Personalized Multimedia Touristic Services for hybrid broadcast/broadband mobile receivers

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***Abstract*—This paper presents the topology of a multimedia tourism service that targets mobile devices with broadband and broadcast access capabilities. The solution adopted relies on existing mobile TV standards, but introduces features that enable the provision of generic multimedia services on top of hybrid mobile networks**

I. INTRODUCTION

The introduction of mobile TV services is following a much slower pace than initially predicted. However, a variety of mobile broadcast networks and technologies are present all over the world. Among these, Hybrid Broadband Broadcast architectures, such as OMA BCAST [1], use mobile broadcast access in combination with mobile broadband access to enable the provision of rich interactive mobile TV services. However, the difficulties inherent to mobile reception make dedicated mobile broadcast networks expensive. Thus, there is a need for new services that benefit from mobile broadcast network resources while generating new revenue streams to ease the monetization of network Capital Expenditures and in turn to encourage the mobile TV market.

On the other hand, services for mobile phones are moving towards a new landscape where mobile applications are seen as highly specialized pieces of software that are independent of each other. In this new scenario, it is interesting to regard new mobile broadcast services not as interactive applications necessarily coupled to the mobile TV offer, but as independent services that bring added value to users while creating new revenue streams in the mobile broadcasting value chain.

This paper describes the topology of a multimedia tourism information service targeting mobile devices that implement both broadcast (DVB-H) and broadband (HSDPA) access. We describe how to use standardized interfaces originally defined for interactive mobile TV broadcasting to build personalized mobile multimedia services that do not deal with TV contents or are not necessarily coupled to a mobile TV service bundle.

II. SERVICE DESCRIPTION

The purpose of the service under study is to provide personalized touristic information to visitors during their stay in a city resort. The service operator is a local tourist agency that, by means of this service, is able to aggregate multimedia content with tourism information into the hybrid broadcast/broadband distribution platform.

Apart from content items, the operator can also include services of the mobile telephony network, such as sending message templates, get contact information, access external links, make automated reservations, buy tickets or hire a baby-sitter via web services.

Tourists access the service through terminals capable of accessing both networks. Upon arrival to the destination resort, the user downloads and installs an ad-hoc client application, meant to access and render the items managed by the platform. This application then connects to a local server and downloads a tourist guide through which users can browse item descriptions.

The multimedia content items within the tourist guide are not delivered together with the tourist guide. Instead, the platform uses the broadcast access to distribute the most popular items. The rest of the content items are available through the broadband access, together with the interactive services.

To accomplish the content distribution over both networks, the tourist guide, which complies with the OMA BCAST *InteractivityMediaDocuments* (IMD) XML document format, provides an access URI for every content item in the guide. In our implementation, terminals are able to resolve this URI into either access information to a GZIP encoded file in a broadcast FLUTE session or to a GZIP file in an HTTP server. Each GZIP file contains XHTML presentation markup together with the multimedia content (e.g. pictures or videos) embedded into that particular tourist multimedia item.

III. PERSONALIZATION

The success of the hybrid content distribution scheme promoted in this project is largely dependant on its effectiveness to satisfy users. This is especially difficult in major destinations due to the vast and heterogeneous touristic offering, parallel to the visitors' demographic variety. This way, it is not easy to provide a complete and general offering of touristic resources without overwhelming the users with a countless collection that makes it difficult to take advantage of the service.

Consequently, a recommendation module in charge of giving priority to resources depending on the visitors' characteristics is a must in this kind of framework where the user terminal is individualized (though it may gather information about the visitors' travelling companion).

To this extent, this project implements a selection mechanism that performs an ordering of touristic resources according to their interest for a given visitor. The recommendation engine is an adaptation of the well-known recommender AVATAR [2][2], extensively tested in different environments for TV content recommendations or for personalized composition of distance learning courses over TV.

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In this tourism context, the recommendation engine has been adapted to estimate the adequacy of a resource for a visitor, according to the available information:

- The characteristics of the touristic resource, taking into account the seasonal constraints.
- Demographic data about the visitors and their preferences.
- Their explicit ratings for previously visited resources. This includes resources located in other destinations as long as they share the recommendation platform.
- Implicit conclusions about their preferences, extracted from their historical behaviour regarding services contracted through the platform (tickets, restaurants, reservations…).

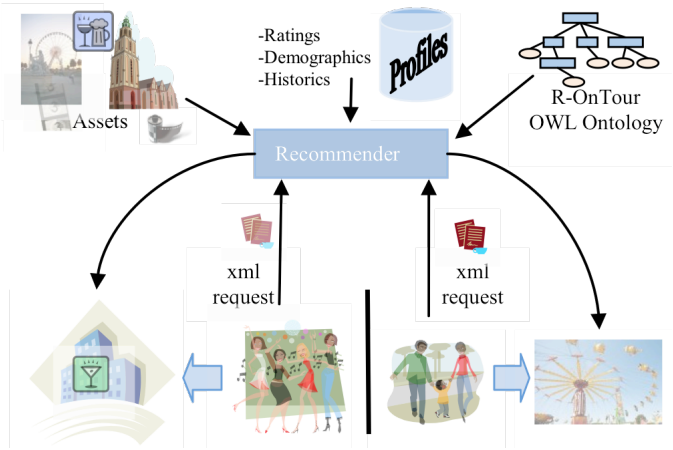

Fig 1. Recommendation system

The recommendation service implements a hybrid strategy composed of two stages: content-based (comparing resources to users) and collaborative filtering (comparing users among them). The kernel algorithm is based on the AVATAR original strategy, fully described in [2]. Starting from the aforementioned techniques that compose the hybrid approach, the suggestions are enhanced with the additional discovery of new significant relationships by means of techniques extracted from the semantic web field. To this extent, all the information characterizing the touristic resources has been organized by means of an OWL ontology named R-OnTour, an ad-hoc extension of the well-known OnTour ontology developed in the OnTour project [3].

By means of the Java API Jena, the recommendation engine explores and weights relationships derived from the properties that characterize the resources in the ontology, searching for semantic links that relate the local tourist resources to those ones positively rated by the user in the past or inferred to be appealing to the user by the system.

IV. LATENCY

In order to provide a satisfactory experience, it is also important to handle the latency of the file delivery over the hybrid distribution network.

Looking at the broadband access, the average latency is mainly dependent of the network delay in overload conditions. To prevent the occurrence of overload events, a back off timing mechanism that distributes the user requests over time is introduced. Most popular files will need larger back off timing windows to level out the access peaks, thus experiencing longer access times.

Hence, the placement of popular files in the broadcast access helps keep the service latency under control, especially in tourist areas where a high density of users per cell is expected. As explained in [4], the average access time to files in the broadcast service area can be optimized, given that an empiric measure of the popularity of files is available. In our implementation, the recommender engine establishes which files compose the broadcast carousel and their respective cycle time. This way, files with higher ratings have a lower cycle time. Similarly, the back off timing parameters of the files in the broadband access are also given by their respective ratings, as an estimate of their popularity, to minimize the probability of network overload.

On reception of the IMD file through the interaction channel, clients start to prefetch the GZIP files from both networks and to store them in cache as the user interacts with the personalized tourist guide. Then, it is necessary to account for the local probability of access of each user in the cache management policy. Again, the recommender software is used to assess the value of items in cache memory. This value is proportional to the local probability of access and to the time cost associated to the file download. The cache manager uses the recommender ratings to estimate the local probability of access whereas the cost for accessing each file is assessed from the available metadata.

V. CONCLUSIONS

This paper has presented a novel tourist information service provisioned through state-of-the-art hybrid networks. Terminals use both broadcast and broadband network resources to access the tourist multimedia information assets. To improve usability and avoid overwhelming the user with information, the platform provides users with personalized tourist guides according to their preferences. The recommender module information is in turn used to minimize the hybrid network latency experienced by users.

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