IoT-Hub HL-7 Integration Briefing

1. Overview

IoT Hub integrates with hospital PDMS/KIS systems using **HL-7 v2 messages over MLLP**, routed through the hospital gateway.

The integration is designed to:

- Support real-world HL-7 variations
- Be configurable without code changes
- Work reliably even when certain message types (e.g. ADT) are not provided

2. Implemented message flow

2.1 ORM Messages (Inbound, preferred)

ORM^O01 messages serve as the authoritative source for patient and case information. When a monitoring order is created in the PDMS/KIS:

- An ORM^O01 is sent to IoT-Hub
- The message must contain:
    - Complete patient demographics
    - Case / visit context
    - Order identifiers

IoT-Hub parses and validates inbound ORM messages using the **HL-7 Mapper Tool**. Order identifiers must be present; otherwise, the system will apply fallback IDs (see fallback note) instead of silently ignoring.

2.2 ADT Messages (Inbound, alternative)

ADT messages may be sent by the hospital to communicate patient admission or demographic updates. ADT messages can be used as an alternative to ORM messages. Supported ADT types (if provided):

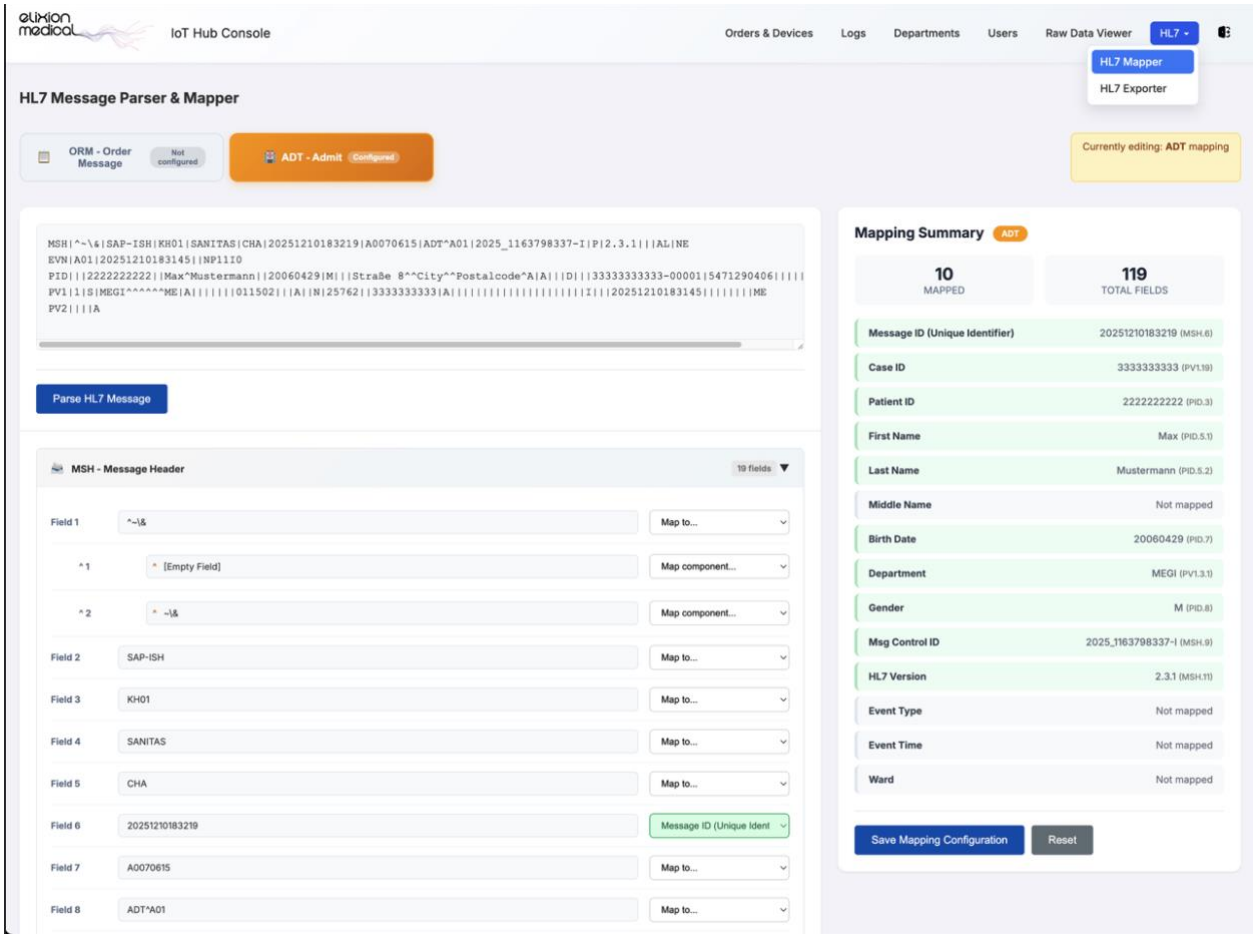
- ADT^A01
- ADT^A02
- ADT^A03

2.3 ORU Messages (Outbound, self-contained)

For every completed observation window, IoT-Hub sends an **ORU^R01** message to the hospital. Outbound ORU messages are **self-contained** and always include:

- Patient identification
- Case / visit identifier
- Order correlation
- Actual observation window
- Observation values

3. HL-7 Mapper Tool



3.1 Purpose

The HL-7 Mapper Tool allows configuration of inbound HL7 mappings **without code changes**. It is accessible from the IoT-Hub's admin portal.

It is used to:

- Parse inbound HL-7 messages
- Map HL-7 fields to the IoT-Hub's internal data model
- Validate mandatory clinical data
- Handle site-specific HL-7 structures

3.2 Supported Message Types

Message Type	Direction	Mapper Usage
ADT	Inbound	Optional
ORM	Inbound	Default
ORU	Outbound	System-generated (no mapping)

3.3 How the Mapper Works

1. An HL-7 message is pasted into the UI
2. The message is parsed
3. Segments (MSH, PID, PV1, ORC, OBR, etc.) are displayed as expandable accordions
4. Each field (and component, where applicable) is mapped to an internal target
5. A **Mapping Summary** shows:
    - Mapped fields
    - Missing mandatory fields
6. Mappings are persisted and reused

Please note that messages missing mandatory fields are **rejected during import**.

3.4 Mandatory vs Optional Mappings (Inbound ORM)

Mandatory (messages are rejected if missing):

Internal Field	**Typical HL7 Field (configurable via Mapper)**
External Patient ID	PID-3
Patient Last Name	PID-5.1
Patient First Name	PID-5.2
Date of Birth	PID-7
Gender	PID-8
Case / Visit ID	PV1-19
Order ID	ORC-2 / ORC-3
Order Code	OBR-4
Department	(mapped; must exist in departments)

Optional (storing if provided):

Internal Field	**Typical HL7 Field (configurable via Mapper)**
Planned Measurement Start	OBR-7
Planned Measurement End	OBR-8

Important:

If OBR-7 and/or OBR-8 are not provided, IoT-Hub derives the effective measurement window internally based on device timestamps and configuration.

if department mapping is missing or not found, the message is rejected or skipped due to department filter.

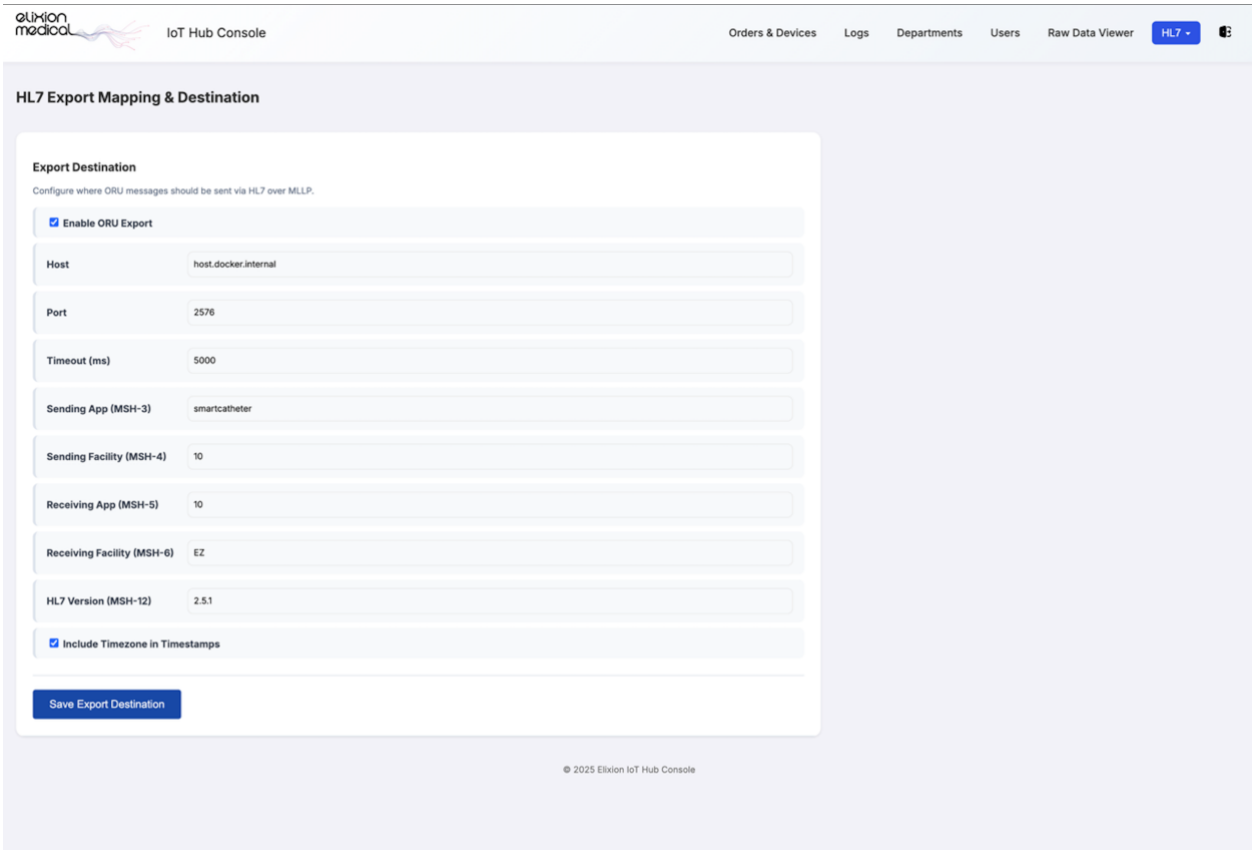
4. Correlation Logic

IoT-Hub correlates data using the following identifiers:

Context	Typical HL7 Field (configurable via Mapper)
Patient	PID-3
Case / Visit	PV1-19
Order	ORC-2 / ORC-3
Measurement Window	OBR-7 / OBR-8 (derived if missing)

Department mapping is required (not optional); PV1-19 and ORC-2/3 are mandatory.

5. Outbound ORU Export Configuration



Outbound ORU messages are sent to the hospital via the **HL-7 Export Mapping & Destination** configuration in the IoT-Hub's admin portal.

This configuration defines **where and how** ORU^R01 messages are delivered.

Setting	Description
Host	Target hostname or IP address of the hospital's gateway or PDMS system.
Port	Target TCP port used for HL-7 MLLP communication.
Timeout (ms)	Maximum time to wait for TCP connection establishment and ACK reception.
Sending Application (MSH-3)	Logical sending application identifier used in outbound HL-7 messages.
Sending Facility (MSH-4)	Logical sending facility identifier.
Receiving Application (MSH-5)	Target receiving application identifier as expected by the hospital.
Receiving Facility (MSH-6)	Target receiving facility identifier.
HL7 Version (MSH-12)	Desired HL-7 version for ORU export.
Include time zone in time stamps	If enabled, all timestamps include time zone information. Recommended for multi-site or cross-region deployments.

Export configuration is persisted centrally and applied immediately to all subsequent ORU messages. **No system restart is required.**

5.1 General Characteristics

- HL-7 Version as defined
- One ORU per completed measurement window
- Actual measurement window **always populated**
- Multiple OBX segments supported per OBR

5.2 Example ORU^R01 Message

MSH|^~\&|ELIXION|UNIVERSITATSKLINIK|HIS|LABOR|20260109150000||ORU^R01|12345-1736434800|P|2.5.1

PID|1||987654^^^HOSP^MR||MULLER^HANS^JOSEF||19650315|M

PV1|1|I|KN-45|||||||||||||ABC-2024-001234

ORC|RE|ELX-12345|ELX-12345

OBR|1|ELX-12345|ELX-12345|ELX-URINE-OUT^Urine output monitoring^99ELX|R|20260109143000|20260109150000

OBX|1|NM|ELX-URINE-DELTA^Urine Output Delta^99ELX||45.5|mL|||N|||F|||20260109150000

OBX|2|NM|ELX-URINE-RATE^Urine Output Rate^99ELX||91|mL/h|||N|||F|||20260109150000

5.3 Key Field Semantics

- **OBR-7 / OBR-8**: Actual measured window (start / end)
- **OBX-5**: Observation value
- **OBX-6**: Unit (UCUM compliant)
- **OBX-14:** Observation timestamp

6. Coding Systems: LOINC vs Local Codes (99ELX)

6.1 LOINC

LOINC is supported where a suitable standard code exists and is agreed upfront. Typical use cases:

- Standard physiological rates (e.g. urine flow rate)

6.2 Local Coding System (99ELX)

For time-window-based delta urine measurements, no single canonical LOINC code exists. Therefore, IoT-Hub uses a local coding system (99ELX) and conveys semantics via:

- Explicit measurement window (OBR-7 / OBR-8)
- OBX descriptions
- UCUM units

LOINC mapping can be introduced later without changing the message structure.

7. ACK Handling

- HL-7 ACK handling (AA / AE / AR) is performed at the **gateway level**
- No ACK configuration is required in the IoT-Hub's admin portal

8. Alignment Checklist

Before going-live, confirm:

- HL-7 versions (inbound vs outbound)
- Patient identifier (PID-3)
- Mandatory patient demographics
- Case / visit identifier (PV1-19)
- Order identifiers (ORC-2 / ORC-3)
- Coding system expectations (LOINC vs local)
- Gateway routing and MLLP connectivity

9. Summary

- ORM messages are preffered and authoritative
- ADT messages can be used if using ORM is not possible / desired
- Patient demographics are mandatory
- Measurement start/end are optional inbound, always populated outbound
- ORU messages are self-contained
- HL-7 mapping is configurable via the Admin UI
- Local coding (99ELX) is used where no canonical LOINC exists

10. Version History

Version	Effective date	Author	Change description
01	13.01.2026	Ulas Arican	First version