FFI RAPPORT

USER-DEFINED ACCESS TO SITUATION INFORMATION SERVICES - AN EXPERIMENT

GAGNES Tommy, LANGMYR Anders

FFI/RAPPORT-2004/04171

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8) ABSTRACT

In a Network Based Defence, the ability for the user to dynamically select information sources will be critical. Information services will be published in the infostructure, ready to be utilized by anyone interested.

In the experiment presented in this report, the objective was to enable lookup of services provided by the Norwegian Command and Control Information System NORCCIS II. To enable dynamic user-selected information flow based on service lookup, registry functionality had to be developed that would allow the announcement and lookup of services.

The experiment has been a joint effort between FFI and the NORCCIS II project team at the Norwegian Defence Communication and Information Services Agency (NDCISA). The registry service developed is called Resource Registry, and has been developed by FFI. Client software of this service, including a Graphical User Interface (GUI) prototype, has been developed by the NORCCIS II project team. A prototype system, showing “proof-of-concept”, was successfully demonstrated in November 2004.

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CONTENTS

USER-DEFINED ACCESS TO SITUATION INFORMATION SERVICES - AN EXPERIMENT

1 INTRODUCTION

In a Network Based Defence, the ability for the user to dynamically select information sources will be critical. Information services will be published in the infostructure, ready to be utilized by anyone interested. The emerging architectural trend of building systems as Service-Oriented Architectures (SOA) can assist in providing this functionality. As described in (2), in an SOA information is delivered from service providers to consumers in a way that is defined by a contract. To enable the lookup of services, a broker, or registry, is needed.

Today, many C4ISR systems are delivering information according to a contract (standards and message formats). As such, they may be called service providers. It is not, however, common to provide a service when no one has requested it yet. Also, the announcement of these services often is not done, as there is no lookup functionality in the system. Especially on a Wide Area Network (WAN) where network communication has to pass firewalls and private IP-networks (Network Address Translation), this is a challenge.

In the experiment presented in this report, the objective was to enable lookup of services provided by the Norwegian Command and Control Information System NORCCIS II. To enable dynamic user-selected information flow based on service lookup, registry functionality had to be developed that would allow the announcement and lookup of services.

As described in (2), Web Services has its own lookup service called UDDI. This registry is, however, mainly targeted as e-Business, its data model not considering important issues in military systems.

The experiment has been a joint effort between FFI and the NORCCIS II project team at the Norwegian Defence Communication and Information Services Agency (NDCISA). The registry service developed is called Resource Registry, and has been developed by FFI. Client software of this service, including a Graphical User Interface (GUI) prototype, has been developed by the NORCCIS II project team. A prototype system, showing “proof-of-concept”, was successfully demonstrated in November 2004.

This report gives an overview of the work done in the experiment. After presenting some brief background information, we proceed with the solution that was jointly architected with the NORCCIS II team. Then, a brief introduction to the metadata model of the resource registry is given. Further, we give a black-box description, that is, a description of the external aspects of the Resource Registry Web Service, before looking inside and presenting a white-box view of the internal aspects of the Resource Registry.

2 BACKGROUND

To receive an information flow, current practice is to request, using "out-of-band" means, the set up of an information flow by the provider. This request could be done by mail, voice or similar, and is a candidate for automation, especially in a Network Based Defence, where dynamic information sharing between all participants is envisioned.

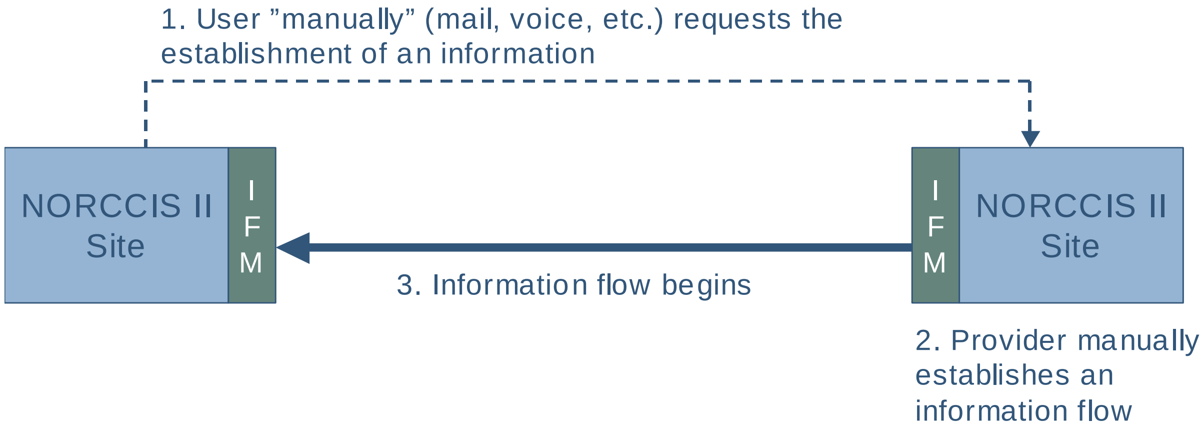

Figure 2.1 The set-up of an information flow in today's system

Figure 2.1 shows a sequence that illustrates the set up of an information flow in today's NORCCIS II. IFM, Information Flow Manager, is a module used to handle the information flows to and from a NORCCIS II site. The IFM is described further in chapter 3. To enable dynamic and partly automatic discovery of services based on metadata and the set up of information flows, an experiment was formulated like this:

- The purpose of the experiment was "further development of today's operational information systems (NORCCIS II) to give access to the Common Operational Picture according to Network Based Defence principles".

- The objective was "to demonstrate that a decision maker using NORCCIS II can obtain user-selected access to a Common Operational Picture".

Thus, a prototype system should be built, showing how a user could browse a registry for available information providers, and select one or more to connect to, based on metadata about providers. Connection to selected providers would then be done based on information found in the registry, thus eliminating the need for this "manual" approach.

3 NORCCIS II AND THE INFORMATION FLOW MANAGER (IFM)

This section is a short description of NORCCIS II. A supplementary description, provided by the NORCCIS II project, is included in Appendix D.

3.1 General Capabilities

NORwegian Command and Control Information System Phase II (NORCCIS II) is Defence Staff Norway's primary Command and Control system for support of Joint Operations at the Operational, Strategic and Tactical levels. It is designed to provide an enhanced operational effectiveness in times of Peace, Crisis and War for both Article 5 and Out-of-Area situations. This is achieved by using a combination of Commercial Off The Shelf (COTS) products and specially developed applications (Figure 3.1).

3.2 System Description

At the heart of the system, is a dynamic database for storage and retrieval of operational data. This data can be displayed both textually (via Textviews) and graphically (via the Map System and OBM). Operational database management is performed through the Main Menu. A Message Processing Tool is used, both to generate and parse formal Military Messages, which are then "transported" into and out of NORCCIS II using the Military Message Handling System. Office Support Tools exist for administrative purposes, and these also allow informal communication with the outside world via Email. For automatic information exchange the Information Flow Manager is used to program formatted message exchange with other NORCCIS II sites or sites outside the NORCCIS II WAN.

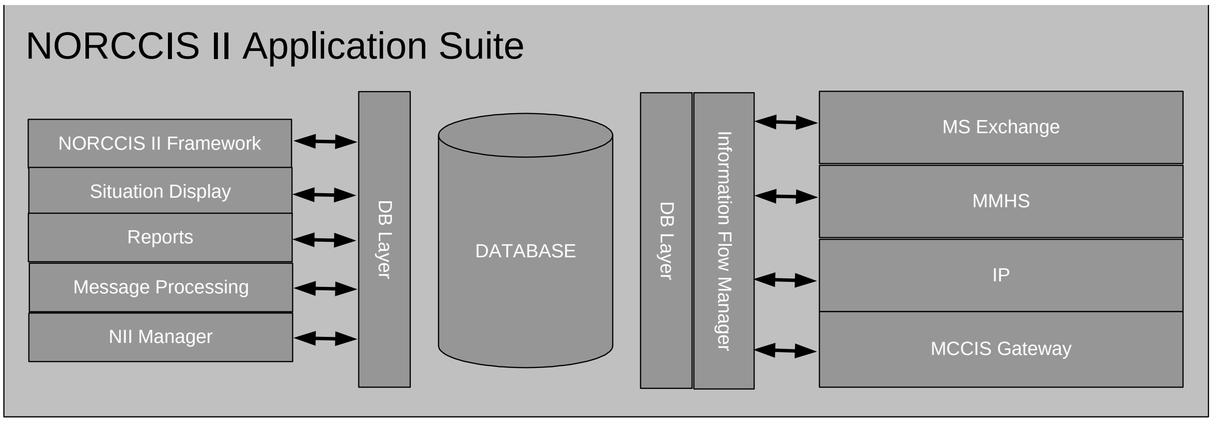

Figure 3.1 NORCCIS II Application Suite

3.3 Data Exchange between NORCCIS II sites

Formatted information exchange between NORCCIS II sites is done in three alternative ways:

- Internal NORCCIS II messages
- Formatted standardized messages ADatP-3, OTHT-G and USMTF
- Data Replication

The newly developed Information Flow Manager is the gateway for all automatic information flow in and out of a NORCCIS II node.

The Information Flow Manager provides:

- Automatic information exchange between NORCCIS II user nodes
- Channels for information exchange through MS Exchange, Military Message Handling System (MMHS) socket and serial communication
- Message logging
- Automatic information exchange based on operational attributes
- Graphical tool to manage dataflow setup

4 SOLUTION

To enable registration, searching, and retrieval of information about services (metadata), a registry service named Resource Registry has been designed, heavily inspired by the SOA paradigm. A sequence that shows the use of this service is depicted in Figure 4.1.

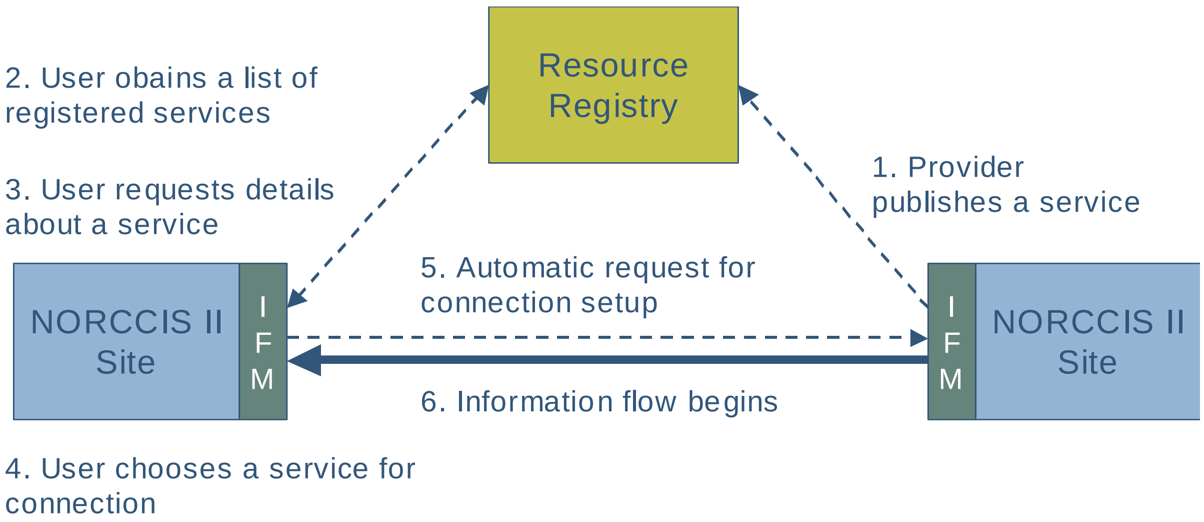

Figure 4.1 Sequence showing the use of a Resource Registry

There are six phases in this scenario, five of which must be completed for the user to obtain application data:

1. Service provider publishes service
2. User obtains list
3. User requests details (optional)
4. User chooses a service to connect to, and client software sets up receiving endpoint
5. Set-up request is automatically sent to service provider
6. Information flow begins

5 IMPLICATIONS FOR OPERATIONAL USE

This represents a new approach where services are announced without necessarily knowing who the recipient is. (Of course, access control can be used to restrict access to services.) Users look for their information sources in a registry. This is more in line with the concept of a Network Based Defence where one envisions information access as more of a “pull”-style operation than a “push”-style operation. Users should be able to decide for themselves what kind of information they want, and when they need it.

Some examples of services that could be published from a NORCCIS II site are:

- Recognized Maritime Picture Northsea
- Own Land Forces Iraq
- Recognized Air Picture South Norway

The process of finding the right information source in the Resource Registry is dependant on the quality of metadata, that is, data about the registered services. The next chapter looks more deeply into this aspect of the prototype system.

6 METADATA FOR SERVICES

Users of the information infrastructure in a Network Based Defence will most probably be dependant on registries and search engines providing information about what information is available and where. Whereas the where-part is often a Uniform Resource Locator, or URL, pointing at the Web Address of a resource, the what-part can be much more complicated to describe. However, if done right, metadata provides a lot of help in finding and locating *relevant* information resources. This is also helpful for limiting options, thus reducing the well-known issue of *information overflow*.

In this experiment, our focus has been on visualizing the possibilities that metadata can give, not on designing an exhaustive metadata model for all cases. This is a complex task, which must be done in close co-operation with users of the system.

When designing the metadata model that forms the basis of information search in the Resource Registry, we have thought along the lines of what, who, where, when, why and how. Assuming that the ‘why’-question is the motivation for doing the information search and publishing, we give some examples of fields in the metadata model that will give some degree of answer to these questions:

Question	**Metadata field in Resource Registry**
What	Situation information (Air, Ground, Surface etc,) Class of NBF component (Sensor, effector, decision support, infostructure)
Who	Organisation Issuer/Contact Person (with call sign, e-mail address etc.)

Where	Geographical area that the service covers Physical location of service (Platform, Position)
When	When the service was published (Timestamp)
How	Access restrictions (Bandwidth, network connection, security) Technical information (network address e.g. for connection)

As can be seen in the table, the metadata model covers both content and properties of a service. In other words, it is possible to find out what content can be expected from a service as well as how to obtain it. Further, as the map metaphor will always be a central part of any military decision maker's way of thinking, we have included the coverage area of a service, for instance a sensor in the metadata. The following chapter describes the black-box view of the Resource Registry. By this we mean the view that external users of the resource registry (e.g. NORCCIS II) will have of the service.

7 RESOURCE REGISTRY, BLACK BOX VIEW

This chapter presents the black-box view that external users will have of the resource registry. The tasks of the resource registry are mainly to accommodate management, search and retrieval of metadata about resources, and one of its goals was that it should be interoperable with clients developed in different languages and on different platforms. The Resource Registry was therefore exposed as a Web Service. An overview of the resource registry with its accompanying XML-schemas and WSDL-documents (Web Services Description Language) is shown in Figure 7.1.

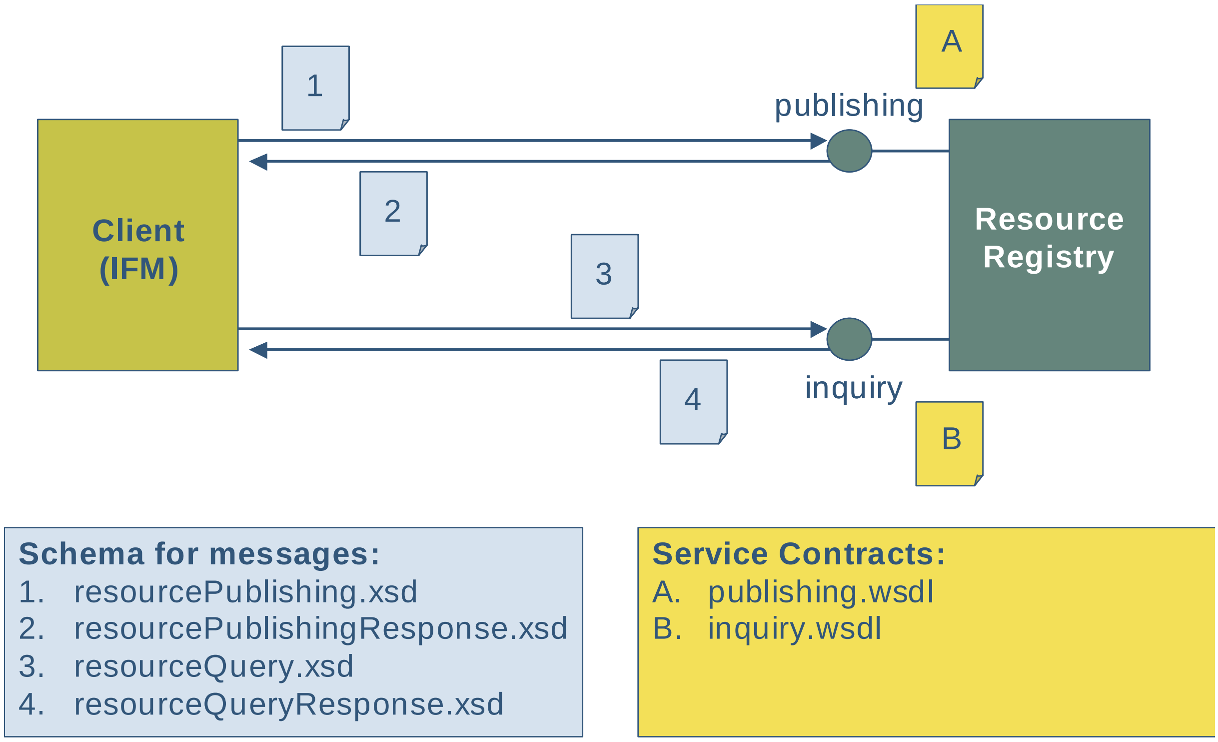

Figure 7.1 A black-box view of the Resource Registry with IFM as client

The Resource Registry as seen by the external users is a web service with two defined interfaces. The first interface (publishing) defines how one can publish, update and delete metadata about services in the resource registry; this interface is described by the WSDL-document *publishing.wsdl*. The second interface (inquiry) defines how one can query the resource registry for information about available services based upon different criteria; this interface is described by the WSDL-document *inquiry.wsdl*.

The two WSDL-documents describe more specifically what kind of messages/requests the resource registry accepts and what responses the resource registry will return based on a specific message/request. This partition in requests and responses is reflected in the structure of the WSDL-documents; each of them is based upon two XML-schemas, where one schema describes the accepted messages/requests and the other schema describes the corresponding responses. The relationships between the WSDL-documents and their corresponding XML-schemas can be seen in Figure 7.1.

To communicate with the Resource Registry the external user will have to send a SOAP message to the resource registry containing one of the accepted messages/requests. The corresponding response from the resource registry will be returned contained in a SOAP message.

SOAP is an XML based communication protocol used to exchange information in distributed surroundings. Its structure is simple; it consists of an envelope that contains an optional header and a required body, see Figure 7.2. The requests the user sends to the resource registry and the responses returned will be contained inside the body.

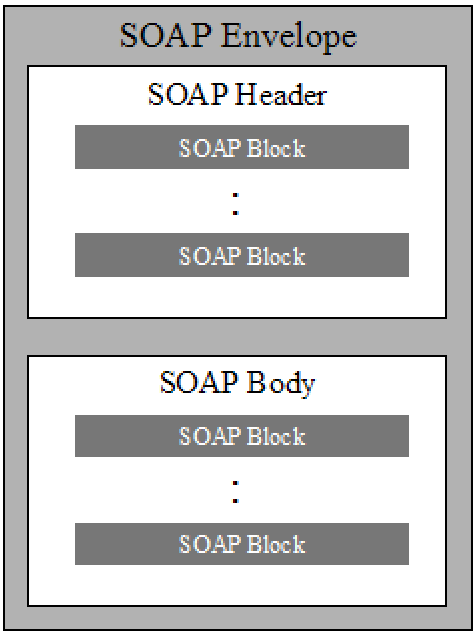

Figure 7.2 The structure of a SOAP message

8 RESOURCE REGISTRY, WHITE BOX VIEW

This chapter presents the internals of the resource registry. As described above, the tasks of the Resource Registry are mainly to accommodate management, search and retrieval of metadata about resources. In Figure 8.1, behind its Web Service interface, we can see that the Resource Registry is based on a technology called Resource Description Framework (RDF), and therefore has a module for accessing RDF content. A database persistence mechanism is also provided, so that the Resource Registry does not loose all information should the system go down.

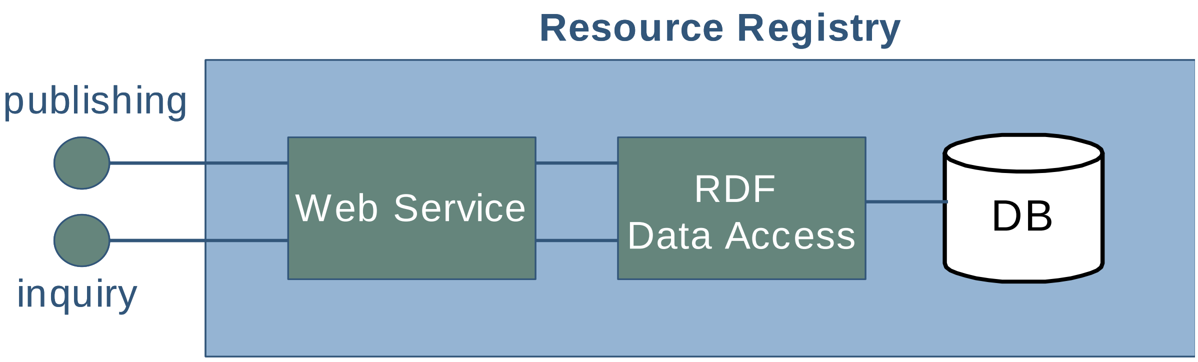

Figure 8.1 White-box view of Resource Registry

RDF is a technology standardized by the World Wide Web Consortium (W3C). RDF is described briefly in (1), and is essentially a mechanism for creating ‘sentences’, or *statements*, of the form <resource, property, value>, where a value can be another resource or a literal (string). By creating several such statements, one ends up with a graph of the resources described. The RDF specification defines an XML-serialization of such a graph. Resources are identified by URIs. Figure 8.2 illustrates an example of an RDF statement that says “Service is published by FOHK”.

Figure 8.2 A RDF statement visualised as a graph

In Figure 8.3, we add another statement that describes the same service as “having the type Sensor”.

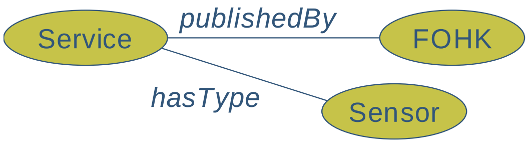

Figure 8.3 Two RDF statements about the same resource (Service)

By creating many such statements, a large graph can be created. Some nodes of the graph will be generic, such as Person, Service, and others may be specific, such as “ServiceXYZ”. We call the generic ones classes, and the specific ones instances, as in object-oriented systems. Figure 8.4 shows a simplified example of the graph that is the Resource Registry data model (green) as well as instance-specific information (blue) for “ServiceXYZ”. A listing of the entire metadata model is included in Appendix A.

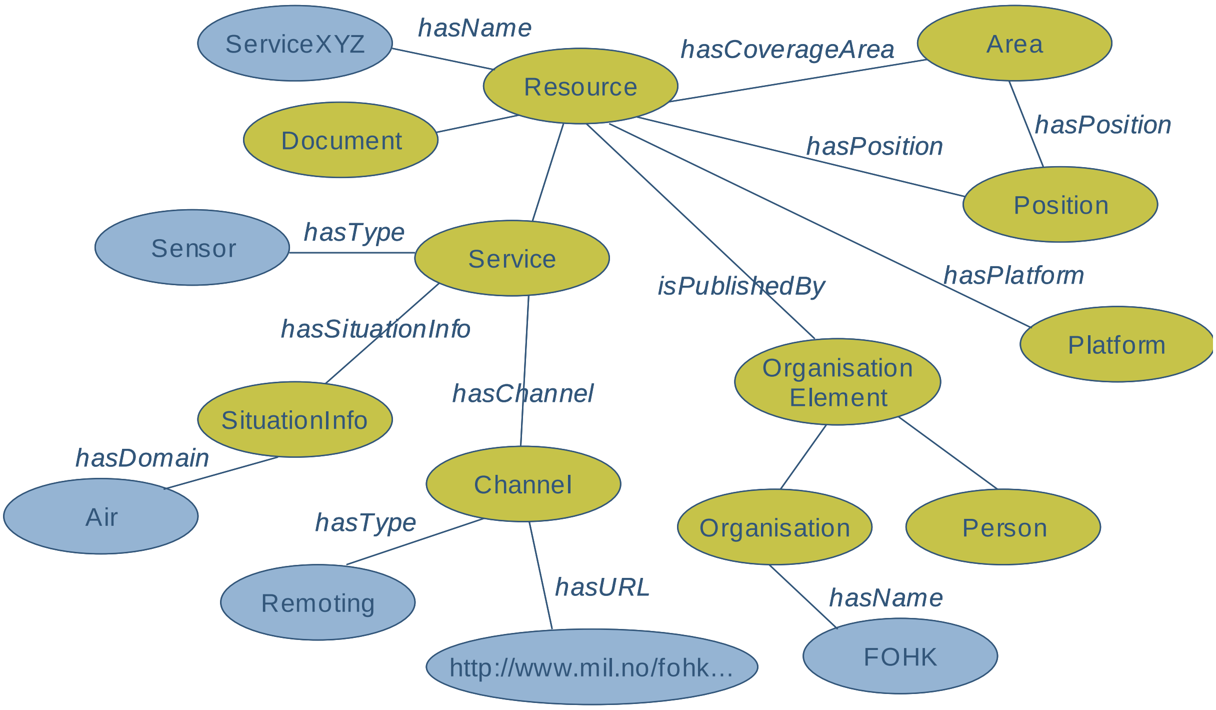

Figure 8.4 An example RDF graph with classes and instances.

Every field of every registered service in the Resource Registry is represented in the graph as instance fields. By querying this graph, information can be retrieved. The main benefits of using this graph-based technology compared to a regular database, is that the associations of the fields are explicit, and therefore easier to search by and to transport via a network.

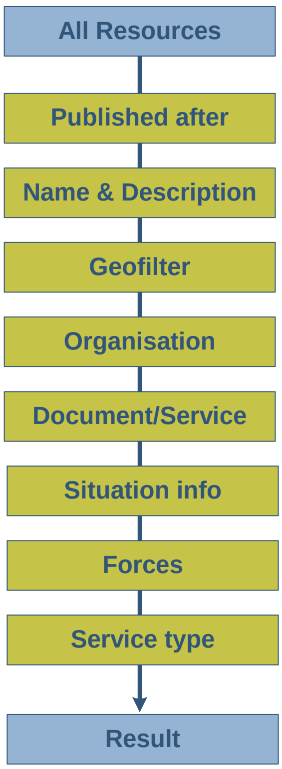

Figure 8.5 Available filters for services in the Resource Registry

When querying the Resource Registry, the default policy is to return all services unless filtering has been added. Various filters have been implemented, as shown in Figure 8.5. It is possible to filter by date, Service Name, Organisation, Situation Information, Force information and service type, but probably the most interesting filter is the Geofilter. This filter enables the user to specify a geographical area of interest, and restrict the results to only the providers whose coverage area intersects an area specified in the query. This is a valuable feature for users that are mainly interested in searching by area.

9 PROTOTYPE & DEMONSTRATION

To develop the prototype system, it was decided that the Norwegian Defence Communication and Information Services Agency was responsible for the further development of the Information Flow Manager module, whereas FFI should develop the Resource Registry. Development was done in a distributed manner, with the Resource Registry running at FFI, and NORCCIS II/IFM at Teleplan, a software development company that is tasked with the development of NORCCIS II and the IFM.

Some discussion following FFIs initial effort on the data model and Web Services interfaces was done via email, before running a successful prototype demonstration on November 25. 2004. The demonstration was a “proof-of-concept” demonstration that showed the following steps:

- Registration of an IFM-managed service in the Resource Registry
- Client Lookup of the service in the Resource Registry
- Client connection to the service

The demonstration was a pure lab exercise, so further work in this area would be to bring the prototype to a military exercise to receive input from the operational use of such a registry. Some screenshots of the extended IFM are included in Appendix B.

10 SUMMARY

The experiment has shown that it is possible to provide a powerful discovery/lookup mechanism through small extensions of existing applications. This can be seen as an interim solution that enables lookup of information sources in the information infrastructure based on users’ needs. Further work could be to bring the system out in an operational context, to test the concept of user-selected access to NORCCIS II services.

APPENDIX

A METADATA MODEL

The entire metadata model described in a readable format is listed below. Classes are shown in bold, whereas properties and their parameter types are shown in italics. An indented class means that it is a subclass of the previous non-indented class.

Area

- *hasPosition(Position)*

Channel

- *hasHost(String)*
- *hasPort(String)*
- *hasType(String)*
- *hasUri(String)*

Latitude

- *hasLatitudeDegrees(int)*
- *hasLatitudeMinutes(int)*
- *hasLatitudeSeconds(int)*

Longitude

- *hasLongitudeDegrees(int)*
- *hasLongitudeMinutes(int)*
- *hasLongitudeSeconds(int)*

OrganisationElement

- **Organisation**
  - *hasOrganisationName(String)*
  - *hasOrganisationURI(URI)*
- **Person**
  - *hasCallSign(String)*
  - *hasEmailAddress(String)*
  - *hasPersonName(String)*
  - *hasPhoneNumber(String)*

Platform

- *hasPlatformClass(String)*
- *hasPlatformName(String)*
- *hasPlatformPosition(Position)*
- *hasPlatformType(String)*

Position

- *hasAltitude(double)*
- *hasLatitude(Latitude)*
- *hasLongitude(Longitude)*

Resource

- *hasCoverageArea(Area)*
- *hasCoveragePosition(Position)*
- *hasDescription(String)*
- *hasID(URI)*
- *hasName(String)*
- *hasPlaceName(String)*
- *hasPublishedTime(dateTime)*
- *hasURL(URI)*
- *isHostedBy(Platform)*
- *isPublishedBy(OrganisationElement)*
- **Service**
  - *deliversMessageFormats[adatP3, J-Series, OTHG]*
  - *hasChannel(Channel)*
  - *hasServiceClass[sensor, effector, decision, infostructure]*
  - *hasServiceType(String)*
  - *hasSituationInfo(SituationInfo)*

SituationInfo

- *hasAirInfo(boolean)*
- *hasFriendlyInfo(boolean)*
- *hasGeographicalInfo(boolean)*
- *hasGroundInfo(boolean)*
- *hasHostileInfo(boolean)*
- *hasNeutralInfo(boolean)*
- *hasSpaceInfo(boolean)*
- *hasSubsurfaceInfo(boolean)*
- *hasSurfaceInfo(boolean)*
- *hasUnknownInfo(boolean)*
- *hasWeatherInfo(boolean)*

B INFORMATION FLOW MANAGER SCREENSHOTS

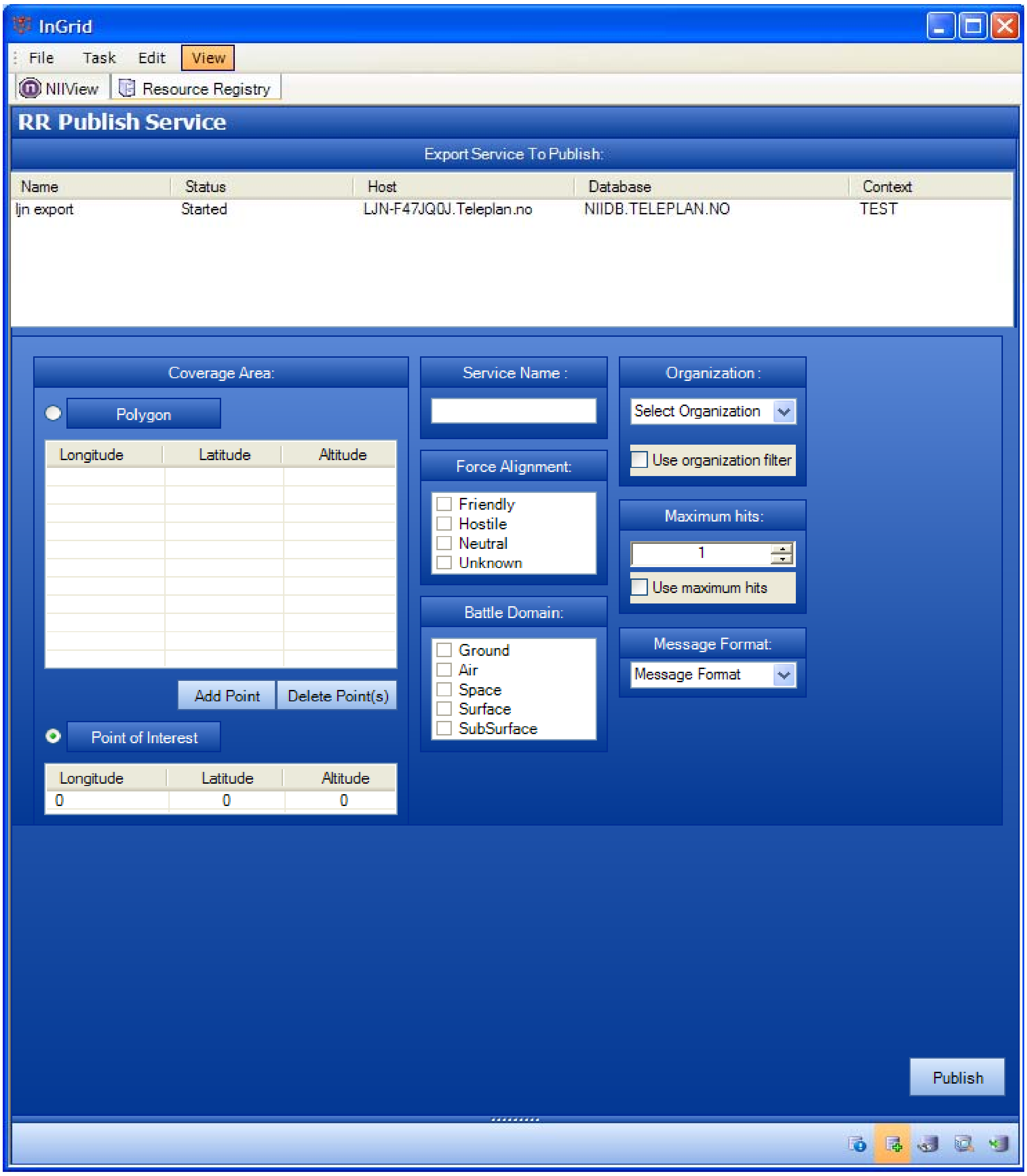

Figure 10.1 Publish view of IFM interaction with the Resource Registry

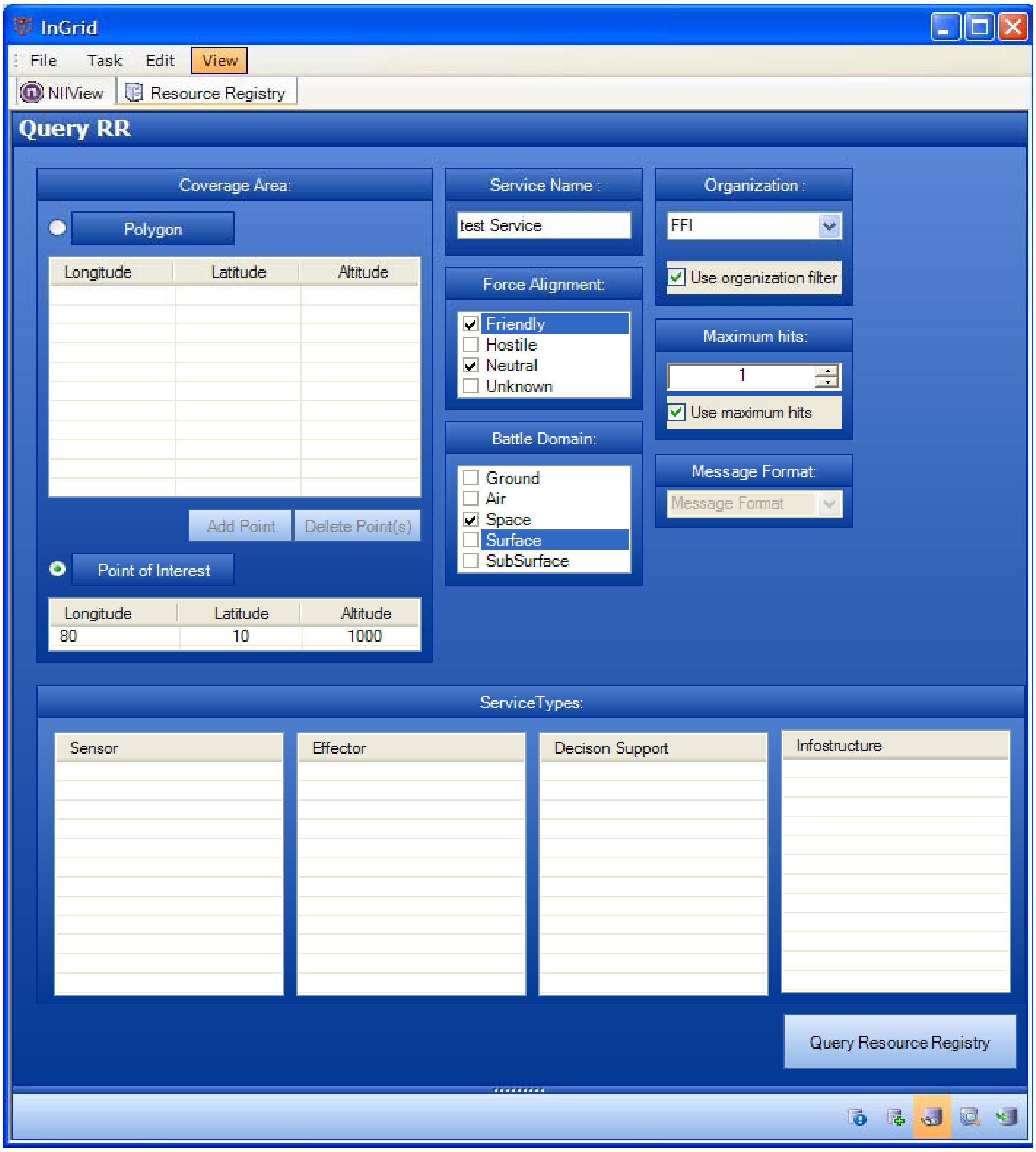

Figure 10.2 Query view of IFM interaction with the Resource Registry

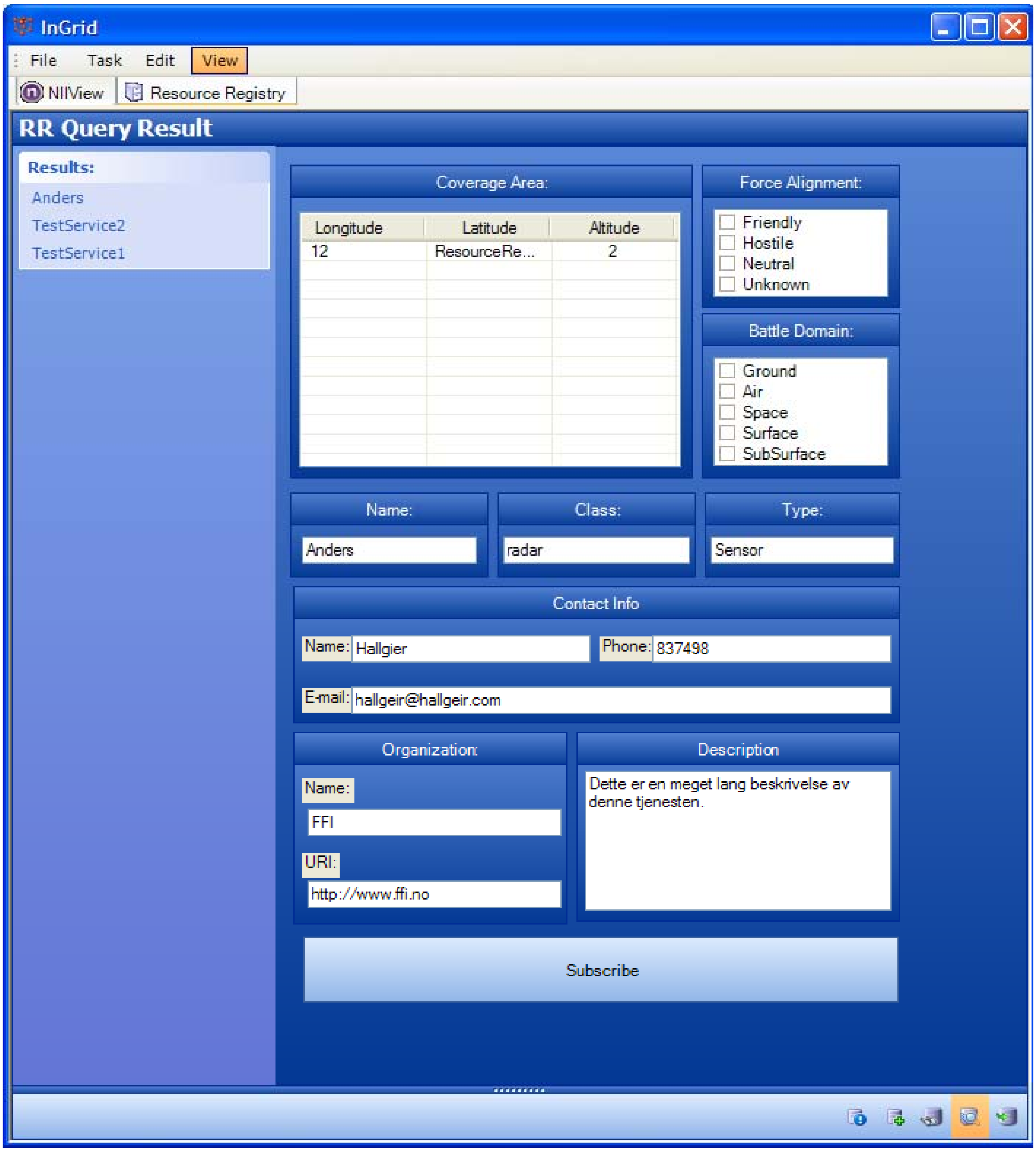

Figure 10.3 Result view of IFM interaction with the Resource Registry

C TOOLS USED TO IMPLEMENT THE RESOURCE REGISTRY

The use of open standards and open source software has proven feasible for this project. All the software libraries used are freely available on the Internet.

C.1 SAAJ

The SOAP with Attachments API for Java (SAAJ) provides a standard way to send XML documents over the Internet from the Java platform. By making method calls using the SAAJ API, one can create, send, and consume XML messages embedded in SOAP envelopes over the Internet (3).

We used this technology to communicate with clients of the resource registry. First, we defined XML schemas that specified the valid messages that could be received and returned from the resource registry. The clients constructed XML documents based on these XML schemas and sent them to the resource registry embedded in a SOAP envelope. The Resource Registry then consumed these requests and generated XML documents in response to the request, which were returned to the clients embedded in SOAP envelopes.

C.2 JAXB

The Java Architecture for XML Binding (JAXB) provides a fast and convenient way to bind XML schemas to Java representations, making it easy to incorporate XML data and processing functions in Java applications. JAXB provides methods for unmarshalling XML instance documents into Java content trees (a hierarchy of Java data objects that represent the source XML data), and for marshalling Java content trees back into XML instance documents (4).

We used this technology in conjunction with the SAAJ API to unmarshall the SOAP requests we received from clients into Java content trees, and to marshall the generated response into a SOAP message that was returned to the client. Because of this technology we could work with a Java representation of the SOAP message instead of the actual XML data, which made the programming much easier.

C.3 XMLSpy

Altova XMLSpy is an XML development environment for modelling editing, debugging and transforming all XML technologies (5).

We used this tool to define the XML Schemas that specified the valid messages that could be received and returned from the resource registry. It could visualize the schemas in a very intuitive manner, so that the structure was clearly understood (see Figure 10.4). This made the development of the schemas more straightforward.

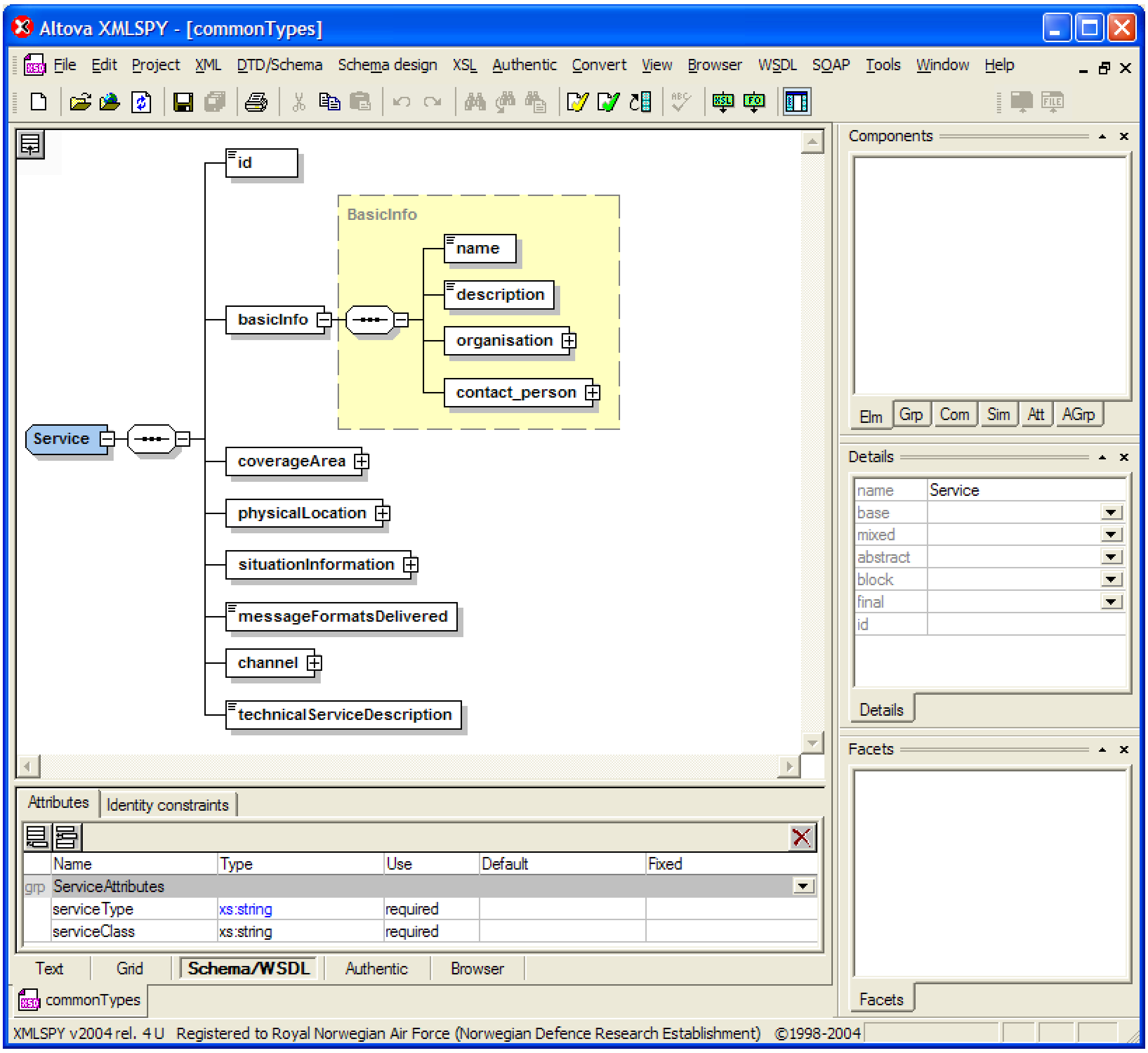

Figure 10.4 Altova XMLSpy.

C.4 The Jena framework

To implement the RDF functionality in the Resource Registry, we used the freely available, open-source Jena framework developed by HP Labs. This is a powerful API for working with RDF. The Jena framework also comes with support for the Resource Description Query Language (RDQL), a query langue for querying RDF statements.

C.5 Apache Tomcat

Tomcat is the servlet container that is used in the official reference implementation for the Java Servlet and Java Server Pages technologies (6). We used this servlet container to host our resource registry web service.

D A MORE DETAILED DESCRIPTION OF NORCCIS II

D.1 General Capabilities

NORwegian Command and Control Information System Phase II (NORCCIS II) is Defence Staff Norway's primary Command and Control system for support of Joint Operations at the Operational, Strategic and Tactical levels. It is designed to provide an enhanced operational effectiveness in times of Peace, Crisis and War for both Article 5 and Out-of-Area situations. This is achieved by using a combination of Commercial Off The Shelf (COTS) products and specially developed applications (Figure 3.1).

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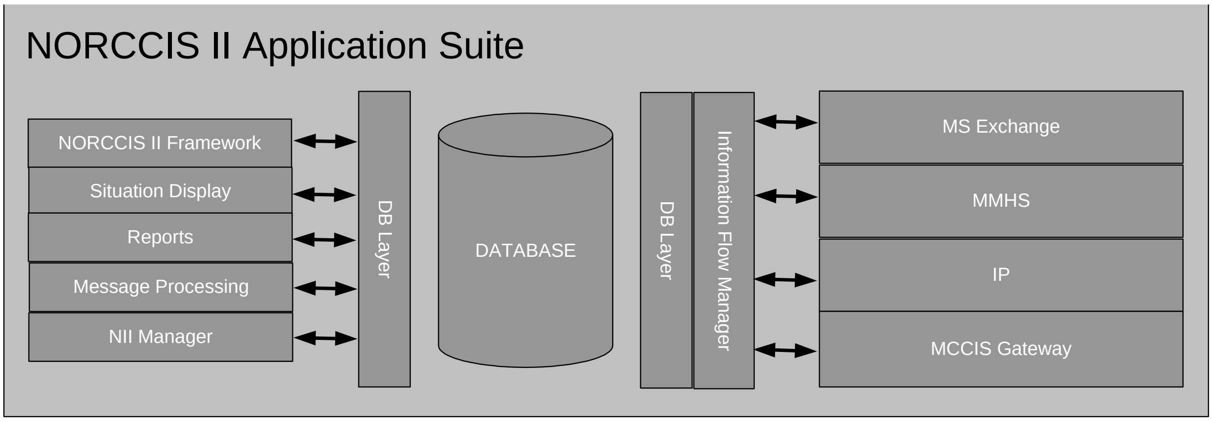

Figure 10.5 NORCCIS II Application Suite

The typical NORCCIS II site consists of several Windows XP workstations and one or more Windows 2000 servers. It is a client – server architecture with NORCCIS II applications running on Windows XP workstations, and the file / applications server running on a Windows 2000 server. The NORCCIS II database is an Oracle 9i database server installation running on a Windows 2000 server. The NORCCIS II application suite is running on the NORwegian Defence Information Services – Secure (NORDIS – S) supporting a partioned, two–domain solution, with a Windows 2000 transfer server for cross domain information exchange. The Thales XOMail MMHS is also integrated into NORDIS-S as a cross-domains service.

NORCCIS II is designed in modules addressing the requirements of various sizes and types of HQs. For instance, the Special Forces can use NORCCIS II on a single laptop; an Army Divisional HQ can have up to thirty users, while large HQs may comprise several hundred users. A NORCCIS II VIP briefcase, which includes SATCOM allowing networking anywhere in the World, is also available. NORCCIS II can also be an excellent choice for an interim capability, based on this scalability and exceptionally short roll-out time required.

D.3 Data Exchange with External Sources

The NORCCIS II database is updated by user input through the C2I application located at NORCCIS II workstations, semi automatic formatted message processing or fully automatic formatted message processing. NORCCIS II is currently deployed at the strategic, operational and tactical level of operation. The main source of information update is formatted messages, supporting ADatP-3, OTHT-G and USMTF. The formatted messages are exchanged primarily through the Millitary Message Handling System or secondary through MS Exchange. The MCCIS Gateway provides full interoperability with MCCIS at dedicated NORCCIS II sites. Data exchange with MIP based systems like the NORTAC CCIS is executed through the MIP DEM standard. The system has the capability to receive, parse and display J-series, M-series messages, Link-1 and Link-14. NORCCIS II has a component that receives and parses messages sent from the Aegis Display System and then maps these messages to corresponding elements in the NORCCIS II database. Weather data from The Norwegian Meteorological Institute is distributed, parsed and presented through a newly developed addin on top of the common operating situation picture.

D.4 Data Exchange between NORCCIS II sites

Formatted information exchange between NORCCIS II sites is done in three alternative ways:

- Internal NORCCIS II messages
- Formatted standardized messages ADatP-3, OTHT-G and USMTF
- Data Replication

The newly developed Information Flow Manager is the gateway for all automatic information flow in and out of a NORCCIS II node.

The Information Flow Manager provides:

- Automatic information exchange between NORCCIS II user nodes
- Channels for information exchange through MS Exchange, MMHS socket and serial communication
- Message logging
- Automatic information exchange based on operational attributes
- Graphical tool to manage dataflow setup

D.5 Communication Interfaces

Information produced on NORCCIS II can be exchanged with external systems based on different mechanisms:

- E-mail / MMHS to send/receive formatted messages (ADatP-3, OTHT-G, USMTF)

  - contact information automatically synchronized with other nations directories
- MMHS Socket Gateway
  - Allows the information to pass through zones/guards and automatically update the NORCCIS II database.
- MMHS Replication Gateway
  - database information automatically replicated one-way from NORCCIS II on NATO Secret Security Level to NORCCIS II on National Secret Security Level mediated through an MMHS server
- MIP DEM (replication)
  - Compatible with current version of LC2IEDM Version 2.2
- WEB portal based on MS Sharepoint with following functionality:
  - Jane's
  - CIA World Factbook
  - Document Publishing and Search
  - Document Subscriptions
  - News - Web Part
  - Meteorology
- NATO WAN connectivity allowing NATO web browsing and e-mail exchange with all NATO users.

D.6 Status of the System

NORCCIS II supports user requirements to communicate swiftly and securely, be it Alliance Classified or National Classified information, whilst keeping the two apart. NORCCIS II is formally accredited to operate in System High mode at NATO SECRET level.

REFERENCES

(1) T. Gagnes (2004): A Survey of the Current State of the Semantic Web, FFI/NOTAT-2004/03985, Ugradert

(2) T. Gagnes (2004): A Survey of Service-Oriented Architectures, Event-Driven Architectures and the Current State of Web Services Technology, FFI/NOTAT-2004/04264, Ugradert

(3) Sun Microsystems (2004): SAAJ, http://java.sun.com/xml/saaj/index.jsp

(4) Sun Microsystems (2004): JAXB, http://java.sun.som/xml/jaxb/about.html

(5) Altova (2004): XMLSpy, http://www.altova.com/products_ide.html

(6) The Apache Jakarta Project (2004): Tomcat, http://jakarta.apache.org/tomcat/