Ontario Health

Ontario Medical Imaging DICOM Implementation Guide

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1. Introduction

1.1 Purpose

This Implementation Guide defines the minimum DICOM requirements that imaging systems must meet to connect safely and reliably to an OCINet-managed regional Diagnostic Imaging Repository (DIR), or to the future provincial Enterprise Imaging Vendor-Neutral Archive (VNA).

This document is based on the **DICOM 3.0 Standard** (Digital Imaging and Communications in Medicine, PS 3.1 – PS 3.20 series) maintained by the DICOM Standards Committee and NEMA. All references to "DICOM" within this guide refer to this version of the standard.

It sets out baseline rules for data integrity such as proper Patient → Study → Series → Instance hierarchy, globally unique UIDs, and mandatory patient and order identifiers. These rules are essential to ensure studies can be ingested, stored, and retrieved consistently across PACS, DIRs, VNAs, and clinical viewers in Ontario.

The aim of the guide is to reduce onboarding challenges for Health Information Custodians and vendors and to ensure that all transmitted imaging studies remain linked to the correct patient, retain clinical usability, and support long-term interoperability across the provincial enterprise imaging ecosystem.

1.2 Background

Ontario Health operates a provincial enterprise imaging environment where Health Information Custodians contribute imaging studies to a regional Diagnostic Imaging Repositories and, in the future state, a provincial vendor-neutral archive. This guide focuses on the minimum DICOM behaviours required so incoming studies can be grouped correctly, stored without collisions, and retrieved reliably across DICOM compliant PACS, DIRs, VNAs, and clinical viewers.

The document is written for imaging vendors, PACS administrators, modality integrators, enterprise imaging architects, and technical teams responsible for configuring or onboarding image-contribution workflows from hospitals and Integrated Community Healthcare Service Centres into the provincial archive.

The background for this guidance is practical: interoperability issues often stem from broken hierarchy, non-unique or malformed UIDs, missing mandatory identifiers, unsupported transfer

syntaxes, and weak error handling. Setting a consistent baseline for these items reduces onboarding friction and prevents downstream clinical disruptions.

This section provides the operational context and audience. The regulatory framework, ministerial approval process, and privacy and security statements are addressed in section 1.3 and its sub-sections as laid out in the template.

1.3 Digital Health Information Exchange (DHIEX)

On January 1, 2021, Ontario Regulation 329/04 ("O. Reg. 329/04") under the Personal Health Information Protection Act, 2004 (PHIPA), was amended to provide a regulatory framework for Ontario Health, as directed by the Minister of Health ("the minister"), to establish, maintain and amend interoperability specifications. This regulatory framework, as set out in sections 26 to 34 of O. Reg. 329/04, is referred to by Ontario Health as the Digital Health Information Exchange (DHIEX) framework.

Ontario Health guides and supports the adoption of modern interoperability specifications applicable to digital health assets as defined in s. 26 of O. Reg. 329/04. Health information custodians (HIC) are required to ensure that every digital health asset that it selects, develops or uses complies with all applicable interoperability specification, as it may be amended from time to time, within the prescribed timelines.

Compliance with the requirements of the DHIEX framework does not relieve a HIC of their broader obligations under PHIPA and its regulations or under the Freedom of Information and Protection of Privacy Act (FIPPA)

Ontario Health must consult with and consider the recommendations of the Information and Privacy Commissioner of Ontario on any specification that relates to the confidentiality of personal health information, the privacy of individuals or the rights of individuals to access or correct records of their personal health information, prior to providing the specification to the Minister of Health for review and approval.

Ontario Health is also required to consult with any health care provider organizations, individuals, partners and other parties as appropriate, in order to inform its decisions concerning the establishment, maintenance or amendment of interoperability specifications.

1.3.1 Applying the DICOM Standard

This specification applies the DICOM Standard to ensure that imaging studies contributed to a regional DIR or the provincial VNA maintain their clinical and technical integrity.

It highlights a minimum set of behaviours and attributes that must be implemented exactly as defined by the DICOM Standard and relevant IHE profiles. Vendors and Health Information Custodians are still responsible for conforming to all other applicable DICOM requirements not explicitly repeated in this document.

The following information is provided in accordance with O.Reg.329/04 under the Personal Health Information Protection Act (PHIPA), 2004, section 28, Application of Specifications as an interoperability specification under Ontario's Digital Health Information Exchange (DHIEX) framework:

Specification Effective Date*	N/A – balloted draft
Class of Health Information Custodians that must select, develop, or use digital health assets that comply with the specification	Health Information Custodians who contribute data to miCDR: - Hospitals as per the Public Hospitals Act, R.R.O. 1990, Reg. 965. - Integrated Community Health Services Centres (ICHSC) within the meaning of the Integrated Community Health Services Centres Act, 2023.
Types of digital health assets to which the specification applies	Picture Archiving and Communication Systems (PACS), imaging forwarding gateways, diagnostic workstations, and other digital health assets that are selected, developed, or used by health information custodians and that originate, process, or transmit DICOM images and related objects (e.g., presentation states, encapsulated documents) containing personal health information to a regional Diagnostic Imaging Repository (DIR) or the provincial Vendor Neutral Archive (VNA).
Circumstances, if any, when a Health Information Custodian may be exempted from the requirement to select, develop or use	Any exemptions will be defined by Ontario Health policy and approved through the

digital health assets that comply with the specification	DHIEX governance process. Until such policy is issued, no automatic exemptions apply.

* Note: This is the date by which all applicable HICs are required to be compliant with the approved interoperability specification. OH will work with the applicable HICs to establish the implementation plan to meet the effective date.

1.3.2 Disclaimer

Pursuant to O. Reg. 329/04, Ontario Health is required to, subject to the review and approval of the Minister, establish, maintain and amend interoperability specifications. The Minister may direct Ontario Health to establish or amend interoperability specifications, and Ontario Health is required to comply with such direction.

In accordance with O. Reg. 329/04, Ontario Health makes the interoperability specification most recently approved by the Minister available to the public by posting it on Ontario Health's website or by such other means as Ontario Health considers advisable.

As the Minister may direct Ontario Health to amend the interoperability specifications from time-to-time, Ontario Health advises the public and any other users of information concerning interoperability specifications to regularly review Ontario Health's website where the interoperability specifications are posted, or such other means Ontario Health considers advisable, in order to confirm that they are accessing the interoperability specifications most recently approved by the Minister.

This specification is provided on an 'as is' basis, without warranties or representations of any kind, express or implied. Ontario Health assumes no responsibility for any use of, or reliance on, this specification, and is not liable for any loss, cost, or damage arising from access to, use of, or reliance on this specification or the information it contains.

1.3.3 Privacy and Security

Under PHIPA, Ontario Health (OH) is a Prescribed Organization (PO) with the power and duty to develop and maintain the electronic health record. In doing so, OH manages and integrates personal health information (PHI) it receives from HICs and enables HICs to collect, use and disclose personal health information by means of the EHR.

HICs who contribute records of PHI to OH as a PO are not considered to be disclosing said records to OH, nor is OH as PO considered to be collecting same from the HIC. Despite this, HICs have responsibilities related to this contribution of PHI and are required to complete onboarding processes, comply with OH privacy and security policies, procedures, and standards, and contribute PHI in accordance with interoperability specifications established by OH. These and other requirements are set forth in the EHR Contributor Agreement (ECA) and other OH agreements as applicable, which OH executes with contributing HICs.

This document is an interoperability specification established by OH pursuant to O. Reg. 329/04 subsection 27(1) and referenced under "EHR Data-In Interface Specifications" in the ECA.
As set out in section 1.3.1, Applying the DICOM Standard, specified Health Information Custodians contributing PHI to Ontario Health in its role as a Prescribed Organization are required to ensure that applicable digital health assets comply with this interoperability specification.

Further to the above, the specified HICs are also required to provide a report to the OH, upon the request by OH that sets out their compliance with the requirement to select, develop or use digital health assets that comply with this interoperability specification. Such reports must be provided by the HIC through the means, in the format, and within the time period determined by OH. These HICs also must co-operate with and assist OH in monitoring their own compliance with the requirements and must provide any information or records (Which must not include PHI) to OH upon request.

Should OH find reasonable grounds to believe that a HIC has contravened or is about to contravene the requirement to select, develop or use digital health assets that comply with this interoperability specification, OH may make a complaint to the Commissioner under Part VI of the Act and may provide to the Commissioner any information and records obtained under O. Reg. 329/04 sections 32 and 33.

Of note, this interoperability specification by itself does not serve to mandate contribution by HICs to the EHR but rather establishes the business and/or technical requirements applicable to contribution by specified HICs and specified digital health assets. The information herein is to be read in conjunction with the terms and conditions set forth in the ECA. For greater certainty, nothing within this interoperability specification relieves a HIC of its obligation to comply with any provisions of PHIPA and its regulations.

1.4 Architecture

1.4.1 Detailed Archival Workflow Sequence (C-MOVE / C-STORE / Storage Commitment)

1. **Association Establishment (A-ASSOCIATE / A-RELEASE)**
   - The PACS or broker (**SCU**) initiates an **A-ASSOCIATE-RQ** with the **SCP**, being the DIR in the current state or the VNA in the future state, and negotiates presentation contexts for C-MOVE, C-STORE, and Storage Commitment.
   - The DIR/VNA returns **A-ASSOCIATE-AC** if negotiation succeeds or **A-ASSOCIATE-RJ** if rejected.
   - DIMSE messages occur within this session until closed via **A-RELEASE-RQ / RP** or aborted with **A-ABORT**.

2. **C-MOVE-RQ (Request)**
   - SCU sends a **C-MOVE-RQ** to the DIR/VNA Move SCP, identifying the study or series to archive and specifying the Destination AE Title (DIR/VNA Storage SCP).
   - Command Field: 0x8021 (C-MOVE-RQ).

3. **C-MOVE-RSP (Response – Pending)**
   - DIR/VNA replies with **C-MOVE-RSP (Pending)**, indicating the number of remaining sub-operations.
   - Command Field: 0x8022 (C-MOVE-RSP).

4. **C-STORE-RQ (Request – per instance)**
   - SCU transmits each SOP Instance to the DIR/VNA (Storage SCP) using **C-STORE-RQ** messages.
   - Command Field: 0x0001 (C-STORE-RQ).

5. **C-STORE-RSP (Response – per instance)**
   - DIR/VNA returns **C-STORE-RSP** for each object, reporting Success (0x0000), Warning, or Failure.

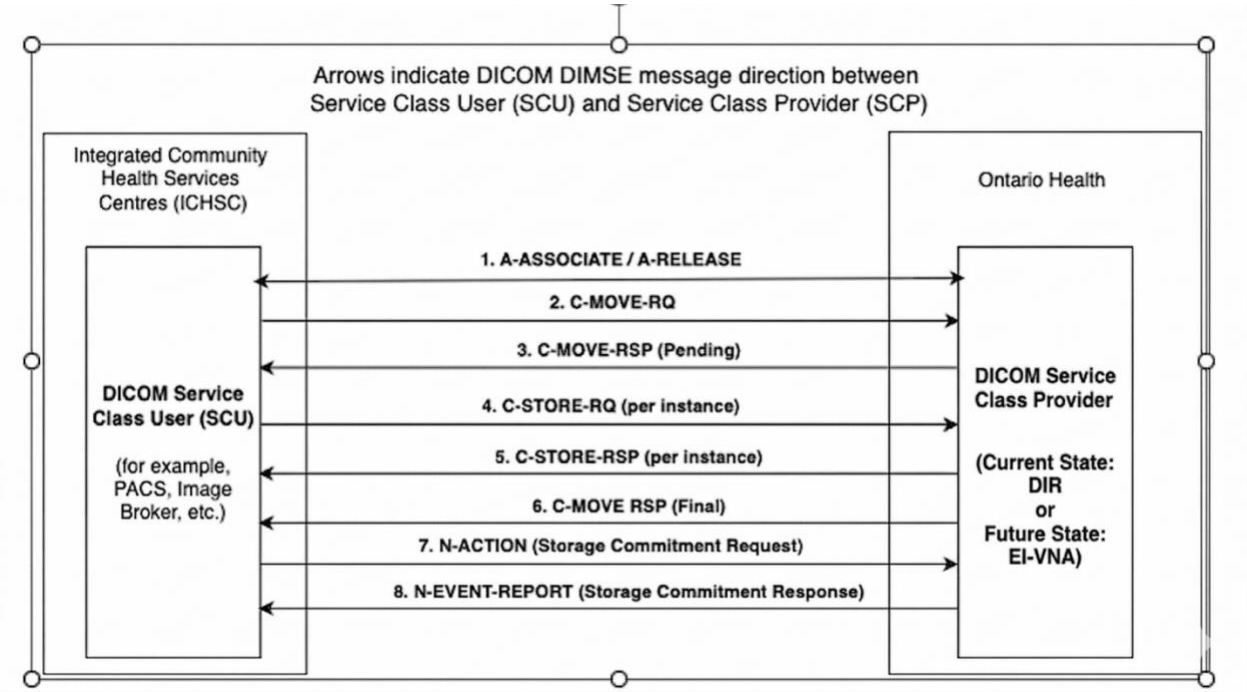
6. **C-MOVE-RSP (Response – Final)**
   - After all C-STORE operations complete, DIR/VNA sends the final **C-MOVE-RSP** indicating Success or any sub-operation errors.

7. **N-ACTION (Storage Commitment Request)**
   - SCU initiates **Storage Commitment** to verify persistence of transmitted objects.
   - SCU sends **N-ACTION** listing the SOP Instance UIDs for confirmation.

- Command Field: 0x0130 (N-ACTION).

8. **N-EVENT-REPORT (Storage Commitment Response)**
   - DIR/VNA asynchronously returns an **N-EVENT-REPORT** confirming success or failure for each SOP Instance.
   - Command Field: 0x0131 (N-EVENT-REPORT).

Figure 1.4.1.: Archival Workflow Sequence (C-MOVE / C-STORE / Storage Commitment)



1.4.2 Detailed Query/Retrieve Workflow Sequence (C-FIND / C-MOVE / C-GET)

1. **Association Establishment (A-ASSOCIATE / A-RELEASE)**
   - The SCU (PACS, viewer, or broker) establishes a DICOM association with the DIR/VNA (SCP), negotiating presentation contexts for C-FIND, C-MOVE, and/or C-GET.
   - A-ASSOCIATE-RQ / A-ASSOCIATE-AC handshake occurs; the session remains active for the duration of query and retrieve operations.

2. **C-FIND-RQ (Query Request)**

- The SCU sends a **C-FIND-RQ** to the DIR/VNA's Query SCP, specifying the query level (e.g., PATIENT, STUDY, SERIES, or IMAGE) and matching keys such as PatientID, AccessionNumber, or StudyDate.
- Command Field: 0x8020 (C-FIND-RQ).

3. **C-FIND-RSP (Query Response)**
   - The DIR/VNA responds with one or more **C-FIND-RSP** messages, each containing matching datasets (e.g., StudyInstanceUID, SeriesDescription, StudyDate, Modality).
   - A final C-FIND-RSP with status **Success (0x0000)** or **Cancel (0xFE00)** terminates the query sequence.
   - Command Field: 0x8021 (C-FIND-RSP).

4. **C-MOVE-RQ or C-GET-RQ (Retrieve Request)**
   - Based on the query results, the SCU issues either:
     - a **C-MOVE-RQ**, instructing the DIR/VNA to send the identified studies to the SCU's Storage AE (using C-STORE), or
     - a **C-GET-RQ**, retrieving the instances directly over the same association.
   - Command Fields: 0x8021 (C-MOVE-RQ) or 0x8010 (C-GET-RQ).

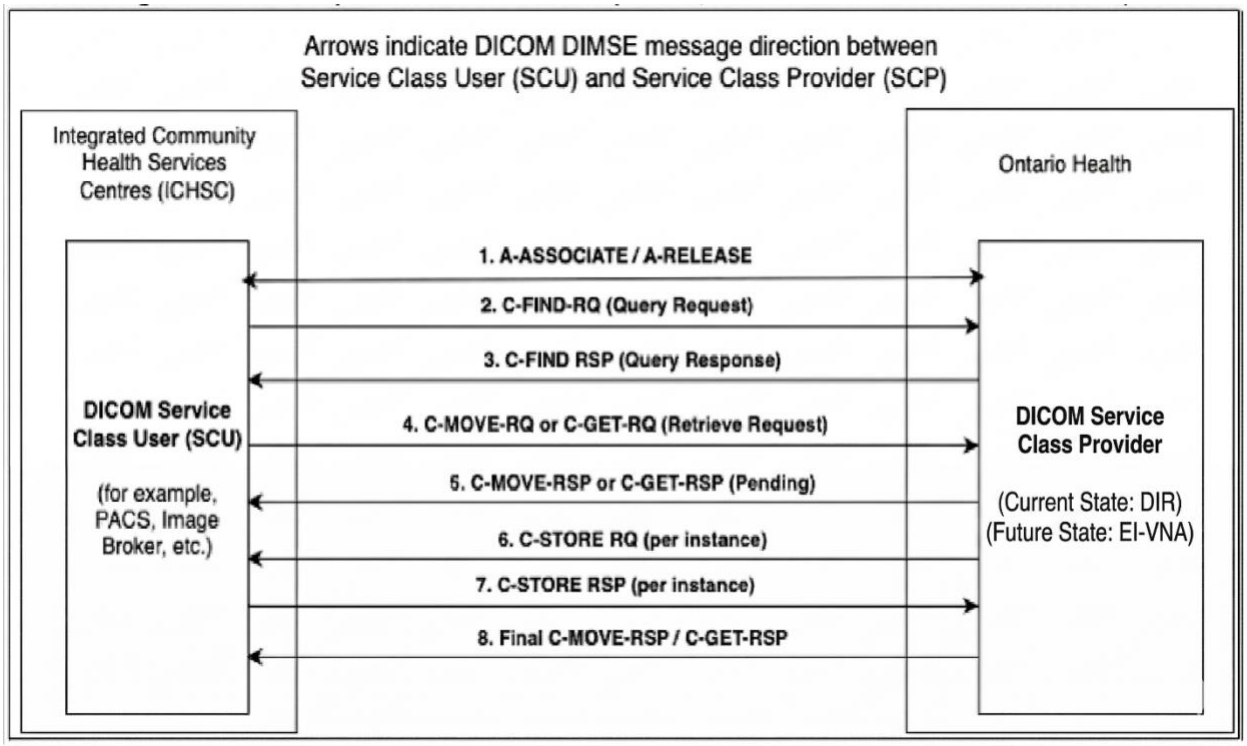
5. **C-MOVE-RSP / C-GET-RSP (Response – Pending)**
   - DIR/VNA replies with one or more **C-MOVE-RSP (Pending)** or **C-GET-RSP (Pending)** messages indicating transfer progress and remaining sub-operations.
   - Command Fields: 0x8022 (C-MOVE-RSP), 0x8011 (C-GET-RSP).

6. **C-STORE-RQ (Request – per instance)**
   - When C-MOVE is used, the DIR/VNA (as C-STORE-SCU) sends each instance to the SCU (C-STORE-SCP) via **C-STORE-RQ** messages.
   - Command Field: 0x0001 (C-STORE-RQ).

7. **C-STORE-RSP (Response – per instance)**
   - The SCU returns a **C-STORE-RSP** for each received instance, indicating success, warning, or failure.
   - Command Field: 0x0001 (C-STORE-RSP).

8. **Final C-MOVE-RSP / C-GET-RSP (Response – Final)**
   - DIR/VNA issues a final **C-MOVE-RSP** or **C-GET-RSP** with overall status (Success, Warning, or Failure) once all transfers complete.

Figure 1.4.2.: Query/Retrieve Workflow Sequence (C-FIND / C-MOVE / G-GET / C-STORE)



1.5 Data Sources

Data sources include the organizations that have custody of the data being transmitted, together with the systems that originate or forward DICOM objects to a regional DIR, or, in the future state, to a provincial VNA. In most hospital and ICHSC environments, imaging modalities are where images are generated, but they do not typically send directly to the DIR or, in the future state, the VNA; instead, studies are first stored in a local PACS or an image broker, which then forwards the objects upstream.

Typical sources include:

- **PACS and site-level forwarding systems:** hospital or clinic PACS, mini-PACS, vendor-neutral image brokers or gateways that aggregate and forward studies, and routing engines that apply lifecycle rules.
- **DICOM content collected and forwarded by those systems:** imaging studies acquired from modalities such as CT, MR, US, XA/DSA, RF/fluoroscopy, CR/DR, MG including tomosynthesis, PET, NM, SPECT-CT, PET-MR, DXA, and mobile point-of-care ultrasound, together with related non-image DICOM objects such as structured reports (SR), key object selection (KOS) documents, GSPS presentation states, dose SR, encapsulated PDFs or video clips, and other DICOM information objects generated by the modality, PACS, or connected workstations.

The specific devices and forwarding paths in use at each HIC will be documented as part of the onboarding process.

2. Scope of Data

This document outlines the minimum metadata requirements for successful DICOM conformance. These baseline requirements are set out in Section 3, DICOM Baseline Conformance Rules,

2.1 Data Not Covered

The following clinical data types are not covered by this standard:

- HL7 v2.x or FHIR™ messaging used for patient registration, orders, or reports.
- Non-DICOM data exchanges such as native PDF uploads, JPEG or video content without DICOM encapsulation, or cloud storage transfers using proprietary APIs.
- Any workflow or transport mechanisms that are not DICOM-compliant, including email, web-based portals, or file-share transfers.

2.2 Supported Functional Use Cases

2.2.1 Use Cases

#	Use Case	Description	Clinical Data Types	Standards / Profile Reference
UC-101	Triggered Send Based on Study Status	The sending system (PACS or broker SCU) transmits studies to the DIR/VNA automatically when a configured status or event (such as Final, Verified, or Archived) occurs. The send trigger is defined by local workflow configuration rather than the DICOM standard.	All DICOM-conformant imaging studies generated by the HIC.	IHE Scheduled Workflow (SWF) – Post-Processing and Storage transactions (RAD-10 / RAD-14); Local configuration policy

#	Use Case	Description	Clinical Data Types	Standards / Profile Reference
UC-102	Archive Studies to DIR/VNA	The SCU initiates a C-MOVE operation to send selected studies from the local PACS or broker to the DIR/VNA for long-term storage. The DIR/VNA receives the studies via C-STORE.	Diagnostic images and related presentation objects (CT, MR, US, XA, MG, CR/DR, NM, PET, PR, etc.).	C-MOVE / C-STORE (DICOM PS 3.4 §C.3)
UC-103	Storage Commitment Confirmation	The SCU requests Storage Commitment from the DIR/VNA using N-ACTION. The DIR/VNA responds with an N-EVENT-REPORT confirming success or failure.	All studies transmitted to the DIR/VNA.	N-ACTION / N-EVENT-REPORT (DICOM PS 3.4 §B.5)
UC-104	Study Retrieval and Consumption	The SCU uses C-FIND to query the DIR/VNA for prior studies and retrieves them via C-MOVE or C-GET for local display or comparison.	Historical or comparison studies required for clinical review.	C-FIND / C-MOVE / C-GET (DICOM PS 3.4 §C.3)

2.2.1.1 Workflow: UC-101 – Triggered Send Based on Study Status

Summary

This workflow describes how a site system (PACS or image broker) detects that a study has reached a configured stats or even threshold, such as Final, Verified, or Archived, and automatically triggers an outbound transmission workflow. It ensures that only imaging studies that have passed local verification and routing conditions are selected for transmission to the to a regional DIR, in the future state, the provincial VNA.

Actors

- **SCU:** The site PACS or image broker responsible for detecting the configured trigger condition and initiating the outbound send workflow.
- **SCP:** The receiving repository or archive endpoint, being the DIR in the current state or the Provincial VNA in the future state.

Pre-conditions

- The study has passed local verification and retention checks and has reached a configured transmission status.
- The PACS or broker is configured with valid AE Titles and network connectivity to the receiving endpoint.

- Required DICOM hierarchy and UID rules are met, including unique and consistent StudyInstanceUID, SeriesInstanceUID, and SOPInstanceUID values.
- Mandatory identifiers such as Patient ID, Accession Number, Modality, and Study Date/Time are correctly populated.
- Supported transfer syntaxes and character sets are available as required by the receiving endpoint.
- The SCU can retry failed transmissions while preserving original UIDs as required in Section 3.1.

Primary Flow

1. A study within the PACS or broker reaches a configured status (for example, Final, Verified, or Completed).
2. The system evaluates the study against local routing, verification, and retention rules.
3. If the configured conditions are met, the system generates an outbound send event.
4. THE SCU identifies the study and associated DICOM objects as eligible for transmission.
5. The SCU invokes the archival transmission workflow described in UC-102.
6. The trigger event and invocation of the outbound send workflow are recorded in the local system log.

2.2.1.2 Workflow: UC-102 – Archive Studies to DIR/VNA

Summary

This workflow describes how a site system (PACS or image broker) transmits finalized studies to a regional DIR, or in the future state, the provincial VNA for archival storage. It covers the transmission, validation, storage, and response steps required to support consistent downstream access within the provincial enterprise imaging model.

Actors

- **SCU:** The site PACS or image broker that initiates the archival transfer.
- **SCP:** The receiving repository or archive endpoint, being the DIR in the current state or the provincial VNA in the future state, which receives, validates, and stores the incoming DICOM objects.

Pre-conditions

- The study has been identified as eligible for archival, whether through UC-101 or another permitted local workflow.
- The SCU is configured with a valid AE Title and network connectivity to receiving endpoint.
- DICOM hierarchy integrity and UID compliance are maintained (StudyInstanceUID, SeriesInstanceUID, SOPInstanceUID).

- Mandatory identifiers (Patient ID, Accession Number, Modality, Study Date/Time) are correctly populated as outlined in section 3.2.
- The transfer syntax and character set used are supported by the DIR/VNA as defined in Section 3.3.
- All required routing and compression rules are applied by the site system prior to transmission.

Primary Flow

1. The SCU identifies one or more triggered studies for archival transmission.
2. The SCU initiates a DICOM **C-STORE** operation to transmit the selected studies to the to the receiving endpoint.
3. The receiving endpoint stores the validated objects and returns an appropriate success or failure to the SCU. The SCU records the transmission method outcome in the local log. Unsuccessful transmissions should be addressed through local retry, error-handling, and troubleshooting processes, while successful transmissions may, where Storage Commitment is implemented, trigger a subsequent Storage Commitment request (see UC-103)

2.2.1.3 Workflow: UC-103 – Storage Commitment Confirmation

Summary

This workflow describes how the site system (SCU) confirms that all images and related DICOM objects sent to a regional DIR or the provincial VNA have been safely stored. Storage Commitment provides greater assurance that the transmitted DICOM objects have been retained by the receiving endpoint and that the data constancy between the sending site and receiving endpoint has been preserved.

Actors

- **SCU:** The site PACS or image broker that initiates the Storage Commitment request.
- **SCP:** The DIR/VNA, which validates and confirms successful persistence of the transmitted objects.

Pre-conditions

- The study has been successfully transmitted to the DIR/VNA using the C-STORE operation (see UC-102).
- All UID and attribute requirements have been validated and accepted by the DIR/VNA.
- The SCU supports the DICOM Storage Commitment service (N-ACTION / N-EVENT-REPORT).

- Both systems have valid AE Titles and a configured association for Storage Commitment.

Primary Flow

1. The SCU issues an **N-ACTION** request to the DIR/VNA to confirm successful storage of previously transmitted objects.
2. The DIR/VNA verifies that the specified SOP Instances have been safely persisted.
3. The DIR, or in the future state, the provincial VNA returns an **N-EVENT-REPORT** indicating success or failure for each object. Where a failure is reported, the sending system should log the result and address it through the local retry, reconciliation, error-handling, and troubleshooting processes.
4. The SCU logs the response and updates local status or retry mechanisms if any failures are reported.

2.2.1.4 Workflow: UC-104 – Study Retrieval and Consumption

Summary

This workflow describes how a site system queries and retrieves studies from a regional DIR or the provincial VNA for local viewing, comparison, or re-distribution. Retrieval ensures that prior imaging studies are available to support clinical review and continuity of care across sites participating in Ontario Health's enterprise imaging model.

Actors

- **SCU:** The site PACS, broker, or clinical workstation that initiates the query and retrieval request.
- **SCP:** The DIR/VNA, which responds to queries and provides the requested DICOM objects for local access.

Pre-conditions

- The DIR/VNA has successfully stored the requested studies (see UC-102 and UC-103).
- The SCU has valid AE Titles and network configuration for querying and retrieval.
- All DICOM hierarchy and UID requirements are maintained for accurate study linkage.
- The SCU supports standard query/retrieve services (C-FIND, C-MOVE, or C-GET) as defined in DICOM PS 3.4.

Primary Flow

1. The SCU issues a **C-FIND** query to the DIR/VNA to locate prior studies based on patient or study-level attributes (for example, Patient ID, Accession Number, or Study Date).
2. The DIR/VNA responds with zero, one, or more matching studies that satisfy the query parameters.
3. The SCU selects one or more studies for retrieval and initiates a **C-MOVE** or **C-GET** operation.
4. The DIR/VNA transmits the requested DICOM objects to the SCU using **C-STORE**.

5. The SCU stores or caches the received objects locally and makes them available for clinical display or comparison.

3. DICOM Baseline Conformance Rules

3.1 UID Compliance

Statement: All Unique Identifiers (UIDs) used in DICOM objects, including **StudyInstanceUID, SeriesInstanceUID, SOPInstanceUID, FrameOfReferenceUID** and any others generated by the system — must conform to the UID format defined in the DICOM Standard (Part 5, Section 9).

This means:

- UIDs shall consist only of digits (0-9) and period separators. No alphabetic characters, spaces, dashes, or special symbols.
- Each UID must follow the dotted-decimal numeric tree format (for example: 1.2.840.113619.2.55.3.604688435).
- The maximum length is 64 characters.
- Every UID must be unique across the entire generating system and over time; once issued, a UID must never be reused for a different object or patient.
- Preserving incoming UIDs is mandatory; they may not be regenerated except in an approved migration process.

Purpose: These rules prevent UID collisions, split-study errors, overwriting of images, and ingestion failures in a regional DIR or the provincial VNA.

Table 3-1: UID Compliance Checklist

#	Requirement	Must / Must Not	DICOM Reference	Notes
1	**Globally unique UIDs across the system**	**Must** guarantee every UID (Study, Series, SOP Instance, FrameOfReference, etc.) is **unique not only within its hierarchy but across the entire generating system and over time**	Part 5 §9.1 – UID Requirements	Prevents collisions between studies or devices that could corrupt the DIR/VNA index
2	**Follow DICOM UID syntax**	**Must** use only digits and periods; **Must Not** include alphabetic characters, spaces, dashes, or other symbols	Part 5 §9.1 – UID Requirements	Invalid characters cause objects to be rejected by downstream systems

3	**Preserve incoming UIDs**	**Must** preserve source UIDs when forwarding to the DIR/VNA; **Must Not** regenerate except in an approved exchange process	IHE SWF IHE_RAD_TF_Vol2 § 4.8.4.1.1.1	Regeneration can break prior-image linkage
4	**Do Not duplicate or reuse UIDs**	**Must Not** reuse any previously issued UID for a different exam, patient, or later acquisition	Part 5 §9.1 – UID Requirements	Reuse can cause downstream systems to overwrite or reject objects
5	**Stable across re-sends**	**Must** send identical UIDs if an object is resent (e.g., after a reject / retry)	IHE SWF IHE_RAD_TF_Vol2 § 4.8.4.1.1.1	Duplicate instances or orphaned presentation states

3.2 DICOM Mandatory Identifiers

Statement: All imaging objects sent to a regional DIR or the provincial VNA must include a set of mandatory identifying attributes so that the archive can correctly link each study to the right patient and order.

These attributes must be populated according to the DICOM Standard modules referenced below and any provincial constraints (e.g., character set and length rules).
Objects that are missing or mis-using these attributes may be rejected during onboarding.

Table 3-2: Mandatory Identifiers Checklist

#	Attribute	Requirement (Must / Must Not)	DICOM Reference	Notes / Local Constraints
1	**Patient ID (0010,0020)**	**Must** be present on every object and remain consistent for all objects belonging to the same patient	Part 3 C.7.1.1 – Patient Module	Must match the identifier assigned by the sending clinic's EMR/RIS; no free-text or temporary IDs
2	**Issuer of Patient ID (0010,0021)**	**Must** be present when more than one facility shares the DIR/VNA to ensure patient-ID uniqueness across HICs	Part 3 C.7.1.1 – Patient Module	Use the HICs OID format
3	**Accession Number (0008,0050)**	**Must** be populated for all ordered exams; must remain identical across all Series in a Study	Part 3 C.7.2.1 – Study Module	Accepts alphanumeric as defined by OH policy; must not exceed provincial max length (e.g., ≤ 64 chars)
4	**Study Date (0008,0020) and Study Time (0008,0030)**	**Must** reflect the date/time of the actual imaging study	Part 3 C.7.2.1 – Study Module	Format per DICOM DA/DT VR; required for chronology and hanging protocols

5	**Modality (0008,0060)**	**Must** be populated with the correct DICOM-defined modality code (CT, MR, US, CR, MG, XA, etc.)	Part 3 C.7.3.1 – Series Module	Do not use vendor-proprietary or obsolete codes
6	**Specific Character Set (0008,0005)**	**Must** be present whenever text contains non-ASCII characters	Part 3 C.12.1 – General Study Module	Allowed sets: UTF-8 or ISO IR 100 (Latin-1) unless otherwise approved by OH
7	**Patient Name (0010,0010)**	**Must** be present using the standard DICOM PN syntax	Part 3 C.7.1.1 – Patient Module	Names must follow DICOM caret-delimited format; must not contain leading/trailing spaces

Common Issues:

- Blank or placeholder Patient IDs such as “12345” used across multiple patients
- Changing Accession Numbers between Series of the same Study
- Using local language characters without declaring Specific Character Set

3.3 Transfer Syntax Policy

Statement: All DICOM objects must be transmitted using a supported Transfer Syntax so that a regional DIR and the provincial VNA can store and render the pixel data without transcoding failures.

Unsupported or proprietary compressions may be rejected during onboarding.

Table 3-3: Transfer Syntax Checklist

#	Requirement	Must / Must Not	DICOM Reference	Notes / Local Constraints
1	**Acceptable Uncompressed Syntax**	**Must** support at least one uncompressed baseline syntax: **Explicit VR Little Endian (1.2.840.10008.1.2.1)** or **Implicit VR Little Endian (1.2.840.10008.1.2)**	Part 5 §10 – Transfer Syntaxes	Ensures basic interoperability and fallback when compressed transfer is unavailable
2	**No Proprietary or Private Transfer Syntax UIDs**	**Must Not** use non-standard Transfer Syntax UIDs	Part 5 §10	Objects encoded with private UIDs will be rejected

Common Issues:

- Proprietary codecs not recognized by the archive or viewers

3.4 Service Class Requirements

Statement: Systems connecting to a regional DIR or the provincial VNA must implement the **standard DICOM service classes** necessary for image storage, retrieval, and workflow acknowledgement.

These services shall conform to the DICOM Standard and relevant IHE profiles; vendor-proprietary services will not be accepted for baseline onboarding.

Table 3-4: Service Class Checklist

#	Service Class / Behaviour	Requirement (Must / Must Not)	DICOM Reference	Notes / Local Constraints
1	**C-STORE – Storage SCU**	**Must** implement standard C-STORE to send images to the DIR/VNA's Storage SCP endpoint	Part 4 §B.2 – Storage Service Class	Baseline requirement for all modalities and PACS
2	**C-MOVE – Query/Retrieve SCU → DIR/VNA SCP**	**Must** support standard C-MOVE when the PACS or workstation requests image retrieval from the DIR/VNA	Part 4 §C.3 – Query/Retrieve Service Class	Needed for pulling priors or sending to downstream devices
3	**C-FIND – Query/Retrieve SCU → DIR/VNA SCP**	**Must** support standard C-FIND to query the DIR/VNA's study/series/image directory as part of the retrieve workflow	Part 4 §C.3 – Query/Retrieve Service Class	Typically used to locate prior studies before a C-MOVE request
4	**Storage Commitment (N-ACTION / N-EVENT-REPORT)**	**Must** support Storage Commitment where available to confirm successful persistence in the DIR/VNA	Part 4 §B.5 – Storage Commitment Service Class	Strongly encouraged for modalities; reduces duplicate re-sends
5	**Consistent AE Title Configuration**	**Must** provide fixed, documented AE Titles for Storage and Commitment	Part 7 – Message Exchange	Helps the onboarding team configure routing, logging, and troubleshooting consistently

3.5 Attribute Integrity

Statement: All DICOM objects transmitted to a regional DIR or the provincial VNA must preserve the **integrity of standard DICOM attributes**.

Attributes shall be used only for their intended purpose as defined in the DICOM Standard; vendor-proprietary overloading or embedding of sensitive information in unintended fields is prohibited.

Table 3-5: Attribute Integrity Checklist

#	Requirement	Must / Must Not	DICOM Reference	Notes / Local Constraints
1	**Use Standard Attributes as Defined**	**Must** use attributes only as defined by the DICOM Standard; **Must Not** overload unrelated attributes to store proprietary values	Part 3 Modules (relevant per modality)	Prevents loss of data fidelity and incompatibility with downstream systems
2	**Avoid Private Tags for Clinical Display Intent**	**Must Not** encode presentation-related info (e.g., window/level, measurement graphics) solely in vendor-private tags	Part 3 C.11 – Presentation State Modules	Use standard Grayscale Softcopy Presentation State (GSPS) or VOI LUT objects where needed
3	**Preserve Attribute Values During Routing/Forwarding**	**Must** maintain all received standard attributes unchanged when forwarding objects to the DIR/VNA	Part 4 B.2 – Storage Service Class	Altering attributes can lead to duplicate or orphaned studies
4	**Consistent Attribute Population Within a Study**	**Must** populate key descriptive attributes (e.g., StudyDescription, BodyPartExamined) consistently across all Series/Instances in the Study	Part 3 C.7.2 & C.7.3	Inconsistent descriptive fields can interfere with hanging protocols and clinical workflow
5	**No Use of Deprecated Attributes**	**Must Not** populate retired or deprecated attributes for active production objects	DICOM Part 3 Retired Attributes tables	Reduces confusion and ensures forward compatibility

Common Issues:

- Measurement lines or annotations encoded only in **private tags** rather than in standard GSPS objects
- Forwarders rewriting StudyDescription or SeriesDescription, causing inconsistent metadata within the study

3.6 Rejection and Error Handling

Statement: All imaging systems sending objects to a regional DIR or the provincial VNA must be able to **detect, report, and respond to ingestion errors or object rejections**.

Vendors are required to implement a clear process for notifying users and resubmitting corrected objects to prevent data loss or incomplete studies.

Table 3-6: Rejection & Error Handling Checklist

#	Requirement	Must / Must Not	DICOM / Best-Practice Reference	Notes / Local Constraints
1	**Detect Rejection Events**	**Must** be able to recognize when the DIR/VNA rejects an object (e.g., due to UID conflict, missing mandatory tags, unsupported transfer syntax)	IHE RAD-14 & RAD-16 – Basic Error Handling	Systems must log rejection events and make them available to support staff
2	**Provide User-Visible Alerts or Logs**	**Must** provide operators with clear alerts or access to logs that indicate the reason for failure	Best Practice – Vendor Implementation	Helps clinical/IT staff quickly identify and resolve issues
3	**Retain Original Object for Re-Send**	**Must** keep a copy of the rejected object(s) until successful transmission is confirmed	Best Practice	Ensures no data loss when correction is needed
4	**Preserve UIDs on Re-Send**	**Must** re-send corrected objects with the **same original UIDs**; **Must Not** generate new UIDs when retrying	DICOM Part 5 §9 – UID Requirements	Prevents duplicate instances or broken study linkage
5	**Document Error Codes & Resolution Steps**	**Must** provide Ontario Health with a list of DICOM status/error codes used by the device and recommended resolution steps	Best Practice	Aids the onboarding team and support staff in troubleshooting recurring errors
6	**Escalation Path**	**Must** include a documented escalation procedure for unresolved ingestion errors	Best Practice	Ensures timely remediation and minimizes workflow disruption

Common Issues:

- Systems silently discarding images that failed to send without notifying the user
- Operators manually resending studies with **newly generated UIDs**, creating duplicates or broken links in the DIR/VNA
- Lack of clear log retention, making troubleshooting difficult after the fact

4. Implementation and Onboarding

4.1 Purpose

This section describes the onboarding and validation steps that each Health Information Custodian (HIC) and vendor must complete before establishing a live connection to a regional

DIR or the provincial VNA. The objective is to confirm that all sending systems conform to the DICOM requirements defined in this guide and that transmission, validation, and rejection handling behave as expected.

4.2 Prerequisites

Before onboarding, each HIC or vendor must:

- Assign a technical contact for the project.
- Provide the latest DICOM Conformance Statement (PS 3.2) for each sending application or modality.
- Supply AE Titles, IP addresses, ports, and TLS configuration details for connectivity planning.
- Verify that all devices are on approved software versions or service packs.

4.3 Test Data Submission

Each HIC must provide a representative set of de-identified test studies for every modality type.

- Test data should include typical image series and presentation states where applicable.
- Test studies must be transmitted using the same AE Titles, transfer syntaxes, and compression settings as planned for production.

4.4 Validation Steps

Each HIC must provide a representative set of de-identified test studies for every modality type.

- Test data should include typical image series and presentation states where applicable.
- Test studies must be transmitted using the same AE Titles, transfer syntaxes, and compression settings as planned for production.

4.4.1 Validation Steps

1. **Connectivity Test** – Confirm network reachability, AE Title resolution, and a successful C-STORE handshake.
2. **Metadata Validation** – Use automated tools (for example, DVTk, dciodvfy, etc) to confirm:
    - UID format and uniqueness
    - Presence of mandatory identifiers (Patient ID, Accession Number, etc.)
    - Character set and encoding
    - Supported transfer syntax
3. **Test Ingestion** – Send the sample studies to the DIR/VNA and confirm:
    - Successful storage without rejections or warnings

- Correct grouping by patient and study hierarchy
- Images are viewable with proper presentation states and VOI-LUTs

4. **Error-Handling Check** – Simulate at least one rejection event (for example, a missing tag) to confirm that the sending system logs and alerts the failure correctly.

5. IHE and Standards References

5.1 Purpose

This section identifies the official DICOM and IHE specifications that underpin the provincial onboarding requirements. It does not restate the standards in full; instead, it highlights the relevant parts implementers must review alongside this guide.

All DICOM references in this section correspond to the **DICOM 3.0 Standard (PS 3.1 – PS 3.20 series)** maintained by the DICOM Standards Committee and NEMA. Implementers should ensure that their systems conform to this version and its associated service classes, transfer syntaxes, and data structure definitions.

5.2 DICOM 3 Standard Reference

Area	Relevant DICOM Part(s)	Notes
Data Elements and UID Format	Part 5 – Data Structures and Encoding, §9 (Unique Identifiers)	Defines UID syntax, maximum 64-character limit, and numeric dotted-decimal structure.
Patient / Study / Series / Instance Hierarchy	Part 3 – Information Object Definitions, C.7 Modules	Defines Patient, Study, Series, and Image modules required for proper hierarchy and identifiers.
Storage Service Class	Part 4 – Service Class Specifications, §B.2	Defines C-STORE for image storage.
Query / Retrieve	Part 4 – Service Class Specifications, §C.3	Defines C-FIND, C-MOVE, and C-GET behaviours.
Transfer Syntaxes	Part 5 – Data Structures and Encoding, §10	Lists standard uncompressed and compressed transfer syntaxes.
Presentation States	Part 3 – Presentation State Modules (C.11)	Defines GSPS and VOI-LUT used instead of private tags.
Character Set	Part 5 – §6.1.2 and Part 3 C.12.1 – General Study Module	Defines Specific Character Set (0008,0005) and supported encodings.
Conformance Statement	Part 2 – Conformance	Vendors must supply a valid Part 2 DICOM Conformance Statement during onboarding.

5.3 IHE Profile References

Profile	Purpose	Reference
IHE Scheduled Workflow (SWF)	Defines how modalities use MWL, C-STORE, and Storage Commitment in an enterprise environment.	IHE Radiology Technical Framework Vol 1–3
IHE PIR – Patient Information Reconciliation	Supports reconciliation of images acquired before accurate demographics are available.	IHE Radiology Technical Framework Vol 1–3
IHE RAD-14, RAD-16	Define basic error and rejection handling transactions.	IHE Radiology Technical Framework Vol 2

6. Glossary

Term	*Definition*
Association (A-ASSOCIATE / A-RELEASE)	The session-level handshake that establishes and terminates communication between DICOM systems. It negotiates presentation contexts and transfer syntaxes before any service operations (such as C-STORE or C-MOVE) occur.
C-FIND	A DICOM query service used by a Service Class User (SCU) to request study, series, or image information from a Service Class Provider (SCP). Commonly used to locate prior studies before retrieval.
C-GET / C-MOVE	DICOM network services used for retrieving studies or images. C-MOVE instructs the Service Class Provider (SCP) to send the requested data to a specified destination AE, while C-GET retrieves data over the same association.
C-STORE	A DICOM network service used by an SCU to transmit images or related objects to an SCP for storage.
DHIEX (Digital Health Interoperability and Exchange)	Ontario's regulatory framework under PHIPA (O. Reg. 329/04, ss. 26–34) that authorizes Ontario Health to define interoperability requirements, issue interoperability specifications, and monitor conformance for the exchange of personal health information across the provincial health system.
DICOM (Digital Imaging and Communications in Medicine)	The international standard for handling, storing, transmitting, and displaying medical imaging information.
Digital Health Asset	A product or service selected, developed, or used by a health information custodian (HIC) that uses electronic means to collect, use, modify, disclose, retain, or dispose of personal health information.
DIMSE (DICOM Message Service Element)	The set of DICOM message services that define how information is exchanged between systems during an active association. Examples include C-STORE, C-FIND, C-MOVE, C-GET, and Storage Commitment (N-ACTION / N-EVENT-REPORT).
Electronic Health Records (EHR)	Has the meaning set out in s. 55.1 of PHIPA and generally means the electronic systems that are developed and maintained by Ontario Health pursuant to Part V.1 of PHIPA for the purpose of enabling HICs to Collect, Use and Disclose PHI by means of the systems
Diagnostic Imaging Repository (DIR)	OCINet-managed legacy regional diagnostic imaging repositories, including SWODIN, HDIRS, and NEODIN. These repositories receive, store, and manage diagnostic imaging studies contributed by participating Health Information Custodians within

	defined regions. They represent the current operational model for regional image exchange.
GSPS (Grayscale Softcopy Presentation State)	A DICOM object that stores how images should be displayed (for example, window/level settings or annotations) in a standard way rather than using proprietary tags.
Hospital	Primarily independent, non-profit corporations operating under the Public Hospitals Act, governed by boards of directors, and funded to provide acute, rehabilitative, or specialized care.
HIC (Health Information Custodian)	A person or organization that has custody or control of personal health information for the purpose of health care or other health-related duties. Examples include physicians, hospitals, pharmacies, laboratories and the Ministry of Health.
ICHSC (Integrated Community Healthcare Service Centre)	An Integrated Community Health Services Centre (ICHSC), formerly known as an Independent Health Facility (IHF), is a community-based, often private clinic in Ontario that is licensed to provide specific OHIP-insured services, including diagnostic imaging (MRI/CT), surgeries (cataract, orthopedics), and other medical procedures.
IHE (Integrating the Healthcare Enterprise)	An initiative that develops implementation profiles based on established standards (such as DICOM and HL7) to promote interoperability among healthcare systems.
IHE Profile	A detailed workflow definition developed by IHE that specifies how existing standards such as DICOM and HL7 are used together to support a particular healthcare use case (for example, Scheduled Workflow, Patient Information Reconciliation, or XDS-I).
Interoperability Specification	A normative document that defines the technical, semantic, and workflow requirements digital health solutions must meet to exchange health information consistently and securely. It profiles recognized standards (e.g., HL7 FHIR, DICOM, IHE, SNOMED CT) and sets the conformance criteria for a defined use case.
N-ACTION / N-EVENT-REPORT	A DICOM service pair used for Storage Commitment and other notification transactions. The SCU sends an N-ACTION request, and the SCP replies with an N-EVENT-REPORT indicating success or failure.
Object Identifier (OID)	A unique numeric string used in Canadian digital health standards to distinguish and identify objects across different systems. OIDs ensure that health information, such as patient records, clinical terminology, and data sets, is uniquely recognized and accurately interpreted when exchanged between systems.
PACS (Picture Archiving and Communication System)	A medical imaging system that stores, retrieves, manages, and displays diagnostic images and associated information.
PHIPA (Personal Health Information Protection Act)	The Ontario health privacy law. It establishes rules for the management of Personal Health Information and the protection of the confidentiality of that information, while facilitating the effective delivery of healthcare services. References to PHIPA include the regulation made thereunder (O. Reg. 329/04), as may be amended or replaced from time to time.
Personal Health Information (PHI)	Identifying information" in oral or recorded form about an individual that: Relates to the physical or mental health of the individual, including information that consists of the health history of the individual's family; Relates to the provision of health care to the individual, including the identification of a person as a provider of health care to the individual; Is a plan that sets out the home and community care services for the individual to be provided by a health service provider or OH Team pursuant to funding under section 21 of the Connecting Care Act, 2019;

	Relates to payments or eligibility for health care or eligibility for coverage for health care, in respect of the individual; Relates to the donation by the individual of any body part or bodily substance of the individual or that is derived from the testing or examination of any such body part or bodily substance; Is the individual's health number; and/or Identifies an individual's substitute decision-maker. PHI also includes identifying information about an individual that is not PHI listed above but that is contained in a record that includes PHI listed above. Information is "identifying" when it identifies an individual or when it is reasonably foreseeable in the circumstances that it could be utilized, either alone or with other information, to identify the individual.
Prescribed Organization (PO)	The organization prescribed in Ontario Regulation 329/04 as the organization for the purposes of PHIPA. The Prescribed Organization has the power and the duty to develop and maintain the EHR in accordance with Part V.1 of PHIPA, and the power to carry out digital health identifier activities in accordance with Part V.2 of PHIPA.
Provincial VNA (Vendor-Neutral Archive)	Future-state Ontario Health–managed provincial enterprise imaging vendor-neutral archive intended to support longitudinal storage and access to diagnostic imaging studies. Over time, it is expected to replace the role of the existing regional diagnostic imaging repositories as part of the future enterprise imaging model.
SCU / SCP (Service Class User / Service Class Provider)	Terms defined by the DICOM Standard. The SCU initiates a DICOM service request (for example, a PACS sending images), and the SCP responds to that request (for example, the DIR/VNA receiving and storing images).
Transfer Syntax	A DICOM term defining how pixel data is encoded for transmission or storage (for example, Explicit VR Little Endian, JPEG Lossless). Both SCU and SCP must support a common transfer syntax for successful data exchange.
UID (Unique Identifier)	That's now complete and airtight — it covers all the DICOM service primitives, Ontario-specific governance terms, and key interoperability acronyms your audience would encounter.