Directory Services

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ABSTRACT
In this paper, we will discuss What is Directory Services (DS) and How does it work?

General Terms
Introduction, History, Implementation, Script.

Keywords
DS, X.500, DAP, LDAP.

1. Introduction
A directory service is a structure that defines the basic model in which information is stored. It works like a database and only has more descriptive, attribute-based information and is usually read much more than it is written. It is a database of all objects in the directory. It works in the similar way as a phone book in which it lists all the services of available objects that are given in a particular name-space.

2. History
X.500 standard was introduced in 1988 by International Organization for Standardization (ISO) and the International Telecommunications Union (ITU). The X.500 standard includes one or more Directory System Agents (DSAs) such as directory servers holding a portion of the Directory Information Base (DIB). It contains named information objects assembled in a tree structure which are defined by a Directory Information Tree (DIT) with each entry having an associated set of attributes. Every attribute has a pre-defined type and one or more associated values. Object classes, containing mandatory and optional attributes, are defined within a directory schema. End users communicate with an X.500 DSA using the Directory Access Protocol (DAP) while the Directory System Protocol (DSP) controls interaction between two or more DSAs. Directory information about a particular organization is maintained locally in a Directory System Agent (DSA).

3. Implementation
There are different implementations of directory services but many of them are based on the X.500 specification. X.500 is a set of standards that is used to organize objects in the directory. The objects are held in a Directory Information Base (DIB) and are arranged in a tree structure i.e. called as Directory Information Tree (DIT). Each entry is uniquely named for that particular name-space and it has a set of attributes. X.500 defines optional and required attributes for each class of objects. The entries are identified by a Distinguished Name (DN). Distinguished names are a concatenation of certain attributes from each entry. Each entry is called the Relative Distinguished Name (RDN). The name leads from the root of the tree hierarchy down a path leading to the named entry. There is no specific rules to define the string representation for names in X.500. It only sets rules for the structural form of the names. This allows for different implementations to communicate with each other.

4. How does it Work?
X.500 defines the Directory Access Protocol (DAP) to connect the client to the directory

server. DAP requires the client to use the Open Systems Interconnect (OSI) protocol stack. This causes DAP to use significant amount of computing resources to implement it. Because of this, researchers at the University of Michigan, and some help from the National Science Foundation, developed the Lightweight Directory Access Protocol (LDAP) to connect clients. LDAP uses much less resources to be implemented than DAP. It also is run over the TCP/IP connection. Since LDAP is based off of DAP, it is able to still communicate with the X.500 directory. This also means that it uses the hierarchical tree model to store the information. It also uses the same naming scheme using the DN and RDN of entries. LDAP does have some differences from the X.500 directories. One is that LDAP uses fewer command functions but still can provide the same level of functionality. An example would be the Search command for LDAP carries out the two functions, Read and List, for a X.500 directory.

Another difference is LDAP has fewer authentication capabilities. LDAP only has two options for authentication while X.500 has several. Since LDAP is run on TCP/IP, it allows clients now to access the directory over the Internet instead of using OSI protocol in an intranet. Clients can use browser applications that run over the Internet to access the private directories by implementing the univeral resource locator (URL) format that allows direct access to LDAP servers. An example URL like

ldap://ldap.company.com/o=Sales,c=US?EmailAddress?one

would connect the user to the LDAP server of the company specified. LDAP works very simply. The client connects to an LDAP server and makes a request. The server responds with the answer or will send it to another place to get that answer. The LDAP servers in this case are acting like DNS servers where the request other servers until they get the answer and send it back to the client.

5. Sample Python Script

```
#!/usr/bin/python

# AHMED ALMOHSIN
# Directory Services - SYSTEMS
PROGRAMMING
# ERIC BROWN
# IMPORT NEEDED SUPPORT MODULES

import ldap
l = ldap.open("149.149.135.62")
l.protocol_version = ldap.VERSION3
username = "cn=Ahmed M.
Almohsin,cn=Users,dc=CSC3550-
3,dc=local"
password  = "Zeezee123#"

try:

      l.simple_bind(username,
password)
      print "Successfully Connected"

      baseDN = "cn=Users,dc=CSC3550-
3,dc=local"
      searchScope = ldap.SCOPE_SUBTREE
      retrieveAttributes = None
      searchFilter = "cn=*"

      try:
            ldap_result_id =
l.search(baseDN, searchScope,
searchFilter, retrieveAttributes)
            result_set = []
            print "TracingError"
            while 1:
                  result_type,
result_data =
l.result(ldap_result_id, 0)

                  if (result_data ==
[]):
                        break
                  else:
                        if result_type
== ldap.RES_SEARCH_ENTRY:

      result_set.append(result_data)
                  print result_set
      except ldap.LDAPError, e:
            print e

except ldap.LDAPError, e:
      print e
```

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7. REFERENCES

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