INTELLIGENT INFORMATION PROCESSING

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INTELLIGENT INFORMATION PROCESSING

IFIP - The International Federation for Information Processing

IFIP was founded in 1960 under the auspices of UNESCO, following the First World Computer Congress held in Paris the previous year. An umbrella organization for societies working in information processing, IFIP's aim is two-fold: to support information processing within its member countries and to encourage technology transfer to developing nations. As its mission statement clearly states,

IFIP's mission is to be the leading, truly international, apolitical organization which encourages and assists in the development, exploitation and application of information technology for the benefit of all people.

IFIP is a non-profitmaking organization, run almost solely by 2500 volunteers. It operates through a number of technical committees, which organize events and publications. IFIP's events range from an international congress to local seminars, but the most important are:

- The IFIP World Computer Congress, held every second year;
- open conferences;
- working conferences.

The flagship event is the IFIP World Computer Congress, at which both invited and contributed papers are presented. Contributed papers are rigorously refereed and the rejection rate is high.

As with the Congress, participation in the open conferences is open to all and papers may be invited or submitted. Again, submitted papers are stringently refereed.

The working conferences are structured differently. They are usually run by a working group and attendance is small and by invitation only. Their purpose is to create an atmosphere conducive to innovation and development. Refereeing is less rigorous and papers are subjected to extensive group discussion.

Publications arising from IFIP events vary. The papers presented at the IFIP World Computer Congress and at open conferences are published as conference proceedings, while the results of the working conferences are often published as collections of selected and edited papers.

Any national society whose primary activity is in information may apply to become a full member of IFIP, although full membership is restricted to one society per country. Full members are entitled to vote at the annual General Assembly, National societies preferring a less committed involvement may apply for associate or corresponding membership. Associate members enjoy the same benefits as full members, but without voting rights. Corresponding members are not represented in IFIP bodies. Affiliated membership is open to non-national societies, and individual and honorary membership schemes are also offered.

Foreword

The papers in this volume represent the program for the Conference on Intelligent Information Processing (IIP 2002) held in conjunction with the 17th World Computer Congress of the International Federation of Information Processing (IFIP), which convened in Montreal, Canada, August 26–29, 2002. The conference represents a major activity of IFIP Working Group 12.5, dedicated to "knowledge-oriented development of applications," of Technical Committee 12, on Artificial Intelligence. Working group 12.5 brings together an international community of scientists concerned with the use of knowledge-based techniques in the engineering of real-world software systems.

IIP 2002 emphasized discussions of knowledge-based system architectures and intelligent information management. Invited talks and panels highlighted important new topics, such as the use of ontologies to support knowledge-based applications, the emergence of knowledge-based techniques on the Web, agent-oriented architectures, and fundamental questions of knowledge representation.

The majority of the conference was devoted to presentation of the scientific results contained in this volume. Through oral presentations, panels and poster sessions, attendees discussed varied dimensions of intelligent information processing. All papers were refereed by at least two reviewers. Of the 44 manuscripts submitted to the conference, the program committee was able to accept 17 full papers and 12 posters. Two keynote presentations and five invited surveys constituted an important part of the conference:

- H. Akkermans (The Netherlands): Being Smart in Information Processing: Technological and Social Challenges and Opportunities
- B. Chandrasekaran (USA): Multimodal Representations as Basis for Cognitive Architecture
- N. Jennings (UK): Agent-Based Computing
- J. Hendler (USA): The Semantic Web

- E. Motta (UK): Architectures and Solutions for the Knowledge Web
- W. Nejdl (Germany): Semantic Web and Peer-to-Peer Technologies for Distributed Learning Repositories
- W. Wahlster (Germany): Personalized Web Interaction

IIP 2002 would not have been possible without the hard work of the scientific program committee. The program co-chairs are also grateful to Nenad Stojanovic and Eva Elliott for their expert assistance in handling manuscripts and assembling these proceedings.

We hope that you will find these proceedings a valuable collection of some of the most stimulating work taking place internationally in the area of intelligent information processing. The emergence of novel architectures for intelligent systems, the advent of the Semantic Web, and the maturation and widespread dissemination of techniques for the construction of intelligent systems make these exciting times for the knowledge-oriented development of software applications. These proceedings serve as a written record of the contributions made by the participants of IIP 2002 and of the promising new results of research in applied artificial intelligence.

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BEING SMART IN INFORMATION PROCESSING

Technological And Social Challenges And Opportunities

Hans Akkermans
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Abstract: A very exciting development in current intelligent information processing is the Semantic Web and the innovative e-applications it promises to enable. This promise will not come true, however, if research limits itself to the technological aspects and challenges only. Both supply-demand sides and business-technology sides need to be investigated in an integrated fashion. This implies that we simultaneously have to address technological, social, and business considerations. Therefore, a comprehensive research strategy for the next decade of intelligent information processing must be of an integrated socio-technical nature covering different levels: (1) Definition and standardization of the baseline infrastructures, content libraries and languages that make up the Semantic Web; (2) The associated construction of generic smart web services that dynamically bridge the low-level (for the end user) infrastructures and the high-level user applications; (3) Designing and studying innovative e-services, information systems, and business processes at the domain, customer, and business level; (4) Understanding and influencing the business and market logics and critical success factors that will determine the social adoption of smart web-based innovations.

Key words: Keynote IFIP IIP-2002

1. EXCITING NEW TECHNOLOGIES

A very exciting development in current intelligent information processing is the Semantic Web (cf. [Berners-Lee et al., 2001] [Fensel et al., to appear]) and the innovative applications it promises to enable. The Semantic Web will provide the next generation of the World Wide Web. The current Web is a very interesting and successful, but also passive and rather unstructured storage place of information resources. This makes it increasingly difficult to quickly find the right information you need, a problem that becomes even

more pressing with the scaling up of the Web. The vision of the Semantic Web is to make the Web from a passive information store into a proactive service facility for its users. This is done by equipping it with information management services, based on semantic and knowledge-based methods, that let the Web act - in the eyes of its users - as understanding the contents and meaning (rather than just the syntax) of the many information resources it contains and, moreover, as capable of knowledge processing these resources. In the words of Tim Berners-Lee: "The Semantic Web will globalise knowledge representation, just as the WWW globalised hypertext". This globalised semantic approach offers concrete research lines how to solve the problem of interoperability between systems and humans in a highly distributed but connected world.

Designing the infrastructure of the Semantic Web poses major technical and scientific challenges. This is already evident if we look at the envisaged technical architecture of the Semantic Web (see Figure 1) that somewhat resembles a delicately layered cake made from a variety of cyberspace ingredients.

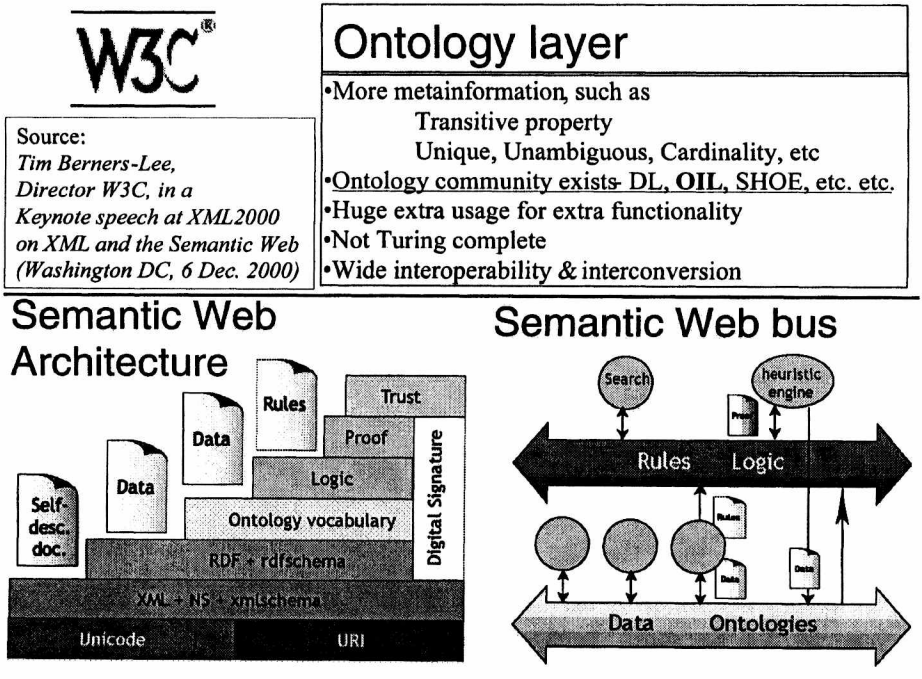

Figure 1. Ingredients and envisaged technical architecture of the Semantic Web.

Some of these ingredients are based on combining existing results and experiences that stem from research areas such as intelligent systems, knowledge representation and reasoning, knowledge engineering and management, or ontology and agent technology. Others are still in the process of invention. Recent progress is reported in the proceedings of this and other conferences and journals (e.g. [Harmelen & Horrocks, 2000], [Staab et al., 2001]).

Challenging and interesting as this is, it is a necessary but not yet sufficient condition to realize the full potential of the Web. For a comprehensive R&D strategy it is necessary to look at the broader picture (depicted in Figure 2) of the Semantic Web: how it is going to be useful in practical real-world applications, and how it will interact with and be beneficial to its users.

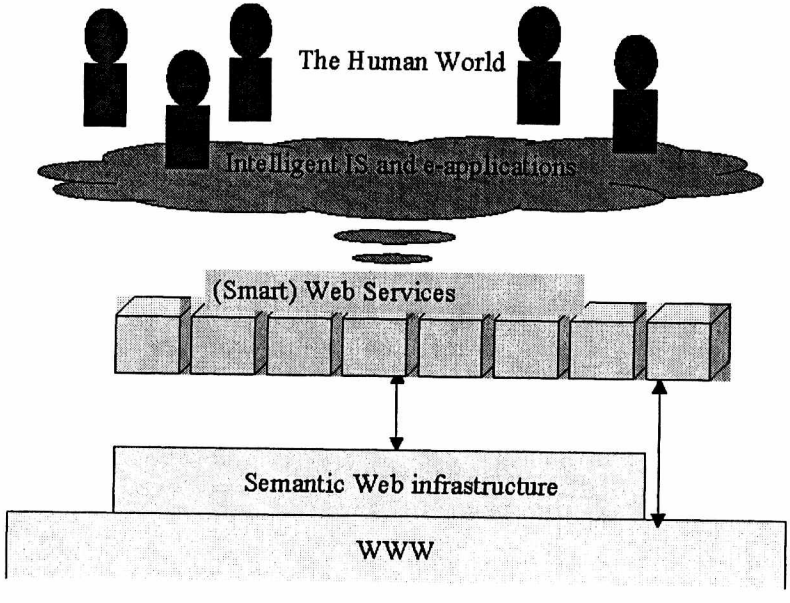

Figure 2. The broader picture: Semantic Web infrastructure, smart services, e-applications and their human-world context.

The ongoing worldwide research effort related to the Semantic Web currently shows an emphasis on those technological issues that are indicated in Figure 2 as web infrastructure and, to a lesser extent, smart web services. This is highly important research because generic semantic infrastructure (such as web ontology languages and content libraries) and associated generic smart web services (such as semantic search, semantic browsing, reasoning,

knowledge processing and ontology management services – these services are highly non-trivial because they must be able to deal with the unavoidable evolutional dynamics of web-based knowledge) are a *conditio sine qua non* for the Semantic Web. Nevertheless, it is also important to look already from the start from an *outside-in* perspective. What are the new business, domain, or user/customer applications that are not yet possible today but will be tomorrow as a result of the Semantic Web? Why would businesses, markets or individuals be willing to adopt such innovations? After all, many great innovations fail or have very long lead times because of significant upfront investments. These are in many cases not just of a financial nature: in addition they require behavioural or -even more problematic- cultural changes from their adopters (whether individuals or organizations). We must recognize that the Semantic Web is such a great innovation. Consequently, there is no reason to assume that the new wave of intelligent information processing is immune to the age-old established social laws that govern innovation adoption [Rogers, 1995].

2. INNOVATIVE E-APPLICATIONS

To illustrate some of the pertinent issues I will consider a few specific examples of advanced intelligent information processing that aim the creation and introduction of innovative e-applications for end users (the third level in Figure 2). In addition to the Web becoming smarter (which is denoted by the Semantic Web effort), it will also become more universal in the sense that it will not just connect computers, but essentially any device. This is variously referred to as "ambient intelligence", "universal connectivity" or "pervasive computing". Mobile commerce applications are one step in this direction, but basically all equipment, including home appliances such as personal audio and video, telecom and home control systems, and even heaters, coolers or ventilation systems, will become part of the Web. This enables a broad spectrum of e-applications and e-services for end consumers in many different industry areas: home security, e-health, e-entertainment, e-shopping, distance learning, digital media services, and smart buildings that are able to manage themselves. All of these new imagined e-services are technically challenging, but will also require and induce different behaviours and attitudes from the end consumers as well as from the businesses delivering these e-services.