# DESIGN OF A CAMPUS NETWORK

**A Report**

*Submitted to* **AMITY University, Kolkata**

*for the partial fulfillment of the award of the degree*
**BACHELORS OF COMPUTER APPLICATION**

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# AMITY UNIVERSITY, KOLKATA
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DECLARATION

I hereby declare that the dissertation entitled "Hospital Network  Design" submitted by me in partial fulfillment of the requirements for the award of the Degree of  Bachelors of Computer Applications to the AMITY UNIVERSITY, KOLKATA is based on the experiments and studies carried out by me. This work is original and has not been submitted in part or full for any other degree or diploma of any university or institution.

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CERTIFICATE

The research work embodied in this dissertation entitled "Hospital Network  Design" submitted by Jay Vachhani,A91404816013 in partial fulfillment of the requirements for the award of the Degree of Bachelors of Computer Applications to the AMITY UNIVERSITY, KOLKATA is based on the experiments and studies carried out by him. This work is original and has not been submitted in part or full for any other degree or diploma of any university or institution.

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Dr. Abhijit Paul

(Signature)

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# ABSTRACT

The network design is a major part of the infrastructure of a hospital. Internet speed is a major component of ensuring that healthcare providers and other professionals achieve timely access to pertinent information. The main aim of this paper is to design a hospital network which meets the requirements of a hospital network like electronic health records, on-call doctors via video communication, billing department records, keeping track of the research in progress, etc.The aim is to provide secured LAN and WLAN network. The network is designed by keeping in mind of upcoming technology in medical field. This will increase the quality of hospital service along with patient safety and clinical effectiveness.

## KEYWORDS
LAN, WLAN, Hub, Switch, Router.

# LITERATURE SURVEY

This research paper is related to a project that uses networking in hospitals and has examined various recommendations and techniques for using the hospital network's private addressing schemes. We switched quickly between the LANs and ensured a secure WLAN network was provided.This will contribute to health promotion, which together with patient safety and clinical effectiveness is a core dimension of quality in hospital services. [1]

This study will dissect and analyze different parts of the network of a hospital, uncovering substandard practices and problematic weaknesses that commonly result in a general decline in the quality of healthcare provided to patients, and adversely affecting hospital and healthcare facilities' business operations.We design a plan which helps in [2]

# INTRODUCTION

The field of Information Technology and Network Infrastructure Management has become a crucial component inside the healthcare industry. Medical experts are working along with the IT departments to create more medical devices that can be connected to the network, hence providing doctors the facility to monitor patients easily over internet. Also, hospitals have initiated the method of electronic health records which are easy to access for doctors as well as the patient's family members. There are several times when a doctor can't be present and this factor has already been overcome by video communication. The hospital network has to be made secure as well so that essential data like medical records and research work does not fall into the wrong hands.

In general, in designing and maintaining the performance, efficiency, architecture and security of the hospital network, the IT manager faces a lot of challenges. An important consideration of network design for today's networks is creating the potential to reliably, scalably and securely support future expansion.

We need to design a network topology that is easy to understand, easy to manage, easy to troubleshoot and is adaptable to change in future according to the new medical equipments. Among the various topologies like bus topology, ring topology, mesh topology, star topology, etc, Hierarchical topology would best meet our demands. The hierarchical network design model serves to help us develop a network topology in separate layers. Each layer focuses on specific functions, enabling us to choose the right equipment and features for the layer. A hierarchical design avoids the need for a fully meshed network in which all network nodes are interconnected and thus making it simple and easy to understand.

## 1.1 REQUIREMENTS

The proposal is to design a state of the art network for a district level hospital. The hospital consists of various departments separated among three buildings. The distance between two buildings is 50 meters. Each building has four floors. Each building has its own reception desk on the ground floor with two desktops, one central medical store and medical store room having two desktops. Each floor has three wings, and each wing has its own nurse stations containing one desktop. Apart from this there were medical instruments requiring both wired and wireless internet connectivity. Visitors of the hospitals would get limited wireless connectivity.

1.2 **OBJECTIVES**

The primary objective of this research paper is to provide state of the art networking facilities for the IP-based medical devices, doctors, nurses, visitors and working staff of the hospital. Given below the points to throw light on the subject matter:

- Providing remote medical consultancy or to supervise the surgery/operation from remote location.

- Uninterrupted high speed internet connectivity.

- Provide better medical facilities to the patients.

- Organised health records for future use.

- Uninterrupted communication between different departments of the hospital.

- Reducing the workload at nurse station, account department, reception desk.

- Keeping the research work of the doctors and medical records of patients secure.

- Providing limited internet access for the visitors.

# MODEL STRUCTURE

The Hierarchical is also known as the progressive inter-networking model. This model improves the construction of a structure which is dependable, versatile, and more affordable various leveled internetwork in light of the fact that instead of concentrating on packet construction, it centers around the three functional area, or layers, of your system:

**CORE LAYER**: This layer is viewed as the foundation of the system and incorporates the top of the line switches and rapid links or cables, for example, fibre cables. In core layer packets are neither manipulated nor does it route traffic at LAN level. The core layer is solely in charge of quick and dependable transportation of data over a network. The main Aim of this layer is to reduce the latency rate while delivering a packet.
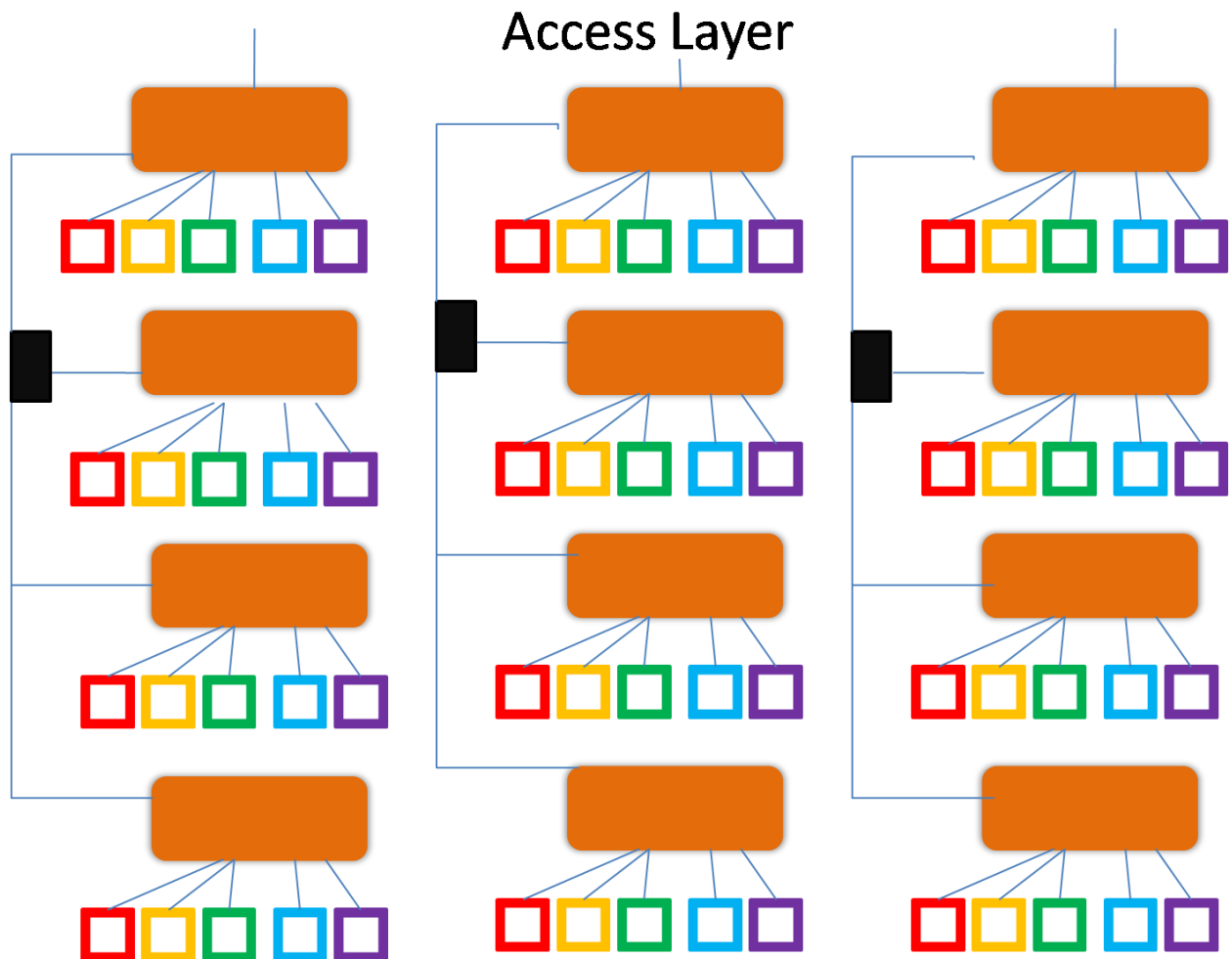
Internet service provider(ISP)

Router

Firewall
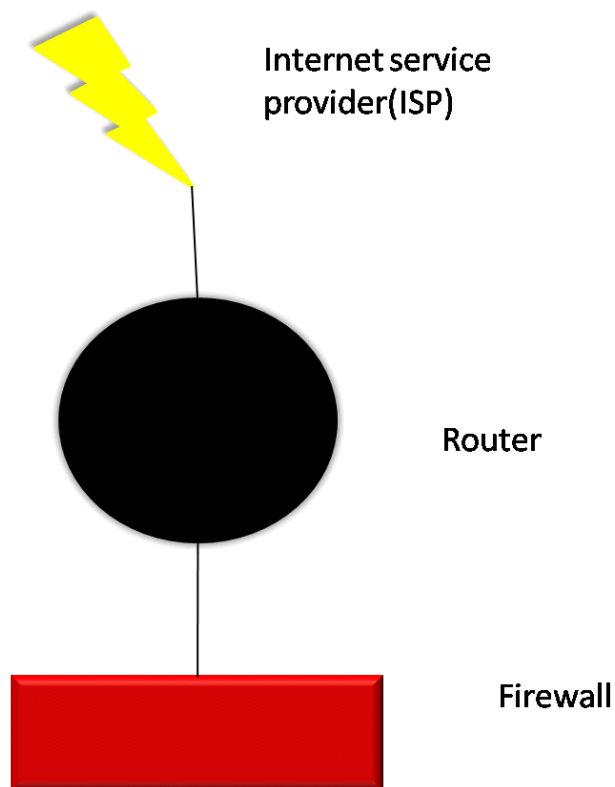
# Core Layer

**DISTRIBUTION LAYER**: The distribution layer is in charge of directing the packets. It additionally gives protocol-based network connectivity. It is at this layer where you start to apply authority over network transmissions, incorporating what comes in and what leaves the network. This layer incorporates LAN-based routers and layer 3 switches. This layer guarantees that data packets are legitimately directed among subnets and VLANs in your endeavour. This layer is likewise called the Work-group layer.



**Distribution Layer**
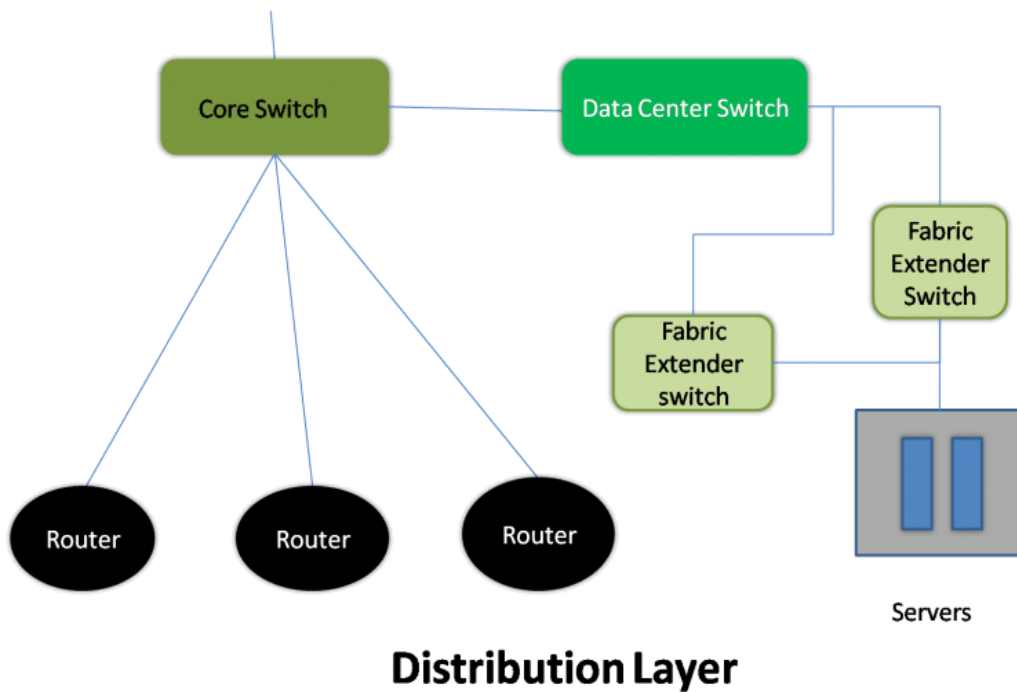
**ACCESS LAYER**: The Access layer contains gadgets that permit work-groups and clients to utilize the role played by the core and distribution layers. In the access layer, you can extend or contract network areas utilizing a repeater, standard switch or a hub. This layer is additionally called the work area or desktop layer since it centers around associating end users, for example, computer system to the network. This layer guarantees that data bundles are conveyed to end client PCs.

## Access Layer

# IMPLEMENTATION
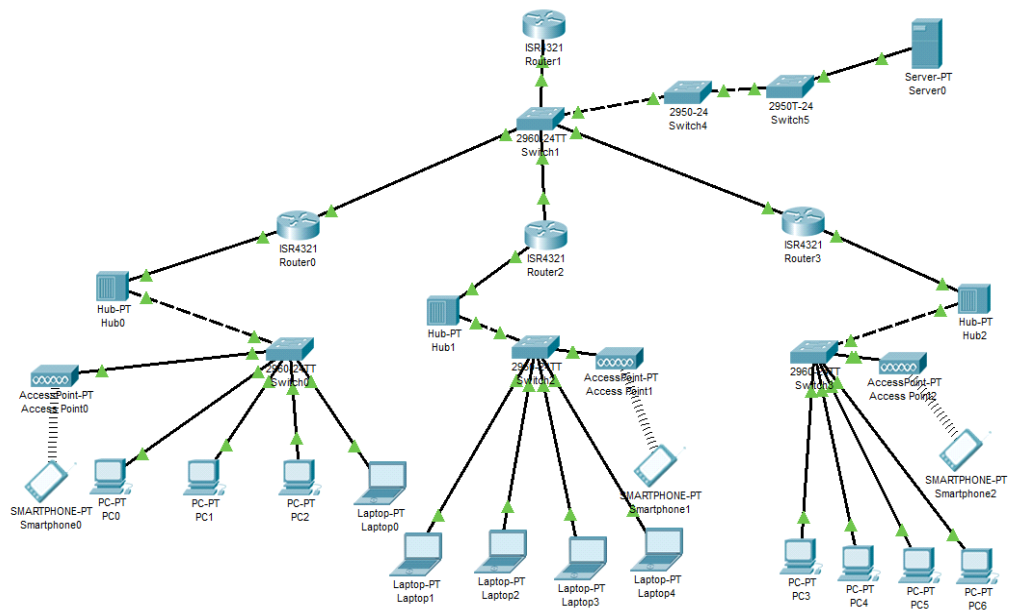
# MODEL ANALYSIS

**ISP:** A network is of little of no use without internet. For the project as big as this consisting almost 400-500 end users accessing internet at the same time we need a high speed internet service provider. We cannot compromise on internet speed as people life's on stack. Here we choose a connection of 100mbps bandwidth from a reputed Internet Service Provider. The reasons behind doing so are

- Providing high speed internet for uninterrupted high quality video communication in various operation theatres.

- Various hospital employees accessing working on their workstations at the same time.

- Providing fixed bandwidth for visitors as they might surf videos or browse sites while waiting in the waiting area.

- Considering near future expendability.

**Router:** In our network we have routers at two levels, one at the core level and one at the distribution layer. We need to handle the bandwidth of 100mbps for now. To handle this bandwidth we are choosing **Cisco 4351** router at the core layer. The reasons behind choosing it are:

- **Cisco 4351** can smoothly give throughput of 200mbps.

- It can be upgraded to 400mbps if required.

- It has 3 onboard LAN/WAN ports.

- It has 48 Maximum switched Ethernet ports.

**Firewall:** Firewall is a system designed to prevent unauthorized access to or from a private network. Firewall prevents unauthorized internet users to access private network connected to internet, especially intranet. All the packets coming or leaving the network has to pass through firewall. It checks and examines every data packets and prevents access if fails to meet security criteria set by the network admin. Firewall can be implemented both at hardware and software level. Here we have installed packet filtering firewall and web application firewall. Former will examine the data packets and later will allow only specific web application to be used by the employees. Our router is capable of filtering the data packets and restricts web applications according to the protocols configured by the admin.

**Core switch:** Core switch comes at the top of distribution switch. It is also known as tandem switch or backbone switch. The main role of core switch in our network is to increase the speed of delivering data packets in the centre of network. Here for our network we have chosen Cisco 6000 series. The reasons behind doing so are

- It has very less failure rate.

- It has very high scalability.

- Upgradable.

**Data centre switch:** The data centre switch is emerging as a new class of switch since data centre networking infrastructures become more disaggregated. Unlike the network switch for traditional three-tier hierarchical networks, data centre class switches are designed to support data and storage for mission critical applications. Here we have chosen Cisco 5548 data centre switch and the reasons behind having a data centre switch in our network are

- They can handle both north-south and east-west traffic flows.

- They support high-bandwidth interconnections using both standard LAN Ethernet protocol and SAN protocols. For example, Fibre Channel and Fibre Channel over Ethernet.

- They have extensive high availability and fault tolerance systems in the hardware and software. Therefore provide better uptime for mission-critical applications.

**Fabric extender switch:** In our network we have chosen this fabric extender purely for future use. As hospital is planning to build two more blocks and if government plan to connect different district level hospitals then traffic will be huge while accessing servers.

**Server:** Server is a central system used for storing and managing data of entire network. Here in our network we have installed three dedicated server i.e. FTP server, mail server, web server.

**Hub:** In a network, a hub is a port that broadcasts to every end device or Ethernet-based device connected to it. Here in our model we used hubs to connect switches of different floor. The reason behind doing is to increase the reliability. We can easily figure out the fault if any floor is not receiving internet connection.

**Wireless Access Point (WAP):** Wireless Access Points are basically devices which allow wireless devices to connect with either the help of WI-FI or Bluetooth medium. We are using two WAP at each floor to provide maximum internet connectivity to wireless medical devices, smart phones, smart mobile tablets, laptops, etc.

**Access switches:** Access switches come at the Access layer of a network. It brings the distribution network inside the building. It is the most commonly used gigabit Ethernet switch which communicates directly with public internet. These switches are responsible for establishing connection with end devices like computers, laptops, mobile phones with both wired and wireless medium. Here in our network we have used one access switch at every floor of our building. In our network we have used Cisco 4510 idf's. The reasons behind it are

- Number of ports.

- High performance.

- Great efficiency.

**Cables:** Last but also the very important part is cabling the entire network. Without connecting one component of a network with other it is pretty much useless. Here in our model we had used Unshielded Twisted Pair (UTP) cables to connect network to router, routers to switch, switch to servers, switch to end devices. WE chose UTP cables because of its interference cancelling capabilities. To be very particular we used cat-6 grade cables because of its maximum transmission speed of 1000mbps/100 meters. There is not much cost difference between cat-5e and cat-6 grade cable. So it is a vice choice to choose cat-6 cable for our network.

# CONCLUSION

With the growth of Information Technology in every sector and the explosion of medical IOT devices, the design of a network of any hospital has become very essential factor. The hospitals need to have a reliable, secure and scalable network design in order to keep the patients information, doctor's research work safe, convenient communication between various departments, etc. as well as keep it ready for any new IOT medical equipments that may be introduced in the future. The hierarchical model of networking best suits our needs along with providing additional features like easy maintenance, high security, simplified troubleshooting and effective performance.

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[2]-Hospital Network Infrastructure: a Modern Look Into the Network Backbone with Real Time Visibility Homan Mike Hirad