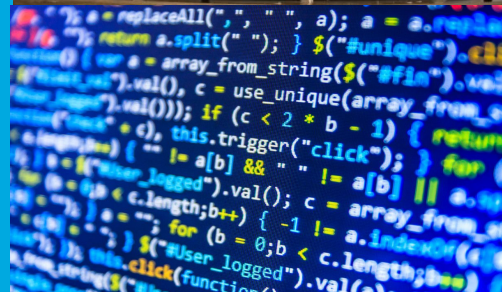
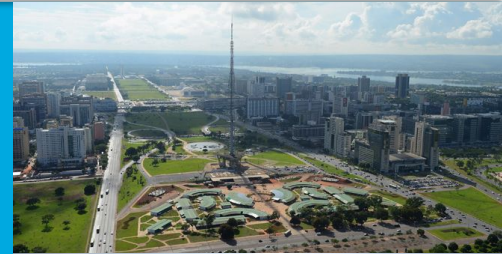


Developer Training Terminology Services

Brasilia, Brazil
2019-05-21



Bem Vindo

SNOMED
International



SNOMED International

Rory Davidson,
Technical Services Executive Lead

SNOMED CT in Brazil



Today's SNOMED CT Menu

SNOMED
International



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

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Você entenderá melhor o SNOMED CT, como implantá-lo facilmente em seus ambientes locais, como manter a terminologia atualizada e como integrá-la aos seus aplicativos

Today's Agenda

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

- **Morning**

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

- **Afternoon**

- Advanced querying
- Reference sets
- SNOMED on FHIR
- The other SNOMED International tools

Guidelines for the day

- Ask questions - put your hand up, ask anything... there are no bad questions!
- Write code to do more than the simple examples
- Use your own applications to work on the examples and exercises
- Enjoy the day

Register for an EC2 instance

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



Or use your computer

You can run and install everything on your computer.

To do so, you will need:

- At least 16GB RAM
- OSX, Linux or Windows 10 Pro
- Install Elasticsearch
<https://www.elastic.co/downloads/past-releases/elasticsearch-6-5-4>

Today's SNOMED CT Tools

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Storing, retrieving and managing SNOMED CT

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

- SCT Snapshot REST API (*will be deprecated*)
<https://github.com/IHTSDO/sct-snapshot-rest-api>
- SNOMED Query Service (*will be deprecated*)
<https://github.com/IHTSDO/snomed-query-service>
- 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
- Fully 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?

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Working with SNOMED CT Releases, Extensions and Snowstorm

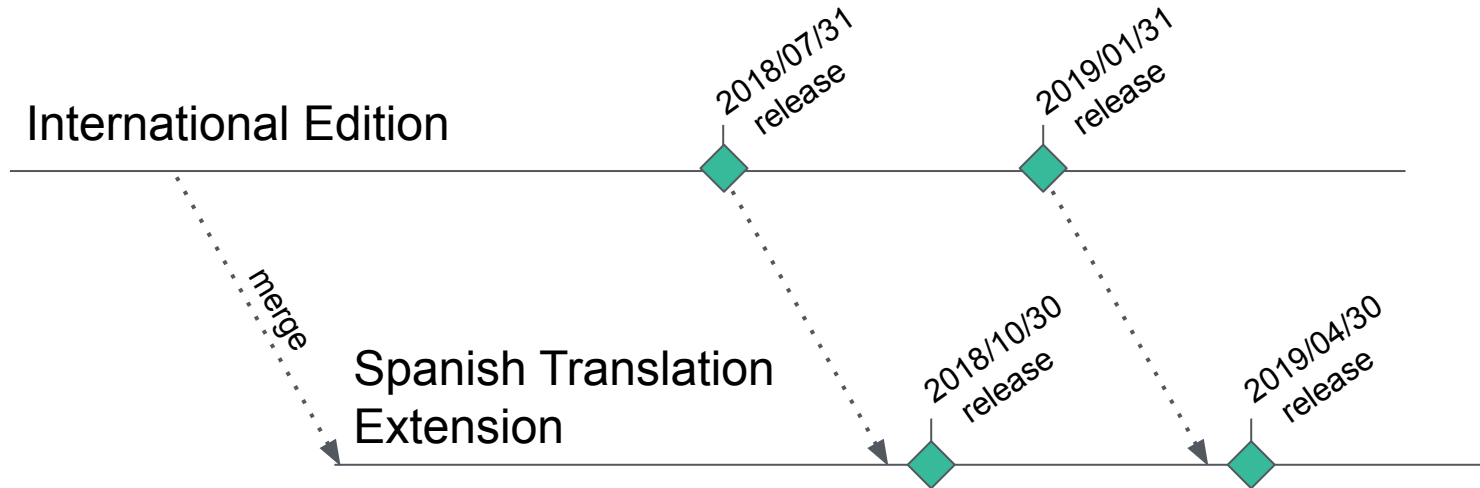
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SNOMED CT Releases and Extensions

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.



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

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-ES (*The Spanish Translation Extension*)
- SNOMEDCT-US (*The United States 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-ES** (*The Spanish Translation Extension*)

Snowstorm - Installing with an Extension

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 three step process:

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

Snapshot entries within the release zip file contain the latest version all released content. We use this for initial setup.

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. Merge **MAIN** into the extension branch
3. Import a ***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

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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 (“asma” or “infarto de miocardio”)
 - <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

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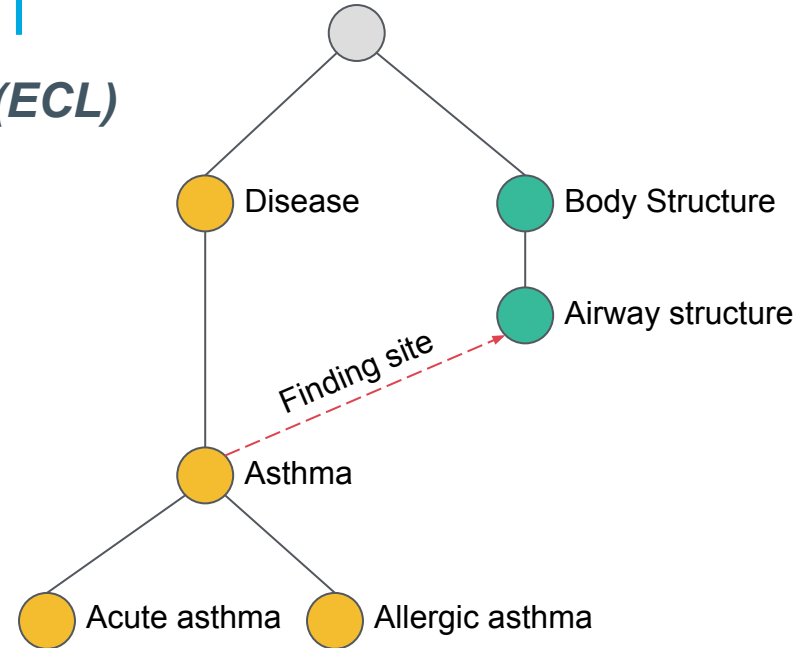
Harness the Power of SNOMED CT

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

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

Reference Sets

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Reference Sets Exercises

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Reference Sets Exercises

- Find out what reference sets exist
 - check the SNOMED International browser, <http://browser.ihtsdotools.org>
 - use the end point on Snowstorm to list all refsets on the server
 - `http://<host>:8080/browser/MAIN/members?activeMember=true`
 - 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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A large, abstract graphic in shades of blue and cyan, resembling a complex network or data structure with various nodes and connecting lines, filling the background of the lower half of the slide.

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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

- 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](http://localhost:8080/fhir/CodeSystem/$lookup?system=http://snomed.info/sct&code=427623005&format=json)
- Expand (*valuesets / refsets / query results*)
 - [http://localhost:8080/fhir/ValueSet/\\$expand?url=http://snomed.info/sct?fhir_vs=isa/27624003&format=json](http://localhost:8080/fhir/ValueSet/$expand?url=http://snomed.info/sct?fhir_vs=isa/27624003&format=json)
 - [http://localhost:8080/fhir/ValueSet/\\$expand?url=http://snomed.info/sct?fhir_vs=ecl/<<27624003&format=json](http://localhost:8080/fhir/ValueSet/$expand?url=http://snomed.info/sct?fhir_vs=ecl/<<27624003&format=json)
- Translate (*currently used to return map targets*)
 - [http://localhost:8080/fhir/ConceptMap/\\$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](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)

Other SNOMED International Tools

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SNOMED International Tools

- Mapping
- Requesting new content or changes to existing content
- SNOMED CT Browser
- Health Data Analytics Demonstrator
- Reference set & translation tool
- 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



Obrigado

SNOMED International

Registered in England and Wales | Company Registration Number 9915820

Reg. address: One Kingdom Street | Paddington Central | London W2 6BD | United Kingdom

Tel: +44 (0) 203 755 0974 | info@snomed.org | www.snomed.org

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