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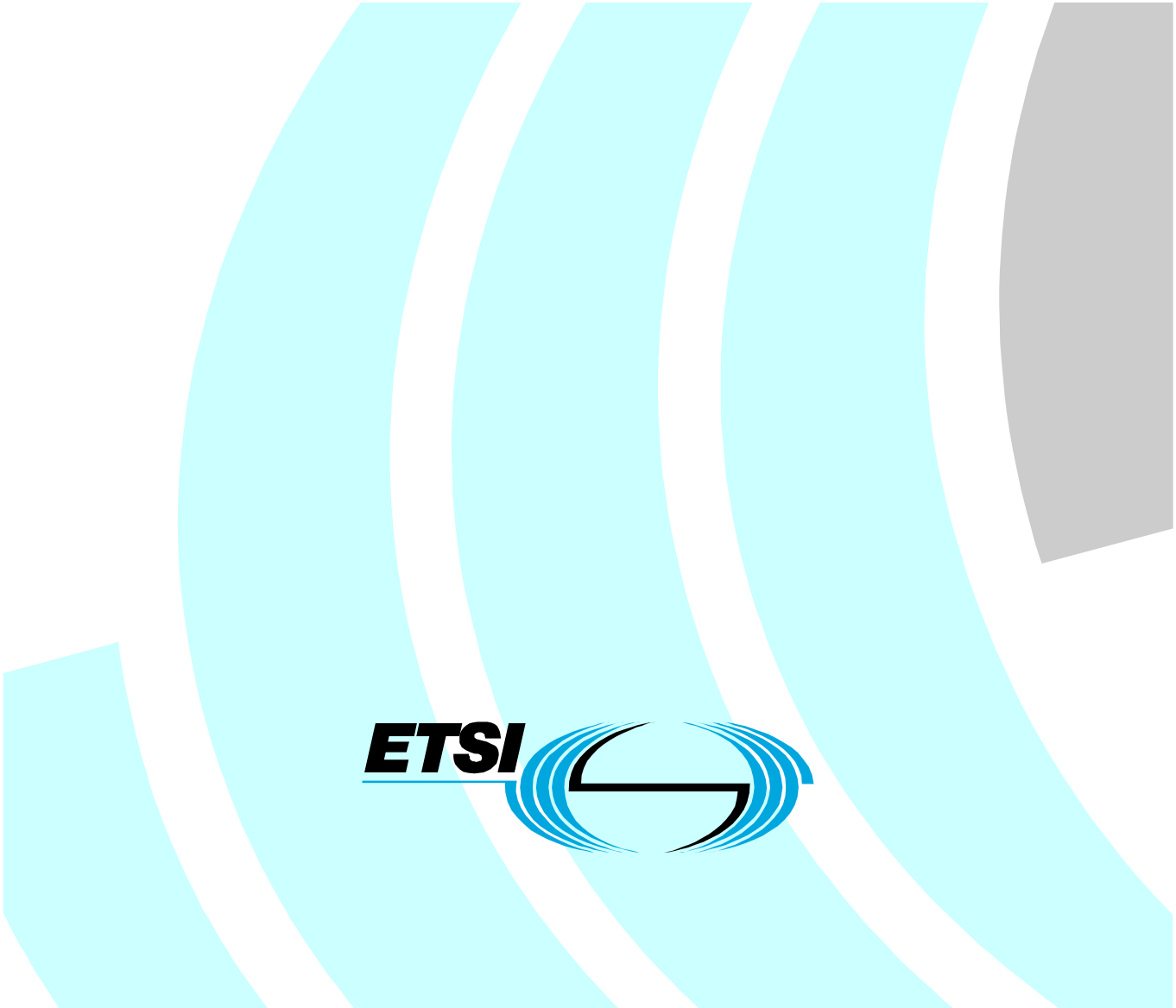
Universal Communications Identifier (UCI);
Results of a detailed study into the technical areas for identification harmonization;
Recommendations on the UCI for NGN



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Foreword

This ETSI Guide (EG) has been produced by ETSI Technical Committee Human Factors (HF).

1 Scope

The present document gives the results of a study performed to identify the identification requirements for users, terminals, networks within the context of next generation networks. The study has included both where a common identity is used to access all services (the UCI concept) and the further development of existing telephone numbering and internet naming within the NGN context.

The present document presents a set of recommendations for implementing the identification requirements to NGN developments.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ITU-T Recommendation E.164: "The international public telecommunication numbering plan".

[2] ETSI TS 101 878: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; Service Capability Definition; Service Capabilities for a simple call".

[3] ETSI TS 101 882: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; Protocol Framework Definition; General (meta-protocol)".

[4] IETF RFC 2916: "E.164 number and DNS".

[5] ETSI EG 201 940: "Human Factors (HF); User identification solutions in converging networks".

[6] ETSI EG 202 067: "Universal Communications Identifier (UCI); System framework".

[7] ETSI TS 102 051 (V1.1.1): "ENUM Administration in Europe".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in EG 202 067 [6] apply.

3.1.1 Definitions of terms used in TS 101 878

NOTE: These terms are defined only for the convenience of readers unfamiliar with object oriented design and programming. Readers in this class are recommended to read the guides to UML from the founders of the language (Grady Booch, James Rumbaugh and Ivor Jacobson) for an introduction to OO methods.

overload: ability to use the same name for multiple operations (i.e. to use setup() as the name of a service capability and for this to encompass *setup()* in (say) SIP, H.323, and ISDN environments)

polymorphism: principle of object orientation that states that an object of a subclass can redefine any of the operations it inherits from its superclass

stereotype: thing that extends the vocabulary of UML, in the case of the NGN model the stereotype <<sc>> is used to indicate an object of type "service capability"

3.2 Symbols

For the purposes of the present document, the following symbol applies:

<<sc>> used in UML class diagrams to indicate a stereotype of type "service capability"

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ATM	Asynchronous Transfer Mode
GSM	Global System for Mobile (deprecated)
ICANN	Internet Corporation for Assigned Names and Numbers
ICT	Information & Communication Technology
IETF	Internet Engineering Task Force
IM	Instant Messaging
IP	Internet Protocol
ISDN	Integrated Services Digital Network
ITU-T	International Telecommunications Union - Telecommunication
NDC	National Destination Code (E.164)
NGN	Next Generation Network
OSA	Open Systems Access
PABX	Private Automatic Branch eXchange
PLMN	Public Land Mobile Network
PSTN	Public Switched Telephone Network
PUA	Personal User Agent
SA	System Agent
SCN	Switched Circuit Network
SDH	Synchronous Digital Hierarchy
SME	Small or Medium Enterprise
UCI	Universal Communications Identifier
UPT	Universal Personal Telecommunications
URI	Universal Resource Identifier
VASP	Value Added Service Provider
VC	Virtual Circuit
XML	eXtensible Markup Language

4 UCI business case issues

4.1 Introduction

In discussing the concept of the UCI, it would be easy to believe that it is a single entity, accessible to all, however this does not represent current thinking on the realization of the UCI. Today there exists the Public Telephony Service as a single concept with a large set of actors supplying aspects of that concept. This view will remain consistent for the UCI in which a single concept will be realized with a large set of actors supplying aspects of that concept. Hence the Public Telephony Service and the UCI may be seen to be analogous. There will be multiple instances of the UCI.

The general concept of the UCI that can be best aligned with the Public Telephony service is the Global Public UCI. There will be commercial entities in operation within that concept that will offer the service.

Similarly within the Public Telephony Service there is also the recognition that the same functionality can exist in parallel yet private implementations. This concept is also possible in UCI, and is often referred to as private UCI, or UCI like capability to distinguish it from the concept of the Global Public UCI.

This clause presents a summary of the issues that any business case analysis for UCI would have to address.

There are two broad scenarios of UCI use that have been examined in identifying the issues presented:

- The personal user who has been allocated an UCI, and is responsible for that UCI.

EXAMPLE 1: Private individuals or SMEs

- Large corporations who are assigned significant quantities of UCI resource.

EXAMPLE 2: Global businesses

It is outside the scope of this analysis to determine the relative merit of organizations expanding their scope as against partnering with other organizations.

4.2 Roles and Stakeholders

In order to ensure that it is possible to examine a number of different options of how UCI may be operated, a set of generic "roles" are defined that relate to a significant function performed in the provision and operation of UCI. This approach means that the operation of UCI can be thoroughly examined without making assumptions about what person or organization performs a specific role. Looking at different scenarios as to how UCI can be operated in practice then simply becomes a task of mapping these generic roles to specific people or organizations.

Table 1: Operational roles in UCI

Role	Description of function	New role for UCI (see note 1)
UCI Provider	Issues a user with a UCI (unique number and placeholder for label and "additional Information" fields)	√
Identity certification organization	Certifies that the user's chosen description in an "authentic label" is legitimate (see note 2)	√
Authentic-identity source	Acts as the authoritive source of valid personal identification data (e.g. name allocated at birth or legally changed name, date of birth and sex)	X
PUA Provider	Provides PUA service to the user	√
SA Provider	Provides SA services for a communications service provider (see also note 1)	√
Communications service supplier	Provides communications services to service subscribers (users)	X
Communications infrastructure provider	Provides the communications necessary to support a communications service (see note 3)	X
NOTE 1: Where a "New role" is identified this may be taken by an organization that already has an existing role in the telecommunications world or it may be taken by a "new entrant". Where a single organization wishes to take several roles, scrutiny by competition and regulatory authorities is likely. NOTE 2 Delegated From "Authentic identity source". NOTE 3: Where carrier selection is provided, users may wish to select their chosen carrier In this case it may be necessary to allow direct choice of carrier from a PUA. In this case SA functionality will need to be provided at the "communications infrastructure provider" layer.		

In order for UCI to happen, organizations have to undertake one or more of the roles identified and defined in table 1. The people or organizations that may perform the UCI roles have been termed "operational stakeholders". What is immediately apparent from early analysis of the various different UCI options (e.g. global public UCI and "private" UCI) is that these operational stakeholders may vary significantly from one option to another.

A number of the roles in UCI are not similar to any roles traditionally associated with electronic communications. Some of these roles may have no obvious equivalent in today's market and thus these roles represent completely new business opportunities for new or existing businesses. Other roles have some parallels outside the field of electronic communications and thus these roles may represent an opportunity for an organization not now involved in the communications marketplace to diversify and expand its traditional business operation. This business expansion could either be by direct expansion of the range of an organization's business or by that business partnering with another business that is more closely aligned with the technical requirements associated with the role.

Organizations will only undertake these roles if they feel they have a commercial benefit in undertaking a role similar to a role described in table 1. Given that UCI provision and operation will evolve from current implementations, the analysis looks firstly at those people or organizations that currently perform roles that are identical to or very similar to the roles described in the UCI model. The assumption is made that these people or organizations form the likely operational stakeholders for similar UCI roles, it is then possible to identify what changes to their current roles will result from these operational stakeholders adopting the proposed UCI role. There is also scope for new entrants to adopt those roles not identified as having equivalents in current business. These changes are likely to be a combination of altered business practices and the acquisition or provision of new equipment or services to enable them to perform the role.

Some examples of operational stakeholders that already perform similar roles to those described in the UCI model are traditional telecommunications service providers and providers of various internet services such as online calendar hosting and the providers of personal portals.

Where operational stakeholders operate services based upon existing technologies, the advantages obtained from having the experience and reputation of running such services my be counterbalanced by the limitations that these existing technologies may impose on effectively and efficiently operating the UCI-based new role.

In order to maximize the efficiency of offering UCI-based roles it may be necessary for an organization to migrate any parts of its services that are based on existing technologies to technologies as represented by the NGN (see clause 10) that provide more of the underlying capabilities that are required to run effective UCI-based service. Any organization offering UCI-based services will need to take into account the need to interwork with legacy systems that may not have been designed to offer explicit support for the operation of UCI-based service.

4.2.1 Other stakeholders

4.2.1.1 Introduction

There are additional organizations that may have an interest in UCI, who may not directly participate in and profit from the operation of UCI but who have a strong interest in the success of UCI.

The benefits that these organizations may see in UCI are described in the following clauses.

Table 2: Non-Operational stakeholders

Stakeholder	Description
The European Commission	The European Commission has a number of strategic objectives related to the use of the internet as part of their eEurope programme.
ETSI	ETSI (and its members) supports the development of standards in communications for Europe.
ITU-T	ITU-T has a remit to create recommendations that have a global scope.
User representative bodies	There are a very diverse range of user representative bodies that might have an interest in UCI.
Regulators	Regulators need to ensure that inclusion of UCI into public service is at the behest of the user who has been granted rights on its use.

4.2.1.2 The European Commission

The European Commission has a number of strategic objectives related to the use of the internet and, as part of their eEurope programme, has an objective to remove barriers to the full participation of people with disabilities in the emerging Information Technology driven markets. By continuing to fund work on UCI the Commission has demonstrated that it sees some merit in UCI. In particular UCI can be seen to address at least the following issues:

- UCI encourages the development of a broad-based multi-service environment in which many service providers can competitively compete to provide elements of full multi-service UCI-enabled services - thus encouraging the emergence of a dynamic competitive ICT market in Europe;

- The use of the UCI "additional information field" provides a mechanism for communications user to express a wide range of their special needs that are of interest to the European Commission. These include:
  - information about the UCI user's language capabilities that can be used when interacting with services to convey to and receive from users information in a language that respects the UCI user's language abilities (an important issue in a region that has many languages that its citizens and its visitors use to communicate);
  - information about a user's preferences for methods of communication that are consistent with any limitations that may result from disabilities that the UCI user may have (and optionally explicit reference to the nature of a persons disabilities that may aid services in providing tailored support for the user).

4.2.1.3 ETSI

UCI has the potential to provide an advanced communications environment based upon ETSI Standards, as a result of undertaking the development of the UCI concept under the eEurope umbrella. Although ETSI has a remit to create standards that apply to communications within Europe, ETSI is always very keen to exploit and/or support standards that have a global significance and that therefore support the development of products and services that have a much wider market potential for ETSI members. UCI is again very relevant as it is a concept that, by its very nature, makes most sense only when seen in a global perspective.

4.2.1.4 ITU-T

ITU-T has a remit to create recommendations that have a global scope. UCI requires standards and agreements at an international level that only ITU-T can deliver in its core telecommunications field. By being responsible for the allocation of numbers complying to the international ISDN-era numbering plan defined in ITU-T Recommendation E.164 [1] (hereinafter referred to as E.164 numbers), ITU-T is able to be influential in controlling the numbering resources that will apply to a range of converged services that will encompass both traditional telecommunications and internet-based voice and text based communications that are the traditional responsibility of bodies such as ICANN and the IETF. UCI might provide the ITU-T with a way of controlling the all important element of a UCI, its number, and thus gives it much greater influence in its role of asserting its expertise in the fields of joint activity between the ITU-T and the IETF.

4.2.1.5 User representative bodies

There are a very diverse range of user representative bodies that might have an interest in UCI. Some of these are elaborated upon below:

- Groups representing the interests of the individual user of communications services would see UCI offering its users the very wide range of powerful communications capabilities that are made more practical with UCI. Its users would also benefit from factors such as the "identifier for life" features that would be a refreshing change to its users who have experienced several forced changes of telephone number and who have had to adopt different email addresses as the unsustainable business models have caused many ISPs to go out of business.
- Groups that represent users who, because of their disabilities, require special assistance to fully participate in today's more complex multi-service communications marketplace. UCI, and in particular its "additional information field" offers a mechanism for users to express their special requirements which services can utilize to deliver them specially tailored communications services.
- Groups that are concerned about the safety of users when they communicate. Groups who are concerned to protect young children when they communicate using the internet could encourage the use of UCI and the elements of authentic identity that cover authentic information on the sex and age of the UCI user. UCI users who wished to participate in "safe" chat rooms would have to agree that this authentic age and sex information could be verified by the chat service to ensure that the UCI user fitted the profile of the intended users of the chat room.
- Groups that are concerned about privacy would be interested to see the emphasis on allowing users to determine how the privacy of any personal information about them should be treated. A system such as UCI which allows a user to determine when and how any information about them is made available to another party when communicating with UCIs would be seen to contrast significantly with most systems where the users rights over their information is usually given away to another party.

4.2.1.6 Regulatory authorities

It is essential to be clear as to the regulatory environment in which UCI will operate, and this will largely be in the context of the numeric element of UCI. It is the rights of use over an existing numbering resource that may determine use of UCI. Regulators may need to ensure that inclusion of this number into the public UCI service is at the behest of the user who has been granted rights on its usage.

As a consequence of the number in use, then the user may or may not have to opt in to the UCI service. For example if a range is allocated, either internationally or nationally for a "UCI service", then by taking that service the user has effectively opted in by default. On the other hand a number taken from the geographic number range, and added to which the customer wants to use a "UCI capability", then that user will have to explicitly choose to opt into the "UCI service".

4.2.2 Interrelationships between stakeholders

The commercial environment in which UCI exists will for a large part determine the interrelationship between stakeholders. Part of that environment will be the regulatory and commercial framework that defines such an environment. As such it is not possible to discuss interrelationships in detail. However there is an element of the interrelationship that can be discussed further, namely trust. In any relationship within telecommunication, two elements can be considered with relation to trust, the technical element and the contractual element. Both are required to create and maintain trust. This is no less true with regard to UCI.

As an example, consider where a PUA that is associated with a person's business role may communicate with a PUA that is associated with the person's personal role. In these circumstances there will be a number of issues associated with ensuring that the information transferred between these PUAs does not compromise the privacy policies associated with each PUA. It may be possible to ensure that many aspects of these privacy policies can be adhered to without the need for any agreement being made between the two organizations that provide the PUAs. However there may also be a need for certain policies to be governed by means of an agreement made between these two organizations.

Similarly, organizations that provide PUAs will be keen to keep tight control over the way in which the relationship between them and their customer is managed. It will be important that the nature of the PUA to PUA data interchange required to negotiate the set-up of a person-to-person communication is not seen as a means to compromise the relationship between PUA providers and their customers.

The success of UCI will depend, to a large degree, on the trust that can be built into the various UCI entities (such as the PUA and the SA). This trust is ultimately dependant on the trust that each UCI stakeholder has with other stakeholders. Whilst these trust relationships need to be supported by good security techniques, they are ultimately dependent on the effectiveness of any commercial agreements that are made between stakeholders. For example, UCI users need to have agreements with their PUA providers that information that they supply to the PUA provider will only be used for certain prescribed purposes. This agreement will only be effective if a PUA provider has effective agreements with other PUA providers on how information passed between the two PUA providers are handled. Similarly, a communications service provider will only wish to participate in UCI if it has an effective agreement with an SA provider about how potentially commercially sensitive information will be treated and when and if that information will be forwarded to another entity such as a PUA. The communications service provider will need to have reached an agreement with the SA provider and will also wish to be confident that the SA provider is reaching appropriate agreements with other parties. All of these relationships can only be made effective with appropriate commercial agreements and no technical solution will avoid the need to make such agreements.

4.2.3 Data protection and privacy issues

As well as the need to satisfy the requirements of the two (or more) parties to the commercial agreements referred to in clause 4.2.2, there may also be a requirement for these agreements to satisfy national and EU legislation relating to factors such as data protection and the privacy of personal data. The interpretation of what national legislation may apply to UCI transactions such as the exchange of personal information may be complex to interpret, but this difficulty is no greater in UCI than in any other situation that exists which operates with users and organizations that are subject to different national and regional legislation.

In order for UCI to work as intended data held within the PUA is exchanged, and the exchange of data has to comply with the requirement set by data protection and data privacy regulation. Privacy and data protection are covered in more details in clause B.1.

5 UCI architecture (review)

UCI offers a framework to allow user interaction with current and future user to user communications. Essentially traditional telephony has built standards in two areas:

- Tele-services: These include voice, fax, data transfer, call modification (supplementary services)
- Bearer services: These include 64k based SDH, X.25 packet VCs, IP, ATM.

The commercial part of telephony, that is the building of commercial services by binding together tele-service and bearer services, has very largely not been addressed in ETSI standardization. In practice the building blocks (tele-services and bearer services) are standardized in ETSI and the commercial service are built by operators and in some instances by operator associations.

In addition to the end-users' communication terminals, the UCI architecture consists of two primary elements:

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

The UCI architecture very broadly maps the System Agent (SA) to the tele-services of conventional telephony. The Personal User Agent (PUA) maps into the previously un-standardized commercial domain. It is not suggested that the commercial domain is standardized, quite the contrary. The flexibility of the PUA and the manner in which it will communicate (see clause 6) with another PUA offers potential revenue streams for providers of the PUA. By having better management of a user's communication, then the ability to generate revenue through greater call completion, and communications management, should exist.

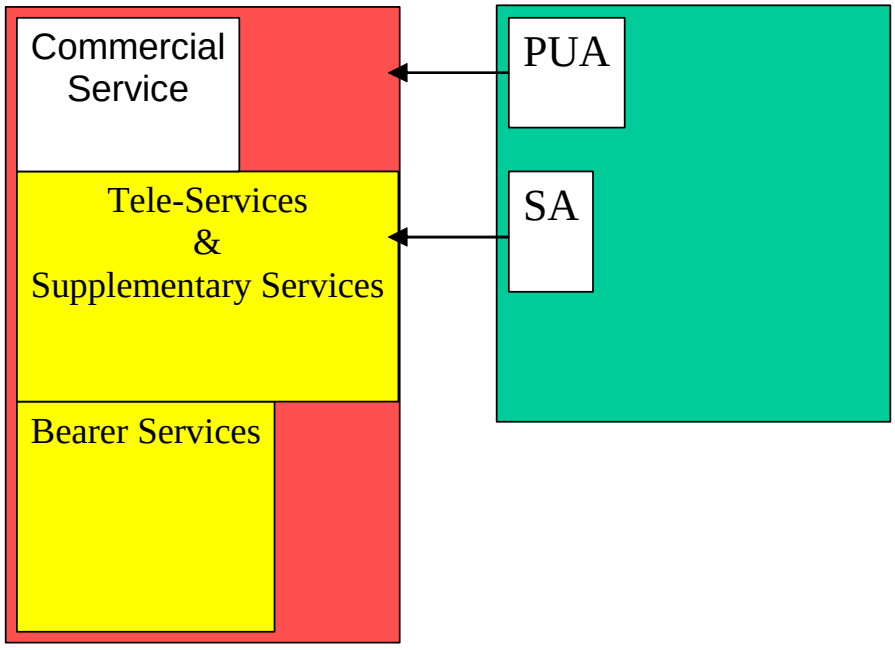


Figure 1: UCI relationship with traditional telecommunications standards layering

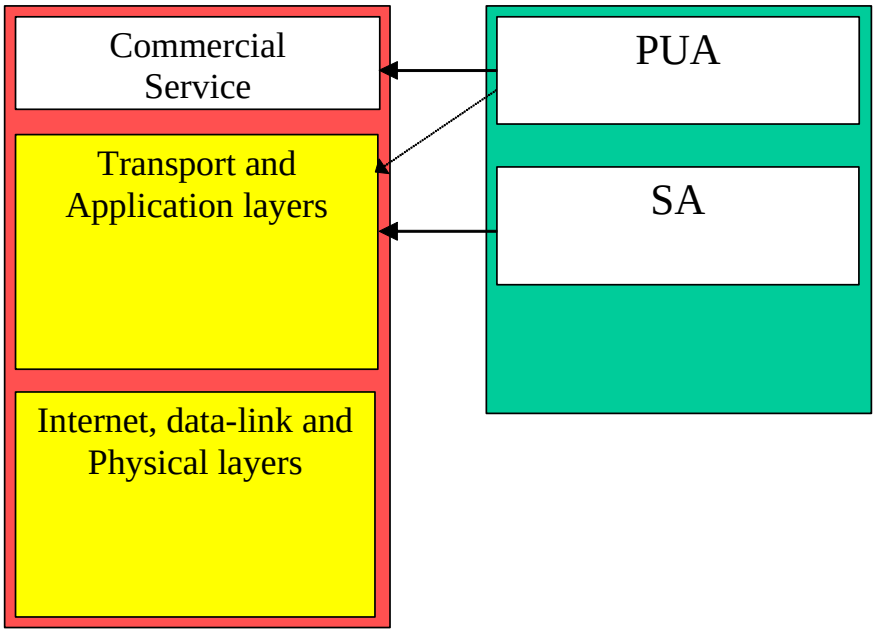


Figure 2: UCI relationship with internet protocol layering

Comparing figures 1 and 2 suggest that some parts of the PUA may be more straightforward to provide over the internet protocol stack.

The interface between PUA and SA should be an open interface in order to allow adopters of UCI to feed the concepts into their networks or architectures.

- A reference point between the PUA and the SA is defined as U_S.
- A reference point allowing access to the PUA, and for communication between PUAs, is defined as U_P.
- A reference point allowing the UCI user to access the PUA is defined as U_U.
- A reference point allowing the SA to access the capabilities of the underlying network is defined as U_N.

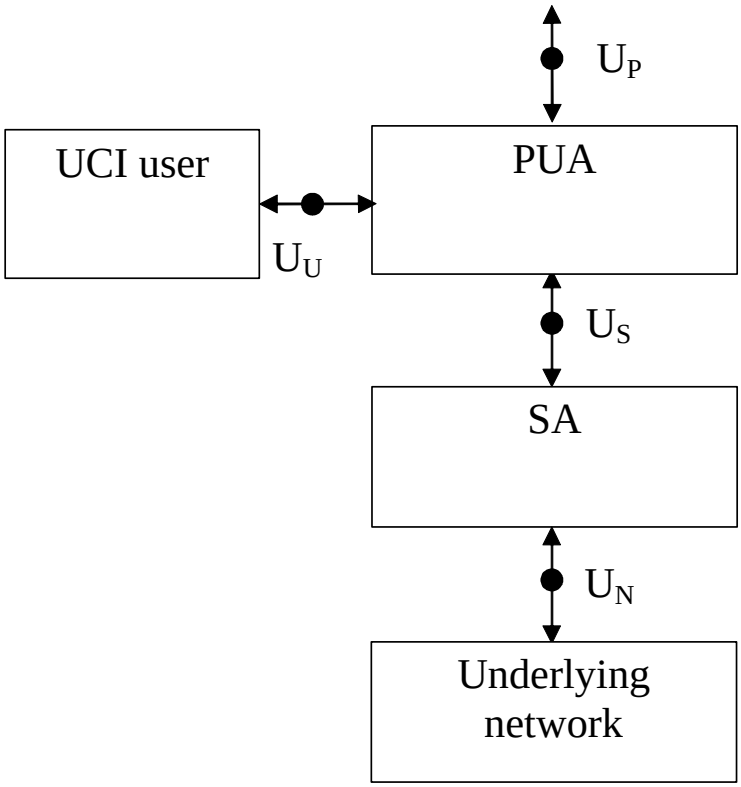


Figure 3: UCI reference points

Standards are not defined in this study although the information flows visible across the reference points defined are considered.

Terminals and end-user applications will vary, as will the access networks that connect these entities and the user's PUA. For this reason the technical solution for providing the required interconnectivity and interworking will vary according to the nature of the various entities.

EXAMPLE: An email application over an always-on broadband network may need a different solution to a PSTN telephone over a standard telephony network.

5.1 UCI construction

The UCI is a 3-part construct as follows:

- Numeric part:
  - This is unique across all UCI.
- Label part:
  - Optional part that may be used to attach a user-name or other user-label to the numeric part of the UCI. The UCI may have zero, one or many labels. See also clause 8.
- Additional data field:
  - The additional data field is optional and may be used to qualify the label (e.g. to indicate its authenticity or to indicate that the label is an alias). See also clause 9.

5.1.1 XML definition of UCI

A simple definition of UCI in XML is given here as an example. Formal definition of UCI is not addressed by the present document but this definition is used in later discussion in the present document.

```
<!ELEMENT UCI (UCI-Numeric, UCI-Label*, UCI-AdditionalData*)>
```

defines element `UCI` as consisting of:

Table 3: Description of UCI definition

child element	element declaration	meaning
UCI-numeric	*(none)*	Exactly one child element
UCI-label	*	Zero or more child elements
UCI-AdditionalData	*	Zero or more child elements

5.2 Requirements for the numeric element of the UCI

5.2.1 Stability

The UCI should be stable and should never need to change throughout the lifetime of the UCI user (which might be the lifetime of the individual who uses the UCI or of the specified business role).

NOTE: A change to the numbers in a numbering plan contravenes this requirement.

5.2.2 Access to the UCI owner without using UCI

Systems implementing UCI should interwork with legacy systems. The telephone networks at the location of the communication originator, and beyond, must be able to process the UCI numeric and route a telephony call to a telephone belonging to the UCI owning recipient. This is a consequence of the fact that the default service delivered to the calling user who enters an E.164 number is the existing international telephony service, according to ITU-T Recommendation E.105, as described in clause 7.3 of TS 102 051 [7].

A person wishing to contact a UCI user should be able to dial the numeric part of the UCI and make a voice telephony call to that person, the consequence of this requirement is that the numeric part of the UCI is in the same format as the legacy telephony networks, i.e. E.164.

In considering legacy systems, and the evolution to an UCI type environment then greater granularity of assessment is required for that consideration. In addition to the impact of the type of number that is used, see clause 7, then the means by which a user accesses the communications environment will also have an impact. A user of a mobile or even a Personal digital assistant, with communication capability, will have to register with the network. This act of registration can be seen to be part of the UCI environment. Similarly a user of a computer "logging on" to an ISP can similarly be seen to be registering. However from fixed line, there will be a requirement for user intervention to register. Such registration could be on an all alls basis, or on a per call basis. It is important to note the distinction between these two cases as it indicates potential migration paths for the implementation of the "UCI Service".

5.2.3 Access to the UCI owner using UCI

A communication between UCI users, where PUA to PUA communication is used makes the requirement of the numeric element no more than an initial mechanism to establish the connection between PUAs. Once established, the negotiation phase begins and this uses data other than the numeric. This is described more fully in clause 9.

5.2.4 Identifying the UCI Number

The cornerstone of the UCI is its use of the E.164 number. The establishment of this resource over time has created various types of E.164 numbers, i.e. international, national, geographic, non-geographic, country or operator. Numbers from any of these ranges may be used as the UCI numeric element. However the requirement for UCI is that the E.164 be easily identifiable as a UCI number. The implications of this requirement upon various numbering resources are discussed in more detail in clause 7.

It must be noted that whilst this requirement is for the public UCI service, the use of various numbering resources in a private UCI capability, such as behind a PABX, may allow a degree of flexibility in deciding what numbers may be used. The flexibility in the corporate environment is derived from the control that an entity has over the numbers it has been allocated. A public environment is, by contrast, the sum of all numbers, for example, nationally. The service-based subdivisions in a national numbering environment are not necessarily present in a corporate numbering scheme.

5.2.5 Requirements summary

When a non-UCI user attempts to make a telephony call to a UCI user, using the numeric part of the UCI, the task of ensuring that a call is completed will differ significantly according to what range of E.164 numbers the numeric part of the UCI is taken from.

For UCI user to UCI user communication, when the PUA understands that the number it has been given is part of a UCI it should not greatly matter what form the numeric element of the UCI takes. When the PUA cannot distinguish whether a number its owner enters is the numeric part of a UCI or a conventional telephony number, a number of unsatisfactory outcomes can arise - either delays in communication setup and redundant "signalling" traffic or communications that fail to exploit the UCI negotiating mechanisms that can produce better communication outcomes.

The greatest efficiency for flexible UCI operation will occur when it is possible to clearly identify that an E.164 number is the numeric part of a UCI and not a conventional telephony number. The choice of number range will also be influenced by the requirements to ensure that the UCI should be stable throughout the lifetime of the UCI user.

5.3 Requirements for the label

The label field of the UCI has to be a string of human readable text.

5.3.1 Constraints on the label

A label that is to be labelled as an "alias" label (see clause 9.3) has no further technical constraints on.

A label that is to be labelled as an "anonymous" label (see clause 9.3) should be a null string.

A label that is to be labelled as an "authentic" label should match the text that appears in the certificate that authorizes its authenticity (this is described more fully in clause 9.4.1).

5.4 Requirements for the additional information field

The size and content of this field is not yet defined but some rules for its construction are defined. This field is required to be extensible so that new elements can be added as UCI develops and extended to meet an ever wider range of end-user requirements.

The only requirement for the additional information field is that all of the (non-human) entities participating in UCI have access to a common schema, assuming the use of XML as a definition language that describes the elements of the field. Access to such a common schema will enable entities (such as PUAs) to:

- create instances of the additional information field that can change according to the requirements of a specific communication instance;
- interpret instances of the additional information field that are received from other entities (PUAs) such that they are able to recognize the individual elements and be able to interpret their meaning.

Because the content and extent of the schema is flexible, no other constraints apply and no other requirements need to be discussed.

Clause 9.4 gives a high-level description of a set of elements of the additional information field that are the most likely to be required when implementing UCI.

6 UCI use cases

NOTE: The use cases described here are illustrative of the application of UCI but are not intended to be exhaustive of all UCI uses.

6.1 General UCI Use Case

The generalized UCI use case is shown in the figure below showing the actors in UCI and the main activities that they perform.

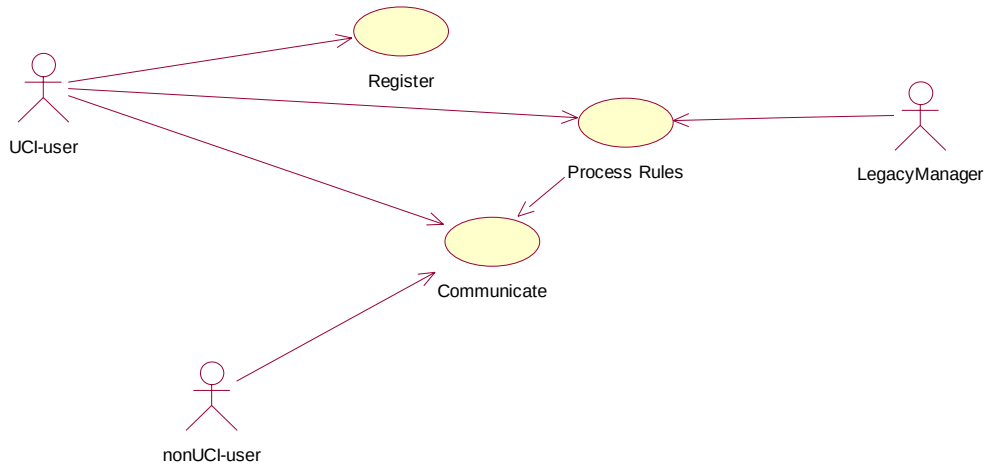


Figure 4: General UCI Use Case

6.2 Use case: UCI registration

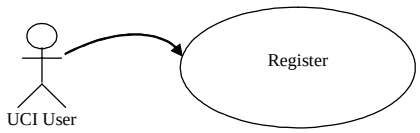
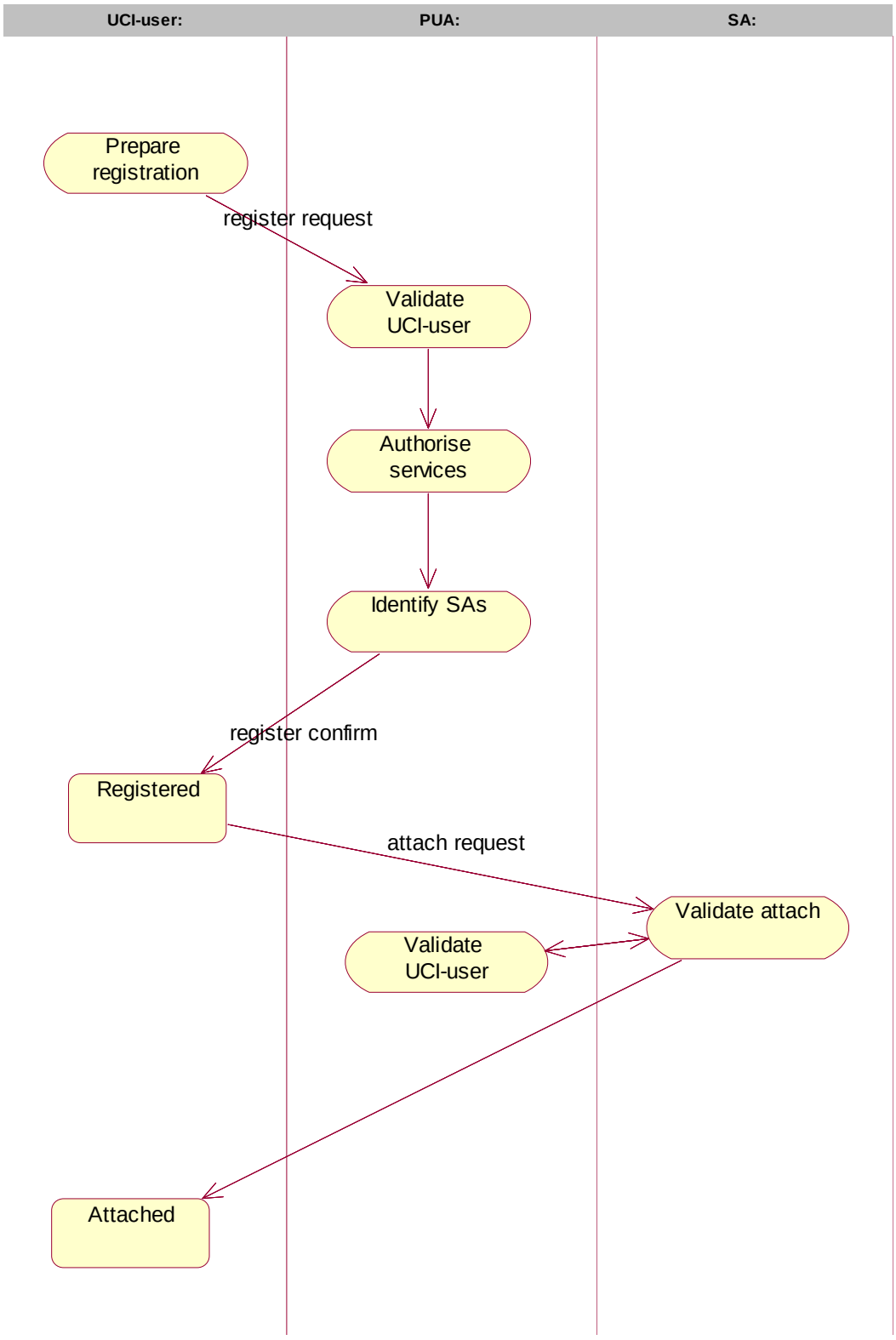


Figure 5: Registration UCI Use Case

This use case introduces the UCI-user as an actor. A UCI user wishes to activate his PUA to assign appropriate SAs for his subscribed to services at his current location. In order to do this the following data has to be exchanged by the user or on his behalf with the PUA:

- identity;
- set of services to be activated;
- terminal capability (i.e. what services the terminal is able to support);
- local network connection capability (i.e. what transport capabilities the local network is able to support (may be expressed in terms of bandwidth, symmetry, jitter, packet-loss, number of concurrent sessions, etc);
- location (network and if appropriate physical location of the user).

In response the PUA shall validate the user, the service set, the authority to invoke those services from the current location, the viability of offering each service in the light of the terminal and network capabilities. On success the PUA shall identify and assign an SA (or set of SAs) as appropriate.



NOTE 1: In the case of a non-UCI user, no PUA exists and no registration occurs.
NOTE 2: The validation activity may refer to rules established by the UCI-user or by the legacy manager via the use case "Process Rules" (see clause 6.3).

Figure 6: Activity chart of registration use-case

6.3 Use case: Process rules

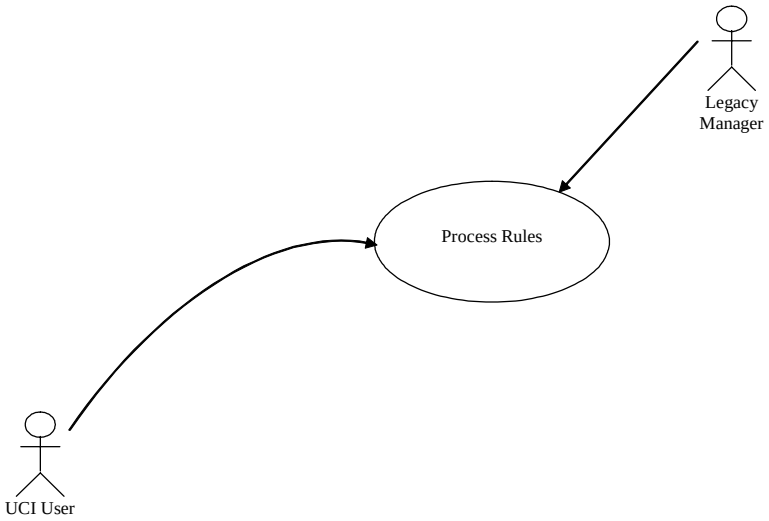


Figure 7: Process rules UCI Use Case

The "Process rules" use case introduces a new actor to UCI, the "Legacy manager". The legacy manager represents the management of a network/service that has been upgraded to interwork with, or to comply with, UCI.

This use case enables the policy held by the UCI User's PUA, in the form of a set of processing rules, for communication by the UCI-user for each of inbound and outbound communication to be established, modified or deleted. In the case of a non-PUA user the Legacy Manager should perform this role as a proxy for the user.

6.4 Use case: Communicate

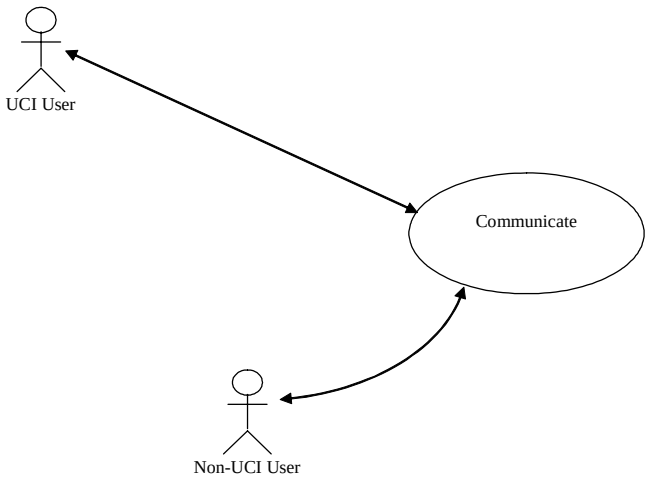


Figure 8: Communicate UCI Use Case

The "communicate" use case introduces a new actor to UCI, the "non-UCI user". The non-UCI user does not have access to all elements of the UCI.

In the case of a UCI user, a communication request and associated data is passed from the User to his PUA. The PUA interacts with the process rules use case to determine rules to be implemented during a communication set-up. Where the recipient is also a UCI user, a dialogue between the originating and recipient PUAs will occur.

In the case of a non-UCI user, no PUA exists. Communication policy is determined by the legacy manager by means of the process rules use case. In the case of PSTN user this is traditional telephony management.

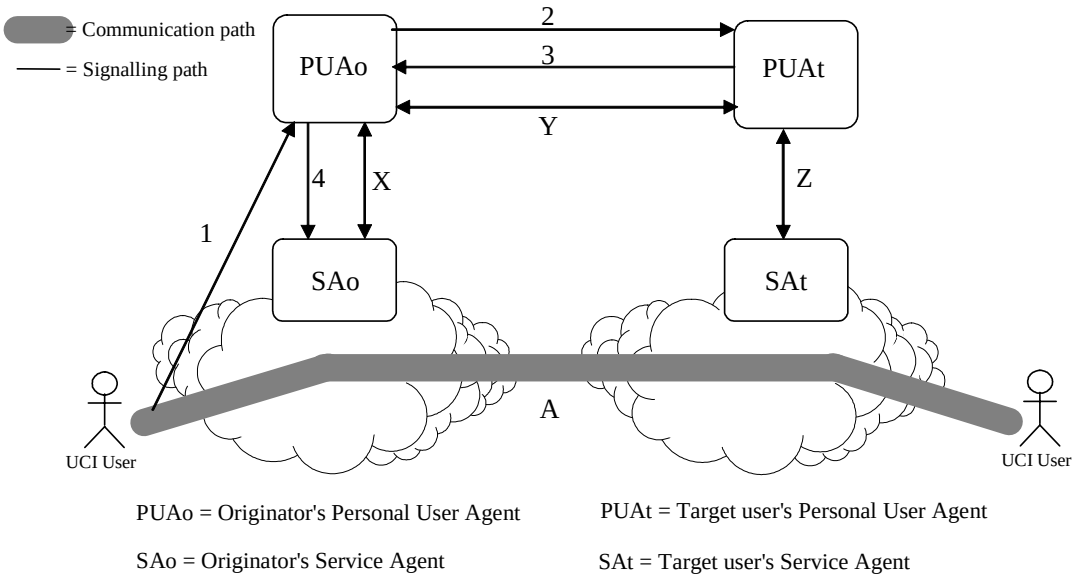
The general UCI use case includes both UCI and non-UCI users for originating and receiving communications, thus enabling the set of communications instances described in table 4 to be constructed.

Table 4: Communications instances described by UCI

Instance	Originator	Recipient	Description
1	Non-UCI User	Non-UCI User	Legacy network e.g. PSTN (see note)
2	UCI User	Non-UCI User	Network directory/familiar names
3	Non-UCI User	UCI User	Limited call screening based on calling number
4	UCI User	UCI User	Full UCI capabilities supported
NOTE: This scenario does not invoke UCI capabilities and is not covered in the remainder of the present document.			

Table 5: Void

The following figure shows the UCI communication flow model described in EG 202 067 [6].



1 The originator initiates call setup using the UCI-numeric associated with an end user's name (label).
2 The originating PUA validates the target UCI and contacts the target user's PUA.

NOTE 1: The UCI numeric part must resolve to the PUA (equivalent to HLR).

3 The target user's PUA responds to the message from the PUAo by supplying necessary information to enable the communication set-up to continue.

NOTE 2: Flows 2 and 3 may be repeated for each round of the negotiation until success is achieved.

4 The originator's PUA supplies the SAo with the necessary information to enable the communication set-up to continue.
X, Y, Z Information regarding the status of a terminal and a service may be communicated between a PUA and its SA and between PUAs before, during and after communications.
A SAo instructs its network to route the communication to the terminating network based on the information supplied by PUAt.

Figure 9: UCI communication flow model

The establish communication process accepts communication requests from the User. The originator's PUA is responsible for determining the service type and routing (including, where appropriate, dialogue with the recipient's PUA) and for establishing communication through the Service Agent (SA).

6.4.1 Communication scenario 1: non-UCI user to non-UCI user

This scenario represents current telecommunications supported by today's networks e.g. PSTN, PLMN, IM/IP-services. Communication is established between the originating and terminating user without knowledge or use of UCI. The communication identity is service specific. No use is made of UCI elements.

6.4.2 Communication scenario 2: non-UCI user to UCI user

This scenario considers where the recipient (the UCI user) is registered to receive services and can accept communications from a non-UCI user. As a minimum, the recipient's network needs to be capable of supporting UCI (e.g. the PUA for inbound service features). Limited use is made of the UCI capabilities (e.g. previously established processing rules may not be fully invoked).

6.4.3 Communication scenario 3: UCI user to non-UCI user

This scenario considers where the originator is registered to initiate UCI communications to other users. As a minimum, the originator's network needs to be capable of supporting UCI (e.g. the PUA determination of an SA for outbound service features). Limited use is made of the UCI capabilities (e.g. negotiation between PUAs to enhance the processing rules may not be fully invoked).

6.4.4 Communication scenario 4: UCI user to UCI user

This scenario considers where both the originator and recipient are UCI registered. PUAs and SAs exist to handle both outbound and inbound services. This includes negotiation between PUAs for the choice of communication. It is this ability for PUAs to negotiate that differentiates UCI communications from previous communications models (e.g. UPT). Full use is made of the UCI attributes to act on the rules contained within the PUAs to determine an optimum communication configuration.

7 Provision of UCI-numeric (analysis of options)

Previous work on UCI [5], [6] has determined that if a UCI is to be reachable from any telephony terminal, the numeric part of the UCI must be a globally diallable number as specified by ITU-T Recommendation E.164 [1]. A critical question for the success of UCI is from what number ranges the UCI numeric can be chosen. The following clauses examine various options from which the UCI numeric could be chosen. The suitability of each of these options as a basis for the creation of a global UCI capability is described. The possibility for the use of these options for the creation of UCI-like capabilities that lie outside the scope of global UCI (e.g. islands of UCI-like capabilities that are available to a closed user group) are also described.

7.1 The re-use of existing numbering resources

A fundamental requirement for UCI is that any person using a telephony network should be able to dial the UCI numeric and access one of the UCI owner's telephony services. Networks use digit analysis to determine how to handle dialled calls; therefore it must be possible, at some point in the handling of the number, to distinguish a UCI numeric from any other telephony number. Differentiation of a UCI number at different levels within the E.164 structure will impact the routeing efficiency associated with this call, e.g. a UCI differentiated at the country code level will route more efficiently than a UCI differentiated at the subscriber number level.

If numbers from existing number ranges are used as UCI numerics, it will be impossible to determine whether the number is a UCI numeric by examining the initial digits of the number, and it may be necessary to examine the number down to the final digit before the true nature of the number is uncovered. Analysis of the number beyond the initial digits would never be handled by the originating network, hence the call set-up would be extended to the destination network and possibly as far as the destination exchange before it was discovered that the number was not a normal telephone number. Discovery that the number is a UCI numeric would cause the original telephony routeing attempt to fail. This would either result in the call attempt to the UCI owner failing or would necessitate the initiation of a new attempt to route the call by means of UCI-based route decoding. Such routeing failures or routeing re-attempts would be considered unacceptable by most network operators.

7.2 The use of exclusive numbering resources

The assignment of any numbering resource for exclusive UCI use would make the identification of a number as a UCI numeric easier than if that UCI numeric were taken from numbering resources already used for other purposes (e.g. for existing telephony usage). In order that the number could be identified as a UCI numeric, it would be necessary to analyze the number as far as the digit that is unique to the UCI number range.

If a complete country code was allocated for UCI usage it would only be necessary to analyze the number as far as the country code to identify that it is a UCI numeric.

If a National destination Code (NDC) behind a country code were to be exclusively allocated to UCI, then it would only be necessary to analyze as far as this NDC to identify that the number is a UCI numeric. In an international situation, following the analysis of the country code, the NDCs are analyzed in the originating country for routeing. The responsibility for correctly handling the routeing of the UCI numeric will always be handed over to the country that is responsible for managing the country code and then to the body that has been allocated a part of its numbering resource to be used for UCI numerics. There should be a reasonable expectation that any body that has allocated blocks of its numbering resource to be used as UCI numerics will have ensured that mechanisms are in place for routeing these numbers using UCI-based routeing decoding. For this reason, solutions that use a unique number range for UCI numerics will always be preferable to solutions that allow parts of a number range to be re-used for UCI numerics.

7.3 Use of national numbering

The numeric part of the UCI is a number that is part of a national E.164 numbering plan. This may be either an existing national number currently allocated to the UCI user's telephony service or it might be a new number not previously allocated.

The advantages of this option are:

- The numbering resources already exist.
- New numbering resources from within the national environment are easier to get international recognition.
- The decision to implement UCI could be taken on a country-by-country basis irrespective of whether blocks of numbers or individual numbers are to be allocated to UCI.

The disadvantages if a block of national numbers were allocated for exclusive use as UCI numerics are:

- Individual countries might not wish to allow the numeric part of UCIs to be taken from their numbering resource. If national numbering resources were the only numbering resources available this would disenfranchise all citizens of the non-participating countries from UCI.
- The number would be subject to potential change as part of any national number change initiative. As a key UCI requirement is that a person's UCI numeric should never need to change (permanently associated with the same person) such changes would mean that the stability of UCIs from that particular country could no longer be relied upon by other UCI users unless steps to compensate for the change of UCI numeric are taken. Where national number changes occur, additional mechanisms beyond the core set of UCI capabilities would be needed to ensure that any UCIs that had been stored in the address books of other UCI users would be automatically updated to reflect the change of the UCI numeric. It is likely that such mechanisms would be extremely difficult to implement effectively.
- When a UCI using the old number was used, a mechanism would be needed to guarantee that a communication attempt to that old UCI would not fail (thereby ensuring that UCI stability feature is not broken). It is not clear what mechanisms could be used to provide such a guarantee.

Additional disadvantages that would arise if numbering resources allocated to existing uses were used as a source of UCI numerics:

- Number analysis would not enable the numeric element of a UCI to be distinguished from a conventional national telephone number. Other mechanisms that would incur significant overheads could be used to resolve this problem.
- Migration of a UCI user's existing telephone number to the numeric element of his UCI would pose administrative complexities such as those currently being encountered in ENUM.

In conclusion, the impossibility of protecting the numeric part of a UCI from change due to national numbering plan changes make this an relatively poor resource for UCI usage. This problem is worse if parts of the numbering range are already used for services, as it will prove impossible to distinguish a numeric part of a UCI from a national telephone number without analysing most or all of every telephone number that is dialled.

7.4 Networks identified by an E.164 Shared Country Code and Identification Code

The numeric part of a UCI could be part of the global network numbering resource called E.164 Shared Country Code and Identification Code. A range of different global networks could provide all of the UCI numbering resource.

The advantages of this option are:

- The numbering resources already exist.
- Global networks that provide multi-service communication facilities to their customers could upgrade all of their customers to an enhanced UCI-based alternative service, whilst keeping the same allocation of customers to their numbers.
- This option would bring a group of customers that already appreciate the need for the flexible communication the enhanced options that UCI can bring.
- Global networks might provide enhanced UCI based services within their own global networks and provide more restricted services when communicating with UCI users in other global networks or in UCI implementations based on different numbering range options.

The disadvantages if a block of numbers behind a global network country code were allocated for exclusive use as UCI numerics are:

- The basic UCI model does not tie the identifier to any specific supplier of communications services whereas the provider of a global network expects to be the supplier of, or at least gateway to, all of the communications services behind that number. Those people running global networks currently have to prove their ability to provide these communications services in order to be allocated the number range.
- The providers of global networks might show some reticence in exposing their valuable customers to the more open environment that UCI encourages - their customers might be encouraged to acquire services from competing suppliers. Allowing the customer to choose services not provided by the body running the global network might create significant tensions over the management of customer relations.
- If a global network provider decided to change its numbering plan, then the UCIs of its customers could not be protected from change - which is an essential requirement of UCI.
- In order that a person can keep their UCI even if they change the supplier of their services, each global network provider would have to agree to port its numbers to other global network providers or to suppliers of UCI based services that are using a different UCI numbering scheme and currently constraints exist based on the rules of allocation.
- All networks would need to recognize this global network number range and be programmed to handle the numbers in appropriate ways for direct dialling of the numeric part of the UCI to work globally (when the originator is establishing contact without using a PUA).
- If the operator of a global network chose to offer a UCI-like capability that only worked within its own global network, this would not be part of a universal global UCI capability (see also clause 7.5.1.2).

An additional disadvantage that would arise if numbering resources allocated to existing use were used as a source of UCI numerics is:

- Unless the provider of a global network decided to upgrade all of its customers to UCI in a single operation, it would prove impossible for a PUA to simply determine whether any number from a global network range was the numeric part of a UCI or not. The global network operator would need to operate or to offer mechanisms that enabled the identification of whether one of its numbers was a conventional telephony number or a UCI numeric. This might incur significant overheads.

In conclusion, the strong association between the global network-provided number and the services that the global network supplies to its customers might be the biggest barrier to the use of global network numbering resources as the numeric part of a UCI.

A global network operator might offer its customers a within network UCI-like service that would bring the full benefits of UCI when customers within that global network communicate with each other (see also clause 7.7.3).

7.5 Global UPT number range

The numeric part of a UCI could be part of a part of the global UPT numbering range.

The advantages of this option are:

- The numbering resource already exists.
- The range of services that UCI enables will be very similar to the range of services that UPT can offer and hence the use of a UPT numbering range has a certain logic. UCI uniquely adds authenticated labelling across the full range of the communication services behind the customer number.

The disadvantages if a block of Global UPT numbers were allocated for exclusive use as UCI numerics are:

- The allocation of UPT numbers to UCI may create some confusion and concern on what extra capabilities will be offered by UCI.
- If there were to be a change to the UPT numbering plan in which the UCI numbers reside, the essential stability of the UCI number would be compromised.

An additional disadvantage that would arise if numbering resources allocated to existing UPT use were shared with UPT:

- The handling of UPT services and UCI based services may be significantly different, but networks might have difficulty in distinguishing calls made to the two different types of service if their numbers are from the same UPT numbering range.

In the analysis of the use of the global UPT number range the impact of number portability has not been considered.

7.6 Use of a new global numbering range

The numeric part of a UCI could be part of a new global numbering range, e.g. a country code assigned by the ITU explicitly for UCI.

The advantages of this option are:

- Determining whether an E.164 number is a UCI numeric would be very simple - only the country code would need to be examined.
- Rules of administration of this scheme would need to be documented in ITU-T recommendations allowing for specific administrative rules to be made, e.g. no re-allocation of numbers.
- There would be no question of some existing body (country or organization) disputing the right to use the number as the numeric part of a UCI.

The disadvantages are:

- This could be the option that the ITU might be most reluctant to consider as it would be taking a potentially large slice of the total possible future global numbering resource.
- UCI would need to be specified as a distinct service in order that any code can be allocated.

- All networks would need to recognize this new number range and be programmed to handle the numbers for direct dialling of the numeric part of the UCI to work globally (when the originator is establishing contact without using a PUA). An individual country or operator might choose not to implement the handling of the new UCI numbering range, thereby preventing successful dialling of UCIs from within that country's or operator's networks.

- All network operators would need to have commercial agreements in place to be able to route conventional telephony calls to these numbers.

If it were possible for all networks to recognize and handle the new numbering range it would be possible to ensure that dialling the numeric part of the UCI would succeed globally. With the new global numbering range conventional UCI user to UCI user communication should be possible with no constraints or special conditions.

7.7 UCI-like implementations outside the global public constraint

7.7.1 Introduction

There are a number of ways in which UCI-like services can be created even though these services do not conform to all of the requirements of the numeric part of the UCI. Two particular options that appear to have merit are:

- internal communication within a company's corporate network;

- internal communications within a global network behind a global network country code.

Within such restricted scope implementations of UCI, it may not be necessary for the numeric element of the UCI to be globally diallable as the scope of the implementation is neither public nor part of a public global UCI service.

Similarly, stability of the numeric element of the UCI may be less critical if all people within the restricted implementation are subject to the same consistent change to the UCI numeric element. Examples of these restricted-domain UCI-like implementations are described further in clauses 7.7.2, 7.7.3 and 7.7.4.

7.7.2 Corporate networks

Where there is only a need for communication within a corporate network (whether PBX or VPN based), the numeric element of the company's internal UCIs may be taken from the existing numbering range used within the company. This would immediately simplify implementation of the UCI-like system as the company already has the allocation of the required numbering range for use for its own purposes.

The use of numbers within a corporate numbering range and the decision to make a company-wide rollout of UCI means that the instant establishment of an island of UCI could be mandated and implemented almost overnight. To prevent confusion between UCI and non-UCI numbers, it would be important that these corporate networks implemented UCI across the company or allocated a distinct block of numbers to UCI.

If a company wished all of its UCIs to be globally reachable, then the numeric part of each UCI would need to be a stable and globally diallable number. This requirement would put a very heavy burden on the company to keep its internal numbering allocation stable over time - which seems very difficult to achieve. It would, however, be immaterial that the UCI number is tied to the specific corporate network as the roles that the UCI represents are roles within the particular company and are thus naturally tied to the resources of that company. Portability of UCI role numbers between corporate networks is a logical nonsense. Instead of global reachability of every internal company number, what might be more achievable is that the corporate network could have some stable globally numbers for public use and retain and maintain its existing internal numbering for internal UCI use.

7.7.3 Networks identified by an E.164 Shared Country Code and Identification Code

The only constraints on the provision of such UCI-like communication within the global network is that the provider of the global network would need to keep the allocation of numbers to people stable in order that the number will be suitable for a UCI numeric. If the UCI-like operation within the global network is not intended to be public global UCI, then the requirement to use the same protocols and APIs as public UCI disappear.

7.7.4 Migration from Private to Public UCI

Corporate network and networks behind a global network country code who have implemented a UCI like capability and wish to migrate to interact with the public UCI service, will need to ensure that its UCIs and its interfaces to the environment outside the network conform to the standards specified for global public UCI. There would be no such requirement for UCI-usage within the company.

7.8 Comparison of different options for UCI numbering

All of the options described in clause 7 have merits and limitations. Also some of the options can be seen as complete or partial solutions to the creation of a universal public UCI service whereas other options only contribute to the creation of private UCI-like capabilities.

Some of the previous clauses of 7 discuss the use of already allocated numbers. As these variants of the options merely increase the number of disadvantages of each option they have been omitted from table 6 to simplify the picture. The various options that involve the allocation of discrete blocks of numbers for the exclusive use of UCI numerics are shown in table 6. Any move towards the use of global numbering resources may increase the level of difficulty in realizing robust registration procedures. This facet requires further consideration. The options listed in the table are assessed against the following list of criteria:

- the ease and speed of application and allocation processes;
- the ease of distinguishing the numbering resource from other numbering resources;
- the timescales to implementation; and
- the susceptibility to involvement in number changes.

Table 6: Efficiency and effectiveness of UCI numbering options

Option	Clause	Public / Private	How efficiently and effectively can the UCI requirements defined in EG 201 940 [5] be achieved using the specified numbering ranges
National numbering	7.3	Public	- easier in application and allocation, using established national processes; - shorter timescale to implement; - more difficult to globally distinguish the number range from other national numbers; - more susceptible to number change.
Networks identified by an E.164 Shared Country Code and Identification Code	7.4	Public	- easier in application and allocation, using established ITU processes; - longer timescale to implement (negotiation with operators globally); - easier to globally distinguish the number range from other network codes; - less susceptible to number change.
Global UPT numbering	7.5	Public	- easier in application and allocation, using established ITU processes; - longer timescale to implement (negotiation with operators globally); - easier to globally distinguish the number range from other network codes; - less susceptible to number change; - unknown impact from having to co-exist within the UPT numbering resource (with its specific rules e.g. number portability)
New global numbering range	7.6	Public	- more difficult in application and allocation, using established ITU processes; - longer timescale to implement (negotiation with operators globally); - easiest to globally distinguish the number range from other network codes; - potentially no susceptibility to number change.
UCI-like implementation in a corporate network	7.7.2	Private	- can implement UCI functionality independent of global public UCI; - out of scope of global public UCI.
UCI-like implementation behind a network identified by an E.164 Shared Country Code and Identification Code	7.7.3	Private	- can implement UCI functionality independent of global public UCI; - out of scope of global public UCI.

8 Provision of UCI-label (analysis of options)

8.1 UCI owner identities

NOTE: A user may have one or more labels.

A UCI owner can use their UCI to present a range of different types of identity. The different types of identity relate to the content of the UCI label field. The three basic types of UCI identity are:

1) Authentic - where a third-party issues credentials that certify that the label being used is a legitimate identity of the UCI owner.

   - Where the 3rd party credentials are in the form of a digital attribute certificate this certificate would certify both the authenticity of the label and the binding of that label to the UCI owner's UCI numeric:

     - The label that is certified is referred to as an "authentic" label,

     - The UCI with that label is referred to as an "authentic" UCI.

2) Alias - where the UCI label field contains information that has not been certified in any way.

   - The content of the label field may represent the user's true identity but may also represent some persona that does not relate to the UCI owner's true identity.

   - Alias identities may be used to identify role based addressing or may be used to aid privacy in public communication where UCI owners do not wish to reveal their true identity.

   - Many current identifiers, such as email addresses, are equivalent to the alias UCI as there is no guarantee that the user name element of the identifier can be relied upon as the true name of the owner of the identifier.

3) Anonymous - where the UCI label field is blank.

The originating PUA should deliver the originator's UCI label to the recipient PUA. The recipient PUA will then be responsible for the delivery of the label to the recipient's terminal. Delivery of the UCI label of the recipient to the originator also uses the same mechanism.

8.1.1 Interpretation of UCI label

When a UCI user communicates with another UCI user, in addition to the numeric element being passed, the label and additional information field of the UCI are also passed from the originator's PUA to the PUA of the recipient. Initially all 3 elements of the recipient's UCI is passed in the reverse direction.

In the "additional information" field of each UCI there are elements that make claims about the nature of the UCI label.

A UCI user may need to evaluate the accuracy of the claim being made in order to judge whether it is reasonable to believe the claimed identity of the other person and whether to trust the content of the communication. Examples of the claims that may need to be evaluated are shown in table 7.

Table 7: Interpretation issues associated with different variants of the UCI label

Claim made in the "additional information field"	Question that a user may need to ask
"The label is authentic"	"Can the authenticity be proven?"
	"Can the content of a communication from this known source be trusted?"
"The label is an alias"	"Is the alias name recognized?"
	"Do I believe that the person is who they claim to be?"
	"Can communication from the identified person be trusted?"
"The label is anonymous"	"Can communication from an anonymous source be trusted?"

Without a known identity (anonymous), users will have no way of knowing whether it is reasonable to trust the communication of the other person. With an alias identity, it will be up to a user's judgment to decide whether they recognize the label and whether they believe it truly describes the person communicating. Where an identity is believed to be correct, the user then has some information to enable a judgment to be made on the trustworthiness of the communication. The alias identity is very similar to the identity that is supported in many of today's communications services (e.g. the email "From" field).

UCI's unique concept of an "authentic label" (a label and the claim "authentic" in the "additional information" field) gives users a potential guarantee that the other person is who they claim to be. However, the strength of the guarantee will be dependant on the UCI user registration process. Where users wish to increase their confidence in the identity guarantee, a user verification process that checks the claim through the original verifier is required.

The degree of risk that the terminating party wishes to accept may be based upon the label type, the cost of invoking a verification process on the authentic label, and the previous history of the claimed identity. The UCI trust model cannot eliminate the risk to the user but may, assuming that verification of any claims is completed and that a trust history is maintained, reduce the risk to any single user.

For UCI to work trust relationships have to be established and maintained between the technical and human entities involved. The data held in the PUA that implements advanced communications handling is intrinsically personal in nature. This clause and the analysis in clause B.2 highlight the trust relationships that may be established.

9 UCI related data

9.1 What is UCI related data?

In order for UCI based communication to work, PUAs need to run rules that process data stored in the PUA. This stored information can be further subdivided into:

- information that is stored in the PUA associated with the UCI and that is never passed to another PUA during the establishment of a communication;
- information that is stored in the PUA and that may be passed to other PUAs during the establishment of communication sessions.

Two elements of the PUA stored data are the UCI numeric and UCI labels. These are described in more detail in clauses 7 and 8 respectively. During the exchange of information between PUAs that accompany every communication between UCI users, the UCI numeric and a label, possibly one of many, that the user has stored in their PUA are passed to the other PUA. In addition to these two elements, an "additional information field" is passed. The "additional information field" is described in clause 9.3.

9.2 PUA stored data

In order that successful communication can be achieved using UCIs, the PUAs need to process data that relates to the UCI user's communication services, personal preferences and the status of any other services that might be relevant to determining the success of any communications (e.g. information that relates to the user's geographical location). Some of this data, such as personal preferences, will be supplied by the UCI user, wither directly or as result of accepting various default options. The source of other data will relate to services outside the PUA and may originate from organizations different to the organization responsible for the PUA. Where the source of the data is another organization, agreements will need to exist between the data supplier and the PUA provider - either directly or via a third-party clearing-house organization.

The information used to maximize the effectiveness of UCI communication could be very varied, and different PUA providers might decide to use different information to achieve the best results. It would thus not be appropriate to attempt to standardize the content or format of all of these various sources of data. What may be needed is an agreement on a minimum amount of information that communications services make available to PUA providers and for there to be a standardized form in which such information is presented across the very wide range of different types of communications services.

One area in which standardization could be useful is in having descriptions of communications services that allow users, or PUAs that are following rules specified by users, to identify when two services are offering substantially the same capabilities. Such descriptions should also allow users (and PUAs) to see that one service has expanded or improved capabilities in relation to another. A deaf UCI user might, for example, wish to specify that they require a certain level of video quality to ensure that they are able to perform lip-reading. The user would only be able to do this if they had access to options that offered service descriptions that conveyed understandable information on video quality. If such user-friendly descriptions of communications services existed, but they all described the services in incompatible ways, the user's PUA would be unable to determine which of the available services could be used in order to meet the user's requirements.

9.3 The UCI additional information field

Previous descriptions of UCI [5] and [6] have referred to an "additional information field" which is in addition to the UCI number and the UCI label. Although described as a single field, the final form of the "additional information field" may well be a number of separate data fields.

The main purposes of the data in the additional information field are either:

- to provide the PUA at the other end of a communication with information that may assist it to propose the most mutually agreeable communication option; or

- to enable a person who has stored the UCI together with its "additional information field" to determine how best to communicate with a UCI user in future communications (by providing relevant information directly to a user who is about to communicate).

Basic communication using UCIs could be achieved without making use of the additional information field. As such, support for the additional information field is not a pre-requisite for basic communication using UCIs. The additional capabilities that various elements of the additional information field enable range from those that would be nice to have if supporting them was not too complex or costly, through elements that could bring very large benefits for certain sub-sections of the total user population, to those that bring the potential for vastly enhanced capabilities for all users when compared with what can be achieved in current non-UCI person-to-person communications services.

The primary path for communication of the additional information field is between PUAs. Transmission of all or part of the additional information field from the PUA that receives it to terminals or applications associated with that PUA can be achieved using a means of communications that will allow the information to be successfully passed. Existing standards for passing information between applications and terminals could be used to pass subsets of the additional information field between the PUA and a terminal or application.

In the descriptions in [5] and [6], several examples are given of what this additional information field might contain. Clauses 9.3.1 to 9.3.4 concentrate on four potential elements of the additional information field that are believed to offer particular advantages and that are candidates for early implementation and support.

9.3.1 The "authenticity" flag

From the earliest discussions of UCI, the idea of being able to support the concept of an "authentic name" was seen as something that might have very powerful and wide-ranging benefits. The very existence of such an "authentic name" could be a trigger for people to manage their communications in different and much more effective ways than at present.

The "authenticity" flag would be used to make an assertion that the contents of the UCI name field was a true and accurate description of the UCI owner. This authenticity would apply whether the UCI was associated with a person or with a business role. For the "authenticity" flag to achieve its purpose, the following additional features would be needed:

- an organization that is universally trusted to agree that a certain UCI label is a true and recognizable description of the UCI owner (e.g. the UCI owner's real name);

- a certificate that is issued by, or on behalf of, the above organization that says that the UCI number and the "authentic label" legitimately belong together (e.g. the owner of the UCI number is the person entitled to use the "authentic name");

- a mechanism that allows a PUA receiving a UCI with an asserted "authentic label" to check the authenticity of the label.

To successfully achieve all of the above features would require global agreement to solve a number of organizational, commercial and technical challenges. Solutions to many of these challenges exist or are in development in the fields of e-commerce, digital signature and digital identity initiatives being undertaken in Europe and elsewhere. Adoption or adaptation of such solutions for UCI may make the achievement of suitable infrastructures and agreements much easier than would be the case if starting to design totally unique solutions.

Once implemented, the concept of an "authentic identity" could be used to help people control their communications much more effectively. Use of an "authentic name" could be seen as an indication of the openness and honesty that most people would recognize as an important sign of a legitimate communication. Anyone wishing to deceive, pester, or harass another person would be unlikely to use their "authentic identity". Such unwanted communications are normally associated with the use of anonymous or misleading identities. Recognizing such patterns of communication behaviour might persuade many people to only allow unfettered communication access to themselves from people using an "authentic identity", treating non-authentic identity communications as suspect and either refusing to take the communication, requesting another communication with an "authentic identity" or asking the non-authentic person to leave a message rather than accepting a real-time person to person communication.

The use of a UCI ensures that repeat communications from the same organization or person can be identified as coming from the same source irrespective of the terminal or communication service is used. The addition of the "authentic identity" ensures that not only can a communication be recognized as coming from the same person or organization but also the identity of that person or organization can be identified with certainty. These characteristics raise the prospect that unsolicited communications, such as SPAM, can be more effectively blocked. The initial stages of SPAM filtering could be to allow communications that use an "authentic UCI" and quarantine any communications that originate from non-UCI sources or UCI sources that do not use an "authentic identity". On examining the quarantined communications, the user will be able to completely block future communications from any person within the quarantined communications that use a UCI, by filtering out all communications that use the same UCI.

9.3.2 A "business/personal" flag

If UCI communications carried a "business/personal" flag, this information could be used to assist the recipient of a communication request to decide how to treat the communication request (e.g. where to route it or whether to handle the communication request in real-time). It is doubtful whether it would be worth instituting mechanisms to check the authenticity of the "business/personal" flag as is proposed for the UCI user name (see clause 9.3.1). It would, however, be comparatively easy to make an association between the organization that certifies the "authenticity" of a UCI label and a "business/personal" flag, as it is likely that the labels of business and personal UCIs would be certified by completely different organizations.

9.3.3 Preferred services indicators

As the UCI is an identifier for multi-service communications, a person making a communication to a UCI user may be unaware of what services the UCI user has available and also which of those services they prefer to use. "Preferred services indicators" could both list the range of communications services by which a UCI user can be contacted and also they could give an indication of the preference order of those services.

A UCI user that has access to the "Preferred services indicators" of the UCI user that they wish to contact can then choose an appropriate communication service to try to contact that user. My making this choice, the UCI user will improve the chance that their communication request will be accepted and it will also reduce the need for PUA to PUA negotiation or the need to use media conversion services (e.g. text to voice services).

9.3.4 Special user requirements

As well as the use of "Preferred services indicators" (clause 9.3.3), people who have special communications needs may wish to make use of some specialized information fields. The use of such fields might be beneficial for people with disabilities who might wish to indicate:

- either specific modalities of communications that will or will not be acceptable (e.g. voice is acceptable and text is unacceptable). This information may be different from "Preferred service indicators" as one modality of communication may map to several communications services;
- or specific disabilities. The coding and sharing of disability information is a potentially very sensitive issue and will be seen as unacceptable by many people with disabilities. However some people with a disability may judge that sharing such information may bring benefits much greater than any threat from making such information public.

10 UCI operations in the NGN context

10.1 The NGN model

NGN, the Next Generation Network, builds upon the developments seen over the past 30 years or so in digital telecommunication. One of the development aims in the NGN has been to be able to support the existing services of the PSTN/ISDN but to ensure their support over a packet based network (IP), and to also support new services and applications, with the ability to deliver new services quickly. It has been a major view of the contributors to NGN development that services themselves should not be standardized but only the language and capabilities for their support on networks. A 3-thread approach to the implementation of NGN has been proposed as below:

- Convergence
  - Bringing IP and SCN together for voice services
- Replacement
  - Allow replacement of SCN by IP
- Improvement
  - Provide services not available before on the SCN with improvements in QoS and Security in particular.

In order to achieve these goals a number of design options can be considered. The method selected in EP-TIPHON and which is proposed to form the foundation of the NGN is an object oriented building block approach, where the rules for joining the blocks together are fully defined. This approach builds on the original ISDN model to some extent, and to more recent developments in computer programming and internet application design. An object engineering approach allows the adoption of a number of significant tools, the most used one being polymorphism. Polymorphism allows a single command to be implemented for a number of different application environments but in each case to exhibit the same abstract behaviour. A common example of this is a *print()* command which is overloaded for different printers and for different document types. In telecommunications a similar example would be a *setup()* that is overloaded for different protocols and network technologies but exhibits consistent behaviour for all.

10.2 Service capability model

The NGN model defined by EP-TIPHON and presented in TS 101 878 [2] proposes the development of services from service capabilities, where the service capabilities are the objects referred to in clause 10.1. The service capabilities are broadly defined as **operations** acting on **attributes** within a **class**. The polymorphism property that allows a single capability (e.g. Call:Setup()) to work for many types of data is defined in TS 101 882 [3] in the form of a meta-protocol to which real protocols are mapped for implementation.

In TS 101 878 [2] there are 6 classes of service capability defined:

- Profile
  - The profile class encompasses the attributes and operations required to support operations against the user or service profile (e.g. registration, authentication).
- Call
  - The call class encompasses the attributes and operations required for session based service domain operations.
- Bearer
  - The bearer class encompasses the attributes and operations required for control of connection based service domain operations.
- Media
  - The media class encompasses the attributes and operations required to enable communications payload encoding and characterization.

- Message
  - The message class encompasses those attributes and operations required for control of datagram transfer including store and forward, and retrieval, in the service domain.
- Transport
  - The transport class encompasses the attributes and operations required for control of links in the transport plane.

The identified classes are shown in figure 10.

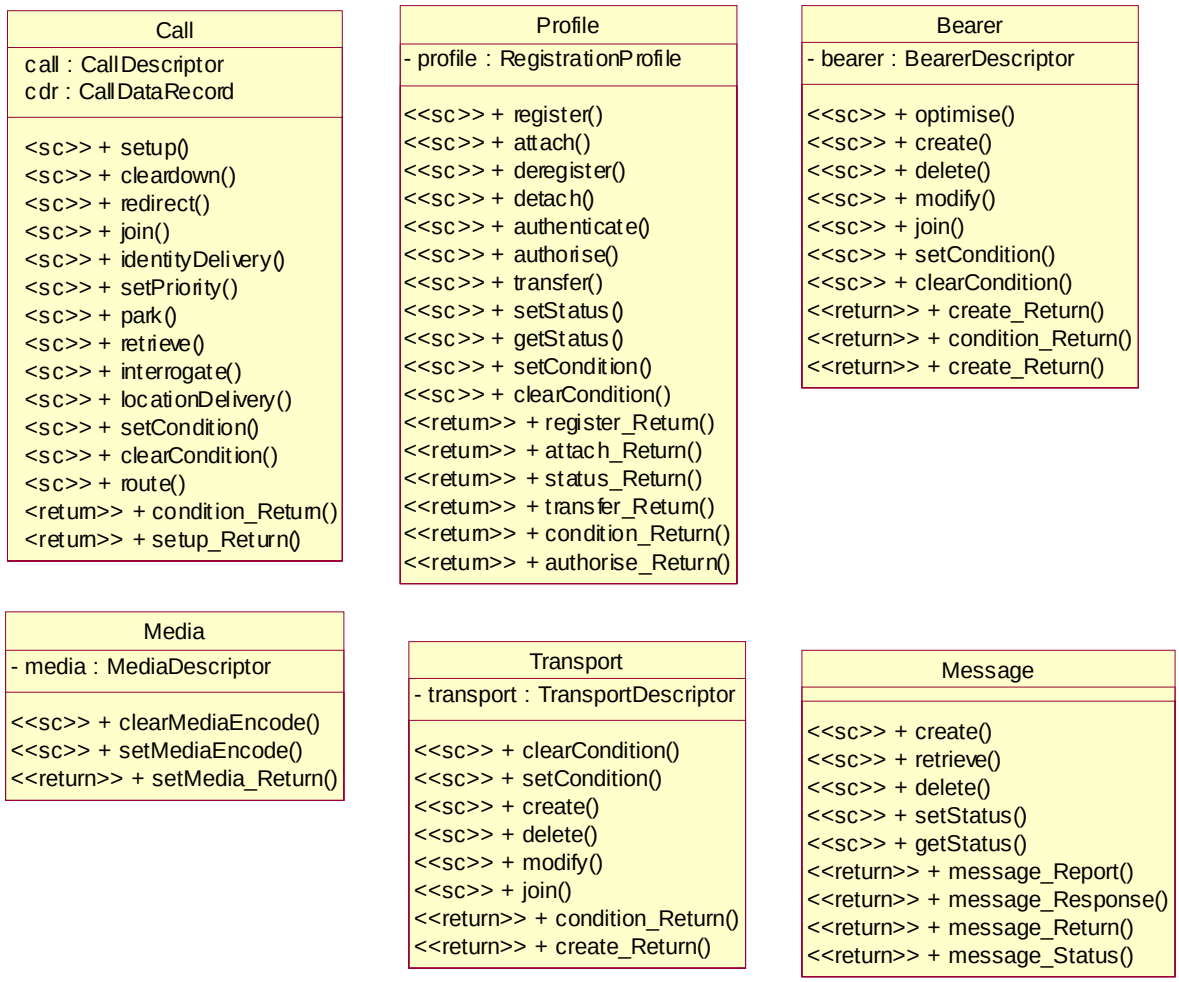


Figure 10: Service capabilities defined in TS 101 878 [2] grouped per class

10.3 Support for UCI in service capability model

Building upon the use-case scenarios from clause 6, this clause illustrates how those use-cases could be supported by the NGN service capability model.

10.3.1 UCI-user

The TIPHON service capability model identifies the NGN/TIPHON user as an actor. The TIPHON user is that entity, generally outside of the TIPHON model, that initializes and terminates transactions such as telephone calls.
TS 101 878 [2] other than recognizing the existence of the TIPHON user as an element in the system that uses service capabilities does not in fact offer a specification of the TIPHON user.

The UCI-user is directly equivalent to the NGN/TIPHON user. However in the specification of UCI the UCI-user will be more fully defined than the equivalent actor in TS 101 878 [2], particularly with respect to the HF aspects of the interaction with the PUA.

10.3.2 Register use-case

The NGN service capability model in TS 101 878 [2] identifies a class of capabilities belonging to "profile". Within this class are service capabilities for registration, authentication, authorization, and to indicate the status of registration. In addition is a capability that allows transfer of parts of the user-profile to other parties.

Examination of the use-case in clause 6.2 and the activity diagram also in clause 6.2 show that interactions between the UCI-user, PUA and SA can be mapped to the general capabilities of the profile class. This is shown in the activity diagram below which overlays the activity diagram of clause 6.2 with the service capability names from the profile class.

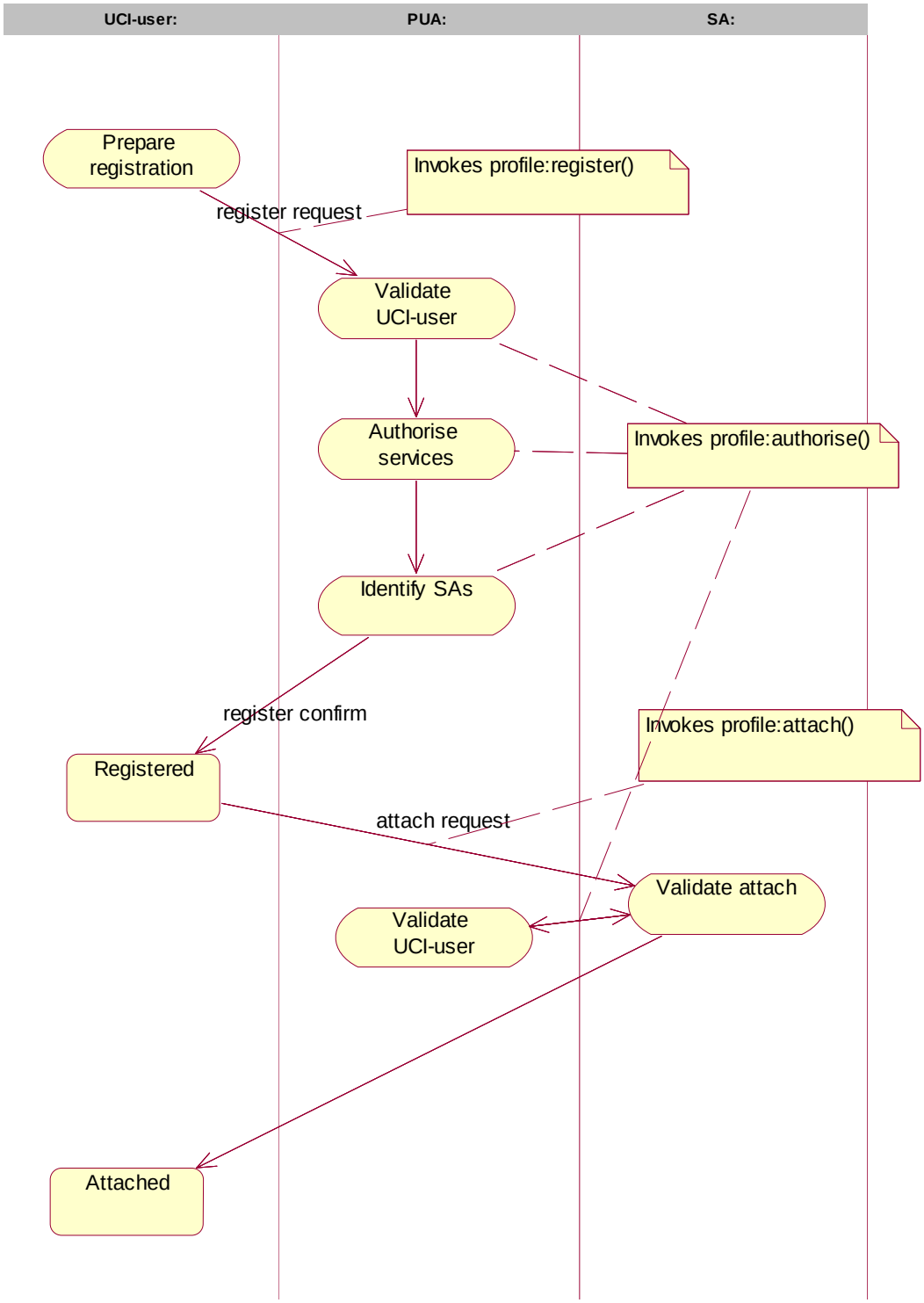


Figure 11: Annotated activity chart of registration showing invocation of service capabilities

10.3.3 Communicate use-case

The NGN service capability model in TS 101 878 [2] identifies a class of capabilities belonging to "call". Within this class are service capabilities for setup, cleardown, redirect, and to allow invocation of capabilities based upon the ability to set events on the progress of a state-machine or some other activity.

Examination of the use-case in clause 6.4 suggests that interactions between the UCI-user, PUA and SA for communication can be mapped to the general capabilities of the call class. In particular the capability to establish and teardown calls, to authorize calls using UCI-rules that are built into the model of TS 101 878 [2] is essential to the success of UCI.

10.3.4 Process rules use-case

The ability to set and use rules for the processing of calls is supported, by inspection, in a number of the service capabilities defined in TS 101 878 [2]. For example:

- Profile: Authorize() may be used to check a rule for both incoming and outgoing calls.
- Call:SetEvent() may be used to invoke alternative call handling based upon some status of the calling or called party.

Annex A (informative): Migration to UCI

Clauses 5 to 7 of the present document describe the overall architecture and protocol suite required to implement UCI. To fully implement UCI as defined would require that the architecture and protocols are provisioned in all UCI networks, where all networks are UCI networks.

This annex identifies schemes that allow timely migration to a global UCI by suggesting methods of providing interim solutions to a fully specified UCI architecture. This may allow UCI to build a user-base prior to global availability.

Key parts of UCI that may be provisioned by interim solutions are:

- Connecting the user terminal/application to the PUA;
- Enabling UCI entities to locate other UCI entities.

For the foreseeable future, interchange of information between user terminals/applications and PUAs cannot assume "always-on" connectionless connectivity. For this reason it is important to identify a range of alternative methods that can be used as interim solutions to providing the requisite terminal/application to PUA communication. Some potential solutions for PSTN telephones belonging to a UCI user include:

- dial-up dialogues using a special access code to "dial" the PUA prior to dialling the UCI numeric string of the called party (cf. services that support telephony calling card access);
- interface boxes between a UCI user's telephony terminal and their PSTN line (which will automatically contact the PUA on the user's behalf);
- direct-connect to PUA on lifting the UCI user's telephone handset.

UCI requires a service which allows a PUA to take a UCI numeric (stored in a PUA-based contact list or entered by the UCI user) and use it to locate the PUA to which its communication request is sent.

UCI numeric translation to URI: Use of a dedicated UCI number resolution service that does the translation of the UCI numeric to, say, an internet URI. Solutions that could be implemented now, or in the near future, could be based upon ENUM [enum]. In this instance the NAPTR record in a public, or "private", ENUM service could have a single entry which is the URI of the PUA that is associated with the numeric UCI that was sent to the ENUM service. It is not clear to what extent the high-level security required by UCI can be met by exploiting a public ENUM option.

Annex B (informative): Privacy, data protection and trust

B.1 Privacy and data protection

In order for UCI to work as intended, it is important that information about a UCI user and his services are used only in the establishment of communications. In ensuring that such information is made available in an appropriate way due consideration has to be taken of regulations as they apply to:

- privacy
  - the property that users are assured that information about themselves or about their communications services are made available and used in accordance with the users' personal privacy requirements;
- data protection
  - data held by any service provider of services used by a UCI user are used only for the purposes of facilitating the services and not supplied to third parties for any reason not directly in support of the service being provided.

In the case of personal information privacy the definition of the user's personal privacy requirements is, in principle, straightforward as it only has to meet the preferences of the affected user. Although many users may not be very familiar with all of the complexities of privacy specification, it would be possible for the providers of PUAs to make it simple for UCI users to choose from one of a number of straightforward privacy profiles that will suit their needs. In practice there could be issues of national or other privacy laws and directives that need to be taken into account, but it is expected that these laws and directives are likely to be in sympathy with the UCI user's requirements and not in opposition.

In the case of data protection for service providers, the case is a great deal more complex. For UCI to succeed, a UCI user's PUA will need access to the maximum amount of information about the communications and other services for that user in order to make appropriate choices when setting-up communications. For example, the PUA needs to know that the UCI user's mobile phone is able to receive a call before sending a voice communication to that user's mobile phone. Similarly, if a PUA knows that its user has very recently made a voice call from the phone at the user's home, it can make a sensible prediction that an incoming call directed to that phone would reach the UCI user. It is thus in the interest of the UCI user that as much information as possible is made available to the UCI user's PUA.

Where the provider of the PUA is the same organization as the provider of a communications service, there should be little data protection concerns in making communication service related data available to the PUA. Where the provider of the PUA and the provider of the communications service are different organizations the view of what information should be released to the PUA will be dependant on the relationship between the two organizations. From the data protection viewpoint, there will tend to be a natural reluctance on the part of the communications service provider to provide any data to the PUA.

There are, at least, three factors that could militate against a service provider's reluctance to make data available to a PUA provider. These are:

1) Regulation - Not only for UCI, but for any service that relies on the passing of data from a communications service provider to a third-party (e.g. any third party VASP usage of OSA), there may be a need for some regulation about what data should be passed between the parties. The regulation would need to ensure that certain data, that is operationally necessary and that cannot be considered to be a reasonable infringement of a service provider's genuine need for the protection of commercially sensitive data, is passed to an appropriate third-party (e.g. a PUA provider or any other legitimate third-party VASP).

2) Commercial agreements - The providers of communications services and PUA providers could have a commercial agreement that clearly defined what data should be passed and that entailed some form of recompense for the provision of that data. Such agreements could be bilateral or, more likely, might be by means of an agency that acts as an intermediary between individual communications service providers and individual PUA providers (e.g. analogous to the situation with GSM roaming).

3) Market pressure - Any provider of communications services that refused to provide adequate information to a PUA provider would have to be deemed not to be supporting UCI, as UCI requires such information to work effectively. Communications service providers taking this stance would find themselves on a UCI blacklist such that anyone wishing to use UCI would need to change their communications service provider to one that did provide the necessary information to PUAs. Such a competitive approach would put pressure on communications service providers to provide reasonable access to service-related data and also it would provide a market for communications service providers who provide this data to take business from those that do not.

B.2 Trust relationships between UCI entities

B.2.1 Relationship between communications networks, services or applications, and SAs

Communications networks, services and applications participate in UCI-based communication by means of an SA as the abstraction entity shielding the specific nature of the networks, services and applications from the PUA and hence from the UCI-user. As indicated by table 2 in the present document, SAs are provided by an "SA Provider" and communications networks, services and applications are provided by a "Communications service supplier" or a "Communications infrastructure provider".

The SA trusts each of the "Communications service supplier" and/or "Communications infrastructure provider" to carry out the communication request. This trust is achieved in large part through the use of standardized protocols and may be augmented by explicit security provisions within the protocols (or as extensions to these protocols). Where explicit security provisions are made the key management infrastructure will be included within the overall trust calculation.

B.2.2 Relationship between SAs and PUAs

A guiding principle of UCI is that the UCI owner's PUA is entrusted with knowledge of that owner's communications services. This trust will be achieved in large part through the use of standardized protocols and may be augmented by explicit security provisions within the protocols (or as extensions to these protocols). Where explicit security provisions are made the key management infrastructure will be included within the overall trust calculation.

Problems of trust may reduce the overall security of UCI. These problems may be minimized by standardization of protocols visible at reference point U_S.

B.2.3 Relationship between PUAs

Each UCI has a one to one relationship with a PUA, however many PUAs may be administered by a single PUA Provider.

In the process of establishing a communication using UCI, it is necessary that the originating party's PUA contact the recipient's PUA to make the communication request and to exchange information. It must be assumed that for many communications there is no pre-established trust relationship between the communicating PUAs. Establishment of trust between PUAs may be achieved through a trusted third party and the UCI model may adopt 3rd party trust establishment using, for example, public keying infrastructure methods to establish a trusted network.

B.2.4 Relationship between PUAs and their UCI owners

The issues that relate to UCI owners making contact with and being authenticated by their PUAs are covered in clause 6.2. This relationship occurs at the Up reference point as shown in figure 3.

Consideration should be given to setting categories of authentication and identification that will provide users with an indication of the level of trust they can place in the information provided. Such information could be provided within the "additional information" field.

Mechanisms that support registration with, and subsequent authorized use of the PUA by the UCI owner, are supported by the service capabilities defined in TS 101 878 [2].

B.2.5 Relationship between UCI owners

In current communications practice, there are parallels to all of the cases discussed in clause 6.2 to 6.5 and one of the solutions that has already been tried in these parallel cases would be likely to work for the UCI cases. However, many of the issues that relate to the relationship between UCI owners and other UCI owners are novel. The questions that relate to the relationship between UCI owners relate to the identity of the UCI owners and to their rights to use a UCI. These relationships say nothing (directly) about the identities that the UCI owners have within the various communications services or of their rights to use those services.

Annex C (informative): UCI FAQ

This annex contains questions with answers that represent a guide to UCI.

Will the unique numerical part of UCI be an E.164 number?

Probably (i.e. E.164 is best solution) subject to advice from ETSI-SPAN and decisions by ITU-T SG2.

- **If so, will UCI be allocated nationally (+44 uci) or internationally (+uci 12345..) or both?**

The view of the STF has been that +uci cc, (i.e. cc after global uci code) is best.

- **If this is unclear, who will decide it and when?**

ITU-T SG2 will make the final decision on any international numbering allocations. It is not clear when such a decision will be made. In addition the EC would be expected to give advice and to coordinate European input to ITU-T SG2.

What new allocation arrangements and procedures will be needed for UCI?

- **Number allocation at national level**

Authentication (e.g. passport) of the user's application for an authentic UCI (extent to which more than the number needs to be authenticated requires further study). New procedures will be required for handling applications

What operational facilities will be needed to support operational use of UCI?

A database that relates the UCI to the personal user agent is needed but there are no clear views on how is should be implemented. DNS (ENUM) and national number databases are possibilities.

- **How might they be funded?**

This has not yet been worked out in detail. There are possibilities of charging for queries of a database and also charging users registration fees for the UCI. There will be critical mass issues in starting the service and funding initial investments.

Will the use of UCI be compatible with the PSTN?

Yes as a design goal, although the final implementations may choose to what extent they support this goal. There is scope for using only the number element of the UCI across the PSTN and sending the associated parts of the UCI over the Internet.

Annex D (informative): ENUM and UCI - A comparison and a contrast

The purpose of this annex is to clarify the relationship between ENUM and UCI. In clarifying the relationships, it is obvious that whilst similarities exist, there are also differences.

EG 202 067 [6] has previously addressed this issue, however at the time of that assessment the formulation of the understanding was still evolving. It is still evolving. The content of this annex is a further statement based on today's understanding. To assist in the expression of today's understanding of the relationship between ENUM and UCI, some of the text from EG 202 067 [6] is used for background, to set the scene, and to allow an evolution from previous thoughts.

It is assumed that the reader of this annex has an understanding of ENUM, and has read the main body of the present document.

The scope of ENUM as stated in IETF RFC 2916 [4] is:

"This document discusses the use of the Domain Name System (DNS) for storage of E.164 numbers. More specifically, how DNS can be used for identifying available services connected to one E.164 number. Routing of the actual connection using the service selected using these methods is not discussed."

Added to this official definition, is the realization in draft-ietf-enum-operation-02 "ENUM Service Reference Model" that, *"Use of the ENUM system to implement time-of-day and other highly dynamic services is discouraged. Where such a service is desired, it is recommended that it is implemented as part of a service indicated by the service records"*.

However ENUM has evolved as attempts have been made at its implementation. In addition to RFC 2916, there are two other elements that have to be considered when using ENUM. First are the (interim) administration rules under which the ITU is consulted to allow a specific country code to be entered into the DNS behind e.164.arpa. Second are the implementation requirements that have been identified in order to make ENUM work. In Europe, at least, these requirements have been specified in ETSI TS102 051 [7].

The Universal Communications Identifier (UCI) [1] identifies a range of names associated with different communications media, by which individual users may be contacted. The choice of the service and associated identifier of the communication receiver is a matter of negotiation between the Personal User Agents (PUAs) of the originator and the receiver of the communication, based on the expression of the user's preferences. Thus ENUM might be used as a mechanism of establishing the communication between the originating and the terminating PUAs.

ENUM has evolved to encapsulate much of the service surround that a product offering will require. Indeed one of the differences between UCI and ENUM is that there are implementations of ENUM, at least trials at this time, whereas UCI is still at the conceptual stage.

Though the UCI is at this conceptual stage, activity is focussed on seeking to influence other standards activities, such as Next Generation Networks, that will allow UCI like concepts to be easily implemented in the future.

Both ENUM and UCI focus on the use of an E.164 number. Both proposals assume the use of an E.164 number to allow the originator of a communication to communicate with the receiver. In UCI, the use of an E.164 number permits use of UCI from legacy environments. In addition when one UCI user contacts another UCI user, alphanumeric labels describing the user can be passed between the Personal User Agents associated with each UCI user. These labels, together with additional information passed between the PUAs, are for use by the PUAs to help establish the most appropriate way to set up the communication. Also the labels can be delivered to terminals, with the communication and then used in similar ways to the labels that are currently associated with numbers stored in a mobile phone's "phone book". Though not unique in their own right, UCI labels could be validated, requiring a trust relationship to exist between service providers.

When contrasting UCI and ENUM, the evolution of ENUM through necessity of implementation has drawn these two concepts together. Whilst identifying user requirements to overcome management of various user identifiers stimulated UCI, facilitating convergence between the world of telephony and IP stimulated ENUM. UCI and ENUM are at different states, with the UCI being used to stimulate and steer appropriate standards, ENUM trials are in progress throughout the globe. Whilst it is possible for UCI to make use of ENUM (thus allowing UCI to be regarded as an ENUM application), it is quite possible to envisage an implementation of UCI that is totally unrelated to ENUM.

Annex E (informative): Bibliography

- ETSI TR 102 081 (V1.1.1): "Network Aspects (NA); Number Portability Task Force (NPTF); Signalling requirements to support number portability".

History

Document history		
V1.1.1	August 2003	Membership Approval Procedure MV 20031024: 2003-08-26 to 2003-10-24
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