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A System for On-line Access to the GSC II

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Abstract. The second Guide Star Catalog (GSC II) will be a catalog of positions, proper motions, magnitudes and colors for stars and galaxies complete down to $V = 18.5$ and is expected to be completed by the end of 1999. Besides its operational nature, the GSC II will also be a powerful tool for galactic and extragalactic research. However, with an expected number of records of the order of two billion, this catalog will pose problems for efficiently accessing the data. In this paper, we describe our on-going effort aimed at building a management system for the GSC II, based on a new technology Object Relational Database Management System, that will allow researchers to fully exploit the scientific content of this catalog. We thus give an overview of the architecture of the system, the data model being developed, the extensions we are making to the database engine to support astronomical data, and the access interfaces currently under development.

1. Introduction

The second Guide Star Catalog (GSC II) will be the successor of the first astrometric and photometric catalog built to support the operations of the Hubble Space Telescope. It will be a catalog of positions, proper motions, magnitudes, and colors for stars and galaxies complete down to V=18.5 whose first release is expected to be completed by the end of 1999.

Besides its operational nature and thanks to its performances and all-sky coverage, the GSC II will be a powerful tool for galactic and extragalactic research (Lasker et al. 1995). Because of its collaboration with the GSC II project, the Italian astronomical community will be provided with a copy of the catalog as soon as it is completed.

With an expected number of records of the order of two billion, this catalog will pose problems for efficient access to the data. In this paper we describe our on going effort aimed at building a management system for the GSC II, based on a new technology Object Relational Database Management System, that will allow researchers to fully exploit the scientific content of this catalog. This project is a logical continuation of our previous research in the field of astronomical database management systems (Baruffolo & Benacchio 1998a, 1998b).

The final system is expected to allow users to efficiently perform searches in the GSC II and some other related catalogs by the means of a Web-based user interface, display results graphically, and save them locally for further anal-

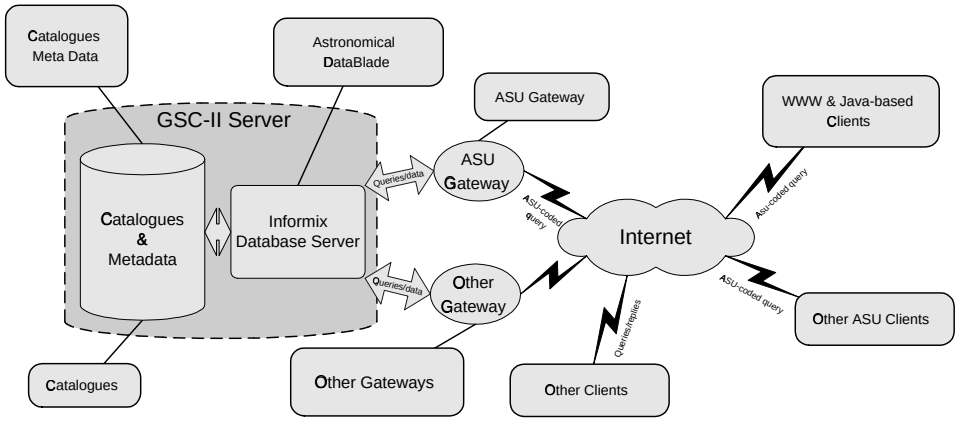

Figure 1. Overall architecture of the GSC II on-line system.

ysis. Gateways will also be provided to allow a variety of clients to access this database.

In Fig. 1 we give an overview of the architecture of the system, where the following elements are highlighted:

1. content of the database;
2. the database structure being developed;
3. the extensions we are developing to the database engine to support astronomical data and queries;
4. access gateways under development or planned;
5. access interfaces currently under development.

In the following sections we briefly describe the various components that make up the GSC II on-line system.

2. Catalogues

At present, only the catalogues which are currently being used or built in the GSC II project are foreseen to be included in the database. They are: HST Guide Star Catalog I & II, Hipparcos and Tycho Catalogues, Guide Star Photometric Catalog 1 & 2, Positions and Proper Motions (North and South), Astrographic Catalogue (AC 2000), ACT Reference Catalog. Other catalogues may be added in the future depending on users' requirements.

3. Catalogues' Metadata

All catalogues in the collection are described in a metadata structure. All applications will access the database through the metadata, so that they will work independently of any catalogue-specific structure. A collection of Java classes for metadata access has been developed and is used in applications written in this language. Using metadata will also simplify the addition of new catalogues to the collection.

4. Astronomical DataBlade

All the catalogues in the collection are managed by means of the Informix Object-Relational DBMS. The database engine can be extended by means of DataBlade modules. These are software modules that plug in to Informix Dynamic Server with Universal Data Option and extend its capabilities in order to store, retrieve and manipulate new data types, besides the *primitive* ones provided with the server.

We are currently developing an astronomical datablade for Informix DS/UD that supports astronomical data (e.g., coordinates), query predicates (e.g., search-by-cone), and R-tree based indices that speed up the execution of queries containing astronomical predicates.

5. ASU Gateway

An Astronomical Server URL (ASU, Albrecht et al. 1996) based gateway is being developed. The ASU is a proposed specification of a syntax for the encoding in a URL of queries to astronomical databases. Our gateway is able to translate queries coded following the ASU specification into queries to the DB and to return results in various formats. It is being developed as a Java servlet. This will allow platform independence and maintain a persistent connection to the DB server for performance reasons. Any client able to submit queries coded following the ASU specification (e.g., ESO's SkyCat) will thus be able to submit queries and retrieve results.

6. WWW & Java-based Clients

We are currently prototyping simple WWW-based clients able to submit ASU encoded queries to the on-line system. These clients are implemented as Java applets. In this way, users are not required to install special client software and more interactivity is possible at the user workstation level (e.g., input validation, name resolving, etc). After this prototyping phase, we plan to design and build more sophisticated interfaces to allow users to submit complex queries to the database possibly in a graphical way, as opposed to the now common form-based interfaces.

7. Other Clients/Gateways

We are following the recent efforts directed at giving users integrated access to world-wide distributed astronomical data collections. We foresee implementing other gateways (e.g., Gamiel, McGrath, & Plante 1998) to allow a variety of clients to query the GSC II on-line system. Our efforts will be directed to provide open access to the system by means of standard conforming interfaces. In our view, this is the most effective way to maximize our system's utilization.

References

Albrecht, M., et al. 1996, "Astronomical Server URL", `http://vizier.u-strasbg.fr/doc/asu.html`

Baruffolo, A., & Benacchio, L. 1998a, in ASP Conf. Ser., Vol. 145, Astronomical Data Analysis Software and Systems VII, ed. R. Albrecht, R. N. Hook, & H. A. Bushouse (San Francisco: ASP), 382

———, 1998b, in SPIE Proc., Vol. 3349, Observatory Operations to Optimize Scientific Return, ed. P. J. Quinn (Bellingham: SPIE), 274

Gamiel, K., McGrath, R., & Plante, R. 1998, in ASP Conf. Ser., Vol. 145, Astronomical Data Analysis Software and Systems VII, ed. R. Albrecht, R. N. Hook, & H. A. Bushouse (San Francisco: ASP), 375

Lasker, B. M., et al. 1995, in Future Possibilities for Astrometry in Space (ESA Publ. SP-379), 173