Kim J. Worm – z/OS LDAP Development
CRUG - RACF User Group
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Accessing RACF data via the IBM Tivoli Directory Server (IBM TDS) for z/OS

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Agenda

- LDAP Overview
- IBM Tivoli Directory Server (TDS) for z/OS Overview
- Using the SDBM (RACF) Backend
- IBM TDS for z/OS Authentication Mechanisms
- Changing RACF Password or Password Phrase
- LDAP-RACF Change Logging
- Remote Authorization and Audit Services
- Conclusion
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LDAP Overview

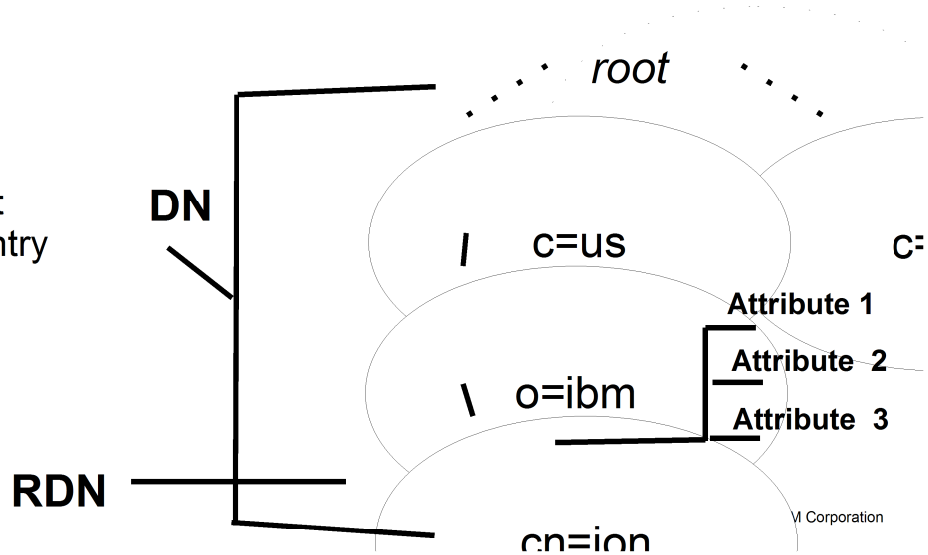
What is LDAP?

- LDAP – Lightweight Directory Access Protocol
  - Originally developed as front-end of X.500 (DAP)
  - TCP/IP based wire protocol for updating directory information
  - Industry standard protocol defined in IETF RFCs
    - Servers and clients reside on different platforms
    - Allows adding, modifying, deleting, searching, and comparing entries in a directory
  - Optimized for searching vs. adding or modifying
  - Commonly used for authentication
  -
- What is a directory?
  - Directory model is based on entries
    - Each entry is identified by a distinguished name (DN)
    - DN: cn=jon,o=ibm,c=us

What is LDAP? (continued)

- Each entry is a collection of attributes
  - Each attribute has a type and values
  - Attributes are grouped into object classes (determine optional and required attributes)
  - Schema defines attributes and object classes

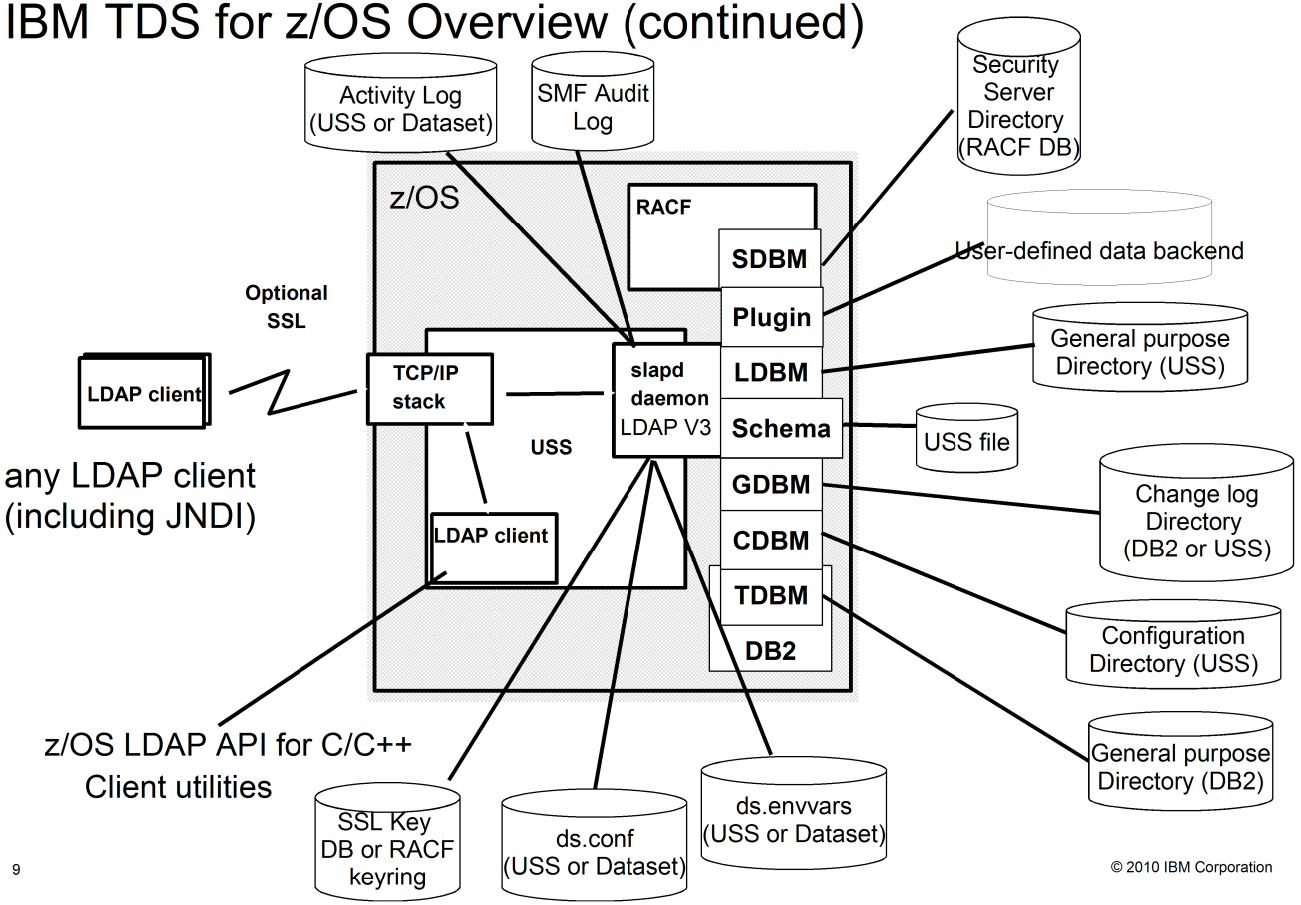
dn: cn=jon,o=ibm,c=us
objectclass: person
cn: jon
sn: cottrell
userpassword: mysecret
description: A sample entry



IBM TDS for z/OS Overview

- IBM TDS available since z/OS R8
  - Free product in base z/OS
  - Previous product on z/OS called Integrated Security Services (ISS) LDAP server
  - ISS is no longer shipped in z/OS R11
  -
- Server runs in 31 or 64 bit mode as an APF-authorized program
-
- Common LDAP operations (add, compare, delete, search, modify) are provided by client utilities in TSO and USS:
  - ldapadd, ldapcompare, ldapdelete, ldapmodify, ldapmodrdn, ldapsearch
    -
    -

IBM TDS for z/OS Overview (continued)



Using the SDBM (RACF) Backend

SDBM Backend Overview

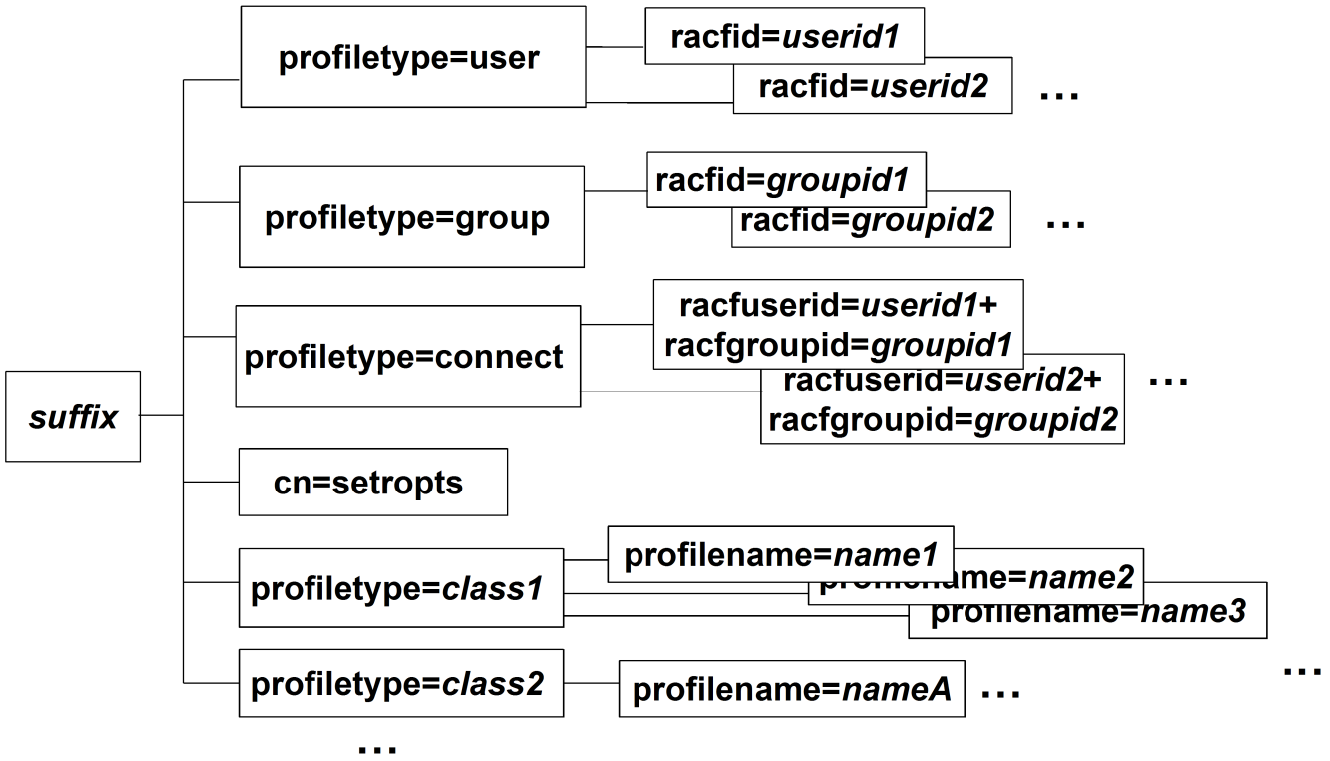
- Provides these features remotely via LDAP protocol:
  - Authentication with users
  - Add, modify, delete RACF users, groups, and general resources
  - Add, modify, and delete user connections to groups
  - Add and remove users and groups in general resource profiles
  - Modify SETROPTS options that affect classes
  - Retrieve RACF information for users, groups, connections, general resources, and class options
  - Retrieve RACF user password and password phrase envelopes

SDBM Backend Overview (continued)

- Converts LDAP operations into RACF commands and services
  - An LDAP add of a RACF user is converted to an ADDUSER command and issued by R_Admin
  - An LDAP search of a RACF resource profile is converted into an R_Admin profile extract
- RACF commands are issued under the bound user's authority
  - Via LDAP you cannot do anything that TSO does not allow
- TDS for z/OS does not copy the data out of the RACF DB
- SDBM configuration is simple, update LDAP configuration file:

```
database sdbm GLDBSD31/GLDBSD64
suffix cn=sdbm
enableResources on
```

SDBM Backend Directory Hierarchy



Example DN: racfid=jon,profiletype=user,cn=sdbm

SDBM Schema

- SDBM distinguished names (DNs):
  - User: racfid=jon,profiletype=user,cn=sdbm
  - Group: racfid=groupc,profiletype=group,cn=sdbm
  - User-Group connection: racfuserid=jon+racfgroupid=groupc,profiletype=connection,cn=sdbm
  - Resource profile: profilename=TERM1,profiletype=TERMINAL,cn=sdbm
  - Setropts: cn=setropts,cn=sdbm
- Initial (minimum) LDAP schema is sufficient for RACF fixed fields
  - Each RACF add/alt/listuser, add/alt/listgrp, connect, rdefine,ralter,rlist keyword is mapped to an LDAP attribute
    - OMVS uid keyword <--> racfOmvsUid attribute

Using SDBM – Examples

- Add a RACF user entry
  - Create a file, u1234.ldif, containing an entry to be added:

```
dn: racfid=u1234,profiletype=user,cn=sdbm
objectclass: racfUser
objectclass: racfUserOmvsSegment
racfid: u1234
racfdefaultgroup: group1
racfowner: radmin
racfattributes: special
racfomvsuid: 1234
racfomvshome: /home/u1234
```

  -
  - Invoke the ldapadd utility:
    - ldapadd -D “racfid=radmin,profiletype=user,cn=sdbm” -w radminpw -f u1234.ldif
  - SDBM executes under the context of bound (radmin) user:

Using SDBM – Examples (continued)

- Modifying a RACF user entry
  - Create a file, modu1234.ldif, containing the modification:

```
dn: racfid=user1234,profiletype=user,cn=sdbm
changetype: modify
add: racfBuilding
racfBuilding: 256
-
add: racfDepartment
racfDepartment: LDAP
```

  - Invoke the ldapmodify utility:
    - ldapmodify -D "racfid=radmin,profiletype=user,cn=sdbm" -w radminpw -f modu1234.ldif
    -
  - SDBM executes under the context of bound (radmin) user:

Using SDBM – Examples (continued)

- Display a RACF user-group connection:
  - Invoke the ldapsearch utility:
    - ldapsearch -L -D “racfid=radmin,profiletype=user,cn=sdbm” -w radminpw -b “racfuserid=u1234+racfgroupid=group1,profiletype=connect,cn=sdbm” “objectclass=*”
    -
    - SDBM executes under the context of bound (radmin) user: LISTUSER U1234 and returns group info for GROUP1

```
dn:
racfuserid=u1234+racfgroupid=GROUP1,profiletype=CONNECT,cn=sdbm
racfuserid: U1234
racfgroupid: GROUP1
racfconnectauthdate: 02/08/10
racfconnectowner: RACFID=RADMIN,PROFILETYPE=USER,CN=SDBM
racfconnectgroupauthority: USE
racfconnectgroupuacc: NONE
racfconnectcount: 0
objectclass: TOP
objectclass: RACFBASECOMMON
objectclass: RACFCONNECT
```

Using SDBM – Examples (continued)

- Add a RACF resource profile to the FACILITY class
  - Create file, mine.ldif, containing an entry to be added:

```
dn: profilename=TERM1,profiletype=TERMINAL,cn=sdbm
objectclass: racfresource
racfOwner: GROUP1
racfUacc: NONE
racfaccesscontrol: ID(U2) ACCESS(READ)
```

  - Invoke the ldapadd utility:
    - ldapadd -D "racfid=radmin,profiletype=user,cn=sdbm" -w radminpw -f mine.ldif
    -
  - SDBM executes under the context of bound (radmin) user:
    - RDEFINE TERMINAL TERM1 OWNER(GROUP1) UACC(NONE)
    - PERMIT TERM1 CLASS(TERMINAL) ID(U2)

Using SDBM – Examples (continued)

- Refresh the FACILITY class
  - Create file, refresh.ldif, containing the modification to the cn=setropts entry:

```
dn: cn=setropts,cn=sdbm
changetype: modify
replace: racfsetroptsattributes
racfsetroptsattributes: REFRESH
-
replace: racfraclist
racfraclist: profiletype=FACILITY,cn=sdbm
```

  - Invoke the ldapmodify utility:
    - ldapmodify -D "racfid=radmin,profiletype=user,cn=sdbm" -w radminpw -f refresh.ldif
    -
  - SDBM executes under the context of bound (radmin) user:

RACF (SDBM) Custom Fields

- Create an LDAP attribute to map the RACF PHONE field in the USER CSDATA segment
- ldapmodify -D *adminDn* -w *adminPw* -f schema.mod

```
dn: cn=schema
changetype: modify
add: attributetypes
attributetypes: (
 racfphone-OID
 NAME 'racfphone'
 DESC 'Represents the PHONE field in the RACF user CSDATA segment'
 EQUALITY caseIgnoreMatch
 SYNTAX 1.3.6.1.4.1.1466.115.121.1.26
 SINGLE-VALUE
 USAGE userApplications
 )
-
add: ibmattributetypes
ibmattributetypes: (
 racfphone-OID
 ACCESS-CLASS sensitive
 RACFFIELD ('USER-CSDATA-PHONE' 'char')
 )
```

RACF (SDBM) Custom Fields (continued)

- Modify RACF user, u1234, to add the racfphone attribute
-
- Create file, modu1234.ldif, to contain the modification:

```
dn: racfid=u1234,profiletype=user,cn=sdbm
changetype: modify
add: racfphone
racfphone: 123-456-7890
```

-
- Invoke the ldapmodify utility
  - ldapmodify -D "racfid=radmin,profiletype=user,cn=sdbm" -w radmin -f modu1234.ldif
  -
- SDBM executes under the context of bound (radmin) user:
  - ALTUSER U1234 CSDATA(PHONE(123-456-7890))

IBM TDS for z/OS
Authentication Methods

IBM TDS for z/OS Authentication Mechanisms

- LDAP is a “stateful” protocol
  - Session starts when client binds to server
    - Can be encrypted with SSL to protect data during transmission
  - Authentication is performed during bind
    - Check password or certificate
    - Determine groups to which user belongs (for authorization checking)
    -
- Simple bind: Distinguished name and password
  - Passwords can be stored in the following locations:
    - TDBM or LDBM – Hashed with crypt, MD5 or SHA-1 or two-way encryption with AES or 3DES
    - RACF
    -

IBM TDS for z/OS Authentication Mechanisms (continued)

- EXTERNAL bind: X.509 certificate over SSL
  - Distinguished name in certificate is used as authorization DN
  - Certificates can be mapped to a RACF user ID
    - Use the RACDCERT MAP command to create mapping
-
- GSSAPI (Kerberos) bind: Kerberos principal sends ticket for LDAP server
  - Kerberos principal can be mapped to RACF, TDBM, and LDBM user

TDBM and LDBM Simple Authentication

Enter userid: jonc
Enter password: ********

Bind Request

<ldap search is done to create the dn>
dn="cn=jonc,o=ibm,c=us"
pw=joncldap
ldap_bind_s(ld, host, port, dn, pw)

Successful bind

IBM TDS for z/OS

Find LDBM or TDBM entry
Verify password
Get LDBM or TDBM groups

TDBM /LDBM

In TDBM/LDBM backend

dn: cn=jonc,o=ibm,c=us
objectclass: person
cn: jon
sn: cottrell
userpassword: joncldap

SDBM (RACF) Simple Authentication

Enter userid: u1234
Enter password: ********

<ldap search is done to create the dn>
dn="racfid=u1234,profiletype=user,cn=sdbm"
pw=racfpw
ldap_bind_s(ld, host, port, dn, pw)

Bind Reque

Successful bind

IBM TDS for z/OS

Verify password or password phrase
__passwd(U1234, racfpw

dn: racfid=u1234,profiletype=user,cn=sdbm
objectclass: racfUser
objectclass: racfBaseCommon
racfid: u1234
racfprogrammername: Jon Cottrell
racfdefaultgroup: racfid=group1,profiletype=group,cn=sdbm
racfconnectgroupname: racfid=group1,profiletype=group,cn=sdbm
racfconnectgroupname: racfid=group2,profiletype=group,cn=sdbm

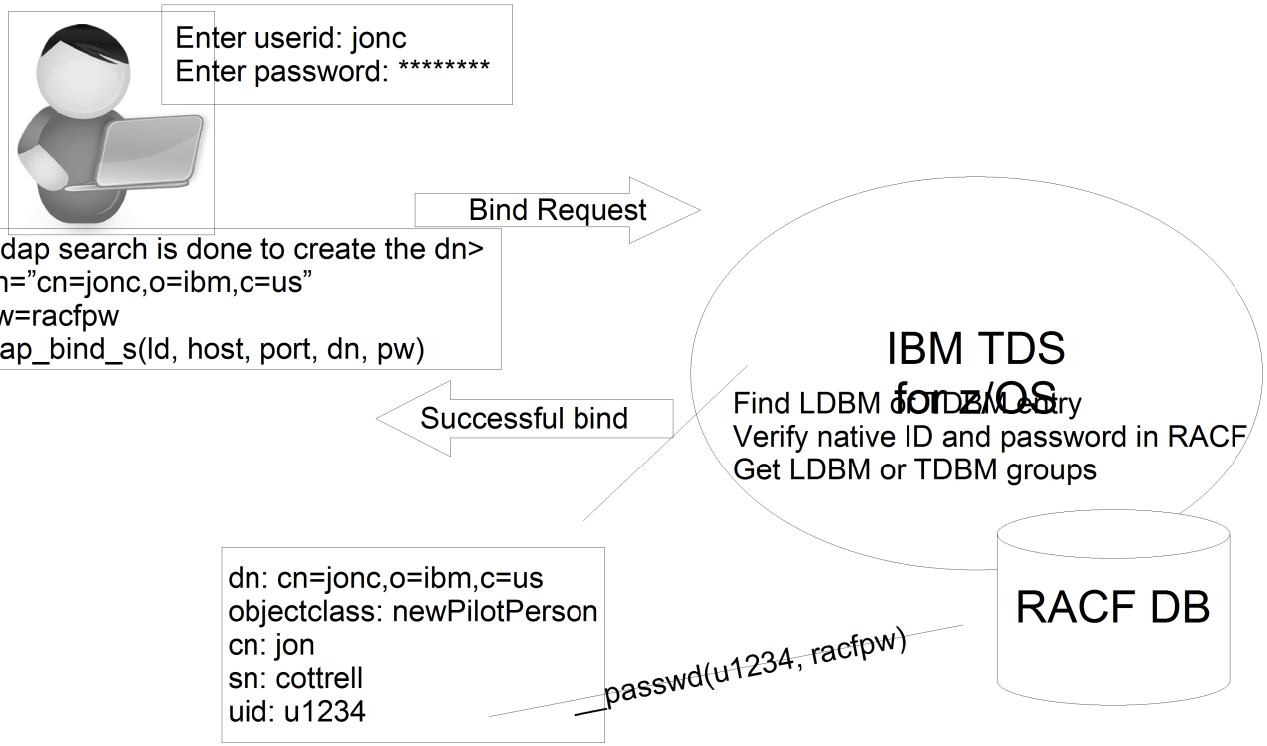
Find RACF user entry
Get RACF groups

RACF DB

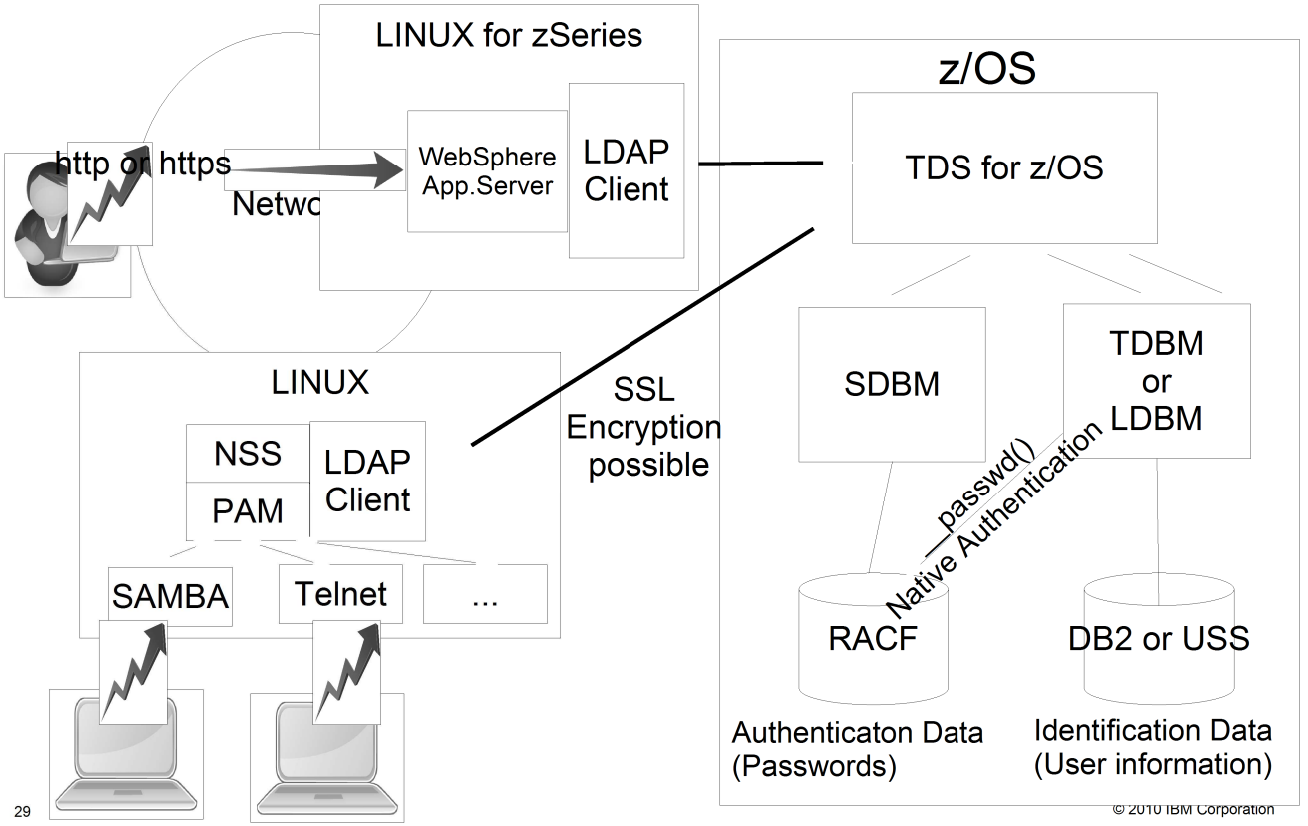
TDBM and LDBM Native Authentication

- Disadvantages of authentication in TDBM and LDBM
  - Another password repository to manage because password stored in the TDBM or LDBM entry
- Disadvantages of authentication in RACF
  - SDBM backend required with long DNs
  - Non-standard schema: Only supported for RACF
  - Limited search capabilities
- Native authentication – Uses entries in TDBM or LDBM but password or password phrase is stored in RACF
  - Standard distinguished names (e.g. cn, o, c)
  - Authentication (password verification) performed by RACF
    - No need for administration or synchronization of multiple password registries
    - RACF authentication triggered by **uid** or **ibm-**

TDBM and LDBM Native Authentication (continued)



Using LINUX to Authenticate to TDS



Changing RACF Password or Password Phrase

Changing RACF Password or Password Phrase

- The ldapmodify utility can be used to change RACF password or password phrase
  - Via SDBM backend:

```
dn: racfid=u1234,profiletype=user,cn=sdbm
replace: racfPassword
racfPassword: mynewpw
racfAttributes: noexpired
```

  -
  - Via LDBM or TDBM with native authentication:

```
dn: cn=jon,o=ibm,c=us
delete: userPassword
userPassword: racfpw
-
add: userPassword
userPassword: mynewpw
```

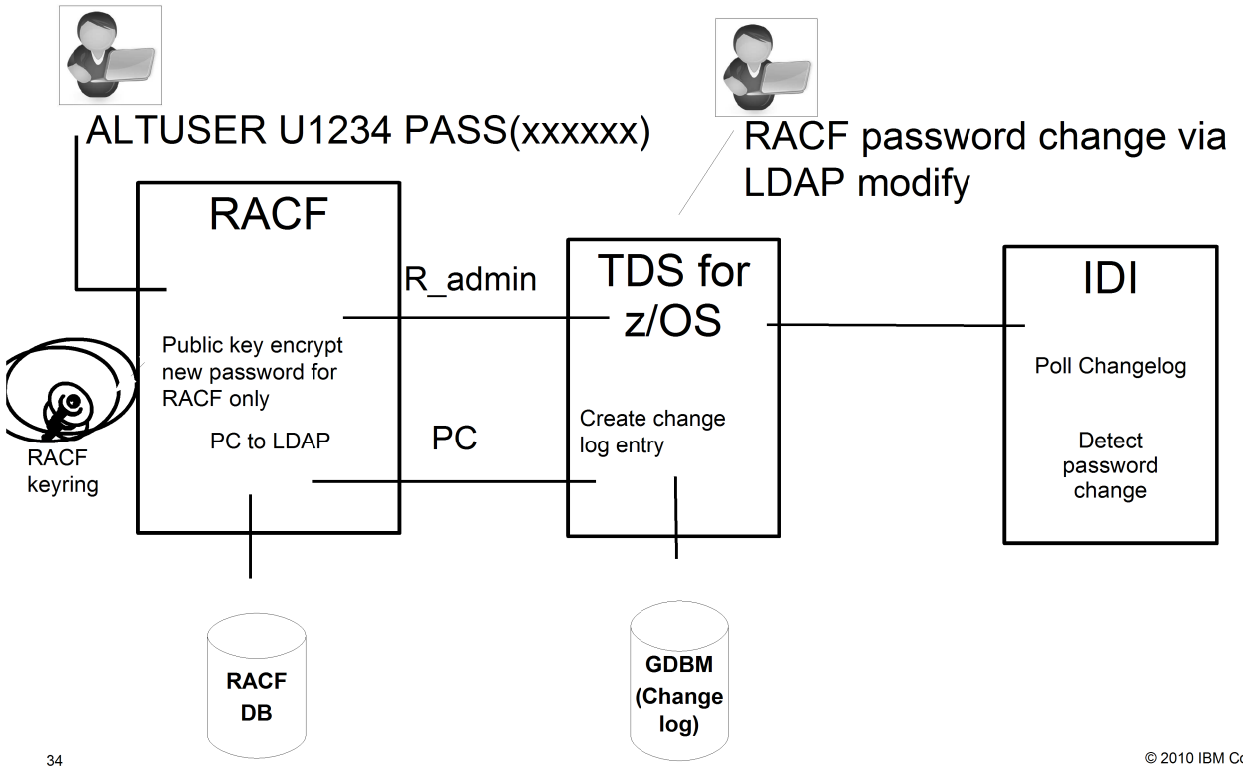
    - Note: replace: userPassword is not supported when changing the RACF password with native authentication

Changing RACF Password or Password Phrase (continued)

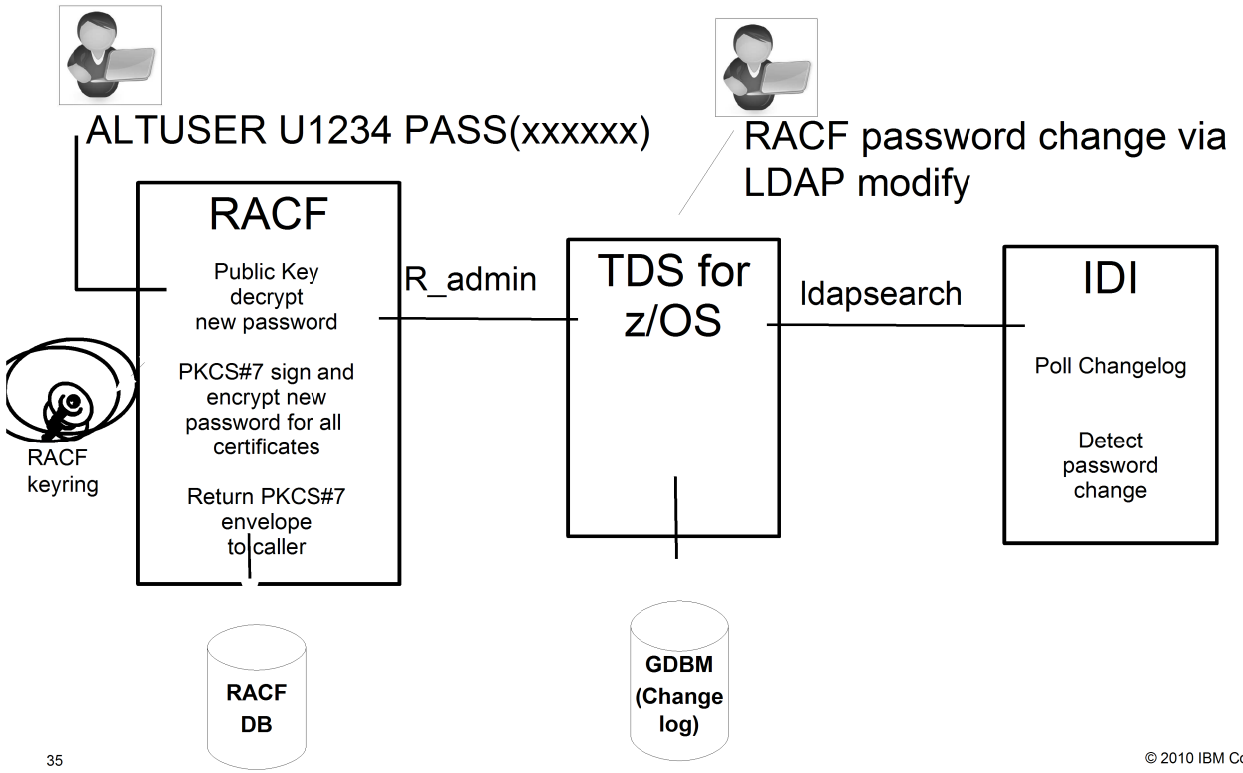
- SDBM or native authentication bind can be used to change a password (even if expired)
  - Specify *old_password*/*new_password* as password value when authenticating
    - ldapsearch -D "racfid=u1234,profiletype=user,cn=sdbm" -w mynewpw/new2pass -s base -b "" "objectclass=*"

LDAP-RACF
Change Logging

LDAP-RACF Change Logging



LDAP-RACF Change Logging (continued)



LDAP–RACF Change Logging (continued)

- Searching the change log using the ldapsearch utility:
  - ldapsearch -D "racfid=radmin,profiletype=user,cn=sdbm" -w radmin -b "cn=changelog" "changeNumber>= 53289"

```
changeNumber=53289,cn=changelog
objectclass=top
objectclass=changeLogEntry
objectclass=ibm-changeLog
changenumber=53289
changetype=modify
targetdn=RACFID=U1234,PROFILETYPE=USER,CN=SDBM
changes=replace: racfPassword
racfPassword: *ComeAndGetIt*

-
ibm-changeinitiatorsname=RACFID=RADMIN,PROFILETYPE=USER,CN=SDBM
changetime=20100209200313.418178Z
```

LDAP–RACF Change Logging (continued)

- Retrieving RACF envelope containing new password:
  - ldapsearch -L
    -D “racfid=radmin,profiletype=user,cn=sdbm”
    -w radmin -b “racfid=u1234,profiletype=user,cn=sdbm”
    “objectclass=*” racfpasswordEnvelope

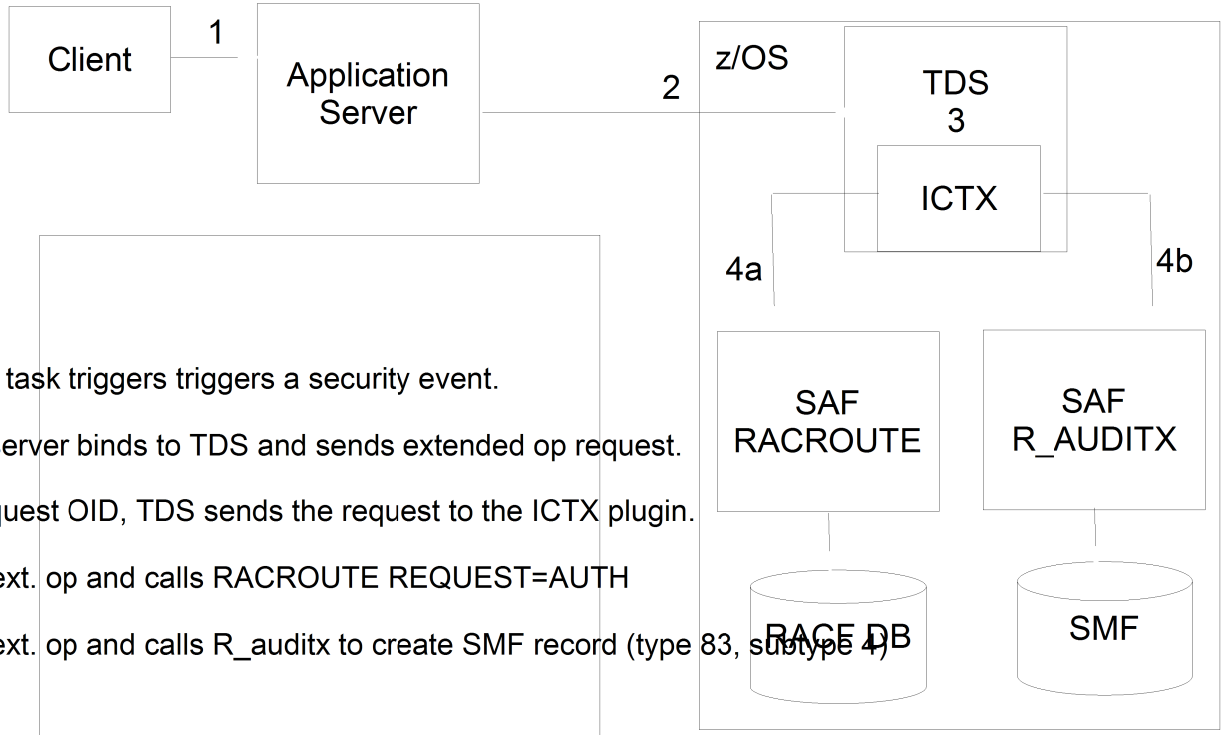
dn: racfid=U1234,profiletype=USER,cn=SDBM
racfPasswordEnvelope:: *base64_pkcs7_password_envelope*

Remote Authorization and Audit Services

Remote Authorization and Audit Services

- Two remote services added to enable distributed applications to access security functions on z/OS:
  - Remote Authorization Service – Allows applications to remotely query a z/OS system to check a user's authority to a resource
    - Can be thought of as a remote interface to the RACROUTE REQUEST-AUTH service
  - Remote Audit Service – Allows applications to remotely write audit records to the z/OS Systems Management Facility (SMF) – Security records (SMF-83)
    - Can be thought of as a remote interface to the R_AUDITX SAF callable service
- These services can be accessed remotely by sending extended operations requests to TDS

Remote Authorization and Audit Services (continued)



· or task triggers triggers a security event.

ın server binds to TDS and sends extended op request.

request OID, TDS sends the request to the ICTX plugin.

ɛs ext. op and calls RACROUTE REQUEST=AUTH

ɛs ext. op and calls R_auditx to create SMF record (type 83, subtype 4)

Conclusion

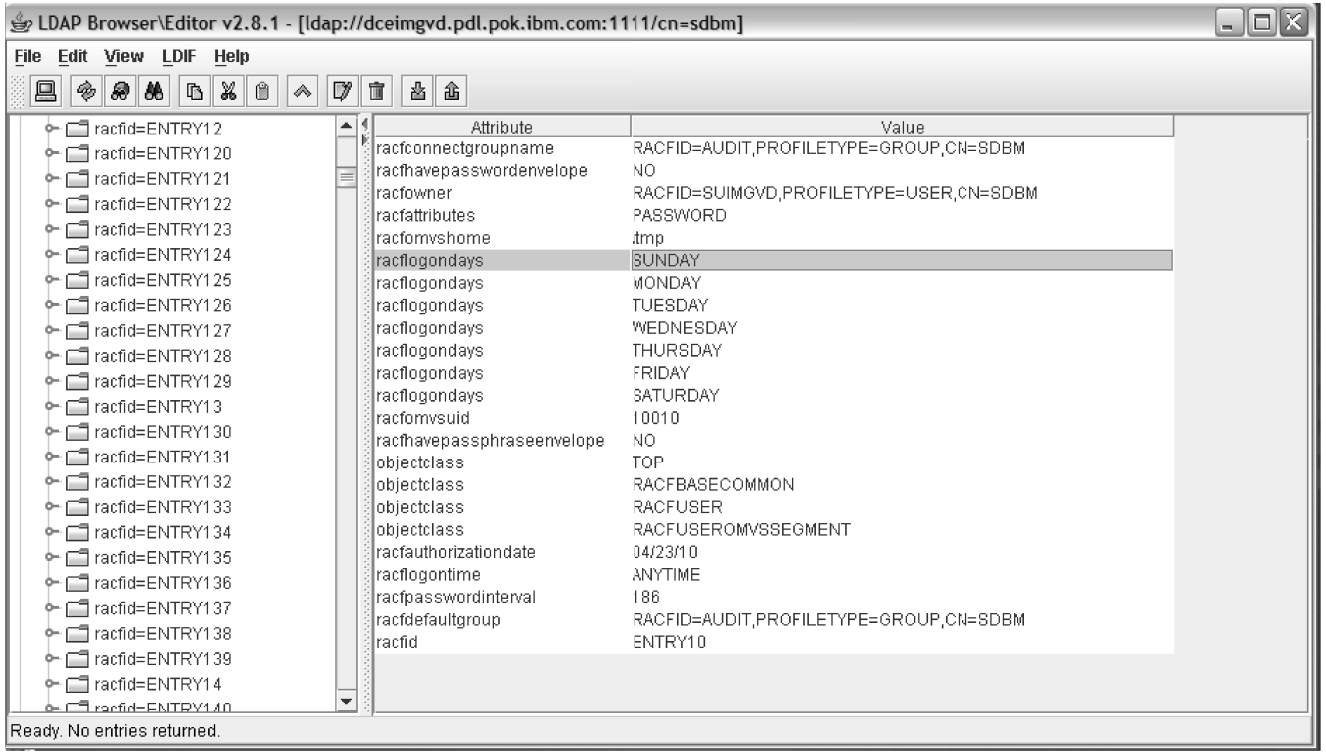
- More information:
  - IBM Tivoli Directory Server Administration And Use for z/OS (SC23-5191)
  - IBM Tivoli Directory Server Client Programming for z/OS (SA23-2214)
  - IBM Tivoli Directory Server Plug-in Reference for z/OS (SA76-0148)
  -
- Contact Information:
  - Kim J. Worm
    - Email: wormkj@us.ibm.com
  -
  -

Appendix
Additional Information

Advantages of using LDAP to access RACF

- Truly remote access to data from anywhere in the world
  - Does not require users to access RACF via 3270 sessions
  - Ability to use LDAP client applications to remotely administer RACF users, groups, user-group connections, and RACF resource profiles
    - Provides an open interface to access RACF data
  -
- Graphical browsers can be used to access and view data (such as LDAP Browser)

Advantages of using LDAP to access RACF (continued)

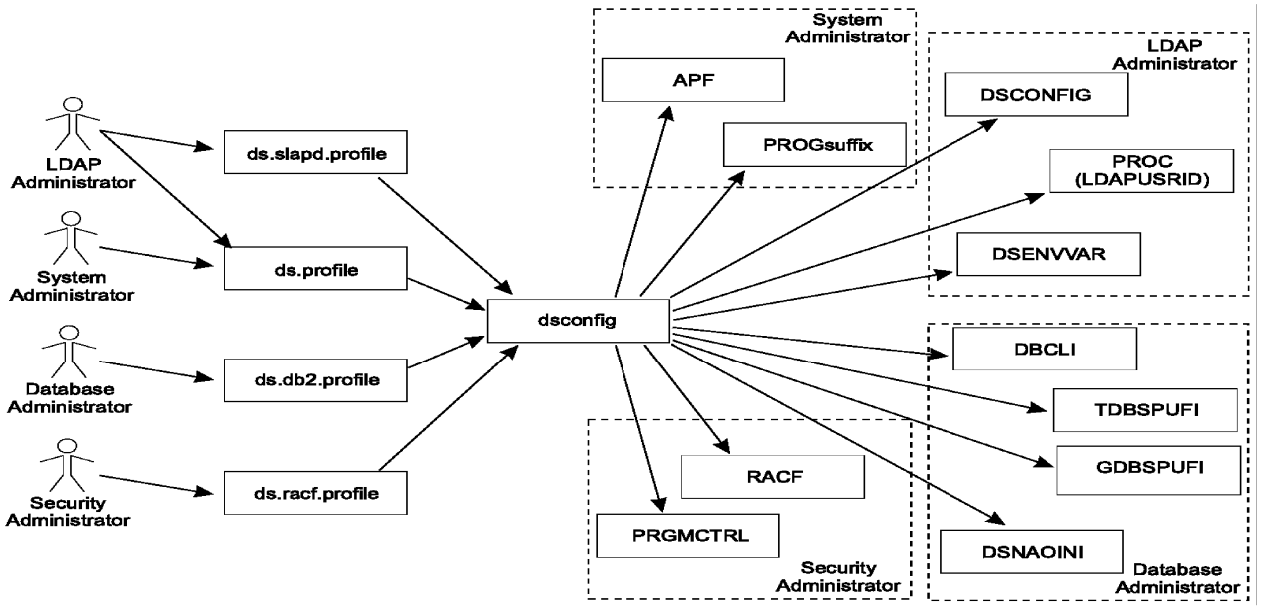


Configuring the LDAP server

- Runs as a started task
- LDAP server shipped in SYS1.SIEALNKE dataset (Must be APF-authorized)
- User ID setup:
  - Read access to the BPX.WLMSERVER profile in the FACILITY class is required (r11 and greater)
  - If BPX.SERVER is defined, UPDATE access is required
  - Read access to the data sets defined in the started task proc
  - Read access to /etc/ldap
  - Read / write access to the schema directory
  - Read / write access to the directories for LDBM, CDBM, and GDBM (file-based) backends

Configuring the LDAP server (continued)

- **dsconfig** utility is provided to simplify LDAP server configuration



EXTERNAL (SSL Certificate) Mapping