MAKING THE EO CATALOGUES WORK TOGETHER:
CATALOGUE INTEROPERABILITY PROTOCOL (CIP) EXPERIENCES

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ABSTRACT

CIP is a communication protocol for accessing the Earth Observation catalogues, and via proper translators the geo referenced metadata catalogues, built on the Z39-50 standard.
MATRA SYSTEMES & INFORMATION Earth Observation team was involved since the year 1997 in several projects using this protocol and has now a complete range of experience, stretching from connection of new catalogues to server's development.
Some recent experiences are described below:

- Develop a "portable" Client in Java language for accessing EO catalogues through the CIP protocol (for European Space Agency),
- Connect the major French SPOT Image catalogue to the INFEO server of the Centre for Earth Observation (CEO) through a specific CIP gateway (for the CEO project),
- Participate in the connection of various catalogues (Institut Géographique National / F, CORINE Landcover / UK and Sweden, British Atmospheric Data Centre, European Environment Agency catalogue "CDS") to INFEO through the CIP / ODBC gateway designed for the INFEO server (for the CEO project),
- Participate in the implementation of a CIP gateway between INFEO server and the MUIS server of European Space Agency, giving access to the ESA major EO catalogues (for ESA),
- Update the Client and this last gateway for the new versions of protocols (for ESA)
- Participate in the new version of the INFEO server, providing a Java applet for the client component (for the CEO project)

1 . INTRODUCTION

One of the main concern of applications using EO data (like risk management, agriculture, urban planning) is the access to multiple sources of data (satellite/airborne optical & SAR , cartography, meteo …). This assesment led ESA/ESRIN and the CEO (Centre for Earth Observation) program of the JRC (Joint Research Centre, of the European Commission) to implement protocols providing interoperability between different EO catalogues.

 Among the industrial partners selected to develop them, MATRA SYSTEMES & INFORMATION, a subsidiary of the AEROSPATIALE MATRA Group, participated to different projects as prime or subcontractor, showing its involvement in this promising field.
In this paper we first summarise what is the CIP and give a brief description of its early implementation : INFEO.
Then, through the wide diversity of our projects, we demonstrate the extent of CIP capabilities.

2 . PRESENTATION OF INFEO & CIP

2.1 Short description of CIP

2.1.1 Presentation

The Catalogue Interoperability Protocol (CIP) has been developed under the initiative of the Committee on Earth Observation Satellites (CEOS). The main aim was to provide international agencies with a way to make EO data, and related data, available in a coherent manner to their user communities.

As introduced in the following figure, the CIP is based on:

- the **Z39.50 standard** already including search and retrieval mechanisms linked to an Explain DataBase providing information on the used attributes and access control,
- a **CIP profile** has been defined to add specific parts linked to the Earth Observation domain and, in particular, this profile includes the definition of two main *CIP Objects*:
- the **collection descriptor** used to group products according to themes of interest for the end-user and a **product descriptor** containing all the useful metadata to describe an EO data.

Extended services have been added to the initial Z39.50 services to support specific tasks such as the **product Ordering**.
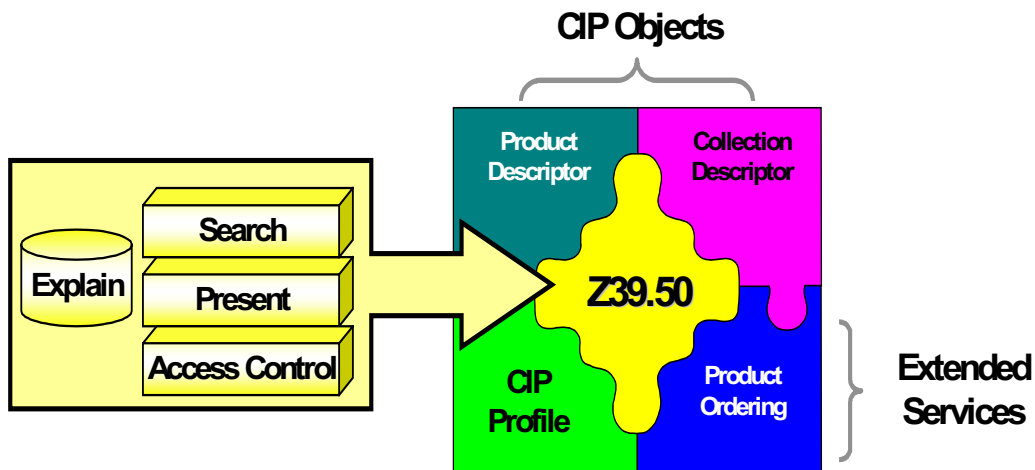
Figure 1 : CIP diagram

2.1.2 Main concepts

The two main interesting concepts in CIP are:

- The **Explain** information, that is a very powerful concept where all the exchanged metadata is described and can be easily modified: a client software can retrieve the search attributes, the possible query conditions, the retrieved attributes and how they are organised into descriptors.
- The **CIP collection** concept, that allows to organise products with a user view: a "non-terminal" collection can be used to group data together which have a similar semantic theme (e. g. the same geographical coverage). This *collection hierarchy* help the end-user in finding information of interest. In addition to data organisation suitable for users, collections provide the mechanism for routing, transparently, distributed search (as introduced in next figure).
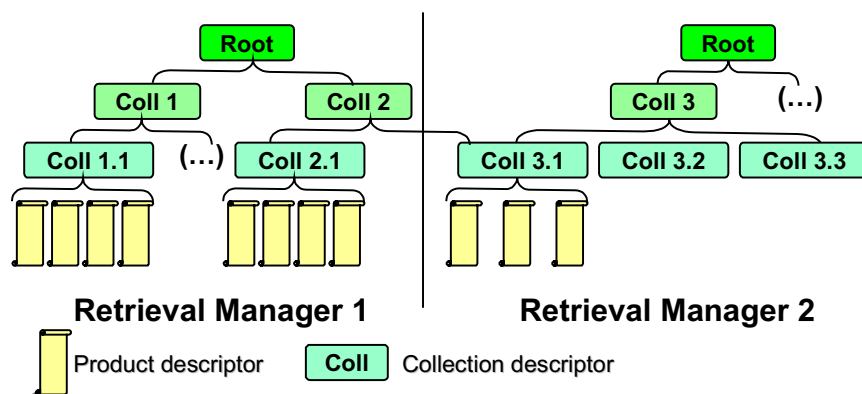
Figure 2 : CIP Collections

2.2 Short description of INFEO (INFormation on Earth Observation)

CEO is a JRC driven program dedicated to the promotion and marketing of Earth Observation data in Europe.

The INFEO system has been developed under this initiative, to build an European middleware node to promote the interoperability of EO catalogues and the easy access to meta data. This system includes a Search server compliant with the CIP protocol and is composed of three main parts:

- **The client**: the end-user can access the CIP Search server either through an HTTP client or a CIP Client software installed on his machine.
- **The server**: the Search server interprets the CIP requests coming from the users and routes it to the different connected gateways. It also manages the Collection and Explain databases.
- **The gateways**: for each connected catalogue, a gateway make the translation from CIP to the native protocol: generic gateway using ODBC provided by INFEO (called CIP-ODBC) or specific gateway in other cases.
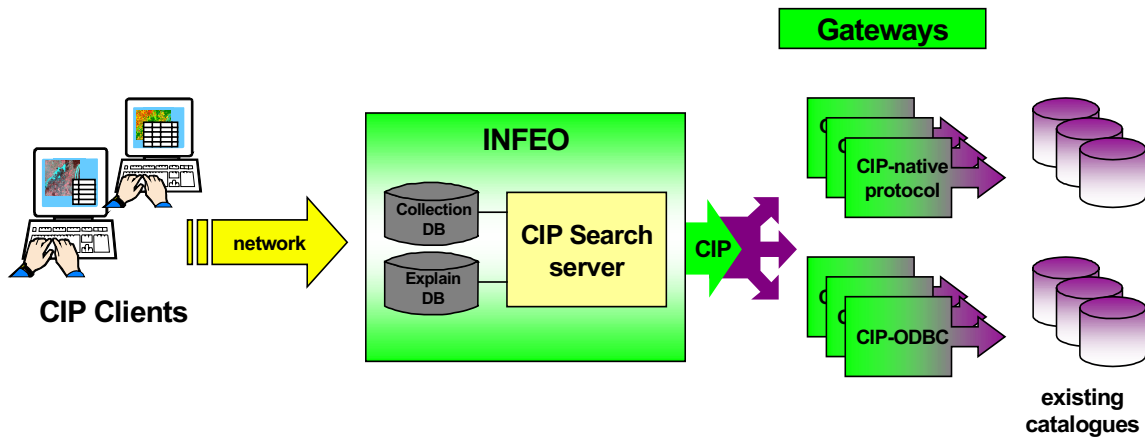

Figure 3 : INFEO diagram

The following chapters describe in more details the projects, in which MS&I was involved, where the main aim was to build a new piece of this ambitious infrastructure.

The INFEO system is operational, more information can be retrieved from: *http://www.infeo.org*

3. MATRA SYSTEMES & INFORMATION PROJECTS IN CIP

Funded by the European Commission or the European Space Agency, these realisations involved other industrial partners like DATAMAT and ACS (Italy), or LOGICA (GB).
This diagram shows the different modules involved in our projects, contributing to build a MUIS-INFEO CIP compatible system.
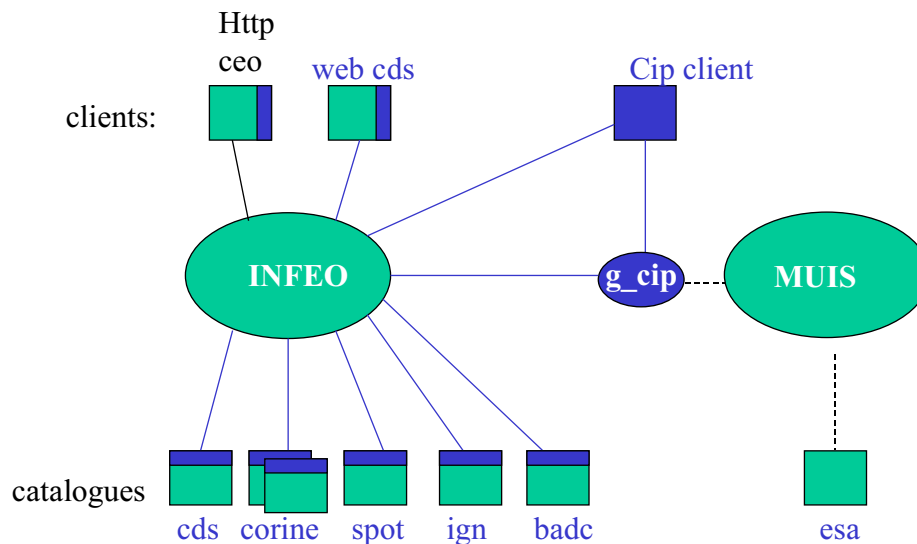
Figure 4 : INFEO/MUIS and MATRA SYSTEMES & INFORMATION projects

3.1 CIE_CEO project (for Joint Research Centre)

CIE_CEO (Catalogue Interoperability Experiment for CEO) project's objective was to connect 3 new catalogues on the INFEO server :

- **SPOT Image catalogue**, in Toulouse (France), containing the SPOT satellites images catalogue, was connected using a specific gateway, since its data-base was not directly accessible through ODBC standard, with a specific high level language.
- **IGN** (Institut Géographique National – France) products catalogue, containing meta data about paper maps, raster maps, vector maps, and aerial photographs, was connected to INFEO using the CIP / ODBC gateway
- **BADC** (British Atmospheric Data Centre – UK) products catalogue, containing meta data about atmospheric measurements (airborne, radiosonde, etc..) was connected to INFEO using the CIP / ODBC gateway.

These connections were performed during the year 1999.

3.2 EEIS project (funded 50% by European Commission, Telematics Applications programme)

EEIS (European Environmental Information Services) objective was to build a bridge between the European Earth Observation and Environment communities. To do this EEIS connected two information systems developed within European initiatives :
- the Catalogue of Data Sources (CDS) of the European Environment Agency (EEA)
- the INFEO system

 EEIS provides unified access to Earth Observation and environmental data. This has been achieved via the use of CIP :
- the **CDS** catalogue, containing meta data about datasets, documents, project and organisations, was connected to INFEO through the standard CIP / ODBC gateway, therefore giving EO community an easy access to Environmental data.
- **MDC** (Miljö Data Centre in Kiruna / Sweden) and **ITE** (Institute for Terrestrial Ecology in Huntingdon / UK) CORINNE Landcover catalogues, containing meta data about these 2 LANDCOVER data providers' available products, were connected to INFEO through the standard CIP / ODBC gateway, bringing new Environment meta data to EO community.
- the **WebCDS** client SW, used for accessing CDS meta data, was connected to the INFEO server, therefore giving Environment community easy access to EO meta data.

These connections were achieved during the year 1999.

3.3 SEARCH_B project (for Joint Research Centre, with Logica as prime)

The SEARCH_B global objective was to provide the CEO team with a new version of the SEARCH server (manager of the "search" queries in the interconnected catalogues) inside INFEO system.
MATRA SYSTEMES & INFORMATION task inside the project was to implement a Java applet for the Client side, allowing the user to build up a query and to send it to the Server using a Java code.
This applet was implemented during the year 1999, and will be integrated in the SEARCH_B complete SW during the year 2000.

3.4 CIP_CLIENT project (for ESA / ESRIN)

The CIP Client was implemented for the European Space Agency, with the following objectives :
- implement a first Java prototype of CIP Client, in order to validate the principles
- implement an operational CIP client in Java using CIP protocol, and offering an advanced Graphical User Interface
- implement a G_CIP gateway for communication with the ESA MUIS Multimission User Information Services (MUIS project), performing the translations between CIP protocol and ESA specific GIP protocol.

The first prototype was delivered during the year 1997.
The complete CIP Client code was delivered during the year 1998.

3.5 DARTAGNAN project (for ESA / ESRIN)

DARTAGNAN project objectives are to update existing components (client+ gateway) of the CIP and GIP protocols, to new versions thus allowing new functionalities such as ordering.
In this project, MATRA SYSTEMES & INFORMATION participates to the following tasks :
- update the Graphic User Interface and the Protocol layer of the CIP CLIENT, in order to implement the CIP 2.4 requirements
- update the G_CIP gateway on the CIP side (following CIP 2.4 requirements)
The DARTAGNAN SW will be delivered during the year 2000.

3.6 CORBIP /CICCIA

MATRA SYSTEMES & INFORMATION assumed prime contractorship for this project, called CICCIA, aiming at studying a new concept in interoperability protocols.

The CORBIP (CORBa Interoperability Protocol) has been defined under an ESA/ESRIN initiative to:
- Design a new interoperable protocol including:
  - full EO meta-data/data and service distribution,
  - full syntactical and semantic interoperability,
  - product ordering and processing with access control suitable for e-commerce,
- and corresponding to the «EO Business scenario»:
  - individually sellable and distributable objects,
  - products with the appropriate "end-user maturity" (existing products can be further elaborated).

This protocol definition is based on the previous different experiences on interoperability and services distribution:
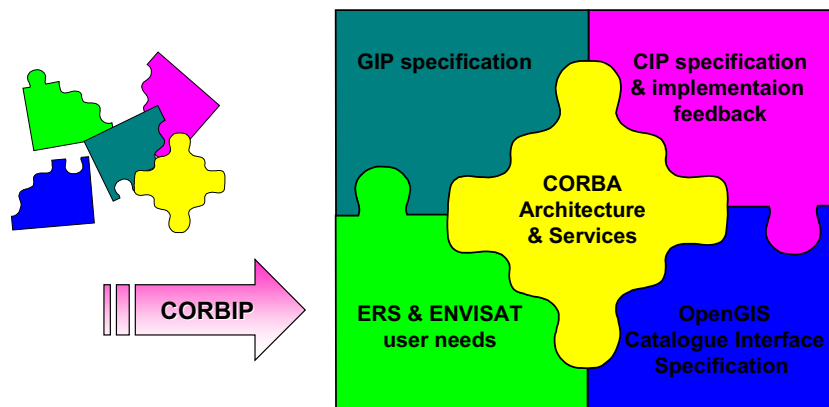

Figure 5 : CORBIP principles

The CORBIP Architectural Design and Interface Control documents will be available by April 2000. Here is a presentation of the CORBIP Architecture with:
- distributed **customers' services**: the services are implemented by service suppliers wherever on the network and transparently accessible to the end-user,
- **infrastructure services**: providing a general framework for the supplied services and, in particular, user administration (e. g. access control) and Yellow Pages managing the list of available services and making the link between a service advertisement and the corresponding implementation.
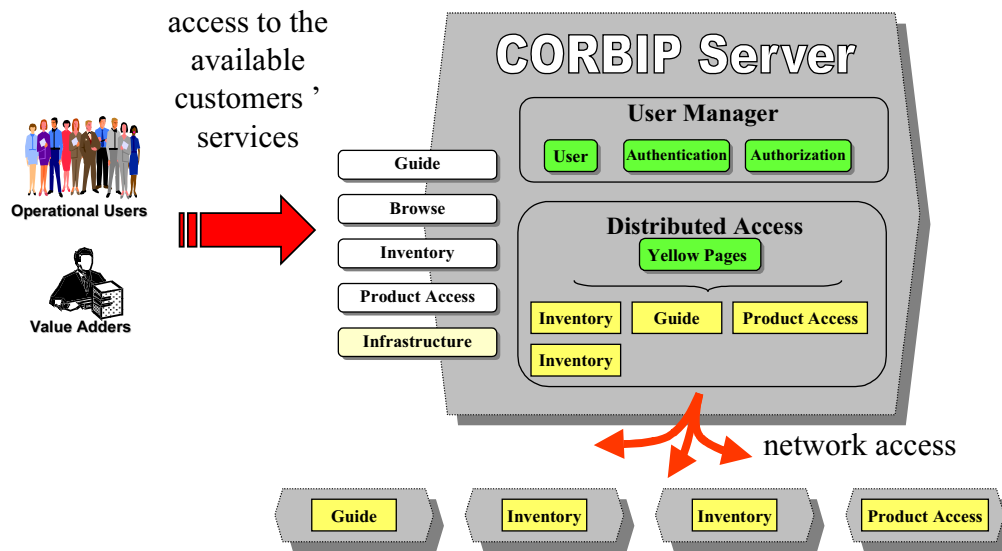
Services implemented at distributed suppliers.

Figure 6 : CORBIP architecture

4. CONCLUSION

In this " technology push" market of EO, the CIP constitutes a major step to data access and presently the European standard in catalogue interoperability.

Emerging solutions such as CORBIP and OPEN GIS are based on CIP main concepts and improve them through new technologies (CORBA, XML).

 MATRA SYSTEMES & INFORMATION background and experience should prove to be especially useful and decisive in this challenge.

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