DIGITAL™ Prioris™ Solution Sizer
Reference Guide

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Digital Equipment Corporation

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PRIORIS SOLUTION SIZER TOOL

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Introduction *1*

Introduction

The Prioris Solution Sizer tool provides VARs with the ability to quickly assess, through a business-oriented interview process, the projected server characteristics of a particular business solution. This release of the tool helps to determine the optimal Prioris server configuration for *either*

- an Intranet/Internet environment using Microsoft Windows NT 4.0 and Microsoft Internet Information Server (IIS) web server

or

- a mail/messaging environment using Microsoft Windows NT 4.0 and Microsoft Exchange server

Unlike other server sizing tools, the Prioris Solution Sizer approach provides benefits for both existing sites with Intranet/Internet and mail/messaging server deployments, and new sites or users unfamiliar with sizing terminology. Solution Sizer goes beyond synthetic industry benchmark data and speculation to base its analysis on actual characterized performance data and application workloads, tested in DIGITAL's performance labs. In conjunction with the Prioris ServerMaker product, it provides VARs and their customers with complete server configuration order information necessary for a successful implementation.

Highlights

- "Wizard style" interview process produces server sizing recommendations based on key performance factors and offers important considerations for web site or electronic mail deployment
- Interview process properly sizes web or Exchange server configurations for new sites lacking specific performance measurements while allowing experienced site managers and resellers to quickly enter appropriate technical information for the characterized results
- Makes sizing recommendations based on extensive characterization testing with actual web or Exchange server workloads instead of generic industry benchmarks and "high-water mark" configurations
- Allows users to change the workload mix to best represent their web server environments. Sizing recommendations for custom configurations are based on a sophisticated calculation methodology
- Bases recommendations on the best-available price/performance and availability/expansion options, allowing VARs and end users to determine which criteria should drive configuration decisions
- Provides sizing data for Windows NT servers running either Microsoft Internet Information Server (IIS) or Microsoft Exchange server on Prioris 6000 series (Pentium Pro) servers, including number of processors, memory, network cards, disk spindles, and storage requirements
- Provides for what-if scenarios, enabling VARs and end users to see the effect of modifying individual parameters on the resulting configuration
- "Advisor" provides feedback to VARs and end users on complementary technologies such as system reliability and availability, and security and networking. It also highlights potential areas of risk
- Link to ServerMaker tool verifies configuration information and produces parts lists and pricing information, providing an easy mechanism for generating quotes
- Tool is part of overall DIGITAL marketing programs designed to provide complete Intranet/Internet and Exchange server solutions
- Frequently planned updates will include items such as new platforms and application and solution modules

What this tool is used to size

The Prioris Solution Sizer provides server sizing information for Intranet/Internet and mail/messaging solutions. The tool draws on the characterization data generated from actual system performance testing with complex application workloads.

The Intranet/Internet component of Solution Sizer characterizes workloads based on typical Intranet/Internet server utilization using Microsoft NT Server, Microsoft Internet Information Server (IIS), and Microsoft Exchange software (functioning as an Internet mail server). The Mail and Messaging component characterizes workloads based on typical server utilization using Microsoft NT Server and Microsoft Exchange software.

For more information about the DIGITAL performance tests, see the IIS Characterization White Paper (IIS.PDF) and the Exchange Characterization White Paper (EXCHANGE.PDF) included with the Solution Sizer software. You can view these files through the Help menu in the Solution Sizer on-line help.

What this manual contains

This manual provides information on how to use the Solution Sizer tool to configure an Intranet/Internet or Microsoft Exchange server. The information is as follows:

- *Introduction*—provides general information about Prioris Solution Sizer
- *Installation*—provides procedures for installing the Prioris Solution Sizer and the Prioris ServerMaker software
- *Information to Get Before Using Solution Sizer*—provides questions that typically may be asked to define an application
- *Getting Started*—provides information on how to use Solution Sizer
- *Sizing an Intranet or Internet Application*—provides detailed information about the questions that are asked to develop an Intranet/Internet solution
- *Sizing a Microsoft Exchange Application*—provides detailed information about the questions that are asked to develop a Microsoft Exchange solution
- *Server Configuration Recommendations*—provides information about recommended server configurations
- *Example Sessions*—provides detailed summaries of cases at DIGITAL
- *Workload Definitions*—provides information on the workload content elements
- *Glossary*—provides the acronyms and definitions for many of the terms used in this guide

Information to have before using the tool

Chapter 3 provides a set of questions for gathering detailed information about the end user's environment before using Prioris Solution Sizer. In general, the questions cover

- Information about the end user—type of business, number of employees, organizational information, and network and computing infrastructure
- Specific application for the server—Intranet or Internet, mail or messaging, scope, integration with other systems
- Type and level of activity planned for the server

ServerMaker

ServerMaker, a server configuration and ordering tool for Prioris servers, is bundled with Solution Sizer. ServerMaker is linked to Prioris Solution Sizer so that it can be called from within the program. When you use Solution Sizer to determine the type of Prioris server required for a configuration, you can then use ServerMaker to verify the configuration and to supply a parts list complete with DIGITAL part numbers.

ServerMaker also offers you the ability to link your price file, in the form of a Microsoft Excel spreadsheet, with the parts list to generate an itemized quote. For more detailed information, see the file, SRVRMAKR.DOC, included with the ServerMaker software.

Getting help

The Solution Sizer tool has an on-line help feature. This help is context-sensitive. By either clicking somewhere on the page and then pressing "F1," or using the help on the menu bar, you can view information about specific questions on that page.

Support

DIGITAL provides support for the Prioris Solution Sizer for authorized VARs through the standard VAR support channels. Further information about Solution Sizer can be obtained on the worldwide web through the VAR's account on the DIGITAL Business Link. For more information, contact your local DIGITAL representative.

Installation *2*

Introduction

This section provides information on how to install the Solution Sizer and ServerMaker tools.

Prerequisites

Before installing Solution Sizer or ServerMaker, please check that the tool will be installed on a standard PC running one of the following operating systems:

- Windows 95
- Windows NT 3.51
- Windows NT 4.0

Your PC should have a CD-ROM drive and approximately 12 MB of disk space for the complete installation of Solution Sizer and ServerMaker. ServerMaker requires a minimum of 12 MB of memory.

If your computer does not have a CD-ROM drive, you can install the software on a network and then load the programs from the network. See "Installing from a network" later in this chapter.

Contents of the Solution Sizer CD

The DIGITAL Prioris Solution Sizer CD contains the following programs and files:

Program or File	*Description*
Solution Sizer	32-bit Solution Sizer program
ServerMaker	32-bit ServerMaker program
Adobe Acrobat Reader	Viewer program for reading .PDF files
EXCHANGE.PDF	Document file for the Exchange characterization white paper
IIS.PDF	Document file for the IIS characterization white paper
REFGUIDE.PDF	Document file for the the Solution Sizer *Reference Guide*

The Solution Sizer program files are described in "Solution Sizer files" later in this chapter.

Using AutoPlay to install programs and view documentation

If your system supports AutoPlay, you can automatically install any of the Solution Sizer programs and immediately view Solution Sizer documentation. Use the following procedure:

1. Insert the Solution Sizer CD in your computer's CD-ROM drive. The Prioris Solution Sizer window appears. If your computer does not support AutoPlay, or if an error occurs, the window does not appear.
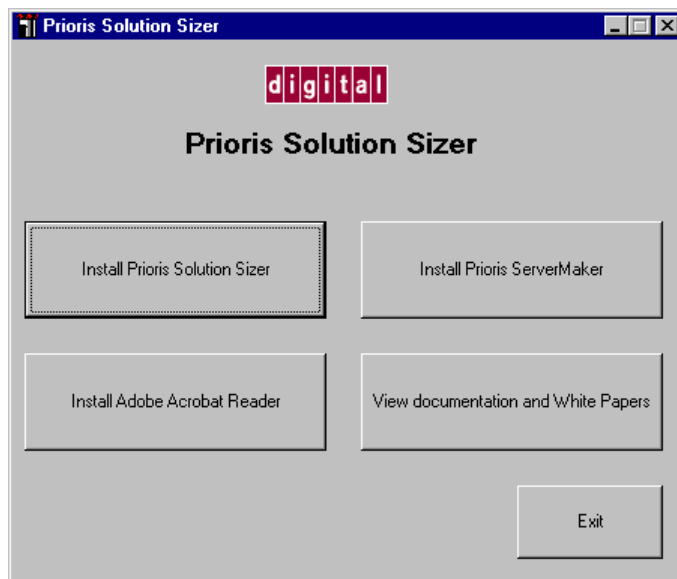
2. Click the button for the program you want to install or for the documentation you want to read.

Note: *To read the Exchange or IIS White Papers, you must first install the Adobe Acrobat Reader.*

See the sections below for instructions on continuing with installation for each of the programs.

Installing Solution Sizer

1. Insert the Solution Sizer CD in your computer's CD-ROM drive.

2. If your computer supports AutoPlay, on the Prioris Solution Sizer window, click the Install Prioris Solution Sizer button. Skip to Step 5.

3. If your computer does not support AutoPlay, click the Windows 95 or Windows NT 4.0 Start button, and click Run. If you are using Windows NT 3.51, use the File Manager **File** menu and **Run** command.

4. Type *d:\solusizr\setup* in the text box. If d: is not your CD-ROM drive, replace *d* with the correct letter.

5. The program asks where to install Solution Sizer. Specify the directory to place the files.

6. At this point during the installation, please read the licensing agreement, found at the beginning of this manual. If you agree to the terms of the license, continue the installation. Otherwise, click the Exit Setup button.

7. If you have a previous version of Solution Sizer installed in the same directory you are installing the new version to, you will be prompted before overwriting those files. Overwriting these files will not hurt Solution Sizer. To overwrite these files, you must NOT use the default answers provided for these prompts. The prompts will read:

   ```
   Setup is about to replace a pre-existing file(s). This may
   cause loss of data for an existing application. Cancel
   setup?
   ```

   You should answer **No** to this.

   ```
   Installing over an existing application without first
   removing it may damage that installation or cause future
   attempts to remove the installation to fail. Are you sure
   you want to continue?
   ```

   You should answer **Yes** to this.

8. Solution Sizer gives you the ability to display your logo on the interview screens. Before you do so, make sure your logo image file is named **logo** and is in one of the following image file formats: *.ICO, *.BMP, *.WMF, or *.RLE . For best results, you should scale the image to an approximate size of 82 pixels wide by 29 pixels high (.85 x .30 inches).

   To display your logo in Solution Sizer, copy the logo file (for example, LOGO.BMP) to the directory that contains the Solution Sizer files. A representative partner logo is included with the Solution Sizer software. To view the sample logo on the Solution Sizer screens, user Windows Explorer to rename SAMPLELOGO.BMP (located in the Solusizr folder) to LOGO.BMP.

Solution Sizer files

The Solution Sizer program consists of the following files:

File	*Description*
Comdlg32.ocx	Support file for 32-bit Solution Sizer
Ctl3d32.dll	Support file for 32-bit Solution Sizer
Exchange.pdf	White paper for the Exchange characterization work
Exchdata.txt	The characterization data file
HX-ZX.bmp	Bitmap of HX and ZX systems
IIS.pdf	White paper for the Intranet characterization work
samplelogo.bmp	Sample logo file
Mfc40.dll	Support file for 32-bit Solution Sizer
Msvcrt20.dll	Support file for 32-bit Solution Sizer
Msvcrt40.dll	Support file for 32-bit Solution Sizer
MX.bmp	Bitmap of MX system
Olepro32.dll	Support file for 32-bit Solution Sizer
Prioris.ico	Prioris Solution Sizer icon file
Readme.doc	Document file with information about using the software
Setup.exe	Installation executable
Setup.lst	Information required for setup.exe
Setup132.exe	Installation executable
Solusizr.exe	The Solution Sizer executable
Solusizr.hlp	On-line help file
St4unst.log	Installation log file
Spin32.ocx	Support file for 32-bit Solution Sizer
Stkit432.dll	Support file for 32-bit Solution Sizer
Tabctl32.ocx	Support file for 32-bit Solution Sizer
Threed32.ocx	Support file for 32-bit Solution Sizer
Vb40032.dll	Support file for 32-bit Solution Sizer
Ven2232.olb	Support file for 32-bit Solution Sizer
XL.bmp	Bitmap of XL system

Installing ServerMaker

Prioris ServerMaker version 2.2 or greater is required to work correctly with this version of Solution Sizer.

1. Insert the Solution Sizer CD in your computer's CD-ROM drive.

2. If your computer supports AutoPlay, on the Prioris Solution Sizer window, click the Install Prioris ServerMaker button. Skip to Step 5.

3. If your computer does not support AutoPlay, click the Windows 95 or Windows NT Start button, and click Run. If you are using Windows NT 3.51, use the File Manager **File** menu and **Run** command.

4. Type *d:***\srvrmakr\setup** in the text box. If d: is not your CD-ROM drive, replace *d* with the correct letter.

5. The program will ask where to install ServerMaker. Specify the directory to place the files.

6. If you have a previous version of ServerMaker installed in the same directory you are installing the new version to, you will be prompted before overwriting those files. Overwriting these files will not hurt ServerMaker. To overwrite these files, you must NOT use the default answers provided for these prompts. The prompts will read:

   ```
   Setup is about to replace a pre-existing file(s). This may
   cause loss of data for an existing application. Cancel
   setup?
   ```

   You should answer **No** to this.

   ```
   Installing over an existing application without first
   removing it may damage that installation or cause future
   attempts to remove the installation to fail. Are you sure
   you want to continue?
   ```

   You should answer **Yes** to this.

Installing Adobe Acrobat Reader

1. Insert the Solution Sizer CD in your computer's CD-ROM drive.

2. If your computer supports AutoPlay, on the Prioris Solution Sizer window, click the Install Adobe Acrobat Reader button. Skip to Step 5.

3. If your computer does not support AutoPlay, click the Windows 95 or Windows NT Start button, and click Run. If you are using Windows NT 3.51, use the File Manager **File** menu and **Run** command.

4. Type *d***:\adobe\ar32e30.exe** in the text box. If d: is not your CD-ROM drive, replace *d* with the correct letter.

5. Follow the instructions provided in the Adobe Acrobat Reader screens to complete installation.

Installing from a network

If your computer does not have a CD-ROM drive, you can install Solution Sizer, ServerMaker, and Adobe Acrobat Reader from a network by using the following procedure:

1. Using a PC with a CD-ROM drive, copy the Solution Sizer, ServerMaker, and Adobe folders from the installation CD to a shared network drive.

2. Connect the computer without CD-ROM to the Solution Sizer network folder.

3. Run **setup.exe**.

4. Continue with Steps 5-8 of the Solution Sizer installation procedure on page 8.

5. Connect to the ServerMaker network folder.

6. Run **setup.exe**.

7. Continue with Steps 5-6 of the ServerMaker installation procedure on page 10.

8. Connect to the Adobe network folder.

9. Run **ar32e30.exe**.

10. Continue with Step 5 of the Adobe Acrobat Reader installation procedure on page 11.

Information To Get Before
Using Solution Sizer *3*

Introduction

This section contains a list of questions that you may use to begin your research into the end user's environment. The answers to these questions provide much of the information you will need to use Solution Sizer to characterize a server solution.

Customer profile:

1. What is the size of the company?
2. What is the company business?
3. What is the business objective/project?
4. What is the timeframe and staging?
5. What is the scope of this web or Exchange server (department, division, business unit, corporation, or Internet)?
6. Who will manage the server?

Existing environment:

1. Is this a replacement for or an addition to an existing server?
2. Is there a network in place?
3. Number of sites/buildings?
4. Is there existing hardware or software?
5. What other applications are in use on the LAN and what resources do they require?
6. What type of network topology is used (10 Mbit, 100Mbit, FDDI, or other)?

User profile:

1. Will the intranet or messaging service be available to all sites/employees?
2. Will all employees be interested in or need the service on the site?
3. What is the estimated number of users?
4. Where will the users be coming from?
5. Will users frequently be mailing large documents (greater than 10 KB)?

Solution:

1. Is it mission-critical?
2. Where will the servers be located?
3. Traffic on each server?
4. Function of each server?
5. Anticipated growth of both data and users?
6. Is the new equipment custom or turn-key and the level of integration that will be required?
7. Will there be sensitive information on the server? What type of information?
8. How much data will be stored on the server?
9. What kind of connectivity will this server have with other internal or external servers?

Getting Started with Solution Sizer *4*

Introduction

This section describes how to begin using Solution Sizer, including

- Starting Prioris Solution Sizer
- Viewing the Introduction Screen
- Starting a new session
- Saving and printing your work
- Navigating inside Solution Sizer

Starting Prioris Solution Sizer

Click the Start menu, point to Programs, then click Prioris Solution Sizer.

Viewing the Introduction Screen

The first window you see when you start Solution Sizer is the Introduction Screen (see Figure 1). This screen contains the question as to the type of solution being sized: either Intranet/Internet or Mail/Messaging. For the purpose of this tool, the Intranet/Internet server workload components include web serving, e-mail, and a link to an external database. If you choose the Mail/Messaging option, Solution Sizer assumes that the end user has decided to deploy Microsoft Exchange and has completed planning the Exchange domain and network infrastructure.

See Chapter 5 for detailed information about conducting an interview session for an Intranet or Internet application. See Chapter 6 for detailed information about conducting an interview session for a Microsoft Exchange mail/messaging application.
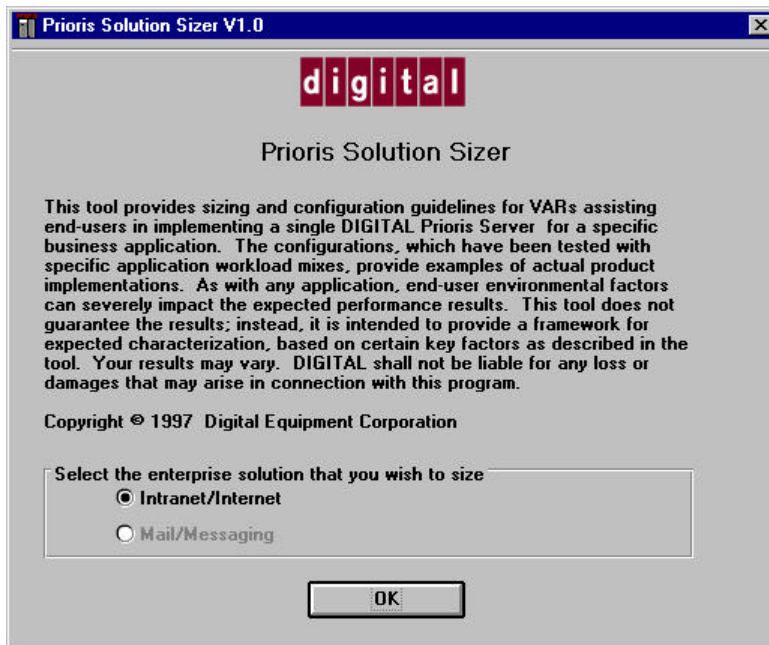
Figure 1.   Introductory Screen with Disclaimer

Starting a new session

You start a new session by selecting the type of solution you want to size on the Introduction screen.

After you select the type of solution, Solution Sizer presents a series of interview screens that contain questions about the enterprise's business, user, and information needs. If you decide you want to start again with a new session of the same type of solution, click the File menu and click Reset to defaults (see Figure 2). If you want to start a new session of a different type of solution, click the File menu and click New.
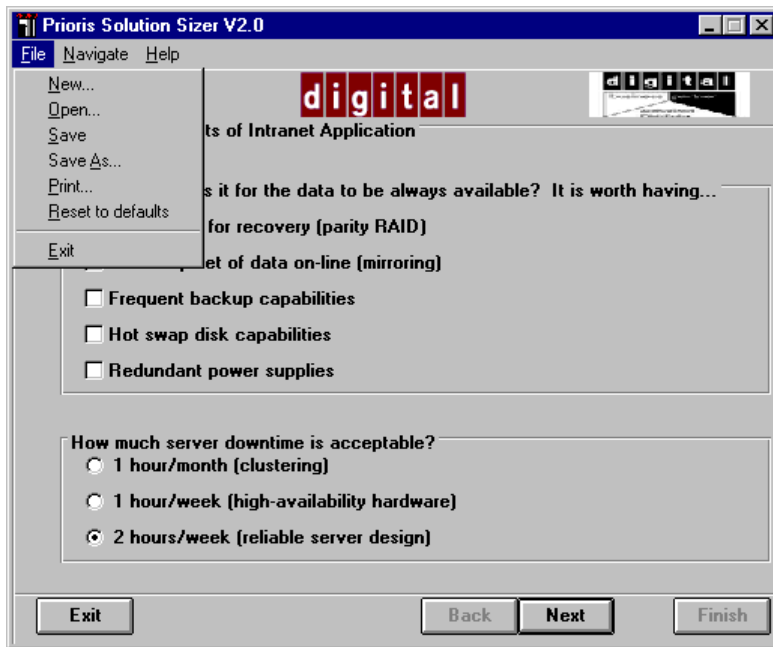
Figure 2.   File menu commands

Saving and printing your work

As you proceed through the interview, you can record the interview data as a text file by using the **Save As** and **Save** commands on the File menu (see Figure 2). You can also use the File menu to open a previously saved file and to print out the results of the interview questions and configuration recommendations. Use the **Restore to defaults** command when you want to delete the input data you have gathered so far and start again.

Your saved data file contains the responses to the interview questions and the recommendations produced by Solution Sizer when you click the Finish button. If, after finishing, you go back and change any of the inputs, you should use the Finish button again. Then, when you save your file again, it will include the updated input and the new solution.

Navigating inside Solution Sizer

Buttons at the bottom of each screen allow you to navigate through Solution Sizer. Use the Back and Next buttons to move either back or forward one screen. Use the Finish button to conclude the characterization when all the input has been entered. Use the Exit button to quit the tool.

Also, you can use the Navigate menu to quickly move between the interview session screens. This option is particularly useful when engaging in "what-if" scenarios, by changing individual responses to interview questions to view the impact on the resulting configuration.
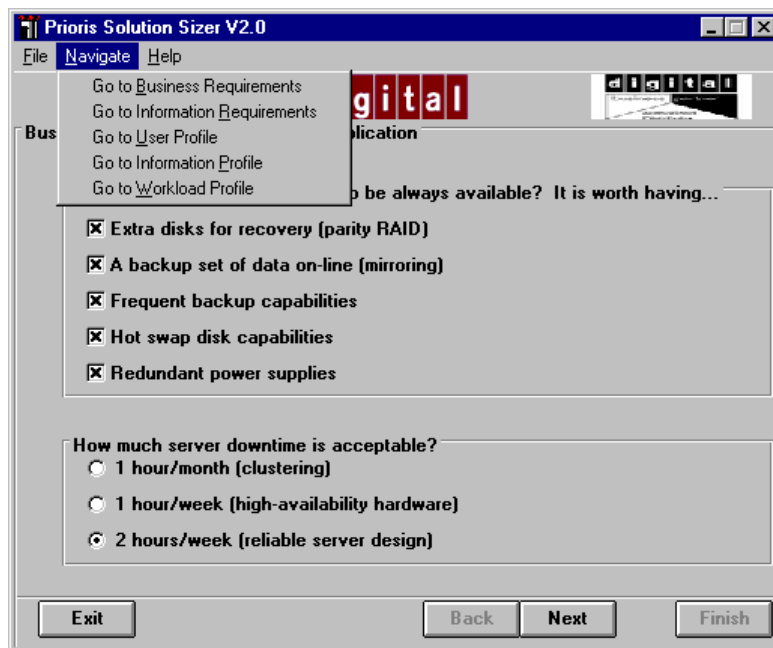
Figure 3.   Navigational tools

Sizing an Intranet
or Internet Application 5

Introduction

This section covers the screens displayed in Solution Sizer when you select the Intranet/Internet option on the Introduction screen (see Chapter 4). The information contained in this chapter provides an overview to the interview questions—more details are covered in the on-line help. All of the interview screens are covered, including the following:

- Business Requirements of Intranet Applications
- Information Requirements of Intranet Applications
- Intranet Application User Profile
- Intranet Application User Profile Details
- Intranet Information Profile
- Intranet Workload Profile
- Example Web Pages
- Custom Workload Mix

The following sections detail each of the screens.

Note: *Application and server characterization data is often dependent upon environmental factors such as network bandwidth and workload mix. DIGITAL does not guarantee the result provided by the Prioris Solution Sizer tool—instead this tool provides a conservative approach to recommending a correctly-sized server configuration to meet the end user's workload requirements. This information is not based on generic benchmark claims, but actual characterization testing in a simulated real-world environment. Solution Sizer highlights as many of the environmental and configuration dependencies related to performance as possible. However, realize that Solution Sizer provides only recommendations based on the assumption that the provided user information is correct and that all other environmental factors remain equal. The end user's results may vary.*

Business requirements of Intranet applications

The Business Requirements of Intranet Application screen addresses the business importance of the Intranet/Internet server (see Figure 4). If the role of this web server is business critical in nature, the end user should consider the following:

- data availability
- acceptable downtime levels
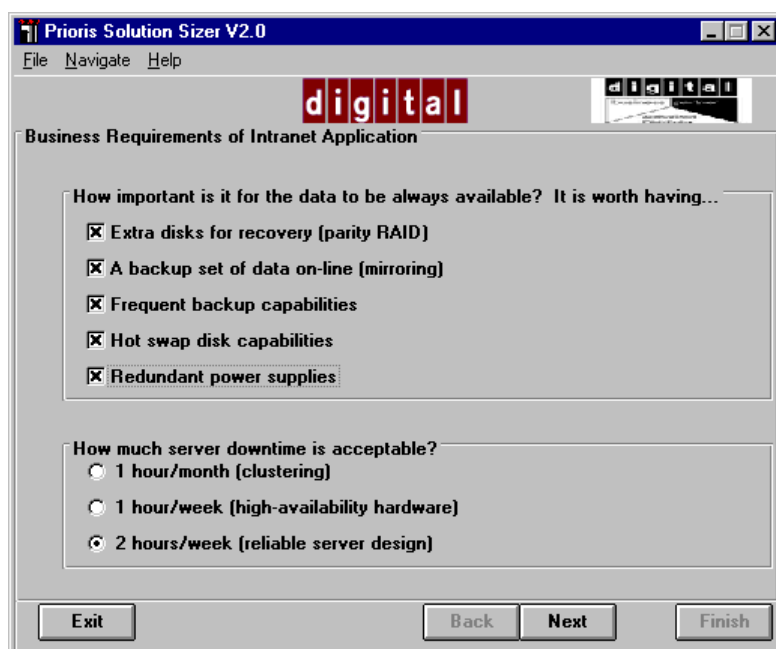
Figure 4.   Data Availability and Reliability Questions

The questions on this screen cover these items:

How important is it for the data to be always available? It is worth having...

The information derived from this question is used in providing Advisor information. The options are:

- Extra disks for recovery (parity RAID)
- A backup set of data on-line (mirroring)
- Frequent backup capabilities
- Hot swap disk capabilities
- Redundant power supplies

Select as many options as are applicable.

If the option "Extra disks for recovery (parity RAID)" is selected, the recommendations will include RAID-3 or 5. RAID-3 and RAID-5 are known as parity RAID, which places data and parity across several disks.

If the option "A backup set of data on-line (mirroring)" is selected, the recommendation may include RAID 0+1 or 1. Raid 0+1 would be Striping and Mirroring which would mean that data is duplicated from one drive to another drive (mirroring provides fault tolerance) and that data is written across several disks (Striping provides performance).

If the option "Frequent backup capabilities" is selected, the recommendations may include frequent backups to ensure data availability

If the option "Hot swap disk capabilities" is selected, the recommendations may include this option to ensure less downtime.

If the option "Redundant power supplies" is selected, the recommendation may include this option to ensure less downtime.

How much server downtime is acceptable?

The options for this question are 1 hour/month, 1 hour/week, and 2 hours/week. For organizations deploying business-critical Intranet and Internet sites, consideration should be given to the costs associated with downtime and conversely, the options available for increasing availability levels.

The typical Pentium Pro server, based on industry-standard components and MTBF, can achieve availability levels of 99%. This equates to 90 hours of downtime yearly (or slightly less than 2 hours per week). By incorporating high-availability hardware options such as RAID, hot swap disks, and redundant power and cooling; availability levels can be increased to an uptime of 99.5%, or a little under 1 hour per week. To further increase availability levels, clustering technology may provide availability levels of 99.9% or higher which may limit downtime to about an hour per month.

Note:	*Clustering technology provides for seamless, automatic failover of file services, applications and client operations*

What causes downtime? According to a Gartner Group survey, the primary causes of downtime are software defects and human intervention. These are either intentional (preventative maintenance and upgrades) or unintentional (operator error). Hardware component failure is less frequently the cause of downtime.

An Oracle survey found that on the average, downtime costs were $1,400 per minute for industries such as catalog sales. In other types of industries such as banking or credit card authorizations, downtime could result in even higher costs.

Selecting the option, "1 hour/1 month (clustering)," means that availability levels of 99.9% or greater are required to support the business critical nature of this web server, and triggers the clustering information in the Advisor page.

Selecting the option, "1 hour/week," means that availability levels of 99.5% are required which indicates high-availability hardware options. Recommendations would include redundant power supplies, hot swap drives and RAID capabilities.

Selecting the option, "2 hours/week," means that the availability levels provided by the Prioris Server family, without additional clustering or high-availability hardware, are sufficient for the business nature of this Intranet/Internet server.

Information requirements of Intranet applications

The "Information Requirements of Intranet Applications" page is designed to determine the site content of this Intranet/Internet server (see Figure 5). This plays an important role in determining which workload mix is used for characterization purposes. For more information on workload mixes, see "Intranet workload profiles" later in this chapter and Appendix A.

The questions on this page concern the type of information and the security requirements necessary to protect the information.
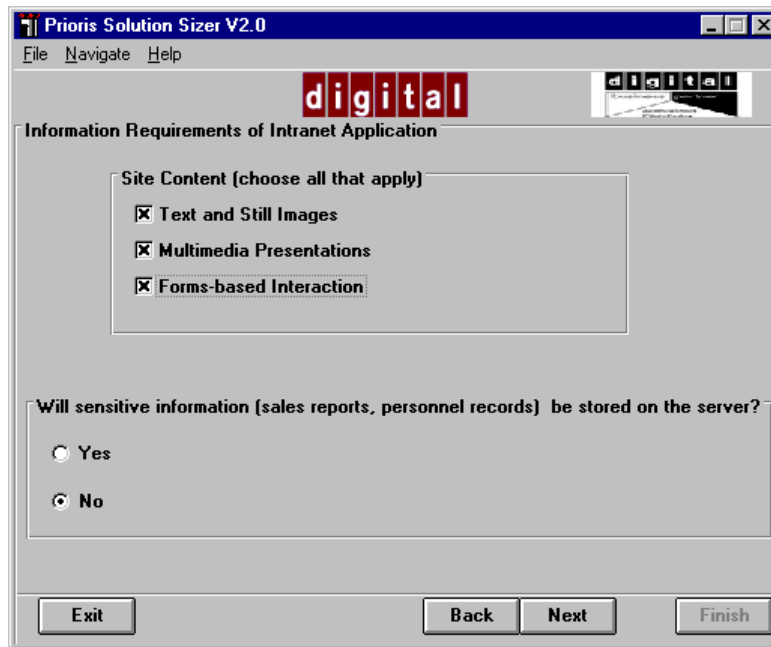
Figure 5.   Site content questions

Site Content (choose all that apply)

The options for site content are Text and Still images, Multimedia presentations, and Forms-based Interaction. The text and still images require the least amount of space and complexity while multimedia requires the most complexity. In general, the more sophisticated and complex the files making up a page are, the more capable the server must be to handle it.

Text and Still Images—The option "text and still images" is typically a default selection for most web sites, as text and graphical web pages are an integral part of most web sites. For some sites, particularly Intranet sites designed to place corporate information online, text and still images may be the primary site content.

Multimedia Presentations—Multimedia presentations are pages that would have significant amounts of streaming video or audio or both. This type of page on a web site requires a significant amount of disk space and significant processing power.

Forms-based Interactions—Forms-Based Interactions are pages that have database links and/or have dynamically generated pages. Examples of this include search engines and employee locator applications.

Will sensitive information (sales reports, personnel records) be stored on the server?

Information security becomes a critical concern as organizations move their business activities to the worldwide web. Whether the information is web-based electronic commerce and financial transactions, or company confidential product plans and price lists, the data needs to be protected on the web server and while it is in transit. Businesses that use Intranets to provide internal access to corporate information need to consider both internal and external threats—especially if the Intranet is connected to the Internet. Technologies such as firewalls, encryption, and digital signatures are common methods of ensuring confidentiality, controlled access, and integrity.

Calculating web server activity (hits/hour)

Web server performance is measured by "hits/hour." Basically, a hit denotes client access to a single file on the web server. The types of files include text, still images, video or audio clips, ActiveX controls, Java applets, and HTML. Multiple files make up a web page.

When trying to calculate hits per hour, the typical "user" concept does not apply. Web sites are more concerned with the number of visits to the site, rather than the number of users who access the information. Though this concept is more easily understood when it is applied to the Internet environment, it also applies to an Intranet environment.

For example, think of the web site as an art museum. When someone enters the museum, they pass through a turnstile at the front door—this turnstile registers their entry as a "visit." If the visitor leaves the museum and then decides to come back in—the visitor must pass through the turnstile again which will register this as another "visit."

Each visitor spends a different amount of time in the museum—some browse through different types and periods of art over the course of several hours while others will concentrate on a particular exhibit for a short period of time. The different exhibits can be thought of as "pages" while the pieces of each exhibit can be thought of as files.

Web activity is measured in a similar fashion. Each time a user connects to a site (server), which is done by loading one of the site's pages into their client browser, the site records a visit. The length of the visit is defined by the continued access of the site

without connecting to another site. If the user connects to a different site during the visit, that ends that particular visit. If after accessing information at another site, the user connects back to this site—it becomes a new visit.

During a visit to a site, a user may access several different pages. For instance, a user may point their browser to "http://www.AltaVista.digital.com" to search for information on a product. The visit starts when they load the AltaVista "home page." After submitting a search string, information is returned which may span multiple pages. Each page that the user views is counted as a new page during the visit. Should the user decide to view the contents of one of the AltaVista search results, the user jumps to the new site and thus, ends the AltaVista visit. After viewing the information on the new site, the user may decide to return to the AltaVista site to view more results—this is done by clicking the "back button" of their browser. This counts as a new visit to AltaVista—not as a continuation of the old visit.

Figure 6 illustrates the Intranet User Profile screen, which asks you whether you want to enter hits/hour or whether you want Solution Sizer to help calculate this figure. Experienced web VARs and end users may already know how many hits/hour to expect for this web server. If so, click Yes. The screen will change to allow you to enter hits/hour and a growth factor.

If you do not know how many hits/hour to expect, click No. Solution Sizer then displays the Intranet Application User Profile Details screen (see Figure 7) and helps you to calculate the value.

Figure 6.   Hits/hour: Calculate or provide figure

Figure 7.   Hits/hour calculations

The Intranet Application User Profile Details screen (Figure 7) requests information that Solution Sizer will use to calculate hits/hour.

How many visits to this site in a typical hour?

The choices range from 10 to 1000. Suggested guidelines are as follows:

- 10-50 —Small workgroup
- 51-200—Departmental solution or a site for a small company
- 201-700—Small customer base, medium company application, or a site in a large company
- 701+—large company site on the Internet

Note: The suggested guidelines may not be the case for all organizations.

How dramatically will the size of this group grow in the next year?

The slide is adjustable from 0 to 100%. This information is factored into the calculations to determine the server configuration.

Average Number of pages per visit

The options to this question are:

- Low browsing (1-2 pages) —form-based application or search results
- Typical search (2-20 pages) —corporate web site search
- Intensive research (20+ pages) —dedicated research, marketing product information

The number of pages per visit plays an important role in determining the number of hits/hour. Each page is comprised of a number of files. A "hit" is defined as access to an individual file. For purposes of calculation, Solution Sizer assumes access to each finished page generates an average of 7 hits. This is a conservative estimate—some pages generate more, others less. Using an average of 7 hits per page in this formula produces the most accurate representation of hits/hour.

Intranet Information Profile

The Intranet Information Profile page (see Figure 8) is used to define the amount of information on the site. Information is measured by pages. A page is defined as a viewable entity comprised of multiple files.
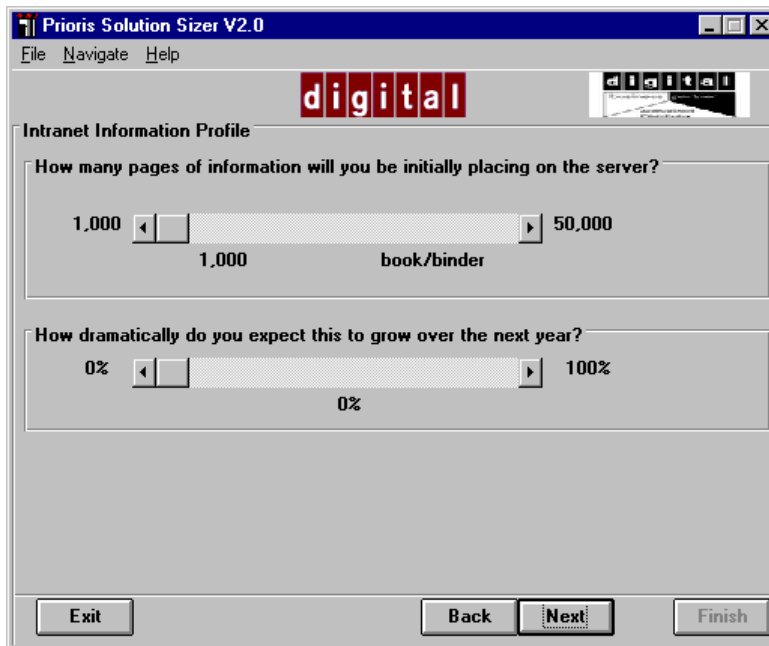
Figure 8.   Amount of information stored on the web site

How many pages of information will you initially be placing on the server?

This option, along with the workload mix, determines how much disk space is required for the web information. Think of the following options as guidelines.

- 1,000-10,000—book/binder
- 11,000-30,000—bookshelf
- 31,000-50,000—bookcase

How dramatically do you expect this to grow over the next year?

This question is used to determine how much the "page information" will need to be adjusted to take into consideration the growth in the coming year.

Intranet Workload Profile

The Intranet Workload Profile page is used to determine the types of data that the site will contain (see Figure 9). The default on this page has been selected based on the answers to the questions preceding this. You can select a different workload mix that more accurately describes the site by clicking a different option. This is not intended to provide an exact match to the site—rather, these examples represent relative mixes in the different workload components that have been tested in DIGITAL labs. See "Customizing the workload mix" later in this chapter and Appendix A for more information on the workloads.

Figure 9.   Workload profile screen

Viewing example web pages

The button, "See example web page," provides an example of the three different types of web pages.

The text/graphics is using an example of a DIGITAL Business Unit Intranet home page site; the mixed is using a DIGITAL library site, comprised of text, graphic and multimedia content; and the multimedia is using a DIGITAL marketing site containing streaming audio/video clips of television and radio ads.
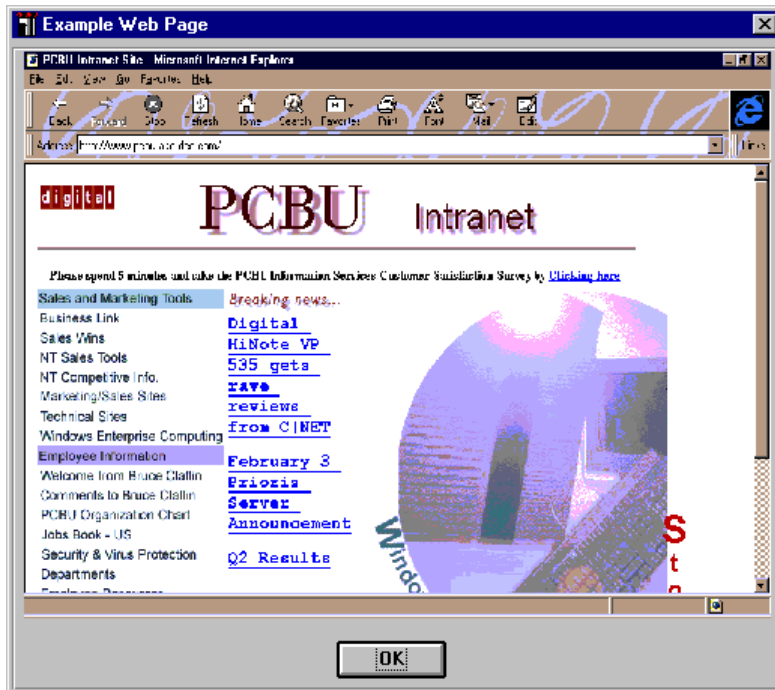
Figure 10. Text / Graphic Workload Example

The text/graphic web site example (Figure 10) is a typical Intranet home page, consisting of mostly text and still images and including elements of searching and

limited audio/video content. Many business-oriented Internet sites include this type of content.

Figure 11. Mixed Workload Example

Figure 11 is the home page from an Intranet corporate library, which is a mixed site example. It provides a balance between text/still images and audio/video clips. Also included are the elements of searching and dynamically generated content. Similar site content might be found on the Internet with sites associated with mass marketing and entertainment companies, as well as corporations utilizing newer web site technology such as Java applets and ActiveX controls.
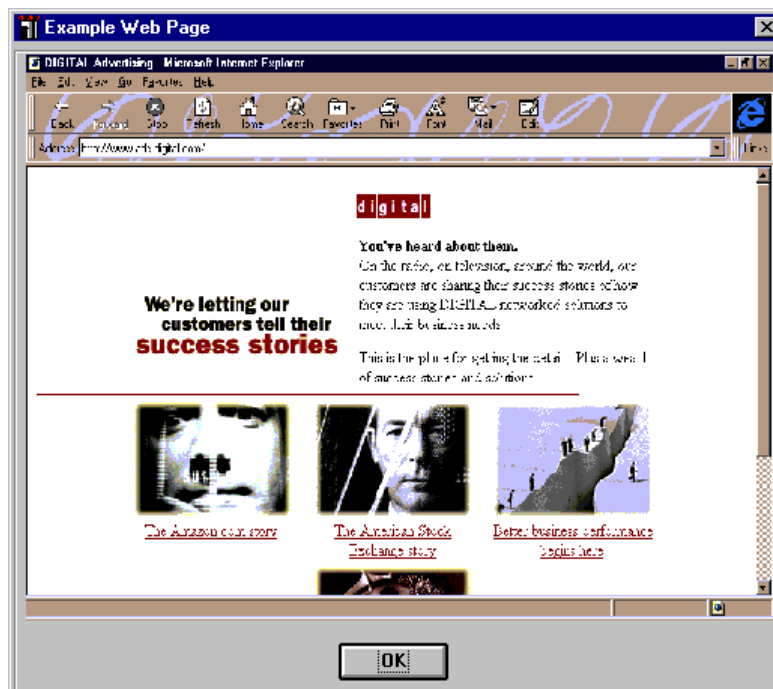
Figure 12. Multimedia Workload example

Figure 12 is a multimedia site example, representing an advertising and marketing site. It has a higher percentage of streaming audio/video than typically found in an Intranet site. Similar site content would be found on the Internet with communications companies such as film, television and recording industry.

Customizing the workload mix

The components that make up the workload are

- Internet mail
- external database access
- dynamic pages (index and search)
- static pages (HTML, audio/video, still images)

Solution Sizer selects a balance of components that DIGITAL has found through testing to be effective for the type of site you have specified. You can view the default component mix of this workload by clicking the Custom button on the Workload Profile screen (see Figure 9). The next screen that appears shows the relative mix of the four components (see Figure 13).
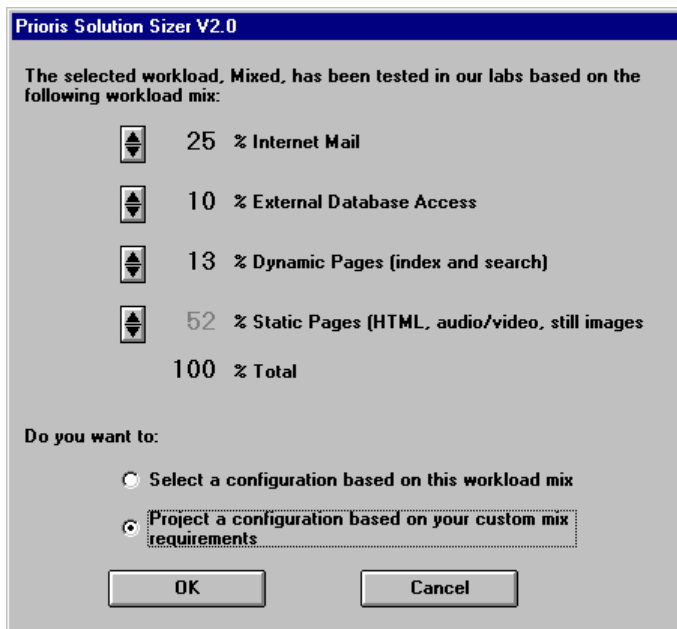
Figure 13. Customizing the workload mix

If you accept the settings, click OK.

If you want to change the relative percentages, you must first click the option labeled "Project a configuration based on your custom mix requirements" at the bottom of the screen. This option enables the spin buttons. You can then click the spin buttons up or down on the first three components. The last component, Static Pages, responds to the other changes you make to keep the total 100%. You cannot control this component directly. The maximum setting for Internet mail is 40%, the minimum setting for Static pages is 40%. Solution Sizer will display messages informing you when you are outside these limits.

After you have made the changes, click OK to return to the Workload Profile screen.

Note:	*Solution Sizer's recommended configurations are based on DIGITAL tests, which were conducted using three standard workload mixes (described in Appendix A). When you customize the workload mix, Solution Sizer's recommendations are projections. That is, they have not been individually tested, but are based on actual performance testing.*

Finishing the assessment

After you have provided input to the interview questions, viewed the example web pages, and accepted or reset the workload mix, click the Finish button at the bottom of the Intranet Workload Profile screen (see Figure 9). Solution Sizer then produces recommendations for configuring Prioris servers. These recommendations are described in more detail in Chapter 7.

Sizing a Microsoft
Exchange Application **6**

Introduction

This section covers the screens displayed in Solution Sizer when you select the Microsoft Exchange option on the Introduction screen (see Chapter 4). This chapter provides an overview of Exchange server and the interview questions—more details are covered in the on-line help. All of the interview screens are covered, including the following:

- Server Requirements for Microsoft Exchange
- Business Requirements for Microsoft Exchange Server
- Microsoft Exchange Optimization Settings
- Microsoft Exchange Server Calculation

Note: *Prioris Solution Sizer assumes that the end user has already decided to deploy Microsoft Exchange and has completed planning the Exchange domain and network infrastructure. The purpose of this tool is to configure an appropriate server to meet the end user's current and anticipated Exchange needs.*

Overview of Microsoft Exchange

Microsoft Exchange is the electronic mail system built in to Windows 95 and Windows NT operating systems. It allows users to communicate with many different e-mail systems and information services. The Microsoft Exchange Server components run as Windows NT services and work together to:

- Store and maintain all mail/messaging information about the organization and each of its sites in the Microsoft Exchange Server directory.
- Control who can access mail/messaging information from the directory and how the information can be used.
- Provide a Universal Inbox that enables users to submit, retrieve, and manage information, such as electronic messages, documents, and faxes, from a single location.
- Receive, deliver, transfer, and route messages throughout and beyond the organization.
- Monitor the state of the servers and their connections.
- Ensure that all the servers within and across sites have the same mail/messaging directory information.
- Manage replication schedules and replication conflicts.

The components of Exchange server

The following section describes the key components of Exchange server. Becoming familiar with these components is critical to understanding Exchange because performance varies depending on how the components are configured.

Exchange MTA

The Message Transfer Agent (MTA) is the engine for routing and transferring data to other servers or systems. It lays the foundation for the Exchange Server communications infrastructure and provides reliable data transmission across multiple sites and networks. MTA functions include mapping addresses, routing messages, and performing message format conversion as required. The MTA uses connectors for routing and transferring data to other servers or foreign systems.

Connectors

Connectors are Exchange software that allow the exchange of information with various messaging systems. They provide tight integration with all the tools and utilities that Exchange administrators will be using in the running of the Server, such as Performance Monitor, Link Monitor, and the Administrator Program. The four primary types of connectors are Exchange Server Site Connectors, X.400 Connectors, Internet Mail Connectors, and Microsoft Mail Connectors.

- **Exchange Server Site Connector**
  Site Connector is a Microsoft Exchange built-in connector designed for sites located on the LAN to facilitate message transfer between Exchange servers. Site Connector provides the most direct link between sites, with communication handled through Remote Procedure Calls (RPCs) in each site. Messages do not need to be converted from Exchange Internal format to a different format to be transmitted to a different site.

- **X.400 Connector**
  The X.400 Connector is the use of a Microsoft Exchange MTA configured to connect to an X.400-based system. It is based on the CCITT X.400 standard and provides an X.400 connector architecture that includes Message Transfer Agent, Message Stores, User Agents, and Access Units and X.400 Addressing.

- **Internet Mail Connector**
  The Internet Mail Connector (IMC) provides integrated, native SMTP connectivity to the Microsoft Exchange Server. The IMC can send and receive SMTP without the need for external hosts and is MIME-compliant. In addition, the IMC allows customers running TCP/IP over the backbone to connect Exchange to each other using the IMC connector.

- **Microsoft Mail Connector**
  The Microsoft Mail Connector provides seamless connectivity to Microsoft Mail for PC Networks, Microsoft Mail for AppleTalk® and Microsoft Mail for PC Networks gateways (PROFS, SNADS, Netware, MHS, and FAX). It uses a "shadow" Post Office that is structured like a Microsoft Mail Post Office.

Exchange Information Store

The Information Store (IS) is the repository of all messaging data transmitted to an Exchange Server, including both private messages sent to individual users and public information folders intended for viewing by many users.

The IS maintains data in two distinct databases: the Private Information Store and the Public Information Store. In Microsoft Exchange 4.0 and 5.0, each of these databases has a limit of 16 GB of storage. Later releases of MS Exchange do not have this limit. In addition to message storage, the IS handles local delivery of messages (when both sender and recipient are on the same server), replicates public folders, and enforces storage limits.

Note: *DIGITAL performed testing of the Microsoft Exchange application using the Private Information Store only. No testing of the Public Information Store was conducted.*

Exchange Directory Service

The Directory Service keeps all the information about users and resources in an organization and includes a structured view of all server names, mailboxes, and distribution lists in a site. Also, the directory keeps configuration information that other Exchange Server components use when mapping addresses and routing messages. Directory data is automatically replicated among all servers in a site through MTA. Directory replication between sites is done on a scheduled basis.

Exchange System Attendant

The service within Exchange that performs general maintenance tasks. Its functions include:

- Monitoring the status of messaging connections between servers.
- Gathering information on each server in a site to assist in running messaging monitoring tools.
- Building routing tables in a site.
- Verifying directory replication and correcting inconsistencies.
- Maintaining information logs about sent messages for tracking purposes.
- Generating addresses for message recipients you create (SMTP, X.400, MS-Mail).

For more information about Exchange, see the Exchange White Paper (EXCHANGE.PDF) included with the Solution Sizer software. You can view this document by using the Help menu in the Solution Sizer on-line help.

Description of test environment

The Mail and Messaging component of this tool is based on DIGITAL's testing of the Microsoft Exchange application and Private Information Store (no testing of the Public Information Store). DIGITAL used Microsoft's LOADSIM utility, Medium User Workload, to characterize Exchange performance on Prioris Servers. DIGITAL used the same settings that Microsoft uses for testing and characterization. For a detailed description of LOADSIM, refer to the *Microsoft Exchange Server White Paper* written by Microsoft. This document provides a good description of the Load Simulator Utility and workload sizing, and is available from the Microsoft Web site (http://www.microsoft.com).

Note:	*Application and server characterization data is often dependent upon environmental factors such as network and disk I/O bandwidth. DIGITAL does not guarantee the result provided by the Prioris Solution Sizer tool—instead this tool provides a conservative approach to recommending a correctly-sized server configuration to meet the end user's requirements. This information is not based on generic benchmark claims, but actual characterization testing in a simulated real-world environment. Solution Sizer highlights as many of the environmental and configuration dependencies related to performance as possible. However, realize that Solution Sizer provides only recommendations based on the assumption that the provided user information is correct and that all other environmental factors remain equal. The end user's results may vary.*

Server requirements for Microsoft Exchange

The Server Requirements screen requests information about the number of MS Exchange users and the amount of storage capacity needed for each user for the Private Information Store (see Figure 14). Solution Sizer multiplies the number of users, anticipated user growth, and individual storage requirement to calculate the Private Information Store requirement. For example:

500 users x 20% growth x 20 MB per user in the Private Store = 12,000 MB (12 GB)

Sizing a Microsoft Exchange Application
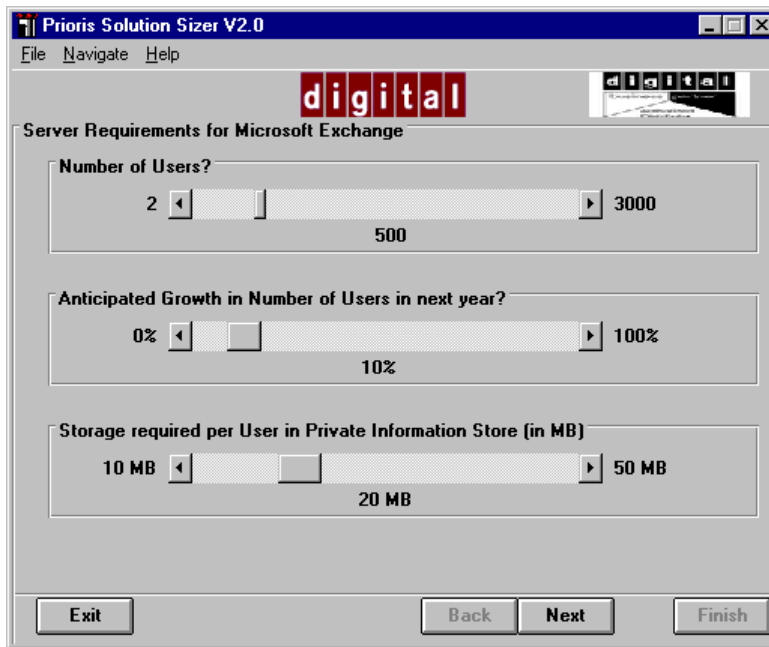
Figure 14. Server Requirements screen

If a site has a large number of users or large storage requirements, the results of the
server requirements calculation may exceed the capacity limit for a single server.
Solution Sizer displays a message when this occurs. You then have two options:

- You can explore a configuration that uses multiple servers. In this case, the
  solution will divide users and storage equally among separate servers.
- You can return to the Server requirements screen and decrease the number of
  users and/or their storage allocations so that the total does not exceed the single
  server limit.

Another way to work within the capacity limits of a single server is to have users store
data in their Personal Folders. These may be located either on their local hard drives or
on a Network File Server. A Network File Server provides a more secure environment
since it is protected by system passwords and is likely to be regularly backed up.

The Server Requirements screen contains the following questions:

Number of users?

The choices range up to 3000 users.

Anticipated growth in the number of users in the next year?

The slide is adjustable from 0 to 100%.

Storage required per user in Private Information Store (in MB)?

The Private Information Store is a database that stores information created by and sent to individual users, such as e-mail messages, attachments, electronic forms, and images.

The slide is adjustable from 10 MB to 50 MB. The default value is 10 MB, which is a common starting point. If you are unsure about how much storage space to allocate, your Information Services or System Manager can provide you with more information.

Business requirements for Microsoft Exchange server

The Business Requirements screen addresses the business importance of the Exchange server (see Figure 15). If the role of Exchange is mission-critical in nature, the end user should consider the following:

- data availability requirements
- acceptable downtime levels
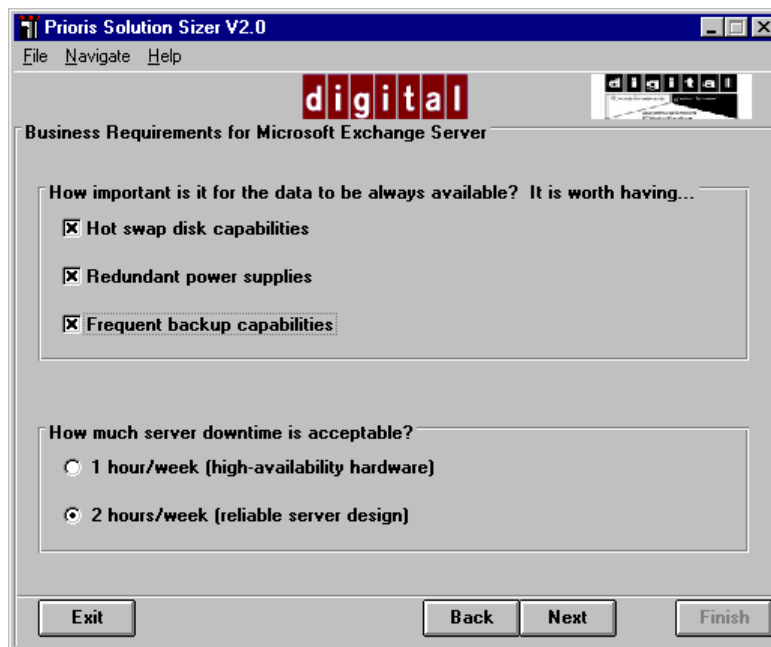
Figure 15. Business requirements screen

How important is it for the data to be always available? It is worth having...

The information derived from this question is used in providing Advisor information. The options are:

- Hot swap disk capabilities?
- Redundant power supplies?
- Frequent backup capabilities?

Select as many options as are applicable.

If the option, "Hot swap disk capabilities?" is selected, the recommendations may include this option to ensure less downtime.

If the option, "Redundant power supplies?" is selected, the recommendation may include this option to ensure less downtime.

If the option "Frequent backup capabilities?" is selected, the recommendations may include frequent backups to ensure data availability

How much server downtime is acceptable?

The options for this question are 1 hour/week, and 2 hours/week.

The typical Pentium Pro server, based on industry-standard components and MTBF, can achieve availability levels of 99%. This equates to 90 hours of downtime yearly (or slightly less than 2 hours per week). By incorporating high-availability hardware options such as RAID, hot swap disks, and redundant power and cooling; availability levels can be increased to an uptime of 99.5%, or a little under 1 hour per week.

Selecting the option, "1 hour/week," means that availability levels of 99.5% are required which indicates high-availability hardware options. Recommendations would include redundant power supplies, hot swap drives and RAID capabilities.

Selecting the option, "2 hours/week," means that the availability levels provided by the Prioris Server family, without additional high-availability hardware, are sufficient for the business nature of this server.

Microsoft Exchange optimization settings

The settings on the MS Exchange Optimization screen help to determine the best methods for storing data and configuring the required hardware. See Figure 16.

Figure 16. Microsoft Exchange Optimization Settings screen

Mirror System and Exchange Transaction Log Disk (RAID-1)?

To improve performance, the Exchange Server database is structured to first write from memory (RAM) to a fast, sequentially organized Transaction Log file rather than directly to the Information Store. Later, when there is less disk activity, it writes from memory to the database store. Since the Transaction Log contains the changes that have occurred between the current state of the database and the backup state of the database, if the Private (or Public) Information Store database is lost, it can easily be reconstructed from the last backup and the Transaction Log.

The System Disk contains NT Server, the NT System Disk, the Exchange Executables, and, in some cases, the Transaction Log. In smaller configurations, it is acceptable to place all Exchange components except the Information Store on two mirrored disks.

Microsoft strongly recommends mirroring the Exchange Transaction Log, therefore, this option is on by default and cannot be changed. With mirroring, information is written to two disks which are mirror images so that if one disk fails, data is unlikely to be lost. Mirroring improves read times, but also takes twice the amount of disk storage. Solution Sizer's recommendations will include RAID-1, a configuration that uses "mirroring."

Put Exchange Transaction Log on a separate disk and mirror it (RAID-1)?

You should consider using a separate mirrored disk for the Exchange Transaction Log in a heavily used system or a system with a large number of users (500 or more). By default, this option is off.

Have extra disk(s) for recovery of the Exchange Private Information Store (RAID-5)?

For best performance, Microsoft recommends that the Information Stores be set up as RAID-0 stripe sets. RAID-0 consists of two or more disks logically combined into a stripe set. Data is written to all disks in the set in a sequential fashion, for example, five megabytes are written to the first disk, then five megabytes are written to the next block on the next disk, and so on. Many of the reads and writes can be done in parallel. This technique results in faster reads and writes.

For further protection of the Information Stores, DIGITAL recommends usage of an additional disk per stripe set to provide RAID-5 protection. With RAID-5, data is written redundantly across all the disks. Any one disk failure can be tolerated. An additional hot swap disk can be designated for one or more RAID-5 sets in the event of a disk failure. This will decrease write performance slightly, but will maximize Exchange Server up-time.

By default, the RAID-5 option is off.

Have a dedicated MTA and Directory Database disk and mirror that disk?

Microsoft recommends that the MTA database (where the MTA stores temporary files) and Directory databases should be placed on a separate disk from the Information Store and Transaction Log, except in configurations with relatively low user populations. In smaller user configurations, it is acceptable to place these on the same disk as the NT System Disk, the Exchange Executables, and the Exchange Transaction Log, and have this disk mirrored. As the number of users increases, MTA is more frequently accessed and a dedicated disk is required. This disk volume does not particularly need high performance, but should have redundancy (RAID-1).

By default, this option is off.

Server calculations

Using SolutionSizer, you can calculate three different types of server workload. These types of server workload are on a continuum ranging from Single Server (LESS) to Multi-Server (MORE) to Multi-Server with Connectors (MOST). For more detailed information, read the Exchange White Paper that is included with the Solution Sizer 2.0 tool.

A Single Server (**SS**) system is an isolated server supporting a number of clients. A Multi-Server (**MS**) system involves two or more Exchange Servers in a single site with a replicated directory structure. Each server hosts a number of users and there is no sharing of databases and resources; Exchange automatically routes mail to the correct server within a site. The overhead on each system increases because it is now transmitting messages to another server. Both Exchange Standard Edition (Site Connector) and Exchange Enterprise Edition (Site Connector, Internet Mail Connector, X.400 Connector) include Connectors. Connectors are software components that perform any necessary transformations and deliver messages to Exchange Mail Systems and other external standards-based mail systems, for example, Internet Mail or X.400. These servers are considered Multi-Server with Connectors (**MSC**) systems.

The questions on the Server Calculation screen (see Figure 17) help to determine the best configuration for Exchange server(s).

Figure 17. Server Calculation screen

Is this Exchange Server being installed into a site containing multiple Exchange Servers?

Answer **YES** if you will install this Exchange Server into an environment where there will be multiple local Exchange Servers. This action will bring up the next question which will determine whether the server should be configured based on either the MS or MSC load**.**

Answer **NO** if you will install this Exchange Server as a single site server. By anwering NO, you have indicated that this is a standalone Exchange Server, and Solution Sizer will then calculate the appropriate configuration (based on a SS load).

Will this Exchange Server send mail to other Exchange servers within this site only?

> Answer **YES** if you plan to utilize multiple Exchange Servers within this single site, but are not planning any additional connections (based on the MS load).

> Answer **NO** if you plan to connect this to a server or server(s) at another site or are planning to use either the Internet Mail Connector or X.400 Connector. This action will bring up the next question, which will determine whether the server should be configured based on the MS or MSC load.

Will this Server be using a Site Connector to connect to other Exchange Servers?

> Answer **YES** if you plan to use Site Connector software to connect to other Exchange Servers, either on this site or at another site, but do not plan to use Internet Mail Connector or X.400 Connector (MS load).

> Answer **NO** if you plan to use Site Connector software **and** Internet Mail Connector or X.400 Connector (MSC load).

Finishing the assessment

After you have provided answers to the interview questions, click the Finish button at the bottom of the Server Calculation screen to have Solution Sizer produce recommendations for configuring Prioris servers. These recommendations are described in more detail in Chapter 7.

Server Configuration Recommendations 7

Introduction

After you respond to the questions on the interview screens and click the Finish button, Solution Sizer applies the calculations and requirements to the characterization data. The tool then offers one or two recommended server configurations along with suggestions for optimizing the final installation.

This chapter describes the information contained in the Solution and Advisor screens for both an Intranet/Internet configuration and an Exchange configuration, including the links to the ServerMaker tool. It includes the following sections:

- Recommended Intranet/Internet server specifications
- Intranet/Internet Advisor
- Recommended Exchange server specifications
- Exchange Advisor
- Exchange Disk, Network, and Throughput considerations
- Link to ServerMaker

Recommended Intranet/Internet server specifications

In most cases, Solution Sizer provides two Intranet/Internet server solutions for the VAR and end user to evaluate. Solution A is appropriate for an enterprise where price and performance are a priority. Solution B is meant for an enterprise that prefers a system that is either more expandable or provides higher levels of availability. See Figures 18 and 19.

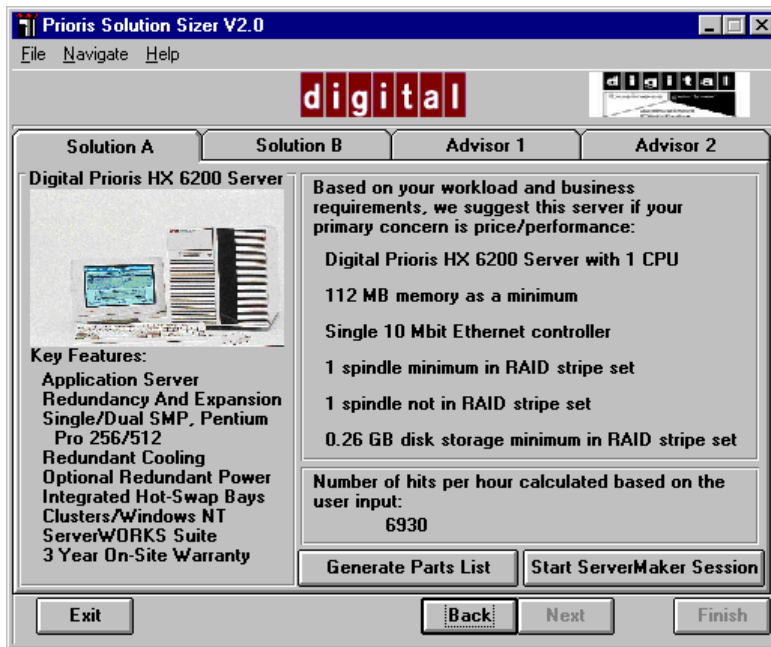Server Configuration Recommendations

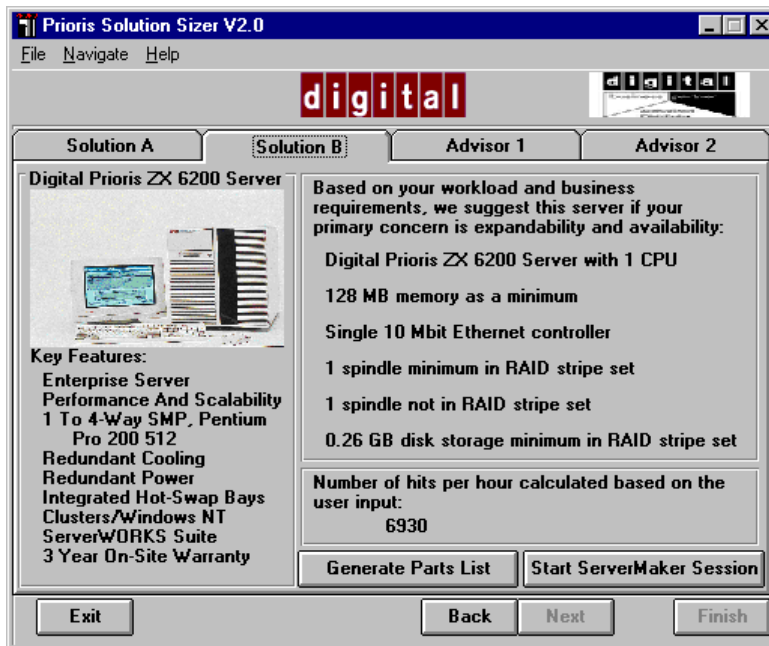*Figure 18. Intranet server configuration: Solution A tab*

Figure 19. Intranet server configuration: Solution B tab

The recommendations include:

- *Type of server*—characterization data for the Prioris 6000 series (Pentium Pro) which includes the XL 6200, MX 6200, ZX 6200, and the HX 6200. Highlights of the recommended server are displayed on the results screen. Also included is the number of CPUs required to achieve the desired performance level.
- *Amount of memory*—the RAM listed is the minimum amount required to achieve the stated performance levels. Although this may not necessarily match the standard memory options available for that server, the ServerMaker tool ensures proper memory configuration for the required platform.
- *Network interface*—network bandwidth is an important factor in web server performance. Without sufficient bandwidth, the CPU and disk performance levels may never reach their potential because of a network bottleneck. The results state the number and type of network adapters required to support the suggested performance levels.

- *Disk requirements*—disk requirements are two-fold, performance and storage. Three elements are considered here:
  — Number of spindles in the RAID stripe set—for the highest performance possible during the characterization tests, testing used RAID-0 stripe sets for the web server data. The number of spindles does not constitute storage space—rather, the number of spindles in the RAID set is required for performance. Typically, disk size does not impact this factor significantly.
  — Number of spindles not in the RAID stripe set—this is also a performance element. Disks for the web server include the system disk and application disk.
  — Disk storage minimum requirement—for a web server, this recommendation is determined by the number of pages specified in the interview and the type of information on the server, which is based on the workload mix. This storage requirement can be spread across the spindles in the RAID stripe set. However, the number of spindles cannot be reduced if the end user expects to achieve the stated performance levels.

Intranet/Internet Advisor

Based on the responses provided during the interview and elements of the resulting configuration, Solution Sizer offers suggestions regarding the business aspects of deploying an Intranet/Internet site. The Advisor 1 and Advisor 2 tabs include suggestions on reliability, availability, security, and networking capabilities. In addition, they provide important information for recognizing potential areas of bottleneck, reducing risks, and improving performance.
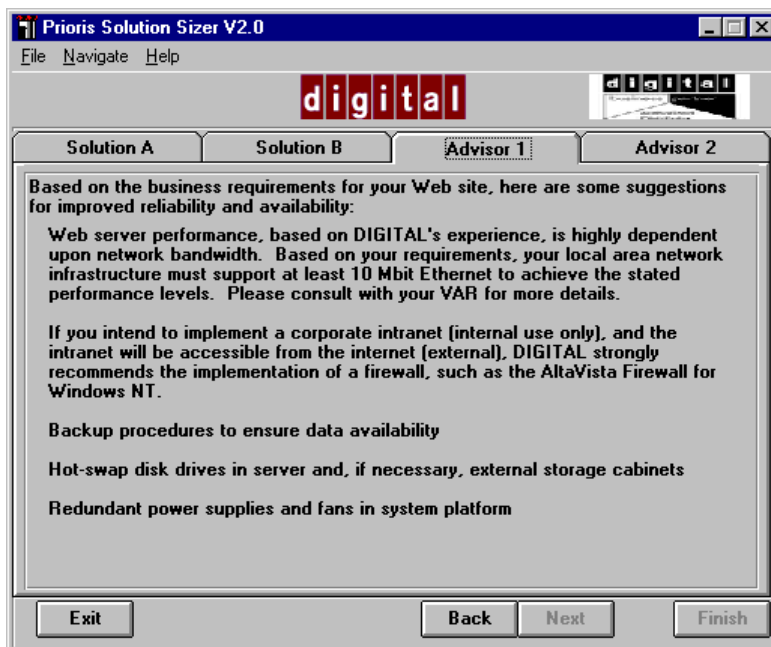
Figure 20. Intranet Advisor 1 tab
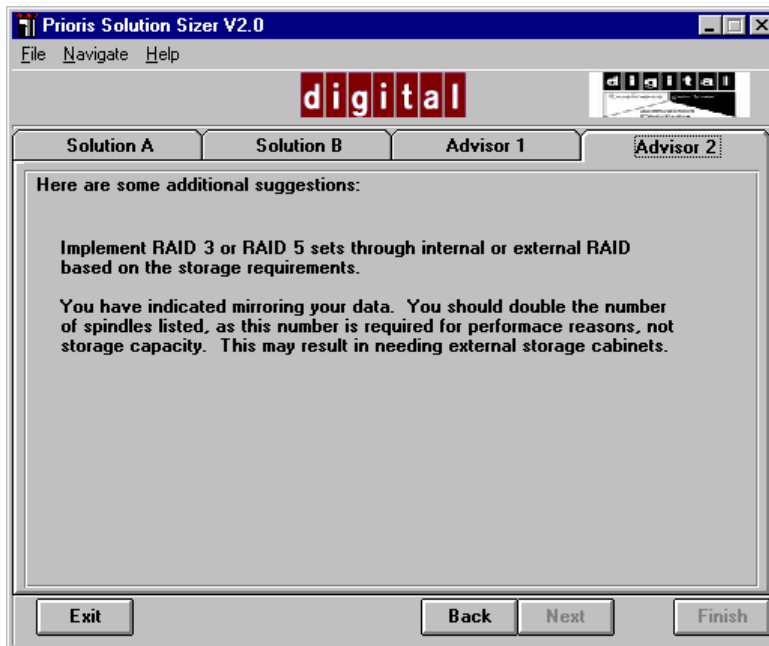
Figure 21. Intranet Advisor 2 tab

The following are some suggestions that may appear:

- Redundant power supplies and fans in system platform.
- Hot swap disk drives in server and if necessary, external storage cabinets.
- Implement Windows NT Clustering to ensure availability of applications and data.
- Investigate appropriate security measures including encryption and tunneling software, firewalls, and security management.
- Implement RAID 3 or RAID 5 sets through internal or external RAID based on the storage requirements.

Recommended Exchange server specifications

In most cases, Solution Sizer provides two Exchange server solutions for the VAR and end user to evaluate. Solution A is appropriate for an enterprise where price and performance are a priority. Solution B is meant for an enterprise that prefers a system that is either more expandable or provides higher levels of availability. See Figures 22 and 23.
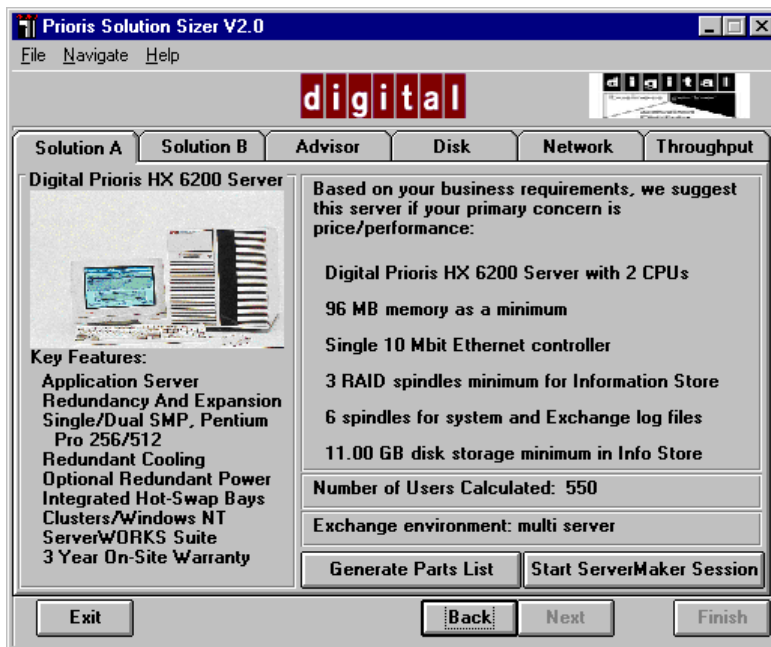

Figure 22. Exchange server configuration: Solution A tab
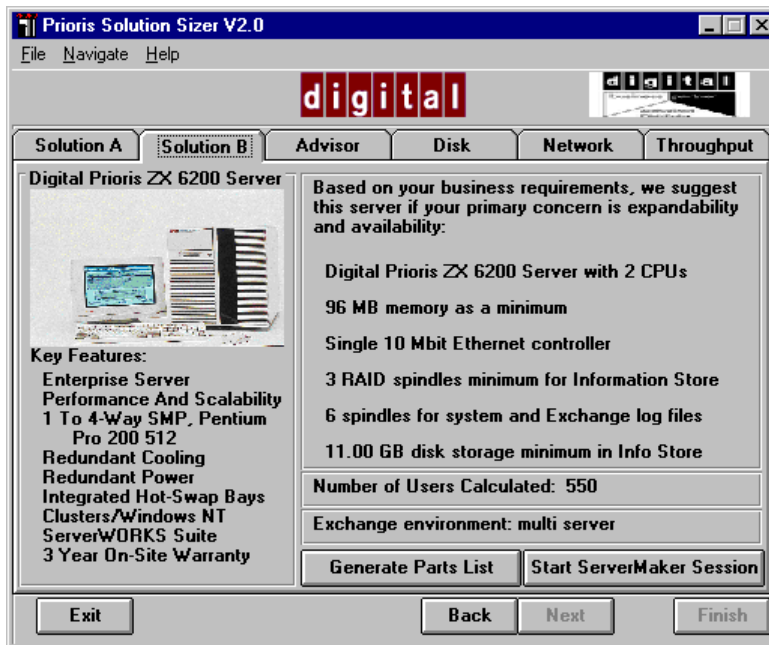
Figure 23. Exchange server configuration: Solution B tab

The recommendations include:

- *Type of server*—characterization data for the Prioris 6000 series (Pentium Pro) which includes the XL 6200, MX 6200, ZX 6200, and the HX 6200. Highlights of the recommended server are displayed on the results screen. Also included is the number of CPUs required to achieve the desired performance level.
- *Amount of memory*—the RAM listed is the minimum amount required to achieve the stated performance levels. Although this may not necessarily match the standard memory options available for that server, the ServerMaker tool ensures proper memory configuration for the required platform.
- *Network interface*—network bandwidth is an important factor in Exchange server performance. Without sufficient bandwidth, the CPU and disk performance levels may never reach their potential because of a network bottleneck. The results state the number and type of network adapters required to support the suggested performance levels.

- *Disk requirements*—disk requirements are two-fold, performance and storage. In Exchange server applications, disk I/O bandwidth is the single most important consideration for supporting the maximum number of users. Three elements are considered here:
  — Spindle minimum for Information Store—For the highest performance possible during the characterization tests, DIGITAL used RAID-0 stripe sets for both the Exchange Server software and the Exchange data. The number of spindles does not constitute storage space—rather, the number of spindles in the RAID set is required for performance. Typically, disk size does not impact this factor significantly.
  — Spindles for system and Exchange log files—This is also a performance element. Disks for the Exchange server include the system disk and, in larger or heavily used systems, the log file disk(s).
  — Disk storage minimum requirement—For an Exchange server, this recommendation is based on the number of users and required storage specified in the interview. This storage requirement can be spread across the spindles in the RAID stripe set. However, the number of spindles cannot be reduced if the end user expects to achieve the stated performance levels.

It is important to remember that Solution Sizer's storage recommendations take into account the storage needed for the Private Information Store, but not the Public Information Store. If the end user wants to have a Public Information Store, you should add storage capacity. As a rough guideline, you can use slightly less storage and fewer spindles for the Public IS as compared with the Private IS, since users will read files more often than they will create files in the Public Store. If you need more guidance, consult the Advisor section on Disk Considerations.

Exchange Advisor

Based on the responses provided during the interview and elements of the resulting configuration, Solution Sizer offers suggestions regarding the business aspects of deploying an Exchange site. The Advisor tab includes suggestions on reliability, availability, security, and networking capabilities (see Figure 24). In addition, the Disk, Network, and Throughput tabs offer guidelines to consider when planning an Exchange application.
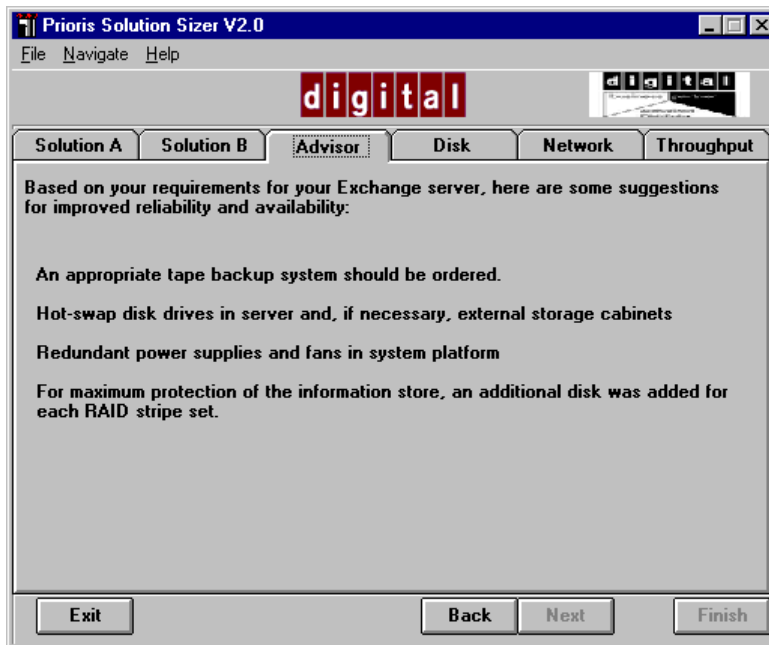
Figure 24. Exchange Advisor tab

The following are some suggestions that may appear:

- For maximum protection of the information store, an additional disk was added for each RAID stripe set.
- Redundant power supplies and fans in system platform.
- Hot swap disk drives in server and if necessary, external storage cabinets.
- An appropriate tape backup system should be ordered.

Disk, Network, and Throughput guidelines

Solution Sizer provides additional suggestions for three major considerations when planning an Exchange deployment: Disk, Network, and Throughput.

Disk considerations

Disk I/O bandwidth is the most important consideration to maximize the number of users on a given Exchange server. The Disk tab (Figure 25) provides guidelines for designing an Exchange Information Store I/O subsystem.
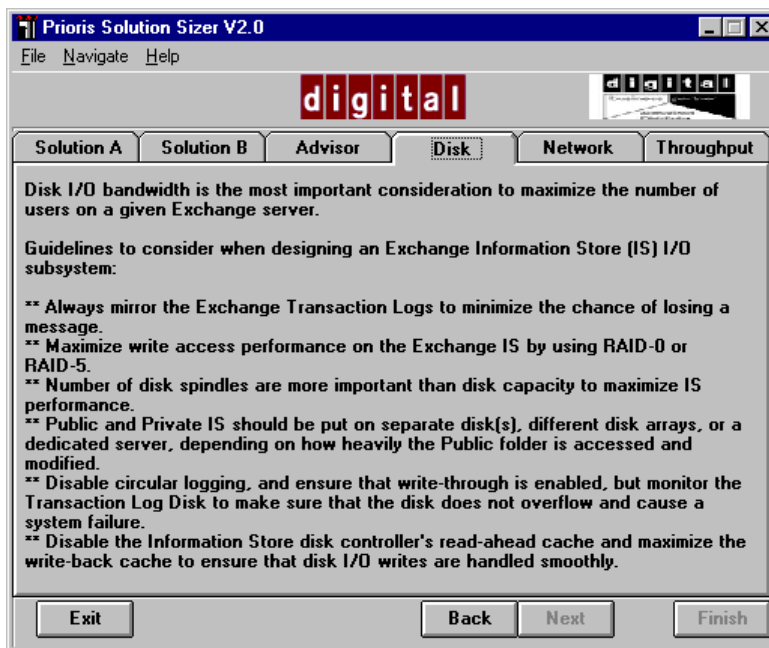
Figure 25. Disk guidelines for an Exchange solution

The following suggestions appear on the Disk tab:

- Always mirror the Exchange Transaction Logs to reduce the chance of losing a message due to a hardware failure.
- Disable circular logging, and ensure that write-through is enabled, but monitor the Transaction Log Disk to make sure that the disk does not overflow and cause a system failure.
- Maximize write access performance on the Exchange Information Store by using disk striping (**RAID-0**) or disk striping with parity (**RAID-5**).

- Disable the Information Store disk controller's read-ahead cache and maximize the write-back cache to ensure that disk I/O writes are handled smoothly.
- Disk spindles play a more important role than disk size to maximize Information Store performance.
- For customers looking for very high availability systems, DIGITAL recommends the implementation of an external RAID subsystem like the StorageWorks RAID Array 310, instead of back-plane controllers.
- For redundancy and large storage, use separate storage enclosures for the following reasons:
  — The disks may be moved easily and rapidly from one system to another, in case of a CPU failure, and in the absence of clustering.
  — A separate storage enclosure may be configured with redundant and fault tolerant components, such as controllers, power supplies, and fans.
  — Sites with a larger number of users (500 or more) may consider the downtime caused by a hardware failure to be critical.
- Public and Private Information Stores should be put on separate disk(s) and may even be placed on a different disk array or a dedicated server, depending on how heavily the Public folder is accessed, the frequency of changes and updates, etc.

Exchange Network considerations

The Network tab (Figure 26) provides guidelines to consider when designing a network including Exchange.

For network traffic, plan on 30 to 40 bytes per second per user. With a multi-server configuration, and/or site connectors, plan for an additional 10 bytes per second per user. At these rates, you are consuming less than 15% of the network bandwidth.
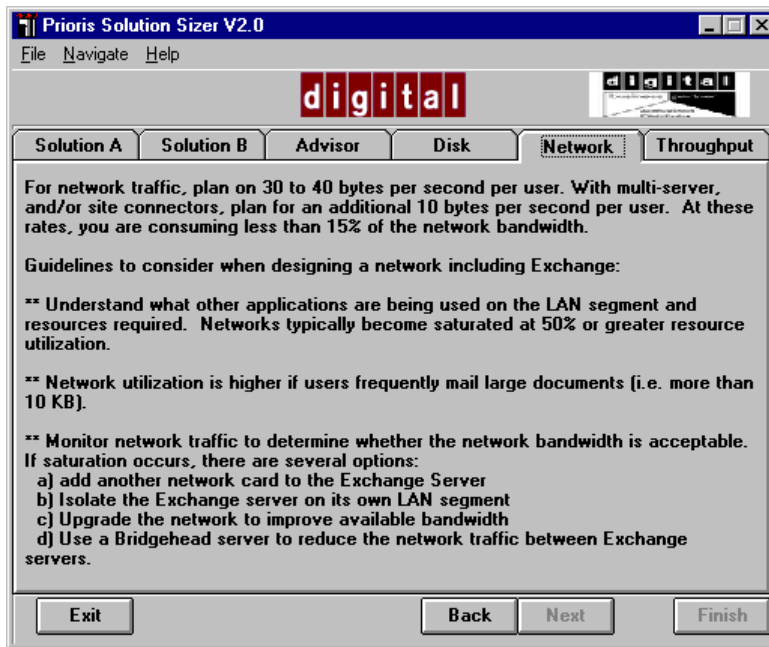
Figure 26. Network guidelines for an Exchange solution

The following suggestions appear on the Network tab:

- Understand what other applications are being used on the LAN segment and the resources they require. The general rule of thumb is that a network becomes saturated at 50% or greater resource utilization.
- Network utilization will also be higher if users frequently mail large documents (i.e. greater than 10 KB).
- Monitor network traffic utilization to determine whether the network bandwidth is acceptable.
- If network saturation occurs, there are several options:
    — Add another network card to the Exchange Server;
    — Isolate the Exchange server on its own LAN segment, or
    — Upgrade the network to improve available bandwidth, for example, by moving to 100 Megabit Ethernet, FDDI backbone, etc.
    — Use a Bridgehead server to reduce the network traffic between Exchange servers.

Exchange Throughput considerations

The Throughput tab provides suggestions for improving the speed at which messages are routed between sites and organizations (see Figure 27).
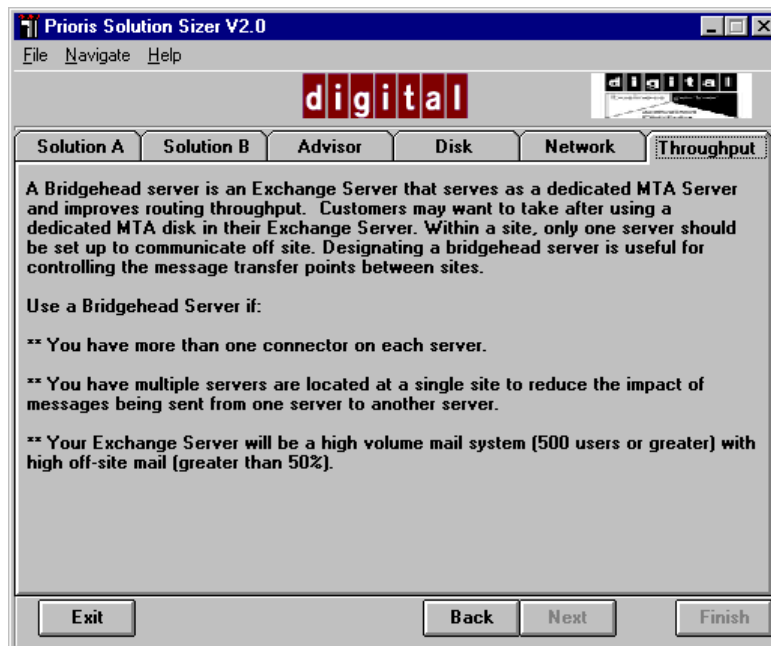
Figure 27. Throughput guidelines for an Exchange solution

Using a dedicated MTA disk in an Exchange Server is the most common way of improving throughput. However, when a configuration includes multiple servers at a single site, a Bridgehead server can reduce the impact of messages being sent from one server to another. A Bridgehead server is a dedicated Exchange Server that has no users or Information Stores and serves as a dedicated MTA Server. Its role is to provide high-speed routing of messages between Exchange servers.

Use a Bridgehead Server if:

- You have more than one connector on each server.
- You have multiple servers located at a single site (to reduce the impact of messages being sent from one server to another).

- Your Exchange Server will be a high volume mail system (500 users or greater) with high off-site mail (greater than 50%).

Link to ServerMaker

The recommended server configuration provided by Solution Sizer can be easily transformed into a verified Prioris server configuration through the link to the Prioris ServerMaker tool. The link is available at the bottom of the Solutions screens (see Figure 28).
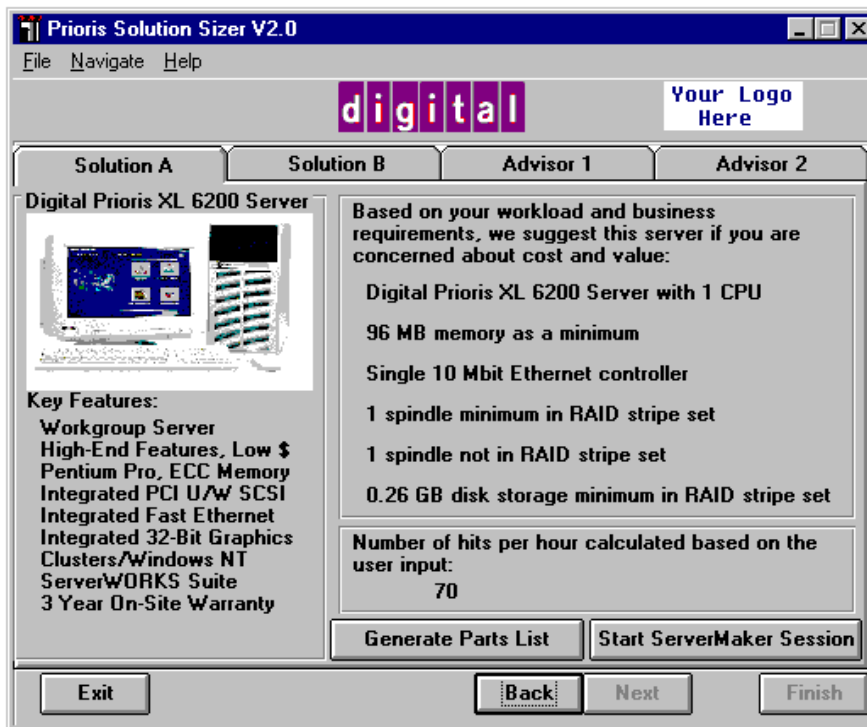

Figure 28. Link to ServerMaker

ServerMaker is a Windows-based tool, designed to lead you step by step through the Prioris Server and Rackmount configuration process. The recommended server configuration in Solution Sizer is automatically parsed into valid part numbers in

ServerMaker. This information can then be used in VAR quotes, user orders, or a Request For Quote/Request For Proposal.

The ServerMaker representation of the Solution Sizer configuration is valid, although it may not be the only possible configuration. If necessary, the VAR and end user should work together to determine other alternative configurations.

The link to ServerMaker through Solution Sizer is available in two forms:

- *Generate Parts List button*—This option converts the Solution Sizer recommended configuration into a valid ServerMaker configuration file and allows the user to save the information to disk. This option is best suited for "what-if" scenarios, where changes are made to individual elements of the environment to view the impact on the final configuration. Each scenario can be saved for later implementation through ServerMaker.
- *Start ServerMaker Session button*—This option launches ServerMaker with the current recommended configuration information. Once ServerMaker is launched, additions/modifications can be made to the configuration before generating the final parts list.

For more detailed information about the ServerMaker tool, see the file, SRVRMAKR.DOC, included with the ServerMaker software.

Example Sessions 8

Introduction

This section contains examples of all of the server solutions you can obtain with Solution Sizer, including the following:

- Example 1 - Intranet Web Site
- Example 2 - Internet Web Site
- Example 3 - Microsoft Exchange - Single server
- Example 4 - Microsoft Exchange - Multiple servers
- Example 5 - Microsoft Exchange - Multiple servers with connectors

Example 1 - Intranet Web Site

This Intranet example is based on DIGITAL's internal PC Business Unit (PCBU) web site. Using the questions in Chapter 3, the information derived is:

- customer profile
  - — size of company is 50,000+
  - — size of business unit is 3500
  - — company business is computer hardware and software
  - — scope of server is worldwide for service, and internal employees
- Existing Environment
  - — this is a replacement for an existing server
  - — there is a network in place
  - — there is existing software and hardware
  - — network topology is 10Mbit
  - — sites/buildings is many

- User Profile
    — information will be available to all internal employees
    — expect limited interest from all employees with heavy interest from employees in business unit
    — estimated numbers of users is 3500+
    — users will be coming from all over the world
- Solution
    — this is not mission-critical
    — servers will be located in one of the sites
    — expected traffic on the server is approximately 400 visitors a day
    — there will be one server supporting this site
    — anticipated growth is 50% for both the data and the users
    — the equipment has to work with existing framework
    — there may be sensitive administrative information
    — the data stored on the web server will be 5 Mbytes

Using the information derived from the previous questions, the questions in Solution Sizer may be answered as follows:

How important is it for the data to be always available?

Availability of data is of medium importance. In this case, frequent backup and hot swap capabilities should suffice.

How much server downtime is acceptable?

This is not considered to be a critical application at this time; 2 hours/week should be acceptable

Site Content (choose all that apply)

The content will be text and multimedia.

Will sensitive information (sales reports, personnel records) be stored on the server?

Sensitive information will be stored on the server

How many visits to this site in a typical hour?

The estimated number of visits would be 50 to 75 visits per hour

How dramatically will the size of this group grow in the next year?

The expected increase will be 50% over the next year

Average Number of pages per visit

> The expected number of pages per visit will be 6 pages

How many pages of information will you initially be placing on the server?

> Initially, we expect to have 500 pages of information on the server

How dramatically do you expect this to grow over the next year?

> This is expected to grow by 50% over the next year

Summation

> Solution Sizer provides two alternative solutions based in part on an expected 4000 - 5000 hits/hour. The first solution provides the best price/performance solution. The second solution provides increased expandability and reliability attributes.

> Based on your workload and business requirements, we suggest this server if your primary concern is **price/performance**:

> Digital Prioris MX 6200 Server with 1 CPU

> 112 MB memory as a minimum

> Single 10 Mbit Ethernet controller

> 1 spindle minimum in RAID stripe set

> 1 spindle not in RAID stripe set

> 0.39 GB disk storage minimum in RAID stripe set

> Based on your workload and business requirements, we suggest this server if your primary concern is **expandability and availability**:

> Digital Prioris HX 6200 Server with 1 CPU

> 112 MB memory as a minimum

> Single 10 Mbit Ethernet controller

> 1 spindle minimum in RAID stripe set

> 1 spindle not in RAID stripe set

> 0.39 GB disk storage minimum in RAID stripe set

Example 2 - Internet Web Site

This Internet example is based on DIGITAL's external PC Business Unit (PCBU) web site. Using the questions in Section 3, the information derived is:

- customer profile
  - size of company is 50,000+
  - size of business unit is 3500
  - company business is computer hardware and software
  - scope of server is worldwide for customers, service, and internal employees
- Existing Environment
  - this is a replacement for an existing server
  - there is a network in place
  - there is existing software and hardware
  - network topology is a mix between FDDI, 10Mbit, and 100Mbit
  - sites/buildings is many
- User Profile
  - information will be available to all internal employees
  - expect limited interest from all employees
  - estimated numbers of users is 50,000+ just for employees
  - users will be coming from all over the world
- Solution
  - this is not mission-critical
  - server will be located in one of the sites
  - expected traffic on the server is approximately 4000 visitors a day
  - there will be one server supporting this web site
  - anticipated growth is 50% for both the data and the users
  - the equipment has to work with existing framework
  - there may be sensitive administrative information
  - the data stored on the server will be 672 Mbytes

Using the information derived from the previous questions, the questions in Solution Sizer may be answered as follows:

How important is it for the data to be always available?

It is more important with this server that information be readily available. In this case, the selection is for extra disks, mirroring, and hot swap capabilities.

How much server downtime is acceptable?

In this case, downtime is not acceptable and therefore, 1 hour/month is selected.

Site Content (choose all that apply)

The site content will be text, multimedia, and forms-based interaction.

Will sensitive information (sales reports, personnel records) be stored on the server)?

No, sensitive information is not expected to be placed on this server.

How many visits to this site in a typical hour?

It is estimated that as many as 700 visits could be expected in an hour.

How dramatically will the size of this group grow in the next year?

This is expected to grow by 50% in the next year.

Average Number of pages per visit

It is expected that 5 pages will be hit on each visit.

How many pages of information will you initially be placing on the server?

It is expected that 3000 pages will be placed on the server initially.

How dramatically do you expect this to grow over the next year?

This is expected to grow by 50% over the next year

Summation

Solution Sizer provides one solution based in part on an expected 35,000 - 40,000 hits/hour.

Based on your workload and business requirements, we suggest this server if your primary concern is **price/performance**:

Digital Prioris ZX 6200 Server with 1 CPU

192 MB memory as a minimum

Single FDDI or 100 Mbit Ethernet controller

5 spindles minimum in RAID stripe set

1 spindle not in RAID stripe set

1.10 GB disk storage minimum in RAID stripe set

Example 3 - Microsoft Exchange - Single Server

The following is an example of the calculation of a single Microsoft Exchange Server. The questions in Solution Sizer Mail/Messaging may be answered as follows:

Number of Exchange users?

300

Anticipated Growth in Number of Users in next year?

20 %

Storage Required per User in Private Information Store (in MB)?

20 MB

How important is it for the data to always be available?

Hot swap disk capabilities?	YES
Redundant power supplies?	NO
Frequent Backup capabilities?	YES

How much server downtime is acceptable?

1 hour/week (high-availability hardware)	YES
2 hours/week (reliable server design)	

Microsoft Exchange Optimization Settings. Which of the follow procedures do you want to follow?

Mirror System and Exchange Transaction Log Disk (RAID-1)?	YES
Put Exchange Transaction Log on a separate disk and mirror it (RAID-1)?	NO
Have extra disks for recovery of the Exchange Private Information Store?	YES
Have a dedicated MTA and Directory Database disk and mirror that disk (RAID-1)?	NO

Is this Exchange Server being installed into a site containing multiple Exchange servers?

NO

Summation

You have requested configuration of a standalone Exchange Server. Solution Sizer provides two alternative solutions. The first solution provides the best price/performance solution. The second solution provides increased expandability and reliability attributes.

Based on your business requirements, we suggest this server if your primary concern is **price/performance**:

Digital Prioris MX 6200 Server with 1 CPU

64 MB memory as a minimum

Single 10 Mbit Ethernet controller

2 RAID spindles minimum for Information Store

2 spindles for system and Exchange log files

7.20 GB disk storage minimum in Info Store

Based on your business requirements, we suggest this server if your primary concern is **expandability and availability**:

Digital Prioris HX 6200 Server with 1 CPU

64 MB memory as a minimum

Single 10 Mbit Ethernet controller

2 RAID spindles minimum for Information Store

2 spindles for system and Exchange log files

7.20 GB disk storage minimum in Info Store

Example 4 - Microsoft Exchange - Multiple Server system

The following is an example of the calculation of a multiple Microsoft Exchange Server system. The questions in Solution Sizer Mail/Messaging may be answered as follows:

Number of Exchange users?

300

Anticipated Growth in Number of Users in next year?

20 %

Storage Required per User in Private Information Store (in MB)?

20 MB

How important is it for the data to always be available?

Hot swap disk capabilities?	YES
Redundant power supplies?	NO
Frequent Backup capabilities?	YES

How much server downtime is acceptable?

1 hour/week (high-availability hardware)	YES
2 hours/week (reliable server design)	

Microsoft Exchange Optimization Settings. Which of the follow procedures do you want to follow?

Mirror System and Exchange Transaction Log Disk (RAID-1)?	YES
Put Exchange Transaction Log on a separate disk and mirror it (RAID-1)?	NO
Have extra disks for recovery of the Exchange Private Information Store?	YES
Have a dedicated MTA and Directory Database disk and mirror that disk (RAID-1)?	NO

Is this Exchange Server being installed into a site containing multiple Exchange servers?

YES

Will this Exchange Server send mail to other Exchange Servers within this Site only?

    YES

Summation

Based on your business requirements, we suggest this server if your primary concern is **price/performance**:

    Digital Prioris MX 6200 Server with 1 CPU

    64 MB memory as a minimum

    Single 10 Mbit Ethernet controller

    2 RAID spindles minimum for Information Store

    2 spindles for system and Exchange log files

    7.20 GB disk storage minimum in Info Store

Based on your business requirements, we suggest this server if your primary concern is **expandability and availability**:

    Digital Prioris HX 6200 Server with 1 CPU

    64 MB memory as a minimum

    Single 10 Mbit Ethernet controller

    2 RAID spindles minimum for Information Store

    2 spindles for system and Exchange log files

    7.20 GB disk storage minimum in Info Store

Example 5 - Microsoft Exchange - Multiple Servers with Connectors

The following is an example of the calculation of a multiple Microsoft Exchange Server system with connectors. The questions in Solution Sizer Mail/Messaging may be answered as follows:

Number of Exchange users?

300

Anticipated Growth in Number of Users in next year?

20 %

Storage Required per User in Private Information Store (in MB)?

20 MB

How important is it for the data to always be available?

Hot swap disk capabilities?	YES
Redundant power supplies?	NO
Frequent Backup capabilities?	YES

How much server downtime is acceptable?

1 hour/week (high-availability hardware)	YES
2 hours/week (reliable server design)	

Microsoft Exchange Optimization Settings. Which of the follow procedures do you want to follow?

Mirror System and Exchange Transaction Log Disk (RAID-1)?	YES
Put Exchange Transaction Log on a separate disk and mirror it (RAID-1)?	NO
Have extra disks for recovery of the Exchange Private Information Store?	YES
Have a dedicated MTA and Directory Database disk and mirror that disk (RAID-1)?	NO

Is this Exchange Server being installed into a site containing multiple Exchange servers?

YES

Will this Exchange Server send mail to other Exchange Servers within this Site only?

> NO

Will this Exchange Server be using a Site Connector to connect to other Exchange Servers?

> NO

Summation

> Based on your business requirements, we suggest this server if your primary concern is **price/performance**:
>
>   Digital Prioris MX 6200 Server with 1 CPU
>
>   96 MB memory as a minimum
>
>   Single 10 Mbit Ethernet controller
>
>   3 RAID spindles minimum for Information Store
>
>   2 spindles for system and Exchange log files
>
>   7.20 GB disk storage minimum in Info Store
>
> Based on your business requirements, we suggest this server if your primary concern is **expandability and availability**:
>
>   Digital Prioris HX 6200 Server with 1 CPU
>
>   96 MB memory as a minimum
>
>   Single 10 Mbit Ethernet controller
>
>   3 RAID spindles minimum for Information Store
>
>   2 spindles for system and Exchange log files
>
>   7.20 GB disk storage minimum in Info Store

Workloads *A*

Intranet workload definitions

The following table defines the functional percentages for the Intranet workloads, as well as indicating the percentage of overall workload consumed by each functional element. The static:dynamic ratio is 90:10 for the text/still image mix, and 80:20 for the other two workload mixes.

Functional Areas	Sub Functions	Mix 1 Text/Still images	Mix 2 Mixed Workload	Mix 3 Multimedia centric
Web Server (65%)	HTML	50%	30%	15%
	Video/Audio	0%	30%	45%
	Indexing/Search	30%	20%	15%
	Still images	20%	20%	25%
E-mail (25%)	Read	70%	70%	70%
	Send	30%	30%	30%
SQL database access (10%)		100%	100%	100%

Table 1.   Intranet workloads

Workload task mix example

The following table illustrates the number and distribution of tasks as they related to the various workload mixes if 1000 tasks were performed.

	Functional Areas	Sub Functions	Mix 1 Task count	Mix 2 Task count	Mix 3 Task count
650	Web server				
		HTML	325	195	97.5
		Video/Audio	0	195	292.5
		Indexing/Search	195	130	97.5
		Still images	130	130	162.5
250	E-mail				
		Read	175	175	175
		Send	75	75	75
100	SQL database access				
			100	100	100
Total tasks			1000	1000	1000

Table 2.   Workload tasks

Exchange workload testing description

DIGITAL tested Microsoft Exchange using the Microsoft Load Simulator (LOADSIM) utility. This test included testing of the Microsoft Exchange application and Private Information Store. No testing of the Public Information Store was undertaken.

The LOADSIM utility provides a standard method to characterize Exchange user loads on a server configuration, and to establish the maximum number of users that each server supports by measuring response times and Send Queue length. LOADSIM collects and stores data on the number of times an operation was done, and the response times achieved for that operation.

The LOADSIM utility emulates the work done by the number of users specified. The System Under Test (SUT) sees the workload on the system as if it were being done by real users. The SUT is not programmed or changed in any way for LOADSIM operation. LOADSIM is run on client systems (other NT systems) that emulate the Mail Applications Programming Interface (MAPI) operations to the SUT.

Load Simulator creates the users on the SUT. Accounts are set up as Exchange users only. No NT accounts were set up.

LOADSIM was configured for a medium user workload using the settings recommended by Microsoft. These are the same settings that Microsoft uses for testing and characterization of systems.

Multiple Alpha and Intel Load Simulator client systems were used to drive the system under test to saturation levels. The tests were run for eight hours to verify that the response times and all measured events and counters were within acceptable limits. The major selection criteria to establish the maximum number of users per server were the Information Store send queue and response time. For a test to successfully pass, the rule was that the queue had to be empty by the end of the test with response times to users of under one second.

For more information on the workload used for test, refer to the *Microsoft Exchange Server White Paper*, written by Microsoft. This workload sizing document is available from the Microsoft Web site (http://www.microsoft.com). The document provides a good description of the Load Simulator Utility.

The tables below describe the user profile and workload definition used in LOADSIM.

User Type	Real World Parallel
Very Light	Novice user; home, Internet, or non-mail intensive corporate user
Light	Typical corporate mail user
Medium	Aggressive mail user for whom a significant portion of job is mail-based
Heavy	Top few percent of corporate users

Table 3.   LOADSIM user profile

Workload Parameter	Very Light	Light	Medium	Heavy
Hours in a Day	12	8	8	8
Originate New Mail (not reply or forward)	2x	2x	4x	6x
Text-Only Message				
Text-Only Message				
1K text (ups1k.msg)	100	90	60	50
2K text (ups2k.msg)			16	10
4K text (ups4k.msg)			4	5
1K Text Message with Attachment				
1K Text Message with Attachment				
10K Attachment (ups10kat.msg)		10	5	10
Microsoft Excel Attachment (upsXLatt.msg)			4	5
Word Attachment (upsWDatt.msg)			2	5
Embedded Bitmap (upsBMobj.msg)			2	5
Embedded Microsoft Excel Object Object (upsXLobj.msg)			2	10
Recipients per New/Forward Message	3	3	3	3
Add a Distribution List to Addressees	Never	30 %	30 %	30 %

Table 4.   LOADSIM workload definitions

Workload Parameter	Very Light	Light	Medium	Heavy
Read New Mail	12x	12x	12x	12x
Send Reply	5 %	5 %	7 %	15 %
Send Reply All	3 %	3 %	5 %	7 %
Send Forward	5 %	5 %	7 %	7 %
Delete (move to DI)	40 %	40 %	40 %	40 %
Move Messages	Never	20 %	20 %	20 %
Load Attachments on Read Mail	N/A	25 %	25 %	25 %
Max. Inbox Size (in Messages)	20	20	125	250
Other Old Mail Processing	5x	5x	15x	20x
Schedule+ Changes	1x	1x	5x	10x
Empty Deleted Items Folder	1x	1x	1x	1x
Messages Sent per Day (computed average)	3.6	4.7	14.2	30.7
Messages Received per Day (computed average)	9.6	22.9	66.3	118.9

Table 4.   LOADSIM workload definitions (Continued)

Glossary *B*

Bridgehead server—A specific Microsoft Exchange Server in a site that is designated to establish communication with remote sites. Normally, the specific server that establishes this connection varies, depending on messaging traffic. Designating a bridgehead server is useful for controlling the message transfer points between sites.

Connectors—Exchange software that allow the exchange of information with various messaging systems. The four primary types of connectors are Site Connectors, X.400 Connectors, Internet Mail Connectors, and Microsoft Mail Connectors.

Directory Service—A directory that stores all the information about users and resources in an organization and includes a structured view of all server names, mailboxes, and distribution lists in a site. Also, the directory keeps configuration information that other Exchange Server components use when mapping addresses and routing messages.

E-Mail— (Electronic mail) Messages transmitted over the Internet or within an organization's Intranet from user to user. E-mail can contain text, but also can carry with it files of any type as attachments.

Hot swap components—System components that are replaced without the system shutting down. Hot swap disks, which are removed and inserted during system operation, are examples of hot swap components.

HTML— (Hypertext Markup Language) The basic language that is used to build hypertext documents on the World Wide Web. It is used in basic, plain ASCII-text documents, but when those documents are interpreted (called rendering) by a Web browser such as Microsoft Internet Explorer, the document can display formatted text, color, a variety of fonts, graphic images, special effects, hypertext jumps to other Internet locations and information forms.

Information Store—The Information Store (IS) is the repository of all messaging data transmitted to an Exchange Server, including both private messages sent to individual users and public information folders intended for viewing by many users. The IS maintains data in two distinct databases: the Private Information Store and the Public Information Store.

Internet Mail Connector—The Internet Mail Connector (IMC) provides integrated, native SMTP connectivity to the Microsoft Exchange Server. The IMC can send and receive SMTP without the need for external hosts and is MIME-compliant. In addition, the IMC allows customers running TCP/IP over the backbone to connect Exchange to each other using the IMC connector.

MTA (Message Transfer Agent)—The engine for routing and transferring data to other servers or systems. MTA functions include mapping addresses, routing messages, and performing message format conversion as required.

Microsoft Mail Connector—The Microsoft Mail Connector provides seamless connectivity to Microsoft Mail for PC Networks, Microsoft Mail for AppleTalk® and Microsoft Mail for PC Networks gateways (PROFS, SNADS, Netware, MHS, and FAX). It uses a "shadow" Post Office that is structured like a Microsoft Mail Post Office.

Mirroring—*See* **RAID**.

RAID (Redundant Array of Inexpensive Disks)—A data storage system that uses multiple disks to improve read/write times or to prevent the possibility of data loss. There are several different methods for configuring the disks.

- RAID-0 is known as "striping" and consists of two or more disks logically combined into a stripe set. Data is written to all disks in sequential fashion, which results in faster reads and writes.
- RAID-1 is known as "mirroring" and consists of a disk or set of disks with an identical disk or set of disks designated as a mirror image. This design improves read times, and provides a redundant set of data.
- RAID-3 and RAID-5 consist of creating a set of disks with one extra disk added for parity purposes. Data is written redundantly across all disks and any one disk failure can be tolerated. An additional hot swap disk can be designated for one or more RAID-5 sets in the event of a disk failure. Performance is slower on writes and normal on reads. Storage systems that contain RAID-3 arrays perform well for applications that transfer large files, but less well in applications that make frequent requests for smaller amounts of data. RAID-5 arrays perform well for input/output transactions that are mostly application read requests.

Search engine—Search engines are similar to card catalog systems for the Intranet/Internet. Automated in nature, search engines maintain databases with listings

of keyword contents from either web sites (Internet) or web pages and internal documents (Intranet). Then, when a search is initiated on a particular topic, the search engines do their best to make a list of all the catalogue entries that best fit the required entry. The most popular Internet web search engines are AltaVista, Webcrawler, Lycos, Excite, and Hotbot. AltaVista also provides search engines both for Intranets and local PCs and LANs.

Site Connector—A Microsoft Exchange built-in connector designed for sites located on the LAN to facilitate message transfer between Exchange servers. Site Connector provides the most direct link between sites, with communication handled through Remote Procedure Calls (RPCs) in each site.

SQL Database Access—Web sites can be linked to SQL databases which allows the display of the collection of data. The links are generated through standard tools in the web server software.

Still Images—Still images are pictures, diagrams and graphical content displayed in web pages. Examples of still image formats are GIF files, or Graphics Interchange Format, and JPEG, or Joint Photographic Experts Group. JPEG files are optimized for compressing full-color or gray-scale photographic-type, digital images.

Striping—*See* **RAID**.

System Attendant—The service within Exchange that performs general maintenance tasks. Its functions include:

- Monitoring the status of messaging connections between servers.
- Gathering information on each server in a site to assist in running messaging monitoring tools.
- Building routing tables in a site.
- Verifying directory replication and correcting inconsistencies.
- Maintaining information logs about sent messages for tracking purposes.
- Generating addresses for message recipients you create (SMTP, X.400, MS-Mail).

Video/Audio—Video/Audio can take two formats: streaming which play when they arrive, or non-streaming which are files that must be accessed, or "played" by a media player. Streaming audio and video files are either supported by web browsers or require "plug-in" modules, which add this capability to a browser. Leading providers of streaming audio and video include Progressive Networks' RealAudio and ReadVideo, and Macromedia Shockwave.

Web Server, web site, web page, web browser—A web server is software that provides the capabilities to host a web site. A Web site is a collection of one or more Web pages. A Web page is a single file that can be displayed by client software, also called a web browser. A Web page includes at least the following elements: copy, graphics, layout, and internal technical design. It may require hooks to existing databases, e-mail processors, or other technical applications. If the Web site has more than one page, or has links to other Web sites, it also needs to be designed for navigation.

X.400 Connector—The X.400 Connector is the use of a Microsoft Exchange MTA configured to connect to an X.400-based system. It is based on the CCITT X.400 standard and provides an X.400 connector architecture that includes Message Transfer Agent, Message Stores, User Agents, and Access Units and X.400 Addressing.

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