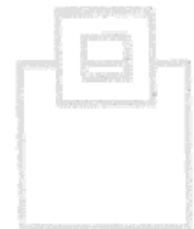
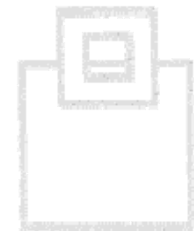
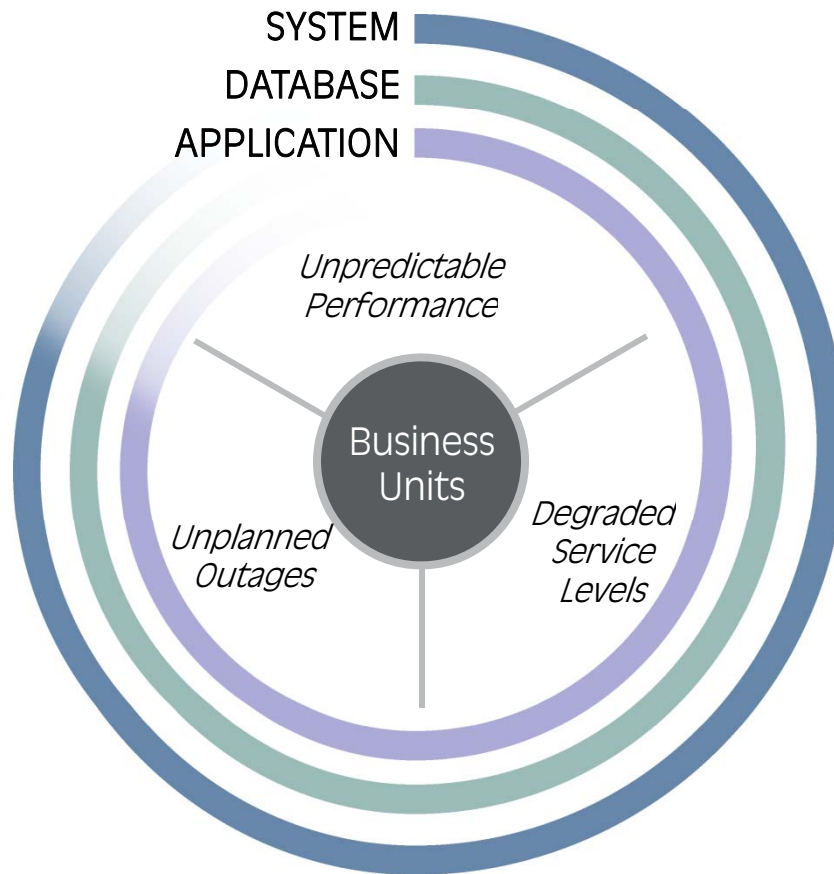


SQL – Life Cycle Management



DB2 Innovations–Addressing Business Exposures



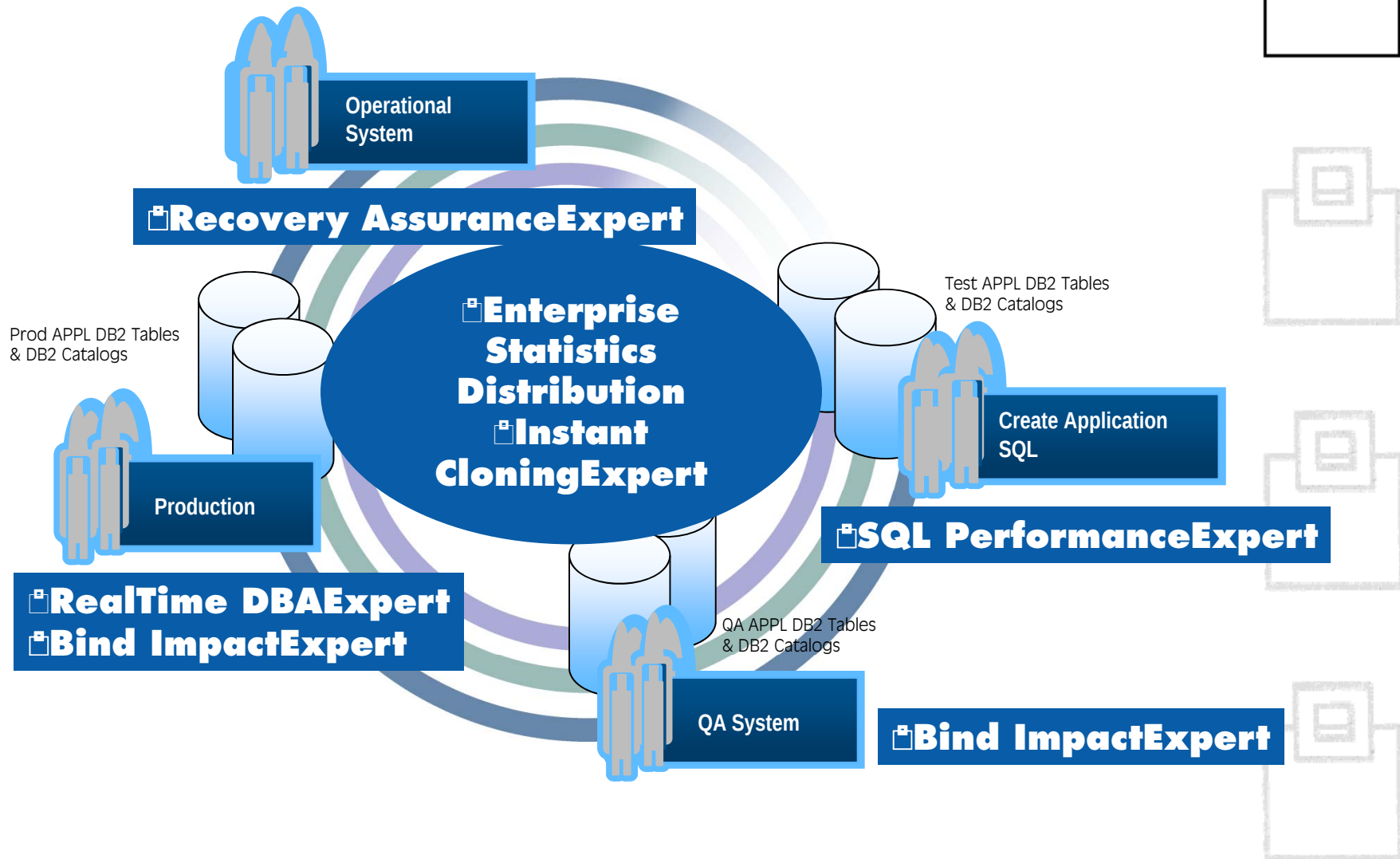
DB2 continues to be vital:

- High rate of change
- Growing data volumes
- New workloads

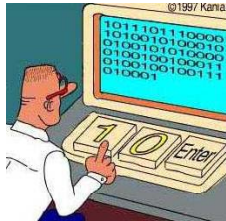
All creating new business exposures



SQL life cycle management



SQL Development life cycle / **SPX** - **BIX**



① Dev

Development

- ❑ Interactive SQL development
- ❑ Access path analysis based on production statistics

SQL



② Q/A

Detect performance issue prior going live

- ❑ Duplicate Production Statistics on test environment (Production Simulator)
- ❑ Highly automated quality insurance for changed application
- ❑ Identify changed application SQL, changed access path

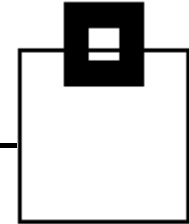
SQL



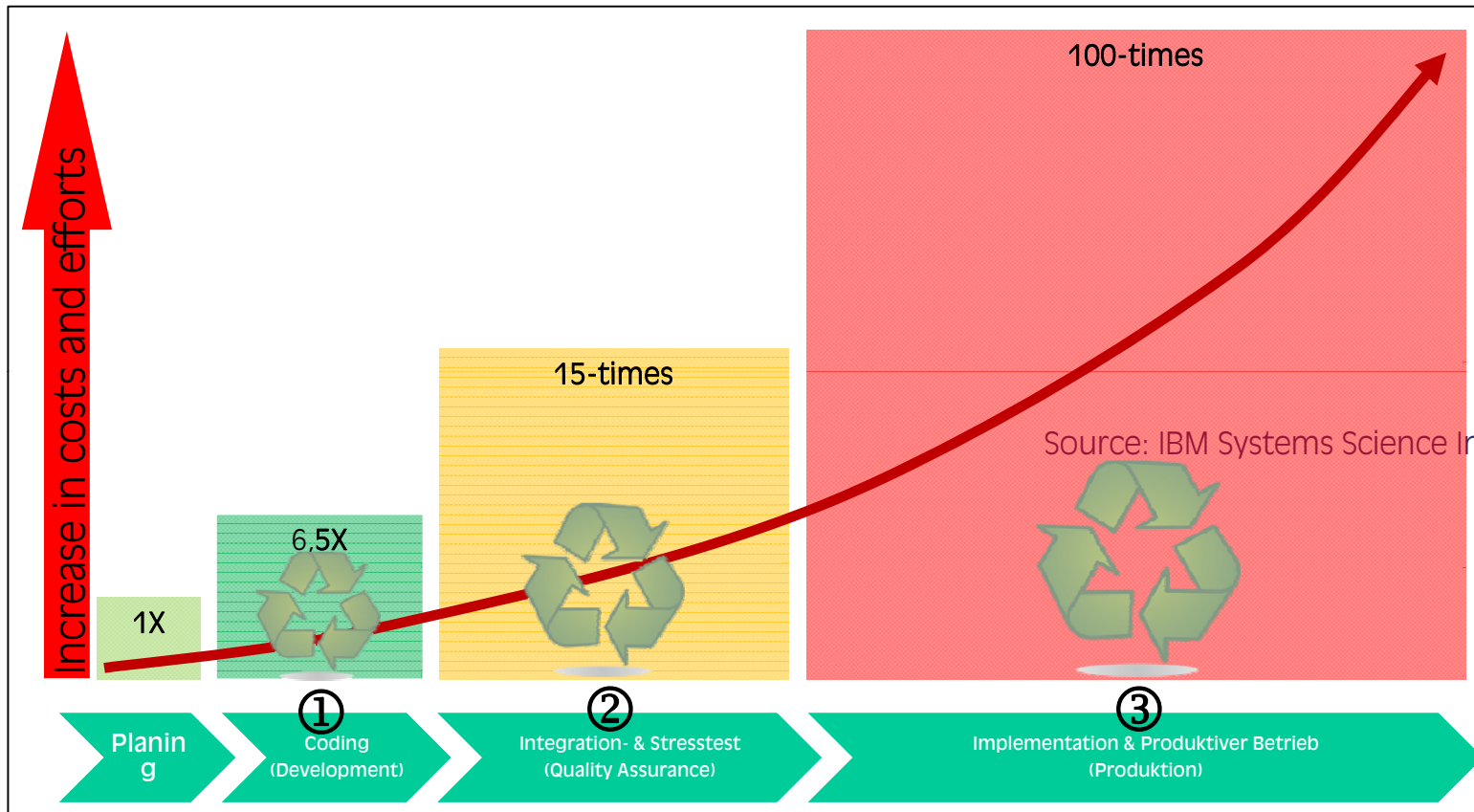
③ Production

Preserve production performance

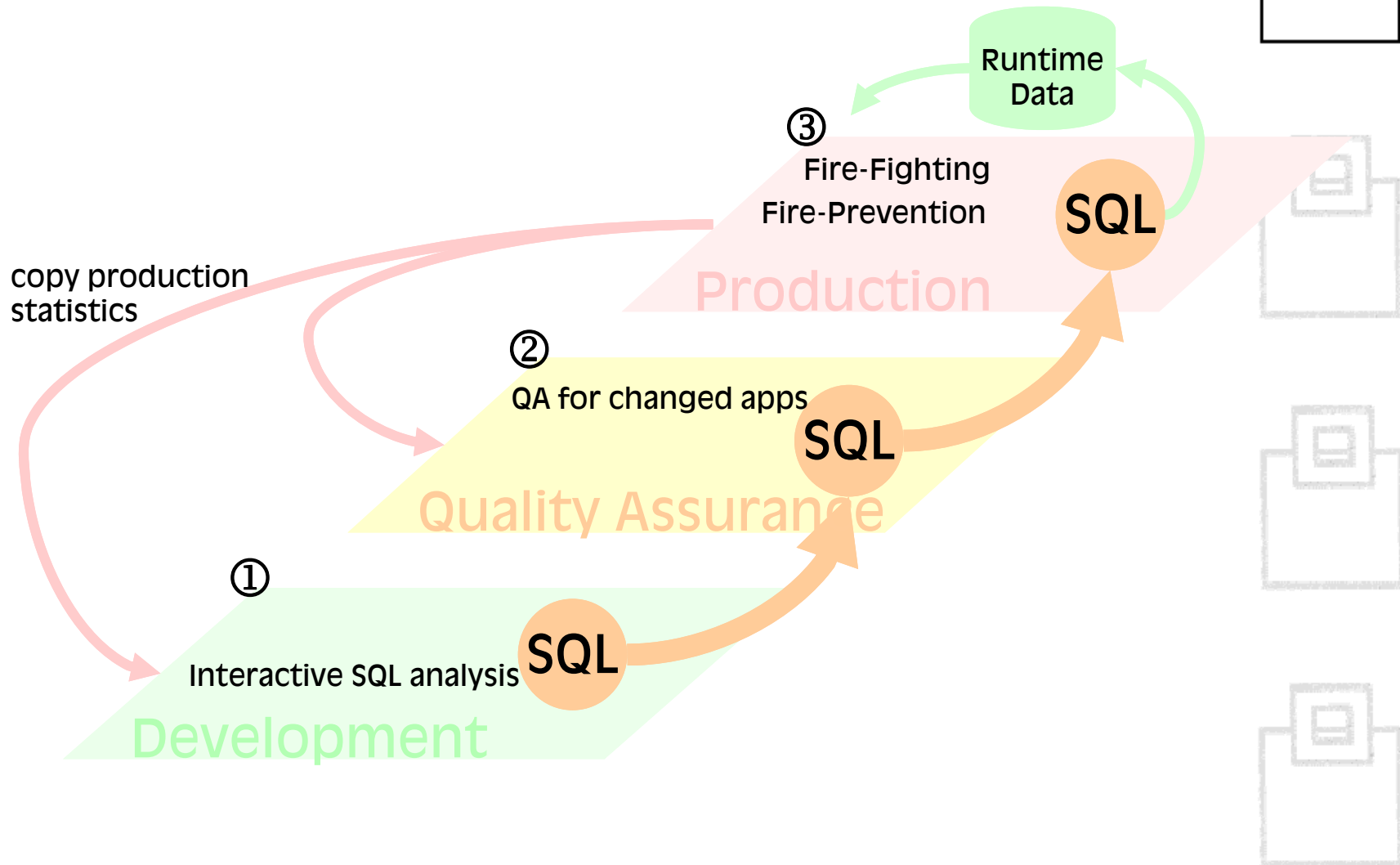
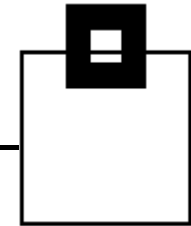
- ❑ Optimize maintenance for best performance and low risk by identifying impact of REBIND
- ❑ Quickly find and tune bad SQL (static/dynamic)
- ❑ Pre-Check impact of new DB2 version



Iterative SQL Life Cycle Management Phase

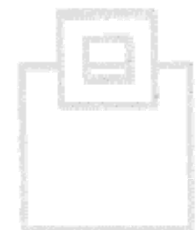
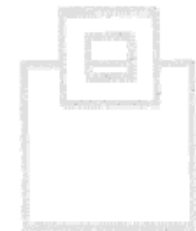
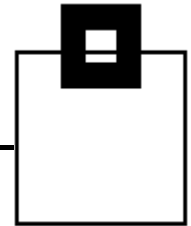


SQL Development life cycle / **SPX** - **BIX**

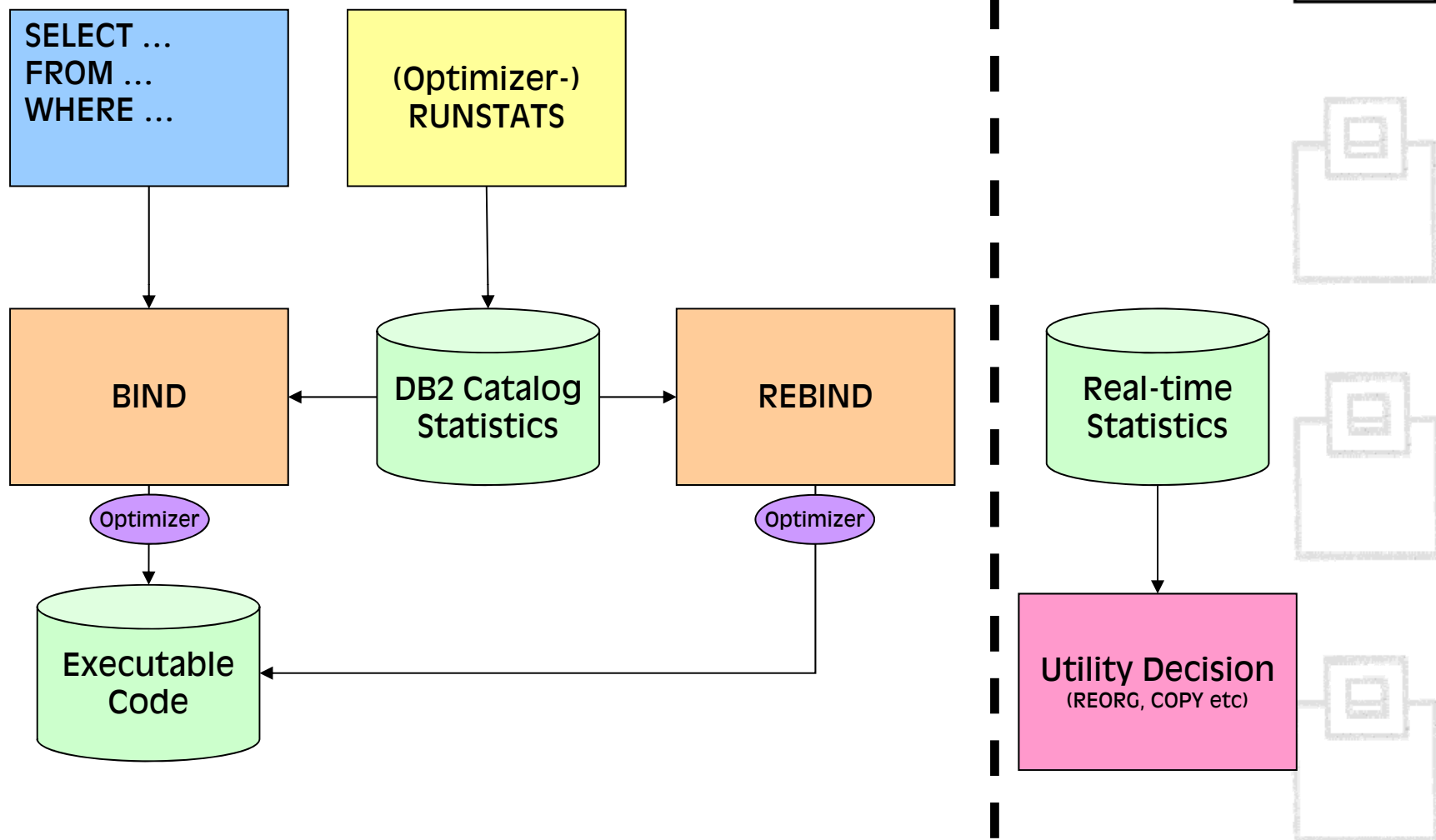


ESD – Key Features

- Provide a production like framework for developers
 - To simulate production environment behavior of SQL
 - Interactively strengthen developers coding
 - To allow access path and workload comparison
 - Proactively forecast effect on the prod. environment
- Support flexible schema naming conversions
- Ensure most efficient resource usage
- Generate statistics for non-existing schema
- Includes hardware virtualization for
 - CPU (model and # of CPs)
 - Memory (BP, RID Pool, ...)

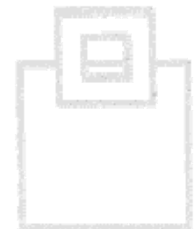
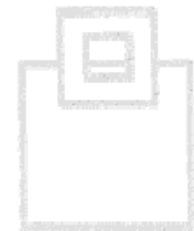
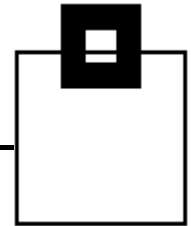


ESD for static SQL – Concept

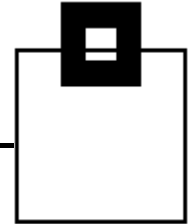


ESD for static SQL – Concept

- Production
 - Central PLAN_TABLE - EXPLAIN(YES)
 - SYSIBM.SYSPACKAGE package statements
 - Capture schema



ESD for static SQL – Concept



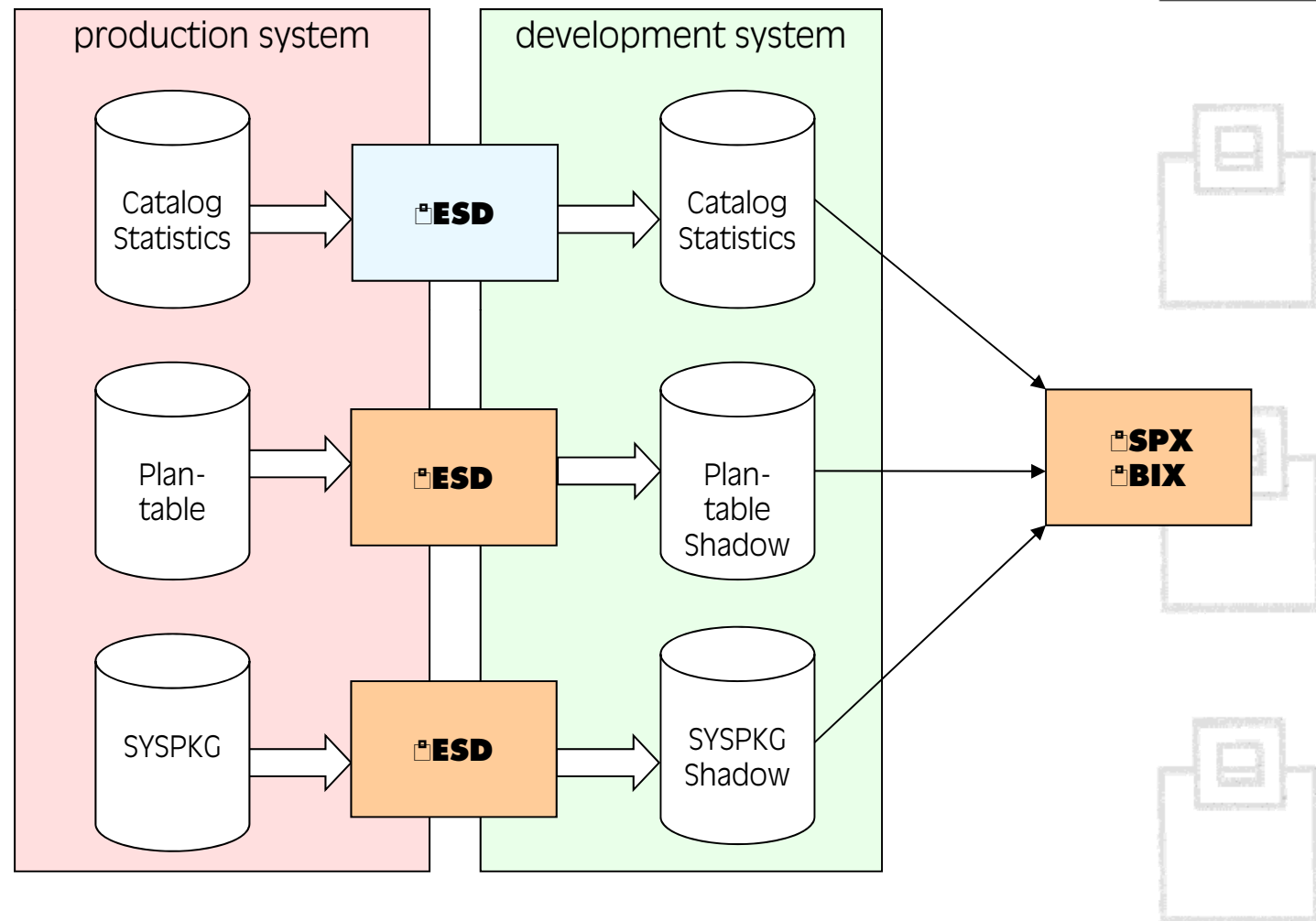
- Development
 - Homogeneous System Copy (without user VSAM cluster) or
 - Clone DDL
 - Update DB2 Catalog with production statistics gathered
 - Populate the central PLAN_TABLE from production
 - Bundle and offer all data as a baseline for easy analysis



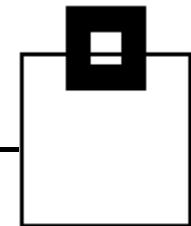
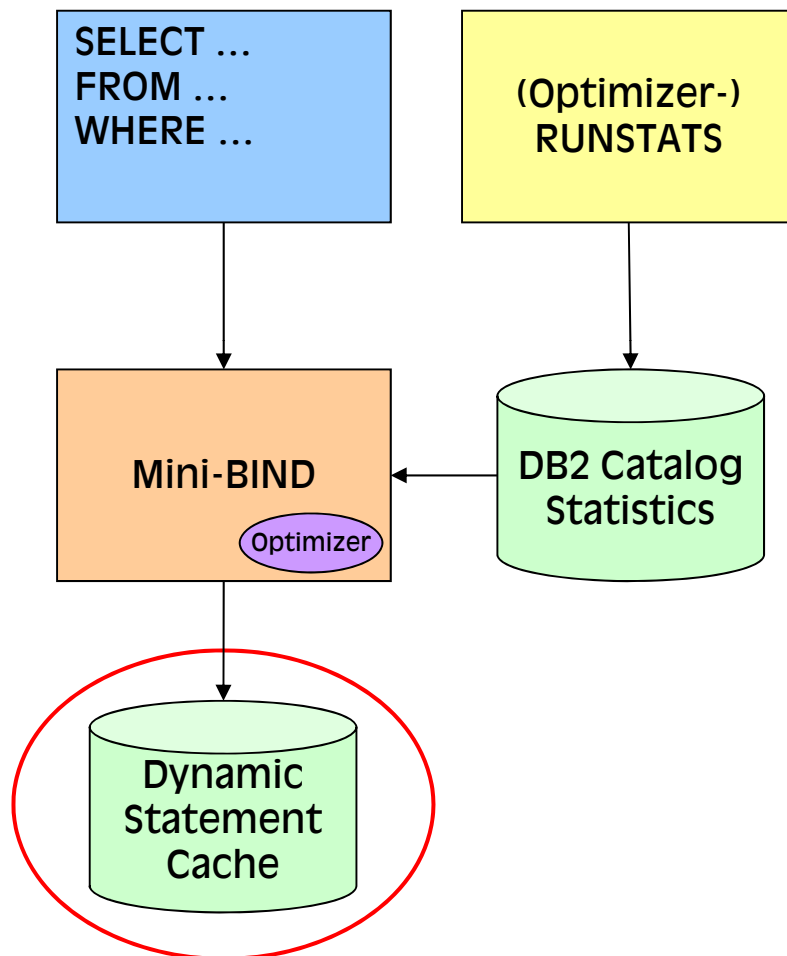
→ Allows interactive and iterative analysis



ESD within SPX - BIX

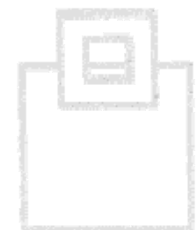
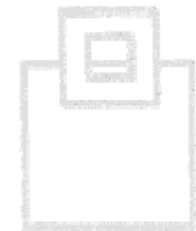
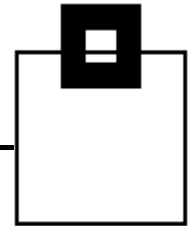


ESD for dynamic SQL – concept



ESD for dynamic SQL – concept

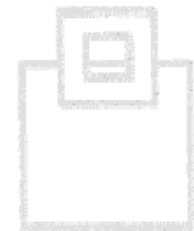
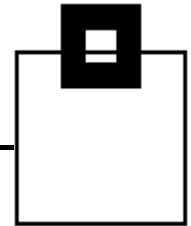
- Production
 - Snapshot of Dynamic Statement Cache
 - Explain of all captured statements to central PLAN_TABLE
 - Capture schema



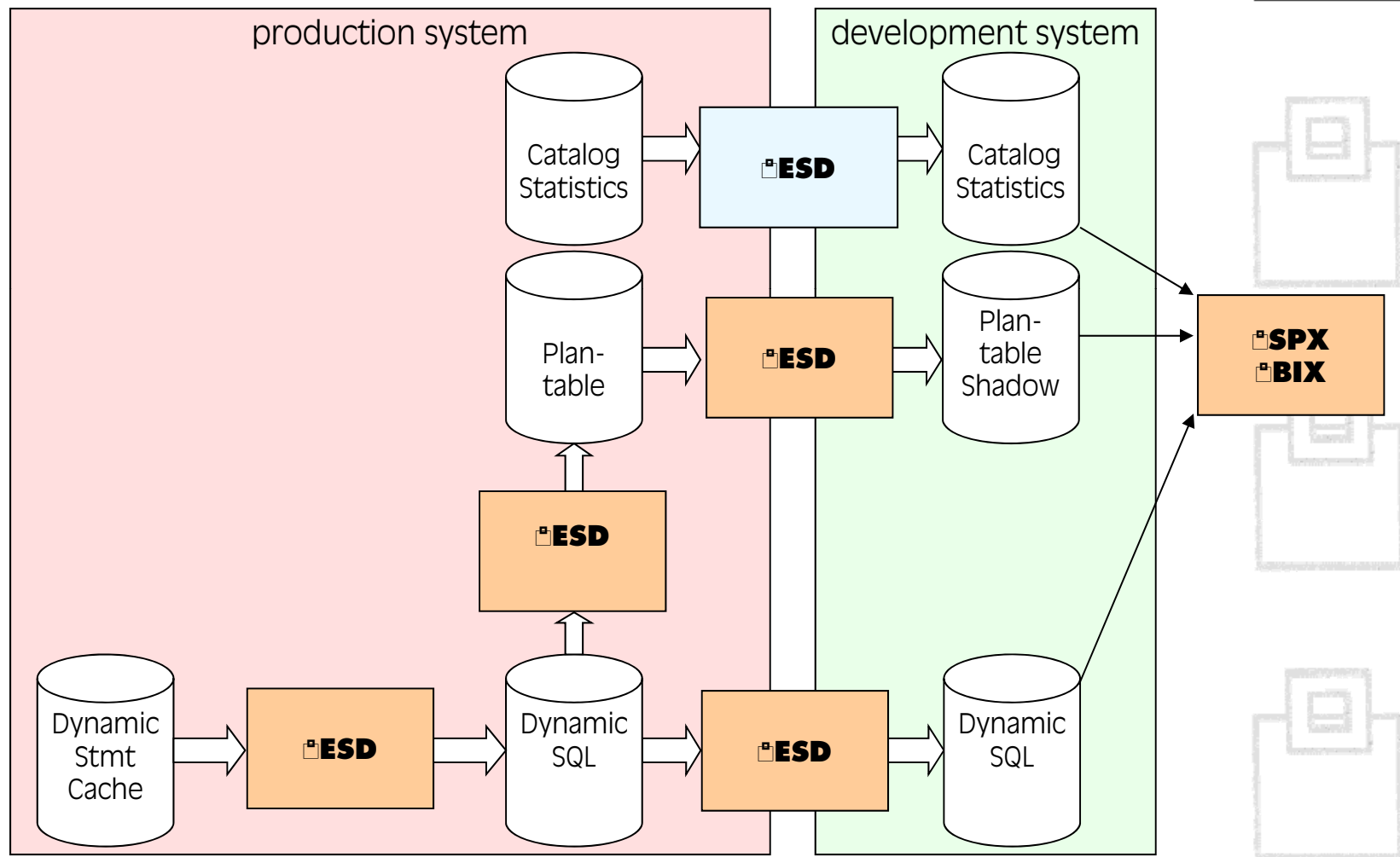
ESD for dynamic SQL – concept

- Development
 - Homogeneous System Copy (without user VSAM cluster) or
 - Clone DDL
 - Update DB2 Catalog with production statistics
 - Copy central PLAN_TABLE from production
 - Copy snapshot of Dynamic Statement Cache
 - Explain of all extracted statements to PLAN_TABLE
 - Bundle and offer all data as a baseline for easy analysis

→ Allows interactive and iterative analysis

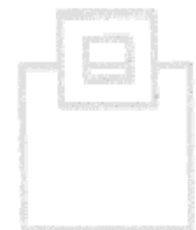
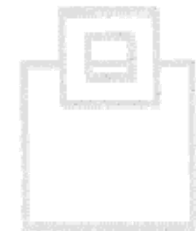
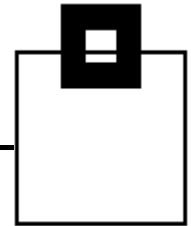


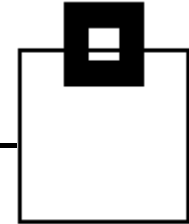
ESD within SPX - BIX



HSC – Key Features

- Exploits storage technology + fast rename technology
 - Supported hardware
 - IBM ESS (Flashcopy)
 - RVA (Snapshot)
 - EMC² (Timefinder)
- Easy “sandbox” set-up for test and development
- Ensures data consistency (online & offline)
- XML based “one-click” automation
- Allows full scope of test szenarios

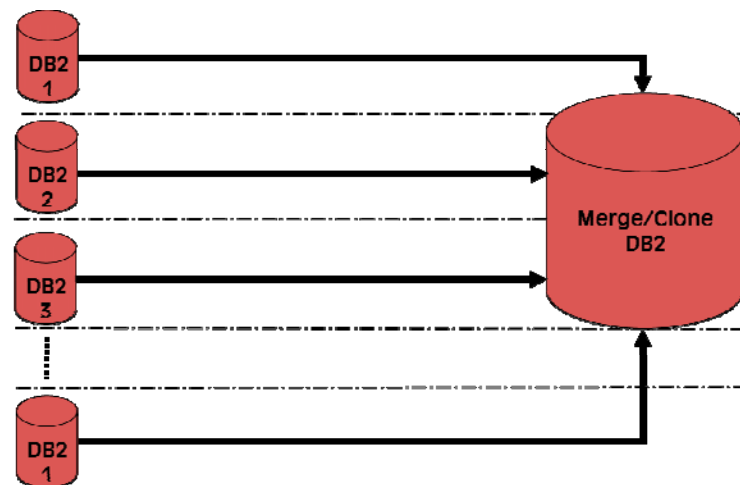




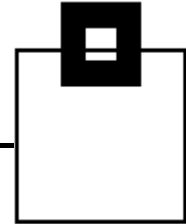
Cloning Management

Allows

- Incremental/refresh cloning
- Merge cloning for multiple DB2 systems



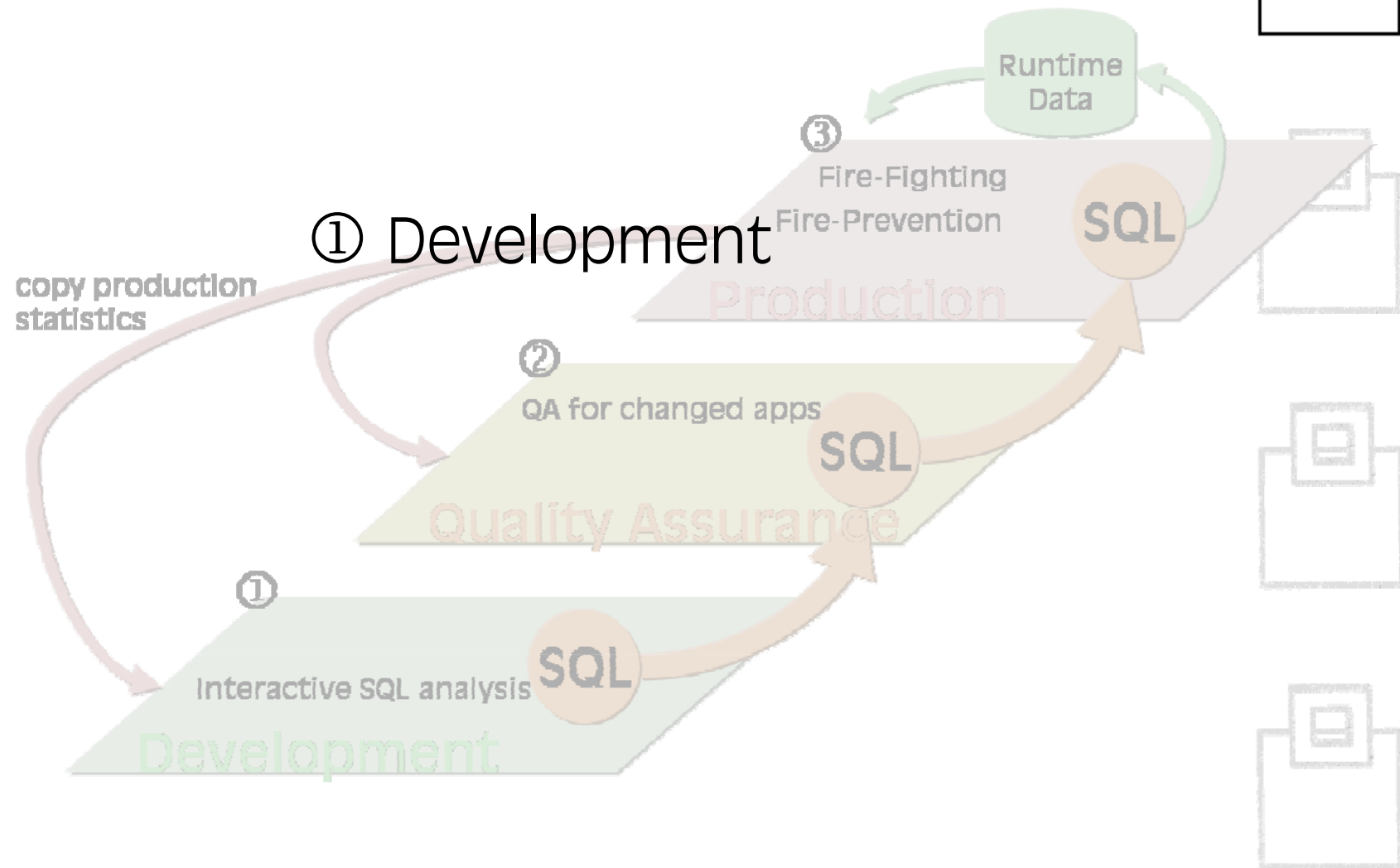
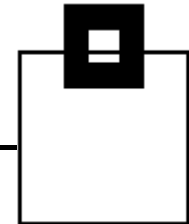
SQL development life cycle / **SPX** - **BIX**



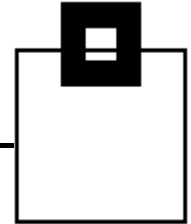
- Development
 - Iterative SQL development
 - Access path analysis based on production statistics
- Quality assurance / Integration
 - Top 10 approach
 - Check changed application / SQL
 - Check changed access paths
 - Performance tests / comparison based on clone
- Production
 - Performance monitoring
 - Change management for access paths



SQL Development life cycle / **SPX** - **BIX**



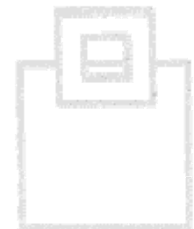
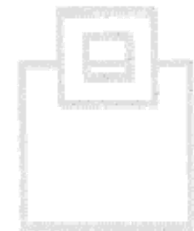
SPX – Key Features



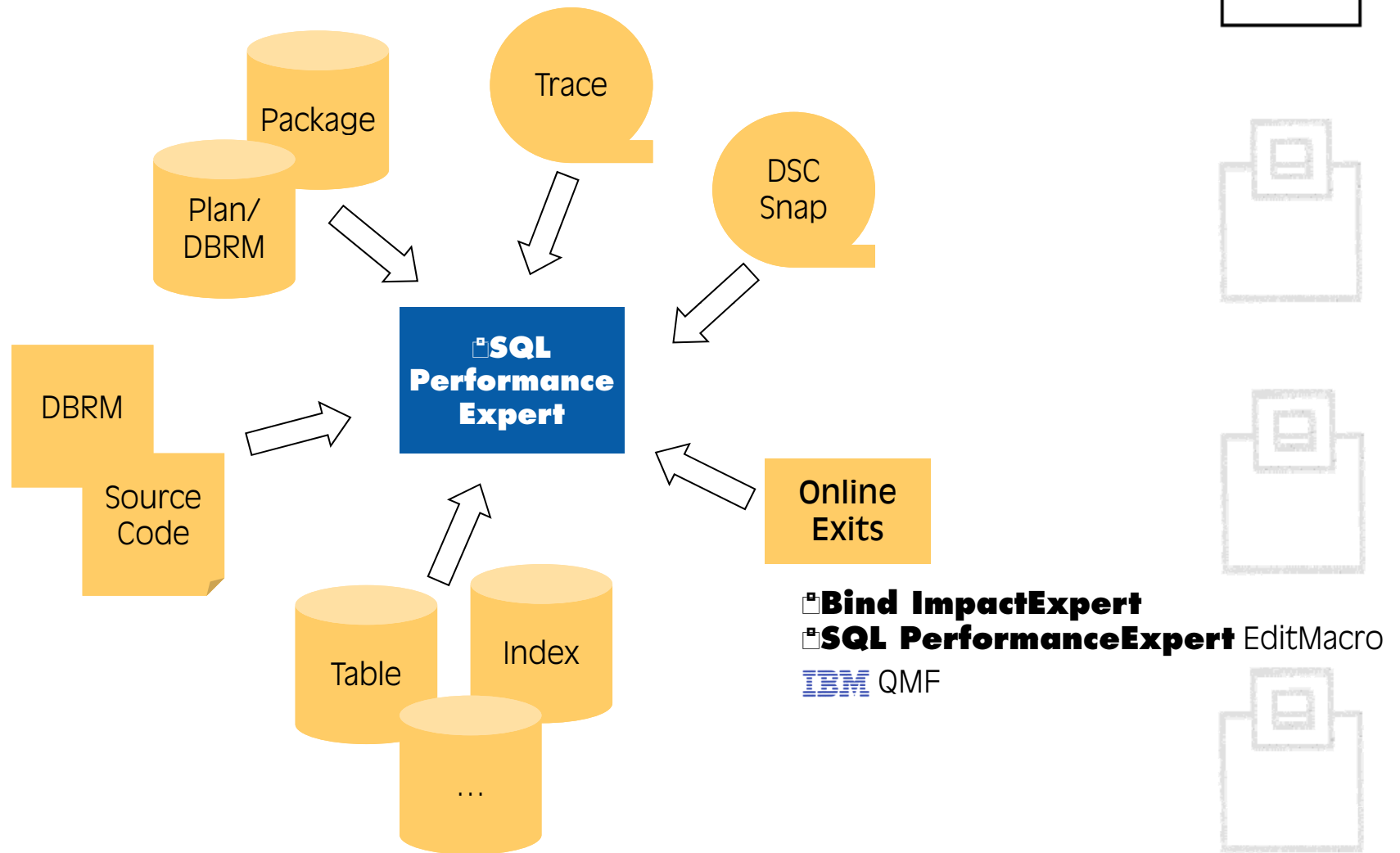
- Extensible Rule System
- Edit Macro
 - Assembler/Fortran/C/Cobol/PL1/Spufi mode
- SQL execution with hostvariable support
- Predicate report (Stage/Filter-Factor)
- Global Explain Table Pool

- DRDA Support for Single Point of Control

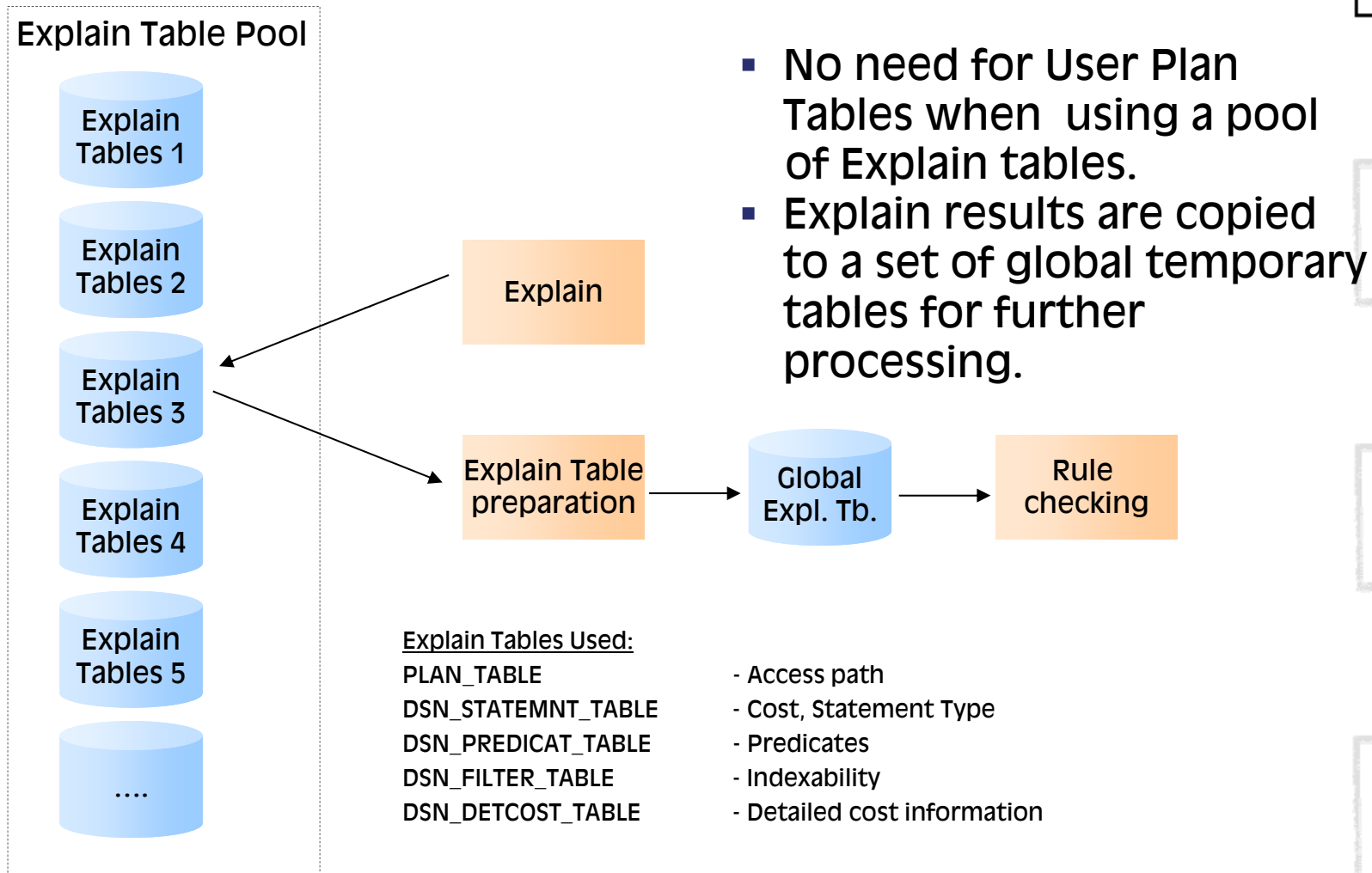
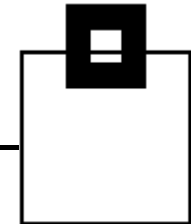
- Integrated Catalog Statistics Browser
- Copy / Transfer Statistics
- Ad-Hoc change of statistics (What-If analysis)



SPX – SQL Sources



SPX – Explain Table Pool



SPX – Explain (SQL browser)

Analyze for DB2 z/OS ----- Package Statements ----- Statement 1 from 3

Command ==> _____ Scroll ==> CSR
DB2: Q10A

Primary cmd: END, CAN(cel), SE(tup), BA(Batch Prepare All),
L(ocate) stmtno

Line cmd: Z(oom), A(nalyze), D(ynamic Analyze), E(dit Statement),
B(at ch Prepare), X(EXecute Statement)

Collection : IQA_COLLECTION_510

Package : ADB2UCTS

Version : 2011-09-28-13.05.36.020867

Bindtime : 2011-09-28-15.05.46.909180 PreComp : 2011-09-28-15.05.36.020867

StmtNo	Millisec	Servunits	Statement Text
--------	----------	-----------	----------------

582	4	13	DECLARE TB-IX-CO-KE-6 CURSOR FOR SELECT TB .
675	4	13	DECLARE TB-IX-CO-KE-7 CURSOR FOR SELECT TB .
768	0	0	DECLARE TB-IX-CO-KE-HIST CURSOR FOR SELECT TB

SPX – Explain (Access Path Overview)

Analyze for DB2 z/OS ----- Explain Data (1/5) ----- Entry 1 from 1

Command ==> _____ Scroll ==> CSR

DB2: Q10A

Primary cmd: END, T(Explain Text), V(iolations), R(unstats), P(redicates),
S(tatement Text), PR(int Reports), Z(oom), SAVExxx, SHOWxxx

Line cmd: Z(oom), I(ndexes of table), S(hort catalog), T(able), X(Index)

DSN = NEWMAN.ADB2.IN

Member = DELME

Stmt = 1

Milliseconds: 433 Service Units: 1696 Cost Category: B

QBNO	QBTYPE	CREATOR	TABLE NAME	ACCS	MTCH	IX	METH	PRNT	TABL	PRE	MXO
PLNO	TABNO	XCREATOR	INDEX NAME	TYPE	COLS	ON	OD	QBLK	TYPE	FTCH	PSQ
1	SELECT	SYSIBM	SYSTABLES	R	0	N	0	0	T	S	0
1	1										

SPX – Statistics Browser

Analyze for DB2 z/OS ----- Index Overview ----- Index 1 from 3

Command ==> _____ Scroll ==> CSR
DB2: Q10A

Primary cmd: END, CAN(cel), SE(tup), Z(oom), L(ocate) creator

Line cmd: C(olumns), D(atabase), K(Packages), P(artitions), T(able), Z(oom)

IX Creator	IX Name	Created by	Created timestamp
TB Creator	TB Name	Database	Statstime
		Indexspace	
---	---	---	---
- SYSIBM	DSNDTX01	SYSIBM	0001-01-01-00.00.00.000000
SYSIBM	SYSTABLES	DSNDB06	0001-01-01-00.00.00.000000
		DSNDTX01	
---	---	---	---
- SYSIBM	DSNDTX02	SYSIBM	0001-01-01-00.00.00.000000
SYSIBM	SYSTABLES	DSNDB06	0001-01-01-00.00.00.000000
		DSNDTX02	
---	---	---	---
- SYSIBM	DSNDTX03	SYSIBM	2011-09-21-23.27.05.275288
SYSIBM	SYSTABLES	DSNDB06	0001-01-01-00.00.00.000000
		DSNDTX03	
---	---	---	---

SPX – Rule violations and recommendations

```
Analyze for DB2 z/OS ----- Violations ----- LINE 00000001 COL 001 080
Command ==> _____ Scroll ==> CSR
                                         DB2: Q10A

Primary cmd: END, E(xplain Data), T(Explain Text), R(unstats), P(predicates),
             S(tatement Text), PR(int Reports), SAVExxx, SHOWxxx

DSN = NEWMAN.ADB2.IN                      MEMBER = DELME
STMT =          1

-----
----- RULE-NO.: 9072 (WARNING) -----
Predicate is stage 2 (neither stage 1 nor indexable). QBLOCKNO: 1, Access:
STAGE2, Predicate: 5 BETWEEN SYSIBM.SYSTABLES.DBID AND SYSIBM.SYSTABLES.OBID
Try to rewrite the predicate as stage 1 or indexable or try to add another (
stage 1 or indexable) predicate for this column(s) to the WHERE or ON clause.
----- RULE-NO.: 9201 (WARNING) -----
A predicate like: '(EXPR) BETWEEN COL1 AND COL2' should be rewritten like:
'(EXPR) >= COL1 AND (EXPR) <= COL2'.
Then the predicates are INDEXABLE.
----- RULE-NO.: 9065 (WARNING) -----
SELECT * can lead to unnecessary data transfer. QBLOCKNO(s) affected: 1.
Select only columns which are really used by your application.
----- RULE-NO.: 9070 (SEVERE-ERROR) -----
Runstats check found critical rule violations.
Please look into the runstats report.
----- RULE-NO.: 9099 (WARNING) -----
```

SPX – Predicate Overview

Analyze for DB2 z/OS ----- Predicates (1/3) ----- Predicate 1 from 1

Command ==> _____ Scroll ==> CSR
DB2: Q10A

Primary cmd: END, E(xplain Data), T(Explain Text), V(iolations), R(unstats),
S(tatement Text), PR(int Reports), Z(oom), SAVExxx, SHOWxxx

Line cmd: Z(oom)

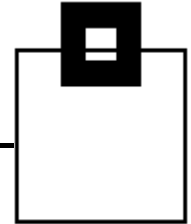
DSN = NEWMAN.ADB2.IN

Member = DELME

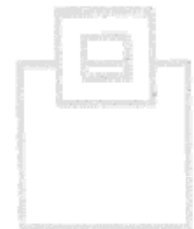
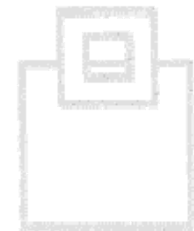
Stmt = 1

Qblkno	Predno	Left_hand_side	Right_hand_side	Stage	TYPE
1	1	VALUE	EXPRESSION	STAGE2	BETWEEN

SPX – Extensible Rule System



- Rules based on
 - Parsed SQL syntax
 - Access Path
 - DB2 Version specific Explain Tables (DSN_*)
 - Catalog Statistics
- Rule Programs
- Rules build from conditions
-  **Statistics HealthCheck** integrated
- Easy to use ISPF online interface for user defined rules



SPX – Ruleset overview

Analyze for DB2 z/OS --- Rule Sets ----- Row 1 to 5 of 5

Command ==> _____ Scroll ==> CSR
DB2: Q10A

Primary cmd: END, CAN(ce1), L(ocate) rule-set

Line cmd: S(elect), I(nsert), D(elete), U(pdate)

	Rule-Set	DB2-Rel.	Type	SE
-	0001	810	DML	
-	0002	910	DML	
- S	0003	810	DML	
-	8008	810	DDL	Y
-	9008	910	DML	Y
-	1008	110	DML	Y

SPX – Active Rules

Analyze for DB2 z/OS --- Rules ----- Row 19 from 45
Command ==> _____ Scroll ==> CSR
DB2: Q10A

Primary cmd: END, CAN(cel), USED, ALL, L(ocate) rule-no.

Line cmd: S(elect), I(nsert), D(elete), U(pdate), T(exts), O(n,Off)

Rule Set: 0001 DB2 Rel.: 110 Type: DML

Rules shown: USED

Rule-No.	Severity	Rule-Type	SE
Description Text			
1058	W	Condition	Y
- *	Access path reoptimization at run time. Access path shown may not be the on		
1059	I	Condition	Y
- *	Non matching index scan. Probably because of a simple tablespace with more		
1060	W	Condition	Y
- *	OPTIMIZE HINT is used. DB2 uses a predefined access path.		
1061	W	Condition	Y
- *	DB2 has to materialize a result table		
1063	W	Program (ADB2R063,RT=1)	Y
- *	Clustered index &&P4 probably not used because of bad clusterratio of &&P5%		

SPX – Active Conditions (Sample Rule 9044)

Analyze for DB2 z/OS --- Conditions ----- Row 21 from 364

Command ==> _____ Scroll ==> CSR
DB2: Q10A

Primary cmd: END, CAN(ce1), USED, ALL, L(ocate) cond-no.

Line cmd: Z(oom), I(nsert), D(elete), U(pdate), O(n, off)

Rule-No: 1044 Severity: W Type: DML SE: Y

Description: Non matching index scan, NLEAF > 32 and INDEXONLY = Y

Conditions shown: USED

Cond-No. Cond-Type SE

Explanation

```
-----
- 1019      SQL      Y
  * PLAN_TABLE: MATCHCOLS = 0
-----
- 1021      SQL      Y
  * PLAN_TABLE: ACCESSNAME NOT = " "
-----
- 1055      SQL      Y
  * PLAN_TABLE: INDEXONLY = Y
-----
- 1059      SQL      Y
  * SYSINDEXES: NLEAF > 32
-----
- 1080      SQL      Y
```

SPX – Dyn. Condition Source (Sample Rule 9019)

```
Analyze for DB2 z/OS ----- Zoom SQL Condition ----- LINE 00000001 COL 001 080
Command ==> _____ Scroll ==> CSR
                                      DB2: Q10A
```

Primary cmd: END

Cond-Number: 1019

Cond-Type : SQL

Explanation: PLAN_TABLE: MATCHCOLS = 0

SELECT

'1'

FROM

&&IQA_PLAN_TABLE PL

WHERE

PL.QBLOCKNO = &&QBLOCKNO

AND

PL.PLANNO = &&PLANNO

AND

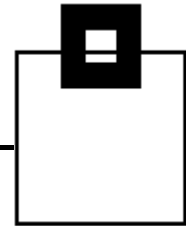
PL.MIXOPSEQ = &&MIXOPSEQ

AND

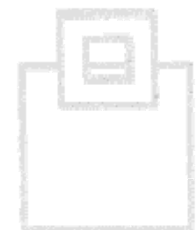
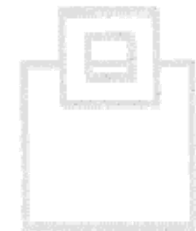
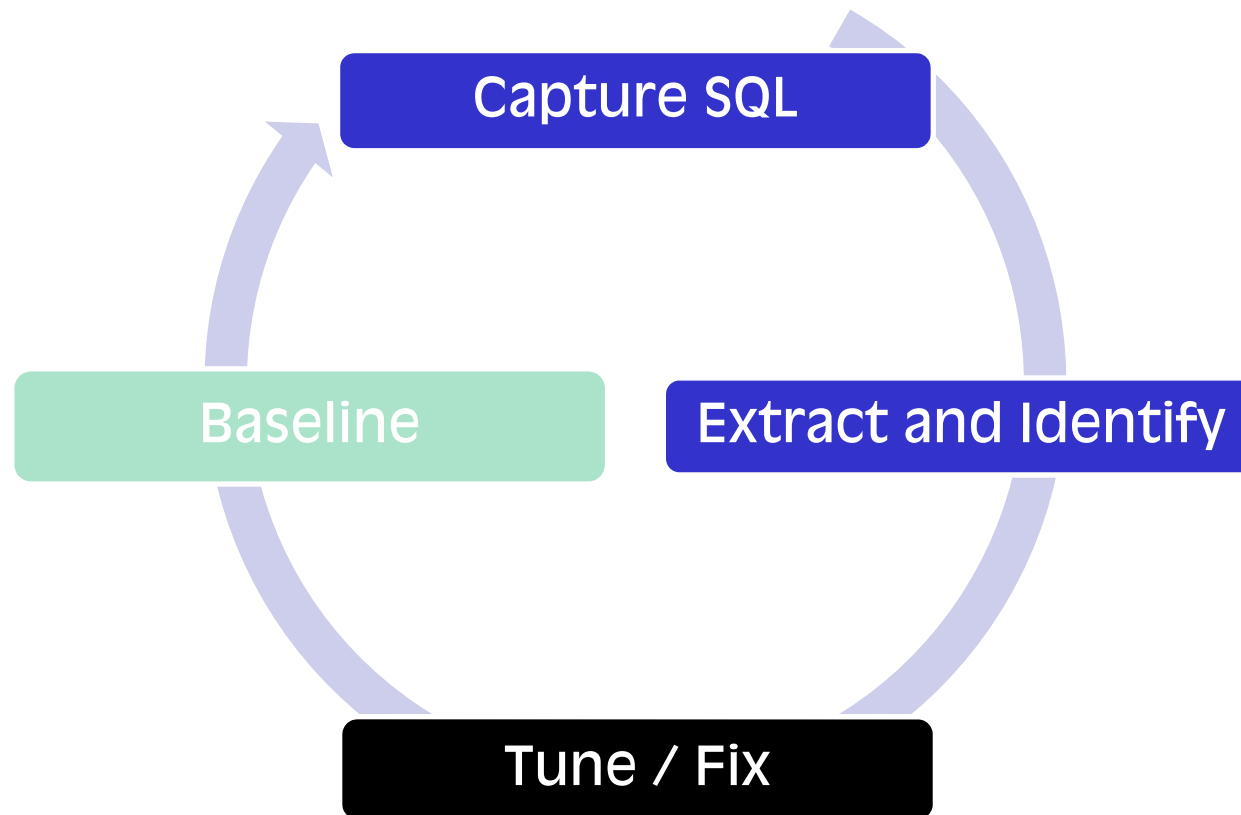
PL.MATCHCOLS = 0

***** Bottom of Data *****

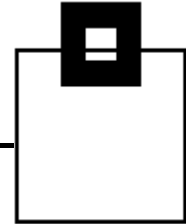
Dynamic SQL Management – Customer Example



Step 1



Dynamic SQL Management – Customer Example



Step 1: Capture SQL

SQL PerformanceExpert for DB2

Capture SQL

DSC Capture:

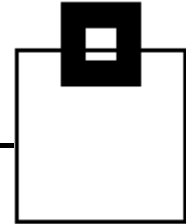
- ☐ Online extraction
- ☐ Batch extraction

Threshold based SQL extract and SQL filtering

Sort statements by
CPU utilization, frequency, timestamps



Dynamic SQL Management – Customer Example



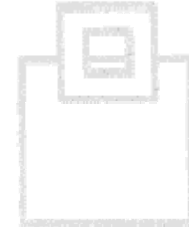
Step 2: Extract and identify

SQL PerformanceExpert for DB2

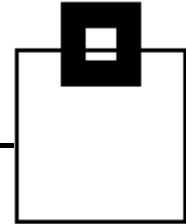
Extract and Identify

Sort statements by
CPU utilization, frequency, timestamps

Identify bad statements with dynamic
explain



Dynamic SQL Management – Customer Example



Step 3: Tune and Fix

SQL PerformanceExpert for DB2

Tune / Fix

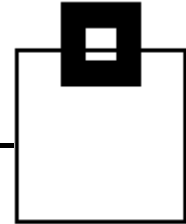
Apply rules based system to identify SQL problems

- ☐ Online
- ☐ Batch for mass analysis

Dynamically Explain SQL Statement



Dynamic SQL Management – Customer Example

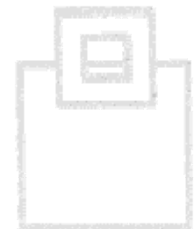
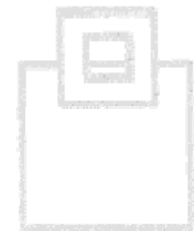


Step 4: Baseline

Bind ImpactExpert for DB2

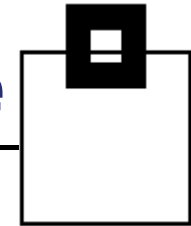
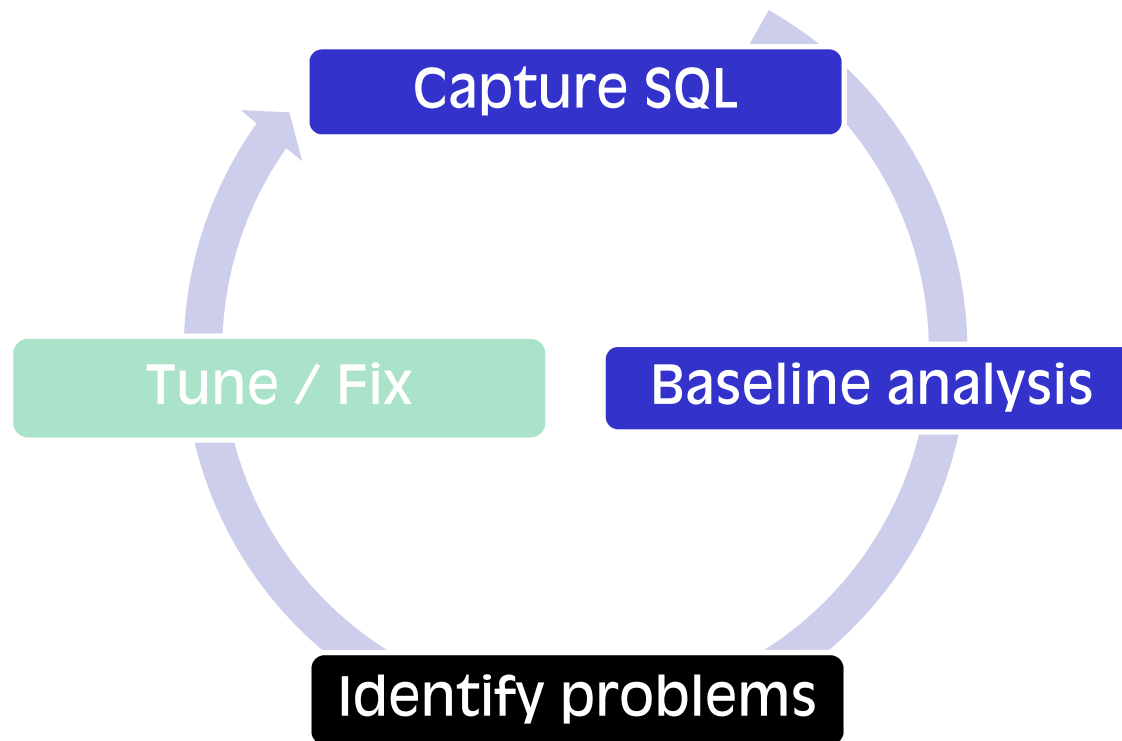
Baseline

- ☐ Stores plan table entry for dynamic SQL statement
- ☐ Mimics analysis of static SQL
- ☐ Enables comparison over time, speeds statement analysis



Dynamic SQL Management – Customer Example

Step n – Repeat as necessary



Dynamic SQL Management – Customer Example



Step 5: Identify problems

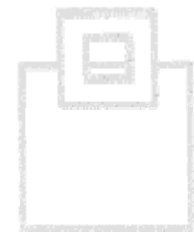
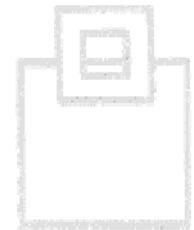
 **Bind ImpactExpert for DB2**

Identify problems

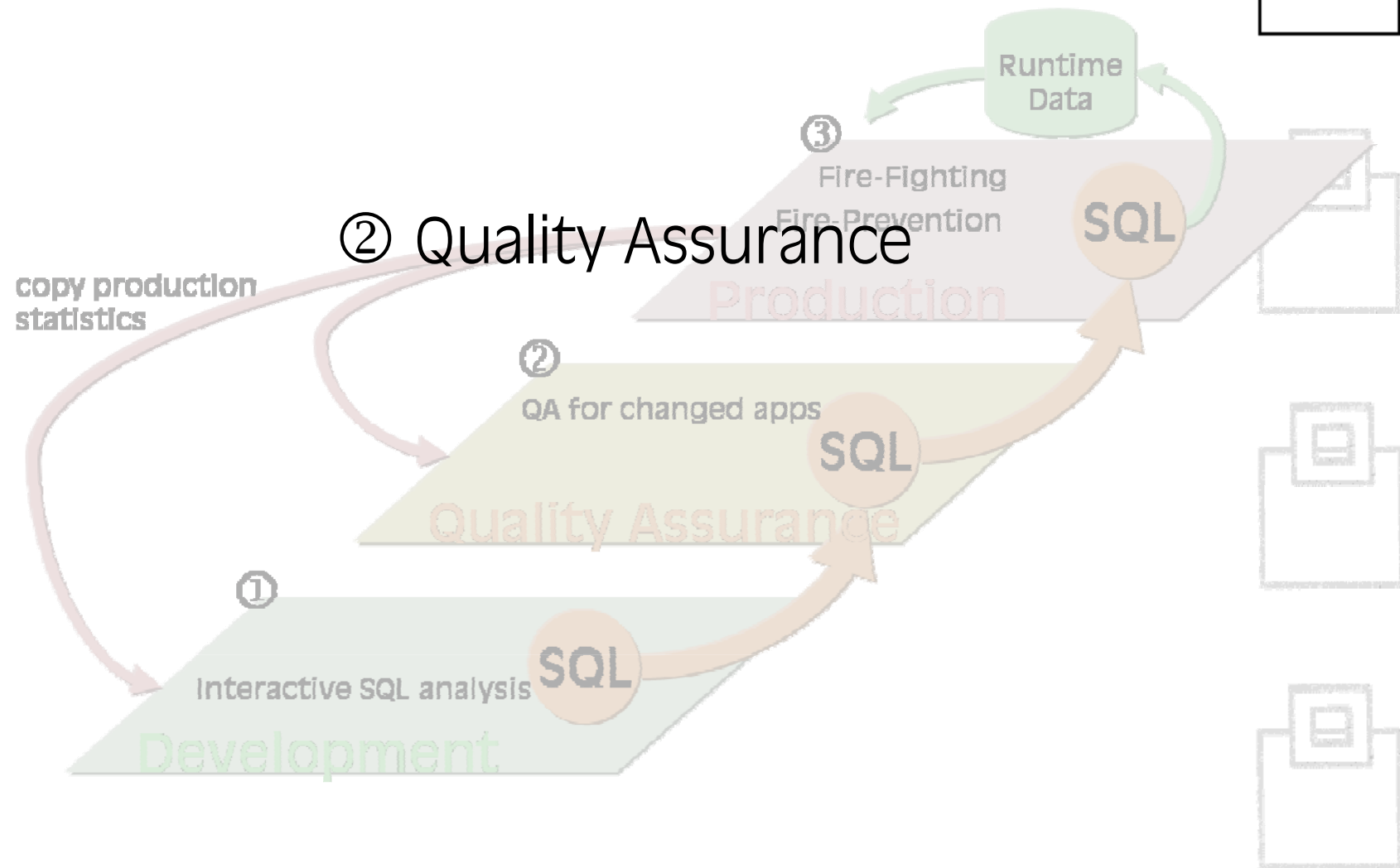
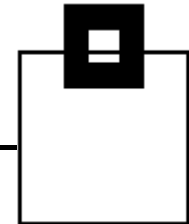
Match SQL statement across application version

Detect degraded access path

- ☐ Online
- ☐ Batch

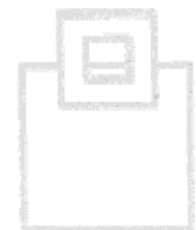
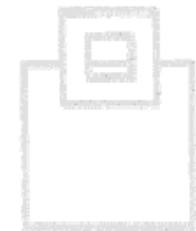
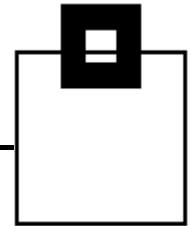


SQL Development life cycle / **SPX** - **BIX**



BIX – QA Key Features

- Pre-Screen application changes
- Matches all statements in a new DBRM to the current DB2 catalog
- Compares access paths old/new
- Highlights statements that are less efficient than the original
- Supports trigger packages
- “Top 10” Lists
- Configurable batch reports with XML support
- Integration into Compile-Procedure possible



BIX – QA scenarios

ImpactExpert for DB2 z/OS ----- Main Menu ----- Version 6.10
Command ==> _____ DB2: Q10A

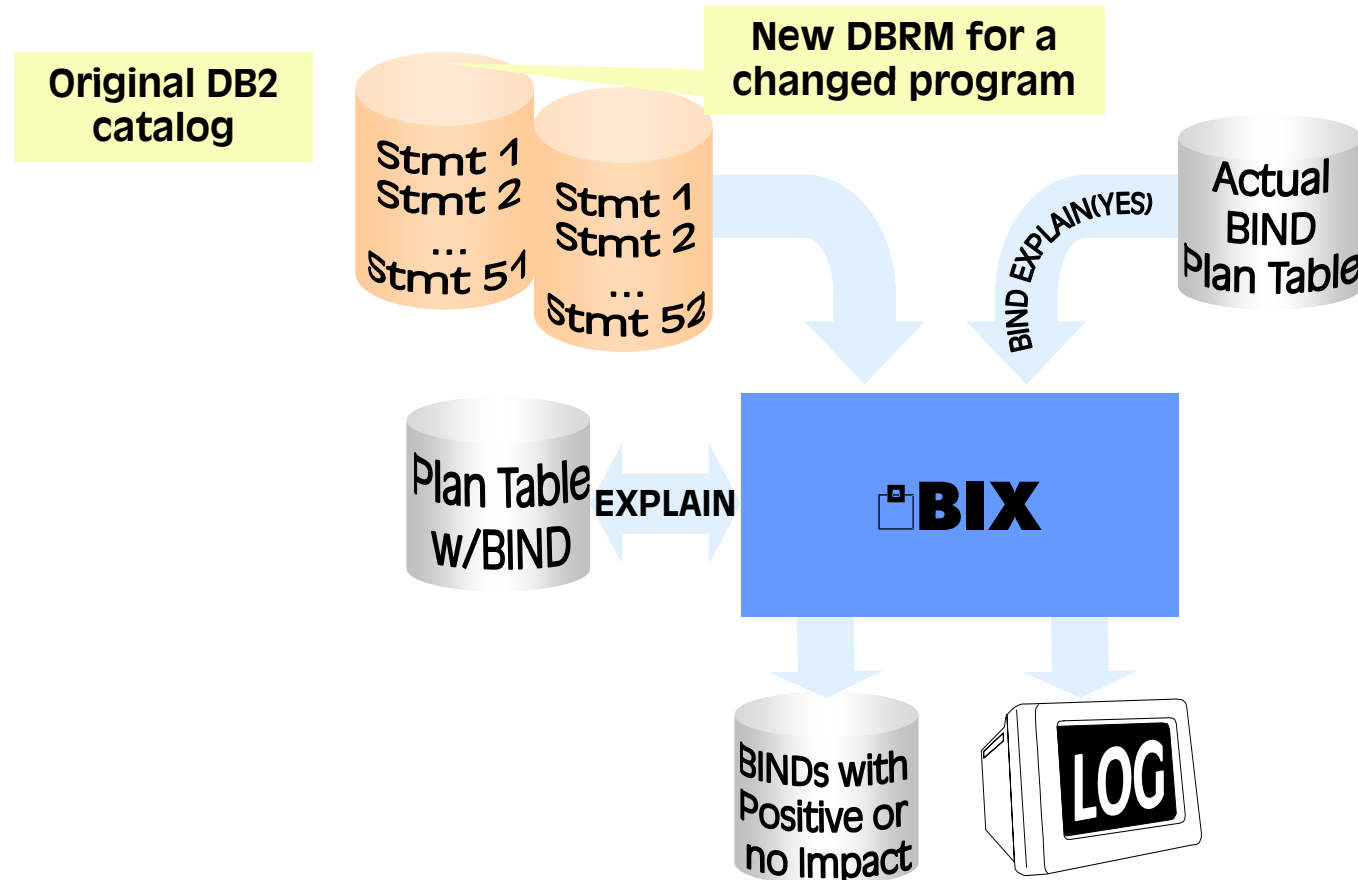
Primary cmd: END, S(ettings), C(leanup), A(bout), O(ld interface), H(istory)
Line cmd: S(elect), I(nfo)

Scenario	Base	Recent	Dyn Expl	Migr. Rules	Convert Qual.	DRDA
-----	-----	-----	----	-----	-----	----
REBIND Analysis	Catalog	-	YES	N	-	-
- Pre-BIND Local	Catalog	DBRM	YES	-	-	-
- Post-BIND Local	History	Catalog	NO	-	-	-
- Pre-BIND Prod-Baseline	Export (*)	DBRM	YES	-	N	N
- Post-BIND Prod-Baseline	Export (*)	Catalog	NO	-	N	N
- Early Precheck Static	Export (*)	-	YES	Y	N	N
- Early Precheck Dynamic	Export (*)	-	YES	Y	N	-
- DSC Protection	Export (*)	-	YES	-	N	-
- Dynamic SQL	DynStmtCache	-	YES	-	-	-
- Static and dynamic SQL	Trace	-	YES	-	-	-
- Plan_table compare	Plan_table 1	Plan_table 2				
- DBRM reconstruct	Catalog					

NOTE (*): Use export/import function to update BIX export tables.

BIX – Bind Control

Automatically finds BIND impacts of changed applications



BIX – Bind Control

```
ImpactExpert for DB2 z/OS ----- Job Overview (1/5) ----- Job 1 from 2
Command ==> _____ Scroll ==> CSR
Mode: PRE-BIND LOCAL DB2: Q10A
Primary cmd: END, A(11), N(ew), R(efresh), Z(oom), L(ocate) -
Line cmd: P(rograms), D(elete), G(raphic), L(Plans), S(tatements), Z(oom)
```

	Job name	Step name	Submitter	Submit time	PLTB owner	Job status
S	BINDPACK	CHKRBIND	NEWMANN	2011-08-27-08.44.06	NEWMANN	DONE
=	BINDPACK	CHKBIND	SMITH	2011-09-02-09.55.43	IMPACT	DONE

BIX – Bind Control

ImpactExpert for DB2 z/OS ----- Programs Summary ----- Status 1 from 7

Command ==> _____ Scroll ==> CSR

Mode: PRE-BIND LOCAL DB2: Q10A

Primary cmd: END, R(efresh), Z(oom)

Line cmd: S(elect)

COLLECTION : *
PACKAGE : *
PLAN : *

	Status	Programs	Statements
	-----	-----	-----
S	PROCESSED	2	7
=	- UNCHANGED	1	5
=	- WORSENERD	1	1
=	- NEW	0	1
=	NON-DETERMINABLE	0	0
=	PLAN_TABLE ISSUES	0	0
=	ERROR	0	0
	-----	-----	-----

BIX – Bind Control

```
ImpactExpert for DB2 z/OS -- All Programs (1/6) ----- Program 1 from 2
Command ==> _____ Scroll ==> CSR
Mode: PRE-BIND LOCAL DB2: Q10A
Primary cmd: END, S(how prepared), Z(oom), L(ocate) programs
Line cmd: S(tatements), A(nalyze), B(IND prepare), Z(oom)
```

	Imp	Collection / Plan	Program	Job submit time	Rel	Rec	EX
=	EQ	BINDDEMO	BINDDEMO	2011-08-27-08.44.06	N/A	YES	
	WRS	BINDDEMO	SQLZDEMO	2011-08-27-08.44.06	V9	NO	
-							

BIX – Bind Control

```
ImpactExpert for DB2 z/OS -- Pre-BIND Overview (1/4) ----- Stmt 1 from 4
Command ==> _____ Scroll ==> CSR
Mode: PRE-BIND LOCAL DB2: Q10A
Primary cmd: END, SE(tup Analyze), Z(oom), L(ocate) stmtno
Line   cmd: S(elect), AO/AN(Analyze Old/New), DO/DN(Dynamic analyze Old/New),
          EO/EN(Edit and analyze Old/New), VO/VN(View Old/New), Z(oom)

Job submit time . 2011-08-27-08.44.06 Bindtime . . 2011-08-27-08.41.08.053757
Collection/Plan . BINDDEMO
Program . . . . . SQLZDEMO
Library . . . . . SE.PRODUCT.IDUG.DEMO.DBRM
```

	StmtNo Catlg	StmtNo DBRM	Imp	Bad access types before BIND	Bad access types with BIND	Explain sqlcode
==	0	66	NEW		NMIX	0
==	10	40	EQ	NMIX	NMIX	0
==	18	24	EQ			0
S	26	58	WRS		SORT	0

BIX – Bind Control

```
ImpactExpert for DB2 z/OS ----- Access Paths ----- LINE 00000001 COL 001 080
Command ==> _____ Scroll ==> PAGE
Mode: PRE-BIND LOCAL DB2: Q10A
Primary cmd: END, C(atalog data), D(etails on/off), S(tatement text)
```

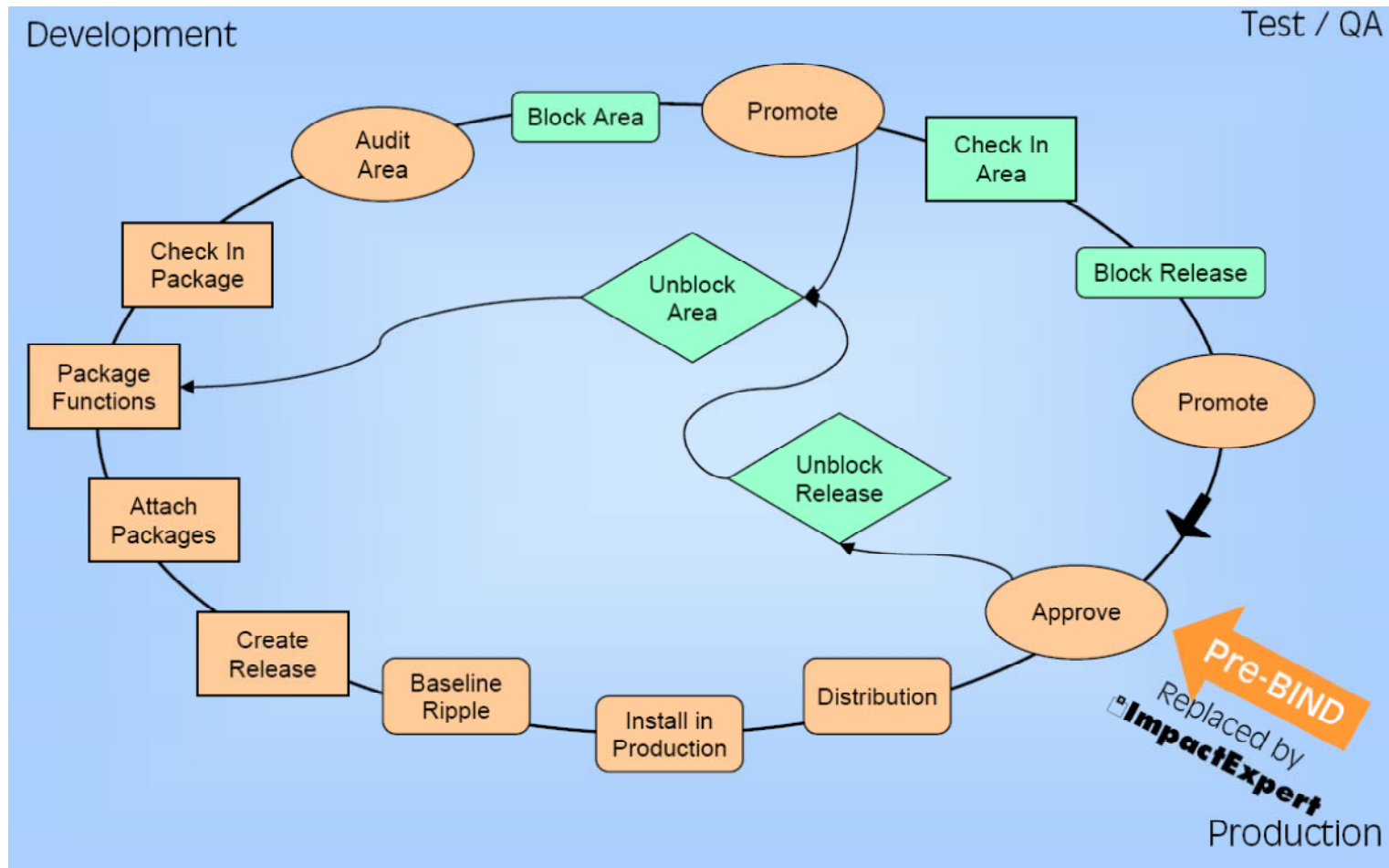
```
Collection . BINDDEMO          Timestamp. . 2011-08-27-08.44.16.630000
Package. . . SQLZDEMO          Version. . . V1
StmtNo old . 26                Bindtime . . 2011-08-27-08.41.08.053757
StmtNo new . 58                SE.PRODUCT.IDUG.DEMO.DBRM
```

```
Access path before BIND -----| Access path with BIND -----
```

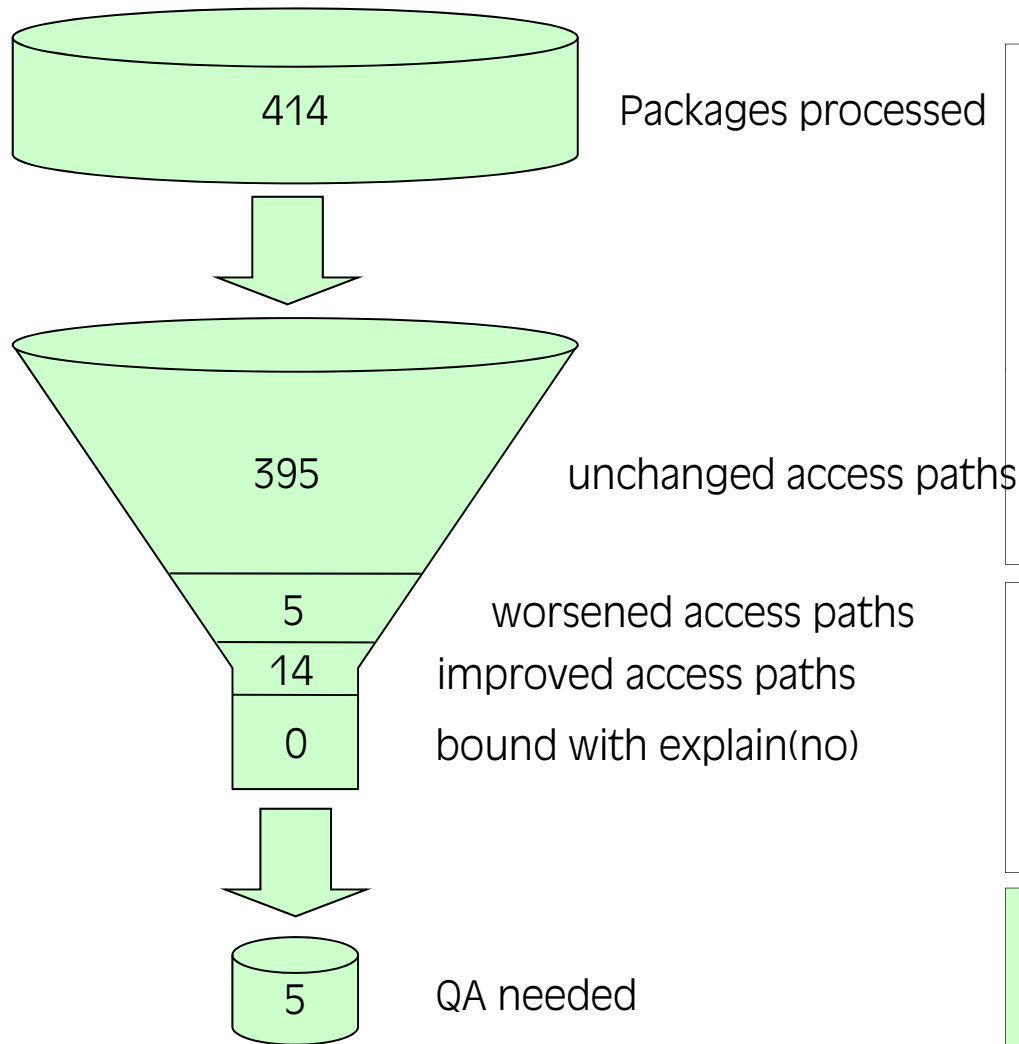
TABLE INDEX	QB	PN	AC TY	MA CO	ME TH	IX ON	PR FT	TABLE INDEX	QB	PN	AC TY	MA CO	ME TH	IX ON	PR FT
SYSCOLUMNS DSNDCX01	1	1	I	1		Y		SYSCOLUMNS DSNDCX01	1	1	I	1		Y	S
									1	2		0	3	N	
Milliseconds:			21					Milliseconds:			89				
Serviceunits:			79					Serviceunits:			348				

```
***** Bottom of Data *****
```

Application Release Rollout – Customer Example



Application Release Rollout – Customer Example



ImpactExpert - Summary Package Level

Packages processed 414

Packages analyzed bound with explain(no) 414

Unchanged 395
Worsened 5
Improved 14

QA omitted 409
QA needed 5

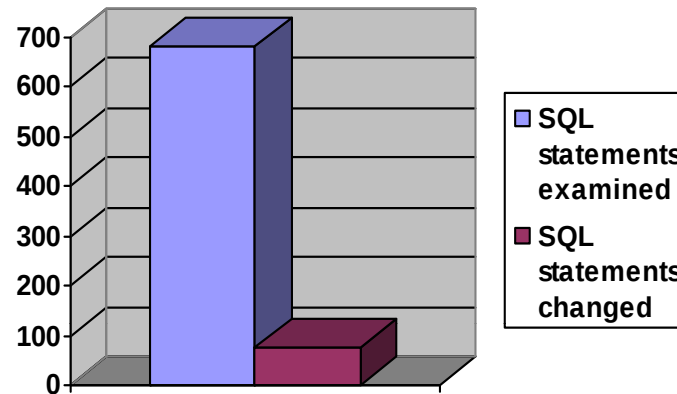
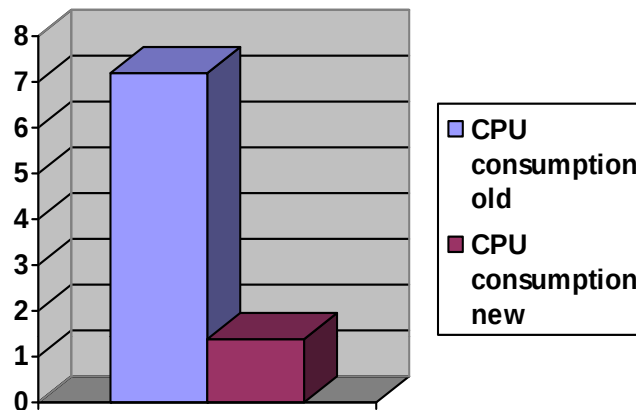
ImpactExpert - Summary SQL Level

SQL analyzed 4304

Unchanged 4264
Worsened 7
Improved 33

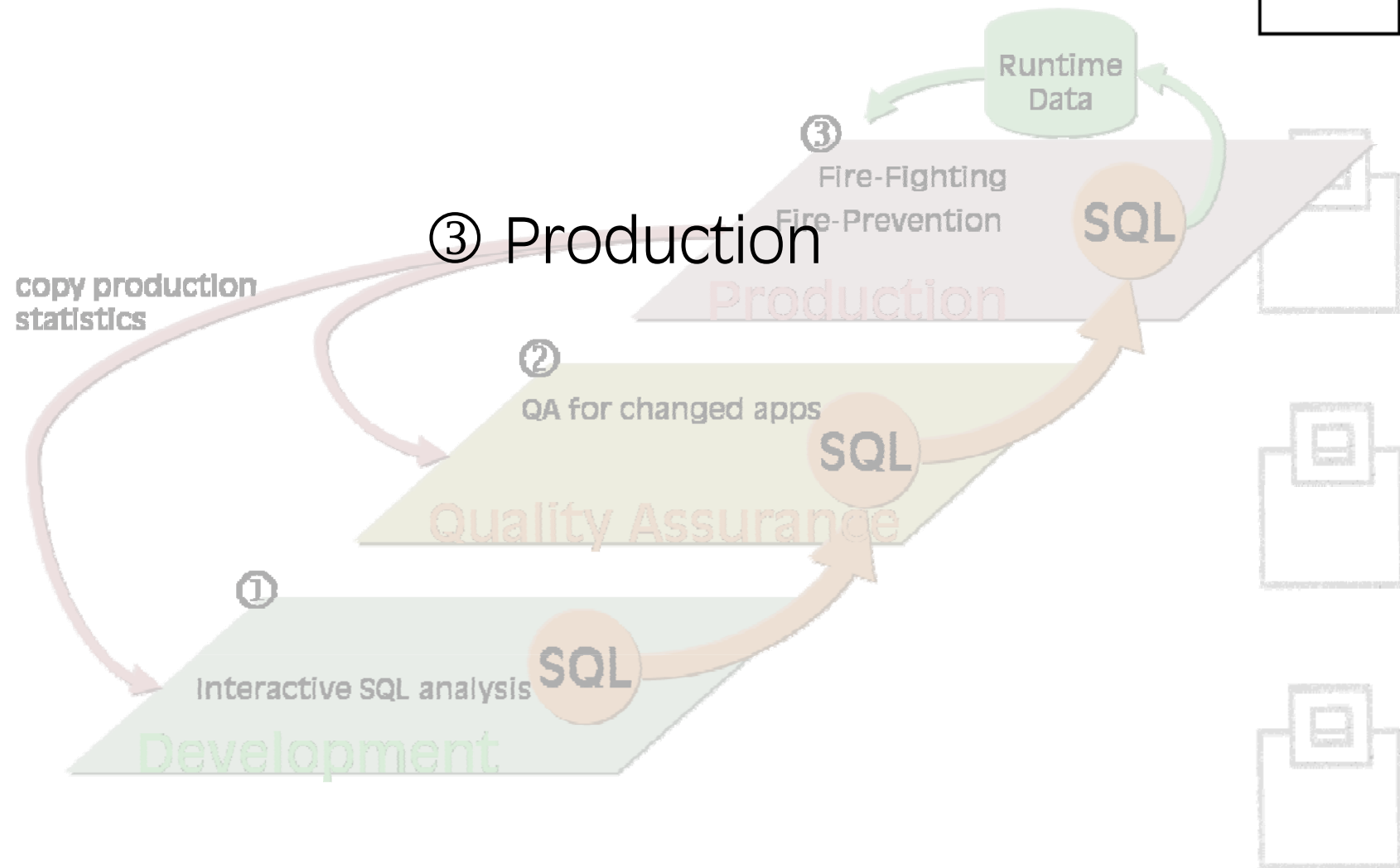
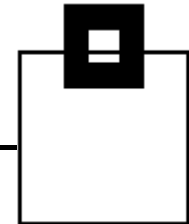
QA omitted: 98,79 %
Critical access path changes prevented: 7

Application Release Rollout – Customer Example



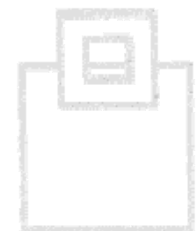
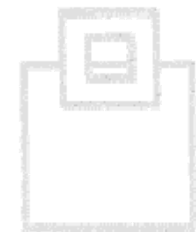
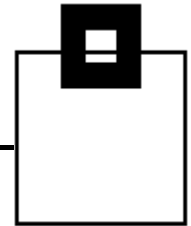
Savings of CPU consumption are in average more than 80%. Additionally the effort for manual investigation of SQL can be reduced to only 20 percent of the original effort.

SQL Development life cycle / **SPX** - **BIX**



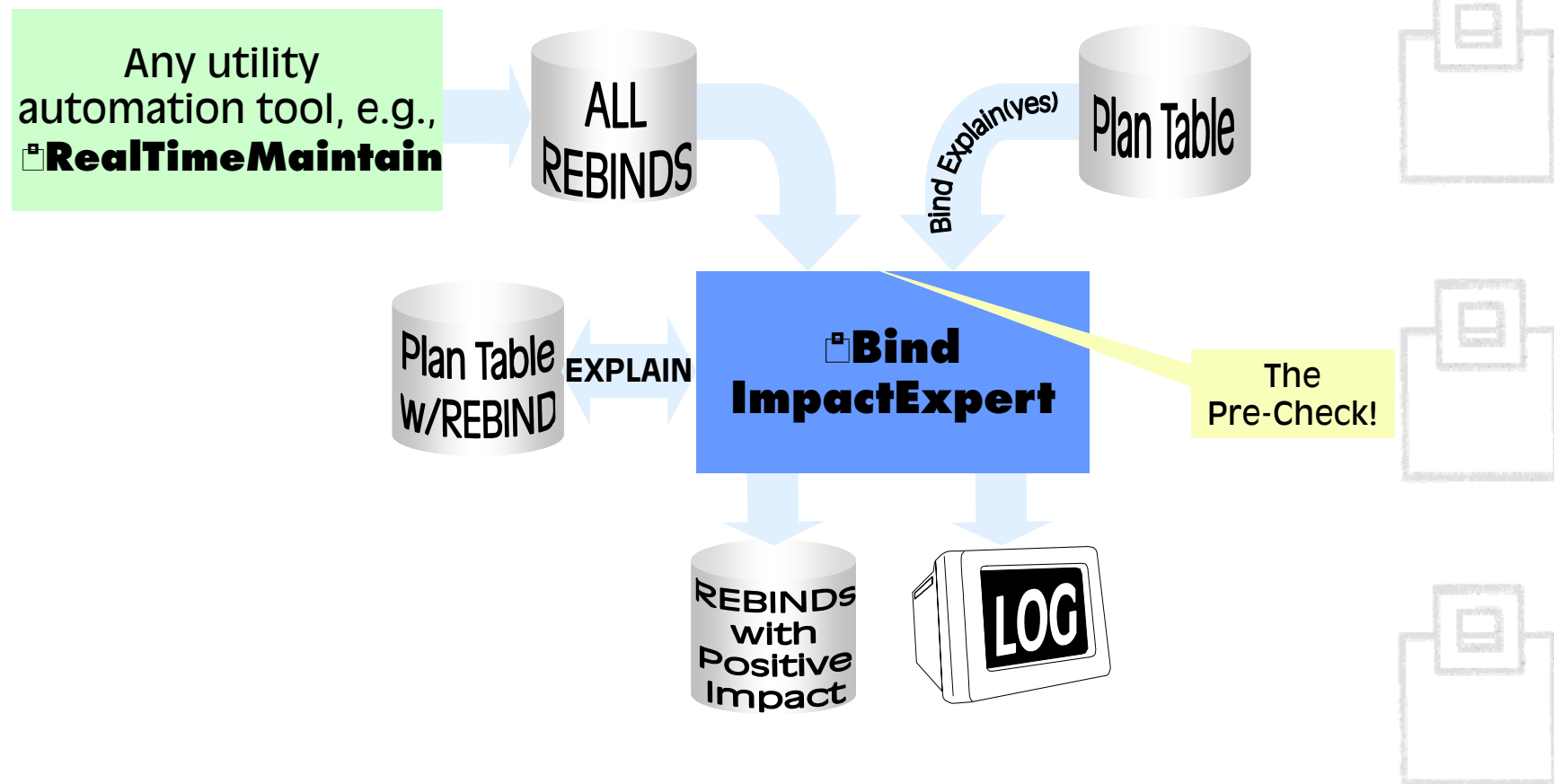
BIX – Production Key Features

- Secures Performance resulting from REBINDs
- Nightly production maintenance, i.e., REBIND after RUNSTATS.
- Migration to new DB2 releases and application of APARs, or anytime when global REBINDs are recommended
- Protects dynamic SQL from degradations



BIX – Rebind Control

Automatically guarantees REBINDs that improve performance



BIX – Rebind Control

ImpactExpert for DB2 z/OS ----- Programs Summary ----- Status 1 from 8

Command ==> _____ Scroll ==> CSR

Mode: REBIND ANALYSIS

DB2: Q10A

Primary cmd: END, R(efresh), Z(oom)

Line cmd: S(elect)

COLLECTION : *
PACKAGE : *
PLAN : *

Status	Programs	Statements
PROCESSED	152	1325
- IMPROVED	6	57
- CHANGED	8	25
- UNCHANGED	131	1203
- WORSENERD	7	40
NON-DETERMINABLE	0	0
PLAN_TABLE ISSUES	0	0
ERROR	0	0



Scroll ==> CSR

DB2: Q10A

```
Line      cmd: S(tatements), A(nalyze), R(EBIND prepare), Z(oom)
```



BIX – Rebind Control

ImpactExpert for DB2 z/OS -- REBIND Overview (1/4) ----- Stmt 1 from 40

Command ==> _____ Scroll ==> CSR

Mode: REBIND ANALYSIS

DB2: Q10A

Primary cmd: END, SE(tup Analyze), Z(oom), L(ocate) stmtno

Line cmd: S(elect), A(nalyze), D(ynamic analyze), E(dit and analyze),
V(iew), Z(oom)

Job submit time . 2011-09-17-11.05.58 Bindtime . . 2011-09-16-18.09.15.916093

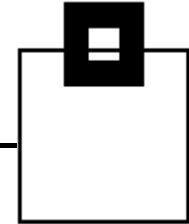
Collection/Plan . RTDX0510

Program MDB2T004

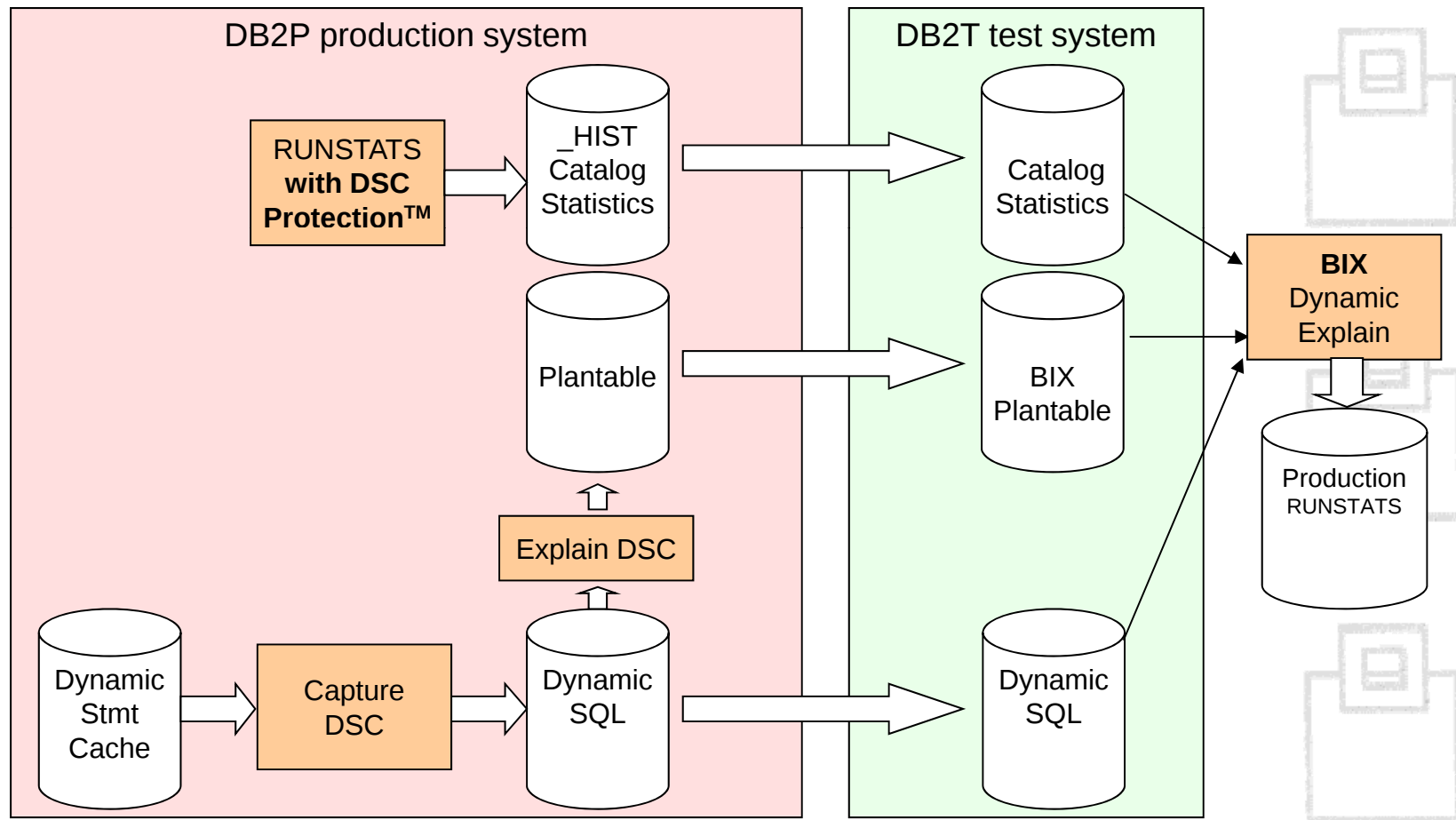
Version

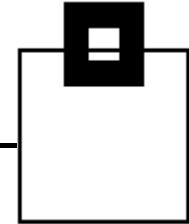
	StmtNo	Imp	Bad access types before REBIND	Bad access types with REBIND	Hint	Explain sqlcode
=	1091	WRS		TS		0
=	1098	IMP	LP,NX0			0
=	1113	EQ	TS	TS		0
=	1120	EQ	TS	TS		0
=	1135	EQ	TS	TS		0
=	1142	EQ				0
=	1157	WRS		TS		0
=	1164	IMP	LP,NX0			0
=	1179	WRS		TS		0

BIX – DSC Protection

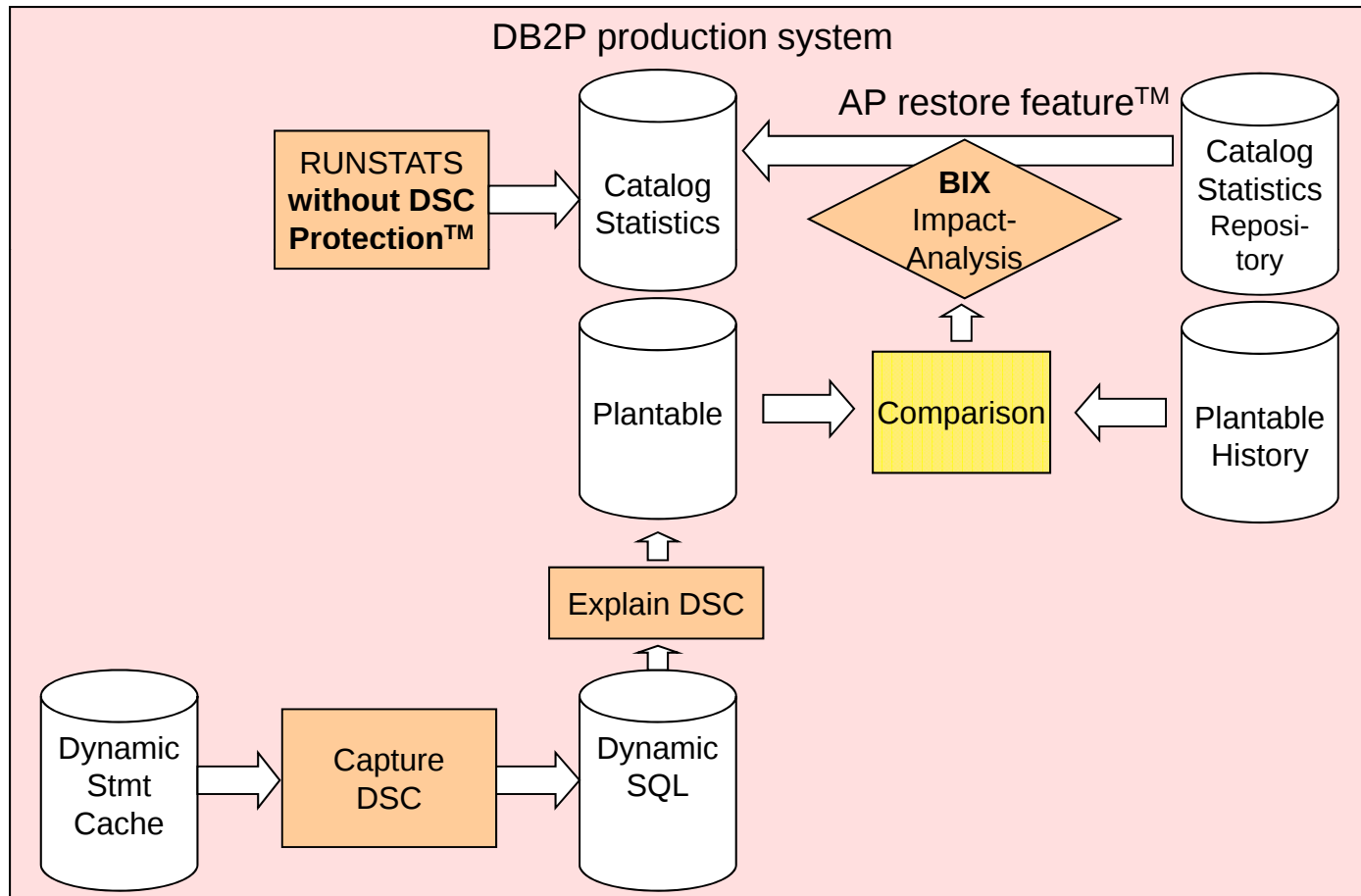


Dynamic SQL management and protection: Proactive QA

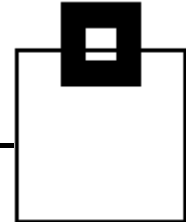




Dynamic SQL management and protection: Reactive QA



BIX – DSC Protection



```
ImpactExpert for DB2 z/OS ----- Job Overview (1/4) ----- Job 1 from 1
Command ==> _____ Scroll ==> CSR
Mode: DSC PROTECTION                               DB2: Q10A
Primary cmd: END, A(11), D(SC Extracts), E(Imported DSC Extracts), N(ew),
              I(mport), X(EXport), R(efresh), Z(oom), L(ocate) submit time
Line  cmd: S(tatements), A(uthIDs), D(elete), R(eset statistics),
              V(iew extract), Z(oom)
```

Job name	Step name	Submitter	Submit time	PLTB owner	Job status
-----	-----	-----	-----	-----	-----
BAIMDSC	CHECKDYN	HOPPE	2011-08-27-15.13.57	HOPPE	DONE
-----	-----	-----	-----	-----	-----

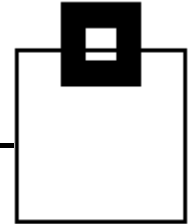
Command ==> Scroll ==> CSR

DB2: Q10A

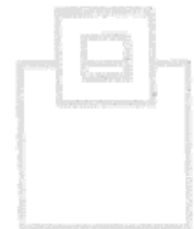
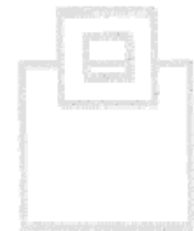
```
Line      cmd: S(elect), DO/DN(Dynamic analyze Old/New), R(eset statistics),
          EO/EN(Edit and analyze Old/New), VO/VN(View Old/New), Z(oom)
```

	StmtID old	StmtID new	Imp	Bad access types old	Bad access types new
—	90	90	WRS	NMIX	LP, SORT
—	93	93	WRS	NMIX	LP, SORT
—	250	250	WRS	TS, LP	TS, NMIX, MSJN

BIX – Workload Analysis



- Trace Facility
- Dynamic Statement Cache Capture (Online / Batch)
- SQL Aggregation Feature
- Trace Hostvar values
- Supports Catalog History Tables
- Integrated Catalog Statistics Browser
- Index what-if analysis



Analyze for DB2 z/OS ----- Limit DSC Snapshot -----
Command ==> _____ DB2: Q10A

Primary cmd: END

MEMBER : _____ Blank(Connected DB2) / *(All members) / member name

NO LIMITATION : X

HIGHEST VALUES : -

EXCEED THRESHOLD: - THRESHOLD: _____

For limitation to highest values or exceeding of specified threshold

EXECUTIONS	: <u>-</u>	ROWS PROCESSED	: <u>-</u>	SORTS	: <u>-</u>
BUFFER READS	: <u>-</u>	ROWS EXAMINED	: <u>-</u>	PARALLEL GROUPS	: <u>-</u>
BUFFER WRITES	: <u>-</u>	INDEX SCANS	: <u>-</u>	RID EXCEED DB2 LIMITS	: <u>-</u>
GETPAGES	: <u>-</u>	TABLE SPACE SCANS	: <u>-</u>	RID EXCEED STORAGE	: <u>-</u>

For limitation to highest values only

ELAPSE TIME : - CPU TIME : -

WAIT TIME FOR ...

SYNCHRONOUS I/O	: <u>-</u>	SYNCR. EXECUTION	: <u>-</u>	READS OTHER THREADS	: <u>-</u>
LOCK AND LATCH	: <u>-</u>	GLOBAL LOCKS	: <u>-</u>	WRITES OTHER THREADS	: <u>-</u>

BIX – DSC Browser

Analyze for DB2 z/OS ----- Filter Dynamic Statement Cache -----

Command ==> _____ DB2: Q10A

Primary cmd: END

FIRST TABLE : _____
CREATOR _____

FIRST TABLE : _____
NAME _____

QUALIFIER : _____

PRIMARY : _____
AUTHID _____

SELECT	<u>X</u>	CURRENT USERS	between	_____	and	_____	(Integer)
INSERT	<u>X</u>	STMT COUNT	between	_____	and	_____	(Integer)
UPDATE	<u>X</u>	AVG CPU TIME	between	_____	and	_____	(MM:SS.TTT)
DELETE	<u>X</u>	AVG ELAPSE TIME	between	_____	and	_____	(MM:SS.TTT)
		AVG GETPAGES	between	_____	and	_____	(Integer)

Total stmts 104

OUTPUT LIMIT: 10000 0 - 25000 Max number of statements to be displayed

ImpactExpert for DB2 z/OS --- Dynamic Statement Cache (4/8) -- Stmt 1 from 182

Command ==> _____ Scroll ==> CSR
DB2: Q10A

Primary cmd: END, SE(tup), Z(oom), L(ocate) getpages

Line cmd: Z(oom), A(nalyze), D(ynamic Analyze), E(dit Statement), O(bjects),
S(tatement Text), T(able), X(EXecute)

	StmtID	Synchr. Buffer Rd	Synchr. Buffer Wr	Rows examined	Rows processed	Index Scans	Tablespc. Scans
=	323	0	0	4473216	2290	0	2468
=	314	0	0	2996152	2295	0	2468
=	324	0	0	2284751	1234	0	1234
=	322	0	0	1621476	1234	0	1234
=	502	0	0	678110	2290	0	159
=	503	0	0	675998	1234	0	159
=	511	0	0	0	2144	0	0
=	493	0	0	0	2144	0	0
=	274	0	0	0	2290	0	0
=	381	34	0	0	77	0	0
=	391	0	0	3495	2819	316	158
=	276	0	0	0	1234	0	0
=	494	0	0	0	156	156	0
=	513	0	0	0	157	0	0
=	477	0	0	2628	49	98	67

ImpactExpert for DB2 z/OS --- Dynamic Statement Cache (4/8) -- Stmt 1 from 182

Command ==> _____ Scroll ==> CSR
DB2: Q10A

Primary cmd: END, SE(tup), Z(oom), L(ocate) getpages

Line cmd: Z(oom), A(nalyze), D(ynamic Analyze), E(dit Statement), O(bjects),
S(tatement Text), T(able), X(EXecute)

	StmtID	Synchr. Buffer Rd	Synchr. Buffer Wr	Rows examined	Rows processed	Index Scans	Tablespc. Scans
=	323	0	0	4473216	2290	0	2468
=	314	0	0	2996152	2295	0	2468
=	324	0	0	2284751	1234	0	1234
=	322	0	0	1621476	1234	0	1234
=	502	0	0	678110	2290	0	159
=	503	0	0	675998	1234	0	159
=	511	0	0	0	2144	0	0
=	493	0	0	0	2144	0	0
=	274	0	0	0	2290	0	0
=	381	34	0	0	77	0	0
=	391	0	0	3495	2819	316	158
=	276	0	0	0	1234	0	0
=	494	0	0	0	156	156	0
=	513	0	0	0	157	0	0
=	477	0	0	2628	49	98	67

ImpactExpert for DB2 z/OS --- Dynamic Statement Cache (6/8) -- Stmt 1 from 182

Command ==> _____ Scroll ==> CSR
DB2: Q10A

Primary cmd: END, SE(tup), Z(oom), L(ocate) getpages

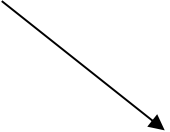
Line cmd: Z(oom), A(nalyze), D(ynamic Analyze), E(dit Statement), O(bjects),
S(tatement Text), T(able), X(EXecute)

StmtID	Total CPU	Average CPU	Total Elapse	Average Elapse
-----	HHHH:MM:SS.ttt	HHHH:MM:SS.ttt	HHHH:MM:SS.ttt	HHHH:MM:SS.ttt
= 323	23.457	0.019	1:34.655	0.077
= 314	17.138	0.014	1:16.865	0.062
= 324	6.339	0.005	26.839	0.022
= 322	4.753	0.004	18.608	0.015
= 502	2.108	2.108	6.242	6.242
= 503	2.039	2.039	5.120	5.120
= 511	0.446	-	1.205	0.001
= 493	1.325	0.001	5.583	0.003
= 274	0.493	-	1.278	0.001
= 381	0.536	0.007	4.194	0.054
= 391	0.979	0.006	2.785	0.018
= 276	0.231	-	0.879	0.001
= 494	0.175	0.001	0.603	0.004
= 513	0.051	-	0.129	0.001
= 477	0.036	0.001	0.094	0.001

BIX – SQL Aggregation

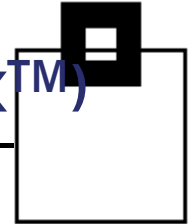
Level 1: Ignore values, spacing, cursor names, select clauses

SQL-Text		Count	CPU-Time
SELECT ... WHERE COL = 'ABC'	1	1s	
SELECT ... WHERE COL = 'BCD'	1	1s	
SELECT ... WHERE COL = 'CDE'	1	1s	
SELECT ... WHERE COL = 'DEF'	1	1s	
SELECT ... WHERE COL = 'EFG'		1	1s
...			



SQL-Text		Count	CPU-Time
SELECT ... WHERE COL = 'ABC'	10.000	10.000s	
...			

BIX – Version Migration control (EarlyPrecheck™)



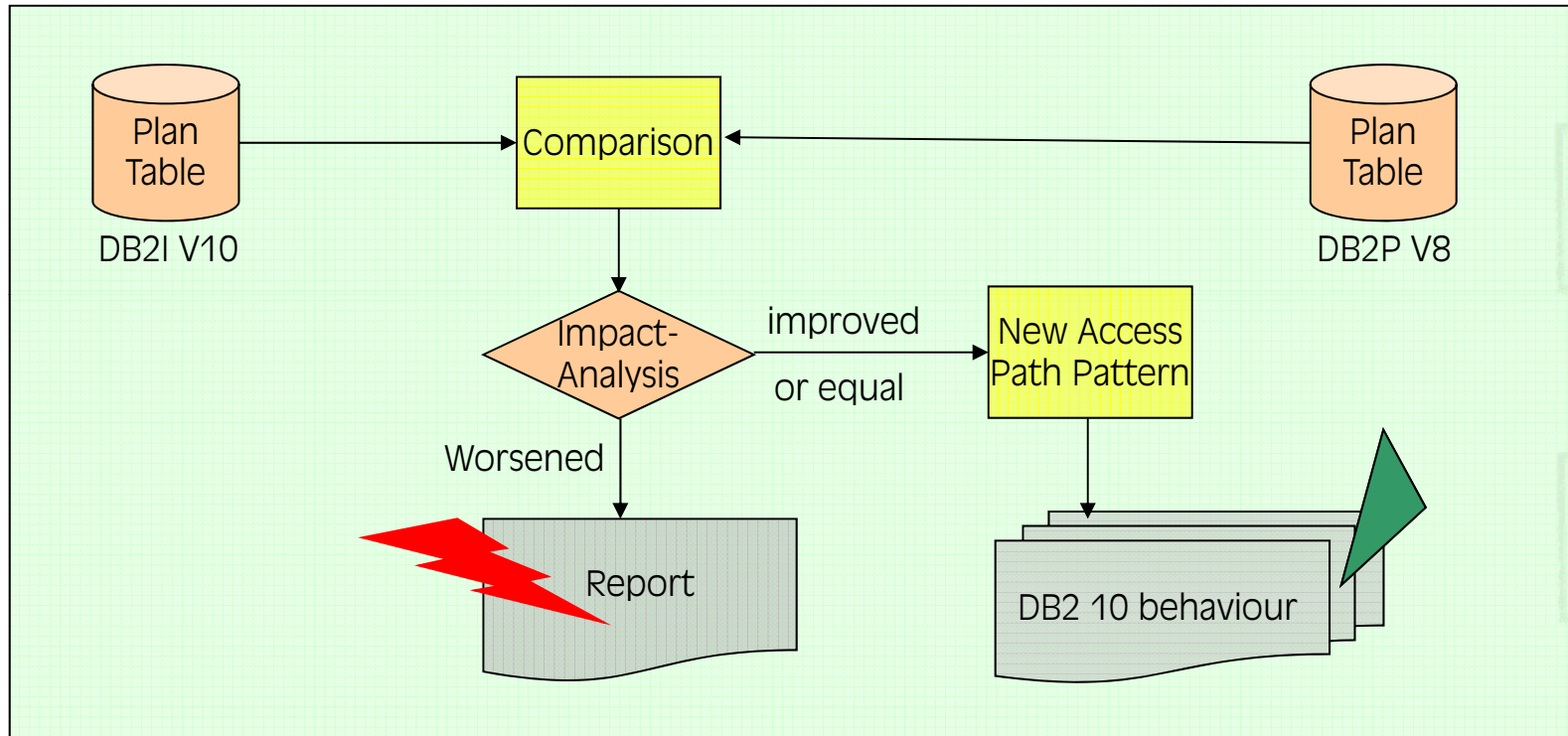
Goal:

Detection of potential access paths degradations before migration of the production system by comparing the access paths of a DB2 Vnow production system with the access paths on a Vnext test system (based on Vnow production statistics) without affecting the production system at the earliest possible stage for static and dynamic SQL.



BIX – Version Migration control (EarlyPrecheck™)

Runs stand-alone for global package processing



BIX – Access Path Comparison

ImpactExpert for DB2 z/OS ----- Comparison ----- LINE 00000077 COL 001 080

Command ==> _____ Scroll ==> CSR

Mode: Precheck Static DB2: Q10A

Primary cmd: END, C(atalog data), D(etails on/off), S(tatement text)

Collection . RTDX0510

Timestamp. . 2011-09-24-08.13.50.890000

Package. . . DSMORPB

Contoken . . 184177A60269695E

StmtNo . . . 332

Bindtime . . 2011-08-23-14.41.12

Verify the access path changes

Access path before REBIND -----! Access path with REBIND -----

TABLE INDEX	QB	PN	AC TY	MA CO	ME TH	IX ON	PR FT	!	TABLE INDEX	QB	PN	AC TY	MA CO	ME TH	IX ON	PR FT
SYSTABLESPACE	1	1	R	0		N	S	!	SYSTABLESPACE	1	1	R	0		N	S
SYSTABLEPART	1	2	I	2	1	N		!	SYSTABLEPART	1	2	I	2	4	N	L
DSNDPX01								!	DSNDPX01							
	1	3		0	3	N		!		1	3		0	3	N	
SYSDATABASE	2	1	R	0		N	S	!	SYSDATABASE	2	1	I	0		N	
								!	DSNDDX02							
	2	2		0	3	N		!		2	2		0	3	N	
Milliseconds:				32				!	Milliseconds:				28			
Serviceunits:				125				!	Serviceunits:				110			

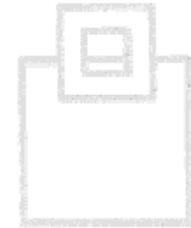
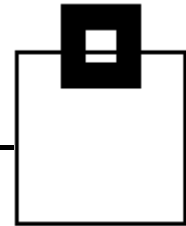
BIX – Version Rule Set

- Each statement is classified to one of the following categories:
 - **UNCHANGED** – Statements without Access Path Change
 - **IMPROVED** – Statements with Improved Access Path
 - **DB2 Vnext special patterns (examples)**
 - V9 pattern 1* – Usage of smaller index
 - V9 pattern 2* – Usage of bigger index, sort avoided
 - V9 pattern 3* – Usage of smaller index, index only get lost
 - V10 pattern 1 – Range list index scan
 - V10 pattern 2 – In memory in list

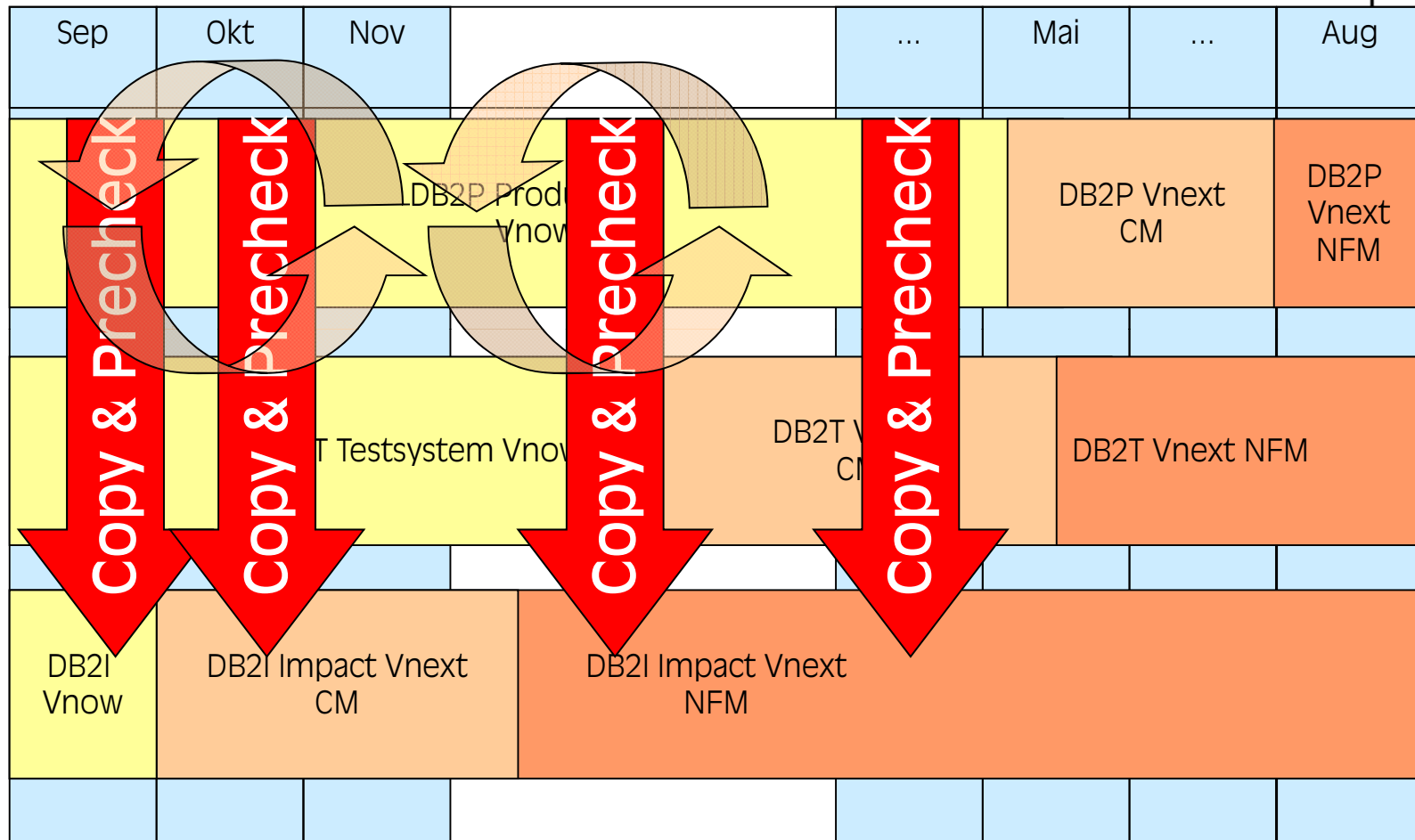
*considered as a result from skip migration

BIX – Version Rule Set

- **WORSENERD** – Statements with Worsened Access Path
- **CHANGED** – Statements with Changed Access Path (not classified)



Repeatable Precheck – Customer Example



BIX/SPX – Module List

Bind ImpactExpert for DB2

Migration Precheck incl. ESD

Bind Management incl. ESD

Rebind Management incl. ESD

SQL PerformanceExpert for DB2

Enterprise Statistics Distribution (ESD)

Dynamic Statement Cache (DSC) Support

Conditional Bind for DB2



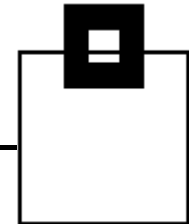
DBRM Reconstruct for DB2



PackageManager for DB2



SPT01 Transparency for DB2



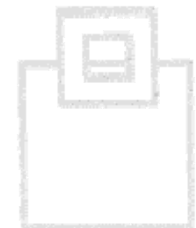
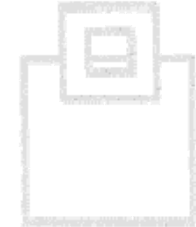
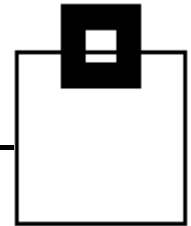
Conditional Bind – Key Features

- Avoid unnecessary binds
- Optimize and accelerate the compile procedure
- Reduce CPU load
- Reduce locks the catalog
- Compatible with the new DB2 Coprocessor



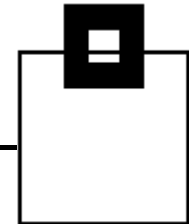
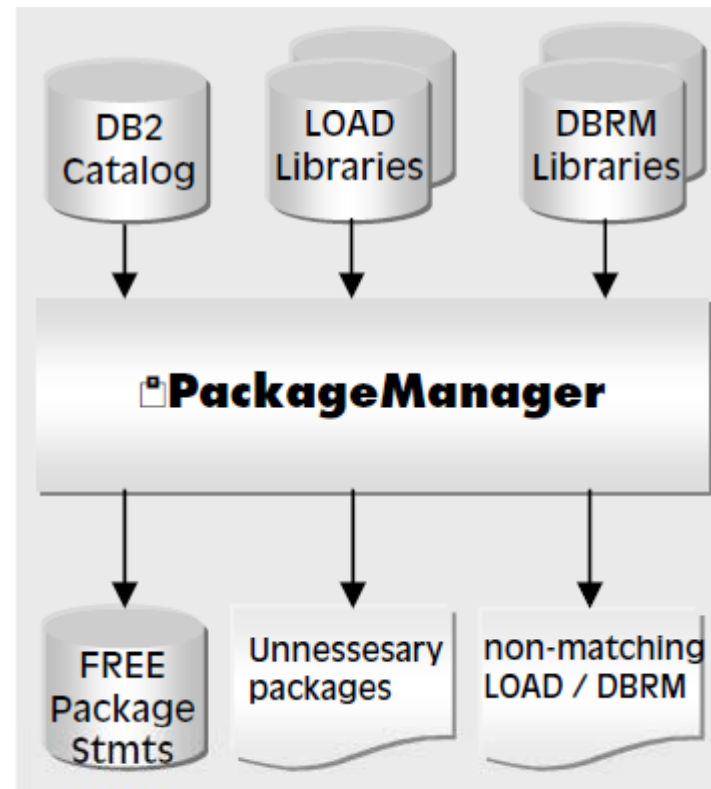
DBRM Reconstruct – Key Features

- Recreates DBRMs from the DB2 catalog
- Generates the original BIND command
- Supports PLANS and PACKAGES
- Allows to recreate multiple PACKAGE versions

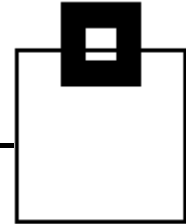


PackageManager – Key Features

- Examine the consistency of load modules and/or DBRMs to avoid SQLCODEs -805 and -818
- Determine unnecessary packages
- Generate and execute the FREE PACKAGE statements to clean up unnecessary package versions
- Supports statically linked load modules



SPT01 Transparency – Key Features



- Reduce the risk of bad access paths after REBIND
- Adds transparency to the new DB2 feature
 - Show existing copies (and their status!)
 - Shows access paths for package copies
- Allow to execute REBINDs for packages that e.g. are rated CHANGED with the ability to switch back in case of a performance degradation*
- Reduces the amount of space needed in SPT01 due to the fact that no REBIND is generated by BIX for unchanged packages*
- Allows to REBIND unchanged packages in a migration scenario without creating a copy*



* Along with  **BIX**