

IDUG® 2007
India

31 May–2 June, 2007
Hotel Grand Ashok
Bangalore, India



Are you sure you're sure? DB2 Maintenance 2007 Guidelines

Ulf Heinrich
SOFTWARE ENGINEERING

01 June 2007 11:30 a.m. – 12:30 a.m.

Platform: DB2 for z/OS



Agenda

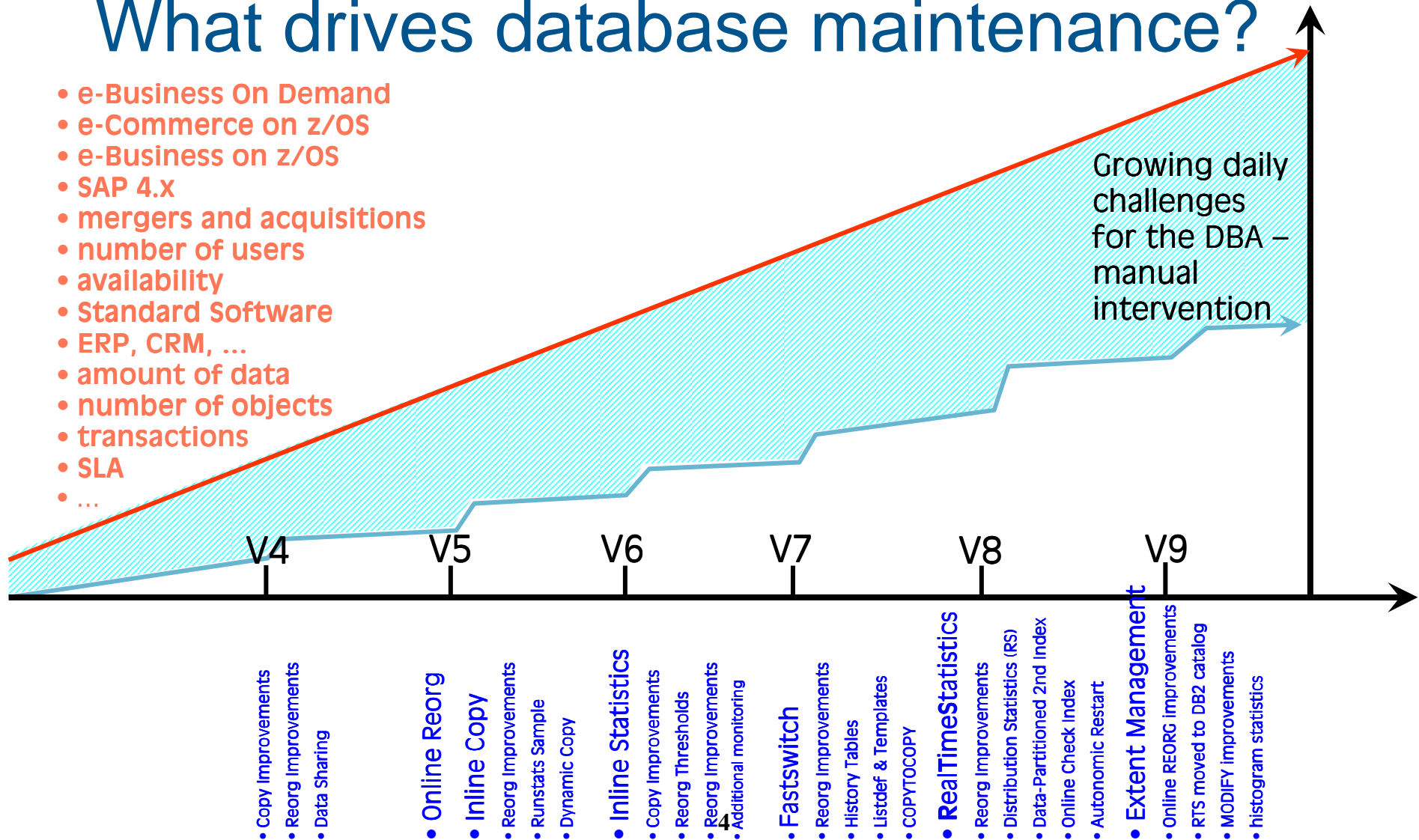
- DB2 for z/OS maintenance: past, present, future
- Rules for the backup strategy
- Where to copy to – tape, VTS, DASD
- How to guarantee DB2 related SLAs
- 24x7 business and 24x7 maintenance rules

DB2 for z/OS maintenance: past, present, future

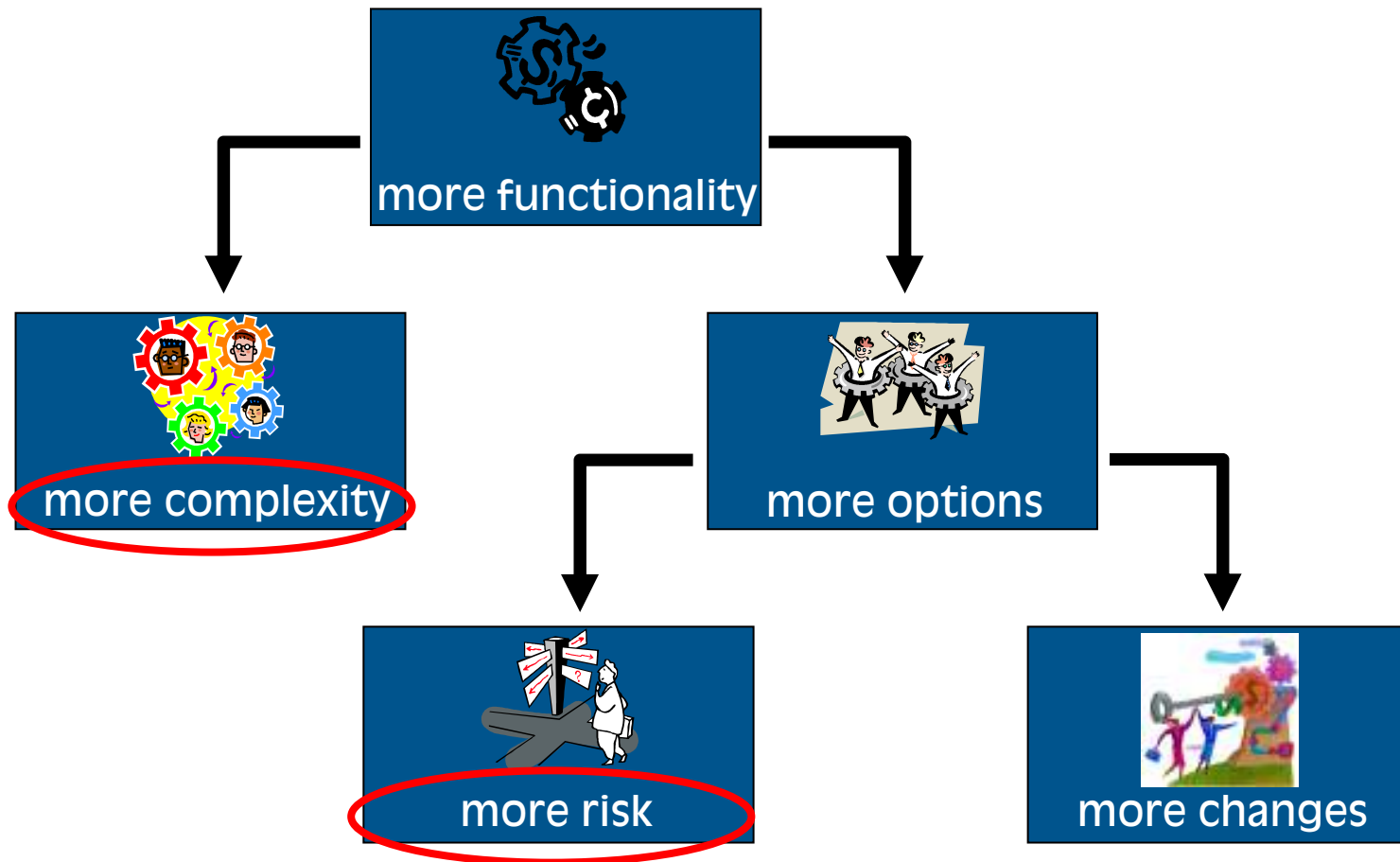
	level 1 <i>cyclic</i>	level 2 <i>re-activ</i>	level 3 <i>automated</i>	level 4 <i>on demand</i>	level 5 <i>autonomic</i>
procedure	static maintenance jobs for all objects	generated maintenance jobs for specific objects	generated, threshold based maintenance jobs	dynamic maintenance jobs based on real-time data	dynamic maintenance integrated via SLA's
operation	manual job building	manual job building	automated, threshold based job generation	continuous, threshold based Job generation	continuous, DB2 based generation
execution	total maintenance, manual execution	selective maintenance, manual execution	selective maintenance, static execution	selective maintenance, automated execution	selective maintenance automated execution
manual intervention					

What drives database maintenance?

- e-Business On Demand
- e-Commerce on z/OS
- e-Business on z/OS
- SAP 4.x
- mergers and acquisitions
- number of users
- availability
- Standard Software
- ERP, CRM, ...
- amount of data
- number of objects
- transactions
- SLA
- ...



Growing daily challenges



Copy Trigger Comparison

- Time-based thresholds (calendar)
- Change rate thresholds (updated pages)
- Exception thresholds (copy pending)
- Recovery Time Objective (RTO) thresholds

Copy Trigger Comparison

- Time-based thresholds:
 - Daily/weekly/... backups
 - Daily/weekly/... backups of changed objects
 - Daily/weekly/... backups if n% changed

Copy Trigger Comparison

- Time-base thresholds

```

RealTime Maintain ----- COPY Parameters -----
Command ==> _____ DB2: S910

DATABASE . . . . : *          TABLESPACE . . . . : *

COPY OBJECT . . . . TP      - TS/TP/V(ariable)
COPY TYPE . . . . . F      - F(ull)/I(ncremental)/V(ariable)/2(FLASHCOPY2)
                           R(ecovery based)                      (*)
COPY SHRLEVEL . . . . C      - R(eference)/C(hange)
COPY CONCURRENT . . . N      - Y(es includes QUIESCE before)/N(o)
MERGE INCR COPY . . .        - Merge incremental copies if this number is reached
COPY CHECKPAGE . . . Y      - Y(es)/N(o)
IGNORE COPY YES IX . N      - Y(es)/N(o)

(*): COPY TYPEs = F or I are not valid for on-demand processing.
    
```

Copy Trigger Comparison

- Time-based thresholds

```
RealTimeMaintain ----- Batch Calendar -----
Command ==> _____ DB2: S910
```

NOTE: This calendar is not used for on-demand processing.

```
DATABASE . . . : *          TABLESPACE . . . : *          UTILITY . . . : CO
```

Specify day interval to process IMAGECOPY entry for the above object group:

```
DAY INTERVAL . . . . ____ - Number of days
```

Specify day(s) of week by marking the fields below with an S:

```
DAY OF WEEK . . . . MON TUE WED THU FRI SAT SUN (*)
```

```
      _ _ _ _ _ U _ _
```

Specify day(s) of month by marking the fields below with an S:

```
DAY OF MONTH . . . . 01 02 03 04 05 06 07 08 09 10 (*)
```

```
      _ _ _ _ _
```

```
      _ _ _ _ _
```

(*) Use U to unconditionally request a full copy (no threshold checking)

Copy Trigger Comparison

- Time-based thresholds:
 - Guaranteed backups after a specified period of time
 - Simple alignment of space management and DB2 database maintenance
 - Simple database maintenance (COPY/MODIFY)
- Effort for database maintenance unreasonably high
- No direct relationship between Backup and Recovery

Copy Trigger Comparison

- Change rate thresholds:
 - Backup if changed
 - Backup if n% changed

Copy Trigger Comparison

- Change rate thresholds

```

RealTime Maintain ----- COPY Parameters -----
Command ==> _____ DB2: S910

DATABASE . . . : *          TABLESPACE . . . : *

COPY OBJECT . . . . TP - TS/TP/V(ariable)
COPY TYPE . . . . . V  - F(ull)/I(ncremental)/V(ariable)/2(FLASHCOPY2)
                          R(ecovery based) (*)
COPY SHRLEVEL . . . . C - R(eference)/C(hange)
COPY CONCURRENT . . . N - Y(es includes QUIESCE before)/N(o)
MERGE INCR COPY . . .     - Merge incremental copies if this number is reached
COPY CHECKPAGE . . . Y - Y(es)/N(o)
IGNORE COPY YES IX . N - Y(es)/N(o)

(*): COPY TYPES = F or I are not valid for on-demand processing.
  
```

Copy Trigger Comparison

- Change rate thresholds

```

----- COPY TYPE Variable -----
! Command ==> _____ DB2: S910
!
! Primary cmd: S(witch off on-demand thresholds)
!
! COPY OBJECT MAX PAGES CLASS 1 1000      CLASS 2 5000      CLASS 3 > CLASS 2
!
!          BATCH ON-DEMAND      BATCH ON-DEMAND      BATCH ON-DEMAND
! COPY TYPE INCR      REG CRIT      REG CRIT      REG CRIT
! PCT UPDATED PAGES . 10 50  ___ . 5 40  ___ . 0 30  ___
! PCT CHANGED ROWS . 20  ___  ___ . 20  ___  ___ . 0  ___  ___
! COPY TYPE FULL
! PCT UPDATED PAGES . 10 50  ___ . 5 40  ___ . 10 30  ___
! PCT CHANGED ROWS . 20  ___  ___ . 20  ___  ___ . 20  ___  ___
! DAYS NO COPY . . . . . 1 3  n/a - If updates and no copy in this time
! DAYS UNCOND COPI . . . . . n/a - If no updates and no copy
! MIN HOURS . . . . . n/a 12  n/a - Minimum hours between copies
! COPY SETTINGS FOR BOTH BATCH AND ON-DEMAND
!   NBR INCR COPY . . . . . 5  - Full if this number of incremental is reached
!   CHECK LOGRANGE . . . . . N  - Also check logrange if no updates in RTS
! COPY SETTINGS FOR ON-DEMAND
!   COPY PEND AS CRIT . . . . . Y  - Treat any copy pending status as a critical
-----
  
```

Copy Trigger Comparison

- Change rate thresholds:
 - Backup if changed
 - No changes = No backup
 - Time-based space management not possible
 - Database maintenance more complex (Copy/Modify)
- Indirect relationship of Backup and Recovery

Copy Trigger Comparison

- Exception thresholds:
 - Backup while/after REORG or LOAD
 - Backup if copy pending in general

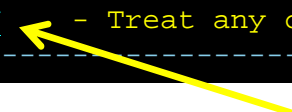
Copy Trigger Comparison

- Exceptions thresholds

```

----- COPY TYPE Variable -----
! Command ==> _____ DB2: S910
!
! Primary cmd: S(witch off on-demand thresholds)
!
! COPY OBJECT MAX PAGES CLASS 1 1000      CLASS 2 5000      CLASS 3 > CLASS 2
!
!           BATCH ON-DEMAND      BATCH ON-DEMAND      BATCH ON-DEMAND
! COPY TYPE INCR           REG CRIT           REG CRIT           REG CRIT
!   PCT UPDATED PAGES . 10  50  ___ .  5  40  ___ .  0  30  ___
!   PCT CHANGED ROWS . 20  ___  ___ . 20  ___  ___ .  0  ___  ___
! COPY TYPE FULL
!   PCT UPDATED PAGES . 10  50  ___ .  5  40  ___ . 10  30  ___
!   PCT CHANGED ROWS . 20  ___  ___ . 20  ___  ___ . 20  ___  ___
!   DAYS NO COPY . . . 1  3  n/a - If updates and no copy in this time
!   DAYS UNCOND COPY . . . . . n/a - If no updates and no copy
!   MIN HOURS . . . . . n/a 12 n/a - Minimum hours between copies
! COPY SETTINGS FOR BOTH BATCH AND ON-DEMAND
!   NBR INCR COPY . . . 5 - Full if this number of incremental is reached
!   CHECK LOGRANGE . . N - Also check logrange if no updates in RTS
! COPY SETTINGS FOR ON-DEMAND
!   COPY PEND AS CRIT . Y - Treat any copy pending status as a critical
-----

```



Copy Trigger Comparison

- Exceptions thresholds

```

RealTime Maintain ----- REORG Dependent Actions -----
Command ==> _____ DB2: S910

DATABASE . . . : *          TABLESPACE . . . : *

REORG LOG . . . . . N      - Y(es)/N(o)/V(ariable)
  MAX PAGES LOG=YES . . _____ - Valid only if REORG LOG = V

BEFORE REORG: QUIESCE . N - Y(es)/N(o)  WRITE . . . . . _ - Y(es)/N(o)
                                         CONSIDER RI . . . _ - Y(es)/N(o)
                                         SHRLEVEL . . . . _ - C(hange)/R(ef)
                                         TYPE . . . . . _ - F(ull)/I(ncr)
                                         CONCURRENT . . . _ - Y(es)/N(o)
                                         CHECKPAGE . . . _ - Y(es)/N(o)

WHILE REORG:  COPY . . . Y ← Y(es)/N(o)
              RUNSTATS . Y ← Y(es)/N(o)

AFTER REORG:  COPY . . . N ← Y(es)/N(o)  CONCURRENT . . . _ - Y(es)/N(o)
              RUNSTATS . N - Y(es)/N(o)
              REBIND . . N - Y(es)/N(o)

IGNORE COPY YES IX . . . N - Y(es)/N(o)
REORG DEPENDENT. . . . . Y - Y(es to avoid redundant copies)/N(o)
    
```

Copy Trigger Comparison

- Exceptions thresholds
 - Guarantees recoverability after LOG NO events
 - Outage avoidance (COPY PENDING)
- Should only be used additional to other triggers
- Direct relationship between Backup and Recovery

Copy Trigger Comparison

- RTO thresholds
 - Backup if the defined RTO is exceeded

Copy Trigger Comparison

- RTO thresholds

```

RealTime Maintain ----- COPY Parameters -----
Command ==> _____ DB2: S910

DATABASE . . . . : *      TABLESPACE . . . . : *

COPY OBJECT . . . . TP - TS/TP/V(ariable)
COPY TYPE . . . . . R - F(ull)/I(ncremental)/V(ariable)/2(FLASHCOPY2)
                       R(ecovery based) (* )
COPY SHRLEVEL . . . . C - R(eference)/C(hange)
COPY CONCURRENT . . . N - Y(es includes QUIESCE before)/N(o)
MERGE INCR COPY . . .   - Merge incremental copies if this number is reached
COPY CHECKPAGE . . . Y - Y(es)/N(o)
IGNORE COPY YES IX . N - Y(es)/N(o)

(*): COPY TYPEs = F or I are not valid for on-demand processing.
    
```

Copy Trigger Comparison

- RTO thresholds

```

----- COPY OBJECT/COPY TYPE -----
Command ==> _____ DB2: S910

Primary cmd: S(witch off on demand thresholds), R(ecovery Time Objectives)

                BATCH ON DEMAND
COPY THRESHOLDS      REG  CRIT
RTO EXCEEDED . . . Y   Y   T   - Y(es), N(o), or T(olerance)
UNREALISTIC RTO . . 25  25  _____ - Percent of ideal recovery time
INDEX COPY REQD . . Y   Y   N   - Y(es to check indexes), N(o)
COPY EXCEPTIONS
COPY PENDING . . . n/a  n/a  Y   - Treat copy pending as critical
BACKUP MISSING . . W   W   E   - W(arning) or E(rror and Warning)
LOG MISSING . . . W   W   E   - W(arning) or E(rror and Warning)
COPY INTERVAL
MIN HOURS . . . . . n/a  36  - Minimum hours between copies
DAYS NO COPY . . . _____ - Full if updated but no copy
UNCOND COPY . . . . _____ - Full if not updated and no copy

COPY SWITCH TO FULL FOR BOTH BATCH AND ON DEMAND
NBR INCR COPY . . . 70  - Full if this incremental count is reached
COPY APPLY PCT . . 75  - Full if copy apply time reaches this RTO pct
PCT UPDATES PAGES . 30  - Full if updates reach this percentage

```

Copy Trigger Comparison

- RTO thresholds
 - Backups that guarantee defined RTOs
 - Considering (update rate, LOG DS distribution, performance) on the object level
- Time-based space management not possible
- Only possible with On Demand maintenance
- Perfect alignment of Backup and Recovery

Copy Devices

- Tape
- VTS
- DASD
- DASD with subsequent migration to tape

Copy Devices

- Tape
 - Cheap media
 - Good performance for sequential access
- Consider
 - Mount time
 - Positioning on tape

Copy Devices

- VTS
 - Good performance for sequential access
 - Easy to use
- Consider
 - It's treated as a tape!!!
 - Staging (real tape → disk cache)

Copy Devices

- DASD
 - Good performance
 - Easy to use
- Consider
 - Costs

Copy Devices

- DASD with subsequent migration to tape
 - Good performance
 - Easy to use
- Consider
 - DFSMSHsm (max. recall tasks ...)

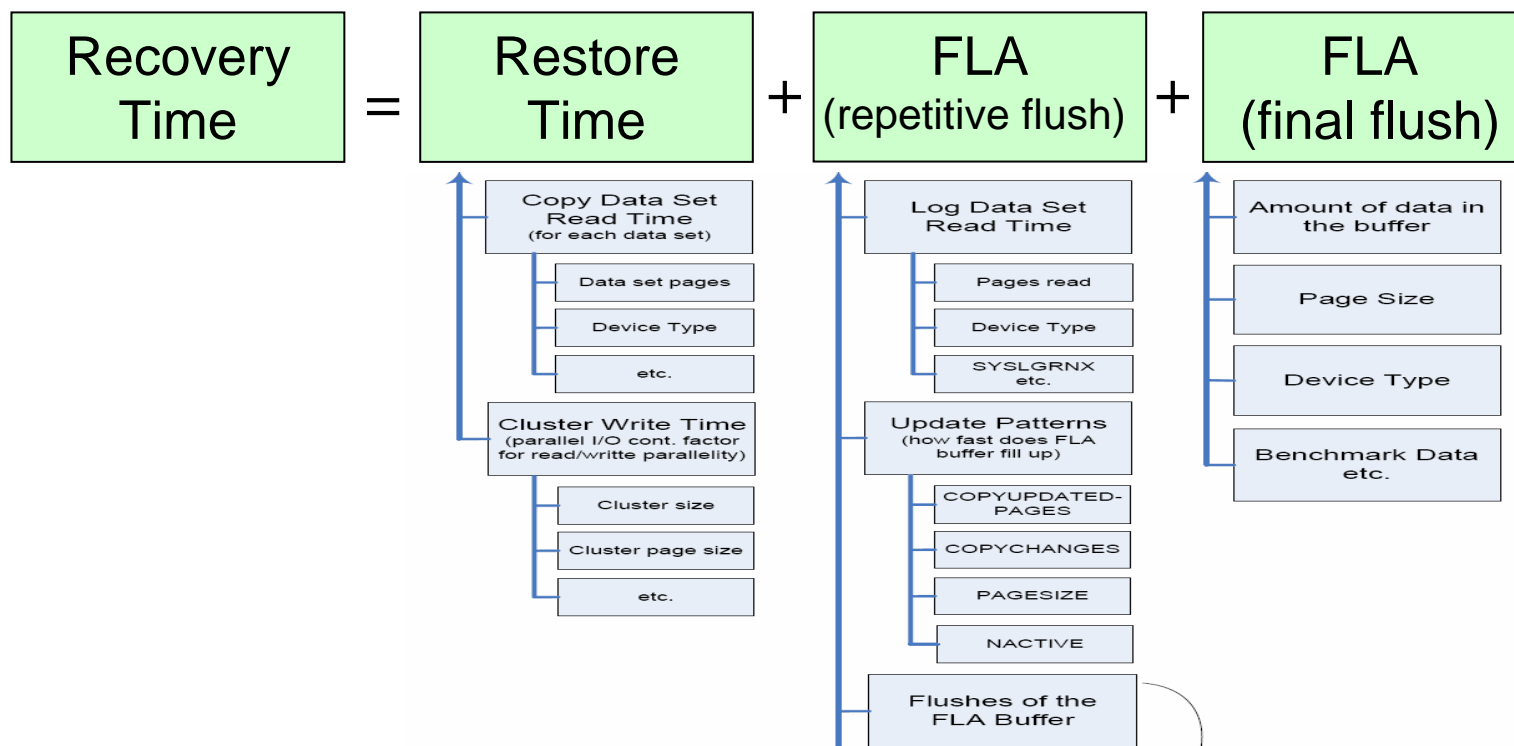
RTOs that satisfy SLAs

- Trigger backups based on updates if you also:
 - care for time required for restore of a backup
 - care for LOG distribution
 - SYSLGRNX
 - BSDS
- Trigger backups based on RTOs

But always trigger on Demand!

RTOs that satisfy SLAs

- Consider all relevant components (total solution):



RTOs that satisfy SLAs

- ... or at least the major ones (basic solution):

$$\text{Recovery Time} = \text{Restore Time} + \text{FLA (repetitive flush)}$$

Object	$T_{(\text{Restore})}$
Object A	53"
Object B	358"
Object C	184"
Object D	3"

Pagegröße	$\emptyset T_{(\text{Apply})}$
4K	0,0005915"
8K	0,0010231"
16K	0,0016241"
32K	0,0051939"

RTOs that satisfy SLAs

- Consider affecting factors (basic solution):
 - Storage Media involved
 - Cluster
 - Copy
 - LOG
 - LOG data set(s)
 - Active / Archive (VSAM vs. SEQ.)
 - Number of data sets

👍 ROT or RTOs 🌟 ?

- Rules of thumb are the easiest way – but they don't guarantee success
- Recovery time objectives assure the most efficient and reliable way

Always keep efforts and results relate to each other.

24x7 Maintenance rules

- Make use of SHRLEVEL CHANGE features
- Make use of REALTIME STATISTICS (since V7, since DB2 9 part of the DB2 CATALOG)
- Make use of FASTSWITCH (REORG)
- Assure proper DEFER and TIMEOUT (REORG)
- Make use of FLASHCOPY (CHECK INDEX)
- Ensure enough work space for utilities
- Make use of inline utilities
- Regularly execute MODIFY utility

24x7 Maintenance rules

- Put Archive LOGs on DASD (migrate afterwards)
- Put copies on DASD (migrate afterwards)
- Assure at least 24 hours to be covered by Active LOGs (LOG sizing)
- Keep an eye on SYSLGRNX (update pattern)
- Make use of Automated Space Management (LPS limit)
- Make use of low workload periods
- Trigger utilities on demand (asap)

Session: B2

Session Are you sure you're
sure? DB2 maintenance 2007
guidelines

Ulf Heinrich

SOFTWARE ENGINEERING

u.heinrich@seg.de