How-to Access RACF From Distributed Platforms

Saheem Granados
IBM
Wednesday, February 6, 2013
12538
sgranado@us.ibm.com
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Agenda

• Why RACF from Distributed?
• LDAP Primer
• Intro to TDS for z/OS
• RACF Authentication from Distributed
• RACF Authorization from Distributed
• RACF Audit Records from Distributed
• Retrieving RACF Profile Data from Distributed
• Summary
• Additional References
Why RACF from Distributed?

- Heavily invested in RACF for securing z-Specific resources
- Enterprise is becoming more diverse
  - Cost of Securing heterogeneous enterprises can increase if deploying many different security solutions for different platforms
    - New Skills
    - New Software/Hardware
- Centralization of security on z and RACF can be cost effective alternative
  - Leverage existing Security Related procedures/skills
  - LDAP facilitates the centralization of enterprise wide security in RACF
What is LDAP?

- Directory – data repository
  - Data stored in Entries managed in a hierarchical fashion, e.g., entries have parent entries
  - Commonly used to store user repository data
    - Also used to store application specific configuration data
  - Each entry contains 1 or more attributes
    - Every entry has a Distinguished Name attribute – unique identifier of the entry
    - Other attributes include password, native ID, etc..

- Lightweight Directory Access Protocol
  - A standard protocol for accessing/managing Directory data over TCP/IP
    - Add, delete, modify entries…
    - Search entries

- Can be key to an enterprises IT security infrastructure
  - Authentication of user
  - Authorization
Directory Server for z/OS

- Tivoli Directory Server is a LDAP server implementation fully optimized for z/OS
  - **Not** a port of distributed TDS server to z/OS
- Supports standard LDAP V3 protocol
- z/OS specific capabilities include
  - Full sysplex support
  - System SSL, ICSF, CTRACE, WLM, ARM, DB2, etc… support
  - LDAP based access to RACF data
    - RACF still responsible for authorization
- LDAP-RACF relationship allows
  - LDAP based remote authentication to be done by RACF
  - Limited LDAP based access to RACF user, resource, and custom profiles
  - LDAP plugin allows for remote RACF audit and authorization services.
Key LDAP Terms

• Distinguished Name (DN) – Attribute in LDAP entry that uniquely identifies any given entry in the directory
  • Made up attribute=value pairs separated by commas
  • Format of DN is recursive, i.e., DN = RDN/Parent’s DN
    • RDN consist of attribute-value pairs within the entry

• Bind – LDAP server authenticates a user
  • Distinguished Name/Password or Passphrase
  • Kerberos
  • X.509 Certificate
Key LDAP Terms cont…

• **SDBM**
  - AN LDAP front-end to RACF Database
    - Data is NOT duplicated in TDS
  - Allows LDAP clients to retrieve profile data (user, group, resource)
  - Allows TDS to have RACF perform authentication
    - TDS sends RACF ID + password/passphrase to RACF to authenticate

• **Native Authentication**
  - Standard LDAP user entries in TDS + a native user ID attribute
  - TDS calls RACF to authenticate native user ID and password or passphrase
RACF Authentication

- Goal: RACF serves as Authentication Authority
- Use passwords/passphrases, Kerberos, or X.509 Certificates to authenticate
- Consider WebSphere Application Server Environment +SDBM
RACF Authentication cont…

- Setup TDS: ds.conf (SDBM)

```plaintext
#-------- GLOBAL ---------
adminDN cn=admin
adminPW secret
listen ldap://:1492
listen ldaps://:1493
audit on
audit all,modify+delete+add+search+connect+disconnect+modifydn+bind+unbind+compare
schemaPath /home/suimgwi/ldap/test/r11db/schema
logfile /home/suimgwi/ldap/test/conf.log
#-------- SDBM -----------
database sdbm GLDBSD31/GLDBSD64 mysdbm
suffix cn=myracf
enableResources on
```
RACF Authentication cont…

- Ds.conf cont… (TDBM+native Auth)

```
#--------- TDBM ---------------
database tdbm GLDBTD31/GLDBTD64 TDBM1
suffix o=sample
extendedgroupsearching on
pwencryption sha
dbuserid DBUSR101
dsnaoini SUIMGWI.PRIVATE.EZCONFIG(DSNAOINI)
useNativeAuth all
nativeAuthSubtree o=sample
```
RACF Authentication cont...

- Setup WAS

In the administrative console go to Security → Global security → User registries → LDAP and supply the values shown in Table 4-1.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value (description, actual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server user ID</td>
<td>Master Administrators’ RACF user ID</td>
</tr>
<tr>
<td>Server user password</td>
<td>Master Administrators’ password</td>
</tr>
<tr>
<td>Type</td>
<td>Custom</td>
</tr>
<tr>
<td>Host</td>
<td>IP address or URL of LPAR where LDAP is listening</td>
</tr>
<tr>
<td>Port</td>
<td>LDAP listen port as specified in slapd.conf</td>
</tr>
<tr>
<td>Base distinguished name (DN)</td>
<td>suffix as in slapd.conf (without the quotes)</td>
</tr>
<tr>
<td>Bind distinguished name (DN)</td>
<td>racfid=BDNracid,profiletype=user,suffix</td>
</tr>
<tr>
<td>Bind password</td>
<td>password of BDNracid</td>
</tr>
</tbody>
</table>

Table 4-2 Filters for Advanced LDAP user registry settings

<table>
<thead>
<tr>
<th>property</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>User filter</td>
<td>racfid=%v</td>
</tr>
<tr>
<td>Group filter</td>
<td>racfid=%v</td>
</tr>
<tr>
<td>User ID map</td>
<td>*.racfid</td>
</tr>
<tr>
<td>Group ID map</td>
<td>*.racfid</td>
</tr>
<tr>
<td>Group member ID map</td>
<td>racfconnectgroupname:racfgroupuserids</td>
</tr>
</tbody>
</table>
ICTX: Remote RACF Authorization/SMF

- ICTX – a TDS for z/OS plug-in that add supports for remote RACF authorization and auditing over LDAP protocol
- Originally shipped with Enterprise Identity Manager for z/OS as of V1R8.
- Now shipped with TDS for z/OS starting in V2R1
- DS.conf update: plugin clientOperation GLDBIC31/GLDBIC64 ICTX_INIT “CN=ICTX”
ICTX: Remote RACF Authorization/SMF cont...

1. Client must bind to TDS for z/OS
   - Native Auth
   - SDBM bind
   - RACF mapping Enabled
     - Kerberos
     - X.509 SASL External bind

2. Client must BER Encode ICTX Request and send to TDS for z/OS

3. Client must BER Decode ICTX Response to check results
Remote RACF Authorization

- TDS issues RACROUTE REQUEST=AUTH SAF
- RACF Required Defines:
  RDEFINE FACILITY IRR.LDAP.REMOTE.AUTH UACC(NONE)
  PERMIT IRR.LDAP.REMOTE.AUTH CLASS(FACILITY) ID(BINDUSER) ACCESS(UPDATE))
  SETROPTS RA.ToList(FACILITY) REFRESH

- BER Encoding/Decoding
  - Client must have code that encodes parameters in BER Encoded block
  - Client must have code that decoded BER encoded response
Remote RACF Authorization

- Authorization Request ASN.1

```plaintext
requestValue ::= SEQUENCE {
  requestVersion INTEGER,
  itemList SEQUENCE of
    item SEQUENCE {
      itemVersion INTEGER,
      itemTag INTEGER,
      userOrGroup OCTET STRING,
      resource OCTET STRING,
      class OCTET STRING,
      access INTEGER,
      logString OCTET STRING
    }
}
```
Remote RACF Authorization

- Authorization Response ASN.1

```
responseValue ::= SEQUENCE {
    responseVersion INTEGER,
    responseCode INTEGER,
    itemList SEQUENCE OF
        item SEQUENCE {
            itemVersion INTEGER,
            itemTag INTEGER,
            majorCode INTEGER,
            minorCode1 INTEGER,
            minorCode2 INTEGER,
            minorCode3 INTEGER
        }
    }
```

Simple Remote RACF Authorization

1. User requests a distributed Application to access a resource in the enterprise
   - Resource may have a profile in RACF or
   - Application may need to map resource to an existing profile name in RACF (could use LDAP to manage mappings)

2. Distributed Application binds to TDS for z/OS, using user’s credentials.

3. Distributed Application encodes the ICTX Authorization Request and sends to TDS for z/OS

4. Distributed Application decodes response

5. If success, the application grants access
Remote RACF Audit

- TDS issues r_auditx (IRRSAX00) SAF callable service
- SMF Record Type 83 subtype 4 records
  - Unload using the IRRADU00 utility
  - RACF controls determine if record written
- RACF Required Defines:
  RDEFINE FACILITY IRR.RAUDITX UACC(NONE)
  PERMIT IRR.RAUDITX CLASSS(FACILITY) ID(LDAPSrv) ACCESS(READ))
  SETROPTS RACLIST(FACILITY) REFRESH
- BER Encoding/Decoding
  - Client must have code that encodes parameters in BER
    Encoded block
  - Client must have code that decoded BER encoded response
Remote RACF Audit

- Audit Request ASN.1

```asciidoc
requestValue ::= SEQUENCE {
  requestVersion INTEGER,
  itemList SEQUENCE of
    item SEQUENCE {
      itemVersion INTEGER,
      itemTag INTEGER,
      linkValue OCTET STRING SIZE(8),
      violation BOOLEAN,
      event INTEGER,
      qualifier INTEGER,
      class OCTET STRING,
      resource OCTET STRING,
      logString OCTET STRING,
      dataFieldList SEQUENCE of
        dataField SEQUENCE {
          type INTEGER,
          value OCTET STRING
        }
    }
}
```
Remote RACF Audit

- Audit Response ASN.1

```plaintext
responseValue ::= SEQUENCE {
  responseVersion INTEGER,  
  responseCode INTEGER,  
  itemList SEQUENCE OF  
    item SEQUENCE {
      itemVersion INTEGER,  
      itemTag INTEGER,  
      majorCode INTEGER,  
      minorCode1 INTEGER,  
      minorCode2 INTEGER,  
      minorCode3 INTEGER
    }
}
```
Simple Remote RACF Audit

1. Administrator defines profiles for different operations in an application
2. Distributed Application binds to TDS for z/OS
   • May have a single/long living TDS connection for remote audit
3. Distributed Application encodes the ICTX Audit Request and sends to TDS for z/OS
4. Distributed Application decodes response
5. If RACF controls set correctly, audit record will be written
SDBM: RACF Data and LDAP

• 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: RACF Data and LDAP

SDBM Backend Directory Hierarchy

Example DN: racfid=jon,profiletype=user,cn=sdbm
SDBM: RACF Data and LDAP
Common SDBM Commands

• Add a RACF user entry
  • Create a file, u1234.ldif, containing an entry to be added:
    
    ```
    dn: racfid=u1234,profiletype=users,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))`
Common SDBM Commands

- Display a RACF user-group connection:
  - `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.
Common SDBM Commands: Search Results

dn:
arrfuserid=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
Common SDBM Commands

- 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:
  
  ```
  SETROPTS REFRESH RACLIST(FACILITY)
  ```
Common SDBM Commands

- 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: anewpw

- 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
SDBM Limitations

- SDBM uses the **R_admin** "run command" interface to implement many RACF related operations
  - Output for search related operations have limits
    - **R_admin** limits output to 4096 records
- LDAP wildcard searching not fully supported for SDBM
- LDAP attribute names are pre-defined and cannot be changed
  - racfPassword for password cannot be customized
- SDBM subtree searching does not return all attributes
  - Must do subtree search to retrieve DNs then a base level search for each DN to retrieve all the attributes
Conclusion

- TDS for z/OS+RACF allows for consolidation of IT security on System z, regardless of platform
  - Existing skills and procedures can continue to be used
- Distributed Applications can
  - Use RACF to perform all authentication
  - Use RACF to perform all authorization
  - Use RACF for centralized Auditing facility
  - New as of V2R1: Use ICSF and System z crypto hardware, to manage/use cryptographic objects and keys
References

• z/OS Hot Topics Newsletter [http://www-03.ibm.com/systems/z/os/zos/bkserv/hot_topics.html](http://www-03.ibm.com/systems/z/os/zos/bkserv/hot_topics.html)
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  • #25, August 2011: “Don’t judge an LDAP server by its name!”
  • #26, August 2012: “z/OS LDAP Plug-ins: Endless Opportunities”

  • IBM Tivoli Directory Server Client Programming for z/OS
  • IBM Tivoli Directory Server Messages and Codes for z/OS
  • **IBM Tivoli Directory Server Plug-in Reference for z/OS**
  • IBM Tivoli Directory Server Administration and Use for z/OS

• IBM Education Assistant  
  • V1R11 – Security
    • Accessing RACF Resource Profiles through the IBM Tivoli Directory Server for z/OS
    • Introduction to configuring advanced replication in the IBM Tivoli Directory Server for z/OS
  • V1R12 – Security
    • Password policy in the IBM Tivoli Directory Server for z/OS
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• IBM Redbooks: WebSphere Application Server on z/OS and Security Integration
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IBM

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