IHE MultiCountry WorkGroup (MCWG)

MCWG Recommendations on Imaging Study Manifest for sharing imaging information at the national/regional level

Develop context of use of manifests, explain the choice of DICOM KOS, refine the content of imaging study manifest in areas such as patient IDs, accession numbers, additional content in study/series descriptions

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For use by MCWG Member Countries

Outline

1. **Need, Role and usage for an Imaging Study Manifest. Content overview.**
2. **Choice of standards for the Imaging Study Manifest.**
3. **Workflow variants in which the Imaging Study Manifest is used**
4. **Detailed recommendations for Imaging Study Manifest content related to :**
    - A. Patient Identification
    - B. Study
    - C. Workflow/identifiers
    - D. Series and Instances
5. **Selection of Significant/important/key images**
6. **Management of End-points (WADO URL and IID URL)**
7. **Open Issues**

Need, role and usage for an Imaging Study Manifest, Content overview of Standard for Imaging Manifest.

Need and Role of a Manifest in the image sharing Workflow

Concept defined by the proposed *eHN Guideline on the Sharing of imaging Study and Imaging Reports:*

> *A document listing the key information about the content of an imaging study (1-to-1 relationship between image manifest and study), It* ***acts as a summary for the actual imaging study*** *that is large (typically megabyte or gigabyte size) and complex (hundreds of data elements).* ***It includes location pointers to its image content*** *and organises this information according to the well-established model of an imaging study made of one or more series and each series made of instances or images.*

Foundation element for an imaging information sharing workflow:

1) To share one imaging study, one split carefully :
    i. making the imaging study "available" , i.e. it can be accessed from a repository where it has been placed to be available,
    ii. from providing key information (often called metadata) to offer the means to decide if the imaging study is of interest or not by any potential "consumer".
2) Access to the imaging study from a repository needs the definition of a "pointer". Because an imaging study is large one needs to have this pointer capable to access to a subset of interest. A structure is needed. Series and Instances (of images) fits this objective.
3) The key information or metadata associated with a manifest has been *analyzed in the companion recommendations on Metadata and Linkages.*
4) The imaging study manifests for all shared imaging studies need to be queryable. They can be centralized in a single repository of manifests or distributed in several repositories accessible through a federated query. *See recommendations on standards and profiles positioning*

Usage of a Manifest in the sharing Workflow

An imaging information sharing workflow – Requester driven image access:

1) Publish the manifest associated to each imaging study and associated imaging reports for sharing;
    i. **Provide key information (or metadata) as an imaging study manifest**.
    ii. Make the imaging study "available" on permanently available repository and **place the structured pointer within the imaging manifest**
2) Search for relevant imaging studies, in one of the following ways:
    i. Broad Search; **Issue a query for manifests** matching specific metadata elements (level 1 metadata elements)
    ii. Narrow search: **Issue a query for manifests** matching one or more identifiers (Level 1 metadata elements)
3) Analyses the responses from the search described in 2). **This is a list of manifests** where each item bears the study manifest metadata (level 2a metadata), from which one or more manifests may be selected for retrieval of the full manifest information (level 2b selection), including the structured pointer from which to access the images of the study.
4) **If one such manifest is selected**, using the structured pointer, requests access to the images of the study, either the entire set of images in the study, or a selected series (or possibly selected images ?).
5) *Display or process those images as desired by the requester (own viewer, image processing applications, etc.).* Specific information in the manifest may facilitate such processing (e.g. image number, number of frames).

An imaging information sharing workflow – Source enable imaging study access:

1) Starting form the Imaging Report, use an embedded link specific to one imaging study to launch a viewer at the location where the imaging study is stored. Note that the access to a specific imaging study **does not have to use the imaging manifest**.

Overview of Recommended Transactions between imaging information consuming & source systems

Summary slide from MCWG Recommendation on Standards and Profile Positioning

2-Filtering and returned Report and Studies Metadata (generic / imaging specific)

3-Imaging Report Content Repre-sentation

4-Imaging Study (Manifest) Content Repre-sentation

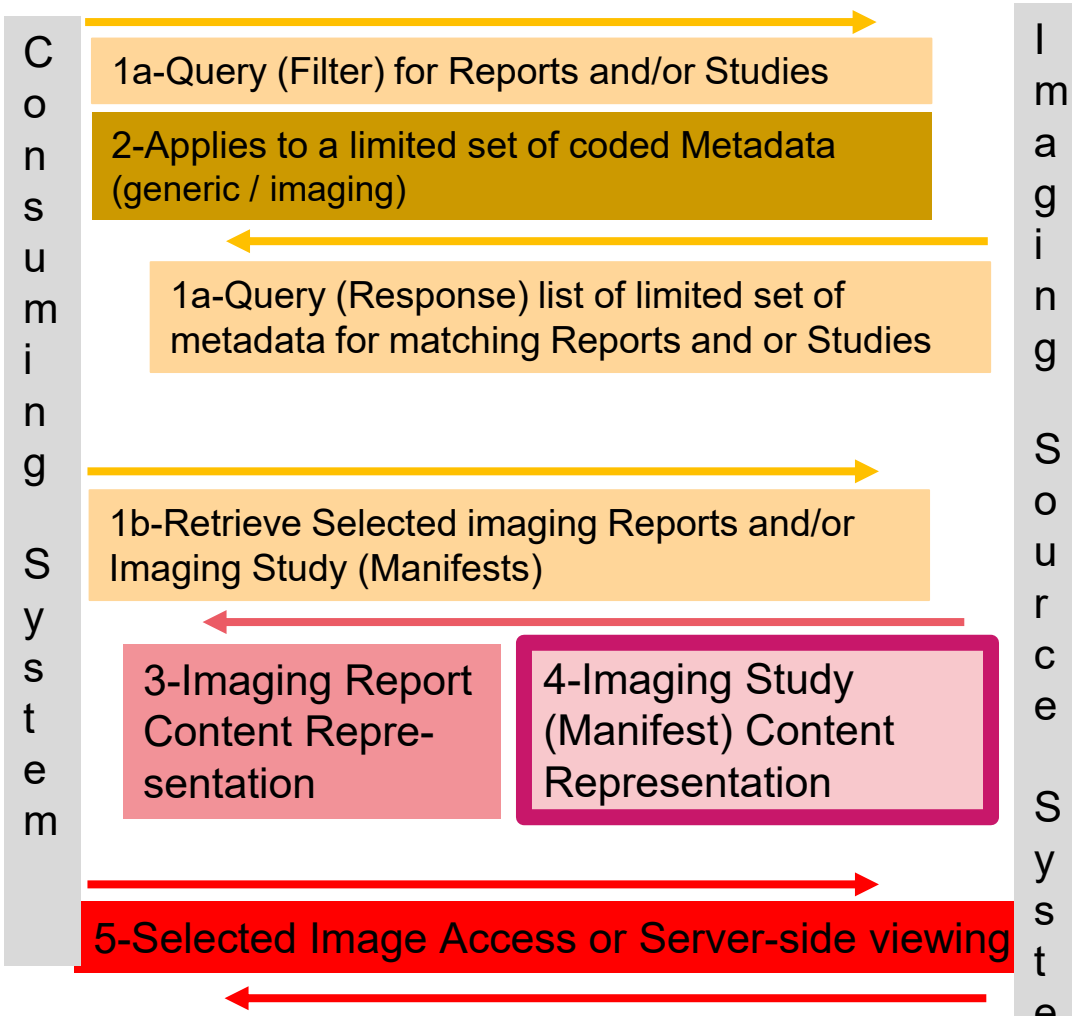
5-Image Access or Server-side viewing

1-Query and Retrieve Imaging Reports and/or Imaging Studies (Manifest)

Patient and HP Identification and Authentification

Security and Privacy rules establishing trust among exchanging systems

This "building block "structure was developed by the European eHealth Network Task Force on Imaging

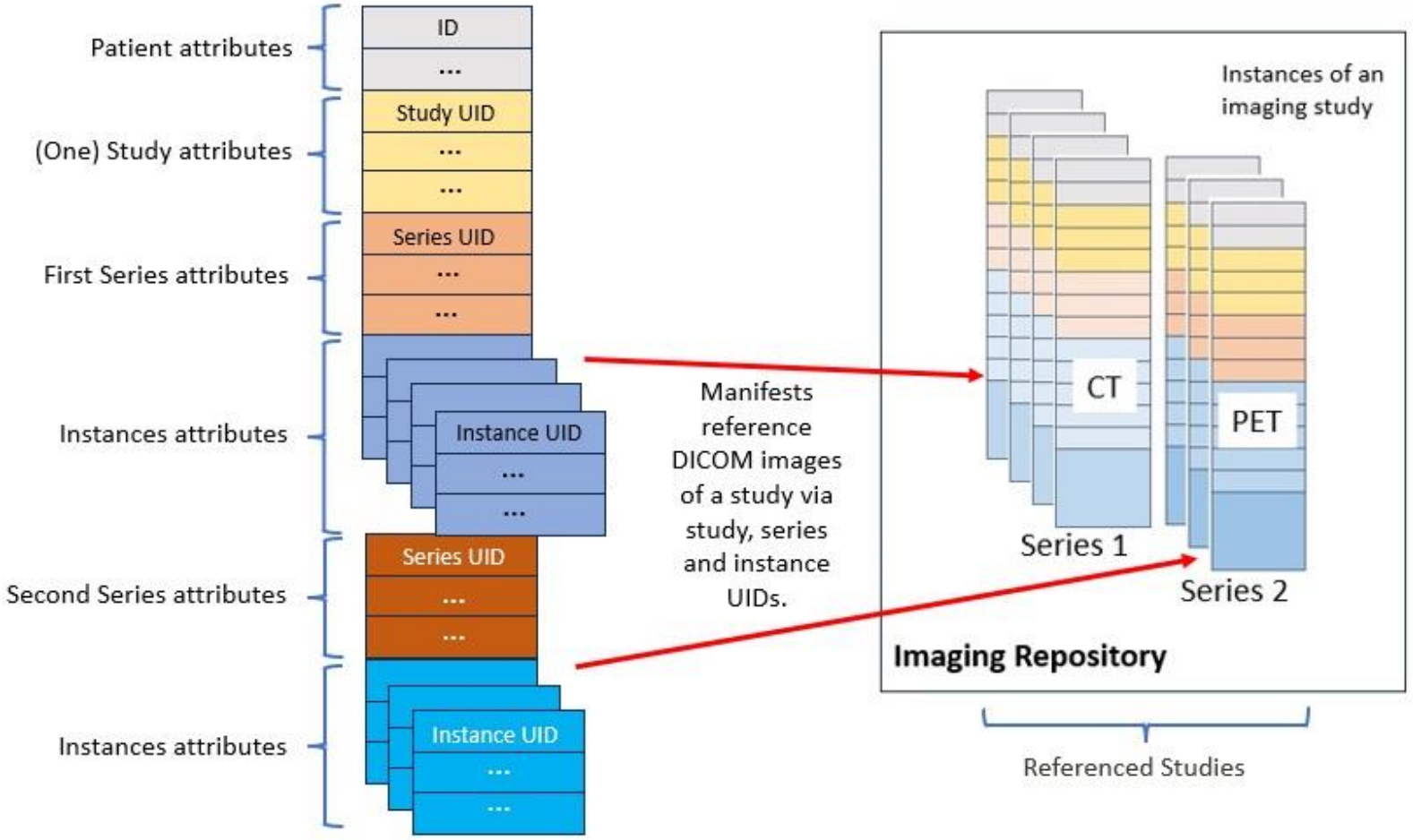


Transactions based on the Building Blocks to Access Imaging Reports and Imaging Studies

Overview of Imaging Manifest structure for Sharing of Imaging Information

In a document sharing context, one Manifest references a single DICOM Study, meaning a 1 to 1 relationship between them.

Object Linkage Attributes for a Sharing Manifest (other attributes … not shown)



Choice of Standard for the Imaging Study Manifest

Choice of Standard– State of the art & Recommendation

- **Two candidates**
  1. DICOM Key Object Selection.
  2. FHIR Document bundle including the Imaging Studies Resource

- **Comparison Overview for the national &regional imaging information sharing Use Case**

Criteria \ *Standard*	***DICOM KOS***	***FHIR Document*** (Imaging Study + Patient + Other Resources)
Content Match	90+% covered - Missing a few standard attributes	90+% - Missing a few standard attributes
Alignment with Imaging Software	Strong Alignment: for consumption. 80% created from Imaging Data	Weak Alignment: for consumption. Only 20% created from “RIS” Information
Breadth of Implementation or adoption	Very wide – 84 vendors passed Connectathon testing of KOS Manifests (XDS-I). Over 100 sharing environments (Hospital, Regional, national) in Europe	Very limited – few pilots
Overall Functional Match	**Better match for use case**	**Less aligned and less mature for use case**

Choice of Standard – Details - Content Match

- **DICOM KOS format is 'easier' for parsing elementary data necessary for retrieval of actual imaging data. FHIR resources requires 'harder' parsing efforts, due to the info being within multiple resources embedded in the FHIR Document.**
  In DICOM KOS, most info available outside the more complicated DICOM SR sequences:
  - Technical: StudyUID, endpointURL
  - Workflow: PatientID, AccessionNumber, StudyDescription

- **FHIR ImagingStudy resource supports IID** (Invoke Image Display) **endpoint (**URL of server-side viewer**) but this is not critical in Manifest, as IID endpoint is mainly needed in the imaging report.**

- **FHIR Imaging Study supports explicitly multiple endpoint transaction types:**
  - But not used, as DICOM WADO-RS is the only transaction recommended by MCWG
- **DICOM and FHIR support a "Retrieve Location OID"** (not associated to any transaction type)**.**
- **Transfer syntax of KOS as a Part 10 Document is always LittleEndian Explicit VR. In FHIR, document encoding might be either in JSON or XML.**

Choice of Standard – Details - Content Analysis

Value	Part of KOS	Part of ImagingStudy
STUDY		
Retrieve URL	No at the study level (Placed at series level to support different series stored in different locations)	Yes (protocol explicit)
IID endpoint	No (But it is not needed as IID URL needs to be placed in the report)	Yes
SERIES		
BodySite & laterality	No (but standard tag (0018,0015) may be added)	Yes
Patient position	No (but standard tag (0018,5100) may be added)	Yes
Retrieve URL	Yes (protocol implicit – Always WADO-RS)	Yes (protocol explicit)
RetrieveLocationUID	Yes (protocol implicit)	Yes (explicit)
INSTANCE		
Referenced Frame Number	Yes	No (FHIR extension may be added.)
Number of Frames	No (but standard tag (0028,0008) may be added)	No (FHIR extension may be added.)
InstanceNumber	No (but standard tag (0020,0013) may be added)	Yes

Choice of Standard – Imaging Software Alignment & Adoption

1. FHIR Document including the Imaging Studies Resource
   - Only 20% of information in manifest originates from the RIS (HL7 V2, CDA, FHIR)
   - Consuming systems of manifest are mainly imaging software already implementing DICOM data sets not FHIR resources
   - Very limited adoption of FHIR on Imaging systems (no critical need except for patient identification resources) – Only a few pilots

2. DICOM Key Object Selection.
   - 80% of information of manifest originates from DICOM images
   - Very wide adoption – 84 vendors tested at formal IHE Connectathons between 2010 and 2023, Imaging Document Sources or Consumers of KOS Manifests (XDS-I).
   - Well over 100 sharing environments (Hospital, Regional, national) are in service today in Europe

Main Workflow and
Variants in which Imaging Study Manifest is used

Transactions to support exchanges and use of Imaging Manifests

1. **These transactions and the associated standards and profiles have been covered by the MCWG Recommendations on Standards and Profiles Positioning (See next slide).**

2. **These recommendations offer different alternatives depending on three deployment architectures:**
    1. A Country (or a single stand-alone Region) with a central document registry both with distributed PACS and or VNAs
    2. A Country with federated regional document registries and regions with distributed PACS and or VNAs
    3. A Country (or region) with a central document registry and a central VNA

    Note: Document Repositories whether centralized or distributed are possible in all above architectures.

3. **The same Imaging Study Manifest (highlighted building block 4) is used in the three deployment architectures.** Transactions recommended are from the following profiles (It is OK to chose more than one within a deployment architecture):
    - A. XDS-I (SOAP-Based) + DICOM WADO-RS
    - B. XCA-I (SOAP based) + DICOM WADO-RS
    - C. MHD (FHIR document reference resource) + DICOM WADO-RS

    Note: IHE Radiology has approved in January 2024 the addition of WADO-RS retrieve (RAD-107) as an option to XDS-I.

Building Blocks with Candidate Standards and profiles depending on deployment architecture

Slide from MCWG Recommendation on Standards and Profile Positioning

Consuming System

Imaging Source System

	A Country/Region with a central document registry & distributed PACS/VNAs	Country with federated Regions/document registries & distributed PACS/VNAs	Country/Region with a central document registry and central VNA
1-Query (Filter) for Reports and/or Studies	XDS-I Query Request and/or MHD (FHIR) List Doc Ref	XCA-I Query Request and/or MHD (FHIR) List Doc Ref	XDS-I Query Request and/or MHD (FHIR) List Doc Ref.
2-Applies to a limited set of coded Metadata (generic / imaging)	Metadata (same as XDS-I)	Metadata (same as XCA-I)	Metadata (same as XDS-I)
1-Query (Response) list of limited set of metadata for matching Reports and or Studies	XDS-I Query Response and/or MHD (FHIR) List Doc Reference response	XCA-I Query Response and/or MHD (FHIR) List Doc Reference response	XDS-I Query Response and/or MHD (FHIR) List Doc Reference response
1-Retrieve Selected imaging Reports and/or Imaging Study (Manifests)	XDS-I Retrieve Document and/or MHD (FHIR) Get Doc	XCA-I Retrieve Document and/or MHD (FHIR) Get Doc	XDS-I Retrieve Document and/or MHD (FHIR) Get Doc
3-Imaging Report Content Repre-sentation / 4-Imaging Study (Manifest) Content Representation	CDA+PDF or FHIR+PDF for unstructured report. FHIR Document for structured Report. DICOM KOS manifest for imaging studies.	CDA+PDF or FHIR+PDF for unstructured report. FHIR Document for structured Report. DICOM KOS manifest for imaging studies.	CDA+PDF or FHIR+PDF for unstructured report. FHIR Document for structured Report. DICOM KOS manifest for imaging studies.
5-Selected Image Access or Server-side viewing	DICOM WADO-RS IHE IID (URL SS viewing)	DICOM WADO-RS IHE IID (URL SS viewing)	DICOM WADO-RS IHE IID (URL SS viewing)

Manifest and Imaging Report publication with 2 possible variants

See *MCWG Recommendation on Metadata and Linkages* for identification of the two « publication variants »

Publication Variant A

1) No publication occurs until a result is available and validated.

2) When a report is available and validated, the manifest referencing all objects available at that point (acquisition and additional objects) is published.

3) When an imaging report is available and validated, it is also published as a separate (non-manifest) document.

4) Can be followed by a "manifest publication update[1]" if additional objects are added or removed from the study after the report based on the exam was validated or if the report is updated.

Note 1: Manifest publication update examples (image processing for surgical planning, CT dose objects generation, de-archiving)

Publication Variant B

1) The imaging study manifest is published as soon as the study acquisition is completed (local event).

2) The manifest may be published (updated) multiple times (local event).

3) When an imaging report is available and validated, it is also published as a separate (non-manifest) document.

4) Can be followed by a "manifest publication update[1]" if additional objects are added or removed from the study after the report based on the exam was validated or if the report is updated.

Image Access Transactions using Manifest Information

See MCWG Recommendation on Standards and Profile Positioning

Modes of image display	1. Display without persistence by a requester	2. Display with persistence by requester
Use case	Display for clinical consultation or display of prior exams before interpretation	Required for comparison during interpretation, post-processing by imaging specialist. Persistence may be short-term or longer term, e.g. archiving of copies.
Transaction	http rendered images to a regular browser on requester system. (Rendering viewer may be on image source or on a proxy).	WADO-RS with a study/series/instance retrieval.
Comment	Imaging Manifest is not needed, Only an Image Invoke Display link (IHE IID Profile) needs to be included within imaging reports.	Imaging Manifest is useful to requester to anticipate display needs. Image data coercion necessary for ingestion by the receiving PACS/VNA system (identifier localization, terminology mapping ....)

Key requirements on SOP Classes retrieved by WADO-RS

- DICOM supports close to 200 different SOP Classes used to exchange specific types of DICOM instances such as images, waveforms and a variety of other objects generally related to imaging in medicine.
- The Spreadsheet included below provides a list of these SOP Classes and classifies them in four broad color-coded categories (white, yellow, pink, brown).

Microsoft Excel Worksheet

Level of usage by various imaging specialties
Widely supported and used by main imaging specialties such as Radiology/Cardiology/Dentistry/Surgery
Rarely supported and used by main imaging specialties such as Radiology/Cardiology/Dentistry/Surgery
Widely supported and used by specific imaging specialties such as Endoscopy, Radiation Therapy, Ophthalmology, Endoscopy, ECG, EEG
Rarely supported and used by specific imaging specialties such as Radiation Therapy, Ophthalmology, EEG, 3D Printing, Pathology Imaging

MCWG recommends that:

1. Sources of imaging manifests (PACS/VNA) that produce DICOM SOP classes in the white or yellow categories support the sharing of these instances.
2. Consumers of imaging manifests support the consumption (display, storage or other) process DICOM SOP Classes in the white or yellow categories.
3. Sources that acquire pink or brown DICOM SOP Classes create manifest and respond to consumers interested to retrieve them.
4. Consumers that access and process Manifests referencing pink or brown SOP Classes they do not process, should present the Manifest content to the user and gracefully decline to retrieve these instances.

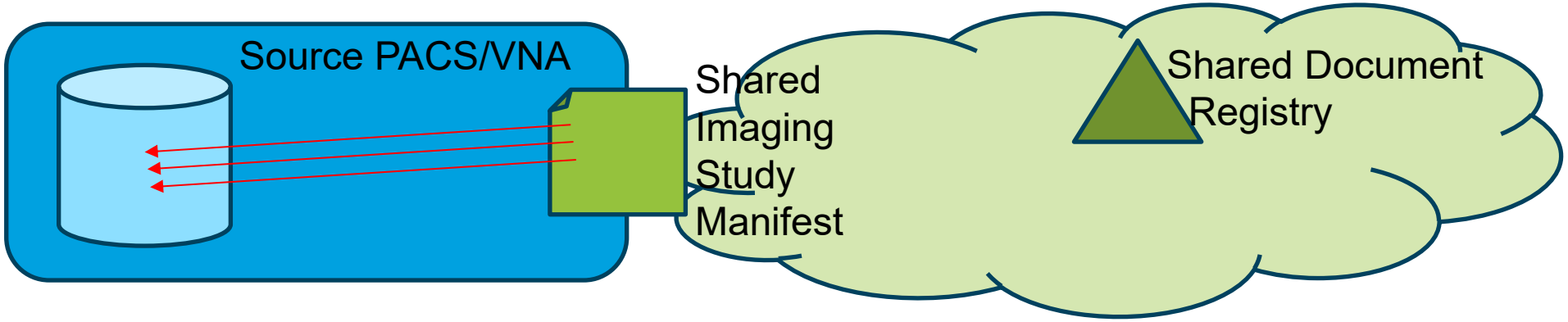
Detailed recommendations for manifest content (what needs to be added, why and how)

- Patient Identification
- Study Information
- Workflow/identifiers
- Series and Instance Information
- Overview of a KOS

DICOM KOS PatientID (0010,0020) and Manifest Metadata PatientId (context)

The DICOM PatientID (0010,0020) is a single-valued attribute that defines the primary patient identifier. The OtherPatientIDsSequence (0010,1002) contains items defining any secondary (other) patient identifiers known for the same patient. Typically, DICOM studies stored in a source PACS will use the corresponding local patient identifier as the primary identifier and the national/regional identifier, if it exists, as a secondary identifier.

In a document sharing environment that uses an image manifest (KOS) to reference a study in a source PACS/VNA, agreement is needed on which identifier to use as primary and which one as secondary in the imaging manifest itself when shared (it is not within our scope to set the patient IDs used within the source PACS/VNA if it chooses to persist shared manifests).



The creation and publication of the KOS manifest may be implemented by the Imaging Document Source in one or two separate steps.

When the creation step is separate, the KOS manifest contains the local patient identifier in (0010,0020) and may include other patient identifier values in the OtherPatientIDsSequence (0010,1002). The patient identifier used in the publication process as registration metadata will be different from the patient id in the KOS manifest, as described in the ***Appendix G: Patient Information Reconciliation for XDS-I.b (INFORMATIVE)*** in the IHE framework Volume 1x IHE RAD TF-1x Appendices, where an excerpt from section "*G.1.1 XDS Affinity Domain Assumptions*" states:

- *A Document Source is responsible for obtaining the XAD (Cross-Affinity Domain) patient ID for registering the document within the registry. The XAD patient ID that is obtained is only used for this purpose and is not used to update any patient IDs within the document. Patient IDs within the document shall remain unchanged by the registration process.*

Note: In the context of national/regional document sharing the XAD patient ID is the same as the **national/regional** identifier.

Recommendations on DICOM KOS PatientID (0010,0020) and Manifest Metadata PatientId

The MCWG recommendation for the manifest Document Source is presented in the table below for national deployments*:

Patient Identification Attributes	Referenced Study in source PACS	DICOM KOS Manifest	Manifest Metadata
PatientID (0010,0020) IssuerOfPatientID (0010,0021)	Local ID	Local ID or National ID	National ID as PatientId
OtherPatientIDsSequence (0010,1002) >PatientID (0010,0020) >IssuerOfPatientID (0010,0021)	National ID (if known)	National ID (if known at time of creation) + optionally Local ID	sourcePatientId sourcePatientInfo - PID-3

Notes:

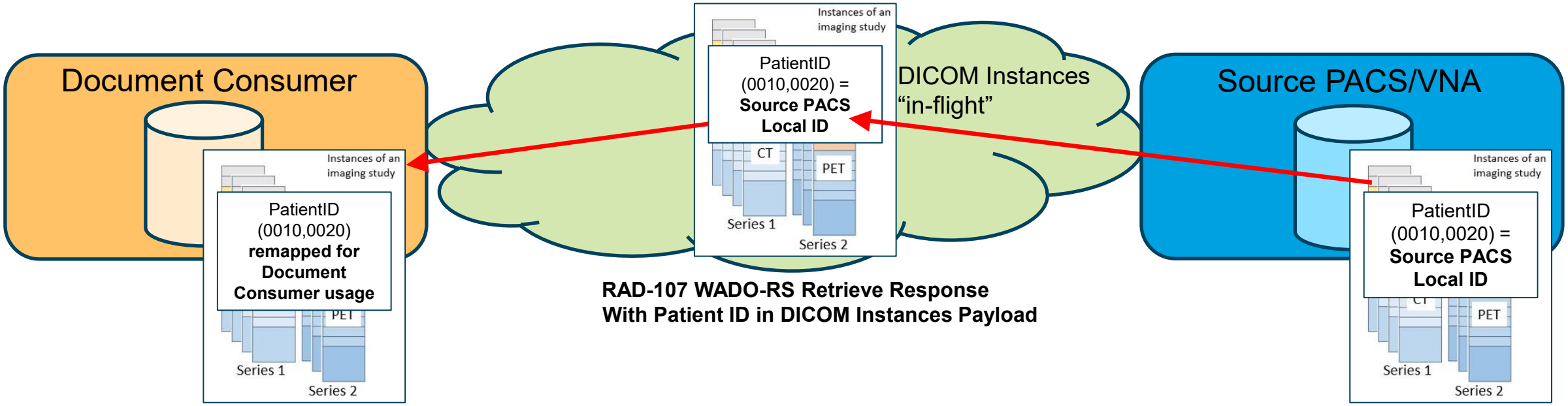
1. Primary patient identifiers are used in the ATNA Audit Trail profile – alignment by using national identifiers is recommended for the audit trail in document sharing.
2. Referenced StudyInstanceUID (0020,000D) can be copied as the KOS study instance UID. Source PACS storage for KOS as part of the source imaging study is not recommended (logging may be useful for reconfiguration and resynchronization).

* Note. *Substitute National ID by regional patient ID if the sharing is strictly regional.*

The MCWG recommendation for the manifest Document Consumer is to query using the national patient identifier registered for the manifest metadata but it shall not rely on having the same patient identifier in the manifest PatientID (0010,0020).

Document Consumer & “in-flight” Patient ID usage in DICOM Images (Informative)

The RAD-107 WADO-RS Retrieve transaction is used by a Document Consumer to retrieve a DICOM Study, Series or Instance from a source PACS/VNA based on the URL defined. This recommendation makes no requirement for the source PACS/VNA to change the Patient ID (0010,0020) value in the DICOM instances, returned as part of the payload of the WADO-RS Retrieve Response, meaning that the “in-flight” patient identification attributes are simply copies of the source PACS attributes.



RAD-107 WADO-RS Retrieve Response With Patient ID in DICOM Instances Payload

Ingestion of the retrieved DICOM instances by the Document Consumer may involve making changes to the PatientID (0010,0020) value depending on the use being made by the Document Consumer of the DICOM instances. These changes are outside the scope of this recommendation but could involve coercing the patient identification (see slide 20) into the scheme used locally by the Document Consumer. This would mean an update to the PatientID (0010,0020) value in the instances imported and persisted into the PACS/VNA, associated with the Document Consumer, as a foreign study.

Note: The National ID may already be available in the instances as an item of the OtherPatientIdsSequence (0010,1002) if known by the source PACS/VNA or be copied by the Document Consumer from the Manifest Metadata PatientId into the instances OtherPatientIdsSequence (0010,1002).

Detailed KOS Content Recommendations – Study Level Extensions

The recommended extensions at Study, Series and Instance levels enrich the KOS object with additional (descriptive) information about the referenced study. This information could be obtained by the Document Consumer from the retrieved DICOM of the study but having it readily available in the KOS object facilitates user decisions without the need access these large volume instances. The extra overhead of adding these attributes to the KOS dataset, during KOS creation (which is a one-time occurrence), is seen as worthwhile to improve KOS consumption performance (which may be a more response time critical and a many-time occurrence) – write-once, read-many (WORM) pattern.

***Study level extensions (addition of attributes) as private standard extensions to the* Key Object Document Module Attributes**

Table C.17.6-2. Key Object Document Module Attributes

Attribute Name	Tag	Attribute Description
…		
Current Requested Procedure Evidence Sequence	(0040,A375)	…
> Include Table C.17-3 "Hierarchical SOP Instance Reference Macro Attributes"		
> Modalities In Study	**(0008,0061)**	**All distinct values used for Modality (0008,0060) in the Series of the Study, if identified as an acquisition modality in CID 29 value set.**
…		

This additional study level attributes is useful to display to the health professional the acquisition modalities present in the study. **The DICOM technical modalities (GSPS, SR, etc.) not defined in the DICOM Value Set CID 29 are removed.**

Detailed Content Recommendations – Series Level Extensions

***Series level extensions as private standard extensions to the* Hierarchical SOP Instance Reference Macro Attributes**

Table C.17-3 Hierarchical SOP Instance Reference Macro Attributes

Attribute Name	Tag	Attribute Description
…		
Referenced Series Sequence	(0008,1115)	…
> Include Table C.17-3a "Hierarchical Series Reference Macro Attributes"		
> Series Date	**(0008,0021)**	**Date the Series started.**
> Series Time	**(0008,0031)**	**Time the Series started.**
> Modality	**(0008,0060)**	**Type of device, process or method that created the Instances in this Series.**
> Series Description	**(0008,103E)**	**Description of the Series.**
> Series Number	**(0020,0011)**	**A number that identifies this Series.**
…		

These additional series level attributes are useful to the Document Consumer for series selection and viewing purposes without the need to access one of the referenced instances to obtain the same attribute values.

Detailed Content Recommendations – Instance Level Extensions

Instance level extensions as a private standard extension to the Hierarchical Series Reference Macro Attributes

Table C.17-3a Hierarchical Series Reference Macro Attributes		
Attribute Name	**Tag**	**Attribute Description**
…		
Referenced SOP Sequence	(0008,1199)	…
> Include Table 10-11 "SOP Instance Reference Macro Attributes"		
> Instance Number	**(0020,0013)**	**A number that identifies this SOP Instance.**
> Number Of Frames	**(0028,0008)**	**Number of frames in a Multi-frame Image. Required if the instance contains multiple frame pixel data.**
…		

These additional instance level attributes are useful to the Document Consumer for viewing purposes to allow the correct sequencing of images and for resource allocation without the need to access the referenced instances to obtain these attribute values.

Detailed Content Recommendations – KOS Content Overview

The embedded spreadsheet summarizes the MCWG recommended detailed content of the DICOM KOS IOD as used as an Imaging Manifest for sharing imaging information at the national/regional level.

Microsoft Excel Worksheet

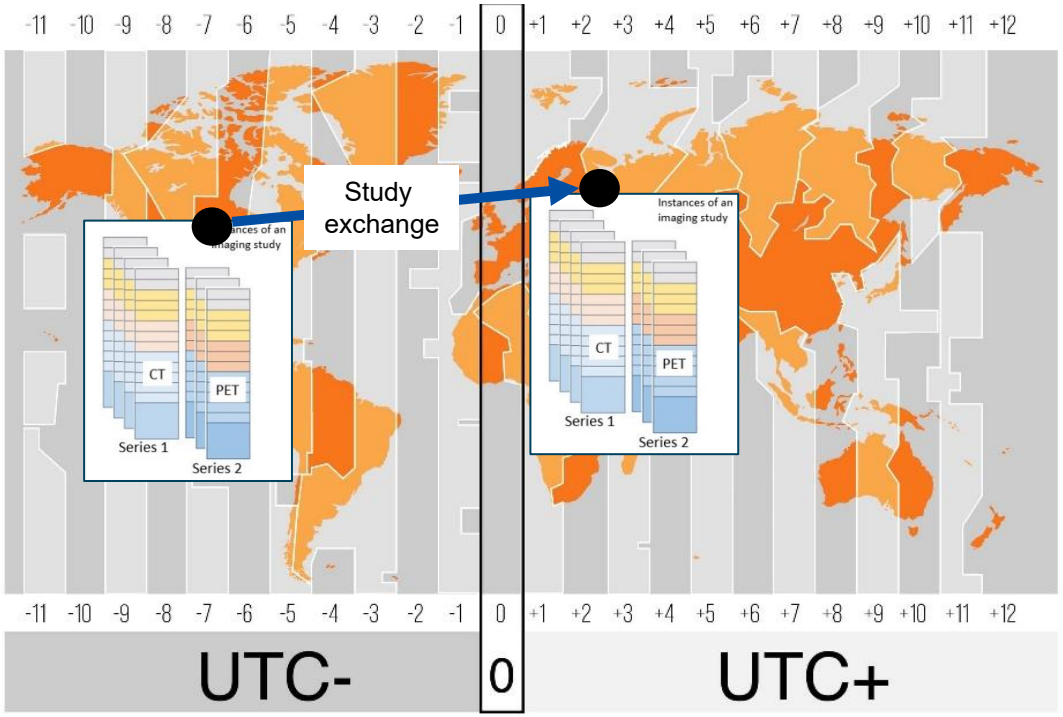
Timezone Offset From UTC (0008,0201) usage

A number of time related attributes can be defined in the referenced study and KOS object:

- Study Time (0008,0030)
- Series Time (0008,0031)
- Acquisition Time (0008,0032)
- Content Time (0008,0033)
- Instance Creation Time (0008,0013)

The KOS object should be seen as reflecting the times defined in the referenced study, meaning that the corresponding **time attributes defined in the KOS object should be copied from the referenced study, even though the KOS object is created after the referenced study**.

In order to fully define all times in terms of UTC, MCWG recommendation is **to mandate the use of the attribute in the KOS object and apply it to the KOS Time Offset From UTC (0008,0201) object and referenced study.** From practice it is known that not all DICOM instance creation devices populate the Time Offset From UTC (0008,0201) attribute.
This recommendation ensures that any consumer may adjust the study and instance time values to its local time after cross time-zone (state/country) image access.



Note: Imported (“foreign”) study instances that do not explicitly define the UTC offset, and which have been acquired in a different time zone to that of the KOS object creation, need to have the Timezone Offset From UTC (0008,0201) attribute added to the instances as part of the study import activity, using the known date/time details of the acquisition location.

Locating the Referenced Study

The location and end point of the study referenced in an Imaging Document Source (PACS/VNA) by the KOS can be identified by the attributes shown below taken from DICOM Table C.17-3a Hierarchical Series Reference Macro Attributes.

Table C.17-3a Hierarchical Series Reference Macro Attributes

Attribute Name	Tag	Attribute Description
…		
Retrieve Location UID	(0040,E011)	Unique identifier of the location where the instances are stored on the network. This is an OID that may be used as a reference to obtain the actual retrieval URL.
Retrieve URL	(0008,1190)	The Retrieve URL is the Base URI + Study Instance UID (0020,000D) + Series Instance UID (0020,000E), so that, if left unchanged, can be used to retrieve the instances of the series where the Retrieve URL is placed in the tree of references. It could be changed to perform a retrieve at an instance or entire study level.
…		

Both attributes are defined as optional in the DICOM KOS IOD. The following recommendations are made on the use of these attributes:

- **Retrieve Location UID (0040,E011)** – **recommend that a unique value representing the origin location (PACS/VNA) is be provided to support any future changes to the Imaging Document Source architecture. (**For example: splitting an archive across 2 or more new archives or merging two or more archives into a single archive.)
- **Retrieve URL (0008,1190)** – **recommended as the preferred choice for the referenced series retrieve end point definition.**

Accession Number / Placer Order Number in the KOS Manifest

MCWG recommends to include Accession Number and Placer Order Number in the KOS using the Referenced Request Sequence (0040,A370) attribute as defined below.

Table C.17.6-2. Key Object Document Module Attributes

Attribute Name	Tag	Attribute Description
…		
Referenced Request Sequence	(0040,A370)	This sequence will contain the same number of items as the **number of unique combinations of accession numbers and order placer numbers associated with this Study**. Each element will have an Accession Number and an Order Placer Number corresponding to and associated with this Study.
> Include Table C.17-3c "Referenced Request Macro Attributes"		
…		

Table C.17-3c. Referenced Request Macro Attributes

Attribute Name	Tag	Attribute Description
Study Instance UID	(0020,000D)	Unique identifier for the Study. **Note** that if this KOS document is shared or exchanged, this same Study Instance UID should be present in the metadata attribute ReferenceIdList (with a type code urn:ihe:iti:xds:2016:studyInstanceUID)
Referenced Study Sequence	(0008,1110)	Zero length sequence. Nothing should be included in this sequence.
Accession Number	(0008,0050)	A number generated by the RIS that identifies an Imaging Procedure Request created by the RIS in response to one of the clinical order (See Order Placer Number below). Note: If this KOS document is shared or exchanged, this same Accession Number must be present in the **ReferenceIdList** (urn:ihe:iti:xds:2013:accession) metadata.
Issuer of Accession Number Sequence	(0008,0051)	Identifier of the Assigning Authority that issued the Accession Number.
Placer Order Number / Imaging Service Request	(0040,2016)	This value must be one of the values associated with one of the imaging requests that resulted in the request for RIS requests for review. Note that if this KOS document is shared or exchanged, this same Placer Order Number will need to be present in the metadata attribute ReferenceIdList (with a type code urn:ihe:iti:xds:2013:order)
Order Placer Identifier Sequence	(0040,0026)	Identifier of the Assigning Authority that issued the Order Placer Number. A unique OID assigned to the system that created the Order Placer number.
…		

Note 1: There is an n - m relationship between Accession Number and Placer Order Number because the same Study may be performed in response to (a grouping of) multiple Imaging Procedure Requests (different Accession Numbers). Example: Two clinical orders for an X-ray of a knee and for an X-ray of the foot (different Placer Order Numbers). Each order would result in an Imaging Procedure Request (may be reported independently) but only one X-ray Study would be performed (same modality, same technician, same appointment) with two series of DR images one for the knee and one for the foot. We have 2 Clinical Orders, 2 Imaging Procedure Requests, but only 1 Study.

Note 2: In the above Macro, Filler Order Number/Imaging Service Request (0040,2017), Requested Procedure ID (0040,1001), Requested Procedure Description (0032,1060), Requested Procedure Code Sequence (0032,1064) may contain no value and if they contain a value, it may be ignored in processing the Manifest.

Selection of Significant Images – State of the art & recommendation

- **Three common approaches are used for "flagging" significant images within a study:**
  1. The creation of specific series of secondary capture images with a pre-defined text in the series description such as SIGNIFICANT IMAGES:
     - This approach is been used in a variety of ad-hoc ways but requires the duplication of images and does not provide a way to state why these significant images have been selected.
  2. The use of the IHE KIN Profile, by creation of a Key Object Selection in a KO series (with a clearly identified series) of the imaging study, with code and text (title)
     - This approach has been designed to address the limitation of approach 1). It avoids the duplication of images and provides a way to document the reason for selection of significant images. The consumption of KIN is reasonably implemented on market PACS and viewers.
  3. Mentioning or referencing those images in the imaging report.
     - This approach is used rather widely by mentioning image numbers with the text of imaging reports. To insert such references as links requires a level of RIS/PACS integration rarely available. It also requires access to the report to find such images and cannot address cases where imaging studies are shared without a report..

- **The IHE-MCWG recommendation is to use the second approach:**
  1. It is more user friendly, both for creation and display.
  2. It is a more explicit in the intend to reduce misinterpretations
  3. The IHE-KIN profile is sufficiently implemented in market deployed products
  4. By being recorded within the imaging study, It can be created before or after a report is produced and in cases where there is no imaging report (encounter-based imaging workflows).
  5. It can be used in addition to placing, within the report, one or more links to the underlying imaging study(ies)

Management of End-points (WADO-RS URL & IID URL)

- Both types of end-points (WADO-RS URL & IID URL) need to be “stable” as they are persisted in shared Manifests and Imaging Reports
- It is the source of Imaging Reports and Imaging Manifests that exposes these end-points
- Recommendations:
  1. Drive stability in end-points URL assignment (create a national registry) with IP addresses in DNS (for flexibility).
  2. Build a trust relationship between consumers of images and sources (Registry offers a signed whitelist of URLs) + Node Authentication.
  3. Handle PACS merges with multi-home URL and address other rare cases:
     - by updating Imaging Reports and Manifests URLs in case of “PACS/VNA DataBase split”.
     - by assigning Retrieve Location UIDs to each PACS/VNA DataBase to support “on the fly” URL remapping
     - By logging and saving published KOS at the sources to simplify resynchronization after PACS migration.

Open Issues

Open Issue 1: Transfer syntaxes supported and negotiation rules by consumer & producer need to be clarified. It d*oes not fit in Manifest recommendations and should be added to the standards and profile positioning Recommendations.*

Questions, Comments and Suggestions are welcome and should be sent to the IHE-Europe Secretariat: secretariat@ihe-Europe.net