Chapter 4

An Object-Oriented Approach to Conceptual Hypermedia Modeling

Wilfried Lemahieu
Katholieke Universiteit Leuven, Belgium

This chapter introduces the MESH approach to hypermedia modeling and navigation, which aims at relieving the typical drawbacks of poor maintainability and user disorientation. The main focus is upon the data model, which combines established entity-relationship and object-oriented abstractions with proprietary concepts into a formal hypermedia data model. Uniform layout and link typing specifications can be attributed and inherited in a static node typing hierarchy, whereas both nodes and links can be submitted dynamically to multiple complementary classifications. In addition, the data model’s support for a context-based navigation paradigm, as well as a platform-independent implementation framework, are briefly discussed.

INTRODUCTION

The hypermedia paradigm looks upon data as a network of nodes, interconnected by links. Whereas each node symbolizes a concept, a link not only stands for a relation between two items, but also explicitly assumes the semantics of a navigation path, hence the quintessential property of navigational data access. Their inherent flexibility and freedom of navigation raises hypermedia systems as utterly suitable to support user-driven exploration and learning. Unfortunately, due to inadequacy of the underlying data models, most hypermedia technologies suffer from severely limited maintain-
ability. Moreover, the downside of complete navigational freedom is the so-called *lost in hyperspace* phenomenon, which denotes a disoriented user’s inability to assess his current position and sort out his navigational options.

The *MESH* hypermedia framework as deployed in Lemahieu (1999) proposes a structured approach to both data modeling and navigation, so as to overcome said maintainability and user disorientation problems. *MESH* is an acronym for *Maintainable, End user friendly, Structured Hypermedia*. Its fundaments are a solid underlying *data model* and a *context-based navigation paradigm*.

The data model is based on concepts and experiences in the related field of database modeling, taking into account the particularities inherent to the hypermedia approach to data storage and retrieval. Established entity-relationship (Chen, 1976) and object-oriented (Rumbaugh et al., 1991; Jacobson et al., 1992; Meyer, 1997; Snoeck et al., 1999) modeling abstractions are coupled to proprietary concepts to provide for a *formal hypermedia data model*. While uniform layout and link typing specifications are attributed and inherited in a *static* node typing hierarchy, both nodes and links can be submitted *dynamically* to multiple complementary classifications. The *MESH* data model provides for a firm hyperbase structure and an abundance of meta-information that facilitates implementation of an enhanced navigation paradigm.

This *context-based navigation paradigm* builds upon the data model to reconcile navigational freedom with nested, dynamically created *guided tours*. Indeed, the intended navigation mechanism is that of an “intelligent book”, which is to provide a disoriented end user with a *sequential path* as a guidance. Such *guided tour* is not static, but is adapted dynamically to the *navigation context*. In addition, a node is able to tune its *visualization* to the context in which it is accessed, hence providing the user with the most relevant subset of its embedded multimedia objects.

These blueprints are translated into a high-level implementation framework, specified in an abstract and platform independent manner. The body of this paper is dedicated to the *MESH* data model. Thereafter, the *context-based navigation paradigm* and the *implementation framework* are briefly discussed. A last section makes comparisons to related work and formulates conclusions.

**MESH'S OBJECT-ORIENTED HYPERMEDIA DATA MODEL**

**Introduction**

The benefits of data modeling abstractions to both orientation and maintainability were already acknowledged in Halasz (1988), Garg (1988), Botafogo et al. (1991), and Rivlin et al. (1994). They yield richer domain knowledge specifications and more expressive querying. Typed nodes and links offer increased consistency in both node layout and link structure (Thüring et al., 1991; Knopik & Bapat, 1994). Higher-order information units and perceivable equivalencies (both on a conceptual and a layout
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