

Semantic Web & Mobile Information Access

Ora Lassila

Research Fellow

Head of Data Modeling and Management

Software and Applications Laboratory

Nokia Research Center

&

Elected Member of Advisory Board

World Wide Web Consortium (W3C)

Keynote @ Wireless Connections 2005



CAUTION

CAVEAT EMPTOR:

- **Research guy talking...**
- **Contains personal opinions**
- **Use at your own risk!**

Semantic Web: A Brief Introduction

- Web (content) was built for humans
 - for the most part, *human interpretation* is needed to accomplish tasks on the Web
 - automation is difficult (esp. automating *unforeseen* situations)
- We need “machine-friendly” content
 - solution: content with *accessible formal semantics*
 - allow machines to *reason* about information
- Current Web essentially gives us a framework for “pointing”
 - but this pointing has no meaning (except sometimes through human interpretation)
- Can we improve on this? Maybe...
 - Note: for us humans, separating our own interpretation from (largely syntactic) representation is hard

Motivation & Drivers

- Original driver: Automation
 - it would be nice if computers could do more (on the Web)
 - origins of the Semantic Web are in *metadata*
- Short term goal: Interoperability
 - combining information from multiple sources
 - Web Services: discovery, composition, “serendipity”
- Long term goal: Make computers work *on our behalf*
 - (instead of using them like tools)
 - remove humans from the loop to the extent possible



Semantics via Sharing

- Controlled vocabularies
 - better interoperability if same terms are always used to denote same thing
 - e.g., instead of arbitrary keywords, choose from a list
- What is an “ontology”
 1. a controlled vocabulary
 2. a concept taxonomy
 3. other relations between concepts
 - definition: “A specification of conceptualization” (Gruber)
- Library scientists are good with this
 - Dewey Decimal System *is* an ontology





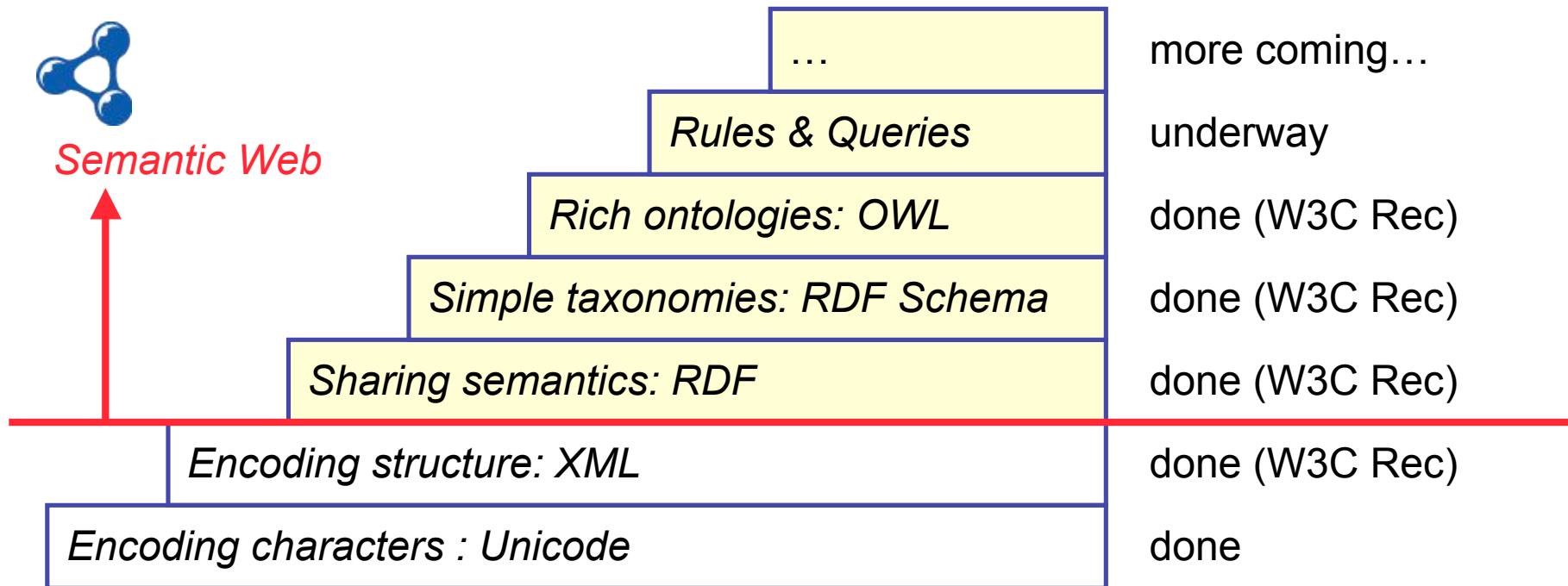
WARNING! Controversial Topic

“I was told that XML is enough...?”

- Typical answer: “yes” (sorry, incorrect)
- What’s going on here...?
 - XML offers a way to introduce new syntax (new names, tags, ...), but no way to introduce, coordinate or share semantics
 - XML’s data model is a tree: if your (representational) problem does not lend itself to be a tree, you lose (sorry – this is even before we get to the “semantics” part)
- Hype still abounds: e.g., “The industry is clearly focusing in on [XML] as the *lingua franca* to enable Web services...” *
 - not only is XML not a *lingua franca*, it is not even a *lingua*

* from a major IT company white paper

Stepping Towards the Semantic Web



- Semantic Web is built in a layered manner
- Not everybody needs all the layers

Mobile Web Access Today

- Web access on mobile devices is available today
- Some *technical limitations*
 - network (bandwidth, latency)
 - display (typically small)
 - input (often no full keyboard)
- Content is typically designed for “standard devices”
 - (= PCs: high bandwidth, large display)
 - most (commercial) content is *rendering-oriented*



Some Issues with Mobile Web Access

- We can overcome the *technical* limitations
 - 3G networks are coming!
 - great progress: mobile browsers are *really* improving
- But the real limitations are of *different nature*...
- Mobile devices are used in “unusual” situations
 - when laptops, etc., are not viable (e.g., in the car)
 - typically, when paying attention to something else
 - mobile users are *attention-constrained*
 - consequently, *browsing* might not be the ideal paradigm for information access
- What do we need?
 - information/content that’s not rendering-oriented
 - more automation (now, humans essentially do all the work)



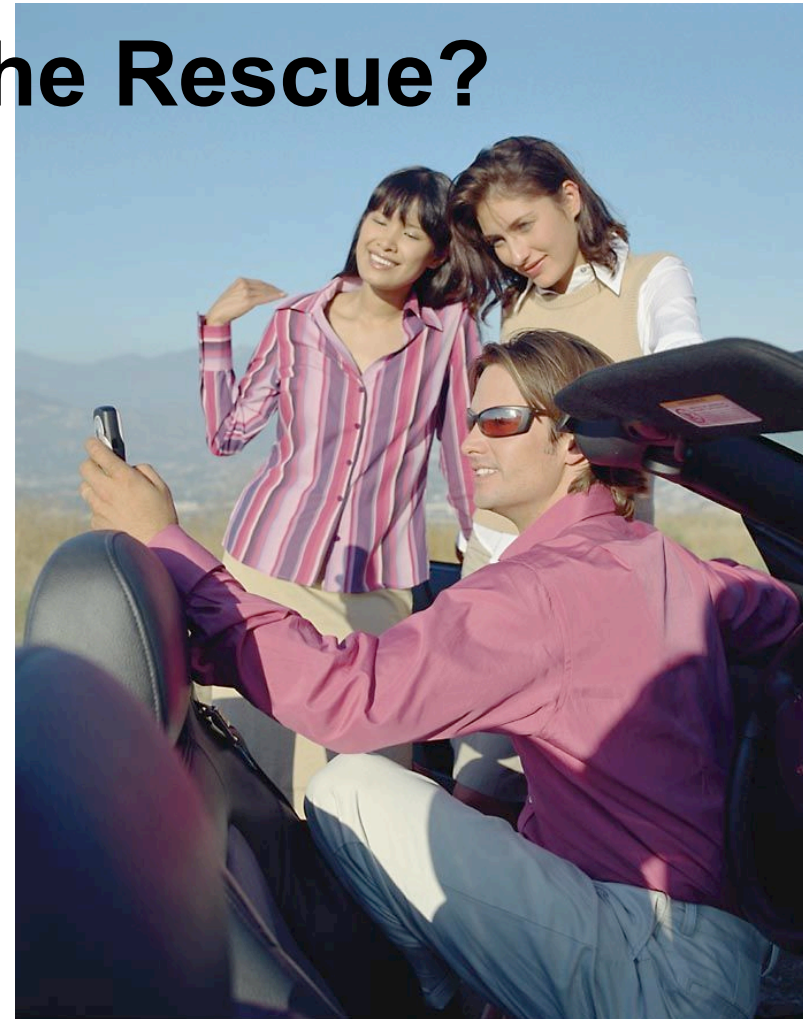
NOKIA

Web Services to the Rescue?

- What are Web Services, really?
 - (“RPC done fancy” – Tim Berners-Lee)
 - integration technology
 - interaction technology (here’s where we can do something)
- Web Services represent a departure from the rendering-oriented Web
 - services make no commitments about specific user interfaces
 - Web Service paradigm decouples user interfaces from service semantics
 - this may even enable higher asynchronicity
- Caveat: Confusing standards situation
 - many standards, standards organizations, “industry white papers”...
 - and again, this architecture was designed for “standard” devices and fast networks

Semantic Web to the Rescue?

- Semantic Web will improve the interoperability of information systems
- Information, in more “raw” form, with semantics, can be used in many different ways
 - not tied to specific rendering, specific device, specific browser, etc.
- Context-awareness and user modeling may be the key
 - Ontological technologies are well suited to context processing



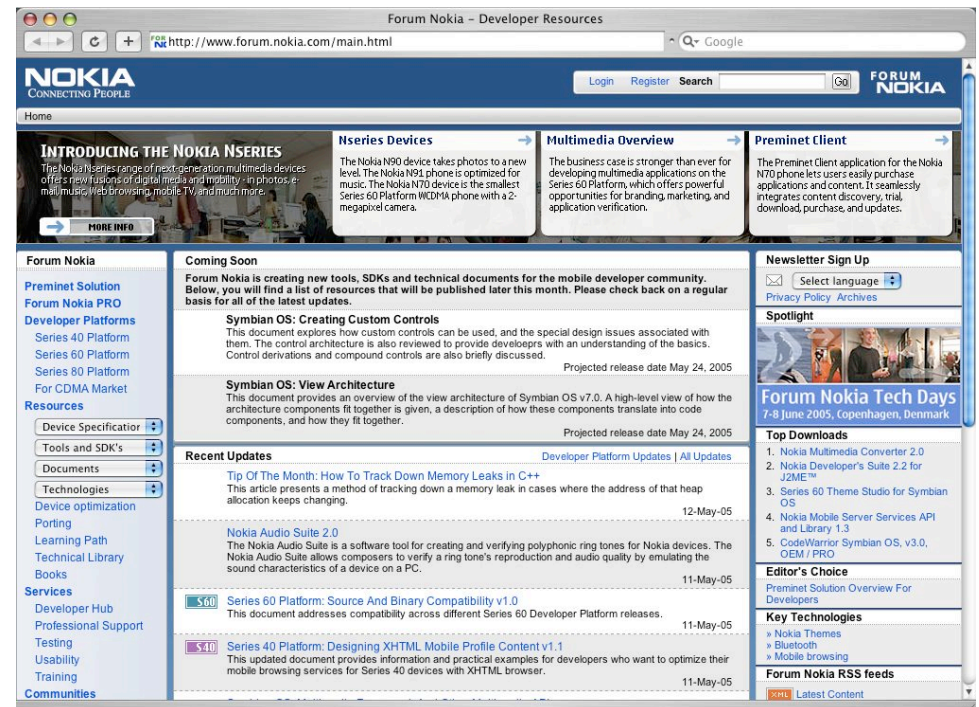
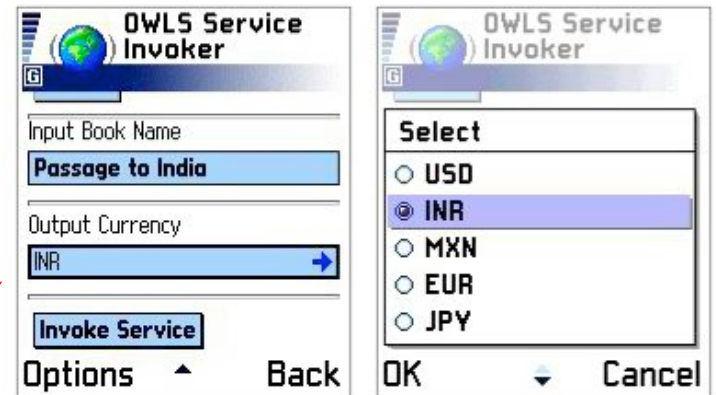
The more we know about the user, the less we have to ask

“Semantic Web Services”? Huh?

- Semantic Web technologies can be used for making content more “understandable” to automated systems
- When this idea is applied to Web Services
 - automatic discovery, composition and invocation are enabled
 - first step: DARPA’s OWL-S activity (Stanford, CMU, Yale, SRI, BBN, Nokia, many others...)
 - let’s not forget the “Tower of Babble” (from Genesis 11:1-9)
- If we can infer what data and services are about, many things become possible, e.g.
 - dynamic, context-dependent generation of user interfaces
 - substitution of “equivalent” services
- Web Services are a good abstraction of *all* kinds of functionality

Nokia & the Semantic Web

- Strong participation in W3C (etc.) standardization efforts
- Active research program
 - rich metadata
 - context-awareness
 - automatic generation of user interfaces
 - “small” reasoning engines
 - our own open source toolkit
 - etc.
- Deployment...
 - e.g., Forum Nokia uses semantic metadata to automate Web site organization



Summary

- Semantic Web is about *data* (as opposed to “content”)
 - allows data from different sources to be combined (automatically)
 - allows machines to do more for you
 - relaxes the dependence on pre-determined formatting and UIs
- Mobile Web access is *difficult*
 - nature of usage situations is the *real* obstacle
 - ultimately, browsing may have to be replaced with more efficient and more appropriate techniques
 - we need *answers to questions*, not just content to see and read
- Web Services represent decoupling of functionality and UIs
 - but this may not be enough...
- Semantic Web Services enable systems to automatically take advantage of Web Services
 - e.g., context-dependent operation

Next Steps (for *You*)

- Learn more about the Semantic Web
 - e.g., <http://www.w3.org/2001/sw/>
- Think in terms of *data*, not in terms of *content*
- Think “ontologically”

