

MARKET EXCHANGE 3.0

OPERATING ENVIRONMENT DOCUMENT

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IDAPTA

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ABOUT THIS DOCUMENT

Introduction

This manual provides information about the MarketExchange 3.0 operating environment configuration.

In the following chapters, we discuss the following issues as they relate to MarketExchange:

- Server configuration
- Operating systems
- RAID storage
- Hard drive configuration
- Oracle configuration

Audience

The primary audiences for this document are technical users and managers who work with the MarketExchange application. Specifically:

System Integrators

System Administrators

Database Administrators

Further Information

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SERVER CONFIGURATION

Overview

The configuration of servers for a MarketExchange implementation has many variables, because it is customer-specific. The number of servers and their configuration will vary, depending on the use requirements of the environment. Customers with low trading volumes and/or simple object graphs require significantly different configurations than those with very busy exchanges or complex object graphs.

For enterprise projects, separate environments are typically configured for production, testing, development, and staging.

Idapta provides assistance in designing the proper infrastructure for your environment; check with your Idapta account representative for details.

Highly Available vs. Non-Highly Available Configurations

The following sections differentiate between highly available and non-highly available configurations.

Highly Available Configurations

For production, most customers choose to deploy a highly available environment in order to minimize unpredictable downtime and provide scalability. This requires, at minimum, a separate test environment that is configured similarly to the production environment (though possibly with less expensive server and storage configurations).

Figure 1 illustrates the minimum production configuration for a highly available environment on Sun Microsystems Enterprise servers.

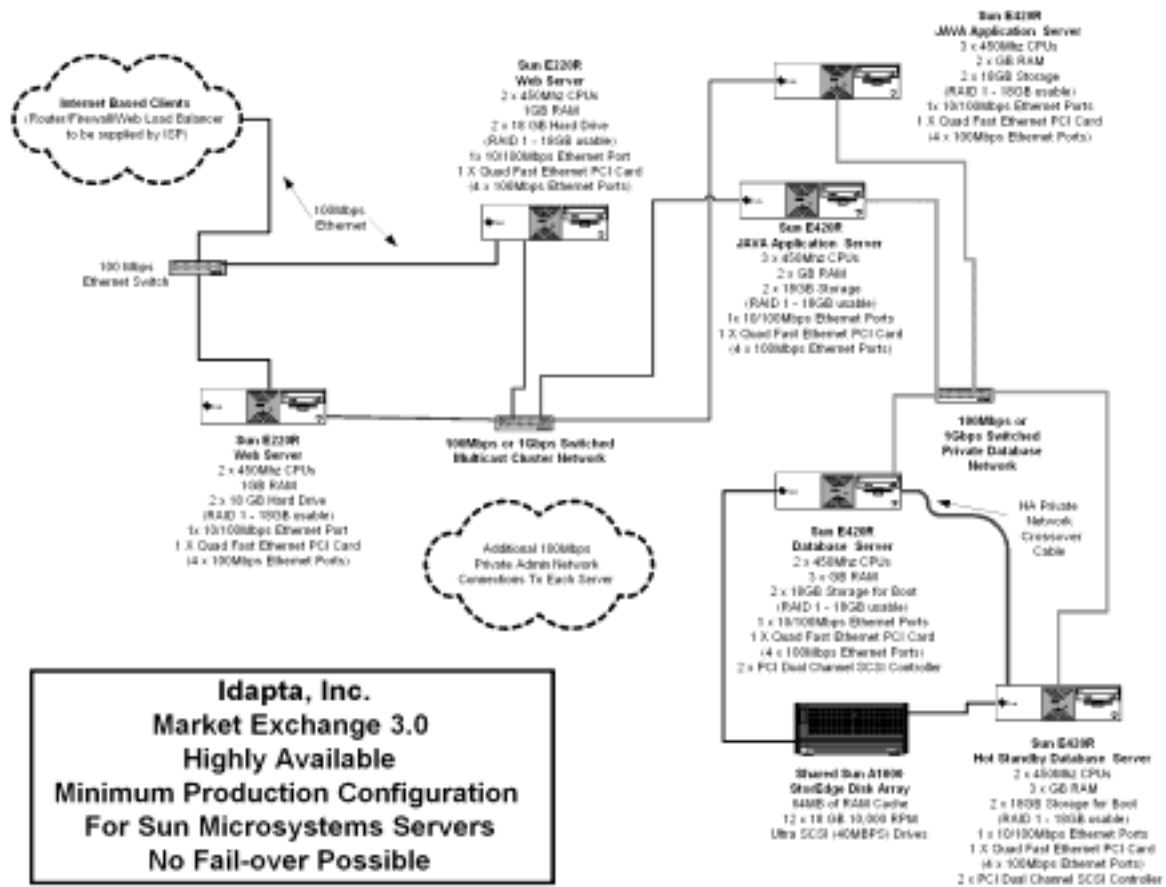


Figure 1: Minimum Production Configuration – Highly Available Environment

Non-Highly Available Configurations

With all enterprise-class software, high-availability and scalability means significant cost increases. Customers building a low-volume exchange or a proof-of-concept environment may want to minimize costs while still providing reasonable system performance. Sometimes, customers wishing to reduce cost delay the deployment of a high-availability system (accepting temporarily the risk of unpredictable downtime for the trading exchange).

The following figure shows the minimum configuration for a non-highly available environment on Sun Microsystems Enterprise servers.

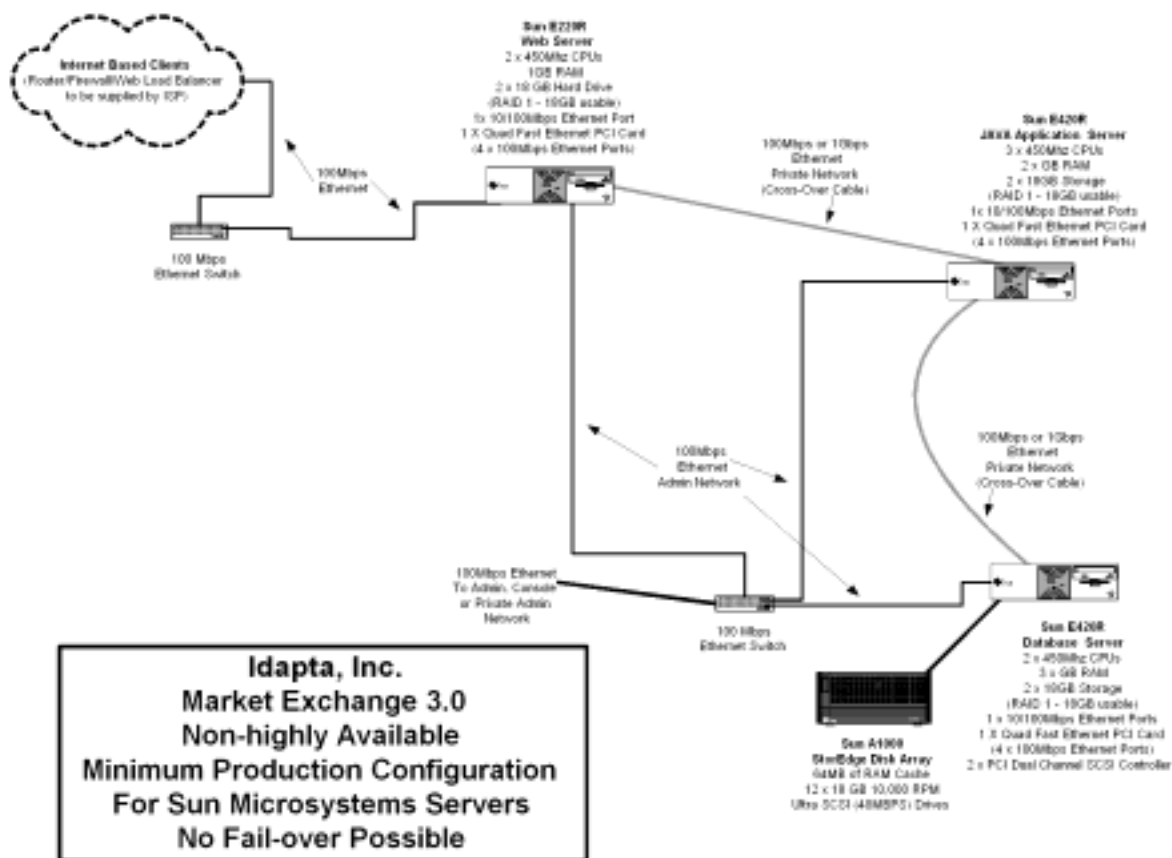


Figure 2: Minimum Production Configuration – Non-Highly Available Environment

Database Servers

Requirements for Database Servers

Currently, MarketExchange requires the following for database servers:

- Oracle 8i Enterprise Edition Database Software
- Sun Solaris (Sparc) operating system
- The most recent Sun-recommended patch set
- Sun UltraSparc II or III Enterprise servers

Recommendations

Oracle Hot-Standby Software for Highly Available Configurations

When a highly available database infrastructure is desired, Idapta recommends Oracle Hot-Standby software. This also requires the deployment of Veritas Cluster or Sun Cluster software to support the automatic fail-over features of Oracle Hot-Standby.

NFS for Sharing Disk Space in Deployments Using Java Application Servers

In cases where clustered Java application servers are deployed, the database server may use NFS to share some disk space with the Java application servers (if you so choose). This can facilitate highly available and fast shared data access by all cluster members.

Minimal Setup for Link Speed Performance

The minimum setup to ensure *adequate* network link speed performance is:

- One private 100 Mbps full-duplex switched Ethernet link between the database server and the Java application server

Additionally, the database server should be configured with at least:

- One private 100 Mbps full-duplex switched Ethernet link for system administration purposes
- One private 100 Mbps full-duplex switched Ethernet link for dedicated data backup purposes (a 1 Gbps data backup link will offer faster data backup and recovery)

This will ensure that MarketExchange database activity is not disrupted or impacted by other network traffic.

Optimal Setup for Link Speed Performance

The minimum setup to ensure *optimal* network link speed performance is:

- One private 1 Gbps full-duplex switched Ethernet link between the database server and the Java application server

NOTE: *If more than one 1 Gbps network link is deployed on the database server, it is recommended that one more CPU be added to the database server. This would be in addition to the minimal number of CPUs required as noted in Table 1. The added CPU provides the necessary processing overhead to the operating system, thus allowing it to move data at high speeds without impacting the trading platform's performance.*

Hardware Configuration for Database Servers

The table below shows hardware configuration guidelines for a MarketExchange database server.

Table 1: Hardware Configuration Guidelines for a MarketExchange Database Server

MarketExchange Storage Logical Disk Space	Typical Range of Users	Minimal Number of CPUs	RAM
120 – 180GB Usable in RAID 0 + 1 (preferred) or Hardware RAID 5 Configuration	0 – 300 Active Traders	Two 750MHz CPUs (RISC)	4 GB
120 – 180GB Usable in RAID 0 + 1 (preferred) or Hardware RAID 5 Configuration	301 + Active Traders	One additional 750MHz CPU (RISC) per 300 Active traders	One additional GB of RAM per 300 Active traders

Java Application Servers

Requirements for Java Application Servers

Currently, MarketExchange requires a Java application server configured as follows:

- BEA Systems' WebLogic Java application server
- Sun Microsystems SDK 1.3 Reference Version
- Oracle 8i Enterprise Database client software
- Running on Sun Solaris (Sparc) operating system
- Installed with the most recent Sun recommended patch set
- Sun UltraSparc II or III Enterprise servers

When deploying the Java application server, keep in mind that at least one CPU should be reserved for handling non-JVM tasks such as disk I/O, logging, network I/O, etc. The use of the Solaris *psrset* command to create a processor affinity set (with one CPU per server not in the created set) that has

the JVM process bound to the created set will allow Solaris to better manage the load on the Java application server.

Recommendations

Clustering

For more concurrent users or for fail-over and load balancing, Idapta recommends the deployment of additional identically configured Java application servers using WebLogic's clustering option. For detailed configuration and planning information on clustering WebLogic 5.1, visit <http://www.weblogic.com/docs51/cluster/index.html> (documentation for other versions of WebLogic can also be found at the WebLogic site).

Clustering WebLogic requires the use of a multi-casting network configuration between the iPlanet Web Servers and the WebLogic Java application servers. Idapta recommends that Gigabit Ethernet be used to create the links used in this multi-casting network.

Additionally, Idapta recommends that a separate Gigabit Ethernet be used for the private network between the WebLogic Java application servers and the Oracle database servers when deploying a WebLogic cluster. If two Gigabit Ethernet cards are used in a single Java application server (as Idapta recommends for clustering), make certain that an additional CPU is reserved to handle the increased overhead of the Gigabit-speed traffic (these should be two CPUs that are *not* in the processor set that the JVM is bound to with Solaris *psrset* command).

Hardware Configuration for Database Servers

The following table gives hardware configuration guidelines for MarketExchange database servers.

Table 2: Hardware Configuration Guidelines for a MarketExchange Java Application Server

MarketExchange Logical Disk Space Per Server	Typical Range of Users Connected at 56Kbps or Less	Minimal # of CPUs Per Server	RAM Per Server
2 x 18 GB Drives 18 GB usable (RAID 1)	0 – 300 Concurrent	2 – 750MHz CPUs (RISC)	3 GB
8 x 18 GB Drives 72 GB usable (RAID 0,1)	301 – 400 Concurrent	4 – 750 MHz CPUs (RISC)	4 GB
8 x 18 GB Drives 72 GB usable (RAID 0,1)	401+ Concurrent	An Additional 4 – 750 MHz CPUs (RISC) Server Clustered per 300 – 400 concurrent users	3 GB

Web Servers

Requirements for Web Servers

Currently, MarketExchange requires iPlanet's Enterprise Web Server product (formerly Netscape Enterprise Server) with the following configuration:

- Running on Sun Solaris (Sparc) operating system
- Installed with the most recent Sun-recommended patch set
- Installed on Sun UltraSparc II or III Enterprise servers

Recommendations

Independent Web Servers for Best Performance

Some Java application servers (such as BEA Systems WebLogic) offer a built-in Web server module that allows the Java application server to perform double duty as a Web server. We recommend that your MarketExchange Web servers be independent of the Java application servers. This is because in most cases, a configuration that uses the Java application server also as a Web server:

- Does not offer the best performance
- Is not as scalable as multiple independent load balanced Web servers

Clustering for Maximum Throughput

To maximize throughput of the Web servers, multiple identically configured Web servers used in conjunction with a load-balancing network traffic device should be used. Of course, careful sizing of the in-bound Internet connection must also be accomplished.

Installing Java SDK 1.3 for Production of JSP Pages

In order to serve customer-created user interface Java server pages (JSPs), it is also necessary to install Sun Microsystems' Java SDK 1.3 Reference Version on the Web server. This provides optimal scaling and performance.

Hardware Configuration for Web Servers

The following table gives guidelines for hardware configuration for a MarketExchange Web server.

Table 3: Hardware Configuration for a MarketExchange Web Server

iPlanet Web Server Logical Disk Space Per Server	Typical Range of Users Connected at 56Kbps or Less	Minimal Number of CPUs Per Server	RAM Per Server
2 x 18 GB Drives 18 GB usable (RAID 1)	0 – 300 Concurrent	2 – 750MHz CPUs (RISC)	3 GB
8 x 18 GB Drives 18 GB usable (RAID 1)	301+ Concurrent	Two additional 750 MHz CPUs (RISC) per 300 concurrent users connected to a load balancing network traffic device	2 – 3 GB per two CPUs

OPERATING SYSTEMS

Overview

Idapta currently supports full deployment of MarketExchange on the Sun Solaris (Sparc) operating system.

For developmental purposes only, Idapta currently offers support for MarketExchange installed on the server versions of Microsoft's Windows 2000 or NT 4.0 operating systems. This gives your developers the option of using a Windows 2000 or NT 4.0 server when they are creating JSP pages for your MarketExchange project. All testing, staging, and production servers need Sun's Solaris operating system installed on Sun UltraSparc II or III Enterprise servers.

For more detailed information on the platforms supported by MarketExchange 3.0, see *Appendix A – MarketExchange 3.0 Supported Platforms*, page 27.

The reasons behind Idapta's decision to support MarketExchange on the Sun Solaris operating system are as follows:

- There are benefits to utilizing an operating system from a market leader, as third-party applications usually offer the best support on these platforms. Additionally, if you deploy a market-leading vendor's operating system, you can purchase excellent support (e.g., two hour on-site service and 24-hour server monitoring).
- Key operating system features in Solaris 7 and Solaris 8 support maximum hardware and application uptime. Internet users and Wall Street investors historically have shown little tolerance when encountering downed Web sites due to preventable hardware issues.
- Idapta personnel have experience with Oracle 8i on Solaris installed on Sun Microsystems Enterprise UltraSparc II and UltraSparc III servers. In addition, Idapta is extensively testing MarketExchange's performance on

Sun's Solaris. We expect Sun's Solaris to continue to be the industry standard for Internet operating systems.

- Security of the operating system is a major concern in the Internet marketplace. Market-leading products that are widely deployed in enterprise-class environments usually receive the most rapid and highest-quality security support from major software vendors and other agencies that provide security warnings and fixes.
- The industry standard is enterprise-class hardware with built-in fail-over features:
 - At a minimum: hot swappable drives, power supplies, and cooling systems
 - Ideally in addition to the above: hot swappable CPUs, memory, and system/IO boards

Additionally, it's important to consider the ability of the systems to support clustering software architectural requirements for added fail-over protection.

- Idapta strongly recommends that you use a platform that is part of Oracle's Tier One Port List; contact your Idapta Account Manager for more details.
- Sun Microsystems currently offers significant discounts on both development and production hardware based on size of company, type of company, etc.
 - Free software for development, such as Oracle and iPlanet
 - Discounts on production software
 - Other benefits to companies that meet certain criteria

NOTE: *It is important that you contact your Idapta Account Manager for details on how your company can qualify, well before you decide on the platform you will deploy or enter any customer agreements with a vendor.*

RAID STORAGE

RAID Overview

In the following sections, we give guidelines on the use of RAID storage technology. Idapta recommends RAID technology for:

- Protecting data in the event of a device failure
- Increasing read/write performance with certain configurations

In RAID terminology:

- *Array* refers to all disks/devices included in a RAID configuration that represent logical disk/devices
- *Device* pertains to a single physical disk

RAID configurations typically require special hardware and software (to manage the logical volumes created when the RAID is installed).

MarketExchange is certified to operate with the following configurations:

- Sun Microsystems RAID Manager (version 6.1 or later) when used with the Sun StorEdge hardware-managed drive arrays
- Sun Solstice DiskSuite and/or Veritas Volume Manger¹ (when not using hardware-managed RAID drive arrays). For this scenario, we currently recommend:
 - Sun Solstice DiskSuite 4.2 or later
 - Veritas Volume Manger 3.x or later

1. Veritas Volume Manager is also called Sun Enterprise Volume Manager (when purchased from Sun Microsystems).

RAID 1

RAID 1 provides duplication of data on separate disks, thereby allowing the system to be available during a single disk failure. When used with the Solaris operating system, RAID 1 also provides increased read speeds when both mirrors are healthy.

Idapta recommends RAID 1 (mirroring) for the following types of files:

- Operating system files
- Oracle executables
- Redo log files
- Archive log Files

RAID 0 + 1 and RAID 5

For disk arrays containing files served by busy Web and Java application servers or Oracle Datafiles, Idapta recommends using one of the following:

- RAID 0 + 1 (striping with mirroring)
- RAID 5 (striping with parity)

RAID 0 + 1 and RAID 5 both have the ability to survive single disk failure and provide increased random read performance. RAID 0 + 1 also provides increased write performance.

Comparison of RAID 0 + 1 vs. RAID 5

Consider the following factors when choosing between RAID 0 + 1 and RAID 5:

- RAID 0 + 1 offers:
 - Considerable read performance increases over non-RAID drive sets and maximum data survivability
 - The ability to automatically and rapidly recover in the event of a drive failure, minimizing the impact to system performance
- RAID 0 + 1 offers increased write performance over software RAID 5, because it does not require the calculation of Error Correction Code (ECC). However, the use of a hardware-managed read/write memory (with 64 MB or more of non-volatile RAM) caching controller can significantly improve RAID 5 write performance.

- As each disk is mirrored in a RAID 0 + 1 configuration, usable disk space on a given installation is half of the total disk space installed. This increases the cost of the usable disk space and consumes more storage space in the data center.
- RAID 5 offers excellent data survivability and considerable read performance increases over non-RAID drive sets. Raid 5 only needs approximately 20-30% of total installed native disk space for storing parity data that is used to reconstruct a failed drive.
- RAID 5 requires the calculation of ECC, which will decrease write performance. However, deploying a hardware-managed read/write memory (64 MB or more of non-volatile RAM) caching controller RAID 5 system will mitigate most of the write performance issue and can improve read performance. RAID 5 data recovery also requires significant system resources (CPU and Disk I/O) and significant time to reconstruct data in the event of a single drive failure. This results in degraded performance of the I/O subsystem while the RAID 5 set is reconstructed.
- RAID 0 + 1 (or RAID 10 which is slightly different and even better) is the preferred configuration for MarketExchange because:
 - RAID 0 + 1 offers performance increases over RAID 5
 - RAID 0 + 1 can provide a higher level of data survivability than RAID 5
 - With the significant decrease in disk storage cost, RAID 5 cost savings no longer impact the total cost of a complete production system as much

HARD DRIVE CONFIGURATION

Overview

When installing server operating systems and application filesystems, we recommend the following steps be taken to ensure optimal performance and reliability:

- Distribute application data across multiple disk drives
- Distribute disk drives across multiple disk controllers
- Distribute disk controllers across multiple system I/O buses to ensure optimal I/O performance and availability

If you are using RAID, a distributed configuration provides maximum data availability in the event of a hardware component failure. Fibre Channel storage should be selected over SCSI-connected storage if your budget permits.

Selecting a Storage Hardware Manufacturer

Idapta does not at this time endorse a particular manufacturer's storage systems. However, we do recommend that you choose a vendor who has a proven reputation in disk storage systems (such as EMC, Network Appliance, or Sun Microsystems).

Idapta personnel have considerable experience with Sun Microsystems' disk storage arrays, and MarketExchange is extensively tested and optimized for performance on Sun Microsystems' disk storage arrays.

Configuring Solaris Operating System Boot Disk for All Servers

Most new servers and workstations ship with 18 GB hard drives or larger. Idapta strongly recommends that the boot hard disk be installed in a RAID 1 (mirrored) configuration.

For detailed instructions on the procedures to mirror (and more importantly, how to recover a failed mirror), refer to *Guide to High Availability: Configuring boot/root/swap*¹. This book contains information that is helpful to system administrators mirroring a Solaris boot drive using either Sun's Solstice DiskSuite product or Sun's Enterprise Volume Manager (Veritas Volume Manager) software.

On all servers that have Sun Solaris installed, Idapta recommends that the disk configuration shown in the following table (using two 18 GB hard drives) be used for the OS/boot drive.

Boot Disk Configuration Guidelines

Table 4: Guideline for the Solaris Operating System Boot Disk for All Servers

	Slice 0	Slice 1	Slice 2	Slice 3	Slice 4	Slices 5 – 7
RAID Type	RAID 1	RAID 1	Reserved for system use	RAID 1	RAID 1	Reserved for system use
Usable Size	4 GB	1,024 – 1,997 MB < 2 GB is required		4 GB	7 GB	Reserve 100 MB of Unallocated Space

1. Jeannie Kobert. *Guide to High Availability: Configuring boot/root/swap*. Prentice Hall PTR/Sun Microsystems Press, 1999.

Table 4: Guideline for the Solaris Operating System Boot Disk for All Servers

Filesystem Name	/	Swap (see <i>Reserving Slices</i>)		/var	/u01 for database servers or /opt for Java app and Web servers	Veritas or DiskSuite RAID software private databases
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Reserving Slices

Note that Slice 2 is reserved for system use and should not be changed from the default configuration offered by Solaris. Also, at least 100 MB (and two slices other than slice 2) should be left as free space (unused) on the drive for RAID software private database use.

Swap Space

When using Solaris, swap space is no longer calculated by the “twice-system-memory-rule.” In fact, it is highly recommended that the system never be allowed to swap processes, because swapping significantly degrades system performance. You can avoid the need to use swapping by adding more RAM.

However, some applications still check to see if swap space is available before running, and swap space is used for the storage of the system memory dump (core file) in the event of a crash. But if more than 2 GB of swap is configured, the system will not be able to write a core file.

Additionally, a new feature in Solaris (tmpfs) allows swap space to be used as temporary file storage space (/tmp) that is automatically configured by Solaris if a /tmp filesystem is not specified. As this can increase system performance (/tmp will automatically use free RAM first, then move to swap as RAM is needed), it is recommended that a /tmp filesystem is not specified by the customer.

ORACLE CONFIGURATION

Overview

Figure 3 illustrates a recommended physical data model for MarketExchange 3.0.

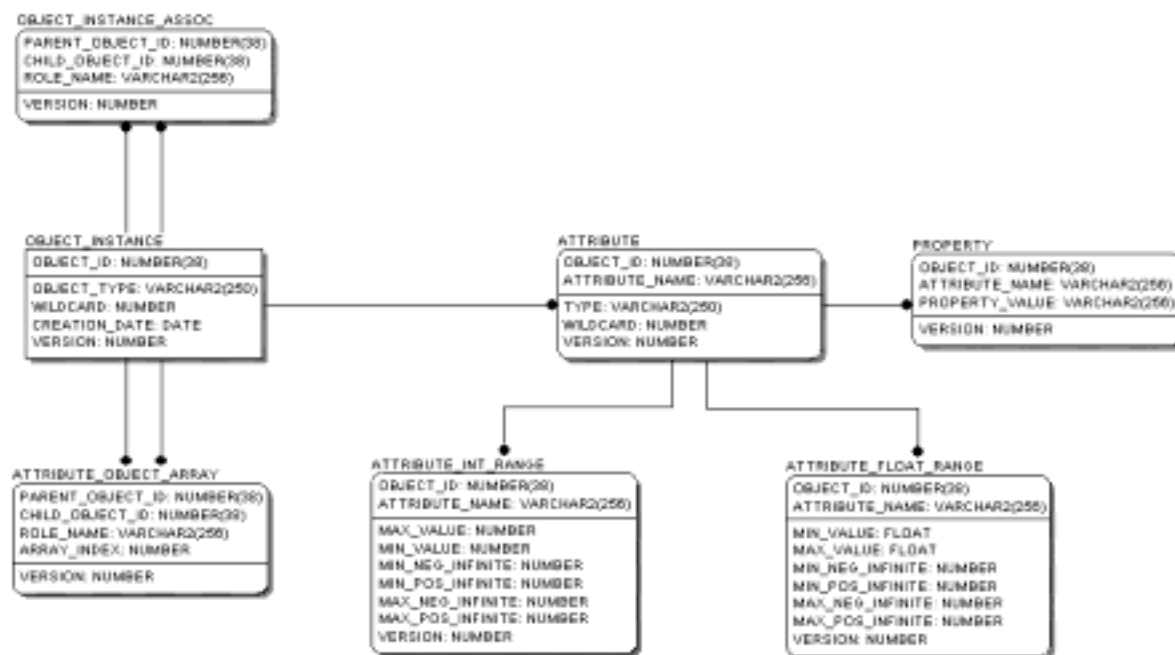


Figure 3: Physical Data Model – MarketExchange 3.0

Oracle Filesystem Configuration

Determining the size and configuration of your MarketExchange Oracle database is an important hardware-planning step because:

- The size of the Oracle database influences other hardware parameters
- A properly configured Oracle database filesystem will improve system performance

SYSTEM Tablespace Size

Use Table 5 to size the SYSTEM Tablespace for low-volume exchanges.

Table 5: Guideline for Oracle SYSTEM Tablespace Sizing (Low-Volume Exchange)

System Configuration	System Tablespace Size
Without Oracle replications	50 – 100 MB

RBS and TEMP Tablespace Size

Use Table 6 to size the RBS and TEMP Tablespaces for low-volume exchanges. The total size of data and index segments determine the size of RBS and TEMP tablespaces.

Table 6: Guideline for Oracle RBS and TEMP Tablespace (Low-Volume Exchange)

Total Size of Data and Index Segments	RBS Tablespace Size	TEMP Tablespace Size
9 GB	250 – 500 MB	500 MB – 1 GB
10 – 20 GB	1 GB	2 GB
Greater than 20 GB	1.5 GB	3 GB

Physical Separation and Layout of Tablespaces and Logs

Separation Requirements

For optimal performance and guaranteed point-in-time recovery, Oracle database files should meet the physical separation (different logical disk partitions) requirements shown in Table 7.

Table 7: Guideline for Oracle Physical Separation and Layout of Tablespaces and Logs

Oracle Files	Separation Requirements
System Tablespace Datafiles	Separate from Redo Log and Archive Log Files.
Tools Tablespace Datafiles	Separate from Redo Log and Archive Log Files
MEDAT n Tablespace Datafiles	Separate from Redo Log, Archive Log Files, and MEIDX n Tablespace Datafiles.
MEIDX n Tablespace Datafiles	Separate from Redo Log, Archive Log Files, MEDAT n Tablespace Datafiles.
Redo Log Files	Separate from ALL Tablespace Datafiles and Archive Log Files. Redo Log files must be mirrored on physically separate disk devices.
Archive Log Files	Separate from ALL Tablespace Datafiles and both sets of mirrored Redo Log Files.

Sizing the MEDAT n and MEIDX n Tablespaces

The Idapta Implementation Team provides guidance with sizing the MEDAT n and MEIDX n tablespaces. Contact your Idapta account representative for details.

Typical Database I/O Subsystem Layout

Table 8 shows typical I/O subsystem layouts based on these requirements:

- 32 GB data store
- A minimum of 100 GB of native disk storage
(50 GB usable RAID 0 + 1 and 68 GB usable for RAID 5)

Table 8: Typical Database I/O Subsystem Layout

Logical Volume	Volume 2	Volume 3	Volume 4	Volume 5
RAID Type	RAID 1	RAID 1	RAID 0 + 1 Or RAID 5	RAID 0 + 1 Or RAID 5
Usable Size	4 GB +	4 GB +	16 GB +	16 GB +
Type of Data	Oracle Archive log files	Oracle Redo log files	Oracle Datafiles for tablespaces: SYSTEM MEDAT n MEIDX n $\frac{1}{2}$ RBS $\frac{1}{2}$ TEMP	Oracle Datafiles for tablespaces: TOOLS MEDAT n MEIDX n MECOMMON $\frac{1}{2}$ RBS $\frac{1}{2}$ TEMP

Example I/O Subsystems

Low-Volume/High Availability Exchanges

Figure 4 shows a possible I/O subsystem for a low-volume exchange with a high-availability configuration.

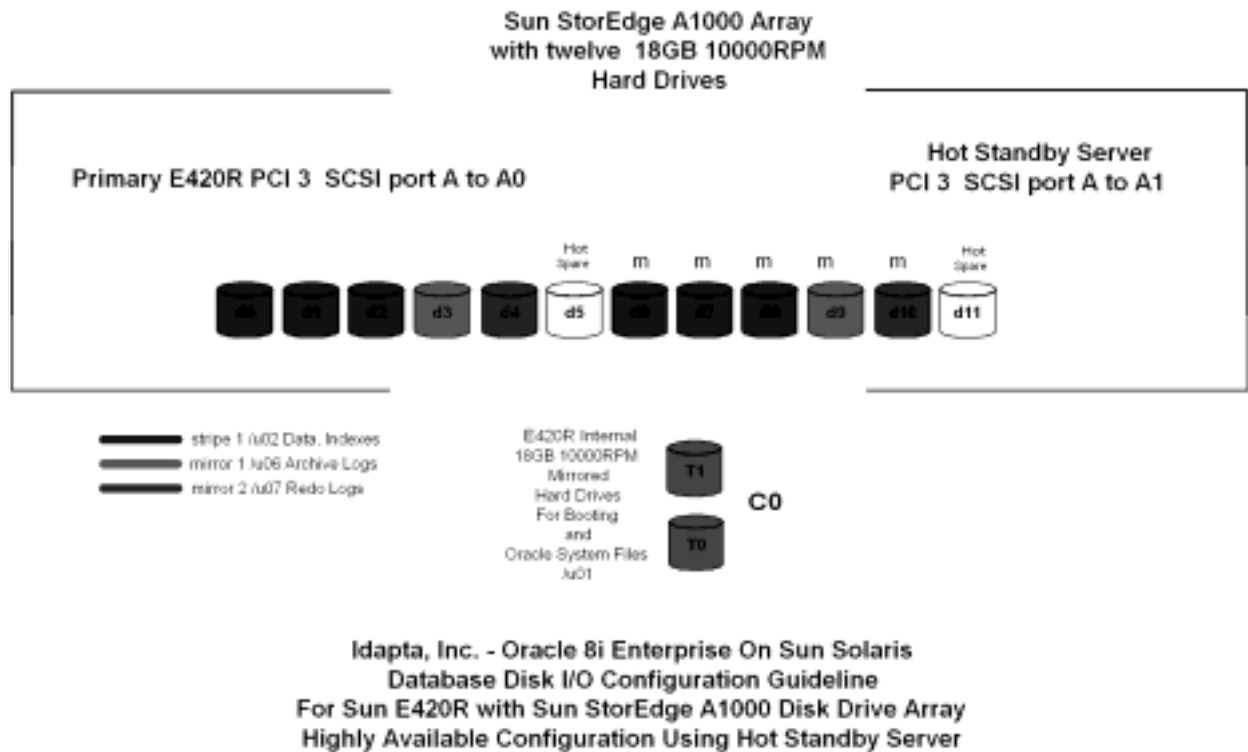


Figure 4: I/O Configuration Guideline for Low-Volume/High-Availability System

High-Volume/High Availability Exchanges

Figure 5 shows a possible I/O subsystem for a high-volume exchange with a high-availability configuration.

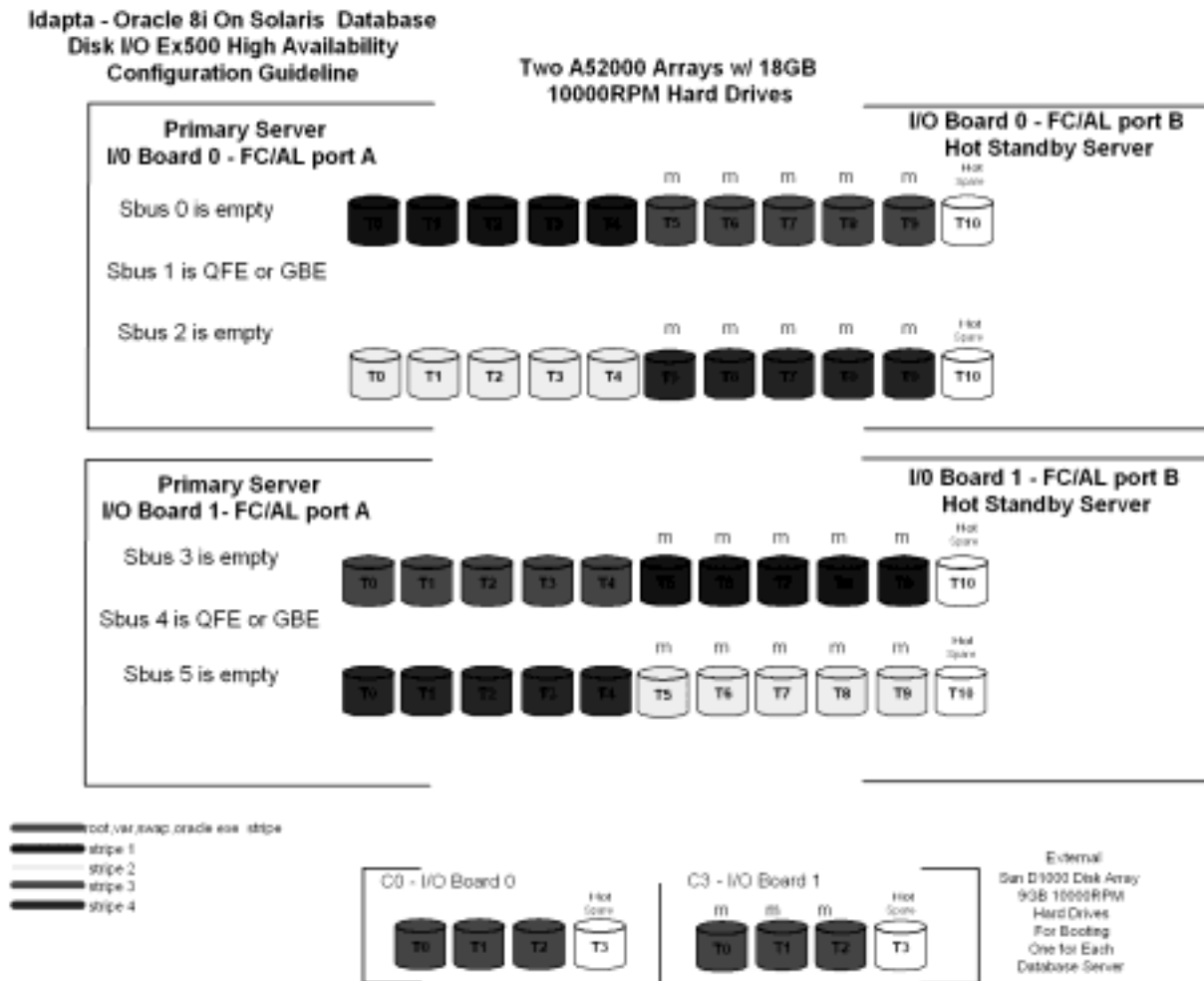


Figure 5: I/O Configuration Guideline for High-Volume/High-Availability System

A

MARKETEXCHANGE 3.0 SUPPORTED PLATFORMS

Overview

Table 9 shows the platforms supported by MarketExchange 3.0.

Table 9: MarketExchange 3.0 Supported Platforms

Server Tier	Supported Operating System for All Servers	Supported Server Software	Supported SDK
Web Server	<p>For deployment:</p> <p>Solaris 7 (Sparc) with latest Sun-Recommended Patch Set</p> <p>For development only:</p> <ul style="list-style-type: none"> Windows NT 4.0 SP6 or Windows 2000 SP1 	iPlanet Enterprise Web Server 4.1 (formally Netscape Enterprise Server)	<p>Sun SDK 1.3 for the Operating System used</p> <p>(Solaris may require additional patches; check www.java.sun.com.)</p>
JAVA Application Server	<p>For deployment:</p> <p>Solaris 7 (Sparc) with latest Sun-Recommended Patch Set</p> <p>For development only:</p> <ul style="list-style-type: none"> Windows NT 4.0 SP6 or Windows 2000 SP1 	<p>BEA's WebLogic JAVA Application Server Version 5.1 Service Pack 6 with Cluster Option</p> <p>Oracle 8i Version 8.1.5 for Clients (Newer versions of Oracle Client are not currently supported.)</p>	<p>Sun SDK 1.3 for the Operating System used</p> <p>(Solaris may require additional patches; check www.java.sun.com.)</p>

Table 9: MarketExchange 3.0 Supported Platforms (Continued)

Database Server	For deployment: Solaris 7 (Sparc) with latest Sun-Recommended Patch Set For development only: <ul style="list-style-type: none">• Windows NT 4.0 SP6 or• Windows 2000 SP1	Oracle 8i Enterprise Edition <ul style="list-style-type: none">• Version 8.1.5 Server or• Version 8.1.6 Server	Sun SDK 1.3 for the Operating System used (Solaris may require additional patches; check www.java.sun.com .)
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