Adaptation and Search: from Dexter and AHAM to GAF

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ABSTRACT

Adaptive Hypermedia Systems (AHS) have long been concentrating on adaptive guidance of links between domain concepts. Here we show parallels between navigation and linking in adaptive hypermedia on the one hand and information searching or querying on the other hand. We present a transition towards search in AHS by aligning the web search process with the layered structure of AHS and adaptation process.

Categories and Subject Descriptors

H.3.3 [**Information Search and Retrieval**]: Search process; H.5.4 [**Hypertext/Hypermedia**]: Architectures

General Terms

Design, Human Factors

1. INTRODUCTION

Since the most cited Adaptive Hypermedia (AH) model AHAM [1] (in 1999) new terms, definitions and models have been introduced and realized in prototypes. Most AH models focus on a layered architecture and concentrate on adaptation to the linking and navigation between concepts of a domain. This architecture dates back to the Dexter Hypertext Model [2]. With the exploding popularity of the Web searching rather than linking is becoming the prevailing form of information access. Hence, besides adaptive linking there is now also a need to provide personalized search in order to meet the requirements of every particular user.

We draw parallels between navigation links and queries, look at the problem of adaptive search and search in Open Corpus environment as a representative use-case, we show the evolution of Hypertext/Hypermedia modelling from Dexter Model through AHAM to the proposed GAF (Generic Adaptation Framework) model, outline advantages of each framework in an adaptive environment and as a result we align the conventional search process with the generic adaptation process model (derived from GAF).

2. FROM DEXTER AND AHAM TO GAF

We show the evolution of the Hypertext reference models, from Hypertext to Adaptive Hypermedia to the new Generic Adaptation Framework (GAF) which encapsulates most recent developments in AH and adjacent fields.

The AHAM [1] reference model could be considered as an adaptive extension to the Dexter model. The major points of AHAM are: *Domain Model (DM)*, describing how the information content of the application or 'hyper-document' is structured, *User Model (UM)* which represents preferences, knowledge, goals, navigation and other relevant user aspects, *Adaptation Model (AM)* which defines how to adapt the presentation of content and link structure to the user's knowledge and interest.

Moving towards a more elaborate framework, GAF [3] will enhance adaptation capabilities and include new methodologies and techniques, facilitating more elaborate adaptation. In figure 1 we present an extended draft architecture of GAF and briefly outline the enhancements (compared to AHAM).

- *Ontologies* will be used in order to provide interoperability in adaptive applications. These ontologies must be agreed upon, considering concept structures and meanings, therefore ontologies as a base concept structures are accepted in more and more research fields. A Domain Model based on an ontology makes interoperability feasible;

- *Open corpus adaptation* which is increasingly considered in adaptive applications will be scrutinized. This is where resources come from search results in dynamic learning object repositories or from a Web search engine (see section 3);

- *Data Mining* is a valuable tool with respect to clustering users into groups based on their navigational patterns or capturing long term effects of adaptation rules;

- *Group-based adaptation* will extend the adaptation by taking group models into account. It determines partitioning of the users into groups and and adapting to the group model;

- *Higher order adaptation* will monitor the user's behaviour also to adapt the adaptation behaviour;

- A *Context awareness (Model)* will allow systems and applications to be decoupled from the existing environment, and make them more sensitive to adapt in many other ways rather than through a set of predefined rules;

- *Multimedia adaptation* provisions a content type independence at any application level, providing a generalization of adaptation techniques and methods to work with.
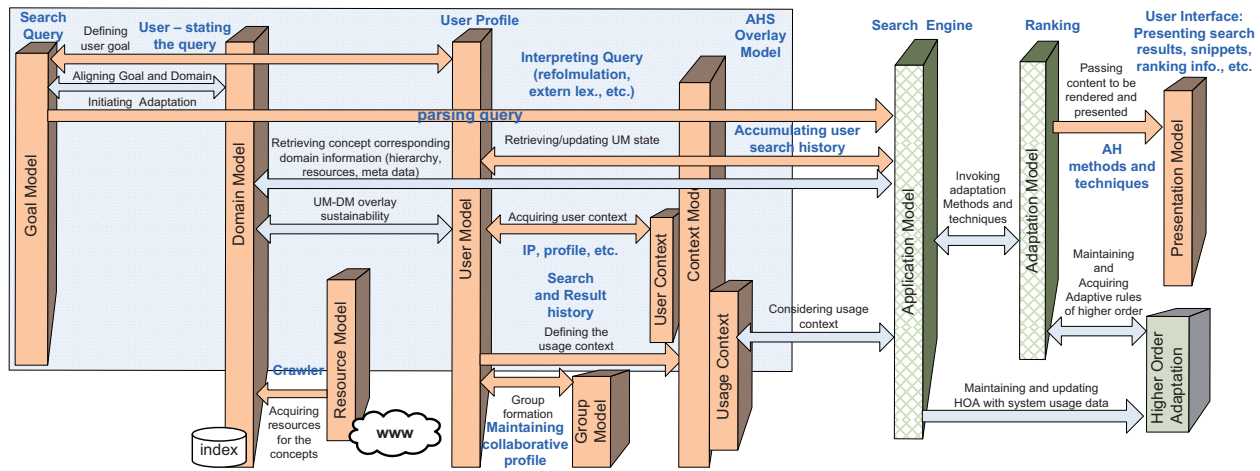
Figure 1: Search compliance with Generic Adaptation Framework

3. SEARCH COMPLIANCE WITH THE GENERIC AHS

Figure 1 presents the compliance of a search process with the overlaying Generic Adaptation Process (GAP) sequence chart. GAP represents the process chart constructed by coupling the layers of GAF. Though we're facing certain issues discriminating Recommendation Engine functionality, in particular the Search Engine and Ranking mechanisms (in this respect Application Model (AM) and Adaptation Model/Engine (AE) can be treated accordingly) we could align the search process and describe its functionality (in terms of aforementioned models) with GAF. On the one hand this proves a generic property of GAF, and on the other hand it opens new horizons to facilitate search aspects in the AH field.

The search process complies with the reference structure of AHS as follows:

- *The User states the goal* thus formulating a new search query, which can be considered as stating or choosing a particular concept (set of concepts) to follow in AHS. It can be interpreted and aligned with DM (availability of concepts, concept structures and sequences, etc.) and UM (considering user competencies, preferences, experience, etc.) thus re-formulating and refining the search query (matching it with the common lexicon or using semantically related terms);

- The *Domain Model* is defined by the search index, representing keywords used to facilitate fast and reliable information retrieval, which is acquired from the *Resource Model* (and essentially WWW). The index information is obtained from WWW *by means of crawling* which is similar to the process of resolving content information of a concept in AHS;

- The *Context Model* defines user and usage context properties such as device, user profile/stereotype, or search and result histories accordingly;

- The *Group Model* refers to maintaining a collaborative profile of the user or stereotyping search results by location or user age group and gender, which later can be used to rank and recommend results;

- Retrieving and updating UM refers to *storing and accumulating UM search history* which can be used to reformulate queries or retrieve personalized results;

- *Application and Adaptation Models* may refer to the Search Engine and Ranking mechanisms, however it may not be entirely clear how to distinguish some particular parts of those. Here we would refer to the Adaptation Model for Ranking, since they both to some extent perform adaptation of the results. The Application Model then serves as the core of the system: coupling other layers and dispatching information in AHS or performing a search as the Search Engine;

- *The Presentation Model* renders search results and presents a ranked result list, snippets, additional rank information, groups result, etc.

4. FUTURE WORK

In the future we plan to extend the search adaptation process sequence, elaborate the description, in particular inter-layer transactions, emphasizing the interoperability of a new AH developments (Ontologies, Open Corpus, Higher-Order Adaptation etc.) in the context of the search process. This may require unifying search and linking methods for AH field. We also plan to present new use-cases and show how exactly user experience, data provenance and open corpus adaptation are facilitated by the linking and search interchangeability and compliance in the AH field.

5. REFERENCES

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