

# I-CSCF DUA-DB LDAP Interface

## Call Session Control Function

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### INTERWORK DESCRIPTION

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# 1 Introduction

This document specifies the Lightweight Directory Access Protocol (LDAP) interface between the Interrogating Call Session Control Function (I-CSCF) and the Dynamic User Association Database (DUA-DB).

The LDAP interface is used within the scope of Dynamic User Identity Support (DUIS). With DUIS enabled, for a terminating request the I-CSCF converts an external user identity of the terminating user of a partner's network to an IP Multimedia Subsystem (IMS) internal identity.



## 2 Interface Overview

The LDAP messages sent between the I-CSCF and the DUA-DB, see Figure 1, are based on the standard LDAP v2 protocol and the standard LDAP v3 protocol defined in the [RFC 1777 Lightweight Directory Access Protocol \(March 1995\)](#) and [RFC 4511 Lightweight Directory Access Protocol \(June 2006\)](#) specifications.

The I-CSCF includes an LDAP Client based on [OpenLDAP 2.4.31](#).



Figure 1 Interface Entities

### 2.1 Interface Role

The LDAP interface between the I-CSCF and the DUA-DB is used by the I-CSCF to search for an internal IMS identity for an external user.

### 2.2 Services

The services used by the I-CSCF are shown in Table 1.

Table 1 Used Services

Used Service	Description
Request for an internal IMS identity (the specific IMPU of a Wildcarded IMPU) for an external user belonging to a partner of the operator.	An LDAP SEARCH command is sent by the I-CSCF to the DUA-DB with the external user identity included. The DUA-DB returns the specific IMPU and a list of DUA-S that the external user has registered with. I-CSCF modifies the received terminating SIP request with the information received from the DUA-DB. The S-CSCF handles the terminating request with the Wildcarded IMPU associated with the external user.

### 2.3 Encapsulation and Addressing

The LDAP interface between the I-CSCF and DUA-DB is running on top of Transmission Control Protocol (TCP) supporting IPv4 and IPv6 protocols. The interface uses standard defined requests and responses. The content within the requests is also based on standard defined formats. The IP address and other information, for example, RootDN related to accessing the DUA-DB are configured in the I-CSCF, refer to *CSCF Configuration Management*.





## 3 Procedures

This section describes the procedures used with the interfaces of the I-CSCF.

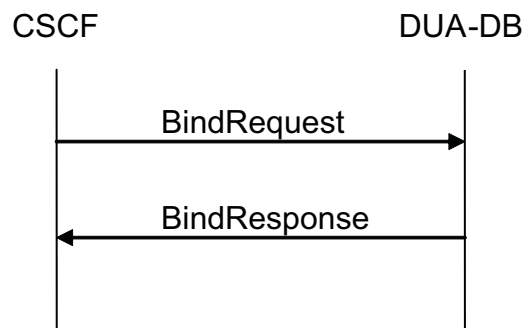
### 3.1 Lower-Level Procedures

The LDAP interface between the I-CSCF and the DUA-DB supports the procedures for the following:

- Establishment of an LDAP session with DUA-DB
- Search in the DUA-DB
- Release of the LDAP session from DUA-DB

### 3.2 Establishment of LDAP Session with DUA-DB

At establishment of an LDAP session, I-CSCF sends a `BindRequest` message to the DUA-DB, as shown in Figure 2.



*Figure 2 Establishment of LDAP Session*

The function of the `BindRequest` message is to initiate an LDAP session between the I-CSCF (the LDAP client) and the DUA-DB (the LDAP server) and to allow the authentication of the I-CSCF with the DUA-DB. The LDAP session is set up over a long-lasting TCP connection. Such session will not be released after a search query.

Once the DUA-DB LDAP server configuration is defined in the I-CSCF, the I-CSCF establishes multiple LDAP sessions to the DUA-DB, typically one per Traffic Processor. Multiple different DUA-DB servers can be configured in the I-CSCF. The DUA-DB server is selected based on availability and priority.

If a connected DUA-DB is removed from the configuration or becomes unavailable, new LDAP sessions are established to another DUA-DB based on availability and priority.

### 3.3 Search in DUA-DB

To convert an external user identity of a business partner network to an IMS internal user identity, the I-CSCF sends a `SearchRequest` to a connected DUA-DB, as shown in Figure 3.

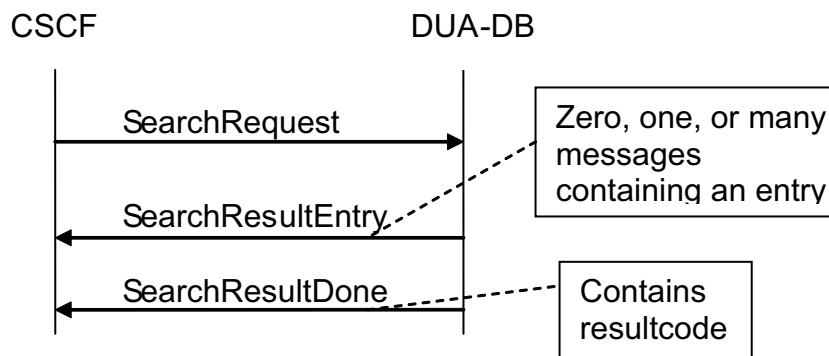


Figure 3 Converting External User Identity to IMS Internal Identity Using `SearchRequest`

One or more `SearchResultEntry` messages can be received for one `SearchRequest`. The `SearchResultDone` message contains a `resultcode` while any previously received `SearchResultEntry` messages contain an entry.

### 3.4 Release of LDAP Session

At release of an established LDAP session, the I-CSCF sends an `UnbindRequest` message the DUA-DB, as shown in Figure 4. There is no response for this message. The I-CSCF checks the status of the TCP connection before sending the `UnbindRequest`. If the TCP connection is lost, the `UnbindRequest` is not sent. Examples of situations when the I-CSCF (the LDAP client) terminates an established LDAP session are at configuration changes of the DUA-DB or the password is updated for a connected DUA-DB.

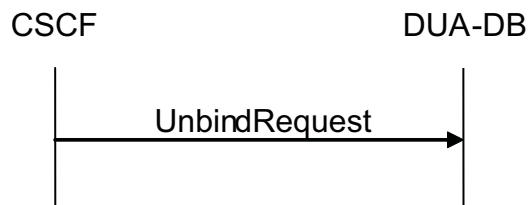


Figure 4 Releasing LDAP Session

The operation is always considered as successful and the TCP connection is torn down immediately by the I-CSCF.



## 3.5 Error Handling

If the DUA-DB does not respond with a `SearchResultDone` message to the LDAP request within a timer set by configuration or the TCP connection is down, then the I-CSCF retries the LDAP request to the same DUA-DB. If the DUA-DB still does not respond, and after a configurable number of retries the I-CSCF considers this DUA-DB unavailable for a period. Then I-CSCF connects to another DUA-DB defined in the configuration based on priority and availability.

For details about the configuration, refer to *CSCF Configuration Management*.



## 4 Information Model

The following LDAP messages are supported by the I-CSCF and the DUA-DB in the previously mentioned procedures:

Message	Sender
BindRequest	I-CSCF
BindResponse	DUA-DB
SearchRequest	I-CSCF
SearchResultEntry	DUA-DB
SearchResultDone	DUA-DB
UnbindRequest	I-CSCF

The following LDAP messages, defined in LDAP version 3, are not supported by the I-CSCF. The `searchResultReference` message and the following listed responses are silently discarded upon reception:

- `searchResultReference`
- `modifyRequest`, `modifyResponse`
- `addRequest`, `addResponse`
- `delRequest`, `delResponse`
- `modifyRDNRequest`, `modifyRDNResponse`
- `compareDNRequest`, `compareDNResponse`

The ASN.1 syntax is used in this document for describing message formats.

### 4.1 BindRequest

ASN.1 syntax:

```
BindRequest ::=
    [APPLICATION 0] SEQUENCE {
        version          Version,
        name              Name,
        authentication    AuthenticationChoice}
```

**Note:** Only simple authentication is supported.

The `BindRequest` is used to establish an LDAP session.

### Example of a BindRequest sent by the I-CSCF:

```
Lightweight Directory Access Protocol
LDAPMessage bindRequest(1) "cn=admin,dc=o,dc=com" simple
  messageID: 1
  protocolOp: bindRequest (0)
    bindRequest
      version: 3
      name: cn=admin,dc=o,dc=com
      authentication: simple (0)
        simple: 70617373776f7264
```

## 4.2 BindResponse

ASN.1 syntax:

```
BindResponse ::= [APPLICATION 1] LDAPResult
```

The BindResponse message indicates the status of the session setup request.

### Example of a BindResponse received by the I-CSCF:

```
Lightweight Directory Access Protocol
LDAPMessage bindResponse(1) success
  messageID: 1
  protocolOp: bindResponse (1)
    bindResponse
      resultCode: success (0)
      matchedDN:
      errorMessage:
```

## 4.3 SearchRequest

ASN.1 syntax:

```
SearchRequest ::=
  [APPLICATION 3] SEQUENCE {
    baseObject      BaseObject,
    scope           Scope,
    derefAliases    DerefAliases,
    sizeLimit       SizeLimit,
    timeLimit       TimeLimit,
    typesOnly       TypesOnly,
    filter           Filter,
    attributes      AttributeDescription}
```

The SearchRequest message is used to convert an external user identity to an IMS internal identity as supported by DUIS.



### Example of a SearchRequest sent by the I-CSCF using SIP URI:

```

Lightweight Directory Access Protocol
LDAPMessage searchRequest (2) "duaExtId=sip:alice@partner.com,dc=duaExtId,ou=identities,o=DuaDb,
dc=o,dc=com" baseObject
messageID: 2
protocolOp: searchRequest (3)
searchRequest
  baseObject:      duaExtId=sip:alice@partner.com,dc=duaExtId,ou=identities,o=DuaDb,
dc=o,dc=com
  scope: baseObject (0)
  derefAliases: derefAlways (3)
  sizeLimit: 0
  timeLimit: 0
  typesOnly: False
  Filter: (objectClass=*)
    filter: present (7)
    present: objectClass
  attributes: 3 items
    AttributeDescription: duaAssocId
    AttributeDescription: specificIMPU
    AttributeDescription: listOfDuaS

```

### Example of a SearchRequest sent by the I-CSCF using tel URI:

```

Lightweight Directory Access Protocol
LDAPMessage searchRequest (2) "duaExtId=tel:\2B16023332059,dc=duaExtId,ou=identities,o=DuaDb,⇒
dc=o,dc=com"
baseObject
  messageID: 2
  protocolOp: searchRequest (3)
  searchRequest
    baseObject:      duaExtId=tel:\2B16023332059,dc=duaExtId,ou=identities,o=DuaDb,⇒
dc=o,dc=com
    scope: baseObject (0)
    derefAliases: derefAlways (3)
    sizeLimit: 0
    timeLimit: 0
    typesOnly: False
    Filter: (objectClass=*)
      filter: present (7)
      present: objectClass
    attributes: 3 items
      AttributeDescription: specificIMPU
      AttributeDescription: listOfDuaS
      AttributeDescription: duaAssocId

```

## 4.4 Search Result

The results of the search operation are returned as zero or more SearchResultEntry messages, followed by a single SearchResultDone message.

ASN.1 syntax:

```

SearchResultEntry ::= [APPLICATION 4] SEQUENCE {
    objectName      BaseObject,
    attributes      PartialAttributeList }

```

```

SearchResultDone ::= [APPLICATION 5] LDAPResult}

```

With the DUIS enabled, the SearchResultEntry message contains a specific IMPU of a Wildcarded IMPU and a list of DUA-S.



### Example of a SearchResultEntry received by the I-CSCF using SIP URI:

```
Lightweight Directory Access Protocol
LDAPMessage searchResEntry(2) "duaExtId=sip:alice@partner.com,dc=duaExtId,ou=identities,=>
o=DuaDb,dc=o,
dc=com" [1 result]
  messageID: 2
  protocolOp: searchResEntry (4)
    searchResEntry
      objectName: duaExtId=sip:alice@partner.com, dc=duaExtId,ou=identities,o=DuaDb,=>
dc=o,dc=com
      attributes: 6 items
        PartialAttributeList item objectClass
          type: objectClass
          vals: 2 items
            AttributeValue: duaExtId
            AttributeValue: duaAssocId
        PartialAttributeList item duaExtId
          type: duaExtId
          vals: 1 item
            AttributeValue: sip:alice@partner.com
        PartialAttributeList item duaAssocId
          type: duaAssocId
          vals: 1 item
            AttributeValue: sip:alice@partner.com
        PartialAttributeList item specificIMPU
          type: specificIMPU
          vals: 1 item
            AttributeValue: sip:WP-A_WPSERVICEPROFILE-5@one.att.net
        PartialAttributeList item listOfDuaS
          type: listOfDuaS
          vals: 1 item
            AttributeValue: DUA-S-17;2012-12-24Z15:30:00;1
        PartialAttributeList item wpUserAliasList
          type: wpUserAliasList
          vals: 1 item
            AttributeValue: tel:+12141234789
```

### Example of a SearchResultEntry received by I-CSCF using tel URI:

```
Lightweight Directory Access Protocol
LDAPMessage searchResEntry(2) " duaExtId= tel:\2B16023332059,dc=duaExtId,ou=identities,=>
o=DuaDb,dc=o,
dc=com" [1 result]
  messageID: 2
  protocolOp: searchResEntry (4)
    searchResEntry
      objectName: duaExtId= tel:\2B16023332059,dc=duaExtId,ou=identities,o=DuaDb,dc=o,=>
dc=com
      attributes: 6 items
        PartialAttributeList item objectClass
          type: objectClass
          vals: 2 items
            AttributeValue: duaExtId
            AttributeValue: duaAssocId
        PartialAttributeList item duaExtId
          type: duaExtId
          vals: 1 item
            AttributeValue: tel:+16023332059
        PartialAttributeList item duaAssocId
          type: duaAssocId
          vals: 1 item
            AttributeValue: sip:alice@partner.com
        PartialAttributeList item specificIMPU
          type: specificIMPU
          vals: 1 item
            AttributeValue: sip:WP-A_WPSERVICEPROFILE-5@one.att.net
        PartialAttributeList item listOfDuaS
          type: listOfDuaS
          vals: 1 item
            AttributeValue: DUA-S-11;2012-12-24Z15:30:00;1
        PartialAttributeList item wpUserAliasList
          type: wpUserAliasList
          vals: 1 item
            AttributeValue: tel:+16023332059
```





Example of a `SearchResultDone` received by the I-CSCF:

```
Lightweight Directory Access Protocol
  LDAPMessage searchResDone(2) success [0 results]
    messageID: 2
    protocolOp: searchResDone (5)
      searchResDone
        resultCode: success (0)
        matchedDN:
        errorMessage:
      [Response To: 21]
      [Time: 0.000418000 seconds]
```

## 4.5 UnbindRequest

ASN.1 syntax:

```
UnbindRequest ::= [APPLICATION 2] NULL
```

The `UnbindRequest` message is to terminate a protocol session.

Example of an `UnbindRequest` sent by the I-CSCF:

```
Lightweight Directory Access Protocol
  LDAPMessage unbindRequest(2)
    messageID: 2
    protocolOp: unbindRequest (2)
      unbindRequest
```





## 5 Formal Syntax

The LDAP client is compliant to the information element descriptions in the [RFC 1777 Lightweight Directory Access Protocol \(March 1995\)](#) and [RFC 4511 Lightweight Directory Access Protocol \(June 2006\)](#) specifications.

The following sections list values of certain elements that are specific to the LDAP interface between the I-CSCF and the DUA-DB.

### 5.1 AuthenticationChoice

ASN.1 syntax:

```
AuthenticationChoice ::= CHOICE {
    simple                [0] OCTET STRING,
                        -- 1 and 2 reserved
    sasl                  [3] SaslCredentials,
    ... }

```

I-CSCF sets authentication to the following:

[0] password

Simple authentication is the only authentication method supported by I-CSCF.

The password is configured in the I-CSCF for each DUA-DB.

### 5.2 DerefAliases

ASN.1 syntax:

```
derefAliases ENUMERATED {
    neverDerefAliases      (0),
    derefInSearching      (1),
    derefFindingBaseObj   (2),
    derefAlways            (3)}

```

The I-CSCF only uses derefAlways.

### 5.3 Entry

ASN.1 syntax:

```
Entry ::= SEQUENCE {
    objectName    LDAPString,

```

```
attributes    SEQUENCE OF SEQUENCE {  
               AttributeType,  
               SET OF AttributeValue}}
```

### 5.3.1 objectName

This element contains the object name given in the search request. The `objectName` is set to the full path of the data element in the LDAP tree that identifies the external identity to be converted, for example, as follows:

```
objectName:  
duaAssocId=sip:alice@partner.com,duaDbWpId=1,ou=duaDbData,o=DuaDb,⇒  
dc=o,dc=com
```

### 5.3.2 Attributes

Only the attributes that are important for the I-CSCF are described in the following subsections.

#### 5.3.2.1 duaAssocId

Attribute `duaAssocId` contains the default external user identity stored in DUA-DB. An example value contained in `duaAssocId` is `sip:alice@partner.com`.

#### 5.3.2.2 duaExtId

Attribute `duaExtId` contains the external user id to be converted. This attribute can be either SIP or TEL. An example value contained in `duaExtId` as SIP is `sip:alice@partner.com`, or as TEL is `tel:+16023332059`.

**Note:** The I-CSCF escapes the + character, as shown in the example.

#### 5.3.2.3 specificIMPU

Attribute `specificIMPU` contains the specific IMPU of a Wildcarded IMPU. An example value contained in `specificIMPU` is `sip:WP-A_WPServiceProfile-1@one.att.net`.

#### 5.3.2.4 listOfDuaS

Attribute `listOfDuaS` contains a list of DUA-S Session Border Gateways (SBGs) that are added as feature tags to the terminating request by the S-CSCF. An example value contained in `listOfDuaS` is `DUA-S-7;2011-12-24Z15:30:00;1`.



### 5.3.2.5 wpUserAliasList

Attribute wpUserAliasList contains list of wholesale partner user alias.

## 5.4 Filter

ASN.1 syntax:

```

Filter ::=
    CHOICE {
        and          [0] SET OF Filter,
        or           [1] SET OF Filter,
        not          [2] Filter,
        equalityMatch [3] AttributeValueAssertion,
        substrings   [4] SubstringFilter,
        greaterOrEqual [5] AttributeValueAssertion,
        lessOrEqual  [6] AttributeValueAssertion,
        present      [7] AttributeDescription,
        approxMatch  [8] AttributeValueAssertion
        extensibleMatch [9] MatchingRuleAssertion,
        ... }

AttributeValueAssertion ::=
    SEQUENCE {
        attributeDescription AttributeDescription,
        attributeValue        AttributeValue}

AttributeValue ::= OCTET STRING

SubstringFilter ::=
    SEQUENCE {
        type AttributeDescription,
        SEQUENCE OF CHOICE {
            initial [0] AssertionValue,
            any     [1] AssertionValue,
            final   [2] AssertionValue}}

MatchingRuleAssertion ::= SEQUENCE {
    matchingRule [1] MatchingRuleId OPTIONAL,
    type         [2] AttributeDescription OPTIONAL,
    matchValue   [3] AssertionValue,
    dnAttributes [4] BOOLEAN DEFAULT FALSE }

```

The I-CSCF only uses the present filter with the value (ObjectClass=\*).

## 5.5 Name

ASN.1 syntax:



`Name ::= LDAPString`

The Name contains the AdminDN in the BindRequest.

## 5.6 LDAPResult

The I-CSCF interprets `LDAPResult success(0)` as a successful result, refer to the [RFC 4511 Lightweight Directory Access Protocol \(June 2006\)](#) specification.

All other results are interpreted as unsuccessful.

## 5.7 Version

ASN.1 syntax:

`Version ::= INTEGER (1 .. 127)`

The I-CSCF sets the value according to a configuration parameter. The default value is 3.



## 6 Security Considerations

Simple authentication is used between the I-CSCF and DUA-DB. The username and a password for the LDAP Servers are defined in the configuration data in clear text.







## 7 Related Standards

Not all LDAP messages are needed in the interface between the I-CSCF and the DUA-DB.

The LDAP messages used between the I-CSCF and the DUA-DB are compliant to the standard LDAP v2 protocol and the standard LDAP v3 protocol defined in the [RFC 1777 Lightweight Directory Access Protocol \(March 1995\)](#) and [RFC 4511 Lightweight Directory Access Protocol \(June 2006\)](#) specifications.