IBM

Aloha from

TIVOLI NATION

Mainframe Security War Stories From The Trenches:

AKA - how to avoid a security disaster

Warning: Contains Technical Material – Parental Guidance recommended

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AGENDA

- PART ONE – the headlines
- PART TWO – the real world issues
- PART THREE – a message from our sponsors
- PART FOUR – Q&A

PART ONE – the headlines

- Why you came today
- Sensationalism – ‘hackers’ at work!
  - Does happen – potentially high profile – headline grabbing
  - But not very often, and often kept as quiet as possible
- It’s the ‘smaller’ ones that happen day to day are the real concerns

What's it all about?

- SPECIAL, SPECIAL, SPECIAL…

RACF Release Timeline

September, 1976, Version 1 Release 1

- User identification/verification
- Data set authorization checking
- Journaling
- UT100, UT200, BLKUPD

July, 1977 Version 1 Release 2

- TAPE and DASD Volume protection
- Dynamic control of RACF options (SETROPTS)
- In-storage index blocks

July, 1978 Version 1 Release 3

- General resources
- In-storage profiles
- Report Writer (9/80)

November, 1981 Version 1 Release 4

- Password processing support
- List-of-groups
- RACF data manager interface (ICHEINTY)

- Q: Privilege Escalation – how do they do it?
  - A: the standard methods – just like any other system…

Standard Methods:

- From outside:
  - Enumeration
  - Fingerprinting
  - Vulnerability scanning
  - Pen-test
  - Trojan
- From inside:
  - Accident
  - Malicious
  - Privileged users/administrators

Standard Responses:

- From outside:
  - But it's a mainframe – no way: Enumeration
  - So what – how does this help them?: Fingerprinting
  - But this is only relevant for users: Vulnerability scanning
  - I trust all my users: Pen-test
  - How exactly?: Trojan
- From inside:
  - We all know this happens: Accident
  - We don't like to think this happens: Malicious
  - We really hope this never happens (to us): Privileged users/administrators

How about an example?

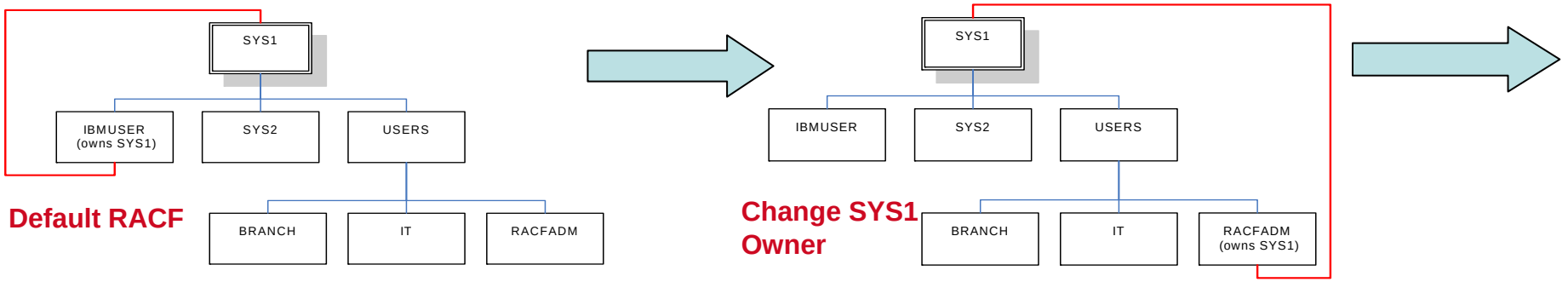
- Simplest method – Trojan Horse technique:
  - Attack Vectors include:
    - Cataloged Procedure datasets
    - Logon CLISTs and REXX execs
    - Any scripts regularly run by privileged users
- Mitigation:
  - Know the datasets vulnerable to this technique
  - Audit these at the necessary access level
  - Most important – least often performed: Review these Audit Reports!
  - Monitor in real-time

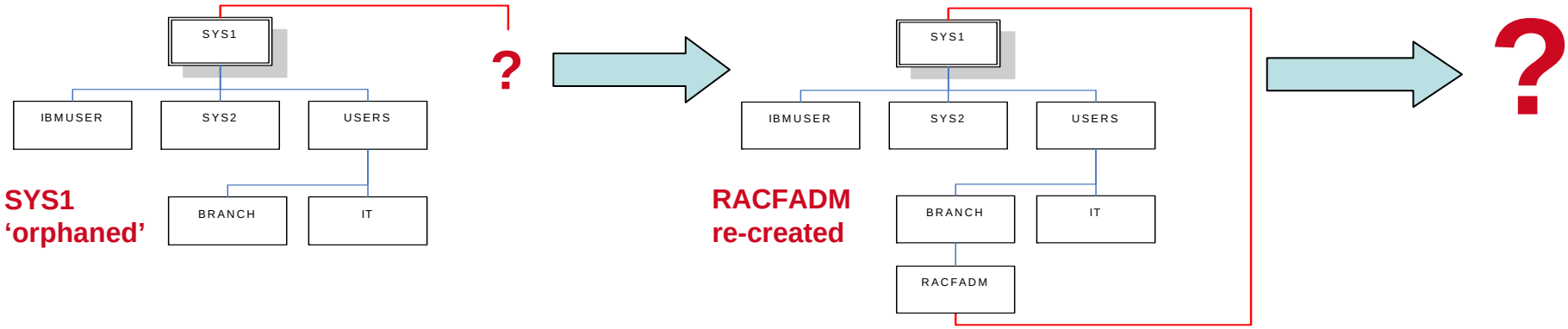
More technical examples

- The SVC that didn't play nicely:
  - Doesn't validate either its caller, and/or and target data area properly
    - Can be called by anyone with BAS skills – even 'script kiddies' could get relevant code in theory
    - Used by professional z/OS Pen-testers
    - Almost always a method to get SPECIAL this way
- The 'magic SVC' installed for 'maintenance/emergency' use
  - There really is no justification for these nowadays
  - If you really must – then make sure it's internally protected
  - And audit/report on this protection as a priority

But it doesn't have to be that technical

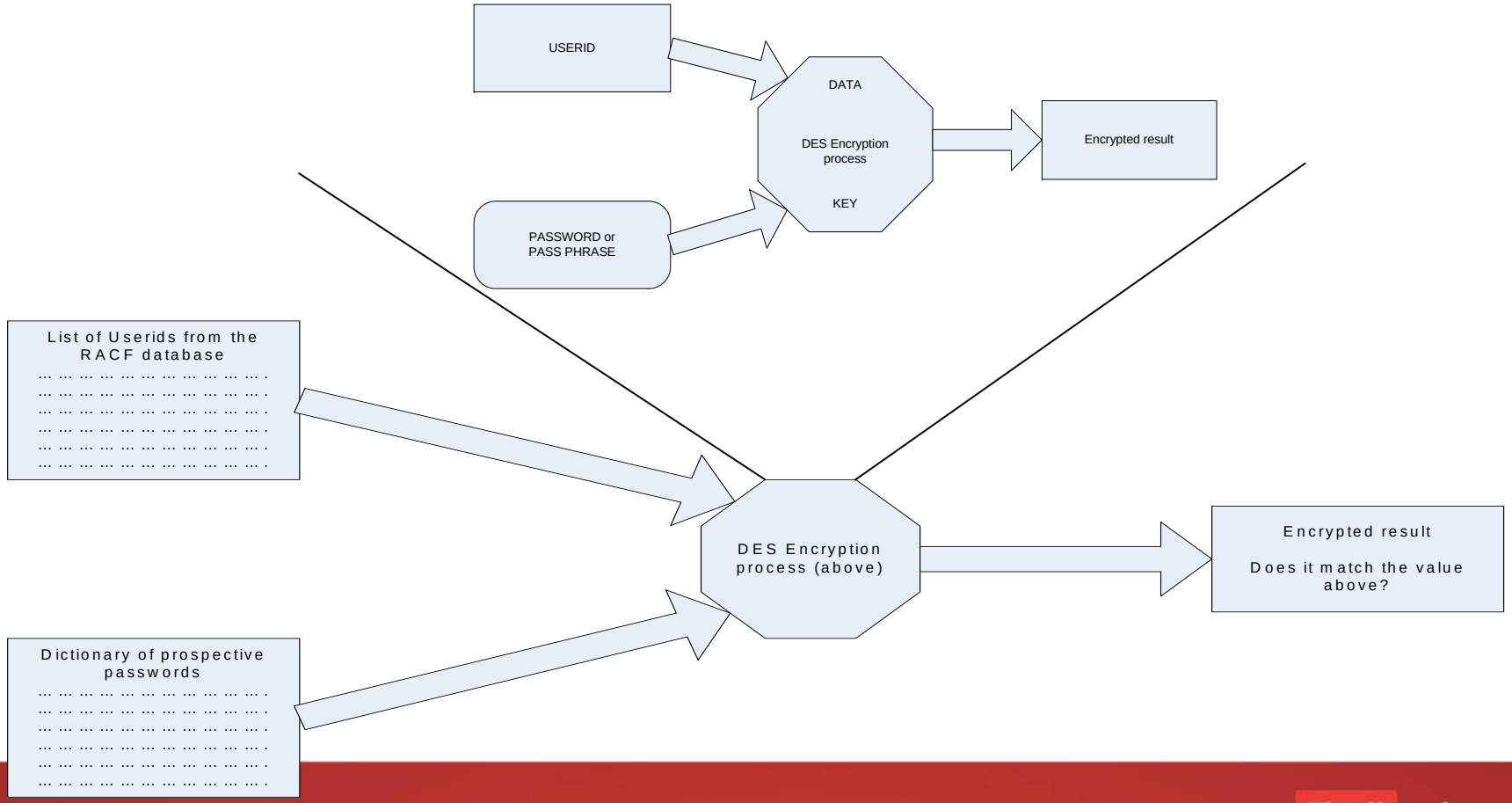
- Seemingly minor administrative actions may cumulatively introduce a serious exposure – Group Special example





The simplest mistake

- READ access to RACF or an exact database copy:
  - Offline brute force attack



Three avenues for total control of z/OS

- SPECIAL
  - Gimme SPECIAL – Gimme your system… :->
- APF authorisation
  - Update to AFP plus BAS skills is enough – but now you can also download programs that extract passwords from RACF
- Copy of RACF database
  - Brute force offline – opens up both above attacks

What to do next?

- Our ‘hacker’:
  - Trojan – wait until I have SPECIAL; he, he, he…
  - SVC attack – get SPECIAL temporarily, grant permanently
  - Group Scope issues – reset a SPECIAL users password
  - Sensitive data in general – discover passwords and config
- Our z/OS security and sysprogs:
  - Trojan – separate logon procs etc for SPECIALs etc
  - SVC attacks – technical z/OS audit and reporting
  - Group Scope issues – control RACF commands
  - Sensitive data in general – data and user classification…

PART TWO – the real world issues

- Data exposures
- Accidental damage/system errors
- Administrator mistakes
- Security ‘not important’ – must deliver application service no matter what the cost…

Data scrubbing and job routing example

- Data from production used in test and development jobs
- User able to specify the output class for jobs
- Test system configured to route work to prod if specified

- User submitted test job, routed to prod system, specifying auto-mailer output class.

- Job printed real customer names/addresses, false statement balances, and was automatically sent to Australia Post

- IT executives spend evening in Aussie Post mail sorting room emptying sacks of mail – you don't want that…

Accidental damage example

- System SPECIAL and AUDITOR activates full SMF auditing for all access
  - System immediately fills SMF datasets
  - Then buffers,
  - Then halts.

- The privileged user again
  - Did they really need that privilege at the time?

More Accidental damage

- System OPERATIONS
  - Should be entirely unnecessary in modern systems
  - If you must retain it – audit it and control the access with RACF
  - Never on personal userids
  - Move towards STGADMIN RACF control
- Falls into the ‘too much access’ bucket
- IT Sec 101: ‘need to know’
- Segregation of authorities is vital…

Administrator error damage example

- System Admin deleted all FTP related userids – oops
- Major international bank – all FTP with mainframe down
- Real problem:
  - Easy to recreate the userids and access
  - Hard to restore the passwords to hard coded values
- Lucky in this case – had software that would fix this
  - Zero outage – corrected before problem was noticed

Delivery over security example

- Batch userids with security administration rights
- Combined with RACF SURROGAT access to these userids by all support staff
- Overall – over 400 staff with the ability to readily ‘hack’
- Large Aussie finance company
- Support staff respond: “We need this access”…
  - Security admin: “All of it?! Full security admin rights as well! For everyone?”

More Delivery over security

- Major system replacement developed in isolated lpar
- Shortly before production implementation
  - RACF differences discovered
- 3 month, high risk/profile project to rectify
  - hundreds of thousands of RACF commands issued
- Really a project management and IT governance issue

What to do next?

- Data exposures
  - Use real/near-time auditing and monitoring to improve security implementation
- Accidental damage/system errors
  - Segregate the ‘killer’ access/privileges
- Administrator mistakes
  - See above + automated controls
- Security ‘not important’ – must deliver application service – no matter what the cost…
  - Business and App Dev governance

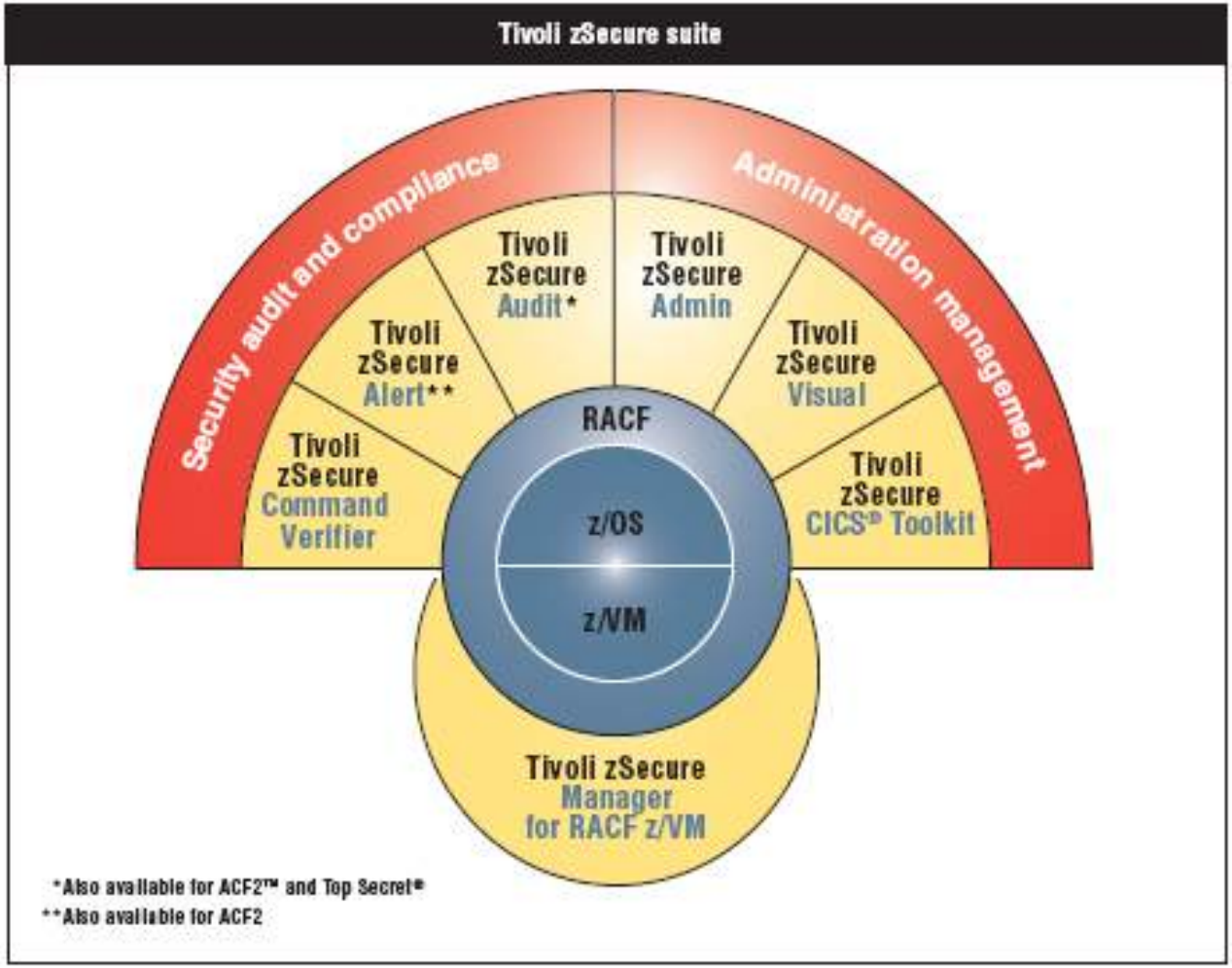
Privacy and confidentiality

- Data classification
  - Classify your data – somehow!
- Role based user access systems
  - Classify your users – provisioning

- Then you can have an ‘access matrix’ – users vs data

- On which you can now implement – Auditing and Monitoring
  - Auditing – once every few months
  - Monitoring – real time

PART THREE – a word from our sponsors



Introduction - A bit of Consul history

- 1987 Collect program IOCONFIG version 1 (now zSecure Collect)
  - Collects system snapshot in IOCONFIG file (now CKFREEZE)
- 1989 Consul enters security market with Consul/RACF (now Admin)
  - CARLa command language (somewhat like SAS)
- 1993 Consul/RACF 1.3.0, introduction of Consul/Audit
  - Fully integrated with Consul/RACF from the start
- 1994 Consul/RACF 1.4.0, introduction of CNGRACF component (now CKGRACF)
- 1996 Consul/Command Verification Option for RACF (now Command Verifier)
- 1998 Consul/RACF+Audit 2.3.0, introduction of Consul/Audit for ACF2
- 1998 Consul/RACF Administrator for Windows 1.1 (now Visual)
  - Windows front-end to Consul/RACF
  - Client/server communication shared with Consul/Enterprise (now TCIM)
- 1999 Consul acquires Palace Guard Software, CICS/RACF Toolkit 3.10
- 1999 Consul/Enterprise Audit 2.1 ships OS/390 event source (now TCIM Enabler for z/OS)

Introduction – Consul zSecure Suite

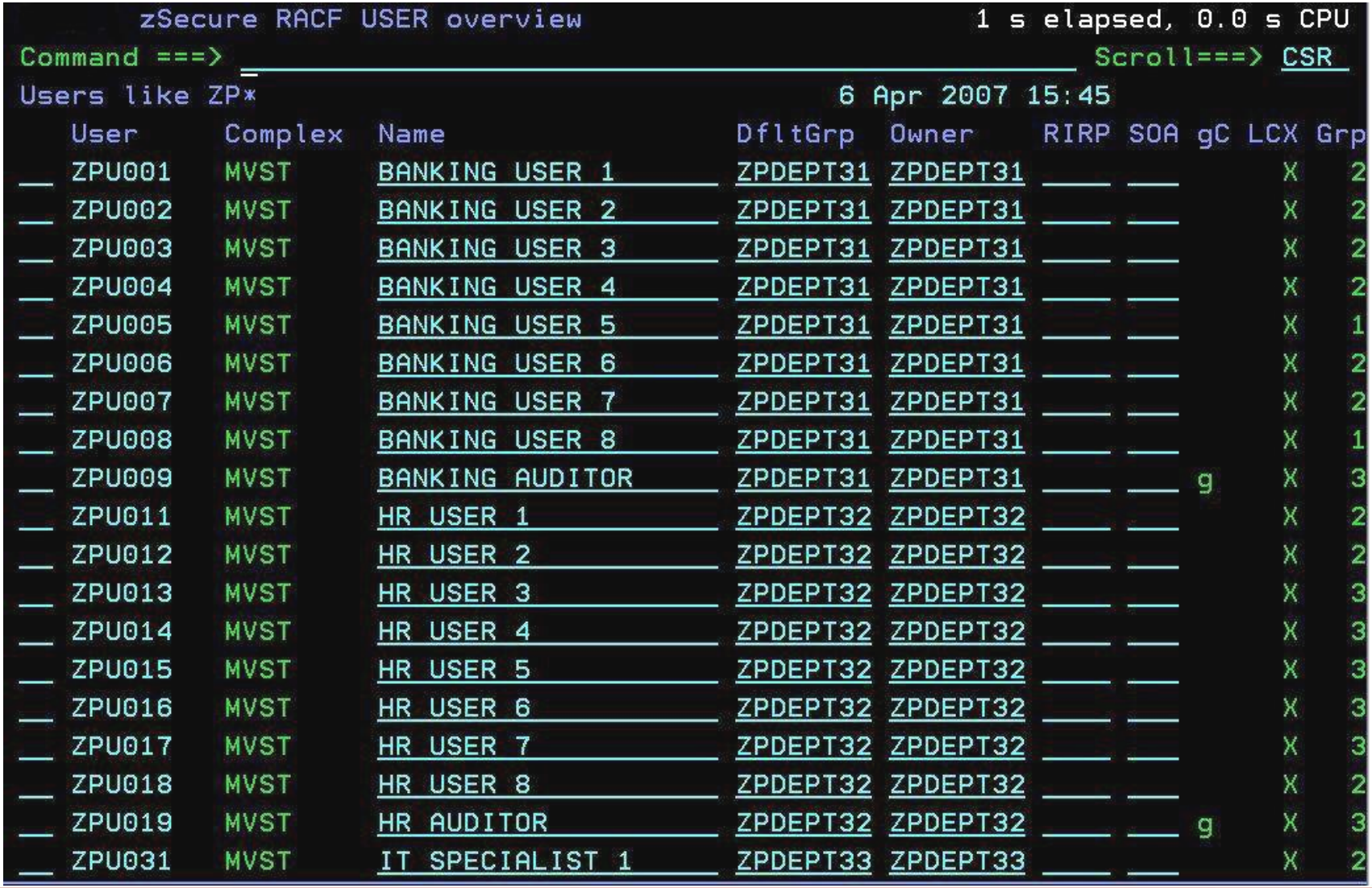
- 2001 The z/OS era: zSecure name introduced for existing products
  - Version numbers follow z/OS (as Collect had already done for OS/390 for some time)
  - 2001 Consul/zAdmin+zAudit 1.1.0, together called Consul/zSecure
  - 2001 Consul/zVisual 1.1.0
  - 2002 Consul/zLock 1.1.0 (née Command Verification Option)
  - 2002 Consul/zToolkit 1.2.0
- 2003 Version 1.4.5, introduction of Consul/zAlert
  - Alert Address Space does the real-time monitoring
  - Invokes CARLa engine to format and send alerts
- 2005 Version 1.6.0, introduction of Consul zAudit TSS
  - Top Secret support mostly consists of SMF and Audit Tracking File support
  - Product names now without “/”, and “InSight” inserted before zAudit, zAlert, zLock
- 2007 Version 1.8.0, introduction of Consul zAlert ACF2

Since IBM

- 2007 The Tivoli era: IBM ramps up development and integration
  - Compare Users/Groups function
  - RACF offline
  - CICS SMF type 110 support
  - More z/OS IP Comms Server support
  - DB2 Trace support
  - Tivoli suite integration

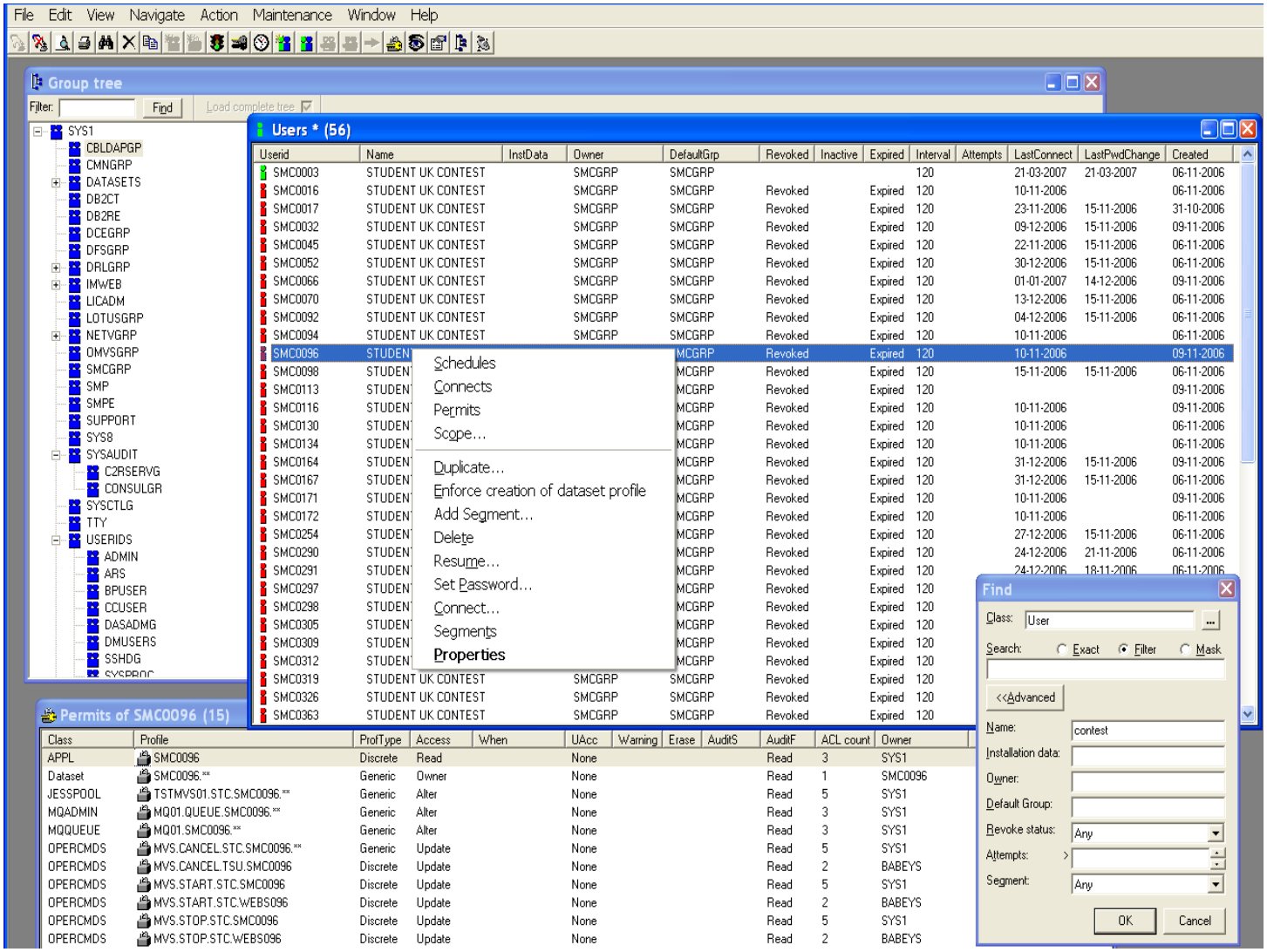
- Demonstrates tighter integration into z/OS development

zSecure Admin

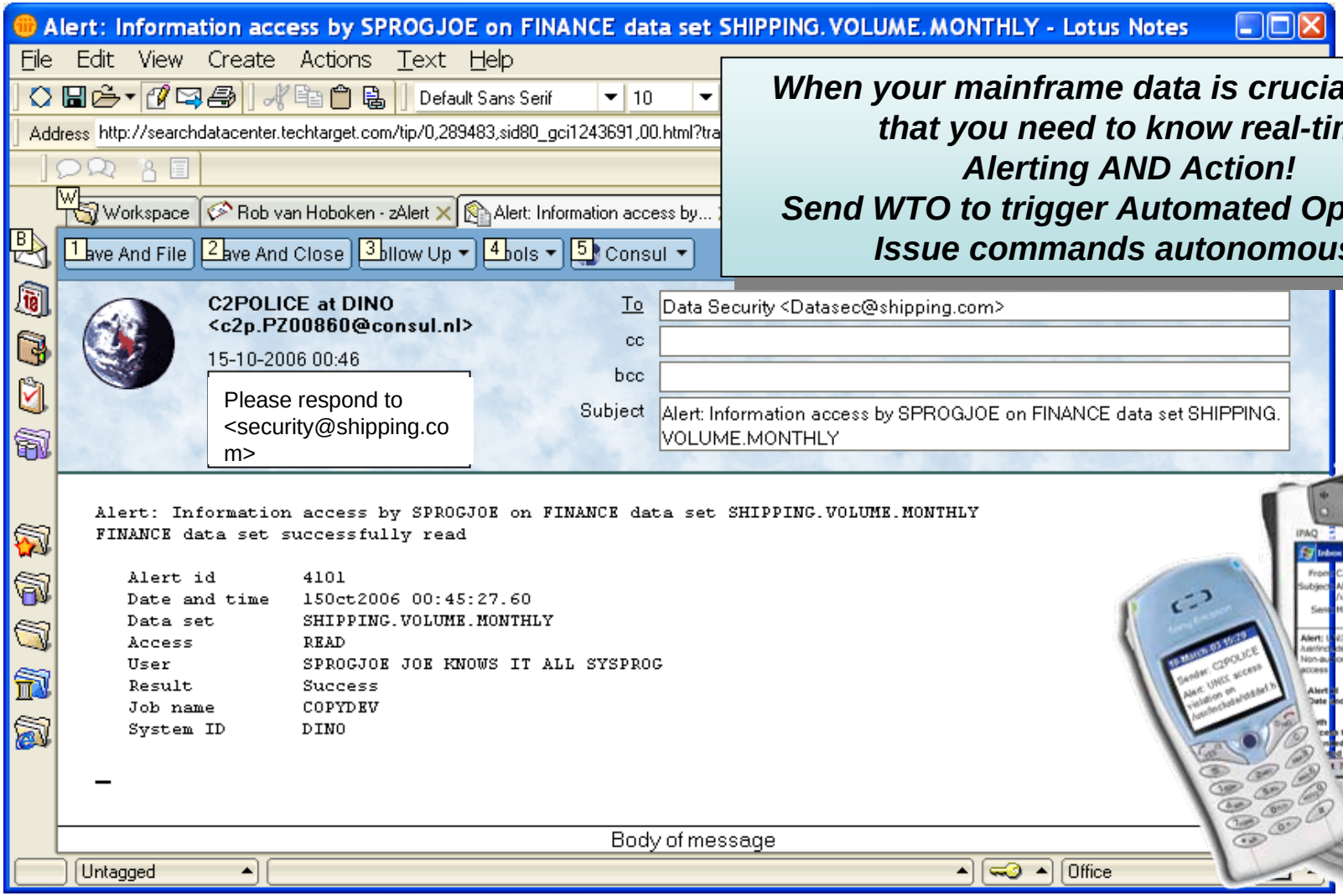


```
      zSecure RACF USER overview                          1 s elapsed, 0.0 s CPU
Command ===> _                                                Scroll===> CSR
Users like ZP*                                    6 Apr 2007 15:45
   User     Complex  Name                 DfltGrp   Owner    RIRP SOA gC LCX Grp
__ ZPU001   MVST     BANKING USER 1       ZPDEPT31  ZPDEPT31                X   2
__ ZPU002   MVST     BANKING USER 2       ZPDEPT31  ZPDEPT31                X   2
__ ZPU003   MVST     BANKING USER 3       ZPDEPT31  ZPDEPT31                X   2
__ ZPU004   MVST     BANKING USER 4       ZPDEPT31  ZPDEPT31                X   2
__ ZPU005   MVST     BANKING USER 5       ZPDEPT31  ZPDEPT31                X   1
__ ZPU006   MVST     BANKING USER 6       ZPDEPT31  ZPDEPT31                X   2
__ ZPU007   MVST     BANKING USER 7       ZPDEPT31  ZPDEPT31                X   2
__ ZPU008   MVST     BANKING USER 8       ZPDEPT31  ZPDEPT31                X   1
__ ZPU009   MVST     BANKING AUDITOR      ZPDEPT31  ZPDEPT31          g     X   3
__ ZPU011   MVST     HR USER 1            ZPDEPT32  ZPDEPT32                X   2
__ ZPU012   MVST     HR USER 2            ZPDEPT32  ZPDEPT32                X   2
__ ZPU013   MVST     HR USER 3            ZPDEPT32  ZPDEPT32                X   3
__ ZPU014   MVST     HR USER 4            ZPDEPT32  ZPDEPT32                X   3
__ ZPU015   MVST     HR USER 5            ZPDEPT32  ZPDEPT32                X   3
__ ZPU016   MVST     HR USER 6            ZPDEPT32  ZPDEPT32                X   3
__ ZPU017   MVST     HR USER 7            ZPDEPT32  ZPDEPT32                X   3
__ ZPU018   MVST     HR USER 8            ZPDEPT32  ZPDEPT32                X   2
__ ZPU019   MVST     HR AUDITOR           ZPDEPT32  ZPDEPT32          g     X   3
__ ZPU031   MVST     IT SPECIALIST 1      ZPDEPT33  ZPDEPT33                X   2
```

zSecure Visual

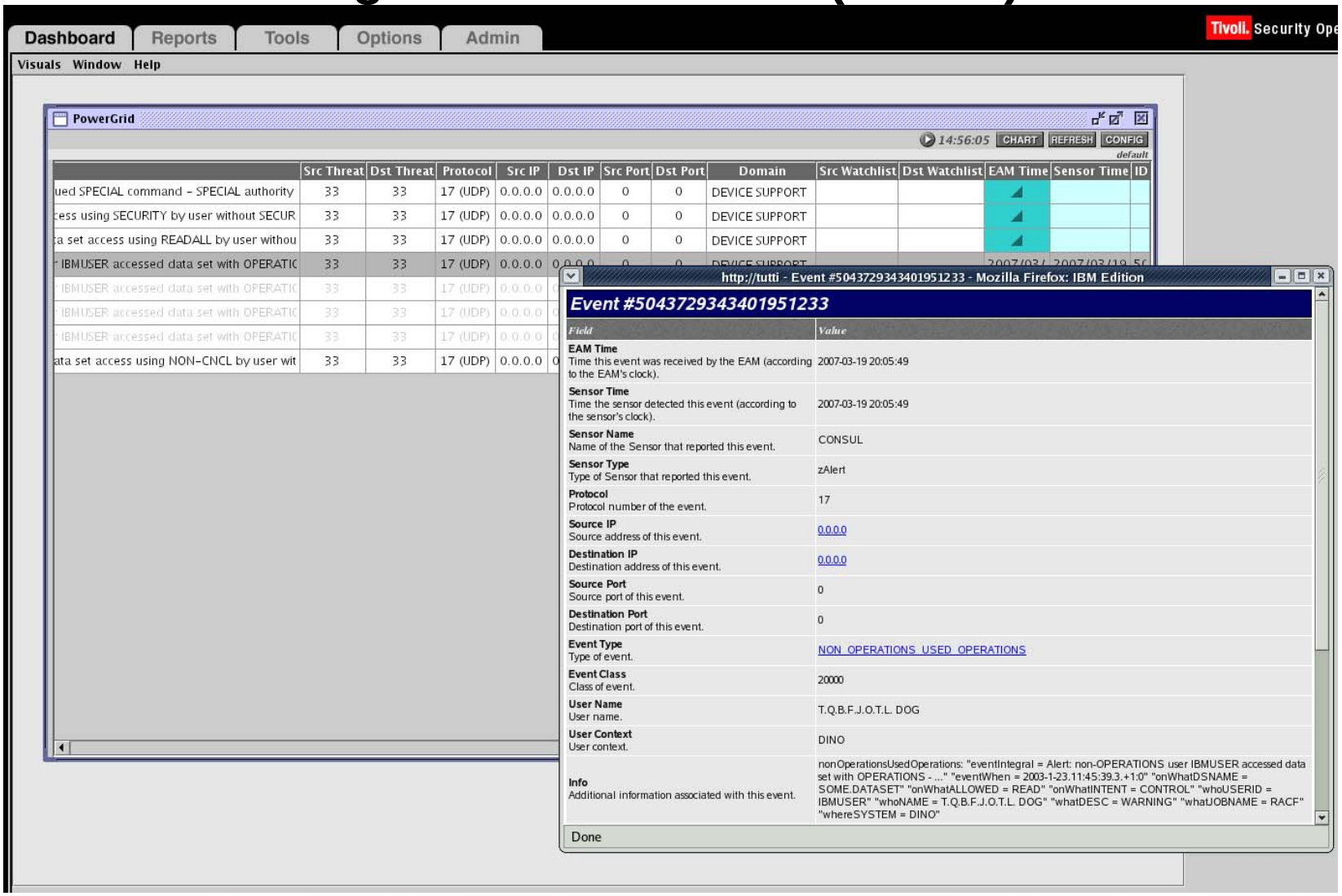


zSecure Alert

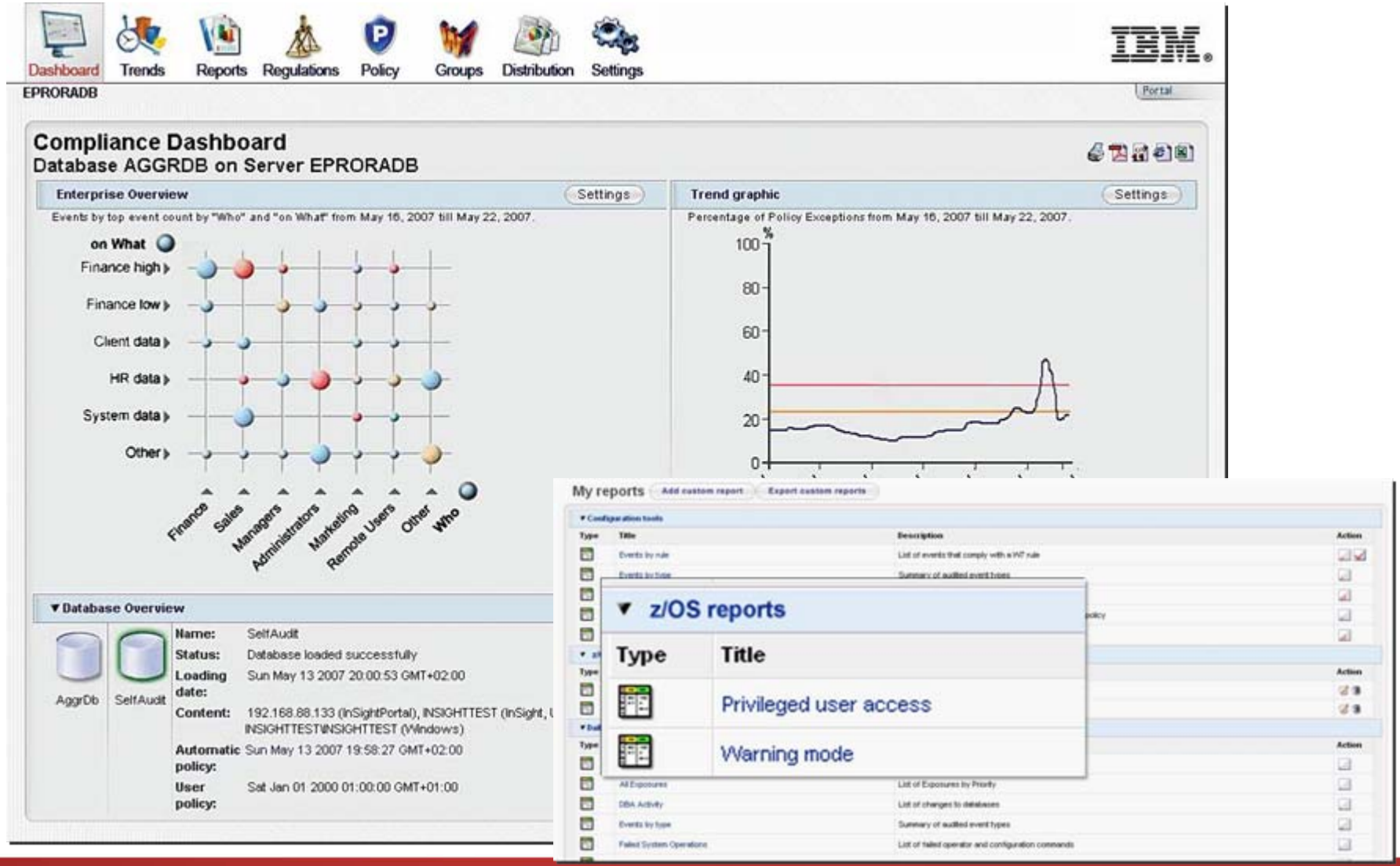


When your mainframe data is crucial enough that you need to know real-time
Alerting AND Action!
Send WTO to trigger Automated Operations
Issue commands autonomously

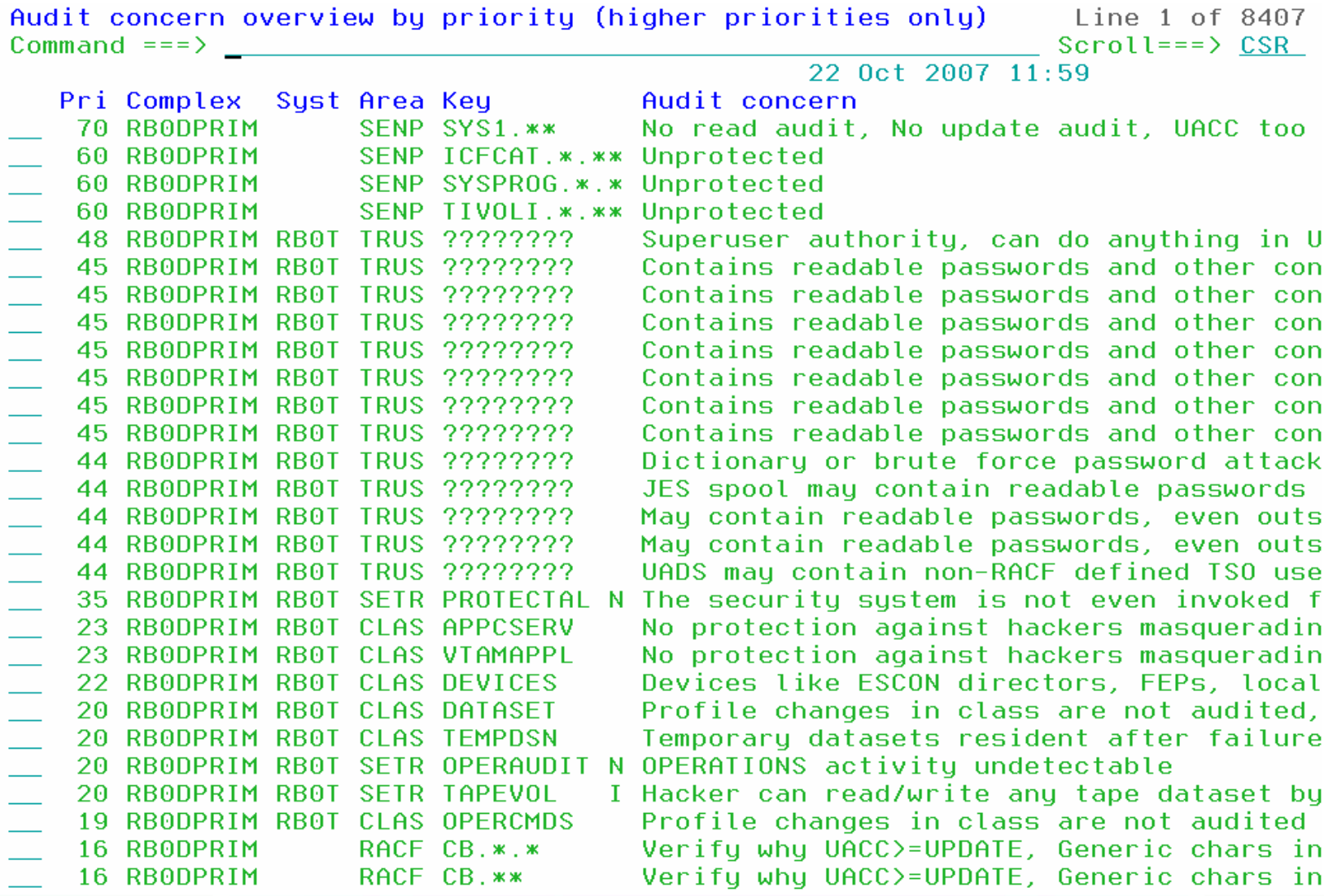
zSecure Alert integration with TSOM (TSIEM)



zSecure integration with TCIM

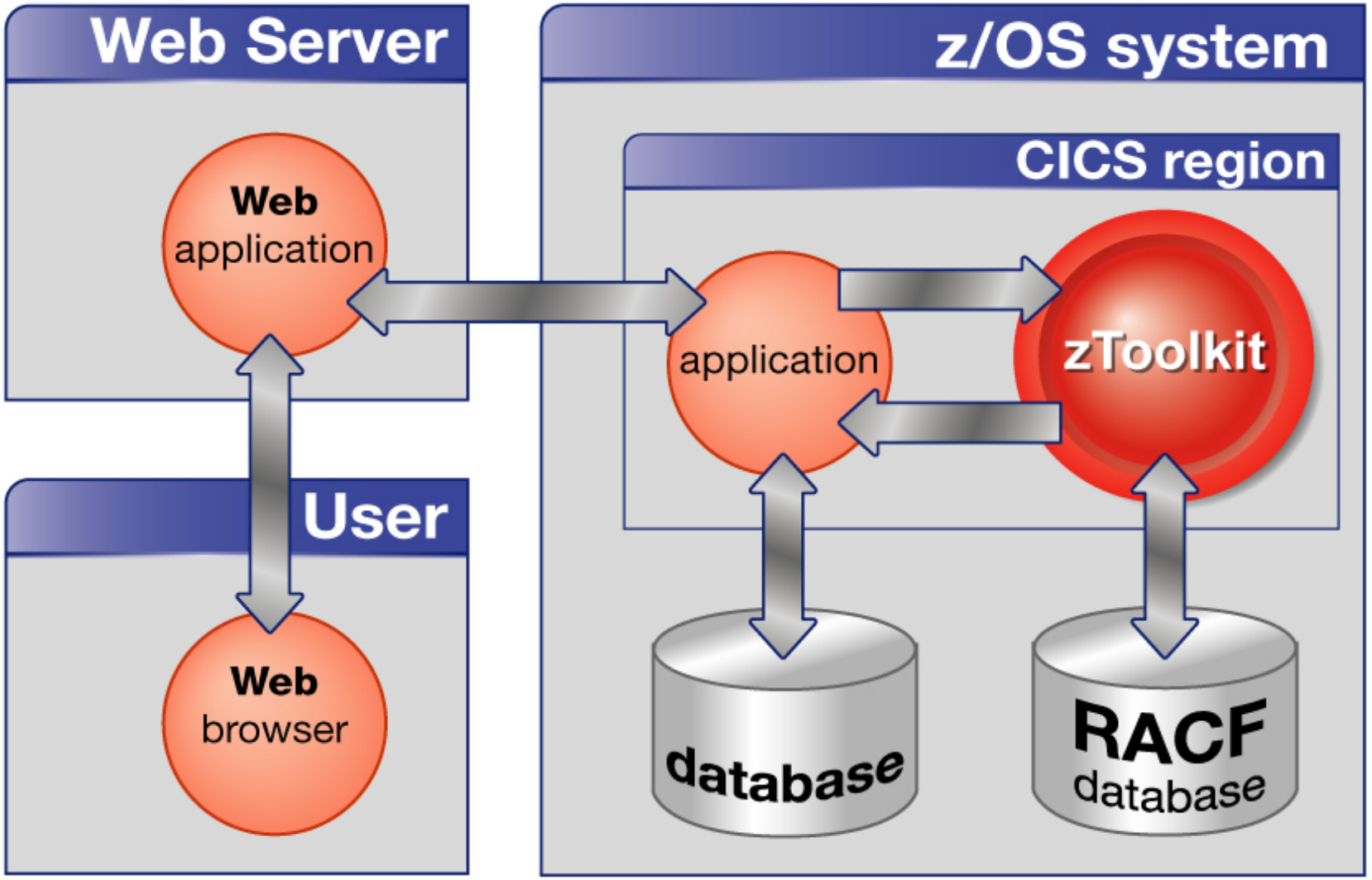


zSecure Audit



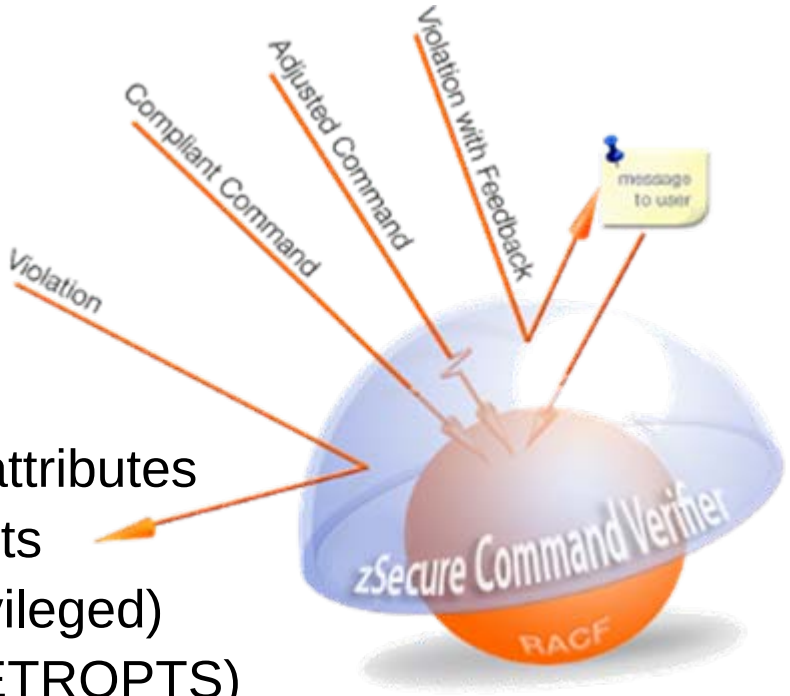
```
Audit concern overview by priority (higher priorities only)      Line 1 of 8407
Command ===> _                                                  Scroll===> CSR
                                                          22 Oct 2007 11:59
   Pri Complex  Syst Area Key          Audit concern
__  70 RB0DPRIM      SENP SYS1.**      No read audit, No update audit, UACC too
__  60 RB0DPRIM      SENP ICFCAT.*.**  Unprotected
__  60 RB0DPRIM      SENP SYSPROG.*.*  Unprotected
__  60 RB0DPRIM      SENP TIVOLI.*.**  Unprotected
__  48 RB0DPRIM RB0T TRUS ????????    Superuser authority, can do anything in U
__  45 RB0DPRIM RB0T TRUS ????????    Contains readable passwords and other con
__  45 RB0DPRIM RB0T TRUS ????????    Contains readable passwords and other con
__  45 RB0DPRIM RB0T TRUS ????????    Contains readable passwords and other con
__  45 RB0DPRIM RB0T TRUS ????????    Contains readable passwords and other con
__  45 RB0DPRIM RB0T TRUS ????????    Contains readable passwords and other con
__  45 RB0DPRIM RB0T TRUS ????????    Contains readable passwords and other con
__  45 RB0DPRIM RB0T TRUS ????????    Contains readable passwords and other con
__  44 RB0DPRIM RB0T TRUS ????????    Dictionary or brute force password attack
__  44 RB0DPRIM RB0T TRUS ????????    JES spool may contain readable passwords
__  44 RB0DPRIM RB0T TRUS ????????    May contain readable passwords, even outs
__  44 RB0DPRIM RB0T TRUS ????????    May contain readable passwords, even outs
__  44 RB0DPRIM RB0T TRUS ????????    UADS may contain non-RACF defined TSO use
__  35 RB0DPRIM RB0T SETR PROTECTAL N The security system is not even invoked f
__  23 RB0DPRIM RB0T CLAS APPCSERV    No protection against hackers masqueradin
__  23 RB0DPRIM RB0T CLAS VTAMAPPL    No protection against hackers masqueradin
__  22 RB0DPRIM RB0T CLAS DEVICES     Devices like ESCON directors, FEPs, local
__  20 RB0DPRIM RB0T CLAS DATASET     Profile changes in class are not audited,
__  20 RB0DPRIM RB0T CLAS TEMPDSN     Temporary datasets resident after failure
__  20 RB0DPRIM RB0T SETR OPERAUDIT N OPERATIONS activity undetectable
__  20 RB0DPRIM RB0T SETR TAPEVOL   I Hacker can read/write any tape dataset by
__  19 RB0DPRIM RB0T CLAS OPERCMDS    Profile changes in class are not audited
__  16 RB0DPRIM      RACF CB.*.*      Verify why UACC>=UPDATE, Generic chars in
__  16 RB0DPRIM      RACF CB.**       Verify why UACC>=UPDATE, Generic chars in
```

zSecure CICS Toolkit



zSecure Command Verifier

- Complete control over all RACF commands (similar to TAMOS)
- Control over command execution
- Enforces installation standards
  - Naming Conventions
  - Defaults for missing values
  - Mandatory values
  - Access Level Standards
  - Elevation of Authority not allowed
    - group special may not pass along attributes
  - Prevent changes to Access Control Lists
  - Prevent use of keywords (Trusted, Privileged)
  - Prevent changes to RACF settings (SETROPTS)
- Optional logging to SMF
- Optional audit trail in RACF profiles



PART FOUR – Q&A

- Some resources for further information
  - www.ibmsystemsmag.com
    - http://www.ibmsystemsmag.com/mainframe/julyaugust05/tipstechniques/9785p1.aspx?ht=
    - http://www.ibmsystemsmag.com/mainframe/marchapril07/tipstechniques/12532p1.aspx?ht=
  - Tivoli zSecure software, education and support
    - http://www-306.ibm.com/software/tivoli/sw-atoz/indexZ.html
    - http://www-306.ibm.com/software/tivoli/education/edu_prd.html#Z
    - http://www-306.ibm.com/software/sysmgmt/products/support/IBMTivolizSecureSuite.html
  - RACF User Group online – RACF-L
    - http://listserv.uga.edu/archives/racf-l.html

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