TERMINUS 2π

GUIDE

CONNECTORS · INTEROPERABILITY STANDARDS

Interoperability and connectors: making your data flow

Connecting your processes to your teams' tools, to healthcare standards and to your industry software, so information entered once serves everywhere.



Terminus 2π

October 2026

Healthcare standards catalogue after a synthesis published by Gencovery in 2025

About this guide

Your processes run through tools that don’t talk to each other: messaging, spreadsheets, CRM, ERP, LIMS, cloud storage, industry software. This guide explains how to connect them, which standards to use in healthcare and life sciences, and how to choose or build the right connector.

It is for leaders, IT managers and business teams who want to eliminate re-keying and make their data usable, including by AI.

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CHAPTER 1

Making data flow

Your tools make each person more efficient. Your losses happen between them: an order received by e-mail and re-keyed into a spreadsheet, a test result copied into a report, a patient record rebuilt from three systems. Each break costs time and produces incomplete or inconsistent data.

A connector links two systems so information flows without re-keying: it is entered once, at the source, then passed on to where it is needed. Connecting your teams' tools rather than replacing them is often the fastest way to digitize a process.

> Interoperability is also the condition for AI: without accessible, structured and comparable data, every model stays locked in a silo.

CHAPTER 2

Standards and regulatory frameworks

Two notions complement each other without overlapping:

- **Interoperability standards** define the *how*: the format, syntax and meaning of the data exchanged.
- **Regulatory frameworks** define the *what* and the *why*: legal obligations, governance, audit.

The same project can therefore fall under the GDPR, a framework, while using FHIR R4, a standard, to exchange patient data. Regulatory frameworks often reference or require standards. The "Regulatory compliance" guide details the frameworks; this one focuses on how data flows.

CHAPTER 3

Three families of connectors

Business activities: agnostic connectors

Everyday tools, whatever the industry. They carry the routine exchanges of processes: notifying a team, filing a document, updating a tracking sheet, finding a customer, placing an order, archiving files or querying a database.

Slack · Google Drive · Excel · Microsoft 365 · E-mail · CRM · ERP · LIMS · Amazon S3 · Databases · REST APIs

Healthcare and life sciences: standards

In healthcare, exchanges rely on shared formats and terminologies, often required by partners or authorities: patient records, imaging, clinical trials, lab results. Chapter 4 presents them one by one.

FHIR · HL7 v2 · DICOM · CDISC · OMOP CDM · openEHR · CI-SIS · SNOMED CT · LOINC

Other industries: custom connectors

Manufacturing, finance, services: every industry has its own software, files and instruments. When no standard connector exists, our team builds it, from the software's API, its exports or its files.

ERP / MES · Supervision · Banking · Accounting · Ticketing · Industry files · Instruments

CHAPTER 4

Healthcare standards

Nine standards shape data exchange in healthcare and life sciences: formats and APIs, messaging, data models, terminologies and clinical data.

STANDARD	TYPE	ORGANIZATION
FHIR R4 / R5	Format / API	HL7 International
CDISC (SDTM / ADaM / CDASH)	Clinical data	CDISC
DICOM	Data format	NEMA / WG-DICOM
HL7 v2	Messaging	HL7 International
OMOP CDM	Data model	OHDSI
openEHR	Data model	openEHR Foundation
CI-SIS	Format / National profiles	ANS (France)
SNOMED CT	Terminology	SNOMED International
LOINC	Terminology	Regenstrief Institute

FHIR R4 / R5

FORMAT / API · HL7 INTERNATIONAL

Domain	Health data exchange
Active version	R4 (stable) · R5 (2023)
Description	HL7 standard for clinical data exchange via REST/JSON API. Technical backbone of Mon Espace Santé and France's CI-SIS.
Regulatory links	HIAPP, HDS, CI-SIS

CDISC (SDTM / ADaM / CDASH)

CLINICAL DATA · CDISC

Domain	Clinical trials / regulatory submissions
Active version	SDTM 1.8 · ADaM 2.1
Description	Family of standards for clinical trial data collection (CDASH), submission (SDTM) and analysis (ADaM). Quasi-mandatory for FDA and EMA regulatory submissions.
Regulatory links	FDA 21 CFR, GCP / ICH E6, EMA

DICOM

DATA FORMAT · NEMA / WG-DICOM

Domain	Medical imaging
Active version	PS 3.x (2024)
Description	Universal standard for storing, transmitting and displaying medical images (MRI, CT, X-ray). Includes patient metadata linked to images.
Regulatory links	ISO 13485, MDR/IVDR, FDA 21 CFR 820

HL7 v2

MESSAGING · HL7 INTERNATIONAL

Domain	Hospital messaging
Active version	v2.8 (2014)
Description	Dominant point-to-point messaging standard in hospital information systems. Widely used despite its age; gradual migration to FHIR underway.
Regulatory links	CI-SIS, HIAPP

OMOP CDM

DATA MODEL · OHDSI

Domain	Observational / real-world data
Active version	v5.4
Description	Common data model for harmonising large-scale observational healthcare data. Used by OHDSI for pharmacovigilance and real-world evidence studies.
Regulatory links	RGPD, GCP / ICH E6

openEHR

DATA MODEL · OPENEHR FOUNDATION

Domain	Structured clinical patient record
Active version	Release 1.1
Description	Open clinical modelling architecture, separating the reference model (data) from archetypes (clinical semantics). Adopted in several European countries for EHR systems.
Regulatory links	HIAPP, CI-SIS

CI-SIS

FORMAT / NATIONAL PROFILES · ANS (FRANCE)

Domain	French health IS interoperability
Active version	2024.01
Description	ANS national framework defining FHIR, IHE and HL7 profiles adapted to the French context. Mandatory reference for services integrating Mon Espace Santé.
Regulatory links	HIAPP, HDS, FHIR R4

SNOMED CT

TERMINOLOGY · SNOMED INTERNATIONAL

Domain	Clinical coding
Active version	Release 2024-07
Description	World-leading clinical terminology (>350,000 concepts). Used to code diagnoses, procedures, drugs and findings in an interoperable way.
Regulatory links	FHIR R4/R5, CI-SIS, OMOP CDM

LOINC

TERMINOLOGY · REGENSTRIEF INSTITUTE

Domain	Lab results & clinical observations
Active version	2.78 (2024)
Description	Universal standard identifying laboratory tests and clinical measurements (>100,000 codes). Natural complement to SNOMED CT for lab results.
Regulatory links	FHIR R4/R5, CDISC, OMOP CDM

CHAPTER 5

Choosing and building a connector

A good connector is decided from the process, not from the tool. A few questions are enough to frame it:

- **Direction and frequency**: does data flow one way or both, in real time or in batches?
- **Source of truth**: which system prevails when two values differ?
- **Identifiers and terminologies**: how do you recognize the same customer, patient or sample from one system to another?
- **Security and access**: who may read and write, with which secrets and permissions?
- **Traceability**: is every exchange logged, for audits and to understand an error?
- **Regulated context**: is the connector part of a computerized system that must be validated (GAMP 5, Annex 11)?

Our approach: map data flows during the diagnostic, connect existing tools rather than adding more, and build the connector that is missing. Connectors fit into the digitized processes: they inherit their audit trail and access management.

CHAPTER 6

Where to start

Start with the process that costs the most in re-keying. List the tools it runs through, the information passed from one to the next and the people who copy it: you have the list of your first connectors.

The Express Process Diagnostic maps your processes and data flows in ten days and hands you a costed action plan, prioritized by gain.

Let’s talk about your constraints

Terminus 2π · Digital process first. AI at the core.

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Standard versions are indicative and change over time: check the version required by your partners and authorities. Healthcare standards catalogue after a synthesis published by Gencovery in 2025, reviewed and extended by Terminus 2π.