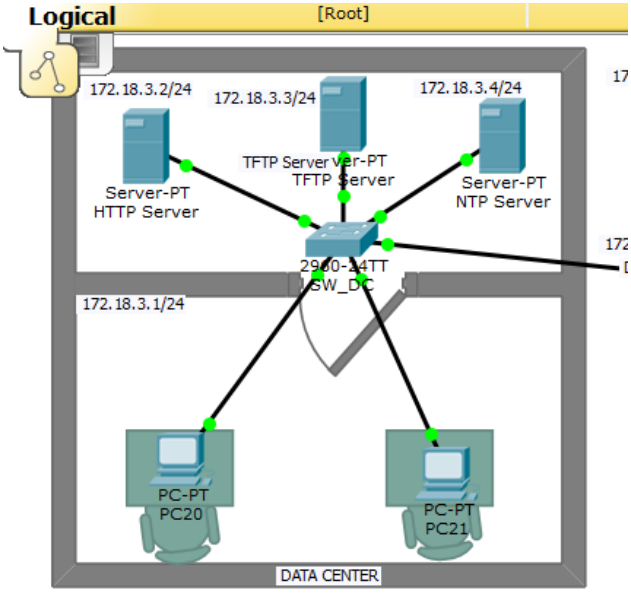

Figure 4: Data centre

One switch model 2980-24TT used to connect all of them. Router 2811 used to connect data centre, branch & internet cloud.

Data centre configuration is straight forward configuration. There is no VTP here, no STP, and Use the same EIGRP routing protocol. Configure the serial interface that will connect to the ISP with the IP address 68.110.171.134/30.

IP for Port:
Serial0/1/168.110.171.133/30
Serial0/1/0 55.55.55.57/30

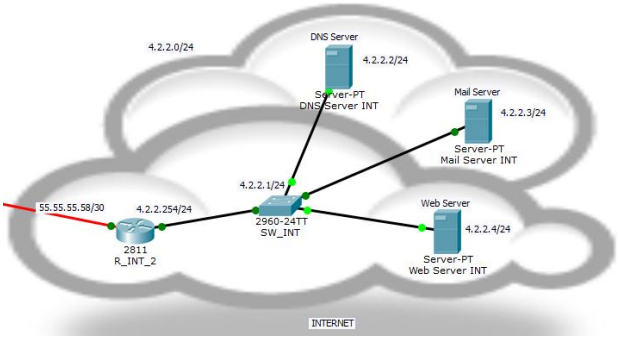

Figure 5: Internet cloud

Internet Cloud provide users and enterprises with various capabilities to store and process their data in third-party data centres. It relies on sharing of resources to achieve coherence and economies of scale, similar to a utility over a network. At the foundation of cloud computing is the broader concept of converged infrastructure and shared services [7].

Also, straight forward; configure static IPs to the servers and all that. But again, do NOT configure a routing protocol on the router. Instead, just configure a static route to the 68.110.171.132/30 network going through the ISP router.

Type IP
DNS Server 4.2.2.2/24
Mail Server 4.2.2.3/24
Web Server 4.2.2.4/24

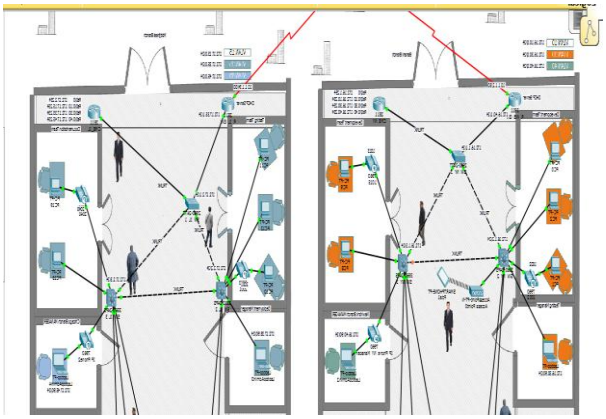

Figure 6: Two branches

For Figure 6, the right side is motijheel branch & left side is Banani branch .Actually these two branches are just models including pc, laptop, and Router, Switch and DHCP server. All these locations are connected through a frame relay switch. The Data Centre is connected to the ISP to get to the simulated Internet (it is a 4.2.2.0/24 network).

V. IP CONFIGURATION USED IN DESIGN

- Switches IP Addresses

  Configure IP addresses for the switches (which will be in VLAN 1, subnet 172.16.1.0/24). Their default gateway will be 172.16.1.254

- VTP & VLANS

  Configure the ports connected between the switches to trunk ports. Create VLANs 30 and 40 on one switch, name them DATA1 and DATA2 respectively. Configure the VTP domain "BB" on the switch.

VLAN Name Status Ports
10 VOICE_WB active
30 DATA1_WB active Fa0/5, Fa0/6
40 DATA2_WB active Fa0/2, Fa0/3, Fa0/4, Fa0/7

- STP & Router

  Configure its Fast Ethernet port on the VLAN 40 subnet and configure the port on the switch on VLAN 40.

ip dhcp pool FORVLAN40
network 172.16.40.0 255.255.255.0
default-router 172.16.40.254
dns-server 4.2.2.2

ip dhcp pool FORVLAN10_VOICE
network 172.16.10.0 255.255.255.0
default-router 172.16.10.254
option 150 ip 172.16.10.254

VI. CONCLUSION

The process of designing a good network requires concerted efforts by network designers and technicians,

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who identify network requirements and select the best solutions to meet the needs of a business. The four fundamental technical requirements of network design are scalability, availability, security, and Manageability. Our Purpose is to just design an enterprise network only for software based not practically.

The main Purpose of this paper is:

- Enterprise network design overview.
- The benefits of enterprise network.
- New design methodology

Besides advantages there are some limitations of enterprise network like:

- Bandwidth
- Encryption
- Everything in HTTP[S]
- NAT, proxies, tunnelling
- Carrier-grade NAT/IPv4 islands
- Lack of knowledge of policy and assets
- Legal restrictions

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BIOGRAPHY

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