

DICOM ja kuvantamisen työnkulku

Juha Järvinen

COMMIT 

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Sisältö

- DICOM Standardi
 - Teoriaa ja käsitteitä
 - Rooli työnkulussa
 - Mitä tarkoittaa DICOM:n tukeminen?
- IHE Scheduled Workflow (SWF)
 - Standardien osuus SWF:ssä
 - Mitä tarkoittaa IHE:n tukeminen?
- Mitä näiden avulla saavutetaan - toimittajariippumaton ympäristö?

Commit; Oy

- Suomalainen yksityinen yritys, perustettu 1989
- Digitalisoinut radiologisia osastoja vuodesta 1996
- 35 asiantuntijaa kahdessa toimipisteessä Helsingissä ja Tampereella

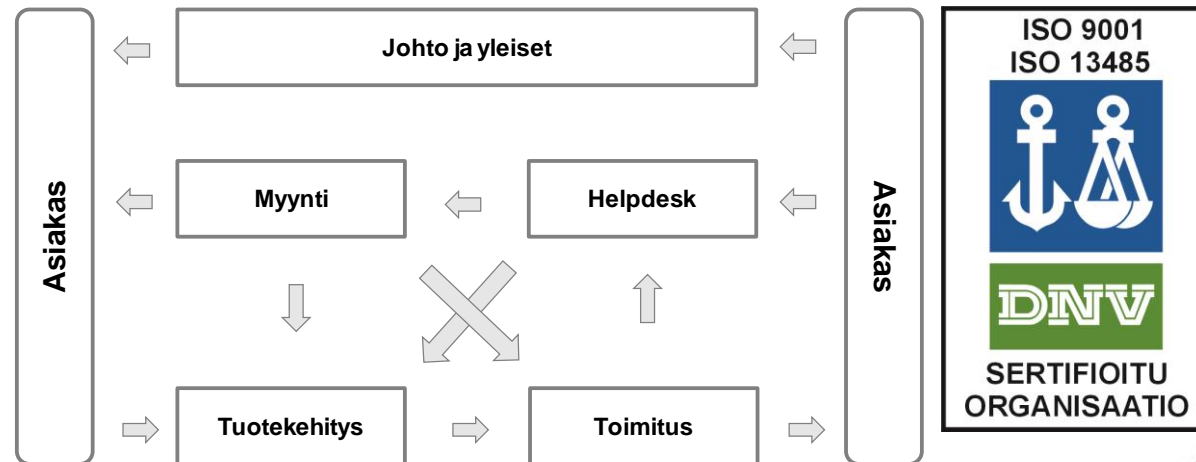
- Commit; tuotteita mm.:
 - Commit; RIS (kuvantamisyksiköiden toiminnanohjaus)
 - Sectra PACS (kuvien arkistointi ja katselu)
 - Commit; Screening (seulonnan työnohjaus - MIS, EIS, PAP)
 - Commit; OIS (leikkausyksiköiden työnohjaus)

Commit; Oy - laatujärjestelmä

- Commit; Oy valmistaa ja jakelee terveydenhuollon ohjelmistotuotteita.
- ISO 9001:2008 sertifikaatti kaikelle toiminnalle
- ISO 13485:2003 sertifikaatti terveydenhuollon toimituksille ja tuotteille, jotka on luokiteltu lääkinällisiksi laitteiksi
- Laatu politiikka: Commit; on sitoutunut toimittamaan asiakkailleen ohjelmistoja ja palveluita siten, että niiden laatu jatkuvasti paranee, samalla säilyttäen taloudellisen kannattavuuden. Terveydenhuollon tuotteiden tulee olla turvallisia käyttää ja ne täyttävät kaikki vaadittavat säädökset.

- Laatumittarit:

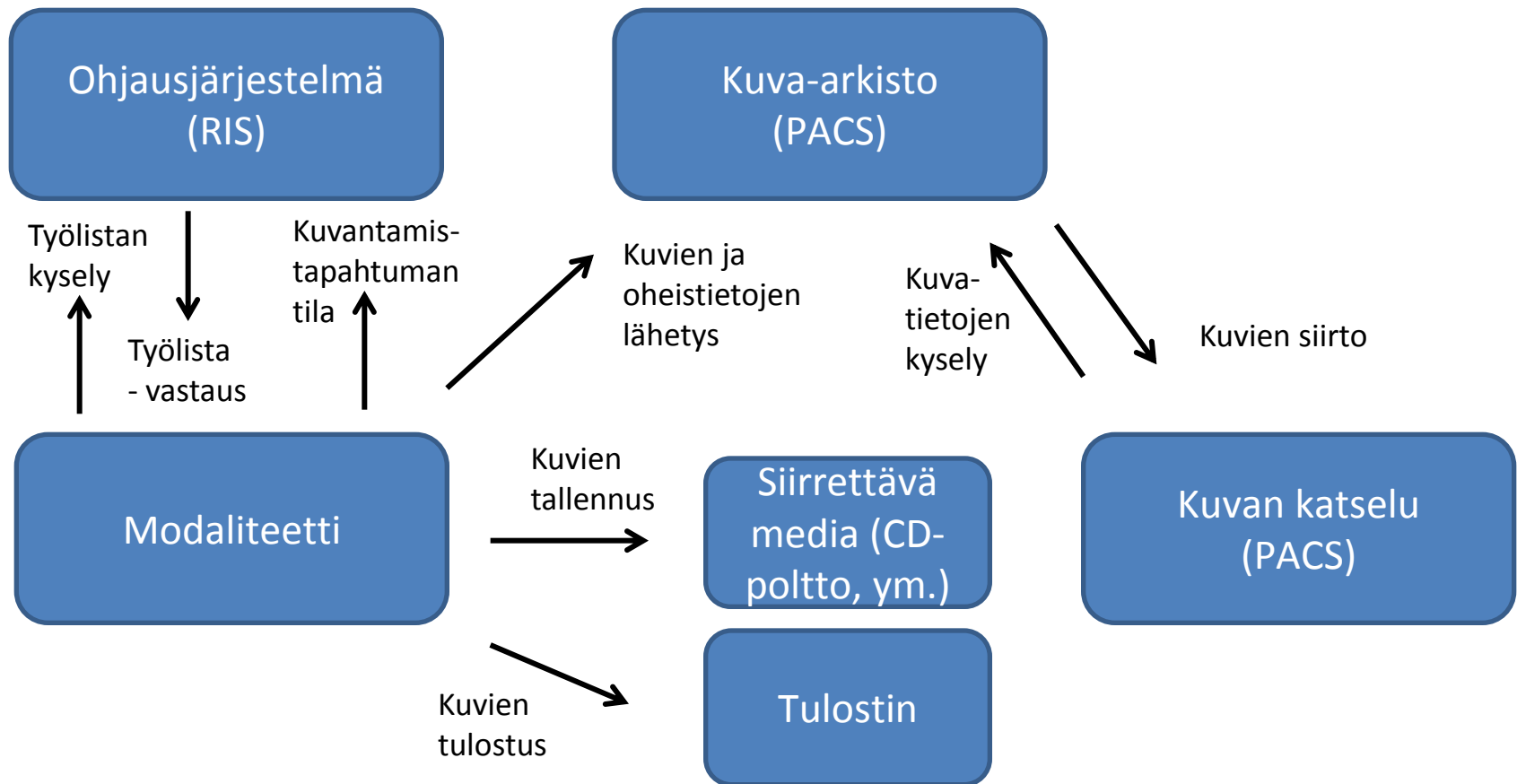
- Oikea-aikaisuus
- Vähän virheitä
- Turvallisuus
- Asiakastyytyväisyys
- Kannattavuus



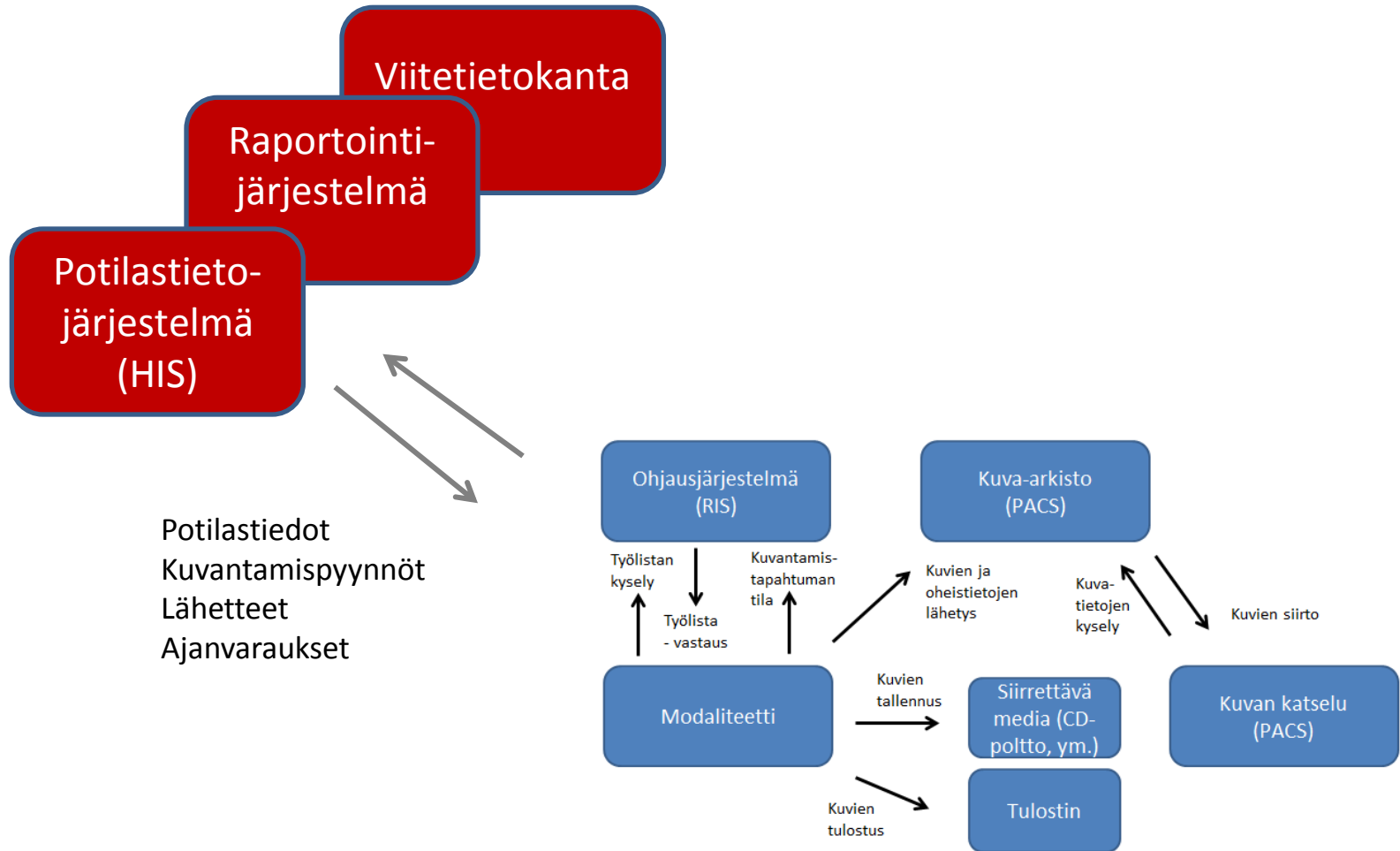
JJ

- Tampereelta
- **DI** (Implementation of the DICOM Standard for a Digital X-Ray Device, 2000)
- 8 v röntgenlaitteiden tuotekehityksessä
- 9 v kuvantamisen tietojärjestelmien tuotekehityksessä ja toimitusprojekteissa
- Asiantuntija, laatupäällikkö, CTO
- ”Erikoisalana” järjestelmien väliset integraatiot (mm. DICOM ja HL7)

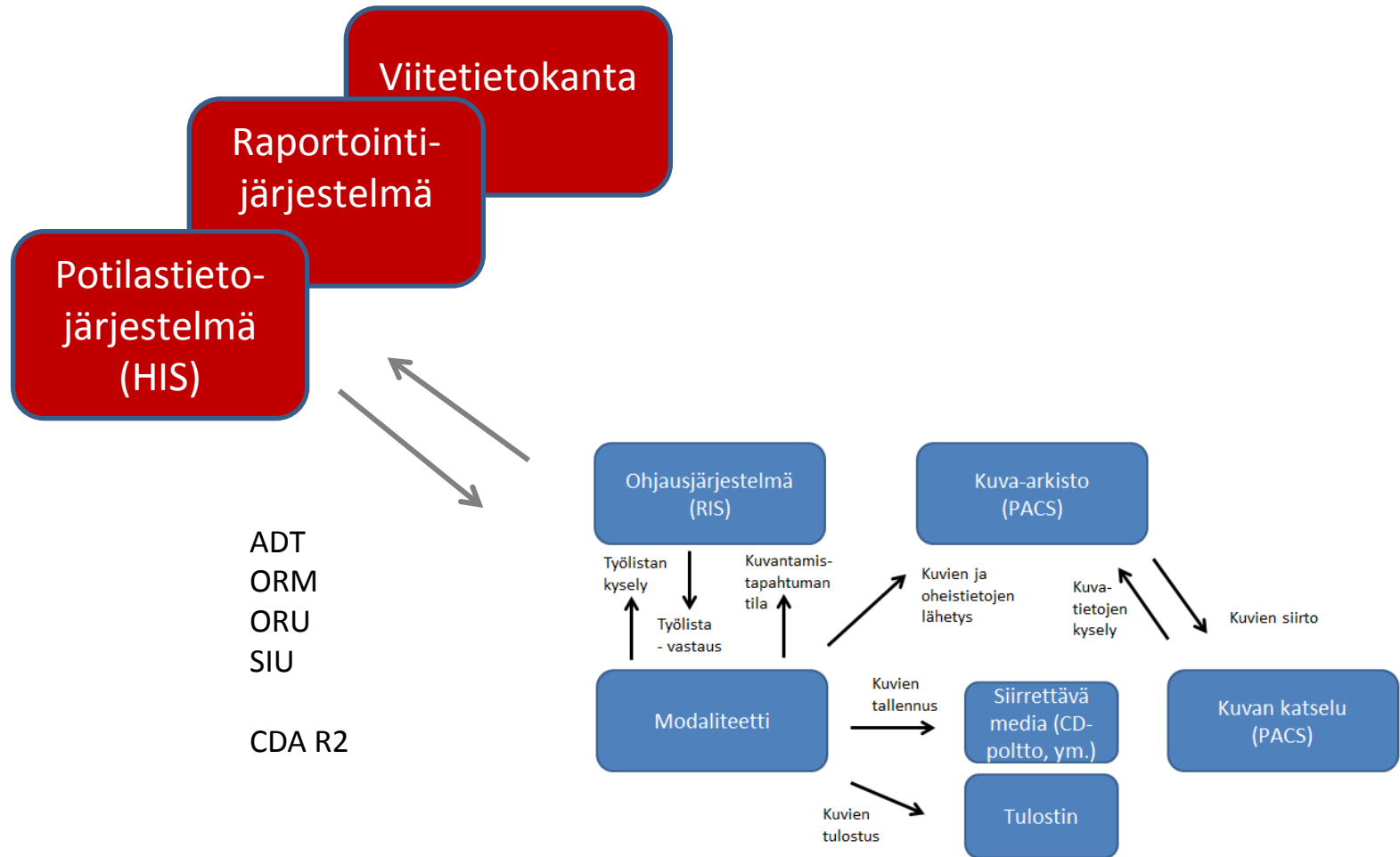
Kuvantamisen tiedonsiirrot



Tiedonsiirrot muihin järjestelmiin



Tiedonsiirrot muihin järjestelmiin



DICOM

- Digital Imaging and Communications in Medicine
- Standardi
- Omistaja: NEMA, National Electrical Manufacturers Association
- Kehitys: DICOM Standards Committee
- Saatavilla veloitusetta
<http://dicom.nema.org/standard.html>

DICOM

- ACR/NEMA 300 vuonna 1985
- ACR/NEMA 2.0 vuonna 1988
- DICOM 3.0 vuonna 1993 (NEMA PS3)
- Tunnustettu kansainväliseksi standardiksi: **ISO 12052**
- **DICOM = DICOM 3.0 = NEMA PS3 = ISO 12052**

DICOM versiointi

- DICOM 3.0 kehittyä jatkuvasti, versionumero ei muutu
- Standard Text, Correction Proposals, Supplements
- Uusi julkaisu koko standardista noin vuosittain
- Julkaisu on vain tietyn hetken näkymä standardista
- “At any point in time the official standard consists of the most recent yearly edition of the base standard (currently 2015a) PLUS all the supplements and correction items that have been approved as Final Text.”
- Muutosten on tarkoitus olla eteen- ja taaksepäin yhteensopivia

DICOM versiointi

- DICOM:n tukeminen = ”yleisesti standardin noudattaminen, ei version tai julkaisun tai supplementin tukeminen”
- NEMA PS3 / ISO 12052, Digital Imaging and Communications in Medicine (DICOM) Standard, National Electrical Manufacturers Association, Rosslyn, VA, USA (available free at <http://medical.nema.org/>)
- The following forms are preferred for references to units of conformance to the Standard: “... conformant to the DICOM <name> SOP Class, as specified in DICOM PS3.4: Service Class Specifications.”

DICOM Standardin osat

DICOM Part 1: Introduction and Overview

DICOM Part 2: Conformance

DICOM Part 3: Information Object Definitions

DICOM Part 4: Service Class Specifications

DICOM Part 5: Data Structures and Encoding

DICOM Part 6: Data Dictionary

DICOM Part 7: Message Exchange

DICOM Part 8: Network Communication Support for Message Exchange

DICOM Part 10: Media Storage and File Format for Media Interchange

DICOM Part 11: Media Storage Application Profiles

DICOM Part 12: Media Formats and Physical Media for Media Interchange

DICOM Part 14: Grayscale Standard Display Function

DICOM Part 15: Security and System Management Profiles

DICOM Part 16: Content Mapping Resource

DICOM Part 17: Explanatory Information

DICOM Part 18: Web Access to DICOM Persistent Objects (WADO)

DICOM Part 19: Application Hosting

DICOM Part 20: Transformation of DICOM to and from HL7 Standards

n. 3000 sivua

DICOM Standardin osat

- Oma mielipide:

DICOM:n perusosat PS3.3 – PS3.7

- PS3.4 toiminnallisuuden määrittely
- PS3.7 toiminnallisuuden yksityiskohdat
- PS3.3 tietosisällön määrittely
- PS3.5 ja PS3.6 tietosisällön yksityiskohdat

PS3.2 tärkeä DICOM:n tukemisen osoittamiseksi

DICOM käsitteitä

- Service Class
- IOD
- SOP Class
- UID
- Transfer Syntax
- DIMSE
- AE Title
- SCU/SCP
- Association
Negotiation
- Conformance
Statement

...

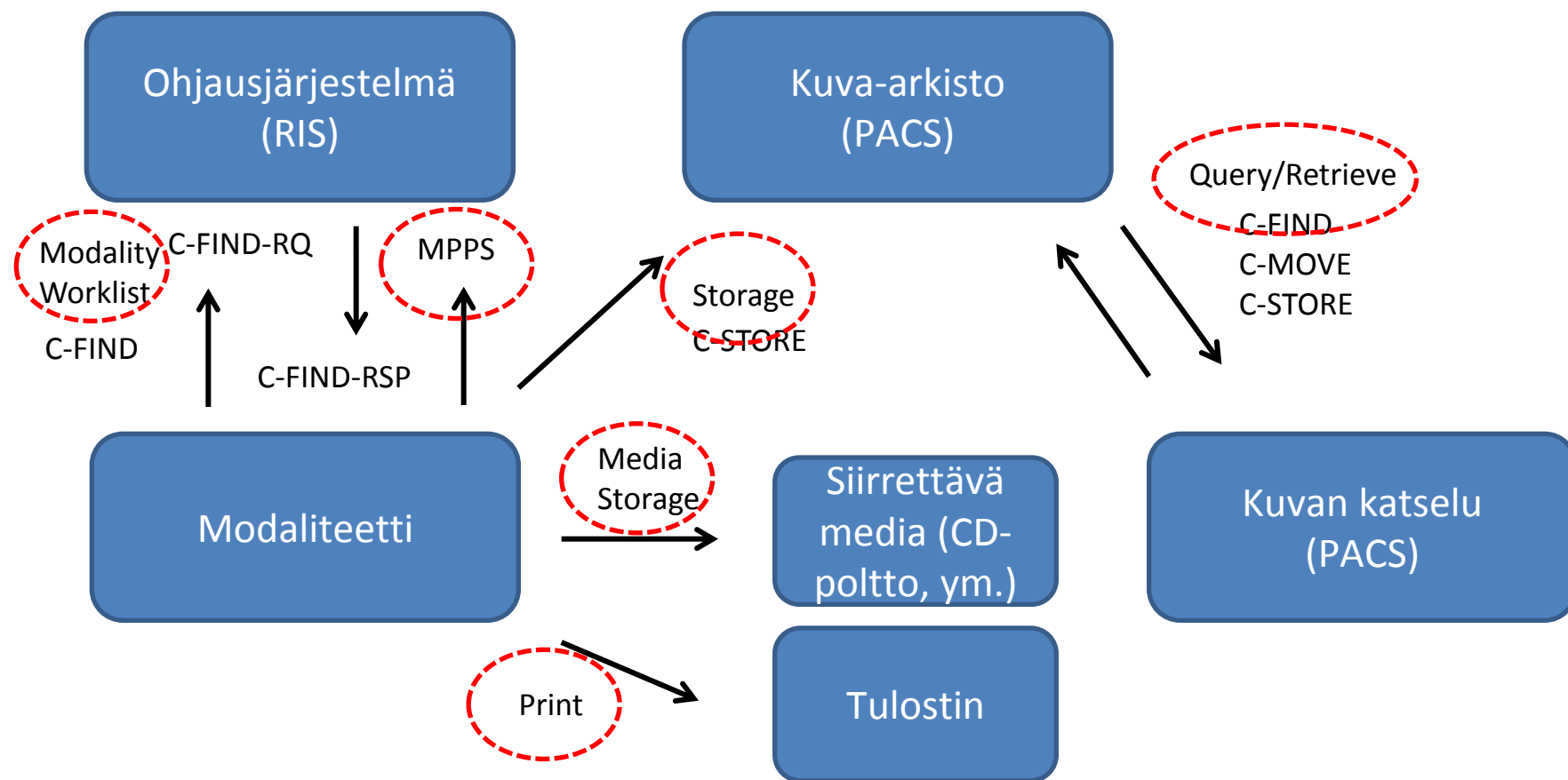
Part 4 - PS3.4

- Service Class Specifications
- N. 400 sivua
- DICOM palvelut, operaatiot
- Määrittelee, ”mitä DICOM tekee”
- SOP Class kuvaukset
- Vahvasti kytköksissä Part 3:een

PS3.4 - DICOM palveluita

- Verification – DICOM yhteyden testaus, ”DICOM ping”
- Storage – kuvien lähetys
- Storage Commitment – kuvien lähetyksen varmistus
- Query/Retrieve – kuvatietojen haku ja kuvien nouto
- Modality Worklist – potilas- ja tutkimustietojen haku kuvantamislaitteelle
- MPPS – kuvantamistapahtuman tietojen lähetys (alku- ja loppuaika, annos, ym.)
- Media Storage – kuvien tallennus siirrettävälle medialle
- Print – kuvien tulostus printterille
- (Grayscale Standard Display Function – ”dicom-kalibrointi” näytöille ja tulostimille)

Kuvantamisen tiedonsiirrot



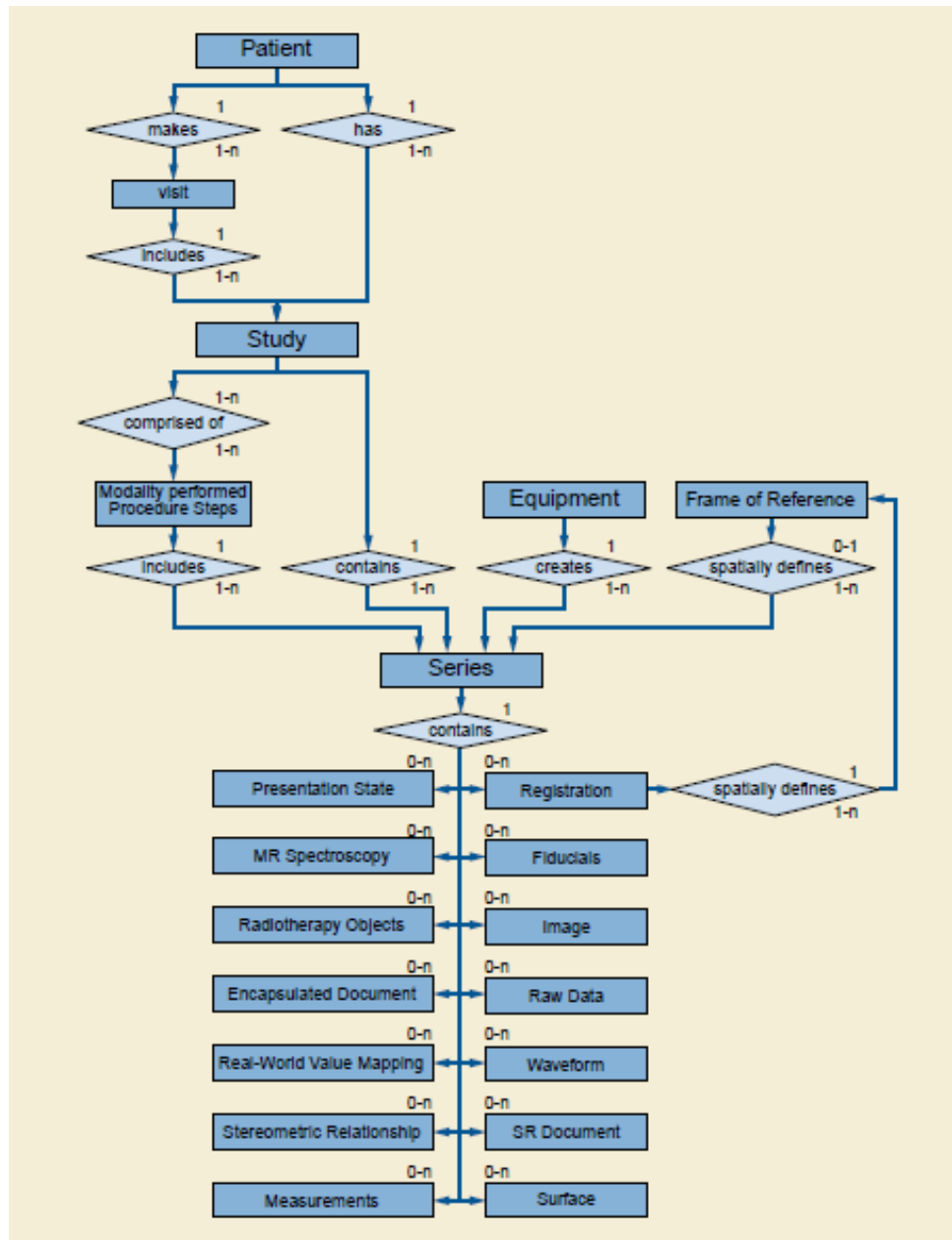
PS3.4 – Storage SOP Class

SOP Class Name	SOP Class UID	IOD Specification (defined in PS3.3)
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	Computed Radiography Image IOD
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	Digital X-Ray Image IOD (see Section B.5.1.1)
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	Digital X-Ray Image IOD (see Section B.5.1.1)
Digital Mammography X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Digital Mammography X-Ray Image IOD (see Section B.5.1.2)
Digital Mammography X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Digital Mammography X-Ray Image IOD (see Section B.5.1.2)
Digital Intra-Oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	Digital Intra-Oral X-Ray Image IOD (see Section B.5.1.3)
Digital Intra-Oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	Digital Intra-Oral X-Ray Image IOD (see Section B.5.1.3)
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Computed Tomography Image IOD
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	Enhanced CT Image IOD (see Section B.5.1.7)
Legacy Converted Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.2	Legacy Converted Enhanced CT Image IOD (see Section B.5.1.7)
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Ultrasound Multi-frame Image IOD
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Magnetic Resonance Image IOD
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	Enhanced MR Image IOD (see Section B.5.1.6)
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2	MR Spectroscopy IOD
Enhanced MR Color Image Storage	1.2.840.10008.5.1.4.1.1.4.3	Enhanced MR Color Image IOD
Legacy Converted Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.4	Legacy Converted Enhanced MR Image IOD (see Section B.5.1.6)

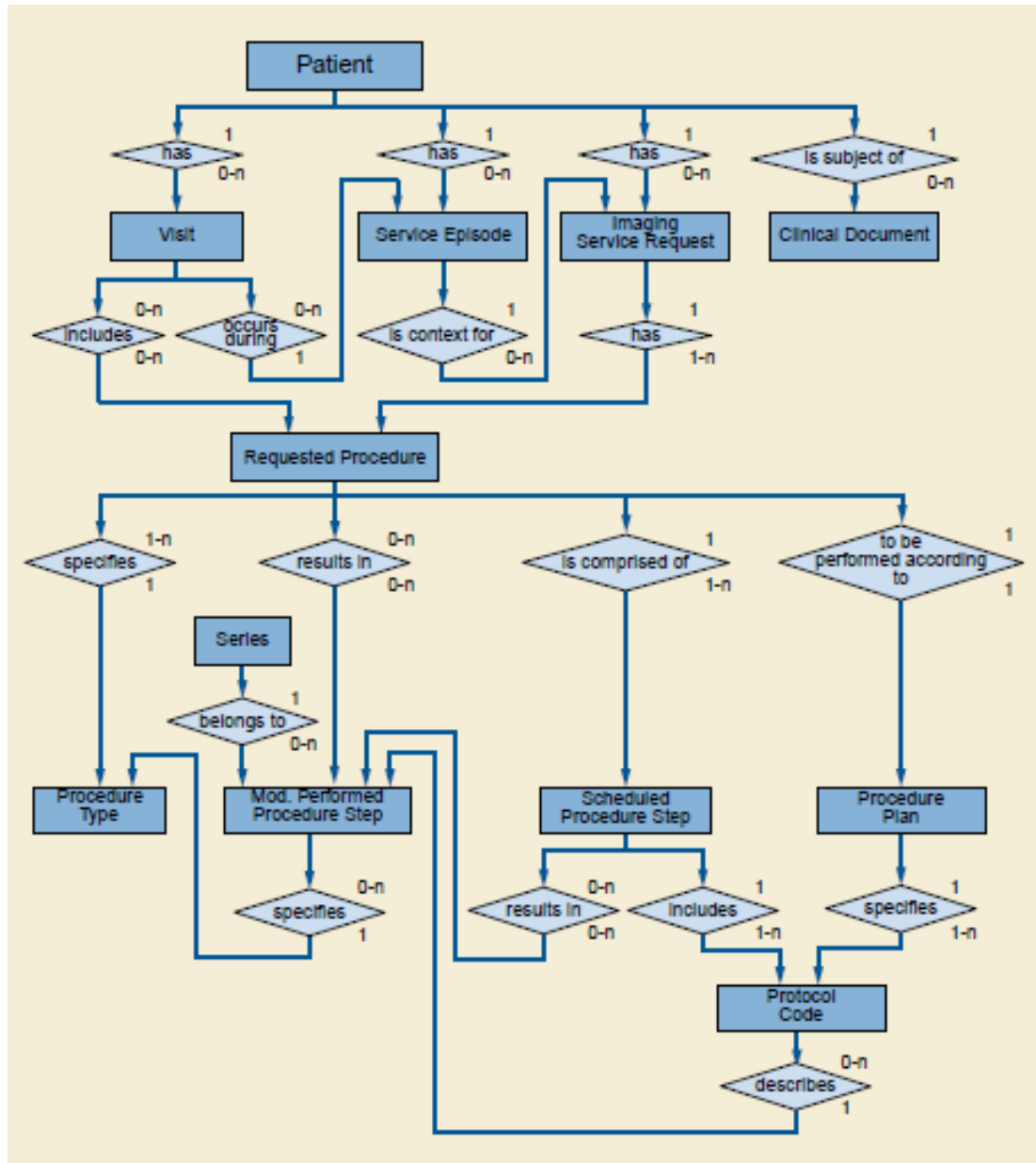
Part 3 – PS3.3

- Information Object Definitions
- N. 1300 sivua!
- DICOM objektien tietosisältö
- Määrittää tietosisällön pakollisuuden ja valinnaisuuden
- SOP Class:n ”O”

DICOM Model

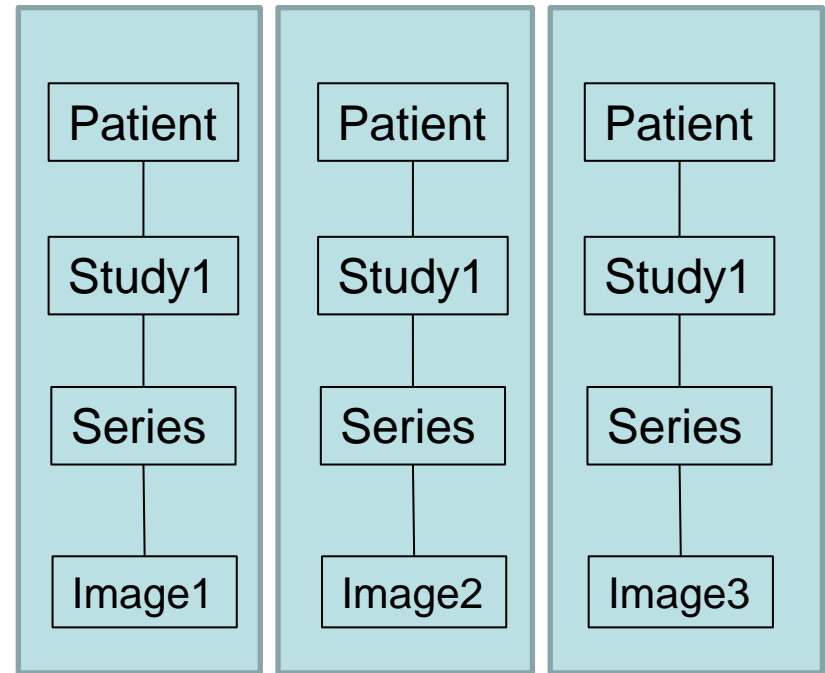
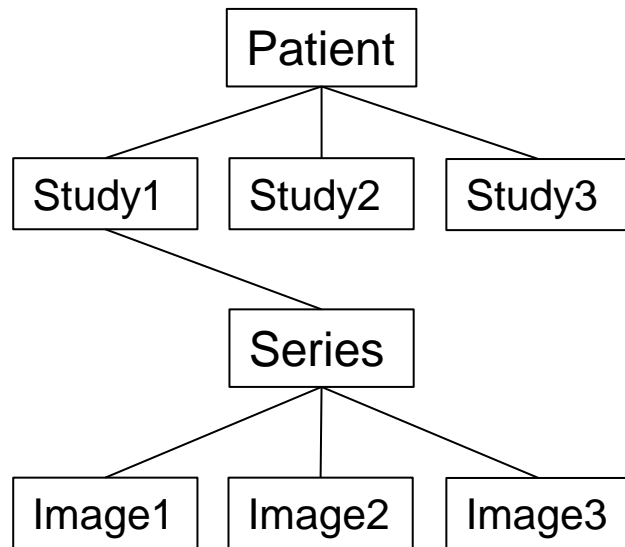


DICOM Model - IS



DICOM Model vs Objektit

Potilaalla kolme tutkimusta, joista yhdessä on kolmen kuvan sarja



Accession Number (AC-numero)

Table C.7-3
GENERAL STUDY MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Unique identifier for the Study.
Study Date	(0008,0020)	2	Date the Study started.
Study Time	(0008,0030)	2	Time the Study started.
Referring Physician's Name	(0008,0090)	2	Name of the patient's referring physician
Referring Physician Identification Sequence	(0008,0096)	3	Identification of the patient's referring physician. Only a single item shall be permitted in this sequence.
<i>>Include 'Person Identification Macro' Table 10-1</i>			
Study ID	(0020,0010)	2	User or equipment generated Study identifier.
Accession Number	(0008,0050)	2	A RIS generated number that identifies the order for the Study.
Study Description	(0008,1030)	3	Institution-generated description or classification of the Study (component) performed.

Modality (modaliteetti, kuvatyyppi)

Table C.7-5a
GENERAL SERIES MODULE ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the images in this Series. See C.7.3.1.1.1 for Defined Terms.
Series Instance UID	(0020,000E)	1	Unique identifier of the Series.
Series Number	(0020,0011)	2	A number that identifies this Series.

Defined Terms for the Modality (0008,0060) are:

CR = Computed Radiography	CT = Computed Tomography
MR = Magnetic Resonance	NM = Nuclear Medicine
US = Ultrasound	OT = Other
BI = Biomagnetic imaging	CD = Color flow Doppler
DD = Duplex Doppler	DG = Diaphanography
ES = Endoscopy	LS = Laser surface scan
PT = Positron emission tomography (PET)	RG = Radiographic imaging (conventional film/screen)
ST = Single-photon emission computed tomography (SPECT)	TG = Thermography
XA = X-Ray Angiography	RF = Radio Fluoroscopy
RTIMAGE = Radiotherapy Image	RTDOSE = Radiotherapy Dose
RTSTRUCT = Radiotherapy Structure Set	RTPLAN = Radiotherapy Plan
RTRECORD = RT Treatment Record	HC = Hard Copy
DX = Digital Radiography	MG = Mammography
IO = Intra-oral Radiography	PX = Panoramic X-Ray
GM = General Microscopy	SM = Slide Microscopy
XC = External-camera Photography	PR = Presentation State
AU = Audio	ECG = Electrocardiography
EPS = Cardiac Electrophysiology	HD = Hemodynamic Waveform
SR = SR Document	IVUS = Intravascular Ultrasound

IOD Modules

Table A.1-1
COMPOSITE INFORMATION OBJECT MODULES OVERVIEW - IMAGES

IODs Modules	CR	CT	MR	Enh MR	NM	US	US MF	SC	SC MF SB	SC MF GB	SC MF GW	SC MF TC	XA	RF	RT IM	PET	DX	MG	IO	VL EN	VL MC	VL SL	VL PH
Patient	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Specimen Identification				U													U	U	U		M	M	C
Clinical Trial Subject	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
General Study	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
Patient Study	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Clinical Trial Study	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
General Series	M	M	M	M	M	M	M	M	M	M	M	M	M	M		M	M	M	M	M	M	M	M
Clinical Trial Series	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
CR Series	M																						
NM/PET Patient Orientation					M											M							
PET Series																M							
PET Isotope																M							
PET Multi-gated Acquisition																C							
RT Series															M								
DX Series																	M	M	M				
Mammo Series																		M					
Intra-oral Series																			M				
Frame Of Reference		M	M	M	U	U	U								U	M	U	C	U			M	

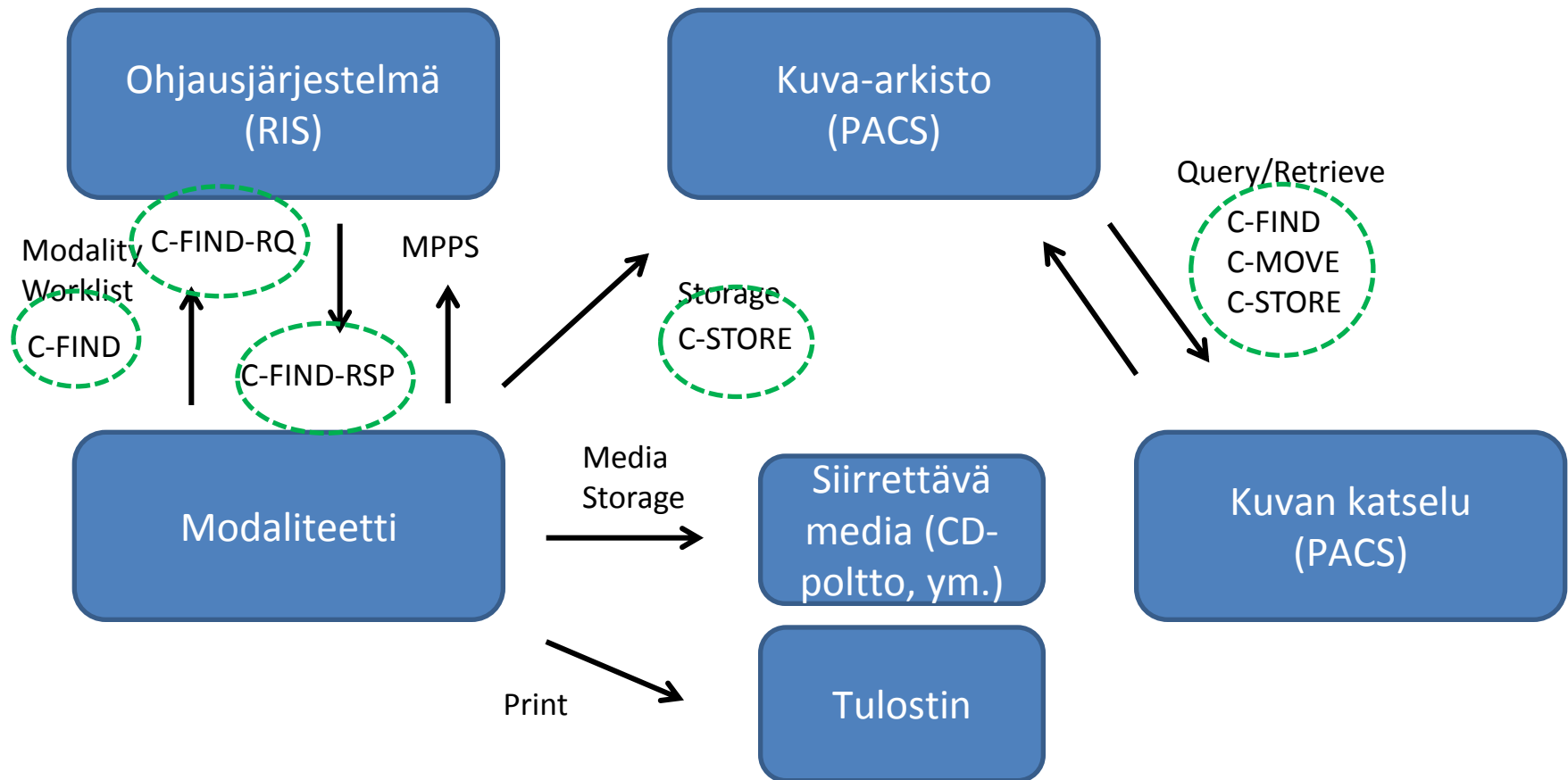
Part 7 – PS3.7

- Message Exchange
- N. 120 sivua
- DIMSE Services (DICOM Message Service Element)
- Association Negotiation
- Viestinvälityksen kuvaus

DIMSE Services

Name	Group	Type
C-STORE	DIMSE-C	operation
C-GET	DIMSE-C	operation
C-MOVE	DIMSE-C	operation
C-FIND	DIMSE-C	operation
C-ECHO	DIMSE-C	operation
N-EVENT-REPORT	DIMSE-N	notification
N-GET	DIMSE-N	operation
N-SET	DIMSE-N	operation
N-ACTION	DIMSE-N	operation
N-CREATE	DIMSE-N	operation
N-DELETE	DIMSE-N	operation

Kuvantamisen tiedonsiirrot



C-STORE-RQ (PS3.7)

Message Field	Tag	VR	VM	Description of Field
Command Group Length	(0000,0000)	UL	1	The even number of bytes from the end of the value field to the beginning of the next group.
Affected SOP Class UID	(0000,0002)	UI	1	SOP Class UID of the SOP Instance to be stored.
Command Field	(0000,0100)	US	1	This field distinguishes the DIMSE-C operation conveyed by this Message. The value of this field shall be set to 0001H for the C-STORE-RQ Message.
Message ID	(0000,0110)	US	1	Implementation-specific value. It distinguishes this Message from other Messages.
Priority	(0000,0700)	US	1	The priority shall be set to one of the following values: LOW = 0002H MEDIUM = 0000H HIGH = 0001H
Command Data Set Type	(0000,0800)	US	1	This field indicates that a Data Set is present in the Message. It shall be set to any value other than 0101H (Null).
Affected SOP Instance UID	(0000,1000)	UI	1	Contains the UID of the SOP Instance to be stored.
Move Originator Application Entity Title	(0000,1030)	AE	1	Contains the DICOM AE Title of the DICOM AE that invoked the C-MOVE operation from which this C-STORE sub-operation is being performed.
Move Originator Message ID	(0000,1031)	US	1	Contains the Message ID (0000,0110) of the C-MOVE-RQ Message from which this C-STORE sub-operations is being performed.
Data Set	(no tag)	-	-	Application-specific Data Set.

C-STORE-RSP (PS3.7)

Message Field	Tag	VR	VM	Description of Field
Command Group Length	(0000,0000)	UL	1	The even number of bytes from the end of the value field to the beginning of the next group.
Affected SOP Class UID	(0000,0002)	UI	1	Contains the SOP Class of the SOP Instance stored.
Command Field	(0000,0100)	US	1	This field distinguishes the DIMSE-C operation conveyed by this Message. The value of this field shall be set to 8001H for the C-STORE-RSP Message.
Message ID Being Responded To	(0000,0120)	US	1	Shall be set to the value of the Message ID (0000,0110) field used in associated C-STORE-RQ Message.
Command Data Set Type	(0000,0800)	US	1	This field indicates that no Data Set is present in the Message and shall be set to a value of 0101H (Null).
Status	(0000,0900)	US	1	The value of this field depends upon the status type. Annex C defines the encoding of the status types defined in the service definition.
Affected SOP Instance UID	(0000,1000)	UI	1	Contains the UID of the SOP Instance stored.

C-FIND-RQ

Message Field	Tag	VR	VM	Description of Field
Command Group Length	(0000,0000)	UL	1	The even number of bytes from the end of the value field to the beginning of the next group.
Affected SOP Class UID	(0000,0002)	UI	1	SOP Class UID associated with this operation.
Command Field	(0000,0100)	US	1	This field distinguishes the DIMSE-C operation conveyed by this Message. The value of this field shall be set to 0020H for the C-FIND-RQ Message.
Message ID	(0000,0110)	US	1	Implementation-specific value that distinguishes this Message from other Messages.
Priority	(0000,0700)	US	1	The priority shall be set to one of the following values: LOW = 0002H MEDIUM = 0000H HIGH = 0001H
Command Data Set Type	(0000,0800)	US	1	This field indicates that a Data Set is present in the Message. It shall be set to any value other than 0101H (Null).
Identifier	(no tag)	-	-	A Data Set that encodes the Identifier to be matched. See Section 9.1.2.1.5.

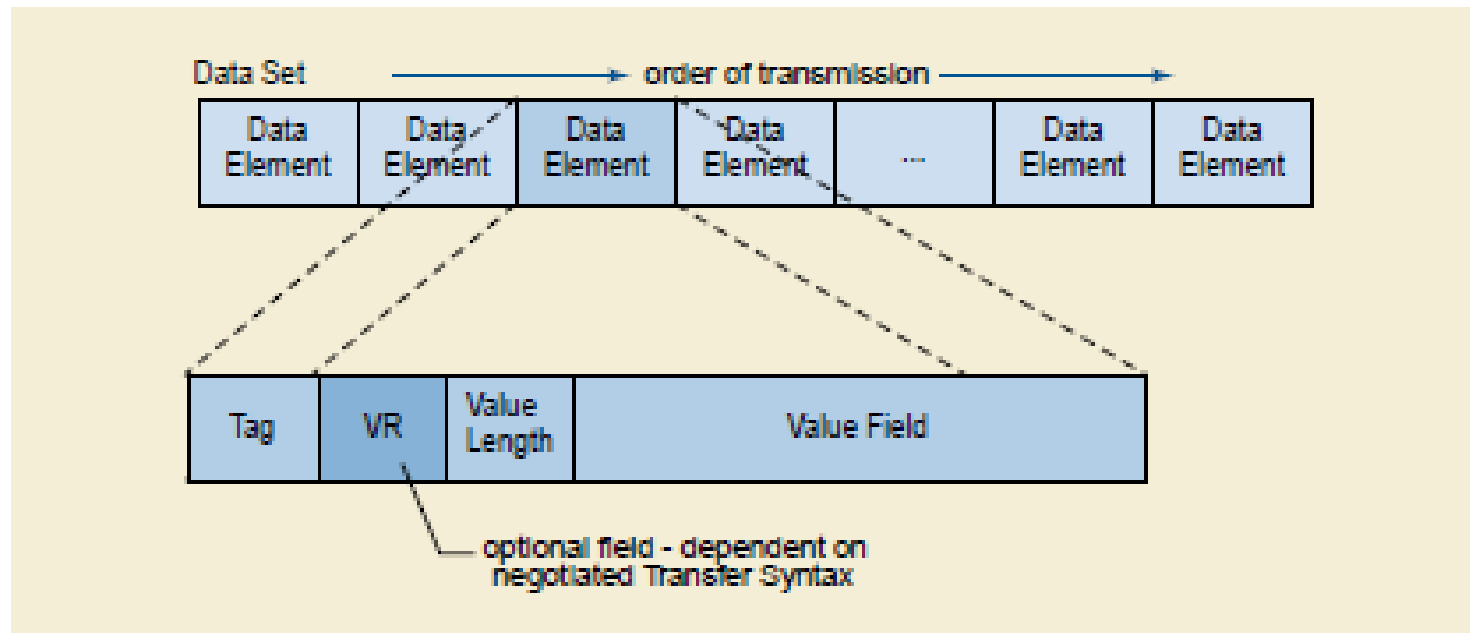
C-FIND-RSP

Message Field	Tag	VR	VM	Description of Field
Command Field	(0000,0100)	US	1	This field distinguishes the DIMSE-C operation conveyed by this Message. The value of this field shall be set to 8020H for the C-FIND-RSP Message.
Message ID Being Responded To	(0000,0120)	US	1	Shall be set to the value of the Message ID (0000,0110) field used in associated C-FIND-RQ Message.
Command Data Set Type	(0000,0800)	US	1	This field indicates if a Data Set is present in the Message. This field shall be set to the value of 0101H (Null) if no Data Set is present; any other value indicates a Data Set is included in the Message.
Status	(0000,0900)	US	1	The value of this field depends upon the status type. Annex C defines the encoding of the status types defined in the service definition.
Identifier	(no tag)	-	-	A Data Set that encodes the Identifier that was matched. See Section 9.1.2.1.5.

Part 5 – PS3.5

- Data Structures and Encoding
- N. 130 sivua
- Tietotyypit ja koodaussäännöt
- DICOM-tagien esitystapa
- DICOM Transfer Syntax
- UID
- Character Set

DICOM Data Set



DICOM Tag ja VR

- Tag on tietoelementin tunniste
- Ilmoitetaan hexadesimaalilukuparina, esim. 0010, 0020 (Patient ID)
- VR (Value Representation) kertoo tagin osoittaman arvon tyypin, esim. LO (long string)
- Tagit ja VR:t määritellään standardissa
- Tägeista koostetaan objektit ja komennot

VR - PN, Person name

PN Person Name	<p>A character string encoded using a 5 component convention. The character code 5CH (the BACKSLASH "\ in ISO-IR 6) shall not be present, as it is used as the delimiter between values in multiple valued data elements. The string may be padded with trailing spaces. The five components in their order of occurrence are: family name complex, given name complex, middle name, name prefix, name suffix. Any of the five components may be an empty string. The component delimiter shall be the caret "^" character (5EH). Delimiters are required for interior null components. Trailing null components and their delimiters may be omitted. Multiple entries are permitted in each component and are encoded as natural text strings, in the format preferred by the named person. This conforms to the ANSI HISPP MSDS Person Name common data type.</p>	<p>Default Character Repertoire and/or as defined by (0008,0005) excluding Control Characters LF, FF, and CR but allowing Control Character ESC.</p>	<p>64 chars maximum per component group (see NOTE in 6.2)</p>
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- Esim. Järvinen^Juha^^^

Transfer Syntax

- Määrittelee Data Setin ja komentojen ("tagijoukkojen") esitysmuodon
- Formaatti, jossa tieto tallennetaan ja välitetään
- DICOM:n oletus Transfer Syntax = Implicit VR Little Endian, 1.2.840.10008.1.2
- DICOM:n oletus JPEG lossless syntax =1.2.840.10008.1.2.4.70
- Lista DICOM:n Transfer Syntaxeista standardin osassa 6

Character Sets

- ISO 8859
- JIS X 0201-1976 Code for Information Interchange
- JIS X 0208-1990 Code for the Japanese Graphic Character set for information interchange
- JIS X 0212-1990 Code of the supplementary Japanese Graphic Character set for information interchange
- KS X 1001 (registered as ISO-IR 149) for Korean Language
- TIS 620-2533 (1990) Thai Characters Code for Information Interchange
- ISO 10646-1, 10646-2, and their associated supplements and extensions for Unicode character set
- GB 18030
- GB2312
- GBK

DICOM default Character Set

					b ₈	0	0	0	0	0	0	0	0	0
					b ₇	0	0	0	0	1	1	1	1	
					b ₆	0	0	1	1	0	0	1	1	
					b ₅	0	1	0	1	0	1	0	1	
b ₄	b ₃	b ₂	b ₁			00	01	02	03	04	05	06	07	
0	0	0	0	00				SP	0	@	P	`	p	
0	0	0	1	01				!	1	A	Q	a	q	
0	0	1	0	02				"	2	B	R	b	r	
0	0	1	1	03				#	3	C	S	c	s	
0	1	0	0	04				\$	4	D	T	d	t	
0	1	0	1	05				%	5	E	U	e	u	
0	1	1	0	06				&	6	F	V	f	v	
0	1	1	1	07				'	7	G	W	g	w	
1	0	0	0	08				(8	H	X	h	x	
1	0	0	1	09)	9	I	Y	i	y	
1	0	1	0	10		LF		*	:	J	Z	j	z	
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Part 6 – PS3.6

- Data Dictionary
- N. 200 sivua
- Listaus DICOM-tageista
- Listaus DICOM:n UID:ista
- ”DICOM-tagien hakemisto”

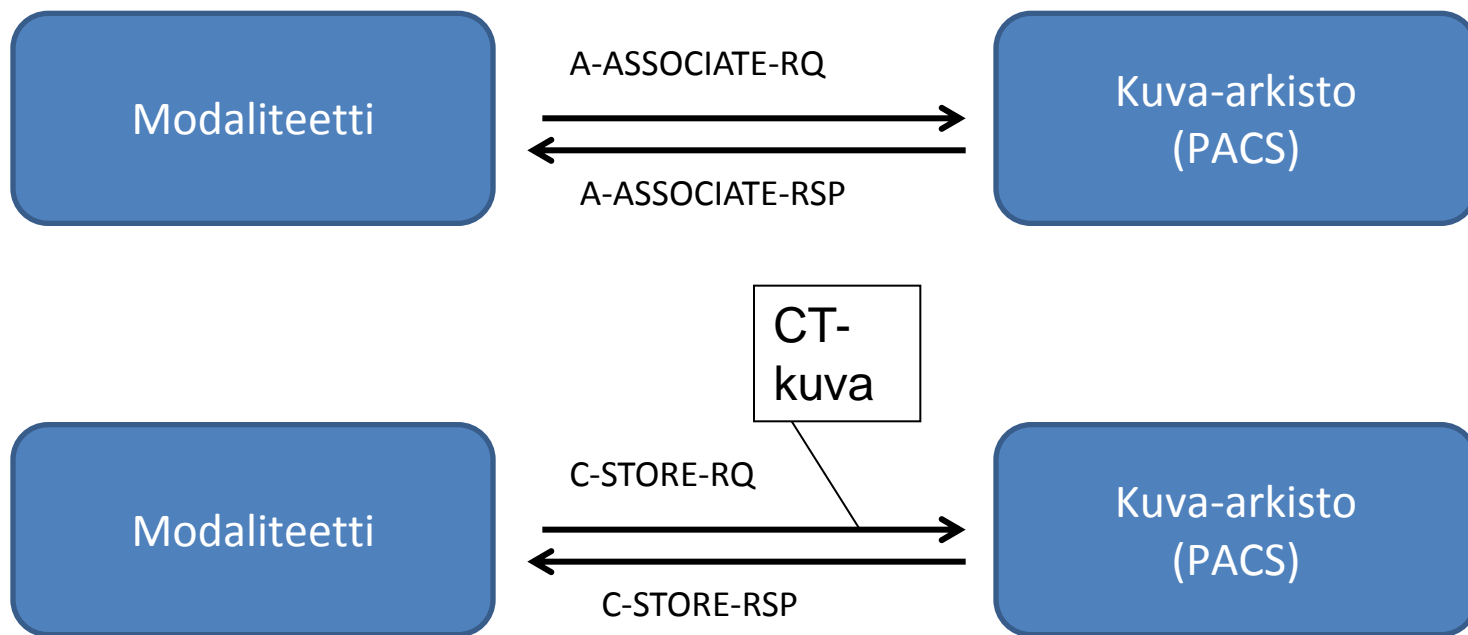
DICOM-viestintä

IP-osoite: 1.2.3.4
TCP-portti: 104

CT Image Storage SOP Class SCU
AE Title: TESTMOD

IP-osoite: 2.3.4.5
TCP-portti: 104

CT Image Storage SOP Class SCP
AE Title: PAKSI



Association Negotiation

- Ennen DICOM-palvelun toimintojen suorittamista tapahtuva yhteyden avaaminen
- SCU ja SCP roolit
- Muistuttaa puhelun aloittamista
- Avaamisen yhteydessä neuvotellaan palvelun sisältö ja formaatti
- ”Jos DICOM-viestinnässä on ongelmia, kyseessä on lähes aina Association Negotiation”

Association Negotiation

- Three key parameters conveyed in the A-ASSOCIATE Service are the *Application Context*, *Presentation Context*, and the *User Information Items*.
- Each Abstract Syntax shall be identified by an Abstract Syntax Name in the form of a UID. DICOM AEs use the Abstract Syntax Name to identify and negotiate which SOP Classes and related options are supported on a specific Association. Abstract Syntax Names shall be defined in the Service Class Definitions specified in PS3.4. Each Abstract Syntax Name defined shall have a value of either
 - a Service-Object Pair Class UID
 - a Meta Service-Object Pair Group UID
- A Presentation Context consists of three components, a Presentation Context ID, an Abstract Syntax Name, and a list of one or more Transfer Syntax Names.
- Transfer Syntaxes define a set of encoding rules used to unambiguously represent one or more Abstract Syntaxes. It allows communicating DICOM AEs to negotiate the encoding techniques they are able to support (e.g., byte ordering, compression, etc.).

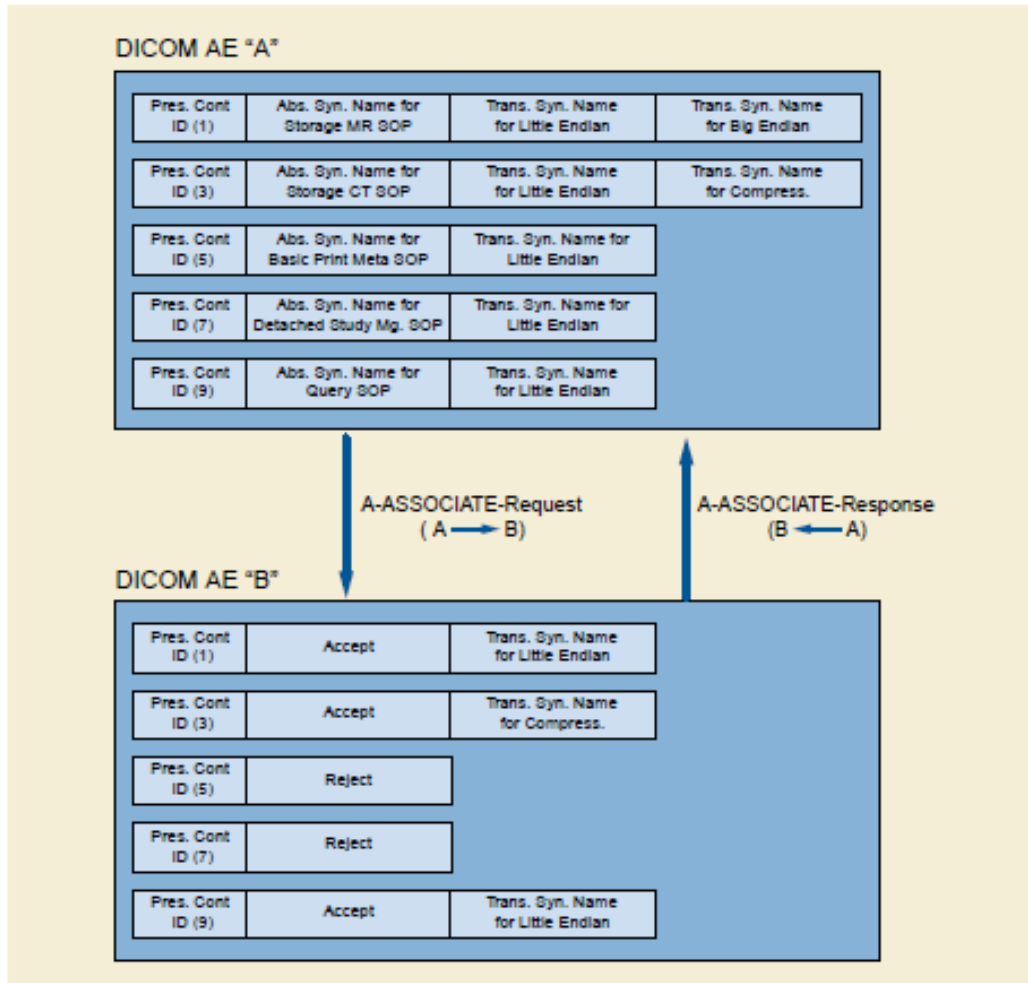
Association Application Context

- Aina sama
- DICOM = 1.2.840.10008.3.1.1.1

Association Presentation Context

- A Presentation Context consists of three components, a *Presentation Context ID*, an *Abstract Syntax Name*, and a list of one or more *Transfer Syntax Names*.
- Abstract Syntax Name = SOP Class UID

Association Presentation Context



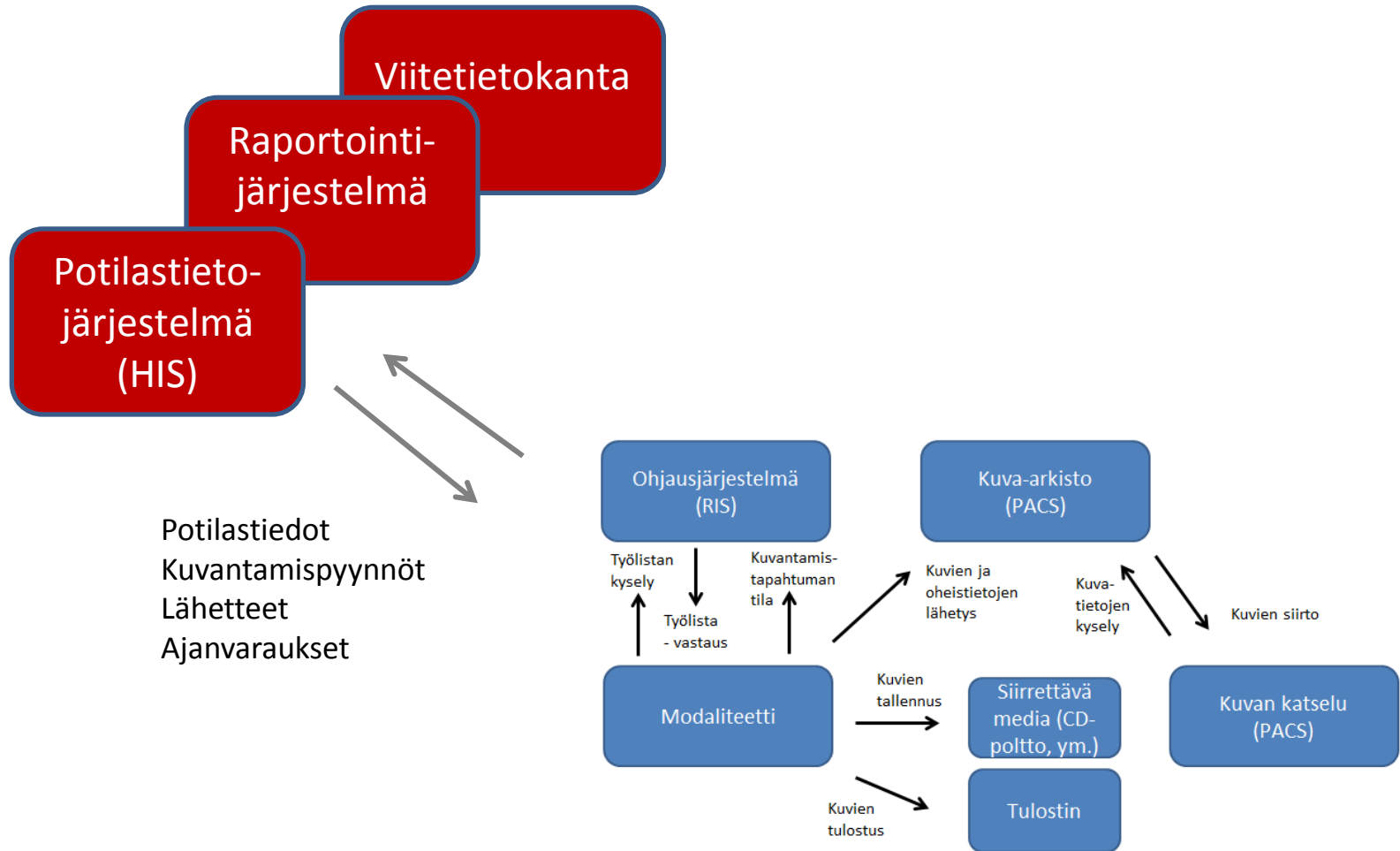
Association User Information

- Maximum Length Application PDU Notification
- Implementation Identification Notification
 - Implementation Class UID
 - Implementation Version Name (optional)
- Asynchronous Operations (optional)
- SCP/SCU Role Selection Negotiation (optional)
- Service-Object Pair (SOP) Class Extended Negotiation (optional)
- Service-Object Pair (SOP) Class Common Extended Negotiation (optional)
- User Identity Negotiation (optional)

Part 2 – PS3.2

- DICOM Conformance Statement
- DICOM-toteutuksen kuvaus
- Pakollinen dokumentti DICOM-sovelluksille
- Yhteensopivuuden edellytykset
- Yhteensopivuuden tae?

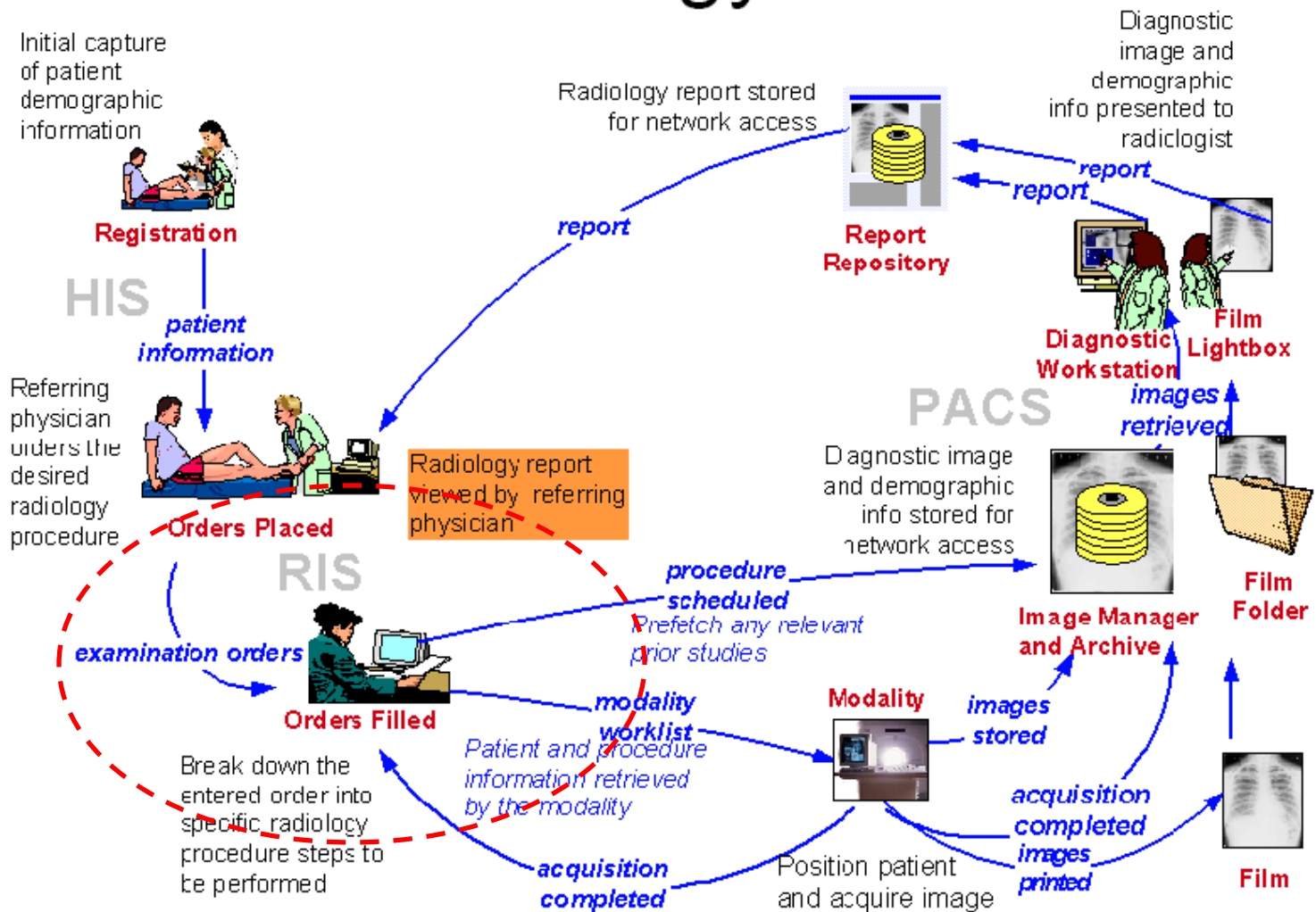
Tiedonsiirrot muihin järjestelmiin

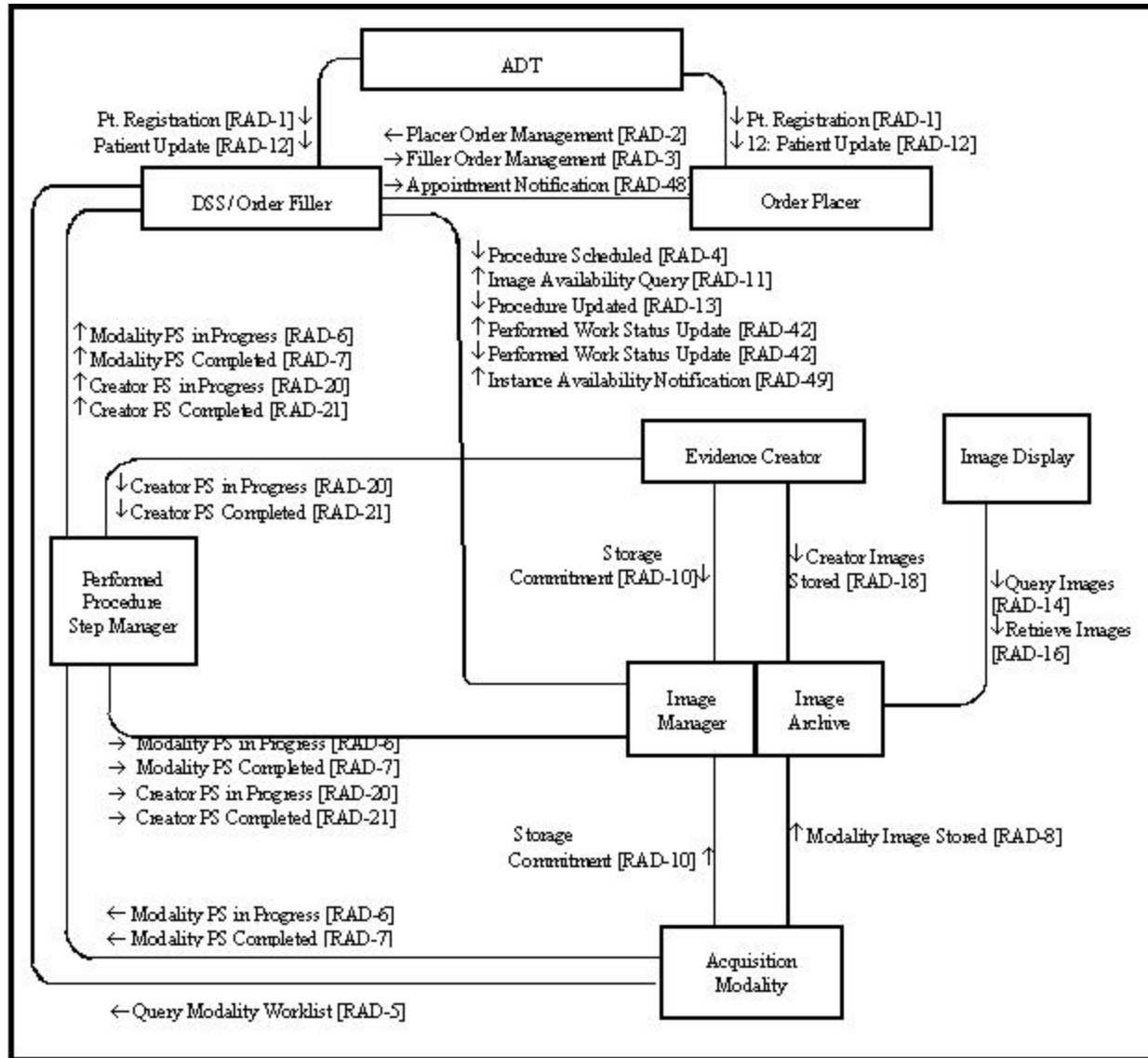


HL7

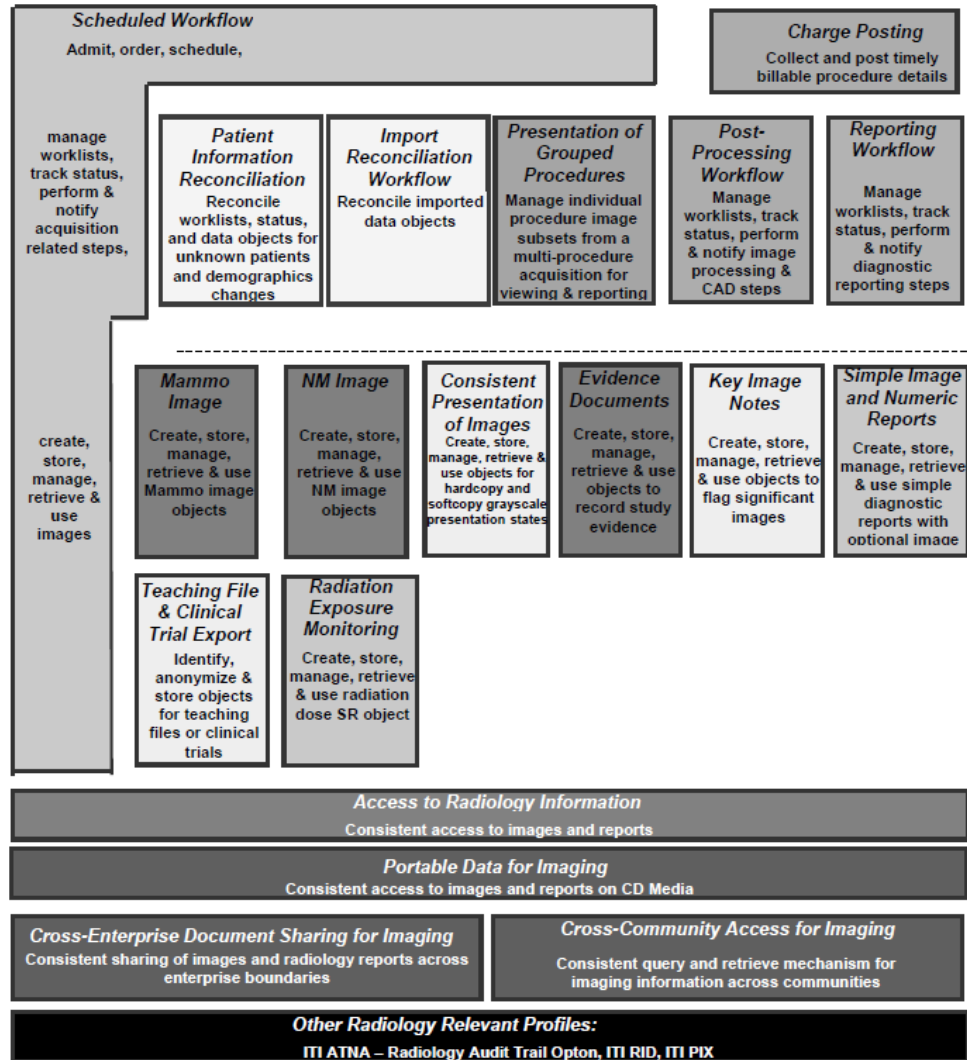
- Terveystieteiden järjestelmien väliseen tiedonsiirtoon tarkoitettu kansainvälinen standardi
- Ei kuvien siirtoon
- Keskittyy määrittelemään tiedon sisällön
- Versioiden 2.x ja 3 välillä merkittävä ero
- CDA (Clinical Document Architecture) perustuu HL7 versioon 3

The Radiology Workflow



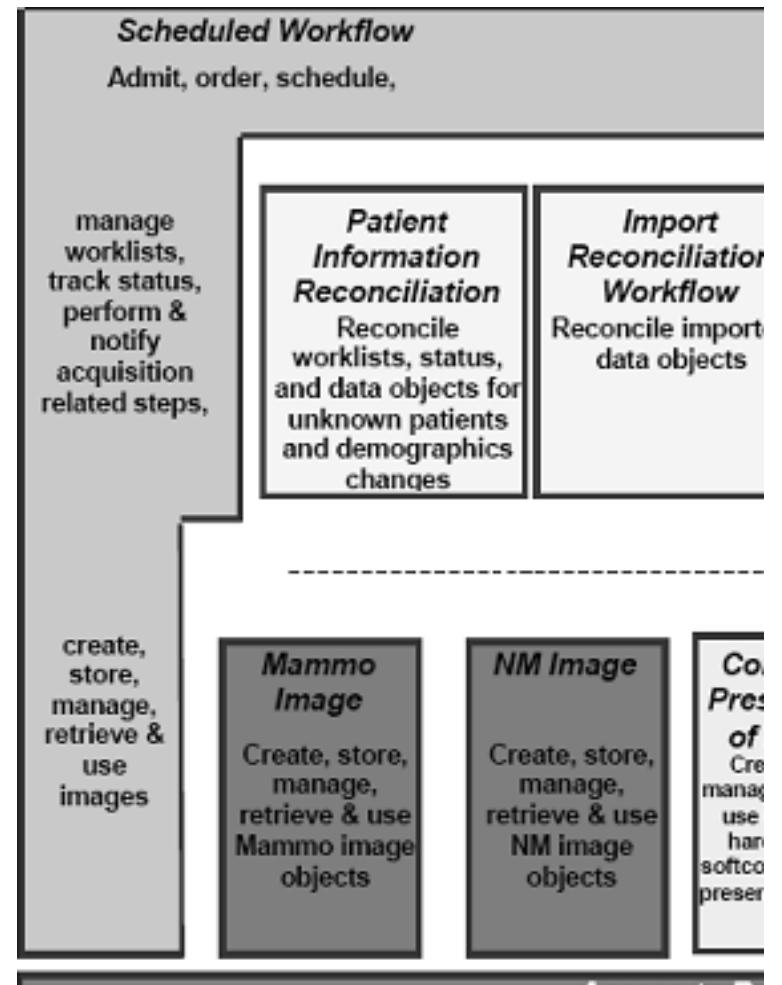


IHE-tarjonta: Integration Profile



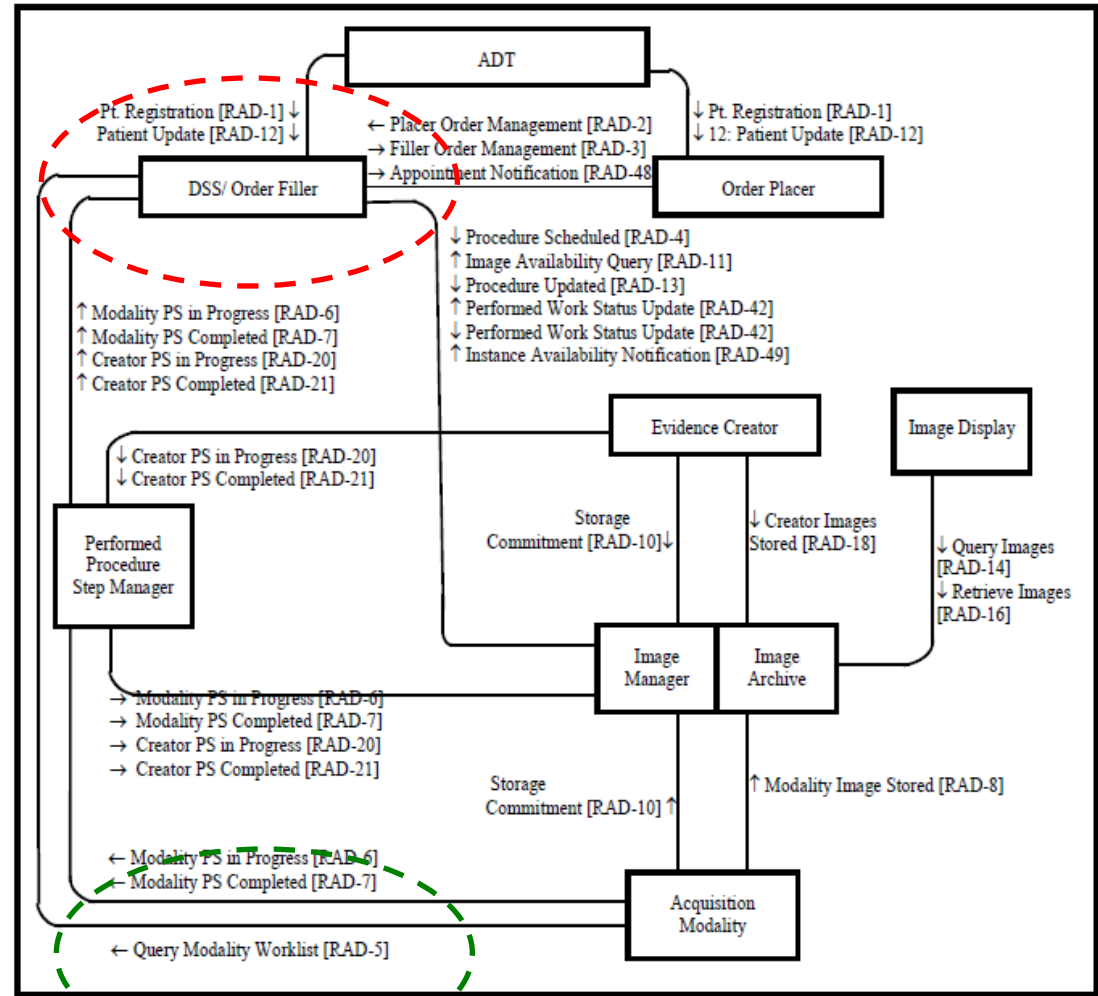
IHE Integration Profile - SWF

- Kuvantamisosaston työnkulku kuvataan IHE:n *Scheduled Workflow (SWF)* –profiilissa
- Profiilit määritelty IHE:n *Technical Framework (TF)* -dokumenteissa



IHE TF - Scheduled Workflow

- Ei termejä HIS, RIS, PACS
- IHE:n *Actoreilla* on määritelty toiminnallisuus, *Transactions*
- Toiminnallisuus määritelty TF:ssä

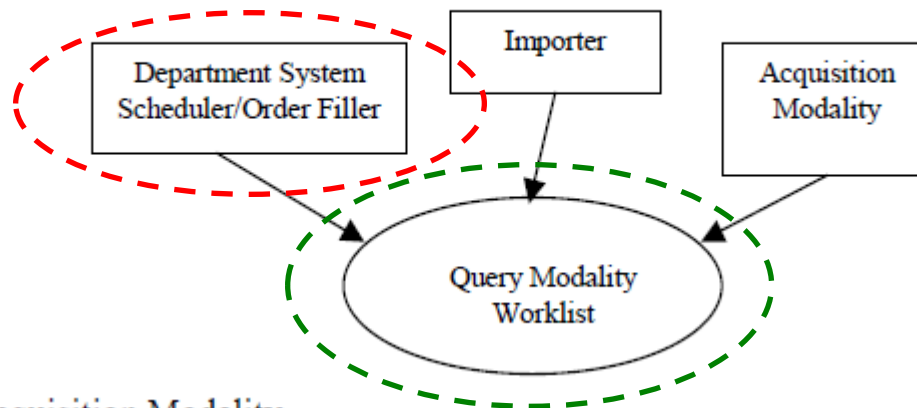


IHE TF - Esimerkki

Actors	Transactions	Optionality	Vol. 2/3 Section
ADT Patient Registration	Patient Registration [RAD-1]	R	4.1
	Patient Update [RAD-12]	R	4.12
Order Placer	Patient Registration [RAD-1]	R	4.1
	Patient Update [RAD-12]	R	4.12
	Placer Order Management [RAD-2]	R	4.2
	Filler Order Management [RAD-3]	R	4.3
	Appointment Notification [RAD-48]	O	4.48
Department System Scheduler/ Order Filler	Patient Registration [RAD-1]	R	4.1
	Patient Update [RAD-12]	R	4.12
	Placer Order Management [RAD-2]	R	4.2
	Filler Order Management [RAD-3]	R	4.3
	Procedure Scheduled [RAD-4]	R	4.4
	Query Modality Worklist [RAD-5]	R	4.5
	Modality Procedure Step In Progress [RAD-6]	R	4.6
	Modality Procedure Step Completed [RAD-7]	R	4.7
	Images Availability Query [RAD-11]	O	4.11
	Procedure Updated [RAD-13]	R	4.13
	Creator Procedure Step in Progress [RAD-20]	R	4.20
	Creator Procedure Step Completed [RAD-21]	R	4.21
	Performed Work Status Update [RAD-42] (as the Receiver, see Note 1))	O	4.42
	Appointment Notification [RAD-48]	O	4.48
	Instance Availability Notification [RAD-49]	O	4.49

IHE TF - Esimerkki

4.5.2 Use Case Roles



Actor: Acquisition Modality

Role: Responsible for requesting and receiving data from the Department System Scheduler/Order Filler.

Actor: Importer

Role: Responsible for requesting and receiving data from the Department System Scheduler/Order Filler.

Actor: Department System Scheduler/Order Filler

Role: Responsible for accepting requests for MWL from an acquisition modality, performing the query, and sending the response back.

4.5.3 Referenced Standards

DICOM 2011 PS 3.4: Modality Worklist SOP Class

IHE TF - Esimerkki

Attribute Name	Tag	Query Keys Matching		Query Keys Return	
		SCU	SCP	SCU	SCP
Accession Number	(0008,0050)	R+ (Note 1)	R+ (Note 1)	R+	R+ [IHE-3]
Requesting Physician	(0032,1032)	O	O	O	R
Requesting Service	(0032,1033)	O	O	O	O
Referring Physician's Name	(0008,0090)	O	O	R+	R
Visit Identification					
Admission ID	(0038,00100	O	O	O	R

(IHE-3): A value (Non empty field) shall be returned in the Accession Number attribute if the field was requested by the MWL SCU.

IHE TF - Esimerkki

Table 4.8-1: Suggested Image SOP Classes

SOP Class UID	SOP Class Name
1.2.840.10008.5.1.4.1.1.1	Computed Radiography Image Storage
1.2.840.10008.5.1.4.1.1.2	CT Image Storage
1.2.840.10008.5.1.4.1.1.4	MR Image Storage
1.2.840.10008.5.1.4.1.1.20	Nuclear Medicine Image Storage
1.2.840.10008.5.1.4.1.1.128	Positron Emission Tomography Image Storage
1.2.840.10008.5.1.4.1.1.481.1	RT Image Storage
1.2.840.10008.5.1.4.1.1.7	Secondary Capture Image Storage
1.2.840.10008.5.1.4.1.1.6.1	Ultrasound Image Storage
1.2.840.10008.5.1.4.1.1.3.1	Ultrasound Multi-frame Image Storage
1.2.840.10008.5.1.4.1.1.12.1	X-Ray Angiographic Image Storage
1.2.840.10008.5.1.4.1.1.12.2	X-Ray Radiofluoroscopic Image Storage
1.2.840.10008.5.1.4.1.1.1.1	Digital X-Ray Image Storage – For Presentation
1.2.840.10008.5.1.4.1.1.1.1.1	Digital X-Ray Image Storage – For Processing
1.2.840.10008.5.1.4.1.1.1.2	Digital Mammography Image Storage – For Presentation
1.2.840.10008.5.1.4.1.1.1.2.1	Digital Mammography Image Storage – For Processing
1.2.840.10008.5.1.4.1.1.1.3	Digital Intra-oral X-Ray Image Storage – For Presentation
1.2.840.10008.5.1.4.1.1.1.3.1	Digital Intra-oral X-Ray Image Storage – For Processing
1.2.840.10008.5.1.4.1.1.77.1.1	VL Endoscopic Image Storage
1.2.840.10008.5.1.4.1.1.77.1.2	VL Microscopic Image Storage
1.2.840.10008.5.1.4.1.1.77.1.3	VL Slide-Coordinates Microscopic Image Storage
1.2.840.10008.5.1.4.1.1.77.1.4	VL Photographic Image Storage

Scheduled Workflow ominaisuuksia

- Vakioitu rajapinta potilastietojärjestelmiin, kuvantamislaitteille ja kuva-arkistoihin
- Tuki potilashallinnon sanomille, kuten henkilötietomuutoksille ja osastosiirroille
- MPPS-palvelu: mahdollistaa tiedon vastaanottamisen kuvantamislaitteilta
- HL7- ja DICOM-standardien linkittäminen
- Mahdollisuus hyödyntää rakenteista kuvantamispyyntöä

Kuvantamispyyntö-esimerkki

Order :
R/O Pulmonary Embolism

Lähettävä lääkäri tilaa kuvantamis-
osastolta kuvantamistutkimuksen

Yksi tilaus voidaan
jakaa osaston
sisällä useaksi
lausuvien
lääkärien
kokonaisuuksiksi

Requested Procedure : *Chest X-ray*

Scheduled Procedure Step :
Chest PA and Lateral

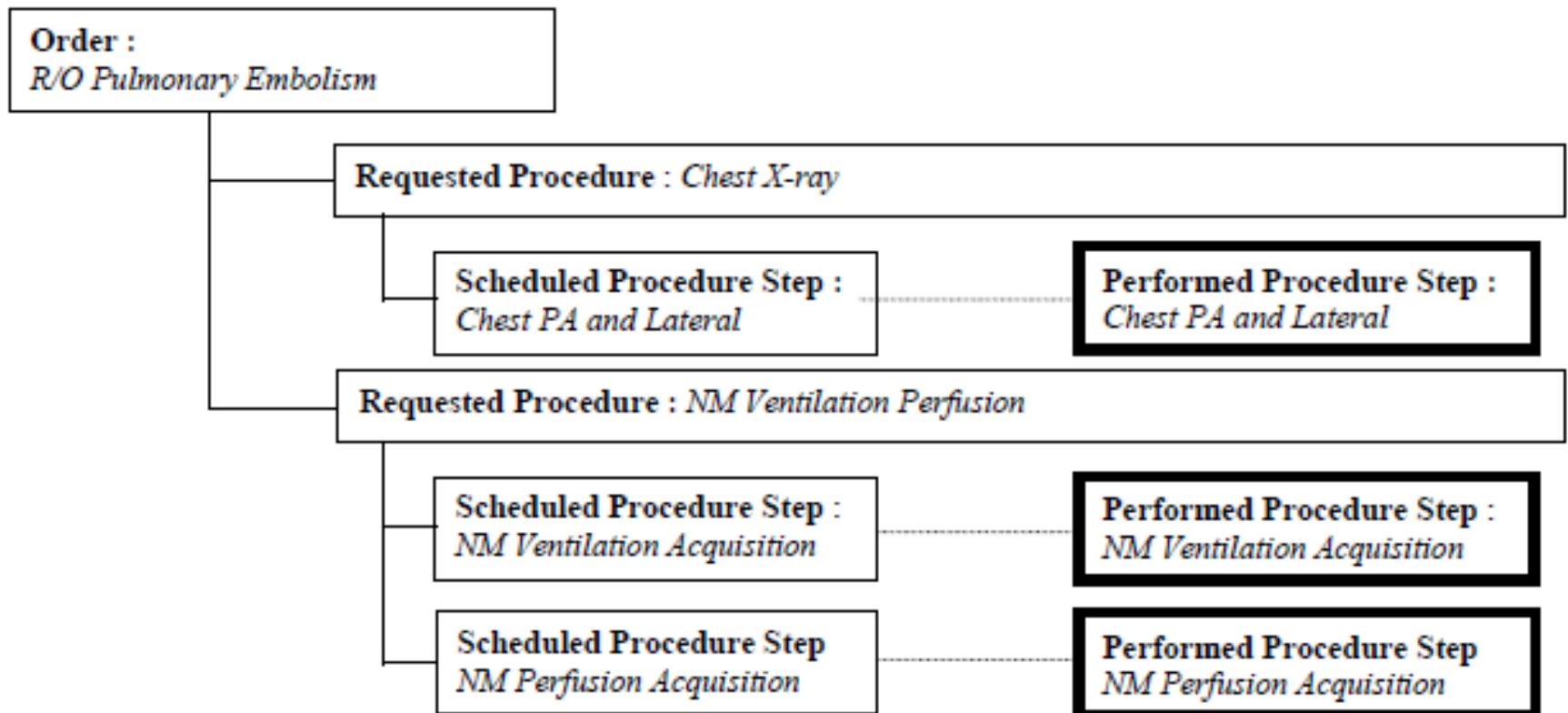
Requested Procedure : *NM Ventilation Perfusion*

Scheduled Procedure Step :
NM Ventilation Acquisition

Scheduled Procedure Step
NM Perfusion Acquisition

Yksi lausuttava kokonaisuus
voi merkitä useaa
kuvantamislaitteiden työlistöille
vietävää **hoitajan** suorittamaa
tutkimusta

Kuvantamispyyntö-esimerkki



Kuvantamispyyntö-esimerkki

Order :
Chest X-ray

Lähettävä lääkäri tilaa kuvantamis-
osastolta kuvantamistutkimuksen

Tilaus sisältää
yhdessä **lausuttavan**
kokonaisuuden

Requested Procedure : *Chest X-ray*

Lausuttava kokonaisuus
sisältää yhden
kuvantamislaitteiden työlistoille
vietävän tutkimuksen

Scheduled Procedure Step :
Chest PA and Lateral

Johtopäätöksiä

- IHE tarjoaa valmistajille ja käyttäjille mahdollisuuden yhdenmukaiseen kuvantamisen työnkulun käsittelyyn
 - Suuri määrä valmista määrittelytyötä
 - Soveltuvuus omaan käyttöön tarkistettava
- Scheduled Workflow –profiili on todettu Commitissa sopivaksi perustaksi RIS:n jatkokehitykselle
- IHE on erinomainen apu, ei ratkaisu kaikkeen

Pohdintaa

- Onko toimittajariippumaton kuvantamisen ympäristö mahdollista saavuttaa?



Kiitos!

juha.jarvinen@commit.fi