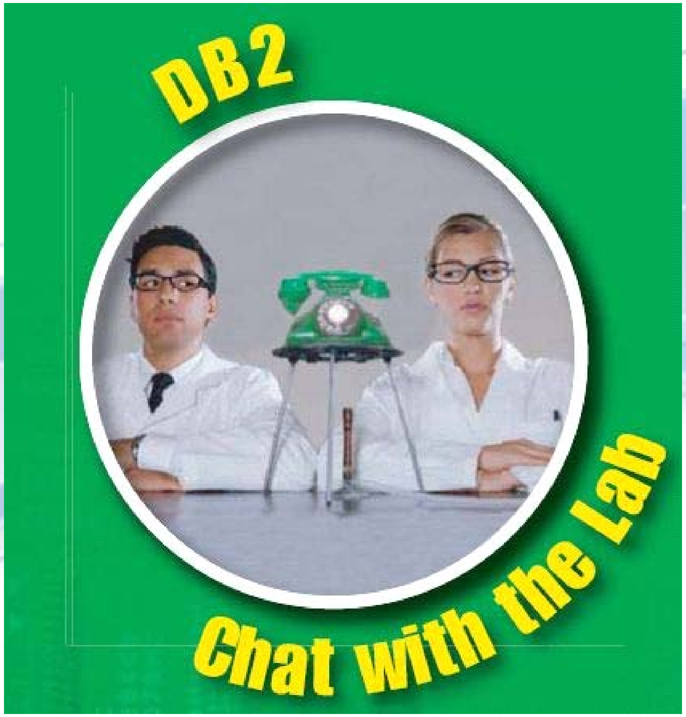

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Data Management

DB2 and Oracle – An Autonomic Computing Comparison

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DB2 and Oracle - An Autonomic Computing Comparison

Chat with the Lab agenda

- **Autonomic Computing Definition**
- **DB2 STMM vs. Oracle ASMM**
  - DB2 cache based self tuning memory management
- **DB2 Automatic Storage vs. Oracle Automatic Storage Management**
  - DB2 simplified storage management
- **DB2 Utility throttling vs. Oracle offerings**
  - DB2 built-in utility control
- **DB2 AUTOCONFIGURE vs. Oracle offerings**
  - DB2 all-in-one performance parameter tuning
- **DB2 Automatic Maintenance vs. Oracle offerings**
  - DB2 self running statistics gathering, table and index REORGs and backups

NOTE:

All DB2 9.7 editions provide all the autonomic computing features shown in this presentation.

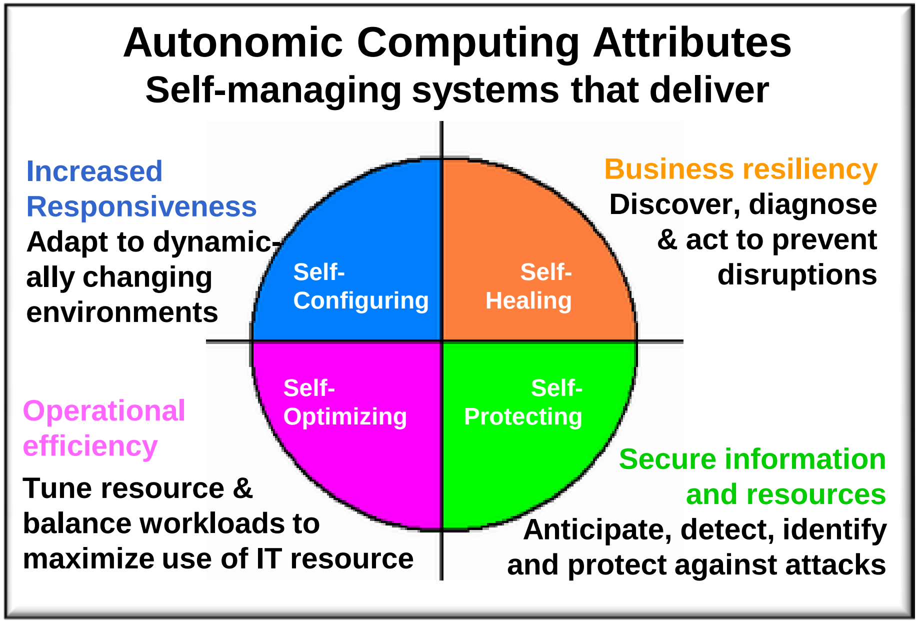
By contrast, only Oracle 11g Enterprise Edition provides its comparable autonomic computing features.

Autonomic Computing
Definition

Autonomic computing systems have the ability to manage themselves and dynamically adapt to change in accordance with business policies and objectives.

This enables computers to identify and correct problems often before they are noticed by IT personnel. They can also "learn", adapt and protect themselves for future situations.

- Autonomic computing architecture provides a foundation on which self-managing information technology systems can be built
- Self-managing autonomic systems exhibit the characteristics of CHOP:
  - Self-**C**onfiguring
  - Self-**H**ealing
  - Self-**O**ptimizing
  - Self-**P**rotecting
- Originally, "autonomics" described the human body's ability to regulate itself, e.g.
  - Increased heart and breathing rate for more blood and oxygen flow during a crisis
  - Sweating to cool down the body when it gets hot
  - Pupil dilation to protect the eye from bright lights



Autonomic Computing Attributes

Self-managing systems that deliver

Increased Responsiveness
Adapt to dynamically changing environments

Self-Configuring

Business resiliency
Discover, diagnose & act to prevent disruptions

Self-Healing

Operational efficiency
Tune resource & balance workloads to maximize use of IT resource

Self-Optimizing

Secure information and resources
Anticipate, detect, identify and protect against attacks

Self-Protecting

As described by: Brent Miller Senior Technical Staff Member, Autonomic Computing Architecture, IBM Corporation

DB2 Self-Tuning Memory Manager (STMM)
Autonomics for managing DB2 memory usage

QUESTION:

Do I need to learn the DB2 cached based memory model in order to tune it?

ANSWER:

Not at all. DB2 Self-Tuning Memory Manager handles this for you!

- DB2 Self-Tuning Memory Manager uses “out of the box” autonomics which:
  - Constantly re-evaluated cached based memory usage
    - Optimizes current workload up to 60 times an hour
    - Stops tuning if it reaches optimal configuration
  - Is on by default for single partition databases, but can be turned off
    - Use db parameter **`SELF_TUNING_MEM OFF`**
  - Can share OS memory with database memory automatically
    - Use db parameter **`DATABASE_MEMORY AUTOMATIC`**
  - Can share various cached based database memory heaps with each other
    - Set these to AUTOMATIC

      ☒ BUFFER POOLS
      ☒ PCKCACHESZ
      ☒ LOCKLIST
      ☒ SHEAPTHRES_SHR
      ☒ SORTHEAP

NOTE:

DB2 Self-Tuning Memory Manager manages cache based memory in DB2 for performance.

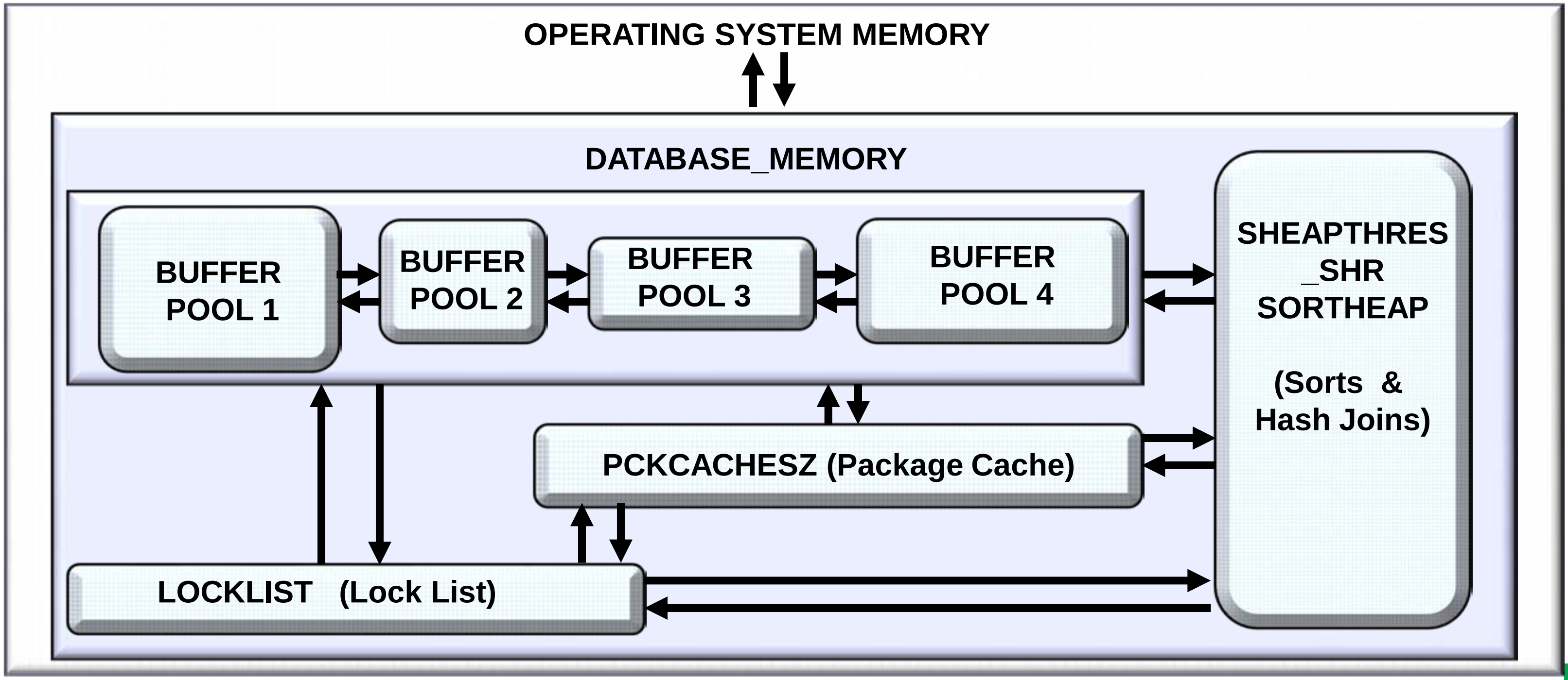
Functional based memory used by application programs are controlled by the parameter **`APPLICATION_MEMORY`**, or if this is set to **`AUTOMATIC`** then **`INSTANCE_MEMORY`** will control this.

DB2 Self-Tuning Memory Manager
DB2 “automatic” memory usage

The DB2 Advantage

Memory can be taken from or given back to the operating system automatically without DBA involvement.

- Setting a few database parameters & the buffer pools to AUTOMATIC
  - Makes DB2 share the entire system memory, when needed, as shown below
    - The database borrows memory from the operating system, or gives it back
    - The buffer pools share memory with each other, even converting the various page sizes
    - The other database memory heaps share with each other as well as the buffer pools



* Registry variable db2_mem_tuning_range limits upper and lower ranges of OS memory usage

DB2 Self-Tuning Memory Manager
Parameter setting details

The DB2 Advantage

Any buffer pool of any page size can participate in automatic memory management or be set to a static size.

- DB2 Self-Tuning Memory Manager itself is on by default for newly created databases
  - IBM Data Studio can turn this off -change **SELF_TUNING_MEM** to **OFF**
  - Or use the following CLP command:

```
UPDATE DB CFG FOR DATABASE [db-name] USING SELF_TUNING_MEM OFF;
```

- **DATABASE_MEMORY** is **AUTOMATIC** by default for newly created databases
  - IBM Data Studio can turn this off - change **DATABASE_MEMORY** to **COMPUTED**
  - Or use the following CLP command:

```
UPDATE DB CFG FOR DATABASE [db-name] USING DATABASE_MEMORY
COMPUTED;
```

- Buffer pools are set to **SIZE AUTOMATIC** by default if size is not specified
  - To freeze this, use IBM Data Studio to alter the buffer pool size to a set page amount
  - Or use the following CLP command:

```
ALTER BUFFERPOOL [bufferpool-name] size [pages];
```

DB2 Self-Tuning Memory Manager
Parameter setting details (continued)

The DB2 Advantage

Any memory area can be individually turned on for automatic use or set to a fixed size avoiding automatic use.

- Sorting and hash joins are controlled by three different parameters
  - By default the DBM parameter **SHEAPTHRES** is set to 0 to put sorts in database shared memory; it must be set to 0 for STMM to manage sort memory
  - By default DB parameters **SHEAPTHRES_SHR** and **SORTHEAP** are set to **AUTOMATIC**
  - Use the IBM Data Studio to alter these or the following CLP commands to change them:

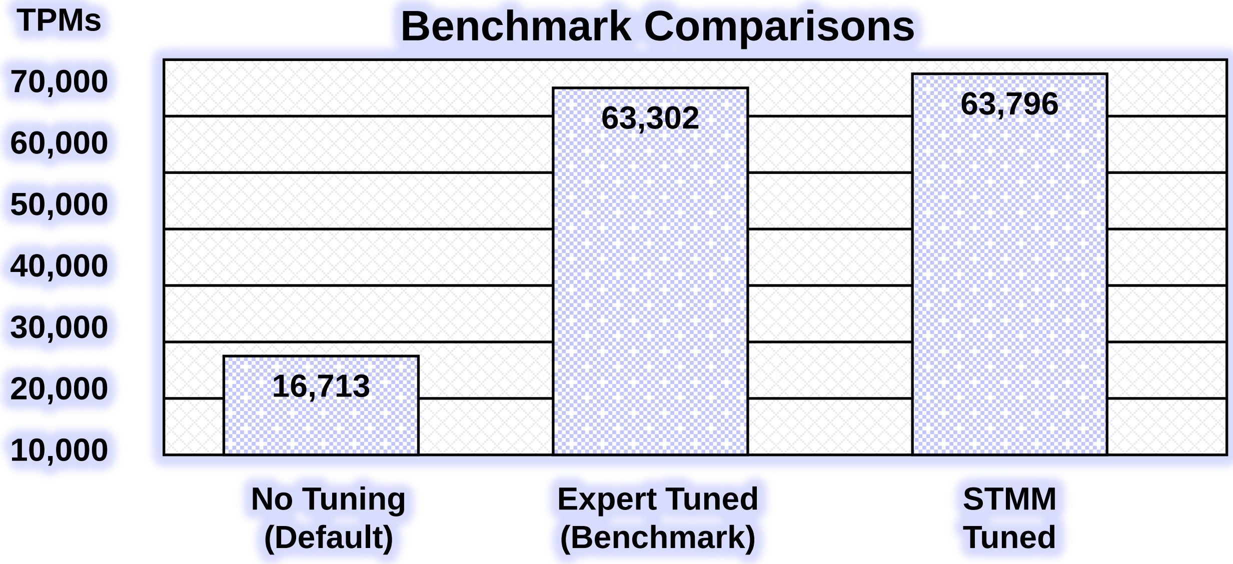
```
UPDATE DBM CFG USING SHEAPTHRES [pages];
UPDATE DB CFG FOR DATABASE [db-name] USING SHEAPTHRES_SHR [pages];
UPDATE DB CFG FOR DATABASE [db-name] USING SORTHEAP [pages];
```

- Package Cache and Lock List set to **AUTOMATIC** by default
  - To freeze their sizes, use IBM Data Studio to alter their sizes to a fixed page amount
  - Or use the following CLP commands:

```
UPDATE DB CFG FOR DATABASE [db-name] USING PCKCACHE_SZ [pages];
UPDATE DB CFG FOR DATABASE [db-name] USING LOCKLIST [pages];
```

DB2 Self-Tuning Memory Manager
Why so useful?

- New DB2 DBAs benefit right away from DB2 Self-Tuning Memory Manager
  - But there’s more to it than that
- Experienced DB2 memory tuning experts can benefit with DB2 Self-Tuning Memory Manager when:
  - Database memory usage is not known at the time of the tuning (guessing is required)
  - Database memory usage is known, but fluctuates greatly hour by hour (or day by day)
  - Database buffer pools are many and differ in page sizes (difficult to tune)
  - System (OS) memory usage is not entirely known, greatly fluctuates or is not completely used
  - Partitioned databases have individual varying memory requirements



Automatic Memory Management
Oracle Automatic (Shared) Memory Management A(S)MM

- ❑ To use Oracle AMM, set **`MEMORY_TARGET`** parameter
  - – For SGA, it will manage these pools (if you do not set **`SGA_TARGET`** -“ASMM”):
    - 1) db cache, 2) shared pool, 3) Java pool, 4) large pool and 5) streams pool
  - – For all PGA (if you do not set **`PGA_AGGREGATE_TARGET`**)
- ❑ Oracle AMM is not like DB2 STMM because:
  - – SGA “non standard” block size pools are not managed by ASMM
    - ☹ With ASMM, if your default block size is 8K, then 2K, 4K, 16K & 32K caches do not participate
    - ☺ With STMM, you manage any and all buffer pools of any page size
  - – Oracle Inter-Instance memory sharing cannot be accomplished by AMM
    - ☹ With AMM, you can only manually de-allocate from **`MEMORY_MAX_TARGET`**
    - ☺ With STMM, memory can be given to and taken from the OS - automatically
  - – SGA pools managed are an all or nothing proposition
    - ☹ ASMM either manages all 5 SGA pools, or it manages none of them - individual SGA pools can only be set to a minimum size or be set to 0
    - ☺ STMM allows any or all memory caches (pools) to be set to a static size if desired
  - – SGA keep & recycle pools are not managed by ASMM
    - ☹ Oracle keep pool critical for memory “pinning” and only matches default db cache block size
    - ☺ DB2 buffer pools can be isolated and set statically for table space object “pinning”

Bottom Line:

DBAs will love DB2 Self-Tuning Memory Manager ease of use, power and flexibility!

Automatic Storage
DB2 automatic storage – how does it work?

The DB2 Advantage

Automatic storage is extremely simple to set up and use and every DBA will use it.

1. Create a DB2 database with the following to enable it:

```
CREATE DATABASE … AUTOMATIC STORAGE YES ON [path/drive]…
```

… or alter an existing DB2 database with the following to enable it:

```
ALTER DATABASE … ADD STORAGE ON [path/drive]…
```

2. Create table space with the following:

```
CREATE TABLESPACE … MANAGED BY AUTOMATIC STORAGE …
```

- That's it! Under the covers, DB2 now creates, names and sizes the data files needed to support the table space without any DBA intervention.
- Path/drive can be any number of subdirectories, mount points or drives
  - Path/drive list can be added to later with an ALTER DATABASE command
- DB2 manages all automatic storage containers within this path
  - Smart enough to make temporary table spaces SMS, all others DMS
  - Automatically stripes containers for you by your number of paths or drives
- Create other DMS or SMS table spaces outside automatic storage if desired
- DB2 Health Monitor indicators signal if paths or drives about to become full

Automatic Storage
Oracle Automatic Storage Management (ASM) – how does it work?

- ASM implemented as a “special”, separate, Oracle instance
  - Recommend: oracle_home of its own
  - Required: OS authentication to connect and administer
  - Required: its own init.ora file with “special” parameters to govern it
  - …and many other maintenance intensive actions …
- Required: its own set of memory
  - Usually around 100 MB
- Required: one ASM instance per server
- All databases using ASM now critically tied to ASM
  - ASM has to be the first instance up and the last down on any server using it
  - ASM instance failure effectively fails all table spaces using it in all databases using it
- ***Question: Are YOU using this?*** (if you’re not in a RAC shop, then probably no…)

Note: Oracle Managed files (OMF) is not really like DB2 automatic storage:

> OMF only controls one data file name and requires the one target path to use a logical volume manager.
> OMF cannot use multiple paths for table space data files and does not create new data files when needed.

Bottom Line:

DBAs will love the DB2 Automatic Storage ease of use and will use it for many of their databases

Utility Throttling
How does it work in DB2?

The DB2 Advantage

Built into DB2 and automatically exploited for every database. DBAs can easily tweak it to get the most from it, but it requires no “set up”.

- Instance level throttling set with one DBM cfg *parameter:* **`UTIL_IMPACT_LIM`**
  - Sets percent of impact for all utilities on the system
  - Default is 10
- **`UTIL_IMPACT_PRIORITY`** can be set for each utility running
  - Determines relative rank of importance of all throttled utilities
  - Entire throttled utility set bound by limit of **`UTIL_IMPACT_LIM`**
- These utilities can be executed with a **`UTIL_IMPACT_PRIORITY`** subcommand
  - Backup
  - Runstats
- Other already running utilities* can be throttled using
  - “Managed Utilities” GUI from the Control Center, or these line commands:

```
LIST UTILITIES SHOW DETAIL;
```

```
SET UTIL_IMPACT_PRIORITY FOR [utility] TO [priority];
```

* Includes: load, reorg, rebalance, redistribute, async_index_cleanup, crash_recovery, restart_recreate_index, restore, rollforward_recovery

Utility Throttling
How does it work in Oracle?

- Backup (RMAN)
  - Set **RATE** option of CHANNEL command
- Data Pump
  - Set **PARALLEL** parameter
- Other utilities can use “resource plans” (similar to DB2 Workload Manager)
  - Requires ADMINISTER_RESOURCE_MANAGER privilege
  - Uses DBMS_RESOURCE_MANAGER package
  - Very customizable
    - Create consumer groups, plan directives and so on
  - But is very complex
    - Requires extensive set up to use
- Result: few Oracle DBAs using these techniques
- ***Question: Are YOU using these Oracle throttling methods?***

Bottom Line:
DBAs will love the DB2 utility throttling power & built-in ease of use!

AUTOCONFIGURE

DB2 all-in-one parameter tuning utility

QUESTION:

How can I tune my performance related configuration parameters and buffer cache ALL AT ONCE?

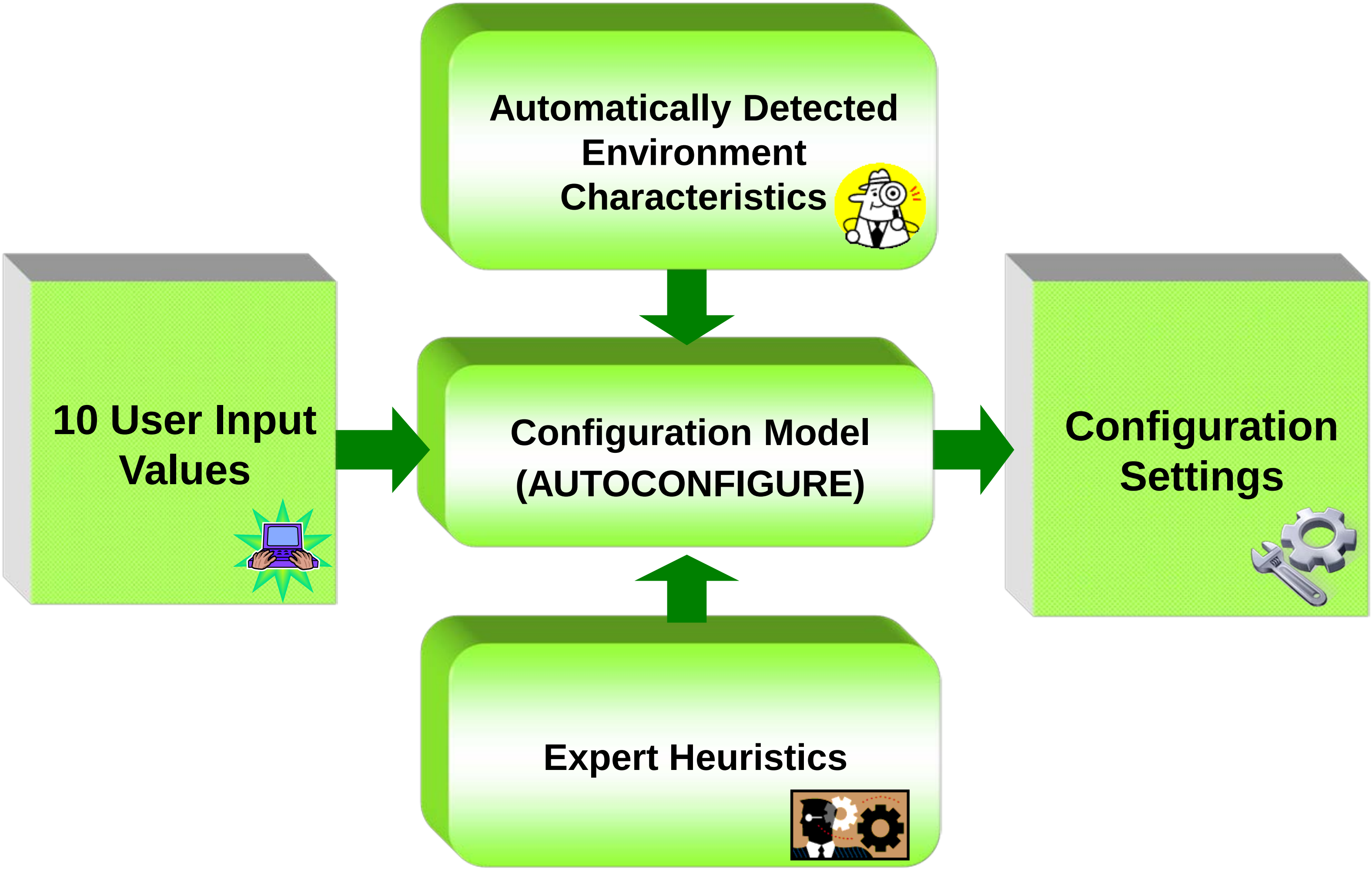
ANSWER:

AUTOCONFIGURE!

- DB2 autonomics runs the AUTOCONFIGURE utility at database creation time
  - This automatically sets many of your instance and database parameters for you
  - No need for a “pfile” like parameter template
- An already created databases can be tuned with either AUTOCONFIGURE or using the DB2 Control Center interface
  - Scope for changes is “**`NONE`**”, “**`DB`**” or “**`DB and DBM`**”
- AUTOCONFIGURE suggests optimum instance and database tuning parameter settings based upon a set of 10 user input values or default values
  - Autonomics automatically senses everything else it needs to know

AUTOCONFIGURE

Architecture



Automatically Detected Environment Characteristics

10 User Input Values

Configuration Model (AUTOCONFIGURE)

Configuration Settings

Expert Heuristics

AUTOCONFIGURE

10 user input values

The DB2 Advantage

Your database environment usage is described here and is more flexible than using a simple template.

Keyword	Valid Value Range	Default Value	Explanation
mem_percent	1-100	25	Percentage of memory to dedicate to DB2 as derived from parameter : instance_memory
workload_type	Simple, Mixed, Complex	Mixed	Online transaction processing (OLTP) I/O intensive, Data warehousing CPU intensive
num_stmts	1-1,000,000	10	Number of statements per unit of work
tpm	1-200,000	60	Transactions per minute
admin_priority	Performance, Recovery, Both	Both	Optimize for more transactions per minute or better recovery time
is_populated	Yes, No	Yes	Is the database populated with data?
num_local_apps	0-5,000	0	Number of local connected applications
num_remote_apps	0-5,000	10	Number of connected remote applications
Isolation	RR, RS, CS, UR	RR	Isolation Level of applications
bp_resizable	Yes, No	Yes	Are buffer pools resizable?

AUTOCONFIGURE

Autonomically detected environment characteristics

The DB2 Advantage

Your unique and current environment is detected by DB2 to use as a basis for all performance parameter settings.

Environment	Autonomically Detected System Characteristics
System	Number of physical disks & spindles
	Physical memory size
	CPU information (number of online and configured CPU)
	OS Features (OS type and release – Linux, UNIX, Windows)
Database	Size of database
	Number of tables
	Number of Indexes
	Number of table spaces
Buffer pool	Name, size and page size for each buffer pool
	Number of buffer pools

AUTOCONFIGURE

Configuration parameter settings - output

The DB2 Advantage

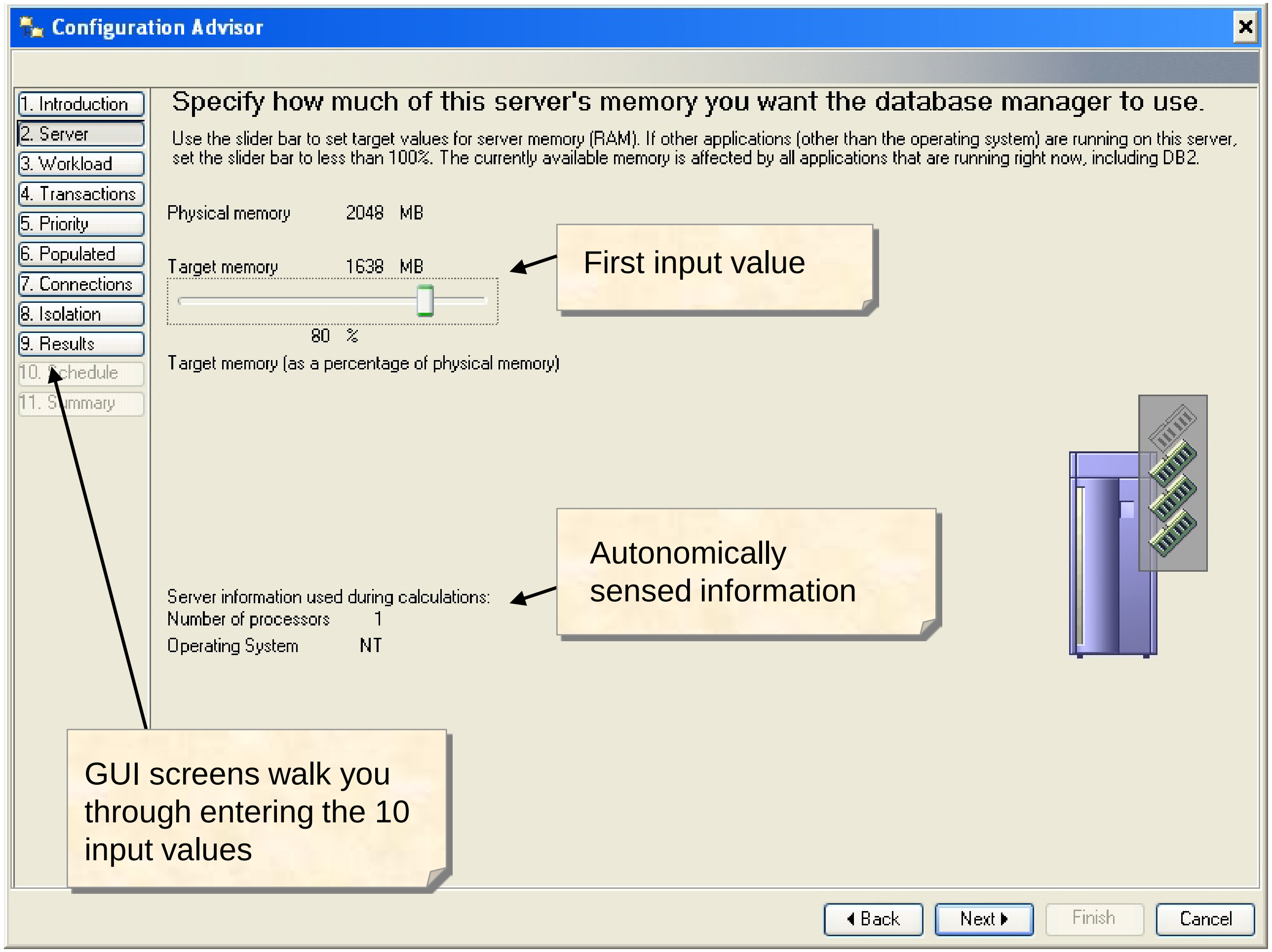
All performance parameters and buffer pool settings can be tuned in one fell swoop.

Environment	Configuration Parameter Settings			
Instance	AGENT_STACK_SZ	ASLHEAPSZ	FCM_NUM_BUFFERS	INTRA_PARALLEL
	MAX_QUERYDEGREE	NUM_INITAGENTS	NUM_POOLAGENTS	PRIV_MEM_THRESH
	RQRIOBLK	SHEAPTHRES		
Database	APP_CTL_HEAP_SZ	APPLHEAPSZ	CATALOGCACHE_SZ *	CHNGPGS_THRESH
	DFT_EXTENT_SZ	DBHEAP	APPGROUP_MEM_SZ	DFT_DEGREE
	DFT_PREFETCH_SZ	LOCKLIST *	DFT_QUERYOPT	LOGBUFSZ
	LOGFILSIZ	LOGPRIMARY	LOGSECOND	MAXAPPLS
	MAXLOCKS	MINCOMMIT	NUM_IOCLEANERS	NUM_IOSERVERS
	PCKCACHESZ *	SOFTMAX	SORTHEAP *	STMTHEAP
	STAT_HEAP_SZ	UTIL_HEAP_SZ	SHEAPTHRES_SHR *	SELF_TUNING_MEM *
	AUTO_MAINT	AUTO_DB_BACKUP	AUTO_TBL_MAINT	AUTO_REORG
	AUTO_RUNSTATS	AUTO_STMT_STATS	AUTO_STATS_PROF	AUTO_PROF_UPD
Buffer Pools	Buffer Pool Size *			

* Self Tuning Memory related parameters

AUTOCONFIGURE
Control Center Interface

- Control Center can invoke DB2 Configuration Advisor GUI



Specify how much of this server's memory you want the database manager to use.

Use the slider bar to set target values for server memory (RAM). If other applications (other than the operating system) are running on this server, set the slider bar to less than 100%. The currently available memory is affected by all applications that are running right now, including DB2.

Physical memory 2048 MB

Target memory 1638 MB

80 %

Target memory (as a percentage of physical memory)

Server information used during calculations:
Number of processors 1
Operating System NT

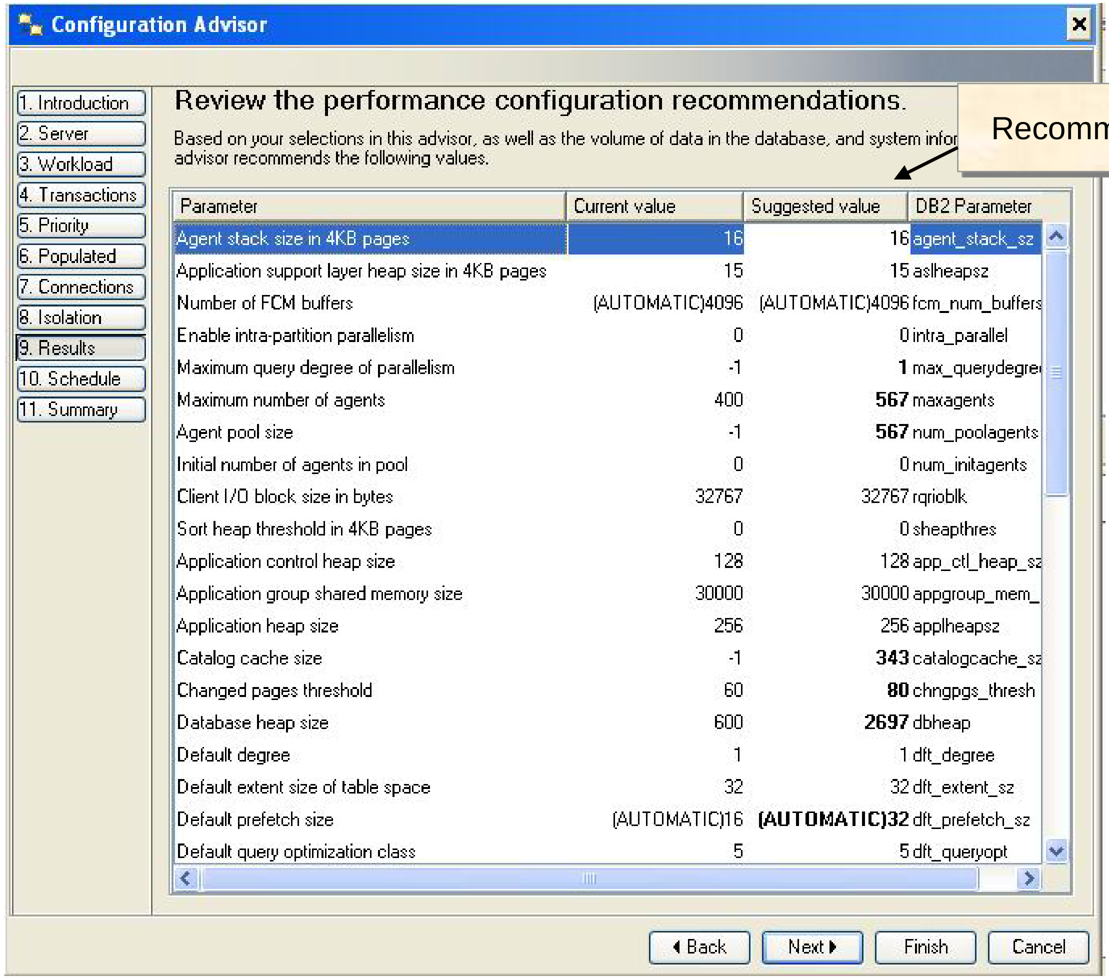
First input value

Autonomically sensed information

GUI screens walk you through entering the 10 input values

AUTOCONFIGURE
Wizard recommendations

- Recommendations from the GUI



Configuration Advisor

1. Introduction
2. Server
3. Workload
4. Transactions
5. Priority
6. Populated
7. Connections
8. Isolation
9. Results
10. Schedule
11. Summary

Review the performance configuration recommendations.

Based on your selections in this advisor, as well as the volume of data in the database, and system infor advisor recommends the following values.

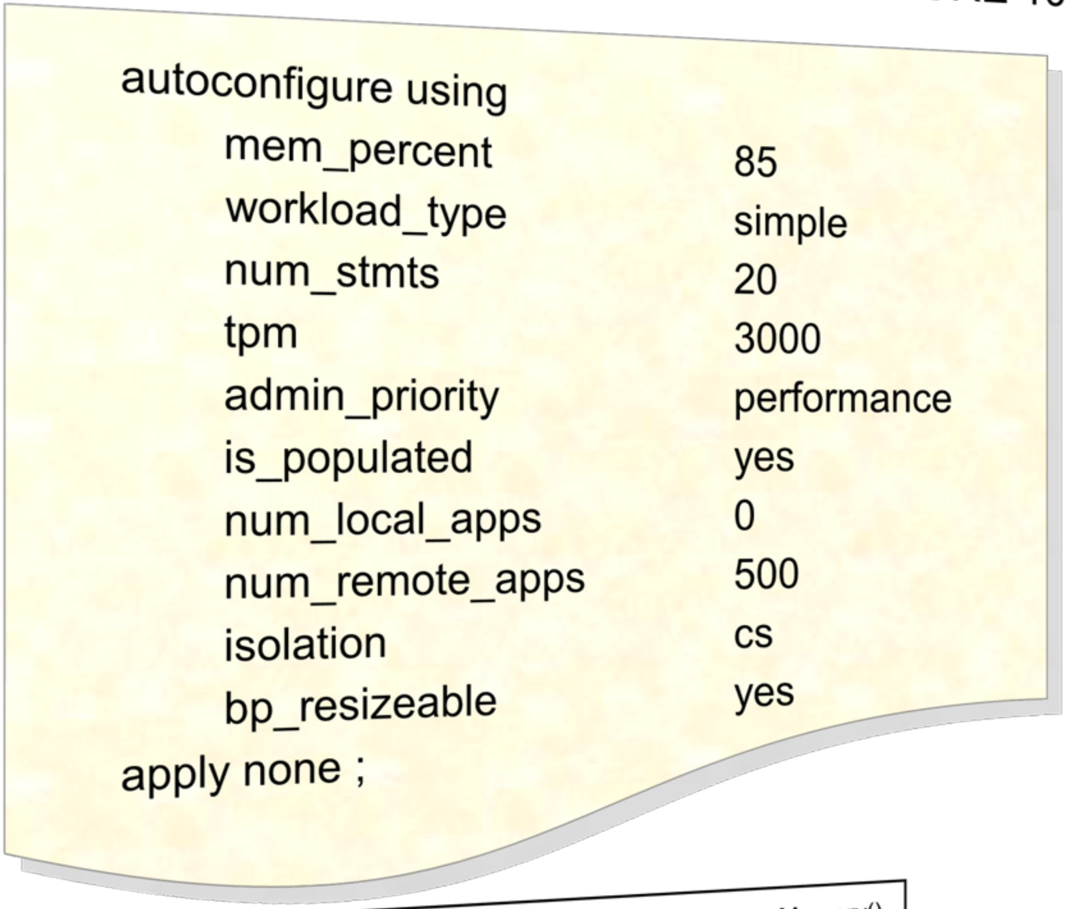
Parameter	Current value	Suggested value	DB2 Parameter
Agent stack size in 4KB pages	16	16	agent_stack_sz
Application support layer heap size in 4KB pages	15	15	aslheapsz
Number of FCM buffers	(AUTOMATIC)4096	(AUTOMATIC)4096	fcm_num_buffers
Enable intra-partition parallelism	0	0	intra_parallel
Maximum query degree of parallelism	-1	**1**	max_querydegre
Maximum number of agents	400	**567**	maxagents
Agent pool size	-1	**567**	num_poolagents
Initial number of agents in pool	0	0	num_initagents
Client I/O block size in bytes	32767	32767	rqrioblk
Sort heap threshold in 4KB pages	0	0	sheapthres
Application control heap size	128	128	app_ctl_heap_sz
Application group shared memory size	30000	30000	appgroup_mem_
Application heap size	256	256	applheapsz
Catalog cache size	-1	**343**	catalogcache_sz
Changed pages threshold	60	**80**	chngpgs_thresh
Database heap size	600	**2697**	dbheap
Default degree	1	1	dft_degree
Default extent size of table space	32	32	dft_extent_sz
Default prefetch size	(AUTOMATIC)16	**(AUTOMATIC)32**	dft_prefetch_sz
Default query optimization class	5	5	dft_queryopt

Recommendations

AUTOCONFIGURE

Command line example *

- Use a command line to give AUTOCONFIGURE 10 input values



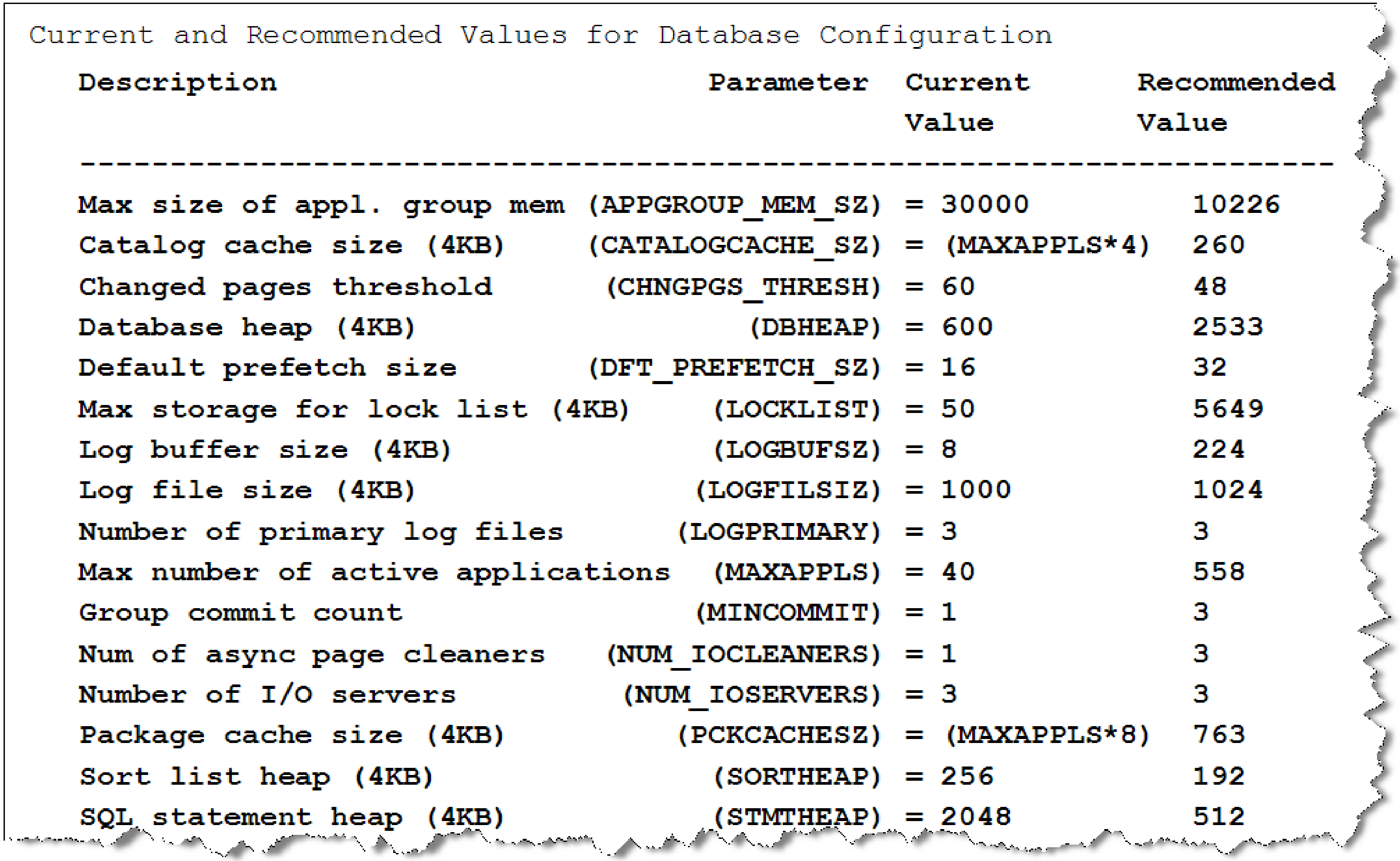
```
autoconfigure using
          mem_percent              85
          workload_type            simple
          num_stmts                20
          tpm                      3000
          admin_priority           performance
          is_populated             yes
          num_local_apps           0
          num_remote_apps          500
          isolation                cs
          bp_resizeable            yes
apply none ;
```

* APIs also available: db2AutoConfig() and db2AutoConfigFreeMemory()

AUTOCONFIGURE

Command line output example: Database

- Database configuration parameter sample output



```
Current and Recommended Values for Database Configuration
   Description                              Parameter  Current        Recommended
                                                       Value          Value
   ---------------------------------------------------------------------------
   Max size of appl. group mem (APPGROUP_MEM_SZ) = 30000           10226
   Catalog cache size (4KB)     (CATALOGCACHE_SZ) = (MAXAPPLS*4)   260
   Changed pages threshold        (CHNGPGS_THRESH) = 60              48
   Database heap (4KB)                    (DBHEAP) = 600             2533
   Default prefetch size           (DFT_PREFETCH_SZ) = 16              32
   Max storage for lock list (4KB)      (LOCKLIST) = 50              5649
   Log buffer size (4KB)                (LOGBUFSZ) = 8               224
   Log file size (4KB)                 (LOGFILSIZ) = 1000            1024
   Number of primary log files        (LOGPRIMARY) = 3               3
   Max number of active applications    (MAXAPPLS) = 40              558
   Group commit count                  (MINCOMMIT) = 1               3
   Num of async page cleaners    (NUM_IOCLEANERS) = 1               3
   Number of I/O servers          (NUM_IOSERVERS) = 3               3
   Package cache size (4KB)           (PCKCACHESZ) = (MAXAPPLS*8)    763
   Sort list heap (4KB)                 (SORTHEAP) = 256             192
   SQL statement heap (4KB)             (STMTHEAP) = 2048            512
```

AUTOCONFIGURE

Oracle offering comparison

Oracle

No real equivalent

The Database Configuration Assistant (DBCA) has a few template choices for parameter defaults for database creation only.

Oracle has some parameters you can set to “automatic” and ADDM helps tune one at a time, but these are not the same as AUTOCONFIGURE.

No tool in Oracle helps you to proactively set all performance parameters and cache settings all at once.

DB2

AUTOCONFIGURE!

Normally database tuning experts have to change one parameter at a time and retest each time to see how the change acts with all other parameters.

DB2 gives you a *huge* head start in this process – it’s an all-in-one performance parameter tuning expert in a box!

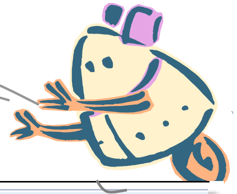
Bottom Line:

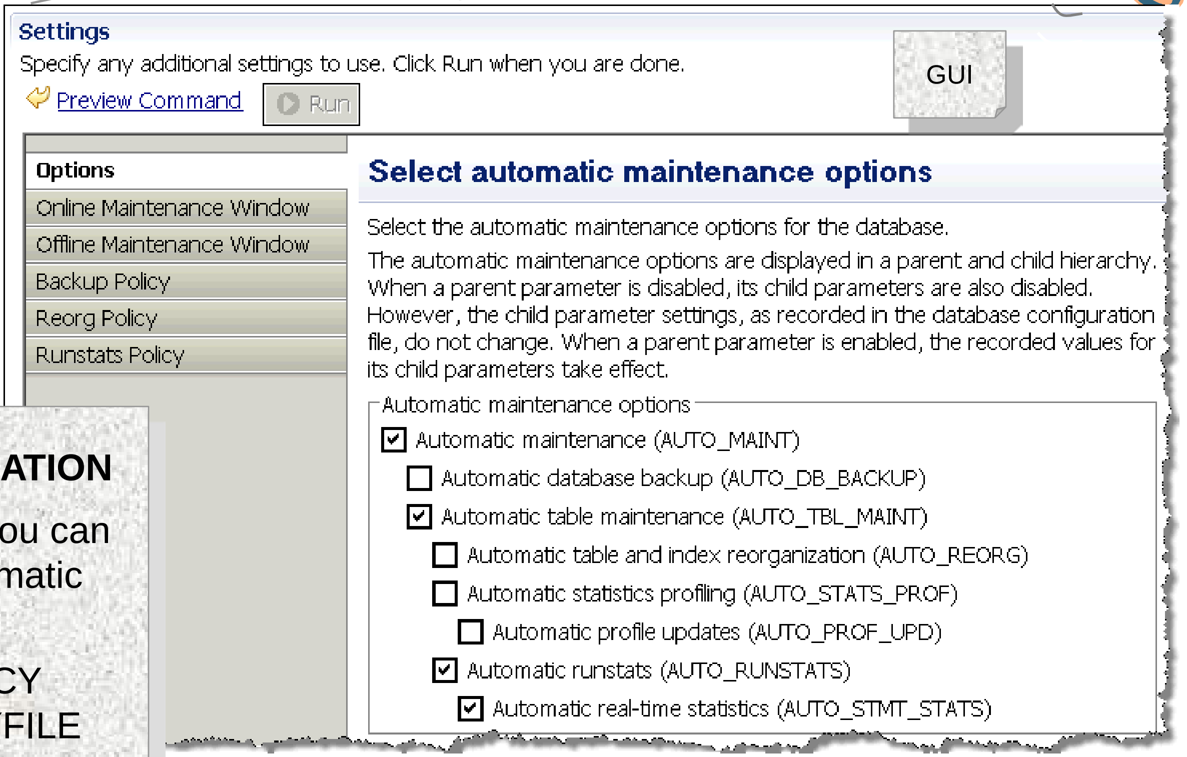
DBAs will love the DB2 powerful and easy to use parameter configuration tool!

Automatic Maintenance
Autonomics approach overview

- DB2 Automatic Maintenance:
  - Only performs activities that need to be done
  - Uses “set it and forget it” autonomics
- Determines when (and whether) to run
  - BACKUPs
  - RUNSTATs
  - REORGs
- Optimizes resources by
  - Phase I - Determining best time to run any given activity in:
    - Online window
    - Offline window
  - Phase II - Running only required activities
- Is easy to manage
  - GUI wizard walks you through the entire process
  - Saves your settings in a profile & can be run over and over again
- Has a “learning” capability
  - Internal scheduling continually estimates times to completion
  - If window not large enough
    - Will not run those activities it cannot complete
    - Will notify you through the Health Monitor

Automatic Maintenance
IBM Data Studio task assistant vs. line command





GUI

Settings

Specify any additional settings to use. Click Run when you are done.

Select automatic maintenance options

Select the automatic maintenance options for the database.

The automatic maintenance options are displayed in a parent and child hierarchy. When a parent parameter is disabled, its child parameters are also disabled. However, the child parameter settings, as recorded in the database configuration file, do not change. When a parent parameter is enabled, the recorded values for its child parameters take effect.

Automatic maintenance options

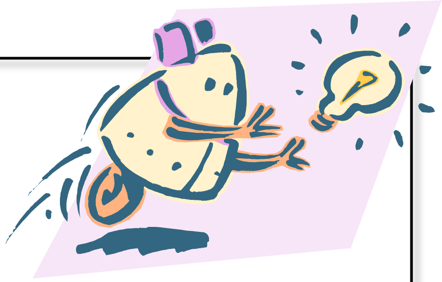
- ☑ Automatic maintenance (AUTO_MAINT)
  - ☐ Automatic database backup (AUTO_DB_BACKUP)
  - ☑ Automatic table maintenance (AUTO_TBL_MAINT)
    - ☐ Automatic table and index reorganization (AUTO_REORG)
    - ☐ Automatic statistics profiling (AUTO_STATS_PROF)
      - ☐ Automatic profile updates (AUTO_PROF_UPD)
    - ☑ Automatic runstats (AUTO_RUNSTATS)
      - ☑ Automatic real-time statistics (AUTO_STMT_STATS)

LINE COMMAND CONFIGURATION

There are stored procedures you can use to manually update automatic maintenance:

AUTOMAINT_GET_POLICY
AUTOMAINT_GET_POLICYFILE
AUTOMAINT_SET_POLICY
AUTOMAINT_SET_POLICYFILE

Automatic Maintenance
Concepts used

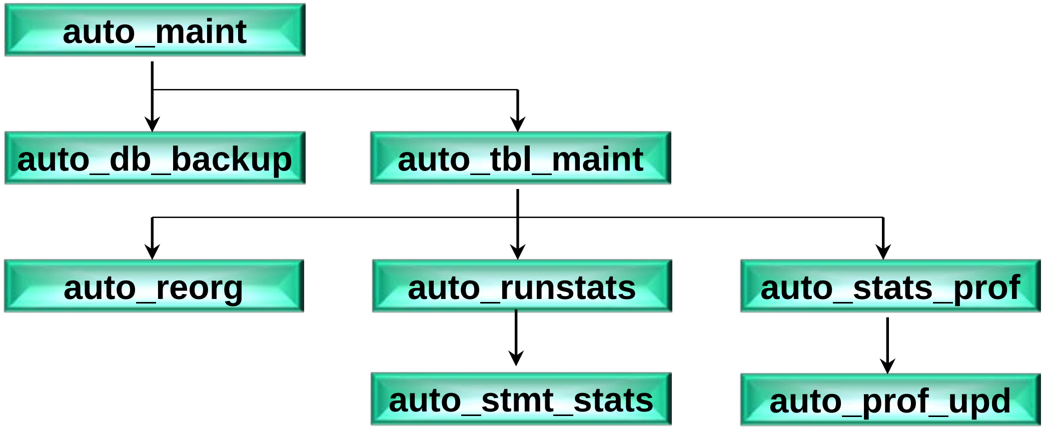


All options use the following concepts:

- Maintenance Windows (or Timing)
  - Defined as:
    - Periods of time for hours of the day, days of the week or month
    - For online and offline time periods
    - Inside or outside defined time periods
  - DB2 uses this window to consider running selected utilities
  - This window should be a relatively unused time period for your database
- Notification
  - List of contacts can be built and used to notify results of auto maintenance actions
- Throttling
  - Auto maintenance uses “adaptive utility throttling” which it controls all by itself
    - The defined maintenance window is used as the overriding priority
    - Uses a fixed 7% limit on resources

Automatic Maintenance

Auto_% DB configuration parameters



auto_maint

auto_db_backup

auto_tbl_maint

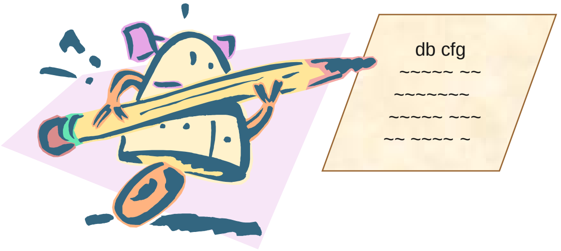
auto_reorg

auto_runstats

auto_stats_prof

auto_stmt_stats

auto_prof_upd



AUTO_MAINT	**Parent to all other auto_% parameters. Sets auto maintenance at a global level.** **Enabled: All recorded values for child parameters take effect.**
AUTO_DB_BACKUP	**Enabled: Allows for automatic BACKUP operations.**
AUTO_TBL_MAINT	**Parent parameter to all other (non backup) auto_% parameters.** **Enabled: All recorded values for child parameters take effect.**
AUTO_REORG	**Enabled: Allows for automatic table and index REORG operations.**
AUTO_RUNSTATS	**Enabled: Allows for automatic asynchronous RUNSTATS operations.**
AUTO_STMT_STATS	**Enabled: Allows real-time, synchronous statistics gathering.**
AUTO_STATS_PROF	**Turns on statistical profile generation, designed to improve applications whose workloads include complex queries, many predicates, joins, and grouping operations over several tables.** **Enabled: Recommendations are stored in the opt_feedback_ranking table.**
AUTO_PROF_UPD	**Enabled: Runstats profile is to be updated with recommendations from opt_feedback_ranking table.**

Automatic Maintenance
Backup settings & workings

The DB2 Advantage

DB2 will only run backups that need to be run.
This is smarter than just running regular backups.

- BACKUP option uses these settings:
  - – Criteria
    - Time elapsed since last full backup since specified by number of hours
      - (Also, if backup has never run before)
    - Log space used between backups more than specified number of 4K pages
  - – Location
    - File System (Disk)
    - Tape
    - Tivoli Storage Manager
    - X/Open Backup Services API (XBSA)
    - Vendor DLL
  - – Mode
    - Online - Archive log (retain) mode supported
      - (Default maintenance mode for this setting is 24 x 7)
    - Offline – Archive log and circular log both supported
      - (Uses **`QUIESCE DATABASE`** in **`DEFER`** mode to allow transactions to complete)

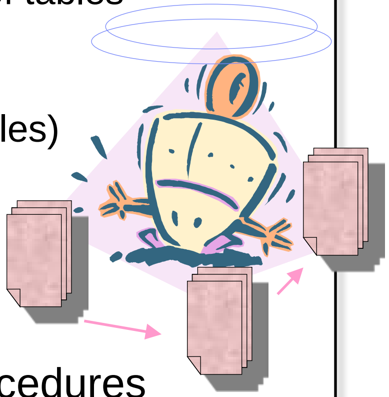
Automatic Maintenance
REORG settings & workings

The DB2 Advantage

DB2 can perform table and index REORGs automatically.

- Auto REORG option uses these settings:
  - – All tables
    - Can include or exclude system catalog tables
  - – Selected tables
    - Can use a simple or custom filter to select range of tables to run against
    - Custom filter can point to a “control table” which contains only the names of tables you desire an automatic REORG to be performed on
  - – Has other options for REORG like:

• Size of table limit	(helps avoid REORG on very large tables)
• Offline storage location	(temporary storage location)
• Dictionary rebuild/no rebuild	(for compressed tables)
• Index reorg mode	(read or write options)



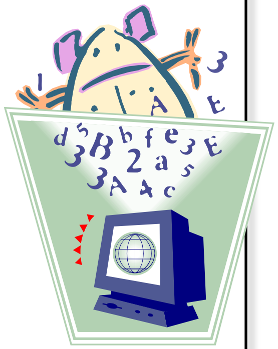
- Auto REORG works by
  - – Using **`reorgchk_tb_stats`** and **`reorgchk_ix_stats`** stored procedures
    - Determines which tables and indexes to perform REORG on
  - – Performs “classic” table REORG on table data
    - Only during a specified offline table maintenance window
    - with no write access during reorganization
    - with no access at all during shadow copy change-over
  - – Performs index REORGs during online or offline table maintenance windows
  - – Keeps working data in SYSTOOLS schema tables

Automatic Maintenance
RUNSTATS settings & workings

The DB2 Advantage

DB2 statistic gathering has a sophisticated algorithm to determine collection requirements.
Also, statistic profiling is unique to DB2.

- Auto RUNSTATS – asynchronous collection
  - DBA selects range of tables for consideration (using GUI)
    - The out of the box default is all tables
  - Utility is non contentious – uses new special kernel locking protocols
  - Utility uses a collection algorithm that learns over time how fast the statistics change
    - Compares histograms on a per table basis
    - Determines the minimum set of statistics that give optimal performance improvement
    - Asynchronously runs background RUNSTATS for tables determined to need it
    - Keeps working data in SYSTOOLS schema tables
- Auto profile generation customizes your statistics gathering
  - DBA sets **AUTO_STATS_PROF** db cfg parameter – gathers automatically
  - DBA sets **AUTO_PROF_UPD** db cfg parameter – updates automatically
  - Stores data in a "feedback warehouse" in SYSTOOLS, tables **OPT_FEEDBACK_*:**
  - By default, statistics collected for synchronous and asynchronous operations are basic table statistics with distribution information and detailed index statistics using sampling. This feature customizes this.

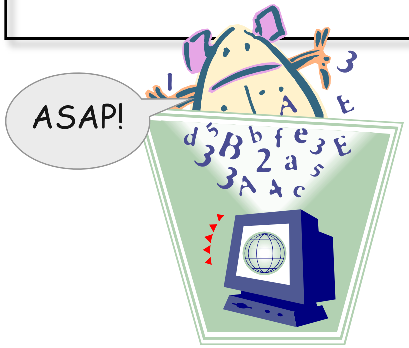


Automatic Maintenance
RUNSTATS real-time statistics collection

The DB2 Advantage

Real-time statistics gathering is unique to DB2 and its default 5 second requirement can be customized.

- Real-time statistics - synchronous collection
  - – DBA sets **AUTO_STMT_STATS** db cfg parameter
  - – Utility collects statistics when needed by that query at run time!
    - Ignores the maintenance windows; runs anytime queries run
    - Uses many different techniques to maximize synchronous collection
      - Placing statistics in statistics cache and writing to the catalog later
      - Limiting the time spent to collect statistics (5 seconds by default)
      - Submitting asynchronous collection request later (if necessary)
      - Fabricating statistics through extrapolation



Automatic Maintenance
Oracle automatic system tasks

- **Oracle Automated Maintenance Tasks is effectively job scheduling**
  - This ability ONLY comes with Oracle Enterprise Manager (OEM) Diagnostic Pack and is set up with the DBCA
    - For example, is not available on Express editions
    - This is provided in all editions of DB2
  - Uses customizable maintenance_window_group for jobs to run under
- **For statistics collection**
  - Uses **`DBMS_AUTO_TASK`** and **`DBMS_STATS`** packages
  - Calls **`GATHER_STATS_PROG`** to collect optimizer statistics for all objects in the database
    - Where there are either no statistics or "stale" statistics (defined as 10% row changes by default, but can be overridden globally or by table)
- **For Oracle REORGs (MOVEs)**
  - You must manually check for and schedule jobs yourself
    - Tuning pack can help you with this but its extra cost
  - Only supported for tables (DB2 is tables and indexes)
- **For Backups**
  - Using DBCA can set up a job to do an incremental backup

Bottom Line:
DBAs will love the DB2 powerful and easy to use automatic maintenance facility!

Next Steps
Proof of Technologies, workshops and other training

- **Proof of Technology: "DB2 9.7 Administration for the Experienced Oracle DBA"**
  - ⇨ Two day free of charge, high level, broad scope event by the author of this "Chat with Lab"
  - ⇨ Ask your IBM sales rep or technical specialist about having one in your area
- **DB2 education professional training courses**
  - ⇨ Deep level of training with a focused scope
  - ⇨ Cost based IBM training
  - ⇨ http://download.boulder.ibm.com/ibmdl/pub/software/data/sw-library/education/curriculum-documents/DB2LUW_2008.pdf
  - ⇨ http://www-304.ibm.com/jct03001c/services/learning/ites.wss/us/en?pageType=page&c=a0000512
- **DB2 Workshop for Oracle Professionals (with free certification testing)**
  - ⇨ Two day free of charge workshop to extend your current experience to DB2
  - ⇨ http://www.ibm.com/db2workshop
- **Self study courses**
  - ⇨ Free of charge online courses on various DB2 subjects
  - ⇨ http://www-01.ibm.com/software/data/education/selfstudy.html#1
  - ⇨ http://www-01.ibm.com/software/data/education/certification.html
- **DB2 DBA fundamentals certification 730 prep**
  - ⇨ http://www.ibm.com/developerworks/offers/lp/db2cert/db2-cert730.html?S_TACT=105AGX19&S_CMP=db2certlp
- **DB2 Application development certification 733 prep**
  - ⇨ http://www.ibm.com/developerworks/offers/lp/db2cert/db2-cert733.html?S_TACT=105AGX11&S_CMP=sum

Questions?

Thank you!

ibm.com/db2/labchats

Thank you for attending!

DB2 and Oracle – An Autonomic Computing Comparison
Chat with the Lab Presentation by:

Burt Vialpando

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IBM Certified Advanced Database Administrator for DB2 V9.7 for Linux UNIX and Windows
IBM Certified Solutions Developer DB2 9.7 SQL Procedures
IBM Certified Application Developer DB2 9
IBM Certified Solutions Designer for DB2 Business Intelligence V8
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