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Users' views on addressing and directories;
Part 1: Requirements for design and interworking

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Contents

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Foreword

This ETSI Technical Report (TR) has been produced by ETSI User Group supported by OSITOP and EWOS/EG DIR.

The present document, Part 1 of a two-part Technical Report was prepared jointly by OSITOP and ETSI and is a common property of these two associations.

Introduction

The present document is the result of the work of a Topic Group (TG) supported by the User Group and OSITOP which in particular encouraged its members to take part in a survey among European companies to identify their needs related to the directory systems, regarding their content, their interworking and their management, the results of which are the basis of this work.

The TG has analysed the results of this survey in order to develop the requirements which should be completed to fulfil the users' needs.

EWOS/EG DIR has also provided key contributions in several parts of this work.

The present document is Part 1 of a multipart document related to addressing and directory issues. Its purpose is to identify the main issues raised by the users for the design and interworking of directory systems. The analysis of user requirements has been carried out to check whether existing products, standardized or not, enable solutions to be found. Therefore, it was not always possible to propose solutions for every item identified. Although X.500 technology is often referred in the present document, this does not imply that the requirements related to interworking may not be fulfilled if a directory system does not fully comply with X.500 technology. Nevertheless, as explained in clause 6, interworking cannot be achieved without conformance to some X.500 key concepts.

Therefore the document may be seen as a list of open issues with some paths to help suppliers to provide solutions.

Annex A gives an abstract of a survey carried out among European users on this matter.

Eight recommendations highlight the needs for standardization development from a user viewpoint, even if it was not always possible to specify the technical details. A summary of these recommendations is given in clause 4.

1 Scope

The present document summarizes the users' views on the main issues related to directory systems (including public, private and corporate ones) from a functional point view. It deals with the design of these systems, the interworking between private directory systems as well as interworking between private directory systems and public ones.

The present document is applicable to private directory system design and provision. Public directory service designers may also find here some useful information about interoperability needs and content, since business users are also seeking information from such services.

There are several directory technologies available. Issues concerning the establishment of private directories are to some degree dependent on the selected technology. Most concepts given in the present document refer to the X.500 directory technology, since, as indicated in subclause 6.2. "Directory schema", the interworking between the different directory systems implies the conformance to at least some X.500 key concepts. In the remainder of the present document, concepts like Directory Information Tree (DIT), directory entry, Distinguished Name (DN), Relative Distinguished Name (RDN), Directory System Agent (DSA), Directory User Agent (DUA), Directory Management Domain (DMD), etc., are assumed to be known by the reader.

2 References

References may be made to:

   a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or

   b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

   c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

   d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

   [1]   ITU-T Recommendation X.500 (1993) | ISO/IEC 9594-1(1995): "Information technology -
           Open Systems Interconnection - The Directory: Overview of Concepts, Models and Services".

   [2]   ITU-T Recommendation X.501 (1993) | ISO/IEC 9594-2 (1995): "Information technology -
           Open Systems Interconnection - The Directory: Models".

   [3]   ITU-T Recommendation X.511 (1993) | ISO/IEC 9594-3 (1995): "Information technology -
           Open Systems Interconnection - The Directory: Abstract Service Definition".

   [4]   ITU-T Recommendation X.518 (1993) | ISO/IEC 9594-4 (1995): "Information technology -
           Open Systems Interconnection - The Directory: Procedures for Distributed Operation".

   [5]   ITU-T Recommendation X.519 (1993) | ISO/IEC 9594-5 (1995): "Information technology -
           Open Systems Interconnection - The Directory: Protocol Specifications".

   [6]   ITU-T Recommendation X.520 (1993) | ISO/IEC 9594-6 (1995): "Information technology -
           Open Systems Interconnection - The Directory: Selected Attribute Types".

   [7]   ITU-T Recommendation X.521 (1993) | ISO/IEC 9594-7 (1995): "Information technology -
           Open Systems Interconnection - The Directory: Selected Object Classes".

   [8]   ITU-T Recommendation X.509 (1993) | ISO/IEC 9594-8 (1995): "Information technology -
           Open Systems Interconnection - The Directory: Authentication Framework".

[9]   ITU-T Recommendation X.525 (1993) | ISO/IEC 9594-9 (1995): "Information technology - Open Systems Interconnection - The Directory: Replication".

[10]   ITU-T Recommendation I.510 (1993): "Definitions and general principles for ISDN interworking".

[11]   ITU-T Recommendation I.112 (1993): "Vocabulary of terms for ISDN".

[12]   ITU-T Recommendation X.402 (1995) | ISO/IEC 10021-2 (1996): "Information technology - Message Handling Systems (MHS) - Overall Architecture".

[13]   EWOS/ETG 027: "Security Architecture for the Directory".

[14]   Internet specification RFC-1274 (1991): "The COSINE and Internet X.500 Schema".

[15]   TR 101 153-2 (1998): "Users' views on addressing and directories; Part 2: Guidelines to the users designing a private directory system".

3   Definitions and abbreviations

In the present document, particular attention should be given to the meaning of the word "private" which, in this context, has been used to indicate that a directory was designed and build by a company or an individual for his own purpose. Where information with privacy aspects is contained in one part of a directory, this part is referred as "restricted use directory".

NOTE: This document makes frequent mention of the "X.500 standard" and similar terms relating to "X.500". In the absence of any more precise reference, the occurrence of such an expression in this text may be taken as referring the **X.500 series of ITU-T Recommendations**, which include [1] to [9].

3.1   Definitions

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

business user: User using telecommunication product/services while performing business tasks which have no direct relationship with the telecommunication business.

corporate directory: An implementation of a private directory for large companies. A corporate directory is here defined as a repository for information shared by all departments, subsidiaries, etc. in a corporation, an organization, or an institution. These different elementary parts are often placed in different countries and may have separate directory systems interconnected and managed in an harmonized way to build a corporate directory.

directory: System or service allowing users and applications to find information related to a category of people, e.g. employee of a company, subscriber of a network, etc. In the following clauses, unless otherwise specified, the word **directory** will be used for **corporate directory**.

end-user: A person or machine delegated by a customer to use the service facilities of a telecommunication network, (term 401 of ITU-T Recommendation I.112 [11]) e.g. consumer, residential or business user without any technical knowledge of telecommunication technology using telecommunication terminals.

interface: The common boundary between two associated systems (term 408 of ITU-T Recommendation I.112 [11]).

interoperability: The ability to communicate between end-users across a mixed environment of various domains, networks, facilities, equipment, etc. from different manufacturers.

interworking: Interactions between networks, between end systems, or between parts thereof, with the aim of providing a functional entity capable of supporting an end-to-end communication (ITU-T Recommendation I.510 [10]).

IT&T manager: Person responsible in a company for telecommunication and information technology activities.

personal directory: Directory managed by an individual for his own use. In general, this is achieved with a personal computer connected to available databases (e.g. public and private directories) and appropriate software to process the local database and add the additional information needed.

private directory: Directory built and managed for private purposes. This may be achieved for home use or business use.

public directory: Directory built and managed for public use.

residential user: User using telecommunication means in private premises.

restricted use directory: Directory containing information with privacy aspects. This may be handled as a "restricted part" of a private directory. In any case this means that it contains information which should not be known outside a small group of people. This can be information on individuals or business information containing competitive aspects.

Service (Telecommunication Service): That which is offered by an Administration or ROA to its customers in order to satisfy a specific telecommunication requirement (term 201 of ITU-T Recommendation I.112 [11]).

NOTE: Bearer service and teleservice are types of telecommunication service. Other types of telecommunication service may be identified in the future.

single-location directory: Directory related to users in a single location within a single ownership/business.

user: Without specific addition this word is used to identify the telecommunication user community in general, e.g. end-users and IT&T managers. It means user of products or services possibly conforming to standards.

3.2   Abbreviations

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

ADDMD	Administration Directory Management Domain
API	Application Programming Interface
CD ROM	Compact Disk Read Only Memory
CSV	Comma Separated Value
DAP	Directory Access Protocol
dap	Directory Access Protocol
DIB	Directory Information Base
DISP	Directory Information Shadowing Protocol
DIT	Directory Information Tree
DMD	Directory Management Domain
DN	Distinguished Name
DSA	Directory System Agent
DSP	Directory System Protocol
DUA	Directory User Agent
EDP	Electronic Data Processing
EIDQ	European International Directory Inquiry
e-mail	Electronic mail
ETSI	European Telecommunications Standards Institute
EWOS	European Workshop for Open Systems
EWOS/EG DIR	EWOS Expert Group on Directories
ID	IDentifier
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
ISP	International Standardized Profile
IT&T	Information Technology and Telecommunications
ITU-T	International Telecommunication Union - Telecommunication Standardization Bureau
LAN	Local Area Network
ldap	Lightweight Directory Access Protocol
MHS	Message Handling System
NDS	Network Directory System
OCG	Operational Co-ordination Group
OSI	Open Systems Interconnection
OSITOP	European User Group for Open Systems
PBX	Private Branch Exchange
PC	Personal Computer

PNO	Public Network Operator
PRDMD	Private Directory Management Domain
RDN	Relative Distinguished Name
RFC	Request For Comment (Internet Society)
SME	Small and Medium Enterprises
SMTP	Simple Mail Transfer Protocol
SNADS	System Network Architecture Distribution Services
SOHO	Small Office, Home Office
TG	Topic Group
UPT	Universal Personal Telecommunications
WWW	World-Wide Web

4   Summary of recommendations

The TG did not have enough time available to deal with Numbering and Addressing. Nevertheless, taking into account the evolution in the numbering policy and the development of mobility and teleworking, the users are concerned with the multiple phone/fax numbers for a single person which makes public and corporate directory systems more and more difficult to use and to keep updated while at the same time it is more and more difficult to contact them when they are not always staying at the same place.

Registering a generic number and asking the telecom networks to reach persons wherever they are could be a possibility, the appropriate terminal (including voice mail system) being activated by voluntary action or automatic means whenever possible. Since users are aware that such a facility could not be implemented very quickly, and since this need is urgent, they would appreciate some rudimentary solutions be offered by service providers in the meantime.

Recommendation #1 - Requirements regarding numbering

Operators and network designers should work to make this old idea of a single number a reality at an affordable cost. The ETSI project in charge of Universal Personal Telecommunications (UPT) should define the organization needed to manage this generic number.

NOTE: The use of interim and fail safe solutions during the development phase, e.g. forwarding, should not be excluded.

Among the user requirements regarding directories, the most important are those related to interoperability. The three following recommendations are dedicated to this issue.

Taking into account the importance of a consistent naming definition to enable interoperability between all directory systems, and particularly the upper naming level, the TG recommends:

Recommendation #2 - Requirements regarding naming

There should be a common agreement on upper level (top level) naming:

- common definition of object classes and attribute types and matching rules;

- same schema definition for every type of general entity or object type;

- compatible data format.

ETSI should deal with such issues, either in an existing project or a new project if appropriate. This project should also define an organization to manage the naming in particular at the international level.

To enable interoperability between public and private Directory Systems, the TG recommends:

Recommendation #3 - Requirements regarding public directories

In our ever changing world, public directories are essential for the development of communications between people, customers and suppliers, applications/processes and machines/devices. To entirely fulfil this role they should be easy and cheap to use. In addition, each piece of information they contain should be clearly identified and those listed in subclause 7.1 should have standardized identification and presentation (e.g. object definition, object identifier and data format). Should recommendation #1 be implemented, the generic number should be part of this common list.

As far as possible the Web interface should be the same to facilitate data interchange.

The work currently being done in ETSI on this subject should take these requirements into account.

To enable interoperability between private directory systems, content and presentation have to be harmonized, therefore the TG recommends:

Recommendation #4 - Requirements regarding private directories

Directories are essential for the development of communications within a company and with its partners, customers and suppliers. To entirely fulfil this role they should be easy and cheap to implement and use. In order to allow a wide interoperability between them, each piece of information they contain should be clearly identified and those listed in subclauses 8.1 and 8.2 should have a standardized identification and presentation, most likely object oriented (e.g. object definition, object identifier and data format).

Synchronization is the key issue to enable updating between directory systems, and synchronization requires an efficient data interchange. Hence, the TG recommends:

Recommendation #5 - Requirements regarding data interchange - synchronization

A common technique for synchronization between directories should be developed. This should be open enough to cope with any type of information.

It should specify in particular:

- *formats and syntax for the connections with other directory servers (public or private);*

- *formats and syntax for update broadcast between connected systems;*

- *formats and syntax for interchange (or possible interchange) with Internet addressing.*

ETSI should check if existing activities cover this matter and set up new work items where appropriate for defining the technical details.

To fulfil the end-user requirements regarding Directory Systems, the TG recommends:

Recommendation #6 - Requirements regarding Links with End-user of directory systems

Directory system standards should be developed to fulfil the end-user requirements related to searches, editing, downloading, updating facilities and in particular, the interface between the directory system and the end-user terminal which, regardless of the distribution of functions, should strive to be compatible with a variety of transmission types (e.g. voice, PCs, data terminals, fax and telex).

The work item referred in recommendation #5 could take care of that.

To ensure a proper management and use of directory systems and particularly that data cannot be altered by mistake or malevolence and that any improper use of the information be avoided, the TG recommends:

Recommendation #7 - Requirements regarding security - privacy - misuse prevention

Directory system standards should be developed to fulfil the users' requirements related to security, privacy and misuse prevention as defined in this chapter. It should be made possible to implement encryption systems in accordance with the level of privacy and security desired.

ETSI should check if existing activities cover this matter and set up new work items where appropriate for defining the technical details.

This study shows that, in the directory area, some standardization work is needed in addition to the existing standard X.500 to achieve interoperability between the different implementations.

Recommendation #8 - Management of the present recommendations

The TG proposes that a meeting with the interested parties be organized to discuss how the standards related to generic numbering (recommendation #1), identification of a common set of information elements for public and private directories (recommendations #3 and 4), data interchanges (recommendation #5), end-user tools (recommendation #6) and privacy/misuse (recommendation #7) could be developed.

This meeting should decide how the organizational issue related to UPT (recommendation #1), Naming (recommendation #2) and possibly privacy/misuse(recommendation #7) could be solved.

Such a meeting could take place as an ad hoc task force of the ETSI Operational Co-ordination Group (OCG).

5   General considerations

From our evaluation of the survey we have carried out it appears that, even though paper directories are still widely used for many reasons, there is a growing need for electronic directory systems as long as they are seen as the best means to provide up-to-date information. Although the survey was carried out among business users, to some extent this result can be perceived valid for public directories. Nevertheless, the requirements for public or private directories are obviously different. Regarding public directories, business users can expect to have additional requirements with respect to those of residential users. In the same way requirements for corporate directories are more complex than those for single-location directories as may be used in small and medium enterprises (SME).

5.1   Public directories

Such facilities may be provided either by Public Network Operators (PNOs) or by any other service providers. They can be supplied either as an on line service or as a database, for example on CD ROM. From a business user's point of view, a public directory may be used to find the phone number and some other pieces of information related to other companies, e.g. customers, suppliers, partners, etc. This may not be sufficient if more information is needed, e.g. e-mail address, WWW address or more specific information on business activity, etc.

5.2   Corporate directories

Business users deem that a corporate directory is a powerful means to find where sources of information are located. In other words, the corporate directory is the communication reference. This reference is useful for the communication between company employees but should also be used for communication with other companies, customers and suppliers.

In the following, the concept of "Corporate Directory" will be used for all type of companies, small and medium enterprises (SMEs) and large ones as well since the requirements for the smaller ones may be seen as a subset of the requirements of the largest companies. For the latter, corporate directories are often the result of the consolidation of separate directories managed independently in the different parts (site, units, etc.) of the corporation. Additional requirements arise from this consolidation.

The biggest problem with most corporate networks is that they contain a number of different electronic mail systems and each time a merger or a new company is purchased their systems have to be integrated very quickly. These systems often have their own methods of addressing and directory management.

The largest corporations may have up to 40 different e-mail systems world-wide with some of the companies having even developed their own. There is little possibility of getting such companies to conform to a single e-mail system.

In addition, each company in the current business world is using extensively outsourcing, subcontracting and teleworking; therefore its outlines become more and more blurred with people from the company working together with employees from other companies.

Moreover, new technologies like workgroup are adding to the confusion by putting their own directories beside the existing ones (PBXs, LANs, e-mail, etc.).

An "interconnector" system may give inter-operability between the various systems, a "names" directory being the directory interface between the different e-mail system, e.g. SNADS, SMTP and X.400 style addressing. Then, from a single directory administration centre, where a common database is maintained, all company directory systems can be updated in a more or less automated way. Updating of the central database can be managed by file transfers from each directory system.

In the following and taking into account the generic X.500 features, X.500 principles are seen as the most appropriate to ensure openness, security, distribution and evolution of systems. This does not preclude that any solution should comply to the X.500 standard but as far as data interchange is needed, the X.500 rules should be used for this interchange. The following requirements are not seen in the X.500 context only but it was considered that when the X.500 standard provides a solution to solve a problem it would be inefficient to spend time in finding different solutions.

In addition, the other main problems encountered by the Information Technology and Telecommunications (IT&T) managers are the following:

- uniqueness of naming without going to esoteric names;

- differences in international character sets (e.g. Scandinavian);

- import and export controls to and from the database to ensure such things as only holding one version of the same address and not returning duplicates to the company;

- high rate of daily changes.

An issue closely related to directory issues, the numbering, should also be mentioned here. Addressing and numbering are important issues since, according to the evolution of the situation regarding that aspect, the directory system design should allow for multiple phone/fax/mobile numbers or not. This issue becomes more and more meaningful when taking into account the growth of teleworking (mobile workers or home workers).
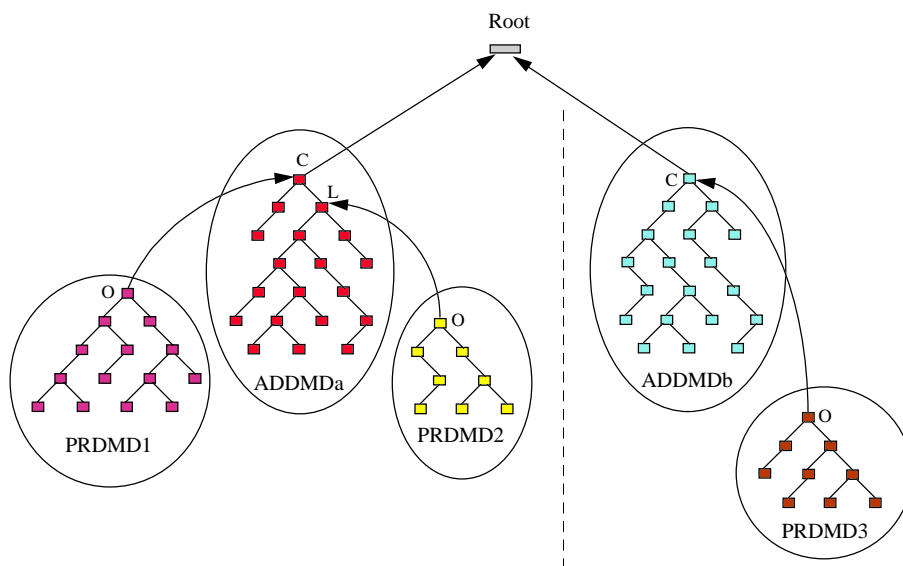
5.3   The directory environment

Figure 1: Scope of a corporate directory

This section describes the scope of a corporate directory with respect to a more general directory infrastructure, e.g. a pan-European Directory. This is illustrated in figure 1, where a number of Administrative Directory Management Domains (ADDMDs) and Private Directory Management Domains (PRDMDs) are shown. In this simple figure the PRDMDs represent the corporate directories, while the ADDMDs are public service provider directories. The ADDMDs have the responsibility for establishing a wider directory infrastructure and for holding the country entry, while the top entry in a PRDMD has the organization entry as the top of its tree (subtree).

It should be understood that this is quite a simplified picture. There may be several ADDMDs in a single country each wanting to hold the country entry. This introduces a number of issues, which can be more or less ignored by a corporate directory (PRDMD) and therefore are out of scope of the present document. Likewise, ADDMDs are faced with other particular issues for their interoperation, which are also outside the scope of the present document.

The scope of the corporate directory as treated in the present document represents the situation where a corporate directory is either an isolated directory not connected to any general infrastructure, or if it is connected, it is subordinate to some ADDMD. Thereby, it is shielded from the particular ADDMD problems. Connecting to a wider infrastructure will allow information provided by the corporate directory to be accessed from the outside, and it will allow corporate users to access information outside the corporate directory, e.g. information in another corporate directory or in a public directory. Even if a corporate directory is initially an isolated directory, it should be part of the planning that it may at some later time be connected to a wider directory infrastructure.

An international organization has additional issues to consider when establishing an international corporate directory. Such issues are examined in subclause 6.5 "International organizations".

On the other hand, a very simple organization may have easier problems to solve but the issues to deal with are about the same.

5.4   Numbering/Addressing

The TG did not have enough time available to deal with this matter. Nevertheless, taking into account the evolution in the numbering policy and the development of mobility and teleworking, the users are concerned with the multiple phone/fax numbers for a single person which makes public and corporate directory systems more and more difficult to use and to keep updated while at the same time it is more and more difficult to contact them when they are not always staying at the same place.

Registering a generic number and asking the telecommunication networks to reach the persons wherever they are could be a possibility, the appropriate terminal (including voice mail system) being activated by voluntary action or automatic means whenever possible. Since users are aware that such a facility could not be implemented very quickly, and since this need is urgent, they would appreciate that some rudimentary solutions be offered by service providers in the meantime.

> **Recommendation #1 - Requirements regarding numbering**
>
> -   Operators and network designers should work to make this old idea of a single number a reality at an affordable cost.
>
> -   The ETSI project in charge of Univeral Personal Telecommunications (UPT) should define the organization needed to manage this generic number.

NOTE: The use of interim and fail safe solutions during the development phase, e.g. forwarding, should not be excluded.

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6   Corporate naming and directory schema

6.1   Introduction

When establishing a corporate directory service, there are many aspects to be considered. This clause considers the following aspects:

-    unambiguously naming all items or objects to be represented in a directory; and

-    how information is structured.

The above aspects are part of what is referred to as the directory schema.

It is assumed here that a directory is based on the X.500 technology. It is also assumed that the reader has a basic knowledge of this technology. However, it has been attempted to keep the technical details down to a minimum level. Some additional X.500 tutorial material may be found in Part 2 of the present document (TR 101 153-2 [15]).

It is important to remember that each object represented in an X.500 directory is represented by an entry in the directory and that the entries are placed in a so-called Directory Information Tree (DIT) where the placement of the entry is determined by the object's (or entry's) name.

6.2   Directory schema

For directory information to be usable and accessible, it has to be organized in a pre-defined way. The rules for how directory information is organized is called the directory schema.

The directory schema is made up of several elements:

- *Object classes* are specifications of the characteristics or an object of a particular type, e.g. a residential person, and therefore determine the contents and other features of the entry representing such an object.

- The entry information is stored as a number of attributes each representing a particular piece of information. The characteristics of an attribute are determined by an *attribute type* definition, which is a specification of its structure and syntax. The syntax can be quite simple or be rather complex.

- When interrogating entry information, it is in many cases necessary to compare the value of an attribute with some data element presented in the user request. This is the case for searches where entries are selected based upon whether they fulfil certain criteria. The rules for how such a comparison shall be made are called *matching rules*. Matching rules can be quite simple like an exact match between two integers, or they can be rather complex, like a word rotation matching rule, phonetic matching rule and other approximate matching rules. While commonly recognized matching rules are implemented in all X.500 products, more special matching rules require special implementation.

- An entry's placement within the Directory Information Tree (DIT) and its name structure is determined by a *structure rule*.

All the above schema elements, and a few more, determine the characteristics of an entry and its relation to other entries.

For a Directory System Agent (DSA), i.e. a directory server, to contain a particular entry it is necessary for the DSA to have implemented all the schema elements that govern the characteristics of that entry.

For a Directory User Agent (DUA), i.e. a directory client, to access this entry and utilize the stored information, it also needs to have a pretty good understanding of all the schema elements. If users through their DUAs access different directory domains, they would expect the same type of information, like an e-mail address, to be controlled by the same schema element independent of location, otherwise the DUA may not be able to utilize the information.

If all organizations, like the Internet, private organizations, national groups, etc., each independently make their own directory schema definitions, which is somewhat the case today, it will not be possible to make a truly integrated European directory. Even though it may be possible to physically interconnect different domains, they will not be able to utilize each other's information.

6.3   Objects in a directory

6.3.1   Object classes and attribute types

As explained in subclause 6.2 "Directory schema", an entry is created based on an object class specification determining the characteristics of the entry. An organization therefore has to decide what object classes to use for the different entries.

An object class specification also determines what attribute types can be represented in an entry, i.e. it determines what kind of information can be stored in the entry in question.

The base X.500 standard defines several object classes and attribute types (ITU-T Recommendation X.520 | ISO/IEC 9594-6 [7] and ITU-T Recommendation X.521 | ISO/IEC 9594-7 [8]). These object classes and attribute types should first be considered and used whenever possible. If they do not fulfil reasonable requirements other generally used schema elements should be used.

The following subclauses further consider this issue.

6.3.2   Organizational persons

When creating entries for organizational persons there are several different object classes that can be considered:

- The X.500 standard defines an object class for persons in general from which the two basic object subclasses for persons, one for residential persons and one for organizational persons (**organizationalPerson**), are derived. The organizational person object class has some limitations with respect to allowable attribute types. When this object class is used, it will in most cases have to be supplemented with one or more auxiliary object classes.

- ITU-T Recommendation X.402 | ISO/IEC 10021-2 [12] defines an auxiliary object class called **mhs-user** which, when combined with a structural object class like **organizationalPerson**, allows inclusion of X.400 relevant attribute types.

- The Internet specification RFC-1274 [14] specifies a number of schema elements that are widely used, e.g. in the NameFLOW-paradise project. This RFC defines a structural object class (**pilotPerson** object class) that can contain quite a lot of useful attributes. However, it is most useful in the academic society.

- The European International Directory Inquiry (EIDQ) activity, which is making schema specifications mostly for the telephone numbering service, is also defining its own person object classes. It has defined a **fdasResPer**, which allows inclusion of several generally usable attributes, but also some that are quite EIDQ specific. The EIDQ specifications cannot be considered stable at the present time.

- An organization could define its own object class either as an auxiliary object class that can supplement some other person related object class, or it can define a complete replacement structural objects class. Defining one's own object classes should be absolutely the last choice.

- EWOS/EG DIR has defined an auxiliary object class. This auxiliary object class allows inclusion of all attribute types which have been judged useful.

6.4   Naming aspects

The X.500 Directory standard requires every object (person, organization, etc.) which is to be represented in a directory to be unambiguously named. A directory name is composed of a number of name components forming a hierarchical structure. Typically, the first component is a country code, the next a locality name, the next again the company name, and so on.

Naming is probably one of the more difficult aspects to consider when establishing a corporate directory.
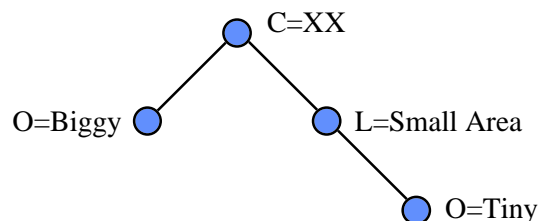
Figure 2: Location of main entry for organization

Account should be taken of the fact that the corporate directory might, in the future, connect into a wider directory infrastructure, e.g. a national or a European structure. It should be checked whether there are some national recommendations on how organizations should be named in a wider directory context. A large corporation will probably have its main entry located right under the country entry, while a smaller organization might have its entry under an entry representing a smaller area, like a postal district.

This is illustrated in figure 2. The large organization to the left has its entry just below the country entry and the name of the main entry is then: { C=XX; O=Biggy }. The organization to the right is a smaller organization represented by an entry having the somewhat longer name: { C=XX; L=Small Area; O=Tiny }.

6.4.1   Corporate subtree

Deep subtree   Shallow subtree

Figure 3: Deep and shallow subtrees

Selecting a naming structure is one of the more crucial choices to be made by an organization when setting up a corporate directory. The choice of naming structure influences the usefulness of the directory, and it affects how the directory can be maintained. The organization's naming tree forms a subtree of a more global Directory Information Tree (DIT), where the organization entry is the root of that subtree as illustrated in figure 1 and as explained in the associated text.
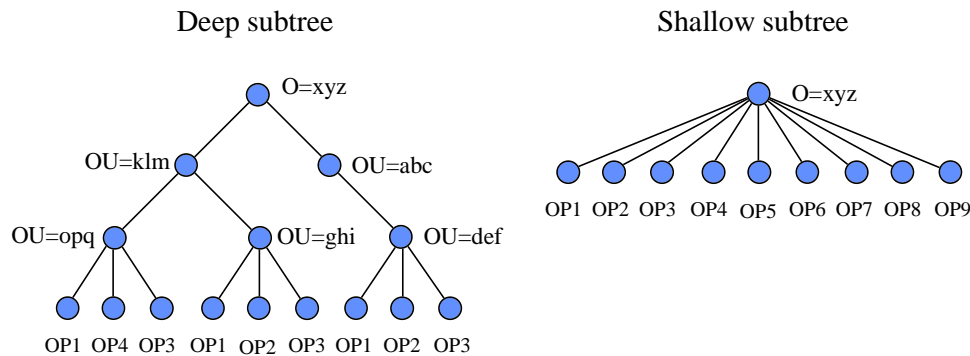
An organization can select to make its subtree deep or shallow. Figure 3 illustrates the extremes of these two approaches.

The left side illustrates the situation where the naming structure, and thereby the information structure, reflects the structure of the organization. The naming structure will then have levels corresponding to the organization hierarchy. The right hand side of the figure shows the other extreme where the naming structure has only a single level below the organization entry. The two approaches have both advantages and disadvantages.

In each particular situation some combination or some in-between solution may be selected, taking into consideration that each approach has advantages and drawbacks.

6.4.2   Naming recommendations

Based on the above general considerations it is possible to make some recommendations on the allocation of names.

Distinguished names (i.e. the complete name starting from the root down to the object in question) are used to reference objects in many places. It is therefore important that names that are referenced in this way be stable over time. Examples of where distinguished names are used are listed in the following:

- Aliases:

    - An alias entry is an entry pointing to another entry thereby giving an alternative (alias) name for an object. The pointer is the distinguished name of the entry to which it points.

- Other types of pointers:

    - Some attributes are pointers to other entries. For example, the **seeAlso** attribute points to one or more other entries using the distinguished names of those entries.

- List of names:

    - It is possible to establish a list of names. Such names are distinguished names of other objects, normally persons.

Depending on to what degree such pointer information is established in a corporate directory, it is evident that frequent changes of distinguished names result in a heavy administrative burden and a high risk for inconsistency in the directory. It is therefore essential to limit the changes of distinguished name with organizational changes to a minimum.

When establishing a DSA it has to be determined what the naming prefix is for the entries in the DSA, i.e. what are the top entries from the root down to the organization entry and how are they named. This requires the organization name to be properly registered by an external registration authority and it requires that an overall structure for the top part of the country subtree is established within the country. If such information cannot be established from the beginning and arbitrary choices have to be made, later changes may require considerable administrative effort.

6.5   International organizations

International organizations may have a directory system which encompasses several countries world-wide; therefore they need an harmonized naming policy between the related countries and thus an international, and not only European, registration authority for such naming.

6.6   Islands of directories

Private enterprises and public institutions are deploying private directory systems to satisfy internal needs. Such private directories contain information that can be relevant to provide to the outside world, such as telephone numbers for individual employees, job responsibilities, etc. On the other hand, users of a private directory may require access to information available in the global European directory.

6.7   Requirements regarding Naming

Taking into account the importance of a consistent naming definition to enable interoperability between all directory systems, and particularly the upper naming level, the TG recommends:

Recommendation #2 - Requirements regarding naming

There should be a common agreement on upper level (top level) naming:

-    common definition of object classes and attribute types and matching rules;

-    same schema definition for every type of general entity or object type;

-    compatible data format.

ETSI should deal with such issues, either in an existing project or in a new project if appropriate. This project should also define an organization to manage the naming in particular at the international level.

7   General requirements about public directories

The environment in this field is becoming more and more complex due to both deregulation and development of electronic directories:

-    advertising, the main source of revenue for directory publishers, is becoming more difficult with electronic directories;

-    the obligation of public services to deliver official directories is becoming more and more difficult with a high risk of piracy by downloading electronic directories;

-    Internet development causes new directory models to appear from new producers where registration is voluntary and resources get new forms;

-    proliferation of electronic addresses and phone numbers makes the picture still more complex.

Nevertheless, whatever the solutions, business users and residential users have some key requirements regarding the content and the features of such public directory systems. This clause contains indications on the users' expectations related to these features.

7.1   Content

Although the survey was not focused on the users' needs in this kind of information, they can nevertheless easily be deduced and classified in three categories:

7.1.1   Identification

-   Mr, Mrs, Ms

-   surname

-   given name

or;

-   company identification

-   category of business, …

7.1.2   Geographical localization

-   postal address

-   physical address

7.1.3   Communication means

-   fixed or(and) mobile phone(s) (switchboard for a company)

-   fax

-   e-mail (www address for a company)

7.2   Data interchange

Data interchange is needed mainly when the information is delivered via an on line service. In such a case, the purpose is either to update a private directory with data from the public directory or to deliver updating information to the public directory provider from a corporate directory if relevant (self registration).

7.3   Search Tools

Different kinds of electronic public directories are available. Depending on how the information is made available - on line service, CD ROMs or Internet - the search tools should be provided either with the service or on the user's terminal.

In any case the searches are quite basic since the information is very simple: name (people or company), category of activity plus additional localization indications.

7.4   Requirements regarding public directories

Among all these requirements, the most important is to ensure interoperability between public and private directory systems. To enable this interoperability, the TG recommends:

Recommendation #3 - Requirements regarding Public Directories

-   In our ever changing world, public directories are essential for the development of communications between people, customers and suppliers, applications/processes and machines/devices. To entirely fulfil this role they should be easy and cheap to use. In addition, each piece of information they contain should be clearly identified and those listed in 7.1 should have standardized identification and presentation (e.g. object definition, object

identifier and data format). Should recommendation #1 be implemented, the generic number should be part of this common list.

- As far as possible the Web interface should be the same to facilitate data interchange.

- The work currently being done in ETSI on this subject should take these requirements into account.

8 General requirements about private directories

In this clause, corporate directories are taken as the most complicated case of private directories. Taking into account the current business world, most of the features needed for corporate directories might be required for the implementation of private directories in simpler organizations.

This clause contains indications on the users' expectations related to the content and features of private directory systems and tools for their management and automated updating.

To comply with the requirement for electronic directory systems, since a unique centralized system is impracticable, the IT&T managers want tools to consolidate information from different sources inside and outside the company. The current systems are still far from supplying this type of tool, since, even within the same company, there are often quite different systems from different providers where some relevant pieces of information are stored and between which interworking is needed.

The end-users (person or unit) aim, in most cases, to put in place their own customized directory system comprising relevant elements from different sources.

8.1 Content

The survey gives a good idea on the main information to be contained in a private directory.

Information about people may be classified in four categories:

8.1.1 Identification

- Mr, Mrs, Ms

- surname

- given name

- photo, …

8.1.2 Geographical localization

- postal address

- physical address

- site

- room number

- building, …

8.1.3   Organizational affiliation

- company

- organizational unit

- division

- function

- speciality, activity, competence area

- hierarchical position

- direct senior officer, …

8.1.4   Communication means

- fixed phone

- mobile phone

- fax

- Email address

- secretariat

- pager

- switch board attendant, …

The above elements should be taken as a basis for the standardization of the content, size and identification as well as for allowing interchange tools to work between the different information sources.

8.2   Data interchange

Since there is a clear need for consolidation or synchronization of information between different sources internal or external to the company, the interfaces between all information sources in private or public areas should be standardized according to a common format. This is true for corporate directories as well as for personal customized directories.

8.3   Security aspects

Since there are understandable reservations about making public any information in a private directory, tools are needed to restrict access to the accredited persons only, according to the type of information concerned.

Similarly, if encryption keys for secured transactions are to be stored in a directory system, access and management of these parameters should obviously be restricted to authorized personel.

8.4   Data management

Although there is a need for a directory system manager, information updating should more and more be dealt with in a decentralized way. Therefore, tools are needed to manage which parts of the database are allowed to be updated by whom.

8.5   Search tools, editing facilities

Sophisticated means are required by the end-users to allow them to find someone not only starting from the approximate spelling of the name but also from quite different criteria like function, professional skills, etc.

Editing facilities are required to enable printing according to end-user criteria and in order to prepare a private directory on paper.

8.6   Requirements regarding private directories

Among all these requirements, the most important is to ensure interoperability between private directory systems. To enable this interoperability, content and presentation have to be harmonized, therefore the TG recommends:

Recommendation #4 - Requirements regarding Private Directories

Directories are essential for the development of communications within a company and with its partners, customers and suppliers. To entirely fulfil this role they should be easy and cheap to implement and use. In order to allow a wide interoperability between them, each piece of information they contain should be clearly identified and those listed in subclauses 8.1 and 8.2 should have a standardized identification and presentation, most likely object oriented (e.g. object definition, object identifier and data format).

9   Data interchange, synchronization, gateways

This text is based upon the following assumptions:

- the technical solution for data interchange, synchronization and gateways is based upon X.500 concepts;

- the directory (whether centralized or distributed) has its own database, fed by different sources.

9.1   Identification of interfaces and gateways needed

9.1.1   Between the directory server and providers of information

9.1.1.1   Inside the company

- the corporate database (staff data, etc.)

- e-mail directory

- PBX and telephone lists

- practical local information on the daily life of the enterprise (meeting rooms, medical services, internal mail circuits,...)

These are the different sources available to feed the private directory, first to initiate the population of the directory and then to regularly update it.

9.1.1.2   Outside the company

- public directory services

- other corporation directory services

- Internet

- public registering systems (Name, Address, VAT, etc.)

9.1.2   Between the directory server and clients

9.1.2.1   Inside the company

- e-mail

- telephone lists and systems

- groupware applications (e.g. Lotus Notes)

- security applications

- access control system

- paper extraction

- LAN, network resources directories (e.g. Novell NDS)

9.1.2.2   Outside the company

- teleworkers

- customers

- suppliers

- company's partners and subsidiaries

9.2   Problems encountered

Figure 4 gives a general picture of the possible data interchanges between the different systems, taking a corporate directory as an example. In this figure, the corporate directory system may or may not be centralized. This means that, if a decentralized solution is chosen, then the corporate directory system is made up of a network of several local servers with or without local replication of the entire database. In any case, the information is circulated between these local servers and possibly a corporate server.

Table 1: Some indications of the possible content of information exchanges

| Piece of information	From Inside the company	From Outside the company	To
Name, identifier	Corporate database (for ex. accounting)		The company directory server(s)
E-mail address	E-mail System	Internet or dedicated servers	The company directory server(s)
Phone number	PBX	Public directory services, other private directory servers	The company directory server(s)
Network address	Network management	Internet	The company directory server(s)
Local information	Company local information systems		The company directory server(s)
Updates	Any company directory server		Any other directory server in the company
Every "public" piece of information	The company directory server(s)		Public directory services, other private directory servers, any user
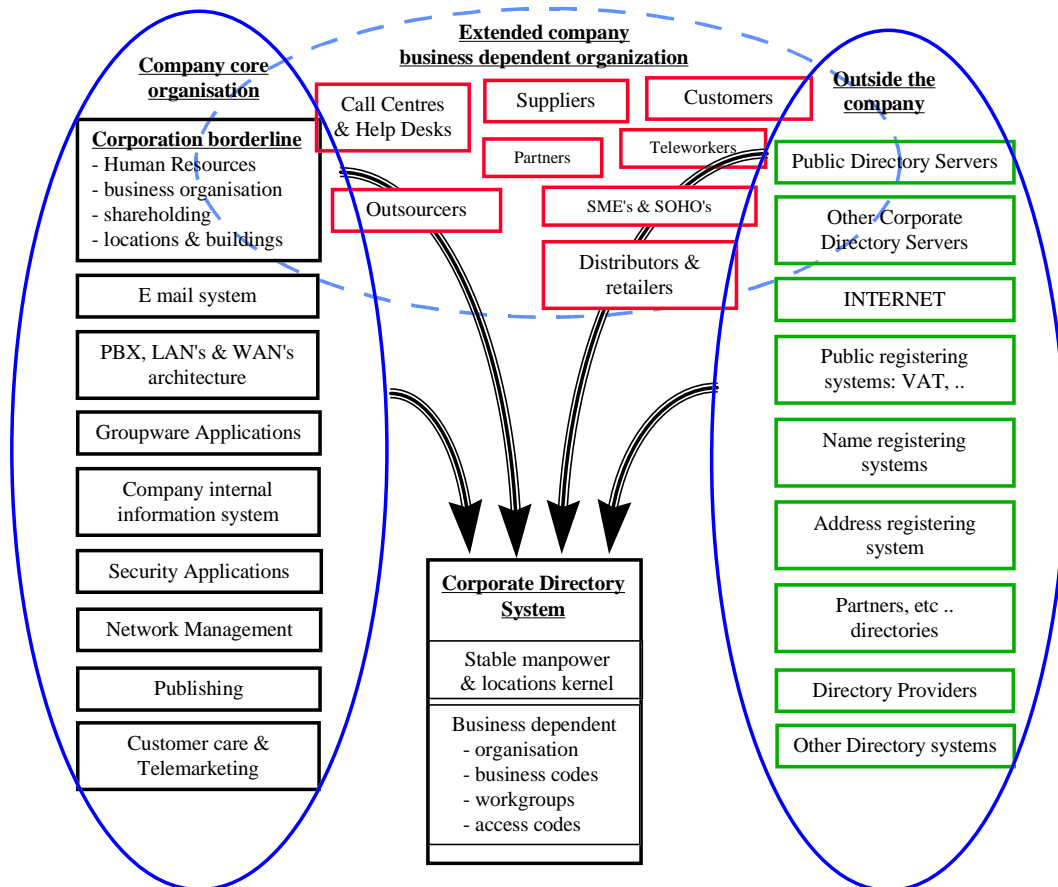
Figure 4: Information Input towards the Corporate Directory System

9.2.1   Functional

Most of the applications listed in subclause 9.1 are based on their own directories, which may be outdated, encumbered with information about persons that have left the company, or who were transferred from one organizational unit to another.

To all these clients, the corporate directory can provide periodic information on the presence of a person within an organizational unit so that they can update their own information. All updating efforts may then be made only on the corporate directory, which then propagates the changes to its clients. The update is most likely to be decentralized, with the exception of the smallest organizations.

9.2.2   Technical

Formats and syntax have to be defined to allow easy data interchange between the different sources and clients. Technical solutions exist, the issue is to agree on which one should be adopted and possibly standardized.

9.2.3   Organizational

Related to naming, it may be difficult to find the right « key » to reach the right entry when synchronizing with a source of information. The couple « Surname-GivenName » may not be sufficient, and an unambiguous identifier is necessary. This aspect is more organizational than technical. More details are given in subclause 6.4 and in part 2 of this report (TR 101 153-2 [15]).

9.3   Solutions

Synchronization products: most of the directory server products provide synchronization tools that allow to import flat files (CSV type);

- «dap» or «ldap» connections;

- APIs: these enable existing applications to sit directly on X.500.

9.4   Requirements regarding data interchange, synchronization, gateways between directory systems

Synchronization is the key issue to enable updating between directory systems, and synchronization requires an efficient data interchange. Hence, the TG recommends:

Recommendation #5 - Requirements regarding data interchange - synchronization

- A common technique for synchronization between directories should be developed. This should be open enough to cope with any type of information.

    - It should specify in particular:

        - *formats and syntax for the connections with other directory servers (public or private);*

        - *formats and syntax for update broadcast between connected systems;*

        - *formats and syntax for interchange (or possible interchange) with Internet addressing.*

ETSI should check if existing activities cover this matter and set up new work items where appropriate for defining the technical details.

10   Links with End-User

10.1   Introduction

Directory system end-users are only interested in finding the person they wish to communicate with, therefore their interest in an electronic directory system is because they expect the information they find there to be up-to-date and accurate.

They need to process the information delivered by the directory system, adding their own elements of information to make it relevant in their own database, each user having specific interests and needs. The latter may be stored either in the directory server or in the end-user's terminal as well.

10.2   Objectives, Requirements

Those interviewed preferred looking for a person by using their own criteria even if this lowers system performance.

10.2.1   Search Tools

When the name of the wanted person is not exactly known, nor his address, nor to which part of a structure they belong, the following features are required for quick identification:

- incomplete name search (namesake possibly non resolved) leading to a need for navigation means;

- phonetic search (homonyms with additional distortion), requiring a sophisticated resolution tool.

However, users want not only to get information on somebody where they know approximately the name but they want also to identify someone with specific skills, activity or responsibility and whom they probably do not know.

Therefore the directory application should enable searches using a selection of criteria taken from the list of preferred items for geographical localization or organizational localization:

postal address	company
site	organizational unit
building	division
room number	function
	speciality, activity
	hierarchical position
	direct senior officer

To be more effective such search tools should include navigation means.

10.2.2   Editing Facilities

Since paper directories remain very popular, the directory system should allow the printing of a selection of the information sorted according to the user's requirements.

10.2.3   Downloading and Updating Facilities

To fulfil the need for managing their personal customized electronic directory, users need not only to get information from the system in the right shape but they require also that this information be updated from the original database when there is a change, without losing the pieces of information they have added in their own database.

If end-users are expected to update some parts of the company directory, the facilities available for that should be user friendly enough to encourage the user to perform this task.

10.2.4   Interfaces

Regardless of the distribution of functions, the interface between the directory system and the end-user terminal should strive to be compatible with a variety of transmission types (e.g. voice, PCs, data terminals, fax and telex).

10.3   Solutions

Most current directory systems provide for advanced searching tools enabling the different kinds of searches described in subclause 10.2.1. Technical solutions exist for advanced updating as described in subclause 10.2.3.

Taking into account the large flexibility needed for searches, downloading and editing facilities, the directory system has, in addition, to provide the same sorting and editing tools as those supplied with most current database systems. These tools could therefore be used by the end-user and by the people in charge of preparing the corporate directory on paper.

10.4   Requirements regarding links with end-user of directory systems

To fulfil the end-user requirements regarding directory systems, the TG recommends:

Recommendation #6 - Requirements regarding Links with End-user of Directory Systems

- Directory system standards should be developed to fulfil the end-user requirements related to searches, editing, downloading, updating facilities and, in particular, the interface between the directory system and the end-user terminal which, regardless of the distribution of functions, should strive to be compatible with a variety of transmission types (e.g. voice, PCs, data terminals, fax and telex).

- The work item referred in recommendation #5 could take care of that.

11   Security - privacy - misuse prevention

11.1   Introduction

This chapter deals with procedures intended to ensure that data cannot be altered by mistake or malevolence and that any unwanted use of the information be avoided. More precisely:

- security is related to how to avoid any unwanted change;

- privacy - how to restrict access to the authorized people only; and

- misuse prevention - to how to prevent too easy production of lists of people fitting sophisticated combinations of several criteria.

11.2   Objectives, requirements

11.2.1   Security

Regarding the database, security procedures should ensure that data remain in conformity with the data dictionary and that any piece of information is not entered twice.

Regarding the system, security procedures should ensure that people accessing the system can only have access to the information to which they have been given authorization and can change only the information they are allowed to change.

This procedure should be further reinforced by the management of information and controls.

11.2.2   Privacy

This issue is related to information with confidential aspects. In general this information is contained in the restricted use directory. In SME or in large companies, this is often a part of the private directory that may only be accessed by authorized people. In any case, this part is restricted to the company's employees but each employee should have access only to his allowed part.

No one other than the authorized persons should have access to any part of the database related to the restricted use directory.

This means that strong authentication means are needed to prevent unwanted intrusion in this part.

11.2.3   Misuse prevention

Assuming that, in the near future, information is available on almost everybody in directory systems scattered all over the world, it could be possible, via sophisticated requests, to get a list of all people meeting specific criteria. Many misuses of such lists are easily conceivable and should be avoided.

It seems clear that the more meaningful the result of a search, the more confidentiality should be applied.

11.3   Open issues

The TG did not have enough competence to propose solutions on the security, privacy and misuse matters. Nevertheless, it should be recommended to make misuse of information impossible or at least to make obtaining lists of people meeting specific criteria very slow and/or difficult.

11.4   Requirements regarding security - privacy - misuse prevention

To ensure a proper management and use of directory systems and particularly that data cannot be altered by mistake or malevolence and that any improper use of the information be avoided, the TG recommends:

Recommendation #7 - Requirements regarding Security - Privacy - Misuse Prevention

- Directory system standards should be developed to fulfil the users' requirements related to security, privacy and misuse prevention as defined in this clause. It should be made possible to implement encryption systems in accordance with the level of privacy and security desired.

- ETSI should check if existing activities cover this matter and set up new work items where appropriate for defining the technical details.

12   Conclusion

This study shows that in addition to the existing standard X.500, some additional standardization work is needed in the directory area to achieve interoperability between the different implementations.

Recommendation #8 - Management of the present recommendations

- The Topic Group proposes that a meeting with the interested parties be organized to discuss how the standards related to generic numbering (recommendation #1), identification of a common set of information elements for public and private directories (recommendations #3 and 4), data interchanges (recommendation #5), end-user tools (recommendation #6) and privacy/misuse (recommendation #7) could be developed.

- This meeting should decide how the organizational issue related to UPT (recommendation #1), Naming (recommendation #2) and possibly privacy/misuse (recommendation #7) could be solved.

- Such a meeting could take place as an ad hoc task force of the OCG.

Annex A (informative):
Abstract of the directory survey among European users

A.1   Sample composition

The sample of people interviewed was mainly composed of executives in charge of telecommunications in different sectors. The rather homogeneous character of responses shows that the fact of being part of different nationalities, job or sector-related groups does not seem of relevance.

The proportion of participation between men and women is about 70 % for men and 30 % for women equally represented for middle-aged women, and none for the age group <25 and >55. The average age for men is somewhere between 45 and 55.

A.2   Need for a Directory service

Directory service within a company received a plebiscite vote of 95 %. According to the opinion expressed by interviewees, a directory system represents a company reference enabling users to easily and rapidly get in touch with their correspondents, organizational units and occasionally, access to information in other domains.

75 % of those interviewed think that a directory should provide application access: that highlights the idea of the directory system being a company reference tool, in fact a rather sophisticated tool. Views are rather different as to the methods to be used for completing a directory, between import/export of data and just in time synchronization.

Requirements for applications interfacing a directory are clear: a company directory is the hub of all telecommunication applications, providing data even to PBXs. There is no ambiguity on how far a directory is seen as a company reference consolidating different information sources and feeding most applications with validated information. Opinions are quite different concerning other applications such as electronic document management, meetings,... Some complementary ideas were given such as work flow, middle ware or facilities.

A.3   How they find someone

As for the means used for locating someone within the enterprise when having only little identification data, those interviewed use practically in equal proportion a paper directory or an electronic directory when available, or they ask someone. The following conclusions regarding the use of different types of directory can be drawn:

-   paper directory for restricted lists - practically for local use;

-   electronic directory for specific search (messaging), or domains of larger coverage;

-   the collective memory for extensive search when paper or electronic directories fail.

Secretariats are still consulted for more in-depth searches such as meeting rooms, security department, miscellaneous inquiries...

The emergence of concepts such as department in charge of... or person in charge of... (e.g. meeting room booking) should be mentioned here.

Most interviewed people use 3 to 4 directories for their professional activity (some even more than 5). The major part of these directories is used daily or weekly, and others monthly or yearly.

Those interviewed prefer looking for a person using their own criteria even if this lowers system performance.

This is particularly true when the names of the persons are not exactly known, as well as their addresses, or which part of an organization they belong to. The following features are therefore required:

- incomplete name search (namesake possibly non resolved) leading to a need for means of navigation;

- phonetic search (homonyms with additional distortion), requiring a sophisticated resolution tool.

It is interesting to note that only one person out of two is interested in searches according to the organization structure. It seems (but a more in-depth analysis would be needed), that according to the sample of interviewees, activity (cross aspects) is more relevant than hierarchical aspects ("I look merely for the person with a profile corresponding to my current preoccupation.").

A.4 Type of information needed

Table A.1 shows which domains users wish to see in a company directory.

Table A.1: Domains users wish to see in a company directory

Information	No	Yes
Persons (name, first name)	0 %	100 %
Geographical situation (building,)	0 %	90 %
Communication (Phone, Fax,)	5 %	80 %
Structure (Organization, divisions…)	14 %	76 %
Infrastructure (Equipment, meeting facilities…)	10 %	67 %
Health care services (Doctor, sick bay…)	14 %	62 %
Transport means, parking slots, taxis…	29 %	43 %
Associations, unions, sports, leisure…	29 %	43 %
Security devices (badges), emergency equipment (fire extinguishers)	33 %	38 %
External partners (mayors, MPs…)	48 %	24 %

Answers were classified in decreasing order of interest (% Yes) and in increasing order of rejection (% No). This appears to confirm responses previously given that a company directory could include such domains as people, locations, communications, organization structures, infrastructure and even services. Responses are much more diversified for the rest.

It is interesting to note that security aspects (to which much attention was paid in a paper version of a company directory) rank just before the last place on the list. It is possible that the question itself was not formulated clearly enough (in particular for safety devices). In particular, several people asked for the corporate directory being used to store and manage encryption keys.

Under the item "others", and concerning specific activities, are listed commercial aspects, such as suppliers, products, or markets.

There is a clear majority on the type of domains to be covered by a directory (persons, communication, organization, location) and on the type of information to include in a directory:

Table A.2: Domains and information types of greatest interest

Identification	Geographical localization	Organizational localization	Communication means
Mr, Mrs, Ms	postal address	organizational unit	fixed phone
surname	site	division	fax
given name	building	function	mobile phone
photo	room number	speciality, activity	Email address
		hierarchical position	secretariat
		direct senior officer	pager
			switch board attendant

It is significant to note that most people are much more interested in obtaining detailed information on other people than they are willing to provide on themselves. This restriction highlights the necessity for implementing security controls allowing access to the most confidential information only by accredited persons.

A.5   Satisfaction and dissatisfaction about current systems

For the most trivial searches, mainly in the local area, the different current directories seem to fulfil the needs, but a more in-depth study shows that the satisfaction becomes rather poor, as long as the search is related to extended geographical areas or to different kinds of information (structures, skill, competencies, etc.).

It appears that 3 persons out of 4 use a personal directory because it is quicker, the coverage better meets their specific needs and it is more reliable; it also provides better confidentiality, specific job classification, or it fulfils the need for an extended domain. This trend towards customization of information seems to be an important criterion in conceiving a directory service. The end-user (person or unit) aims, in most cases, to put in place his own directory application comprising relevant elements from different sources.

A.6   Response time

Concerning the acceptable response time, rather homogeneous answers were also obtained here. They can be classified into three main categories according to the interest of the search criteria, and on the other side to the difficulties encountered by the search process itself:

- full name or e-mail address: 5s;

- truncated name or organization: 10s;

- lists or images: 15s.

A.7   Information management

Concerning each participant's own experience and requirements of a company directory, just-in-time updating was not strongly requested. A week was accepted by 32 % as a reasonable period of time whilst one day is an expectation expressed by 63 %.

The need to synchronize a directory with other data sources is confirmed by 60 % of the votes.

If the management of the information included in a directory relies mainly on "managers" today, users are prepared - 40 % - to get more involved in the updating process in order to obtain better results.

A.8   Interfaces

More than 90 % of the people interviewed require a data extracting facility provided in particular in an electronic file format and, strangely enough, in paper form also. This confirms partly the findings analysed earlier and concerning the directory customization.

Considering the access interfaces to implement, very diversified demands were given (networked PCs 100 %, www 67 %, telematics servers 43 %, paper 33 %, switch board attendant 24 %). Even though a demand for the screen-type access is preferred by a majority, one should not underestimate the importance of paper, still considered interesting. Paper support can be considered as a sub-product of a company directory.

A.9   Security

From the number of abstention votes, aspects of security of access are still badly known. A requirement for the security features of the directory itself appears more clearly (80 %) as the idea of free access to a directory within the enterprise is a matter of much discussion. Encryption of data was referred by several people. This point provokes a need for complementary work to be done by the working group.

EWOS/ETG 027 [13] would appear to be relevant in this context.

A.10   Future

A company directory has been implemented in more than 50 % of the companies interviewed and, as far as projects are concerned, a majority of 83 % is in favour of X.500 type solutions against 17 % for proprietary ones.

New emerging ideas concern both directories and services derived from a company directory. The most interesting return on future development seems to be the possibility of using addressing schemes as information for distribution of information (mail, messaging...). A company directory cannot, in this case, be considered as a tool for direct use, but, once implemented, as a communication base vital for all communications. This in turn raises the difficult question of the accessory work of extraction, notably because the extraction criteria seem rather complex.

History

Document history		
V1.1.1	January 1998	Publication