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The Pragmatic Web: A Manifesto

The Web has been extremely successful in enabling information sharing among a seemingly unlimited number of people worldwide. The ever-growing amount of documents on the Web, however, results in information overload and often makes it difficult to discover the information that is relevant. The goal of the Semantic Web is to develop the basis for intelligent applications that enable more efficient information use by not just providing a set of linked documents but a collection of knowledge repositories with meaningful content and additional logic structure. Data and rules for reasoning about data and information are systematically described, for example by using the Resource Description Framework (RDF), after which they can be more easily shared and used by people as well as by distributed software agents. The main components for implementing the Semantic Web are ontologies. Ontologies represent concepts and relations between the concepts; these can be hierarchical relations, whole-part relations, or any other meaningful type of linkage between the concepts.

Will it work this way? According to Rob McCool, cofounder of the large-scale RDF project TAP, the answer is negative. "Because it's a complex format and requires users to sacrifice expressivity and pay enormous costs in translation and maintenance, the Semantic Web will never achieve its widespread public adoption." The most problematic assumption is that context-free facts and logical rules would be sufficient [1]. Internet researcher Munindar Singh, well-known for his pioneering work on agent communication, writes: "If there is one lesson to be learned from the long history of databases, it is that it is practically impossible to describe data well enough for it to be used in arbitrary applications" [2]. These warnings echo the insights put forward by Winograd and Flores in 1986 when they criticized the notion of

context-independent knowledge underlying many AI efforts of that time.

However, it is not necessary to reach for context-independent ontological knowledge. Most of the ontologies used in practice assume a certain context and the perspective of some community. Therefore, there are branch-specific ontologies, for instance, for the construction industry or computer science. These ontologies enable clear and precise interorganizational communication and interaction within distinct professional boundaries.

Ontologies are not fixed, but co-evolve with their communities of use. Communication partners have to agree continuously on what they can assume to be the shared background. This is especially important in an organizational context where parties from different professional, social, and cultural backgrounds need to understand each other. In order to enable the use of the Web for communicating, agreeing upon, and cooperatively modifying ontologies, the support provided by the Semantic Web is insufficient. An ontology is an agreed-upon conceptual specification used for making ontological commitments. The crucial question is: how do human agents commit and renegotiate their meaning commitments? And what kind of socio-technical infrastructure is required to leverage these conversations? This Pragmatic Web constitutes the new challenge that will not replace but extend the Semantic Web. As Singh writes: "The best hope for the Semantic Web is to encourage the emergence of communities of interest and practice that develop their own consensus knowledge on the basis of which they will standardize their representations" [2].

Consider the following example, in which a German architect is responsible for building a so-called low-energy house. The architect must find, choose, and coordinate all relevant trades. In order to do so, the concept of "low-energy house" must be clarified. In Germany, there are regulations specifying that new houses must only need the equivalent of two to three litres of energy per square meter of area. To search for potential window manufacturers (WMs), current search engines suffice, although a general ontology may offer improvement. But once negotiations with different window manufacturers begin, a branch-specific ontology is required that includes, for example, the specification of construction materials. The WM should only use highly insulated window frames and should construct the windows using specific techniques to avoid thermal bridges. If the WM is not German, the legal regulations might be unknown and so the manufacturer must understand the underlying ontology and commit to it. It can also occur that the partners must add new concepts to the existing ontology. For example, they might have to agree on a specific type of low-energy house, namely one using three litres of energy per square meter of area with controlled ventilation and using geological heat sources. Such a concept is not an objective description of a given reality, but is developed within the conversation between the parties, who in their conceptualization of this kind of house take into account many tacit, non-formalizable context factors. The effect of the resultant joint definition may be that contract negotiation is smoothened, or even that the costs are reduced since some requirements may turn out to be superfluous.

The vision of the Pragmatic Web is thus to augment human collaboration effectively by appropriate technologies, such as systems for ontology negotiations, for ontology-based business interactions, and for pragmatic ontology-building efforts in communities of practice. In this view, the Pragmatic Web complements the Semantic Web by improving the quality and legitimacy of collaborative, goal-oriented discourses in communities.

In order to realize the Pragmatic Web vision, new systematic analysis approaches are required. Insights from the language-action perspective, among others, can serve as a theoretical foundation for communication modeling and system design. To set the research agenda for this important next phase in the evolution of the Web, we will be conducting the First International Pragmatic Web Conference this year in Stuttgart, Germany. Details about this event and about Pragmatic Web research are available at www.pragmaticweb.info. C

References

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