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SECTION III – CHAPTER 9 - OUTLINE
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INTRODUCTION
Informatics – “Information” Computers are used to help us solve problems in the real world.
Imaging Informatics - In radiology that “information” is images and textual data used to improve work performance and improve patient care.
Information Technology

Definition: “a general term that describes any technology that helps to produce, manipulate, store, communicate, and/or disseminate information.”

Williams (2007)

• Computer Technology – The structure and Function of a computer, and how it is used to solve problems.
• Communications Technology – The use of electromagnetic devices and systems for communicating over long distances.

Computer Technology Basics

Computers consist of various electrical devices for converting raw data into information in a form that can be used to solve problems. They have two components:

• Software – Computer programs that direct the hardware to solve problems.
• Hardware – Physical components of the computer: keyboard, mouse, monitor, CPU, RAM, motherboard, etc.

Computer Technology Basics (Cont.)

Computers have five fundamental operations:
1. Input – keyboard, mouse, microphone
2. Processing – CPU, processing data
3. Storage – data can be stored temporarily or permanently internally or externally.
4. Output – monitor, printer
5. Communications – peer-to-peer, intranet
Communication Technology Basics

- **Modem** – MOdulate/DEModulate
  
  ![Diagram showing Modulate and Demodulate process]

  Digital Signal > Analog Signal > Digital Signal

  Modulate = Digital to Analog  
  Demodulate = Analog to Digital

- **Communications Media**
  - Phone lines
  - Coaxial cables
  - Fiber optics
  - Microwave
  - Satellites

- **Protocol** – A precommunication agreement
  - TCP/IP – Transmission Control Protocol/Internet Protocol

A network is a “highway” for information (data) to travel from point to point.

Types of networks:

- **LAN** (Local Area Network) – A smaller network (distance) that is usually confined to a building.
- **WAN** (Wide Area Network) – A larger network (distance) that covers a larger area (cities, states, countries). The Internet is an example of a WAN.
Communication Technology Basics

• Network Topology

Network - Terminology

• Node – an individual device or a point on the network (printer, computer, CT, server, etc).
• Bridge – connects network nodes together.
• Router – Tells the packets where to go.
• Port – access to the server for a specific application. PACS port number is 104
• Socket – Port number + IP address
• Repeater – receives a signal, cleans it and amplifies the outgoing signal

What is Informatics?

• The process of changing data to information.
Informatics Subspecialties

Informatics has spread to many different disciplines:

- Medical Informatics
- Healthcare Informatics
- Biomedical Informatics
- Nursing Informatics
- Imaging Informatics
- Cardiology Informatics
- Clinical Informatics

Health Care Informatics/Medical Informatics

The application of IT to health care or medicine is referred to as health care informatics and medical informatics.

Health Care Informatics is the term used more frequently because it represents a more widespread view of health care including citizens as agents in their own care.

Scope of Health Informatics

- Health care Information Systems (HIS)
- Clinical systems
  - Nursing
  - Laboratory
  - Cardiology
  - Radiology
- Administrative Systems
  - Patient registration
  - Scheduling
- Other systems topics
  - Training
  - Security
  - Integration
  - EMR
  - Regulations
  - Disaster recovery
Medical Imaging Informatics (MII)

The application of IT to medical imaging is referred to as Medical Imaging Informatics (MII).

- Diagnostic Radiography
- Computed Tomography (CT)
- Nuclear Medicine
- Medical Sonography
- Magnetic Resonance Imaging (MRI)
- And others............

Medical Imaging Informatics

- Modalities = Image acquisition stations.
- PACS = Visualization, Distribution, and Management of Images.

Framework for MII

- Customized Software
  - Application-oriented software that deals with issues related to research, education, and clinical services.
- Database and knowledge-base management
  - Software tools to manage image processing and visualization, communications, GUIs, and data and knowledge.
- PACS image and related database
  - The management of images using standards such as DICOM (images) and HL-7 (textual).
PACS Technology (Chapter 8)

A combination of computer technology and communications technology.

Major Components:
• Acquisition modalities
• Database server
• Archive
• Display/Viewing/Reading workstations
• Network Distribution

Health Information Systems

A computer-based system used to collect and process data to provide users with information needed for problem solving and decision-making.

Two major components:
• Clinical Information Systems (CIS)
  — Order Entry
  — Nursing Information Systems
  — Laboratory Information Systems
  — Radiology Information Systems (RIS)
• Administrative Information Systems (AIS)
  — Registration
  — Scheduling
  — Payroll
  — Quality Assurance
  — Contract Management
Radiology Information Systems (RIS)

Features of the RIS:
- Order Entry – Registration
- Scheduling
- Report Generation – Radiologist Interpretation of exam.
- Billing Preparation
- Other – Quality Assurance, Inventory monitoring, Statistical analysis, interdepartmental communications

Electronic Health Record (EHR)

“A secure, real-time, point-of-care, patient-centric information source for physicians.” (HIMSS)

Medical information and data about the patient from all clinical sources: radiology, lab, surgery, emergency room, etc.

Electronic Health Record (EHR)

Data and information that falls into the following categories:
- Order Entry
- Clinical Documentation
- Data Repository
- Decision Support
- Results Reporting
- Clinical Messaging and E-mail (Communications)
Systems Integration

**Systems Integration:** Information systems, imaging modalities, and PACS need to communicate with one another in order to be more effective and efficient.

- **Requirements:**
  - Interface – clinical data repository and “mapping” (associating terms from one system to another system)
  - Data dictionary – definition of terms
  - Uniform language
  - Master patient index (MPI) – database holding patient data
  - Communication standards – DICOM and HL-7

IT Security

The protection of information systems against unauthorized access to or modification of information.

**Threats:**
- Social Engineering attacks
  - Information obtained by deception
- Hardware attacks
  - Theft or physical damage to equipment
- Software attacks
  - Altering or damaging the operating system or application software (malware, viruses, denial of service)

**Methods:**
- Antivirus software
- Spyware detection
- Firewalls
- Authentication
- Passwords
- Physical containment
- Encryption
The Technologist as Informaticist

Roles and Responsibilities:
• Image acquisition (modalities)
• Works with the Radiologist and clinicians on display/viewing workstations
• Administration of the PACS
• Quality Control
• Trainer/Education
• Post Processing

The PACS Technologist

The Society of Imaging Informatics in Medicine (SIIM) defines four areas needed for radiology informatics:
• Information Technology (IT)
• Clinical Informatics
• PACS administration
• Academics

PACS Administrator

Skills:
• Behavioral
  – Training, workflow analysis, reading environment, customer relations
• Technical
  – Security, troubleshooting, systems management, modalities, clinical exams
• Business
  – PACS readiness, economics, strategic vision, vendor selection.
**Job Classification**

These skills are based on a “blend” of three job classifications:

- **Radiologic Technologist** *(Behavior)*
- **Radiology Administrator** *(Business)*
- **Information Technology Specialist** *(Technical)*

**“Street Smarts”**

“The capabilities needed for a successful PACS administrator go beyond those conventionally included in the position description of RTs, Radiology Administrators, or IT specialists. The PACS administrator must also have business know-how, including managerial training, as well as the ability to deal effectively with a wide range of individuals – from patients to administrators – each with his or her own interests, investments, and agenda.”

(Paul Nagy PhD et al.)
Certification in PACS
PARCA – PACS Administrators in Radiology Certification Association
http://www.pacsadmin.org
1. Certified PACS Associate (CPAS)
   – Clinical or Technical Exam
2. Certified PACS Interface Analyst (CPIA)
3. Certified PACS System Analyst (CPSA)
4. Certified PACS System Manager (CPSM)

Certified Imaging Informatics Professional (CIIP)
What is the CIIP Exam?
Exam for PACS administrators
The American Board of Imaging Informatics (ABII) has created and manages the Imaging Informatics Professional (IIP) certification program.

History of the ABII
SIIM
American Registry of Radiologic Technologists
American Board of Imaging Informatics (Founded in 2007)
Mission of the ABII
The ABII is an independent, non-profit organization, ABII’s mission is to enhance patient care, professionalism, and competence in imaging informatics.

CIIP Exam Content Outline
I. Procurement 5%
II. Project Management 5%
III. Operations 10%
IV. Communications 10%
V. Training and Education 5%
VI. Image Management 20%
VII. Information Technology 15%
VIII. Systems Management 10%
IX. Clinical Engineering 10%
X. Medical Informatics 10%

Why Care About IT and Data?
Information Technology has the best promise to improve quality and reduce costs fairly.

Healthcare costs are 15-16% of the GDP.

In 20 years we have quadrupled our healthcare expenses.
Ms. Susan Bostrom
Senior Vice President Cisco Systems, Inc.

“If we look at other industries, we see a direct correlation between productivity gains and investment in Information Technology (IT) capital and solutions. These industries, on average, invest about $8,000 per year per employee in IT. In comparison, the healthcare industry invests only $1,100 per worker.”

Ms. Susan Bostrom
Senior Vice President Cisco Systems, Inc.

“But saving money is only one part of the equation. Information Technology can also help reduce medical errors and save thousands of lives each year.”

Ms. Susan Bostrom
Senior Vice President Cisco Systems, Inc.

“If healthcare organizations widely adopted just one Information Technology solution - Electronic Health Records (EHR) - the industry could save close to $78 billion annually.”
Ms. Susan Bostrom  
Senior Vice President Cisco Systems, Inc.

“Changing the way information is handled may not seem like a development to rival antibiotics or X-rays, but it has the potential to be every bit as revolutionary.”

“I do not fear computers. I fear the lack of them.”
Isaac Asimov, author and scientist (1920–1992)

QUESTIONS??

“Forgot to make a back-up copy of my brain, so everything I learned last semester was lost.”

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