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Joint ICTP-IAEA School of Nuclear Knowledge Management

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Improving Organizational Performance with a KM System

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Improving Organizational Performance with a KM System

School of Nuclear Knowledge Management

1-5 September 2008, Trieste, Italy

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Knowledge Management

- Knowledge Management is the answer to rising requirements when dealing with the increasing knowledge- and information glut in the world of business (Wikipedia).
- Knowledge Management in detail is a summing up of all management practices aiming to develop and to deploy knowledge in organisations in order to achieve the organisation's aims at the best (Wikipedia).

Knowledge Management: why?

- Business needs:
 - Performance
 - Competitiveness
- Lessons recently learned from the Internet:
 - Access to vast amount of information
 - Full text searching capabilities
 - Rapid access almost independent from location of information retriever
- Lessons learned from other techniques:
 - e.g. semantic nets, workflow systems, Internet portals



Knowledge Management: what is it good for?

- Knowledge management is to facilitate and support business processes
- Knowledge management (including information management) supports the handling of the increasing mass of information and data- and knowledge
 - Knowledge management is no substitute for genuine thinking and real analysis of problems.
 - Knowledge is neither inherently new nor old, nor good or bad. What one has invented, another may discover and still others revise.
 - Business knowledge is not scientific knowledge. So don't expect to get ever lasting truths from knowledge management- it emerged from business.

Knowledge Management

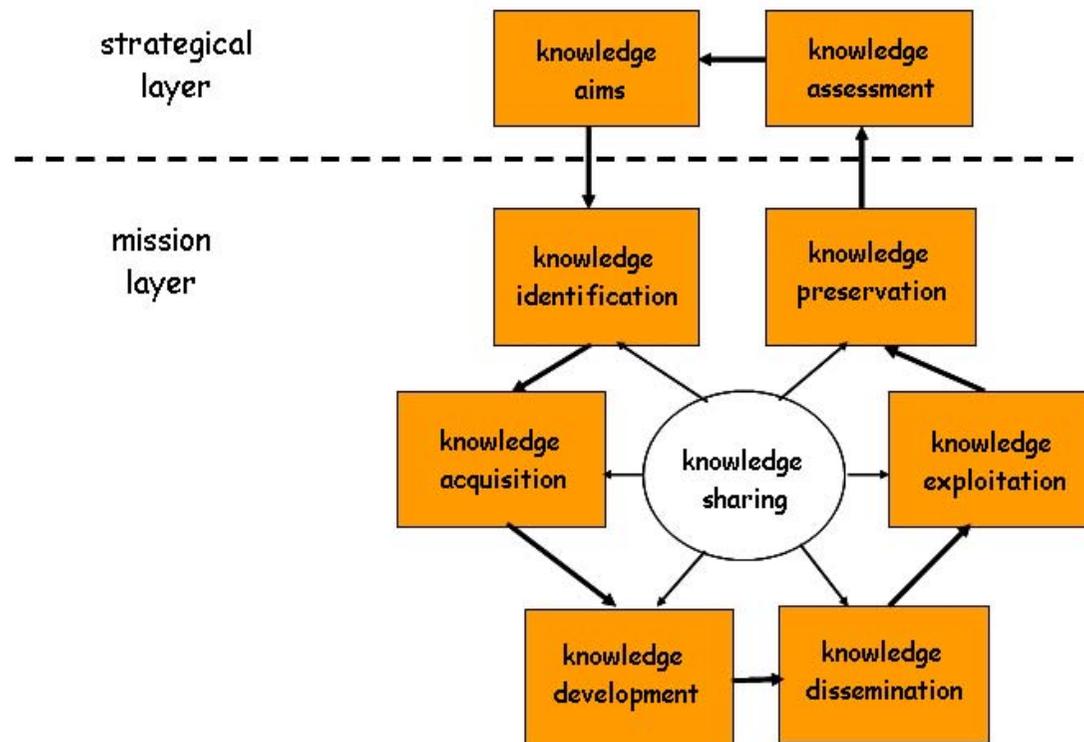
- Helps to deal with the ever increasing amount of information and data
- Gives versatile tools for structuring these information and data
- Changes the ways of communication and interaction between humans

Knowledge Management

- What is considered here
 - Existing KM tools and procedures
 - New developments emerging from new techniques / new communication channels
- ... and what is not (or mentioned only):
 - Human resource management
 - Training
 - Management reporting

The Knowledge Management Cycle (Probst 1996)

Knowledge Management Cycle (Probst)



Beware ...



Tools for Knowledge Management

- Procedures for identifying imminent knowledge gaps with leaving experts
 - E.g. TVA taxonomy
- Procedures for capturing knowledge
 - Interviews
 - Mentoring
- DP Tools for capturing and codifying knowledge
 - AI (Artificial Intelligence) Systems
 - Expert Systems
 - Neural Nets
 - Fuzzy Logic systems
 - Genetic Algorithms

Tools for Knowledge Management (continued)

- Web collaborative DP tools (Sharepoint, Sametime, Groove)
- DP Tools for sharing and leveraging acquired knowledge
 - customer relations management, enterprise resource planning, sales force automation, document management, data warehousing
- DP Tools for creating knowledge
 - Authoring Tools
 - E-Learning Tools
 - CAD Systems

Recent DP Tools for Knowledge Management

- Portals and collaborative platforms
- Process modelling tools (workflow)
- Wikis, blogs
- Bookmarking services
- Semantic tools
 - Taxonomies
 - Thesauri
 - Topic Maps
 - Ontologies

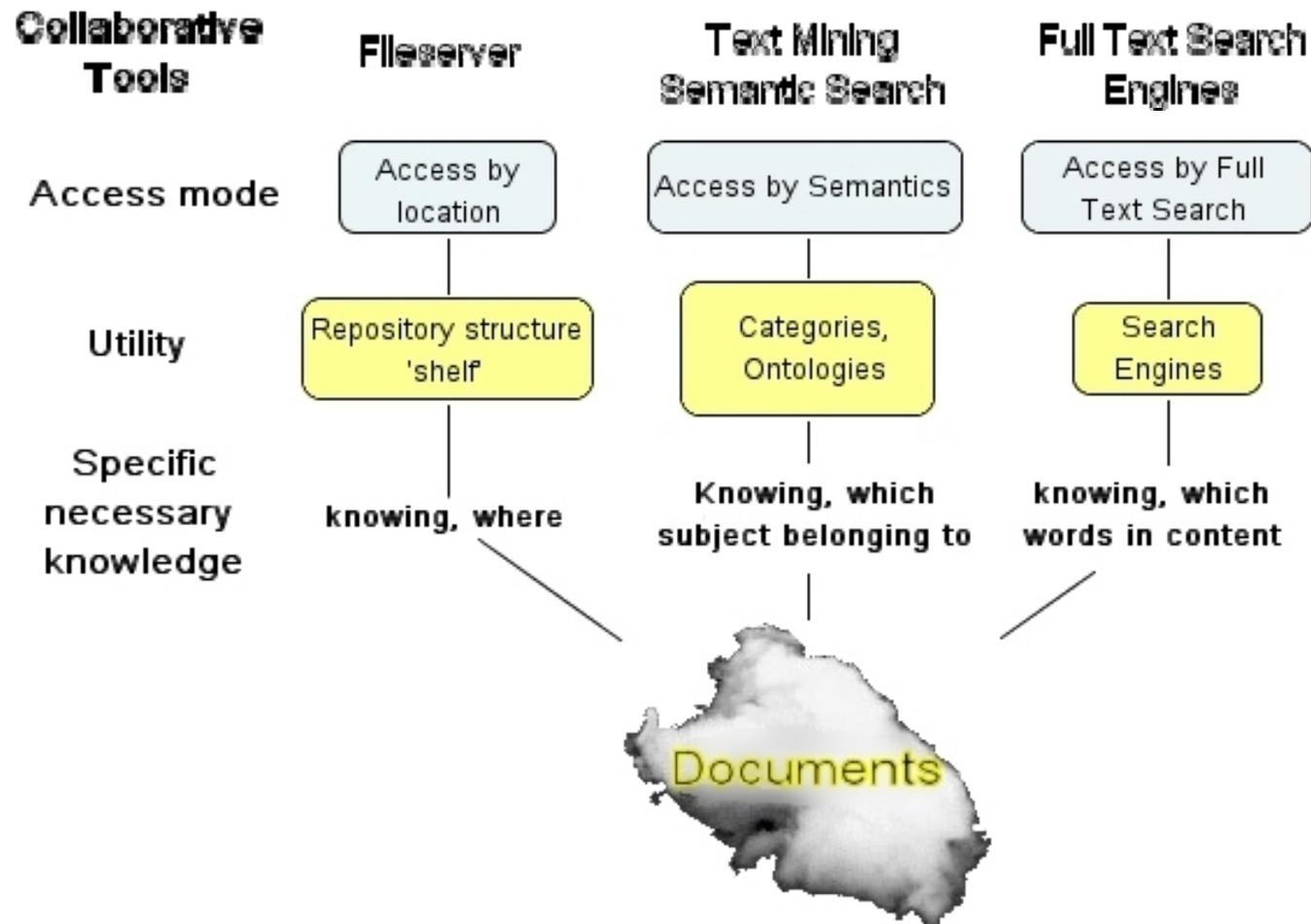
Embedding of DP Tools

- When used, the DP KM tools must be embedded carefully in an organisation's structure.
- Don't forget legal aspects (whenever applicable):
 - **An obligation to preserve records (e.g. emails)**
 - **An obligation to access records within a specified time period**

The DP KM Tools ‘Currency’:

- Document structures (e.g. portals, repositories, office systems) consisting of office documents, audio files, video clips as base items
- Non-document structures (e.g. Wikis, Blogs, Discussion boards, on-the-fly-assembled data from repositories, yellow pages) consisting of various (non-document) base items
- Integrated structures (e.g. workflows, ontologies) consisting of various (document and non-document) base items

The Three Ways to Access a Document Corpus



Access by Location

- Local: desktop with hierarchical directory structure
- Enterprise / organisation: fileserver with hierarchical directory structure
- www: bookmarking, link lists, net representations

Two Kinds of Networks in KM

- Semantic networks (e.g. ontologies); presently mostly focusing on relations without time sequences (no cause-consequence relations)
- Networks based on cause-consequence relations (timed networks e.g. workflows, run-down diagrams)

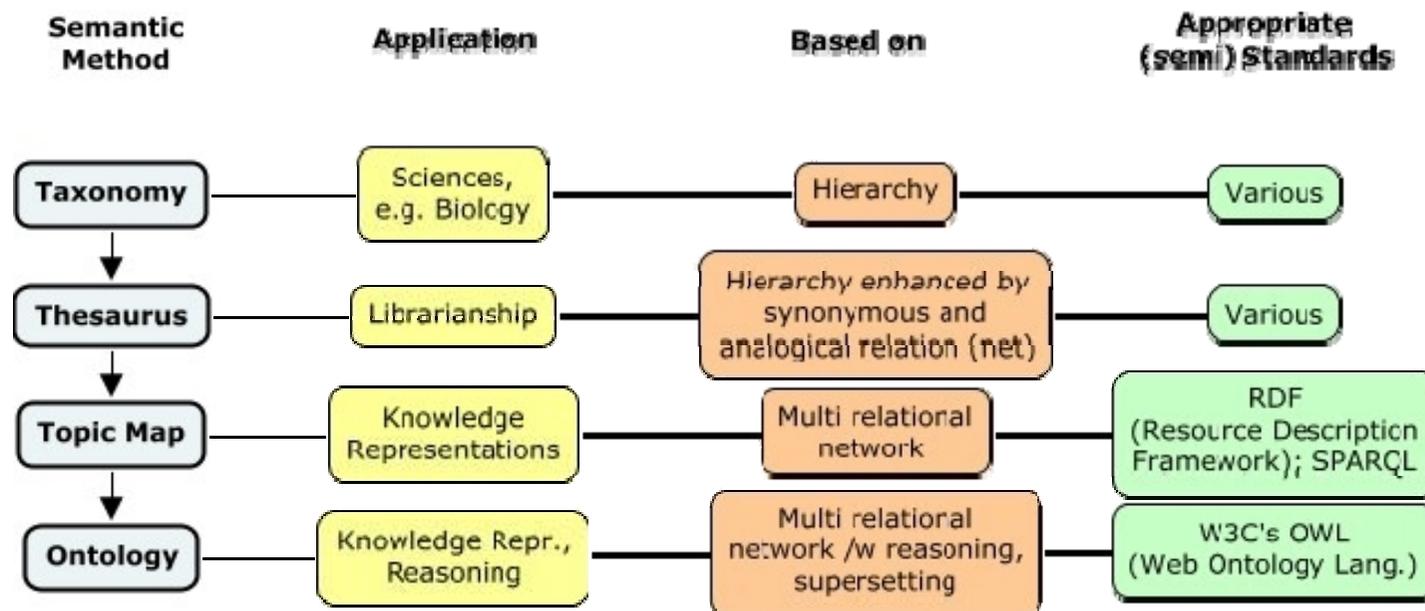
Ontology

- In philosophy, ontology is the study of being or existence and forms the basic subject matter of metaphysics
- The notion has been adopted from IT workers to characterize what exists and is represented for computers
- Ontology is a model of knowledge
- Ontology is the specification of a conceptualization
- An ontology is recordable by use of a ‘representation language’
- It is a semantic structure- no randomness, no statistics
- Although different in notation, ontologies in their most formal characteristics are equivalent to Turing Machines (see e.g. Marko A. Rodriguez and Johan Bollen, Modeling Computations in a Semantic Network, Digital Library Research and Prototyping Team, Los Alamos National Laboratory, Los Alamos 2007)

Ontologies- what is it Good for

- Ontologies enable better access to information for humans
- Ontologies enable more extensive processing and information exchange for machines
- Ontologies-
 - Enhance searching
 - Enable thematic navigation

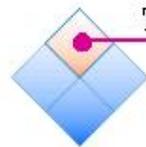
Semantic Methods



Semantic Activities

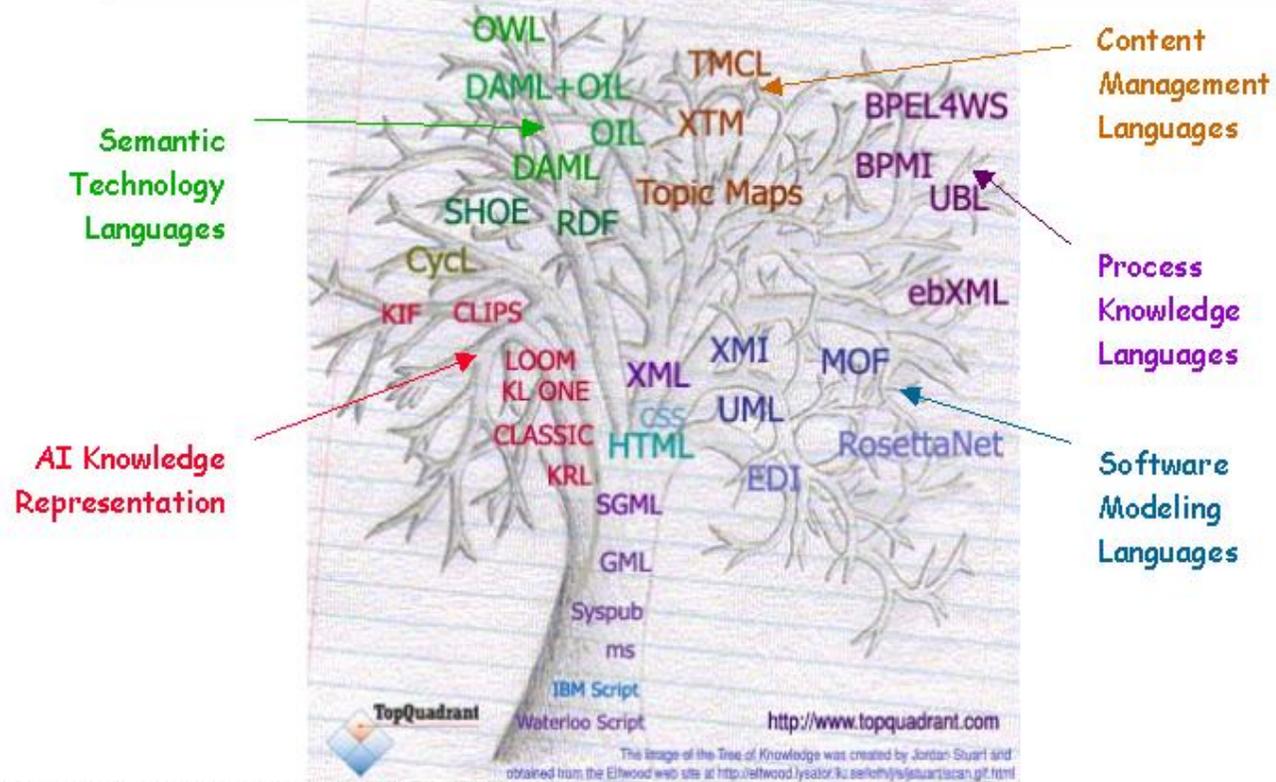
- The Dublin Core Metadata Scheme <http://dublincore.org>
- RDF (Resource Description Framework) <http://www.w3c.org>
- The Knowledge Interchange Format (KIF)
<http://logic.stanford.edu/kif/kif.html>
- OWL (one world language for ontologies) and SPARQL
(Sparql Query Language) <http://www.w3c.org>

Knowledge Technologies (see <http://www.topquadrant.com/>)



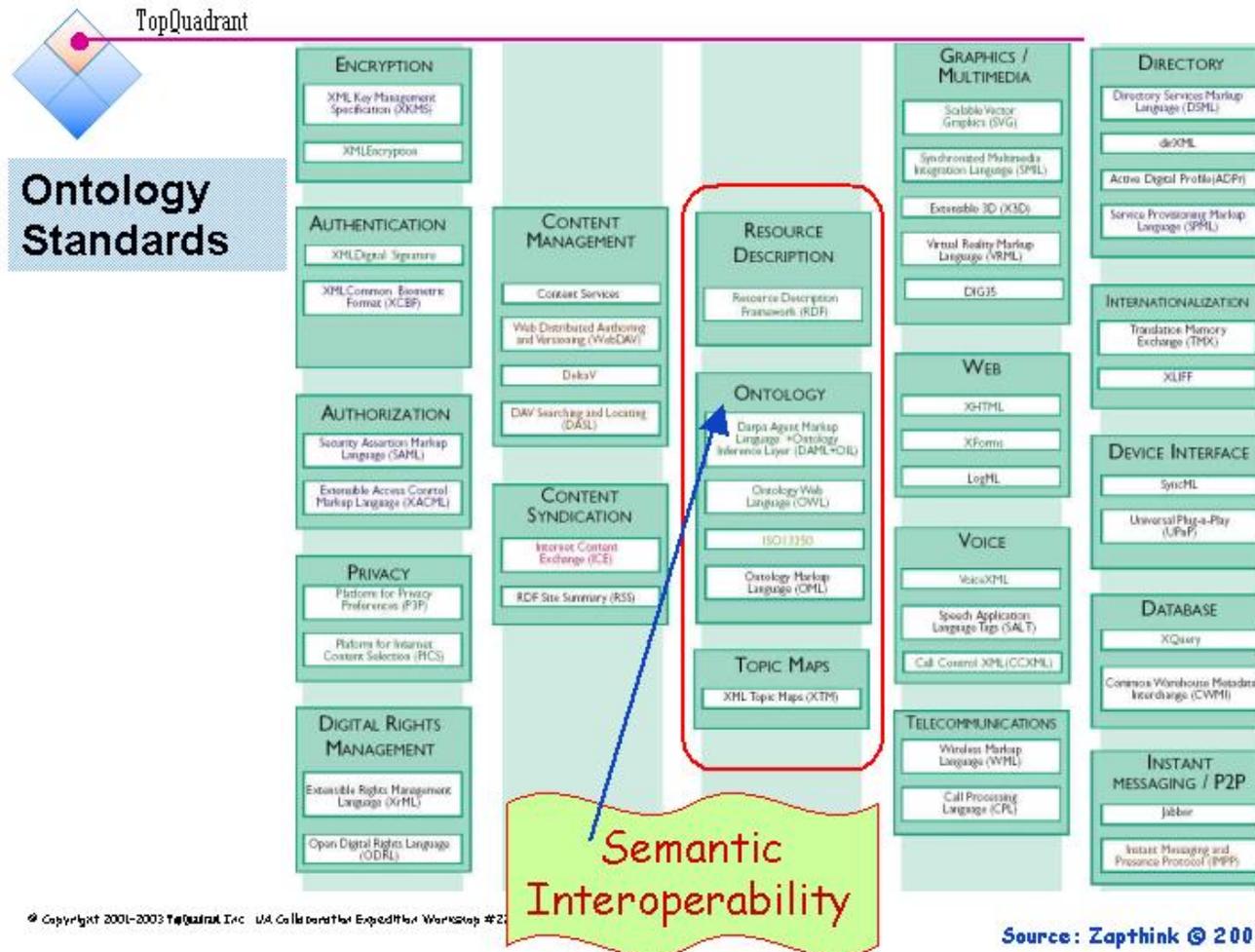
TopQuadrant

The Tree of Knowledge Technologies



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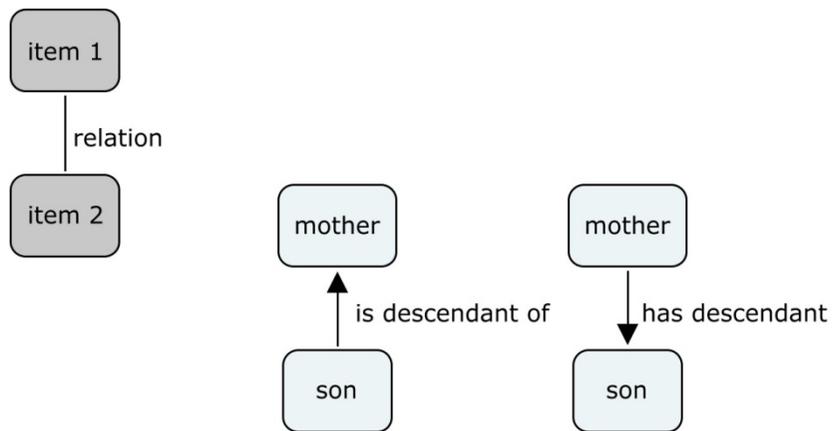
Ontology Standards



The two Worlds of Knowledge Management

- Formal concepts, frame works and modelling to promote machine / network reasoning
 - Procedural approaches
- Informal / partly formal KM for humans, with machine / network support
 - Value added by statistical means: context identification, keywords extraction

Relations



‘Blowing up Dictionaries’

- Enhancing dictionaries by relation type ‘sub type of super type’ in a strict hierarchy:

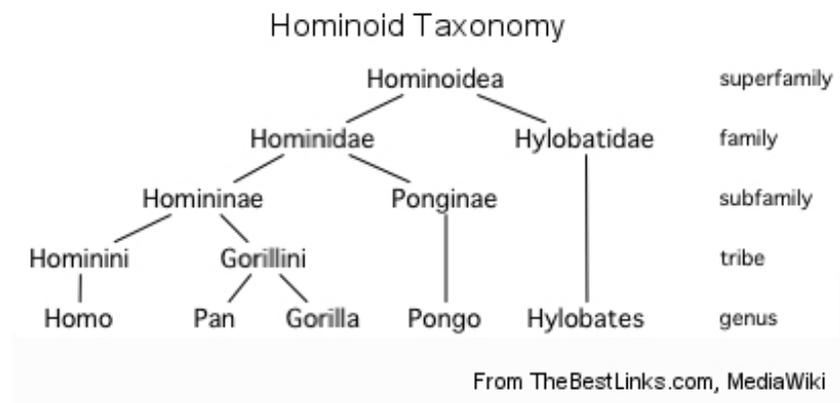
=> Taxonomy

- Enhancing taxonomies by free relations and meshing (i.e. expanding the hierarchy concept):

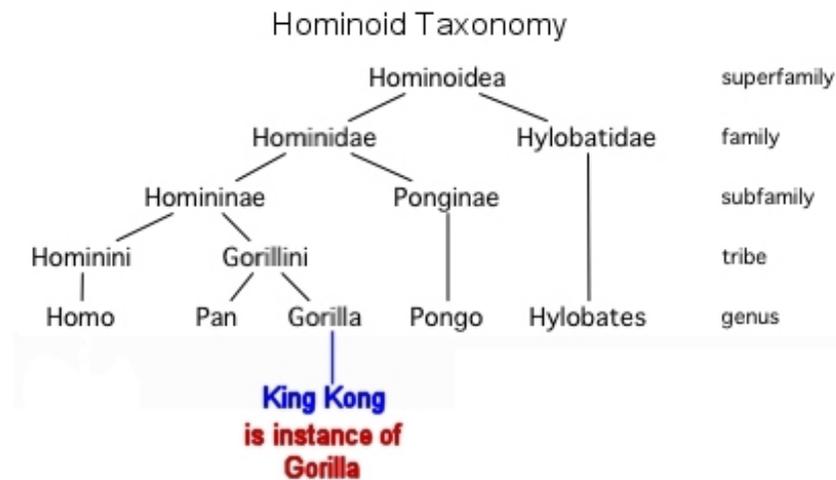
=> Ontology

- Semantic net paradigm: structure is independent of content

Example of a Hierarchy: a Taxonomy

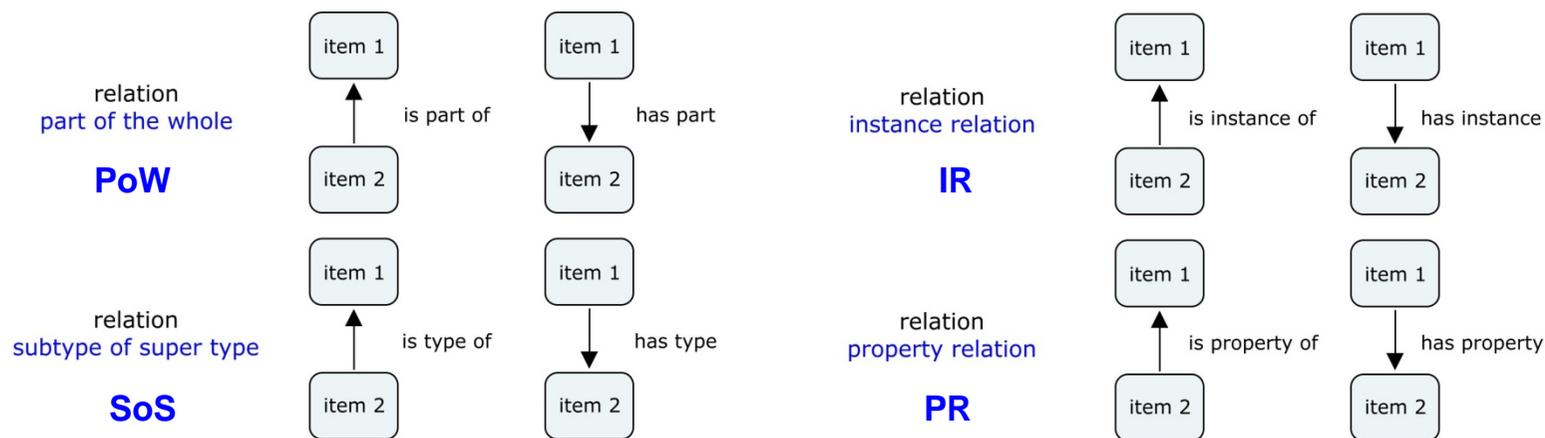


Instances and Inheritance



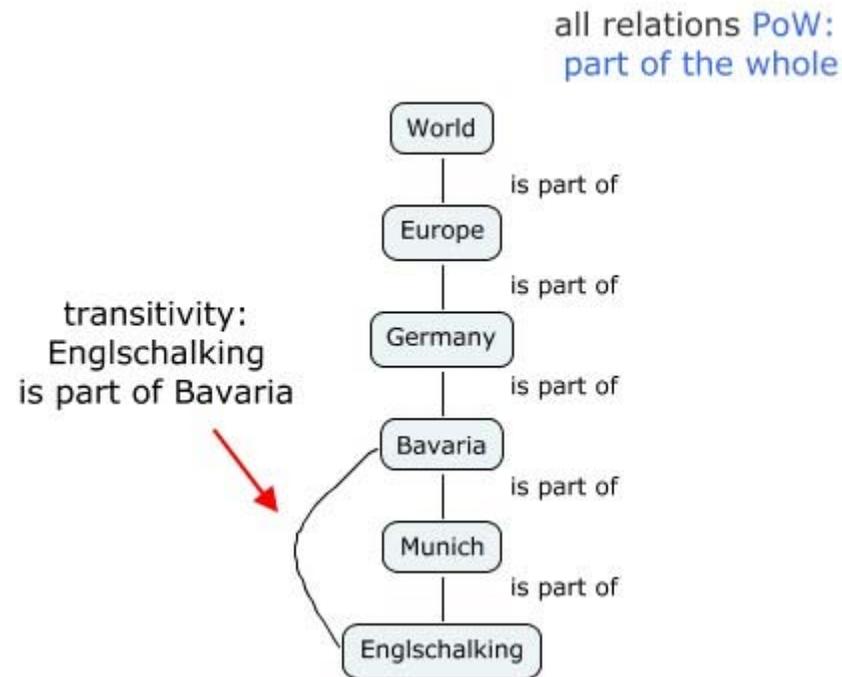
- an instance inherits the attributes of its predecesing concept

Ontology Standard Relations



- Ontologies can easily be enhanced by further relations
- SoS/ IR type subtrees: concepts/ instances inherit attributes of roots

Transitivity of PoW Relations



How can Ontologies be Designed?

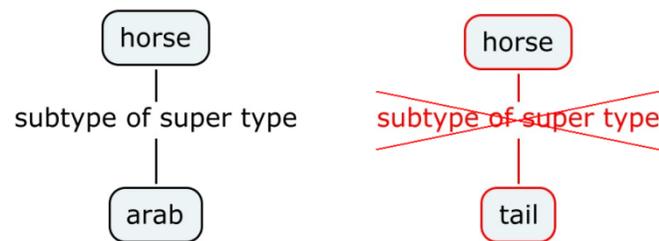
- How formal must a design be?
- Should an item have more than one supertype?
- Do we need semantic relations?
- What is better- Top Down or Bottom Up?
- Can we incorporate several different taxonomies?

Common Design Rules

- Design should support searching and navigation
- Redundancies- as little as possible
- Modelling must keep strictly to facts
- Modelling must remain understandable
- 4f errors: problems emanate from freezing a system, forgetting a property, faulting, and flattening realities –all of them must be avoided

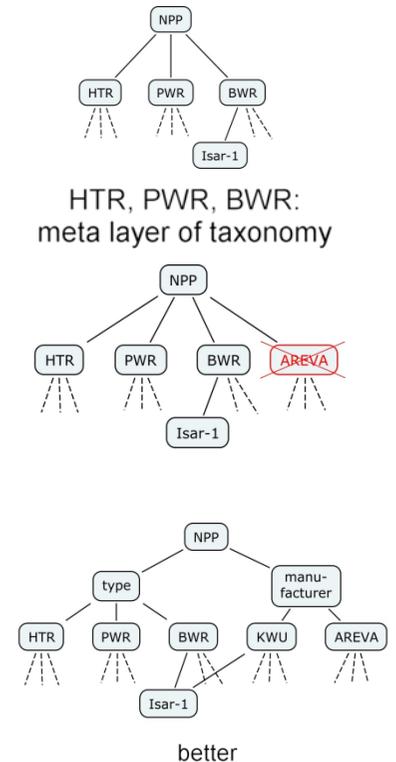
Concepts, Instances, Subtypes and Super Types

- Concept / instance: not always clearly distinguishable
- All I can touch is an instance (it's a rough rule of thumb)
- The subtype of super type relation is always a strong relation in that a subtype represents a subset of the super type, but is not a part of the super type (meaningful for inheritance of attributes)



Meta Layers

- Ontology design deals with meaningful grouping of concepts
- Concepts of meta layers should be on a similar level of abstraction
- Much is depending on a clever clustering of concepts/ instances: attributes and relations should comprise as many concepts as meaningful (i.e. they should reside in the net's tree as high as possible and as low as necessary)
- Attributes can be modelled as relations (see previous slide of ontology design draft)



Former GRS Project: Development of a “Containment-Ontology”

- 2-days Workshop with four field and three KM experts –resulting in a first draft
- Refined in several steps by other experts
- Recorded by use of the tool ”Semantic Miner” by Ontoprise GmbH

Containment Ontology – Search Window

semantic miner [Home](#) | [zurücksetzen](#) English | Deutsch  Search Easy to use. Repeat Here

tolerant exakt

Suchergebnisse WWW Visualizer Einstellungen

Wissensbrowser

<http://www.grs.de/contain> > DEFAULT_ROOT_CONCEPT > Modelle von Phänomenen ±/:

Beschreibung: Charakteristisch für Normalbetrieb, Störungen, Störfälle und auslegungsüberschreitende Ereignisse (z.B. Unfälle)

Modelle von Phänomenen	Rechenprogramm	Rechenprogramme ±/:
	Beschreibung	string
	Ressourcen	string

- [Graphitbrand ±/:](#)
- [Kabelbrand ±/:](#)
- [Schmelzverhalten ±/:](#)
- [Spaltprodukte ±/:](#)
- [Sump Clogging ±/:](#)
- [Thermohydraulik ±/:](#)

SemanticMiner v1.1.1.2 © 2005 by ontoprise GmbH

Containment Ontology –Results of Searching

semantic miner home | zurücksetzen English | Deutsch **Ontoprise** know how to use. Know how

"Sump Clogging" Suche tolerant exakt

Suchergebnisse WWW Visualizer Einstellungen

Wissensbrowser
Sump_Clogging +/-

GRS-Portal
OntoSearch

Suchen in: X

und

und

Suchen Neue Suche Normal

Suche nach **'sump clogging'** in **Alle Quellen** [Hilfe](#)
Mehr als 40 Ergebnisse zurückgegeben, Einträge 1 - 40 werden angezeigt

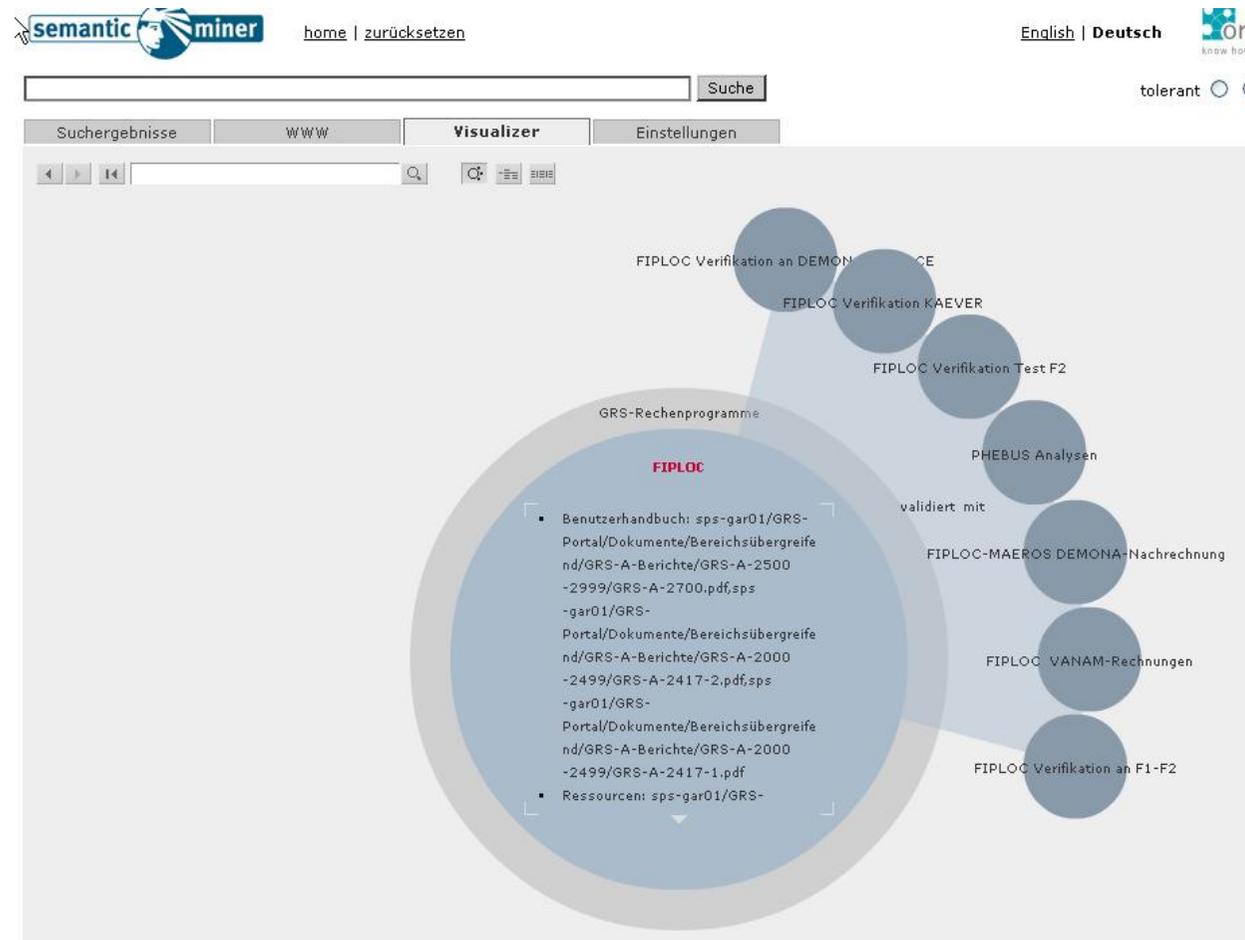
Sortierung durch gruppiert dann durch [Zu meinen Hyperlinks hinzufügen](#) | [Benachrichtigen](#)

Gruppen: INT 9152 Generische Sicherheitsfragen (9) GRS-Portal (12) SR 2472 Internationaler Regelwerksvergleich (1) SR 2475 Projektportal (4) A1140 (1) SR 2440 Projektportal (8) SR 2510 Projektportal (2) A503 (2) SR 2486 Nukleare Sicherheitskonvention (1)

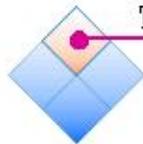
INT 9152 Generische Sicherheitsfragen

Kein Folientitel Clogging-GPR/RSK http://project-gar01/projekte/INT9152/Arbeitsakte/07_Beigestellte_Unterlagen/GPR... - 221 KB Zu meinen Hyperlinks hinzufügen Benachrichtigen Zur Dokumentenbibliothek Eintragsdetails	Kersting	11.07.2005
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Bewertung (Ranking) der Issues Folie Ergebnisbericht,Projektgespräch am 13.07.05 http://project-gar01/projekte/INT9152/Zentralakte/04_Arbeitsergebnisse/Projektge... - 59 KB Zu meinen Hyperlinks hinzufügen Benachrichtigen Zur Dokumentenbibliothek Eintragsdetails	Simon	14.07.2005
Folie		11.07.2005

Containment Ontology -Visualisation

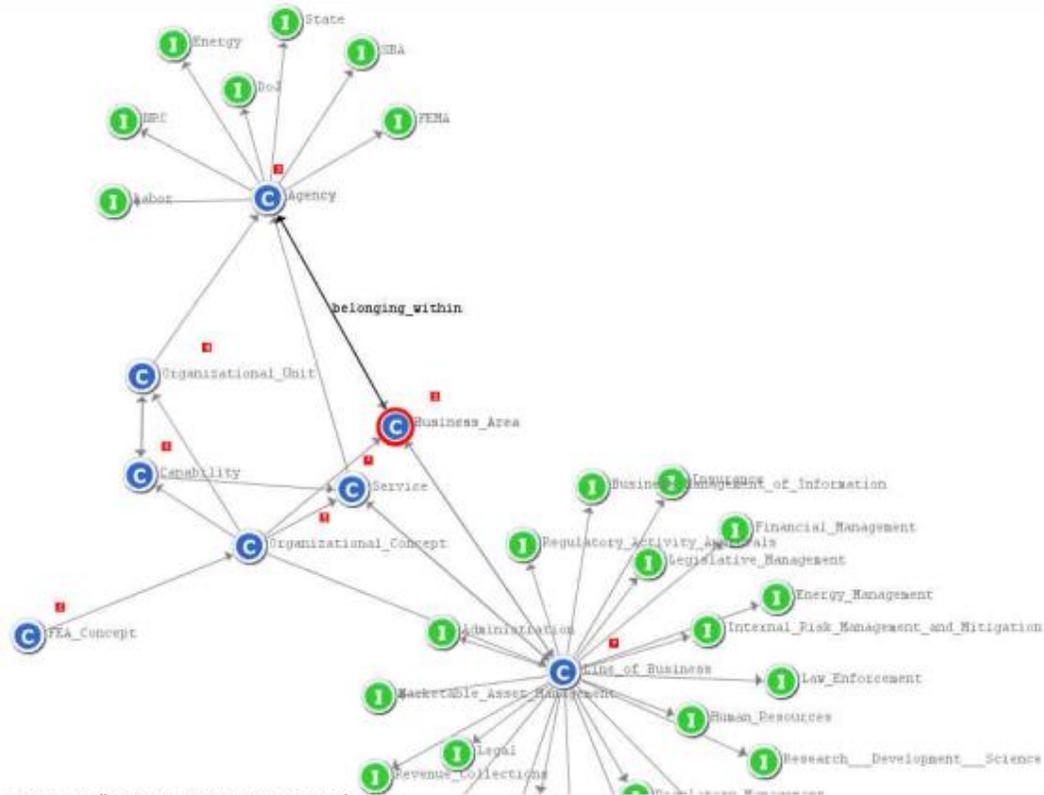


Example of Network View of an Ontology



TopQuadrant

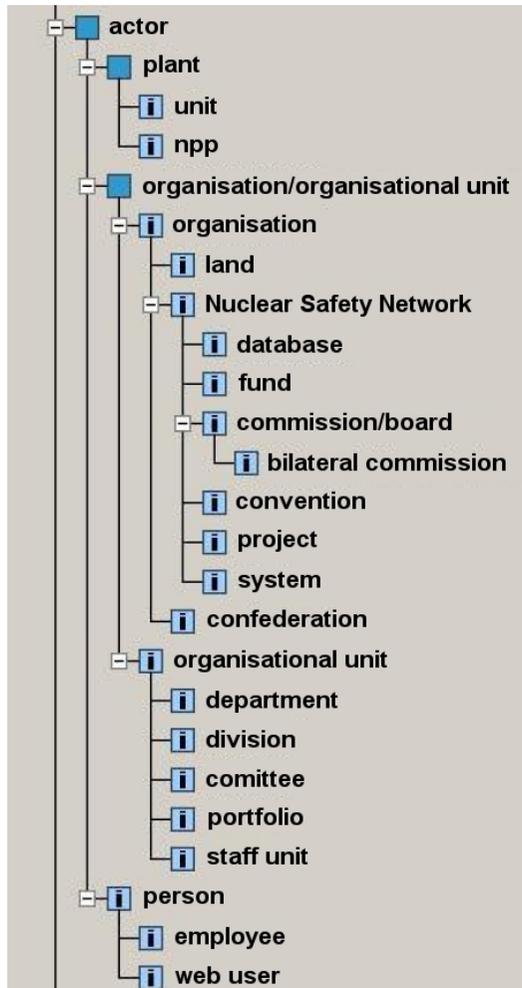
Example from the FEA Ontology using Ontoprise's OntoEdit Tool



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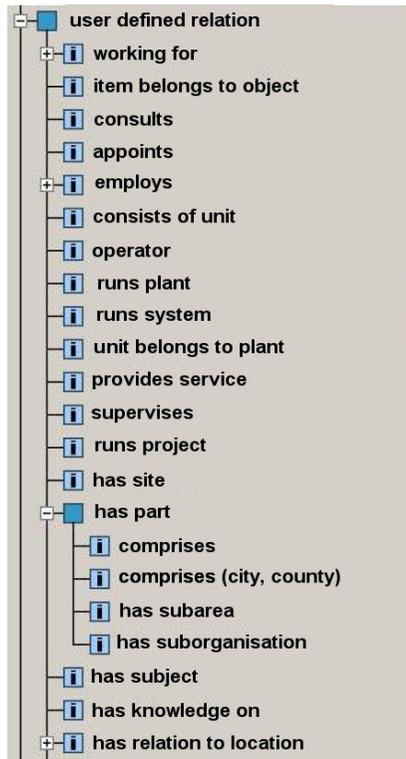
Example of Concepts: Organisations



- In order to dispose of a root, the artificial concept of actor has been added at the top

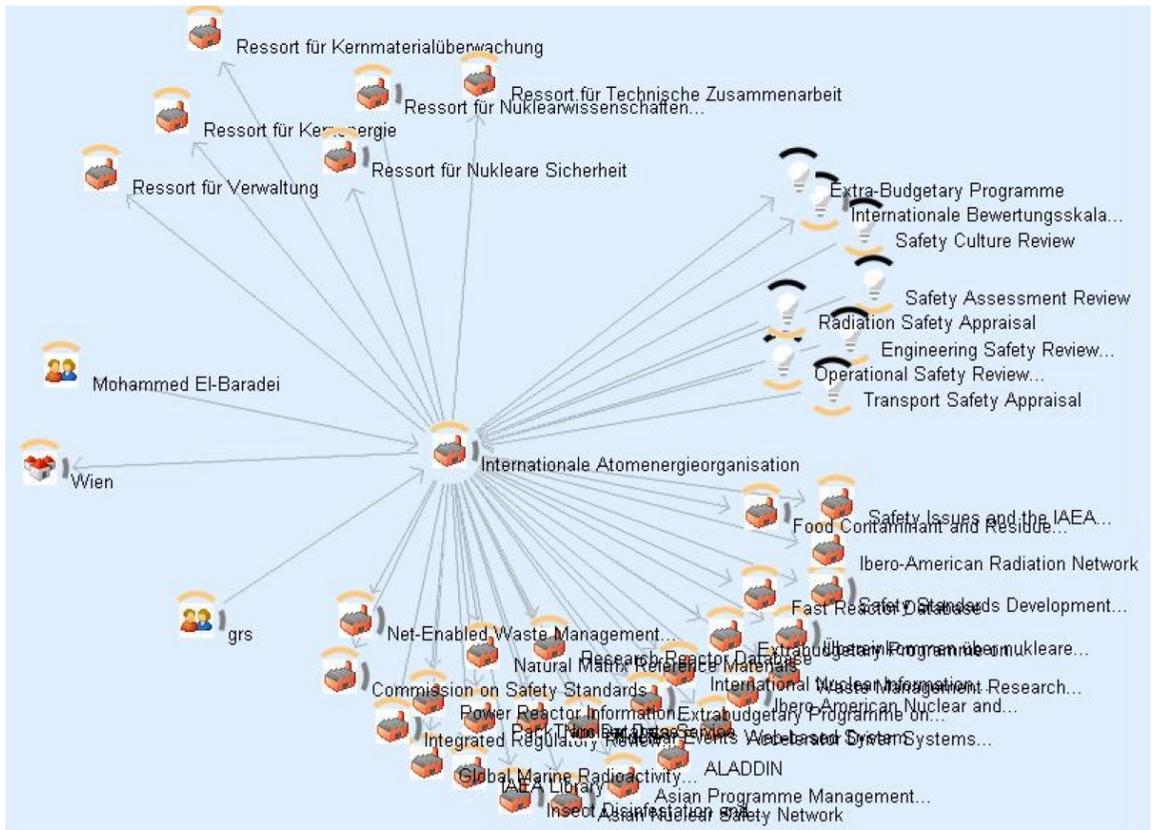
k-infinity tool of intelligent views gmbh

Example of Relations



k-infinity tool of intelligent views gmbh

Example of Displaying an Interactive Network



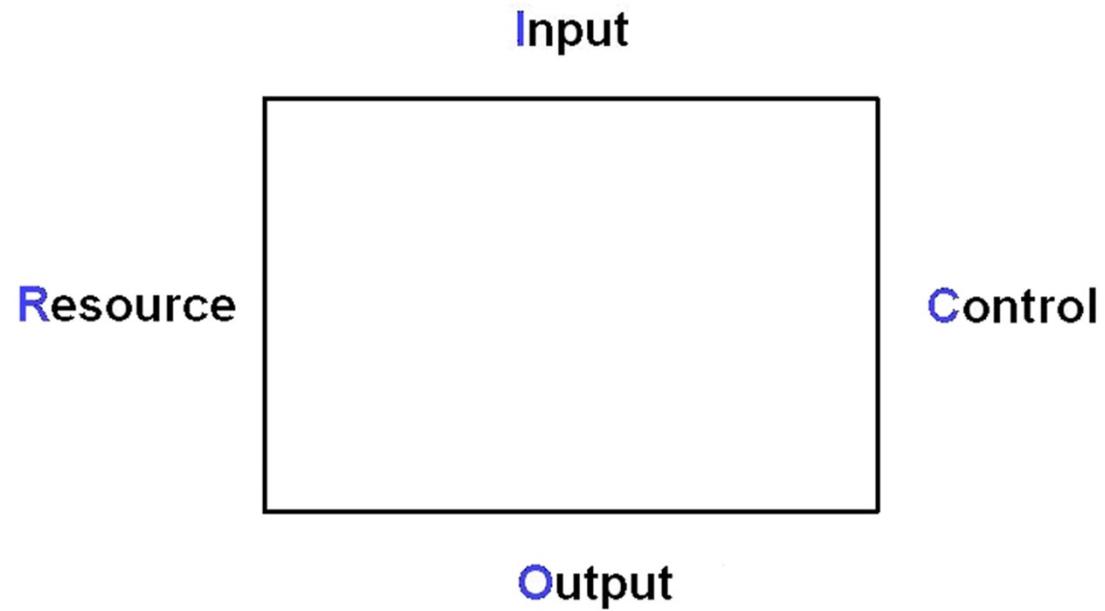
k-infinity tool of intelligent views gmbh

Process Oriented KM: Workflow modelled by use of SADT Features

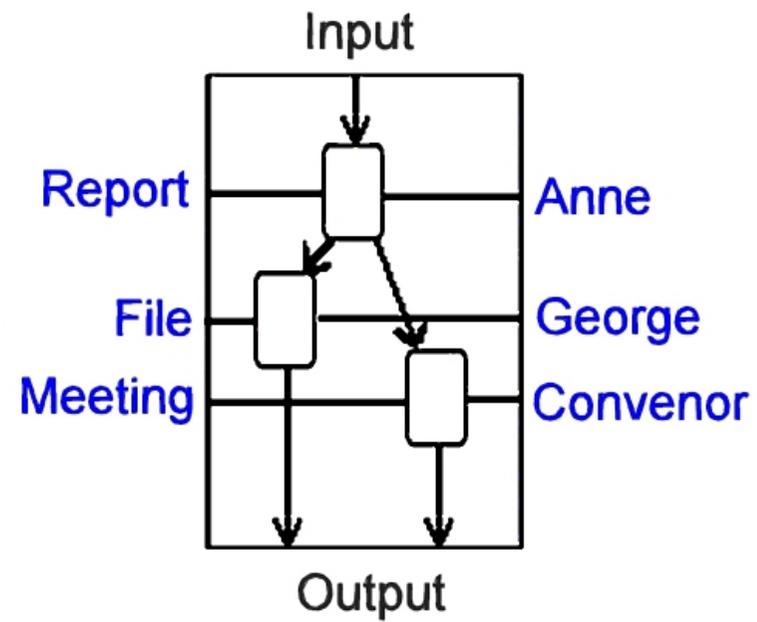
- SADT: the Structured Analysis and Design Technique, which is a trademarked and copyrighted by Softech Inc in 1976. A SADT model is a collection of diagrams organized in a tree structure. (Wikipedia)
- The "box and arrow" graphics diagramming shows a function as a box and the interfaces to or from other function as arrows entering or leaving the box. To express functions, boxes operate simultaneously with other boxes, with the interface arrows "constraining" when and how operations are triggered and controlled.
- Diagrams may be connected by hierarchies / networks

SADT- Diagramming

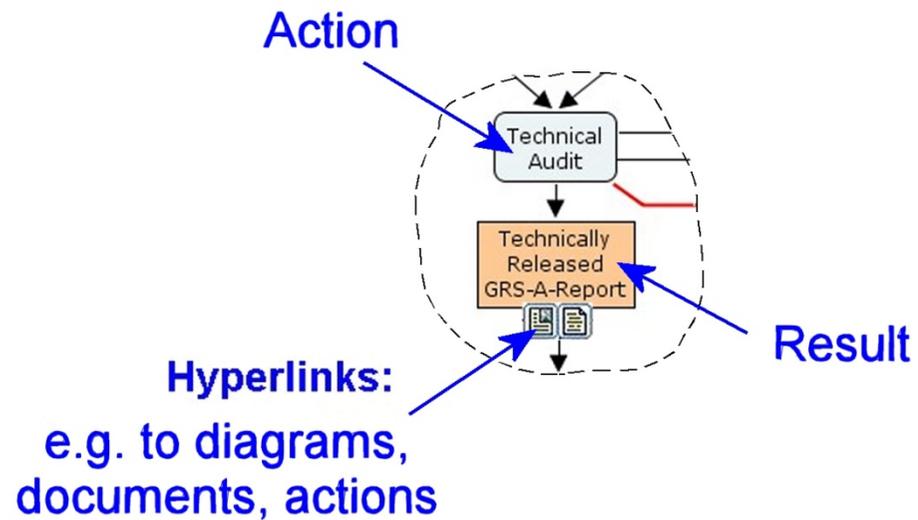
Sides- Arrangement due to the 'ICOR' Principle



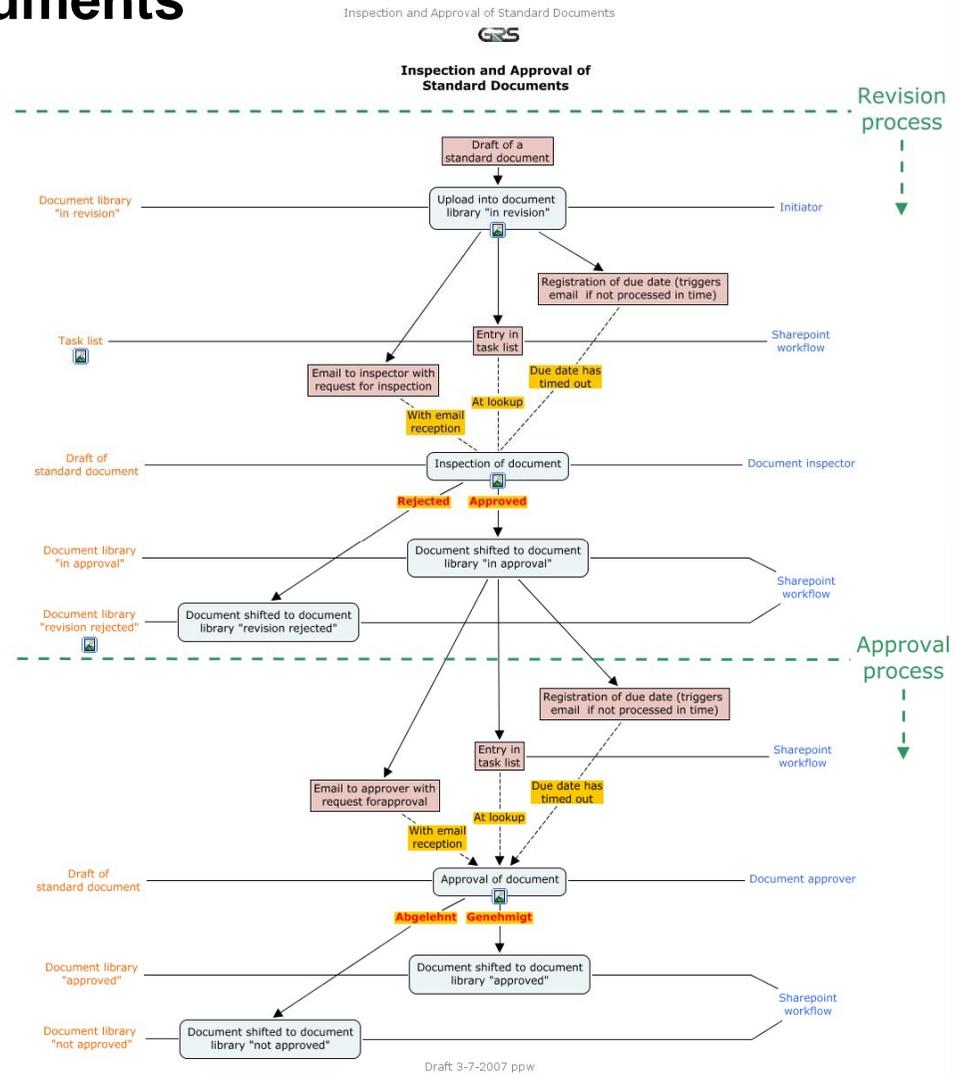
SADT Example Diagram



Knowledge Process Modelling with Cmap and SADT



Example of a Process Description: Inspection and Approval of Standard Documents



Workflow 'Approval of Standard Documents' (1)

The screenshot shows a web browser window displaying an intranet page for document approval. The browser address bar shows the URL: `http://grs-portal/Workflows/FreigabeSD/default.aspx`. The page header includes the GRS logo and the word 'INTRANE'. The main content area is titled 'Freigabe Standarddokumente' and contains two primary sections:

- In Revision (Dokumente zur Prüfung):** A section for documents under review. It includes a table with columns for 'Typ', 'Name', and 'Geändert von'. Below the table, there is a note: 'In dieser Ansicht der Dokumentbibliothek "In Revision" sind keine Elemente anzeigbar. Klicken Sie unten auf "Neues Dokument hinzufügen", um ein neues Element zu erstellen.' A link 'Neues Dokument hinzufügen' is provided.
- In Genehmigung (Dokumente zur Genehmigung):** A section for documents pending approval. It includes a table with columns for 'Typ', 'Name', 'Titel', 'Genehmigung eines SD', and 'Geändert von'. Below the table, there is a note: 'In dieser Ansicht der Dokumentbibliothek "In Genehmigung" sind keine Elemente anzeigbar. Klicken Sie unten auf "Neues Dokument hinzufügen", um ein neues Element zu erstellen.' A link 'Neues Dokument hinzufügen' is provided.

On the right side of the page, there are three additional sections:

- Dokumente nach Status geordnet:** A list of document statuses:
 - Dokumente, die bei der Prüfung abgelehnt wurden
 - Dokumente, die geprüft aber noch nicht genehmigt wurden
 - Dokumente, die nicht genehmigt wurden
 - Dokumente, die genehmigt wurden
 - Dokumente, die geprüft werden sollen
- Aufgaben und Status:** A section for tasks and status:
 - Übersicht über Prüfungs- und Genehmigungsaufgaben
- Beschreibung des Workflows:** A section for workflow description:
 - Workflowbeschreibung als klickbare CMap
 - Workflowbeschreibung als Dokument

At the bottom of the page, a large flowchart titled 'Prüfung und Freigabe von Standarddokumenten' is displayed. The flowchart is divided into two main horizontal sections: 'Prüfungsprozess' (top) and 'Genehmigungsprozess' (bottom). The 'Prüfungsprozess' starts with 'Prüfung des Dokuments' and leads to 'Freigabe des Dokuments'. The 'Genehmigungsprozess' starts with 'Genehmigung des Dokuments' and leads to 'Freigabe des Dokuments'. The flowchart includes various steps, decision points, and roles involved in the process.

Workflow 'Approval of Standard Documents' (2)

- The workflow has been built by use of
 - MS Sharepoint integrated basic workflows (such as 'Approval')
 - User designed workflow on base of elements provided by MS Sharepoint Designer

The screenshot displays the 'Details für 'Protokollierung 2' angeben' window in Microsoft SharePoint Designer. The window is titled 'Schrittname: Protokollierung 2'. Below the title, there is a section for defining conditions and actions for this workflow step. The main area contains two conditional action blocks. The first block is triggered 'Wenn Verknüpfen beginnt mit http://info.grs.de/Workflow/InRevision' and contains three actions: 'Erkennt: In Revision' for logging, 'In Revision:Titel' for logging, and 'Aufgaben:Status' for logging. The second block is triggered 'Andernfalls wenn Verknüpfen beginnt mit http://info.grs.de/Workflow/InGene' and contains three actions: 'Erkennt: In Genehmigung' for logging, 'In Genehmigung:Titel' for logging, and 'Aufgaben:Status' for logging. On the right side, there is a 'Workflowsschritte' pane showing a list of steps: 'Beendigung Teilaufgabe', 'Protokollierung 1', 'Protokollierung 2' (highlighted), and 'Ergebnisauswertung'. At the bottom of the window, there are several buttons: 'Workflow überprüfen', 'Initiierung...', 'Variablen...', 'Abbrechen', '< Zurück', 'Weiter >', and 'Fertig stellen'.

Full Text Searching

- Lessons learned from the web: searching with Google, Yahoo, Altavista- expecting the same features and performance for portal searching
- Bad surprise- portal searching is different
 - Poor ranking mechanisms, among others because of small statistical base
 - Any www search engine opens up less than 20 % of web content; this is hardly perceived because users don't overlook the search domain
 - in a portal, a search domain is often well known to the user- a bad surprise is to not find something of which you know that it is in
- Being aware of different search mechanisms- e.g. word breaking, stemming:
 - Searching for “management tool” is different from searching for management tool, or management's tool

Formal / informal Knowledge Management

- Formal concepts, frame works and modelling to promote machine / network reasoning
 - Procedural approaches
- Informal / partly formal KM for humans, with machine / network support
 - Value added by statistical means: context identification, keywords extraction

The Bulk: Information Management

- Also a lesson learned from the web: vast amounts of unstructured information, now accessible by full text search

- Accessibility must be possible for all information of an organisation or community

Bulk Data

- Print, film, magnetic, and optical storage media produced about 5 exabytes of new information in 2002.
- Ninety-two percent of the new information was stored on magnetic media, mostly in hard disks.

1 Exabyte = 100.000 Terabyte = 100.000.000.000 Megabyte

(From study „How Much Information”, 2003 Lyman, Peter und Hai R. Varian, UC Berkeley's School of Information Management and Systems)

Bulk Data

- Storage Medium Paper (in Tera Bytes = 1 Mio. Megabyte)

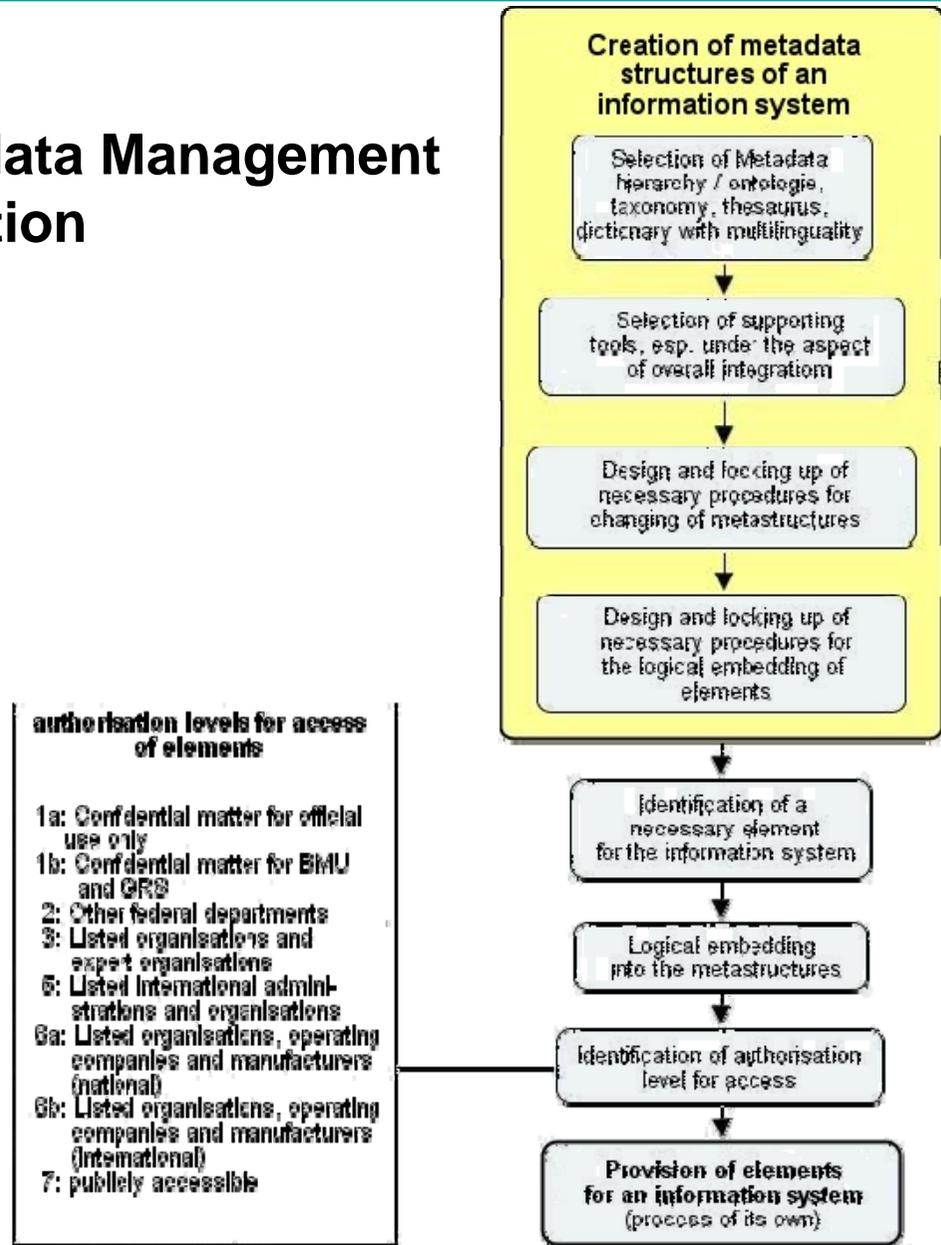
Type of Content	Upper Estimate	Lower Estimate
Books	39	8
Newspapers	138.4	27.7
Office Documents	1,397.5	279.5
Mass market periodicals	52	10
Journals	6	1.3
Newsletters	0.9	0.2
Subtotal	1,633.8	326.7

(From study „How Much Information”, 2003 Lyman, Peter und Hai R. Varian, UC Berkeley's School of Information Management and Systems)

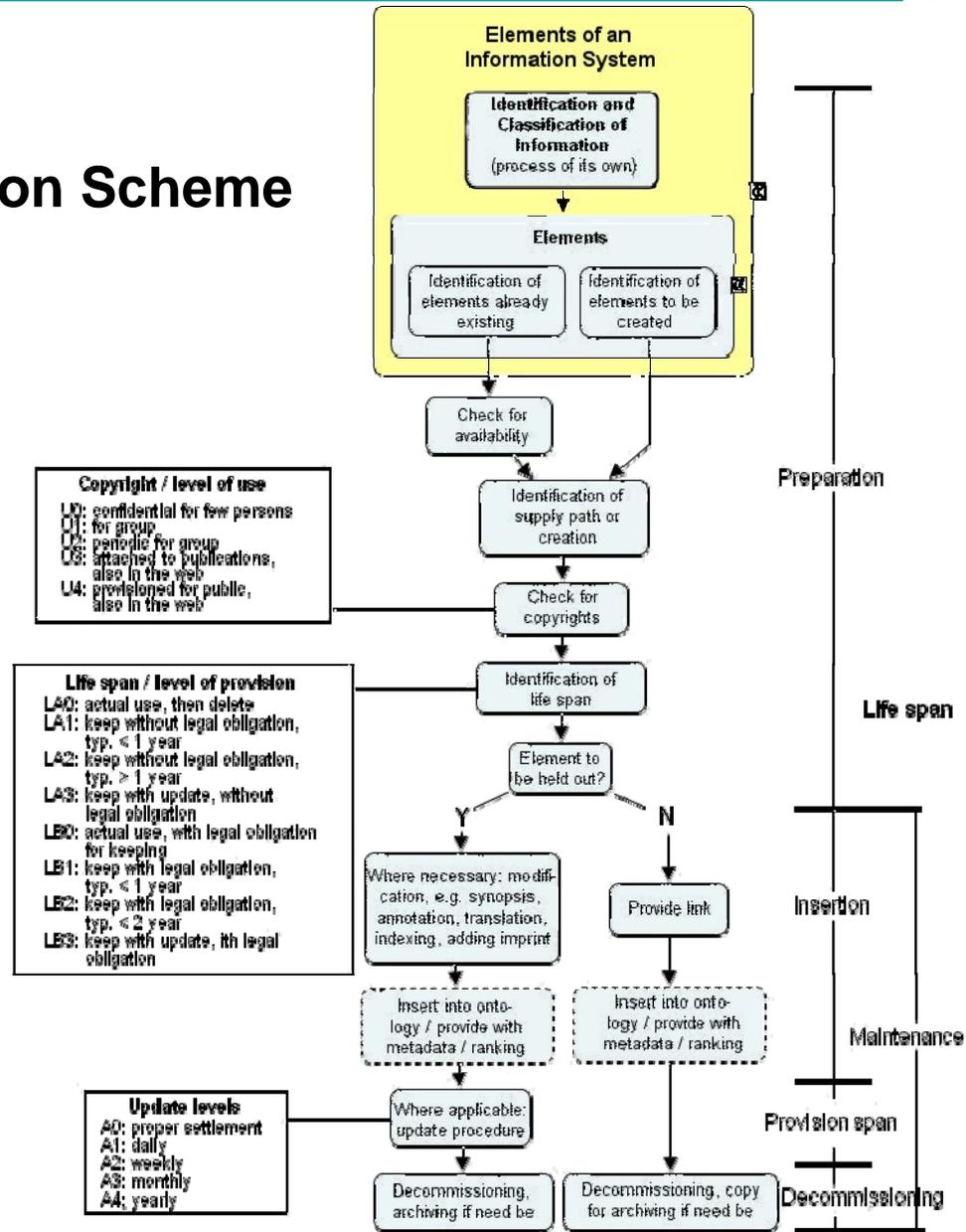
Document Management Systems

- Embedding into the organisation
- Structure management
- Management of documents

Preparation of Metadata Management and Document Insertion



A Document Classification Scheme



Improving Organizational Performance with a KM System- what has been implemented at GRS

- An intranet portal system with document management , containing
 - Yellow pages, announcements, data collections, support informations, , suggestion box, newsticker for workscope news, message boards for depts.
 - Knowledge representations of skill areas
 - Complete documentation sets for all running projects
- Various collaboration platforms for internal / external and mixed use
 - Presently 15 portals

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Thank you for your Attention