# Developer Training
# Terminology Services

Germany - Online
Thursday, 18th February 2021

## http://snomed.org/de-training

## https://public-snomedintl.slack.com

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Leading healthcare
terminology, worldwide
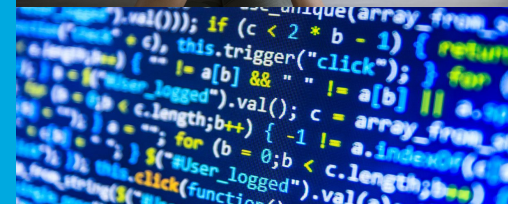
# Welcome & Introductions

## The SNOMED International Team

**Rory Davidson,**
Chief Information Officer

**Kai Kewley**
Technical Architect

**Peter Williams**
Technical Specialist

# SNOMED CT in Germany

# https://www.menti.com/5ezk655uyt

Today's Menu

To better understand SNOMED CT,

how to deploy it easily in your local environments,

how to keep the terminology updated and

how to integrate it with your applications

# Today's Agenda

- **Morning**
  - What is SNOMED CT?
  - Installing, deploying and querying an open source SNOMED CT terminology server
  - Advanced querying

- **Afternoon**
  - Reference sets
  - SNOMED & FHIR Terminology Services
  - The other SNOMED International tools

**http://snomed.org/de-training**

# Guidelines for the (online) day

- Ask questions - put your (virtual) hand up, ask anything using the link above … there are no bad questions!

- Shout if you need help and a Zoom breakout room will be created where someone will help

- Write code to do more than the simple examples

- Use your own applications to work on the examples and exercises

- Don't feel the need to keep your webcam on all day!

- Use the **Slack** channel - #de-dev-training - on the public SNOMED International Slack

- Sign up to Slack - **http://snomed.org/slack-signup**

What is SNOMED CT?

# SNOMED Clinical Terms

**A controlled coded clinical terminology for use in Electronic Health Records**

- Developed in the USA and the UK as a merger of earlier versions of SNOMED with the NHS Clinical Terms (Read Codes)
    - College of American Pathologists in USA
    - National Health Service (NHS) in the UK
- Design based on
    - Identified user requirements
    - Practical experience
    - Scientific principles established in peer reviewed publications
- First released in 2002

**Acquired for the public good by IHTSDO in 2007**

## In 2017 IHTSDO adopted the trading name

## SNOMED International

# Requirements for Meaningful Health Records

**Making health records electronic**

A significant step forward

Improves communication

Increases availability of relevant information

**... but it is only a partial solution;**

**the real challenge is ...**

**Making health records meaningful**

Identifying significant facts in oceans of data

Enabling effective meaning-based retrieval

Linking the EHR to authoritative clinical knowledge

**SNOMED CT represents clinical information meaningfully as part of a well-designed EHR**

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# SNOMED CT and Classifications

- **Classifications like ICD-9 and ICD-10**
    - Valuable for statistical reporting
    - Limited clinical value in an individual patient EHR
- **SNOMED CT**
    - Rich semantic structure adds meaning to the EHR
    - Adequate detail for clinical recording
    - Broad scope of coverage
- **SNOMED CT maps to Classifications**
    - Existing maps to ICD-9-CM and ICD-10
    - Enhanced rule-based mapping to ICD-10
    - Maps to ICD-10 are used by NLM for mapping to ICD-10-CM
- **SNOMED International and WHO**
    - Cooperate on approaches to shared challenges
    - As a common terminology SNOMED CT eases transition to future versions of classifications

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# Supporting clinical queries – ICD-10

**Data entry**

J12 Viral pneumonia, not elsewhere classified

**EHR Data**

**J12**

**Does patient have respiratory disorder?**

Yes: code starts with "J" ✓

**Does patient have an infection?**
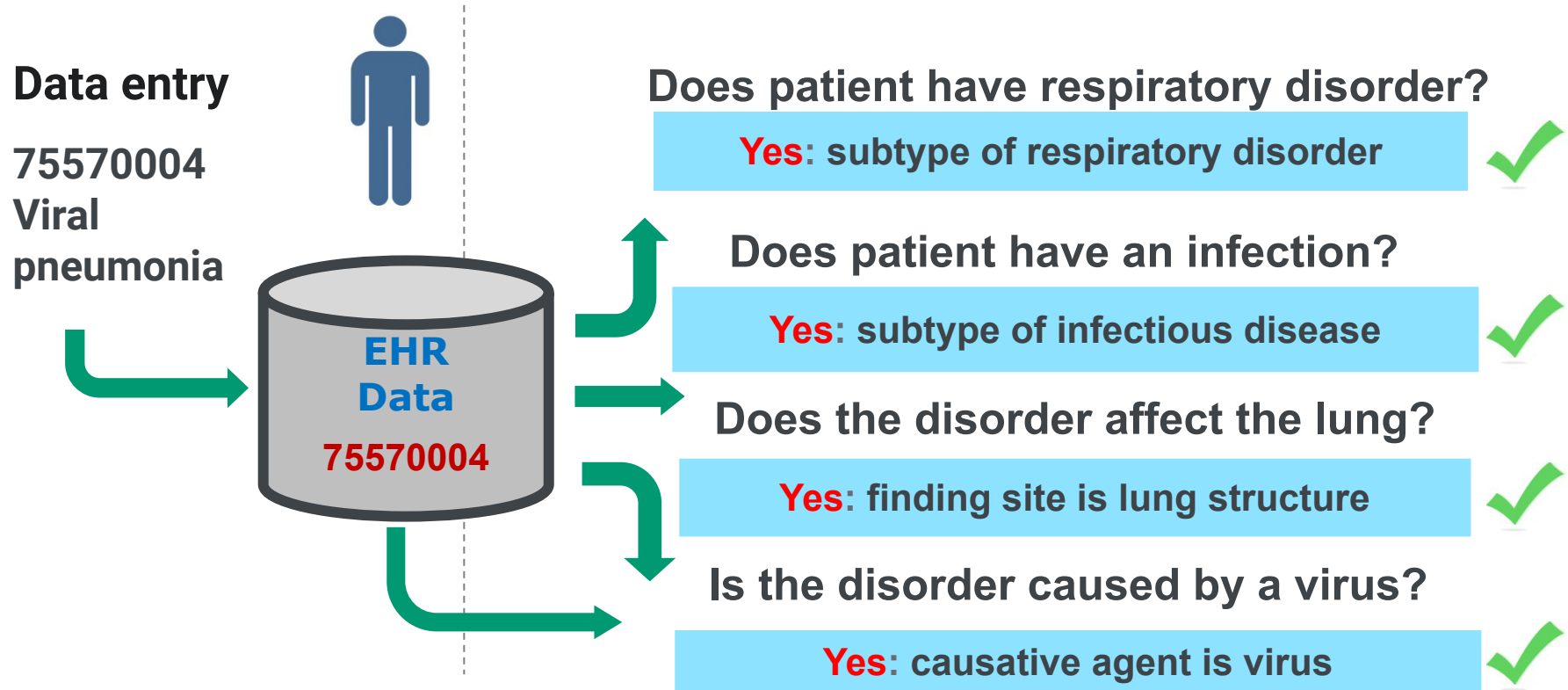
No: code does not start with "A" ✗

**Does the disorder affect the lung?**

Unknown: no easy way to tell this ✗

**Is the disorder caused by a virus?**

Unknown: cannot identify specific virus ✗

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# Supporting clinical queries − SNOMED CT

**Data entry**

**75570004
Viral
pneumonia**

**EHR
Data**

**75570004**

**Does patient have respiratory disorder?**

**Yes: subtype of respiratory disorder** ✓

**Does patient have an infection?**

**Yes: subtype of infectious disease** ✓

**Does the disorder affect the lung?**

**Yes: finding site is lung structure** ✓

**Is the disorder caused by a virus?**

**Yes: causative agent is virus** ✓

# EHR Benefits of SNOMED CT

## Enhancing care of individual patients by enabling:

- Display of appropriate information
- Guideline and decision support integration
- Communicating and sharing relevant information

## Enhancing care of populations of patients by supporting:

- Epidemiology monitoring and reporting
- Research into the causes and management of diseases

## Supporting cost-effective delivery of care by facilitating:

- Use of guidelines that minimize the risk of costly errors
- Detection and reduction of duplicated investigation and interventions
- Auditing of the delivery of clinical services
- Future service planning by detection of emerging health trends

# Design Benefits of SNOMED CT

## Logical definitions

- Common framework for consistent retrieval and processing
- Defining relationships between concepts
- Retrieval criteria based on the meaning of any related concept

## Optional post-coordination

- Combining codes to add detail and specificity
- Increases scope without 'combinatorial explosion' of codes

## Updates and versioning

- Regular updates to International Release (six-monthly)
- Support for incremental updates
- Full historical view of all previous versions of SNOMED CT

## Comprehensive clinical scope

- Reduces need to support multiple code systems
- Common framework for consistent retrieval and processing

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# https://browser.ihtsdotools.org

# **SNOMED CT** Overview of the Logical Design

**Content components**

- Concepts
- Descriptions
- Relationships

**Localization mechanisms**

- Reference sets
- Extensions

**Concept model**

- How relationships represent the computable meaning of each concept

**Expression model**

- How SNOMED CT can be used to represent meaningful information in clinical records, knowledge resources, etc.

# Concepts

- Concepts are the central components of SNOMED CT
- A SNOMED CT Concept is a clinical idea associated with a unique identifier
  - The meaning is specified by an association with a term known as the *fully specified name*
  - The link between the identifier and the meaning of that clinical idea is permanent and unchangeable

**Fully specified name**

**Identifier**

**Concept**

# Concept Design

## Each *concept* includes

- Its own unique identifier
    - A numeric identifier of up to 18 digits
    - This concept identifier is used to refer to that concept
        - From other SNOMED CT components
        - In health records or knowledge bases
- Versioning data
    - To allow it to be inactivated if necessary without deleting it
- An indication of whether its defining relationships are sufficient to distinguish it from other concepts

# Concepts and Descriptions

- Each *concept* is associated with several *descriptions*
- A *description* links a human-readable *term* to a *concept*



**Descriptions**

- appendectomy (procedure)
- appendectomy
- appendicectomy
- excision of appendix
- appendektomi
- apendicectomía
- resección del apéndice íleocecal
- apendicectomía (procedimiento)

**80146002**

**Concept**

SNOMED International
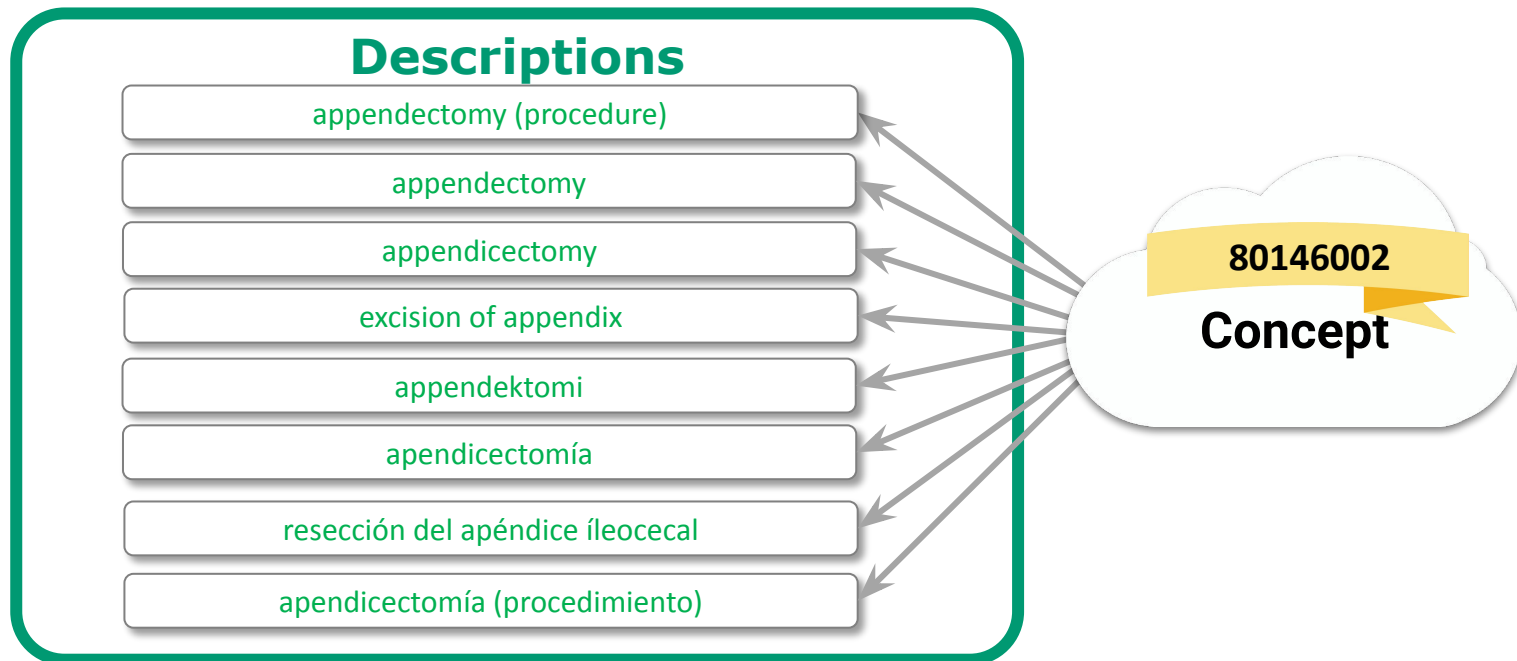
# Description Design

Each description includes

- Its own unique identifier
  - (not the same as the identifier of the concept)
- Versioning data
  - To allow it to be inactivated if necessary without deleting it
- The identifier of the concept to which it applies
- The human-readable *term*
  - Uses UTF-8 to support accented characters and full range of Unicode characters
- An indication of the *description type* …

# Description Types

## There are several types of description

**FSN**   **Fully Specified Name**

- A phrase that unambiguously describes the concept
- Contains a hierarchy tag (semantic tag) in brackets after the phrase to indicate the type of concept
- *Example*: appendectomy (procedure)

**Syn**   **Synonym**

- A word or phrase commonly used by clinicians to refer to a concept
- Used at user interface for search, selection and display
- *Examples*: appendectomy
  - appendicectomy
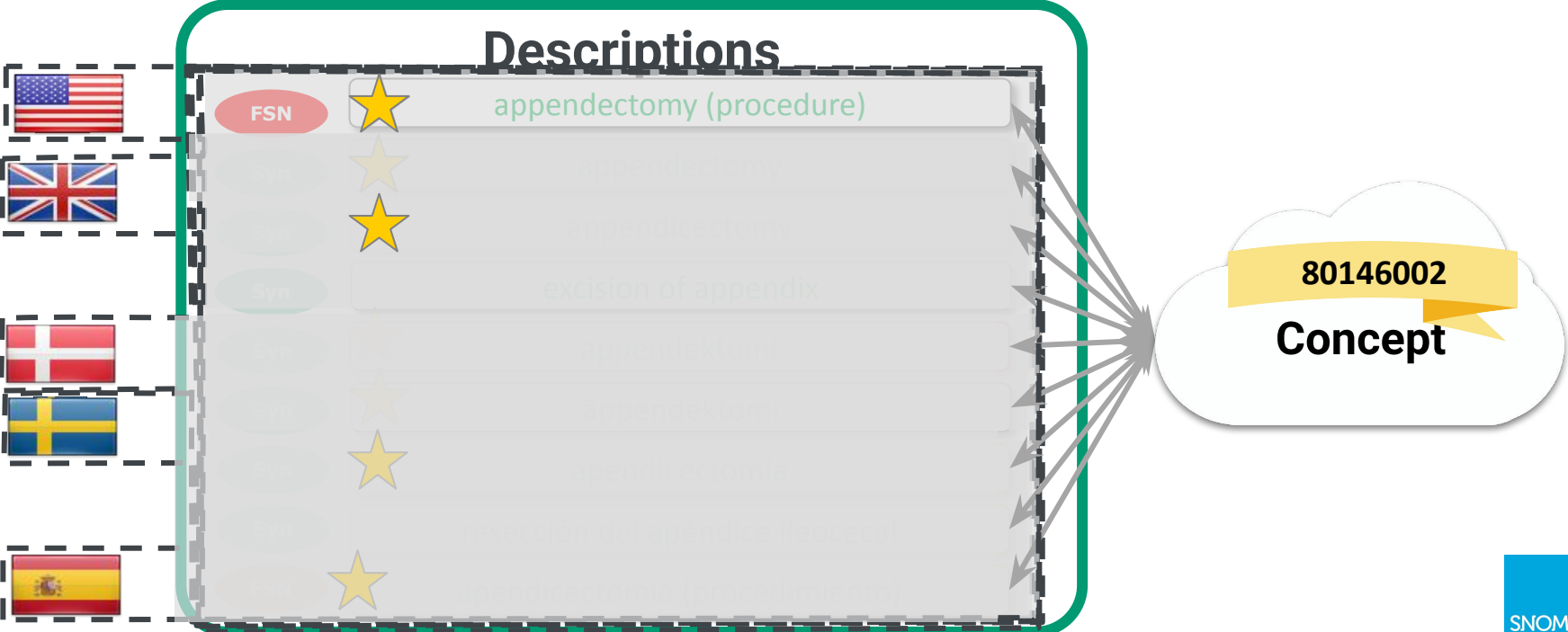  - resección del apéndice íleocecal

**Concept**

# Description Types - Example

Description types applied to descriptions of the concept

80146002 | Appendectomy (procedure) |
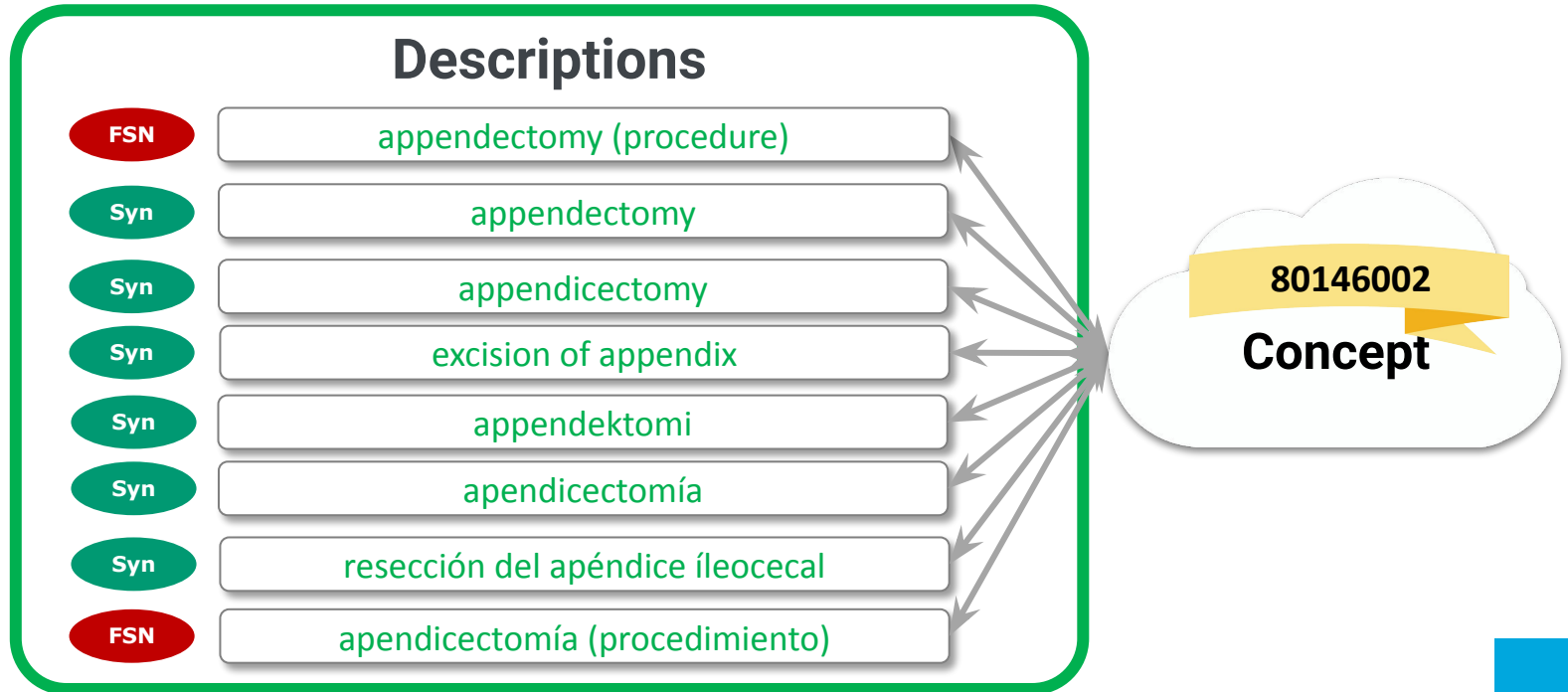
# Description Acceptability and Preferences

Language or dialect *acceptability* and *preferences* for particular terms are specified (in "Language Refsets")

# Preferred Terms

- The *preferred term* is the default display term for a concept
  - This means the *preferred term* should be displayed unless another term is explicitly selected or specified by a user
- *Preferred term* is <u>not</u> a *description type* as it can differ according to language or dialect
- The *preferred term* is the *synonym* marked as *preferred* in a particular language or dialect

For example
- Each of these is a *preferred term* in one or more language or dialect as indicated by the national flags

| | |
|---|---|
| appendectomy | 🇺🇸 |
| appendicectomy | 🇬🇧 |
| appendektomi | 🇩🇰 |
| appendektomi | 🇸🇪 |
| apendicectomía | 🇪🇸 |

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# Terms Do Not Need to be Unique

**The same *term* can be a *synonym* of more than one *concept***

- In these cases there is more than one *description* containing the same *term* and each description refers to a different *concept*
- The *fully specified name* can be checked to disambiguate *terms* that are associated with more than one concept

*For example*

- The *term* "fundus" is a short synonym which according to context can refer to one of four different body structures

| Synonym | Fully specified name |
|---------|---------------------|
| Fundus | Gastric fundus structure (body structure) |
| Fundus | Structure of fundus of eye (body structure) |
| Fundus | Structure of fundus uteri (body structure) |
| Fundus | Structure of fundus of gallbladder (body structure) |

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# Concepts and Relationships

- Each concept is associated with other concepts by a set of relationships
- The relationships express defining characteristics of a concept
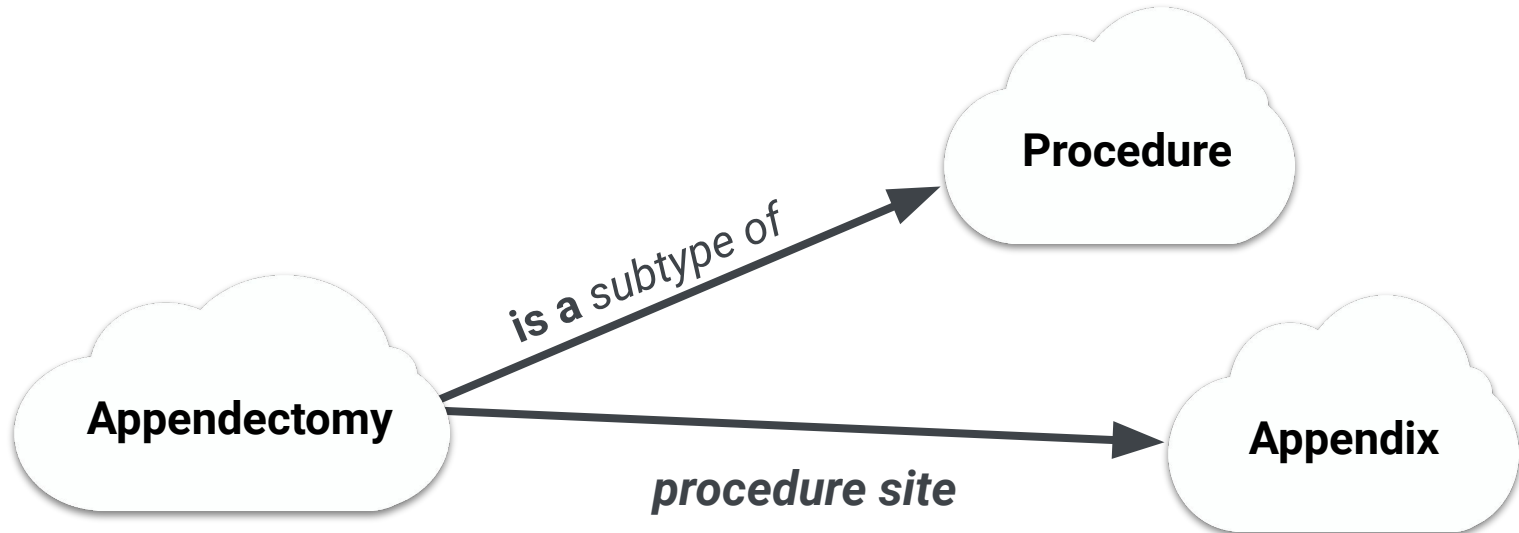
# Relationship Design

## Each *relationship* includes

- Its own unique identifier
  - (not the same as the identifier of the concept)
- Versioning data
  - To allow it to be inactivated if necessary without deleting it
- The identifier of the *source* concept
  - The concept defined by the relationship
- The identifier of the relationship *type* concept
  - **is a** (if the destination is a more general concept)
  - or
  - a specific attribute (e.g. procedure site)
- The identifier of the *destination* concept
  - the more general (supertype) concept
  - or
  - the value of the attribute

# Subtype Hierarchy Relationships

## Subtype relationships

- Create a hierarchy linking each concept to more general concepts
- Enable retrieval of specific concepts in response to general queries

operation on appendix          partial excision of large intestine

**is a** subtype of
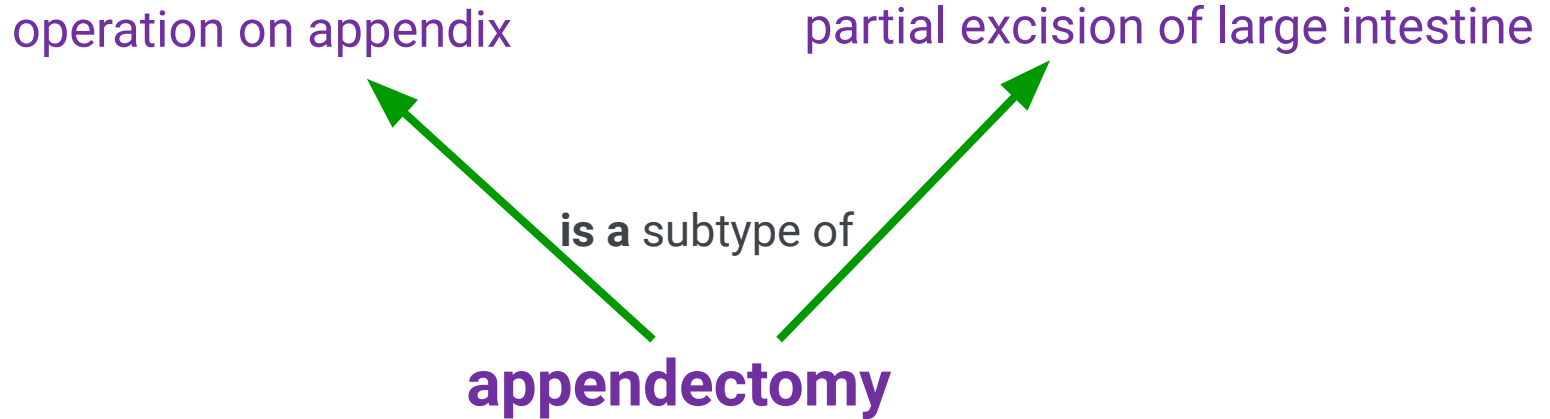
**appendectomy**

# Supertypes of Appendectomy

| Operation on appendix | Partial excision of large intestine |
|---|---|

Appendectomy
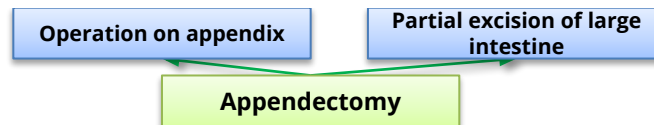
# Attribute Relationships

**Attribute relationships provide additional defining information about concepts**

*Examples:*

- Linking disorder concepts to sites, causative agents and morphological abnormalities
- Linking procedure concepts to sites and methods

appendix structure ← **appendectomy** → excision - action

Procedure site - direct                    method

# All the Defining Relationships of Appendectomy

operation on appendix

partial excision of large intestine

**is a** subtype of

appendix structure ← **appendectomy** → excision - action

Procedure site - direct

method

SNOMED International
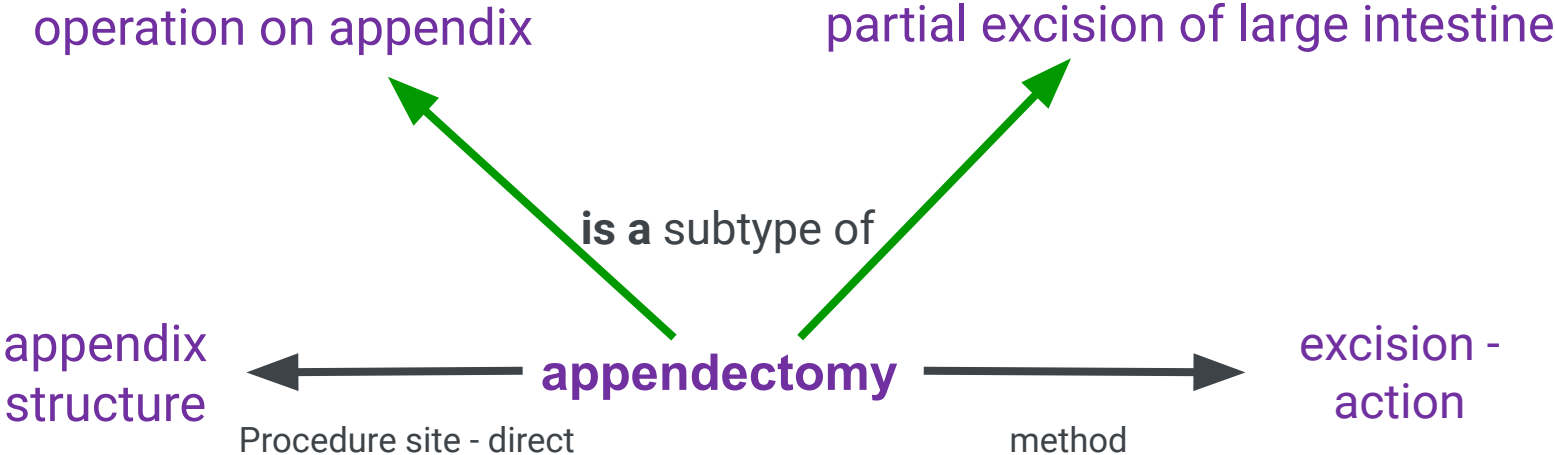
# Defining Relationships Must be "necessarily true"

- This means that a defining relationship must always be true for the concept it defines

operation on appendix

partial excision of large intestine

**is a** subtype of

appendix structure ← **appendectomy** → excision - action

Procedure site - direct

method
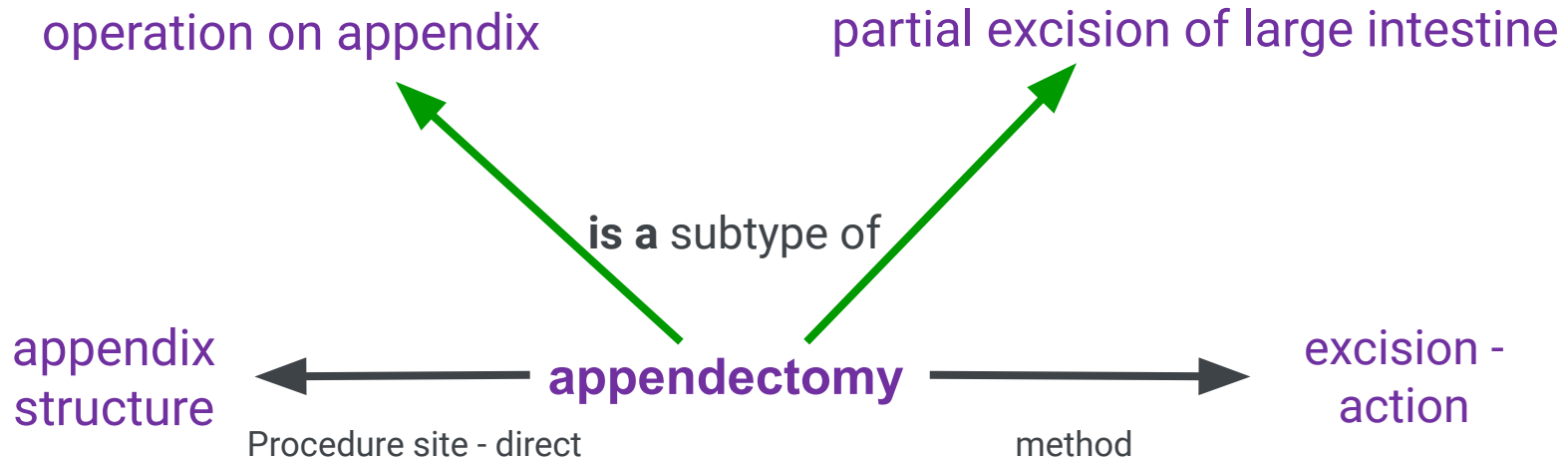
# Examples of Concept Definitions

80146002     Appendectomy (procedure)     Definition Status = Defined

| Source | Type | Destination |
|--------|------|-------------|
| appendectomy | is a | partial excision of large intestine |
| appendectomy | is a | operation on appendix |
| appendectomy | procedure site - direct | appendix structure |
| appendectomy | method | excision − action |

82730006     Incidental appendectomy (procedure)     Definition Status = Primitive

| Source | Type | Destination |
|--------|------|-------------|
| incidental appendectomy | is a | appendectomy |
| incidental appendectomy | procedure site - direct | appendix structure |
| incidental appendectomy | method | excision − action |

# Logical Model of SNOMED CT Content Components

@Snomedct | © 2020 IHTSDO
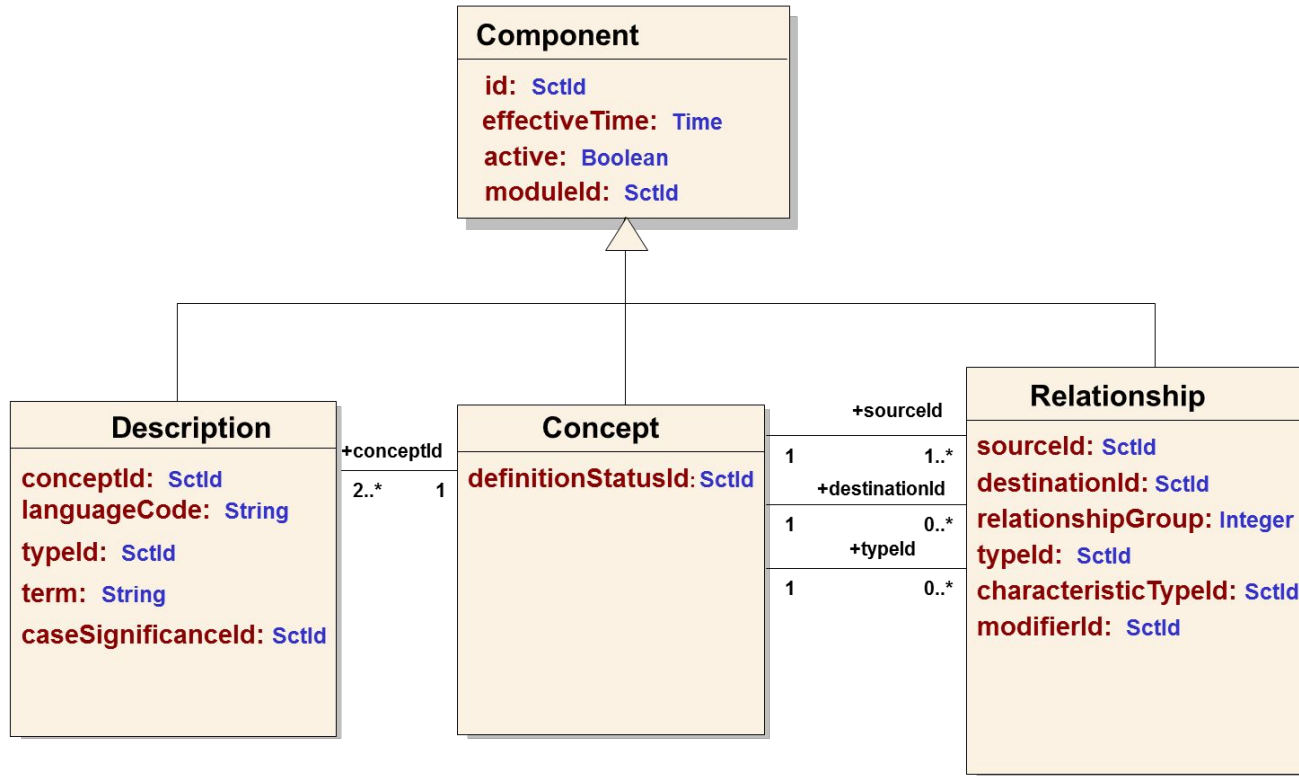
# Links to Further Information

**A summary of SNOMED CT components is provided in the SNOMED CT Starter Guide**
- http://snomed.org/sg

**Detailed documentation of SNOMED CT components is provided in the Release Files Specifications**
- http://snomed.org/relfiles

**Review other examples of concepts, descriptions and relationships by using an online browser**
- SNOMED International's SNOMED CT Browser
- Other SNOMED CT Browsers

# Today's SNOMED CT Tools

# Storing, retrieving and managing SNOMED CT

SNOMED International has had a number of open source servers to retrieve the terminology:

- **Snowstorm**
  *https://github.com/IHTSDO/snowstorm*

- Snow Owl (no longer maintained by SNOMED International)
  *https://github.com/b2ihealthcare/snow-owl*

Snowstorm is a terminology server built by SNOMED International upon Elasticsearch with the following features:

- Easy to install and run
- Full ECL v1.3 compliant
- FHIR Terminology Services support
- No database, leverages the scalability provided by Elasticsearch

Snowstorm:
- is a modern web application, built with Java Spring Boot;
- runs on any server platform and operating system;
- has an open source Apache 2.0 license

However, Snowstorm:
- is not commercially supported by SNOMED International
- only supports SNOMED CT, and not other terminologies

# Working with SNOMED CT Releases, Extensions and Snowstorm

# SNOMED CT Releases

## SNOMED CT Release Packages

- All SNOMED CT releases are distributed in the RF2 format (Release Format 2). This is a set of TSV files compressed as a zip archive.

- Within a release package there are three directories:

  - **Snapshot** - the current state of all components in that edition

  - **Delta** - the changes and additions since the previous release

  - **Full** - the full history of every component in all releases of the edition

# SNOMED CT Editions and Extensions
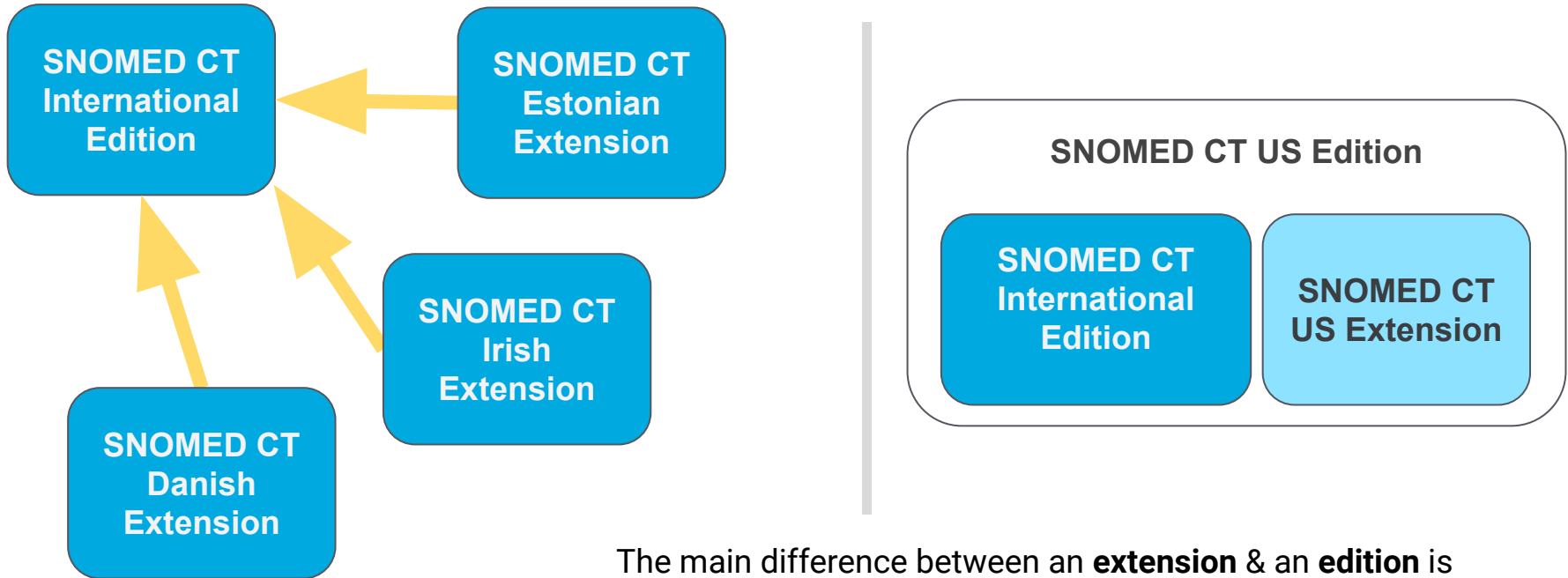


The main difference between an **extension** & an **edition** is how they are packaged and distributed

# How we're going to do this...

- You will all be assigned an EC2 server instance from SNOMED International's AWS infrastructure and should all have received an email with an IP address already.

- The SSH private key (*training.pem*) required for access will be provided on the zoom chat.

# http://bit.ly/sct-dev-ex1

# SNOMED CT Releases and Extensions

## Within a Terminology Server

A Terminology Server which implements branching allows us to:

- Store and access the SNOMED International Edition

- Store and access one or many SNOMED Extensions

- Import new releases as they become available

- Retain access to previous SNOMED releases

# SNOMED CT Releases and Extensions

- The content of SNOMED releases and extensions can be managed like source code repository.
- The content of each International Edition release can be added, then rebased into an Extension branch and new Extension content added.
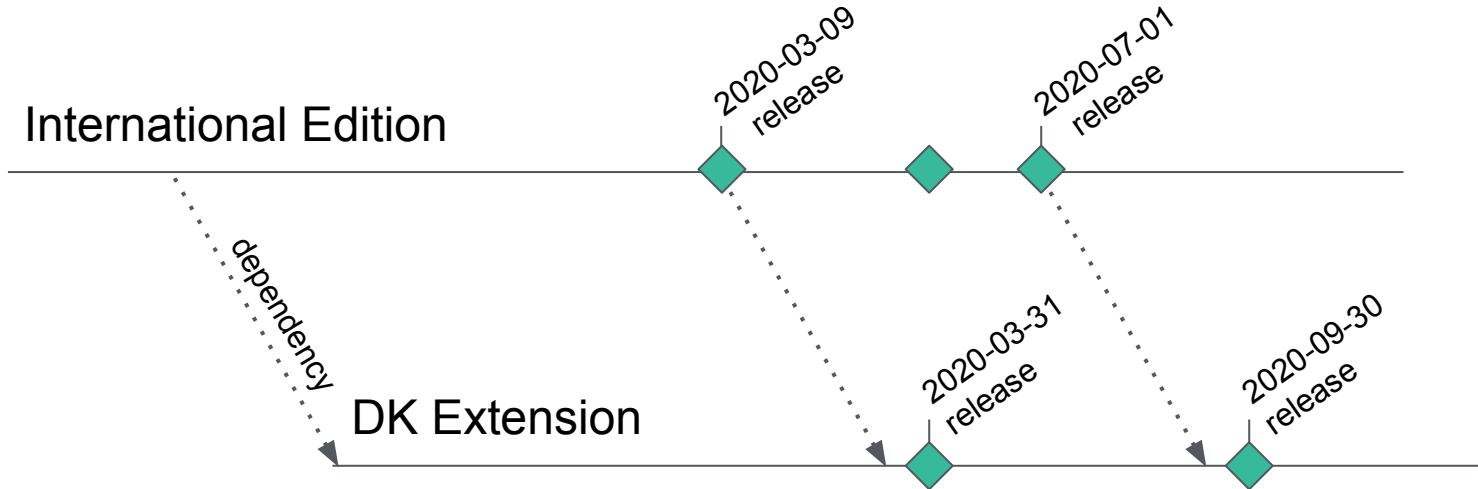
# Snowstorm Terminology Server

## Code Systems and Branches

- Content version control and branching is used

- A Code System registry is used to keep track of which code systems and which releases of each SNOMED Edition and Extension are imported

- Examples of Code Systems:

  - SNOMEDCT *(The International Edition)*

  - SNOMEDCT-DK *(The Danish Extension)*

  - SNOMEDCT-ES (*The Spanish Translation Extension*)

# Snowstorm Terminology Server

## Code Systems and Branches

- Each Code System has a working branch, containing its SNOMED content, and a version branch, for each release

- The International Edition is stored on a working branch called **MAIN**, this is the root of the repository

- Extensions working branches exist under **MAIN** and use a short name matching their Code System

- Examples of Edition/Extension branches:
  - **MAIN** *(The root branch containing the International Edition)*
  - **MAIN/SNOMEDCT-DK** *(The Danish Extension)*
  - **MAIN/SNOMEDCT-ES** *(The Spanish Translation Extension)*

# Snowstorm - Extension Setup

When Snowstorm is started the **SNOMEDCT** Code System and its working branch **MAIN** is created automatically ready for the terminology content to be imported.

Setting up an extension is a three step process:

1.  Import the *Snapshot* of the International Edition onto **MAIN**

2.  Create the extension Code System "SNOMEDCT-DK"

3.  Import the *Snapshot* of the additional extension content onto the extension branch **MAIN/SNOMEDCT-DK**

# Snowstorm - Extension *Upgrade*

When a new SNOMED CT release becomes available you can import that too. You will still have access to previously imported content.

Upgrading an extension is a three step process:
1.  Import the ***Delta*** of the new International Edition release into **MAIN**
2.  Upgrade the Danish Code System to depend on the new Int release
3.  Import the ***Delta*** of the new extension release onto the Danish extension branch

*Delta* entries within the release zip file contain just the new content for that release. We use these for upgrading content. The new content will lay on top of the previously imported snapshot in version control.

# Getting stuff out of SNOMED CT

Simple retrieval can be done in a few ways:

- Concept identifier: e.g. 195967001 or 225796000
  - http://<host>:8080/browser/MAIN/concepts/225796000

- Term search: e.g. "asthma" or "myocardial infarction", or using prefixes "myo infar"
  - http://<host>:8080/MAIN/concepts?activeFilter=true&term=asthma&offset=0&limit=5

- Uses HTTP header 'Accept-Language' to choose which descriptions are returned:
  - curl -X GET --header 'Accept: application/json' --header 'Accept-Language: da' 'http://<host>:8080/MAIN/SNOMEDCT-DK/concepts?term=astma&offset=0&limit=50'

# Examples

https://github.com/IHTSDO/Frontend-Interaction-Demonstration

- Built using javascript and already set up on your instance at http://<ip-address>

- Uses the Snowstorm API

- View a single concept in JSON format, eg:
  - `curl http://localhost:8080/browser/MAIN/SNOMEDCT-DK/concepts/225796000 | json_reformat`

- *Try to search for different concepts using the identifier and terms*
- *From search results, get more information on the concepts in the results*
- *Do you have anything to connect to Snowstorm?*

# Advanced SNOMED CT Retrieval

# Harness the Power of SNOMED CT

## With the *Expression Constraint Language (ECL)*

SNOMED CT is a semantically rich terminology.

The concepts are organised into hierarchies.
This can help us find more general or more specific variations of a medical concept.

The concepts also contain other attribute information which allows us make selections cutting across hierarchies. For example we could select *Disorder* or *Procedure* concepts using the location where they occur in the body.
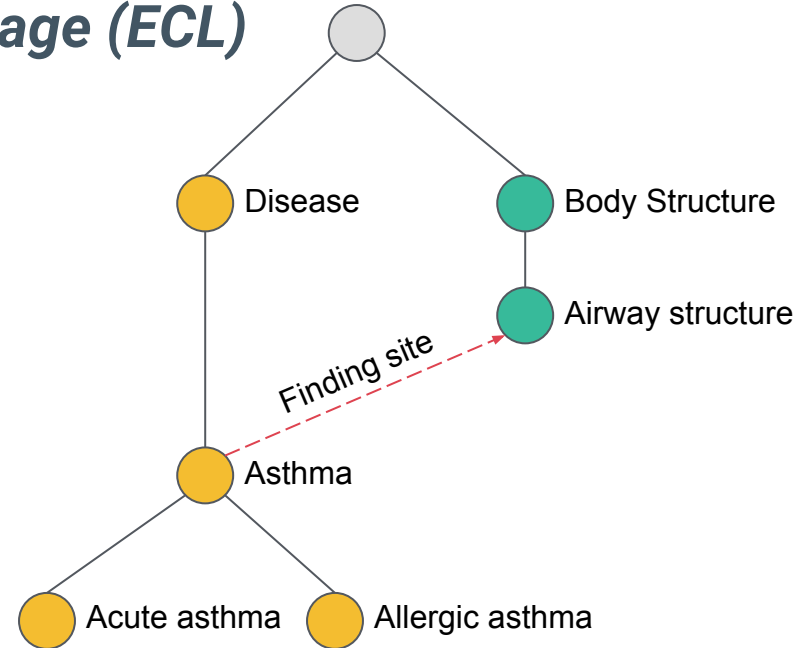
# Subsumption
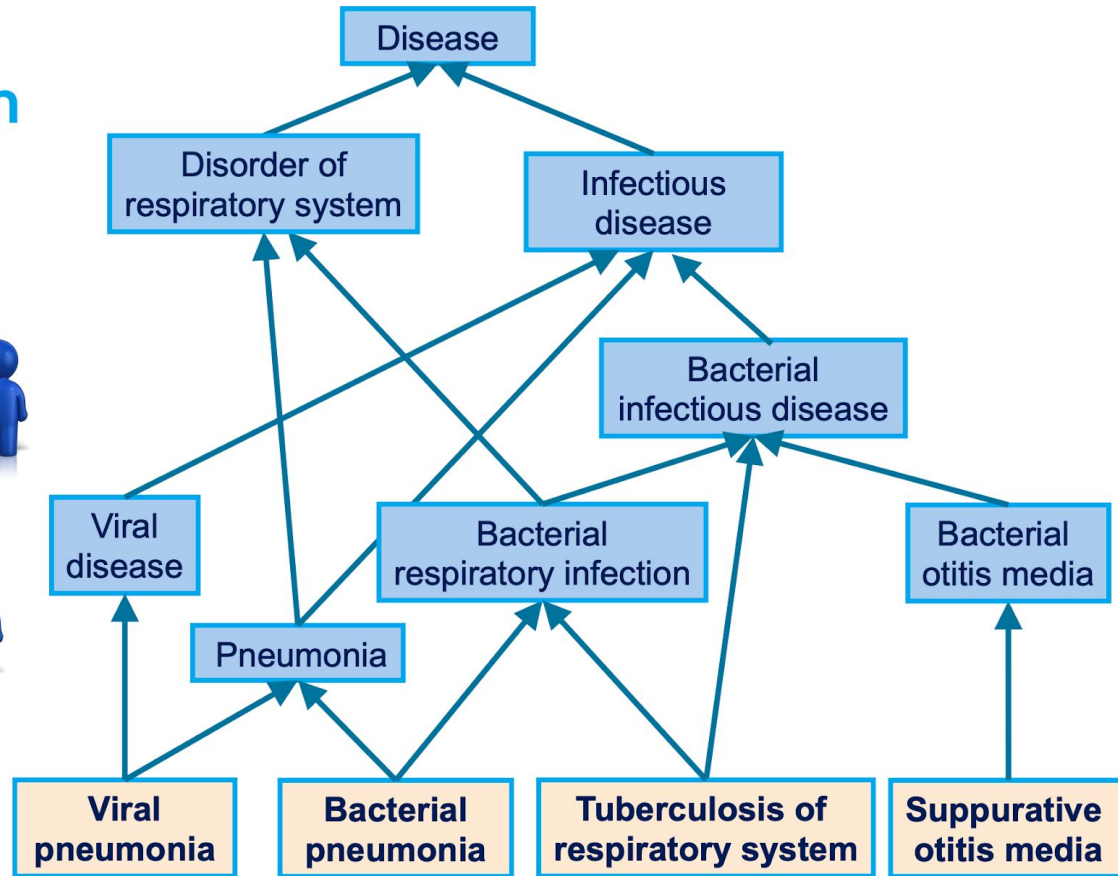
Subsumption

Identify people with respiratory diseases
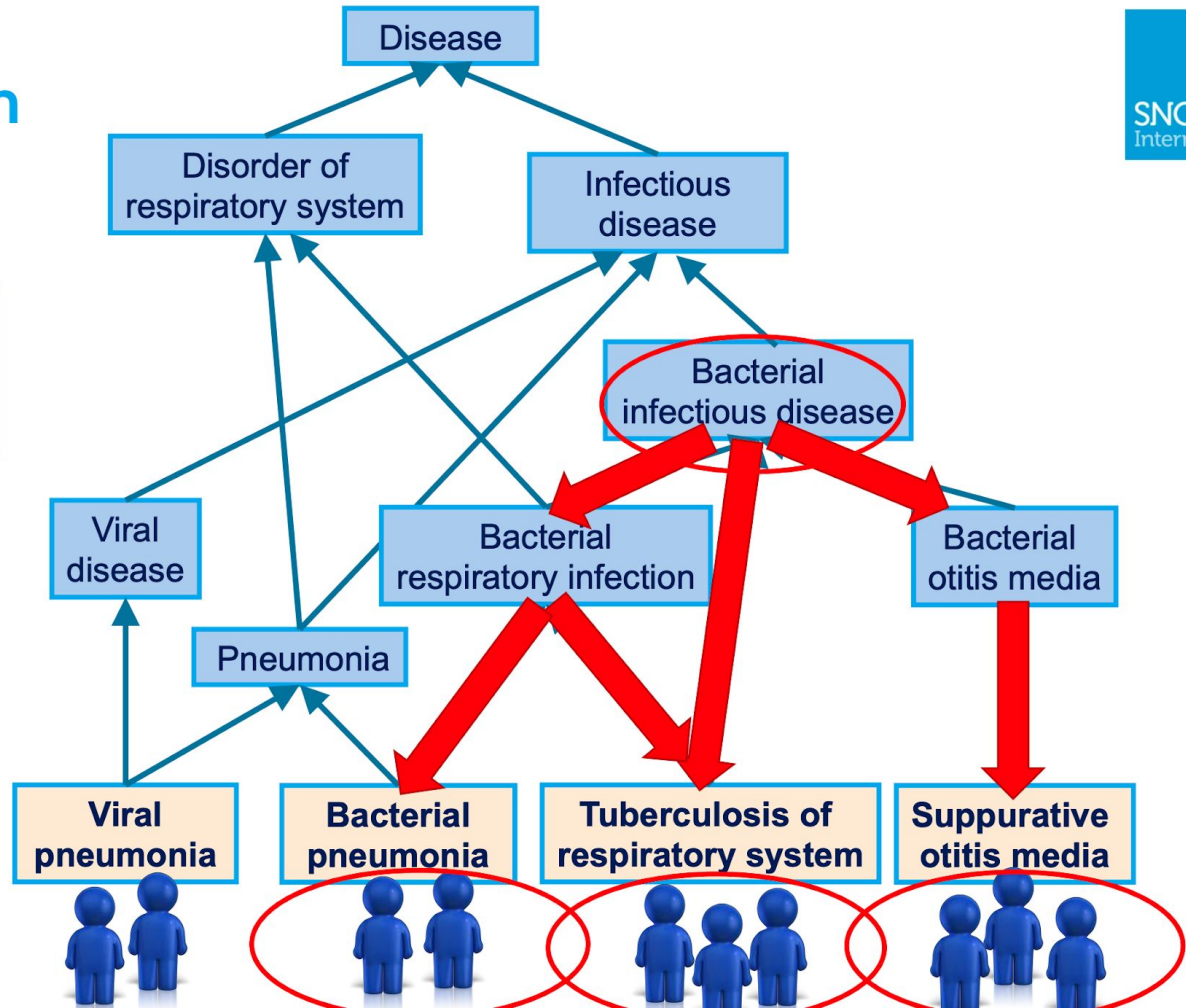
# Expression Constraint Language - Use Cases

## Data Analysis

● When analysing patient data ECL can be used to find the relevant set of concepts to match against patient records:

   ○ Find patients with any type of Diabetes:
   *<< 73211009 | Diabetes mellitus |*

   ○ Find patients with any infectious disorder of the lung:
   *< 40733004 | Infectious disease | :*
   *363698007 | Finding site | = << 39607008 | Lung structure |*

   ○ Find patients with any behaviour finding
     within the Nursing Health Issues Reference Set:
   *^ 733991000 |Nursing Health Issues Reference Set| AND*
   *< 844005 |Behavior finding (finding)|*

# Expression Constraint Language - Use Cases

## Data Input

- Modern applications use advanced input fields like typeahead/incremental search when there are a large number of options.

- In a medical application ECL can be combined with a text search to limit typeahead matches to the relevant area of the hierarchy.

Typeahead field constrained by ECL to match *Assessment Scales* in SNOMED rather than *Disorders*.

This makes finding the relevant concept easier!

**Assessment Used:**

Asth|

Asthma control test (assessment scale)

Asthma control questionnaire (assessment scale)

# Expression Constraint Language

## ECL in Snowstorm

In Snowstorm ECL can be combined with a text search using the REST API:

- *GET {branch}/concepts?ecl={ecl}&term={term}*

- Example:
  `GET /MAIN/concepts?ecl=<<73211009|Diabetes_mellitus|&term=ulcer`

  *Note that the ECL section of the URL must be URL encoded.*

## Documentation
The full set of examples and documentation for ECL can be found here:
### *http://snomed.org/ecl*

# Examples

## http://snomed.org/ecl
### See Section 6

- Use the Snowstorm API
- Try the examples available in the ECL guide
- Use the guide to create your own ECL

- **Quiz questions:**
  - Create a query to find **all respiratory disorders due to allergic reaction caused by pollen**

  - Create a query to find **all medicinal products containing caffeine**

# Sets... all types of them

### Reference Sets

A refset consists of a set of references to SNOMED CT components, like concepts, descriptions or relationships and is a published/released artefact

### Value sets

A FHIR resource, a uniquely identifiable set of valid concept representations from **any** coding system/terminology

### Subsets

A set is a subset if all of its members are all contained in another set.

## Within SNOMED CT, both value sets and subsets can be represented by refsets

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# Reference Sets

- A refset is a data structure defined by SNOMED International

- A refset consists of a set of references to SNOMED CT components, like concepts, descriptions or relationships

  - In its simplest form a refset can represent a subset of SNOMED CT components

# References Sets with Additional Attributes

**Most types of refsets include other attributes providing additional information about members of the refset**

- This allows refsets to do far more than just define subsets

*For example*

- Define mappings to other nomenclatures, classifications and knowledge structures
- Define alternative hierarchical structures for concepts
- Support aspects of the SNOMED CT technical design

**Refsets can be of different sizes**

- A few concepts … right up to every concept

# Reference Set Types

- **Different types of refsets exist**
  - Content
  - Technical
- **New refset types can be created**
  - Designed to meet additional requirements
  - Associate other additional properties with the components in the refset than the already existing refset types
- **All refset types are described by a refset descriptor**

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# A Summary of Refset Uses

**Refsets are used for many different purposes**

- To represent subsets
- To indicate language/dialect preference for terms
- To prioritize particular items in a search list
- To specify alternative hierarchies
- To attach metadata to a component
- To attach annotations or other information to a component
- To represent maps to or from other code systems or classifications

# Simple Reference Set

- Represents an extensional definition of a subset of components (concepts, descriptions, relationships and refsets)

- The components can be specified for inclusion or exclusion for a specified purpose

- Member attributes:

  - **referencedComponentId**: refers to a component that is a member of the refset

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# Simple Reference Set Example

82272006
Common cold (disorder)

58675001
Upper respiratory tract structure (body structure)

374645000
Amoxicillin 400mg tablet (product)

49872002
Virus (organism)

419956001
Human insulin 100units/mL injection solution 10mL vial (product)

329525004
Aspirin 300mg tablet (product)

281794004
Viral upper respiratory tract infection (disorder)

Virtual medicinal product simple reference set

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# Simple Map Reference Set

- Allows representation of simple maps between SNOMED CT concepts and codes in other code systems

- The refset type is similar to the Simple type refset except the mapTarget

- Member attributes:

  - **referencedComponentId:** refers to a component that is a member of the refset

  - **mapTarget:** the code in the other code system

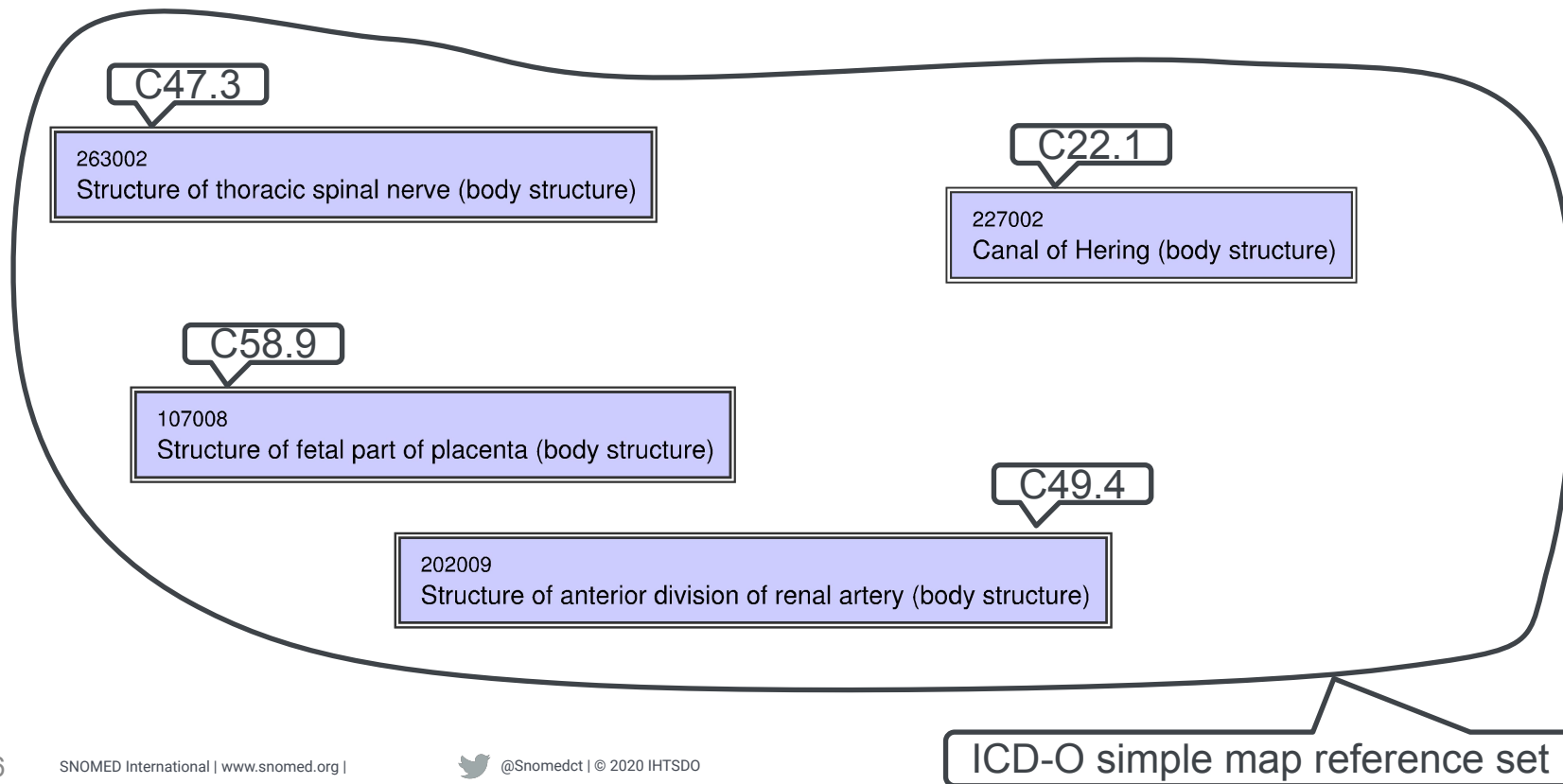@Snomedct | © 2020 IHTSDO

# Simple Map Reference Set

- Usually only appropriate for "one-to-one" mappings

- "Many-to-one", "one-to-many" and "many-to-many" mappings possible, but often less useful

- Complex and Extended map reference sets are normally used when each SNOMED CT concept may map to more than one code in a target scheme

# Simple Map Reference Set Example

C47.3

263002
Structure of thoracic spinal nerve (body structure)

C22.1

227002
Canal of Hering (body structure)

C58.9

107008
Structure of fetal part of placenta (body structure)

C49.4

202009
Structure of anterior division of renal artery (body structure)

ICD-O simple map reference set

SNOMED
International

# Language Reference Set

- This refset type is used to indicate which descriptions contain terms that are acceptable or preferred in a particular language or dialect

- Member attributes:

  - **referencedComponentId**: refers to a description that is used in the specified dialect or use case

  - **acceptabilityId**: indicating whether the description is acceptable or preferred for use in the specified dialect or use case

    - Preferred

    - Acceptable

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# Association Reference Set

- Represents a set of unordered associations of a particular type between components

- Several historical association refsets exists
    - Possibly equivalent to
    - Same as
    - Replaced by
    - ...

- Member attributes:
    - **referencedComponentId**: the source component of the association
    - **targetComponentId**: the target component of the association

# Reference Sets Summary

- **A refset consists of a set of references to SNOMED CT components**

- **Each of these references is a member of the refset**

- **There are different types of refset**
  - A simple refset represents a subset of components
  - Other refsets have additional attributes that provide additional information about members of the refset
- **Refsets are used for many purposes including**
  - Representing subsets
  - Indicating language/dialect preference for terms
  - Prioritize particular items in a search list
  - Mapping to other code systems and classification
  - Technical support for managing inactivated components
- **Refsets are likely to have more uses in future**

# Links to Further Information

**SNOMED CT Starter Guide**
- http://snomed.org/sg
  Extensions & Customization

**SNOMED CT Release File Specifications**
- Reference Set Release Files Specification
  http://snomed.org/rfs-refsetspec

**SNOMED CT Terminology Services Guide**
- Working with metadata
  http://snomed.org/tsg-metadata

**SNOMED CT Record Services Guide**
- http://snomed.org/rsg-comm
  Using Reference Sets to represent allowable value sets

# Reference Set Examples & Exercises

# Reference Sets Exercises

- Find out what reference sets exist
  - check the SNOMED International browser, http://browser.ihtsdotools.org

  - use ECL on Snowstorm
    - e.g. `<<446609009 |Simple type reference set (foundation metadata concept)|` or
    - `<<900000000000496009 |Simple map type reference set (foundation metadata concept)|`

- Find members of a reference set
  - `http://<host>:8080/MAIN/members?active=true&referenceSet=721144007`

- Use the map reference sets to find the equivalent SNOMED CT for the ICD-10 code, **T38.3 - *Poisoning: Insulin and oral hypoglycaemic [antidiabetic] drugs***
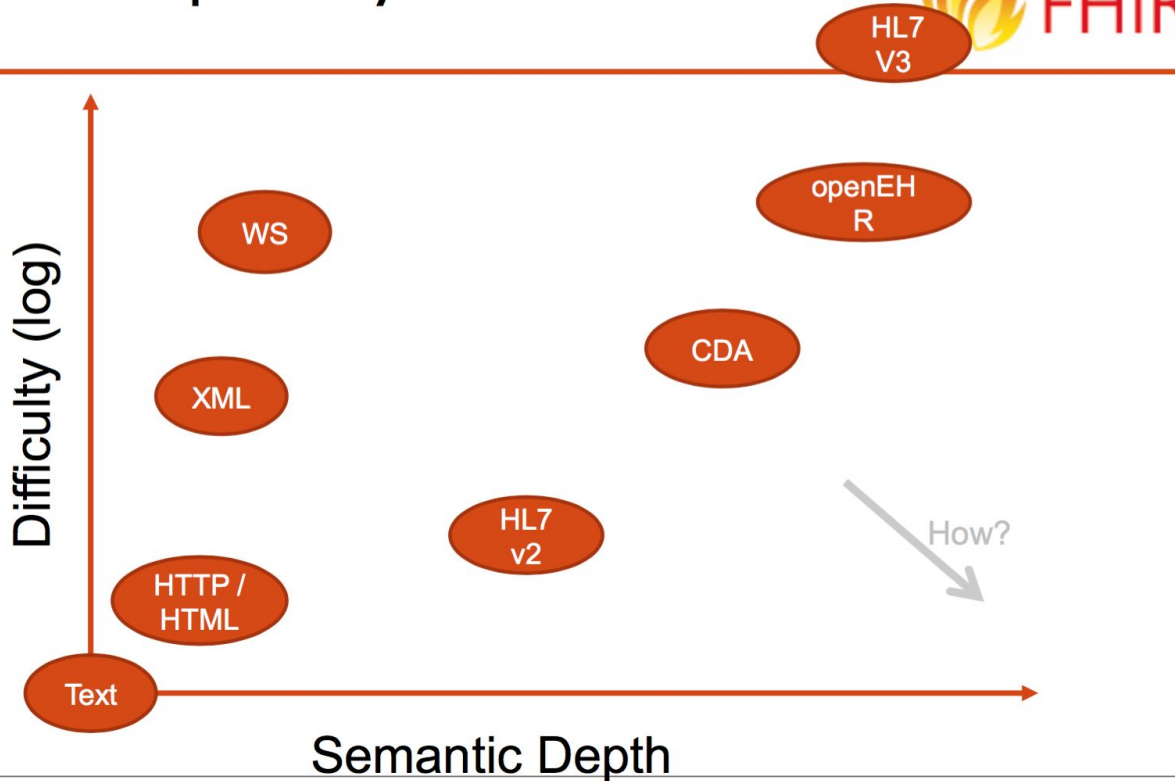
SNOMED CT on FHIR

HL7® FHIR®

# HL7 FHIR

- F – Fast (to design and implement - message format and API)
- H – Health
- I – Interoperable
- R – Resources (building blocks)

## Environmental Factors

- Increased pressure to broaden scope of sharing
  - Across organisations
  - Mobile and cloud-based apps
- Need to achieve interoperability faster, reduce time-to-market

- Creators
- Community
- Implementers
- REST
- Modular
- Terminology Agnostic
- Champions



Interchange standards - Complexity

FHIR

Difficulty (log) vs Semantic Depth

HL7 V3, openEHR, WS, CDA, XML, HL7 v2, HTTP / HTML, Text

How?

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# Now visit  http://fhir.hl7.org

- Generated Documentation
  - Self describing via StructureDefinition
- Resources
  - Maturity Model
  - Governance and Balloting of Members
  - Condition Resource
    - Isomorphic rendering (xml, json, turtle)
    - Datatypes,  see code & bodysite, mention codeable concept
    - ValueSets - like simple reference sets
- Terminologies
  - See SNOMED CT page
  - SNOMED specific properties
- Profiles and Extensions - extension structure referenced in instance
- See also http://build.fhir.org   (4.2.0)

# Snowstorm's FHIR EndPoints

See documentation in the Snowstorm GitHub repo - https://github.com/IHTSDO/snowstorm/blob/develop/docs/using-the-fhir-api.md

- Based on HAPI libraries
- Doesn't support Swagger
- Documentation also in HTTP request files & Postman (see below)
  - https://documenter.getpostman.com/view/462462/S1TVXJ3k?version=latest
- HAPI doesn't start until first endpoint hit

org.snomed.snowstorm.fhir.config
org.snomed.snowstorm.fhir.domain
org.snomed.snowstorm.fhir.repositories
org.snomed.snowstorm.fhir.services
  FHIRCodeSystemProvider.java
  FHIRConceptMapProvider.java
  FHIRHelper.java
  FHIROperationException.java
  FHIRValueSetProvider.java
  HapiParametersMapper.java
  HapiValueSetMapper.java
org.snomed.snowstorm.fhir.utils
org.snomed.snowstorm.mrcm
org.snomed.snowstorm.mrcm.model

# Using SNOMED CT with FHIR (and Snowstorm)

Terminology Resources with Operations particular to SNOMED CT

| CodeSystem | ValueSet | ConceptMap |
|---|---|---|
| $lookup | Implicit valuesets | $translate |
| $validate-code | $validate-code | |
| $subsumes | $expand | |

# CodeSystem - instances & searching

https://temp-snowstorm.ihtsdotools.org/fhir/CodeSystem

.../CodeSystem?version=20190731

.../CodeSystem?publisher:contains=SNOMED

Example:

.../fhir/CodeSystem/sct_11000181102_20191130

| MODULE SCTID | EFFECTIVE DATE |
|---|---|
| 11000181102 | 20191130 |

# CodeSystem - $lookup

https://temp-snowstorm.ihtsdotools.org/fhir/CodeSystem/$lookup?system=http://snomed.info/sct&code=840539006

.../CodeSystem/$lookup?code=840539006&version=http://snomed.info/sct/900000000000207008/version/20190731

.../CodeSystem/$lookup?code=322236009&property=normalForm

```
- {
    name: "property",
  - part: [
      - {
          name: "code",
          valueString: "normalForm"
      },
      - {
          name: "valueString",
          valueString: "780128004|Product containing only paracetamol in oral dose form (medicinal
          product form)| : 411116001|Has manufactured dose form (attribute)| = 421026006|Conventional
          release oral tablet (dose form)|, 763032000|Has unit of presentation (attribute)| =
          732936001|Tablet (unit of presentation)|, 766952006|Count of base of active ingredient
          (attribute)| = 38112003|1 (qualifier value)|, { 762949000|Has precise active ingredient
          (attribute)| = 387517004|Paracetamol (substance)|, 732943007|Has basis of strength substance
          (attribute)| = 387517004|Paracetamol (substance)|, 732944001|Has presentation strength
          numerator value (attribute)| = 732775002|500 (qualifier value)|, 732945000|Has presentation
          strength numerator unit (attribute)| = 258684004|milligram (qualifier value)|, 732946004|Has
          presentation strength denominator value (attribute)| = 38112003|1 (qualifier value)|,
          732947008|Has presentation strength denominator unit (attribute)| = 732936001|Tablet (unit of
          presentation)| }"
      }
  ]
},
```

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# CodeSystem - $validate

https://temp-snowstorm.ihtsdotools.org/fhir/CodeSystem/$validate-code?coding=http://snomed.info/sct|32553006

.../CodeSystem/$validate-code?coding=http://snomed.info/sct|32553006&display=nausea

.../CodeSystem/$validate-code?code=443971000124108

# CodeSystem - $subsumes

Check if 399144008 |Bronze diabetes (disorder)| is a type of 73211009 |Diabetes mellitus (disorder)|.    Does B "subsume" A?

…/CodeSystem/$subsumes?codeA=399144008&codeB=73211009

# ValueSet- instances & searching

https://temp-snowstorm.ihtsdotools.org/fhir/ValueSet

https://temp-snowstorm.ihtsdotools.org/fhir/ValueSet?title:contains=condition

# ValueSet - $expand

https://temp-snowstorm.ihtsdotools.org/fhir/

ValueSet/allergyintolerance-code/$expand?

force-system-version=http://snomed.info/sct/11000146104

&displayLanguage=nl&

filter=pollen

# Implicit ValueSet

**Procedures on the heart**
<< 362958002 |Procedure by site (procedure)| :
       << 363704007 |Procedure site (attribute)| = << 80891009 |Heart structure (body structure)|

.../ValueSet/$expand?url=http://snomed.info/sct?fhir_vs=
ecl/<<362958002:<<363704007=<<80891009

.../ValueSet/$expand?url=http://snomed.info/sct?fhir_vs=
ecl/<<362958002:<<363704007=<<80891009&
filter=MRI

# ValueSet - $validate-code

Is this code part of my ValueSet and is the correct display term used?

.../ValueSet/$validate-code?

url=http://snomed.info/sct/900000000000207008/version/20200309?fhir_vs=ecl/<<34014006|Viral+disease|&

coding=http://snomed.info/sct|840539006

# ConceptMap - $translate

.../ConceptMap/$translate?code=254153009&

system=http://snomed.info/sct&

source=http://snomed.info/sct?fhir_vs&

target=http://hl7.org/fhir/sid/icd-10&

url=http://snomed.info/sct?fhir_cm=447562003

**ICD-10 Map target for 254153009
|Familial expansile osteolysis
(disorder)|**

.../ConceptMap/$translate?code=134811001&

system=http://snomed.info/sct&

source=http://snomed.info/sct?fhir_vs&

target=http://snomed.info/sct?fhir_vs&

url=http://snomed.info/sct?fhir_cm=900000000000527005

**Historical Association find the "SAME
AS" target for inactivated concept**

# ConceptMap - $translate is dangerous in reverse

…/ConceptMap/$translate?code=Q79.8&

system=http://hl7.org/fhir/sid/icd-10&

source=http://hl7.org/fhir/sid/icd-10&

target=http://snomed.info/sct

**Q79.8**

**Other congenital malformations of musculoskeletal system**

# Application Demo

# http://snomed.org/ui

## Driven by implicit ValueSets + text filter

# Hands on exercises

http://snomed.org/fhir-exercises

# SNOMED on FHIR Workgroup

- Created Wellington, NZ Oct 2016
  - At request of members
  - Intended to support FHIR implementation specifically using SCT
- Every Tuesday evening 20:00 UTC
- HL7 and SI on equal footing - Rob Hausam co-chair
- Two streams of work (week about)
  - Terminology Services
    - Michael Lawley (CSIRO), Peter Jordan (HL7 NZ)
  - Terminology Binding
    - Jeremy Rogers (NHS Digital), Daniel Karlsson
- https://confluence.ihtsdotools.org/display/FHIR/SNOMED+on+FHIR

# Other SNOMED International Tools

# SNOMED International Tools

- Mapping - https://mapping.ihtsdotools.org

- CRS - Requesting new content or changes to existing content

- SNOMED CT Browser - https://browser.ihtsdotools.org

- Health Data Analytics Demonstrator - https://www.youtube.com/watch?v=hmB3VMu_74w

- Reference set & translation tool - https://refset.ihtsdotools.org

- Release service

- MLDS - https://mlds.ihtsdotools.org/de

# Links to Further Information

**SNOMED International Training &**

**Terminology Services Certification Course**

- **https://courses.ihtsdotools.org/**

**SNOMED International Tools**

- **http://snomed.org/tools**

**Open Source Repositories**

- **https://github.com/IHTSDO**

**Getting in touch**

- **Technical**
  - **techsupport@snomed.org**
- **General**
  - **info@snomed.org**

# Thank you