

RSNA 2010

Sharing Images on CD, DVD &
USB: Standards, Tools & IHE PDI,
IRWF and BIR Profiles

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IHE Radiology Technical Committee Co-Chair

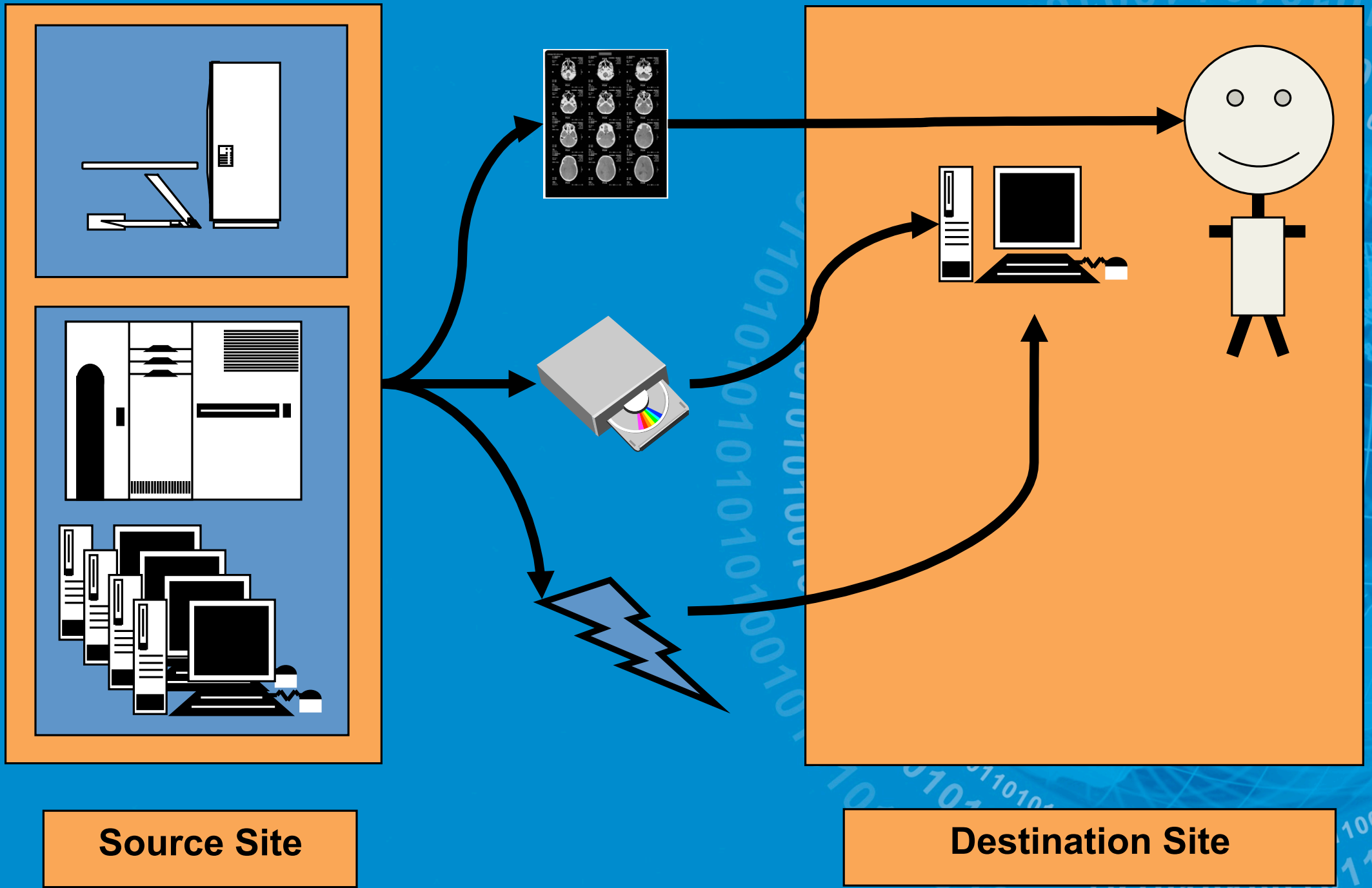


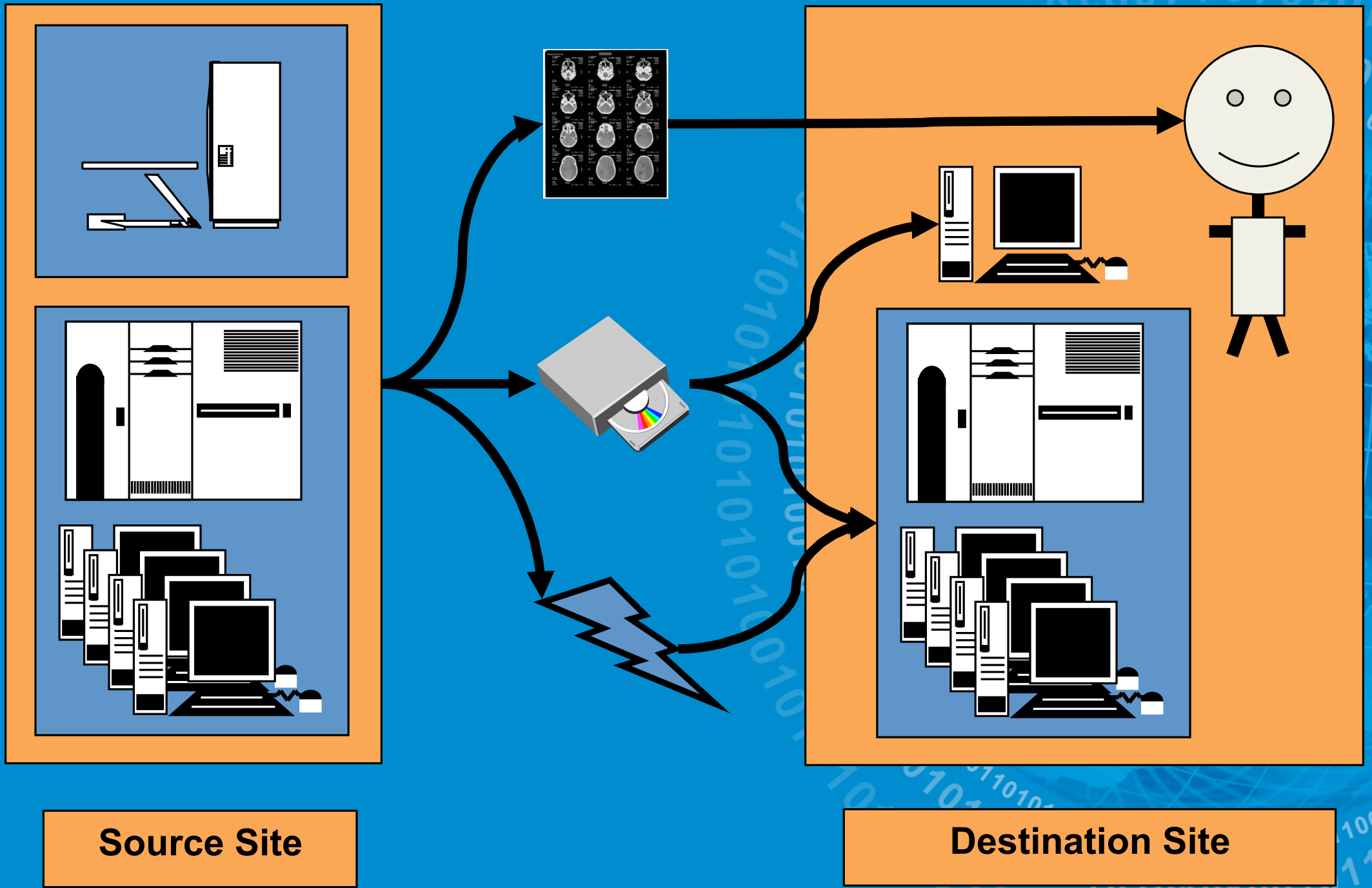
Overview

- Media relevance
- Media problems
- Interoperability – standard format DICOM/PDI
- Importation – IRWF
- Viewing – BIR
- Other stuff on media
- Report
- Annotations
- Radiation Dose & other Structured Reports

Primary Use Case

- Images of patient made at source site
 - Hospital
 - Imaging center
 - Doctor's office
- Need to be used by staff at another site
 - Referring doctor who ordered exam
 - Doctor to whom patient has been referred
 - Specialist hospital (tertiary referral center)



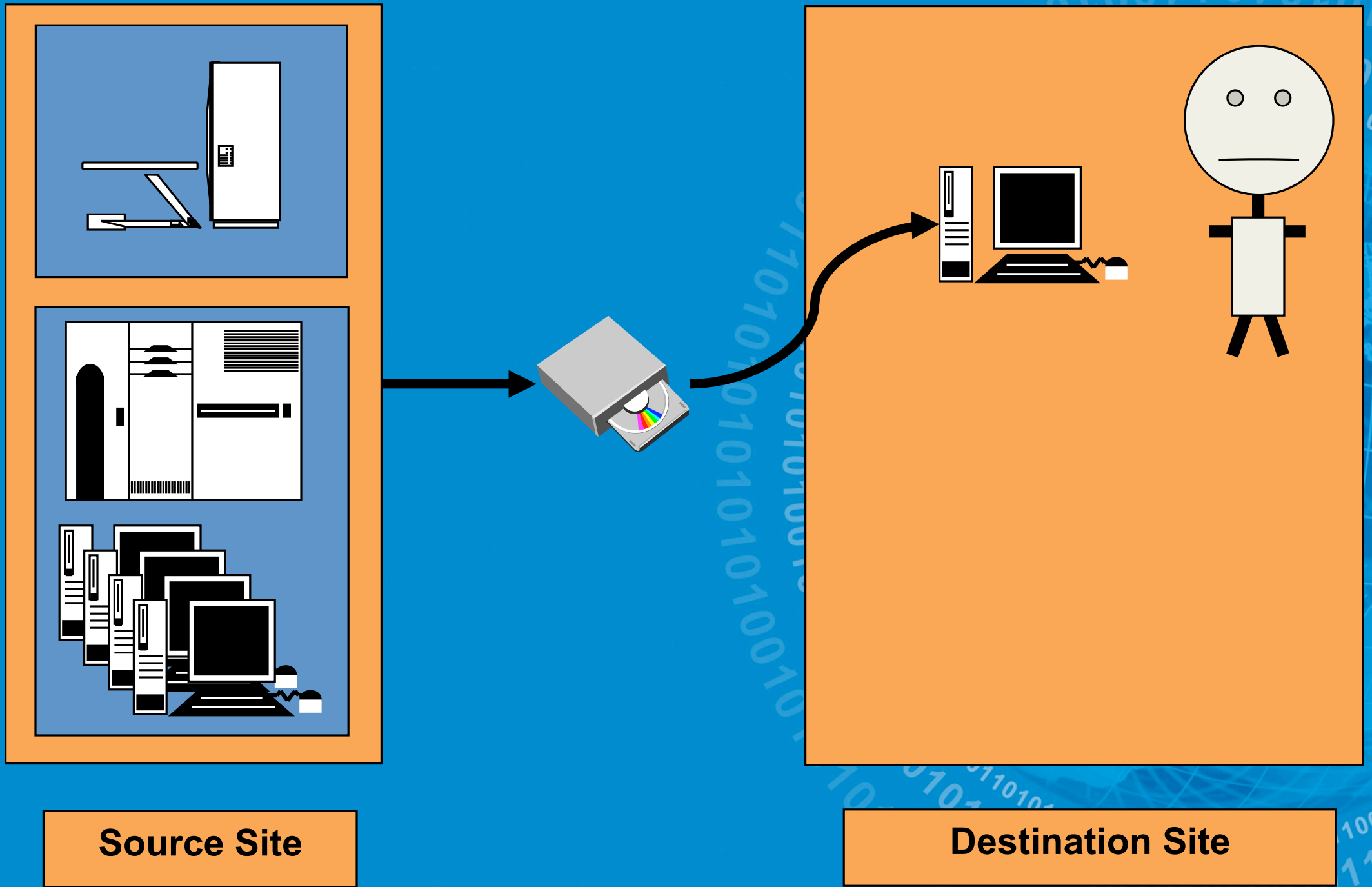


Is Media Still Relevant ?

- Everyone dreams of exchanging images via the Internet ... but where is the ...
 - infrastructure & bandwidth
 - access control, provisioning, authorization
 - business-to-business agreements
 - common patient identifiers
 - reimbursement
- Most common interchange remains via CD

Image Sharing Demonstration

- Site provided
- Patient controlled
- IHE XDS-I based
- Transfer via clearing house to PHR
- South Building Booth #2852



Source Site

Destination Site

Is the Standalone PC Viewer a solution ?

Standalone PC Viewer Issues

- CDs burned with Windows auto-run viewer
- Does everyone have a (big/fast enough) PC ?
 - in the referring doctor's examining room ?
 - in the out-patient clinics ?
- Hospital IT security policy ?
 - should IT allow any CD to be loaded on a PC ?
 - risk of viruses - how many clinic PCs virus-safe ?
- Interference with running applications
 - auto-run may need to be disabled

Standalone PC Viewer Issues

- Quality, training and ease of use for viewers
 - how many viewers does one need to learn ?
- Long-term access requirements
 - need images to become part of legal record
 - follow-up visits
 - use during treatment (RT, surgery (OR), etc.)
 - need for distributed access
 - internal referrals, clinical conferences, tumor boards

Extreme End-User Dissatisfaction

- American Academy of Neurological Surgeons
- Rallied many other specialty societies
- American Medical Association
- Fed up with incompatible media and inadequate, unreliable and deviant viewers
- Met with industry (MITA), DICOM & IHE
- Two actions – statement & viewer profile

Statement

- By the AMA Expert Panel on Medical Imaging:

“All medical imaging data distributed should be a complete set of images of diagnostic quality in compliance with IHE-PDI.”

“This standard will engender safe, timely, appropriate, effective, and efficient care; mitigate delayed care and confusion; enhance care coordination and communication across settings of care; decrease waste and costs; and, importantly, improve patient and physician satisfaction with the medical imaging process”

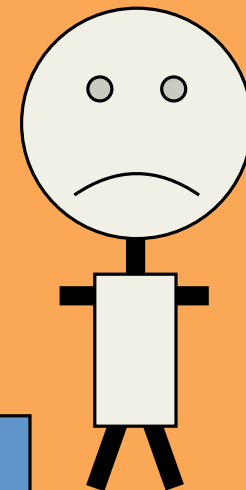
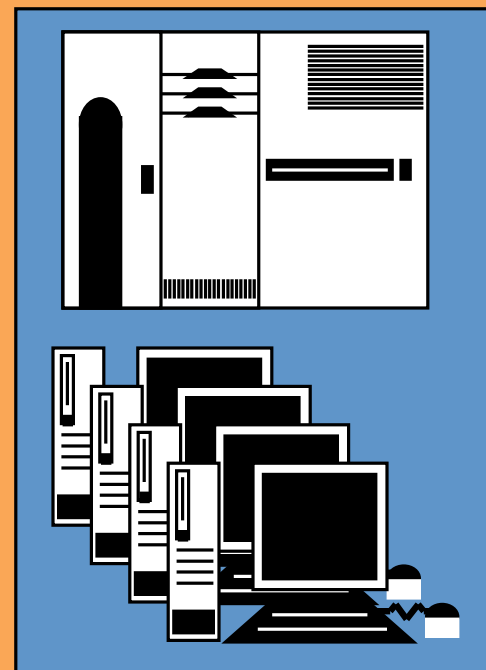
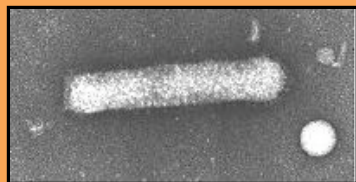
So what is IHE PDI ?

- Portable Data for Imaging
- Initially – uncompressed DICOM CDs
- More recently – additional options
 - DVD and USB media
 - Compression (JPEG & JPEG 2000)
 - Encryption
 - Sending software

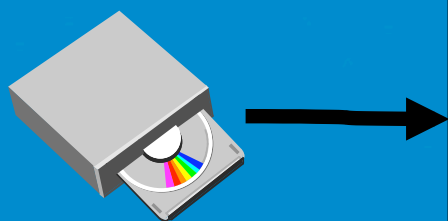


DICOM

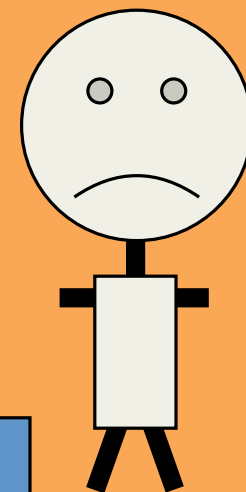
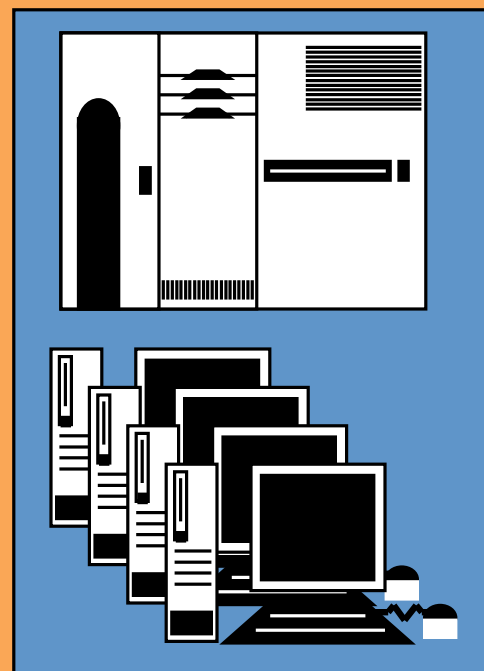
1234 Smith^Mary
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9876 Mary Smith



Barriers to viewing & import: format, ID reconciliation, viruses



DICOM



Barriers to viewing & import: DICOM compliance issues

Issues with Format

- Proprietary media (not DICOM at all)
- Not DICOM General Purpose CD-R profile
- DICOM but unsupported compression
- Illegal filenames
 - DICOM says 8 chars, capitals, no extension
 - frequent errors - too long, with .dcm extension

Issues with Format

- DICOMDIR errors especially prevalent
 - DICOMDIR completely missing
 - long filenames
 - illegal DICOMDIR entries
 - missing required attributes
 - e.g. Referenced Transfer Syntax UID
 - violation of identifier attribute types
 - DICOMDIR requires Type 1 Patient ID, Type 2 in image

Issues with Format

- Media creators:
 - should do better & comply with standard
 - no excuse for poor quality software
 - no legitimate reason for deliberate violations (such as file naming)
- Media readers:
 - could be more tolerant
 - installed base of non-compliant creators
 - Installed base of shelved non-compliant media

IHE PDI

- Portable Data for Imaging
- Recapitulated DICOM GP CD Profile
- Avoided compression
- Emphasized common mistakes
- Renewed opportunity to promote compliance
- Opportunity for interoperability testing
- Public demonstration & compliance tool

IHE PDI Connectathon Testing

- Peer-to-Peer vendor testing
- Results checked by RSNA project managers
- 50+ companies tested PDI



IHE PDI – Beyond the Basic

- Too small ?
 - DVD options
 - Including compression (JPEG & JPEG 2000)
 - With option, compression permitted on CD
- Too slow ?
 - USB (e.g., memory sticks)
- Too insecure ?
 - Privacy protection – password or PKI based

Use PDI Options with Care

- With flexibility comes risk of incompatibility
- Not all recipients have DVD drives
- Not all recipients will support compression
- Not all recipients will support decryption
- Passwords/certificates lost/unavailable
- Sending software option mitigates concern over unsupported compression or decryption, and permits importation

Import Use Cases

- Media is not just for viewing
- Referring physicians may need to import
- Other facilities may need to import
- More capable viewer or workstation
- Planning, template, measurement software
- Operating room display
- Priors for new study, re-reading
- Studies contracted to outside performer

Two Types of Import

- Import to single workstation, use and discard
 - no need to reconcile identifiers
 - no need to match with local studies
 - no need to automate workflow
 - e.g., advanced viewer, outside consultation
- Import to local “system” (e.g., PACS)
 - reconcile & match identifiers and studies
 - workflow integration (orders, reports)

Import Requirements

- All types of import require standard format
- IHE PDI (DICOM) is the basis for all import
- Proprietary media formats are the antithesis
- Import into the “system” additionally requires
 - reconciliation
 - workflow

IHE Import Reconciliation Workflow (IRWF) Profile

- Convert identifiers
 - Patient ID (local MRN), Name (local spelling)
 - replace/remove Accession Numbers
 - replace codes with local values
 - keep old values in Original Attributes Sequence
- Workflow and source of replacement info
 - Unscheduled – HL7 Patient Demographics Query
 - Scheduled – DICOM Modality Worklist (& MPSS)

Import Policy & Support Issues

- Import to PACS is now the standard of care
 - failure to do so may compromise patient care
- Import does not imply the need for a report
 - some systems may have issues with status flags
- Import may or may not require archival
 - evidence for decision making
 - use as priors in future
 - some systems may not distinguish imports

What about Viewers?

- Viewing remains a key use
- Identified as major source of dissatisfaction
- Inconsistency between
 - different CD viewers
 - CD viewer and PACS viewer
 - PACS viewer and remote/web viewer
- Is there a “basic” set of viewer requirements?
- Could they be satisfied by a common solution?

Implementation or Features?

- First AMA proposal
 - a standard viewer implementation
 - required to be included on all media
- AMA/MITA/IHE compromise
 - a standard set of viewer requirements
 - a standard set of user interface features

→ IHE Basic Image Review profile

Basic Image Review (BIR)

- Not just for media
- Could be applied to PACS or PHR viewer
- Requirements for:
 - feature set
 - look and feel (standard icons & mouse directions)
 - performance (speed of loading & display)

Basic Image Review (BIR)

- basic grayscale or color rendering of images of any modality
- visual series selection through the use of thumbnails
- side-by-side comparison of at least two sets of images
- synchronized scrolling, panning and zooming
- annotate laterality, orientation, demographics, technique
- spatial localization (localizer lines, cross-hairs)
- simple measurements of linear distance and angle
- cine capability (e.g., for US and XA)
- splitting of dual echo MR, windowing mode for NM
- flip and rotate for non-cross-sectional images

BIR Icons



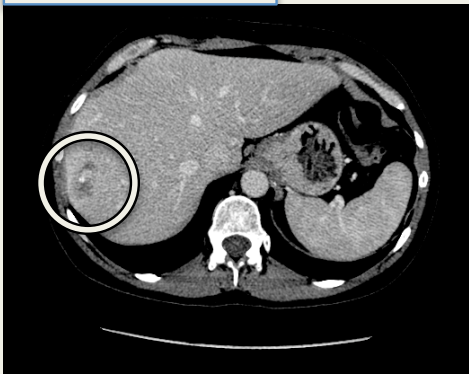
Other Stuff On Media

- IHE-PDI allows for optional Web Content
 - browser viewable pre-rendered images
- Radiologist's report
 - DICOM SR, HL-7 CDA, PDF, plain text, ???
- Key images and annotations
- Other DICOM Structured Reports
 - Radiation Dose
 - Mammo CAD

Burned In

Header

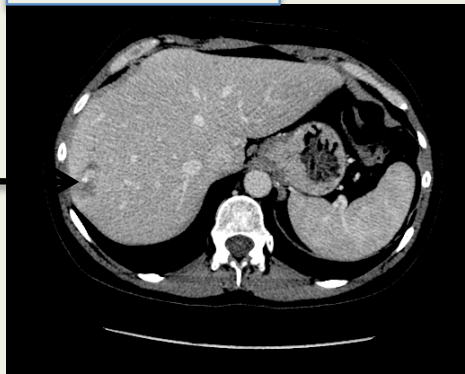
Pixel Data



Overlay

Header

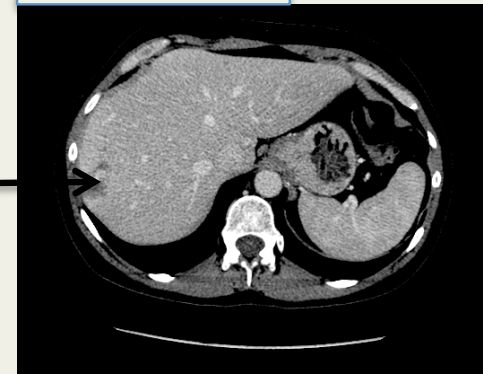
Pixel Data



Separate

Header

Pixel Data



Presentation State or SR



Key Images & Annotations

- Both are common PACS features
- Older PACS cannot export in a standard form
- Modern PACS import/export GPSS
 - Grayscale Presentation State Storage
 - IHE Consistent Presentation of Images (CPI)
- *Need to be able to import/export on media*
- *Even if CD viewer doesn't display them*

Radiation Dose SR

- IHE Radiation Exposure Monitoring (REM)
- Structured content rather than secondary capture of dose or protocol screen
- RDSRs recorded by the modality
- Stored in the PACS as part of the study
- Used by Dose Information Reporters
- Separate SOP Class from other SRs
- Transport on media for dose-history decision making

Be the solution, not the problem

- Don't be radiology-centric ...
 - consider the non-radiologist end-user
 - complete set of diagnostic quality images
- Don't be facility-centric ...
 - consider the receiving importing facility
- Write ONLY compliant IHE PDI media
 - include an IHE BIR profile viewer
 - key images (KIN) annotations (CPI), radiation dose (REM)
- Import external media with IHE IRWF