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Interoperability of ESA Science Archives

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Abstract. The ISO Data Archive (IDA) and the XMM-Newton Science Archive (XSA) have been developed by the Science Operations and Data Systems Division of ESA in Villafranca, Spain. They are both built using the same flexible and modular 3-tier architecture: Data Products and Database, Business Logic, User Interface. This open architecture, together with Java and XML technology have helped in making the IDA and XSA inter-operable with other archives and applications. The various accesses from the IDA and the XSA to remote archives are described as well as the mechanism to directly access these ESA archives from remote archives

1. Open and Flexible 3-Tier Architecture

The IDA and the XSA were both built—by a common team—using the open 3-tier architecture described in Figure 1. The main goal of this architecture is to separate the data from the presentation, which allows a more modular and flexible development.

As the data volume is not that big, data are saved on magnetic disks for fast access as a normal UNIX file system. From the data products, metadata is extracted and put in a Relational Data Base, SYBASE. Note that the data ingestion from the data producer and the metadata extraction are separate processes to allow new metadata data extraction when user requirements evolve.

The middle tier, also called the Business Logic, provides transparent access to the data products and to the metadata. This key layer has been developed in Java and XML and resides on the archive server.

On the client side, several types of applications can be found. The standard IDA and XSA User Interface is a Java applet downloaded by the end user to access the archive content.

Remote applications and other archives can also have access to the data and the metadata, bypassing the standard User Interface, by speaking to the Business Logic that will provide them with the required services via Java Server Pages.

This architecture is especially powerful in the context of the worldwide Virtual Observatory initiatives where archives will all have to interoperate in a manner transparent to the end user.

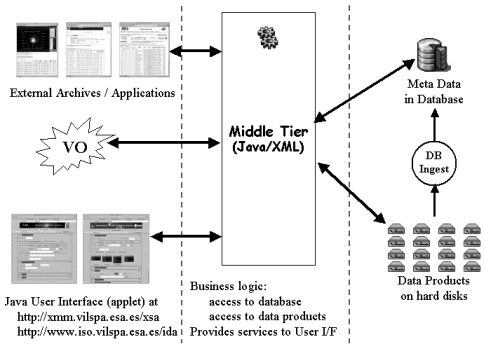

Figure 1. Open 3-tierArchitecture

2. From ESA Archives to External Archives

2.1. Name Resolution with NED or SIMBAD

On the IDA or XSA Query Panel, one can query against a target name (see Figure 2). By entering a target name and choosing the name resolver (NED or SIMBAD), the IDA or XSA will make contact with the IPAC or CDS server to resolve the target name into coordinates and then search the ISO observations catalog against these coordinates. This is done completely transparently to the user.

For SIMBAD and NED, the target name is resolved into coordinates, calling the CDS server at Strasbourg, France or the NED one at IPAC, USA respectively via a specific TCP/IP socket.

2.2. Access to Electronic Articles

From the IDA or XSA Latest Results Panel, the button "Articles" indicates if there are known publications linked to the observation (see Figure 2). By clicking on the button, one gets an extra window showing the Title, Authors, Journal, etc. By clicking the "Abstract" button, the applet will launch a browser window with the ADS WWW mirror at Strasbourg, France with the abstract of the article associated with the selected observation. The call is made through a standard URL/cgi-bin script as defined by the ADS interface.

2.3. Access to IRAS Data

From the IDA Latest Results Panel, one can see the small icons giving a quick overview of what the observations are about. By clicking on one of them, a bigger window is launched with the postcard giving more information on the ISO observation (see Figure 2). By clicking the button "Access to IRAS", a browser window will open, from the InfraRed Science Archive (IRSA) webpage located at IPAC, USA. The window will contain the data covering the region of the sky of the selected ISO observation. The call is made through a standard URL/cgi-bin script as defined by the IRSA interface.

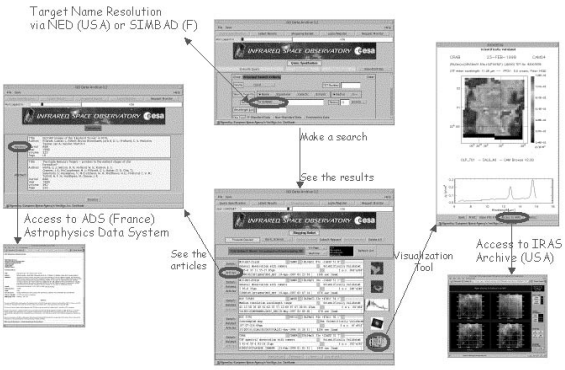

Figure 2. Access from IDA to External Archives.

3. From External Archives to ESA Archives

3.1. General Concepts

ISO and XMM-Newton products can also be obtained directly from external archives or applications, bypassing the standard user interface. That allows such data to be available from other well established archives where multi-missions data can be found.

Such access can be achieved in 3 steps:

- delivery of the archive observation/exposure log to the remote archive;
- integration of this log into the remote archive;
- linking from the remote archive to the *Postcard Server* and/or to the *Product Server*.

3.2. The Observation/Exposure Log

The Observation log consists of a file (generally ASCII) containing the list of ISO or XMM-Newton observations with associated parameters (observation id, PI name, coordinates, time, quality flag, release date...). In the case of XMM-Newton, each observation contains several instrument exposures with relevant specific parameters.

According to the requirements of the remote archive, the log can contain more or fewer parameters depending on the intended use.

The standard format is ASCII (fixed width, tab or character separated). This log is just a view of the content of the IDA or XSA database and can be easily exported into other formats such as XML, HTML, VOTable, etc... that will make it easier to ingest in remote archive databases.

The delivery can be via FTP, http or electronic mail.

3.3. ISO and XMM-Newton Postcard Server

Through calling a URL/Java Server Page (JSP) containing the ISO or XMM-Newton observation identifier, the Postcard Server (see Figure 3) returns the ISO

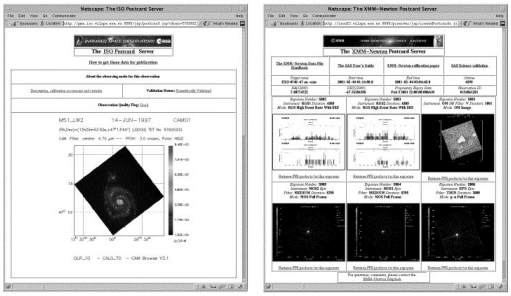

Figure 3. ISO and XMM-Newton Postcard Servers.

or XMM-Newton postcard (GIF or PNG image) of this observation and ancillary quality information embedded into an HTML page. Within this HTML page, links to relevant documentation as well as the data quality flag can be found.

This service is available for ISO in CDS, IRSA, ADS and HEASARC and should soon be available for XMM-Newton from in CDS, ADS and HEASARC.

3.4. ISO and XMM-Newton Product Server

The Product Server uses similar concepts to the Postcard Server. The URL/JSP returns an HTML page which automatically initiates an FTP session for downloading the data products.

Both ISO and XMM-Newton Product Servers are now available and can be accessed directly or from the corresponding Postcard Server.

4. Conclusions

The ESA science archives, in particular the ISO Data Archive and the XMM-Newton Science Archive are based on an open 3-tier architecture which allows easy interoperability with other archives or applications. This will ensure their easy and fast integration in the VO architecture.

The inter-operable mechanisms already in place are flexible, fast, direct and secure both from the ESA archives to external archives and in the other direction.

Currently, dedicated interfaces have been defined with the remote archives inter-operating with the IDA and the XSA. But having common standards, such as XML and VOTables, would help integration of services in the context of the VO.

References

Hernandez, J. 2003, this volume, 275