

IHE[®] | EXPERIENCE
EUROPE | DAY | 13
SEPTEMBER
2022



What's New in DICOM

Björn Nolte, Chair DICOM WG06 Base Standard



What is currently in development?



20% complete

JPEG XL Transfer Syntax Sup232
First Read

40% complete

DICOMweb API for Server-Side Volumetric Rendering Sup228
Before Public Comment

Photoacoustic Image Sup229
Before Public Comment

60% complete

Adaptive Dynamic Range Greyscale Presentation State Sup231
Before Letter Ballot

80% complete

2G-RT: Enhanced RT Image Sup213
After Letter Ballot

100% complete in standard.

Archive Inventory Sup223
Final Text

Elastography SR Template Sup227
Final Text

June 2022

20% complete

TLS 2021 update Sup230
First Read

40% complete

Service Discovery and Control Sup224
Before Public Comment

Confocal Microscopy Sup226
Before Public Comment

Photoacoustic Image Sup229
Before Public Comment

60% complete

Adaptive Dynamic Range Greyscale Presentation State Sup231
In Public Comment

80% complete

Conformance Statement Template Sup209
In Letter Ballot

Archive Inventory Sup223
In Letter Ballot

Elastography SR Template Sup227
In Letter Ballot

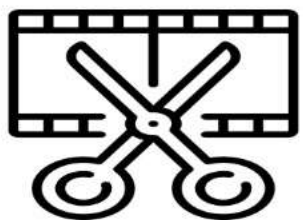
2G-RT: Enhanced RT Image Sup213
After Letter Ballot

100% complete in standard.

Multi-Fragment Video Transfer Syntax Changes Sup225
Final Text

March 2022

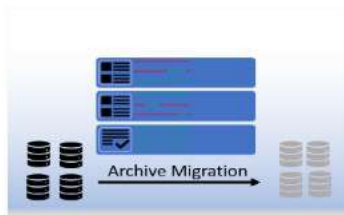
2022



Multi-Fragment Video Transfer ^{Sup225}



Elastography SR Template ^{Sup227}

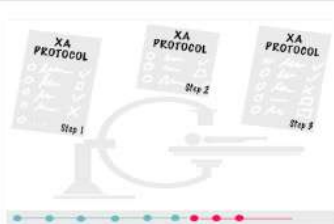


Archive Inventory ^{Sup223}

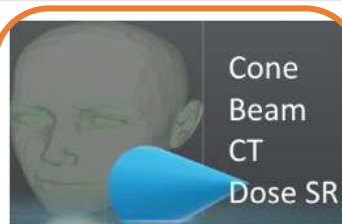
2021



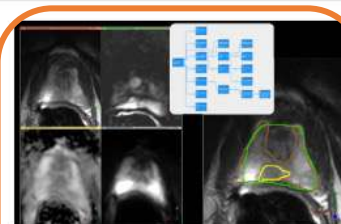
2G-RT: Patient Setup & Delivery ^{Sup160}



XA Protocol ^{Sup212}



Cone-beam CT Radiation Dose SR ^{Sup214}



MR Prostate Imaging Structured Report ^{Sup220}



Whole Slide Imaging Annotation ^{Sup222}

2020



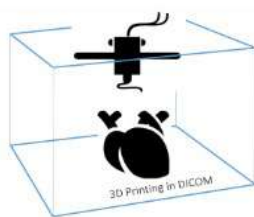
2nd Gen. Other non C-Arm RT Treatment

Sup176



RT Radiation Records

Sup199



Encapsulated Additional Models 3D Manufacturing

Sup208



Neurophysiology Waveform

Sup217



Dermoscopy

Sup221

2019



2nd Gen. C-Arm RT Treatment

Sup175



Webservices Redocumentation

Sup183



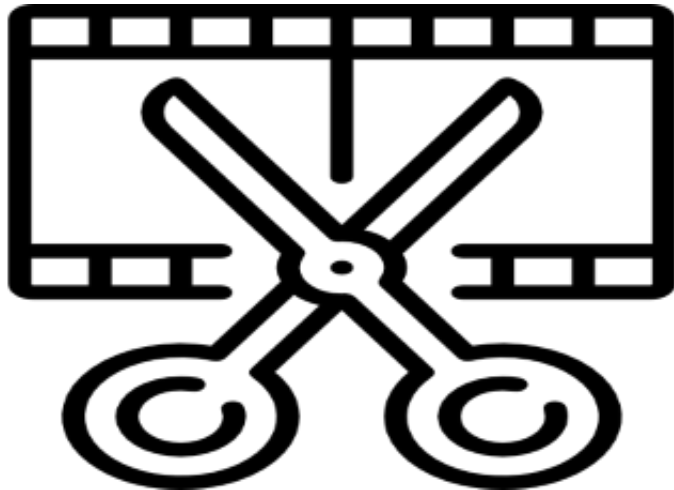
Realtime Video

Sup202



Thumbnail Service over DICOMweb

Sup203



Problem:

DICOM limits MPEG2 and H.264 Transfer Syntax encoding to 1 fragment

→ Limits total size to 4 GB

→ Vendors report surgical videos of 100 GB

Today: Multiple vendors ignore fragment limit

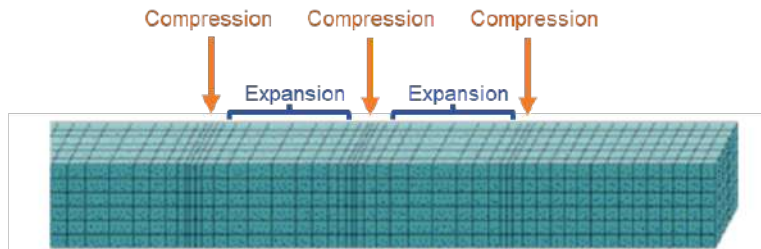
Solution:

Add a multiple fragment capability to video in DICOM.

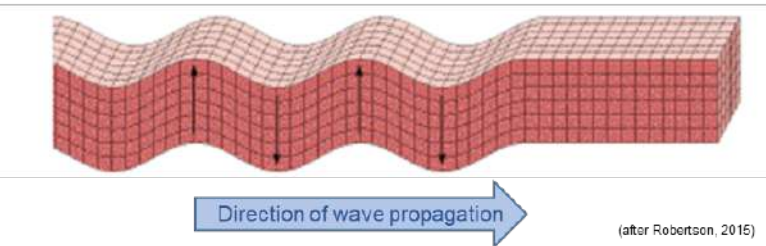
Both sender and receiver need to support this to make it work.

- Add 64-bit combined fragment length field
- Supports odd length streams

Compression wave (p-wave):



Shear wave (s-wave):



An **SR template** for elastography of organs/tissues such as **liver, breast, prostate**.

Ultrasound can measure the speed at which an induced **shear wave propagates** through tissue.

Tissue stiffness can be converted into an estimated Elasticity in kPa.

Elastography involves drawing 3-12 ROIs at differing depths on the acquired images.

Report record: Mean and Standard Deviation for **wave speed** and **elasticity** within each ROI, and summary statistics.

ROI #	Shear Wave Speed (m/s)		Elasticity (kPa)		Dispersion (m/s/kHz)		ROI Depth (cm)
	ROI Mean	ROI SD	ROI Mean	ROI SD	ROI Mean	ROI SD	
1							
2							
...							
R							

Summary Statistics	Shear Wave Speed (m/s)	Elasticity (kPa)	Dispersion (m/s/kHz)
Mean			
SD			
Median			
IQR			
IQR/Median			

Use Cases:

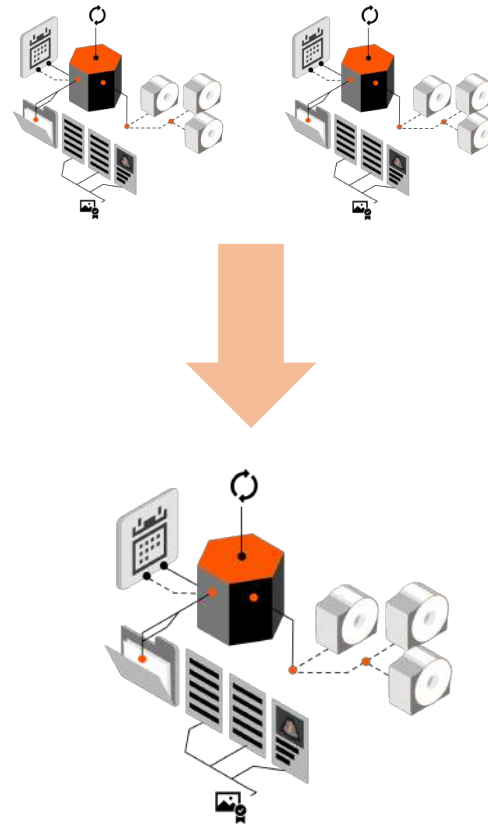
Migrating / Porting DICOM repositories from one image management system (PACS or VNA) to another.

Large scales, and handle both on-premises and remote (e.g., cloud-based) storage.

Migration usually during **clinical operation**.

Healthcare institutions **merge** separate **repositories** into an enterprise repository.

Bulk access to the archive: Research use cases, including artificial intelligence and machine learning.



Two alternative inventory strategies:

Production model

of an archive inventory object = tree of all information in the archive.

Remote initiation

Asynchronous

Query Response model

A query response returns all matching objects as a tree of a complete archive, or a subset thereof as specified by key attributes.

Use Cases:

- Managing protocols site consistent
- Record protocol details for follow up studies
- Vendor trouble shooting image quality issues
- Best practice sharing
- Protocol life cycle management, Quality assurance

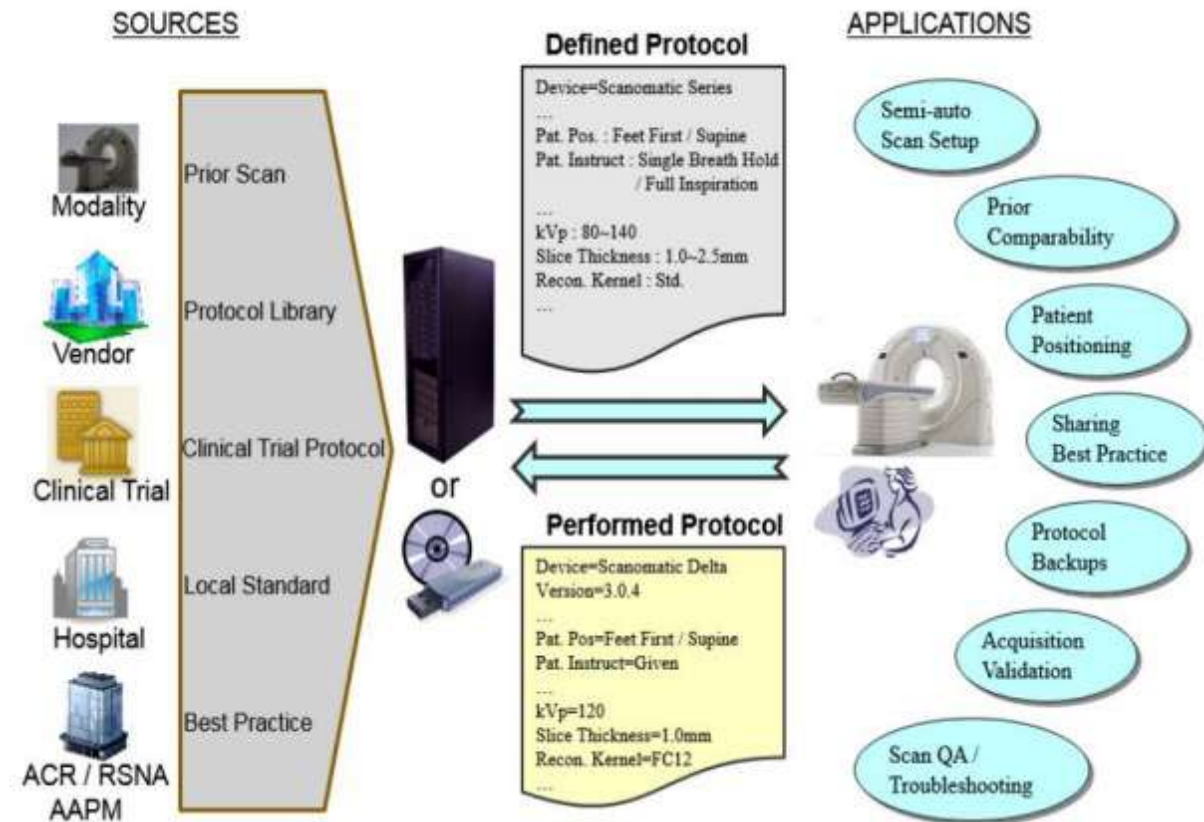
Protocol: Definition part

Prepare (**define setup**) of equipment for an Xray acquisition including:

- Patient preparation & positioning
- Equipment characteristics
- Acquisition technique
- Reconstruction technique
- Preliminary image handling such as filtering, enhancement
- Results data storage (auto-sending)

Protocol: Performed part

Record parameters used during the acquisition / procedure of the Xray equipment.

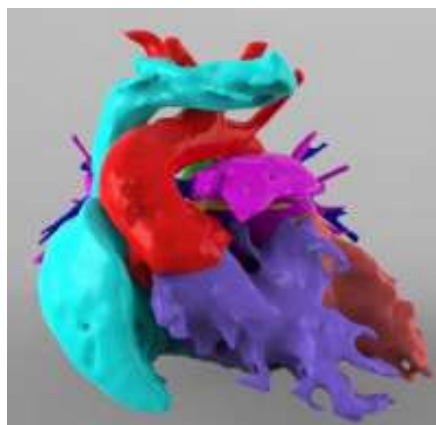
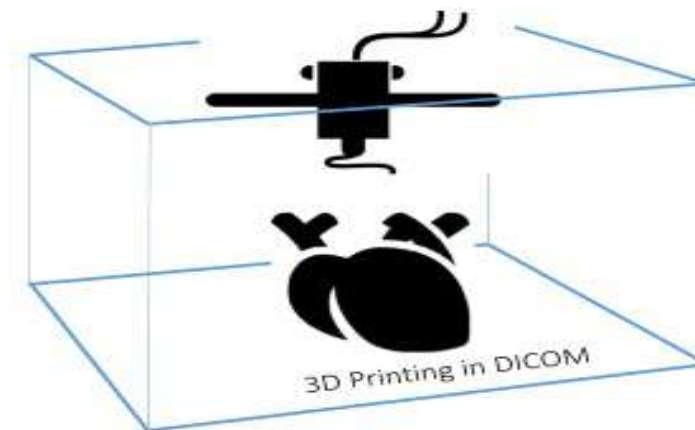


Use Cases:

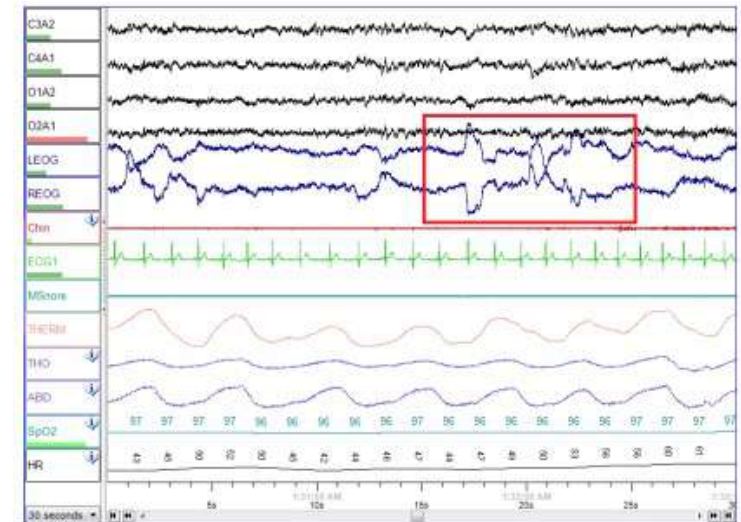
- Allow store/query/retrieve 3D models, intended for 3D manufacturing (and virtual reality), as DICOM objects
- Address medical 3D manufacturing and uses of Virtual Reality, Augmented Reality, and Mixed Reality.

New enriched capabilities beyond STL encapsulation:

- Support for a new 3D model type: Object File (OBJ)
- Identification of models for assembly into a larger object
- Capturing a preferred color for manufacturing or display of a model OBJ Encapsulation

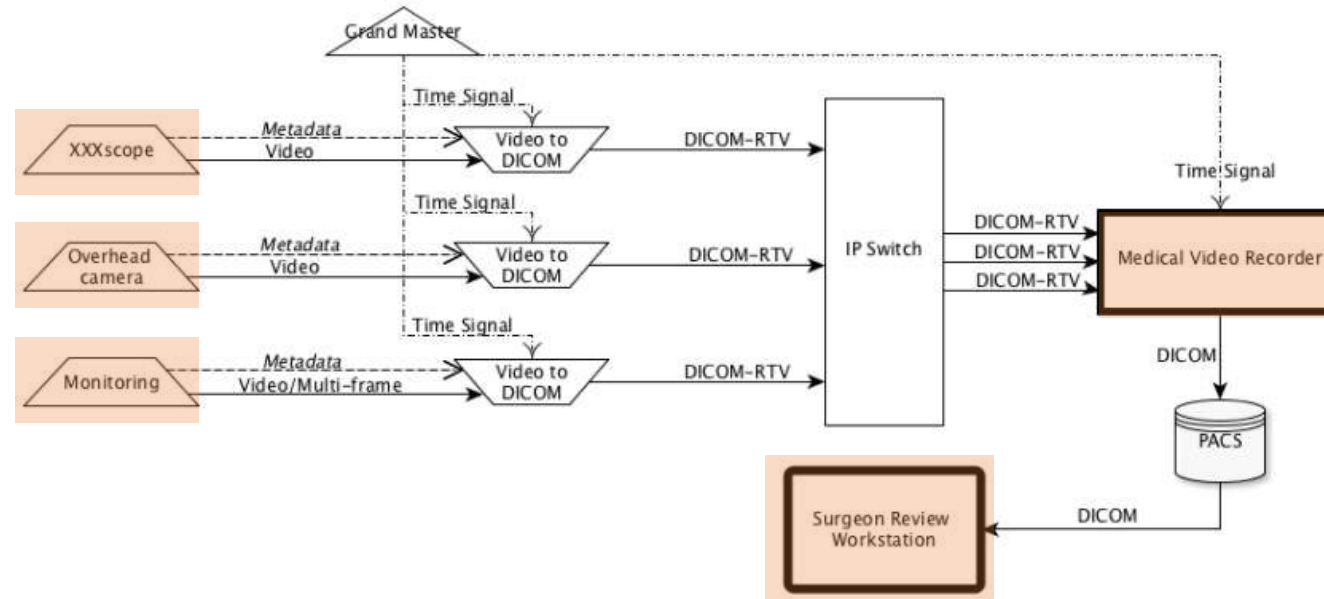


- **Electrical activity of the brain:** Routine electroencephalography (EEG) data recording collected on the skull.
- **Electrical activity of skeletal muscles:** Electromyography (EMG) data recording.
- **Recording eye movement** Electrooculography (EOG) data collected near the eyes.
- **Sleep study:** Electroencephalography (EEG) for a **polysomnography** (PSG) study.
- **Respiratory data** using more than a single channel.
- **Patient's position** continuously.

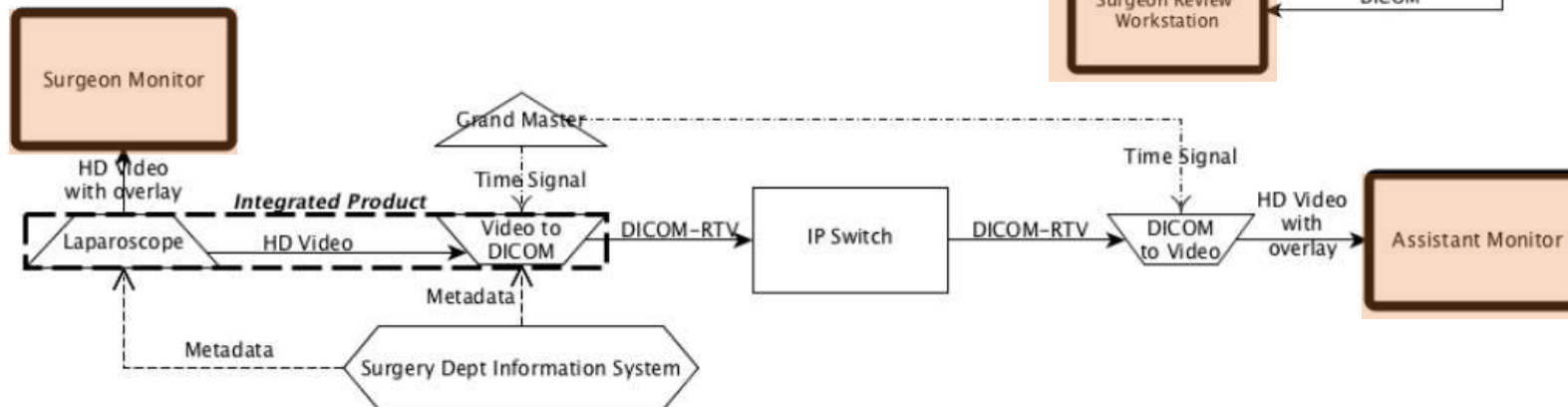


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<https://commons.wikimedia.org/w/index.php?curid=24506939>

Use Case: Senior surgeon review:



Use Case: Assistant monitoring:





The DICOM standard:
<https://www.dicomstandard.org/current>



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Photoacoustic Image	Sup229
Before Public Comment	
TLS Security update 2021	Sup230
Before Public Comment	

2022

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Elastography SR Template	Sup227

2021

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XA Protocol	Sup212
Cone Beam CT Radiation Dose SR	Sup214
MR Prostate Imaging Structured Report	Sup220
Whole Slide Imaging Annotation	Sup222

2020

2nd Gen. Other non C-Arm RT Treatment	Sup176
RT Radiation Records	Sup199
Encapsulated Additional Models 3D Manufacturing	Sup200
Neurophysiology Waveforms	Sup217
Dermoscopy	Sup221

In Work 2022 2021 2020

JPEG XL Transfer Syntax	Sup232	Multi-Fragment Video Transfer Syntax Changes	Sup225	Whole Slide Imaging Annotation	Sup222	Dermoscopy	Sup221	
Adaptive Dynamic Range Greyscale Presentation Data	Sup231	Release 2022	Archive Inventory	Sup223	MR Prostate Imaging Structured Report	Sup220	Neurophysiology Waveforms	Sup217
TLS 2021 update	Sup230	Release 2022	Elastography SR Template	Sup227	Cone Beam CT Radiation Dose SR	Sup214	Encapsulated Additional Models 3D Manufacturing	Sup200
Photoacoustic Image	Sup229	Release 2022			XA Protocol Storage	Sup212	RT Radiation Records	Sup199
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Confocal Microscopy Image	Sup226				Release 2021			
Multi-Fragment Video Transfer	Sup225							
Service Discovery and Control	Sup224							
JSON Representation of Structured Reports	Sup219							
MR Protocol Storage	Sup218							
2G-RT: RT Brachytherapy Objects	Sup216							

DICOM News
<https://www.dicomstandard.org/news>

DICOM Progress
<https://www.dicomstandard.org/approved-supplements>

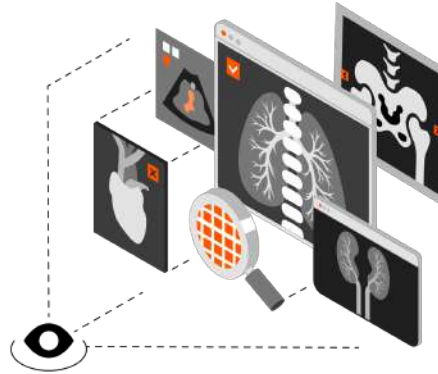
DICOM by feature and year:
<https://www.dicomstandard.org/supplements>

ImageStudy resource:
Use case illustrations

EHR App FHIR-queries EHR Backend to retrieve **DICOM** Studies with images for a specific patient.

Images are displayed with Image Display App (**IHE profile**) from DICOM Thumbnails.

ImageStudy resource is used between primary care, echo lab, and Cathlab IHE XDS-I on demand retrieve.



ImageSelection resource:

- frames, segments, 2D/3D region
- Observation, measurement
- Context sharing

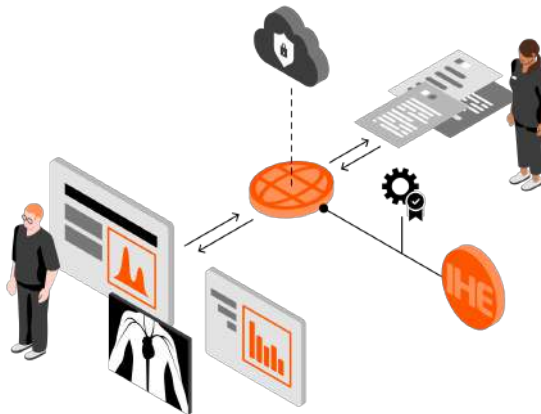
Radiation Dose Summary

- Summary of DICOM dose radiation

FHIR Observation

- mapping from DICOM SR

Imaging ordering workflow in FHIR



DICOM Secretariat dicom@dicomstandard.org

Security, TLS

Robert Horn

Web Services

Steven Nichols

Photoacoustic Image

Brian Bialecki

Gender Enhancement - Patient Model

Robert Horn

Greyscale Presentation State

Nicholas Bevins

Elastography SR

Kevin O'Donnell

X-ray

Francisco Sureda

HL7 DICOM Interop

Jonathan Whitby

Chris Lindop

Neurophysical Waveform

Silvia Winkler

Cone Beam CT

Nick Bevins

MR Prostate

Andrey Fedorov

Web Services

Bialecki, Brian

Physics

Nicholas Bevins

Brian Bialecki

video, compression

Bill Wallace

Realtime video

Emmanuel Cordonnier

Archive Inventory

Harry Solomon

DCS template

Antje Schroeder

Radiotherapy

Christof Schadt

Ulrich Busch

Jim Percy

Microscopy, Dermoscopy

Liam Caffery

Whole Slide Imaging Annotation

David Clunie

3D Manufacturing

Allan Noordvyk

Justin Ryan