Service and Content Presentation in Ubiquitous Environments

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Abstract. The heterogeneous, dynamic nature of ubiquitous environments necessitates that all system components that form part of a personalisation framework should be context aware. Personalised service delivery requires that the system must detect and interpret device modality contexts in real time and provide automated adaptation on behalf of the user. Towards this aim, this paper presents the design and implementation of a demonstrator that offers personalised, context sensitive, service and content delivery.

Keywords: Adaptation, context awareness, personalisation, rule-based reasoning.

1 Introduction

The stereotypical vision of a future with 'ubiquitous services' often involves a user, having different preferences and requirements and using a heterogeneous mix of devices, each with varied capabilities. As the number of connected devices increase, in conjunction with the explosion of capabilities, it would become less and less tangible for service providers to continue to prepare their content in advance, tailored specifically for every conceivable device and user context. This demonstration identifies that for such a future to become reality, device capabilities and modalities must be automatically understood and reasoned in order to provide autonomous adaptation on behalf of the users. Secondly, there is a need for a dynamic adaptation mechanism that allows content and service to be automatically adapted to a user's delivery context, i.e. device and environment capabilities and their individual preferences and requirements.

To achieve these aims, this paper presents a demonstrator that is designed to facilitate context sensitive service provisioning in ubiquitous communication environments by tailoring service delivery according to the user's current situation. It supports the ubiquitous environment concept where the system optimises a number of parameters to receive an optimum service whilst minimising user distraction.

2 PAA-AMF Architecture

The demonstrator consists of two coupled components to achieve context awareness: the Personal Assistant Agent (PAA) and the Adaptation Management Framework (AMF). Fig. 1 shows the logical architecture.

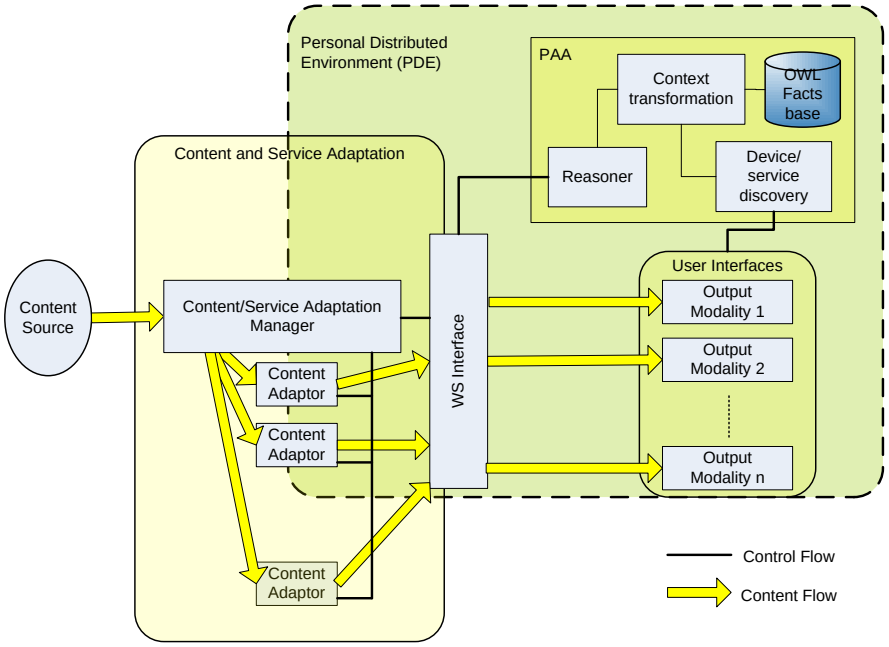

Fig. 1. PAA- AMF architecture

The PAA builds on traditional service discovery mechanisms to create an understanding of devices and services. It utilises an ontology model for formalising the device and service descriptions obtained through modality context discovery. Rule based reasoning mechanisms are then employed to formulate recommendations on the best suited device for content presentation, depending upon the device and content context and the user preferences.

The AMF consists of the Adaptation Manager (AM), content adaptors and ADMEs (Adaptation Mechanisms). The AM formulates adaptation decisions and performs physical adaptation through content adaptors that handle which ADMEs to use and their order of execution. The AMF minimises the management complexity of service and content delivery to users by rapid service creation agnostic to users' devices. It also facilitates reduction in storage requirements for service and content.

2.1 Technology Description

The PAA implements discovery adaptors for discovery of device modality context. It supports two different models of context acquisition through an enhanced UPnP protocol [1]: active advertisements and passive discovery. Active advertisements from devices, for instance in a networked home environment, involves devices hosting their own descriptions. Passive retrieval comes into play when the discovered device holds a pointer to a manufacturer supplied URL where the device capability information is stored. A SWRL rule base is employed for context inference and reasoning. For scenarios where current context does not return a valid match for content presentation, the AMF functionality provides automated adaptation mechanisms to provide a seamless user experience.

The PAA-AMF interface has been executed through Web Services. An adaptation request is accompanied by the device profile URL and the URL of the content to be adapted. The AMF offers interoperable and extensible adaptation by using OWL 2.0 based refinement of retrieved data to higher level context. It then executes MPEG-21 DIA [2] and rule based reasoning for adaptation decision taking [3].

The demonstrator shows, in the first instance, the media capabilities of the devices as they are dynamically discovered. Secondly, it shows the ranking of devices based on different content types and previously input user preferences. It then uses these inputs together with information on the media stream and service request to infer the necessary adaptation strategy and to implement the content adaptation. Finally, the adapted content is delivered via the (before) identified 'most suited' modality and device.

2.2 Key Features

The developed mechanisms provide a semantic, dynamic view of available modalities in the ambient environment. The inherent complexity of the operating environment is hidden from service providers and user environments through dynamic device selection, thus realising the notion of 'right service to the right device'.

The adaptation management mechanisms use specialised services, targeted at specific content types, to adapt the multimedia rich content / services. This can foster creation of new business opportunities for third party adaptation management services and specialised adaptation services. The AMF also employs dynamic content adaptation as opposed to storing multiple versions of the content, thus facilitating lower cost of providing adaptation services.

3 Conclusions

The developed mechanisms facilitate a seamless, personalised content delivery and user experience. This demonstrator gives an idea of how different devices can be managed and their capabilities best used. Thus, this work aims to hide complexity by enabling dynamic device selection.

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