Designing Advanced College Network using Cisco Packet Tracer

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Abstract— The aim of this project was collage network design and implementation and the introduction of a suitable network for most college's around the world with IOT devices implementation. This thesis/project includes advanced proposal for "College Network architecture", where in we have implemented some techniques like IOT device connectivity. The network design is without any references to the existing computer network being used in the college but we had made a case study to build it more reliable and upgraded. The upgraded network design in college model keeps in view services like

1) IOT device implementation and their connectivity
2) (ii)Wi-Fi enabled campus with restricted and secured access
3) Providing a high quality of service for the college's network with ensuring internet on each desk by implementing dual ISP dynamic configuration.

The thesis/project also focuses on the problems in network connectivity and effectively implements new technologies that helps to reduce problem's in existing network and also protocols as HSRP (Hot spot routing protocol), OSPF (Open shortest path first routing protocol) routing, use of DHCP (Dynamic host configuration protocol server). This project should be useful to Network Communications Engineers as it covers the major requirement that necessitates of a college network. The proposed network design uses simulator software 'Cisco Packet Tracer 5.1. Details of 'Cisco Packet Tracer 5.1' have also been provided in this thesis report. All the necessary networking basics and background information has also been provided for the sake of completeness in the 'Appendix' section and non-experts can refer the same.
Key words: Networking, Dual ISP, IoT Devices

I. INTRODUCTION

A group of computers physically connected through a communication medium is called a Network. Computer Network is a communication system which links computers and their resources. The sharing of information and resources within a network is known as Networking.

Today a network is a part of the infrastructure at homes, small offices to huge enterprises. Training in the telecom sector can give us an idea how huge the industry earnings are from various networking technologies.

The following project focused on three main parts: IOT implementation, quality of service, and suitable routing protocol. The project has been provided with different server to introduce a network with a high quality of service level for the college. These servers are IOT server, DHCP server. All of these server have been configured to provide advanced environment for the entire network.

Improving the performance of any network requires a high quality of techniques and services which help to improve the general task of the network. The technical services that have been placed in the college's network are

failover redundancy with dual ISP dynamic configuration using HSRP (Hot standby routing protocol), a Dynamic Host Configuration Protocol (DHCP) server and a cabling system. These tools can increase the performance of the network in general and provide a stable internet service for the college System by using dual internet service providers and the failover utility.

The dual internet service providers' role was to provide priority service to the accounts management department and student exam department, which helps to confirm the backup operation for the most complex task holders system to outside the local network.

II. PROBLEM DESCRIPTION

In this project, there were many issues that have been solved technically in simulation software. The first concern was failover of network, the second concern was quality and the third concern was to reduce manual efforts towards less power consumption using IOT service configuration.

In the network architecture centered analysis, the college's network provides services for different people, including student and staff and visitors, so there may be a good service insured. The tools and techniques that have been used to provide advanced level to the college's network are OSPF routing, HSRP routing, IOT implementation, DHCP server, IOT server

These techniques are used for the student section, accounts section, exam section, management department, the most safety critical department. Nevertheless, these techniques must provide an advanced level for the network and stop failure of network by using auto-switching to standby ISP from active one.

We have used two ISP's on two different routers so that if one goes down for some reason the other will pick up the network traffic dynamically. And after the first ISP gets return to active state the second will go in standby state automatically. Both the routers uses a virtual Gateway IP address in between their coordination

III. PROPOSED METHODOLOGY

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A. Modules of the project

1) Dual ISP configuration with automatic load balancing

For today network with multiple internet connections/dual ISP connections would need a network load balancer to load balance LAN. ISP load balancing is very important not only in the enterprise networks but even in some small networks also need ISP load balancing for LAN IP. Most of the case, people want end user LAN can access to internet with different ISP from server farm LAN. To achieve the objective of dual ISP dynamic configuration we have used hot standby routing protocol on Cisco router.

There are three Cisco routers. R1 is the router in customer network and the other two routers will act like two different ISP, so we have multiple internet connections for the customer network. ISP01 is used serve internet connection for end user computer LAN which is 192.168.1.2 and ISP02 is used serve internet connection on standby state which is 192.168.1.3 there is one router which will be act as communicator between two ISP within the LAN network. Two ISP are connected to two routers from them r1 is default routers which is always active state and if goes down the R2 will act as default router which hold on standby state while other is active.
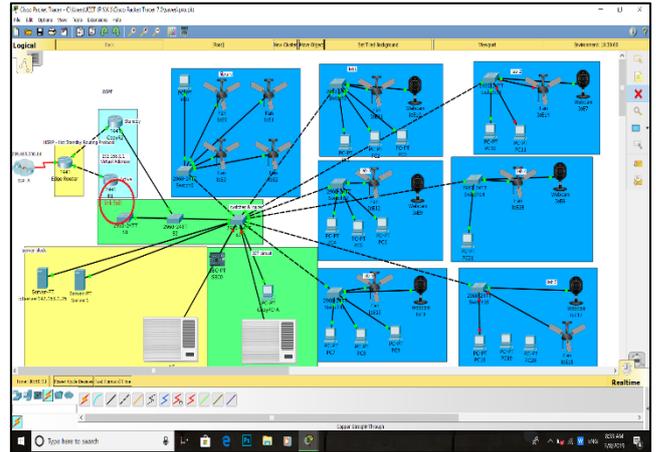
Router R1 active

Router R1 fail
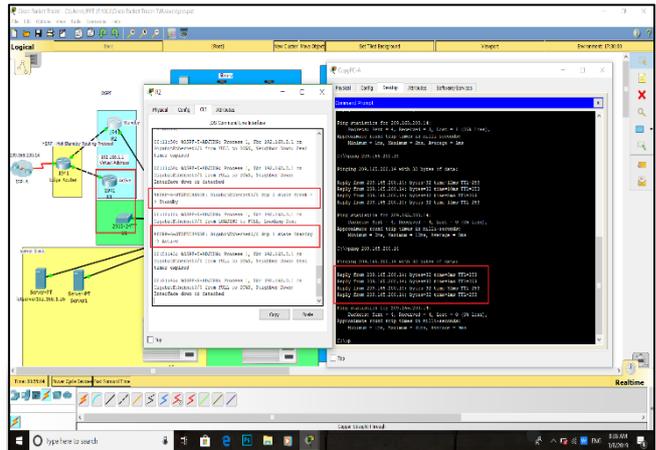
Router R2 active

2) Implementing different type of server services

a) DHCP Server

The DHCP (dynamic host configuration protocol) is a standardized network protocol which is used in internet protocol (IP) networks. DHCP is used to assign IP automatically to the system with the help of a machine called DHCP server. A DHCP server enables computers to request IP addresses and networking parameters automatically. In the absence of a DHCP server, each computer on the network needs to statically (manually) assigned to an IP address.

b) HTTP Server

HTTP (Hypertext Transfer Protocol) is a medium which is used to make communication in between client and server. The primary function of an HTTP server is to store, process and deliver web pages to clients. Pages delivered are most frequently HTML documents, which may include images, style sheet and scripts in addition to text content.

c) IoE Registration Server

The IoE Things can directly register on college Server device configured with the IoE service.

The picture below shows IOE Things attached to a the server and connected to the Internet through it's Internet WAN ethernet port.

The IoE Things can be remotely managed through a web interface hosted by the server ip address on website. The Home Gateway internal (LAN) IP address is 192.168.1.26 but it can also be accessed through it's Internet facing IP address configuration done with a connected computer in control
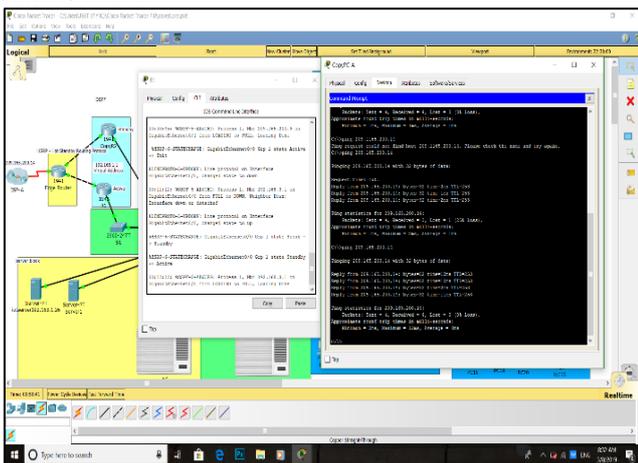
roon. The following screenshot displays the status of the Thigs connected to the computer

login (web): college
password: admin

IT brings services to the connected devices after the IOE server is enabled. Smart devices can access their services from the web server by using their respected ip addresses after the hypertext transfer protocol of the server is started. In other words, the smart devices can be accessed by using the ip address of the IOT server. It associates IOE smart devices to the IOT gateway with the ip address of the IOE server. In general, it controls the devices connected to it.
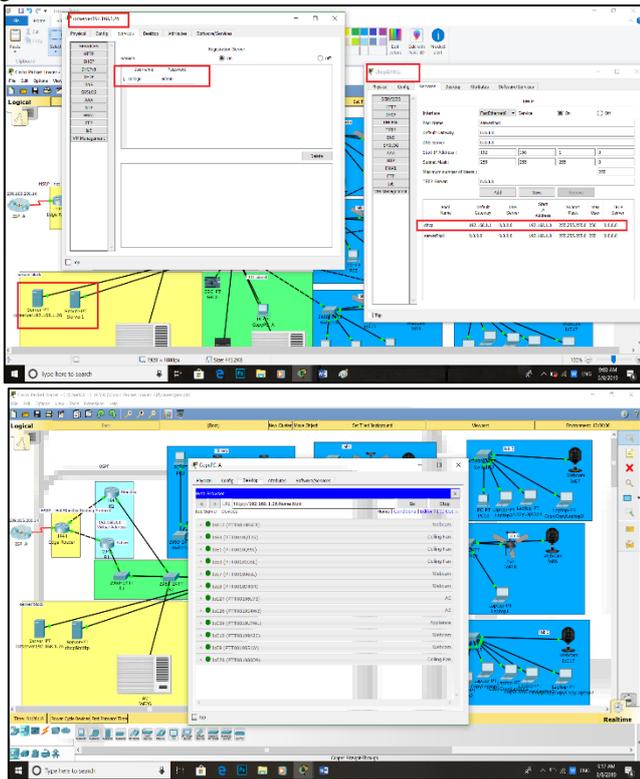
3) Designing Network Topology

The college network design has different department so we will create different network for each separate department with 24 port cisco 2650/24 switches. There is one control room for controlling all IoT devices which is connected to the s3 switch. Switch s3 is main switch which is connected to all the lab's switches. Further each lab has one switch to connect all devices in the lab to network.
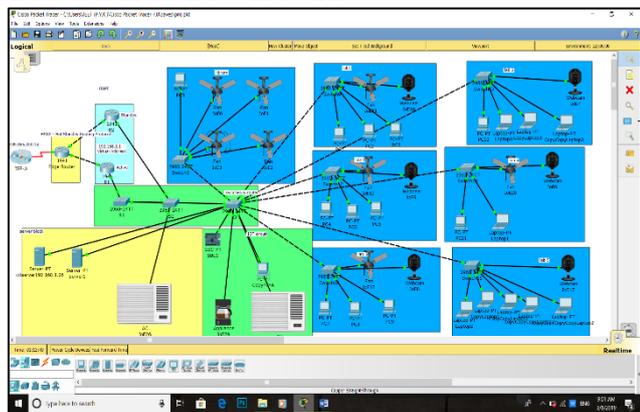

4) Implementing IOT (Internet of Thing) Device Configuration

To implement smart college Cisco packet tracer is used which is a new released technology that includes smart objects intended for college automation. These devices are like: smart light, smart fan, smart camera, smart door and smart window. However, home gateway provides or server controlling mechanisms by registering smart devices respectively via the cloud (WAN).

Smart college design is a structure that has some smart devices and they can be controlled by the staffs from smart phones. This makes the tasks easier, enjoyable and can be used as security means in the campus. However, IOT Gateway provides a connecting mechanism for the smart office devices to help of the internet through the cloud. It also provides, protocol translation, data filtering security and controlling means of the smart devices. It connects them to the cloud

And the servers (IOT server, DNS server) of the campus to store data, provide access and controlling mechanism of the devices with the help of laptop and smart phones. All the smart devices are indirect (remote) connected to the IOT server in such a way that the end user can access the data stored in the IOT server remotely through the web hosted on the server

The campus server contains two things, IOT server and DNS server. The DNS server provides an access to the hosted website on the IOT server not by IP address but a username. The IOT server stores all the sensed data from the office and give users an authorized access to the resources by entering username and password.
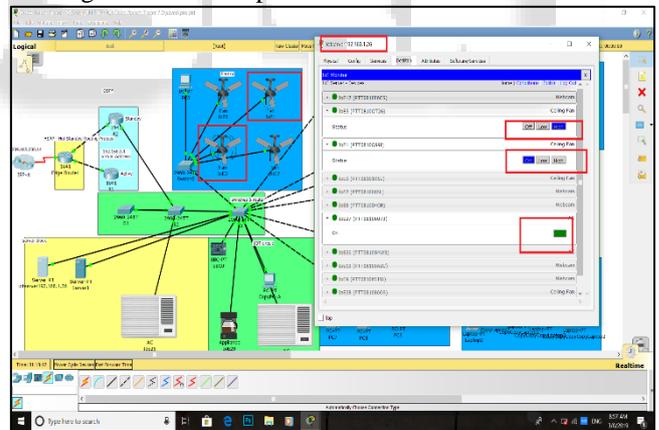
IV. Conclusions

This research and virtual implementation work to investigate the concept of the internet of things and its relevance in campus context and also designing advanced college network with high quality. Internet of things is a new technology that is used for the interconnection of the devices with the help of the internet connection. It enables the devices to sense and monitor devices remotely. It has been shown how to successfully build a smart campus that will contain advanced network which has IOT device implementation and also it focused on three main aspects of network that is security, quality, safety.

For designing and IOT devices implementation we have used simulator software cisco packet tracer. we have

designed a college network which build up with advanced concept like dual ISP IOT device implementation which ensure an reliable network architecture.

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