

Designing semantic software by numbers

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A system for creating semantic software could transform application development from a cottage industry to an industrial-style production line. Semantic applications are the next frontier for information science, but creating them is very difficult.

Now, European researchers in the NeOn project are developing tools that will make it easier to create semantic applications, powerful programs that identify data not just by their textual content, but also by the information's relevance to users.

The tools they created are being tested by the Food and Agriculture Organisation (FAO) and by Spain's pharmaceutical industry. The FAO, a project partner, is testing the tools as a means of creating an over-fishing alert system as a means of improving the management of the world's fisheries. (See part two of this two-part article – 'Semantic technologies help world's fisheries')

In Spain, pharmaceutical companies are testing the NeOn tools as a means of allowing the industry to share data resources and exchange information on diseases, epidemiology, treatments, and other medical issues.

Enormous potential

Right now, searching a computer or the internet works by using filenames or keywords, but people still need to sort the results for relevance. This sorting process can become a huge task when assessing large datasets of closely related information like the information

typically kept by the world's major corporations, governments and institutions.

Semantic software promises to revolutionise information science. Semantic applications could be used to turn massive amounts of data into machine-readable, easily identifiable and actionable information.

With semantic applications, searchers can find resources by what data means, its context, relevance and connotations, because the information is machine-readable. Computers can understand the data.

Semantic applications work by using metadata, descriptions of information. The metadata is stored in dictionaries, called ontologies.

An ontology defines the concepts and relationships used to describe and represent a domain of knowledge. An ontology specifies standard conceptual vocabularies with which to exchange data among networked systems, provide services for answering queries, publish reusable knowledge bases, and offer services to allow interoperability across multiple systems and databases.

Ontologies make it possible for machines to find valuable information currently buried in databases and on Web pages, saving time. More importantly, the applications access information that might otherwise be missed, and can find unsuspected connections between different pieces of information.

Such applications can also sort a vast dataset in seconds, a task that could take humans days, weeks or months to do.

A quantum leap

There is just a big problem. Developing semantic applications is a difficult, costly and time-consuming process. Currently, developers work

as a kind of cottage industry – at a small-scale and loosely organised.

Ontologies are difficult to develop and manage. Little support exists for collaboration so individuals or small teams do most of the work. There is no standard way for re-using existing semantic resources.

There are many projects that have, at the cost of great effort, resulted in semantic applications. However, the NeOn team is creating what is called a ‘development environment’ that will make the design of semantic applications much simpler.

While Henry Ford created a paradigm shift in manufacturing by implementing production lines in his factory, NeOn’s researchers intend to create a similar shift in the development of semantic applications.

Their strategy is the difference between making just one car and employing a production line so that lots of people can work together to make more cars quicker.

“NeOn’s goal is to make a quantum leap in the level of support for semantic application development,” explains Enrico Motta, the project’s coordinator. “We want to create an industrial strength development environment that gives software engineers all the tools they need to create semantic applications easily.”

There are three main thrusts to the researcher’s work: a toolkit, a methodology and case studies. All three tasks feed into each other.

As the tools are developed, the methodology becomes more defined. The researchers then test and refine both the tools and the methodology in case studies with the FAO and the Spanish pharmaceutical industry.

The NeOn researchers are tackling every aspect of semantic application

development. One team is working on the dynamics of managing and updating ontologies across networks, a major innovation.

Other researchers are working on developing collaborative tools, so distant teams can work together. A third group is studying how ontologies can be adapted to different applications or contexts.

Finally, the researchers are looking at human-ontology interaction.

“Traditionally, semantic applications forgot about the human beings,” says Motta. “NeOn is also looking at the way people interact with these novel technologies, their issues and expectations.”

Novel studies

The project team conducted novel empirical studies to determine how developers worked and the problems they encountered in designing semantic applications. Then the researchers developed solutions, new tools or methods to create such applications simply and easily. The toolkit they developed can accept plugins, the software modules used to extend the functionality of specific software.

The project just entered the third year of its four-year term, and already the researchers have developed working prototypes. The researchers plan to continue the work after the lifetime of the project, which ends in early 2010.

“The NeOn platform is open source software, which means people can change and adapt it,” says Motta. “We are currently setting up the NeOn Foundation to foster a community around the technology. This will ensure it gets maintained, updated and improved over time.”

A free prototype is already available for download. But by the end of the NeOn project, which received funding from the EU's Sixth Framework

Programme for research, the team plans to have created a fully-functional, development environment for semantic applications.

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