

Capacity Planning Report Data Processing Section University of Queensland

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Preface

This document presents the results of the Capacity Planning Service undertaken in December 1989 for the Data Processing Section's VAXes (UQADM and UQEVE), being part of the VAXcluster situated at Prentice Computer Centre, University of Queensland, St. Lucia.

Acknowledgments

Digital would like to thank Ian Burgess for his assistance in collecting the data for the analysis, and Robert Claire for his assistance in classifying the users.

Disclaimer

This report and recommendations are based on information furnished by the Client. The Client is responsible for evaluating Digital's recommendations and any implementation.

Chapter 1

Executive Summary

1.1 Purpose of Study

The Data Processing Section currently runs production and development environments on a VAX 8650 (UQADM::). The feeling is that this system is close to saturation, and the new Enrolments System has yet to be developed and put into production. A uVAX 3300 (UQEVE::) has been added to the VAXcluster as a LAVC member. The development programmers will be relocated from UQADM:: to UQEVE:: to ease the load on UQADM::.

The purpose of the pilot study into the computing capacity of the University's VAXcluster is to determine the ability of the VAX 8650 to take on additional load. At this stage this additional load is unknown, being a new application written in DECforms, Rdb and COBOL, and measurements of this load cannot yet be recorded. Therefore the load increases will be modelled as percentage increases in the existing production load. It is hoped that these results will help the University to understand their current system resource consumption and to assist in predicting computing resource requirements for the future.

1.2 Conclusions and Recommendations

This study has demonstrated that UQADM:: in its current configuration can expect no more than a 30% increase in production load. This is limited by the capacity of the VAX 8650 CPU. To attain any further increase in capacity, little can be achieved without also upgrading the cluster system disk from the present RA81 to a faster disk, preferably a pair of RA90 drives configured as a shadow set. As much write load should be removed from them as possible. Coupling this with a CPU upgrade to a VAX 6420 would give at least a 60% increase in capacity, still potentially limited by the capacity of the system disk. In this configuration, the CPU would only be 50% utilized. More capacity would be achievable if the system disk load could be spread to other disks.

Chapter 2

Site Description

2.1 System Configuration

Table 2-1 summarizes the configuration under test.

Table 2-1: System Configuration

Description	UQADM::	UQEVE::	UQVAX::
CPU Type	VAX 8650	uVAX 3300	VAX 8550
# of CPUs	1	1	1
Cluster type	CI/NI	NI	CI/NI
Total Memory	96Mb	44Mb	32Mb
VMS Version	V5.1-1	V5.1-1	V5.1-1
Total HCSs	2 HSC50s		
Total Disks	1 RL02		
	2 RA80s		
	8 RA81s		
	4 RA82s		
	1 RF30		

2.2 Performance Observations

Overall Performance Observations for all members of the VAXcluster are included in Section C.1.1 in the sections titled *Global System Statistics* and *Disk Statistics*.

Chapter 3

Workload Characterization

Classification of users has been based on the premise that the development users will be moved from UQADM:: to UQEVE::. All other user load is expected to increase, so is largely grouped together.

Class description:

1. **dev-int** represents all interactive development users
2. **dev-batch** represents all batch usage by development users
3. **qa-train** represents training accounts
4. **other-ints** represents all other interactive users
5. **other-batch** represents all other batch users
6. **other** represents all other detached or transient processes, symbionts, etc.

The table titled *Cluster Population Distribution* in Section C.1.1 shows how the user population is distributed amongst the three VAXes.

Chapter 4

Capacity Planning Study

Workload characterization is the process of categorizing and quantifying the work which the system is required to perform. The requirements of this study made it necessary to characterize the workload during periods of peak activity. For this reason, data was collected during several periods. The period determined to exhibit the greatest workload was then analyzed to provide an accurate workload characterization.

4.1 Data Collection

Extensive performance data was collected during five periods of expected peak workload (morning and afternoon of 11th December to 13th December 1989). This data included not only global system statistics such as CPU, memory, and device utilizations but resource requirements and performance metrics for each transaction. Of these, two data collections were unusable. Of the remaining three, a period between 14:30 and 16:10 on 13th December 1989 was selected as the most consistently representative load. The system performance statistics are included in Section B.1

4.2 Model Validation

The validation of the model derived from the measured data is included in Section C.1.2. Validation compares the results of a modelling run with the results of analyzing the collected data. The largest percentage error is for Percentage Utilization of disk \$19\$DUA1:.

Analytic models typically predict resource utilizations within 10% and response times within 30%. The very low percentage of error found in this study indicates both an accurate model and an excellent characterization.

4.3 Assumptions for Performance Projections for UQADM::

This section details the assumptions and projections of system performance over the range of workload growth of interest. It must be understood that these are projections of performance under periods of *peak* workload, not average workload.

4.3.1 Modeling Assumptions

- 1. Operating System Upgrade**

No upgrade of the operating system has been allowed for in this study.

- 2. Migration of Development and Training Users**

All development and training users are moved from UQADM:: to UQEVE::, leaving UQADM:: as a production only machine.

- 3. Disk Workload Balancing**

All disk load for the development and training users (except system disk load) is moved from the HSC50 based disks to the disks attached directly to UQEVE::. This shift of load is combined with a load balancing exercise between \$19\$DUA0: and \$19\$DUA1: to bring \$19\$DUA0: back from the verge of saturation.

- 4. Other Systems Static**

Only growth of the user population on UQADM:: is considered. No growth is modelled for the other two VAXes.

4.3.2 Modeling Results

The difference in %CPU utilization when development and training users are moved from UQADM:: to UQEVE:: is minimal (from 74% to 71%). The results are tabulated in Section C.1.3.

4.4 Scenario 1 : Find Saturation Point for UQADM::

The user population of UQADM:: was increased (user population on the other nodes was kept constant) to find a point where either the %CPU utilization exceeded 90% or the %Utilization of one disk (typically the system disk) exceed 60%. Each of these conditions would imply that the system was saturated.

4.4.1 Modeling Results

Section C.1.5 shows that saturation occurs after applying a 30% growth factor to all classes on UQADM:: only. This not only suggests that at this stage the CPU of UQADM:: will support 30% more users before it saturates (Average CPU utilization >90%), but that all disks are still below saturation level (average utilization <50% - i.e. average I/O queue length <1.0).

4.5 Scenario 2 : Hardware upgrade for UQADM::

This scenario investigates what type of hardware upgrade might be necessary to achieve a greater capacity. An upgrade to a VAX 6420 was investigated.

4.5.1 Modeling Results

Section C.1.6 shows that upgrading UQADM:: from a VAX 8650 to a VAX 6420 and using an RA90 shadow pair as the system disk results in saturation of the system disk (\$1\$DUA0:) after a 60% increase in user population on UQADM::.. The CPU is still only at 50% utilization. This is basically because the system disk is saturated.

The system disk is currently a single RA81. To achieve some significant improvement, two RA90 disks in a shadow set configuration were investigated.

Appendix A

Terminology

- **Capacity Planning**

Capacity planning is the process of determining the computing resources needed to satisfy the anticipated future requirements based upon the business direction and anticipated business growth.

- **Performance Evaluation**

Performance evaluation is the process of understanding, optimizing, and tuning existing computer system environments.

- **Capacity Management**

Capacity Management is the distribution of current computing resources based upon business objectives and requirements.

- **Service Level Objective**

Service level objectives are the desired performance, throughput, and response time.

- **Saturation**

Saturation is the point at which the system's service level objective is reached when processing expected workloads.

- **Utilization**

Utilization is the percentage of real time that the device is busy.

- **Throughput**

Throughput is used to express the rate of work done. Typical examples are system throughput (the number of transactions per second) or disk I/O throughput (the number of disk I/Os per second).

- **Hard Page Faults**

Hard page faults are page faults that actually result in disk I/Os.

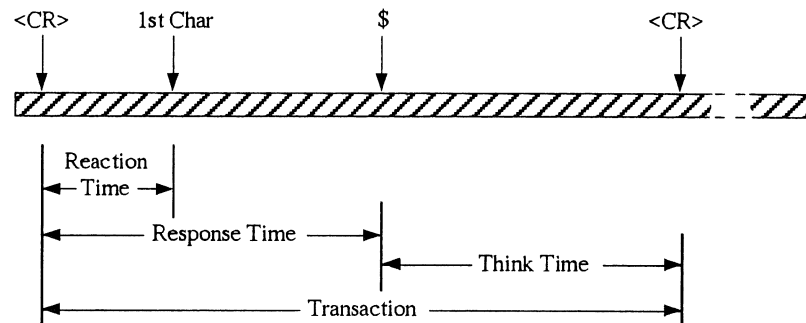
- **Soft Page Faults**

Soft page faults are page faults that do not result in disk I/Os.

- **True I/O**

True I/O is physical user disk I/Os that exclude hard page faults.

Figure A-1: Transaction



- **Response Time**

Response time is the elapsed time between the end of input and the next prompt for input.

- **Think Time**

Think time is the elapsed time between the prompt for input and the completion of input.

- **Transaction**

A transaction is a response and think time pair.

Appendix B

Supporting Data - SPM

B.1 SPM Details for Selected Period

----- VAX VMS System Configuration -----

```
! Node : UQADM
! Experiment name : DECCp Data Collection
! Log File : BBOCP SYS:[CLAIRE.DECCP.UQ]UQADM 19891213_1400.SPM;2
! Data collection started : 13-DEC-1989 14:01:04.78
! Data collection ended : 13-DEC-1989 16:30:02.68
! Sample interval : 120 seconds / 2.000 minutes
! Report generated : 20-MAY-1990 23:21:28.24
! Processor type is : 8650
! Running VMS version V5.1-1
! TR 3 Unibus Adapter 0
! TR 14 CI PORT
! System Allocation Class : 1
! Total memory : 196608 pages = 96.00 MB
! Floating Point Accelerator Status:
!   None of the floating data types are emulated
! Non-paged memory = 21045 pages (10.7% of total memory)
! Paged memory = 175563 pages (89.3% of total memory)
! System working set = 2000 pages ( 1.1% of paged memory)
! User memory (paged-system working set) = 173563 pages (98.9% of paged memory : 88.3% of total memory)
```

FINAL Statistics

FINAL CHARACTERISTICS

Data Analyzed: from	13-DEC-1989 14:31:37.19	to	13-DEC-1989 16:11:15.44
---------------------	-------------------------	----	-------------------------

[illegible]

Proc Count	Balset Count	Free Pages	Modify Pages	Total MEMutl	Paged MEMutl	User MEMutl	Modify MEMutl	Queues		Header InSWP	Header OutSWP	Swaper CPU %
								Mem	CPU			
146	144	9970	814	94.9%	93.2%	94.3%	0.5%	0	4	0	0	0.2%

CPU Statistics

CPU	Total	Busy	Inter	Kernel	Exec	Super	User	Compat	System	Task
ID	Idle	Wait	Stack							
0	28.8%	0.0%	9.5%	17.6%	7.5%	11.7%	24.9%	0.0%	34.6%	36.6%

----- CPU and I/O Overlap

Page Wait	Swap Wait	Page or Swp Wait	CPU+IO Idle	CPU Only	I/O Only	Multi I/O	CPU+IO Busy
4.4%	0.1%	4.4%	11.8%	33.2%	17.4%	19.5%	37.6%

Paging Rates (per second)

Page Faults	System Faults	Pages Read	Read I/Os	Pages Written	Write I/Os	Free List	Modify List	Bad List	Dzero Faults	Gvalid Faults	Trans Faults	WritIN Prog	Hard Faults	Soft Faults
96.4	0.7	25.2	4.1	13.2	0.2	15.3	9.4	0.0	40.5	26.9	0.0	0.1	4.2%	95.8%

I/O Rates (per second)

Direct I/Os	Buford I/Os	Lognam Trans	Mailbx Reads	Mailbx Writes
25.6	57.7	25.7	3.2	2.9

File Cache Attempt Rate (per second)

Dir	Dir	File	File	File	Bit
FCB	Data	Id	Quota	Hdr	Map
2.2	3.8	1.0	0.2	4.4	1.2
					0.0

Disk Statistics

	Work Avail %	Paging %	Swing %	Contrl %	Rate (/s)	Read %	Remote I/O%	Serv Time (ms)	Resp Time (ms)	Queue Length	Space Used %
\$1\$DUAO	19.2	46.9	0.0	40.7	6.1	83.4	0.0	31	40	0.2	96.7
\$1\$DUAl	2.0	64.7	34.9	9.4	0.7	64.7	0.0	29	37	0.0	90.7
\$1\$DUAlO	5.8	0.0	0.0	9.4	1.7	0.0	0.0	34	35	0.1	52.3

Disk Statistics										
Work Avail %	Paging %	Swping %	Contlr %	Rate (/s)	Read %	Remote I/O%	Serv Time (ms)	Resp Time (ms)	Queue Length	Space Used %
! \$1\$DUAL1	0.6	0.0	0.0	0.2	3.7	0.0	32	32	0.0	97.6
! \$1\$DUA2	11.8	0.6	0.0	5.9	81.5	0.0	20	22	0.1	84.3
! \$1\$DUA3	11.0	0.9	0.0	5.0	78.9	0.0	22	25	0.1	95.5
! \$1\$DUA4	9.7	25.4	15.0	3.5	59.2	0.0	27	35	0.1	80.2
! \$1\$DUA5	16.1	1.1	0.0	6.2	48.7	0.0	26	29	0.2	67.2
! \$1\$DUA6	0.0	0.0	0.0	0.0	55.6	0.0	30	30	0.0	96.2
! \$1\$DUA7	0.0	0.0	0.0	0.0	80.0	0.0	36	36	0.0	69.5
! \$1\$DUA8	0.5	0.0	0.0	0.2	0.0	0.0	33	33	0.0	82.6
! \$1\$DUA9	0.2	2.4	0.0	0.1	27.0	0.0	42	42	0.0	79.7
! \$19\$DIA0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	52.9
! \$19\$DUA0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	65.4
! \$19\$DUA1	2.7	0.0	0.0	0.1	98.4	0.0	205	205	0.0	59.2
! CSA1	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	100.0

Server Statistics			
Work Avail %	Paging %	Swaping %	Queue Length
! CSA	0.0	0.0	0.0
! HSC000\$	20.7	10.0	0.3
! HSC003\$	42.6	0.0	0.6
! UQVE\$	2.8	0.0	0.0

Report Date: 20-MAY-1990 23:21

Run Statistics

Total Intervals Found For Analysis: 49
Prime Hours: 08, 09, 10, 11, 12, 13, 14, 15, 16
Input Source: Log File V3.3

Command Line:

REPO=LOG/OUT=UQADM.LOG/SIN=13-DEC-1989 14:30:00.00/BEF=13-DEC-1989 16:10:00.00 UQADM_19891213_1400.SPM

ELAPSED: 0 00:00:23.03 CPU: 0:00:06.93 BUFIO: 7 DIRIO: 274 FAULTS: 546

UQADM

VAX SPM V3.3-03

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----- VAX VMS System Configuration -----

```
! Node : UQ EVE
! Experiment name : DECcp Data Collection
! Log File : BBOCP_SYS:[CLAIRE.DECCP.UQ]UQ EVE 19891213_1400.SPM;1
! Data collection started : 13-DEC-1989 14:01:56.23
! Data collection ended : 13-DEC-1989 16:30:01.01
! Sample interval : 120 seconds / 2.000 minutes
! Report generated : 20-MAY-1990 23:20:55.94
! Processor type is : 3400
! Running VMS version V5.1-1
! TR 0 KA640 CPU
! TR 1 Unibus Adapter 0
! System Allocation Class : 19
! Total memory : 90112 pages = 44.00 MB
! Floating Point Accelerator Status:
!   H float data type emulated
! Non-paged memory = 8164 pages ( 9.1% of total memory)
! Paged memory = 81948 pages (90.9% of total memory)
! System working set = 999 pages ( 1.2% of paged memory)
! User memory (paged-system working set) = 80949 pages (98.8% of total memory)
```

FINAL Statistics

Data Analyzed: from 13-DEC-1989 14:30:08.31 to 13-DEC-1989 16:10:52.62

AVE Process-Memory Counts				Memory Utilization				AVE Mem/CPU		Swapper Counts			
Proc	Balset	Free	Modify	Total	Paged	User	Modify	Mem	CPU	InSWP	OutSWP	Header	Swapper
Count	Count	Pages	Pages	MEMMutl	MEMMutl	MEMMutl	MEMMutl	Mem	CPU	InSWP	OutSWP	OutSWP	CPU %
23	21	65468	114	27.3%	18.9%	19.1%	0.1%	0	1	0	0	0	0.0%

		CPU Statistics								
CPU ID	Total Idle	Busy Wait	Inter Stack	Kernel	Exec	Super	User	Compat	System	Task
0	53.6%	0.0%	6.2%	10.5%	26.4%	0.1%	3.2%	0.0%	43.1%	3.4%

Lost CPU		CPU and I/O Overlap				
Page Wait	Swap Wait	Page or Swp Wait	CPU+IO Idle	CPU Only	I/O Only	CPU+IO Busy
0.7%	0.0%	0.7%	0.1%	17.6%	53.8%	28.6%

Paging Rates (per second)														
Page Faults	System Faults	Pages Read	Read I/Os	Pages Written	Write I/Os	Free List	Modify List	Bad List	Dzero Faults	Gvalid Faults	Trans Faults	WritIN Prog	Hard Faults	Soft Faults
9.5	0.3	1.6	0.3	0.5	0.0	2.1	0.5	0.0	4.3	2.3	0.0	0.0	2.7%	97.3%

I/O Rates (per second)					File I/O Rates (per second)					
Direct I/Os	Buford I/Os	Lognam Trans	Mailbx Reads	Mailbx Writs	Window Hits	Window Turns	Split I/Os	Erase I/Os	File Opens	
27.4	3.0	1.5	0.0	0.0	27.1	0.0	0.0	0.0	0.1	
										AVE
										Open Files
										252

File Cache Attempt Rate (per second)						File cache Effectiveness					
Dir FCB	Dir Data	Quota	File Id	File Hdr	Bit Map	Dir FCB	Dir Data	Quota	File Id	File Hdr	Bit Map
0.1	0.2	0.2	0.0	0.6	0.1	0.1	0.2	0.2	0.0	0.6	0.1
					0.0	95.1%	81.3%	100.0%	97.2%	97.4%	99.8%
					0.0						0.0%

Disk Statistics											
	Work Avail %	Paging %	Swping %	Contrlr %	Rate (/s)	Read %	Remote I/O%	Serv Time (ms)	Resp Time (ms)	Queue Length	Space Used %
	3.1	55.7	0.1	40.2	0.5	90.2	0.0	57	58	0.0	96.7
\$1\$DUA0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	90.6
\$1\$DUA1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	58.2

Disk Statistics										
Work Avail %	Paging %	Swapping %	Contlr %	Rate (/s)	Read %	Remote I/O%	Serv Time (ms)	Resp Time (ms)	Queue Length	Space Used %
\$1\$DUAL1	0.2	0.0	2.1	0.0	8.2	0.0	90	90	0.0	97.5
\$1\$DUAL2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	92.4
\$1\$DUAL3	2.1	1.1	25.8	0.5	98.7	0.0	41	41	0.0	95.0
\$1\$DUAL4	2.3	0.1	29.0	0.5	99.9	0.0	49	49	0.0	78.1
\$1\$DUAL5	0.1	8.9	1.7	0.0	92.4	0.0	53	53	0.0	67.5
\$1\$DUAL6	0.0	0.0	0.3	0.0	76.9	0.0	48	48	0.0	95.4
\$1\$DUAL7	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	69.7
\$1\$DUAL8	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	82.6
\$1\$DUAL9	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0.0	67.6
\$19\$DIA0	5.2	0.0	100.0	1.2	0.0	0.0	44	45	0.1	57.4
\$19\$DUA0	78.8	0.0	87.8	23.0	96.4	0.0	34	54	1.2	69.8
\$19\$DUAL	16.7	0.0	12.2	2.1	94.5	7.3	79	81	0.2	59.3

Server Statistics			
Work Avail %	Paging %	Swapping %	Queue Length
PUA	78.4	0.0	0.1
R3QZEC\$	5.1	0.0	0.1
UQVAX\$	7.4	22.9	0.0

Report Date: 20-MAY-1990 23:20

Run Statistics

Total Intervals Found For Analysis: 50
Prime Hours: 08, 09, 10, 11, 12, 13, 14, 15, 16
Input Source: Log File V3.3

Command Line:

REPO=LOG/OUT=UQEVE.LOG/SIN=13-DEC-1989 14:30:00.00/BEF=13-DEC-1989 16:10:00.00 UQEVE_19891213_1400.SPM

ELAPSED: 0 00:00:09.01 CPU: 0:00:02.92 BUFIO: 7 DIRIO: 76 FAULTS: 522

UQEVE

VAX SPM V3.3-03

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```
----- VAX VMS System Configuration -----
!
! Node : UQVAX
! Experiment name : DECCp Data Collection
! Log File : BBOCP_SYS:[CLAIRE.DECCP.UQ]UQVAX 19891213_1400.SPM;1
! Data collection started : 13-DEC-1989 14:01:00.66
! Data collection ended : 13-DEC-1989 16:30:01.85
! Sample interval : 120 seconds / 2.000 minutes
! Report generated : 20-MAY-1990 23:18:20.41
! Processor type is : 8550
! Running VMS version V5.1-1
! TR 32 BI - CI Adapter
! TR 34 BI - NMI Adapter (NBIB)
! TR 39 BI - NI Adapter (DEBNA)
! System Allocation Class : 1
! Total memory : 65536 pages = 32.00 MB
! Floating Point Accelerator Status:
!   None of the floating data types are emulated
! Non-paged memory = 10772 pages (16.4% of total memory)
! Paged memory = 54764 pages (83.6% of total memory)
! System working set = 1415 pages ( 2.6% of paged memory)
! User memory (paged-system working set) = 53349 pages (97.4% of paged memory)
!
!-----
```

FINAL Statistics

Data Analyzed: from 13-DEC-1989 14:31:21.29 to 13-DEC-1989 16:10:23.12

+	---	AVE	Process-Memory	Counts	---	+	AVE	Mem/CPU	---	+	Swapper	Counts	---	+
+	---	AVE	Process-Memory	Counts	---	+	AVE	Mem/CPU	---	+	Swapper	Counts	---	+

Proc Count	Balset Count	Free Pages	Modify Pages	Total MEMutl	Paged MEMutl	User MEMutl	Queues			Swap-Off Count			
							Mem	CPU		OutSWP	InSWP	Header InSWP	Header OutSWP
97	95	12617	552	80.7%	74.4%	76.4%	0	3	0	0	0	0	0.1%

CPU Statistics

CPU	Total	Busy	Inter	Kernel	Exec	Super	User	Compat	System	Task
ID	Idle	Wait	Stack							
1	79.7 %	0.0 %	3.7 %	6.9 %	1.8 %	0.7 %	7.2 %	0.0 %	12.3 %	7.9 %

Lost CPU	CPU	CPU and I/O overlap
-----+-----	-----+-----	-----+-----

Page Wait	Swap Wait	Page or Swp Wait	CPU+IO Idle	CPU Only	I/O Only	Multi I/O	CPU+IO Busy
6.8%	0.2%	6.8%	0.0%	0.0%	79.7%	100.0%	20.3%

Paging Rates (per second)

Page Faults	System Faults	Pages Read	Read I/Os	Pages Written	Write I/Os	Free List	Modify List	Bad List	Dzero Faults	Gvalid Faults	Trans Faults	WritIN Prog	Hard Faults	Soft Faults
56.4	1.3	12.6	1.9	4.2	0.1	10.7	6.3	0.0	20.4	16.7	0.0	0.2	3.4%	96.6%

I/O Rates (per second)

Direct I/Os	Buford I/Os	Lognam Trans	Mailbx Reads	Mailbx Writes	Window Hits	Window Turns	Split I/Os	Erase I/Os	File Opens	AVE Open Files
10.6	21.7	12.6	1.1	1.1	8.2	0.1	0.3	0.0	0.9	472

File Cache Attempt Rate (per second)

[illegible]

Disk Statistics

	Work Avail %	Paging %	Swpng %	Ctrlr %	Rate (/s)	Read %	Remote I/O%	Serv Time (ms)	Resp Time (ms)	Queue Length	Space Used %
\$1\$DUA0	18.1	33.5	0.0	63.3	5.2	81.2	9.6	35	44	0.2	96.7
\$1\$DUAL	0.6	15.5	0.6	12.5	0.2	98.1	0.0	26	32	0.0	90.7
\$1\$DUAL10	2.7	0.0	0.0	7.0	0.8	0.1	0.0	33	34	0.0	52.3

Disk Statistics										
Work Avail %	Paging %	Swping %	Contl'r %	Rate (/s)	Read %	Remote I/O%	Serv Time (ms)	Resp Time (ms)	Queue Length	Space Used %
\$1\$DUAL1	0.7	25.1	3.8	2.1	0.2	42.7	16.8	37	0.0	97.5
\$1\$DUAL2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	80.5
\$1\$DUAL3	1.1	0.0	0.0	2.7	0.5	97.4	99.8	21	0.0	95.0
\$1\$DUAL4	1.5	0.0	0.0	23.7	0.5	99.1	99.2	32	0.0	79.4
\$1\$DUAL5	0.1	0.0	0.0	0.6	0.0	29.5	33.1	30	0.0	67.5
\$1\$DUAL6	4.9	1.3	0.0	13.9	1.5	55.2	0.3	35	0.1	96.4
\$1\$DUAL7	100.0	15.8	33.4	63.8	0.8	50.5	0.0	1279	6774.7	69.7
\$1\$DUAL8	0.1	0.0	0.0	0.3	0.0	61.5	0.0	34	0.0	82.5
\$1\$DUAL9	100.0	2.6	0.0	10.2	1.1	49.6	0.0	947	5384.4	79.7
\$19\$DIA0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	54.6
\$19\$DUA0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	64.1
\$19\$DUA1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0	59.1

Server Statistics			
Work Avail %	Paging %	Swapping %	Queue Length
HSC000\$	4.8	12.0	21.4
HSC003\$	28.4	22.1	0.1
UQEVE\$	0.1	0.0	0.0

Report Date: 20-MAY-1990 23:18

UQVAX

VAX SPM V3.3-03

Page

5

Run Statistics

Total Intervals Found For Analysis: 49

Prime Hours: 08, 09, 10, 11, 12, 13, 14, 15, 16

Input Source: Log File V3.3

Command Line:

REPO=LOG/OUT=UQVAX.LOG/SIN=13-DEC-1989 14:30:00.00/BEF=13-DEC-1989 16:10:00.00 UQVAX_19891213_1400.SPM

ELAPSED: 0 00:00:17.14 CPU: 0:00:05.23 BUFIO: 7 DIRIO: 189 FAULTS: 575

Appendix C

Supporting Data - DECcp

C.1 DECcp Results

This Appendix provides the full reports from the classification and validation stages of the study, as well as the reports of the modelling undertaken.

The Class Profile Summary provides a summary of the initial model, grouping the user population according to transaction size. This grouping is achieved by splitting up the interactive population according to the sum of the average CPU time per transaction (normalized to a VAX 780 CPU power) and the average I/O time per transaction.

C.1.1 Class Profile Summary based on User Groups

This classification of users is based on separating out the Data Processing development users and training accounts which will be moved onto UQVEVE::: All other users are grouped together as "other-interactive", "other-batch" or "other".

DECcp OUTPUT: CLUSTER CONFIGURATION

NODE NAME	UQADM	UQVEVE	UQVAX
CPU TYPE	V8650	V3400	V8550
# CPUS	1	1	1
VMS VER	V5.1-1	V5.1-1	V5.1-1
IC TYPE	MI	MI	MI
CI ADAPT	CI780	NONE	CI750
NI ADAPT	DELUA	DESVa	DEBNA
TOTAL MEM	96.0 Mb	44.0 Mb	32.0 Mb
SERVERS	6	6	6
DISKS	16	15	15
PROCESSES	219	21	121
CLASSES	6	6	6
ELAPSE(s)	3538.5	3505.9	3394.8

GLOBAL SYSTEM STATISTICS

NODE NAME	UQADM	UQEVE	UQVAX
CPU UTIL %	74.05%	48.41%	20.67%
THROUGHPUT	10.77	1.17	2.24
TRUE I/O RATE	22.84	26.84	5.10
HARD FAULT RATE	3.50	0.15	1.67
SOFT FAULT RATE	92.63	5.38	52.36
MEMORY UTIL %	94.86%	25.38%	76.07%
I/O UTIL %	4.76%	4.41%	1.59%

CLUSTER POPULATION DISTRIBUTION

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	10	7	0
2	dev-batch	1	0	0
3	qa-train	2	0	0
4	other-ints	122	0	47
5	other-bat	32	0	13
6	other	52	14	61
T O T A L		219	21	121

CLUSTER INFORMATION : RESPONSE TIME (sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.908	0.713	0.000
2	dev-batch	0.000	0.000	0.000
3	qa-train	0.379	0.000	0.000
4	other-ints	1.228	0.000	1.160
5	other-bat	0.000	0.000	0.000
6	other	0.000	0.000	0.000
O V E R A L L		1.197	0.713	1.160

CLUSTER INFORMATION : CPU UTILIZATION (%)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	2.519	11.442	0.000
2	dev-batch	0.433	0.000	0.000
3	qa-train	0.074	0.000	0.000
4	other-ints	58.671	0.000	15.448
5	other-bat	5.276	0.000	1.325
6	other	7.079	36.972	3.897
T O T A L		74.051	48.414	20.670

CLUSTER INFORMATION : SYSTEM THROUGHPUTS (trans/sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.942	1.166	0.000
2	dev-batch	0.000*	0.000*	0.000*
3	qa-train	0.043	0.000	0.000
4	other-ints	9.784	0.000	2.235
5	other-bat	0.009*	0.000*	0.004*
6	other	0.332*	1.106*	11.177*
O V E R A L L		10.769	1.166	2.235

DISK CONFIGURATION INFORMATION

D I S K				D I S K S E R V E R		
NO	DISK NAME	TYPE	SHDW	SERVER NAME	TYPE	CHNL
1	1\$CSA1	RL02	0	UQADM\$LO	MBA	1
2	1\$DUA0	RA81	0	HSC003	HS50	1
3	1\$DUA1	RA81	0	HSC000	HS50	1
4	1\$DUA2	RA82	0	HSC000	HS50	2
5	1\$DUA3	RA82	0	HSC003	HS50	2
6	1\$DUA4	RA82	0	HSC000	HS50	3
7	1\$DUA5	RA82	0	HSC003	HS50	3
8	1\$DUA6	RA81	0	HSC003	HS50	4
9	1\$DUA7	RA81	0	HSC000	HS50	4
10	1\$DUA8	RA81	0	HSC003	HS50	5
11	1\$DUA9	RA81	0	HSC003	HS50	6
12	1\$DUA10	RA81	0	HSC003	HS50	1
13	1\$DUA11	RA81	0	HSC003	HS50	2
14	19\$DIA0	RF30	0	UQEVE	VAX	1
15	19\$DUA0	RA80	0	UQEVE\$L1	UBA	1
16	19\$DUA1	RA80	0	UQEVE\$L1	UBA	1

DISK STATISTICS

D I S K		%UTIL	THRUPUT I/O/sec	AVG QUEUE LENGTH	SERV TIME (ms)	AVG I/O SIZE (blocks)	%READ I/O
NO	DISKNAME						
2	1\$DUA0	29.66%	8.51	0.42	34.86	4.25	84.06
3	1\$DUA1	2.84%	0.79	0.03	36.12	13.25	89.87
4	1\$DUA2	8.59%	4.40	0.10	19.52	3.21	84.45
5	1\$DUA3	15.16%	5.63	0.18	26.93	7.15	82.99
6	1\$DUA4	14.54%	4.27	0.17	34.06	6.15	75.77
7	1\$DUA5	14.77%	6.08	0.18	24.28	6.29	46.63
8	1\$DUA6	4.56%	1.19	0.05	38.23	3.21	52.38
9	1\$DUA7	2.15%	0.39	6786.97	54.76	13.49	65.94
10	1\$DUA8	0.43%	0.12	0.00	35.98	11.73	7.89
11	1\$DUA9	2.55%	0.49	5468.32	51.77	4.39	48.39
12	1\$DUA10	7.50%	2.34	0.08	32.02	9.61	0.05
13	1\$DUA11	1.13%	0.28	0.01	39.89	10.45	11.87
14	19\$DIA0	4.97%	1.15	0.05	43.09	7.64	0.12
15	19\$DUA0	49.97%	23.00	1.01	21.73	5.65	95.42
16	19\$DUA1	13.43%	1.45	0.16	92.77	14.39	84.50
O V E R A L L		10.77%	60.10	766.11	28.66	6.05	77.63

DISK STATISTICS

D I S K		TRUE	FAULT
NO	DISKNAME	I/O RATE (/sec)	I/O RATE (/sec)
2	1\$DUA0	4.688	3.816
3	1\$DUA1	0.415	0.368
4	1\$DUA2	4.453	0.021
5	1\$DUA3	5.676	0.042
6	1\$DUA4	3.531	0.806
7	1\$DUA5	6.124	0.062
8	1\$DUA6	1.142	0.022
9	1\$DUA7	0.228	0.155
10	1\$DUA8	0.120	0.000
11	1\$DUA9	0.450	0.034
12	1\$DUA10	2.352	0.000
13	1\$DUA11	0.270	0.016
14	19\$DIA0	1.161	0.000
15	19\$DUA0	23.171	0.000
16	19\$DUA1	1.461	0.000
T O T A L		55.243	5.341

TRUE DISK I/O RATE (I/O/sec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	0.119	0.000	0.000	0.769	0.198	0.360
2	dev-batch	0.016	0.000	0.000	0.002	0.256	0.001
3	qa-train	0.002	0.000	0.000	0.001	0.000	0.016
4	other-ints	1.381	0.336	4.453	4.844	1.529	5.386
5	other-bat	0.767	0.000	0.000	0.000	0.766	0.273
6	other	2.402	0.079	0.001	0.059	0.781	0.089
T O T A L		4.688	0.415	4.453	5.676	3.531	6.124

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA6	DUA7	DUA8	DUA9	DUA10	DUA11
1	dev-int	0.000	0.000	0.000	0.000	0.000	0.000
2	dev-batch	0.000	0.000	0.000	0.000	0.000	0.000
3	qa-train	0.000	0.000	0.000	0.000	0.000	0.000
4	other-ints	0.991	0.109	0.110	0.079	0.000	0.013
5	other-bat	0.070	0.000	0.000	0.192	0.000	0.000
6	other	0.081	0.119	0.010	0.178	2.352	0.257
T O T A L		1.142	0.228	0.120	0.450	2.352	0.270

USER GROUP		19\$	19\$	19\$
NO	GROUP NAME	DIA0	DUA0	DUA1
1	dev-int	0.000	5.836	1.033
2	dev-batch	0.000	0.000	0.000
3	qa-train	0.000	0.000	0.000
4	other-ints	0.000	0.000	0.229
5	other-bat	0.000	0.000	0.000
6	other	1.161	17.336	0.199
T O T A L		1.161	23.171	1.461

PAGE FAULT DISK I/O RATE (I/O/sec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	0.321	0.011	0.000	0.006	0.051	0.007
2	dev-batch	0.036	0.000	0.000	0.001	0.000	0.000
3	qa-train	0.013	0.000	0.000	0.000	0.017	0.000
4	other-ints	1.865	0.284	0.021	0.035	0.653	0.040
5	other-bat	1.089	0.003	0.000	0.000	0.034	0.013
6	other	0.491	0.069	0.000	0.000	0.051	0.001
T O T A L		3.816	0.368	0.021	0.042	0.806	0.062

USER GROUP		1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA6	DUA7	DUA9	DUA11
1	dev-int	0.000	0.000	0.000	0.000
2	dev-batch	0.000	0.000	0.000	0.000
3	qa-train	0.000	0.000	0.000	0.000
4	other-ints	0.022	0.105	0.031	0.016
5	other-bat	0.000	0.000	0.000	0.000
6	other	0.000	0.050	0.003	0.000
T O T A L		0.022	0.155	0.034	0.016

C.1.2 Validation Report for Model based on User Groups

GLOBAL SYSTEM STATISTICS

MEASURED				MODELED			
NODE NAME	UQADM	UQEVE	UQVAX	UQADM	UQEVE	UQVAX	
CPU UTIL %	74.1%	48.4%	20.7%	74.1%	48.4%	20.7%	
THROUGHPUT	10.77	1.17	2.24	10.78	1.17	2.24	
TRUE I/O RATE	22.84	26.84	5.10	22.90	27.11	5.11	
HARD FAULT RATE	3.50	0.15	1.67	3.51	0.15	1.67	
SOFT FAULT RATE	92.63	5.38	52.36	92.69	5.39	52.38	
I/O UTIL %	4.8%	4.4%	1.6%	4.8%	4.5%	1.6%	

GLOBAL SYSTEM STATISTICS %ERROR

MODEL ERROR

NODE NAME	UQADM	UQEVE	UQVAX
CPU UTIL %	0.0%	0.0%	0.0%
THROUGHPUT	0.1%	0.0%	0.0%
TRUE I/O RATE	0.3%	1.0%	0.2%
HARD FAULT RATE	0.3%	0.0%	0.0%
SOFT FAULT RATE	0.1%	0.2%	0.0%
I/O UTIL %	0.0%	2.3%	0.0%

CLUSTER INFORMATION : RESPONSE TIME (sec)

MEASURED				MODELED			
CLASS NAME	UQADM	UQEVE	UQVAX	UQADM	UQEVE	UQVAX	
dev-int	0.908	0.713	0.000	0.905	0.711	0.000	
dev-batch	0.000	0.000	0.000	0.000	0.000	0.000	
qa-train	0.379	0.000	0.000	0.378	0.000	0.000	
other-ints	1.228	0.000	1.160	1.222	0.000	1.157	
other-bat	0.000	0.000	0.000	0.000	0.000	0.000	
other	0.000	0.000	0.000	0.000	0.000	0.000	
OVERALL	1.197	0.713	1.160	1.191	0.711	1.157	

CLUSTER INFORMATION : RESPONSE TIME %ERROR

MODEL ERROR			
CLASS NAME	UQADM	UQEVE	UQVAX
dev-int	0.33%	0.28%	0.00%
dev-batch	0.00%	0.00%	0.00%
qa-train	0.26%	0.00%	0.00%
other-ints	0.49%	0.00%	0.26%
other-bat	0.00%	0.00%	0.00%
other	0.00%	0.00%	0.00%
OVERALL	0.50%	0.28%	0.26%

CLUSTER INFORMATION : CPU UTILIZATION (%)

MEASURED

MODELED

CLASS NAME	UQADM	UQEVE	UQVAX	UQADM	UQEVE	UQVAX
dev-int	2.519	11.442	0.000	2.520	11.446	0.000
dev-batch	0.433	0.000	0.000	0.433	0.000	0.000
qa-train	0.074	0.000	0.000	0.074	0.000	0.000
other-ints	58.671	0.000	15.448	58.745	0.000	15.453
other-bat	5.276	0.000	1.325	5.276	0.000	1.325
other	7.079	36.972	3.897	7.079	36.972	3.897
OVERALL	74.051	48.414	20.670	74.126	48.419	20.675

CLUSTER INFORMATION : CPU UTILIZATION %ERROR

MODEL ERROR

CLASS NAME	UQADM	UQEVE	UQVAX
dev-int	0.04%	0.03%	0.00%
dev-batch	0.00%	0.00%	0.00%
qa-train	0.00%	0.00%	0.00%
other-ints	0.13%	0.00%	0.03%
other-bat	0.00%	0.00%	0.00%
other	0.00%	0.00%	0.00%
OVERALL	0.10%	0.01%	0.02%

CLUSTER INFORMATION : SYSTEM THROUGHPUT (trans/sec)

MEASURED

MODELED

CLASS NAME	UQADM	UQEVE	UQVAX	UQADM	UQEVE	UQVAX
dev-int	0.942	1.166	0.000	0.942	1.167	0.000
dev-batch	0.000	0.000	0.000	0.000	0.000	0.000
qa-train	0.043	0.000	0.000	0.043	0.000	0.000
other-ints	9.784	0.000	2.235	9.797	0.000	2.236
other-bat	0.009	0.000	0.004	0.009	0.000	0.004
other	0.332	1.106	11.177	0.332	1.106	11.177
OVERALL	10.769	1.166	2.235	10.782	1.167	2.236

CLUSTER INFORMATION : SYSTEM THROUGHPUT %ERROR

MODEL ERROR

CLASS NAME	UQADM	UQEVE	UQVAX
dev-int	0.00%	0.09%	0.00%
dev-batch	0.00%	0.00%	0.00%
qa-train	0.00%	0.00%	0.00%
other-ints	0.13%	0.00%	0.04%
other-bat	0.00%	0.00%	0.00%
other	0.00%	0.00%	0.00%
OVERALL	0.12%	0.09%	0.04%

DISK STATISTICS

MEASURED			MODELED	
DISK NAMES	%UTIL	THRUPUT /sec	%UTIL	THRUPUT /sec
1\$DUA0	29.66%	8.51	29.84%	8.52
1\$DUA1	2.84%	0.79	2.84%	0.79
1\$DUA2	8.59%	4.40	8.62%	4.41
1\$DUA3	15.16%	5.63	15.27%	5.67
1\$DUA4	14.54%	4.27	14.57%	4.28
1\$DUA5	14.77%	6.08	14.82%	6.10
1\$DUA6	4.56%	1.19	4.57%	1.20
1\$DUA7	2.15%	0.39	2.15%	0.39
1\$DUA8	0.43%	0.12	0.43%	0.12
1\$DUA9	2.55%	0.49	2.56%	0.49
1\$DUA10	7.50%	2.34	7.61%	2.34
1\$DUA11	1.13%	0.28	1.14%	0.28
19\$DIA0	4.97%	1.15	4.97%	1.15
19\$DUA0	49.97%	23.00	50.40%	23.20
19\$DUA1	13.43%	1.45	13.75%	1.48
OVERALL	10.77%	60.10	10.85%	60.44

DISK STATISTICS %ERROR

MODEL ERROR

DISK NAMES	%UTIL	THRUPUT /sec
1\$DUA0	0.61%	0.12%
1\$DUA1	0.00%	0.00%
1\$DUA2	0.35%	0.23%
1\$DUA3	0.73%	0.71%
1\$DUA4	0.21%	0.23%
1\$DUA5	0.34%	0.33%
1\$DUA6	0.22%	0.84%
1\$DUA7	0.00%	0.00%
1\$DUA8	0.00%	0.00%
1\$DUA9	0.39%	0.00%
1\$DUA10	1.47%	0.00%
1\$DUA11	0.88%	0.00%
19\$DIA0	0.00%	0.00%
19\$DUA0	0.86%	0.87%
19\$DUA1	2.38%	2.07%
OVERALL	0.74%	0.57%

C.1.3 Model Report for Redistributed Users

The following report shows the likely effect on the VAXcluster of moving the CPU and disk load for the development team and user training from UQADM:: to UQEVE::.. The loading of disk drives \$19\$DUA0: and \$19\$DUA1: have also been balanced to reduce queuing effects.

DECcp OUTPUT: CLUSTER CONFIGURATION

NODE NAME	UQADM	UQEVE	UQVAX
CPU TYPE	V8650	V3400	V8550
# CPUS	1	1	1
VMS VER	V5.1-1	V5.1-1	V5.1-1
IC TYPE	MI	MI	MI
CI ADAPT	CI780	NONE	CI750
NI ADAPT	DELUA	DESVa	DEBNA
TOTAL MEM	96.0 Mb	44.0 Mb	32.0 Mb
SERVERS	5	3	6
DISKS	16	15	15
PROCESSES	206	34	121
CLASSES	6	6	6

GLOBAL SYSTEM STATISTICS

NODE NAME	UQADM	UQEVE	UQVAX
CPU UTIL %	71.25%	53.94%	20.67%
THROUGHPUT	9.82	2.02	2.24
TRUE I/O RATE	22.05	27.25	5.11
HARD FAULT RATE	3.27	0.40	1.67
SOFT FAULT RATE	86.37	14.27	52.38
MEMORY UTIL %	62.32%	29.98%	75.23%
I/O UTIL %	4.56%	4.41%	1.60%
CI ADPT UTIL %	3.54%	0.00%	1.12%
NI ADPT UTIL %	0.00%	37.64%	0.00%
SERVER UTIL %	3.86%	3.58%	0.98%

CLUSTER POPULATION DISTRIBUTION

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0	17	0
2	dev-batch	0	1	0
3	qa-train	0	2	0
4	other-ints	122	0	47
5	other-bat	32	0	13
6	other	52	14	61
T O T A L		206	34	121

CLUSTER INFORMATION : RESPONSE TIME (sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	1.157	0.000
2	dev-batch	0.000*	248.140*	0.000*
3	qa-train	0.000	0.780	0.000
4	other-ints	1.210	0.000	1.157
5	other-bat	104.239*	0.000*	17.146*
6	other	7.125*	1.849*	1.062*
O V E R A L L		1.210	1.149	1.157

CLUSTER INFORMATION : CPU UTILIZATION (%)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	15.853	0.000
2	dev-batch	0.000	0.951	0.000
3	qa-train	0.000	0.159	0.000
4	other-ints	58.893	0.000	15.453
5	other-bat	5.276	0.000	1.325
6	other	7.079	36.972	3.897
O V E R A L L		71.247	53.936	20.675

CLUSTER INFORMATION : SYSTEM THROUGHPUTS (trans/sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	1.976	0.000
2	dev-batch	0.000*	0.000*	0.000*
3	qa-train	0.000	0.043	0.000

CLUSTER INFORMATION : SYSTEM THROUGHPUTS (trans/sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
4	other-ints	9.821	0.000	2.236
5	other-bat	0.009*	0.000*	0.004*
6	other	0.332*	1.106*	11.177*
O V E R A L L		9.821	2.019	2.236

CLUSTER INFORMATION : CPU QUEUE LENGTHS

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	0.187	0.000
2	dev-batch	0.000	0.010	0.000
3	qa-train	0.000	0.002	0.000
4	other-ints	1.592	0.000	0.190
5	other-bat	0.183	0.000	0.017
6	other	0.197	0.803	0.041
O V E R A L L		1.973	1.001	0.247

DISK CONFIGURATION INFORMATION

D I S K				D I S K S E R V E R			
NO	DISK NAME	TYPE	SHDW	SERVER NAME	TYPE	CHNL	CHNL UTL%
1	1\$CSA1	RL02	0	UQADM\$L0	MBA	1	0.00
2	1\$DUA0	RA81	0	HSC003	HS50	1	0.85
3	1\$DUA1	RA81	0	HSC000	HS50	1	0.25
4	1\$DUA2	RA82	0	HSC000	HS50	2	0.33
5	1\$DUA3	RA82	0	HSC003	HS50	2	0.85
6	1\$DUA4	RA82	0	HSC000	HS50	3	0.58
7	1\$DUA5	RA82	0	HSC003	HS50	3	0.83
8	1\$DUA6	RA81	0	HSC003	HS50	4	0.09
9	1\$DUA7	RA81	0	HSC000	HS50	4	0.12
10	1\$DUA8	RA81	0	HSC003	HS50	5	0.03
11	1\$DUA9	RA81	0	HSC003	HS50	6	0.05
12	1\$DUA10	RA81	0	HSC003	HS50	1	0.53
13	1\$DUA11	RA81	0	HSC003	HS50	2	0.07
14	19\$DIA0	RF30	0	UQEVE	VAX	1	0.41
15	19\$DUA0	RA80	0	UQEVE\$L1	UBA	1	1.88
16	19\$DUA1	RA80	0	UQEVE\$L1	UBA	1	1.61

TOTAL CHANNEL UTILIZATION (%)

SERVER NAME	TYPE	CHANNEL	CHANNEL UTIL %
HSC000	HS50	1	0.25
HSC000	HS50	2	0.33
HSC000	HS50	3	0.58
HSC000	HS50	4	0.12
HSC003	HS50	1	1.38
HSC003	HS50	2	0.92
HSC003	HS50	3	0.83
HSC003	HS50	4	0.09
HSC003	HS50	5	0.03
HSC003	HS50	6	0.05
UQEVE	VAX	1	0.41
UQADM\$L0	MBA	1	0.00
UQEVE\$L1	UBA	1	3.49

DISK STATISTICS

D I S K		%UTIL	THRUPUT I/O/sec	AVG QUEUE LENGTH	SERV TIME (ms)	AVG I/O SIZE (blocks)	%READ I/O
NO	DISKNAME						
2	1\$DUA0	29.78%	8.51	0.42	34.86	4.25	84.06
3	1\$DUA1	2.83%	0.78	0.03	36.17	13.39	89.72
4	1\$DUA2	8.64%	4.43	0.09	19.52	3.21	84.45
5	1\$DUA3	13.19%	4.89	0.15	26.99	7.38	80.43
6	1\$DUA4	12.92%	3.78	0.15	34.17	6.54	77.94
7	1\$DUA5	13.92%	5.74	0.16	24.25	6.18	47.89
8	1\$DUA6	4.57%	1.20	0.05	38.23	3.21	52.38
9	1\$DUA7	2.15%	0.39	0.02	54.76	13.49	65.94
10	1\$DUA8	0.43%	0.12	0.00	35.98	11.73	7.89
11	1\$DUA9	2.56%	0.49	0.03	51.77	4.39	48.39
12	1\$DUA10	7.60%	2.34	0.08	32.02	9.61	0.05
13	1\$DUA11	1.14%	0.28	0.01	39.89	10.45	11.87
14	19\$DIA0	8.92%	2.74	0.10	32.50	6.33	42.17
15	19\$DUA0	30.55%	14.05	0.44	21.75	5.70	96.11
16	19\$DUA1	30.08%	9.99	0.43	30.10	6.85	92.86
O V E R A L L		10.58%	59.74	0.14	28.30	6.05	77.63

DISK UTILIZATION (%)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	1.38	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.17	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.05	0.00	0.00	0.00	0.00	0.00
4	other-ints	11.62	2.21	8.64	13.04	7.36	13.06
5	other-bat	6.45	0.01	0.00	0.00	2.61	0.64
6	other	10.12	0.61	0.00	0.15	2.95	0.21
T O T A L		29.78	2.83	8.64	13.19	12.92	13.92

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA6	DUA7	DUA8	DUA9	DUA10	DUA11
1	dev-int	0.00	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.00	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.00	0.00	0.00	0.00	0.00	0.00
4	other-ints	3.98	1.13	0.39	0.61	0.00	0.12
5	other-bat	0.27	0.00	0.00	1.00	0.00	0.00
6	other	0.32	1.02	0.04	0.94	7.60	1.02
T O T A L		4.57	2.15	0.43	2.56	7.60	1.14

USER GROUP		19\$	19\$	19\$
NO	GROUP NAME	DIA0	DUA0	DUA1
1	dev-int	4.22	11.89	2.72
2	dev-batch	0.79	0.00	0.00
3	qa-train	0.09	0.00	0.00
4	other-ints	0.00	0.00	2.70
5	other-bat	0.00	0.00	0.00
6	other	3.81	18.66	24.66
T O T A L		8.92	30.55	30.08

DISK THROUGHPUT (I/O/sec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	0.39	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.05	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.01	0.00	0.00	0.00	0.00	0.00
4	other-ints	3.29	0.63	4.43	4.83	2.17	5.37
5	other-bat	1.87	0.00	0.00	0.00	0.79	0.28
6	other	2.91	0.15	0.00	0.06	0.82	0.09
T O T A L		8.51	0.78	4.43	4.89	3.78	5.74

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA6	DUA7	DUA8	DUA9	DUA10	DUA11
1	dev-int	0.00	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.00	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.00	0.00	0.00	0.00	0.00	0.00
4	other-ints	1.04	0.22	0.11	0.11	0.00	0.03
5	other-bat	0.07	0.00	0.00	0.20	0.00	0.00
6	other	0.08	0.17	0.01	0.18	2.34	0.26
T O T A L		1.20	0.39	0.12	0.49	2.34	0.28

USER GROUP		19\$	19\$	19\$
NO	GROUP NAME	DIA0	DUA0	DUA1
1	dev-int	1.30	5.45	0.96
2	dev-batch	0.26	0.00	0.00
3	qa-train	0.03	0.00	0.00
4	other-ints	0.00	0.00	0.23
5	other-bat	0.00	0.00	0.00
6	other	1.15	8.60	8.80
T O T A L		2.74	14.05	9.99

DISK WAIT TIME PER TRANS (msec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	2.94	0.00	0.00	0.00	0.00	0.00
2	dev-batch	2509.03	0.00	0.00	0.00	0.00	18.43
3	qa-train	4.60	0.00	0.00	0.13	0.00	0.00
4	other-ints	13.28	0.21	0.83	2.01	1.11	2.15
5	other-bat	4313.65	0.38	0.00	0.00	428.23	115.16
6	other	67.33	0.53	0.00	0.65	7.79	1.01

USER GROUP		1\$	1\$	1\$	1\$	1\$	19\$
NO	GROUP NAME	DUA6	DUA7	DUA9	DUA10	DUA11	DIA0
1	dev-int	0.00	0.00	0.00	0.00	0.00	2.08
2	dev-batch	0.00	0.00	0.00	0.00	0.00	2727.11
3	qa-train	0.00	0.00	0.00	0.00	0.00	2.15
4	other-ints	0.85	0.11	0.07	0.00	0.01	0.00
5	other-bat	33.92	0.09	68.83	0.00	0.00	0.00
6	other	0.01	0.02	0.21	13.07	0.27	3.38

USER GROUP		19\$	19\$
NO	GROUP NAME	DUA0	DUA1
1	dev-int	26.30	5.88
2	dev-batch	0.00	0.00
3	qa-train	0.00	0.00
4	other-ints	0.00	1.18
5	other-bat	0.00	0.00
6	other	74.23	95.92

SERVER UTILIZATION (%)

USER GROUP		HSC000	HSC003	UQEVES L1
NO	GROUP NAME			
1	dev-int	0.00	0.11	1.93
2	dev-batch	0.00	0.01	0.00
3	qa-train	0.00	0.00	0.00
4	other-ints	2.06	4.05	0.73
5	other-bat	0.22	0.66	0.00
6	other	0.42	1.70	4.94
T O T A L		2.70	6.53	7.60

SERVER THROUGHPUT (I/O/sec)

USER GROUP		HSC000	HSC003	UQEVES L1	UQEVES L1
NO	GROUP NAME				
1	dev-int	0.00	0.39	1.30	6.41
2	dev-batch	0.00	0.05	0.26	0.00
3	qa-train	0.00	0.01	0.03	0.00
4	other-ints	7.45	14.77	0.00	0.23
5	other-bat	0.79	2.42	0.00	0.00
6	other	1.14	5.93	1.15	17.40
T O T A L		9.38	23.57	2.74	24.04

SERVER WAIT TIME PER TRANS (msec)

USER GROUP		HSC000	HSC003	UQEVES L1
NO	GROUP NAME			
1	dev-int	0.00	0.04	0.80
2	dev-batch	0.00	33.83	0.00
3	qa-train	0.00	0.07	0.00
4	other-ints	0.08	0.47	0.06
5	other-bat	6.62	75.49	0.00
6	other	0.20	2.16	3.67

C.1.4 Model Report for 30% Growth of Redistributed Users

The following report follows on from the previous Model Report (includes user population redistribution and disk load balancing), applying a 30% growth factor to all classes. This not only suggests that at this stage the CPU of UQADM:: will saturate (Average CPU utilization > 90%),

but that the system disk (\$1\$DUA0:) will also become a bottleneck (average utilization >50% - i.e. average I/O queue length >1) to other systems which access it.

DECcp OUTPUT: CLUSTER CONFIGURATION

NODE NAME	UQADM	UQEVE	UQVAX
CPU TYPE	V8650	V3400	V8550
# CPUS	1	1	1
VMS VER	V5.1-1	V5.1-1	V5.1-1
IC TYPE	MI	MI	MI
CI ADAPT	CI780	NONE	CI750
NI ADAPT	DELUA	DESVa	DEBNA
TOTAL MEM	96.0 Mb	44.0 Mb	32.0 Mb
SERVERS	5	3	6
DISKS	16	15	15
PROCESSES	266	43	156
CLASSES	6	6	6

GLOBAL SYSTEM STATISTICS

NODE NAME	UQADM	UQEVE	UQVAX
CPU UTIL %	90.14%	68.99%	26.18%
THROUGHPUT	12.38	2.58	2.82
TRUE I/O RATE	27.98	34.97	6.70
HARD FAULT RATE	4.15	0.50	11.47
SOFT FAULT RATE	109.81	17.94	56.95
MEMORY UTIL %	76.90%	35.36%	91.38%
I/O UTIL %	5.79%	5.66%	4.28%
CI ADPT UTIL %	4.49%	0.00%	2.63%
NI ADPT UTIL %	0.00%	48.29%	0.00%
SERVER UTIL %	4.89%	4.61%	2.59%

CLUSTER POPULATION DISTRIBUTION

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0	22	0
2	dev-batch	0	1	0
3	qa-train	0	2	0
4	other-ints	158	0	61
5	other-bat	41	0	16
6	other	67	18	79
T O T A L		266	43	156

CLUSTER INFORMATION : RESPONSE TIME (sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	1.207	0.000
2	dev-batch	0.000*	260.454*	0.000*
3	qa-train	0.000	0.800	0.000
4	other-ints	1.408	0.000	2.587
5	other-bat	157.740*	0.000*	64.503*
6	other	7.811*	2.368*	1.906*
O V E R A L L		1.408	1.201	2.587

CLUSTER INFORMATION : CPU UTILIZATION (%)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	20.339	0.000
2	dev-batch	0.000	0.951	0.000
3	qa-train	0.000	0.159	0.000
4	other-ints	74.264	0.000	19.506
5	other-bat	6.759	0.000	1.630
6	other	9.121	47.536	5.047
O V E R A L L		90.144	68.985	26.183

CLUSTER INFORMATION : SYSTEM THROUGHPUTS (trans/sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	2.536	0.000
2	dev-batch	0.000*	0.000*	0.000*
3	qa-train	0.000	0.042	0.000

CLUSTER INFORMATION : SYSTEM THROUGHPUTS (trans/sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
4	other-ints	12.384	0.000	2.823
5	other-bat	0.012*	0.000*	0.005*
6	other	0.428*	1.422*	14.475*
O V E R A L L		12.384	2.578	2.823

CLUSTER INFORMATION : CPU QUEUE LENGTHS

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	0.254	0.000
2	dev-batch	0.000	0.010	0.000
3	qa-train	0.000	0.002	0.000
4	other-ints	3.474	0.000	0.256
5	other-bat	0.686	0.000	0.022
6	other	0.449	1.533	0.053
O V E R A L L		4.609	1.798	0.331

DISK CONFIGURATION INFORMATION

D I S K				D I S K S E R V E R			
NO	DISK NAME	TYPE	SHDW	SERVER NAME	TYPE	CHNL	CHNL UTL%
1	1\$CSA1	RL02	0	UQADM\$LO	MBA	1	0.00
2	1\$DUA0	RA81	0	HSC003	HS50	1	1.87
3	1\$DUA1	RA81	0	HSC000	HS50	1	0.42
4	1\$DUA2	RA82	0	HSC000	HS50	2	0.42
5	1\$DUA3	RA82	0	HSC003	HS50	2	1.07
6	1\$DUA4	RA82	0	HSC000	HS50	3	0.74
7	1\$DUA5	RA82	0	HSC003	HS50	3	1.05
8	1\$DUA6	RA81	0	HSC003	HS50	4	0.13
9	1\$DUA7	RA81	0	HSC000	HS50	4	0.39
10	1\$DUA8	RA81	0	HSC003	HS50	5	0.04
11	1\$DUA9	RA81	0	HSC003	HS50	6	0.12
12	1\$DUA10	RA81	0	HSC003	HS50	1	0.68
13	1\$DUA11	RA81	0	HSC003	HS50	2	0.11
14	19\$DIA0	RF30	0	UQEVE	VAX	1	0.52
15	19\$DUA0	RA80	0	UQEVE\$L1	UBA	1	2.42
16	19\$DUA1	RA80	0	UQEVE\$L1	UBA	1	2.06

TOTAL CHANNEL UTILIZATION (%)

SERVER NAME	TYPE	CHANNEL	CHANNEL UTIL %
HSC000	HS50	1	0.42
HSC000	HS50	2	0.42
HSC000	HS50	3	0.74
HSC000	HS50	4	0.39
HSC003	HS50	1	2.56
HSC003	HS50	2	1.18
HSC003	HS50	3	1.05
HSC003	HS50	4	0.13
HSC003	HS50	5	0.04
HSC003	HS50	6	0.12
UQEVE	VAX	1	0.52
UQADM\$LO	MBA	1	0.00
UQEVE\$LL	UBA	1	4.48

DISK STATISTICS

D I S K		%UTIL	THRUPUT	AVG	SERV	AVG I/O	%READ
NO	DISKNAME		I/O/sec	QUEUE LENGTH	TIME (ms)	SIZE (blocks)	I/O
2	1\$DUA0	65.41%	18.68	1.89	34.86	4.26	83.99
3	1\$DUA1	4.93%	1.37	0.05	36.16	13.38	89.77
4	1\$DUA2	10.91%	5.59	0.12	19.52	3.21	84.45
5	1\$DUA3	16.67%	6.17	0.20	26.99	7.38	80.43
6	1\$DUA4	16.45%	4.81	0.20	34.17	6.54	77.97
7	1\$DUA5	17.60%	7.26	0.21	24.25	6.18	47.89
8	1\$DUA6	6.36%	1.66	0.07	38.23	3.22	52.38
9	1\$DUA7	7.69%	1.42	0.08	54.75	13.48	65.96
10	1\$DUA8	0.54%	0.15	0.01	35.98	11.73	7.89
11	1\$DUA9	4.22%	0.81	0.04	51.79	4.45	48.69
12	1\$DUA10	9.97%	3.02	0.11	32.02	9.62	0.05
13	1\$DUA11	1.84%	0.46	0.02	39.89	10.45	11.92
14	19\$DIA0	11.23%	3.45	0.13	32.54	6.42	42.37
15	19\$DUA0	39.32%	18.08	0.65	21.75	5.70	96.12
16	19\$DUA1	38.62%	12.84	0.63	30.12	6.86	92.86
O V E R A L L		15.74%	85.78	0.28	29.29	6.05	77.66

DISK UTILIZATION (%)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	1.80	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.17	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.05	0.00	0.00	0.00	0.00	0.00
4	other-ints	33.63	4.13	10.91	16.47	9.31	16.51
5	other-bat	14.29	0.02	0.00	0.00	3.34	0.83
6	other	15.47	0.79	0.00	0.19	3.80	0.27
T O T A L		65.41	4.93	10.91	16.67	16.45	17.60

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA6	DUA7	DUA8	DUA9	DUA10	DUA11
1	dev-int	0.00	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.00	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.00	0.00	0.00	0.00	0.00	0.00
4	other-ints	5.61	4.61	0.50	1.77	0.00	0.52
5	other-bat	0.33	0.01	0.00	1.24	0.00	0.00
6	other	0.41	3.07	0.05	1.21	9.97	1.32
T O T A L		6.36	7.69	0.54	4.22	9.97	1.84

USER GROUP		19\$	19\$	19\$
NO	GROUP NAME	DIA0	DUA0	DUA1
1	dev-int	5.44	15.33	3.51
2	dev-batch	0.79	0.00	0.00
3	qa-train	0.09	0.00	0.00
4	other-ints	0.00	0.00	3.41
5	other-bat	0.00	0.00	0.00
6	other	4.90	23.99	31.71
T O T A L		11.23	39.32	38.62

DISK THROUGHPUT (I/O/sec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	0.50	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.05	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.01	0.00	0.00	0.00	0.00	0.00
4	other-ints	9.56	1.17	5.59	6.10	2.74	6.78
5	other-bat	4.14	0.00	0.00	0.00	1.01	0.36
6	other	4.41	0.19	0.00	0.08	1.06	0.11
T O T A L		18.68	1.37	5.59	6.17	4.81	7.26

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA6	DUA7	DUA8	DUA9	DUA10	DUA11
1	dev-int	0.00	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.00	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.00	0.00	0.00	0.00	0.00	0.00
4	other-ints	1.47	0.90	0.14	0.33	0.00	0.13
5	other-bat	0.09	0.00	0.00	0.24	0.00	0.00
6	other	0.11	0.52	0.01	0.24	3.02	0.33
T O T A L		1.66	1.42	0.15	0.81	3.02	0.46

USER GROUP		19\$	19\$	19\$
NO	GROUP NAME	DIA0	DUA0	DUA1
1	dev-int	1.68	7.02	1.24
2	dev-batch	0.26	0.00	0.00
3	qa-train	0.03	0.00	0.00
4	other-ints	0.00	0.00	0.29
5	other-bat	0.00	0.00	0.00
6	other	1.48	11.06	11.31
T O T A L		3.45	18.08	12.84

DISK WAIT TIME PER TRANS (msec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	13.26	0.00	0.00	0.00	0.00	0.00
2	dev-batch	11291.83	0.00	0.00	0.00	0.00	24.35
3	qa-train	20.77	0.00	0.00	0.17	0.00	0.00
4	other-ints	183.16	0.61	1.08	2.65	1.47	2.84
5	other-bat	43829.79	0.67	0.00	0.00	567.97	152.16
6	other	303.37	0.95	0.00	0.86	10.33	1.33

USER GROUP		1\$	1\$	1\$	1\$	1\$	19\$
NO	GROUP NAME	DUA6	DUA7	DUA9	DUA10	DUA11	DIA0
1	dev-int	0.00	0.00	0.00	0.00	0.00	2.68
2	dev-batch	0.00	0.00	0.00	0.00	0.00	3523.76
3	qa-train	0.00	0.00	0.00	0.00	0.00	2.79
4	other-ints	1.33	1.33	0.27	0.00	0.03	0.00
5	other-bat	48.11	1.77	115.69	0.00	0.00	0.00
6	other	0.02	0.18	0.35	17.61	0.45	4.36

USER GROUP		19\$	19\$
NO	GROUP NAME	DUA0	DUA1
1	dev-int	38.73	8.60
2	dev-batch	0.00	0.00
3	qa-train	0.00	0.00
4	other-ints	0.00	1.72
5	other-bat	0.00	0.00
6	other	109.32	140.31

SERVER UTILIZATION (%)

USER GROUP		HSC000	HSC003	UQEVE\$
NO	GROUP NAME			L1
1	dev-int	0.00	0.14	2.48
2	dev-batch	0.00	0.01	0.00
3	qa-train	0.00	0.00	0.00
4	other-ints	2.90	6.73	0.92
5	other-bat	0.28	1.32	0.00
6	other	0.67	2.37	6.35
T O T A L		3.85	10.57	9.76

SERVER THROUGHPUT (I/O/sec)

USER GROUP		HSC000	HSC003	UQEVE	UQEVE\$
NO	GROUP NAME				L1
1	dev-int	0.00	0.50	1.68	8.26
2	dev-batch	0.00	0.05	0.26	0.00
3	qa-train	0.00	0.01	0.03	0.00
4	other-ints	10.40	24.50	0.00	0.29
5	other-bat	1.02	4.83	0.00	0.00
6	other	1.77	8.31	1.48	22.38
T O T A L		13.19	38.22	3.45	30.92

SERVER WAIT TIME PER TRANS (msec)

USER GROUP		HSC000	HSC003	UQEVE\$ L1
NO	GROUP NAME			
1	dev-int	0.00	0.06	1.05
2	dev-batch	0.00	57.78	0.00
3	qa-train	0.00	0.11	0.00
4	other-ints	0.15	1.46	0.08
5	other-bat	9.61	249.62	0.00
6	other	0.30	3.67	4.83

C.1.5 Model Report for 30% Growth of Remaining Users on UQADM::

The following report follows on from the previous Model Report (includes user population redistribution and disk load balancing), applying a 30% growth factor to all classes on UQADM:: only. This not only suggests that at this stage the CPU of UQADM:: will support 30% more users before it saturates (Average CPU utilization >90%), but that the system disk (\$1\$DUA0:) will not yet be a bottleneck (average utilization >50% - i.e. average I/O queue length >1) for other systems which access it.

DECcp OUTPUT: CLUSTER CONFIGURATION

NODE NAME	UQADM	UQEVE	UQVAX
CPU TYPE	V8650	V3400	V8550
# CPUS	1	1	1
VMS VER	V5.1-1	V5.1-1	V5.1-1
IC TYPE	MI	MI	MI
CI ADAPT	CI780	NONE	CI750
NI ADAPT	DELUA	DESVa	DEBNA
TOTAL MEM	96.0 Mb	44.0 Mb	32.0 Mb
SERVERS	5	3	6
DISKS	16	15	15
PROCESSES	266	34	121
CLASSES	6	6	6

GLOBAL SYSTEM STATISTICS

NODE NAME	UQADM	UQEVE	UQVAX
CPU UTIL %	90.26%	53.93%	20.67%
THROUGHPUT	12.40	2.02	2.24
TRUE I/O RATE	27.93	27.20	5.11
HARD FAULT RATE	4.16	0.40	1.67
SOFT FAULT RATE	109.91	14.27	52.37
MEMORY UTIL %	76.90%	29.98%	75.23%
I/O UTIL %	5.79%	4.41%	1.61%
CI ADPT UTIL %	4.50%	0.00%	1.12%
NI ADPT UTIL %	0.00%	37.64%	0.00%
SERVER UTIL %	4.89%	3.58%	0.97%

CLUSTER POPULATION DISTRIBUTION

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0	17	0
2	dev-batch	0	1	0
3	qa-train	0	2	0
4	other-ints	158	0	47
5	other-bat	41	0	13
6	other	67	14	61
T O T A L		266	34	121

CLUSTER INFORMATION : RESPONSE TIME (sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	1.157	0.000
2	dev-batch	0.000*	248.689*	0.000*
3	qa-train	0.000	0.781	0.000
4	other-ints	1.378	0.000	1.159
5	other-bat	145.574*	0.000*	17.643*
6	other	7.605*	1.853*	1.063*
O V E R A L L		1.378	1.149	1.159

CLUSTER INFORMATION : CPU UTILIZATION (%)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	15.851	0.000
2	dev-batch	0.000	0.951	0.000
3	qa-train	0.000	0.159	0.000
4	other-ints	74.378	0.000	15.449
5	other-bat	6.759	0.000	1.325
6	other	9.121	36.972	3.897
O V E R A L L		90.258	53.934	20.671

CLUSTER INFORMATION : SYSTEM THROUGHPUTS (trans/sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	1.976	0.000
2	dev-batch	0.000*	0.000*	0.000*
3	qa-train	0.000	0.043	0.000

CLUSTER INFORMATION : SYSTEM THROUGHPUTS (trans/sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
4	other-ints	12.404	0.000	2.236
5	other-bat	0.012*	0.000*	0.004*
6	other	0.428*	1.106*	11.177*
O V E R A L L		12.404	2.019	2.236

CLUSTER INFORMATION : CPU QUEUE LENGTHS

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	0.187	0.000
2	dev-batch	0.000	0.010	0.000
3	qa-train	0.000	0.002	0.000
4	other-ints	3.498	0.000	0.190
5	other-bat	0.694	0.000	0.017
6	other	0.451	0.803	0.041
O V E R A L L		4.643	1.001	0.247

DISK CONFIGURATION INFORMATION

D I S K				D I S K S E R V E R			
NO	DISK NAME	TYPE	SHDW	SERVER NAME	TYPE	CHNL	CHNL UTL%
1	1\$CSA1	RL02	0	UQADM\$LO	MBA	1	0.00
2	1\$DUA0	RA81	0	HSC003	HS50	1	0.97
3	1\$DUA1	RA81	0	HSC000	HS50	1	0.28
4	1\$DUA2	RA82	0	HSC000	HS50	2	0.42
5	1\$DUA3	RA82	0	HSC003	HS50	2	1.07
6	1\$DUA4	RA82	0	HSC000	HS50	3	0.72
7	1\$DUA5	RA82	0	HSC003	HS50	3	1.05
8	1\$DUA6	RA81	0	HSC003	HS50	4	0.09
9	1\$DUA7	RA81	0	HSC000	HS50	4	0.12
10	1\$DUA8	RA81	0	HSC003	HS50	5	0.04
11	1\$DUA9	RA81	0	HSC003	HS50	6	0.05
12	1\$DUA10	RA81	0	HSC003	HS50	1	0.63
13	1\$DUA11	RA81	0	HSC003	HS50	2	0.09
14	19\$DIA0	RF30	0	UQEVE	VAX	1	0.41
15	19\$DUA0	RA80	0	UQEVE\$L1	UBA	1	1.87
16	19\$DUA1	RA80	0	UQEVE\$L1	UBA	1	1.69

TOTAL CHANNEL UTILIZATION (%)

SERVER NAME	TYPE	CHANNEL	CHANNEL UTIL %
HSC000	HS50	1	0.28
HSC000	HS50	2	0.42
HSC000	HS50	3	0.72
HSC000	HS50	4	0.12
HSC003	HS50	1	1.60
HSC003	HS50	2	1.15
HSC003	HS50	3	1.05
HSC003	HS50	4	0.09
HSC003	HS50	5	0.04
HSC003	HS50	6	0.05
UQEVE	VAX	1	0.41
UQADM\$LO	MBA	1	0.00
UQEVE\$L1	UBA	1	3.57

DISK STATISTICS

D I S K		%UTIL	THRUPUT I/O/sec	AVG QUEUE LENGTH	SERV TIME (ms)	AVG I/O SIZE (blocks)	%READ I/O
NO	DISKNAME						
2	1\$DUA0	34.04%	9.73	0.52	34.86	4.26	84.23
3	1\$DUA1	3.20%	0.88	0.03	36.19	13.46	88.42
4	1\$DUA2	10.89%	5.58	0.12	19.52	3.21	84.45
5	1\$DUA3	16.63%	6.16	0.20	26.99	7.38	80.43
6	1\$DUA4	15.94%	4.66	0.19	34.18	6.56	77.30
7	1\$DUA5	17.57%	7.25	0.21	24.25	6.18	47.89
8	1\$DUA6	4.57%	1.19	0.05	38.23	3.21	52.38
9	1\$DUA7	2.15%	0.39	0.02	54.76	13.49	65.94
10	1\$DUA8	0.53%	0.15	0.01	36.02	11.83	6.21
11	1\$DUA9	2.63%	0.51	0.03	51.74	4.31	47.81
12	1\$DUA10	9.12%	2.81	0.10	32.00	9.54	0.04
13	1\$DUA11	1.36%	0.34	0.01	40.00	10.78	10.46
14	19\$DIA0	8.90%	2.74	0.10	32.50	6.33	42.17
15	19\$DUA0	30.49%	14.02	0.44	21.75	5.70	96.11
16	19\$DUA1	30.77%	10.04	0.44	30.69	7.22	92.91
O V E R A L L		11.80%	66.46	0.15	28.38	6.10	76.56

DISK UTILIZATION (%)

USER GROUP		1\$ DUA0	1\$ DUA1	1\$ DUA2	1\$ DUA3	1\$ DUA4	1\$ DUA5
NO	GROUP NAME						
1	dev-int	1.37	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.17	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.05	0.00	0.00	0.00	0.00	0.00
4	other-ints	13.17	2.40	10.89	16.44	9.29	16.48
5	other-bat	7.69	0.02	0.00	0.00	3.34	0.83
6	other	11.59	0.78	0.00	0.19	3.30	0.27
T O T A L		34.04	3.20	10.89	16.63	15.94	17.57

USER GROUP		1\$ DUA6	1\$ DUA7	1\$ DUA8	1\$ DUA9	1\$ DUA10	1\$ DUA11
NO	GROUP NAME						
1	dev-int	0.00	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.00	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.00	0.00	0.00	0.00	0.00	0.00
4	other-ints	3.97	1.13	0.50	0.61	0.00	0.12
5	other-bat	0.27	0.00	0.00	1.00	0.00	0.00
6	other	0.32	1.02	0.04	1.01	9.12	1.25
T O T A L		4.57	2.15	0.53	2.63	9.12	1.36

USER GROUP		19\$	19\$	19\$
NO	GROUP NAME	DIA0	DUA0	DUA1
1	dev-int	4.20	11.83	2.71
2	dev-batch	0.79	0.00	0.00
3	qa-train	0.09	0.00	0.00
4	other-ints	0.00	0.00	3.40
5	other-bat	0.00	0.00	0.00
6	other	3.81	18.66	24.66
T O T A L		8.90	30.49	30.77

DISK THROUGHPUT (I/O/sec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	0.38	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.05	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.01	0.00	0.00	0.00	0.00	0.00
4	other-ints	3.73	0.69	5.58	6.09	2.74	6.77
5	other-bat	2.23	0.00	0.00	0.00	1.01	0.36
6	other	3.33	0.19	0.00	0.07	0.91	0.11
T O T A L		9.73	0.88	5.58	6.16	4.66	7.25

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA6	DUA7	DUA8	DUA9	DUA10	DUA11
1	dev-int	0.00	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.00	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.00	0.00	0.00	0.00	0.00	0.00
4	other-ints	1.04	0.22	0.14	0.11	0.00	0.03
5	other-bat	0.07	0.00	0.00	0.20	0.00	0.00
6	other	0.08	0.17	0.01	0.20	2.81	0.31
T O T A L		1.19	0.39	0.15	0.51	2.81	0.34

USER GROUP		19\$	19\$	19\$
NO	GROUP NAME	DIA0	DUA0	DUA1
1	dev-int	1.30	5.42	0.96
2	dev-batch	0.26	0.00	0.00
3	qa-train	0.03	0.00	0.00
4	other-ints	0.00	0.00	0.29
5	other-bat	0.00	0.00	0.00
6	other	1.15	8.60	8.80
T O T A L		2.74	14.02	10.04

DISK WAIT TIME PER TRANS (msec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	3.58	0.00	0.00	0.00	0.00	0.00
2	dev-batch	3054.01	0.00	0.00	0.00	0.00	24.30
3	qa-train	5.60	0.00	0.00	0.17	0.00	0.00
4	other-ints	16.17	0.24	1.07	2.64	1.42	2.83
5	other-bat	5251.82	0.43	0.00	0.00	546.99	151.84
6	other	81.98	0.61	0.00	0.85	9.95	1.33

USER GROUP		1\$	1\$	1\$	1\$	1\$	19\$
NO	GROUP NAME	DUA6	DUA7	DUA9	DUA10	DUA11	DIA0
1	dev-int	0.00	0.00	0.00	0.00	0.00	2.07
2	dev-batch	0.00	0.00	0.00	0.00	0.00	2719.69
3	qa-train	0.00	0.00	0.00	0.00	0.00	2.14
4	other-ints	0.85	0.11	0.07	0.00	0.01	0.00
5	other-bat	33.89	0.09	70.74	0.00	0.00	0.00
6	other	0.01	0.02	0.21	15.94	0.33	3.37

USER GROUP		19\$	19\$
NO	GROUP NAME	DUA0	DUA1
1	dev-int	26.22	6.08
2	dev-batch	0.00	0.00
3	qa-train	0.00	0.00
4	other-ints	0.00	1.22
5	other-bat	0.00	0.00
6	other	74.01	99.10

SERVER UTILIZATION (%)

USER GROUP		HSC000	HSC003	UQEVE\$ L1
NO	GROUP NAME			
1	dev-int	0.00	0.10	1.92
2	dev-batch	0.00	0.01	0.00
3	qa-train	0.00	0.00	0.00
4	other-ints	2.55	4.91	0.92
5	other-bat	0.28	0.78	0.00
6	other	0.48	1.98	4.94
T O T A L		3.30	7.79	7.78

SERVER THROUGHPUT (I/O/sec)

USER GROUP		HSC000	HSC003	UQEVE	UQEVE\$ L1
NO	GROUP NAME				
1	dev-int	0.00	0.38	1.30	6.38
2	dev-batch	0.00	0.05	0.26	0.00
3	qa-train	0.00	0.01	0.03	0.00
4	other-ints	9.23	17.90	0.00	0.29
5	other-bat	1.01	2.85	0.00	0.00
6	other	1.28	6.93	1.15	17.40
T O T A L		11.52	28.14	2.74	24.07

SERVER WAIT TIME PER TRANS (msec)

USER GROUP		HSC000	HSC003	UQEVE\$ L1
NO	GROUP NAME			
1	dev-int	0.00	0.04	0.82
2	dev-batch	0.00	40.92	0.00
3	qa-train	0.00	0.08	0.00
4	other-ints	0.10	0.57	0.06
5	other-bat	8.16	91.34	0.00
6	other	0.25	2.61	3.77

C.1.6 Model Report for Hardware Upgrade for UQADM::

The following results show that upgrading UQADM:: from a VAX 8650 to a VAX 6420 and using an RA90 shadow pair as the system disk results in saturation of the system disk (\$1\$DUA0:) after a 60% increase in user population on UQADM:: The CPU is still only at 50% utilization.

DECcp OUTPUT: CLUSTER CONFIGURATION

NODE NAME	UQADM	UQEVE	UQVAX
CPU TYPE	V6420_T	V3400	V8550
# CPUS	2	1	1
VMS VER	V5.1-1	V5.1-1	V5.1-1
IC TYPE	MI	MI	MI
CI ADAPT	CIBCA	NONE	CI750
NI ADAPT	DEBNI	DESVa	DEBNA
TOTAL MEM	96.0 Mb	44.0 Mb	32.0 Mb
SERVERS	5	3	6
DISKS	16	15	15
PROCESSES	329	34	121
CLASSES	6	6	6

GLOBAL SYSTEM STATISTICS

NODE NAME	UQADM	UQEVE	UQVAX
CPU UTIL %	50.66%	53.94%	20.69%
THROUGHPUT	16.24	2.02	2.24
TRUE I/O RATE	36.20	27.21	5.11
HARD FAULT RATE	30.99	0.40	1.67
SOFT FAULT RATE	115.12	14.27	52.41
MEMORY UTIL %	91.97%	29.98%	75.23%
I/O UTIL %	10.54%	4.35%	1.27%
CI ADPT UTIL %	11.15%	0.00%	1.12%
NI ADPT UTIL %	0.00%	37.64%	0.00%
SERVER UTIL %	10.89%	3.60%	1.16%

CLUSTER POPULATION DISTRIBUTION

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0	17	0
2	dev-batch	0	1	0
3	qa-train	0	2	0
4	other-ints	195	0	47
5	other-bat	51	0	13
6	other	83	14	61
T O T A L		329	34	121

CLUSTER INFORMATION : RESPONSE TIME (sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	1.155	0.000
2	dev-batch	0.000*	245.981*	0.000*
3	qa-train	0.000	0.776	0.000
4	other-ints	1.049	0.000	1.149
5	other-bat	101.832*	0.000*	15.265*
6	other	6.426*	1.865*	1.062*
O V E R A L L		1.049	1.147	1.149

CLUSTER INFORMATION : CPU UTILIZATION (%)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	15.858	0.000
2	dev-batch	0.000	0.951	0.000
3	qa-train	0.000	0.159	0.000
4	other-ints	42.040	0.000	15.466
5	other-bat	3.679	0.000	1.325
6	other	4.943	36.972	3.897
O V E R A L L		50.662	53.941	20.688

CLUSTER INFORMATION : SYSTEM THROUGHPUTS (trans/sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	1.977	0.000
2	dev-batch	0.000*	0.000*	0.000*
3	qa-train	0.000	0.043	0.000

CLUSTER INFORMATION : SYSTEM THROUGHPUTS (trans/sec)

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
4	other-ints	16.240	0.000	2.238
5	other-bat	0.014*	0.000*	0.004*
6	other	0.530*	1.106*	11.177*
O V E R A L L		16.240	2.020	2.238

CLUSTER INFORMATION : CPU QUEUE LENGTHS

USER GROUP		UQADM	UQEVE	UQVAX
NO	GROUP NAME			
1	dev-int	0.000	0.188	0.000
2	dev-batch	0.000	0.010	0.000
3	qa-train	0.000	0.002	0.000
4	other-ints	1.114	0.000	0.190
5	other-bat	0.124	0.000	0.017
6	other	0.125	0.803	0.041
O V E R A L L		1.362	1.001	0.247

DISK CONFIGURATION INFORMATION

D I S K				D I S K S E R V E R			
NO	DISK NAME	TYPE	SHDW	SERVER NAME	TYPE	CHNL	CHNL UTL%
1	1\$CSA1	RL02	0	UQADM\$L0	MBA	1	0.00
2	1\$DUA0	RA90	2	HSC003	HS50	1	2.93
3	1\$DUA1	RA81	0	HSC000	HS50	1	0.86
4	1\$DUA2	RA82	0	HSC000	HS50	2	0.57
5	1\$DUA3	RA82	0	HSC003	HS50	2	1.45
6	1\$DUA4	RA82	0	HSC000	HS50	3	1.82
7	1\$DUA5	RA82	0	HSC003	HS50	3	1.43
8	1\$DUA6	RA81	0	HSC003	HS50	4	0.09
9	1\$DUA7	RA81	0	HSC000	HS50	4	0.12
10	1\$DUA8	RA81	0	HSC003	HS50	5	0.05
11	1\$DUA9	RA81	0	HSC003	HS50	6	0.05
12	1\$DUA10	RA81	0	HSC003	HS50	1	0.74
13	1\$DUA11	RA81	0	HSC003	HS50	2	0.10
14	19\$DIA0	RF30	0	UQEVE	VAX	1	0.41
15	19\$DUA0	RA80	0	UQEVE\$L1	UBA	1	1.87
16	19\$DUA1	RA80	0	UQEVE\$L1	UBA	1	1.83

TOTAL CHANNEL UTILIZATION (%)

SERVER NAME	TYPE	CHANNEL	CHANNEL UTIL %
HSC000	HS50	1	0.86
HSC000	HS50	2	0.57
HSC000	HS50	3	1.82
HSC000	HS50	4	0.12
HSC003	HS50	1	3.67
HSC003	HS50	2	1.55
HSC003	HS50	3	1.43
HSC003	HS50	4	0.09
HSC003	HS50	5	0.05
HSC003	HS50	6	0.05
UQEVE	VAX	1	0.41
UQADM\$LO	MBA	1	0.00
UQEVE\$LL	UBA	1	3.70

DISK STATISTICS

D I S K		%UTIL	THRUPUT	AVG	SERV	AVG I/O	%READ
NO	DISKNAME		I/O/sec	QUEUE LENGTH	TIME (ms)	SIZE (blocks)	I/O
2	1\$DUA0	51.29%	27.78	1.05	18.70	4.25	84.36
3	1\$DUA1	11.90%	3.37	0.14	36.21	13.54	87.31
4	1\$DUA2	14.62%	7.49	0.17	19.52	3.21	84.45
5	1\$DUA3	22.55%	8.35	0.29	26.99	7.38	80.43
6	1\$DUA4	40.20%	11.76	0.67	34.18	6.57	76.76
7	1\$DUA5	24.00%	9.90	0.32	24.25	6.18	47.89
8	1\$DUA6	4.57%	1.20	0.05	38.23	3.21	52.38
9	1\$DUA7	2.15%	0.39	0.02	54.76	13.49	65.94
10	1\$DUA8	0.69%	0.19	0.01	36.04	11.90	5.10
11	1\$DUA9	2.81%	0.54	0.03	51.71	4.22	47.21
12	1\$DUA10	10.96%	3.32	0.12	31.98	9.49	0.04
13	1\$DUA11	1.60%	0.40	0.02	40.08	11.03	9.38
14	19\$DIA0	8.90%	2.74	0.10	32.50	6.33	42.17
15	19\$DUA0	30.50%	14.02	0.44	21.75	5.70	96.11
16	19\$DUA1	31.83%	10.13	0.47	31.29	7.60	92.95
O V E R A L L		16.16%	101.58	0.24	25.50	6.14	75.64

DISK UTILIZATION (%)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	0.70	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.08	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.02	0.00	0.00	0.00	0.00	0.00
4	other-ints	21.64	8.61	14.62	22.31	29.98	22.39
5	other-bat	14.90	0.11	0.00	0.00	5.02	1.26
6	other	13.94	3.18	0.00	0.23	5.19	0.35
T O T A L		51.29	11.90	14.62	22.55	40.20	24.00

DISK UTILIZATION (%)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA6	DUA7	DUA8	DUA9	DUA10	DUA11
1	dev-int	0.00	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.00	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.00	0.00	0.00	0.00	0.00	0.00
4	other-ints	3.98	1.13	0.65	0.61	0.00	0.12
5	other-bat	0.27	0.00	0.00	1.00	0.00	0.00
6	other	0.32	1.02	0.04	1.19	10.96	1.49
T O T A L		4.57	2.15	0.69	2.81	10.96	1.60

DISK UTILIZATION (%)

USER GROUP		19\$	19\$	19\$
NO	GROUP NAME	DIA0	DUA0	DUA1
1	dev-int	4.20	11.84	2.71
2	dev-batch	0.79	0.00	0.00
3	qa-train	0.09	0.00	0.00
4	other-ints	0.00	0.00	4.46
5	other-bat	0.00	0.00	0.00
6	other	3.81	18.66	24.66
T O T A L		8.90	30.50	31.83

DISK THROUGHPUT (I/O/sec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	0.38	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.05	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.01	0.00	0.00	0.00	0.00	0.00
4	other-ints	12.03	2.56	7.49	8.26	8.84	9.20
5	other-bat	8.58	0.03	0.00	0.00	1.52	0.55
6	other	6.71	0.77	0.00	0.09	1.40	0.15
T O T A L		27.78	3.37	7.49	8.35	11.76	9.90

DISK THROUGHPUT (I/O/sec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA6	DUA7	DUA8	DUA9	DUA10	DUA11
1	dev-int	0.00	0.00	0.00	0.00	0.00	0.00
2	dev-batch	0.00	0.00	0.00	0.00	0.00	0.00
3	qa-train	0.00	0.00	0.00	0.00	0.00	0.00
4	other-ints	1.04	0.22	0.18	0.11	0.00	0.03
5	other-bat	0.07	0.00	0.00	0.20	0.00	0.00
6	other	0.08	0.17	0.01	0.23	3.32	0.37
T O T A L		1.20	0.39	0.19	0.54	3.32	0.40

DISK THROUGHPUT (I/O/sec)

USER GROUP		19\$	19\$	19\$
NO	GROUP NAME	DIA0	DUA0	DUA1
1	dev-int	1.30	5.42	0.96
2	dev-batch	0.26	0.00	0.00
3	qa-train	0.03	0.00	0.00
4	other-ints	0.00	0.00	0.37
5	other-bat	0.00	0.00	0.00
6	other	1.15	8.60	8.80
T O T A L		2.74	14.02	10.13

DISK WAIT TIME PER TRANS (msec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	1\$
NO	GROUP NAME	DUA0	DUA1	DUA2	DUA3	DUA4	DUA5
1	dev-int	3.72	0.00	0.00	0.00	0.00	0.00
2	dev-batch	3108.89	0.00	0.00	0.00	0.00	36.00
3	qa-train	5.72	0.00	0.00	0.24	0.00	0.00
4	other-ints	25.64	1.48	1.54	3.99	12.39	4.35
5	other-bat	12931.55	10.21	0.00	0.00	2343.57	276.06
6	other	218.34	8.10	0.01	1.24	54.45	2.09

DISK WAIT TIME PER TRANS (msec)

USER GROUP		1\$	1\$	1\$	1\$	1\$	19\$
NO	GROUP NAME	DUA6	DUA7	DUA9	DUA10	DUA11	DIA0
1	dev-int	0.00	0.00	0.00	0.00	0.00	2.07
2	dev-batch	0.00	0.00	0.00	0.00	0.00	2720.38
3	qa-train	0.00	0.00	0.00	0.00	0.00	2.14
4	other-ints	0.85	0.11	0.08	0.00	0.01	0.00
5	other-bat	33.92	0.09	75.93	0.00	0.00	0.00
6	other	0.01	0.02	0.29	19.60	0.39	3.37

DISK WAIT TIME PER TRANS (msec)

USER GROUP		19\$	19\$
NO	GROUP NAME	DUA0	DUA1
1	dev-int	26.23	6.38
2	dev-batch	0.00	0.00
3	qa-train	0.00	0.00
4	other-ints	0.00	1.28
5	other-bat	0.00	0.00
6	other	74.03	104.11

SERVER UTILIZATION (%)

USER GROUP		HSC000	HSC003	UQEVE\$ L1
NO	GROUP NAME			
1	dev-int	0.00	0.13	1.92
2	dev-batch	0.00	0.02	0.00
3	qa-train	0.00	0.00	0.00
4	other-ints	5.25	9.20	1.21
5	other-bat	0.42	3.12	0.00
6	other	0.95	4.13	4.94
T O T A L		6.62	16.60	8.07

SERVER THROUGHPUT (I/O/sec)

USER GROUP		HSC000	HSC003	UQEVE	UQEVE\$ L1
NO	GROUP NAME				
1	dev-int	0.00	0.39	1.30	6.38
2	dev-batch	0.00	0.05	0.26	0.00
3	qa-train	0.00	0.01	0.03	0.00
4	other-ints	19.11	30.91	0.00	0.37
5	other-bat	1.55	9.46	0.00	0.00
6	other	2.35	12.80	1.15	17.40
T O T A L		23.01	53.63	2.74	24.16

SERVER WAIT TIME PER TRANS (msec)

USER GROUP		HSC000	HSC003	UQEVE\$ L1
NO	GROUP NAME			
1	dev-int	0.00	0.13	0.85
2	dev-batch	0.00	118.09	0.00
3	qa-train	0.00	0.22	0.00
4	other-ints	0.28	1.80	0.07
5	other-bat	20.80	533.64	0.00
6	other	1.07	12.23	3.92

