

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

LDAP Overview

What is LDAP?

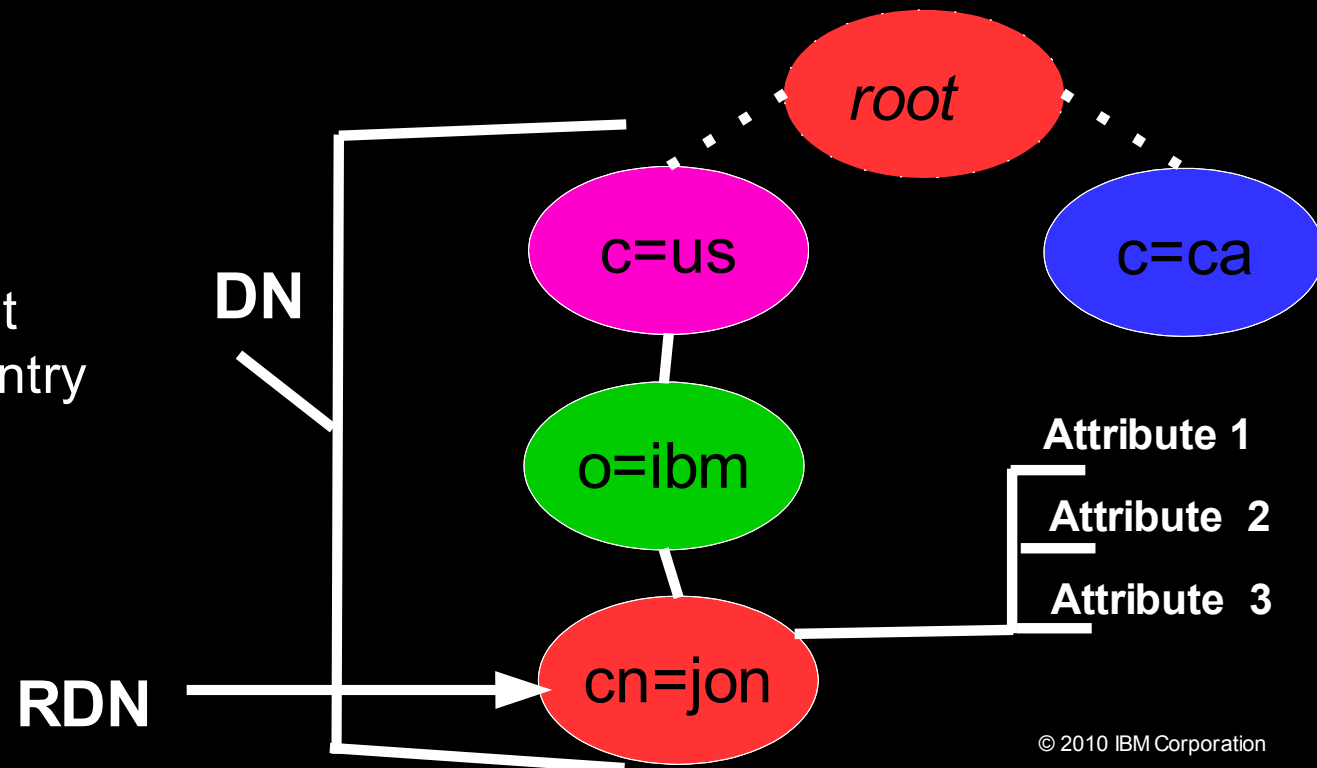
- LDAP – Lightweight Directory Access Protocol
 - Originally developed as front-end of X.500 (DAP)
 - TCP/IP based wire protocol for updating directory information
 - Industry standard protocol defined in IETF RFCs
 - Servers and clients reside on different platforms
 - Allows adding, modifying, deleting, 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



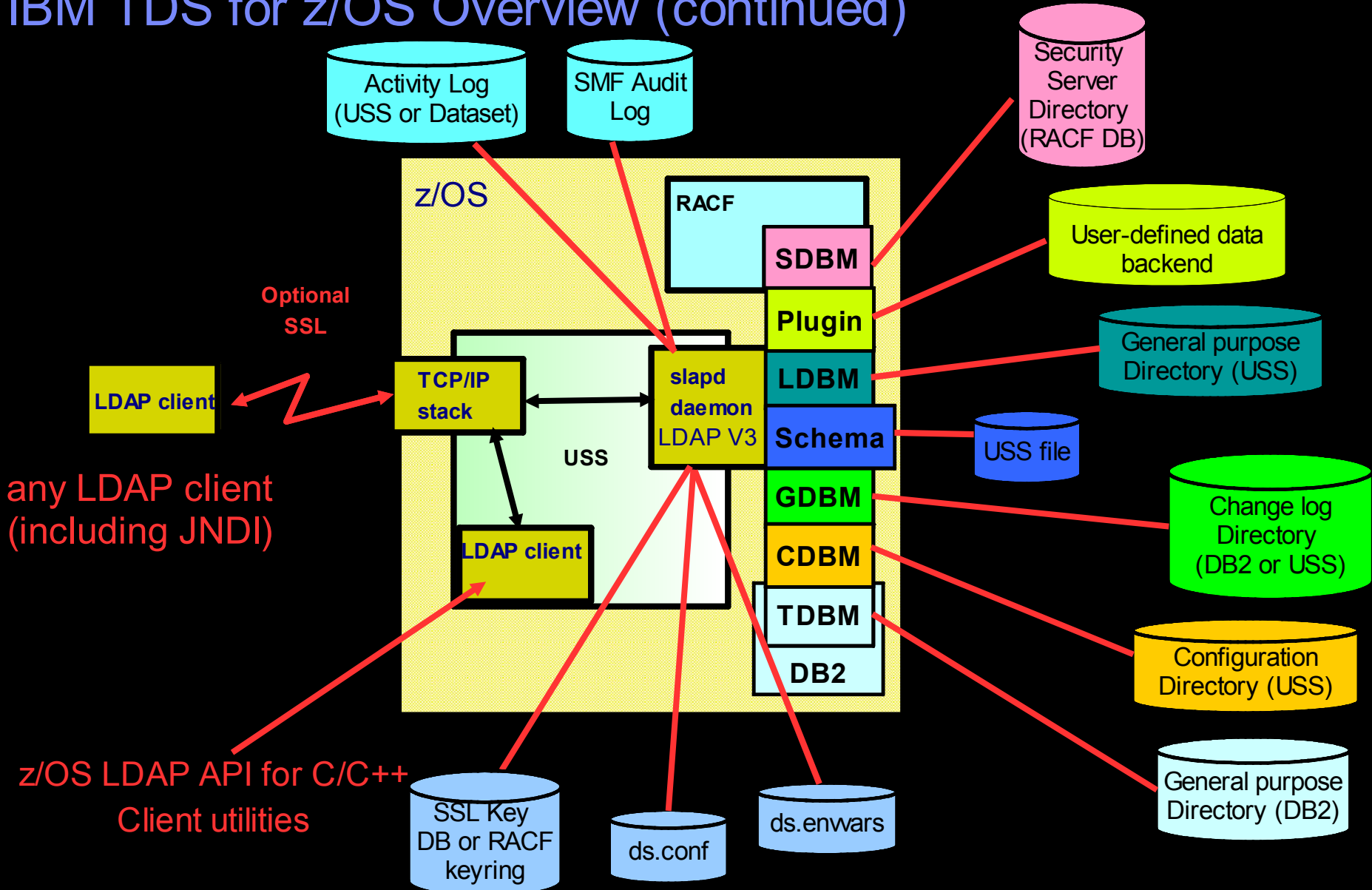
IBM TDS for z/OS Overview

- IBM TDS available since z/OS R8
 - 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

- Common LDAP operations (add, compare, delete, search, modify) are provided by client utilities in TSO and USS:
 - Idapadd, Idapcompare, Idapdelete, Idapmodify, Idapmodrdrn, Idapsearch

IBM TDS for z/OS Overview (continued)



Using the SDBM (RACF) Backend

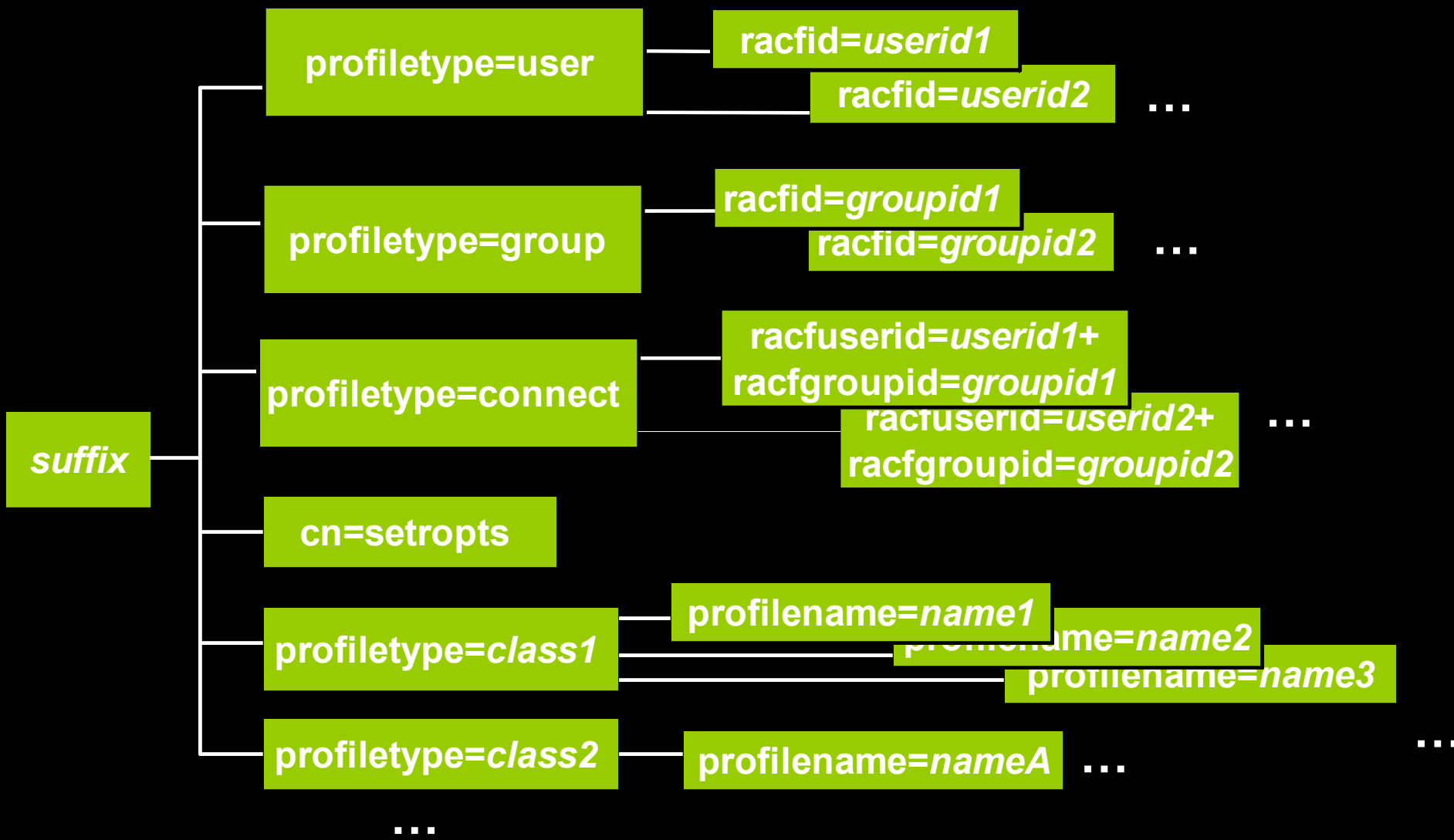
SDBM Backend Overview

- 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=BPX.SERVER,profiletype=FACILITY,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 <--> racfOmvsvId 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:
 - ADDUSER u1234 OWNER(radmin) DFLTGRP(group1)
SPECIAL OMVS(UID(1234) HOME(/home/u1234))

Using SDBM – Examples (continued)

- Modifying a RACF user entry

- Create a file, modu1234.ldif, containing the modification:

```
dn: racfid=u1234,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:

- ALTUSER U1234 WORKATTR(WABLDG('256')
WADEPT('LDAP'))

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=IRR.RADMIN.LISTUSER,profiletype=FACILITY,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 FACILITY IRR.RADMIN.LISTUSER OWNER
(GROUP1) UACC(NONE)
 - PERMIT IRR.RADMIN.LISTUSER CLASS(FACILITY) ID
(U2) ACCESS(READ)

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=racf
```

- 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:
 - SETROPTS REFRESH RACLIST(FACILITY)

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

IBM TDS
for z/OS

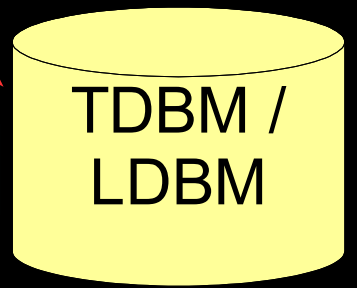
<ldap search is done to create the dn>
dn="cn=jonc,o=ibm,c=us"
pw=joncldap
ldap_bind_s(ld, host, port, dn, pw)

Successful bind

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

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

In TDBM/LDBM
backend



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)

IBM TDS
for z/OS

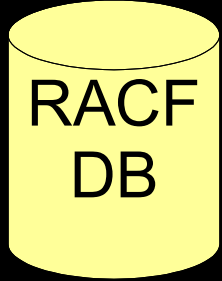
Bind Request

Successful bind

Verify password or
password phrase
__passwd(U1234, racfpw)

```
dn: racfid=u1234,profiletype=user,cn=sdbm
objectclass: racfUser
objectclass: racfBaseCommon
racfid: u1234
racfprogrammename: 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



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-nativeId** attribute

TDBM and LDBM Native Authentication (continued)



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

Bind Request

IBM TDS
for z/OS

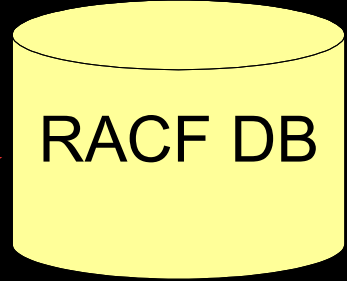
```
<ldap search is done to create the dn>  
dn="cn=jonc,o=ibm,c=us"  
pw=racfpw  
ldap_bind_s(ld, host, port, dn, pw)
```

Successful bind

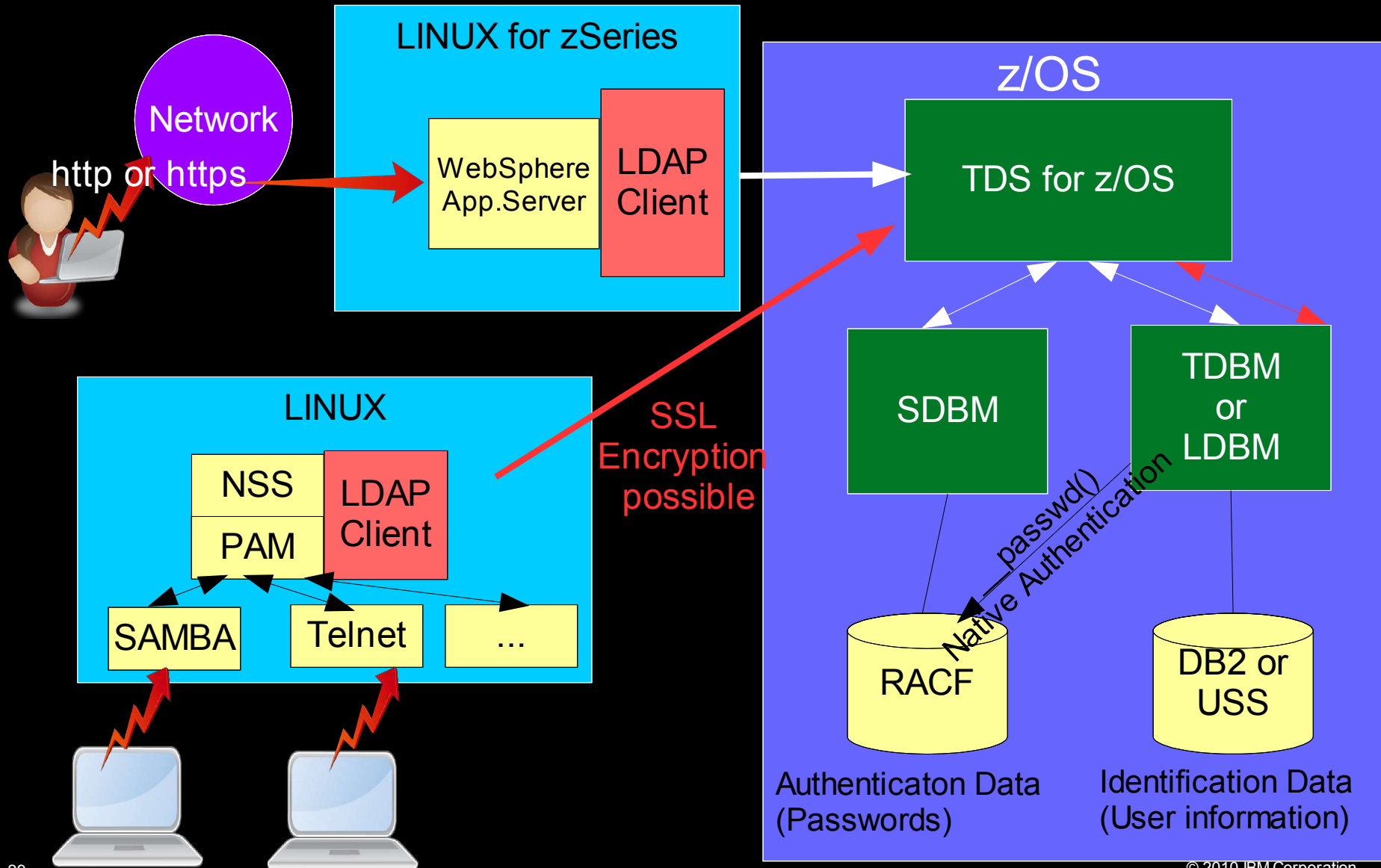
Find LDBM or TDBM entry
Verify native ID and password in RACF
Get LDBM or TDBM groups

```
dn: cn=jonc,o=ibm,c=us  
objectclass: newPilotPerson  
cn: jon  
sn: cottrell  
uid: u1234
```

passwd(u1234, racfpw)



Using LINUX to Authenticate to TDS



Changing RACF Password or Password Phrase

Changing RACF Password or Password Phrase

- The Idapmodify 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
```

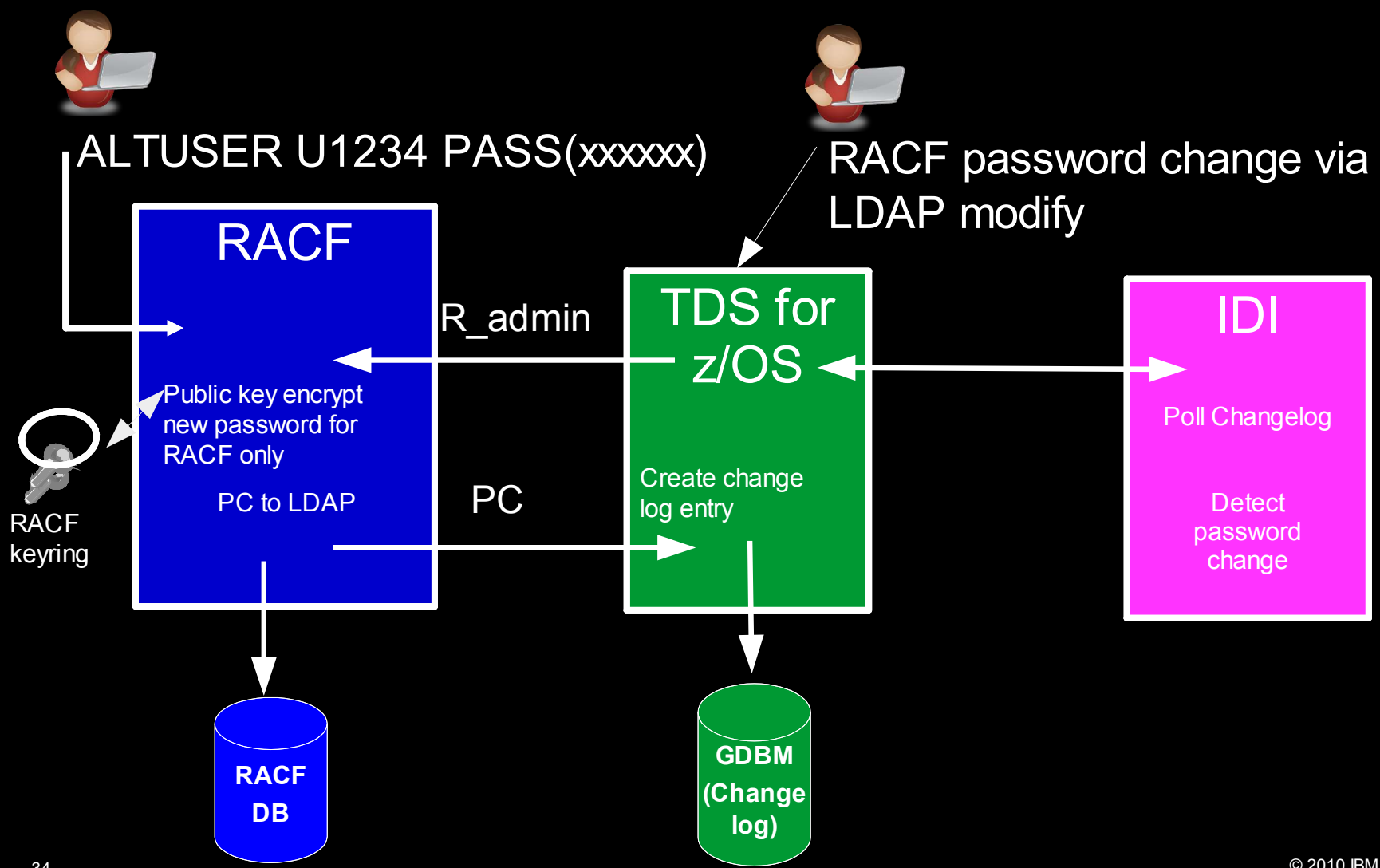
 - Note: **replace: userPassword** is not supported when changing the RACF password with native authentication

Changing RACF Password or Password Phrase (continued)

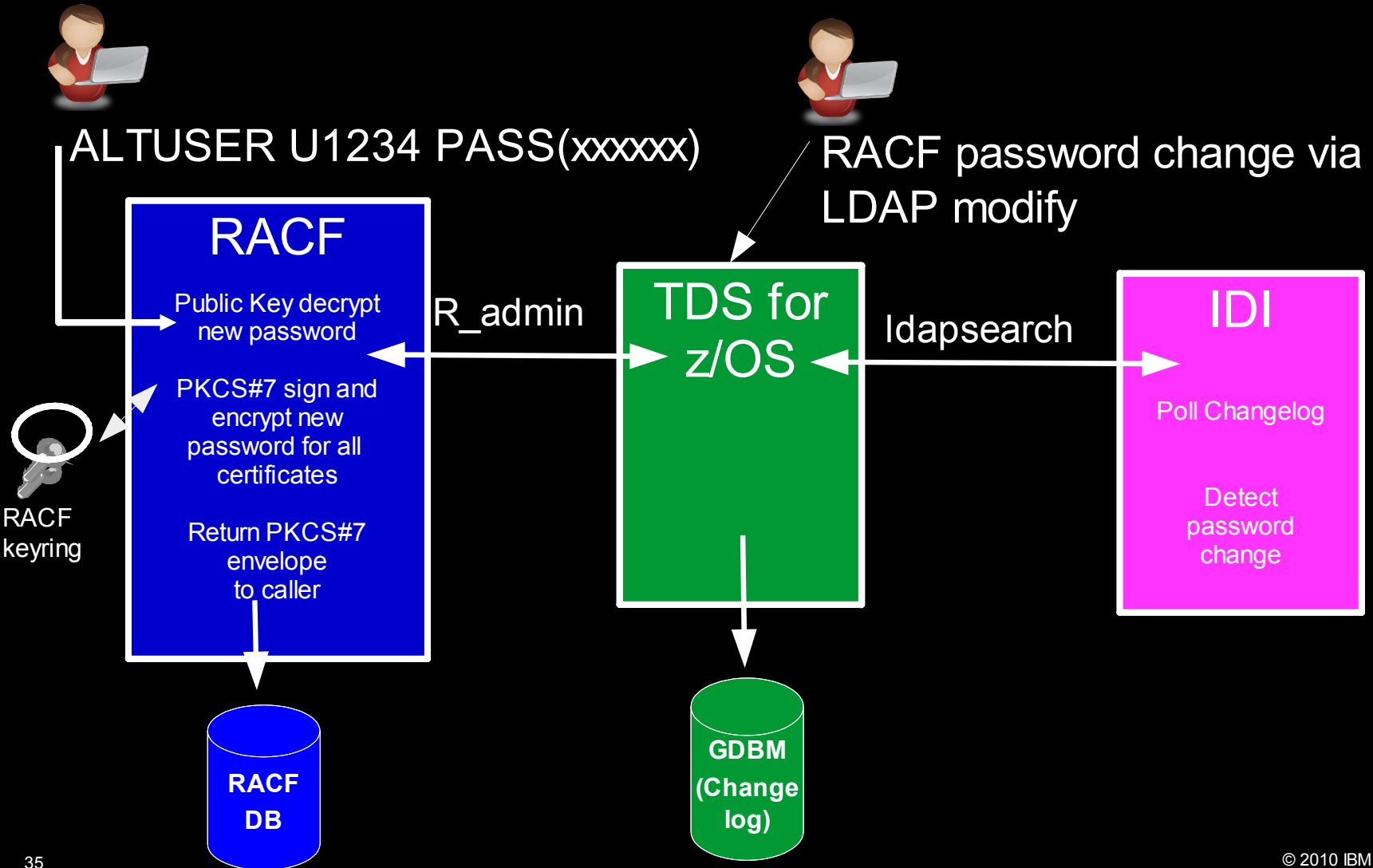
- SDBM or native authentication bind can be used to change a password (even if expired)
 - Specify *old_password/new_password* as password value when authenticating
 - `ldapsearch -D "racfid=u1234,profiletype=user,cn=sdbm" -w mynewpw/new2pass -s base -b "" "objectclass=*"`

LDAP-RACF Change Logging

LDAP-RACF Change Logging



LDAP-RACF Change Logging (continued)



LDAP-RACF Change Logging (continued)

- Searching the change log using the Idapsearch utility:
 - Idapsearch -D “racfid=admin,profiletype=user,cn=sdbm”
-w admin -b “cn=changelog” “changeNumber>= 53829”

```
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

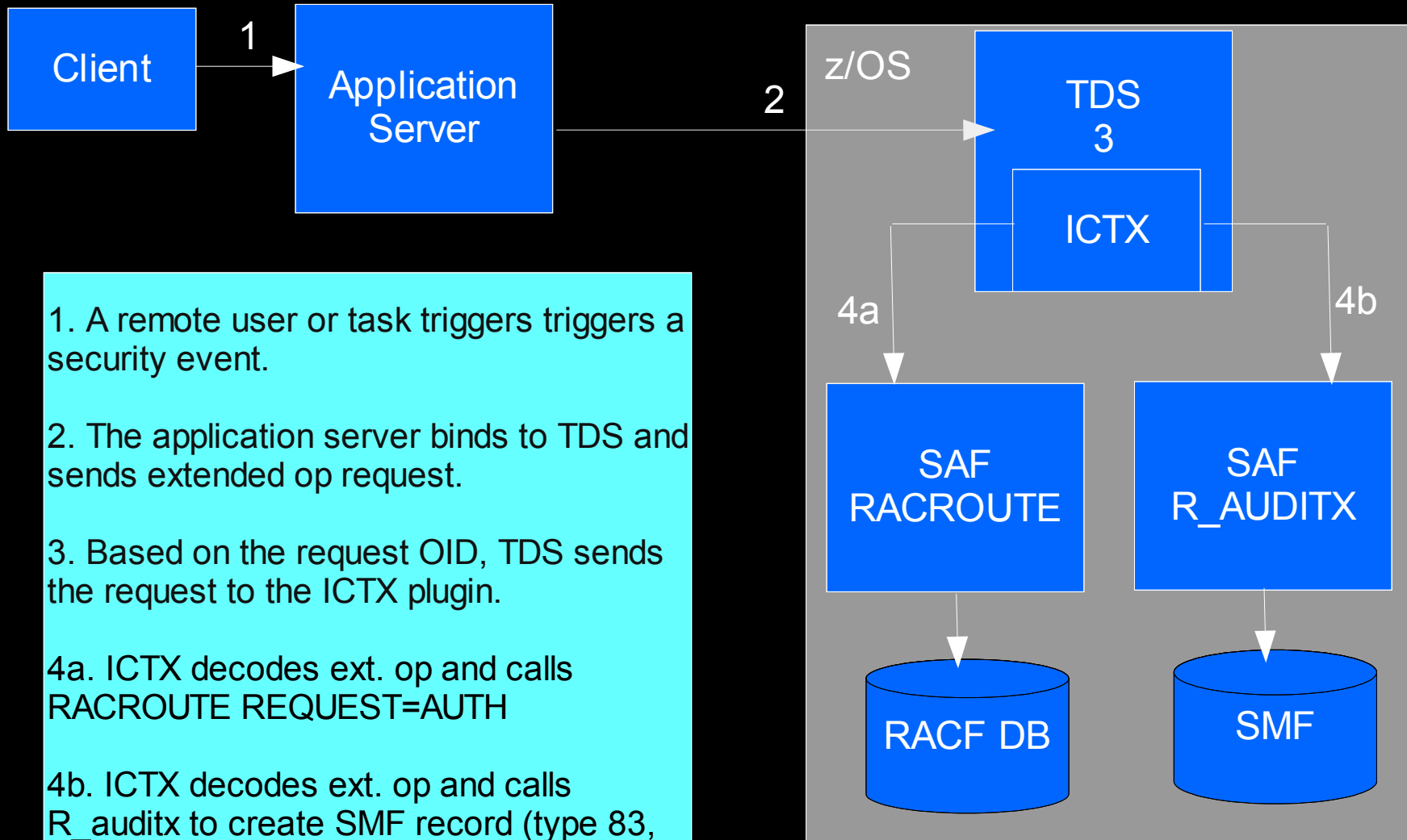
racfPasswordEnvelope: *base64_pkcs7_password_envelope*

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)



1. A remote user or task triggers a security event.
2. The application server binds to TDS and sends extended op request.
3. Based on the request OID, TDS sends the request to the ICTX plugin.
- 4a. ICTX decodes ext. op and calls RACROUTE REQUEST=AUTH
- 4b. ICTX decodes 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:
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Appendix

Additional Information

EXTERNAL (SSL Certificate) Mapping



Specify key database or RACF keyring: CLIENTRING
Specify SSL certificate: clientCert

EXTERNAL (SSL) Bind Request

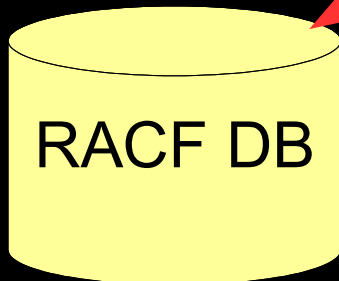
IBM TDS
for z/OS

Successful bind

clientCert information:

Subject's Name:
cn=u1234.o=ibm.c=us
Issuer's Name:
cn=radmin.o=ibm,c=us

Map clientCert to RACF userid, U1234



RACDCERT MAP ID(U1234) SDNFILTER('CN=U1234.O=IBM.C=US')