

Designing Personalized Information Systems - A Personal Media Center

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1 Introduction

With the evolution of the simple set-top box from being a device for receiving and unscrambling analogue transmissions, towards its role as an 'interactive' portal for not only broadcast-content, but all kinds of content and services, the consumer is faced with a significant challenge: too much content, too little time...

Media convergence enables a unified environment in which content is available from a variety of sources. The same content can be delivered from several suppliers, by many methods onto many devices at many places [9]. The set-top box as a portal has the potential of becoming the most important gateway from the home environment to the 'outside world' of content. For the consumer there is a certain tension between the increasing amount of digital content that has the potential of being of interest, and the decreasing amount of time to spend due to the overall increasing speed of living [1]. The way out of this predicament is by making choices. Businesses recognize this consumer predicament by adopting a consumer-centric focus and providing flexibility for consumers to adjust products/services to their individual circumstances. That is, in a converged media environment, characterized by an abundance of digital content and a consumer-centric focus, the need arises for personalization.

The unified content environment encountered in the TV home environment is made up of three basic sources: broadcast content, the Internet and the home network (see figure 1). The home network consists of locally stored digital content (music libraries, family photos, documents, stored video, etc). Currently each one has its own way of letting the consumer search for specific content and its own way of presenting the results. For broadcasting this is the Electronic Program Guide (EPG), for the Internet these are search engines and directory services, and for locally stored digital content this is a PC-like file system interface. If we truly want a unified 'portal', an integration of these should be pursued, this means integrated search facilities for content and an integrated presentation of the results.

In this paper we present our research into a more general approach for designing personalized information systems, and describe work in progress on a demonstrator

we are building that will address the integration of search facilities and presentation as sketched above.

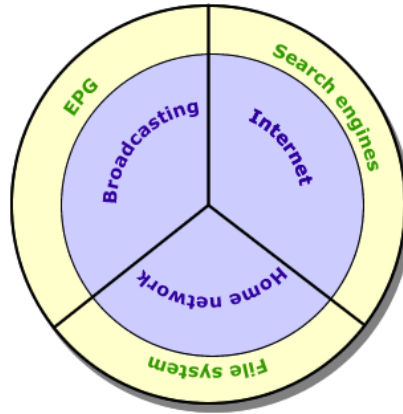


Fig. 1. Unified content environment encountered in the TV home environment.

2 Personalization

The integration of search facilities and subsequent presentation should provide an integrated view on personalization for the consumer, however different types of services require different types of personalization techniques. For example, some personalized services are based on the explicit mentioned interests of the user (e.g. personalized news services), while other services are based on implicit mentioned interests (e.g. likes and dislikes in music recommendation systems). Another example is PTV's personalized EPG [8], where time plays a role in the personalization process, whereas other services (e.g. music recommendation) are not time dependent.

For these reasons, it is important to understand what factors have greatest influence on the personalization process in certain design situations. In general there are several factors that can be important in the design of a personalized information system. The four main groups of influencing factors are:

1. *User factors* [3]: the interests of users, their preferences, their characteristics etc. The user factors determine how the information should be personalized;
2. *Information or content factors* [3]: properties of the information, e.g. the media type, the lifespan of the information, and whether there is content and/or associated meta-data. These factors determine how information can be personalized;
3. *Context factors* [3]: the environment of the personalized information system and its user, e.g. the current location, used hard- and software and the application domain;
4. *Retrieval approaches*: There are different types of information retrieval approaches from a user's point of view which also influence the design (e.g. querying and browsing are different types of information retrieval).

These four factor groups determine the limits and requirements of a personalized information system. They also influence the choices that need to be made when designing personalized information systems. One choice is which retrieval technique(s) to use, e.g. category selection [4], query adjustment [2], information

filtering [5], social filtering [5], and/or collaborative information filtering (which combines information filtering and social filtering techniques) [5] [6] [7].

The main objective of our research is to create a general design approach for designing personalized information systems, including tools to help designers. These tools include, but are not limited to, a functional reference architecture for personalized information systems and design guidelines. The design approach is based on existing designs of personalized information systems. For this reason, the first step in the project focuses on analyzing the design of existing personalized information systems. Based on this analysis, a first version of the design approach, functional reference architecture and design guidelines will be created. They will be evaluated and adjusted extensively by designing actual personalized information systems, like a personal media center, as discussed in the following section.

3. Personal Media Center

Within the GigaCE project¹, we are developing a demonstrator of a Personal Media Center, which handles multiple content types, as discussed in the introduction. This demonstrator aims to include many aspects of the research conducted within the project and involves developing the following system components:

- A Personal Content Guide (PCG) which provides an integrated personalized view on the available content;
- A content-based search and retrieval component which provides the user with a top-level search interface capable of searching many content domains (e.g. WWW, local video content, broadcast programming, images and sound);
- A personalization component which facilitates adaptive profiling of users;
- A storage management component which handles storage of content and profiles;
- An advanced content sharing component based on peer-to-peer networking.

In the case of advanced set-top boxes, more common personalization issues are for instance to provide users with suggestions on prospective content that the user may find interesting and/or take the initiative to pre-record content on the user's behalf. In addition to these standard functionalities our demonstrator will include: allowing users to create personal content channels, assisting the user with storage management by suggesting content that may be archived, 'forwarded' or deleted, portability of profile information amongst applications and devices, and the combination of individual profiles for group recommendations. These functionalities of the demonstrator give rise to new issues regarding personalization:

- As the demonstrator integrates different types of information sources, it is necessary to identify how personalization factors from different sources influence each other;

¹ The GigaCE (GigaPort Content Engineering) project (gigace.telin.nl) is a knowledge acquisition project focussing on content engineering, which is part of the GigaPort project (www.gigaport.nl). GigaPort prepares the Dutch industry and knowledge institutes for Next Generation Internet. GigaPort is a joint initiative of industry, higher education, research institutes and the Dutch government.

- As different services require different personalization techniques, it is necessary to develop an effective way of integrating different personalization techniques;
- Because each of the individual services has a piece of knowledge about the user, the integrated service can have a more complete model of the user, resulting in an increased quality of the personalization process. This raises the question of: "how to integrate the different services and user models in such a way that it enhances the personalization process for the user?"
- Because watching TV is often a group activity, another questions is "how to combine individual user profiles to recommend information for groups of users?"

4. Conclusion

In this position paper we elaborated on personalization in a home environment by looking at a personal media center. This personal media center provides the consumer a unified access point to a heterogeneous content environment. Focussing on the integration of different content sources, we identified some outstanding issues with regard to personalization that must be addressed. Our research leads to a design approach for the design of personalized information systems, including tools to help the designers, which include a reference architecture and design guidelines. This design approach will be tested and evaluated when developing several personalized systems, of which the first is the personal media center.

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