



# Dynamic Warehousing

## DB2 Advanced Features for Business Intelligence

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IBM Information On Demand 2008  
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ALLA LUCE DELL'INFORMATION ON DEMAND  
Milano, 15 aprile 2008

# Agenda

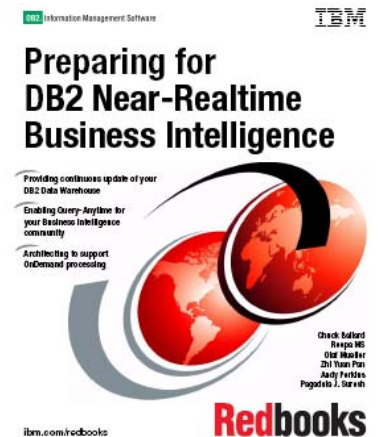


- Data Warehousing, le linee evolutive
- DB2, le risposte

# Agenda



- **Data Warehousing, le linee evolutive**
- DB2, le risposte





## ***Riduzione dello sfasamento temporale vs. sistemi operazionali***

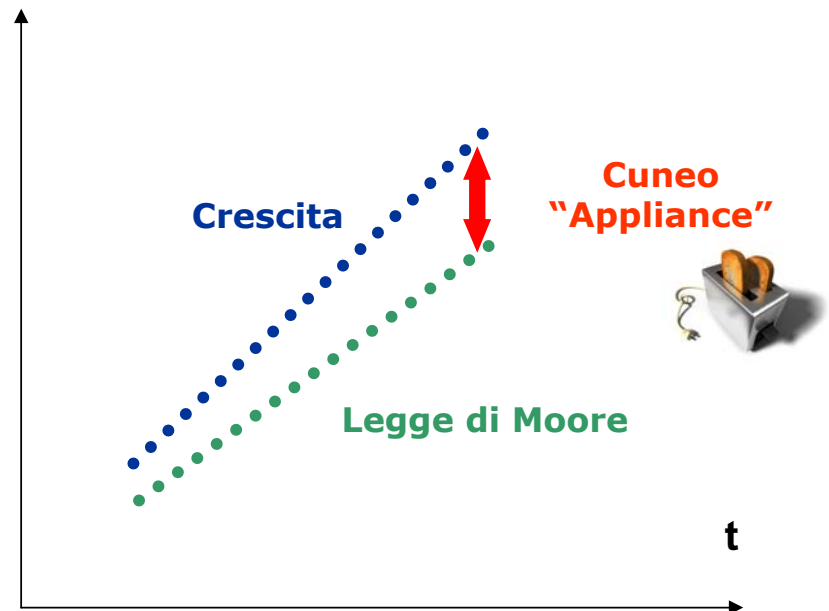
- Richiesta generalizzata da parte degli utilizzatori
- BI: “Take-over” (puntuale) di funzioni precedentemente nel perimetro dei sistemi operazionali
  - Requisiti più forti in termini di:
    - ✓ Disponibilità dei sistemi (High Availability, Disaster Recovery)
    - ✓ Accuratezza dei dati
    - ✓ Sofisticazione delle trasformazioni
    - ✓ Prestazione dei sistemi:
      - accessi on-line & caricamenti
      - livelli (con garanzia di stabilità)





## Crescita dei volumi

- Normative legali/fiscali
- Natura dei tipici ERP (“voracità” di storage)
- Richieste utenti
  - Perché f/e sofisticati “ingolosiscono”
  - Perché i sistemi lo permettono





## *Ottimizzazione del rapporto risorse/complessità*

- Crescita della complessità
  - Volume di dati
  - Numero di sistemi
  - Numero di utenti
  - Capacità analitiche dei f/e → formulazione di accessi più complessi
  - Numero e tipologia delle trasformazioni
  - Acquisizioni/fusioni societarie
  
- Vincoli di budget
  - HW → utilizzo più efficace delle risorse a disposizione
  - DBA → alleggerimento dai compiti “trivial” - tanto ne nascono di nuovi!  
(Regulatory Compliance: Encryption, Auditing, ...)



# Agenda



- Data Warehousing, le linee evolutive
- **DB2, le risposte**

# DB2 per il Dynamic Warehousing – le grandi direttrici



**Prestazioni**

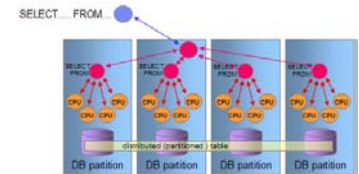
**Disponibilità**

**Semplicità di gestione**

**Cost effectiveness**



- Parallelismo (DPF)
- Compressione
- MultiDimensional Clustering
- Workload Manager
- SMART (Self Managing and Automated Resource Tuning) features
- Balanced Configuration Unit

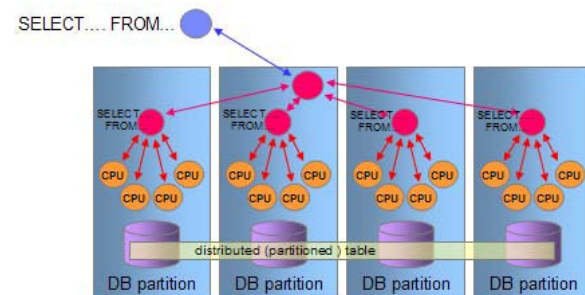




# Database Partitioning Feature (DPF)



- Architettura parallela basata sui modelli di elaborazione di tipo MPP (Massively Parallel Processing).
- Implementazione particolare (parallela) del motore relazionale. Non un *kernel* completamente diverso dal motore tradizionale.
- Non mutuamente esclusiva con altre tecniche di 'partizionamento' (Range Partitioning, Multidimensional Clustering).
- Trasparenza applicativa.

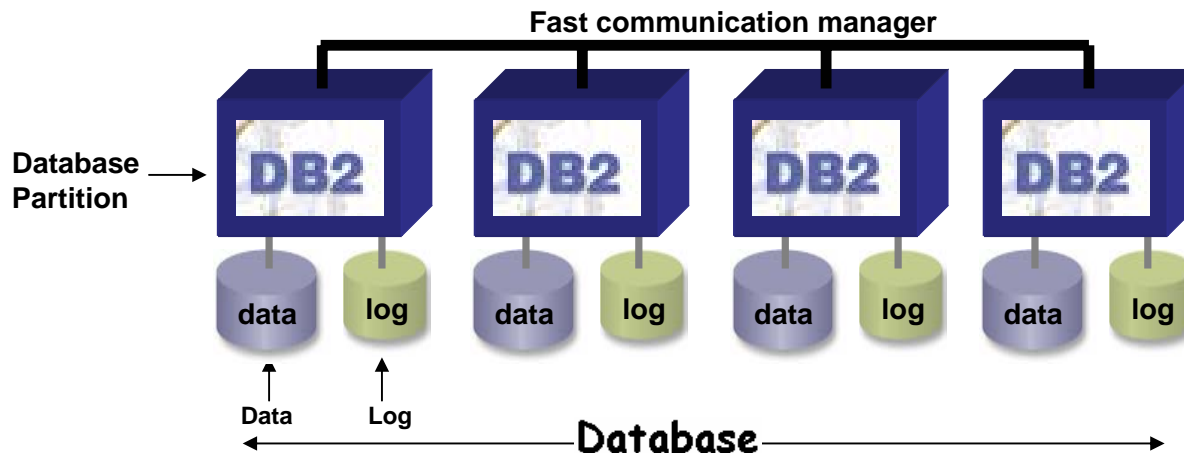


# DPF – Shared Nothing Architecture



## Partitioned Database Model

- ✓ Database diviso in partizioni
- ✓ Le partizioni possono risiedere su macchine fisiche diverse
- ✓ Ogni Database Partition ha risorse dedicate (Engine, Log Mgr., Lock Mgr., Caches, ...)
- ✓ Parallel Processing coordinato dal DBMS
- ✓ *Single system image per utenti ed applicazioni*



# DPF - partitioning via Hashing Algorithm



```
CREATE TABLE customer (  
  cust_id VARCHAR(80)  
  ,gender CHAR(5))  
PARTITIONING KEY(cust_id);
```

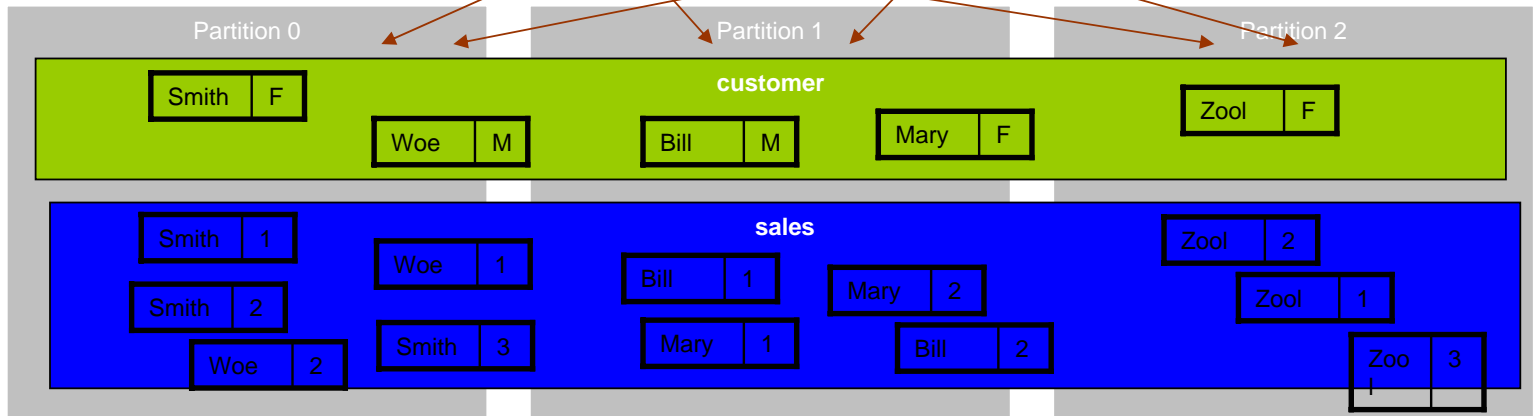
```
CREATE TABLE sales (  
  cust_id VARCHAR(80)  
  ,qty INTEGER)  
PARTITIONING KEY(cust_id);
```

Customer	
cust_id	Gender
Smith	F
Bill	M
Woe	M
Zool	M
Mary	F

Sales	
cust_id	Qty
Smith	1
Smith	2
Smith	3
Zool	1
Zool	2
...	...

Hash (cust\_id)

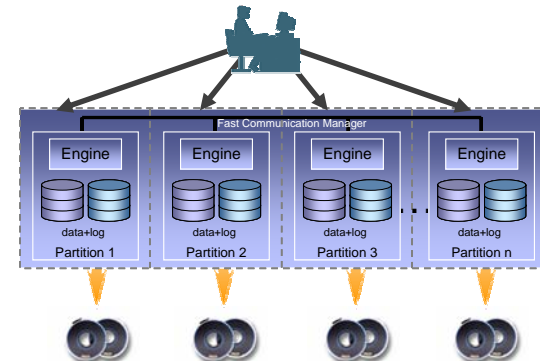
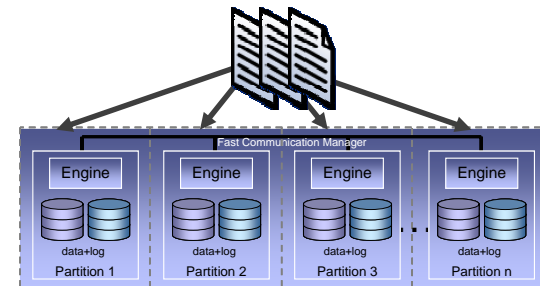
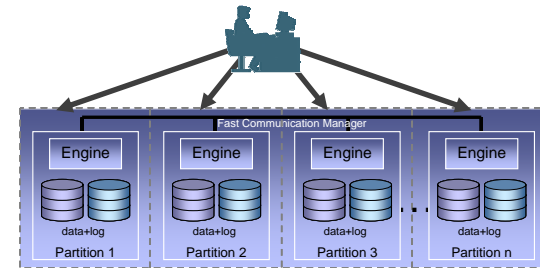
1	2	3	4	5	6	7	8	...	4096
0	1	2	0	1	2	0	1	2	0



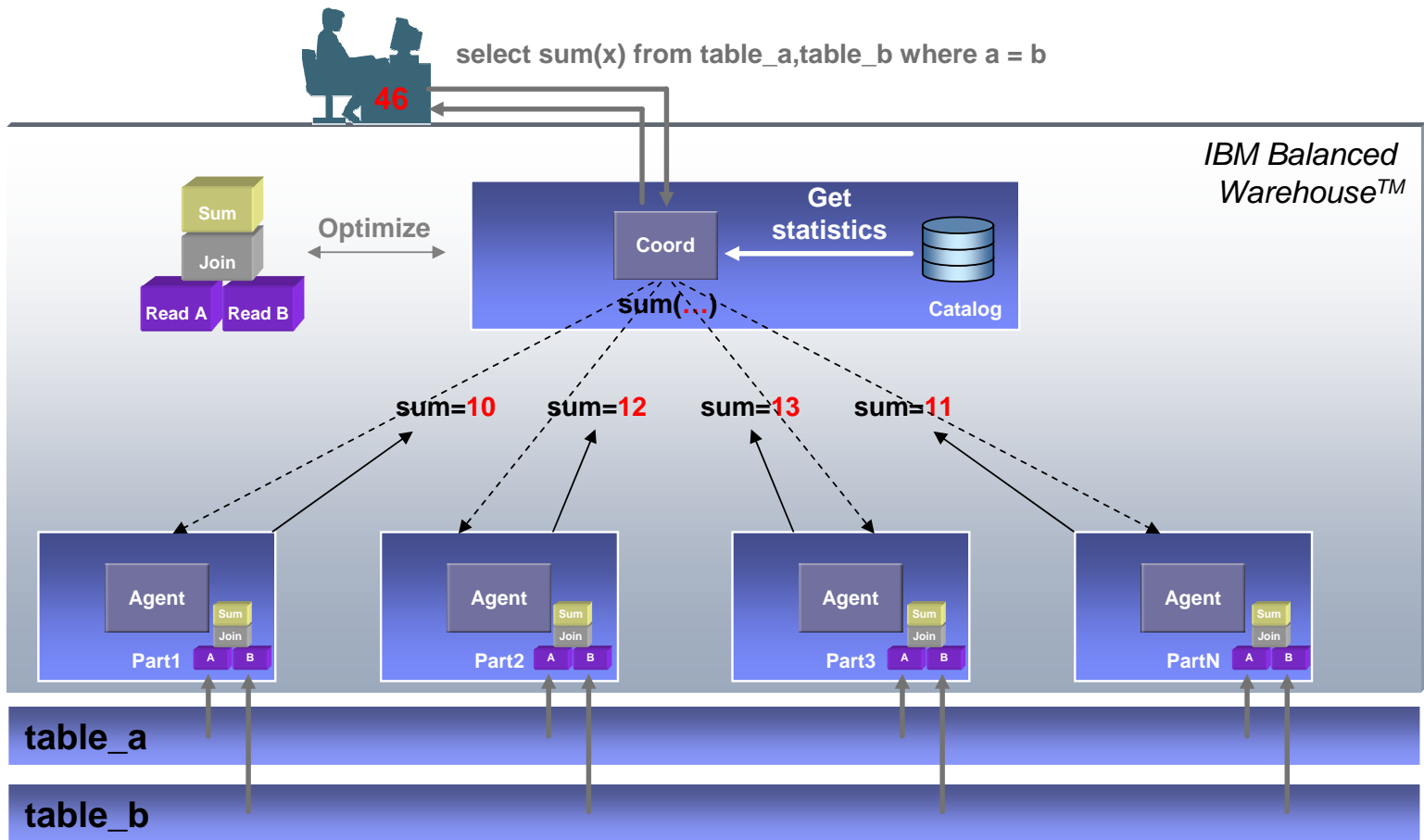
# DPF: parallelismo a 360°



- Parallel queries
  - Select/Insert/Delete/Update
- Parallel Load
  - load from file1, file2, ...  
insert into tablename
- Parallel utilities
  - Backup
  - Restore
  - Reorg
  - (...)



# DPF: query processing



# Performance (TPC-H @ 10 TB, QppH)



Browser window: Ideas Top Performers TPC-H (10000GB) - Mozilla Firefox: IBM Edition

URL: http://www.ideasinternational.com/benchmark/ben020.aspx?b=d154c216

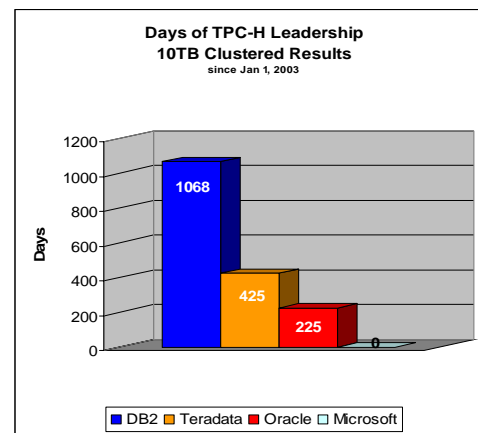
Navigation: CONTACT US, HOW IDEAS CAN ASSIST YOU, PRODUCTS & SERVICES, BENCHMARK GATEWAY, ABOUT IDEAS, INVESTOR RELATIONS, RESEARCH STORE, SHOP NOW

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### IDEAS TOP PERFORMERS TPC-H (10000GB)

QpH

Rank	Product	Chips	Cores	QpH	\$/QpH	Database	Date
1	IBM System p 570	64	128	343,551.20	2.89	DB2 Warehouse 9.5	15-Oct-07
2	IBM System p5 575	128	128	180,108.10	47.00	IBM DB2 UDB 8.2	14-Jul-06
3	HP Integrity Superdome	64	128	171,380.00	37.91	Oracle Database 10g Release 2 Enterprise Edition	27-Feb-07
4	Sun Fire E25K	72	144	108,099.70	53.80	Oracle 10g Database Enterprise Edition Release 2	29-Nov-05
5	HP Integrity Superdome	128	128	86,282.70	161.00	Oracle 10g Database Enterprise Edition	7-Oct-04

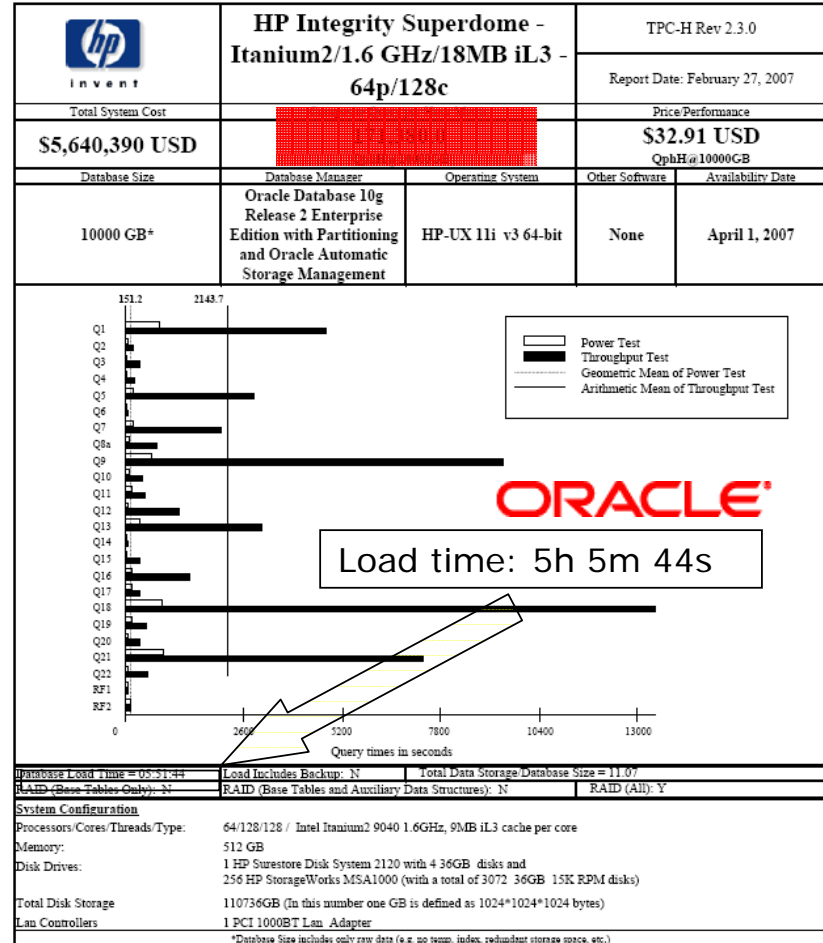
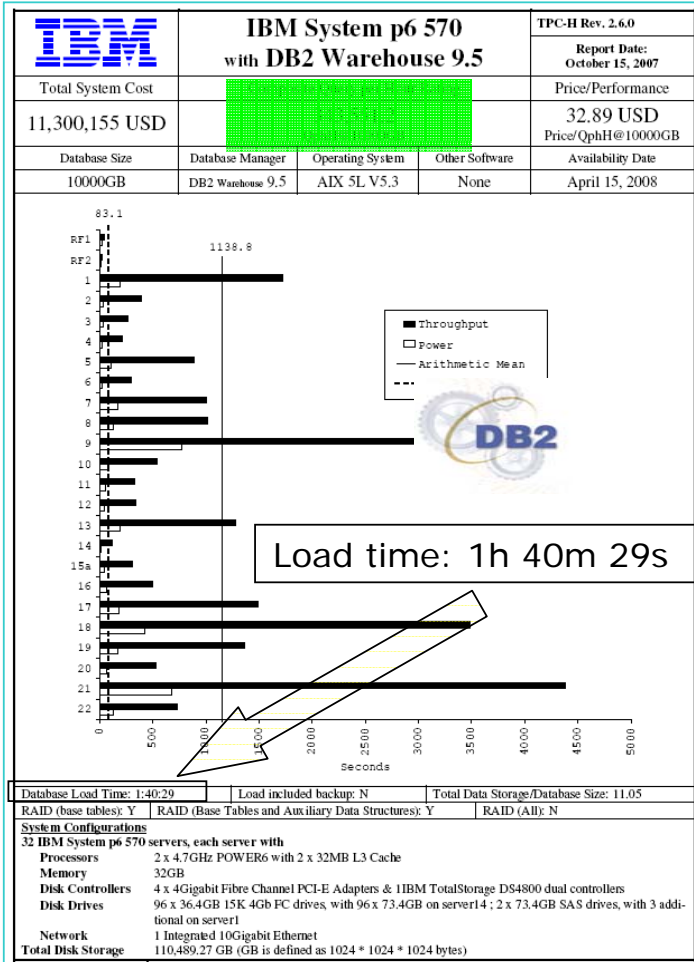


**ORACLE**

- # cores → ==
- Performance → + 100%

- DB2 Load time ..... : 1h 40m 29s
- Oracle load time ... : 5h 5m 44s

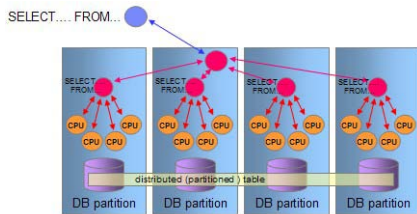
# DPF - TPC-H @ 10 TB, load time



# DPF – what do we get?



## DPF



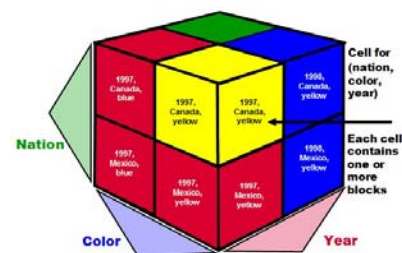
- + **PRESTAZIONI 360°**: on-line, maintenance
- + **DISPONIBILITA'**: abbattimento tempi di maintenance: load/backup/reorg/...
- + **SEMPLICITA'**: trasparenza applicativa, scalabilità
- + **COST EFFECTIVENESS**: capacità di gestione di grandi volumi con risorse HW/SW/DBA non specializzate (“*appliance-like*”)



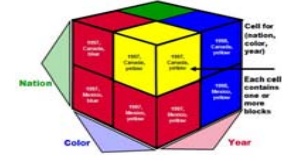
# MultiDimensional Clustering Tables (MDC)



- Organizzazione fisica di dati ed indici ottimizzata per le navigazioni multidimensionali.
- Velocità nella navigazione, nell'aggiornamento e nel *rolling* degli oggetti.
- Trasparenza applicativa.



# MDC – MultiDimensional Clustering Tables



MDC Index

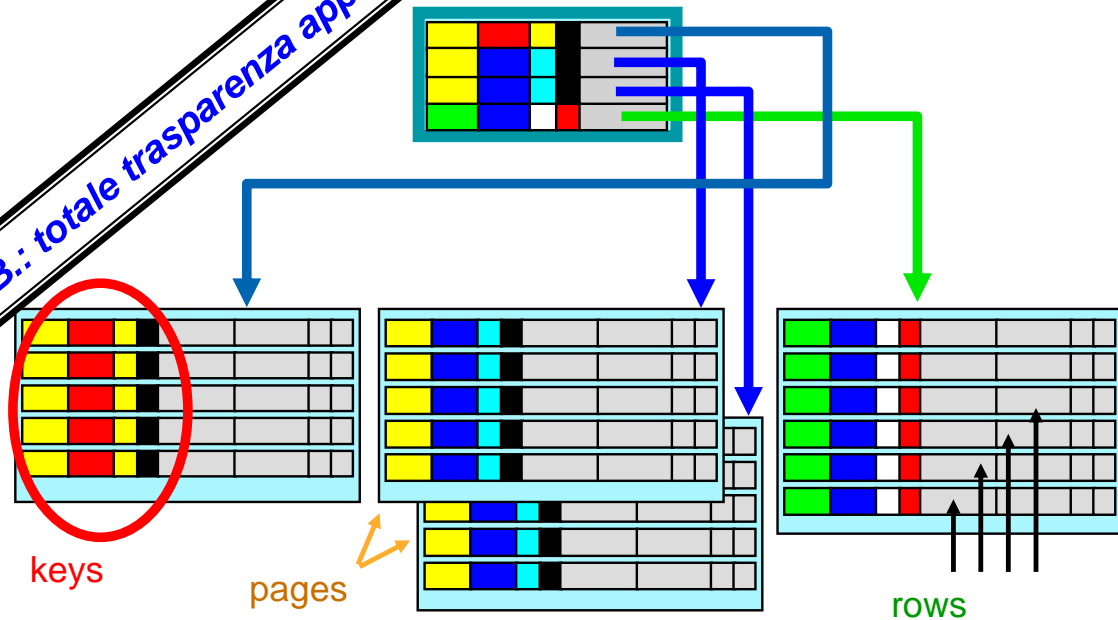
*N.B.: totale trasparenza applicativa!!!*

CREATE TABLE MDC1

(SKU integer,  
Store integer,  
Date\_A date,  
Category char (8),  
QTY integer,  
AMT integer,  
register\_ID char (4), ...)

**ORGANIZE BY DIMENSIONS**

(SKU, Store, Date, Category)



# MDC - esperienze

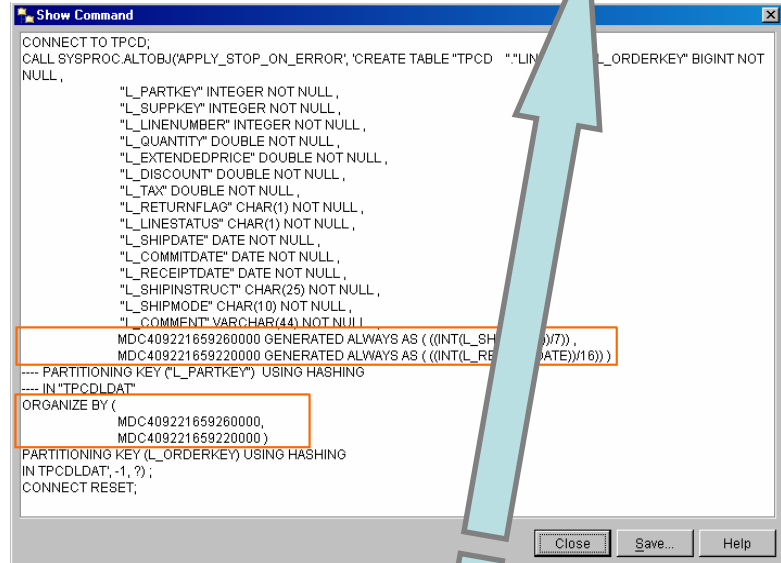
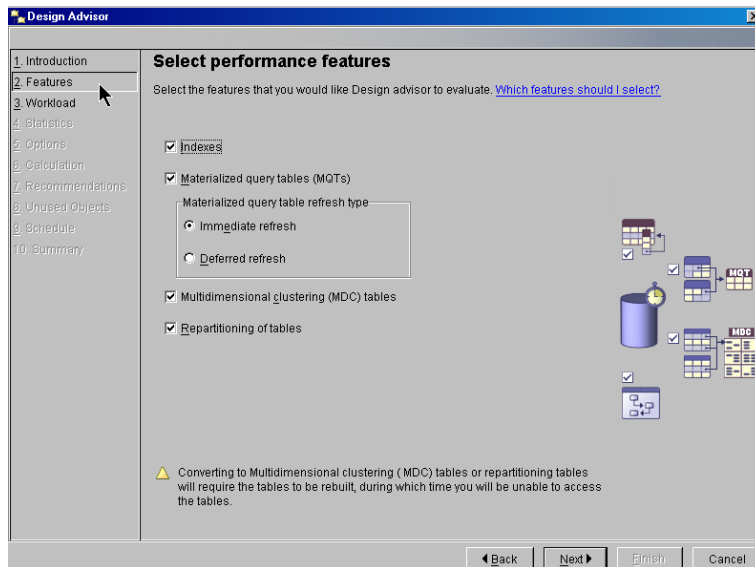


Database

IBM DB2 Universal Database

eWEEK.com

We saw performance improvements of as much as 40 percent when performing multidimensional queries.

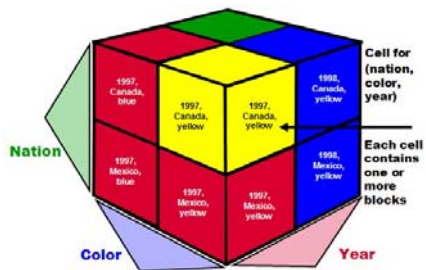


... Conferma & rilancia ...

# MDC – what do we get?



## MDC



+ **PRESTAZIONI**: navigazione multidimensionale, aggiornamento

+ **DISPONIBILITA'**: abbattimento tempi di maintenance: rolling/reorg/...

+ **SEMPLICITA'**: trasparenza applicativa

# Compressione



- Tecnica per la riduzione delle dimensioni dei database.
- Soluzione largamente collaudata ('ereditata' da DB2 for z/OS).
- 'Effetto moltiplicatore' #1: applicazione su tutti i sistemi di un *landscape* (prod, pre-prod, dev, QA, ...).
- 'Effetto moltiplicatore' #2: applicazione su tutte le versioni di backup dei vari sistemi.
- Incrementi di prestazioni (soprattutto per sistemi I/O bound).
- Riduzione tempi di backup.
- Migliore utilizzo della memoria (dati in formato compresso).
- Minori scritture sui log.
- Total application transparency.

# Compressione - concetti



- Symbol table per la compressione/decompressione dei dati
- Algoritmo Lempel-Ziv (LZ) con simboli a 12 bit
- Dizionario ***per tabella*** memorizzato nell'oggetto (~75KB in size; disk+memory). Tecnica molto più efficace di una a dizionario ***per blocco (pagina)***
- Su disco: memorizzazione dei simboli e non dei dati effettivi
- Applicabile anche a gruppi (consecutivi) di colonne

Fred	500	10000	Plano	TX	24385	John	500	20000	Plano	TX	24385	...
Fred	(01)	10000	(02)	John	(01)	20000	(02)	...				

01	Dept 500
02	Plano, TX 24385
...	...

# Compression – POC



	No-Compression (32 KB pages)	Compression (32 KB pages)	Factor	Card
<b>RB.SRAVSTOR2007</b>	91.000	32.700	64,1%	15.000.000
<b>RB.SRTABPRMK2007</b>	80	20	75,0%	1.500
<b>RB.SRTABSTRU2007</b>	3.100	500	83,9%	47.500
<b>RB.SRAVANDA</b>	116.000	46.000	60,3%	11.530.000
<b>RB.SRAVANMOV2007</b>	125.000	22.600	81,9%	11.750.000
<b>U6.SRMSCOMW</b>	3.112	1.132	63,6%	1.070.000

		average	min	max
<b>que_84444</b>	<b>elapsed</b>	153	108	475
	<b>CPU (User)</b>	2	2	2
<b>que_84444_c</b>	<b>elapsed</b>	121	84	162
	<b>CPU (User)</b>	2	2	2

		average	min	max
<b>que_71312</b>	<b>elapsed</b>	159	125	485
	<b>CPU (User)</b>	5	0	10
<b>que_71312_c</b>	<b>elapsed</b>	47	36	72
	<b>CPU (User)</b>	7	0	15

		average	min	max
<b>que_19490</b>	<b>elapsed</b>	32	28	43
	<b>CPU (User)</b>	0	0	2
<b>que_19490_c</b>	<b>elapsed</b>	30	26	33
	<b>CPU (User)</b>	0	0	1

# Compression – vantaggi su competitor



## 3.1 Compression Test on HP Itanium Hardware

Used Space	Other Database	DB2
Tables	1.632 GB	655 GB
Indexes	673 GB	683 GB
<b>Total</b>	<b>2.305 GB</b>	<b>1338 GB</b>

DB2 required 42,7% less space than the competitive database.  
 DB2 tables required ~60% less space than the tables in the competitive database.

Roughly 600 of the largest database tables were compressed.

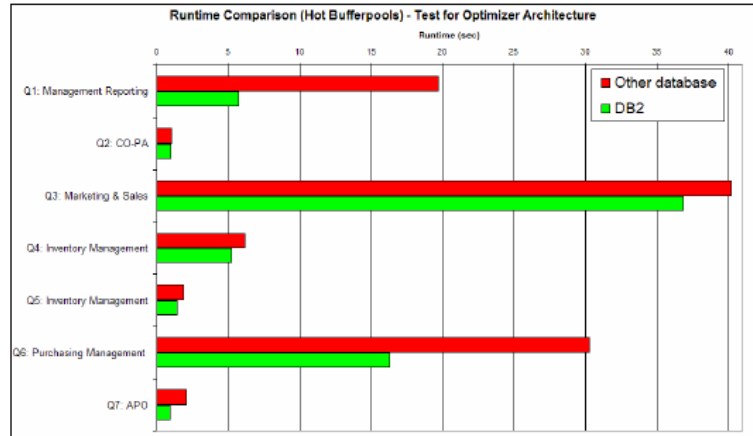


Figure 2: Test with filled database cache

**DB2 9 Row Compression in a SAP R/3 production system**  
Compression Attributes and Performance Influence  
**White Paper**  
**Analysis Documentation**  
Version 1.2

IBM SAP DB2  
Center of Excellence

Revision date: 01.03.2007 15:44  
 Author: Waldemar Guida

DB2 Proof of Concept with SAP Business Warehouse

SAP® Business Warehouse  
 Performance and Space Comparison  
 between the IBM® DB2® database  
 and a competitive Database

Author: Andreas Christian  
 IBM SAP DB2 Center of Excellence

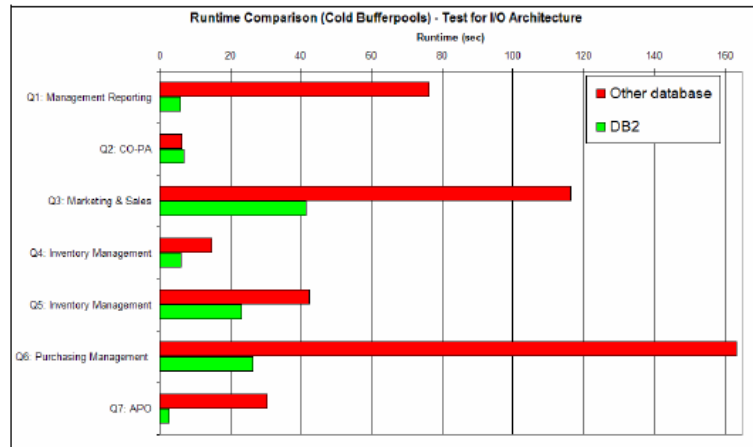


Figure 1: Test with empty database cache





## Compressione



- + **PRESTAZIONI 360°**: abbattimento I/O
- + **DISPONIBILITA'**: abbattimento tempi di maintenance: backup/reorg/...
- + **COST EFFECTIVENESS**:
  - riduzione storage (dischi, nastri)
  - riduzione costi di energia
  - riduzione “footprint”

# Workload Management (WLM)

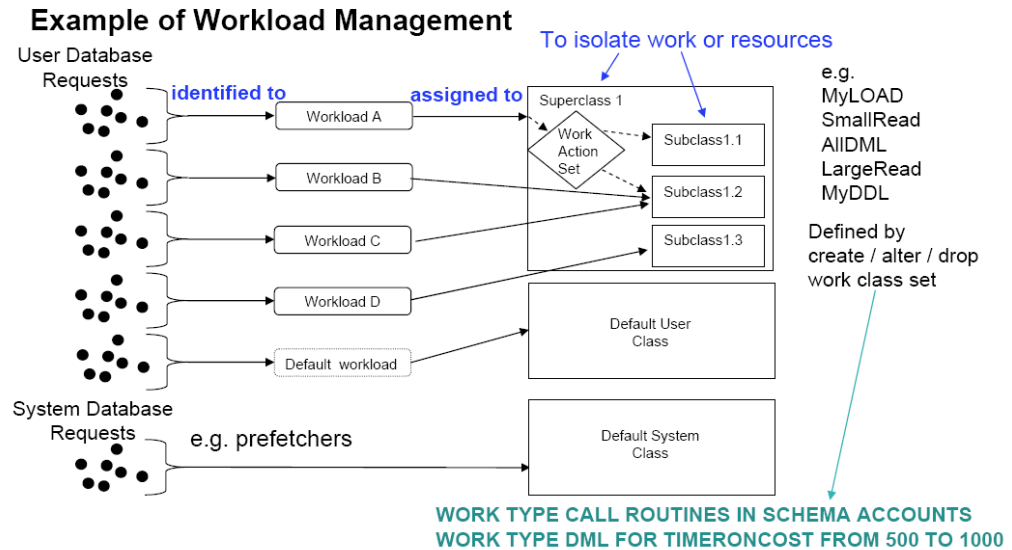


- Tecnica per disciplinare il carico di lavoro.
- Massimizzazione del throughput ed ottenimento di sistemi con comportamenti stabili e predicibili.
- Affiancamento di strumenti esistenti (predittivi: Query Patroller; reattivi: Governor).
- Granularità del controllo.
- Gestione business priorities.
- Basso overhead.
- Trasparenza applicativa.

# Workload Management



- Individuazione del tipo di operazione
- Identificazione dell'utente
- Assegnazione di risorse ('manopole di regolazione')



Requests are evaluated against and assigned to specific workloads, then executed in a particular service class. Requests, which cannot be matched to workloads will be handled by the „default workload“

# Workload Management – what do we get?



## WLM



**+ PRESTAZIONI 360°**

**+ DISPONIBILITA'**: stabilità/predicibilità dei comportamenti

**+ COST EFFECTIVENESS:**

- migliore uso delle risorse
- meno operatività DBA
- gestione di *business priorities*

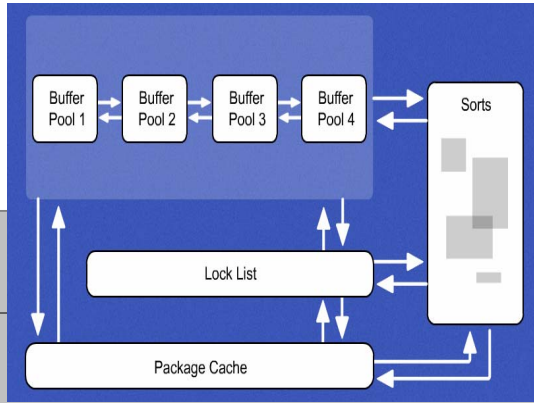
# Self Managing and Automated Resource Tuning (SMART)



- ‘Iniezione’ di tecniche per rendere i sistemi più autonomi in aree di tradizionale competenza DBA (per attività onerose in termini di tempo – nonché ‘error prone’):
  - Configurazioni
  - Prestazioni
  - Individuazione/correzione di errori
  
- Percorso iniziato in v7 ed in costante accelerazione (v8, v9.1, v9.5, ...)

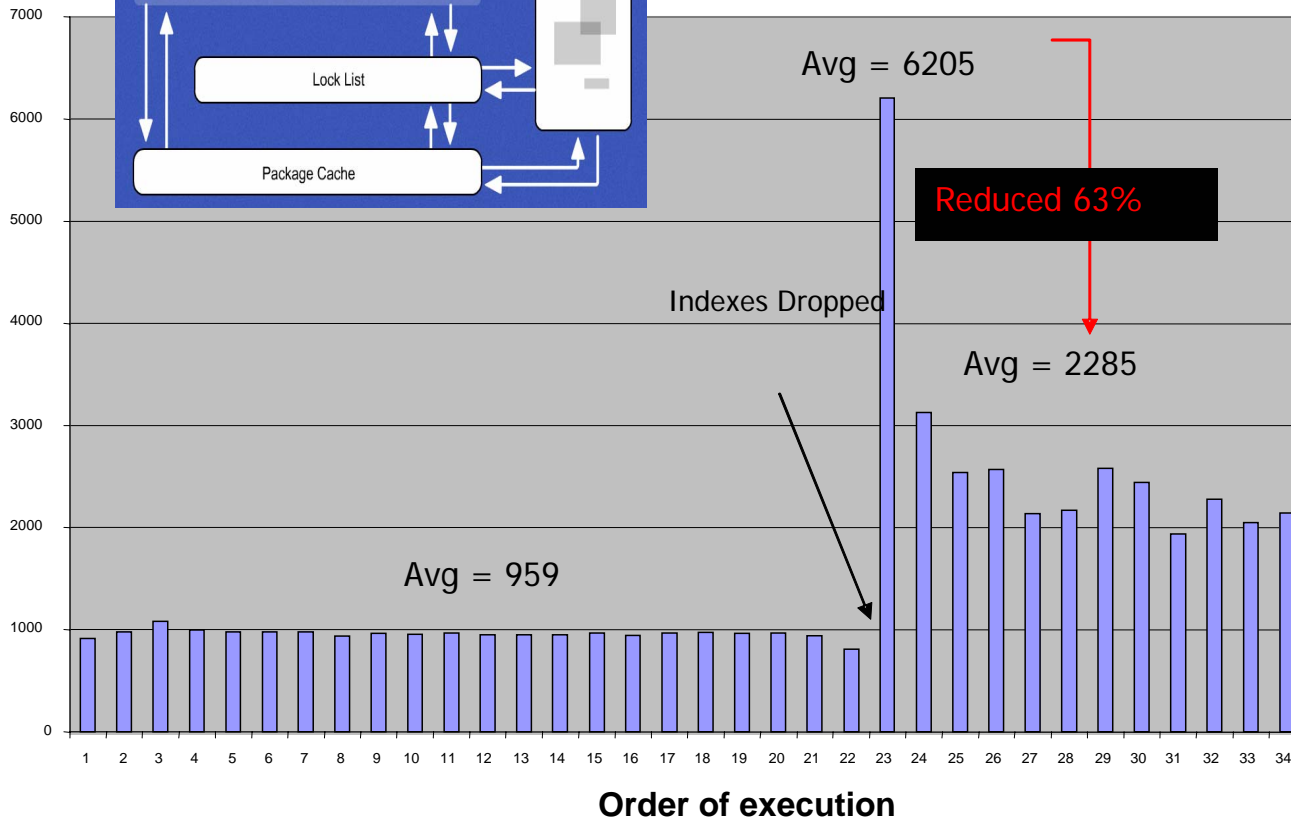


# SMART: Self Tuning Memory Manager



Riallocazione automatica ed continua delle aree di memoria.

Es. Q # 21TPC-H:



# SMART: Utilities



## ■ Utility

✓ Non invasive

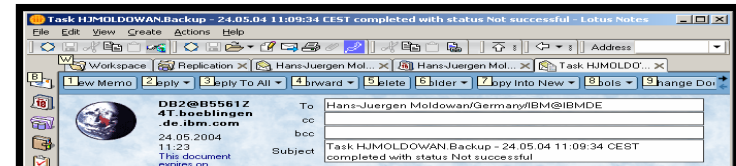
- Backup a caldo
- Reorg non esclusiva
- Reorg: pausa/ripartenza
- ...

✓ 'Autonomiche'

- Reorg/Runstats/Backup
- RunTime Statistics (9.5)

✓ 'Throttling'

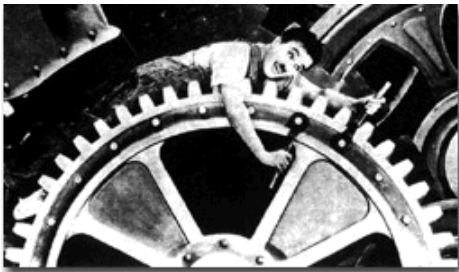
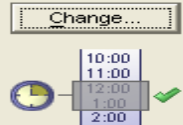
Status as of:	<b>4/14/04 7:34 AM</b>	<a href="#">Refresh</a>
DBM State:	<b>Started</b>	<a href="#">Stop</a>
Last Backup:	<b>4/13/04 9:00 AM</b>	<a href="#">Backup Database</a>
Size:	<b>19 MB</b>	<a href="#">Manage Storage</a>
Capacity:	<b>5316 MB</b>	<input type="text" value="1%"/>
Health:	<b>Normal</b>	<a href="#">Monitor DB Health</a>
Maintenance:	<b>Fully automated</b>	<a href="#">Maintenance</a>



Online maintenance window

Online automatic maintenance can occur during the following window

Time	00:00 - 05:00 (5 hours)
Days of the week	All
Days of the month	All
Activities using this window	Backup database (BACKUP), Optimize data access (RUNSTATS)



# SMART: Automatic Storage Provisioning



**1** Choose Service      **2** Define Parameters      **3** Check Parameters      **4** Execute Service      **5** Completed

### IBM DB2 UDB for UNIX and Windows > Sapdata Directories

Rename, add, or remove sapdata directories for storage paths or tablespace containers

**Important Information**  
If you want to perform a multiple-partition installation, you must not use the option *Use automatic storage management by DB2 (Autostorage)*.

**Storage Management and Tablespaces**  
Use automatic storage management by DB2 (Autostorage)

```
CREATE DATABASE DB_001 AUTOMATIC
STORAGE YES
    ON /data/path1, /data/path2

CREATE TABLESPACE TS1
    INITIALSIZE 500 K
    INCREASESIZE 100 K
    MAXSIZE 100 M
...
```

**Storage path(s) associati al DB all'atto della creazione**

**Per i Tablespace:**

- Nessuna associazione esplicita di spazio
- Auto-estensione

< Back    Next >    Cancel    View Log    L...



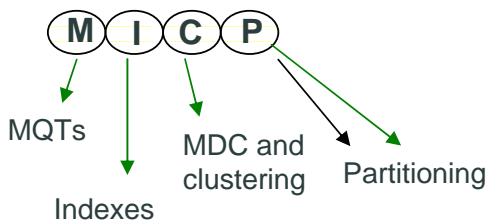
# SMART: AutoConfiguration Advisors & Wizards



## Ottimizzazione automatica della configurazione



```
db2adviz -d <DB name> -i  
<workloadfile>  
-m MICP
```



**Configure Performance Wizard**

**Review the performance configuration recommendations.**

Based on your selections in this wizard, as well as the volume of data in the database, and system information, this wizard recommends the following values. Below the list, specify if you want to save the new values to a script, or apply them to the database immediately.

Parameter	Current value	Suggested value	DB2 Parameter
Application control heap size	128	128	app_ctl_heap_sz
Buffer pool size	250	35956	bufilepage
Catalog cache size	32	262	catalogcache_sz
Changed pages threshold	60	60	chnpggs_thresh
Database heap size	600	912	dbheap
Default degree	1	1	dft_degree
Default prefetch size	16	32	dft_prefetch_sz
Maximum storage for lock list	50	329	locklist
Log buffer size	8	32	logbufsz
Log file size	250	250	logfilsiz
Number of primary log files	3	6	logprimary
Number of secondary log files	2	10	logsecond
Maximum number of active applications	40	84	maxappls
Maximum locks per application	22	13	maxlocks

Apply these recommendations immediately  
 Save these recommendations to the Script Center

Script name:   
Script description: Configure Performance wizard recommendations

Back Finish Cancel

# SMART: Self monitor/Self Healing



- Controllo dello “stato di salute”
- Definizione di soglie allarme/attenzione
- Notifiche
- Innesco automatico di azioni

Data Element	Value	Category
ARTISAN SALES		
Alarm		
Database-wide Shared Sort Memory Utilization	95	Sorting

All Alerts  
Choose instance > Home > Current Alerts

Sort by: Timestamp | Alert Type

Alert Type: ALARM  
Health Indicator: Database-wide shared sort memory utilization  
Time stamp: 7/17/2001 08:00

Alert Type: WARNING  
Health Indicator: Container\_One\_short\_of\_space  
Time stamp: 7/17/2001 08:00

Alert Type	Health Indicator	Value	Category	Object Name	Partition	Object Type	Time Stamp
Alarm	Database-wide shared sort memory utilization	89%	Memory	Matrix.Artisan	0	Database	7/17/2001 08:00
Alarm	Container_One is nearing out of space	96%	File	Matrix.Artisan	0	Database	7/17/2001 08:00
Warning	Container_One is nearing out of space	92%	File	Matrix.Artisan	0	Database	7/17/2001 08:00

```
(horman@healthy) /home/horman $ db2 get health snapshot for DBM

Database Manager Health Snapshot

Node type                = Database Server with local clients
Instance name            = horman
Snapshot timestamp       = 03-27-2002 13:24:51.799180

Database Manager Health Indicators:

Health Indicator ID      = 2 (db2.sort_privmem_util)
Value                    = 86
Evaluation timestamp     = 03-27-2002 13:20:07.910561
Alert state              = warning
```

# SMART – what do we get?



## SMART



**+ PRESTAZIONI 360°**

**+ DISPONIBILITA'**: maintenance 'alleggerita'  
per tempi ed invasività

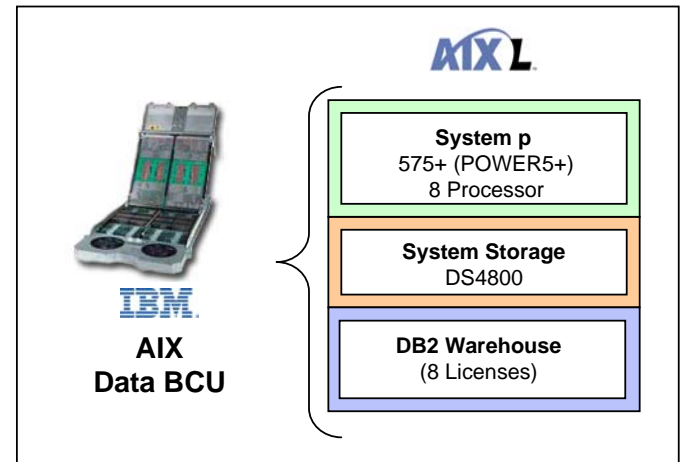
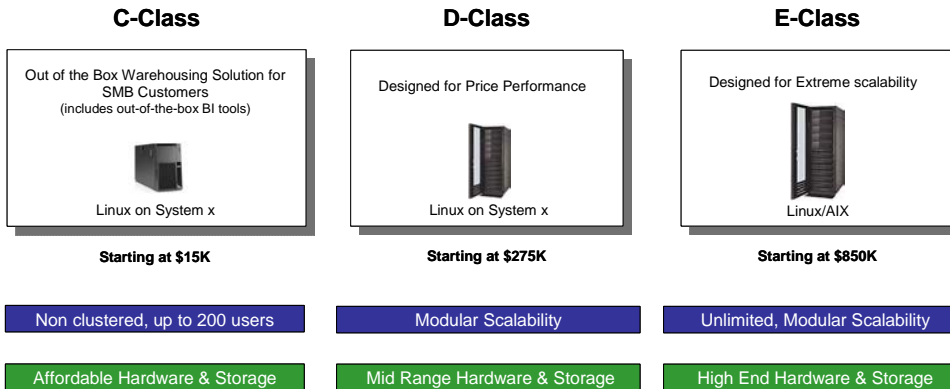
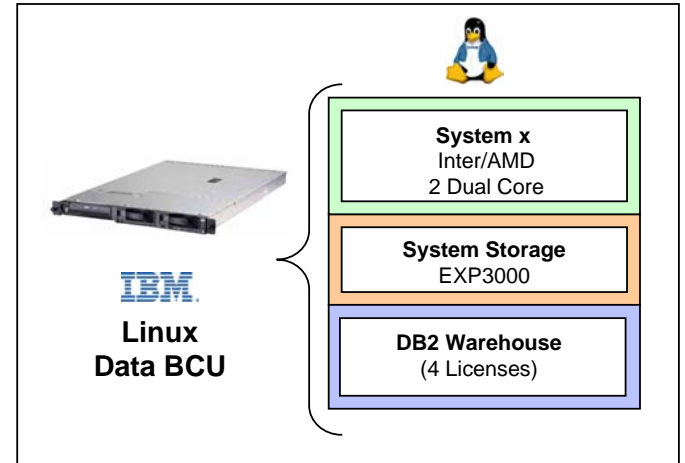
**+ COST EFFECTIVENESS:**

- migliore uso delle risorse
- alleggerimento compiti DBA

# DB2 Balanced Configuration Unit



- I concetti dell'approccio "appliance" – ma con componenti standard
- Balanced performance
- Price/performance
- Scalabilità
- High availability



# BCU – corredo software: DB2 Warehouse



**Admin Console (Web/JSF)**

**Design Studio (Eclipse)**

**Data  
Modeling**

**SQL  
Warehousing**

**Mining**

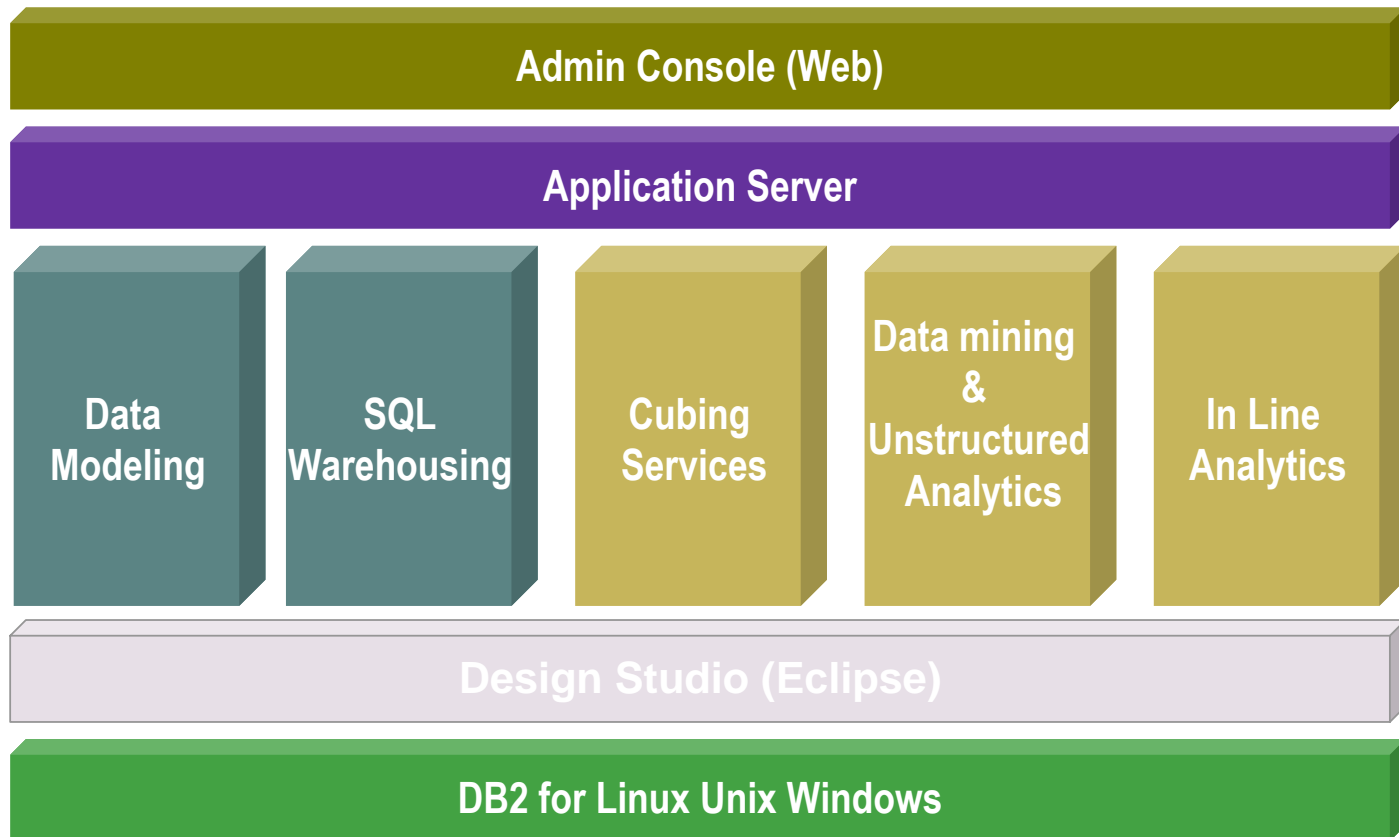
**OLAP  
Cubing  
Services**

**In Line  
Analytics**

**BI Infrastructure (Websphere App Server)**

**DB2 9 for Linux, Unix and Windows**

# BCU – corredo software: IBM DB2 Warehouse 9.5



# DB2 Warehouse - Integrated tooling



## DWE Design Studio

The screenshot shows the DWE Design Studio interface. On the left, there is a Navigator pane with a tree view of the project structure. The main workspace displays a data flow diagram with nodes for 'Table Source', 'Order By', 'Distinct', 'Where Condition', and 'Fact Key Replace'. A SQL script is visible in the right-hand pane, containing the following code:

```
CODE_UNIT.SQLSCRIPT
($$RESOURCE = $(grpl/sql1db1)

SET CURRENT SCHEMA=$(grpl/sql1db1)*;

DECLARE GLOBAL TEMPORARY TABLE INPUT_02SCD_TEMP_02
INSERT INTO SESSION.INPUT_02SCD_TEMP_02 (SELECT
DELETE FROM INPUT_02 WHERE NOT EXISTS (SELECT
UPDATE HULLIAG.SCD_FACT_SET (AMT) = (SELECT I
UPDATE HULLIAG.SCD_FACT_SET (AMT, FSK2, SERVE
TRUSPT, INPA, WITTI1A, RPA, PLPT, SMP, FSKP)
```

## Web-Based Runtime Administration Console

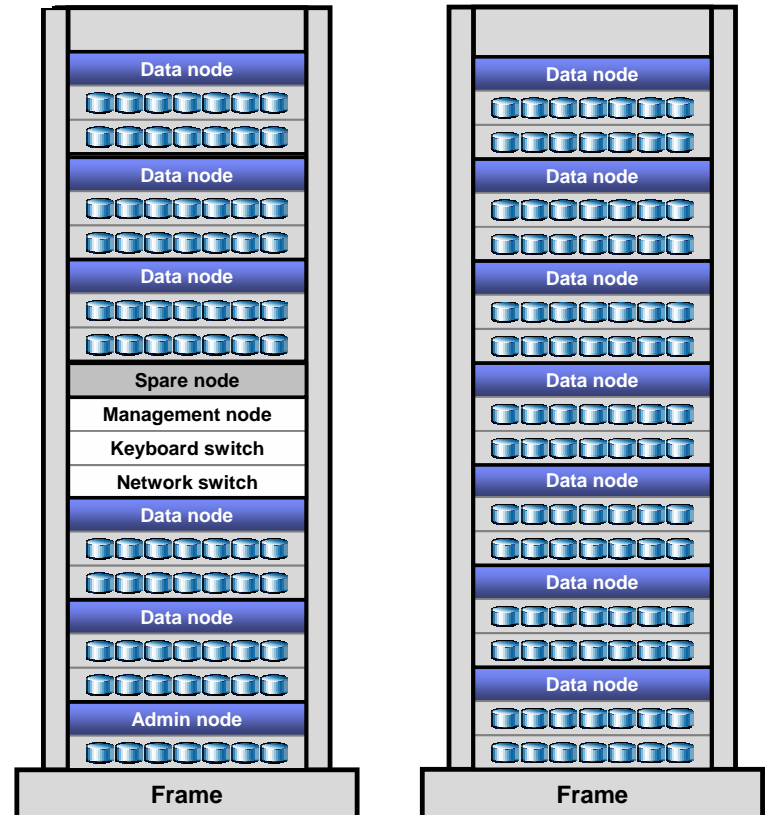
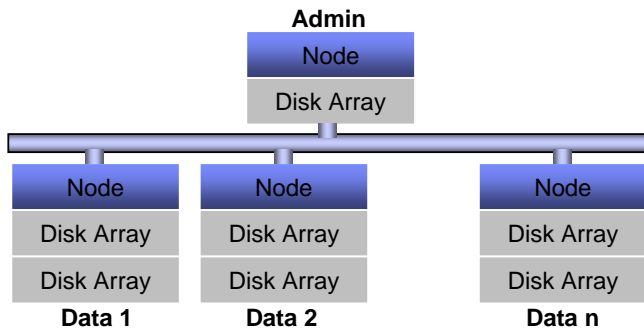
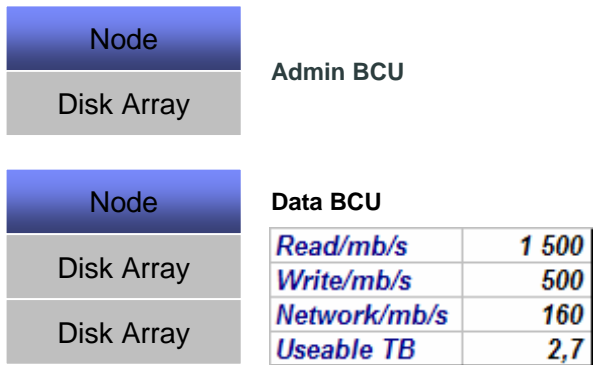
The screenshot shows the DWE Administrative Console web interface. The page title is 'DWE Administrative Console - Microsoft Internet Explorer'. The main content area displays 'Process Instances' with a list of 23 rows. The table below shows the details of these instances:

Select	Instance Name	State	Time Finished	Process Name	Application	Description
<input type="checkbox"/>	test500111	Finished	Tue, Sep 20 2005 14:51:43 CDT	simple2	sept02_sept02sbp	
<input type="checkbox"/>	act510r111	Finished	Tue, Sep 20 2005 12:15:09 CDT	simple2	sept02_sept02sbp	
<input type="checkbox"/>	test1r0w11	Finished	Tue, Sep 20 2005 10:34:26 CDT	simple2	sept02_sept02sbp	
<input type="checkbox"/>	test112	Finished	Sun, Sep 18 2005 01:11:10 CDT	simple2	sept02_sept02sbp	
<input type="checkbox"/>	simple21127020705452	Finished	Sun, Sep 18 2005 00:18:27 CDT	simple2	sept02_sept02sbp	
<input type="checkbox"/>	simple21127020405453	Finished	Sun, Sep 18 2005 00:13:27 CDT	simple2	sept02_sept02sbp	
<input type="checkbox"/>	simple21127020105291	Finished	Sun, Sep 18 2005 00:08:28 CDT	simple2	sept02_sept02sbp	
<input type="checkbox"/>	simple21127019805628	Finished	Sun, Sep 18 2005 00:03:29 CDT	simple2	sept02_sept02sbp	
<input type="checkbox"/>	simple21126995000281	Finished	Sat, Sep 17 2005 17:10:03 CDT	simple2	sept02_sept02sbp	
<input type="checkbox"/>	simple21126994820244	Finished	Sat, Sep 17 2005 17:07:03 CDT	simple2	sept02_sept02sbp	

# Packaging & scalability – D5000 Example

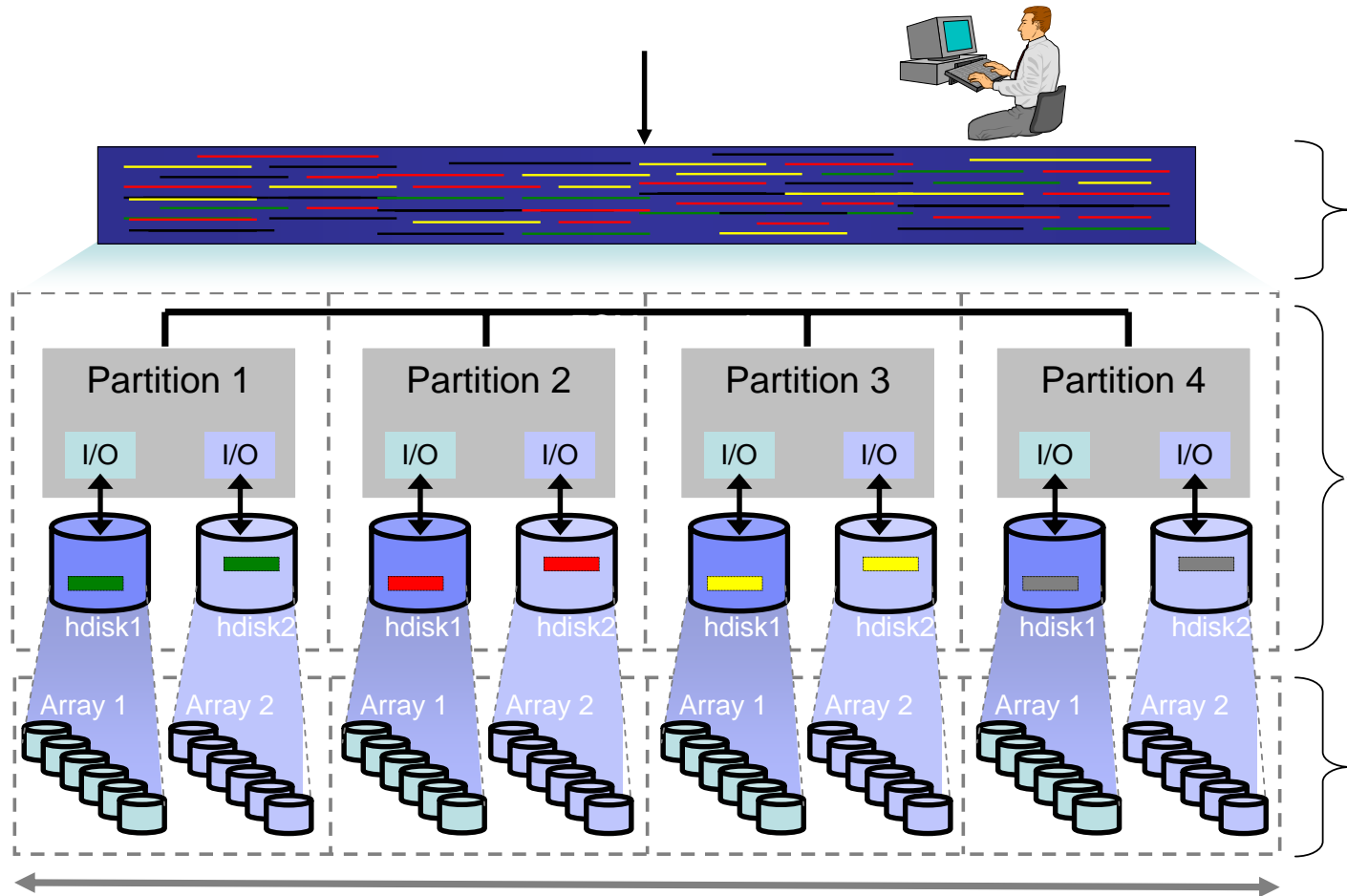


34TB – 17,0GB/s





# DB2 BCU – I/O Parallelism



# BCU – what do we get?



## BCU



**+ PRESTAZIONI 360°**

**+ DISPONIBILITA'**: maintenance 'alleggerita'  
per tempi ed invasività

**+ COST EFFECTIVENESS:**

- gestione "appliance-like"
- componenti tipo commodity
- scalabilità lineare
- suite prodotti SW end-to-end per BI

# Links

<http://www-306.ibm.com/software/data/businessintelligence/>

<http://www.redbooks.ibm.com>

<http://www.ibm.com.developerworks>

**Create Web services for real-time scoring using DB2 Warehouse V9.5**

IBM Business Intelligence

Unlock the business value of information

**THE BALANCED WAREHOUSE**  
Go Beyond Simple Query and Reporting

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API that can be used in custom Java OWE Design Studio to seamlessly ... Intelligence Reporting Tool with IBM's DB2 Data Warehouse Edition, ... DB2 Data Warehouse Edition.

Warehouse Edition, Part 3: 27 Sep 2007

ool for report generation, is very ... to generate reports based on pointing Tool with DB2 Data with IBM's DB2 Data Warehouse Edition DB2 Data Warehouse

(V9.5) migration tool 15 Jan 2008

API that can be used in custom Java OWE Design Studio to seamlessly ... version, The ... on January ... use the migration tool

**Leveraging DB2 Data Warehouse Edition for Business Intelligence**

IBM Business Intelligence

Unlock the business value of information

**THE BALANCED WAREHOUSE**  
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**IBM Redbooks Search**

Search results for: **DB2 AND warehouse**

61 results found in Redbooks, Redpapers, Drafts and Technotes

To learn more about Redbooks and Redpapers, click here.

1. **DB2 Warehouse Management, High Availability and Problem Determination Guide**, SG24-6844-00 Redbooks, published 22 March 2002, Rating: **\*\*\*\*\*** (based on 1 review)
2. **Leveraging DB2 Data Warehouse Edition for Business Intelligence**, SG24-7374-00 Redbooks, published 29 November 2006, last updated 10 September 2007, Rating: **\*\*\*\*\*** (based on 3 reviews)
3. **Building and Expanding SAP Business Information Warehouse on DB2 UDB EEE**, SG24-7094-00 Redbooks, published 29 June 2004, last updated 29 October 2004, Rating: **\*\*\*\*\*** (based on 5 reviews)
4. **Migrating to DB2 UDB Version 9.5 in a Virtual Warehouse Environment**, SG24-6107-00 Redbooks, published 2 August 2000, Rating: **\*\*\*\*\*** (based on 1 review)
5. **Using the Web Connector with DB2 Warehouse Manager V7.3**, TIPS0007 Technote, published 25 June 2002
6. **Dynamic Warehouse Data Marts Made Easy**, SG24-7418-00 Redbooks, published 6 September 2007, Rating: **\*\*\*\*\*** (based on 4 reviews)
7. **Building the Operational Data Store on DB2 UDB Using IBM Data Replication, WebSphere MQ Family, and Data Warehouse Manager**, SG24-4813-00 Redbooks, published 19 December 2001, Rating: **\*\*\*\*\*** (based on 2 reviews)
8. **Business Intelligence Front-End Tool Access to OS/390 Data Warehouse**, SG24-5688-00 Redbooks, published 31 May 2001
9. **Configuring the Web Connector with DB2 Warehouse Manager**, TIPS0002 Technote, published 25 June 2002



# Thank YOU

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*Milano, 15 aprile 2008*

