Al-Mustaqbal University

Biomedical Engineering Department

Class: 4th

Subject: Clinical issues of Biomedical Engineering

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1st term – Lect. 6: Picture Archiving and Communication Systems (PACS)

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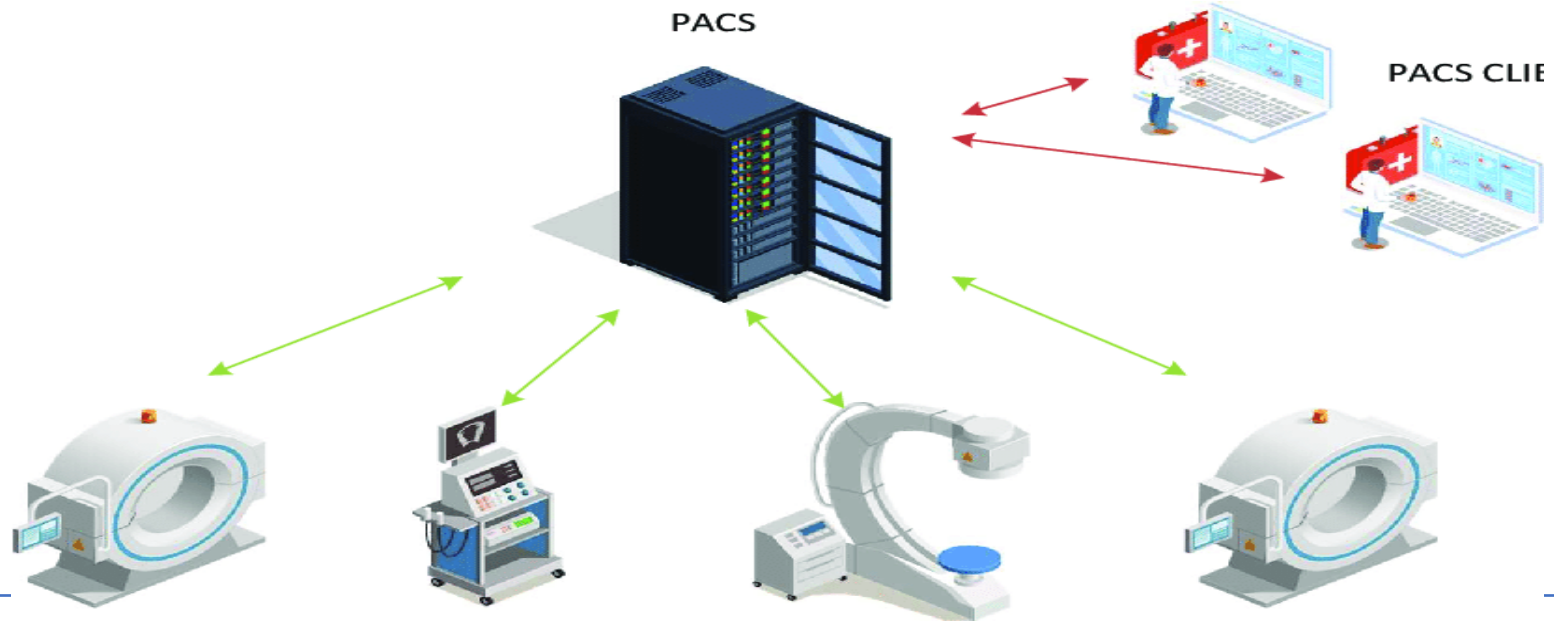
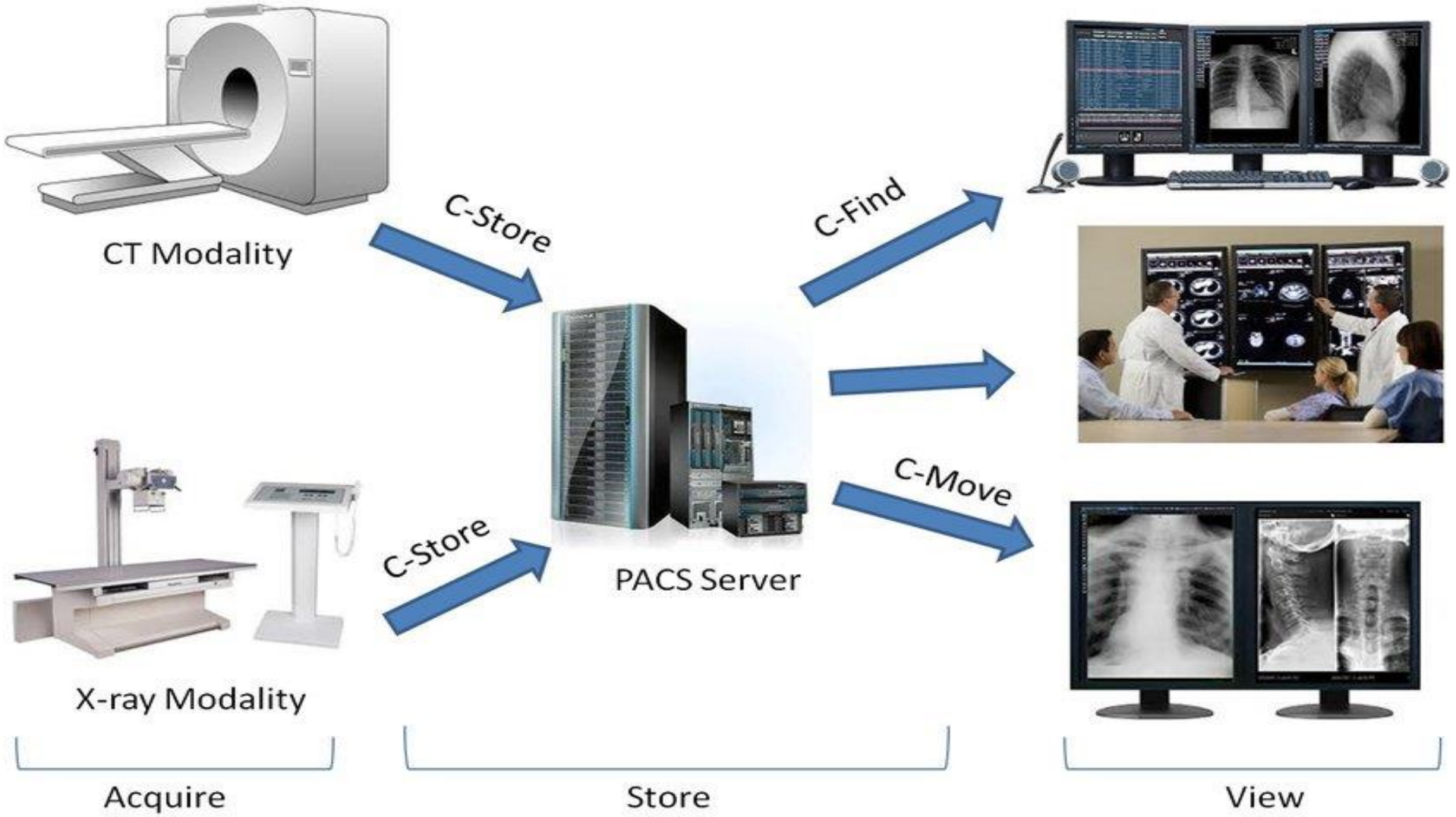
Picture Archiving and Communication Systems (PACS)

- A picture archiving and communication systems (PACS) is a system that electronically processes, stores, distributes, and retrieves digital medical images in a portion of, or throughout, a health care enterprise.
- PACS consist of acquisition, display, workstations and storage devices interconnected through an network.



Picture Archiving and Communication Systems (PACS)



PACS Technology

- PACS is most commonly used in **radiology departments** to process and route radiographs and other diagnostic imaging modalities including MRIs, CTs, nuclear medicine scans, and ultrasound images.
- PACS handles the image from various medical imaging instruments.

PACS Technology

- PACS are computer network-based image storage, processing, distribution, and retrieval systems that can be used to capture, store, recall, display, manipulate, and print medical images and associated data.
- PACS systems are typically made up of the following components:

✓ Reading stations

✓ Physician review stations

✓ Web access

✓ Technologist quality control stations

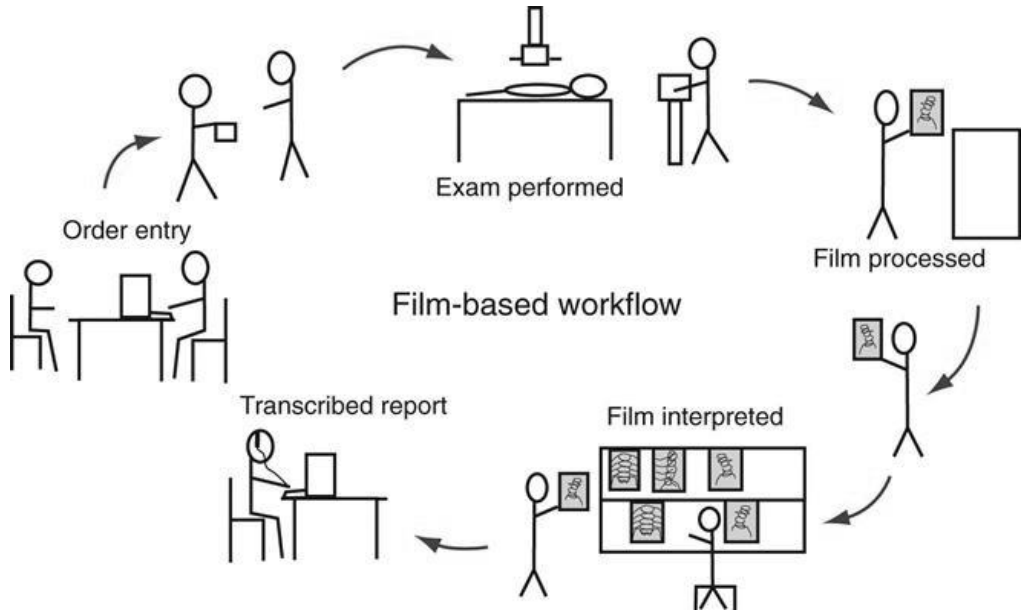
✓ Administrative stations

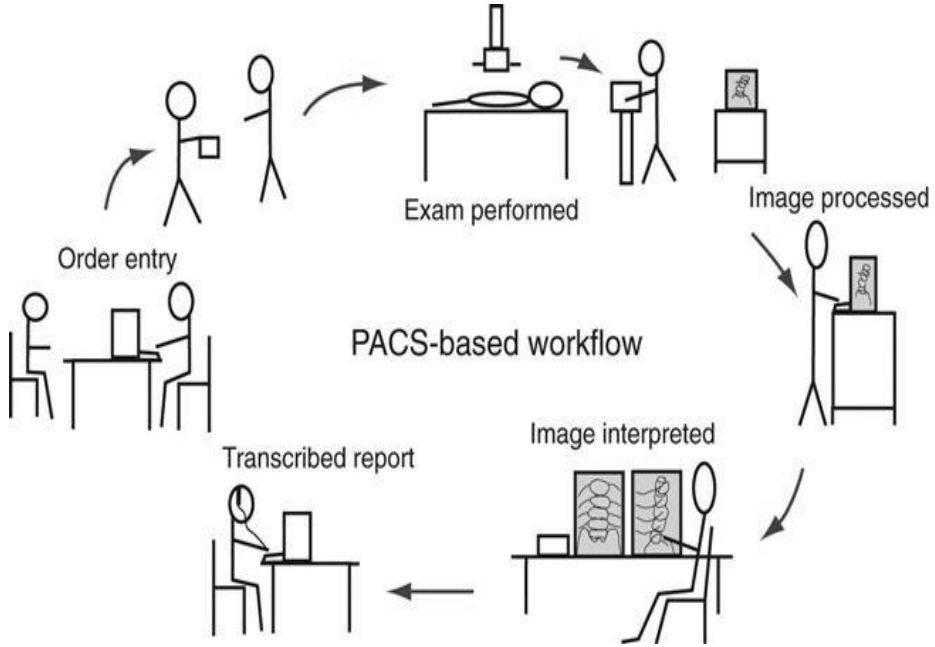
✓ Archive systems

✓ Multiple interfaces to other hospital and radiology systems

Workflow

- Workflow is a term that can be used in any industry to describe how a process is done, step by step.
- In radiology, workflow describes how examination is done from order entry to transcribed report.
- With PACS, it is possible that the time it takes from performing the examination to completing the final radiologists report is only a couple hours, compared with a couple days for the film-based workflow.





System Architecture of PACS

System architecture can be defined as the hardware and software infrastructure of a computer system. In a PACS, the system architecture normally consists of acquisition devices, storage, display workstations, and an image management system.

- Client server systems.
- Distributed systems.
- Web based systems

Client server systems

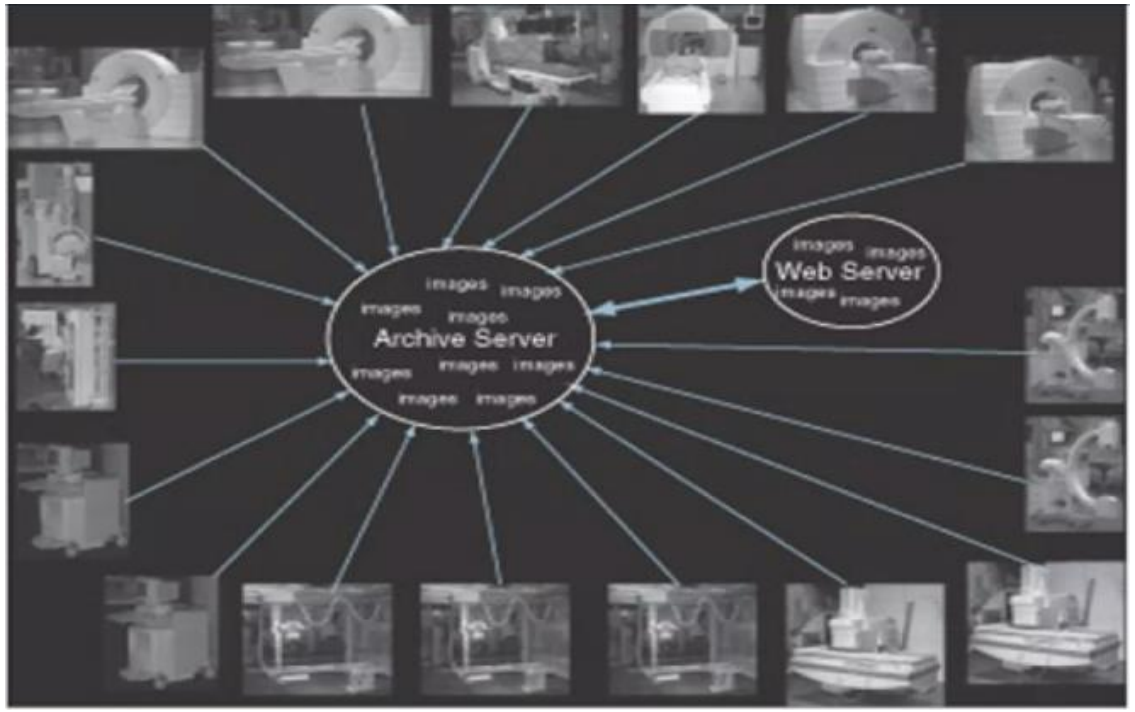
- Images are sent to archive server.
- Display workstation functions as a client of the archive server.
- Accesses images based on a centralized work list.
- Person at the client chooses a name from the list.
- Archive server sends the image data to the client.
- The image data is only on the client while viewing.
- Most systems allow basic image manipulation at the client.
- Changes are saved on the archive server.

Distributed systems

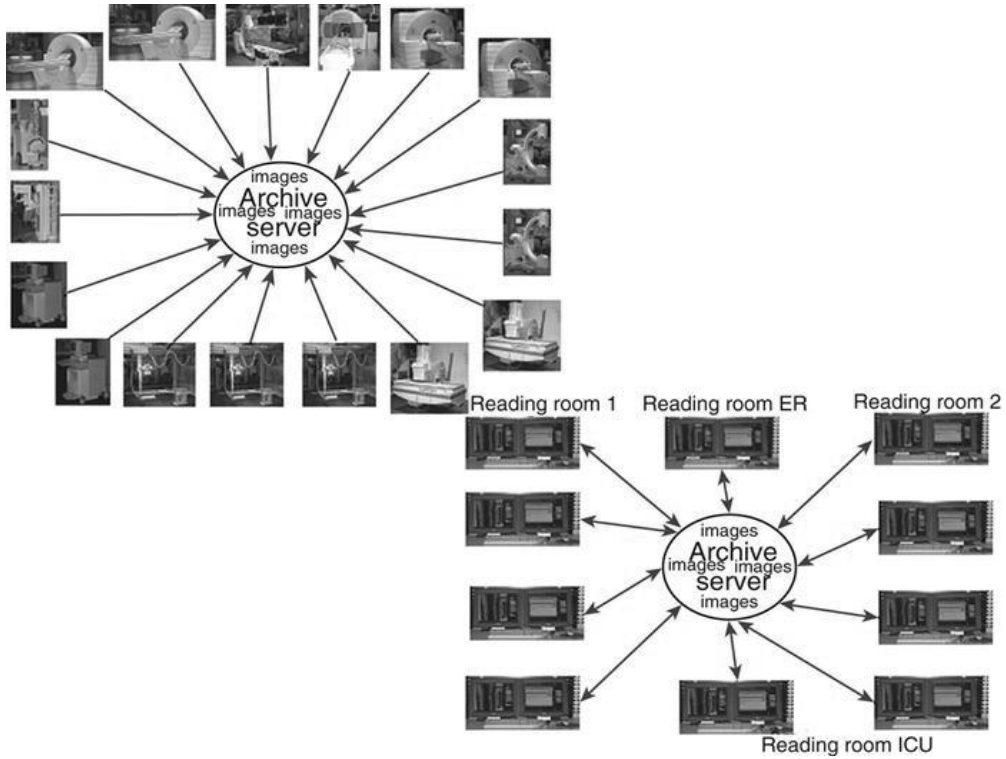
- Distributed systems are also known as Distributed systems or stand alone models.
- Acquisition modalities send the images to a designed reading station and possibly to review station.
- In some system the images are sent from the modality to the archive server, and the archive server distributed the images to the designated workstation.
- Reading station designations may be designed on radiologist reading preferences.
- Designation is decided after extensive workflow observations.

Web based systems

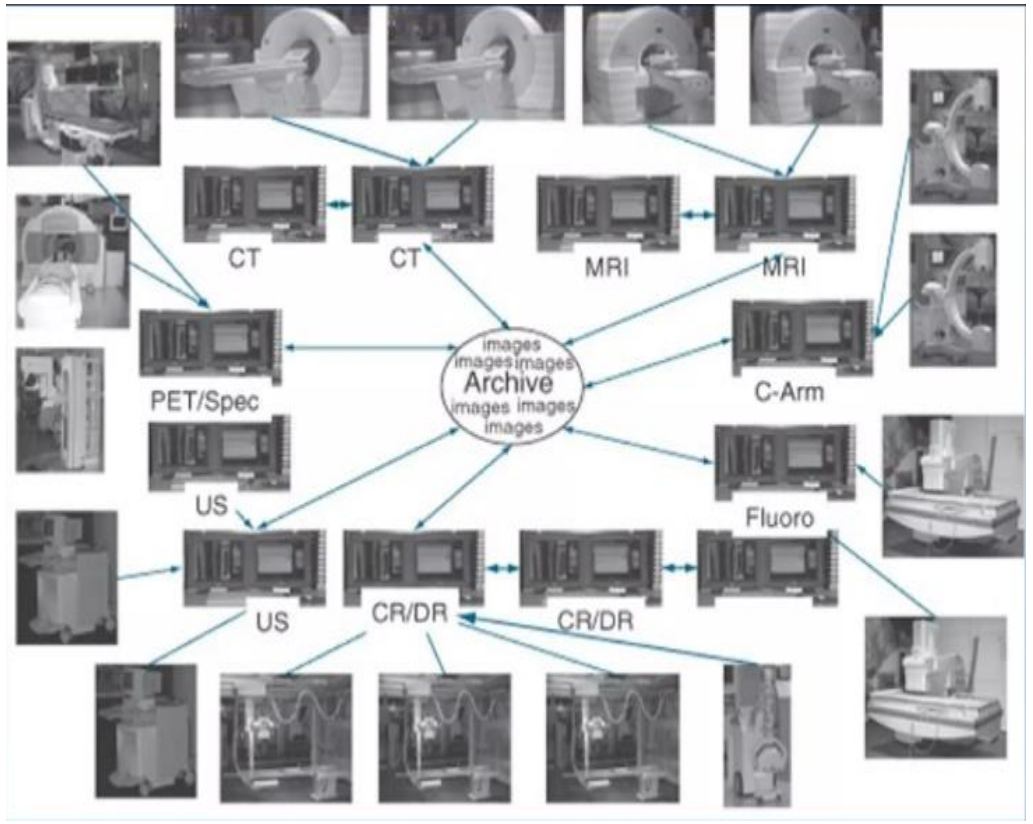
- Web based systems are similar to a client server systems.
- Biggest differences are that images and application software are held centrally and loads to the client display.
- Only the images are held at the archive.



System Architecture of PACS



Client server systems



Distributed systems

Modality Interfaces

- All radiological imaging devices can be interfaced to a PACS. Digital modalities (e.g., CT, MRI) are usually interfaced directly with DICOM.
- X-ray machines can be interfaced to PACS by using computed radiography (CR).

Networks

- A PACS is typically configured as its own local area network (LAN) or as a dedicated sub-net in a wide-area-network (WAN) environment.
- Modalities (or modality interfaces), servers, workstations, and peripherals are interconnected with high-speed computer networks via coaxial, twisted pair, and/or fiber optic cables.

Cables

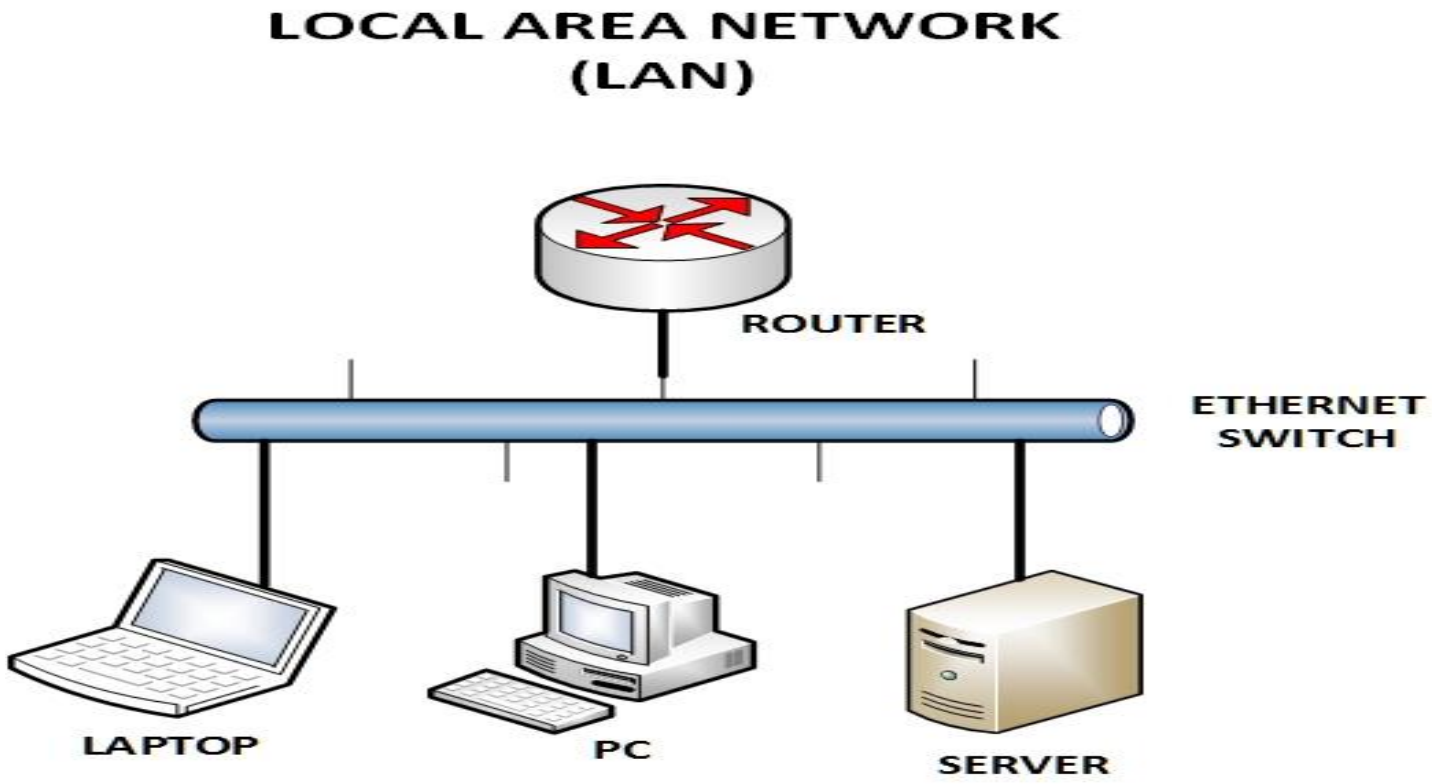
coaxial cable

fiber optic cable

twisted-pair cable

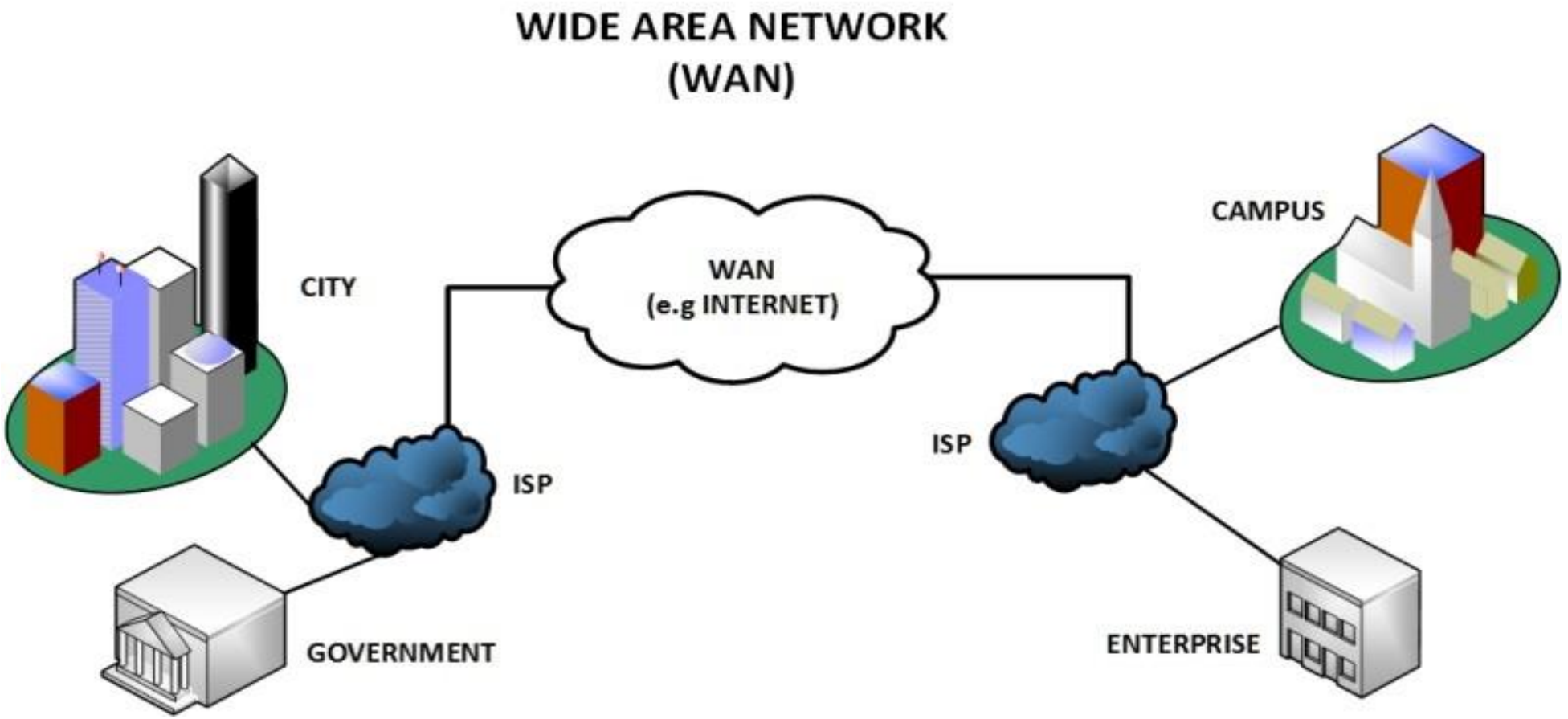
Local Area Network (LAN)

The collection of multiple computers and other networked devices (such as network printers, laptops, servers etc) which are all connected on the same local network forms a **Local Area Network (LAN)**.



Wide Area Network (WAN)

WANs seem to just be larger LANs



Workstations

There are two types of workstations:

- Diagnostic workstations.
- Clinical workstations.

Diagnostic workstations

- Primary diagnostic workstations (Reading stations) are used by the radiologist to view images for patient diagnosis.
- Workflow must also be optimized as the radiologist might be reading a large number of studies in one day.
- Workstation users can review and manipulate (e.g., magnify, rotate, zoom on a region of interest) the images and add, edit, and delete annotations for later reference by themselves or other clinicians.

Diagnostic workstations

Mammography

CT/MRI/US/DR,CR

PET/CARDIOLOGY,CT

Workstations

Secondary review workstations, sometimes called "clinical review" workstations, are used by medical personnel outside of the radiology department to review images in areas where image information is important and timely, such as intensive care units (ICUs) and emergency rooms (ER). Referring physicians might need to view an image and sometimes might show the image to the patient. This can be accomplished with a less sophisticated, lower-resolution display system.

Archives

- Large radiology departments can generate more than 70 gigabytes of data per day. The ability to collect, store, retrieve, and distribute that large amount of data is one of PACS's primary challenges. Quick retrieval is always an important specification for the radiologist for initial diagnosis.
- All images that are recent and/or otherwise likely to be retrieved in the near-future are typically stored on near- (or short-) term archive, usually using redundant array of independent disks (RAID) technology.

THANK YOU!