Adaptive Hypermedia Systems Analysis Approach

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ABSTRACT

Adaptive Hypermedia Systems (AHS) have long been concentrating on adaptive guidance of links between domain concepts with lots of custom developments and ad-hoc implementations in the field. Here we consider a formalization approach to AHS composition and design by defining building blocks' interfaces and presenting corresponding dependencies by means of the GAF framework. This helps to identify system design guidelines and start building adaptive system from scratch as well as analyze adaptive system behaviour, architecture and risks involved. As a result of the investigation we present a use-cases of the 'HeyStaks' recommender system compliance and analyze it in the context of adaptive systems composition and process flow. This shows us that it helps in further system development and improvement.

Categories and Subject Descriptors

H.5.4 [**Hypertext/Hypermedia**]: Architectures

General Terms

Design, Human Factors

Keywords

Adaptation, System Analysis, Architecture Dependencies, GAF

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. With the exploding popularity of the Web searching rather than linking, or Recommender systems (RS) to rank relevant content and provide personalized information the area of AHS has gained a lot. The Generic Adaptation Framework (GAF) [1] research project aims to develop a new reference model for the adaptive hypermedia research field. The new model considers new developments, techniques and methodologies in the areas of adaptive hypermedia and adjacent fields. Besides GAF concerns the detailed system analysis in terms of AHS building blocks, connections and dependencies, approaches that can be used to implement such a system.

[1]http://www.win.tue.nl/ eknutov/gaf.html

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2. AHS ANALYSIS APPROACH

As thoroughly investigated in [4] the evaluation of AH systems plays an important role. The described layered evaluation provides the description of the system functionality and helps to solve many related problems. In our work we consider a more formalized and specific system analysis approach by taking up systems' block composition scenarios, interfaces. Thus we define dependencies between models, methods they use to communicate with each other and particular implementations (based on usage scenarious).

As a reference we took [2]. The main steps of such an analysis are presented in Figure 1. By scenarios here we mean framework use-case (adaptive search, adaptive eLearning, recommender system, etc.), mostly covered in [3]. We also consider system specific aspects and AHS building blocks composition which impacts the system architecture, such as event-driven system or service oriented or these two together.

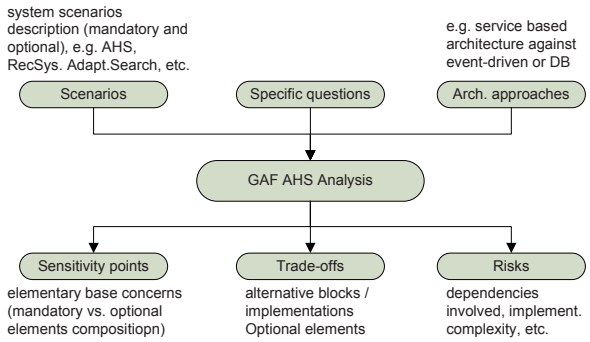

Figure 1: AHS analysis approach

As a result of this approach we would have elementary base concerns of AHS, which would explain mandatory and optional building blocks of the system, trade-off available, mostly concerning optional elements of AHS, and the dependencies involved presented as a table.

3. AHS MODELS ANALYSIS APPROACH

In Figure 2 we show an example of the Domain Model interface dependencies which after further analysis comprise the dependency table 1 of building blocks interfaces (such as Domain, Use, Resource, Context models), scenarios of how these models are used and which type of the system is being described (AHS, Adaptive eLearning, Recommender System, etc.), possible technologies to implement (DataBases, OWL ontologies, TF-IDF index for search, etc.). As a result we'll have a detailed picture of the system com-

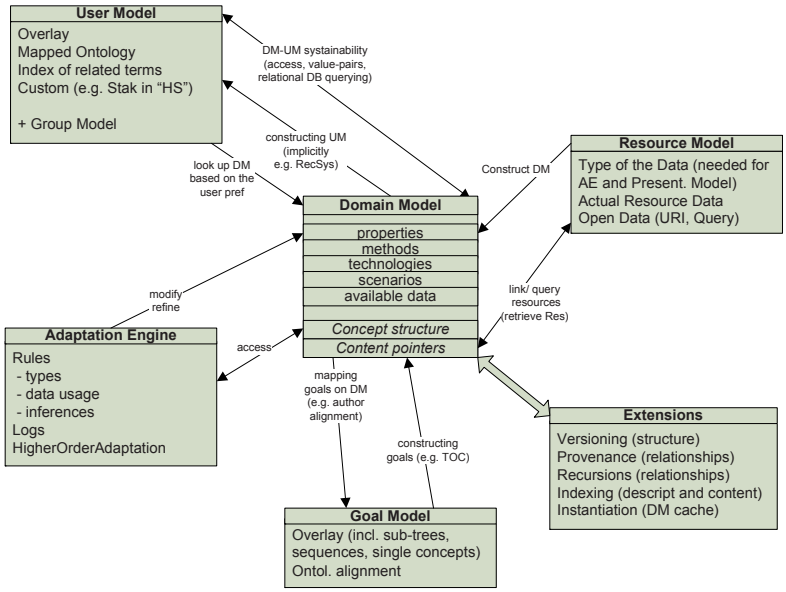

Figure 2: Domain Model interface dependencies

ponents, evaluated against the reference model (GAF), which will help to identify all pros and cons.

Table 1: partial GAF DM blocks high-level dependencies

DM prop. and meth.	Scenario	Resource Model	Adaptation Engine	User Modelling
concept tree	conventional AHS eLearning	content pages	ECA rules prerequisites	UM overlay
feature space	RecSys	datasets	promotions and ranking mechanisms	implicit user profiling
index	adaptive search	WWW	ranking	implicit user profiling

Finally on the poster we show an example of the 'HeyStaks' social recommender system analysis using the aforementioned approach. We decompose the system in building blocks (domain and user model, user and usage context models, goal model, reasoning and the actual presentation model), analyze dependencies, identify strong and week points, possible trade-offs and room for further system extension.

4. CONCLUSIONS AND FUTURE WORK

The coming years will bring more use-cases of how AHS can provide adaptation and personalization, what techniques will be introduced, and what research areas will introduce new technologies in its evolution. So far a study of existing adaptation and personalization approaches was done to check their compliance with the layered structure of adaptive information systems, which raised the problem of system composition and design analysis. We try to solve this problem using classical software architecture analysis approach extending it with adaptation framework specific questions and interface dependencies in order to meticulously analyze any adaptive system in terms of GAF framework.

At the same time evaluating the proposed general-purpose AHS architecture (GAF framework) against recommender system has shown that the GAF architecture is generic enough to accommodate the description of different personalization approached including recommenders, as well as provide the flexibility of both AH and RS in one go by building a custom system with the GAF building blocks. The real though not very meticulous case study has proven our points. It has given us new challenges to investigate the applicability of new approaches, as well as new developments in adaptive information systems which will allow to decide on the system composition on the implementation level and this is where one would need the AHS analysis.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

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GAF: Extensive AHS Analysis Approach

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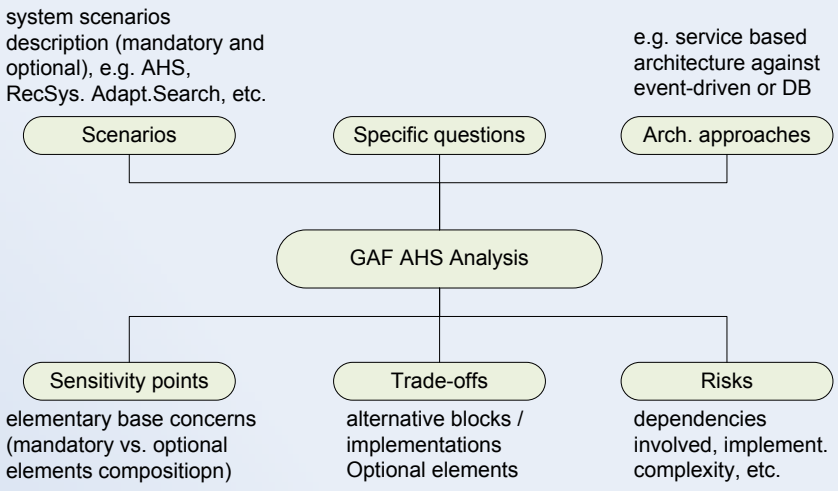
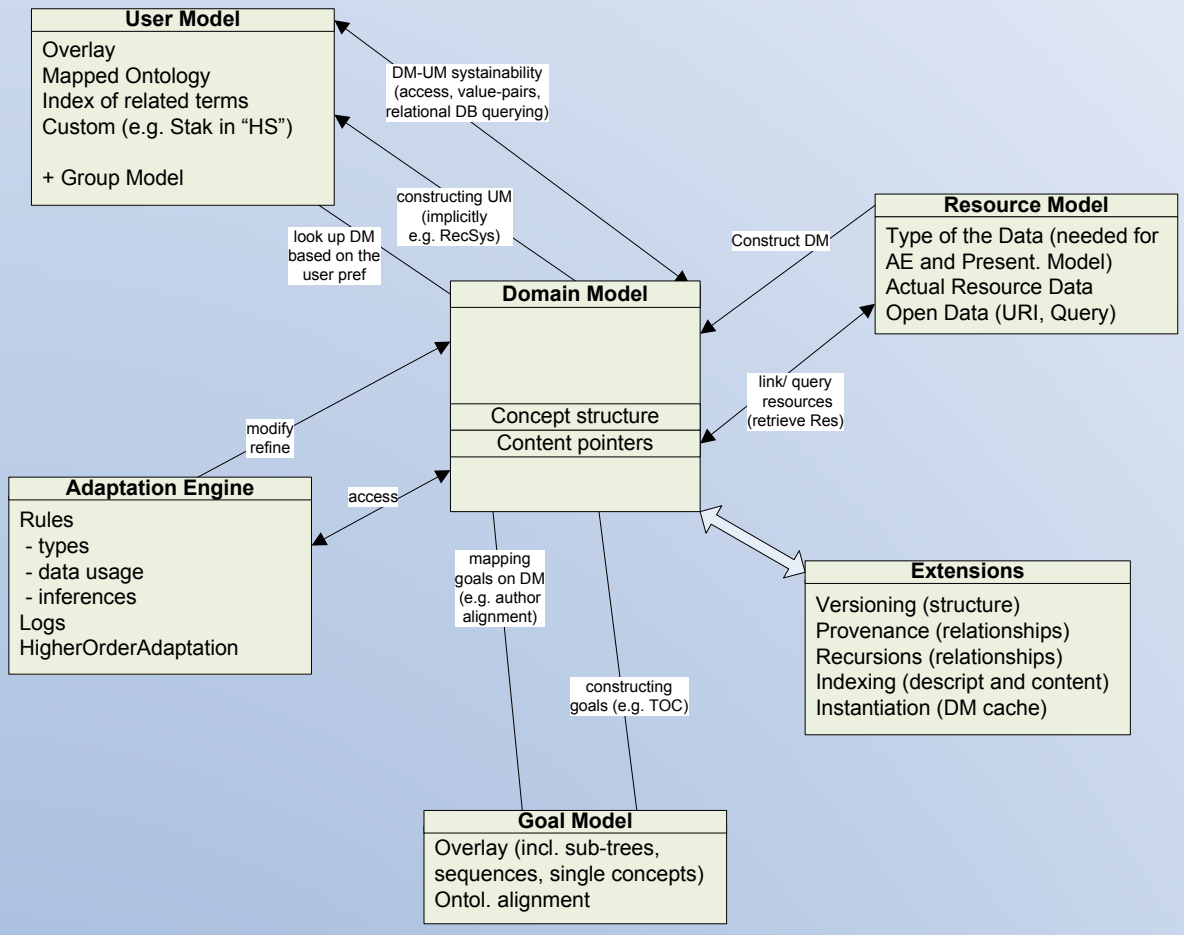
Introduction, Goal

The Generic Adaptation Framework research project aims to develop a new reference model for the adaptive hypermedia research field. The new model will consider new developments, techniques and methodologies in the areas of adaptive hypermedia and adjacent fields (Data Mining and Machine Learning, Semantic Web, Open Corpus Adaptation, etc.).

AHS Analysis Approach



GAF Domain Model Dependencies Structure



GAF Domain Model Analysis

DM properties and methods	Scenario	Resource Model	Adaptation Engine	User Modelling
Concept tree	Conventional AHS / eLearning	Content pages	ECA reasoning prerequisites	UM Overlay
Feature space	RecSys	Datasets	Promotion and Ranking	Implicit user profiling
Index	Adaptive Search	WWW	Ranking	Implicit user profiling

GAF: Analysis Impact on HeyStaks Recommender