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# UNIT 10 NETWORKING FOR HOSPITAL AND CLINICS

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## 10.0 OBJECTIVES

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After completing this unit, the student should be able to :

- develop knowledge on the need and benefits of networking,
- get familiar with basic concepts and terminology used in a network,
- explain different types of computer set-up in an hospital/clinic,
- enumerate the hardware and software options available for a network,
- develop skills on use of network - copy, share and move files and folders; and
- design a network suitable for nursing in hospital.

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## 10.1 INTRODUCTION

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A group of interconnected computers is called a network. Networking computers is a tremendous advancement in information technology. It has revolutionized the way people work and share information.

As you have read in BNSL-212, Block 1 that networks allow computers to communicate with each other no matter how far apart they are physically.

Imagine a Nursing Superintendent's office where a group of nurses are working on a particular project to improve the patient care. Assume that all of them have a computer each to work on. Each team member records her/his ideas in the computer. Also, each member stores information related to her work on the project in the computer.

Most of the time, the team members would like to share their information and ideas.

Consider the case when none of the computers are interconnected. Information has to be shared by paper printouts (usually multiple copies). Ideas have to be shared by all the team members collecting together for a meeting (not all members may be able to attend at the same time and can result in rescheduling). All this can result in a significant loss of productivity. In essence, an otherwise efficient team might produce a very average output.

Now consider the case when all the computers of nursing team are interconnected. Information is easily shared between team members. All information is accessible through the network. This prevents the need for printing multiple copies of documents. Any ideas can be exchanged without all the team members having to group together physically. The team members need not even come to the office. They can communicate with each other from their homes by e-mail or chat using a modem.

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## **10.2 WHY NETWORKING IN HOSPITALS**

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Computer networking in hospital connects various medical and non-medical devices in a scalable, reliable and secure way. It facilitates health care staff easy access to the devices from anywhere in hospital. It enhances the efficiency of medical staff by interconnecting different departments of hospital and facilitating different medical services in a common platform. It provides real-time medical information for more collaborative, proactive patient care.

Sharing of data is essential, especially in any kind of hospital setting. For staff and doctors of a hospital, if they have details of patients readily available at their disposal, they definitely will be able to provide prompt and proper treatment and nursing care. The key to proper and timely treatment is obviously the availability of proper data at proper place and time.

Computerization of patient records has made life much easier as bulky files or folders do not need to be carried around by the staff. But if the patients, files are located on a particular computer and is not accessible to people at different locations, the problem still remains the same.

In such a situation, it is always desirable that computers at different locations are able to share the data stored in them with each other. This would ensure that critical information about a patient is always available to the people who require it, as and when required. Hence the role of "networking" arises.

## 10.3 BASIC NETWORKING TERMINOLOGY

Some of the important terms are discussed in this section.

### 10.3.1 LAN

LAN stands for Local Area Network. This kind of network consists of a set of interconnected computers that are not geographically spread out over a large area.

For example, computers within a college of Nursing campus or in the office of Nursing Superintendent may be connected to each other through a LAN. Typically LAN are not spread out over an area exceeding 2 to 4 square kilometers.

Some examples of a small sized LAN which may be useful in a Hospital are indicated below in Fig 10.1 and Fig 10.2:



Fig 10.1 : A small LAN comprising a network between Doctor and Nurse's Station. A single printer is shared by both the computers

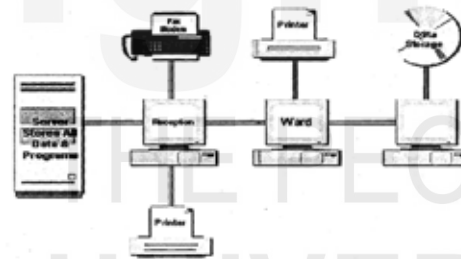


Fig 10.2: A small LAN comprising of the Network between three sites- Nurses station, ward and reception. Usually the data is stored on the server. Multiple printers and data storage devices, are shared by different users. A fax modem is also shared through which the Internet connection can be used at all sites

### 10.3.2 WAN

You have read in BNSL-212, Block I that WAN stands for a Wide Area Network. This kind of network is spread out over a very wide geographical area. The area might include cities, countries and even continents. Communication between computers is usually established through modems, telephone lines or satellite links. (Fig 10.3)

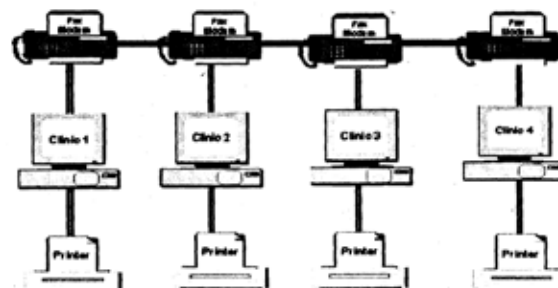


Fig 10.3: A WAN connecting various clinics or departments of an organization spread over a long distance, connected through telephone line using a Fax modem interface

### 10.3.3 Server

In a network, the resources of computers comprising network are usually shareable. In fact, one of the main objectives of networking is to make the computing resources shareable.

Computers in a network that make their resources available for sharing are called server. Typically, Servers are very powerful computers (relative to other computers in the network). A server is also said to be the one providing services e.g a server can offer services for sharing files, printers, etc. In such cases the server is appropriately called a file server or a print server etc.

A server usually has a network operating system running on it to enable it to provide the services. This operating system could be Linux, Unix, Windows Server 2000, Windows Server 2003, Windows Server 2008, Windows Server 2012 or Windows Server 2016

### 10.3.4 Client

Computers that avail the services provided by a server are known as clients. Clients are usually less powerful computers (this is not universally true). Clients are connected to servers to give them access to services. In order for a computer to be a client, it should run appropriate networking software.

A typical manner in which a server and a client interact is shown in the Fig 10.4.

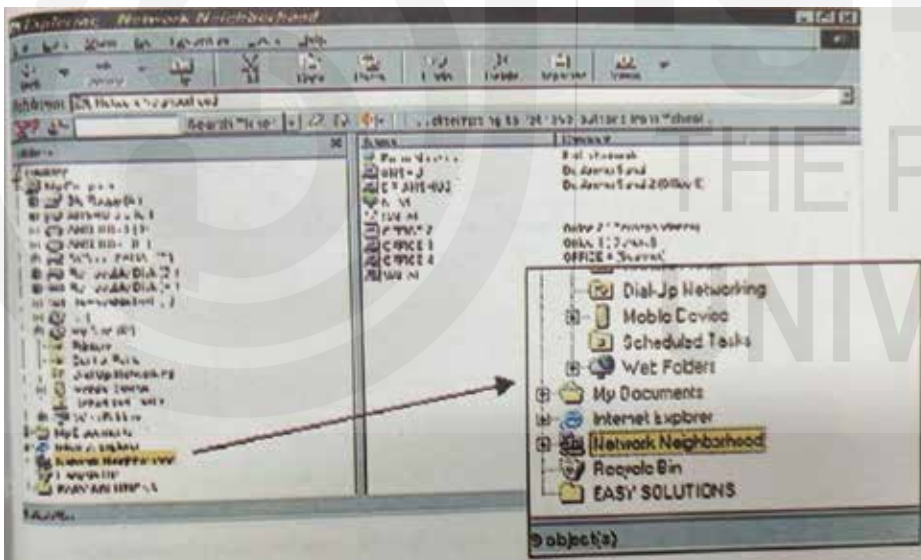


Fig 10.4: Using neighborhood network to view shared resources

### 10.3.5 Workgroup

A Workgroup is a group of people who are working together on the same project. The members of such a group are usually (not always) located in close physical proximity to one another - typically in a single room. The computers that these team members use are also said to be belonging to the same workgroup

The concept of workgroups makes it very simple to communicate to a group of relevant people at the same time. Most network operating systems support the workgroup concept.

### 10.3.6 Login

Because the information on a network is sharable, networks are very susceptible to unauthorized intruders. In order to prevent unauthorized access to use the services of the network, the user identifies self by providing name and a confidential password. The NOS then allows access only if both the name and password are correct,

This process is known as Login. The user is said to be logging into the network. The name which the user uses to enter the network is called the login-ID or login name.

### 10.3.7 User Accounts

Every authentic user in network has an account on it. The user account includes information on the user, e.g his home directory, the amount of disk space that he can access or use at a given time, the times that he/she is allowed to login, her/his password and personal data, etc.

### 10.3.8 Rights

Every user has a set of permission for using the network resources and not all users are allowed to modify critical information like the financial information of the organization/hospital. Only relevant users can access this information. This set of permission is also referred to as the rights that the user has in the network. If the user attempts to access some data, resource or program for which she/he has not been assigned rights, s/he is denied and unable to access it.

### 10.3.9 System Administrator

The system Administrator is in-charge of maintaining the network. This includes, creating new users, accounts, creating disk space for storing additional information, removing unused information, configuring the network resources, etc. The system administrator is generally well aware of network technology and is a highly skilled person.

### 10.3.10 Cloud Network

Scalability and bandwidth issues are some of the limitations in traditional computer networks infrastructure. Cloud networking facilitates remote access to computer infrastructure with flexible, reliability and secure way to medical staff on any time anywhere basis at much lower cost.

#### Check Your Progress 1

What do you understand by the following terms:

1) LAN

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2) WAN

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3) Workgroup
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4) Server
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## 10.4 HARDWARE AND SOFTWARE FOR NETWORKING

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For Networking you would need Hardware and Software.

### 10.4.1 Hardware

Hardware includes the cable and a hub/switch that will connect the participating computers together. Printers or any other peripherals connected to one computer can be shared across on any terminal on the network. Typically, each computer requires a LAN (or Ethernet) Card to be installed in it. To this LAN Card the cable is attached, with the other end terminating in the hub/switch. A hub/switch is a device which connects different computer cables and allows communication between various computers of the network. You could also say that the Hub acts as a policeman, standing on a busy crossroad, directing traffic. Similarly, the Hub directs traffic (data) between various computers, uninterrupted flow of information from one point to the other.

Over the years, new computers have the LAN card inbuilt on the motherboard. Also wireless LAN cards and switch/router are now available, which facilitate and permit the transmission of data from one system to other without the need of laying down cumbersome wires.

Commonly used network Devices which connects computers and other electronic devices are: Switches, Bridges, Hubs, Repeaters, Gateways, Routers etc

### 10.4.2 Software

Any Windows i.e from 95 onwards has the capacity to connect two computers with the help of Ethernet cards (generally known as LAN card) and CAT5 cable. This set-up of connecting two computers is called Peer-

to-Peer Networking. More than two computers can be connected with the help of a 8/16 port. Such networks ideally require special software and appropriate hardware.

Software system for large scale networking is Novell-Netware, Linux, Unix and many versions of Windows Server. Network Performance can be monitored with the help of network traffic device management software.

### **10.4.3 Windows and Networking**

You have read about many version of Windows Server 2000. These include built-in networking support with a wide range of improvements over earlier versions of Windows. This includes built-in support for popular networks plus an open, extensible networking architecture.

### **10.4.4 Network Interface**

Windows provides an easy to use interface to configure the network setting of your computer . All network components are installed and configured by using the “Network” option in the Control Panel rather than by editing configuration files manually.

The Windows set-up program automatically installs the network software based on what is detected about the existing networking components in the computer.

Any computer running Windows NT Server can be set-up to serve as a file and print server for other computers on the network. Resources can be protected from unauthorized access by assigning each resource a list of authorised users and their respective rights.

Using Windows NT, it is possible to establish simultaneous connection to multiple networks on a computer . The number of network connections allowed on a computer running Window NT depends only on the limits assigned in the networking software’s configuration.

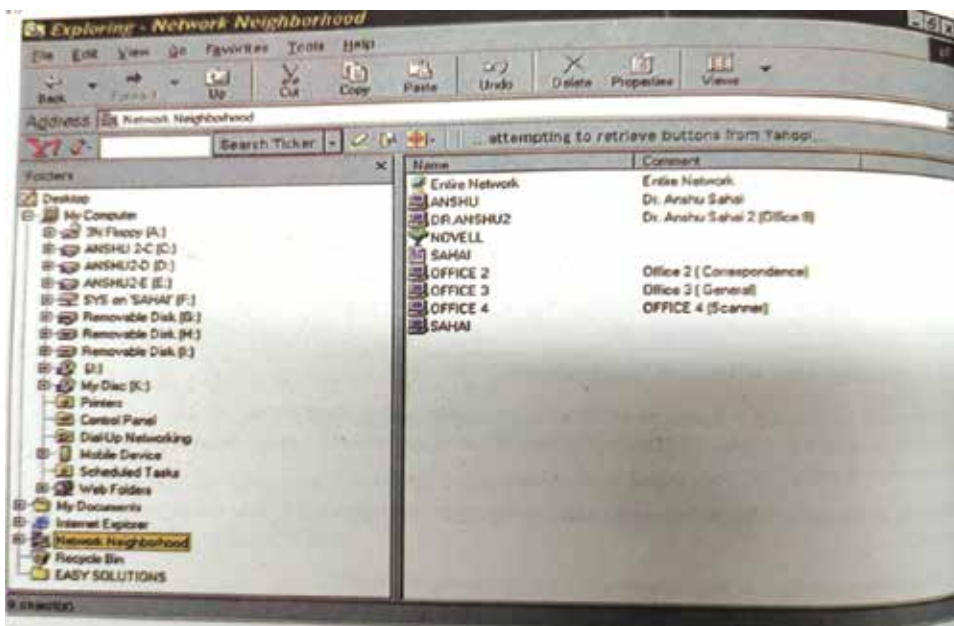
### **10.4.5 Accessing Other Computers**

The advanced networking feature of Windows combined with the easy to use user interface makes the task of sharing information with other computers / users quite simple and intuitive.

In order to share information between two computers, certain conditions must be satisfied.

- The computers must be connected to a common network.
- The resources of the computers must be made shared.
- The persons using the computers should have sufficient rights to access those resources.

**Accessing other computers** is done through the “Network Neighborhood”. To open this object, double click on the Network Neighborhood icon on the desktop and a window opens. This window is the interface to the entire network. Using this window you can access the resources of any computer in the network provided you have sufficient rights to access the resources



**Fig 10.5: List of computers on the network**

By default only those computers are listed that belong to the same workgroup. Even your own computer is also listed. (Fig 10.5)

Computers that have been accessed recently are also listed in the Network Neighborhood window.

In order to access the resources of another computer, double-click on the icon for that computer, e.g. to access the computer “office 2” double click on its icon. (Fig 10.6)



**Fig 10.6: Shared resources of the network computer office**

A separate window gets opened, which displays the shared resources of that computer. Double-clicking any of the shared resource lists the contents of the resources in a window.

To access a computer not in your immediate workgroup, double-click the “Entire Network” icon or Shortcut in the Network Neighborhood window.





**Fig. 10.7:** Use of entire network lists all computers of different work group on the network

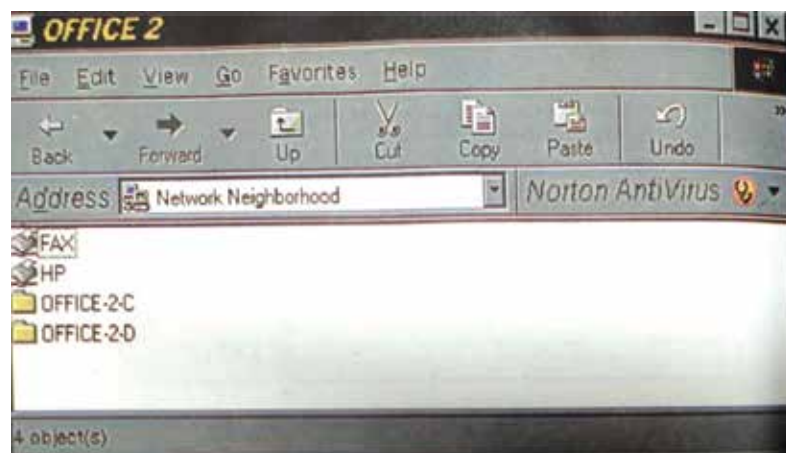
This lists all the computers in the network. (Fig 10.7) The computers are listed in two ways:

- a) Computers belonging to the same workgroup or which have been accessed recently are listed one-by-one. An icon followed by its name represents each computer.
- b) The rest of the computers in the network are not listed, but the workgroups they belong to are listed.

To access another computer not in your workgroup, double-click on the workgroup to which that computer belongs to, e.g. to access the computer “office5” in the “Bsc Nursing” workgroup, double-click on the “Bsc Nursing” Office workgroup icon.

#### Accessing Folders and Printers

Accessing folders, files and printers of another computer is as easy as accessing another computer. To access folders and printers of another computer, it is necessary to access the other computer first. For example, to access the folders and printers of the computer “OFFICE”2 , it is necessary to access the “OFFICE 2” computer. The computer itself can be accessed through the Network Neighborhood. (Fig 10.8)



**Fig. 10.8:** The shared components of office 2 computer

The contents include a list of shared folders, drives and printers available on the computer. To browse through each folder in this, double-click on the corresponding folder’s icon. The contents of the folder are displayed in a

separate window e.g to browse through the folder “OFFICE 2-C”, double-click on its folder icon.

### How to Share Folder/Printers

Making a folder on your computer accessible to other users is done in two steps. You may have to share folder of patients with all the shift nurses.

- Mark the folder sharable and assign a share name.
- Granting rights to users who need to access that folder.

This paragraph describes the procedure for making a folder shared and granting access to a shared folder. (Fig 10.9)

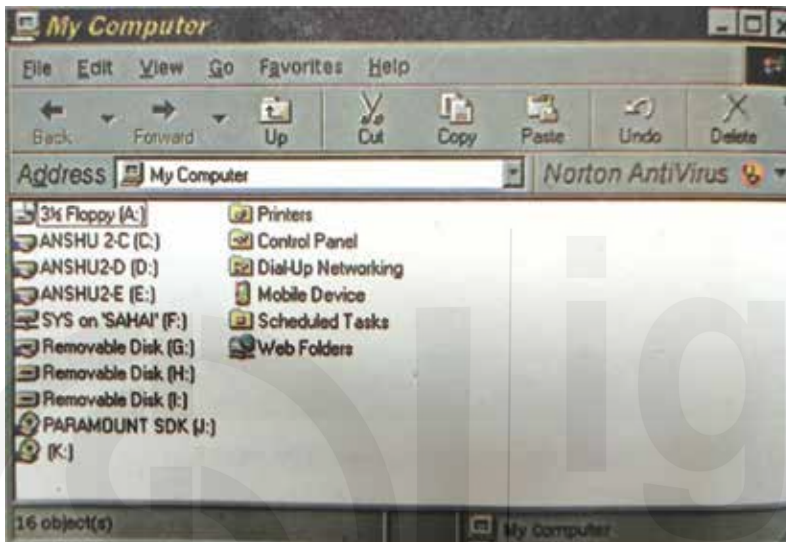


Fig. 10.9: List of components of the computer which may be made shareable

To make a folder sharable, you need to access the folder first. If the folder is on the Desktop, it is already accessible. If the folder is not on the Desktop, you can use Windows Explorer or My Computer to access the folder.

To make that particular folder sharable, point to it and click the right mouse button. (Fig 10.10) The following menu appears :

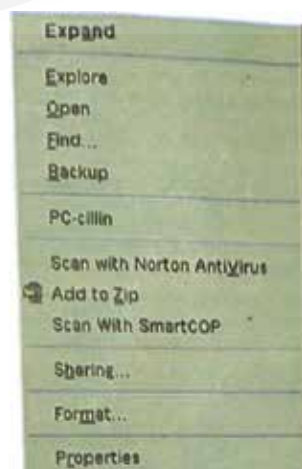
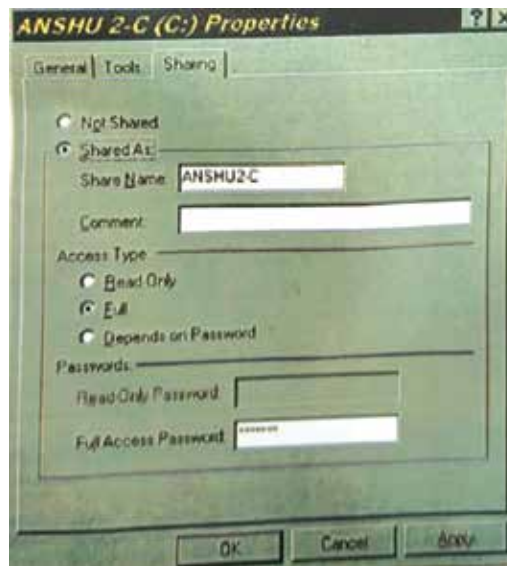


Fig. 10.10: Right click on a folder brings up the option for sharing

One of the options in this menu is “Sharing”. Point to this option and click, the Properties dialog box for the “Nursing Foundation” folder appears. (Fig 10.11) The sharing property gets displayed.



**Fig. 10.11: Security and sharing options for the computer folder**

If the folder is currently not shared and this is indicated by the “Not shared” option being checked. To make the folder sharable, click on the “Shared as” option. This makes the folder sharable and accessible to other people on the network.

The next step is to provide a share name that others will use to access this folder. A share name need not necessarily be the same as the folder name, but it helps to have a similar name. A share name cannot have any spaces in it.

Windows provides by default a share name for the folder. You can either accept it or type a new name.

In this case Windows suggests the share name “MS”. As this name suits us, fine, we will accept it.

In the “Comments” text box, we type a descriptive comment for this sharable folder. Users who will browse this computer can get an idea of the contents of this folder.

The next step is to create a list of users who have rights to access this folder. To create a list of users who will have access to the shared folder, click the ADD button. Windows will get the lists of users in your network from a network server.

Depending on the type of network, the network server will either be a Windows NT server or Novell Netware.

This is a security feature in Windows to prevent unauthorized access to the shared information.

Assigning rights “Read only/full” depends on Password to all users in the network. A specific set of rights that you should assign to a user will depend on his requirement. If the user needs to access the folder to both, read and write files, he should be given both “read and write files” access. Different Networking Software have different security options.

To indicate that a folder is shared, Windows changes the icon for the shared folder. The icon for the folder has a hand beneath it.

### **Opening Documents Situated on Different Computers**

In order to work with documents situated on other computers, you need sufficient rights to access the folder in which it is placed. Just as you have to grant rights to other users to access your folders, other users will also have to grant you rights to access their folders.

This paragraph tells you how to open a document situated on a different computer. It is assumed that you have sufficient rights to access the folder in which the document is placed.

In this paragraph we will access the remote document “Sample Text Nurse” on computer named “Office-2”.

The first step to open a document is to access the shared folder in the computer. This is easily done through Network Neighborhood. Double-click on the Network Neighborhood icon on the Desktop and on “OFFICE-2” computer in the Network Neighborhood window.

This will list all the share-out folders on “OFFICE-2” machine.

Double-click on the shared folder “My Documents” to access the files placed in it.

Double-click on the document to open it. Depending on the applications you loaded on your system, either the MS-Word or wordpad applications will be launched to display the contents of the file.

You can now change the contents of this document and save it back on “OFFICE-2” machine.

### **Copying and Moving Documents on Other Computers**

To make a local copy of the document, simply drag the icon and drop it on your desktop. The document will be copied on to your desktop.

To move the file instead of copying it, press “shift” while dragging the icon.

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## **10.5 AUDIO/VIDEO APPLICATIONS ON NETWORK**

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Clinical applications of a computer include recording of images, audio and video on a computer. These still images or even videos can be recorded on a data storage server or the local computer itself. The images can then be edited, enhanced and stored for use in the patients management, presentations or just for the sake of completeness of the patients records. Since these images are usually big in size, copying them on a floppy and transferring them from one system to the other is a cumbersome job. Even more so for a video recording made either of nursing care of patient in ICU image from the slit lamp or from the camera mounted on the operating microscope in the operation while assisting in the complicated surgery, the sheer size of most image or video clippings make them difficult to transfer. Also storage and archive becomes an issue. The option of having these images available at different locations also needs to be considered.

In most cases a simple solution of all these issues is a properly set-up network, with a dedicated data server. Some people also like to use the term “Image Server” for the server which is used to store clinical nursing care

images. These servers ideally should have sufficient space to permit storage and archival of the images for an extended period of time. For the purpose of storage, the server would ideally have a large hard disk capacity (something like 80 gigabyte or further multiples of this as required) or cassette tape drives for secure storage. ACD writer or DVD writer is also a desirable option so as to enable the administrator to have a back-up disk of the data in the rare situation of problems with the data server. Presence of the data on the server enables all the people who have been assigned rights to view and utilize these images and videos.

One major advantage of the network is to collect and organize all data pertaining to OPD/IPD patient, surgery reports from intensive care units, scan results from radiology and testing laboratories etc together as a single directory and record on a single system. All this data can also be directly linked with the patient's basic data file. In the absence of such a network, single patient's record and images would have to be retrieved from various different systems spread throughout the clinic or hospital. This would not only be manpower and time consuming, but also would be bothersome for the patient.

An advanced application on a network would be using a Closed Circuit Television (CCTV) camera with a DVR card. This camera can be linked to the desktop computer of a nurse's station or nurse administrator on the network, allowing to monitor the entire hospital while doing routine tasks

### **Storage of Hospital Data**

Hospital requires high performance and secure large Memory Storage . Now a day, Storage Area Networks (SAN), Network-Attached Storage System (NAS), external hard disks or SSDs and cloud storage are being used to store patient records, electronic medical records (EMR) and their backups, radiological images, insurance claims, office documents etc.

#### **Check Your Progress 2**

- 1) How would you access a computer on the network?  
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- 2) What do you understand by "sharing". How would you share a folder or file on you computer?  
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- 3) Design a LAN environment for your Hospital. Give a diagrammatic representation of the same.  
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4) Discuss the role of a network in image and clinical data management.

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## 10.6 LET US SUM UP

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- A group of interconnected computer is called a Network.
- Networks allow computer to communicate with each other no matter how far apart they are physically
- LAN stands for Local Area Network, this kind of a network consists of a set of interconnected computers that are not geographically spread out over a large area.
- WAN stands for a Wide Area Network, this kind of network is spread out over a very wide geographic area.
- Servers offer services like file and printer sharing.
- Computers in a network that make use of services provided by a server are known as Clients.
- A Workgroup is a group of people who are working together on the same project.
- A Protocol is a language that two computers use to talk to each other.
- Two computers, which are at the same level in the network, are called Peers.
- In order to prevent unauthorized access to network resources, almost all network operating systems provides features for security of information in the network.
- Every authentic user in a network has an account in it.
- Every user has a set of permission for using the network resources called as his rights.
- The system administrator is incharge of maintaining the network. This includes, creating new user accounts, creating disk space for storing additional information, removing unused information, configuring the network resources, etc.
- The Windows operating system includes built-in networking support with a wide rage of improvement over earlier versions of windows.
- All network components are installed and configured by using the network option in control panel rather than by editing configuration files manually.

- The Windows Set-up Programme automatically installs the network software based on information detected about the existing networking components in the computer.
- Any computer running Windows can be set-up to serve as a file and print server for other computers on the network.
- Windows also provides plug and play networking support.
- Accessing other computers is done through the Network Neighborhood Objects.
- The Networking Neighborhood window displays a list of computers in the network.
- You can access your own computer through network.
- To access the folders and printers of another computer, it is necessary to access the other computer first.
- Making folder on your computer accessible to other users is done in two steps:
  - ◆ Make the folder sharable and assign a share name.
  - ◆ Granting rights to users who need to access that folder.
- In order to work with documents situated on other computer, you need sufficient rights to access the folder in which it is placed.
- To make a local copy of a documents, simply drag the icon and drop it on your desktop. The document will be copied on to your desktop.

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## **10.7 ANSWERS TO CHECK YOUR PROGRESS**

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### **Check Your Progress 1**

- 1) LAN stands for Local Area Network. This kind of a network consists of a set of interconnected computers that are not geographically spread out over a large area. Computers within a college campus or an office may be connected to form a LAN. Typically LANs are not spread out over an area exceeding 2 to 4 square kilometers. The computer in a LAN is connected to twisted pair or coaxial cables. The number of computer is LAN usually does not exceed 400.
- 2) WAN stands for a Wide Area Network. This kind of network is spread out over a very wide geographic area. The area might include cities, countries and even continents. Communication between computers is usually established through modems, telephone lines or satellite links.
- 3) A workgroup is a group of people who are working together on the same project. The members of such a group are usually located in close physical proximity to one another. The computers that these team members use are also said to be belonging to the same workgroup.
- 4) Computer in a network that make their resources available for sharing are called server. Typically, Servers are very powerful computers (relative to other computers in the network). A server is also said to be the one providing services e.g. a server can offer services for sharing files, printers, etc. In such cases the server is appropriately called a file server or a print server etc.



## Check Your Progress 2

- 1) Accessing other computer is done through the “Network Neighborhood”. To open this object, double click on the Network Neighborhood icon on the desktop and a window opens. This window is the interface to the entire network. Using this window you can access the resources of any computer in the network provided of which you have sufficient rights to access the resources. In order to access the resources of another computer, double click on the icon for that computer.
- 2) Sharing is the process of making a folder on your computer accessible to other users. To make a folder sharable, you need to point to it and click the right mouse button. A menu appears with the option “Sharing”. Point to this option and click. To make the folder sharable, click on the “shared” as “option”. This makes the folder as sharable, and accessible to other people on the network. Now we create a list of users who have rights to access this folder.

3)

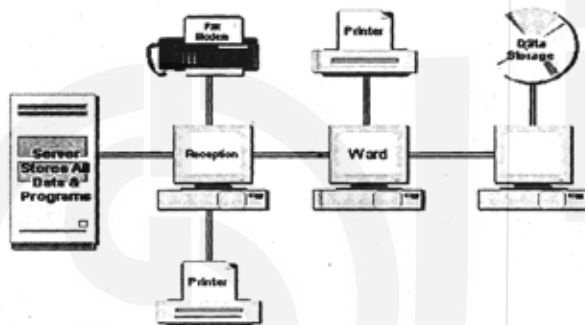


Fig: LAN network for the hospital

- 4) Clinical applications of a computer network includes recording of patient images or videos on a computer. The images can then be edited, enhanced and stored for use in the patients management, nursing care records, presentations or just for the sake of completeness of the patients records. “Image Server” are servers used to store clinical images. The network can also be utilized for transfer, storage and archival of images and videos from various diagnostic equipment. Images from a Fundus Camera, Visual Field Analyser, B-Scan ultrasound, Digital X-Ray, CT Scan, Corneal Topography Unit, and various other equipment can similarly be transferred, stored and archived on the data server through the network. Advantage of the network is to collect and organize all data pertaining to single patient together as a single directory and record, on a single system.

## 10.8 ACTIVITIES

- 1) Find out the type of network you have in the hospital.
- 2) List the source of communication through the network you get in your hospital.