A Workflow-Based Hypermedia Development Methodology

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Abstract

Recently, many enterprises have attempted to construct hypermedia systems for electronic commerce innovations by the use of Internet technologies. In this hypermedia-enabled environment, it is useful to think hypermedia development in terms of workflow. This paper proposes a workflow-aware, hypermedia development methodology, WHDM (Workflow-Based Hypermedia Development Methodology) to guide developers in creating hypermedia applications. The methodology employs a workflow model based on corporate documents and thus is more likely to capture users' business requirements in a natural fashion. The methodology consists of four phases such as workflow analysis, document analysis, hypermedia design, and implementation. The emphasis of each phase is on aligning business requirements with hypermedia technical details. To demonstrate the practical usefulness of the methodology, a real-life case is illustrated.

1. Introduction

Many organizations are utilizing Internet technologies and developing innovations for their growth. Hypermedia systems are recognized as a practical weapon for today's businesses to maintain competitiveness. Such important business avenues as EC (Electronic Commerce) and CALS (Commerce At Light Speed) show the developments based upon hypermedia. This paper proposes a methodology for developing hypermedia applications based upon document-based workflow.

2. A Methodology

The methodology is devised for developing hypermedia applications on the basis of workflow. Therefore, the methodology is referred to as WHDM (Workflow-Based Hypermedia Development Methodology). WHDM adopts a document-based perspective consistently through the overall phases. WHDM considers business process, organization, security problems, and technical design for implementation. Hence, WHDM consists of four phases: workflow analysis, document analysis, application design, and implementation (Figure 1). These phases are performed in an iterative way, even though feedback is not depicted for the simplicity of presentation.

The first phase of WHDM is workflow analysis for capturing the process and data of the target business area. In the domain analysis sub-phase, we grasp overall workflow of the targeted area by investigating information and its flow based on related agent domains. As a result of this sub-phase, WDDs are produced. Then, based on these WDDs, further specifications are modeled. This work results in WSDs.

The next document analysis phase solves three important issues such as contents, data, and navigation. The first task is to define the contents of the hyperdocuments captured in WSDs. As a result, Contents Analysis Cards (CACs), which contains information about contents, are generated.
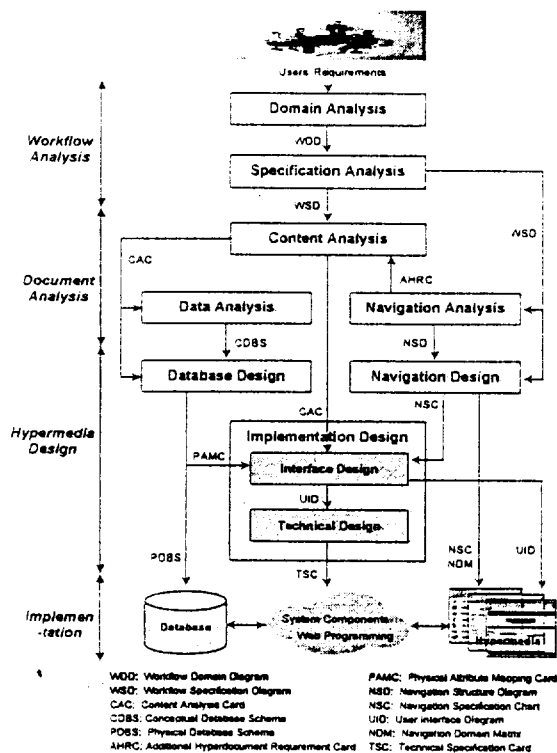
<Figure 1> WHDM Architecture

Secondly, based on these CACs, Conceptual Database Schemas (CDBSs) result from conceptual database modeling. Finally, in the navigation analysis sub-phase, Navigation Structure Diagrams (NSDs) capture the navigation structure of hyperdocuments.

The hypermedia design phase deals with implementation issues such as navigation, database, interface and technical specifications. The navig-ation design sub-phase defines navigation specifi-cations. First, anchors of hyperdocuments are defined on the basis of NSDs. As a result, Navigation Specification Charts (NSCs) are produced. Second, Navigation Domain Matrix (NDM) determines for the design of security functions, we determine the navigation domains and access levels in each domain. The database design sub-phase produces Physical Database Schemas (PDBSs) based on CDBSs, and then generates Physical Attribute Mapping Cards (PAMCs). The implementation design sub-phase consists of two stages: interface design and technical design. In the interface design stage, User Interface Diagrams

(UIDs) are drawn based on CACs and PAMCs. The technical design stage specifies technical details of not only a hyperdocument, but also its components in terms of hardware and software. As a result, Tech -nical Specification Cards (TSCs) are documented.

The implementation phase integrates hyper-documents with the database and implements naviga -tion and access mechanisms for security as well as interface components. NSC, NDM, PDBS, UIDs and TSCs support this phase.

3. Methodology Comparison

Most of the methodologies of the past have adopted two kinds of key modeling techniques: the entity-relationship model and the object-oriented model. WHDM is different from other methodologies in that it is based on document-oriented workflow. Accordingly, workflow diagrams is used as a modeling tool for business analysis in WHDM.

In particular, WHDM, as well as EORM and SOHDM, can better integrate hyperdocuments with transactional data. In order to capture users' views on data, WHDM uses document-based Content Analysis Cards (CACs), rather than conventional data models. The CACs can be integrated into a global schema of any data model, unlike any other methodologies that depend on the particular data models. Accordingly, hypermedia can be imple-mented by using any DBMSs. WHDM takes into consideration technical factors and security issues. Technical Specification Cards (TSCs) specifies system resources captured by User Interface Diagrams (UIDs). In addition, WHDM specifies security methods in design level in terms of navigation by determining navigation domains and access authorities. In WHDM, the document relation -ships are used for navigation analysis.

For supporting the WHDM, a repository system called HyDoMIS (Hypermedia Document Meta-Information System) is under development. Table 1 compares WHDM with other five major methodologies.

<Table 1> Comparisons of Hypermedia Development Methodologies

Methodology / Criteria	RMM (Isakowitz et al., 1995)	OOHDM (Schwabe & Rossi, 1995)	EORM (Lange, 1996)	VHDM (Lee et al., 1998a)	SOHDM (Lee et al., 1998b)	WHDM
Key Modeling Concept	E-R	O-O	O-O	E-R	O-O	Workflow
Mechanism of Business Analysis	N/A	N/A	Scenario	N/A	Scenario	Document-Based Workflow
Modeling Tool of Business Analysis	N/A	N/A	OMT	N/A	Scenario Activity Chart	Workflow Diagram
Integration with Transactional Data	Weak	Weak	Strong	Weak	Strong	Strong
Approach to Identifying Users' Views	N/A	O-O View	N/A	View	O-O View	CAC
Data Model	E-R	O-O	O-O	E-R	O-O	E-R, O-O
Applicable Database	N/A	N/A	O-O	Relational	Relational & O-O	Relational & O-O
Approach to Organization of Hyperdocuments	N/A	N/A	N/A	N/A	N/A	HSD
Source of Navigation	E-R Relationship	O-O Relationship	O-O Relationship	View Relationship	Scenario & O-O View Relationship	Document Relationship
Approach to System Specifications	N/A	N/A	N/A	N/A	N/A	UID, TSC
Approach to Security	N/A	N/A	N/A	N/A	N/A	Navigation Domain, Access Level
Implemented System	RMM-Case Tool	N/A	ODMTool	N/A	N/A	HyDoMIS (under development)

4. Conclusions

The proposed methodology, WHDM focuses on corporate systems such as extranets that require capability to handle complex business functions. This paper redefines the extranet as compared with intranet by the use of a taxonomy. This paper also proposes a document-based workflow model. Hypermedia system is a hyperdocument-based system, and thus the workflow model is used in capturing hypermedia requirements effectively. WHDM attempts to solve security problems in navigation design through both navigation domain and access authority. Furthermore, WHDM provides various analysis and design tools such as cards, diagrams, and matrix for hypermedia system developers. The methodology is effective for replacing paper documents by hyperdocuments on the basis of workflow. In addition, it can integrate a hypermedia system with corporate database to achieve virtual workplace.

References

[Isakowitz et al., 1995] T. Isakowitz, E. Stohr, and P. Balasubramanian, "RMM: A Methodology for Structured Hypermedia Design," Communication of the ACM, Vol.38, No.8, August 1995, pp.34-44.

[Lange, 1996] D.B. Lange, "An Object-Oriented Design Approach for Developing Hypermedia Information Systems," Journal of Organizational Computing and Electronic Commerce, Vol.6, No.3, 1996.

[Lee et al., 1998a] H. Lee, J. Kim, Y. Kim, and S. Cho, "A View Based Hypermedia Design Methodology," Journal of Database Management (In press), 1998.

[Lee et al., 1998b] H. Lee, C. Lee, and C. Yoo, "A Scenario-Based Object-Oriented Methodology for Developing Hypermedia Information Systems," Proceedings of the 31th Hawaii International Conference on System Sciences, 1998. California, 1995.

[Schwabe & Rossi, 1995] D. Schwabe and G. Rossi, "Building Hypermedia Applications as Navigational Views of Information Models," Proceedings of the 28th Hawaii International Conference on System Science, Vol.III, 1995, pp.231-240.