

*Title:***CIMI's Z39.50 Interoperability Testbed: Search and Retrieval of Distributed Cultural Heritage Information***Authors & affiliation:***William E. Moen <wemoen@jove.acs.unt.edu>  
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Denton, TX***URL:***Consortium for the Computer Interchange of Museum Information <www.cimi.org>***Country or countries involved:***Austria, Canada, Greece, Italy, Netherlands, Taiwan, United Kingdom, United States,***Content size:***N/A***Subject matter or topical area of digital library content:***Cultural Heritage Information, Museum Information, Bibliographic Information, Images***Publisher or publishers or data information providers involved:***Various museums provided data to interoperability testbed participants***Interfaces:***WWW, Java***Research/development focus/topic:***Distributed search and retrieval of cultural heritage information; Z39.50; metadata; image retrieval***Protocol for interoperability/federations:***Z39.50, HTTP**

The [Consortium for the Computer Interchange of Museum Information](#) (CIMI) is leading an international effort to provide distributed search and retrieval of cultural heritage information [2]. A primary aspect of CIMI's work utilizes [ANSI/NISO Z39.50-1995](#), an American National Standard protocol for information retrieval [4]. The International Organization for Standardization (ISO) recently approved Z39.50 as ISO 23950. CIMI chose Z39.50 to enable uniform access to existing and emerging digital collections and the vast repositories of cultural heritage information resources. These resources include a variety of physical and digital objects--physical artifacts and digital derivatives of those artifacts, descriptive records designed for collection management, bibliographic records, full-text documents, online tools such as thesauri and authoritative lists of artists' names, and more. CIMI's application of Z39.50 in the networked cultural heritage information environment is breaking new ground in distributed and integrated access to textual and non-textual digital collections.

CIMI membership reflects a diversity of museums, museum organizations, projects, and research centers. CIMI members share a commitment to working cooperatively to solve problems that restrict the electronic interchange of museum information and more broadly, cultural heritage information. CIMI's work demonstrates how existing and emerging standards, such as Z39.50 and the Dublin Core Metadata Element Set [3], address major interoperability barriers between heterogeneous information systems for users attempting distributed search and retrieval in the networked environment.

In the past two years (1995-1997), CIMI explored and applied Z39.50 as part of a demonstration project funded by the United States National Endowment for the Humanities. The ultimate goal of this two-year experience was to demonstrate the utility of Z39.50 in applications for search and retrieval of cultural heritage information. To accomplish this, the CIMI Z39.50 Working Group, comprising experts in museum information systems and Z39.50, software developers, and commercial vendors, developed specifications for using Z39.50 in this application and documented these specifications in the *CIMI Profile: Z39.50 Application Profile for Cultural Heritage Information* [2]. An application profile is an ancillary standards mechanism that specifies the use of one or more standards to achieve a set of functions and provides guidance in applying the standards interoperably in a specific limited context. The CIMI Profile details specifications for the use of Z39.50 and other standards by museums and other organizations offering cultural heritage information. CIMI published a draft of the Profile in June 1996 and a revised stable draft in February 1998.

To achieve meaningful distributed search and retrieval, the CIMI Z39.50 Working Group addressed three basic problems:

- Modeling search and retrieval across a variety of museum information resources comprised of different data and content types
- Providing clear semantics related to access points and other query criteria for communication of searches between disparate and heterogeneous systems and databases
- Developing schemas and abstract record structures to enable retrieval of component parts and/or entire digital objects from distributed systems.

The application profile specifications provide a workable solution to these problems.

In addition to the development of the CIMI Profile, participants in the Working Group implemented Z39.50 servers and clients as proof of concept. During May-October 1997, 13 participants representing various organizations such as museums, research centers, commercial vendors, database developers, and universities implemented Z39.50 servers and clients as part of the CIMI Z39.50 Interoperability Testbed. CIMI also entered into sponsoring relationships with two software developers to build Z39.50 tools for use in the testbed. Testbed participants included: Blue Angel Technologies (US), Canadian Heritage Information Network (Canada), Center of Excellence for Research in Computer Systems (Taiwan), Crossnet Systems Ltd. (UK), Databasix Information Systems (Netherlands), ELISE/DeMontfort University (UK), ELISE/Tilburg University (Netherlands), Finsiel, S.p.A. (Italy), Information Systems and Software Technology Group of the Institute of Computer Science of the Foundation for Research and Technology (Greece), Intermuse Willoughby Associates, Ltd. (US), Joanneum Research Center (Austria), System Simulation Ltd. (UK), and the University of California, Division of Library Automation (US).

The testbed's primary goal was to test specifications from the CIMI Profile and to demonstrate the capability of Z39.50 to support search and retrieval between multiple server and client implementations of specific types of cultural heritage information resources: collection management object records with images, images with associated text, and bibliographic records. Implementations used Z39.50 to search and retrieve textual data from testbed servers and Hypertext Transfer Protocol (HTTP) to transfer images between testbed servers and clients. [Figure 1](#) presents the architecture for the testbed; blue arrows represent Z39.50 protocol communication and orange arrows represent HTTP communication.

A key concern of search and retrieval of museum information is handling multiple images associated with a museum artifact and the potentially multiple resolutions of those images. Using the functionality available in the Z39.50 Generic Record Syntax (GRS-1, as defined in ANSI/NISO Z39.50-1995), testbed servers presented a Java-based Z39.50 interoperability testing client with an object record describing the original museum artifact, one or more digitized images associated with the object, and one or more resolutions (e.g., thumbnail, high resolution) of each image. Descriptive metadata for each image and each resolution were retrieved as well.

CIMI's testbed demonstrated the power of Z39.50 client/server implementations--used in conjunction with existing museum systems and databases of cultural heritage information resources--to offer users new capabilities in discovering networked resources as well as performing precise and selective searching across distributed servers. A

user can issue a single query to search one or more of the testbed servers and results from each server would be presented back to the user. Semantic interoperability between these distributed resources through Z39.50 means that users have the ability to conduct very specific searches on access points related to museum information such as object title, artist name, material, and provenance and receive meaningful results. A client supporting the CIMI Z39.50 specifications provides users with a uniform interface to cultural heritage databases around the globe. Client-side configuration files allow each client to hold detailed information about available servers. In addition, robust Z39.50 clients such as the Java-based testbed client can manage multiple result sets from concurrent distributed searches, for example merging the results or grouping sets associated with each database.

The testbed effort also jump-started Z39.50 implementation for cultural heritage information; the result was eight independently developed Z39.50 servers and three separate Z39.50 clients that support the CIMI Profile. Two clients were HTTP/Z39.50 gateway clients, and the third was a Java-based Z39.50 client. Most important, the testbed provided an opportunity for a range of implementors who will be providing new functionality to their users and customers to gain experience with Z39.50 and specifically the CIMI Profile.

CIMI shares a vision for distributed search and retrieval of cultural heritage information with other groups and projects. One such project is the European Community's [Aquarelle Project](#) whose aim is validating and demonstrating standards supporting cultural documentation exchange [1]. Participants in Aquarelle (some of whom participated in the CIMI interoperability testbed) based their work on the CIMI Profile while extending those specifications for particular objectives of Aquarelle. CIMI will work collaboratively with efforts such as Aquarelle to ensure harmonization of Z39.50 and other specifications to achieve the level of interoperability and interchange of cultural heritage information envisioned by CIMI.

CIMI's use of Z39.50 has reached important first milestones for distributed search and retrieval. As proof of concept, CIMI demonstrated Z39.50's utility in the networked cultural heritage information environment. As a collaborative international effort, the CIMI Interoperability Testbed brought together implementors interested in sharing experiences and expertise related to Z39.50 and access to digital information. As a testbed, the six-month experience raised new and exciting questions and problems related to the complexity of interoperability and distributed search and retrieval. CIMI will continue the testbed approach as an appropriate mechanism to take up these challenges.

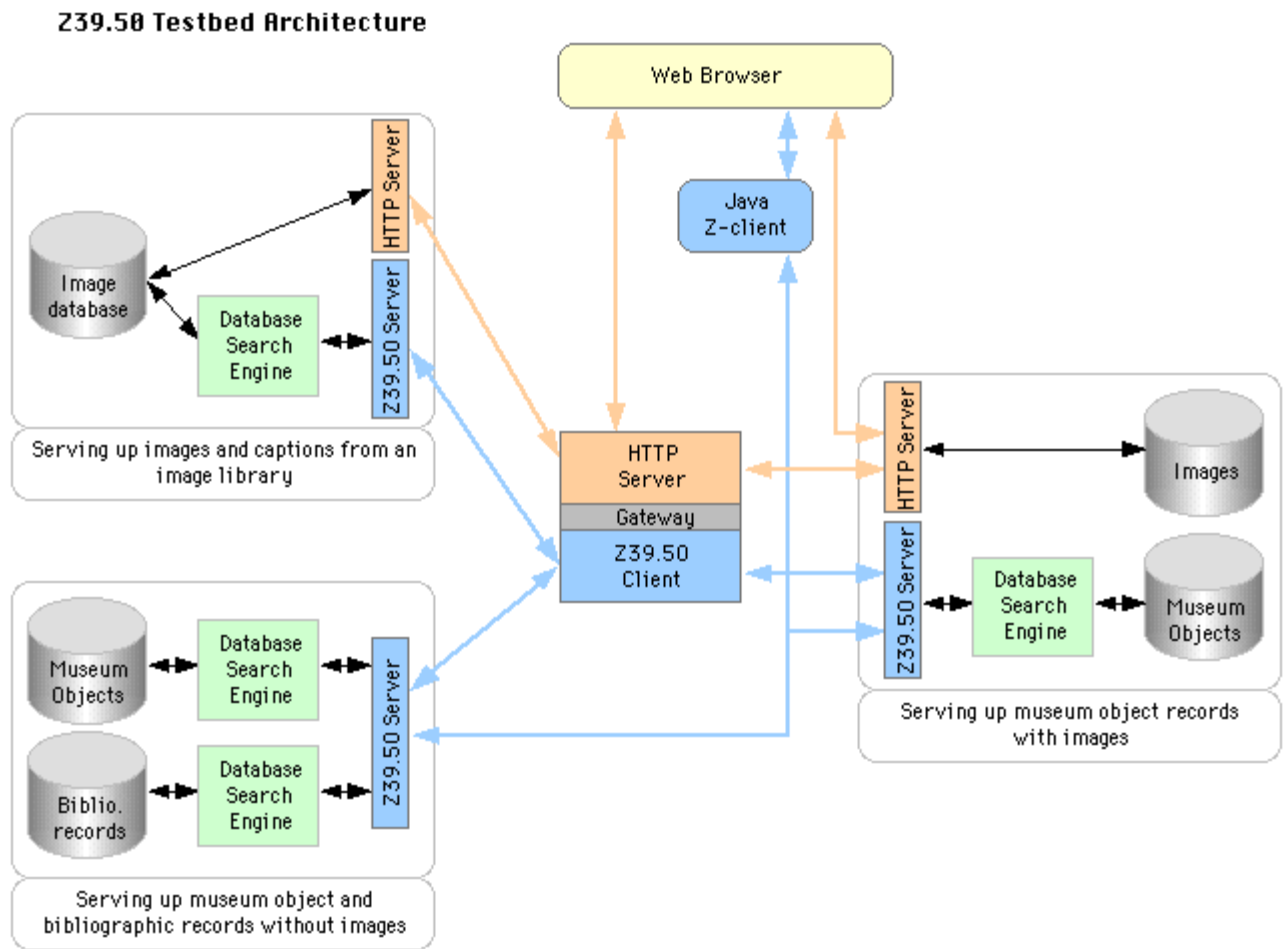
## Future Work

The interoperability testbed participants will continue to evolve the CIMI Z39.50 specifications in a number of areas during 1998. For example, museums have important concerns with intellectual property protection and access control to their resources. Z39.50 supports different levels of access control by the server, and implementors will test out practical ways of using such functionality. Participants will also continue to address issues related to metadata, semantic interoperability, and expansion of the CIMI Profile to handle other types of cultural heritage information resources.

## References

1. [Aquarelle: The Information Network on Cultural Heritage](http://aqua.inria.fr/). <URL: http://aqua.inria.fr/>
2. Consortium for the Computer Interchange of Museum Information. CIMI Z39.50 Working Group. **The CIMI Profile: Z39.50 Application Profile for Cultural Heritage Information, Draft Release 1.0.**, 1988. Electronic version available at [Consortium for the Computer Interchange of Museum Information](http://www.cimi.org) <URL: www.cimi.org>
3. [Dublin Core Metadata Element Set](http://purl.org/metadata/dublin_core). <URL:http://purl.org/metadata/dublin\_core>
4. National Information Standards Organization. **Z39.50: Information Retrieval (Z39.50): Application Service Definition and Protocol Specification**. NISO Press, Bethesda, MD, 1995. Electronic version available at the [Z39.50 Maintenance Agency](http://lcweb.loc.gov/z39.50/agency) <URL: lcweb.loc.gov/z39.50/agency>

Figure 1



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