

Imaging Informatics

DICOM

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SCOPE

- ① Why I can't we use internet technology like the browser,(Facebook, twitter) to share medical images instead of PACS
- ① Why is it important to know about technical stuff in my career .

Prior to Establishing standards for data communication, every vendor spoke a different “language.”

Interoperability

- in·ter·op·er·a·bil·i·ty (n) The ability of two or more systems or components to exchange information and to **use** the information that has been exchanged.

- IEEE Computer Dictionary

“**Use**” has many connotations

Messaging

Workflow

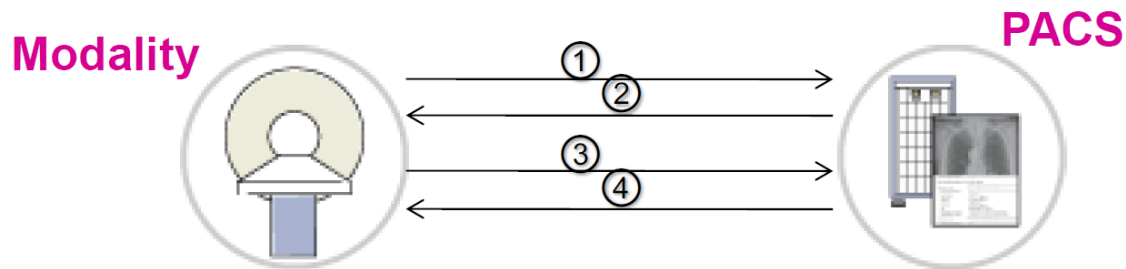
Messaging

Format

Vocabulary

Reliable transport of a composed unit of information from one system to another

- Example: DICOM Network Storage Service

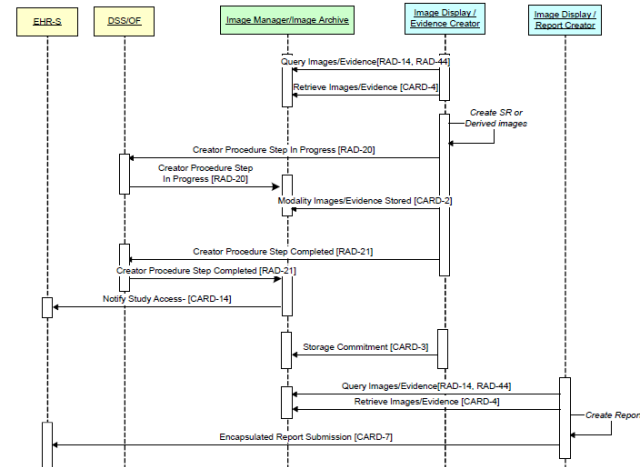
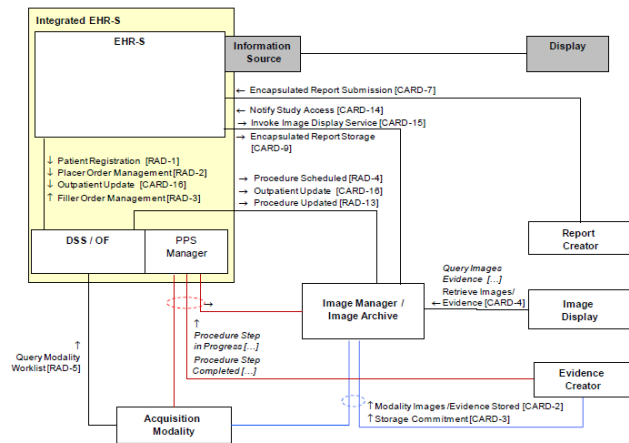


Workflow

Workflow
Messaging
Format
Vocabulary

Interaction among multiple users and systems (actors) to achieve a specific task

- Example: IHE Image Enabled Office Workflow



DICOM

- ⦿ Digital Imaging and Communication in Medicine
- ⦿ is a **standard** for handling, storing, printing, and transmitting information in medical imaging. It includes a **file format** definition and a network **communications protocol**.

Standard Definition of “Standard”

Document, established by consensus and approved by a recognized body, that provides, **for common and repeated use**, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

ISO/IEC Guide 2:2004 *Standardization and related activities -- General vocabulary*

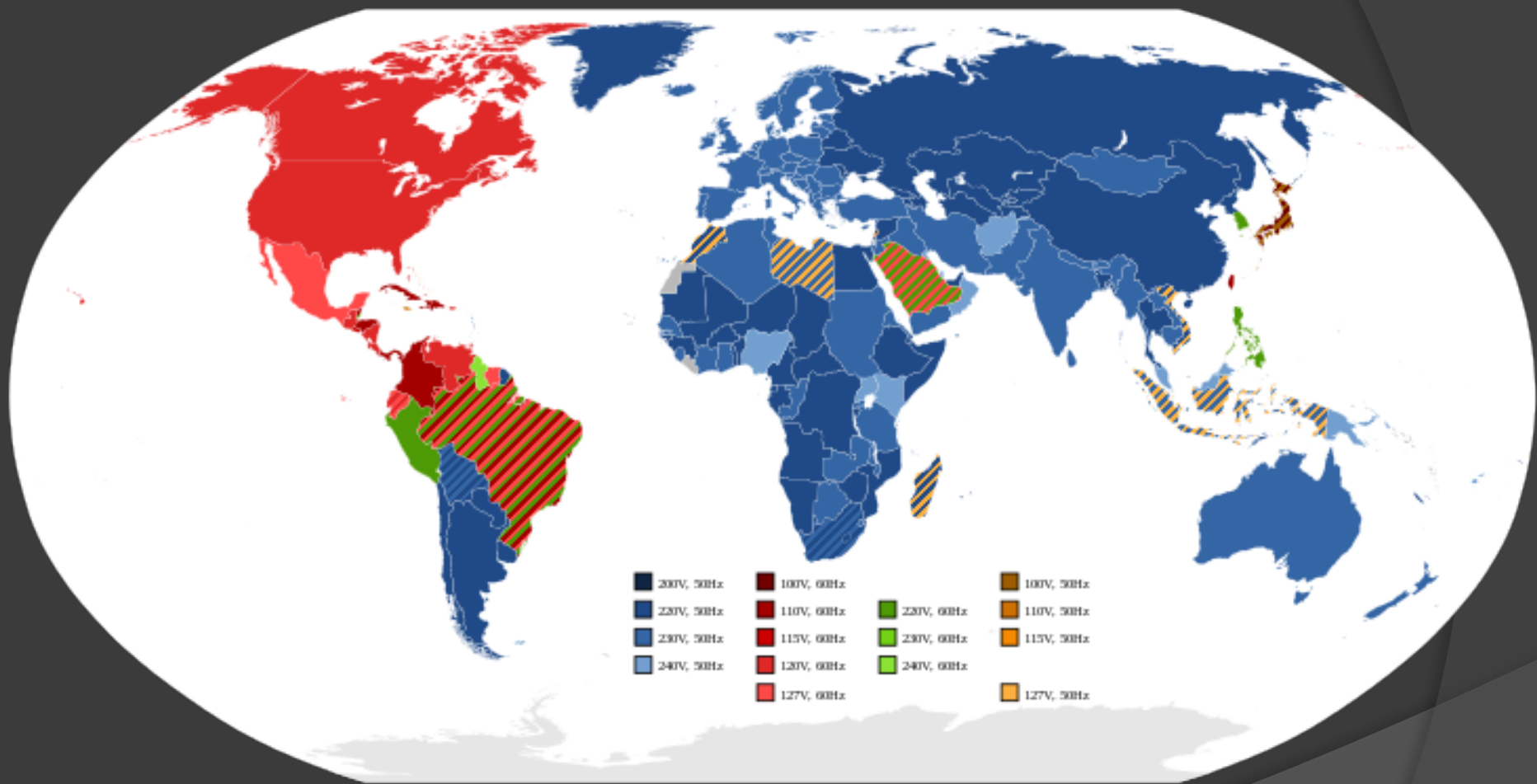


International
Organization for
Standardization



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

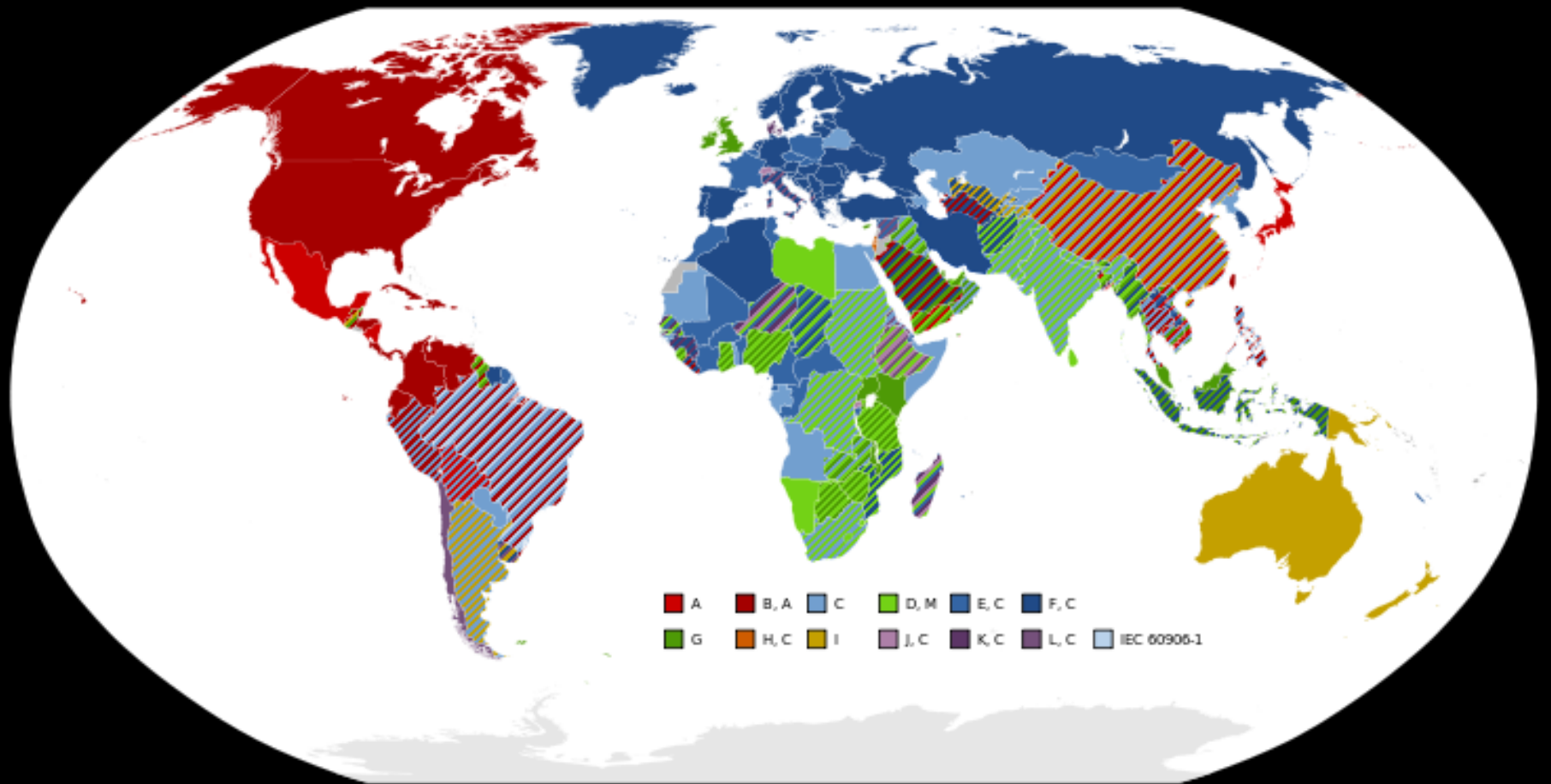
***The essence of standards – amortize the cost
of design over many implementations***



Plea

Country	PolyScience Plug Designation
USA (120 VAC)	B or C
European, standard (240 VAC)	E
USA (230 VAC)	D
Argentine, Australia, New Zealand	A
United Kingdom, Bangladesh, China, Hong Kong, Ireland, Malaysia, Nigeria, Saudi Arabia, Singapore, UAE, Vietnam, Zambia, Zimbabwe	P
China (similar to A but polarity is reversed)	Y
Argentina (similar to A but with different pin lengths)	G
Korea	K
India, Pakistan, South Africa	M
Israel	R
Chile, Italy, Syria	S
Denmark, Bangladesh	T
Switzerland	Z







- American College of Radiology (ACR)
- National Electrical Manufacturer's Association (NEMA)



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1300 North 17th Street
Rosslyn, VA 22209
Ph: (703) 841-3281
<http://dicom.nema.org>
dicom@medicalimaging.org

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Search

[DICOM Calendar](#)

[2013
International
Conference
& Seminar](#)

[About DICOM](#)

PURPOSE & ORGANIZATION

- [Strategic Document & Principal Contacts](#)
- [Members of the DICOM Standards Committee](#)

PROCESS

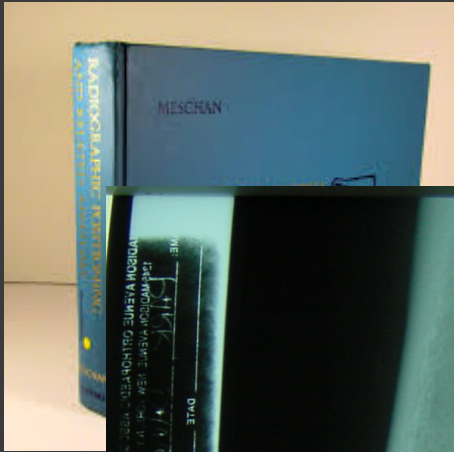
- [DICOM Procedures](#)
- [Meeting Minutes](#)
- [Demonstrations, Presentations & Meetings](#)

PRODUCTS

- [The DICOM Standard](#)
- [Recently Approved Change Proposals](#)
- [Recently Approved Standards](#)

What is the Goal ?

The goals of DICOM are to achieve compatibility and to improve workflow efficiency between imaging systems and other information systems in healthcare environments worldwide.



History

- 1983 ACR-NEMA establishes committee
- 1985 First ACR-NEMA standards published
- 1988 Follow up standards (ACR-NEMA 2.0)
- 1993 DICOM Version 3.0 published
- Version 3.0 is “DICOM 3.0” and is updated every year (there is no DICOM 3.1, etc)

Where does it come from ?

- DICOM Standards Committee

1-Vendors – Agfa, Boston Scientific, Camtronics, Carl Zeiss Meditec, Dejarnette, Dynamic Imaging, Eastman Kodak, ETIAM, Fuji, GE, Hologic, IBM, Konica, Matrixview, McKesson, MEDIS, Merge, Philips, RadPharm, R2, Sectra, Siemens, Sony, 3DHISTECH, Toshiba

- DICOM Standards Committee

2- Users – American Academy of Ophthalmology, ACC, ACR, American College of Veterinary Radiology, American Dental Association, College of American Pathologists, Deutsche Roentgengesellschaft, European Society of Cardiology, HIMSS, Medical Image Standards Association of Taiwan, Societa Italiana di Radiologia Medica, SIIM (SCAR), Societe Francaise de Radiologie

26 DICOM Working Groups

- WG-01 Cardiac and Vascular Information
- WG-02 Projection Radiography
- WG-03 Nuclear Medicine
- WG-11 Display Function Standard
- WG-21 CT
- WG-22 Dentistry

DICOM Standards address 5 areas of functionality

- Transmission and persistence of complete objects (such as images, waveforms and documents),
- Query and retrieval of such objects,
- Performance of specific actions (such as printing images on film),
- Workflow management (support of worklists and status information)
- Quality and consistency of image appearance (both for display and print).”

Transmissions and Objects but NOT architecture or function

DICOM TAGS

- Group, Element
- Even number
- Odd number
- Chapter 6
- Mobile Phone image

DICOM CONFORMANCE STATEMENT

2.2.1 DICOM Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM v3.0 SOP Classes as an SCU:

SOP Class Name (SCU)	SOP Class UID
CT Image Information Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Information Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture image storage	1.2.840.10008.5.1.4.1.1.7
Standalone Overlay storage	1.2.840.10008.5.1.4.1.1.8
Study Root Query/Retrieve - FIND	1.2.840.10000.6.1.4.1.2.2.1
Study Root Query/Retrieve - MOVE	1.2.840.10000.6.1.4.1.2.2.2
Verification (Echo)	1.2.840.10000.1.1

This Application Entity provides Standard Conformance to the following DICOM v3.0 SOP classes as a SCP:

SOP Class Name (SCP)	SOP Class UID
Verification (Echo)	1.2.840.10000.1.1
CT Information Storage	1.2.840.10000.6.1.4.1.1.2
MR Information Storage	1.2.840.10000.6.1.4.1.1.4
Secondary Capture image storage	1.2.840.10008.5.1.4.1.1.7
Standalone Overlay storage	1.2.840.10008.5.1.4.1.1.8
Study Root Query/Retrieve - FIND	1.2.840.10000.6.1.4.1.2.2.1
Study Root Query/Retrieve - MOVE	1.2.840.10000.6.1.4.1.2.2.2

DICOM Service Classes

- Network image management
- Network image interpretation management
- Network print management
- Imaging procedure management
- Off-line storage media management

Scanner

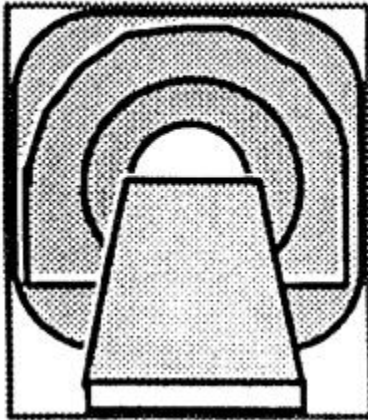
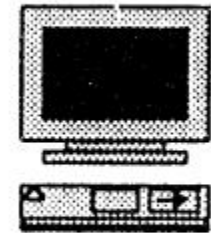


Image Send



Workstation



Scanner

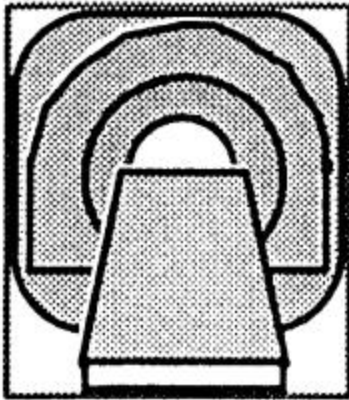
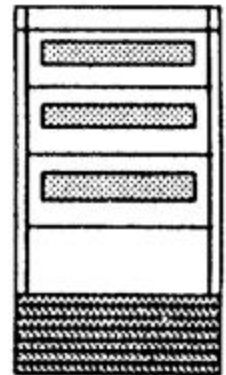


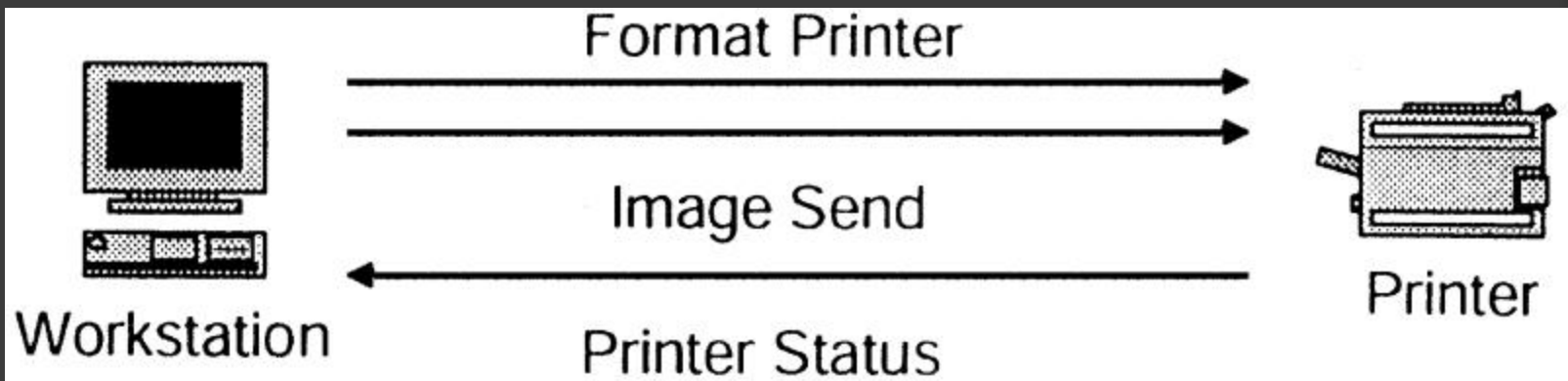
Image Send

Storage Commitment Request

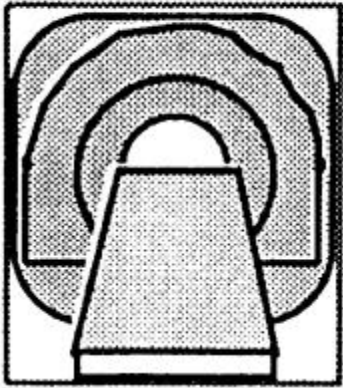
Storage Committed



Archive



Scanner



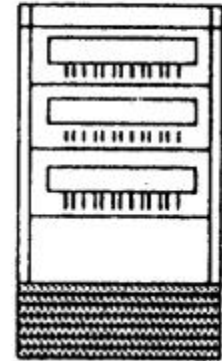
Information System
Scheduling Application



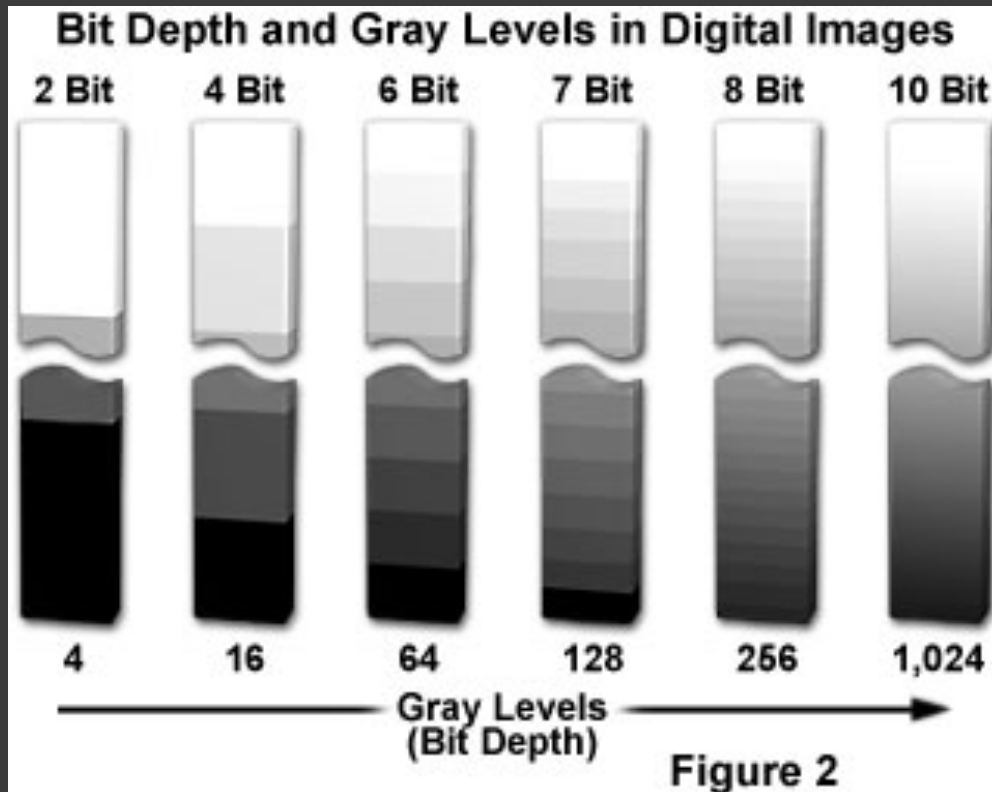
Request Worklist

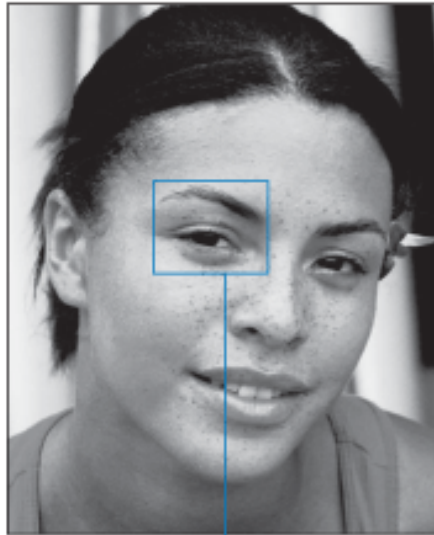


Send Worklist



Why can't





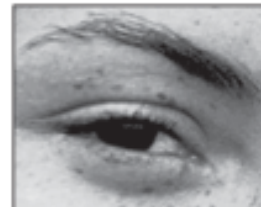
1 bit
2 possible values



2 bits
4 possible values



4 bits
16 possible values



8 bits
256 possible values



CT
Modality



MR
Modality



US



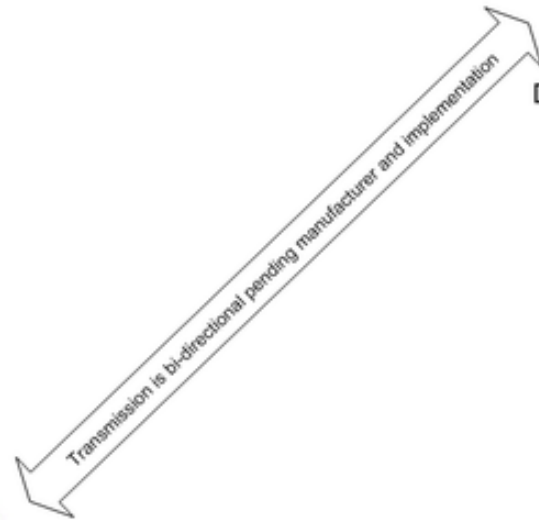
DICOM



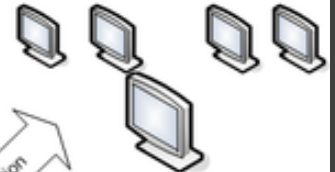
QA
Workstation/
Gateway



Archive



Transmission is bi-directional pending manufacturer and implementation



Doctors Reading
Workstation

CT MRI ENDOSCOPY ECG



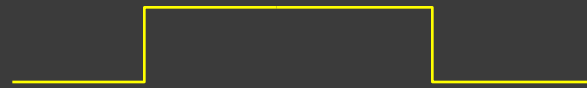
DICOM

PACS

HL7

HIS

RIS



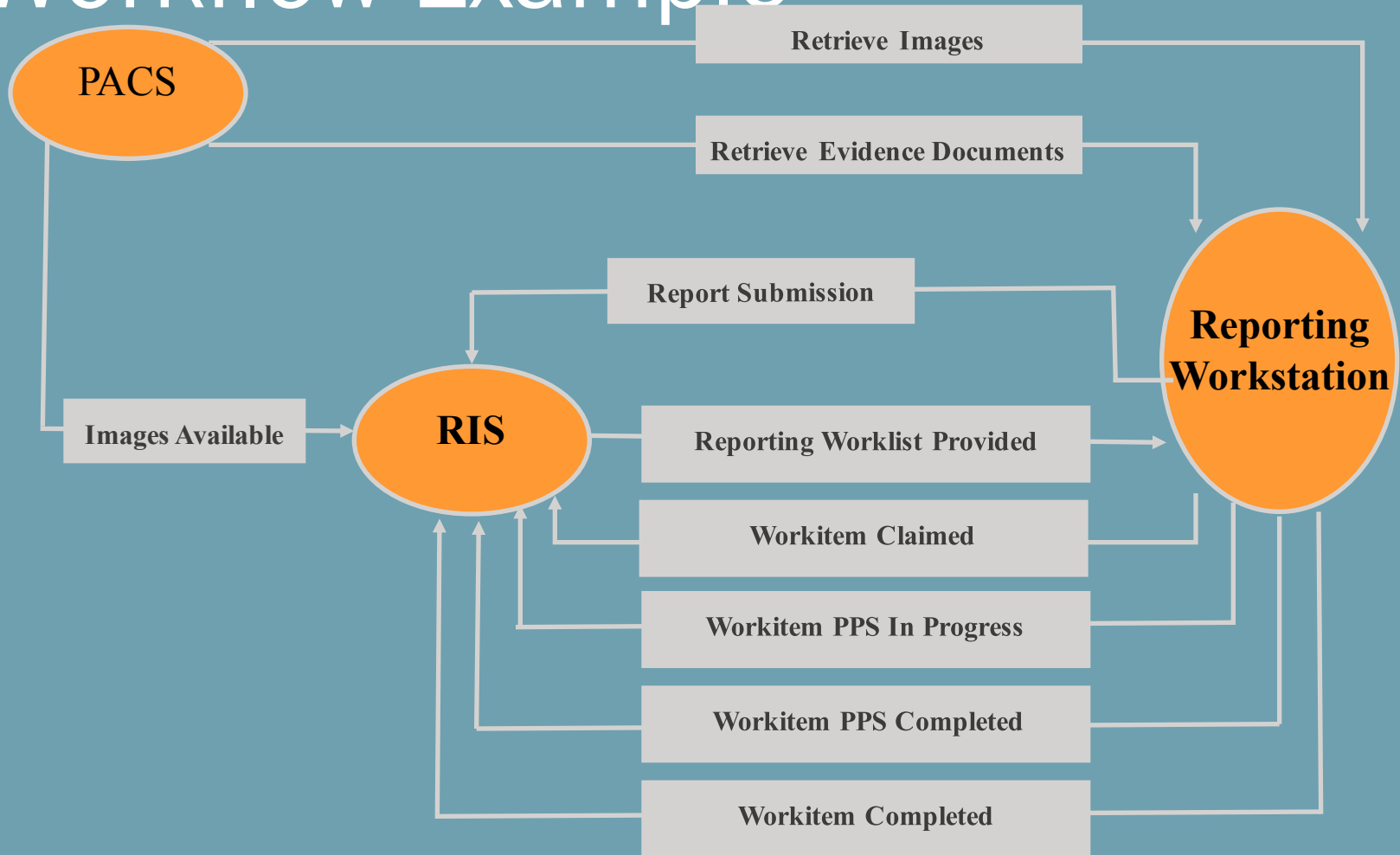
Take home message

- ⦿ DICOM is a standard file type and protocol.
- ⦿ Dicom conformance statement. What the modality or software can do and how much interoperability.
- ⦿ Dicom file type contain:
 - Pixel data
 - Header file (DICOM tages, eg , patient demographic data , modality parameters)

DICOMIZER software can change image files into DICOM standard.

e.g of image files (JPEG, TIFF, GIF, SVG, PDF)

Workflow Example



◎ HIS ->RIS-> PACS

HIS

- ① Name
- ① Age
- ① Gender
- ① Address
- ① Marital status
- ① DM, HTN , Genetic disease

RIS (radiology information system)

- ⦿ CT
- ⦿ MRI
- ⦿ US
- ⦿ Xray
- ⦿ NM
- ⦿ IR

RIS

- ⦿ Room assignment
- ⦿ Once procedure is finished
- ⦿ Assign a radiologist for reporting
- ⦿ Radiologist will report the case:
 - By using template
 - Voice recognition.

Radiologist sign and approve the report

→ HIS