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**Lightweight Directory Access Protocol (v3):
UTF-8 String Representation of Distinguished Names
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Status of Memo

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Abstract

The X.500 Directory uses distinguished names as the primary keys to entries in the directory. Distinguished Names are encoded in ASN.1 in the X.500 Directory protocols. In the Lightweight Directory Access Protocol, a string representation of distinguished names is

transferred. This specification defines the string format for representing names, which is designed to give a clean representation of commonly used distinguished names, while being able to represent any distinguished name.

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 [RFC 2119](#) [[RFC2119](#)].

1. Background

This specification assumes familiarity with X.500 [[X.500](#)], and the concept of Distinguished Name. It is important to have a common format to be able to unambiguously represent a distinguished name. The primary goal of this specification is ease of encoding and decoding. A secondary goal is to have names that are human readable. It is not expected that LDAP clients with a human user interface would display these strings directly to the user, but would most likely be performing translations (such as expressing attribute type names in one of the local national languages).

2. Converting DistinguishedName from ASN.1 to a String

In X.501 [[X.501](#)] the ASN.1 structure of distinguished name is defined as:

```
DistinguishedName ::= RDNSequence

RDNSequence ::= SEQUENCE OF RelativeDistinguishedName

RelativeDistinguishedName ::= SET SIZE (1..MAX) OF
    AttributeTypeAndValue

AttributeTypeAndValue ::= SEQUENCE {
    type AttributeType,
    value AttributeValue }
```

The following sections define the algorithm for converting from an ASN.1 structured representation to a UTF-8 [[RFC2279](#)] string representation.

2.1. Converting the RDNSequence

If the RDNSequence is an empty sequence, the result is the empty or zero length string.

Otherwise, the output consists of the string encodings of each RelativeDistinguishedName in the RDNSequence (according to 2.2), starting with the last element of the sequence and moving backwards toward the first.

The encodings of adjoining RelativeDistinguishedNames are separated by a comma character (',' ASCII 44).

[2.2.](#) Converting RelativeDistinguishedName

When converting from an ASN.1 RelativeDistinguishedName to a string, the output consists of the string encodings of each AttributeTypeAndValue (according to 2.3), in any order.

Where there is a multi-valued RDN, the outputs from adjoining AttributeTypeAndValues are separated by a plus ('+' ASCII 43) character.

[2.3.](#) Converting AttributeTypeAndValue

The AttributeTypeAndValue is encoded as the string representation of the AttributeType, followed by an equals character ('=' ASCII 61), followed by the string representation of the AttributeValue. The encoding of the AttributeValue is given in [section 2.4](#).

If the AttributeType is in the following table of attribute types associated with LDAP [[RFC2252](#)], then the type name string from that table is used, otherwise it is encoded as the dotted-decimal encoding of the AttributeType's OBJECT IDENTIFIER. The dotted-decimal notation is described in [[RFC2251](#)].

String	X.500 AttributeType
CN	commonName
L	localityName
ST	stateOrProvinceName
O	organizationName
OU	organizationalUnitName
C	countryName
STREET	streetAddress
DC	domainComponent
UID	userId

[2.4.](#) Converting an AttributeValue from ASN.1 to a String

If the AttributeValue is of a type which does not have a string representation defined for it, then it is simply encoded as an octothorpe character ('#' ASCII 35) followed by the hexadecimal representation of each of the octets of the BER encoding of the X.500 AttributeValue. This form SHOULD be used if the AttributeType is of the dotted-decimal form.

Otherwise, if the AttributeValue is of a type which has a string representation, the value is converted first to a UTF-8 string according to its syntax specification (see for example [section 6 of \[RFC2252\]](#)).

If the UTF-8 string does not have any of the following characters which need escaping, then that string can be used as the string representation of the value.

- a space or "#" character occurring at the beginning of the string
- a space character occurring at the end of the string
- one of the characters ",", "+", "\"", "<", ">" or ";"

Implementations MAY escape other characters.

Each octet of the character to be escaped is replaced by a backslash and two hex digits, which form a single octet in the code of the character. Alternatively, if and only if the character to be escaped is one of

",", "+", "\"", "<", ">", ";", "#", "=", or " "

it may be prefixed by a backslash ('\ ' ASCII 92).

Examples of the escaping mechanism are shown in [section 4](#).

[3](#). Parsing a String back to a Distinguished Name

The structure of the UTF-8 string is specified using the following Augmented BNF [[RFC2234](#)] grammar.

```
distinguishedName = [name]
                    ; may be empty

name                = name-component *(COMMA name-component)

name-component      = attributeTypeAndValue *(PLUS attributeTypeAndValue)
```


attributeTypeAndValue
= attributeType EQUALS attributeValue

attributeType = keyword / oid

keyword = ALPHA 1*keychar

keychar = ALPHA / DIGIT / MINUS

oid = 1*DIGIT *(DOT 1*DIGIT)

attributeValue = string / hexstring

string = *(stringchar / pair)
; the string MUST NOT start with SHARP or SP
; and MUST NOT end with SP

stringchar = <any UTF-8 character (can be multiple octets)
except one of escaped or ESC>

pair = ESC (ESC / special / hexpair)

special = escaped / SHARP / EQUALS / SP

escaped = COMMA / PLUS / %x22 / %x3C / %x3E / %3B
; ", " / "+" / "" / "<" / ">" / ";"

hexstring = SHARP 1*hexpair

hexpair = HEX HEX

HEX = DIGIT / %x41-46 / %x61-66
; 0-9 / A-F / a-f

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

DIGIT = %x30-39
; 0-9

SP = %x20 ; space (" ")

SHARP = %x23 ; sharp sign ("#")

PLUS = %x2B ; plus sign ("+")

COMMA = %x2C ; comma (",")

MINUS = %x2D ; minus sign ("-")

DOT = %x2E ; period (".")

EQUALS = %x3D ; equals sign ("=")

ESC = %x5C ; backslash ("\")

4. Examples

This notation is designed to be convenient for common forms of name. This section gives a few examples of distinguished names written using this notation. First is a name containing three relative distinguished names (RDNs):

```
UID=jsmith,DC=example,DC=net
```

Here is an example name containing three RDNs, in which the first RDN is multi-valued:

```
OU=Sales+CN=J. Smith,DC=example,DC=net
```

This example shows the method of quoting of a comma in a common name:

```
CN=John Smith\, III,DC=example,DC=net
```

An example name in which a value contains a carriage return character:

```
CN=Before\0dAfter,DC=example,DC=net
```

An example name in which an RDN was of an unrecognized type. The value is the BER encoding of an OCTET STRING containing two octets 0x48 and 0x69.

```
1.3.6.1.4.1.1466.0=#04024869,DC=example,DC=com
```

Finally, an example of an RDN commonName value consisting of 5 letters:

Unicode Letter Description	10646 code	UTF-8	Quoted
LATIN CAPITAL LETTER L	U0000004C	0x4C	L
LATIN SMALL LETTER U	U00000075	0x75	u
LATIN SMALL LETTER C WITH CARON	U0000010D	0xC48D	\C4\8D
LATIN SMALL LETTER I	U00000069	0x69	i
LATIN SMALL LETTER C WITH ACUTE	U00000107	0xC487	\C4\87

Could be written in printable ASCII (useful for debugging purposes):

```
CN=Lu\C4\8Di\C4\87
```

5. Security Considerations

The following security considerations are specific to the handling of distinguished names. For security considerations specific to LDAP, see [RFC 2251](#), [RFC 2829](#), and [RFC 2830](#).

[5.1. Disclosure](#)

Distinguished Names typically consist of descriptive information about the entries they name, which can be people, organizations, devices or other real-world objects. This frequently includes some of the following kinds of information:

- the common name of the object (i.e. a person's full name)
- an email or TCP/IP address
- its physical location (country, locality, city, street address)
- organizational attributes (such as department name or affiliation)

Most countries have privacy laws regarding the publication of information about people.

[5.2. Use of Distinguished Names in Security Applications](#)

The transformations of an AttributeValue value from its X.501 form to an LDAP string representation are not always reversible back to the same BER or DER form. An example of a situation which requires the DER form of a distinguished name is the verification of an X.509 certificate.

For example, a distinguished name consisting of one RDN with one AVA, in which the type is commonName and the value is of the TeletexString choice with the letters 'Sam' would be represented in LDAP as the string CN=Sam. Another distinguished name in which the value is still 'Sam' but of the PrintableString choice would have the same representation CN=Sam.

Applications which require the reconstruction of the DER form of the value SHOULD NOT use the string representation of attribute syntaxes when converting a distinguished name to the LDAP format. Instead, they SHOULD use the hexadecimal form prefixed by the octothorpe ('#') as described in the first paragraph of [section 2.4](#).

[6. References](#)

- [X.500] The Directory -- overview of concepts, models and services. ITU-T Rec. X.500(1993).

- [X.501] The Directory -- Models. ITU-T Rec. X.501(1993).
- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [RFC 2119](#).
- [RFC2234] Crocker, D., and P. Overell, "Augmented BNF for Syntax Specifications: ABNF", [RFC 2234](#), November 1997.
- [RFC2247] S. Kille, M. Wahl, A. Grimstad, R. Huber, S. Sataluri, "Using Domains in LDAP/X.500 Distinguished Names", [RFC 2247](#), January 1998.
- [RFC2279] Yergeau, F., "UTF-8, a transformation format of ISO 10646", [RFC 2279](#), January 1998.
- [RFC2251] Wahl, M., Howes, T., and S. Kille, "Lightweight Directory Access Protocol (v3)", [RFC 2251](#), December 1997.
- [RFC2252] Wahl, M., Coulbeck, A., Howes, T. and S. Kille, "Lightweight Directory Access Protocol (v3): Attribute Syntax Definitions", [RFC 2252](#), December 1997.

[7.](#) Acknowledgment

This document is an update to [RFC 2253](#), by Mark Wahl, Tim Howes, and Steve Kille. Design ideas included in this revised specification are based upon those discussed in LDAP Revision (proposed) Working Group (LDAPbis) and other IETF Working Groups. The contributions of individuals in these working groups is gratefully acknowledged.

[8.](#) Document Editor's Address

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[Appendix A.](#) Changes made to [RFC 2253](#)

[Editor's Note: this non-normative appendix may be removed prior to publication as an RFC]

The following substantive changes were made to [RFC 2253](#):

- Removed IESG Note
- Removed specification of additional requirements for LDAPv2 implementations which also support LDAPv3 ([Section 4](#)).

- Updated 2.3 to clarify which table is the published table of names which may be appear in DNs. Remove "as an example" language.
- Updated 2.4 to allow hex pair escaping of all characters and clarified escaping for when multiple octet UTF-8 characters are present.
- Rewrote [Section 3](#) to use ABNF as defined in [RFC 2234](#).
- Rewrote [Section 3](#) ABNF to be consistent with 2.4.
- Rewrote examples
- Added reference to documentations containing LDAP-specific security considerations

In addition, numerous editorial changes were made.

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