

— CHAPTER 04 · TERMINOLOGY BINDINGS · BEAT 1 — WHICH CODES?

Last chapter we built the Coding. Now — which systems fill it.

A CodeableConcept holds a system, a code, and a display. This chapter answers the question that leaves open. We map the five code systems clinicians actually use, learn the four binding strengths that decide what is allowed, and run the three terminology operations that make codes queryable.

What you will be able to do

● Code systems — SNOMED · LOINC · RxNorm · ICD-10 · UCUM

● Binding strengths — required to example

● Tx operations — expand · validate-code · translate

— COMPARISON · FIVE CODE SYSTEMS AT A GLANCE

Five systems carry almost all of FHIR's meaning.

Each has a clinical purpose and an owner — and four of the five are free worldwide. SNOMED CT is the one exception. That single fact reshapes a lot of deployments.

• FINDINGS · PROCEDURES

SNOMED CT

Clinical findings, problems, body sites.
Owner — SNOMED International.

● LICENSED

• LAB · OBSERVATIONS

LOINC

Laboratory and clinical observations.
Owner — Regenstrief.

● FREE

• MEDICATIONS

RxNorm

Normalized medications. Owner — US
National Library of Medicine.

● FREE

• BILLING

ICD-10-CM

Billing and reimbursement codes.
Owner — the CDC / NCHS.

● FREE

• UNITS OF MEASURE

UCUM

Machine-parseable units. Owner — the
UCUM project.

● FREE

• THE CATCH

Four free, one not

SNOMED CT needs a per-country
national license. We come back to it
next slide.

● Deploy-time blocker

— CONCEPT · SNOMED CT — THE BIG ONE, AND THE LICENSING SCAR

Chest pain is one code. Pointing HAPI at SNOMED is not free.

— CONDITION.CODE — SNOMED CODING

```
{ "system": "http://snomed.info/sct", "code": "29857009", "display": "Chest pain" }
```

The same Coding shape from last chapter — filled in. Hundreds of thousands of concepts cover findings, procedures, and body sites. The content is excellent.



Ava

Here is the scar — no. SNOMED CT requires a national member license.



Marcus · production scar

At deploy time, not design time. NHS Digital in the UK, ANS in France, BfArM in Germany. A public tx server cannot legally hand you all of it.

— CONCEPT · LOINC — WHAT CODES A LAB RESULT

Observation.code is almost always a LOINC code.

If SNOMED is findings, LOINC is measurements — Logical Observation Identifiers, Names and Codes. Drop a LOINC code into Observation.code and any system on earth knows exactly what was measured.

— OBSERVATION.CODE — LOINC CODING

```
{ "system": "http://loinc.org", "code": "2823-3", "display": "Potassium [Moles/volume] in Serum or Plasma" }
```

Serum potassium, two-eight-two-three-dash-three. The same Coding we built last chapter — now carrying the canonical lab identifier.

The relief after SNOMED

● Default for lab and clinical observations

● FREE worldwide — Regenstrief license, attribution only

● No national gate

— COMPARISON · CLINICAL VS BILLING — A LINE WORTH INTERNALIZING

RxNorm normalizes medicines. ICD-10 codes the claim.

A single Condition often carries two Codings in one CodeableConcept — a SNOMED code for clinical reasoning and an ICD-10 code for the bill. Clinical truth and billing truth, side by side. That is why the Coding array from last chapter is an array.

— CLINICAL · RXNORM

Medication.code

```
{ "system":  
  "http://www.nlm.nih.gov/research/umls/rxnorm",  
  "code": "857005", "display": "lisinopril 10 MG  
  Oral Tablet" }
```

Owned by the US National Library of Medicine.
Free in the US. Also fills
MedicationRequest.medicationCodeableConcept.

● RxNorm — FREE (US, NLM)

● ICD-10-CM — FREE (US)

— BILLING · ICD-10-CM

Condition.code

```
{ "system": "http://hl7.org/fhir/sid/icd-10-cm",  
  "code": "I20.9", "display": "Angina pectoris,  
  unspecified" }
```

For reimbursement, not primary clinical
reasoning. Free in the US under public domain.

— DIAGRAM · UCUM — THE UNIFIED CODE FOR UNITS OF MEASURE

The Quantity we met last chapter — now its code field gets a real system.

Seventy kilograms is not just value seventy, unit kg. The full Quantity carries a system and a machine-parseable code. Always populate the code, not just the unit.

— OBSERVATION.VALUEQUANTITY — UCUM

```
{ "value": 70, "unit": "kg", "system": "http://unitsofmeasure.org", "code": "kg" }
```

For kilograms, unit and code look the same. The difference shows for compounds — millimoles per litre is unit "mmol/L" but the UCUM code is "mmol/L" the machine can parse and convert.

Two fields, two jobs

● unit — the human display string

● code — the literal a machine can compute on

● UCUM is free and open

— FRAMEWORK ANCHOR · VALUESET BINDING STRENGTHS

Four strengths. Two of them can fail validation — two only warn.

Every coded element binds to a ValueSet at one of four strengths. The strength decides whether HAPI's validator raises an error or merely warns. That distinction saves hours of debugging.

● STRENGTH · 1

required

You MUST use a code from the set. HAPI raises a validation ERROR otherwise.

● **HAPI — ERROR · blocks**

● STRENGTH · 2

extensible

Use a code from the set if one fits; extend only when nothing matches.

● **HAPI — ERROR if a fitting code was ignored**

● STRENGTH · 3

preferred

Encouraged but not enforced. Use the set where you reasonably can.

● **HAPI — WARNING · never blocks**

● STRENGTH · 4

example

Purely illustrative. Shows the kind of code expected, nothing more.

● **HAPI — informational only**

● **required + extensible — can fail validation**

● **preferred + example — only ever a warning**

— WALKTHROUGH · THE THREE TERMINOLOGY OPERATIONS

Codes are data. Three operations make them queryable.

\$expand

ENUMERATE THE MEMBER CODES

Run on a ValueSet. Returns the full enumerated list of member codes, paged with offset and count.

\$validate-code

MEMBERSHIP — YES OR NO

Asks whether a Coding is a member of a ValueSet. One question, one boolean answer.

\$translate

MAP ACROSS SYSTEMS

Uses a ConceptMap to map a code from one system to another — say SNOMED to ICD-10.

And where do these run — tx-server topology

• PUBLIC

tx.fhir.org

Conformant and free. The default external terminology server.

• IN-PROCESS

HAPI tx-server

Upload your own CodeSystem, ValueSet, and ConceptMap resources.

• LICENSED

Snowstorm edition

How you legally serve real SNOMED at scale. Back to that license again.

• NOTE

ConceptMap

The input to \$translate only — it defines the cross-system mapping.

— TRY IT YOURSELF · 60 SECONDS

One curl, one jq — a live terminology operation.

Run `$expand` on the observation-status ValueSet against the public HAPI sandbox, pipe to `jq`, and read `expansion.total` — that is how many codes are in the set.

— RUN THIS IN YOUR TERMINAL

```
curl 'https://hapi.fhir.org/baseR4/ValueSet/$expand?
url=http://hl7.org/fhir/ValueSet/observation-status' | jq '.expansion.total'
```

One line, and you have run `$expand` against a conformant tx server — no SDK, no setup.

Recap

● 5 code systems

● 4 binding strengths

● 3 tx operations

● 1 licensing trap — SNOMED