VARIATIONS: A HYPERMEDIA PROJECT PROVIDING INTEGRATED ACCESS TO MUSIC INFORMATION

Michael Burroughs
Department of Computer Science
Indiana University
Bloomington, IN 47405 U.S.A.
burrough@cs.indiana.edu

David Fenske
School of Music, Music Library
Indiana University
Bloomington, IN 47405 U.S.A.
fenske@uci.indiana.edu

ABSTRACT: The VARIATIONS project is designed to integrate a multimedia, object-oriented database engine with a graphically-oriented hypermedia front end. VARIATIONS is designed using a client/server architecture and is separated into two distinct parts. The database engine provides the data server functions and controls all data manipulation. The display manager acts as the client and is responsible for display of information and the interface with the user. Communication between the two consists of the passing of command messages and data objects. This paper presents an overview of the database engine and a more in depth look at the hypermedia interface.

The data object is the primary element of importance within the VARIATIONS system. The object contains a unique handle identifying it within the information base, information about the author and subject, a flag indicating the type of data contained in the object, the actual data, and a list of handles of other related objects in the information base. There are five different types of information stored in these objects: TEXT, stored in a word processor format; GRAPHICS, stored in GIF file format; SCORES, stored in a special hierarchical data structure; SOUND, stored either in digitized format, or as a reference to a CD source; and BIBLIOGRAPHIC references, stored in OCLC format. By storing the information in an object of this structure, the information base can be easily manipulated as a collection of objects and the database engine does not need to manipulate several different types of information.

The database engine manipulates the objects in the information base and provides access to objects to application programs. Since each object has associated with it a unique handle, the database engine must keep track of the handles in use and provide new ones as objects are created and added to the information base. In addition to managing the allocation of handles, the database engine provides access to the various objects in the information base through a simple command language. Storage, retrieval, and updates are all performed by an application issuing commands to the database engine. The following commands are examples of the command language.

CREATE NEW OBJECT
This command returns a handle to the application, guaranteeing it to be unique.

RETRIEVE OBJECT 14353
This command returns information associated with the object with handle 14353.

DELETE OBJECT 15364
Removes the object with handle 15364 from the information base.

COPY OBJECT 13452
Makes an exact copy of the object and returns the handle which points to this object.

BACKUP
Makes a copy of the information base on a backup device.
The display manager maintains the VARIATIONS user interface. The user interface provides five different windows, each specialized to display a particular data format.

1) The TEXT window is used to display information contained within a text object. In addition to allowing the user to browse through full-text contained within an object, this window will allow for creating and editing text objects using a word processor-type interface. Additional functionality will link the text window to text scanners, allowing for simple entry of printed material. The text window will also provide a macro interpreter which will allow for the execution of special VARIATIONS macros. The macro language, based on the standard programming language PASCAL, will allow instructors to program lessons in which user input can be prompted, controlled and collected, and the appearance of other windows can be scheduled.

2) The GRAPHIC window is used to display GIF images stored in graphic objects. The window will provide a complete set of drawing and image manipulation tools for image creation and editing. In addition a scanner interface will be provided to allow for the entry of printed images.

3) The SCORE window will interpret the information contained within the score object and display it in standard score notation. This information is stored in a special format developed to allow analytic search techniques to be performed on sets of scores. Translation facilities for DARMS, SCORES and other commonly used formats will be provided. Facilities to edit and manipulate scores will be included as well as a MIDI interface which should provide a fairly useful composition utility. Complete rhythm, pitch and interval sequence search algorithms will make the score window a powerful analytic tool as well.

4) The SOUND window will control the playing of sound stored in sound objects. Sound objects may contain digitized sound stored in the industry standard CD format. Playback of digitized sound will be performed using standard digital-to-analog conversion technology. Alternately, a sound object might contain instructions for interfacing with a CD player. A prompt to the user to insert the appropriate CD will be displayed on the screen. The CD player will then be issued commands to play the appropriate piece. Digital recording through an analog to digital converter will provide a means of creating sound objects. This facility could be used to digitize current analog recordings for library archive and listening library purposes. A set of digital analysis and synthesis tools will be provided as well.

5) The CATALOG window will be used to display and search through the bibliographic reference objects. Every TEXT, SCORE, GRAPHIC and SOUND object in the VARIATIONS information base will have bibliographic reference objects linked to it. In addition, facilities will be provided to download machine-readable cataloging from a variety of standardized sources: local automated catalogs, OCLC, RLIN, etc., allowing for an extensive collection of bibliographic references to materials outside of the VARIATIONS information base. Cataloging information from these sources is the most internally consistent with respect to name and namestyle entries. If an institution wishes to use it, facilities will be provided to load the Library of Congress Name Authority File (LCNAF) and its subsequent updates. The catalog window will also allow for on-line catalog searches of external bibliographic databases based either on the topic of the currently active window, or on one entered by the user. Typically the sources for these searches will include a local automated catalog or bibliographic utilities such as OCLC or RLIN. They might also include other off-line bibliographic citation indexes such as the ARTS AND HUMANITIES CITATION INDEX or those available in a network available CD-ROM format such as OCLC’s sound recording database or RLIN ABSTRACTS.

ICMC GLASGOW 1990 PROCEEDINGS
VARIATIONS ability to associate one object with others in the information base provides a very dynamic method for moving between various points of information. Each object contains the handles of the related objects, as well as information about who associated the two objects, and why the association was made. This block of information, handle, author and description, constitutes a link. Each window displays this link information in the form of link buttons, appearing on the screen. Activating a link button will bring up a small window containing the link author and description, as well as bringing up the appropriate window to display the information in the linked object. By exploring various link pathways the user may open any number of windows of any type. There is no limit to the number of windows which may be open at any time.

Although the information contained within the links is the same in all cases, they appear to the user to belong to two different classes: 1) linking a TEXT, SCORE, GRAPHIC or SOUND object with a catalog window entry (hereafter called a catalog link); 2) directly linking two TEXT, SCORE, GRAPHIC or SOUNDS objects together without reference to the catalog window (hereafter called a common link).

CATALOG LINKS

From the catalog window, the user might search a particular topic in a manner similar to searching from an on-line catalog. Activating the Brahms' FIRST PIANO SONATA link button from the catalog window would bring up a score window displaying the selected score. Going back to the catalog window, the user might next activate a biography of Brahms or a description of sounds causing a text window to appear containing the desired text. Additionally the user might wish to hear various recordings of the piece. Activating the appropriate links from the catalog window would bring up a sound window, from which playback of a recording could be managed. In addition to using the catalog window to search for items within the VARIATIONS information base, it might be the case that a activating a link gives the bibliographic information by which the printed source could be obtained from a library.

CONTENT LINKS

Content links cover associations that are not necessarily based on bibliographic similarities. The score window in the above example might have several link buttons. Activating these links might bring up additional score windows displaying scores related only by their similar themes. Instructors might also use these content links to annotate objects within the information base. Typically the user might find several link buttons in a window. Following these links would cause any number of additional windows to appear. The number and type of links allowed from any given object is unlimited. At any point in this process, the user could utilize the catalog window to search for additional references.

By differentiating between these two types of links a very powerful method of searching the information base can be developed. By taking advantage of the authority work provided by using standard library catalog entries in bibliographic objects, the difficulties is dealing with variation in the spelling of names can be surmounted. A search using the catalog window for Tchaikovsky is sure to get all the references, independent of variations in spelling the name. Once these initial links are activated, content links can be used to broaden the scope of the information surrounding a particular topic.

USERS

There are three types of users: 1) those who can establish a general link, visible to all VARIATIONS users; 2) those who can establish special links visible to only a small group of users; 3) those who cannot establish any links.
The first group of people include those in charge of managing the VARIATIONS system, and those individuals who have been specifically authorized to modify the information base. Additionally, only the managers of the system can make the catalog links. This will assure that internal consistency in the use of bibliographic objects.

The second group of users is designed with class implementation in mind. By creating special links visible to only an instructor, or a class group, VARIATIONS can be used as an electronic classroom bulletin board. Instructors and students alike may make links that pertain to class material and is relevant only in that setting. Links of this nature should not be generally available. This also gives the instructor control over when various links are made visible, thereby keeping the information base in sync with the presentation of the course material. Students may also add new objects to the database demonstrating to the instructor their understanding of the material. These objects can remain private until the instructor, or other managers of the system, choose to make them visible to everyone.

The third group includes the general user. These users will see those links previously established by those in the first group. These users will not be able to add objects to the information base, but can benefit from additions made by authorized users.

The initial implementation of VARIATIONS is being done on a 386 workstation using SCO UNIX and SCO Open Desktop as the GUI. Open Desktop supports the MOTIF interface standard. By making both the database engine and the display manager local to the workstation we hope to be able to quickly develop a working implementation of the project, but as a practical matter, a local soup of this nature is inadequate.

The amount of data that will be manipulated by the system will quickly surpass the limits of the typical workstation and thus require either a large centralized server, or a distributed database system. We hope to make this transition simple by separating the display manager functions and the database engine functions. By moving the database engine to file serving machines, the workstations can make network calls to get information. This will have the added benefit of removing the file processing burden from the workstations, thereby speeding up execution of the graphics functions. A second issue is that of workstation platforms. Currently one could choose from several operating systems (DOS, OS/2, Mac, and several flavors of UNIX) and several GUI's (Windows, OS/2, Mac, Motif etc.) Again separating the database and graphics portions of the project will facilitate addressing this problem, as only the display manager will have to be redesigned, the database engine will not have to be changed. A complete VARIATIONS system might have its files stored on several mainframe computers, each running the database engine. Users of the system would then sit down at their workstations and run the display manager from there. Using network connections, the display manager software would remotely retrieve all of the data that the user requested from the database engines.

VARIATIONS provides an unstructured environment for study and research. Allowing individuals to load and link information will provide a dynamic and continually growing knowledge base from which users can draw. The ability to do this comes directly from its implementation as a hypertext system. Users not only can retrieve information from the base, but they can add to it as well, developing over time a significant collective knowledge base.

ICMC GLASGOW 1990 PROCEEDINGS

224