Recommendation F.500

INTERNATIONAL PUBLIC DIRECTORY SERVICES

Given the rapid multiplication and expansion of CCITT-defined telecommunication services, there is a growing need for subscribers to these telecommunication services to be able to communicate with each other. In order to facilitate such intercommunication for the subscribers of the various services, public directory services will be required.

The CCITT,

considering

(a) that the CCITT-defined telecommunication services, including Telegraphic, telematic and telephone services, have directory requirements;

(b) that such requirements are being implemented as on-line electronic directories (in addition to traditional hard-copy versions);

(c) that national initiatives are being taken to develop electronic integrated directories or service specific directories;

(d) that the system definition is being undertaken by the CCITT in the field of electronic directories in the X.500-series of Recommendations,

unanimously declares

that the specifications of this Recommendation should be applied to the provision of public directory services.

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1 Introduction

International public directory services will enable subscribers to determine rapidly and easily what services are available and how to access and address their correspondents. Public directories may also be used internally by the various telecommunication services for the proper routing of calls or messages. However, this application of directory systems is not covered by this Recommendation.

Service specific directories may be implemented as part of a global directory service. Consistent with the need to make directory information as widely available as possible, it is anticipated that Administrations will aim to provide global electronic directory services.

In order to provide international public directory services, Administrations should mutually cooperate in handling inquiries for information across national boundaries.

Public directory services should solve the primary problem of name to address association, e.g. obtaining a company's telex number by querying the directory with the name of the company.

The reverse question, i.e., obtaining the name and other information from the address, may also be applicable in certain services and its provision is at the option of an Administration.

Public directory services should include directory information concerning the provision of services, service descriptions, operational instructions, tariff conditions, etc.

Public directory services should make provision for accessing information without knowing the name of the object sought, e.g., designating categories of goods, business areas or services.

Advertising is included in the scope of public directory services, but is left to national implementations.

Public directory services can be considered as supplementary to the services for which they provide information or by which they are accessed.

Private directory services which are compliant with the public directory services defined in CCITT Recommendations may be permitted to intercommunicate with public directory services under national regulations.

2 Purpose and scope

This Recommendation provides for the general framework for the provision of international public directory services. It defines the requirements for and the service features associated with the provision of public directory services. It specifies naming aspects, describes operational issues to be taken into account in providing the public directory services as well as quality of service aspects.

3 Organizational provisions

Provision of a public directory service will be done in accordance with the organizational model described in Recommendation X.501. An Administration Directory Management Domain (ADDMD) is responsible for the application of the basic service features and the optional user facilities provided in that domain. Directory management domains shall intercommunicate with each other as far as the provision of the public directory services requires it. The protocol to be used for interworking as well as the directory's overall concept and behavior, is described in the X.500 series of Recommendations.

Private Directory Management Domains (PRDMDs) may exist and intercommunicate with ADDMDs, following national regulations.

A Directory Management Domain (DMD) consists of one or more Directory System Agents (DSAs) and zero or more Directory User Agents (DUAs).

Each directory management domain may act as the naming authority for that domain. Names need to be unambiguous.

The intercommunication between PRDMDs is *outside* of the scope of this Recommendation.

4 Public directory services

4.1 Service requirements

The fundamental ability of a public directory service is to provide a means by which subscribers or users of telecommunication services may, in a user-friendly manner, and from information they would normally possess, obtain information about a desired recipient, such as addresses or communication capabilities.

This public directory service is provided in an on-line and interactive manner. It should be made available for subscribers or users at the discretion of the Administration offering the service.

Each Administration is responsible for the access methods used. The characteristics of the access methods between terminals and the public directory service are a national matter. However, the directory service offered is independent of the access method, the terminal used and the location of the user.

Public directories of Administrations should intercommunicate (or refer to each other) to fulfill requests made by customers when the directory serving the customer does not have available the information requested.

4.1.1 Basic service requirements

The following basic service requirements are fulfilled by the public directory services:

- to provide subscribers with information, e.g., a telex number, needed for establishing communication with other subscribers or users of telecommunication services;
- to provide subscribers with information, e.g., service instructions, needed to use the telecommunication services and the directory itself;
- to assist subscribers in the formulation of queries to narrow the scope of the operation;
- to allow for flexibility in the formulation of a request, e.g., names should not artificially remove natural ambiguities; names should admit natural abbreviations and commonly used variations in spelling.

4.1.2 Non-basic service requirements

The following non-basic service requirements are fulfilled by the user facilities of the public directory services.

- to provide subscribers with other information, e.g., advertising;
- to provide subscribers with “yellow page” information, e.g., categories of goods, business areas or services;
- to provide an interted directory for specific services, e.g., for telex and teletex;
- to provide “wildcards” capability to ease, as far as possible, the input of the requests to the directory;
- to provide means for the verification of credentials, under conditions specified by the provider of the directory service;
- to provide possibilities for the search of distribution lists;
- to provide means for the phonetic matches.

4.2 Service features and optional user facilities

The service features and the optional user facilities of a public directory service will be provided in accordance with the X.500-series of Recommendations. The terms used in the context of service features and optional user facilities discussed below are explained in Annex H.

4.2.1 Basic service features

Basic service features are *inherent* in directory services and are always available for use in directory service. They are provided by *all* service providers offering international public directory services or by private directories intercommunicating with public directory services.

The basic features are:

- read operation;

- search operation.

Other basic features are for further study.

4.2.2 Optional user facilities

Optional user facilities may be selected by the user or subscriber at the time the service is being used. Each optional user facility visible to the user is classified as either essential or additional. Essential (E) optional user facilities *are* to be made available internationally by Administrations. Additional (A) optional user facilities *may* be made available by Administrations for national use and for international use on the basis of bilateral agreement.

The major terms used in this Recommendation are contained in Annex H.

The classification of optional user facilities is shown in Table 1/F.500.

TABLE 1/F.500

Classification of optional user facilities

	Classification
Abandon	E (see Note 1)
Add	A
Additional service controls	A
Compare	A
Distribution lists	A
List	A
Management of access control	A (see Note 2)
Modify	A
Remove	A
Security capabilities	A
Time limit service control	E

Note 1 - This abandon operation is not guaranteed outside of the local scope, i.e., the DSA or DMD to which the original request was made.

Note 2 - The full functionality is presently not provided in the present system specification of the X.500 series of Recommendations (see X.501, § 3 and Annex F). This is for further study and referred to as being presently a national matter. Access control functions are for further study.

Other optional user facilities are for further study.

4.3 Further features and facilities

Some of the following items are not yet specified as elements of service in the X.500 series of Recommendations and will be studied further. Some others will need further study under

service aspects. The following list may provisionally be considered as guidance for service providers to be taken into account for the provision of public directory services under national responsibility. The items may become basic features or optional user facilities in the future or/and will be included with descriptive text in future Recommendations.

- Provision of inverted directories for telex and teletex services.
- Provision of additional information with or after the result of a query.
- Provision of query cost information.
- Provision of information about services, service instructions, tariffs, etc., in standardized formats taking into account additional attributes.
- Provision of additional service controls.
- Provision of full functionality of access control mechanisms.
- The ability of the user to indicate the desire not to receive partial results when service control maximum parameters are exceeded.
- Provision of the return of multiple responses in groups of *n* (*n* = any number).
- Provision of administrative procedures for authentication.
- Provision of standardized error service messages.
- Provision of shadowing (controlled replication) of directory information.
- Provision of geographical extension.
- Consequences of distributed directory services.

4.4 Service controls

Because of its generality and scope, the direcory service can fulfill subscribers' requests that might require consumption of resources beyond a level desired by the subscriber or by the service provider. Service controls help to prevent such situations by imposing limits on the resources that may be consumed in fulfilling a request for service. Service controls not impacting the provision of international directory services are a local matter. The following service controls are provided by the system application (see Recommendation X.511):

4.4.1 Prefer chaining

This service control indicates a choice for chaining over referral and multicasting. For the international intercommunication of public directories, chaining is the preferred choice.

The setting of this service control is for the service provider who may allow the user to invoke it.

4.4.2 Chaining prohibited

The scope of a search will then be limited to the local portion of the Directory Information Base (DIB) by prohibiting chaining.

The setting of this service control is for the service provider who may allow the user to invoke it.

4.4.3 Local scope

The scope of the operation will be limited to the local portion of the DIB. The determination of local is restricted to a single DSA or DMD in accordance with an Administration's policy.

For the international intercommunication of public directories, generally no limitation to local scope is assumed. Public directories will aim to open their scope as much as possible. The setting of this service control is for the service provider who may allow the user to invoke it.

4.4.4 Do not use copy

This service prevents a DMD from returning copied information.

The setting of this service control is for the service provider who may allow the user to invoke it.

4.4.5 Do not dereference alias

This service control allows reference to an alias entry itself rather than to the aliased entry.

The setting of this service control is for the service provider.

4.4.6 Priority: low, medium, high

The setting of this service control is for the service provider.

The usefulness of this service control is for further study.

4.4.7 Time limit

The scope of this service control is to limit an operation in terms of total elapsed time such that if the limit is exceeded, then the operation will be terminated, and for search and list operations partial results should be returned, with the indication that results are incomplete due to the time limit. This service control *shall* be honoured by any DMD involved.

The setting of this service control is for the service provider who may allow the user to invoke it.

Note - This service control is an essential optional user facility. All service controls other than the time limit are a local matter and when implemented, need not be made available by the service provider to the user.

4.4.8 Size limit (applicable to search or list operations)

If the list size specified is exceeded any results equal in number to the size limit should be returned, with the indication that the results are incomplete due to the size limit.

The setting is for the service provider who may allow the user to invoke it.

4.4.9 Scope of referrals

Indicates the scope to which a referral (or advice), if generated, is to be restricted to, i.e., limits the range of alternate access points at which the requestor (DUA or DSA) may alternately use to satisfy the request. The limitation can be restricted to a country or DMD.

The setting of this service control is for the service provider who may allow the user to invoke it.

Note - Combination of some service controls may affect the quality of the results, e.g., combination of priority, time limit and size limit may conflict, or chaining cannot be both preferred and prohibited simultaneously. If no service controls are supplied with an operation, the following is assumed: referrals and/or chained operations may be used; no limit on the scope of the operation; locally held copies of information are permitted; no preference of priority for operation processing; there is no time or size constraint; referrals, if generated, are not restricted to a DMD or country; and aliases are dereferenced.

5 Names as the key to directory searches

5.1 General

A *name* within the directory service is a label which is constructed to identify a particular object, that is, which singles out an object from the set of all objects. A name should not be ambiguous, that is, should *not* denote more than one object. However, there may be more than one name for an object. Thus, it is possible to call an object by the name *International Widget Makers* or IWM. In either case, one and only one object is identified.

A more abstract definition of “name” can be found in Annex H.

5.2 Entries

The directory service will provide information about entries. The complete set of such information is called the Directory Information Base (DIB). The information about entries is composed of attributes; attributes, in turn, are composed of an attribute type (one type of attribute could be a telex number) and one or more attribute values. (The actual telex number would be a value.) The entries are arranged in a tree, called the Directory Information Tree (DIT). This is graphically illustrated in Figure 1/F.500. However, this does not preclude other directory information structures.

Thus, an entry may be viewed as an entity which is named through one or a series of attributes. A company may be sufficiently named simply through the use of its actual legal name e.g., the PADRAIC STEEL CO. A plumber in Secausus, N.J. can be named through the use of his common name, his postal address and his business category “plumber”. A human person may be named through the use of his or her common name and telephone number.

5.3 Distinguished names

It should be noted that within the directory system recommendations, the term “distinguished name” is used. This is the combination of the minimum attribute value assertions (AVAs) needed to denote an entry uniquely. This minimum will be established in accordance with the requirements of the naming authority and/or the directory management domain, and the preference of the owner of tne entry named. Use of the distinguished name may be of assistance in performing the most effective search of the DIB. However, it should be recognized that in some instances, distinguished names may not be user friendly and may contain information, which, in fact, is the object of the directory search, i.e., a person's postal address.

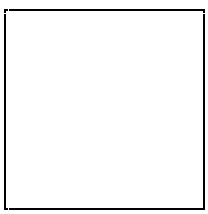

Figure 1/F.500

5.4 Classification of requests

To satisfy the most common needs of directory users which are presently met by so-called “white pages” or “yellow pages” (classified directories) or organization directories, three classifications of requests to the directory service are provided.

5.4.1 Common name requests (type 1)

Information returned under this type of request includes information about one or more of the following entries. (Selected object classes can be found in Recommendation X.521; they are listed in Annex C.)

a) A person

Example: Bernadette L. Casey

b) A residential person

Example: Cornelius Fecit

2 Humbug Road

Fun City, New York 11666

USA

c) An application entity

Example: Some logical name, usually a sequence of alpha and/or numeric characters identifying an application process; consequently not necessarily user friendly.

d) A communication device

Example: the XYZ 9.6 modem (however, this information is normally associated with an organization and is thus generally of greatest utility to organizations).

e) An alias

Example: Neil Fecit [an alias for the residential person in b)]

f) An organizational role

Example: Director of regulatory affairs

g) A group of names

Example: Members of special rapporteur's group Question 14/1.

5.4.2 Business category requests (type 2)

Information returned under this type of request includes information about one or more of the following entries. (Selected object classes can be found in Recommendation X.521; they are listed in Annex C.)

a) A person

Example: John Smith

b) A residential person

Example: John Smith, with the rest of the postal address

c) An organization

Example: The Padraic Steel Company

d) An organizational unit

Example: Regulatory Affairs Department

e) A group of names

Example: The plumbers in Secausus

5.4.3 Organization requests (type 3)

Information returned under this type of request includes information about one or more of the following entries. (Selected object classes can be found in Recommendation X.521; they are listed in Annex C.)

a) An organization
   Example: The Padraic Steel Company
b) An organizational unit
   Example: Regulatory Affairs Dept.
c) An organizational person
   Example: John Jones, Padraic Steel Company
d) An organization role
   Example: Chief Operating Office
e) A group of names
   Example: The President's Staff
f) An application entity
   Example: as above in § 5.4.1 c)
g) A device
   Example: An XYZ 9.6 modem
h) An organizational unit alias
   Example: the “bean counters” which is an alias for the “Controller's Dept.”
i) An organizational name alias
   Example: GMC for “Good Modern Cooks Inc.”

5.4.4 Use of attributes

Attribute types that are recommended to be included, whenever they exist (subject to the permission of the owner) in each entry of each group, either for query or retrieval, are listed in Table 2/F.500 (see also Annex D).

TABLE 2/F.500

Use of attributes for each type of request

Attribute type	Abbreviation	for Type 1	for Type 2	for Type 3
Business category	BCTG	-	M	R
Common name	COM	M	Q	Q
Country name	CTN	M	M	M
Description (free text)	DES	R	R	R
Destination indicator (public telegram)	DI	-	-	-
Facsimile telephone number	FAX	-	Q	Q
ISDN address	ISDN	-	Q	Q
Knowledge information	KI	-	-	-
Locality name	LOC	M	Q	Q
Member	MEM	R	R	R
Object class	CLASS	Q	Q	Q
O/R address (MHS) (see Note 1)	O/R	R	R	Q
Organization name	ORG	-	-	M
Organizational unit name	OUN	-	-	Q
Owner	OWN	-	-	-
Physical delivery office name	PDO	Q	Q	Q
Post office box	POB	Q	Q	Q
Postal address	PADD	Q	Q	Q
Postal code (see Note 2)	PCOD	Q	Q	Q
Preferred delivery method	DLM	R	R	R
Presentation address	PRADD	R	-	R
Registred address (public telegram)	RADD	-	R	R
Role occupant	RO	R	-	R
Search guide	SG	R	R	R

See also	SEE	R	R	R
Serial number	SN	-	-	-
State or province name	STN	M (see Note 3)	Q	Q
Street address	SADD	Q	Q	Q
Supported application context	SAC	Q	Q	Q
Surname	SUR	Q	Q	Q
Telephone number	TEL	Q	Q	Q
Teletex terminal identifier	TTX	R	Q	Q
Telex answerback (see Note 4)	A/B	R	R	R
Telex number	TLX	R	Q	Q
Title	TIT	-	-	Q
User certificate	UC	R	R	R
User password	UP	R	R	R
Videotex user number (see Note 4)	VTX	Q	Q	Q
X.121 address	X.121	-	Q	Q

Note 1 - This attribute type is defined in the X.400 series of Recommendations.

Note 2 - The postal address will normally contain the postal code. Requirements may exist to justify the postal code as being a separate attribute type. Specific conditions are applied to a postal address for Physical Delivery (see Recommendation F.401).

Note 3 - Depending on the value of the attribute “CTN”.

Note 4 - This attribute type has not yet been defined in Recommendation X.520.

M Mandatory to *reach* an object of this type.

Q May be used to reach an object of this type (within a distinguished name or as a search filter), but may also be part o the directory response. Additional attribute types may be used for selection criteria within national implementations.

R Normally part of the directory response with regard to the request of the user.

- This attribute type may either be part of a local sub-object class or used nationally.

Some terms used in Table 2/F.500 are explained in Annex H. Definitions of other terms can be found in the X.500 series of Recommendations.

5.5 Naming of entries

To reach an entry, a user has to provide some information, a part of which is essential to the performance of the request (e.g., the provision of attributes CTN, ORG, CLASS, for an organizational object), as described in § 5.2.

Depending on the knowledge the user has about the naming structure of the part of the directory information tree (DIT) to which the entry of the intended object belongs, the request information provided by this user to reach the intended entry is either the distinguished name of the entry (in which case the response is unique), or the value of some relevant search attributes (already known by the user) arranged in a logical pattern to act as a filter to reduce as far as possible the number of the directory responses.

Since distinguished names have to be unambiguous, it is not expected that they will always be user-friendly. For instance, a name of a residential person may include the telephone number and thus be rather difficult to predict, especially if the telephone number is the information requested from the directory. It is recognized that the distinguished name (DN) of an object may not be commonly known, in which case the DN may be acquired by using a list operation and in some instances a search operation.

To perform efficiently the search or list operation, it is recommended that one narrows as far as possible the scope of the search, either by giving a base object (from which the search starts in the DIT) near enough to the intended entry (in terms of DIT levels), or by obtaining and using the appropriate filtering.

It should be possible to obtain from the directory which of the attributes (qualified with “Q” in Table 2/F.500) may be used as part of the search filter for a given object class starting from a given base object. However, it is recognized that the use of this feature across domain boundaries is subject to national restrictions and bilateral agreements.

It is expected in most cases that a directory management domain will be able to provide from previous experience the useful search criteria of subordinate levels, whether or not they efficiently manage those levels, without exploring the DIT further for each request. Knowledge of the search criteria may also be acquired by DUAs from the directory by automatic means, e.g., by reading the “search guide attribute” if available.

It is up to the Directory Management Domain (DMD) managing a given entry to select from the attribute types specified in § 5.4 for use as search criteria.

The use of wildcards to replace the value or part of the value of unknown recommended search criteria should be made possible.

Phonetic or orthographic extensions, when requested, may be *locally* applied to the provided values for query operations. However, their actual provision depends on the capabilities of the directory system. The fall-back mode is phonetic or orthographic extensions not supported.

5.6 Qualifications of attribute types

Some criteria of the selected attribute types require qualification.

“Mandatory” in Table 3/F.500 indicates that, if *that* attribute type exists in an entry of the directory, it shall be part of any response provided, when asked for by the user, and that no combination of access controls may be kept on attributes which would preclude provision of a meaningful directory service, subject to the owner's approval.

The “required length” of an attribute type in Table 3/F.500 designates the minimum number of character positions to be made available for the attribute type to be displayed on the terminal of a user, and can therefore assist Administrations in defining their attribute values with the assurance that the attribute value will not be truncated. (The X.500-series Recommendations have system qualifications for the maximum length of attribute types.)

The system specification does not provide multiple values for country name and preferred delivery method. All others may be recurring. For example, an organization may be “Padraic Steel” and “Padraic Steel Company”. Only one value needs to be displayed to the user.

Table 3/F.500 contains a list of the user-visible selected attribute types to be used in the directory service. The figures shown may require revision in the light of experience.

TABLE 3/F.500

Qualifications of attribute types

Attribute type	Mandatory	Required length
Business category	Yes	128
Common name	Yes	64
Country name (see Note 1)	Yes	30
Description	Yes	1024
Destination indicator (public telegram)	Yes	4
Facsimile telephone number	No	150
ISDN addresse	No	16
Knowledge-information	No	-
Locality name	Yes	64
Member	No	-
Object class	No	-
O/R address MHS (see Note 2)	Yes	-
Organization name	Yes	64
Organizational unit name	Yes	64
Owner	No	-
Physical delivery office name	No	64
Post office box	No	40
Postal address	No	180
Postal code (see Note 2)	No	20
Preferred delivery method (see Note 3)	Yes	15
Presentation address	No	-
Registered address (public telegram)	Yes	60
Role occupant	No	-
Search/Guide	Yes	-

See also	Yes	-
Serial number	No	64
State or province	Yes	64
Street address	No	64
Supported application context	No	-
Surname	No	64
Telephone number	No	16
Teletex terminal identifier	No	24
Telex answerback (see Note 2)	No	21
Telex number (see Note 3)	No	36
Title	No	64
User password	No	-
User certificate	No	-
Videotex user number (see Note 2)	No	17
X.121 address	No	15

Note 1 - The system specification provides only a 2-character length, to correspond to the ISO 3166 value.

Note 2 - The postal address will normally contain the postal code. Requirements may exist to justify the postal code as being a separate attribute type. Specific conditions are applied to a postal address for Physical Delivery (see Recommendation F.401).

Note 3 - The system specification provides a shorter field.

Note 4 - For some attribute types, values are stored in encoded/compressed format and will need to be displayed in a non-encoded format or human readable format.

Note 5 - See also Recommendation X.520, Annex C.

6 Character repertoire and languages

6.1 Character repertoire

Directory information will be entered and stored locally using a character repertoire suitable to the country where the directory is located. More than one character repertoire may be needed to cover different languages or to provide for access from different types of communication terminals.

However, in order to provide international public service, the character repertoire to be used internationally should be limited to CCITT standardized sets, i.e., the IA5 and T.61 character repertoires.

For the intercommunication between public directory services, the repertoires may be agreed to bilaterally.

However, where no such agreement exists, the character repertoire to be used shall consist only of those characters defined as “printable string” in Recommendation X.208. Furthermore, those Administrations which use character reportoires other than this repertoire shall provide suitable conversion of the information into this character repertoire for directory requests from Administrations with which no bilateral agreement has been reached.

Subscribers have to be instructed on the use of the appropriate character repertoires.

6.2 Language of requests to the directory and responses from the directory

Subject to the conditions in § 6.1, the results of requests to the directory should normally be provided in the language or languages of the DMD providing the information. However, the information is presented to the requestor is a national matter.

7 Display of a response

Attribute types and values will be displayed to the user, when required, by converting the values in accordance with Recommendation X.408.

Though it is logical enough that the right response always be sought, in some cases where no such answer can be provided, and on explicit request of the requestor, the directory may also provide phonetic and orthographic extensions corresponding to the intended object.

For displaying directory responses, the following order is recommended:

a) the right answer(s);

b) the answer(s) approaching the right answer(s) using conjunctions, particles, articles, as well as extended or concatenated abbreviations;

c) the phonetic and orthographic extensions (e.g. plural instead of singular denominations). It should be noted that such responses may be erroneous.

Partial responses, including referrals, should be displayed to the requestor and properly identified as such. The cause for partial responses should also be displayed.

8 Operational issues

8.1 Management

It is the responsibility of the Directory Management Domains (DMDs) to exercise the management of information within their Domains. Inter-Domain Management is for further study.

8.2 Authentication

Authentication in this context means that the identity of the subscriber or user is established. In some cases, the directory service has to ensure that directory information is released only to authorized requestor(s), and in some cases it has to ensure that data is modified only by an authorized originator (e.g., by employing techniques related to data origin authentication).

Checking and keeping of credentials, when performed, are at the discretion of the DMD, taking into account the requirements of privacy of the owner of the information. The precise reason for credential failure will be masked from the user. The user will be advised that denial of the request was because an inappropriate authentication level was encountered.

See also Recommendation X.509.

Further study is required.

8.3 Access control

Access controls are a national matter. When access control prohibits the return of the information requested, an appropriate code error code will be returned.

Note - The international application of access control is for further study.

8.4 Operational actions

Actions performed within a directory can be categorized as:

1) primary (subscriber/directory) action - always in direct support of a subscriber;
2) secondary action in support of a subscriber request, either serving the subscriber's DUA or an intermediary DSA.

These actions are qualitatively different, and differ also in what they imply concerning the obligations of an ADDMD.

Examples of such interactions can be found in Recommendation X.518.

8.4.1 Primary (subscriber/directory) action

The public directory service should provide three user-visible activities of support, as follows:

a) Request formation

In this activity, the subscriber composes a request to the directory. The way in which these functions are performed is a national matter.

b) Presentation of results

In this activity, the directory service presents to the subscriber the results of a previously entered request. The format, presentation medium and other aspects of result presentation are a national matter.

c) Subscriber assistance

In this activity, the directory service assists the subscriber by providing instructions on the use of the directory. The means through which the subscriber asks for such instruction, and the manner in which an instruction is delivered, are a national matter.

8.4.2 Secondary action for subscriber support

In order to provide the public directory service, DMDs shall cooperate. Such cooperation includes adherence to defined patterns of interaction, and also includes provision of requested directory information to one another, subject only to internationally agreed access controls (or bilateral arrangements). This technical cooperation among DMDs implies an equivalent level of cooperation in service terms, especially with regard to information sharing, among the DMDs. Examples of such interaction can be found in Recommendation X.518.

8.5 Maintenance of the directory information

The service provider has to ensure integrity of the information contained in the directory. Shadowing (controlled replication) of information in other DMDs is *permitted* by bilateral agreement. The international application is for further study.

Creation and modification of directory information by the subscribers may be permitted by the DMDs concerned.

8.6 Error handling

Error conditions will be returned as a value of an error code for all standardized operations. The meaning will be displayed according to national implementations as service error messages to the user.

See Annex B/F.500 for guidance.

8.7 Operator assistance

For further study.

9 Quality of service aspects

9.1 Availability

In principle, a public directory service should be available to subscribers 24 hours a day, seven days a week.

9.2 Security of directory information

Information in public directories should be given the broadest dissemination. However, subscribers or users about whom information is available in a directory should be able to require the entity charged with the management of the directory to limit access to such information to ensure their own privacy.

9.3 Successful directory requests

Normally, a successful directory request will result in a report of all the requested information, unless it is denied because of authorization restrictions.

Requests to the directory which do not provide sufficient information to execute a reasonable search will normally not lead to a successful result.

9.4 Access

Providers of a public directory service should ensure that an adequate number of access ports are available to accommodate subscribers' requests for information. In principle, this means that a requestor will receive a prompt within 15 seconds as a goal.

9.5 Response time

Recognizing that responses to requests will be controlled in part by the level of ambiguity tolerated in requests and the number of DMDs which shall be traversed to retrieve the information requested, a subscriber normally should expect an initial acknowledgement regarding his request within 5 seconds. The scope and priority of the request may have an impact on the response time. The requestor may terminate his request at any time.

A final response (successful or unsuccessful) will depend on the capabilities of the directories consulted. A response indicating that no information or incomplete information is available (possibly with hints for further searches) should be given within one minute.

Note - The figures for quality of service are provisional and may be revised in the future.

10 References

10.1 Recommendations of the X.500 series - Data communication networks: directory

X.500 The directory - Overview of concepts, models and services

X.501 The directory - Models

X.509 The directory - Authentication framework

X.511 The directory - Abstract service definition

X.518 The directory - Procedures for distributed operation

X.519 The directory - Protocol specification

X.520 The directory - Selected attribute types

X.521 The directory - Selected object classes

10.2 *Recommendations of the X.200 series* - Data communication networks: open systems interconnection (OSI)

10.3 *Recommendations of the F.400 series* - Message handling and directory services operations and definition of service

10.4 *Recommendations of the X.400 series* - Data communication networks: message handling systems