Addressing Audit and Compliance requirements in a DB2 z/OS environment

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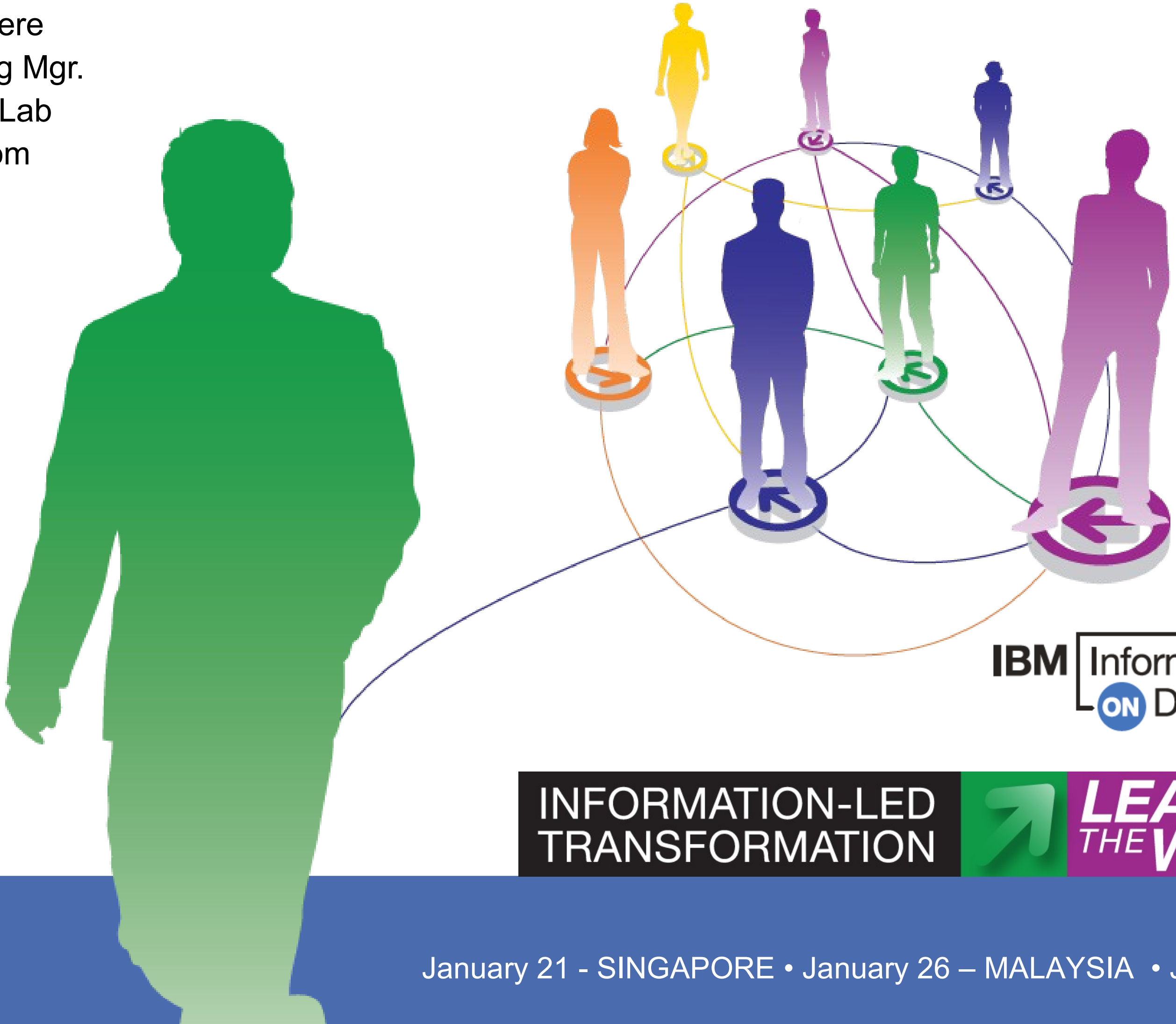
Session: 003



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Landscape – Customer Challenges

- Tremendous regulatory compliance pressures to demonstrate adequate institutional controls including audit reporting.
- Current DB2 on z/OS environment typically has minimal auditing
- Manual effort requiring interaction by DBA’s
- Reactive in nature with the implication that you only find information post event, or after the first breach
- Home grown process can provide some level of access reporting, however:
  - Application managed code you have to maintain
  - Exposure as a lack of robust application change controls can allow disabling of audit processing
- Overhead (perceived or actual) in many cases drive decision to not audit DB2 on z/OS data
- DB2 trace based processes are managed by DBA’s
  - **The DBA’s are responsible for generating audit data with which they are in turn audited, this constitutes a significant security risk and exposure.**

DB2 Audit Trace versus RACF

Why Audit when Production is Locked Down?

- Common arguments:
  - "We don't need to audit, we have controls surrounding who can access data"
  - "'We control who is connected to the DB2 SYSADM group and we know what those people are authorized to do"
- Counter arguments:
  - RACF does two things:
    - Prevents people from accessing a resource that is not essential or appropriate for their jobs
    - Allows people access to the necessary data to do their jobs
  - But RACF does NOT:
    - prevent a malicious update if the user has authority to the data.
    - prevent an authorized user from accessing sensitive data that is ***NOT*** within the scope of their job.
      - E.g. a bank teller looks up the CEOs bank balance or personal customer information
    - provide meaningful information about access to protected DB2 resources (authorized or not).

DB2 Audit Trace versus RACF

- Key Points:
  - RACF provides significant controls to protect access to resources, but does little in the way of meaningful access reporting
  - DB2 Audit trace will do nothing to protect data, but provides data to help understand what type of access has occurred.
    - Auditing is about ensuring that the appropriate controls are in place to identify inappropriate access and use of production data
    - You need some form of audit facility to watch your privileged users who have RACF and/or DB2 authority and users that have access to sensitive data within the scope of their job
    - Understanding how trusted (privileged) users access sensitive information is essential to ensuring that data is indeed protected

What to Audit – A busy slide

- **Closed Application Environment (*Probably not a candidate*)**
  - **–Traditional Application controls well defined and comprehensive**
    - **CICS and IMS TM – Signon and Transaction Access secured via RACF**
    - **Production Batch – Controlled via program pathing / Job Scheduling**
- Data warehouse – no risk of update but access audit might be needed
- Adhoc execution environnent – QMF, SPUFI, etc. Constitutes exposure
  - –SPUFI Plan can be restricted but ALL use should be audited
- Privleged ID's (DBA/Sysadmin) should be audited
- Distributed Application Environment
  - –Use of SQLESETI can provide granularity with credential population to IFI extensions
    - End User Workstation Name
    - End User Workstation Process
    - End User Workstation Userid
  - –Implement RACF Enterprise Identify Mapping Feature
    - http://www-03.ibm.com/servers/eserver/security/eim
- Data may not be as granular as you think
  - –Depending on how you configured your connections into DB2 – CICS attach, SAP, or CICS users with unique id's, and distributed transactions. May get all audit data but may not be meaningful because of attach environments. Group versus AUTHID. SQLESETI implementation can help
- "Offline" Utilities and certain tools are used outside of DB2
  - –RACF dataset access defined controls
  - –"Trigger" based audit
  - –Use of DSN1COPY should be restricted

Audit data sources

- DB2 catalog
  - SQL queries on catalog, other data
  - audit, accounting and performance traces
  - recovery log, current & historical data
  - RACF audit facility, other SMF data, ...
- Audit tools and techniques
  - tracing: audit, performance, accounting, monitor
  - formatting the traces: OMPE or PM, others
  - TCIM, DB2 Audit Management Expert, others
  - DSN1SMFP, others
  - log formatting: tools, DSN1LOGP, Log Analyzer
  - various recovery and cloning techniques
    - triggers
  - REPORT RECOVERY
  - RACF print, unload

What actions are needed to start the Audit trace?

- -DSN START TRACE (AUDIT) CLASS (1,2,4,5,8) DEST (SMF)
  - Requires one of the following privileges:
    - SYSOPER
    - SYSCTRL
    - SYSADM
    - TRACE
  - In addition, Class 4 and 5 events will only be collected for objects (tables) with the audit attribute turned on via ALTER:
    - AUDIT CHANGES – enables collection of changes in conjunction with CLASS (4)
    - AUDIT ALL – enables collection of changes and / or reads with CLASS 4 and/or 5 active
  - Note: When ALTER AUDIT is performed, plan and package invalidation occurs which requires a rebind to be performed

Audit class Events that are traced

1.Access attempts that DB2 denies because of inadequate authorization. This class is the default.

2.Explicit GRANT and REVOKE statements and their results. This class does not trace implicit grants and revokes.

3.CREATE, ALTER, and DROP statements that affect audited tables, and the results of these statements. This class traces the dropping of a table that is caused by DROP TABLESPACE or DROP DATABASE and the creation of a table with AUDIT CHANGES or AUDIT ALL. ALTER TABLE statements are audited only when they change the AUDIT option for the table.

4.Changes to audited tables. Only the first attempt to change a table, within a unit of recovery, is recorded. (If the agent or the transaction issues more than one COMMIT statement, the number of audit records increases accordingly.) The changed data is not recorded, only the attempt to make a change is recorded. If the change is not successful and is rolled back, the audit record remains; it is not deleted. This class includes access by the LOAD utility.

Accesses to a dependent table that are caused by attempted deletions from a parent table are also audited. The audit record is written even if the delete rule is RESTRICT, which prevents the deletion from the parent table. The audit record is also written when the rule is CASCADE or SET NULL, which can result in deletions that cascade to the dependent table.

5.All read accesses to tables that are identified with the AUDIT ALL clause. As in class 4, only the first access within a DB2 unit of recovery is recorded. References to a parent table are also audited.

6. The bind of static and dynamic SQL statements of the following types:

INSERT, UPDATE, DELETE, CREATE VIEW, and LOCK TABLE statements for audited tables. Except for the values of host variables, the audit record contains the entire SQL statement.

SELECT statements on tables that are identified with the AUDIT ALL clause. Except for the values of host variables, the audit record contains the entire SQL statement.

7. Assignment or change of an authorization ID because of the following reasons:

Changes through an exit routine (default or user-written)

Changes through a SET CURRENT SQLID statement

An outbound or inbound authorization ID translation

An ID that is being mapped to a RACF ID from a Kerberos security ticket

8. The start of a utility job, and the end of each phase of the utility.

Suggested Audit traces on DB2 for z/OS DB2 Common Criteria

- IFCIDs for Audit
- Accounting
  - 0003 successful access
- Audit
  - 0140: Audit all authorization failures
  - 0141: Audit all grants & revokes
  - 0142: Audit DDL Create / Alter / Drop
  - 0143: Audit First Write
  - 0144: Audit First Read
  - 0145: Audit DML Statement
  - 0314: Authorization Exit Parameters
- Performance
  - 0004: Trace Start
  - 0005: Trace Stop
  - 0023: Utility Start
  - 0024: Utility Change
  - 0025: Utility End
  - 0106: System Parameters
  - 0247: input host variables
  - 0350: SQL Statement

Suggested Audit traces – The “Bare Bones Minimum”

- DB2 security audit suggestions:
  - Catalog table queries
  - Audit class 1, 2, 3
    - 0140: audit all authorization failures
    - 0141: audit all grants & revokes
  - DB2 9 audit class 10: audit trusted context
    - 0269: establish trusted connection and switch user
    - 0270: CREATE & ALTER TRUSTED CONTEXT statements
  - Performance
    - 0004: Trace Start
    - 0005: Trace Stop
    - 0106: System Parameters

Auditing utilities which act outside of DB2

The audit gap

- When a 3rd party unload is executed against the DB2 VSAM data sets instead of through DB2, the IBM audit record has no knowledge of data access. However, the 3rd party utility “history” table will contain the date and time of the utility with the relevant utility id. The utility activity at run time is kept in another “in-flight” table. But the records are deleted upon completion of the utility.

Closing the Gap

- A DB2 trigger is deployed on the “in-flight” table that checks against the list of sensitive tablespaces. If it is one of our audited objects, the after trigger fires to insert this information into the DBA version of the in-flight table.

```
CREATE TRIGGER
      xxxxx.trigger name
        AFTER
        INSERT
      ON xxxxx.DBA_UTILITY_INFLIGHT
        REFERENCING
         NEW AS N
        FOR EACH ROW
       MODE DB2SQL
   WHEN  (N.NAME2 IN  ('TS1', 'TS2', 'TS3', 'TS4','TS5’) ) BEGIN
   ATOMIC INSERT INTO xxxxx. DBA_UTILITY_INFLIGHT  (UTILID, NAME1, NAME2, KIND,
   PARTITION, UTILNAME, SHRLEVEL, STATUS, XCOUNT, DDNAME,
   BLOCKS, ORIG_STATUS, EXTRBA, STATE ) VALUES  (N.UTILID, N.NAME1,
   N.NAME2, N.KIND, N.PARTITION, N.UTILNAME, N.SHRLEVEL,
   N.STATUS, N.XCOUNT, N.DDNAME, N.BLOCKS, N.ORIG_STATUS, N.EXTRBA,
    N.STATE)  ; END
```

- In DBA_UTILITY_INFLIGHT, the record will not be deleted and so the audit trail is left in tact. A separate query of this table will yield all 3rd party unload activity.

Audit Trace Overhead

- The performance impact of auditing is directly dependent on the amount of audit data produced. When the audit trace is active, the more tables that are audited and the more transactions that access them, the greater the performance impact. The overhead of audit trace is typically less than 5% but workload dependent.
- When estimating the performance impact of the audit trace, consider the frequency of certain events. For example, security violations are not as frequent as table accesses. The frequency of utility runs is likely to be measured in executions per day. Alternatively, authorization changes can be numerous in a transaction environment.
  - Following is the summary of results of the DB2 V8 Audit trace measurements :

    The measurements were done with Audit trace class(*) on and all the tables in the workload were enabled for 'Audit All'.

    For OLTP measurement with distributed IRWW SQL CLI workload with 9 Tables, 3 PI, 8 NPI and 7 transactions running at 493 transactions per second, the DB2 Class 2 CPU increase was +7.2%.

    For Utility measurements with LOAD, Rebuild Index, Reorg Table, Reorg Index utilities using 1 Table, 10 partitions, 1 PI and 5 NPI, there was no measurable CPU increase.
- Weigh auditing requirements against workload and anticipated impacts to application service levels and performance objectives carefully.
- Don’t underestimate impact on SMF activity and associated overhead

V9 Trace Extensions – START TRACE

- Qualifications by:
  - LOC
    - Location-Name
    - LUName
    - IPAddress
  - PLAN
  - PACKAGE
    - PKGLOC
    - PKGCOL
    - PKGPROG
  - Workstation Identifiers
    - USERID
    - APPLNAME
    - WRKSTN
  - Miscellaneous
    - CORRID
    - CONNID
    - ROLE

- Exclude by:
  - LOC
    - XLOC
  - PLAN
    - XPLAN
  - PACKAGE
    - XPKGLOC
    - XPKGCOL
    - XPKGPROG
  - Workstation Identifiers
    - XUSERID
    - XAPPLID
    - XWRKSTN
  - Miscellaneous
    - XCORRID
    - XCONNID
    - XROLE

V9 Trace Extensions - Wildcards

- Tracing threads using the * wildcard:
  - You can use the wildcard suffix, “*” to filter threads. For example, if you specify “-START TRACE PLAN (A,B,C*)”, DB2 will trace, and then return A, B, CDE, CDEFG, CDEFGH, and so on. It will trace threads “A”, “B” and all threads starting with “C”.
- Tracing threads using the positional, (_) wildcard:
  - You can utilize the positional wildcard, which is represented by the, “_” character, to trace threads when you want the wildcard in the middle, or when you want to trace threads of a specific length. For example, if you specify “-START TRACE PLAN (A_C), all threads will be traced that are three characters that have “A” as the first character, and “C” as the third.
- Tracing multiple threads at once using wildcards:
  - You also have the option of tracing multiple threads based on multiple trace qualifications. For example, you can specify, “-START TRACE PLAN (A*, B*, C*) to simultaneously trace ALL threads for plan that start with “A”, “B”, and “C”. The wildcard character, “*” will trace all threads.
  - You have the ability to filter multiple threads at the same time, setting specific criteria for the trace: For example, you can specify “-START TRACE PLAN (A) USERID (B). This will trace the threads where the plan thread is A, and the user ID is B.

V9 Trace Extensions – Some Restrictions

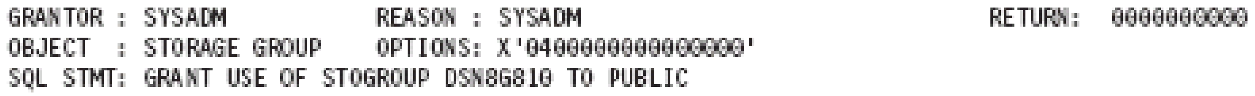
- When tracing threads, you can only specify more than one thread criteria for one filter per “-START TRACE” command.
  - –For example, you can specify “-START TRACE PLAN (A,B) USERID (B) WRKSTN (E),” but you cannot specify “-START TRACE PLAN (A, B) USERID (A, B) WRKSTN (E).
- If you use one or no values for PLAN, AUTHID, or LOCATION, the START TRACE command starts a single trace. If you use multiple values for PLAN, AUTHID, or LOCATION, the command starts a trace for each plan, authorization ID, or location. There can be a total of up to 32 traces going at one time (all trace types).
- You must use a privilege set of the process that includes one of the following privileges or authorities:
  - –TRACE privilege
  - –SYSOPR authority
  - –SYSCTRL authority
  - –SYSADM authority

DSN1SMFP offline utility

- The DSN1SMFP utility processes DB2 trace data into reports.
- DSN1SMFP accepts data that SMF collects in standard SMF format and produces from one to fifteen reports. DSN1SMFP accepts all SMF record types, but it processes only type 101 (DB2 Accounting) and 102 (DB2 Performance) records.
- DSN1SMFP checks each type 101 and 102 record for DB2 audit trace types of these DB2 IFCIDs:
  - 003: Accounting - DDF Data by Location (security-relevant fields only)
  - 004: Trace Start
  - 005: Trace Stop
  - 023: Utility Start
  - 024: Utility Change
  - 025: Utility End
  - 106: System Parameters (security-relevant fields only)
  - 140: Audit Authorization Failures
  - 141: Audit DDL Grant/Revoke
  - 142: Audit DDL Create/Alter/Drop
  - 143: Audit First Write
  - 144: Audit First Read
  - 145: Audit DML Statement
  - 350: SQL Statement

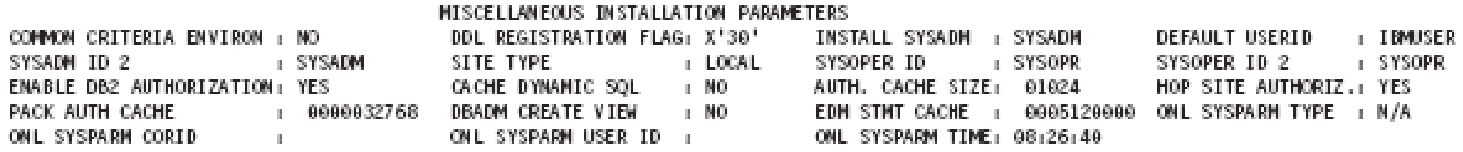
DSN1SMFP – Sample Report Outputs

IFCID – 141 Audit Grant/Revoke Report



```
GRANTOR : SYSADM            REASON : SYSADM                                   RETURN:  0000000000
OBJECT  : STORAGE GROUP     OPTIONS: X'0400000000000000'
SQL STMT: GRANT USE OF STOGROUP DSN8G810 TO PUBLIC
```

IFCID – 106 System Parameters Report



```
                                          MISCELLANEOUS INSTALLATION PARAMETERS
COMMON CRITERIA ENVIRON : NO             DDL REGISTRATION FLAG: X'30'     INSTALL SYSADM   : SYSADM       DEFAULT USERID    : IBMUSER
SYSADM ID 2             : SYSADM         SITE TYPE            : LOCAL     SYSOPER ID       : SYSOPR       SYSOPER ID 2      : SYSOPR
ENABLE DB2 AUTHORIZATION: YES            CACHE DYNAMIC SQL    : NO        AUTH. CACHE SIZE:  01024        HOP SITE AUTHORIZ.: YES
PACK AUTH CACHE         :  0000032768    DBADM CREATE VIEW    : NO        EDM STMT CACHE   :  0005120000  ONL SYSPARM TYPE  : N/A
ONL SYSPARM CORID       :                ONL SYSPARM USER ID  :           ONL SYSPARM TIME: 08:26:40
```

OMEGAMON XE for DB2 Performance Monitor/Expert for z/OS

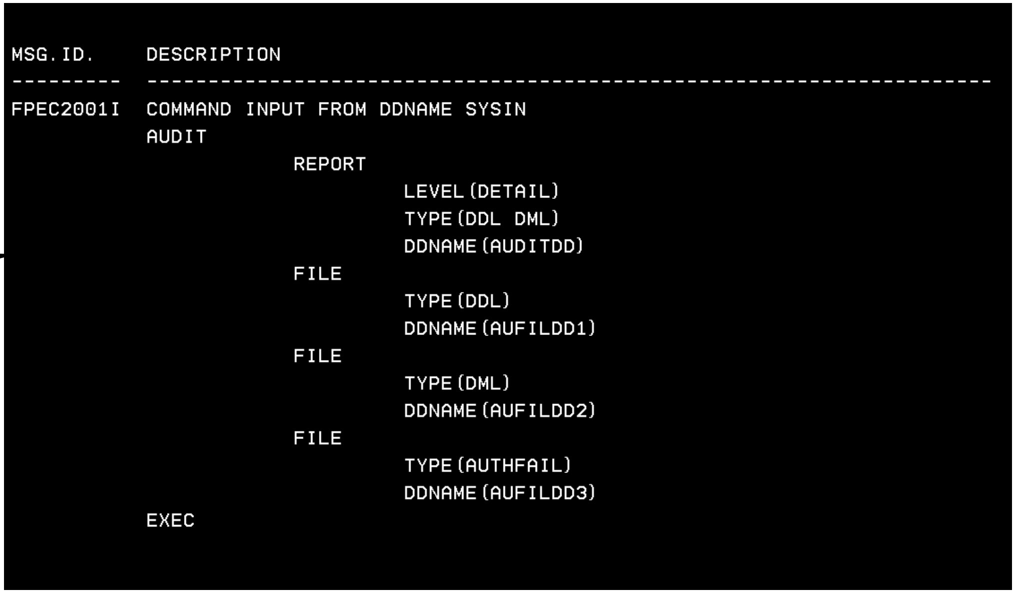
- Real-time monitoring
  - Threads and Statistics monitoring
  - DB2 Connect monitoring
  - Object Analysis
  - Data Sharing/Sysplex data (DB2Plex data)
- Near-term history
- Trace collection **(also as part of the PWH process support)**
- Reporting
  - Accounting, Statistics, SQL Activities, Locking, I/O Activity, Audit, Utilities, Record Trace
  - Executable as separate jobs or via PWH process engine
- Performance Warehouse with expert analysis support
- Buffer Pool Analysis, expert advice, and simulation **(only with the OMEGAMON XE for DB2 Performance Expert)**

DB2 OMEGAMON Performance Expert Audit Report Set

- Not strictly a performance report.
- Reports information about usage of auditable objects and authorization management.
  - Authorization changes
  - Authorization control (GRANTs and REVOKEs of privileges)
  - Authorization failures
  - DML statements against auditable DB2 tables at bind time
  - DDL operations against auditable DB2 tables
  - Read/write access against auditable DB2 tables
  - Utility executions against auditable DB2 tables
- Traces show individual events.
- Reports show audit information for an aggregation of DB2PE identifiers, e.g. primauth-planname-objects.

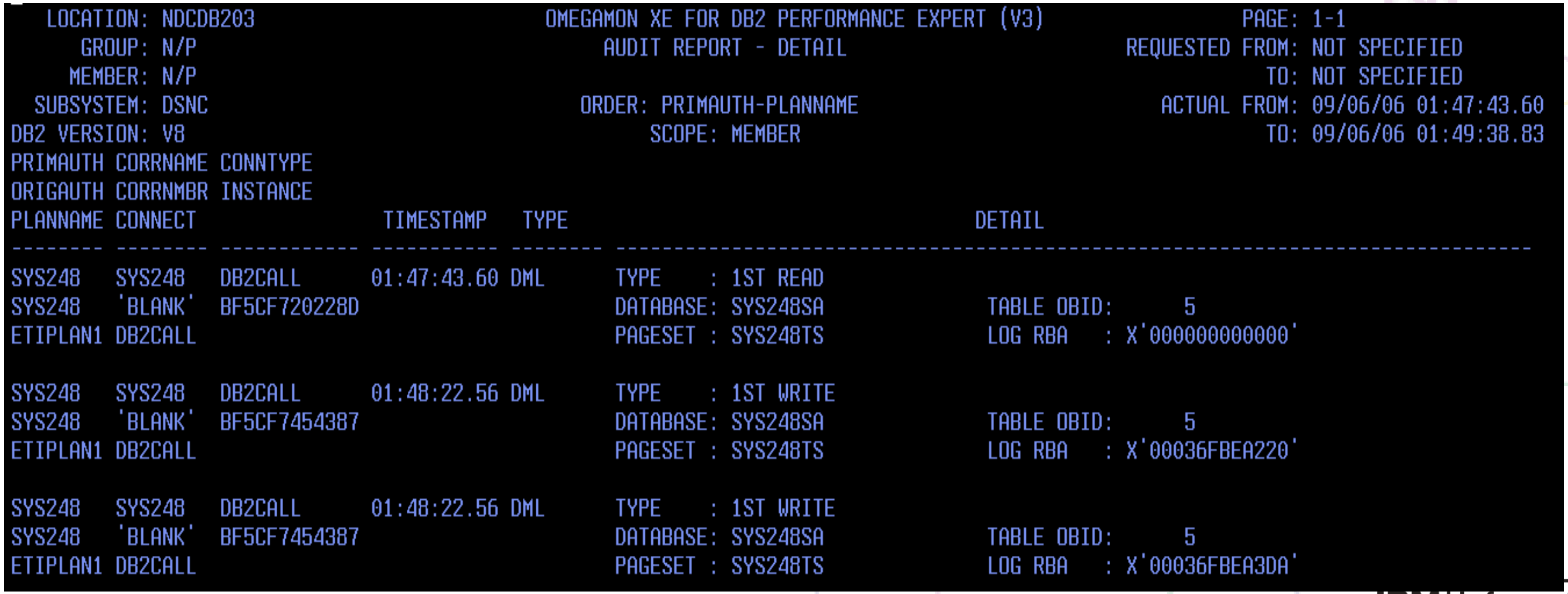
The OMPE “File” Report command is used to create DB2 Load compatible record formats

OMPE “File” report commands



```
MSG.ID.    DESCRIPTION
---------  ------------------------------------------------------------------------
FPEC2001I  COMMAND INPUT FROM DDNAME SYSIN
           AUDIT
                        REPORT
                                 LEVEL(DETAIL)
                                 TYPE(DDL DML)
                                 DDNAME(AUDITDD)
                        FILE
                                 TYPE(DDL)
                                 DDNAME(AUFILDD1)
                        FILE
                                 TYPE(DML)
                                 DDNAME(AUFILDD2)
                        FILE
                                 TYPE(AUTHFAIL)
                                 DDNAME(AUFILDD3)
           EXEC
```

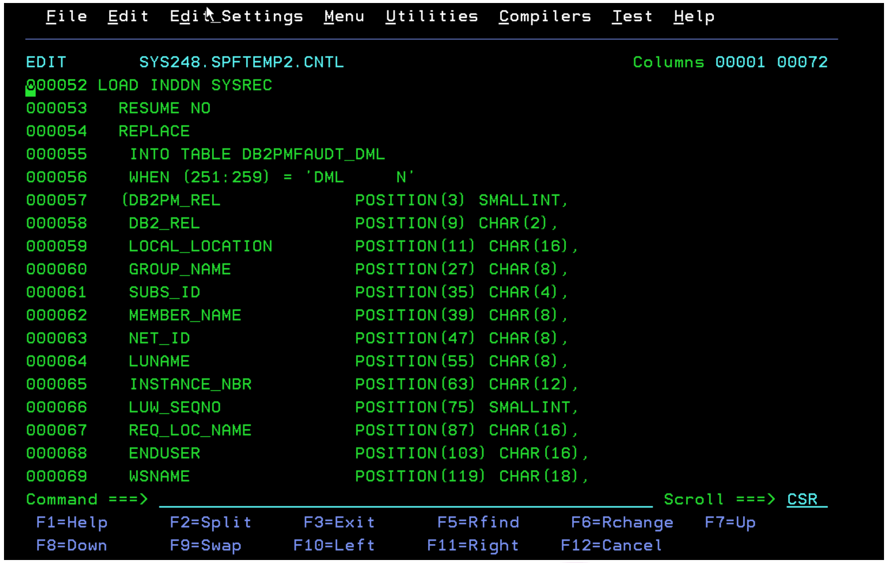
OMPE Audit Detail Report



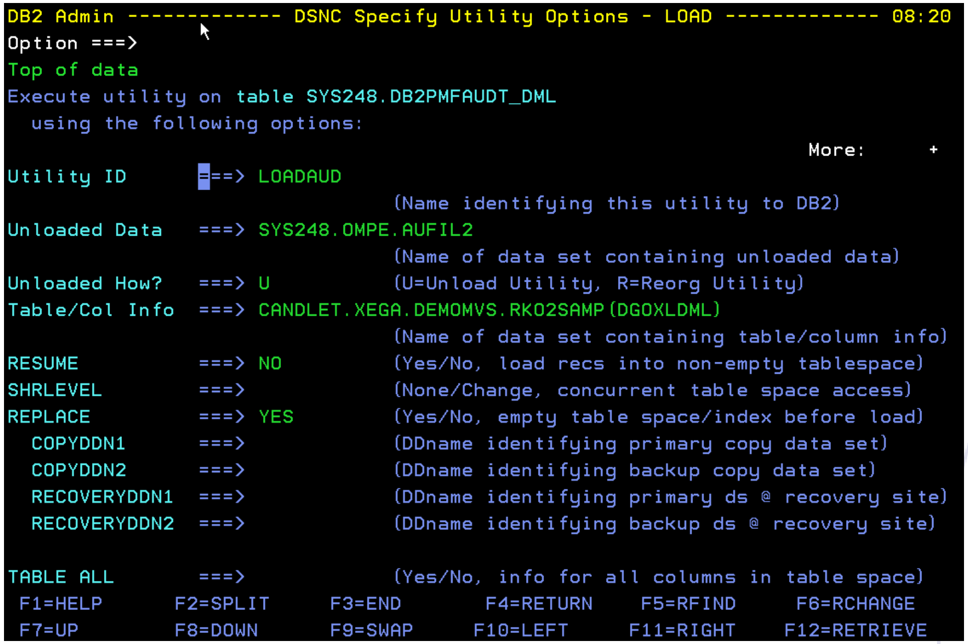
```
   LOCATION: NDCDB203                       OMEGAMON XE FOR DB2 PERFORMANCE EXPERT (V3)                PAGE: 1-1
      GROUP: N/P                                 AUDIT REPORT - DETAIL                       REQUESTED FROM: NOT SPECIFIED
     MEMBER: N/P                                                                                         TO: NOT SPECIFIED
  SUBSYSTEM: DSNC                          ORDER: PRIMAUTH-PLANNAME                             ACTUAL FROM: 09/06/06 01:47:43.60
DB2 VERSION: V8                                  SCOPE: MEMBER                                           TO: 09/06/06 01:49:38.83
PRIMAUTH CORRNAME CONNTYPE
ORIGAUTH CORRNMBR INSTANCE
PLANNAME CONNECT                TIMESTAMP   TYPE                                DETAIL
-------- -------- ------------ ----------- -------- -----------------------------------------------------------------------------
SYS248   SYS248   DB2CALL      01:47:43.60 DML      TYPE    : 1ST READ
SYS248   'BLANK'  BF5CF720228D                      DATABASE: SYS248SA                TABLE OBID:       5
ETIPLAN1 DB2CALL                                    PAGESET : SYS248TS                LOG RBA    : X'000000000000'

SYS248   SYS248   DB2CALL      01:48:22.56 DML      TYPE    : 1ST WRITE
SYS248   'BLANK'  BF5CF7454387                      DATABASE: SYS248SA                TABLE OBID:       5
ETIPLAN1 DB2CALL                                    PAGESET : SYS248TS                LOG RBA    : X'00036FBEA220'

SYS248   SYS248   DB2CALL      01:48:22.56 DML      TYPE    : 1ST WRITE
SYS248   'BLANK'  BF5CF7454387                      DATABASE: SYS248SA                TABLE OBID:       5
ETIPLAN1 DB2CALL                                    PAGESET : SYS248TS                LOG RBA    : X'00036FBEA3DA'
```

Invoking the DB2 load utility to populate the DB2 Performance DB with Audit data.

Load Control sample statements located in RKO2SAMP



```
 File  Edit  Edit Settings  Menu  Utilities  Compilers  Test  Help
EDIT       SYS248.SPFTEMP2.CNTL                              Columns 00001 00072
000052 LOAD INDDN SYSREC
000053   RESUME NO
000054   REPLACE
000055    INTO TABLE DB2PMFAUDT_DML
000056    WHEN (251:259) = 'DML      N'
000057   (DB2PM_REL                POSITION(3)  SMALLINT,
000058    DB2_REL                  POSITION(9)  CHAR(2),
000059    LOCAL_LOCATION           POSITION(11)  CHAR(16),
000060    GROUP_NAME               POSITION(27)  CHAR(8),
000061    SUBS_ID                  POSITION(35)  CHAR(4),
000062    MEMBER_NAME              POSITION(39)  CHAR(8),
000063    NET_ID                   POSITION(47)  CHAR(8),
000064    LUNAME                   POSITION(55)  CHAR(8),
000065    INSTANCE_NBR             POSITION(63)  CHAR(12),
000066    LUW_SEQNO                POSITION(75)  SMALLINT,
000067    REQ_LOC_NAME             POSITION(87)  CHAR(16),
000068    ENDUSER                  POSITION(103)  CHAR(16),
000069    WSNAME                   POSITION(119)  CHAR(18),
Command ===> ______________________________________________ Scroll ===> CSR
 F1=Help      F2=Split     F3=Exit      F5=Rfind     F6=Rchange   F7=Up
 F8=Down      F9=Swap     F10=Left     F11=Right    F12=Cancel
```

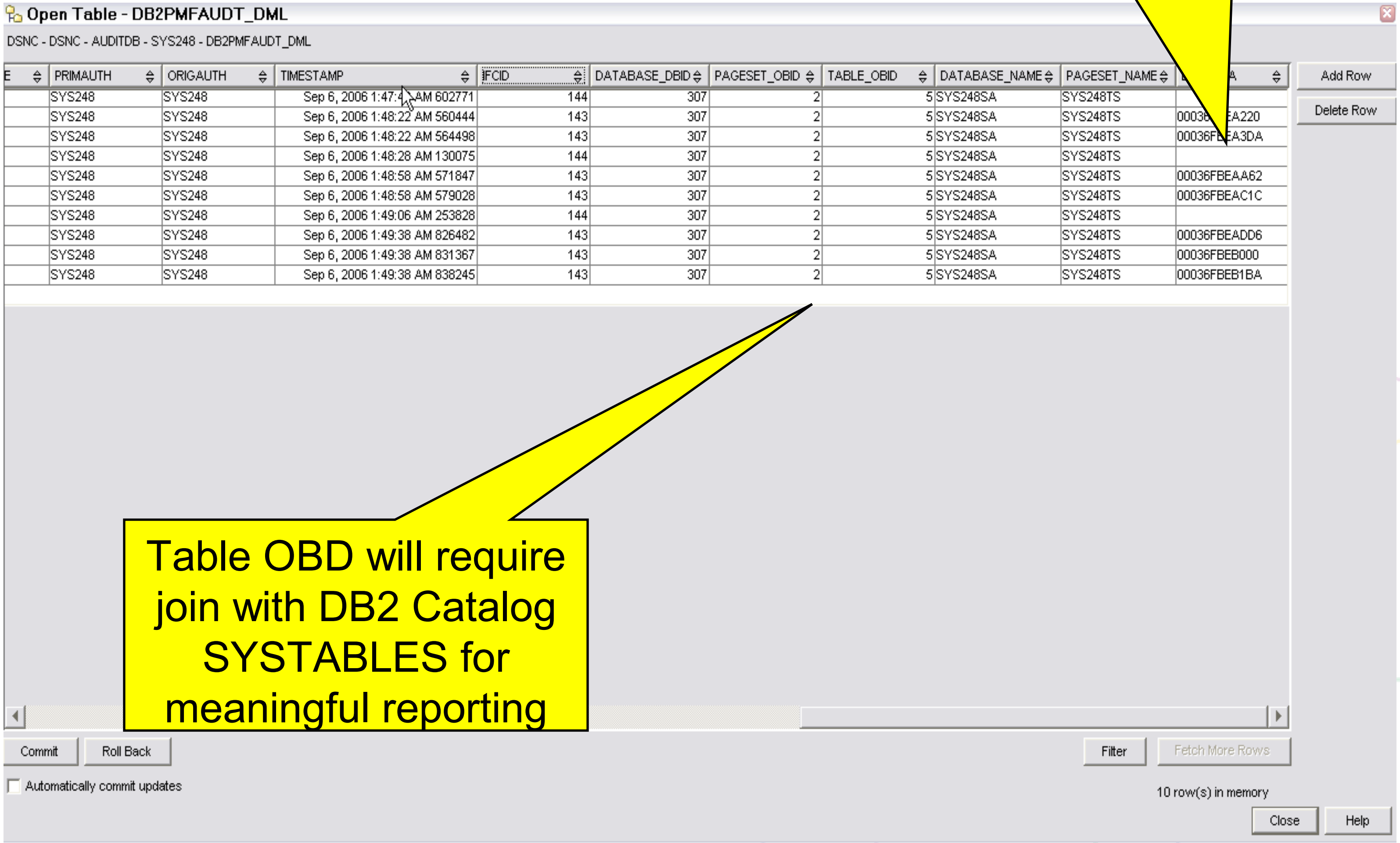


```
DB2 Admin ------------- DSNC Specify Utility Options - LOAD ------------- 08:20
Option ===>
Top of data
Execute utility on table SYS248.DB2PMFAUDT_DML
  using the following options:
                                                                       More:     +
Utility ID       ===> LOADAUD
                                   (Name identifying this utility to DB2)
Unloaded Data    ===> SYS248.OMPE.AUFIL2
                                   (Name of data set containing unloaded data)
Unloaded How?    ===> U            (U=Unload Utility, R=Reorg Utility)
Table/Col Info   ===> CANDLET.XEGA.DEMOMVS.RKO2SAMP(DGOXLDML)
                                   (Name of data set containing table/column info)
RESUME           ===> NO           (Yes/No, load recs into non-empty tablespace)
SHRLEVEL         ===>              (None/Change, concurrent table space access)
REPLACE          ===> YES          (Yes/No, empty table space/index before load)
  COPYDDN1       ===>              (DDname identifying primary copy data set)
  COPYDDN2       ===>              (DDname identifying backup copy data set)
  RECOVERYDDN1   ===>              (DDname identifying primary ds @ recovery site)
  RECOVERYDDN2   ===>              (DDname identifying backup ds @ recovery site)

TABLE ALL        ===>              (Yes/No, info for all columns in table space)
 F1=HELP      F2=SPLIT     F3=END       F4=RETURN    F5=RFIND     F6=RCHANGE
 F7=UP        F8=DOWN      F9=SWAP     F10=LEFT     F11=RIGHT    F12=RETRIEVE
```

Creation of the LOAD utility statements and JCL using DB2 Administration Tool

A view of the audit data stored in the OMPE performance warehouse using DB2 Control Center

Log RBA can be used to locate details about other actions for the LUW



Open Table - DB2PMFAUDT_DML

DSNC - DSNC - AUDITDB - SYS248 - DB2PMFAUDT_DML

E	PRIMAUTH	ORIGAUTH	TIMESTAMP	IFCID	DATABASE_DBID	PAGESET_OBID	TABLE_OBID	DATABASE_NAME	PAGESET_NAME	L[illegible]A
	SYS248	SYS248	Sep 6, 2006 1:47:4[illegible] AM 602771	144	307	2	5	SYS248SA	SYS248TS	
	SYS248	SYS248	Sep 6, 2006 1:48:22 AM 560444	143	307	2	5	SYS248SA	SYS248TS	00036[illegible]EA220
	SYS248	SYS248	Sep 6, 2006 1:48:22 AM 564498	143	307	2	5	SYS248SA	SYS248TS	00036F[illegible]EA3DA
	SYS248	SYS248	Sep 6, 2006 1:48:28 AM 130075	144	307	2	5	SYS248SA	SYS248TS	
	SYS248	SYS248	Sep 6, 2006 1:48:58 AM 571847	143	307	2	5	SYS248SA	SYS248TS	00036FBEAA62
	SYS248	SYS248	Sep 6, 2006 1:48:58 AM 579028	143	307	2	5	SYS248SA	SYS248TS	00036FBEAC1C
	SYS248	SYS248	Sep 6, 2006 1:49:06 AM 253828	144	307	2	5	SYS248SA	SYS248TS	
	SYS248	SYS248	Sep 6, 2006 1:49:38 AM 826482	143	307	2	5	SYS248SA	SYS248TS	00036FBEADD6
	SYS248	SYS248	Sep 6, 2006 1:49:38 AM 831367	143	307	2	5	SYS248SA	SYS248TS	00036FBEB000
	SYS248	SYS248	Sep 6, 2006 1:49:38 AM 838245	143	307	2	5	SYS248SA	SYS248TS	00036FBEB1BA

□ Automatically commit updates

10 row(s) in memory

Table OBD will require join with DB2 Catalog SYSTABLES for meaningful reporting

Limitations of the audit trace

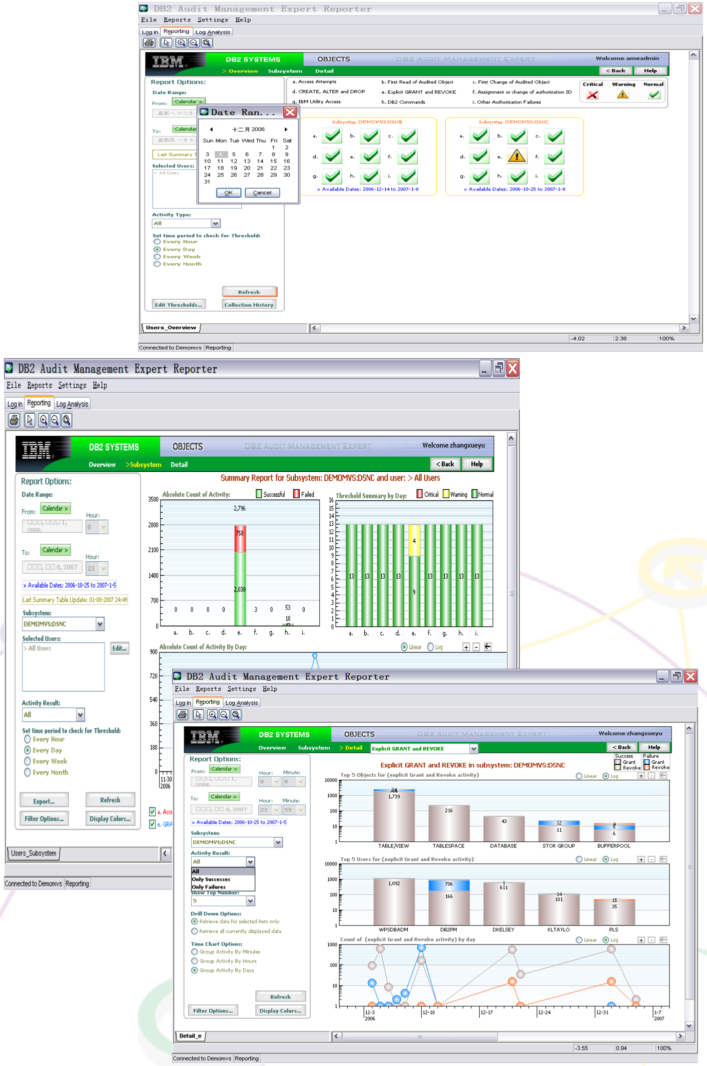
- The audit trace does not record everything, as the following list of limitations indicates:
  - The auditing that is described in this information takes place only when the audit trace is on.
  - The trace audits only the tables that you specifically choose to audit.
- The trace does NOT capture before/after change data because the DB2 log records this information.
  - If an agent or transaction accesses a table more than once in a single unit of recovery, the audit trace records only the first access.
- The audit trace does not audit some utilities. The trace audits the first access of a table with the LOAD utility, but it does not audit access by the COPY, RECOVER, and REPAIR utilities. The audit trace does not audit access by stand-alone utilities, such as DSN1CHKR and DSN1PRNT.
- You cannot audit the catalog tables because you cannot create or alter catalog tables.
- 3rd Party DB2 utilities (run outside of DB2) will not be caught with the AUDIT CLASS 8
- Dynamic SQL host variable data not collected
- This auditing coverage is consistent with the goal of providing a moderate volume of audit data with a low impact on performance. However, when you choose classes of events to audit, consider that you might ask for more data than you are willing to process.
- Depending on AUDIT classes active, and workload mix, significant increases in SMF activity might be experienced. One customer scenario, with CLASS (1-6) a 12% increase in SMF was observed.

Separation of Roles and Responsibilities

- DB2 trace based processes are managed by DBA's
  - The DBA's are responsible for generating audit data with which they are in turn audited, this constitutes a significant security risk and exposure
  - Trace data collection can be interfered with or turned off completely
    - DBA can issue –DSN Stop Trace
    - Use IFASMFDMP to selectively filter SMF data based on timestamp
    - Use DB2PM (Or Equivalent) filter such as DATE/TIME/EXCLUDE to filter selected records
  - Having the DBA involved in the collection of audit data is viewed as weak from a compliance and control perspective
- Security and Auditors with system privileges
  - Also viewed as problematic from a compliance perspective
  - Requires additional technical skills not within their core competencies
  - Misuse of privileges without coordination can result in performance and availability issues
    - Turning on traces without proper filtering to reduce overhead or quantity of trace data collected
    - Altering objects to AUDIT without ensuring that plan/package invalidation is not an issue

Audit Management Expert - Monitor and Audit

- **Helps auditors answer:**
  - Who, What, Where, Why, When, How
- **Centralizes the audit data**
  - Pulls together disparate data sources from all the systems into a central repository
- **Automates auditing process**
  - Eliminates all home grown processes
- **Creates segregation of duties**
  - Gives auditors the business activity collected without being reliant on the technical personnel they need to monitor
- **Flexible Reporting**
  - Drill down from overview to detail for forensic analysis


DB2 Audit Management Expert Reporter
File Reports Settings Help
Log in Reporting Log Analysis
IBM
DB2 SYSTEMS
OBJECTS
DB2 AUDIT MANAGEMENT EXPERT
Welcome ameadmin
Welcome zhangxueyu
< Back
Help
Overview
Subsystem
Detail
Report Options:
Date Range:
From:
To:
Calendar >
Date Ran...
OK
Cancel
Selected Users:
Activity Type:
Set time period to check for Threshold:
Every Hour
Every Day
Every Week
Every Month
Refresh
Edit Thresholds...
Collection History
Users_Overview
Critical
Warning
Normal
Summary Report for Subsystem: DEMOMVS:DSNC and user: > All Users
Absolute Count of Activity:
Successful
Failed
Threshold Summary by Day:
Absolute Count of Activity By Day:
Subsystem:
DEMOMVS:DSNC
Selected Users:
> All Users
Activity Result:
All
Export...
Filter Options...
Display Colors...
Users_Subsystem
Explicit GRANT and REVOKE in subsystem: DEMOMVS:DSNC
Top 5 Objects for (explicit Grant and Revoke activity)
TABLE/VIEW
TABLESPACE
DATABASE
STOR GROUP
BUFFERPOOL
Top 5 Users for (explicit Grant and Revoke activity)
WPSDBADM
DB2PM
DKELSEY
KLTAYLO
PLS
Count of (explicit Grant and Revoke activity) by day
Only Successes
Only Failures
Drill Down Options:
Retrieve data for selected item only
Retrieve all currently displayed data
Time Chart Options:
Group Activity By Minutes
Group Activity By Hours
Group Activity By Days
Detail_e
Connected to Demomvs Reporting

Audit Management Expert Overview

- Auditors will be able to Access:
  - SELECT, INSERT, UPDATE, and DELETE activity by user or by object
  - **SQL Text and Host Variable value for each statement**
    - **Row count that SQL statement affects**
  - CREATE, ALTER, and DROP operations against an audited object
  - Explicit GRANT and REVOKE operations
  - Utility access to an audited object
  - DB2 commands entered
  - Assignment or modification of an authorization ID
  - Authorization failures
- **Provides auditors with flexible options for examining the data in the audit repository**
  - Audit Trace Data, **Audit SQL Collector (ASC)**, Log Analysis data
    - V2.1 no longer needs to alter objects to 'AUDIT ALL' for read/update
    - DB2 Catalog Objects can now be audited for SQL read/update

Security and separation of roles

- Supporting internal and external auditors in collection and reporting of DB2 audit data
  - Does not require auditors to be DB2 defined users within the monitored DB2 system(s)
  - Does not require the auditors to log on to the operating system where the monitored system is running
    - Does not require extensive interaction between the auditor and the system support personnel (DBA/Sys admin)
- Auditor will not be able to directly manipulate any DB2 resources
- Provide complete visibility of all auditable objects to an administrator level user
- Provide controls for limiting visibility to auditors of auditable objects

- Removes DBA from audit data collection process. With V2.1 removes the “ALTER for AUDIT” requirement

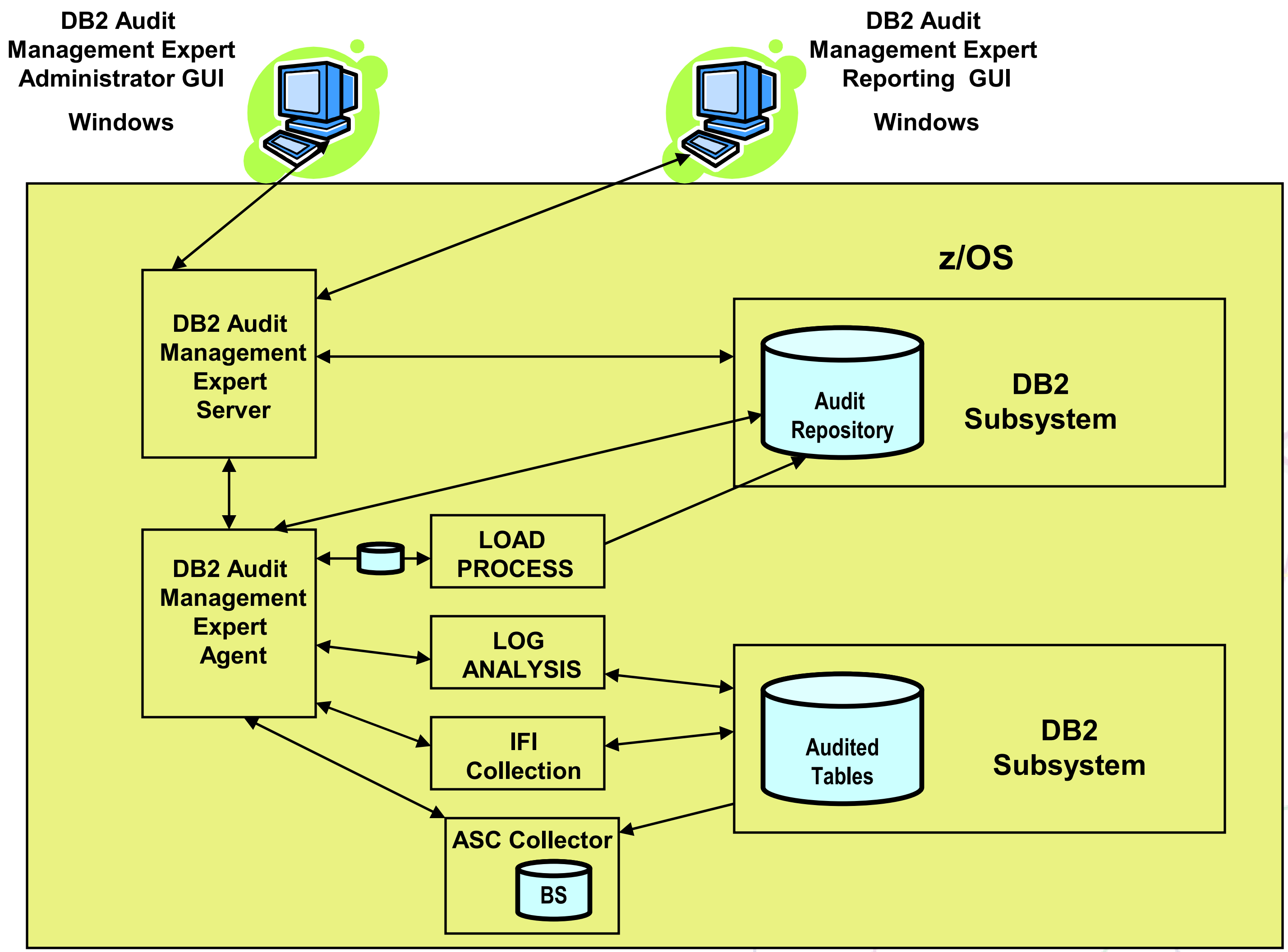
DB2 Audit Management Expert Components

- Audit server
  - Started task or batch job
  - central control point for an Audit Management Expert network
  - single audit server can support data collection from multiple agents on multiple z/OS systems

- Agent
  - Started Task or batch job
  - responsible for communications in an Audit Management Expert environment
  - acts as a "container" to run the various collectors
  - One per DB2 to Audit

- CLIENT User interfaces
  - Audit Management Expert Reporter
  - Audit Management Expert Administration
  - Windows

DB2 Audit Management Expert Architecture


DB2 Audit Management Expert Administrator GUI
Windows
DB2 Audit Management Expert Reporting GUI
Windows
z/OS
DB2 Audit Management Expert Server
Audit Repository
DB2 Subsystem
DB2 Audit Management Expert Agent
LOAD PROCESS
LOG ANALYSIS
IFI Collection
ASC Collector
BS
Audited Tables
DB2 Subsystem

ASC- Audit SQL Collector

DB2 Audit Management Expert Profiles

- Profiles are created/maintained via **Administration UI**
  - Collection Profile
    - records the details for what audit data is stored to the Audit Management Expert repository
  - Agent Profile
    - Select ASC collection method
    - Configure General settings
      - Retention count, interval length
    - DB2 Load utility parameters
    - Define Job cards for load and log analysis
  - User Profile
    - contain information specific to an individual Audit Management Expert user such as: the user type, configurable privileges, and associated user groups

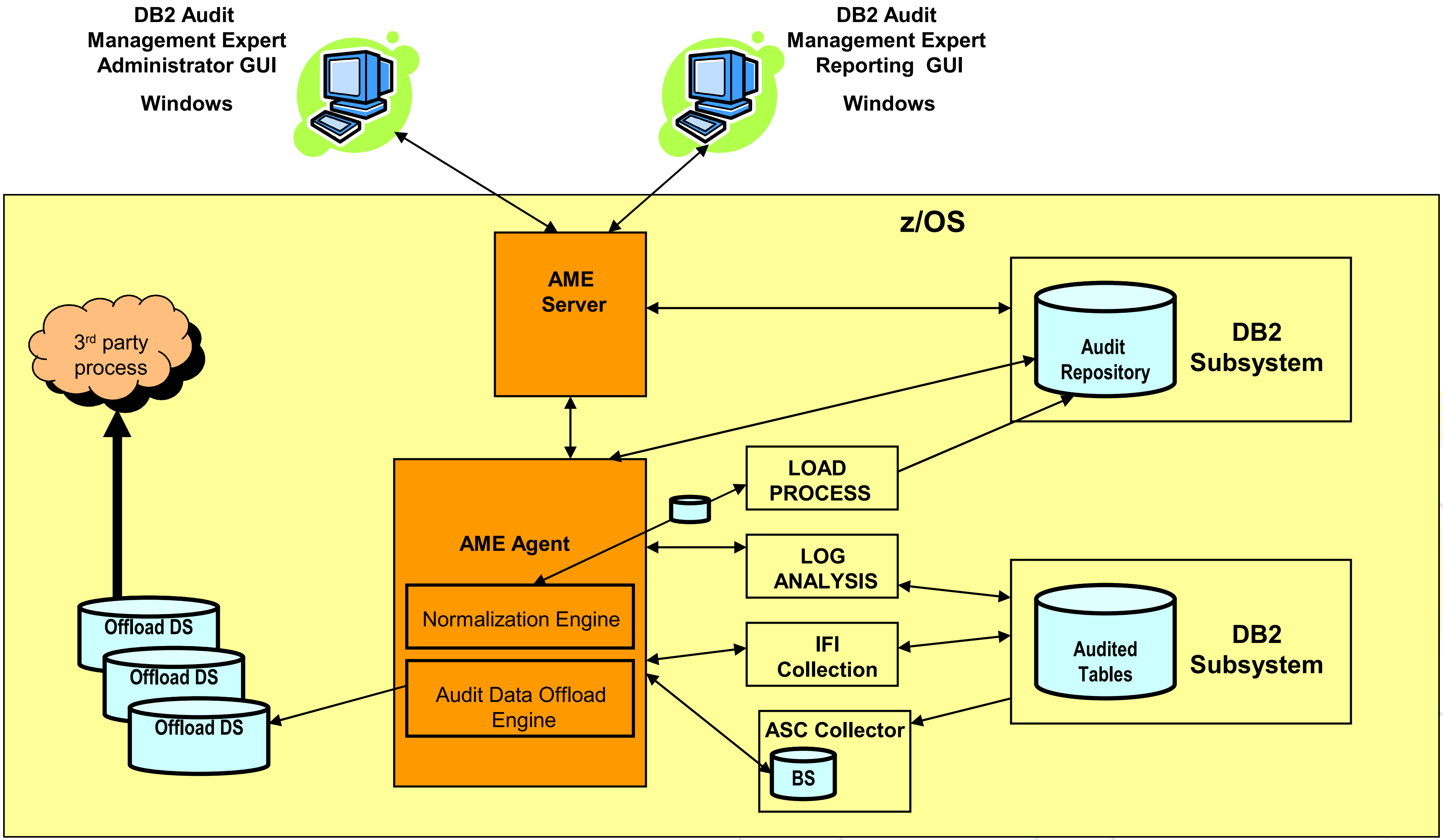
AME and Enterprise Wide Auditing - Challenges

- Existing appliance technology based on data feeds from primarily 2 sources
  - Event log from DB2 trace events written to SMF (agent)
  - Network "Sniffer" implementation (appliance)
- Restrictions and challenges with DB2 Trace versus a superior low overhead data collection approach with AME's ASC
- Network traffic based audit feeds challenged by
  - Encrypted Data Streams
  - Local Attachments (Batch, TSO, etc.)
  - Stored Procedures
  - Performance impact to network throughput due to indiscriminate examination of all network flows
- Strong requirement to view and manage Audit events across the enterprise from a single UI

AME Extract File Enhancement via maintenance stream (PTFs UK41519, UK41521, UK41523)

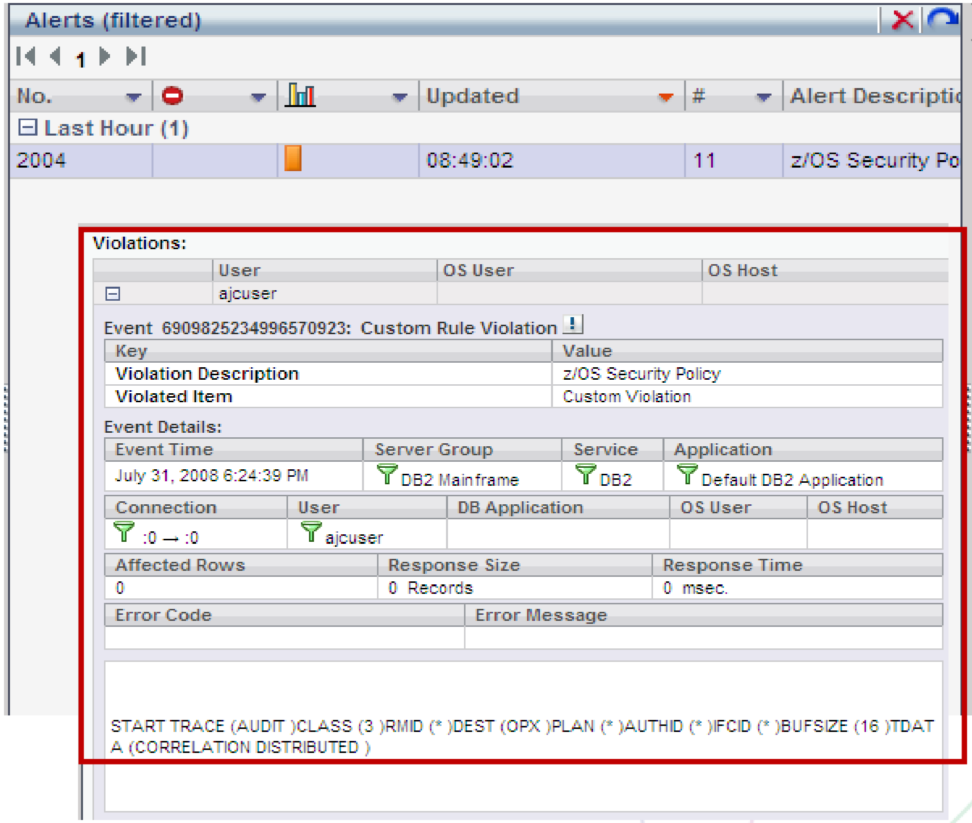
- AME will provide an option to generate audit log data sourced from either DB2 Trace or ASC (Audit SQL Collector) in an documented extract file format.
- Extract files will be standard physical sequential datasets.
- Exploiters will be responsible for transporting (via secure FTP for example) data to appliance server environment.
- Management of Extract files (archiving, deleting, etc.) will be the responsibility of exploiters
- Data will be not be aggregated (normalized), this is to reduce overhead of data collection.
- Static SQL statement collection will be optional, this is to avoid the overhead of accessing the catalog with static SQL statement number to extract SQL statement text.
- Exploiters to include
  - Tivoli Consul Insight Manager (coming Q1 2010)
  - Tizor - Mantra
  - Imperva - SecureSphere
  - Others anticipated at a future date

DB2 Audit Management Expert Architecture
Dual Mode



Alerts

- Real-time alert monitoring
- Exceptions outside of expected business process
- Immediate triaging & response
- Easy integration with 3rd-party IT ecosystems: SYSLOG, SNMP, Email...



Alerts (filtered)

No.			Updated	#	Alert Descripti
⊟ Last Hour (1)					
2004		🟧	08:49:02	11	z/OS Security Po

Violations:

	User	OS User	OS Host
⊟	ajcuser		

Event 6909825234996570923: Custom Rule Violation

Key	Value
Violation Description	z/OS Security Policy
Violated Item	Custom Violation

Event Details:

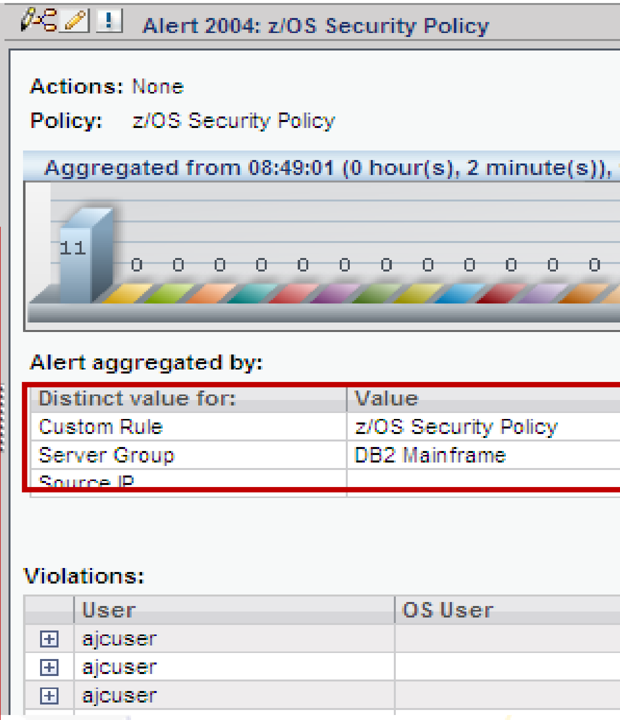
Event Time	Server Group	Service	Application
July 31, 2008 6:24:39 PM	DB2 Mainframe	DB2	Default DB2 Application

Connection	User	DB Application	OS User	OS Host
:0 → :0	ajcuser			

Affected Rows	Response Size	Response Time
0	0 Records	0 msec.

Error Code	Error Message

START TRACE (AUDIT)CLASS (3)RMID (*)DEST (OPX)PLAN (*)AUTHID (*)IFCID (*)BUFSIZE (16)TDATA (CORRELATION DISTRIBUTED)



Alert 2004: z/OS Security Policy

Actions: None

Policy: z/OS Security Policy

Aggregated from 08:49:01 (0 hour(s), 2 minute(s)),

Alert aggregated by:

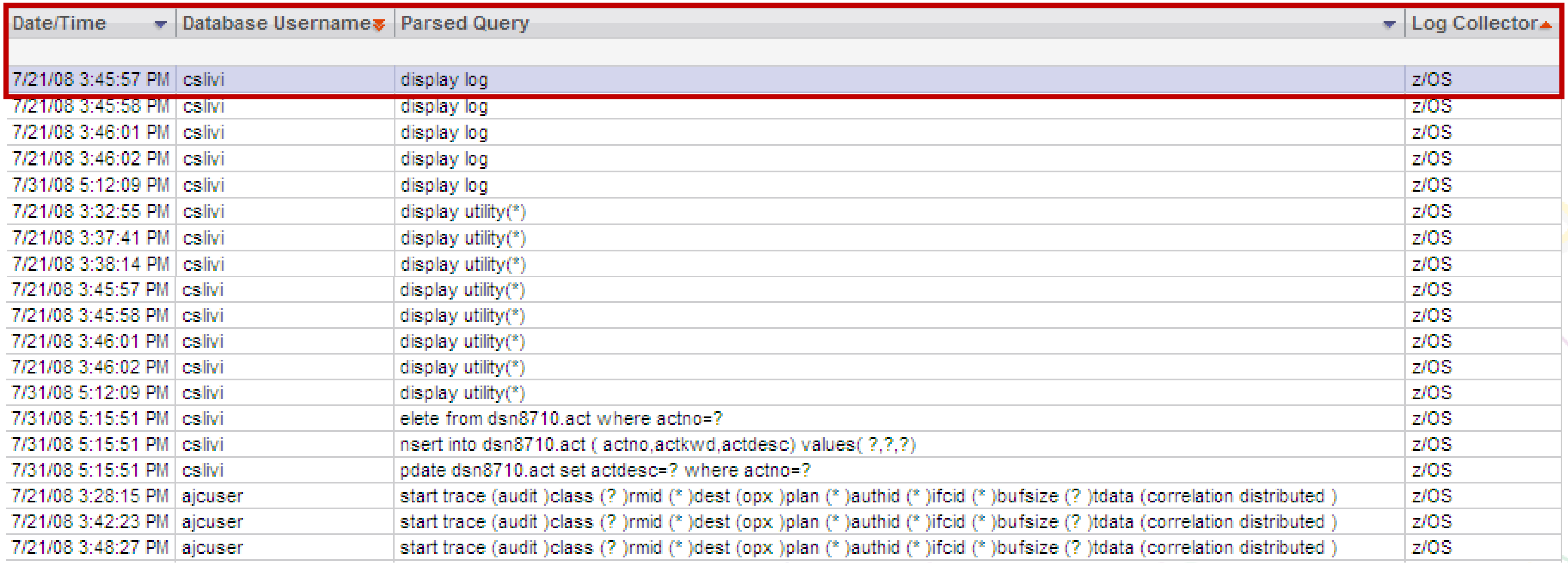
Distinct value for:	Value
Custom Rule	z/OS Security Policy
Server Group	DB2 Mainframe
Source IP	

Violations:

	User	OS User
⊞	ajcuser	
⊞	ajcuser	
⊞	ajcuser	

Viewing the Audit Logs:

Provides all the details including: date and time , database user name and parsed query



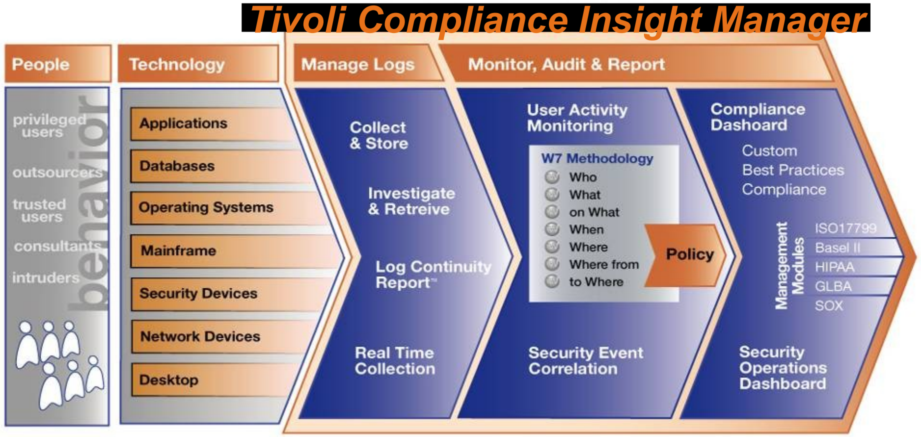
Date/Time	Database Username	Parsed Query	Log Collector
7/21/08 3:45:57 PM	cslivi	display log	z/OS
7/21/08 3:45:58 PM	cslivi	display log	z/OS
7/21/08 3:46:01 PM	cslivi	display log	z/OS
7/21/08 3:46:02 PM	cslivi	display log	z/OS
7/31/08 5:12:09 PM	cslivi	display log	z/OS
7/21/08 3:32:55 PM	cslivi	display utility(*)	z/OS
7/21/08 3:37:41 PM	cslivi	display utility(*)	z/OS
7/21/08 3:38:14 PM	cslivi	display utility(*)	z/OS
7/21/08 3:45:57 PM	cslivi	display utility(*)	z/OS
7/21/08 3:45:58 PM	cslivi	display utility(*)	z/OS
7/21/08 3:46:01 PM	cslivi	display utility(*)	z/OS
7/21/08 3:46:02 PM	cslivi	display utility(*)	z/OS
7/31/08 5:12:09 PM	cslivi	display utility(*)	z/OS
7/31/08 5:15:51 PM	cslivi	elete from dsn8710.act where actno=?	z/OS
7/31/08 5:15:51 PM	cslivi	nsert into dsn8710.act (actno,actkwd,actdesc) values(?,?,?)	z/OS
7/31/08 5:15:51 PM	cslivi	pdate dsn8710.act set actdesc=? where actno=?	z/OS
7/21/08 3:28:15 PM	ajcuser	start trace (audit)class (?)rmid (*)dest (opx)plan (*)authid (*)ifcid (*)bufsize (?)tdata (correlation distributed)	z/OS
7/21/08 3:42:23 PM	ajcuser	start trace (audit)class (?)rmid (*)dest (opx)plan (*)authid (*)ifcid (*)bufsize (?)tdata (correlation distributed)	z/OS
7/21/08 3:48:27 PM	ajcuser	start trace (audit)class (?)rmid (*)dest (opx)plan (*)authid (*)ifcid (*)bufsize (?)tdata (correlation distributed)	z/OS

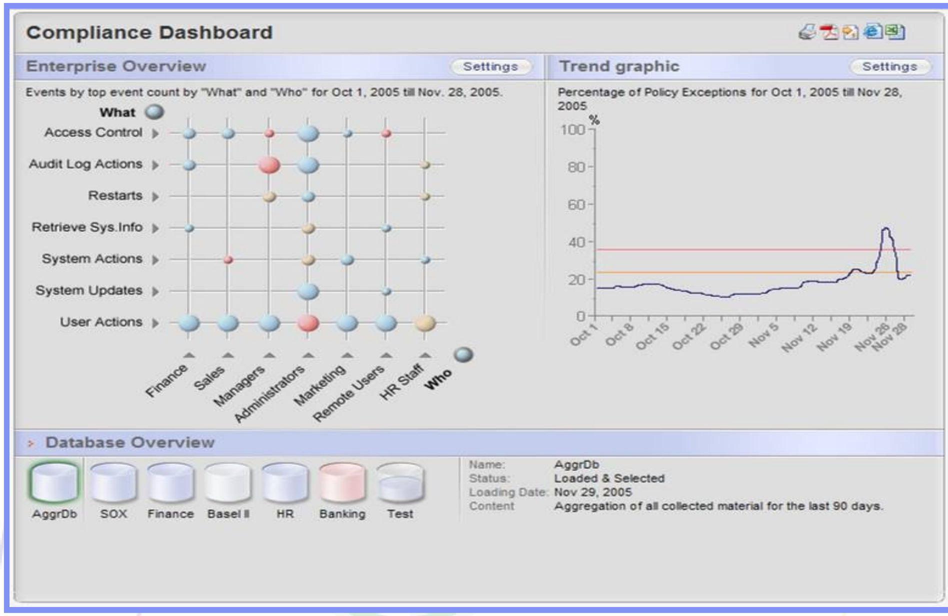
Tivoli Compliance Insight Manager

Tivoli Compliance Insight Manager provides an enterprise security compliance dashboard with in-depth privileged user **monitoring** capabilities, all powered by a comprehensive log and audit trail collection capability

Key Features

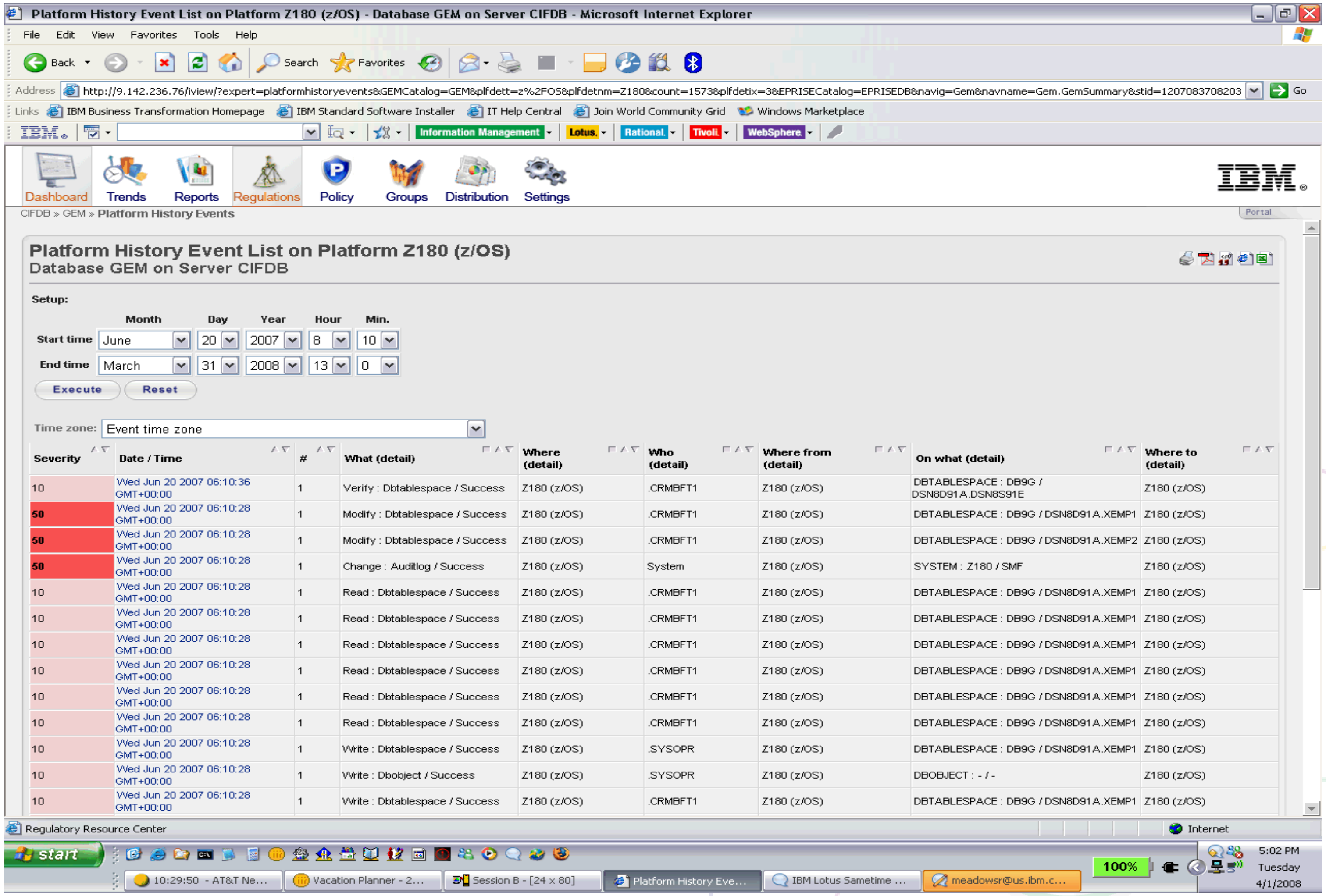
- Compliance management modules and regulation-specific reports
- Unique ability to monitor user behavior, including PUMA (Privileged User Monitoring and Audit) reporting
- Broadest, most complete log and audit trail capture capability
- W7 log normalization translates your logs into business terms
- Easy ability to compare behavior to regulatory and company policies – auditors no longer need RACF expertise to monitor activities
- Enabler event source integrates the OS and mainframe database events into TCIM's enterprise compliance dashboard




Compliance Dashboard

Name: AggrDb
Status: Loaded & Selected
Loading Date: Nov 29, 2005
Content: Aggregation of all collected material for the last 90 days.

TCIM – Representative Screen


Platform History Event List on Platform Z180 (z/OS) - Database GEM on Server CIFDB - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address
Go
Links IBM Business Transformation Homepage IBM Standard Software Installer IT Help Central Join World Community Grid Windows Marketplace
IBM
Information Management Lotus. Rational. Tivoli. WebSphere
Dashboard
Trends
Reports
Regulations
Policy
Groups
Distribution
Settings
IBM
Portal
Regulatory Resource Center
Internet
start
10:29:50 - AT&T Ne...
Vacation Planner - 2...
Session B - [24 x 80]
Platform History Eve...
IBM Lotus Sametime ...
meadowsr@us.ibm.c...
100%
5:02 PM
Tuesday
4/1/2008

http://9.142.236.76/iview/?expert=platformhistoryevents&GEMCatalog=GEM&plfdett=z%2FOS&plfdetnm=Z180&count=1573&plfdetix=3&EPRISECatalog=EPRISEDB&navig=Gem&navname=Gem.GemSummary&stid=1207083708203

CIFDB » GEM » Platform History Events

Platform History Event List on Platform Z180 (z/OS)
Database GEM on Server CIFDB

Setup:

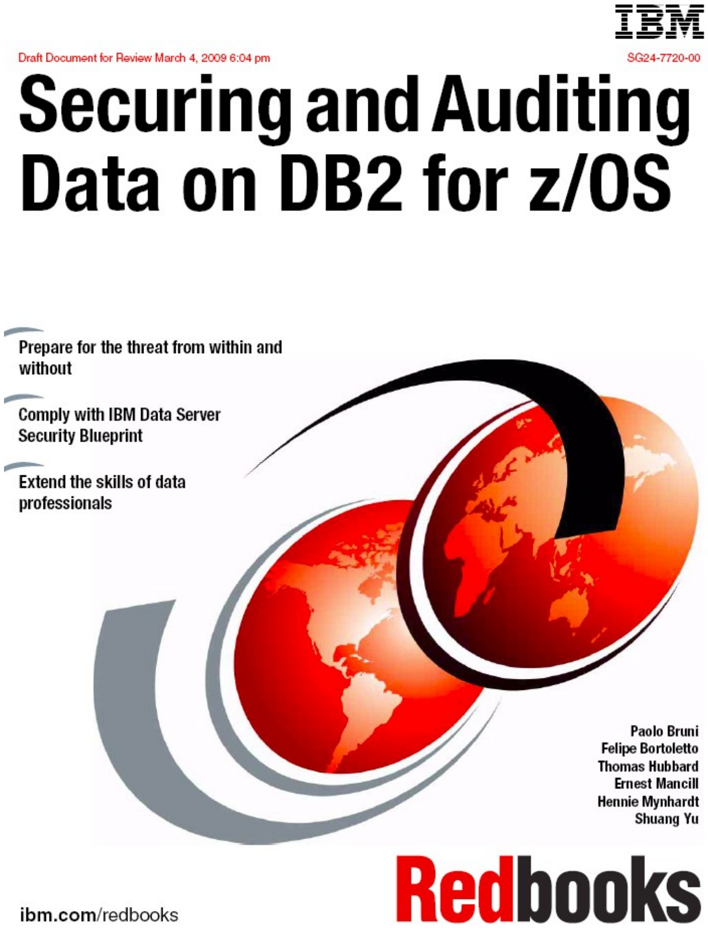
	Month	Day	Year	Hour	Min.
Start time	June	20	2007	8	10
End time	March	31	2008	13	0

Execute Reset

Time zone: Event time zone

Severity	Date / Time	#	What (detail)	Where (detail)	Who (detail)	Where from (detail)	On what (detail)	Where to (detail)
10	Wed Jun 20 2007 06:10:36 GMT+00:00	1	Verify : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.DSN8S91E	Z180 (z/OS)
50	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Modify : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
50	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Modify : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP2	Z180 (z/OS)
50	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Change : Auditlog / Success	Z180 (z/OS)	System	Z180 (z/OS)	SYSTEM : Z180 / SMF	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Write : Dbtablespace / Success	Z180 (z/OS)	.SYSOPR	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Write : Dbobject / Success	Z180 (z/OS)	.SYSOPR	Z180 (z/OS)	DBOBJECT : - / -	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Write : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)

Redbook on Audit and Encryption on DB2 for z/OS – SG24-7720



IBM

Draft Document for Review March 4, 2009 6:04 pm

SG24-7720-00

Securing and Auditing Data on DB2 for z/OS

- Prepare for the threat from within and without
- Comply with IBM Data Server Security Blueprint
- Extend the skills of data professionals

Paolo Bruni
Felipe Bortoletto
Thomas Hubbard
Ernest Mancill
Hennie Mynhardt
Shuang Yu

Redbooks

ibm.com/redbooks

Data Management Communities for DB2

- IDUG – the worldwide community of DB2 users
  - Membership is FREE – join today! www.idug.org
- Data Management Community – share and interact with peers around the world
  - www.ibm.com/software/data/management/community.html
- Information Champions – recognizes individuals who have made the most outstanding contributions to the Information Management community
  - www.ibm.com/software/data/champion

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Landscape – Customer Challenges

- Tremendous regulatory compliance pressures to demonstrate adequate institutional controls including audit reporting.
- Current DB2 on z/OS environment typically has minimal auditing
- Manual effort requiring interaction by DBA's
- Reactive in nature with the implication that you only find information post event, or after the first breach
- Home grown process can provide some level of access reporting, however:
  - Application managed code you have to maintain
  - Exposure as a lack of robust application change controls can allow disabling of audit processing
- Overhead (perceived or actual) in many cases drive decision to not audit DB2 on z/OS data
- DB2 trace based processes are managed by DBA's
  - **The DBA's are responsible for generating audit data with which they are in turn audited, this constitutes a significant security risk and exposure.**

DB2 Audit Trace versus RACF

Why Audit when Production is Locked Down?

- Common arguments:
  - "We don't need to audit, we have controls surrounding who can access data"
  - "'We control who is connected to the DB2 SYSADM group and we know what those people are authorized to do"
- Counter arguments:
  - RACF does two things:
    - Prevents people from accessing a resource that is not essential or appropriate for their jobs
    - Allows people access to the necessary data to do their jobs
  - But RACF does NOT:
    - prevent a malicious update if the user has authority to the data.
    - prevent an authorized user from accessing sensitive data that is ***NOT*** within the scope of their job.
      - E.g. a bank teller looks up the CEOs bank balance or personal customer information
    - provide meaningful information about access to protected DB2 resources (authorized or not).

DB2 Audit Trace versus RACF

- Key Points:
  - RACF provides significant controls to protect access to resources, but does little in the way of meaningful access reporting
  - DB2 Audit trace will do nothing to protect data, but provides data to help understand what type of access has occurred.
    - Auditing is about ensuring that the appropriate controls are in place to identify inappropriate access and use of production data
    - You need some form of audit facility to watch your privileged users who have RACF and/or DB2 authority and users that have access to sensitive data within the scope of their job
    - Understanding how trusted (privileged) users access sensitive information is essential to ensuring that data is indeed protected

What to Audit – A busy slide

- **Closed Application Environment (*Probably not a candidate*)**
  - **Traditional Application controls well defined and comprehensive**
    - **CICS and IMS TM – Signon and Transaction Access secured via RACF**
    - **Production Batch – Controlled via program pathing / Job Scheduling**
- Data warehouse – no risk of update but access audit might be needed
- Adhoc execution environnent – QMF, SPUFI, etc. Constitutes exposure
  - SPUFI Plan can be restricted but ALL use should be audited
- Privleged ID's (DBA/Sysadmin) should be audited
- Distributed Application Environment
  - Use of SQLESETI can provide granularity with credential population to IFI extensions
    - End User Workstation Name
    - End User Workstation Process
    - End User Workstation Userid
  - Implement RACF Enterprise Identify Mapping Feature
    - http://www-03.ibm.com/servers/eserver/security/eim
- Data may not be as granular as you think
  - Depending on how you configured your connections into DB2 – CICS attach, SAP, or CICS users with unique id's, and distributed transactions. May get all audit data but may not be meaningful because of attach environments. Group versus AUTHID. SQLESETI implementation can help
- "Offline" Utilities and certain tools are used outside of DB2
  - RACF dataset access defined controls
  - "Trigger" based audit
  - Use of DSN1COPY should be restricted

Audit data sources

- DB2 catalog
  - SQL queries on catalog, other data
  - audit, accounting and performance traces
  - recovery log, current & historical data
  - RACF audit facility, other SMF data, ...
- Audit tools and techniques
  - tracing: audit, performance, accounting, monitor
  - formatting the traces: OMPE or PM, others
  - TCIM, DB2 Audit Management Expert, others
  - DSN1SMFP, others
  - log formatting: tools, DSN1LOGP, Log Analyzer
  - various recovery and cloning techniques
    - triggers
  - REPORT RECOVERY
  - RACF print, unload

What actions are needed to start the Audit trace?

- -DSN START TRACE (AUDIT) CLASS (1,2,4,5,8) DEST (SMF)
  - Requires one of the following privileges:
    - SYSOPER
    - SYSCTRL
    - SYSADM
    - TRACE
  - In addition, Class 4 and 5 events will only be collected for objects (tables) with the audit attribute turned on via ALTER:
    - AUDIT CHANGES – enables collection of changes in conjunction with CLASS (4)
    - AUDIT ALL – enables collection of changes and / or reads with CLASS 4 and/or 5 active
  - Note: When ALTER AUDIT is performed, plan and package invalidation occurs which requires a rebind to be performed

Audit class Events that are traced

1.Access attempts that DB2 denies because of inadequate authorization. This class is the default.

2.Explicit GRANT and REVOKE statements and their results. This class does not trace implicit grants and revokes.

3.CREATE, ALTER, and DROP statements that affect audited tables, and the results of these statements. This class traces the dropping of a table that is caused by DROP TABLESPACE or DROP DATABASE and the creation of a table with AUDIT CHANGES or AUDIT ALL. ALTER TABLE statements are audited only when they change the AUDIT option for the table.

4.Changes to audited tables. Only the first attempt to change a table, within a unit of recovery, is recorded. (If the agent or the transaction issues more than one COMMIT statement, the number of audit records increases accordingly.) The changed data is not recorded, only the attempt to make a change is recorded. If the change is not successful and is rolled back, the audit record remains; it is not deleted. This class includes access by the LOAD utility.

Accesses to a dependent table that are caused by attempted deletions from a parent table are also audited. The audit record is written even if the delete rule is RESTRICT, which prevents the deletion from the parent table. The audit record is also written when the rule is CASCADE or SET NULL, which can result in deletions that cascade to the dependent table.

5.All read accesses to tables that are identified with the AUDIT ALL clause. As in class 4, only the first access within a DB2 unit of recovery is recorded. References to a parent table are also audited.

6. The bind of static and dynamic SQL statements of the following types:

INSERT, UPDATE, DELETE, CREATE VIEW, and LOCK TABLE statements for audited tables. Except for the values of host variables, the audit record contains the entire SQL statement.

SELECT statements on tables that are identified with the AUDIT ALL clause. Except for the values of host variables, the audit record contains the entire SQL statement.

7. Assignment or change of an authorization ID because of the following reasons:

Changes through an exit routine (default or user-written)

Changes through a SET CURRENT SQLID statement

An outbound or inbound authorization ID translation

An ID that is being mapped to a RACF ID from a Kerberos security ticket

8. The start of a utility job, and the end of each phase of the utility.

Suggested Audit traces on DB2 for z/OS DB2 Common Criteria

- IFCIDs for Audit
- Accounting
  - 0003 successful access
- Audit
  - 0140: Audit all authorization failures
  - 0141: Audit all grants & revokes
  - 0142: Audit DDL Create / Alter / Drop
  - 0143: Audit First Write
  - 0144: Audit First Read
  - 0145: Audit DML Statement
  - 0314: Authorization Exit Parameters
- Performance
  - 0004: Trace Start
  - 0005: Trace Stop
  - 0023: Utility Start
  - 0024: Utility Change
  - 0025: Utility End
  - 0106: System Parameters
  - 0247: input host variables
  - 0350: SQL Statement

Suggested Audit traces – The “Bare Bones Minimum”

- DB2 security audit suggestions:
  - Catalog table queries
  - Audit class 1, 2, 3
    - 0140: audit all authorization failures
    - 0141: audit all grants & revokes
  - DB2 9 audit class 10: audit trusted context
    - 0269: establish trusted connection and switch user
    - 0270: CREATE & ALTER TRUSTED CONTEXT statements
  - Performance
    - 0004: Trace Start
    - 0005: Trace Stop
    - 0106: System Parameters

Auditing utilities which act outside of DB2

The audit gap

- When a 3rd party unload is executed against the DB2 VSAM data sets instead of through DB2, the IBM audit record has no knowledge of data access. However, the 3rd party utility “history” table will contain the date and time of the utility with the relevant utility id. The utility activity at run time is kept in another “in-flight” table. But the records are deleted upon completion of the utility.

Closing the Gap

- A DB2 trigger is deployed on the “in-flight” table that checks against the list of sensitive tablespaces. If it is one of our audited objects, the after trigger fires to insert this information into the DBA version of the in-flight table.

```
CREATE TRIGGER
   xxxxx.trigger name
    AFTER
    INSERT
   ON xxxxx.DBA_UTILITY_INFLIGHT
    REFERENCING
     NEW AS N
    FOR EACH ROW
    MODE DB2SQL
 WHEN  (N.NAME2 IN  ('TS1', 'TS2', 'TS3', 'TS4','TS5’) ) BEGIN
 ATOMIC INSERT INTO xxxxx. DBA_UTILITY_INFLIGHT  (UTILID, NAME1, NAME2, KIND,
 PARTITION, UTILNAME, SHRLEVEL, STATUS, XCOUNT, DDNAME,
 BLOCKS, ORIG_STATUS, EXTRBA, STATE ) VALUES  (N.UTILID, N.NAME1,
 N.NAME2, N.KIND, N.PARTITION, N.UTILNAME, N.SHRLEVEL,
 N.STATUS, N.XCOUNT, N.DDNAME, N.BLOCKS, N.ORIG_STATUS, N.EXTRBA,
  N.STATE)  ; END
```

- In DBA_UTILITY_INFLIGHT, the record will not be deleted and so the audit trail is left in tact. A separate query of this table will yield all 3rd party unload activity.

Audit Trace Overhead

- The performance impact of auditing is directly dependent on the amount of audit data produced. When the audit trace is active, the more tables that are audited and the more transactions that access them, the greater the performance impact. The overhead of audit trace is typically less than 5% but workload dependent.
- When estimating the performance impact of the audit trace, consider the frequency of certain events. For example, security violations are not as frequent as table accesses. The frequency of utility runs is likely to be measured in executions per day. Alternatively, authorization changes can be numerous in a transaction environment.
  - Following is the summary of results of the DB2 V8 Audit trace measurements :

    The measurements were done with Audit trace class(*) on and all the tables in the workload were enabled for 'Audit All'.

    For OLTP measurement with distributed IRWW SQL CLI workload with 9 Tables, 3 PI, 8 NPI and 7 transactions running at 493 transactions per second, the DB2 Class 2 CPU increase was +7.2%.

    For Utility measurements with LOAD, Rebuild Index, Reorg Table, Reorg Index utilities using 1 Table, 10 partitions, 1 PI and 5 NPI, there was no measurable CPU increase.
- Weigh auditing requirements against workload and anticipated impacts to application service levels and performance objectives carefully.
- Don’t underestimate impact on SMF activity and associated overhead

V9 Trace Extensions – START TRACE

- Qualifications by:
  - LOC
    - Location-Name
    - LUName
    - IPAddress
  - PLAN
  - PACKAGE
    - PKGLOC
    - PKGCOL
    - PKGPROG
  - Workstation Identifiers
    - USERID
    - APPLNAME
    - WRKSTN
  - Miscellaneous
    - CORRID
    - CONNID
    - ROLE

- Exclude by:
  - LOC
    - XLOC
  - PLAN
    - XPLAN
  - PACKAGE
    - XPKGLOC
    - XPKGCOL
    - XPKGPROG
  - Workstation Identifiers
    - XUSERID
    - XAPPLID
    - XWRKSTN
  - Miscellaneous
    - XCORRID
    - XCONNID
    - XROLE

V9 Trace Extensions - Wildcards

- Tracing threads using the * wildcard:
  - You can use the wildcard suffix, “*” to filter threads. For example, if you specify “-START TRACE PLAN (A,B,C*)”, DB2 will trace, and then return A, B, CDE, CDEFG, CDEFGH, and so on. It will trace threads “A”, “B” and all threads starting with “C”.
- Tracing threads using the positional, (_) wildcard:
  - You can utilize the positional wildcard, which is represented by the, “_” character, to trace threads when you want the wildcard in the middle, or when you want to trace threads of a specific length. For example, if you specify “-START TRACE PLAN (A_C), all threads will be traced that are three characters that have “A” as the first character, and “C” as the third.
- Tracing multiple threads at once using wildcards:
  - You also have the option of tracing multiple threads based on multiple trace qualifications. For example, you can specify, “-START TRACE PLAN (A*, B*, C*) to simultaneously trace ALL threads for plan that start with “A”, “B”, and “C”. The wildcard character, “*” will trace all threads.
  - You have the ability to filter multiple threads at the same time, setting specific criteria for the trace: For example, you can specify “-START TRACE PLAN (A) USERID (B). This will trace the threads where the plan thread is A, and the user ID is B.

V9 Trace Extensions – Some Restrictions

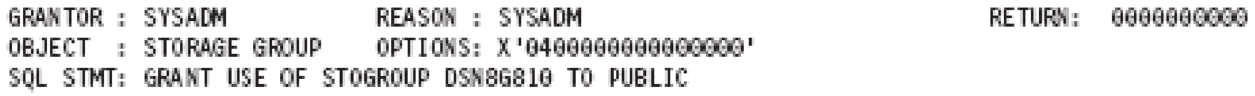
- When tracing threads, you can only specify more than one thread criteria for one filter per "-START TRACE" command.
  - For example, you can specify "-START TRACE PLAN (A,B) USERID (B) WRKSTN (E)," but you cannot specify "-START TRACE PLAN (A, B) USERID (A, B) WRKSTN (E).
- If you use one or no values for PLAN, AUTHID, or LOCATION, the START TRACE command starts a single trace. If you use multiple values for PLAN, AUTHID, or LOCATION, the command starts a trace for each plan, authorization ID, or location. There can be a total of up to 32 traces going at one time (all trace types).
- You must use a privilege set of the process that includes one of the following privileges or authorities:
  - TRACE privilege
  - SYSOPR authority
  - SYSCTRL authority
  - SYSADM authority

DSN1SMFP offline utility

- The DSN1SMFP utility processes DB2 trace data into reports.
- DSN1SMFP accepts data that SMF collects in standard SMF format and produces from one to fifteen reports. DSN1SMFP accepts all SMF record types, but it processes only type 101 (DB2 Accounting) and 102 (DB2 Performance) records.
- DSN1SMFP checks each type 101 and 102 record for DB2 audit trace types of these DB2 IFCIDs:
  - 003: Accounting - DDF Data by Location (security-relevant fields only)
  - 004: Trace Start
  - 005: Trace Stop
  - 023: Utility Start
  - 024: Utility Change
  - 025: Utility End
  - 106: System Parameters (security-relevant fields only)
  - 140: Audit Authorization Failures
  - 141: Audit DDL Grant/Revoke
  - 142: Audit DDL Create/Alter/Drop
  - 143: Audit First Write
  - 144: Audit First Read
  - 145: Audit DML Statement
  - 350: SQL Statement

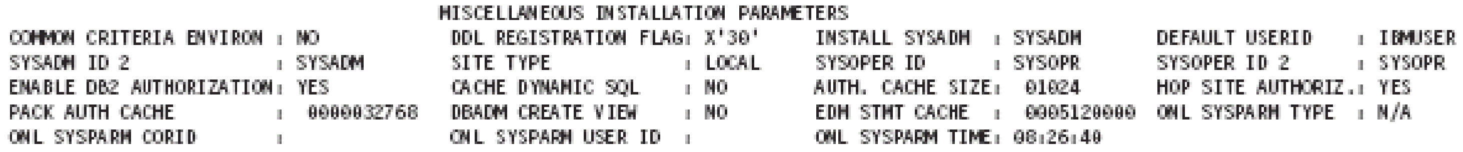
DSN1SMFP – Sample Report Outputs

IFCID – 141 Audit Grant/Revoke Report



```
GRANTOR : SYSADM           REASON : SYSADM                                          RETURN:  0000000000
OBJECT  : STORAGE GROUP    OPTIONS: X'0400000000000000'
SQL STMT: GRANT USE OF STOGROUP DSN8G810 TO PUBLIC
```

IFCID – 106 System Parameters Report



```
                                      MISCELLANEOUS INSTALLATION PARAMETERS
COMMON CRITERIA ENVIRON : NO           DDL REGISTRATION FLAG: X'30'     INSTALL SYSADM   : SYSADM      DEFAULT USERID    : IBMUSER
SYSADM ID 2             : SYSADM       SITE TYPE            : LOCAL     SYSOPER ID       : SYSOPR      SYSOPER ID 2      : SYSOPR
ENABLE DB2 AUTHORIZATION: YES          CACHE DYNAMIC SQL    : NO        AUTH. CACHE SIZE:  01024       HOP SITE AUTHORIZ.: YES
PACK AUTH CACHE         :  0000032768  DBADM CREATE VIEW    : NO        EDM STMT CACHE   :  0005120000 ONL SYSPARM TYPE  : N/A
ONL SYSPARM CORID       :              ONL SYSPARM USER ID  :           ONL SYSPARM TIME: 08:26:40
```

OMEGAMON XE for DB2 Performance Monitor/Expert for z/OS

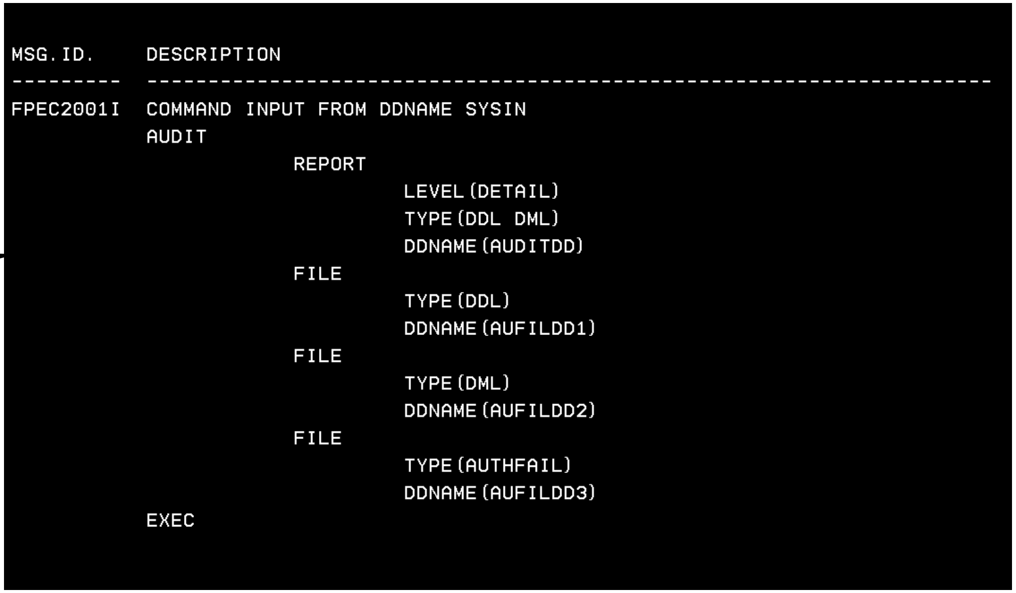
- Real-time monitoring
  - Threads and Statistics monitoring
  - DB2 Connect monitoring
  - Object Analysis
  - Data Sharing/Sysplex data (DB2Plex data)
- Near-term history
- Trace collection **(also as part of the PWH process support)**
- Reporting
  - Accounting, Statistics, SQL Activities, Locking, I/O Activity, Audit, Utilities, Record Trace
  - Executable as separate jobs or via PWH process engine
- Performance Warehouse with expert analysis support
- Buffer Pool Analysis, expert advice, and simulation **(only with the OMEGAMON XE for DB2 Performance Expert)**

DB2 OMEGAMON Performance Expert Audit Report Set

- Not strictly a performance report.
- Reports information about usage of auditable objects and authorization management.
  - Authorization changes
  - Authorization control (GRANTs and REVOKEs of privileges)
  - Authorization failures
  - DML statements against auditable DB2 tables at bind time
  - DDL operations against auditable DB2 tables
  - Read/write access against auditable DB2 tables
  - Utility executions against auditable DB2 tables
- Traces show individual events.
- Reports show audit information for an aggregation of DB2PE identifiers, e.g. primauth-planname-objects.

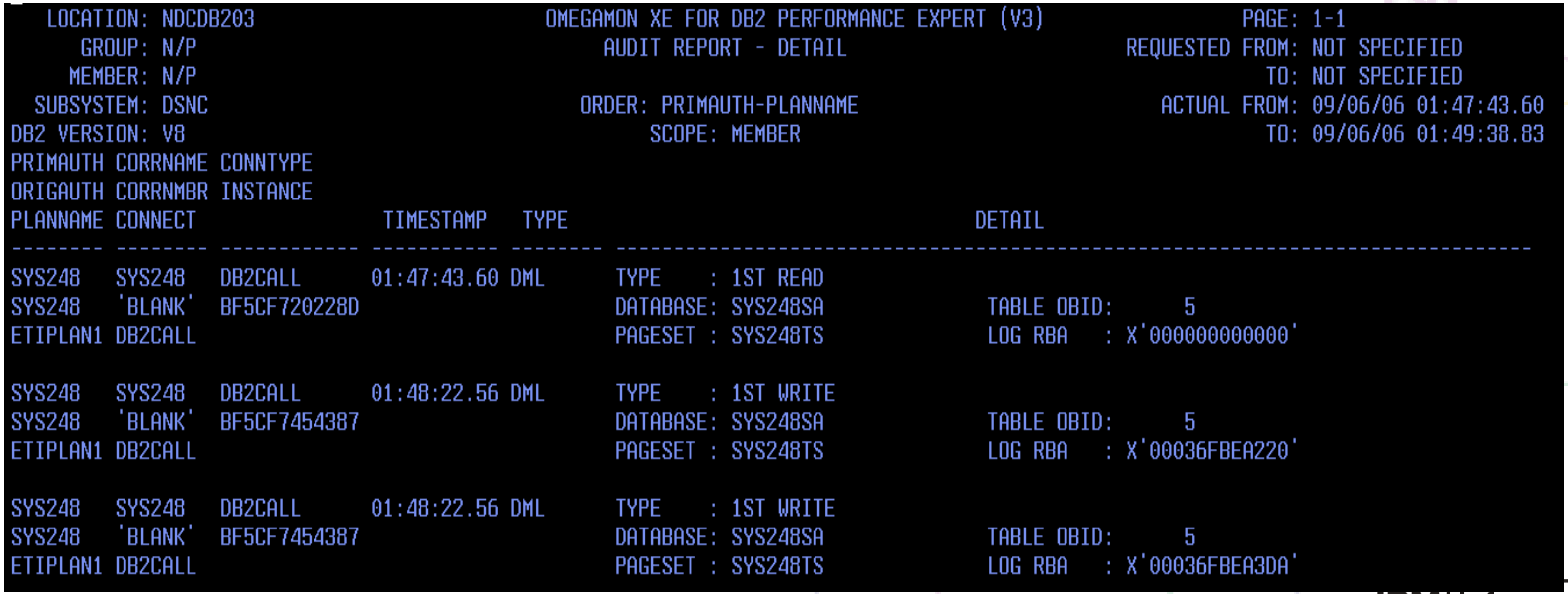
The OMPE “File” Report command is used to create DB2 Load compatible record formats

OMPE “File” report commands



```
MSG.ID.     DESCRIPTION
---------   ----------------------------------------------------------------
FPEC2001I   COMMAND INPUT FROM DDNAME SYSIN
            AUDIT
                        REPORT
                                 LEVEL(DETAIL)
                                 TYPE(DDL DML)
                                 DDNAME(AUDITDD)
                        FILE
                                 TYPE(DDL)
                                 DDNAME(AUFILDD1)
                        FILE
                                 TYPE(DML)
                                 DDNAME(AUFILDD2)
                        FILE
                                 TYPE(AUTHFAIL)
                                 DDNAME(AUFILDD3)
            EXEC
```

OMPE Audit Detail Report

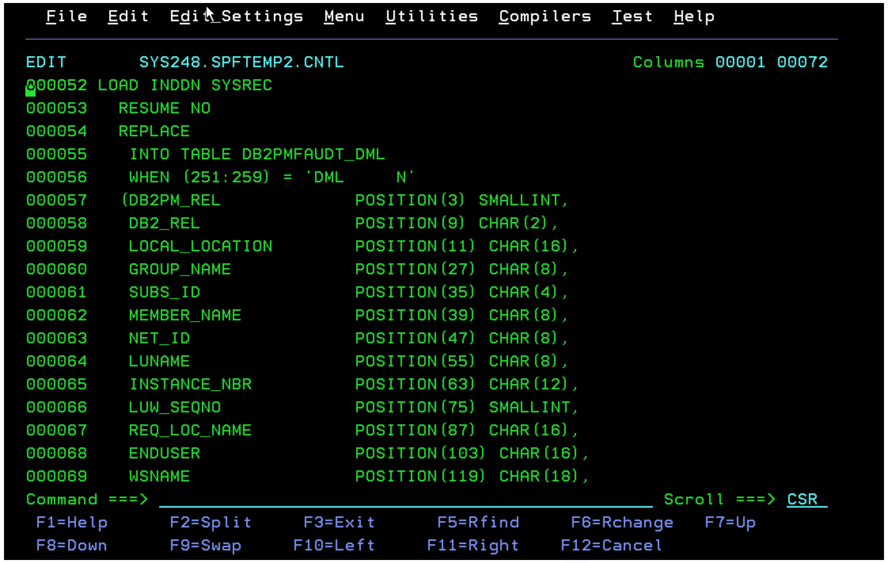


```
   LOCATION: NDCDB203                           OMEGAMON XE FOR DB2 PERFORMANCE EXPERT (V3)                PAGE: 1-1
      GROUP: N/P                                     AUDIT REPORT - DETAIL                       REQUESTED FROM: NOT SPECIFIED
     MEMBER: N/P                                                                                            TO: NOT SPECIFIED
  SUBSYSTEM: DSNC                                 ORDER: PRIMAUTH-PLANNAME                          ACTUAL FROM: 09/06/06 01:47:43.60
DB2 VERSION: V8                                         SCOPE: MEMBER                                       TO: 09/06/06 01:49:38.83
PRIMAUTH CORRNAME CONNTYPE
ORIGAUTH CORRNMBR INSTANCE
PLANNAME CONNECT                TIMESTAMP   TYPE                                DETAIL
-------- -------- ------------ ----------- -------- --------------------------------------------------------------------------------
SYS248   SYS248   DB2CALL      01:47:43.60 DML      TYPE     : 1ST READ
SYS248   'BLANK'  BF5CF720228D                      DATABASE: SYS248SA                TABLE OBID:      5
ETIPLAN1 DB2CALL                                    PAGESET : SYS248TS                LOG RBA    : X'000000000000'

SYS248   SYS248   DB2CALL      01:48:22.56 DML      TYPE     : 1ST WRITE
SYS248   'BLANK'  BF5CF7454387                      DATABASE: SYS248SA                TABLE OBID:      5
ETIPLAN1 DB2CALL                                    PAGESET : SYS248TS                LOG RBA    : X'00036FBEA220'

SYS248   SYS248   DB2CALL      01:48:22.56 DML      TYPE     : 1ST WRITE
SYS248   'BLANK'  BF5CF7454387                      DATABASE: SYS248SA                TABLE OBID:      5
ETIPLAN1 DB2CALL                                    PAGESET : SYS248TS                LOG RBA    : X'00036FBEA3DA'
```

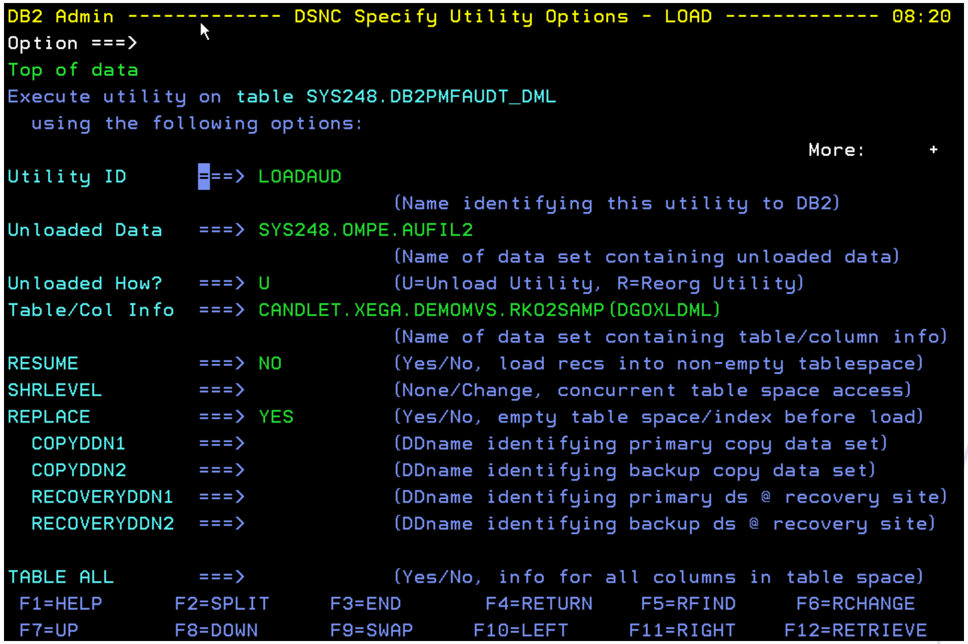
Invoking the DB2 load utility to populate the DB2 Performance DB with Audit data.



```
 File  Edit  Edit Settings  Menu  Utilities  Compilers  Test  Help

EDIT       SYS248.SPFTEMP2.CNTL                            Columns 00001 00072
000052 LOAD INDDN SYSREC
000053   RESUME NO
000054   REPLACE
000055    INTO TABLE DB2PMFAUDT_DML
000056    WHEN (251:259) = 'DML      N'
000057   (DB2PM_REL                 POSITION(3)  SMALLINT,
000058    DB2_REL                   POSITION(9)  CHAR(2),
000059    LOCAL_LOCATION            POSITION(11)  CHAR(16),
000060    GROUP_NAME                POSITION(27)  CHAR(8),
000061    SUBS_ID                   POSITION(35)  CHAR(4),
000062    MEMBER_NAME               POSITION(39)  CHAR(8),
000063    NET_ID                    POSITION(47)  CHAR(8),
000064    LUNAME                    POSITION(55)  CHAR(8),
000065    INSTANCE_NBR              POSITION(63)  CHAR(12),
000066    LUW_SEQNO                 POSITION(75)  SMALLINT,
000067    REQ_LOC_NAME              POSITION(87)  CHAR(16),
000068    ENDUSER                   POSITION(103)  CHAR(16),
000069    WSNAME                    POSITION(119)  CHAR(18),
Command ===> ________________________________________________ Scroll ===> CSR
 F1=Help       F2=Split      F3=Exit       F5=Rfind      F6=Rchange    F7=Up
 F8=Down       F9=Swap      F10=Left      F11=Right     F12=Cancel
```

Load Control sample statements located in RKO2SAMP



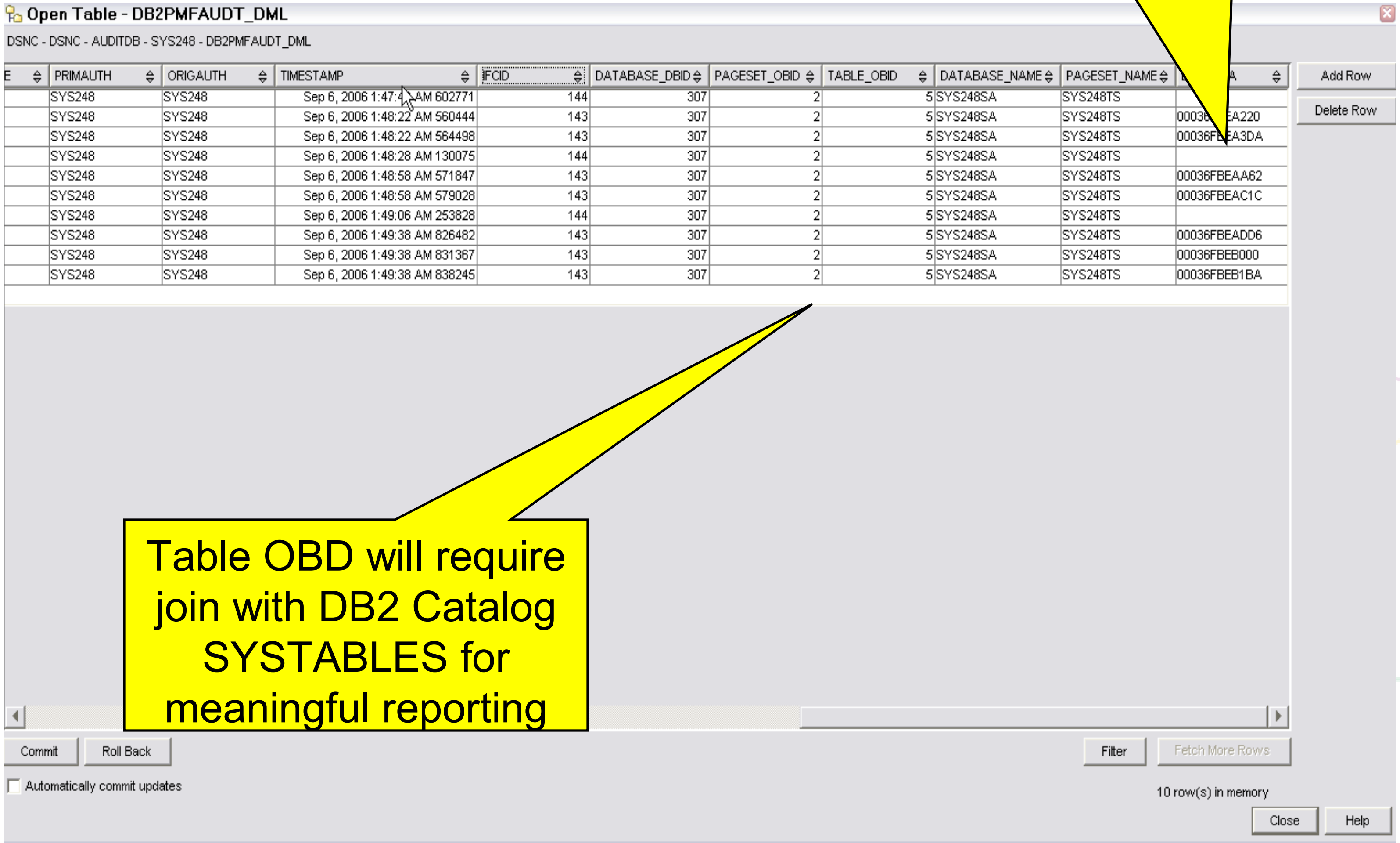
```
DB2 Admin ------------- DSNC Specify Utility Options - LOAD ------------- 08:20
Option ===>
Top of data
Execute utility on table SYS248.DB2PMFAUDT_DML
  using the following options:
                                                                   More:     +
Utility ID       ===> LOADAUD
                                (Name identifying this utility to DB2)
Unloaded Data    ===> SYS248.OMPE.AUFIL2
                                (Name of data set containing unloaded data)
Unloaded How?    ===> U         (U=Unload Utility, R=Reorg Utility)
Table/Col Info   ===> CANDLET.XEGA.DEMOMVS.RKO2SAMP(DGOXLDML)
                                (Name of data set containing table/column info)
RESUME           ===> NO        (Yes/No, load recs into non-empty tablespace)
SHRLEVEL         ===>           (None/Change, concurrent table space access)
REPLACE          ===> YES       (Yes/No, empty table space/index before load)
  COPYDDN1       ===>           (DDname identifying primary copy data set)
  COPYDDN2       ===>           (DDname identifying backup copy data set)
  RECOVERYDDN1   ===>           (DDname identifying primary ds @ recovery site)
  RECOVERYDDN2   ===>           (DDname identifying backup ds @ recovery site)

TABLE ALL        ===>           (Yes/No, info for all columns in table space)
 F1=HELP      F2=SPLIT     F3=END       F4=RETURN    F5=RFIND     F6=RCHANGE
 F7=UP        F8=DOWN      F9=SWAP     F10=LEFT     F11=RIGHT    F12=RETRIEVE
```

Creation of the LOAD utility statements and JCL using DB2 Administration Tool

A view of the audit data stored in the OMPE performance warehouse using DB2 Control Center

Log RBA can be used to locate details about other actions for the LUW



Open Table - DB2PMFAUDT_DML

DSNC - DSNC - AUDITDB - SYS248 - DB2PMFAUDT_DML

E	PRIMAUTH	ORIGAUTH	TIMESTAMP	IFCID	DATABASE_DBID	PAGESET_OBID	TABLE_OBID	DATABASE_NAME	PAGESET_NAME	L[illegible]A
	SYS248	SYS248	Sep 6, 2006 1:47:4[illegible]AM 602771	144	307	2	5	SYS248SA	SYS248TS	
	SYS248	SYS248	Sep 6, 2006 1:48:22 AM 560444	143	307	2	5	SYS248SA	SYS248TS	0003[illegible]EA220
	SYS248	SYS248	Sep 6, 2006 1:48:22 AM 564498	143	307	2	5	SYS248SA	SYS248TS	00036FBEA3DA
	SYS248	SYS248	Sep 6, 2006 1:48:28 AM 130075	144	307	2	5	SYS248SA	SYS248TS	
	SYS248	SYS248	Sep 6, 2006 1:48:58 AM 571847	143	307	2	5	SYS248SA	SYS248TS	00036FBEAA62
	SYS248	SYS248	Sep 6, 2006 1:48:58 AM 579028	143	307	2	5	SYS248SA	SYS248TS	00036FBEAC1C
	SYS248	SYS248	Sep 6, 2006 1:49:06 AM 253828	144	307	2	5	SYS248SA	SYS248TS	
	SYS248	SYS248	Sep 6, 2006 1:49:38 AM 826482	143	307	2	5	SYS248SA	SYS248TS	00036FBEADD6
	SYS248	SYS248	Sep 6, 2006 1:49:38 AM 831367	143	307	2	5	SYS248SA	SYS248TS	00036FBEB000
	SYS248	SYS248	Sep 6, 2006 1:49:38 AM 838245	143	307	2	5	SYS248SA	SYS248TS	00036FBEB1BA

Table OBD will require join with DB2 Catalog SYSTABLES for meaningful reporting

Limitations of the audit trace

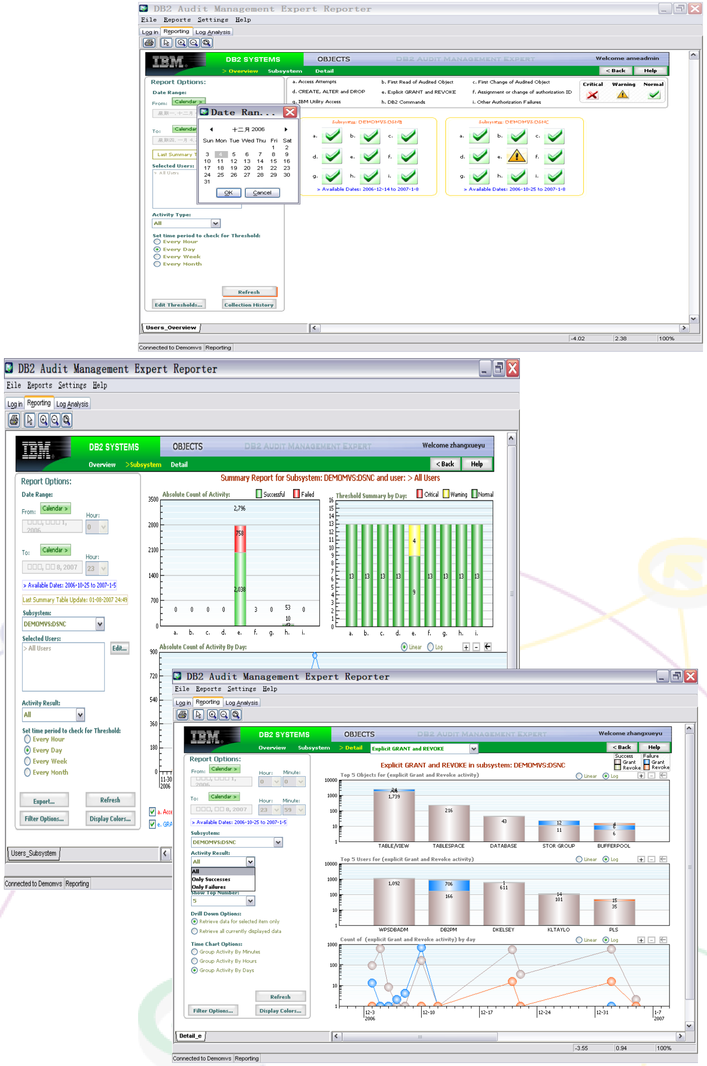
- The audit trace does not record everything, as the following list of limitations indicates:
  - The auditing that is described in this information takes place only when the audit trace is on.
  - The trace audits only the tables that you specifically choose to audit.
- The trace does NOT capture before/after change data because the DB2 log records this information.
  - If an agent or transaction accesses a table more than once in a single unit of recovery, the audit trace records only the first access.
- The audit trace does not audit some utilities. The trace audits the first access of a table with the LOAD utility, but it does not audit access by the COPY, RECOVER, and REPAIR utilities. The audit trace does not audit access by stand-alone utilities, such as DSN1CHKR and DSN1PRNT.
- You cannot audit the catalog tables because you cannot create or alter catalog tables.
- 3rd Party DB2 utilities (run outside of DB2) will not be caught with the AUDIT CLASS 8
- Dynamic SQL host variable data not collected
- This auditing coverage is consistent with the goal of providing a moderate volume of audit data with a low impact on performance. However, when you choose classes of events to audit, consider that you might ask for more data than you are willing to process.
- Depending on AUDIT classes active, and workload mix, significant increases in SMF activity might be experienced. One customer scenario, with CLASS (1-6) a 12% increase in SMF was observed.

Separation of Roles and Responsibilities

- DB2 trace based processes are managed by DBA's
  - The DBA's are responsible for generating audit data with which they are in turn audited, this constitutes a significant security risk and exposure
  - Trace data collection can be interfered with or turned off completely
    - DBA can issue –DSN Stop Trace
    - Use IFASMFDMP to selectively filter SMF data based on timestamp
    - Use DB2PM (Or Equivalent) filter such as DATE/TIME/EXCLUDE to filter selected records
  - Having the DBA involved in the collection of audit data is viewed as weak from a compliance and control perspective
- Security and Auditors with system privileges
  - Also viewed as problematic from a compliance perspective
  - Requires additional technical skills not within their core competencies
  - Misuse of privileges without coordination can result in performance and availability issues
    - Turning on traces without proper filtering to reduce overhead or quantity of trace data collected
    - Altering objects to AUDIT without ensuring that plan/package invalidation is not an issue

Audit Management Expert - Monitor and Audit

- **Helps auditors answer:**
  - Who, What, Where, Why, When, How
- **Centralizes the audit data**
  - Pulls together disparate data sources from all the systems into a central repository
- **Automates auditing process**
  - Eliminates all home grown processes
- **Creates segregation of duties**
  - Gives auditors the business activity collected without being reliant on the technical personnel they need to monitor
- **Flexible Reporting**
  - Drill down from overview to detail for forensic analysis


DB2 Audit Management Expert Reporter
File Reports Settings Help
Log in Reporting Log Analysis
DB2 SYSTEMS
OBJECTS
Welcome ameadmin
Overview Subsystem Detail
Report Options:
Date Range:
Date Ran...
Critical Warning Normal
Edit Thresholds...
Collection History
Refresh
Users_Overview
Connected to Demomvs Reporting
DB2 Audit Management Expert Reporter
Welcome zhangxueyu
Summary Report for Subsystem: DEMOMVS:DSNC and user: > All Users
Absolute Count of Activity:
Threshold Summary by Day:
Absolute Count of Activity By Day:
Export...
Filter Options...
Display Colors...
Users_Subsystem
DB2 Audit Management Expert Reporter
Explicit GRANT and REVOKE in subsystem: DEMOMVS:DSNC
Top 5 Objects for (explicit Grant and Revoke activity)
TABLE/VIEW
TABLESPACE
DATABASE
STOR GROUP
BUFFERPOOL
Top 5 Users for (explicit Grant and Revoke activity)
Count of (explicit Grant and Revoke activity) by day
Detail_e

Audit Management Expert Overview

- Auditors will be able to Access:
  - SELECT, INSERT, UPDATE, and DELETE activity by user or by object
  - **SQL Text and Host Variable value for each statement**
    - **Row count that SQL statement affects**
  - CREATE, ALTER, and DROP operations against an audited object
  - Explicit GRANT and REVOKE operations
  - Utility access to an audited object
  - DB2 commands entered
  - Assignment or modification of an authorization ID
  - Authorization failures
- **Provides auditors with flexible options for examining the data in the audit repository**
  - Audit Trace Data, **Audit SQL Collector (ASC),** Log Analysis data
    - V2.1 no longer needs to alter objects to ‘AUDIT ALL’ for read/update
    - DB2 Catalog Objects can now be audited for SQL read/update

Security and separation of roles

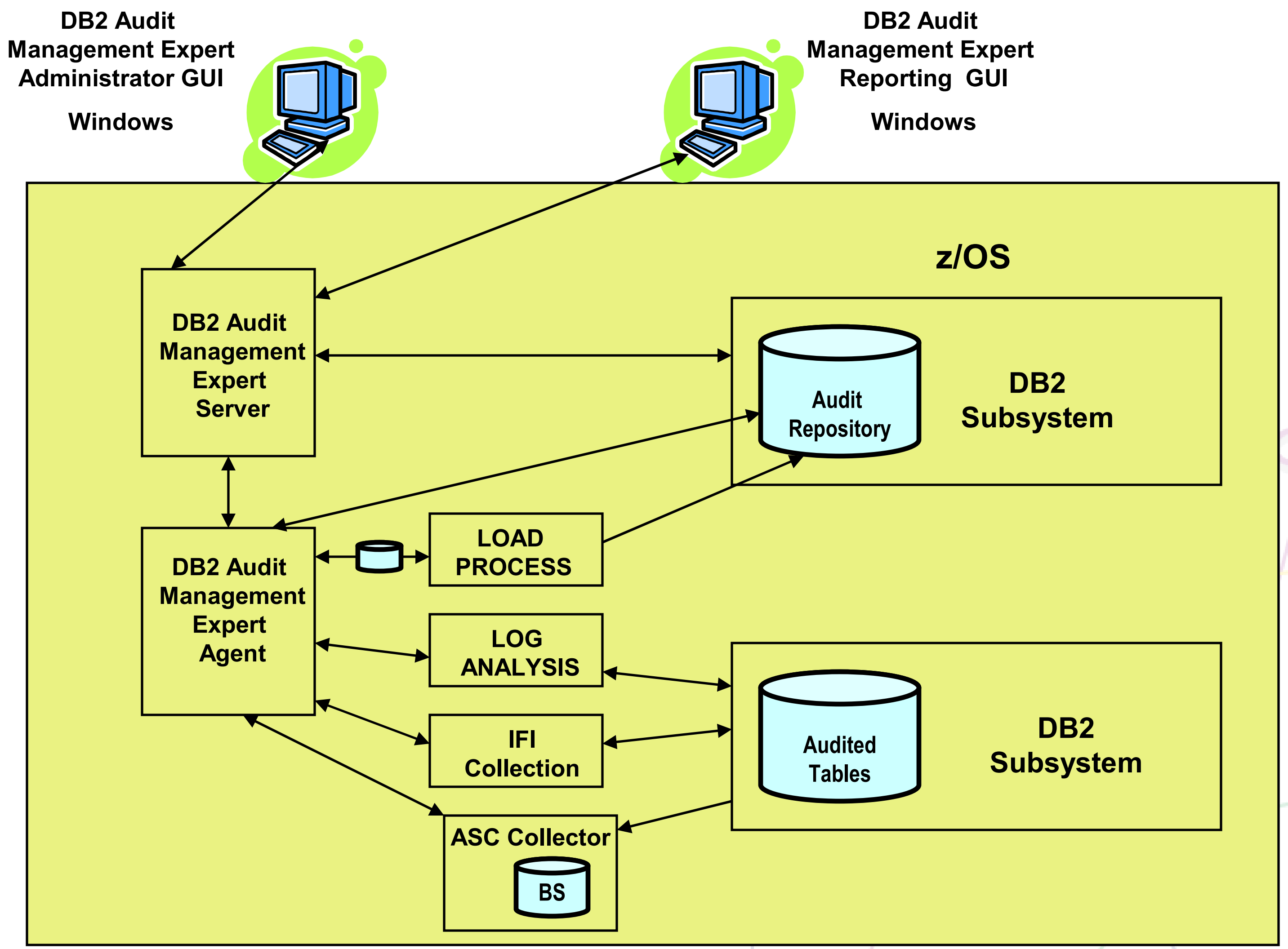
- Supporting internal and external auditors in collection and reporting of DB2 audit data
  - Does not require auditors to be DB2 defined users within the monitored DB2 system(s)
  - Does not require the auditors to log on to the operating system where the monitored system is running
    - Does not require extensive interaction between the auditor and the system support personnel (DBA/Sys admin)
- Auditor will not be able to directly manipulate any DB2 resources
- Provide complete visibility of all auditable objects to an administrator level user
- Provide controls for limiting visibility to auditors of auditable objects

- Removes DBA from audit data collection process. With V2.1 removes the "ALTER for AUDIT" requirement

DB2 Audit Management Expert Components

- Audit server
  - –Started task or batch job
  - –central control point for an Audit Management Expert network
  - –single audit server can support data collection from multiple agents on multiple z/OS systems
- Agent
  - –Started Task or batch job
  - –responsible for communications in an Audit Management Expert environment
  - –acts as a "container" to run the various collectors
  - –One per DB2 to Audit
- CLIENT User interfaces
  - –Audit Management Expert Reporter
  - –Audit Management Expert Administration
  - –Windows

DB2 Audit Management Expert Architecture



ASC- Audit SQL Collector

DB2 Audit Management Expert Profiles

- Profiles are created/maintained via **Administration UI**
  - Collection Profile
    - records the details for what audit data is stored to the Audit Management Expert repository
  - Agent Profile
    - Select ASC collection method
    - Configure General settings
      - Retention count, interval length
    - DB2 Load utility parameters
    - Define Job cards for load and log analysis
  - User Profile
    - contain information specific to an individual Audit Management Expert user such as: the user type, configurable privileges, and associated user groups

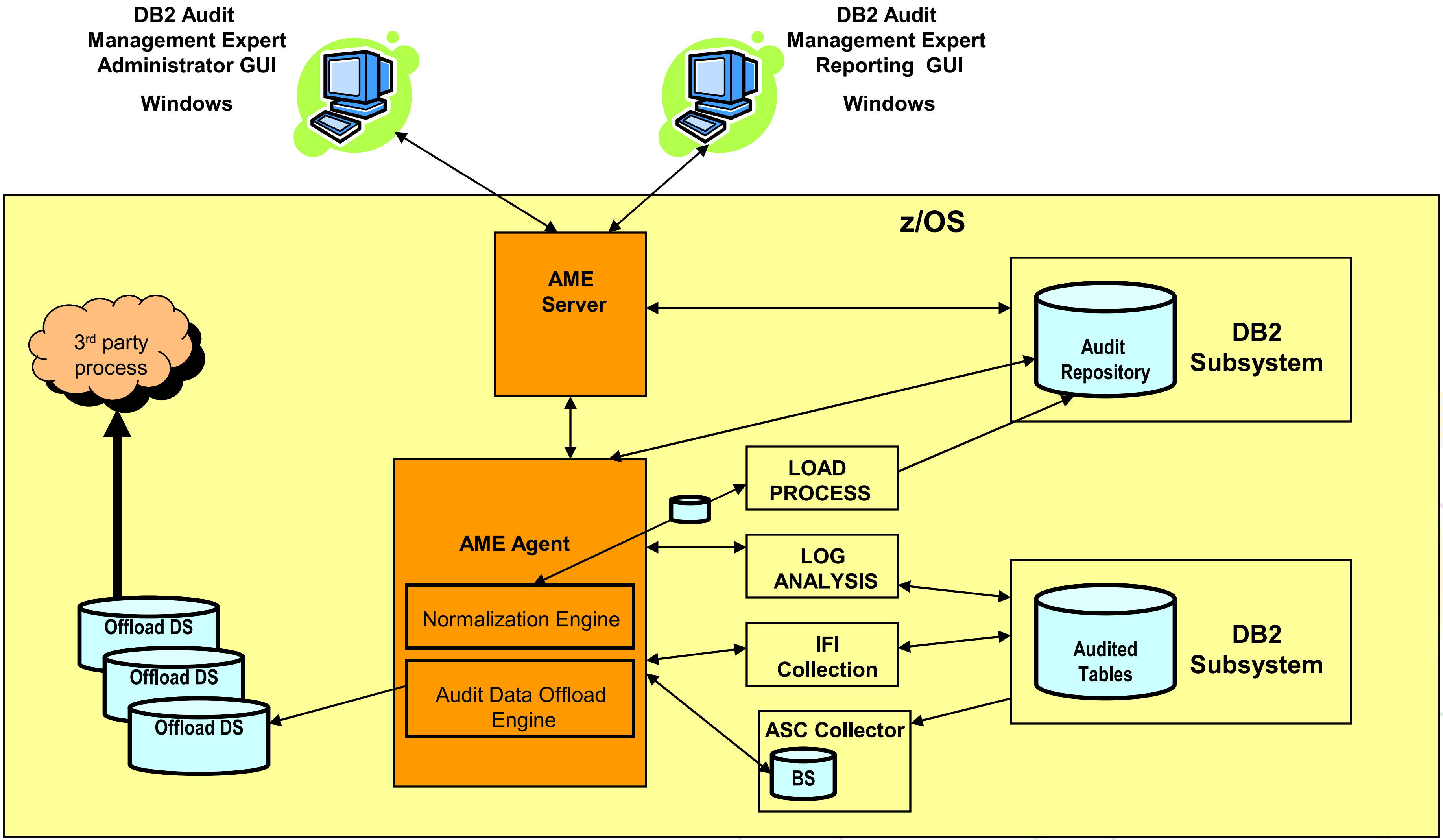
AME and Enterprise Wide Auditing - Challenges

- Existing appliance technology based on data feeds from primarily 2 sources
  - Event log from DB2 trace events written to SMF (agent)
  - Network "Sniffer" implementation (appliance)
- Restrictions and challenges with DB2 Trace versus a superior low overhead data collection approach with AME's ASC
- Network traffic based audit feeds challenged by
  - Encrypted Data Streams
  - Local Attachments (Batch, TSO, etc.)
  - Stored Procedures
  - Performance impact to network throughput due to indiscriminate examination of all network flows
- Strong requirement to view and manage Audit events across the enterprise from a single UI

AME Extract File Enhancement via maintenance stream (PTFs UK41519, UK41521, UK41523)

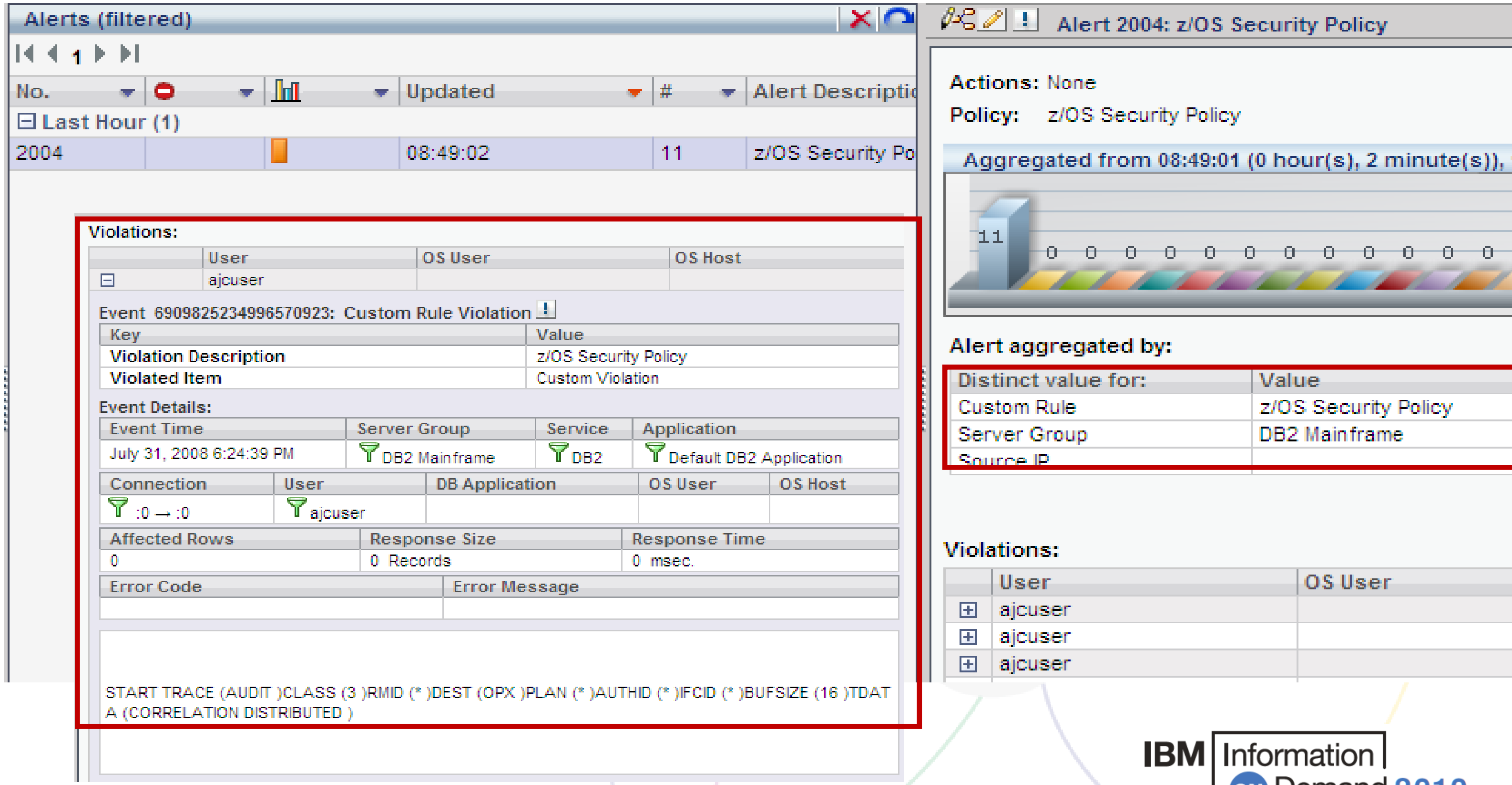
- AME will provide an option to generate audit log data sourced from either DB2 Trace or ASC (Audit SQL Collector) in an documented extract file format.
- Extract files will be standard physical sequential datasets.
- Exploiters will be responsible for transporting (via secure FTP for example) data to appliance server environment.
- Management of Extract files (archiving, deleting, etc.) will be the responsibility of exploiters
- Data will be not be aggregated (normalized), this is to reduce overhead of data collection.
- Static SQL statement collection will be optional, this is to avoid the overhead of accessing the catalog with static SQL statement number to extract SQL statement text.
- Exploiters to include
  - Tivoli Consul Insight Manager (coming Q1 2010)
  - Tizor - Mantra
  - Imperva - SecureSphere
  - Others anticipated at a future date

DB2 Audit Management Expert Architecture Dual Mode



Alerts

- Real-time alert monitoring
- Exceptions outside of expected business process
- Immediate triaging & response
- Easy integration with 3rd-party IT ecosystems: SYSLOG, SNMP, Email...



Alerts (filtered)

No.			Updated	#	Alert Descriptio
Last Hour (1)					
2004		🟧	08:49:02	11	z/OS Security Po

Violations:

	User	OS User	OS Host
⊟	ajcuser		

Event 6909825234996570923: Custom Rule Violation

Key	Value
Violation Description	z/OS Security Policy
Violated Item	Custom Violation

Event Details:

Event Time	Server Group	Service	Application
July 31, 2008 6:24:39 PM	DB2 Mainframe	DB2	Default DB2 Application

Connection	User	DB Application	OS User	OS Host
:0 → :0	ajcuser			

Affected Rows	Response Size	Response Time
0	0 Records	0 msec.

Error Code	Error Message

START TRACE (AUDIT)CLASS (3)RMID (*)DEST (OPX)PLAN (*)AUTHID (*)IFCID (*)BUFSIZE (16)TDATA (CORRELATION DISTRIBUTED)

Alert 2004: z/OS Security Policy

Actions: None
Policy: z/OS Security Policy

Aggregated from 08:49:01 (0 hour(s), 2 minute(s)),

Alert aggregated by:

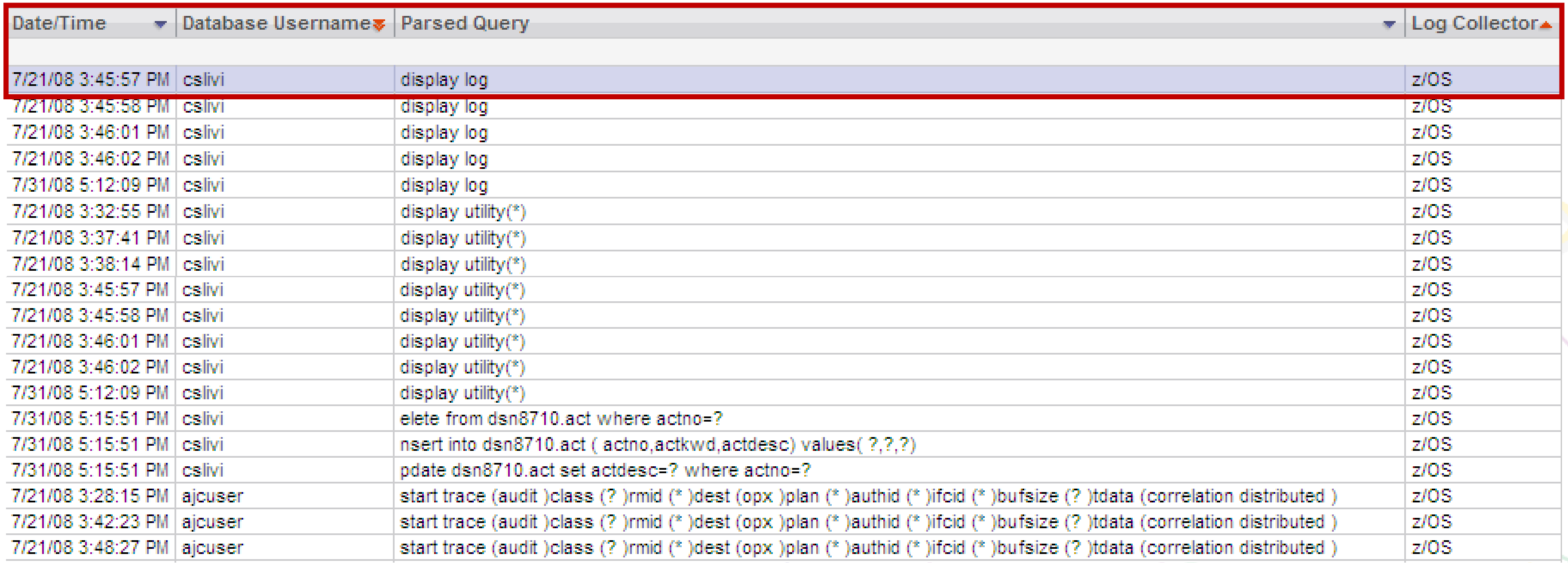
Distinct value for:	Value
Custom Rule	z/OS Security Policy
Server Group	DB2 Mainframe
Source IP	

Violations:

	User	OS User
⊞	ajcuser	
⊞	ajcuser	
⊞	ajcuser	

Viewing the Audit Logs:

Provides all the details including: date and time , database user name and parsed query



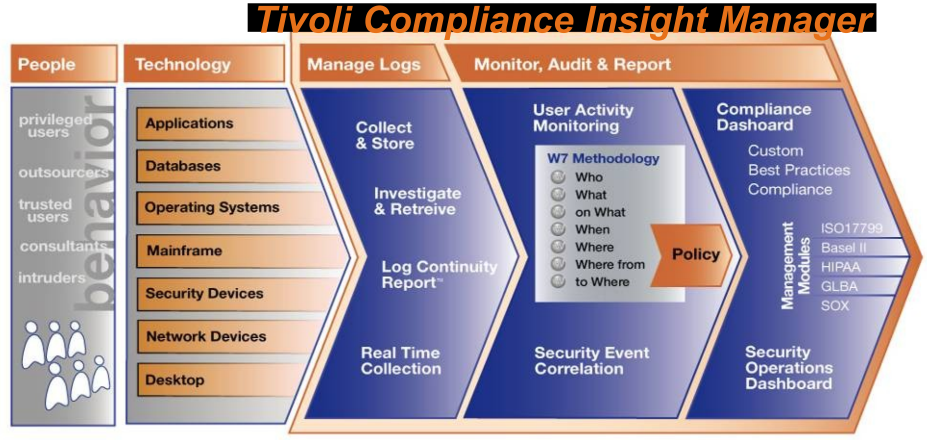
Date/Time	Database Username	Parsed Query	Log Collector
7/21/08 3:45:57 PM	cslivi	display log	z/OS
7/21/08 3:45:58 PM	cslivi	display log	z/OS
7/21/08 3:46:01 PM	cslivi	display log	z/OS
7/21/08 3:46:02 PM	cslivi	display log	z/OS
7/31/08 5:12:09 PM	cslivi	display log	z/OS
7/21/08 3:32:55 PM	cslivi	display utility(*)	z/OS
7/21/08 3:37:41 PM	cslivi	display utility(*)	z/OS
7/21/08 3:38:14 PM	cslivi	display utility(*)	z/OS
7/21/08 3:45:57 PM	cslivi	display utility(*)	z/OS
7/21/08 3:45:58 PM	cslivi	display utility(*)	z/OS
7/21/08 3:46:01 PM	cslivi	display utility(*)	z/OS
7/21/08 3:46:02 PM	cslivi	display utility(*)	z/OS
7/31/08 5:12:09 PM	cslivi	display utility(*)	z/OS
7/31/08 5:15:51 PM	cslivi	elete from dsn8710.act where actno=?	z/OS
7/31/08 5:15:51 PM	cslivi	nsert into dsn8710.act (actno,actkwd,actdesc) values(?,?,?)	z/OS
7/31/08 5:15:51 PM	cslivi	pdate dsn8710.act set actdesc=? where actno=?	z/OS
7/21/08 3:28:15 PM	ajcuser	start trace (audit)class (?)rmid (*)dest (opx)plan (*)authid (*)ifcid (*)bufsize (?)tdata (correlation distributed)	z/OS
7/21/08 3:42:23 PM	ajcuser	start trace (audit)class (?)rmid (*)dest (opx)plan (*)authid (*)ifcid (*)bufsize (?)tdata (correlation distributed)	z/OS
7/21/08 3:48:27 PM	ajcuser	start trace (audit)class (?)rmid (*)dest (opx)plan (*)authid (*)ifcid (*)bufsize (?)tdata (correlation distributed)	z/OS

Tivoli Compliance Insight Manager

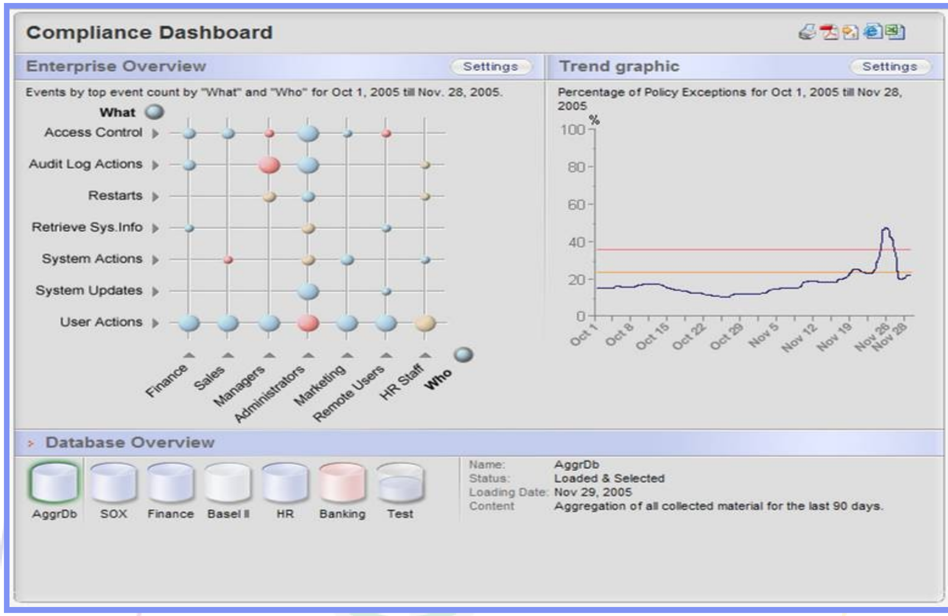
Tivoli Compliance Insight Manager provides an enterprise security compliance dashboard with in-depth privileged user **monitoring** capabilities, all powered by a comprehensive log and audit trail collection capability

Key Features

- Compliance management modules and regulation-specific reports
- Unique ability to monitor user behavior, including PUMA (Privileged User Monitoring and Audit) reporting
- Broadest, most complete log and audit trail capture capability
- W7 log normalization translates your logs into business terms
- Easy ability to compare behavior to regulatory and company policies – auditors no longer need RACF expertise to monitor activities
- Enabler event source integrates the OS and mainframe database events into TCIM's enterprise compliance dashboard



Tivoli Compliance Insight Manager



Compliance Dashboard

Enterprise Overview

Events by top event count by "What" and "Who" for Oct 1, 2005 till Nov. 28, 2005.

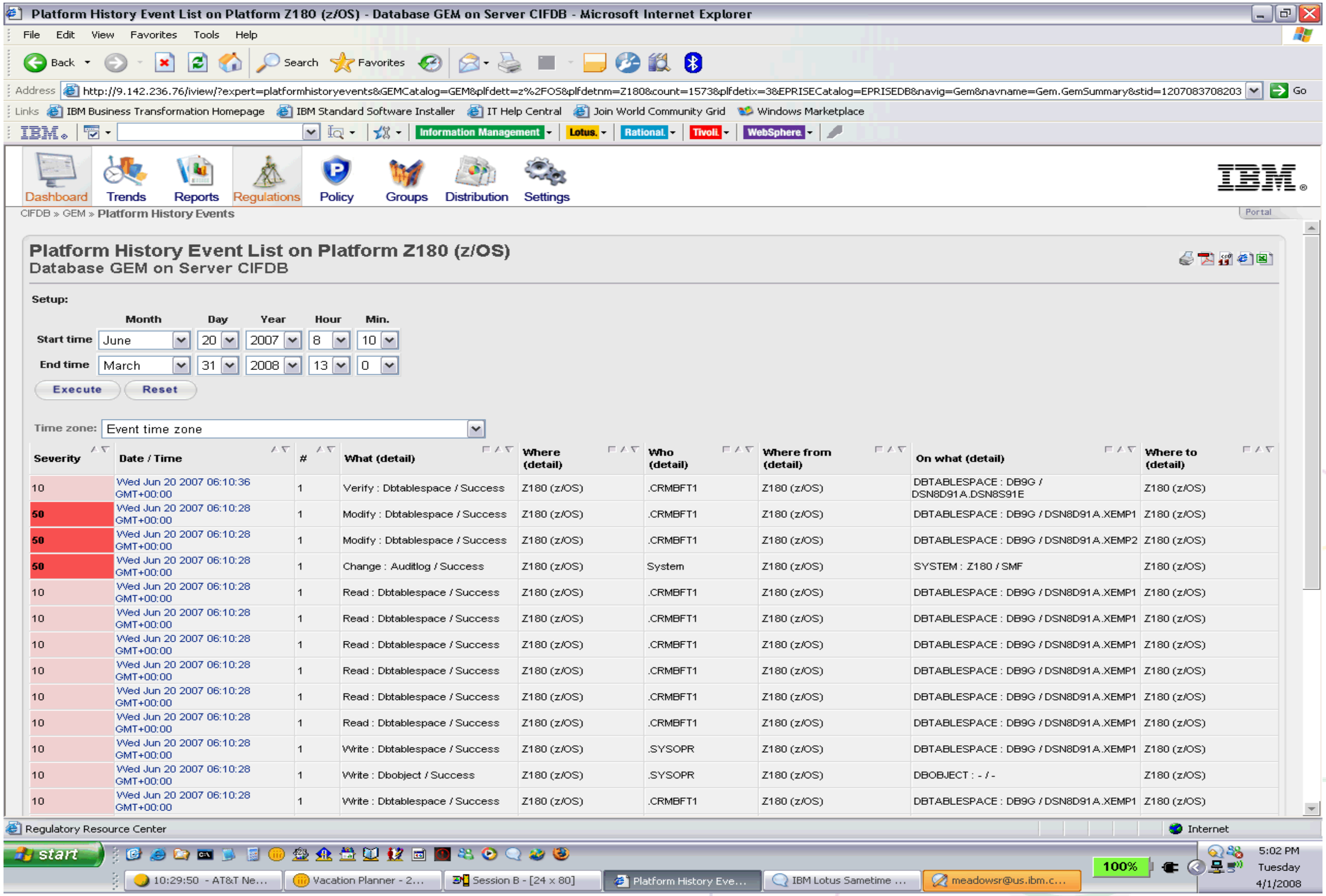
Trend graphic

Percentage of Policy Exceptions for Oct 1, 2005 till Nov 28, 2005

Database Overview

Name: AggrDb
Status: Loaded & Selected
Loading Date: Nov 29, 2005
Content: Aggregation of all collected material for the last 90 days.

TCIM – Representative Screen



Platform History Event List on Platform Z180 (z/OS) - Database GEM on Server CIFDB - Microsoft Internet Explorer

http://9.142.236.76/iview/?expert=platformhistoryevents&GEMCatalog=GEM&plfdett=z%2FOS&plfdetnm=Z180&count=1573&plfdetix=3&EPRISECatalog=EPRISEDB&navig=Gem&navname=Gem.GemSummary&stid=1207083708203

CIFDB » GEM » Platform History Events

Platform History Event List on Platform Z180 (z/OS)
Database GEM on Server CIFDB

Setup:

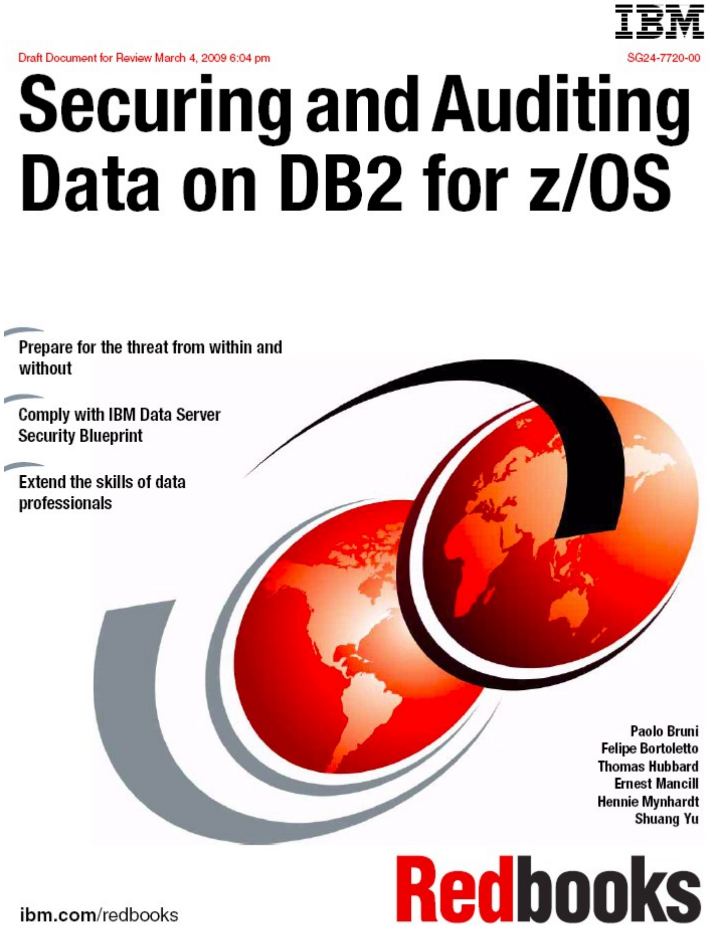
	Month	Day	Year	Hour	Min.
Start time	June	20	2007	8	10
End time	March	31	2008	13	0

Time zone: Event time zone

Severity	Date / Time	#	What (detail)	Where (detail)	Who (detail)	Where from (detail)	On what (detail)	Where to (detail)
10	Wed Jun 20 2007 06:10:36 GMT+00:00	1	Verify : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.DSN8S91E	Z180 (z/OS)
50	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Modify : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
50	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Modify : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP2	Z180 (z/OS)
50	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Change : Auditlog / Success	Z180 (z/OS)	System	Z180 (z/OS)	SYSTEM : Z180 / SMF	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Read : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Write : Dbtablespace / Success	Z180 (z/OS)	.SYSOPR	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Write : Dbobject / Success	Z180 (z/OS)	.SYSOPR	Z180 (z/OS)	DBOBJECT : - / -	Z180 (z/OS)
10	Wed Jun 20 2007 06:10:28 GMT+00:00	1	Write : Dbtablespace / Success	Z180 (z/OS)	.CRMBFT1	Z180 (z/OS)	DBTABLESPACE : DB9G / DSN8D91A.XEMP1	Z180 (z/OS)

Regulatory Resource Center

Redbook on Audit and Encryption on DB2 for z/OS – SG24-7720



IBM

Draft Document for Review March 4, 2009 6:04 pm

SG24-7720-00

Securing and Auditing Data on DB2 for z/OS

- Prepare for the threat from within and without
- Comply with IBM Data Server Security Blueprint
- Extend the skills of data professionals

Paolo Bruni
Felipe Bortoletto
Thomas Hubbard
Ernest Mancill
Hennie Mynhardt
Shuang Yu

ibm.com/redbooks

Redbooks

Summary

- **Take Back Control with IBM Data Governance solutions :**
  - Transform your information from a Liability into your most strategic, valuable Asset
  - Help manage business risk by enforcing security, audit, privacy and policy controls
  - Lower operational costs by optimising data management, retention and archiving
  - Increase profitability by enabling more accurate business intelligence
  - Increase management's confidence in making more informed decisions based on quality and more complete data
  - Increase customer satisfaction and retention through targeted advertising and up/cross selling
- **Software, Hardware and Expertise.**
  - Information Management - the most complete end-to-end Data Governance software solutions
  - zSeries the ultimate platform to govern your enterprise data
  - IBM Industry Data Models as a fast-start, best practice and help with industry compliance
  - GBS - Expertise and skills from DG readiness assessments to solution implementation.

Thank
You

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