DB2 Family: Client/Server Performance Measurement Series
Importing/Exporting using DDCS for OS/2

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1. Introduction

This technical report is one of a series of technical reports dealing with performance prediction and capacity planning issues for the DB2 family of products operating in a client/server configuration. The goal of these technical reports is to help the customer:

- Assess proposed configurations for acceptable performance
- Assess performance of current configurations
- Choose proper hardware capacity for a proposed configuration
- Choose the proper software programs for a proposed configuration
- Tune a new or current configuration

This report is unique because it describes the impacts on the numerous components involved in a client/server environment when importing and exporting between the DB2 common server platforms and DB2 for MVS/ESA. Use this report as an example configuration that could be analyzed and potentially applied to other configurations. This report describes the throughput, CPU utilization, CCU utilization, network utilization, and response times when importing and exporting between DDCS for OS/2 and DB2 for MVS/ESA.

In order to provide a general configuration that can be used widely, four things were determined to be the most important measurement considerations:

- Small size tables vs. large size tables
- Fixed size rows vs. variable size rows for the tables
- Many combinations of RQRIOBLK size and RU size
- Default thresholds for all buffer pools

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2. Configuration

This technical report provides information in regards to the following configuration:

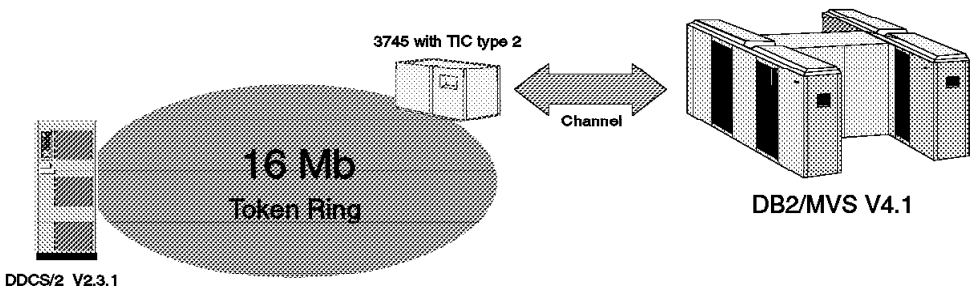

Figure 1. Measurement Configuration

Specifications

- **DB2 for MVS/ESA** Version 4.1 running on MVS Version 5.2 with VTAM Version 4.2. The processor is a 9121-742 (4-way) with 1 GByte of main storage and 1 GByte of expanded storage. The processor is partitioned into four logical partitions, with any one partition having the ability to utilize the other processors, if needed. The partition running DB2 for MVS/ESA has 576 MBytes of storage available to it. The processor is attached to a 3745 model 210 with 8 MBytes of storage on a 4.5 MByte block multiplex channel. The 3745 is attached to the 16 Mbit LAN via a TIC type 2.
- **Distributed Database Connection Services for OS/2** Version 2.3.1 running on a PC Server 720 with 4 Pentium 100 MHZ processors and 128 MB RAM using a LAN Streamer Token Ring card. The Import/Export utility is run from this machine.
- **16 Mbit Token Ring LAN**

Network protocols in use between the components are as follows:

- APPC is in use between DDCS for OS/2 and DB2 for MVS/ESA.

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The components in this configuration are monitored using the following programs:

- MVS: Resource Measurement Facility (RMF)
- DB2 for MVS/ESA: DB2 Accounting and Statistics traces
- 3745: Netview Performance Monitor (NPM)
- LAN: DatagLANce Network Analyzer for Ethernet and Token Ring for OS/2
- OS/2: System Performance Monitor/2 (SPM/2)

3. Workload Description

The Import and Export utilities for DB2 for OS/2 are used for these measurements. Import will take data from an external file and put it into the target database table. Export will create an external file from the data that is in the target database table.

Table Characteristics

Table 1 describes the characteristics of the tables used in the measurement.

Table 1. Table Characteristics

Table	Row Length	# of rows	# of columns	# of Indexes	Partitioned	Total size
T1	85 bytes (fixed)	100,000	4	1	No	9.3 Mbytes
T2	179-679 bytes (variable)	240,000	21	1	No	140.7 Mbytes

For the table characteristics:

- Row Length - describes whether each row of the table is fixed or variable, and if variable, the range of bytes possible.
- Partitioned - describes whether the table is partitioned versus segmented. ″No″ indicates the table is not partitioned.

Locking definitions

Type 2 indexes are used for all indexes. Page level locking is in use for both tables.

Buffer Pool Allocation

Table 2 on page 6 describes the characteristics of the buffer pools used for the tables and indexes.

Default values are used for all buffer pool thresholds.

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Table 2. Buffer Pool Characteristics

Buffer Pool	Size	Table/Index
BP4	7000	T2/Index1
BP7	2000	T1/Index2

4. Results

The next sections describe the results from the measurements. The effects on each component in the configuration are described as well as the performance. The component results can help you understand hardware capacity issues.

Network

Each measurement adjusts the RU size to find the optimal RU size for the Import/Export of these tables. For importing, a RU size of 16K is optimal and is the only RU size described in this report. For exporting, a RU size of 4K and a RQRIOBLK of 32K is optimal. This report provides the full matrix of RQRIOBLK sizes and RU sizes measured for export.

NCP

The GROUP LNCTL=CA DELAY parameter and the PCCU DELAY parameter in the NCP are both set to 0.0. Initially the LNCTL=CA parameter was set to 0.1. By changing the parameter to 0.0, throughput is improved 30-50%, though this adds approximately 10% to the CCU utilization of the NCP. The NCP CCU utilization reaches a maximum of 47% at the highest throughput level.

LAN

The 16 Mbit Token Ring LAN is lightly utilized during these measurements.

CPU

The maximum throughput while exporting is achieved with a RQRIOBLK size of 32K and a RU size of 4K. At this point, the PC Server 720 reaches a CPU utilization of 69% and the 9121-742 reaches a CPU utilization of 5.4%.

Although there are 4 Pentium processors in the PC Server 720, OS/2 does not provide any symmetric multiprocessing capability to take advantage of the additional processors. Therefore, the results for these measurements can be treated as if they are on a single processor machine.

Important: The processor running MVS for these measurements is not 100% dedicated. Therefore, the CPU numbers for MVS should be looked at as a worst case value.

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Import

Table 3 on page 8 describes the results for the import measurements of tables T1 and T2. An RU size of 16K is used throughout. RQRIOBLK size has no effect on import traffic.

Table 3. Import measurement results for tables T1 and T2

Table	Throughput (MB/hr)	720 CPU%	MVS CPU%	NCP CCU%	LAN%
T1	122	23.6	9.2	23.0	5.5
T2	350.6	17.7	7.8	31.0	7.2

For the import measurement results in Table 3 :

- Throughput - describes the amount of data in megabytes per hour that is inserted into the table on MVS/ESA.
- 720 CPU% - describes the CPU used by the PC Server 720 as a DDCS.
- MVS CPU% - describes the CPU utilization on the 9121-742 running MVS/ESA.
- NCP CCU% - describes the CCU utilization on the 3745 that is running the NCP.
- LAN% - describes the percent utilization of the Token Ring LAN between the DDCS for OS/2 system and the NCP.

Export

Export results for table T1

Table 4 on page 9 describes the results for the export measurements of T1. In this table, throughput describes the amount of data in megabytes per hour that is retrieved from the database table and saved in a file on the DDCS machine. The RQRIOBLK size varies from 4K to 32K and the RU size varies from 4K to 16K.

In general, the throughput increases as the RQRIOBLK size increases and the RU size decreases. For this table, the greatest throughput is achieved with a RQRIOBLK size of 8K and a RU size of 16K. The reason this combination is better for this table than a RU of 4K and a RQRIOBLK of 32K is up for further study.

Table 4. Export measurement results for table T1.

RQRIOBLK size	RU size	Throughput (MB/hr)	720 CPU%	MVS CPU%	NCP CCU%	LAN Util%
32K	16K	469.1	99.0	8.2	19	5.5
32K	8K	482.7	99.0	7.0	22	6.3
32K	4K	444.1	93.5	7.2	23	5.8
16K	16K	472.4	99.0	8.1	20	6.1
16K	8K	475.8	99.1	7.5	23	6.1
16K	4K	462.6	98.7	7.4	24	5.9
8K	16K	497.1	95.7	7.9	25	6.5
8K	8K	469.1	98.9	7.6	24	6.1
8K	4K	475.8	99.1	7.9	26	6.2
4K	16K	427.0	94.3	8.0	27	5.7
4K	8K	416.3	98.4	7.8	26	5.6
4K	4K	421.6	94.9	8.0	27	5.6

Export results for table T2

Table 5 describes the results for the export measurements of T2. The RQRIOBLK size is varied from 4K to 32K and the RU size is varied from 4K to 16K.

The greatest throughput is achieved with a RQRIOBLK size of 32K and a RU size of 4K. In general, the throughput increases as the RQRIOBLK size increases and the RU size decreases.

Table 5. Export measurement results for table T2.

RQRIOBLK size	RU size	Throughput (MB/hr)	720 CPU%	MVS CPU%	NCP CCU%	LAN Util%
32K	16K	788.0	63.6	5.0	33	11.2
32K	8K	855.9	64.9	5.2	40	12.3
32K	4K	876.6	68.8	5.4	43	12.5
16K	16K	624.0	50.6	4.7	28	8.9
16K	8K	725.9	61.7	5.3	35	10.4
16K	4K	775.9	61.6	5.5	40	11.1
8K	16K	562.3	48.8	5.0	30	8.1
8K	8K	562.3	48.9	5.0	30	8.1
8K	4K	632.2	55.0	5.5	35	9.1
4K	16K	453.2	42.8	4.5	31	6.7
4K	8K	453.2	42.6	5.1	31	6.7
4K	4K	455.2	42.9	5.1	30	6.7

5. Summary of tuning considerations

- Changing the Transmit window count and Receive window count in the Token Ring SNA DLC Profile provides a dramatic improvement in performance. In this measurement, the Transmit window count is reduced from 16 to 7, and the Receive window count is reduced from 8 to 4. An export that takes 1 hour and 20 minutes to complete, finishes in less than 5 minutes after the change!
- In general, the smaller the RU size and the larger the RQRIOBLK size the better the performance.
- Use ″alter bufferpool″ to change buffer pool thresholds to as high as possible during the import/export. When the thresholds are turned off for this measurement, there is approximately 30% degradation in throughput.
- If possible, remove all NCP delays. For our measurements, changing the GROUP LNCTL=CA delay parameter from 0.1 to 0.0 improved throughput by 30-50%, with a CCU utilization increase of approximately 10%.

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6. Conclusions

This technical report shows the results and analysis of some performance measurements for a relational database configuration that includes DB2 for MVS/ESA and DDCS for OS/2.

The focus of this report is to provide a base throughput result that can be used to assess current import/export performance for tuning and re-configuration purposes.

Some questions to ask when analyzing this report and applying it to your current configuration are:

- How does the data throughput compare to my environment or proposed environment?
  - On the LAN?
  - Through DDCS for OS/2?
  - Through the NCP?
- How much processor capacity would I need for my environment considering the throughput and transaction mix? DDCS for OS/2, DB2 for MVS, etc...
- How much network line capacity would I need considering throughput?

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7. Other sources of information

- **DB2/MVS Administration Guide** SC26-3265
- **DB2 Administration Guide For Common Server V2** S20H-4580
- **DB2 for OS/2 Command Reference**

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