Databases, Nomenclature Standardisation, Networking, and IT Infrastructure

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AUSTRALIAN ANIMAL HEALTH LABORATORY
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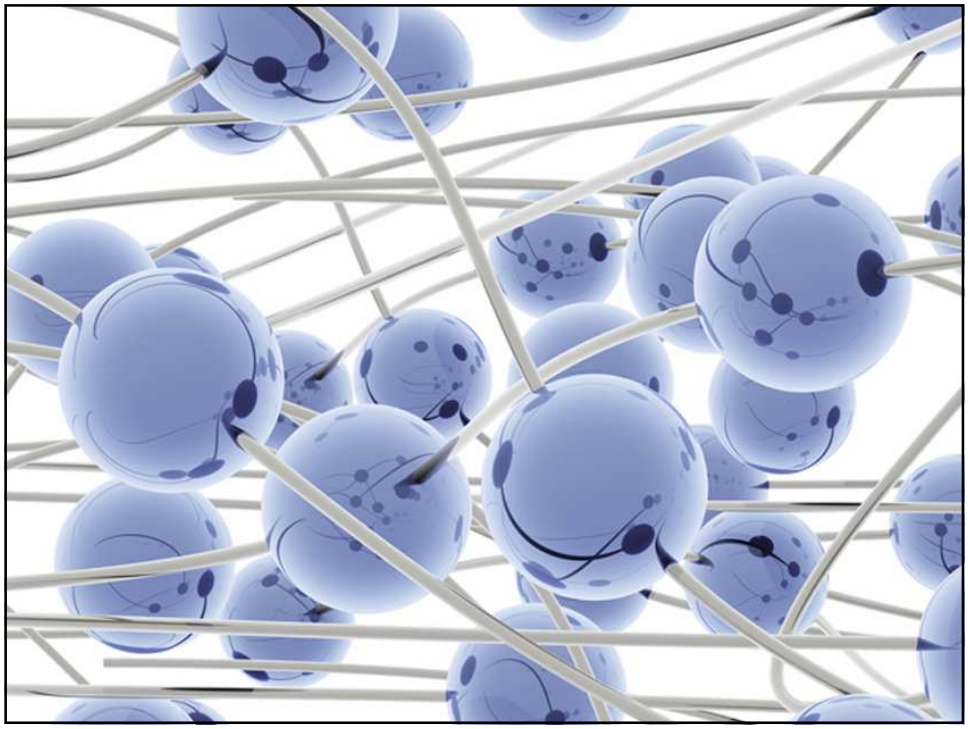
Introduction

- What's this all about?



Infrastructure

Introduction

- Laboratories host important collections of data
- Often, these are too isolated
- There are other related data collections
  - In country
  - Across borders
- Communication between systems limited, often manual

Benefits

- Share data between labs
- Automate referral of testing between labs
- Communication with surveillance systems
- Direct client reporting
- Direct regulatory reporting
- Cross-sector sharing

- Share data with other repositories
  - Biobanks
  - Virus archives
  - Other collections

The Problem

- Lack of common data standards
- Laboratory data management – LIMS – may be dominated by immediate drivers
- There can be large hurdles to overcome in moving beyond this view
- Few participants are prepared or able to take a whole of system perspective
- Secondary usage of data may not be seen as a priority
- Ownership and jurisdictional boundary issues complicate implementation

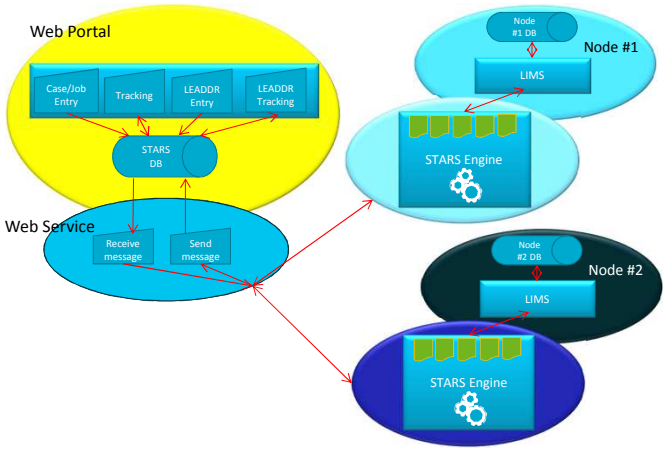
The Problem

- Lack of common data standards
- Laboratory data management – LIMS – may be dominated by immediate drivers
- There can be large hurdles to overcome in moving beyond this view
- Few participants are prepared or able to take a whole of system perspective
- Deeply embedded inefficiencies and forgone opportunities
- Ownership and jurisdictional boundary issues complicate implementation

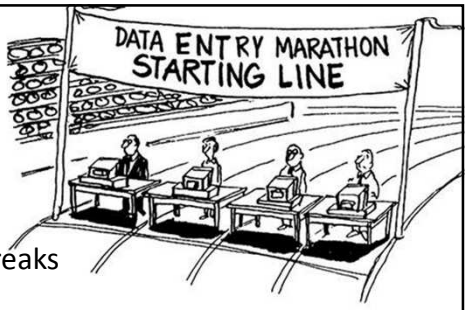
An example: STARS

- Project began nearly 10 years ago
- Ability to electronically lodge submissions between laboratories
- Ability to receive results electronically
- Ability to track status of cases

STARS

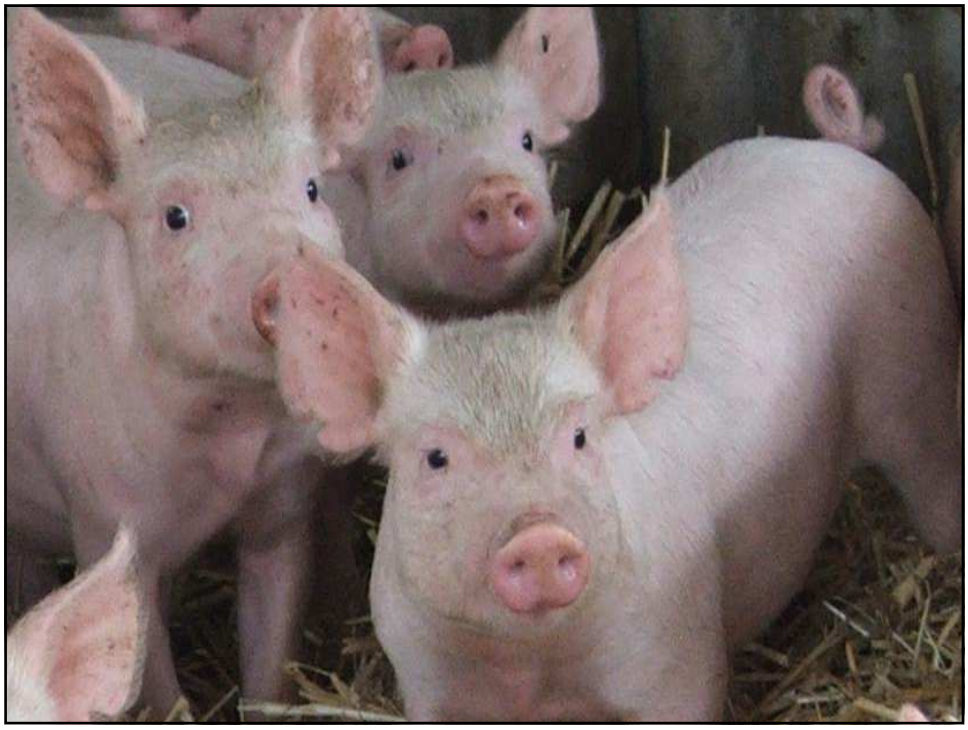


The benefits…

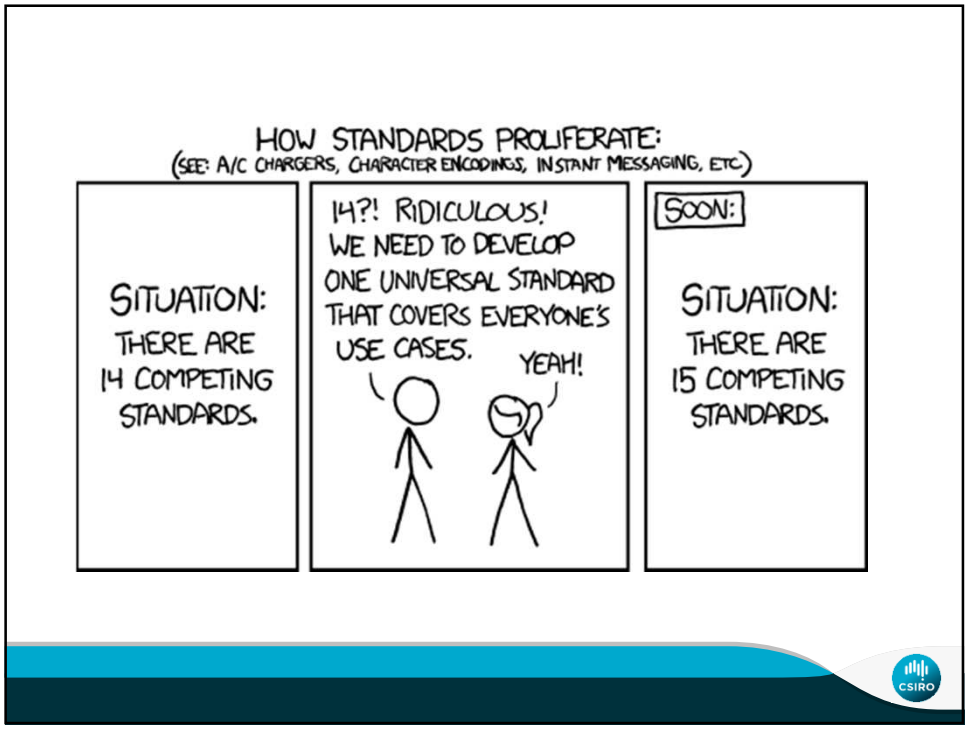


- Primary:
- Single data entry – reduce errors, increase efficiency
- Supports surge capacity for outbreaks

- Secondary:
- Planning – visibility of incoming shipments
  - and those failing to come in…
- Integration with other systems
- Extension to other domains
- Enablement of internal systems



Data Standards



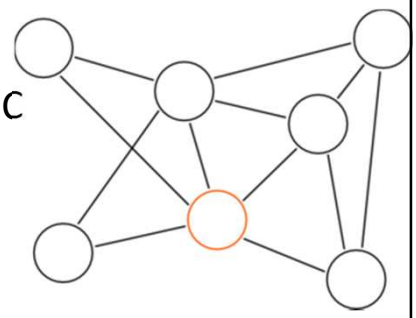
Why standards?

According to ISO, a standard is:

A document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

Examples of what has been done

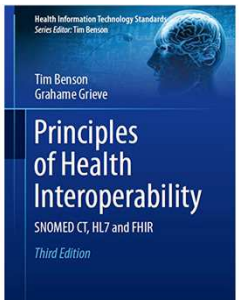
- NAHLN
  - HL7, SNOMED, LOINC



- STARS
  - V1 – Internal standard
  - V2 – planning open standards

What else is possible?

- Cross domain standardization
- Cross domain interoperability



FHIR

- Fast Healthcare Interoperability Resources
- Modern standards framework
- Uses the latest web standards
- Focus on implementation, APIs
  - REST API, JSON, XML, RDF

Emerging trends

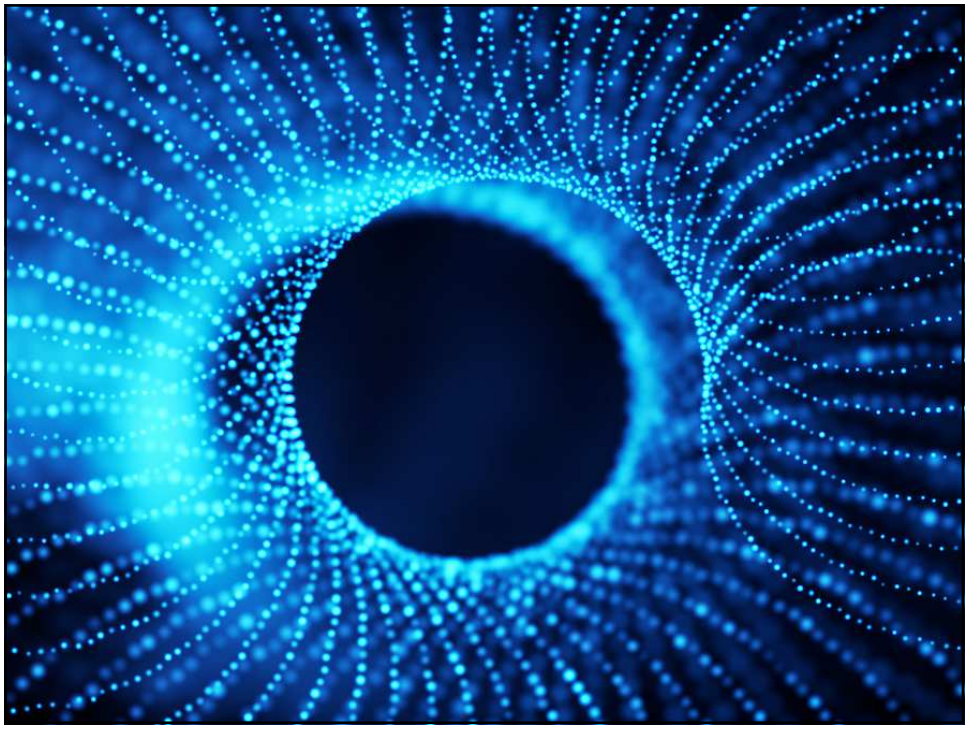
- Strong focus on eHealth
- Interoperability seen as important
- General trend to digital solutions

- Much of this applies to Animal Health
  - or can be applied fairly easily

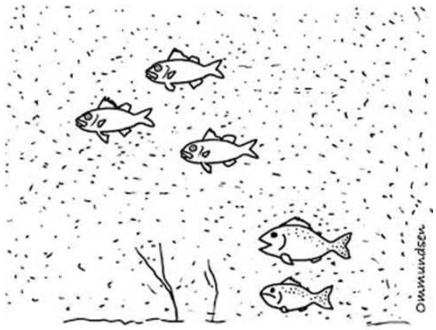
- Provides the tools to open up exchange of information

Nomenclature

– this is the hard bit!

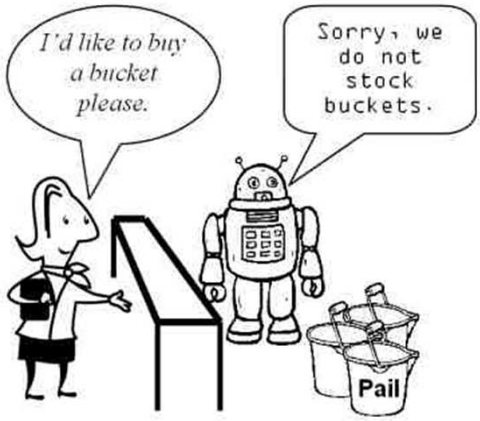


Taxonomy

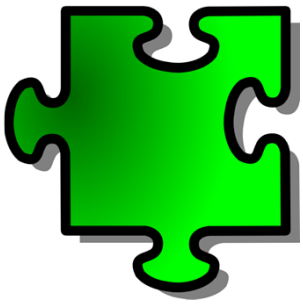


"They're going through a difficult time. Half of their family has been split off into a new genus."

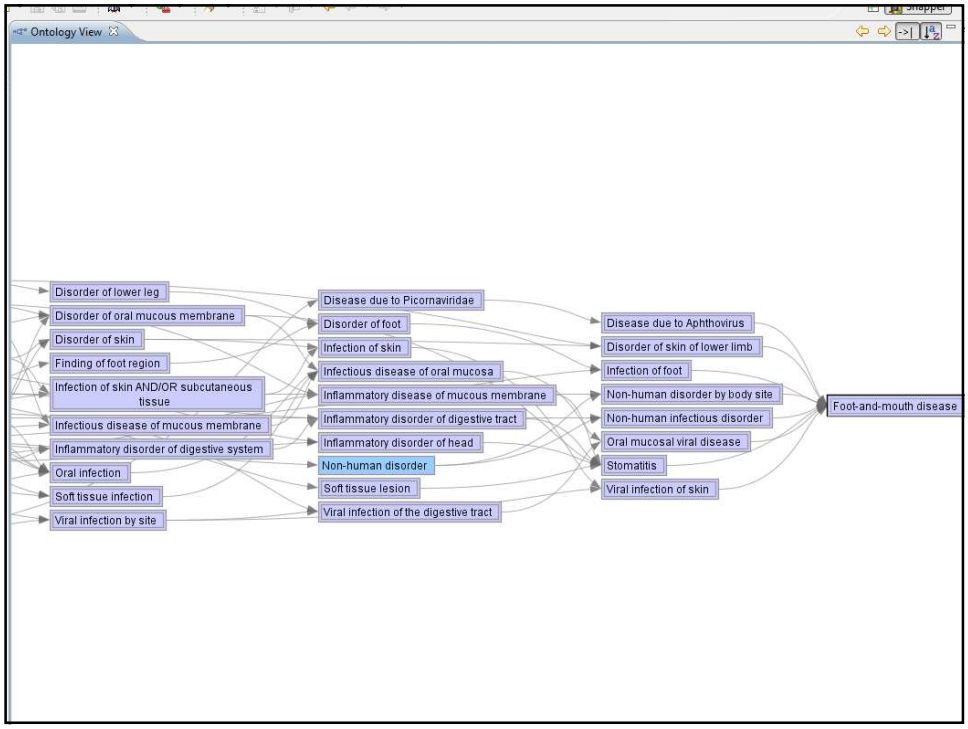
Synonymy

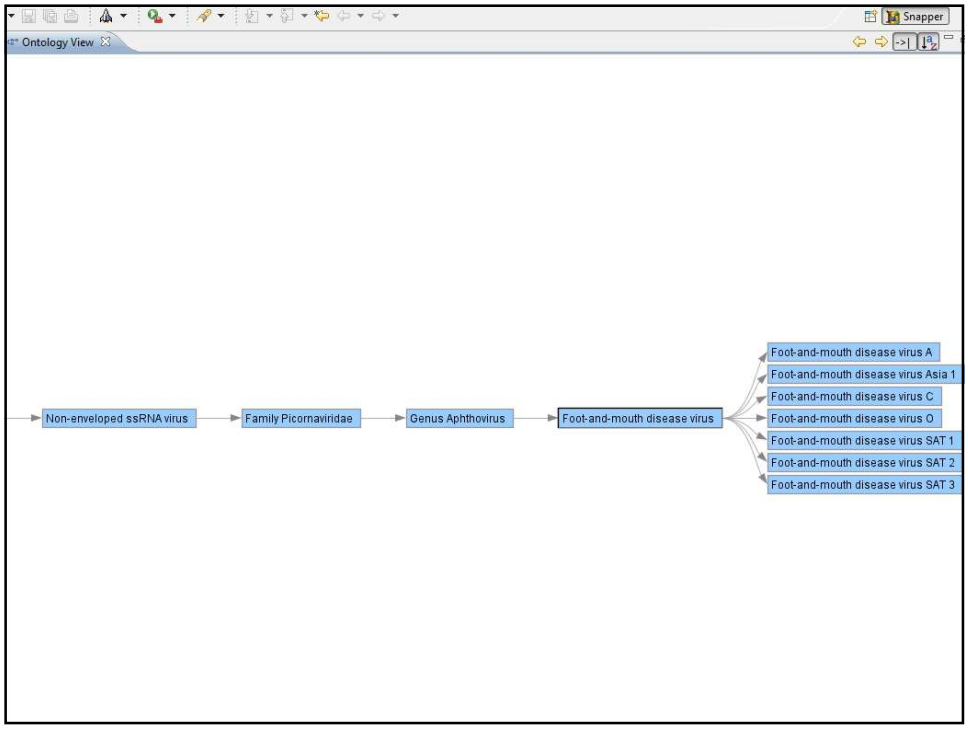


Semantics



- Begins with data standards:
- Based on established ontologies
- SNOMED is the closest to a standard
- Over 300 000 terms
- But more than 1 400 000 relationships


Ontology View
Disorder of lower leg
Disorder of oral mucous membrane
Disorder of skin
Finding of foot region
Infection of skin AND/OR subcutaneous tissue
Infectious disease of mucous membrane
Inflammatory disorder of digestive system
Oral infection
Soft tissue infection
Viral infection by site
Disease due to Picornaviridae
Disorder of foot
Infection of skin
Infectious disease of oral mucosa
Inflammatory disease of mucous membrane
Inflammatory disorder of digestive tract
Inflammatory disorder of head
Non-human disorder
Soft tissue lesion
Viral infection of the digestive tract
Disease due to Aphthovirus
Disorder of skin of lower limb
Infection of foot
Non-human disorder by body site
Non-human infectious disorder
Oral mucosal viral disease
Stomatitis
Viral infection of skin
Foot-and-mouth disease


Snapper
Ontology View
Non-enveloped ssRNA virus
Family Picornaviridae
Genus Aphthovirus
Foot-and-mouth disease virus
Foot-and-mouth disease virus A
Foot-and-mouth disease virus Asia 1
Foot-and-mouth disease virus C
Foot-and-mouth disease virus O
Foot-and-mouth disease virus SAT 1
Foot-and-mouth disease virus SAT 2
Foot-and-mouth disease virus SAT 3

Metke-Jimenez et al. Journal of Biomedical Semantics (2018) 9:24
https://doi.org/10.1186/s13326-018-0191-z

Journal of Biomedical Semantics

SOFTWARE Open Access

Ontoserver: a syndicated terminology server

Alejandro Metke-Jimenez*, Jim Steel, David Hansen and Michael Lawley

Abstract

Background: Even though several high-quality clinical terminologies, such as SNOMED CT and LOINC, are readily available, uptake in clinical systems has been slow and many continue to capture information in plain text or using custom terminologies. This paper discusses some of the challenges behind this slow uptake and describes a clinical terminology server implementation that aims to overcome these obstacles and contribute to the widespread adoption of standardised clinical terminologies.

Results: Ontoserver is a clinical terminology server based on the Fast Health Interoperability Resources (FHIR) standard. Some of its key features include: out-of-the-box support for SNOMED CT, LOINC and OWL ontologies, such as the Human Phenotype Ontology (HPO); a fast, prefix-based search algorithm to ensure users can easily find content and are not discouraged from entering coded data; a syndication mechanism to facilitate keeping terminologies up to date; and a full implementation of SNOMED CT's Expression Constraint Language (ECL), which enables sophisticated data analytics.

Conclusions: Ontoserver has been designed to overcome some of the challenges that have hindered adoption of standardised clinical terminologies and is used in several organisations throughout Australia. Increasing adoption is an important goal because it will help improve the quality of clinical data, which can lead to better clinical decision support and ultimately to better patient outcomes.

Keywords: Clinical terminologies, Interoperability, SNOMED CT, FHIR

Background

The problem of sharing and reusing knowledge in software systems is common across many domains. In the area of health there have been several efforts to create clinical ontologies to address this issue, such as SNOMED CT, considered the most comprehensive clinical terminology in a significant effort for implementors. For example, SNOMED CT is distributed in *Release Format 2* (RF2) [3], a table-based format that is non-trivial to process (the SNOMED CT implementation guide is over 700 pages long). Other clinical terminologies are modelled in completely different formats. For example, LOINC is

Inference

- Ontological relationships give data a rich semantic context
- Semantically rich data can be interrogated by machine reasoners
- This enables automated data surveillance across heterogenous systems
- Opens opportunities for ML/AI approaches

What does this all mean?

- Your lab data has relevance beyond your local context
- Data repositories don't have to be isolated
- Maximise use and reuse of increasingly valuable data sets
- It can be hard to start down this road, but there are many benefits when you do.

An opportunity

- There is a need to establish standards for Animal Health data
- There is an opportunity to build on existing work
- There is an opportunity to link to public health as well

The OIE - A standards setting organization – is well placed to lead such an initiative

Thank you

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