

DOC-2026-312 — XyDromatics Encounter Engine: DICOM Conformance Statement

DRAFT — DOC number tentative. Verify next-available DOC number against PROD QMS before filing; rename file + update Document Information accordingly.

Document number: DOC-2026-312 (tentative) **Release version:** 1.0.1.109 **Version:** 1 **Product:** XyDromatics Encounter Engine v1.0.x (1.0.1.109+) **Audience:** Modality vendors, AI vendors, VNA/PACS vendors configured as EE's downstream STOW-RS or C-STORE target, EMR integration teams receiving HL7 ORM^O01 or FHIR R4 ServiceRequest. **Owner:** Synthology Healthcare Solutions Group (SHSG) **Cross-references:** DOC-2026-183 v2 (EE EUG), DOC-2026-311 (EE HW/SW Requirements — tentative), DOC-2026-308 (EE Pen Test — tentative), DOC-2026-074 (Router DICOM Conformance — sibling-product comparator), DOC-2026-138..142 (VNA-family Conformance Statements — downstream targets).

Structured per DICOM PS3.2 (Conformance) 2024c. HL7 v2.x message semantics per HL7 v2.5.1. FHIR R4 semantics per the HL7 FHIR R4 specification.

1. Introduction

1.1 Revision History

Version	Date	Change
1	2026-05-07	Initial release (Encounter Engine v1.0.0.12+).

1.2 Audience

Integrators connecting modality / AI-vendor / clinical-IT staff wiring Encounter Engine between upstream DICOM producers + HL7 ADT producers and downstream archive (VNA) + EMR (HL7 ORM or FHIR ServiceRequest) targets.

1.3 Remarks

XyDromatics Encounter Engine is the **order-and-encounter coordination tier** of the XyDromatics product family. Its core function:

1. Accept DICOM studies via C-STORE.
2. Accept HL7 ADT^A01/A08 messages via MLLP (license-gated `adt_feed`).
3. Maintain a verification queue with accession minting and ADT-driven matching.
4. Forward verified studies to downstream DICOM destinations (C-STORE SCU or STOW-RS).
5. Optionally emit outbound HL7 ORM^O01 (license-gated `emr_order_hl7`) or FHIR R4 ServiceRequest (license-gated `emr_order_fhir`).

6. Optionally consume Phase 8 customer keypairs to pseudonymize forwarded payloads (read-only consumer; install/rotate at Router).

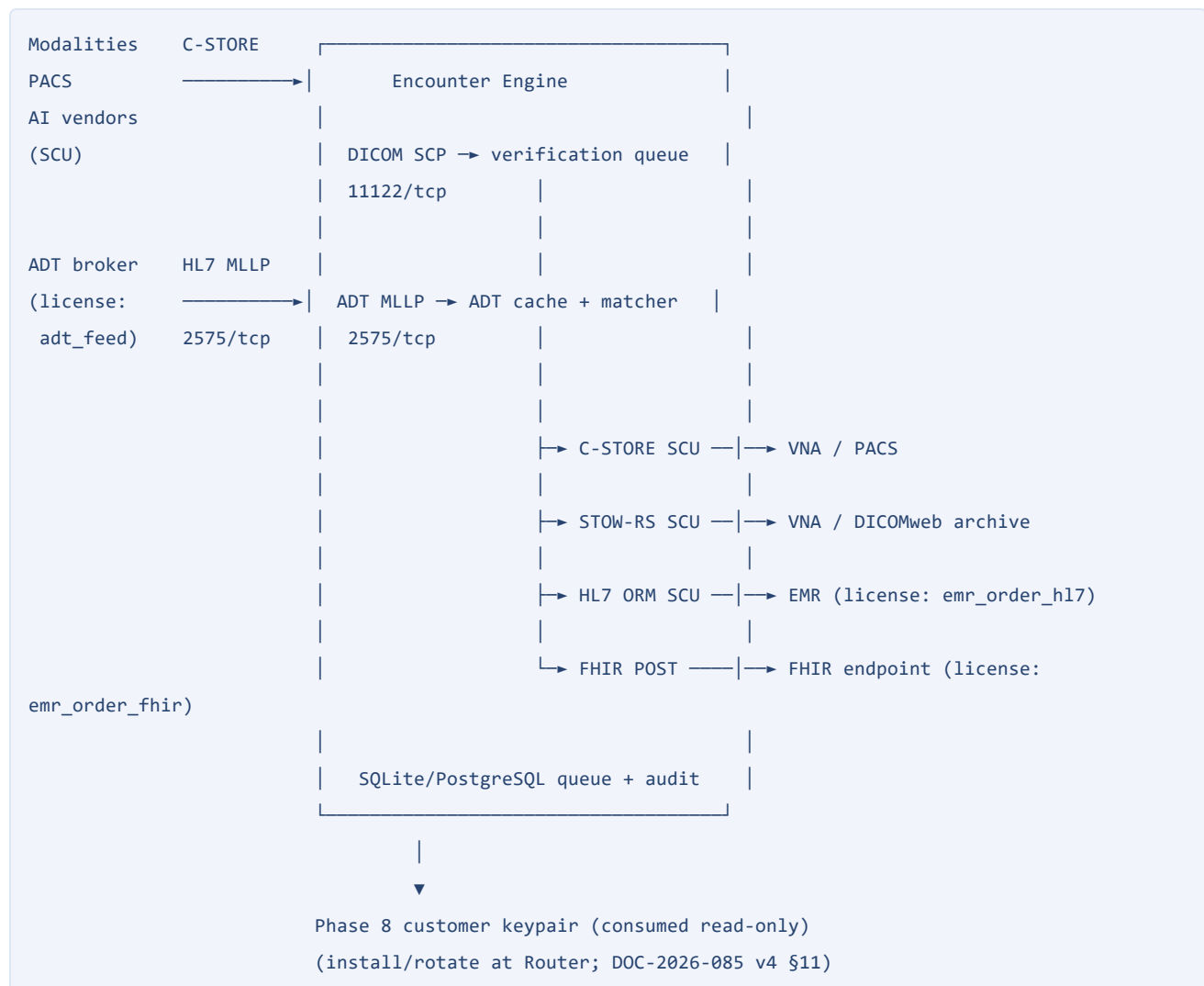
Encounter Engine is **not** a PACS, **not** a clinical viewer, **not** a structured-report parser (see SR Engine, DOC-2026-077, for that role), **not** a vendor-neutral archive (see VNA family), and **not** a general routing engine (see Router, DOC-2026-074).

1.4 Conformance References

- DICOM PS3.1–PS3.18, 2024c.
- DICOMweb (DICOM PS3.18) — STOW-RS, QIDO-RS subsets.
- HL7 v2.5.1 Chapter 3 (Patient Administration — ADT message).
- HL7 v2.5.1 Chapter 4 (Order Entry — ORM message).
- HL7 MLLP (Minimal Lower Layer Protocol).
- HL7 FHIR R4 — `ServiceRequest` resource.

2. Implementation Model

2.1 Application Data Flow



2.2 Functional Definitions

- **Storage SCP (DICOM)** — inbound C-STORE on 11122/tcp; accepts a configurable SOP class set (§3.1).
- **Peer-AE whitelist** — first-class design feature; non-whitelisted Calling-AEs are rejected at association.
- **ADT MLLP listener** (license-gated) — accepts ADT^A01 (admit) and ADT^A08 (update) messages on 2575/tcp; populates the ADT cache used by the matcher.
- **Verification queue + matcher** — pairs newly-arrived studies with ADT entries by patient-identifier + AccessionNumber + arrival-time-window; ambiguous matches surface to the operator UI.
- **C-STORE SCU + STOW-RS SCU** — forwards verified studies to admin-configured destinations (license-gated `multi_destination` enables >1 destination).
- **HL7 ORM SCU** (license-gated) — generates ORM^O01 from queue context and sends via outbound MLLP.

- **FHIR ServiceRequest emitter** (license-gated) — generates FHIR R4 `ServiceRequest` and POSTs to admin-configured endpoint.
- **Phase 8 keypair consumer** — read-only consumption from `<DataDir>/customer-crypto/` ; pseudonymization runs in-process when the destination is configured for it.

3. AE Specifications

3.1 Storage SCP AE (Encounter Engine)

3.1.1 SOP Classes Supported

Encounter Engine accepts the **broad** Storage SOP class set typical of a coordination tier. Specifically:

SOP Class family	Examples	Role
Verification	1.2.840.10008.1.1	SCP
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	SCP
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	SCP
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	SCP
CR Image Storage	1.2.840.10008.5.1.4.1.1.1	SCP
DX Image Storage (for Presentation/for Processing)	1.2.840.10008.5.1.4.1.1.1.1[.1]	SCP
MG Image Storage	1.2.840.10008.5.1.4.1.1.1.2	SCP
Enhanced CT/MR/US/MG Image Storage	(various)	SCP
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	SCP
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1	SCP
RT Plan / RT Dose Storage	(various)	SCP
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	SCP
Structured Report (Basic / Enhanced / Comprehensive)	1.2.840.10008.5.1.4.1.1.88.11/.22/.33	SCP

The full accepted SOP-class set is configurable via `<DataDir>/configs/sop_classes.json` ; the default ships with the common diagnostic-imaging classes above. Production deployments typically narrow the list to the modalities actually in use.

Non-supported SOP Classes are **rejected** at presentation-context negotiation with `abstract-syntax not supported` .

3.1.2 Transfer Syntaxes Supported

Transfer Syntax	UID	Role
Implicit VR Little Endian	1.2.840.10008.1.2	Baseline
Explicit VR Little Endian	1.2.840.10008.1.2.1	Preferred
JPEG Baseline	1.2.840.10008.1.2.4.50	Compressed
JPEG Lossless (selection 1)	1.2.840.10008.1.2.4.70	Lossless compressed
JPEG 2000 Lossless	1.2.840.10008.1.2.4.90	Lossless compressed
JPEG 2000 (lossy)	1.2.840.10008.1.2.4.91	Compressed
RLE Lossless	1.2.840.10008.1.2.5	Compressed

Encounter Engine does **not** transcode or decompress on receipt; the dataset is forwarded verbatim. Downstream destinations must declare the relevant transfer syntaxes in their own conformance.

3.1.3 Maximum Length / PDU

- Default maximum PDU length: 16,384 bytes (configurable up to 1,048,576).
- Maximum number of presentation contexts per association: 128.
- Configurable per `<DataDir>/configs/dicom_scp.json`.

3.1.4 Association Acceptance Policy

- Calling-AE title must appear in the peer-AE whitelist (`<DataDir>/configs/peer_ae_whitelist.json`) — non-whitelisted associations are rejected with `calling-ae-title not recognised`.
- Optional source-IP / CIDR check tied to each whitelist entry.
- TLS-DICOM is supported (license-gated `dicom_tls`); non-TLS associations rejected when TLS is enforced.
- Maximum concurrent associations: 32 (license-gated `max_listeners` permits higher).

3.2 Storage SCU AE (forwarding)

3.2.1 SOP Classes Supported

Same set as §3.1.1 — Encounter Engine forwards the dataset verbatim, so the SCU SOP class set matches the SCP set.

3.2.2 Forwarding Mode

- **C-STORE SCU** to admin-managed DICOM destinations.
- **STOW-RS SCU** to admin-managed DICOMweb destinations.
- License feature `multi_destination` permits >1 destination concurrently.
- Per-destination optional pseudonymization (Phase 8 keypair consumer mode).

3.2.3 Outbound TLS

- HTTPS-only for STOW-RS targets when `hipaa_mode` posture demands; configurable per destination.
- Mutual TLS supported for STOW-RS via per-destination client cert config.

3.3 No Q/R SCP

Encounter Engine does **not** expose a Query/Retrieve SCP. C-FIND / C-MOVE / C-GET are out of scope.

4. HL7 ADT Listener (license-gated `adt_feed`)

4.1 Message Types Supported

Message	Purpose
ADT^A01	Admit / Visit notification
ADT^A08	Update patient information

Other ADT trigger events (A02, A03, A04, A05, A06, A07, A09, A10, A11, A12, A13, A28, A31, A38, A40) are **acknowledged with NACK** (Application Reject) — they are out of scope for Encounter Engine's matcher logic.

4.2 Transport

- HL7 MLLP on 2575/tcp (configurable port).
- LLP-over-TLS supported when `mlp_tls_required` config flag is set.
- Source IP must appear in the ADT-source allowlist; non-allowlisted source IPs rejected at the TCP layer (no MLLP ACK).

4.3 Idempotency

Messages with duplicate MSH-10 (Message Control ID) within a 24h window are silently de-duplicated; only one queue/cache update is applied. The duplicate is logged + ACK is returned (so the upstream sender does not retry).

5. HL7 ORM Outbound Emitter (license-gated `emr_order_h17`)

5.1 Message Types Generated

Message	Trigger
ORM^O01	New order (when a verified study lacks an existing accession in the EMR target)

5.2 Transport

- HL7 MLLP outbound to admin-managed destination allowlist (no ad-hoc URL entry).
- LLP-over-TLS supported via per-destination config.

5.3 Field Mapping

Mapping from EE verification-queue context to ORM^O01 fields is configurable via

`<DataDir>/configs/orm_mapping.json`. The default mapping covers PID-3 (patient ID), PID-5 (patient name), PV1-

19 (visit number), ORC-2 (placer order number = newly-minted accession), ORC-3 (filler order number = source AccessionNumber), OBR-2/-3 (placer/filler), OBR-4 (universal service identifier).

6. FHIR R4 ServiceRequest Emitter (license-gated `emr_order_fhir`)

6.1 Resource Generated

`ServiceRequest` (FHIR R4).

6.2 Transport

- HTTPS POST to admin-managed FHIR endpoint allowlist.
- OAuth2 client-credentials flow; token endpoint configured per FHIR endpoint.
- JSON serialization (FHIR R4 default).

6.3 Field Mapping

Mapping from EE verification-queue context to FHIR `ServiceRequest` is configurable via

`<DataDir>/configs/fhir_mapping.json`. Default mapping covers `subject` (Patient reference), `requester` (Practitioner reference if available, else PlaceholderId), `code` (CodeableConcept from configured terminology), `identifier` (accession), `occurrenceDateTime` (study acquisition date).

7. Privacy / Security Posture Summary

- Peer-AE whitelist enforced on all DICOM associations.
- ADT-source allowlist enforced on HL7 MLLP listener.
- Outbound destinations validated against admin-managed allowlists (DICOM + STOW-RS + HL7 ORM + FHIR).
- TLS supported (and configurable as required) on every ingress/egress surface.
- Audit log captures every ingress, every queue update, every forward, every ADT match decision.
- Phase 8 customer keypairs consumed read-only (install/rotate at Router; non-issuer posture).

Detailed pen-test posture is in DOC-2026-308 (Encounter Engine Pen Test) — see Sections 6, 7, 11, 13, 14, 15.

8. Configuration Profiles

8.1 Base profile (no license features)

- DICOM Storage SCP only.
- C-STORE SCU + STOW-RS SCU to a single configured destination.
- No HL7, no FHIR, no Phase 8 consumption.

8.2 ADT-aware profile (license: `adt_feed`)

- Adds inbound HL7 ADT listener (port 2575).

- ADT-driven matcher in the verification queue.

8.3 Order-emitting profile (license: `emr_order_h17` and/or `emr_order_fhir`)

- Adds outbound HL7 ORM^O01 (`emr_order_h17`).
- Adds outbound FHIR R4 ServiceRequest (`emr_order_fhir`).

8.4 Phase 8 consumer profile (license: any keypair-issuer paired)

- Consumes customer keypair from `<DataDir>/customer-crypto/` to pseudonymize outbound payloads when the destination is configured for it.
- Requires a paired Router (or SynthQMS) deployment that issued the keypair.

9. Out of Scope

- DICOM Q/R SCP (C-FIND / C-MOVE / C-GET).
 - DICOM Storage Commitment, MPPS, MWL.
 - HL7 v2 message types other than ADT^A01/A08 (inbound) and ORM^O01 (outbound).
 - HL7 v3 / CDA / IHE-XDS / IHE-XDR.
 - FHIR resources other than `ServiceRequest` .
 - Inbound FHIR (Encounter Engine does not expose a FHIR server endpoint).
 - Clinical viewer, structured-report parsing, cohort-builder.
 - Phase 8 customer-keypair install/rotate (consumer-only).
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Review cycle: 1 year, or on change to supported SOP class set, HL7 v2 / FHIR R4 spec changes, license feature catalog, or downstream-target conformance changes. **Next review due:** 2027-05-07.

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