
**Information technology — Open Systems
Interconnection — The Directory:
Selected attribute types**

*Technologies de l'information — Interconnexion de systèmes ouverts
(OSI) — L'Annuaire: Types d'attributs sélectionnés*

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Published by ISO in 2000

Printed in Switzerland

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO/IEC 9594 may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

International Standard ISO/IEC 9594-6 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation X.520.

This third edition cancels and replaces the second edition (ISO/IEC 9594-6:1995), of which it constitutes a minor revision.

ISO/IEC 9594 consists of the following parts, under the general title *Information technology — Open Systems Interconnection — The Directory*:

- *Part 1: Overview of concepts, models and services*
- *Part 2: Models*
- *Part 3: Abstract service definition*
- *Part 4: Procedures for distributed operation*
- *Part 5: Protocol specifications*
- *Part 6: Selected attribute types*
- *Part 7: Selected object classes*
- *Part 8: Authentication framework*
- *Part 9: Replication*
- *Part 10: Use of systems management for administration of the Directory*

Annex A forms a normative part of this part of ISO/IEC 9594. Annexes B to E are for information only.

Introduction

This Recommendation | International Standard, together with other Recommendations | International Standards, has been produced to facilitate the interconnection of information processing systems to provide directory services. A set of such systems, together with the directory information which they hold, can be viewed as an integrated whole, called the *Directory*. The information held by the Directory, collectively known as the Directory Information Base (DIB), is typically used to facilitate communication between, with or about objects such as application entities, people, terminals, and distribution lists.

The Directory plays a significant role in Open Systems Interconnection, whose aim is to allow, with a minimum of technical agreement outside of the interconnection standards themselves, the interconnection of information processing systems:

- from different manufacturers;
- under different managements;
- of different levels of complexity; and
- of different ages.

This Recommendation | International Standard defines a number of attribute types which may be found useful across a range of applications of the Directory, as well as a number of standard attribute syntaxes and matching rules. One particular use for many of the attributes defined herein is in the formation of names, particularly for the classes of object defined in ITU-T Rec. X.521 | ISO/IEC 9594-7.

This third edition technically revises and enhances, but does not replace, the second edition of this Recommendation | International Standard. Implementations may still claim conformance to the second edition. However, at some point, the second edition will not be supported (i.e. reported defects will no longer be resolved). It is recommended that implementations conform to this third edition as soon as possible.

This third edition specifies version 1 and version 2 of the Directory protocols.

The first and second editions also specified version 1. Most of the services and protocols specified in this edition are designed to function under version 1. When version 1 has been negotiated differences between the services and between the protocols defined in the three editions are accommodated using the rules of extensibility defined in this edition of ITU-T Rec. X.519 | ISO/IEC 9594-5. However some enhanced services and protocols, e.g. signed errors, will not function unless all Directory entities involved in the operation have negotiated version 2.

Implementors should note that a defect resolution process exists and that corrections may be applied to this part of this International Standard in the form of technical corrigenda. The identical corrections will be applied to this Recommendation in the form of corrigenda and/or an Implementor's Guide. A list of approved technical corrigenda for this part of this International Standard can be obtained from the subcommittee secretariat. Published technical corrigenda are available from your national standards organization. The ITU-T corrigenda and Implementor's Guides may be obtained from the ITU Web site.

Annex A, which is an integral part of this Recommendation | International Standard, provides the ASN.1 notation for the complete module which defines the attributes, attribute syntaxes, and matching rules.

Annex B, which is not an integral part of this Recommendation | International Standard, provides a table of attribute types, for easy reference.

Annex C, which is not an integral part of this Recommendation | International Standard, provides suggested upper bounds value constraints used in these Directory Specifications.

Annex D, which is not an integral part of this Recommendation | International Standard, lists alphabetically the attributes and matching rules defined in this Directory Specification.

Annex E, which is not an integral part of this Recommendation | International Standard, lists the amendments and defect reports that have been incorporated to form this edition of this Recommendation | International Standard.

INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN SYSTEMS INTERCONNECTION – THE DIRECTORY: SELECTED ATTRIBUTE TYPES

SECTION 1 – GENERAL

1 Scope

This Recommendation | International Standard defines a number of attribute types and matching rules which may be found useful across a range of applications of the Directory.

Attribute types and matching rules fall into three categories, as described below.

Some attribute types and matching rules are used by a wide variety of applications or are understood and/or used by the Directory itself.

NOTE – It is recommended that an attribute type or matching rule defined in this document be used, in preference to the generation of a new one, whenever it is appropriate for the application.

Some attribute types and matching rules are internationally standardized, but are application-specific. These are defined in the standards associated with the application concerned.

Any administrative authority can define its own attribute types and matching rules for any purpose. These are not internationally standardized, and are available to others beyond the administrative authority which created them only by bilateral agreement.

2 Normative references

The following Recommendations and International Standards contain provisions which, through reference in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation X.200 (1994) | ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The Basic Model.*
- ITU-T Recommendation X.500 (1997) | ISO/IEC 9594-1:1998, *Information technology – Open Systems Interconnection – The Directory: Overview of concepts, models and services.*
- ITU-T Recommendation X.501 (1997) | ISO/IEC 9594-2:1998, *Information technology – Open Systems Interconnection – The Directory: Models.*
- ITU-T Recommendation X.509 (1997) | ISO/IEC 9594-8:1998, *Information technology – Open Systems Interconnection – The Directory: authentication framework.*
- ITU-T Recommendation X.511 (1997) | ISO/IEC 9594-3:1998, *Information technology – Open Systems Interconnection – The Directory: Abstract service definition.*
- ITU-T Recommendation X.518 (1997) | ISO/IEC 9594-4:1998, *Information technology – Open Systems Interconnection – The Directory: Procedures for distributed operation.*

- ITU-T Recommendation X.519 (1997) | ISO/IEC 9594-5:1998, *Information technology – Open Systems Interconnection – The Directory: Protocol specifications.*
- ITU-T Recommendation X.521 (1997) | ISO/IEC 9594-7:1998, *Information technology – Open Systems Interconnection – The Directory: Selected object classes.*
- ITU-T Recommendation X.525 (1997) | ISO/IEC 9594-9:1998, *Information technology – Open Systems Interconnection – The Directory: Replication.*
- ITU-T Recommendation X.530 (1997) | ISO/IEC 9594-10:1998, *Information technology – Open Systems Interconnection – The Directory: Use of system management for Administration of the Directory.*
- ITU-T Recommendation X.680 (1997) | ISO/IEC 8824-1:1998, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation.*
- ITU-T Recommendation X.681 (1997) | ISO/IEC 8824-2:1998, *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification.*
- ITU-T Recommendation X.682 (1997) | ISO/IEC 8824-3:1998, *Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification.*
- ITU-T Recommendation X.683 (1997) | ISO/IEC 8824-4:1998, *Information technology – Abstract Syntax Notation One (ASN.1): Parametrization of ASN.1 specifications.*

2.2 Other references

- CCITT Recommendation E.123 (1988), *Notation for National and International Telephone numbers.*
- ITU-T Recommendation E.164 (1997), *The international public telecommunication numbering plan.*
- ITU-T Recommendation F.1 (1998), *Operational provisions for the international public telegram service.*
- CCITT Recommendation F.31 (1988), *Telegram retransmission system.*
- CCITT Recommendation F.401 (1992), *Naming and addressing for public message handling services.*
- ITU-T Recommendation T.30 (1996), *Procedures for document facsimile transmission in the general switched telephone network.*
- ITU-T Recommendation T.62 (1993), *Control procedures for teletex and Group 4 facsimile services.*
- ITU-T Recommendation X.121 (1996), *International numbering plan for public data networks.*
- ISO 3166 (all parts), *Codes for the representation of names of countries and their subdivisions.*
- ISO 639-2:1998, *Codes for the representation of names of languages – Part 2: Alpha 3 code.*
- ISO/IEC 9945-2:1993, *Information technology – Portable Operating System Interface (POSIX) – Part 2: Shell and Utilities.*

3 Definitions

For the purposes of this Recommendation | International Standard, the following definitions apply.

The following terms are defined in ITU-T Rec. X.501 | ISO/IEC 9594-2:

- a) *attribute type;*
- b) *object class;*
- c) *matching rule.*

4 Conventions

With minor exceptions, this Directory Specification has been prepared according to the "Presentation of ITU-T | ISO/IEC common text" guidelines in the Guide for ITU-T and ISO/IEC JTC 1 Cooperation.

The term "Directory Specification" (as in "this Directory Specification") shall be taken to mean ITU-T Rec. X.520 | ISO/IEC 9594-6. The term "Directory Specifications" shall be taken to mean the X.500-series Recommendations | parts of ISO/IEC 9594.

This Directory Specification uses the term "1988 edition systems" to refer to systems conforming to the first (1988) edition of the Directory Specifications, i.e. the 1988 edition of the series of CCITT X.500 Recommendations and the ISO/IEC 9594:1990 edition. This Directory Specification uses the term "1993 edition systems" to refer to systems conforming to the second (1993) edition of the Directory Specifications, i.e. the 1993 edition of the series of ITU-T X.500 Recommendations and the ISO/IEC 9594:1995 edition. Systems conforming to this third edition of the Directory Specifications are referred to as "1997 edition systems".

This Directory Specification presents ASN.1 notation in the bold Helvetica typeface. When ASN.1 types and values are referenced in normal text, they are differentiated from normal text by presenting them in the bold Helvetica typeface. The names of procedures, typically referenced when specifying the semantics of processing, are differentiated from normal text by displaying them in bold Times. Access control permissions are presented in italicized Times.

Attribute types and matching rules are defined in this Recommendation | International Standard by use of the **ATTRIBUTE** and **MATCHING-RULE** information object classes defined in ITU-T Rec. X.501 | ISO/IEC 9594-2.

Examples of the use of the attribute types are described using an informal notation, where attribute type and value pairs are represented by an acronym for the attribute type, followed by an equals sign ("="), followed by the example value for the attribute.

SECTION 2 – SELECTED ATTRIBUTE TYPES

5 Definition of selected attribute types

This Directory Specification defines a number of attribute types which may be found useful across a range of applications of the Directory.

Many of the attributes defined in this Specification are based on a common ASN.1 syntax:

```
DirectoryString { INTEGER : maxSize } ::= CHOICE {
    teletexString      TeletexString (SIZE (1..maxSize)),
    printableString    PrintableString (SIZE (1..maxSize)),
    bmpString          BMPString (SIZE (1..maxSize)),
    universalString    UniversalString (SIZE (1..maxSize)) }
```

Some implementations of the Directory do not support **BMPString** or **UniversalString**, and will not be able to generate, match, or display attributes having such a syntax.

5.1 System attribute types

5.1.1 Knowledge Information

The *Knowledge Information* attribute type specifies a human readable accumulated description of knowledge mastered by a specific DSA.

NOTE – This attribute is now obsolete.

```
knowledgeInformation ATTRIBUTE ::= {
    WITH SYNTAX
    EQUALITY MATCHING RULE
    ID
    DirectoryString {ub-knowledge-information}
    caseIgnoreMatch
    id-at-knowledgeInformation }
```

5.2 Labelling attribute types

These attributes type are concerned with information about objects which has been explicitly associated with the objects by a labelling process.

5.2.1 Name

The *Name* attribute type is the attribute supertype from which string attribute types typically used for naming may be formed.

```
name ATTRIBUTE ::= {
    WITH SYNTAX
    EQUALITY MATCHING RULE
    SUBSTRINGS MATCHING RULE
    ID
    DirectoryString {ub-name}
    caseIgnoreMatch
    caseIgnoreSubstringsMatch
    id-at-name }
```

5.2.2 Common Name

The *Common Name* attribute type specifies an identifier of an object. A Common Name is not a directory name; it is a (possibly ambiguous) name by which the object is commonly known in some limited scope (such as an organization) and conforms to the naming conventions of the country or culture with which it is associated.

An attribute value for common name is a string chosen either by the person or organization it describes or the organization responsible for the object it describes for devices and application entities. For example, a typical name of a person in an English-speaking country comprises a personal title (e.g. Mr., Ms., Rd, Professor, Sir, Lord), a first name, middle name(s), last name, generation qualifier (if any, e.g. Jr.) and decorations and awards (if any, e.g. QC).

Examples:

CN = "Mr. Robin Lachlan McLeod BSc(Hons) CEng MIEE";

CN = "Divisional Coordination Committee";

CN = "High Speed Modem".

Any variants should be associated with the named object as separate and alternative attribute values.

Other common variants should also be admitted, e.g. use of a middle name as a preferred first name; use of "Bill" in place of "William", etc.

commonName ATTRIBUTE	::=	{
SUBTYPE OF		name
WITH SYNTAX		DirectoryString {ub-common-name}
ID		id-at-commonName }

5.2.3 Surname

The *Surname* attribute type specifies the linguistic construct which normally is inherited by an individual from the individual's parent or assumed by marriage, and by which the individual is commonly known.

An attribute value for Surname is a string, e.g. "McLeod".

surname ATTRIBUTE	::=	{
SUBTYPE OF		name
WITH SYNTAX		DirectoryString {ub-surname}
ID		id-at-surname }

5.2.4 Given Name

The *Given Name* attribute type specifies the linguistic construct which is normally given to an individual by the individual's parent, or is chosen by the individual, or by which the individual is commonly known.

An attribute value for Given Name is a string, e.g. "David", or "Jean Paul".

givenName ATTRIBUTE	::=	{
SUBTYPE OF		name
WITH SYNTAX		DirectoryString {ub-name}
ID		id-at-givenName }

5.2.5 Initials

The *Initials* attribute type contains the initials of some or all of an individual's names, but not the surname(s).

An attribute value for Initials is a string, e.g. "D" or "D." or "J.P.".

initials ATTRIBUTE	::=	{
SUBTYPE OF		name
WITH SYNTAX		DirectoryString {ub-name}
ID		id-at-initials }

5.2.6 Generation Qualifier

The *Generation Qualifier* attribute type contains a string which is used to provide generation information to qualify an individual's name.

An attribute value for Generation Qualifier is a string, e.g. "Jr." or "II".

```

generationQualifier ATTRIBUTE ::= {
  SUBTYPE OF           name
  WITH SYNTAX         DirectoryString {ub-name}
  ID                  id-at-generationQualifier }

```

5.2.7 Unique Identifier

The *Unique Identifier* attribute type specifies an identifier which may be used to distinguish between object references when a distinguished name has been reused. It may be, for example, an encoded object identifier, certificate, date, timestamp, or some other form of certification on the validity of the distinguished name.

An attribute value for Unique Identifier is a bit string.

```

uniqueIdentifier ATTRIBUTE ::= {
  WITH SYNTAX         UniqueIdentifier
  EQUALITY MATCHING RULE bitStringMatch
  ID                  id-at-uniqueIdentifier }
UniqueIdentifier ::= BIT STRING

```

5.2.8 DN Qualifier

The *DN Qualifier* attribute type specifies disambiguating information to add to the relative distinguished name of an entry. It is intended to be used for entries held in multiple DSAs which would otherwise have the same name, and that its value be the same in a given DSA for all entries to which this information has been added.

```

dnQualifier ATTRIBUTE ::= {
  WITH SYNTAX         PrintableString
  EQUALITY MATCHING RULE caseIgnoreMatch
  ORDERING MATCHING RULE caseIgnoreOrderingMatch
  SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
  ID                  id-at-dnQualifier }

```

5.2.9 Serial Number

The *Serial Number* attribute type specifies an identifier, the serial number of a device.

An attribute value for Serial Number is a printable string.

```

serialNumber ATTRIBUTE ::= {
  WITH SYNTAX         PrintableString (SIZE (1..ub-serialNumber))
  EQUALITY MATCHING RULE caseIgnoreMatch
  SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
  ID                  id-at-serial-number }

```

5.3 Geographical Attribute Types

These attribute types are concerned with geographical positions or regions with which objects are associated.

5.3.1 Country Name

The *Country Name* attribute type specifies a country. When used as a component of a directory name, it identifies the country in which the named object is physically located or with which it is associated in some other important way.

An attribute value for country name is a string chosen from ISO 3166.

```

countryName ATTRIBUTE ::= {
  SUBTYPE OF         name
  WITH SYNTAX       CountryName
  SINGLE VALUE      TRUE
  ID                id-at-countryName }

```

CountryName ::= PrintableString (SIZE(2)) -- ISO 3166 codes only

5.3.2 Locality Name

The *Locality Name* attribute type specifies a locality. When used as a component of a directory name, it identifies a geographical area or locality in which the named object is physically located or with which it is associated in some other important way.

An attribute value for Locality Name is a string, e.g. L = "Edinburgh".

localityName ATTRIBUTE	::=	{
SUBTYPE OF		name
WITH SYNTAX		DirectoryString {ub-locality-name}
ID		id-at-localityName }

The *Collective Locality Name* attribute type specifies a locality name for a collection of entries.

collectiveLocalityName ATTRIBUTE	::=	{
SUBTYPE OF		localityName
COLLECTIVE		TRUE
ID		id-at-collectiveLocalityName }

5.3.3 State or Province Name

The *State or Province Name* attribute type specifies a state or province. When used as a component of a directory name, it identifies a geographical subdivision in which the named object is physically located or with which it is associated in some other important way.

An attribute value for State or Province Name is a string, e.g. S = "Ohio".

stateOrProvinceName ATTRIBUTE	::=	{
SUBTYPE OF		name
WITH SYNTAX		DirectoryString {ub-state-name}
ID		id-at-stateOrProvinceName }

The *Collective State or Province Name* attribute type specifies a state or province name for a collection of entries.

collectiveStateOrProvinceName ATTRIBUTE	::=	{
SUBTYPE OF		stateOrProvinceName
COLLECTIVE		TRUE
ID		id-at-collectiveStateOrProvinceName }

5.3.4 Street Address

The *Street Address* attribute type specifies a site for the local distribution and physical delivery in a postal address, i.e. the street name, place, avenue, and the house number. When used as a component of a directory name, it identifies the street address at which the named object is located or with which it is associated in some other important way.

An attribute value for Street Address is a string, e.g. "Arnulfstraße 60".

streetAddress ATTRIBUTE	::=	{
WITH SYNTAX		DirectoryString {ub-street-address}
EQUALITY MATCHING RULE		caseIgnoreMatch
SUBSTRINGS MATCHING RULE		caseIgnoreSubstringsMatch
ID		id-at-streetAddress }

The *Collective Street Address* attribute type specifies a street address for a collection of entries.

collectiveStreetAddress ATTRIBUTE	::=	{
SUBTYPE OF		streetAddress
COLLECTIVE		TRUE
ID		id-at-collectiveStreetAddress }

5.3.5 House Identifier

The *House Identifier* attribute type specifies a linguistic construct used to identify a particular building, for example a house number or house name relative to a street, avenue, town or city, etc.

An attribute value for House Identifier is a string, e.g. "14".

houseIdentifier ATTRIBUTE	::=	{
WITH SYNTAX		DirectoryString {ub-name}
EQUALITY MATCHING RULE		caseIgnoreMatch
SUBSTRINGS MATCHING RULE		caseIgnoreSubstringsMatch
ID		id-at-houseIdentifier }

5.4 Organizational attribute types

These attribute types are concerned with organizations and can be used to describe objects in terms of organizations with which they are associated.

5.4.1 OrganizationName

The *OrganizationName* attribute type specifies an organization. When used as a component of a directory name it identifies an organization with which the named object is affiliated.

An attribute value for OrganizationName is a string chosen by the organization (e.g. O = "Scottish Telecommunications plc"). Any variants should be associated with the named Organization as separate and alternative attribute values.

```
organizationName ATTRIBUTE ::= {
  SUBTYPE OF          name
  WITH SYNTAX         DirectoryString {ub-organization-name}
  ID                   id-at-organizationName }
```

The *Collective Organization Name* attribute type specifies an organization name for a collection of entries.

```
collectiveOrganizationName ATTRIBUTE ::= {
  SUBTYPE OF          organizationName
  COLLECTIVE          TRUE
  ID                   id-at-collectiveOrganizationName }
```

5.4.2 Organizational Unit Name

The *Organizational Unit Name* attribute type specifies an organizational unit. When used as a component of a directory name it identifies an organizational unit with which the named object is affiliated.

The designated organizational unit is understood to be part of an organization designated by an OrganizationName attribute. It follows that if an Organizational Unit Name attribute is used in a directory name, it must be associated with an OrganizationName attribute.

An attribute value for Organizational Unit Name is a string chosen by the organization of which it is part (e.g. OU = "Technology Division"). Note that the commonly used abbreviation "TD" would be a separate and alternative attribute value.

Example:

O = "Scottel", OU = "TD"

```
organizationalUnitName ATTRIBUTE ::= {
  SUBTYPE OF          name
  WITH SYNTAX         DirectoryString {ub-organizational-unit-name}
  ID                   id-at-organizationalUnitName }
```

The *Collective Organizational Unit Name* attribute type specifies an organizational unit name for a collection of entries.

```
collectiveOrganizationalUnitName ATTRIBUTE ::= {
  SUBTYPE OF          organizationalUnitName
  COLLECTIVE          TRUE
  ID                   id-at-collectiveOrganizationalUnitName }
```

5.4.3 Title

The *Title* attribute type specifies the designated position or function of the object within an organization.

An attribute value for Title is a string.

Example:

T = "Manager, Distributed Applications"

```
title ATTRIBUTE ::= {
  SUBTYPE OF          name
  WITH SYNTAX         DirectoryString {ub-title}
  ID                   id-at-title }
```

5.5 Explanatory attribute types

These attribute types are concerned with explanations (e.g. in a natural language) of something about an object.

5.5.1 Description

The *Description* attribute type specifies text which describes the associated object.

For example, the object "Standards Interest" might have the associated description "distribution list for exchange of information about intra-company standards development".

An attribute value for Description is a string.

description ATTRIBUTE	::=	{
WITH SYNTAX		DirectoryString {ub-description}
EQUALITY MATCHING RULE		caseIgnoreMatch
SUBSTRINGS MATCHING RULE		caseIgnoreSubstringsMatch
ID		id-at-description }

5.5.2 Search Guide

The *Search Guide* attribute type specifies information of suggested search criteria which may be included in some entries expected to be a convenient base-object for the search operation, e.g. country or organization.

Search criteria consist of an optional identifier for the type of object sought and combinations of attribute types and logical operators to be used in the construction of a filter. It is possible to specify for each search criteria item the matching level, e.g. approximate match.

The Search Guide attribute may recur to reflect the various types of requests, e.g. search for a Residential Person or an Organizational Person, which may be fulfilled from the given base-object where the Search Guide is read.

searchGuide ATTRIBUTE	::=	{
WITH SYNTAX		Guide
ID		id-at-searchGuide }
Guide	::=	SET {
objectClass	[0]	OBJECT-CLASS.&id OPTIONAL,
criteria	[1]	Criteria }
Criteria	::=	CHOICE {
type	[0]	CriteriaItem,
and	[1]	SET OF Criteria,
or	[2]	SET OF Criteria,
not	[3]	Criteria }
CriteriaItem	::=	CHOICE {
equality	[0]	AttributeType,
substrings	[1]	AttributeType,
greaterOrEqual	[2]	AttributeType,
lessOrEqual	[3]	AttributeType,
approximateMatch	[4]	AttributeType }

Example:

The following is a potential value of the Search Guide attribute that could be stored in entries of object class Locality to indicate how entries of object class Residential Person might be found:

```
residential-person-guide Guide ::= {
  objectClass residentialPerson.&id,
  criteria and : {
    type : substrings : commonName.&id,
    type : substrings : streetAddress.&id }}
```

The construction of a filter from this value of Guide is straightforward.

Step (1) produces the intermediate Filter value

```

intermediate-filter Filter ::=
and : {
  item : substrings {
    type commonName.&id,
    strings { any : teletexString : "Dubois" }},
  item : substrings {
    type streetAddress.&id,
    strings { any : teletexString : "Hugo" }}}

```

Step (2) produces a filter for matching Residential Person entries in the subtree:

```

residential-person-filter Filter ::=
and : {
  item : equality : {
    type objectClass.&id,
    assertion residentialPerson.&id },
  intermediateFilter }

```

5.5.3 Enhanced Search Guide

The *Enhanced Search Guide* attribute provides an enhancement of the **searchGuide** attribute, adding information about the recommended search depth for searches among subordinate objects of a given object class.

```

enhancedSearchGuide ATTRIBUTE ::= {
  WITH SYNTAX      EnhancedGuide
  ID                id-at-enhancedSearchGuide }

EnhancedGuide ::= SEQUENCE {
  objectClass      [0] OBJECT-CLASS.&id,
  criteria         [1] Criteria,
  subset          [2] INTEGER
  { baseObject (0), oneLevel (1), wholeSubtree (2) } DEFAULT oneLevel }

```

5.5.4 Business Category

The *Business Category* attribute type specifies information concerning the occupation of some common objects, e.g. people. For example, this attribute provides the facility to interrogate the Directory about people sharing the same occupation.

```

businessCategory ATTRIBUTE ::= {
  WITH SYNTAX      DirectoryString {ub-business-category}
  EQUALITY MATCHING RULE caseIgnoreMatch
  SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
  ID                id-at-businessCategory }

```

5.6 Postal Addressing attribute types

These attribute types are concerned with information required for physical postal delivery to an object.

5.6.1 Postal Address

The *Postal Address* attribute type specifies the address information required for the physical delivery of postal messages by the postal authority to the named object.

An attribute value for Postal Address will be typically composed of selected attributes from the MHS Unformatted Postal O/R Address version 1 according to CCITT Recommendation F.401 and limited to 6 lines of 30 characters each, including a Postal Country Name. Normally the information contained in such an address could include an addressee's name, street address, city, state or province, postal code and possibly a Post Office Box number depending on the specific requirements of the named object.

```

postalAddress ATTRIBUTE ::= {
  WITH SYNTAX      PostalAddress
  EQUALITY MATCHING RULE caseIgnoreListMatch
  SUBSTRINGS MATCHING RULE caseIgnoreListSubstringsMatch
  ID                id-at-postalAddress }

PostalAddress ::= SEQUENCE SIZE(1..ub-postal-line) OF DirectoryString {ub-postal-string}

```


The *Collective Postal Address* attribute type specifies a postal address for a collection of entries.

collectivePostalAddress ATTRIBUTE	::=	{
SUBTYPE OF		postalAddress
COLLECTIVE		TRUE
ID		id-at-collectivePostalAddress }

5.6.2 Postal Code

The *Postal Code* attribute type specifies the postal code of the named object. If this attribute value is present it will be part of the object's postal address.

An attribute value for Postal Code is a string.

postalCode ATTRIBUTE	::=	{
WITH SYNTAX		DirectoryString {ub-postal-code}
EQUALITY MATCHING RULE		caseIgnoreMatch
SUBSTRINGS MATCHING RULE		caseIgnoreSubstringsMatch
ID		id-at-postalCode }

The *Collective Postal Code* attribute type specifies a postal code for a collection of entries.

collectivePostalCode ATTRIBUTE	::=	{
SUBTYPE OF		postalCode
COLLECTIVE		TRUE
ID		id-at-collectivePostalCode }

5.6.3 Post Office Box

The *Post Office Box* attribute type specifies the Post Office Box by which the object will receive physical postal delivery. If present, the attribute value is part of the object's postal address.

postOfficeBox ATTRIBUTE	::=	{
WITH SYNTAX		DirectoryString {ub-post-office-box}
EQUALITY MATCHING RULE		caseIgnoreMatch
SUBSTRINGS MATCHING RULE		caseIgnoreSubstringsMatch
ID		id-at-postOfficeBox }

The *Collective Post Office Box* attribute type specifies a post office box for a collection of entries.

collectivePostOfficeBox ATTRIBUTE	::=	{
SUBTYPE OF		postOfficeBox
COLLECTIVE		TRUE
ID		id-at-collectivePostOfficeBox }

5.6.4 Physical Delivery Office Name

The *Physical Delivery Office Name* attribute type specifies the name of the city, village, etc. where a physical delivery office is situated.

An attribute value for Physical Delivery Office Name is a string.

physicalDeliveryOfficeName ATTRIBUTE	::=	{
WITH SYNTAX		DirectoryString {ub-physical-office-name}
EQUALITY MATCHING RULE		caseIgnoreMatch
SUBSTRINGS MATCHING RULE		caseIgnoreSubstringsMatch
ID		id-at-physicalDeliveryOfficeName }

The *Collective Physical Delivery Office Name* attribute type specifies a physical delivery office name for a collection of entries.

collectivePhysicalDeliveryOfficeName ATTRIBUTE	::=	{
SUBTYPE OF		physicalDeliveryOfficeName
COLLECTIVE		TRUE
ID		id-at-collectivePhysicalDeliveryOfficeName }

5.7 Telecommunications Addressing attribute types

These attribute types are concerned with addressing information needed to communicate with the object using telecommunication means.

5.7.1 Telephone Number

The *Telephone Number* attribute type specifies a telephone number associated with an object.

An attribute value for Telephone Number is a string that complies with the internationally agreed format for showing international telephone numbers, CCITT Recommendation E.123 (e.g. "+ 44 582 10101").

```
telephoneNumber ATTRIBUTE ::= {
    WITH SYNTAX                      TelephoneNumber
    EQUALITY MATCHING RULE           telephoneNumberMatch
    SUBSTRINGS MATCHING RULE        telephoneNumberSubstringsMatch
    ID                               id-at-telephoneNumber }

TelephoneNumber ::= PrintableString (SIZE(1..ub-telephone-number))
-- String complying with CCITT Recommendation E.123 only
```

The *Collective Telephone Number* attribute type specifies a telephone number for a collection of entries.

```
collectiveTelephoneNumber ATTRIBUTE ::= {
    SUBTYPE OF                      telephoneNumber
    COLLECTIVE                      TRUE
    ID                               id-at-collectiveTelephoneNumber }
```

5.7.2 Telex Number

The *Telex Number* attribute type specifies the telex number, country code, and answerback code of a telex terminal associated with an object.

```
telexNumber ATTRIBUTE ::= {
    WITH SYNTAX                      TelexNumber
    ID                               id-at-telexNumber }

TelexNumber ::= SEQUENCE {
    telexNumber                      PrintableString (SIZE (1..ub-telex-number)),
    countryCode                      PrintableString (SIZE (1..ub-country-code)),
    answerback                       PrintableString (SIZE (1..ub-answerback)) }
```

The *Collective Telex Number* attribute type specifies a telex number for a collection of entries.

```
collectiveTelexNumber ATTRIBUTE ::= {
    SUBTYPE OF                      telexNumber
    COLLECTIVE                      TRUE
    ID                               id-at-collectiveTelexNumber }
```

5.7.3 Teletex Terminal Identifier

Since CCITT Recommendation F.200 has been withdrawn and has not been replaced, the use of the *teletexTerminalIdentifier* and the *collectiveTeletexTerminalIdentifier* attribute types is deprecated.

The *Teletex Terminal Identifier* attribute type specifies the Teletex terminal identifier (and, optionally, parameters) for a teletex terminal associated with an object.

An attribute value for Teletex Terminal Identifier is a string which complies with CCITT Recommendation F.200 and an optional set whose components are according to ITU-T Recommendation T.62.

```
-- teletexTerminalIdentifier ATTRIBUTE ::= {
-- WITH SYNTAX                      TeletexTerminalIdentifier
-- ID                               id-at-teletexTerminalIdentifier }

-- TeletexTerminalIdentifier ::= SEQUENCE {
-- teletexTerminal                  PrintableString (SIZE(1..ub-teletex-terminal-id)),
-- parameters                      TeletexNonBasicParameters OPTIONAL}
```

The *Collective Teletex Terminal Identifier* attribute type specifies a teletex terminal identifier for a collection of entries.

```
-- collectiveTeletexTerminalIdentifier ATTRIBUTE ::= {
-- SUBTYPE OF                      teletexTerminalIdentifier
-- COLLECTIVE                      TRUE
-- ID                               id-at-collectiveTeletexTerminalIdentifier }
```

5.7.4 Facsimile Telephone Number

The Facsimile Telephone Number attribute type specifies a telephone number for a facsimile terminal (and optionally its parameters) associated with an object.

An attribute value for the facsimile telephone number is a string that complies with the internationally agreed format for showing international telephone numbers, CCITT Recommendation E.123 (e.g. "+81 3 347 7418") and an optional bit string (formatted according to CCITT Recommendation T.30).

```

facsimileTelephoneNumber ATTRIBUTE ::= {
  WITH SYNTAX           FacsimileTelephoneNumber
  ID                   id-at-facsimileTelephoneNumber }

FacsimileTelephoneNumber ::= SEQUENCE {
  telephoneNumber       TelephoneNumber,
  parameters           G3FacsimileNonBasicParameters OPTIONAL}

```

The *Collective Facsimile Telephone Number* attribute type specifies a facsimile telephone number for a collection of entries.

```

collectiveFacsimileTelephoneNumber ATTRIBUTE ::= {
  SUBTYPE OF           facsimileTelephoneNumber
  COLLECTIVE          TRUE
  ID                   id-at-collectiveFacsimileTelephoneNumber }

```

5.7.5 X.121 Address

The *X.121 Address* attribute type specifies an address as defined by ITU-T Recommendation X.121 associated with an object.

```

x121Address ATTRIBUTE ::= {
  WITH SYNTAX           X121Address
  EQUALITY MATCHING RULE numericStringMatch
  SUBSTRINGS MATCHING RULE numericStringSubstringsMatch
  ID                   id-at-x121Address }

X121Address ::= NumericString (SIZE(1..ub-x121-address))
  -- String as defined by ITU-T Recommendation X.121

```

5.7.6 International ISDN Number

The *International ISDN Number* attribute type specifies an International ISDN Number associated with an object.

An attribute value for International ISDN Number is a string which complies with the internationally agreed format for ISDN addresses given in ITU-T Recommendation E.164.

```

internationalISDNNumber ATTRIBUTE ::= {
  WITH SYNTAX           InternationalISDNNumber
  EQUALITY MATCHING RULE numericStringMatch
  SUBSTRINGS MATCHING RULE numericStringSubstringsMatch
  ID                   id-at-internationalISDNNumber }

InternationalISDNNumber ::= NumericString (SIZE(1..ub-international-isdn-number))
  -- String complying with ITU-T Recommendation E.164 only

```

The *Collective International ISDN Number* attribute type specifies an international ISDN number for a collection of entries.

```

collectiveInternationalISDNNumber ATTRIBUTE ::= {
  SUBTYPE OF           internationalISDNNumber
  COLLECTIVE          TRUE
  ID                   id-at-collectiveInternationalISDNNumber }

```

5.7.7 Registered Address

The *Registered Address* attribute type specifies a mnemonic for an address associated with an object at a particular city location. The mnemonic is registered in the country in which the city is located and is used in the provision of the Public Telegram Service (according to ITU-T Recommendation F.1).

```

registeredAddress ATTRIBUTE ::= {
  SUBTYPE OF           postalAddress
  WITH SYNTAX         PostalAddress
  ID                   id-at-registeredAddress }

```

5.7.8 Destination Indicator

The *Destination Indicator* attribute type specifies (according to ITU-T Rec. F.1 and CCITT Rec. F.31) the country and city associated with the object (the addressee) needed to provide the Public Telegram Service.

An attribute value for Destination Indicator is a string.

```
destinationIndicator ATTRIBUTE ::= {
    WITH SYNTAX
    EQUALITY MATCHING RULE
    SUBSTRINGS MATCHING RULE
    ID
    DestinationIndicator
    caseIgnoreMatch
    caseIgnoreSubstringsMatch
    id-at-destinationIndicator }

DestinationIndicator ::= PrintableString (SIZE(1..ub-destination-indicator))
-- alphabetical characters only
```

5.8 Preferences attribute types

These attribute types are concerned with the preferences of an object.

5.8.1 Preferred Delivery Method

The *Preferred Delivery Method* attribute type specifies the object's priority order regarding the method to be used for communicating with it.

```
preferredDeliveryMethod ATTRIBUTE ::= {
    WITH SYNTAX
    ny-delivery-method
    mhs-delivery
    physical-delivery
    telex-delivery
    teletex-delivery
    g3-facsimile-delivery
    g4-facsimile-delivery
    ia5-terminal-delivery
    videotex-delivery
    telephone-delivery
    SINGLE VALUE
    ID
    SEQUENCE OF INTEGER {
        (0),
        (1),
        (2),
        (3),
        (4),
        (5),
        (6),
        (7),
        (8),
        (9) }
    TRUE
    id-at-preferredDeliveryMethod }
```

5.9 OSI Application attribute types

These attribute types are concerned with information regarding objects in the OSI Application Layer.

5.9.1 Presentation Address

The *Presentation Address* attribute type specifies a presentation address associated with an object representing an OSI application entity.

An attribute value for Presentation Address is a presentation address as defined in ITU-T Rec. X.200 | ISO/IEC 7498-1.

```
presentationAddress ATTRIBUTE ::= {
    WITH SYNTAX
    EQUALITY MATCHING RULE
    SINGLE VALUE
    ID
    PresentationAddress
    presentationAddressMatch
    TRUE
    id-at-presentationAddress }

PresentationAddress ::= SEQUENCE {
    pSelector          [0] OCTET STRING OPTIONAL,
    sSelector          [1] OCTET STRING OPTIONAL,
    tSelector          [2] OCTET STRING OPTIONAL,
    nAddresses         [3] SET SIZE (1..MAX) OF OCTET STRING }
```

5.9.2 Supported Application Context

The *Supported Application Context* attribute type specifies the object identifier(s) of application context(s) that the object (an OSI application entity) supports.

```
supportedApplicationContext ATTRIBUTE ::= {
  WITH SYNTAX          OBJECT IDENTIFIER
  EQUALITY MATCHING RULE objectIdentifierMatch
  ID                   id-at-supportedApplicationContext }
```

5.9.3 Protocol Information

The *Protocol Information* attribute type associates protocol information with each network address in the Presentation Address attribute.

For each **nAddress**, the protocol component identifies the protocol or profile for the network and transport layers.

```
protocolInformation ATTRIBUTE ::= {
  WITH SYNTAX          ProtocolInformation
  EQUALITY MATCHING RULE protocolInformationMatch
  ID                   id-at-protocolInformation }

ProtocolInformation ::= SEQUENCE {
  nAddress,
  profiles,
  SET OF OBJECT IDENTIFIER }
```

5.10 Relational attribute types

These attribute types are concerned with information regarding the objects which are related to a particular object in certain ways.

NOTE – The DistinguishedName syntax used in these attribute types allows use of the primary distinguished name or an alternative distinguished name. Use of the primary distinguished name, if it is known, ensures consistency and interworking with pre-1997 DSAs. Specific usage may require that a particular alternative name be used. Context information and alternative distinguished values may also be kept as part of the **valuesWithContext** component of any RDN, as described in 9.3 of ITU-T Rec. X.501 | ISO/IEC 9594-2.

5.10.1 Distinguished Name

The *Distinguished Name* attribute type is an attribute for specifying the name of an object.

```
distinguishedName ATTRIBUTE ::= {
  WITH SYNTAX          DistinguishedName
  EQUALITY MATCHING RULE distinguishedNameMatch
  ID                   id-at-distinguishedName }
```

5.10.2 Member

The *Member* attribute type specifies a group of names associated with the object.

An attribute value for Member is a distinguished name.

```
member ATTRIBUTE ::= {
  SUBTYPE OF          distinguishedName
  ID                   id-at-member }
```

5.10.3 Unique Member

The *Unique Member* attribute type specifies a group of unique names associated with an object. A unique name is a name that is optionally disambiguated by the inclusion of its unique identifier.

An attribute value for Unique Member is a distinguished name accompanied by an optional unique identifier.

```
uniqueMember ATTRIBUTE ::= {
  WITH SYNTAX          NameAndOptionalUID
  EQUALITY MATCHING RULE uniqueMemberMatch
  ID                   id-at-uniqueMember }

NameAndOptionalUID ::= SEQUENCE {
  dn,
  DistinguishedName,
  UniqueIdentifier OPTIONAL }
```

5.10.4 Owner

The *Owner* attribute type specifies the name of some object which has some responsibility for the associated object.

An attribute value for Owner is a distinguished name (which could represent a group of names) and can recur.

```
owner ATTRIBUTE ::= {
  SUBTYPE OF      distinguishedName
  ID              id-at-owner }
```

5.10.5 Role Occupant

The *Role Occupant* attribute type specifies the name of an object which fulfills an organizational role.

An attribute value for Role Occupant is a distinguished name.

```
roleOccupant ATTRIBUTE ::= {
  SUBTYPE OF      distinguishedName
  ID              id-at-roleOccupant }
```

5.10.6 See Also

The *See Also* attribute type specifies names of other Directory objects which may be other aspects (in some sense) of the same real world object.

An attribute value for See Also is a distinguished name.

```
seeAlso ATTRIBUTE ::= {
  SUBTYPE OF      distinguishedName
  ID              id-at-seeAlso }
```

5.11 Domain attribute types

5.11.1 DMD name

The DMD Name attribute type specifies a DMD. When used as a component of a directory name it identifies a DMD which manages the named object.

An attribute value for DMD Name is a string chosen by the DMD.

```
dmdName ATTRIBUTE ::= {
  SUBTYPE OF      name
  WITH SYNTAX     DirectoryString{ub-common-name}
  ID              id-at-dmdName }
```

SECTION 3 – MATCHING RULES

6 Definition of matching rules

NOTE – For definitions of **objectIdentifierMatch** and **distinguishedNameMatch**, see ITU-T Rec. X.501 | ISO/IEC 9594-2.

6.1 String matching rules

In the matching rules specified in 6.1.1 through 6.1.11, the following spaces are regarded as not significant:

- leading spaces (i.e. those preceding the first character that is not a space);
- trailing spaces (i.e. those following the last character that is not a space);
- multiple consecutive spaces (these are taken as equivalent to a single space character).

A string consisting entirely of spaces is equivalent to a string containing exactly one space.

In the matching rules to which these apply, the strings to be matched shall be matched as if the insignificant spaces were not present in either string.

6.1.1 Case Ignore Match

The *Case Ignore Match* rule compares for equality a presented string with an attribute value of **type PrintableString, NumericString, TelexString, BMPString, UniversalString, or DirectoryString**, without regard to the case (upper or lower) of the strings (e.g. "Dundee" and "DUNDEE" match).

caseIgnoreMatch MATCHING-RULE	::=	{
SYNTAX		DirectoryString {ub-match}
ID		id-mr-caseIgnoreMatch }

The rule returns TRUE if the strings are the same length and corresponding characters are identical except possibly with regard to case.

Where the strings being matched are of different ASN.1 syntax, the comparison proceeds as normal so long as the corresponding characters are in both character sets. Otherwise matching fails.

6.1.2 Case Ignore Ordering Match

The *Case Ignore Ordering Match* rule compares the collation order of a presented string an attribute value whose type is one of the ones listed in 6.1.1, without regard to the case (upper or lower) of the strings.

caseIgnoreOrderingMatch MATCHING-RULE	::=	{
SYNTAX		DirectoryString {ub-match}
ID		id-mr-caseIgnoreOrderingMatch }

The rule returns TRUE if the attribute value is "less" or appears earlier than the presented value, when the strings are compared using the normal collation order for their syntax after lower-case letters in both strings have been replaced by their upper-case equivalents.

Where the strings being matched are of different ASN.1 syntax, the comparison proceeds as normal so long as the corresponding characters are in both character sets. Otherwise matching fails.

6.1.3 Case Ignore Substrings Match

The *Case Ignore Substrings Match* rule determines whether a presented value is a substring of an attribute value whose type is one of the ones listed in 6.1.1, without regard to the case (upper or lower) of the strings.

caseIgnoreSubstringsMatch MATCHING-RULE	::=	{
SYNTAX		SubstringAssertion
ID		id-mr-caseIgnoreSubstringsMatch }

SubstringAssertion ::= SEQUENCE OF CHOICE {

initial	[0]	DirectoryString {ub-match},
any	[1]	DirectoryString {ub-match},
final	[2]	DirectoryString {ub-match} }

-- at most one initial and one final component

The rule returns TRUE if there is a partitioning of the attribute value (into portions) such that:

- the specified substrings (**initial**, **any**, **final**) match different portions of the value in the order of the **strings** sequence;
- **initial**, if present, matches the first portion of the value;
- **final**, if present, matches the last portion of the value;
- **any**, if present, matches some arbitrary portion of the value.

There shall be at most one **initial**, and at most one **final** in **strings**. If **initial** is present, it shall be the first element of **strings**. If **final** is present, it shall be the last element of **strings**. There shall be zero or more **any** in **strings**.

For a component of substrings to match a portion of the attribute value, corresponding characters must be identical, except in regard to case. Where the strings being matched are of different ASN.1 syntax, the comparison proceeds as normal so long as the corresponding characters are in both character sets. Otherwise matching fails.

6.1.4 Case Exact Match

The *Case Exact Match* rule compares for equality a presented string with an attribute value whose type is one of the ones listed in 6.1.1.

```
caseExactMatch MATCHING-RULE ::= {
  SYNTAX      DirectoryString {ub-match}
  ID          id-mr-caseExactMatch }
```

The rule is identical to the **caseIgnoreMatch** rule except that case is not ignored.

6.1.5 Case Exact Ordering Match

The *Case Exact Ordering Match* rule compares the collation order of a presented string with an attribute value whose type is one of the ones listed in 6.1.1.

```
caseExactOrderingMatch MATCHING-RULE ::= {
  SYNTAX      DirectoryString {ub-match}
  ID          id-mr-caseExactOrderingMatch }
```

The rule is identical to the **caseIgnoreOrderingMatch** rule except that lower-case letters are not replaced by upper-case letters.

6.1.6 Case Exact Substrings Match

The *Case Exact Substrings Match* rule determines whether a presented value is a substring of an attribute value whose type is one of the ones listed in 6.1.1.

```
caseExactSubstringsMatch MATCHING-RULE ::= {
  SYNTAX      SubstringAssertion -- only the PrintableString choice
  ID          id-mr-caseExactSubstringsMatch }
```

The rule is identical to the **caseIgnoreSubstringsMatch** rule except that case is not ignored.

6.1.7 Numeric String Match

The *Numeric String Match* rule compares for equality a presented numeric string with an attribute value of type **NumericString**.

```
numericStringMatch MATCHING-RULE ::= {
  SYNTAX      NumericString
  ID          id-mr-numericStringMatch }
```

The rule is identical to the **caseIgnoreMatch** rule except that all space characters are skipped during comparison (case is irrelevant as characters are numeric).

6.1.8 Numeric String Ordering Match

The *Numeric String Ordering Match* rule compares the collation order of a presented string with an attribute value of type **NumericString**.

```
numericStringOrderingMatch MATCHING-RULE ::= {
  SYNTAX      NumericString
  ID          id-mr-numericStringOrderingMatch }
```

The rule is identical to the **caseIgnoreOrderingMatch** rule except that all space characters are skipped during comparison (case is irrelevant as characters are numeric).

6.1.9 Numeric String Substrings Match

The *Numeric String Substrings Match* rule determines whether a presented value is a substring of an attribute value of type **NumericString**.

```
numericStringSubstringsMatch MATCHING-RULE ::= {
  SYNTAX      SubstringAssertion
  ID          id-mr-numericStringSubstringsMatch }
```

The rule is identical to the **caseIgnoreSubstringsMatch** rule except that all space characters are skipped during comparison (case is irrelevant as characters are numeric).

6.1.10 Case Ignore List Match

The *Case Ignore List Match* rule compares for equality a presented sequence of strings with an attribute value which is a sequence of **DirectoryStrings**, without regard to the case (upper or lower) of the strings.

caseIgnoreListMatch MATCHING-RULE	::=	{
SYNTAX		SEQUENCE OF DirectoryString {ub-match}
ID		id-mr-caseIgnoreListMatch }

The rule returns TRUE if and only if the number of strings in each is the same, and corresponding strings match. The latter matching is as for the **caseIgnoreMatch** matching rule.

6.1.11 Case Ignore List Substrings Match

The *Case Ignore List Substring Match* rule compares a presented substring with an attribute value which is a sequence of **DirectoryStrings**, but where the case (upper or lower) is not significant for comparison purposes.

caseIgnoreListSubstringsMatch MATCHING-RULE	::=	{
SYNTAX		SubstringAssertion
ID		id-mr-caseIgnoreListSubstringsMatch }

A presented value matches a stored value if and only if the presented value matches the string formed by concatenating the strings of the stored value. This matching is done according to the **caseIgnoreSubstringsMatch** rule; however, none of the **initial**, **any**, or **final** values of the presented value are considered to match a substring of the concatenated string which spans more than one of the strings of the stored value.

6.1.12 Stored Prefix Match

The *Stored Prefix Match* rule determines whether an attribute value, whose syntax is **DirectoryString**, is a prefix (i.e. initial substring) of the presented value, without regard to the case (upper or lower) of the strings.

NOTE – It can be used, for example, to compare values in the Directory which are telephone area codes with a purported value which is a telephone number.

storedPrefixMatch MATCHING-RULE	::=	{
SYNTAX		DirectoryString {ub-match}
ID		id-mr-storedPrefixMatch }

The rule returns TRUE if the attribute value is an initial substring of the presented value with corresponding characters identical except possibly with regard to case.

6.2 Syntax-based matching rules

6.2.1 Boolean Match

The *Boolean Match* rule compares for equality a presented Boolean value with an attribute value of type **BOOLEAN**.

booleanMatch MATCHING-RULE	::=	{
SYNTAX		BOOLEAN
ID		id-mr-booleanMatch }

The rule returns TRUE if the values are the same, i.e. both are TRUE or both are FALSE.

6.2.2 Integer Match

The *Integer Match* rule compares for equality a presented integer value with an attribute value of type **INTEGER**.

integerMatch MATCHING-RULE	::=	{
SYNTAX		INTEGER
ID		id-mr-integerMatch }

The rule returns TRUE if the integers are equal.

6.2.3 Integer Ordering Match

The *Integer Ordering Match* rule compares a presented integer value with an attribute value of type **INTEGER**.

integerOrderingMatch MATCHING-RULE	::=	{
SYNTAX		INTEGER
ID		id-mr-integerOrderingMatch }

The rule returns TRUE if the attribute value is less than the presented value.

6.2.4 Bit String Match

The *Bit String Match* rule compares a presented bit string with an attribute value of type **BIT STRING**.

```
bitStringMatch MATCHING-RULE ::= {
  SYNTAX                      BIT STRING
  ID                          id-mr-bitStringMatch }
```

The rule returns TRUE if the attribute value has the same number of bits as the presented value and the bits match on a bitwise basis.

6.2.5 Octet String Match

The *Octet String Match* rule compares for equality a presented octet string with an attribute value of type **OCTET STRING**.

```
octetStringMatch MATCHING-RULE ::= {
  SYNTAX                      OCTET STRING
  ID                          id-mr-octetStringMatch }
```

The rule returns TRUE if and only if the strings are the same length and corresponding octets are identical.

6.2.6 Octet String Ordering Match

The *Octet String Ordering Match* rule compares the collation order of a presented octet string with an attribute value of type **OCTET STRING**.

```
octetStringOrderingMatch MATCHING-RULE ::= {
  SYNTAX                      OCTET STRING
  ID                          id-mr-octetStringOrderingMatch }
```

The rule compares octet strings from first octet to last octet, and from the most significant bit to the least significant bit within the octet. The first occurrence of a different bit determines the ordering of the strings. A zero bit precedes a one bit. If the strings are identical but contain different numbers of octets, the shorter string precedes the longer string.

6.2.7 Octet String Substrings Match

The *Octet String Substrings Match* rule determines whether a presented octet string is a substring of an attribute value of type **OCTET STRING**.

```
octetStringSubstringsMatch MATCHING-RULE ::= {
  SYNTAX                      OctetSubstringAssertion
  ID                          id-mr-octetStringSubstringsMatch }
```

```
OctetSubstringAssertion ::= SEQUENCE OF CHOICE {
  initial          [0] OCTET STRING,
  any              [1] OCTET STRING,
  final           [2] OCTET STRING }
-- at most one initial and one final component
```

The rule returns TRUE if the attribute value contains the sequence of octets in the presented string, as described for **caseIgnoreSubstringsMatch**.

6.2.8 Telephone Number Match

The *Telephone Number Match* rule compares for equality a presented value with an attribute value of type **PrintableString** which is a telephone number.

```
telephoneNumberMatch MATCHING-RULE ::= {
  SYNTAX                      PrintableString
  ID                          id-mr-telephoneNumberMatch }
```

The rules for matching are identical to those for **caseIgnoreMatch**, except that all space and "-" characters are skipped during the comparison.

6.2.9 Telephone Number Substrings Match

The *Telephone Number Substrings Match* rule determines if a presented substring is a substring of an attribute value of type **PrintableString** which is a telephone number.

```
telephoneNumberSubstringsMatch MATCHING-RULE ::= {
  SYNTAX                               SubstringAssertion
  ID                                   id-mr-telephoneNumberSubstringsMatch }
```

The rules for matching are identical to those for **caseExactSubstringsMatch**, except that all space and "-" characters are skipped during the comparison.

6.2.10 Presentation Address Match

The *Presentation Address Match* rule compares for equality a presented Presentation Address with an attribute value of type **PresentationAddress**.

```
presentationAddressMatch MATCHING-RULE ::= {
  SYNTAX                               PresentationAddress
  ID                                   id-mr-presentationAddressMatch }
```

The rule returns TRUE if and only if the selectors of the presented and stored presentation address are equal and the presented **nAddresses** are a subset of the stored ones.

6.2.11 Unique Member Match

The *Unique Member Match* rule compares for equality a presented Unique Member value with an attribute value of type **NameAndOptionalUID**.

```
uniqueMemberMatch MATCHING-RULE ::= {
  SYNTAX                               NameAndOptionalUID
  ID                                   id-mr-uniqueMemberMatch }
```

The rule returns TRUE if and only if the **dn** components of the attribute value and the presented value match according to the **distinguishedNameMatch** rule, and the **uid** component is absent from the attribute value or matches the corresponding component from the presented value according to the **bitStringMatch** rule.

6.2.12 Protocol Information Match

The *Protocol Information Match* rule compares for equality presented values of **ProtocolInformation** with values of the same type.

```
protocolInformationMatch MATCHING-RULE ::= {
  SYNTAX                               OCTET STRING
  ID                                   id-mr-protocolInformationMatch }
```

A value of the assertion syntax is derived from a value of the attribute syntax by using the **nAddress** component.

The value returns True if the presented value and the **nAddress** component of the stored value match according to the **octetStringMatch** rule.

6.3 Time matching rules

6.3.1 UTC Time Match

The *UTC Time Match* rule compares for equality a presented value with an attribute value of type **UTCTime**.

```
uTCTimeMatch MATCHING-RULE ::= {
  SYNTAX                               UTCTime
  ID                                   id-mr-uTCTimeMatch }
```

The rule returns TRUE if the attribute value represents the same time as the presented value. If a UTC time is specified with the seconds absent, the number of seconds is assumed to be zero.

6.3.2 UTC Time Ordering Match

The *UTC Time Ordering* rule compares the time ordering of a presented value with an attribute value of type **UTCTime**.

```
uTCTimeOrderingMatch MATCHING-RULE ::= {
  SYNTAX          UTCTime
  ID              id-mr-uTCTimeOrderingMatch }
```

The rule returns TRUE if the attribute value represents a time which is earlier than the presented time. UTC times with year values 50 to 99 shall be taken to represent times that are earlier than UTC times with year values 00 to 49. If a UTC time is specified with the seconds absent, the number of seconds is assumed to be zero.

The value of the two-digit year field shall be rationalized into a four-digit year value as follows:

- if the 2-digit value is 00 through 49 inclusive, the value shall have 2000 added to it; and
- if the 2-digit value is 50 through 99 inclusive, the value shall have 1900 added to it.

6.3.3 Generalized Time Match

The *Generalized Time Match* rule compares for equality a presented value with an attribute value of type **GeneralizedTime** [as per 41.3 b) or c) of ITU-T Rec. X.680 | ISO/IEC 8824-1].

```
generalizedTimeMatch MATCHING-RULE ::= {
  SYNTAX          GeneralizedTime
                  -- as per 41.3 b) or c) of ITU-T Rec. X.680 | ISO/IEC 8824-1
  ID              id-mr-generalizedTimeMatch }
```

The rule returns TRUE if the attribute value represents the same time as the presented value. If a time is specified with the minutes or seconds absent, the number of minutes or seconds is assumed to be zero.

6.3.4 Generalized Time Ordering Match

The *Generalized Time Ordering Match* rule compares the time ordering of a presented value with an attribute value of type **GeneralizedTime** [as per 41.3 b) and c) of ITU-T Rec. X.680 | ISO/IEC 8824-1].

```
generalizedTimeOrderingMatch MATCHING-RULE ::= {
  SYNTAX          GeneralizedTime
                  -- as per 41.3 b) or c) of ITU-T Rec. X.680 | ISO/IEC 8824-1
  ID              id-mr-generalizedTimeOrderingMatch }
```

The rule returns TRUE if the attribute value represents a time which is earlier than the presented time. If a time is specified with the minutes or seconds absent, the number of minutes or seconds is assumed to be zero.

6.4 First component matching rules

6.4.1 Integer First Component Match

The *Integer First Component Match* rule compares for equality a presented integer value with an attribute value of type **SEQUENCE** whose first component is mandatory and of type **INTEGER**.

```
integerFirstComponentMatch MATCHING-RULE ::= {
  SYNTAX          INTEGER
  ID              id-mr-integerFirstComponentMatch }
```

The rule returns TRUE if the attribute value has a first component whose value equals the presented integer.

A value of the assertion syntax is derived from a value of the attribute syntax by using the value of the first component of the SEQUENCE.

6.4.2 Object Identifier First Component Match

The *Object Identifier First Component Match* rule compares for equality a presented object identifier value with attribute values of type **SEQUENCE** whose first component is mandatory and of type **OBJECT IDENTIFIER**.

```
objectIdentifierFirstComponentMatch MATCHING-RULE ::= {
  SYNTAX          OBJECT IDENTIFIER
  ID              id-mr-objectIdentifierFirstComponentMatch }
```

The rule returns TRUE if the attribute value has a first component whose value matches the presented object identifier using the rules of **objectIdentifierMatch**.

A value of the assertion syntax is derived from a value of the attribute syntax by using the value of the first component of the SEQUENCE.

6.4.3 Directory String First Component Match

The *Directory String First Component Match* rule compares for equality a presented **DirectoryString** value with an attribute value of type **SEQUENCE** whose first component is mandatory and of type **DirectoryString**.

```
directoryStringFirstComponentMatch MATCHING-RULE ::= {
    SYNTAX          DirectoryString {ub-directory-string-first-component-match}
    ID              id-mr-directoryStringFirstComponentMatch }
```

The rule returns TRUE if the attribute value has a first component whose value matches the presented **DirectoryString** using the rules of **caseIgnoreMatch**.

A value of the assertion syntax is derived from a value of the attribute syntax by using the value of the first component of the SEQUENCE.

6.5 Word matching rules

6.5.1 Word Match

The *Word Match* rule compares a presented string with words in an attribute value of type **DirectoryString**.

```
wordMatch MATCHING-RULE ::= {
    SYNTAX          DirectoryString {ub-match}
    ID              id-mr-wordMatch }
```

The rule returns TRUE if a presented word matches any word in the attribute value. Individual word matching is as for the **caseIgnoreMatch** matching rule. The precise definition of a "word" is a local matter.

6.5.2 Keyword Match

The *Keyword Match* rule compares a presented string with keywords in an attribute value of type **DirectoryString**.

```
keywordMatch MATCHING-RULE ::= {
    SYNTAX          DirectoryString {ub-match}
    ID              id-mr-keywordMatch }
```

The rule returns TRUE if a presented value matches any *keyword* in the attribute value. The identification of keywords in an attribute value and of the exactness of match are both local matters.

SECTION 4 – CONTEXTS

7 Definition of Context Types

This Directory Specification defines a number of context types which may be found useful across a range of applications of the Directory.

7.1 Language Context

The *Language Context* associates an attribute value with a specific language(s):

```
languageContext CONTEXT ::= {
    WITH SYNTAX      LanguageContextSyntax
    ID              id-avc-language }
```

```
LanguageContextSyntax ::= PrintableString (SIZE(2..3)) -- ISO 639-2 codes only
```

A presented value is considered to match a stored value if the sequence of characters in the presented value is identical to that in the stored value.

7.2 Temporal Context

The Temporal Context associates an attribute value with a set of times. Various expressions of time are possible, including:

- a) absolute start or end times (e.g. 24:00 December 14, 1994);
- b) specific time bands within the day (e.g. 09:00 to 17:00)
- c) days within the week (e.g. Monday);
- d) days within the month (e.g. the 10th; the 2nd last day, etc.);
- e) months within the year (e.g. March);
- f) a particular year (e.g. 1995);
- g) weeks within the month (e.g. the second week);
- h) periodic day or week (e.g. every 2nd week);
- i) logical negatives (e.g. not Monday).

temporalContext CONTEXT ::= {

WITH SYNTAX	TimeSpecification
ASSERTED AS	TimeAssertion
ID	id-avc-temporal }

TimeSpecification ::= SEQUENCE {

time	CHOICE {
absolute	SEQUENCE {
startTime	[0] GeneralizedTime OPTIONAL,
endTime	[1] GeneralizedTime OPTIONAL },
periodic	SET OF Period },
notThisTime	BOOLEAN DEFAULT FALSE,
timeZone	TimeZone OPTIONAL }

Period ::= SEQUENCE {

timesOfDay	[0]	SET OF DayTimeBand OPTIONAL,
days	[1]	CHOICE {
		intDay SET OF INTEGER,
		bitDay BIT STRING { sunday (0), monday (1), tuesday (2),
		wednesday (3), thursday (4), friday (5), saturday (6) },
		XDayOf } OPTIONAL,
weeks	[2]	CHOICE {
		allWeeks NULL,
		intWeek SET OF INTEGER,
		bitWeek BIT STRING { week1 (0), week2 (1), week3 (2), week4 (3),
		week5 (4) } } OPTIONAL,
months	[3]	CHOICE {
		allMonths NULL,
		intMonth SET OF INTEGER,
		bitMonth BIT STRING { january (0), february (1), march (2), april (3),
		may (4), june (5), july (6), august (7), september (8),
		october (9), november (10), december (11) }
		} OPTIONAL,
years	[4]	SET OF INTEGER (1000 .. MAX) OPTIONAL }

XDayOf ::= CHOICE {

first	[1]	NamedDay,
second	[2]	NamedDay,
third	[3]	NamedDay,
fourth	[4]	NamedDay,
fifth	[5]	NamedDay }

```

NamedDay ::= CHOICE {
    intNamed Days      ENUMERATED {
        sunday (1),
        monday (2),
        tuesday (3),
        wednesday (4),
        thursday (5),
        friday (6),
        saturday (7) },
    bitNamedDays      BIT STRING { sunday (0), monday (1) , tuesday (2),
        wednesday (3), thursday (4), friday (5), saturday (6) } }

DayTimeBand ::= SEQUENCE {
    startDayTime      [0]      DayTime DEFAULT { hour 0 },
    endDayTime        [1]      DayTime DEFAULT { hour 23, minute 59, second 59 }

DayTime ::= SEQUENCE {
    hour              [0]      INTEGER (0..23),
    minute            [1]      INTEGER (0..59) DEFAULT 0,
    second            [2]      INTEGER (0..59) DEFAULT 0}

TimeZone ::= INTEGER (-12..12)

TimeAssertion ::= CHOICE {
    now              NULL,
    at               GeneralizedTime,
    between          SEQUENCE {
        startTime    [0] GeneralizedTime,
        endTime      [1] GeneralizedTime OPTIONAL,
        entirely     BOOLEAN DEFAULT FALSE } }

```

The **absolute** choice of **time** expresses a specific time or time band using absolute time notations (GeneralizedTime). A specific time is expressed by setting the **startTime** equal to the **endTime**. Otherwise, **startTime** is earlier in time than **endTime** and a span of time is expressed. If **endTime** is missing the time span includes all times after **startTime**.

periodic allows the specification of **time** as a set of periods. The combined effect is a logical OR of the set.

NOTE 1 – Alternatively, an attribute value could be associated with the temporal context with multiple context values, one for each of the periods, since this also acts a logical OR. However, the SET OF is included here to allow **notThisTime** to cover the set and thus effect a logical 'neither'. When **notThisTime** is FALSE, the choice of which approach to use to specify a set of periods is up to the specifier.

Within each Period each element in the SEQUENCE OF is considered as "within" the following element in the SEQUENCE OF. The SEQUENCE OF is in rising order of granularity of time period, although not all levels must be present.

The final element in a **Period** is assumed to be valid for all time periods of higher granularity.

NOTE 2 – For example, if a **Period** SEQUENCE OF ends with **timesOfDay**, it is considered valid for all days.

A **timesOfDay** indicates the valid time bands during the days specified in the next element of **Period**. If **days** is not the next element, then the time bands are valid for all possible days within the next element. If **timesOfDay** is not included, all times of the day are valid within the next element. Different time bands may be specified for different days, by having multiple occurrences of **Period**.

The **days** element expresses specific days of a week, month or year depending on the next element of **Period**. If **days** precedes **weeks** in a **Period**, then it expresses days of the week and the INTEGERS are constrained to the values 1 to 7, where 1 is Sunday. If **days** precedes **months** in a **Period**, then it expresses days in the month and the INTEGERS are constrained to the values 1 to 31, where 1 is the first day of the month. If **days** precedes **years** in a **Period**, then it expresses days of the year and the INTEGERS are constrained to the values 1 to 366, where 1 is the first day of the year.

dayOf is used to indicate the 1st, 2nd, 3rd, 4th, and 5th occurrence of the **NamedDay** in a month (e.g. the first Monday of the month, or the second Tuesday and Friday of August). The use of **fifth** shall always indicate the last **NamedDay** of that month (e.g. the last Tuesday of July). If the **dayOf** choice for **days** is specified, then the **weeks** element of **Period** is not meaningful if present and is ignored.

If **days** is not specified, then all days are valid within the next element of the **Period**.

The **weeks** element expresses specific weeks of a month or year, depending on the next element of **Period**. If **weeks** precedes months in a **Period**, then it expresses weeks of the month and the INTEGERS are constrained to the values 1 to 5, where 1 is the first week of the month. The first week of the month shall be assumed to be the first week containing at least four days of that month. The fifth week always means the last week of the month.

If **weeks** precedes years in a **Period**, then it expresses weeks of the year and the INTEGERS are constrained to the values 1 to 53, where 1 is the first week of the year. The first week of the year shall be assumed to be the first week containing at least four days of that year. The 53rd week is always the last week of the year.

If **allWeeks** is specified, then all weeks are valid within the next element of the **Period** (this allows **days** to express days of the week for all weeks).

If **weeks** is not specified, then all weeks are valid within the next element of the **Period**.

The **months** element expresses specific months of the year. When **months** is expressed with INTEGERS, the INTEGERS are constrained to the values 1 to 12, where 1 is the first month of the year (i.e. January).

If **allMonths** is specified, then all months of the year are valid (this allows **weeks** to express weeks of the month for all months, or if **weeks** is not specified it allows **days** to express days of the month for all months).

If **months** is not specified, then all months of the year are valid.

The **years** component expresses one or more years. If **years** is not specified, then all years are valid.

timeZone expresses the time zone, in hours delta from GMT, in which **time** is expressed. If **timeZone** is not present, a DSA processing the temporal context shall interpret the **time** relevant in the time zone of the DSA.

If **notThisTime** is **FALSE**, then the temporal context value is the time expressed in **time** in the **TimeSpecification**. If **notThisTime** is **TRUE**, then the temporal context value is considered to be all time except that expressed in **time** in the **TimeSpecification** (that is, a logical NOT is performed).

A time assertion is considered to match a time specification if there is an overlap in the times specified. If the time assertion contains **now**, then the current time is used in the evaluation. If **now** or **at** is specified, then the assertion is considered true if the specific time falls within the times covered by the stored **TimeSpecification**. If the time assertion uses **between** and **entirely** is **FALSE**, then the assertion is considered true if any portion of the **between** time band falls within the times covered by the stored **TimeSpecification** (the overlap need not be complete: as long as there is a period of overlap within the two time specifications, they are considered to match). If the time assertion uses **between** and **entirely** is **TRUE**, then the assertion is considered true only if the entire **between** time band falls within the times covered by the stored **TimeSpecification**.

Examples:

NOTE 3 – The following examples use the INTEGER formats for elements where a choice is available of INTEGER or BIT STRING.

- a) 09:00 to 17:00 every day, would be expressed as:

```
periodic {
    timesOfDay { {
        startDayTime hour 9,
        endDayTime hour 17 } } }
```

- b) Every Monday would be expressed as:

```
periodic {
    days intDay : {2} }
```

- c) 09:00 to 12:00 noon Monday to Friday and all day Saturday during January, and all day for Tuesdays in February and March would be expressed as:

```
periodic {
    timesOfDay { {
        startDayTime hour 9,
        endDayTime hour 12 } }
    days    intDay : {2,3,4,5,6},
    weeks   allWeeks : NULL,
    months  intMonth : {1} },
```

```

{   days {7},
    weeks {1,2,3,4,5}
    months {1} }

{   days {3}
    weeks {1,2,3,4,5},
    months {2,3} } }

```

- d) All of August 1996 would be expressed as:

```

periodic {
  {   months {8}
      years {1996} } }

```

- e) The first day of every month would be expressed as:

```

periodic {
  {   days {1}
      months NULL } }

```

7.3 Locale Context

The Locale Context associates an attribute value with a specific locale(s) as defined in POSIX:

```

localeContext CONTEXT ::= {
  WITH SYNTAX      localeContextSyntax
  ID              id-avc-locale }

localeContextSyntax ::= CHOICE {
  localeID1        OBJECT IDENTIFIER,
  localeID2        DirectoryString }

```

A presented value is considered to match a stored value if they are both object identifiers and the two object identifiers are equal, or they are both strings and are the same.

Only registered object identifiers or strings for locales may be used as context values. The concept of locales is described in ISO/IEC 9945-2:1993 Information Technology – Portable Operating System Interface (POSIX) – Part 2: Shell and Utilities.

NOTE – Registration authorities will be created to assign OIDs and/or string identifiers to locale specifications. For example, the European Committee for Standardization, CEN, has published a European standard for registration of locale information, ENV12005 :1996 Procedures for European Registration of Cultural Elements.

Annex A

Selected attribute types in ASN.1

(This annex forms an integral part of this Recommendation | International Standard)

This annex includes all of the ASN.1 type and value definitions contained in this Directory Specification in the form of the ASN.1 module **SelectedAttributeTypes**.

```
SelectedAttributeTypes {joint-iso-itu-t ds(5) module(1) selectedAttributeTypes(5) 3}
```

```
DEFINITIONS ::=
```

```
BEGIN
```

```
-- EXPORTS All --
```

```
-- The types and values defined in this module are exported for use in the other ASN.1 modules contained
-- within the Directory Specifications, and for the use of other applications which will use them to access
-- Directory services. Other applications may use them for their own purposes, but this will not constrain
-- extensions and modifications needed to maintain or improve the Directory service.
```

```
IMPORTS
```

```
informationFramework, upperBounds, id-at, id-mr, id-avc
```

```
FROM UsefulDefinitions {joint-iso-itu-t ds(5) module(1) usefulDefinitions(0) 3 }
```

```
ATTRIBUTE, MATCHING-RULE, AttributeType, OBJECT-CLASS, DistinguishedName,
objectIdentifierMatch, distinguishedNameMatch
```

```
FROM InformationFramework informationFramework
```

```
G3FacsimileNonBasicParameters, TeletexNonBasicParameters
```

```
FROM MTSAbstractService {joint-iso-itu-t mhs(6) mts(3) modules(0)
```

```
mts-abstract-service(1) version-1999(1) }
```

```
ub-answerback, ub-name, ub-common-name, ub-surname, ub-serial-number, ub-locality-name,
ub-state-name, ub-street-address, ub-organization-name, ub-organizational-unit-name, ub-title,
ub-description, ub-business-category, ub-postal-line, ub-postal-string, ub-postal-code,
ub-post-office-box, ub-physical-office-name, ub-telex-number, ub-country-code,
ub-teletex-terminal-id, ub-telephone-number, ub-x121-address, ub-international-isdn-number,
ub-destination-indicator, ub-user-password, ub-match, ub-knowledge-information, ub-name,
ub-directory-string-first-component-match
```

```
FROM UpperBounds upperBounds ;
```

```
-- Directory string type --
```

```
DirectoryString { INTEGER : maxSize } ::= CHOICE {
    teletexString      TeletexString (SIZE (1..maxSize)),
    printableString    PrintableString (SIZE (1..maxSize)),
    bmpString          BMPString (SIZE (1..maxSize)),
    universalString    UniversalString (SIZE (1..maxSize)) }
```

```
-- Attribute types --
```

```
knowledgeInformation ATTRIBUTE ::= {
    WITH SYNTAX      DirectoryString { ub-knowledge-information }
    EQUALITY MATCHING RULE caseIgnoreMatch
    ID               id-at-knowledgeInformation }
```

```
name ATTRIBUTE ::= {
    WITH SYNTAX      DirectoryString { ub-name }
    EQUALITY MATCHING RULE caseIgnoreMatch
    SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
    ID               id-at-name }
```

```
commonName ATTRIBUTE ::= {
    SUBTYPE OF      name
    WITH SYNTAX      DirectoryString {ub-common-name}
    ID               id-at-commonName }
```

```
surname ATTRIBUTE ::= {
    SUBTYPE OF      name
    WITH SYNTAX      DirectoryString {ub-surname}
    ID               id-at-surname }
```

givenName ATTRIBUTE ::= {
 SUBTYPE OF name
 WITH SYNTAX DirectoryString {ub-name}
 ID id-at-givenName }

initials ATTRIBUTE ::= {
 SUBTYPE OF name
 WITH SYNTAX DirectoryString {ub-name}
 ID id-at-initials }

generationQualifier ATTRIBUTE ::= {
 SUBTYPE OF name
 WITH SYNTAX DirectoryString {ub-name}
 ID id-at-generationQualifier }

uniqueIdentifier ATTRIBUTE ::= {
 WITH SYNTAX UniqueIdentifier
 EQUALITY MATCHING RULE bitStringMatch
 ID id-at-uniqueIdentifier }

UniqueIdentifier ::= BIT STRING

dnQualifier ATTRIBUTE ::= {
 WITH SYNTAX PrintableString
 EQUALITY MATCHING RULE caseIgnoreMatch
 ORDERING MATCHING RULE caseIgnoreOrderingMatch
 SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
 ID id-at-dnQualifier }

serialNumber ATTRIBUTE ::= {
 WITH SYNTAX PrintableString (SIZE (1..ub-serial-number))
 EQUALITY MATCHING RULE caseIgnoreMatch
 SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
 ID id-at-serialNumber }

countryName ATTRIBUTE ::= {
 SUBTYPE OF name
 WITH SYNTAX CountryName
 SINGLE VALUE TRUE
 ID id-at-countryName }

CountryName ::= PrintableString (SIZE (2)) --SO 3166 codes only

localityName ATTRIBUTE ::= {
 SUBTYPE OF name
 WITH SYNTAX DirectoryString {ub-locality-name}
 ID id-at-localityName }

collectiveLocalityName ATTRIBUTE ::= {
 SUBTYPE OF localityName
 COLLECTIVE TRUE
 ID id-at-collectiveLocalityName }

stateOrProvinceName ATTRIBUTE ::= {
 SUBTYPE OF name
 WITH SYNTAX DirectoryString {ub-state-name}
 ID id-at-stateOrProvinceName }

collectiveStateOrProvinceName ATTRIBUTE ::= {
 SUBTYPE OF stateOrProvinceName
 COLLECTIVE TRUE
 ID id-at-collectiveStateOrProvinceName }

streetAddress ATTRIBUTE ::= {
 WITH SYNTAX DirectoryString {ub-street-address}
 EQUALITY MATCHING RULE caseIgnoreMatch
 SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
 ID id-at-streetAddress }

collectiveStreetAddress ATTRIBUTE ::= {
 SUBTYPE OF streetAddress
 COLLECTIVE TRUE
 ID id-at-collectiveStreetAddress }

houseIdentifier ATTRIBUTE ::= {
WITH SYNTAX DirectoryString {ub-name}
EQUALITY MATCHING RULE caseIgnoreMatch
SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
ID id-at-houseIdentifier }

organizationName ATTRIBUTE ::= {
SUBTYPE OF name
WITH SYNTAX DirectoryString {ub-organization-name}
ID id-at-organizationName }

collectiveOrganizationName ATTRIBUTE ::= {
SUBTYPE OF organizationName
COLLECTIVE TRUE
ID id-at-collectiveOrganizationName }

organizationalUnitName ATTRIBUTE ::= {
SUBTYPE OF name
WITH SYNTAX DirectoryString {ub-organizational-unit-name}
ID id-at-organizationalUnitName }

collectiveOrganizationalUnitName ATTRIBUTE ::= {
SUBTYPE OF organizationalUnitName
COLLECTIVE TRUE
ID id-at-collectiveOrganizationalUnitName }

title ATTRIBUTE ::= {
SUBTYPE OF name
WITH SYNTAX DirectoryString {ub-title}
ID id-at-title }

description ATTRIBUTE ::= {
WITH SYNTAX DirectoryString {ub-description}
EQUALITY MATCHING RULE caseIgnoreMatch
SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
ID id-at-description }

searchGuide ATTRIBUTE ::= {
WITH SYNTAX Guide
ID id-at-searchGuide }

Guide ::= SET {
objectClass [0] OBJECT-CLASS.&id OPTIONAL,
criteria [1] Criteria }

Criteria ::= CHOICE {
type [0] CriteriaItem,
and [1] SET OF Criteria,
or [2] SET OF Criteria,
not [3] Criteria}

CriteriaItem ::= CHOICE {
equality [0] AttributeType,
substrings [1] AttributeType,
greaterOrEqual [2] AttributeType,
lessOrEqual [3] AttributeType,
approximateMatch [4] AttributeType}

enhancedSearchGuide ATTRIBUTE ::= {
WITH SYNTAX EnhancedGuide
ID id-at-enhancedSearchGuide }

EnhancedGuide ::= SEQUENCE {
objectClass [0] OBJECT-CLASS.&id,
criteria [1] Criteria,
subset [2] INTEGER
 { baseObject (0), oneLevel (1), wholeSubtree (2) } DEFAULT oneLevel }

businessCategory ATTRIBUTE ::= {
WITH SYNTAX DirectoryString {ub-business-category}
EQUALITY MATCHING RULE caseIgnoreMatch
SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
ID id-at-businessCategory }

postalAddress ATTRIBUTE ::= {
 WITH SYNTAX PostalAddress
 EQUALITY MATCHING RULE caseIgnoreListMatch
 SUBSTRINGS MATCHING RULE caseIgnoreListSubstringsMatch
 ID id-at-postalAddress }

PostalAddress ::= SEQUENCE SIZE(1..ub-postal-line) OF DirectoryString {ub-postal-string}

collectivePostalAddress ATTRIBUTE ::= {
 SUBTYPE OF postalAddress
 COLLECTIVE TRUE
 ID id-at-collectivePostalAddress }

postalCode ATTRIBUTE ::= {
 WITH SYNTAX DirectoryString {ub-postal-code}
 EQUALITY MATCHING RULE caseIgnoreMatch
 SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
 ID id-at-postalCode }

collectivePostalCode ATTRIBUTE ::= {
 SUBTYPE OF postalCode
 COLLECTIVE TRUE
 ID id-at-collectivePostalCode }

postOfficeBox ATTRIBUTE ::= {
 WITH SYNTAX DirectoryString {ub-post-office-box}
 EQUALITY MATCHING RULE caseIgnoreMatch
 SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
 ID id-at-postOfficeBox }

collectivePostOfficeBox ATTRIBUTE ::= {
 SUBTYPE OF postOfficeBox
 COLLECTIVE TRUE
 ID id-at-collectivePostOfficeBox }

physicalDeliveryOfficeName ATTRIBUTE ::= {
 WITH SYNTAX DirectoryString {ub-physical-office-name}
 EQUALITY MATCHING RULE caseIgnoreMatch
 SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
 ID id-at-physicalDeliveryOfficeName }

collectivePhysicalDeliveryOfficeName ATTRIBUTE ::= {
 SUBTYPE OF physicalDeliveryOfficeName
 COLLECTIVE TRUE
 ID id-at-collectivePhysicalDeliveryOfficeName }

telephoneNumber ATTRIBUTE ::= {
 WITH SYNTAX TelephoneNumber
 EQUALITY MATCHING RULE telephoneNumberMatch
 SUBSTRINGS MATCHING RULE telephoneNumberSubstringsMatch
 ID id-at-telephoneNumber }

TelephoneNumber ::= PrintableString (SIZE(1..ub-telephone-number))
 -- String complying with CCITT Recommendation E.123 only

collectiveTelephoneNumber ATTRIBUTE ::= {
 SUBTYPE OF telephoneNumber
 COLLECTIVE TRUE
 ID id-at-collectiveTelephoneNumber }

telexNumber ATTRIBUTE ::= {
 WITH SYNTAX TelexNumber
 ID id-at-telexNumber }

TelexNumber ::= SEQUENCE {
 telexNumber PrintableString (SIZE(1..ub-telex-number)),
 countryCode PrintableString (SIZE(1..ub-country-code)),
 answerback PrintableString (SIZE(1..ub-answerback))}

collectiveTelexNumber ATTRIBUTE ::= {
 SUBTYPE OF telexNumber
 COLLECTIVE TRUE
 ID id-at-collectiveTelexNumber }

facsimileTelephoneNumber ATTRIBUTE ::= {
WITH SYNTAX FacsimileTelephoneNumber
ID id-at-facsimileTelephoneNumber }

FacsimileTelephoneNumber ::= SEQUENCE {
telephoneNumber TelephoneNumber
parameters G3FacsimileNonBasicParameters OPTIONAL}

collectiveFacsimileTelephoneNumber ATTRIBUTE ::= {
SUBTYPE OF facsimileTelephoneNumber
COLLECTIVE TRUE
ID id-at-collectiveFacsimileTelephoneNumber }

x121Address ATTRIBUTE ::= {
WITH SYNTAX X.121Address
EQUALITY MATCHING RULE numericStringMatch
SUBSTRINGS MATCHING RULE numericStringSubstringsMatch
ID id-at-x121Address }

X121Address ::= NumericString (SIZE(1..ub-x121-address))
-- String as defined by ITU-T Recommendation X.121

internationalISDNNumber ATTRIBUTE ::= {
WITH SYNTAX InternationalISDNNumber
EQUALITY MATCHING RULE numericStringMatch
SUBSTRINGS MATCHING RULE numericStringSubstringsMatch
ID id-at-internationalISDNNumber }

InternationalISDNNumber ::= NumericString (SIZE(1..ub-international-isdn-number))
-- String complying with ITU-T Recommendation E.164 only

collectiveInternationalISDNNumber ATTRIBUTE ::= {
SUBTYPE OF internationalISDNNumber
COLLECTIVE TRUE
ID id-at-collectiveInternationalISDNNumber }

registeredAddress ATTRIBUTE ::= {
SUBTYPE OF postalAddress
WITH SYNTAX PostalAddress
ID id-at-registeredAddress }

destinationIndicator ATTRIBUTE ::= {
WITH SYNTAX DestinationIndicator
EQUALITY MATCHING RULE caseIgnoreMatch
SUBSTRINGS MATCHING RULE caseIgnoreSubstringsMatch
ID id-at-destinationIndicator }

DestinationIndicator ::= PrintableString (SIZE (1..ub-destination-indicator))
-- alphabetical characters only

preferredDeliveryMethod ATTRIBUTE ::= {
WITH SYNTAX SEQUENCE OF INTEGER {
any-delivery-method (0),
mhs-delivery (1),
physical-delivery (2),
telex-delivery (3),
teletex-delivery (4),
g3-facsimile-delivery (5),
g4-facsimile-delivery (6),
ia5-terminal-delivery (7),
videotex-delivery (8),
telephone-delivery (9) }

SINGLE VALUE TRUE
ID id-at-preferredDeliveryMethod }

presentationAddress ATTRIBUTE ::= {
WITH SYNTAX PresentationAddress
EQUALITY MATCHING RULE presentationAddressMatch
SINGLE VALUE TRUE
ID id-at-presentationAddress }

PresentationAddress ::= SEQUENCE {
pSelector [0] OCTET STRING OPTIONAL,
sSelector [1] OCTET STRING OPTIONAL,
tSelector [2] OCTET STRING OPTIONAL,
nAddresses [3] SET SIZE (1..MAX) OF OCTET STRING}

supportedApplicationContext ATTRIBUTE ::= {
WITH SYNTAX OBJECT IDENTIFIER
EQUALITY MATCHING RULE objectIdentifierMatch
ID id-at-supportedApplicationContext }

protocolInformation ATTRIBUTE ::= {
WITH SYNTAX ProtocolInformation
EQUALITY MATCHING RULE protocolInformationMatch
ID id-at-protocolInformation }

ProtocolInformation ::= SEQUENCE {
nAddress OCTET STRING,
profiles SET OF OBJECT IDENTIFIER }

distinguishedName ATTRIBUTE ::= {
WITH SYNTAX DistinguishedName
EQUALITY MATCHING RULE distinguishedNameMatch
ID id-at-distinguishedName }

member ATTRIBUTE ::= {
SUBTYPE OF distinguishedName
ID id-at-member }

uniqueMember ATTRIBUTE ::= {
WITH SYNTAX NameAndOptionalUID
EQUALITY MATCHING RULE uniqueMemberMatch
ID id-at-uniqueMember }

NameAndOptionalUID ::= SEQUENCE {
dn DistinguishedName,
uid UniqueIdentifier OPTIONAL }

owner ATTRIBUTE ::= {
SUBTYPE OF distinguishedName
ID id-at-owner }

roleOccupant ATTRIBUTE ::= {
SUBTYPE OF distinguishedName
ID id-at-roleOccupant }

seeAlso ATTRIBUTE ::= {
SUBTYPE OF distinguishedName
ID id-at-seeAlso }

dmdName ATTRIBUTE ::= {
SUBTYPE OF name
WITH SYNTAX DirectoryString{ub-common-name}
ID id-at-dmdName }

-- Matching rules --

caseIgnoreMatch MATCHING-RULE ::= {
SYNTAX DirectoryString {ub-match}
ID id-mr-caseIgnoreMatch }

caseIgnoreOrderingMatch MATCHING-RULE ::= {
SYNTAX DirectoryString {ub-match}
ID id-mr-caseIgnoreOrderingMatch }

caseIgnoreSubstringsMatch MATCHING-RULE ::= {
SYNTAX SubstringAssertion
ID id-mr-caseIgnoreSubstringsMatch }

SubstringAssertion ::= SEQUENCE OF CHOICE {
initial [0] **DirectoryString {ub-match},**
any [1] **DirectoryString {ub-match},**
final [2] **DirectoryString {ub-match} }**
-- at most one initial and one final component

caseExactMatch MATCHING-RULE ::= {
SYNTAX **DirectoryString {ub-match}**
ID **id-mr-caseExactMatch }**

caseExactOrderingMatch MATCHING-RULE ::= {
SYNTAX **DirectoryString {ub-match}**
ID **id-mr-caseExactOrderingMatch }**

caseExactSubstringsMatch MATCHING-RULE ::= {
SYNTAX **SubstringAssertion -- only the PrintableString choice**
ID **id-mr-caseExactSubstringsMatch }**

numericStringMatch MATCHING-RULE ::= {
SYNTAX **NumericString**
ID **id-mr-numericStringMatch }**

numericStringOrderingMatch MATCHING-RULE ::= {
SYNTAX **NumericString**
ID **id-mr-numericStringOrderingMatch }**

numericStringSubstringsMatch MATCHING-RULE ::= {
SYNTAX **SubstringAssertion**
ID **id-mr-numericStringSubstringsMatch }**

caseIgnoreListMatch MATCHING-RULE ::= {
SYNTAX **SEQUENCE OF DirectoryString {ub-match}**
ID **id-mr-caseIgnoreListMatch }**

caseIgnoreListSubstringsMatch MATCHING-RULE ::= {
SYNTAX **SubstringAssertion**
ID **id-mr-caseIgnoreListSubstringsMatch }**

storedPrefixMatch MATCHING-RULE ::= {
SYNTAX **DirectoryString {ub-match}**
ID **id-mr-storedPrefixMatch }**

booleanMatch MATCHING-RULE ::= {
SYNTAX **BOOLEAN**
ID **id-mr-booleanMatch }**

integerMatch MATCHING-RULE ::= {
SYNTAX **INTEGER**
ID **id-mr-integerMatch }**

integerOrderingMatch MATCHING-RULE ::= {
SYNTAX **INTEGER**
ID **id-mr-integerOrderingMatch }**

bitStringMatch MATCHING-RULE ::= {
SYNTAX **BIT STRING**
ID **id-mr-bitStringMatch }**

octetStringMatch MATCHING-RULE ::= {
SYNTAX **OCTET STRING**
ID **id-mr-octetStringMatch }**

octetStringOrderingMatch MATCHING-RULE ::= {
SYNTAX **OCTET STRING**
ID **id-mr-octetStringOrderingMatch }**

octetStringSubstringsMatch MATCHING-RULE ::= {
SYNTAX **OctetSubstringAssertion**
ID **id-mr-octetStringSubstringsMatch }**

OctetSubstringAssertion ::= SEQUENCE OF CHOICE {
initial [0] **OCTET STRING,**
any [1] **OCTET STRING,**
final [2] **OCTET STRING }**
-- at most one initial and one final component

```

telephoneNumberMatch MATCHING-RULE ::= {
    SYNTAX          PrintableString
    ID              id-mr-telephoneNumberMatch }

telephoneNumberSubstringsMatch MATCHING-RULE ::= {
    SYNTAX          SubstringAssertion
    ID              id-mr-telephoneNumberSubstringsMatch }

presentationAddressMatch MATCHING-RULE ::= {
    SYNTAX          PresentationAddress
    ID              id-mr-presentationAddressMatch }

```

-- Contexts --

```

languageContext CONTEXT ::= {
    WITH SYNTAX      LanguageContextSyntax
    ID              id-avc-language
}

```

LanguageContextSyntax ::= PrintableString (SIZE(2..3)) -- ISO 639-2 codes only

```

temporalContext CONTEXT ::= {
    WITH SYNTAX      TimeSpecification
    ASSERTED AS      TimeAssertion
    ID              id-avc-temporal }

```

```

TimeSpecification ::= SEQUENCE {
    time              CHOICE {
        absolute      SEQUENCE {
            startTime  [0] GeneralizedTime OPTIONAL,
            endTime    [1] GeneralizedTime OPTIONAL },
        periodic      SET OF Period },
    notThisTime      BOOLEAN DEFAULT FALSE,
    timeZone          TimeZone OPTIONAL }

```

```

Period ::= SEQUENCE {
    timesOfDay        [0] SET OF DayTimeBand OPTIONAL,
    days              [1] CHOICE {
        intDay        SET OF INTEGER,
        bitDay        BIT STRING { sunday (0), monday (1), tuesday (2),
            wednesday (3), thursday (4), friday (5), saturday (6),
            dayOf      XDayOf } OPTIONAL,
        weeks          [2] CHOICE {
            allWeeks    NULL,
            intWeeks    SET OF INTEGER,
            bitWeeks    BIT STRING { week1 (0), week2 (1), week3 (2), week4 (3),
                week5 (4) } } OPTIONAL,
        months          [3] CHOICE {
            allMonths    NULL,
            intMonth      SET OF INTEGER,
            bitMonth      BIT STRING { january (0), february (1), march (2), april (3),
                may (4), june (5), july (6), august (7), september (8),
                october (9), november (10), december (11) }
            } OPTIONAL,
    years             [4] SET OF INTEGER (1000 .. MAX) OPTIONAL }

```

```

XDayOf ::= CHOICE {
    first      [1] NamedDay,
    second     [2] NamedDay,
    third      [3] NamedDay,
    fourth     [4] NamedDay,
    fifth      [5] NamedDay}

```

```

NamedDay ::= CHOICE {
    intNamedDays    ENUMERATED {
        sunday      (1),
        monday      (2),
        tuesday      (3),

```