IBM Smart Analytics Optimizer for DB2 for z/OS

SHARE - Session 8881

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IBM

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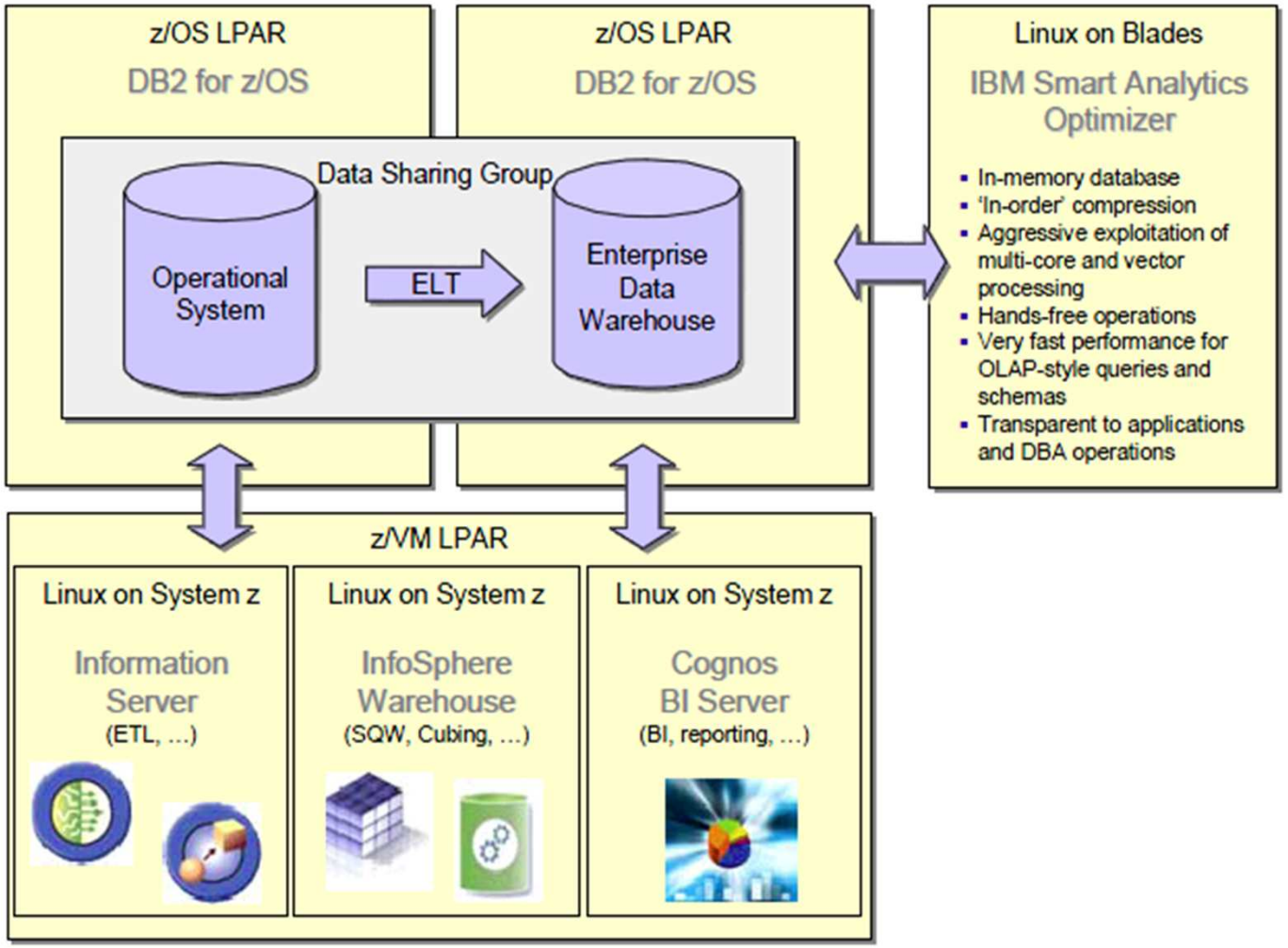
Agenda

- **Smart Analytics Optimizer Overview (quickly)**
  - Product Positioning
  - Components
  - Type of workloads that qualify
  - Offerings
- **Beta Experiences**
  - Test databases
  - Determining if queries ran on the accelerator
  - Query performance
  - DB2 data sharing

Smart Analytics Optimizer for System z

- **An appliance for accelerating certain Data Warehouse and Business Intelligence queries dramatically**
- **Based on the *Blink* project in IBM's Research Division which developed technologies to accelerate processing of long-running online analytical processing (OLAP) queries by orders of magnitude.**
  - Additional details can be found at http://www.almaden.ibm.com/cs/projects/blink/
- **The Smart Analytics Optimizer design point is to execute queries that are typically found in business intelligence (BI) and data warehousing (DW) applications with fast and predictable response time**

Adding the Smart Analytics Optimizer to System z



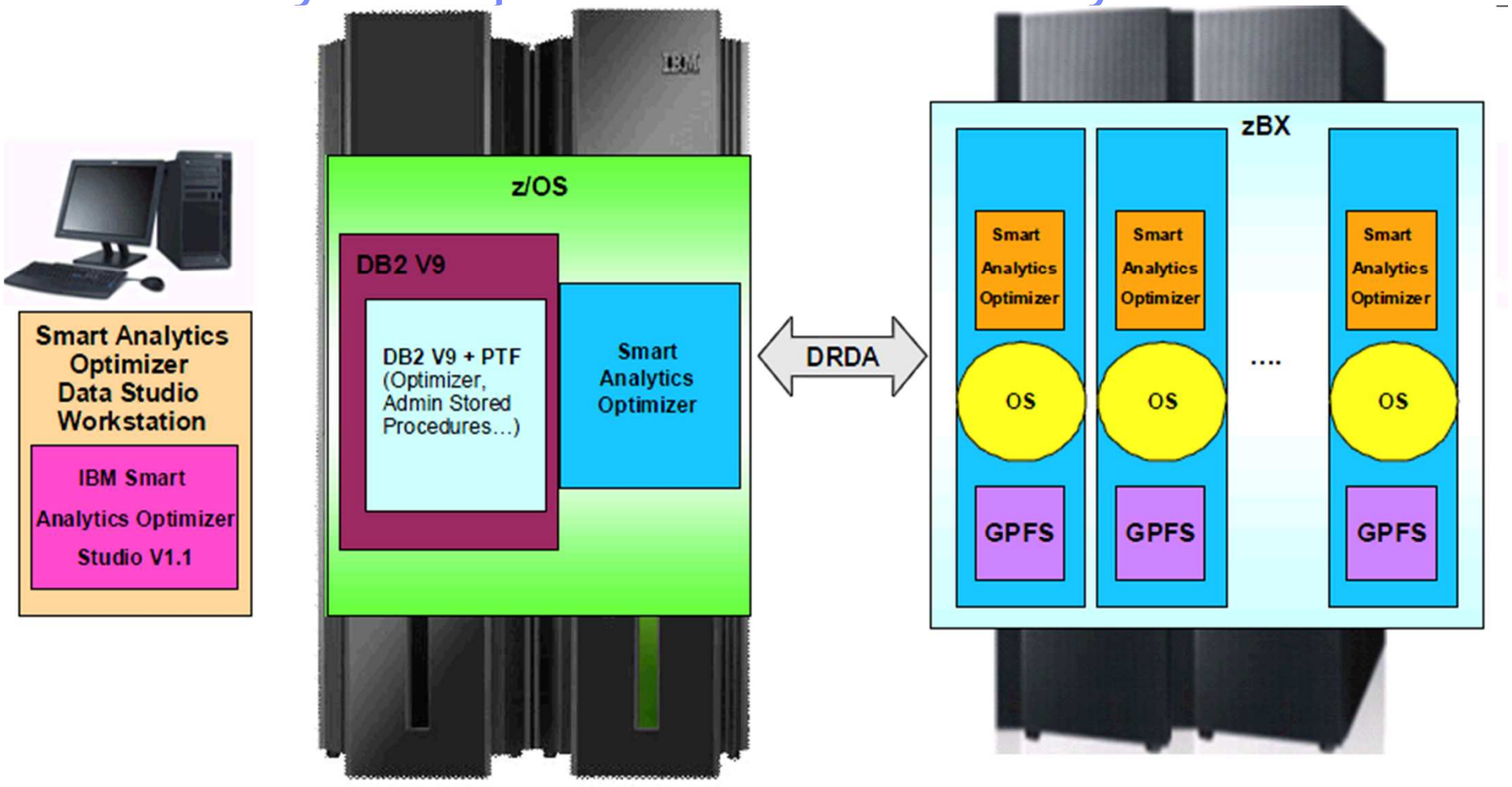
Components of Smart Analytics Optimizer Solution

- **IBM Blade center(s) housed in System z BladeCenter Extension (zBX) frame attached to an IBM zEnterprise server**
  - A closed platform that runs on the blades and includes an operating system and the IBM General Parallel File System V3.x (GPFS™).
- **IBM software with installation features for simple initial deployment assisted by graphical tooling. This software is composed of three parts:**
  - The unique code developed by IBM and named *Smart Analytics Optimizer Application*.
  - DB2 for z/OS Stored Procedures running on DB2 for z/OS V9 or above with PTF maintenance applied
  - *IBM Smart Analytics Optimizer Studio*. This Eclipse-based GUI runs on a workstation attached to System z and connected to DB2 for z/OS.

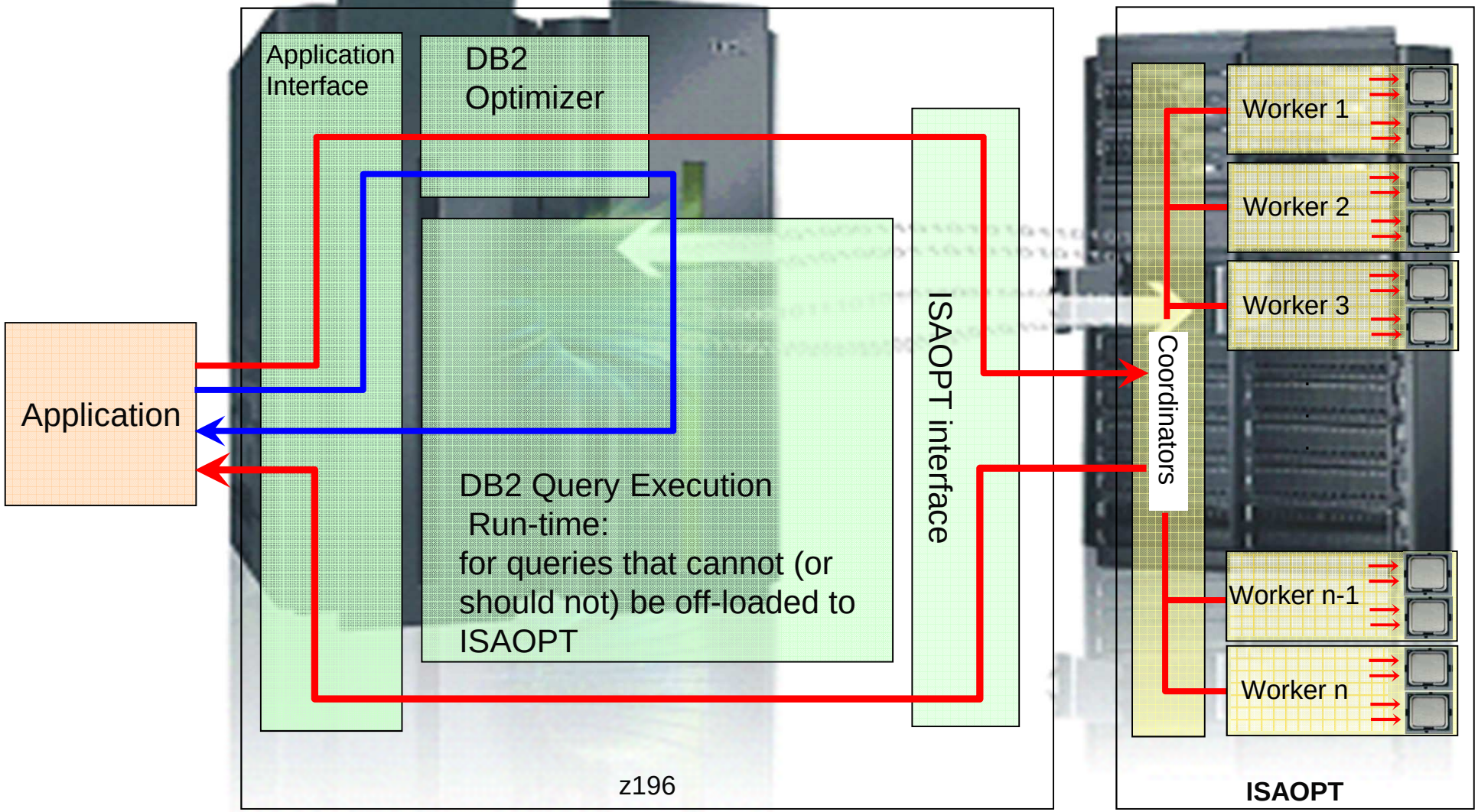
Smart Analytics Optimizer Blade Roles

- **The Smart Analytics Optimizer automatically assigns roles to the zBX blades.**
  - **Coordinator node -** Accepts and queues work. Distributes and coordinates work for the worker nodes and forwards results to requester (DB2).
  - **Worker node -** Processes the work requests from the coordinator node.
- **While two blades on an extra small configuration and three blades on each blade center for small, medium, large, and extra large ISAO configurations are configured as coordinator blades, only one coordinator blade per blade center is required. The additional coordinator blades can be used to automatically replace failing worker or coordinator blades.**

Smart Analytics Optimizer Software Layers



Query Execution Process Flow



Queries executed without ISAOPT

Queries executed with ISAOPT

Which types of workload qualify?

- **Smart Analytics Optimizer V1 requirements for query block offload**
  - Dynamic SQL
  - All tables referenced must be defined in one Data Mart
  - The query must reference a FACT table in the Data Mart
  - All columns referenced in the Select list, Where clause, On Clause, Group by clause, Order by Clause, and Having clause must be defined in a single Data Mart
  - Join predicates must use the = comparison operator

Which types of workload qualify…?

- Join type must be Inner or Left Outer Join
- No local filtering predicates on the non-surviving side of a Left Outer Join are permitted in the On clause
- Must not contain:
  - User defined functions
  - Mathematical functions (SIN, COS, TAN, EXP, etc.)
  - Character-wise string functions
  - Advanced string functions (LOCATE, LEFT, OVERLAY, POSITION, etc.)
  - Advanced OLAP functions (RANK, DENSE RANK, ROW NUMBER, ROLLUP, CUBE)
  - Certain Data Types (GRAPHIC, VARGRAPHIC, DECFLOAT, LOB, XML, binary types)

Query access path selection and processing

- **Accelerator Data Marts are defined in the DB2 on z catalog as one or more Accelerator Query Tables (AQTs)**
- **The DB2 optimizer's consideration of the AQTs is very similar to the way DB2 considers MQTs, however the internal structure of the AQTs is quite different from the MQTs and is based on BLINK technology**
- **When AQTs are loaded on the accelerator**
  - A single FACT table for each data mart is partitioned across the Worker Blades
  - **The DIMENSION tables are replicated in their entirety on each Worker Blade**

Query access path selection and processing…

- **The Accelerator processes a single query block in parallel across all of the Worker Blades accessing compressed data in memory on each blade.**
  - No access to the attached disk storage (5020) occurs during query processing, it is used for start-up and recovery only
  - Certain predicates are processed directly on compressed data in memory, others must de-compress the data in memory before processing the predicate
  - One query block per Coordinator node is processed at a time on the accelerator

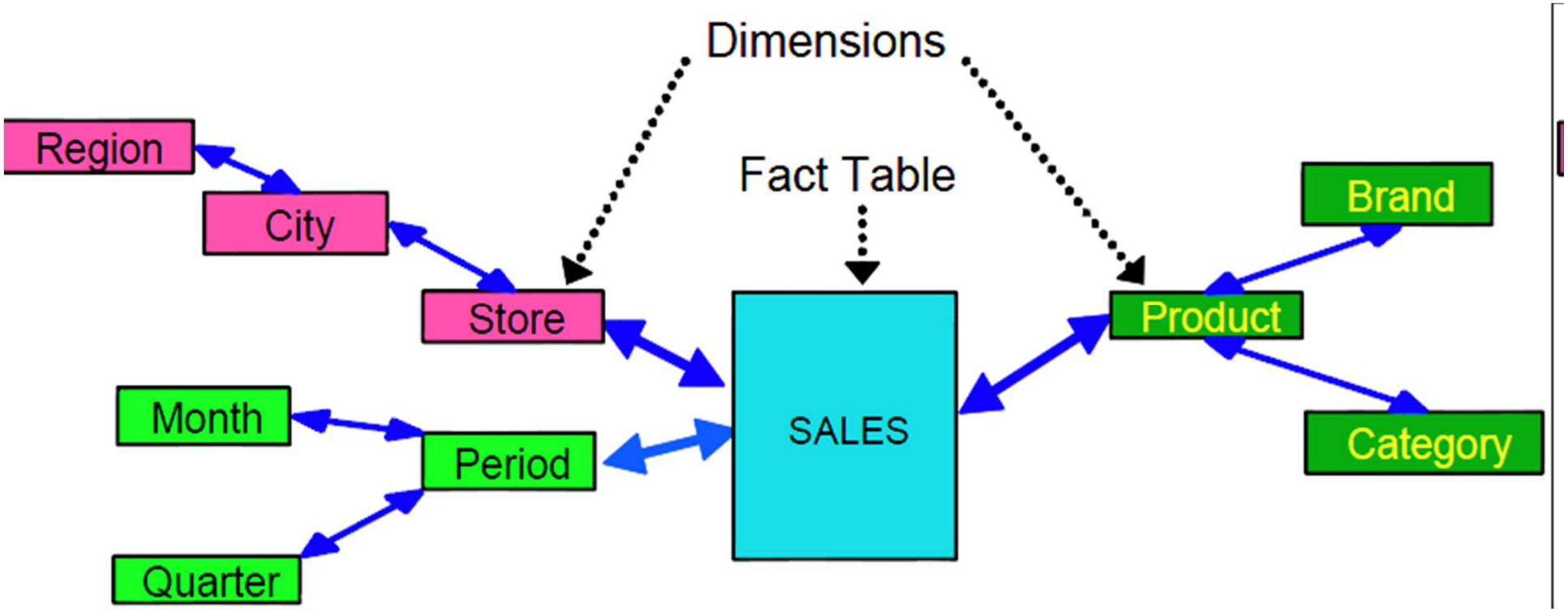
Smart Analytics Optimizer Offerings

- **For planning purposes, a 3X compression ratio is a reasonable assumption.**
- **Factors to keep in mind when considering required capacity**
  - Only the tables and columns used by your longest running queries are required in the accelerator for query offload. However, future flexibility will be enhanced by including more columns from the tables defined in the data mart.
  - DIMENSION tables are stored in their entirety in each worker blade

Smart Analytics Optimizer Offerings

Solution Offering	Number of Blade Centers	Number of zBX racks	Total Number of blades	Number of Coordinator blade	Number of Worker blades	Blade Fail-over Capability	Total Memory GB (48 GB per blade)	Memory available for Data Mart data GB(32 GB per worker blade)	Memory available for Data Mart data GB with 3X compression
A1-7	1	1	7	2	5	1	336	160	480
A1-14	1	1	14	3	11	2	672	352	1056
A1-28	2	1	28	6	22	5	1344	704	2112
A1-42	3	2	42	9	33	8	2016	1056	3168
A1-56	4	2	56	12	44	11	2688	1408	4224

Snow Flake Schema Fact and Dimension Tables



Internal Early Support Program – ISAOpt

- **Objectives**
  - Gain experience with Smart Analytics Optimizer
  - Test drive installation process
  - Report problems to ESP sponsors
  - Provide feedback & “customer” perspective to development
- **Project team skills**
  - z/OS system programmer
  - Hardware and facilities planning
  - DB2 administrator
  - Data warehouse expertise

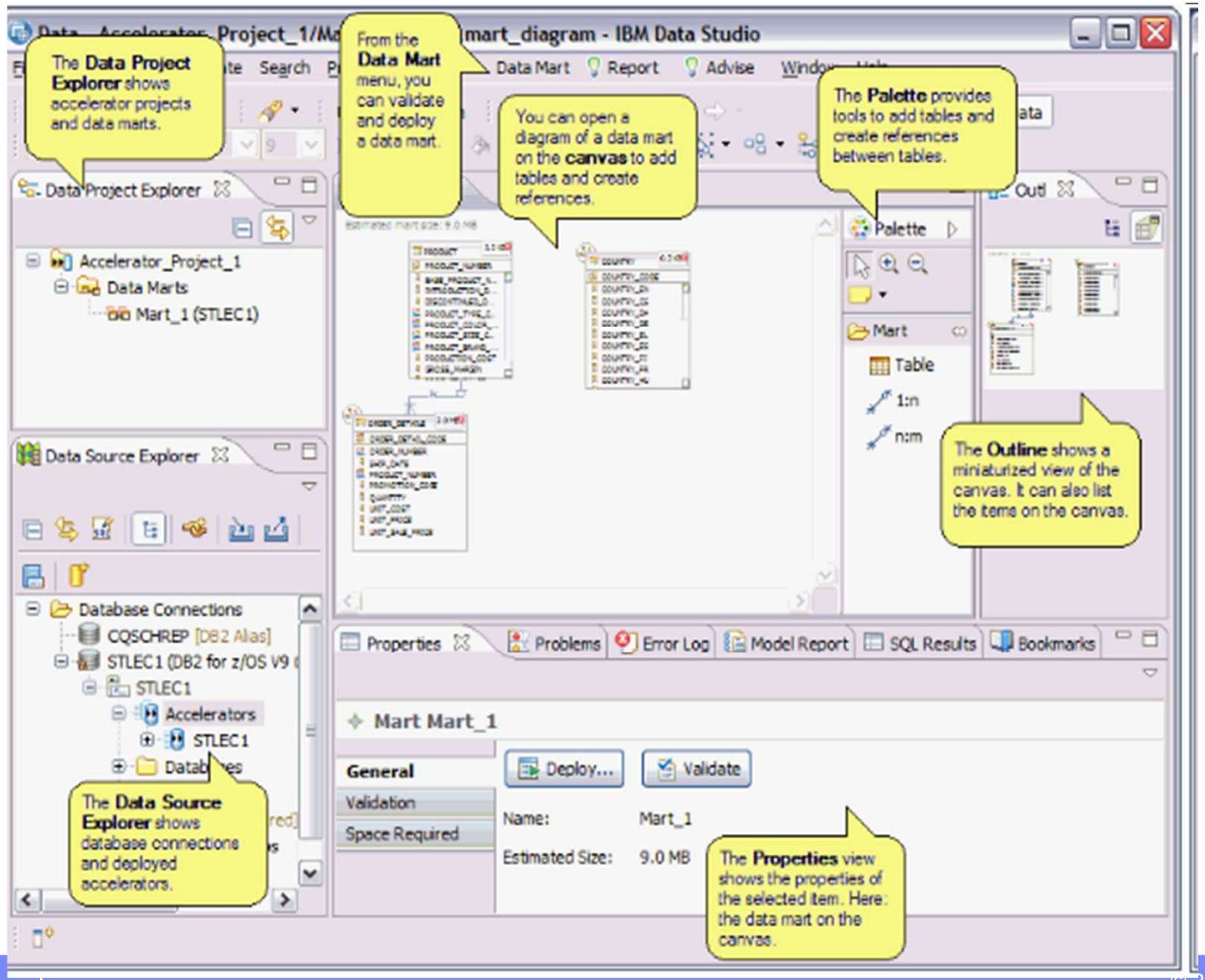
Internal Early Support Program – ISAOpt

- **Status**
  - Installed ISAOpt on zBX model 002 in September 2010
  - Available to DB2 on two z196 z/OS LPARs
  - Running queries from two workloads on Smart Analytics Optimizer
    - Workload A: LineItem data model
    - Workload B: Store_Sales data model

Data Marts

- **Data marts created and deployed using Smart Analytics Optimizer Studio**
  - Select tables and columns included in the data mart
- **FACT table(s)**
  - Data mart must have a FACT table, usually the largest table
  - Partitioned across worker blades (only for 1 FACT table per data mart)
  - Query must reference a FACT table to be offloaded to optimizer
- **DIMENSION table(s)**
  - Each blade contains a copy of all of the DIMENSION tables
- **Table relationships**
  - Defined relationships constrains the query joins that can be offloaded to the accelerator

Smart Analytics Optimizer Studio



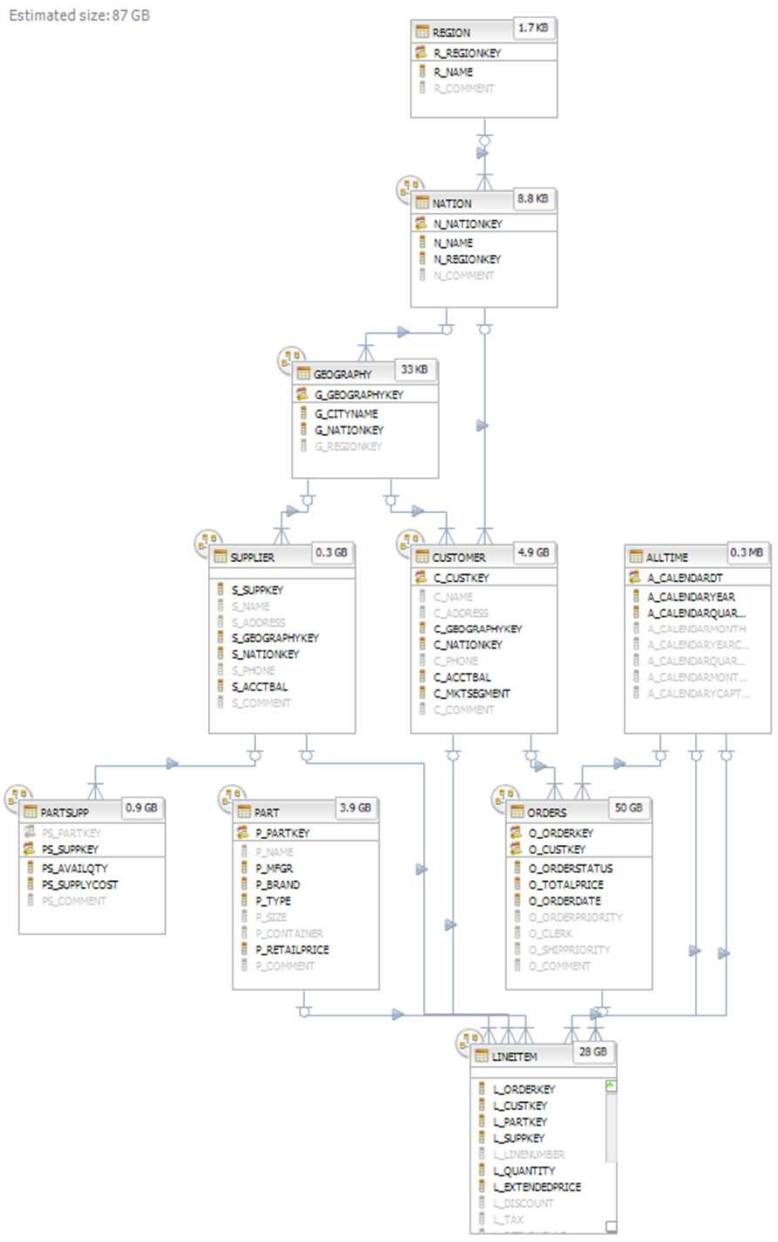
Workloads Used During Beta Testing

- **Two different query workloads were created to test IBM Smart Analytics Optimizer acceleration capabilities which accessed two different data models**
  - Workload A based on a 100GB version of the TPC-H data model
  - Workload B based on a 100GB version of the TPC-DS data model
- **The query workloads used do not contain any of the benchmark queries associated with these data models.**
- **These performance tests were not official benchmarks and they did not adhere to the official benchmarks rules, nor have we submitted results to any formal review by the TPC board. We have constructed test workloads that access these readily available data bases.**
- **The query workloads will hereafter be referred to as 'workload A' and 'workload B‘ to distinguish them as clearly as possible from benchmark workloads.**

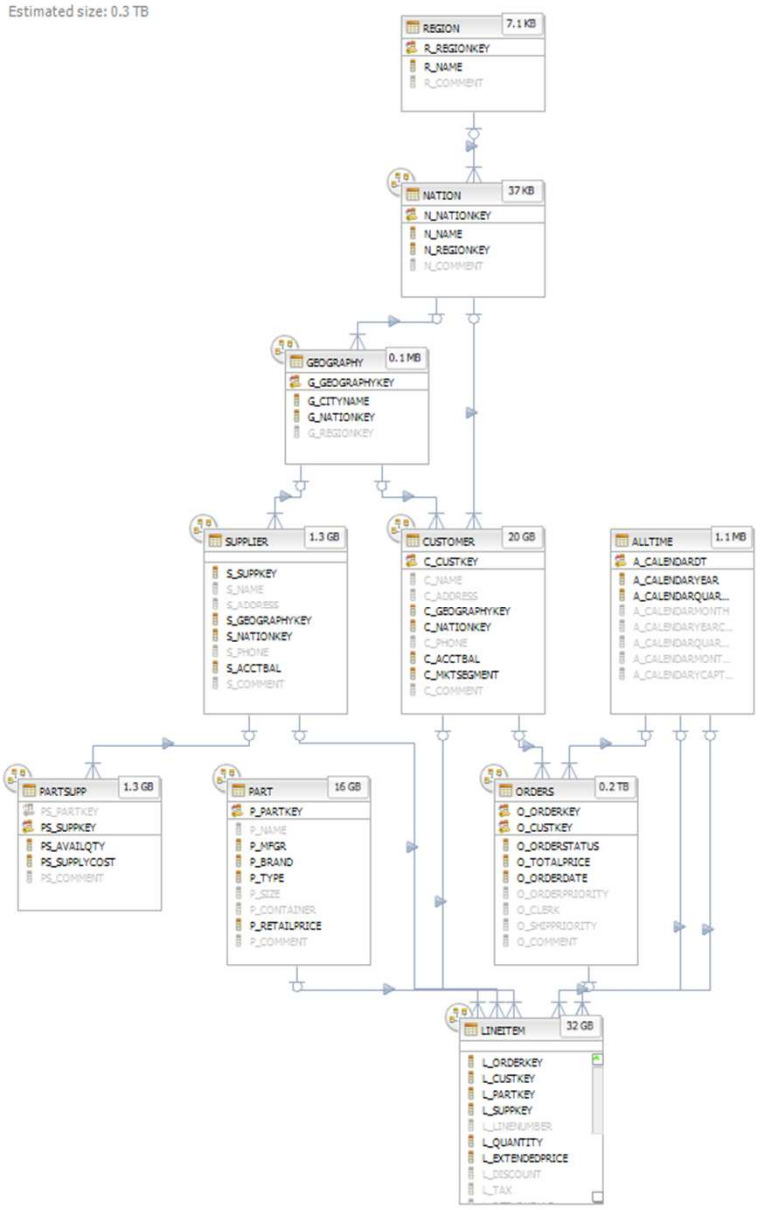
Workload A Data Mart(s)

- **The Workload A data model is not a star schema, but rather a relational schema like you would normally find in an ODS**
- **There are many of the queries in the test workload that would not offload to the accelerator because they did not reference the Lineitem table, the only default FACT table in this Data Mart definition.**
- **To allow all of the long running queries to offload to the accelerator, it was necessary to define additional FACT tables; tables that functioned as DIMENSION tables for some queries and as FACT tables for other queries**
- **This data mart scales poorly as the number of blade centers on the accelerator is increased. This behavior is caused by the distribution of data between FACT and DIMENSION tables in this data mart. The DIMENSION tables in this data mart contain 29% of the data in the data model.**

Workload A LineItem Data Mart – Space estimate for 14-blades



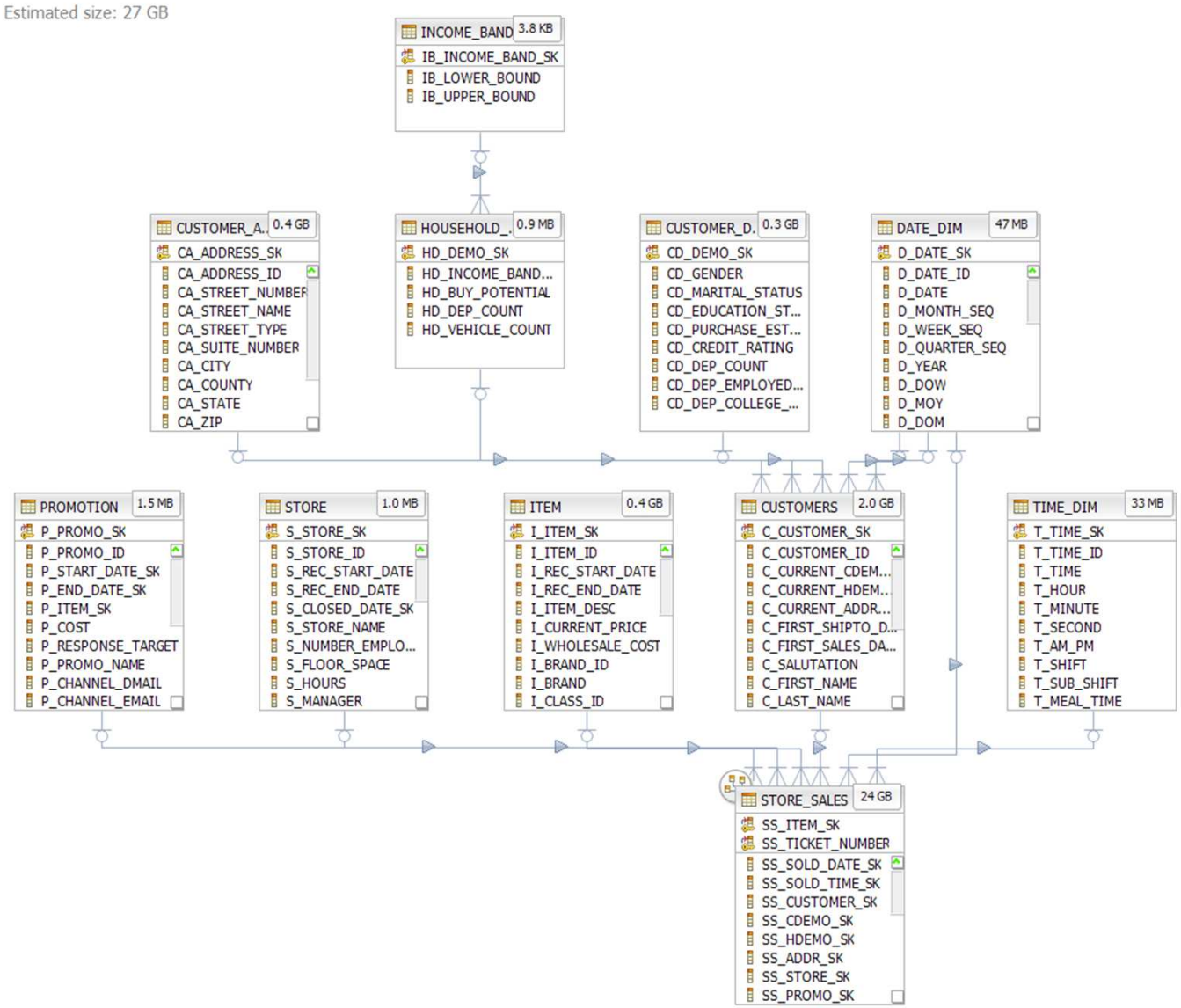
Workload A LineItem Data Mart – Space estimate for 56-blades



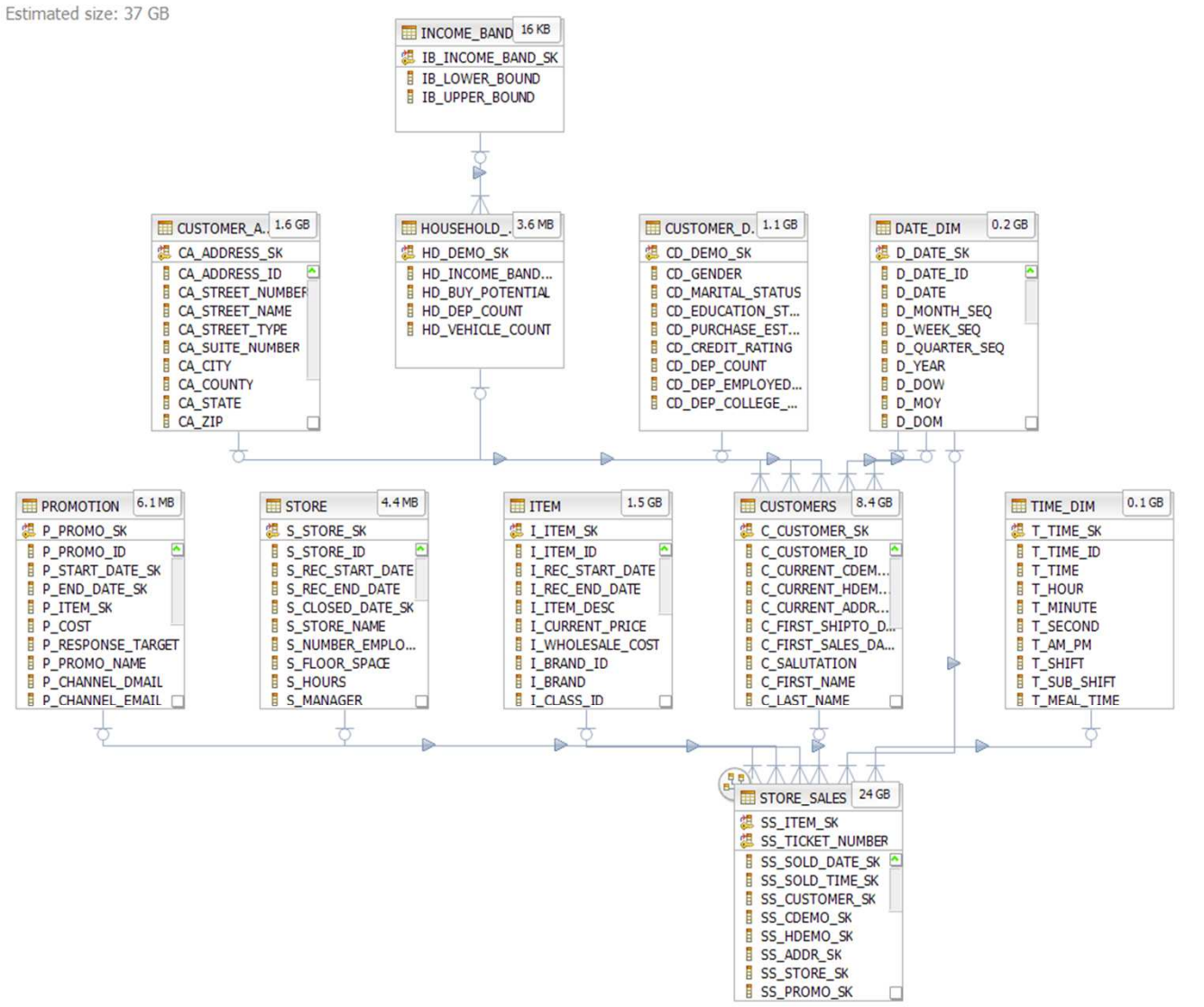
Workload B Store_Sales Data Mart

- **The Workload B Store_Sales data model is a classic star schema which allows all of the 13 queries in my test workload to offload using a single Data Mart definition with a single FACT table.**
- **Since the DIMENSION tables only represent 3 % of the data in the data model, this data mart scales fairly linearly as the number of blade centers on the accelerator is increased.**

Workload B Store_Sales Data Mart – Space estimate for 14-blades



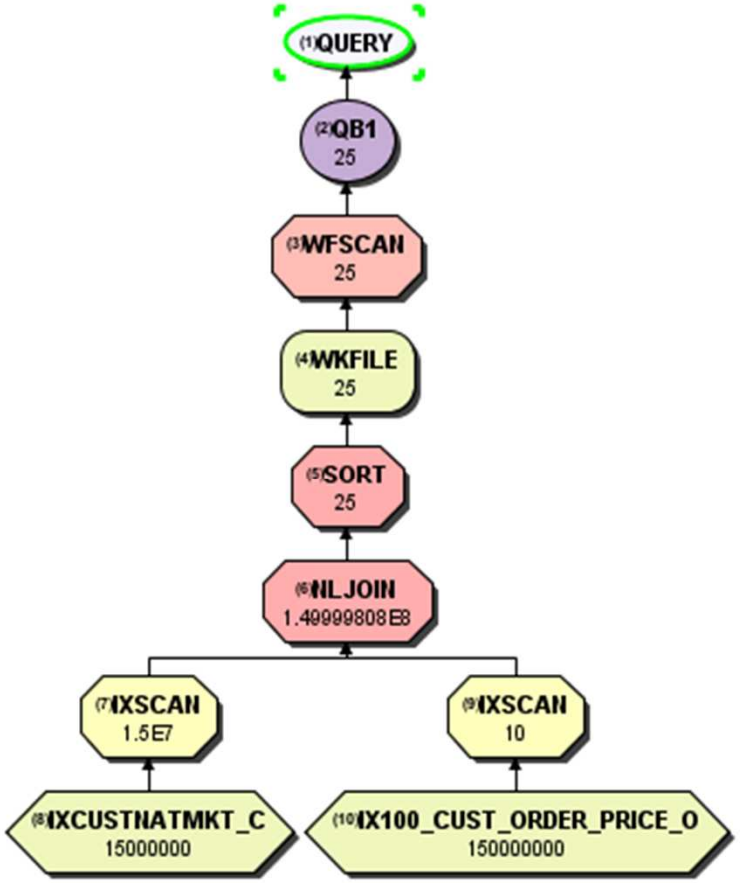
Workload B Store_Sales Data Mart – Space estimate for 56-blades



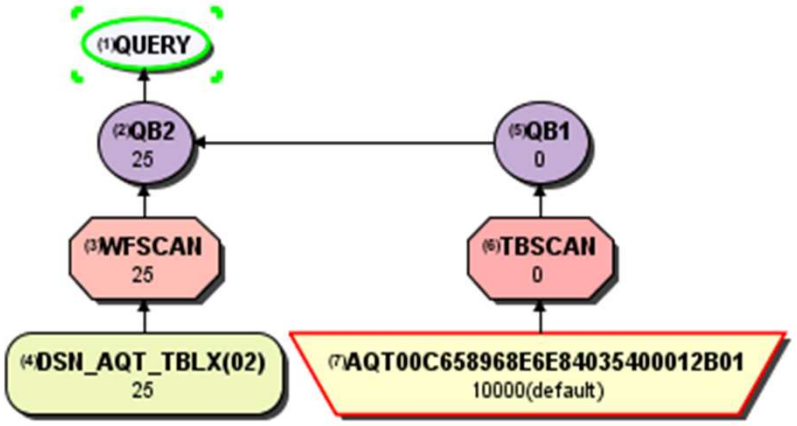
Determining if Queries will be offloaded

- **Run DB2 EXPLAIN for the query with data mart defined on a real or virtual accelerator**
  - If the PLAN_TABLE refers to AQT table(s), query block offload is expected
  - If query blocks do not offload, the new EXPLAIN table DSN_QUERYINFO_TABLE lists the reason the query block was not eligible for offload.
- **If runtime errors occur while a query block is executing on the Accelerator, internal errors are reported in DB2 MSTR message log and the system log**
  - Detailed error message explanation is written to IFCID 191

Access Plan Graph with ‘SET CURRENT REFRESH AGE 0;’



Access Plan Graph with ‘SET CURRENT REFRESH AGE ANY;’



OMPE Accounting Report with Accelerator Offload

```
ELAPSED TIME DISTRIBUTION                                  CLASS 2 TIME DISTRIBUTION
 ------------------------------------------------------------  ------------------------------------------------------------
 APPL   |                                                     CPU    |
 DB2    |                                                     NOTACC |
 SUSP   |================================================> 100%  SUSP   |============================================> 100%

 TIMES/EVENTS  APPL(CL.1)  DB2 (CL.2)  IFI (CL.5)    CLASS 3 SUSPENSIONS   ELAPSED TIME    EVENTS    HIGHLIGHTS
 ------------  ----------  ----------  ----------    --------------------  ------------  --------  -------------------------
 ELAPSED TIME   31.086663   31.082156         N/P    LOCK/LATCH(DB2+IRLM)       0.000000         0  THREAD TYPE    : ALLIED
  NONNESTED     31.086663   31.082156         N/A    SYNCHRON. I/O              0.000000         0  TERM.CONDITION: NORMAL
  STORED PROC    0.000000    0.000000         N/A     DATABASE I/O              0.000000         0  INVOKE REASON : DEALLOC
  UDF            0.000000    0.000000         N/A     LOG WRITE I/O             0.000000         0  COMMITS       :          1
  TRIGGER        0.000000    0.000000         N/A    OTHER READ I/O             0.000000         0  ROLLBACK      :          0
                                                     OTHER WRTE I/O             0.000000         0  SVPT REQUESTS :          0
 CP CPU TIME     0.003298    0.001531         N/P    SER.TASK SWTCH            31.079452        14  SVPT RELEASE  :          0
  AGENT          0.003298    0.001531         N/A     UPDATE COMMIT             0.000000         0  SVPT ROLLBACK :          0
   NONNESTED     0.003298    0.001531         N/P     OPEN/CLOSE                0.000000         0  INCREM.BINDS  :          0
   STORED PRC    0.000000    0.000000         N/A     SYSLGRNG REC              0.000000         0  UPDATE/COMMIT :       0.00
   UDF           0.000000    0.000000         N/A     EXT/DEL/DEF               0.000000         0  SYNCH I/O AVG.:        N/C
   TRIGGER       0.000000    0.000000         N/A     OTHER SERVICE            31.079452        14  PROGRAMS      :          1
  PAR.TASKS      0.000000    0.000000         N/A    ARC.LOG(QUIES)             0.000000         0  MAX CASCADE   :          0
                                                     LOG READ                   0.000000         0  PARALLELISM   : NO
  IIPCP CPU      0.000000         N/A         N/A    DRAIN LOCK                 0.000000         0
                                                     CLAIM RELEASE              0.000000         0
 IIP CPU TIME    0.000000    0.000000         N/A    PAGE LATCH                 0.000000         0
  STORED PROC    0.000000    0.000000         N/A    NOTIFY MSGS                0.000000         0
                                                     GLOBAL CONTENTION          0.000000         0
 SUSPEND TIME    0.000000   31.079452         N/A    COMMIT PH1 WRITE I/O       0.000000         0
  AGENT               N/A   31.079452         N/A    ASYNCH CF REQUESTS         0.000000         0
  PAR.TASKS           N/A    0.000000         N/A    TCP/IP LOB                 0.000000         0
  STORED PROC    0.000000         N/A         N/A    TOTAL CLASS 3             31.079452        14
  UDF            0.000000         N/A         N/A

 NOT ACCOUNT.         N/A    0.001173         N/A
 DB2 ENT/EXIT         N/A          52         N/A
 EN/EX-STPROC         N/A           0         N/A
 EN/EX-UDF            N/A           0         N/A
 DCAPT.DESCR.         N/A         N/A         N/P
 LOG EXTRACT.         N/A         N/A         N/P
```

Smart Analytics Optimizer Instrumentation

- **DB2 commands to start, stop, and show status**
  - -DSNA Start Accel
  - -DSNA Stop Accel
  - -DSNA Display Accel(*) [Detail]
- **Instrumentation provided by Accelerator**
  - New fields in DB2 SMF 100 and 101 records
  - Accelerator traces started in Smart Analytics Optimizer Studio

Output from "/-DSNA Display Accel(*) Detail"

```
NC0000000 SYSA     10213 07:30:37.76 SCHRAY   00000210  -DSNA DIS ACCEL(*) DETAIL
NR0000000 SYSA     10213 07:30:37.76 STC16212 00000010  DSNX810I  -DSNA DSNX8CMD DISPLAY ACCEL FOLLOWS -
MR0000000 SYSA     10213 07:30:37.76 STC16212 00000010  DSNX830I  -DSNA DSNX8CDA 689
DR                                 689 00000010  ACCELERATOR                     MEMB  STATUS  REQUESTS QUED MAXQ FAIL
DR                                 689 00000010  ------------------------------- ---- -------- -------- ---- ---- ----
DR                                 689 00000010  ZBX1                            DSNA STARTED       65    0    1    0
DR                                 689 00000010  PORT=1400 IPNAME=07C2C17D
DR                                 689 00000010  IPADDR=10.9.130.1 HEALTHY
DR                                 689 00000010  IPADDR=10.9.130.2 HEALTHY
DR                                 689 00000010  DETAIL STATISTICS
DR                                 689 00000010    LEVEL  = AQT01010
DR                                 689 00000010    STATUS = FULLY OPERATIONAL
DR                                 689 00000010    AVERAGE QUEUE WAIT                                  =        0
DR                                 689 00000010    MAXIMUM QUEUE WAIT                                  =        1
DR                                 689 00000010    PROCESSING CAPACITY                                 =   657139
DR                                 689 00000010    TOTAL NUMBER OF PROCESSORS                          =      112
DR                                 689 00000010    AVERAGE CPU UTILIZATION ON COORDINATOR NODES         =      .62%
DR                                 689 00000010    NUMBER OF ACTIVE COORDINATOR NODES                  =        2
DR                                 689 00000010    PHYSICAL MEMORY AVAILABLE ON COORDINATOR NODES      =    47180 MB
DR                                 689 00000010    PHYSICAL MEMORY AVERAGE USAGE ON COORDINATOR NODES  =     1094 MB
DR                                 689 00000010    AVERAGE CPU UTILIZATION ON WORKER NODES             =      .62%
DR                                 689 00000010    NUMBER OF ACTIVE WORKER NODES                       =        5
DR                                 689 00000010    PHYSICAL MEMORY AVAILABLE ON WORKER NODES           =    39864 MB
DR                                 689 00000010    PHYSICAL MEMORY AVERAGE USAGE ON WORKER NODES       =     8410 MB
DR                                 689 00000010    SHARED MEMORY DATA AVAILABLE ON WORKER NODES        =     4290 MB
DR                                 689 00000010    SHARED MEMORY DATA AVERAGE USAGE ON WORKER NODES    =    27861 MB
DR                                 689 00000010    MAXIMUM SHARED MEMORY DATA IN USE ON WORKER NODES   =    27873 MB
ER                                 689 00000010  DISPLAY ACCEL REPORT COMPLETE
NR0000000 SYSA     10213 07:30:37.76 STC16212 00000010  DSN9022I  -DSNA DSNX8CMD '-DISPLAY ACCEL' NORMAL COMPLETION
```

After Workload A execution

```
NR0000000 SYSA     10213 07:43:24.34 STC16212 00000010  DSNX810I  -DSNA DSNX8CMD DISPLAY ACCEL FOLLOWS -
MR0000000 SYSA     10213 07:43:24.34 STC16212 00000010  DSNX830I  -DSNA DSNX8CDA 821
DR                                821 00000010  ACCELERATOR                      MEMB  STATUS  REQUESTS QUED MAXQ FAIL
DR                                821 00000010  ------------------------------- ---- -------- -------- ---- ---- ----
DR                                821 00000010  ZBX1                            DSNA STARTED      89    0    1    0
DR                                821 00000010  PORT=1400 IPNAME=07C2C17D
DR                                821 00000010  IPADDR=10.9.130.1 HEALTHY
DR                                821 00000010  IPADDR=10.9.130.2 HEALTHY
DR                                821 00000010  DETAIL STATISTICS
DR                                821 00000010    LEVEL  = AQT01010
DR                                821 00000010    STATUS = FULLY OPERATIONAL
DR                                821 00000010    AVERAGE QUEUE WAIT                                =        0
DR                                821 00000010    MAXIMUM QUEUE WAIT                                =        1
DR                                821 00000010    PROCESSING CAPACITY                               =   657139
DR                                821 00000010    TOTAL NUMBER OF PROCESSORS                        =      112
DR                                821 00000010    AVERAGE CPU UTILIZATION ON COORDINATOR NODES       =      .00%
DR                                821 00000010    NUMBER OF ACTIVE COORDINATOR NODES                =        2
DR                                821 00000010    PHYSICAL MEMORY AVAILABLE ON COORDINATOR NODES     =    47181 MB
DR                                821 00000010    PHYSICAL MEMORY AVERAGE USAGE ON COORDINATOR NODES =     1093 MB
DR                                821 00000010    AVERAGE CPU UTILIZATION ON WORKER NODES           =      .00%
DR                                821 00000010    NUMBER OF ACTIVE WORKER NODES                     =        5
DR                                821 00000010    PHYSICAL MEMORY AVAILABLE ON WORKER NODES         =    39864 MB
DR                                821 00000010    PHYSICAL MEMORY AVERAGE USAGE ON WORKER NODES     =     8410 MB
DR                                821 00000010    SHARED MEMORY DATA AVAILABLE ON WORKER NODES      =     4290 MB
DR                                821 00000010    SHARED MEMORY DATA AVERAGE USAGE ON WORKER NODES  =    27861 MB
DR                                821 00000010    MAXIMUM SHARED MEMORY DATA IN USE ON WORKER NODES =    27873 MB
ER                                821 00000010  DISPLAY ACCEL REPORT COMPLETE
NR0000000 SYSA     10213 07:43:24.34 STC16212 00000010  DSN9022I  -DSNA DSNX8CMD '-DISPLAY ACCEL' NORMAL COMPLETION
```

How Can We Determine How Many Queries Executed Successfully on the Accelerator?

- **From the previous two accelerator displays, we can tell that 24 of the 26 (89 – 65) of the Workload A queries completed successfully on the accelerator**
- **For each individual job step, we could determine from an OMPE trace which of the queries ran successfully on the accelerator**
- **When queries are expected to run on the accelerator from EXPLAIN results but do not successfully run on the accelerator, how do we tell what internal errors occurred?**

Smart Analytics Optimizer Internal Error Debugging

System LOG error message (also found in the DB2 MSTR started task)

```
DSNX871I  -DSNA DSNX8DJN DRDA EXCEPTION CONDITION IN 489
RESPONSE FROM ACCELERATOR=ZBX1 FOR THREAD WITH
LUWID=USIBMWZ.DSNAAPPL.C6364562E46A=0
REASON=00E7000A
ERROR ID=DSNX8OPQ0005
CORRELATION ID=TPCHQ01
CONNECTION ID=BATCH
IFCID=0191
SEE TRACE RECORD WITH IFCID SEQUENCE
NUMBER=00000077
```

OMPE RECTRACE of IFCID 191

```
SCHRAY   BATCH    C63633672040 'BLANK'          'BLANK'                        'BLANK'
SCHRAY   TCPDSQ10 TSO          08:51:26.89095159 171408   3 191 DDM LEVEL 6B   NETWORKID:  USIBMWZ   LUNAME:  DSNAAPPL  LUWSEQ:     1
DSNTEP91 'BLANK'               N/P                              OBJECTS
         |-------------------------------------------------------------------------------------------------------------------------------|
         |0000  00F50000  C4D9C4C1  F0F1F9F1  E9C2E7F1   40404040  40404040  40404040  40400001  | .5..DRDA0191ZBX1              ..
         |0020  00000000  00000000  00000000  00E7F803   C4E2D5E7  F8D9D7C1  0071C4E2  D5E7F8D9  | .............X8.DSNX8RPA..DSNX8R
         |0040  D7C1F0F0  F7F1200D  D7F10000  00000000   00000000  00000000  00000000  00000000  | PA0071..P1.....................
         |0060  00040202  05060600  02010000  00000000   00000000  00000000  0000C4D9  C4C1D9D7  | ........................DRDARP
         |0080  D3E8C4D9  C4C1E2E4  C3C31233  00010000   00AC0000  00000000  00000000  00000000  | LYDRDASUCC.....................
         |00A0  00000000  00000000  00000000  0000C4D9   C4C1D9D7  E840003F  D0020005  00391233  | .............DRDARPY ..}.......
         |00C0  002F1153  E3888540  81838385  93859981   A3969940  83819540  9596A340  88819584  | ....The accelerator can not hand
         |00E0  93854094  96998540  98A48599  8985A200   06114900  08                          | le more queries.....
         |-------------------------------------------------------------------------------------------------------------------------------|
```

Performance Measurements

- **The Smart Analytics Optimizer Beta performance measurements that follow should be considered in the following context:**
  - The actual performance that any user will experience will vary depending upon considerations such as the amount of data on each blade in the AQT table being referenced. Therefore, no assurance can be given that an individual user will achieve response time improvements equivalent to those stated here.
  - Queries built for the two data models to exercise the Smart Analytics Optimizer during Beta testing were designed to be likely to offload to the accelerator. The queries referred to in this presentation are presented as illustrations of the manner in which response time would be enhanced when queries qualify to offload to the accelerator. Actual query workloads may offload at substantially different rates depending on the degree to which the queries meet first release requirements for query block offload.
  - This publication was produced in the United States. IBM may not offer the products, services or features discussed in this document in other countries, and the information may be subject to change without notice. Consult your local IBM business contact for information on the product or services available in your area.

Workload A Query Performance

	Current Refresh Age 0		Current Refresh Age ANY		
StepName	ET Secs on z	CP secs on z	ET secs on ISAO	CP secs on ISAO	ET_secs Acceleration Factor
WorkloadA-Q01	254.20	902.75	2.19	0.02	116.07
WorkloadA-Q02	14.19	7.01	0.39	0.01	36.38
WorkloadA-Q03	10.11	11.71	0.42	0.01	24.07
WorkloadA-Q04	58.23	162.31	0.73	0.01	79.77
WorkloadA-Q05	40.81	129.89	6.53	0.01	6.25
WorkloadA-Q06	19.84	6.35	0.72	0.02	27.56
WorkloadA-Q07	20.08	43.54	1.68	0.01	11.95
WorkloadA-Q08	13.73	0.07	0.39	0.01	35.21
WorkloadA-Q09	7.52	0.76	0.54	0.01	13.93
WorkloadA-Q10	56.18	216.25	6.61	0.01	8.50
WorkloadA-Q11	3.88	2.73	0.41	0.01	9.46
WorkloadA-Q12	0.65	0.01	0.38	0.01	1.71
WorkloadA-Q13	952.27	3210.91	0.80	0.02	1190.34
WorkloadA-Q14	1014.21	3301.59	0.81	0.02	1252.11
WorkloadA-Q15	848.29	880.83	0.91	0.03	932.19
WorkloadA-Q16	1716.52	806.00	1.31	0.01	1310.32
WorkloadA-Q17	1758.42	951.95	2.82	0.01	623.55
WorkloadA-Q18	539.32	1079.47	81.03	0.02	6.66
WorkloadA-Q19	102.85	5.99	2.16	0.02	47.62
WorkloadA-Q20	334.18	70.27	5.04	0.02	66.31
WorkloadA-Q21	1281.22	2461.69	1.12	0.02	1143.95
WorkloadA-Q22	402.49	102.23	1.09	0.01	369.26
WorkloadA-Q23	282.71	541.02	0.54	0.01	523.54
WorkloadA-Q24	871.91	1612.62	0.78	0.02	1117.83
WorkloadA-Q25	900.23	1637.07	0.93	0.01	967.99
WorkloadA-Q26	28.82	26.85	1.80	0.01	16.01

Workload B Query Performance

	Current Refresh Age 0		Current Refresh Age ANY		
StepName	**ET Secs on z**	**CP secs on z**	**ET secs on ISAO**	**CP secs on ISAO**	**ET_secs Acceleration Factor**
WokrloadB-Q01	41.63	150.75	1.91	0.02	21.80
WokrloadB-Q02	493.98	925.28	2.87	0.02	172.12
WokrloadB-Q03	41.21	158.48	2.43	0.02	16.96
WokrloadB-Q04	379.04	1308.27	1.44	0.01	263.22
WokrloadB-Q05	14.92	4.91	0.75	0.02	19.89
WokrloadB-Q06	218.87	822.69	1.51	0.01	144.95
WokrloadB-Q07	214.79	787.24	1.52	0.01	141.31
WokrloadB-Q08	346.66	729.83	1.65	0.01	210.10
WokrloadB-Q09	705.81	1182.05	2.90	0.01	243.38
WokrloadB-Q10	790.95	1578.70	2.86	0.02	276.56
WokrloadB-Q11	890.69	194.10	1.76	0.02	506.07
WokrloadB-Q12	991.07	1245.95	3.54	0.01	279.96
WokrloadB-Q13	187.89	706.11	0.73	0.01	257.38

DB2 Data Sharing

- **Testing took place using 1 DB2 data sharing group**
- **Two z196 LPARs on a single CEC each contained one DB2 data sharing member, DSNA & DSNB**
- **The Smart Analytics Optimizer was installed on DSNA on SYSA, but was available to both data sharing members**
- **To test access from both data sharing members to the accelerator, multiple jobs each containing multiple SQL steps were submitted on LPARs SYSA and SYSB at the same time.**

DB2 Data Sharing…

- **Queries from both DSNA and DSNB were offloaded to the accelerator and interspersed in the accelerator queue**
- **Since the accelerator processes only one Query block per Coordinator blade at a time, the other Queries from the multiple jobs queued on the accelerator waiting to execute**
- **When the queue length exceeded a threshold, additional queries arriving at the accelerator received an internal error and then executed on z**
- **Subsequent job steps after executing on z ran on the accelerator as long as the queue length did exceed the threshold**

Q&A