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A University LAN Network Design with Internet Access Restricted of a Department

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Abstract: A University is confined with many departments like Accountings, Practical computer Labs, Staff Room, Library, principle and vice principle. The departments in network topology will have its own requirement of end devices. The proposed system aim is to provide internet access only to department in which it is needed and restrict the internet access in practical laboratory were students are supposed to form experiment and not surf unnecessary things on internet. This can be achieved by providing extended access list on the corresponding router of that department
Keywords: Access control list, extended access control list, open shortest path first, router, IP address, switch.

I. INTRODUCTION

A University consists of many departments. In this project only 5 departments are considered. Accounts, practical laboratories, Staff room, library, and principal. All of them will have a particular amount of computers confined with them. A LAN network will be used to design this topology.

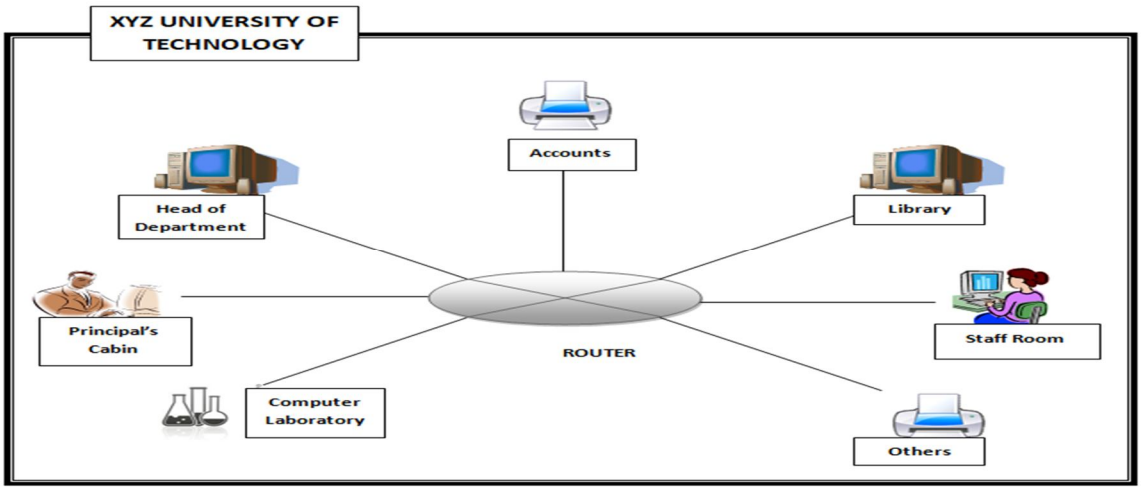

Fig: General LAN Network

LAN or Local Area Network is a group of computers and other device which is confined to a small geographical area. It is basically in a same network in a building like office, colleges or home. That area might be any place and it could contain just few devices. It might also be a much larger area, like an entire office building that contains hundreds of devices. But midst of size, the single prominent characteristic of a LAN is that it connects devices that are in a single, limited area. To start the designing of network, Subnetting is required. Subnet will reduce the wastage of IP address. IP class which will be used is Class C. After subnetting the IP addresses Routing protocol should be decided. The current best dynamic routing protocol is OFPS (Open shortest path first). OSPF is a routing protocol for finding the shortest path from one router to another in a local area network. As long as a network is IP-based, the **OSPF** algorithm will calculate the most efficient path for data to be transmitted. Extended access list will be required to be activated at inbound of few router which will be a computer lab network. Internet access should be blocked in those areas as student should be prohibited from using internet on college computer during practical hours. Rest of the areas will have internet access. Access control list is read from top to bottom, stops at first match. It checks if particular IP address is denied from access. Extended Access Control Lists (ACLs) allow you to permit or deny traffic or packets from specific IP addresses to a specific destination IP address and port. It also allows you to specify different types of traffic such as ICMP, TCP, UDP or their corresponding port numbers.

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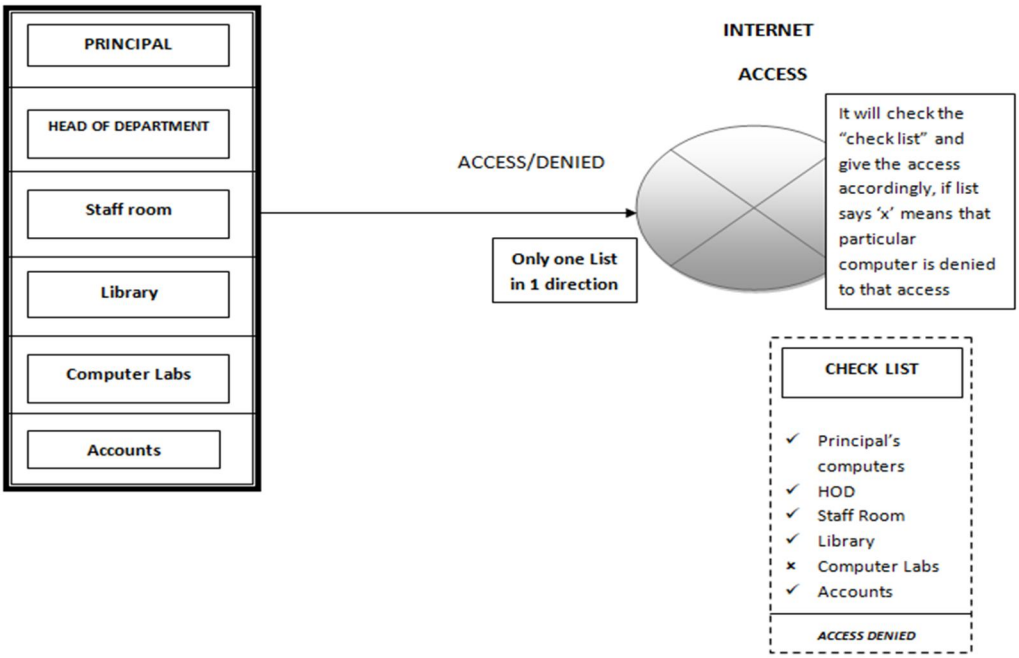

Fig: 1.2 Overall working of access control list

Further section will discuss the detailed methodology of the implementation of the proposed network for this university.

II. IMPLEMENTATION OF THE NETWORK TOPOLOGY

A. Subnetting.

IP class which will be used is class C. The Host requirement for each network is (Network and broadcast IP included):

1) Principle's cabin computers- 4
2) Head of the department computers- 4
3) Staff room computers- 32
4) Library computer- 24
5) Accounts- 32
6) Computer Labs- 64

Below diagram shows the subnetting part of the network topology. The Network ID is 192.168.1.0 and subnet mask is 255.255.255.0 as it is class c.

HOST REQUIREMENTS	NETWORK	FIRST IP ADDRESS	LAST IP ADDRESS	BROADCAST ADDRESS	SUBNET MASK
1. Computer labs (64)	192.168.1.0/26	192.168.1.1/26	192.168.1.62/26	192.168.1.63/26	255.255.255.192
2. Staff Room (32)	192.168.1.64/27	192.168.1.65/27	192.168.1.94/27	192.168.1.95/27	255.255.255.224
3. Accounts (32)	192.168.1.96/27	192.168.1.97/27	192.168.1.126/27	192.168.1.127/27	255.255.255.224
4. Library (24)	192.168.1.128/27	192.168.1.129/27	192.168.1.158/27	192.168.1.159/27	255.255.255.224
5. Principal (4)	192.168.1.160/30	192.168.1.161/30	192.168.1.162/30	192.168.1.163/30	255.255.255.252
6. HOD (4)	192.168.1.164/30	192.168.1.165/30	192.168.1.166/30	192.168.1.167/30	255.255.255.252

Fig: 2.1 Subnetting of the Network.

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B. Network Topology Design.

The following topology is the networ design of the project. For simplicity it all requirments are not considered. Only first and last IP address of a particular network. The Green box represents Network Id and white box delineats IP address of

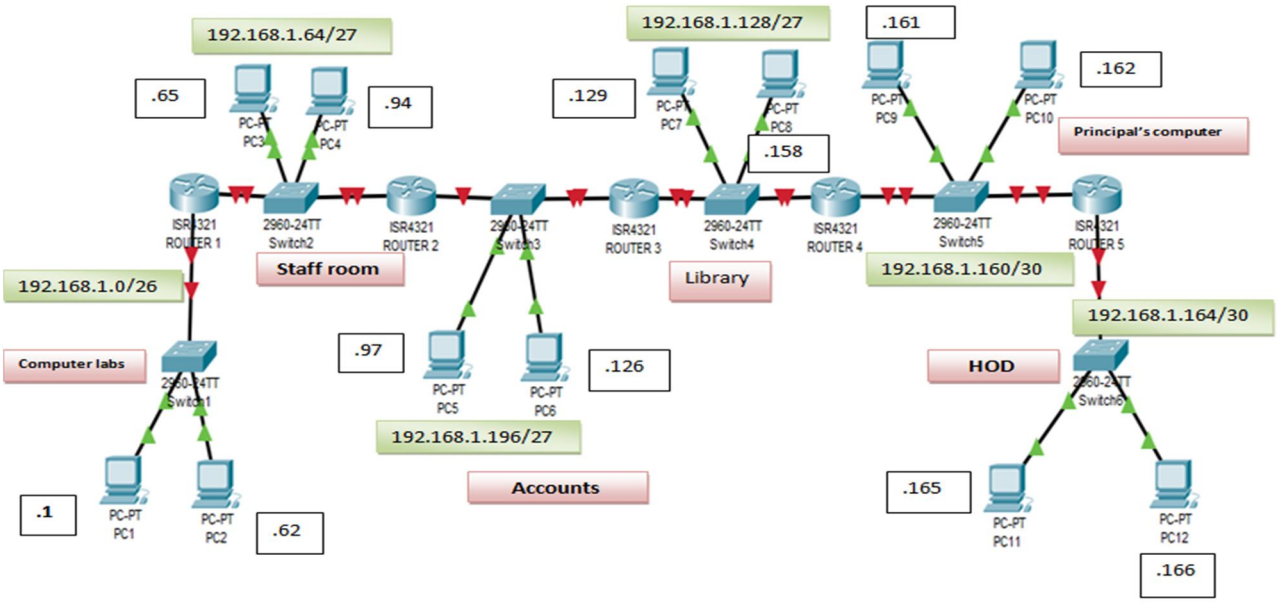

Fig: 2.2 Network Topology of University

the corresponding PC. The pink box represents respective departments. After topology designing the router and the PCs should be given their respective IP addresses according to the Subnetting. After doing the basic IP addressing, Routing needs to be done. OSPF protocol is used for routing since it is highly considered during the implementation of large networks.

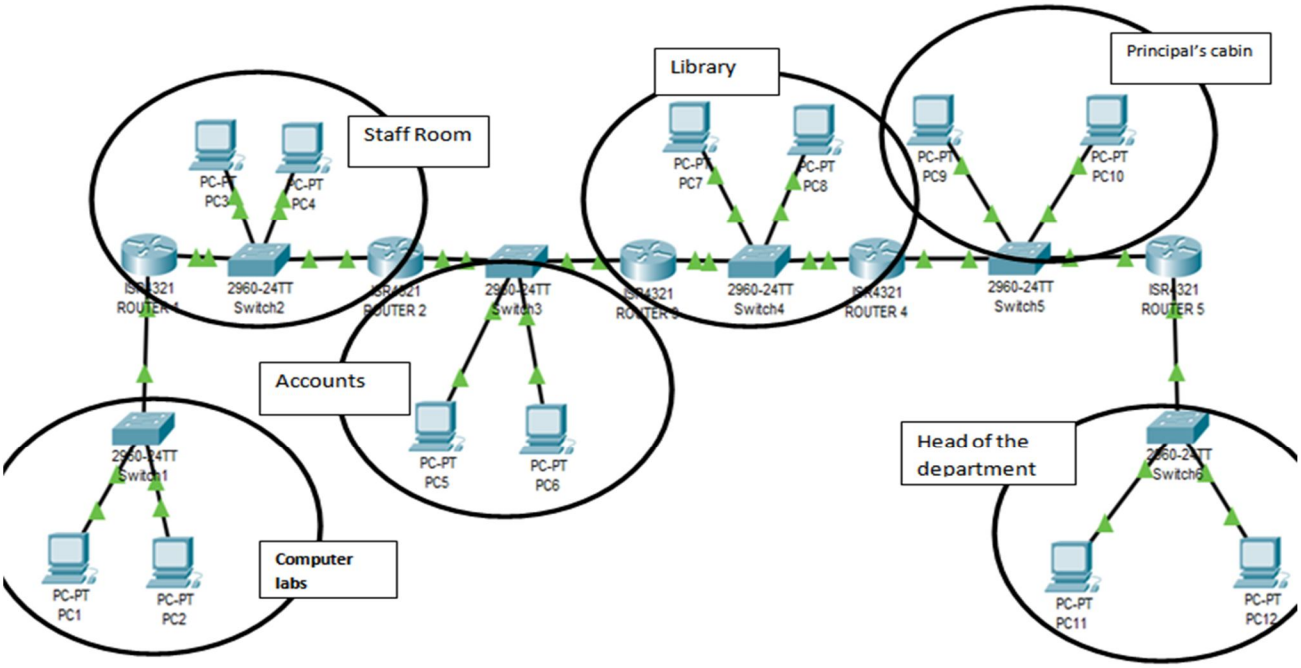

Fig: 2.3 Topology ready to send and receive data

When the routing is done the topology will get up. The green indication is that there is a established to pass data through. In order to check if the data a flow through topology. "Ping" command is used for the testing. If the data flow is correct Router 1 must get a reply from Router 5 after pinging.

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```
R1(config)#do ping 192.168.1.165

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.165, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 11/17/24 ms
```

Fig: 2.4 Testing of Routing

The testing shows that all 5 packets were transferred without any data loss. Usually first packet gets drop that is because of Address Resolution Protocol. Arp is an IP mapping protocol.

III. RESULTS

All university data can be flow from PC 1 to PC 12. The following results show the ping between PC1 to PC 11 with IP address 192.168.1.166.

```
C:\> ping 192.168.1.166

Pinging 192.168.1.166 with 32 bytes of data:

Reply from 192.168.1.166: bytes=32 time=12ms TTL=123
Reply from 192.168.1.166: bytes=32 time=25ms TTL=123
Reply from 192.168.1.166: bytes=32 time=25ms TTL=123
Reply from 192.168.1.166: bytes=32 time=11ms TTL=123

Ping statistics for 192.168.1.166:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 11ms, Maximum = 25ms, Average = 18ms
```

Fig: 3.1 Ping from PC 1 to PC 11

Proposal's main aim of this topology was to deny internet access on Computer Labs PCs so that student don't surf internet during study ours. This was done using Extended access list created at the inbound of the Router 1. The http server was enabled in all the routers but it was denied specifically at the inbound of Router 1.

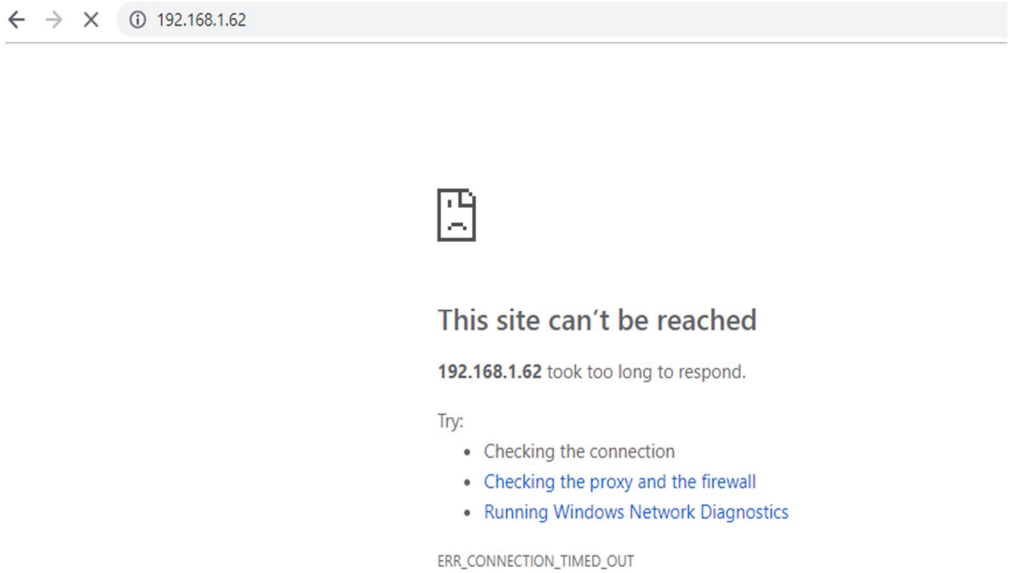

Fig 3.2 Internet access denied at one of the PC's of laboratory

IP address 192.168.1.162 is one the computer lab PC. The internet access is blocked with the help of access control list.

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IV. CONCLUSION.

This is a small topology with simple configuration of represenation it can further be made more secured by using authentication protocols. If more Ip addresses are required then Class A addressing can also be used. It is not feasible to do subnetting for large network so DNs serves can be made to allocate IP addresses. Firewalls can be assmebled as other department will use internet. In order to imcrease the integrity and privacy the data flow can be encypted and decrypted.

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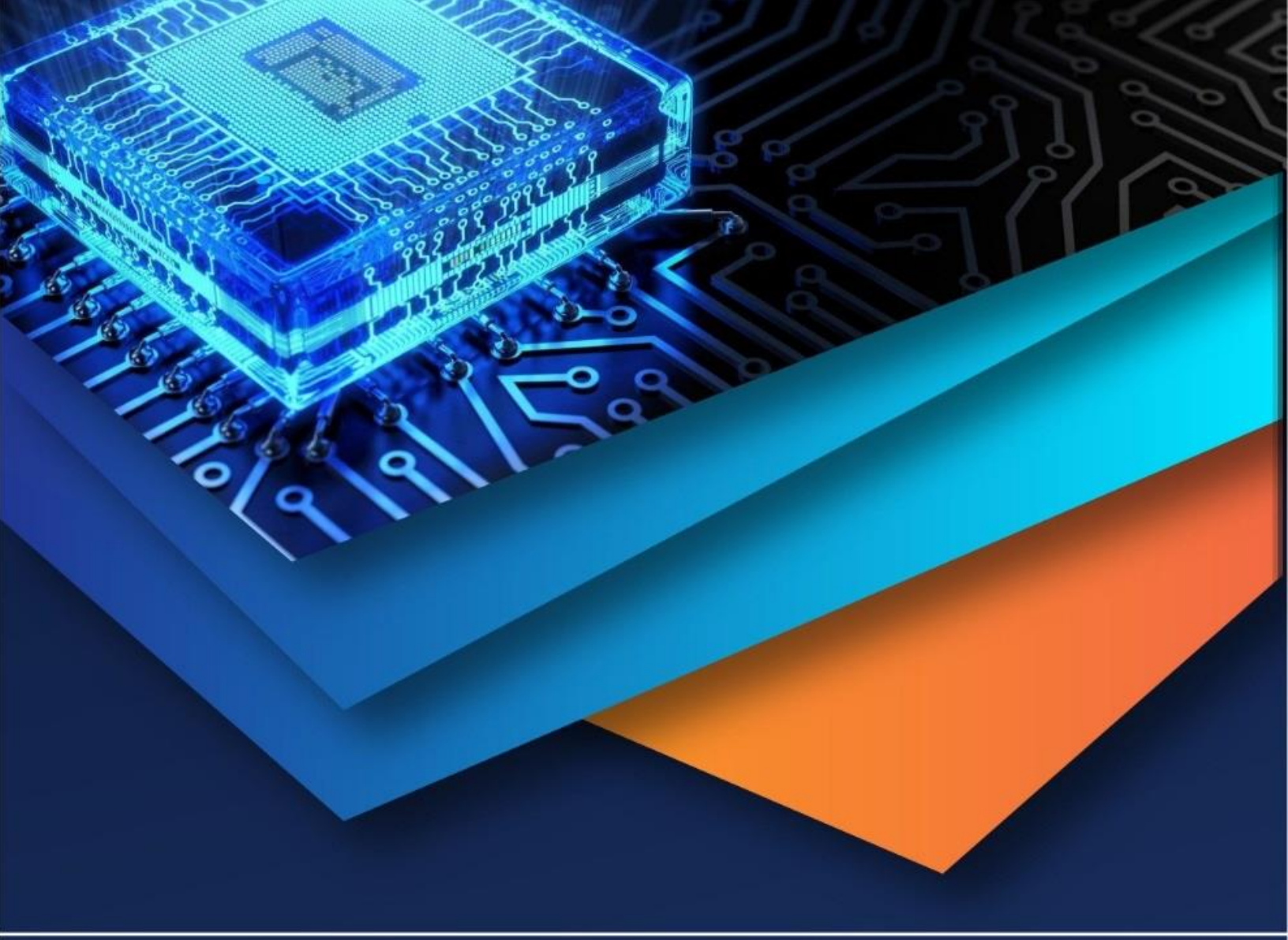

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