

IHE MultiCountryWorkGroup Recommendation on

Flagging specific images as significant in the context of the sharing of imaging studies

Approved Version by MCWG Plenary - December 3rd, 2024.

Scope

eHealth Network Guideline on the electronic exchange of health data under Cross Border Directive 2011/24/EU - Medical imaging studies and reports

In use case 1 “Request and retrieval of imaging studies and imaging reports by a health professional involved in providing care for a patient” one of the preconditions requires “a means to identify a set of relevant/significant images within the imaging study should be available for fast review of imaging studies and the ability to retrieve/display first these images.”

This use case addresses imaging exchange in a cross-border environment with the intent to also cover an intra-border environment.

This document proposes a mechanism to fulfill this requirement, which would not only work in a cross-border environment but in the same way also within a country.

The proposed changes are aligned with the recommendations already approved by MCWG (<https://ihe-europe.net/multi-country-working-group-Imaging-Information-Sharing>) :

1. [Profile and Standards Positioning](#) (May 2024)
Positions the role of HL7 FHIR in the sharing of imaging information architectures, choice of profiles and standards such as MHD(FHIR), XDS-I. Coexistence with XCA and FHIR/MHD, integration of Web Access to DICOM Objects (WADO-RS) in XDS-I.
2. [Imaging Metadata and linkages](#) (December 2023)
Strategies or metadata definitions for filtering access in queries (key filtering elements) and linkages between orders, reports and imaging studies.
3. [Extensions to Imaging Study Manifest](#) (February 2024)
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.

Definition:

A **significant image** in an imaging study is an image that has been identified as being relevant for a specific reason or purpose by the study producer (e.g. interpreter, evidence document creator, imaging report creator, etc.). More than one significant image within an imaging study may be identified for the same reason. A code chosen from a predetermined set, and a free text comment may further explain that reason, but pertains to the entire set.

Images may be highlighted as significant images with the designation “Of Interest”. However, in case of other selection reasons or other purposes, other designations may be used.

Multiple sets of significant images created for different reasons may exist. It is recommended to distinguish them when displayed, even if the creator of the selection has chosen not to include a comment, and even if some of them share a common designation code.

Use Case:

Creator Use case: A health professional is offered the possibility to flag specific images in an imaging study as significant. The professional that chooses to make use of this possibility may select one or more significant images in one or many series within a single imaging study. The Health Professional may also create a textual comment to keep track of the reason for which those selected images¹ are significant.

Consumer Use case: A Health Professional who wants to access imaging studies for a patient, may select a study among² imaging studies that were filtered, and for this imaging study may decide to:

- Find out whether significant images were marked by the imaging producer,
- Request that only images marked as significant be retrieved and displayed.
- Alternatively, choose to retrieve one or more series of images within the selected imaging study and he/she might expect that when such series are displayed, each significant image present be “marked” as significant so that more specific attention be provided to the marked images.

¹ A single comment applies to the entire set of selected images as being significant.

² This process is the basic process recommended in the MCWG Recommendation on Metadata to search for relevant studies for a patient (Slide 3: <https://www.ihe-europe.net/sites/default/files/2024-05/2-MCWG-Recommendations-Imaging%20Sharing%20Metadata-Linkages-FinalPublished-V7.pdf>)

Challenges in applying IHE KIN Profile in the sharing of images context

Introducing the IHE KIN Profile

The **IHE Key Image Note (IHE KIN)** is a profile developed by the IHE Radiology Domain Committee. The Key Image Note allows users to highlight important images and add specific notes or comments to them. This can be useful for various purposes, such as helping the requesting physician to easily find the most relevant images or identify them for specific treatments (e.g. surgery).

The IHE KIN specifies the means to document, in the form of a DICOM Key Objects Selection (KOS):

- the unique identification of one or more imaging instances (SOP Instance UIDs) that have been flagged for their significance
- Assign a mandatory code value to label at a generic level the rationale for such a marking of significance for the set of instances. DICOM includes an extensive value set for these codes in PS 3.16 CID 7010 (see current value set in Annex B of the present document).
- Associate an optional free text comment to further explain the rationale for such a marking of significance for the set of instances.
- Such DICOM KOS objects that contain the above descriptive information are placed in a series like any other class of DICOM object, but with the modality code KO. In IHE KIN, the series shall be placed within the imaging study in which one finds the imaging instances that have been flagged or selected as significant.

In its IHE KIN Profile, IHE references the full flexibility of the DICOM KOS and only restricts the imaging instances flagged as significant to belong to the imaging study within which the KOS used as KIN resides.

The use case and design of the IHE KIN Profile is to be used when the imaging study and the Key Image Note reside within a single imaging system. In this case, the imaging study that contains one or more Key Image Note instances may be transferred by networking or media interchange. Such transfer fully preserves the Key Image Note referencing mechanism information in the destination system. Therefore, every system that complies with the IHE KIN profile as a creator or as a consumer is fully interoperable.

In the following text the term **KOS/KIN** is used to reference a DICOM KOS object, whose purpose is to highlight specific images including those which we describe here as being significant images, especially such KOS/KIN with a document title code “Of Interest”. This has to be distinguished from the KOS manifest, which is used to identify the contents of an imaging study for the purpose of sharing in a national or regional infrastructure.

When a KOS/KIN is created and published as part of the study itself, then it consequently is one of the referenced SOP Instances in the KOS manifest.

Status of adoption and deployment of IHE KIN Profile

As of 2024, a large number of imaging systems (PACS, VNA, Imaging Workstations, Modalities) supports creating and processing DICOM KOS and in most cases also support the IHE KIN Profile. Between 2005 and 2024 more than 700 Vendor-Actors-Pairs have been successfully tested at IHE Connectathons worldwide.

Challenge in the broader context of Imaging Information sharing

In an extended Imaging Information Sharing infrastructure, the involved imaging systems operate within a national or regional infrastructure that is generally aligned with the MCWG Recommendations (typically using a **DICOM KOS Manifest** as a summary document for each shared imaging study).

In such a sharing infrastructure, requesters may choose to access an imaging study stored on a remote system, and this imaging study may include the marking of some significant images using a KOS/KIN, for example with a document title “Of Interest”. This requester is then faced with a number of challenges:

1. Find whether there exists a KOS/KIN to designate one or many images as significant within the study: To know that there is such a Key Image Note, it has to explore the imaging study by retrieving all instances in series of modality KO. Then, it needs to access this(these) series and among those instances, it needs to further filter at least those with a document title code indicating that these instances are significant.
2. If the requester decides to retrieve only the significant images, then the KOS/KIN needs to be explored to identify the SOP Instance UIDs of the significant images and retrieve them.
3. If the requester decides to retrieve one or more series of images in the imaging study, each returned image needs to be checked against the SOP Instance UIDs in the KOS/KIN(s) in order to flag on the display the significant images of the retrieved series.
4. For a wide adoption of the KOS/KIN in an imaging sharing environment, a baseline interoperability between creator and consumer has to be guaranteed at least for the basic use case, where images are marked as being significant in a general sense.

Challenge 1 is the most impactful. Identifying the series of modality KO in the imaging study manifest is easy. But retrieving all instances from each series requires one WADO-RS at the series levels for each such KO modality series. The requester will not know if there are significant images until this(ese) WADO-RS retrieval(s) are completed. This

introduces a delay of a few seconds because it adds one or more transactions with a remote PACS/VNA in case there are any KO series in the study. The more significant images are used, the more overhead is created.

Often the challenges 2 and 3 are already addressed if the image viewer supports the IHE KIN Profile.

To address challenge 4, one should define a general-purpose title code such as “Of Interest”. Requiring the support of this code by all creators and consumers of KOS/KIN in an imaging sharing environment establishes a baseline that is likely to facilitate the widespread adoption of KOS/KIN.

To address challenge 1, one should try to avoid an extra transaction at the time of each imaging study access that contains a KO series, even if there are no significant images in that study. Therefore, it is proposed to add “significant images” related information in the KOS manifest object associated with the imaging studies. The proposal is to:

- A. Add an attribute in the imaging study KOS manifest to include a copy of the document title code (from CID 7010) in every reference to a SOP Instance that is flagged by a KOS/KIN. It could be sufficient to include a copy of such a title code only the images flagged by a KOS/KIN with a code “Of Interest”, but because the creator of the study manifest needs to explore all KOS/KIN present in an imaging study it makes available for sharing, it is proposed to keep the generality of the extension. This may prove useful for later use cases such as accounting for the impact of the Image Object Change Management (IOCM) Profile. Requesters shall be required to handle the code “Of Interest” when managing significant images. Handling document title codes other than “Of Interest” is possible in the same way, but not required.
- B. Along with the above attribute, add the SOP Instance UID and the Series Instance UID for the KOS/KIN that marks this SOP instance as significant. These two UIDs would allow to traverse effectively the KOS manifest of the imaging study to locate the entry that references the corresponding KOS/KIN and extract the textual comment that may have been also added (see below).
- C. Add an attribute to include a copy of the comment in every reference to a KOS/KIN SOP instance that is used to flag one or more SOP instances and include a (optional) comment. Because a KOS/KIN may have a comment that applies to several significant images, the comment is copied from the referenced KOS/KIN to the reference in the KOS manifest to such KOS/KIN to maintain a single copy of the comment.
- D. Since a given SOP instance may be referenced by more than one KOS/KIN, the potential multiplicity needs to be handled in A, B and C in the above list.

These additional attributes are depicted graphically in the example below in the case of an imaging study that contains a single KOS/KIN with a title code “Of Interest” that flags two images located in different series. A comment is present in the KOS/KIN.

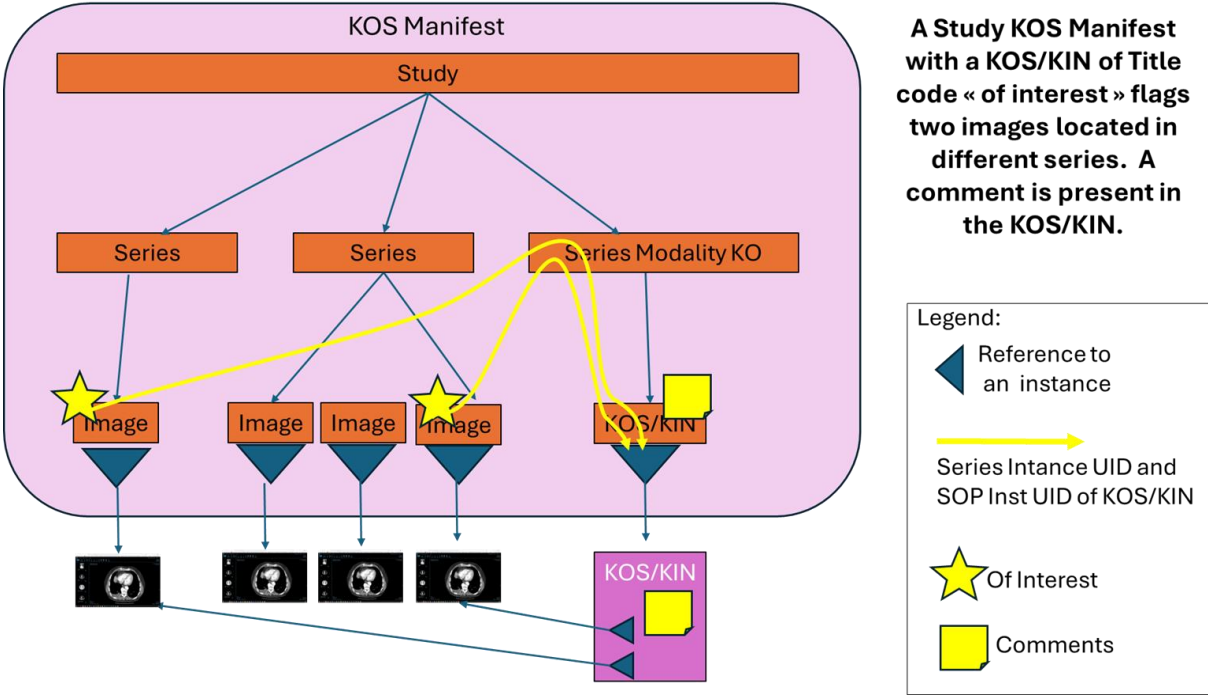


Figure 1 Example of a KOS Manifest extended for significant images

DICOM encoding details of these standard extension to the KOS Manifest for the support of significant images in the context of Imaging Information sharing.



The included spreadsheet **MCWG-Significant-Images-KOS-Manifest** consists of three worksheets:

1. The worksheet entitled “**MCWG manifest recommendations**” shows the KOS manifest extensions already defined by the three sets of published MCWG recommendations (See Scope Section).
2. “**Ref. to Marking KIN**” lists attributes in **red over blue** to be added to the references to SOP Instances which are flagged in a KOS/KIN, in order to know that the SOP instance is flagged and to provide the reference to the flagging KOS/KIN, in order to access the comment within the manifest. These extensions are presented also in Annex A .1
3. “**Referenced KIN Comment**” shows how to extend the reference to the KOS/KIN (in **red over blue**) in order to provide access to the comment, if any, within the referenced KOS/KIN. These extensions are presented also in Annex A .2

Annex A : Extensions to the MCWG DICOM KOS Manifest to support significant images

A.1 Extensions attributes necessary to be added to the references to SOP Instances which are flagged in a KOS/KIN,

These indicate if any referenced SOP instance is flagged and to provide the reference to the flagging KOS/KIN.

>>Referenced SOP Sequence UID	(0008,1199)			
>>>Referenced SOP Instance UID	(0008,1155)			
>>>Referenced SOP Class UID	(0008,1150)			
>>>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.	
>>>Related Series SQ	(0008,1250)	3		Sequence of Items identifying Series, which contain references to the SOP Instance in this Item. One or more Items are permitted in this Sequence.
>>>>Series Instance UID	(0020,000E)	1	Series Instance UID of the series to which belongs the KOS/KIN with the SOP Instance UID specified in the Attribute (0008,1155) in the same Sequence Item.	This Attribute facilitates traversing the KOS Manifest to locate the KOS/KIN in the corresponding Reference SOP Sequence. This helps when accessing the content of the KOS/KIN comment, if any.
>>>>Referenced SOP Sequence	(0008,1199)	1	This Sequence shall contain one or more Items as there are KOS/KIN SOP Instances in this Item of Related Series Sequence.	
>>>>>Referenced SOP Class UID	(0008,1150)	1		SOP Class UID of the referenced KOS (= always fix KOS SOP Class UID) (present to stick to the SOP Instance reference macro)
>>>>>Referenced SOP Instance UID	(0008,1155)	1		The SOP Instance UID of a KOS/KIN object that flag(s) the referenced SOP Instance
>>>>>Purpose of Reference Code Sequence	(0040,A170)	3		"Of Interest" / BCID 7010
>>>>>Code Value	(0008,0100)	1	Shall use the CodeValue : « 113000 ».if significant images of interest are flagged. May use any other code value from CID 7010.	
>>>>>Coding Scheme Designator	(0008,0102)	1	Shall use a fixed value: Coding Scheme Designator : « DCM ».	Identifier of the coding scheme in which the Code Value (0008,0100): DICOM coding scheme
>>>>>Code Meaning	(0008,0104)	1	Convey the code meaning as specified by CID 7010. For example "Of Interest » for the code value 113000..	

A.2 Extensions attributes necessary to extend the reference to the KOS/KIN in the KOS Manifest

These extensions provide access to the comment, if any, within the referenced KOS/KIN that references to SOP Instances which are flagged in a KOS/KIN.

These indicate if any referenced SOP instance is flagged and to provide the reference to the flagging KOS/KIN.

>>Referenced SOP Sequ	(0008,1199)			
>>>Referenced SOP Instance UID	(0008,1155)			
>>>Referenced SOP Class UID	(0008,1150)			
>>>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.	
>>>Content Sequence	(0040,A730)	3	If the Content Item with Concept Name (113012, DCM, "Key Object Description") is present in the KOS/KIN, this sequence contains a single item; If a Comment is not present in the KOS/KIN, this sequence shall be absent (Type 3)	This sequence, if present, shall contain a single item.. Shall be present if the referenced SOP Instance is a SOP Class of type Key Object Selection with a title code « of interest ».May be present if the referenced SOP Instance is a SOP Class of type Key Object Selection with a title code other than « of interest ».
>>>>Text Value	(0040,A160)	1	Contains the KOS/KIN Object Description Text Value from the KOS/KIN Object referenced.	Non-formatted textual data, allowing for implementation specific display. This value may contain spaces as well as CR LF separators for one or more lines.

Annex B : DICOM PS3.16 - CID 7010

https://dicom.nema.org/medical/dicom/current/output/chtml/part16/sect_CID_7010.html

Coding Scheme Designator	Code Value	Code Meaning
DCM	113000	Of Interest
DCM	113001	Rejected for Quality Reasons
DCM	113002	For Referring Provider
DCM	113003	For Surgery
DCM	113004	For Teaching
DCM	113005	For Conference
DCM	113006	For Therapy
DCM	113007	For Patient
DCM	113008	For Peer Review
DCM	113009	For Research
DCM	113010	Quality Issue
DCM	113013	Best In Set
DCM	113018	For Printing
DCM	113020	For Report Attachment
DCM	113021	For Litigation
DCM	113030	Manifest
DCM	113031	Signed Manifest
DCM	113032	Complete Study Content
DCM	113033	Signed Complete Study Content
DCM	113034	Complete Acquisition Content
DCM	113035	Signed Complete Acquisition Content
DCM	113036	Group of Frames for Display
DCM	113037	Rejected for Patient Safety Reasons

DCM	113038	Incorrect Modality Worklist Entry
DCM	113039	Data Retention Policy Expired
DCM	113022	Collection of Presentation States
DCM	128181	Diagnostic Source Images
DCM	128182	Segmentation Result
DCM	128183	Registration Result
DCM	128195	For Diagnosis
DCM	128218	Diagnosis Input Used
DCM	128196	For Segmentation
DCM	128219	Contouring Input Used
DCM	128199	For Plan Comparison
DCM	128220	Plan Comparison Input Used
DCM	128203	For Tumor Board
DCM	128221	Tumor Board Input Used
DCM	128208	For Tumor Registry
DCM	128222	Tumor Registry Input Used
DCM	128207	For Clinical Trial Submission
DCM	128223	Clinical Trial Submission Input Used
<i>Include CID 7023 "RT Process Output"</i>		
<i>Include CID 7024 "RT Process Input"</i>		
<i>Include CID 7025 "RT Process Input Used"</i>		
<i>Include CID 7014 "Export Additional Information Document Title"</i>		
<i>Include CID 7070 "Real Time Video Rendition Title"</i>		