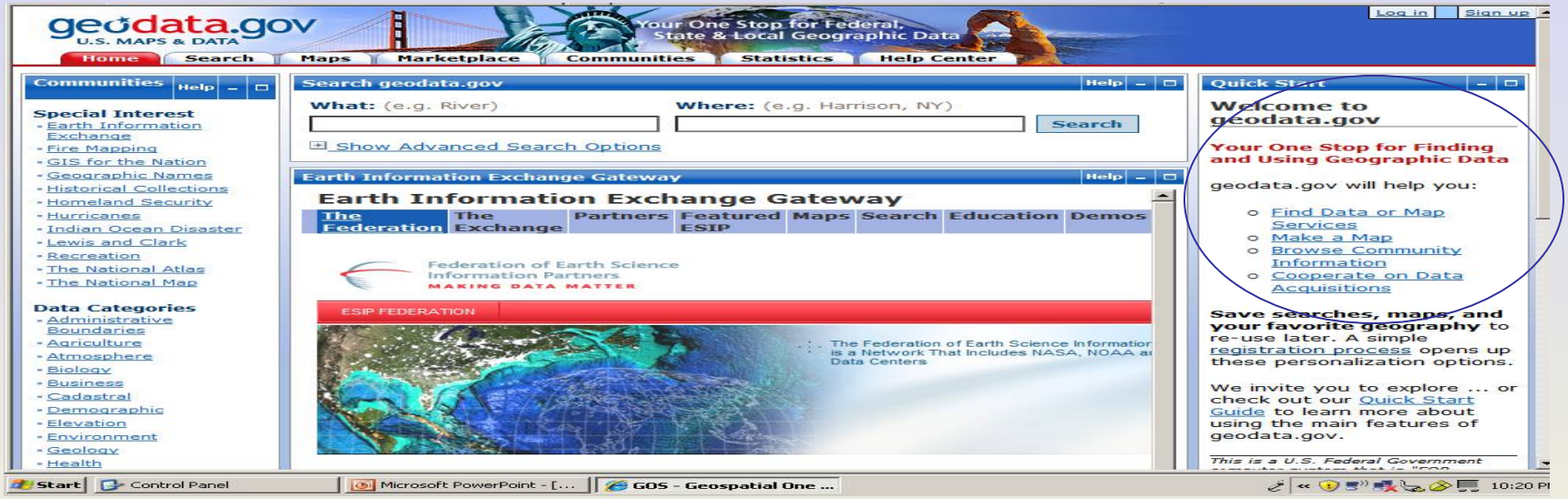
Exploring eGov Cooperation and Knowledge Sharing using Geospatial Ontologies in a Semantic Wiki

EGov web/knowledge portals are among the most complex webs in existence, based on the size (368 million pages in US .government domain in 2005), number of users, number of information providers and the diversity of information.



Gary Berg-Cross, Ph.D.
Engineering Management & Integration (EM&I)
Suite 350 455 Spring park Place
Herndon VA 20170
703-742-0585
Gary.Berg-Cross@em-i.com

Toward More Transparent Government
Workshop on eGovernment and the Web

Topics

- Background –eGov foundations and the web/knowledge management challenge - Geospatial Line of Business example
- Incremental semantics requires better semantic analysis
  - Semantic Wiki and Communities of practice play a role

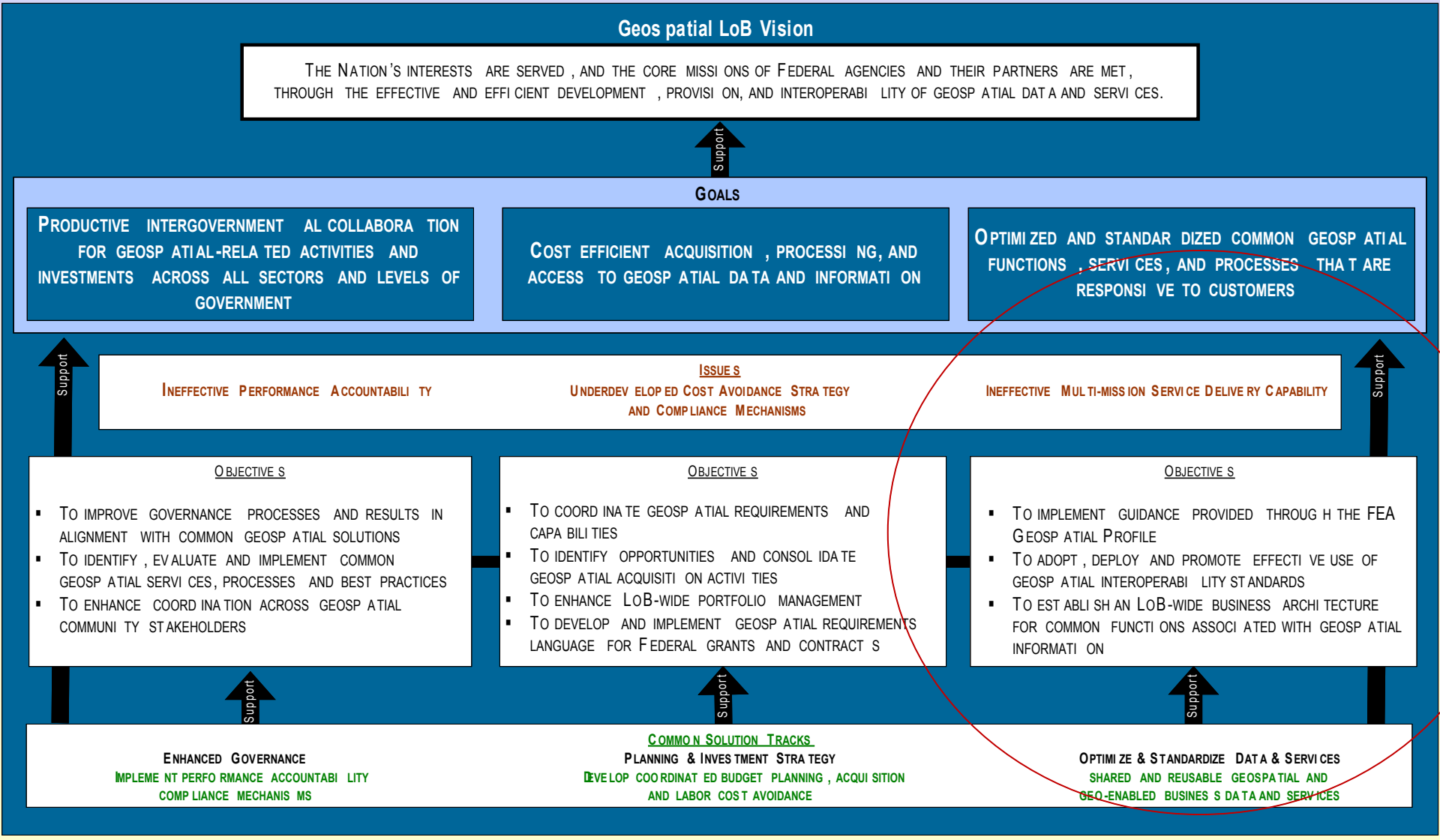
3. Focused work of the Spatial Ontology Community of Practice (SOCoP)
   - Is a CoPs a natural starting point to help with such work?
   - The SOCoP wiki

– Summing up

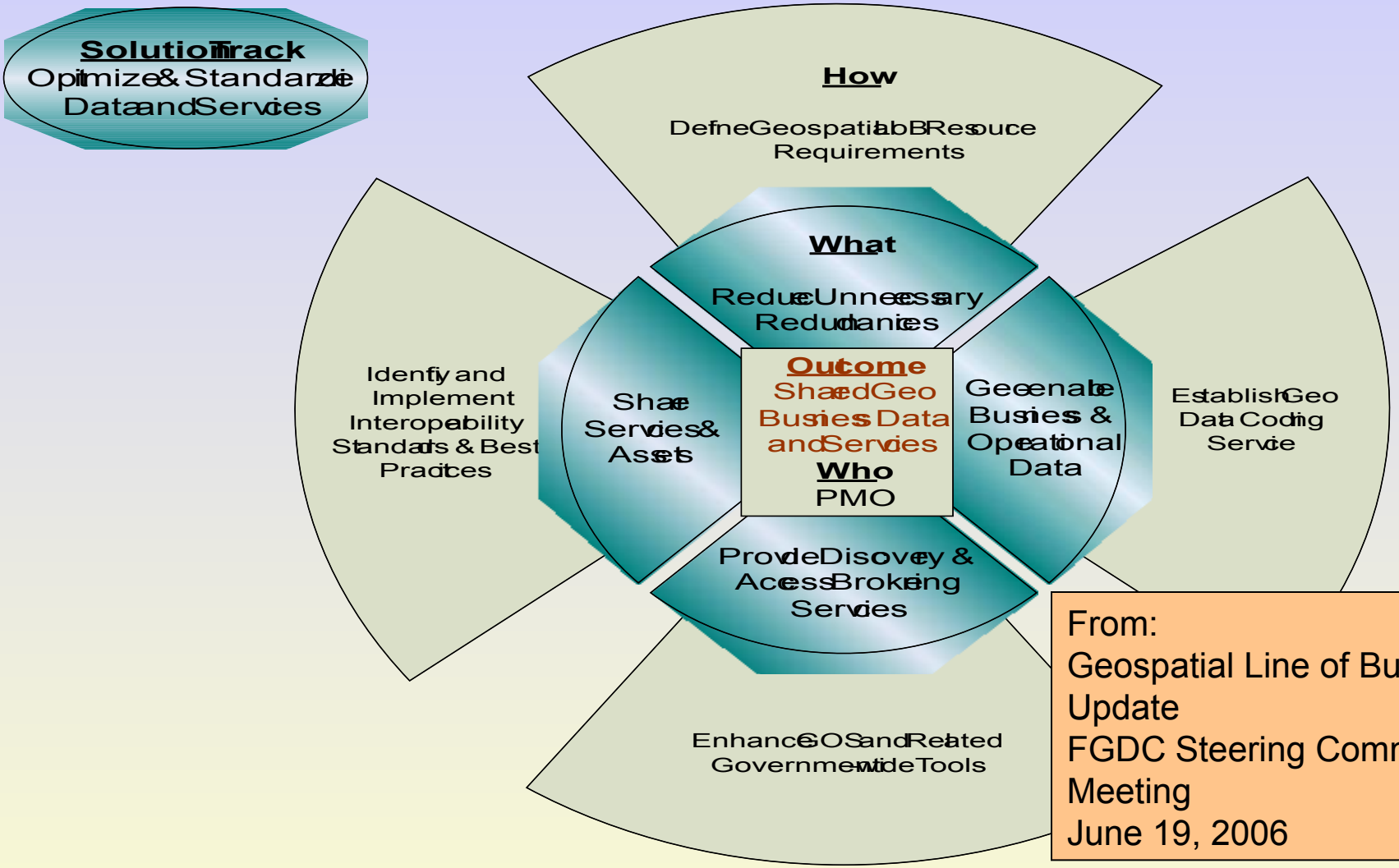
eGov Work in Context

- eGov Act of 2002 established an Intergovernmental Committee on Government Information (ICGI) and Data Integration Pilots, Federal Enterprise Architecture work such as:
  - Data Reference Model (DRM) and its Data Management Strategy to enable Intergovernmental Data Exchange.
  - Supported by conferences whose material is stored on Wikis:
    - SICoP Special Conference: Building DRM 3.0 and Web 3.0 by Managing Context Across Multiple Documents and Organizations .
    - http://colab.cim3.net/cgi-bin/wiki.pl?SICoP
- **We have growing web content on eGov but it doesn't necessarily cohere or grow in expected ways.**
- The job of gaining a unified view of an enterprise's knowledge assets across government remains difficult to implement in practice and current **Wiki approaches (including above) seem too ad hoc** to provide progressive integration.

Challenging eGov example: The Geospatial LOB



Service Solution Component



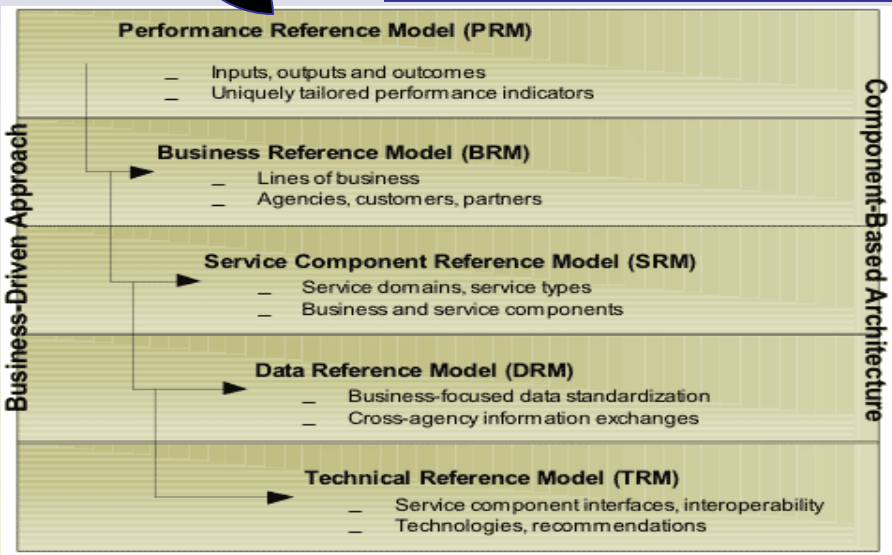
From:
Geospatial Line of Business Update
FGDC Steering Committee Meeting
June 19, 2006

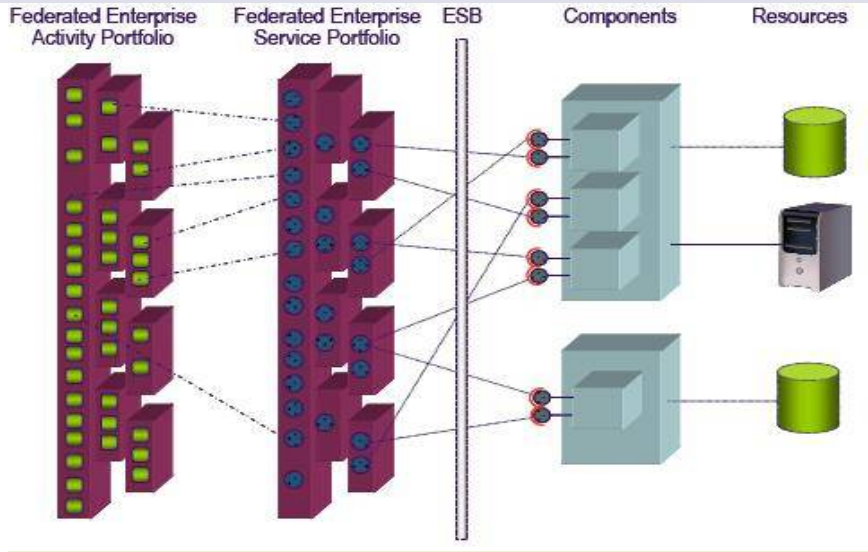
Toward More Transparent Government
Workshop on eGovernment and the Web

Foundations for eGov - Architecture and Supporting Collaboration with Wikis

Wikis as repositories of information about EA, SOA etc.

Interagency Collaborative Expedition Workshops, community groups as typified by ONTOLOG & COLAB, SICoP, DRM site etc.





Enterprise Architectures

Service Oriented Architectures

Toward More Transparent Government
Workshop on eGovernment and the Web

Foundations for eGov Architecture and Supporting Collaboration with Wikis

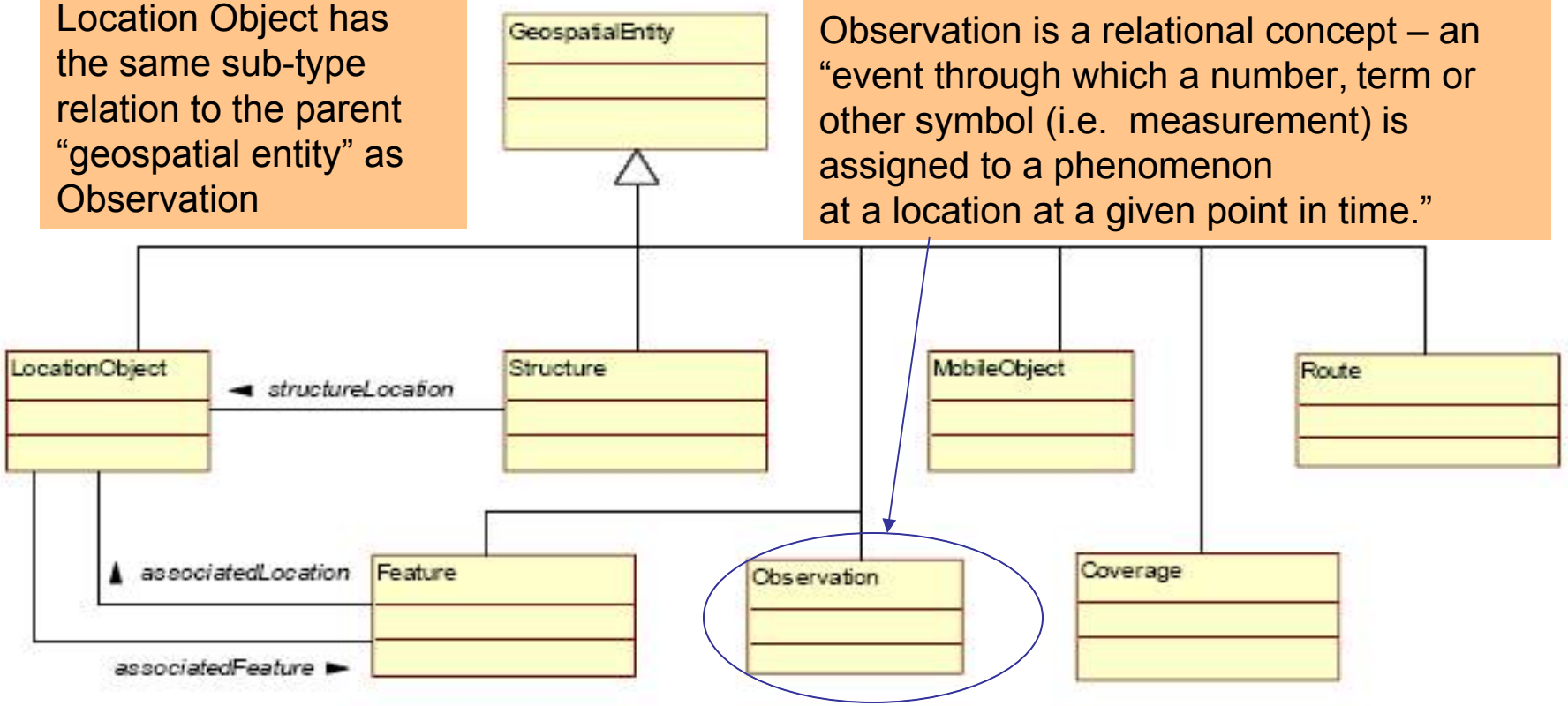
- Enterprise architecture (EA)
  - EA components (Business, Information and Technical) support eGov by helping to control ad hoc applications and data modeling across the government.
  - But EAs have several problems.
    - Properties of a target EA are clearer than the path to them.
      - EA visions tends to be strategic diagram, or simple top-level lists which don't adequately ground (SOA) implementation.
    - Most EAs are based as much on natural language descriptions as structured models.
    - Meta-models used to capture architecture are typically semantically weak (Sowa & Zachman 1992).

Heaping Geospatial Entity Types Together in an EA

It would be nice to start on a geospatial vocabulary model, even as informal as FOAF, but the community has to reach some agreements on the basic vocabulary used across many standards.

Very general entity of Location Object has the same sub-type relation to the parent "geospatial entity" as Observation

Observation is a relational concept – an "event through which a number, term or other symbol (i.e. measurement) is assigned to a phenomenon at a location at a given point in time."



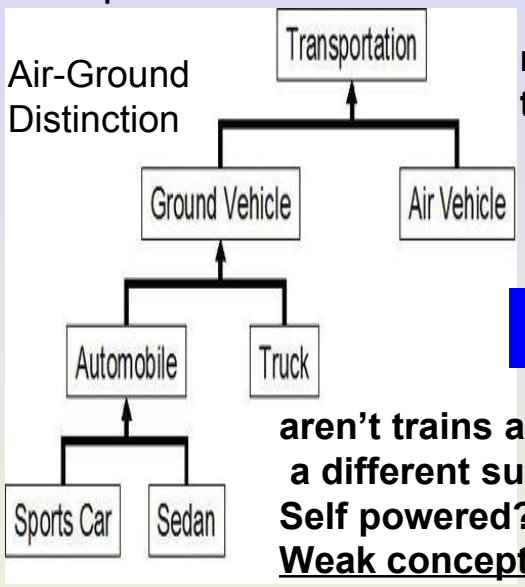
Toward More Transparent Government
Workshop on eGovernment and the Web

From DHS EA, 2006

Can't be Naive about Standards

As part of the DRM, federal agencies will categorize their data and information assets, as "they deem appropriate and most beneficial to their stakeholders", in accordance with the elements of an XML schema using taxonomies and topics.

But a problem is illustrated by a sample taxonomy offered as part of DRM 2.0 shown below.



really of transport devices

aren't trains and autos a different sub-type? Self powered? Weak conceptualization for Bikes, Wheelchairs ?

```
<?xml version="1.0"?> <rdf:RDF
xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"

xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"

xmlns:owl="http://www.w3.org/2002/07/owl#"

xmlns:daml="http://www.daml.org/2001/03/daml+oil#"

xmlns="http://www.owl-ontologies.com/unnamed.owl#"
xmlns:dc="http://purl.org/dc/elements/1.1/"

xml:base="http://www.owl-ontologies.com/unnamed.owl"> <owl:Ontology
rdf:about=""/> <owl:Class rdf:ID="Transportation"/> <owl:Class
rdf:ID="AirVehicle"> <rdfs:subClassOf rdf:resource="#Transportation"/>
Etc.
```

A very informal hierarchy of transportation concepts represents a pseudo-formalization not based on a deep conceptualization and categorization of the domain in terms of distinguishing properties or systematic relations between levels.

This is not an uncommon problem and reflects the lack of the necessary conceptual analysis going into EAs and Service models

Semantic Web Tech & Challenges

- Creating a richer (Semantic) Web infrastructure to practically organize the content and relations of the EGov webs would have several payoffs
  - but it is challenging. Not just size but structure. Some challenges:
  - **A wiki is not pre-determined, and neither top down or bottom up so how do we:**
    - **Structure it consistently?**
    - **Handle its evolution driven by the user community?**
    - **Keep the markup for "authors" "very simple"?**
  - **How do we move from current Wikis to more semantic ones?**

Maybe a Cop Helps Solve Some of This

Community of Practice

- *Small group of people who've worked together over a period of time (or formed to do that).*
- *Somewhat informal - not a team, not a task force, not necessarily an authorized or identified group.*
  - *peers in the execution of "real work"*
- *What holds a CoP together is a* **common sense of purpose***,* **exposure to a common class of problems, common pursuit of solutions, thereby themselves embodying a store of knowledge** *with a real need to know what each other knows or at least thinks they know.*
  - But there are many sub-communities…and formal vs informal approaches
- **A COP can use a Wiki to coordinate actions, describe progress and the knowledge gathered reused in other efforts (like FEA effort), especially if we share a common metadata schema for the efforts.**

Spatial Ontology Community of Practice (SOCoP) officially begun in October of 2006

- **Purpose** SOCoP chartered as a CoP under the Best Practices Committee of the Federal CIO Council
- **Role**
  - Foster **collaboration** among researchers, technologists & users of spatial knowledge representations and reasoning towards the development of spatial ontologies for use by all in the Semantic Web.
  - Support **open collaboration** and open standards for increased interoperability of spatial data across government
  - **Synchronize with Geospatial Profile of FEA and the Geospatial LOB** as well as across the entire spectrum of applicable geospatial standards (via W3C, ISO, OGC, etc.).

    Goal to establish a more coordinated approach to producing, maintaining, and using geospatial data and services and ----ensure sustainable participation from Federal partners to establish a collaborative model for geospatial-related activities and investments.
  - **Document best practices**, and create opportunities to partner with other cross domain and ontology CoP groups.
  - Help inventory geospatial ontologies, develop an approach to institutionalizing and streamline the effort to support the development and management of ontologies across geospatial lines of business both in and out of government

Toward More Transparent Government
Workshop on eGovernment and the Web

Spatial Ontology Community of Practice

- **Current Focus**
  - Build membership
  - Conduct an Inventory of Spatial Ontologies
  - Establish relationships with other geospatial ontology and semantics activities such as OGC, W3C, and the Geospatial Intelligence Standards Working Group
  - Participate/Present at Conferences and Workshops
  - Examine the potential for a pilot
- **Membership** - open to interested parties
- **Co-Chairs:**
  - Kevin Backe, Topographic Engineering Center, US Army Corps of Engineers
  - John Moeller, Northrop Grumman Information Technology
- **Executive Secretariat**:
  - Gary Berg-Cross, Engineering, Management and Integration
  - **For more information go to the SOCoP wiki at: http://www.visualknowledge.com/wiki/socop**

Toward More Transparent Government
Workshop on eGovernment and the Web

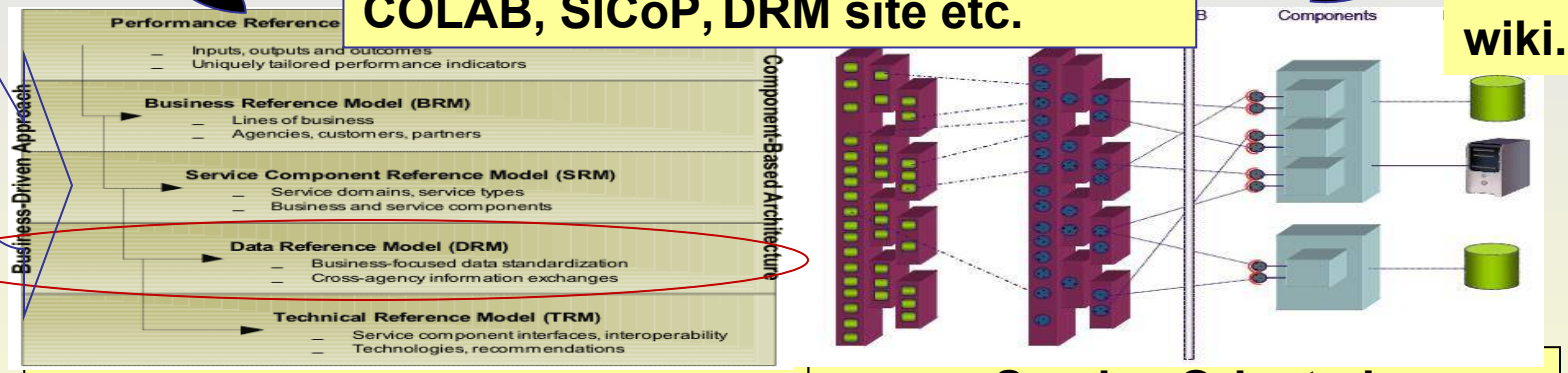
SOCoP Might Help with Foundations and Tools

- There are many official standards or de facto standards:
  - The Types for "Named entities"... geopolitical entity names, locations and geographical places, Individual events (e.g. Gulf of Tonkin),
  - E.g. Geospatial Profile of FEA and the Geospatial LOB

Wikis repositories of information about EA, SOA

Interagency Collaborative Expedition Workshops, community groups as typified by ONTOLOG & COLAB, SICoP, DRM site etc.

Use existing ontologies to bootstrap the contents and vocabulary of the semantic wiki.



Enterprise Architectures

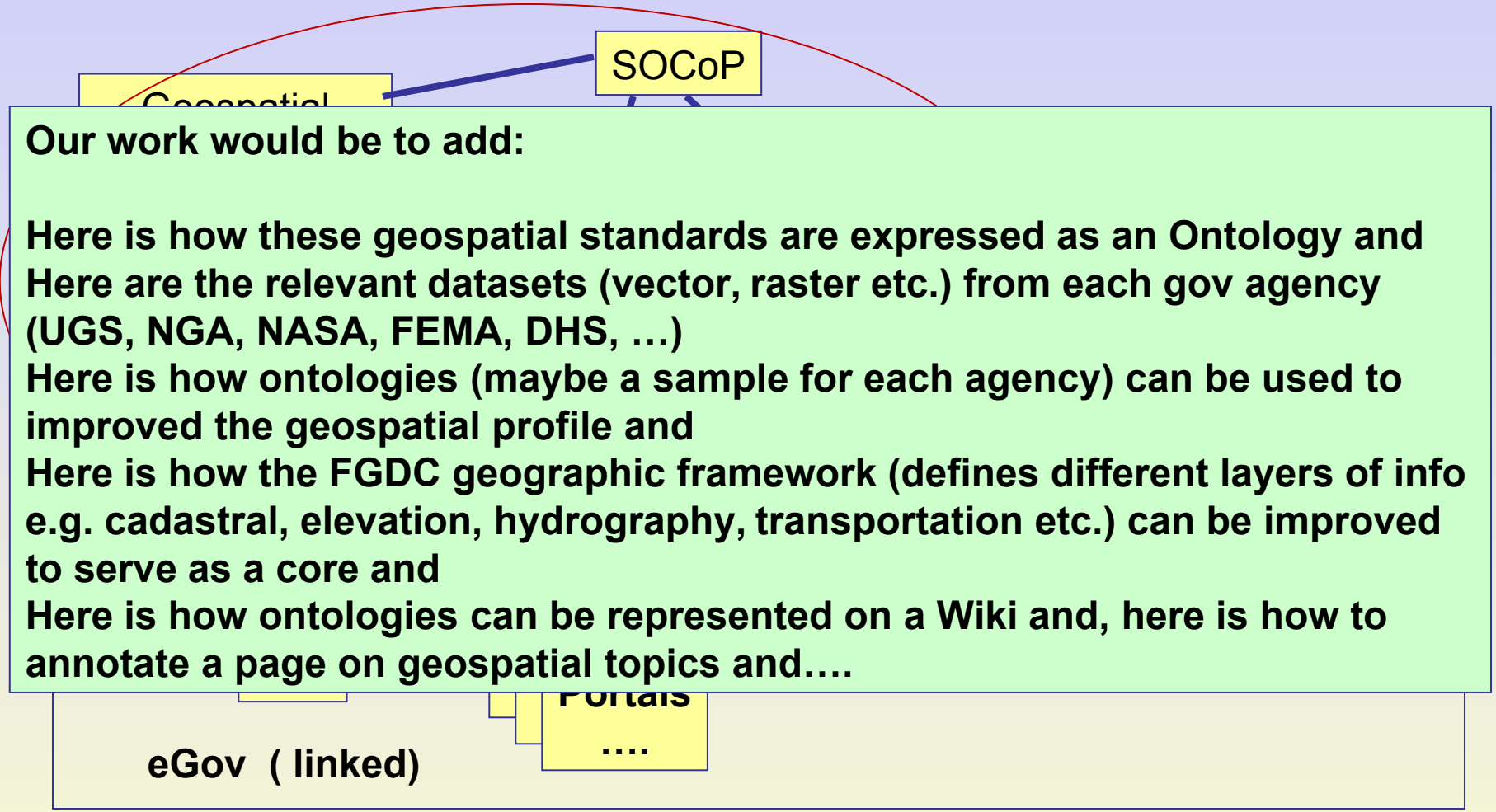
Service Oriented Architectures

Toward More Transparent Government
Workshop on eGovernment and the Web

A SOCoP Wiki

- As an aid to collaboration across the community a SOCoP Wiki was established: (http://www.visualknowledge.com/wiki/socop)
- Currently hosted by Visual Knowledge® Software, Inc. this initially functioned as a traditional Wiki, but is can use Visual Knowledge “Semantic Wiki” capabilities to become a fully integrated Web 3.0 development and execution platform for building:
  - semantic suites,
  - semantic blogs and
  - high performance knowledge-driven applications.
- Supported by:
  - analysis of Wikis
  - analysis of ontologies etc…

The Big, Messy Picture



Our work would be to add:

Here is how these geospatial standards are expressed as an Ontology and
Here are the relevant datasets (vector, raster etc.) from each gov agency (UGS, NGA, NASA, FEMA, DHS, …)
Here is how ontologies (maybe a sample for each agency) can be used to improved the geospatial profile and
Here is how the FGDC geographic framework (defines different layers of info e.g. cadastral, elevation, hydrography, transportation etc.) can be improved to serve as a core and
Here is how ontologies can be represented on a Wiki and, here is how to annotate a page on geospatial topics and….

The SOCoP Wiki

Spatial Ontology COP

Home Calendar Directory Help

Search

Advanced

Welcome to the Spatial Ontology Working Group

It has been stated that up to 80% of all information contains some notion of location. Indeed, this provides opportunity for some of the fundamental stitching needed to sew the Semantic Web. A widely-used, common set of spatial ontologies would enable the linkage of data from a vast & varying number of domains that will need to interoperate in the Semantic Web. To date, such a set of multi-purpose, robust spatial ontologies has yet to emerge. Hence, this semantic wiki serves as a collaborative forum for the development of such a set of common spatial ontologies for the Semantic Web that could eventually lead to standardization.

We seek to build strong momentum for such development by utilizing the wiki to formalize a Spatial Ontology Community of Interest (COI). The COI will serve as a hub for researchers, technologists, practitioners & the user community to converge and collaborate on matters pertaining to spatial ontology. It should be noted that this forum is strictly constrained to focus on issues relevant to spatial ontology alone. It does not serve the interests of corporations nor serve general interests concerning technology, Semantic Web, etc.

The first step in the formalization of this COI entailed a Spatial Ontology for the Semantic Web workshop held at the National Science Foundation in Ballston, VA on June 20-22, 2006. Researchers, technologists & the user community gathered to provide an initial assessment of the requirements that would be needed in the development of spatial ontologies for the Semantic Web. To help accelerate the development of this COI this semantic wiki was generously offered by Visual Knowledge Corporation to provide the needed online collaboration.

As well, many others contributed to the success of both the NSF workshop

Login

Email

Password

Login

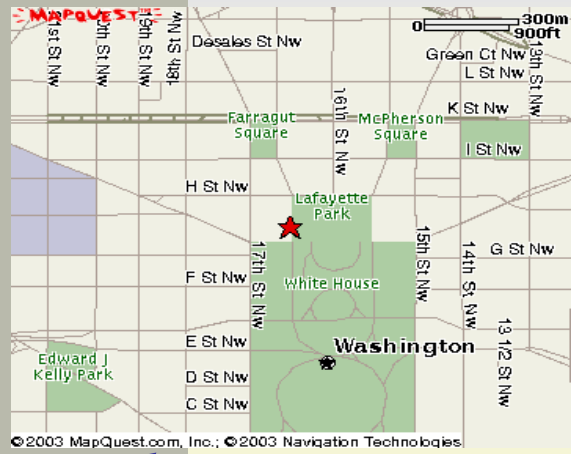
Forgot Password?

Join Spatial Ontology COP

Create an account to access powerful knowledge modeling tools, contribute your knowledge to the community, and to network with other community members.

SIGN UP

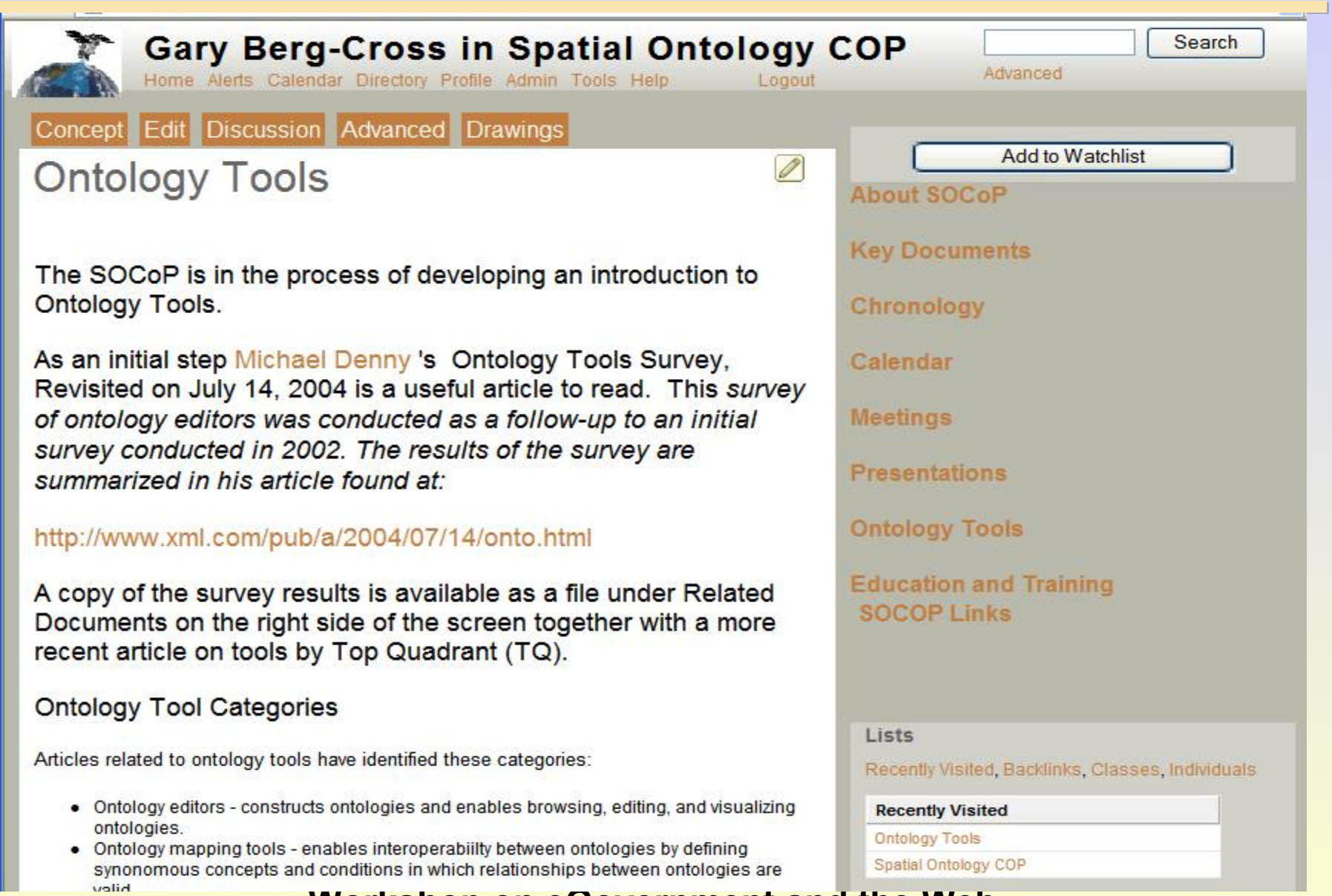
- About SOCoP
- Key Documents
- Chronology
- Calendar
- Meetings
- Presentations
- Ontology Tools
- Education and Training



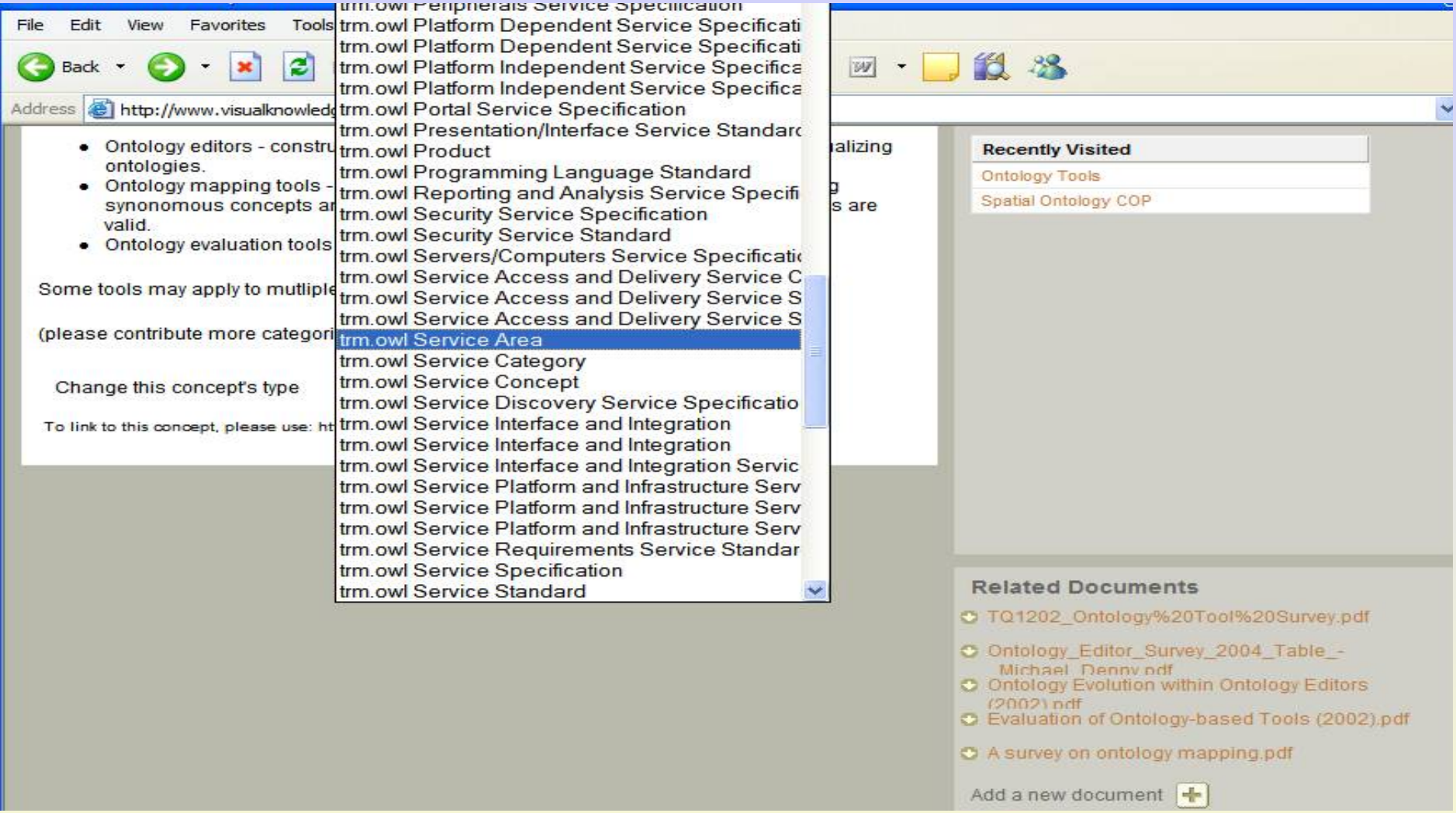
Transparent eGov Workhop Near Here

Toward More Transparent Government
Workshop on eGovernment and the Web

Logged in to Typical Content



“Concepts” in text can immediately become active resources (pages/links)



Additional Wiki Capabilities

Considering how we would like to use the wiki we want to:

- Easily reference existing geospatial ontological vocabularies/standards from the wiki,
- import data from existing, external (RDF/OWL) ontologies,
  - allow these to be stored, edited and approved by the community in the wiki.
- Utilize geospatial schema information and constraints from external models ando ntologies,
- Support matching and comparison of SOCoP developed ontologies with others (external)

All to aid things like the Geospatial Profile, DRM etc.

Summary of Ontological COP as a Semantic Wiki Testbed

- SOCoP community discussion is intended as a iterative, since a living ontology relies chiefly on its community.
- Strategically a community devoted to building ontologies may be a great position to build semantic wikis if for no other reason than that its users are already familiar with ontological concepts and their development.
- SOCoP is particularly suited as a semantic wiki testbed because the geospatial domain is widely relevant but has a theoretical core of concepts well developed and focused.
- For all of these reasons SOCoP represents a practical testbed for semantic Wikis. It is also useful for demonstrating ontology design that is:
  - Meaningful - all named classes can have instances
  - Formal –can be represented/put into a form amenable to automated processing
  - Rigorous – stands up to rational analysis (geospatial entity example)
  - Correct - captured intuitions of domain experts
  - Minimally redundant - no unintended synonyms
  - Sufficiently axiomatized – include detailed constraining descriptions as axioms

Backups

May Need to Go Beyond Simple RDF/S

- RDFS is widely used in Semantic Wikis but lacks sufficient semantics for the difficult parts.
- For example, formal annotations need an agreement about which formal identifier stands for particular real-world artifact.
  - With RDF, these problems get even worse because URIs are used for formal identifers which are a superset of URLs, which are locations of real-world web resources, e. g. an HTML page.
  - This problem has been called the URI ”crisis”.
- Other problems with RDFS have been noted in Berg-Cross (2007) including its deficiencies as too informal an ontology language.
  - For example its vocabulary allows annotating that <Human,type,Species> and <Amber,type,Customer> which are very different meanings that arise because RDFS hasn’t distinguished between classes (Human) and instances (Amber).
  - Better semantics such as provided by ontologies is needed to adequately ground the RDF vocabulary and expand it to needed concepts.
  - Use of ontologies would help semantically interconnect and enhance data and service definitions and descriptions by alignment with domain and system reference ontologies.
  - But it might make the annotation task too difficult…we will see

Semantic Wiki (covered in previous talks)

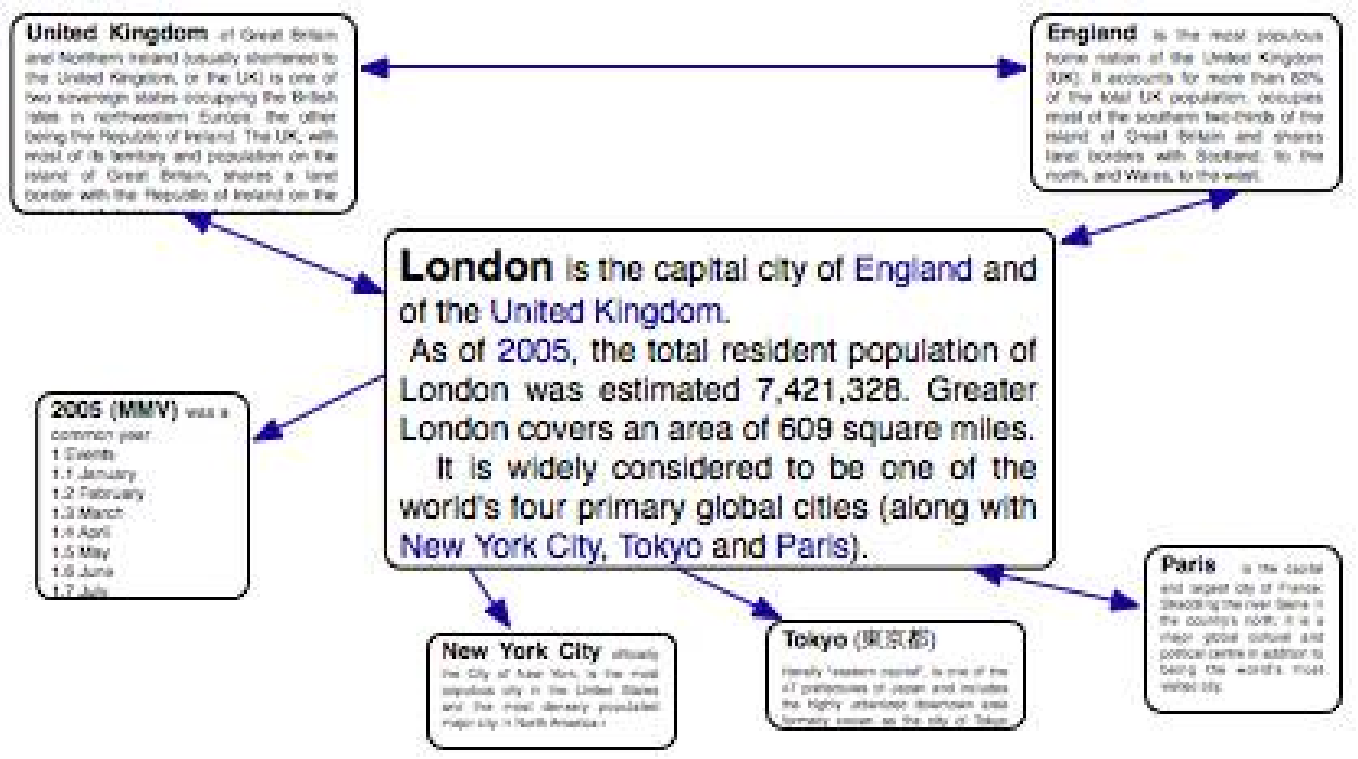
- A Wiki enhanced with technologies developed by the Semantic Web community in order to encode more knowledge than just structured text and hyperlinks.
- Usually this extra knowledge, which may include an automated classifier of content, is available in a formal language, so that machines can (at least partially) process it.
- In particular, machines can calculate new facts from the given facts. (from Wikipedia)

Research on S-Wikis Annotations etc.

A key Wiki challenge is how to use the power of semantic technologies for organizing and retrieving Wiki knowledge while keeping them easy enough for a community to use. Semantic Wikis typically create a “knowledge layer” or overlay network structure that defines concepts, attributes, and relationships of the underlying content of the Wiki . Relationships become explicit as links.

RDFWiki (Palmer) Rhzome	Provides users with a simple text-based interface to edit content and metadata and stores all data as RDF statements/Allows users to express RDF statements through a simplified syntax (ZML).
The SemanticMedia Wiki (Krotzch et al, 2005)	Extension of MediaWiki (the Wiki platform used by the Wiki Pedia community (Wiki pedia.org) that allows users to add metadata understandable by automatic processes too
SemWiki	Like other Semantic Wikis lets users make semantics annotations, that are not bound to a particular page. Rather, the annotations belong to the Wiki as a whole.
SweetWiki	Models wikis declaratively described: OWL schema for concepts - wiki words, wiki, forward and backward link, author, etc. Includes embedded semantic search engine (Corese) and a standard WYSIWYG editor (Kupu) extended to support semantic annotation using social tagging approach like such as flickr.com.

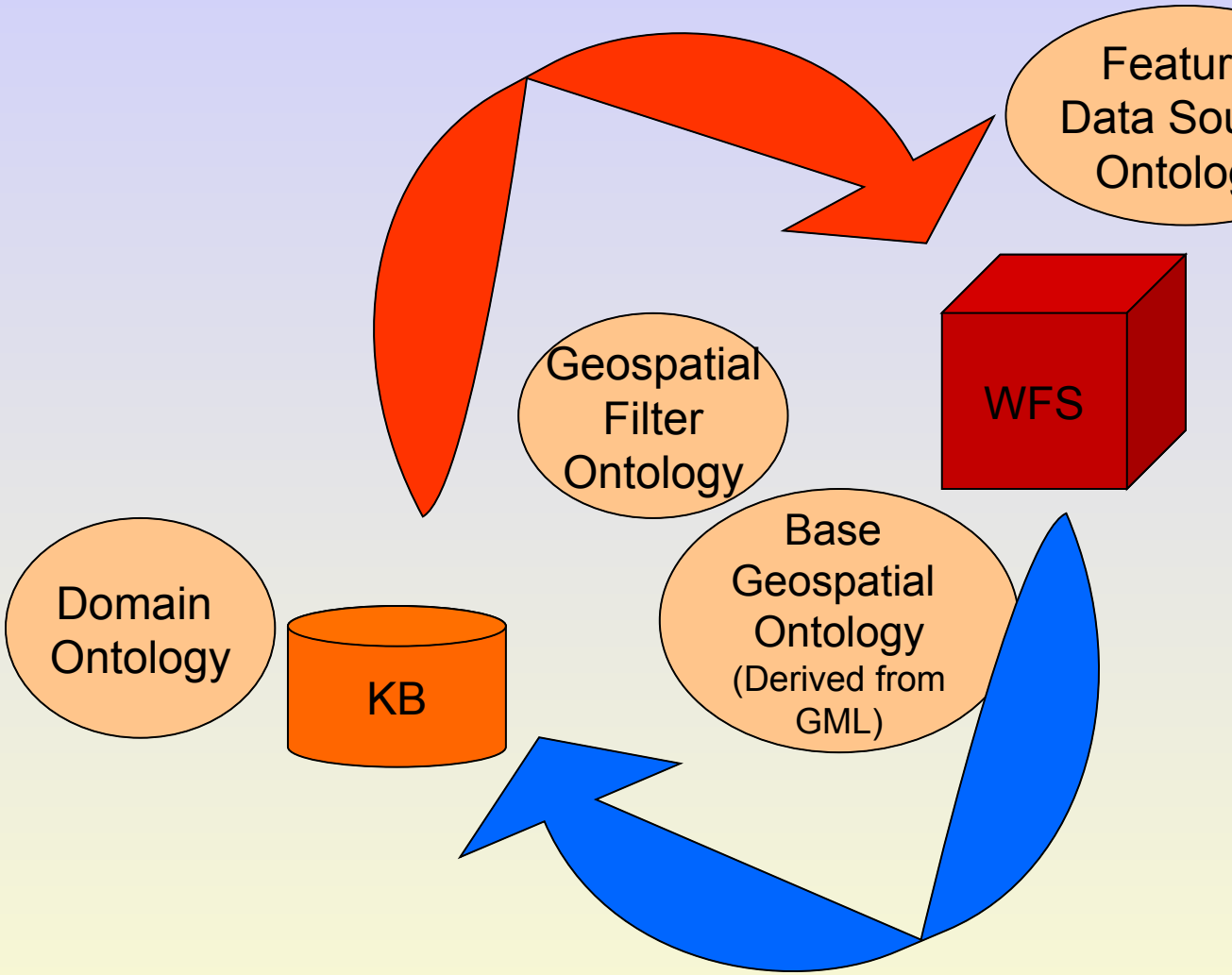
SOCoP Might Help with Semantic Annotations but..



Much of this will be based on a model of annotation with select primitives not of geospatial knowledge.

- Geography: perception of the terrain
- GIS: adding information to features Cartography: symbolic representation of the terrain
- GeoWeb: connecting features across the Web
- Google Earth: the terrain as video game
- GeoRSS: adding features to information
- Geospatial Semantic Web: forming and distributing rich geospatial relationships across the Web

May be able to Leverage a Family of Geospatial Ontologies



DAFIF
- US standard forAeronautical data
- Simple ontology mirrors DAFIF schema

AIXM
- Aeronautical data – US/European standard
- Ontology mirrors XML schema

Gazetteer of City locations..

Knowledge we might accumulate to support Priorities

- To showcase benefits of spatial ontology
- Firm requirements for a coordinated group of spatial ontologies and gauge existing ones against it identifying gaps.
- Help with unifying techniques and approaches