

The OaPd System for Web Access to Large Astronomical Catalogues

Lucio Benfante, Alessandra Volpato, Andrea Baruffolo, Leopoldo Benacchio

Osservatorio Astronomico di Padova, Vicolo dell'Osservatorio, 5 - 35122 Padova, Italy

Abstract. At the Padova Astronomical Observatory (OaPd), we are developing a system for managing large sets of astronomical data, such as the GSCII catalog that will be released in the near future. In this paper we describe the different parts of the retrieval system: the Database Management System (DBMS) containing the data and the meta-data of the catalogs, the CORBA services, the Java Servlets and finally the Java Applet Client. A brief description of the hardware and of the support software is also presented. The result is a system that allows one to access a set of astronomical catalogs using heterogeneous clients (i.e., Astrobrowse, StarCat). The first public release is expected in January 2001.

1. Introduction

At the Padova Astronomical Observatory (OaPd), we are developing a system for managing large sets of astronomical data, such as the soon-to-be-released GSCII catalog. The main purpose of the system is to allow a powerful and efficient querying activity on large astronomical catalogues through the Internet by using a simple Web interface. The only requirement for the user is to have a java-enabled Web browser. Figure 1 shows the overall architecture of the system as described in Baruffolo, Benacchio & Benfante (1999). In the following sections we briefly describe both the hardware and software components of the system.

2. Database Server

The catalogue data and meta-data are managed by the Informix Dynamic Server (IDS), an object-relational Database Management System. The IDS is enhanced by the PosAstro DataBlade. This OaPd-developed module provides functionality that is required to handle spatial information for astronomical objects. Functionalities and features available in the current version of the PosAstro DataBlade allow one to create tables containing astronomical coordinates objects that can be queried by content. The DataBlade supports the creation of R-Tree based indices on coordinates objects (Guttman 1984, Baruffolo 1999) that are used by the database query engine to optimize execution of queries.

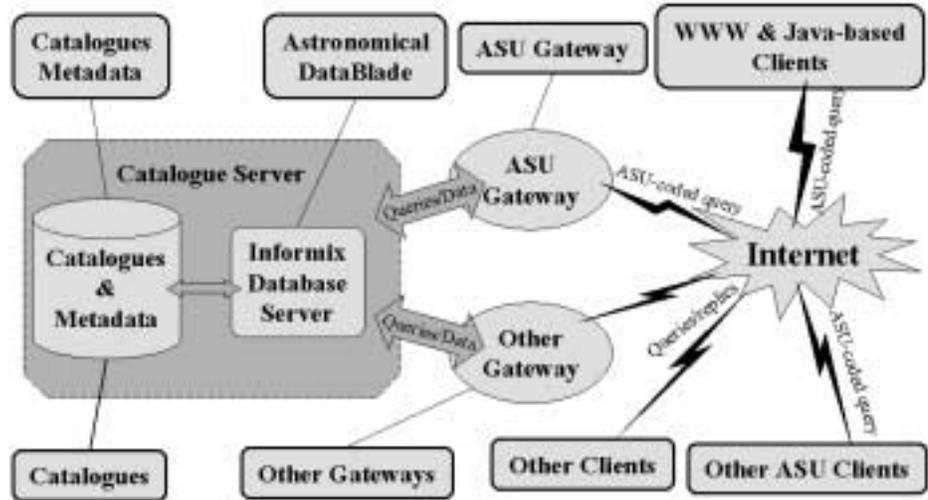


Figure 1. Overall architecture of the system

3. CORBA Services

The system is mainly based on Java code and platform-independent protocols. Nevertheless the use of some legacy C code was necessary. To allow the access to that code in a language-neutral, platform-independent and distributed manner, we embedded it into CORBA objects¹. The C code that is now available as CORBA services is:

- the C version of the SLALIB for string decoding, sexagesimal conversion, coordinates and astrometry functions (Wallace 1999),
- the library for querying the NED² name resolver,
- the library for querying the Simbad³ name resolver.

4. Servlets

The server services are provided to the clients by a set of HTTP Java Servlets (Davidson & Coward 1999). The main servlets are the ASU Servlet, the Catalogue Metadata Servlet and the Name Resolver Servlet.

The ASU Servlet provides the main query service for the system. It receives a standard ASU query (Albrecht et al. 1996) and, after retrieving data from the Database Server, it returns the requested catalogues data to the client in the selected format. Any client following the ASU specification (e.g., ESO's Skycat⁴) will be able to submit queries and retrieve results. The current allowed output

¹<http://www.omg.org/technology/documents/formal/corbaiiop.htm>

²<http://nedwww.ipac.caltech.edu>

³<http://simbad.u-strasbg.fr>

⁴<http://archive.eso.org/skycat>

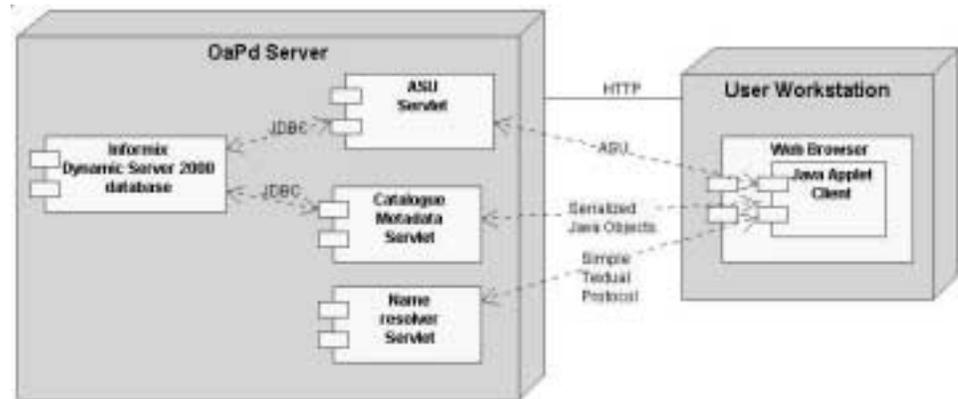


Figure 2. Java Applet Client communications

formats are HTML with tables, Tabbed Separated Values (TSV) and Starbase format (Roll 1996). Support for FITS and XML output will be provided at a later date, if necessary. The servlet uses the CORBA services for name resolving and for astronomical coordinates manipulation (via Slalib).

The Catalogue Metadata Servlet provides the client with the meta-data of the catalogues available in the database. Examples of these meta-data are the list of catalogues, the list of fields of each catalogue, the units of a field, etc. The servlet communicates with its clients by exchanging serialized Java objects through an HTTP connection. To make this communication easier, the applet utilises a servlet-specific Java library providing a simple interface for the Metadata Servlet services.

The Name Resolver Servlet is an HTTP wrapper to the CORBA name resolving services. Its textual communication protocol is very simple. It receives as input the name of the name resolver to query (NED or Simbad) and a name of an astronomical object to resolve. The output will be the resolved coordinates of the object or an error code.

5. Java Applet Client

The user interface is implemented with a Java applet to allow portability and service via the Web. The applet is a thin client for the OaPd catalogue server. It is structured as a “wizard” that guides the user in forming the queries and checks its input. The query execution is done on the server side. For requesting server-side services, the applet contacts the servlets through the HTTP protocol. Figure 2 shows the interaction among the applet and the servlets.

6. Hardware & Software

The server-side part of system runs on a COMPAQ AlphaServer DS10 466 MHz, equipped with 640 MB of RAM. The operating system is Compaq Tru64 UNIX (ex Digital UNIX). The data, meta-data and indexes of the catalogs are managed by the Informix Dynamix Server 2000. The final projected disk space is 250 GB.

The server-side Java objects are executed by a Compaq Java 2 Virtual Machine (VM)⁵. For the client-side Java Applet a Java 1.1 VM has been ordered. The servlet engine is Tomcat⁶, mounted on an Apache Web Server.

The CORBA objects are handled by the ORBacus⁷ Object Request Broker for C++ and for Java.

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⁵<http://www.compaq.com/java/alpha/>

⁶<http://jakarta.apache.org/tomcat/>

⁷<http://www.ooc.com>