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# Connection-less Lightweight X.500 Directory Access Protocol

## Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

## X.500

The protocol described in this document is designed to provide access to the Directory while not incurring the resource requirements of the Directory Access Protocol (DAP) [3]. In particular, it is aimed at avoiding the elapsed time that is associated with connection-oriented communication and it facilitates use of the Directory in a manner analagous to the DNS [5,6]. It is specifically targeted at simple lookup applications that require to read a small number of attribute values from a single entry. It is intended to be a complement to DAP and LDAP [4]. The protocol specification draws heavily on that of LDAP.

## 1. Background

The Directory can be used as a repository for many kinds of information. The full power of DAP is unnecessary for applications that require simple read access to a few attribute values. Applications addressing is a good example of this type of use where an application entity needs to determine the Presentation Address (PA) of a peer entity given that peer’s Application Entity Title (AET). If the AET is a Directory Name (DN) then the required result can be obtained from the PA attribute of the Directory entry identified by the AET. This is very similar to DNS.

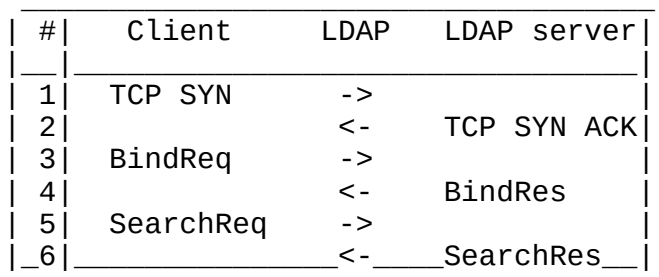
Use of DAP to achieve this functionality involves a significant number of network exchanges:

| # | Client (DUA) | DAP | Server (DSA) |
|---|---|---|---|
| 1 | N-Connect.request | -> | |
| 2 | | <- | N-Connect.response |
| 3 | T-Connect.request | -> | |
| 4 | | <- | T-Connect.response |
| | S-Connect.request, | | |
| | P-Connect.request, | | |
| | A-Associate.request, | | |
| 5 | DAP-Bind.request | -> | |
| | | | S-Connect.response, |
| | | | P-Connect.response, |
| | | | A-Associate.response, |
| 6 | | <- | DAP-Bind.response |
| 7 | DAP-Read.request | -> | |
| 8 | | <- | DAP-Read.response |
| | S-Release.request, | | |
| | P-Release.request, | | |
| | A-Release.request, | | |
| 9 | DAP-Unbind.request | -> | |
| | | | S-Release.response, |
| | | | P-Release.response, |
| | | | A-Release.response, |
| 10 | | <- | DAP-Unbind.response |
| | T-Disconnect.request, | | |
| 11 | N-Disconnect.request | -> | |
| | | | T-Disconnect.response, |
| 12 | | <- | N-Disconnect.response |

This is 10 packets before the application can continue, given that it can probably do so after issuing the T-Disconnect.request. (Some minor variations arise depending upon the class of Network and Transport service that is being used; for example use of TP4 over CLNS reduces the packet count by two.) LDAP is no better in the case where the LDAP server uses full DAP to communicate with the Directory:

| # | Client | LDAP | LDAP_server | DAP | DSA |
|---|---|---|---|---|---|
| 1 | TCP SYN | -> | | | |
| 2 | | <- | TCP SYN ACK | | |
| 3 | BindReq | -> | | | |
| 4 | | | N-Connect.req | -> | |
| 5 | | | | <- | N-Connect.res |
| 6 | | | T-Connect.req | -> | |
| 7 | | | | <- | T-Connect.res |
| 8 | | | DAP-Bind.req | -> | |
| 9 | | | | <- | DAP-Bind.res |
| 10 | | <- | BindRes | | |
| 11 | SearchReq | -> | | | |
| 12 | | | DAP-Search.req | -> | |
| 13 | | | | <- | DAP-Search.res |
| 14 | | <- | SearchRes | | |
| 15 | TCP FIN | -> | | | |
| 16 | | | DAP-Unbind.req | -> | |
| 17 | | | | <- | DAP-Unbind.res |
| 18 | | | N-Disconnect.req | -> | |
| 19 | | | | <- | N-Disconnect.res |

Here there are 14 packets before the application can continue. Even if the LDAP server is on the same host as the DSA (so packet delay is negligible), or if the DSA supports LDAP directly, then there are still 6 packets.




This protocol provides for simple access to the Directory where the delays inherent in the above exchanges are unacceptable and where the additional functionality provided by connection-mode operation is not required.

## 2. Protocol Model

CLDAP is based directly on LDAP [4] and inherits many of the key aspects of the LDAP protocol:

- - Many protocol data elements are encoding as ordinary strings (e.g., Distinguished Names).

- - A lightweight BER encoding is used to encode all protocol elements.

It is different to LDAP in that:

- - Protocol elements are carried directly over UDP or other connection-less transport, bypassing much of the session/presentation overhead and that of connections (LDAP uses a connection-mode transport service).

- - A restricted set of operations is available.

The definitions of most protocol elements are inherited from LDAP.

The general model adopted by this protocol is one of clients performing protocol operations against servers. In this model, this is accomplished by a client transmitting a protocol request describing the operation to be performed to a server, which is then responsible for performing the necessary operations on the Directory.

Upon completion of the necessary operations, the server returns a response containing any results or errors to the requesting client.

Note that, although servers are required to return responses whenever such responses are defined in the protocol, there is no requirement for synchronous behaviour on the part of either client or server implementations: requests and responses for multiple operations may be exchanged by client and servers in any order, as long as servers eventually send a response for every request that requires one.

Also, because the protocol is implemented over a connection-less transport service clients must be prepared for either requests or responses to be lost. Clients should use a retry mechanism with timeouts in order to achieve the desired level of reliability. For example, a client might send off a request and wait for two seconds. If no reply is forthcoming, the request is sent again and the client waits four seconds. If there is still no reply, the client sends it again and waits eight seconds, and so on, until some maximun time. Such algorithms are widely used in other datagram-based protocol implementations, such as the DNS. It is not appropriate to mandate a specific algorithm as this will depend upon the requirments and operational environment of individual CLDAP client implementations.

It is not required that a client abandon any requests to which no response has been received and for which a reply is no longer required (because the request has been timed out), but they may do so.

Consistent with the model of servers performing protocol operations on behalf of clients, it is also to be noted that protocol servers are expected to handle referrals without resorting to the return of such referrals to the client. This protocol makes no provisions for the return of referrals to clients, as the model is one of servers ensuring the performance of all necessary operations in the Directory, with only final results or errors being returned by servers to clients.

Note that this protocol can be mapped to a strict subset of the Directory abstract service, so it can be cleanly provided by the DAP.

## 3. Mapping Onto Transport Services

This protocol is designed to run over connection-less transports, with all 8 bits in an octet being significant in the data stream. Specifications for two underlying services are defined here, though others are also possible.

### 3.1. User Datagram Protocol (UDP)

The CLDAPMessage PDUs are mapped directly onto UDP datagrams. Only one request may be sent in a single datagram. Only one response may be sent in a single datagram. Server implementations running over the UDP should provide a protocol listener on port 389.

### 3.2. Connection-less Transport Service (CLTS)

Each LDAPMessage PDU is mapped directly onto T-Unit-Data.

## 4. Elements of Protocol

CLDAP messages are defined by the following ASN.1:

```
 CLDAPMessage ::= SEQUENCE {
     messageID       MessageID,
     user            LDAPDN,         -- on request only --
     protocolOp      CHOICE {
                     searchRequest   SearchRequest,
                     searchResponse  SEQUENCE OF
                                         SearchResponse,
                     abandonRequest  AbandonRequest
     }
 }
```

where MessageID, LDAPDN, SearchRequest, SearchResponse and AbandonRequest are defined in the LDAP protocol.

The 'user' element is supplied only on requests (it should be zero length and is ignored in responses). It may be used for logging purposes but it is not required that a CLDAP server implementation apply any particular semantics to this field.

Editorial note:

There has been some discussion about the desirability of authentication with CLDAP requests and the addition of the fields necessary to support this. This might take the form of a clear text password (which would go against the current IAB drive to remove such things from protocols) or some arbitrary credentials. Such a field is not included. It is felt that, in general, authentication would incur sufficient overhead to negate the advantages of the connectionless basis of CLDAP. If an application requires authenticated access to the Directory then CLDAP is not an appropriate protocol.

Within a searchResponse all but the last SearchResponse has choice 'entry' and the last SearchResponse has choice 'resultCode'. Within a searchResponse, as an encoding optimisation, the value of the objectName LDAP DN may use a trailing '*' character to refer to the baseObject of the corresponding searchRequest. For example, if the baseObject is specified as "o=UofM, c=US", then the following objectName LDAPDNs in a response would have the indicated meanings

| objectName returned | actual LDAPDN denoted |
|---|---|
| "*" | "o=UofM, c=US" |
| "cn=Babs Jensen, *" | "cn=Babs Jensen, o=UofM, c=US" |

## 4.1. Errors

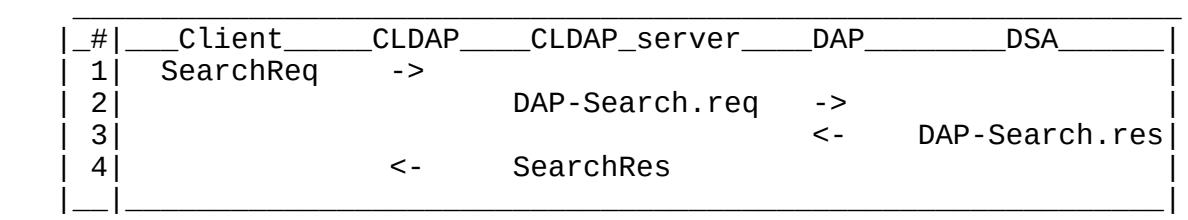
The following error code is added to the LDAPResult.resultCode enumeration of [4]:

```
                          resultsTooLarge             (70),
```

This error is returned when the LDAPMessage PDU containing the results of an operation are too large to be sent in a single datagram.

## 4.2. Example

A simple lookup can be performed in 4 packets. This is reduced to 2 if either the DSA implements the CLDAP protocol, the CLDAP server has a cache of the desired results, or the CLDAP server and DSA are co-located such that there is insignificant delay between them.




# 5. Implementation Considerations

The following subsections provide guidance on the implementation of clients and servers using the CLDAP protocol.

### 5.1. Server Implementations

Given that the goal of this protocol is to minimise the elapsed time between making a Directory request and receiving the response, a server which uses DAP to access the directory should use techniques that assist in this.

- - A server should remain bound to the Directory during reasonably long idle periods or should remain bound permanently.

- - Cacheing of results is highly desirable but this must be tempered by the need to provide up-to-date results given the lack of a cache invalidation protocol in DAP (either implicit via timers or explicit) and the lack of a dontUseCopy service control in the protocol.

Of course these issues are irrelevant if the CLDAP protocol is directly supported by a DSA.

### 5.2. Client Implementations

For simple lookup applications, use of a retry algorithm with multiple servers similar to that commonly used in DNS stub resolver implementations is recommended. The location of a CLDAP server or servers may be better specified using IP addresses (simple or broadcast) rather than names that must first be looked up in another directory such as DNS.

## 6. Security Considerations

This protocol provides no facilities for authentication. It is expected that servers will bind to the Directory either anonymously or using simple authentication without a password.

## 7. Bibliography

[1] The Directory: Overview of Concepts, Models and Service. CCITT Recommendation X.500, 1988.

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[4] Yeong, W., Howes, T., and S. Kille, "X.500 Lightweight Directory Access Protocol", RFC 1487, Performance Systems International, University of Michigan, ISODE Consortium, July 1993.

[5] Mockapetris, P., "Domain Names - Implementation and Specification", STD 13, RFC 1035, USC/Information Sciences Institute, November 1987.

[6] Mockapetris, P., "Domain Names - Concepts and Facilities", STD 13, RFC 1034, USC/Information Sciences Institute, November 1987.

## 8. Acknowledgements

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