- SEMANTICS FOR THE WEB -

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Semantic information integration with ontologies

Semantic technologies have the power to revolutionize the IT world. In a heterogeneous world of information they allow a flexible and seamless integration of applications and data sources. They provide an intelligent access, understand context, give answers and generate knowledge.

"We tackle one of the hottest IT topics around in The Semantic Web: Trying to Link the World'. The Semantic Web is shaping up to be a potentially powerful technology that will allow much better search, information access and data interoperability. It also has the potential to improve machine-to-machine communication, thereby creating a new wave of automation."

Gartner Group, "Innovating Information Supply", 09/2001

Considering the growing amount of distributed information in applications, databases, intranets and the internet companies know that the ability to handle and use that information is key to their success. Trying to integrate them often is a big struggle with different data formats, structures and schemas. The main problem is that approaching the issue on a syntactical level lacks of an important aspect of information - the meaning. Being able to understand the meaning of information brings information integration to a new layer of automation and flexibility. Additionally it allows for an intelligent information access, understanding coherences, being able to infer implicit and therefore new knowledge.



Three core technologies enable this new generation of IT. Ontologies as the backbone of semantic applications are a set of shared concepts and their interconnections. They define all concepts in a taxonomical structure, their attributes and relations. Ontologies can be specified for applications (usage-oriented) or define a knowledge domain.

Metadata link the data with the ontologies. The semantic Web is enriched with semantic metadata. Structured information stored in databases can be linked automatically. Wrappers, information extraction and text analysis combine unstructured information with the model and thereby create metadata.

Relations can be qualitatively exploited and axioms can be defined through the addition of logic expressions to ontologies. These axioms can be processed with an inference engine.

Powerful inferencing allows for upgrading the integration and mapping issue from a concrete to an abstract level. Through the definition of simple axioms the effort of mapping heterogeneous structures, formats and schemas can be minimized. Additionally logical relations can be modelled to break the disadvantages of syntactical approaches.

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Example: employee E is member of project P. Project P relates to the finance sector. A simple rule can be defined that if an employee is member of a project and the project is taking place in a specific sector then the employee has knowledge of the sector. This rule is valid for all occurrences of employees, projects and sectors and has to be defined only once and not for each occurrence. Through axioms additional aspects can be handled like personalization, access trough various devices and localization.

Putting a semantic layer on a syntactical architecture is creating an environment where the integration issue can be upgraded to an abstract level where graphical modelling allows a yet unknown degree of flexibility and sustainability in developing and maintaining applications.



Architecture Semantic Information Integration

The portal scenario: finding the expert

Finding the right people with the right knowledge in an organization can be a difficult task. The question is how to define an expert. Is somebody an expert in java development if this is specified in the HR system? Probably. Is he an expert with setting up Java on a certain operating system? Well, without semantic integration we would have to ask the project management system or take a look at the file server if he has written a related documentation. Additionally one could take a look at the java classes if they are specified with the right metadata. Having some luck we can find the right expert who is helping us out with our specific problem. The solution of the problem is based on two manual tasks: the integration of information from different systems and the logical combination of those. Overall we would first have to know where we can find the information and access them manually. Portals have taken that into account and are helping employees to access all kind of information.

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By exploiting the possibilities of semantic technologies the solution of the problem can be automated. First of all the integration of heterogeneous sources can be done on an abstract level. It is no longer necessary to concretely map each database, schema, structure, application with each other leading to a highly complex (N^2) problem. Whereas on an abstract level there is only one relation between the structure and the model, the ontology. The mapping effort comes down to a linear problem. Furthermore the relations can be graphically modelled and don't have to be programmed leading to a homogeneous, solid and maintainable architecture.

Additionally through the use of logical expressions (rules) and relations the access to the information is brought to a new level. With the use of ontologies the user can be supported in creating the right queries and the system is able to understand his context. Additionally answers are delivered instead of links to documents if information out of unstructured sources is processed. Finally new knowledge can be derived out of existing information.

Ontoprise is leading in the development of semantic technologies. With its Ontology engineering environment $OntoEdit^{TM}$ and the inference engine $OntoBroker^{TM}$ it delivers sophisticated and market-proven products.

 Products with evolutionary vocabularies (ontologies) will win out.[...]
 Ontology-aware software agents will succeed -- others will age rapidly.
 [...] Ontologies will proliferate, then consolidate, enabling unprecedented interoperability between Internet-connected devices.
 Vendors and users that don't make their systems evolutionary will fall behind and lose out."
 Forrester Research, "How Things Will Communicate", 12/2001

Further information:

- § <u>OntoEdit</u>: Flyer, Tutorial, several papers on ontology engineering
- § <u>OntoBroker</u>: Flyer, F-Logic Tutorial Whitepaper B2B mapping
- Articles:
 "A Smarter Web" by Mark Frauenfelder
 "The Semantic Web" by Tim Berners-Lee
 "Semantic Community Web Portals" by Prof. Dr. Studer, Hans-Peter Schnurr

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