Lightweight Directory Access Protocol (LDAP)

Overview

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- Directory structure
- Operations
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  - Bind
  - Delete
  - Search and compare
  - Modify
- Schema

Lightweight Directory Access Protocol

Introduction

- Open, vendor-neutral, industry standard application protocol for accessing and maintaining distributed directory information services over an Internet Protocol (IP) network
- Directory services may provide any organized set of records, often with a hierarchical structure
    - *eg. telephone directory is a list of subscribers with an address and a phone number*
- LDAP is specified in a series of Internet Engineering Task Force (IETF) Standard Track publications called Request for Comments (RFCs), using the description language ASN.1. The latest specification is Version 3, published as RFC 4511.
- A common use of LDAP is to provide a central place to store usernames and passwords.
- Allows many different applications and services to connect to the LDAP server to validate users.
- Platform-independent protocol

Lightweight Directory Access Protocol

Protocol Overview

- Directory System Agent (DSA)
  - ❖ A client starts an LDAP session by connecting to an LDAP server by default on TCP and UDP port 389
  - ❖ The client then sends an operation request to the server, and the server sends responses in return
    - StartTLS — use the LDAPv3 Transport Layer Security (TLS) extension for a secure connection
    - Bind — authenticate and specify LDAP protocol version
    - Search — search for and/or retrieve directory entries
    - Compare — test if a named entry contains a given attribute value
    - Add a new entry
    - Delete an entry
    - Modify an entry
    - Modify Distinguished Name (DN) — move or rename an entry
    - Abandon — abort a previous request
    - Extended Operation — generic operation used to define other operations
    - Unbind — close the connection (not the inverse of Bind)

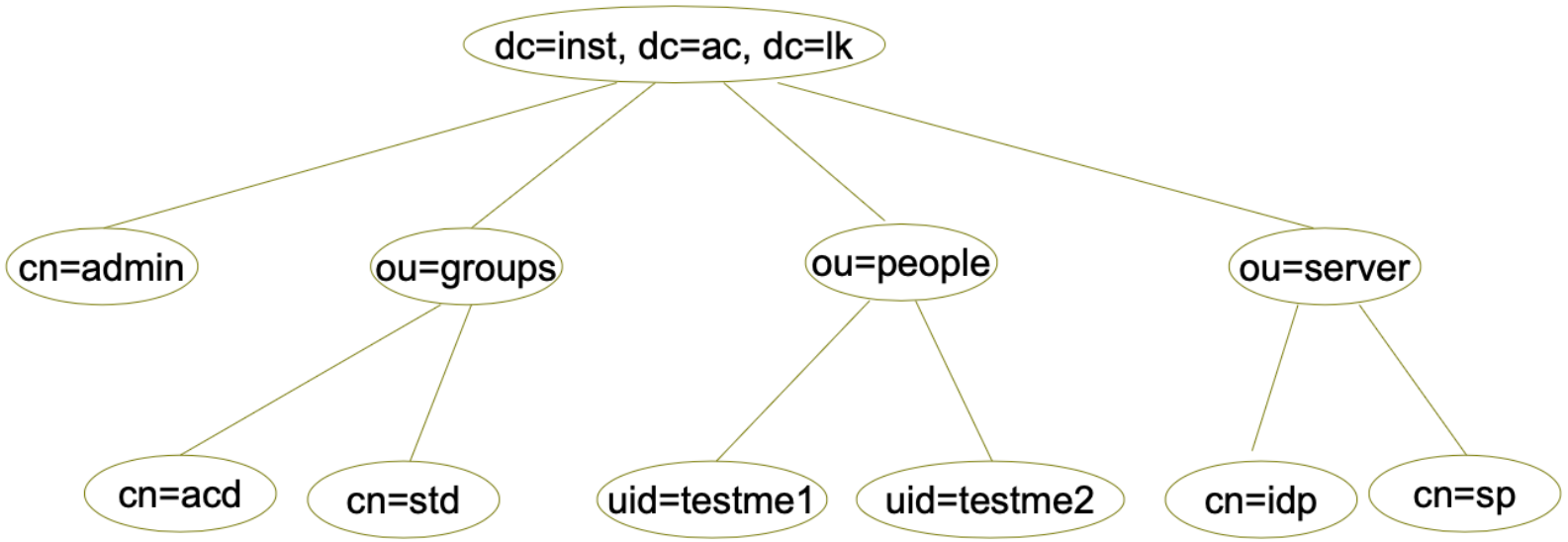
Lightweight Directory Access Protocol

Directory Structure

- Usually structured hierarchically as a tree of nodes
- The LDAP directory tree is sometimes referred to as the Directory Information Tree, or DIT
- Each node represents a record, or “entry” in the LDAP database
- The Distinguished Name (DN)
  - An LDAP entry consists of numerous attribute-value pairs
  - uniquely identified by what is known as a “distinguished name” (DN)
    - eg.

```
dn: mail=joe@novell.com, dc=novell, dc=com
objectclass: inetOrgPerson
cn: Joe
sn: Somebody
mail: joe@novell.com
telephoneNumber: 1 234 567 8912
```

LDAP DIT


dc=inst, dc=ac, dc=lk
cn=admin
ou=groups
ou=people
ou=server
cn=acd
cn=std
uid=testme1
uid=testme2
cn=idp
cn=sp

Open LDAP

What is Open LDAP

- Free, open source implementation of the Lightweight Directory Access Protocol (LDAP)
- BSD-style license called the OpenLDAP Public License
- Developed by the OpenLDAP Project
- OpenLDAP has three main components
  - ✓ Slapd – stand-alone LDAP daemon and associated modules and tools
  - ✓ Libraries implementing the LDAP protocol and Basic Encoding Rules (BER)
  - ✓ Client software: ldapsearch, ldapadd, ldapdelete, and others

Open LDAP

Open LDAP using OLC (cn=config)

- On-Line configuration for previous slapd.conf
- Dynamic configuration of static configuration in slapd.conf where slapd restart needed
- Configuration may be perform run time using a DIT cn=config
- Zero down time configuration
- Stored in /etc/ldap/slapd.d directory
- Introduce in version 2.3

LDAP Schema

Schema

- A set of rules that define what can be stored as entries in an LDAP directory
- Each LDAP directory has a default schema
- The elements of a schema
    - Attributes, syntaxes, object classes

Attributes

- Defines a piece of information that directory entries contain
    - For example, some common attributes for entries related to people are cn (common name), telephoneNumber, and userPassword.

Syntaxes

- Defines the data format in which an attribute value is stored.
    - Directory String, Integer, and JPEG are examples of standard LDAP syntaxes.

LDAP Schema

Object Classes

- Defines a set of attributes for a type of directory entry
- Two or more object classes in an object class hierarchy define the attributes for a type of entry
- An object class inherits attributes from all parent object classes in the hierarchy and then adds attributes of its own
    - for example:
      Object class 1: adds attribute A
      Object class 2: inherits attribute A and adds attributes B, C, and D
      Object class 3: inherits attributes A, B, C, and D, and adds attributes E and F
- There are three types of object classes: abstract, structural, and auxiliary

LDAP Schema Example

objectclass (2.5.6.6 NAME 'person' DESC 'RFC2256: a person' SUP top STRUCTURAL

MUST (sn $ cn)
MAY (userPassword $ telephoneNumber $ seeAlso $ description))

attributetype (2.5.4.4 NAME ('sn' 'surname')
DESC 'RFC2256: last (family) name(s) for which the entity is known by' SUP name)

attributetype (2.5.4.4 NAME ('cn' 'commonName')
DESC 'RFC4519: common name(s) for which the entity is known by' SUP name)

Thank You