

DB2 BLU Acceleration for SAP

Kyösti Laiho, IBM



SAP's Announcement to Partners & Customers

...

Open Choice and Full Support to Customers
 SAP remains committed to support its customers' choice of database technologies and vendors. SAP will continue to provide innovation for all databases supported and work with its database partners to support these innovations, which may include in-memory optimizations.

...

Taken from SAP Corporate Newsroom on January 10th, 2013
www.sap.com/corporate-en/news.epx?articleID=20221

<p>Hasso Plattner SAP founder</p>	<p>"...Thanks to the power of SQL we have only one version going forward. [...] We do not abandon - and that's very important – we do not abandon with this release the current database vendors. [...] Customers have the choice. [...]</p> <p>There are some features in the other databases missing. We will tell the database manufacturers what these features are, and if they can develop them we will also support them. If we don't have a certain functionality we simply keep for the traditional databases the current code. [...] So the customer has the choice..."</p>
<p>Vishal Sikka SAP CTO</p>	<p>"...as Hasso said, the Business Suite continues to run on all the databases it has run on. Not only continues to run. All the optimizations that we are doing because of the power of HANA we are also working with all our database partners to bring the same optimizations using their database technology as well. So this benefit comes not only because of HANA, it comes to everybody. And the choice is there for everyone..."</p>



1000+ SAP customers selected to DB2



You're in safe hands



Colgate World of Care



Driven by performance

Dansk Supermarked



SGL GROUP THE CARBON COMPANY

SCHAEFFLER GROUP



DB2 for SAP Suomessa



Lemminkäinen



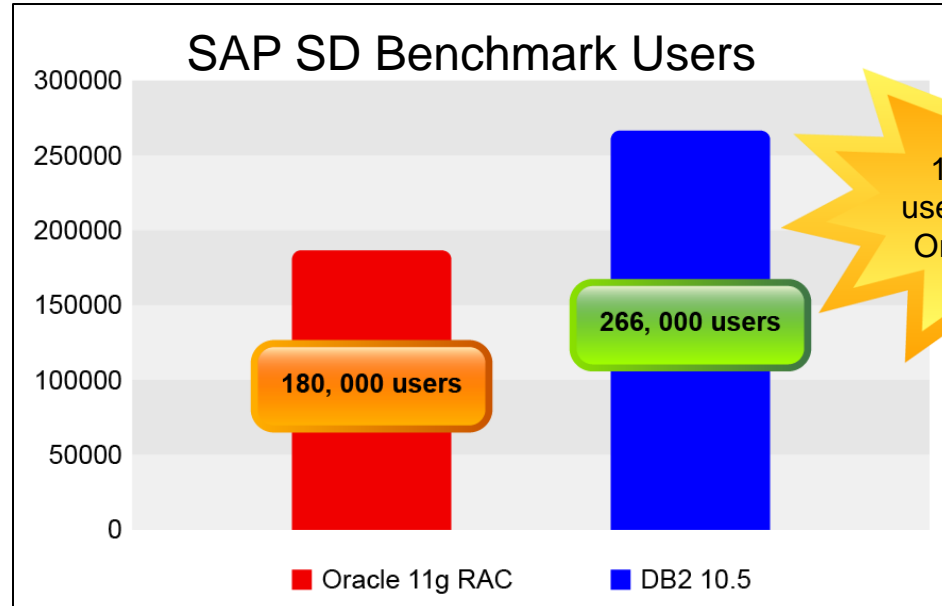
IBM achieves new WORLD RECORD on three-tier SAP® Sales and Distribution (SD) standard application benchmark with record 266,000 SAP SD users; reaching 1,471,680 SAPS¹



Featuring 64-core IBM Power® 780 AIX® 7.1 & DB2® 10.5



DB2 on Power has held the leadership result for the highest number of SAP SD users on the three-tier SAP SD standard application benchmark for over 7 years²



DB2®

- 1) Results of DB2® 10.5 on IBM Power 780 on the three-tier SAP SD standard application benchmark on SAP enhancement package 5 for SAP ERP 6.0, achieved 266,000 SAP SD benchmark users, certification # 2013010. Configuration: 8 processors / 64 cores / 256 threads, POWER7+ 3.72 GHz, 512 GB memory, running AIX 7.1
- 2) Results of Oracle 11g Real Application Clusters (RAC) on SAP sales and distribution-parallel standard application benchmark running the SAP enhancement package 4 for SAP ERP 6.0, achieved 180,000 SAP SD benchmark users, certification # 2011037. Configuration: 8 x Sun Fire X4800 M2 each with 8 processors / 80 cores / 160 threads, Intel Xeon Processor E7-8870, 2.40 GHz, 8 x 512 GB memory, running Solaris 10

Source: <http://www.sap.com/benchmark>

SAP, R/3 and all SAP logos are trademarks or registered trademarks of SAP AG in Germany and several other countries.

All other trademarks are the property of their respective owners.

Database Cumulative/Bundle-Patches

Database	# Cumulative Patches*	# Months
DB2 8	18	113
DB2 9.1	11	70
DB2 9.5	9	53
DB2 9.7	5	33
SQL2008R2	25	26
Oracle 10.2g	213	68
Oracle 11.2g	181	26

Status: 10th June 2012

Source: SAP hint 101809, 1137346, <http://support.microsoft.com>, <http://blogs.msdn.com/b/sqlreleaseservices>
 SAP Marketplace → Downloads → Database Patches

* Cumulative/bundle patches consist of a group of patches collected in a single patchset. Security and hot fixes not included

Remark: Oracle 10.2g patches with status by November 2011. Oracle 10.2g out of standard support since 31st July 2011



What is DB2 with BLU Acceleration?

New technology for analytic queries in DB2 LUW

New unique runtime technology which leverages the CPU architecture and is **built directly into the DB2 kernel**

DB2 column-organized tables add columnar capabilities to DB2 databases

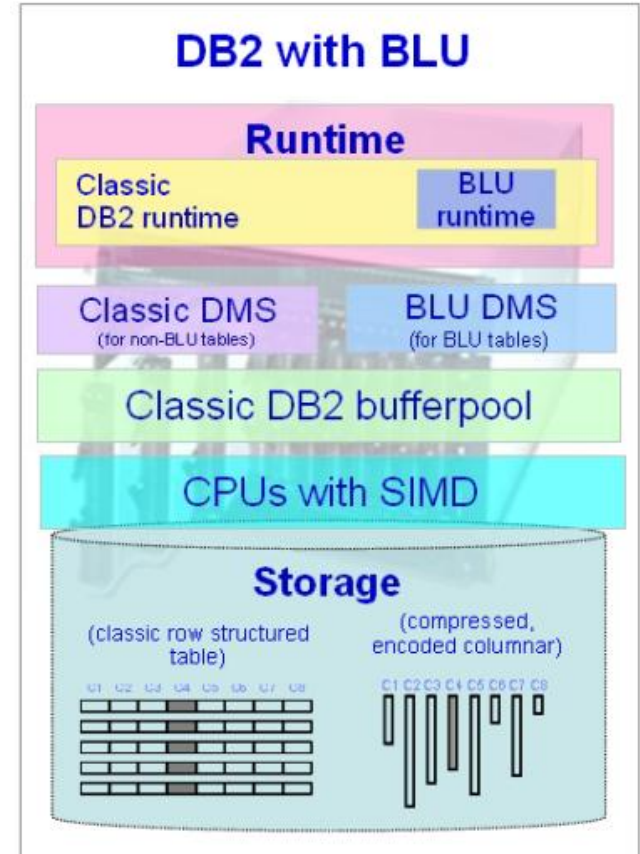
Table data is stored column organized rather than row organized

Using a vector processing engine

Using this table format with star schema data marts provides **significant improvements to storage, query performance, ease of use, and time-to-value**

New unique encoding for **speed and compression**

This new capability is both main-memory optimized, CPU optimized, and I/O optimized



Why is BLU Acceleration Different - Technology

Dynamic In-Memory

In-memory columnar processing with dynamic movement of data from storage



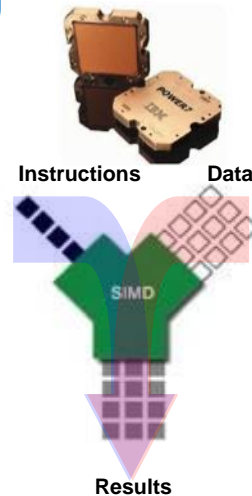
Actionable Compression

Patented compression technique that preserves order so data can be used without decompressing



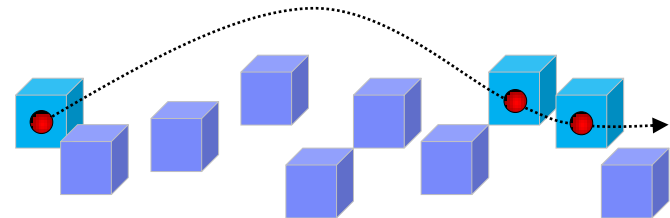
Parallel Vector Processing

Multi-core and SIMD parallelism (Single Instruction Multiple Data)



Data Skipping

Skips unnecessary processing of irrelevant data



Super Fast, Super Easy — Create, Load and Go!

No Indexes, No Aggregates, No Tuning, No SQL changes, No schema changes

Unlimited Concurrency with “Automatic WLM”

DB2 10.5 BLU has built-in and automated query resource consumption control

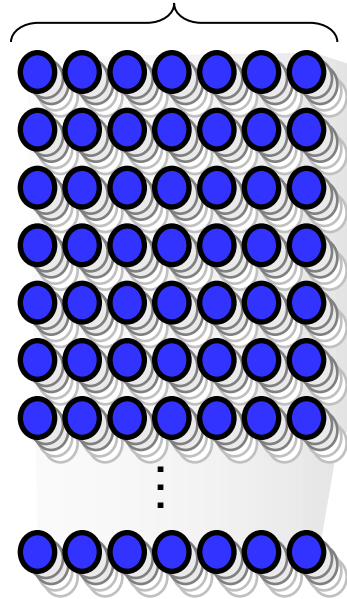
Every additional query that runs naturally consumes more memory, locks, CPU, and memory bandwidth. In other database products more queries means more contention

DB2 10.5 BLU automatically allows a high level of concurrent queries to be submitted, but limits the number that consume resources at any point in time

Enabled automatically when `DB2_WORKLOAD=ANALYTICS`

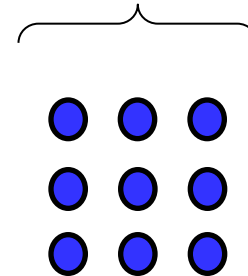
Applications and Users

Up to tens of thousands of SQL queries at once



DB2 DBMS kernel

Moderate number of queries consume resources



Planned DB2 10.5 BLU Support for SAP BW and Near-Line Storage

Support of SAP NetWeaver BW 7.00 and higher

SAP BW support starting with DB2 10.1 FP1

Planned SAP certification for DB2 10.1 FP1: September 2013

Delivery of DB2 10.5 BLU extensions is planned with latest SAP BW support packages with planned SAP BW release dates in September 2013 dependent on SAP BW release

Support of DB2 specific Near-Line Storage (NLS) Solution in SAP BW support packages (same as SAP BW) starting with SAP NetWeaver BW 7.01.

In addition the NLS extensions will be available as code corrections for all SAP BW support packages, which includes the DB2 NLS solution (starting with SAP BW 7.01 SP 6)



Planned BW Support on DB2 10.5 BLU – Implementation (1)

Planned support of BW objects on DB2 BLU with initial SAP delivery (September 2013) based on DB2 10.5 FP1

Standard InfoCube *

Non-Cumulative InfoCube

Planned support of BW objects on DB2 BLU in a second phase

Standard DSO *

Direct Update DSO

Write-Optimized DSO

Master Data *

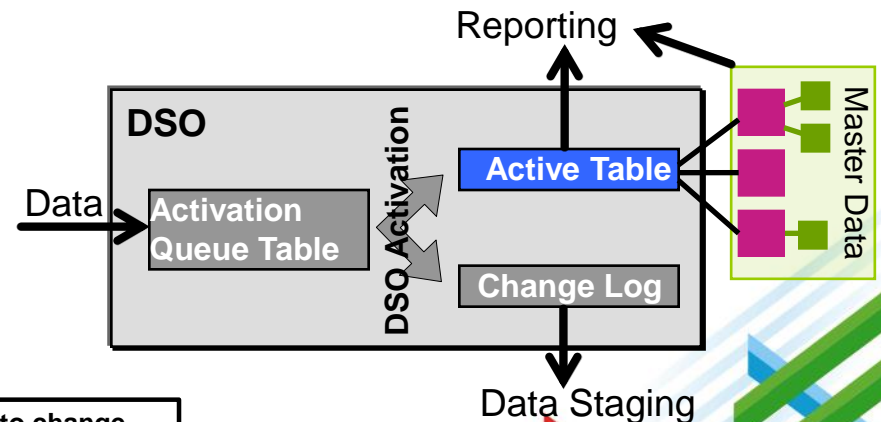
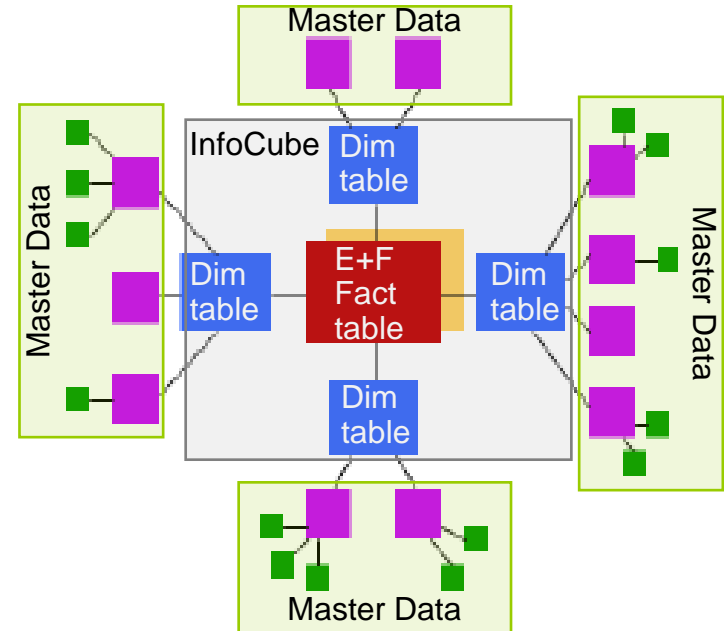
InfoSet

Transactional InfoCube

Flat InfoCube

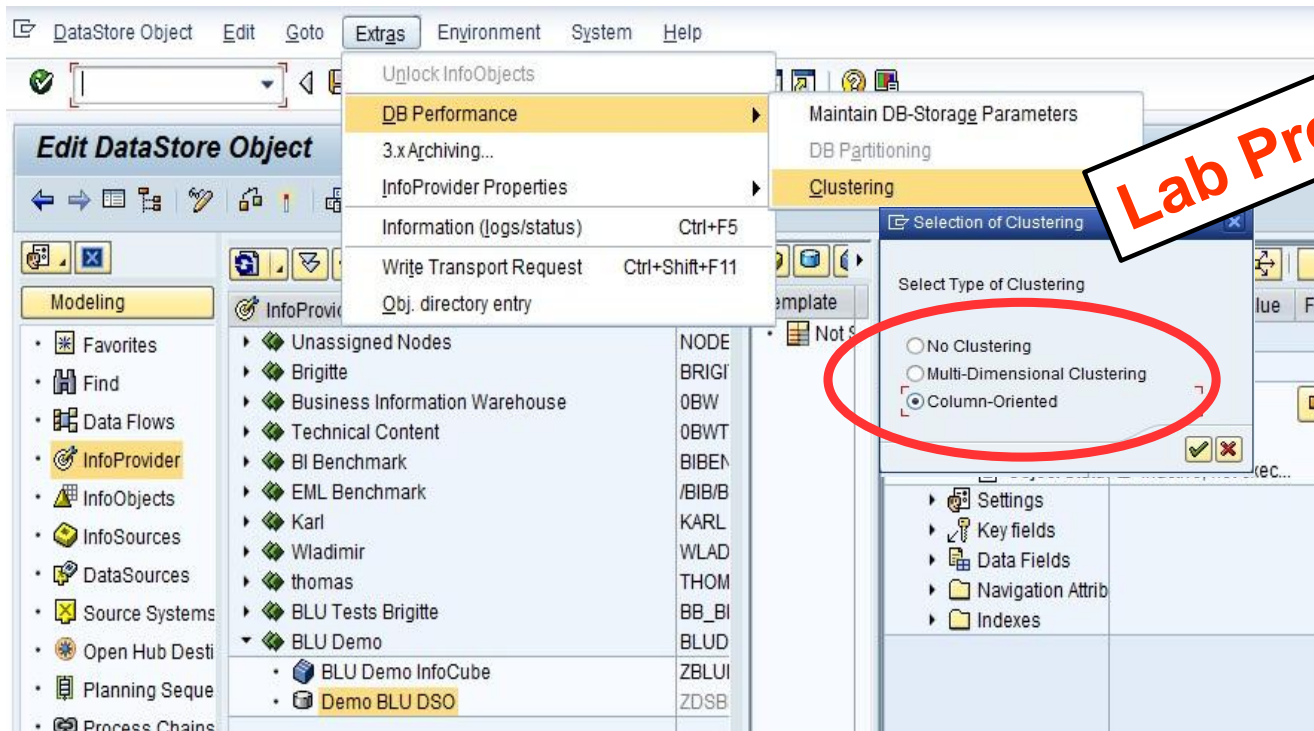
Persistent Staging Area (PSA)

Note: * most important BW objects



Planned BW Support on DB2 10.5 BLU – Implementation (2)

Selection of DB2 BLU for the implementation of InfoCubes and DSOs in the DB2 database via the „Clustering“ dialog in the SAP BW Data Warehousing Workbench



Existing InfoCubes and DSOs together with the used InfoObjects can be converted to DB2 BLU with the new report SAP_CDE_CONVERSION_DB6

Selection of InfoCubes and DSO tables together with the used master data tables for conversion to DB2 BLU

The report creates DB6CONV conversion jobs for the tables to be converted to DB2 BLU tables

DB6CONV converts the row-based tables to BLU tables online using ADMIN_MOVE_TABLE



BW Support on DB2 10.5 BLU – BW Query Performance

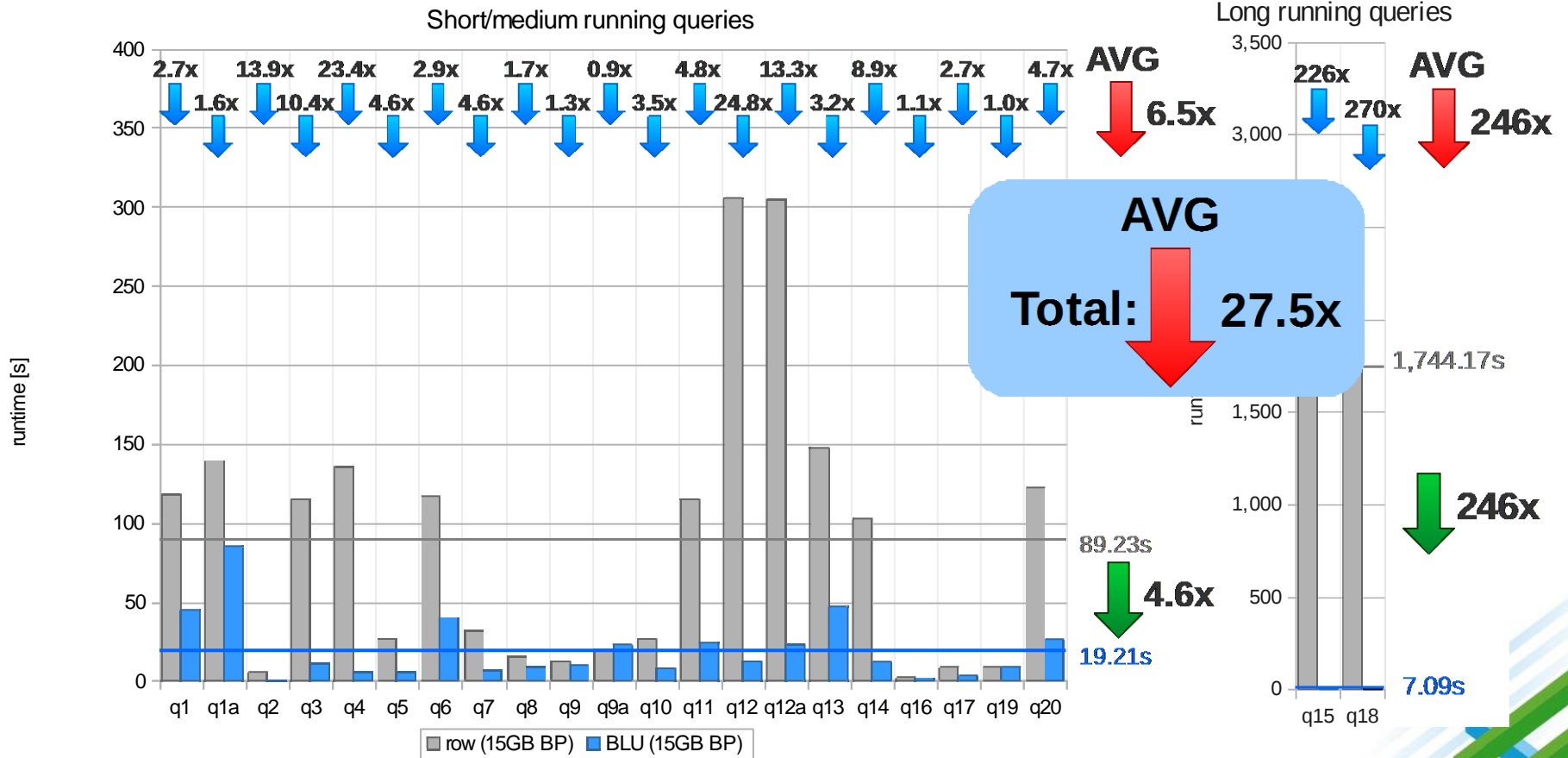


BW InfoCube scenario

- Fact table with 438 Million records
- Size (table + indexes)
 - Row based (adaptive compr.): 33 GByte
 - BLU: 12 GByte
- DB2 parallel query degree switched ON

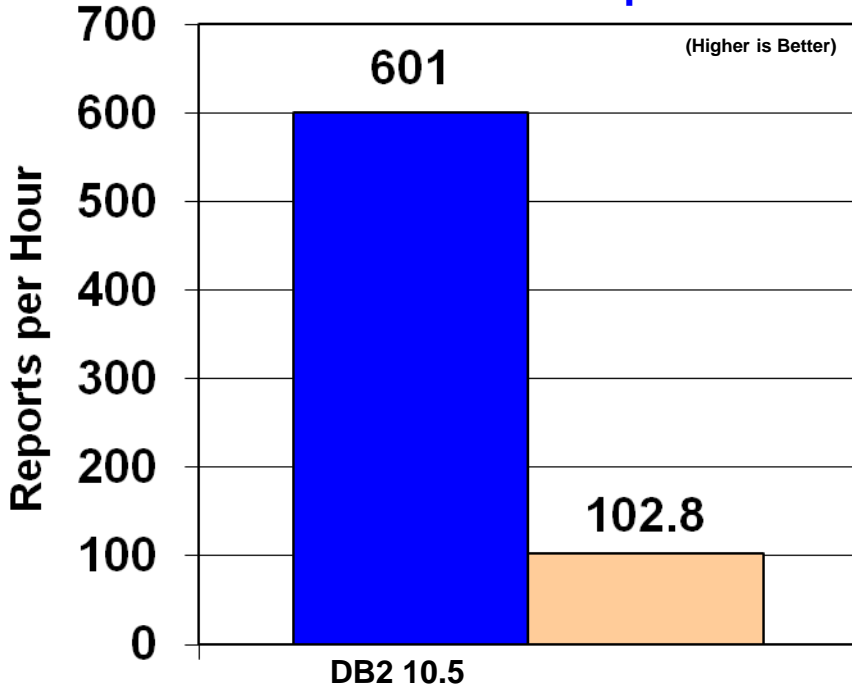
Test environment

- 2 Intel® Xeon® processors (8 cores in total), 2.14GHz
- 32 GB RAM
- SUSE Linux Enterprise Server V11
- SAP BW 7.30
- DB2 10.5 pre GA, 15 GB Bufferpool

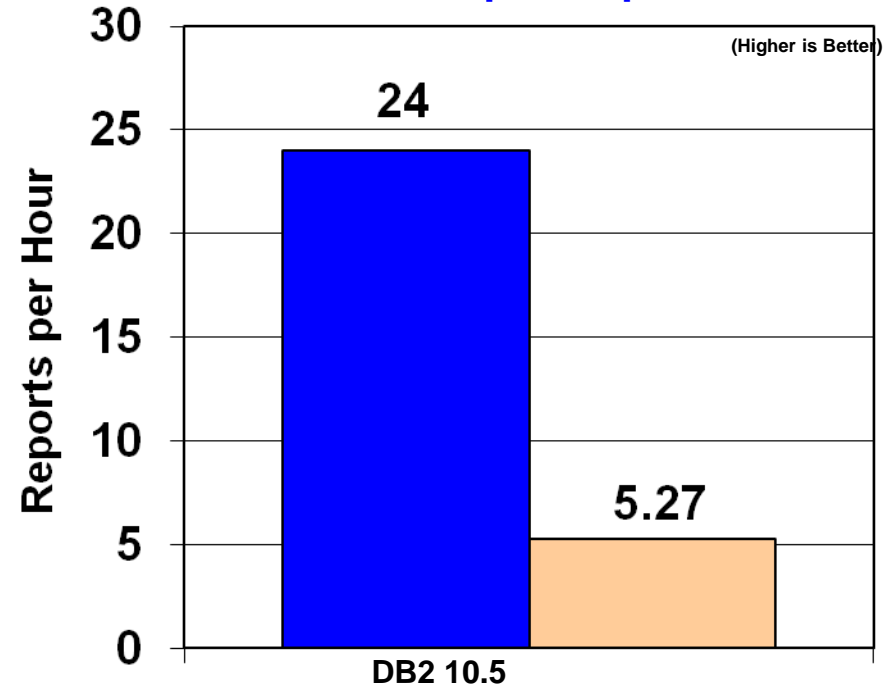



BLU Acceleration On Power vs. In Memory DB Vendor Deep Analytics Throughput (23 Users)

5.8x Faster
Intermediate reports



4.6x Faster
Complex reports

32 POWER 7+ cores
72GB RAM Used ■
All HDD storage
DB2 10.5, AIX 7.1 TL2

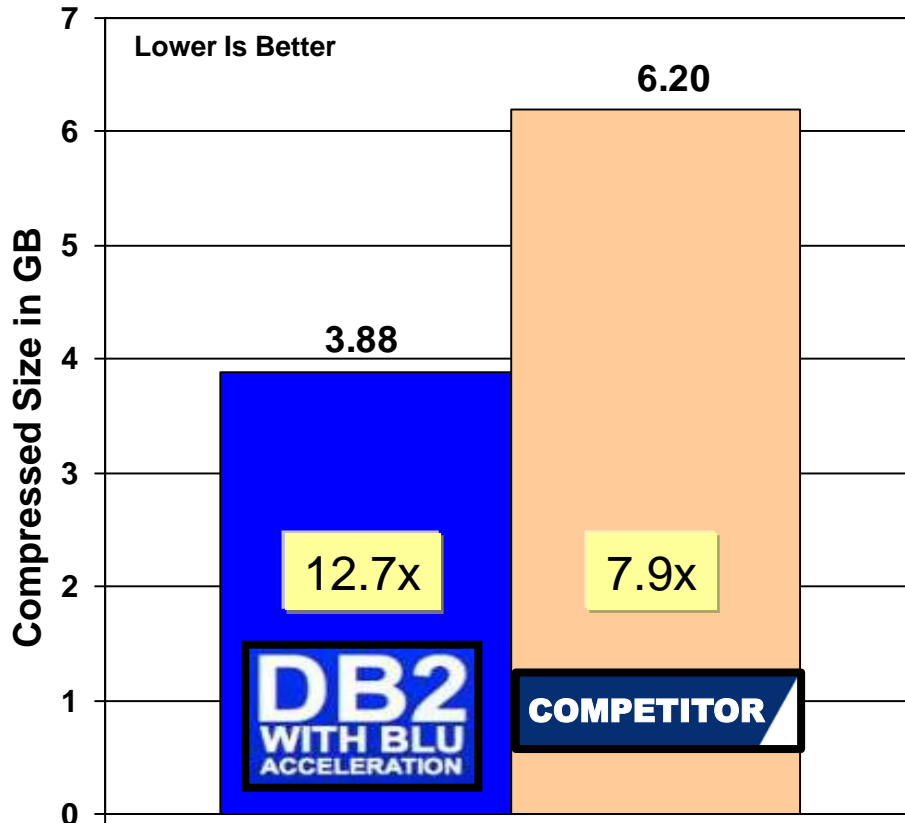
Identical workloads
220GB raw fact size



40 Intel Westmere cores
512GB RAM ■
8x900 HDDs
1.2TB SSD

COMPETITOR

BLU Acceleration Compresses Data 37% Better than **COMPETITOR** on SAP BW Data



- **Compression results (on disk) from Fact table in the star schema**
 - ~50 GB of data
 - 146 million rows in the fact table



DB2 BLU Acceleration Beats In-Memory **COMPETITOR** using Like Hardware for SAP BW Workload

DB2 10.5 with BLU Acceleration

40 Intel Westmere cores
512GB RAM
4x900 HDDs



✓ **10x** Faster for small queries

✓ **8x** Faster for large queries

~50 GB SAP BW Workload

0.9 sec Average Response Time
Small Result Set Queries

2.9 sec Average Response Time
Large Result Set Queries

In-memory Database **COMPETITOR**

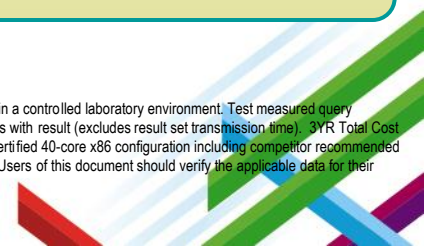
40 Intel Westmere cores
512GB RAM
8x900 HDDs
1.2TB SSD



9.5 sec Average Response Time
Small Result Set Queries

23.5 sec Average Response Time
Large Result Set Queries

Based on IBM internal tests comparing IBM BLU Acceleration system with a comparably priced, comparably tuned competitor configuration (version available as of 08/01/2013) executing a materially identical 50GB SAP Business Warehouse query set in a controlled laboratory environment. Test measured query response times of 15 small (1 – 1200 row results set) and 8 large (>100,000 row results set) queries. Results show average response times for queries in each category. Response time defined as from when client submits query to when server responds with result (excludes result set transmission time). 3YR Total Cost of Acquisition (TCA) based on publicly available U.S. prices current as of August 1, 2013, including hardware, software, and maintenance. Compared prices exclude applicable taxes, and are subject to change without notice. Competitor configuration: certified 40-core x86 configuration including competitor recommended software options and features. IBM configuration: System x3850 40-core 512GB RAM, DB2 v10.5. Results may not be typical and will vary based on actual workload, configuration, applications, queries and other variables in a production environment. Users of this document should verify the applicable data for their specific environment.



BLU PoC for Customer Fossil

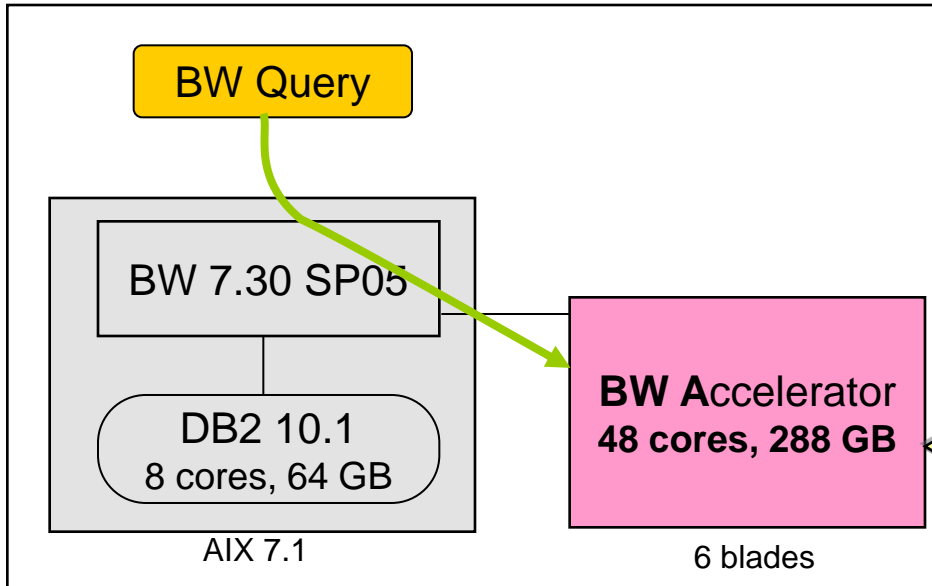


***Fossil:** Global retailer specializing in the design, innovation, and marketing of fashion lifestyle and accessory products with headquarters in Dallas (U.S.).*

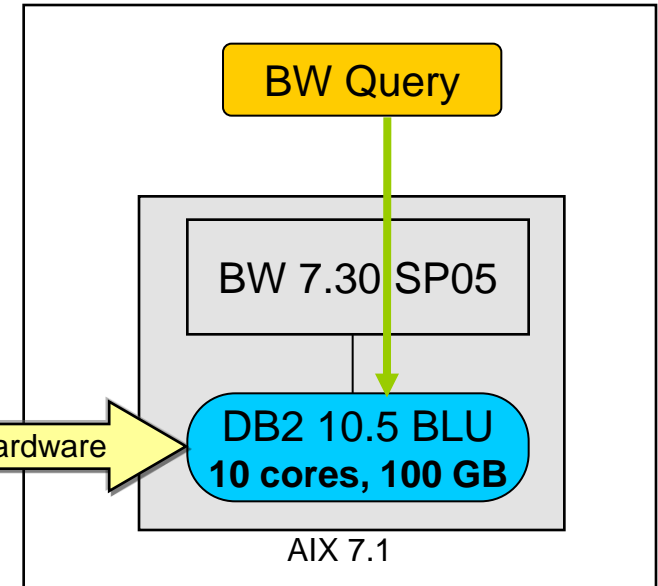


BLU PoC for Fossil - Test Environment

Production System (for SAP BWA Tests)



Test System (for DB2 BLU Tests)



- ⇒ DB2 BLU uses ~5 x less cores than SAP BWA
- ⇒ DB2 BLU uses ~3 x less memory than SAP BWA
- ⇒ SAP BWA was used in production (no isolated test environment)



Performance Test Results

SAP BW Reports on MultiProviders (multiple concurrent SQL statements per BW Report)	Isolated Test Environment, Hot Run				Production Environment, Hot Run			
	DB2 row-based (BR9) INTRA_PARALLEL=YES, no DB2 Compression		DB2 columnar (BR9)		DB2 row-based (BRP) INTRA_PARALLEL=YES, without DB2 Compression		SAP BWA	
	OLAP	DB	OLAP	DB	OLAP	DB	OLAP	DB
1 YRPA_MC03_QR110_S	9,8	42,4	10,0	4,8	9,3	671,0	10,1	3,7
2 ZRPA_MC13_QR01_V4	2,5	5,1	2,1	4,4	1,5	96,4	2,0	8,0
3 ZRPA_MC03_QR16_TRAFFIC_70	1,3	0,8	1,0	2,0	0,9	14,2	1,2	0,4
4 ZRPA_MC13_QR01_V3	3,1	266,6	2,0	25,0	2,4	1.318,0	4,1	13,2
5 Y_ZRPA_MC03_QR16_KENJICHAN	3,6	8,1	3,6	3,0	3,4	79,8	3,6	3,1
6 ZRPA_MC03_QR102_1	2,6	2,3	2,2	3,4	2,0	34,3	1,8	2,1
7 ZRPA_MC03_QR16_70	1,3	2,0	1,2	2,0	1,2	50,0	1,0	5,9

BLU is ~factor 10 faster than DB2 for long running Queries

BLU and BWA provide similar Performance*

*No exact apples-to-apples comparison, because BWA used much more hardware and was not tested in isolated environment

Storage Reduction with BLU

- COL_OBJECT_P_SIZE: Table size
- DATA_OBJECT_P_SIZE: Meta data size
- INDEX_OBJECT_P_SIZE: Page map and unique indexes

Tabname	Row-based Tables			Columnar Tables										Row vs. Columnar (Tables + Indexes)	
	NPAGES	NPAGES	% pages saved	NLEAF	SUM (KB)	NPAGES	CARD	PCTPAGE	COL_OBJECT_P_SIZE	DATA_OBJECT_P_SIZE	INDEX_OBJECT_P_SIZE	SUM P_SIZE	% Reduction	% Reduction	
/BIC/FZIM_C01	5.762.494	1.195.676	79	2.504.171	132.266.640	691.855	604.994.123	88	11.074.336	736	13.088	11.088.160	91,6	88,0	
/BIC/FZSD_AUDIT	4.580.203	676.718	85	2.507.811	113.408.224	338.937	275.772.979	93	5.424.032	512	6.464	5.431.008	95,2	92,6	
/BIC/FZPOSC01	789.288	396.559	50	483.906	20.371.104	205.832	150.479.991	93	3.294.080	224	3.968	3.298.272	83,8	73,9	
/BIO/FORT_C05	3.771.965	304.498	92	750.557	72.360.352	201.545	101.827.916	95	3.225.504	736	3.904	3.230.144	95,5	94,6	
/BIC/FZSAUDIT	2.458.526	383.581	84	1.594.617	64.850.288	196.979	147.825.337	92	3.154.816	320	3.808	3.158.944	95,1	92,0	
/BIC/FZIM_C03	186.913	42.116	77	83.100	4.320.208	159.762	19.579.664	14	2.557.024	64	3.296	2.560.384	40,7	14,4	
/BIC/FZIM_C02	1.108.128	257.574	77	483.082	25.459.360	144.038	116.308.211	87	2.308.128	512	2.816	2.311.456	90,9	87,0	
/BIO/EORT_C05	2.648.458	222.276	92	733.729	54.114.992	134.891	72.082.443	95	2.159.392	352	2.656	2.162.400	96,0	94,9	
/BIC/EZSAUDIT	1.312.557	200.085	85	1.193.725	40.100.512	100.562	80.974.688	93	1.609.536	192	2.016	1.611.744	96,0	92,3	
/BIO/FOTCT_C02	456.160	151.089	67	750.541	19.307.216	94.727	80.730.162	79	1.506.048	1.120	1.888	1.509.056	92,2	79,3	
/BIC/FZRT_C35	779.640	150.467	81	388.828	18.695.488	93.075	53.888.591	88	1.489.728	640	1.856	1.492.224	92,0	88,0	
/BIC/EZIM_C361	931.003	145.288	84	527.292	23.332.720	85.674	59.123.971	92	1.371.264	640	1.728	1.373.632	94,1	90,8	
/BIO/FORPA_C05	2.688.158	220.134	92	842.498	56.490.496	83.755	104.762.551	97	1.340.576	224	1.696	1.342.496	97,6	96,9	
/BIC/FZSD_C01	664.857	123.436	81	331.562	15.942.704	73.902	63.666.672	89	1.182.816	320	1.504	1.184.640	92,6	88,9	
/BIO/EORT_C36	677.035	117.145	83	428.189	17.683.584	72.221	49.418.422	92	1.156.000	448	1.472	1.157.920	93,5	89,3	
/BIC/FZSD_C02	531.444	122.866	77	293.164	13.193.728	70.559	48.954.141	87	1.129.312	704	1.440	1.131.456	91,4	86,7	
/BIC/FZRT_C02_C	1.211.470	132.715	89	349.272	24.971.872	57.172	33.916.004	95	915.904	384	1.184	917.472	96,3	95,3	
/BIC/FZRT_C40	653.515	112.106	83	293.041	15.144.896	56.958	53.703.754	93	911.744	416	1.184	913.344	94,0	91,3	
/BIC/EZIM_C01	535.958	94.847	82	418.712	15.274.720	48.366	56.275.531	91	774.144	224	2.108.064	2.882.432	81,1	66,4	
/BIO/FORT_C36	540.266	75.584	86	137.367	10.842.128	45.744	28.427.452	92	732.384	480	992	733.856	93,2	91,5	
	32.288.038		81 (Average)		758.131.232							49.491.040	90,1 (Average)	84,7 (Average)	

In this example columnar compression reduced table and index space by **93%** (sum of converted tables)



Thank You !!

Kyosti Laiho
Sales Lead, IBM Databases, Nordics
kyosti.laiho@fi.ibm.com
October, 2013



Planned SAP Adoption for DB2 10.5 FP1 BLU Feature

Supported SAP Applications

SAP NetWeaver BW 7.00 and higher

Support planned to start with DB2 10.5 FP1 (September 2013)

DB2 10.5 BLU extensions are delivered with SAP BW support packages in August/September 2013

Minimum support packages are mandatory

Unicode System mandatory

SAP NW Release	SAP Basis Support Package	SAP BW Support Package
7.00	SP29	SP31
7.01	SP14	SP14
7.02	SP14	SP14
7.11	SP12	SP12
7.30	SP10	SP10
7.31, 7.03	SP09	SP09
7.40	SP04	SP04