

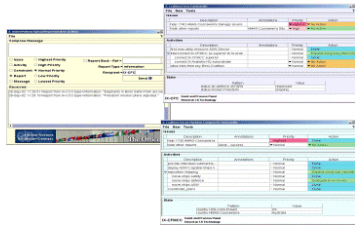
I-X

Intelligent Messaging, Event and Process Panels



Description:

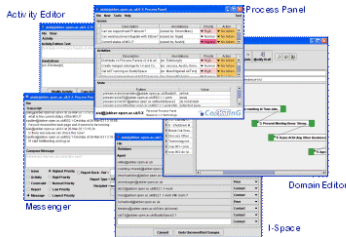
- ◆ Can take on and handle issues, activities, constraints, and annotations/reports in the C² process.
- ◆ Intelligent messaging support.
- ◆ Intelligent workflow and process support.
- ◆ Uses a simple <I-N-C-A> ontology
 - ◆ Issues, Nodes/Activities, Constraints, Annotations.
- ◆ Operates anywhere in continuum from manual to fully automatic.
- ◆ Part of CoAX – Coalition Agents Experiment.



DARPA CoAX Demo

Further work:

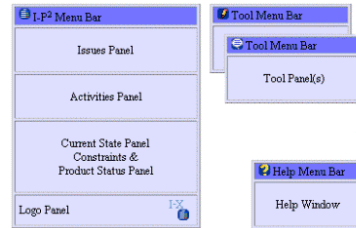
- ◆ Intelligent Planning Aid ("I-Plan").
- ◆ "On-the-fly" repair and recovery during planning, execution and control of Coalition C² processes.
- ◆ Group collaboration facilities; links to other collaboration & video-teleconferencing aids.
- ◆ Improved process library editor.
- ◆ Improved "I-Space" agent relationship management tool and links to Grid Management Services.
- ◆ Improved deployment.



I-X Process Panel Interfaces

Results:

- ◆ Process Panels used for each command or country in CoAX demonstration.
- ◆ Flexible and loadable process models, process product descriptions and issue descriptions.
- ◆ Inter-agent commands, reports and message logging.
- ◆ Clarification of who says what to who else.
- ◆ Links to external capabilities.



Schematic of I-X Process Panel Components



AIAI
Funded by the DARPA CoABS & DAML initiatives
<http://i-x.info>



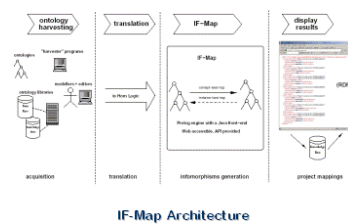
Advanced Knowledge Technologies

The next generation of knowledge lifecycle technologies



Description:

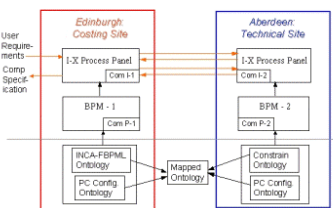
- ◆ Multi-million pound 6 year collaboration between 6 university groups:
 - ◆ Aberdeen: cooperative KA & knowledge refinement;
 - ◆ Edinburgh: lifecycles & ontologies;
 - ◆ Open Univ: internet-based services & knowledge modelling components;
 - ◆ Sheffield: textanalysis & information extraction;
 - ◆ Southampton: two groups with skills in multimedia, ontologies, agents, knowledge acquisition, etc.
- ◆ Aims to identify or invent the next generation of technologies for capture, modelling, publishing, reuse and management of knowledge.



IF-Map Architecture

Further work:

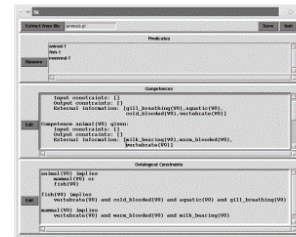
- ◆ The ultimate goal of F-Life is to permit assembly of distributed software components over the Semantic Web, to perform complex transformations on large repositories of knowledge.
- ◆ The aim of KRAFT-IX is to provide a distributed virtual knowledge-based (and agent-based) workflow system.
- ◆ The overall aim of AKT is to provide seamless, intelligent, personalised access to and reasoning across the Web and other knowledge sources.



KRAFT-IX Ontology based Collaboration support

Results:

- ◆ IF-Map: uses Information Flow theory to merge two ontologies, based on a reference ontology.
- ◆ F-Life life-cycle editor, life-cycle interpreter and property checker: uses a formal life cycle calculus to describe property alterations during transformations.
- ◆ ExtrAKT Ontology Constraint Extraction Tool: finds ontology constraints in existing declarative knowledge bases & extracts them.
- ◆ KRAFT-IX Collaborative Support tool: integrates open-architecture workflow system with remote constraint solving system.



The ExtrAKT Ontology Constraint Extraction Tool



Universities of Aberdeen, Edinburgh, Sheffield, Southampton & OU
Funded by EPSRC as an Interdisciplinary Research Collaboration
<http://www.aiai.ed.ac.uk/project/akt/>



International Innovation In Artificial Intelligence

Artificial Intelligence Applications Institute

Four decades of world-leading research and teaching in AI at Edinburgh

Two decades of innovative applications of AI at AIAI

Examples of key achievements include:

- **Formation** - a knowledge-based design system to lay out all British Telecom Yellow Pages directories and to create a new business area for Pindar Set Ltd for responsive marketing support and catalogue layout systems. Winner of an award for innovative applications of AI in 1998.
- **Expert Provisioner** - a rule-based system for the RAF Logistics to assist with procurement of spare parts. Saves £30m per annum for the RAF and is now being deployed to the British Army and Navy.
- **EASE** – a rule-based system deployed throughout Europe to estimate occupational exposure to hazardous substances for health and safety regulations.
- **Fraud Detection** – case-based reasoning has been applied to screen applications for financial products with MCL Software.
- **GhostWriter** - plan generation and multilingual presentation for aero-engine maintenance procedures with British Aerospace and Dassault Aviation (France).
- **O-Plan** and **I-X** - command, planning and control agents to support non-combatant evacuation operations, US Army military operations in urban terrain, multinational coalition operations, disaster relief, search & rescue, etc.
- **Optimum-AIV** - planning system for assembly, integration and test of Ariane IV payloads for the European Space Agency.
- **EUMETSAT** - specification of the telecommand system for the European Meteorological Spacecraft Control Centre.
- **International Standards** - inputs to the development of standards for process specification, workflow, enterprise modelling, etc.

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Formation

Knowledge-Based Layout of BT Yellow Pages



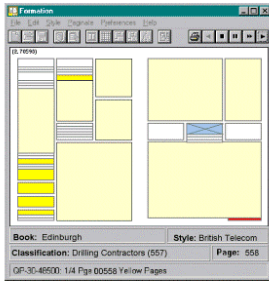
Description:

- ◆ A knowledge-based system for laying out Yellow Pages.
- ◆ Must include text entries, fixed size advertisements, headings etc.
- ◆ Allows programming of document styles.
- ◆ Allows dialogue-based modification and reconfiguration of programmed styles.
- ◆ Automatically lays out telephone directory according to style.



Technical approach:

- ◆ Layout styles are defined in a purpose-built object-oriented language, implemented in Lisp.
- ◆ Allows definition of page geometry, page items, layout strategy, and modular heuristics.
- ◆ Can be used by non-programmers.
- ◆ Pindar staff worked alongside AIAI during language development to obtain full working knowledge of the language.
- ◆ Success through flexibility, usability & technology transfer.



Benefits:

- ◆ Commissioned by Pindar Set who hold the contract to lay out BT Yellow Pages.
- ◆ Lays out directories at over 1500 pages/hour.
- ◆ Fast and flexible response to change requests.
- ◆ Small reduction in wasted space brings large cost savings.
- ◆ Generic and customisable, allowing Pindar Set to bid to lay out other countries' Yellow Pages.



AIAI and Pindar Set
<http://www.aiai.ed.ac.uk/project/formation/>



Expert Provisioner

Accurate prediction and ordering of aircraft parts



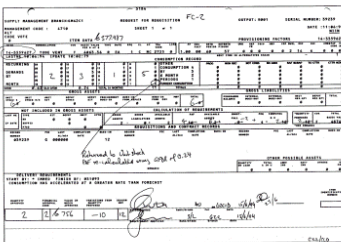
Description:

- ◆ A knowledge-based provisioning support system.
- ◆ Removes mundane form processing and prevents misinterpretation of special codes.
- ◆ Brings together information formerly stored on paper forms and index cards.
- ◆ Prompts user to investigate where necessary.
- ◆ Developed and distributed on networked Windows PCs.



Technical approach:

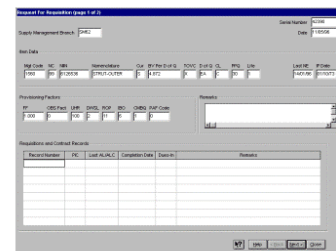
- ◆ RAF Logistics Support personnel trained in AI techniques.
- ◆ Intelligent provisioning used as a worked example.
- ◆ Management interest led to development of prototype using CLIPS rule-based system.
- ◆ Senior management interest in prototype led to development of full system.
- ◆ Visual Basic and MS Access used.
- ◆ Success through using the simplest technology adequate for the task.



Original order form

Benefits:

- ◆ Reduces the uncertainty of procurement budgets near financial year-ends.
- ◆ Reduces wastage through over-ordering.
- ◆ Takes advantage of price breaks for large orders.
- ◆ Maintains consistency of order processing.
- ◆ Easy to use and to understand.
- ◆ Estimated savings of £30 million per year.



Order form in Expert Provisioner



AIAI and RAF Logistics Support Services
<http://www.aiai.ed.ac.uk/projects/ep/>



GhostWriter

Plan based generation of multilingual aircraft manuals



Description:

- ◆ An authoring environment to support production of technical documents by British Aerospace and Dassault Aviation.
- ◆ Each aircraft has a large number of maintenance & other documents, required in both English and French.
- ◆ GhostWriter supports generation of technical documentation in either language.
- ◆ It also gives advice about possible errors and omissions during the construction of a publication.



Technical approach:

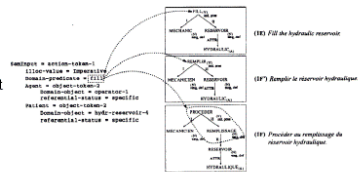
- ◆ Maintenance procedures are written using a plan-based knowledge representation.
- ◆ Planning technology validates these procedures.
- ◆ Documents are then generated from this language-neutral representation.
- ◆ Procedures can be displayed using simple graphics.
- ◆ Success through improved productivity and increased error checking.



A Tornado aircraft with its accompanying technical documentation

Benefits:

- ◆ Prototype has been used to produce documents for most of a complex maintenance procedure for the Falcon 900.
- ◆ The resulting texts are at a level close to that produced by human authors.
- ◆ Current version is interactive and semi-automatic.
- ◆ It also offers a potential speed-up in document authoring.



The internal representation used by GhostWriter

BAE SYSTEMS

British Aerospace, Dassault Aviation, & University of Edinburgh

<http://www.aii.ed.ac.uk/project/ghostwriter/>



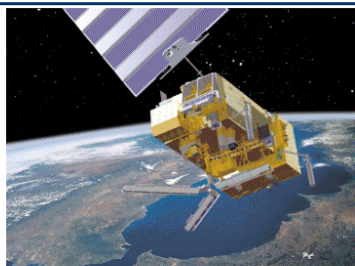
Optimum-AIV

Planning for Spacecraft Assembly, Integration & Test



Description:

- ◆ A knowledge-based system for planning and scheduling of spacecraft assembly, integration and verification (AIV).
- ◆ Aims to overcome simplified planning which manages temporal constraints but not resources or parallel activities.
- ◆ Commercial planning tools are either too simple to represent problems correctly or too complex to be used interactively.
- ◆ Used for planning the production of the vehicle equipment bays (VEB) for the Ariane-4 launcher.



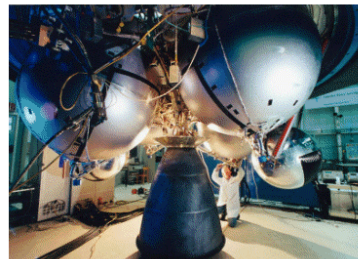
Technical approach:

- ◆ A resource-driven scheduling mechanism facilitates the specification of different scenarios.
- ◆ Schedule development can be monitored while alternately using automatic mode/manual mode.
- ◆ Notes conflicting demands for resources that cannot be solved automatically and supports the user in solving them.
- ◆ Allows monitoring of plan execution.
- ◆ Success through involving & supporting the user in difficult decisions.



Benefits:

- ◆ Rich description of AIV constraints is provided to user and used by the tool.
- ◆ Supports user in resolving resource conflicts.
- ◆ Clear representation & interactive capability allows assessment of several planning scenarios.
- ◆ Provides a single solution to both schedule management and the allocation of component equipment modules amongst competing VEBs.



AI I, Computer Resources Intl, Matra Marconi Space & Progespace

Funded by the European Space Agency

<http://www.aii.ed.ac.uk/project/optimum-aii/>

