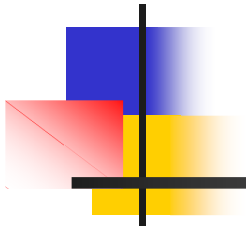
What it means to be a DBA



Best Practices

Natural Conference in Boston, MA
August 17-20, 2008

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DBA ?

- Doing Business As ……
- Deutsche Ba (German airline)
- Doctor of Business Administration
- Davis-Bacon Act of 1931
- Design Basis Accident
- Design Business Association
- Dual Band Antenna
- Direct Budget Authority
- Dollar Bill Acceptors
- Dumb But Adorable
- Danish Beekeepers' Association

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Data Base Administrator

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Content 1

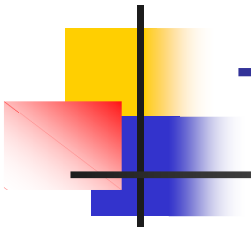
- Tasks of a DBA
- [Help to] determine the database design
  - Hardware level
  - Application design level
- Determine the ADABAS parameters
- Help to determine the transaction design
- Coordinate the online and batch processes

Content 2

- Develop Back-up and recovery procedures
- Ensure (force) quality assurance and quality control
- Performance and tuning
- Educate and train staff members
- [Help to] determine data security

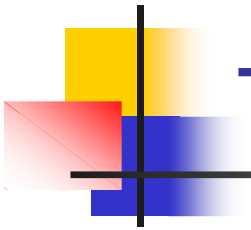
Content 3

- [Help to] determine standard routines and help functions
- Maintain and optimize the database system
- Ideal DBA profile -- technically and personally
- Future requirements
- Position and salary of the DBA in the enterprise



Tasks of a DBA

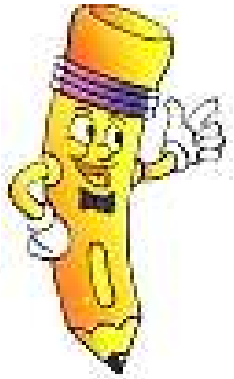
- Sometimes different organizational units
  - Run Utilities
  - Create FDT
  - Determine Disks
  - Determine DB Components
  - Determine Access paths
  - Install ADABAS SVC/Router



Tasks of a DBA

- Leads to performance problems
- DBA must have good knowledge about development as well as system tasks, for example
  - Programming (Natural, Cobol, Assembler), design
  - Operating system, TP monitor, SVC installation
  - Supervisor and coordinator
  - Mainframe, Unix, Linux and/or Windows

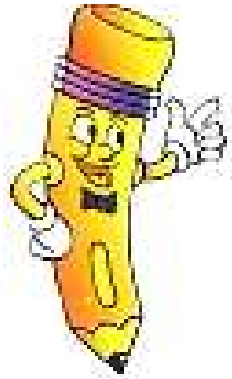
Database Design (Mainframe)



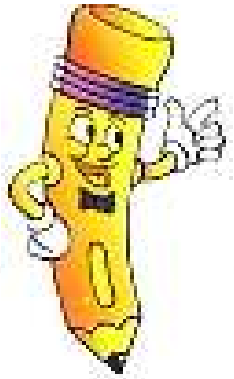
Hardware level

- Help to determine number and type of disks, cache
- Help to distribute disks to channels
- Determine which component to be allocated on what disk, for example ASSO, DATA, WORK, PLOG, TEMP, SORT, CLOG, etc.
- Disk arrays – distribution still important?

	ASSO	DATA	WORK	TEMP	SORT	PLOG1	PLOG2	CLOG1	CLOG2
ASSO	-	N - K	N - K	J	N	N	N	N	N
DATA	N - K	-	J	N	J	N	N	N	N
WORK	N - K	J	*)	J	J	N	N	N	N
TEMP	J	N	J	-	J	J	J	J	J
SORT	N	J	J	J	**)	J	J	J	J
PLOG1	N	N	N	N	N	-	N	N	N
PLOG2	N	N	N	N	N	N	-	N	N
CLOG1	N	N	N	J	J	N	N	-	N
CLOG2	N	N	N	J	J	N	N	N	-



Database Design (Mainframe)



Hardware level – PLOG Performance

- **Since ADA52: LFIOP > 0**
- **WORK and PLOG I/Os asynchronously**
- **No wait for I/Os**
- **Minimize I/Os by using large blocksizes for WORK and PLOG**
- **Good results with half-track blocking**
- **For PLOG: don't use tape, use disk NPLOG=[0, 2-8]**

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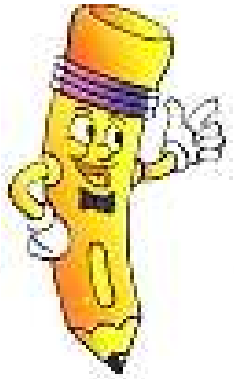
Database Design (Mainframe)



Hardware level – CLOG Performance

- **Very costly in performance**
- **Activate on demand only**
- **APAS has own CLOG, writing from a subtask**
- **TRIM is using crunching to minimize I/Os**
- **NCLOG=[0, 2-8]**

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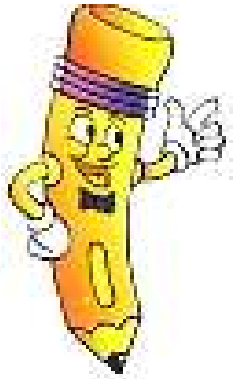
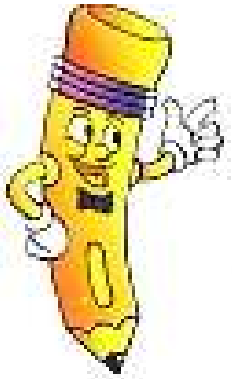
Database Design (Mainframe)



Hardware level

- Distribution of ADABAS nuclei to different CPUs
- Help to determine the priorities between ADABAS, TP Monitor, EntireX and others
- Distribution of nuclei to logical machines (VM)
- Work load manager and service class http://storrconsulting.com/sc510-ada006.html

Database Design (Mainframe)



Hardware level – to be measured (1)

- DASD analysis, space and data management
- Channel and I/O activities
- Processor status and usage, SRM and PR/SM
- Address space activities
- Paging and swapping
- Cache device usage

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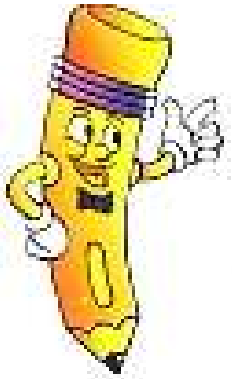
Database Design (Mainframe)



Hardware level – to be measured (2)

- Usage of CSA, ECSA, SQA, ESQA (ADA SVC)
- ENQ usage
- ASP usage of work space
- Used OP code
- Type and reason for interrupts
- Name of loaded system overlays / length of overlay queues

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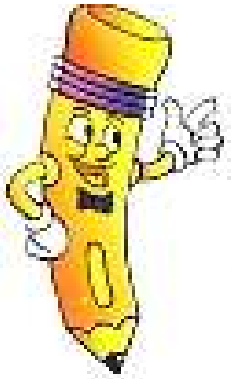
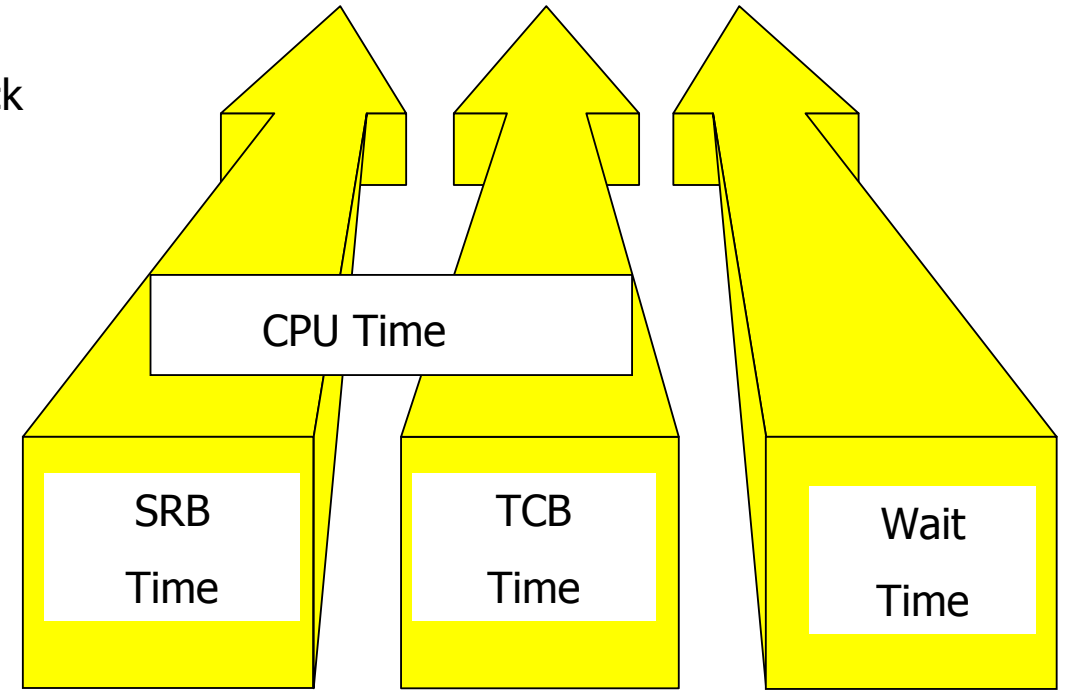
Database Design (Mainframe)



SRB = Service Request Block

TCB = Task Control Block

CPU = Processor



elapsed time = wait time + SRB time + TCB time

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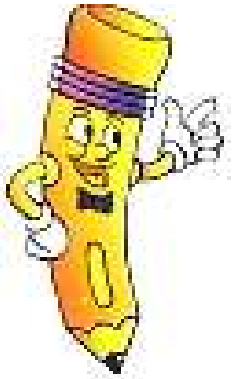
Database Design (Mainframe)



Hardware level – tools

- MVS -- z/OS:

  ALERT, CMF, CUE, EXPLORE, LOOK, MVS-PT, OMEGAMON, RESOLVE, RMF-II

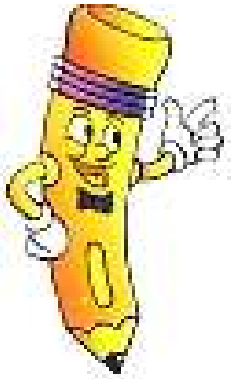
- VSE:

  EXPLORE, SMART, SMT

- CICS:

  CMF, EXPLORE for CICS, THE MONITOR FOR CICS

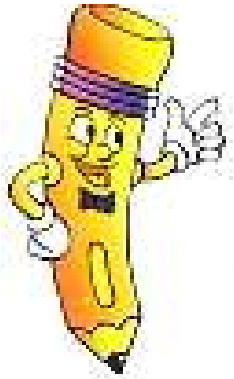
Database Design (Unix)



Hardware level

- Spreading the container files (RAID devices?)
- For Linux only: use file system ext3
- Most of what applies on the mainframe also applies to ADABAS on Unix or Windows
- Increasing system V IPC resources by using several parameters, e.g. AIO_MAX (not for AIX)

Database Design (Unix)



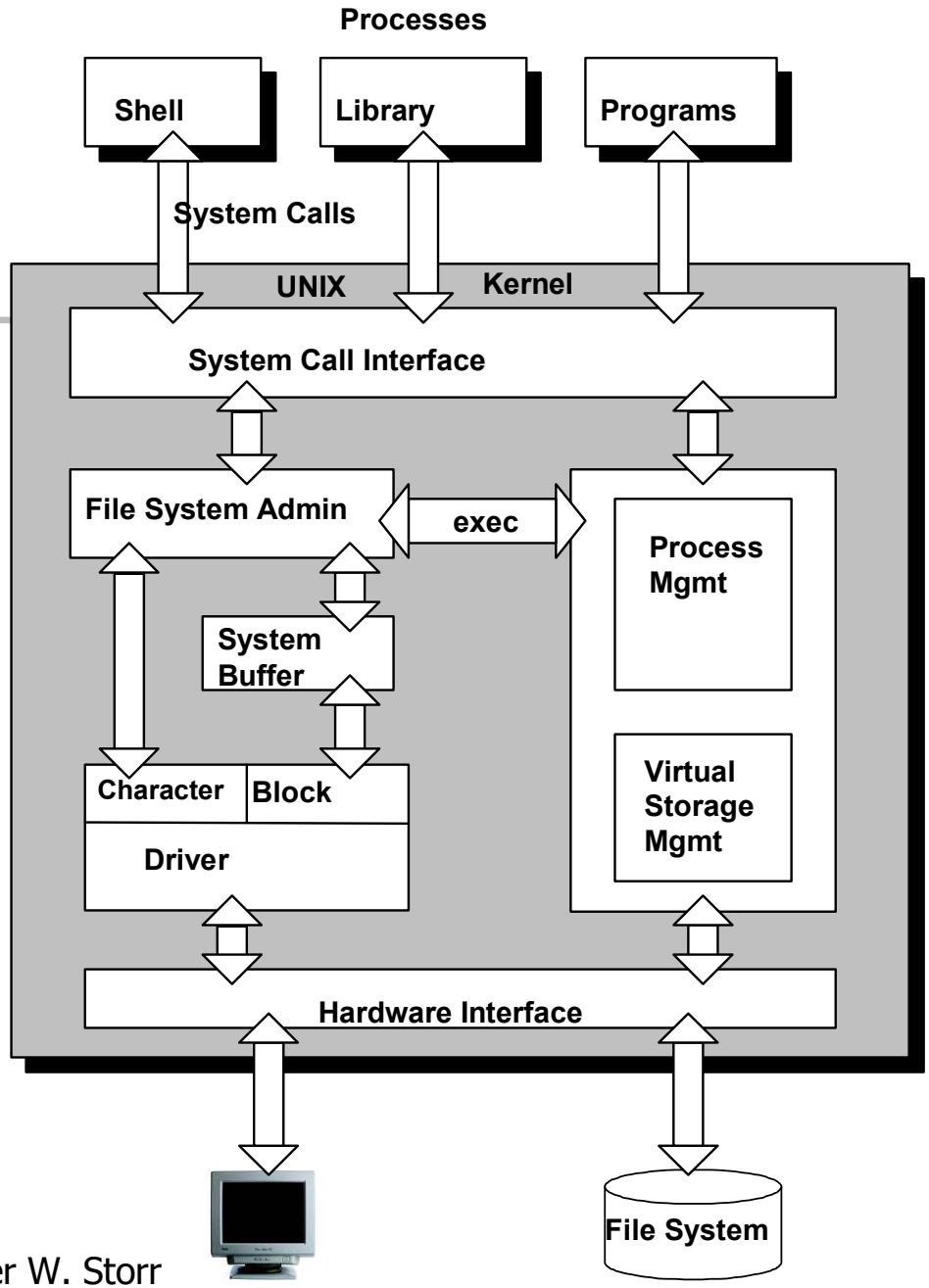
Hardware level

- Enabling asynchronous I/O (AIX)
- Changing the thread scheduling model (AIX)
- Raw device or file system
  - Most of the ADABAS container files can be located on both, for example ASSO, DATA, WORK, SORT, etc.
  - Some files can only be loaded on file system, for example ADAMUP ISN, FDT, raw data

Database Design (Unix)

OS (Processor)

- **IBM AIX**
- **SUN Solaris (UltraSPARC)**
- **HP-UX (PA_RISC)**
- **HP-UX (Itanium)**
- **LINUX (IA-32) Red Hat**
- **LINUX (IA-32) SUSE**
- **IBM zLinux (zSeries)**



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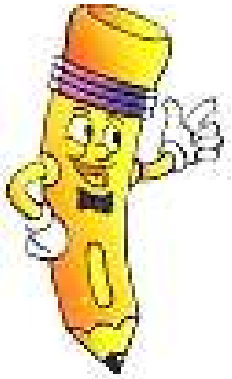
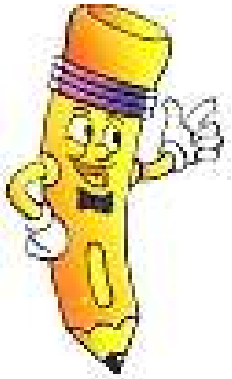
Database Design (Unix)



- Process Management
  - Parallel execution of multiple processes (multi tasking)
  - Mode switching
    - Privileged kernel mode
    - Less privileged user mode
  - Context switch – process is swapped out to RAM
  - Excessive context switching = CPU bottleneck

http://www.uwsg.iu.edu/UAU/process/manage.html

Database Design (Unix)

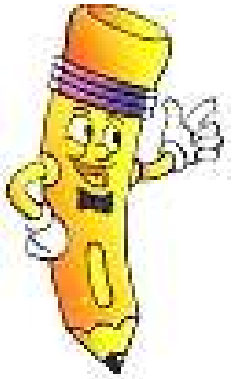


Memory Management

- IPC **I**nter**p**rocess **C**ommunication
  - Message queue (like a mailbox)
  - Signals, files, pipes
  - Shared memory segments
  - Semaphore (locking mechanism used to control access to to files, shared memory, message queues or any system resource)
    - **ipcs** displays and **ipcrm** destroys a semaphore

More info see SL24, technical papers

Database Design (Unix)



Performance Management

- User-state CPU
- System-state CPU
- I/O Time and Network Time
- Virtual Memory Performance
- Time spent running other programs

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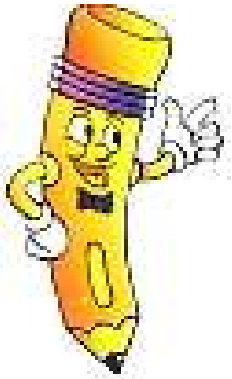
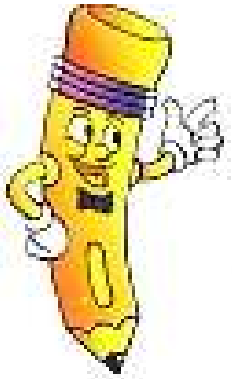
Database Design (Unix)



Measure Performance Management (1)

- **cron** Process scheduling
- **nice/renice** Change priorities
- **setpri** Set priorities
- **netstat** Network statistics
- **nfsstat** NFS statistics
- **time/timex** Process CPU Utilization
- **uptime** System Load Average

Database Design (Unix)

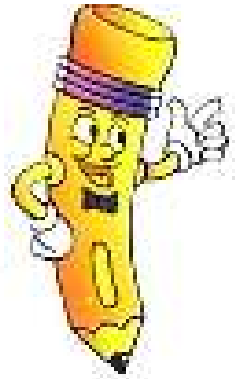


Measure Performance Management (2)

- **ps** Process Statistics
- **iostat** BSD tool for I/O
- **sar** Bulk System Activity
- **vmstat** BSD tool for V. Memory
- **gprof** Call Graph profiling
- **prof** Process Profiling
- **trace** Used to get more depth

http://www.circle4.com/jaqui/papers/webunuk.html

Database Design (Unix)



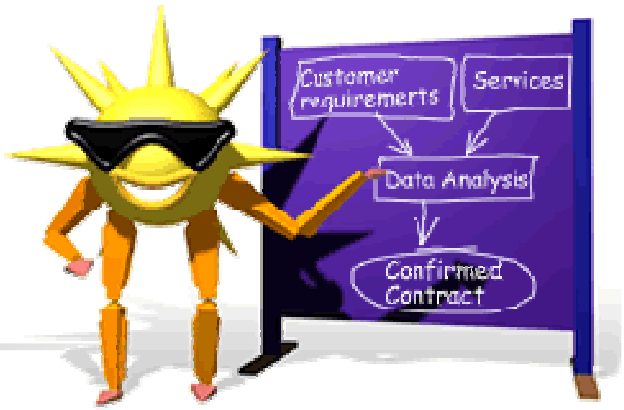
Measure Performance Management (3)

- Commands may differ depending on the platform they are being run on, for example AIX:
  - tprof CPU Usage
  - **svmon** Memory Usage
  - **filemon** Filesystem, LV .. activity
  - **netpmon** Network resources
  - **sar** command with several sar –options

  SarCheck from Aptitune Corp., analyzing sar output

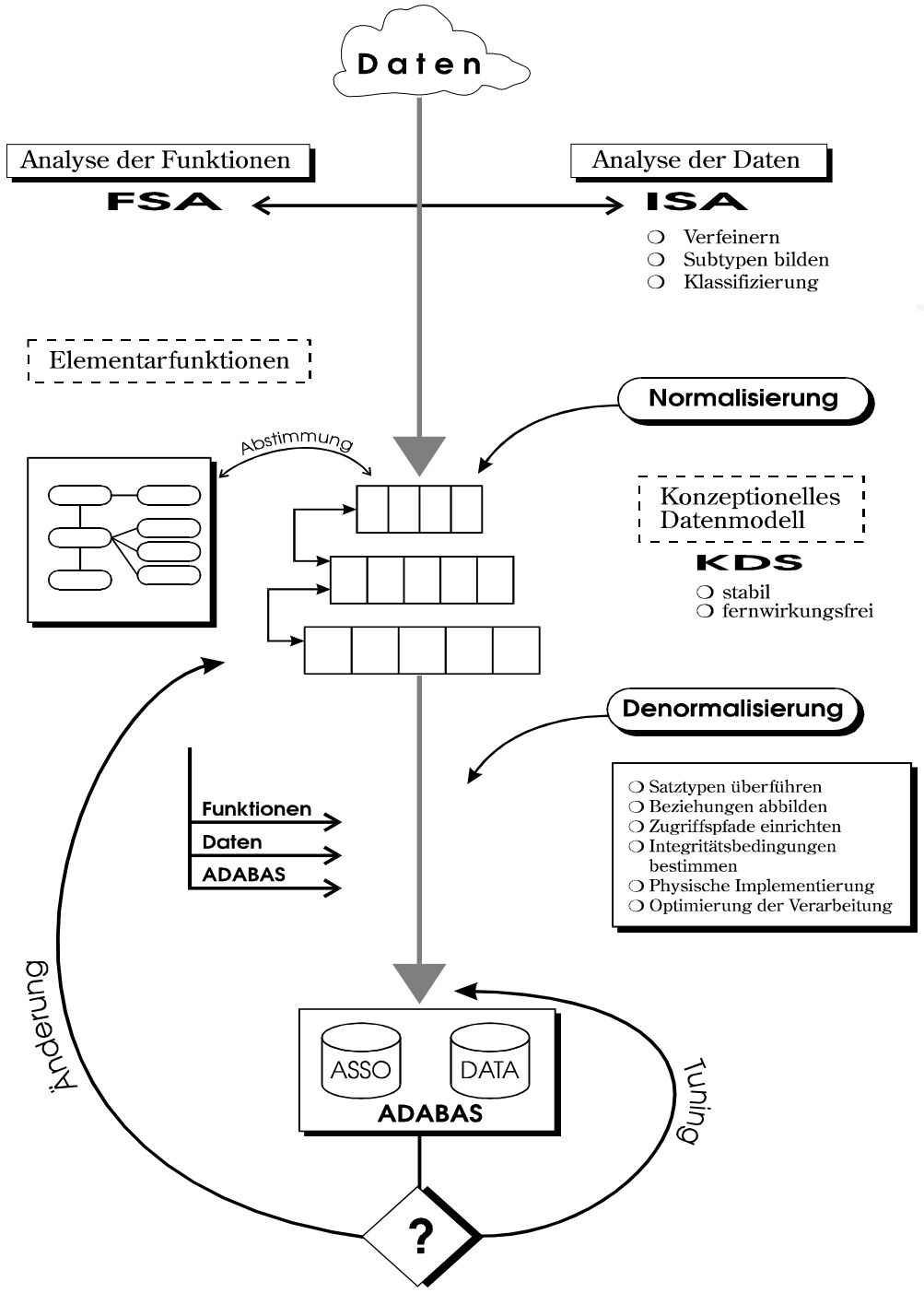
http://www.circle4.com/jaqui/papers/webunuk.html

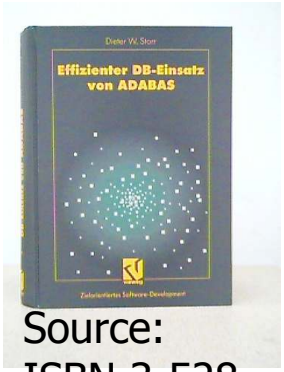
Database Design



User level

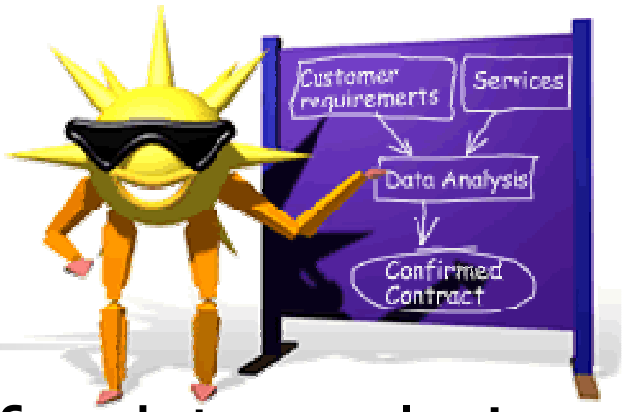
- Data modeling
- [Help to] determine the transition from logical to physical database design (DBA or DA)
- Entity relationship
  - Normalization
  - Denormalization
- Unified Modeling Language





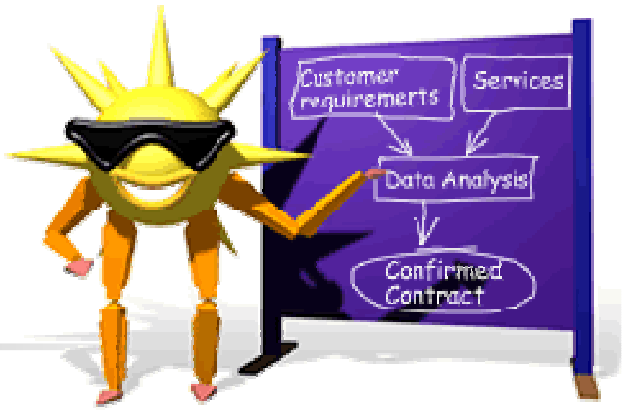
Source: ISBN 3-528-15289-3

Database Design



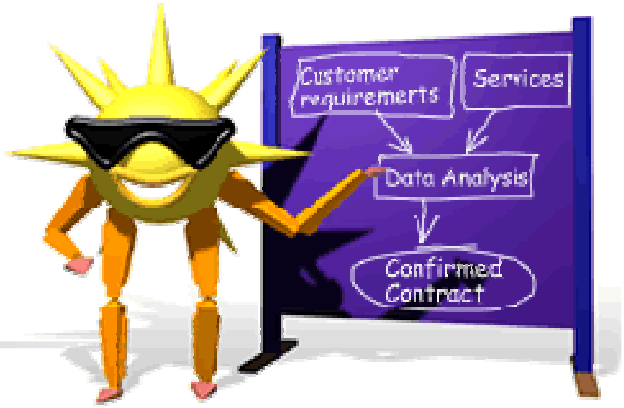
- Normalization – technique for data analysis defined in relational database theory
  - First normal form 1NF
    - Eliminate repeating attributes / groups
    - Each record has a primary key
  - Second normal form 2NF
    - Eliminate attributes, which are related to a multi valued key. Create a separate table.
  - Third normal form 3NF
    - Eliminate attributes not dependent to the key. Create a separate talbe.

Database Design



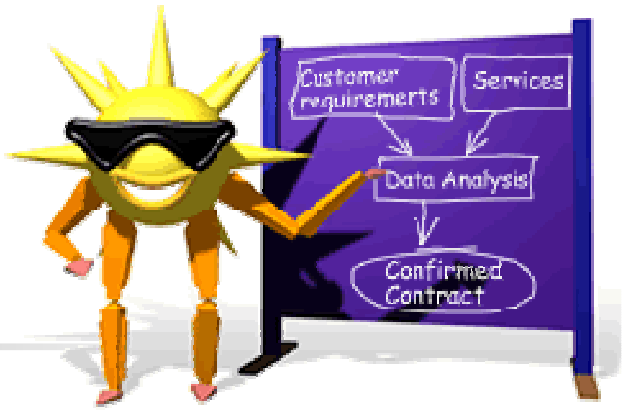
- Denormalization
  - Transform entities / relation and cardinality
    - 1:1 same primary key
    - 1:1 different primary key but same attributes
    - 1:N common part of primary key
    - 1:N hierarchical structure
    - Sub-entities and common primary key
    - Split record type
    - Add record types, for example results
    - Add fields

Database Design



- Denormalization
  - 1:N Integrate primary key as foreign key into subordinated entity
  - 1:1C or 1:NC Insert new attribute into primary entity
  - 1:N recursive primary key of superordinated line is foreign key in the subordinated line or all primary keys of subordinated
  - 1:N multiple recursive: Primary key in relational table.

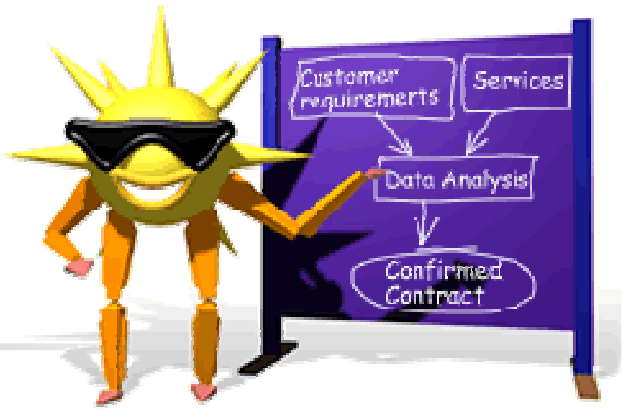
Database Design



- Denormalization N:M
  - Two files and multiple field in second entity
  - One file with multiple field in PE group
  - Two files and multiple field in first entity
  - One file and one PE group

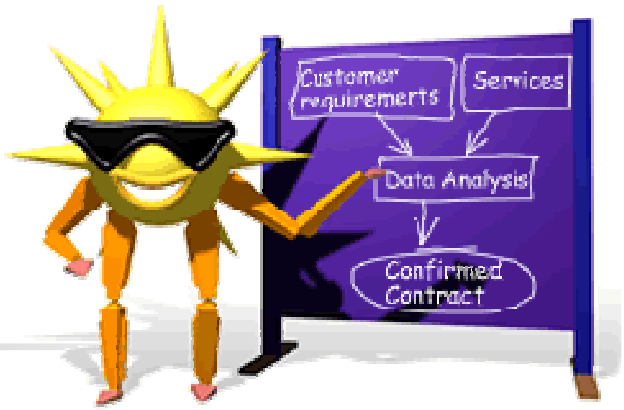
All solutions have pros and cons

Database Design



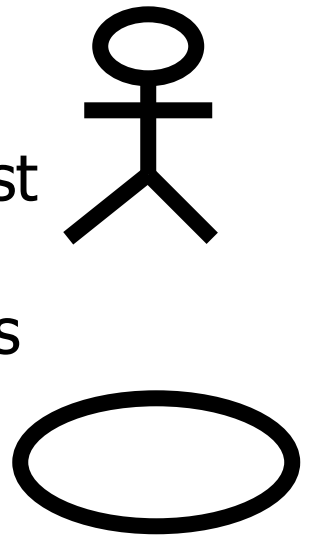
- Manual denormalization
  - Transform relations and cardinalities
  - Determine integrity rules
  - Determine access paths
  - Implement database physically
  - Optimize processes
  - Performance and tuning

Database Design



From Object-Oriented Programming

- Unified Modeling Language (UML)
  - UML is a standard notation for the modeling of real-world objects as a first step in developing an object-oriented design methodology. Determine access paths



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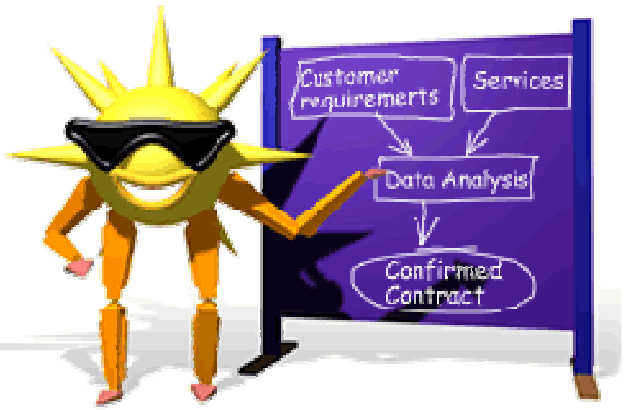
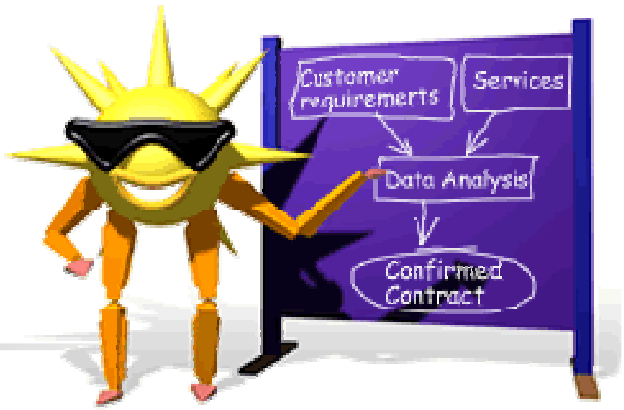
Database Design

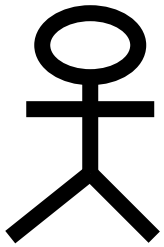


- Its notation is derived from and unifies the notations of three object-oriented design and analysis methodologies:
  - Grady Booch's methodology for describing a set of objects and their relationships
  - James Rumbaugh's Object-Modeling Technique (OMT)
  - Ivar Jacobson's approach which includes a use case methodology

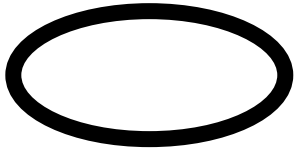
Database Design



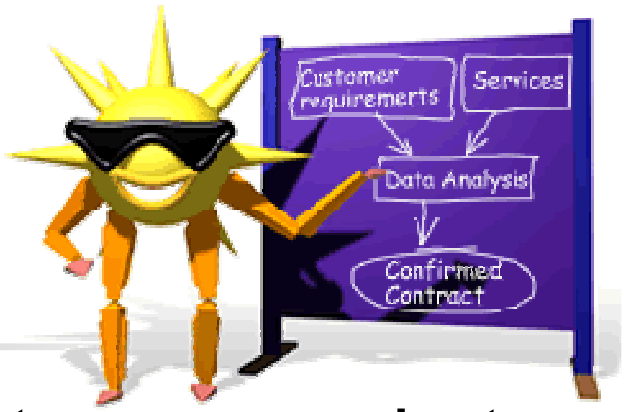
- **Use-Case Modeling**



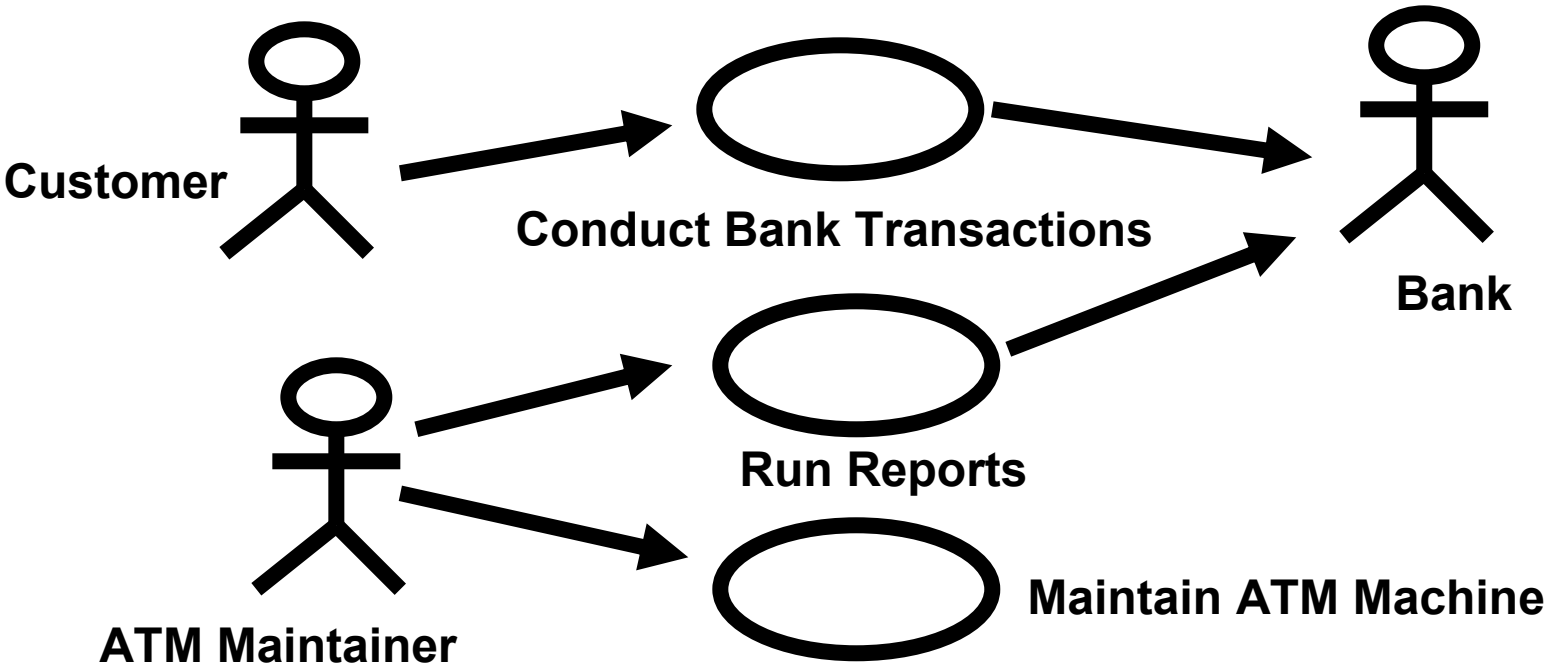
  - An actor represents anything that interacts with the system

  - A use case  is a “chunk” of functionality performed by a system, yielding a measurable result of value for an actor

Database Design



A use case diagram is drawn to illustrate that use cases and actors interact by sending stimuli to one another



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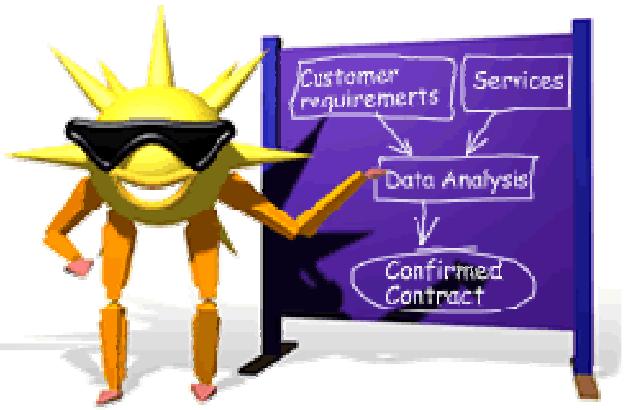
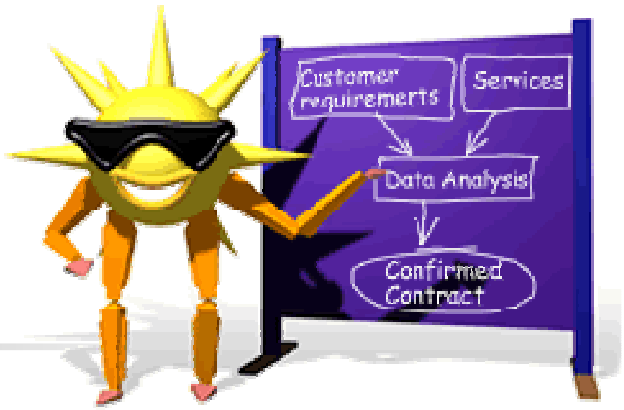
Database Design



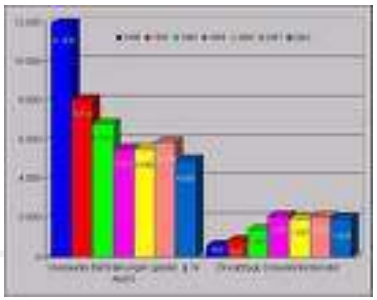
- Scenario
- Object (State, Behavior, Identity)
- Interaction Diagrams
- Sequence Diagrams and Scripts
- Collaboration Diagrams
- Link Notations
- Classes and Objects

Database Design



- User level
  - Different databases for
    - DBAs, Test and development
    - User acceptance test
    - Production and staging (FNAT, FUSER, FSEC, FDIC)
    - Training, Spool NAF, CON-NECT, CASE, ESS, etc.

ADABAS Parameters



- Determine some of the parameters in connection with the system group to avoid an increase of
  - CPU time
  - Paging rate
  - Number of I/Os

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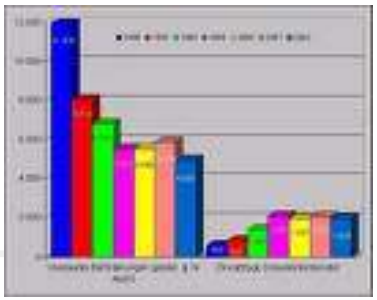
ADABAS Parameters



- Influences performance
  - Size of buffer pool
  - Size of work pool
  - Size of dynamic caching
  - Number of buffer flushes
  - Bypass device caching
  - Size of protection log (work part 1)

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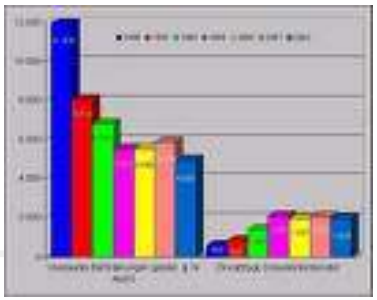
ADABAS Parameters



- Influences performance
  - Number of queues and threads
  - Size of format buffer
  - Size of TBI pool
  - Size of hold queue
  - Size of security pool
  - Values of time limit windows

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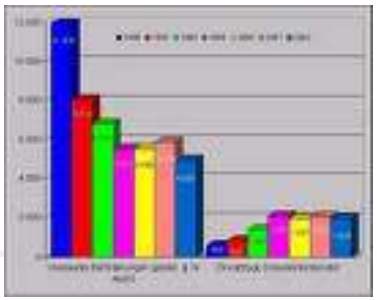
Transaction Design



DB transaction must end before DC transaction

```
READ  VIEW1 BY ISN
   DISPLAY FIELD1
   UPDATE
   END TRANSACTION
END-READ
```

```
R1. READ VIEW1 BY ISN
   DISPLAY FIELD1
   G1. GET VIEW1(R1.)
   UPDATE (G1.)
   END TRANSACTION
END-READ
```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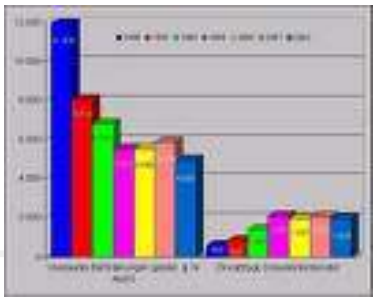
Transaction Design



Add many DB transactions into one (batch)

Reason: performance, ET commands are costly

```
. . .
UPDATE
ADD 1 TO #UPDATE-COUNTER
IF #UPDATE-COUNTER > 50
   RESET #UPDATE-COUNTER
   END TRANSACTION
END-IF
```

Note:

Hold queue overflow
NAT3009-1
NAT3045

Work-1 overflow
NAT3009-15

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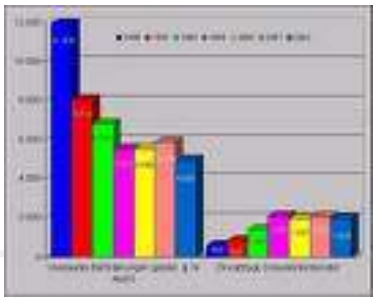
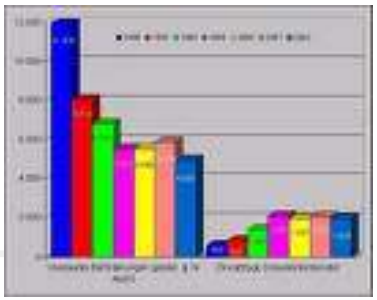
Transaction Design



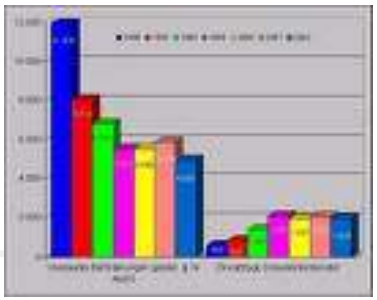
- Determine the number of write commands per logical DB transaction
  - STORE, UPDATE, DELETE
  - Hold queue overflow NAT3009-1 NAT3045
  - Back-out, Work-1 overflow, NAT3009-15
  - Adjust parameters HQ, LP

Transaction Design



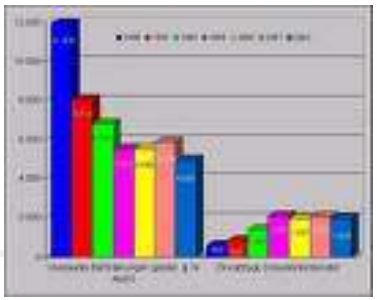
- Determine the maximal number of ADABAS commands per DC transaction
  - Between terminal I/Os
  - Adjust Natural parameter MADIO to avoid NAT1009
  - TP monitor: CPU time limit exceeded
  - TP monitor: ADALIMIT=32767 (before cancel)
  - TP monitor: ADACALLS=50 (before rolls)
  - TP monitor: ADAROLL=.1 (before rolls)

Transaction Design



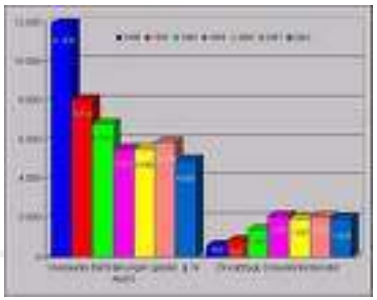
- See handouts:
  'System Event Conditions and User ID Handling'
  - Unplanned System Event Descriptions
  - Parameter values in different databases
  - Effect
  - Action

Online and Batch Process

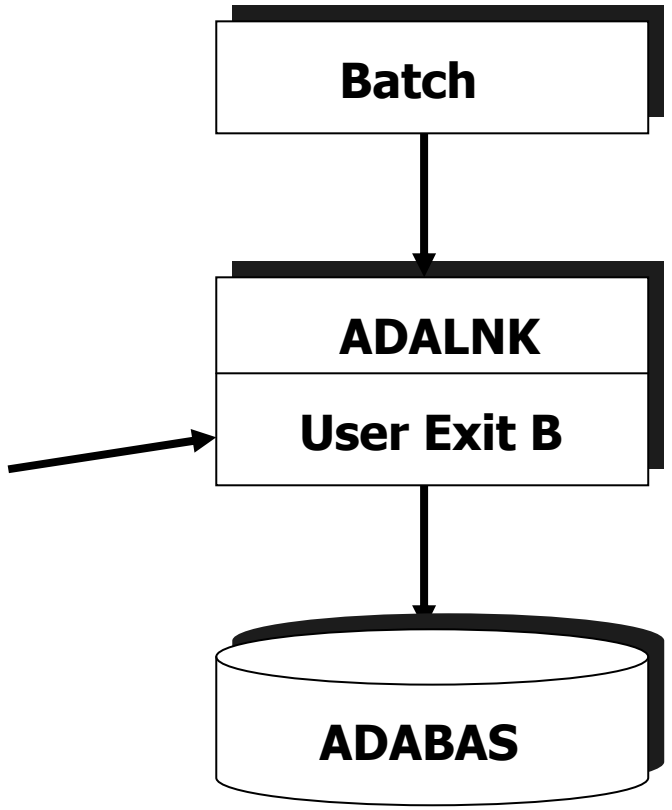


- ADABAS doesn't differentiate between online and batch users
- Batch users can send more ADABAS commands per second than online users
- Batch users can influence the online response time
- DBAs can discuss with OP the best time to use batch programs, for example before 8:00 AM and after 5:00 PM.

Online and Batch Process



- Possibilities to slow down batch processes
  - Write user exit B in ADALNK
  - Batch slow down from Treehouse (TRMUEXBB) by time, commands, jobs
  - Batch class priorities
  - Work load manager



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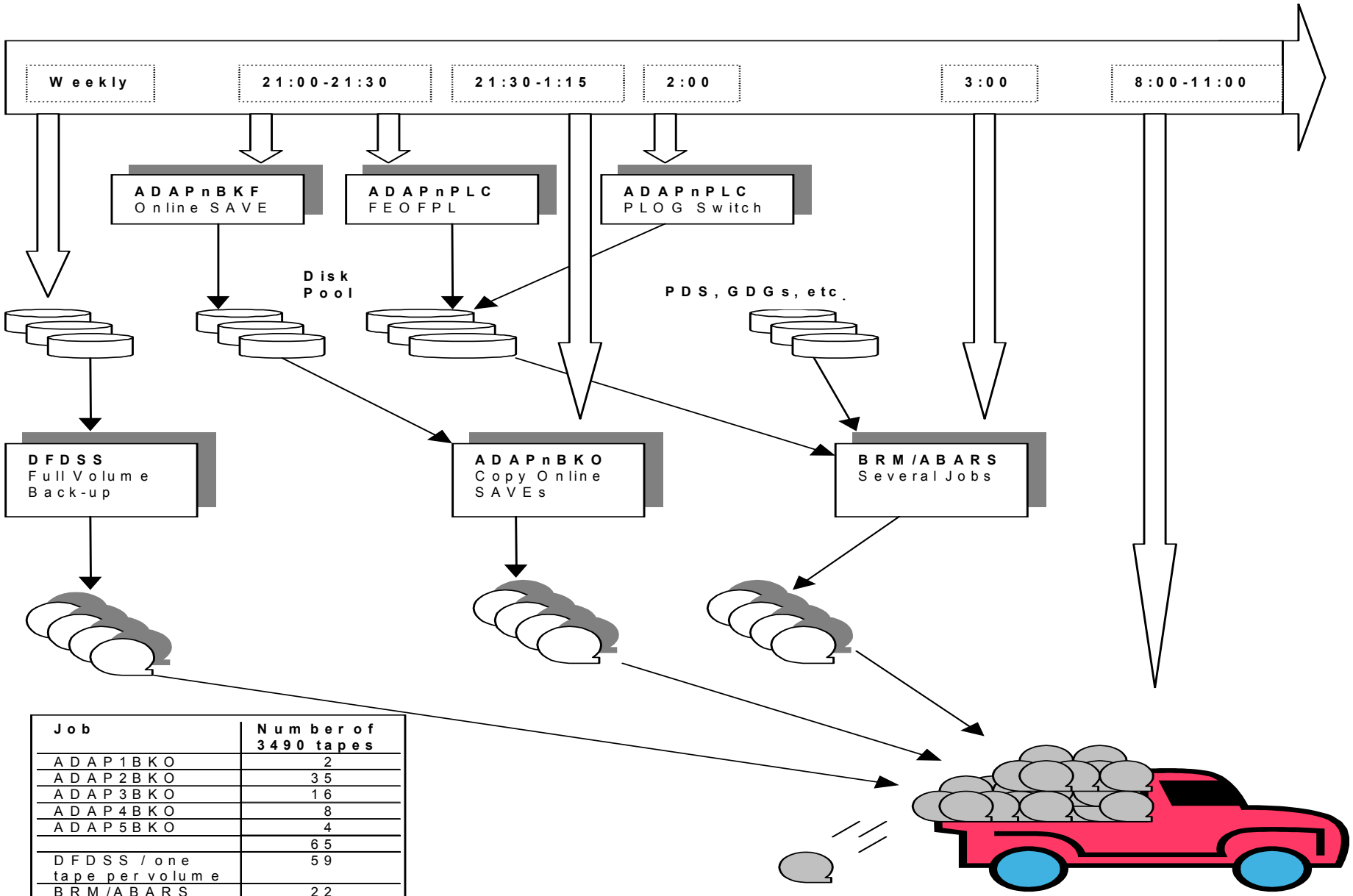
Back-up and Recovery Procedures

- ADABAS backup is primarily used to physically restore a database
- Create procedures (JCL) to back-up and restore databases
- Create procedures for disaster recovery D/R



Job	Number of 3490 tapes
ADAP1BKO	2
ADAP2BKO	35
ADAP3BKO	16
ADAP4BKO	8
ADAP5BKO	4
	65
DFDSS / one tape per volume	59
BRM/ABARS	22
TOTAL (Only for ADABAS)	211

Status: 12 Nov 2004

Back-up and Recovery Procedures

Basic restore procedure (based on the previous slide)

- Full volume restore (only formatted ASSO, DATA, WORK, PLOG etc. areas)
- Format WORK, PLOG1, and PLOG2
- Restore the databases by using online save back-ups and protection logs (RESTONL)
- Regenerate all activities after the last back-up of all databases by using the protection logs
- Repeat ADABAS utilities, for example mass ADALOD updates
- Continue to regenerate the relevant files

Where to get recovery info from

Without ADARAI

- ADAREP and ADASAV: Session/PLOG #
- ADASAV job: dataset name
- ADAREP CPLIST: SYN1/SYN2 and other synchronized checkpoints
- PLCOPY jobs: dataset name, from/to block #

Where to get recovery info from

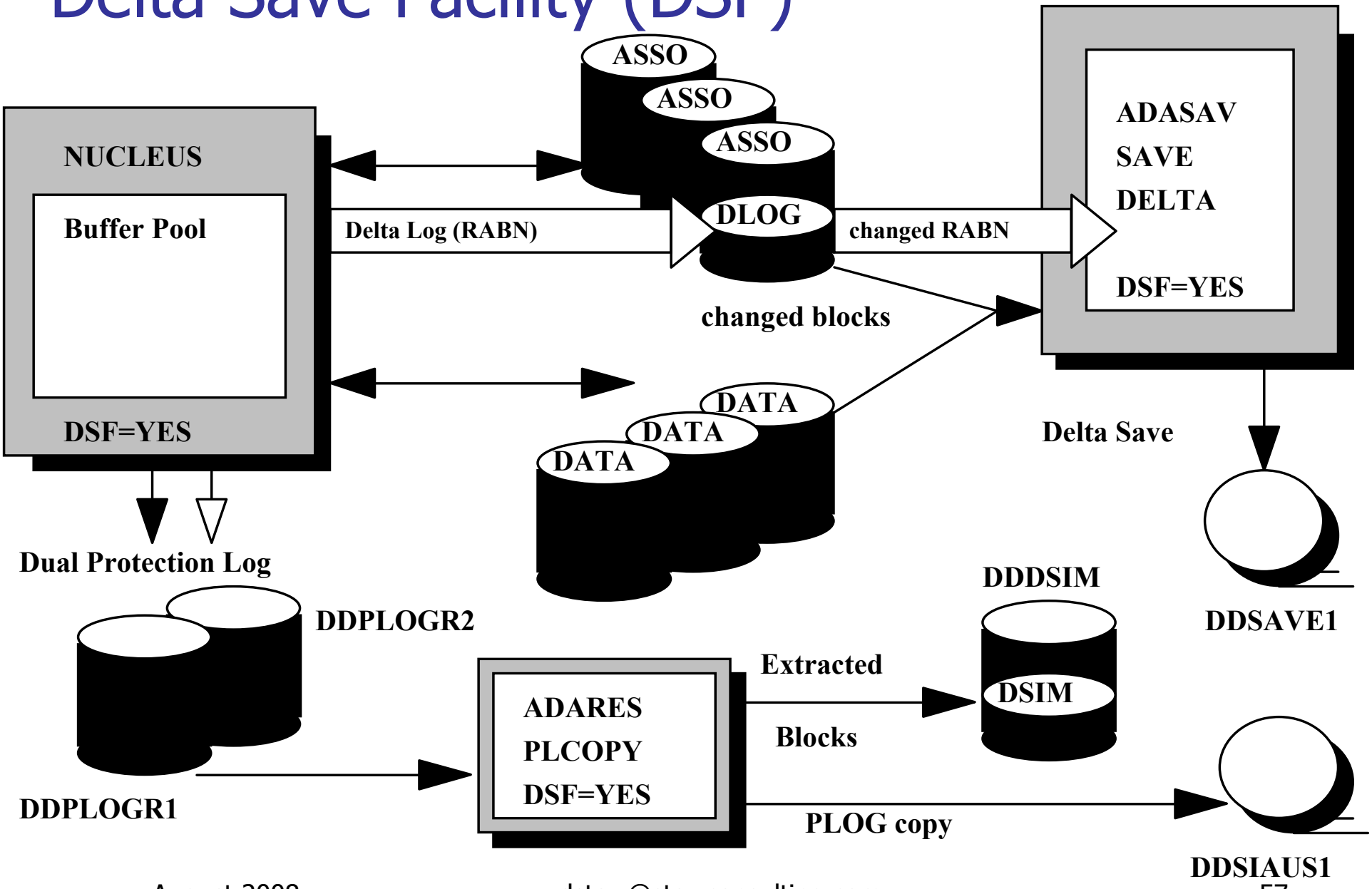
With ADARAI

- CHKDB: Check the Database Status
- DISABLE: Deactivate Recovery Logging
- LIST: Display Current RLOG Generations
- PREPARE: Initialize and Start the RLOG
- RECOVER: Build a Recovery Job Stream
- REMOVE: Remove the Recovery Aid

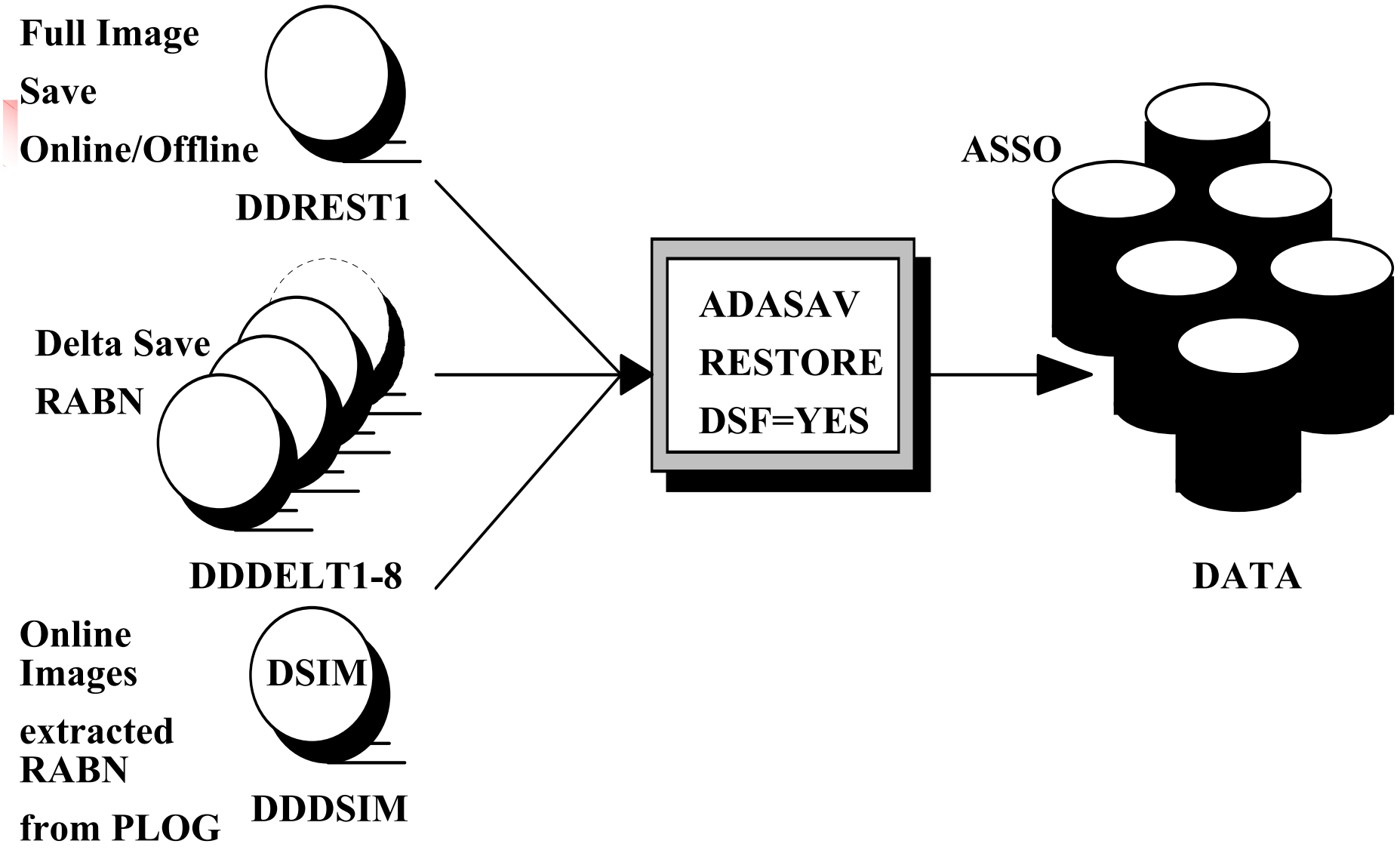
```
A D A R A I   V7.4  SM2   DBID = 00215  Started          2006-08-26  20:15:10

Parameters:
-----------
ADARAI LIST GENS=YES,RELGEN=2-0
Recovery Log File for database 215

   MINGENS value is                      16
   Start RABN for Log Data Area is       21
   Highest Log Area RABN is              480
   Current value for Rotating RABN is    305
I Gen-   I   I      Block      I                 Date / Time                 I
I Number I S I   From       To I          From                      To        I
I--------I---I-----------------I-------------------------------------------I
I    744 I N I    305      305 I 2006-08-26  14:32:32   2006-08-26  14:32:54 I
I    743 I N I    304      304 I 2006-08-25  21:03:04   2006-08-26  14:32:32 I
I    742 I N I    303      303 I 2006-08-24  21:03:28   2006-08-25  21:03:04 I
I    741 I N I    302      302 I 2006-08-23  21:03:11   2006-08-24  21:03:28 I
I    740 I N I    301      301 I 2006-08-22  21:02:50   2006-08-23  21:03:11 I
I    739 I N I    300      300 I 2006-08-21  21:02:58   2006-08-22  21:02:50 I
I    738 I N I    299      299 I 2006-08-20  21:02:48   2006-08-21  21:02:58 I
I    737 I N I    298      298 I 2006-08-19  14:33:30   2006-08-20  21:02:48 I
I    736 I N I    297      297 I 2006-08-18  21:02:40   2006-08-19  14:33:30 I
I    735 I N I    296      296 I 2006-08-17  21:03:18   2006-08-18  21:02:40 I
I    734 I N I    295      295 I 2006-08-16  21:02:48   2006-08-17  21:03:18 I
I    733 I N I    294      294 I 2006-08-15  21:02:53   2006-08-16  21:02:48 I
I    732 I N I    293      293 I 2006-08-14  21:03:03   2006-08-15  21:02:53 I
I    731 I N I    292      292 I 2006-08-13  21:02:59   2006-08-14  21:03:03 I
I    730 I N I    291      291 I 2006-08-12  14:34:19   2006-08-13  21:02:59 I
I    729 I N I    290      290 I 2006-08-11  21:02:43   2006-08-12  14:34:19 I
I--------I---I-----------------I-------------------------------------------I
```

```
<snip>

***       2006-10-09           21:03:29  Nucleus PLOG Number=1815
*** SAVE DATABASE ONLINE

    Save dataset PLOG Number          = 1815
    Block number of SYN1/4-Checkpoint = 4174
    Block number of SYN2/5-Checkpoint = 4184
    FILES = 6,7,8,9,11,12,15,17,19,25,37,40,42,46,53,55,77,106
    FILES = 108,109,111,113,117,122,198

      ADARUN DBID=215,SVC=254,DEVICE=9990,LP=65535
      ADARUN PROGRAM=ADASAV,TNAX=18000
      ADARUN IGNDIB=NO

      ADASAV SAVE BUFNO=2,TTSYN=60

    //DDSAVE1  DD DSN=ADABAS.PROD.DB1.BACKUP.FULL.G2327V00(+1),
    //            UNIT=3490,DISP=NEW,DCB=(RECFM=VB,BLKSIZE=262144,
    //            LRECL=32756),
    //            VOL=SER=(L06352,L08301,L06382)

    DDSAVE1    VOLSER=L06352    From Block=1 (ASSO)
.                                To   Block=115236
.              Volume is associated with PLOG No. 1817
.
.    DDSAVE1    VOLSER=L06352    From Block=1 (DATA)

<snip>
```

Delta Save Facility (DSF)

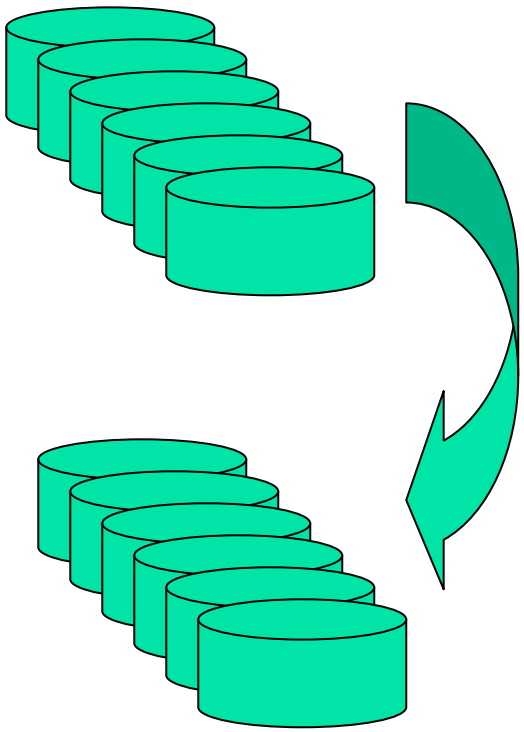


Delta Save Facility



B/R Methods

- **Disk to Disk**
- Mirroring
  - Hardware
  - Software
- Replicating
  - Software



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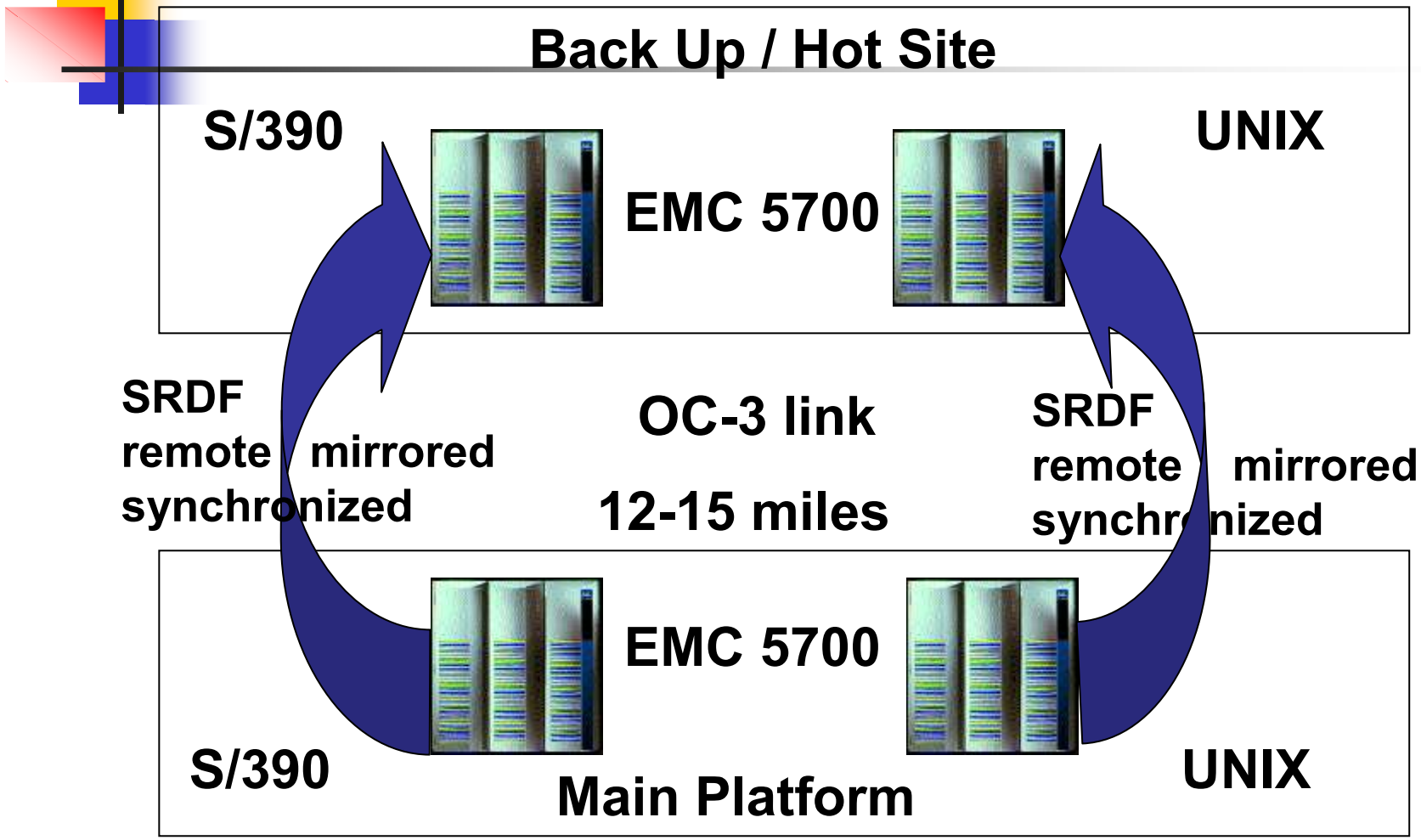
Example For Disk Mirroring



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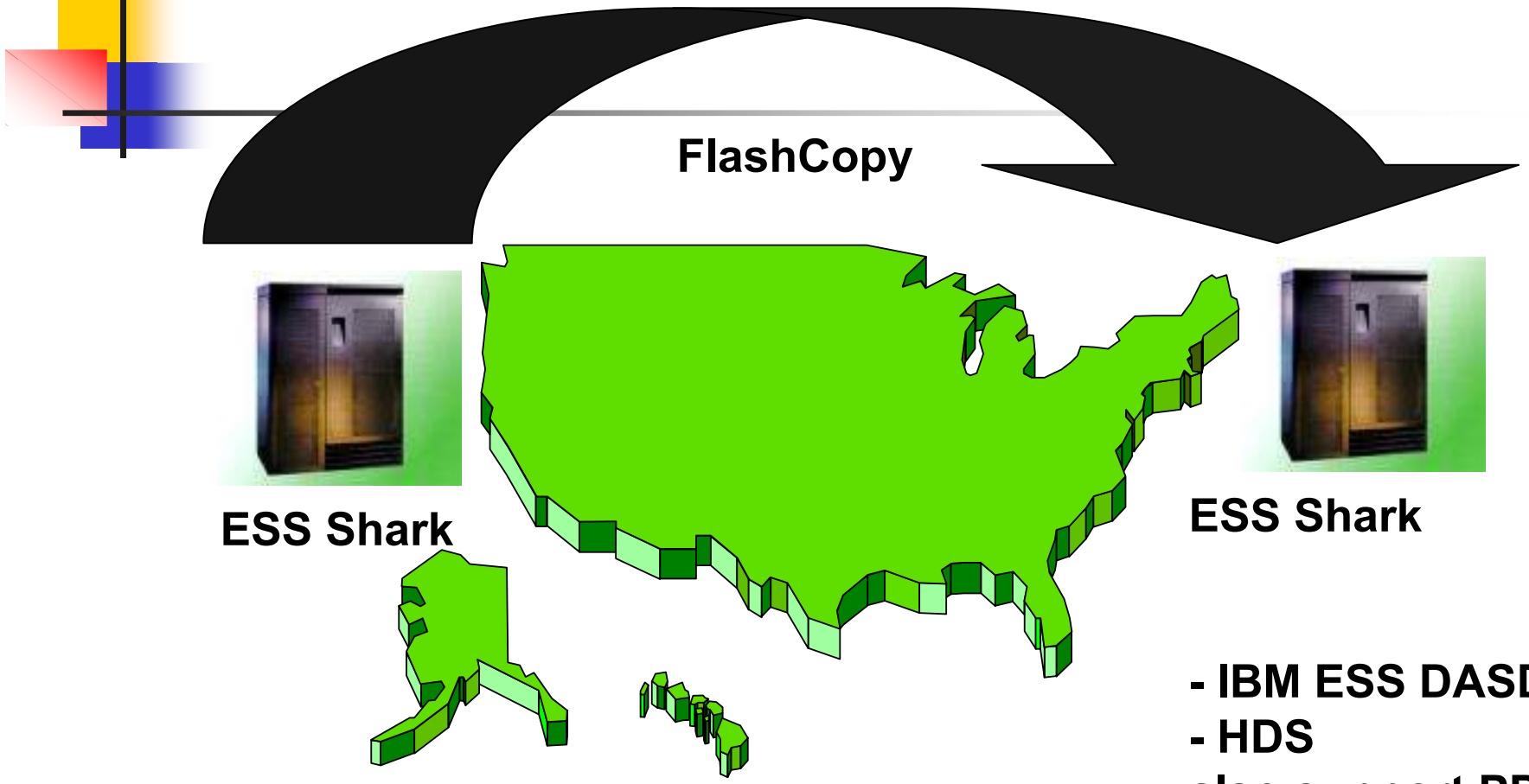
Peer-to-Peer Remote Copy Extended Distance (PPRC-XD)

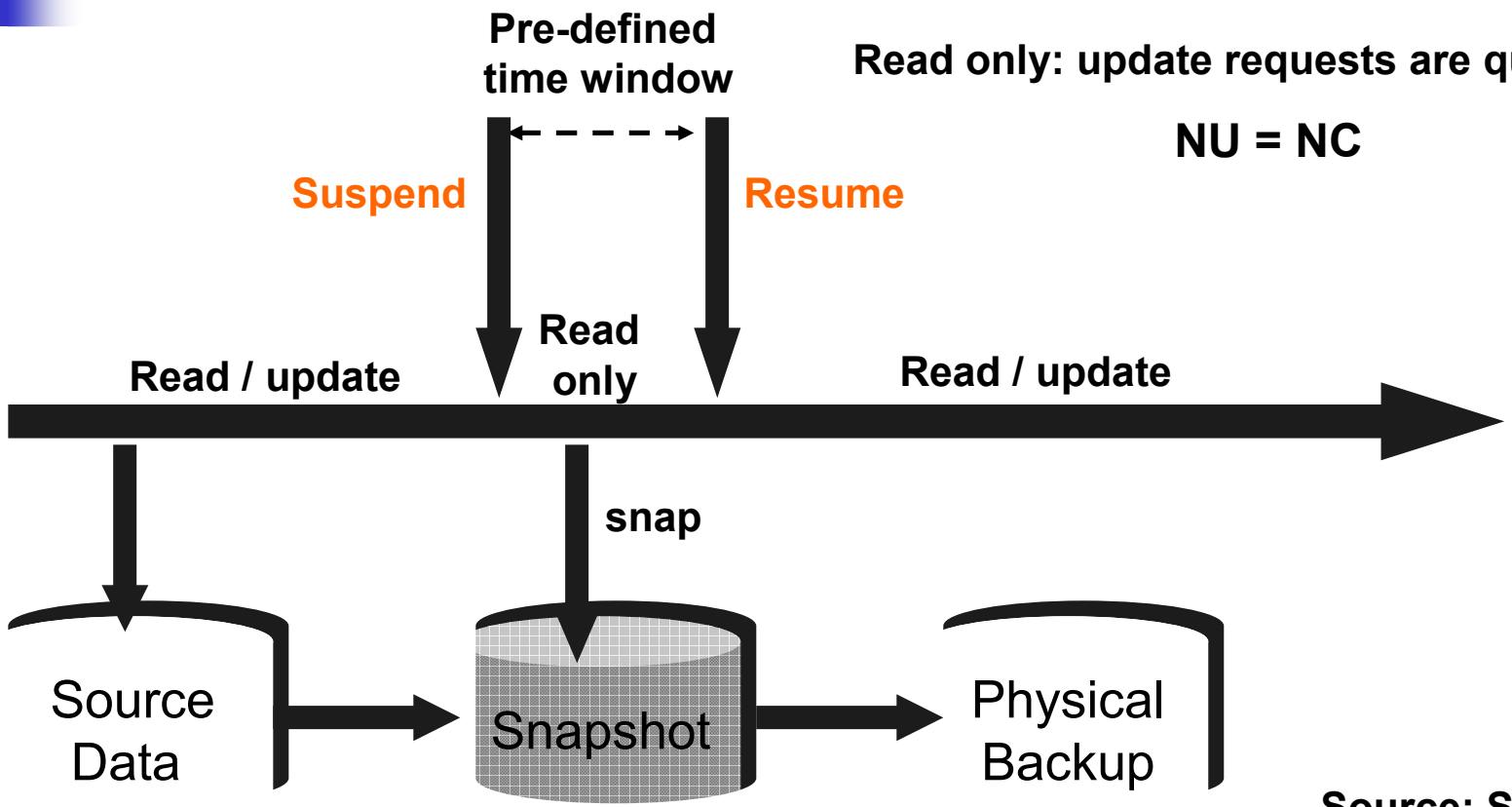
PPRC = 60 miles - PPRC-XD = continent



- IBM ESS DASD
- HDS
also support PPRC

Also see TimeFinder from EMC

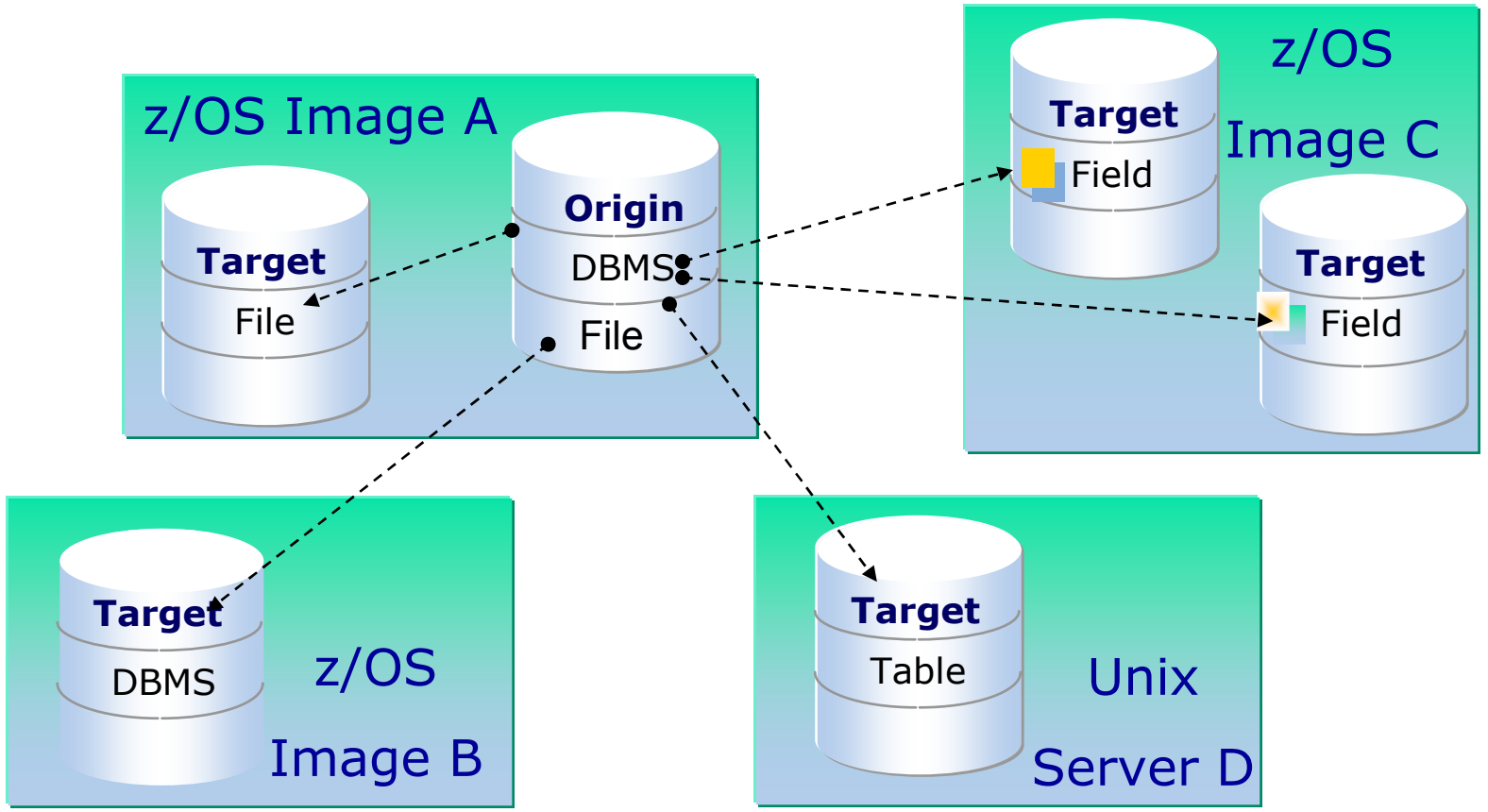
How FlashCopy Works



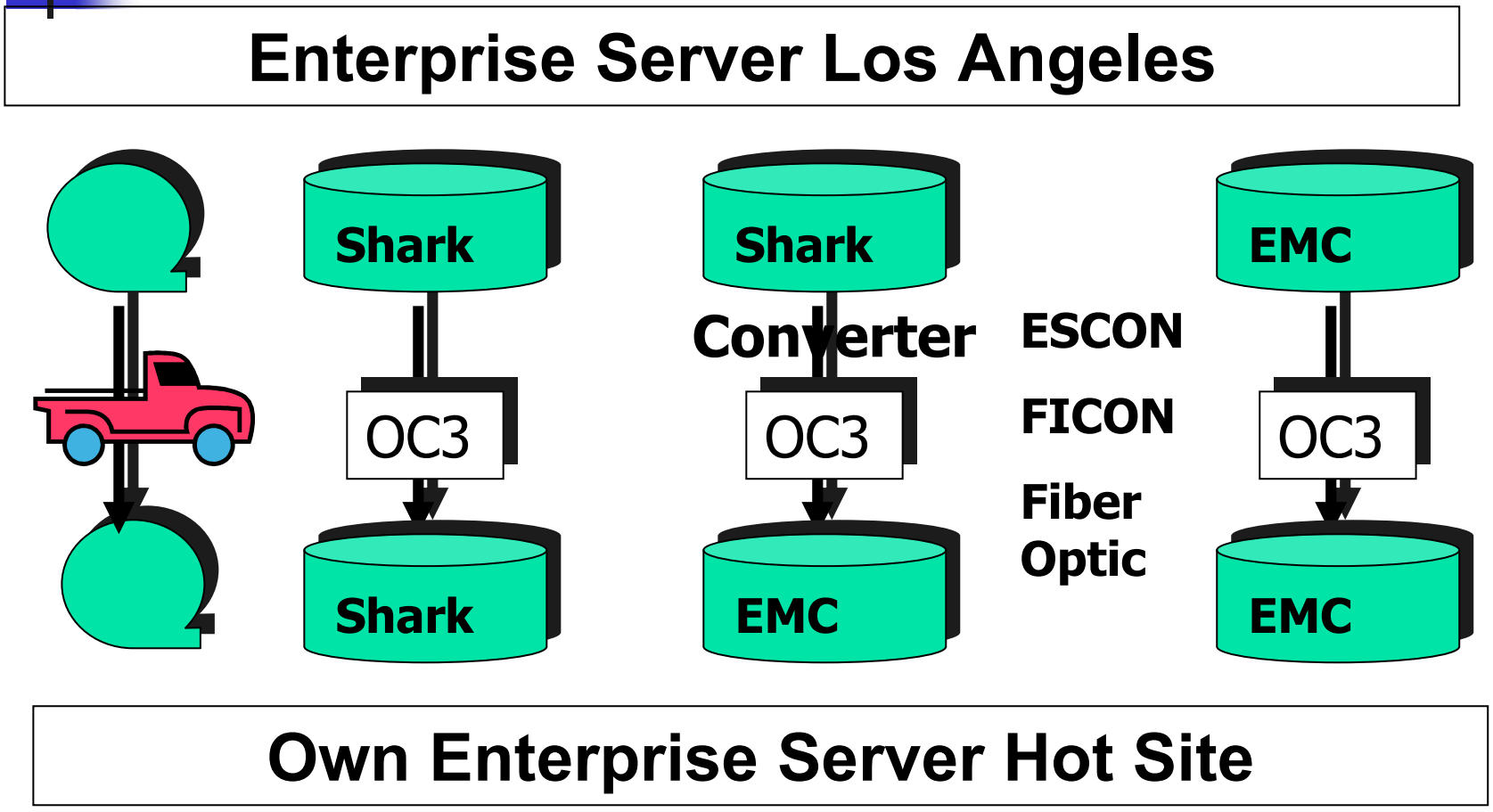
Source: SAG

ADADBS TRANSACTIONS SUSPEND,TTSYN=60,TRESUME=120

ADABAS Data Replication

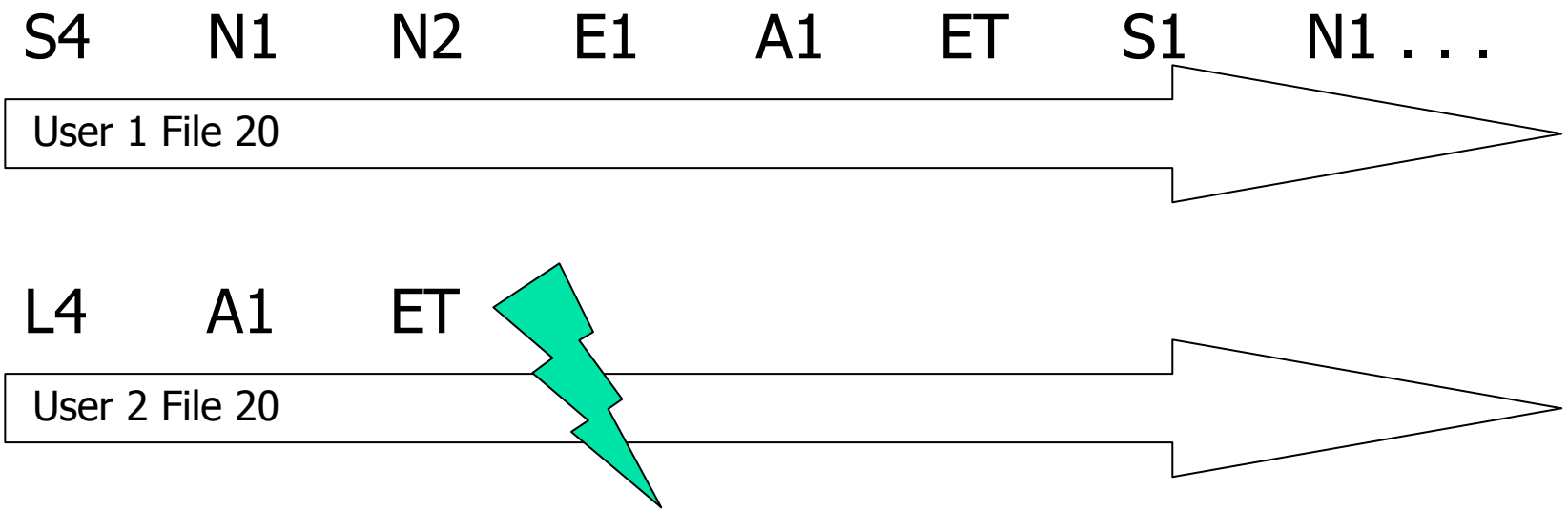


Possible Hot Site Solutions



Back-up and Recovery Procedures

- Logical restore in a parallel updated environment is generally impossible



Back-up and Recovery Procedures

Handbook: z/OS Recovery Procedures

- Recovering the z/OS platform
- Reestablishing the network connections
- Recovering the ABARS aggregates
  Aggregate Backup And Recovery Support (ABARS) is a function of DFSMShsm.
- Recovering the ADABAS databases
- Restoring third-party software products

Quality Assurance
Quality Control

- Measure hardware and software to control the performance of the database
- Evaluate database statistics, for example
  - Reports
  - Session statistics
  - ASF
  - SYSAOS
  - Performance monitors

Quality Assurance
Quality Control

- Analyze programs regarding database access efficiency and transaction design
- Educate and train developers and programmers regarding database access commands by using Natural, Cobol, PL/1, Assembler, SQL
- Performance and tuning in detail ➔

Performance and Tuning

- What data can be collected
- What tools can be used
- How to analyze

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Performance and Tuning

Symptoms

- Development
  - One program is using workload
- Production
  - Resources are no longer available and the cause must be found

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Performance and Tuning

- Symptoms for increased workload
  - Number of I/Os
  - Number of ADABAS commands
  - CPU time
  - Duration of ADABAS commands

Performance and Tuning

- Collect performance data (free tools)
  - ADAREP
  - Session statistics
  - User exit 4
  - Command log

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Performance and Tuning

ADAREP

Physical layout ASSO, DATA, WORK

```
From          To      Number  Dev    Table File VOLSER
 Blk          Blk    of Blks Type    Type       Number

1306    -    1398          93 9990    DSST      0 PAR076
1399    -    1430          32 9990     PPT      0 PAR076
1431    -    1433           3 9990     AC      19 PAR076
1434    -    1434           1 9990     NI      19 PAR076
<snip>
```


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Performance and Tuning

ADAREP

File components

File	Name	Loaded	TOP-ISN	MAX-ISN	Extents		Padding	
					NUA	D	A%	D%
13	AGNT-DRAW-ACTVTY	1991-10-26	3368661	3739111	111	1	1	1
14	AGNT-SRVC-CMPLNT	1995-02-25	6317341	7694255	111	1	1	1
18	CUST-ACCT-ADJSTM	1990-10-14	16079502	20000543	111	1	1	1
19	CHECKPOINT	2002-10-05	2338	5023	111	1	1	1
22	CUSTOMER-ACCOUNT	1994-12-16	11205876	20000543	121	1	1	1

<snip>

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Performance and Tuning

ADAREP

File space allocations

File	Name	Alloc.: / Unused:	NI	UI	AC	Data/Cyl
13	AGNT-DRAW-ACTVTY		316484	2044	2977	178371/1698
13			115650	1100		34070/324
14	AGNT-SRVC-CMPLNT		41953	485	6126	60502/576
14			2412	254		12900/122
22	CUSTOMER-ACCOUNT		119923	549	15924	416526/3966
22			42850	254		46786/445

<snip>

Performance and Tuning

ADAREP

File extents

List Type	Dev Type	Block Lngth	Space Alloc. Blocks	Space Alloc. Cyl	From RABN	To RABN	Unused Space Blocks	Unused Space Cyl
AC	9990	3768	15924	81	2926304	2942227		
NI	9990	3768	119923	614	2942228	3062150	42850	219
UI	9990	3768	292	1	3062151	3062442		
UI	9990	3768	257	1	3904794	3905050	254	1
DSST	9990	3768	111	0	1548	1658		
DS	9990	7548	416526	3966	913133	1329658	46786	445

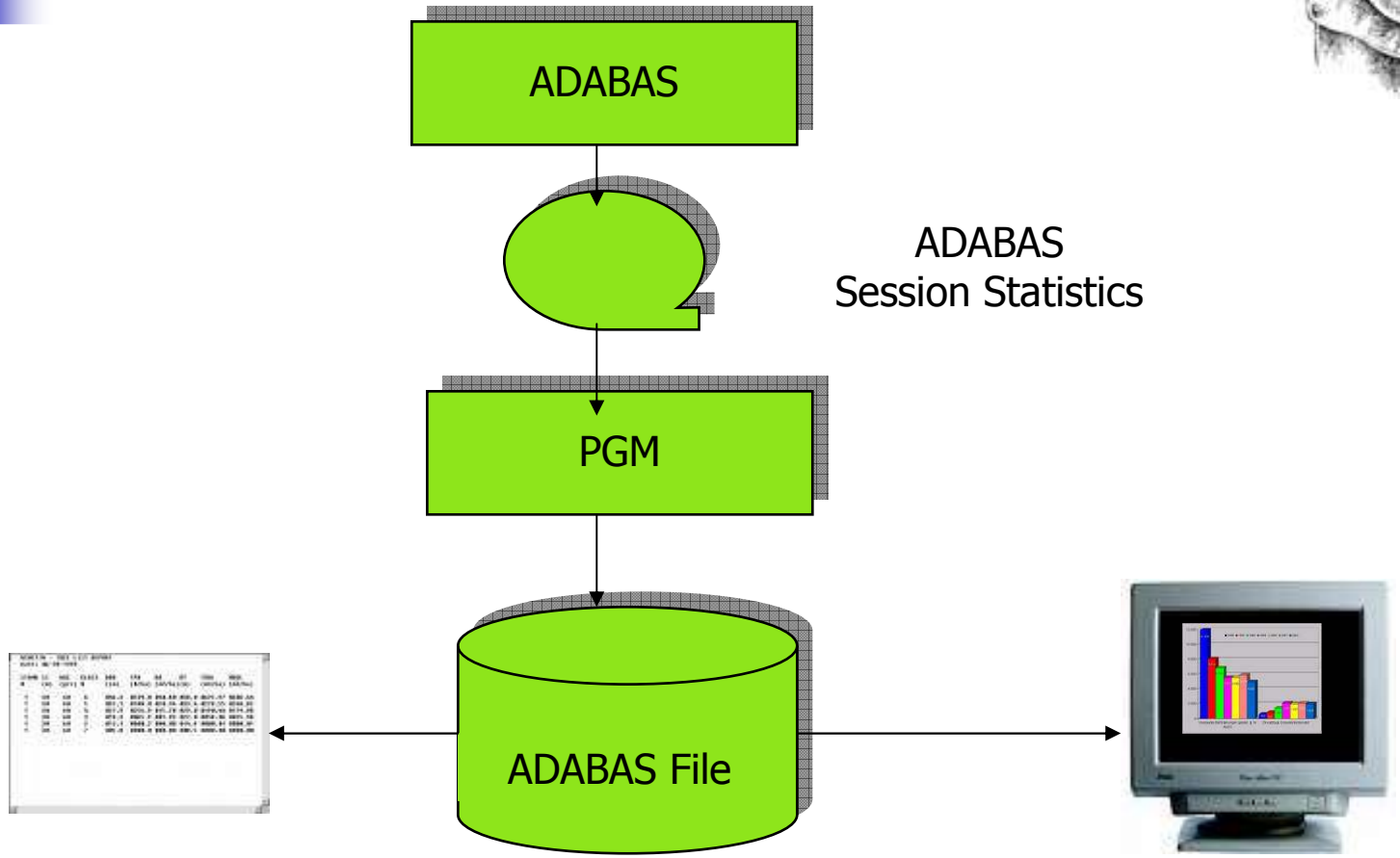
<snip>

Performance and Tuning

Nucleus session statistics

- Duration, wait time, CPU time
- I/O statistics
- Logical reads / buffer efficiency
- Command statistics, by thread, by file, by type
- Translated and overwritten formats
- Auto restarts and throwbacks
- Buffer flushes

Performance and Tuning



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Performance and Tuning

```
18:31:35                      *** A D A - P E R ***                      2006-09-18
 ADAPER-P                  Select Statistics For More Info                PER-M005
Start with DBID: 214 Date: 20060429 Time: 2126
-------------------------------------------------------------------------------
S Date      CMD/S    LBP     LWP     LFP   LFIOP FTrans FOvW BFlus AuRe ThBI ThBS
- -------- ----- ----mb ----mb ----mb ----mb ----mb ---- ----- ---- ---- ----
_ 20060107   956  288.0     3.0     3.3     8.3     5.3         3060          5
_ 20060114  3142  288.0     3.0     3.3     8.3     0.5          542
_ 20060121   891  288.0     3.0     3.3     8.3     4.5         2716
_ 20060128  3098  288.0     3.0     3.3     8.3     1.5   31     600     2     1
_ 20060204   923  288.0     3.0     3.3     8.3     8.9   29    7976          5
_ 20060218   862  288.0     3.0     3.3     8.3     4.6         2847          2
_ 20060225  1021  288.0     3.0     3.3     8.3     9.6         5836          5
_ 20060311   982  288.0     3.0     3.3     8.3     3.9         4909     2    3
_ 20060319   921  288.0     3.0     3.3     8.3     4.7         2842
_ 20060325  1102  288.0     3.0     3.3     8.3     4.3         2748          3
_ 20060402   958  288.0     3.0     3.3     8.3     5.3         3128
_ 20060409  1002  288.0     3.0     3.3     8.3     4.2         5220     1    1
_ 20060415   934  288.0     3.0     3.3     8.3     4.8         2881
_ 20060422   909  288.0     3.0     3.3     8.3     4.3         2844     1    1
_ 20060429  1069  288.0     3.0     3.3     8.3     5.4         3232          2
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
Find  Help  Sel   End   Cmd/S LBP   LWP   -     +     LFP   HWM
```


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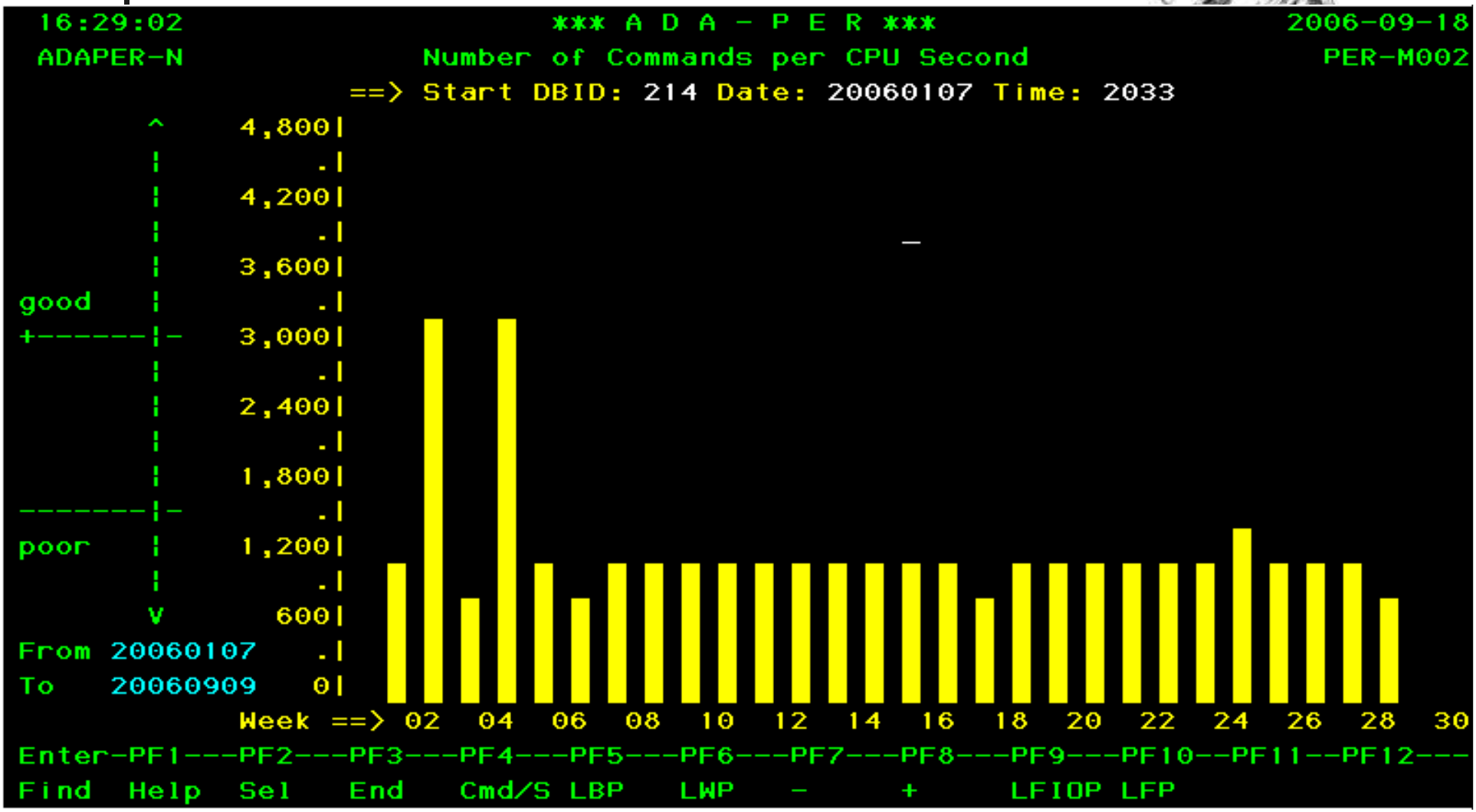
Performance and Tuning



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Performance and Tuning

```
 16:33:03                        *** A D A - P E R ***                    2006-09-18
 ADAPER-N                  Number of Commands per CPU Second               PER-M002
                        ==> Start DBID: 230 Date: 20060107 Time: 2033
         ^     4,800|
         |          .|
         |     4,200|
         |          .|
         |     3,600|
good     |          .|
+--------|-    3,000|
         |          .|
         |     2,400|
         |          .|
         |     1,800|
---------|-         .|
poor     |     1,200|
         |          .|
         V       600|
From 20060107     .|
To   20060911     0|
                Week ==> 02   04   06   08   10   12   14   16   18   20   22   24   26   28   30
Enter-PF1---PF2---PF3---PF4---PF5---PF6---PF7---PF8---PF9---PF10--PF11--PF12---
Find  Help  Sel   End   Cmd/S LBP   LWP   -     +     LFIOP LFP
```


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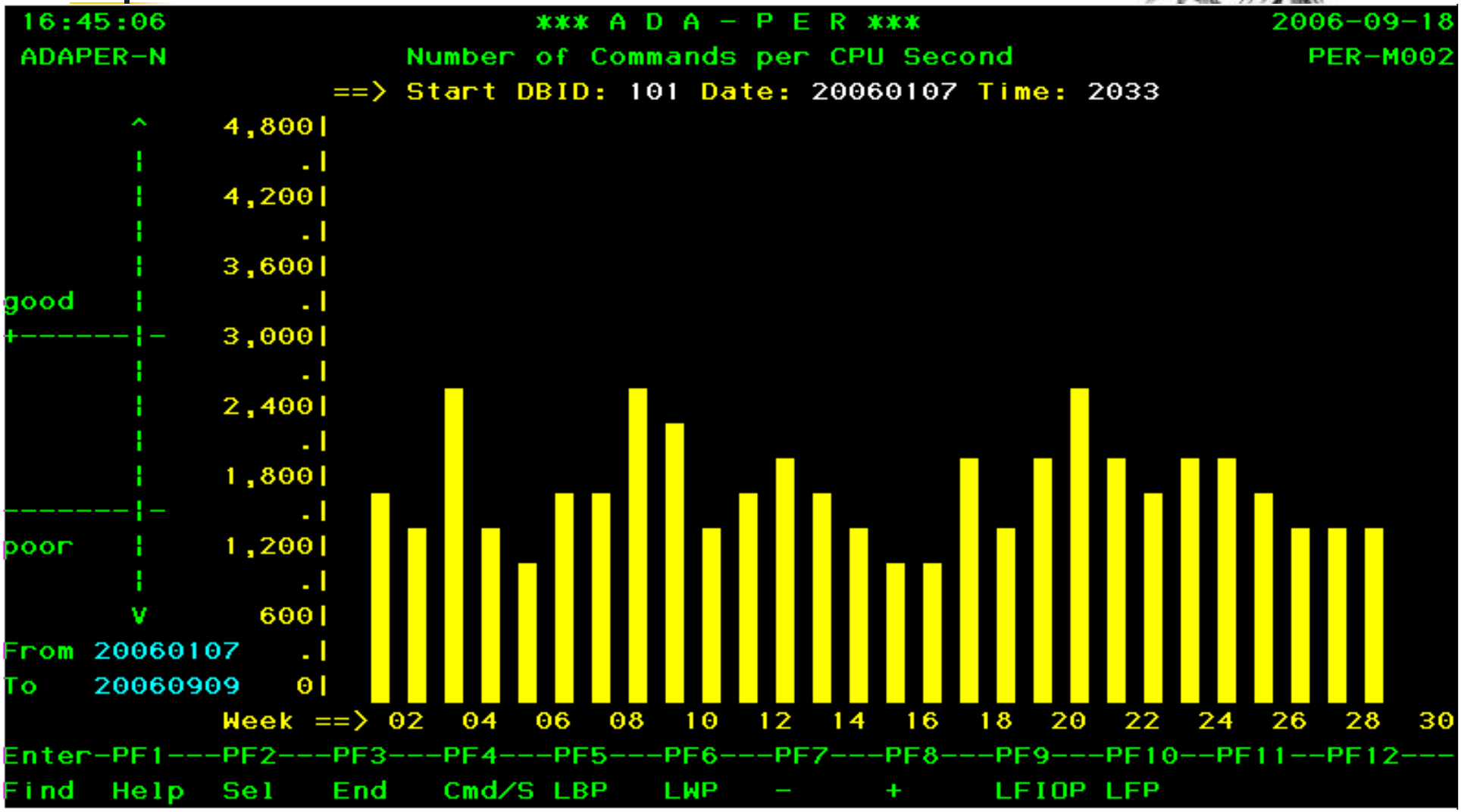
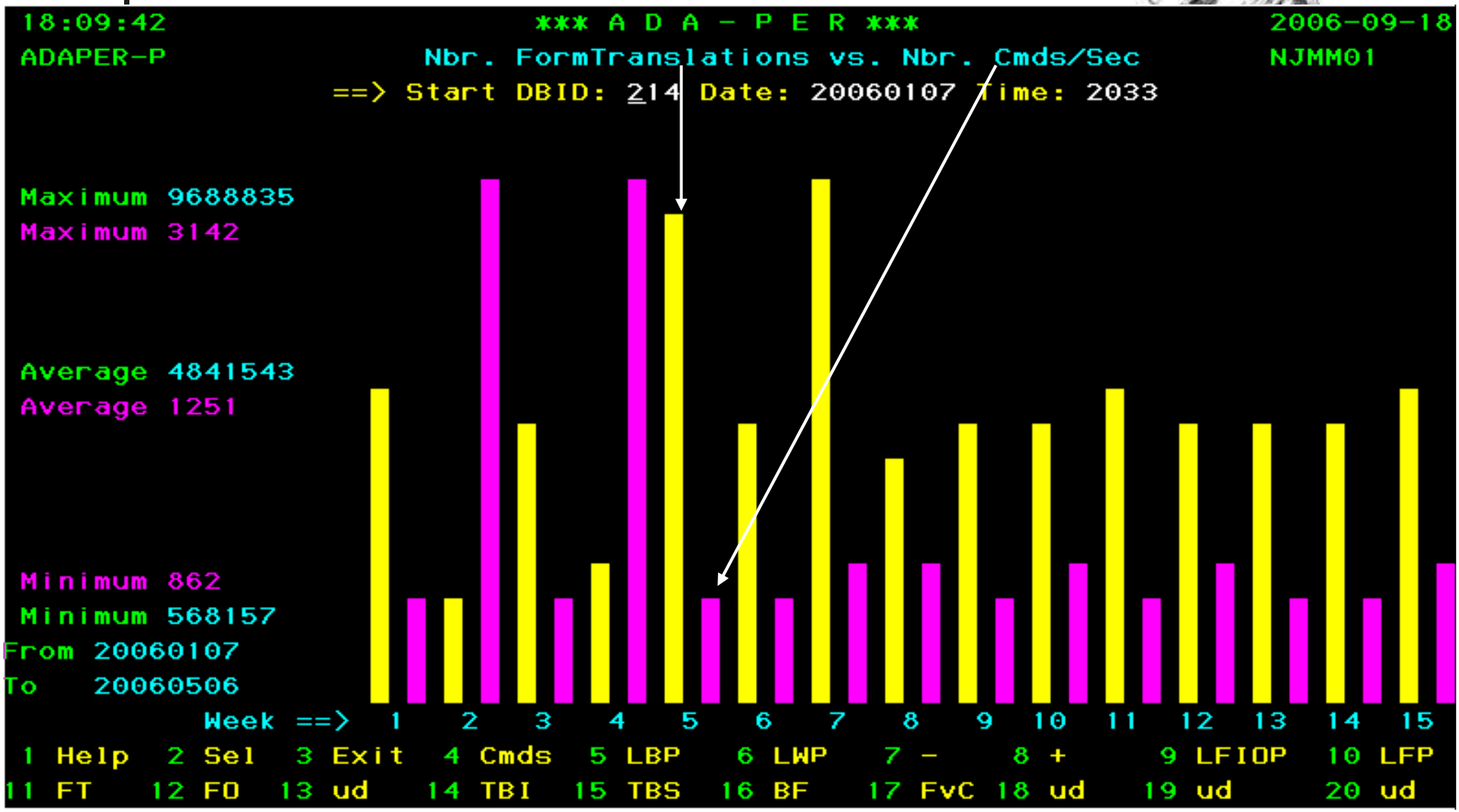
Performance and Tuning



Performance and Tuning



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Performance and Tuning

User exit 4

- Example assembler program see source dataset ADABAS.ADA742.SRCE(USEREX4), ADA811: no
- ADARUN parameter UEX4=pgm
- Gets control after a command processed and before CLOG will be written
- CLOG dataset must be defined (not dummy)
- ADARUN parameter: LOGGING=YES
- Collect info and print it out at nucleus end

Performance and Tuning

User exit B[efore] and A[fter]

- Called from link routine (ADALNK, ADALNC) before the command will be processed
- Define length of user block (7th ADABAS parameter) in user exit 4: LNUINFO=xxx bytes
- Fill in user block in UEXITB with performance data, for example Natural program name
- Example assembler program see source dataset ADABAS.ADA742.SRCE(UEXITB), ADA811: no

Performance and Tuning

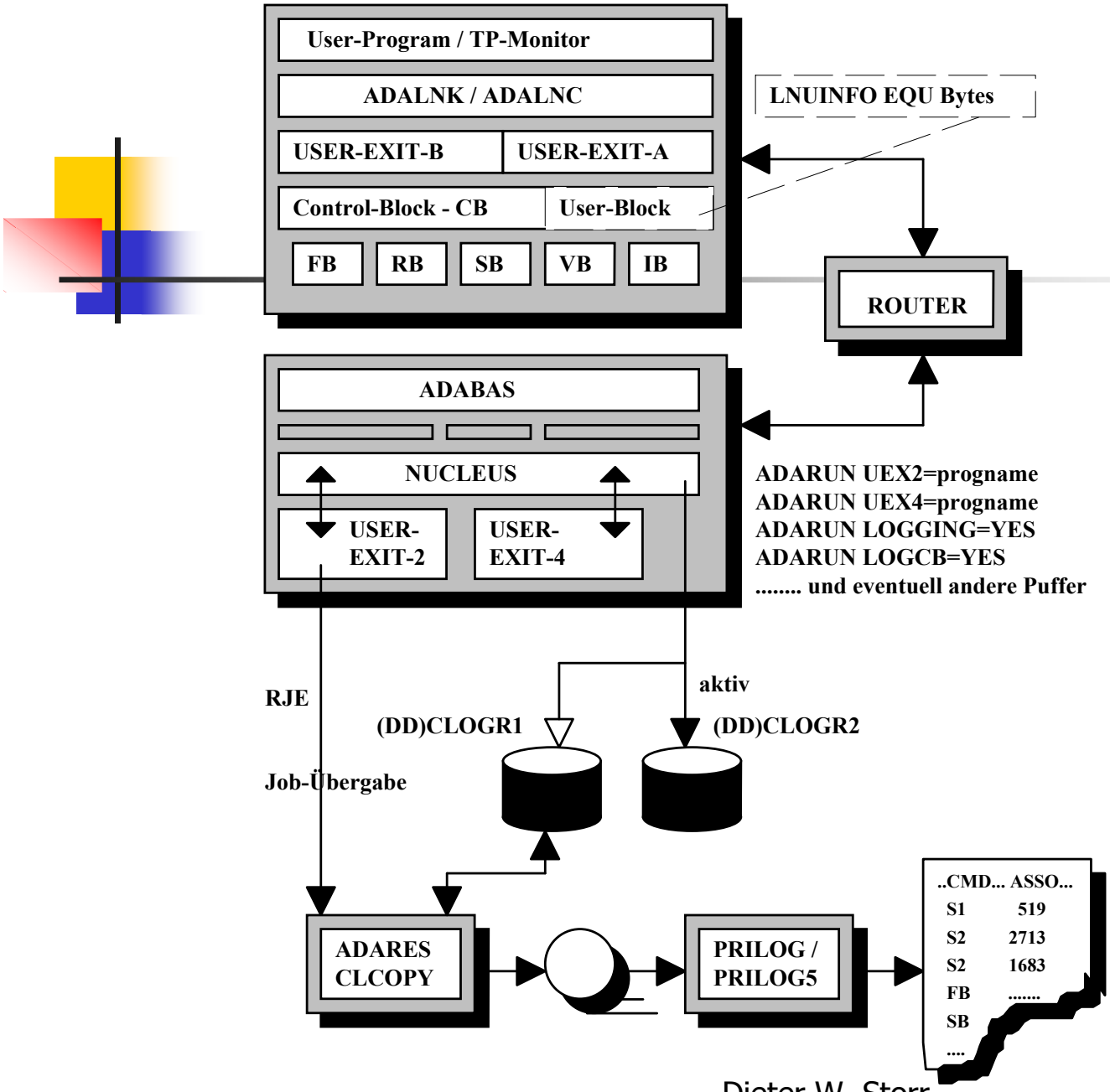
Command Log

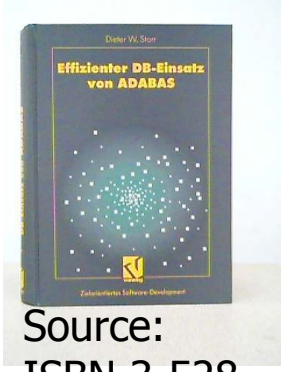
- V4: CLOGLAYOUT=4 (ADA8: no longer supported)
- V5-7: CLOGLAYOUT=5
- V8: CLOGLAYOUT=8, also new extended ADABAS control block (ACBX)
- ADARUN parameter LOGGING=YES
- ADABAS PRILOG utilities for V4, V5, for V8 available with ADA811 and L002 tape

Performance and Tuning

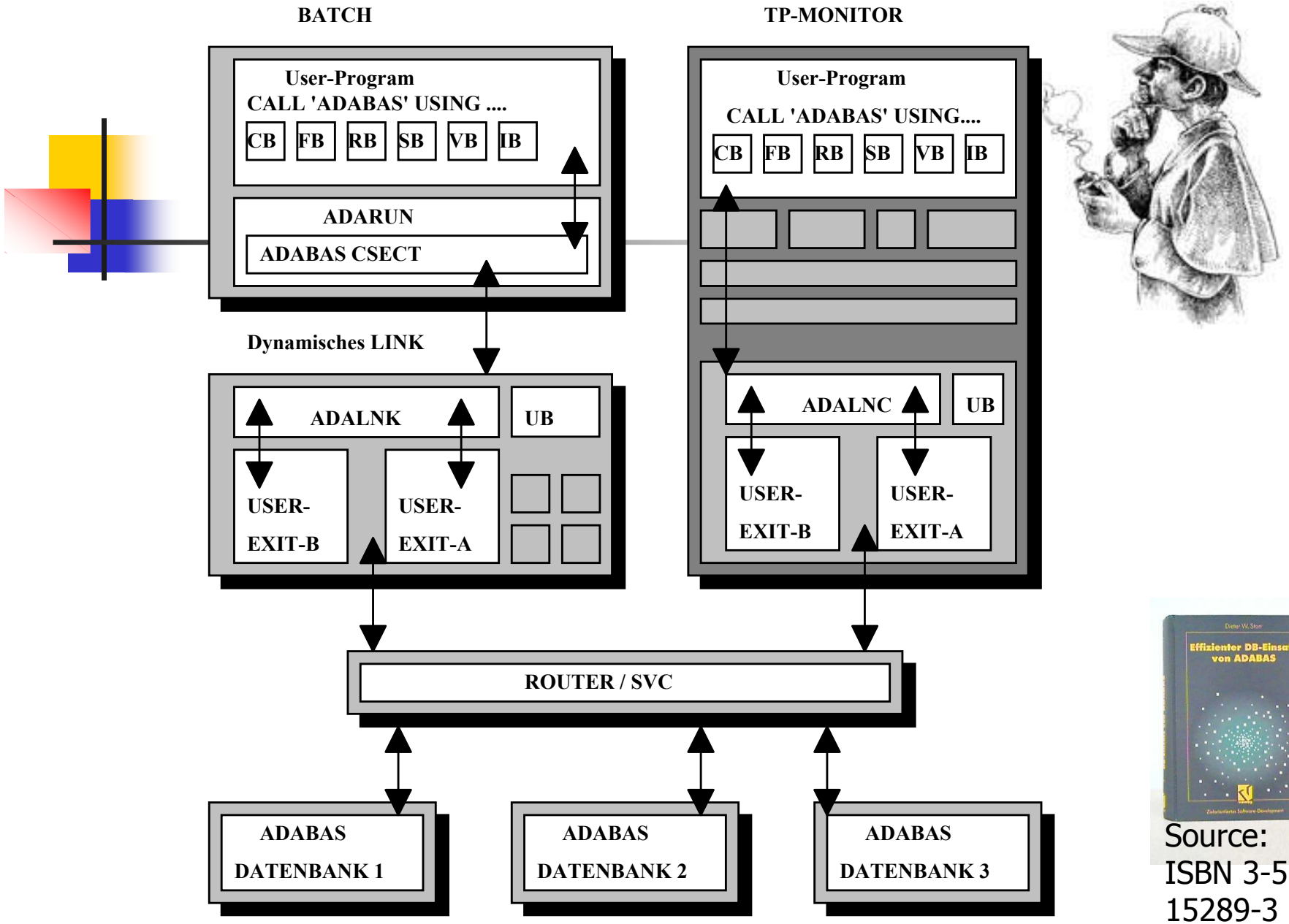
Command Log

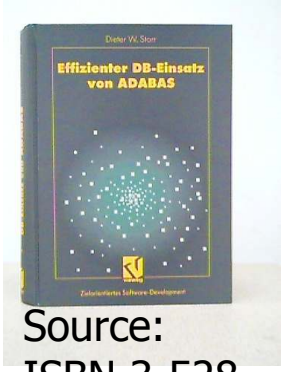
- Physical I/Os are very costly in time
- Be careful: CLOG is using the work pool (LWP), even if it is not written physically – was a problem under ADA526, RC88, under ADA7/8 ?
- CLOG can be switched on and off via UEX4
- CLCOPY via UEX2 and





Source: ISBN 3-528-15289-3





Source:
ISBN 3-528-15289-3

Performance and Tuning

AFPLOOK

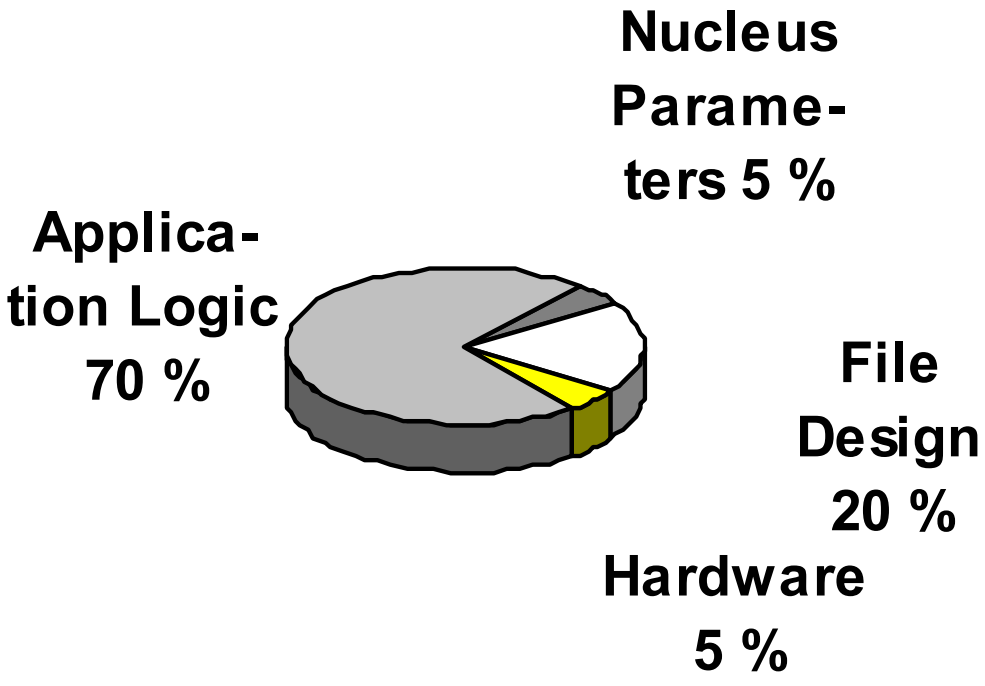
- Determine, which files are candidates for ADABAS Fast Path
- ADABAS 7.1: ADAAFP
- ADABAS 7.2 and ADA811: AFPADA
- It is invoked using the ADARUN command: ADARUN FASTPATH=YES
- Was (<ADA7) special user exit 4 from SAG

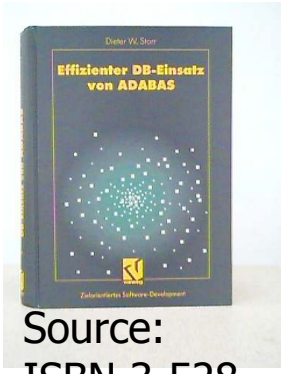
Performance and Tuning

AVILOOK

- ADABAS Access Analysis Tool
- Identify files that may benefit from the ADABAS Vista partitioning option.
- It's a SYSAOS function

Performance and Tuning





Source:
ISBN 3-528-15289-3

Performance and Tuning

- Collect performance data (add-on tools)
  - SYSAOS (SAG)
  - ADABAS Statistic Facility (SAG)
  - Review (SAG)
  - APAS/Insight/SpaceMan (Debug, Goal, Legent, CA)
  - TRIM (Treehouse)

Performance and Tuning

- Collect performance data (add-on tools)
  - Profiler for Natural (Treehouse)
  - Test Coverage Analyzer for Natural (World Quality Systems Limited, Derby, England
  - INFONAT from InfoTech-CS, s.r.o. Brno, CSSR
  - Omegamon (Candle, IBM)
  - Strobe (Compuware)
  - TMON – The Monitor for CICS (ASG Software Solutions)

Performance and Tuning SYSAOS

Code	Basic Services	Code	Other Services
A	Session monitoring	1	Adabas Cache Facility
C	Checkpoint maintenance	2	Delta Save Facility
F	File maintenance	3	Trigger Maintenance
M	Database maintenance	4	AOS Security
O	Session opercoms	5	Transaction Manager
R	Database report	6	Adabas Statistics
S	Space calculation	7	Vista
?	Help	8	Fastpath
.	Exit	9	SAF Security

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Performance and Tuning

PREFETCH / MULTIFETCH

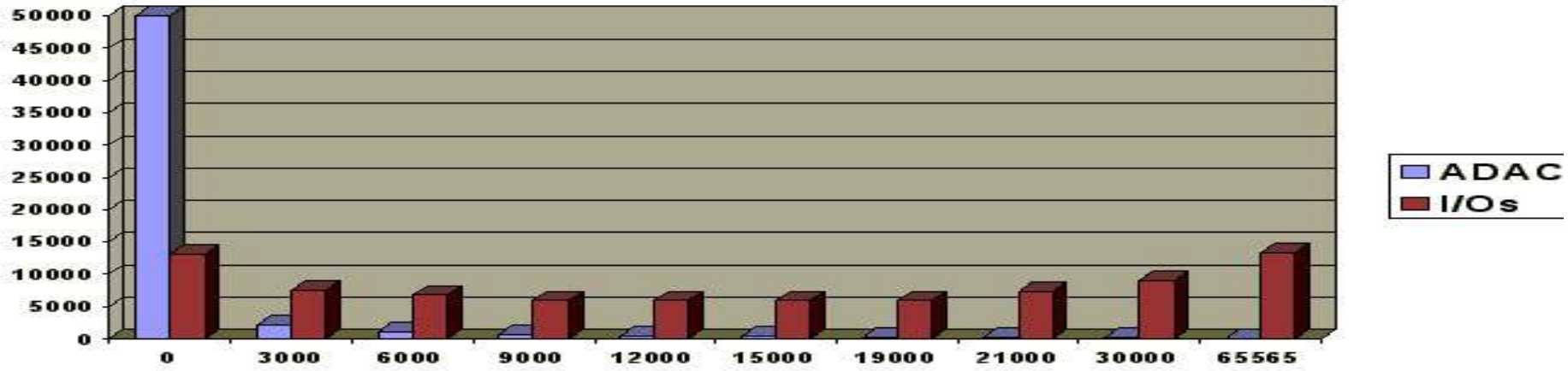
- Find candidates with high number of read sequenses
- For batch and online – but mostly for batch

Performance and Tuning

PREFETCH / MULTIFETCH

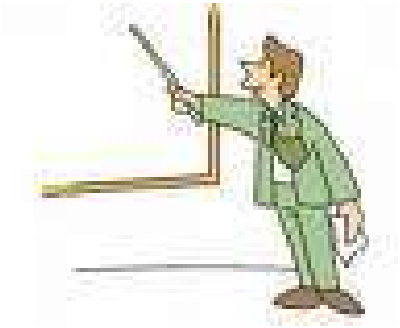
```
//DDCARD DD DISP=SHR,DSN=ADABAS.CNTLLIB(ADANUC)
//       DD DISP=SHR,DSN=ADABAS.CNTLLIB(MULTFTCH)

PREFETCH=YES
PREFIFILE=123,PREFICMD=L1          include file (<7.4 exclude)
PREFIFILE=135,PREFICMD=L3
PREFIFILE=135,PREFICMD=L9
PREFNREC=xxx      not higher than the number of reads per loop
PREFSBL=xxxxx     PREFSBL = 2* ( ARB * PREFNREC * 4/3 )
PREFTBL=xxxxxx    set equal to PREFSBL unless multiple
                  sequential processes are involved
```

Performance and Tuning



READ (50000) VIEW1 BY ISN with different PREFSBL.
ADABAS Calls w/o Multifetch = 50,000
ADABAS Calls with Multifetch: see figure
Number of I/Os with and w/o Multifetch are approx. the same but can be different depends on the ADABAS buffer pool

Education and Training



- Educate and train staff members
- Inhouse or extern training through SAG or others

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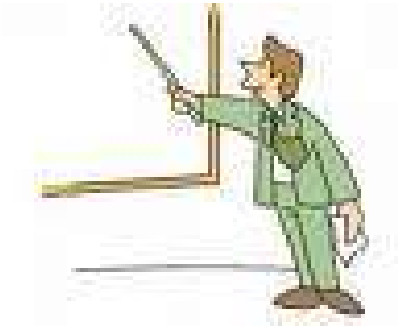
Education and Training



Analysts, developers, programmers

- Improve database techniques and access routines
- Learn programming techniques, e.g. in NATURAL
- Learn how to us the data dictionary PREDICT
- New and updated versions and releases

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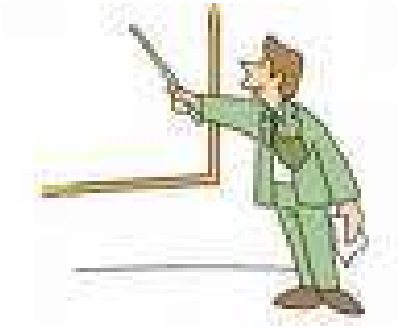
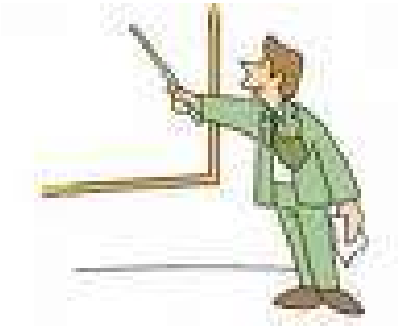
Education and Training



Data Administrators

- Transform the logical into the physical data model
- Determine and evaluate optimal access paths and use it for the data model
- Usage of scheme generator of PREDICT CASE

Education and Training



Data Administrators

- Usage of PREDICT GATEWAY to migrate from Excelerator or IEW to PREDICT
- Learn how to migrate to PREDICT from
  - UML
  - BPM, for example ARI
  - . . . . . .
- Inform about new and updated versions and releases

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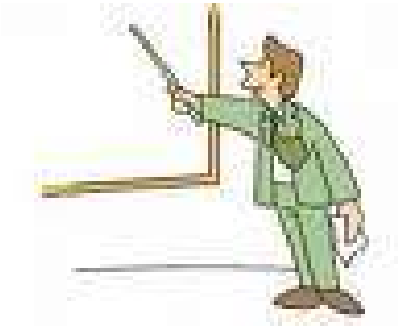
Education and Training



Operating

- Design and apply job procedures to support the database, e.g. utilities, jobs, MQSeries, EntireX
- Inform about new and updated versions and releases

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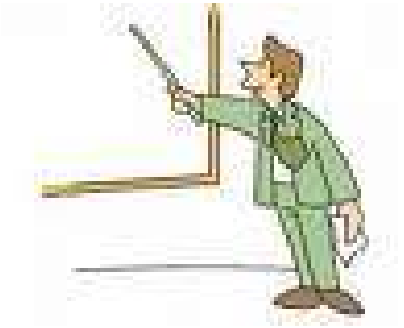
Education and Training



User

- Help to develop and carry out training for new or updated applications
- Help to train end-user if they can use applications like Super Natural, especially in search strategies

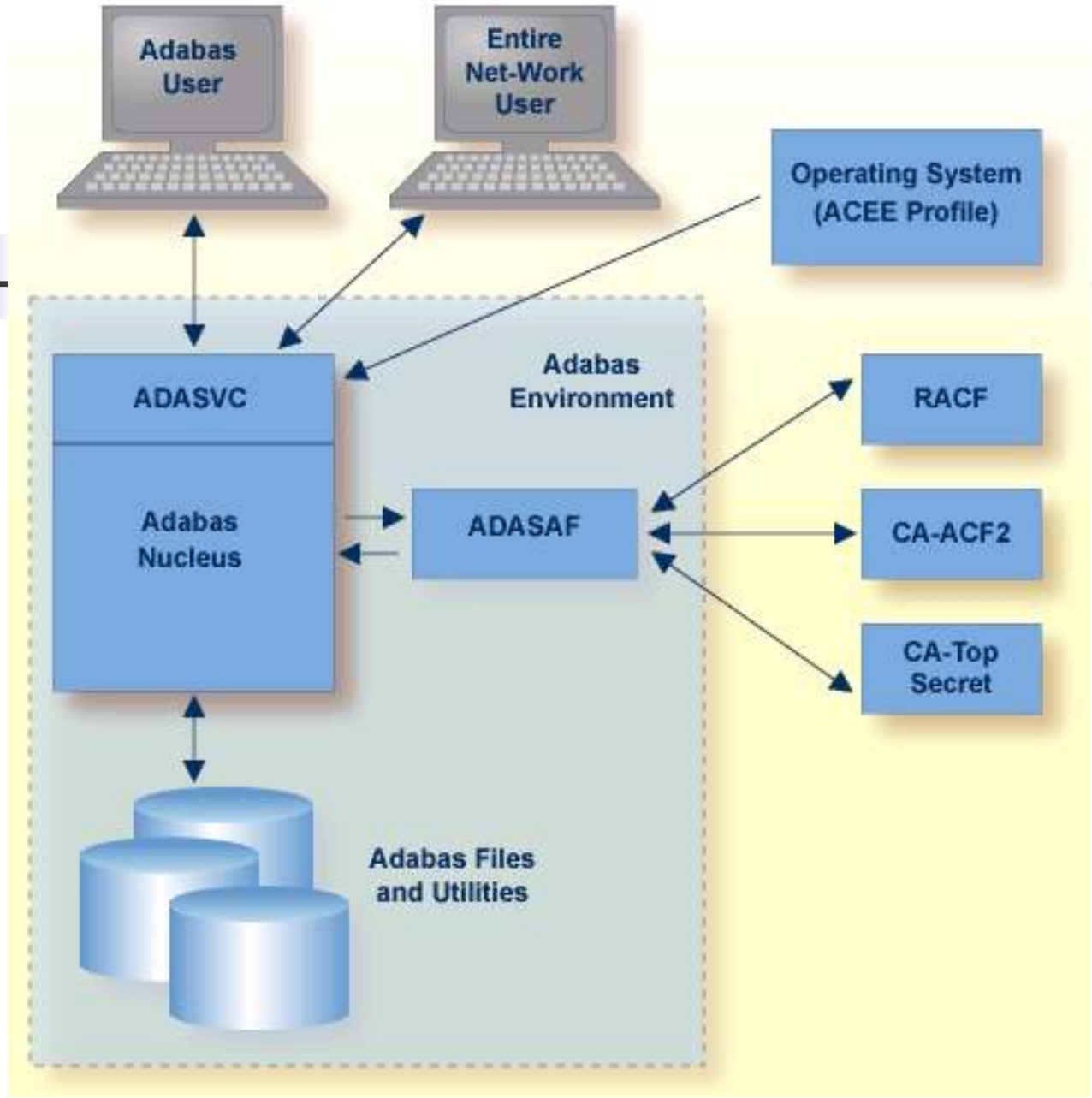
Data Security

- ADABAS Security
- NATURAL Security
- PREDICT Security
- SYSAOS Security
- Third-party products, e.g TRIM, APAS/Insight, N2O, etc.

Data Security

ADABAS Security

- Data encryption (only DATA)
- ADASCR
  - Access or update level by file
  - Value-level protection
- ADASAF -- System Authorization Facility
  - RACF, ACF2, Top Secret
- ADAESI


Adabas User
Entire Net-Work User
Operating System (ACEE Profile)
ADASVC
Adabas Environment
Adabas Nucleus
ADASAF
RACF
CA-ACF2
CA-Top Secret
Adabas Files and Utilities

http://

Data Security

SAF Repository

Product	Protects
ADABAS SAF	ADABAS
ADABAS SQL Server SAF	ADABAS SQL
Entire Net-Work SAF	Entire Net-Work version 5.6 and above
EntireX SAF	EntireX, Entire Broker, Broker Services
NATURAL SAF	NATURAL

Data Security

ADASAF

- Entire SAF Gateway
- Entire Network SAF (NETSAF)

Data Security

- NATURAL Security (MF, UNIX, Windows)
  - SYSSEC
    - Users
    - Libraries
    - Links Between Users and Libraries
    - DDMs/Files
    - Utilities
    - Applications
    - Other Object Types
    - Profile Parameters

Data Security

- NATURAL Security (MF, UNIX, Windows)
  - LOGONEX1-3
  - NSCxxEX1: xx= US, LI, DD, FI, EX – User Exits
  - NSC---L, NSC---P, etc. -- Application Interfaces
  - SECNOTE - User Exit for Security Notes
  - Plug-ins under NSC
  - SYSDIC under NSC
  - SYSAOS under NSC

Data Security

- NATURAL SAF Security
  - Add-on to NSC
  - SAF-compliant (RACF, CA-ACF2, CA Top Secret)
  - SYSSAFOS (defined in NSC)
  - SAF interfaces: NSFNPAS, NSFNPASZ, NSFNPAX

Data Security

- PREDICT Security

Data Security

ADABAS Online System Security

- Requires Natural Security

Data Security

- Third-party products, e.g TRIM, APAS/Insight, N2O, etc.

Standard Routines
Help Functions

- Write HTML-based help functions and publish it into your Intranet
- Publish the manuals (not security)

Maintain and Optimize DB System

- Check and search SL24 for
  - Early warnings
  - Fixes
  - Technical papers
- Search SAG-L for
  - Problems and customer solutions
- Do a Google search, for example
  - "ADABAS response code 148" or "Unix Tools"

Maintain and Optimize DB System

- Observe the databases – plan ahead
  - Nucleus session statistics
    - Extents
    - Buffer flushes
    - ASSO, DATA, WORK I/Os
    - Compare logs with previous sessions
    - . . . . .

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Maintain and Optimize DB System

- Observe the databases – plan ahead
  - ADABAS reports
    - Extents
    - Unused spaces
    - File distribution in connection with accesses
    - . . . . .

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Maintain and Optimize DB System

- Observe the databases – plan ahead
  - Reports of performance monitors
    - High water marks
    - I/O activities
    - Unusual events
    - Number of field accesses (format buffer)
    - Descriptor usages
    - . . . . .

Maintain and Optimize DB System

```
11:56:34          ***** A D A B A S  BASIC  SERVICES *****          2006-10-02
DBID 215                      -  High Water Marks  -                PACUH02

  Pool / Queue          I    Size    I    Used    I %Used I   Date        Time   I
-------------------------------------------------------------------------------
Attached Buffer(NAB)  I    1310720 I     276224 I  21.0 I                      I
Command Queue   (NC)  I      61440 I       4800 I   7.8 I 2006-10-02 09:27:34 I
Format Pool     (LFP) I    2650000 I    2649844 I  99.9 I 2006-10-01 00:07:04 I
Hold Queue      (NH)  I     112168 I      10304 I   9.1 I 2006-10-02 09:13:38 I
ISN-List Table  (LI)  I       7000 I       3668 I  52.4 I 2006-10-01 08:00:50 I
Seq. Cmd. Table(LQ)   I       9000 I       2912 I  32.3 I 2006-09-23 21:25:21 I
User Queue      (NU)  I      90848 I      57120 I  62.8 I 2006-10-02 09:24:43 I
Unique DE Pool  (DUQ) I       5300 I       1980 I  37.3 I 2006-09-28 18:00:33 I
Security Pool   (LCP) I       2000 I          0 I   0.0 I                      I
UQ File List    (UQF) I      31080 I      14256 I  45.8 I 2006-10-02 09:24:43 I
ATM Trans. IDs  (XID) I          0 I          0 I   0.0 I                      I
Work Pool       (LWP) I     870000 I     410292 I  47.1 I 2006-09-23 21:25:22 I
Redo Pool       (LRDP)I          0 I          0 I   0.0 I                      I
```

Maintain and Optimize DB System

```
I/O statistics
I/O counts  (including initialization)
                  READS       WRITES
-------------------------------------
ASSO            8919359      1462298
DATA           74228690      1191707
WORK              1625      1168619
PLOG                70       927378
CLOG                 0            0
-------------------------------------
Total          83149744      4750002

Log. reads     804,563,314   [/  phys. reads =]
Buffer eff.          9.0
```


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Maintain and Optimize DB System

```
5299,256 Formats had to be translated

0 Formats had to be overwritten

0 Autorestarts were done

4 Throw-backs due to  ISN  problem

0 Throw-backs due to space problem

3,235 Bufferflushes   were done
```


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Maintain and Optimize DB System

Command Queue (NC)

ET	L3	S1			

Selection by
- **Priority**
- **Age**
- **Cmd type**
- **ET block**

Throwbacks if
- **ISN problem**
- **Space problem (LWP)**
- **Deadlocks (LBP RABNs**

Threads (NT)

A1 active	S1 ready to run	S2 waiting

Interrupts and thread changes by waiting of resources
I/Os, RABNs, LWP space, WORK-II

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Maintain and Optimize DB System

- Observe the databases – plan ahead
  - Reports of special ADABAS utilities
    - ADAICK, ADAACK, ADADCK
    - Block usage
    - Padding area usage
    - Compressed record length (other block sizes?)
    - Estimate ADAM accesses (if used)
    - . . . . .

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Maintain and Optimize DB System

```
ADAACK

*********************************************

* Check AC for File 19 (CHECKPOINT      )   *

*********************************************

Reusable ISNS (Hexadecimal):

     00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000

<snip>

Pass  1 - Load Address Converter into memory.

-------------------------------------------

ERROR-126, AC-ELEMENT contains DS-RABN 00000004 (4) (Duplicate ISN)

           DS Block=00000007 (7), ISN=000009D1 (2513)

<snip>
```

Maintain and Optimize DB System

```
ADADCK DSCHECK FILE=019,USAGE


 RABN  LNG  I....1....2....3....4....5....6....7....8....9.....I   %
00000001 1CDA I********************************************** I  98
00000002 1CA8 I*********************************************  I  97
00000003 10B5 I****************************                   I  57 <
00000004 1D0C I********************************************** I  99
00000005 1D1E I********************************************** I  99
   RABN  LNG  I....1....2....3....4....5....6....7....8....9.....I   %


412 Records processed for File 19,
 the largest record has 629 bytes.
```


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Maintain and Optimize DB System

- Observe the databases – plan ahead
  - Reports of ADABAS Statistic Facility
    - Analyze trend reports
    - . . . . .
  - Reports of user exits (4 and B)
    - . . . . .

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Maintain and Optimize DB System

```
-------------------------------------------------------------------------------
2005-12-12 18:16:13          ADABAS Capacity Planning              Page      1
ADAREP3                                                            ZINDWS
-------------------------------------------------------------------------------
DB     Allocated Mega Bytes    Used Mega Bytes      Unused Mega Bytes    Number
       ASSO / DATA  PCT        ASSO / DATA   PCT    ASSO / DATA   PCT    Volume
-----  -----------  -----      -----------   -----  -----------   -----  ------
PROD1         2336  100.0              285    12.2         2051    87.8       1
              2520  100.0             2093    83.1          427    16.9       1
-----  -----------  -----      -----------   -----  -----------   -----  ------
Subtot        4856  100.0             2378    49.0         2478    51.0       2
-------------------------------------------------------------------------------
PROD2        16357  100.0            13780    84.2         2577    15.8       7
             27726  100.0            25555    92.2         2171     7.8      11
-----  -----------  -----      -----------   -----  -----------   -----  ------
Subtot       44083  100.0            39335    89.2         4748    10.8      18
-------------------------------------------------------------------------------
<snip>
```


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Maintain and Optimize DB System

```
--------------------------------------------------------------------------------
 DB     Allocated Mega Bytes    Used Mega Bytes      Unused Mega Bytes   Number
        ASSO / DATA  PCT        ASSO / DATA   PCT    ASSO / DATA   PCT   Volume
 -----  -----------  -----      -----------   -----  -----------   ----- ------
 Total       522508  100.0           458609    87.7        63899    12.2    213
 --------------------------------------------------------------------------------
Remarks:
 In addition to the above mentioned ASSO and DATA volumes,
 the following additional space is needed for each database:
 ---  ------------------------------------------------
 Vol  Database Components
 ---  ------------------------------------------------
   1  WORK1
   2  PLOG1/2 - protection log
   1  ADARAI  - recovery log information
   -  RLOG1   - recovery log information / with PLOG
   -  RLOGM1  - recovery log information / with PLOG
   -  CLOG1/2 - command log information  / not yet (2)
   2  TEMP1/2 - temporary area for utilities
   2  SORT1/2 - sort area for utilities
   1  DSIM1   -
 ---  ------------------------------------------------
   9
 --------------------------------------------------------------------------------
 End of the report
 --------------------------------------------------------------------------------
```

Maintain and Optimize DB System

- Document installation processes
- Describe all datasets
- Describe scheduled jobs, for example CA-7
- Add new volumes
- Write tools (ADAREP+) for capacity planning
- Analyze and evaluate shut-down statistics
- Maintain ADABAS databases and versions

Maintain and Optimize DB System

- Maintain used and free file numbers
- Reorganize databases and files
- Refresh development, acceptance test, and training DB with production data
- Analyze problems and solve them

Maintain and Optimize DB System

- Analyze problems and solve them, for example
  - ADABAS nucleus doesn't respond to ADAEND
  - ADABAS nucleus won't start
  - Change tape/cartridge/VTS unit
  - User file is blocked after 5th extent
  - User file extent cannot be allocated
  - Checkpoint file extent cannot be allocated

Maintain and Optimize DB System

- Maintain and optimize other SAG products:
  - NATURAL
  - NATURAL Security
  - ADABAS Basic System (AOS, etc.)
  - PREDICT
  - TP Monitor Interfaces (Com-plete and/or CICS)
  - Review
  - EntireX
  - . . . . .

Maintain and Optimize DB System

- Maintain and optimize third-party products:
  - CA: APAS/Insight, SpaceMan, PLEU
  - Treehouse: TRIM, N2O, ...
  - UNIX performance tools
    - Mercury LoadRunner and others – see the URLs
    - http://h30097.www3.hp.com/docs/porting/interop/performance.html
    - http://www.itworld.com/Comp/3380/UIR010329cockcroftletters/#ruletool

Maintain and Optimize DB System

- Open problem request to SAG (SL24)
- Open C/E requests (SL24)
- Discuss problems and C/Es at your User Group meetings and/or SIGs
- Give presentations during SAGGROUP meetings. --- Yes! You will learn from it!
- . . . . . .

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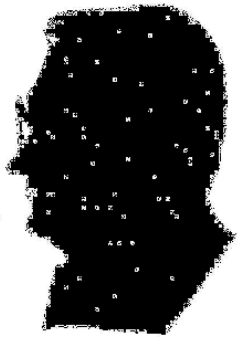
Ideal DBA Profile



Mainframe and Unix

- Organizing and managing computer data
- Ensure integrity and availability
- Ensure that computer server environments are functioning properly
- Ensure that any development or modifications are consistent with the organization's computer architecture

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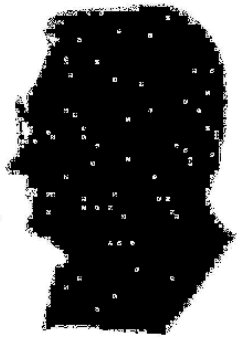
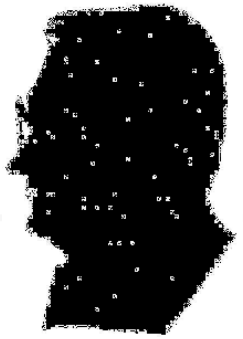
Ideal DBA Profile



Mainframe and Unix

- Plan and install upgrades to DBMS
- Maximize performance of computer systems
- Design and modify databases as per user requests and system requirements
- Monitor system performance
- Establish and implement backup and recovery processes

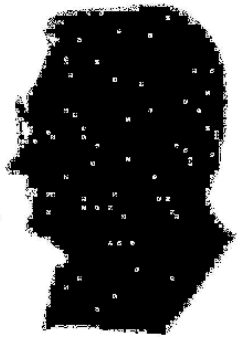
Ideal DBA Profile



Mainframe and Unix

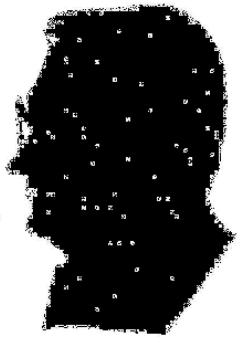
- Establish data security and integrity
- Manage disk space
- May need to be available after hours to perform some of the duties

Ideal DBA Profile



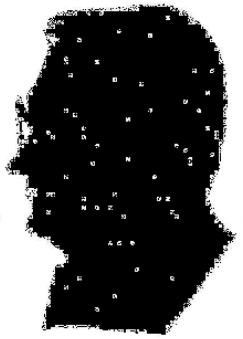
- Bachelor's degree in MIS, Computer Science or related field.
- Minimum of five years IT experience with at least 2 years as a DBA
- Experiences in one or more DBMS
- Knowledge of DB concepts, theories and principles

Ideal DBA Profile



- 2-3 years experience in DB design – from logical to physical DB design
- Excellent analytical skills
- Previous success working on mission critical technology projects.
- Capacity planning

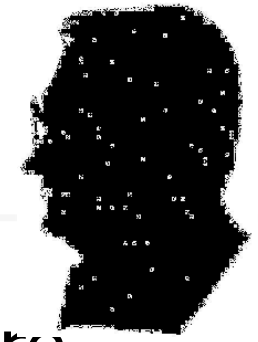
Ideal DBA Profile



Very good experience in hard and software

- Mainframe, for example
  - Hardware architecture, for example
    - Coupling links, channels,
  - Operating systems, for example
    - z/OS, z/VM, VSE, Linux, Unix, or BS2000
  - Languages, for example
    - Assembler, Natural, JCL
  - System and tuning software

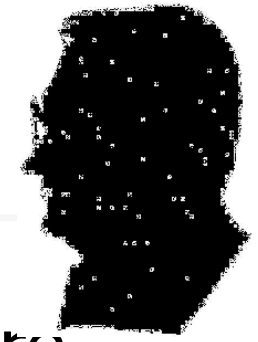
Ideal DBA Profile



Very good experience in hard and software

- UNIX
  - Hardware architecture
    - SAN devices
    - Unix authentication and administration
    - Active Directory
  - Operating systems, for example
    - HP-Unix, Windows XP, Linux, AIX – Unix/Sun Solaris

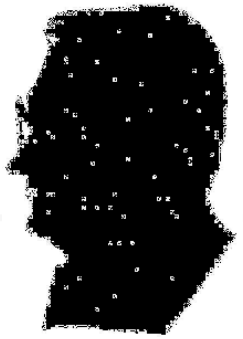
Ideal DBA Profile



Very good experience in hard and software

- UNIX
  - Knowledge of programming concepts, techniques and languages, for example
    - Development Platforms
    - Client server
    - Citrix
    - n-tier
    - Web

DBA Salary



- US:
  - Starting level up to: $73,896
    Santa Barbara, for example $81,390
  - Median expected salary: $84,824
    Santa Barbara, for example $93,299
  - Senior level: $96,162+
    Santa Barbara, for example $105,734
  - + bonuses

Source: http://swz.salary.com/salarywizard/.....

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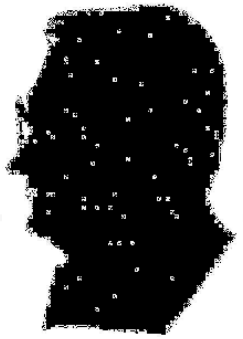
DBA Salary

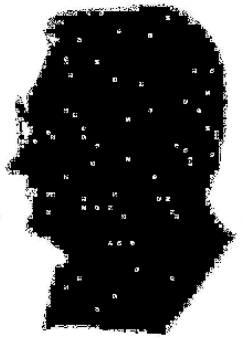


- UK:
  - Range of typical starting salaries: £16,000 - £20,000 ($37.514)
  - After two-three years salaries typically range from £20,000 - £30,000 ($56.270)
  - At a senior level/with experience (e.g. after 10-15 years in the role): £35,000 - £45,000+ ($84.406)

1 British Pound = 1.87569 US Dollar

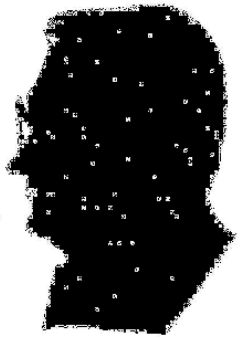
Source: http://www.prospects.ac.uk/..... (July 2006)

Ideal DBA Profile



- Must be able to effectively work on multiple projects concurrently
- Strong organizational and time management skills.

Ideal DBA Profile



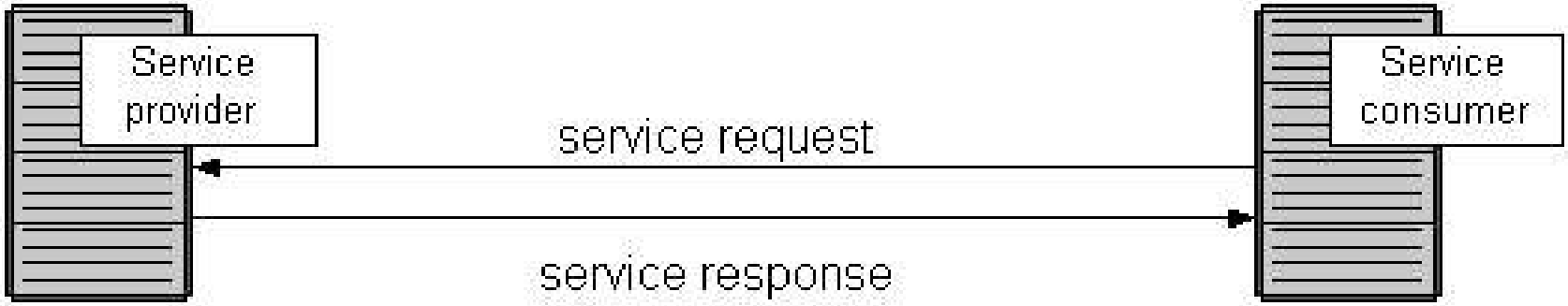
- Excellent written and oral communication skills
- Ability to work in a team environment
- Project management experience
- Knowledge in data dictionaries
- Tuning knowledge
- System automation knowledge

Future Requirements

- Network administration
- Knowledge of networking architecture
- How to measure response time in the network
- Web access
- Knowledge in downsizing, for example from the mainframe to Unix or Windows
- Client-server technology

Future Requirements

- Service-Oriented Architecture (SOA)
  - Collection of services
  - Loosely coupled software architecture
  - Services and connections



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Future Requirements

Acquiring knowledge about

- Model Driven Architecture (MDA)
  A way to organize and manage enterprise architectures (Leader: IBM Rational)
  - Computation Independent Model (CIM)
  - Platform Independent Model (PIM)
  - Platform Specific Model (PSM)
  - Implementation Specific Model (ISM)

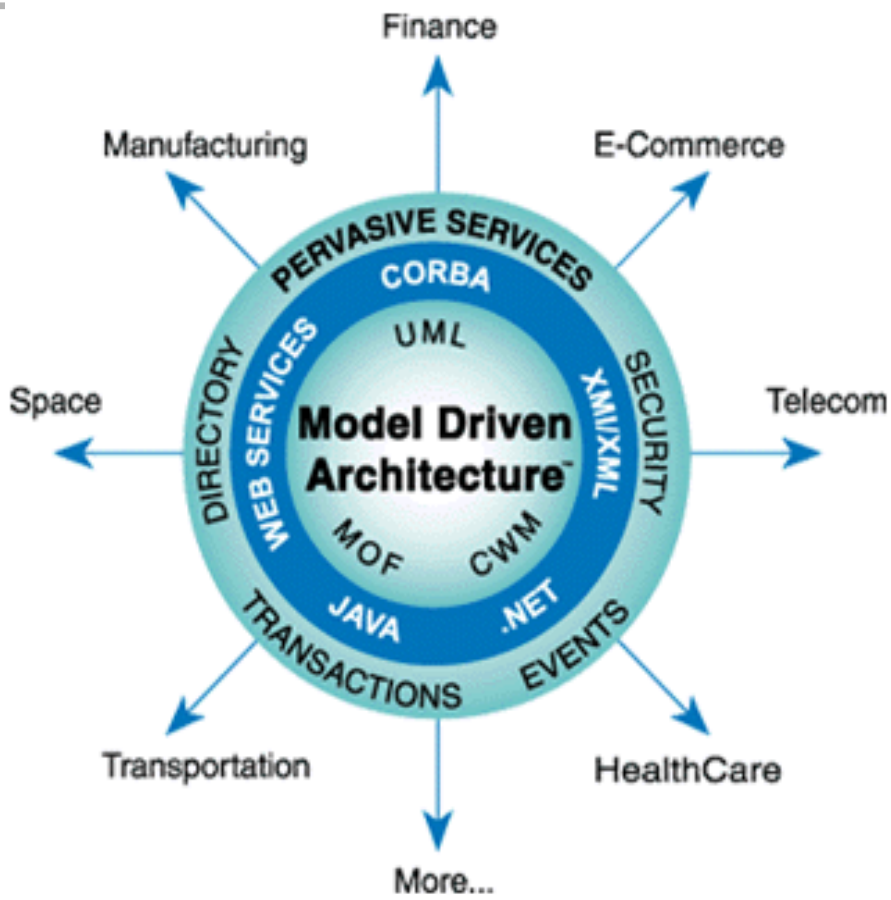
Future Requirements

MDA provides an open, vendor-neutral approach to the challenge of business and technology change

MDA separates business and application logic from underlying platform technology

Built using UML and other OMG model standards

Source: http://www.omg.org/mda/



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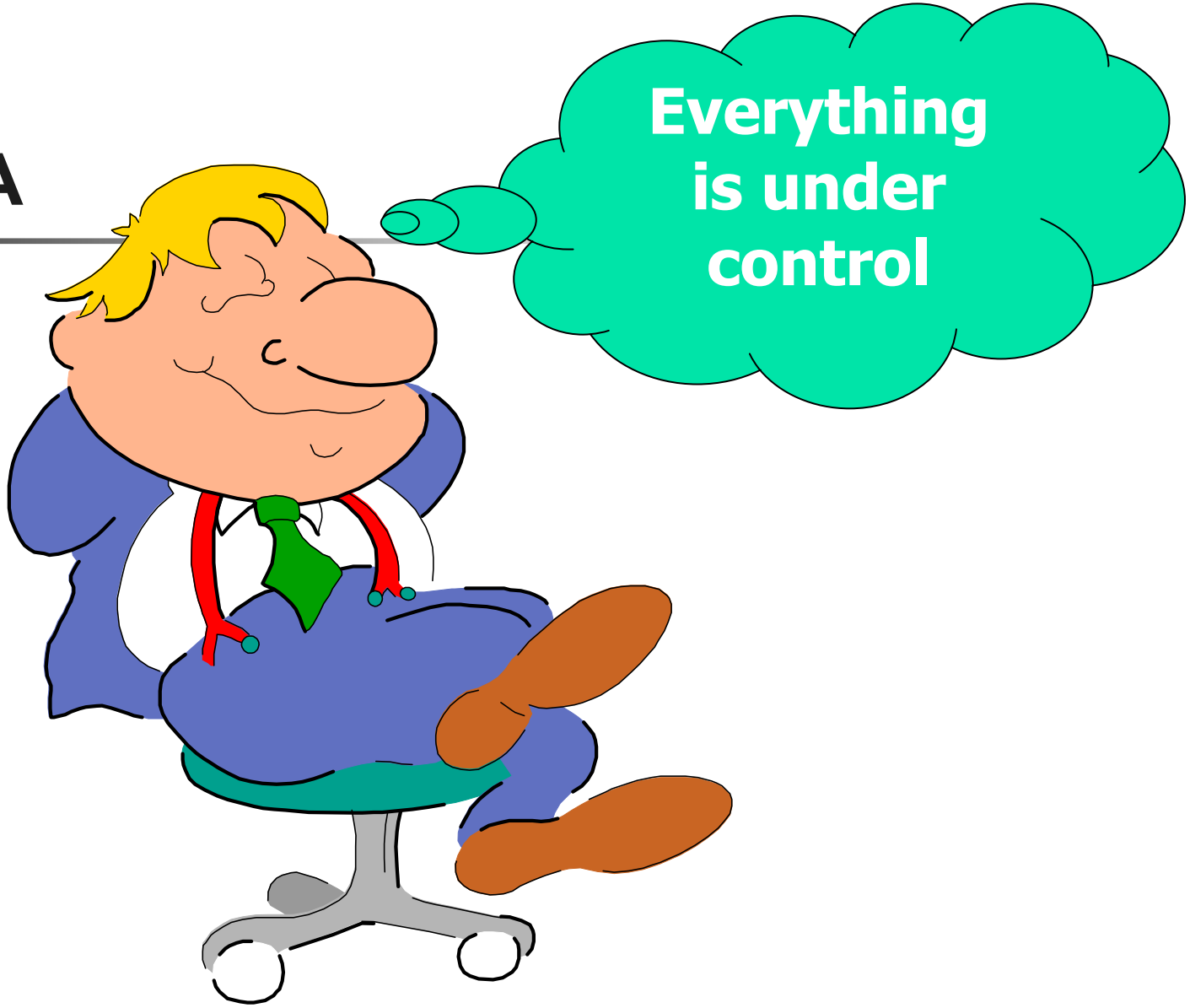
Position of a DBA

- Part of a database group (ADABAS, Oracle, Sybase, etc.)
- Not integrated in programming
- Authorized to issue directives
- Same level as programming managers and system programmer manager

Position of a DBA

- Help to design or “the designer?”
- Help to advise or “the adviser?”
- . . . . .

DBA