

Semantic Web Language Layers

Excerpt from the (better-defined parts of the) W3C "layer cake" diagram:

Logic e.g. RuleML
Ontology e.g. DAML+OIL, OWL
Information – RDF, RDF Schema
Data – XML & Unicode

Proof, trust, etc omitted





Semantic Web & Web Services

- Web Services are
 - Describable using semantically-rich language e.g. DAML-S
 - Locatable using yellow pages / broker services e.g. UDDI
 - Invocable using high-level protocols e.g. SOAP
- Course-grained distributed computing revisited!
- Emphasis on loose-coupling





Agents & Web Services

- Agents are describable, locatable, invocable...
- Agents use messaging rather than RPC-style communications
- Growing use of XML in agent platforms (KQML, FIPA, ...)
- Agents offer greater flexibility in interactions
 real loose-coupling
- So: agents & Web services competition or assimilation?





Intelligent Web Services

- Web services using intelligent systems techniques
- Fusion of
 - (Semantic) Web service technology: W3C standards including (but not restricted to)
 "layer cake" languages
 - Ontology technology: <u>semantic</u> data models, promoting sharing & reuse
 - Agent technology: autonomy, interaction, negotiation





Intelligent Web Services: Applications

- Knowledge management, including
 - communities of practice (COP)
 - intelligent integration of information (I³)
- Ecommerce, including
 - auctions
 - B2B
- Bootstrapping services for the Semantic Web itself, including
 - ontology services
 - brokers
 - markup tools



IEEE IS Jan/Feb 2002 Preece & Decker (eds)





If We Don't... Who Will?

- "Eating our own dogfood"
- The services we can build <u>now</u>, and <u>use</u> ("picking the low-hanging fruit")
 - metadata on ourselves & our activities, supporting COP-building
 - calendar management
 - meeting support
 - travel support
 - etc





The Rest of this Talk

- Vignettes from 3 projects
 - AKT: Advanced Knowledge Technologies
 - CONOISE: Constraint Oriented Negotiation in Open Information Services Environments
 - Agentcities@Aberdeen
- Highlighting
 - Importance of Web standards
 - Role of agents
 - "Dogfood" & "low-hanging fruit"





The AKT Project

- 5 UK university sites
 - Aberdeen
 - Edinburgh
 - Open
 - Sheffield
 - Southampton (lead)
- 6 years
- ♦ 7+ million pounds from EPRSC IRC initiative
- project to develop "whole life-cycle knowledge management tools & techniques"

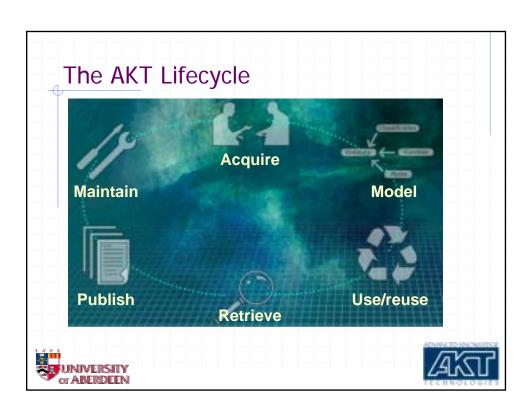
See

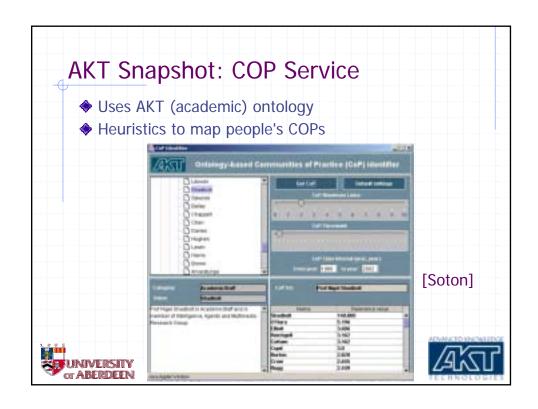
http://www.aktors.org

Industry club of 20+ companies

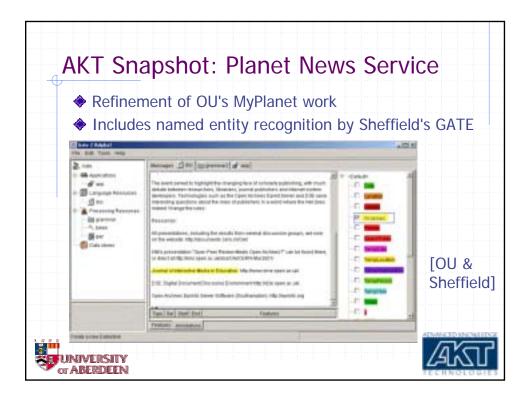


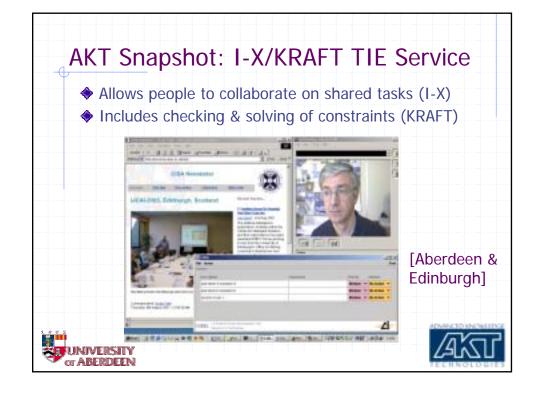


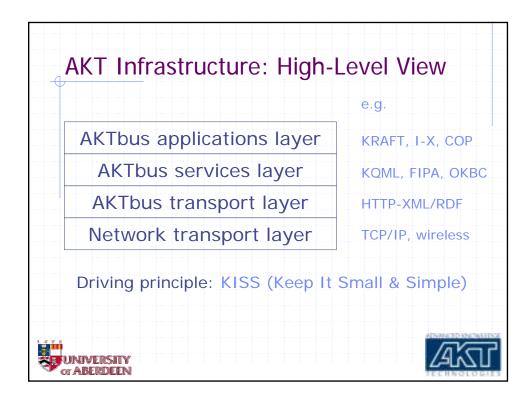


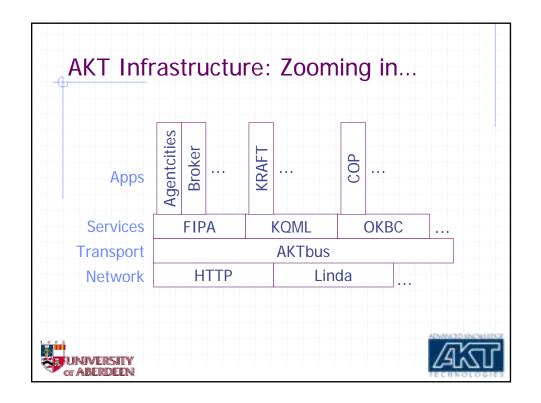


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AKTbus Message Samples See http://www.csd.abdn.ac.uk/research/akt/aktbus

Lesson 1: Not Everything is an Agent

- Some AKT services are simply client-server RPCs
 - e.g. interface to the COP Protégé server
- Some content can be carried either inside ACL messages, or not
 - e.g. our RDF query language (see later...)
- We're using agent technology only where <u>necessary</u>
 - aiming for lightweight, "KISS" principle





Lesson 2: Content is a Battleground

- ◆ Language wars: RDF vs DAML+OIL vs OKBC vs ...
- Emerged consensus for RDF as low baseline
- Querying still in a variety of formats: OKBC, RDF QLs,
- Storage & reasoning using Southampton's triple store, Protégé, Ontobroker, ...
- All this is good enough to do <u>useful</u> work





Lesson 3: Web Standards are Key

- The W3C's standard set are the most important game in town
- Defined ACLs as XML protocols
- Content languages are all XML-based:
 - E-R / ontology data
 - constraints (& rules)
 - queries
- Service description & location
 - working on DAML-S mapping





The CONOISE Project

- Constraint Oriented Negotiation in Open Information Services Environments
- Multi-site project: Aberdeen, Cardiff, Southampton, BT
- See http://www.conoise.org
- Automate & investigate Virtual Organisation life-cycle: formation, operation, and disbanding
- CONOISE@Aberdeen: using CLP to decide:
 - who to form VO with
 - help maintain VO
 - when to disband VO











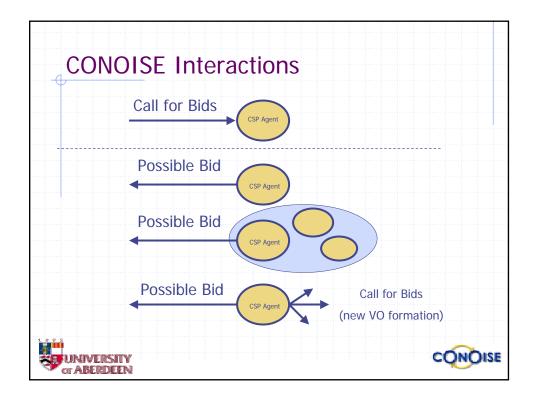
CONOISE: Negotiation & Constraints

- Types of constraint
 - user requirements / preferences (hard / soft)
 - Domain restrictions (axioms on ontology)
 - "small print" on instances
- Negotiation & solving
 - CSP composed automatically, and passed to a suitable solver
 - often unsolvable, so need to relax constraints
 - leads to negotiation, trade-offs ...

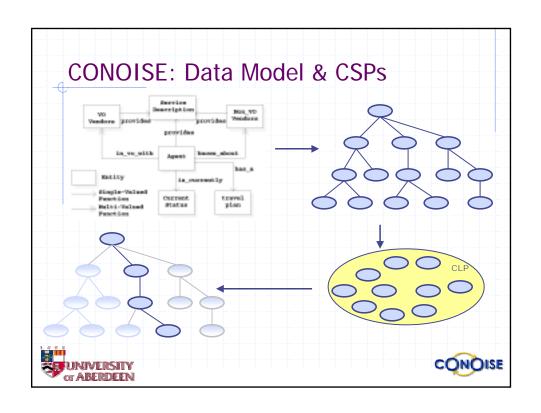


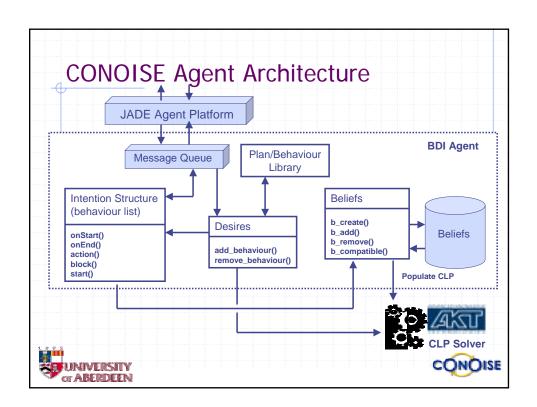


CONOISE: Sample Applications B2B ecommerce following-on from KRAFT Travel arranger see our CIA-2002 paper Infotainment packages "Agentcities-like scenario"



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CONOISE: Samples

Constrain all t in travel_plan such that travel_method(t) = train and travel_class(t) = sleeper_train to have arrival_time(t) < 0830

(\forall t,a) travel_plan(t) & travel_method(train, t) & travel_class(sleeper_train,t) & arrival_time(a,t) \rightarrow a < 0830

See

http://www.csd.abdn.ac.uk/research/akt/cif







CONOISE & Web Standards

- In our (Aberdeen's) current prototype:
 - instances defined on RDF (future: OWL)
- Services being defined on DAML-S
 - to include quality-of-service (QoS) attributes
- Constraints defined in XML-CIF (in future, align with RuleML?)
- ◆ Transport is JADE with HTTP MTP
- ACL is the <u>only non-XML</u> format!





Agentcities @ Aberdeen

- Agentcities.NET node
- People

Pete Edwards Alun Preece

Ken Brown Gunnar Grimnes

Mairi McCallum Nick Gianniotis

Chris Kartsaklis

- Deployment grant: deploying AKT services on Agentcities network
- Complements our activity in AgentLink-II & Ontoweb
- See

http://www.csd.abdn.ac.uk/research/agentsgroup





Aberdeen "Dogfood" Domains

- WeatherAgent (now)
- Academic services (internal access)
 - IdAgent
 - Publications
- Visitor info (coming soon)
 - Hotels
 - Restaurants
 - Pubs!



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Aberdeen WeatherAgent

- Running since January 2002
- Repackages UK met office data ...

Aberdeen 5 day forecast



- ... against <u>DAML ontology</u>
- Key issue was ontology <u>mapping</u>: <u>not unusual</u>





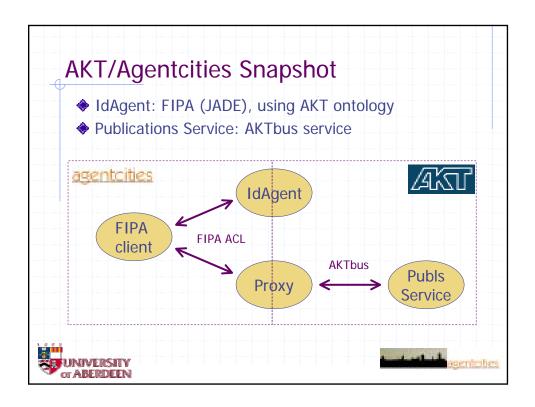
RDF Query-By-Example

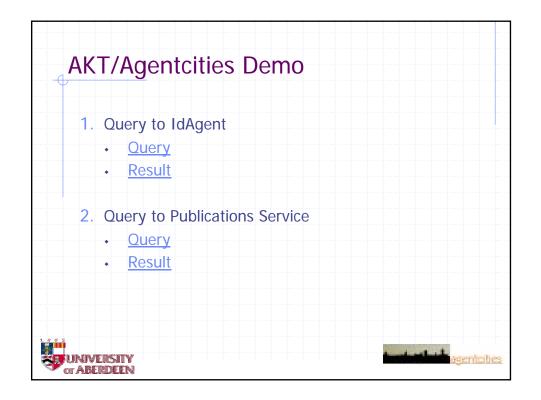
- Principle: query RDF using RDF
- If users can read RDF descriptions, they can write patterns that <u>match</u> RDF descriptions
- Basic queries exact-match OAV triples [example]
- More advanced queries use XML-CIF to incorporate variable expressions
- See

http://www.csd.abdn.ac.uk/research/AgentCities/QueryByExample/



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Towards IdAgent2

- Interested in learning research profiles
 - people aren't good at maintaining them!
- Work to date
 - converting CiteSeer data to RDF
 - using Progol FOL learner
 - Early results reported at ECML Semantic Web Mining workshop
- Applications
 - COP identification (knowledge management)
 - recommender systems



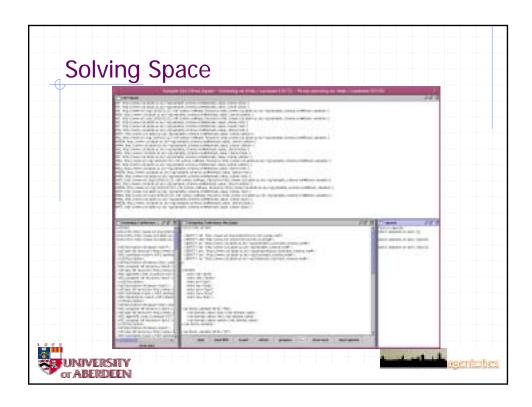


Coming Soon...

- Services under development
 - Solving space (derived from I-X/KRAFT TIE)
 - Scheduler ("evening" scenario)
- Anticipated next 3-6 months



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Issues: Web Technology

- The new big game in town
 - Bigger than CORBA, bigger than Java
- Need to <u>play</u> this game, and <u>steer</u> the evolving standards
 - Protocols: steer towards messaging & <u>real</u> loosecoupling
 - Description & location services: steer towards rich, composable service descriptions
 - Content: semantically-rich, modal?
- Avoid getting locked-out!











Issues: Ontologies

- "Weak" ontologies are <u>useful</u>
 - let's play with them
- Remember the 80/20 rule
 - perfection isn't achievable anyway!
- Live with multiple ontologies
 - align, reconcile, merge as needed
- Make your ontologies freely available
 - don't obstruct reuse it's hard enough already!











Issues: Agents

- Agents must co-exist with non-agents
 - layering
- Agents must align with the Web, or risk being sidelined
 - living in an XML, not a LISP world ☺
- Learn to travel light throw away some baggage
 - keep negotiation, interaction, autonomy
 - loose the stuff the Web has replaced specific platforms and message formats...











Credits & Questions?

- Work done at Aberdeen in collaboration with
 - AKT: Peter Gray, Kit Hui, Derek Sleeman
 - CONOISE: Peter Gray, Tim Norman, Stuart Chalmers
 - Agentcities: Pete Edwards, Gunnar Grimnes, Mairi McCallum, Nick Gianniotis
 - ... and other members of Agents@Aberdeen
- Opinions, however, are mine!

Questions?









