DICOMweb Modality Services
WG27
Public Comment

November 2024

WORK ITEM 2023-10-C – DICOMWEB MODALITY SERVICES

Introduction

The DICOM Standard defines several services. Two of these are targeted towards modalities, namely the Modality Worklist service (see PS3.4, Annex K, more specifically K.6.1) and the Modality Performed Procedure Step service (see PS3.4, Annex F, more specifically F.7-F.9). Currently, these services are defined using DIMSE.

Limitations of Current Standard

Both the Modality Worklist service and the Modality Performed Procedure Step service are not yet available in DICOMweb. This limits a) the uptake of DICOMweb for modalities and b) the support of workflow services for modalities that are (intended to be) part of a web-based ecosystem.

Description of Proposal

Add the Modality Worklist and the Modality Performed Procedure Step services to DICOMweb, in principle based on the existing DICOMweb Worklist service (UPS-RS; see PS3.18, section 11). This would boil down to creating an informative annex and any normative changes needed if gaps are discovered.

PROGRESS

Done since last meeting

- Extensive analysis of information models of MWL/MPPS and UPS (yet unverified and unfinished)
  - Resulted in a few new CPs
    - Align MPPS Retrieve SOP Class with MPPS SOP Class
    - Make explicit where *All [other] Attributes of … Module/Sequence* can be found
- Created examples of DICOMweb modality workflow communication

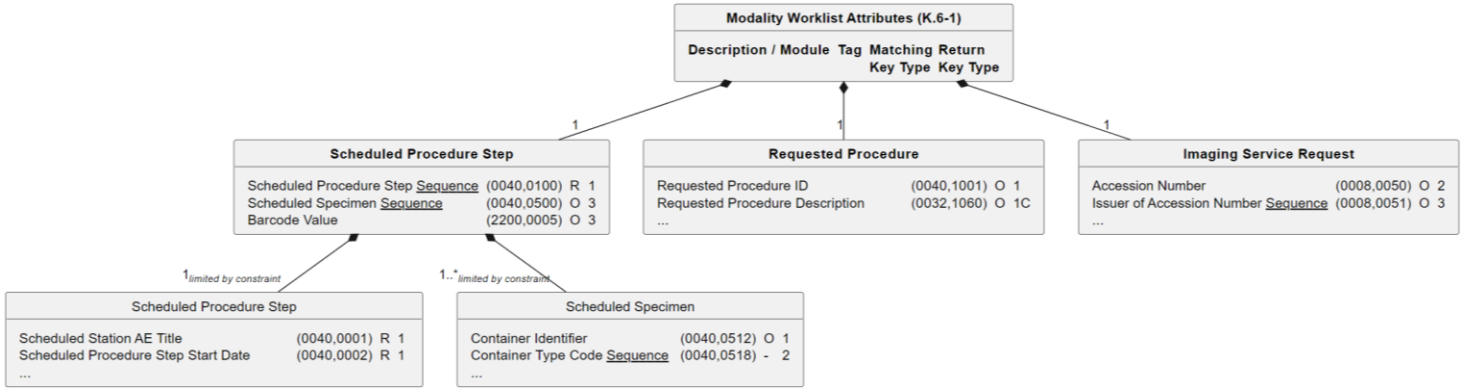
Agenda

- Show and discuss analysis results
- Show and discuss examples
- Conclude on how to proceed
- Discuss and conclude on what HTTP method to be used for updates

ANALYSIS OF INFORMATION MODELS – INTRODUCTION

Graphical representation of tables as UML class diagrams

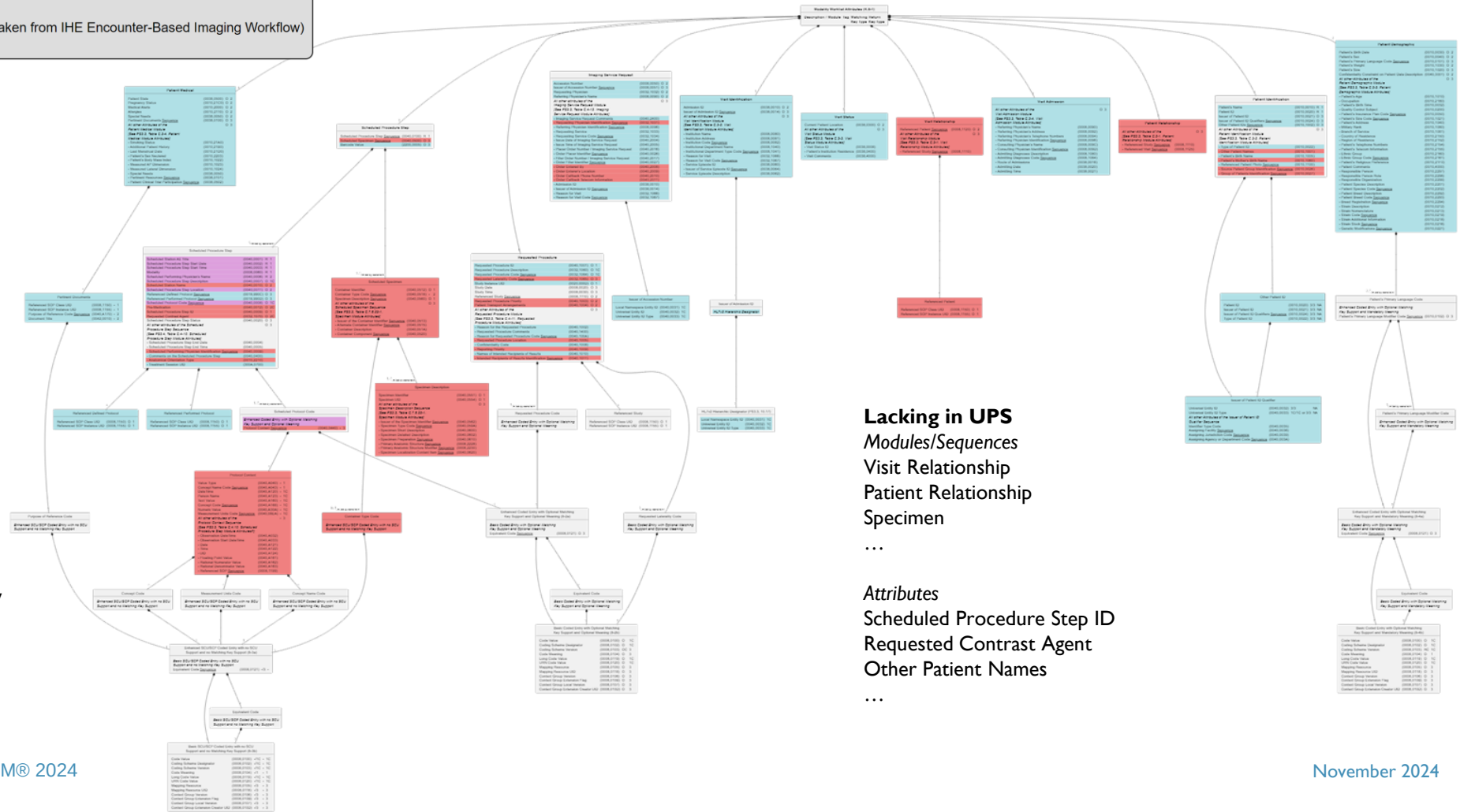
- Each table is represented by a class, having a **bold** name, showing the (relevant) columns
- Each sub-table (identified by a bold heading in the table) is represented by a class having a **bold** name which is contained in the table class (1:1)
- Sequences are underlined, to signify the fact that elements of each sequence are represented by a class, contained in the class using the sequence (0:n when unconstrained)
  - Diagrams contain only explicitly mentioned sequences, not those in *All [other] Attributes …*
- Each inclusion is represented by a class, contained in the including class, that shows the include *italic*
- Implicit attributes (included by *All [other] Attributes …*) are given starting with a dash



Description / Module	Tag	Matching Key Type	Return Key Type
Scheduled Procedure Step			
Scheduled Procedure Step Sequence	(0040,0100)	R	1
>Scheduled Station AE Title	(0040,0001)	R	1
>Scheduled Procedure Step Date	(0040,0002)	R	1
>…			
Scheduled Specimen Sequence	(0040,0500)	O	3
>Container Identifier	(0040,0512)	O	1
>Container Type Code Sequence	(0040,0518)	-	2
>…			
Barcode Value	(2200,0005)	O	3
Requested Procedure			
Requested Procedure ID	(0040,1001)	O	1
Requested Procedure Description	(0032,1060)	O	1C
…			
Imaging Service Request			
Accession Number	(0008,0050)	O	2
Issuer of Accession Number Sequence	(0008,0051)	O	3
…			

ANALYSIS OF INFORMATION MODELS – MWL

Legend
Mapped to UPS
Requires specific mapping to UPS (taken from IHE Encounter-Based Imaging Workflow)
Lacking in UPS



Incompatibility
MWL's Scheduled Protocol Code Sequence has two parts, of which the Protocol Context Sequence is *not* part of the UPS's Scheduled Workitem Code Sequence to which EBIW maps it.
Furthermore, there's no distinction between 'primary' and equivalent codes in UPS.

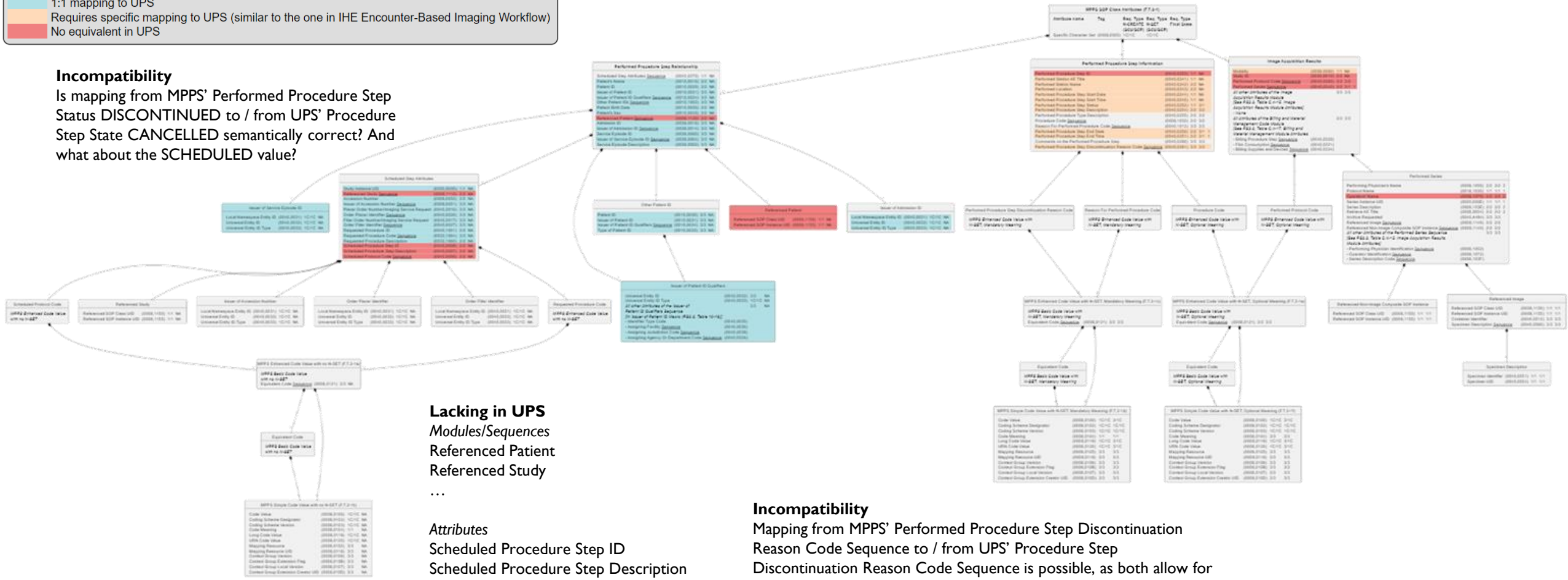
Lacking in UPS
Modules/Sequences
Visit Relationship
Patient Relationship
Specimen
…

Attributes
Scheduled Procedure Step ID
Requested Contrast Agent
Other Patient Names
…

ANALYSIS OF INFORMATION MODELS – MPPS

Legend
1:1 mapping to UPS
Requires specific mapping to UPS (similar to the one in IHE Encounter-Based Imaging Workflow)
No equivalent in UPS

Incompatibility
Is mapping from MPPS' Performed Procedure Step Status DISCONTINUED to / from UPS' Procedure Step State CANCELLED semantically correct? And what about the SCHEDULED value?

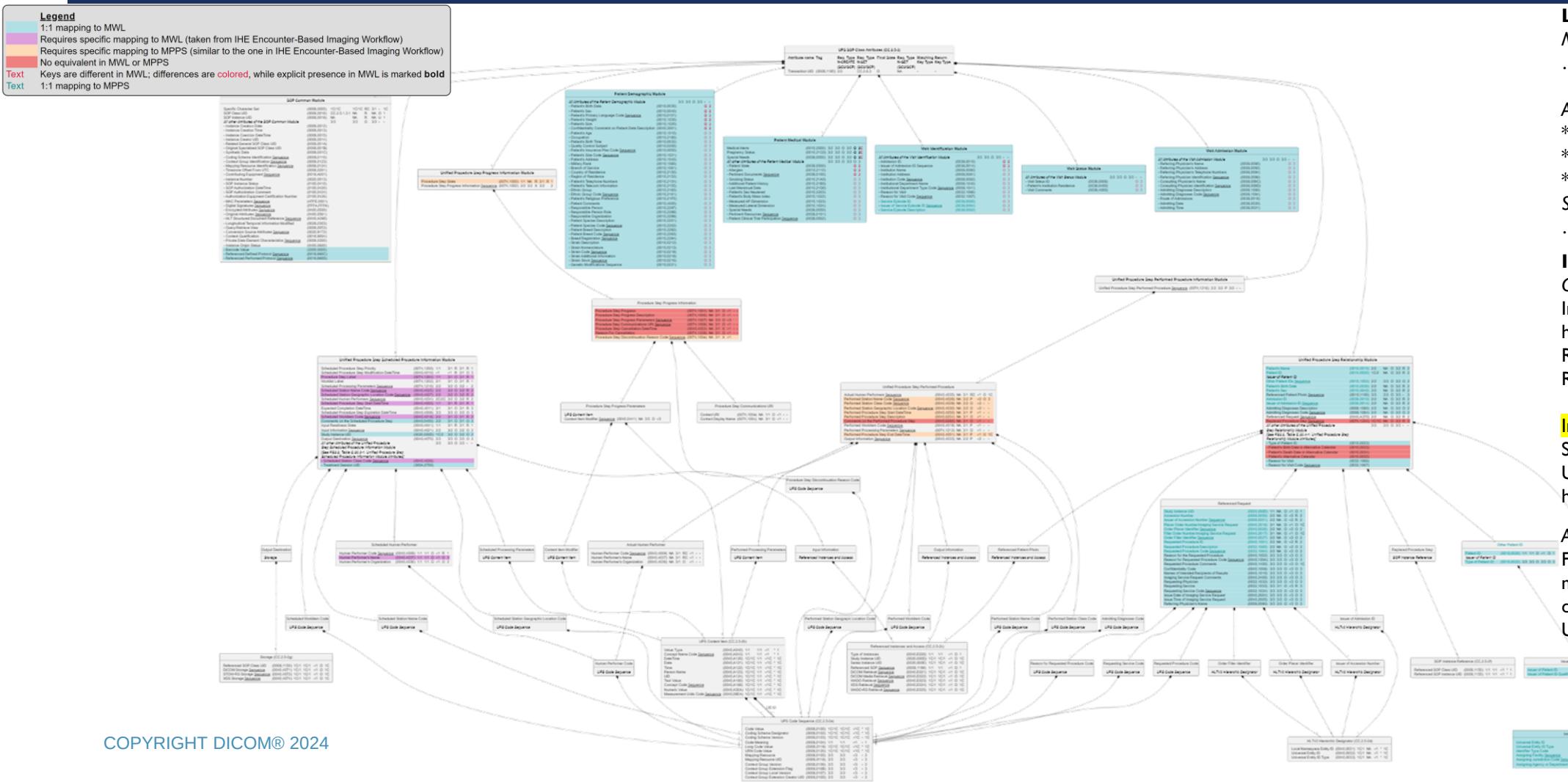


Lacking in UPS
Modules/Sequences
Referenced Patient
Referenced Study
…

Attributes
Scheduled Procedure Step ID
Scheduled Procedure Step Description
…

Incompatibility
Mapping from MPPS' Performed Procedure Step Discontinuation Reason Code Sequence to / from UPS' Procedure Step Discontinuation Reason Code Sequence is possible, as both allow for multiple codes, but in MPPS there is one 'primary' code with possible equivalents, while UPS does not state how the codes are related.

ANALYSIS OF INFORMATION MODELS – UPS



Lacking in MWL/MPPS

Modules/Sequences

…

Attributes

* Alternative Calendar *
* Progress *
* Cancellation *

Scheduled Procedure Step Priority

…

Incompatibilities

Cardinality

In MWL Imaging Service Request has a 1:1 relationship, while in UPS Referenced Request has a 1:n Relationship.

In MWL the Performed Procedure Step has a 1:1 relationship, while in UPS the Performed Procedure Step has a 1:n relationship.

Attribute Keys

For many attributes in 'shared' modules, keys have been defined differently (MWL: O and 2 or 3 and UPS - and -.

DICOMWEB MWL/MPPS EXAMPLES

CONCLUSION

- Mapping DIMSE MWL/MPPS to UPS(-RS) and vice versa has insurmountable problems, related to
  - Compatibility – taking away incompatibilities would require a) breaking changes and b) a tremendous amount of work (which would be beyond the scope of this supplement)
  - Efficiency – mapping all attributes in both directions would require a large amount of effort (even after having made the information models compatible)
    - Sticking the head in the sand by ignoring the inherent complexities and 'just' looking at some straightforward use cases will give the wrong impression (and will lead to backtracking, and not just one time)
  - Usability – it would result in a specification that is very complex to use, aiming for low adoption to begin with
  - Implementing proxies (for hybrid settings with DIMSE and DICOMweb systems) would be very cumbersome and error-prone due to the huge amount of details
- It is, however, relatively straightforward to map DIMSE MWL/MPPS to *new* DICOMweb services and resources, e.g.
  - C-FIND$_{MWL}$ `GET SP /modality-worklist?{&match*}{&includefield}{&fuzzymatching}{&offset}{&limit} SP version CRLF`
  - N-CREATE$_{MPPS}$ `PUT SP /modality-performed-procedure-steps/{mppsUID} SP version CRLF CRLF payload`
  - N-SET$_{MPPS}$ `PATCH SP /modality-performed-procedure-steps/{mppsUID} SP version CRLF CRLF payload`
  - N-GET$_{MPPS}$ `GET SP /modality-performed-procedure-steps/{mppsUID} SP version CRLF`
  - N-EVENT-REPORT$_{MPPS}$
    ```
    POST   SP /modality-performed-procedure-steps/{mppsUID}/subscribe/{aetitle} SP version CRLF
    DELETE SP /modality-performed-procedure-steps/{mppsUID}/subscribe/{aetitle} SP version CRLF
    ```
- The above would be complete *by definition*, covering all possible use cases and all inherent complexity
  - MPPS Notifications are an intrinsic exception, as there is an issue with the Standard not having specified how SCPs know what SCUs to notify

Therefore, create *new* Modality Services resources instead of basing 'MWL-RS' / 'MPPS-RS' on UPS-RS (the DICOMweb Worklist service)

WHAT HTTP METHOD IS TO BE USED FOR UPDATES ETC?

`PATCH` versus `PUT` and `POST`

- The `PUT` method provides a replacement of the *entire* resource (and thus requires bandwidth).
- The `POST` method doesn't have any generic semantics.
  - "Server and client-side developers must write application-specific code to support it, then do QA on it, debug the corner cases, and eventually rewrite the API to fix the problems they inevitably find (partial updates can get subtle). Once you get a lot of these hanging around, it's a pain."
- The `PATCH` method is a request method for making partial changes to an existing resource.
  - It is atomic, so either all or no changes

The current `PUT` for the Change Workitem State Transaction in UPS-RS is weird

- Requires a separate resource for changing a state, not the intent of HTTP

REFERENCES

This presentation, the examples and the analysis images (and much more) can be found at

- https://github.com/krotz-dieter/dicomweb-dmwl-mpps