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IANA Considerations for LDAP
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Abstract

This document provides procedures for registering extensible elements of LDAP (Lightweight Directory Access Protocol). The document also provides guidelines to IANA (Internet Assigned Numbers Authority) describing conditions under which new values can be assigned.

1. Introduction

The Lightweight Directory Access Protocol [LDAPTS] (LDAP) is an extensible protocol. LDAP supports:

- addition of new operations,
- extension of existing operations, and
- extensible schema.

This document details procedures for registering values of used to unambiguously identify extensible elements of the protocol including:

- LDAP message types,
- LDAP result codes,
- LDAP authentication methods,
- LDAP attribute description options, and
- Object Identifier descriptors.

These registries are maintained by the Internet Assigned Numbers Authority (IANA).

In addition, this document provides guidelines to IANA describing the conditions under which new values can be assigned.

2. Terminology and Conventions

This section details terms and conventions used in this document.

2.1. Policy Terminology

The terms "IESG Approval", "Standards Action", "IETF Consensus", "Specification Required", "First Come First Served", "Expert Review", and "Private Use" are used as defined in BCP 26 [RFC2434].

2.2. Requirement Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119]. In this case, "the specification" as used by BCP 14 refers to the processing of protocols being submitted to the IETF standards process.

2.3. Common ABNF Productions

A number of syntaxes in this document are described using ABNF [RFC2234]. These syntaxes rely on the following common productions:

```
ALPHA = %x41-5A / %x61-7A    ; A-Z / a-z

LDIGIT = %x31-39             ; 1-9

DIGIT = %x30 / LDIGIT        ; 0-9

HYPHEN = %x2D                ; "-"

DOT = %x2E                   ; "."

number = DIGIT / ( LDIGIT 1*DIGIT )

keychar = ALPHA / DIGIT / HYPHEN

leadkeychar = ALPHA

keystring = leadkeychar *keychar
```

A keyword is a case-insensitive string of UTF-8 [RFC2279] encoded characters from the Universal Character Set (UCS) [ISO10646] restricted to the <keystring> production.

3. IANA Considerations for LDAP

This section details each kind of protocol value which can be registered and provides IANA guidelines on how to assign new values.

3.1. Object Identifiers

Numerous LDAP schema and protocol elements are identified by Object Identifiers. Specifications which assign OID to elements SHOULD state who delegated the OIDs for its use.

For IETF developed elements, OIDs under "Internet Directory Numbers" (1.3.6.1.1.x) SHOULD be used. IANA will assign numbers under this OID arc upon Expert Review with Specification Required. Only one OID per specification SHOULD be assigned. The specification MAY then assign any number of OIDs within this arc without further coordination with IANA.

For elements developed by others, any properly delegated OID can be used, including those under "Internet Private Enterprise Numbers" (1.3.6.1.4.1.x) assigned by IANA <http://www.iana.org/cgi-bin/enterprise.pl>.

To avoid interoperability problems between early implementors of

''works in progress'' and implementors of the published specification (e.g., the RFC), experimental OIDs SHOULD be used in ''works in progress''. Experimental OIDs MUST replaced before publication. OIDs under the Internet Experimental OID arc (1.3.6.1.3.x) may be used for this purpose.

Practices for IANA assignment of Internet Enterprise and Experimental OIDs are detailed in STD 16 [RFC1155].

3.2. Object Identifier Descriptors

LDAP allows short descriptive names (or descriptors) to be used instead of a numeric Object Identifier to identify protocol extensions [RFC2251], schema elements [RFC2252], LDAP URL [RFC2255] extensions, and other objects. Descriptors SHALL be restricted to strings of UTF-8 encoded UCS characters restricted by the following ABNF:

```
name = keystring
```

Descriptors are case-insensitive.

Multiple names MAY be assigned to a given OID. For purposes of registration, an OID SHALL be represented in numeric OID form conforming to the ABNF:

```
numericoid = number *( DOT number ) ; e.g. 1.1.0.23.40
```

While the protocol places no maximum length restriction upon descriptors, they SHOULD be short. Descriptors longer than 48 characters MAY be viewed as too long to register. IANA MAY reject obviously bogus registrations.

Descriptors beginning with "x-" are for Private Use and SHALL NOT be registered.

Descriptors beginning with "e-" are reserved for experiments. IANA SHALL register any descriptor beginning with "e-" on a First Come First Served basis.

Expert Review is REQUIRED before accepting registration of all other descriptors.

IANA SHALL NOT verify the registrant "owns" the OID being named.

The OID namespace is managed by The ISO/IEC Joint Technical Committee 1 - Subcommittee 6.

3.3. AttributeDescription Options

An AttributeDescription [RFC2251, Section 4.1.5] can contain zero or more options specifying additional semantics. An option SHALL be restricted to a string UTF-8 encoded UCS characters limited by the following ABNF:

```
option = keystring
```

Options are case-insensitive.

While the protocol places no maximum length restriction upon option strings, they SHOULD be short. Options longer than 24 characters MAY be viewed as too long to register. IANA MAY reject obviously bogus registrations.

Values ending with a hyphen ("-") reserve all option names which start with the name. For example, the registration of the option "optionFamily-" reserves all options which start with "optionFamily-" for some related purpose.

Options beginning with "x-" are for Private Use and SHALL NOT registered.

Options beginning with "e-" are reserved for experiments. IANA SHALL register any option beginning with "e-" on a First Come First Served basis.

IANA SHALL register other options by either Standards Action or Expert Review with Specification Required.

3.4. LDAP Message Types

Each protocol message is encapsulated in an LDAPMessage envelope [RFC2251, Section 4.1.1]. The protocolOp CHOICE indicates the type of message encapsulated. Each message type consists of a keyword and a non-negative choice number is combined with the class (APPLICATION) and data type (CONSTRUCTED or PRIMITIVE) to construct the BER tag in the message's encoding. The choice numbers for existing protocol messages are implicit in the protocol's ASN.1 defined in [RFC2251].

New values SHALL only be registered by Standards Track action.

Note: LDAP provides extensible messages which reduces, but does not eliminate, the need to add new message types.

3.5. LDAP Result Codes

LDAP result messages carry an resultCode enumerated value to indicate the outcome of the operation [RFC2251, Section 4.1.10]. Each result code consists of a keyword and a non-negative integer.

IANA SHALL register new resultCode integers in the range 0-1023 upon Standards Action, in the range 1024-4095 with Expert Review with Specification Required, and in the range 4096-16383 on a First Come First Served basis. Keywords associated with integers in the range 0-4095 SHALL NOT start with "e-" or "x-". Keywords associated with integers in the range 4096-16383 SHALL start with "e-". Values greater than or equal to 16384 and keywords starting with "x-" are for Private Use and SHALL NOT be registered.

IANA MAY reject obviously bogus registrations.

3.6. LDAP Authentication Method

The LDAP Bind operation supports multiple authentication methods [RFC2251, Section 4.2]. Each authentication choice consists of a keyword and a non-negative integer.

Authentication methods usage SHALL be classified using one of the following terms:

```
COMMON      - method is appropriate for common use on the Internet,
LIMITED USE - method is appropriate for limited use,
OBSOLETE    - method has been deprecated or otherwise found to be
              inappropriate for any use.
```

IANA SHALL NOT register new OBSOLETE authentication methods. Methods without publicly available specifications SHALL NOT be classified as COMMON. IANA MAY reject obviously bogus registrations.

IANA SHALL register new authentication method integers in the range 0-1023 upon Standards Action, in the range 1024-4095 with Expert Review with Specification Required, and in the range 4096-16383 on a First Come First Served basis. Keywords associated with integers in the range 0-4095 SHALL NOT start with "e-" or "x-". Keywords associated with integers in the range 4096-16383 SHALL start with "e-". Values greater than or equal to 16384 and keywords starting with "x-" are for Private Use and SHALL NOT be registered.

Note: LDAP supports SASL [RFC2222] as an Authentication CHOICE. SASL is an extensible LDAP authentication method.

3.7. Directory Systems Names

The IANA-maintained "Directory Systems Names" registry [IANADSN] of valid keywords for well known attributes used in the LDAPv2 string representation of a distinguished name [RFC1779]. RFC 1779 was obsoleted by RFC 2253.

Directory systems names are not known to be used in any other context. LDAPv3 uses Object Identifier Descriptors [Section 3.2] (which have a different syntax than directory system names).

IANA SHALL NOT register new Directory System Names. For historical purposes, the current list of registered names SHOULD remain available.

4. Registration Procedure

The procedure given here MUST be used by anyone who wishes to use a new value of a type described in Section 3 of this document.

The first step is for the requester to fill out the appropriate form. Templates are provided in Appendix A.

If the policy is Standards Action, the completed form SHOULD be provided to the IESG with the request for Standards Action. Upon approval of the Standards Action, the IESG SHALL forward the request (possibly revised) to IANA. The IESG SHALL be viewed as the owner of all values requiring Standards Action.

If the policy is Expert Review, the requester SHALL post the completed form to the <directory@apps.ietf.org> mailing list for public review. The review period is two (2) weeks. If a revised form is later submitted, the review period is restarted. Anyone may subscribe to this list by sending a request to <directory-request@apps.ietf.org>. During the review, objections may be raised by anyone (including the Expert) on the list. After completion of the review, the Expert, based upon public comments, SHALL either approve the request and forward it to the IESG OR deny the request. In either case, the Expert SHALL promptly notify the requester of the action . Actions of the Expert may be appealed [RFC2026]. The Expert is appointed by Applications Area Director(s). The requester is viewed as the owner of values registered under Expert Review.

If the policy is First Come First Served, the requester SHALL submit the completed form directly to the IANA <iana@iana.org>. The requester is viewed as the owner of values registered under First Come First Served.

Neither the Expert nor IANA will take position on the claims of copyright or trademarks issues regarding completed forms.

5. Registration Maintenance

This section discusses maintenance of registrations.

5.1. Lists of Registered Values

IANA makes lists of registered values readily available to the Internet community on their web site <http://www.iana.org/>.

5.2. Change Control

The registration owner MAY update the registration subject to the same constraints and review as with new registrations. In cases where the owner is not unable or unwilling to make necessary updates, the IESG MAY assert ownership in order to update the registration.

5.3. Comments

For cases where others (anyone other than the owner) have significant objections to the claims in a registration and the owner does not agree to change the registration, comments MAY be attached to a registration upon Expert Review. For registrations owned by the IESG, the objections SHOULD be addressed by initiating a request for Expert Review.

The request form to these requests is ad hoc, but MUST include the specific objections to be reviewed and SHOULD contain (directly or by reference) materials supporting the objections.

6. Security Considerations

The security considerations detailed in [RFC2434] are generally applicable to this document. Additional security considerations specific to each namespace are discussed in Section 3 where appropriate.

Security considerations for LDAP are discussed in documents comprising the technical specification [LDAPTS].

7. Acknowledgment

This document is a product of the IETF LDAP Revision (LDAPbis) Working Group. Some text was borrowed from "Guidelines for Writing an IANA Considerations Section in RFCs" [RFC2434] by Thomas Narten and Harald Alvestrand.

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9. Normative References

[RFC1155] M. Rose, K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based Internets", STD 16 (also RFC 1155), May 1990.

[RFC2026] S. Bradner, "The Internet Standards Process -- Revision 3", BCP 9 (also RFC 2026), October 1996.

[RFC2119] S. Bradner, "Key words for use in RFCs to Indicate Requirement Levels", BCP 14 (also RFC 2119), March 1997.

[RFC2234] D. Crocker, P. Overell, "Augmented BNF for Syntax Specifications: ABNF", RFC 2234, November 1997.

[RFC2251] M. Wahl, T. Howes, S. Kille, "Lightweight Directory Access Protocol (v3)", RFC 2251, December 1997.

[RFC2252] M. Wahl, A. Coulbeck, T. Howes, S. Kille, "Lightweight Directory Access Protocol (v3): Attribute Syntax Definitions", RFC 2252, December 1997.

[RFC2255] T. Howes, M. Smith, "The LDAP URL Format", RFC 2255, December, 1997.

[RFC2256] M. Wahl, "A Summary of the X.500(96) User Schema for use with LDAPv3", RFC 2256, December 1997.

[RFC2279] F. Yergeau, "UTF-8, a transformation format of ISO 10646", RFC 2279, January 1998.

[RFC2434] T. Narten, H. Alvestrand, "Guidelines for Writing an IANA

Considerations Section in RFCs", BCP 26 (also RFC 2434), October 1998.

[LDAPTS] J. Hodges, R.L. Morgan, "Lightweight Directory Access Protocol (v3): Technical Specification", draft-ietf-ldapbis-ldapv3-ts-xx.txt (a work in progress).

[IANADSN] IANA, "Directory Systems Names", http://www.iana.org/assignments/directory-system-names.

[ISO10646] Universal Multiple-Octet Coded Character Set (UCS) - Architecture and Basic Multilingual Plane, ISO/IEC 10646-1 : 1993.

10. Informative References

[RFC1779] S. Kille, "A String Representation of Distinguished Names", RFC 1779, March 1995.

[RFC2222] J. Myers, "Simple Authentication and Security Layer (SASL)", RFC 2222, October 1997.

Appendix A. Registration Templates

This appendix provides registration templates for registering new LDAP values.

A.1. LDAP Object Identifier Registration Template

Subject: Request for LDAP OID Registration

Person & email address to contact for further information:

Specification: (I-D)

Author/Change Controller:

Comments:

(Any comments that the requester deems relevant to the request)

A.2. LDAP Descriptor Registration Template

Subject: Request for LDAP Descriptor Registration

Descriptor (short name):

Object Identifier:

Person & email address to contact for further information:

Usage: (One of attribute type, URL extension,
object class, or other)

Specification: (RFC, I-D, URI)

Author/Change Controller:

Comments:

(Any comments that the requester deems relevant to the request)

A.3. LDAP Attribute Description Option Registration Template

Subject: Request for LDAP Attribute Description Option Registration

Option Name:

Family of Options: (YES or NO)

Person & email address to contact for further information:

Specification: (RFC, I-D, URI)

Author/Change Controller:

Comments:

(Any comments that the requester deems relevant to the request)

A.4. LDAP Message Type Registration Template

Subject: Request for LDAP Message Type Registration

LDAP Message Name:

Person & email address to contact for further information:

Specification: (Approved I-D)

Comments:

(Any comments that the requester deems relevant to the request)

A.5. LDAP Result Code Registration Template

Subject: Request for LDAP Result Code Registration

Result Code Name:

Person & email address to contact for further information:

Specification: (RFC, I-D, URI)

Author/Change Controller:

Comments:

(Any comments that the requester deems relevant to the request)

A.6. LDAP Authentication Method Registration Template

Subject: Request for LDAP Authentication Method Registration

Authentication Method Name:

Person & email address to contact for further information:

Specification: (RFC, I-D, URI)

Intended Usage: (One of COMMON, LIMITED-USE, OBSOLETE)

Author/Change Controller:

Comments:

(Any comments that the requester deems relevant to the request)

Appendix B. Assigned Values

The following values are currently assigned.

B.1. Object Identifiers

Currently registered "Internet Private Enterprise Numbers" can be found at <http://www.iana.org/assignments/enterprise-numbers>.

Currently registered "Internet Directory Numbers" can be found at <http://www.iana.org/assignments/smi-numbers>.

B.2. Object Identifier Descriptors

NAME	Type	OID [REF]
account	O	0.9.2342.19200300.100.4.5 [RFC1274]
alias	O	2.5.6.1 [RFC2256]
aliasedEntryName	A	2.5.4.1 [X.501]
aliasedObjectName	A	2.5.4.1 [RFC2256]
altServer	A	1.3.6.1.4.1.1466.101.120.6 [RFC2252]
applicationEntity	O	2.5.6.12 [RFC2256]
applicationProcess	O	2.5.6.11 [RFC2256]
aRecord	A	0.9.2342.19200300.100.1.26 [RFC1274]
associatedDomain	A	0.9.2342.19200300.100.1.37 [RFC1274]
associatedInternetGateway	A	1.3.6.1.4.1.453.7.2.8 [RFC2164]
associatedName	A	0.9.2342.19200300.100.1.38 [RFC1274]
associatedORAddress	A	1.3.6.1.4.1.453.7.2.6 [RFC2164]
associatedX400Gateway	A	1.3.6.1.4.1.453.7.2.3 [RFC2164]
attributeTypes	A	2.5.21.5 [RFC2252]
audio	A	0.9.2342.19200300.100.1.55 [RFC1274]
authorityRevocationList	A	2.5.4.38 [RFC2256]
bitStringMatch	M	2.5.13.16 [RFC2252]
buildingName	A	0.9.2342.19200300.100.1.48 [RFC1274]
businessCategory	A	2.5.4.15 [RFC2256]
C	A	2.5.4.6 [RFC2256]
cACertificate	A	2.5.4.37 [RFC2256]
calCalAdrURI	A	1.2.840.113556.1.4.481 [RFC2739]
calCalURI	A	1.2.840.113556.1.4.478 [RFC2739]
calCAPURI	A	1.2.840.113556.1.4.480 [RFC2739]
calEntry	O	1.2.840.113556.1.5.87 [RFC2739]
calFBURL	A	1.2.840.113556.1.4.479 [RFC2739]
calOtherCalAdrURIs	A	1.2.840.113556.1.4.485 [RFC2739]
calOtherCalURIs	A	1.2.840.113556.1.4.482 [RFC2739]
calOtherCAPURIs	A	1.2.840.113556.1.4.484 [RFC2739]
calOtherFBURLs	A	1.2.840.113556.1.4.483 [RFC2739]
caseExactIA5Match	M	1.3.6.1.4.1.1466.109.114.1 [RFC2252]
caseIgnoreIA5Match	M	1.3.6.1.4.1.1466.109.114.2 [RFC2252]
caseIgnoreListMatch	M	2.5.13.11 [RFC2252]
caseIgnoreMatch	M	2.5.13.2 [RFC2252]
caseIgnoreOrderingMatch	M	2.5.13.3 [RFC2252]
caseIgnoreSubstringsMatch	M	2.5.13.4 [RFC2252]
certificateRevocationList	A	2.5.4.39 [RFC2256]
certificationAuthority	O	2.5.6.16 [RFC2256]
certificationAuthority-V2	O	2.5.6.16.2 [RFC2256]
CN	A	2.5.4.3 [RFC2256]

```
cNAMERecord                    A 0.9.2342.19200300.100.1.31 [RFC1274]
co                             A 0.9.2342.19200300.100.1.43 [RFC1274]
commonName                     A 2.5.4.3 [RFC2256]
country                        O 2.5.6.2 [RFC2256]
countryName                    A 2.5.4.6 [RFC2256]
createTimestamp                A 2.5.18.1 [RFC2252]
creatorsName                   A 2.5.18.3 [RFC2252]
cRLDistributionPoint           O 2.5.6.19 [RFC2256]
crossCertificatePair           A 2.5.4.40 [RFC2256]
DC                             A 0.9.2342.19200300.100.1.25 [RFC2247]
dcObject                       O 1.3.6.1.4.1.1466.344 [RFC2247]
deltaCRL                       O 2.5.6.23 [RFC2587]
deltaRevocationList            A 2.5.4.53 [RFC2256]
description                    A 2.5.4.13 [RFC2256]
destinationIndicator           A 2.5.4.27 [RFC2256]
device                         O 2.5.6.14 [RFC2256]
distinguishedName              A 2.5.4.49 [RFC2256]
distinguishedNameMatch         M 2.5.13.1 [RFC2252]
distinguishedNameTableEntry    O 1.3.6.1.4.1.453.7.1.5 [RFC2293]
distinguishedNameTableKey      A 1.3.6.1.4.1.453.7.2.3 [RFC2293]
dITContentRules                A 2.5.21.2 [RFC2252]
dITRedirect                    A 0.9.2342.19200300.100.1.54 [RFC1274]
dITStructureRules              A 2.5.21.1 [RFC2252]
dmd                            O 2.5.6.20 [RFC2256]
dmdName                        A 2.5.4.54 [RFC2256]
dnQualifier                    A 2.5.4.46 [RFC2256]
dNSDomain                      O 0.9.2342.19200300.100.4.15 [RFC1274]
document                       O 0.9.2342.19200300.100.4.6 [RFC1274]
documentAuthor                 A 0.9.2342.19200300.100.1.14 [RFC1274]
documentIdentifier             A 0.9.2342.19200300.100.1.11 [RFC1274]
documentLocation               A 0.9.2342.19200300.100.1.15 [RFC1274]
documentPublisher              A 0.9.2342.19200300.100.1.56 [RFC1274]
documentSeries                 O 0.9.2342.19200300.100.4.8 [RFC1274]
documentTitle                  A 0.9.2342.19200300.100.1.12 [RFC1274]
documentVersion                A 0.9.2342.19200300.100.1.13 [RFC1274]
domain                         O 0.9.2342.19200300.100.4.13 [RFC2247]
domainComponent                A 0.9.2342.19200300.100.1.25 [RFC2247]
domainNameForm                 N 1.3.6.1.4.1.1466.345 [RFC2247]
domainRelatedObject            O 0.9.2342.19200300.100.4.17 [RFC1274]
drink                          A 0.9.2342.19200300.100.1.5 [RFC1274]
dSA                            O 2.5.6.13 [RFC2256]
dSAQuality                     A 0.9.2342.19200300.100.1.49 [RFC1274]
dynamicObject                  O 1.3.6.1.4.1.1466.101.119.2 [RFC2589]
dynamicSubtrees                A 1.3.6.1.4.1.1466.101.119.4 [RFC2589]
enhancedSearchGuide            A 2.5.4.47 [RFC2256]
entryTtl                       A 1.3.6.1.4.1.1466.101.119.3 [RFC2589]
extensibleObject               O 1.3.6.1.4.1.1466.101.120.111 [RFC2252]
facsimileTelephoneNumber       A 2.5.4.23 [RFC2256]
```

favouriteDrink A 0.9.2342.19200300.100.1.5 [RFC1274]
friendlyCountry O 0.9.2342.19200300.100.4.18 [RFC1274]
friendlyCountryName A 0.9.2342.19200300.100.1.43 [RFC1274]
generalizedTimeMatch M 2.5.13.27 [RFC2252]
generalizedTimeOrderingMatch M 2.5.13.28 [RFC2252]
generationQualifier A 2.5.4.44 [RFC2256]
givenName A 2.5.4.42 [RFC2256]
GN A 2.5.4.42 [RFC2256]
groupOfNames O 2.5.6.9 [RFC2256]
groupOfUniqueNames O 2.5.6.17 [RFC2256]
homePhone A 0.9.2342.19200300.100.1.20 [RFC1274]
homePostalAddress A 0.9.2342.19200300.100.1.39 [RFC1274]
homeTelephone A 0.9.2342.19200300.100.1.20 [RFC1274]
host A 0.9.2342.19200300.100.1.9 [RFC1274]
houseIdentifier A 2.5.4.51 [RFC2256]
info A 0.9.2342.19200300.100.1.4 [RFC1274]
initials A 2.5.4.43 [RFC2256]
integerFirstComponentMatch M 2.5.13.29 [RFC2252]
integerMatch M 2.5.13.14 [RFC2252]
internationaliSDNNumber A 2.5.4.25 [RFC2256]
janetMailbox A 0.9.2342.19200300.100.1.46 [RFC1274]
jpegPhoto A 0.9.2342.19200300.100.1.60 [RFC1488]
knowledgeInformation A 2.5.4.2 [RFC2256]
L A 2.5.4.7 [RFC2256]
labeledURI A 1.3.6.1.4.1.250.1.57 [RFC2079]
labeledURIObject A 1.3.6.1.4.1.250.3.15 [RFC2079]
lastModifiedBy A 0.9.2342.19200300.100.1.24 [RFC1274]
lastModifiedTime A 0.9.2342.19200300.100.1.23 [RFC1274]
ldapSyntaxes A 1.3.6.1.4.1.1466.101.120.16 [RFC2251]
locality O 2.5.6.3 [RFC2256]
localityName A 2.5.4.7 [RFC2256]
mail A 0.9.2342.19200300.100.1.3 [RFC2798]
mailPreferenceOption A 0.9.2342.19200300.100.1.47 [RFC1274]
manager A 0.9.2342.19200300.100.1.10 [RFC1274]
matchingRules A 2.5.21.4 [RFC2252]
matchingRuleUse A 2.5.21.8 [RFC2252]
mcgamTables A 1.3.6.1.4.1.453.7.2.9 [RFC2164]
mDRecord A 0.9.2342.19200300.100.1.27 [RFC1274]
member A 2.5.4.31 [RFC2256]
mixerGateway O 1.3.6.1.4.1.453.7.1.4 [RFC2164]
mobile A 0.9.2342.19200300.100.1.41 [RFC1274]
mobileTelephoneNumber A 0.9.2342.19200300.100.1.41 [RFC1274]
modifiersName A 2.5.18.4 [RFC2252]
modifyTimestamp A 2.5.18.2 [RFC2252]
mXRecord A 0.9.2342.19200300.100.1.28 [RFC1274]
name A 2.5.4.41 [RFC2256]
nameForms A 2.5.21.7 [RFC2252]
namingContexts A 1.3.6.1.4.1.1466.101.120.5 [RFC2252]

```
nSRecord                          A 0.9.2342.19200300.100.1.29 [RFC1274]
numericStringMatch                M 2.5.13.8 [RFC2252]
numericStringSubstringsMatch      M 2.5.13.10 [RFC2252]
O                                 A 2.5.4.10 [RFC2256]
objectClass                       A 2.5.4.0 [RFC2256]
objectClasses                     A 2.5.21.6 [RFC2252]
objectIdentifierFirstComponentMatch M 2.5.13.30 [RFC2252]
objectIdentifiersMatch            M 2.5.13.0 [RFC2252]
octetStringMatch                  M 2.5.13.17 [RFC2252]
omittedORAddressComponent         O 1.3.6.1.4.1.453.7.1.3 [RFC2164]
oRAddressComponentType            A 1.3.6.1.4.1.453.7.2.7 [RFC2164]
organization                      O 2.5.6.4 [RFC2256]
organizationalPerson              O 2.5.6.7 [RFC2256]
organizationalRole                O 2.5.6.8 [RFC2256]
organizationalStatus              A 0.9.2342.19200300.100.1.45 [RFC1274]
organizationalUnit                O 2.5.6.5 [RFC2256]
organizationalUnitName            A 2.5.4.11 [RFC2256]
organizationName                  A 2.5.4.10 [RFC2256]
otherMailbox                      A 0.9.2342.19200300.100.1.22 [RFC1274]
OU                                A 2.5.4.11 [RFC2256]
owner                             A 2.5.4.32 [RFC2256]
pager                             A 0.9.2342.19200300.100.1.42 [RFC1274]
pagerTelephoneNumber              A 0.9.2342.19200300.100.1.42 [RFC1274]
person                            O 2.5.6.6 [RFC2256]
personalSignature                 A 0.9.2342.19200300.100.1.53 [RFC1274]
personalTitle                     A 0.9.2342.19200300.100.1.40 [RFC1274]
photo                             A 0.9.2342.19200300.100.1.7 [RFC1274]
physicalDeliveryOfficeName        A 2.5.4.19 [RFC2256]
pilotDSA                          O 0.9.2342.19200300.100.4.21 [RFC1274]
pilotObject                       O 0.9.2342.19200300.100.4.3 [RFC1274]
pilotOrganization                 O 0.9.2342.19200300.100.4.20 [RFC1274]
pilotPerson                       O 0.9.2342.19200300.100.4.4 [RFC1274]
pkiCA                             O 2.5.6.22 [RFC2587]
pkiUser                           O 2.5.6.21 [RFC2587]
postalAddress                     A 2.5.4.16 [RFC2256]
postalCode                        A 2.5.4.17 [RFC2256]
postOfficeBox                     A 2.5.4.18 [RFC2256]
preferredDeliveryMethod           A 2.5.4.28 [RFC2256]
presentationAddress               A 2.5.4.29 [RFC2256]
presentationAddressMatch          M 2.5.13.22 [RFC2252]
protocolInformation               A 2.5.4.48 [RFC2256]
protocolInformationMatch          M 2.5.13.24 [RFC2252]
qualityLabelledData               O 0.9.2342.19200300.100.4.22 [RFC1274]
registeredAddress                 A 2.5.4.26 [RFC2256]
residentialPerson                 O 2.5.6.10 [RFC2256]
RFC822LocalPart                   O 0.9.2342.19200300.100.4.14 [RFC1274]
RFC822Mailbox                     A 0.9.2342.19200300.100.1.3 [RFC1274]
rFC822ToX400Mapping               O 1.3.6.1.4.1.453.7.1.1 [RFC2164]
```

roleOccupant	A	2.5.4.33 [RFC2256]
room	O	0.9.2342.19200300.100.4.7 [RFC1274]
roomNumber	A	0.9.2342.19200300.100.1.6 [RFC1274]
searchGuide	A	2.5.4.14 [RFC2256]
secretary	A	0.9.2342.19200300.100.1.21 [RFC1274]
seeAlso	A	2.5.4.34 [RFC2256]
serialNumber	A	2.5.4.5 [RFC2256]
simpleSecurityObject	O	0.9.2342.19200300.100.4.19 [RFC1274]
singleLevelQuality	A	0.9.2342.19200300.100.1.50 [RFC1274]
SN	A	2.5.4.4 [RFC2256]
sOARecord	A	0.9.2342.19200300.100.1.30 [RFC1274]
ST	A	2.5.4.8 [RFC2256]
stateOrProvinceName	A	2.5.4.8 [RFC2256]
street	A	2.5.4.9 [RFC2256]
streetAddress	A	2.5.4.9 [RFC2256]
strongAuthenticationUser	O	2.5.6.15 [RFC2256]
subschema	O	2.5.20.1 [RFC2252]
subschemaSubentry	A	2.5.18.10 [RFC2252]
subtree	O	1.3.6.1.4.1.453.7.1.1 [RFC2293]
subtreeMaximumQuality	A	0.9.2342.19200300.100.1.52 [RFC1274]
subtreeMinimumQuality	A	0.9.2342.19200300.100.1.51 [RFC1274]
supportedAlgorithms	A	2.5.4.52 [RFC2256]
supportedApplicationContext	A	2.5.4.30 [RFC2256]
supportedControl	A	1.3.6.1.4.1.1466.101.120.13 [RFC2252]
supportedExtension	A	1.3.6.1.4.1.1466.101.120.7 [RFC2252]
supportedLDAPVersion	A	1.3.6.1.4.1.1466.101.120.15 [RFC2252]
supportedSASLMechanisms	A	1.3.6.1.4.1.1466.101.120.14 [RFC2252]
surname	A	2.5.4.4 [RFC2256]
table	O	1.3.6.1.4.1.453.7.1.2 [RFC2293]
tableEntry	O	1.3.6.1.4.1.453.7.1.3 [RFC2293]
telephoneNumber	A	2.5.4.20 [RFC2256]
telephoneNumberMatch	M	2.5.13.20 [RFC2252]
telephoneNumberSubstringsMatch	M	2.5.13.21 [RFC2252]
teletexTerminalIdentifier	A	2.5.4.22 [RFC2256]
telexNumber	A	2.5.4.21 [RFC2256]
textEncodedORAddress	A	0.9.2342.19200300.100.1.2 [RFC1274]
textTableEntry	O	1.3.6.1.4.1.453.7.1.4 [RFC2293]
textTableKey	A	1.3.6.1.4.1.453.7.2.1 [RFC2293]
textTableValue	A	1.3.6.1.4.1.453.7.2.2 [RFC2293]
title	A	2.5.4.12 [RFC2256]
top	O	2.5.6.0 [RFC2256]
uid	A	0.9.2342.19200300.100.1.1 [RFC2253]
uniqueIdentifier	A	0.9.2342.19200300.100.1.44 [RFC1274]
uniqueMember	A	2.5.4.50 [RFC2256]
uniqueMemberMatch	M	2.5.13.23 [RFC2252]
userCertificate	A	2.5.4.36 [RFC2256]
userClass	A	0.9.2342.19200300.100.1.8 [RFC1274]
userId	A	0.9.2342.19200300.100.1.1 [RFC1274]

```
userPassword                    A 2.5.4.35 [RFC2256]
userSecurityInformation         O 2.5.6.18 [RFC2256]
x121Address                     A 2.5.4.24 [RFC2256]
x400ToRFC822Mapping             O 1.3.6.1.4.1.453.7.1.2 [RFC2164]
x500UniqueIdentifier            A 2.5.4.45 [RFC2256]

Legend
------------------------
A => Attribute Type
C => DIT Content Rule
E => LDAP URL Extension
M => Matching Rule
N => Name Form
O => Object Class
```

B.3. Attribute Description Options

Option	Owner	Reference
binary	IESG	[RFC2251]
lang-*	IESG	[RFC2596]

* family of options

B.4. LDAPMessage types

Name	Code	Owner	Reference
bindRequest	0	IESG	[RFC2251]
bindResponse	1	IESG	[RFC2251]
unbindRequest	2	IESG	[RFC2251]
searchRequest	3	IESG	[RFC2251]
searchResEntry	4	IESG	[RFC2251]
searchResDone	5	IESG	[RFC2251]
modifyRequest	6	IESG	[RFC2251]
modifyResponse	7	IESG	[RFC2251]
addRequest	8	IESG	[RFC2251]
addResponse	9	IESG	[RFC2251]
delRequest	10	IESG	[RFC2251]
delResponse	11	IESG	[RFC2251]
modDNRequest	12	IESG	[RFC2251]
modDNResponse	13	IESG	[RFC2251]
compareRequest	14	IESG	[RFC2251]
compareResponse	15	IESG	[RFC2251]
abandonRequest	16	IESG	[RFC2251]
reserved	17-18	IESG	

searchResRef	19	IESG	[RFC2251]
reserved	20-22	IESG	
extendedReq	23	IESG	[RFC2251]
extendedResp	24	IESG	[RFC2251]

B.5. resultCode values

Name	Code	Owner	Reference
success	0	IESG	[RFC2251]
operationsError	1	IESG	[RFC2251]
protocolError	2	IESG	[RFC2251]
timeLimitExceeded	3	IESG	[RFC2251]
sizeLimitExceeded	4	IESG	[RFC2251]
compareFalse	5	IESG	[RFC2251]
compareTrue	6	IESG	[RFC2251]
authMethodNotSupported	7	IESG	[RFC2251]
strongAuthRequired	8	IESG	[RFC2251]
reserved (partialResults)	9	IESG	[RFC2251]
referral	10	IESG	[RFC2251]
adminLimitExceeded	11	IESG	[RFC2251]
unavailableCriticalExtension	12	IESG	[RFC2251]
confidentialityRequired	13	IESG	[RFC2251]
saslBindInProgress	14	IESG	[RFC2251]
noSuchAttribute	16	IESG	[RFC2251]
undefinedAttributeType	17	IESG	[RFC2251]
inappropriateMatching	18	IESG	[RFC2251]
constraintViolation	19	IESG	[RFC2251]
attributeOrValueExists	20	IESG	[RFC2251]
invalidAttributeSyntax	21	IESG	[RFC2251]
noSuchObject	32	IESG	[RFC2251]
aliasProblem	33	IESG	[RFC2251]
invalidDNSyntax	34	IESG	[RFC2251]
reserved (isLeaf)	35	IESG	[RFC2251]
aliasDereferencingProblem	36	IESG	[RFC2251]
reserved	37-47	IESG	
inappropriateAuthentication	48	IESG	[RFC2251]
invalidCredentials	49	IESG	[RFC2251]
insufficientAccessRights	50	IESG	[RFC2251]
busy	51	IESG	[RFC2251]
unavailable	52	IESG	[RFC2251]
unwillingToPerform	53	IESG	[RFC2251]
loopDetect	54	IESG	[RFC2251]
reserved	55-63	IESG	
namingViolation	64	IESG	[RFC2251]
objectClassViolation	65	IESG	[RFC2251]
notAllowedOnNonLeaf	66	IESG	[RFC2251]

notAllowedOnRDN	67	IESG	[RFC2251]
entryAlreadyExists	68	IESG	[RFC2251]
objectClassModsProhibited	69	IESG	[RFC2251]
reserved (resultsTooLarge)	70	IESG	[RFC2251]
reserved	71-79	IESG	
other	80	IESG	[RFC2251]
reserved (APIs)	81-90	IESG	[RFC2251]

B.6. Bind Authentication Method

Method	Value	Owner	Usage	Reference
simple	0	IESG	LIMITED USE	[RFC2251,RFC2829]
krbv42LDAP	1	IESG	OBSOLETE*	[RFC1777]
krbv42DSA	2	IESG	OBSOLETE*	[RFC1777]
sasl	3	IESG	COMMON	[RFC2251,RFC2829]

* These LDAPv2-only mechanisms were deprecated in favor LDAPv3 SASL authentication method, specifically the GSSAPI mechanism.

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