IHE Work Item Proposal (detailed)

1. Proposed Work Item: AI Service Capabilities (AISCap)

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Date: 2026-06-30

Version: 1.0

Domain: IHE RAD

2. The Problem

The increasing adoption of AI systems in medical imaging environments has led to a growing complexity in managing and operating these systems. As the number of AI applications rises, administrators, system integrators, and end users are required to handle a diverse and evolving AI infrastructure.

Administrators and system integrators must configure and maintain image processing environments, e.g. PACS components to satisfy the specific requirements of each AI system. This often involves significant manual effort and specialized knowledge.

Users, on the other hand, frequently lack transparency regarding the available AI systems, e.g. their capabilities and versions. As a result, identifying the appropriate AI system for a particular task can be challenging, so can the validation of AI results as for this the version of the AI solution might need to be taken into account.

Workflow management becomes increasingly difficult as the number of AI systems grows:

- In single-system scenarios, users/ systems must understand which AI system is capable of processing which types of data and ensure that data is routed correctly.
- In multi-system scenarios, users/ systems must coordinate and sequence the execution of multiple AI systems to obtain the desired final result, which might require complex manual configuration and orchestration.

These challenges create a need for better transparency about the capabilities of the AI systems, simplified configuration, and increased automation in the management and operation of AI-enabled imaging workflows.

Currently, standardized ways are defined to dispatch AI work, to invoke services and encode results, but no standardized way has been defined to discover which AI services exist, what each is clinically capable of, and what input it requires.

3. Key Use Case

For all use cases fig. 1 shows the underlying communication principle between the involved systems. This profile will only focus on the "Capability Discovery" process and the therefore required technical specifications, e.g. transactions, data structures.

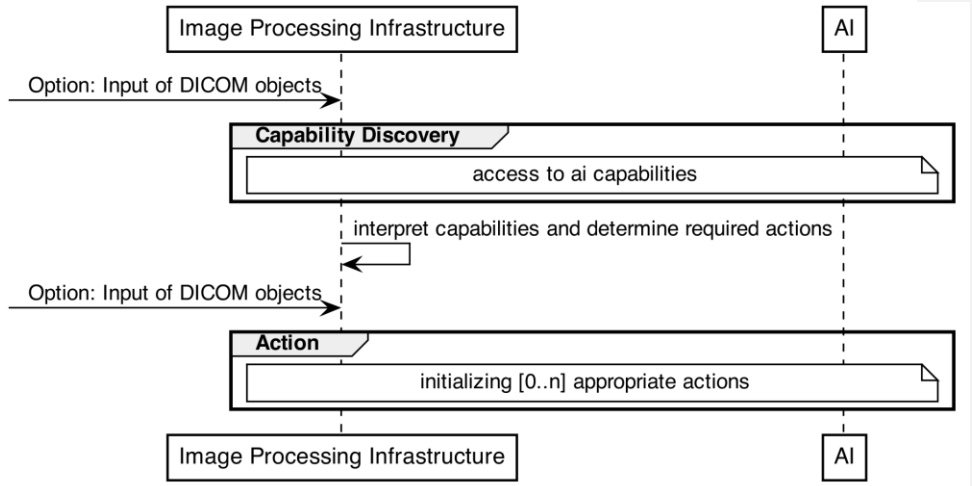

fig. 1 - Communication principle

Appropriate actions (not part of the profile) can be, e.g.

- Retrieving / Routing of DICOM objects
- Initiating an ai processing
- Configuration of network nodes
- Workflow management of sequential receiving and routing of DICOM objects

This communication principle will satisfy two key use cases:

1. Configuration of the image processing environment
2. Dataflow automation

1. **Configuration of the image processing environment**

   Based on the capability information of an ai system the image processing environment, e.g. DICOM nodes can be automatically configured.

   Example: The ai system has two different ports/ AETs for receiving DICOM objects. These StoreSCPs determine which results the AI will send back. Based on the capabilities the PACS will auto-configure DICOM send nodes.

2. **Dataflow automation**

   Capability information enables actors, e.g. orchestrators to automatically decide to which ai system DICOM objects should be moved or routed to, without the need for manual intervention.

   The capabilities will also enable actors like an orchestrator to set up dataflow automation chains which use output of an ai system to feed it into the next so the user receives the desired results.

4. Standards & Systems

- Systems involved in this profile include
  - AI Solutions
  - AI Orchestrator
  - VNA / PACS (Archive, Viewer)
- Standards
  - FHIR (as an option for encoding the AI capability record)
  - Standards for exchanging the AI capability record (e.g. ITI Non-Patient File Sharing NFPS)

5. Discussion

This profile complements existing AI task workflow management by working alongside established standards such as the IHE Radiology profile AIW-I (AI Workflow for Imaging).

Related efforts are complementary but distinct in scope:

- DICOM Supplement 224 covers comparable ground, yet AISCap is considerably leaner and more specific; some of its concepts may be reusable.
- Supplement 251 governs client request execution and complements AISCap, but does not enable AI capability discovery.
- The RSNA Atlas cards provide model and dataset documentation for human consumption and are complementary.

AISCap addresses an unmet need: configuring the systems that exchange objects with, and receive results from, AI applications. A standardized definition of a capability record is required to foster market acceptance and the integration of AI solutions into the imaging workflow. Advancing this proposal is therefore in the interest of IHE.

6. Technical Approach

Actors

- AI Capability Provider (e.g the AI Solution)
- AI Capability Consumer (e.g AI orchestrators, PACS/VNA systems, Displays)
- AI Capability Manager (could be a standalone system or be grouped with the consumer)

Transactions

- Submission of Capability Record
- Query for Capability Record
- Retrieve of Capability Record
- Update/withdrawal of Capability Record

Content Definition

The solution shall cover the minimal requirements to fulfill the use cases. The essential work will be the definition of the data structure for providing the ai system's information:

- System identifying information (Name, Vendor, Version)
- Required input objects defined by DICOM header information
- Output on IOD level (e.g. DICOM SR, DICOM SC, DICOM)
- Description of the result content
- DICOM endpoint(s) (port, AET, URL)

Profile

Following the workflow defined in the NFPS profile, an AI solution in the role of AI Capability Provider would submit its capability statement to the AI Capability Manager. An AI Capability Consumer (e.g. a PACS or an AI Orchestrator) can query and retrieve the capability statements for the AI Solutions in its image processing infrastructure. The usage scenarios for this capability statement (e.g network configuration, initiation of AI task or display to the user are out of the scope of this profile).

AI Capability Providers can update or withdraw capability statements when some of this information changes due to software updates.

Work on this profiles includes

- Writing the profile itself
- Concepts
    - different usage scenarios for the AI Capability Statement (e.g. the clinical usage scenarios as defined above)
    - "Version management" of the AI Capability Statements
    - Description of the information in the AI Capability Statement
    - Translating natural language into DICOM header tags
- Technical Use Cases for submission, query, retrieve and update/withdrawal of AI Capability Statements
- Definition of the AI Capability Statement.
    - This will be based on the work at the last AI Plugathons
    - If FHIR based
        - Select Resources/Profile that are used (Bundle, Device, Parameter, Endpoint, Provenance …
        - Profile selected resources to meet the needs for the AI Capability Statement
- Draft the transactions using NPFS as a model
    - Submission of AI Capability Record
    - Query for Capability Record
    - Retrieve of Capability Record
    - Update/withdrawal of Capability Record

Decisions/Topics Uncertainties

- Standard used for encoding the AI Capability Statement
- Can the NPFS Profile be used as the infrastructure for sharing the AI Capability statements. *On my first glimpse, I assume, it would not work, because it uses a binary resource for encoding the file. However we can use the transaction as a base for transactions needed here.*
- How much version management must be supported

7. Support and Resources

This work item will be developed by the IHE Europe AIGI Task force, which is supported by xxx vendors.

The proposal is based on experiences and discussion of the related workflows during the AI Plugathons in Vienna and Brussels.

8. Risks

A clear definition of the scope of this work item is needed some decisions need to be made regarding scenarios like

9. Technical Committee Evaluation

Effort Evaluation (as % of Tech Cmte bandwidth)

- Xx% for MUE
- YY % for MUE

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SME/Champion

10. Discussion

Commented [1]: Most likely goes away