

# Will the Semantic Web deliver Information Interoperability?

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# Network Enabled Capability: e-Defence

- Key Drivers
  - not just plumbing legacy systems!
  - achieving shared understanding & decision-making – semantic interoperability
  - enabling two types of networks: people & equipment
- Key NEC Themes
  - Effect Synchronisation
  - Agile Mission Groups
  - Dynamic Collaborative Working
  - Shared Understanding
  - Full Information Accessibility
  - Resilient Information Infrastructure
  - Inclusive Flexible Acquisition



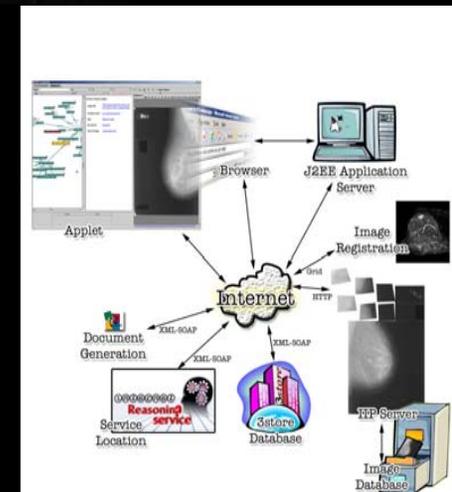
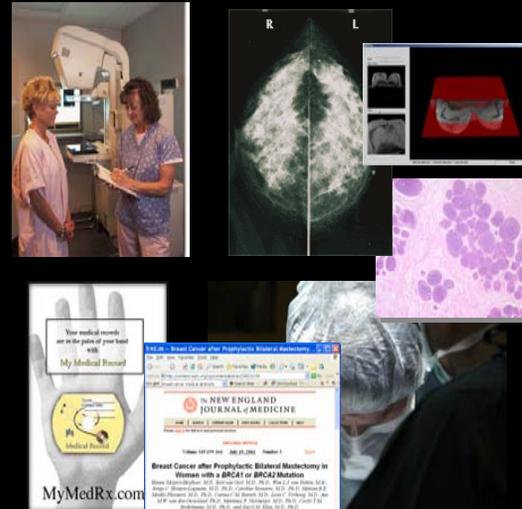
**Specifying the information required and using it better**

**Getting information to the right place and sharing it**



# Network Enabled Healthcare: e-Health

- Key Drivers
  - not just plumbing legacy systems!
  - achieving shared understanding & decision-making – semantic interoperability
  - enabling two types of networks: people & equipment
- Key NEH Themes
  - Effect Synchronisation
  - Agile Medical Teams
  - Dynamic Collaborative Working
  - Shared Understanding
  - Full Information Accessibility
  - Resilient Information Infrastructure
  - Inclusive Flexible Acquisition



# Putting Semantics on the Web

<http://www2002.org>

## WWW 2002



HAWAII

THE ELEVENTH INTERNATIONAL  
WORLD WIDE WEB CONFERENCE

Sheraton Waikiki Hotel  
Honolulu, Hawaii, USA  
7-11 May 2002

CONFERENCE ORGANIZERS



International World Wide  
Web Conference Committee

**1 LOCATION. 5 DAYS. LEARN. INTERACT.**

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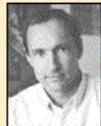
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On 7-11 May 2002, Honolulu, Hawaii will provide the backdrop for The Eleventh International World Wide Web Conference. This prestigious series of the International World Wide Web Conference Committee (IW<sup>3</sup>C<sup>2</sup>) attracts participants from around the world, and it provides a public forum for the World Wide Web Consortium (W3C) through the annual W3C track.

The conference is being organized by the [International World Wide Web Conference Committee \(IW<sup>3</sup>C<sup>2</sup>\)](#), the [University of Hawaii](#) and the [Pacific Telecommunications Council \(PTC\)](#).

### FEATURED SPEAKERS (CONFIRMED)



Tim Berners-Lee, inventor of the World Wide Web and Director of the W3C who now holds the 3Com Founders chair at the Laboratory for Computer Science (LCS) at the Massachusetts Institute of Technology (MIT).



Richard A. DeMillo, vice president and chief technology officer for Hewlett-Packard Company.



Ian Foster, guru of "Grid Computing", associate



James S. Glimm, McArthur Prize Winner,

# Machine Readable....

<http://www2002.org>

## WWW 2002

THE ELEVENTH INTERNATIONAL  
WORLD WIDE WEB CONFERENCE



Sheraton Waikiki Hotel  
Honolulu, Hawaii, USA  
7-11 May 2002

Event:WebPage

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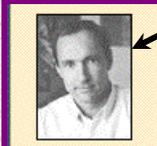
- Conference Proceedings
- Call for Participation
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### Registered participants

Australia · Canada · Chile  
Netherlands · Norway · Singapore

On 7-11 May 2002, Honolulu, Hawaii, provides a prestigious series of the International World Wide Web Conference. It provides a public forum for the exchange of ideas and information.

The conference is being co-located with the Pacific Telecommunications Conference.



Tim Berners-Lee and Dan Connolly are the Founders chair at the Laboratory for Computer Science (LCS) at the Massachusetts Institute of Technology (MIT).

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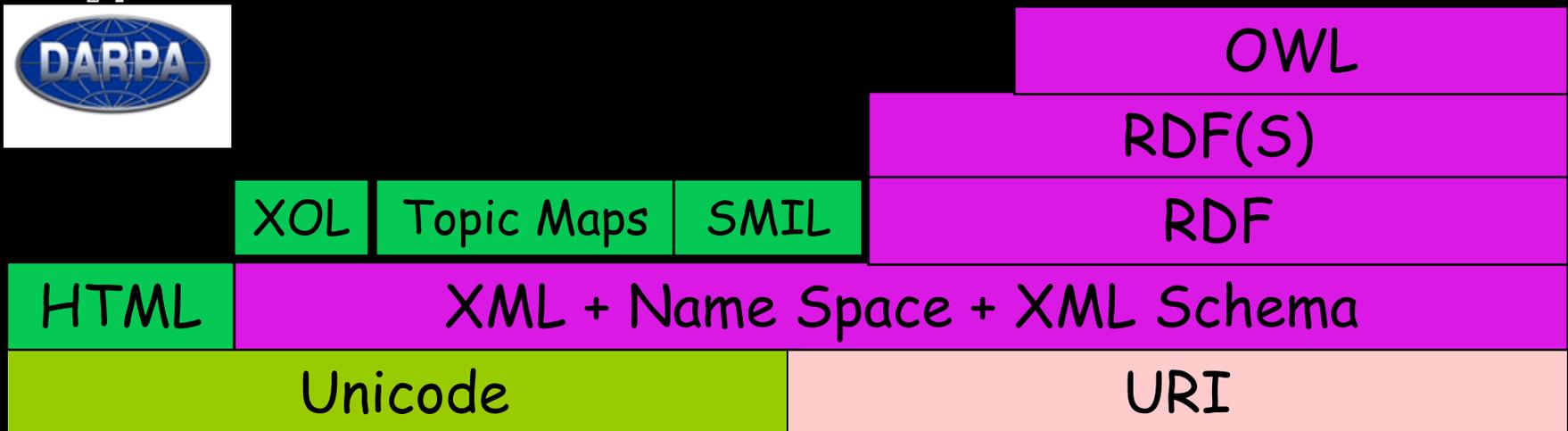
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describes a generic concept about events
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# Standards are fundamental



# Ontologies: Fundamental Building Blocks of the Semantic Web

# Perspectives on ontologies

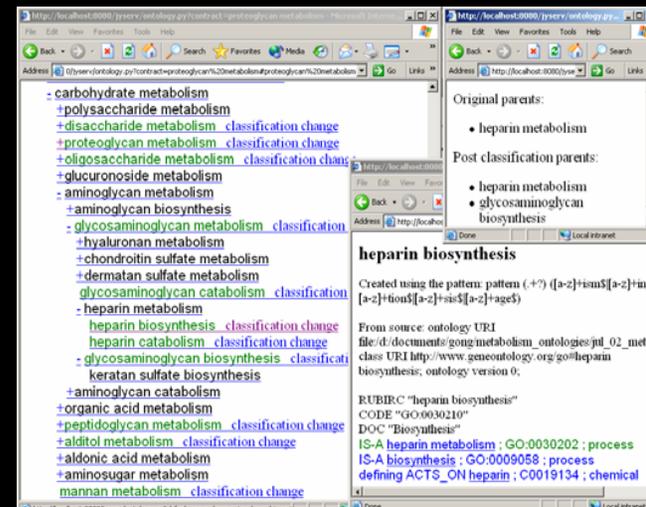
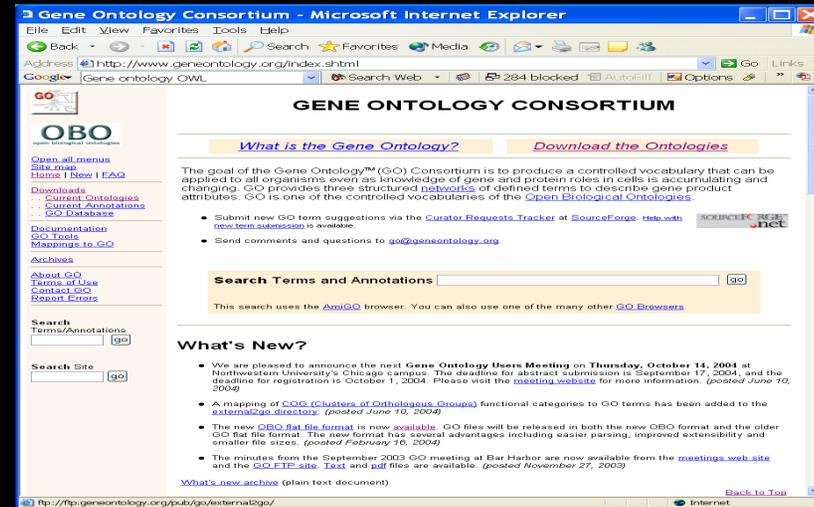
- A shared and agreed conceptualisation
- Agreed terminology
- The salient concepts and relations between them
  
- **The semantic view:** An ontology is the context needed to understand a specification, model, or other communication in the way that was intended.
  
- **The specification / reference view:** "An ontology is an explicit specification of a conceptualization."
  
- **The modeling view:** An ontology is a metamodel.

# Ontologies offer....

- Communication
  - Normative models
  - Networks of relationships
  - Consistent and unambiguous
  - Integrate multiple perspectives
- Inter-operability and Integration: Sharing & Reuse
  - Inter-lingua
  - Specifications
  - Reliability
- Control
  - Controlled vocabularies
  - Accurate data collection or retrieval
  - Classification
  - Finding, sharing, discovering, navigation, indexing

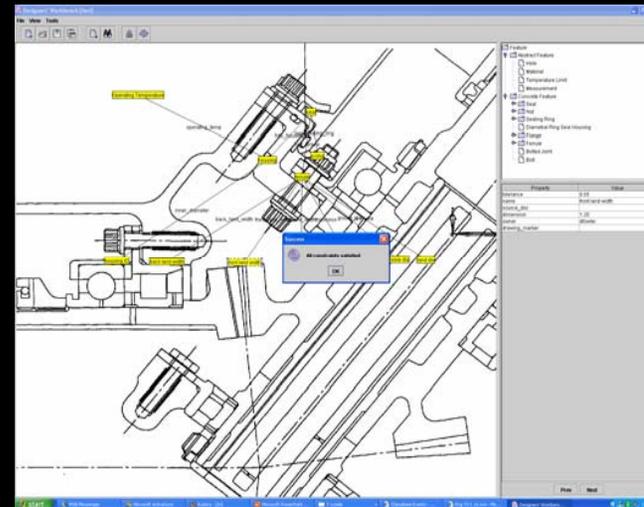
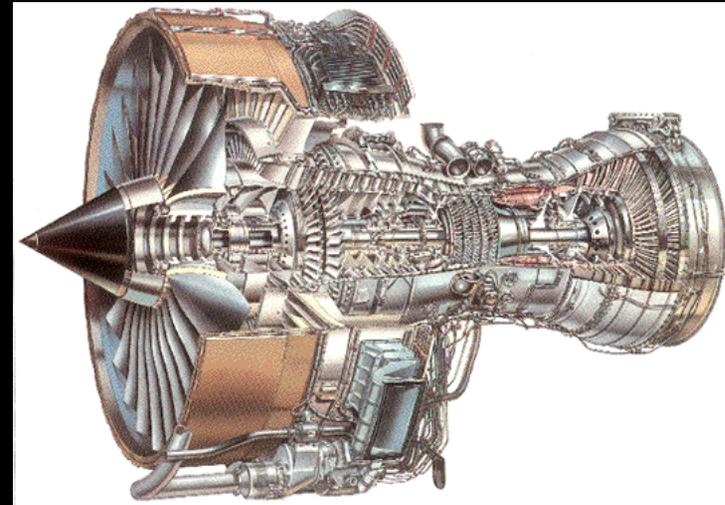
# Genetics: Gene Ontology

- One of the earliest examples of the benefits of ontologies
- Integration and interoperability were big wins
- Specific tool support
- Considerable resources invested and continuing in maintenance
- Translated into Description Logics to provide formal semantics
- Spawned more generic biological ontology efforts



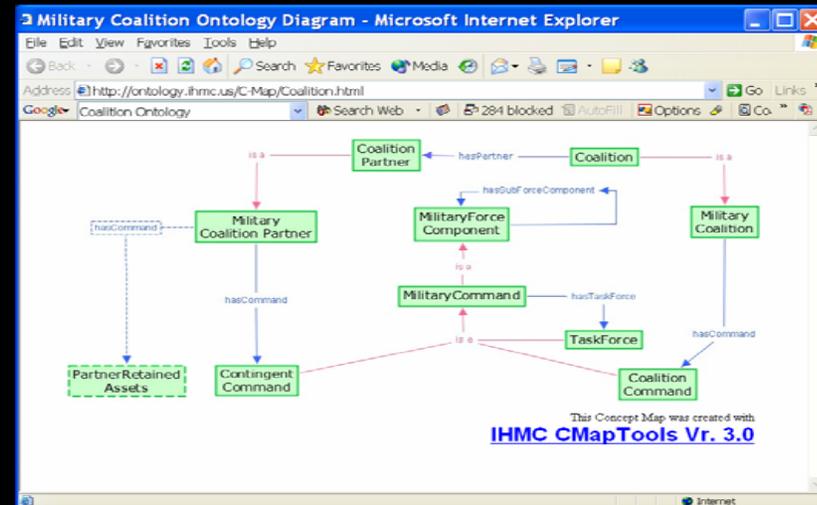
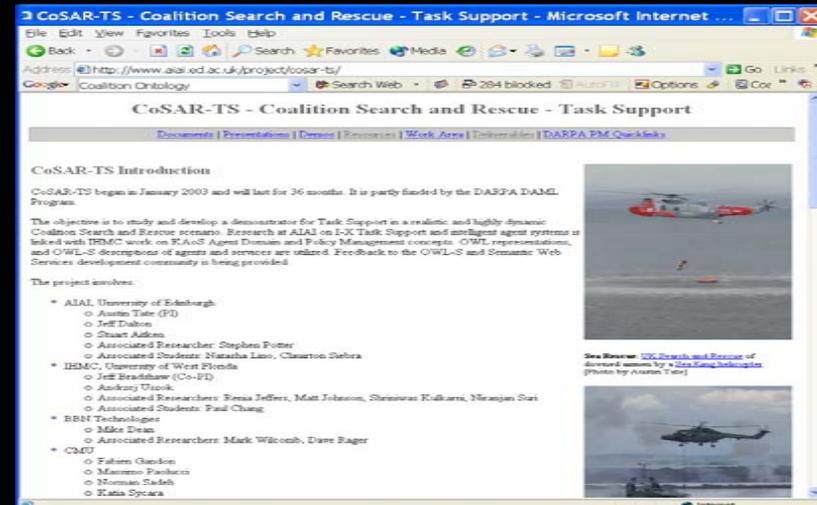
# Manufacturing: Aerospace

- Considerable work on ontologies for products and components
- Used in all stages of the life cycle, from design to in service maintenance
- Need for multiple perspectives e.g.
  - Whole engine
  - Heat transfer
  - Cost model
  - Manufacturing
  - Assembling/Maintenance



# Military: Coalition Operations

- Some of the original motivation behind DAML work
- Lots of activity to build ontologies in a range of contexts
- Particularly important in coalition operations
- Central requirement for the concept of Network Enabled Capability



# Ontologies: Observations

- In any domain
  - Usually highly implicit
  - Poorly documented
  - Likely to be ambiguous, vague, inconsistent
- When modelling
  - Interaction Problem: tasks influence ontologies
  - Integration Problem: integrating multiple ontologies
  - Modularity Problem: how to modularise and what grain size?
- Maintenance
  - Ongoing maintenance overhead
  - Ontologies evolve and change
  - Design rationale is important
- Upside
  - They do facilitate interoperability
  - They do enhance reuse
  - They are becoming part of the infrastructure

# Advanced Knowledge Technologies IRC



AKT started Sept 00, 6 years, £8.8 Meg, EPSRC

[www.aktors.org](http://www.aktors.org)

Around 65 investigators and research staff

# Ontology Mediated Information Interoperability: An example from Medicine

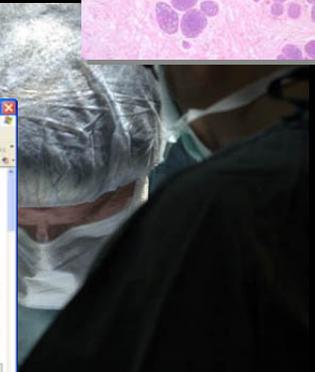
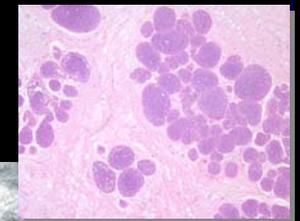
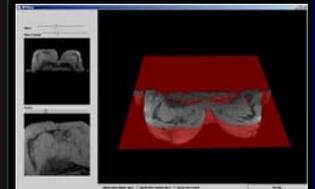
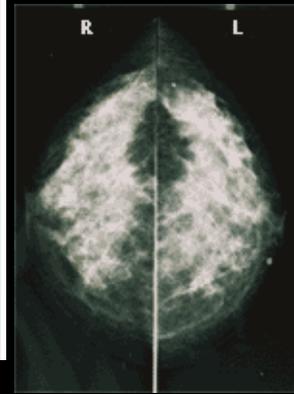


Professor Nigel Shadbolt  
The University of Southampton

Professor Sir Michael Brady  
Oxford University

# Multi-disciplinary Assessment: Multiple Ontologies and Multiple Information Sources

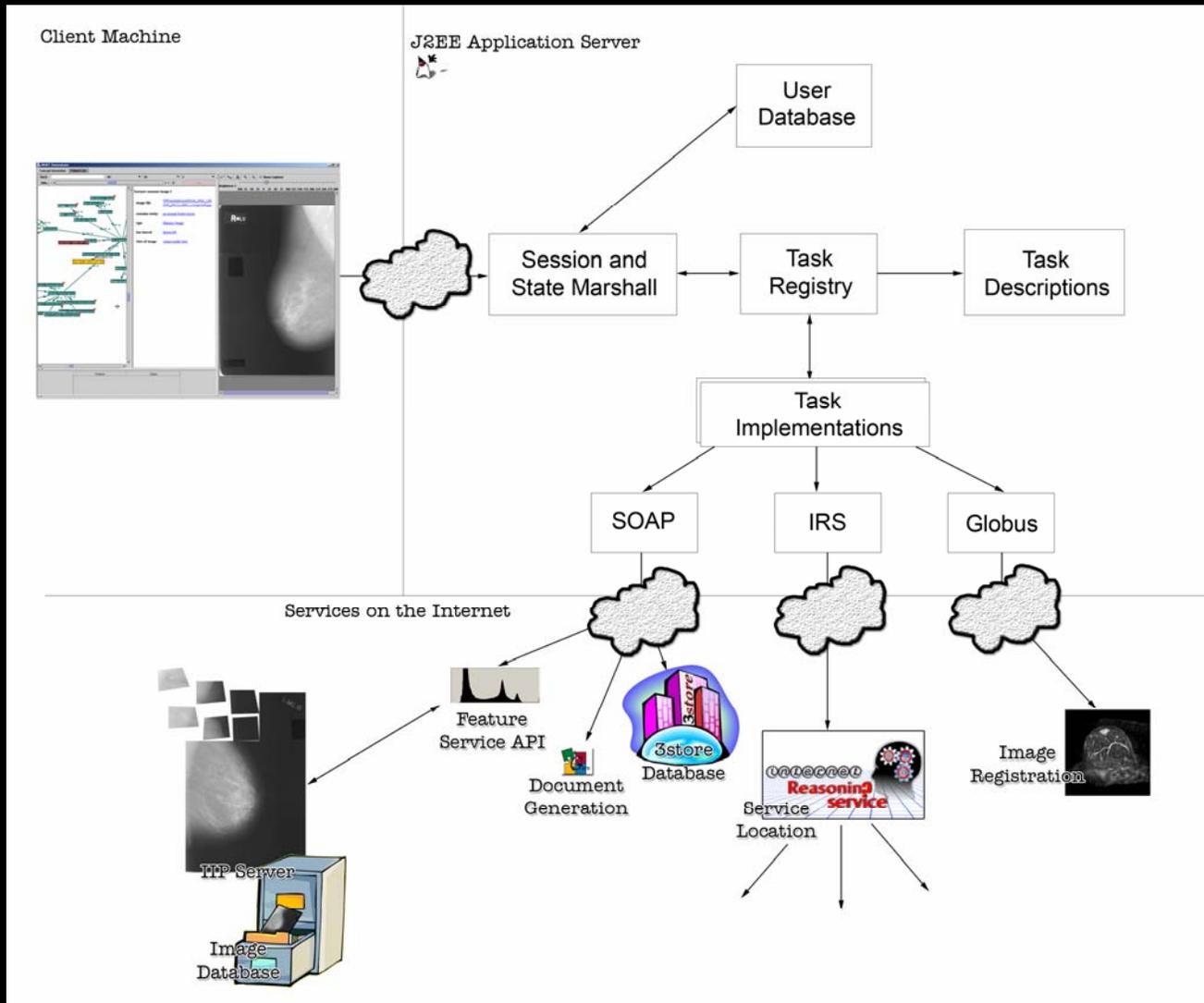
- Diverse and heterogeneous content
- Clinical examination
  - Notes
- Imaging
  - X-ray,
  - Ultrasound
  - MRI
- Microscopy
  - Histopathology
- Treatment
  - Protocol Records
  - Re-assessment
- Medical Records
  - Case sets
  - Individual patient records
- Published background
  - Epidemiology
  - Medical Abstracts



# MIAKT Services

- Image Analysis Services
  - Oxford's XRay Mammogram Analyser
  - KCL MRI Mammogram Analyser/Classifier
- Classification Services
  - Abnormality Naïve Bayes Classifier (Soton)
  - MRI Lesion Classifier (KCL)
- Patient Data Retrieval Services (OU)
  - For example, "Find Patients With Same Age"
- Image Registration (KCL)
  - GRID service invoked via web-service
- Natural Language Report Generation (Sheffield)
  - Generate a patient report from RDF description
- UMLS Lookup (Sheffield)
  - Lookup term definitions in the UMLS
- Patient Records also accessed through web-service (Soton)
  - Web-service enabled AKT 3store

# The MIAKT Framework is Ontology Based



# Knowledge-Intensive Fusion for Situational Awareness

## UK DIF DTC Project 8.14



Professor Nigel Shadbolt et al  
The University of Southampton

# Desired Outcome

- a knowledge-guided environment to accomplish intelligent information...
  - FUSION
    - using formal knowledge models (inc ontologies) of the sources, user roles and tasks to perform the aggregation task
  - PROCESSING
    - using the knowledge models to integrate and reason over the incoming streams of information, generating new knowledge, summaries, predictions, guidance, and direct attention
  - INTERACTION
    - supporting effective visualisation of and interaction with diverse information sources as a decision-making aid

# The Domain

## OOTW Humanitarian Relief

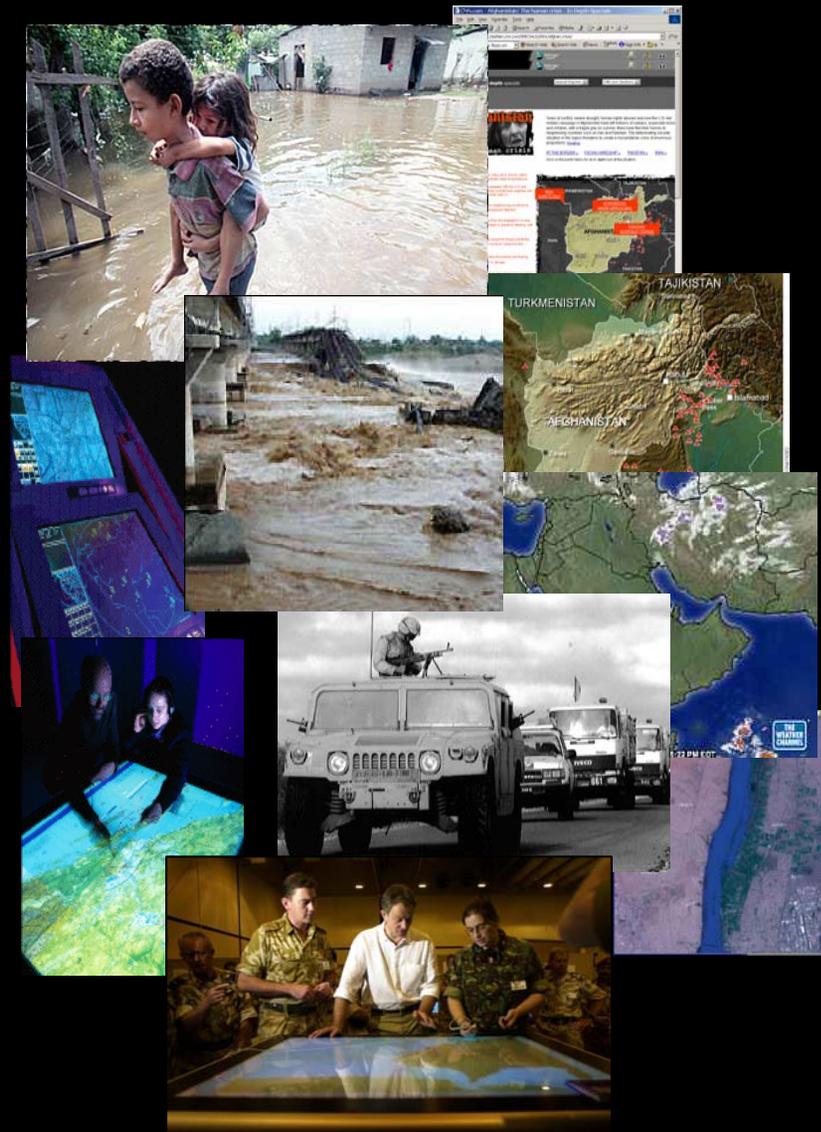
### Number of possible data sources

- Media reports
- Meteorological forecasts and reports
- ELINT
- Reports from NGOs
- Other field reports

### Multiple foci of situational awareness

- Refugee concentrations and movements
- Communications and transport infrastructure
- Weather conditions, water levels, current and predicted
- Hostile Militia Activity

### Views on data and information for needs of different users

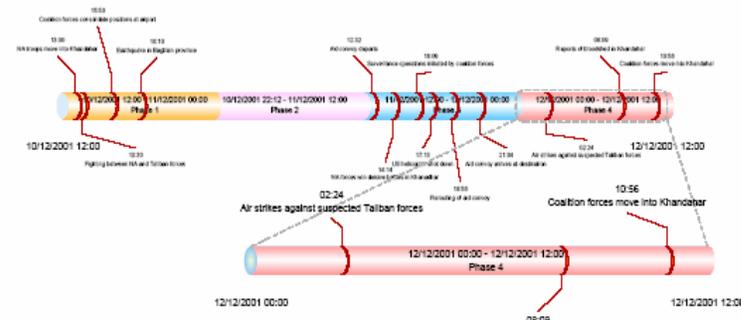


# The Scenario

- Comprehensive Afghanistan scenario
- Based on recent available historical data
- Rich source of information feeds
- Ample scope for key properties of KBSA to be demonstrated
- Basis for ontologies

Epistemics Ltd      MILITARY (UNCLASSIFIED)      DTC/WP100/Scenario  
Version 1 / 26 March 2004

## 4.2.4 Phase 4: 36-48 Hours



### 4.1.1.1.5 Humanitarian Aid Initiative

Description	The humanitarian-aid-initiative concept subsumes the various types of humanitarian aid programme that are delivered to target groups .
Subtypes	<ul style="list-style-type: none"> <li>o Emergency Assistance</li> <li>o Refugee</li> <li>o Food Aid</li> <li>o Search and Rescue</li> </ul>
Attributes	<ul style="list-style-type: none"> <li>o resource</li> <li>o aid-orga</li> <li>o duration</li> <li>o start-dat</li> <li>o trigger: t</li> <li>o status: tl</li> <li>o equipme</li> <li>o impleme</li> </ul>

### 2.8 IDP and Refugee Settlements

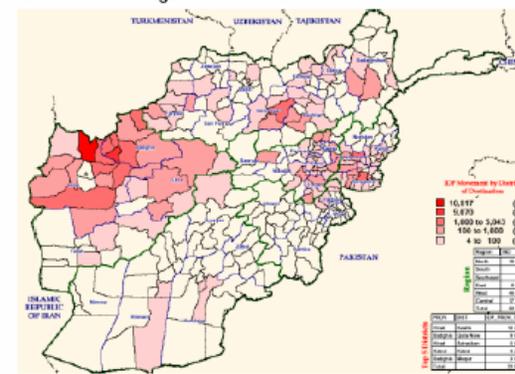


Figure 2-38: IDP Movements by District of Destination



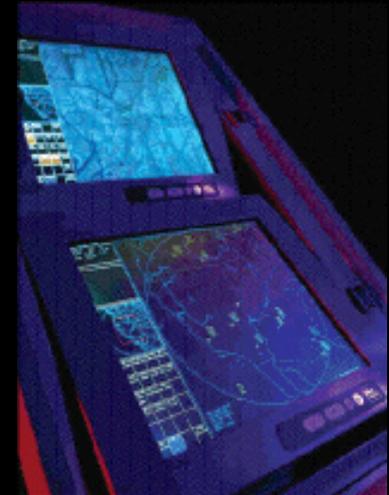
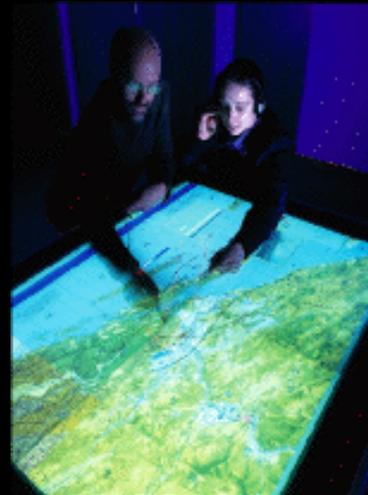
# Interaction and Visualisation

Content Streams will be

- Multiple User
- Machine assisted
- Rapidly changing
- High-volume
- Multi-source

Need to support content affordances

- Seeing the big picture
- Zooming in on appropriate detail
- Swapping viewpoints and content feeds
- Changing user perspectives
- Avoiding einstellung “functional fixity”



## Novelty & Invention

- Group represents leading edge in Semantic Web research and application
- Research and development in this context is new
- Extends work on ontologies for Situation Assessment
- Exploiting semantic annotation for information fusion and selective attention is novel in this context
- *Semiometric* approach novel in context of military information fusion
- Potential to relate to work in US and DSTL interest in information management

## The Semantic Web: Will it happen?

“Is this rocket science? Well, not really ... We are not inventing relational models for data, or query systems or rule-based systems. We are just webizing them. We are just allowing them to work together in a decentralized system – without a human having to custom handcraft every connection.”

*Tim Berners-Lee, Business Case for the Semantic Web, <http://www.w3.org/DesignIssues/Business>*



"We're not sure what it is. Rob cobbled it together from paper clips and stuff in the mail room, but MAY wait till you see how scalable it is."

## Will the Semantic Web Deliver Information Interoperability?

**Professor Nigel Shadbolt**

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**Will the Semantic Web Deliver Information Interoperability?**

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