



Ontology and Taxonomy Development for GEOSS AR-09-01d

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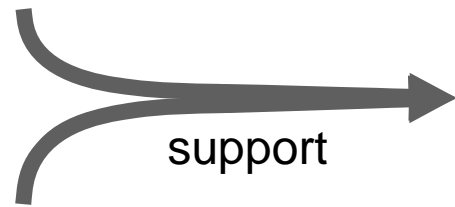
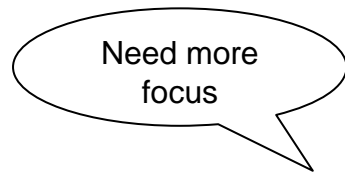
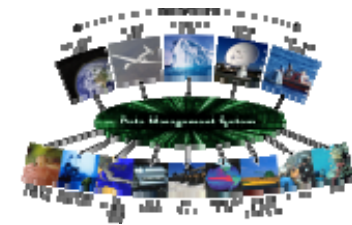
IEEE, SJS Khalsa, sjsk@nsidc.org

Challenge for *Data Interoperability*



Syntax Interoperability

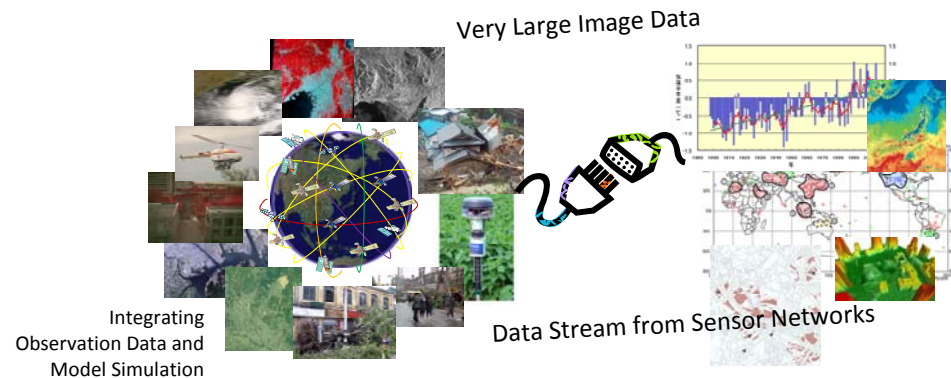
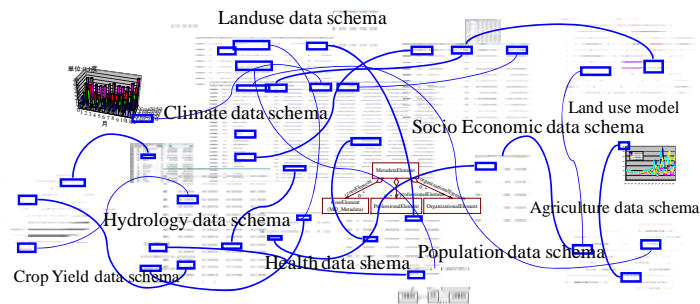
Proposal of Standard Schema and Interface.
It is not always enough for diversified Geo-spatial Information.



Need to Manage Heterogeneous Data

Semantic Interoperability

Semantic Interoperability for geo-spatial data by using data definitions, terminologies, relations, gazetteers (*Ontology*) etc.



Sub-task Definition ***(as given in the 2009-2011 Work Plan):***

- As part of the **Best Practices Registry**, create an **Ontology and Taxonomy** section to get an overview of available ontologies and taxonomies.
- **Compare and analyze** ontologies and taxonomies such as to avoid unnecessary overlaps and conflicts.
- As appropriate, **develop ontologies and taxonomies** stored in the Best Practices Registry **into standards**.
- **Assist in the deployment of a referenceable ontology** for Earth observation to link the User Requirements Registry with the Components and Services Registry.
- **Assess how to use the ontology and taxonomy** section of the best practices registry for discovery composition and access in the frame of the GEOSS architecture.

Proposed approach

1. Collect outline information on existing ontologies and taxonomies associated with Earth observation, and provide an overview.
2. Compare and analyze the ontologies and taxonomies.
 - + Scope, Objectives, Language?
 - + Overlaps? Relationships? Maintenance?
 - + Models? (format, logical structure etc.)
3. Populate Best Practice Wiki on Ontologies/Taxonomies as referenceable basis for GEOSS.
4. Assess the possibility of “Standard” Ontology/Taxonomies for GEOSS.
5. Assist in the deployment of the referenceable ontologies and taxonomies in Best Practice Wiki for Earth observation in populating the Registries.
6. Assess how to use the ontologies and taxonomies for discovery composition and access in the frame of the GEOSS architecture.⁴

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Overview of existing ontologies/taxonomies

The screenshot shows the SWEET OntologyWiki page. The browser title is "SWEET - OntologyWiki". The page content includes a navigation menu on the left, a main heading "SWEET", a description of the ontologies, a list of relations, and a "Facts about SWEET" section. A callout bubble points to the "Category: Earth system science" link.

Set \$wgLogo to the URL path to your own logo image.

navigation

- Main Page
- Community portal
- Current events
- Recent changes
- Random page
- Help
- Donations

search

Go Search

toolbox

- What links here
- Related changes
- Special pages
- Printable version
- Permanent link

Log in / create account

page discussion edit history

SWEET

The ontologies within the Semantic Web for Earth and Environmental Terminology (SWEET) provide an upper-level ontology for Earth system science which is developed by NASA Jet Propulsion Laboratory. The SWEET ontologies include several thousand terms, spanning a broad extent of Earth system science and related concepts (such as data characteristics) using the OWL language.

[Semantic Web for Earth and Environmental Terminology \(SWEET\)](#)

relations

[edit]

Earth Realm

Physical Phenomena Physical Process Physical Property Physical Substance Sun Realm Biosphere Data Data Center Human Activity Material Thing Numerics Sensor Space Time Units

Facts about SWEET

RDF feed

Part Holonym of [Earth Realm](#), [Physical Phenomena](#), [Physical Process](#), [Physical Property](#), [Physical Substance](#), [Sun Realm](#), [Biosphere](#), [Data](#), [Data Center](#), [Human Activity](#), [Material Thing](#), [Numerics](#), [Sensor](#), [Space](#), [Time](#), and [Units](#)

Category: [Earth system science](#)

This page was last modified 12:18, 31 July 2008. This page has been accessed 48 times.

Powered By MediaWiki

<http://babel.csis.u-tokyo.ac.jp/dict/ontology/index.php/SWEET>
<http://babel.csis.u-tokyo.ac.jp/rdic2-ontology/>

6

Starting with the list of available ontology

Relationships among ontologies/taxonomies

Editing SWEET - OntologyWiki
ページ(P) ツール(O)

Set \$wgLogo to the URL path to your own logo image.

navigation

- [Main Page](#)
- [Community portal](#)
- [Current events](#)
- [Recent changes](#)
- [Random page](#)
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search

toolbox

- [What links here](#)
- [Related changes](#)
- [Special pages](#)

page discussion edit history

Editing SWEET

Warning: You are not logged in. Your IP address will be recorded in this page's edit history.

table-edit

Propulsion Laboratory. The SWEET ontologies include several thousand terms, spanning a broad extent of Earth system science and related concepts (such as data characteristics) using the OWL language.

[http://sweet.jpl.nasa.gov/index.html Semantic Web for Earth and Environmental Terminology (SWEET)]

=== relations ===

```

[[Category:Earth system science]]
[[Part Holonym of::Earth Realm]]
[[Part Holonym of::Physical Phenomena]]
[[Part Holonym of::Physical Process]]
[[Part Holonym of::Physical Property]]
[[Part Holonym of::Physical Substance]]
[[Part Holonym of::Sun Realm]]
[[Part Holonym of::Biosphere]]
[[Part Holonym of::Data]]
[[Part Holonym of::Data Center]]
[[Part Holonym of::Human Activity]]
[[Part Holonym of::Material Thing]]
[[Part Holonym of::Numerics]]
[[Part Holonym of::Sensor]]
[[Part Holonym of::Space]]
[[Part Holonym of::Time]]
[[Part Holonym of::Units]]
                    
```

table-edit

up

down

remove

relation	tag for Relation	op	direction word
カテゴリー	Category	:	Earth system science
全体語-要素	Part Holonym of	::	Earth Realm
全体語-要素	Part Holonym of	::	Physical Phenomena
全体語-要素	Part Holonym of	::	Physical Process
全体語-要素	Part Holonym of	::	Physical Property
全体語-要素	Part Holonym of	::	Physical Substance
全体語-要素	Part Holonym of	::	Sun Realm
全体語-要素	Part Holonym of	::	Biosphere
全体語-要素	Part Holonym of	::	Data
全体語-要素	Part Holonym of	::	Data Center

Please note that all contributions to OntologyWiki may be edited, altered, or removed by other contributors. If you don't want your writing to be edited mercilessly, then don't submit it here.

Examples of Gazetteers

Digital Gazetteer (Global)



ADL



Geonames



Wikimapia

Geospatial Ontology



The Getty Thesaurus of Geographical names

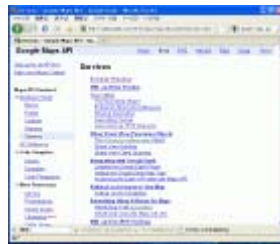


GEMET



Wikipedia

Geocoding Services



Google Geocoding



Yahoo! Geocoding



CSIS Address matching service (Japan)

Examples of Regional Gazetteers



Geoscience Australia
(Australia)



Natural Resources Canada
(Canada)



China Historical GIS
(China)



genealogy.net
(Germany)

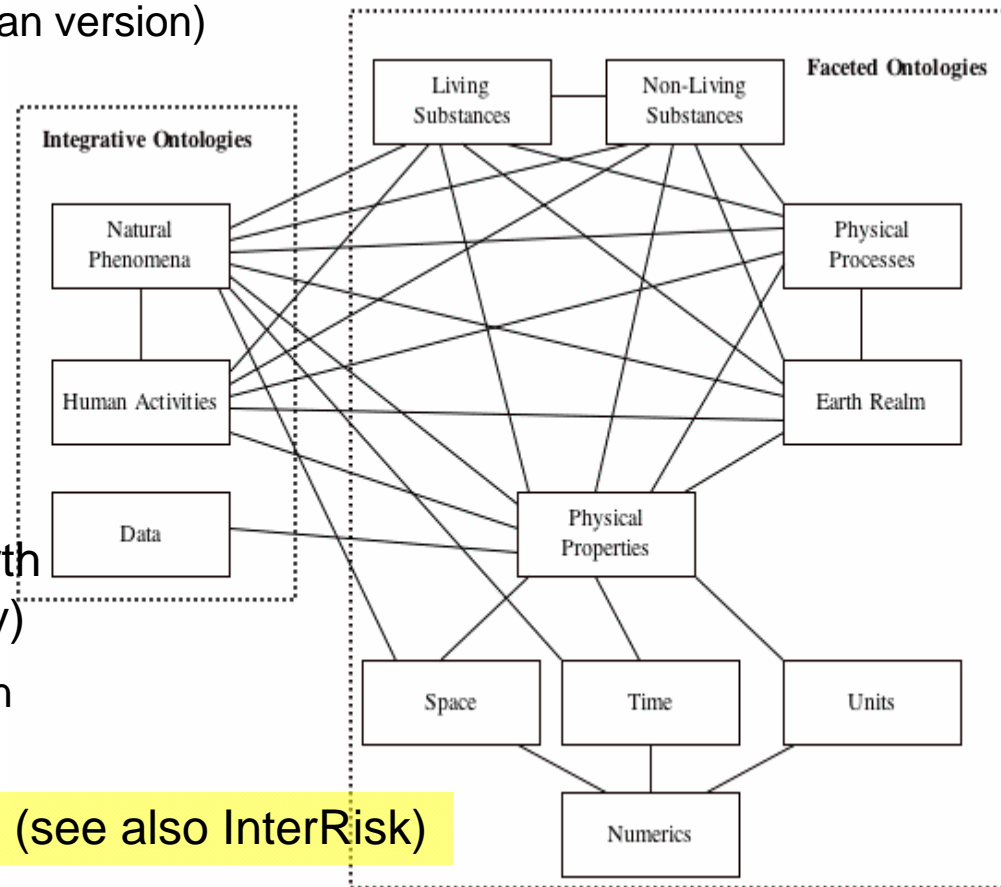


Base map information view service
(Japan)

Proposed approach

1. Collect outline information on existing ontologies and taxonomies associated with Earth observation, and provide an overview.
- 2. Compare and analyze the ontologies and taxonomies.**
 - + **Scope, Objectives, Language?**
 - + **Overlaps? Relationships? Maintenance?**
 - + **Models? (format, logical structure etc.)**
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- GEMET (General Multilingual Environmental Thesaurus)
 - Groups / Themes, 21 languages
- EARTH (Environmental Applications Reference Thesaurus)
 - GEMET for Italy (English – Italian version)
- Wiktionary (~ Wikipedia)
 - Multilingual dictionary with definitions, etymologies,...
- Eurovoc Thesaurus
 - On EC fields, 21 languages
- SWEET (Semantic Web for Earth and Environmental Terminology)
 - Earth science data / information



None focused on EO applications (see also InterRisk)

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Overview of existing ontologies/taxonomies

The screenshot shows the SWEET OntologyWiki page. The browser title is "SWEET - OntologyWiki". The page has tabs for "page", "discussion", "edit", and "history". The main content area is titled "SWEET" and contains a paragraph describing the ontologies within the Semantic Web for Earth and Environmental Terminology (SWEET), developed by NASA Jet Propulsion Laboratory. Below this is a link to "Semantic Web for Earth and Environmental Terminology (SWEET)".

The "relations" section lists various ontologies: Earth Realm, Physical Phenomena, Physical Process, Physical Property, Physical Substance, Sun Realm, Biosphere, Data, Data Center, Human Activity, Material Thing, Numerics, Sensor, Space, Time, and Units. A callout bubble points to this list with the text "Starting with the list of available ontology".

The "Facts about SWEET" section includes an "RDF feed" link and a "Part Holonym of" list: Earth Realm, Physical Phenomena, Physical Process, Physical Property, Physical Substance, Sun Realm, Biosphere, Data, Data Center, Human Activity, Material Thing, Numerics, Sensor, Space, Time, and Units.

The page footer indicates it was last modified on July 31, 2008, and has been accessed 48 times. It is powered by MediaWiki.

Starting with the list of available ontology

Individual terms can also be managed with Wiki

The screenshot shows a Wiki page for 'Photographic paper'. The page title is 'Photographic paper' and it is categorized under 'Radiation'. The page content includes a description: 'Photographic paper is paper coated with light-sensitive chemicals, used for making photographic prints.' Below the description, there is a 'relations' section with an '[edit]' link. The relations section lists 'method' and 'sunshine duration'. Under 'sunshine duration', there are links to 'Jordan sunshine recorder' and 'Campbell-Stokes sunshine recorder'. A 'Facts about Photographic paper' section lists 'Holonym of Method', 'Hypernym of Sunshine duration', and 'Hyponym of Jordan sunshine recorder and Campbell-Stokes sunshine recorder'. A speech bubble points to the 'Relations' section with the text 'Relationships among terms'. An arrow points to the bottom right with the text 'Converted to/from RDF'.

Photographic paper - River

Log in / create account

page discussion edit history

Photographic paper

Photographic paper is paper coated with light-sensitive chemicals, used for making photographic prints.

relations [edit]

method

sunshine duration [Jordan sunshine recorder](#) [Campbell-Stokes sunshine recorder](#)

Facts about Photographic paper

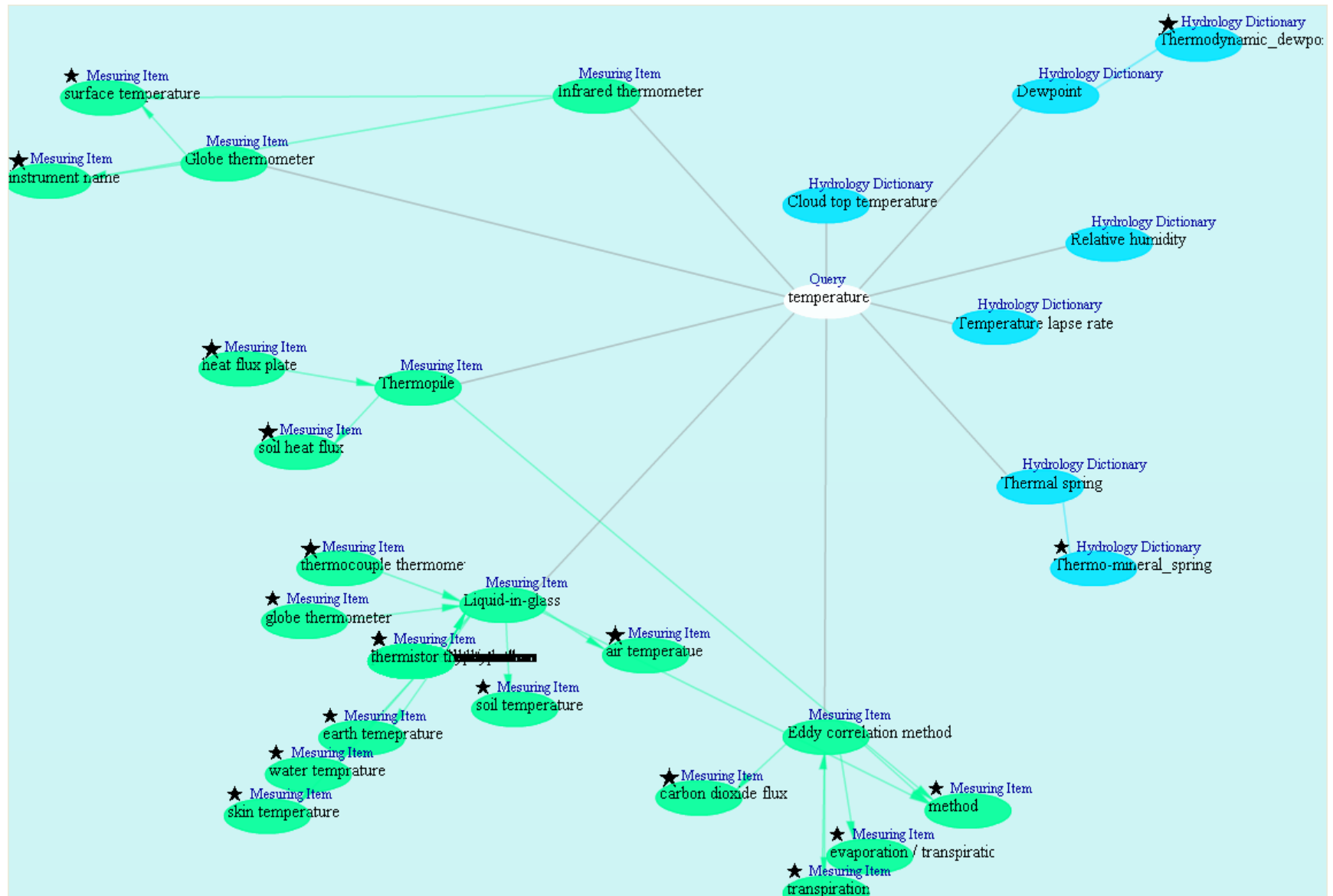
- Holonym of [Method](#)
- Hypernym of [Sunshine duration](#)
- Hyponym of [Jordan sunshine recorder](#), and [Campbell-Stokes sunshine recorder](#)

Category: [Radiation](#)

Relationships among terms

→ Converted to/from RDF

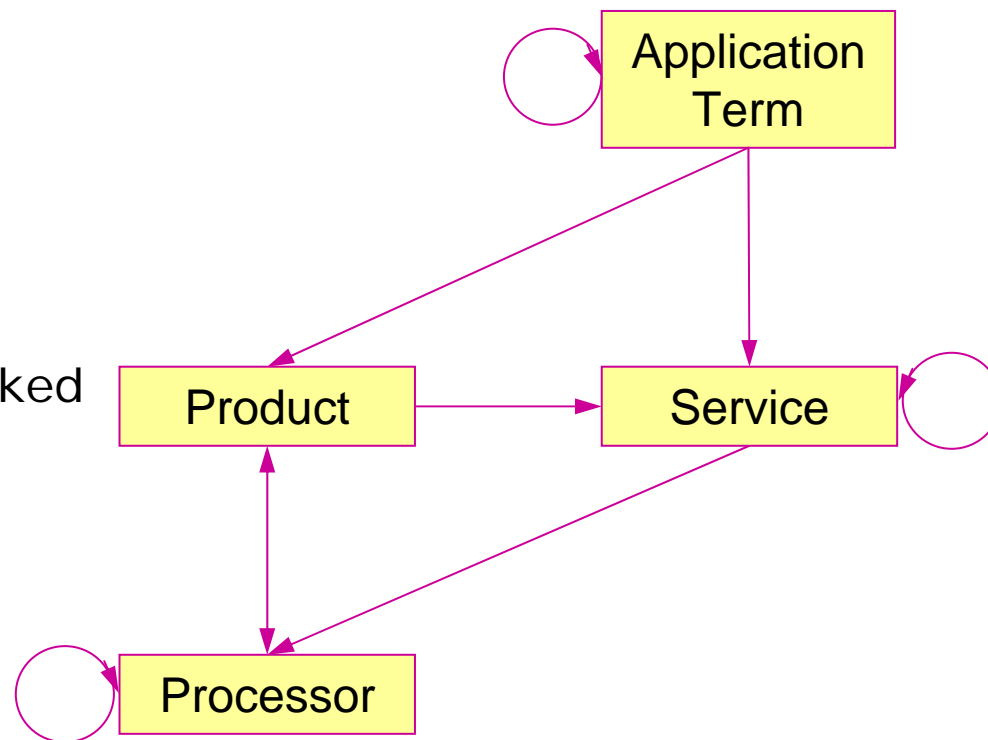
KeyGraph Viewer



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Product = Packed data or information



Unstable: many changes possible below "Application Term"

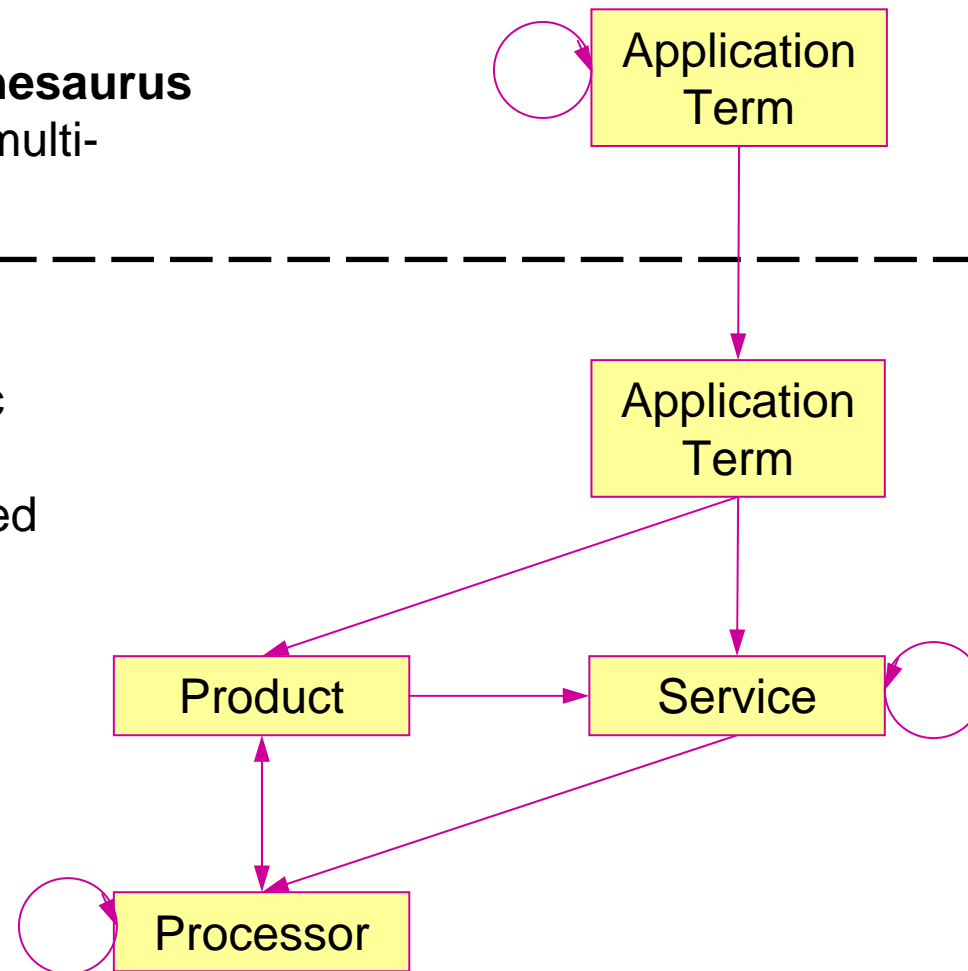
Multi-domain Thesaurus

(shared, stable, multi-lingual)

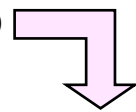
Semantic links

System Specific Taxonomy

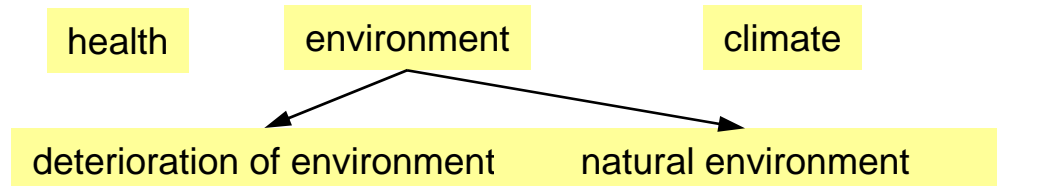
(dynamic, selected language)



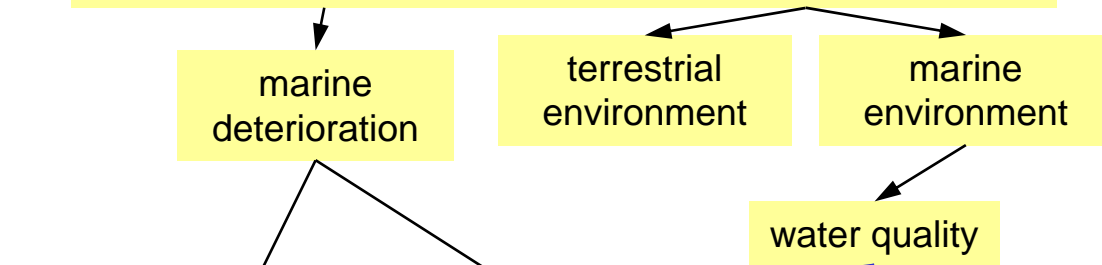
Application Terms can be related to



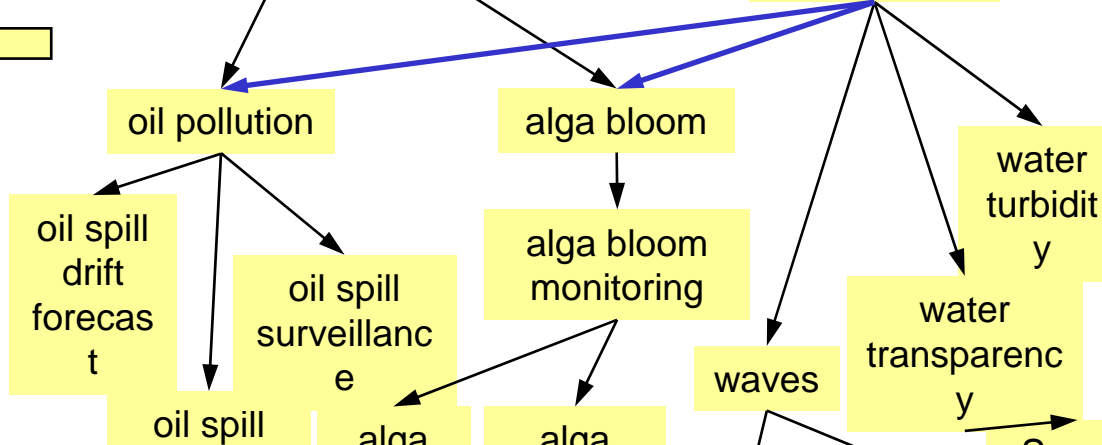
themes



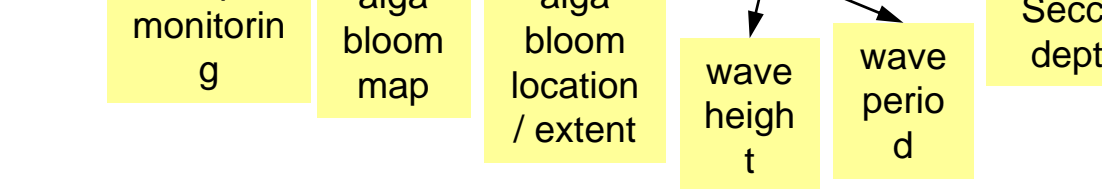
domains



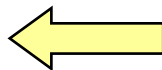
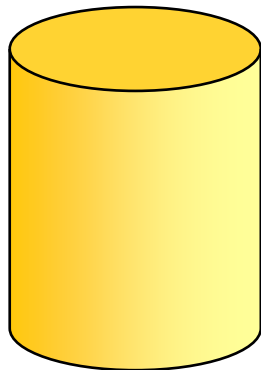
information

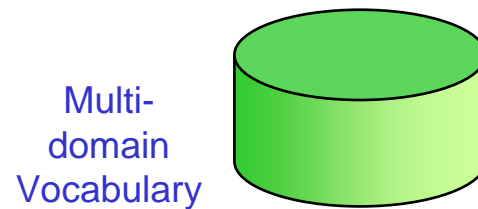


measures



Multi-domain Thesaurus



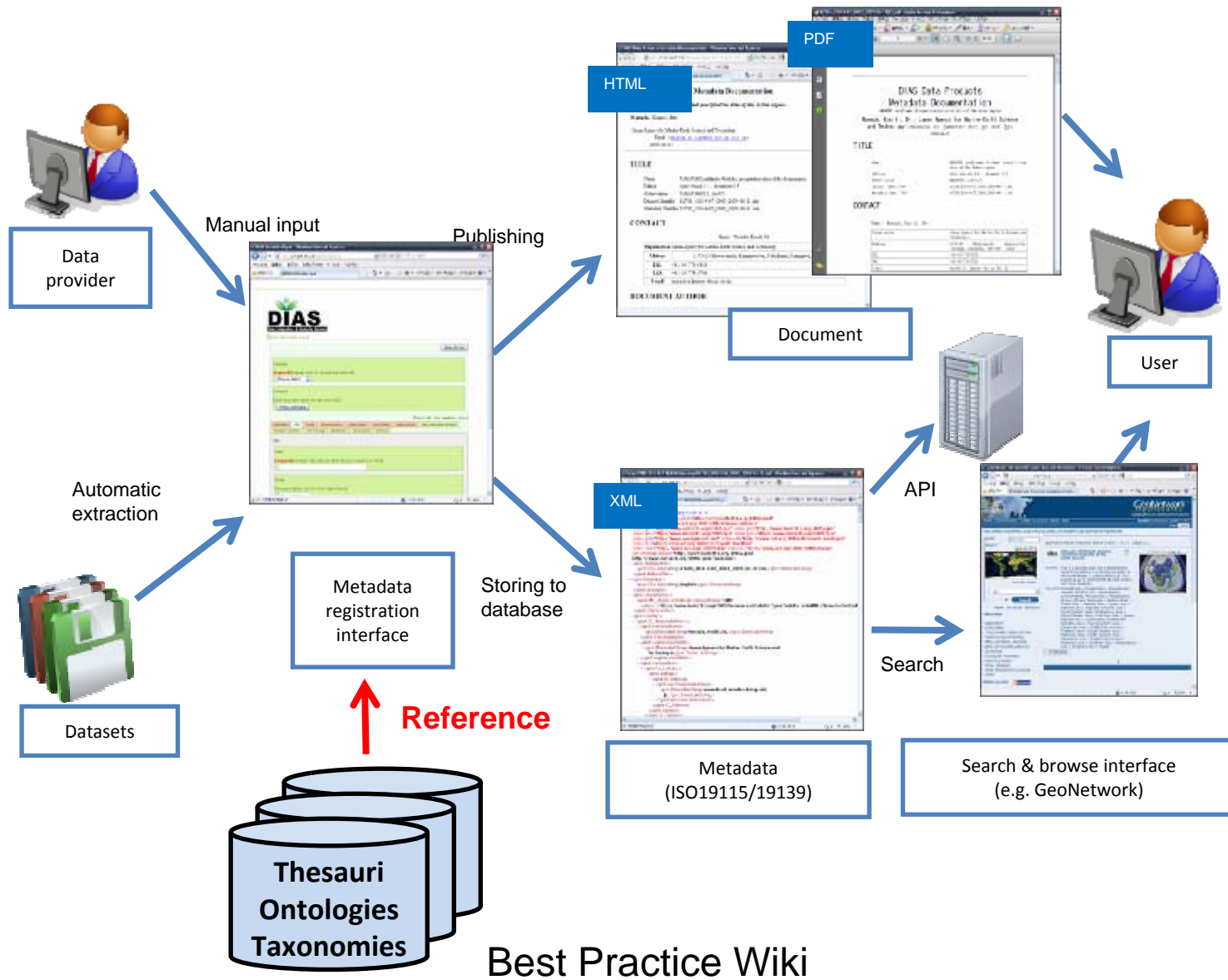


Term Type	Term	Application Domain	Description	Synonyms	Related terms
Application	alga bloom	marine deterioration	An alga bloom is a rapid increase in the population ...	harmful alga bloom, marine bloom, water bloom, ...	eutrophication, ...
Application	alga bloom	marine environment	“	“	“
...

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Developing the support tool for generating metadata



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Requires Java
1.6

Link to 2D
Navigator

Multi-domain
Thesaurus and
Vocabulary

Reverse Dictionary to help find exact entry words for search

Reverse Dictionary - Windows Internet Explorer

http://babel.iis.u-tokyo.ac.jp/rdic-e/index.php

Reverse Dictionary

Reverse Dictionary

Powered by GETA

Hydrology Geography

List 10

earth environment observation by using satellite or air-craft Search

<input type="checkbox"/> Synchronous satellite	0.750667
<input type="checkbox"/> Sun-synchronous satellite	0.715394
<input type="checkbox"/> Stationary orbit	0.698367
<input type="checkbox"/> Monitoring	0.533819
<input type="checkbox"/> Cloud top temperature	0.516652
<input type="checkbox"/> Hydrological observation	0.444679
<input type="checkbox"/> Piezometer	0.405057
<input type="checkbox"/> Air moisture	0.371945
<input type="checkbox"/> Rime	0.371916
<input type="checkbox"/> Observation well	0.370266

google google scholar

Re-direct Search

Synchronous satellite
An equatorial west-to-east satellite orbiting the Earth at an altitude of 35 900 km at which altitude it makes one revolution in 24 hours synchronous with the Earth's rotation. (MRS)→geostationary satellite, stationary orbit
[score:0.750667 - re-search](#)

Sun-synchronous satellite
Earth satellite of which the orbital plane is near polar and the altitude such that the satellite passes over all places on the earth having the same latitude twice daily at the same local sun time. (MRS)
[score:0.715394 - re-search](#)

Stationary orbit
Orbit in which an equatorial satellite revolves about the Earth at the same angular rate as the Earth rotates on its axis. From the Earth. →synchronous satellite
[score:0.698367 - re-search](#)

Monitoring
Continuous or frequent standardized measurement and observation of the environment, often used for warning and control. →surveillance
[score:0.533819 - re-search](#)

Cloud top temperature
Temperature of cloud top or air nearly at that level as determined by satellite radiometer measurements.
[score:0.516652 - re-search](#)

Hydrological observation

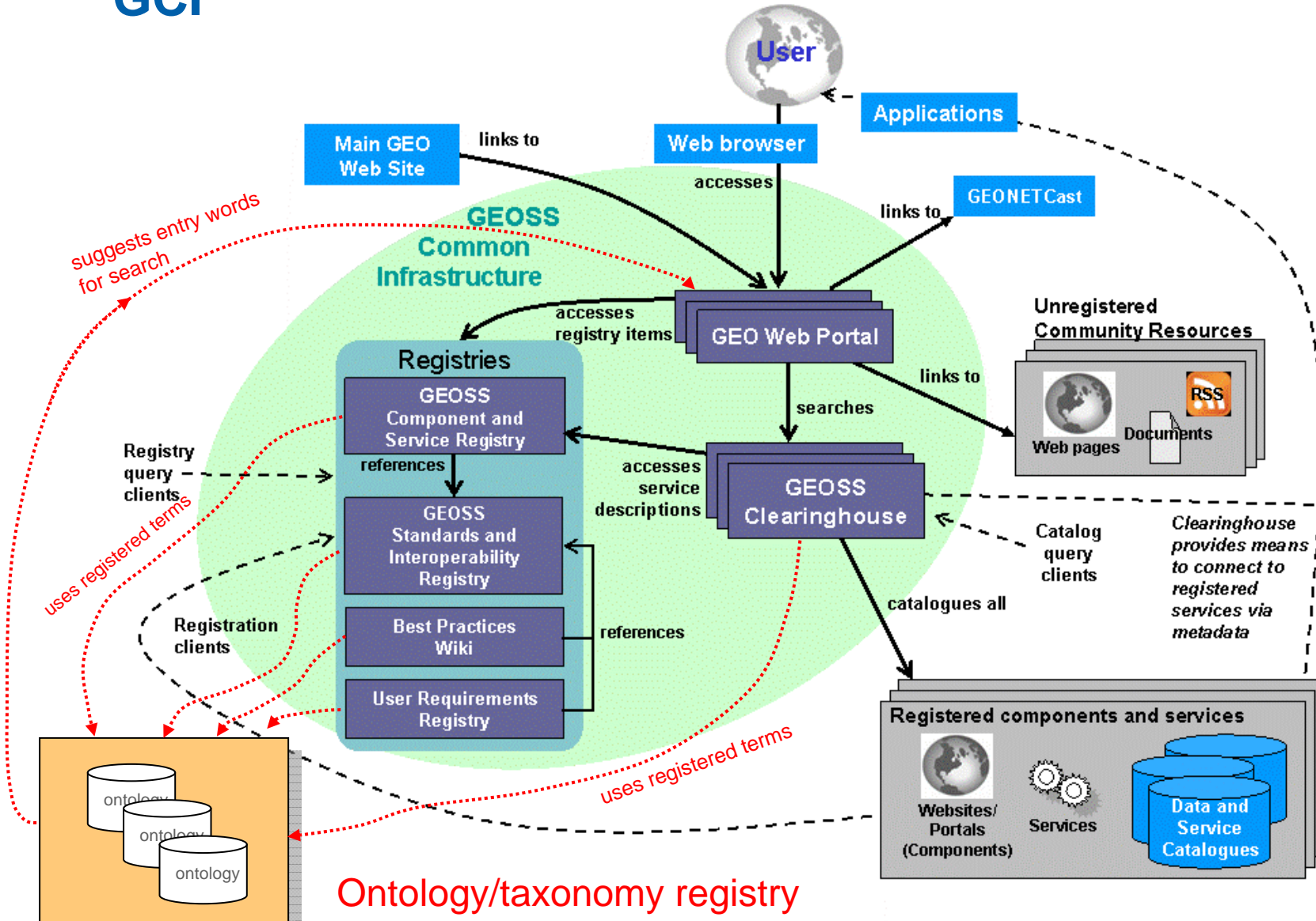
ページが表示されました

インターネット | 保護モード: 有効

100%



Possible use case of ontology/taxonomy registry for GCI



Ontology/taxonomy registry

Draft Roadmap

1. Collect outline information (inventory development) on existing ontologies and taxonomies associated with Earth observation, and provide an overview. → **Dec. 2009**
2. Compare and analyze the ontologies and taxonomies. → **Mar. 2010**
3. Populate Best Practice Wiki on Ontologies/Taxonomies as referenceable basis for GEOSS. → **Mar. 2010**
3. Assess the possibility of “Standard” Ontology/Taxonomies for GEOSS. → **After the end of AIP-3?**
4. Assist in the deployment of the referenceable ontologies and taxonomies in populating the registries. → **AIP-3?**
5. Assess how to use the ontologies and taxonomies for discovery composition and access in the frame of the GEOSS architecture. → **AIP-3?**

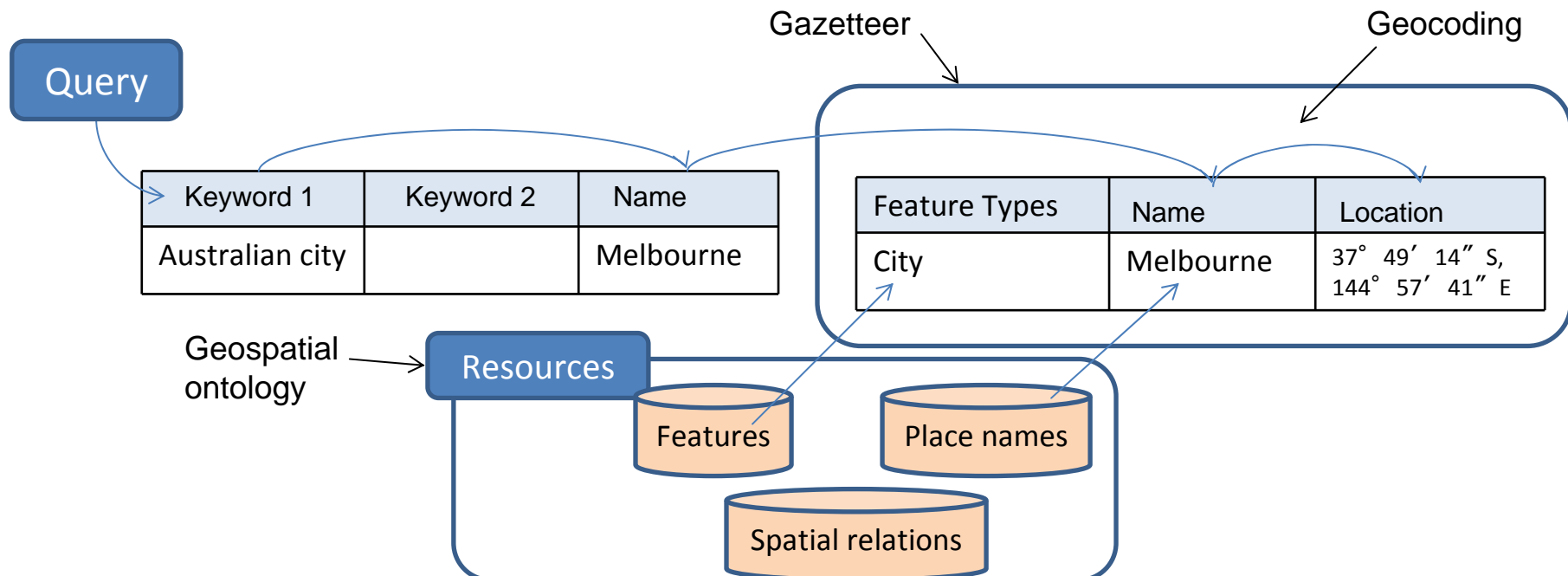
Immediate actions

- Monthly telecon
- Start the development of Wiki-based inventory
 - Invite volunteers by circulating CFP among GEO members. (CEOS, WMO etc.)
 - Collect information on existing ontology/taxonomy.
 - Determine which to be invented.
 - Develop the inventory.



Geospatial domain related concepts

- **Gazetteer**
 - Digital gazetteer is the dictionary of types, names and locations.
 - Focuses on database equipment.
- **Geospatial ontology**
 - Geospatial ontology is the knowledge resources about geospatial features, place names or spatial relations.
 - Focuses conceptual modeling
- **Geocoding**
 - Geocoding is the act of transforming descriptive text into a valid spatial representation.
 - Focuses on translation process.



Quality Criteria of Digital Gazetteer

- The quality element in evaluating each digital gazetteers.
 - 1)Availability
 - Use constraint or restriction for digital gazetteer (ex. right, security, policy)
 - 2)Scope
 - Target scope on earth surface. Regional/ National/ Worldwide level?
 - 3)Completeness
 - Degrees on covering various kinds of data within target scope
 - 4)Currency
 - Handling famous, familiar name? Managing update and change?
 - 5)Accuracy
 - Degrees of correctness for name or accuracy for location.
 - 6)Granularity
 - Degrees of resolution or scale
 - 7)Richness of annotation/description/information
 - Association with database.



END