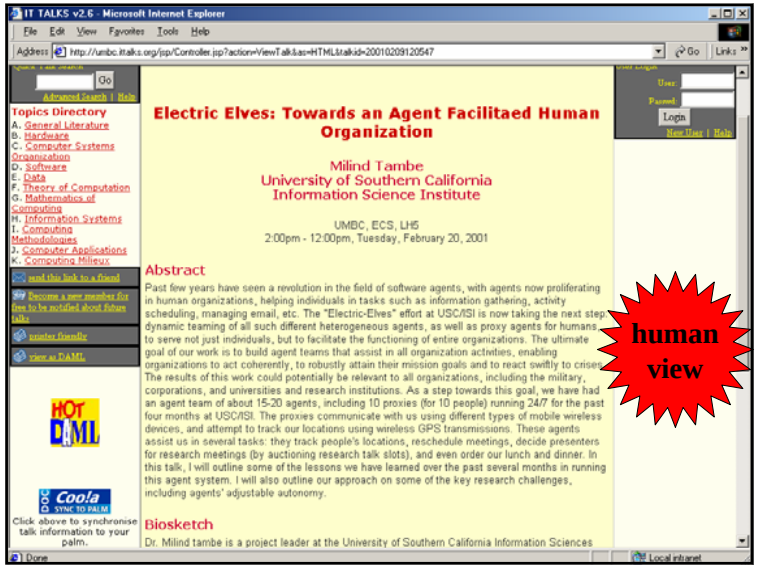
Introduction to the Semantic Web

example applications

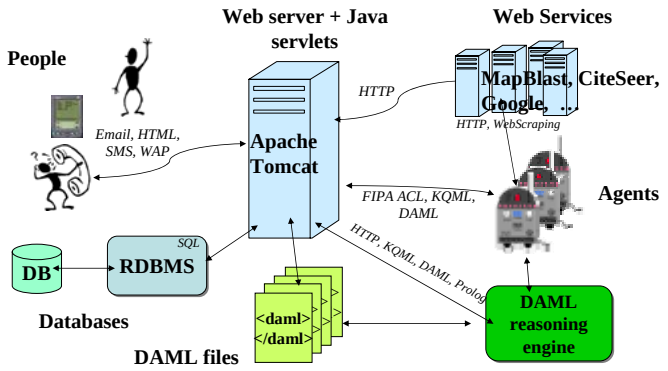
ITTALKS

- **ITTALKS** is a database driven web site of IT related talks at UMBC and other institutions. The database contains information on
  - Seminar events
  - People (speakers, hosts, users, ...)
  - Places (rooms, institutions, ...)
- Web pages with DAML markup are generated
- The DAML markup supports agent-based services relating to these talks.
- Users get talk announcements based on the interests, locations and schedules.

http://ittalks.org/



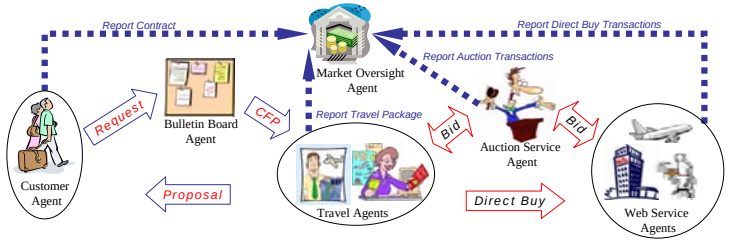
ITTALKS Architecture



Travel Agent Game in Agentcities

TAGA UMBC

Motivation	Features	Technologies	Ontologies
Market dynamics Auction theory (TAC) Semantic web Agent collaboration (FIPA & Agentcities)	Open Market Framework Auction Services OWL message content OWL Ontologies Global Agent Community	FIPA (JADE, April Agent Platform) Semantic Web (RDF, OWL) Web (SOAP,WSDL,DAML-S) Internet (Java Web Start)	http://taga.umbc.edu/ontologies/ travel.owl - travel concepts fipaowl.owl - FIPA content lang. auction.owl - auction services tagaql.owl - query language



FIPA platform infrastructure services, including directory facilitators enhanced to use DAML-S for service discovery

http://taga.umbc.edu/

Acknowledgements: DARPA contract F30602-00-2-0591 and Fujitsu Laboratories of America. Students: Y. Zou, L. Ding, H. Chen, R. Pan. Faculty: T. Finin, Y. Peng, A. Joshi, R. Cost. 4/03

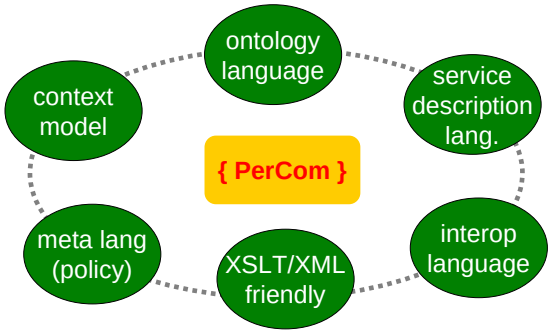
DAML FUJITSU agentcities DARPA

http://ebiquity.umbc.edu/

- Our research group's web site generate both HTML and OWL.
- **HOW?** This is relatively easy since the content is in a database.
- PHP is sufficient for the job.
- HTML pages have links to corresponding OWL
- **WHY?** This exposes the information to programs and agents – no more web scraping.

Mobile & Pervasive Computing Uses

How does OWL Help?



OWL provided a uniformed language which met many needs in developing a complex pervasive computing system.

OWL as an Ontology Language

- Key Benefits
  - Helps to separate the task of knowledge engineering and system engineering
  - Helps to define "semantic" specifications for applications that exploit KR and reasoning
  - Opens the door to the Semantic Web for mobile and pervasive computing applications
    - Gaining access to a vast amount of information on the Web
    - Applications will be less restricted by their sensing capability

OWL as a Service Description Lang.

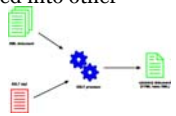
- Key benefits
  - Enables **semantic** service discovery and matching
    - Expressing more detailed and more precise service description
  - Provides a means for ubiquitous service composition
  - Allows intelligent applications to have fine-grain control over system execution
    - E.g. is it economic to print using a close by printer?
    - E.g. is it polite to display my email using the room's project?

OWL as a Language for Interoperability

- Key benefits
  - Encourages independently developed systems to interoperate
    - A standard language backed up the W3C
    - Industrial organizations tend to follow W3C standards
    - Amateurs tend to develop programs based on W3C standards
  - Enables knowledge sharing and reasoning
    - APIs for processing RDF/XML -- the normative exchange syntax of OWL -- are widely available and suitable for building commercial strength applications
    - OWL has well defined language semantics for building OWL reasoners. A few number of OWL reasoners are now available.
  - Provides standard constructs for ontology mapping
    - Multiple ontologies will likely to exist in a shared PerCom space
    - Ontology mapping can help apps. that adopt different ontologies to interoperate

OWL is XSLT/XML Friendly

- Key benefits
  - Information expressed in OWL can be transformed into other languages for external processing
    - OWL => Prolog rules or Jess rules
    - OWL => XHTML
    - OWL => PHP, JavaScript
  - Maximizes the reusability of the knowledge that is encoded in OWL
    - Not all useful tools and applications can process OWL
    - Not all XML developers are willing to switch to OWL
    - Not all users think OWL (esp. in RDF/XML) is easily readable



OWL as a Meta Language

- Key benefits
  - Helps to define new languages to control the high level behavior of a complex system (e.g. policy languages)
    - It's inflexible to adjust the dynamic behavior of a complex system by writing low level code
    - Using meta languages, users can change system behavior without needing to change the low-level system implementation
  - Meta languages (e.g. policy) defined using OWL can be used to work with other knowledge that is expressed in OWL
    - Security -- define policy to control actions that are expressed in OWL
    - Privacy protection -- define policy to protect user private information that are expressed in OWL

OWL for Defining Context Model

- Key benefits
  - Helps to overcome semantic ambiguities in representing contexts using programming languages
    - Java representations of contextual knowledge has limited expressiveness
    - OWL representations have well defined semantics
  - Encourages the reuse of previously defined context model
    - Generic context models (e.g., time, space, actions, policy) can shared and reused by different context-aware systems
    - Tools (e.g., reasoners, APIs) associated with these generic context models often can also be used by different system implementations

Ontology-Driven PerCom Systems

How Different Systems Use Ontology

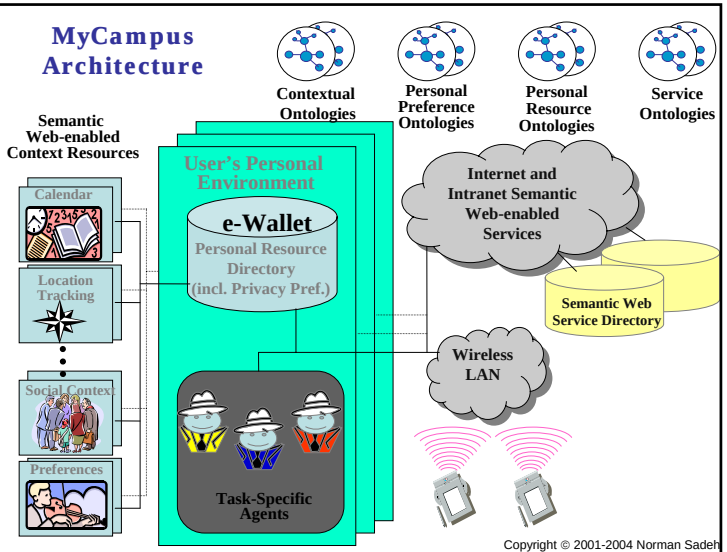
	Context modeling	Interop. Language	Define Meta-Lang. (Policy)	Enhance service discovery	XML/XSLT Integration
myCampus (CMU)	X	X	X		X
Task Computing (Fujitsu)		X		X	
EasyMeeting (UMBC)	X	X	X		
Context Broker Architecture (UMBC)	X	X	X		

CMU MyCampus Project

- **Objective**: Enhance campus life through context-aware services accessible over the WLAN
- Ontologies
  - Personal/contextual: location, calendar, organizational etc.
  - Privacy preferences: who has access to what, "obfuscation" rules
  - Web services: automated service identification and access (OWL-S)

http://www.cs.cmu.edu/~sadeh/mycampus.htm#Video

MyCampus Architecture



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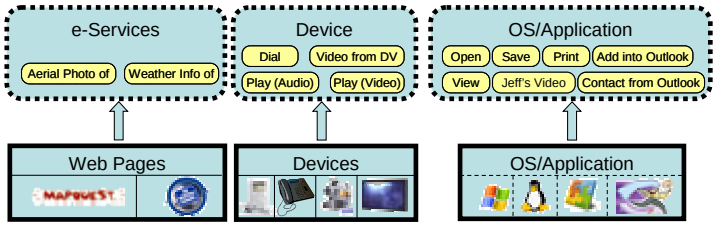
Fujitsu Task Computing

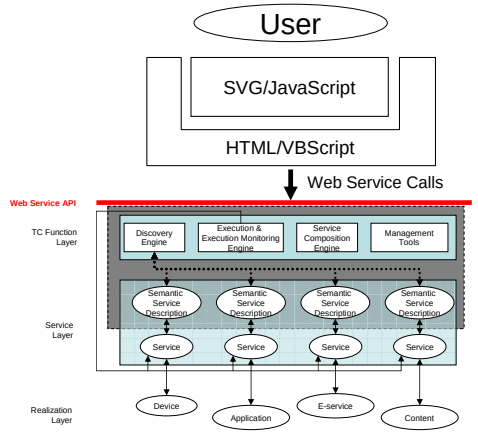
http://www.taskcomputing.org/

- **Objective:** Make computing available throughout the physical environment while it is effectively invisible to the users

Play Jeff's Video
Dial Contact from Outlook
Weather Info of FLA, CP
…

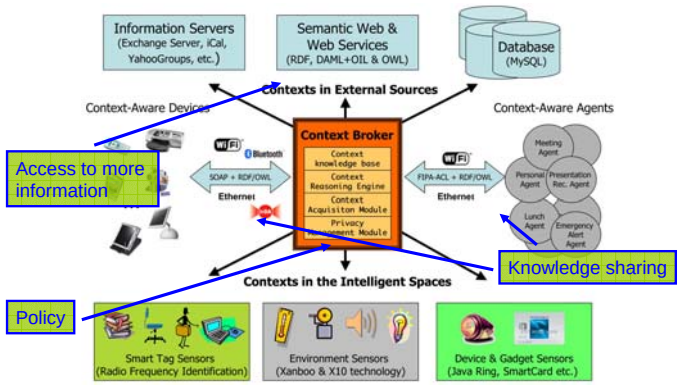


STEER-SIS for Web Services

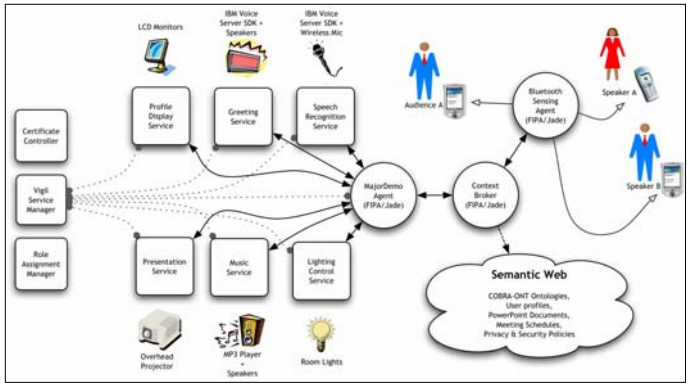


The Context Broker Architecture

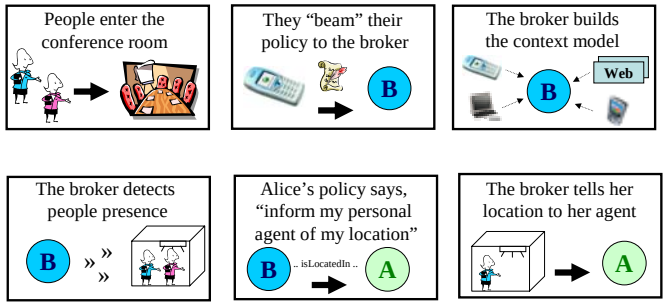
http://cobra.umbc.edu/



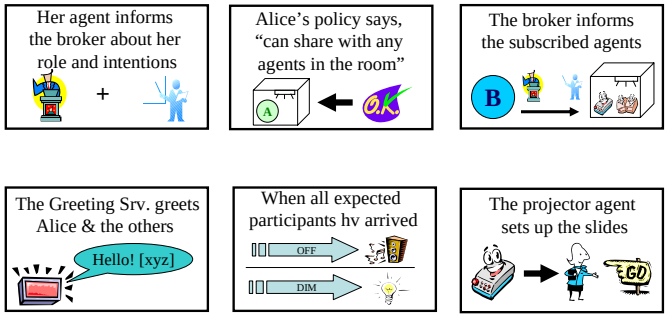
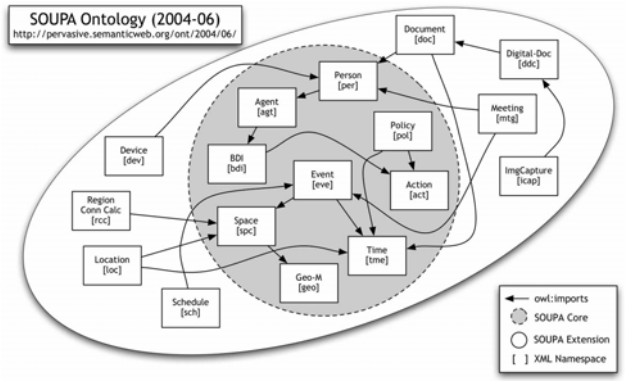
The EasyMeeting System



An EasyMeeting Scenario



An EasyMeeting Scenario



The SOUPA Ontology