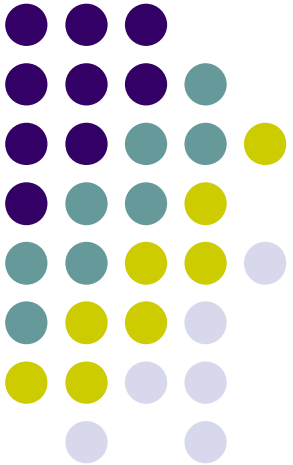
Applying Ontology in Network Analysis

EWG-DSS
Research Collaboration Network
EWG-DSS Collab-Net V.2



Applying Ontology in Network Analysis

(EWG-DSS Collab-Net V.2: A Case-Study)

"Ontology bridging Knowledge Management and Decision Making"

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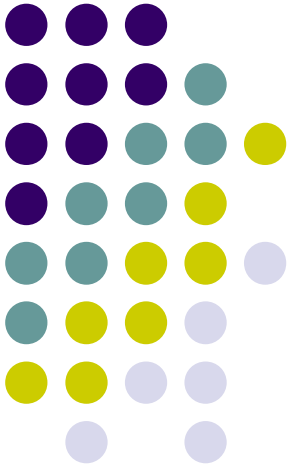
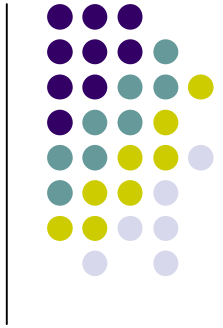
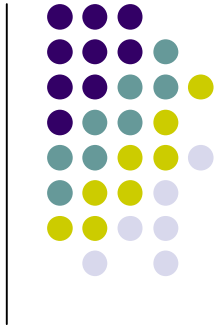


EWG-DSS Collab-Net



- **A project that evaluates a collaboration research network among the members of the EURO Working Group on Decision Support Systems.**

EWG-DSS-Collab-Net V.2



Specifies refined models of:

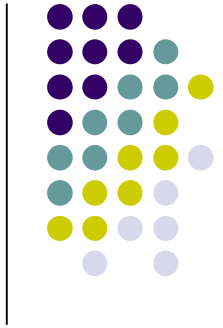
- the publication relationship structure:

"author-title-journal_conference-multiple_keywords-multiple_topics"

- the collaboration relationship structure:

(including workshop/conference publications, informal work meetings, event co-organisations, scientific committees/boards, book/journal editorials, etc.)

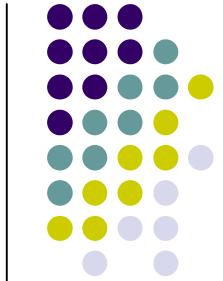
Ontology in the Analysis of a Research Collaboration Network



Main aim:

- to specify an ontology model to be used within the collaboration research network EWG-DSS-Collab-Net.

- with the ontology model a common vocabulary of classifications relative to the main areas of the publications can be defined and matched with the existing key-words, co-authorship, etc …



What about Ontology?

- An ontology is an explicit specification of a conceptualization.
- An ontology model can be described by defining its set of representational terms within a particular formal way.
- For knowledge-based systems, what "exists" is exactly that which can be represented: the *Universe of Discourse*.
- In an ontology, definitions associate the names of entities in the universe of discourse *(e.g., classes, relations, functions, or other objects)* with human-readable text describing what the names are meant to denote, and formal axioms that constrain the interpretation and well-formed use of those terms.

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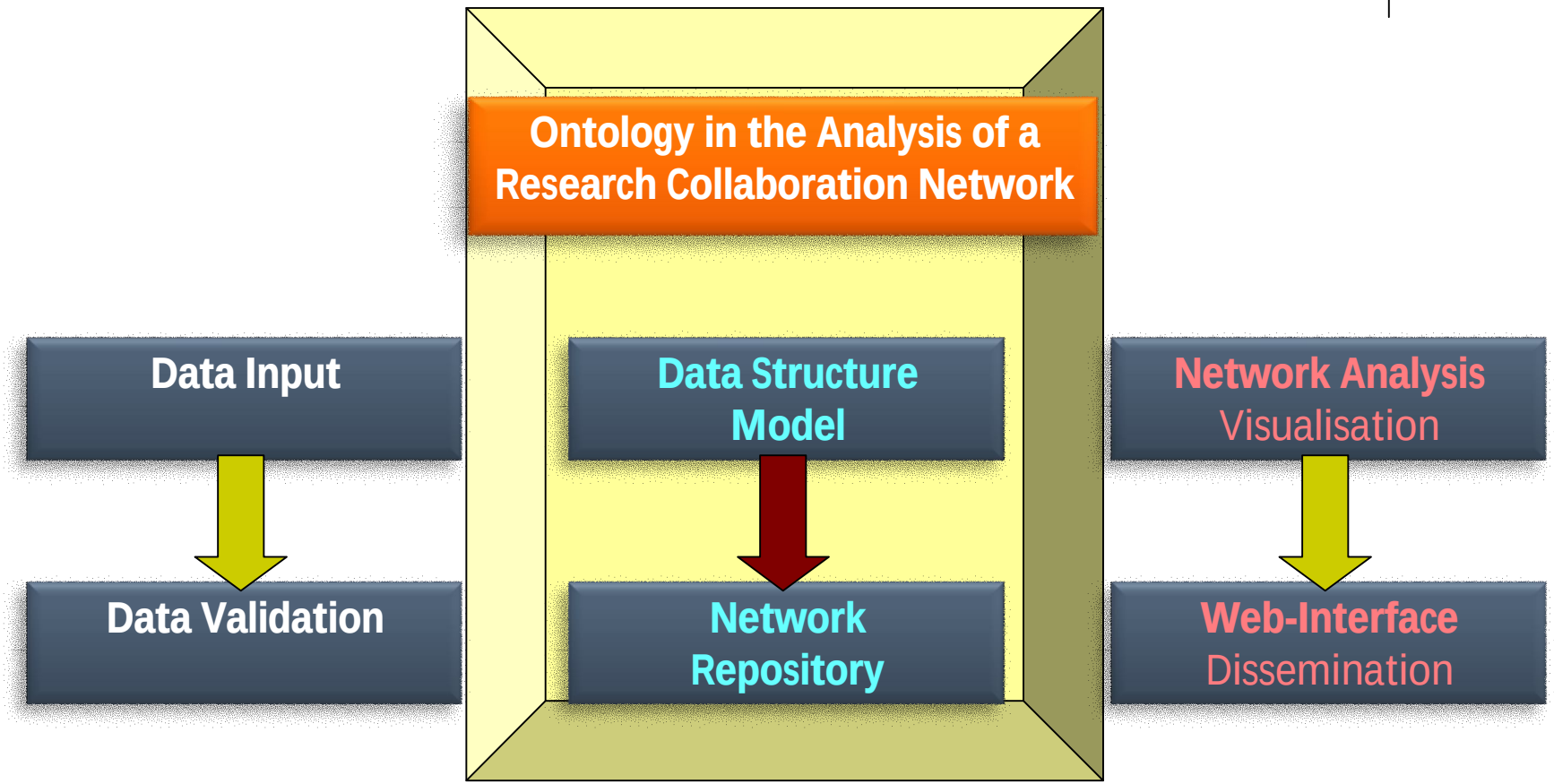
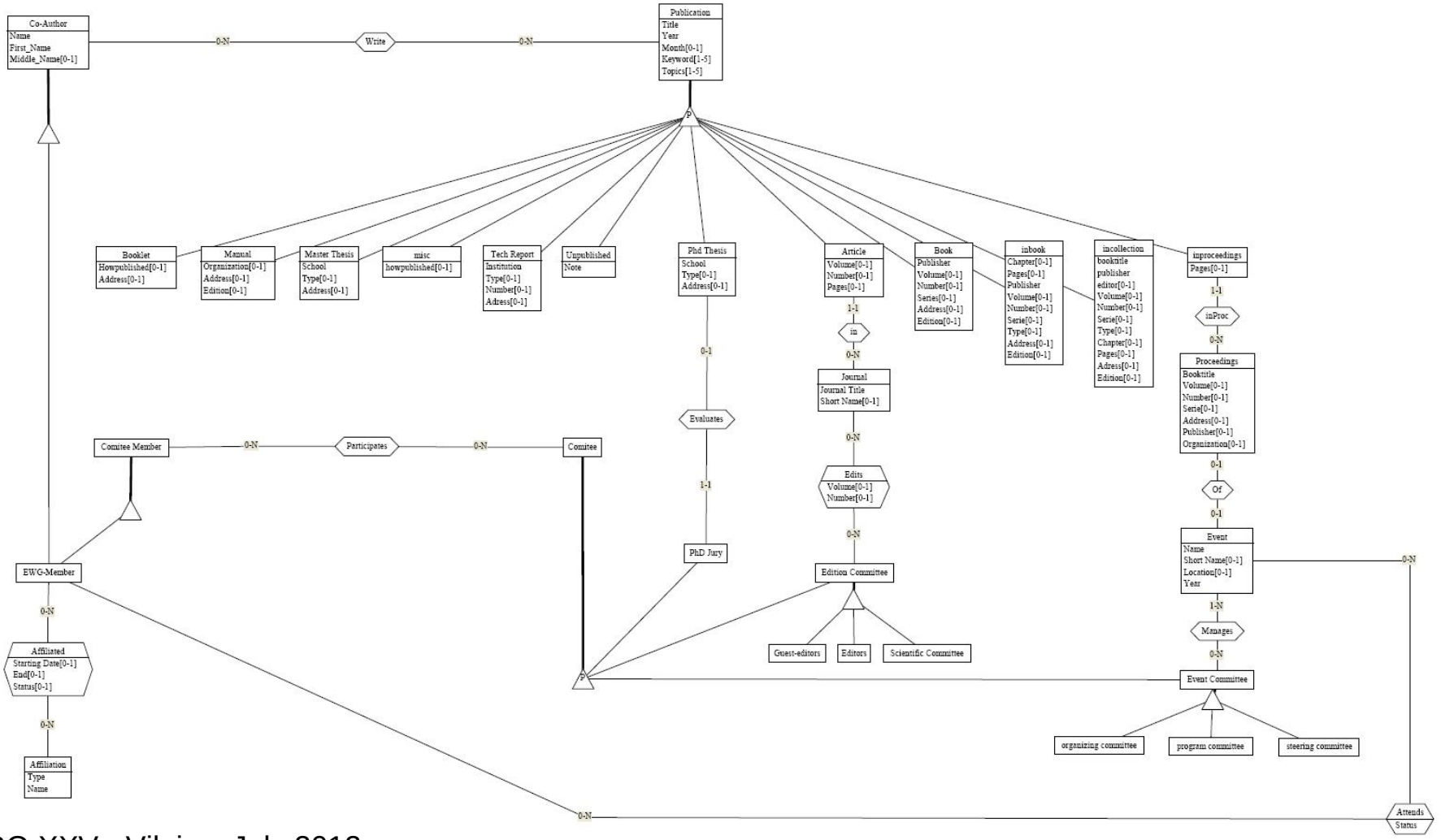


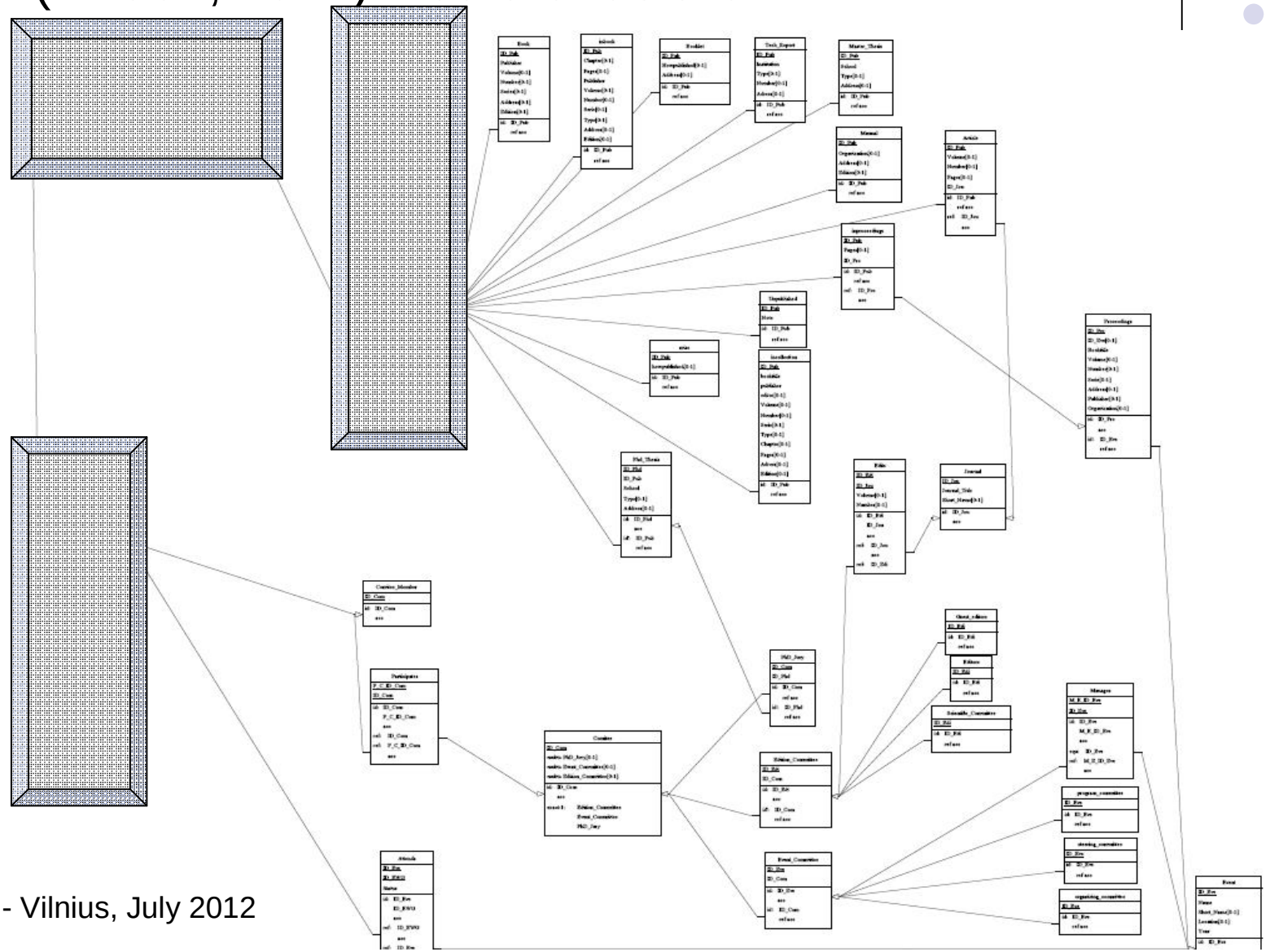
EWG-DSS Collab-Net

from (Linden, 2012) – Domain Information – v.1



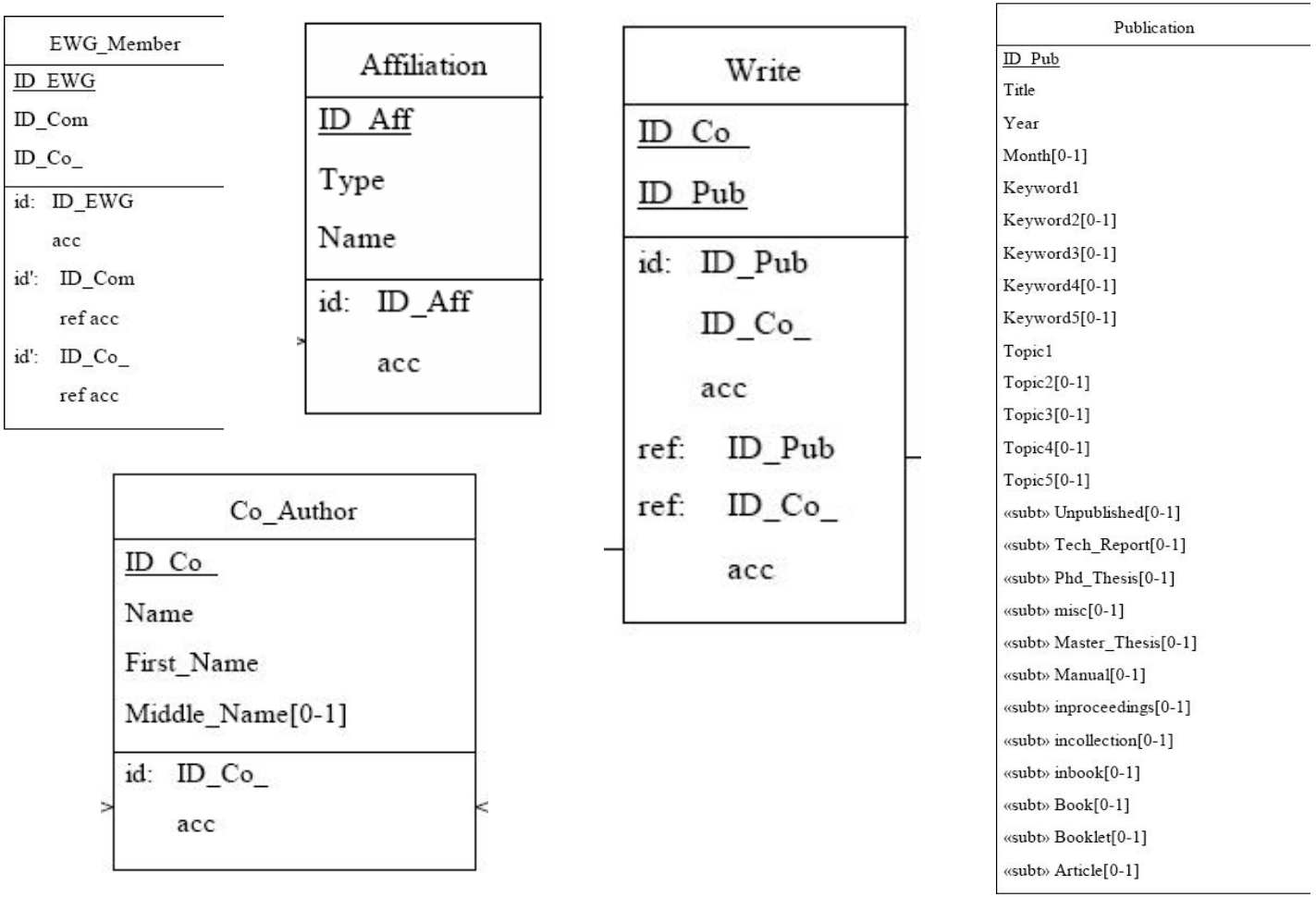
EWG-DSS Collab-Net Domain

from (Linden, 2012) – data structure – v.1

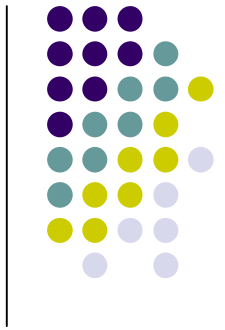


EWG-DSS Collab-Net Domain

from (Linden, 2012) – data structure – v.1



EWG-DSS Collab-Net V.2



Data Model

RDF (Resource Description Framework):

RDF is a method for expressing knowledge in a decentralized world and is the foundation of the Semantic Web, in which computer applications make use of distributed, structured information spread throughout the Web.

RDF decomposes any type of knowledge into small pieces, with some rules about the semantics, or meaning, of those pieces.

RDF is a particularly useful technology when you want to mesh together distributed information.

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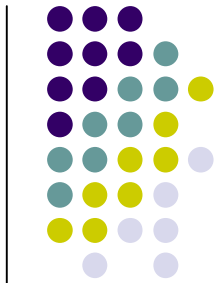


RDF Data Model

RDF can be defined in three simple rules:

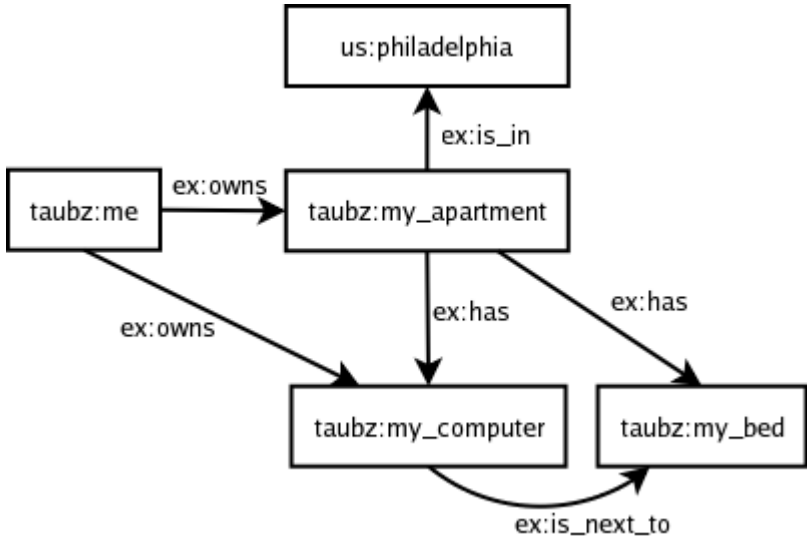
1. **A fact is expressed as a triple of the form (*Subject, Predicate, Object*). It's like a little English sentence.**

- **Subjects, predicates, and objects are names for entities, whether concrete or abstract, in the real world.**
  - **Names are either 1) global and refer to the same entity in any RDF document in which they appear, or 2) local, and the entity it refers to cannot be directly referred to outside of the RDF document.**

1. **Objects can also be text values, called literal values.**

EWG-DSS Collab-Net V.2
RDF Data Model

Example of a RDF Model as a Graph:



RDF as a Graph
- Source: (http://rdfabout.com/quickintro.xpd)
- *Let taubz: abbreviate http://razor.occams.info/index.html*
- *Let ex: abbreviate http://example.org/*

- In RDF, the nodes are **names** and the edges (arrows) are **statements.**

- The name at the **start node** of the arrow is the statement's **subject,** the name at the **end node** of the arrow is the statement's **object,** and the name that **labels the arrow** is the **predicate.**

Example: taubz:my_apartment
ex:has *(http://example.org/has)*
taubz:my_computer

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Ontologies

- **Ontologies to be considered in the Data Model:**

  BIBO *(Bibliographic Ontology)* ;

  FOAF *("Friend of a Friend" Ontology)*;

  OWL *(OWL Web Ontology Language)*;

  SKOS *(Simple Knowledge Organization System)*;

  …

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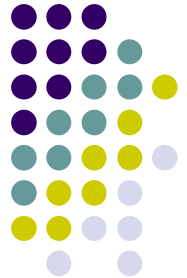
Bibo Ontology

www.biblioontology.com



Bibliographic Ontology

- ***Bibo*** *describes bibliographic things on the Semantic Web in RDF.*

- *It is mainly used as a citation ontology and as a document classification ontology. It can also be used as a common ground for converting other bibliographic data sources.*

- *It provides main concepts and properties for describing citations and bibliographic references (i.e. quotes, books, articles, etc) on the Semantic Web.*

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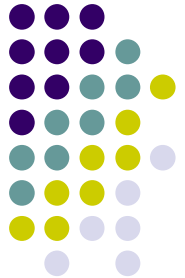
Bibo Ontology

www.biblioontology.com



Ontology: bibo

http://purl.org/ontology/bibo/
http://purl.org/dc/terms/creator: bibo:bdarcus *Bruce D'Arcus*
http://purl.org/dc/terms/creator: bibo:fgiasson *Frederick Giasson*
versionInfo: "http://purl.org/ontology/bibo/1.3/"

All Resources (189):

Classes (69)	*{AcademicArticle; AudioDocument; Book; Journal; …}*
Object Properties (52)	*{authorList; citedBy; editor; reviewOf; …}*
Data Properties (54)	*{abstract; chapter; edition; identifier; …}*
Individuals (14)	*{degrees/ms; degrees/phd; status/accepted; status/legal…}*

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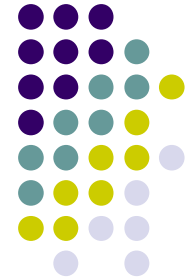
FOAF Ontology



http://www.foaf-project.org/ http://xmlns.com/foaf/0.1/

The FOAF ("**Friend of a Friend**") is a Semantic Web project described as a "practical experiment" in the application of RDF (Resource Description Framework) Data Model and Semantic Web technologies to social networking.

FOAF is a project devoted to linking people and information using the Web.

FOAF integrates three kinds of network:

- social networks of human collaboration, friendship and association;
- representational networks that describe a simplified view of a cartoon universe in factual terms;
- information networks that use web-based linking to share independently published descriptions of this inter-connected world.

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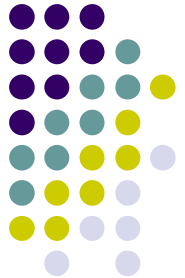
FOAF Ontology

http://xmlns.com/foaf/0.1/



FOAF Classes and Properties:

Classes: | *Agent* | *Document* | *Group* | *Image* | *LabelProperty* | *OnlineAccount* | *OnlineChatAccount* | *OnlineEcommerceAccount* | *OnlineGamingAccount* | *Organization* | *Person* | *PersonalProfileDocument* | *Project* |

Properties: | *account* | *accountName* | *accountServiceHomepage* | *age* | *aimChatID* | *based_near* | *birthday* | *currentProject* | *depiction* |*depicts* | *dnaChecksum* | *familyName* | *family_name* | *firstName* | *focus* | *fundedBy* | *geekcode* | *gender* | *givenName* | *givenname* | *holdsAccount* | *homepage* | *icqChatID* | *img* | *interest* | *isPrimaryTopicOf* | *jabberID* | *knows* | *lastName* | *logo* | *made* | *maker* | *mbox* | *mbox_sha1sum* | *member* | *membershipClass* | *msnChatID* | *myersBriggs* | *name* | *nick* | *openid* | *page* | *pastProject* | *phone* | *plan* | *primaryTopic* | *publications* | *schoolHomepage* | *sha1* | *skypeID* | *status* | *surname* | *theme* | *thumbnail* | *tipjar* | *title* | *topic* | *topic_interest* | *weblog* | *workInfoHomepage* | *workplaceHomepage* | *yahooChatID* |

EWG-DSS Collab-Net V.2

OWL Ontology

http://www.w3.org/TR/owl-ref/

OWL Web Ontology Language

- The OWL is intended to provide a language that can be used to describe the classes and relations between them that are inherent in Web documents and applications.

- OWL is a semantic markup language for publishing and sharing ontologies on the World Wide Web.

- The **World Wide Web Consortium (W3C)** created the Web-Ontology Working Group as part of their Semantic Web Activity in 2001, with co-chairs James Hendler and Guus Schreiber. **OWL** became a formal W3C recommendation on February, 2004.

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SKOS Ontology

http://www.w3.org/TR/swbp-skos-core-guide

SKOS - Simple Knowledge Organization System

- ***SKOS*** *is a formal language and schema designed to represent such structured information domains as thesauri, classification schemes, taxonomies, subject-heading systems, controlled vocabularies, etc. It is a* ***W3C*** *initiative more fully defined in its* ***SKOS Core*** *Guide.*
- *Using SKOS,* ***concepts*** *can be :*
  - *identified, labeled in natural languages, assigned notations, documented,*
  - *linked to other concepts and organized into informal hierarchies and association networks,*
  - *aggregated into concept schemes,*
  - *grouped into labeled and/or ordered collections, and mapped to concepts in other schemes.*

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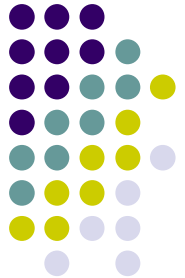
SKOS Ontology

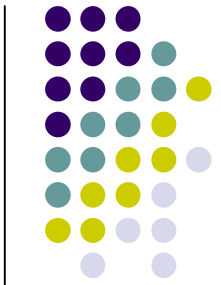
http://www.w3.org/TR/swbp-skos-core-guide



SKOS Core

- *SKOS Core defines the classes and properties based on a **concept-centric view of the vocabulary**.*
- *Each **SKOS concept** is defined as an RDF data model resource.*
- *Each concept can have RDF properties attached to it.*
- *Concepts can be organized in hierarchies using broader-narrower relationships, or linked by non-hierarchical (associative) relationships.*
- *Concepts can be gathered in concept schemes, to provide consistent and structured sets of concepts, representing whole or part of a controlled vocabulary.*

Ontology Model & Data Validation

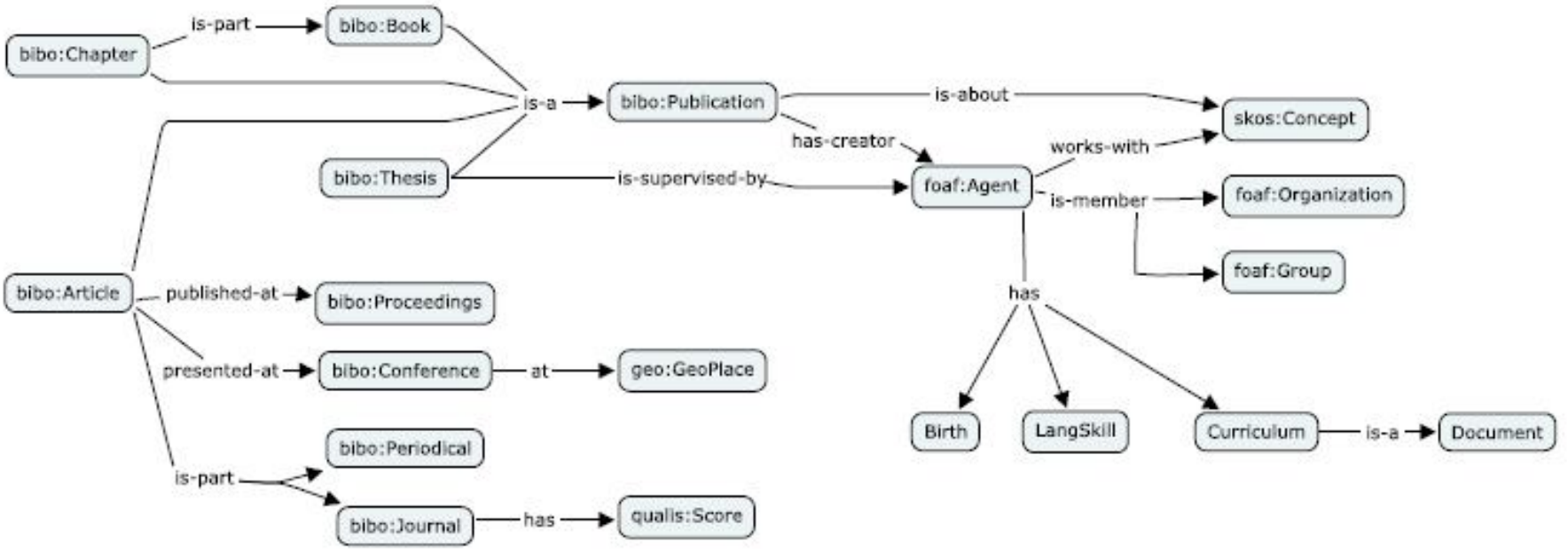


The Data Model including Ontologies will cater for the validation of the publications input data.

- Knowledge areas
- Keywords
- Authors' information
- Normalization

Data Model Example

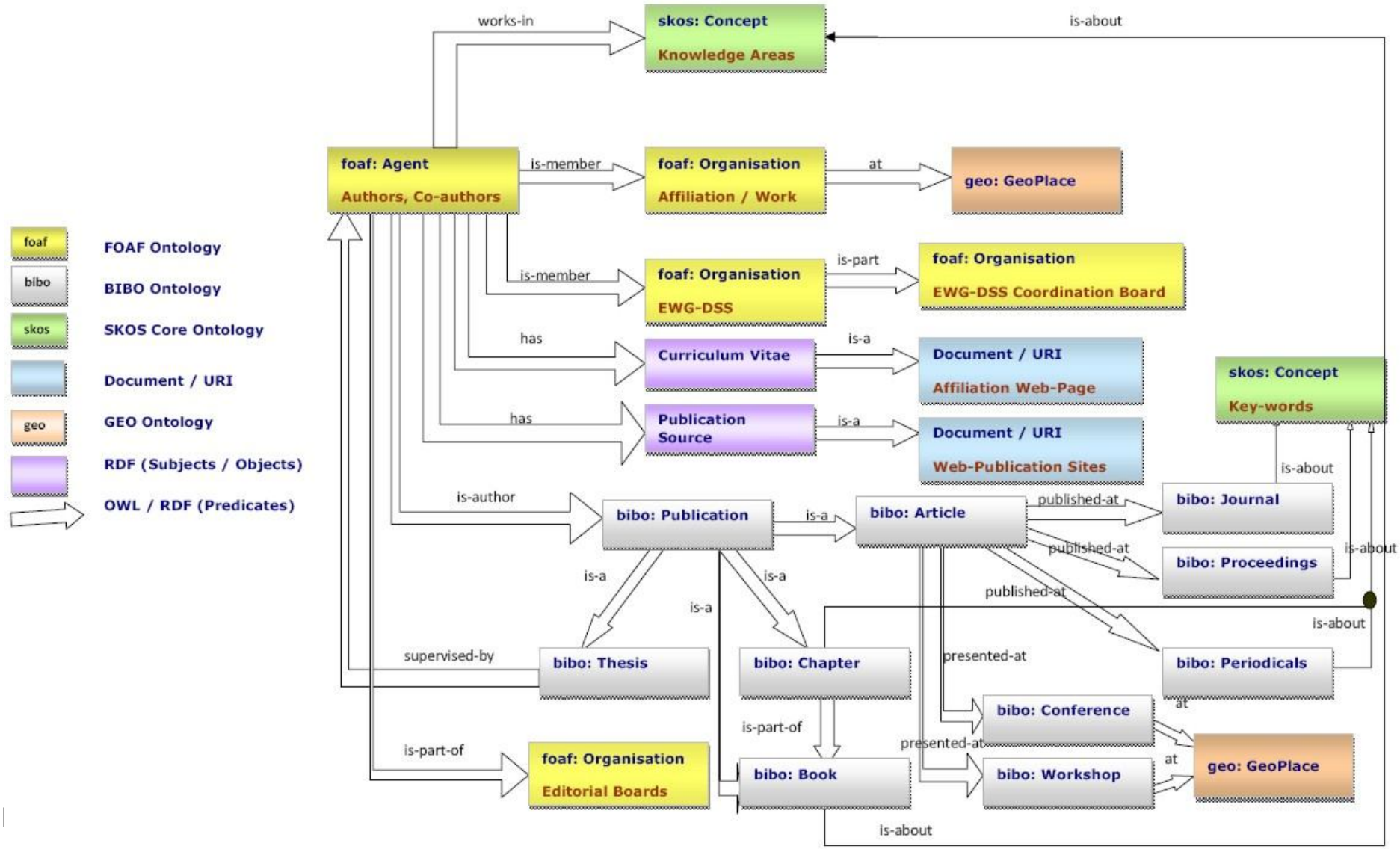
from FGV Project (Rademaker, 2012)



- RDF Data Model Example with Ontologies to be followed
- Source: (Rademaker, 2012)

EWG-DSS Collab-Net

Project EWG-DSS Collab-Net V.2 - Data Model with Ontology – Spec. V.1



Conclusions :

- The ontology model of the EWG-DSS Collab-Net V.2 will allow us to refine the publication relationship structure, as well as the collaboration relationship structure of the EWG-DSS Network.

Benefits:

- It represents *better structured processes* to take maximum advantage of knowledge.
- The ontologies can be leveraged to help improve knowledge management and *allow for better decisions*.
- **EWG-DSS:** better promotion of continued and further research collaboration among the members of the group and co-authors.

Final Remarks :

- With the ontology model of the EWG-DSS Collab-Net V.2, we catch up with new technologies.
- We keep our initial project goals to provide solutions that the contemporary society demands.

  - KM – ontologies - DM → Successful Results

the right way to go!

Thanks
for your attention!