

Developer Training Terminology Services

November 2019

New Zealand



snomed.org/nz-training



public-snomedintl.slack.com

SNOMED CT in New Zealand

—
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SNOMED
International

A stylized world map in shades of blue and white, serving as a background for the central text box.

Welcome



Today's SNOMED CT Menu

Today's Objective

*You will 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

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

Afternoon

- Advanced querying
- Reference sets
- SNOMED & FHIR Terminology Services
- SNOMED CT use in Analytics - a demo
- The other SNOMED International tools

<http://snomed.org/dev-training>

Guidelines for the day

1

Ask questions - put your hand up, ask anything... there are no bad questions!

3

Use your own applications to work on the examples and exercises

2

Write code to do more than the simple examples

4

Enjoy the day!

Register for an EC2 instance

<http://bit.ly/sct-dev-signup>





Today's SNOMED CT Tools

SNOMED CT

The global
language of
healthcare

Storing, retrieving and managing **SNOMED CT**

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



Snow Owl

<https://github.com/IHTSDO/snow-owl>



Snowstorm

<https://github.com/IHTSDO/snowstorm>

Snowstorm

Snowstorm is a new 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;
- is open sourced under the Apache v2 license



However, Snowstorm:

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

What is SNOMED CT?

SNOMED CT

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Working with SNOMED CT Releases, Extensions and Snowstorm

SNOMED CT Releases and Extensions Within a Terminology Server

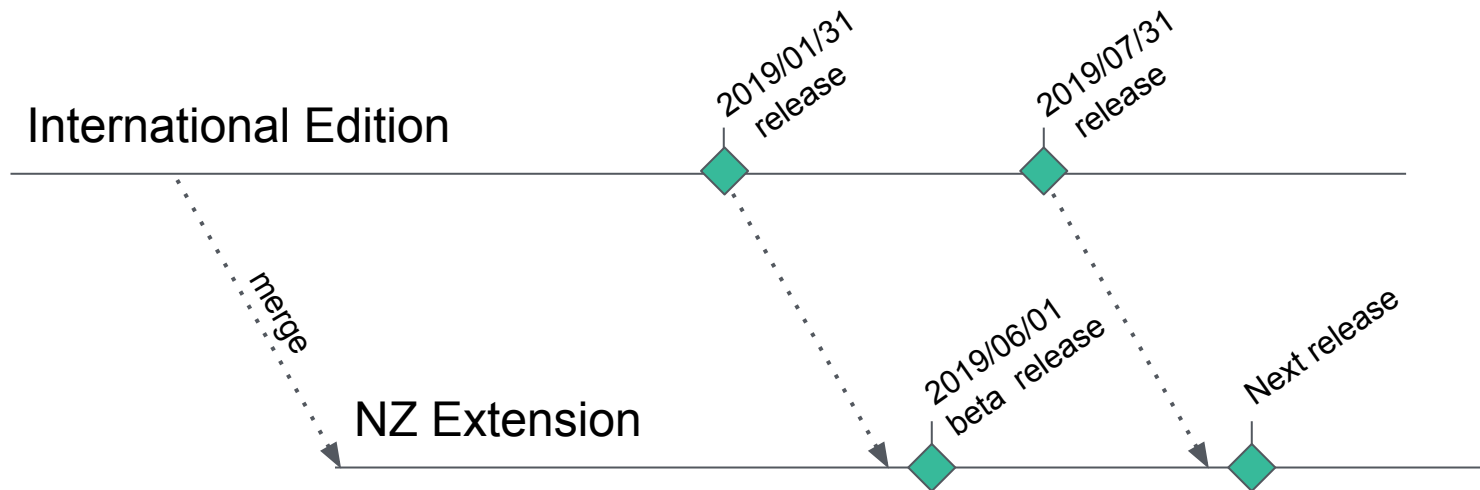
Terminology Server which implements branching allows us to:

- 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. For each release of the International Edition the content can be merged into an Extension where it can be customised to create an Extension release.



Snowstorm Terminology Server

Code Systems and Branches

The Snowstorm terminology server implements branching like a source code repository.

A Code System registry is used to keep track of which releases of each SNOMED Edition and Extension are imported onto what branch.

Examples of Code Systems:

- SNOMEDCT (*The International Edition*)
- SNOMEDCT-NZ (*The New Zealand Extension*)
- SNOMEDCT-ES (*The Spanish Translation Extension*)



Snowstorm Terminology Server

Code Systems and Branches

Each Code System has a branch containing its SNOMED content.

The International Edition is stored on a branch called **MAIN**. This is the root of the repository, like the *master* branch in git.

Extension branches exist below **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-NZ** (*The New Zealand Extension*)
- **MAIN/SNOMEDCT-ES** (*The Spanish Translation Extension*)

Snowstorm - Extension Setup

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

Setting up an extension is a five step process:

1. Import a **Snapshot** of the International Edition onto **MAIN**
2. Create the extension Code System “SNOMEDCT-NZ”
3. Import a **Snapshot** of the extension onto the extension branch **MAIN/SNOMEDCT-NZ**



Snowstorm - Extension Upgrade

When a new SNOMED 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 a **Delta** of the new International Edition release into **MAIN**
2. Upgrade the **dependent version** of the CodeSystem
3. Import the **Delta** of the new extension release onto the 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.



Setup & Walkthrough

<http://bit.ly/sct-dev-ex1>



Getting Around SNOMED CT

SNOMED CT
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Getting stuff out of **SNOMED CT**

Simple retrieval can be done in a few ways:

Concept identifier (195967001 or 225796000)

```
http://<host>:8080/browser/MAIN/concepts/195967001
```

Term search (“asthma” or “myocardial infarction”)

```
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: es'
'http://54.81.95.208:8080/MAIN/SNOMEDCT-ES/concepts?term=infarto
&offset=0&limit=50'
```

Examples

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

- Built using javascript and already running 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-ES/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 Retrieval

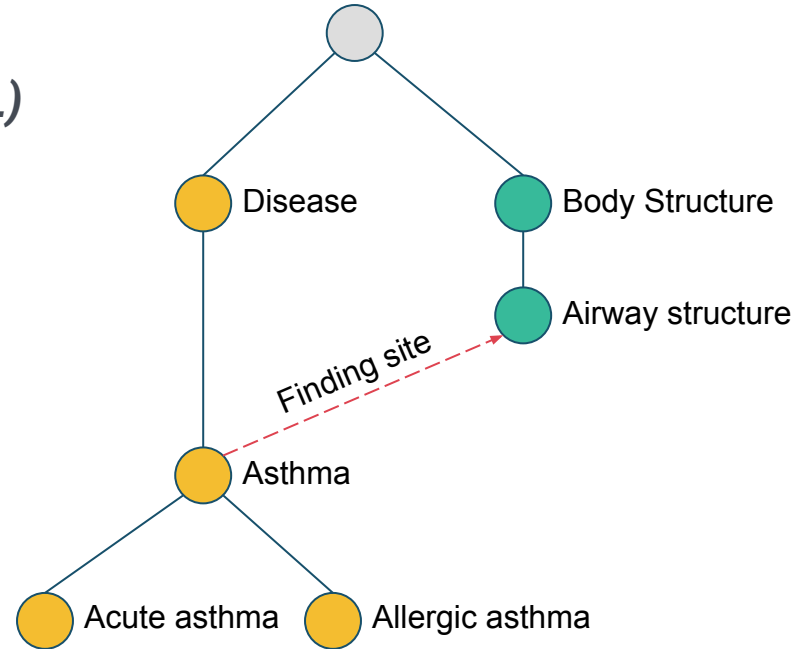
Harness the Power of SNOMED CT

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.



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 - Use Cases

Data Analysis

- When analysing patient data ECL can be used to find the relevant 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 in the Nursing Health Issues Reference Set:
`^ 733991000 |Nursing Health Issues Reference Set| AND
 < 844005 |Behavior finding (finding)|`

Expression Constraint Language - Syntax

- `memberOf` = "^"
- `wildCard` = "*"
- `descendantOf` = "<"
- `descendantOrSelfOf` = "<<"
- `childOf` = "<!"
- `ancestorOf` = ">"
- `ancestorOrSelfOf` = ">>"
- `parentOf` = ">!"
- `conjunction` = "AND"
- `disjunction` = "OR"
- `exclusion` = "MINUS"
- `to` = ".."
- `exclusion` = "MINUS"
- `reverseFlag` = "R"
- `expressionComparisonOperator` = "=" / "!="
- `numericComparisonOperator` = "=" / "!=" / "<=" / "<" / ">=" / ">"
- `stringComparisonOperator` = "=" / "!="
- `numericValue` = ["-"/"+"] (decimalValue / integerValue)
-

For more information see the ECL guide - <http://snomed.org/ecl>

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:

```
http://localhost:8080/MAIN/concepts?ecl=<<73211009|Diabetes_mellitus|
```

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>

or

<https://confluence.ihtsdotools.org/display/DOCECL/6.+Examples>

- Use the Snowstorm API
- Try the examples available in the ECL guide
- Use the guide to create your own ECL
- Using the SNOMED CT Browser, <https://browser.ihtsdotools.org>, to find the concepts, create a query to find **all respiratory disorders due to allergic reaction caused by pollen**
<< 50043002 |Disorder of respiratory system (disorder)| : 42752001 |Due to (attribute)| = 418364006 |Allergic reaction caused by pollen (disorder)|

Reference Sets

Reference Sets 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  
<<9000000000000496009 |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**

SNOMED CT on FHIR

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FHIR & SNOMED CT

- HL7 Fast Healthcare Interoperability Resources (<https://hl7.org/fhir>)
- Standardized REST API with standard libraries available (including HAPI, <http://hapifhir.io/>)
- Snowstorm ships with the SNOMED International API and FHIR Terminology Services, <http://www.hl7.org/FHIR/terminology-module.html>
- Through FHIR & Snowstorm, you can use the following operations:
 - **Lookup**, <http://www.hl7.org/FHIR/codesystem-operation-lookup.html>
 - **Expand**, <http://www.hl7.org/FHIR/valueset-operation-expand.html>
 - **Translate**, <http://www.hl7.org/FHIR/conceptmap-operation-translate.html>
- SNOMED CT & FHIR URLs are always in the following format:

```
http://<host>:8080/fhir/<operation>?url=http://snomed.info/sct?<request>
```

Operations - Lookup & Translate

Server Capability

`http://localhost:8080/fhir/metadata?_format=json`

Lookup (*lookup a give SNOMED CT code*)

`http://localhost:8080/fhir/CodeSystem/$lookup?system=http://snomed.info/sct&code=427623005&_format=json`

Translate (*currently used to return map targets*)

`http://localhost:8080/fhir/ConceptMap/$translate?code=254153009&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=&_format=json`

Operations - Expand

- list the descendants of the SNOMED CT code 27624003

```
http://snomed.info/sct?fhir\_vs=isa/27624003&count=10&format=json
```

- list the concepts with a description containing “heart attack”

```
http://snomed.info/sct?fhir\_vs&filter=heart%20attack&count=10&format=json
```

- list the concepts within a given ValueSet/refset

```
http://snomed.info/sct/21000210109?fhir\_vs=refset/61000210102&count=10&format=json
```

- list the concepts within a given ValueSet defined by ECL

```
http://snomed.info/sct/21000210109?fhir\_vs=ecl/73211009&count=10&format=json
```

Other SNOMED International Tools

SNOMED International Tools

- Mapping
- Requesting new content or changes to existing content
- SNOMED CT Browser



- Health Data Analytics Demonstrator
<http://snomed.org/analytics-video>
- Reference set & translation tool
- [SNOMED CT UI Coding Examples](#)
- Release service
- MLDS

Links to further information

SNOMED International Tools

<http://snomed.org/tools>

Open Source Repositories

<https://github.com/IHTSDO>

Getting in touch

techsupport@snomed.org



THANK YOU