

# Personalization and the Universal Communications Identifier Concept

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**Abstract**—As communications systems and technology become more advanced and complex, it will be increasingly important to focus on users' individual needs. Personalization and effective user profile management will be necessary to ensure the uptake and success of new services and devices and it is therefore important to focus on the users' requirements in this area and define solutions that meet these requirements. The work on personalization and user profiles emerged from earlier ETSI work on a Universal Communications Identifier (UCI) which is a unique identifier of the user rather than a range of identifiers of the many of communication devices or services (e.g. numbers of fixed phone at home/work, mobile phones, fax and email addresses). This paper describes work on personalization including standardized information and preferences and an architectural framework providing a description of how personalization can be integrated in Next Generation Networks, together with the UCI concept.

**Keywords**—Interoperability, Next Generation Network (NGN), Personalization, Universal Communications Identifier (UCI), User Profile Management (UPM)

## I. INTRODUCTION

CURRENTLY, the range of preferences and values that can be set by users are not consistent across different devices and services, or between comparable services and devices from different vendors. Therefore, it is impossible to transfer the settings that have been set for one particular device or service to another similar device or service in a way that ensures the same user experience.

In order to achieve the best user experience, there is a need

The work on personalization presented in this paper is performed at European Telecommunications Standards Institute (ETSI) [1] by the members of the Specialist Task Force (STF) 342 [2] under the guidance of the ETSI TC HF (Human Factors). ETSI produces globally-applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies and is officially recognized by the European Commission as a European Standards Organization. ETSI is a not-for-profit organization whose 720+ ETSI member companies and organizations benefit from direct participation and are drawn from 60 countries worldwide. ETSI Specialist Task Forces (STF) [3] are teams of highly-skilled experts working together over a pre-defined period to draft an ETSI standard under the technical guidance of an ETSI Technical Body and with the support of the ETSI Secretariat. The task of the STFs is to accelerate the standardization process in areas of strategic importance and in response to urgent market needs. The work on personalization presented in this paper is co-financed by the EC/EFTA in response to the EC's ICT Standardisation Work Programme.

to ensure interoperability of services, devices and the users' preferences defined in their profiles. The realization of this objective depends on standardization of information and preferences and the ways in which these are expressed in user profiles. In addition, there is a need for an architectural framework that supports this concept. This work is currently performed at European Telecommunications Standards Institute (ETSI) technical committee Human Factors, by the Specialist Task Force (STF) 342 [2].

Furthermore, with the expanding range of communications services and with an even greater range of organizations providing those services, the future communications environment is very exciting, but also potentially complex. As people start to use new services they acquire more and more telephone numbers, email addresses, instant messaging identities, etc. With this increase of possible contact options, often changing over time, it may get even more difficult to contact people.

ETSI has looked at this issue and concluded there is a need to introduce a new communications identifier that can be used for all forms of current and future communications instead of this increasing mass of different identifiers. Not only will this new Universal Communications Identifier (UCI) [4], [5] solve the problem of coping with the increasing number of identifiers; it will allow the person you are communicating with to be clearly identified in a way that the user can trust. Furthermore, it will allow users more control of how and when they communicate, and it will help users protect themselves from spam and other online threats whilst at the same time improving the chances that wanted communications will be successful. The UCI concept has been developed based on an analysis of users' needs and an architectural framework within the Next Generations Network (NGN) has been developed by ETSI [6]. In order to make new and advanced information and communication services and devices a success, it has been recognized that it is essential to perform standardization work on personalization and user profile management, which will be beneficial for a whole range of new and advanced information and communication services.

## II. OVERVIEW OF THE PERSONALIZATION CONCEPT

A. The concept of a profile usually refers to a set of preferences, information and rules that are used by a service or device to deliver customized capabilities to the user. In practice, many products and services already contain profiles that are specific to that product and unrelated to any other. Commercial and technical constraints will dictate that having profile components associated, and co-located, with each product or service is likely to remain a common model for profiles. This model is reflected in proposed system architectures such as the 3GPP (3rd Generation Partnership Project) GUP (Generic User Profile) [7], [8], [9] (3GPP 2005, 2007). Later 3GPP work has further developed the concept [10].

B. There will be a number of user characteristics and preferences that will apply independently of any particular product or service (e.g. preferred language or need for enlarged text). Users frequently find themselves moving from one situation to another throughout a typical day (e.g. at home, driving, working), as will be reflected in situation dependent profiles (SDP) which can be activated automatically depending on the context. The "Normal profile" defines the profile data that will be applied even when no specific user-defined situation applies. In each of these Normal profile or situation dependent profiles, users will have specific needs. At present, an increasing number of products already provide the user with ways of tailoring their preferences to these situations. ETSI EG 202 325 [11], which was published in 2005, describes the personalization and profile concept and presents guidelines to manufacturers and service providers in shaping their product and service requirements in ways to maximize human and social benefit. This work identifies how to make it easy for users to specify their situation dependent needs in ways that require the minimum need to understand the potentially wide range of such products. In order to achieve the best user experience, there is a need to ensure inter-operability of services, devices and the users' preferences defined in their profiles. The ETSI technical committee is therefore working on the architecture and standardized information and preferences.

## III. UNIVERSAL COMMUNICATIONS IDENTIFIER

Universal Communications Identifier (UCI) offers a framework to allow user interaction with current and future user to user communications. UCI is made up of three parts. These are:

- a globally unique numeric identifier;
- an alphanumeric label;
- an additional information field (coded information not for direct presentation to users).

Some of the most notable characteristics of the UCI include:

- it is a unique identifier for a person, role or organization;
- it allows a label to be used as a "user-friendly" name that describes the originator and/or recipient of a communication;

- it allows the originator or recipient of a communication to claim authenticity for their identifier;
- where it is particularly important to claim authenticity, additional procedures can be invoked to make sure that it is not another person using the UCI owner's service or device and thus not the person it seems to be;
- it is independent of services and networks;
- it is independent of communication service provider;
- it can communicate a selection of important additional information such as:

- flags that mark important properties of the UCI, e.g. that the name element is an "authentic name";
- the user's preferred language;
- the user's preferred alphabet;
- whether the UCI is a business or personal one.

This additional information may, with the UCI owner's permission, be made available to other people.

The UCI concept [4], [5] has evolved from a period when a user had many identifiers, covering many services but where each identifier was restricted to a single service. The concept now being developed in NGN specifies a single identifier, either a SIP URI or a Telephone number (E.164 [12] or tel-ur), which can be associated with many services. The UCI model was therefore a development based on the user-control of calls and sessions being separated from the network-provision of calls and sessions. A Personal User Agent (PUA) is a functional entity that has a one-to-one relationship to a specific UCI. It stores, or has access to a user profile that contains information on all the UCI user's preferences about their communication services. The PUA also has access to information on the current status of these services (e.g. 'mobile phone switched on and reachable', 'unable to access home telephone', 'unable to read emails at this time', etc.) via Service Agents.

The various entities provided by the NGN, as already defined, are able to deliver the majority of the functionality that was specified in the UCI abstract architecture described in the earlier work on UCI (i.e. the Personal User Agent (PUA) and the Service Agent (SA) [5] functionality).

Architecturally, UCI consists of two primary elements:

- Personal User Agent (PUA); and
- Service Agent (SA).

The UCI architecture very broadly maps the Service Agent (SA) to the tele-services of ISDN-era telephony which of themselves map into the IMS/PES/PSS domains of the NGN. The Personal User Agent (PUA) maps largely into the application services plane of NGN.

The analysis of the use cases specified in [6] has led to the mapping of the UCI functional entities to NGN functional entities. Mapping the PUA reference points to NGN interfaces and/or internal reference points depends on its placement inside or outside the NGN environment as identified in [6]. Three scenarios have been identified, including whether the PUA is placed:

- outside the NGN;
- inside the NGN as a new component;

- inside the NGN and is using the existing components. In this scenario, PUA represents a combination of User Profile Server Function (UPSF), Application Server Function (ASF), Call Session Control Function (CSCF) and NGN Presence Server.

#### IV. STANDARDIZED INFORMATION AND PREFERENCES

Currently, the range of parameters that can be set by users and the values that may be set will not be consistent between different devices or services, or between comparable services and devices from different vendors. Where such diversity exists, it makes it impossible to transfer the settings that have been set for one device or service to another similar device or service in a way that ensures that the same outcome will be achieved. This problem would be overcome if:

- different devices or services of the same type had consistent sets of parameters which had value ranges that produced identical effects;
- settings in one proprietary form on one device or service can be converted to settings in another proprietary form on a similar device or service from a different supplier.

Therefore, the ongoing ETSI project standardizes information and preferences because:

- For preferences to be useful, the users wish them to always result in the same standardized user experiences. For this to be achieved, these terms need to map to technical descriptions that have universal applicability across a wide range of services and devices and usage scenarios.
- If data in profile components relating to a device or service has been specified by the user, then related profile fields for other devices or services can be directly populated by the same standardized data or data translated to produce the same effects. Users will benefit greatly where mechanisms exist to set many device and service specific settings to values that are based upon the data stored in their profiles. The realization of this objective depends on standardization of information and preferences and the ways in which these are expressed. The results will therefore be provided in Resource Description Framework (RDF) syntax [13], which is based on XML [14]. The project is collecting input from end-users and their representatives, including people with disabilities.

#### V. ARCHITECTURAL OVERVIEW OF THE UPM

The ongoing ETSI Human Factors project is developing an architectural framework for achieving the personalization and profile management concept described in EG 202 325 [11]. In this section, the architectural capabilities of the UPM system will be described firstly. Then, we will show how the UPM architecture can be mapped to the UCI concept.

The UPM system is composed of a set of functional entities which provide UPM services. All services can be modeled as a set of capabilities. The UPM system interacts with:

- End users [10] – human beings consuming services. End-users exist independently of a particular service at first, but may be granted access to different services by subscribers (so

called contract holders). End users are uniquely identified by the collection of their own identities and keys and may be assigned a Unique Identifier. In the UPM system, end users may play two roles [11]:

- (UPM) User – role played by end users when using their existing profiles, including activation or deactivation of their situation dependent profiles.
- (UPM) Administrator – role played by end users when defining new profiles or modifying existing ones.

The same end user can play both the user role and the administrator role. ETSI EG 202 325 [11] describes several use cases in which the administrator role is played by different end users than the user of the given UPM system, for example when a company administers profiles for employees or when parents administer profiles for their children.

- Network Functions (e.g. “low level” location detection through NGN transport layer Functional Entities).
- NGN Applications and Services (application providing functionality across single or multiple subsystem, e.g. messaging exchange between fixed and mobile terminals, presentation of incoming calls and phone list management on TV, IPTV gaming applications based on user presence, etc.).
- Enterprise Applications (applications in the OSS/BSS environment of a network or service provider).
- Web Applications.
- End-user devices (includes communication and other kinds of devices, e.g. home automation devices, intelligent in-car devices).

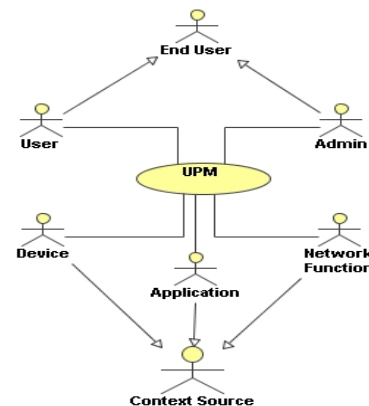


Fig. 1: UPM system boundaries

Network functions, applications/services and end-user devices which are sources of profile data represent potential targets for the UPM system. In general, they are sources of context information. Context information may be used by the UPM system to evaluate state variables and situations. Examples of context sources include but are not limited to: NGN Presence Server for presence information; UPSF for network context information (e.g. information related to QoS,

bandwidth, location, privacy, etc.); various sensors in the end-user device or in a customer premise network (GPS location, volume, brightness, temperature, etc.).

It should be noted that profile data represent a particular class of context information which can be manipulated by the UPM system. For example, some profile data in a given user profile may be used as context information in another.

The UPM system (Figure 2) consists of five functional entities:

- Profile Storage Agent;
- Profile Processing Agent;
- Profile Activation Agent;
- User Interface Agent; and
- Context Watcher.

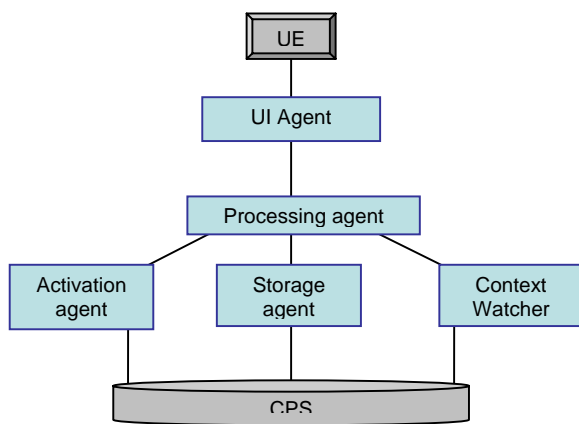


Fig. 2: Overview of the Profile Agent components and interfaces

When the architecture is implemented in distributed systems, the storage agent, the activation agent and the context watcher do not interface directly to network functions, services/applications and devices, but they use external functional entities, hereafter referred to as Common Profile Storage (CPS), to perform such a task (Figure 2). CPS is not an object of this specification. The definition of a CPS function for NGN is provided in [10].

The purpose of the User Interface Agent is to provide the interface to the end-user for viewing and editing, and controlling the activation of their profiles. This includes:

- Ensuring that only legitimate end users (in their role of UPM users or UPM administrator) have access to appropriate UPM system functionalities;
- Selecting the information to be displayed to the user;
- Allowing end users to edit their profiles including normal profile and situation dependent profiles (SDPs);
- Allowing preferences related to the UPM system itself to be edited;
- Adapting the system model to the user view (e.g. displaying, editing, notifications) and vice versa;
- Providing end users with different degree of flexibility in managing their profiles, by enabling or disabling access to some functionalities;

- Allowing UPM users to manually activate and deactivate situations.

The Profile Processing Agent processes profile and context data and initiates achievement of the behaviour encoded in the profile rules. It is responsible for ensuring that all the operations required by the profile rules are carried out. The Profile Processing Agent implements an evaluation engine functionality, used to:

- determine which SDP must be automatically activated/deactivated;
- how conflicts are solved (further described below);
- provide feedback to the profile administrator when defining new profiles or modifying existing ones.

The Processing Agent normally subscribes to the Context Watcher for changes in the values of state variables (Note: State variables are Boolean expressions used by the Profile Processing Agent to automatically calculate which SDPs have to be activated and which ones should be deactivated, unless explicit manual activation or deactivation by the user is performed). Unless the UPM system is in “manual mode” (Note: Manual activation and deactivation refers to the capability of giving the user the explicit control over the activated situations.), as soon as it is informed about changes in state variables, the Processing Agent retrieves the corresponding Situation Dependent Profiles (SDPs), compares their preferences with the ones in the active profile and evaluates which preferences need to change value. When the same preference is addressed in more than one of the aforementioned SDPs, referred to as a “conflict”, the Processing Agent checks the corresponding priorities and sets the preference to the value associated with the highest priority. The Processing Agent calculates the new values of all preferences which are addressed in the profiles associated with the state variables which have the value “true”, and then passes on the result to the Profile Activation Agent.

The Profile Activation Agent must exhibit the functionality of an execution engine. This means that it is responsible for taking the changes identified by the processing agent and applying those changes to the relevant network functionalities, services/applications and devices. It is also responsible for informing the processing agent and thus initiating a recovery procedure if the activation is not successfully achieved. Two different modes of activation are possible: in push mode, the Activation Agent initiates an interaction that concludes with a notification of the profile data to the corresponding network function, service/application or device. In pull mode, the network function, service/application or device initiates the interaction by retrieving the profile data from a target repository in which the Activation Agent has previously stored it. The activation agent may act as a client for the CPS.

The Profile Storage Agent is responsible for answering any query by the profile processing agent by storing and retrieving SDPs, rules, templates and any other metadata defined in the

UPM system. It ensures that user profile data are kept consistent by exploiting synchronization and transaction integrity mechanisms. It ensures the requested levels of privacy required by the UPM system users and administrators by exploiting data access control mechanisms. The Profile Storage Agent may act as a client for the CPS.

The Context Watcher is initially used by the processing agent to discover which profile information and settings are available to the UPM system (per UPM user), and the range of values allowed for those settings. It also informs the Processing Agent about which context information can be used in state variables and is responsible for keeping the correct mapping to each context source. The Context Watcher may obtain context information from context sources by using either a subscription mechanism or a query mechanism. The Context Watcher is also involved in automatic activation and deactivation of SDPs. As soon as it detects a change in at least one state variable, the context watcher notifies the processing agent which may initiate the activation procedure (unless the UPM system is in “manual mode”). The Context Watcher may act as a client for the CPS.

In a typical profile management scenario, there are multiple profile storage locations. Many of these locations will not store the total profile but only components that apply to a device, an application, a network function or service. Different locations may have different persistence and priority levels. Although the user profile data is distributed amongst a range of devices, applications and services, ideally, all profile data should always be available, over all networks, from all supported devices and services, including fixed and mobile services allowing service continuity (e.g. IPTV services using “bookmarks”) and optimal user experience.

The purpose of the Common Profile Storage [10] is to guarantee a uniform view of profile data by providing an abstraction of the profile data independent from:

- the physical location where they reside;
- the different data formats in which they are expressed;
- the different protocols used to retrieve them;

and keeping a mapping to the locations where such data can be found.

An implementation of the CPS can be done, for example, through the GUP Server Architecture as defined in [8]. More details on the capabilities provided by the CPS can be found in [10].

## VI. MAPPING THE UPM ARCHITECTURE TO THE UCI

The UPM system described above defines a functional architectural framework supporting the personalization and user profile management concepts described in EG 202 325 [11]. In order to make such systems operable in a seamless way, it is necessary to be able to include it into the standardized network architecture. Recent ETSI work has identified how IMS based Next Generation Networks can be

extended to support UCI, see EG 284 004 [6].

The following figure illustrates how the UPM architecture can be mapped to the UCI system described in section III.

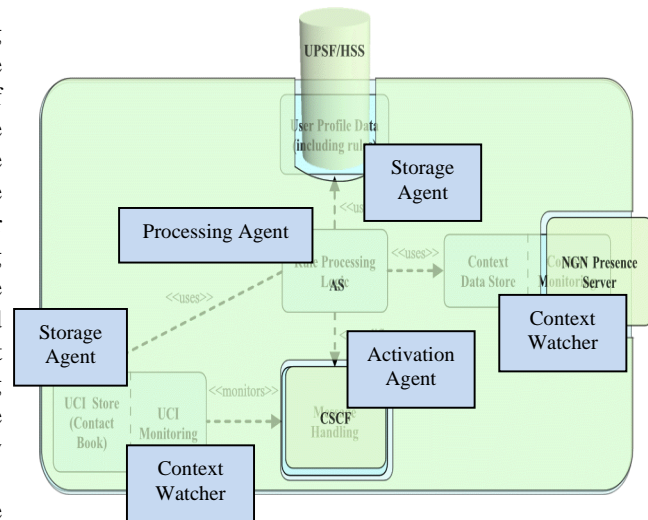


Fig.3: Mapping the UPM architecture to a UCI PUA

## VII. CONCLUSION

Personalization will be critical to the uptake and success of new and advanced communication services. Profiles promise to ease the conflict between the benefits of common technology deployments versus diverse social and cultural demands, and variations in individual physical and cognitive abilities and preferences. In order to achieve this goal, ETSI is standardizing information and preferences, and providing an architectural framework for personalization and user profile management.

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