A View-Based Hypermedia Design Methodology

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Hypermedia extends the hypertext paradigm into multimedia. Recently, many enterprises have attempted to incorporate hypermedia functionality into their diverse range of business applications such as decision support systems, document management, software management, and team collaboration. This paper presents a methodology for designing hypermedia applications based on users’ views. In designing hypermedia applications, view support is highly desirable. The methodology consists of five phases: requirement analysis, data modeling, view design, navigational design and mapping. Views are generated from the entity-relationship diagram, and used for subsequent navigational and mapping design. This methodology is especially effective for integrating enterprise databases with distributed hypermedia systems on the Internet.

Traditional data management systems such as file system, relational databases and object-oriented databases, have tried to articulate dynamic user requirements of multimedia, distribution, heterogeneity, documentation and bottom-up information infrastructure. These systems extend their functionality to cope with dynamically changing environments. Traditional information systems are, however, inflexible. They are storage-oriented systems with a sequential data management approach, and consequently cannot provide flexible information access as hypermedia systems do (Tompa, 1989).

There have been a number of attempts to incorporate hypermedia functionality into a diverse range of applications, such as collaborative authoring of papers, decision support, document management, documentation, educational and corporate training, financial benchmarking, software engineering, and team collaboration (Bieber and Isakowitz, 1995, Bieber and Kacmar, 1995). Hypermedia extends the hypertext paradigm into multimedia. Figure 1 shows various issues involved with integrating hypermedia systems and traditional data management systems. Basically, these needs originate from the inability of traditional data management systems to cope with dynamically growing users’ requirements.

For designers, a simple and semantically rich model not only improves design and development processes, but also facilitates analyzing and evaluating hypermedia applications (Garzotto et al., 1995). “Yet, we lack guidelines and tools to design and develop hypermedia applications. Without such design guidelines and tools, the ever-growing network of interlinked applications is becoming increasingly spaghetti-like and hard to maintain” (Bieber and Isakowitz, 1995, p.26).

Conceptual design, prior to implementation, has proved to be an essential requirement in information system analysis and design. Hypermedia design is not an exception. Several researchers have supported this view. Therefore, two primary objectives of our paper are (i) to suggest a view-based methodology for designing hypermedia applications called VHDM (View-Based Hypermedia Design Methodology), and (ii) to implement a real-life case, in which it integrates WWW(World Wide Web) hypermedia systems with a relational database by the use of VHDM.

To our best knowledge, there had been little formal design associated with hypermedia approaches until the development of Garzotto, Paolini and Schwabe’s HDM (Hypermedia Design Method) (Garzotto et al., 1993, Kendall,...
et al., 1992). Over 20 development groups in six different countries have used it for applications in different domains. It is based on an object-oriented model that builds hierarchical structures as an aggregation of simple ones, and at the same time encourages use of different perspectives in presenting the same conceptual entity in different ways.

A step-by-step methodology, RMM (Relationship Management Methodology) (Balasubramanian et al., 1994, Isakowitz et al., 1995) is based on an E-R approach. Familiarity with E-R abstractions among system analysts is well documented. RMM is built on top of HDM. It enhances HDM concepts with additional access structures (conditional indexes and guided tours) and proposes a seven step process for building hypermedia applications. RMM steps include E-R design, slice design, navigational design, conversion protocol design, user-interface design, runtime behavior design and construction/testing.

Object-oriented ideas have been used in the hypermedia field for several years. EORM (Enhanced Object Relationship Model) (Lange, 1993) was the first object-oriented design methodology; it consists of three frameworks: class framework, composition framework, and GUI framework. Two activities are related to the class framework, class identification, and class refinement. The composition framework consists of a reusable library of link class definitions. The GUI framework includes two activities: (i) presentation with window identification and (ii) mapping of classes and compositions to the presentation.

In OOHDM (Object Oriented Hypermedia Design Model) (Schwabe and Rossi, 1995), a hypermedia application is built within the framework of a four-step process supporting an incremental or prototype process model. In the domain analysis step, a conceptual model of the application domain is built by the use of object-oriented principles, augmented with some primitives associated with users and tasks. OOHDM describes the navigational structure of hypermedia applications in terms of navigational contexts, which are induced from the navigation classes such as nodes, links, indexes, and guided tours.

The original concept of VHDM was introduced by Lee et al. (1996a). A view is a subset of the hypermedia application domain associated with a particular user’s viewpoint. VHDM attempts to explore the functionality of view by optimizing various objectives of users, designers and developers. In designing hypermedia applications, view support is highly desirable for a number of reasons. First, hypermedia applications should support a number of users, who have different requirements. Secondly, cognitive overhead can be reduced effectively. Because classes consist of a large number of heterogeneous attributes, it is desirable to group attributes into views. Thirdly, views can be used to represent semantic relationships among navigational nodes. Finally, additional presentational or navigational requirements can be accommodated easily (Thuring et al., 1995).

VHDM is based on the assumption that the practical target of hypermedia systems uses a relational database as information storage, for two reasons. The primary reason is that VHDM provides a mapping process between a hypermedia data model and actual hypermedia systems. Typically, relational database systems support views. Secondly, relational databases are used widely. This fact alone provides a motivation to explore VHDM. There is no doubt that hypermedia applications can help relational database systems to cope with a wave of changes with respect to IT (Information Technology) environment.

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**VHDM Architecture**

We base our data model on RMM (Relationship Management Methodology). Our methodology is similar to RMM in that both are step-by-step methodologies, and start from E-R design. But RMM is a top-down approach; in contrast, VHDM (View-Based Hypermedia Design Methodology) is based on a bottom-up approach.

The phases are shown in Figure 2. VHDM spans fundamental stages which include requirement analysis, conceptual modeling of a domain, and mapping of the results into the target hypermedia system. Hypermedia systems can be deve-