IBM Information Protection Capabilities on z/OS

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Agenda

- **The need to protect data**
- **Information Protection entry point to Information Governance**
- **IBM’s Information Protection capabilities**
- **Summary**

Organizations facing many of the following challenges

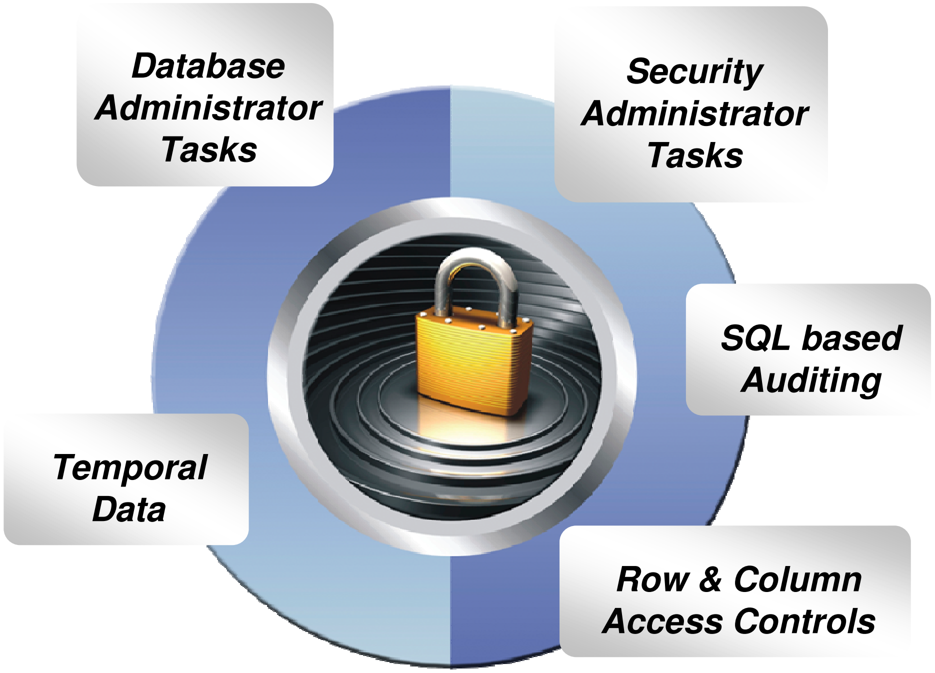
- Discovering what data needs to be secured
- How to secure your data
- Audit and separation of roles – privileged user conundrum
- Encryption and data obfuscation
- Data in a test environment
- Data life-cycle management and data growth

IBM Information Management Solutions for System z – End to end Solution

Security, Audit, and Encryption for z/OS

Satisfy Your Auditor: Plan, Protect and Audit

- Data Access
  - Minimize the use of a superuser authorities such as SYSADM
  - A different group should manage access to restricted data than the owner of the data
- Data Auditing
  - Any dynamic access or use of a privileged authority needs to be included in your audit trail
  - Maintain historical versions of data for years or during a business period
- Data Privacy
  - All dynamic access to tables containing restricted data needs to be protected


Database Administrator Tasks
Security Administrator Tasks
SQL based Auditing
Temporal Data
Row & Column Access Controls

Today's Mainframe:
The power of industry-leading security,
the simplicity of centralised management

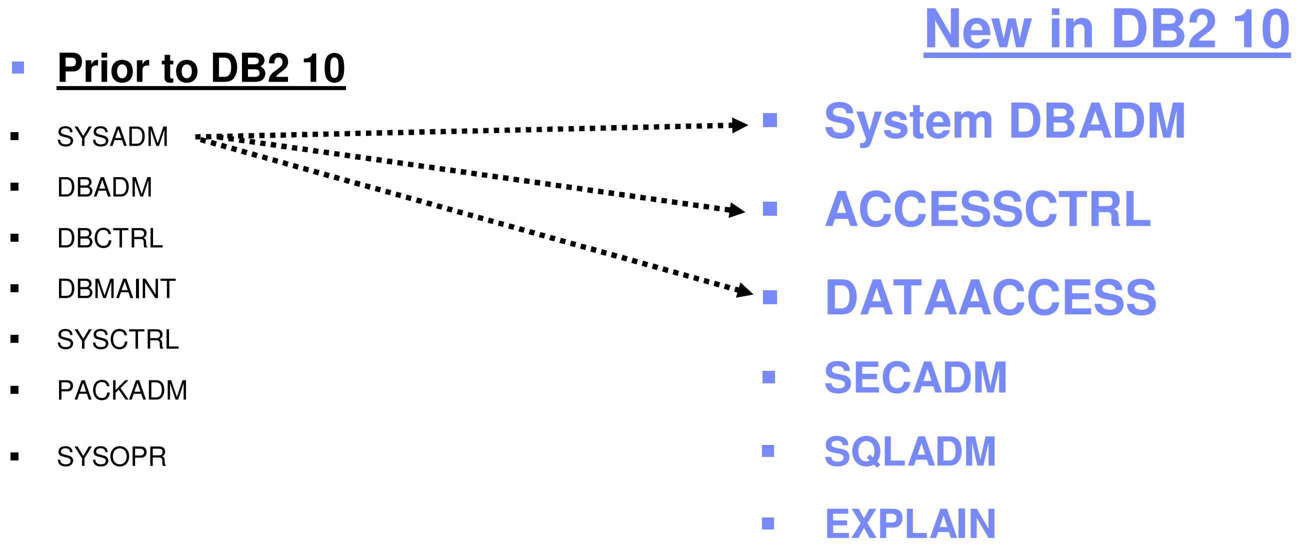
DB2 10 for z/OS Security Enhancements

Help Satisfy Your Auditors using new features

- ✓ New granular authorities to reduce data exposure for administrators
- ✓ New auditing features using new audit policies comply with new laws
- ✓ New row and column access table controls to safe guard your data
- ✓ New temporal data to comply with regulations to maintain historical data

Reduce your risk by minimizing use of SYSADM

New granular system authorities and install security parameters



New in DB2 10

- **Prior to DB2 10**
  - SYSADM
  - DBADM
  - DBCTRL
  - DBMAINT
  - SYSCTRL
  - PACKADM
  - SYSOPR

- **System DBADM**
- **ACCESSCTRL**
- **DATAACCESS**
- **SECADM**
- **SQLADM**
- **EXPLAIN**

Prevents SYSADM and SYSCTRL from granting or revoking privileges

- New separate security install zparm parameter
- New install **SECADM** authority manages subsystem security
- SYSADM and SYSCTRL can no longer implicitly grant or revoke privileges

Control cascading effect of revokes

- New revoke dependent privileges install parameter
- New revoke dependent privileges SQL clause

New authority for performing security tasks without ability to change or access data

- **SECADM** authority
  - Allows the user to
    - Issue SQL GRANT, REVOKE statements on all grantable privileges and administrative authorities
    - Manage DB2 9 roles and trusted contexts
    - Manage DB2 10 row permissions and column masks
    - Manage DB2 10 Audit policies
    - Access catalog tables
    - Issue START, STOP, and DISPLAY TRACE commands

New authority for managing objects without ability to access data or control access to data

- **System DBADM** authority
  - Allows the user to
    - Issue SQL CREATE, ALTER, DROP statements to manage most objects in the DB2 subsystem
    - Issue most DB2 commands
    - Execute system defined stored procedures and functions
    - Access catalog tables

RACF and Data Servers on z/OS

- RACF and DB2
  - DB2 Subsystem Access Control (outside of DB2)
  - Control connections to the DB2 subsystem
    - CICS
    - IMS
    - CAF
    - BATCH
  - Assign identities
  - Protect the underlying DB2 data store (underlying data sets of DB2 can be protected by RACF dataset services)
  - In addition to database server-provided security, RACF can be used to control access to database objects, authorities, commands and utilities by using the RACF access control module of the database server.

- RACF and IMS
  - The IBM Information Management System (IMS™) has been enhanced to make use of RACF for controlling access to IMS resources. It is possible to use the original IMS security features, the new RACF features, and combinations of these. RACF provides more flexibility than the older security features. The normal features of RACF can be used to protect both system and database IMS data sets

Tools from Tivoli to enhance RACF

- Tivoli zSecure Admin
  - User friendly layer over the native RACF administration panels
  - Automatically generated RACF commands
    - Reduce complexity
    - Increased RACF administration productivity
    - Fewer errors
    - Less risk of inadvertent data exposure due to inappropriate/insufficient security
- Tivoli zSecure Visual
  - GUI/Windows based UI
  - Insulates security administrators from TSO/ISPF
  - Increased productivity requiring less sophistication in administration skills
- Tivoli Identity Management software
  - Tivoli Directory Server
  - Tivoli Identity Manager

End User Identity Mapping - Why is this Important?

- Proper end user assignment of rights and privileges on the data server is important, but equally important:.
  - In many mult-tier implementations, to ease administration, and to influence performance through mechanisms such as connection pooling, thread reuse, etc. Shared (common) authorization IDs are used for connecting to the Data Server
  - In these types of implementations, this leads to loss of end user identification, and any associated ability to completely audit activity on the data server from these types of connections.
  - Various mechanisms can be use to preserve these credentials:
    - SQL Language Extension vis SQLESETI
    - Extended identity propagation using JDBC drivers
    - Enterprise Identity Mapping
- Support distributed identities introduced in z/OS V1R11
    - A distributed identity is a mapping between a RACF user ID and one or more distributed user identities, as they are known to application servers

The DB2 client information fields

DB2 allows applications to send information about them to the database with each SQL operation.

- The database externalizes this information then in its monitoring data
- The performance impact of setting them is negligible (but for DB2 on LUW V9.1 FP6 is recommended)
- The data can be set by the application itself, or via database driver properties (see next slides)
- The following information can be set:

Field	Description	Length (LUW, z/OS)
Client user ID	This user ID is for identification purposes only, and is not used for any authorization. It typically identifies the user of an application.	255, 16
Client workstation name	The workstation name of the client system. Some applications also use this field to identify the business transaction executed within an application.	255, 18
Client application name	It can be used to identify the application hosted in an application server, or to identify the business transaction within an application.	255, 32
Program name	Identifies the application running on the client. It is only supported for a connected DB2 on z/OS database.	-, 80
Accounting string	It can be used to specify charge-back information, or to add additional monitoring details about the database workload.	200, 200

Ways to instrument your application

JDBC offers methods of `class com.ibm.db2.jcc.DB2BaseDataSource`^1

```
public static void main(String[] args) {
  String url = "jdbc:db2://lap1.boeblingen.de.ibm.com:50000/DEMO";
  Class.forName("com.ibm.db2.jcc.DB2Driver");
  Connection conn = DriverManager.getConnection(url, user, password);

  conn.setClientInfo("ClientUser", “xyz");
  conn.setClientInfo("ClientHostname, “my laptop");

  conn.prepareStatement("SELECT * FROM SYSIBM.SYSDUMMY1" + "WHERE 0 = 1").executeQuery();
}
```

CLI offers the `setsqli()`^2 interface

```
SQL_API_RC SQL_API_FN sqleseti (
  unsigned short DbAliasLen,
  char * pDbAlias,
  unsigned short NumItems,
  struct sqle_client_info* pClient_Info,
  struct sqlca * pSqlca);

SQL_STRUCTURE sqle_client_info {
  unsigned short type;
  unsigned short length;
  char *pValue; };
```

1) see http://publib.boulder.ibm.com/infocenter/db2luw/v9r7/index.jsp?topic=/com.ibm.db2.luw.apdv.java.doc/doc/r0021822.html

2) see http://publib.boulder.ibm.com/infocenter/db2luw/v9r5/index.jsp?topic=/com.ibm.db2.luw.apdv.api.doc/doc/r0001709.html

Why auditing is important in a RACF controlled environment

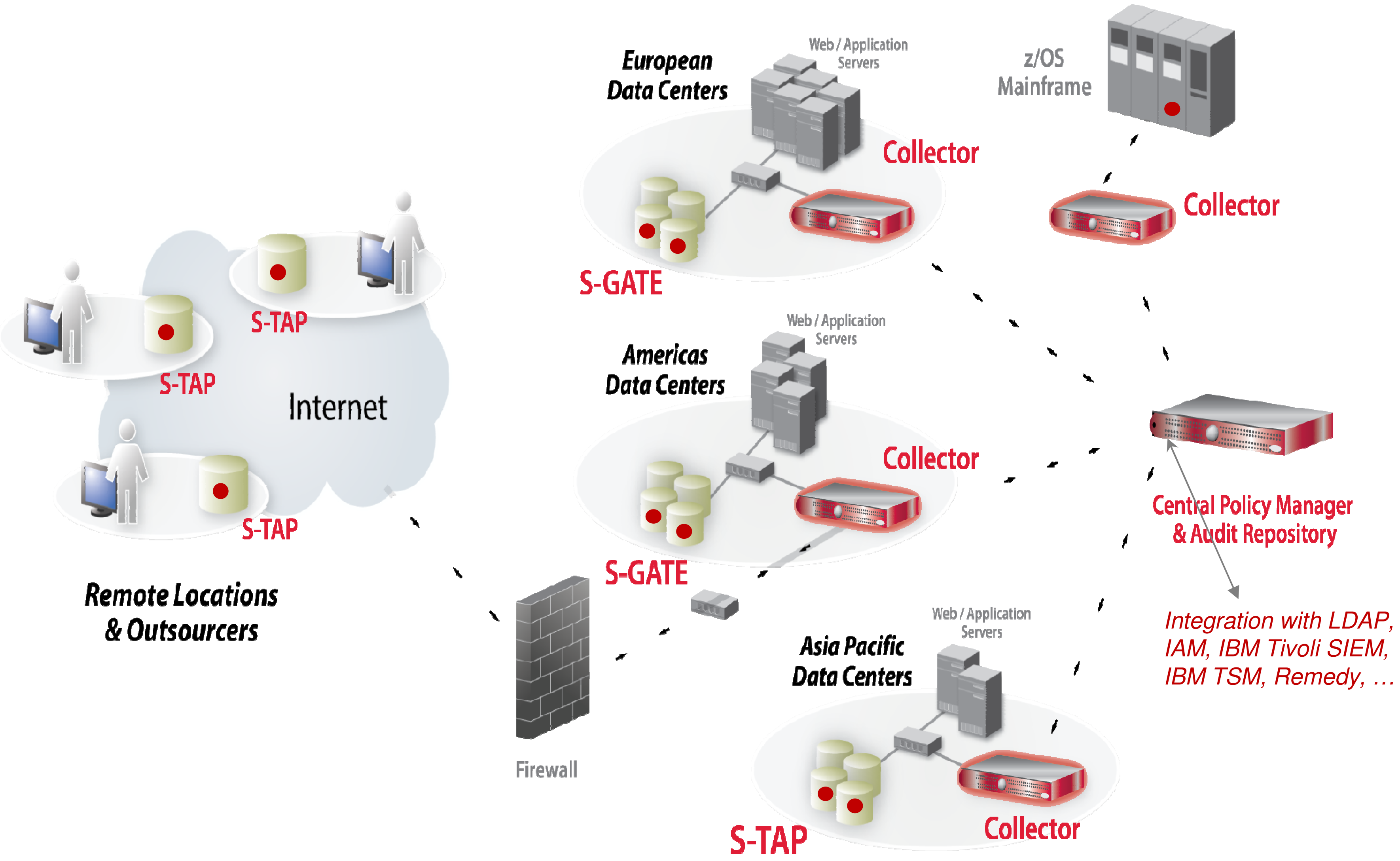
- RACF provides significant controls to protect access to resources, but does little in the way of meaningful access reporting
  - RACF does two things:
    - Prevents people from accessing a resource that is not essential or appropriate for their jobs
    - Allows people access to the necessary data 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 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

Auditing the Privileged Database User

- 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

Scalable Multi-Tier Architecture



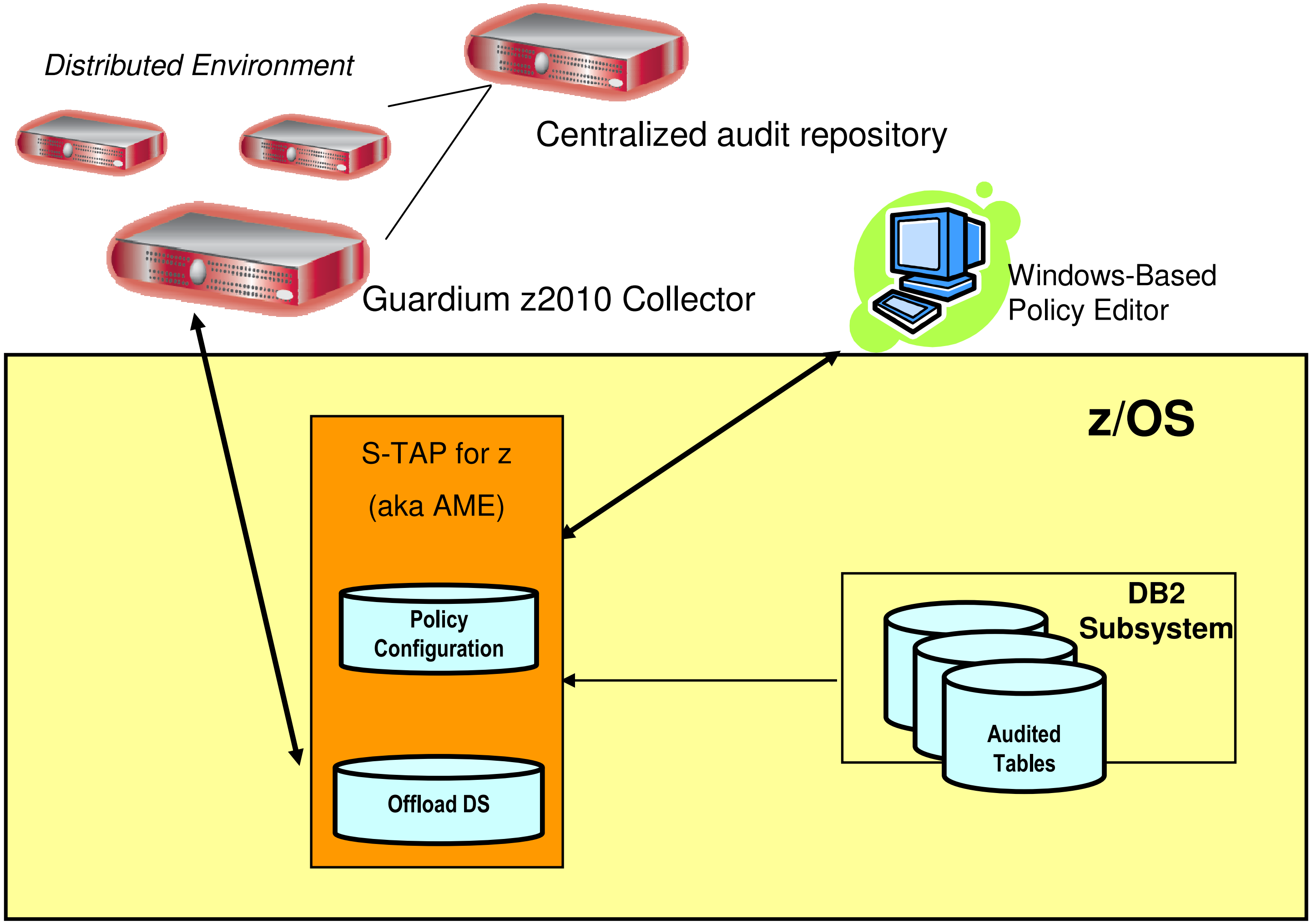
Integration with LDAP, IAM, IBM Tivoli SIEM, IBM TSM, Remedy, …

Guardium for z - Components

- S-TAP for System z (Aka AME)
  - Mainframe probe
  - Collects audit data for Collector appliance
  - Leverages existing IBM DB2/z collection technology
  - When used in the Guardium context, we’re NOT calling it AME, we’re calling it S-TAP for z. But, we’re STILL ordering AME (5655-T67)
  - NOT z-TAP, that’s another solution

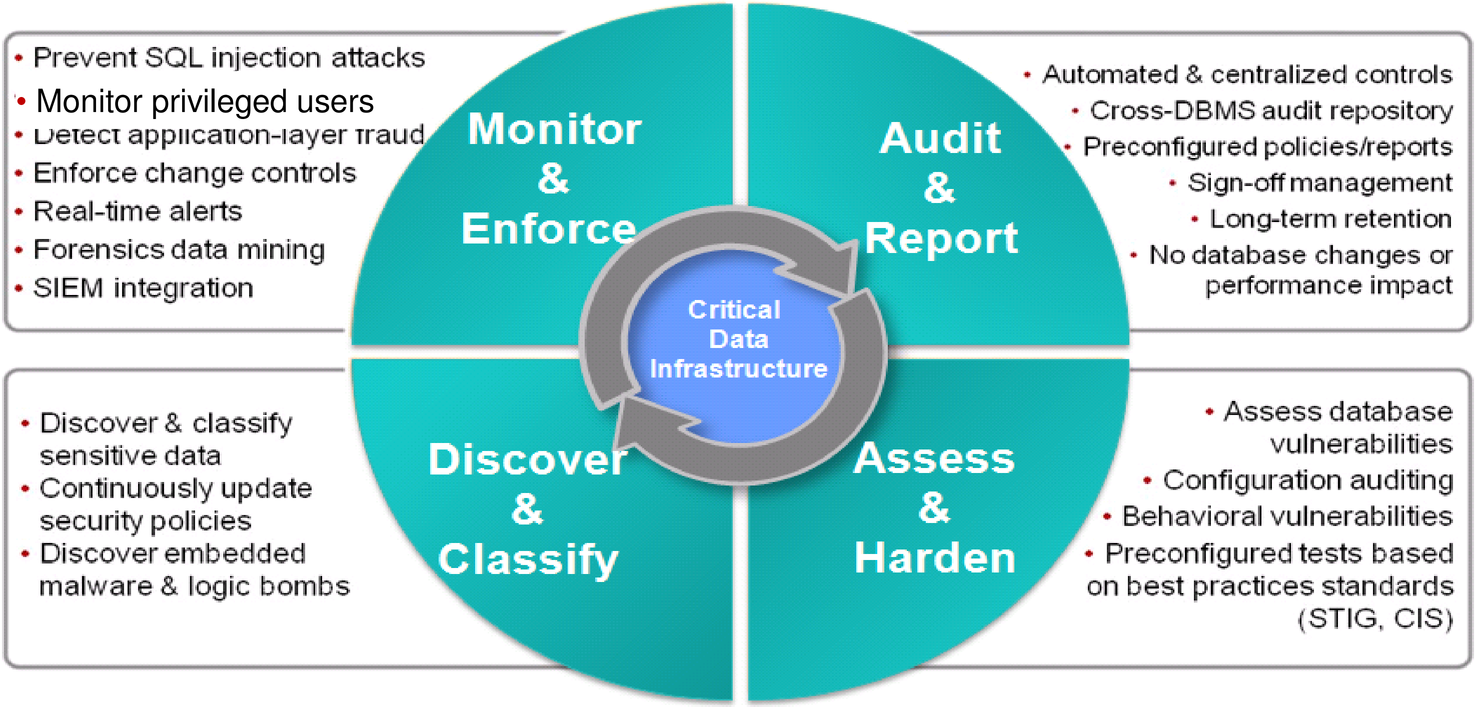
- Guardium z2010 Collector appliance
  - Securely stores audit data collected by mainframe probe
  - Provides analytics, reporting & compliance workflow automation
    - Offloads audit data processing from mainframe
  - Integrated with Guardium enterprise architecture
    - Centralized, cross-platform audit repository for enterprise-wide analytics and compliance reporting across mainframe & distributed environments
(Oracle, SQL Server, DB2, Informix, Sybase, MySQL, Teradata)

Guardium for z – Architecture



Database Activity Monitoring using Guardium

- Guardium ensures separation of roles and audit data integrity
  - No reliance on native DBMS trace or logging facilities for audit data collection
  - Audit repository placed on hardened Linux appliance
    - No Root Access
    - No “native” database access allowed
  - Control of collection and audit policies by Security administrators with no DBA involvement and without any DBMS or server privileges needed



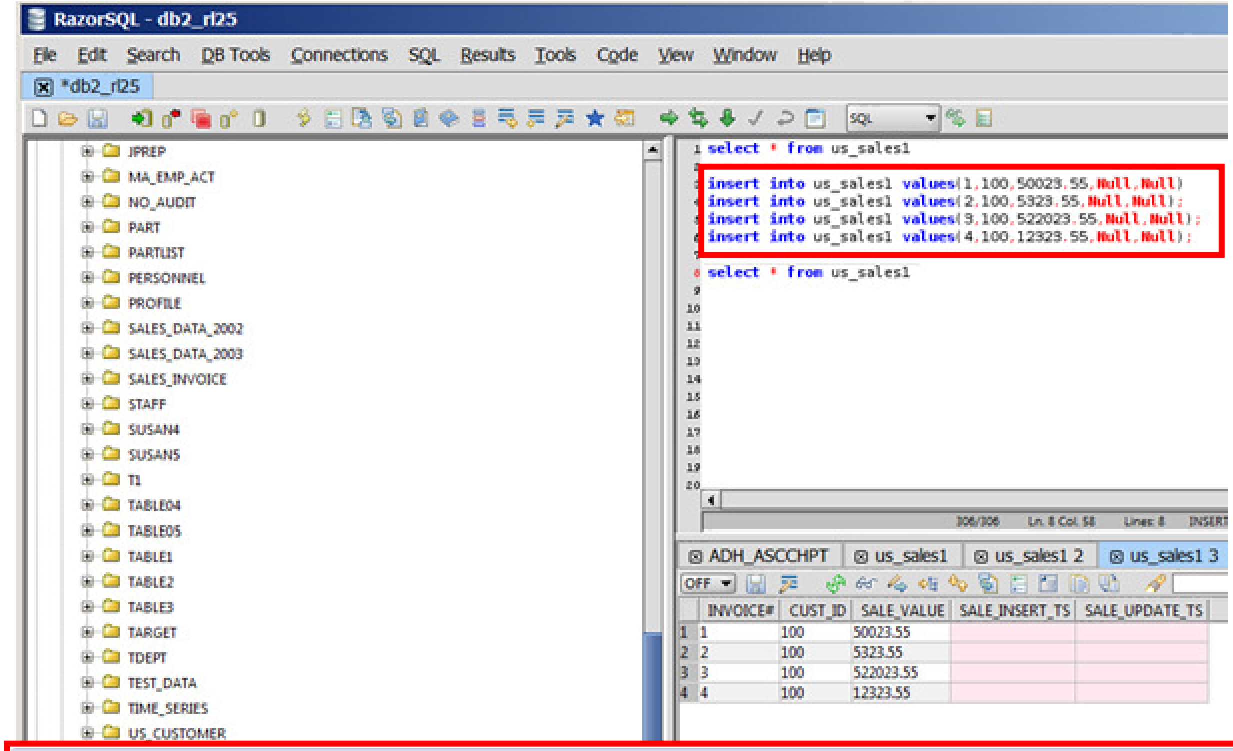
- Prevent SQL injection attacks
- Monitor privileged users
- Detect application-layer fraud
- Enforce change controls
- Real-time alerts
- Forensics data mining
- SIEM integration

- Automated & centralized controls
- Cross-DBMS audit repository
- Preconfigured policies/reports
- Sign-off management
- Long-term retention
- No database changes or performance impact

- Discover & classify sensitive data
- Continuously update security policies
- Discover embedded malware & logic bombs

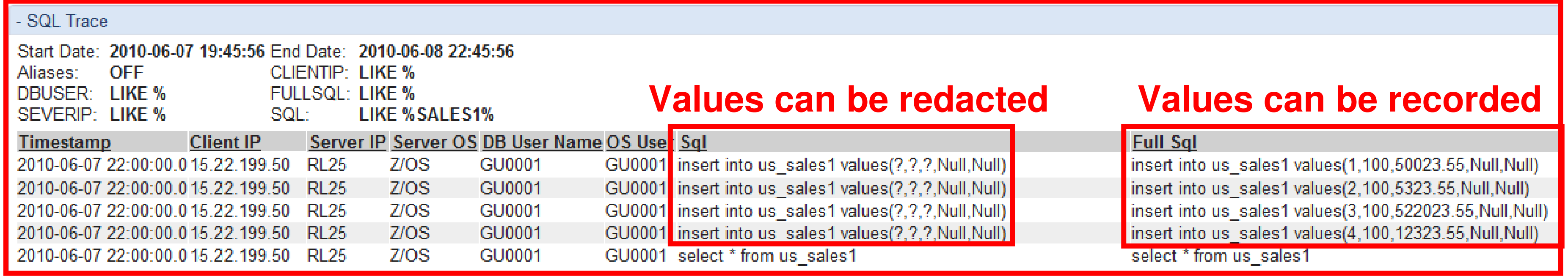
- Assess database vulnerabilities
- Configuration auditing
- Behavioral vulnerabilities
- Preconfigured tests based on best practices standards (STIG, CIS)

Reports - Inserts…



```
select * from us_sales1

insert into us_sales1 values(1,100,50023.55,Null,Null)
insert into us_sales1 values(2,100,5323.55,Null,Null);
insert into us_sales1 values(3,100,522023.55,Null,Null);
insert into us_sales1 values(4,100,12323.55,Null,Null);

select * from us_sales1
```

	INVOICE#	CUST_ID	SALE_VALUE	SALE_INSERT_TS	SALE_UPDATE_TS
1	1	100	50023.55		
2	2	100	5323.55		
3	3	100	522023.55		
4	4	100	12323.55		



- SQL Trace

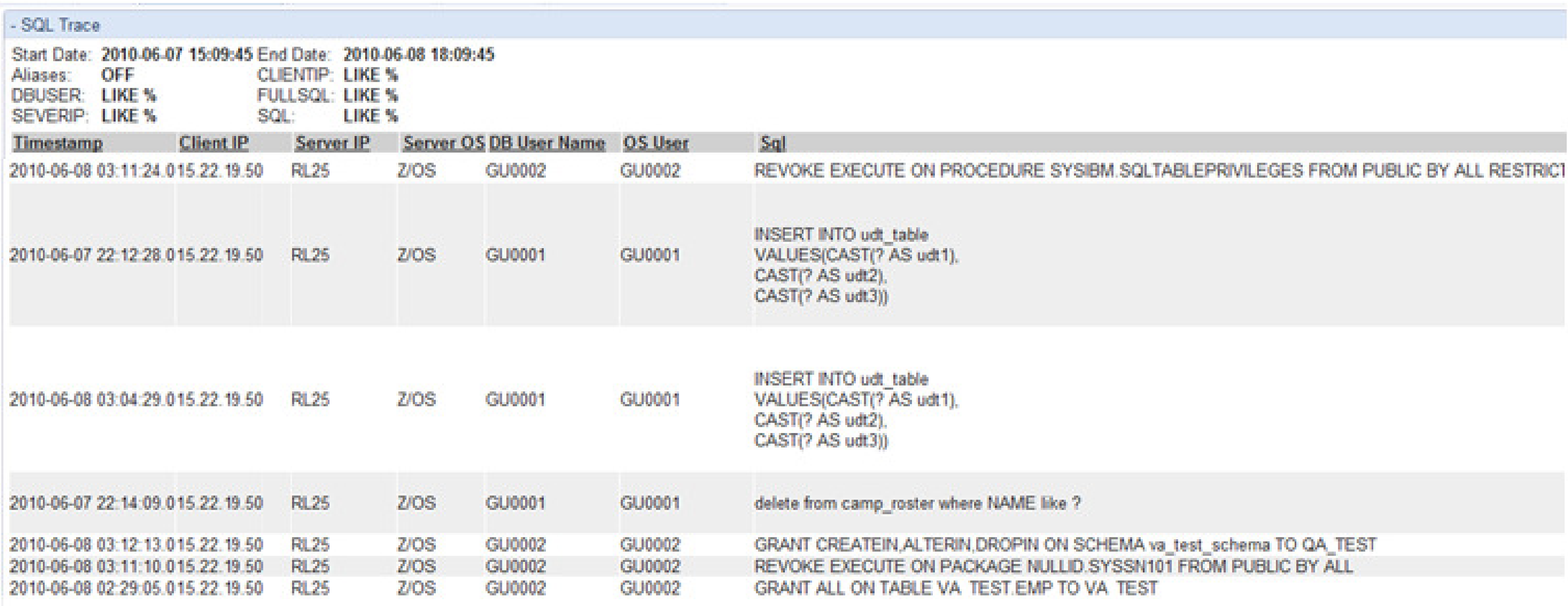
Start Date: **2010-06-07 19:45:56** End Date: **2010-06-08 22:45:56**
Aliases: **OFF** CLIENTIP: **LIKE %**
DBUSER: **LIKE %** FULLSQL: **LIKE %**
SEVERIP: **LIKE %** SQL: **LIKE %SALES1%**

Values can be redacted

Values can be recorded

Timestamp	Client IP	Server IP	Server OS	DB User Name	OS Use	Sql	Full Sql
2010-06-07 22:00:00.0	15.22.199.50	RL25	Z/OS	GU0001	GU0001	insert into us_sales1 values(?,?,?,Null,Null)	insert into us_sales1 values(1,100,50023.55,Null,Null)
2010-06-07 22:00:00.0	15.22.199.50	RL25	Z/OS	GU0001	GU0001	insert into us_sales1 values(?,?,?,Null,Null)	insert into us_sales1 values(2,100,5323.55,Null,Null)
2010-06-07 22:00:00.0	15.22.199.50	RL25	Z/OS	GU0001	GU0001	insert into us_sales1 values(?,?,?,Null,Null)	insert into us_sales1 values(3,100,522023.55,Null,Null)
2010-06-07 22:00:00.0	15.22.199.50	RL25	Z/OS	GU0001	GU0001	insert into us_sales1 values(?,?,?,Null,Null)	insert into us_sales1 values(4,100,12323.55,Null,Null)
2010-06-07 22:00:00.0	15.22.199.50	RL25	Z/OS	GU0001	GU0001	select * from us_sales1	select * from us_sales1

Sample Report



- SQL Trace

Start Date:	2010-06-07 15:09:45	End Date:	2010-06-08 18:09:45
Aliases:	OFF	CLIENTIP:	LIKE %
DBUSER:	LIKE %	FULLSQL:	LIKE %
SEVERIP:	LIKE %	SQL:	LIKE %

Timestamp	Client IP	Server IP	Server OS	DB User Name	OS User	Sql
2010-06-08 03:11:24.0	15.22.19.50	RL25	Z/OS	GU0002	GU0002	REVOKE EXECUTE ON PROCEDURE SYSIBM.SQLTABLEPRIVILEGES FROM PUBLIC BY ALL RESTRICT

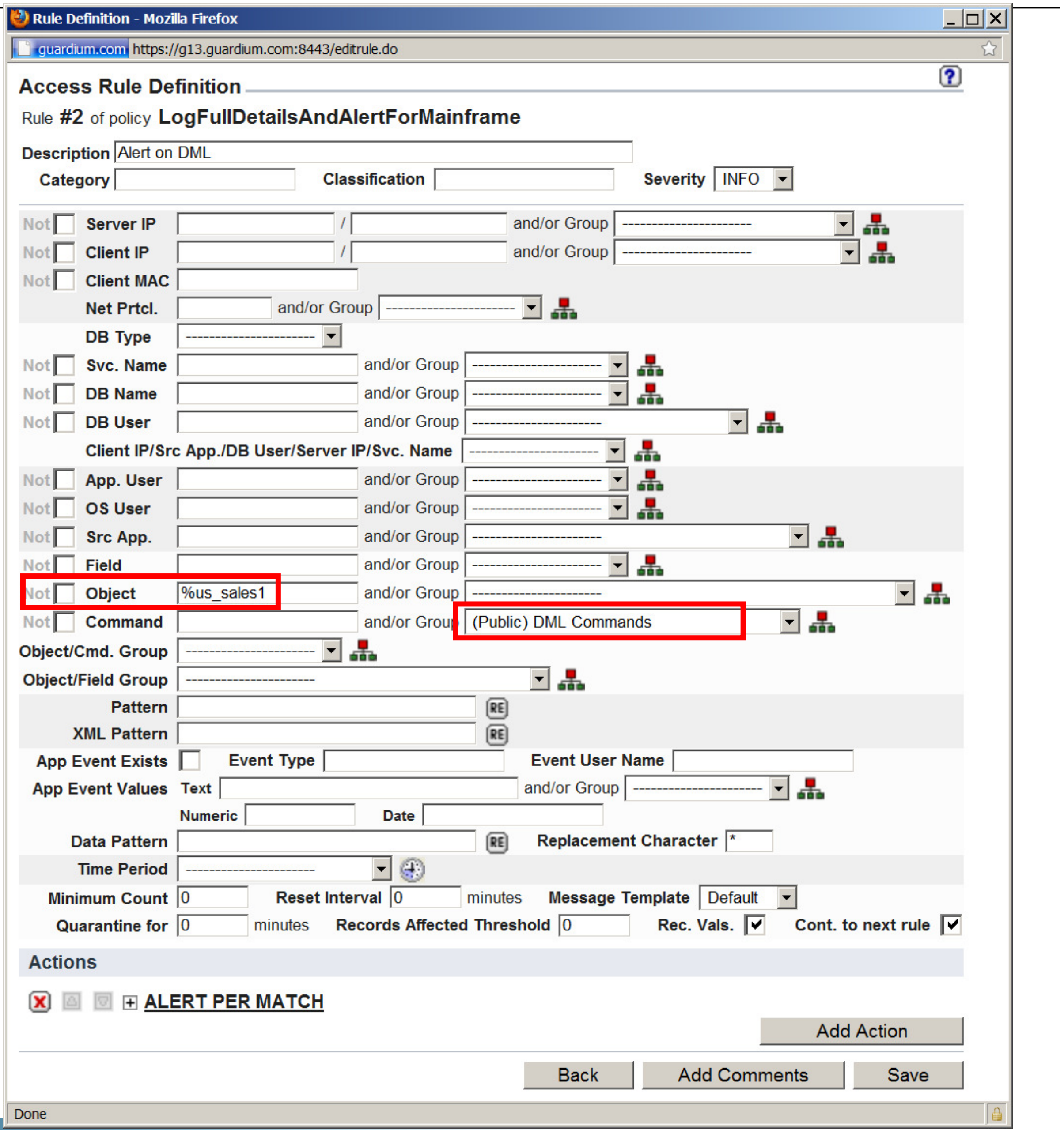
2010-06-07 22:12:28.0	15.22.19.50	RL25	Z/OS	GU0001	GU0001	INSERT INTO udt_table
						VALUES(CAST(? AS udt1),
						CAST(? AS udt2),
						CAST(? AS udt3))

2010-06-08 03:04:29.0	15.22.19.50	RL25	Z/OS	GU0001	GU0001	INSERT INTO udt_table
						VALUES(CAST(? AS udt1),
						CAST(? AS udt2),
						CAST(? AS udt3))

2010-06-07 22:14:09.0	15.22.19.50	RL25	Z/OS	GU0001	GU0001	delete from camp_roster where NAME like ?
2010-06-08 03:12:13.0	15.22.19.50	RL25	Z/OS	GU0002	GU0002	GRANT CREATEIN,ALTERIN,DROPIN ON SCHEMA va_test_schema TO QA_TEST
2010-06-08 03:11:10.0	15.22.19.50	RL25	Z/OS	GU0002	GU0002	REVOKE EXECUTE ON PACKAGE NULLID.SYSSN101 FROM PUBLIC BY ALL
2010-06-08 02:29:05.0	15.22.19.50	RL25	Z/OS	GU0002	GU0002	GRANT ALL ON TABLE VA TEST.EMP TO VA TEST

Alerts

- Processed audit data can create alerts
- Alert on any component within the policy
- In this example, US_SALES1 with DML Commands



Rule Definition - Mozilla Firefox

guardium.com https://g13.guardium.com:8443/editrule.do

Access Rule Definition

Rule **#2** of policy **LogFullDetailsAndAlertForMainframe**

Description Alert on DML

Category **Classification** **Severity** INFO

Not □ **Server IP** / and/or Group --------------------

Not □ **Client IP** / and/or Group --------------------

Not □ **Client MAC**

Net Prtcl. and/or Group --------------------

DB Type --------------------

Not □ **Svc. Name** and/or Group --------------------

Not □ **DB Name** and/or Group --------------------

Not □ **DB User** and/or Group --------------------

Client IP/Src App./DB User/Server IP/Svc. Name --------------------

Not □ **App. User** and/or Group --------------------

Not □ **OS User** and/or Group --------------------

Not □ **Src App.** and/or Group --------------------

Not □ **Field** and/or Group --------------------

Not □ **Object** %us_sales1 and/or Group --------------------

Not □ **Command** and/or Group (Public) DML Commands

Object/Cmd. Group --------------------

Object/Field Group --------------------

Pattern RE

XML Pattern RE

App Event Exists □ **Event Type** **Event User Name**

App Event Values **Text** and/or Group --------------------

Numeric **Date**

Data Pattern RE **Replacement Character** *

Time Period --------------------

Minimum Count 0 **Reset Interval** 0 minutes **Message Template** Default

Quarantine for 0 minutes **Records Affected Threshold** 0 **Rec. Vals.** ☑ **Cont. to next rule** ☑

Actions

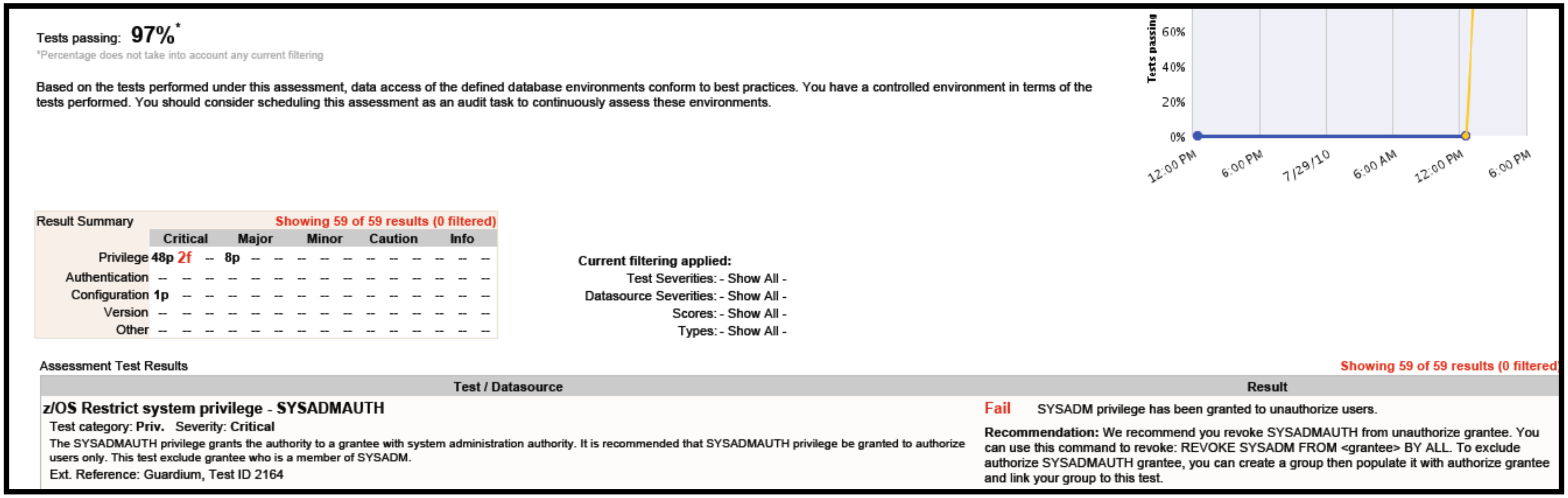
☒ ALERT PER MATCH

Vulnerability Assessment - Why is this important?

- **Database Vulnerability Assessment** –scans the database infrastructure for vulnerabilities and provides evaluation of database and data security health, with real time and historical measurements.
  - The Guardium Vulnerability Assessment application enables organizations to identify and address database vulnerabilities in a consistent and automated fashion.
  - Guardium's assessment process evaluates the health of the database environment and recommends improvement by:
  - Assessing system configuration against best practices and finding vulnerabilities or potential threats to database resources, including configuration and behavioral risks. Some examples are:
    - identifying all default accounts that haven't been disabled; checking public privileges and authentication methods chosen, etc.
    - Finding any inherent vulnerabilities present in the IT environment, like missing security patches
    - Recommending and prioritizing an action plan based on discovered areas of most critical risks and vulnerabilities. The generation of reports and recommendations provide guidelines on how to meet compliance changes and elevate security of the evaluated database environment

- VA (Vulnerability Assessment) for DB2 on z/OS (Phase 1) in Guardium V8
  - Based on DB2 Development at SVL, DISA STIG and CIS security standards
    - Server defaults
    - Patch levels
    - OS and DBMS Vulnerability Assessment

VA for DB2 z/OS



Tests passing: 97%*

*Percentage does not take into account any current filtering

Based on the tests performed under this assessment, data access of the defined database environments conform to best practices. You have a controlled environment in terms of the tests performed. You should consider scheduling this assessment as an audit task to continuously assess these environments.

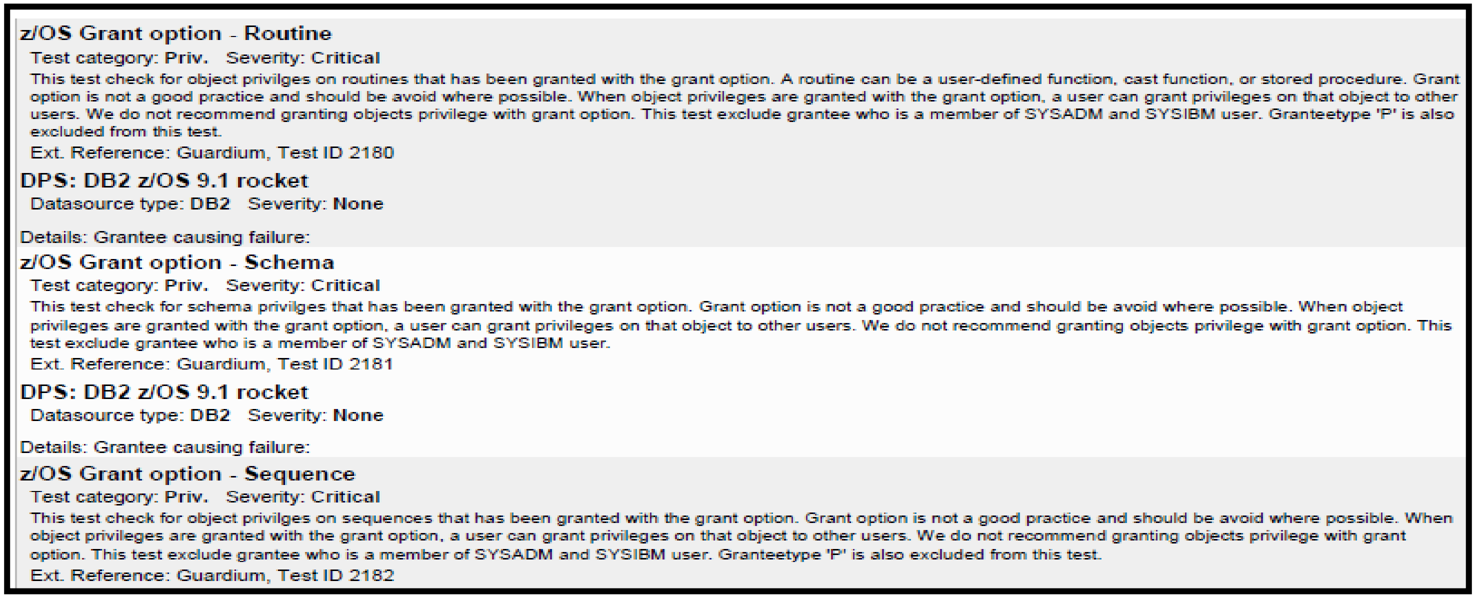
Result Summary — Showing 59 of 59 results (0 filtered)

	Critical			Major			Minor			Caution			Info		
Privilege	48p	2f	--	8p	--	--	--	--	--	--	--	--	--	--	--
Authentication	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Configuration	1p	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Version	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Other	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Current filtering applied:
Test Severities: - Show All -
Datasource Severities: - Show All -
Scores: - Show All -
Types: - Show All -

Assessment Test Results — Showing 59 of 59 results (0 filtered)

Test / Datasource	Result
z/OS Restrict system privilege - SYSADMAUTH Test category: **Priv.** Severity: **Critical** The SYSADMAUTH privilege grants the authority to a grantee with system administration authority. It is recommended that SYSADMAUTH privilege be granted to authorize users only. This test exclude grantee who is a member of SYSADM. Ext. Reference: Guardium, Test ID 2164	Fail SYSADM privilege has been granted to unauthorize users. **Recommendation:** We recommend you revoke SYSADMAUTH from unauthorize grantee. You can use this command to revoke: REVOKE SYSADM FROM <grantee> BY ALL. To exclude authorize SYSADMAUTH grantee, you can create a group then populate it with authorize grantee and link your group to this test.



z/OS Grant option - Routine

Test category: **Priv.** Severity: **Critical**

This test check for object privilges on routines that has been granted with the grant option. A routine can be a user-defined function, cast function, or stored procedure. Grant option is not a good practice and should be avoid where possible. When object privileges are granted with the grant option, a user can grant privileges on that object to other users. We do not recommend granting objects privilege with grant option. This test exclude grantee who is a member of SYSADM and SYSIBM user. Granteetype 'P' is also excluded from this test.

Ext. Reference: Guardium, Test ID 2180

DPS: DB2 z/OS 9.1 rocket

Datasource type: **DB2** Severity: **None**

Details: Grantee causing failure:

z/OS Grant option - Schema

Test category: **Priv.** Severity: **Critical**

This test check for schema privilges that has been granted with the grant option. Grant option is not a good practice and should be avoid where possible. When object privileges are granted with the grant option, a user can grant privileges on that object to other users. We do not recommend granting objects privilege with grant option. This test exclude grantee who is a member of SYSADM and SYSIBM user.

Ext. Reference: Guardium, Test ID 2181

DPS: DB2 z/OS 9.1 rocket

Datasource type: **DB2** Severity: **None**

Details: Grantee causing failure:

z/OS Grant option - Sequence

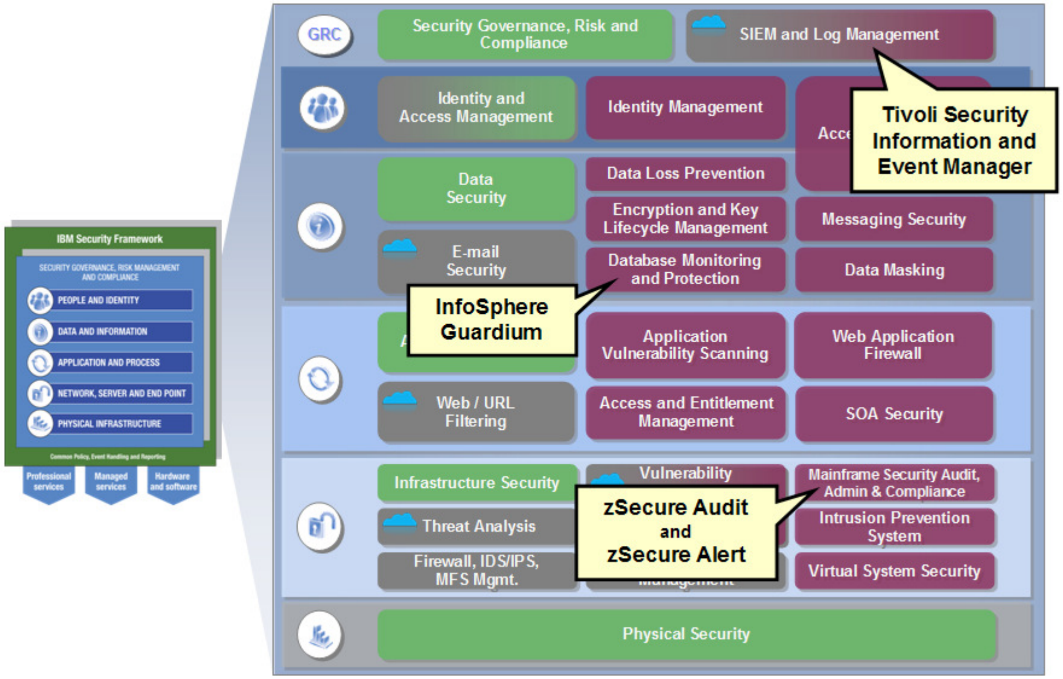
Test category: **Priv.** Severity: **Critical**

This test check for object privilges on sequences that has been granted with the grant option. Grant option is not a good practice and should be avoid where possible. When object privileges are granted with the grant option, a user can grant privileges on that object to other users. We do not recommend granting objects privilege with grant option. This test exclude grantee who is a member of SYSADM and SYSIBM user. Granteetype 'P' is also excluded from this test.

Ext. Reference: Guardium, Test ID 2182

Why is Guardium Needed With TSIEM and zSecure?

- Traditional approaches to database security and compliance rely upon native logging, which:
  - Does not meet auditors requirements for separation of duties
  - Can easily be circumvented by DBAs
  - Imposes a higher performance overhead on database servers
  - Does not provide real-time alerting or blocking
  - Does not enable enforcement of consistent policies in heterogeneous environments



Tivoli Security Information and Event Manager

InfoSphere Guardium

zSecure Audit and zSecure Alert

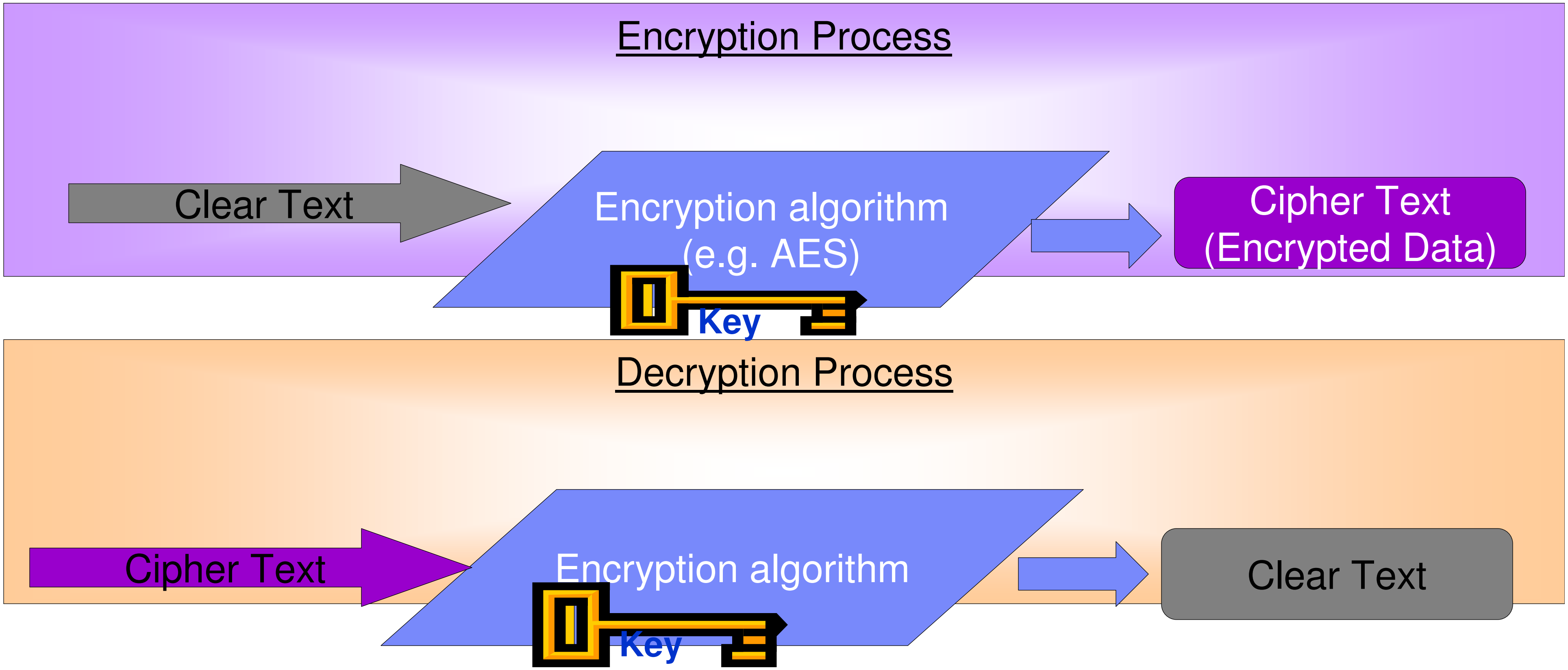
Encryption and “Data at Rest” Protection

- Key requirement for most of the “popular” data protection initiatives
- Main requirement is to protect “data at rest” to ensure that only access if for business need-to-know, and through mechanisms which can be controlled by the native security mechanisms (such as RACF)
- Consider the following scenario:
  - DB2 Linear VSAM datasets are controlled via RACF from direct access outside of DB2 via dataset access rules
  - DBA or Storage Administrator has RACF authority to read VSAM datasets in order to perform legitimate storage administration activities.
  - Administration privileges can be abused to read the linear VSAM datasets directly and access clear-text data outside of DB2/RACF protections.
- Now consider the above scenario, but with the underlying Linear VSAM datasets encrypted
  - When DBA or Storage Administrator uses their RACF dataset authorities in a manner which is outside of business need-to-know, the data retrieved is cybertext and thus remains encrypted and protected.
  - Only way to access and obtain clear-text data will be via SQL which can be protected via DB2/RACF interface

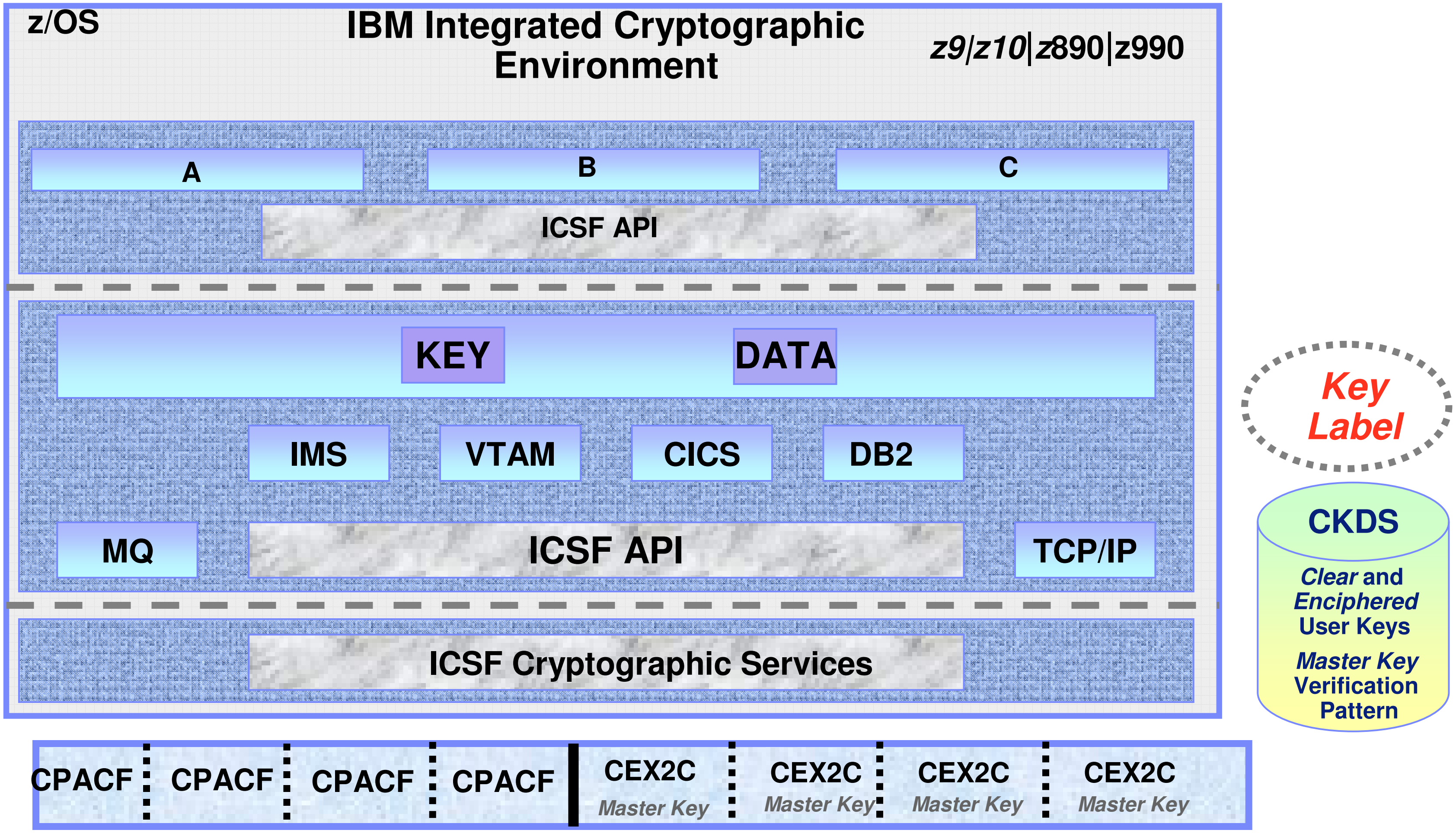
Encryption and DB2 for z/OS

- IBM Data Server Drivers starting in V9.5 support SSL protocol and AES encryption.
- Starting with Fix Pack 2, non-Java clients supports the Secure Sockets Layer (SSL) protocol. All DB2 Version 9.5 clients now support SSL. In addition, Java and CLI clients now support 256-bit AES encryption.
- SSL connectivity and AES user ID and password encryption requires Communication's AT-TLS configured and ICSF started. AES support requires PK56287 to be applied on DB2.
- Starting with DB2 for z/OS V8, column level encryption implemented via SQL primitives is supported
- Row level encryption implemented for all supported releases of DB2 for z/OS using the IBM Encryption Tool for IMS and DB2 databases
- DS8000 DASD Based Encryption
- TS1120/TS1130 Tape Based Encryption
- TKLM (Tivoli Key Lifecycle Manager) Required for DS8000 and recommended for TS1120/TS1130

Encryption is a technique used to help protect data from unauthorized access



- Data that is not encrypted is referred to as “clear text”
- Clear text is encrypted by processing with a “key” and an encryption algorithm
  - Several standard algorithms exist, include DES, TDES and AES
- Keys are bit streams that vary in length
  - For example AES supports 128, 192 and 256 bit key lengths



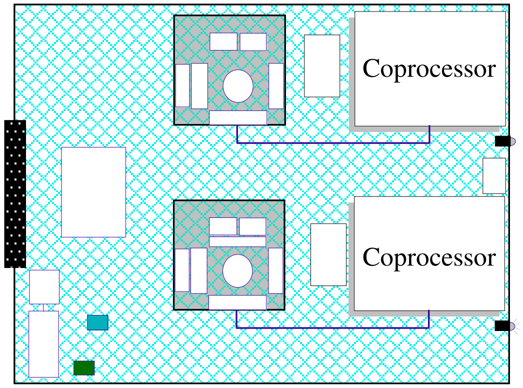
CP Assist for Cryptographic Functions

- Problem State Instructions
- Clear Keys Only
- DES/TDES Encryption
- AES (128 Bit)
- SHA-1 (256 on z9)

Crypto Express 2 Coprocessor

- ICSF Access Only (Key 0)
- Master Key Stored Within Boundary of Crypto Express 2 Feature
- Secure Key DES/TDES Encryption
- SSL Accelerator
- Tamper Resistant

System z9/z10 Cryptographic Support Summary



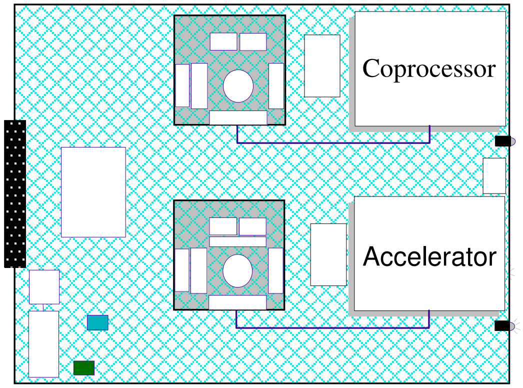
CP Assist for Cryptographic Function (CPACF) “free”

- Supports DES, TDES and SHA-1
- Standard on System z9/z10 (feature code 3863)
- Standard on every CP and IFL
- Advanced Encryption Standard (AES)
- Secure Hash Algorithm – 256 (SHA-256)
- Pseudo Random Number Generation (PRNG)

Crypto Express2 (feature code 0863) “fee”

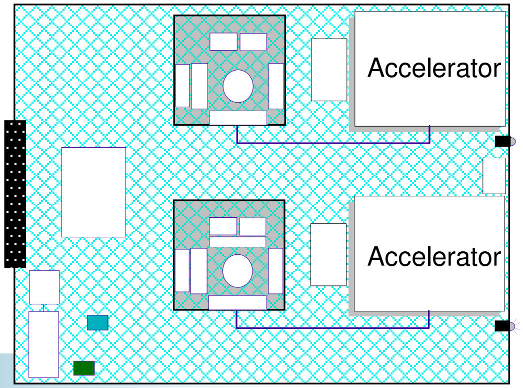
Crypto Express3 (feature code 4863) “fee”

- Two configuration modes
- Coprocessor (default)
- Federal Information Processing Standard (FIPS) 140-2 Level 4 certified
- “Tamper Resistant”
- (Secure Key) – “Exclusive”
- SSL Accelerator (Handshake offload)



Three configuration options

- Default set to Coprocessor (1)
- SSL Acceleration (3)
- Mixture of configuration (2)



Encryption - key forms on z/OS

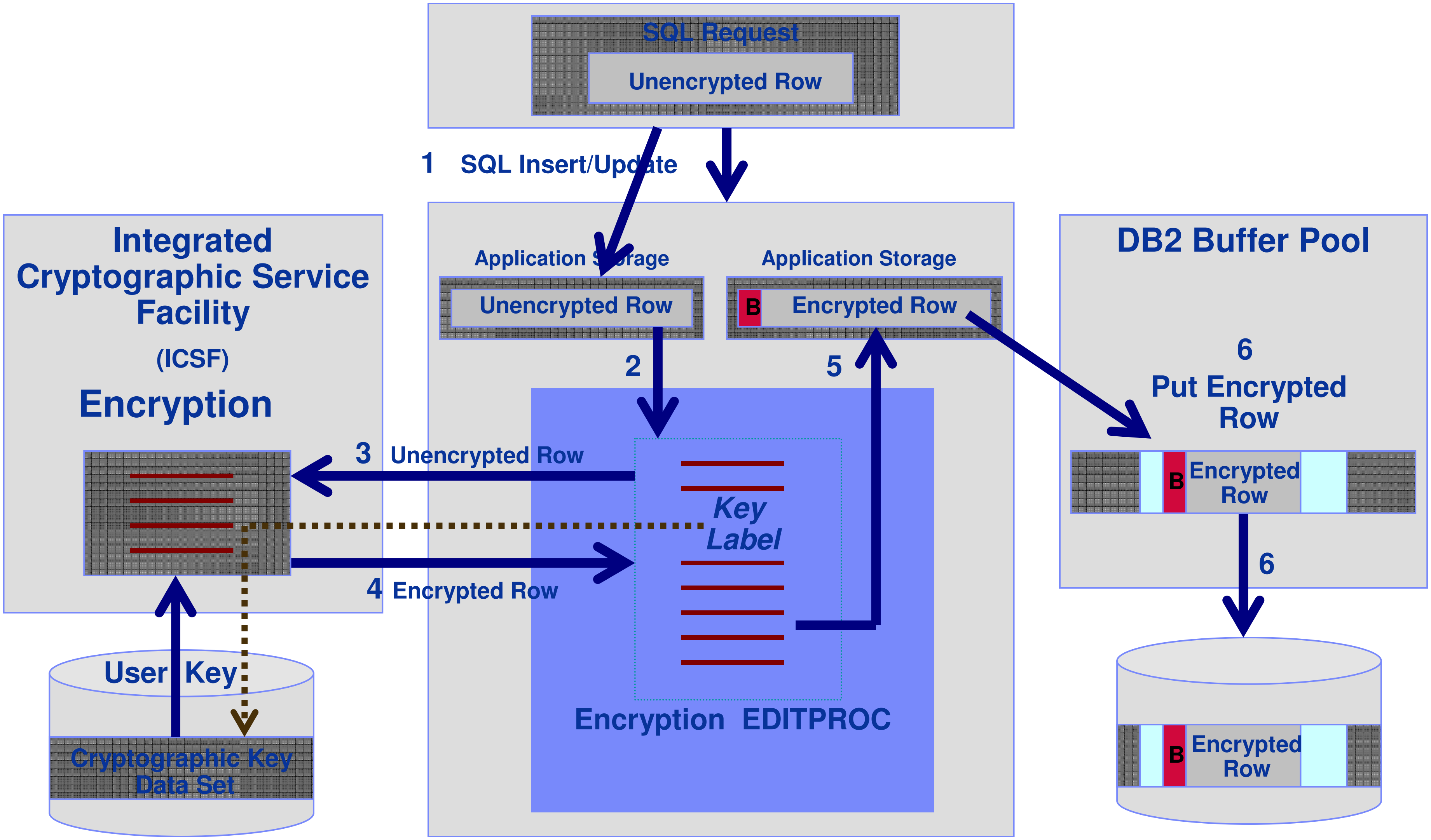
	zSeries 900	System z9 & z10		System z10
	CCA Secure Key	Clear Key	CCA Secure Key	CPACF Protected Key
Key Wrapping: Host Storage	CCA Master Key **– Key material is never visible in the clear outside the tamper resistant hardware boundary**	None – **Key material is visible in the clear in system and application storage .**	CCA Master Key – **Key material is never visible in the clear outside the tamper resistant hardware boundary**	CPACF Wrapping Key **– Key material is not visible in the clear in *operating system or application storage*.**
Key Wrapping: Key Store	CCA Master Key – **Key material is never visible in the clear outside the tamper resistant hardware boundary**	None – **Key material is visible in the clear key store.**	CCA Master Key – **Key material is never visible in the clear outside the tamper resistant hardware boundary**	CCA Master Key – **Key material is never visible in the clear outside the tamper resistant hardware boundary**
Key Store	CKDS or *application key file*	CKDS or *application key file*	CKDS or *application key file*	CKDS only
Encryption Engine	CCF	CPACF **or software**	CEX2C	CPACF
Symmetric Encryption Algorithms	DES and TDES	DES, TDES and AES	DES, TDES and AES	DES, TDES and AES
Benefits	***High Security***	***High Performance***	***High Security***	***High Performance*** ***High Security***

Encryption Tool for IMS and DB2 Databases

- **Generates standard DB2 EDITPROC for Accessing Cryptographic Functions**
- **All Supported DB2 Versions**
- **Member of IBM IMS | DB2 Tools Family of Products**
- **Pre-coded EDITPROC for encryption of DB2® Data**
- **Encryption/Decryption occurs at the DB2 Row Level**
- **Unique EDITPROC can be defined for each DB2 Table**
- **Exploits z/OS Integrated Cryptographic Service Facility (ICSF)**
- **Exploits zSeries CPACF Cryptographic Hardware Directly**
- **Requires no changes to your applications**
- **Fast implementation**

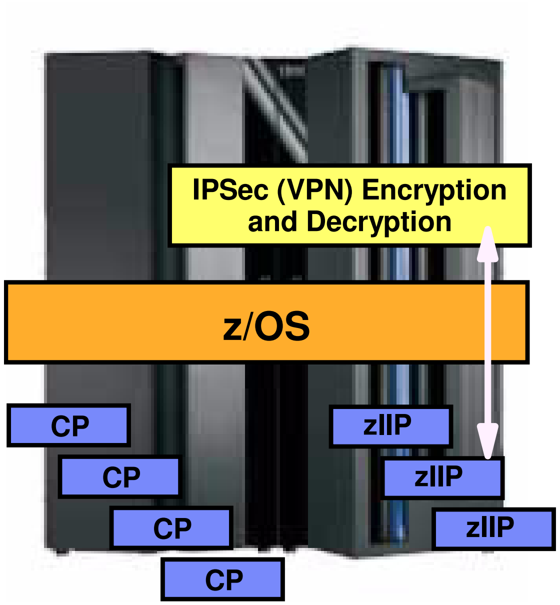
- **Edit Procedures (EDITPROC) are Programs that:**
- **Transform Data on INSERT | UPDATE | LOAD**
- **Restore Data to Original Format on SELECT**
- **Transformations on Entire ROW**
- **Supported by Utilities**
- **Implemented via Create Table specification**
- **Requires unload/load of data**

DB2 Data Encryption Flow – Insert / Update



zIIP Assisted IPSec (VPN) on z/OS

- **Benefits of having secure channel end-point on z/OS**
  - No clear-text data on any network segments
    - Security regulations compliance
  - End-to-end authentication of secure channel end-points
    - Both end-point authentication and message authentication
  - Key management and storage done on System z by z/OS
  - Compliance with end-to-end security regulations
- **System z CPU cost is a concern**
  - Encryption/decryption CPU cost can be a significant percentage of overall CPU cost for a given application
  - Especially the case for streaming workloads (file transfer type of workload)
- **zIIP processors**
  - Specialty processor on System z9 or later hardware
  - zIIPs priced lower than general purpose processors
  - No IBM software charges on zIIPs
- **zIIP Assisted IPSec**
  - Use zIIP processors for most IPSec encryption/decryption
  - Lower the cost of doing IPSec processing on z/OS



System z9 or later

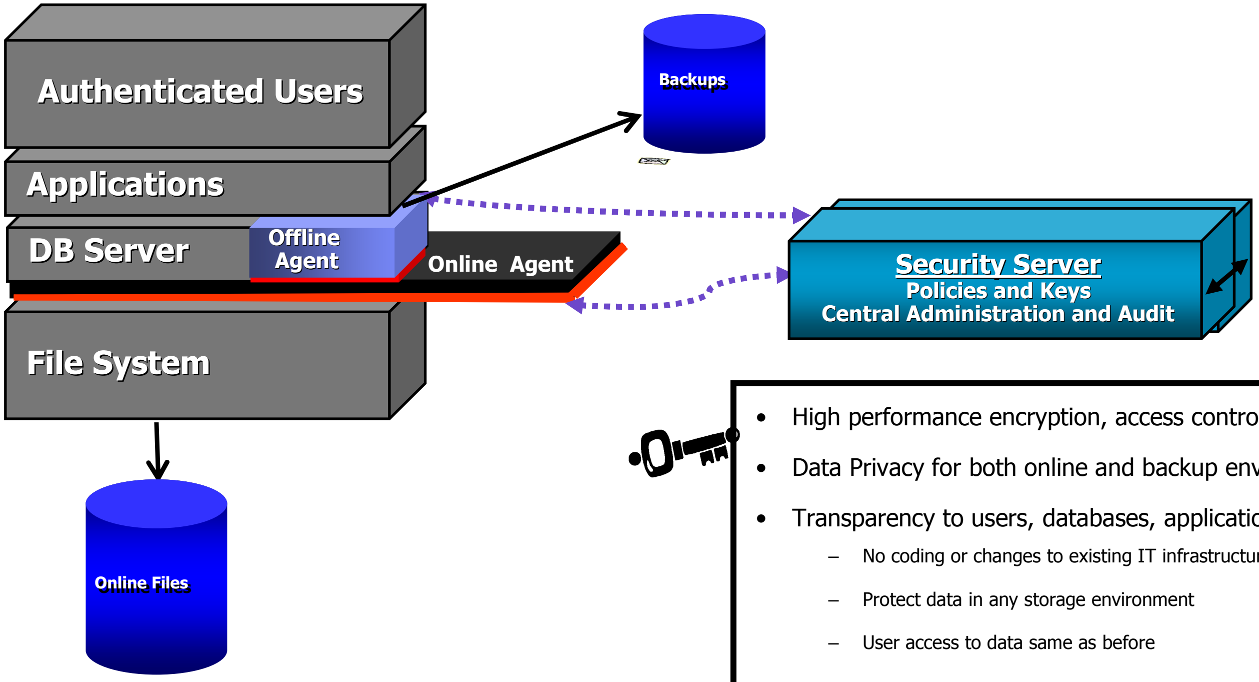
z/OS CS V1R8 + PTFs

z/OS CS V1R9

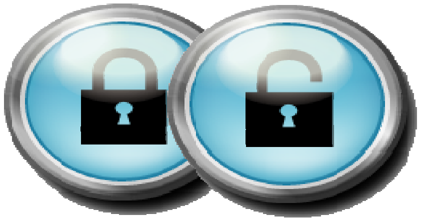
IBM DS8000 Disk Encryption - Characteristics

- Customer data at rest is encrypted
  - Data at rest = data on any disk or in any persistent memory
- Customer data in flight is not encrypted
  - Data in flight = on I/O interfaces or in dynamic memories (Cache, NVS)
    - If you can read/write to disk, you get access to clear-text data.
- Uses Encrypting Disk
  - Encryption hardware in disk (AES 128)
  - Runs at full data rate
  - 146/300/450 GBs 15K RPM
    - No measurable performance impact
- Integrated with Tivoli Key Lifecycle Manager (TKLM)
  - DS8000 automatically communicates with TKLM when configuring encryption group or at power on to obtain necessary encryption keys to access customer data
  - Each disk has an encryption key
    - Data is always encrypted on write and decrypted on read
    - Encryption key is wrapped with access credential and maintained within the disk
    - Access credential maintained by TKLM
    - Establishing a new encryption key causes cryptographic erasure
- Key attack vectors prevented:
  - Disk removed (repair, or stolen)
  - Box removed (retire, or stolen)

Optim Encryption Expert – Data Encryption



UDB, IDS, and Others



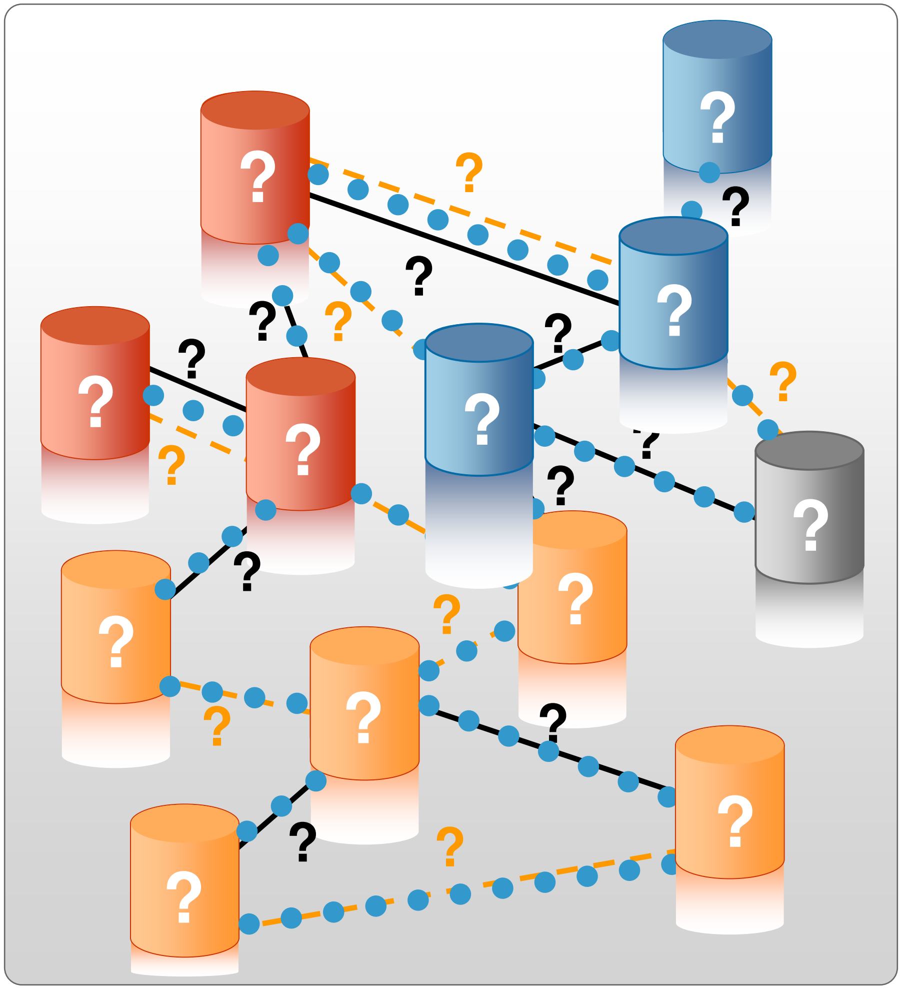
- High performance encryption, access control and auditing
- Data Privacy for both online and backup environments
- Transparency to users, databases, applications, storage
  - No coding or changes to existing IT infrastructure
  - Protect data in any storage environment
  - User access to data same as before
- Centralized administration
  - Policy and Key management
  - Audit logs
  - High Availability

Discovery, Test Data Management/Obfuscation, and Data Growth

Automate Discovery and Accelerate Information Understanding

- Significant Acceleration of Information Agenda projects
  - Data Growth Management
  - Test Data Management
  - Sensitive Data De-identification
  - Application/Data Consolidation, Migration & Retirement
  - Master Data Management and Data Warehousing

- Why is this Different?
  - Data-based discovery
  - Automate discovery of business entities, cross-source business rules & transformation logic
  - Evaluate multiple data sources simultaneously
  - Identify & remediate cross-system rules and inconsistencies



InfoSphere Discovery Components

Cross-Profiler

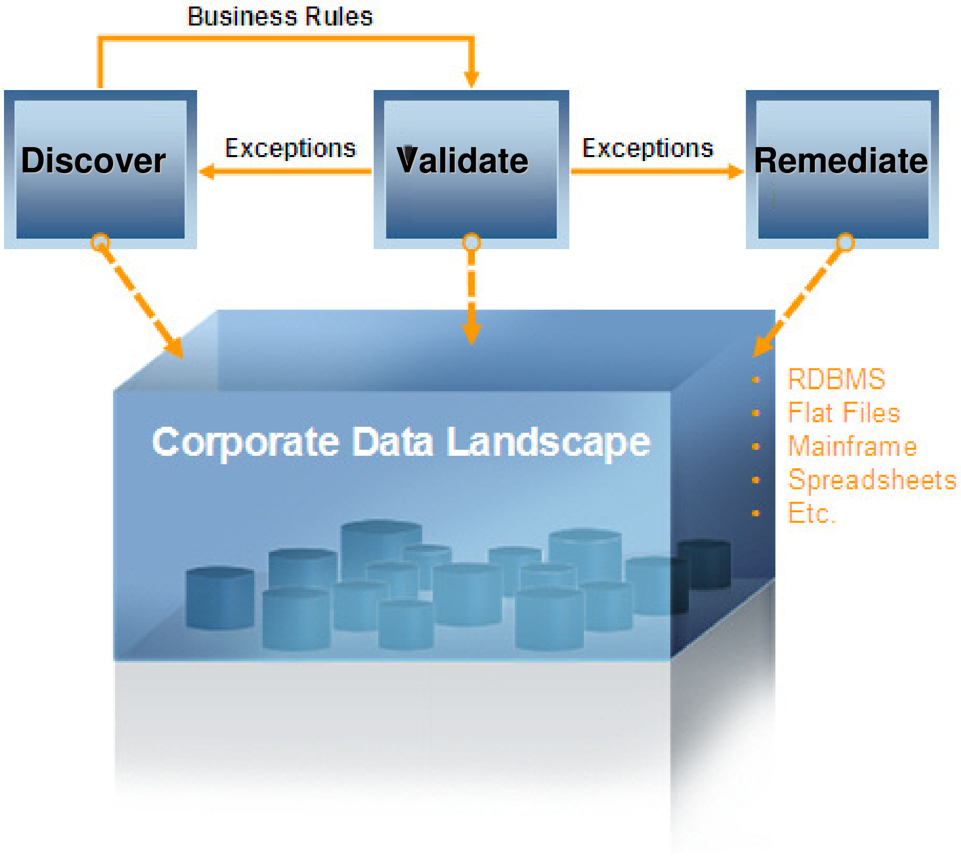
– Basic profiling plus automated primary-foreign key, business entity & cross-source overlaps discovery

Unified Schema Builder:

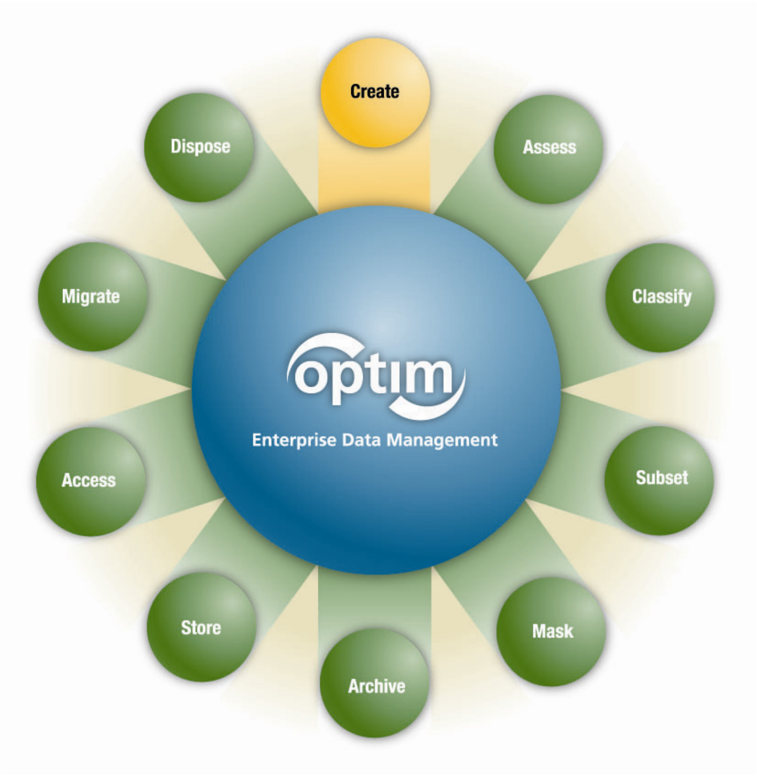
– Prototype empty targets from the combination of many data sources

Transformation Analyzer:

– Discover complex business rules and transformation logic between two data sources

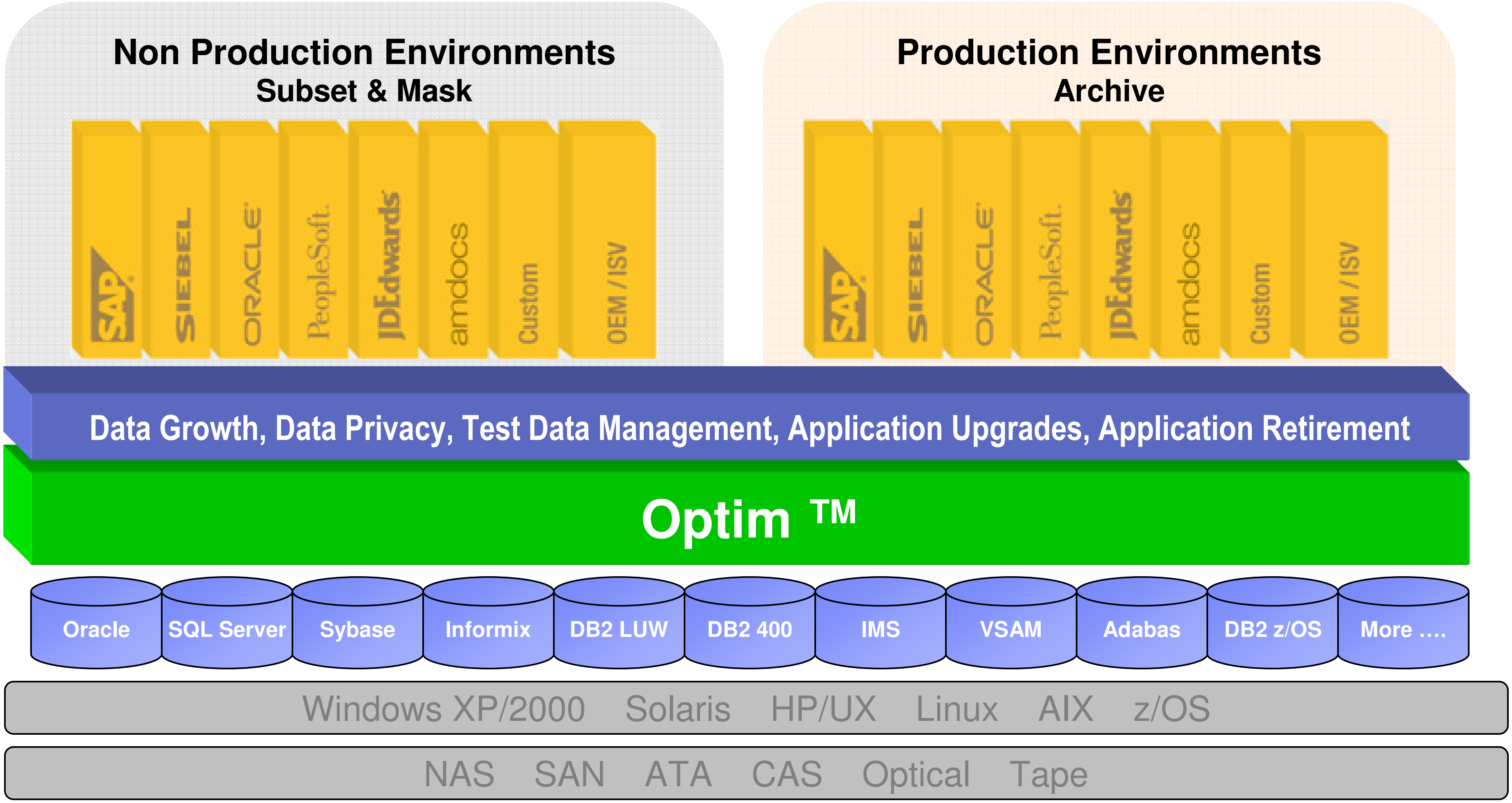


Optim™ Solutions



- Optim™ Data Growth Solution (Archiving)
  - Improve performance
  - Control data growth, save storage
  - Support retention compliance
  - Enable application retirement
  - Streamline upgrades
- Optim™ Test Data Management Solution
  - Create targeted, right sized test environments
  - Improve application quality
  - Speed iterative testing processes
- Optim™ Data Privacy Solution
  - Mask confidential data
  - Comply with privacy policies
- Enterprise Capabilities
  - Single, scaleable solution for complex multi-DB application environments

Enterprise Architecture

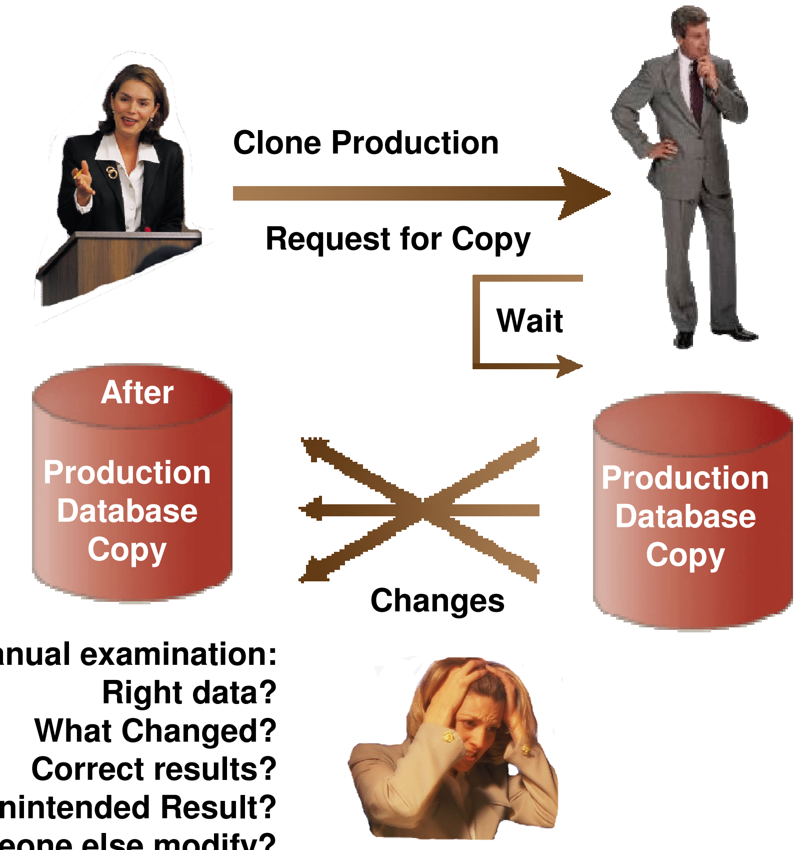


- Single, scalable, interoperable EDM solution provides a central point to deploy policies to extract, store, port, and protect application data records from creation to deletion

Current Practices?

#1 - Clone Production

Repeat ?*%$!



Clone Production

Request for Copy

Wait

After

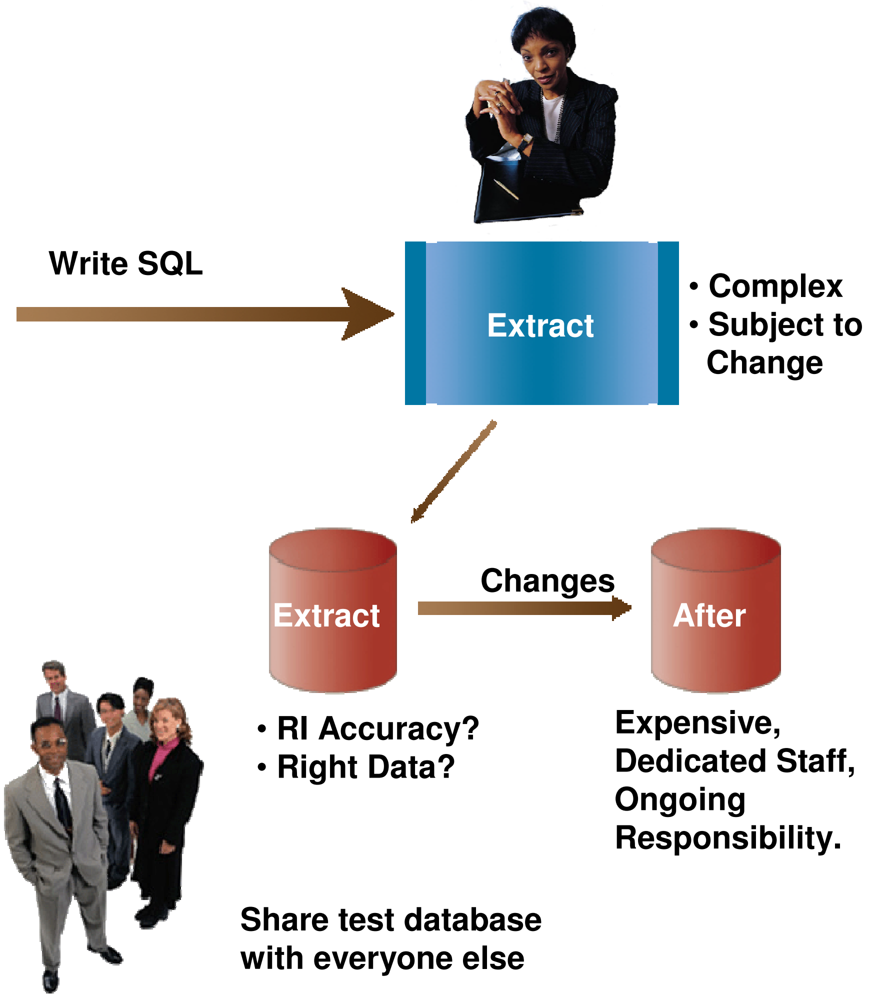
Production Database Copy

Changes

Production Database Copy

Manual examination:
Right data?
What Changed?
Correct results?
Unintended Result?
Someone else modify?

#2 - Write SQL



Write SQL

Extract

- Complex
- Subject to Change

Extract

Changes

After

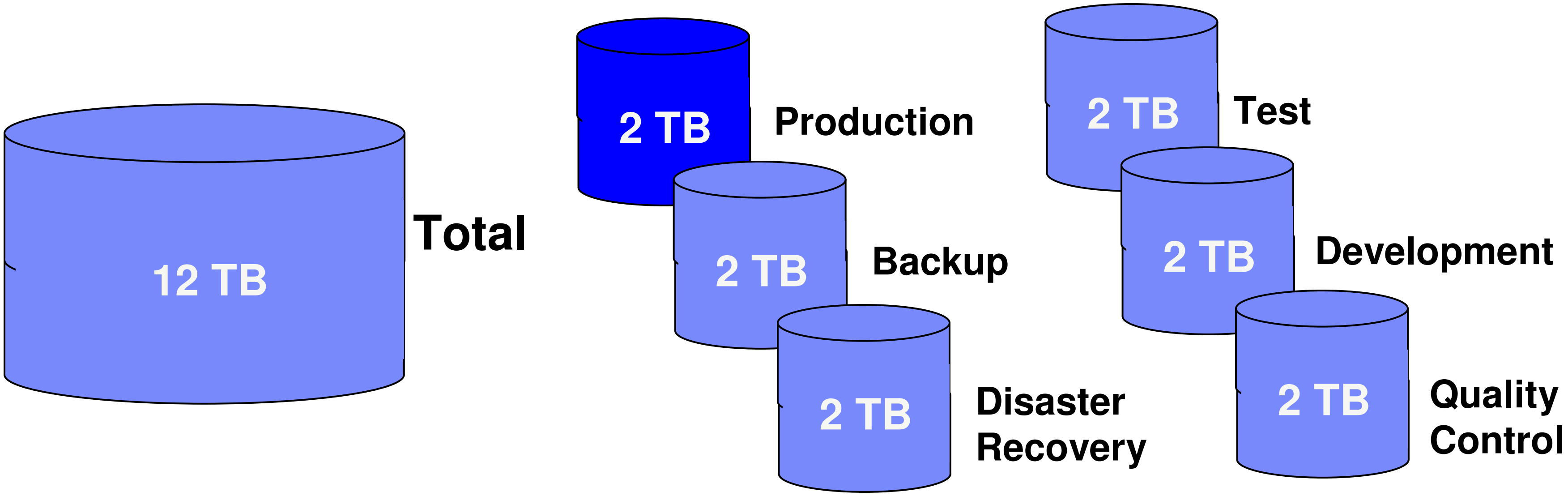
- RI Accuracy?
- Right Data?

Expensive,
Dedicated Staff,
Ongoing
Responsibility.

Share test database
with everyone else

Data Multiplier Effect

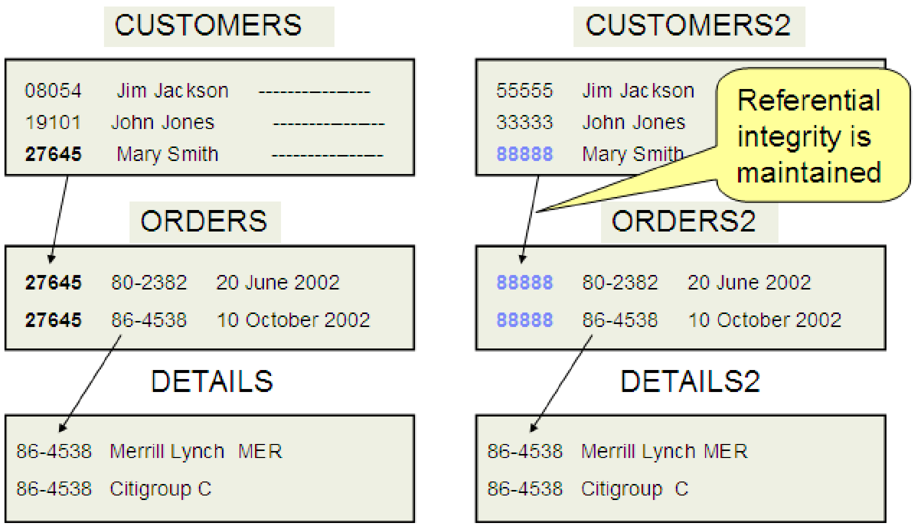
Actual Data Burden = Size of production database + all replicated clones



Data Obfuscation and Data Relationships

- Data Obfuscation
  - AKA data masking, depersonalization, desensitization, obfuscation or data scrubbing
  - Technology that helps conceal real data
  - Scrambles data to create new, legible data
  - Retains the data's properties, such as its width, type, and format
  - Common data masking algorithms include random, substring, concatenation, date aging
  - Used in Non-Production environments as a Best Practice to protect sensitive data

Obfuscation of Key Columns: When sensitive data is a key column involved in a relationship, then care must be taken to ensure that the obscured value is changed in all rows of data that reference that changed value, this is referred to as key propagation.



CUSTOMERS

08054	Jim Jackson	---------------
19101	John Jones	---------------
27645	Mary Smith	---------------

ORDERS

27645	80-2382	20 June 2002
27645	86-4538	10 October 2002

DETAILS

86-4538	Merrill Lynch	MER
86-4538	Citigroup	C

CUSTOMERS2

55555	Jim Jackson
33333	John Jones
88888	Mary Smith

Referential integrity is maintained

ORDERS2

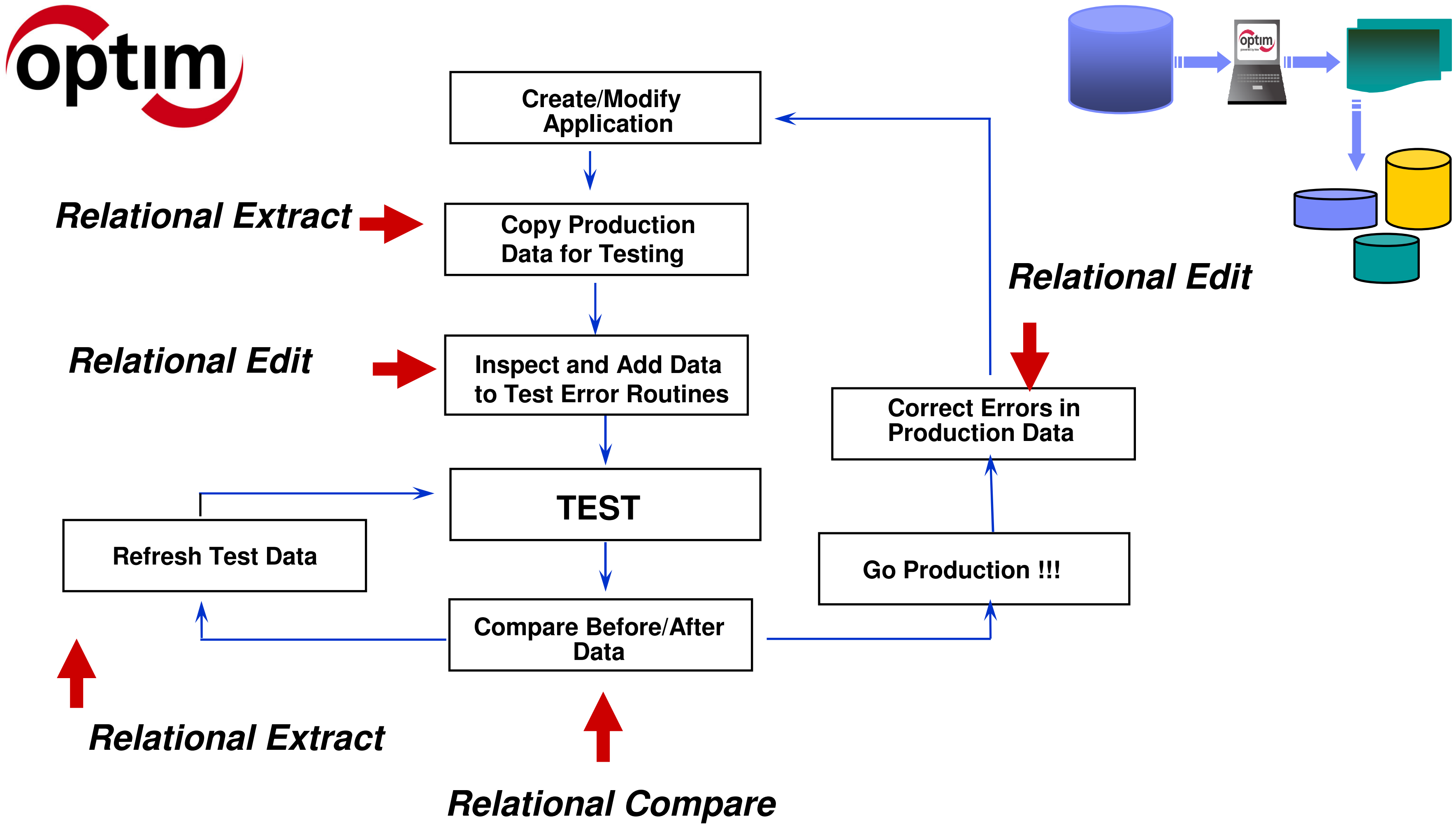
88888	80-2382	20 June 2002
88888	86-4538	10 October 2002

DETAILS2

86-4538	Merrill Lynch	MER
86-4538	Citigroup	C

Optim Overview
Relational Extract Facility / Test Data Management

Product Overview : Optim Test Data Management



Create/Modify Application

Relational Extract

Copy Production Data for Testing

Relational Edit

Inspect and Add Data to Test Error Routines

TEST

Refresh Test Data

Compare Before/After Data

Relational Extract

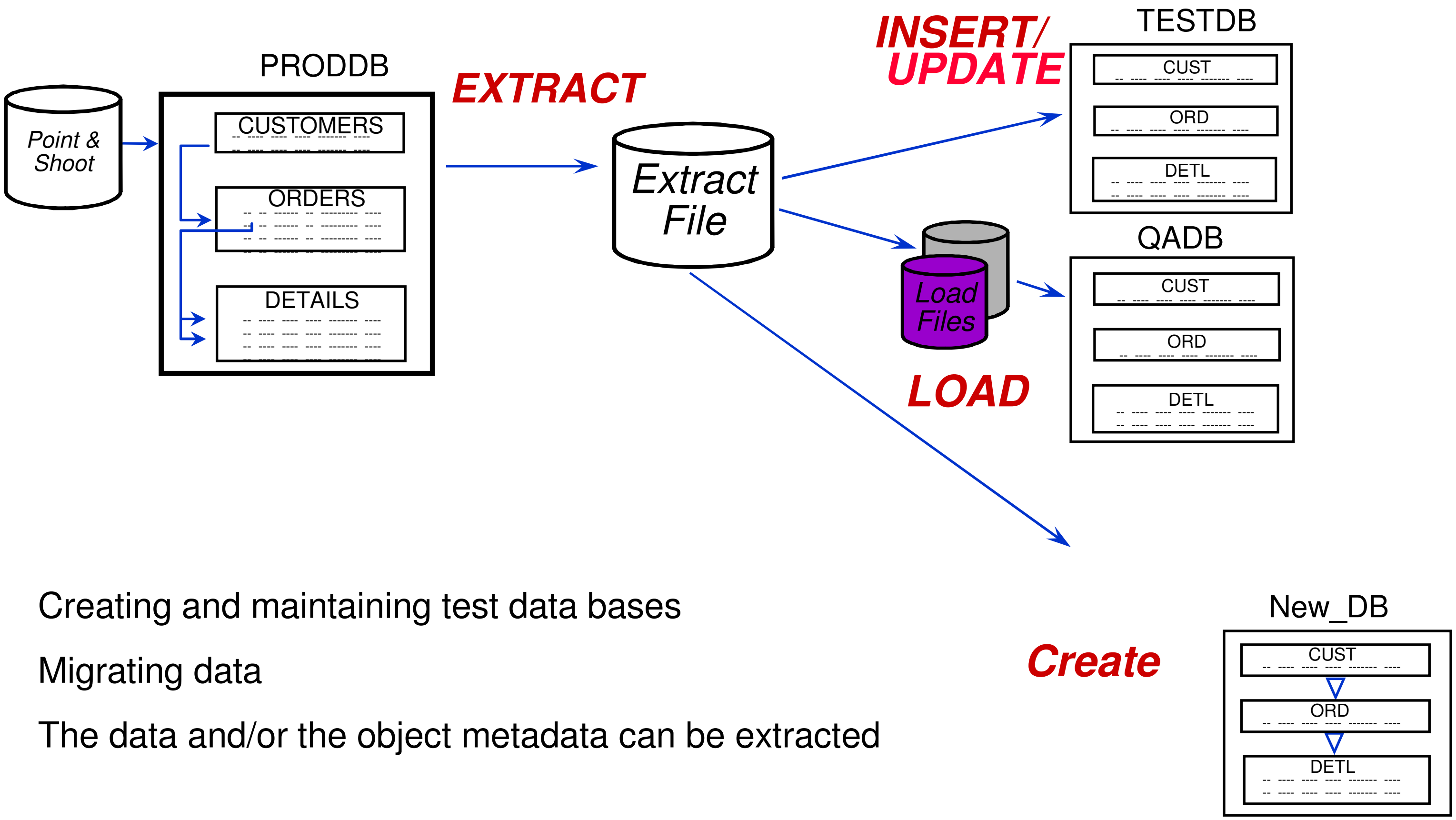
Relational Compare

Go Production !!!

Correct Errors in Production Data

Relational Edit

OPTIM Relational Extract Facility



- Creating and maintaining test data bases
- Migrating data
- The data and/or the object metadata can be extracted

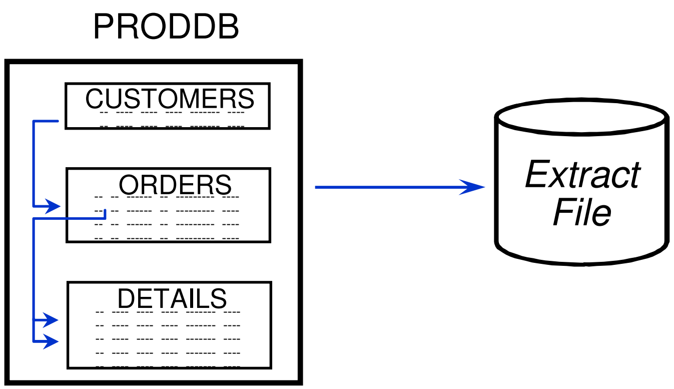
Defining the Extract…..

Tables

Views

Synonyms

Aliases



Required:

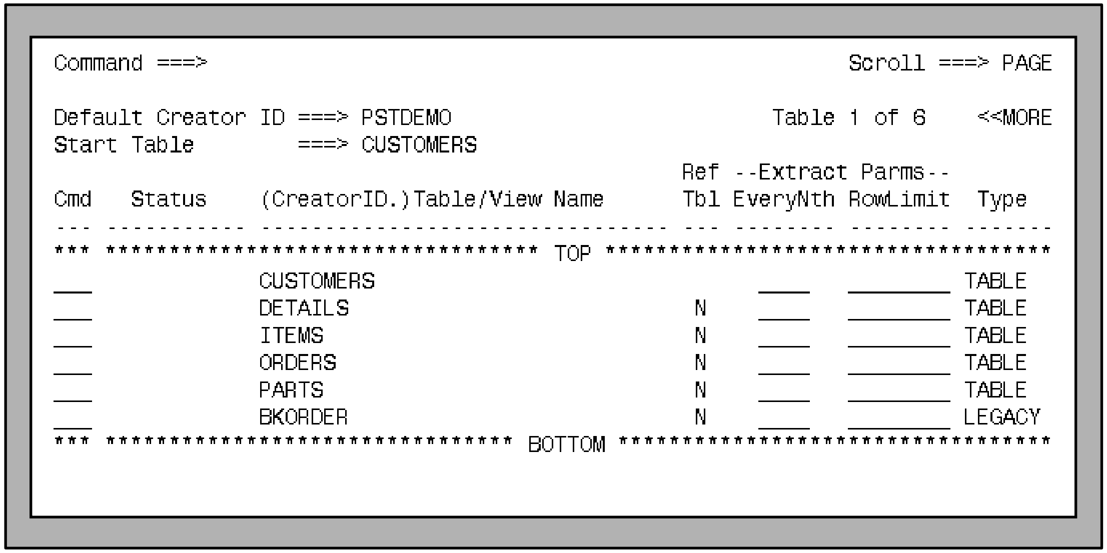
- **Start Table**
- **Set of Tables**

Optional:

- Selection Criteria
- Data Sampling
- Data Partitioning
- Point and Shoot
- Relationship Usage

Extract Process

The Table List

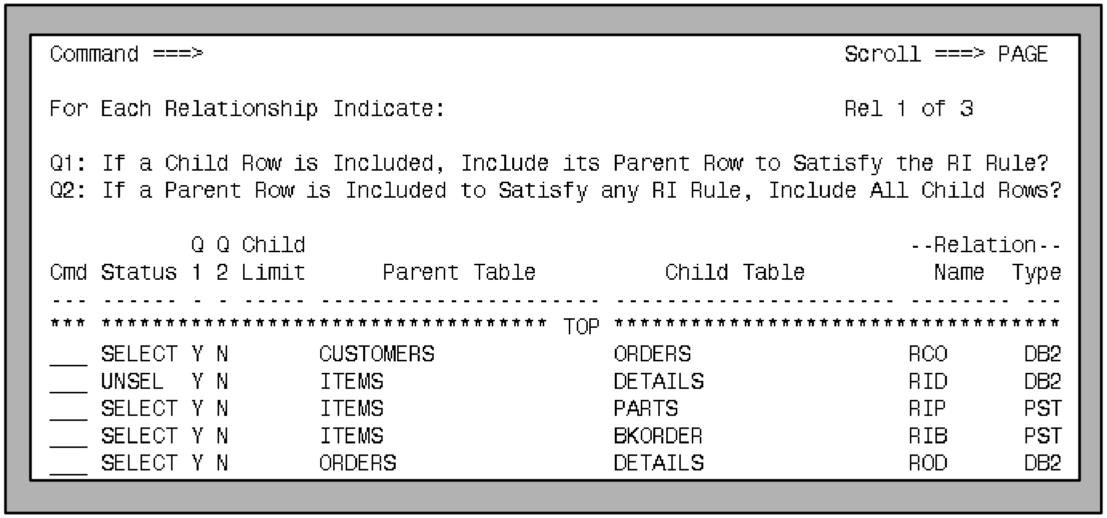


```
Command ===>                                                  Scroll ===> PAGE

Default Creator ID ===> PSTDEMO                         Table 1 of 6    <<MORE
Start Table        ===> CUSTOMERS
                                                 Ref --Extract Parms--
Cmd   Status     (CreatorID.)Table/View Name     Tbl EveryNth RowLimit  Type
--- ----------- -------------------------------- --- -------- -------- -------
*** ********************************** TOP ***********************************
___             CUSTOMERS                              ____   ________ TABLE
___             DETAILS                           N    ____   ________ TABLE
___             ITEMS                             N    ____   ________ TABLE
___             ORDERS                            N    ____   ________ TABLE
___             PARTS                             N    ____   ________ TABLE
___             BKORDER                           N    ____   ________ LEGACY
*** ******************************** BOTTOM **********************************
```

- Identify the Start Table
- Use the RELATED functions to populate list
- Include random selection factor, extract limits and selection criteria

Extract Process

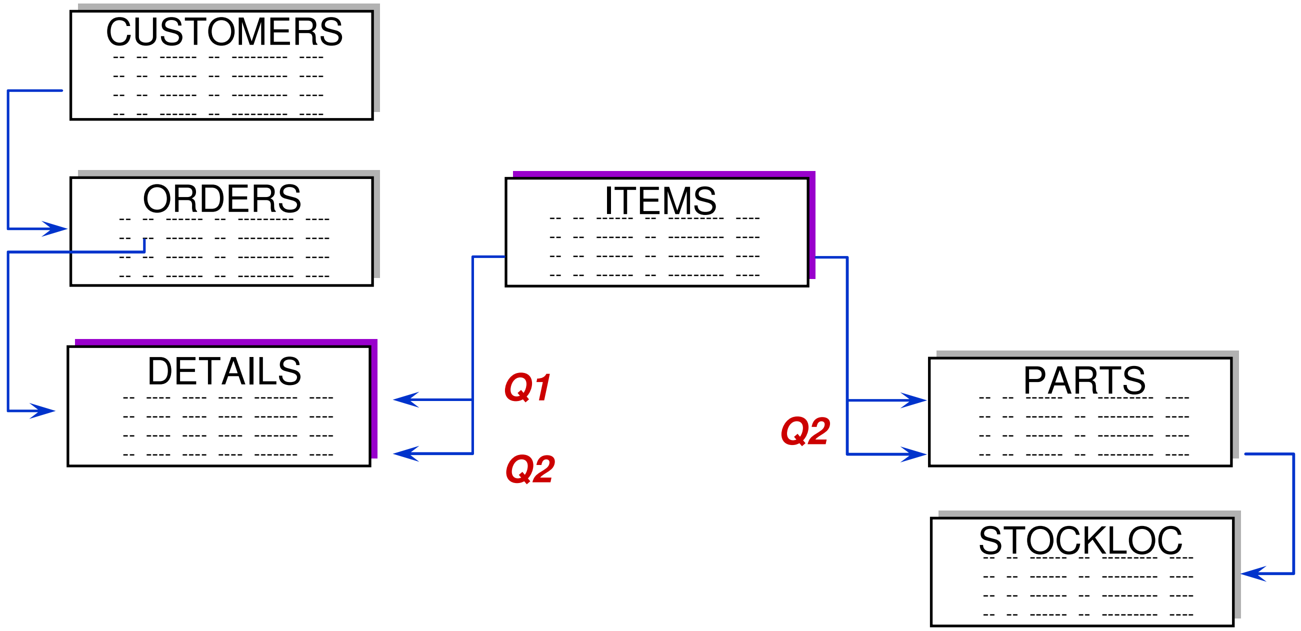
Relationship Usage



```
Command ===>                                                    Scroll ===> PAGE

For Each Relationship Indicate:                                 Rel 1 of 3

Q1: If a Child Row is Included, Include its Parent Row to Satisfy the RI Rule?
Q2: If a Parent Row is Included to Satisfy any RI Rule, Include All Child Rows?

           Q Q Child                                                --Relation--
Cmd Status 1 2 Limit      Parent Table          Child Table           Name   Type
--- ------ - - ----- -------------------- -------------------- -------- ---
*** *********************************** TOP ***********************************
___ SELECT Y N       CUSTOMERS            ORDERS                 RCO      DB2
___ UNSEL  Y N       ITEMS                DETAILS                RID      DB2
___ SELECT Y N       ITEMS                PARTS                  RIP      PST
___ SELECT Y N       ITEMS                BKORDER                RIB      PST
___ SELECT Y N       ORDERS               DETAILS                ROD      DB2
```

- Select relationship paths
  - Defined to DB2 catalog or PST Directory
- Designate relationship traversal
- Limit number of child rows extracted

Extract Process
Relationship Traversal

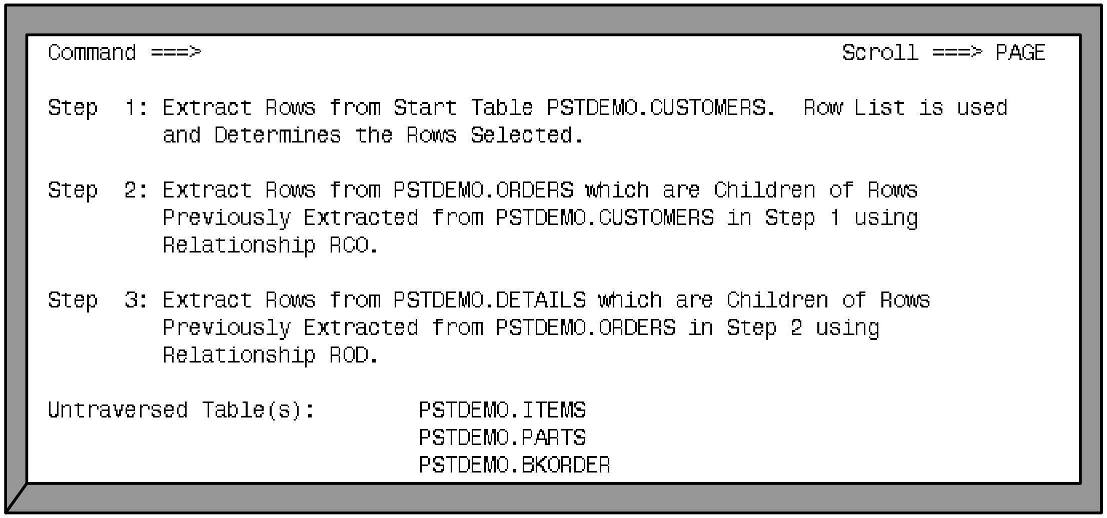


Q1 Only ITEMS that are parents of DETAILS

Q2 All other DETAILS for those ITEMS ...
Each of the PARTS for those ITEMS

Extract Process

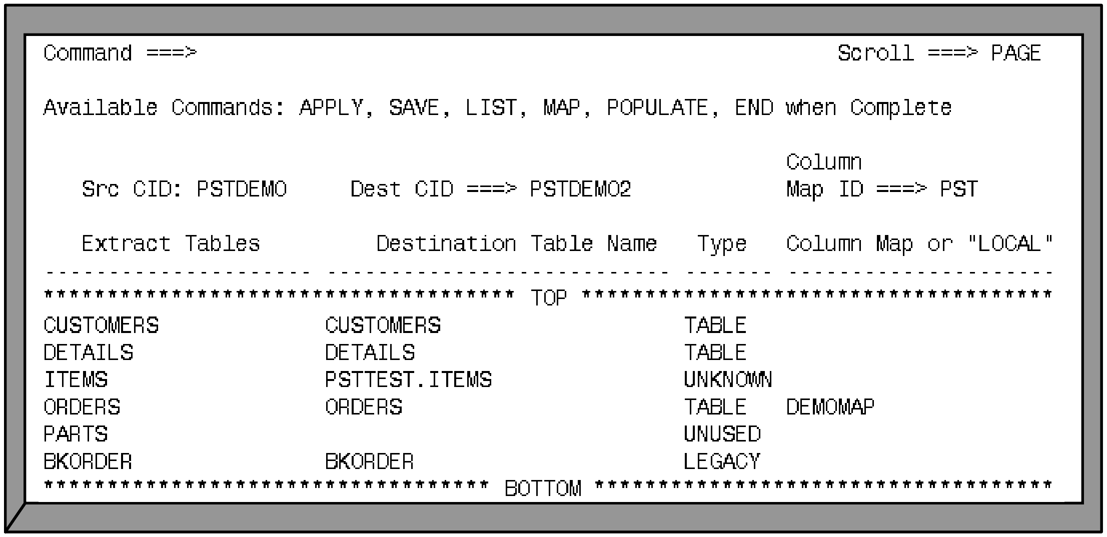
Show the Extract Steps



```
Command ===>                                                   Scroll ===> PAGE

Step  1: Extract Rows from Start Table PSTDEMO.CUSTOMERS.  Row List is used
         and Determines the Rows Selected.

Step  2: Extract Rows from PSTDEMO.ORDERS which are Children of Rows
         Previously Extracted from PSTDEMO.CUSTOMERS in Step 1 using
         Relationship RCO.

Step  3: Extract Rows from PSTDEMO.DETAILS which are Children of Rows
         Previously Extracted from PSTDEMO.ORDERS in Step 2 using
         Relationship ROD.

Untraversed Table(s):        PSTDEMO.ITEMS
                             PSTDEMO.PARTS
                             PSTDEMO.BKORDER
```

- Steps required to perform extract
- Cycles processed
- Untraversed tables

Populate Destination Tables
Table Map



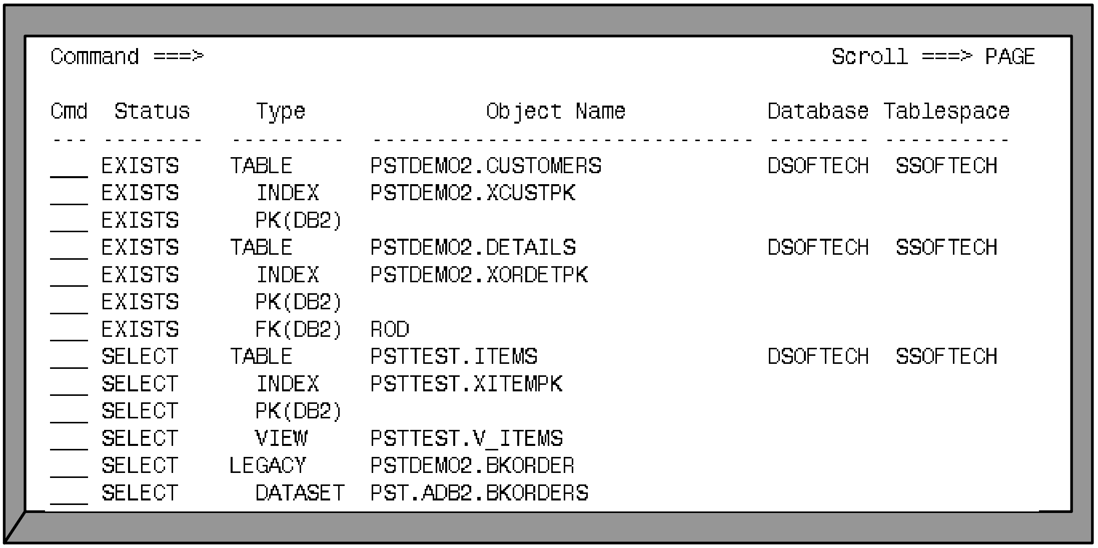
```
Command ===>                                                  Scroll ===> PAGE

Available Commands: APPLY, SAVE, LIST, MAP, POPULATE, END when Complete

                                                          Column
   Src CID: PSTDEMO     Dest CID ===> PSTDEMO2            Map ID ===> PST

   Extract Tables          Destination Table Name   Type   Column Map or "LOCAL"
--------------------- --------------------------- ------- ---------------------
************************************* TOP *************************************
CUSTOMERS             CUSTOMERS                   TABLE
DETAILS               DETAILS                     TABLE
ITEMS                 PSTTEST.ITEMS               UNKNOWN
ORDERS                ORDERS                      TABLE   DEMOMAP
PARTS                                             UNUSED
BKORDER               BKORDER                     LEGACY
*********************************** BOTTOM ************************************
```

- Table names need not match
- Change qualifier and/or table name
- Can be saved in PST Directory

Populate Destination Tables

Creating New Tables

Missing destination object(s)

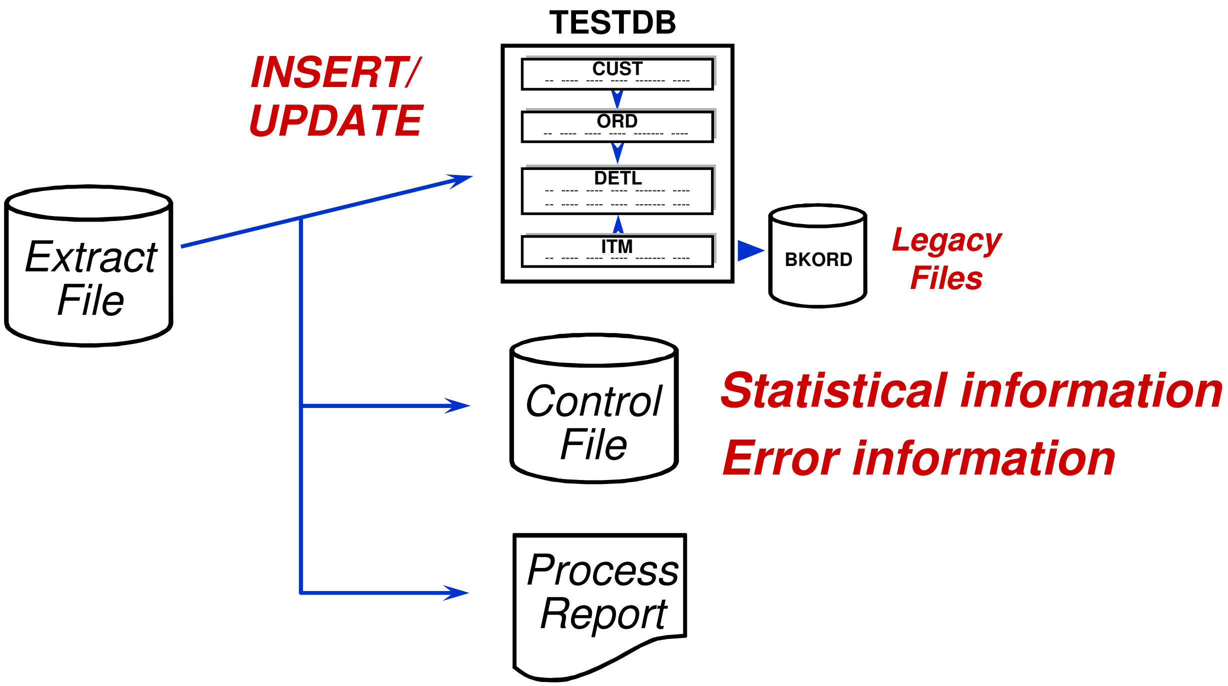


```
Command ===>                                                 Scroll ===> PAGE

Cmd  Status     Type            Object Name          Database Tablespace
--- --------  ---------  ------------------------------ -------- ----------
___ EXISTS    TABLE      PSTDEMO2.CUSTOMERS             DSOFTECH  SSOFTECH
___ EXISTS      INDEX    PSTDEMO2.XCUSTPK
___ EXISTS      PK(DB2)
___ EXISTS    TABLE      PSTDEMO2.DETAILS               DSOFTECH  SSOFTECH
___ EXISTS      INDEX    PSTDEMO2.XORDETPK
___ EXISTS      PK(DB2)
___ EXISTS      FK(DB2)  ROD
___ SELECT    TABLE      PSTTEST.ITEMS                  DSOFTECH  SSOFTECH
___ SELECT      INDEX    PSTTEST.XITEMPK
___ SELECT      PK(DB2)
___ SELECT      VIEW     PSTTEST.V_ITEMS
___ SELECT    LEGACY     PSTDEMO2.BKORDER
___ SELECT      DATASET  PST.ADB2.BKORDERS
```

- Select destination object(s) to be created from source table definitions
- Functions include DROP, key conversion, and display of SQL

Populate Destination Tables

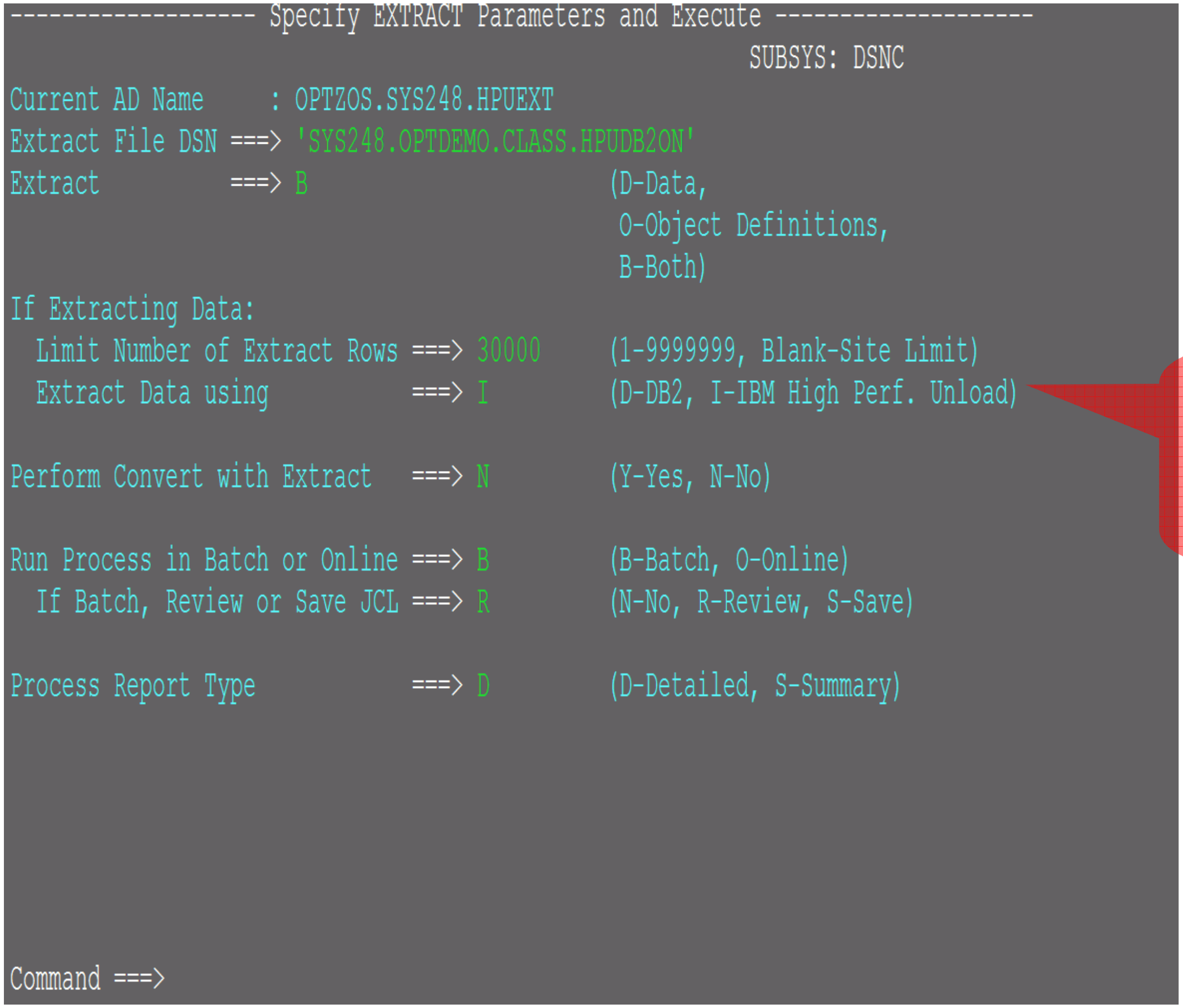
Control File



If INSERT/UPDATE errors occur:

1. BROWSE the control file for error information
2. RETRY/RESTART the INSERT/UPDATE

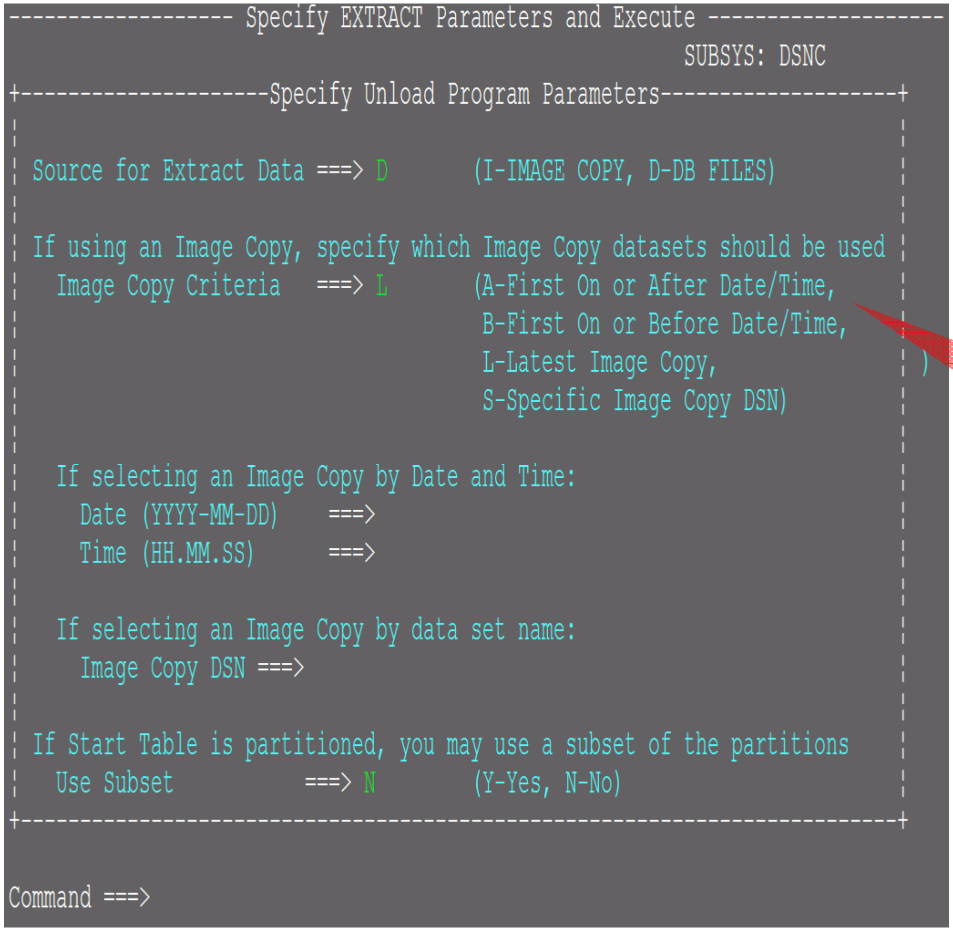
Extract Parameters and Execution - Data Source



```
------------------- Specify EXTRACT Parameters and Execute --------------------
                                                        SUBSYS: DSNC
Current AD Name     : OPTZOS.SYS248.HPUEXT
Extract File DSN ===> 'SYS248.OPTDEMO.CLASS.HPUDB2ON'
Extract          ===> B                       (D-Data,
                                               O-Object Definitions,
                                               B-Both)
If Extracting Data:
  Limit Number of Extract Rows ===> 30000     (1-9999999, Blank-Site Limit)
  Extract Data using           ===> I         (D-DB2, I-IBM High Perf. Unload)

Perform Convert with Extract   ===> N         (Y-Yes, N-No)

Run Process in Batch or Online ===> B         (B-Batch, O-Online)
  If Batch, Review or Save JCL ===> R         (N-No, R-Review, S-Save)

Process Report Type            ===> D         (D-Detailed, S-Summary)






Command ===>
```

IBM HPU as source

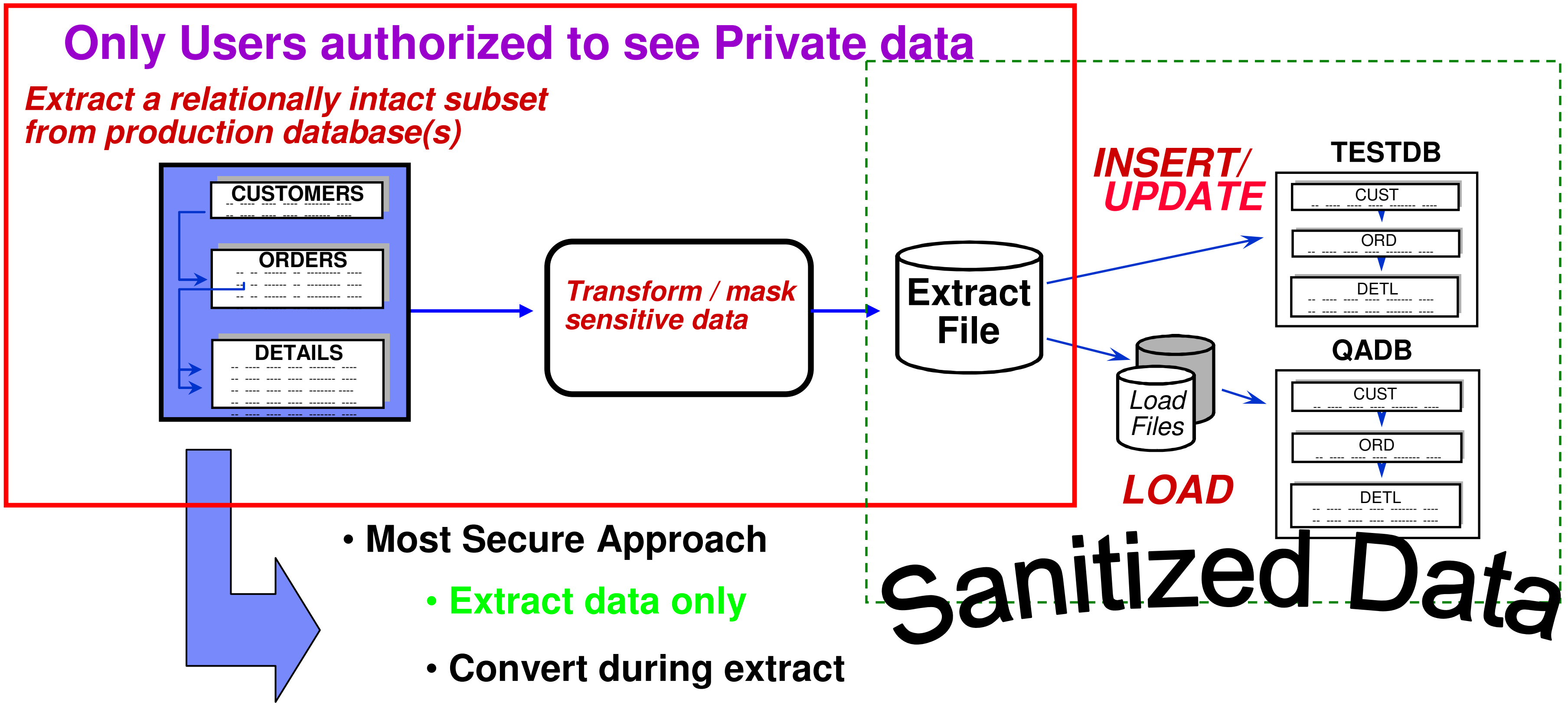
Extract Data Parameters – Image Copy Opions



```
------------------- Specify EXTRACT Parameters and Execute --------------------
                                                            SUBSYS: DSNC
+--------------------Specify Unload Program Parameters--------------------+
¦                                                                          ¦
¦ Source for Extract Data ===> D        (I-IMAGE COPY, D-DB FILES)        ¦
¦                                                                          ¦
¦ If using an Image Copy, specify which Image Copy datasets should be used ¦
¦   Image Copy Criteria   ===> L        (A-First On or After Date/Time,    ¦
¦                                        B-First On or Before Date/Time,   ¦
¦                                        L-Latest Image Copy,              ¦ )
¦                                        S-Specific Image Copy DSN)        ¦
¦                                                                          ¦
¦   If selecting an Image Copy by Date and Time:                           ¦
¦     Date (YYYY-MM-DD)     ===>                                           ¦
¦     Time (HH.MM.SS)       ===>                                           ¦
¦                                                                          ¦
¦   If selecting an Image Copy by data set name:                           ¦
¦     Image Copy DSN ===>                                                  ¦
¦                                                                          ¦
¦ If Start Table is partitioned, you may use a subset of the partitions    ¦
¦   Use Subset           ===> N        (Y-Yes, N-No)                       ¦
+--------------------------------------------------------------------------+

Command ===>
```

Different Image Copy Input Options

Data Privacy in Application Testing



Only Users authorized to see Private data

Extract a relationally intact subset from production database(s)

Sanitized Data

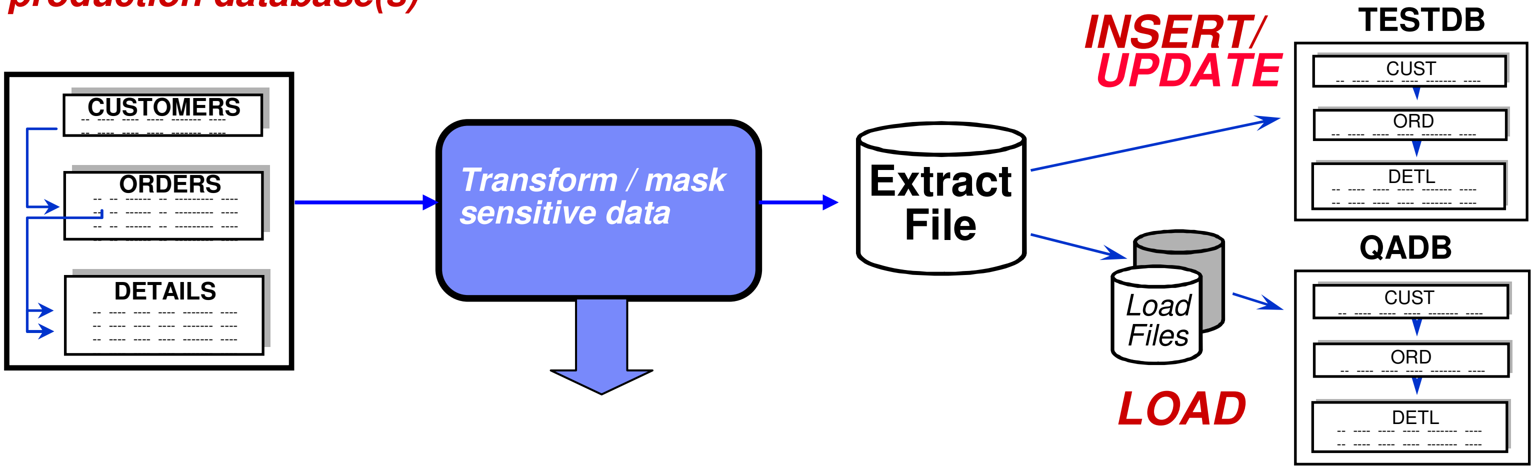
- **Most Secure Approach**
  - **Extract data only**
  - **Convert during extract**

•Extract file already contains masked data

•Can be shared with testers to reuse

Data Privacy in Application Testing

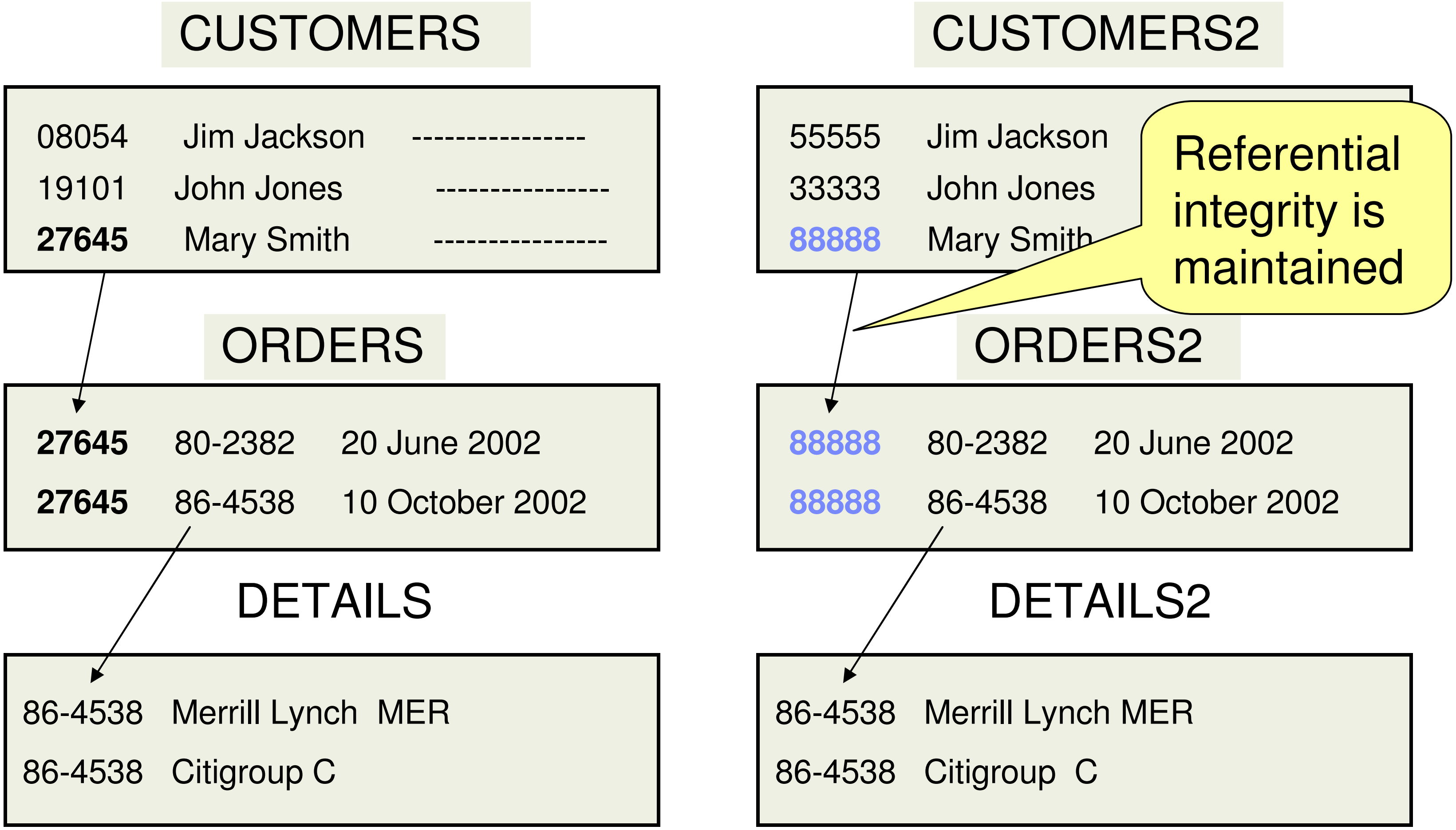
Extract a relationally intact subset from production database(s)



Data transformation functions:

- **Hard-code literals,**
- **special registers such as date, time**
- **Arithmetic calculations**
- **Sequential number generation**
- **Random number generation**
- **Substring and/or concatenation of values**
- **Lookup Table Functions Random, Specific or HASH**
- **Intelligent TRANSformation Library – SSN, CCN, email,…**
- **Access to client-defined exit routines to apply complex algorithms, encryption, …**
- **Propagation of masked primary keys to dependent foreign keys**

Propagating Keys



CUSTOMERS

08054	Jim Jackson	----------------
19101	John Jones	----------------
27645	Mary Smith	----------------

ORDERS

27645	80-2382	20 June 2002
27645	86-4538	10 October 2002

DETAILS

86-4538	Merrill Lynch	MER
86-4538	Citigroup	C

CUSTOMERS2

55555	Jim Jackson
33333	John Jones
88888	Mary Smith

Referential integrity is maintained

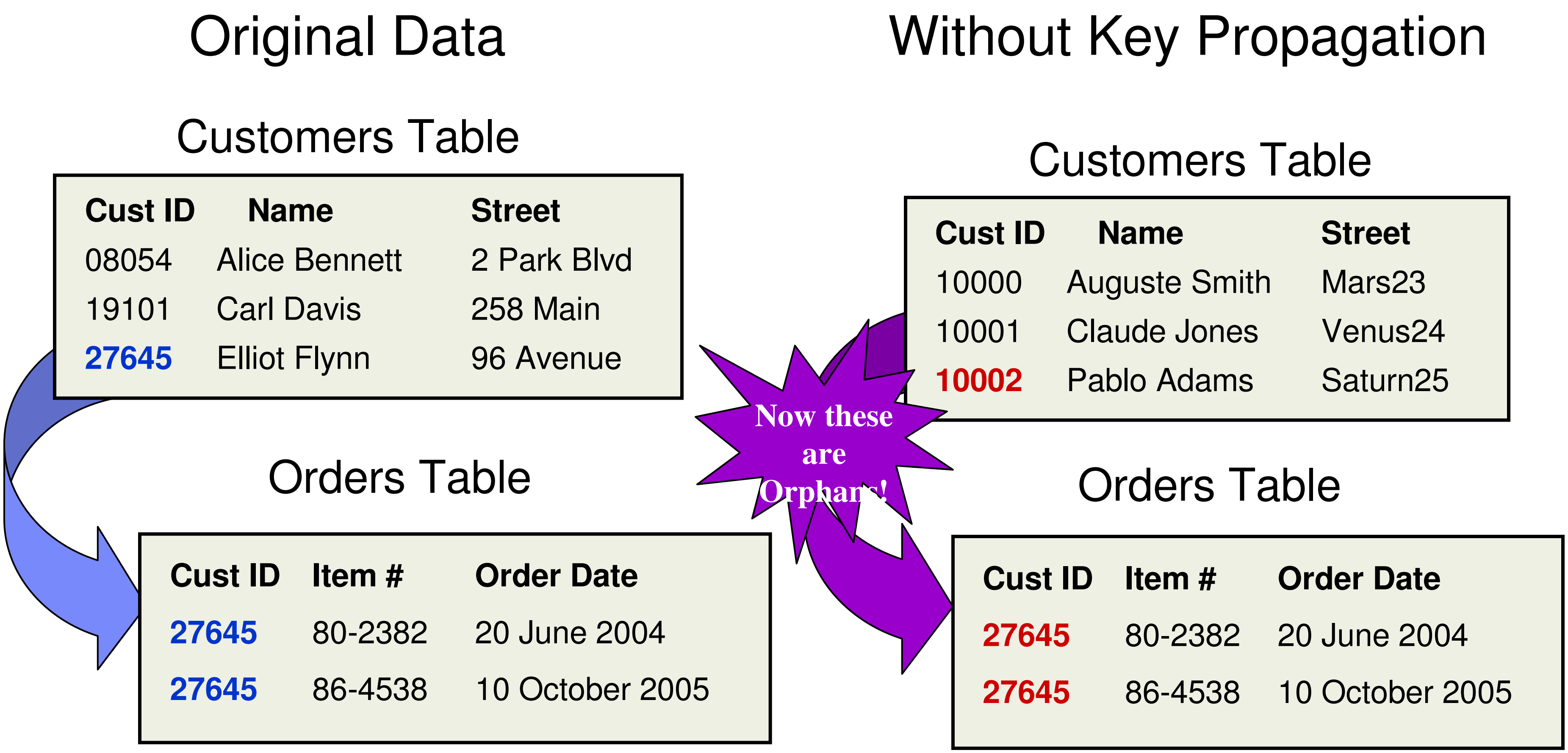
ORDERS2

88888	80-2382	20 June 2002
88888	86-4538	10 October 2002

DETAILS2

86-4538	Merrill Lynch	MER
86-4538	Citigroup	C

Without Key Propagation…



Original Data

Customers Table

Cust ID	Name	Street
08054	Alice Bennett	2 Park Blvd
19101	Carl Davis	258 Main
27645	Elliot Flynn	96 Avenue

Orders Table

Cust ID	Item #	Order Date
27645	80-2382	20 June 2004
27645	86-4538	10 October 2005

Without Key Propagation

Customers Table

Cust ID	Name	Street
10000	Auguste Smith	Mars23
10001	Claude Jones	Venus24
10002	Pablo Adams	Saturn25

Orders Table

Cust ID	Item #	Order Date
27645	80-2382	20 June 2004
27645	86-4538	10 October 2005

Now these are Orphans!

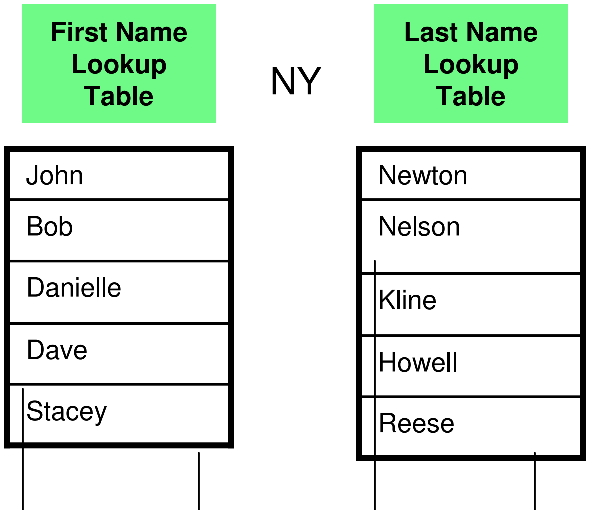
First Names and Last Names Data Sets

Production Database

First Name	Last Name		GPA	High School	
Advisor State					
Paul Johnson	Smith NJ		3.2	Princeton	

2.7 Albany Kline

NY



First Name Lookup Table

John
Bob
Danielle
Dave
Stacey

Last Name Lookup Table

Newton
Nelson
Kline
Howell
Reese

1) Client is a University who wishes to mask the first and last name fields in their admissions database

2) Optim now has a first name lookup table with over 5,000 male/female names and a last name lookup table with over 80,000 names

3) Use Lookup Tables to randomly replace table first and last names

Test Database

First Name	Last Name	GPA	High School	Advisor
State				
Stacey Johnson	Nelson NJ	3.2	Princeton	
Dave	Reese NY	2.7	Albany	Kline

Street Address/City/State/Zip Code Data Sets

Total Assets	Customers	Street	City	State	Zip Code
$534,674,233	54,999	12 Buttercup Ln	Cleveland	OH	44101
$8,777,733,811	105,333	6767 Rte 1 S	Princeton	NJ	08540

1) Client is a Bank who wishes to mask its assets by location

Address Lookup Table

288 Elm St	Milwaukee	WI	53201
12 Rodeo Dr	Los Angeles	CA	90001
3526 Diamond Rd	Seattle	WA	98101
12 Street Road	Las Vegas	NV	89101
2 Applegarth Ln	Brunswick	ME	04011

2) Optim provides corresponding Street Address/City/State/Zip Codes for masking

3) Leverage Multiple Column Replacement. Entire address row can be masked with a valid CASS address using enhanced random lookup function

New Table with Masked Data

Total Assets	Customers	Street	City	State	Zip Code
$534,674,233	54,999	**3526 Diamond Rd**	**Seattle**	**WA**	**98101**
$8,777,733,811	105,333	**21 Street Rd**	**Las Vegas**	**NV**	**89101**

Intelligent Masking Capability

Production Database

F. Name	L. Name	Credit Card#	SSN#
John	Denver	5298774132478855	254-77-6644
Vanessa	Jones	4324115574123654	154-74-7788

Data before Masking

Test Database

F. Name	L. Name	Credit Card#	SSN#
John	Denver	**5326458711224956**	**854-77-6644**
Vanessa	Jones	**4972584612457744**	**154-74-7788**

Valid

Valid

Data after Masking… Masked with Valid CC# and SS#

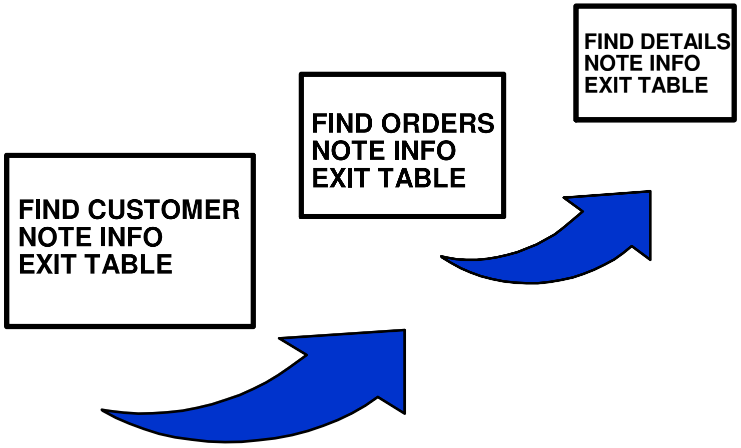
How are these numbers valid?

For Social Security Numbers	For Credit Card Numbers
A Social Security Number (SSN) consists of nine digits. The first three digits is called the "area number'. The central, two-digit field is called the "group Number". The final four-digit field is called the "serial Number". All numbers must fit the latest available criteria for each section.	Most credit card numbers are encoded with a "Check Digit". A check digit is a digit added to a number (either at the end or the beginning) that validates the authenticity of the number. A simple algorithm is applied to the other digits of the number which yields the check digit.

Traditional vs. Relational Tools

Single Table Editors

- One table/view at a time
- No edit of related data from multiple tables



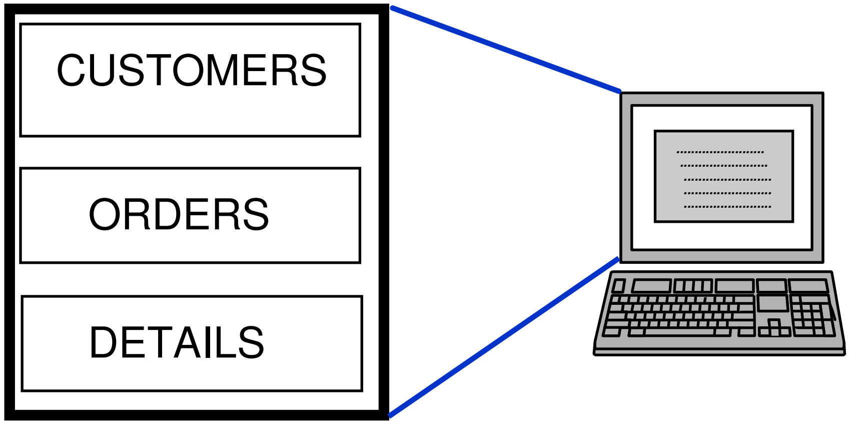
FIND CUSTOMER
NOTE INFO
EXIT TABLE

FIND ORDERS
NOTE INFO
EXIT TABLE

FIND DETAILS
NOTE INFO
EXIT TABLE

The Relational Editor

- ***Simultaneous*** **browse/edit of related data from multiple tables**

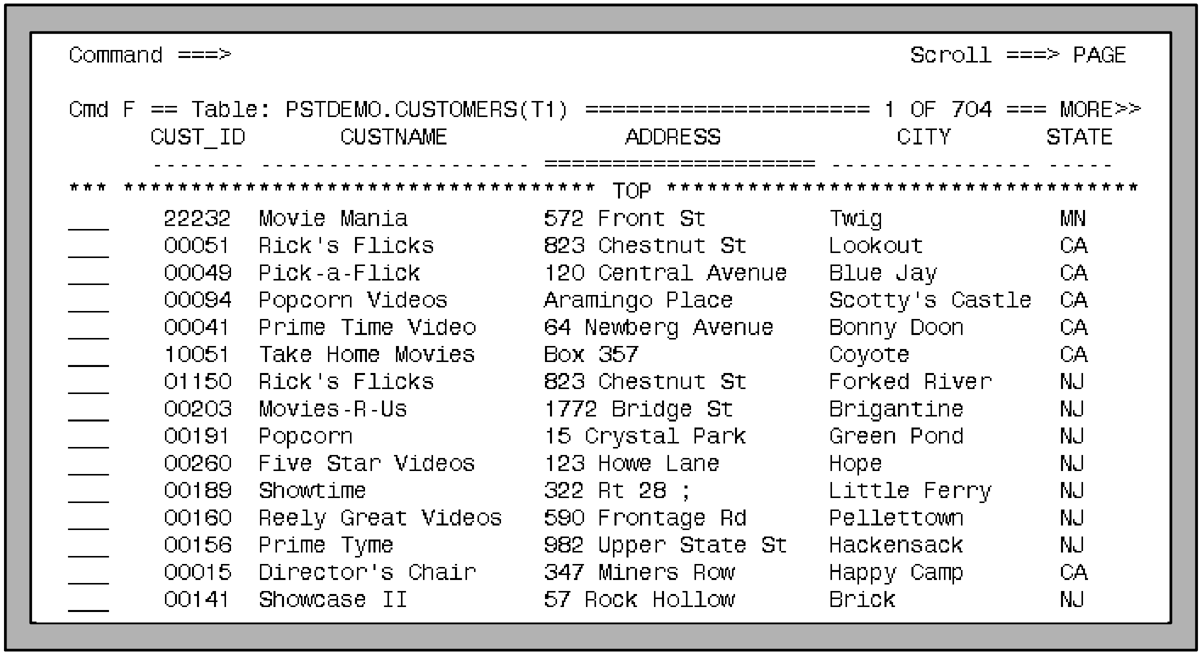


CUSTOMERS

ORDERS

DETAILS

Browsing or Editing Data

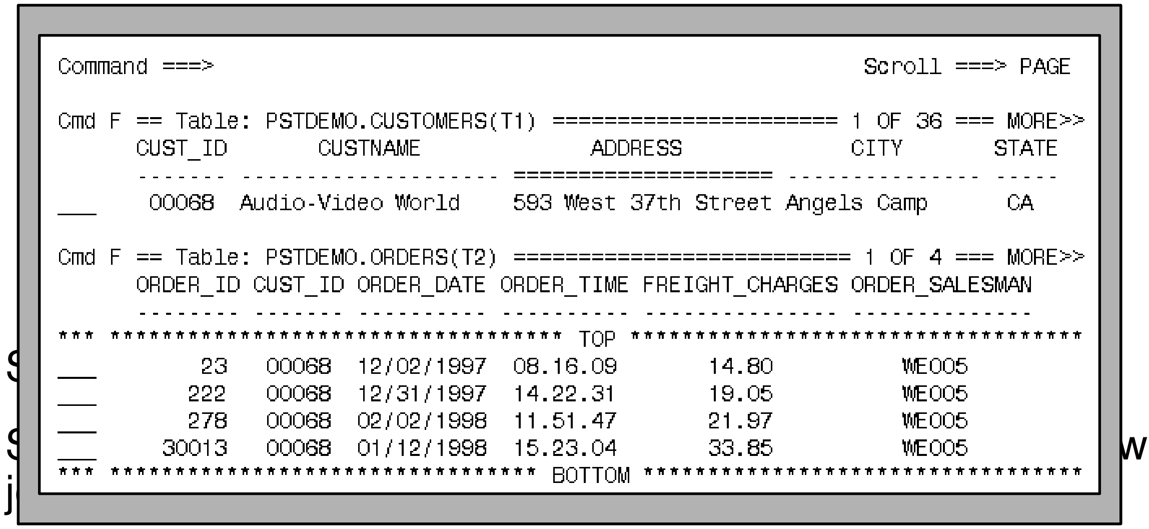


```
Command ===>                                                Scroll ===> PAGE

Cmd F == Table: PSTDEMO.CUSTOMERS(T1) ==================== 1 OF 704 === MORE>>
      CUST_ID       CUSTNAME              ADDRESS             CITY       STATE
      ------- ------------------- ==================== --------------- -----
*** ********************************** TOP ***********************************
___    22232  Movie Mania          572 Front St         Twig             MN
___    00051  Rick's Flicks        823 Chestnut St      Lookout          CA
___    00049  Pick-a-Flick         120 Central Avenue   Blue Jay         CA
___    00094  Popcorn Videos       Aramingo Place       Scotty's Castle  CA
___    00041  Prime Time Video     64 Newberg Avenue    Bonny Doon       CA
___    10051  Take Home Movies     Box 357              Coyote           CA
___    01150  Rick's Flicks        823 Chestnut St      Forked River     NJ
___    00203  Movies-R-Us          1772 Bridge St       Brigantine       NJ
___    00191  Popcorn              15 Crystal Park      Green Pond       NJ
___    00260  Five Star Videos     123 Howe Lane        Hope             NJ
___    00189  Showtime             322 Rt 28 ;          Little Ferry     NJ
___    00160  Reely Great Videos   590 Frontage Rd      Pellettown       NJ
___    00156  Prime Tyme           982 Upper State St   Hackensack       NJ
___    00015  Director's Chair     347 Miners Row       Happy Camp       CA
___    00141  Showcase II          57 Rock Hollow       Brick            NJ
```

- User can define how data is displayed
  - SORT, HEX, sidelabel/columnar format
- All DB2 access authority enforced

Joining to Another Table

JOIN [table]



```
Command ===>                                                Scroll ===> PAGE

Cmd F == Table: PSTDEMO.CUSTOMERS(T1) ====================== 1 OF 36 === MORE>>
      CUST_ID       CUSTNAME              ADDRESS             CITY       STATE
      ------- -------------------- ==================== --------------- -----
___    00068  Audio-Video World    593 West 37th Street Angels Camp      CA

Cmd F == Table: PSTDEMO.ORDERS(T2) ========================= 1 OF 4 === MORE>>
      ORDER_ID CUST_ID ORDER_DATE ORDER_TIME FREIGHT_CHARGES ORDER_SALESMAN
      -------- ------- ---------- ---------- --------------- --------------
*** *********************************** TOP *************************************
___        23   00068  12/02/1997  08.16.09           14.80          WE005
___       222   00068  12/31/1997  14.22.31           19.05          WE005
___       278   00068  02/02/1998  11.51.47           21.97          WE005
___     30013   00068  01/12/1998  15.23.04           33.85          WE005
*** ********************************* BOTTOM ***********************************
```

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- S wer- j

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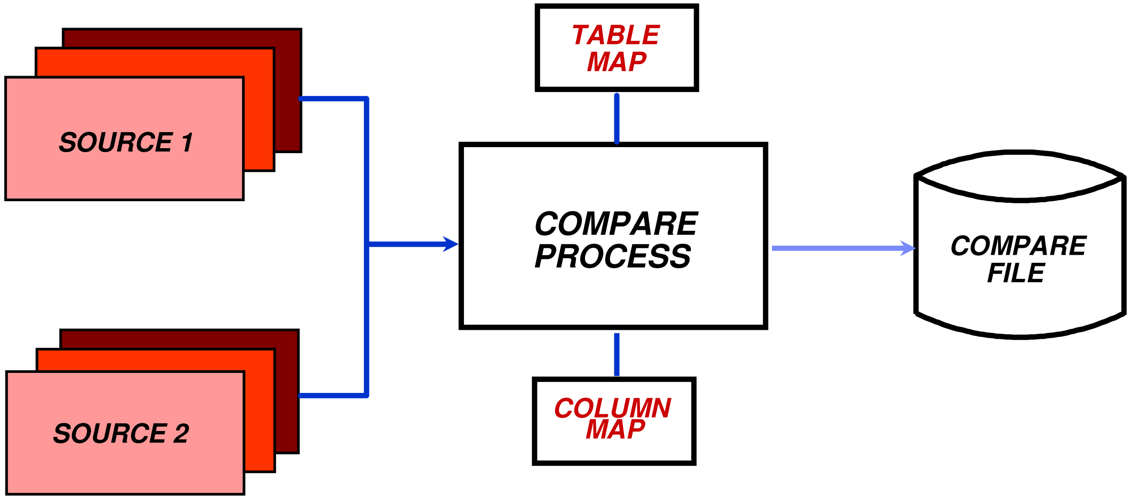
OPTIM TDM Compare Facility



- Single-table or multi-table compare
- Creates compare file of results

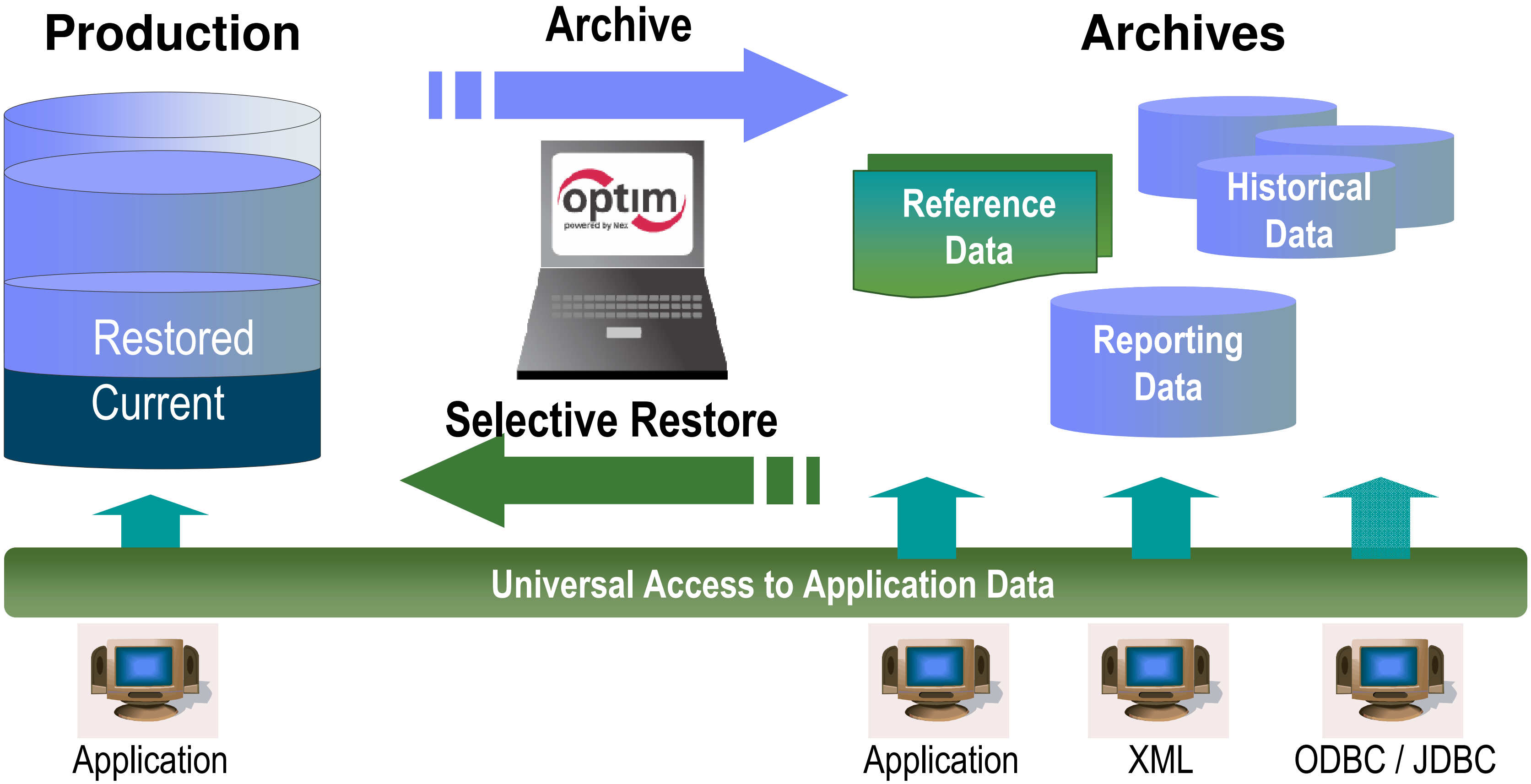
- Displays results on screen
- For application testing, QA, and to verify database contents
- Enhances productivity by finding unexpected changes in the data

What are the Key Drivers of Data Growth?

- Mergers & acquisitions
- Organic business growth
  - eCommerce
  - ERP/CRM
- The digital revolution
- Records retention
  - Basel II
  - SOX
  - Euro-SOX
- Data multiplier effect
- Forrester estimates that 85% of data stored in databases is inactive

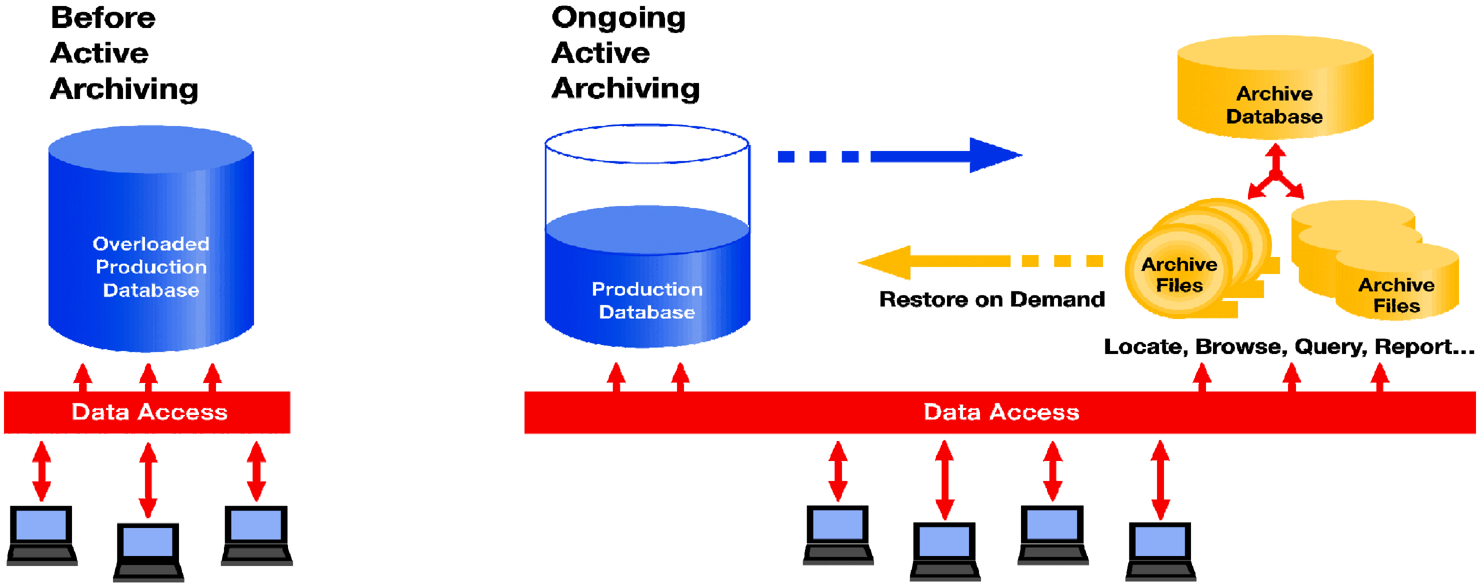
* Source: Noel Yuhanna, Forrester Research, Database Archiving Remains An Important Part Of Enterprise DBMS Strategy, 8/13/07

Optim™ Data Growth Solution: Archiving



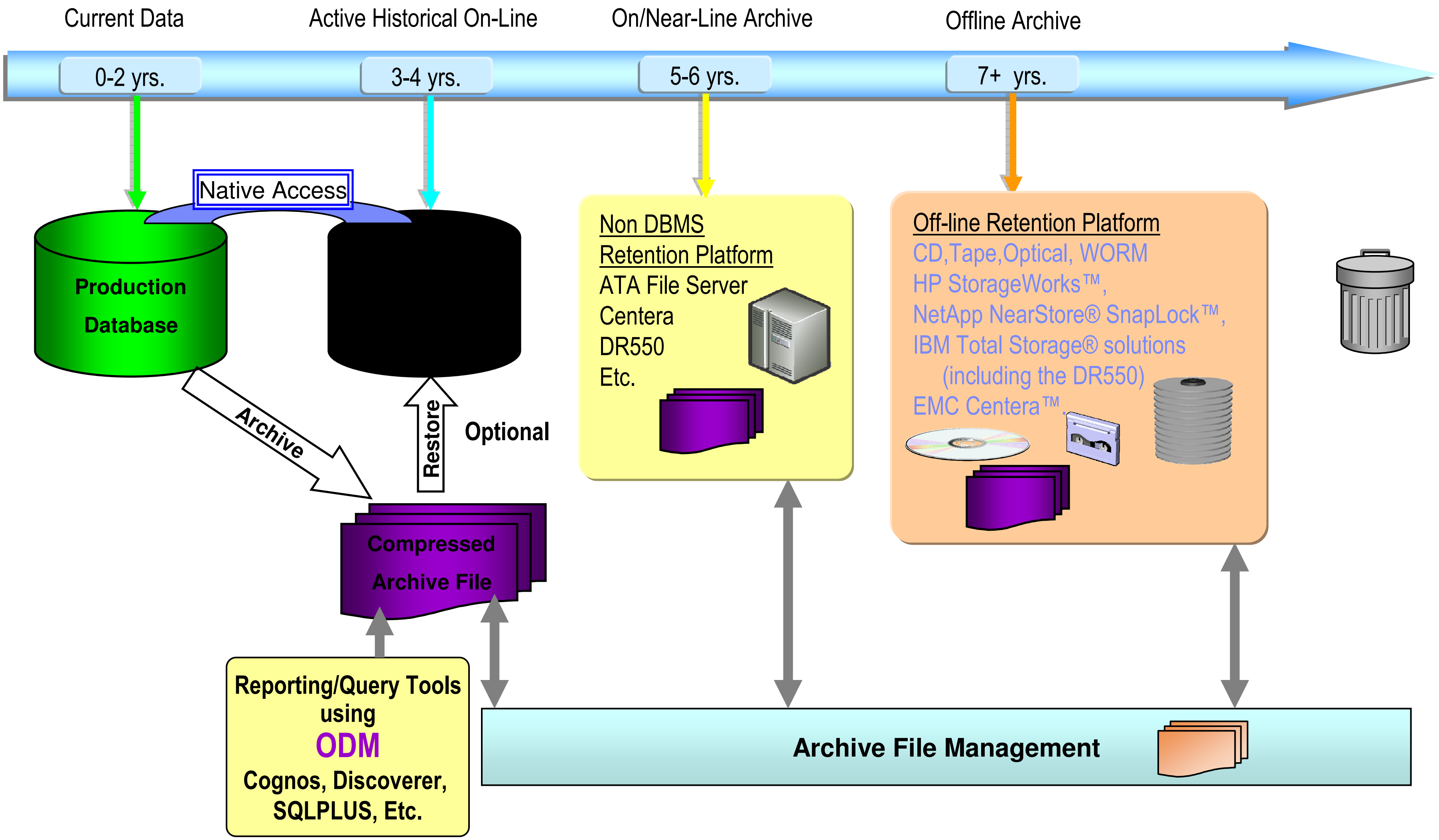
- Complete Business Object provides historical reference snapshot of business activity
- Storage device independence enables ILM
- Immutable file format enables data retention compliance

Active Archiving Defined

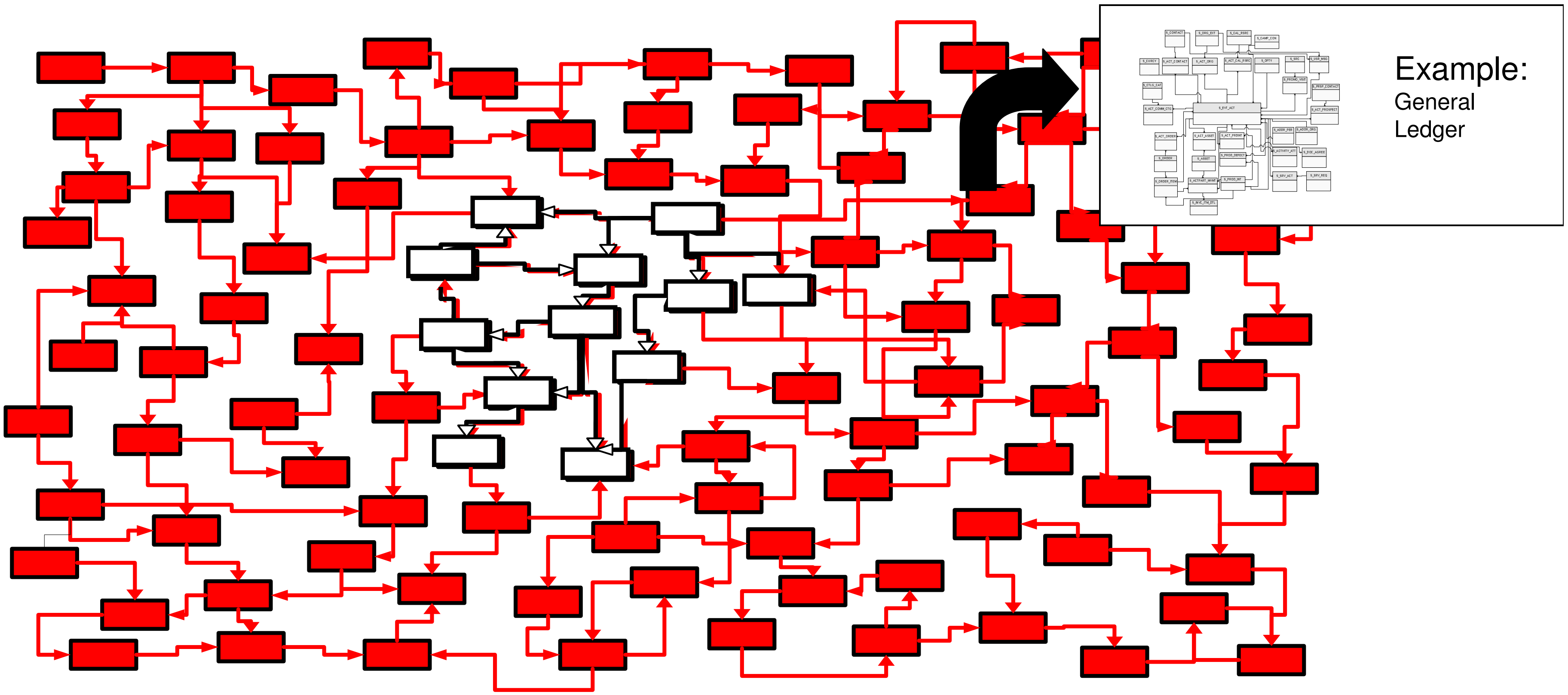


- Reduce the amount of data in the application database by:
  - Separating infrequently accessed data from transactional data
  - Preserve metadata and relationships of archived data outside db
  - Archive relational subsets vs. entire files
- Enable easy user access to archived information
  - View, research and restore as needed
- Complementary to Information Lifecycle Management (ILM)

Information Lifecycle

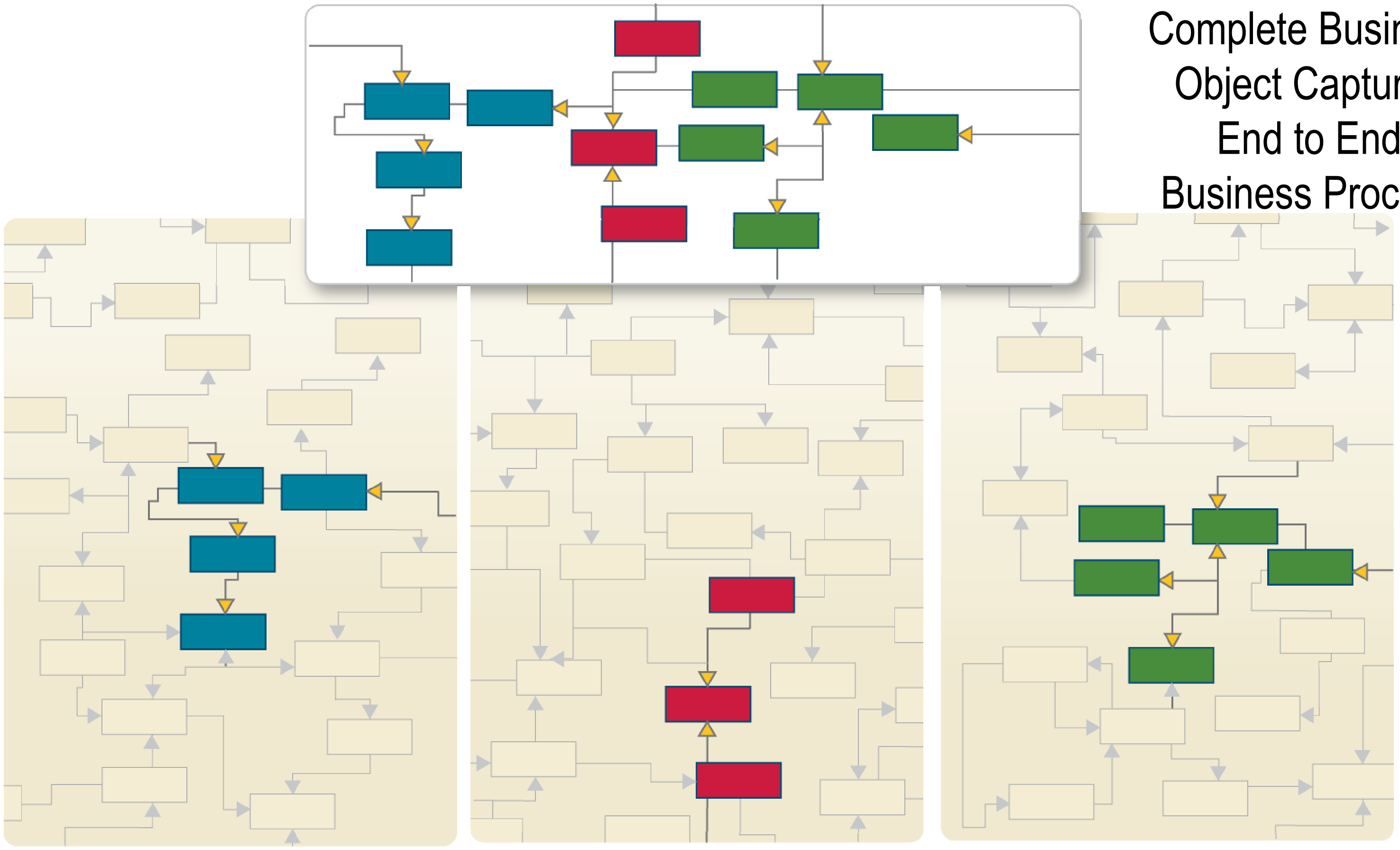


Our Unique Capability: Complete Business Object



Example:
General
Ledger

Extract - Federated Data Support



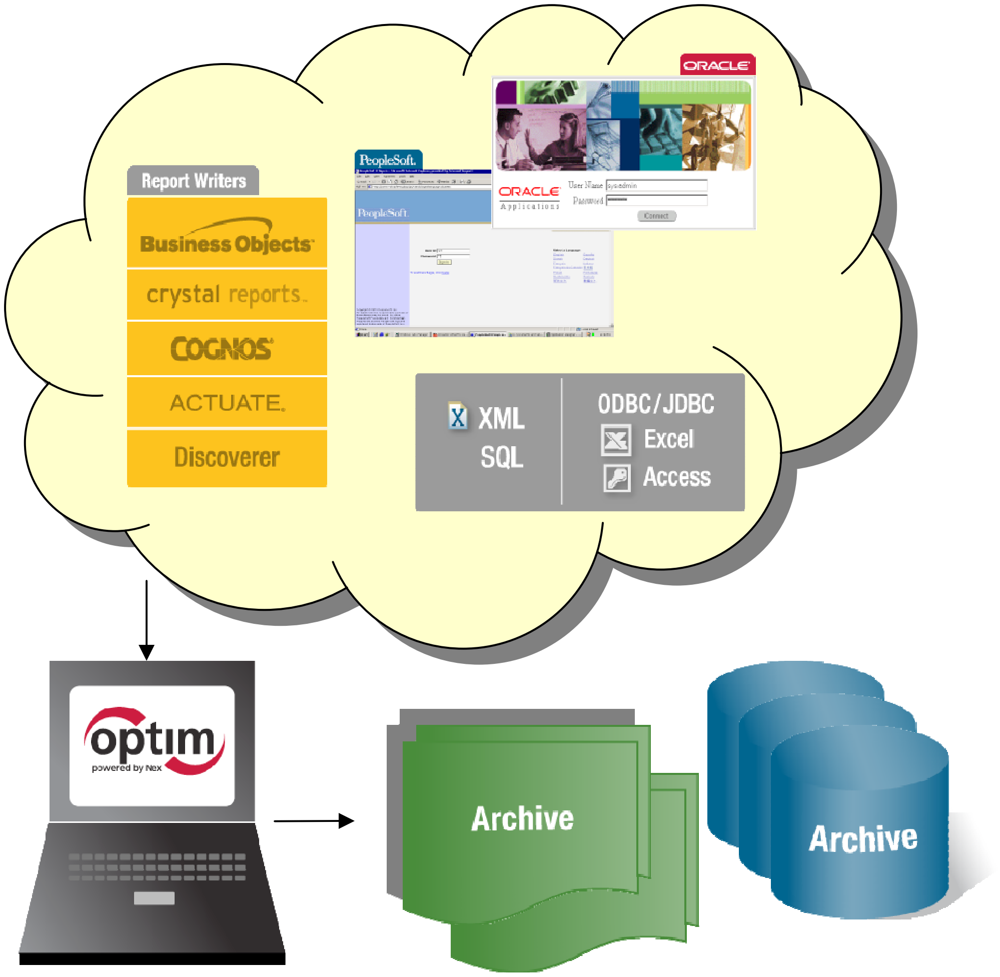
Complete Business Object Captures End to End Business Process

Retek / Oracle

Custom Inventory Management / DB2

Other apps / any DBMS

Universal Access



Access Any Record, Anytime, Anywhere!

- Native application access
  - Familiar screens and processes
- Application independent access
  - Industry standard methods: SQL, ODBC/JDBC, XML
  - Portals
  - Report writers: Crystal Reports, Cognos, Business Objects, Discoverer, Actuate
  - Desktop formats: Excel, CSV, MS Access
  - Database formats

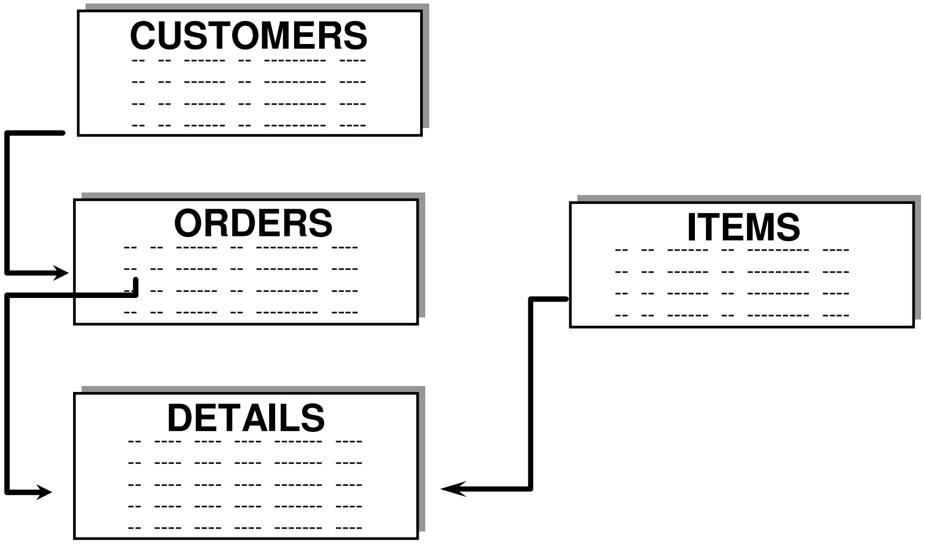
Steps for Archiving Data

- Identify the data to be archived
- Define the data to be deleted
- Choose a delete method
- Create the archive & Delete the data
- Find Data in the Archives
- Browse or Restore

Identify the data to be archived

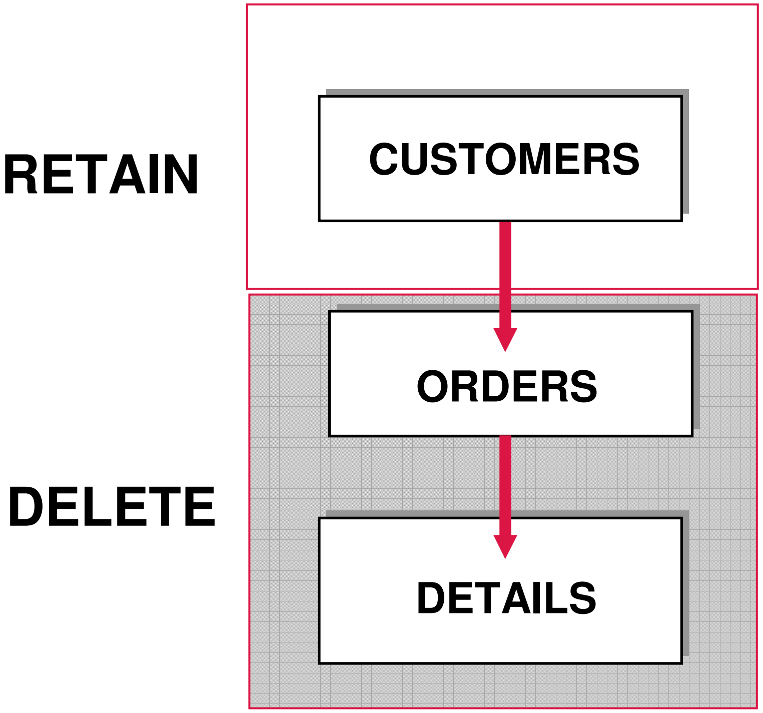
Access Definition

Defines a subset of of relational data



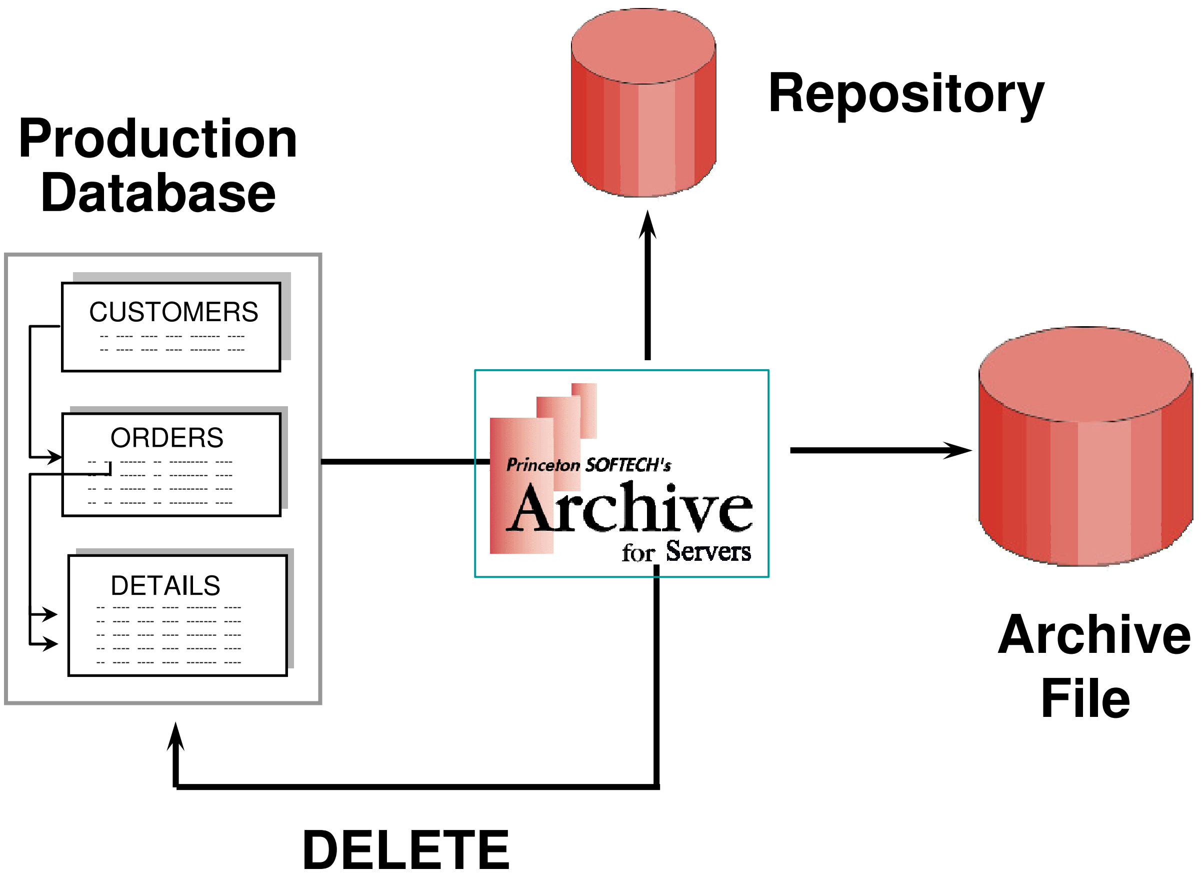
- Start table
- Associated data
- Relationships
- Extraction rules
- Index specifications

Define the data to be deleted



- **Archive all data**
- **Delete orders and details after they are safely archived**
- **Preserve semantic intelligence**

Create the archive



Researching the Archives

Direct access to archived data:

- User maintainable indexes
- Global searches
- Simple or complex criteria
- Intelligent browse
- ODBC Access
- ODM Access
- Save as CSV

Restore archived data only when you need to

Why Restore?

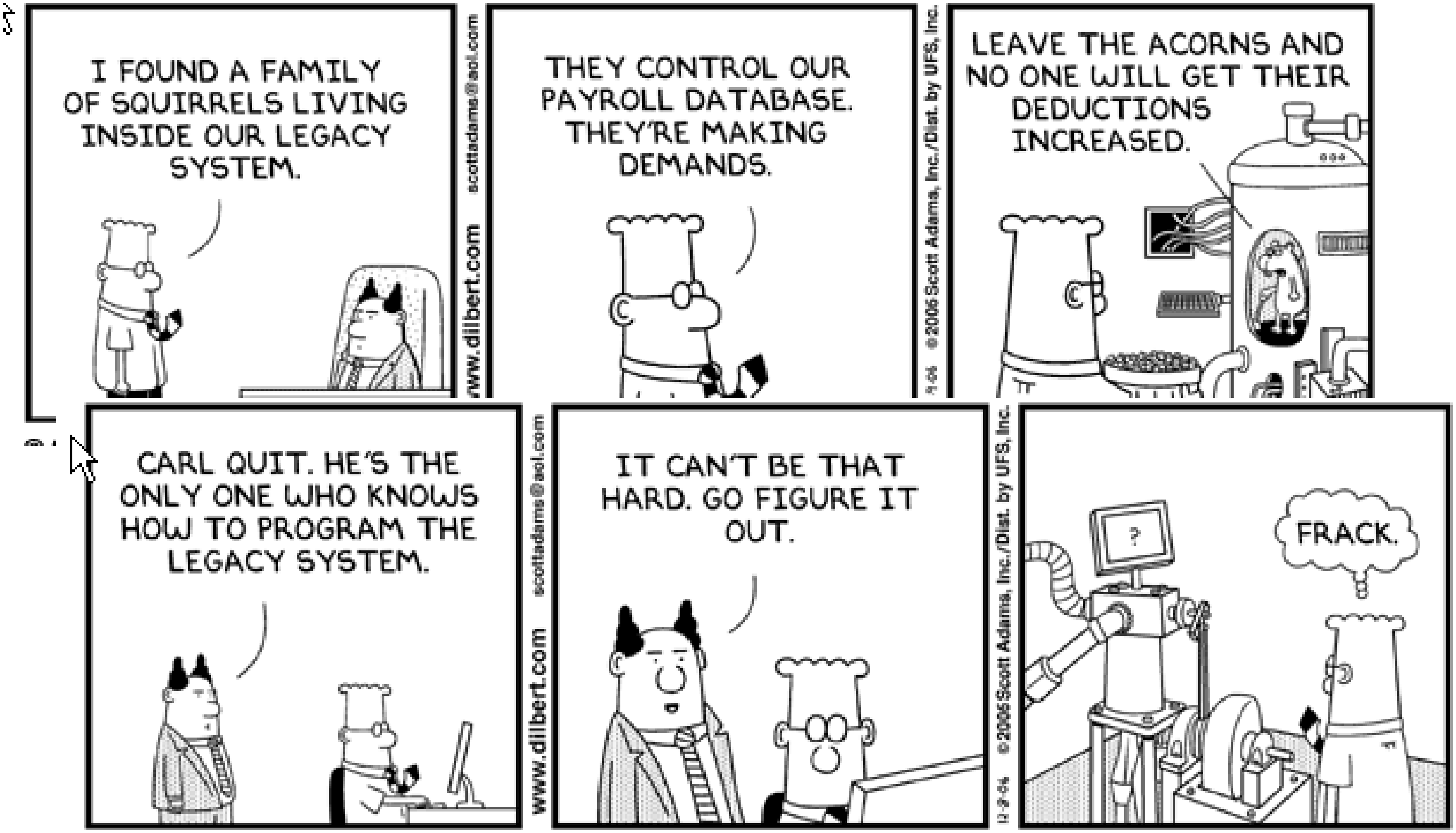
Browse archived data for:

- Customer service
- Answering questions
- Archive research

Restore archived data for:

- Audit situations
- Application-generated reports

Untold stories of legacy applications


I FOUND A FAMILY OF SQUIRRELS LIVING INSIDE OUR LEGACY SYSTEM.
www.dilbert.com
scottadams@aol.com
THEY CONTROL OUR PAYROLL DATABASE. THEY'RE MAKING DEMANDS.
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LEAVE THE ACORNS AND NO ONE WILL GET THEIR DEDUCTIONS INCREASED.
CARL QUIT. HE'S THE ONLY ONE WHO KNOWS HOW TO PROGRAM THE LEGACY SYSTEM.
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IT CAN'T BE THAT HARD. GO FIGURE IT OUT.
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?
FRACK.

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Issue: Retire obsolete applications

CIO:

- Reduce risk and cost by sunsetting obsolete or redundant technologies
- Reduce IT expenses (software, hardware, personnel)
- Preserve access to legacy system data for retention compliance

Business Line Executive:

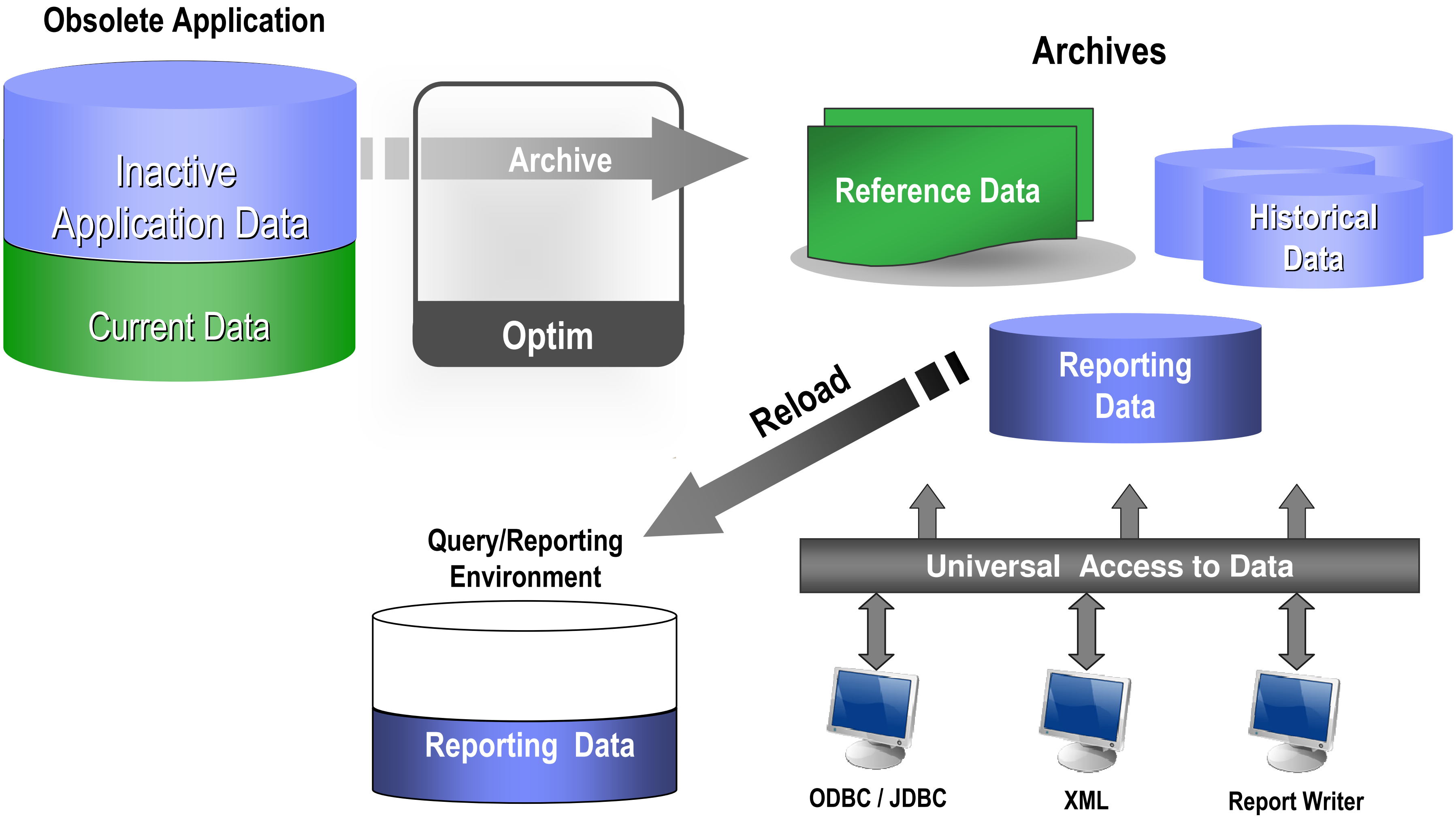
- Minimize negative budget variances and reduce IT charge-backs to line of business
- Allocate scarce resources for priority business needs
- Maintain access to historical business data for retention compliance

Technical Management:

- Eliminate expenses associated with underperforming assets
- Enable application-independent access to legacy system data for retention compliance
- Reduce risks from dependence on specialized labor and no longer supported vendor products

Enterprise Challenge: Application Retirement

Optim Supports Application Retirement Strategies



Summary

- **Take Back Control with IBM Information Protection solutions on System z:**
  - 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

- **Software, Hardware and Expertise.**
  - Information Management - the most complete end-to-end Information Protection software solutions
  - Information Protection Entry point as part of your wider Information Governance strategy
  - System z - the ultimate platform to for security
  - Clear ROI business cases for each area of Information Protection .

- For more information visit
  - www.ibm.com/software/data/db2imstools/solutions/data-governance.html
  - Download the Information Protection white paper now.

Thank
You