# The Advantages Of External Security For DB2 And The Migration Towards RACF

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# Agenda

- The need for better data security
- What does DB2 offer ?
- Why externalizing security ? Why RACF ?
- How to migrate from DB2 security to RACF security ?
  - Translate DB2  into RACF
  - Getting started with RACF
  - Fallback
  - Potential issues

# The need for better data security

- **Internal reasons**
  - Audit team
    - separation of duties
    - Controling your administrative users
    - Access to your administrative users
    - Not within this scope but also important:
      - Who changed, which data and when ?
      - Did someone issue a start force command?
  - Job loss

# The need for better data security

- **External reasons**
  - Negative publicity
  - Damage to company reputation
  - Share price erosion
  - Loss of customer loyalty
  - Loss of revenue
  - Fines, penalties and bank rating
  - Increased operations costs

# The need for better data security

- Data theft is big business:
  - *In 2007 personal information for at least 53 million US citizens has been lost, stolen or compromised*
  - Your data is worth a lot, not just to you :
    - Credit Card Number With PIN - $500
    - Credit Card Number with Security Code and Expiration Date - $7-$25
    - Drivers License - $150
    - Birth Certificate - $150
    - Social Security Card - $100
    - Paypal account Log-on and Password - $7

*(Source: USA TODAY research 10/06)*

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# What does DB2 offer ?

- Multi Level Security (RACF pre-req)
- Trusted context
- Trusted role
- Secure Socket Layer
- Enterprise Identity Mapping (RACF pre-req)
- Improved auditing
    - Client userid of end-user
    - Workstation name
    - IP-address

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# Externalizing DB2 security in RACF

- NEW security options are possible (e.g. multi level security)
- SECURITY and DATA are separated

- Advantages of managing security in RACF
  - DB2 follows company standard
  - Generic RACF profiles
  - RACF rules can manage multiple subsystems
  - Objects don’t need to exist
  - Rights are preserved when object is dropped
  - Eliminating cascading revoke (e.g. SYSADM leaves company)
  - RACF AUDITING option is POSSIBLE

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# Native DB2 security

- DB2 can manage it's own security through
  GRANT and REVOKE
  Example: GRANT SELECT ON TAB1 TO USER1

- Information is stored SYSIBM.SYSxxxxAUTH tables

SYSIBM.SYSCOLAUTH
SYSIBM.SYSDBAUTH
SYSIBM.SYSPACKAUTH
SYSIBM.SYSPLANAUTH
SYSIBM.SYSRESAUTH
SYSIBM.SYSROUTINEAUTH
SYSIBM.SYSSCHEMAAUTH
SYSIBM.SYSSEQUENCEAUTH
SYSIBM.SYSTABAUTH
SYSIBM.SYSUSERAUTH

# Translate DB2 to RACF

- To know:
  - In DB2 **one catalog/SSID** to manage Security
  - One RACF to manage **multiple SSID**, objects must be **qualified**
  - In DB2 **catalog table** per type of object
    e.g. SYSDBAUTH
  - One RACF **class** per type of object

# RACF classes for DB2

| Class name | Description |
|---|---|
| DSNADM | DB2 administrative authority class |
| MDSNBP | buffer pool privileges |
| MDSNCL | collection privileges |
| MDSNDB | database privileges |
| … | |
| MDSNSM | system privileges |
| MDSNTB | table, index, or view privileges |
| MDSNTS | tablespace privileges |
| ... | |

Appendix A (source: RACF Access Control Module Guide SC18-7433-02)

# Translate DB2 to RACF

Grant select on table owner.tb1 to user1;

Permit **SSID.OWNER.TB1.SELECT CLASS(MDSNTB) id(user1) ACCESS(READ)**

Revoke select on table owner.tb1 from user1;

Permit **SSID.OWNER.TB1.SELECT CLASS(MDSNTB) id(user1) DELETE**

**SSID.OWNER.TB1.SELECT = PROFILE**

# Translate DB2 to RACF

- In DB2 only grant if table exists !
- In RACF only permit if profile exists !
  Define profile first

RDEF MDSNTB **SSID.OWNER.TB1.SELECT** **UACC(NONE)**

**UACC = default access allowed on this profile**

**NONE = without explicit permit no access allowed**
**READ = this profile is open to anyone**

# Order of checking

For table privileges:

1. Ownership of table
2. MDSNTB privileges (select/insert/update...)
3. DSNADM privileges
    1. DBADM
    2. SYSADM
4. If no RACF profile, DB2 decides
    1. Table privileges in SYSIBM.SYSTABAUTH
    2. DBA rights in SYSIBM.SYSDBAUTH
    3. SYSADM rights in SYSIBM.SYSUSERAUTH

# “granting” privileges

RDEF MDSNTB DB8G.CPKST.EMPLOYEE.* UACC(NONE)
RDEF MDSNTB DB8G.CPKST.EMPLOYEE.SELECT UACC(NONE)
RDEF MDSNTB DB8G.CPKST.EMPLOYEE.UPDATE UACC(NONE)
RDEF MDSNTB DB8G.CPKST.EMPLOYEE.INSERT UACC(NONE)
RDEF MDSNTB DB8G.CPKST.EMPLOYEE.DELETE UACC(NONE)

- Only owner (CPKST) can access the table
- To “grant” access use permit command

**PERMIT DB8G.CPKST.EMPLOYEE.SELECT CLASS(MDSNTB) ID(CPACA) ACCESS(READ)**
**PERMIT DB8G.CPKST.EMPLOYEE.INSERT CLASS(MDSNTB) ID(CPACA) ACCESS(READ)**
**PERMIT DB8G.CPKST.EMPLOYEE.UPDATE CLASS(MDSNTB) ID(CPACA) ACCESS(READ)**
**PERMIT DB8G.CPKST.EMPLOYEE.DELETE CLASS(MDSNTB) ID(CPACA) ACCESS(READ)**
**...**

**SETROPTS RACLIST(MDSNTB) REFRESH ➔ to activate/refresh**

# “revoking” privileges

To “revoke” also use permit command

**PERMIT DB8G.CPKST.EMPLOYEE.SELECT CLASS(MDSNTB) ID(CPACA) DELETE**

**Be careful**

- Dynamic statement cache not flushed (access remains)
  - Run “grant select” + “revoke select” for that user OR
  - Run “runstats .. Update none report no” for tablespace
- Packages not invalidated

# “granting” genericly

RDEF MDSNTB DB8G.CPKST.*.* UACC(NONE)
RDEF MDSNTB DB8G.CPKST.*.SELECT UACC(NONE)
RDEF MDSNTB DB8G.CPKST.*.UPDATE UACC(NONE)
RDEF MDSNTB DB8G.CPKST.*.INSERT UACC(NONE)
RDEF MDSNTB DB8G.CPKST.*.DELETE UACC(NONE)

- Protects all tables of owner CPKST
- To “grant” access to alle tables of that user

**PERMIT DB8G.CPKST.*.SELECT CLASS(MDSNTB) ID(CPACA) ACCESS(READ)**
**PERMIT DB8G.CPKST.*.INSERT CLASS(MDSNTB) ID(CPACA) ACCESS(READ)**
**PERMIT DB8G.CPKST.*.UPDATE CLASS(MDSNTB) ID(CPACA) ACCESS(READ)**
**PERMIT DB8G.CPKST.*.DELETE CLASS(MDSNTB) ID(CPACA) ACCESS(READ)**
**...**

**SETROPTS RACLIST(MDSNTB) REFRESH ➔ to activate/refresh**

# “closing” security

RDEF MDSNTB DB8G.*.*.*  UACC(NONE)

- With this profile all tables are protected.
- Only owners can access their own tables
- Users holding administrative rights

# Profile order

**The most specific profile decides**

RDEF MDSNTB DB2P.AW.*.SELECT UACC(READ)

RDEF MDSNTB DB2P.AW.TAB*.SELECT UACC(NONE)

Permit DB2P.AW.TAB*.SELECT class(MDSNTB) id(user1) access(READ)

Permit DB2P.AW.TAB*.SELECT class(MDSNTB) id(user2) access(READ)

Permit DB2P.AW.TAB*.SELECT class(MDSNTB) id(user3) access(READ)

RDEF MDSNTB DB2P.AW.TABA.SELECT UACC(NONE)

Permit DB2P.AW.TABA.SELECT class(MDSNTB) id(user1) access(READ)

# Examples of other classes

- **DSNADM (Administrator rights)**

RDEF DSNADM **DB8G.SYSADM UACC(NONE)**

PERMIT DB8G.SYSADM CLASS(DSNADM) ID(CPKST) ACCESS(READ)

…

PERMIT DB8G.TESTDB.DBADM CLASS(DSNADM) ID(CPLDB) ACCESS(READ)

SETROPTS RACLIST(DSNADM) REFRESH

- **MDSNDB (Database privileges)**

RDEF MDSNDB **DB8G.TESTDB.* UACC(NONE)**

PERMIT DB8G.TESTDB.LOAD CLASS(MDSNDB) ID(CPACA) ACCESS(READ)

PERMIT DB8G.TESTDB.DISPLAY CLASS(MDSNDB) ID(CPACA) ACCESS(READ)

…

SETROPTS RACLIST(MDSNDB) REFRESH

- **MDSNSM (System resources)**

RDEF MDSNSM SSID.* UACC(NONE)

RDEF MDSNSM **SSID.DISPLAY UACC(READ)** ➔ **uacc(read) = grant to public**

# Examples of other classes

- Packages/collections can be protected through *specific classes*.
  - MDSNPK: packages
  - MDSNCL: collections
- Or they can be protected through an *admin class*.
  - DSNADM: *SSID.COLLID.PACKADM*

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# How to implement RACF?

- Use RACFDB2 CLIST as inspiration
- Activate DSNX@XAC module in SDSNEXIT
- Use provided DB2 resource classes
- Define needed profiles

# RACFDB2 CLIST

- Download RACFDB2 CLIST
  www-03.ibm.com/servers/eserver/zseries/zos/racf/downloads/racfdb2.html
- Turns each grant/privilege into corresponding RACF control statement
- Use this output as an inspiration

# Activate DSNX@XAC

- Module DSNX@XAC:
  RACF access controle module
- Find source in SDSNSAMP(DSNXRXAC)
- Customize source and assemble into SDSNEXIT

# SDSNSAMP(DSNXRXAC)

```
DSNX@XAC TITLE 'RACF/DB2 External Security Module - Symbols'
         SYSSTATE ARCHLVL=1                                          @L3A
*-------------------------------------------------------------------------
* Global SET Symbols: See $SET for a description
*-------------------------------------------------------------------------
              GBLC  &CLASSNMT,&CHAROPT,&CLASSOPT,&ERROROPT           @09C
              GBLA  &PCELLCT,&SCELLCT,&XAPLDBCK
&CLASSOPT     SETC  '2'     1 - Use Classification Model I
.*                                (One set of classes for EACH subsys)
.*                          2 - Use Classification Model II
.*                                (One set of classes for ALL subsys)
&CLASSNMT     SETC  'DSN'   DB2 Subsystem Name (Up to 4 chars)
&CHAROPT      SETC  '1'     One character suffix (0-9, #, @ or $)
&PCELLCT      SETA  50      Primary Cell Count
&SCELLCT      SETA  50      Secondary Cell Count
&ERROROPT     SETC  '1'     1 - Defer to DB2 authorization if        @L3C
.*                                exit abends, sets terminating      @09A
.*                                return code(12), or sets an        @09A
.*                                unexpected return code.            @09A
.*                          2 - Terminate DB2 if                     @09A
.*                                exit abends, sets terminating      @09A
.*                                return code(12), or sets an        @09A
.*                                unexpected return code.            @09A
```

# DSNX@XAC options

- &CLASSOPT either value ‘1’ or ‘2’
  - &CLASSOPT ‘2’ (recommended)
    multiple subsystem scope

    One set of DB2 resource classes to protect multiple ssid’s

    Those resource classes resemble ➔ ***MDSNxx e.g. MDSNTB***

    Profiles are prefixed with ssid ex: ***ssid.creator.table.select***
  - &CLASSOPT ‘1’
    single subsystem scope

    One set of DB2 resource classes per ssid

    ***You have to define resource classes Myyyyxx e.g MPPPTB***

    ➔ ***These classes must ALL be defined (see later)***

    Profiles are not prefixed with ssid ex : ***creator.table.select***

# DSNX@XAC options

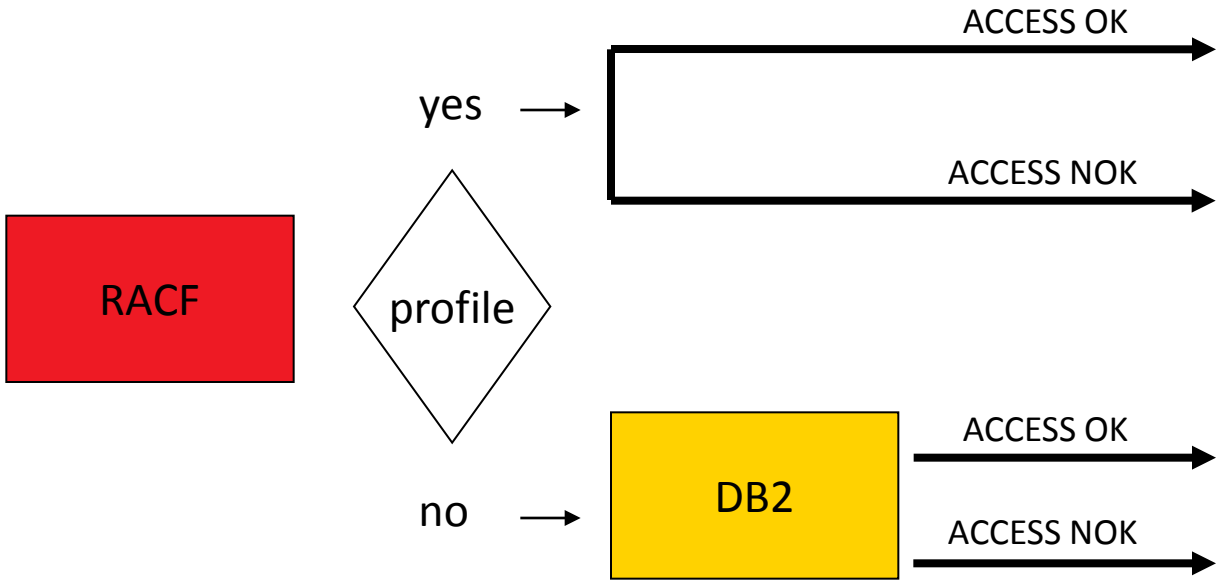
- &CLASSMNT ‘DSN’ (recommended)
  - Only meaning for &classopt=2
  - Represents ‘middle qualifier’ in class name
    e.g. RACF class M*DSN*TB
  - Can be any 1-4 characters
    e.g. &classMNT ‘AAAA’ ➔ M*AAAA*TB
    this requires you defining extra classes

# DSNX@XAC options

- &ERROROPT values ‘1’ or ‘2’
  - &ERROROPT ‘1’ (recommended but ...)
    - Return to DB2 security when unexpected error occurs
  - &ERROROPT ‘2’
    - Terminate DB2 when unexpected error occurs
- Unexpected error
  - Abend in DSNX@XAC module
  - Unexpected return code in DSNX@XAC

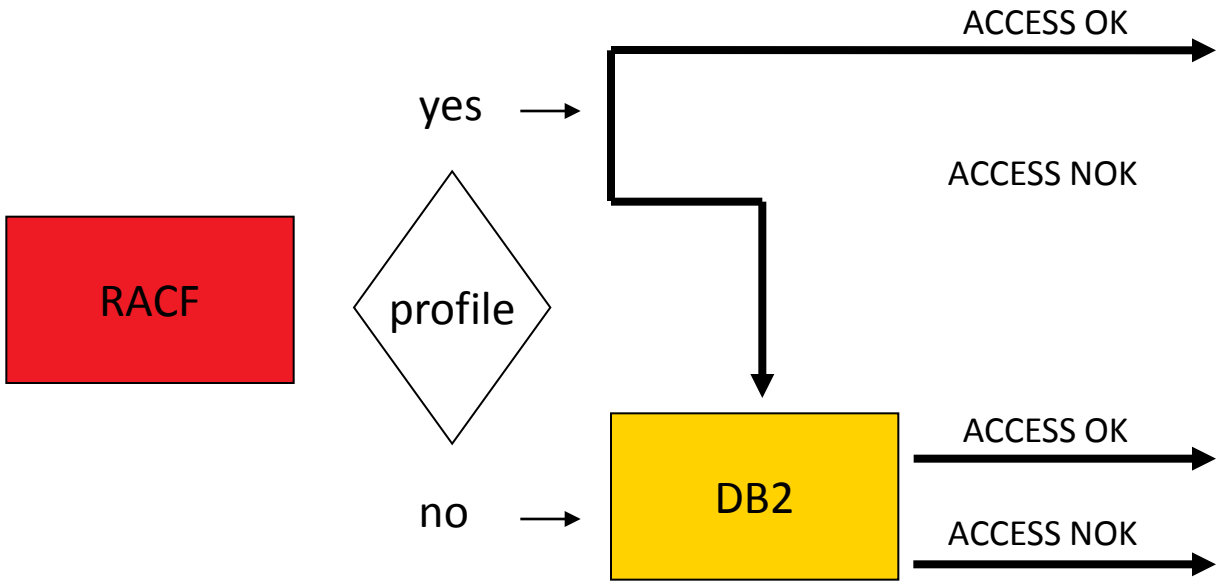
# DSNX@XAC working

- Standard DSNX@XAC



# DSNX@XAC working

- Customized DSNX@XAC




  - Allows for a phased approach
  - Set it up that DB2 grants access but still an ICH4081 is issued

# Phases

- **Phase 0:**
  **CLEAN UP YOUR authorisations in DB2 first !**
  - **Remove individual grants by groups**
  - **Review if access is still needed**
- Phase I:
  Migrate all profiles to RACF
  Use customized exit
  Add ‘forgotten’ profiles when needed
  New definitions only in RACF
- Phase II:
  Switch customized exit and use standard exit
  Keep catalog definitions for reference
- Phase III:
  Clean up catalog **(optional/dangerous/not needed)**

# Activate the classes

Before you can use a class you need to activate it.

```
//S01PWD   EXEC PGM=IKJEFT01,DYNAMNBR=20
//SYSUDUMP DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD *
    SETROPTS CLASSACT(DSNADM)
    SETROPTS CLASSACT(MDSNTB) GENERIC(MDSNTB)
    SETROPTS RACLIST(DSNADM) REFRESH
    SETROPTS RACLIST(MDSNTB) REFRESH
```

Stop and Start DB2

# Activate the classes

- DBM1 printout

```
IEF695I START DB8GDBM1 WITH JOBNAME DB8GDBM1 IS ASSIGNED TO USER START2  ,
$HASP373 DB8GDBM1 STARTED
IEF403I DB8GDBM1 - STARTED - TIME=11.08.49
IRR908I RACF/DB2 EXTERNAL SECURITY MODULE FOR DB2 SUBSYSTEM DB8G HAS  329
        A MODULE VERSION OF PK08127  AND A MODULE LENGTH OF 00005C00.
IRR909I RACF/DB2 EXTERNAL SECURITY MODULE FOR DB2 SUBSYSTEM DB8G  330
        IS USING OPTIONS: &CLASSOPT=2
                          &CLASSNMT=DSN
                          &CHAROPT=1
                          &ERROROPT=1
                          &PCELLCT=50
                          &SCELLCT=50
IRR910I RACF/DB2 EXTERNAL SECURITY MODULE FOR DB2 SUBSYSTEM DB8G  331
        INITIATED RACLIST FOR CLASSES:
         MDSNDB   MDSNPK   MDSNPN   MDSNBP   MDSNCL
         MDSNTS   MDSNSG   MDSNTB   MDSNSM   MDSNSC
         MDSNUT   MDSNUF   MDSNSP   MDSNJR   MDSNSQ
         DSNADM
IRR911I RACF/DB2 EXTERNAL SECURITY MODULE FOR DB2 SUBSYSTEM DB8G  332
        SUCCESSFULLY RACLISTED CLASSES:
         MDSNTB   DSNADM
```

# ICH408i message

```
ICH408I USER(CPLDB   ) GROUP(CP      ) NAME(CP - DEBEUF LAURENT )
  DB8G.CPKST.EMPLOYEE.SELECT CL(MDSNTB  )
  INSUFFICIENT ACCESS AUTHORITY
  ACCESS INTENT(READ   )  ACCESS ALLOWED(NONE   )
```

- Are accompanied by SQLCODE -551
- Best keep track, scrolling SYSLOG
- In a migration these profiles, indicate potentially needed profiles.

# How to start a migration?

- Two possibilities :
  - Start from your theoretic rules
    - Reinforce your rules
    - Might not be the same as before
    - Only to be used in phased approached
  - Start from reality (DB2 catalog as input)
    - Everything works as before
    - Difficult to complete
    - Difficult to manage/work generic
- **FIRST STEP :always ENSURE the RACF dataset is big enough run a test, extrapolate**

# How to start a migration?

- Start from reality (DB2 catalog as input)

  **1. start counting per qualifier, is someone a super user ?**

  Example :

  Owner PRD1 owns 10 tables, is there someone who has select on all 10 tables?
  If so create profile SSID.PRD1.*.SELECT UACC(NONE)

  What if PUBLIC has select on all 10?

  2 options :

  1. RDEF …… UACC(read)

  **2. RDEF …… UACC(none)**

  **Permit…….. ID( *)**

  What do you do if someone has select on 9 tables ?
  Is it forgotten? Is it wanted ?

# How to start a migration?

- Start from reality (DB2 catalog as input)

  **2. Make sure a super user has acces to more specific profiles**

  Example :

  Owner PRD1 owns 10 tables, **user1** has select on all 10 tables? But user2 only on PRD1.TB1

  Profiles:

  RDEF MDSNTB SSID.PRD1.*.SELECT UACC(NONE)

  RDEF MDSNTB SSID.PRD1.TB1.SELECT UACC(NONE)

  Permits:

  Permit SSID.PRD1.*.SELECT cl(mdsntb) id(**user1**)….

  Permit SSID.PRD1.TB1.SELECT cl(mdsntb) id(**user2**)….

  Permit SSID.PRD1.TB1.SELECT cl(mdsntb) id(**user1**)….

# How to start a migration?

- Start from reality (DB2 catalog as input)

**3. Do you have special RACF needs ?**

**talk to your SECADM**

Example :

Are there restricted users ?

restricted user only has access to if authority is explicitly given !

**User3 is a restricted user & TB1 has select to public**

Profiles:

RDEF MDSNTB SSID.PRD1.TB1.SELECT UACC(READ)

Permits:

Permit SSID.PRD1.TB1.SELECT cl(mdsntb) id(**user3**)….

# How to start a migration?

**DO you need to follow your special users ?**

need to activate

RDEF *class profile uacc* AUDIT(ALL)

Example :

**RDEF DSNADM DB2P.SYSADM UACC(NONE) AUDIT(ALL)**

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# Fallback  3 methods

1. Proactive approach
   - When generating your RDEF statements, create a second file containing all corresponding RDEL commands
2. Reactive approach
   - If RACF information is loaded into DB2 tables,  use the information to generate RDEL statements
   - If RACF information is NOT loaded into DB2 tables, use the RACF dataset to unload (next slides)
3. Very bad reactive approach
   - Desactivate RACF exit ➔ requires stop start of DB2

# Fallback ( from RACF dataset)

- Step 1: Unload “SYS1.RACF.DS01”

```
//UNLOAD  EXEC PGM=IRRDBU00,PARM=NOLOCKINPUT
//SYSPRINT DD SYSOUT=*
//INDD1      DD DISP=SHR,DSN=SYS1.RACF.DS01
//OUTDD      DD DSN=myfile
//             RECFM=VB,LRECL=3100
```

- Step2

REXX to screen output unload and generate

RDEL for all profiles defined on certain date, class, ssid,…

And execute all RDEL

- Step 3

Correct errors in SQL script and begin all over

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## Some potential issues

RACF Access Control Module Guide (SC18-7433-02)

**Chapter 10 : special considerations**

# READ IT !!

# Some examples

- **CREATETMTAB privilege**
  DB2: DBMAINT, DBCTRL, and DBADM are sufficient
  RACF: *CREATETMTAB, CREATETAB, SYSCTRL, SYSADM*

- **PUBLIC* not supported**
  Public at all locations is not supported by RACF

- **REVOKE**
  doesn't invalidate plans, drop views etc

- ***Bindagent (see next slides)***

# Bindagent problem

- **In DB2**
  - Bindagent can bind for another owner
  - Authorization owner is used for bind
    - Select
    - Insert/update/delete
- **In RACF**
  - Bindagent needed to bind for another owner
  - Authorization *BINDER* used for bind
  - Binder must have all sel/ins/upd/del needed

# Bindagent solution

Stored procedure **ADMIN_COMMAND_DSN**

- Version 9 feature
- Version 8 retro fitted (UK32059)
- Can execute **BIND/REBIND/FREE**
- Returns output to caller
- To solve bindagent use **SECURITY DEFINER**
- Definer technical user with all needed authorizations e.g. DB2BNDR
- Grant execute stored procedure to developpers

# Some quotes :

- The way to be safe, is never to feel secure
  (Czechoslovakian proverb)
- The user's going to pick dancing pigs over security every time
  (Bruce Schneier)
- Precaution is better than cure
  (Edward Coke)
- Better to be safe than sorry
  (my mom)

**Thank You**
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