Recommended readings

- `LDAP for Rocket Scientists`
- Basic LDAP Concepts
- Understanding the LDAP Protocol, Data Hierarchy, and Entry Components

Openldap server documentation

Exercises are based on the `OpenLDAP` server implementation.

Related material at `http://www.openldap.org`.

What is LDAP anyway?

- **L**ightweight **D**irectory **A**ccess **P**rotocol
- Vendor independent
- IETF standard:

  Clients interact with servers using a directory access protocol

LDAP Server cli bind

Command	Result

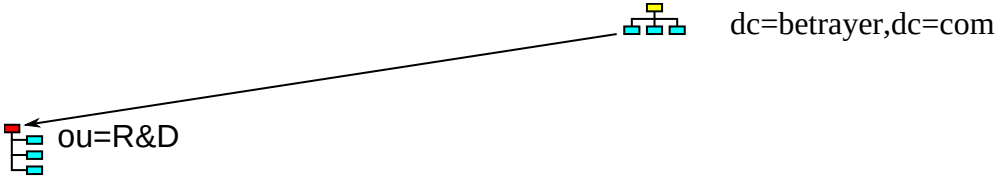
ldapsearch \
  -h localhost ❶ \
  -D "cn=admin,dc=betrayer,dc=com" ❷\
  -w password -x ❸\
  -b "dc=betrayer,dc=com" ❹\
  -s sub ❺ \
  -LLL ❻
	dn: dc=betrayer,dc=com ❶
	objectClass: top
	objectClass: dcObject
	objectClass: organization
	o: Betrayers heaven ❷
	dc: betrayer
	
	dn: cn=admin,dc=betrayer,dc=com ❸
	objectClass: simpleSecurityObject
	objectClass: organizationalRole
	cn: admin ❹
	description: LDAP administrator
	userPassword:: e1NT...dE53N1E= ❺

Document Information Tree (DIT)

dc=betrayer,dc=com

ou=R&D

Document Information Tree (DIT)



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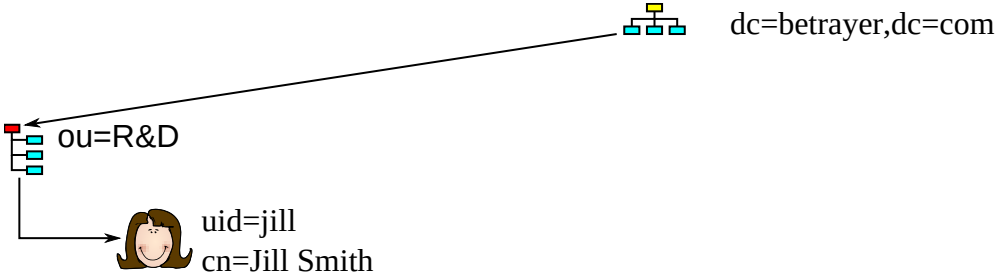

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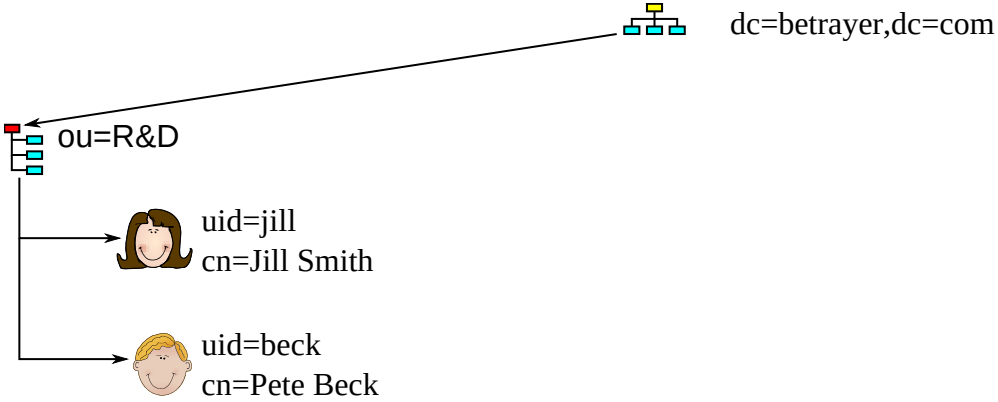

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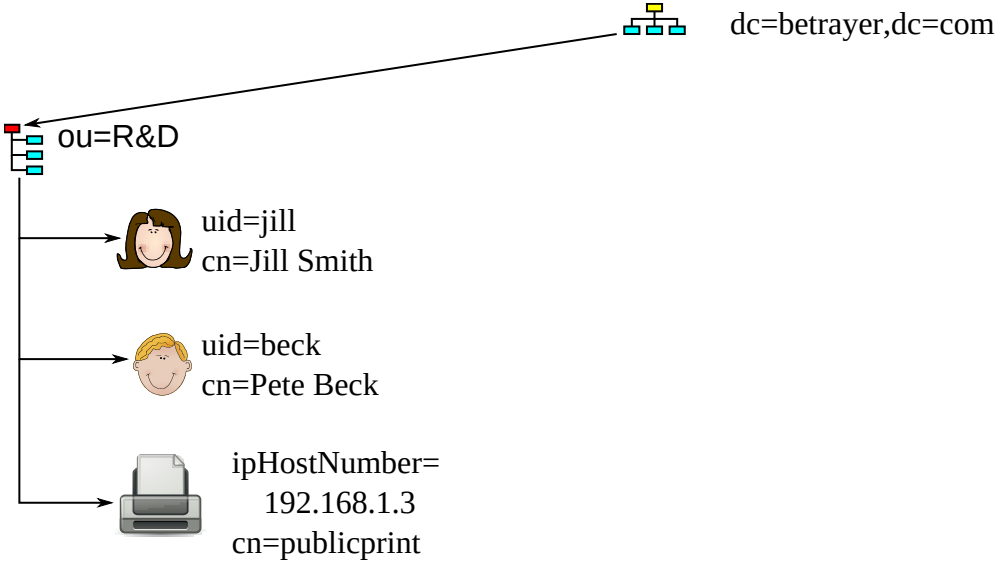

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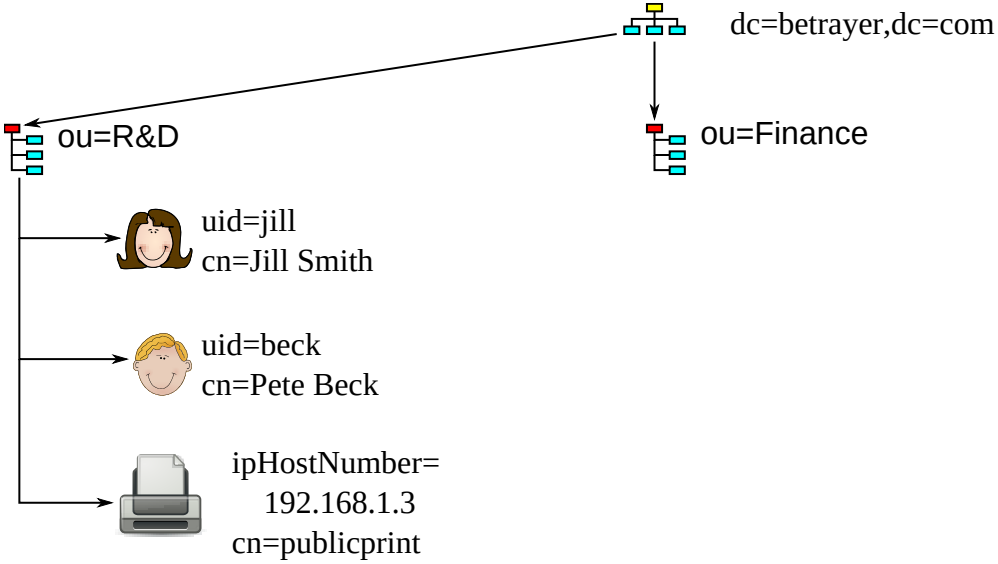

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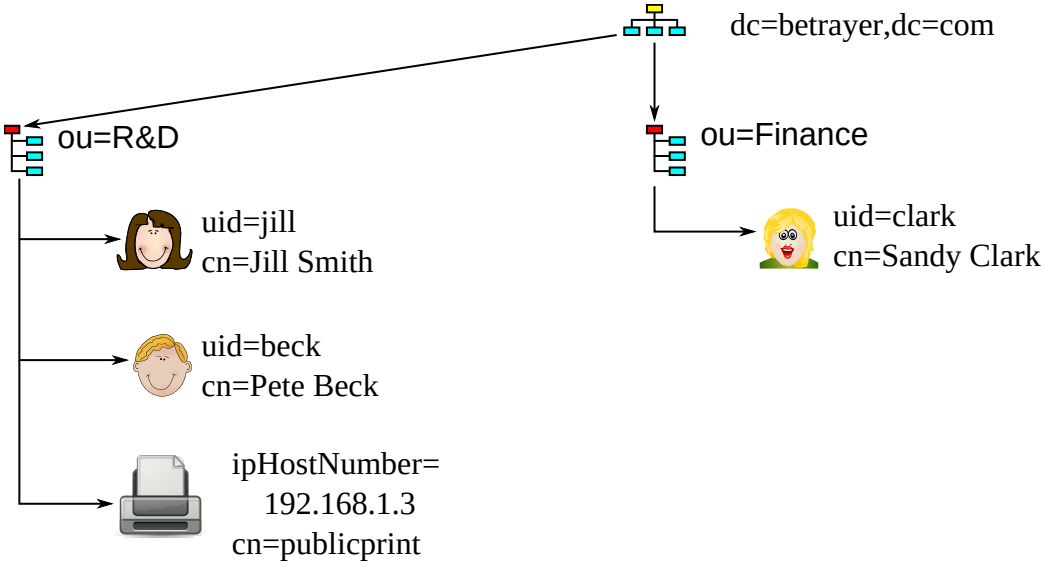

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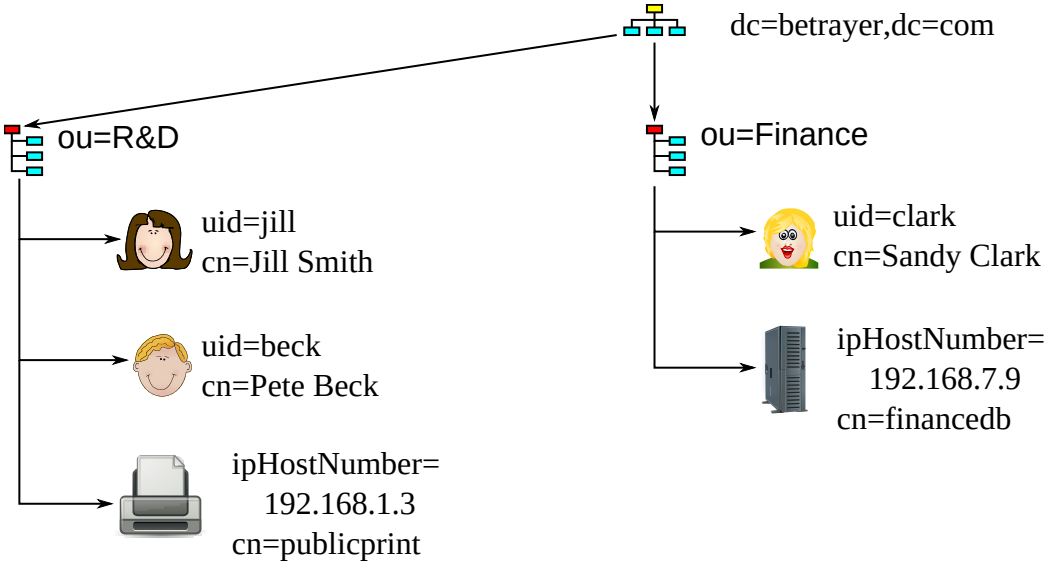

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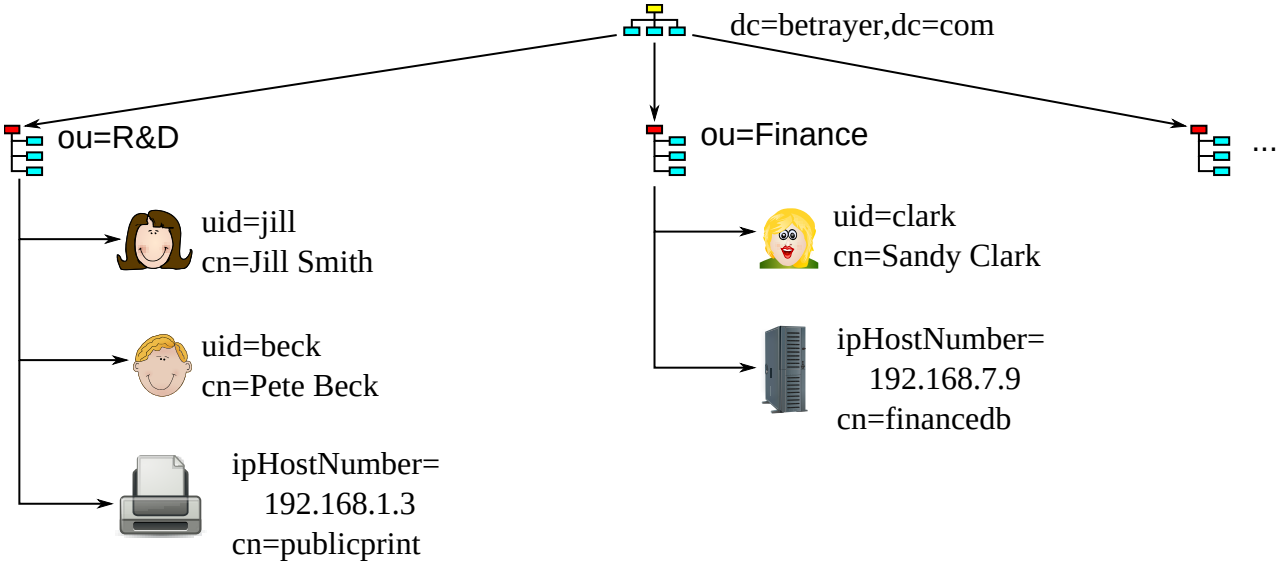
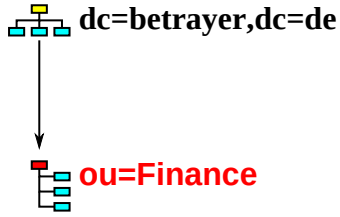


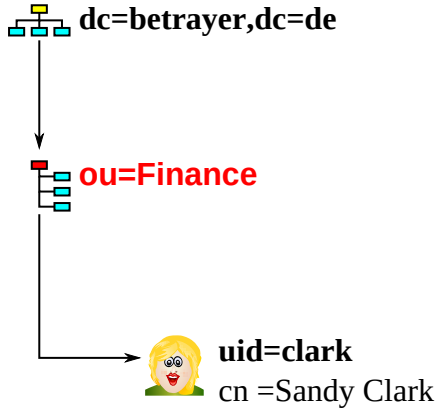
Relative and absolute DNs

dc=betrayer,dc=de

Relative and absolute DNs

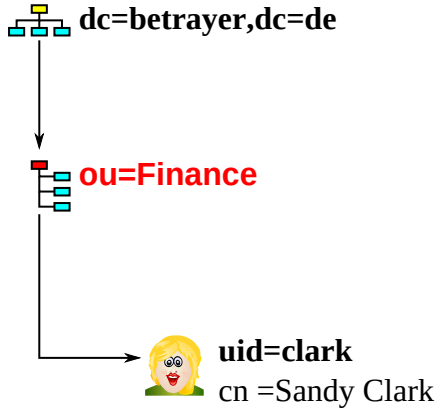


Relative and absolute DNs



Relative and absolute DNs

Relative DN values



Relative and absolute DNs

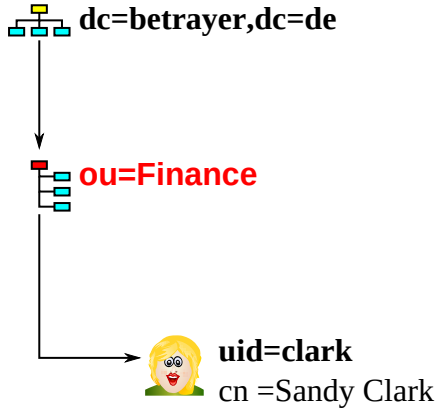
Absolute DN values

dc=betrayer,dc=de

ou=finance,dc=betrayer,dc=de

uid=clark,ou=finance,dc=betrayer,dc=de

Relative DN values



Relative and absolute DNs

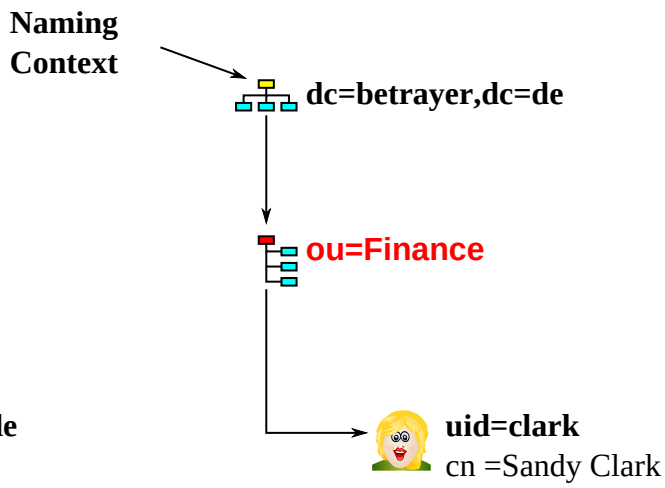
Absolute DN values

Relative DN values

dc=betrayer,dc=de

ou=finance,dc=betrayer,dc=de

uid=clark,ou=finance,dc=betrayer,dc=de



User example

```
dn: uid=clark,ou=finance,dc=betrayer,dc=de ❶
cn: Sandy Clark
homeDirectory: /home/clark
sn: Clark
uid: clark ❷
uidNumber: 21101
givenName: Sandy
loginShell: /bin/bash
mail: clark@betrayer.com ❸
mail: finance@betrayer.com
postOfficeBox: 10G
userPassword: {SSHA}noneOfYourBusiness
```

objectClass

- Structuring LDAP entry data.
- Categories:
  - Structural
  - Auxiliary
  - Abstract

objectClass clarifications

Abstract classes: To be extended by other classes

Structural classes:

- Each entry requires exactly one.
- Specify the “main” type of object.
- Must not inherit from auxiliary classes.

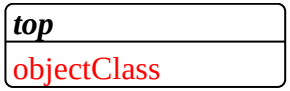
Auxiliary classes:

- Provide non-conflicting supplementary information.
- Think of (Java™) interfaces.
- Must not inherit from structural classes.

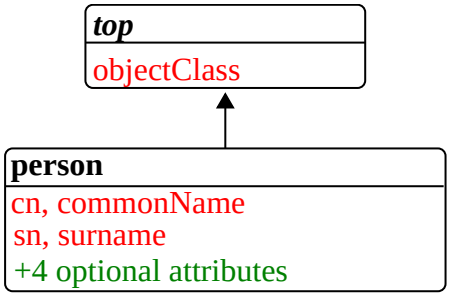
Augmenting `inetOrgPerson` by `posixAccount`

Class	Instance **uid=clark,ou=finance,dc=betrayer,dc=de**
inetOrgPerson (structural)	
sn	sn: Clark
cn	cn: Sandy Clark
...	▲
	|
posixAccount (auxiliary)	|
cn	**see above** ❶
gidNumber	gidNumber: 23113
homeDirectory	homeDirectory: /home/clark
uid	uid: clark
uidNumber	uidNumber: 21101
userPassword	userPassword: {SSHA}noneOfYourBusiness
.....	

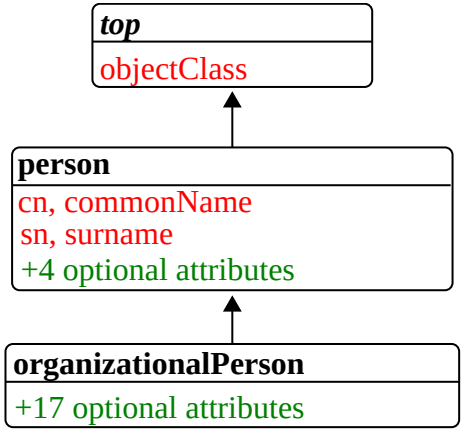
Structural objectClass definitions



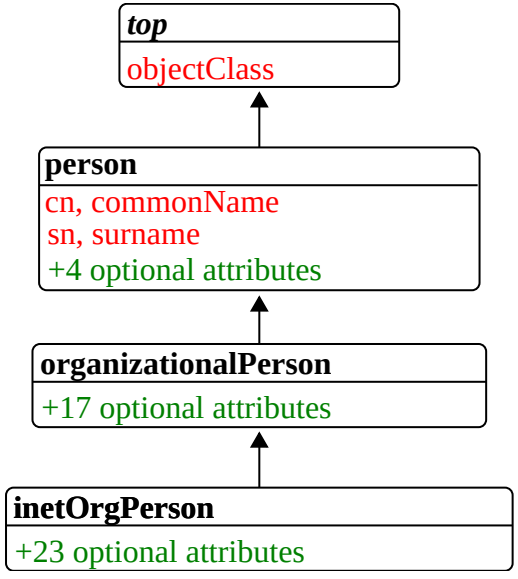
Structural objectClass definitions



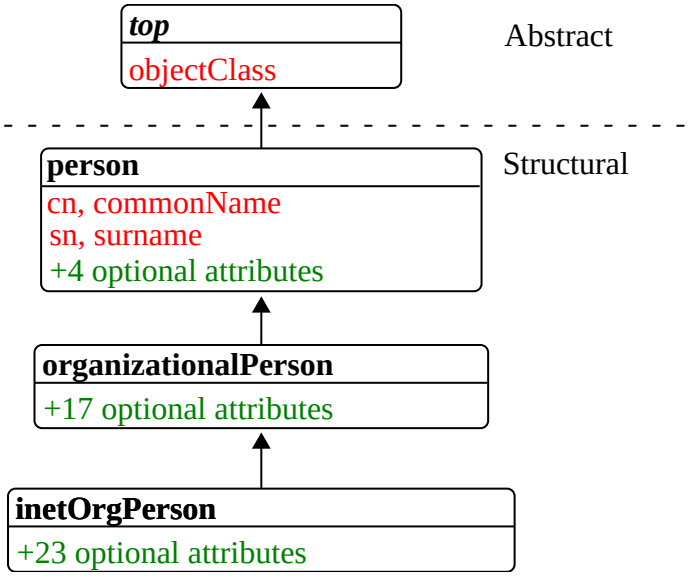
Structural objectClass definitions



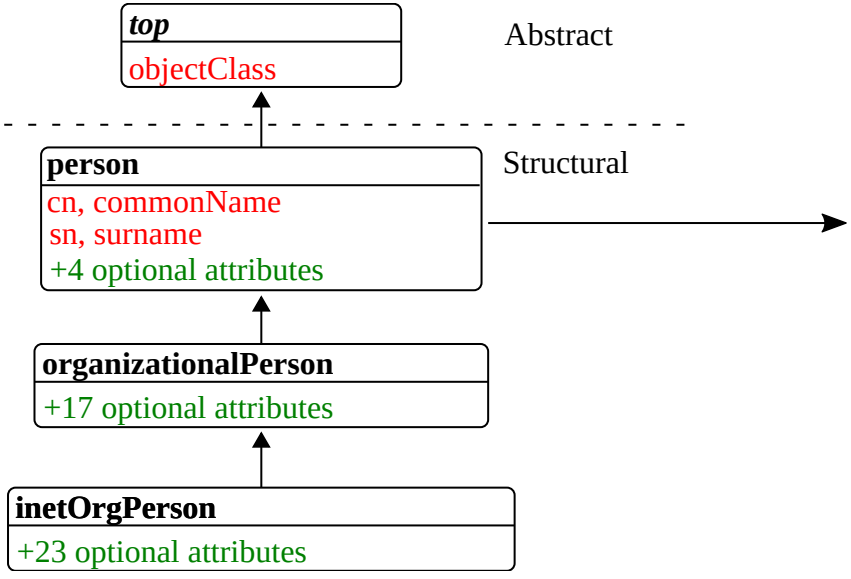
Structural objectClass definitions



Structural objectClass definitions



Structural objectClass definitions



Relational counterpart sketch:

```
CREATE TABLE person (
  cn VARCHAR NOT NULL,
  sn VARCHAR NOT NULL,
  telephoneNumber
    VARCHAR NULL,
  ...-- +3 more
)
```

Search scopes

RFC 4520 defines three LDAP search scopes:

- baseObject (`base`)
- singleLevel (`one`)
- wholeSubtree (sub)

Predicate based queries

RFC 4520 defines predicate based queries using RPN style:

- `(| (cn=k*) (uidNumber < 2000))`

LDAP bind types

- Anonymous bind: No user credentials.

  Note: This typically provides limited privileges.

- Simple bind: User's DN + password:

```
DN: uid=clark,ou=finance,dc=betrayer,dc=de
password: 123456789
```

LDIF exchange format

- **L**dap **D**ata **I**nterchange **F**ormat.
- Importing and exporting LDAP Data.
- Modifying existing entries (CRUD operations).
- Pure ASCII.

LDIF sample

```
dn: uid=clark,ou=finance,dc=betrayer,dc=de
objectClass: posixAccount
objectClass: inetOrgPerson
cn: Sandy Clark
homeDirectory: /home/clark
sn: Clark
uid: clark
uidNumber: 21101
givenName: Sandy
loginShell: /bin/bash
mail: clark@betrayer.com
mail: finance@betrayer.com
postOfficeBox: 10G
userPassword: {SSHA}noneOfYourBusiness
```

OpenLdap server architecture

OpenLdap server

OpenLdap server architecture

dc=betrayer,dc=com

OpenLdap server

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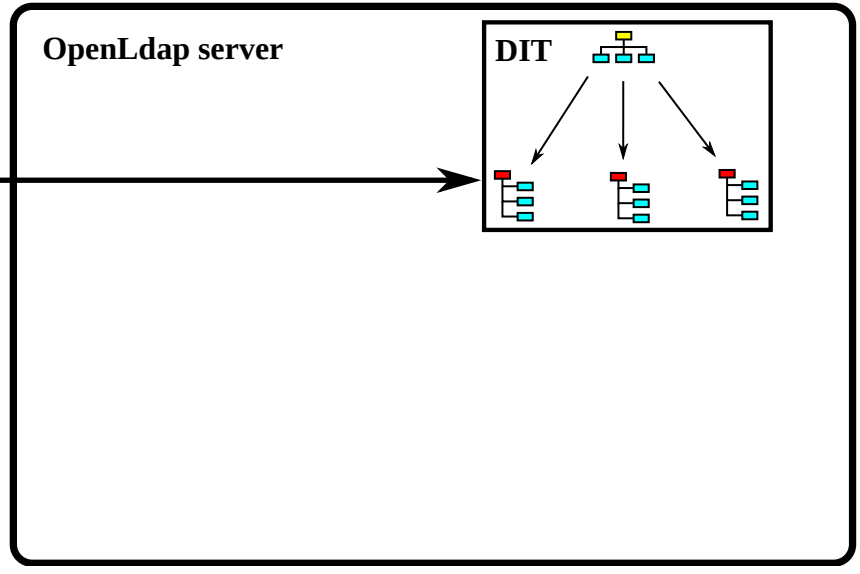
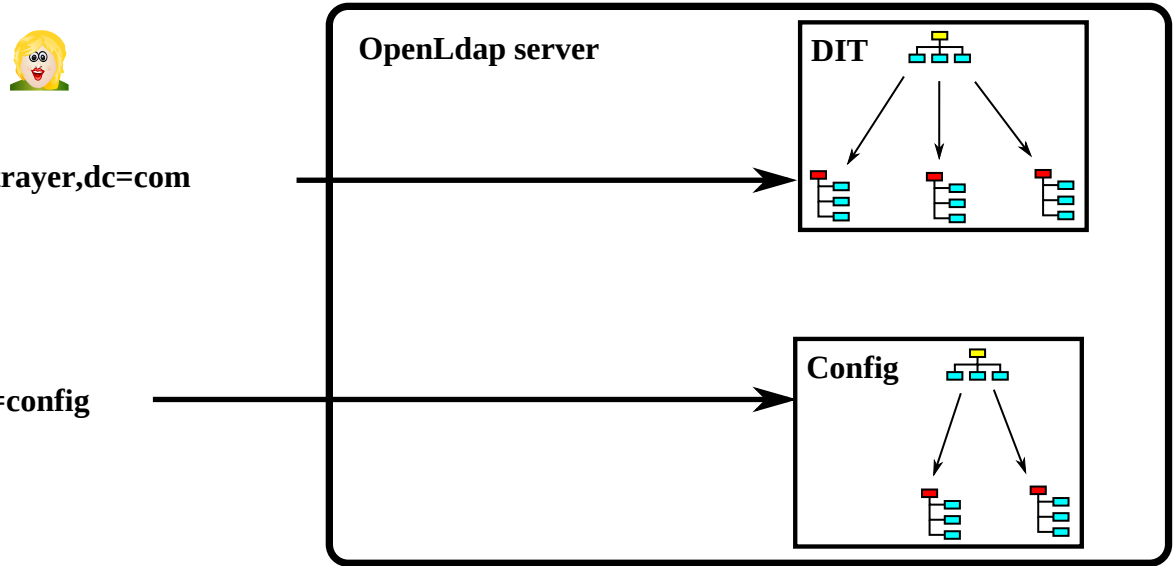
dc=betrayer,dc=com



OpenLdap server architecture



An example LDAP Tree