



SAS Oracle Rdb7 OpenVMS AlphaServer 4x00

DIGITAL HiTest Notes

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Preface

This document provides an overview of DIGITAL HiTest Suites and detailed technical information about the SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite. This information includes the HiTest AppSet, the HiTest Foundation, configuration details, installation instructions, tuning parameters, problems encountered and their solutions, tests and test results, and system diagrams. Together, a HiTest Foundation and HiTest AppSet (Application Set) comprise all of the components in a HiTest Suite. The HiTest Foundation includes the hardware, operating system, middleware, and database software. The HiTest AppSet contains a collection of software specific to one class of customer solutions.

Audience

Primary users of this document are DIGITAL and Partners, sales representatives, and technical support personnel. Secondary audiences include product managers, customers, and the personnel responsible for installing, setting up, and operating a DIGITAL HiTest Suite.

Organization

This document is organized as follows:

Chapter Title	Description
Chapter 1 – Advantages of DIGITAL HiTest Suites	Provides a summary of the benefits of DIGITAL HiTest Suites and an overview of the Suite covered in this document.
Chapter 2 – About This DIGITAL HiTest Suite	Describes the specific characteristics of this HiTest Suite.
Chapter 3 – Configuration Data	Includes tables of configuration data about the hardware and software components that define the DIGITAL HiTest Template, and special configuration rules if any.
Chapter 4 – System Installation and Setup	Provides information for installing and setting up this DIGITAL HiTest Suite.
Chapter 5 – Tests and Results	Describes how the tests were set up including database organization, where data and programs were placed, and how the tests were run. It also describes system limits and characterization data.
Chapter 6 – Problems and Solutions	Discusses any problems and solutions that were discovered during testing.
Chapter 7 – Detailed Hardware Configuration	Contains more detailed information about the configuration of the hardware and software components listed in the Configuration Data chapter.
Appendix A – Query Optimization Considerations	Describes how to optimize the performance of SQL Queries.

Chapter Title	Description
Appendix B – SQL Script Listings	Contains listings of the SQL queries used in the testing of this HiTest Suite.
Appendix C – Database and Disk Logicals Setup Script	Contains a listing of the script that was used to set up the database logicals and disk logicals for the testing of this HiTest Suite.

Customer Feedback

What our readers think of this or any other DIGITAL documentation is important to us. If you have any comments, we would appreciate hearing from you. Send your comments to: *reader-comments@digital.com*.

Please reference the complete document title and part number (EK-HSOVA-HN. A01) in your correspondence about this document.

Ordering Information

Copies of this and other DIGITAL documents can be ordered by calling 1-800-344-4825.

This document and other HiTest documents can be downloaded from the DIGITAL HiTest web site, which also provides access to other HiTest information such as configuration tools and parts updates.

http://cosmo.tay.dec.com/public/configsys/config_systems.htm

You can also visit the Technical Support Center web page, which provides additional information such as pointers to benchmark centers and major technical training and events:

<http://cosmo.tay.dec.com> (Intranet)

<http://www.businesslink.digital.com>, then select Technical Support (Internet)

Related Documents

This document references the following manuals.

Base System Hardware Guides

The following manuals are provided with the AlphaServer base systems:

- *AlphaServer 4000 System Drawer User's Guide* (EK-4000A-UG)
- *AlphaServer 4100 System Drawer User's Guide* (EK-4100A-UG)
- *AlphaServer 4000/4100 Configuration and Installation Guide* (EK-4100A-CG)
- *Alpha Systems Firmware Update V5.0 Release Notes Overview* (AA-PW8YW-TE)

Operating System Guides

The following manuals are provided with the AlphaServer base systems:

- *OpenVMS Cluster Systems* (AA-PV5WC-TK)
- *OpenVMS System Manager's Manual: Essentials* (AA-PV5MD-TK)
- *Digital TCP/IP Services for OpenVMS User's Guide* (AA-PC276-TE)

ESA 10000 Storage Subsystem Guides

The following manuals are provided with the ESA 10000 Storage Subsystem:

- *StorageWorks RA 7000 and ESA 10000 Storage Subsystems User's Guide* (EK-SMCP-UG)
- *Digital StorageWorks HSZ70 Array Controller HSOV V7.0 Configuration Manual — Alpha Installation Guide*
- *Digital StorageWorks HSZ70 Array Controller HSOV V7.0 CLI Reference Manual*

Application Guides

The following manuals are provided on the installation media for Oracle Rdb7 for OpenVMS:

- *Oracle Rdb7 for OpenVMS Installation and Configuration Guide, Release 7.0* (A42342-1)
- *Oracle Rdb7 for OpenVMS Oracle SQL Services Installation Guide, Release 7.0* (A42343-1)

The following manuals are provided on the installation media for the SAS system:

- *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*
- *SAS Companion for the OpenVMS Environment, Version 6, Second Edition*

System Management Station Guides

The following manuals are provided with the DIGITAL PC 5510 system:

- *DIGITAL PC 3500/5510 System Reference* (ER-G2BWW-UA)
- *Quick Setup Guide* for the DIGITAL PC 5510

Note

In the System Management Station, a functionally equivalent 80 x 86 system may be substituted for the DIGITAL PC 5510 without invalidating the HiTest Template.

Advantages of DIGITAL HiTest Suites

This chapter describes what a HiTest Suite is, the suite components and advantages, and customer add-ons.

What Is a DIGITAL HiTest Suite?

DIGITAL HiTest Suites are guidelines for configuring a set of prequalified computer systems. A HiTest Suite often contains all the hardware and software needed for a complete customer solution. DIGITAL HiTest Suites can be used as a basis for configuring systems that satisfy a wide set of customer requirements. Typically, Suites target specific markets such as Data Warehousing and Data Mining of sales data for companies in the manufacturing, financial services, telecom, retail, insurance, and pharmaceutical industries.

In each HiTest Suite, the components are selected and the configurations designed to ensure system reliability, application performance, and ability to upgrade. The suite's hardware and software components have been successfully tested for interoperability.

The specifications for allowed ranges of hardware and software components, part numbers, and descriptions are listed in the *DIGITAL HiTest Template* in Chapter 3.

DIGITAL HiTest Suite Components

The SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite contains three groups of components: the *DIGITAL HiTest Foundation*, the *DIGITAL HiTest AppSet*, and the *System Management Station*.

The DIGITAL HiTest AppSet contains application software unique to the targeted market. The DIGITAL HiTest Foundation contains the operating system, software, and hardware and can be used as a configuration guideline for the base platform for many applications and target markets. The System Management Station is an optional standalone personal computer system containing software used to manage the HiTest system.

Select components from the HiTest Template to configure a DIGITAL HiTest System. Any system configured as specified in the DIGITAL HiTest Template can be called a DIGITAL HiTest System.

Additional Hardware and Software

Besides the hardware and software specified in a DIGITAL HiTest Suite, additional hardware and software can be added to a HiTest System. Add-on hardware consists of accessory components such as printers, modems, and scanners that are supported by the operating system and other software. Adding these components should not affect interoperability and, therefore, the system can still be considered a DIGITAL HiTest System.

Customers who purchase a DIGITAL HiTest System that is configured below the maximum specified in the Template, can later add additional hardware up to the specified maximum range and still maintain the integrity of a DIGITAL HiTest System.

If additional hardware components beyond the maximum specified in the Template are configured into a system, you still have the assurance that the rest of the system has been thoroughly tested for component interoperability. Therefore, the risk of experiencing problems is greatly reduced.

About This DIGITAL HiTest Suite

This HiTest Suite satisfies the needs of Oracle Rdb7 customers who require data warehousing and data mining capabilities. The customers typically maintain a database of between 100 and 500 GB of data and use SAS for decision support.

The SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite includes the following components:

- The SAS System
- Oracle Rdb7 for OpenVMS
- OpenVMS
- AlphaServer 4x00
- StorageWorks ESA 10000

This chapter describes the following characteristics of the SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite and evaluates the Suite in terms of each:

- Availability
- Installability
- Interoperability
- Manageability
- Price Range
- Scalability
- Services
- Year 2000 Compliance

Availability

Availability, which describes a computer system's ability to quickly recover from a failure, can be described in terms of the following:

- Data Protection – Ensures long-term data accessibility by providing the facility to do offline data backup.
- Data Availability – Stores redundant data on line for rapid, automatic data recovery in the event of a failure. Data availability is typically provided through the use of RAID technology.

About This DIGITAL HiTest Suite

- Platform Availability – Enables processing to continue during failure by using technologies that support failover to other components. Clustering, redundant power supplies, battery backup, and other components provide support for platform availability.
- Disaster Tolerance – Protects against computer room disasters such as fire, flood, and sabotage. Disaster Tolerant Systems require an additional system at a remote site and are more expensive than the previously defined alternatives. (The DIGITAL HiTest process does not test disaster tolerant configurations. If disaster tolerance is a requirement, your sales person can provide more information.)

Features of SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite

The DIGITAL HiTest process verified that each of the availability features provided by this Suite operate correctly and provide the protection required for all configurations.

Table 2-1 indicates availability features that are always included in this HiTest Suite when configured with the AppSet and those that are customer options.

Table 2-1: SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite Availability Features

Availability Feature	Enabling Technology	Always Included	Customer Optional
Data Protection	Backup and restore	Yes	
Data Availability	Redundant disk storage (RAID)	Yes	
	Redundant disk controllers	Yes	
Platform Availability	System failover (clustering)	Yes	
	Redundant power for system		Yes

Recommendations for SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite

This HiTest Suite provides high availability while maintaining high performance because hardware with a high mean-time-between-failure (MTBF) is used. Use of fault-tolerant and redundant hardware avoids single points of failure, and redundant data storage ensures data availability. To reduce the risk of system failures, DIGITAL recommends that the following levels of availability features be considered for this HiTest Suite:

- Data Protection
 - Long term data accessibility is always provided with this HiTest Suite by the TL896 automated tape library, which provides up to 12.32 TB of compressed data storage.
- Data Availability
 - High performance data access was maintained by using the non-redundant RAID 5.
 - Shared SCSI bus storage protects against the failure of a single node.

- Platform Availability
 - The cluster configuration provides redundancy at the system level. The available Server configuration of the cluster is used as this is the only configuration certified by the partner for use with their application.
 - Redundant power supplies are used to avoid a single point of failure.

It may be necessary to create failover scripts for software applications that run on the clustered configurations of this DIGITAL HiTest Suite.

Understanding Availability Features

This section provides background information on the availability features included in this HiTest Suite.

Backup and Restore

Backup and restore ensures that data remains available from one day to the next. It is generally identified as a *data protection* technique because the stored information can also be removed to a remote, protected environment. DIGITAL offers a range of backup and restore capabilities from individual tape systems to automated tape libraries.

Disk Storage Technologies

This section describes the disk storage technologies used to provide availability for DIGITAL HiTest configurations.

Just a Bunch of Disks (JBOD)

Just a bunch of disks (JBOD) refers to a multiple disk drive configuration, internal or external to a host computer, in which there is no storage controller. Disk drives are managed by the host system. To increase availability, JBOD storage systems are often configured with hardware such as redundant power supplies and fans, or multiple SCSI buses.

Redundant Array of Independent Disks (RAID)

A Redundant Array of Independent Disks (RAID) is a collection of disks managed by specialized array management software. When using RAID, all disks in the RAIDset should be the same type. Array management software may be *host-based* (execute in the host computer) or *subsystem-based* (execute in an intelligent disk controller).¹

Disk striping (RAID Level 0), is technically not RAID because it does not offer redundancy.

RAID Levels 2 and 3 are parallel access arrays (members are accessed concurrently). To ensure that all disks participate in every I/O request, the minimum chunk size is kept small (for example, a byte).

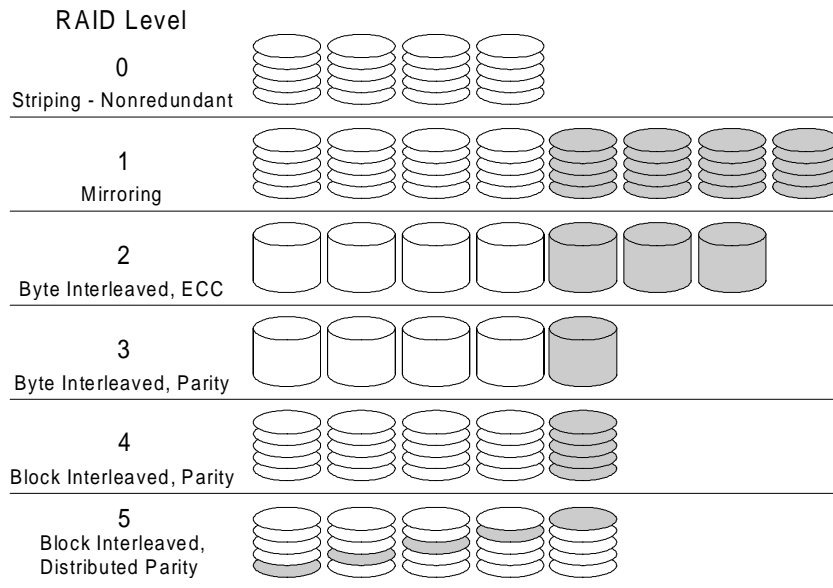
RAID Levels 4 and 5 are independent access arrays (members are not required to be accessed concurrently). By keeping the minimum chunk size at least as large as a disk sector (block), not all members have to participate in each I/O request.

RAID Levels 2 and 4 are not in general use.

Figure 2-1 summarizes the RAID levels. The shaded areas in Figure 2-1 refer to space used for redundancy features.

¹ The RAID technique was described by D. A. Patterson, G. Gibson, and R. H. Katz "A Case for Redundant Arrays of Inexpensive Disks (RAID)," Report No. UCB/CSD 87/391, University of California, Berkeley CA 1987.

Figure 2-1: RAID Level Summary



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DIGITAL and other companies also use the terms RAID 0+1, RAID 1+5 and Adaptive 3/5 to refer to the combinations of these, and other, storage technologies. Table 2-2 describes the RAID types to consider when choosing a RAID configuration.

Table 2-2: RAID Levels and Descriptions

RAID Level	Description	Advantages/Disadvantages
0	<ul style="list-style-type: none"> • Striping • Data segmented and distributed across several disks 	<ul style="list-style-type: none"> + increase in performance due to parallelism in read and write - no fault tolerance (<i>not</i> a high availability solution)
1	<ul style="list-style-type: none"> • Hardware Mirroring • Data written twice to different disk spindles within the disk array 	<ul style="list-style-type: none"> + good performance in read-intensive applications (data can be read in parallel from several disks) - slower in writes (multiple writes required) - spindle costs doubled
0+1	<ul style="list-style-type: none"> • Striped Mirroring • Combined level 0 and 1 • Data mirrored onto and striped across several disks • Best for performance-critical, fault-tolerant environments 	<ul style="list-style-type: none"> + good performance in reads (RAID 1) + write performance improved versus RAID 1 due to parallelism + adequate response maintained in event of disk failure - spindle costs doubled - recovery is I/O intensive
2	<ul style="list-style-type: none"> • Parallel access array • Striped • ECC on separate drives 	<ul style="list-style-type: none"> + high data transfer rate + ECC detects and corrects errors - low I/O request rate - not appropriate with modern drives

RAID Level	Description	Advantages/Disadvantages
3	<ul style="list-style-type: none"> • Parallel access array • Small minimum chunk size • Check bit calculated from data • Parity bits on dedicated disk, data striped across remaining disks 	+ good performance in reads due to parallelism (like RAID 0) + costs only slightly increased compared to disks without high availability solutions + good performance with long records (high data transfer rate) - write performance penalty due to check bit calculation - cannot overlap I/O (low I/O request rate)
4	<ul style="list-style-type: none"> • Independent access array • Parity disk 	+ processes multiple requests simultaneously - parity disk is a bottleneck on writes
5	<ul style="list-style-type: none"> • Independent access array • Parity Bit • Check bit and data distributed (striped) across multiple disks • Best in environments that are mostly read and are not performance sensitive 	+ good performance in reads due to parallelism (like RAID 0) + costs only slightly increased compared to disks without high availability solutions + overlapped I/O - write performance penalty due to check bit calculation
1+5	<ul style="list-style-type: none"> • RAID 5 combined with mirroring • Mirroring provided by LSM or Volume Shadowing • Most reliable and highest performance solution 	+ good performance in reads due to parallelism (like RAID 0) + double redundancy makes disk failure barely noticeable - spindle costs more than double - write performance penalty due to check bit calculation
Adaptive 3/5	<ul style="list-style-type: none"> • The best features of 3 and 5 • Adapts between Level 3 and Level 5 in response to changes in the application's workload 	+ good performance in reads due to parallelism (like RAID 0) + costs only slightly increased compared to disks without high availability solutions + performs well with a wide variety of I/O loads even when load characteristics change minute by minute. - write performance penalty due to check bit calculation

Volume Shadowing

OpenVMS Volume Shadowing, sometimes referred to as disk mirroring, maintains redundant copies of data on a collection of disks (one copy per disk) called a shadow set. Shadow sets consist of one, two, or three compatible disk volumes that are referred to as shadow set members. This duplication of data provides enhanced data availability; if data is recorded on multiple disk volumes, it remains accessible if one volume becomes unavailable. When one disk fails, disk read and write operations continue transparently with the remaining members of the shadow set.

Clustering

A cluster is a group of systems that works collectively to provide fast, uninterrupted computing service. Close cooperation can maximize performance and minimize down time. Within a cluster, individual systems and their components do not have to match the characteristics of mainframes, supercomputers, or fault-tolerant systems, yet can cooperate to achieve the same results. Most clusters provide a cost-effective solution to achieve optimal system availability and application performance, extensive scaling capability, and simplified system management.

A DIGITAL OpenVMS Cluster is a highly integrated organization of Alpha and or VAX computer systems, application and operating system software, and storage devices. The systems can be connected to each other and storage components in a variety of ways, depending on the needs of your business. OpenVMS Cluster systems give you the ultimate in a highly available, scalable, and flexible computing environment. The cluster also allows you to connect systems of all sizes and capacities and achieve an easy-to-manage, single virtual system. OpenVMS Clusters can be configured into disaster-tolerant multisite clusters located up to 500 miles (800 kilometers) apart. OpenVMS Clusters may be used as the server system for Windows NT clients.

Systems and storage in an OpenVMS Cluster exchange information through physical communication links known as interconnects. OpenVMS Clusters offer a range of interconnect choices including:

- Small Computer Storage Interconnect (SCSI)
- Memory Channel (MC)
- Computer Interconnect (CI)
- Local Area Network infrastructures: Ethernet and Fiber Distributed Data Interface (FDDI)

Redundant Components

Providing redundant components with a system increases that system's availability. If two identical components provide complete redundancy to each other, the availability factor for the set of components can increase by over 99% over a single component. Clustering and RAID are technologies that use redundancy of systems and of disks. Other components may be used in redundant configurations to further improve availability. Examples include disk controllers, power supplies, and network controllers. Many are hot swappable components that further increase availability by eliminating down time during replacement of the failed unit.

Installability

Installability is the ease with which hardware and software components can be installed and configured for use. Factors that are considered when evaluating installability include clarity of installation steps, number of steps and duration appropriate to the complexity of the product, and completeness of the installation and configuration information.

The DIGITAL HiTest process thoroughly examined all aspects of the installation of this HiTest Suite. The installation procedures that were used are documented in Chapter 4.

No problems were found with the hardware installation or the software installation.

Within the HiTest environment, after removing the system from the shipping skid, it required 16 hours to install and configure the hardware for the maximum configuration. Installation and configuration of the software took 48 hours. Expect installation times to vary significantly in other environments depending on factors such as the expertise of the installer and the environment in which the installation occurs.

DIGITAL Multivendor Computer Services (MCS) offers expert installation services.

Interoperability

Major components of this HiTest Suite have been tested for interoperability, including the application, database, operating system, hardware, firmware, and service packs and patches. Minimum and maximum configurations for this Suite have been tested. The specific processes used for testing this Suite are described in Chapter 5.

The HiTest Notes provide solutions to interoperability problems in several ways. First, installation and setup instructions in Chapter 4 are written so that many interoperability problems are avoided. Second, problems and solutions are documented in Chapter 6.

There are no major interoperability issues in this Suite.

Note

Be aware that the interoperability of SAS with Oracle Rdb7 does not require the installation of a special software interface during the post-installation processing for SAS; Oracle Rdb7 interfaces directly with SAS.

Manageability

System manageability is the ease with which a system is managed or controlled. Because a system is composed of many components, manageability is described according to which component (application, database, operating system, server, storage) of the system is being controlled. For each of those components, manageability is measured by five features:

- Administration – The ease with which the systems management tools manage the system components
- Alarms – The effectiveness of triggers at detecting problems in system components
- Performance – The tuning and monitoring of system components
- Security – File access, user access, and intrusion detection
- Accounting – Logging the use of system resources

While system management is optional for this HiTest Suite, DIGITAL has specified the best system management solution in Chapter 3. Table 2-3 summarizes the manageability features that this solution provides.

Table 2-3: SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite Manageability Features

	N/A	Admin.	Alarms	Performance	Security	Accounting
Application		N/A	N/A	Yes	Yes	N/A
Database		Yes	Yes	Yes	Yes	Yes
Operating System		Yes	Yes	Yes	Yes	Yes
Server		Yes	Yes	Yes	Yes	Yes
Storage		Yes	Yes	Yes	N/A	N/A

System management tools were not used during the testing of this HiTest Suite.

Scalability

For this HiTest Suite, scalability can be described in two ways. In terms of hardware, scalability refers to the additional hardware components that can be added to a system within and beyond the HiTest configuration. In terms of performance, scalability refers to the workload capability of the HiTest configuration.

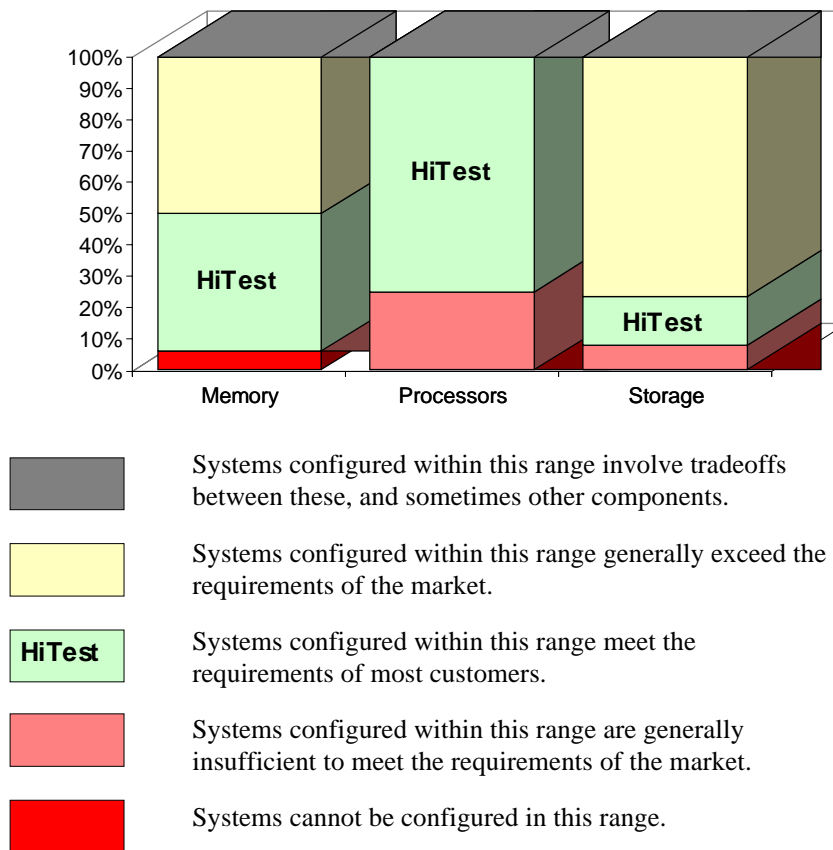
Additional Hardware Components

Systems that are configured from this HiTest Suite can easily be upgraded both within and beyond the ranges specified in the Suite.

In Figure 2-2, hardware scalability for this Suite is illustrated in terms of memory, number of CPUs, and disk space. Within the limits set for the enclosures called for in this HiTest Suite, comparisons are shown for the minimum and maximum limits of the system configuration. Provides the data from which this graph is derived.

Note that within this DIGITAL HiTest Suite, the choice of system or cabinets can limit future expansion. If expansion is needed, select components that will allow future expansion.

Figure 2-2: SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite Scalability



Services

DIGITAL offers a range of service options. The following portfolio of Business Critical Services is available for HiTest Suites and is backed by the DIGITAL Uptime Guarantee.

Proof of Commitment: The DIGITAL Uptime Guarantee

The DIGITAL Uptime Guarantee is a formal contract that commits DIGITAL to keeping a client's business critical systems in operation at least 99.5% of the time, excluding outages beyond the control of DIGITAL, such as electrical shutdowns, environmental failures, and downtime caused by application failure. If uptime levels are lower than 99.5%, clients do not pay the full service charge.

Portfolio of Business Critical Services

The three vital elements of DIGITAL Business Critical Services are:

- Availability Review

The first step in initiating a Business Critical engagement with DIGITAL is a customized, in-depth availability analysis of the computing environment, beginning with an overview of operating goals. This review identifies potential risks and trouble spots in hardware, software, operations, physical environment, and network. A comprehensive written report forms the basis for determining serviceability requirements.

- Business Critical Gold Support

Clients who purchase Business Critical Gold Support work with a named technical account manager who serves as the single point of contact and ensures that problems are resolved quickly. A privileged hotline assures crisis response within 30 minutes. An assigned support team works with the account manager to apply continuous effort to critical problems. The on-site support agreement for Gold Support Customers provides coverage 24 hours a day and seven days a week. Additional benefits include:

- Notification of software patches as soon as they become available
- Notification of known problems and fixes
- Monthly service activity review
- Operating system upgrade impact planning
- Bi-annual System Healthcheck assessments. These are conducted using advanced system-based tools to assess the performance and security of systems. The collected data is analyzed against accepted practices, and the findings, together with recommendations for corrective action, are documented in a summary report.

- Availability Partnership

With Availability Partnership, system availability is maintained at the required level by measuring and analyzing actual system availability, and conducting regular updates to the original Availability Review. Particular focus is placed on:

- Configuration and topology documentation
- Availability status reporting
- Change impact analysis
- Proactive problem avoidance based on proactive patch/FCO/firmware management
- Periodic detailed data collection and analysis
- Availability model update

About This DIGITAL HiTest Suite

- Contingency planning
- Service planning and advising

Complementary Support Services

The three key Business Critical Services are augmented by:

- On-Site Parts Service
DIGITAL works with the client to determine the appropriate inventory levels for their environment. A cost-effective *rental* parts solution is developed to maintain an on-site inventory of spare parts.
- Installation and Startup
DIGITAL offers rapid, worry-free implementation of new hardware and software – including systems, PCs, terminals, workstations, networking components, operating systems, layered products, applications, and software updates. Clients can choose hardware installation, software installation and startup, or both.

Meeting Client Needs Locally or Globally

With 450 service center locations in 100 countries, DIGITAL is prepared to deliver consistent and comprehensive service capabilities on a local or multinational basis. These services encompass:

- Total system support for servers, network operating system, applications, switching components, and PCs
- Multivendor support for a diverse range of products including networking equipment, applications, and peripherals
- Microsoft Solution Provider and Authorization Support Centers with the largest concentration of Microsoft certified engineers in the world

For More Information

To find out more about DIGITAL Business Critical Services, contact your local DIGITAL Multivendor Customer Services sales specialist or visit the Business Critical Services web site at http://www.digital.com/services/mcs/mcs_critical.htm.

Year 2000 Compliance

Year 2000 Compliance refers to whether computer systems will properly recognize the date change from December 31, 1999 to January 1, 2000. Current information on Year 2000 status of DIGITAL products can be obtained from the DIGITAL Year 2000 Program web site at <http://ww1.digital.com/year2000/>. Current information on the Year 2000 status of other vendor's products should be confirmed with those vendors.

While HiTest does not explicitly test for Year 2000 compliance in the components of this Suite, HiTest does check the published status of components where Year 2000 compliance would be a concern. The Year 2000 information presented here is accurate as of July 1, 1998. Table 2-4 summarizes these findings.

The color codes used in the table represent the following categories of readiness:

- Blue – Version specified is Year 2000 ready today.
- Green – Currently not Year 2000 ready. Version to be Year 2000 ready specified with Year 2000 date noted.
- Yellow – Under evaluation.

- Red – Will not be made ready for Year 2000. Product will be removed from active status on or before 31 March 1998.
- N – Not Applicable - No Year 2000 implications exist for this component.

Table 2-4: SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 Year 2000 Compliance

Component	Year 2000 Status
The SAS System	Blue
Oracle Rdb7 for OpenVMS	Blue
AlphaServer 4100	Blue
StorageWorks ESA 10000	Blue

Configuration Data

This chapter describes the DIGITAL HiTest Suite including the hardware and software components. If required, special configuration rules are explained.

Hardware and Software Components

Table 3-1 and Table 3-2 identify the range of hardware and software components that can be configured using the SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite. These two tables form the DIGITAL HiTest Template. The ranges of hardware provided in this template include the following:

- 512 MB through 4 GB of memory per server
- 56 through 152 4.3 GB UltraSCSI disks of storage
- Two through four 533 MHz CPUs per server
- A 176-Cartridge Tape Library with 6 TZ89 drives

Table 3-3 lists the optional system management station hardware and software.

The DIGITAL HiTest Template consists of three categories:

- AppSet Software – Includes software specific to one class of customer solutions, in this case SAS data warehousing
- Foundation Hardware – Includes the base system, storage, and other hardware options
- Foundation Software – Includes the OpenVMS operating system, OpenVMS Layered Products, Oracle Rdb7, DIGITAL Enterprise Integration Package, and the Storage Library System for OpenVMS

When ordering an item from a HiTest Template, select a quantity that is within the minimum and maximum range for the item. If the minimum quantity is zero (0), then the component is optional. If the minimum quantity is one or more, order at least the minimum quantity, but be cautious about exceeding the maximum quantity. The maximum quantity represents the greatest number of components that were tested for interoperability with all the other components in the Suite.

For more details on the HiTest Suite hardware configuration, see Chapter 7.

Table 3-1: DIGITAL HiTest Template – AppSet Software and Foundation Hardware

SAS Oracle Rdb7 HiTest AppSet OpenVMS AlphaServer 4x00 HiTest Foundation Hardware				
For documentation and updates: http://cosmo.tay.dec.com and http://www.businesslink.digital.com and select Technical Support				
Line Item	Description	Part Number	HiTest Range	
			Min	Max
AppSet Software				
1	The SAS System, Release 6.12 <i>AppSet includes:</i> <ul style="list-style-type: none"> • SAS/ACCESS • SAS/CALC • SAS/ETS • SAS/GRAPH • SAS/STAT • SAS/TOOLKIT Contact the SAS Institute at: http://www.sas.com	SAS Institute	1	1
Foundation Hardware				
2	<i>Order two base systems:</i> AlphaServer 4000,OpenVMS, 512 MB,16 Slot AlphaServer 4000,OpenVMS, 1 GB,16 Slot AlphaServer 4000,OpenVMS, 2 GB,16 Slot AlphaServer 4100,OpenVMS, 512 MB AlphaServer 4100,OpenVMS, 1 GB AlphaServer 4100,OpenVMS, 2 GB <i>Hardware includes:</i> <ul style="list-style-type: none"> • 5/533-MHz CPU with 4-MB cache • Memory • SCSI CD-ROM drive • RX23L-AB 1.44 MB Floppy drive • Three-button PS/2 compatible mouse • LK46W-A2 OpenVMS Style Keyboard, US/English <i>Software includes:</i> <ul style="list-style-type: none"> • Factory Installed Software • OpenVMS operating system license and media • DIGITAL Enterprise Integration Package 	DY-53KED-EA DY-53KED-FB DY-53KED-GB DY-51KAD-EA DY-51KAD-FB DY-51KAD-GB	2	2
3	<i>Select a Pedestal or Cabinet Enclosure, as appropriate, for each system:</i> Pedestal Enclosure Cabinet Enclosure	BA30P-AA H9A10-MC	2	2
4	<i>If Cabinet Enclosures were selected in line item 3, order the following:</i> Cabinet Front Door Note: Only order this line item if cabinet enclosures were selected in line item 3; do not order this line item if Pedestal Enclosures were selected in line item 3.	H9C10-TF	2 (See Note)	2 (See Note)
5	<i>Select a Pedestal or Cabinet UltraSCSI Shelf, as appropriate, for each system:</i> Single-bus UltraSCSI shelf for Pedestal Single-bus UltraSCSI shelf for Cabinet	BA36R-SD BA36R-RC	2	2

SAS Oracle Rdb7 HiTest AppSet				
OpenVMS AlphaServer 4x00 HiTest Foundation Hardware				
For documentation and updates: http://cosmo.tay.dec.com and http://www.businesslink.digital.com and select Technical Support				
Line Item	Description	Part Number	HiTest Range	
			Min	Max
6	4.3 GB 7200 RPM UltraSCSI disk	DS-RZ1CF-VW	8	8
7	<i>Order one kit for each system drawer in a cabinet enclosure:</i> System Drawer Mounting Kit	CK-BA30A-BA	2	2
8	533 MHz CPU OpenVMS SMP UPG Note: The 4000 holds a maximum of two CPUs.	KN305-DC	2	6
9	450 Watt power supply Note: One additional power supply supports 3–4 CPUs or N+1 for two CPU systems. Two additional power supplies support N+1 for up to four CPUs.	H7291-AA	0	4
10	128 MB Memory Option 512 MB Memory Option 1 GB Memory Option 2 GB Memory Option 1 GB High-Performance Memory Option (50ns) 2 GB High-Performance Memory Option (50ns) Note: This HiTest Template supports a memory range from 512 MB to 4 GB per system. When selecting memory options, stay within the Template's 4 GB maximum. The 4000 holds a maximum of two memory options.	MS320-CA MS330-EA MS330-FA MS330-GA MS332-FA MS332-GA	0	See Note
11	PCI to Memory Channel controller	CCMAA-BA	2	2
12	Memory Channel cable	BC12N-10	1	1
13	PCI one-port FWD SCSI Controller, HD64	KZPBA-CB	4	4
14	SCSI Differential terminator	H879-AA	2	2
15	SCSI Y cable, 68-pin	BN21W-0B	4	4
16	3 m SCSI-3 cable "P" straight/90°	BN21K-02	2	2
17	PCI, UWSE SCSI adapter	KZPBA-CA	2	2
18	68HD male to VHDCI male SCSI cable	BN38C-02	2	2
19	PCI 10/100 Mbit Fast Ethernet NIC	DE500-AA	2	2
20	Video Extension Cable	17-04776-01	1	1
21	S3 TRIO 1 MB RAM 2D Graphics Adapter	PB2GA-JC	2	2
22	StorageWorks ESA 10000 High Capacity Base Unit <i>Includes:</i> <ul style="list-style-type: none">• Two Dual DS-HSZ70-AH• Two BN37A-10• Two BN38E-0B• Two DS-BA370-AA (48 SBB)	DS-SWXES-BA	1	1
23	StorageWorks ESA 10000 Dual Expansion Base Unit <i>Includes:</i> <ul style="list-style-type: none">• Cabinet Joiner Kit• Two DS-BA370-AA (48 SBB)	DS-SWXES-CA	0	2
24	HSZ70 Solutions Software Kit <i>Includes:</i> <ul style="list-style-type: none">• PC card containing storage controller software• StorageWorks Command Console (SWCC) and licenses• HSZ70 and SWCC supporting documentation	QB-5SBAC-SA	1	1

Configuration Data

SAS Oracle Rdb7 HiTest AppSet OpenVMS AlphaServer 4x00 HiTest Foundation Hardware				
For documentation and updates: http://cosmo.tay.dec.com and http://www.businesslink.digital.com and select Technical Support				
Line Item	Description	Part Number	HiTest Range	
			Min	Max
25	HSZ70 Solutions Software Kit Note: Same as item 24, except no documentation	QB-5SBAC-SB	3	3
26	4.3 GB 7200 RPM UltraSCSI Disks	DS-RZ1CF-VW	48	144
27	176 Cartridge Tape Library with 6 TZ89 drives	DS-TL896-BA	1	1
28	PCI, FWD single-port host adapter, HD68 connector	KZPBA-CB	2	2
29	15 meter SCSI cable. HD68 connectors	BN21K-15	2	2
30	Ethernet Twisted Pair cable	BN25G-07	2	2
31	<i>Select one high-resolution color monitor:</i> 15-in Flat-square with 0.28 dot pitch 17-in Trinitron aperture grille, 0.25mm 21-in Diamondtron aperture grille, 0.28 dot pitch	SN-VRCX5-WA ⓘ SN-VRCX7-WA ⓘ SN-VRCX1-WA ⓘ	1	1
32	System Management Station	See Table 3-3	0	1

ⓘ Indicates that geography-specific part number variants are available. Check the appropriate price book for details.

Table 3-2: DIGITAL HiTest Template – Foundation Software

OpenVMS AlphaServer 4x00 Foundation Software						
For documentation and updates: http://cosmo.tay.dec.com and http://www.businesslink.digital.com and select Technical Support						
Line Item	Description	Part Number	HiTest Range		Required By	
			Min	Max	Fnd [†]	App [†]
Foundation Software						
1	OpenVMS, V7.1	Included with base system	1	1	Yes	Yes
2	OpenVMS Media and documentation on CD-ROM	QA-MTIAA-H8	1	1	Yes	Yes
3	OpenVMS Cluster Software License	QL-MUZAC-AA	1	1	Yes	Yes
4	OpenVMS Layered Products CD-ROM	QA-03XAA-H8	1	1	Yes	Yes
5	DIGITAL Enterprise Integration Package <i>Includes:</i> <ul style="list-style-type: none"> • DIGITAL TCP/IP Services for OpenVMS • DECwindows Motif for OpenVMS Alpha • DECprint Supervisor for OpenVMS Alpha, Plus • DECprint Supervisor for OpenVMS Alpha, Open • DECnet-Plus for OpenVMS Alpha End System • Archive/Backup System for OpenVMS Management Tools • Archive/Backup Agent for Windows NT • Datametrics ViewPoint Data Collector • DIGITAL OpenVMS Disk Services for Windows NT • DIGITAL Office Server for OpenVMS • DIGITAL PATHWORKS 32 • PATHWORKS V6 for OpenVMS (Advanced Server) • DIGITAL Office Server Client Access License 	Included with base system	1	1	Yes	Yes
6	Oracle Rdb7 for OpenVMS V6.0 <i>Includes:</i> <ul style="list-style-type: none"> • Oracle SQL/Services • Oracle Parallel Query & Distributed Option 	Oracle	1	1	Opt'l	Yes
7	Storage Library System V 2.9B for OpenVMS	QL-0YPAG-AA	1	1	Yes	Yes
8	Hard copy of this Suite's HiTest Notes	EK-HSOVA-HN	1	1	Yes	Yes

[†]Fnd = Foundation, App = AppSet

Table 3-3: System Management Station Template

SAS Oracle Rdb7 HiTest AppSet System Management Station				
For documentation and updates: http://cosmo.tay.dec.com and http://www.businesslink.digital.com and select Technical Support				
Line Item	Description	Part Number	HiTest Range	
			Min	Max
Management Station Hardware				
Note: This HiTest Suite supports the use of a system management station. When the management station option is included, this HiTest Template identifies the items required. When system management is provided through other means, this option may be omitted without invalidating the HiTest Suite.				
1	DIGITAL PC 5510 ST System <i>Hardware includes:</i> <ul style="list-style-type: none"> • 233-MHz Pentium II CPU, 32 KB Cache • 512 KB secondary cache • 32 MB SDRAM memory • Integrated Fast Ethernet (10/100) • 24X CD-ROM • Integrated 3D Graphics adapter • 3.2 GB Ultra DMA disk drive • 1.44 MB floppy • Integrated Audio • Country Kit, North American Note: A functionally equivalent 80 x 86 system may be substituted without invalidating this HiTest Template. <i>Software includes:</i> <ul style="list-style-type: none"> • Windows NT Workstation 4.0 (factory installed) 	FR-G2B2A-VB	1	1
2	32 MB SDRAM dual-bank DIMM Memory	FR-PCCAM-EC	1	1
3	Diamond 56.6 K Modem Note: This line item is used for page notification.	FR-PCXFA-AA	0	1
4	<i>Select one high-resolution monitor:</i> 21" (19.6" view) 1600 x 1200 @75Hz 19" (18" view) 1600 x 1200 @75Hz 17" (16" view) 1280 x 1024 @75Hz	FR-PCXAV-WZ FR-PCXAV-TZ FR-PCXAV-YZ	1	1
Software Installed on Management Station				
5	Windows NT Server V4.0 Contact Microsoft at: http://www.microsoft.com or call (800) 360-7561.	Microsoft	1	1
6	Windows NT Server Service Pack 3 (SP3) Contact Microsoft at http://www.microsoft.com or ftp://ftp.microsoft.com/bussys/winnt or call (800) 360-7561.	Microsoft	1	1
7	OpenVMS Management Station V2.1	Included with the base system	1	1
8	DIGITAL PATHWORKS 32 V7.0A	Included with EIP V2.0	1	1
9	Datametrics ViewPoint Workstation Version 4.1 Contact http://www.datametrics.com or 1-888-436-6300	Datametrics	1	1
10	OpenVMS Management Station license	Included with the OpenVMS base license	1	1

SAS Oracle Rdb7 HiTest AppSet System Management Station				
For documentation and updates: http://cosmo.tay.dec.com and http://www.businesslink.digital.com and select Technical Support				
Line Item	Description	Part Number	HiTest Range	
			Min	Max
11	DIGITAL PATHWORKS 32 V7.0A system license	Included with EIP V2.0	1	1
12	DECams console software, Version 7.1 license	Included with the OpenVMS base license	1	1
13	Archive/Backup System for OpenVMS Management Tools, V2.1 for Windows NT Workstation license	QL-5LSA9-3B	0	1
Software Installed on Managed System(s)				
14	OpenVMS Management Tools, V2.1 license	Included with EIP V2.0	1	1
15	ViewPoint, V4.2 Data Collector license	Included with EIP V2.0	1	1
16	Archive/Backup System for OpenVMS Management Tools, V2.1 for OpenVMS Alpha license	QL-5LQA*-AA	0	1
0 Indicates that geography-specific part number variants are available. Check the appropriate price book for details.				

Special Configuration Rules

The special configuration rules for the SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite include:

- When loading large quantities of data, the rows to be committed should be specified with the commit parameter of the load command to prevent the working set quotas from being exceeded. For example, the commit parameter was set to 10000 for testing this HiTest Suite.
- Before importing data from external databases, ensure that the dates in the external databases are in the following RDB-compatible format:

DD-MMM-YYYY HH:MM:SC.NN

where:

DD is a two-digit number from 01 through 31 (Inclusive)

MMM is one of the following three-letter abbreviations for the month:

JAN, FEB, MAR, APR, MAY, JUN,
JUL, AUG, SEP, OCT, NOV, DEC

YYYY is a four-digit number

HH, MM, and SC are each two-digit numbers from 00 through 59 (inclusive)

NN is a two-digit decimal number

For example, 12-JAN-1998 13:01:07.53 is January 12, 1998 at 1 minute, 7.53 seconds past 1:00 PM.

Configuration Data

- The use of a common shared system disk is recommended for systems based on this HiTest Suite. This allows the authorization files, accounts, system files, and parameters for both AlphaServers to be stored in one place.
- Oracle Rdb7 should be licensed for all servers on which queries will be run in parallel; errors will occur if queries are run in parallel on multiple servers and one or more of the servers running queries in parallel is not licensed for Oracle Rdb7.

Note

The Oracle Rdb7 license limits the number of nodes that can run a query at the same time, not the number of nodes that can run queries. Services failover processing for ASE still applies to a single license on a cluster with one node being a backup for another.

- The tape robot and devices of the TL896 Tape Library must be controlled by only one AlphaServer.

System Installation and Setup

This chapter describes how to install and set up a DIGITAL HiTest System configured from this DIGITAL HiTest Suite. System preparation includes installing hardware, operating system, management station, and applications.

Hardware Installation

The *AlphaServer 4000/4100 Configuration and Installation Guide* provides instructions for installing your AlphaServer 4x00 system. Chapter 7 of this HiTest Note provides additional information specific to the minimum and maximum configurations of this HiTest Suite.

When configuring AlphaServer 4100 systems, the following must be noted:

- Memory is always configured as dual boards.
- Because of architecture and multi-CPU capability, memory boards cannot be placed in contiguous slots.

Planning the Data Warehouse

Before the RAID Array is configured, the data warehouse should be planned. To plan the data warehouse, do the following:

1. Determine the requirements for the data warehouse, including life cycle considerations.
2. Determine the data warehouse database model.
3. Determine the amount of data to be stored.
4. Determine the projected growth of data for a two-year period.
5. If record layouts are available, do the following:
 - I. Size the records.
 - II. Determine record counts.
 - III. Calculate the table sizes.
6. Determine the functional storage areas of the data warehouse.
7. Estimate the amount of disk space that will be required for each storage area.

Functional Storage Areas

For data warehouses based on this HiTest Suite, the following functional storage areas are recommended:

- Shared System Disk Area – This is the system disk area used for system-related file storage for both AlphaServers in the cluster. The shared system disk area is accessed by both AlphaServers.
- Data Table Disk Area – This area is used for storing the Oracle data tables. Table 5-1 shows the physical layout of all RAID disks in the minimum configuration, including data table disks and index table disks. Table 5-3 shows the physical layout of all RAID disks in the maximum configuration, including data table disks and index table disks.
- Index Table Data Disk Area – This is the area that is used for storing the Oracle index tables. Table 5-1 shows the physical layout of all RAID disks in the minimum configuration, including data table disks and index table disks. Table 5-3 shows the physical layout of all RAID disks in the maximum configuration, including data table disks and index table disks.
- Database Sort Disk Area – This is the area where the database sorts, index sorts, and VMS sorts are performed. The contiguous database sort area can be allocated by either:
 - Creating one large RAIDset disk during disk initialization
 - Binding multiple RAID disks together using the MOUNT/BIND command as shown in the following example:

```
$ MOUNT/BIND=SORTDISK $1$DKC200: , $1$DKD200: SORT1, SORT2
```
- SAS/Oracle Executable Disk Area – This area is used for storing the executables, work files, and general files related to SAS and Oracle.
- SAS Data Set Area – This area is for maintaining SAS datasets “data.” The SAS datasets “data” is extracted from the main data warehouse database and stored within the SAS system files and datafiles.
- Extra Space for flat file loads – This area must be as large as the quantity of data to be loaded and stored into the database. This extra space should not be the sort/temp space because this will most likely clash with Index creation which uses that temporary space.
- Spare Disks for hot auto-replacement of failed disks – It is recommended that 10% of total disk space be allocated for this purpose.

Required Disk Space

The amount of disk space required for each storage area depends on several factors. The factors include, but are not limited to, the following:

- Quantity of data used for decision support
- Indexing requirements
- Available disk space
- Disk size
- Data rotation policy
- Data loading policy
- SAS usage policy

Note

This HiTest Suite assumes that SAS is used for decision support and not major data storage.

After the disk space requirements for each storage area have been estimated, the RAID Array can be configured.

Table 4-1 shows the storage space allocated for the maximum utilization of each of the functional storage areas in the *minimum* configuration of this HiTest Suite. As Table 4-1 indicates, the maximum data table storage that is supported in the minimum configuration of this HiTest Suite is 42.83 GB. This assumes a disk size of 4.3 GB and disk utilization of 83%.

Table 4-1: Storage Space Required for Each Functional Storage Area (Minimum Configuration)

Functional Storage Area	Disk Count	Percentage of Storage	Storage Utilization	Disk Size	Utilization
System Disk (shared)	1	2.08%	3.57	4.3	83.00%
Data Table Disks	12	25.00%	42.83	4.3	83.00%
Index Table Disks	12	25.00%	42.83	4.3	83.00%
Sort/Temp Space Disks	12	25.00%	42.83	4.3	83.00%
SAS/Oracle Executable	3	6.25%	10.71	4.3	83.00%
SAS Database SET Space	3	6.25%	10.71	4.3	83.00%
Spare Disks	5	10.42%	17.85	4.3	83.00%
TOTAL	48	100.00%	171.31	4.3	83.00%

To support more than 42.83 GB of data table storage, the storage utilization for Index Table Disks and Sort/Temp Space disks must be increased proportionally.

Note

Table 4-1 shows the storage utilization that was allocated for testing the minimum configuration of this HiTest Suite; depending on the data warehouse model that is used, the storage utilization may vary for other systems based on this configuration.

System Installation and Setup

Table 4-2 shows the storage space allocated for the maximum utilization of storage space that was required for the maximum utilization of each of the functional storage areas in the maximum configuration of this HiTest Suite. As Table 4-2 indicates, the maximum data table storage that is supported in the maximum configuration is 128.48 GB. This assumes a disk size of 4.3 GB and disk utilization of 83%.

Table 4-2: Storage Space Required for Each Functional Storage Area (Maximum Configuration)

Functional Storage Area	Disk Count	Percentage of Storage	Storage Utilization	Disk Size	Utilization
System Disk (shared)	6	4.17%	21.41	4.3	83.00%
Data Table Disks	36	25.00%	128.48	4.3	83.00%
Index Table Disks	36	25.00%	128.48	4.3	83.00%
Sort/Temp Space Disks	36	25.00%	128.48	4.3	83.00%
SAS/Oracle Executable	6	4.17%	21.41	4.3	83.00%
SAS Database SET Space	18	12.50%	64.24	4.3	83.00%
Spare Disks	6	4.17%	21.41	4.3	83.00%
TOTAL	144	100.00%	513.94	4.3	83.00%

Note

Table 4-2 shows the storage utilization that was allocated for testing the maximum configuration of this HiTest Suite; depending on the data warehouse model that is used, the storage utilization may vary for other systems based on this configuration.

RAID Array Configuration

Install the ESA10000 High Capacity Base Unit and optional ESA10000 Dual Expansion Base Unit as described in *Getting Started HSZ70 Solutions Software V7.0B for Windows NT Server — Alpha Installation Guide*.

Configure the ESA10000 High Capacity Base Unit and optional ESA10000 Dual Expansion Base Unit as described in the *Digital StorageWorks HSZ70 Array Controller HSOF V7.0 CLI Reference Manual*.

Note

It is recommended that logicals be assigned to individual data disks to associate the disks with specific storage areas. This facilitates access to individual disks. Refer to Appendix C for the database and disk logicals setup script that was used in the testing of this HiTest Suite.

OpenVMS Firmware Upgrades

Before the OpenVMS operating system can be installed, the OpenVMS firmware on the AlphaServers must be at the latest revision levels. The Loadable Firmware Update (LFU) Utility is used to verify and update firmware revisions. To run the LFU Utility, enter the command LFU from the console prompt.

For more information about verifying and updating firmware revisions, refer to the *Alpha Systems Firmware Update V5.0 Release Notes Overview* supplied with the OpenVMS Media and Documentation Kit.

When firmware updates are required, they should be performed on both AlphaServers in the cluster.

Note

Do not update the AlphaServer firmware if the firmware revisions on the AlphaServers are later than those on the Alpha Systems Firmware Update CD. Installing older versions of firmware on the AlphaServers could have an adverse impact on system performance and operation.

Operating System Installation

When the OpenVMS firmware is at its latest revision levels, the OpenVMS Operating System can be installed.

This section describes how to install the OpenVMS Operating System.

OpenVMS is included as Factory Installed Software (FIS) on the AlphaServer base system for this HiTest Suite. This means that OpenVMS is on the system and the final installation steps begin when the AlphaServer is booted for the first time.

Before installing the OpenVMS operating system, you should review the *OpenVMS Version 7.1 Release Notes* that are included with the OpenVMS Media and documentation kit. The *OpenVMS Version 7.1 Release Notes* contain information about OpenVMS that was not available at the time the *OpenVMS Alpha Version 7.1 Upgrade and Installation Manual*, and other documents in the OpenVMS documentation set, were published.

Install the OpenVMS operating system as described in the *OpenVMS Alpha Version 7.1 Upgrade and Installation Manual*.

Note

During the install of OpenVMS, soft copies of the *OpenVMS Version 7.1 Release Notes* and the *OpenVMS Alpha Version 7.1 Upgrade and Installation Manual* are moved to sys\$help. The VMS backup Utility can be used to retrieve them from the OpenVMS release CD.

Information to Have on Hand During Installation

Several prompts are displayed during the execution of the OpenVMS install program. To complete the install of the OpenVMS, specific information must be provided in response to each prompt. The information should be readily available when the install program is run.

The information that must be provided in response to prompts includes the following:

- SCS Node Names of each node in the cluster
- DECnet addresses of each node in the cluster
- SCSYSID for the node on which the install is being performed
- License packs for OpenVMS and layered products
- Whether OpenVMS is being used in the cluster
- Whether DECnet is being used in the cluster

Note

Answer “Yes” to the prompts for OpenVMS and DECnet.

OpenVMS Licenses

The install program allows the entry of licenses for OpenVMS products during the install of OpenVMS. It is recommended that licenses be entered during OpenVMS install. If licenses for specific products are not entered, messages announcing the lack of licenses will be displayed when the unlicensed products are run.

A hard copy of the licensing information for each OpenVMS product is included with the OpenVMS Media and Documentation Kit. The licensing codes for each OpenVMS product that you have purchased are on this sheet. The OpenVMS install program will prompt for the entry of these licensing codes.

Verifying the OpenVMS Licenses

After the OpenVMS licenses have been entered, do the following to verify that they have been entered correctly:

1. Enter the following command to shut down the system:

```
@sys$system:shutdown.com
```

Before shutting down the system, a prompt for selecting the Auto-reboot option is displayed.

2. Select the Auto-reboot option. The system will be automatically rebooted after the system shutdown has completed.

The system prompt (\$) is displayed when automatic reboot is completed.

3. Enter the following command from the \$ prompt:

```
show license
```

This displays a list of all of the licenses on the system. The list of licenses that is displayed should be consistent with the licenses that were received and entered for OpenVMS.

For more information on shutting down and rebooting the system, refer to *OpenVMS System Manager's Manual: Essentials*.

Note

Error messages are displayed when attempts are made to run unlicensed software applications.

Patch ALPLOGI06_071 Installation

After OpenVMS has been installed and the OpenVMS Licenses have been entered and verified, patch ALPLOGI06_071 must be installed on the AlphaServer.

To obtain and install patch ALPLOGI06_071, do the following:

1. Go to <http://ftp.service.digital.com/public/vms/axp/>. This displays a list of OpenVMS version numbers.
2. Click on the version of OpenVMS 7.1 that you are using. (There are three choices: v7.1-1h1/, v7.1-1h2/, and v7.1/.)

This displays the list of OpenVMS patches and associated cover letters and README files for the version of OpenVMS that you selected.

3. Scroll down the list until you reach `alplogi06_071.CVRLET`.
4. Double click on `alplogi06_071.CVRLET` to display the cover letter for patch ALPLOGI06_071.
5. Install patch ALPLOGI06_071 by following the instructions in the displayed cover letter.

Cluster Configuration

Set up your cluster according to the *OpenVMS Cluster Systems* manual.

Make the following settings in the cluster:

- The quorum disk has one vote.
- Both AlphaServers in the cluster should be set as cluster-enabled, with one vote per AlphaServer.
- The votes required to form a cluster should be set to 2. (This allows a single machine and the shared storage to form a cluster.)

Note

Setting the quorum disk, and each AlphaServer, with one vote and then setting the votes required to form a cluster at 2 allows one AlphaServer and a quorum disk to form a cluster. It can prevent the inadvertent corruption of shared disks when one AlphaServer is in standalone mode and tries to write to the shared storage without knowledge of the other machine. The *OpenVMS Cluster Systems* manual describes how to set votes and explains the implications of setting votes.

UCX VMS TCP Services Setup

UCX provides the TCP communications services on VMS. The UCX services include various services with one being REXEC Remote execution service. The eXcursion workstation X-Server package software uses the REXEC command which must be enabled to allow access from remote client systems. For more information on enabling REXEC, refer to the *Digital TCP/IP Services for OpenVMS User's Guide*.

To verify your UCX configuration, do the following:

1. Enter the following command from the \$ prompt on the AlphaServer base system:

```
@ucx$config.com
```

This command displays the TCP/IP Services for OpenVMS Configuration Menu.

2. Select Client Components (option 2) from the TCP/IP Services for OpenVMS Configuration Menu.

This option displays the TCP/IP Services for OpenVMS Configuration Menu. At a minimum, the following services should show a status of "Enabled" on the TCP/IP Services for OpenVMS Configuration Menu:

- FTP
- REXEC and RSH
- RLOGIN
- TELNET

Note

Other services, in addition to those mentioned in the preceding list, may need to be enabled for your installation. Contact your System Administrator for information about additional services that must be enabled.

3. Enable any additional services as required for your installation.
4. Exit UCX.

At this point, UCX should be set up and ready to accept client connections and X-windows processing on the cluster.

Define Remote Hosts

As part of setting up host access, the AlphaServer systems must know about all systems that will be accessing them from remote and local networks. Remote hosts must have entries in the host database. If a system management station is used, it must be defined specifically in the Hosts database.

To define a remote host, enter the following command from the \$ prompt on the AlphaServer base system:

```
SET HOST <rhost_name>/address=<host_ip>
```

where <rhost_name> is the name of the remote host and <host_ip> is the IP address assigned to the client systems being set up to access the cluster.

Setting Up X-windows Access

X-windows management provides communications facilities between Servers and Clients for the purpose of screen management and functionality. The DECwindows software is an X-windows compliant package on the Server side. eXcursion is a workstation client-side X-server package which interfaces to the DECwindows manager.

Prerequisites for Setting Up X-Windows Access

The following are prerequisites to setting up X-Windows access:

- *DECwindows must be available and running*— SAS provides two user interfaces: one based on X-Windows and the other based on a character cell (vt100) interface. Generally speaking, DECwindows is automatically available and running on the system after FIS system install is complete. To use the SAS X-windows interface, you should be sure the AlphaServer systems are running the DECwindows server services and the workstation is running the X-windows Client services. Refer to the OpenVMS Systems Management Manual for more information on setting up DECwindows.
- *Work Station X-server software must be installed and running*— Any workstations, such as the system console, requiring access to the systems using the X-Windows/DECwindows interface need to have an X-windows server. The eXcursion package is provided with the OpenVMS software. The system console workstation connected needs it as well as any other workstations accessing the system using the X-windows interface.
- *The cluster must know about all workstations to be accessing the system*— This is to register the nodes as valid clients. After they workstations are registered, they are then allowed to access the cluster to run X-Windows applications from your workstation.

Setting Up the X-Window Display

The X-windows display variable must be set to point to the workstation. Each session is associated with a display setup. This is initiated and defined automatically when connecting to the cluster using DECwindows facilities. (The system console requires setting up the display location on the clustered systems.) In the following example, the set display command is used to set up the display location on the clustered systems and supercomp is the system console:

```
$ set display/create/node=supercomp
$ show DISPLAY
  Device:  WSA2: [super]
  Node:    SUPERCOMP
  Transport: DECNET
  Server:  0
  Screen:  0
```

Start the X-server package on the workstation. eXcursion was used for testing; eXcursion is an X-server package setup specifically for Digital systems.

With the X-server running, from a Telnet session you can execute the following after defining the display variable:

```
$create/term/detach
```

This will create a new terminal window on the workstation allowing the entry of commands and interfaces with the DCL prompt.

The display setting workstation name [Supercomp] should be the workstation computer name. This identifies the system used to display the X-windows screens on. The workstation name will vary with your installation requirements. It is previously shown as an example.

Oracle Rdb7 Installation

The *Oracle Rdb7 for OpenVMS Installation and Configuration Guide, Release 7.0* describes how to install Oracle Rdb7.

The Oracle Rdb7 Release Notes contain information about Oracle Rdb7 that was not available at the time the Oracle Rdb7 documentation set was published. Before installing Oracle Rdb7, you should review the Oracle Rdb7 Release Notes.

Printing the Oracle Rdb7 Release Notes and Installation Guide

Both the *Oracle Rdb7 for OpenVMS Installation and Configuration Guide, Release 7.0* and the Oracle Rdb7 Release Notes are stored on the installation media for Oracle Rdb7. To print both documents, do the following:

1. Insert the Oracle Rdb7 installation CD-ROM in the CD-ROM drive of an AlphaServer in the cluster where Oracle Rdb7 is to be installed.
2. Enter the following command from the \$ prompt of the AlphaServer where the Oracle Rdb7 installation CD-ROM is inserted:

```
MOUNT/OVER=ID <device_name>
```

where <device_name> is the device name of the CD-ROM drive where the Oracle Rdb7 installation CD-ROM is inserted.

This mounts the Oracle Rdb7 installation CD-ROM.

3. From the \$ prompt of the AlphaServer where the Oracle Rdb7 installation disk is mounted, enter the following command:

```
@SYS$UPDATE:VMSINSTALL <variant_name> <device_name>  
OPTIONS N
```

where <variant_name> is the save set variant name. For RDB the variant name is RDBA070 or RDBAMV070 and <device_name> is the device name for the CD-ROM drive and a directory name that is the same as the variant_name. For example, DKA500:[RDBA070.KIT] is a device name where DKA500 is the device name of the CD-ROM drive and RDBA070 is the variant name.

Note

For the purpose of printing the Release Notes and Installation Guide, it does not matter whether RDBA070 or RDBAMV070 is specified as the variant name in the VMSINSTALL command.

After the VMSINSTALL command is entered, the following prompt is displayed:

```
* Are you satisfied with the backup of your system disk [Y]?
```

4. Press the Enter key to accept the default [Y] response to the previous prompt.

The Release Notes are automatically copied to SYS\$HELP:RDB070.RELEASE_NOTES and SYS\$HELP:RDB070_RELEASE_NOTES.PS. You can print the Release Notes from SYS\$HELP:RDB070 after exiting this procedure.

The Install Guide is automatically copied to SYS\$HELP:RDB070.INSTALL_GUIDE.

The last message to display is the following prompt:

* Would you like to print the installation guide? [NO]

5. Enter "Y" in response to the preceding prompt. The installation guide is printed on the default printer.

Without user intervention, VMSINSTALL will exit after the installation guide is printed.

Print the Release Notes from the location to which they were automatically copied in step 4 (SYS\$HELP:RDB070.RELEASE_NOTES or SYS\$HELP:RDB070_RELEASE_NOTES.PS).

Prerequisites for Installing Oracle Rdb7

You must verify all of the items described in this section before installing Oracle Rdb7. For more information on the prerequisites described in this section, refer to the *Oracle Rdb7 for OpenVMS Installation and Configuration Guide, Release 7.0*.

Verify that EPC\$SHR.EXE is Installed as a Shared, Protected Image

Oracle Rdb7 requires that SYS\$LIBRARY:EPC\$SHR.EXE be installed as a shared, protected image. To verify that EPC\$SHR.EXE is installed correctly, enter the following command from the \$ prompt:

```
INSTALL LIST SYS$LIBRARY:EPC$SHR.EXE
```

If SYS\$LIBRARY:EPC\$SHR.EXE is installed as a shared, protected image, output similar to the following is displayed:

```
DISK: <SYSCOMMON.SYSLIB>.EXE
EPC$SHR;1      Open Hdr Shar      Prot Lnkbl
```

If the preceding output is *not* displayed, OpenVMS should be reinstalled. For information on reinstalling OpenVMS, refer to the Operating System Installation section.

Verify that the Installing Account has the SETPRV Privilege Authorized

Oracle Rdb7 must be installed from an account that has the SETPRV privilege authorized. To verify that the SETPRV privilege is authorized, enter the following command from the \$ prompt in the account that will be used to install Oracle Rdb7:

```
SHOW PROCESS/PRIVILEGES
```

If the SETPRV privilege is not authorized for the installing account, the AUTHORIZE utility must be used to authorize the SETPRV privilege for it.

Note

To authorize the SETPRV privilege for the installing account, the AUTHORIZE utility must be run from the installing account. The installing account must have the SYSPRV privilege authorized to run the AUTHORIZE utility from it.

System Installation and Setup

To authorize the SETPRV privilege for the installing account, do the following from the \$ prompt in the installing account:

1. Enter the following commands:

```
SET DEFAULT SYS$SYSTEM
RUN AUTHORIZE
```

After “RUN AUTHORIZE” is entered, the \$ prompt changes to the “UAF>” prompt.

2. Enter the following commands from the “UAF>” prompt:

```
MODIFY <account_name>/PRIVILEGES=(SETPRV)
EXIT
```

After the “EXIT” command is issued, the \$ prompt is redisplayed.

3. Log out of the installing account.
4. Log in to the installing account.

The SETPRV privilege is now authorized for the installing account.

No-Lock Password for the Installing Account

The installing account must have a No-Lock Password to allow Oracle to add passwords for the RDB\$REMOTE account.

If the installing account does *not* have a No-Lock Password, you need to use the AUTHORIZE utility to make the installing account password No-Lock.

Note

To make the Password for the installing account No-Lock, the AUTHORIZE utility must be run from the installing account. The installing account must have the SYSPRV privilege authorized to run the AUTHORIZE utility from it.

To make the password for the installing account No-Lock, do the following from the \$ prompt in the installing account:

1. Enter the following command:

```
RUN AUTHORIZE
```

After “RUN AUTHORIZE” is entered, the \$ prompt changes to the “UAF>” prompt.

2. Enter the following commands from the “UAF>” prompt:

```
MODIFY <account_name>/FLAGS=NOLOCKPWD
EXIT
```

After the “EXIT” command is issued, the \$ prompt is redisplayed.

The password for the installing account is now No-Lock.

Verify System Parameters

The System parameters should be at the values listed in Section 1.6.10 of the *Oracle Rdb7 for OpenVMS Installation and Configuration Guide, Release 7.0*.

Run SYSGEN to verify the settings of the system parameters.

If it is necessary to change any of the system parameter settings, you can do so with the AUTOGEN utility as described in Section 1.6.10.3 of the *Oracle Rdb7 for OpenVMS Installation and Configuration Guide, Release 7.0*.

Verify Global Pages

The system parameter GBLPAGES must be set to 27000.

Run SYSGEN to verify the value of GBLPAGES. SYSGEN can also be used to reset the value of GBLPAGES if it has a value of less than 27000.

Installing Oracle Rdb7

Install Oracle Rdb7 as described in Chapter 3 of the *Oracle Rdb7 for OpenVMS Installation and Configuration Guide, Release 7.0*.

During the install of the Oracle Rdb7, the user is prompted to enter a UIC code for the RDB\$REMOTE70 account and a UIC code for the RDBMAIJSRV account. The UIC codes entered for the RDB\$REMOTE70 account and the RDBMAIJSRV account should be recorded by the user for future reference.

The following prompt is also displayed by the Oracle Rdb7 install program:

```
Do you want to run the IVP verification process [YES]
```

Providing the default "YES" response to this prompt runs the IVP verification process during installation. It is recommended that this process be run to verify that Oracle Rdb7 installed properly. This procedure can be run at any time after installation by entering the following commands from the \$ prompt:

```
SET DEFAULT SYS$COMMON: [SYSTEST]
@RDB$IVP70
```

Commands for Starting and Stopping the Rdb7 Database Engine

On completion of the install you have control over starting and stopping the Rdb7 Database engine by using the following commands. It is helpful to create symbols for these operations for manual startup and shutdown.

Stop the server:

```
$ @SYS$COMMON: [SYSMGR]RMONSTOP70.COM;1
```

Start the server:

```
$ @SYS$COMMON: [SYS$STARTUP]RMONSTART70.COM;1
```

Setting Up the SQL Access Symbol

After Oracle Rdb7 is installed, the SQL Access symbol should be set up. The SQL Access symbol allows users to access SQL.

The SQL Access symbol is set up by adding the following entry to the systemwide user login file:

```
SQL ::= "$SQL$"
```

After adding the preceding entry to the systemwide user login file, do the following to verify that the SQL Access symbol has been set up:

1. Log out from the system prompt (\$).
2. Log back in when prompted for a User ID and Password.
3. Enter the following command at the \$ prompt:

```
SQL
```

If the SQL> prompt is displayed, it means that the SQL Access symbol has been set up. (The SQL> prompt also indicates that the SQL utility is running.)

System Installation and Setup

When the SQL Access symbol is set up, the DB schema file can be used to create the database for the data warehouse.

Oracle SQL/Services Installation

Oracle SQL/Services is a client/server system that enables client applications on PCs and workstations to access data in Oracle Rdb7 databases on server systems. If you plan on running remote client/server access and ODBC applications connecting to Oracle Rdb7, Oracle SQL/Services must be installed.

The *Oracle Rdb7 for OpenVMS Oracle SQL Services Installation Guide, Release 7.0* describes how to install Oracle SQL/Services.

The Oracle SQL/Services Release Notes contain information about Oracle/SQL Services that was not available at the time the Oracle/SQL Services documentation set was published. Before installing Oracle SQL/Services, you should review the Oracle SQL/Services Release Notes.

Printing the Oracle SQL/Services Release Notes and Installation Guide

Both *Oracle Rdb7 for OpenVMS Oracle SQL Services Installation Guide, Release 7.0* and the Oracle SQL/Services Release Notes are stored on the installation media for Oracle Rdb7. During the install of Oracle SQL/Services, the install guide and the Release Notes for Oracle SQL/Services are copied to SYS\$HELP.

To print both documents prior to installing Oracle SQL/Services, do the following:

1. Insert the Oracle Rdb7 installation CD-ROM in the CD-ROM drive of an AlphaServer in the cluster where Oracle SQL/Services is to be installed.

Note

During the install of Oracle Rdb7, the Oracle Rdb7 installation CD-ROM was mounted in an AlphaServer CD-ROM drive. If the Oracle Rdb7 installation CD-ROM is still *mounted* in an AlphaServer CD-ROM drive, you should skip the following step of this procedure and continue with step 3.

2. Enter the following command from the \$ prompt of the AlphaServer where the Oracle Rdb7 installation CD-ROM is inserted:

```
MOUNT/OVER=ID <device_name>
```

where <device_name> is the device name of the CD-ROM drive where the Oracle Rdb7 installation CD-ROM is inserted.

This mounts the Oracle Rdb7 installation CD-ROM.

3. From the \$ prompt of the AlphaServer where the Oracle Rdb7 installation disk is mounted, enter the following command:

```
@SYS$UPDATE:VMSINSTALL variant_name device_name OPTIONS N
```

where variant_name is SQLSRVAM070 and device_name is the device name for the CD-ROM drive and a directory name that is the same as the variant_name. For example, \$1\$DKC300:[RDBKIT] is a device name where \$1\$DKC300 is the device name of the CD-ROM drive and RDBKIT is the variant name.

After the VMSINSTALL command is entered, the following prompt is displayed:

```
* Are you satisfied with the backup of your system disk [Y]?
```

4. Press the Enter key to accept the default [Y] response to the this prompt.

This displays a menu of options for printing the Release Notes.

5. Select option 2 for printing the Release Notes. The Release Notes are printed and they are also copied to SYSSHELP.

The following prompt is displayed:

```
* Would you like to print the installation guide? [NO]
```

6. Enter “Y” in response to the previous prompt. The installation guide is printed on the default printer.

Without user intervention, VMSINSTALL will exit after the installation guide is printed.

Prerequisites for Installing Oracle SQL/Services

You will be prompted for two UICs one for the SQLSRV\$DEFLT and the other for the RMU\$SRV Accounts. You should find free UICs to be entered for the “NEW” accounts associated with SQL services.

To find a free UIC in the 300 group (or another group if you want), run the authorize utility and issue the 'SHOW/BRIEF [300,*]' command. This will display all the used UICs in the 300 group.

Note

The installation kit for Oracle SQL/Services provides the Oracle SQL/Services server and the local OpenVMS Alpha client. OpenVMS remote client kits are provided on the Oracle Rdb7 OpenVMS CD-ROM. All other remote client kits are provided on a separate Oracle Rdb7 Clients CD-ROM.

Installing Oracle SQL/Services

Install Oracle SQL/Services as described in Chapter 2 of the *Oracle Rdb7 for OpenVMS Oracle SQL Services Installation Guide, Release 7.0*.

Before you install Oracle SQL/Services, you should plan how you will respond to the following prompts from the Oracle SQL/Services install program:

- What version of SQL should the GENERIC service specify?: — You must respond to this prompt by entering the version number 7.0.
- Do you want to use the default Oracle SQL/Services network ports: — Responding “yes” to this prompt sets the Oracle SQL/Services network ports to the following defaults:
 - DECnet object: 81
 - TCP/IP port: 118
 - IPX/SPX port: 33969 (%0x84b1)
- Do you want to install SQL*Net for Oracle SQL/Services?: — If you plan to use SQL*Net, the response to this prompt should be “yes.” SQL*Net is the Oracle communications protocol for database connectivity. For more information on SQL*Net, refer to the *Oracle Rdb7 for OpenVMS Oracle SQL Services Installation Guide, Release 7.0*.

System Installation and Setup

- Do you want to run the IVP after the installation [YES]? — Providing the default “YES” response to this prompt runs the IVP verification process. It is recommended that this process be run to verify that Oracle SQL/Services installed properly.
- If the IVP operation fails during installation, after resolving the problem, you can rerun the IVP operation by executing the following commands from the \$ prompt:

```
SET DEFAULT SYS$COMMON: [ SYSTEST.RDB70 ]  
@SQL$IVP.COM
```

Refer to the SQLSRVHELP70.HLP help file for information on any errors or problems that may occur during the install of Oracle SQL/Services.

Considerations for Data Loading

The parallel loading operation can enhance performance of loading data into data warehouses. The RMU utility implements parallel loading by having one load manager/reader and multiple executors/writers. To fully implement RMU parallel loading, the load files must have data distribution crossing the data storage files partition mapping specifications. RMU creates one write thread for each storage area datafile. Data storage mapping specifies the distribution of the data across multiple files, partitioning data of one table across multiple storage areas. The RMU loader will load the data with multiple write threads as long as the distribution of the data crosses partitioning bounds. If data to load is broken up along partitioning lines, the RMU loader will be forced to run only single threaded, with one executor.

During testing between 10 and 200 million rows were loaded at a time.

Note

Individual performance may vary, depending on such features as the record size and I/O block sizes.

Single Executor Loading Method

In the Single Executor Loading Method, the data to be loaded is partitioned by month (1 through 12) and the database is partitioned by month (1 through 12). The load manager can serve the data to only one partition; only one executor is run. This method of loading data is appropriate when the quantity of data is not excessive in relation to the time required to do the loading.

Multiple Executor Loading Method

In the Multiple Executor Loading Method, also known as Parallel Loading, the data for all twelve months is contained in a single load file and the database is partitioned by month. Multiple executor loading is invoked by the partitioning scheme.

For example, a load file that contained both male and female data could be loaded into a database with partition loading be male and female. The RMU loader would split the load with two executors, thereby invoking the parallel loading feature and improving the performance of the load.

Note

In general, running multiple RMU load operations in tandem tends to cause contention for locks and results in longer load times.

The data in data warehouses is typically static. Therefore loading times should not be a problem if loading is done at regular intervals, such as once per month or once per week. If loading times are restricted and critical, further data reduction of the load data should be considered to reduce the amount of data being loaded.

Generating Record Layout Files Automatically

The RMU loader requires record definitions for loading the data. The unload command can be used to automatically generate the record definition for a database.

For example, the following unload command was used to generate the record definition for the database that was used in the testing of this HiTest Suite:

```
rmu/unload/noexecute/record definition=(file=facts_rec.rrd, format=delimited_text,
(TERMINATOR="#") - sql$database SALES_FACT SALES_FACT.UNL
```

The preceding example of the unload command produced the FACTS_REC.RRD and the SALES_FACT.UNL files as output. The FACTS_REC.RRD file contained the record definition and the SALES_FACT.UNL file contained the unloaded data.

Note

The output files of the unload command are generated in the default directory.

Creating the Index

Creating indexes on very large tables requires setting up contiguous temporary disk space equal to or greater than the table being indexed. The Rdb7 indexing and sort operations use the VMS Sort utilities. The sort utilities use work files for temporary storage of data and sort processing. This requires that workfile specifications be setup for sorts; using the default settings will cause the index creation operation to fail. The first step is to prepare and setup disk storage areas with sufficient free space for the index build. This may be accomplished by either creating a very large raid set when setting up the StorageWorks disk subsystems or by binding disks together after setup using the following command. This command was used to combine the 2 preallocated sort disks, creating a single logical disk that is used for temporary work files associated with sorts:

```
MOUNT/CLUSTER/BIND=SORTDISK $1$DKC200: , $1$DKD200: SORT1 , SORT2
```

The Sort utility is able to use multiple work files but cannot spread sorting across two or more files for one sort. For this reason, disks must be joined together to provide a single contiguous space for the sort work file. The work file specification is set as shown in the following example:

```

$! Setup for Database Index and Sort processing
$! This configuration will be using 2 files in minimum and more in max
$! The two logicals required to specify the number of files.
$ defsys RDMS$BIND_SORT_WORKFILES 2
$ defsys RDB_BIND_SORT_WORKFILES 2
$! Assign the files to a their respective work spaces.
$ assign $1$DKC200:[WORKSPACE] SORTWORK0
$ assign $1$DKD200:[WORKSPACE] SORTWORK1
```

For the testing of this HiTest Suite, index creation was performed for 64100000 rows of SALES_FACT data to support the minimum HiTest configuration.

SAS Installation

This section describes how to install the SAS software and the SAS/ACCESS interface to Oracle Rdb7.

Prerequisites for SAS Installation

Before installing SAS, do the following:

- Ensure that the OpenVMS operating system has been installed on your AlphaServer base systems. For information on installing OpenVMS, refer to the Operating System Installation section of this chapter.
- Ensure that OpenVMS is running with the latest firmware revisions. For information on upgrading the OpenVMS firmware, refer to the OpenVMS Firmware Upgrades section of this chapter.
- Ensure that Oracle Rdb7 and Oracle SQL Services have been installed. For information on installing Oracle Rdb7 and Oracle SQL Services, refer to the Oracle Rdb7 Installation and Installing Oracle SQL/Services sections of this chapter.
- Perform all of the tasks in the *Preinstallation Checklist* at the beginning of Chapter 3 of the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*.
- Set the SYSGEN parameters and AUTHORIZE quotas to the values listed in Chapter 3 of the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*.

If the SYSGEN parameters and AUTHORIZE quotas are not set to the values specified in Chapter 3 of the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*, the SAS install program will be interrupted and a screen for resetting the SYSGEN parameters and AUTHORIZE quotas will be displayed.

Installation Assumptions

The following assumptions are made about the installation of SAS which is described in this HiTest Suite:

- This is a NEW installation with no prior releases of SAS on the system.
- SAS will be installed as a layered product on top of Oracle Rdb7 v6.0 and OpenVMS 7.1
- SAS will not be used as the data warehouse but as a shell over the Oracle Rdb7 data warehouse.

Installing the SAS Software

To install the SAS software, do the following:

1. Create and define the SAS install directory by entering the following commands from the \$ prompt:

```
create/dir <openvms_device>:<openvms_directory>
define SAS$ROOT <openvms_device>:<openvms_directory>

where <openvms_device> is an OpenVMS device name and
<openvms_directory> is an OpenVMS directory specification.
```

2. Use the following command to set as default the SAS install directory which you created and defined in the preceding step:

```
set def <openvms_device>:<openvms_directory>
```

where <openvms_device> is the OpenVMS device that contains the SAS install directory and <openvms_directory> is the directory specification of the SAS install directory.

3. Insert the SAS installation disk in the CD-ROM drive of one of the base system AlphaServers.
4. Perform the installation steps described in the Invoking the Installation section of Chapter 2 of the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*.

After you have invoked the SAS install program with VMSINSTALL and responded to a series of prompts, the “Welcome to the SAS System Installation” screen is displayed. This screen is illustrated in Step 1 of the Performing the Install section of the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*.

Steps 2, 3, 8, and 9 of the Performing the Install section in the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045* illustrate the other screens that are displayed during a normal install of SAS software.

The Following the Install Process section in Chapter 2 of the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045* describes how to select fields on the install screens and navigate about the install screens.

The rest of this section describes the responses that you should make to each screen in the install sequence.

Welcome to the SAS System Installation Screen

This is the first screen that displays in the SAS Install program. It is illustrated in Step 1 of the Performing the Install section in the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*. While this screen is displayed, it is recommended that you select the Help option to display information on navigating between screens.

After returning from the Help screen, select Continue from the “Welcome to the SAS System Installation” screen to display the “View Media Contents” screen.

View Media Contents Screen

This screen is illustrated in Step 2 of the Performing the Install section in the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*. The contents of the SAS installation disk are listed on this screen.

Select Full Install and Continue from the “View Media Contents” screen to install the full contents of the installation disk and display the “Set Target Location” screen.

Set Target Location Screen

This screen is illustrated in Step 3 of the Performing the Install section in the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*. This screen contains a field for entering the disk and directory path in which you want to install SAS. After you have entered this path, the fully qualified path for the specified target location is displayed in a read-only field of this screen. If the fully qualified directory path is incorrect, you can press the Return key and respecify the disk and directory path in which you want to install SAS.

After you have entered the correct disk and directory path, select Continue from the “View Media Contents” screen. This displays the “Post-processing” Screen.

License the SAS System Screen

This screen is illustrated in the Other Installation Screens section of Chapter 2 in the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*. This screen is displayed after the "Set Target Location" Screen.

If the SETINT.SAS file has been prepared from a valid license provided by SAS, the file name and location of the SETINT.SAS file may be entered on the alternate license field of this screen. After entering the file name and location of the SETINT.SAS file, select Continue from the "License the SAS System" Screen.

If you prefer to supply the SAS licensing information at a later time, the alternate license field of this screen may be left blank. If the alternate license field is left blank, select Continue from the "License the SAS System" Screen. The following error message is displayed:

```
Proceeding WITHOUT valid license information!
```

The SAS install will continue without the valid license information, but SAS will not run until the valid license information is supplied.

Post-processing Screen

This screen is illustrated in Step 8 of the Performing the Install section in the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*. This screen is displayed after the "Set Target Location" Screen.

Select Skip from the "Post-processing" Screen.

Note

This screen is exited by selecting Skip because it is not necessary to set up any SAS interfaces; SAS can interface directly with Oracle Rdb7.

Successful Installation Screen

This screen is illustrated in Step 9 of the Performing the Install section in the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*. This screen is displayed after you enter "C" in response to the prompt for linking to the SAS/ACCESS Interface to ORACLE.

Select Enable Install Error Mail-back Routine and then select Continue from the "Successful Installation" Screen. This displays the "Post-processing" Screen.

Note

Selecting Enable Install Error Mail-back Routine creates an error file which is automatically emailed to SAS if errors occur in the installation. SAS can use the error file that they receive by e-mail to troubleshoot any conditions which may have led to the installation errors.

Other Installation Screens

The SAS install program may display screens other than those that are described in the preceding sections. When this happens, it indicates conditions which could lead to errors in the SAS install. These conditions can include insufficient disk space, the existence of previously installed SAS images, expired SAS licenses, and inadequate settings for SYSGEN parameters and AUTHORIZE quotas.

For more information on these screens, refer to the Other Installation Screens section in Chapter 2 of the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*. In addition to descriptions and illustrations of the screens, the Other Installation Screens section of the SAS Install manual contains suggestions for correcting the error conditions that caused the screens to display.

Licensing SAS After Installation

If the licensing information for SAS was not specified during the SAS install, it must be specified after the install; SAS cannot be run until it is licensed. The installation procedure will create the file SETINIT.SAS. The SETINIT.SAS file should be updated with the new license information provided with the software.

To license SAS after the SAS software install, do the following:

1. Type the SAS licensing information into the file SAS\$ROOT:[TOOLS]SETINIT.SAS.

Note

The licensing information must be entered exactly as it is presented on the hardcopy license document. The hardcopy license document is customarily provided with the SAS installation CD. However, it may also be sent by fax. If you receive the hardcopy license document by fax, examine the fax carefully before entering the licensing information in the SETINIT.SAS file; some of the licensing text may have been distorted during faxing.

2. Enter the following command from the \$ prompt:

```
SAS$ROOT : [ TOOLS ] SAS612 . COM
```

This command defines the SAS logicals.

3. Enter the following command from the \$ prompt:

```
SAS / SETINIT SAS$ROOT : [ TOOLS ] SETINIT . SAS
```

This command runs the SAS license script.

4. Review the SETINIT log file to verify that the SAS license processed without errors.

The SETINIT log file is at SAS\$ROOT:[TOOLS]SETINIT.LOG.

5. If the SETINIT log file shows errors, repeat steps 1 through 4 until the SETINIT log file shows that the SAS license processed without errors.

Note

When editing the SETINIT.SAS file, ensure that its contents are an exact match for the hardcopy license document.

When the SAS license script runs without errors, SAS can be run.

Adding SAS as a Known Image

After SAS has been licensed, it must be added as a known image.

For information on how to add SAS as a known image, refer to the Parameters for Installing the SAS image as a Known Image section in Chapter 3 of the *Installation Instructions and System Manager's Guide for the SAS System for OpenVMS Alpha, Release 6.12, TS045*.

System Installation and Setup

SAS Command Language Definition File Setup

SAS needs to have logicals setup in the System DCL tables. SAS has its own set of DCL commands defined in the file SAS\$ROOT:[IMAGE]SAS612.CLD. This is added by modifying the SYS\$COMMON:[SYSLIB]DCLTABLES.EXE with the install.

Find the existing DCL file used by the system, to get the correct DCL file updated. To do this enter the following commands from the \$ prompt:

```
INSTALL ::= $SYS$SYSTEM:INSTALL/COMMAND
INSTALL LIST SYS$COMMON:[SYSLIB]DCLTABLES
```

The following output should be displayed:

```
DISK$AXPVMSSYS:<SYS0.SYSCOMMON.SYSLIB>.EXE
DCLTABLES;72 Open Hdr Shar Lnkb1
```

Add SAS Logicals for Systemwide Access

Set up SAS logicals to be systemwide, used by user login.

To do this, enter the following commands from the \$ prompt:

```
SET COMMAND/TABLES =SYS$COMMON:[SYSLIB]DCLTABLES.EXE -
/OUTPUT=SYS$COMMON:[SYSLIB]DCLTABLES.EXE -
SAS$ROOT:[IMAGE]SAS612.CLD

INSTALL REPLACE SYS$COMMON:[SYSLIB]DCLTABLES.EXE
```

Then enter the following command from the \$ prompt to check the logicals that are set for SAS:

```
$ show logicals SAS*
```

Note

SAS execution command (VERB) is defined in the SAS CLD file running the IMAGE SAS\$IMAGE which is defined and setup in SAS\$ROOT:[TOOLS]SAS612.COM.

Verification of Connectivity Between SAS and Oracle Rdb7

The two methods for achieving connectivity between SAS and Oracle Rdb7 are SAS Pass-through and SAS/Access descriptors. Both methods should be working after the following have been done:

- SAS has been installed, licensed, and added as a known image.
- The SAS Command Language Definition File and systemwide SAS logicals have been set up.

Refer to the preceding sections of this chapter for more information on how to install SAS, license SAS, and add SAS as a known image. The preceding sections of this chapter also contain information on how to set up the SAS Command Language Definition File and set up systemwide SAS logicals.

Before Verifying the Connectivity between SAS and Oracle Rdb7

Before verifying the connectivity between SAS and Oracle Rdb7, do the following:

1. Create an Oracle Rdb7 database that contains a data table on which data selection can be performed.

2. Ensure that the default database logical SQL\$DATABASE points to the Oracle Rdb7 database that was created in step 1.
3. Verify the default database logical by entering the following command from the \$ prompt:

```
DIR SQL$DATABASE
```

The output from the above command should look similar to the following:

```
Directory ORACLE_BASE:[SYSTEM]
<database_name>;1
Total of 1 file
```

where <database_name> is the name of the database that was created in step 1.

4. Create a SAS library directory by entering the following command from the \$ prompt:

```
CREATE/DIR <device_specification>:[SAS.LIB]
```

where <device_specification> is an OpenVMS device specification.

Verifying Connectivity via SAS/Access Descriptors

To verify the SAS/Access Descriptors method of connectivity, do the following:

1. Run the following SAS/Access script, replacing “<device_specification>” with the OpenVMS device specification of the device on which the SAS library directory resides and “<database_table_name>” with a data table name from your database:

```
libname CPG '<device_specification>:[SAS.LIB]';
proc access dbms=rdb;
create cpg.<database_table_name>.access;
database = 'sql$database';
table = <database_table_name>;
create cpg.<database_table_name>.view;
select all;
run;
proc print;
```

2. Examine the output files from the script that you ran in step 1. The output files will be in the same directory as the SAS/Access script and will consist of a log file and a listing file (*.log and *.lis, where * is replaced with the prefix of the SAS/Access script filename).

If connectivity was successfully achieved via the SAS/Access Descriptors method, the *.lis file will contain the data selected from the specified data table. If connectivity was *not* successfully achieved via the SAS/Access Descriptors method, the *.log file will contain the errors from the execution of the SAS/Access script.

Verifying Connectivity via SAS Pass-through

To verify the SAS Pass-through method of connectivity, do the following:

1. Run the following SAS Pass-through script, replacing “<database_table_name>” with a data table name from your database:

```
proc sql;
connect to rdb (database=sql$database);
select * from connection to rdb (select * from <database_table_name>);
quit;
```

2. Examine the output files from the script that you ran in step 1. The output files will be in the same directory as the SAS Pass-through script and will consist of a *.log file and a *.lis file, where * is replaced with the prefix of the SAS Pass-through script filename.

System Installation and Setup

If connectivity was successfully achieved via the SAS Pass-through Descriptors method, the *.lis file will contain the data selected from the specified data table. If connectivity was *not* successfully achieved via the SAS Pass-through Descriptors method, the *.log file will contain the errors from the execution of the SAS Pass-through script.

Management Station Installation

If you have selected a Management Station, use the instructions in this section to install and configure the hardware and software on the management station and the software on the systems being managed.

Hardware Installation

Install the System Management Station hardware using the instructions in the *Quick Setup Guide* provided with your DIGITAL PC 5510 system.

Connect your system as shown in the *DIGITAL PC 3500/5510 System Reference* provided with your DIGITAL PC 5510 system.

Software Installation

This section describes how to install the Management Station software, including the operating system, the management applications installed on the management station, and the clients and agents installed on the systems to be managed.

Operating System Installation

The Windows NT Server operating system is included as Factory Installed Software on the DIGITAL PC 5510.

Windows NT Service Pack 3 (SP3) must also be installed on the DIGITAL PC 5510.

Service Pack Installation

Service packs are available from the following sources:

- A Microsoft reseller
- The Microsoft web page at: <http://www.microsoft.com>
- The Microsoft Order Desk in the United States at (800) 360-7561 between 6:30 A.M. and 5:30 P.M., Pacific time
- The Microsoft support page located at:
<ftp://ftp.microsoft.com/bussys/winnt>

Install Windows NT Service Pack 3 (SP3).

Note

Windows NT Service Pack 3 (SP3) *must* be installed after installing the operating system and after installing any applications.

5

Tests and Results

The DIGITAL HiTest program tests for several types of problems that affect the system. The HiTest program works together with other organizations to obtain and share test information for other categories.

This chapter describes the overview of test results, how the tests were set up, and where the data and programs were placed.

Also covered in this chapter is the test environment, tools used for testing, test configuration, test management, system limits and characterization data, and the test process.

Note

Testing was not performed on the maximum configuration of this HiTest Suite. For this reason, this chapter does not present any test results for the maximum configuration of this HiTest Suite.

Overview of Results

Interoperability testing was performed successfully on the SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite. Tests were performed to ensure the HiTest Suite met installability and interoperability criteria.

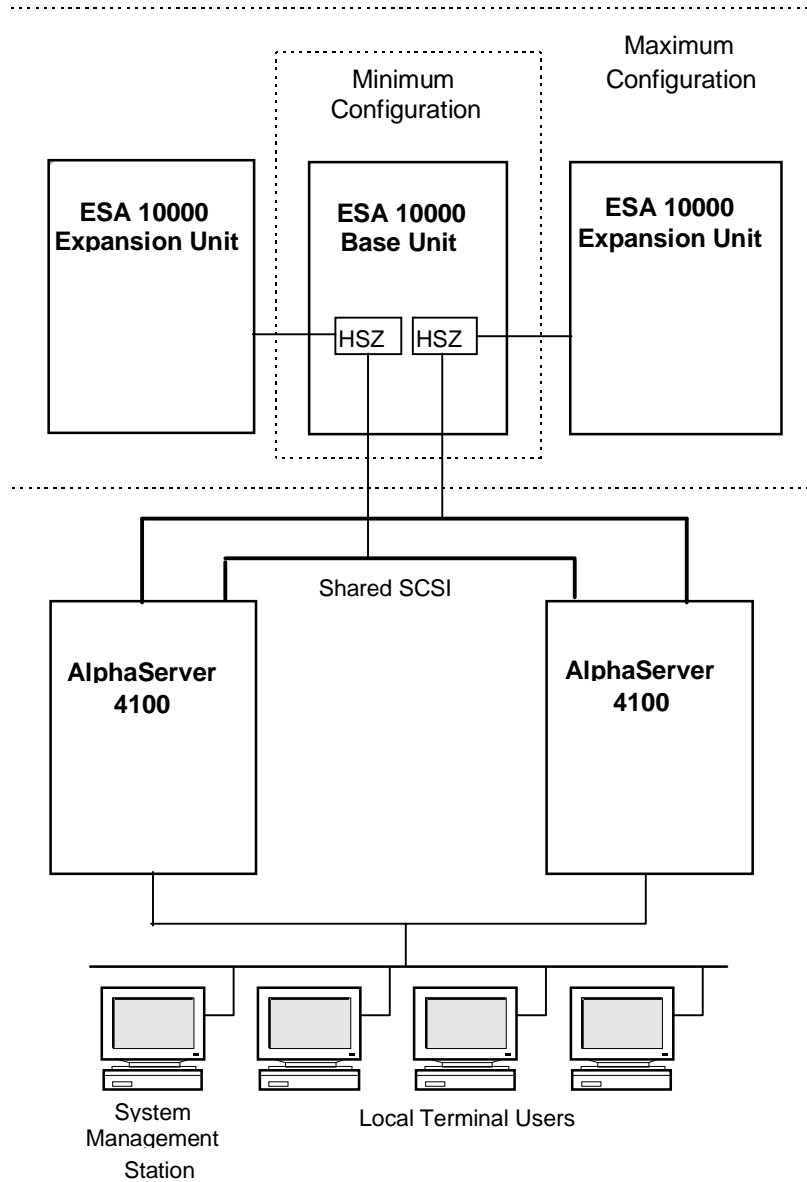
SQL scripts were run successfully against the data warehouse with some performance issues related to index usage.

The SAS/Oracle Rdb7 interface was exercised using the SAS descriptors method and the SAS/ACCESS pass-through method.

Test Environment

Figure 5-1 shows the SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 test environment.

Figure 5-1: Test Environment



Test Tools

The following tools were used for interoperability testing:

- CPG test scripts – These were the SQL scripts used for querying against the Consumer Packaged Goods (CPG) data warehouse model. Both the CPG test scripts and the CPG data warehouse model were provided by the Oracle Corporation. Refer to Appendix B for source code listings of the CPG test scripts.

- SAS Testing Scripts – Scripts for demonstrating connectivity to the Rdb7 database. The scripts that were used for this purpose are provided in Verification of Connectivity Between SAS and Oracle Rdb7 in Chapter 4.
- The CPG data generator – A C program with seed data files which was used to generate flat files containing the data for loading into the main data warehouse table (SALES_FACT).
- RMU – Rdb7 Management Utility used for loading the data and for managing and monitoring the database engine during the execution of queries and during database processing.
- Rdb7 SQL facilities – Queries were executed to test the creation of indexes related to the data warehouse.

Test Configuration

The test load was generated as follows:

1. The CPG data generator generated the flat files containing between 43 million and 200 million rows of test data.
2. The test data was in-turn loaded into the database.
3. SQL scripts were used to extract information from the database. The SQL scripts characterized questions comparing products of different markets, regions, states, and quantities.
4. SAS scripts were used to extract data from the Rdb7 database to prove connectivity and integration of Oracle Rdb7 and SAS. The scripts exercised the SAS interface with Oracle Rdb7.

The test database consisted of one year's worth of database data files which were partitioned in the database by month; there were 12 files with each file containing a different month's data. The data loading was FIFO (one month in/one month out).

Both single loading and parallel loading were used to populate the data tables.

Parallel loads were processed along data partitioning lines; one set of data files was generated with each file containing data for many months within the range of a year.

For single-load processing, a set of data files was generated with each file containing one month's worth of data.

Tests and Results

Minimum Configuration

The minimum configuration included 56 disks: 4 JBOD disks on each AlphaServer, 24 disks connected to the VMSSZ1-HSZ70 redundant disk controller as shown in Table 5-1, and 24 disks connected to the VMSSZ2-HSZ70 redundant disk controller as shown in Table 5-2.

Table 5-1: Disk Configuration for the Minimum Configuration (VMSSZ1-HSZ70 Disk Controller)

Disk Drive Group Name	Number of Disk Drives	Disk Drive Port	Disk Drive Target	Disk Drive Lu	Disk Drive Content and Data	Group Type	Usable Capacity
DATA1	6	1 2 3 4 5 6	0 0 0 0 0 0	0 0 0 0 0 0	Rdb7 Datafile (data tables)	RAID 5	21.5 GB
INDEX1	6	1 2 3 4 5 6	1 1 1 1 1 1	0 0 0 0 0 0	Rdb7 Datafile (Index tables)	RAID 5	21.5 GB
SORT1	6	1 2 3 4 5 6	2 2 2 2 2 2	0 0 0 0 0 0	Rdb7 Datafile (Sort Temp tables)	RAID 5	21.5 GB
SAS/ORACLE	3	1 2 3	3 3 3	0 0 0	Rdb7 Datafile (data tables)	RAID 5	8.6 GB
SYSTEM Alpha	1	4	3	3	VMS SYSTEM	JBOD	4.3 GB
SPARESET	2	5 6	3 3	0 0	Hot Replacement	N/A	8.6 GB
Usable Total: 86.0 GB							

Table 5-2: Disk Configuration for the Minimum Configuration (VMHSZ2-HSZ70 Disk Controller)

Disk Drive Group Name	Number of Disk Drives	Disk Drive Port	Disk Drive Target	Disk Drive Lu	Disk Drive Content and Data	Group Type	Usable Capacity
DATA2	6	1 2 3 4 5 6	0 0 0 0 0 0	0 0 0 0 0 0	Rdb7 Datafile (data tables)	RAID 5	21.5 GB
INDEX2	6	1 2 3 4 5 6	1 1 1 1 1 1	0 0 0 0 0 0	Rdb7 Datafile (Index tables)	RAID 5	21.5 GB
SORT2	6	1 2 3 4 5 6	2 2 2 2 2 2	0 0 0 0 0 0	Rdb7 Datafile (Sort Temp tables)	RAID 5	21.5 GB
SAS Set Space	3	1 2 3	3 3 3	0 0 0	Rdb7 Datafile (SAS Dataset files)	RAID 5	8.6 GB
SPARESET	3	4 5 6	3 3 3	0 0 0	Hot Replacement	N/A	12.9 GB
Usable Total: 86.0 GB							

Maximum Configuration

The maximum configuration included 148 disks: 4 JBOD disks on each AlphaServer, 72 disks connected to the VMSSZ1-HSZ70 redundant disk controller as shown in Table 5-3, and 72 disks connected to the VMSSZ2-HSZ70 redundant disk controller as shown in Table 5-4.

Note

Testing was not performed on the maximum configuration of this HiTest Suite.

Table 5-3: Disk Configuration for the Maximum Configuration (VMSSZ1-HSZ70 Disk Controller)

Disk Drive Group Name	Number of Disk Drives	Disk Drive Port	Disk Drive Target	Disk Drive Lu	Disk Drive Content and Data	Group Type	Usable Capacity
DATA1	6	1	0	0	Rdb7 Datafile (data tables)	RAID 5	21.5 GB
		2	0	0			
		3	0	0			
		4	0	0			
		5	0	0			
		6	0	0			
INDEX1	6	1	1	0	Rdb7 Datafile (Index tables)	RAID 5	21.5 GB
		2	1	0			
		3	1	0			
		4	1	0			
		5	1	0			
		6	1	0			
SORT1	6	1	2	0	Rdb7 Datafile (Sort Temp tables)	RAID 5	21.5 GB
		2	2	0			
		3	2	0			
		4	2	0			
		5	2	0			
		6	2	0			
SAS/ORACLE	3	1	3	0	Rdb7 Datafile (data tables)	RAID 5	8.6 GB
		2	3	0			
		3	3	0			
SYSTEM Alpha	1	4	3	0	VMS SYSTEM	JBOD	4.3 GB
SPARESET	2	5	3	0	Hot Replacement	N/A	8.6 GB
		6	3	0			
DATA3	6	1	8	0	Rdb7 Datafile (Index tables)	RAID 5	21.5 GB
		2	8	0			
		3	8	0			
		4	8	0			
		5	8	0			
		6	8	0			

Tests and Results

Disk Drive Group Name	Number of Disk Drives	Disk Drive Port	Disk Drive Target	Disk Drive Lu	Disk Drive Content and Data	Group Type	Usable Capacity
INDEX3	6	1 2 3 4 5 6	9 9 9 9 9 9	0 0 0 0 0 0	Rdb7 Datafile (Sort Temp tables)	RAID 5	21.5 GB
SORT3	6	1 2 3 4 5 6	10 10 10 10 10 10	0 0 0 0 0 0	Rdb7 Datafile (Sort Temp tables)	RAID 5	21.5 GB
ESTORAGE1	6	1 2 3 4 5 6	11 11 11 11 11 11	0 0 0 0 0 0	Rdb7 Datafile (Sort Temp tables)	RAID 5	21.5 GB
DATA4	6	1 2 3 4 5 6	12 12 12 12 12 12	0 0 0 0 0 0	Rdb7 Datafile (Data tables)	RAID 5	21.5 GB
INDEX4	6	1 2 3 4 5 6	13 13 13 13 13 13	0 0 0 0 0 0	Rdb7 Datafile (Index tables)	RAID 5	21.5 GB
SORT4	6	1 2 3 4 5 6	14 14 14 14 14 14	0 0 0 0 0 0	Rdb7 Datafile (Sort/Temp tables)	RAID 5	21.5 GB
ESTORAGE2	3	1 2 3	15 15 15	0 0 0	Extra Storage Area	RAID 5	8.6 GB
SPARESET	3	4 5 6	15 15 15	0 0 0	Hot Replacement	N/A	12.9 GB
Usable Total: 258.0 GB							

Tests and Results

Table 5-4: Disk Configuration for the Maximum Configuration (VMHSZ2-HSZ70 Disk Controller)

Disk Drive Group Name	Number of Disk Drives	Disk Drive Port	Disk Drive Target	Disk Drive Lu	Disk Drive Content and Data	Group Type	Usable Capacity
DATA2	6	1 2 3 4 5 6	0 0 0 0 0 0	0 0 0 0 0 0	Rdb7 Datafile (data tables)	RAID 5	21.5 GB
INDEX2	6	1 2 3 4 5 6	1 1 1 1 1 1	0 0 0 0 0 0	Rdb7 Datafile (Index tables)	RAID 5	21.5 GB
SORT2	6	1 2 3 4 5 6	2 2 2 2 2 2	0 0 0 0 0 0	Rdb7 Datafile (Sort Temp tables)	RAID 5	21.5 GB
SASSET SPACE	3	1 2 3	3 3 3	0 0 0	SAS Set Space	RAID 5	8.6 GB
SPARESET	6	4 5 6	3 3 3	0 0 0	Hot Spare Replacements	N/A	21.5 GB
DATA5	6	1 2 3 4 5 6	8 8 8 8 8 8	0 0 0 0 0 0	Rdb7 Datafile (Data tables)	RAID 5	21.5 GB
INDEX5	6	1 2 3 4 5 6	9 9 9 9 9 9	0 0 0 0 0 0	Rdb7 Datafile (Index tables)	RAID 5	21.5 GB

Disk Drive Group Name	Number of Disk Drives	Disk Drive Port	Disk Drive Target	Disk Drive Lu	Disk Drive Content and Data	Group Type	Usable Capacity
SORT5	6	1	10	0	Rdb7 Datafile (Sort Temp tables)	RAID 5	21.5 GB
		2	10	0			
		3	10	0			
		4	10	0			
		5	10	0			
		6	10	0			
ESTORAGE3	6	1	11	0	Extra Storage Datafile	RAID 5	21.5 GB
		2	11	0			
		3	11	0			
		4	11	0			
		5	11	0			
		6	11	0			
DATA6	6	1	12	0	Rdb7 Datafile (Data Disk tables)	RAID 5	21.5 GB
		2	12	0			
		3	12	0			
		4	12	0			
		5	12	0			
		6	12	0			
INDEX6	6	1	13	0	Rdb7 Datafile (Index tables)	RAID 5	21.5 GB
		2	13	0			
		3	13	0			
		4	13	0			
		5	13	0			
		6	13	0			
SORT6	6	1	14	0	Rdb7 Datafile (Sort/Temp tables)	RAID 5	21.5 GB
		2	14	0			
		3	14	0			
		4	14	0			
		5	14	0			
		6	14	0			
ESTORAGE4	3	1	15	0	Extra Storage space	N/A	8.6 GB
		2	15	0			
		3	15	0			
SPARESET	3	4	15	0	Hot Spare Replacements	N/A	12.9 GB
		5	15	0			
		6	15	0			
Usable Total: 266.6 GB							

Test Management

The HiTest configuration was managed using OpenVMS Management Station; the tests were managed by running SQLs and SAS Queries using the X-terminals and by manual processing. There were no automated testing tools used for suite testing.

Test Process and Results

Testing was performed to verify the interoperability of Oracle Rdb7 with the Foundation Hardware and Foundation software of this HiTest Suite and to verify the interoperability of the SAS System with Oracle Rdb7.

Test Database Structure

For the testing of this HiTest Suite, DIGITAL HiTest Engineering used data from the Consumer Packaged Goods (CPG) Database which is provided by Oracle Corporation. The CPG Database represents typical marketing and sales data for a consumer products manufacturing firm. The data includes one year of sales data in a star schema data warehouse optimized for decision support.

The CPG database, constructed with Oracle Rdb7, consisted of six tables:

- SALES_FACTS table, which consists of the bulk of the database
- Five dimension tables: CHANNEL, DAILY_PERIOD, MONTHLY_PERIOD, MARKET, and PRODUCT

Table 5-5 shows the five table spaces in the CPG database:

Table 5-5: CPG Database

Table Space	Contents	Size
FACTS	SALES_FACTS Table 12 data files (varying sizes)	64,140,000 rows
FACTSINDEX	SF_KEY Index on SALES_FACTs Table 12 data files	64,140,000 rows
DIMENSION	1 Data File Dimension Tables: CHANNEL DAILY_PERIOD MONTHLY_PERIOD MARKET PRODUCT	10 MB 20 rows 2182 rows 365 rows 1002 rows 522 rows
DIMINDEX	1 Data File Index for Dimension Tables	10 MB

Each table storage area was created using the CREATE STORAGEAREA command. The data table storage files were mapped using RDB storage map specifications; data partitioning was by month, with one month allocated to a each storage area.

Tablespace Configurations

Both the FACTS and FACTSINDEX tablespaces use the storage parameters shown in Table 5-6. The FACTS tablespace contains the SALES_FACT table, which is populated using RMU loader. The initial extent was set to 1000 pages to limit this unusable space. As shown in Table 5-6, the only difference between the tablespace configurations between the maximum and minimum configurations is the datafile size.

Table 5-6: Database Tablespace Storage Parameters

Storage Parameters	FACTS	FACTSINDEX	TEMP (Allocated)
Max Raw Disk space available (Max. Configuration)	154.8 GB	154.8 GB	154.8 GB
(Min. Configuration)	51 GB	51.6 GB	51.6 GB
6 Disk Sets Raid 5 Multiple of (85%) (Max. Configuration)	131.58 GB	131.58 GB	131.58 GB
(Min. Configuration)	43.86 GB	43.86 GB	43.86 GB
Max Datafile size (12 files 1/month) (Max. Configuration)	10.96 GB	10.96 GB	N/A
(Min. Configuration)	3.65 GB	3.65 GB	N/A
Page Size	32 K	32 k	N/A
Initial Allocation	1000 pages	1,000 pages	N/A
Note: To decrease unused data block space, Snap files can be minimized for read only which is desirable in data warehouses due to the read-only and bulk-update nature of the environment.			

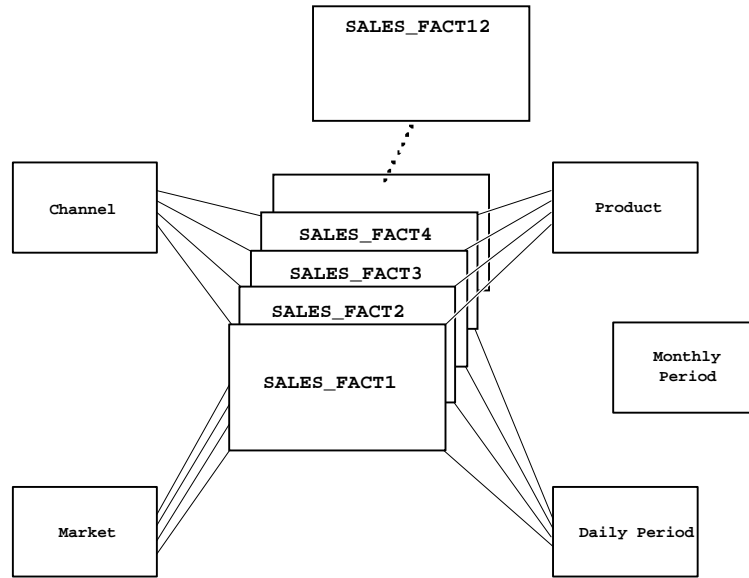
Tablespace Creation

Initial database layout was setup with one datafile per month of data. Storing one years worth of data required 12 datafiles or storage areas for the FACTS data table and 12 datafiles for the index storage areas. The initial allocation of the datafiles was 1000 Pages for the Minimum configuration database.

Maximum database file configuration was not implemented although the architecture was the same with the file allocations spread across six raid disks rather than two. Refer to the previous table. In Rdb7, the CREATE STORAGEAREA command is a serial function due to data dictionary lock requirements. Each table storage area (12 files for the FACTS table) and (12 for the associated index) were created serially. The data table storage files were mapped using RDB storage map specifications. This partitioned the data by month allocating one month to a file. Data warehouses tend to implement a FIFO data processing method roll new data in and roll old data out, “One month of data in/one month of data out.” Additional Storage areas were created for maintaining CPG facts table related tables. The tables contain data which could be considered index keys of the FACTS table although there are no actual constraints binding the supporting tables to the Facts table as foreign key joins or data constraint rules.

Figure 5-2 shows the architecture of the database implementation.

Figure 5-2: Architecture of the Database Implementation



Note

The key to the extensibility of the database is in providing additional buffers for database storage areas using the command `RESERVE n STORAGE AREAS` in the create database parameters. These reserved buffer areas can be used later for dynamically expanding the database or spreading the database out across more disks. This allocation allows you to add disks and expand to the maximum without requiring the recreation of the database.

The plan for expanding the minimum configuration to the maximum configuration was to reorganize the facts table by adding four additional storage areas for data, four for index and extra free disk space for temporary sort/temp space. The FACTS table would be remapped to spread the 12 files allocated to two storage areas in the minimum configuration to six storage areas for the maximum. This would spread two FACTS table data files to each of six DATA disks for a total of 12 files. The existing minimum facts table setup of two storage areas would be re-mapped to contain two files each.

As shown in Table 5-7, the resultant database consists of five tablespaces with the specified row counts used for testing.

Table 5-7: Oracle7 Database, Minimum Configuration

Tablespace	Contains	Row Count
FACTS	SALES_FACTS Table 12 Data Files	64,140,000
FACTSINDEX	SF_KEY Index on SALES_FACTs Table 12 Data Files	64,140,000
DIMENSION	1 Data File, Dimension Tables: CHANNEL DAILY_PERIOD MARKET PRODUCT DAILY_PERIOD	10 MB 20 rows 2182 rows 1002 rows 522 rows 108 rows
DIMINDEX	1 Data File Index for Dimension Tables	10 MB

Test Procedure

The testing of Oracle Rdb7 in this HiTest Suite was performed in the following sequence of steps:

1. Creation of the database.
2. The CPG data generator generated the flat files containing the test data.
3. The test data was in-turn loaded into the database.
4. Creating the Index
5. Executing the queries

The rest of this section describes these functions in the order performed.

Step 1: Creation of the database

The database schema file was created and adjusted to prepare for the database creation. Symbols and logicals were setup to define the context of where the database files and programs would reside.

Step 2: Generation of the test data

The database data was generated from a C program producing flat load files. The load files were loaded using the RMU load utility. The datafiles were generated originally to have one month of data in each file for 12 files. With each file being one month and the database being laid out with storage areas containing one months of data, the load operations could only run in SERIAL loading one file at a time. The second time flat files were generated, they were setup to take advantage of the parallel load process by placing contiguous records that crossed the month partitioning lines. This forced the load process to start Executor threads for each datafile receiving data during the load.

Tests and Results

Step 3: Loading the database

Data was loaded into the SALES_FACT table of the CPG database using the Rdb7 RMU SQL Loader. Both the serial and parallel methods of data loading were used. Serial loading tested the load of 40 millions rows, and 200 million rows respectively. The loads were performed separately.

Serial Data Loading

In the serial method of data loading, one flat file of 39 million rows was loaded through RMU for a single data partition. The rate of CPU utilization was 94% during serial data loading. As shown in Table 5-8, the serial data load took 2 hours, 22 minutes, 1 second at an average loading rate of 277,843 rows per minute.

Parallel Data Loading

In the parallel method of data loading, one flat file of 210 million rows was loaded with 1 manager and 12 executors with 95% CPU utilization. As shown in Table 5-8, the parallel data load took 10 hours, 10 minutes, 3 seconds at an average loading rate of 349,514 rows per minute.

Table 5-8: Facts Database Load Rates

Data Files	Rows	Time	Rows/Minute	Load Scenario
FACTS_1	39453750	02:22:01	277843	Serial Load, 1 manager, 1 executor
FACTS_1	215000000	11:47:31	349514	Parallel Load, 1 manager, 12 executors.

Step 4: Creating the Index

Index creation was performed for 64,100,000 rows of data from the SALES_FACT table of the database.

Note

Index creation times are unavailable.

The following CREATE INDEX statement was used:

```
create unique index SF_KEY
on SALES_FACT
(TRANS_DAY asc,
PRODUCT_ID asc,
CHANNEL_ID asc,
MARKET_ID asc)
type is SORTED
node size 960
usage query
enable compression
store using (TRANS_DAY)
in CPG_FACTS_INDEX_MNTH1 with limit of ('01-FEB-1997')
in CPG_FACTS_INDEX_MNTH2 with limit of ('01-MAR-1997')
in CPG_FACTS_INDEX_MNTH3 with limit of ('01-APR-1997')
in CPG_FACTS_INDEX_MNTH4 with limit of ('01-MAY-1997')
in CPG_FACTS_INDEX_MNTH5 with limit of ('01-JUN-1997')
in CPG_FACTS_INDEX_MNTH6 with limit of ('01-JUL-1997')
```

```

in CPG_FACTS_INDEX_MNTH7 with limit of ('01-AUG-1997')
in CPG_FACTS_INDEX_MNTH8 with limit of ('01-SEP-1997')
in CPG_FACTS_INDEX_MNTH9 with limit of ('01-OCT-1997')
in CPG_FACTS_INDEX_MNTH10 with limit of ('01-NOV-1997')
in CPG_FACTS_INDEX_MNTH11 with limit of ('01-DEC-1997')
in CPG_FACTS_INDEX_MNTH12 with limit of ('01-JAN-1998') ;

```

Step 5: Executing the Queries

The test queries exercised the functionality of the RDBMS server and SQL. The query script listings are shown in Appendix B.

Queries were executed sequentially and in parallel as described in the Oracle Database Tests section. All queries returned results grouped by month. The queries were executed from the SQL utility prompt (SQL>). The following commands were used to display the SQL prompt and execute queries:

```
$ SQL
```

```
SQL>@<query_name>
```

where <query_name> is the name of the query.

This generated an output file and a log file upon completion. The log file contained any errors or error messages. The list file contained the data.

Refer to the Test Queries section for descriptions of each of the five queries.

Refer to the Test Results section for the results of query tests.

Test Queries

The test queries were designed to emulate typical decision support questions about the historical activity of a product sales environment. In most cases, the results of the queries would be used to generate sales trends. All queries returned results grouped by month.

This section contains descriptions of all of the queries used in the testing of this HiTest Suite. Appendix B contains listings of the query scripts.

Query 1

Query 1 asked *“What was the product share of a specific brand of cereal as compared to other cereals in the same product category, in a particular state in a particular type of store.”* The information was grouped by month to show market trends.

The business question asked was *“How did 20 oz. Wheat Flakes do in 1995 as compared to all types of wheat flakes in supermarkets in the state of Connecticut?”*

Query 2

Query 2 compared the sales of a specific product, in a particular outlet in a region, against the sales of the same product through all channel outlets. The information was grouped by month to show market trends.

The business question asked was *“What percentage of sales of 15 oz. Wheat Flakes were made in the Safeway stores in NY and PA as compared to all outlets in the NY and PA areas?”*

Query 3

Query 3 compared the market share of a product in a particular type of store, in a particular market location, to sales of all types of outlets in the region. The information was grouped by month to show market trends.

Tests and Results

The business question asked was *“How are 10 oz. Wheat Flakes doing in convenience stores in Bridgeport Connecticut as compared to the entire northeast region?”*

Query 4

Query 4 compared the market share of a particular product, in a particular type of store, in a particular market location to all sales of competitive products in the same market location. The information was grouped by month to show market trends.

The business question asked was *“What was the market share of 20 oz. Wheat Flakes in Connecticut supermarkets in 1995?”*

Query 5

Query 5 compared the product share of a given product, combining several areas, to total sales across the same areas.

The business question asked was *“What was the market share of 20 oz. Wheat Flakes across 10 test market areas”*

Oracle Database Tests

Due to time constraints and problems with index creation and data loading, testing was limited to running a single set of sequential queries (SQL joins). All five of the queries described in the Test Queries section were executed. The queries were executed in cold-cache mode. Refer to the Test Results section for a description of the test results of the Oracle Database Tests.

SAS System Database Tests

Functional testing of SAS consisted of interactive script execution where the interactive mode used the X-windows display manager and vt100 terminal mode. The scripts attempted to retrieve data from the CPG database via SAS descriptors and SAS/ACCESS using the pass-through mode. The test scripts were designed to test SAS capabilities for forecasting and data modeling.

Due to gaps in the CPG database data, it was not possible to generate forecasts by running the SAS test scripts. However, by running the SAS test scripts the interoperability of SAS with Oracle Rdb7 was verified.

Test Results

The Oracle Rdb7 test consisted of five sequential queries (SQL joins). The queries were executed in cold-cache mode and the results of the queries are listed in Table 5-9.

Table 5-9: Performance Results for Test One, Minimum Configuration

Minimum Configuration (64100000 Rows)	
	1 USER
	Cold Cache
Query 1	3:01:54 Hours
Query 2	00:49:25 min
Query 3	01:18:09 hours
Query 4	03:14:05 hours
Query 5	03:51:40 hours

Due to gaps in the CPG database data, there are no test results for the SAS tests. However, by running the SAS test scripts the interoperability of SAS with Oracle Rdb7 was verified.

6

Problems and Solutions

This chapter describes problems encountered during the testing. Where appropriate, a solution for each problem is given which provides a fix or workaround. An impact statement is also provided.

Foundation Hardware

No problems were encountered.

Foundation Software

No problems were encountered.

AppSet Software

The following problems were identified:

Queries Cannot Run Simultaneously on Both Nodes

Problem	An error message was produced when there was an attempt to execute SQL statements from both nodes at the same time due to licensing issues.
Impact	Queries can be run from either node, but not simultaneously.
Solution	If there are plans to perform database queries on multiple nodes at the same time, Oracle Rdb7 database licenses must be purchased for each node to be used.

Note

This does not affect failover and availability of the database server. Cluster service management provides high availability by moving services from a failed cluster node to another good node. The single node license supports this facility, allowing the database services to run on both systems providing availability and failover capability.

SQL/Services Installation Verification Procedure Fails

Problem	After running the installation procedure for Oracle Rdb7 SQL/Services, the final Installation step, Installation Verification Procedure (IVP) failed to verify the installation. This was due to the database server being shutdown before installation.
Impact	To run IVP for Oracle Rdb7 SQL/Services, the Rdb7 database server must be running.
Solution	<p>Do not shutdown the Rdb7 database server during the install of Oracle Rdb7 SQL/Services; some users shut down the Rdb7 database server by mistake when a list of running database processes, and a prompt for continuing the install, is displayed by the install program. For the Oracle Rdb7 SQL/Services IVP to run successfully, the Rdb7 database server must be running.</p> <p>If your not sure that the Rdb7 database server is running, execute the following command at the \$ prompt:</p> <pre>@SYS\$COMMON:[SYS\$STARTUP]RMONSTART70</pre> <p>This will start the database server if it is not running, or indicate that the data server is already running.</p>

Insufficient Space Allocated for Load Files

Problem	There was not enough space allocated for storing load files on the system. Temp and Sort space was allocated but was used as temporary sort space for index processing and query processing.
Impact	If load files were placed in the allocated Temp/Sort space, they must be removed from the system before index creation begins.
Solution	When specifying disk usage and disk space allocation, provide additional empty space for load file storage. There should be enough space to allow for at least the largest file, if not a set of files.

Date Format Incompatibility

Problem	UNIX dates and date data are incompatible with VMS dates and cannot be loaded using RMU.
Impact	UNIX dates, or dates with only day; month; and year require conversion before being loaded using RMU.
Solution	When preparing to load date data into an Rdb7 database, convert the date data containing only day; month; and year to native VMS date format before loading the date data using RMU. For example, the UNIX date 10/1/98 converts to the VMS date [10-JAN-1998 00:00:00.00].

VMS Dates Cannot Be Used for Joins

Problem	VMS dates containing date fields and time fields cannot be used for doing joins on the basis of date.
Impact	Queries using date comparisons for joins must match times, as well as dates, for the join to be successful. An alternative to matching both the time and date is to modify the query to cast the time fields in the dates.
Solution	When creating a join using dates and the time is not to be used you must cast the dates using the following command join specification in the where clause: <pre>AND CAST(AL5.TRANS_DAY AS DATE ANSI) = CAST(AL2.TRANS_DAY AS DATE ANSI))</pre> <p>The above specification will cast the VMS date/time fields to date only; matching would view the dates as (12/01/98 = 12/01/98) rather than (12-dec-1998 01:01:01.00 = 12-dec-1998 01:01:01.00) where the times must match for the join to be successful.</p>

Note

Casting impacts performance of the query. An alternative to casting is to store the date as a string and use matching at that level. This effectively bypasses the dates functionality provided by the database.

Insufficient Contiguous Disk Space is Allocated for Sort Work Files

Problem	The disk layout of the temp/sort space allocated for database processing and sorts was not contiguous. There was enough space allocated for sorts, but the disks were not set up as a single disk as required for VMS Sort Utility workfile usage.
Impact	Index creation fails after many hours of index creation.
Solution	To solve this problem, you can either create a RAIDset large enough to store all the data of your largest table or, after allocating multiple disks, mount the disks with binding to bind the multiple disks together in a logical specification. <p>To bind the disks, use a command similar to the following:</p> <pre>\$ MOUNT/CLUSTER/BIND=SORTDISK \$1\$DKC200:,\$1\$DKD200: SORT1,SORT2</pre> <p>Be sure to add this command to your clusterwide disk mounting command file. Subsequent Mountings must be specified in the same manner. Otherwise, mounting and dismounting of the associated disks will have problems.</p> <p>After mounting the Disk, allocate sort work files to the new disk using commands similar to the following:</p> <pre>create/directory \$1\$DKC200:[WORKSPACE] create/directory \$1\$DKD200:[WORKSPACE] defsys RDMS\$BIND_SORT_WORKFILES 2 defsys RDB_BIND_SORT_WORKFILES 2 ASSIGN \$1\$DKC200:[WORKSPACE] SORTWORK0 ASSIGN \$1\$DKD200:[WORKSPACE] SORTWORK1</pre>

System Management Station

No problems were encountered.

7

Detailed Hardware Configuration

This chapter describes the minimum and maximum hardware configuration for the SAS Oracle Rdb7 OpenVMS AlphaServer 4x00 HiTest Suite by providing the following:

- System Diagram
- HiTest System Slot Configurations
- AlphaServer 4100 PCI Slot Usage
- Database Storage Maps

System Diagram

Figure 7-1 shows a diagram of the maximum configuration of this HiTest Suite and Table 7-1 lists the major cables.

Figure 7-1: System Diagram

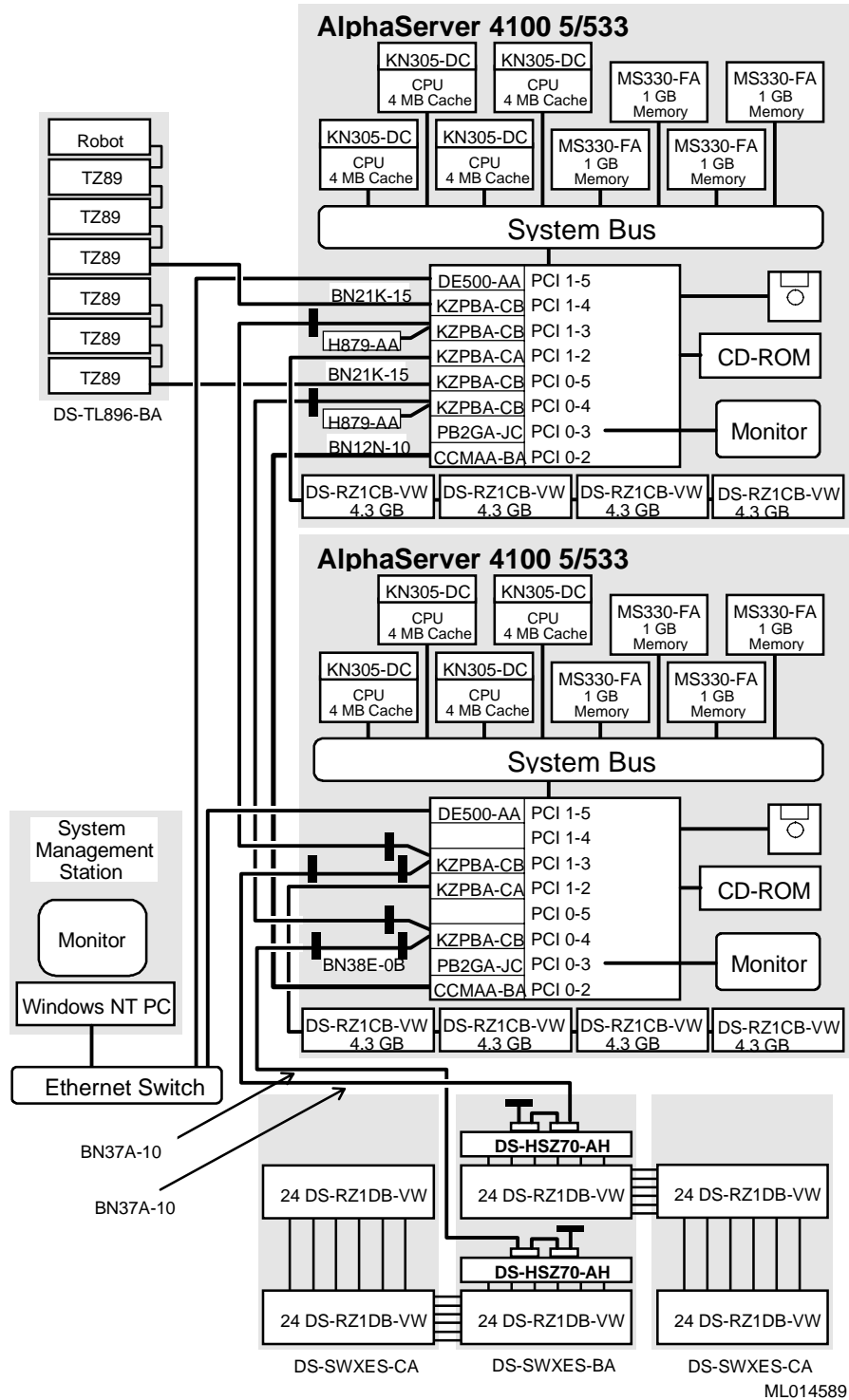


Table 7-1: Configuration Cabling

Part Number	Qty	Description	From	To
BN21K-15	2	15 M SCSI Cable	PCI SCSI Controller (KZPBA-CB)	Tape Library (DS-TL896-BA)
BN12N-10	1	Memory Channel Cable	PCI-to-Memory Channel Controller in AlphaServer 1 (CCMAA-BA)	PCI-to-Memory Channel Controller in AlphaServer 2 (CCMAA-BA)
BN38E-0B	2	VHDCI Female to 68HD Male	PCI SCSI Controller in AlphaServer 2 (KZPBA-CB)	Ultra 70 SCSI Controller (DS-HSZ70-AH)
BN37A-10	2	Ultra 68VHD 10 M Cable	PCI SCSI Controller in AlphaServer 2 (KZPBA-CB)	Ultra 70 SCSI Controller (DS-HSZ70-AH)
BN25G-07	2	Ethernet Twisted Pair Cable	DE500-AA Network Interface	Local Area Network (LAN)

HiTest System Slot Configurations

Figure 7-2 shows the HiTest System Slot Usage and Table 7-2 describes the minimum and maximum hardware configurations used in this HiTest Template.

Figure 7-2: HiTest System Slot Usage

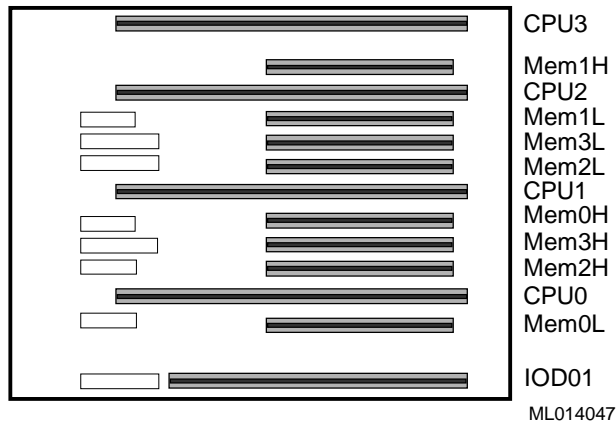


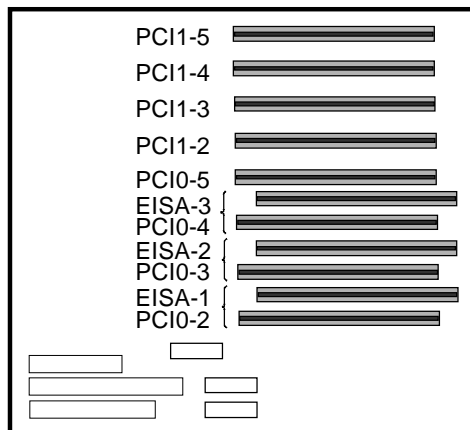
Table 7-2: System Slot Usage (Minimum and Maximum Configurations)

Slot	Minimum Configuration Options	Maximum Configuration Options	Description
CPU3	–	KN305-DC	5/533-MHz CPU with 4-MB cache (upgrade)
Mem1H	Memory Option	MS330-FA	Memory Option
CPU2	–	KN305-DC	5/533-MHz CPU with 4-MB cache (upgrade)
Mem1L	Memory Option	MS330-FA	MS330-CA, MS330-EA, MS330-FA, or MS330-FA
Mem3L	Memory Option	Memory Option	MS330-CA, MS330-EA, MS330-FA, or MS330-FA
Mem2L	–	–	–
CPU1	KN305-DC	KN305-DC	5/533-MHz CPU with 4-MB cache (upgrade)
Mem0H	MS330-EA	MS330-FA	Memory Option
Mem3H	–	Memory Option	MS330-CA, MS330-EA, MS330-FA, or MS330-FA
Mem2H	–	Memory Option	MS330-CA, MS330-EA, MS330-FA, or MS330-FA
CPU0	KN305-DB	KN305-DB	5/533-MHz CPU with 4-MB cache
Mem0L	MS330-EA	MS330-EA	512 MB Memory
IOD01	–	–	–

AlphaServer 4100 PCI Slot Usage

Figure 7-3 and Table 7-3 show the PCI slot usage for the minimum and maximum configurations of this HiTest Template.

Figure 7-3: AlphaServer 4100 PCI Slot Usage



ML013980

Table 7-3: PCI Slot Usage (Minimum and Maximum Configurations)

Slot	Minimum Configuration Options	Maximum Configuration Options	Description
PCI1-5	DE500-AA	DE500-AA	Network interface Card
PCI1-4	KZPBA-CB	KZPBA-CB	SCSI Shared Buss Disk Storage
PCI1-3	KZPBA-CB	KZPBA-CB	SCSI Shared Buss Disk Storage
PCI1-2	KZPBA-CA	KZPBA-CA	SCSI Local Disk Storage
PCI0-5	—	—	—
EISA-3/PCI0-4	KZPBA-CB	KZPBA-CB	SCSI Shared Buss Disk Storage
EISA-2/PCI0-3	PB2GA-JC	PB2GA-JC	Monitor Interface
EISA-1/PCI0-2	CCMAA-BA	CCMAA-BA	Memory Channel

Database Storage Maps

The following tables map each OpenVMS device name to the HSZ physical devices in each RAIDset (RAID 5).

In Tables 7-4 through 7-7, the HSZ Container Names that use the “Rn” naming scheme are RAIDset names. For example, “R1” is RAIDset 1, “R2” is RAIDset 2, and so on.

Table 7-4: Database Storage Map for VMSHSZ1

OpenVMS Device Name	Volume Label	Volume Description	HSZ LUN	HSZ Container Name	HSZ Physical Devices	Chunk Size (blocks)
\$1\$DKC0	DATA1	Data Disk	D0	R1	DISK10000 20000 30000 40000 50000 60000	256
\$1\$DKC1	AXPVMSSYS	OpenVMS System Disk	D1	D1	DISK40300	256
\$1\$DKC100	INDEX1	Index Disk	D100	R2	DISK10100 20100 30100 40100 50100 60100	256
\$1\$DKC200	SORT1	Sort/Temp Disk	D200	R3	DISK10200 20200 30200 40200 50200 60200	256
\$1\$DKC300	SASORACLE	SAS/Oracle Executable Disk	D300	R4	DISK10300 20300 30300	256
—	—	—	—	SPARESET	DISK50300 60300	256

Detailed Hardware Configuration

Table 7-5: Database Storage Map for VMSSH2Z

OpenVMS Device Name	Volume Label	Volume Description	HSZ LUN	HSZ Container Name	HSZ Physical Devices	Chunk Size (blocks)
\$1\$DKD0	DATA2	Data Disk	D0	R1	DISK10000 20000 30000 40000 50000 60000	256
\$1\$DKD100	INDEX2	Index Disk	D100	R2	DISK10100 20100 30100 40100 50100 60100	256
\$1\$DKD200	SORT2	Sort/Temp Disk	D200	R3	DISK10200 20200 30200 40200 50200 60200	256
\$1\$DKD300	SASSET	SAS Data Set Disk	D300	R4	DISK10300 20300 30300	256
–	–	–	–	SPARESET	DISK40300 50300 60300	256
–	–	–	–	FAILEDSET	None	256

Table 7-6: Database Storage Map for VMSSHZ1

OpenVMS Device Name	Volume Label	Volume Description	HSZ LUN	HSZ Container Name	HSZ Physical Devices	Chunk Size (blocks)
\$1\$DKC0	DATA1	Data Disk	D0	R1	DISK10000 20000 30000 40000 50000 60000	128
\$1\$DKC1	AXPVMSSYS	OpenVMS System Disk		D1	DISK10300 20300 30300	128
\$1\$DKC2	Data3	Data disk	D2	R5	DISK10800 20800 30800 40800 50800 60800	128
\$1\$DKC3	Index3	Index Disk	D3	R6	DISK10900 20900 30900 40900 50900 60900	128
\$1\$DKC100	INDEX1	Index Disk	D100	R2	DISK10100 20100 30100 40100 50100 60100	128
\$1\$DKC101	Sort3	Sort/Temp space	D101	R7	DISK11000 21000 31000 41000 51000 61000	128
\$1\$DKC102	Estorage1	Extra disk and storage space	D102	R8	DISK11100 21100 31100 41100 51100 61100	128
\$1\$DKC200	SORT1	Sort/Temp Disk	D200	R3	DISK10200 20200 30200 40200 50200 60200	128

Detailed Hardware Configuration

OpenVMS Device Name	Volume Label	Volume Description	HSZ LUN	HSZ Container Name	HSZ Physical Devices	Chunk Size (blocks)
\$1\$DKC201	Data4	Data Disk	D201	R9	DISK11200 21200 31200 41200 51200 61200	128
\$1\$DKC202	INDEX4	Index Disk	D202	R10	DISK11300 21300 31300 41300 51300 61300	128
\$1\$DKC300	SASORACLE	SAS/Oracle Executable Disk	D300	R4	DISK10300 20300 30300	128
\$1\$DKC301	SORT4	Sort Disk	D301	R11	DISK11400 21400 31400 41400 51400 61400	128
\$1\$DKC302	ESTORAGE2	Extra Storage Disk	D302	R12	DISK11500 21500 31500	128

Table 7-7: Database Storage Map for VMSSHZ2

OpenVMS Device Name	Volume Label	Volume Description	HSZ LUN	HSZ Container Name	HSZ Physical Devices	Chunk Size (blocks)
\$1\$DKD0	DATA2	Data Disk	D0	R1	DISK10000 20000 30000 40000 50000 60000	128
\$1\$DKD2	DATA5	Data Disk	D2	R5	DISK10800 20800 30800 40800 50800 60800	128
\$1\$DKD3	INDEX5	Index Disk	D3	R6	DISK10900 20900 30900 40900 50900 60900	128
\$1\$DKD100	INDEX2	Index Disk	D100	R2	DISK10100 20100 30100 40100 50100 60100	128
\$1\$DKD101	SORT5	Sort Disk	D101	R7	DISK11000 21000 31000 41000 51000 61000	128
\$1\$DKD102	ESTORAGE3	Storage Data Disk	D102	R8	DISK11100 21100 31100 41100 51100 61100	128
\$1\$DKD200	SORT2	Sort/Temp Disk	D200	R3	DISK10200 20200 30200 40200 50200 60200	128
\$1\$DKD201	DATA6	Data Disk	D201	R9	DISK11200 21200 31200 41200 51200 61200	128
\$1\$DKD202	INDEX6	Index Disk	D202	R10	DISK11300 21300 31300 41300 51300 61300	128

Detailed Hardware Configuration

OpenVMS Device Name	Volume Label	Volume Description	HSZ LUN	HSZ Container Name	HSZ Physical Devices	Chunk Size (blocks)
\$1\$DKD300	SASSET	SAS Data Set Disk	D300	R4	DISK10300 20300 30300	128
\$1\$DKD301	SORT6	Sort Disk	D301	R11	DISK11400 21400 31400 41400 51400 61400	128
\$1\$DKD302	ESTORAGE4	Data Disk	D300	R4	DISK10300 20300 30300	128
\$41\$DKA0	DEPOT4_PAGE	Paging Disk	D2	D2	D2	128
\$41\$DKA100	D4STORAGE1	Data Disk	D3	D3	D3	128
\$41\$DKA200	D4STORAGE2	Data Disk	D4	D4	D4	128
\$41\$DKA300	D4STORAGE3	Data Disk	D5	D5	D5	128
\$51\$DKA0	DEPOT5_PAGE	Paging Disk	D2	D2	D2	128
\$51\$DKA100	D5STORAGE1	Data Disk	D3	D3	D3	128
\$51\$DKA200	D5STORAGE2	Data Disk	D4	D4	D4	128
\$51\$DKA300	D5STORAGE3	Data Disk	D5	D5	D5	128

Query Optimization Considerations

The performance of a query is dependent upon the optimizer choosing an efficient query plan. In general, analyzing the tables and indexes enable the optimizer to produce effective plans.

Queries performed against large data warehouse databases require study, analysis and testing for efficient, fast execution of queries. Query analysis and techniques include working with indexes to provide efficient access to data.

The Rdb7 Management Utility (RMU) provides monitoring facilities for locking and query performance monitoring. It is helpful to set up a symbol, as in the following example, for the RMU monitor:

```
MONITOR_RDB ::= "rmu /show statistics sql$database"
```

Performance will vary based on database design, implementation and query optimization efforts. Time spent on query analysis can be well spent and is of primary importance in data warehouse development. Creating Indexes, adjusting queries and using RMU to monitor performance will go a long way in supporting efficient query performance and processing.

System optimization begins with reviewing and considering the amount of data to be stored, the types of queries to be run (joins VS direct access), the number of users, the amount of memory and the general system usage and workload characteristics.

When tuning a system for a production data warehouse, be aware of the working set usage, page file specifications and user quotas. The system parameters file `SYSSYSTEM:SETPARAMS.DAT` contains the system working environment. The current system operating parameters can be viewed by the `SYSGEN` utility. Other user-working quotas are managed in the `AUTHORIZE` utility.

There are three major system parameters and privileges that can impact the performance and execution of queries in RDB. These include `SYSGEN` parameters, `WSMAX`- working set max per process, and `MAX PAGE` file quotas. Using the query results can help in tuning these values.

There are multiple indicators showing the general system usage characteristics in query results. When you run into problems like “The query fails to run or never finishes”, “The query runs too long”, or “the query is not using indexes efficiently” you must evaluate the system parameters that may be impacting the query execution results.

For example, the following query was crashing due to working set and maximum available virtual pages. Note the Page Faults, the Peak working set size, and Peak virtual size. Performance is severely impacted with increased page faults, increasing working set size will minimize page faults, but there are tradeoffs with these adjustments relative to the number of users. `AUTOGEN` should be run on a regular basis and comparisons made to suggested system parameter changes show in the `AUTOGEN` report. These changes are based on the system statistics collected from an active processing system.

Query Optimization Considerations

The following shows a before and after shot with tuning of the system and working set parameters:

TEST CONDITIONS:

The first run was run standalone. The second run was run in parallel with 5 other queries therefore no conclusions should be drawn from comparison of the execution times between the queries.

TIMEDSCRIPTS_5 RESULTS:

=====

FAILURE:

Accounting information:

Buffered I/O count:	14540	Peak working set size:	262144	<====
Direct I/O count:	304230	Peak virtual size:	892912	<====
Page faults:	32172541	Mounted volumes:	0	
Charged CPU time:	0 01:25:46.84	Elapsed time:	0 02:00:05.28	

SUCCESS:

Accounting information:

Buffered I/O count:	847	Peak working set size:	750464	<====
Direct I/O count:	956580	Peak virtual size:	993648	
Page faults:	46584	Mounted volumes:	0	
Charged CPU time:	0 01:27:04.61	Elapsed time:	0 03:51:40.62	

You can see the Peak working set size has a direct impact on the Page Faults. (Page faults are related to using Disk for memory overflow.) In the first run, the work set size was the default from system installation. The second run was run with the working set modified by AUTOGEN.

In evaluating the memory usage perform a show memory. This can also help with evaluating the memory usage for addressing cases where queries crash or fail to run due to memory allocation and working set memory size specifications:

Recording the memory usage for the query

Physical Memory Usage (pages):	Total	Free	In Use	Modified
Main Memory (512.00Mb)	65536	19459	29960	16117

Virtual I/O Cache (Kbytes):	Total	Free	In Use
Cache Memory	3200	0	3200

The working set can be adjusted based on free space as shown in the memory allocation information. Below are some calculations to help determine available space and allocations of working set space. Note this is an example. Refer to system documentation for information on optimizing working set and memory usage for your particular system implementation.

Calculate the bytes of working set:

$$262144 * 512 = 134217728 / \text{bytes of working set specification}$$

Calculate free space Bytes:

$$19459 * 8192 \text{ mem page size} = 159408128 / \text{bytes}$$

Calculate comparison of free space to working set space in Bytes:

$$159408128 - 134217728 = 25190400$$

This example shows that you can double the working set $26144 * 2 = 52288$ and still fit into the free space. We will also boost the page files size to accommodate the need for additional space for the query. Increasing the working set will reduce the page faults which would enhance performance.

MC AUTHORIZE

```
UAF> mod system /wsquota=52288
```

```
%UAF-I-MDFYMSG, user record(s) updated
```

```
UAF> mod system /pgfl=800000
```

```
%UAF-I-MDFYMSG, user record(s) updated
```


B

SQL Script Listings

This appendix contains source code listings for the five SQL scripts which were used in the testing of this HiTest Suite.

TIMEDSCRIPTS_1.SQL Script

The TIMEDSCRIPTS_1.SQL script was used to execute Query 1 in the testing of this HiTest Suite.

Query 1 asked *“What was the product share of a specific brand of cereal as compared to other cereals in the same product category, in a particular state in a particular type of store.”*

The business question asked was *“How did 20 oz. Wheat Flakes do in 1995 as compared to all types of wheat flakes in supermarkets in the state of Connecticut?”*

The source code for the TIMEDSCRIPTS_1.SQL script is as follows:

```
set output daily_load.log;
set language ENGLISH;
set default date format 'SQL92';
set quoting rules 'SQL92';
set date format DATE 00000001;

select 'All Wheat Flakes' Product, AL2."MONTH",
sum(AL5.UNIT_SALES) UNITS, sum(AL5.DOLLAR_SALES) DOLLARS,
count(*),
DISTRICT, CHANNEL_GROUP CHNL
FROM PRODUCT AL4, SALES_FACT AL5,
CHANNEL AL1, DAILY_PERIOD AL2, MARKET AL3
WHERE (AL5.PRODUCT_ID=AL4.PRODUCT_ID
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
```

SQL Script Listings

```
AND
(DISTRICT='Connecticut'
AND CHANNEL_GROUP in('Supermarket')
AND BRAND in ('Quellogs Wheat Flakes')
AND "YEAR"=1997)
GROUP BY DISTRICT, CHANNEL_GROUP,
'All Wheat Flakes', AL2."MONTH"

UNION

select '20 Oz Wheat Flakes' Product, AL2."MONTH",
sum(AL5.UNIT_SALES) UNITS, sum(AL5.DOLLAR_SALES) DOLLARS,
count(*),
DISTRICT, CHANNEL_GROUP CHNL
FROM PRODUCT AL4, SALES_FACT AL5,
CHANNEL AL1, DAILY_PERIOD AL2, MARKET AL3
WHERE (AL5.PRODUCT_ID=AL4.PRODUCT_ID
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
AND
(DISTRICT ='Connecticut'
AND CHANNEL_GROUP in('Supermarket')
AND PRODUCT='QLGS WHT FLK 20 OZ'
AND "YEAR"=1997)
group by DISTRICT, CHANNEL_GROUP,
'20 Oz Wheat Flakes', AL2."MONTH" ;
commit;
```

TIMEDSCRIPTS_2.SQL Script

The TIMEDSCRIPTS_2.SQL script was used to execute Query 2 in the testing of this HiTest Suite.

Query 2 compared the sales of a specific product, in a particular outlet in a region, against the sales of the same product through all channel outlets. The information was grouped by month to show market trends.

The business question asked was *“What percentage of sales of 15 oz. Wheat Flakes were made in the Safeway stores in NY and PA as compared to all outlets in the NY and PA areas?”*

The source code for the TIMEDSCRIPTS_2.SQL script is as follows:

```

type TIMEDSCRIPTS_2.SQL/page

set output daily_load.log;
set language ENGLISH;
set default date format 'SQL92';
set quoting rules 'SQL92';
set date format DATE 00000001;

select  'All Channels' CHNL,  AL2."MONTH",
sum(AL5.UNIT_SALES) Units, sum(AL5.DOLLAR_SALES) Dollars,
count(*),
'NY + PA' DISTRICT, PRODUCT
FROM PRODUCT AL4, SALES_FACT AL5,
CHANNEL AL1, DAILY_PERIOD AL2, MARKET AL3
WHERE (AL5.PRODUCT_ID=AL4.PRODUCT_ID
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
AND DISTRICT in ('New York', 'Pennsylvania')
AND CHANNEL_GROUP in ('Supermarket','Convenience',
'Warehouse','Drug','Discount')
AND PRODUCT= 'QLGS WHT FLK 15 OZ'
AND "YEAR"=1997
group by SYSDATE, 'NY + PA', 'All Channels',

PRODUCT , AL2."MONTH"

UNION

select CHANNEL CHNL,  AL2."MONTH",
sum(AL5.UNIT_SALES) Units, sum(AL5.DOLLAR_SALES) Dollars,
count(*),

```

SQL Script Listings

```
'NY + PA' DISTRICT , PRODUCT
FROM PRODUCT AL4, SALES_FACT AL5,
CHANNEL AL1, DAILY_PERIOD AL2, MARKET AL3
WHERE (AL5.PRODUCT_ID=AL4.PRODUCT_ID
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
AND DISTRICT in ('New York' , 'Pennsylvania')
AND CHANNEL='Safeway'
AND PRODUCT='QLGS WHT FLK 15 OZ'
AND "YEAR"=1997
group by 'NY + PA', CHANNEL,
PRODUCT, AL2."MONTH";

commit;
```

TIMEDSCRIPTS_3.SQL Script

The TIMEDSCRIPTS_3.SQL script was used to execute Query 3 in the testing of this HiTest Suite.

Query 3 compared the market share of a product in a particular type of store, in a particular market location, to sales of all types of outlets in the region. The information was grouped by month to show market trends.

The business question asked was *“How are 10 oz. Wheat Flakes doing in convenience stores in Bridgeport Connecticut as compared to the entire northeast region?”*

The source code for the TIMEDSCRIPTS_3.SQL script is as follows:

```
set output daily_load.log;
set language ENGLISH;
set default date format 'SQL92';
set quoting rules 'SQL92';
set date format DATE 00000001;

select 'Northeast Total' MARKET, AL2."MONTH",
sum(AL5.UNIT_SALES) Units, sum(AL5.DOLLAR_SALES) Dollars,
count(*),
CHANNEL_GROUP, PRODUCT
```

```

FROM PRODUCT AL4, SALES_FACT AL5,
CHANNEL AL1, DAILY_PERIOD AL2, MARKET AL3
WHERE (AL5.PRODUCT_ID=AL4.PRODUCT_ID
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
AND (REGION='Northeast'
AND CHANNEL_GROUP in ('Convenience')
AND PRODUCT= 'QLGS WHT FLK 10 OZ'
AND "YEAR" = 1997)
group by 'Northeast Total', CHANNEL_GROUP,
PRODUCT , AL2."MONTH"

UNION

select MARKET, AL2."MONTH",
sum(AL5.UNIT_SALES) Units, sum(AL5.DOLLAR_SALES) Dollars,
count(*),
CHANNEL_GROUP, PRODUCT
FROM PRODUCT AL4, SALES_FACT AL5,
CHANNEL AL1, DAILY_PERIOD AL2, MARKET AL3
WHERE (AL5.PRODUCT_ID=AL4.PRODUCT_ID
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
AND (MARKET='Bridgeport'
AND CHANNEL_GROUP in ('Convenience')
AND PRODUCT='QLGS WHT FLK 10 OZ'
AND "YEAR" = 1997)
group by MARKET, CHANNEL_GROUP,
PRODUCT, AL2."MONTH";

```

TIMEDSCRIPTS_4.SQL Script

The TIMEDSCRIPTS_4.SQL script was used to execute Query 4 in the testing of this HiTest Suite.

Query 4 compared the market share of a particular product, in a particular type of store, in a particular market location to all sales of competitive products in the same market location. The information was grouped by month to show market trends.

The business question asked was *“What was the market share of 20 oz. Wheat Flakes in Connecticut supermarkets in 1995?”*

The source code for the TIMEDSCRIPTS_4.SQL script is as follows:

```
set output daily_load.log;
set language ENGLISH;
set default date format 'SQL92';
set quoting rules 'SQL92';
set date format DATE 00000001;

select 'All Wheat Products' Product, AL2."MONTH",
sum(AL5.UNIT_SALES) Units, sum(AL5.DOLLAR_SALES) Dollars,
count(*),
DISTRICT, CHANNEL_GROUP CHNL
FROM PRODUCT AL4, SALES_FACT AL5,
CHANNEL AL1, DAILY_PERIOD AL2, MARKET AL3
WHERE (AL5.PRODUCT_ID=AL4.PRODUCT_ID
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
AND (district='Connecticut'
AND CHANNEL_GROUP in('Supermarket'))
AND BRAND IN ('Quellogs Wheat Flakes', 'Boast Weeties', 'Boast
Oatey Rounds',
'Quellogs Wheaten Rye')
AND "YEAR"=1997)
group by DISTRICT, CHANNEL_GROUP,
'All Wheat Products', AL2."MONTH"
```



```

UNION AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
AND (district='Connecticut'
AND CHANNEL_GROUP in('Supermarket')
AND BRAND IN ('Quellogs Wheat Flakes', 'Boast Weeties', 'Boast
Oatey Rounds',
'Quellogs Wheaten Rye')
AND "YEAR "=1997)
group by DISTRICT, CHANNEL_GROUP,
'All Wheat Products', AL2."MONTH"

UNION
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
AND (district='Connecticut'
AND CHANNEL_GROUP in('Supermarket')
AND BRAND IN ('Quellogs Wheat Flakes', 'Boast Weeties', 'Boast
Oatey Rounds',
'Quellogs Wheaten Rye')
AND "YEAR "=1997)
group by DISTRICT, CHANNEL_GROUP,
'All Wheat Products', AL2."MONTH"

UNION
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
AND (district='Connecticut'
AND CHANNEL_GROUP in('Supermarket')

```

SQL Script Listings

```
AND BRAND IN ('Quellogs Wheat Flakes', 'Boast Weeties', 'Boast
Oatey Rounds',
'Quellogs Wheaten Rye')
AND "YEAR"=1997)
group by DISTRICT, CHANNEL_GROUP,
'All Wheat Products', AL2."MONTH"

UNION

select '20 Oz Wheat Flakes' Product, AL2."MONTH",
sum(AL5.UNIT_SALES) Units, sum(AL5.DOLLAR_SALES) Dollars,
count(*),
DISTRICT, CHANNEL_GROUP CHNL
FROM PRODUCT AL4, SALES_FACT AL5,
CHANNEL AL1, DAILY_PERIOD AL2, MARKET AL3
WHERE (AL5.PRODUCT_ID=AL4.PRODUCT_ID
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
CAST(AL2.TRANS_DAY AS DATE ANSI))
AND (district = 'Connecticut'
AND CHANNEL_GROUP in('Supermarket'))
AND PRODUCT='QLGS WHT FLK 20 OZ'
AND "YEAR"=1997)
group by DISTRICT, CHANNEL_GROUP,
'20 Oz Wheat Flakes', AL2."MONTH";
```

TIMEDSCRIPTS_5.SQL Script

The TIMEDSCRIPTS_5.SQL script was used to execute Query 5 in the testing of this HiTest Suite.

Query 5 compared the product share of a given product, combining several areas, to total sales across the same areas.

The business question asked was “*What was the market share of 20 oz. Wheat Flakes across 10 test market areas?*”

The source code for the TIMEDSCRIPTS_5.SQL script is as follows:

```

set output daily_load.log;
set language ENGLISH;
set default date format 'SQL92';
set quoting rules 'SQL92';
set date format DATE 00000001;

select 'All Wheat Flakes' Product, AL2."MONTH",
sum(AL5.UNIT_SALES) Units, sum(AL5.DOLLAR_SALES) Dollars,
count(*),
CHANNEL_GROUP CHNL, '10-States'
FROM PRODUCT AL4, SALES_FACT AL5,
CHANNEL AL1, DAILY_PERIOD AL2, MARKET AL3
WHERE (AL5.PRODUCT_ID=AL4.PRODUCT_ID
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID
AND AL5.TRANS_DAY BETWEEN '01-JAN-1997 00:00:00.00'
AND '31-DEC-1997 23:59:59.00'
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
AND (district in ('Connecticut',
'Delaware', 'Maine', 'Pennsylvania', 'New York',
'Oregon', 'Alaska', 'CA North', 'CA South', 'Washington'))
AND CHANNEL_GROUP in('Supermarket')
AND BRAND IN ('Quellogs Wheat Flakes'))
GROUP BY 'All Wheat Flakes', AL2."MONTH", CHANNEL_GROUP, '10-
States'

UNION

select '20 Oz Wheat Flakes' Product, AL2."MONTH",
sum(AL5.UNIT_SALES) Units, sum(AL5.DOLLAR_SALES) Dollars,
count(*),
CHANNEL_GROUP CHNL, '10-States'
FROM PRODUCT AL4, SALES_FACT AL5,
CHANNEL AL1, DAILY_PERIOD AL2, MARKET AL3
WHERE (AL5.PRODUCT_ID=AL4.PRODUCT_ID
AND AL5.MARKET_ID=AL3.MARKET_ID
AND AL5.CHANNEL_ID=AL1.CHANNEL_ID

```

SQL Script Listings

```
AND CAST(AL5.TRANS_DAY AS DATE ANSI) =
      CAST(AL2.TRANS_DAY AS DATE ANSI))
AND (district in ('Connecticut',
'Delaware','Maine','Pennsylvania','New York',
'Oregon', 'Alaska', 'CA North', 'CA South','Washington')
AND CHANNEL_GROUP in('Supermarket')
AND PRODUCT='QLGS WHT FLK 20 OZ'
AND "YEAR"=1997)
GROUP BY '20 Oz Wheat Flakes', AL2."MONTH" ,CHANNEL_GROUP, '10-
States';
```

C

Database and Disk Logicals Setup Script

The following script was used to set up database logicals and disk logicals for the testing of this HiTest Suite:

```
#!/ Define the oracle database root disk and database identifier.
$ defsys ::= define/system
$ defsys ivp70 SYSS$COMMON:[SYSTEST]RDB$IVP70.COM
$ defsys      CPG_DIR $1$DKC300:[ORACLE.CPG_INFO]
$ defsys oracle_base $1$DKC300:[oracle.]/trans=conc
$ defsys oracle_root oracle_base:[system]
$ defsys sql$cpg98 oracle_root:cpg98
$ defsys rdb$system oracle:[oracle] /trans=conc
$ defsys sql$database sql$cpg98
$ defsys      CPG_1D $1$DKC0:[rdb.data]
$ defsys      CPG_2D $1$DKE0:[rdb.data]
$ defsys      CPG_1I $1$DKC100:[rdb.data]
$ defsys      CPG_2I $1$DKE100:[rdb.data]
$ defsys      CPG_1S $1$DKC200:[rdb.data]
$ defsys      CPG_2S $1$DKE200:[rdb.data]
#!/ defsys sql$dbi root_dir:dbi
```

