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Introduction to White Pages Services based on X.500

Status of this Memo

This memo provides information for the Internet community. This memo does not specify an Internet standard of any kind. Distribution of this memo is unlimited.

Abstract

This document aims at organisations who are using local and global electronic communication on a day to day basis and for whom using an electronic White Pages Service is therefore indispensable.

The document provides an introduction to the international ITU-T (formerly CCITT) X.500 and ISO 9594 standard, which is particularly suited for providing an integrated local and global electronic White Pages Service.

In addition a short overview of the experience gained from the Paradise X.500 pilot is given. References to more detailed information are included.

The document should be useful for managers of the above mentioned organisations who need to get the necessary executive commitment for making the address information of their organisation available by means of X.500.

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1. Introduction

Due to the tremendous growth and development of international computer networks we have nowadays the possibility to overcome - without having to travel - geographical distances when working together with other people. Besides the possibility of using the telephone we may use electronic data exchange to discuss working documents, new ideas, plans or whatsoever. One of the most popular means for this is electronic mail, which can be used to exchange all kinds of electronic data: from informal pure text messages to formatted and multi-media documents.

As the number of people connected to computer networks grows (and it does continuously, it is at least doubling each year!), it becomes more difficult to track down people's electronic (mail) addresses. Hence, in order to make global communication over computer networks work, a global White Pages service is indispensable. Such a service should of course provide people's electronic mail addresses, but could also easily contain telephone and fax numbers and postal addresses.

Currently, one technical solution for a globally distributed White Pages service is X.500 and there exists an international infrastructure based on X.500 technology called 'Paradise' (Piloting An inteRnationAl DIrectory SEService), which contains about 1.5 million entries belonging to persons and 3,000 belonging to organisations. Worldwide 35 countries are involved. Paradise is also a project of the EC. The project continues until September 1994. Afterwards its operational tasks will be taken over by a European service provider for the R&D community (DANTE).

The goal of Paradise and related national initiatives is to stimulate and extend the use of the X.500 White Pages service. Within the pilot attention is paid to technical and organisational aspects. The Paradise infrastructure is mainly based on the Internet Protocol. The specific issues that are related to the use of the Internet Protocol for X.500 can be found in [5].

In the decision process of joining the international X.500 infrastructure and opening (part) of the local (address) information to the outside world, it is important that an organisation fully understands the technical and organisational issues that are involved.

This document tries to be of help in this matter first by explaining the main concepts of X.500 (section 2) and subsequently by pointing out its benefits (section 3), the organisational aspects that are involved (section 4), and for which other

applications the X.500 infrastructure may be used in the near future (section 5).

2. Concept of X.500

The X.500 standard describes a so-called 'Directory Service', which can be used for all types of electronic directories. This document focusses on the use of X.500 for a global White Pages Directory. The concept of X.500 may roughly be divided in the 'Directory model' and the 'Information model'.

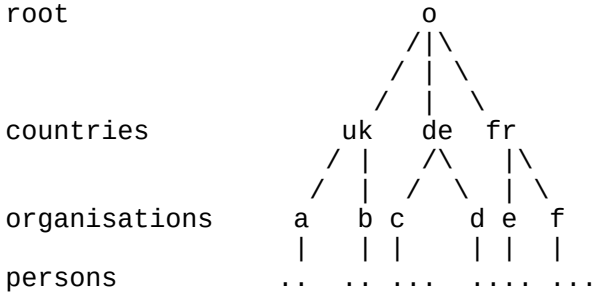
2.1 Directory model

X.500 uses a distributed approach to achieve the goal of a global Directory Service. The idea is that local (communication oriented) information of an organisation is maintained locally in one or more so called Directory System Agents (DSA's). 'Locally' is a flexible expression here: it is possible that one DSA keeps information of more than one organisation. A DSA essentially is a database:

- in which the information is stored according to the X.500 standard (see section 2.2),

- that has the ability, where necessary, to exchange data with other DSA's.

Through the communication among each other the DSA's form the Directory Information Tree (DIT). The DIT is a virtual hierarchical datastructure consisting of a 'root', below which 'countries' are defined. Below the countries (usually) 'organisations' are defined, and below an organisation 'persons', or first additional 'organisational units', are defined (see the simplified illustration below where only three countries and no organisational units are presented). The DIT is a representation of the global Directory.



Each DSA holds a part of the global Directory and is able to find out, through the hierarchical DIT structure, which DSA holds which parts of the Directory.

The standard does not describe how to distribute different part of the Directory among DSA's. However, the information corresponding to a single node of the DIT (i.e., a country, organisation, person) cannot be distributed over several DSA's. In practice a large organisation will maintain one or more DSA's that hold its part of the Directory. Smaller organisations may share a DSA with other organisations.The distribution among the DSA's is totally transparent to the users of the Directory.

A user of the Directory can be a person or a computer. A user accesses the Directory through a so-called Directory User Agent (DUA). The DUA automatically contacts a nearby DSA by means of which the user may search or browse through the DIT and retrieve corresponding information. A DUA can be implemented in all sorts of user interfaces. Therefore users may access the Directory through dedicated DUA interfaces or for example e-mail applications. Currently most DUA nterfaces to be used by persons are dedicated, but it is expected that in the near future a lot of DUA interfaces will be integrated with other applications.

2.2 Information Model

Besides the Directory model, the X.500 standard also defines the information model used in the Directory Service.

All information in the Directory is stored in 'entries', each of which belongs to at least one so-called 'object class'. In the White Pages application of X.500, on which we focus here, object classes are defined such as 'country', 'organisation', 'organisational unit' and 'person'.

The actual information in an entry is determined by so-called 'attributes' which are contained in that entry. The object classes to which an entry belongs define what types of attributes an entry may use and hence what information is specific for entries belonging to that object class. The object class 'person' for example allows attribute types like 'common name', 'telephone number', and 'e-mail address' to be used and the object class 'organisation' allows for attribute types like 'organisation name' and 'business category'. Dependent on its type an attribute can take one or more values.

To specify the name of an entry in the DIT, at least one attribute value of the entry is used. The entry of a person is usually named after the value of the attribute type 'common name'. The name of an

entry must be unique on the same level in the subtree of the DIT to which the entry belongs.

An example of an entry belonging to the object class 'person' is:

Attribute type	Attribute value
Object Class:	top
	person
Common Name:	Thomas Lenggenhager
	T. Lenggenhager
Surname:	Lenggenhager
Postal Address:	SWITCH
	Limmatquai 138
	CH-8001 Zuerich
Telephone Number:	+41 1 268 1540
Facsimile Telephone Number:	+41 1 268 1568
Mail:	lenggenhager@switch.ch

This entry corresponds to the node in the DIT that occurs below the node of the organisation 'SWITCH' and is named after the first value of the attribute type 'common name': 'Thomas Lenggenhager'.

3. Benefits of X.500

Why should one use X.500 for a local White Pages service? Here are some good arguments:

- The distributed character of the service. A large organisation may distribute the responsibility for the management of the information it presents through X.500 by distributing this information over several DSA's (without losing the overall structure)

- The flexibility of the service. Besides for public purposes, X.500 may also be used for specific private Directory Service applications. Whereas the definitions of the DIT, object classes and attribute types of the public White Pages information within an organisation have to conform to those of the rest of world, the internal applications may use their own DIT structure and their own definitions of object classes and attributes (the values being only visible within (a part) of the organisation). Nevertheless one local infrastructure can be used for both the public and private computers.

- Good alternative for paper Directories. The provision of White Pages services based on X.500 may be a good alternative for paper directories, because the latter directories are rarely up-to-date (due to the printing costs) and because X.500 not only can be used by humans but also by applications.

Some important arguments in favour of X.500 for global use are:

- By its distributed nature X.500 is particularly suited for a large global White Pages directory. Maintenance can take place in a distributed way.

- Good searching capabilities. X.500 offers the possibility to do searches in any level or in any subtree of the DIT. In order to do a search an attribute type together with a value have to be specified. Then the Directory searches for all entries that contain an attribute of that type with the given value. For example one can search for all persons in an organisation having a particular common name, or all organisations within a country that have telecommunications as their business category. It is up to the organisations that maintain the DSA's to decide who may perform which searches and also how many levels deep a search may be.

  Searches can be done on the basis of an exact or approximate match. It is worthwile to note that distributed searches (that need connections to a lot of DSA's) may be expensive and are generally not encouraged.

- There are DUA interfaces for the White Pages service availablefor all types of workstations (DOS, Macintosh OS, Unix). For an overview of X.500 available software see RFC 1292 [2] or updates of this document.

- X.500 is an international standard. Using a standard obviously means less problems with interoperability and interworking.Also the standard is updated according to practical experience.

4. Organisational aspects of X.500 (experience from Paradise)

The organisational aspects involved in operating a local X.500 (or any other electronic) Directory can roughly be divided in three sub-aspects:datamanagement, legal issues and cost aspects. With respect to cost aspects there is no publicly known model or experience at the moment.

Therefore the focus in this document is on datamanagement and legal issues.

Data management refers to issues that are related to inserting appropriate information into the Directory and keeping it up to date.

From the experience of participants in Paradise we obtain that the following items are of first importance:

- Executive commitment. Without this it is almost impossible to create an organisation wide up-to-date electronic Directory.

- Structure of the local DIT. In joining the international infrastructure an organisation has to conform to some rules for the local DIT structure as presented to the global X.500 infrastructure. A recommendation on how to structure a local DIT and how to use the available attributes can be found in [7]. The most important recommendation in the latter document is to keep the local part of the DIT as simple (flat) as possible. The reason is that users from outside the organisation may otherwise have difficulties in finding entries of persons within the organisation (searches in the DIT are often only allowed one level deep).

- Attributes to be used. For the existing infrastructure the objects and associated attributes that are globally used, are documented in [1].

- Sources of the data. An organisation has to find out where to get what kind of data and develop procedures for uploading its DSA('s).

- Delegating responsibilities for updates. Procedures have to bedeveloped for updates of the local Directory. These procedures have to include delegation of responsibilities.

- Security procedures. Rules have to be set for access and security. Who may contact the DSA? Who will have access to which subtrees and what attributes?

A study of the legal consequences of presenting (address) information via X.500 lead to the main conclusion that in Europe an organisation has to formally register its data collections. Registration implies defining a goal for the application. This has to be done for the White Pages service as well as for any deviating local application of X.500. However, the different national laws may differ with respect to legal restrictions. For more information on this subject we refer to "Building a Directory Service, Final Report test phase SURFnet

X.500 pilot project", E. Huizer, SURFnet B.V., Utrecht NL, 1994. (copies available from SURFnet B.V.)

Among the Paradise members there are several pilots running at the moment with the goal to evaluate the organisational aspects. Case studies coming from these pilots will be documented.

Small or medium size organisations that have not too many entries to insert in the Directory may use one of the different national initiatives concerning a 'central DSA'. These central DSA's are operated by national service providers and contain the White Pages information of a lot of small and medium size organisations. For organisations in countries without such a national service there is also a European central DSA (Paradise) and an American central DSA (InterNIC). It is worth noting that the central DSA services are only technical services, i.e., a participating organisation still has to cover the organisational issues. However, part of a central DSA service may be consultancy with respect to datamanagement and legal issues.

5. Applications of X.500

Besides for White Pages, X.500 can be useful for all kinds of distributed information storage from which humans or machines can benefit. Examples that are likely to use X.500 in the near future are: distribution list mechanism, public key distribution for Privacy Enhanced Mail (PEM), routing of X.400 messages, distribution of EDI identifiers, etc. For more information we refer to [7]. Below the first three applications are briefly discussed.

The distribution list mechanism uses X.500 for finding the e-mail addresses of the persons that have subscribed to a list. The distributed approach of X.500 makes it possible that people change their e-mail address without having to change their subscription to distribution lists.

PEM (see a.o. [8] or [4]) uses a public key mechanism for exchanging secure e-mail messages. For example: one will be able to end a secure message by encrypting a message with the publicly known (public) key of the recipient. Only the recipient of the message can decipher the message using his/her private key. In order to make such a mechanism work one must have access to the public keys of all possible recipients. X.500 can be used for this purpose.

At this moment a world-wide pilot is running in which X.400 routing is done by means of X.500. X.400 MTA's use special DUA's to find via the Directory the MTA's to which the recipients of a message want their mail to be delivered. The distributed approach of X.500 will

mean much less routing management (currently tables are used that have to be updated/exchanged periodically).

6. References

[1] Barker, P., and S. Kille,"The COSINE and Internet X.500 Schema", RFC 1274, University College London, November 1991.

[2] Getchell, A., and S. Sataluri, Editors, "A Revised Catalog of Available X.500 Implementations", FYI 11, RFC 1632, Lawrence Livermore National Laboratory, AT&T Bell Laboratories, May 1994.

[3] Weider, C., and J. Reynolds, "Executive Introduction to Directory Services using the X.500 Protocol", FYI 13, RFC 1308, ANS, USC/Information Sciences Institute, March 1992.

[4] Linn, J., "Privacy Enhancement for Internet Electronic Mail:Part I: Message Encryption and Authentication Procedures", RFC 1421, IAB IRTF PSRG, IETF PEM WGs, Feblruary 1993.

[5] Hardcastle-Kille, S., Huizer, E., Cerf, V., Hobby, R., and S. Kent, "A Strategic Plan for Deploying an Internet X.500 Directory Service", RFC 1430, ISODE Consortium, SURFnet bv, Corporation for National Research Initiatives, University of California, Davis, Bolt, Beranek and Newman, February 1993.

[6] Yeong, W., Howes, T., and S. Kille, "Lightweight Directory Access Protocol", RFC 1487, Performance Systems International, University of Michigan, ISODE Consortium, July 1993.

[7] Weider, C., and R. Wright, R., "A Survey of Advanced Usages of X.500", FYI 21, RFC 1491, Merit Network, Inc, Lawrence Berkeley Laboratory, July 1993.

[8] "Privacy Enhanced Mail in more detail", Zegwaart, E., Computer Networks for Research in Europe Vol. 2, pp. 63-71.

[9] Barker, P., Kille, S., and T. Lenggenhager, T., "Naming and Structuring Guidelines for X.500 Directory Pilots", RTR 11/RFC 1617, University College London, ISODE Consortium, SWITCH, May 1994. For a good technical introduction to X.500 we also recommend:

[10] Rose, M., "The Little Black Book", PSI Inc., Prentice Hall Inc., New Jersey, 1992.

[11] Steedman, D., "The Directory standard and its application", Technology Appraisals, Twickenham (U.K.), 1993.

7. Security Considerations

Security issues are not explicitly discussed in this memo.

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