Migration Strategy and Planning

5 Steps Toward e3000 Transition Success

Migration – Environmental Assessment 1

- Establish **where** you are today.
- **How** long the existing system will last?
- **What** are the options for the interim?

Migration –

1 Environmental Assessment

- System Review
- PASS Program
- Second Opinion
- Capacity Plan

Migration – 1 Environmental Assessment

REPORT CARD

OVERALL SYSTEM: YELLOW

Technology - Yellow

Hardware	–	HP 995/400 - HP will end support in August 2003.
Operating System	–	MPE/iX 6.5 ppT was scheduled for obsolescence in March 2001.
Comments	–	Consider upgrading to MPE/iX 6.5 or better.

Central Processing Unit - HP e3000 Series 995/400 Yellow

Loading	–	CPU is highly loaded.
Balance	–	Heavily loaded but distributed throughout the entire 24 hour period
Characterization	–	Well defined workloads contributing to effective problem management
Comments	–	Consider upgrading Memory first and current O/S version.

Memory - Red

Memory Management	–	CPU spent on memory management averages 6.3% well above 4% threshold.
Page Faults	–	Page faults are good, peaking at less than 80/sec.
Comments	–	Most of the top CPU processes are all impeded by a memory wait.

Disk Input/Output - Green

Balance	–	The system volset is under a heavy burden. Application set looks good.
Queue Length/Read	–	Queue lengths are minimal and below threshold of 1.
Application Vol. Sets	–	Application volset looks good, but slightly fragmented.
Comments	–	Consider adding a disk to the system volume set to increase I/O bandwidth.

User Response - Red

Prompt/Response Time	–	Prompt response time is high, all running RESD01 from DROGOG.SYMBOL
CPU Queue Length	–	CPU queue length looks good, rarely peaking above the threshold of 5.
Comments	–	There is room for improvement in response time.

Batch Performance - Green

Run To Daylight	–	There is CPU available during off hours, Consider rescheduling some jobs.
Interactive Impact	–	On the heavy day, 11/1, the heavy amount of batch processing was probably affecting the on-line users.
Comments	–	Follow recommendations given in Executive Summary.

COMPANY
SYSTEM REVIEW • REPORT #X

JANUARY 2, 2002
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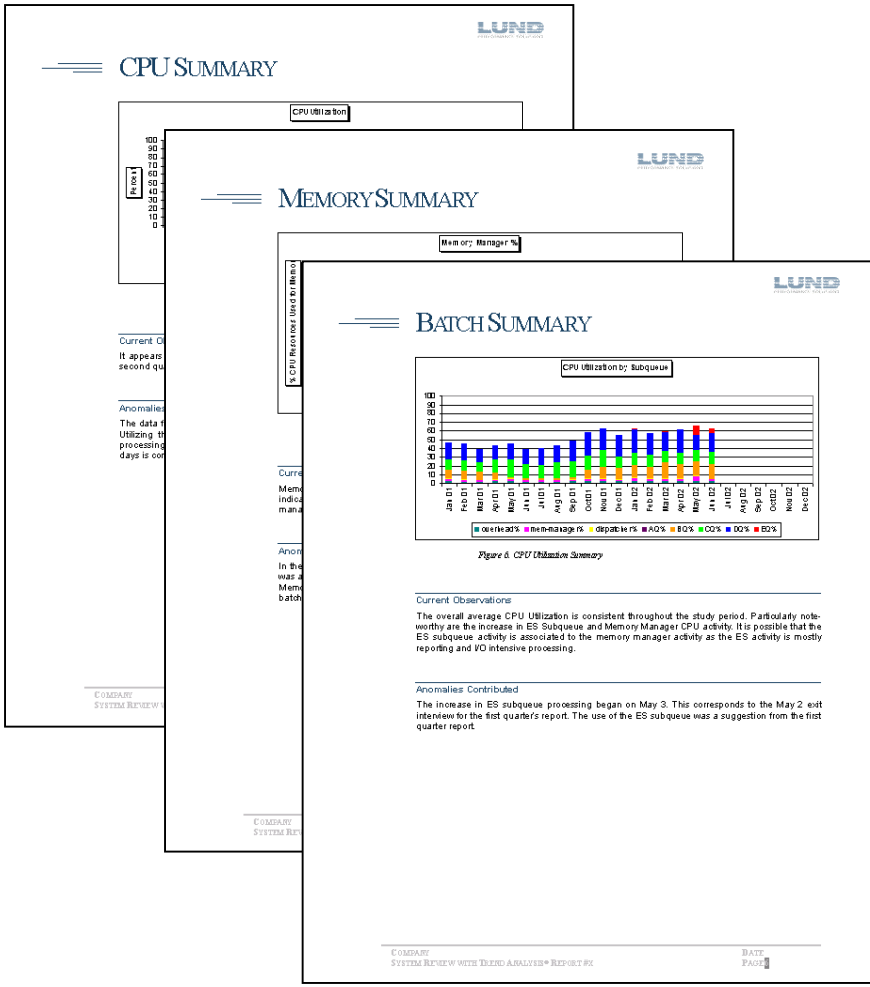

Migration – Environmental Assessment

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EXECUTIVE SUMMARY

The purpose of this study is to evaluate the current system performance, trend recent system performance, forecast the impact of the projected growth and provide recommendations. The data collected from August 26, 2002 to September 1, 2002 was utilized as the baseline for the performance analysis. The data collected on August 27, 2002 was selected for further drill down of performance however August 28, 2002 was selected for capacity projections.

Current System Analysis

Technology Hardware

The HP e3000 928RX is current hardware technology and has no immediate issues of obsolescence. This model of server utilizes the earlier PA 7xxx model of CPU chip limiting the configuration, relative performance growth, and expandability of the memory configuration. All of the peripherals attached to the system also are current technology and have no obsolescence issues. Check the HP web site for further details. Also, HP has announced significant trade-in allowances available through the end of the hardware support life of the system. HP has announced that the hardware support will last until December 2006, which is also the end of support for MPE operating systems.

Technology Software

The MPE/iX 6.5, version of the operating system installed on the system will remain current and supported through December 2004. As recent as the HP World conference in September 2002, HP continues to review the supportability of MPE/iX 6.5 through the end of MPE hardware support, December 2006. We would further recommend that you be at minimal power patch level 2. If you are unsure of the release installed on this system, you can further print the flat file HPSWINFO.PUB.SYS to determine the release and date of installation. This file also contains all of the individual patches. HP has potentially targeted this release as the last operating system version to support many other models of server that have already been targeted for hardware obsolescence. Lund would be happy to assist you in installing the current patch level release.

Patch Management

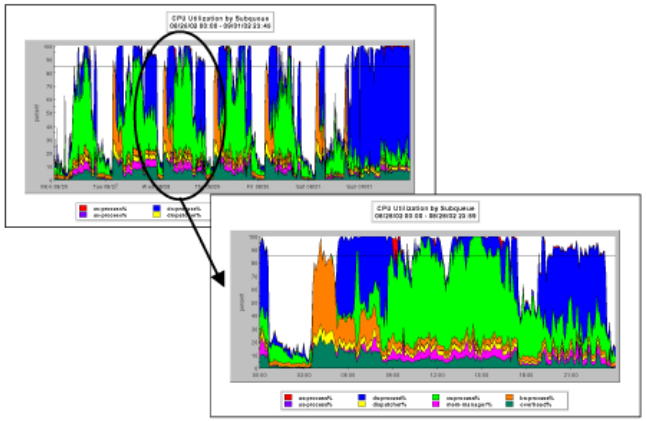
There are several very significant performance release patches applicable to the O/S release of 6.5. One of the most significant patch efforts has concentrated on the transaction manager (XM). The goal has been to increase the frequency of the posting and decrease the priority of the activity. In some environments, customers have experienced great delays at the time of the post activity. This can be evidenced in several ways. Interactively, you can use the SOS Performance Advisor tool and look for the system process, PIN #11. This is the XM post. Also, you can look for increased activity reactively in Performance Gallery Gold, from Lund Performance Solutions, and concentrate on the overhead category. Both of these activity levels are directly related to the amount of "write" activity conducted by the system. Patch management must be a routine maintenance activity. At least twice a year, current patch levels should be reviewed for recent releases concerning system aborts, networking, and performance. Maintaining a proactive approach to your patch management is extremely important to the performance and availability of the computer.

CPU Utilization

The current CPU load of the system is very high. The average utilization is 80% with spikes to 100% during the sample period. The CPU resource has been able to satisfy the current load

CPU RESOURCE UTILIZATION

CPU Utilization by Sub-Queue



Explanation of Chart: The CPU Utilization by Subqueue graph shows the breakdown of the CPU busy into the system subqueues along with the percentage of CPU used to manage memory, the dispatcher, and system overhead. Sub-queues allow the CPU to assign different priorities to various tasks requesting the CPU resource. The CS subqueue is typically assigned to interactive users while the DS and ES subqueues are usually for batch jobs. This allows for an analysis of the activity that makes up the total usage on the system. The horizontal line set at 85 percent is used to mark the beginning threshold of CPU saturation. The weekly chart above is averaged at one data point every 15 minutes.

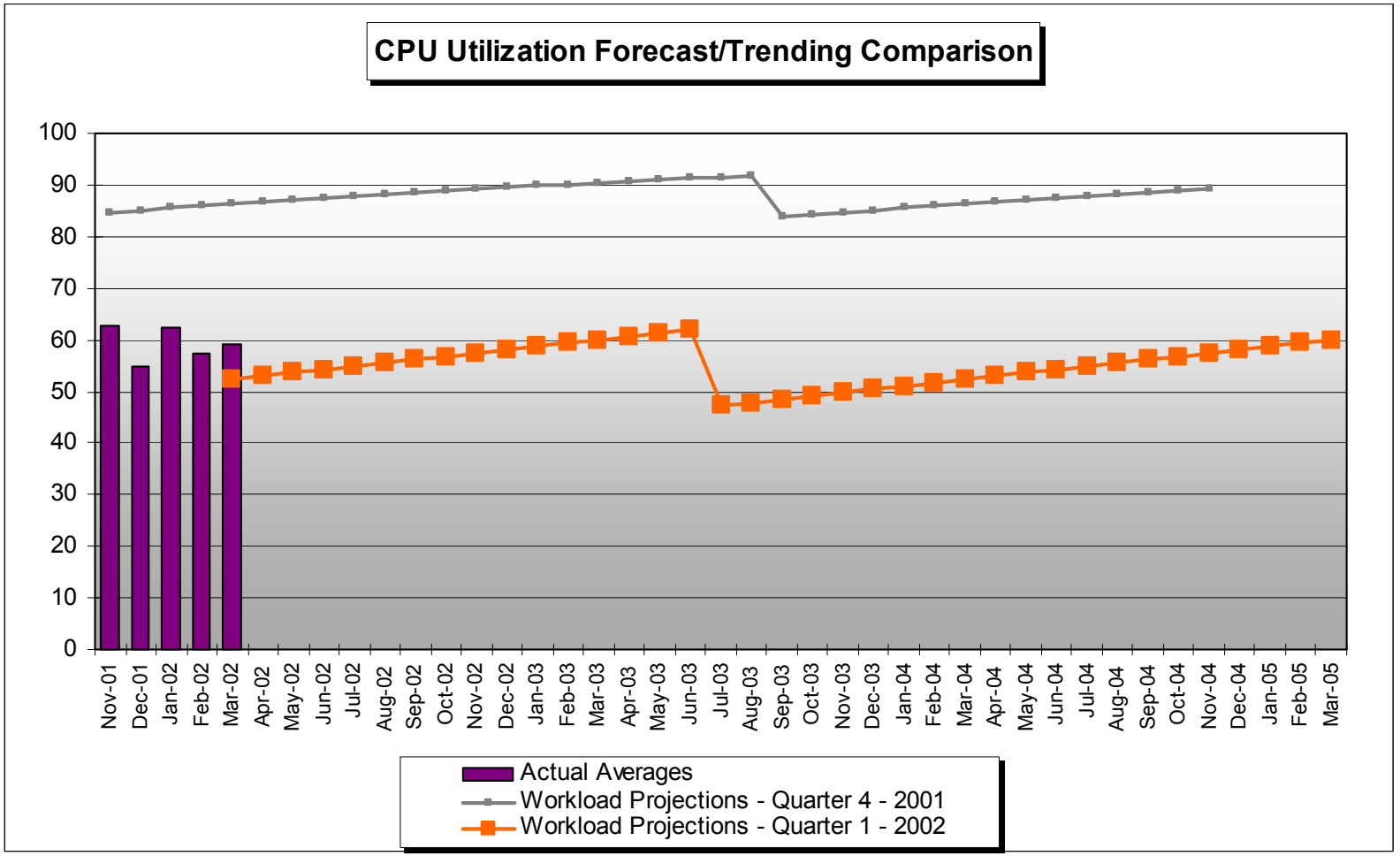
Figure 1. CPU Utilization by Subqueue

Analysis

Looking at the workload distribution in an entire week's worth of data, it is easy to see that all of the days are similar in load. Much of the week in study showed heavy CPU utilization with primary shift spikes across the 85% threshold. There is a moderate amount of DS subqueue processing during the primary shift, however the morning on-line backup appears to start at 3:30am and does not complete until ~ 8:00am, consider starting the backup 1 hour earlier so as to no interfere with production. The batch activity may be interfering with on-line users and should be kept to a minimum during the primary sift. The AS and BS subqueues are typically reserved for Hewlett Packard activity. There is a high amount of system overhead that should be analyzed and a plan put in place in an attempt to reduce the overhead.

The bulk of the early morning batch activity is the on-line store process. Consider scheduling the back-up 1-2 hours earlier to allow for completion before the primary shift.

Migration – Environmental Assessment



LUND PERFORMANCE SOLUTIONS

WHAT YOU NEED TO KNOW, **WHEN** YOU NEED TO KNOW IT.

Migration – Environmental Assessment

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```
               * * * File Space Utilization * * *
    ----Used---  ---Avail---  --Max %---  --------Contiguous Free Space--------
Dev  Trans  Perm  Trans  Perm  Trans Perm  Largest  <100 <1000  <10K <100K 100K+
''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''''
  1 2473K 2140K    10M   10M     75   75 11938816 17408 53280 93712 59024   12M
  2  982K 5576K    10M   10M    100  100  9955856 30208  136K 63344 32096 9955K
 30     0   23M    13M   13M    100  100  9552672 50160  163K  275K  123K   12M
 31     0   23M    12M   12M    100  100  8674576 50528  164K  309K  210K   12M
 32     0   23M    12M   12M    100  100  8903632 58416  167K  347K  147K   12M
ALL 3456K   77M    58M   58M     97   97 11938816  206K  684K 1089K  572K   58M
```

Figure 15. Disk Space Utilization

Analysis

The system and test volume sets look fine for free space. Industry experts recommend 30% to 50% free space for active, production environments. The individual volumes in each of the system and test volume sets fall within these criteria. However, the production volume set averages 19-20% free space. This value is less than recommended and a plan to increase the amount of free space on the production volume set either by maintenance or by adding drives should be measured. Maintain a proactive approach to disk space maintenance. Disk space can be optimized and effectively maintained by utilizing tools such as Lund's De-Frag/X.

MAP ALL

```
De-Frag/X> map all
                                                        Disk Size of
                                              Available  Size  chunks
Ldev [ (disk usage map...)                    ] PermMBs   MBs    MBs
   1 [Pppppppppppppp                          ]  2,508  4,095   81.9
   2 [pppppppppppppppppppppt                  ]  2,498  4,095   81.9
  30 [ppppppppppppppppppppPPppppppppppp pPp   ]  3,108  8,683  173.7
  31 [ppppppppppppppppppppPppppppppppppp pPp  ]  3,039  8,683  173.7
  32 [ppppppppppppppppppppPppppppppppppp pPp  ]  3,039  8,683  173.7
```

Explanation Of Chart: In the above figure, each letter or item represents a chunk of disk depending on the size of the drive. The key at the bottom of the screen defines each letter and what it represents. P - means that the block of space consists of 95 percent or greater permanent space, p - means that some of the space is permanent, T and t refer to transient space in the same manner, and X refers to unmovable space. From an organizational point of view, the uppercase "P" characters should be consolidated together near the left-hand side of the presentation, and the asterisks all together on the right hand side.

Figure 16. Map All Output

Analysis

The system and test volume sets don't appear to be experiencing significant fragmentation issues, though some disk maintenance would be of value especially within the system volume set. Utilizing a disk maintenance tool such as Lund's De-Frag/X would improve the condition of these drives and increase the contiguous free space even more. Routine disk maintenance should be part of the system maintenance regimen.

Individual Maps

The following maps include one map for each of the drives

IMAGE DATABASE EFFICIENCIES

Image databases become inefficient over time as data is added and deleted from the system. Data locality within a dataset can adversely impact performance by causing additional disk I/O. Repacking detail data sets and altering the capacities of master data sets will improve data locality and reduce disk I/O.

The view of Lund Performance Solution is that all database changes, either capacity increases or repacks of data sets should be performed on a regular schedule. Reserving every long weekend for this activity is standard operating procedure for many large database clients.

Database Maintenance

Given the volume of transactions in the Sample Company databases and the information supplied from the HowMessy report it would be prudent to set up a schedule of routine database maintenance that takes advantage of upcoming weekend maintenance windows.

Also examined were the database flags for the production databases. Lund recommends the following actions be performed on all of the databases.

Disable databases for HWMput (High Water Mark DBPUT's – not delete chain)

While there could be some benefit, there is relatively no benefit if the database environment is properly maintained. If regular housekeeping is performed (i.e. repacking after archiving), this is not necessary and could cause unnecessary overhead.

To view setting of HWMput:	**:Run DBUTIL.PUB.SYS** **>Show DBNAME all**
To enable:	**>enable DBNAME for HWMput**
To disable:	**>disable DBNAME for HWMput**

Enable databases for DSEM (dependency semaphores – multi threaded access)

In versions prior to C.07.00, TurboIMAGE/XL serialized the execution of **DBPUT**, **DBDELETE**, and **DBUPDATE** when critical item update (CIU) is enabled, to protect the structural integrity of the database. This serialization is done via a semaphore known as **PUTDELETE** semaphore. This translates into processing only one **DBPUT**, **DBDELETE**, or **DBUPDATE** with CIU enabled at a time for every database. This is acceptable for the low-end machines but not for the high-end and multi-processor machines.

When **DSEM** is enabled, TurboIMAGE/XL internally groups the database into independent sub-databases based on physical linkages/relationships or dependency of master and detail data sets. In addition, it uses multiple semaphores as well as specific criteria to lock the necessary semaphores for a sub-database. The result allows the "modify" intrinsic capability to execute concurrently for these independent sub-databases.

Migration – 1 Environmental Assessment

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HowMessy/XL (Version 2.8) for IMAGE/3000 databases — Data Base: MACORD.MACSDATA.SGAII By Robelle Solutions Technology Inc. — Run on: THU, AUG 29, 2002, 8:11 PM — Page: 1

Data Set	Type	Capacity	Entries	Load Factor	Secon-daries (Highwater)	Max Blks	Blk Fact	Search Field	Max Chain	Ave Chain	Std Dev	Expd Blocks	Avg Blocks	Ineff Ptrs	Elong-ation
ORDER-KEYS	Ato	1732579	1221500	70.5%	39.7%	0	76	ORDER-NO	21	1.66	1.09	1.00	1.35	20.9%	1.35
DB-SET-NUMS	Man	1	1	100.0%	0.0%	1	6	DB-SET-KEY	1	1.00	0.00	1.00	1.00	0.0%	1.00
CUSTOMERS	Man	595129	408479	68.6%	0.0%	81694	5	CUST-EDP	1	1.00	0.00	1.00	1.00	0.0%	1.00
OH-ADDITIONS	Man	20873	14656	70.2%	27.9%	1	17	FULL-ORDER-NO	5	1.39	0.65	1.00	1.23	18.3%	1.23
PICK-LOT-HEADER	Man	136883	102617	75.0%	30.4%	5	14	LOT-NO	7	1.44	0.71	1.00	1.21	16.2%	1.21
STANDING-HEADER	Man	307	0	0.0%	0.0%	0	18	CUST-EDP	0	0.00	0.00	0.00	0.00	0.0%	0.00
ORDER-BATCH	Man	1361	914	67.2%	26.0%	1	5	BATCH-NO	5	1.35	0.61	1.00	1.77	63.4%	1.77
CUSTOMER-ADDL	Det	153995	109916	71.4%	(109913)		19	!CUST-EDP	1	1.00	0.00	1.00	1.00	0.0%	1.00
CUSTOMER-PHONE	Det	462944	349056	75.4%	(349053)		34	!CUST-EDP	1	1.00	0.00	1.00	1.00	0.0%	1.00
CUSTOMER-COMP	Det	632506	483011	76.4%	(483008)		14S	!CUST-EDP	9	1.19	0.47	1.00	1.13	11.0%	1.13
CUSTOMER-DEMO	Det	34	4	11.8%	(4)		17S	!CUST-EDP	1	1.00	0.00	1.00	1.00	0.0%	1.00
CUSTOMER-PROMO	Det	600	0	0.0%	(0)		30	!CUST-EDP	0	0.00	0.00	0.00	0.00	0.0%	0.00
CUST-XREF	Det	1157135	824001	71.2%	(823991)		35	CUST-EDP	141	2.17	1.53	1.00	1.79	36.6%	1.79
								!XREF-NO	1507	1.10	2.86	1.00	1.09	8.2%	1.09
ORDER-HEADER	Det	1782504	1221597	68.5%	(1221592)		8	!CUST-EDP	5519	4.25	15.24	1.22	4.10	72.8%	3.35
ORDER-SUB-HEAD	Det	3000000	2208935	73.6%	(2208930)		15S	!ORDER-NO	191	1.81	1.67	1.00	1.12	6.5%	1.12
ORDER-COMMENTS	Det	578370	423388	73.2%	(423388)		26								
FINANCIAL-ORDER	Det	4364250	3395118	77.8%	(3395107)		25								
ACCT-COMMENTS	Det	140010	95510	68.2%	(95510)		26	!CUST-EDP	36	2.63	2.65	1.00	1.12	4.7%	1.12
CUSTOMIZATION	Det	52360	37495	71.6%	(37495)		17S	!ORDER-SEQ	3	1.00	0.03	1.00	1.00	0.0%	1.00
BO-FILE	Det	3360	972	28.9%	(3333)		30	!EDP-NO	55	2.13	4.64	1.01	2.11	52.3%	2.10
ACTIONS	Det	79634	1894	2.4%	(79614)		29	!CUST-EDP	49	1.09	1.20	1.00	1.09	8.5%	1.09
CREDIT-APPROVAL	Det	150018	99876	66.6%	(99876)		11	!CUST-EDP	9	1.10	0.34	1.00	1.08	7.1%	1.08
OPEN-AR	Det	13860	6285	45.3%	(11154)		35	!CUST-EDP	915	2.01	16.53	1.01	1.99	49.2%	1.97
CLOSED-AR	Det	261625	192043	73.4%	(192043)		35	!CUST-EDP	6176	6.67	40.17	1.05	2.52	22.7%	2.41
MESSAGE-FILE	Det	15003	0	0.0%	(0)		9								
ORDER-ACTIONS	Det	4163614	3013297	72.4%	(3013291)		26								
PROCESSING	Det	36438	4682	12.8%	(36433)		6	!ACTION-SEARCH	2056	106.09	317.66	18.14	106.23	99.2%	5.86
RETURNS	Det	111060	80568	72.5%	(80568)		12	!CONTROL-1	313	2.11	4.52	1.02	1.22	10.3%	1.20
CUSTOM-CORR	Det	1914	1339	70.0%	(1339)		22S	!FULL-ORDER-NO	125	41.84	28.06	2.38	2.88	4.5%	1.21
TRANSMITTAL	Det	763440	533948	69.9%	(533948)		30								
FRAUDS	Det	3780	849	22.5%	(2392)		21	!FRAUD-SEARCH	3	1.01	0.13	1.00	1.01	0.8%	1.01
								CUST-EDP	91	2.23	4.61	1.01	1.13	5.6%	1.11
ORDER-XREF	Det	1703416	1231290	72.3%	(1231289)		26	!XREF-NO	1212	1.05	1.66	1.00	1.03	3.2%	1.03
AR-COMMENTS	Det	136942	95718	69.9%	(95718)		26								
PICK-LOT-DETAIL	Det	2614780	2028874	77.6%	(2028874)		10	!LOT-NO	774	19.85	31.54	2.57	2.91	9.6%	1.13
ORDER-KITS	Det	16302	12451	76.4%	(12471)		19	!ORDER-LINE	40	4.02	1.54	1.00	2.13	28.0%	2.12
ADDED-DATA-1	Det	50	23	46.0%	(33)		10	!GENERIC-SEARCH	4	2.09	1.22	1.00	1.09	4.3%	1.09
ADDED-DATA-2	Det	15370	10795	70.2%	(10796)		10	!GENERIC-SEARCH	3	1.00	0.02	1.00	1.00	0.0%	1.00
ADDED-DATA-3	Det	600	365	60.8%	(365)		10	!GENERIC-SEARCH	1	1.00	0.00	1.00	1.00	0.0%	1.00
GIFT-TRACKS	Det	3620	2766	76.4%	(2766)		20	!GIFT-CERT-NO	7	1.01	0.17	1.00	1.01	1.0%	1.01
OLD-CUST	Det	199520	150811	75.6%	(150811)		5								
NEW-CUST	Det	656	0	0.0%	(0)		8								
SERVICE-TRACK	Det	12000	8070	67.3%	(8070)		1	CUST-EDP	30	1.28	0.78	1.28	1.28	22.1%	1.00

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Migration – Environmental Assessment

1

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BASELINE TODAY

CPU Usage

The following graphs represent the environmental baseline established for the Capacity Plan Analysis Report completed August 2002 and the environmental baseline for the current time slice in study. The colored areas represent all of the active workloads from the 997/1200 system on the day of June 6, 2002, which was typical of the data we analyzed. This system's CPU usage averages well below the 85% threshold marker during normal user hours and affords many available resources for spikes in use or company growth.

Figure 1 represents the baseline activity between 12:00 p.m. and 2:00 p.m. on June 6, 2002, which was shown to be representative of most activity in this environment. The black, horizontal line at 85% is the threshold percentage at which performance begins to degrade.

Second Quarter 2002

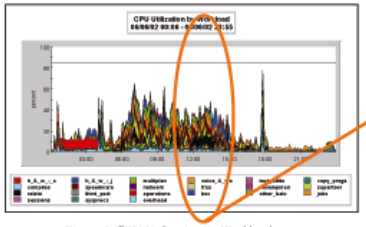

Figure 1. CPU Utilization By Workload

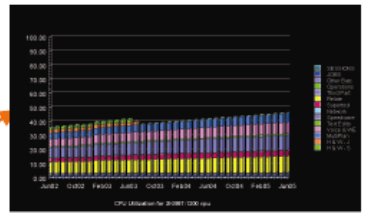

Figure 3. Baseline Today

First Quarter 2002

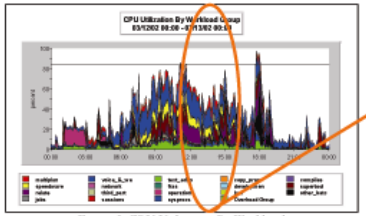

Figure 2. CPU Utilization By Workload

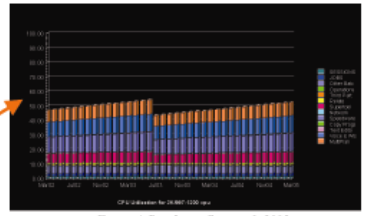

Figure 4. Baseline – Quarter 1, 2002

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BASELINE TODAY

CPU Usage

In the following graph (Figure 24), an average, busy day is illustrated. The colored areas represent all of the active priority workloads from the HP e3000 Series 928RX system, located in Ann Arbor, Michigan, on August 28, 2002, which was typical of the data we analyzed. Since this system's CPU usage averages above the 85% threshold marker during normal user hours, this server has very little available resources for spikes in use or company growth.

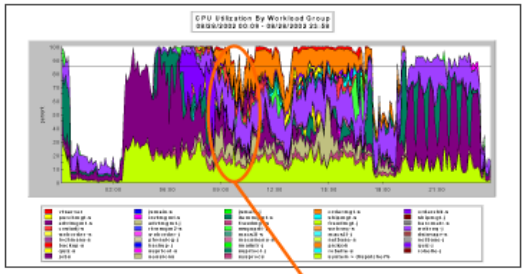

Figure 24 shows the sample period used as a baseline for this report. All workload activity has been evaluated during a sample to extract an average. In order to give you a complete capacity plan, CPU, memory, and disk options have been specifically addressed in this capacity planning report.

Figure 24. CPU Utilization By Workload Group

The CPU is undersized for the current load. The CPU spends most of the primary shift time above the 85% utilization threshold. However projected company growth must be addressed before a capacity-planning conclusion can be reached.

Figure 25 represents the baseline average CPU utilization between 9:00 a.m. and 11:00 a.m. on August 28, 2002, which was chosen to be representative of the processing in this environment. 85% is the threshold percentage at which performance begins to degrade.

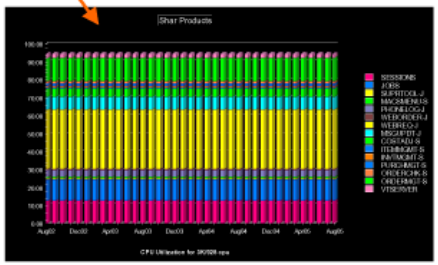

Figure 25. Current CPU Average

This is a stacked area graph illustrating the utilization in each workload group stacked on top of the each other to give the entire CPU utilization picture.

Migration – Environmental Assessment

Workload Increase

Forecast Of Workload Increase

The graph below represents the baseline of the 'Study' system, with a 15% annual company growth and the elimination of the Sample1 and Sample2 accounts mid year 2003 as requested. Additionally there was increase due to the XYZ workload migration from the 'Study2' system. The 15% growth, as well as the overall increase due to the XYZ processing, was applied at the request of Contact2, system administrator. The table below represents the expected load changes requested. The only modification to the system load apart from the proposed migration of the Sample1 and Sample2 workload and the workload from the 'Study2' system is the projected overall company growth.

Growth Description	Estimated CPU Growth %
Projected Annual Growth	15%
Sample1 and Sample2 Account Migration mid 2003	Workload group decrease
Estimated growth due to XYZ workload migration from 'Study2'	4%

Figure 5. Expected Growth Table

In this Capacity Plan Analysis Report the Sample1 and Sample2 account activity has been isolated in the H & W – J and H & W –S workload groups. By isolating the workload Lund was able to track the projected impact of migrating this workload more closely in this analysis report. This has allowed Company to leverage Lund's experience and knowledge base to assist in making critical business decisions regarding the overall workload of the 'Study' system especially during the upcoming high utilization enrollment period in the fall of 2002.

Additionally quantifying the load attributed to the XYZ processing was done using the transaction data provided by Company and through conversations with Contact1 and Contact2. It was determined that the ABC, GHI, LMPNOP and XYZ account related processing represented 70% of the total processing on the 'Study2' system. Utilizing the transaction data provided it was determined that the XYZ processing equated to 14% of that 70%. That 14% load equated to a 6% reduction on the 'Study2' system and a 4% increase on the 'Study' system when the workload was migrated. The migration of the XYZ processing was projected in the seventh month of the study period allowing six months of testing and proactive planning.

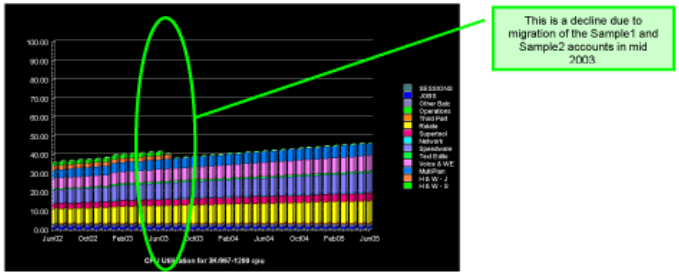

Figure 6. Increased workload and Sample1 and Sample2 migration on current CPU

Memory

HP has suggested that as much as 4.0 GB of memory is the minimal configuration for optimal utilization of 64-bit architectures employed in both MPE/iX 6.5 and 7.0 operating system versions. A common formula for calculating the memory configuration is provided below.

Memory Calculation	Projected	New Load
5 MB memory per user	56* Users	0.280 GB
20 MB per batch job	11* Batch Jobs	0.220 GB
Ratio of 1% memory to total	35.9 GB Disk Capacity	0.359 GB
1 GB memory per processor	1 processor	1.024 GB
Total Memory Configuration For Optimal Performance		1.883 GB

* This number was derived from System Configuration screens in SOS Performance Advisor (see Appendix A).

Figure 30. Memory Requirements Table

The 928 has a maximum memory configuration limitation of 512 MB. This is less than one third of the recommended configuration for optimal performance based on the current utilization. The 928 used by Sample Company is currently configured with the maximum memory available.

Current Configuration	0.512 GB
Optimal Configuration	1.883 GB
Necessary Memory Upgrade	1.371 GB

Figure 31. Memory Calculation

Disk

System Volume Set Requirements

Category	Projected	New Load
Operating System Increase	Increase of 5% per Operating System version upgrade (the N-class servers run MPE/iX 7.0)	1,700,000 sectors
Transient space	56 users multiplied by 10k sectors per process plus 4-10k per son process	75,000 sectors

Figure 32. Projection of Operating System File Space

This projection should be allocated across multiple drive spindles, maintaining the highest amount of free space possible.

Migration – Environmental Assessment

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CPU Summary

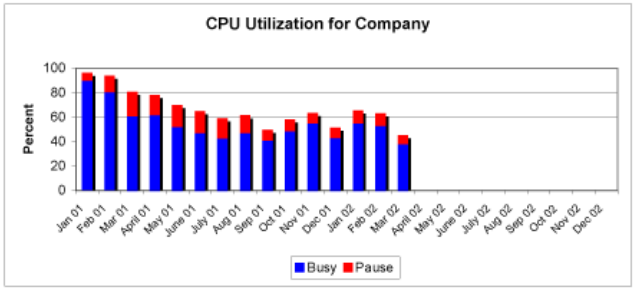

Figure 2. CPU Summary

Current Observations in the Trend

The overall decrease in CPU utilization was quite significant. From 55% and 53% with nearly 10% pause for disk in January and February we see a decline to 38% with 6.5% pause for disk.

Anomalies Contributing to Trend Data Point This Month

The decrease in the pause for disk is a good indication of the impact of disk maintenance. It appears that some performance tuning may have taken place between Friday, February 22, 2002 and Tuesday, February 26, 2002. The decrease in CPU utilization is significant at this point.

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The following is a list of specific activity both before and after the queue changes demonstrating the effectiveness of the solution:

Activity	Before	After
Roll Labels	5-10 minutes	2 seconds
Online Index	10-15 minutes	45 seconds
Extruder Changes	10-15 minutes	45 seconds
Pallet ticket shipping label3s	3-5 minutes	7 seconds
Inquiry to line index	10-15 minutes	46 seconds
Test Data	5-10 minutes	1 second
ORD02J PC Upload	27 minutes	2 minutes

Figure 1. Queue Modification Changes

Technology Hardware

The HP e3000 928 is current hardware technology and has no immediate plans of obsolescence. This model of server utilizes the earlier PA 7xxx model of CPU chip limiting the configuration, relative performance growth, and expandability of the memory configuration. All of the peripherals attached to the system are also current technology and have no obsolescence issues. The 9x8 server model is scheduled to be removed from the current Hewlett Packard price list in October 2001. This server cannot meet the demand of the environment and there is NO life left in this system. The computer is undersized and in drastic need of an upgrade. If properly sized, the software application currently in place can easily meet the demand and growth of the system for many years to come. The application is considered a "good fit" by plant management and shop floor staff. The best investment of capital would be served by an upgrade to a much faster CPU. Several options will be presented in the capacity-planning portion of this document. If another hardware platform were considered, conversion costs would be extremely high and the investment in hardware, software licensing, application design, and knowledge would be lost.

Technology Software

The MPE/iX 6.5, power patch 2, version of the operating system installed on the system will remain current and supported through well into 2005 or 2006. This is the last operating system version to support many other models of servers that have already been targeted for obsolescence. This is the pre-64 bit architecture release version. The full 64 bit structures are not implemented until version 7.0. Many other customers with similar environments to yours, have experienced performance degradation as a result of the pseudo 64-bit structure implementation. Most system managers have quantified the degradation to be between 5% and 10%. Hewlett-Packard has not officially quantified the CPU loss and this is probably due to the variety of applications and environments supported. Even though the most recent performance patches have been applied, the low end systems are still paying the price for the expanded structure capabilities of the larger systems. Although there is a slight performance issue with this release, it is not the cause of the interactive and batch response problems at the Orange Plant facility. This problem would be the same on any level of the operating system, 64 bit or otherwise.

Patch Management

At the time of the analysis, all of the current patches applicable to the MPE/iX 6.5 power patch 2 releases have been applied to the system. Patch management must be a maintenance activity. Since the time of the analysis, Hewlett Packard that may be of benefit to the environment

Migration – Environmental Assessment

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CAPACITY COMPARISON RECOMMENDATIONS AND SOLUTIONS

CPU Forecast/Trending Comparison

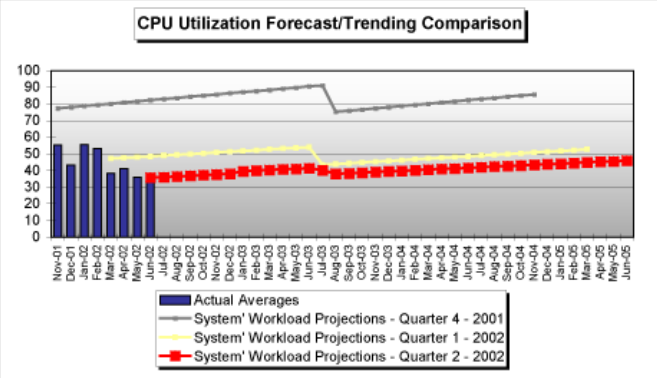

Figure 10. CPU Utilization Forecast/Trending Comparison

Overview

The existing 997/1200 system will not exceed 85% threshold especially after the Sample1 and Sample2 migration in mid 2003. This leaves plenty of room for peaks in interactive user activity and additional growth in the processing environment. Figure 10 shows that the 'Study' system remains **below the 85% threshold** for the entire 36-month study period.

Figure 10 illustrates the capacity trend as seen on the 'Study' system. The bars represent the actual utilization trend points as reported in the trending analysis. The lines represent the projected utilization as seen in the fourth quarter capacity plan from 2001 and the first and second quarter capacity plans from 2002.

Analysis

The data represented in Figure 10 illustrates the correlation between the trending data points and the forecasted data. The quarter-four sample was taken from the **heavy utilization open enrollment period in November 2001**, while the data for quarters one and two of 2002 was based on a quarter average. This graph shows the difference between open enrollment and 'average' processing.

Upgrade and Implementation

In Figure 11, the 997/1200, N4000/300-550 and N4000/400-440 showed the best price for performance

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Priority Workload Squeeze

When the CPU is heavily utilized and annual growth is added to it, some lower priority workload groups begin to receive less CPU time while the higher priority processes take the CPU resources they need. This is called priority workload squeeze. The lower priority processes take much longer to complete while waiting for excess CPU. High priority processes become CPU bound also increasing response time and time to completion. With the current level of utilization, this is not likely to happen on the 'Study' system, however when considering the further future workload migration projections, this is certainly a factor to a look at closely.

Memory

HP has suggested that 4 GB of memory is minimal configuration for optimal utilization of 64-bit architectures employed in both MPE/iX 6.5 and 7.0 versions. This system is currently configured with its maximum capacity of 16 GB. No memory upgrade is recommended.

Memory Calculation	Projected	New Load
5Mb memory per user	290* Users	1,450 MB
20 Mb per batch job	60* Batch Jobs	1,200 MB
Ratio of 1% memory to total disk	587 GB Disk Capacity	5,877 MB
1 GB memory per processor	12 processors	12,288 MB
Total Memory Configuration For Optimal Performance		**20.815 GB**

* This number was derived from System Configuration screens in SOS Performance Advisor (see Appendix A).

Figure 7. Memory Requirements Table

Disk

System Volume Set Requirements

Category	Projected	New Load
Operating System Increase	Increase of 5% per O/S version upgrade	TBD
Transient space	290 users multiplied by 10k sectors per process plus 4-10k per son process	10,000,000 sectors

Figure 8. Projection of Operating System File Space

Migration – 2 Migration Analysis & Plan

Migration Recommendations

Budgetary Considerations

There are many elements to consider when compiling a budget for this HP e3000 migration project. Lund has provided a high-level, list of items that should be considered in the budget and where possible, approximated costs associated with the migration element has been provided.

Migration Consideration	Approximated Cost
New hardware: Hewlett Packard rp5470 (650 MHz)	Expect between $150k and $250k
New databases: Eloquence – unlimited users	Approximately $7k
3GL and 4GL software licensing COGNOS	Expect between $50k and $150k per server
Replacement tools (i.e. backup, spooling, job scheduling)	Expect between $50k to $150k
Optional migration tools and technologies	To be determined
Migration resources	Expect between $75k and $200k if completely outsourced
New personnel	To be determined
Application enhancements or facelifts	Expect between $20k and $50k plus labor
Training of operations and development staff	Expect between $20k and $75k
Implementation	To be determined

Figure 1. Migration Budget Considerations

Target Platform

Due to the existing HP hardware's ability to support both the MPE/iX and HP-UX operating systems, and the portability of Cognos's PowerHouse 4GL application to HP-UX, we would recommend the selection of a single HP-UX system to host the production system. The selection of Hewlett-Packard and HP-UX to host the new Sample Company XYZ application is very logical. The current HP e3000 Series 969/200 is exactly the same hardware employed in the HP-UX environment and is referred to as a "K" box. HP is offering an operating system switch from MPE/iX to HP-UX on the current hardware; however, we would not recommend the use of the existing system. By the time the migration takes place, the "K" box hardware will soon be obsolete from hardware maintenance.

The greatest probability for success can be achieved from parallel conversion and testing in both environments, utilizing a newly purchased system. A new system for hosting the application will also facilitate a clean back-out and contingency plan should there be a problem when the production switch takes place. HP is announcing new developments in hardware on a regular basis. Since the appropriation of hardware for the migration is still about 6 months out, we would recommend budgeting on the price of a current HP-UX system with a performance rating between 7 and 10 HP-UX performance units and then a more definitive price can be acquired at the time of order readiness. Lund does not provide hardware pricing due to the pricing confidentiality between Sample Company and their hardware vendor, whether the system be new from HP or refurbished from any of the certified reseller market.

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concurrent users. If Sample Company sees a large or dramatic change in its near or distant future that would cause the number of users to encroach upon the Eloquence ceiling, then a different RDBMS solution will need to be considered.

Timeline

Sample Company has expressed a desire to complete the migration process from MPE/iX to a new candidate platform by first quarter of 2004. At the time of this analysis, given the status of the current migration utilities and third-party projections for completion, the projection is very realistic. It is estimated that this project will take approximately 13 months, which is under the 15 to 18 months remaining before the projected project conclusion of first quarter, 2004. These estimates are what we would consider the minimal conservative timelines based on initial investigation and interviews of the Sample Company staff members. A high level outline of the project plan specific to Sample Company has been included for further updates and refinement. The following table summarizes the major portions of the project.

Action Item	Timeline Consideration
Tools	Production support in Cognos, Omnidex, and Eloquence is projected for late fourth quarter, 2002 to first quarter, 2003.
Hardware Acquisition	All hardware should be available for delivery and installation within 30 days of committing to a purchase order.
Installation and configuration	The hardware and software will take a minimum of one week to install once the hardware has been received.
Development Training	Approximately 2 months of training should be allocated for the in-house development team.
Code Migration	We estimate this effort to be approximately 3 months in time but a more granular and accurate estimate should be obtained from the Sample Company development team and Cognos support upon completion of the full integration with Omnidex and Eloquence.
Application testing	Usually the test effort is projected to equal that of the development effort. Conservatively, this could be 3 months as well.
User Training	User training in two waves can be accomplished in 30 days for operations and another two weeks for the user community.
Load Test and Right Sizing of new machine	The load/stress test is usually projected at 1 week for the analysis and the capacity plan is projected to take about 3 weeks to complete.
User Acceptance and Switching to live production	One month is projected for the acceptance from the user test team and the actual switching of the system into a live, production environment.

Figure 2. High-level Timeline Considerations

Migration – 2 Migration Analysis & Plan

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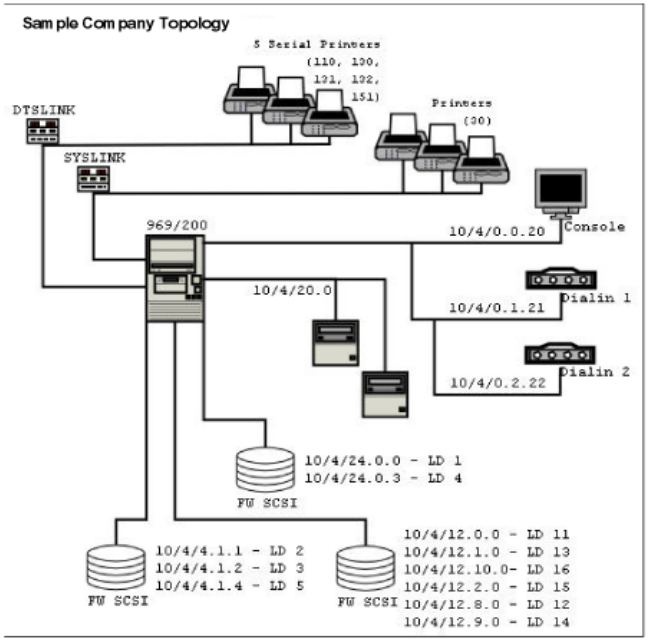

Figure 4. Hardware Topology

Current Accounting Structures

An inventory of the accounts on the system has provided the identification of operating system accounts, software, and data/programs that need to be addressed. A majority of the accounts do not need to be migrated to a new hosting environment. Essentially, only the code and data are needed however the accounts do need to be addressed by functionality for the new host. There are several default HP accounts that were created at system installation and updates. These particular accounts do not apply to an HP-UX, or other operating system, environment and therefore can be eliminated from the consideration and migration effort. In addition, there are third-party software accounts that need to only be replaced in either operating system functionality or another OS specific solution provider. Some solutions are just not available or applicable on the HP-UX side. There are many accounts that are not candidates for migration however the information contained within is very important and should be kept for reference.

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4GL Code

Code Type	# of Programs	Version Program	# lines Code	Location of Code
Cognos		QUICK QUIZ QTP	292,969 160,772 76,672	ABC and DEVELOP
Totals	2293		530,413	

Figure 7. 4GL Code disbursement

Current Databases and Data

The majority of the Sample Company data is housed within the HP e3000 proprietary Data Base Management System (DBMS) called Image and located within the ABC and TESTXL accounts. There are approximately 37 databases with approximately 18.88 GB of production data. Sample Company also utilizes several HP proprietary Keyed Sequential Access Method (KSAM) databases in both native and compatibility mode format. There are a total of 128 databases that contain approximately 51.8 GB of total data.

Database Account	Quantity	Database Account	Quantity
CIC	1	ABC	37
DEMO	22	ROBELLE	2
HCC	1	SYS	1
JMS3000	2	TESTXL	42
LASERDEM	2	THREEK	3
LARC	3	VESOFT	1
MBFOSTER	5	DISC	6
Total Databases :	128		

Figure 8. Total Database Quantification

IMAGE Production Databases

Total # of Databases: 37
Total # Datasets: 641
Largest Database: ABCMIS.ABCMIS.ABC at 4.3 GB
Total # JUMBO Datasets: 0

Database Name	Size in MB	Database Name	Size in MB
ARDB.ARDBASE.ABC	281.152	MDRBAS.ABCMIS.ABC	19.236
CLAIMS.CLAIMS.ABC	58.552	MENUDB.ABCMIS.ABC	2.760
CLHIST.CLMSHIST.ABC	3701.660	ABCMIS.ABCMIS.ABC	4406.116
UTILDB.DEL95DAY.ABC	18.524	PRODIR.ABCMIS.ABC	5.268
ABASE.ABCMIS.ABC	3212.676	PROVDB.ABCMIS.ABC	28.996
AGNTDB.ABCMIS.ABC	31.484	PRVCON.ABCMIS.ABC	62.664
ARSDB.ABCMIS.ABC	46.420	RATEDB.ABCMIS.ABC	24.232
AUDIT.ABCMIS.ABC	1976.288	REMCLM.ABCMIS.ABC	1964.116
BILLDB.ABCMIS.ABC	206.824	REQDB.ABCMIS.ABC	.516
CAPIT.ABCMIS.ABC	334.096	RXDB.ABCMIS.ABC	1382.300
CASBAS.ABCMIS.ABC	107.764	RXMBAS.ABCMIS.ABC	120.036
CKDB.ABCMIS.ABC	152.408	SEQDB.ABCMIS.ABC	.432
CLMDB.ABCMIS.ABC	.536	SHDBAS.ABCMIS.ABC	350.220
CONVDB.ABCMIS.ABC	.072	UCR2DB.ABCMIS.ABC	22.616
EMPDB.ABCMIS.ABC	.068	UCRDB.ABCMIS.ABC	40.208
GRPDB.ABCMIS.ABC	200.516	UTILDB.ABCMIS.ABC	18.948
GRPDB.ABCMIS.ABC	200.516	UTILDX.ABCMIS.ABC	18.524
GXCTRL.ABCMIS.ABC	7.116	WEBDB.ABCMIS.ABC	.144
MBRDB.ABCMIS.ABC	74.848		
Total # Sectors :	18.88 GB		

Figure 9. Image Database Quantification

Migration – 2 Migration Analysis & Plan

KSAM Databases

Please note that some of these KSAM files are temporary files created for reporting reasons. The structures will need to be migrated but the data will not.

Code Type	# of Database	Version Program	# lines Code	Location of Code
Native Mode	132	KSAM		ABC and TESTXL
Compatibility Mode	8	KSAM		ABC
Totals	140			

Figure 10. KSAM Database Quantification

Allbase Databases

Code Type	# of Database	Version Program	# lines Code	Location of Code
ALLBASE	0			N/A

Figure 11. Allbase Database Quantification

Data Dictionaries

Code Type	Quantity	Version Program	# lines Code	Location of Code
				ABC

Figure 12. Data Dictionary Quantification

Suprtool

Code Type	Quantity	Version Program	# lines Code	Location of Code
SUPRTOOL	102		2799	ABC

Figure 13. Suprtool Quantification

Current User Interfaces

Through the implementation of the Cognos environment, Sample Company has utilized the Cognos's QUICK screens. There are no additional viewing mechanisms to quantify in the Sample Company environment.

Current Batch Processing and Commands

All production batch jobs are contained in the JOB group of the ABC account. There are 1564 Job Control Language (JCL) files with approximately 555 of those scheduled on a regular basis.

Code Type	Quantity	Version Program	# lines Code	Location of Code
JCL	1564	MPE/iX		JOB.ABC

Figure 14. JCL Quantification


```
37   (network_address = 10.1.5.68)  #Individual Sales - 5n
38   (network_address = 10.1.5.65)  #Dental Claims - 4000
40   (network_address = 10.1.5.36)  #MemberShip - 4000
41   (network_address = 10.1.5.24)  #Bldg A - Upstairs - 4050
42   (network_address = 10.1.5.54)  #Provider Networking - 4050
43   (network_address = 10.1.5.49)  #Actuarial Services - 4000
44   (network_address = 10.1.5.59)  #Actuarial Services - 4050
45   (network_address = 10.1.5.76)  #Medical Affairs - 4050
49   (network_address = 10.1.5.77)  #Computer Room - 8150HN
50   (network_address = 10.1.5.31)  #Finance - security - 4si
```

Figure 16. Network Printer Configurations

Modem

There is one dialup telesupport port configured for remote support by HP and vendors.

File Transfer Protocol (FTP)

There are 230 batch jobs that currently reference the FTP.ARPA.SYS file.

Current 3rd Party Software

Performance Management – Lund Performance Solutions (Acct: LPS and LPSTOOLS)

Lund Performance Solutions' software provides comprehensive performance monitoring and diagnostic software. Lund's software assists with problem detection, isolation, monitoring, alerting, and correction.

Print Forms – LARC Computing (Acct: LARC)

The Fantasia laser printing and output management program is capable of typesetting techniques, font, logos and graphs. In addition, it produces standard barcodes. It is unclear to what degree the Fantasia product is being used, whether it's just for logos and graphics or if barcoding is utilized as well.

E-Mail – 3K Associates (Acct: THREEK)

The NetMail product is used to send email and files from the HP e3000. NetMail allows the HP e3000 to exchange electronic information with any Internet-compatible (SMTP) mail system whether it is mainframe, midrange Unix or Windows. There are many other customer features within the software that enhances and supplements the communication with the HP e3000.

Backups – Formerly Unison Tymlabs, now ROC Software (Acct: TYM)

BackPack/iX and Roadrunner provide HP e3000 backup capability with integration into tape library utilities and scheduling software. These backup solutions can include data compression and online backup.

Print Spooling – NOBIX, Inc. (Acct: NSD)

The NSD software offers several utilities including a spoolfile processing utility that analyzes spool print files and the completion status. It can manage both online report viewing and print distribution. Selected materials can be printed on demand eliminating the need for spoolfile storage, retrieval, and distribution.

Database Indexing – Dynamic Information Systems Corporation (Acct: DISC)

Omnidex is a database indexing utility that creates partial key indexes to Image data. This allows fast query and analysis capabilities for applications across the HP e3000. Omnidex is a preferred alternative to the MPE/iX supplied QUERY utility.

Migration – 2 Migration Analysis & Plan

MIGRATION ELEMENTS

The scope of a migration project is dependant on the relationship between the current environment and the new target environment. Once the current environment has been quantified and the functionalities have been outlined, the research for migration vehicles and solutions can begin.

In this section Lund utilized the information about the current environment to outline the elements of Sample Company's migration solution. The issues associated with the migration elements are discussed and premium solutions are provided for planning purposes. This information takes a proactive approach to migration by identifying constraints and considerations that are important to the migration planning and success. The presented information seeks to answer the following questions:

- What can move without changes and what will require changes?
- What can be utilized in the new environment?
- What is already included in HP-UX?
- What needs to be created?
- What new vendor solutions are required?
- What new technology or features can be employed?
- What security features can and should be implemented?
- What cannot be migrated to HP-UX?
- What does not move and becomes obsolete?

Future Hardware

Number of Systems

In many situations, there is both a need and an opportunity to utilize multiple servers to host the previous single host application that was resident on the HP e3000. It is common for new environments to be configured with an application server, a web server, a database server, a print server, a hot failover server, a QA and Test server, and then finally a development server. The Sample Company environment would not require a configuration to this extreme. First, a new single HP-UX server could service the needs of the production, web, database, and print requirements. The development, QA, and test requirements could also be resident on this system if sized properly. In a perfect world, we would like to see those final requirements satisfied by their own dedicated, but reduced, system. Either purchasing a new, dedicated system or converting the existing 969/ks200 to an HP-UX system, can achieve this business requirement. The hardware obsolescence date from the existing "k"s200 system may be too close to the HP-UX obsolescence date when it is completed. A new system may need to be considered. Also, if you would like to minimize the initial expenses of the migration effort, the development/QA/test hardware could be purchased first for parallel testing. Once the load test and right-sizing activity takes place, the appropriate production hardware could be purchased for the final migration.

CPU Sizing

When attempting to project the new HP-UX system to purchase, there are several differences to address: operating system, application, and relative performance benchmarks. Over the past eight years, the Lund migration partners in Europe have typically seen an increased requirement, by a multiple of 1.4, when moving from MPE to HP-UX. This is due to the significant differences in the operating system and the way in which it supports and interacts with the application and vendor solutions. Also, all vendors, including Hewlett-Packard, publish

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Cleaning up the existing Environment

Prior to migrating your data to the new environment, thorough housekeeping should take place on your existing system. Decreasing the amount of data that is migrated can reduce the necessary migration efforts. Disk and database maintenance prior to migration is recommended. By optimizing the disk and databases prior to migration you improve the odds of success and reduces the immediate maintenance necessary on the target platform once the system is migrated. This includes the archiving of data that does not need to be moved into the new environment.

Future User Interfaces

Users will continue to access the host through terminal emulation software on a PC workstation. Many solutions including the Reflections utility from Walker Richer and Quinn (WRQ) have both the HP e3000 and HP 9000 solutions bundled together in one offering. The migration team will need to assist each of the users in the software setup in order to access the new system for the test period and the final switch to live production. The use of the Reflection's software is the same.

The XYZ application will continue to have data access through the Cognos solution. The Axiant solution and PowerHouse Web convert each QUIK program into a new, self-contained transaction. This will provide a great enhancement to the user interface by providing a GUI look and feel.

Future Batch Processes, Commands, and OS Specific

The current use of command files, user-defined commands, and JCL may require creation and development in the new environment. There are MPE/iX porting and emulation utilities available to reduce this effort. Both Neartek's AMXW and Ordina-Denkart's ViaNova solutions are similar to the Axiant tool for the Cognos code migration. They allow for an MPE/iX shell, which provides the use of many MPE/iX commands automatically converted to HP-UX. However, it is likely that these solutions will be cost prohibitive for Sample Company as they are priced on the total lines of 3GL code to be converted, with a minimal entry point of 500,000 lines of code. The Axiant tool may be able to assist with some of the functionality. The alternative to these solutions is to completely rewrite the structures in a native mode format for the HP-UX platform.

Future Networking

The same network topology and hardware utilized by the HP e3000 can be utilized by the HP-UX system. The 100-BaseT hardware and cabling are consistent in the HP-UX environment. If Sample Company utilizes a parallel implementation strategy, then a new class "A" IP address will have to be assigned to the new system until the production switchover takes place. At that time, the new system's IP address could be changed to the old system IP address.

Future 3rd Party Software

Performance Management – still available from Lund Performance Solutions

Lund Performance Solutions provides its performance management software suite for HP-UX, Solaris, Linux, and Windows platforms. The SOS, now Meta-View, product will function in almost the same exact manner that it currently is for the MPE/iX environment. There should be no learning curve for the operations and management staff in implementing the same and greater functionality. New functionality has been added to the product line at no additional cost that will allow you to monitor the entire environment or single host system from three different views: Host ASCII, WEB, and mobile PDA's.

Migration – 2 Migration Analysis & Plan

Migration Project Management

Significant Event Management might be described as an effective means of overseeing a system event to maximize effectiveness of both the purpose of the event and the event itself. A high-quality, deliberated plan will increase the probability of success in addition to leveraging the success of future transitions. In order for your internal customers; management and partnering departments, to subscribe to your transition you must show that there will be no ill affect on production and that the resources requested will be utilized at maximum optimization. Most migrations are also somewhat labor intensive, which can only be inhibited by lack of organization. Planning is fundamental to the success of any migration and planning is the heart of Lund's Migration Project Management. This section contains a proposed schedule of high-level of events for an HP e3000 migration.

Significant Event Management

Basic pre-project planning should kick-off migration project. The goal of the project is established and decisions are made regarding the members of various business units that should be a part of the core migration team. The purpose of the team is to coordinate and escalate migration elements and clarify the changes to be made through regular update and decision-making meetings.

A complete detailed migration project plan should be documented to assist in the communication and organization of the migration implementation. This project plan will be a mix of high-level information for upper-level management or business units and low-level information for those more deeply involved with the implementation, changes and testing.

Schedule and Accountability

A master calendar should be developed that would include regular administrative meetings, on site visits, a schedule of events, deadlines for significant benchmarks, and a contact list of all the players. Decide who will attend meetings at what point in the project and what are your objectives at major meeting points. Look at how you will effectively track action items as they arise and who will follow through so that they become "actions" and not just "items". Preparation tasks, testing teams and measurements for success should be established. A successful migration should be well planned, well prepared with cushioned timelines and clearly outlined tasks.

Project documentation

Project documentation may include documents indicating decision points, action points, flow of work charts, and the roles of everyone involved, including who is responsible for the lead in each phase and their contact information. You may also want to include description of the software changes, back out plan, go, no go decision points, testing, a listing of additional documents or information needed to complete the project, checklists for preparation, installation and startup. Finally, this is also where you would include diagrams of system configuration; architecture, and computer room plans where applicable.

Scope Creep

In the realm of Project Management, scope creep is a culprit of project failure or unmet deadlines. By understanding the scope creep concept, one can prepare for the alternatives and understand the importance of proper and well-planned project plans.

If you do not have objectives, goals and a solid plan identified, then as the project progresses, more and more variables get introduced into the into the project. By the time you implement the solution, what you thought you were going to address is nowhere near what you had identified when you first

started the project. In the event that scope creep takes place during early project tasks, the overall affect can be compounded throughout the project and the end results may be completely skewed even to the point of unrecognizable.

Timeline considerations

The following table describes and discusses a methodical approach to the project management of your migration. A Gant chart has been created in Microsoft Project® that outlines a milestone-oriented approach to project management. As you review the table below, you should be able to follow along with the high-level timeline (Gant chart snapshots) as shown on page 32. Task numbers in the table correspond to the tasks in the Gant chart. Also included in the table are estimates of minimum time required to complete each milestone.

Task #s	Task	Duration
1 - 3	**Baseline Study**	**40 days**
	Performance Baseline Study of 969/ks200 – Sample Company has taken the first steps in the successful migration of the XYZ application. A performance baseline study, capacity plan, and project study will all have been completed prior to the commencement of the migration project. (COMPLETE) **Capacity Plan Assurance of System Life** – Currently, the 969/ks200 is running at 97% capacity and there is worry that there may be latent need that is not being satisfied. To maintain utilization under the threshold of 80%, it has been recommended that as much as a two-processor upgrade would be needed. This will either accelerate the timeline and importance of the migration, or require that the existing system upgrade be introduced into the scope of the project. (COMPLETE) Action item: Determine if upgrade to 969/ks200 will be performed	
4 - 6	**Maintain System Stability**	**Entire project**
	Quarterly Performance Reviews – In the short period of time that this study has taken place, the dynamic nature of the environment has shown just how much change is taking place. Quarterly assessments of the system and the code base will be needed to ensure both that the 969/ks200 does not hit the performance wall and that the code and data requirement does not significantly alter the development time required to convert. Action item: Establish quarterly review process. **Quarterly Maintenance** – Regular maintenance is critical to the cleanliness of the data in the new environment. An archival of the unneeded code and data prior to the conversion process will significantly reduce the scope and effort required to complete the conversion. Action item: Review and archive unneeded code and data.	
7 - 13	**Planning The Project**	**30 days**
	Lund Migration Project Study – (COMPLETE) **Assemble Migration Team** – The migration team should consist of representatives from each of the departments of business units that the HP e3000 supports. Each member will be responsible for representing the needs of the department and convey status of the migration project back to their department. The proactive communication in this process will be both an image lift for the IT department and comfort any fears of the pending change. **Outline Roles and Responsibilities** – Definition of the roles and responsibilities of each team member will assist in the assignment of action items and promote channels of communication. **Identify Blackout Dates** - Black out dates should be strategically placed in a migration timeline, as these are periods in which the system is unavailable. This may affect the success of completion for certain testing. Sample Company has identified Labor Day weekend, 2003 as the date range for moving to the new data center building. This may be a strategic date in which the setup and 'turn on' of the system in the new environment can be in sync with a setup or 'turn on' date in the migration plan.	

Migration – Migration Analysis & Plan

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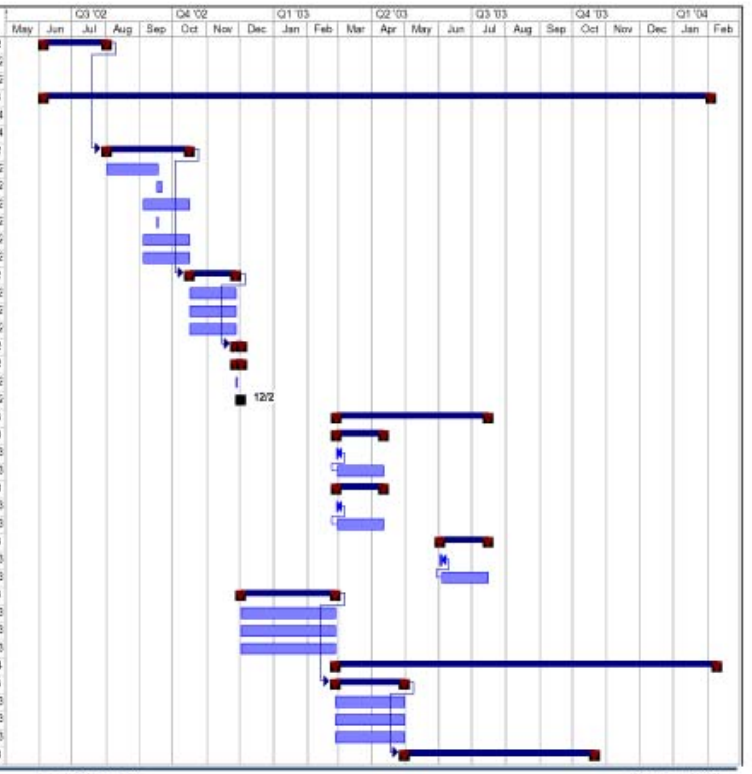
Expended & Detailed Time Line

ID	Task Name	Duration	Start	Finish
1	**Baseline Study**	**40 days**	**Wed 6/5/02**	**Wed 7/31/02**
2	Performance Baseline Study of 959	40 days	Wed 6/5/02	Wed 7/31/02
3	Capacity plan assurance of system life	40 days	Wed 6/5/02	Wed 7/31/02
4	**Maintain System Stability**	**423 days?**	**Wed 6/5/02**	**Tue 2/3/04**
5	Quarterly performance reviews	423 days?	Wed 6/5/02	Tue 2/3/04
6	Quarterly maintenance	423 days?	Wed 6/5/02	Tue 2/3/04
7	**Planning The Project**	**53 days**	**Thu 8/1/02**	**Tue 10/15/02**
8	Lund Migration Project Study	32 days	Thu 8/1/02	Mon 9/16/02
9	Assemble migration team	5 days	Mon 9/16/02	Fri 9/20/02
10	Outline roles and responsibilities	30 days	Wed 9/4/02	Tue 10/15/02
11	Identify black out dates	1 day	Mon 9/16/02	Mon 9/16/02
12	Identify Go/No-Go Decision Dates	30 days	Wed 9/4/02	Tue 10/15/02
13	Create complete migration project plan	30 days	Wed 9/4/02	Tue 10/15/02
14	**Solution Investigation**	**30 days**	**Wed 10/16/02**	**Tue 11/26/02**
15	Hardware Investigation	30 days	Wed 10/16/02	Tue 11/26/02
16	3rd party & app. software investigation	30 days	Wed 10/16/02	Tue 11/26/02
17	Code & data porting software investigation	30 days	Wed 10/16/02	Tue 11/26/02
18	**Budget Request and Approval**	**3 days?**	**Wed 11/27/02**	**Mon 12/2/02**
19	**Steering Committee Presentation**	**3 days?**	**Wed 11/27/02**	**Mon 12/2/02**
20	Statement - Availability of Solutions	1 day	Wed 11/27/02	Wed 11/27/02
21	Funds are available	1 day?	Mon 12/2/02	Mon 12/2/02
22	**Development and Delivery of Staff Training**	**97 days?**	**Thu 2/27/03**	**Tue 7/15/03**
23	**Operations and System Admin**	**31 days?**	**Thu 2/27/03**	**Thu 4/10/03**
24	Training material created	1 day?	Thu 2/27/03	Fri 2/28/03
25	Training delivery	30 days	Fri 2/28/03	Thu 4/10/03
26	**Development**	**31 days?**	**Thu 2/27/03**	**Thu 4/10/03**
27	Training material created	1 day?	Thu 2/27/03	Fri 2/28/03
28	Training delivered	30 days	Fri 2/28/03	Thu 4/10/03
29	**User Test Team**	**31 days?**	**Mon 6/2/03**	**Tue 7/15/03**
30	Training material created	1 day?	Mon 6/2/03	Tue 6/3/03
31	Training delivery	30 days	Tue 6/3/03	Tue 7/15/03
32	**Acquisition**	**60 days**	**Mon 12/2/02**	**Tue 2/25/03**
33	Hardware	3 mons	Mon 12/2/02	Tue 2/25/03
34	3rd party and application software	3 mons	Mon 12/2/02	Tue 2/25/03
35	Code and data porting software	3 mons	Mon 12/2/02	Tue 2/25/03
36	**Significant Event Management**	**243 days?**	**Wed 2/26/03**	**Sun 2/8/04**
37	**Installation**	**45 days**	**Wed 2/26/03**	**Tue 4/29/03**
38	Hardware	45 days	Wed 2/26/03	Tue 4/29/03
39	Software	45 days	Wed 2/26/03	Tue 4/29/03
40	Code Porting Software	45 days	Wed 2/26/03	Tue 4/29/03
41	**System Migration and Testing**	**120 days**	**Wed 4/30/03**	**Mon 10/20/03**



SAMPLE COMPANY PAGE 35 OF 37 PROJECT ID #

Migration – Migration Analysis & Plan

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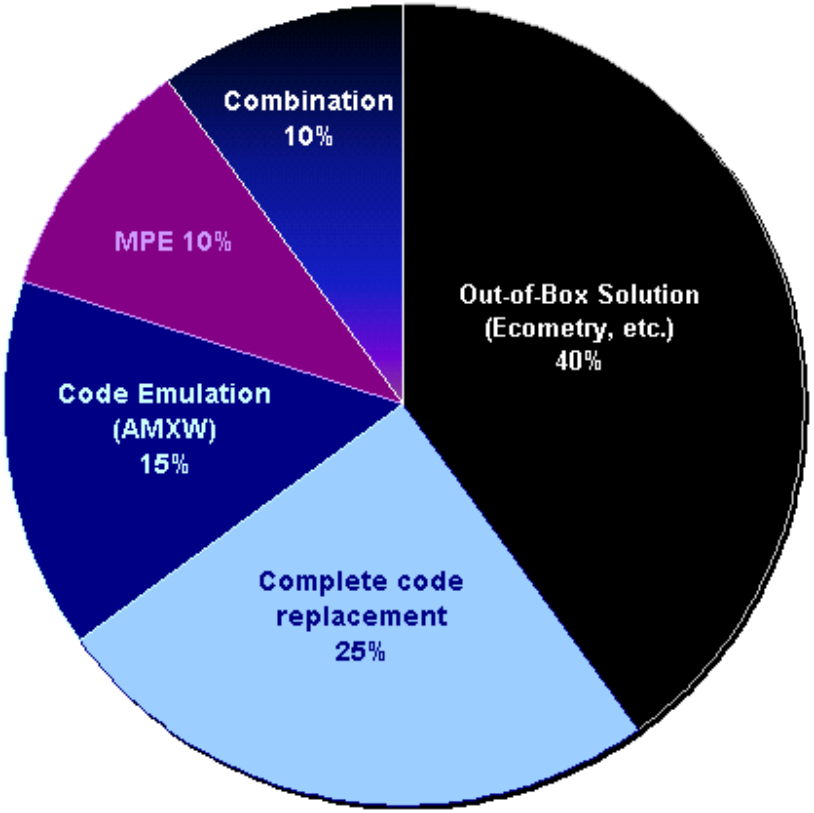

Out-of-Box Solution (Ecometry, etc.)

Complete code replacement

Code Emulation (AMXW)

Remain on MPE (All, partial, attrition)

Some combination of all of the above

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WHAT YOU NEED TO KNOW, WHEN YOU NEED TO KNOW IT.

Migration – 2 Migration Analysis & Plan

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Current Databases and Data

The majority of the Company data is housed within the e3000 proprietary DBMS called IMAGE and located within the PHA and TESTXL accounts. There are approximately 36 databases with approximately 18.88 GB of production data. Company also utilizes several HP proprietary Keyed Sequential Access Method (KSAM) databases in both native and compatibility mode format. There are 128 databases with approximately 51.8 GB of total data.

Database Account	Number	Database Account	Number
CIC	1	PHA	37
DEMO	22	ROBELLE	2
HCC	1	SYS	1
JMS3000	2	TESTXL	42
LASERDEM	2	THREEK	3
LARC	3	VESOFT	1
MBFOSTER	5	DISC	6
Total Databases :		128	

IMAGE Production Databases

Total # of Databases: 37

Total # Datasets: 641

Largest Database: PHAMIS.PHAMIS.PHA at 4.3 GB.

No JUMBO Datasets

Database Name	MB	Database Name	MB
ARDB.ARDBASE.PHA	281.152	MDRBAS.PHAMIS.PHA	19.236
CLAIMS.CLAIMS.PHA	58.552	MENUDB.PHAMIS.PHA	2.760
CLHIST.CLMSHIST.PHA	3701.660	PHAMIS.PHAMIS.PHA	4405.116
UTILDB.DEL95DAY.PHA	18.524	PRODIR.PHAMIS.PHA	5.268
ABASE.PHAMIS.PHA	3212.676	PROVDB.PHAMIS.PHA	28.996
AGNTDB.PHAMIS.PHA	31.484	PRVCON.PHAMIS.PHA	62.664
ARSDB.PHAMIS.PHA	45.420	RATEDB.PHAMIS.PHA	24.232
AUDIT.PHAMIS.PHA	1976.288	REMCOM.PHAMIS.PHA	1964.116
BILLDB.PHAMIS.PHA	205.824	REQDB.PHAMIS.PHA	.516
CAPIT.PHAMIS.PHA	334.096	RXDB.PHAMIS.PHA	1362.300
CASBAS.PHAMIS.PHA	107.764	RXMBAS.PHAMIS.PHA	120.036
CRDB.PHAMIS.PHA	152.408	SEQDB.PHAMIS.PHA	.432
CLMDB.PHAMIS.PHA	.536	SHDBAS.PHAMIS.PHA	350.220
CONVDB.PHAMIS.PHA	1.072	UCR2DB.PHAMIS.PHA	22.616
EMPDB.PHAMIS.PHA	1.068	UCRDB.PHAMIS.PHA	40.208
GRPDB.PHAMIS.PHA	200.516	UTILDB.PHAMIS.PHA	18.948
GRPDB.PHAMIS.PHA	200.516	UTILDX.PHAMIS.PHA	18.524
GXCTRL.PHAMIS.PHA	7.116	WEBDB.PHAMIS.PHA	.144
MBRDB.PHAMIS.PHA	74.848		
Total # Sectors :		18.88 GB	

KSAM Databases

Number	Code Type	Version Program	Location of Code
132	Native Mode	KSAM	PHA and TESTXL
8	Compatability Mode	KSAM	PHA
140	Total		

Please note that some of these KSAM files are temporary files created for reporting resaons. The structures need to be migrated the data will not.

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Redevelopment – Some HP e3000 environments have already begun the parallel development of their new production environment. These are extremely large and costly deployments of company time, talent, and treasures. Common problems include budget over runs, development resources, and "scope creep" the ever-evolving project definition. The business impact of this option is also potentially high because of the difference in the final application when compared to the existing application. Process changes and the loss in productivity can be significant.

Migration or Porting – Leveraging the existing investment of time, knowledge, application development, licenses, and vendor relationships is the most cost effective solution available. Since the majority of the application is written in the COGNOS Powerhouse 4GL application, use of the Axiant migration tool should make the transition relatively painless. In theory, 4GL languages were created to easily extract data and migrate applications across platforms. In this scenario, Company's code, indexing, extracts, interface and data format will remain relatively the same. This reduces the potential business impact of the migration decision.

Insurance Claims Processing Application

Claims Processing and payables PHA, DEVELOP

Company has developed a "homegrown" caims processing system. The data is stored in two Hewlett-Packard proprietary database structures, IMAGE and KSAM. Users interface into the data with COGNOS QUIK screens and extract information through the QUIZ and QTP report generators.. Efficiency is further obtained through the use of OMNIDEX indexing into the data and SUPERTOOL data management routines. Both COBOL and BASIC languages have been utilized for a few complementarty and auxiliary functions. Finally, there are a variety of systems management tools that enhance the MPE/iX operating system functions for email, print, scheduling, security, backups, database management, and performance management.

Migration Recommendations

Cost – There are many elements to consider when completing the budget for this project. Based on the information that we have reviewed, here are the main categories to complete the migration:

- ✓ New hardware – Hewlett Packard rp5470 (650MHz) expect between 150k and 250k
- ✓ New databases – Eloquence approximately $7,000 unlimited users
- ✓ 3GL and 4GL software licensing – COGNOS expect between 50k and 150k per server
- ✓ Replacement tools i.e. backup, spooling, job scheduling – expect between 50k to 150k
- ✓ Optional migration tools and technologies
- ✓ Migration resources – expect between 75k and 200k if completely outsourced
- ✓ New hires
- ✓ Application enhancements or facelifts – expect between 20k and 50k plus labr
- ✓ Training of operations and development staff – expect between 20k and 75k
- ✓ Implementation.

Platform – Due to the similarity of the Hewlett-Packard hardware in support of both the MPE/iX and HP-UX operating systems, and the portability of the COGNOS POWERHOUSE 4GL application to the HP-UX OS, we would recommend the selection of a single HP-UX system to host the production system. The

Migration – 2 Migration Analysis & Plan

I also found that some Image intrinsics were returning Omnidex status (for instance 3217 and 3313 for DBFIND) which were tested by the program.

Analysis

It can be considered as very unlikely that a string such as PR6 present in the address field is not the post code. If this assumption cannot be made, a possible solution would be to split the address field and create a post code column.

An index must first be created on HDC_CUST_ADDRESS and on HDC_CUSTNAME in order to replace the Omnidex indexes.

The code used to format the customer name criterion and the post code can be partially reused in order to produce a buffer that could be passed to DBFIND. The two DBFINDs need to be merged into one, with a buffer which should look like:

HDC-CUSTNAME=« Rees AND Jones » AND HDC_CUST_ADDRESS LIKE « %PR6% ».

HD85.HDMS

```
CREATE TABLE  HDMS.RETURN_HDR
   (SRN_NO              CHAR(0006)     NOT NULL, /*  X6        */
    IBT_RETURN_NO       CHAR(0006)     NOT NULL, /*  X6        */
    IBT_DESPATCH_NO     CHAR(0006)     NOT NULL, /*  X6        */
    USER_ID             CHAR(0006)     NOT NULL, /*  X6        */
    RETURN_DATE         CHAR(0008)     NOT NULL, /*  X8        */
    HDC_STORE_KEY       CHAR(0006)     NOT NULL, /*  X6        */
    HDC_ORDER_KEY       CHAR(0012)     NOT NULL, /*  X12       */
    NEWLAB_CHRONO         NUMBER(10)   NOT NULL)
TABLESPACE HDMS_DATA086;
```

An Omnidex index should be present on RETURN-HDR(RETURN-DATE)

```
CREATE TABLE  HDMS.RETURN_SUPP_ITEM
   (SRN_NO              CHAR(0006)     NOT NULL, /*  X6        */
    COMPANY_SKU         CHAR(0008)     NOT NULL, /*  X8        */
    RETURN_SELL_QTY     NUMBER(10)     NOT NULL, /*  I2        */
    HDC_SUPP_KEY        CHAR(0006)     NOT NULL, /*  X6        */
    SUPP_ITEM           CHAR(0012)     NOT NULL, /*  X12       */
    RETURN_ITEM_QTY     NUMBER(10)     NOT NULL, /*  I2        */
    COST_PRICE          NUMBER(10)     NOT NULL, /*  I2        */
    NEWLAB_CHRONO         NUMBER(10)   NOT NULL)
TABLESPACE HDMS_DATA087;

CREATE TABLE  HDMS.SUB_EVENT_LOG
   (ITEM_EVENT_NO       CHAR(0008)     NOT NULL, /*  Z8        */
    EVENT_DATE          CHAR(0008)     NOT NULL, /*  Z8        */
    EVENT_TIME          NUMBER(5)      NOT NULL, /*  I1        */
    LOCATION_KEY        CHAR(0008)     NOT NULL, /*  X8        */
    SUB_EVENT_QTY       NUMBER(10)     NOT NULL, /*  I2        */
    POST_EVENT_QTY      NUMBER(10)     NOT NULL, /*  I2        */
    LOCATION_USE        CHAR(0002)     NOT NULL, /*  X2        */
    CURR_LOC_TYPE_NO    CHAR(0002)     NOT NULL, /*  X2        */
    EVENT_TYPE          CHAR(0002)     NOT NULL, /*  X2        */
    SUPP_ITEM_KEY       CHAR(0018)     NOT NULL, /*  X18       */
    REASON_CODE         CHAR(0008)     NOT NULL, /*  X8        */
    PRINTED_FLAG        CHAR(0002)     NOT NULL, /*  X2        */
      NEWLAB_CHRONO       NUMBER(10)   NOT NULL)
  TABLESPACE HDMS_DATA055;
```


COBOL MIGRATION

Before HP e3000 cobol code may be compiled under UNIX using the Microfocus COBOL compiler, some modifications are necessary. AMX provides utilities which will automate these changes.

Some of the changes (among a lot of others) are:

- Any COBOL source files or Copy libraries which contains macros or the $INCLUDE command need to be identified and preprocessed by utilizing the UxTrCobCop utility. UxTrCobCop will expand the macro or include the relevant file.
- Compilation options ($CONTROL) are commented out.
- Replacement of HP e3000 functionnalities such as CONDITION-CODE by proprietary procedures.
- Syntactical changes in COPY, CALL, GOBACK, etc. statements.
- Inclusion of an initialisation paragraph that will make file equations and variables available to a particular process.
- Inclusion of a cleanout procedures after leaving the program: files closures, purge of "new files", etc.

Though the modifications made above will cover most of the required code changes, the translation process always require some manual intervention. MicroFocus Cobol has a lot of options. Some of them will set some syntactical standards. An option such as OSVS or NOOSVS will for example allow some statements while disallowing others.

Prerequisites

The file $NLROOTDIR/SYS/PUB/DEVICES should be updated prior to running UxTrCobCop. This file maps MPE devices to Unix devices, e.g. LPTEST can be mapped to /dev/LPTEST. This was not done for the purpose of the feasability study.

Translation of COPYLIB maintained within KSAM files

This step must be taken prior to the the translation of the cobol files. A Microfocus copylib is merely an include file. Each module has to be extracted from the copy library as a flat file.

The WBCOPLIB was translated. A copylib named BBCOPLIB was later found to be missing. The KSAM file is first converted into a flat ASCII file on the HP e3000:

```
RENAME WBCOPLIB WBOLD
FILE WBBCOPLIB;REC=-80,,F,ASCII
FCOPY FROM=WBOLD;TO=*WBCOPLIB;NEW
```

UxTrCobCop may then be run against the copylib. The files were created under the $NLROOTDIR/WBCOPLIB directory. One file is created per module.

Migration –

Migration Analysis & Plan

2

- What to do, what to do (with the application)?
- The Five Choices

1)	Retire	Who needs it!
2)	Maintain	Keep it on the 3000!
3)	Rewrite	Create your own replacement.
4)	Replace	We never liked it anyway.
5)	Migrate	We need it.

Migration – 2 Code & Data Porting Study

MIGRATION OF IMAGE DATABASES

CTRL, HDMS and WBSARC were transported to Unix in an Oracle database:

- CTRL
- HDMS
- WBSARC

Migration of Image schema

Entities and relations

Our Image converter will automatically perform the following translations:

- Detail and manual manual sets become tables
- Automatic master sets become indexes
- Search and sort items are indexed in the detail sets
- Master set key items are indexed by a "unique index"

Relationships between masters and details are not automatically created, though they can be created later through referential constraints.

The default is for the tables owner to be the data base name: the MENU_COMPANIES set from CTRL would become the CTRL.MENU_COMPANIES table. This can be changed: if MENU_COMPANIES was to be possessed by MYOWN, a file equation such as FILE CTRL=MYOWN could be set through the AMX MPE-like shell.

An extra column (default name NEWLAB_CHRONO) is added to the list of the items in each resulting ORACLE table. This column is used to keep a unique addresse for each row. ORACLE does not guarantee that a row keeps the same rowid throughout its life. This column is mostly used for DBGET 4 calls. These addresses are also used if forward and backward pointers are stored in a program buffer.

Physical structure

The default physical structure is for each database to create one tablespace for data and one tablespace for indexes:

Image data base	Tablespaces	Data files
HDMS	HDMS_DATA HDMS_INDEX	HDMS01 HDMS02
CTRL	CTRL_DATA CTRL_INDEX	CTRL01 CTRL02
WBSARC	WBSARC_DATA WBSARC_INDEX	WBSARC01 WBSARC02

I also found that some Image intrinsics were returning Omnidex status (for instance 3217 and 3313 for DBFIND) which were tested by the program.

Analysis

It can be considered as very unlikely that a string such as PR6 present in the address field is not the post code. If this assumption cannot be made, a possible solution would be to split the address field and create a post code column.

An index must first be created on HDC_CUST_ADDRESS and on HDC_CUSTNAME in order to replace the Omnidex indexes.

The code used to format the customer name criterion and the post code can be partially reused in order to produce a buffer that could be passed to DBFIND. The two DBFINDs need to be merged into one, with a buffer which should look like:

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HD85.HDMS

```
CREATE TABLE  HDMS.RETURN_HDR
    (SRN_NO                 CHAR(0006)    NOT NULL, /*  X6        */
     IBT_RETURN_NO          CHAR(0006)    NOT NULL, /*  X6        */
     IBT_DESPATCH_NO        CHAR(0006)    NOT NULL, /*  X6        */
     USER_ID                CHAR(0006)    NOT NULL, /*  X6        */
     RETURN_DATE            CHAR(0008)    NOT NULL, /*  X8        */
     HDC_STORE_KEY          CHAR(0006)    NOT NULL, /*  X6        */
     HDC_ORDER_KEY          CHAR(0012)    NOT NULL, /*  X12       */
     NEWLAB_CHRONO            NUMBER(10)  NOT NULL)
TABLESPACE HDMS_DATA086;
```

An Omnidex index should be present on RETURN-HDR(RETURN-DATE)

```
CREATE TABLE  HDMS.RETURN_SUPP_ITEM
    (SRN_NO                 CHAR(0006)    NOT NULL, /*  X6        */
     COMPANY_SKU            CHAR(0008)    NOT NULL, /*  X8        */
     RETURN_SELL_QTY        NUMBER(10)    NOT NULL, /*  I2        */
     HDC_SUPP_KEY           CHAR(0006)    NOT NULL, /*  X6        */
     SUPP_ITEM              CHAR(0012)    NOT NULL, /*  X12       */
     RETURN_ITEM_QTY        NUMBER(10)    NOT NULL, /*  I2        */
     COST_PRICE             NUMBER(10)    NOT NULL, /*  I2        */
     NEWLAB_CHRONO            NUMBER(10)  NOT NULL)
TABLESPACE HDMS_DATA087;

CREATE TABLE  HDMS.SUB_EVENT_LOG
    (ITEM_EVENT_NO          CHAR(0008)    NOT NULL, /*  Z8        */
     EVENT_DATE             CHAR(0008)    NOT NULL, /*  Z8        */
     EVENT_TIME             NUMBER(5)     NOT NULL, /*  I1        */
     LOCATION_KEY           CHAR(0008)    NOT NULL, /*  X8        */
     SUB_EVENT_QTY          NUMBER(10)    NOT NULL, /*  I2        */
     POST_EVENT_QTY         NUMBER(10)    NOT NULL, /*  I2        */
     LOCATION_USE           CHAR(0002)    NOT NULL, /*  X2        */
     CURR_LOC_TYPE_NO       CHAR(0002)    NOT NULL, /*  X2        */
     EVENT_TYPE             CHAR(0002)    NOT NULL, /*  X2        */
     SUPP_ITEM_KEY          CHAR(0018)    NOT NULL, /*  X18       */
     REASON_CODE            CHAR(0008)    NOT NULL, /*  X8        */
     PRINTED_FLAG           CHAR(0002)    NOT NULL, /*  X2        */
       NEWLAB_CHRONO          NUMBER(10)  NOT NULL)
  TABLESPACE HDMS_DATA055;
```

Migration – 2 Code & Data Porting Study

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An Omnidex index should be present on SUB-EVENT-LOG(EVENT-DATE)

```
CREATE TABLE  HDMS.PO_LINE_REC_HIST
    (PO_NO                  CHAR(0008)     NOT NULL, /*  X8        */
     PO_LINE_NO             CHAR(0004)     NOT NULL, /*  X4        */
     PO_RECEIVED_DATE       CHAR(0008)     NOT NULL, /*  X8        */
     PO_QTY_RECEIVED        NUMBER(10)     NOT NULL, /*  I2        */
     PO_DRL_NO              CHAR(0006)     NOT NULL, /*  X6        */
     HDC_SUPP_KEY           CHAR(0006)     NOT NULL, /*  X6        */
     SUPP_ITEM              CHAR(0012)     NOT NULL, /*  X12       */
     PO_IN_STOCK            CHAR(0002)     NOT NULL, /*  X2        */
     ALT_HDC_SUPP_KEY       CHAR(0006)     NOT NULL, /*  X6        */
     SUPP_DEL_NO            CHAR(0008)     NOT NULL, /*  X8        */
     NEWLAB_CHRONO            NUMBER(10)   NOT NULL)
TABLESPACE HDMS_DATA069;
```

An Omnidex index should be present on PO_LINE_REC_HIST(PO_RECEIVED_DATE).

The first image calls are:

- DBFIND on RETURN-HDR(ODX-RETURN-DATE) (no Omnidex specific extension)
- DBGETs on the retrieved rows
- DBFIND on RETURN-SUPP-ITEM(SRN_NO) (no Omnidex)
- DBFIND on SUB-EVENT-LOG(ODX-EVENT-DATE) (no Omnidex specific extension)
- DBGET mode 7 on PARM-SET
- DBGETs on the SUB-EVENT-LOG retrieved rows
- DBFIND on RETURN-HDR(ODX-RETURN-DATE) (no Omnidex specific extension)
- DBGETs on the retrieved rows
- DBFIND on RETURN-SUPP-ITEM(SRN_NO) (no Omnidex)
- DBFIND on SUB-EVENT-LOG(ODX-EVENT-DATE) (no Omnidex specific extension)
- DBFIND on PO_LINE_REC_HIST(ODX-PO_REC_DATE) (no Omnidex specific extension)
- DBGETs on the retrieved rows

Analysis

Indexes must be created on the image tables and columns were Omnidex indexes exist.

No subset of a column is indexed here which makes things much simpler. Two changes have to be made to the code:

The appropriate SQL statement has to be passed to DBFIND

The DBFIND Omnidex specific status has to be hanlded appropriately.

Locks

Ilock strategy:

If ilock is enabled (default), all calls to DBLOCK and DBUNLOCK under AMX are managed by the ilock daemon process. Application programs communicate with this process to request Image locks. The locks obtained by DBLOCK are not required in order to update Oracle data: they are only necessary if exclusive access to data is required by the

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COBOL MIGRATION

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Some of the changes (among a lot of others) are:

- Any COBOL source files or Copy libraries which contains macros or the $INCLUDE command need to be identified and preprocessed by utilizing the UxTrCobCop utility. UxTrCobCop will expand the macro or include the relevant file.
- Compilation options ($CONTROL) are commented out.
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- Syntactical changes in COPY, CALL, GOBACK, etc. statements.
- Inclusion of an initialisation paragraph that will make file equations and variables available to a particular process.
- Inclusion of a cleanout procedures after leaving the program: files closures, purge of "new files", etc.

Though the modifications made above will cover most of the required code changes, the translation process always require some manual intervention. MicroFocus Cobol has a lot of options. Some of them will set some syntactical standards. An option such as OSVS or NOOSVS will for example allow some statements while disallowing others.

Prerequisites

The file $NLROOTDIR/SYS/PUB/DEVICES should be updated prior to running UxTrCobCop. This file maps MPE devices to Unix devices, e.g. LPTEST can be mapped to /dev/LPTEST. This was not done for the purpose of the feasability study.

Translation of COPYLIB maintained within KSAM files

This step must be taken prior to the the translation of the cobol files. A Microfocus copylib is merely an include file. Each module has to be extracted from the copy library as a flat file.

The WBCOPLIB was translated. A copylib named BBCOPLIB was later found to be missing. The KSAM file is first converted into a flat ASCII file on the HP e3000:

```
RENAME WBCOPLIB WBOLD
FILE WBBCOPLIB;REC=-80,,F,ASCII
FCOPY FROM=WBOLD;TO=*WBCOPLIB;NEW
```

UxTrCobCop may then be run against the copylib. The files were created under the $NLROOTDIR/WBCOPLIB directory. One file is created per module.

Migration – 2 Code & Data Porting Study

CONCLUSIONS

Image

- No incompatibilities were found in the structure
- The Omnidex indexes will have to be detected and created manually.

Cobol code

- No language restrictions were found.
- There are few incompatibilities as far as general purpose intrinsics and MPE commands are concerned and workaround exists for each of them. Two exceptions were however found:
  - The proprietary version of DISCFREE cannot be ported.
  - The definition and use of STARTRAN and STOPSTRAN need to be cleared.
- Allbase SQL can be migrated to Oracle.
- Two programs in SOCKCODE will have to be rewritten. The others can be amended to acomodate the socket layer.
- It is not possible to automate the Omnidex migration. Each source has to be individually analysed. The identified changes are:
  - When indexes are set on an item subset (for instance column 14 to 18), structural changes are required in order to produce an Oracle column that can be indexed.
  - When Omnidex sublists are used, merge of several DBFIND into one in order to emit a single SQL call.
  - When not used, for each DBFIND, produce the appropriate SQL call.
  - If necessary modify the code to accomodate DBFIND and DBGET Omnidex returned status.
- Visual basic

<Under investigation>

APPENDIX 1

Sample of the WBSCODE Cobol migration traces:

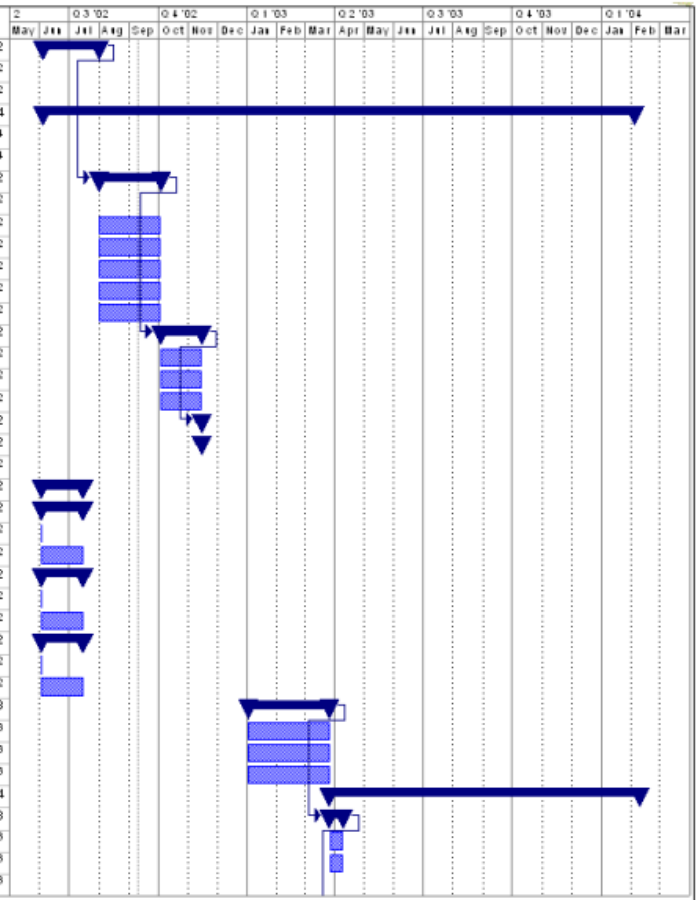
```
 &dBMACRO integratio
 &dJfrom /users/NEWLAB/MPEXL/XYZ COMPANY/WBSCODE/A1TRANC

 &dBMACRO integratio
 &dJfrom /users/NEWLAB/MPEXL/XYZ COMPANY/WBSCODE/A1TRANC
 &dJto   /users/XYZ COMPANY/WBSCODE/A1TRANCB.tm
End of Program

 &dBTranslation of
 &dJ/users/XYZ COMPANY/WBSCODE/A1TRANCB.tmp to
 &dJ/users/XYZ COMPANY/WBSCODE/A1TRANCB.cb

 &dJModifyin
      $CONTROL SUBPROGRAM,OPTFEATURES=LINKALIGNED16
==>
      *$CONTROL SUBPROGRAM,OPTFEATURES=LINKALIGNED16

 &dJ odifying
           CONDITION-CODE IS C-CODE.
==>
      *    CONDITION-CODE IS C-CODE.

 &dJModifyin
       WORKING-STORAGE SECTION.
==>
       WORKING-STORAGE SECTION.
      *
      * NEWLAB Declarations
      *
       01 NL--CMD           PIC X(512).
       01 NL--DMY           PIC S9(9) COMP-5 VALUE 0.
       01 NL--INT16         PIC S9(4) COMP-5 OCCURS 5.
       01 NL--INT32         PIC S9(9) COMP-5 OCCURS 5.
       01 NL--INT64         PIC S9(15) COMP-5 OCCURS 5.
       01 C-CODE              PIC S9(4) COMP.
      *
      * End of NEWLAB Declarations
      *

 &dJModifyin
           ENTRY "FILA1RED" USING LK-REPLY,
                                  LK-A1TRANS.
==>
           ENTRY "FILA1RED" USING LK-REPLY
                                  LK-A1TRANS.

 & JModifying
           GOBACK.
==>
           EXIT PROGRAM.

 &dJModifyin
           ENTRY "FILA1WRT" USING LK-REPLY,
                                  LK-A1TRANS.
==>
           ENTRY "FILA1WRT" USING LK-REPLY
                                  LK-A1TRANS.

 &dJModifyin
           GOBACK.
==>
```

Migration – Significant Event Management

3

LUND PERFORMANCE SOLUTIONS

ID	Task Name	Duration	Start	Finish
1	Baseline Study	40 days	Wed 6/5/02	Wed 7/31/02
2	Performance Baseline Study of 969	40 days	Wed 6/5/02	Wed 7/31/02
3	Capacity plan assessment of system life	40 days	Wed 6/5/02	Wed 7/31/02
4	Maintain System Stability	423 days?	Wed 6/5/02	Tue 2/3/04
5	Quarterly performance reviews	423 days?	Wed 6/5/02	Tue 2/3/04
6	Quarterly maintenance	423 days?	Wed 6/5/02	Tue 2/3/04
7	Planning The Project	45 days	Thu 8/1/02	Thu 10/3/02
8	Lead Migration Project Study	45 days	Thu 8/1/02	Thu 10/3/02
9	Assemble migration team	45 days	Thu 8/1/02	Thu 10/3/02
10	Outline roles and responsibilities	45 days	Thu 8/1/02	Thu 10/3/02
11	Identify black out dates	45 days	Thu 8/1/02	Thu 10/3/02
12	Identify Go/No-Go Decision Dates	45 days	Thu 8/1/02	Thu 10/3/02
13	Create complete migration project plan	45 days	Thu 8/1/02	Thu 10/3/02
14	Solution Investigation	30 days	Fri 10/4/02	Thu 11/14/02
15	Hardware investigation	30 days	Fri 10/4/02	Thu 11/14/02
16	3rd party & app. software investigation	30 days	Fri 10/4/02	Thu 11/14/02
17	Code & data porting software investigation	30 days	Fri 10/4/02	Thu 11/14/02
18	Budget Request and Approval	1 day	Fri 11/15/02	Fri 11/15/02
19	Steering Committee Presentation	1 day	Fri 11/15/02	Fri 11/15/02
20	Statement - Availability of Solutions	1 day	Fri 11/15/02	Fri 11/15/02
21	Development and Delivery of Staff Training	30 days?	Mon 6/3/02	Mon 7/15/02
22	Operations and System Admin	30 days?	Mon 6/3/02	Mon 7/15/02
23	Training material created	1 day?	Mon 6/3/02	Mon 6/3/02
24	Training delivery	30 days	Mon 6/3/02	Mon 7/15/02
25	Development	30 days?	Mon 6/3/02	Mon 7/15/02
26	Training material created	1 day?	Mon 6/3/02	Mon 6/3/02
27	Training delivered	30 days	Mon 6/3/02	Mon 7/15/02
28	User Test Team	30 days?	Mon 6/3/02	Mon 7/15/02
29	Training material created	1 day?	Mon 6/3/02	Mon 6/3/02
30	Training delivery	30 days	Mon 6/3/02	Mon 7/15/02
31	Acquisition	60 days	Thu 1/2/03	Wed 3/26/03
32	Hardware	3 mons	Thu 1/2/03	Wed 3/26/03
33	3rd party and application software	3 mons	Thu 1/2/03	Wed 3/26/03
34	Code and data porting software	3 mons	Thu 1/2/03	Wed 3/26/03
35	Significant Event Management	222 days?	Thu 3/27/03	Sun 2/8/04
36	Installation	10 days	Thu 3/27/03	Wed 4/9/03
37	Hardware	2 wks	Thu 3/27/03	Wed 4/9/03
38	Software	2 wks	Thu 3/27/03	Wed 4/9/03
39	Code Porting Software	1 day	Thu 3/27/03	Thu 3/27/03



Project: PSHP e3000 Migration Planni
Date: Tue 9/10/02

Task
Split
Milestone
Summary
Project Summary
External Tasks
External Milestone

Page 1

Migration – Significant Event Management 3

started the project. In the event that scope creep takes place during early project tasks, the overall affect can be compounded throughout the project and the end results may be completely skewed even to the point of unrecognizable.

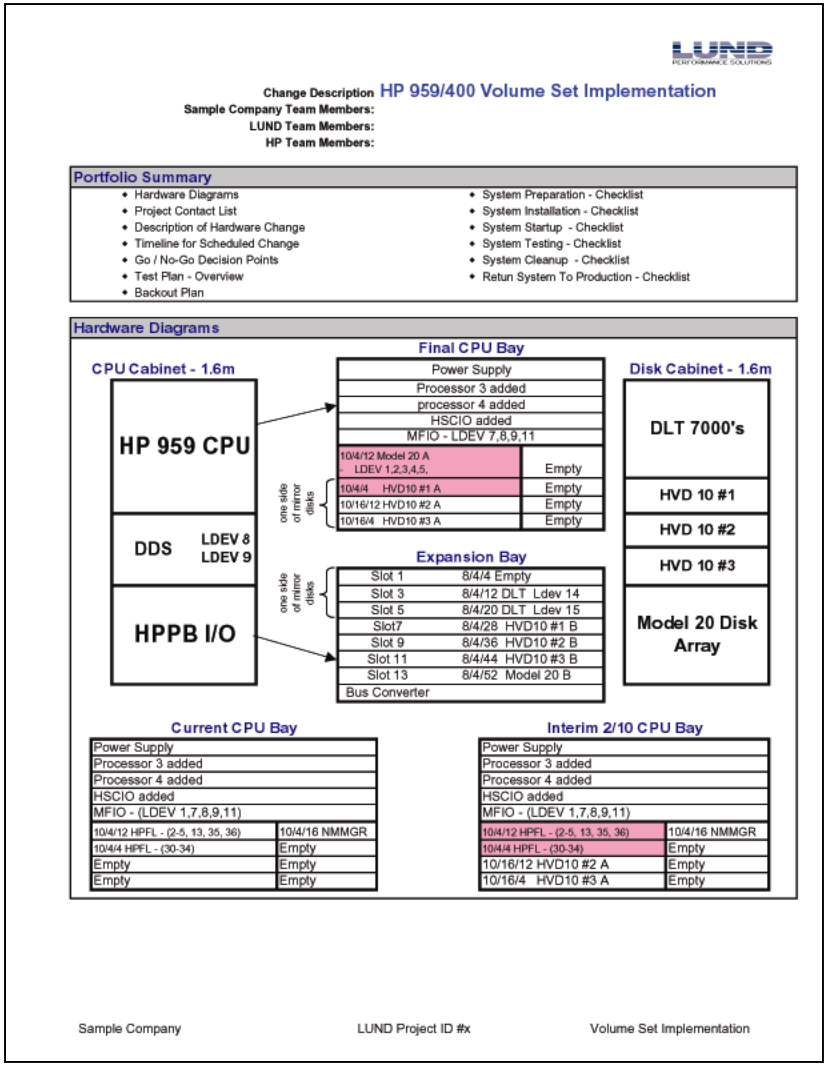
Timeline considerations

The following table describes and discusses a methodical approach to the project management of your migration. A Gant chart has been created in Microsoft Project® that outlines a milestone-oriented approach to project management. As you review the table below, you should be able to follow along with the high-level timeline (Gant chart snapshots) as shown on page 32. Task numbers in the table correspond to the tasks in the Gant chart. Also included in the table are estimates of minimum time required to complete each milestone.

Task #s	Task	Duration
1 - 3	**Baseline Study**	**40 days**
	Performance Baseline Study of 969/ks200 – Sample Company has taken the first steps in the successful migration of the XYZ application. A performance baseline study, capacity plan, and project study will all have been completed prior to the commencement of the migration project. (COMPLETE) **Capacity Plan Assurance of System Life** – Currently, the 969/ks200 is running at 97% capacity and there is worry that there may be latent need that is not being satisfied. To maintain utilization under the threshold of 80%, it has been recommended that as much as a two-processor upgrade would be needed. This will either accelerate the timeline and importance of the migration, or require that the existing system upgrade be introduced into the scope of the project. (COMPLETE) Action item: Determine if upgrade to 969/ks200 will be performed	
4 - 6	**Maintain System Stability**	**Entire project**
	Quarterly Performance Reviews – In the short period of time that this study has taken place, the dynamic nature of the environment has shown just how much change is taking place. Quarterly assessments of the system and the code base will be needed to ensure both that the 969/ks200 does not hit the performance wall and that the code and data requirement does not significantly alter the development time required to convert. Action item: Establish quarterly review process. **Quarterly Maintenance** – Regular maintenance is critical to the cleanliness of the data in the new environment. An archival of the unneeded code and data prior to the conversion process will significantly reduce the scope and effort required to complete the conversion. Action item: Review and archive unneeded code and data.	
7 - 13	**Planning The Project**	**30 days**
	Lund Migration Project Study – (COMPLETE) **Assemble Migration Team** – The migration team should consist of representatives from each of the departments of business units that the HP e3000 supports. Each member will be responsible for representing the needs of the department and convey status of the migration project back to their department. The proactive communication in this process will be both an image lift for the IT department and comfort any fears of the pending change. **Outline Roles and Responsibilities** – Definition of the roles and responsibilities of each team member will assist in the assignment of action items and promote channels of communication. **Identify Blackout Dates** - Black out dates should be strategically placed in a migration timeline, as these are periods in which the system is unavailable. This may affect the success of completion for certain testing. Sample Company has identified Labor Day weekend, 2003 as the date range for moving to the new data center building. This may be a strategic date in which the setup and 'turn on' of the system in the new environment can be in sync with a setup or 'turn on' date in the migration plan.	

Migration – Significant Event Management

3



LUND PERFORMANCE SOLUTIONS

Change Description HP 959/400 Volume Set Implementation
Sample Company Team Members:
LUND Team Members:
HP Team Members:

Portfolio Summary

- Hardware Diagrams
- Project Contact List
- Description of Hardware Change
- Timeline for Scheduled Change
- Go / No-Go Decision Points
- Test Plan - Overview
- Backout Plan
- System Preparation - Checklist
- System Installation - Checklist
- System Startup - Checklist
- System Testing - Checklist
- System Cleanup - Checklist
- Retun System To Production - Checklist

Hardware Diagrams

Final CPU Bay

CPU Cabinet - 1.6m

HP 959 CPU

DDS LDEV 8 LDEV 9

HPPB I/O

Power Supply	
Processor 3 added	
processor 4 added	
HSCIO added	
MFIO - LDEV 7,8,9,11	
10/4/12 Model 20 A - LDEV 1,2,3,4,5,	Empty
10/4/4 HVD10 #1 A	Empty
10/16/12 HVD10 #2 A	Empty
10/16/4 HVD10 #3 A	Empty

one side of mirror disks

Expansion Bay

Slot 1	8/4/4 Empty
Slot 3	8/4/12 DLT Ldev 14
Slot 5	8/4/20 DLT Ldev 15
Slot7	8/4/28 HVD10 #1 B
Slot 9	8/4/36 HVD10 #2 B
Slot 11	8/4/44 HVD10 #3 B
Slot 13	8/4/52 Model 20 B
Bus Converter	

Disk Cabinet - 1.6m

DLT 7000's

HVD 10 #1

HVD 10 #2

HVD 10 #3

Model 20 Disk Array

Current CPU Bay

Power Supply	
Processor 3 added	
Processor 4 added	
HSCIO added	
MFIO - (LDEV 1,7,8,9,11)	
10/4/12 HPFL - (2-5, 13, 35, 36)	10/4/16 NMMGR
10/4/4 HPFL - (30-34)	Empty
Empty	Empty
Empty	Empty

Interim 2/10 CPU Bay

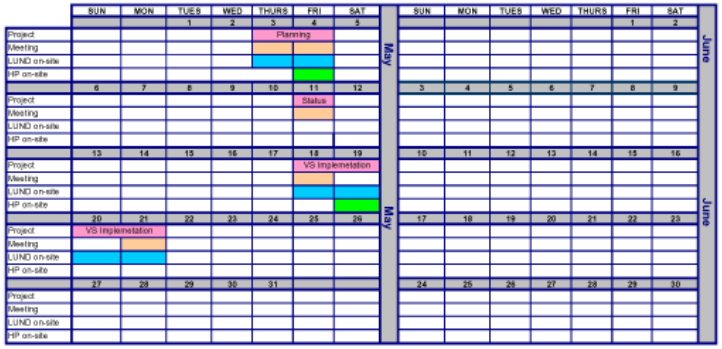
Power Supply	
Processor 3 added	
Processor 4 added	
HSCIO added	
MFIO - (LDEV 1,7,8,9,11)	
10/4/12 HPFL - (2-5, 13, 35, 36)	10/4/16 NMMGR
10/4/4 HPFL - (30-34)	Empty
10/16/12 HVD10 #2 A	Empty
10/16/4 HVD10 #3 A	Empty

Sample Company LUND Project ID #x Volume Set Implementation

Migration – Significant Event Management

3

Project: **Volume Set Implementation**
Date: June 5, 2002
Subject: Project Planning Session
LUND Attendees: Scott Pierson, Kate Billera, Camatha Groshong
Meeting Method: Teleconference



Meeting Summary

- Action Item Update
- Modification of backup plan
- Modification of DLTFull job
- Review status of preparation for on-site visit

Action Items

#	Actionee	Action	Status	Assigned
2	Camatha Groshong	Completion of Test Plan	Closed	3-May-02
4	Scott Pierson	Check with Rocky as to who creates new SLT config	Closed	3-May-02
6	Scott Pierson	Create SYSGEN Configuration and SLT	Closed	4-May-02
7	Kate Billera	Check for other AMISYS customers using Mirror/iX for Jeff	Closed	15-May-02
8	Scott Pierson	Copy and modify new DLTFULL to include auto VSTORE of baqckup	Closed	15-May-02
9	Camatha Groshong	Check with HiComp for HiBack and Mirror/iX conflicts	Closed	15-May-02
10	Kate Billera	Check for issues with RESTORE of HFS directries and file structures	Closed	15-May-02
11	Kate Billera	Purge Account ORACLEDB	Closed	15-May-02
12	Kate Billera	Modify the backup command	New	5-Jun-02
13	Camatha Groshong	Investigate whether Hi-Back has "onvs" capability or not	New	5-Jun-02
14	Scott Pierson	Investigate whether "onvs" command is required in backup process	New	5-Jun-02
15	Kate Billera	Modify DLTFULL job stream to add in bringing the tape online	New	5-Jun-02
16	Jeff	Jeff to email additions to the change control document	New	5-Jun-02

Action Item Updates — *Subject Lead: Scott Pierson*

2 Updates received from both Jeff and Diana
4 Rocky directed Lund to create the configuration
6 SLT Generated Wednesday, 5/16/01
7 Examples of Amysis customers using Mirror/iX provided to Jeff
8 DLTFULL modified to DLTFULLN, DEVCONTROL form Telesup worked, MPEX did not
9 HiComp informed us that there are no differences or complications
10 No issues in RESTORE process
11 Account Purged

Modification of Backup Plan — *Subject Lead: Kate Billera*

- The current backup jobs will need to be modified as there now exists 2 transaction managers
- The backup job needs to be modified so backups will occur on the volume set level
- The question arose of whether or not HPSM's Hi-Back software supports "onvs" commands
- The question arose of whether or not the "onvs" command is required in the backup

Resulting Action Item:	12	Modify the backup command	Kate Billera
	13	Investigate whether Hi-Back has "onvs" capability or not	Camatha Groshong
	14	Investigate whether "onvs" command is required in backup process	Scott Pierson

Modification of DLT job — *Subject Lead: Jeff Yong*

- The DLTFULL job needs to be modified to represent the following process
  1st - load the library
  2nd - Store
  3rd - Needs to be added in - Bring tape online & vstore before unload
  4th - Unload tape

Resulting Action Item:	15	Modify DLTFULL job stream to add in bringing the tape online	Kate Billera

Preparation Status for On-Site visit — *Subject Lead: Scott Pierson*

- Confirmed Kate Billera will be on-site 5/18 (Friday) on through the weekend
- Kate has a Power Point presentation prepared for the visit
- Jeff has some issues he would like included in the change control document
- Jamaica cabinet has arrived

Resulting Action Item:	2	Disburse the testing plan	Camatha Groshong
	16	Jeff to email additions to the change control document	Kate Billera

Meeting Schedule

Date	Type of Meeting	Meeting Purpose	Status
20-Jun	Planning	Confirm planning information with HP hardware installation	Complete
22-Jun	Teleconference status	Confirmation of status and completed preparation steps	Complete
8-Jul	Confirmation Go/NoGo	Confirm schedule and change preparation completion	Tentative

Migration – Significant Event Management 3

LUND PERFORMANCE SOLUTIONS

VOLUME SET IMPLEMENTATION

The implementation proceeded on schedule with only minor disruptions. There were no critical issues with the hardware installation, the installation of Mirrored Disk or the system reload. The system was fully operational on Sunday Afternoon.

Action Items

1. Fax the HP support and purchase document to Lund for evaluation.
2. Request two copies of MPE/iX OS level 6.5 power patch 3 and supplemental patches.
3. Remove HPIB printer from existing 939.
4. Order and install additional equipment for 989.
5. Update 939 to MPE/iX level 6.5 power patch 3 and supplemental patches.
6. Install 6.5 power patch 3 and data from 939 onto 989 system as a test.
7. Obtain HP and third party license transfers for 939 to 989.
    a. Hewlett Packard and Beechglen support
    b. SUPRTOOL (remains the same, part of Ecometry)
    c. ESPOOL (changed from NBSpool)
    d. ORBIT (new $9000 acquisition)
    e. Ecometry (require new license and pay upgrade)
    f. JMS (require new license and pay upgrade)
    g. Lund (require new license and pay upgrade)
    h. VESoft (require new license and pay upgrade)
    i. DBGenrl - (remains the same, part of Ecometry)
    j. (Not moving) NBSpool, Allegro

Hardware

The hardware installation was delayed by 1 hour due to printing of backup spool files. The HASS cabinet was installed without issue. All disk drives were repositioned for volume sets and the cables rerouted. At startup we noticed that there were two disks with a different manufactures code. The disks were moved to be a mirrored pair. Validation of the disks was performed via the ODE Mapper utility.

One issue that surfaced was redundancy in terms of power protection. Currently all devices are protected by a UPS unit installed in the base of the 1.6 Meter Rack. If the UPS should fail all disks,

LUND PERFORMANCE SOLUTIONS

this includes both sides of the mirror would fail. The recommendation is to migrate the power cord for one of the power supplies to a separate 1.6 Meter Rack. In order to accomplish this task longer power cords would have to be purchased. Given the state of the electrical grid we strongly recommend that this task be accomplished in the near term.

Software

The Mirrored Disk software was installed without incident. The MPEXL and PROD Volume sets were created and the disks initialized. The drive initialization for Mirrored disk was accomplished in four hours rather than the budgeted eight. The reduction in time is attributable to the number of processors, memory capacity and the number of disks per FWSCSI card.

Restore Of Files

For the most part, the restore of files to the MPEXL and PROD Volume set proceeded without incident. Some files living in the POSIX space were not restored on the first pass. This issue was remedied on Sunday. The restore of data to the PROD Volume set required only four hours to complete.

Observations

Below are some observations of the AMISYS environment that were made during the Volume Set Implementation and via conversations with CUSTOMER Staff

Disk Clean-Up

There are a large number of files, which have not been accessed in over thirty days. Many of these files have not been accessed since the date they were created. These files are impacting system operations on a daily basis. They are overhead for the file system, impact the full backup and will impact any recovery from a disaster. A serious effort should be made to identify, cleanup and put in place procedures to remove files of no business use.

Database

In looking at a Howmessy Report run on Sunday there are two issues that should be addressed: Data Archiving and database maintenance.

The number of transactions in the Claims Subsystem is excessive. It is impacting any process that uses this subsystem from entry to reporting. Archiving of data does not have to mean removal from the system. Many AMISYS users create a repository for old claims. Transactions are then migrated from the Production to the History environment. The History environment is available for lookup and reporting purposes. This significantly reduces the volume of transactions in the Production AMISYS account speeding up all processes. We recommend that Archiving of Claims and Services be seriously considered by CUSTOMER.

The Howmessy report also revealed that there are a number of datasets, which are extremely inefficient in terms of disk I/O. In some cases five times the number of disk I/O's are being performed. We strongly recommend that regular maintenance be performed on the Production Databases.

Migration – Significant Event Management

3

Meeting management / scheduling / reporting

Action item management

Communication coordination

Event description

System preparation

Event timeline creation

Go/No-Go Decision Points

Back out plans

Technical assistance in the change event

System start-up and bring the system back to production

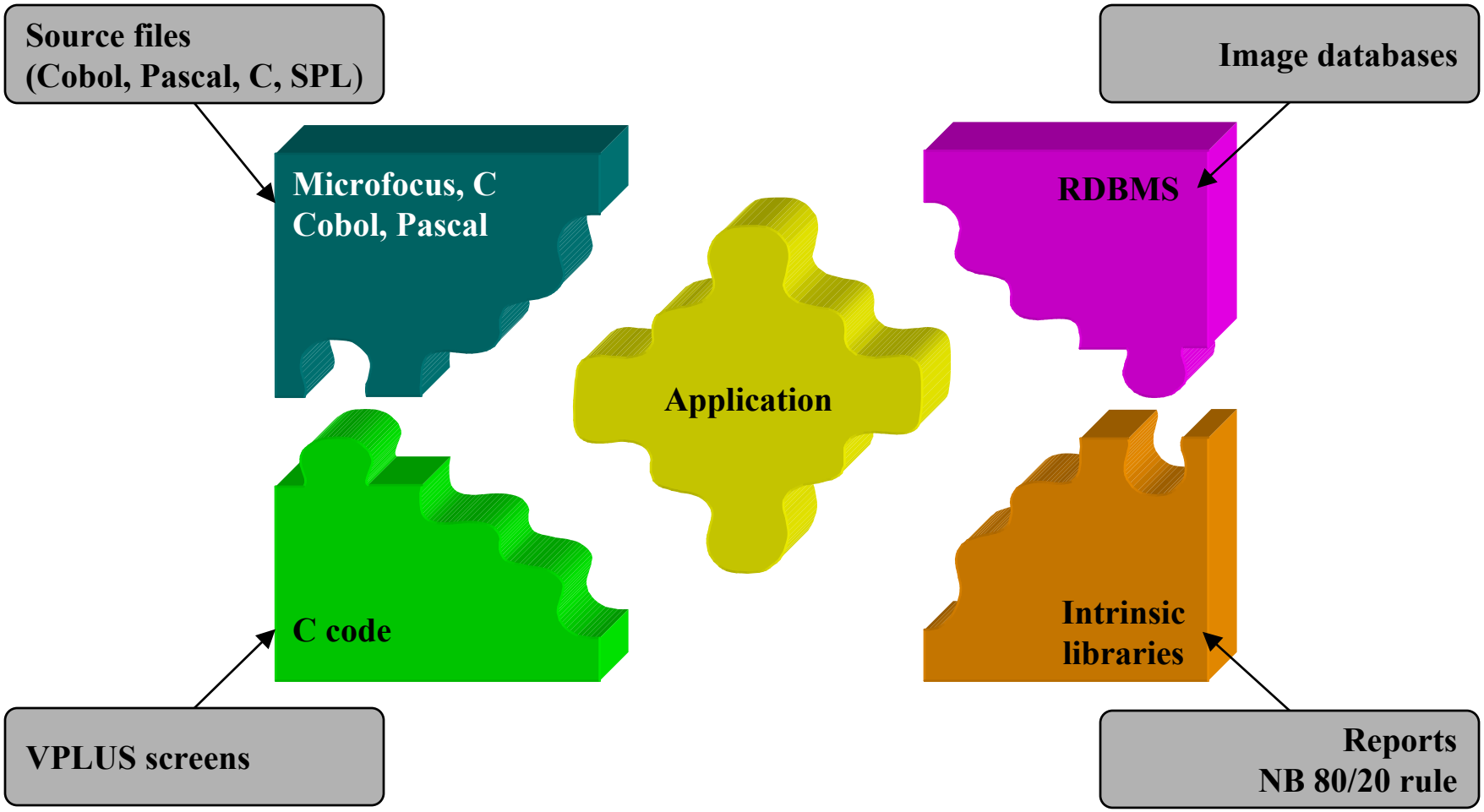
Formal portfolio outlining the event

On-Site meetings/support/assistance

Training

Remote dial up and preparation

Migration – 4 Code & Data Conversion



Migration – 4 Code & Data Conversion

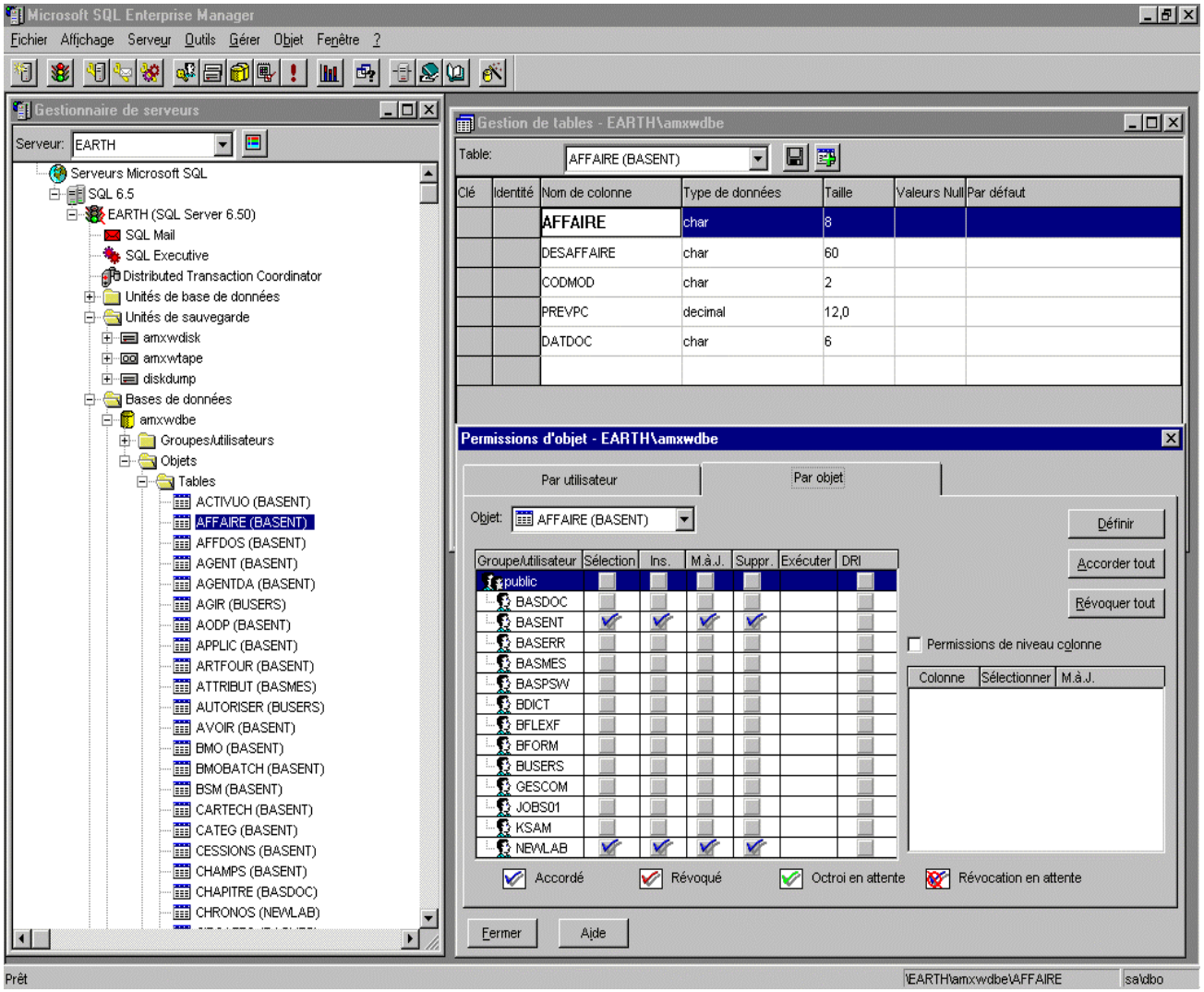
HP e3000 Applications

Databases	IMAGE/TURBOIMAGE, ALLBASE
Files	SEQUENTIALS, MESSAGE, KSAM, SPOOL
Programs	COBOL, FORTRAN*
Screens	VPLUS
System calls	Intrinsics
JCL	COMMANDS, UDC
Utilities	SORT/MERGE, FCOPY

*HP-UX

Migration –

Code & Data Conversion
Migration Utilities



neartek
Migration made easier

Migration – Capacity Planning 5

LUND PERFORMANCE SOLUTIONS

BEFORE & AFTER COMPARISON

Introduction

The following pages graphically and numerically show comparisons of performance both before significant maintenance and after. By looking at the both the system's performance and business pulse points, one can determine the success of the maintenance for future planning. Averages include data for Monday through Wednesday, 24 hours per day.

Central Processing Unit

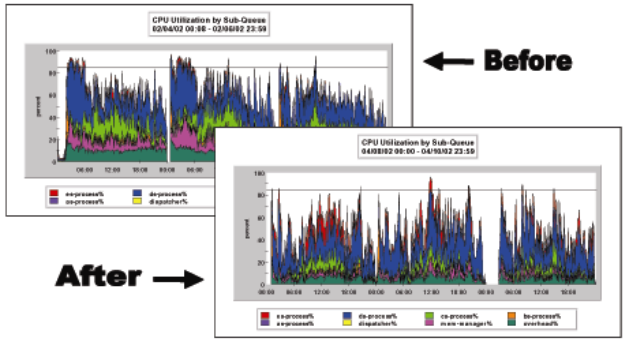


Figure 2. CPU Utilization By Subqueue

Data Metric	"Before"	"After"
ES subqueue process%	2.0273	7.2324
DS subqueue-process%	25.048	24.0933
CS subqueue-process%	11.4476	5.3624
BS subqueue-process%	2.3102	1.3633
AS subqueue-process%	0.0	0.0001
Dispatcher%	1.2864	0.9571
Memory Manager %	8.0678	2.9655
Overhead%	10.0588	5.3183

Figure 3. Averaged CPU Utilization by Subqueue

Analysis

In result of the maintenance activity, the system was able to perform more batch processing without the corresponding overhead that normally resulted. In the table above (figure 2) you can see that system overhead processing reduced by half and the amount of CPU spent on memory management

SAMPLE COMPANY
BEFORE AND AFTER PERFORMANCE REPORT – PROJECT ID#X

DATE, 2002
PAGE 6

Migration – 5 Capacity Planning

BASELINE TODAY

CPU Usage

In the following graph (Figure 24), an average, busy day is illustrated. The colored areas represent all of the active priority workloads from the HP e3000 Series 928RX system, located in Ann Arbor, Michigan, on August 28, 2002, which was typical of the data we analyzed. Since this system's CPU usage averages above the 85% threshold marker during normal user hours, this server has very little available resources for spikes in use or company growth.

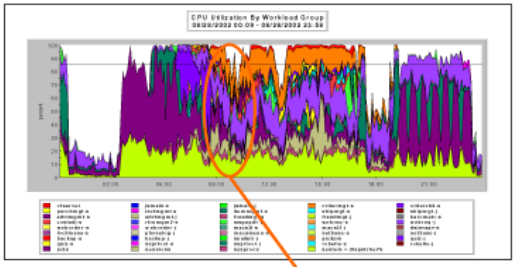


Figure 24 shows the sample period used as a baseline for this report. All workload activity has been evaluated during a sample to extract an average. In order to give you a complete capacity plan, CPU, memory, and disk options have been specifically addressed in this capacity planning report.

Figure 24. CPU Utilization by Workload Group

The CPU is undersized for the current load. The CPU spends most of the primary shift time above the 85% utilization threshold. However projected company growth must be addressed before a capacity-planning conclusion can be reached.

Figure 25 represents the baseline average CPU utilization between 9:00 a.m. and 11:00 a.m. on August 28, 2002, which was chosen to be representative of the processing in this environment. 85% is the threshold percentage at which performance begins to degrade.

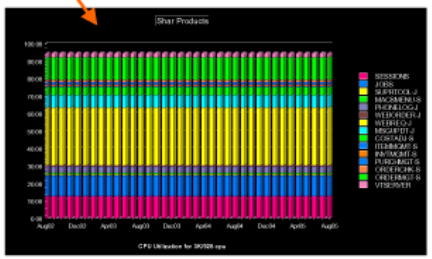


Figure 25. Current CPU Average

This is a stacked area graph illustrating the utilization in each workload group stacked on top of the each other to give the entire CPU utilization picture.

WORKLOAD INCREASE

Forecast Of Workload Increase

The graph below represents the baseline of the 'Study' system, with a 15% annual company growth and the elimination of the Sample1 and Sample2 accounts mid year 2003 as requested. Additionally there was increase due to the XYZ workload migration from the 'Study2' system. The 15% growth, as well as the overall increase due to the XYZ processing, was applied at the request of Contact2, system administrator. The table below represents the expected load changes requested. The only modification to the system load apart from the proposed migration of the Sample1 and Sample2 workload and the workload from the 'Study2' system is the projected overall company growth.

Growth Description	Estimated CPU Growth %
Projected Annual Growth	15%
Sample1 and Sample2 Account Migration mid 2003	Workload group decrease
Estimated growth due to XYZ workload migration from 'Study2'	4%

Figure 5. Expected Growth Table

In this Capacity Plan Analysis Report the Sample1 and Sample2 account activity has been isolated in the H & W – J and H & W –S workload groups. By isolating the workload Lund was able to track the projected impact of migrating this workload more closely in this analysis report. This has allowed Company to leverage Lund's experience and knowledge base to assist in making critical business decisions regarding the overall workload of the 'Study' system especially during the upcoming high utilization enrollment period in the fall of 2002.

Additionally quantifying the load attributed to the XYZ processing was done using the transaction data provided by Company and through conversations with Contact1 and Contact2. It was determined that the ABC, GHI, LMPNOP and XYZ account related processing represented 70% of the total processing on the 'Study2' system. Utilizing the transaction data provided it was determined that the XYZ processing equated to 14% of that 70%. That 14% load equated to a 6% reduction on the 'Study2' system and a 4% increase on the 'Study' system when the workload was migrated. The migration of the XYZ processing was projected in the seventh month of the study period allowing six months of testing and proactive planning.

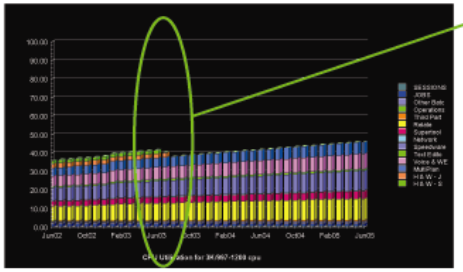


Figure 6. Increased workload and Sample1 and Sample2 migration on current CPU

Migration – Capacity Planning

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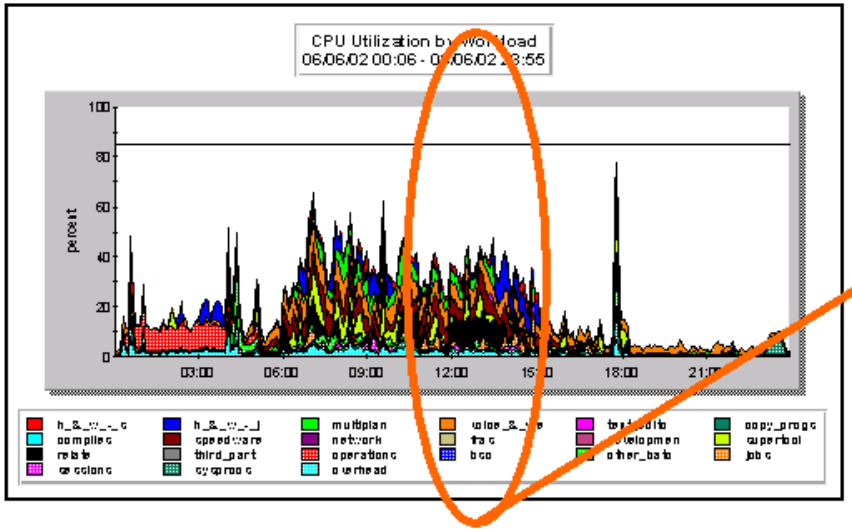

Figure 1. CPU Utilization By Workload

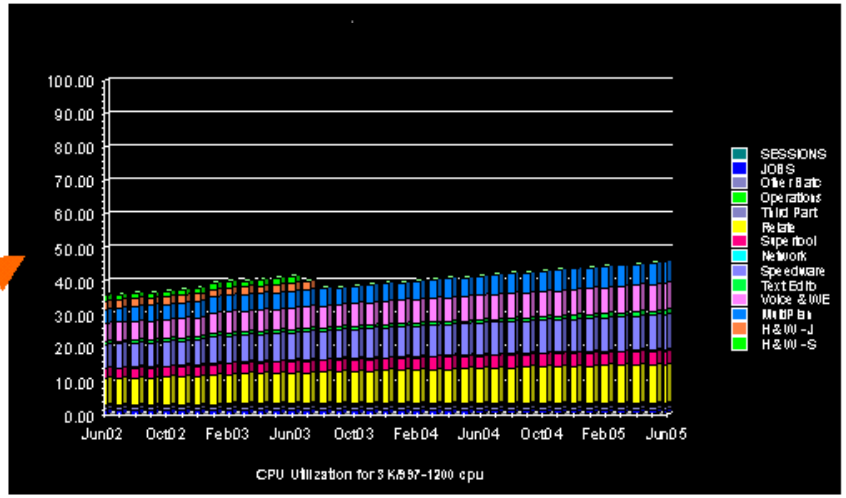

Figure 3. Baseline Today

Migration Performances

Memory	2 to 5 MB / user
Unix/ NT CPU size	1.3 to 1.5 x HP3000 CPU *<<NB Unix equivalents of MPE boxes are much less expensive>>*
Wide area network	Wingspan works in character mode (X25 and Frame Relay tuning)

Mathematical models to predict the actual response time

Costing Review

• New hardware	Low $15,000 - $100,000
	Mid $100,000 - $1,000,000
• New database	$5,000 - $30,000 per server
• 3GL and 4GL licensing	$10,000 - $200,000 per server
• Replacement tools	$10,000 - $100,000
• Migration tools	$30,000 - $100,000
• Resources (in-house or outsourced)	$25,000 - $200,000
• New hires	$ TBD
• Application Enhancements / face lifts	$20,000 - $100,000 plus labor
• Training	$20,000 - $40,000
• Implementation	$ TBD

Migration Strategy and Planning

- Environmental Assessment
- Migration Analysis & Plan and Code & Data Porting Study
- Significant Event Management
- Code and Data Conversion and Infrastructure Installation
- Capacity Plan and Final Hardware Configuration with Testing, Auditing, and Training

Questions and Answers