ACT

Automated Clearance Tool:
Improving the Diplomatic Clearance Process for AMC

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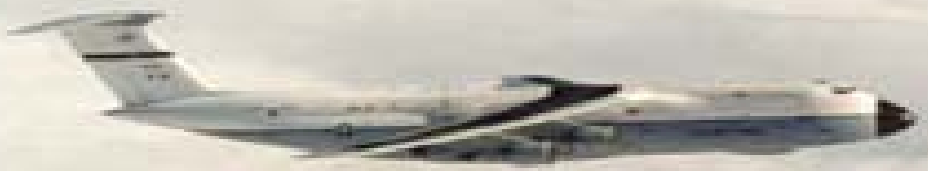
ACT
Automated Clearance Tool

ACT is an agent based, decision-support tool that supports the processing of diplomatic clearances at Air Mobility Command (AMC).



By leveraging the *Semantic Web* concept, ACT software agents utilize ontologies to reason about annotated data.

The Problem Domain

Air Mobility Command plans global missions at a rate greater than 300 per day, many requiring a set of diplomatic clearances. Today mission planners must manually calculate lead times, calendar constraints, and country restrictions to determine diplomatic clearance viability. ACT automates much of this process, allowing the human planners to concentrate on the more difficult and timely problems.

Is there HAZMAT aboard? ***What type and category is it?***

Is there enough lead time for a clearance?

Which countries are you flying over?

What is the cargo? ***Who is aboard?***

Is this flight part of an accepted mission?

Is a Blanket Clearance needed?

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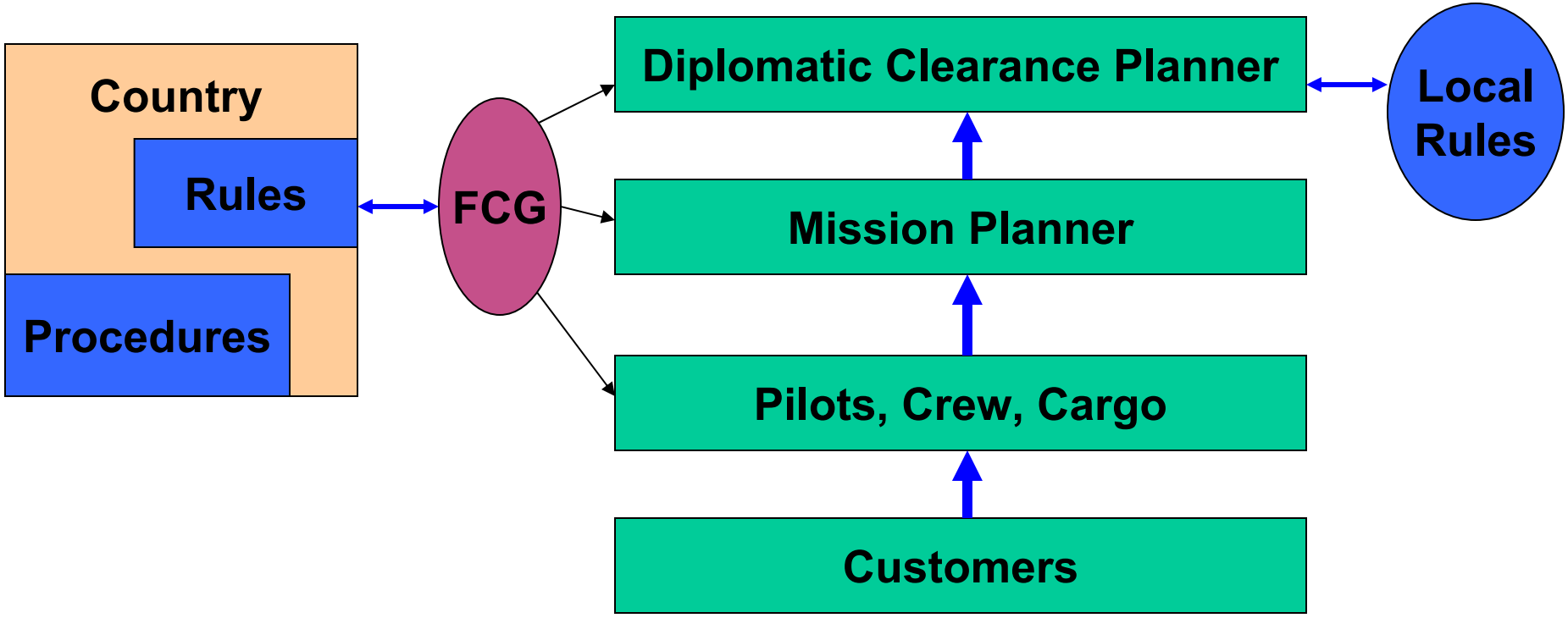
Relevance to Command and Control

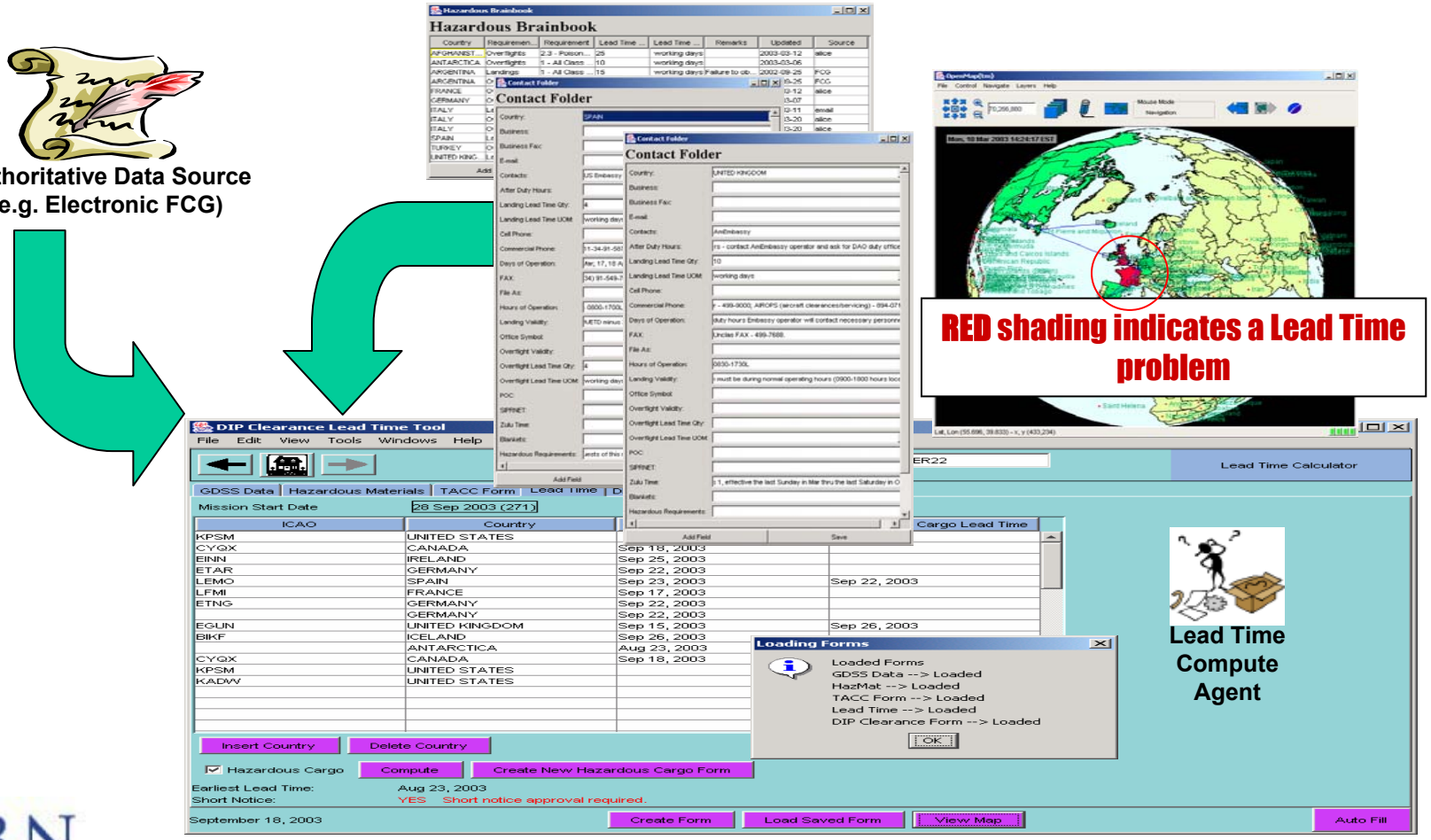
Allow planners at different levels of the C2 structure to reason about the requirements of an AMC mission for diplomatic clearances.



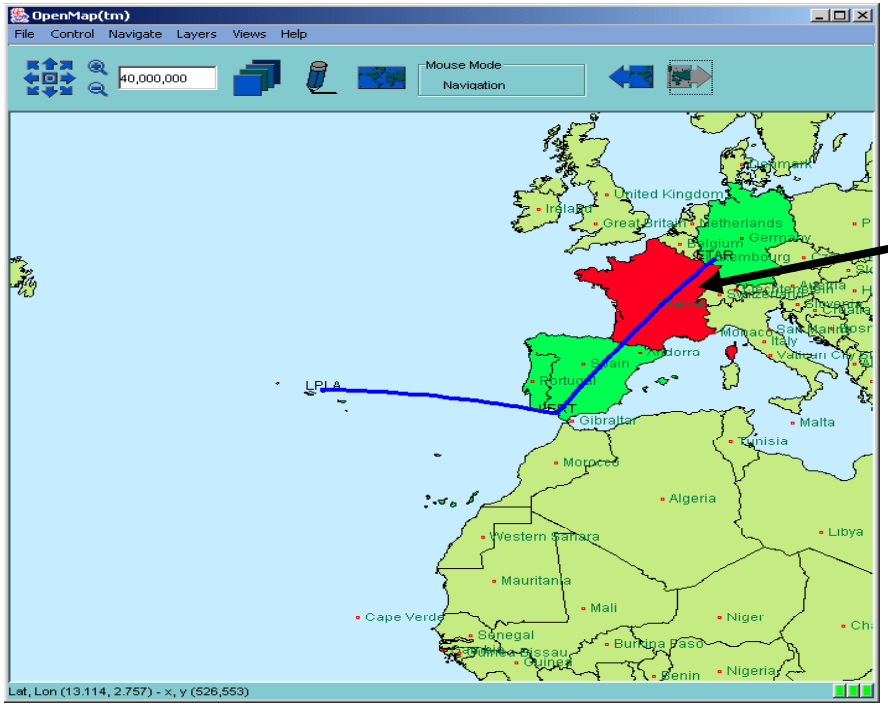
The Automated Clearance Tool

Semantically Annotated Brain Books

Authoritative Data Source
(e.g. Electronic FCG)

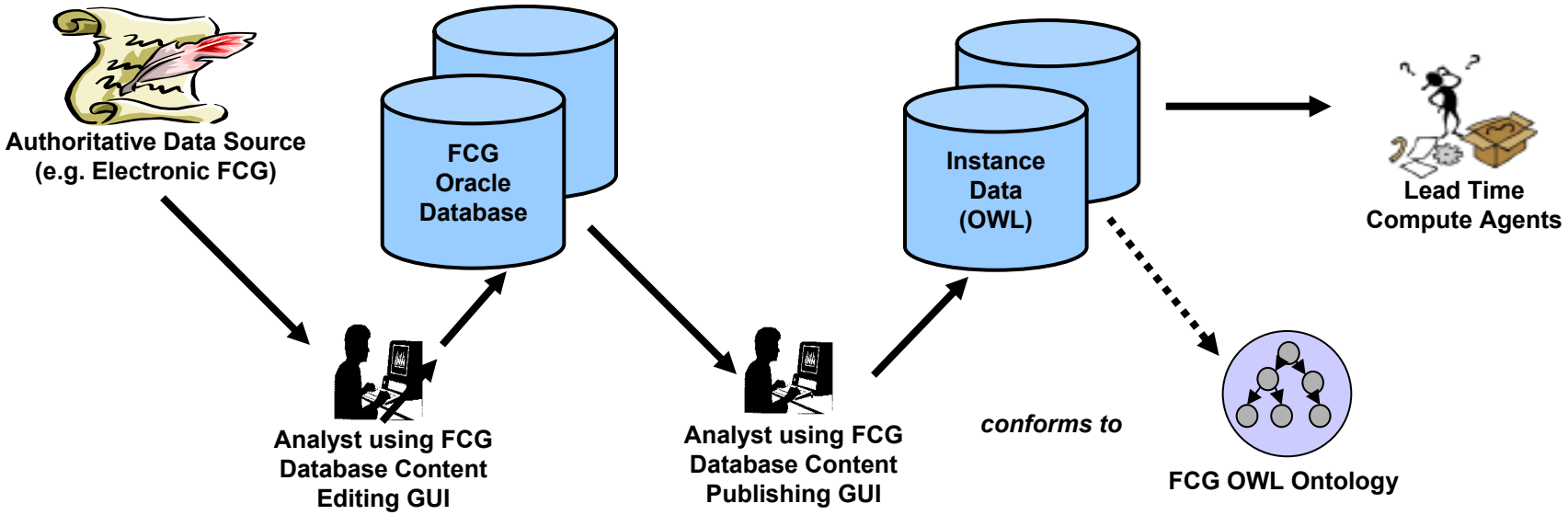


Using Act to Support Diplomatic Clearance Processing

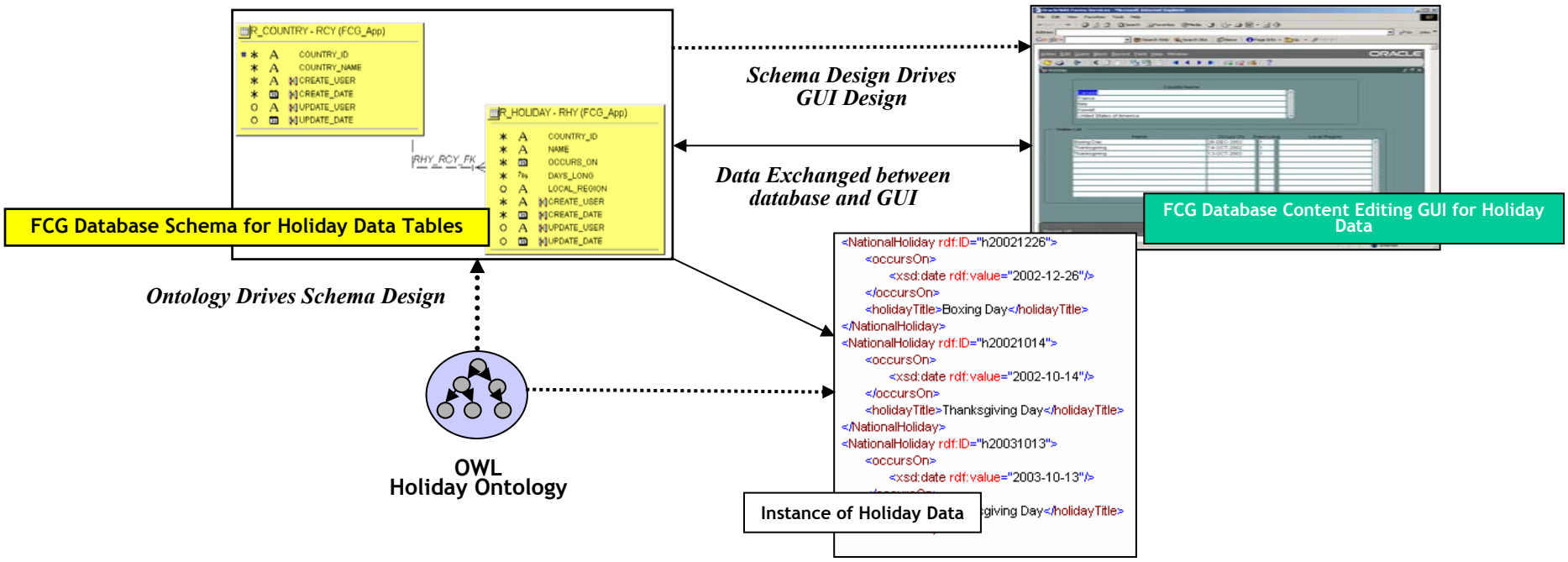


Restriction identified by ACT software agent using rules derived from semantically annotated documents

Data Content Markup Process



Ontology Driven Information Processing



Ontologies Developed to Date

Aircraft Clearance Request
Aircraft Type
Airport Cargo Exception
Airport
Clearance Option
Contact
Country
Hazardous Cargo
Holiday
Lead Time
Mission

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Using Semantic Markup To Support Agent-Based Decision Making

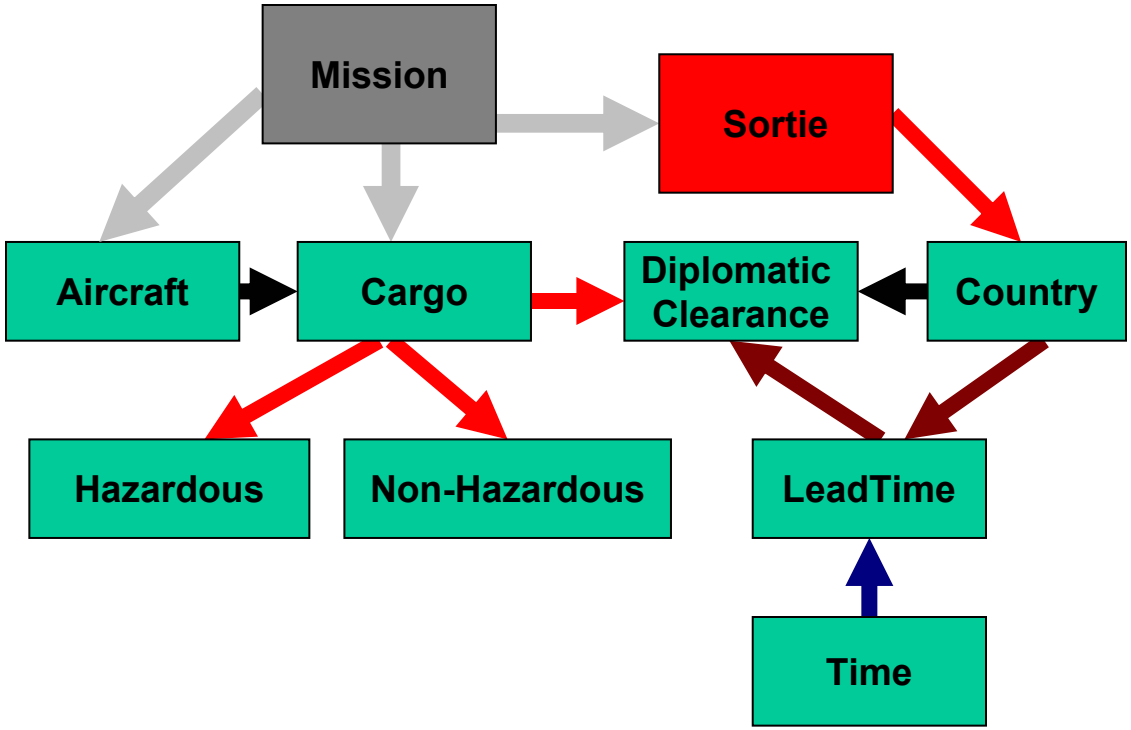
- Ontology inference rules supply reasoning information to the software agents in ACT.
- ACT enables a user to create or modify some of the rules through the use of semantically tagged tools.
- Each tool has an underlying model that describes relationships among its entities.
- Software agents can interpret the rules and use them to make calculations and identify mission restrictions.

The Semantic Web

- The Semantic Web is an extension of the existing web, in which information has well-defined meaning through the use of markup tags that are associated with ontologies.
- The Ontology Web Language (OWL) is built on XML, adding structure to web content that is required to support automated reasoning.
- An ontology formally specifies a concept and its relationship to other concepts. When classes, subclasses, and relationships among entities expressed in the ontology are defined, they provide a very powerful medium for assisting in the interpretation of the data by software agents.
- A set of related ontologies forms a semantic web.

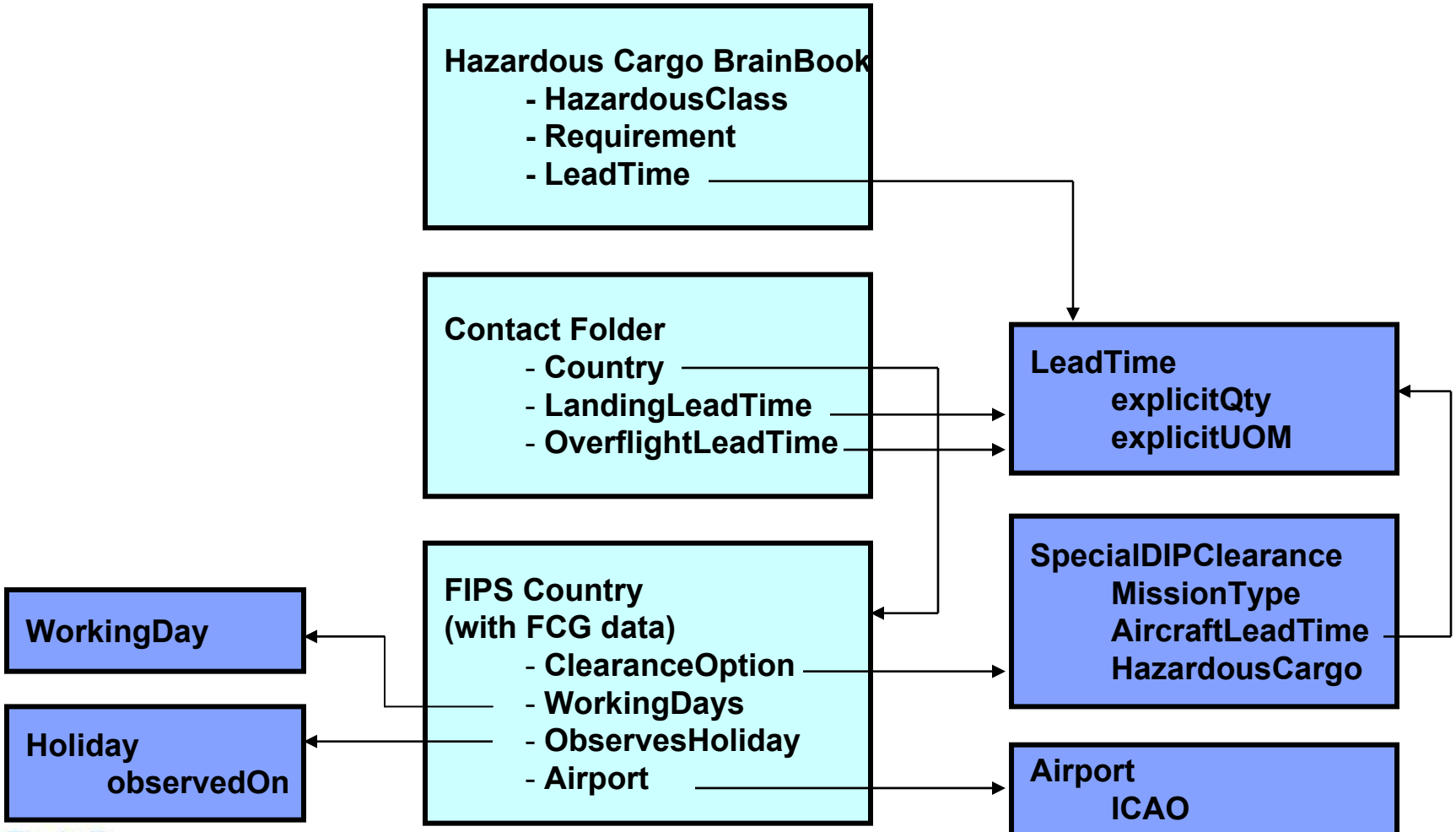
Use of Ontologies

- ACT data sources are semantically annotated (encoded) data, so they can be interpreted by software agents.
- ACT is a tool that leverages the concept of the "Semantic Web", utilizing a group of ontologies that describe the problem.



Foundation ontologies were provided to the BBN tool developers to analyze from the perspective of an information consumer, which resulted in incremental revisions to the ontologies.

Using Ontologies to Support Automated Reasoning



ACT Highlights

ACT provides a framework for:

- ✓ Processing diplomatic clearance mission requests.
- ✓ *Monitoring key events* in the process.
- ✓ Making changes to existing plans as needed.

ACT provides the following capabilities

- ✓ *Data-form consistency* and update.
- ✓ *Alerts* to the user about environment changes, e.g., new missions, data changes.
- ✓ *Graphical methods* to display mission and/or diplomatic clearance problems.
- ✓ Automatically generates and maintains *explanations* of how calculations are performed.

Challenges to Automated Systems that Use Ontologies

- **Data Source Preference**

  In ACT we developed a preference parameter that lets the user choose which data source to use for computation. Users need to specify data sources for specific instances of data, not just for the entire data set.

- **Ontology Validation**

  While tools exist to develop XML schemas and ontologies, there is little guarantee that the resulting ontologies are valid for a given problem-solving domain. For example, while there is generally higher integrity for representations of more concrete concepts (e.g., airports, holidays), representation of rule-like information tends to be biased by the way that the information will be used by a particular tool.

Recommendations

- *XML Tools* must be developed to allow consumers to *annotate data sources*, to the granularity that their applications require, without corrupting the original source.

- User-friendly methods need to be developed to allow users to *identify preferred data sources* at a granularity that is as fine as a single term associated with a data provider, e.g., “temperature” from the source “weather.com”.

- *Ontology development must be managed* in order to maintain consistency across ontologies.

- *User-friendly methods* need to be developed to *adapt existing software agents* to changing ontologies and/or data sources.

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