COMPAQ

Implementing Lotus Notes on Compaq Servers with Microsoft LAN Manager

Compaq TechNote

. . . .

NOTICE

The information in this publication is subject to change without notice.

COMPAQ COMPUTER CORPORATION SHALL NOT BE LIABLE FOR TECHNICAL OR EDITORIAL ERRORS OR OMISSIONS CONTAINED HEREIN, NOR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE FURNISHING, PERFORMANCE, OR USE OF THIS MATERIAL.

This publication contains information protected by copyright. No part of this publication may be photocopied or reproduced in any form without prior written consent from Compaq Computer Corporation.

The software described in this guide is furnished under a license agreement or non disclosure agreement. The software may be used or copied only in accordance with the terms of the agreement.

This publication does not constitute an endorsement of the product or products that were tested. The configuration or configurations tested or described may or may not be the only available solution. This test is not a determination of product quality or correctness, nor does it ensure compliance with any federal, state, or local requirements. Compaq does not warrant products other than its own strictly as stated in Compaq product warranties.

Product names mentioned herein may be trademarks and/or registered trademarks of their respective companies.

Implementing Lotus Notes on Compaq Servers with Microsoft LAN Manager

Contents

Recommendations for Decision Makers   *continued*

Chapter 4
Effective Lotus Notes Applications

Chapter 5
Planning Issues

Chapter 10
Directory Links and Database Links

Chapter 11
Setting Up Connection Records

Chapter 1
Introduction

This TechNote targets key decision-makers, systems analysts, network planners, systems administrators, and others who need to know the critical factors for a successful, large-scale implementation of Lotus Notes as a distributed application technology. This document uses the Compaq experience in implementing Lotus Notes world-wide as the basis for providing information.

The purpose of this TechNote is to:

■ Provide large organizations with business insight in implementing Lotus Notes.

■ Support Compaq customers with tips and techniques for implementing Lotus Notes on COMPAQ products in a Microsoft LAN Manager or a compatible network environment.

Implementing Lotus Notes can yield positive results, including shortened database development time, increased interaction among workgroups, and improved productivity. This document highlights the significant decisions that you must make proactively to maximize your benefits. These decisions can ease your transition to a production-level system. Once you have successfully implemented Lotus Notes, you will find tips and techniques in this document to help you monitor and optimize your system.

Audience

This TechNote covers a broad range of topics relating to a Lotus Notes implementation. Accordingly, this document addresses audiences such as:

■ *Decision makers* interested in the:

  ❏ Compaq experience with Lotus Notes

  ❏ Important recommendations

■ Systems analysts, network planners, and decision makers interested in recommendations for decision making, planning issues, and evaluation criteria.

■   Systems administrators interested in implementation details.

Some chapters in this document provide information that you may find directly applicable to you, and you may want to skim over other areas of the document that are only of general interest.

Information Organization

The information in this document highlights the elements of a systems approach to implement Lotus Notes and includes the following:

■   From a business perspective, this document focuses on important system recommendations and discusses planning issues and relevant evaluation criteria. Chapters 2 - 6 provide you with business related information.

■   From a technical perspective, this document discusses Lotus Notes pre-installation considerations, implementation, and maintenance. The information includes a combination of integration lab testing, as well as a corporate-wide implementation of Lotus Notes applications such as: technical information dissemination, field status reporting, issue tracking, and so on.

  ❏   Chapters 7 - 12 provide you with technical information that is independent of any underlying network operating system.

  ❏   Chapters 13 - 23 provide you with implementation details for a Microsoft LAN Manager network.

■   Appendixes A - C provide you with supplemental information.

  ❏   A Case Study that provides an example of solving a real-world business problem using Lotus Notes.

  ❏   An example of planning techniques you can use to estimate required server resources to support dial-in users.

  ❏   Operation research principle techniques that you can use as a reference for decision making under uncertainty.

Use the information included in this TechNote as a guideline. Your implementation of Lotus Notes will require that you adapt some of these suggestions to suit specific requirements within your organization.

Additional Reading

The information in this TechNote supplements documentation available from Compaq Computer Corporation and Lotus Development Corporation.

This TechNote refers to additional information from Compaq Computer Corporation, including:

■   *COMPAQ Server Manager/R Administrator's Guide* provides information on setting up and configuring the COMPAQ 32-Bit Server Manager/R board to monitor the operation of your COMPAQ computer in one of the following environments: Banyan VINES, Novell NetWare, Microsoft LAN Manager, and SCO UNIX.

Information from Lotus Development Corporation includes:

■   *Lotus Notes Site Planning Guide* - provides information on overall system design (site planning, server topology, administration, security, setting up a support organization, and so on).

■   *Lotus Notes Administrator's Guide* - provides information to systems administrators for setting up and administering a Lotus Notes server.

■   *Notes Security: A Technical Perspective* - provides an in-depth look at security in the Lotus Notes environment.

Chapter 2
Compaq and Lotus Notes

In today's marketplace, Lotus Notes is an important "validating" application for industry standard based systems platforms. The basis for this document is experience at Compaq Computer Corporation; not only from a systems integration perspective, but also from actual world-wide implementation.

History of Lotus Notes at Compaq

Compaq Computer Corporation has had a long history of involvement with Lotus Notes. This has helped our world-wide deployment of this product. For nearly a decade, our two companies have enjoyed a strategic relationship. Therefore, when Lotus Development Corporation needed a partner to stress a new version of their product, Lotus Notes, Compaq was the logical choice for a beta-test. At the same time, Compaq was using many client-server applications to benchmark and stress test our systems and subsystems to optimize and improve the COMPAQ SYSTEMPRO Line of Computer Systems and Servers. Both companies recognized the mutual benefit of pooling resources for the stress test. It was during this benchmarking process that Compaq realized the potential and strategic advantages of the Lotus Notes product offering and the emerging groupware market.

The integration group that performed the benchmarking test had also been searching for a platform for distributing continually updated technical information to an external audience of specialized systems engineers. The group selected Lotus Notes because of its suitability as a rapid development and deployment platform.

NOTE: For a detailed look at the approach Compaq followed to implement the above project, refer to Appendix A, "Case Study: Information Dissemination Using Lotus Notes."

As Lotus Notes gained more industry exposure, the demand for the technology and the number of Lotus Notes applications increased significantly and rapidly. Consequently, Compaq negotiated the purchase of a large number of licenses for world-wide use. These licenses include international versions, multiple languages, and support from Lotus. This agreement has been a key factor to our success in implementing and deploying Lotus Notes on a world-wide basis.

World-Wide use of Lotus Notes

Following the domestic implementation of Lotus Notes, Compaq International selected Lotus Notes as a platform for offering not only online information, but also as a preferred medium for communications between Compaq and its business partners. In Europe, this led to the development of other applications that link databases with sales and marketing data, and electronic mail.

The sales and marketing databases use the Lotus Notes programming interface to transfer corporate data into Lotus Notes databases in the subsidiaries. Compaq Resellers and Compaq Representatives can then access this information locally. This linking application relies upon our international Banyan VINES corporate network to transfer data from our domestic and international offices to the subsidiaries. Unlike other implementations that rely solely on replication via modem, the Compaq network offers real-time access to Lotus Notes servers virtually anywhere in our corporate world. Compaq only replicates databases to load balance the network. However, Compaq offers dial-in access to resellers and other business partners, as well as Compaq field personnel in remote areas who do not have network access.

Compaq also uses Lotus Notes globally to handle case tracking and escalation. Support personnel in each subsidiary escalate customer issues to our international centers, and then on to Houston, Texas. A similar system exists for our domestic case management. This allows us to get a complete picture about our multi-national accounts and to track our customer issues world-wide. Additionally, we have enterprise network workgroups connecting our major manufacturing and business centers: Houston, Texas; Erskine, Scotland; Munich, Germany and Singapore.

Lotus Notes Platform Infrastructure at Compaq

The world-wide use of Lotus Notes by Compaq has the following characteristics:

■ The corporate Banyan VINES network offers the required connectivity between servers and workstations anytime, anywhere in the Compaq corporate world.

■ Where appropriate, Compaq uses Microsoft LAN Manager for server-to-server replication with TCP/IP connectivity. This enables Compaq to isolate specific servers from the corporate network (such as those used for dial-in access by external groups and individuals), and to manage them using standard Microsoft LAN Manager services.

■ Compaq also has a Lotus Notes-to-Banyan VINES mail gateway for those employees who do not have Lotus Notes on their desktops. This provides mail integration between Banyan VINES and Lotus Notes.

■ Additionally, Compaq provides extensive dial-in capabilities for remote users such as on-the-road field personnel and Compaq external audiences.

Administering Lotus Notes

Developing guidelines has been critical to our successful use of Lotus Notes domestically and internationally. We anticipated that the flexibility of Lotus Notes can provide mixed results: on one hand, it is a platform that can accomplish many tasks easily in many different ways. On the other hand, developing Lotus Notes applications without standards would cause a corporate jumble of isolated databases, and the inability to properly integrate information across databases.

Through a gradual, evolutionary, and international process, Compaq developed administration standards for the domestic and international use of Lotus Notes. These standards include topics such as:

■ Standard roles and responsibilities

❏ Lotus Notes server and systems administration

❏ Network administration

❏ Database development and administration

- Security guidelines

- Training offerings: internal courses, standard and customized versions

- Naming standards: domains, networks, servers, users, and groups

- Server roles: hub, production, application, development, or gateway

- Database development and deployment guidelines

- Server administration standards

- Operational procedures

    - Issuing licenses

    - Server backup and recovery

    - Virus scanning software and procedures

Corporate Direction with Lotus Notes

More and more, Compaq uses Lotus Notes for doing business in many areas: Sales, Marketing, Product Development, and Customer Service, to name a few. Our corporate MIS department views Lotus Notes as an important platform for rapid application development and dissemination. Lotus Notes fits in with our philosophy of moving toward distributed, client-server technology. The functionality of future Lotus Notes versions should offer a closer marriage between Lotus Notes and our other platforms of choice. This should lead to increased productivity and decreased application development and maintenance costs.

Active evaluations of Lotus Notes, future enhancements, and Lotus Notes add-on products have been instrumental to a successful deployment of Lotus Notes at Compaq. This allows us to foresee how our applications may grow in parallel with the functionality in Lotus Notes and the groupware market. Feedback from employees and customers offers valuable insights for fine tuning the way Compaq uses Lotus Notes, and allows us to mold our offerings to business partners. Additionally, Compaq continually provides Lotus Development Corporation with input on desired product features and enhancements.

A critical area that Compaq believes needs industry attention is server and application management. Compaq has a strong commitment to systems management. Compaq continually works with our industry partners, consultants, systems integrators, value-added resellers, and vendors to ensure that our recommended solutions will enable you to manage your distributed applications efficiently. The COMPAQ Server Manager/R is just one example of how we have addressed server and remote management issues for personal computer-based platforms.

At Compaq, our commitment to investigate and understand emerging technologies and application integration markets remains as strong as ever. Compaq also believes that it is equally important to disseminate the information and the knowledge gained through integration information products such as this TechNote.

Chapter 3
Recommendations for Decision Makers

This chapter contains recommendations for those individuals who will be looking at Lotus Notes from a decision making point of view. Compaq suggests that you view these recommendations as guidelines in your evaluation process.

Provide Strong Upper-Level Management Commitment

Providing strong upper-level management commitment is critical to the success of implementing a technology like Lotus Notes. You can measure some benefits, such as reduced cost of labor and travel. However, other benefits, such as improved quality of decisions and enhanced corporate image, are intangible. Judging the value of such benefits is difficult.

Even so, you must carefully review the business benefits of adopting this technology. Lotus Notes can be a powerful, strategic tool: implemented appropriately, it can improve coordination of corporate-wide activities. The marketplace has recognized Lotus Notes as an important groupware product in the nineties. Lotus Notes incorporates features such as group discussion, electronic mail, and document management that are typically important to any organization.

Adopting this technology will probably mean a substantial corporate investment. Some possible expenses are:

■   Purchasing Lotus Notes licenses and software upgrades

■   Buying new hardware so that you may run platforms with Graphical User Interfaces (GUIs) more efficiently

■   Training key personnel

Case studies have shown some companies have found the rewards of investment to be well worth the costs.

Encourage the Success of Your Application
Through the Corporate Culture

Corporate culture plays an important role in the success of groupware applications. Typically, organizations with established inter-departmental teams will readily accept Lotus Notes. Still, you cannot assume that information-sharing through Lotus Notes will happen automatically. Providing potential users with training materials and prototype applications and encouraging user participation will help you to ensure a successful implementation. This is true for any technology, but groupware is one area where commitment and cooperation throughout the organization are critical.

Take a Systems Approach

By taking a systems approach, you can possibly design small-scale systems without rigorous engineering analysis of decision making and evaluation. However, the cost of ignoring these efforts for large-scale systems can be quite high.

The preferred systems approach minimizes your risk by extending analysis techniques to all the steps involved. In particular, evaluation becomes a critical step that provides you with the necessary feedback to refine, reject, or transfer the system. For best results, you must define your evaluation criteria simultaneously with your system design.

A successful large-scale implementation of Lotus Notes generally requires a systems approach similar to the illustration that follows.
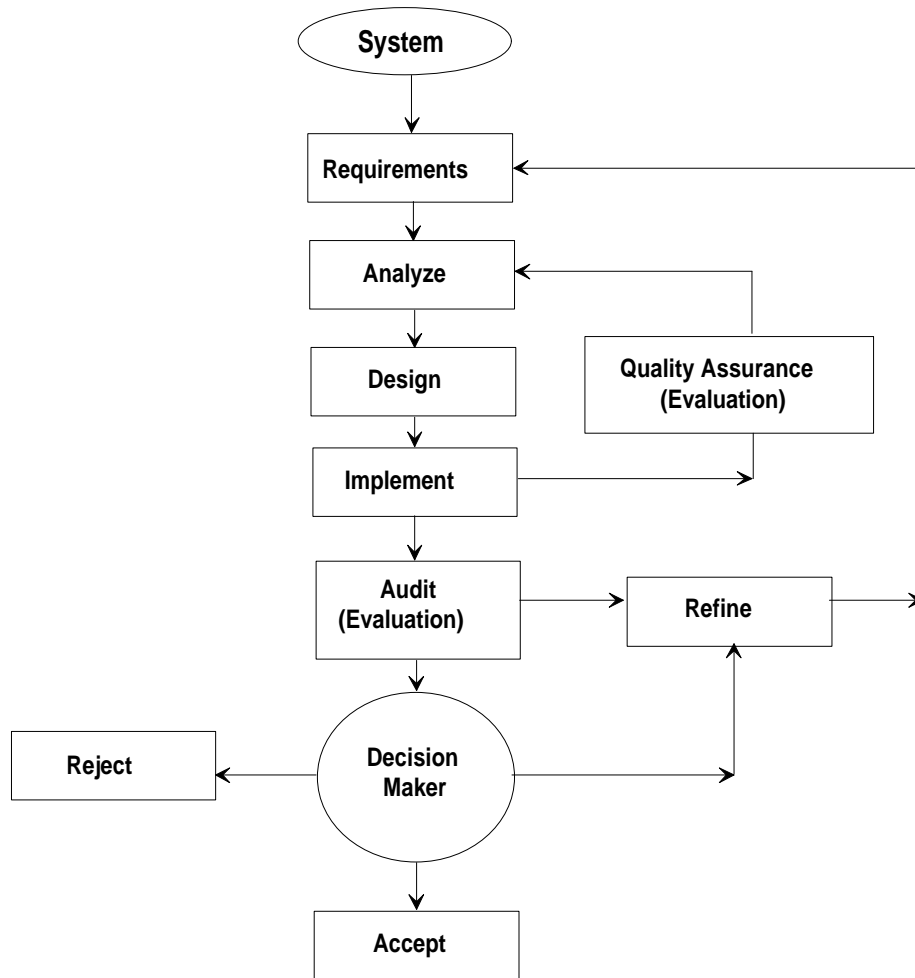
Figure 3-1. Systems Approach

Planning

Consider the following suggestions while planning your Lotus Notes implementation.

Plan for Growth

Once people become familiar with it, Lotus Notes can proliferate quickly throughout your organization. It is possible for your users to develop prototype applications rapidly. This trend can affect your Lotus Notes implementation by spawning large numbers of databases.

You must prepare to carefully manage this growth. Developing standards, instituting appropriate server management, and administering database catalogs are some important issues that you must consider. Thorough planning allows you to manage the growth of Lotus Notes.

Standardize Early

Standardization is critical early in the implementation. Choosing an inappropriate standard can be difficult to change. These are very important lessons. Standards must apply to all aspects of the system:

■ Name & Address Book elements (end-user system identification, server, and connection records)

■ Access lists

■ Database design styles

■ Hardware configuration

■ Location of servers

System Management Issues

Systems management involves certain issues that require careful attention. The following are suggestions to assist you in managing those issues.

Use Your Existing Network

Generally, you can use your existing network connections to route Lotus Notes traffic. Like other distributed applications, the underlying network plays an important part in the use of the technology. A successful implementation requires careful study of the networking issues involved, particularly performance and manageability.

Manage FUTURE Growth

In an explosive-growth environment, even careful planning will not prevent the risk of judgment errors or computer system failure. Your organization must react quickly to critical component failure. For instance, the cost of losing your important client-tracking application might be unacceptable to you.

You must carefully study issues such as remote server management, remote configuration, asset management, and problem resolution. Careful planning in these areas will ensure that your solutions of today will work with the new technologies of tomorrow.

Evaluate the Impact on Your Electronic Communication

Lotus Notes provides you with a variety of features, including electronic mail. As mentioned earlier, Lotus Notes allows your organization to expand electronic discussion beyond traditional boundaries with its capability to include many-to-many interaction. Carefully consider the impact of using this tool with respect to other electronic communication tools in your organization. The following are some points to consider:

■ Do you already have electronic mail in your organization?

■ Are you considering Lotus Notes to replace your existing electronic mail system or to complement it?

■ How will you integrate multiple mail systems?

■ How will your users react to a choice of mail systems?

Address the Speed-of-Access Issue for Remote Users

For acceptable performance, we have found that users strongly prefer 9600 baud modems over 2400 baud modems with compression. Though Lotus Notes' client-server technology minimizes traffic across a phone line, online GUI search applications involve much interaction, including graphics. Therefore, the traffic pattern is sometimes comparable to host-to-host terminal systems over a low-speed line. There are several ways to address this issue:

■ Where possible, provide methods for your remote users to use high-speed links. For example, remote users in field offices who are not traveling on the road can connect to a corporate backbone network with high-speed links. You will need to balance the cost of maintaining these links against their traffic patterns and usage.

■ Design your databases for dial-up access, where appropriate. For example, while it may be fine for your LAN users to access images and graphics, your remote users will find the long delays to access the same information over a modem line unacceptable.

■ Encourage your remote users to download the required information selectively, using the replication feature of Lotus Notes. Once they have completed working on the data, they can upload their changes using replication.

Provide Local Access to Data

Database replication to a local network server or a standalone computer (laptop or a desktop) is one way to localize the user access to the data. Other alternatives include using private or public networks to access corporate data while incurring local access charges. Examples of such enabling technologies are packet-switching, frame relay and Integrated Services Digital Network (ISDN) services. Currently, these technologies are best suited for server-to-server replication of data. However, industry trends are to use the same technologies for client-to-Lotus Notes server connections, as well.

Training

Training is an important aspect of any successful implementation. The following suggestions will provide assistance in making decisions for your training requirements.

Identify and Train Local or Regional Administrators

The success of a distributed application depends not only on support from corporate headquarters, but also from the geographic regions. Lotus Notes incorporates wide area networks with its ability to replicate data across geographically separated servers. This feature can appeal to field personnel who want an interactive link with headquarters. This link is more powerful than regular electronic mail, because Lotus Notes allows expanded discussion beyond traditional electronic mail boundaries.

Provide End-User Training on Using Lotus Notes for Your Applications

Educate your users on effectively using Lotus Notes for your applications. Lotus Notes lets you quickly prototype pilot applications to solve specific business problems. Therefore, once you provide training to your users, you can use their feedback to make important changes to your applications.

Evaluation

The section that follows provides recommendations to keep in mind while evaluating your corporate requirements and the suitability of Lotus Notes as a solution.

Match the Expectation Level

You must have an understanding of what problems you expect to solve using Lotus Notes and how your users will use this technology to solve those problems. Lotus Notes is not a relational database. Therefore, it is not suitable for all classes of business applications. However, there are several problems involving group interaction that it solves very well. Understanding both the capabilities and the limitations of this tool and effectively communicating them to your users are key elements for your success.

Identify and Develop Your Evaluation Measurements Concurrently with Your System Design

By closely working with your end-users and incorporating their feedback into the system design, you can maximize your chances of success. Lotus Notes has the ability to prototype applications quickly and to incorporate most requests for change. Additionally, by developing evaluation measurements *prior* to your system implementation, you can continually evaluate progress. You can ensure that your criteria for success are being met (reduced development time, increased productivity, and so on).

Chapter 4
Effective Lotus Notes Applications

This chapter contains information that will help you categorize and define your appropriate application uses for Lotus Notes.

Some characteristics of effective Lotus Notes applications are:

■   Shared communication of semi-structured information

■   Mix of text and graphics

■   Periodic updates

■   Electronic mail for communications

■   Multiuser access

■   Integrated information from a variety of external sources

■   Multi-site access to information

Inappropriate Uses of Lotus Notes

Lotus Notes is not a relational database application. Therefore, Lotus Notes would not be appropriate for:

■   Intensive numeric calculations

■   Distributed transactions processing and record locking

■   Ad-hoc queries

■   Online transaction processing (OLTP)

■   Immediate updates

Although Lotus Notes is not a relational database, some organizations use it as a front-end application for database management systems such as Microsoft SQL Server. Programs can import Microsoft SQL Server data into Views within Lotus Notes. This is possible with C language routines that make function calls to the programming libraries available with both Microsoft SQL Server and Lotus Notes. Lotus Notes can also act as a Dynamic Data Exchange (DDE) client to import data from other DDE-compliant application programs. Additionally, Version 2.1 supports Linking and Embedding (OLE).

Types of Lotus Notes Applications

Lotus Development Corporation categorizes Lotus Notes applications into three main groups, according to the degree of interaction (low, medium, or high). The categories are:

■ Routing - Information maintained and reviewed over time

■ Interacting - Workgroup discussions and responses

■ Publishing - Distributed information

In each category, the structure can be simple or complex, as shown in the table that follows.

Table 4-1
Lotus Notes Applications Categories

Category	Less Structure	More Structure
Routing (Low interaction)	Forms Routing: Travel Authorization Purchase Order Account History Employee Records	Mail: Electronic Mail Status Report
Interacting (Medium interaction)	Tracking: Project Management Call Report Tracking Customer Support	Discussion: New Product Design Special Interest Groups
Publishing (High interaction)	Reference: Polices and Procedures Market Research Contract Library	Broadcast: Current Events Industry News Agenda/Minutes

Chapter 5
Planning Issues

Planning a large-scale system like Lotus Notes involves a number of factors. The *Lotus Notes Site Planning Guide* is a good source of information you can use to address typical issues associated with planning and implementing a Lotus Notes system. This TechNote provides detailed information on topics such as setting up a support organization, site planning, server topology, administration, and security.

The information in this chapter supplements the *Lotus Notes Site Planning Guide*. Typically, you must develop plans for some of the areas listed below. Consider your own special requirements and adopt specific areas to focus upon. Use the following information as a *guideline;* you might not need to develop detailed plans for all these areas. Generally, you should be able to use your existing distributed application network and support organization.

Hardware Requirements

Consider the following hardware requirements when planning a Lotus Notes installation:

- Existing configurations versus minimum or recommended requirements for laptops and portables, desktops, and servers.

  NOTE: For details on recommended platforms available from Compaq, refer to the "Recommended Hardware and Software" topic in Chapter 7, "Planning Your Implementation."

- Existing access methods (modem lines, high speed links) versus acceptable speed requirements.

- Hardware fault tolerance.

- Physical security of your servers.

Software Requirements

Consider the following software requirements when planning a Lotus Notes installation:

■   Application level monitoring (problem determining, security, trends analysis, performance monitoring, and so on)

■   Software fault tolerance (replication of databases, online copies of critical application, network and operating system components)

■   Backup schedules

■   Virus scanning

System Requirements

Consider the following system requirements when planning a Lotus Notes installation:

■   Manageability of your network components (servers, clients, links, bridges, routers, gateways, and so on)

  ❑   Configuration

  ❑   Auditing

  ❑   Performance

  ❑   Problem determination

  ❑   Security

■ Network and server topology, that is, connections between components at the network level (node-to-node) versus the application level (client-to-server, or server-to-server connections)

■ Network and server resource estimates

   NOTE: If you need a detailed analysis of estimating the server resources for dial-in users, refer to Appendix B: "Planning for Dial-In Access."

■ Existing access protocols (asynchronous or synchronous, LAN or WAN protocols) versus performance

■ Standards for systems administration and database design, including maintenance of the public Name and Address Book database:

   ❏ Domain names

   ❏ Network names

   ❏ Server names

   ❏ People and group records

   ❏ Connections between servers (including outside servers)

Administrative Requirements

The following requirements are addressed according to administrative function.

Software Administration

Consider the following software administration requirements when planning a Lotus Notes installation:

■ Forecast license requirements and maintenance costs.

■ Negotiate license and maintenance agreements with Lotus Development Corporation or other providers (for example, Lotus Notes VARs).

■ Purchase Lotus Notes software and maintenance services to bill to cost centers.

■ Receive, stock and distribute Lotus Notes licenses, software, and documentation to system administrators.

■ Generate and track Lotus Notes IDs.

Systems Administration

Consider the following systems administration requirements when planning a Lotus Notes installation:

■ Establish and enforce consistent naming standards for all aspects of system administration (domain names, network names, server names, and so on).

■ Determine inherent mail-enabled features of Lotus Notes (mail server, mail box sizes, enabling or disabling mail, and so on).

■ Define expected performance service levels.

■ Forecast equipment needs and expected utilization levels.

■ Provide utilization analysis for decision making.

■ Identify trends and provide trending analysis for decision making.

■ Monitor inactive or overactive users (abuse tracking).

■ Provide performance reports and trending of experience versus goals.

■ Meet periodically to set up agenda for decision making.

■ Consolidate proposals for enhancement.

■ Define issues for resolution by appropriate teams.

■ Initiate corrective action.

Systems Maintenance

Consider the following systems maintenance requirements when planning a Lotus Notes installation:

■ Additional features to users, fine tuning of the system for performance, security, reliability, and so on, through upgrades of vendor software.

■ Test plan recommendations.

■ Final level of support for complex problems.

System Enhancement

Perform requirements analysis, design, prototype (and other research), development, and testing proof of concept of new applications and uses.

Application Development

Consider the following application development requirements when planning a Lotus Notes installation:

- Define application access (class of user).

- Define access control lists (ACLs) for each class of user.

- Ensure that appropriate information is made available to users, consistent with corporate goals.

- Provide consistent format and style across databases.

- Establish standards of database design.

Application Maintenance and Enhancement

Consider the following application maintenance and enhancement requirements when planning a Lotus Notes installation:

- Maintain standards of database design.

- Monitor usage by classes of users.

- Incorporate feedback from users.

- Incorporate new features and functionality using new versions of Lotus Notes and other application development tools.

Data Population

Consider the following data population requirements when planning a Lotus Notes installation:

■ Provide consistent format and style *of data* across databases.

■ Establish and maintain standards of data content.

■ Protect corporate information (copyrights, trademarks, and so on).

■ Provide value for the user through quick access to information.

■ Ensure that databases are properly maintained with current, accurate information.

■ Ensure data input quality for controlled access and proper database classification.

■ Ensure that data collection of information is coordinated and systematic.

■ Ensure that procedures, equipment, and software needed for data input are in place.

■ Maintain a record of tasks and time required for periodic updates.

Support

Consider the following support requirements when planning a Lotus Notes installation:

■ Mission critical support and dispatch.

■ Problem escalation procedures.

■ Problem tracking and trends analysis.

■ Feedback to users on the status of issues.

■ Service level objectives and user expectations.

Training

Consider the following training requirements when planning a Lotus Notes installation:

■ Train end-users (application usage, security guidelines, contacts for problem reporting).

■ Train system administrators (guidelines, server management, problem resolution).

■ Train database administrators (guidelines, use and appropriateness of applications).

Chapter 6
Evaluation Design

Evaluation design is an important element in the systems approach. Evaluation encompasses two aspects: quality assurance and auditing.

Quality assurance involves verifying that the implementation follows established standards for systems administration and application development. This also includes incorporating feedback from users to improve the system continually. With Lotus Notes, you can easily prototype applications. This allows you to make quick adjustments to the system without severely impacting your overall implementation schedule.

NOTE: The "Administrative Requirements" topic discussed in Chapter 5, "Planning Issues" provides details about many of the procedures for quality assurance.

Auditing involves analysis of the bottom line: What is the return on investment? Does the system meet the criteria for success? Unfortunately, this aspect of evaluation is usually tagged on at the end of a program design. This makes it difficult to understand any shortcomings of large-scale systems. Recognizing early trends is key to your overall success. This is the basis for developing evaluation methods concurrently with the system design.

An in-depth look at evaluation methods is beyond the scope of this document. However, the following are some important *guidelines* to consider.

Evaluation Measurements for Lotus Notes

Define quantitative measures to evaluate systems. Qualitative methods are subjective and relative, that is, one person's opinion might differ from another person's opinion. Quantitative measures point out specific deficiencies and areas for improvement. Statements that a project "went over budget" or "took too long" or "did not meet expectations" are not helpful in identifying why something cost too much, got delayed, or failed to deliver.

To evaluate the system accurately, you must look at it as a whole. For instance, reducing cost is not desirable if it reduces quality. Therefore, evaluation design involves defining the measurements and a set of relationships. For Lotus Notes, the following table provides a suggested set of measurements.

Table 6-1
Suggested Evaluation Measurements for Lotus Notes

Goal	Measurements
Reduce cost	What resources are required?
	■ Hardware requirements (server, workstation)
	■ Software requirements (Operating Environment upgrade?)
	■ Personnel (system administrator, network support, database administrator)
Reduce time of development	How long will it take to implement using Lotus Notes? Is that acceptable?
	What is the alternative? How long will that take?
Meet design goals	Does it meet field conditions?
	■ What is missing?
	■ Are the users satisfied? (Scale of 1-5?)
Overall Value (Evaluate tangible benefits)	What is the percentage increase in productivity?
	What is the cost savings through reduced travel?
	What is the overall usage of the system?

Using these measurements as guidelines, you can continually track the progress of your implementation in terms of meeting your business requirements.

Chapter 7
Planning Your Implementation

The target audience for this information is the systems analyst or system administrator who needs to know the important considerations prior to implementing Lotus Notes. This involves:

■ Understanding the hardware and software requirements at the servers and the clients

■ Determining the number of servers you will need

■ Deciding upon the server topology

■ Setting up the servers

■ Special considerations for a dial-in server

The technical information provided in this TechNote relates to Lotus Notes, Version 2.1. Chapters 7 through 12 provide information that is network operating system independent. Chapters 13 through 23 assume that your network operating system environment is Microsoft LAN Manager Version 2.x or compatible.

Recommended Hardware and Software

The following is a list of COMPAQ products that can meet your requirements for a typical Lotus Notes server or client:

Server

■ An 80386 system processor or higher with 16 megabytes of RAM

❏ COMPAQ SYSTEMPRO/LT Family of Personal Computer Servers

❏ COMPAQ SYSTEMPRO Personal Computer System

- High-capacity hard drive subsystem (according to requirements and options supported)

  - COMPAQ 510-Megabyte Integrated Drive Electronics (IDE) drive or one of a similar capacity

  - COMPAQ 650-Megabyte Enhanced Small Device Interface (ESDI) drive or one of a similar capacity

  - COMPAQ 32-Bit Intelligent Drive Array (IDA) Controller (various configurations available)

  - COMPAQ Intelligent Array Expansion System (IAES) (various configurations available)

- EISA bus master network interface controller

- COMPAQ 32-Bit Server Manager/R board (recommended for remote server management)

- MS OS/2-compatible graphics adapter (VGA recommended)

- MS OS/2-compatible mouse recommended

- Microsoft MS OS/2 Standard Version 1.21 as published by Compaq, IBM OS/2 Version 1.3, or Microsoft OS/2 Version 1.3

NOTE: The COMPAQ products mentioned are subject to availability and may be changed without notice.

Network Client

- An 80386/486 system processor with 4-6 megabytes of RAM for Microsoft Windows clients and 8 megabytes for Microsoft OS/2 clients.

  ❑ COMPAQ DESKPRO/M Family of Personal Computers

  ❑ COMPAQ DESKPRO/i Family of Personal Computers

  ❑ COMPAQ Prolinea Line of Personal Computers

  ❑ COMPAQ PORTABLE 486 Family of Personal Computers

  ❑ COMPAQ LTE Family of Personal Computers (with a Desktop Expansion Base)

- Hard drive or access to network file server (need 10 megabytes of free space for Lotus Notes software and databases)

- Network interface controller (16 bit recommended)

- Microsoft Windows or MS OS/2-compatible graphics adapter and monitor (VGA or better resolution recommended)

- Mouse recommended (must be compatible with the operating system)

- Microsoft Windows 3.x, or any of the recommended MS OS/2 versions for a server

NOTE: The availability of the COMPAQ products and models listed here are subject to change without notice.

Portable Client

■ An 80386/486 system processor with 4 megabytes of RAM for Windows clients, 8 megabytes for Microsoft OS/2 clients.

    ❏ ❏ COMPAQ LTE Family of Personal Computers

    ❏ ❏ COMPAQ SLT Family of Personal Computers

    ❏ ❏ COMPAQ Contura Family of Personal Computers

    ❏ ❏ COMPAQ PORTABLE 486 Family of Personal Computers

■ Hard drive or access to network file server (need 10 megabytes of free space for Lotus Notes software and databases)

■ COMPAQ Enhanced 2400-Baud Internal Modem or COMPAQ Enhanced 9600-bps Internal Modem (9600-bps modem recommended)

■ Microsoft Windows or MS OS/2-compatible graphics adapter and monitor (VGA or better resolution recommended)

■ Mouse recommended (must be compatible with the operating system)

■ Microsoft Windows 3.x, or any of the recommended OS/2 versions for a server

NOTE: The availability of the COMPAQ products and models listed here are subject to change without notice.

Determining the Number of Servers

The *Lotus Notes Site Planning Guide* provides some suggestions that you should consider when evaluating the number of servers that you need. These suggestions focus on designating specific roles for various Lotus Notes servers in your network. For example, a hub server is one that is dedicated to routing mail and replicating databases between other Lotus Notes servers. The following supplements the information in the *Lotus Notes Site Planning Guide.*

An important factor to consider is the total number of services that a server can provide. For example, this could be a combination of file and print services, connectivity services, and database services.

Consider running other application servers (Microsoft SQL Server, mail, or FAX gateway servers) along with Lotus Notes in the same computer. As a rule, this is not a recommended configuration. Depending on usage, these applications can compete for resources and severely degraded performance if they coexist in the same server. However, for small groups of users (ten or less), such configurations might be acceptable.

There are several factors that you must balance when looking at the total number of servers you need:

■ From a performance standpoint, the more servers you have, the better response your users will experience. Also, having more servers will distribute the load better. When one server fails, the entire system does not suffer.

■ From a maintenance standpoint, the fewer the number of servers, the lower the maintenance costs. Also, remote administration is simpler when there are fewer servers in the system.

■ Complexity of the overall design.

■ Overall cost of implementation and configuration.

■ Overall topology.

You must carefully balance these factors in deciding the best configuration for your system.

NOTE: For additional information in the Microsoft LAN Manager environment, refer to Chapter 14, "Implementation Considerations for Microsoft LAN Manager Networks."

Server Topology

Choose a topology that eliminates loops between servers through connection records. Such situations exist with a *mesh* topology, where a group of servers can have multiple connections among themselves. This can cause a problem because it is difficult to measure how long it will take for a change to propagate through the network. Another potential problem is the effect of incorrect connection records, which can result in infinite loops, undelivered mail, and additional stress on both your server and your network resources.

The preferred topology is the *hub and spoke* design. This topology has a hierarchy of servers. At the lowest level, workstations communicate with servers directly above them in the hierarchy. Such servers are called spoke servers. Each spoke server, in turn, communicates either with the workstations it serves or with hub servers one level up in the hierarchy. Hub servers can communicate with spoke servers directly below them or other hub servers directly above them.

In this topology, communication is strictly to the level directly above or directly below. Two spoke servers cannot directly communicate with each other, even if they are on the same level. They must communicate (for example, to exchange database updates) through the intermediate hub server.

The hub and spoke topology has several advantages:

■ Minimizes network traffic, since communication is strictly one level above or below in the hierarchy.

■ Simplifies administration because of fewer connection records.

■ Easy to trouble shoot and isolate problem areas. For example, a problematic spoke server can be cut from the rest of the network.

■ Expandability. Hub or spoke servers can be added as growth and traffic conditions warrant.

■ Simplifies corporate control over critical databases such as the Name and Address Book. You can incorporate changes to this database at a single master server and then replicate to downstream servers in the hierarchy.

The hub and spoke topology has these disadvantages:

■ If a hub server fails, several spoke servers can be affected. You can minimize the impact of such failures by splitting the functions of the hub servers. For example, Hub A may serve mail routing functions for a group of spoke servers and Hub B may be the FAX gateway server for the same group.

■ It might be difficult for small groups of users to justify the system of hub and spoke servers. Consider maintaining a hub system to be shared among several groups to reduce the costs.

Setting Up a Lotus Notes Server

Once you have decided upon the number of servers and their topology, you will still need to consider other factors that can impact your setup. You must have a clear idea of how you are going to assign names to your Lotus Notes servers and what network names you are going to associate them with. In addition, you must determine what groups of users will have access to a server. A discussion of these issues follows later in Chapter 8, "Recommended Lotus Notes Naming Conventions" and Chapter 9, "Security Tips."

Even though you may have a good idea of your system-wide server names and security rights, you still need to consider other important steps in setting up a server. Start by setting up the server from the *bottom up*, that is, by first setting up the hardware and configuring the hardware components, then the operating system, then the network operating system, and finally the Lotus Notes application.

Once you have set up your server for the appropriate network operating system, you can install your server according the steps in the *Lotus Notes Administrator's Guide*.

The following are the important considerations for installing the hardware, the operating system, and Lotus Notes. In addition, a separate discussion looks at the special considerations for a dial-in server.

Hardware Considerations

Since Lotus Notes uses client-server architecture, your performance bottlenecks are likely to be the system processor and the hard drive subsystem. (By contrast, in a resource-sharing environment, such as a file server, the bottlenecks are likely to be the hard drive and the network.) Therefore, from a hardware perspective, you must consider your investments in the system processor and disk subsystems when making your choice of hardware platform for a Lotus Notes server.

System Processor (CPU) Considerations

Lotus Notes extensively utilizes the system processor, particularly during database replications and mail functions. Any additional tasks (such as statistics and indexing) also take up processor cycles.

The server type determines the best processor for your needs. For example, a hub server that is only replicating with other hub servers and spoke servers might operate efficiently with a 386 system processor. By contrast, a spoke server servicing many user tasks will probably require a 486 system processor.

If your processor is a bottleneck, you might consider upgrading to a different processor (from a 386 to a 486) and to higher speed (25 MHz to 33 MHz to 50 MHz, and so on). You can determine your processor usage and upgrade needs by referring to the suggestions in Chapter 16, "Monitoring and Optimizing the System Processor."

Hard Drive Subsystem Considerations

Your choice of the hard drive subsystem depends on whether you wish to locate all the Lotus Notes databases on the server itself, or locate them across the network on a file server. Regardless of where you locate the data, the computer on which you are locating the data is the one for which you must optimize the disk subsystem.

You can optimize the hard drive by choosing drive arrays over IDE drives. Drive array systems provide you with both fast disk response times and fault tolerance capabilities. You can determine your hard drive usage and your upgrade needs by referring to the suggestions in Chapter 17, "Monitoring and Optimizing the Hard Drive Subsystem."

Memory Considerations

Under MS OS/2 1.x, the maximum amount of physically addressable memory is 16 megabytes of RAM. Depending on your configuration, you must allocate memory to the operating system, network operating system, file system caches, and the applications themselves (including Lotus Notes).Therefore, in all but the simplest configurations, Compaq recommends configuring your server with 16 megabytes of system memory.

Slot Considerations

The number of slots is usually not an important consideration. However, you must determine if the number of available slots is adequate for your expandability. For example, if you add multiport boards to your server for dial-in access, the connections of the cables might necessitate that you keep adjacent slots free for ease of installation and maintenance. In this case, you must factor the loss of usable slots into your choice of computer systems. You might also need more slots if you are planning on adding disk and tape controller boards, FAX boards, multiple network interface controllers, and so on.

Recommended Configuration

Compaq makes a variety of hardware platforms to suit your needs regarding processor type, disk subsystems, and number of slots. As a typical recommendation for a Lotus Notes server, the COMPAQ SYSTEMPRO/LT Family of Personal Computers is versatile: you can choose from a range of upgradable system processor boards and drive subsystems to suit your needs. This family also has seven EISA slots to suit your expandability requirements. A typical configuration might be:

- COMPAQ SYSTEMPRO/LT Model 486/33-1020 with a 32-Bit IDA Controller and a 1020-Megabyte Drive Array Pair (two 510-Megabyte hard drives).

- System memory expanded from 8 megabytes (standard) to a total of 16 megabytes

- COMPAQ 32-Bit Server Manager/R board for monitoring

This configuration is only representative of general requirements. Your particular configuration may vary depending on your requirements. Consult your Authorized COMPAQ Computer Reseller or Compaq Representative for information on current products that meet your needs.

MS OS/2 Considerations

From an operating system perspective, you can optimize your configuration by installing the High Performance File System (HPFS) and locating your databases files on the HPFS partition. The HPFS file system offers greater performance benefits over the File Allocation Table (FAT) file system for Lotus Notes in resource-sharing environment. HPFS improves upon the slow throughput and inefficient storage management of the FAT file system. In the Lotus Notes environment, where you can have dynamically changing file contents, HPFS offers an improvement over FAT.

Once you have partitioned a disk for HPFS, you can no longer access it with MS-DOS or by booting off an MS-DOS diskette. For this reason, we recommend that you partition your disk to have a small (but sufficient) boot partition with a FAT file system (C drive). You use this to boot up your operating system, network and any utilities. You can then partition the remainder of your disk with HPFS (for example, D drive) and install your applications such as Lotus Notes on the HPFS partition. With this setup, you can boot off an MS-DOS diskette if necessary, and make changes to important files, such as your *CONFIG.SYS* and *STARTUP.CMD* on your C drive. Data on HPFS partitions is not accessible by MS-DOS.

! **IMPORTANT:** In database environments, such as Microsoft SQL Server, FAT offers better performance than HPFS. Therefore you must be careful about matching the proper file system to your data.

NOTE: For additional information in the Microsoft LAN Manager environment, please refer to Chapter 14, "Implementation Considerations for Microsoft LAN Manager Networks."

Lotus Notes Installation Considerations

While the Lotus Notes installation process is fairly smooth, there are some installation considerations regarding the location of program and data files, and parameters in the *NOTES.INI* file.

During installation, you are prompted to answer where you would like to install Lotus Notes. By default, this is C:\NOTES. If you have a HPFS partition on the D drive, it is a good idea to install Lotus Notes on that drive. Another suggestion is to install your Lotus Notes data files on a directory separate from your program files, for example in D:\NOTES\NOTEDATA. By separating the data files, you have greater flexibility in moving them around as your needs grow and enforcing additional security with directory link files. For a detailed discussion on directory link files, please refer to Chapter 9, "Security Tips" and Chapter 10, "Directory Links and Database Links."

You can modify settings on your *NOTES.INI* file to provide additional information and security. The following are some sample lines and a discussion of what they mean:

```
LogReplications = 1
Log Sessions = 1
;Log=LOG.NSF, 1, 0, 7, 8000
Log=LOG.NSF, 1, 0, 30, 8000
DENY_ACCESS=FormerUsers
```

The *Log Replications* and *Log Sessions* settings provide additional information at the server console and in the log file about replications and sessions. Although these settings increase the size of your log file, it is a good idea to have them initially enabled to provide you with tracking information when you are setting up a new server. Once you are satisfied with the installation, you can disable these settings by setting them to values of 0, or removing the appropriate lines from the *NOTES.INI* file on your Lotus Notes server.

The *LOG* setting increases the default time period of when Lotus Notes automatically deletes log file entries from seven days to 30 days. Once again, this increases your log file size, but you can track your initial installation over a longer period of time.

Finally, the *DENY_ACCESS* setting prevents any member of the group "FormerUsers" from accessing your server. For further details, refer to Chapter 9, "Security Tips."

If you are planning on installing a number of servers and would like to ensure that the above *NOTES.INI* parameters are uniformly applied to all your servers, consider modifying the *SRVNOTES.INI* file on your installation directory (or disk). Any modifications to the *SRVNOTES.INI* file apply to all the servers installed using this file as the base. For example, if you want to include the DENY_ACCESS list for all your *new* servers, edit the *SRVNOTES.INI* file to look like:

```
[Notes]
DENY_ACCESS=FormerUsers
```

For details on modifying the *SRVNOTES.INI* file, please refer to the *Lotus Notes Administrator's Guide.*

Setting Up a Lotus Notes Server with Multiple Network Connections

In some instances, you may need to setup a Lotus Notes server to bridge between two separate networks or network operating systems. Such a server is usually a specialized case of a hub server, and its purpose is to facilitate replication of databases between different networks.

Because the server is a part of both networks, it needs an enabled network connection for each network. The server record in the Name and Address book must be updated to include the multiple connections. For example, if a server is a part of a Microsoft LAN Manager network and a Banyan VINES network, the server record might include entries as follows (the order of network names must match the respective protocols):

Name: Notes Server
Network(s): MS LAN Manager, Banyan VINES

Additionally, the LAN ports must be enabled to match the protocols used, that is, LAN0=NETBIOS and LAN1= VINES.

The above setup works even if the same protocol exists in both networks. For example, if a server is used to replicate databases between two LAN Manager networks, the server record might include entries as follows:

Name: Notes Server
Network(s): MS LAN Manager NET1, MS LAN Manager NET2

In this case, both LAN0 and LAN1 must be enabled for NetBIOS.

You can have multiple protocols loaded on either a single network interface controller (NIC) or on separate NICs. Using separate NICs at the server reduces trouble shooting and downtime, because it is easier to localize one network from another. Therefore, it is a good idea to have multiple NICs in your server, each loaded with a single protocol stack, unless you have a specific reason not to do so.

Special Considerations for a Dial-In Server

A dial-in server has additional requirements, specifically concerning the number of dial-in ports to allocate, the choice of modems, and the setup of multiport boards.

Estimating the Number of Dial-In Ports

You must initially estimate the number of dial-in ports that you will need for your expected level of traffic. For details on techniques to estimate this number, please refer to Appendix B, "Planning for Dial-In Access."

Choosing the Appropriate Modem

There are several good choices for modems in the marketplace today. Keep the following points in mind when making a choice:

■ Compatibility, support for standards and versatility of speeds. Your dial-in server is like a bulletin board, that is, your modems on the server must answer calls from a variety of modem types. You must take steps to ensure that your choice of modems will be compatible with the originating modems in terms of adjusting as far as possible to the optimal speed and feature negotiation (error correction and compression). If you already know the possible modem types at your clients prior to making your choice at the server, you might want to conduct tests to verify their compatibility.

■ Popularity of modem for various applications. For example, you might want to reconfigure your setup from a dial-in Lotus Notes server to a server accessible by applications that provide LAN services across asynchronous lines. You must ensure that your modem has supported scripts for such applications.

■ Certification of modem internationally. If you are a global organization, you must ensure that the appropriate countries of interest have certified your modem choices for operation within their borders.

■ Support for rack mounting and *busy out* capability. Although rack
mounting is not a requirement, most rack-mountable modems have a
busy out feature that is an important consideration. This feature allows
you to generate a busy signal on the telephone line if you need to take
the modem down for maintenance. This feature is typically available
through the hardware (either with a switch on the modem or by
unseating the modem from the rack mount chassis).

The advantage with this feature is that when a modem is busied out,
your telephone hunt group automatically rotors over an incoming call
to the next available free modem. Additionally, if you must either take
down your Lotus Notes server or your entire modem bank for
maintenance, your users get a busy signal and try back later. This
avoids the annoying situation where a user dials your server and the
line rings without any modem to answer.

Configuring a Multiport Board

If you need more than the number of available serial ports in your computer,
or if you need to off load serial port communication tasks from your system
processor, you must install a multiport board in your server.

When considering multiport boards, keep the following in mind:

■ Number of ports: multiport boards typically come in 4 port, 8 port,
16 port versions.

■ Type of serial connectors: RJ-45 type or RS-232.

■ Number of slots required. Most boards fit into a single slot, but
sometimes it helps to leave the adjacent slot free for ease of installation
and maintenance (especially ribbon cables).

DigiBoard, Inc. is the recommended multiport board vendor. DigiBoard makes a variety of boards to suit your needs. A typical board configuration is the PC/16i with 16 serial ports. This board has RS-232 connectors, which you can directly connect to your modems with standard cables. (By contrast, you need special cables to connect from RJ-45 connectors to your modem.) If you use RJ-45 connectors, you need special cables to support 10 pins rather the standard 8-pin RJ-45 connection. (A modem connection requires signals from the 10-pin configuration.)

NOTE: When installing certain models of multiport boards, it is a good idea to leave the adjacent slot free. Although this is not necessary, this leaves more room for the ribbon cables attached to these boards. Consequently, this reduces stress on the cables during installation and subsequent reconfiguration.

Although most DigiBoard multiport boards are Industry Standard Architecture (ISA) based, you can configure them in your Extended Industry Standard Architecture (EISA) computer using the COMPAQ EISA Configuration Utility supplied with your computer. This ensures that there are no conflicts with other boards in your system. Install the board referring to the manual supplied with your board, taking care to note down the interrupt, memory address, and I/O port settings. You will need these when setting up the MS OS/2 driver.

!   **IMPORTANT:** The DigiBoard installation manual contains warnings about mixing 8-bit and 16-bit boards in your computer. Be sure not to overlook these warnings.

When installing your DigiBoard and configuring it with the COMPAQ EISA Configuration Utility, consider disabling the on-board serial port(s) in your computer. This frees up the associated interrupts for use with other add-in boards, such as your multiport board. Also, using intelligent multiport boards similar to the DigiBoard for serial communications puts less overhead on your CPU than directly using an on-board serial port.

After you successfully install your DigiBoard, you must setup your *CONFIG.SYS* to load the appropriate MS OS/2 driver. You can obtain the MS OS/2 driver, called *XALL.SYS,* by calling the DigiBoard bulletin board. This driver supports a variety of boards manufactured by DigiBoard, but it is a good idea to contact DigiBoard to confirm the proper MS OS/2 driver for your multiport board.

DigiBoard, Inc.
6400 Flying Cloud Drive
Eden Prairie, MN 55344

(612) 943-9020

The following are the relevant lines:

```
REM DEVICE=C:\OS2\COM01.SYS
DEVICE=E:\DIGIBORD\XALL.SYS /N:1 /D:N81 /B:9600 /P:110 /I:3 /M:0D0000
```

In the example above, the default *COM01.SYS* driver has been remarked out
because the COMPAQ EISA Configuration Utility disabled the associated on-
board serial ports. All serial communications are run from the DigiBoard,
including COM1. This is setup by the /N:1 parameter. (If you have COM1,
and COM2 as on-board ports and would like to keep them enabled and start
your DigiBoard ports from COM3, use the /N:3 parameter). The /I:3 specifies
that the interrupt setting is IRQ3. Similarly the /M and /P parameters set up
the memory and I/O ports, respectively.

NOTE: If your DigiBoard driver configuration allocates serial ports starting from
COM3, this is the first physical port on the board itself (that is, port 1).

Verify a Successful Installation

Before connecting your modems and configuring Lotus Notes to use the
DigiBoard, a recommended test is to verify your successful installation as
follows:

1. Boot up your computer into MS OS/2 and verify that the DigiBoard
    driver successfully loads.

2. Connect a null modem cable between one of the serial ports (for
    example COM1) on the DigiBoard to a second computer running a
    terminal emulation program.

3. Set up your serial port settings on the DigiBoard and the other
    computer's terminal emulation to match. For example: 9600 bps, even
    parity, 1 stop bit.

4. Open up an MS OS/2 Full Screen window. At the command prompt,
    execute the following command:

    DIR C:*.* > COM1

5. Verify that a directory listing shows up on the screen of the second
    computer running the terminal emulation.

6. Repeat steps 2 through 5 for each of the remaining COM ports (for
    example, COM2 to COM 16).

Chapter 8

Lotus Notes Recommended Naming Conventions

Use corporate network naming standards wherever possible, especially when you set up Lotus Notes servers and group names. If there are any existing standards for accessing your corporate network, implement Lotus Notes to fit them as practically as possible.

Also consider standards to maintain the Name and Address Book database. The Name and Address Book database is a critical part of your Lotus Notes implementation. Ideally, changes to this database must be coordinated with a central group that incorporates the changes into a master copy. The master copy is then replicated to all the Lotus Notes servers in your organization.

If multiple groups have unrestricted access to modify this database, they may inadvertently nullify or modify group names or connection records that can affect other users. By providing standards for all the elements of this database, and by establishing rules on how to implement changes, you can eliminate or minimize such problems.

NOTE: The following naming conventions are based on standards set by Compaq Computer Corporation. Use these conventions as guidelines and make modifications to suit your particular needs. These conventions are not a requirement to implement Lotus Notes. You may use standards that are not as structured, if they suit your needs. However, some form of standardization is valuable insurance against potential inconsistency problems as organizational use of Lotus Notes grows.

Corporate Domain Names

Typically, corporations consist of geographical regions. A recommended convention is to use a domain name per region, with a single Name and Address Book per domain. Also by convention, each domain has its own certificate. Consider the example of a hypothetical organization called Major Accounts Corporation with three geographical regions. You can have three domains as illustrated in the table that follows.

Table 8-1
Domain Names

Domain Name	Representing	Domain Administrator Maintains
MAJACCT_NA	Major Account Corporation, North America	Name and Address Book, certificate for domain name MAJACCT_NA
MAJACCT_EUR	Major Account Corporation, Europe	Name and Address Book, certificate for domain name MAJACCT_EUR
MAJACCT_PAC	Major Account Corporation, Asia-Pacific	Name and Address Book, certificate for domain name MAJACCT_PAC

All user IDs with names contained in a domain *Name and Address Book* must be stamped with the corresponding certificate. For improved security, Lotus Notes servers accessible by users external to your organization (for example, resellers and suppliers) must belong in a separate domain with a separate certificate name.

You must be careful when choosing domain names and certificates for the domains. All IDs in a domain must be stamped with the certificate for that domain. When you change a certificate name, all IDs immediately become invalid; they must be re-stamped with the new certificate name.

! **IMPORTANT:** You must restrict access to your certifier ID. Anyone with access to this ID can generate user IDs to access your servers.

Network Names and Connection Records

Lotus Notes uses network names in the Name and Address Book to display lists of affiliated Lotus Notes servers. A recommendation for network names is that they indicate the type, location, protocol, and sequential network number.

The *type* of a network describes the function of Lotus Notes servers on that network. A suggested list of network types might be:

■ Operations, for Lotus Notes servers with active databases (Operations Notes servers are the same as spoke servers in the hub and spoke configuration.)

■ Test, for Lotus Notes servers used for testing purposes

■ Development, for developing databases not readily accessible to users

■ Hub, for purposes of database replication only

■ External, which exists only as bridges to servers outside of any corporate domain

The following table is a sample of how you might generate network names:

Table 8-2
Network Names

Type	Location	Protocol + Sequential Number	Network Name
OPERATIONS	New York	BANYAN + 01	OPS_NYC_B01
OPERATIONS	London	BANYAN + 01	OPS_LON_B01
TEST	San Francisco	NOVELL + 01	TEST_SF_N01
HUB	Chicago	LANMAN + 01	HUB_CHI_LM01
EXTERNAL	New York	LANMAN + 01	EXT_NYC_LM01
DEVELOPMENT	New York	TCP/IP + 01	DEV_NYC_TC01

Grouping servers by function into separate network names avoids clutter for both administrators and users. Administrators can treat all servers in a network type as a group. Your users need only deal with a finite set of servers. For example, users on your Operations network, who execute a "File Database Add" command from the Lotus Notes menu will neither see nor interact with servers on your Test network.

The protocol is helpful in identifying the typical LAN protocol, especially if your environment contains multiple operating systems such as Banyan VINES, Microsoft LAN Manager, and Novell NetWare. The sequence number is useful to identify separate physical networks, if required. For example, there might be two separate Microsoft LAN Manager networks for two buildings on your campus.

NOTE: Segmenting by network names only occurs at the Lotus Notes application level. The underlying network layer can be the same, such as a single Banyan VINES, Microsoft LAN Manager, or Novell NetWare network.

You have some flexibility in choosing network names. If you need to alter the names at a later date, you may modify the Name and Address Book without any major changes to the system.

However, you must take the precaution to include connection documents for mail routing between servers in different network names. For example, if server A is in the Operations network, and server B is in Development, a connection record must exist between A and B for a developer on server B to send or receive mail to someone in A. You do not need a connection record to route mail between servers on the same network.

!   **IMPORTANT:** If you have a multiprotocol server, mail routing does not happen automatically on any port except LAN0. If you need to route mail on LAN1, for example, you need to add a specific connection record for that port.

For administrative purposes, it is simpler to treat the system of Lotus Notes servers in your organization as a *hub and spoke* design, rather than as a mesh of interconnected servers. This minimizes the total number of replication connect documents you must maintain. You can take advantage of any mail routing connections to perform replication at the same time.

Therefore, a preferred method of setting up connection records is to do it in two passes. First, set up connection records for exchanging mail between servers in different networks, or between multiprotocol servers, or external servers. Second, set up replication records, taking advantage of any mail routine connections. For details refer to Chapter 11, "Setting Up Connection Records."

Server Names

Servers that run in NetBIOS compatible networks, such as Microsoft LAN Manager, must consider the limit of 15 characters for a NetBIOS name (the sixteenth character is a class indicator).

You might want to name the server to match its networked computer name, or you might want to identify a Lotus Notes server with a specific structure for the 15 characters. You might also want to consider a structure for the Lotus Notes server name if it will help you administratively to immediately identify a server and its organization from its name. A suggested structure might be to use a combination of an organizational abbreviation, sequential server number, and location. All servers may have a prefix identifier for the corporation (for example, MA for Major Accounts Corporation) and an identifier for a Lotus Notes server (for example, NS). The following table provides an example.

Table 8-3
Server Names

Organization	Org Abbreviation + Sequence Number	Location	Server Name
Marketing	Mkt + 01	New York	MANS_MKT01_NYC
Marketing	Mkt + 02	New York	MANS_MKT02_NYC
Sales	Sls + 01	London	MANS_SLS01_LON

> **!** **IMPORTANT:** Once you assign server names, they are extremely difficult to change. Server names are associated with connection records, access control lists, desktop icons, and so on.

Give special thought to the impact of server names in your organization and how your users typically use them. Once you pick server names for your implementation, you will probably never want to change them again because of the difficulty of the steps involved.

Global User Group Names

Global user group names are group names that are accessible throughout the organization; they are commonly understood names that represent the corporate organizational structure. A suggested method is that you define user group names according to the user's group (for example, Marketing - North America) and organization (for example, Marketing). Group names then follow the patterns below:

Organizations_{domain}All Organizations registered within the Domain.

Groups_{org} Groups with respective '_{org}' appendices.

Members_{grp}_{org}All User Names with respective '_{grp}_{org}' appendices.

This creates a hierarchy of groups and super groups until it encompasses all the employees in the domain. This setup assumes that there is only one Name and Address book per domain.

For example, you may have

Organizations_MAJACCT_NA

Groups_Sales Programs_Sales NYC

Groups_Marketing Operations_Mkt NYC

Members_Marketing Operations_Mkt NYC

Susan Smith

Bill Jones

In the above example, Susan and Bill are members of a group called *Marketing Operations.* The Marketing Operations group is a part of an organization called *Mkt NYC* to represent the Marketing organization in New York. All such organizations for example, *Mkt NYC* and *Sales NYC* belong in the domain MAJACCT_NA, representing the North America division of Major Account Corporation.

Note the prefix of each user group name. For example, a user group name starting with the prefix *Members* denotes that it contains individual members, such as Susan and Bill in the example. Similarly, a user group name with the prefix *Groups* denotes that it contains entire groups, such as Marketing Operations. Finally, the prefix *Organizations* denotes that a user group name contains entire organizations, such as both Sales and Marketing in New York.

This hierarchy makes it easy to refer to entire groups or organizations of people. For instance, if you want to provide access to a database for only the members of Marketing Operations, you would include the group name Members_Marketing Operations_Mkt NYC in your Access Control List. If a new member joins this group, you would include that person's name as an entry in the group and grant that person access without changing anything else.

Certain other group names are required for administrative purposes. The following table is a representative list.

Table 8-4
Group Names

NotesAdministrators	Lotus Notes Administrators in a domain
DatabaseManagers	Database Managers in a domain
FormerUsers	Former users who are no longer allowed access
LocalDomainServers	All servers running in the local domain
OtherDomainServers	Servers in foreign domains that connect to the local domain

Applying this framework of default user groups provides a mechanism to authorize distinct users without having to define a set of separate user groups for each new Access Control List designed. Often, the default groups will be sufficient for normal access authorization.

Local User Groups Names

Local User groups are meaningful either to a particular organization or a particular group. The following describes a procedure to maintain local user groups within the Name and Address Book of a domain. Local user groups will not be replicated to other Name and Address Books in the domain.

Implementing Local User Groups

To implement local user groups, you must first perform the following steps on the master server -- the server from which you replicate all changes to the Name and Address Book:

1. Make a backup copy of your existing Name and Address Book for replication. You can use the "File Database Copy" command from the Lotus Notes menu.

2. Use the Lotus Notes workstation program on your server to create a new form called "LocalGroup" in the Name and Address Book. Base this form on the existing form called "Group" in the Name And Address Book. The LocalGroup form is identical to the Group form except for the addition of a privilege level in the design to create and read the form. You might want to start with Privilege Level 1.

3. Save your changes in the Name and Address Book.

4. Replicate your changes to other servers and ensure that the new LocalGroup form is available on all copies of the Name and Address Book in your organization.

5. If you have any problems, go back to your original Name and Address Book, check your configuration for errors, and repeat the process.

Maintaining Local User Groups

Perform the following steps to maintain local user groups:

1. If your server is already using a Name and Address Book, rename it to something other than *NAMES.NSF*. Use the Lotus Notes workstation program on your server to create a replica of the domain's Name and Address Book in the data directory of your server. The replica must be named *NAMES.NSF*.

2. Use the workstation on your server to create two new groups within the replica of the domain's Name and Address Book. These groups must be created with the LocalGroup form offered in the compose menu.

3. The first local group must be named "LocalGroupAdministrators" and should contain the user names of the Lotus Notes administrators responsible for the servers belonging to the local group. The persons entered will receive Editor access to the Name and Address Book together with the LocalGroupAdmin privilege set.

4. The second local group must be named "LocalGroupServers" and should contain the names of the servers that belong to the local group. A local group of servers within the domain is a cluster of servers sharing the same set of local documents. Enter at least the name of your current server. LocalGroupServers will have the same access rights and privileges set as the LocalGroupAdministrators to access the Name and Address Book.

5. If there are additional servers in the local group, create a replica of the domain's Name and Address Book in the Lotus Notes data directory of each server and enter the LocalGroupServers document as described above.

6. After replication of these two user groups among all servers of the local group, the LocalGroupAdministrators will have Editor access to the domain's Name and Address Book on each server within their local group. The LocalGroupAdministrators will be able to create and maintain LocalGroup documents. LocalGroup documents will only be replicated to servers listed as members of the LocalGroupServers. Such documents will not be replicated corporate-wide.

Preserving Specific User Groups

If you want to preserve specific user groups of your previous Name and Address Book as local groups, perform the following steps:

1. Select all group documents you need from your old Name and Address Book and copy them to the clipboard (Edit/Copy command).

2. Open the domain's Name and Address Book and paste the copied groups from the Clipboard into the database (Edit/Paste command).

3. Enter edit mode and set the form name of the group to "Local Group" for *each* pasted group.

4. Save each group document with the new LocalGroupAdmin privilege flag.

5. Repeat steps 3 and 4 until you have exhausted your group list. Alternatively, you could set up a filter to automate steps 3 and 4.

NOTE: You can also use this mechanism to correct local groups that were accidentally created with the Group form.

User Names

Lotus Notes users are identified by their actual names, such as Bill Jones. Duplicate names require extension to their middle initial and middle name, if needed. This reduces administrative requirements for changing user IDs.

Using the actual user names makes it easy for your users to quickly identify documents written by a particular individual. If you must have another naming convention for administrative purposes, consider using aliases in the person record in your Name and Address book, (for example, Bill Jones, BillJones_MKT_NYC).

Changing the user name of an ID invalidates all its certificates. This also has implications on access lists. If a user must change the ID name for any reason, a recommended method is for you to generate a *new* ID and update the user group name(s) containing the user.

For ease of administration, the Access Control Lists (ACLs) in the database should *not* contain an individual's name. Instead, grant access through group names. In this format, if a user name changes, it is easier for you to update a few places in the Name and Address book, rather than in multiple ACLs over a group of databases.

Chapter 9
Security Tips

The term security includes server access, communicating with outside servers, and preventing unauthorized or accidental access to your data.
This chapter discusses some of these issues. The table that follows is a summary of the security options.

Table 9-1
Lotus Notes Security Options

Security Level	Function
Field	Encryption keys (must be attached to the user ID file)
Form	5 privilege levels to create and/or read documents using the form
View	5 privilege levels to use the view (matches the 5 levels above)
Database	7 access levels (Manager through No Access)
Directory	Can lock access to a set of secure databases in a directory using a directory link file
Port	Can lock access to specific ports (LAN, COM)
Server	Can lock access to the server and can restrict creation of new or replica databases to certain users
Workstation	Must share a common certificate with a server to access it; passwords provide client-side protection
System-wide	Encrypt all incoming and outgoing mail

For a detailed look at how security works in the Lotus Notes environment, refer to the document titled *Notes Security: A Technical Perspective.* You may obtain this document from Lotus Development Corporation.

Physical Access to the Server

Physical access to the Lotus Notes server console means access to parts of the Lotus Notes network with administrator privileges. Using the Lotus Notes workstation program on the server console means using the identity of the server. Each server effectively has *Manager* access to all the databases that reside on its drives (this includes hard drives and networked drives, if they exist). Keep your Lotus Notes servers within a locked area. To prevent unauthorized access to the data from the server console, consider storing the data in an encrypted form. Additionally, hardware-based solutions are available. The COMPAQ SYSTEMPRO Line offers several options to enhance the physical security of your Lotus Notes server. For example, features for password security include:

■ Power-on Password

■ Keyboard password

■ QuickLock

■ Network Server Mode

For a list of specific options available, consult the documentation included with COMPAQ SYSTEMPRO Personal Computer Systems and Servers.

The default access to all Lotus Notes databases *must* be set to *No Access* even if all users within the domain shall have access to the database. This allows the maximum security. Use the Organizations_{domain} group to set the database access for all users registered within the respective domain.

By default, most Lotus Notes database templates include two groups in their access control lists (ACLs), namely *LocalDomainServers* and *OtherDomainServers.* Usually, you would not provide these groups with any access, since these group names are likely to be shared among multiple organizations. You should probably rename these example groups and customize them to your organization.

Every server must have the *FormerUsers* group included in its DENY_ACCESS list. The FormerUsers group in the Name and Address Book contains names of users who are now denied access to servers in that domain. Enter the following command at the Lotus Notes server prompt:

```
>SET CONFIG "DENY_ACCESS=FormerUsers"
```

An alternate method is to include the following line in the *NOTES.INI* file on your server:

```
DENY_ACCESS=FormerUsers
```

You can even use a list of groups, such as:

```
DENY_ACCESS=FormerUsers, Ex-Contractors
```

When you enter the console command, the change takes place immediately. Additionally, the console command automatically updates the *NOTES.INI* file. If you choose to make the changes to *NOTES.INI* yourself, you must stop and restart the server for the changes to occur.

To ensure that all your new servers are setup with similar (or identical) configurations in their respective *NOTES.INI* files, consider editing the *SRVNOTES.INI* file in the master installation directory used to install your servers:

```
[Notes]
DENY_ACCESS=FormerUsers
```

This technique ensures that any lines in the *SRVNOTES.INI* file are automatically included in the *NOTES.INI* file for building a new server.

The Human Resources group in your organization can provide you with input to maintain the FormerUsers group. When a user leaves your organization, invalidate that user's access by making the following changes in the master copy of the Name and Address Book:

■   Delete the user's Person record from the Name and Address Book. This automatically maintains your Name and Address Book with only the authorized users in your organization. If you must maintain a copy of the Person record, consider archiving it in a backup copy. You must make sure that this backup copy is *not* a replica copy of your Name and Address Book.

■   Edit the group name called *FormerUsers* in the Name and Address Book. Add the deleted user's name to this group.

■   Replicate your changes to other servers in the organization, forcing replication if necessary.

If you do not want to maintain the *FormerUsers* group, there is an alternate method to prevent unauthorized method from someone who leaves your organization. This method still requires that you delete the user's Person record (you must ensure that Name and Address Book contains only valid users). You can then use the DENY_ACCESS list as before, but restrict access to only those people listed in a specific view:

>SET CONFIG "DENY_ACCESS" = "*ViewName*"

where *ViewName* is a valid view name. Conversely, you can use the ALLOW_ACCESS list to allow access explicitly to a group of people.

Keep the following points in mind when using views in a list such as DENY_ACCESS:

■   Using a view for a server access list is usually slower than using a group. This is because it takes longer to look up a user in a view than looking up that user in a group.

■   The view must be a valid view name that exists in the Name and Address Book. If you use multiple Name and Address Books, the Lotus Notes program code searches successive Name and Address Books only until it finds the first matching view.

As another security step, you can restrict the ability of unauthorized users to copy databases to the data directory of your server. A recommended list of authorized users can be database designers and administrators. By restricting access to your server resources, you have better control in ensuring that applications are developed and tested according to agreed corporate standards. You can enable the CREATE_FILE_ACCESS and CREATE_REPLICA_ACCESS lists to prevent unauthorized users from copying databases and their replica to the server's data directory. The following are the console commands to use:

>SET CONFIG "CREATE_FILE_ACCESS=NotesAdministrators, DatabaseManagers"

>SET CONFIG "CREATE_REPLICA_ACCESS=NotesAdministrators"

As before, you can make changes in the *NOTES.INI* or *SRVNOTES.INI* file.

Even though you are placing restrictions on the server resources, this does not prevent your users from exercising their creativity in developing new applications. Your users can develop applications either locally on their workstations, or on a development server. Once the application has been tested and approved, you can designate a responsible administrator for releasing the database as production.

Communicating with Outside Servers

To communicate with Lotus Notes servers outside your organization, you must take security precautions to insulate corporate servers from the outside servers. Consider implementing the following steps:

1. Create or establish a common outside certificate (for example, something other than the corporate certificate for a new server to be considered exclusively for outside access).

2. Certify this second, external server and an existing corporate server with a second certificate. When certifying, *do not check* the box that says "Trust other certificates signed by the certifier." This setting isolates your corporate servers from external access. For details, refer to the *Lotus Notes Administrator's Guide.*

3. Create a group document for outside servers that can create file and replica access. Call this group something appropriate, like *OutsideServers.* Also, create any internal groups that you want to allow access.

4. Type in the following commands at the consoles of both servers:

    >SET CONFIG "ALLOW_ACCESS=OutsideServers, NotesAdministrators"

    >SET CONFIG "CREATE_FILE_ACCESS=OutsideServers, NotesAdministrators"

    >SET CONFIG "CREATE_REPLICA_ACCESS=OutsideServers, NotesAdministrators"

5. Set default access to *No Access* on the Access Control Lists of all databases.

6. Create Remote Connection records in the Name and Address book on the external server to connect to the outside.

7. Create appropriate database stubs for replicating databases with outside servers, using the File Database New command.

8. Dial the outside server(s) and perform database exchange(s).

Replication Settings

Replication Settings are settings that affect individual databases. By checking the appropriate boxes for these settings, you can control how you want to disseminate information about your databases.

As a security measure, you could obstruct outside audiences from seeing the database catalog in your organization. To prevent unauthorized users from seeing a list of active databases, you must:

■   Access the external server that communicates with outside servers.

■   Access the catalog database on that server and check the Replication Settings box that says "Disable replication for this database." This action prevents the database contents from replicating with outside servers, as well as the other servers in your organization.

Since the content of this particular database catalog contains only a list of public databases on your external server, this is the only information that an outside user can access.

You can also ensure that unauthorized users do not see database information in the catalog by enabling the check box that says "Do Not list in Database Catalog" in the Replication Settings for a database. This prevents that *particular* database from being listed in a database catalog.

Consider taking these precautions. Most people in an organization have by default, *Reader* access to the database catalog. You can access Replication Settings for a database by choosing "File Database Information Replication" from the Lotus Notes menu.

Directory Links

Directory links allow you an additional measure of security. As an example, suppose you have a set of databases that you want to mark *Private.* Anyone that connects to your server can browse the databases that are on it by performing a File Database Add command from the Lotus Notes menu, even though you have set up specific groups in the Name and Address Book and the Access Control Lists. They can see the titles of your databases even though they cannot access the databases. This still might attract unwanted attention and curiosity.

Restricting Database Title View

The directory link file provides a method to hide database titles. To use this technique, you must perform the following steps:

1.   Create a directory on your hard drive on the lines of:

    md C:\notedata\private

2.   Move the private databases to the newly created directory, that is, copy them over and then delete them in their previous location (after you verify that the copy was successful).

3.   Change directory to your default Lotus Notes directory (usually C:\NOTES) and create a file with a neutral name like *MISC.DIR.* The extension is *important.* With this file, you are creating a directory called MISC to Lotus Notes. When a user does a File Database Add to your server, the MISC entry appears as a subdirectory under Notes, even though it does not really exist.

4.   To let only limited users access to this "directory," edit the *MISC.DIR* file as follows:

    c:\notedata\private
    TopSecretReaders
    Administrators

5. The first line points Lotus Notes to the actual subdirectory on the hard drive. This is the one you created in step 1. The second line lists the groups who can see the directory contents. Now only a user in one of the above groups can open this directory called MISC by doing a <u>F</u>ile <u>D</u>atabase <u>A</u>dd. The remaining users cannot access the directory, and are unaware of the private databases or their contents.

As before, you can also use a view name in the list. For example, if you have a view called LegalUsers in your Name and Address Book, your directory link file can read:

```
c:\notedata\private
*LegalUsers
```

The "*" character is important to denote the view name. Be aware that using view names to set up access will incur a performance penalty.

Chapter 10

Directory Links and Database Links

The directory link function provides a method to implement a form of security. Another advantage of directory links is that you can isolate fairly simple ACLs at the individual database level, and more complex or commonly used groups in another place, namely in the directory link file. Directory link files also allow you to link to directories and files across the network on a file server. This offers the advantage of using the disk space and file backup strategies that are normally in place for the file server.

Be aware of the following cautions about using directory link files to point to files across the network:

■   If your network or networked file server has problems, your Lotus Notes users might not have access to the data on the networked file server. This might include your dial-in users if they are trying to get to the same databases as your LAN connected users.

■   You must implement proper network security to ensure that your Lotus Notes security is not compromised by a user who has direct access to sensitive data on the file server. As a general precaution, encrypt sensitive data on the disk, regardless of where you store it (on the hard drive of the Lotus Notes server or a networked file server).

■   You must manually keep track of your directory link files. If you move files or directories around, you must remember to update your directory link files where applicable.

Database link files are like directory link files, except that they have a *.NSF* extension (just like any Lotus Notes database). Also, they do not have a method of using lists to restrict access, so you would not want to use them for security reasons.

NOTE: The cautions stated about directory link files also apply to database link files.

Database link files work well in situations where you want to tell Lotus Notes to look in some other directory for a database file. For example, suppose you have a database called *GOODSTUF.NSF* that you would like to move to another subdirectory or drive. However, your users have already setup their Lotus Notes desktops to access this database.

You can move the database to a new directory named C:\NEWDIR) and then setup a filename in the original directory. This filename must have the same name as your database (for example, *GOODSTUF.NSF).* Edit this file so that it looks like:

    C:\NEWDIR\GOODSTUF.NSF

Now *GOODSTUF.NSF* in your original directory is a database link (pointer) to the *GOODSTUF.NSF* file on C:\NEWDIR. Your users are transparently pointed to the right place, and they do not have to change their desktops.

The above also works if you want to rename an existing database filename without affecting your users. For example, you can rename *GOODSTUF.NSF* to *GREAT.NSF* and let the user desktops point to *GOODSTUF.NSF*.

This method provides users with a window of time to modify their desktops to the new database location without causing all of them to change at once. After a month or so, you can always delete the database link file. By deleting the appropriate file, you can remove either a directory link or a database link.

NOTE: Whenever you add or remove directory link files, stop and restart your Lotus Notes server to reinitialize its pointers in memory.

Chapter 11
Setting Up Connection Records

Connection records are important documents in your Name and Address book database. These documents govern how replication and mail routing occurs in your network. The most effective way to set up connection records is to first draw a network diagram of your Lotus Notes server topology. This provides you with a good understanding of which servers need to be connected with each other. Use the following guidelines when setting up connection records:

■ Set up your connection records to route mail. You do not need connection records to route mail between servers in the same network, because mail routing happens automatically in this case. However, you must include connection documents for mail routing between servers in different network names.

Automatic mail routing does not occur on any port except LAN0. On a multiprotocol server, if you plan on using LAN1 (for example, to route mail) you need a connection record for that port.

NOTE: Using separate network names is a perspective of Lotus Notes, and is a decision independent of whether the separate networks share the same physical network or the same network operating system. However, in a multiprotocol Lotus Notes server, each protocol must be associated with a network name in the Name and Address Book.

■ When setting up mail routing, you need connection documents on either side, (Server A needs a document to send mail to Server B, and Server B needs a document to send to Server A).

■ Where possible, use your connection records both for routing mail and replication. This is particularly useful to save costs for servers that communicate over modem lines.

■ Unlike mail, you do not need separate replication records. Regardless of who initiates the connections, Server A replicates its databases with Server B, and Server B replicates its databases with Server A.

■ Since replication between databases can occur at one of three priorities (low, medium, and high), you need separate connection records if you choose to replicate databases between two servers at different priorities.

■ Avoid creating loops for replication. Trouble shooting problems with loops can be very time consuming.

■ For administrative purposes, it is simpler to treat the system of Lotus Notes servers in your organization as a hub and spoke design, rather than as a mesh of interconnected servers. This minimizes the total number of replication documents you must maintain.

In the hub and spoke system, either the hub or the spoke server can initiate the replication connection. It is a good idea for the hub to always call the spoke servers. This reinforces the idea that changes to the system flow from the top to the bottom (a master to all downstream servers in the hierarchy), and minimizes the task that a spoke server must perform to get new updates. This puts the load on the hub server, rather than on the spoke server, which may be servicing live users.

Chapter 12
Defining a Backup Strategy

Defining an appropriate backup strategy is an important part of maintaining a
Lotus Notes server. Sometimes, there is a tendency among novice
administrators to consider the database replication feature of Lotus Notes as a
form of backup and to not implement any other procedures. However, as the
following discussion shows, replication of data alone is *not* an alternative for
running backup procedures.

Even with distributed servers replicating data, depending on how often they
have been setup to replicate, the replicated copy might or might not be
accurate with what really needs to be backed up. Consider, for example, that
you are inputting data to server A. It replicates to Server B only in the
mornings. If you lose Server A in the middle of the night, the data on Server B
is only from the replication of the previous morning, and so on. This means
that you have lost an entire day of work on A. The problem gets more difficult
to manage when databases replicate at different priority levels and each
priority level of replication occurs at a different time.

Another problem is that once you have deleted a document from a database, it
is permanently erased. A backup system is the only way you can recover a
deleted document.

Tape backup and fault tolerance are two complementary strategies. Tape
backup is a method to recover from human error. Fault tolerance is a method
to recover from hardware failure. Both are important points to consider as part
of your overall backup strategy.

Tape Backup

Compaq provides the following tape drive options for backing up your Lotus Notes server:

■   COMPAQ 150-/250-Megabyte Tape Drive

■   COMPAQ 320-/525-Megabyte Tape Drive

■   COMPAQ 1.3-/2.0-Gigabyte Digital Audio Tape (DAT) Drive

To facilitate an unattended operation (a method of backing up all your data to one tape without requiring operator intervention), be sure you are using a tape drive of sufficient capacity to backup all your critical files. For example, if your database files total 300 megabytes in size, you might consider using the 320-/525-Megabyte Tape Drive to fit all of that data onto one tape.

Compaq provides software driver support for the above drives. Compaq recommends Sytron Corporation's Sytos Plus tape backup software available for the Microsoft Operating System/2 Standard Version 1.21, as published by Compaq and Microsoft Operating System/2 Version 1.3. The *Sytron Sytos User's Guide for MS OS/2* available with the backup software provides guidelines on adopting the appropriate tape backup strategy.

Select a backup schedule that is appropriate to your organization. Some guidelines are:

■   Consider following the same backup schedule as your network servers. This facilitates using the same procedures and personnel to backup both your Lotus Notes servers and your file servers.

■   Consider rotating tapes over generations, such as *parent, child* or *grandparent, parent, child.* If you perform weekly full backups, the current week's backup tape is the child, the previous week's the father, and so on.

■   Consider performing virus scans periodically prior to your backup.

■   When a Lotus Notes server is active, it locks the *LOG.NSF* (Log file), and *NAMES.NSF* (Name and Address Book) database files. To backup these files, you can adopt one of two methods:

■ You can create replica copies of these databases and back these up. However, you must ensure that the replicated copies are current just prior to executing your backup procedure. Also, you must set up your backup procedure to ignore the original files during the backup. You must have sufficient disk space to allow duplicate copies.

■ You can shut down the Lotus Notes server, execute your backup process and bring it back up again. You must ensure that you do not have any active users or active replications when you decide to shut down the server. Alternatively, consider automating the process, so that these steps are executed from a batch *(.CMD)* file at night. This batch file can be executed from within Lotus Notes by utilizing the ability of the program to start up other programs. You need to setup the program name in the Name and Address Book of the server.

NOTE: The syntax for shutting down a server from a batch file or a command line is:

NOTES SERVER-Q

Fault Tolerance

Fault tolerance can take two forms; hardware fault tolerance and software fault tolerance.

Hardware fault tolerance is independent of the operating system. You can achieve hardware fault tolerance with drive array technology. Compaq provides different options for you in this area with the COMPAQ Intelligent Drive Array and the COMPAQ Intelligent Array Expansion System. For example, you can use data guarding or drive mirroring to recover your data in case of drive failure.

Software fault tolerance, as the name implies, requires support from the host operating system and the network operating system. For a detailed discussion of your hardware and software fault tolerance options, refer to the appropriate COMPAQ Integration ToolKit.

NOTE: For additional information in the Microsoft LAN Manager environment, please refer to Chapter 23, "Backup and Fault Tolerance."

Chapter 13

Optimizing Lotus Notes for Dial-In Access

Lotus Notes uses the XPC protocol to access your Lotus Notes server over asynchronous lines. You will experience slower response times compared to your LAN access. To optimize your performance over phone lines, you must improve two different areas:

■ Modem Connection

■ Lotus Notes Configuration

Improving Your Modem Connection

We have found, from testing in the Compaq Integration labs, that you realize the greatest performance benefit by improving the speed of the connection itself. Therefore, consider using modems that support carrier speeds of 9600 baud and above. Your users may accept the speed of 2400-baud modems only in those situations that involve minimal interaction with the server, such as exchanging mail. Even in these circumstances, a 2400-baud modem with compression capabilities should be your minimal configuration.

Even though Lotus Notes' client-server technology minimizes the amount of packets that must transfer across a phone line, graphical user interfaces (such as Lotus Notes) need many packets to transfer Rich Text Field information (containing formatting information, bitmaps, and even voice).

Compression by itself does not guarantee improved performance. In situations where the modems start to compress data that is already compressed, performance degrades. If you notice unacceptably slow performance in replicating data across a modem line, try repeating the connection by disabling compression and see if it improves.

You must also have a good understanding of the elements that make up the *end-to-end* connection between your workstation serial port and your server serial port. The following figure illustrates a modem connection.
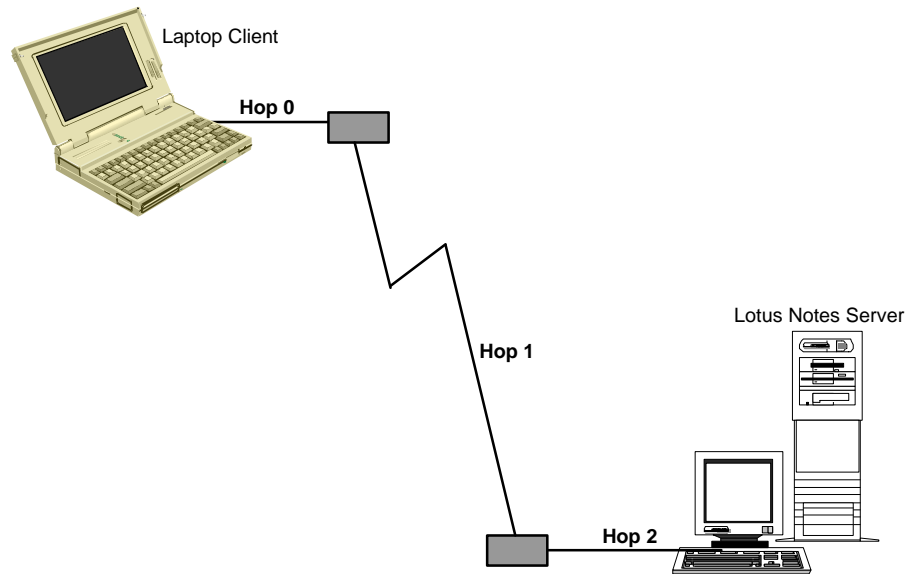
Figure 13-1.   Modem Connection

As this figure illustrates, Hop 0 is the connection from the serial port of your workstation to the modem. Often, modem manuals refer to the speed between the two pieces of equipment as the CONNECT speed or the DTE speed. Hop 1 is the connection between the two modems. Modem manuals refer to the speed between the two modems as the CARRIER speed or the DCE speed. Finally, Hop 2 is the connection between the remote modem and the remote server. This speed is also referred to as DTE speed.

For best results, your *end-to-end* connection must have all three hops operating at the same uniform speed. This is the same as connecting the two computers directly with a null modem cable at that speed. Your goal is to come as close as possible to a direct connection with your modems. For specific speeds, a direct connection always yields faster times than an equivalent modem connection because there are no modulation functions in the direct connect case.

There are limits to the highest speeds you can obtain in practice. The hardware or software may cause limitations or they may be based on the laws of physics. From the hardware perspective, make sure that your computer uses a high-speed serial port controller, the 16550 UART. This controller allows for higher speed communication when compared to the older 8250 chip.

NOTE: Although your hardware (serial ports, modems, and so on) might be capable of going up to speeds above 19,200 bps, you need the proper driver support from the software to achieve those speeds. For example, under Microsoft Windows 3.0, the maximum speed supported is 19,200 bps. This speed increases to 38,400 bps with Microsoft Windows 3.1. Similarly, the default *COMOX.SYS* driver with Microsoft Operating System/2 Version 1.x supports speeds only up to 19,200 bps. However, you can achieve higher speeds under Microsoft OS/2 by using third-party multiport boards and their device drivers. A good example is the DigiBoard *XALL.SYS* driver.

If any one of your DTE speeds is lower than the other, your overall speed will be governed by the lower speed. For example, if your Hop 0 speed is 9600 bps and your Hop 2 speed is 2400 bps, you will notice that your performance is close to 2400 bps.

If your DCE CARRIER speed is lower than one of the DTE speeds, you might get performance close to the DTE speed, depending on compression. If your modems connect at 9600 bps on the carrier side, and 19,200 bps on the DTE side, you might approach performance close to 19,200 bps. That is, the modems can steadily perform a 2:1 compression on your data. However, this is the ideal case. In actuality, even though some compression schemes like V.42bis provide 4:1 compression, your data might not compress very well. In such cases, you get lower performance.

As this discussion shows, the key to success is to ensure that your modems have compatible features that provide the best settings for all three hops in your connection. If your modems are incompatible, they often fail to negotiate the connection to an optimal value.

When trying out a new modem or a new script, consider enabling the log file entries within Lotus Notes at both the server and the workstation. Once you establish a connection between the two, you must check the log file events to verify that both sides are connected to their respective modems at optimum speeds. To check the log files, open the *LOG.NSF* database on either side, and look at the view that displays "Miscellaneous events." There are entries with a time stamp close the time you made the call. If you open up the document, you notice log file entries similar to the one shown in the following figure.

```
05-22-92 05:07:01 PM  COM3: Modem xmt:  ATH0 (9600 Baud)
05-22-92 05:07:01 PM  COM3: Modem rcv:
05-22-92 05:07:01 PM  COM3: Modem rcv:  OK
05-22-92 05:07:01 PM  COM3: Modem xmt:  AT&F (9600 Baud)
05-22-92 05:07:01 PM  COM3: Modem rcv:
05-22-92 05:07:01 PM  COM3: Modem rcv:  OK
05-22-92 05:07:01 PM  COM3: Modem xmt:  ATE0X1&A1B0 (9600 Baud)
05-22-92 05:07:02 PM  COM3: Modem rcv:
05-22-92 05:07:02 PM  COM3: Modem rcv:  OK
05-22-92 05:07:02 PM  COM3: Modem xmt:  ATV1&B0&I0&K1&M4&S1&N0S27=128 (9600 Baud)
05-22-92 05:07:02 PM  COM3: Modem rcv:
05-22-92 05:07:02 PM  COM3: Modem rcv:  OK
05-22-92 05:07:02 PM  COM3: Modem xmt:  AT (9600 Baud)
05-22-92 05:07:04 PM  COM3: Modem rcv:
05-22-92 05:07:04 PM  COM3: Modem rcv:  OK
05-22-92 05:07:04 PM  COM3: Modem xmt:  AT&H1&R2&K1&M4 (9600 Baud)
05-22-92 05:07:04 PM  COM3: Modem rcv:
05-22-92 05:07:04 PM  COM3: Modem rcv:  OK
05-22-92 05:07:16 PM  COM3: Modem xmt:  ATS9=6 (9600 Baud)
05-22-92 05:07:16 PM  COM3: Modem rcv:
05-22-92 05:07:16 PM  COM3: Modem rcv:  OK
05-22-92 05:07:16 PM  COM3: Modem xmt:  ATDT99999,, (9600 Baud)
05-22-92 05:07:29 PM  COM3: Modem rcv:
05-22-92 05:07:29 PM  COM3: Modem rcv:  CONNECT 9600/ARQ
05-22-92 05:07:29 PM  COM3: 9600  baud connection established
05-22-92 05:07:29 PM  COM3: 9600  baud connection established
05-22-92 05:07:31 PM  COM3: Modem xmt:  • (9600 Baud)
```

Figure 13-2.   Log File Entry Example

As the example shows, the connection occurred at 9600 bps. In your case, you must verify that both sides connected at 9600 bps. If not, you must look at the script file settings of the modems to debug why they are not connecting at the optimal speed.

There are several reasons why modems might fail to connect at the optimal speed or fail to connect at all. The following are some tips to consider:

■ Check the action that either modem takes upon negotiation failure. Usually, the modem(s) fall back to an asynchronous connection (no error control or compression). However, at times the action might be to drop the call. This is usually defined by the setting of the S36 register.

■ Some answering modems require specific originating modem error correction and compression features, and incoming speed. For example, if the call does not come in at a specific speed, like 9600 bps, the answering modem drops the call.

■ A good place to check is the setting of the S7 register. This denotes the wait time for carrier after dialing. If this value is too low, and your modems are spending time handshaking, and the S7 timer pops, the applicable modem drops the call in the middle of the negotiation process. If you have calls that drop soon after the handshake, try setting this to a high value, approximately in the 50-60 range (or even longer for international connections). If your default value is 30, you might be hitting the timer limit.

When trouble shooting modem problems, consider the following tips:

■ Ensure that your modem is responding to the commands from the software. Often this means that you must manually issue the commands yourself and look for the response from the modem. The best way to do this is to use any terminal emulation package and configure it for the appropriate settings (COM port, speed, and so on). If you use Microsoft Windows, use the Terminal program provided with Windows. Usually this is in the "Accessories" group. Verify that your modem is in command state by typing AT and pressing the **ENTER** key. You should see an "OK" screen response. If not, you must test the modem by using the test utilities and diagnostics provided with your modem.

■ Verify that your modem responds to the setup string from the software. Enter the exact command string as the setup string in the script, and look for the "OK" response from the modem. If you get an ERROR message back from the modem, it means that either you have typed in more characters than the modem allows in a single command string, or you have an invalid command in your string.

■ Ensure that your command string fits the available modem command string buffer. For most modems, this is a limit of 40 characters. If you send a command string greater than this value, you get an ERROR response. To reduce the number of characters, try entering the command without blanks. Blanks are useful for readability, but are not required in the command. For example, type AT&F&C1&D2 rather than AT&F &C1 &D2 to save characters. If you still run out of characters, store your most commonly used settings in a user profile and recall the appropriate profile with the ATZ or AT&Y commands. Refer to your modem guide for details.

■ Do not repeat default commands in your setup string. You can typically recall the default profile by using the AT&F command. You need only to add commands to your setup string that are required to override default values.

■ Ensure that you are passing the appropriate values to the command. For example, the appropriate values for the ATZ command are 0 or 1 (for user profile 0 or 1). Therefore, the valid strings are ATZ0 or ATZ1. Entering invalid strings will generate an ERROR response. Keep in mind that not all AT commands and "S-register" values are universal. Commands that are valid for one particular brand of modem may not be valid with another, even though they are both Hayes-compatible.

■ Verify your active profile with the AT&V0 command. The settings must match the default values where applicable, with any overrides specified in your command setup string.

Lotus Notes Configuration

The Lotus Notes document *Laptop Notes* provides you with useful hints on setting up your computer to communicate with a Lotus Notes server while you are on the road. The important considerations are:

■　As far as possible, use replication to replicate database changes to a replicated copy on your workstation.

■　When setting up replication with the server, replicate only the databases that you currently need for immediate use, rather than all the databases on your desktop.

■　Make effective use of the *Purge Interval* and *Document Cutoff Date* values under the Replication Settings for your databases. Set these to appropriate values so that you are not unnecessarily replicating documents that may be a few days old, and therefore, are not as important for you to read immediately.

■　From a database design perspective, consider the following tips:

■　Avoid creating databases that require frequent re-indexing. Re-indexing is costly, especially over a modem line.

■　Avoid databases with a lot of graphics. If possible, separate these into different views, so that a laptop user can avoid replicating graphics over a modem line.

■　Provide an estimate of how long it will take for a user to download a file as an attachment over a typical modem connection.

■　Store your databases on HPFS partitions to take advantage of the performance improvements of HPFS over FAT.

Chapter 14

Implementation Considerations for Microsoft LAN Manager Networks

This chapter provides supplemental implementation and integration information specific to the Microsoft LAN Manager environment. The chapter discussion assumes that you have already read through the topics presented in Chapter 7, "Planning Your Implementation." Chapter 7 provides important early considerations regarding your implementation.

Determining the Number of Servers

In the Microsoft LAN Manager environment, you have some flexibility in evaluating the number of servers that you need. Since the network operating system is also an MS OS/2 program, it is possible for both the Microsoft LAN Manager file server and the Lotus Notes server to coexist in the same computer.

There is an advantage for a Microsoft LAN Manager file server and a Lotus Notes server to coexist: remote control. In this scenario, the server is not primarily a file server, but a Lotus Notes server. However, because it is a file server, it has all the capabilities of being remotely administered using standard network services. For example, an administrator across the network can access the files on this server. Although this does not give you complete remote capabilities (such as a remote console), it provides you with a mechanism to access files on the Lotus Notes server across the network.

NOTE: This is possible only if you are using a Microsoft LAN Manager or compatible network. This is not possible with Novell NetWare or Banyan VINES. The Lotus Notes server can coexist on those networks *only as MS OS/2 clients.* You may still use Lotus Notes features to administer a Lotus Notes server, regardless of the operating system.

Another advantage of the two servers coexisting in the same computer is that you can take advantage of the Microsoft LAN Manager environment to implement software fault tolerance for your data. However, if you must implement fault tolerance, but do not want to restrict yourself to the operating system, consider hardware fault tolerance offered by the COMPAQ drive array technology. For a discussion of hardware and software fault tolerance and implementing it with the COMPAQ servers in the Microsoft LAN Manager environment, refer to Chapter 23, "Backup and Fault Tolerance."

Setting up a Lotus Notes Server

To properly setup your COMPAQ server for MS OS/2 and Microsoft LAN Manager, Compaq recommends that you refer to the *Compaq and Microsoft Integration ToolKit.* The ToolKit provides you with information on correctly setting up your hardware components and installing the MS OS/2 base operating system and the Microsoft LAN Manager network operating system. In addition, the ToolKit provides you with details on performance tuning and monitoring.

Multiprocessing Considerations

The Microsoft LAN Manager multiprocessing implementation is asymmetrical in design, where specific processors execute certain tasks. The first system processor executes all application processing, including the operating and the network operating systems, the FAT file system, and the hardware interrupts. The secondary processor executes network I/O and file I/O to the HPFS386 system. Therefore, it is important to balance the activities over both processors to take advantage of multiprocessing in any environment.

The COMPAQ SYSTEMPRO best demonstrates multiprocessing capabilities in a combined resource-sharing environment and application server environment. You can add more users to the system with multiple processors while achieving the same throughput and response time.

In a dedicated client-server environment, such as Lotus Notes, the performance improvements are minimal. In such an environment, your network requests are minimized, and you can take advantage of the second processor only for file requests to the HPFS386 file system. Additionally, as an application server under MS OS/2, Lotus Notes currently does not support multiprocessing. Therefore, for a dedicated Lotus Notes server, multiprocessing architecture-based computer systems are not recommended.

Multiprocessing offers the most benefits in an environment with combined file servers (resource-sharing) and Lotus Notes servers. In such a case, Lotus Notes runs entirely on the first system processor. Your databases, and the shared files must reside on HPFS386 partitions, which is the requirement to use the second system processor.

NOTE: Not all network interface controllers and their device drivers support multiprocessing in the Microsoft LAN Manager environment. Among the network controllers that do support multiprocessing in this environment are the COMPAQ 32-Bit DualSpeed Token Ring Controller and the Novell NE3200 Bus Master Ethernet Controller.

MS OS/2 Considerations

Microsoft LAN Manager allows you to use a 32-bit version of HPFS termed HPFS386 (HPFS386 can take advantage of multiprocessing to utilize a second system processor if it is installed). HPFS and HPFS386 file systems offer greater performance benefits over the File Allocation Table (FAT) file system. HPFS improves upon the slow throughput and inefficient storage management of the FAT file system. In the Lotus Notes environment, where you can have dynamically changing file contents, HPFS offers an improvement over FAT.

As mentioned earlier, HPFS386 partitions are an important consideration for multiprocessing.

With MS OS/2 1.x, there is a physical memory limitation of 16 megabytes. Because you must allocate memory to the operating system, the network, as well as to file system cache and applications, we strongly recommend configuring your server for 16 megabytes of memory.

By default, the HPFS386 cache is automatically determined based on the total amount of memory available. For a 16-megabyte system, the default HPFS cache is approximately 9 megabytes. In this configuration, only the remaining 7 megabytes are available for your applications, which is not optimal.

We suggest that you manually set the cache size with the /C parameter to a smaller value like 2048 (2 megabytes). Refer to your Microsoft OS/2 documentation for details. You can periodically check the performance of your HPFS cache at the server by using the cache utility with the /STATS option. Then adjust the cache value higher or lower for optimal performance. Also refer to the size of the *SWAPPER.DAT* file to ensure that you are not unnecessarily swapping out to disk.

Special Considerations for a Dial-In Server

In the Microsoft LAN Manager environment, a conflict exists between *RDRHELP.SYS* and the *COM0X.SYS* drivers (or any other COM driver from a third-party vendor like DigiBoard). Microsoft LAN Manager setup adds the following line to *CONFIG.SYS* (assuming that it installs in the C:\LANMAN directory):

```
DEVICE=C:\LANMAN\NETPROG\RDRHELP.SYS
```

The *RDRHELP.SYS* driver ensures that device names COM1 - COM9 and LPT1 - LPT9 are recognized by the operating system so that LAN Manager can assign these device names to network resources. *RDRHELP.SYS* detects COM and LPT devices already installed by the operating system, and then creates *dummy devices* for any that are not installed.

If you try to install another COM device after installing *RDRHELP.SYS* and the install program tries to open a device name in the COM1 - COM9 range, it will fail because *RDRHELP.SYS* has already installed those device names. To ensure that the COM driver successfully installs, you must load any COM drivers like the *COM0X.SYS* or the DigiBoard *XALL.SYS* driver before you load *RDRHELP.SYS*.

NOTE: Microsoft LAN Manager setup automatically detects the presence of *COM0X.SYS* to ensure the correct load order in your *CONFIG.SYS* file. However, setup does not auto detect any third-party drivers. In this case, you must manually verify the correct load order in *CONFIG.SYS*.

Lotus Notes using Microsoft LAN Manager Remote Access Service (RAS)

Remote Access Service (RAS) is a feature available with Microsoft LAN Manager 2.1. RAS allows a user at a workstation to call up a server over phone lines and participate in the network services as if the phone line was transparent. The user can view, access, and use network resources in exactly the same way as colleagues working on computers that are physically attached to the LAN. The RAS server and client components provide a method to run NetBIOS applications across an asynchronous line.

RAS provides additional security features to complement the standard Microsoft LAN Manager features. For example, a remote user must have explicit remote access permission on a server. This is in addition to a valid account name and password. RAS also provides a variety of features, including the ability of an incoming user to provide a call back number to the server. This situation works well for those users who are often on the road and who would like the server side to pay for most of the connection charges.

For further details on the above features, refer to the *Microsoft LAN Manager Remote Access Service Administrator's Guide*. Also, refer to the February and March 1992 issues of *NETNews*, a Technical Resource Group Publication available from Microsoft Corporation.

Advantages of Lotus Notes with Remote Access Service (RAS)

Lotus Notes is a good example of a client-server application for this environment. One advantage of using RAS versus straight dial up to a Lotus Notes server is that it allows the incoming user to see *all* the LAN Manager based Lotus Notes servers on the LAN rather than just the dial-in server. This provides some advantages:

■   Users can see *all* the Lotus Notes servers in the network, not just the one they dial into.

■   Users can remotely participate in the network with the same functionality as directly attached workstations. This means that they can perform routine Microsoft LAN Manager functions such as NET USE and NET VIEW.

■   Administratively, setup is easier because you treat both remote and local users as the same.

■   RAS supports features such as modem pooling, which is transparent to Lotus Notes.

■   It is possible to combine the Lotus Notes server, the Remote Access Server, and the LAN Manager File Server functions into one physical computer for small locations. This combination is possible since all these functions share the MS OS/2 environment. This reduces the problems of remote server management. As usage grows, you can split up the functions without affecting the users.

■   Remote Access provides additional security features that allow the administrator to monitor usage and abuse. Also, the administrator has a choice in setting call-back features.

Support for COMPAQ Modems

The default installation of Remote Access Software does not support the COMPAQ Enhanced 2400-Baud Internal Modem and the COMPAQ Enhanced 9600-bps Internal Modem. You can use these modems with the COMPAQ LTE Family of Personal Computers, the COMPAQ SLT Family of Personal Computers, and the COMPAQ PORTABLE 486 Family of Personal Computers.

COMPAQ Enhanced 2400-bps Internal Modem

You can use the following script for the COMPAQ Enhanced 2400-Baud Internal Modem. Using the detailed steps provided in *Appendix A of the RAS Administrator's Guide*, it is possible to modify the *MODEMS.INF* file to add support for this modem. Add the following lines to the *MODEMS.INF* file:

```
#------------------------------------

[Compaq_2400_Enhanced]

MAXBAUD=9600

[Compaq_2400_Enhanced.INIT]

[Compaq_2400_Enhanced.INIT.command]

COMMAND=AT&FV1X4&C1&D2&Q0S0=0S2=128S7=55S37=6*cr

[Compaq_2400_Enhanced.INIT.RESPONSE]

OK=*cr*lfOK*cr*lf

ERROR=*cr*lfERROR*cr*lf
```

COMPAQ Enhanced 9600-bps Internal Modem

The script for the COMPAQ Enhanced 9600-bps Internal Modem is provided below. The differences from the Enhanced 2400-Baud Internal Modem are highlighted. The following lines must be added to the *MODEMS.INF* file:

```
#-------------------------------------

[Compaq_9600_Enhanced]

MAXBAUD=19200

[Compaq_9600_Enhanced.INIT]

[Compaq_9600_Enhanced.INIT.command]

COMMAND=AT&FV1X4&C1&D2&Q0S0=0S2=128S7=55S37=9*cr

[Compaq_9600_Enhanced.INIT.RESPONSE]

OK=*cr*lfOK*cr*lf

ERROR=*cr*lfERROR*cr*lf
```

Setup

SETUP does not involve any changes at the Lotus Notes server side. Your RAS server must simultaneously run Remote Access Service together with other LAN Managers services as described in the documentation.

At the workstation side, your setup varies depending on the role of the remote computer. If the remote computer connects to the server *only* via a modem, it is a *single-role computer.* If it connects both via a modem and a network interface controller, it is a *dual-role computer.* The *Microsoft LAN Manager Remote Access Service Administrator's Guide* provides details of typical scenarios where you might use dual-role computers.

You must enable the network port for LAN access, for single-role computers, even though the physical connection to the network is via a COM port, that is, by modem. The default LAN port protocol, NetBIOS, is sufficient for a successful connection and use of the remote Lotus Notes server.

NOTE: The above assumes that no network interface controller drivers (including drivers for special adapters that use the parallel port to connect to a LAN) have been loaded in memory. If such a driver is present in memory, and you enable the LAN port in Lotus Notes, the program code will cause Lotus Notes to use that device driver unsuccessfully to search for servers. This bypasses the ASYBEUI driver that can access the server names on the network. In such cases, you *must* treat your computer setup as a dual-role computer, regardless of the fact that you may not be connected to a LAN. The figure that follows illustrates the setup.
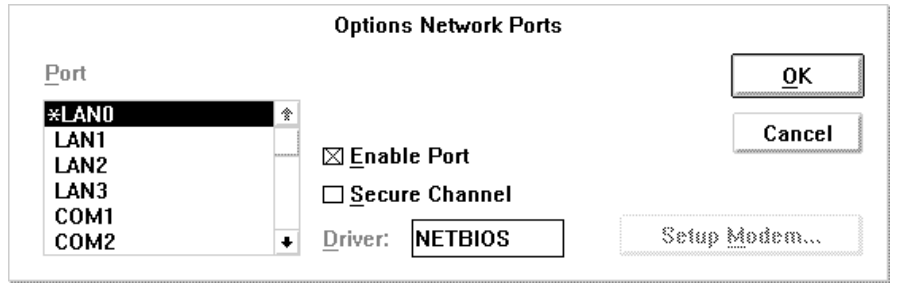
Figure 14-1.   Single-Role Computer Setup

You must disable the network port for LAN access, for dual-role computers, and the COM port must be enabled. In addition, the default COM protocol, XPC must be replaced with the NetBIOS protocol. The following figure illustrates the setup.
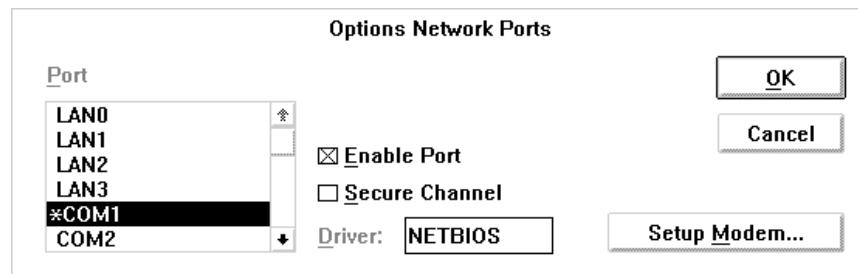

Figure 14-2.   Dual-Role Computer Setup

Comparison with XPC

Lotus Notes over RAS provides an alternative to the traditional method of
dialing into a Lotus Notes server. Although the ASYBEUI protocol offers the
advantages noted earlier, there are some performance considerations in
comparison with the traditional method of dialing up a server using the XPC
protocol (the default used by Lotus Notes).

The following test setup in the Compaq Integration Lab tested the two
alternatives.

■   RAS Server: Server with 16 megabytes of memory running MS OS/2
     Version 1.21, Microsoft LAN Manager Version 2.1, Remote Access
     Service (server) and Lotus Notes (server).

■   RAS Client: Client with 12 megabytes of memory running MS OS/2
     Version 1.3, Microsoft LAN Manager 2.1, Remote Access Service
     (client) and Lotus Notes (workstation).

The test compared two scenarios:

■   Test A: The two units were set up to connect with Remote Access
     Service via ASYBEUI. Lotus Notes was enabled to use NetBIOS at the
     application layer.

■   Test B: The two units were set up to connect with XPC (the default
     protocol used by Lotus Notes over asynchronous lines).

The test file size was 147,456 bytes and contained 45 Lotus Notes documents.
The test measured the time stamps after steady state (after
ten initial cycles).

Next, the test replaced the null modem cable with modems. The modem
at the RAS server side was a US Robotics Courier Dual Standard Modem. On
the workstation side, the installed modem was the COMPAQ Enhanced 9600-
bps Internal Modem. The following table summarizes the test results.

Table 14-1
Test Results (Lotus Notes with RAS)

Test Setup	Protocol	Speed=2400 bps Test Completion Time in Seconds	Speed=9600 bps Test Completion Time in Seconds
Modem connection with V.42bis compression enabled	ASYBEUI	612	165
Modem connection with V.42bis compression enabled, raw SMBs enabled	ASYBEUI	609	163
Modem connection without any compression	ASYBEUI	596	160
Modem connection without any compression, raw SMBs enabled	ASYBEUI	585	157
Modem connection with V.42bis compression enabled	XPC	395	123
Null modem connection	ASYBEUI	501	132
Null modem	XPC	378	110

As the test results show (from both the null modem and the COMPAQ Enhanced 9600-bps Internal Modem testing), the XPC protocol results in faster times when compared to ASYBEUI. However, the difference between the two protocols becomes smaller at higher speeds. The following table shows the analysis.

Table 14-2
Analysis of Test Results (Lotus Notes with RAS)
Performance Degradation of ASYBEUI with Respect to XPC

	Speed = 2400 bps	Speed = 9600 bps
Test using null modem cable	24.5%	16.6%
Test using modems (no compression, raw SMBs disabled). This is the preferred (and default) configuration.	33.7%	23.125%

No numbers are currently available for 19,200 bps using modems, but a similar test with a null modem cable at 19,200 bps resulted in a difference of three percent.

Compression did not make any difference in the overall results. In fact, the times for any connection involving compression are slightly higher than those without compression. You can attribute this to the extra time taken by the modems to compress data that previously was optimized for transmission over an asynchronous line.

Enabling raw Server Message Blocks (SMBs) provides a small, but noticeable reduction in the test times. However, because the performance gains are small, and the procedure to enable raw SMBs requires an experienced user, the default setting is sufficient in most instances. Accidentally modifying the **wrkheuristics** parameter in the *LANMAN.INI* file may lead to unpredictable results.

In summary, use RAS in situations where the LAN Manager environment is important to your configuration, and remote connectivity to the LAN is relevant. With RAS and Lotus Notes, your remote users can see *all* the Lotus Notes servers in your LAN, as opposed to access to a single Lotus Notes server with the XPC protocol. Additionally, administration is easier since you have a uniform setup for both your local and remote users. Although XPC is faster, the performance differences become smaller at higher speeds. If you are willing to trade a decreased performance for increased functionality, RAS is an appropriate tool to consider.

Lotus Notes Using NetBIOS Over TCP/IP

Currently, the only routable protocol that Lotus Notes supports directly is Banyan VINES. The other network protocol that Lotus Notes uses is NetBIOS, which is not routable. For such environments, it is sometimes necessary to provide a solution of NetBIOS over TCP/IP in a routed network.

A solution is available using 3Com Corporation's NetBIOS over TCP/IP package on each of the Lotus Notes servers that must talk LAN Manager using TCP/IP. With this solution, no change in the Lotus Notes application is necessary because the NetBIOS packets are transparently routed over TCP/IP.

The following is a summary of the steps required:

1. Determine which IP addresses you want to use with your different servers.

2. Load the 3Com software after you have loaded the LAN Manager server software. The 3Com setup program handles this automatically. During the setup you are asked for the IP address you want to assign to the server.

3. Use the INETNAME program that is included with the 3Com software to load a local NetBIOS name table called NBHOSTS at boot time in your *STARTUP.CMD* file. The command syntax is:

    INETNAME /L

The following are possible problems and caveats:

■ This setup is difficult to administer, especially when the number of servers increases. This is because you must to maintain the host name table (NBHOSTS) locally at each computer involved. There is no provision here for a central host name table. Therefore, when a machine's IP address changes, you must manually make the change in the *NBHOSTS* file on each computer.

■ Because of the way the *NBHOSTS* file is set up, you can have your TCP/IP based Lotus Notes server communicating with only *one* other TCP/IP based Lotus Notes server (see example).

Example Setup

Consider a setup with the following:

■ The LAN Manager (NetBIOS) server name is SERVER_1

■ SERVER_1 has a Lotus Notes server name of NOTES_1, and it needs to talk to NOTES_2

■ SERVER_1 has an IP address of 111.222.123.001

■ The NBHOSTS table looks like this (format is IP address followed by NetBIOS name) on SERVER_1:

111.222.456.002   SERVER_2\20\20\20\20\20\20\20\20

111.222.456.002   SERVER_2\20\20\20\20\20\20\20\03

111.222.456.002   SERVER_2\20\20\20\20\20\20\20\00

111.222.456.002   NOTES_2\20\20\20\20\20\20\20\2B

111.222.456.002   IRISNAMESERVER\20\33

111.222.456.002   IRISMULTICAST\20\20\2F

■ The other server NetBIOS name is SERVER_2

■   SERVER_2 has a Lotus Notes server name of NOTES_2, and it
    needs to talk to NOTES_1

■   SERVER_2 has an IP address of 111.222.456.002

■   The NBHOSTS table looks like this (format is IP address followed
    by NetBIOS name) on SERVER_2:

    111.222.123.001   SERVER_1\20\20\20\20\20\20\20\20

    111.222.123.001   SERVER_1\20\20\20\20\20\20\20\03

    111.222.123.001   SERVER_1\20\20\20\20\20\20\20\00

    111.222.123.001   NOTES_1\20\20\20\20\20\20\2B

    111.222.123.001   IRISNAMESERVER\20\33

    111.222.123.001   IRISMULTICAST\20\20\2F

The lines in the NBHOSTS table that begin with SERVER are necessary for
server-to-workstation communication; it contains the required IP addresses
and NetBIOS names for other workstations and servers your computer needs
to communicate with. The NetBIOS names *must* be 16 characters long; this is
why the host name file contains the pad characters (\20 denoting a space in
hex). You can include as many different computer names and associated IP
addresses as you want.

NOTE: In an application, you must replace the lines that begin with SERVER with
the remote server name of the server that your server needs to communicate with.
You must use the pad characters, if necessary.

The line that begins with NOTES describes the IP address and NetBIOS name
for the Lotus Notes server you want to talk to. Again, notice the 16 character
NetBIOS name with pad characters.

NOTE: In an application, you must replace the line that begins with NOTES with the
remote Lotus Notes server name that your server must communicate with. You
must use the pad characters, if necessary. Also, this implies that your Lotus Notes
server names cannot be more than 15 characters long, since the sixteenth
character is a *class* byte at the end of the name.

The lines that begin with IRIS are the *key* to allowing replication and other Lotus Notes communication to happen. It contains the IP addresses and NetBIOS names required by Lotus Notes for communication. You cannot duplicate these NetBIOS names elsewhere in the name table because they are common to all Lotus Notes servers.

NOTE: The last two lines in both *NBHOSTS* contain the same NetBIOS name (IRISNAMESERVER and IRISMULTICAST). Because these are hard-coded by the NBHOSTS table to route to a specific IP address, and because you cannot have the same NetBIOS name allocated to two different IP addresses, NOTES_1 can only communicate with NOTES_2, and vice versa.

TCP/IP with Microsoft LAN Manager Version 2.1

Even though Microsoft LAN Manager, Version 2.1 supports NetBIOS over TCP/IP, you cannot use the current host name table implementation for Lotus Notes. The reason lies in the special characters (for example, NULL) needed by Lotus Notes in the sixteenth byte of the NetBIOS name. Current efforts by the Compaq Integration teams have not revealed a method in the existing implementation, which allows you to include characters such as NULL into the host name table.

However, the Microsoft LAN Manager, Version 2.1 implementation of TCP/IP lets you run any NetBIOS application over a TCP/IP network, as long as it does not require the special characters in the host name table.

NOTE: The reference to the host name file here is specifically to the filename *LMHOSTS* used by the TCP/IP implementation. The *LMHOSTS* file translates NetBIOS names into TCP/IP addresses and vice-versa.

The Microsoft LAN Manager, Version 2.1 implementation for NetBIOS over TCP/IP supports RFCs 1001 and 1002.

NOTE: Request for Comment (RFC) is the mechanism for submitting proposals and designs for the Internet.

Like most other implementations, the Microsoft LAN Manager, Version 2.1 method of handling the broadcast traffic of NetBIOS over TCP/IP uses the B-node (Broadcast node). For an in-depth discussion of the Microsoft implementation, refer to the March, April, and May 1992 issues of *NETNews*, a Technical Resource Group Publication available from Microsoft Corporation.

Besides B-node, RFC 1001/1002 describe two other methods of handling broadcast traffic: P-node (Point-to-Point node) and M-node (Mixed node). Unlike the B-node method, the P-node and the M-node methods require the services of a NetBIOS Naming Service (NBNS). Currently, Ungermann-Bass is a vendor that supports all three methods of handling NetBIOS broadcast traffic over TCP/IP. For details contact Ungermann-Bass at:

Ungermann-Bass, Inc.
3900 Freedom Circle
Post Office Box 58030
Santa Clara, CA 95052-8030

Phone: (408) 496-0111

NOTE: The above vendor information is provided for informational purposes only and is not a product endorsement from Compaq.

Chapter 15

Maintaining a Lotus Notes Server in a Microsoft LAN Manager Environment

Maintaining a Lotus Notes server involves monitoring the server for potential problem areas and optimizing the server for performance. The performance of your server is a key consideration. The chapters that follow provide you with information on monitoring and optimizing various components of your server.

Timed tests provide baseline comparisons for understanding performance on a particular system. In a timed test, you apply a particular test to a system and measure the time for the test to complete. Then, you vary the configuration, apply the same test, and measure the time again. Finally, you must compare and analyze the results.

The typical way to conduct a timed test is to write a Lotus Notes API program that runs on the client. The program opens a file on the server, and time stamps the beginning of a transaction. At the end of the transaction, the program takes a second time stamp and calculates the difference. The program cleans up by closing all open files. The transaction can be as simple or as complex as you like. For example, you might want to test the time for a simple open, read, close of a database on the server; or you might want to test the time needed to
make a replicated copy of the server database on the client.

An example of a timed test is the one referred to in Chapter 14, "Implementation Considerations for Microsoft LAN Manager Networks" under the topic "Comparison with XPC" in the context of "Lotus Notes Using Microsoft LAN Manager Remote Access Service (RAS)."

Basically, you perform a timed test to simulate the typical transactions performed by your users. You might want to compare the results of your program under different scenarios. For example, you might run the program between a client and server connected over a LAN versus a dial-up connection. This gives you an idea of the performance degradation of choosing a dial-up connection. You can repeat the dial-up tests at various line speeds to compare performance. You can use timed tests to measure average response time, the distribution of response times and to study the impact of multiple users on performance.

NOTE: Measure performance when your system reaches a steady state, not during the first few seconds or minutes of the test run.

An equally important method of monitoring performance is the analysis of current utilization. Using a collection of tools available from Compaq, Lotus Development and third-party developers, you can monitor the health of a Lotus Notes server in the following areas:

■   System processor monitoring and optimization

■   Hard drive subsystem monitoring and optimization

■   System memory monitoring and optimization

■   Network monitoring and optimization

■   Microsoft OS/2 monitoring and optimization

■   Lotus Notes server monitoring and optimization

Chapter 16
Monitoring and Optimizing the System Processor

The following tools will help you to monitor system processor (CPU) utilization.

MSPMONIT Utility

Source: Compaq Computer Corporation
Public Domain: No
File Size: Multiple files, approximately 3 Kbytes on the server and 390 Kbytes on a secondary PC

MSPMONIT is a system processor utilization monitor that measures *Task Time* and *Interrupt Time.* The interrupt time is the period that the system processor is servicing interrupts, usually generated by network controllers or disk controllers. The task time is the period that the processor is *not* servicing interrupts; the system processor is utilized by executing the operating system, the network system or the application code.

MSPMONIT displays current, average, and historical information using a secondary PC. A custom cable connects it to the parallel port of the monitored server. MSPMONIT places extremely low overhead on the monitored system. A display utility executes on the secondary PC to view the information generated by the server. MSPMONIT is ideal for monitoring and optimizing both resource-sharing and client-server systems. For further technical information, refer to the documentation provided with MSPMONIT.

MSPMONIT supports both Microsoft MS OS/2 Version 1.21 as published by Compaq and Microsoft OS/2 Version 1.3. However, you must obtain the correct version of MSPMONIT for the appropriate version of MS OS/2. Contact Compaq Customer Support (1-800-345-1518) for more details, or contact your local Compaq Field Systems Engineer (FSE).

The following figure contains an illustration of the MSPMONIT Utility screen.
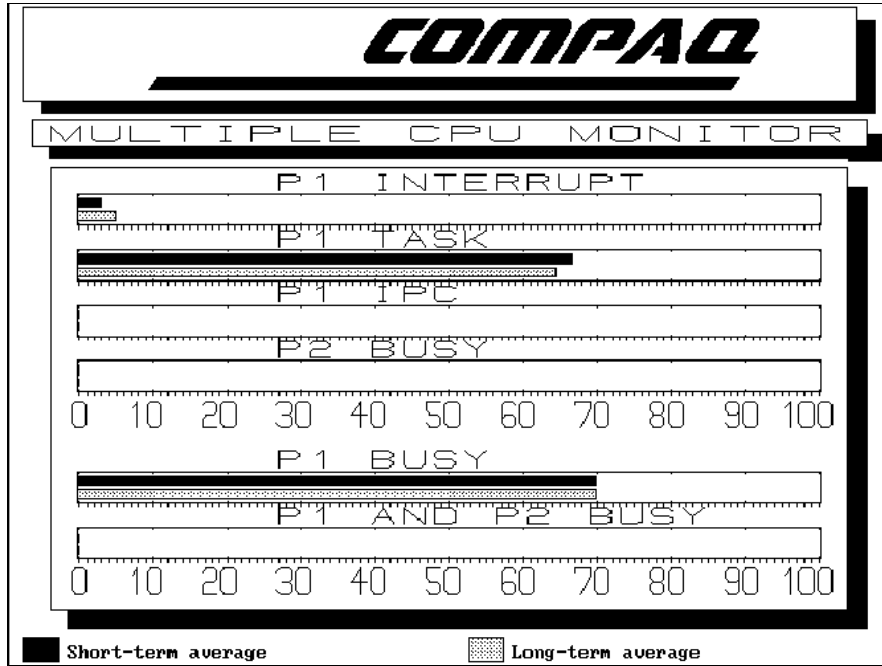
Figure 16-1.   MSPMONIT Utility

CPUMETER Utility

Source: MSJ (Microsoft Systems Journal) November 1990, Vol 5,
No. 6
Author: Bob Chiverton
Public Domain: Yes
File Size: 42,432 bytes (after compile)

CPUMETER is an MS OS/2 Presentation Manager utility that displays
a histogram view of system processor Task Time utilization only. It measures
the amount of time spent by the system processor executing applications, the
network system and the operating system, ignoring the time required to process
device interrupt service routines. The main window displays the histogram
while the title bar reflects instantaneous percentage utilization. Unlike the
MSPMONIT Utility, CPUMETER does not require any additional hardware.
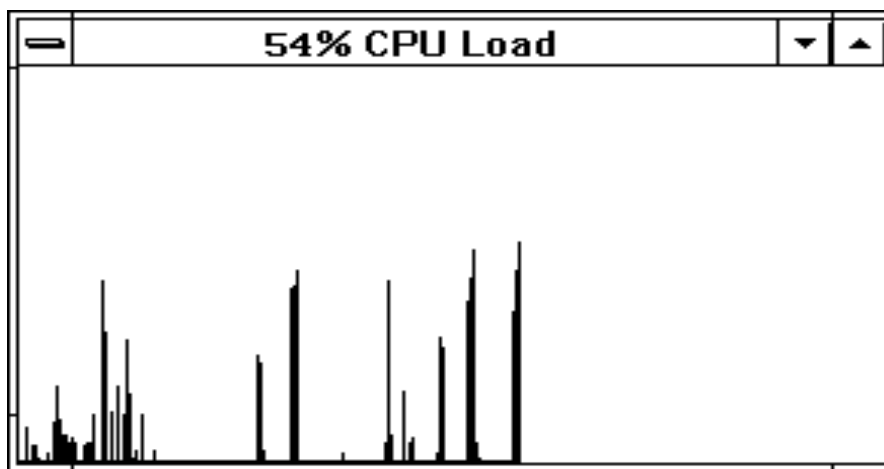
Figure 16-2.   CPUMETER screen

Interpretation of CPUMETER is similar to MSPMONIT. If the system processor utilization is consistently high, then performance may be suffering. However, you cannot determine the overall system processor utilization precisely with CPUMETER since it does not monitor the Interrupt Time. CPUMETER also does not measure the activity of a secondary system processor, if present. Still, you can use it as an early warning monitor, especially if no other utility is available at the time.

If CPUMETER displays a very high system processor utilization, it is a reliable warning that the system processor is spending too much time executing operating system and network system code or application code. However, if CPUMETER displays a low system processor utilization, the results may be inconclusive. It may be spending too much time servicing interrupts. If this is the case, you are recommended to install another system processor monitoring utility, such as MSPMONIT, and to repeat the investigation.

Since CPUMETER is running at the server, it also induces additional overhead on the server and increases the task time.

NOTE: Run only one system processor utilization tool at a time on the server. Otherwise, the tools may interfere with each other and give inaccurate results.

Monitoring the Task Time and the Interrupt Time of the system processor helps you determine what components you need to modify to improve performance. For example, if the Task Time is consistently high (90 percent or more), then software requests might be saturating the system processor.

You can expect your Task Time to be high in an environment where a Lotus Notes server is processing a good deal of mail traffic as well as servicing users as a database server. However, if Task Time is consistently over 90 percent, and the combined system processor utilization is close to 100 percent, the system processor utilization is too high. Several alternatives are available, if the utilization is high. You can upgrade to a faster processor, or optimize other components such as the software or the disk drive subsystem. You can also split up the role of the server over multiple servers. For example, a general-purpose server can be split into two separate servers, one for servicing Lotus Notes mail and the other for database use. You can find details about the various roles of servers in the *Lotus Notes Site Planning Guide.*

In the Lotus Notes environment, Interrupt Time depends on server load. However, as a rule, this value should be very low (ten percent or less). If the Interrupt Time is substantially higher than it should be, consider using more efficient disk and network controllers (EISA rather than ISA controllers, bus master rather than non-bus master controllers). Upgrading the controllers requires less system processor interrupt time and allows more service requests to process.

Also, if you upgrade the system processor (from a 80386 to a 80486, for example), system processor utilization decreases. Both of these approaches also allow for greater capacity, which means the ability to add more users to the network.

Chapter 17

Monitoring and Optimizing the Hard Drive Subsystem

The monitoring and optimization tools for the hard drive subsystem vary from the simple to the sophisticated. The hard drive activity lights and LED activity provide important information about the hard drive subsystem performance. The COMPAQ Server Manager/R tracks a broad range of hardware and operating system activity. Using these tools and understanding you system configuration will help you optimize the hard drive subsystem.

Hard Drive Activity Light

The hard drive activity light serves as a primitive but often sufficient monitoring tool. Even though it does not provide any performance details or statistics, it lets you know when the hard drive subsystem is used. If the light is constantly on, then further investigation into the hard drive subsystem performance may be necessary. Remember that the hard drive activity light represents drive activity for all hard drive controllers installed in the system.

Hard Drive Controller LEDs

The LEDs located on both the COMPAQ Intelligent Drive Array Controller and the COMPAQ Intelligent Array Expansion Controller can also monitor hard drive activity. These LEDs show physical hard drive access, as well as whether the controller operates in the bus master mode or in the (non-bus master) mode. You must take the system cover off the unit to view the LEDs on these controllers.

COMPAQ Intelligent Array Expansion
System Disk Access LEDs

Similar to the hard drive controller LEDs, the COMPAQ Intelligent Array
Expansion System has eight LEDs located in the front of the unit that display
physical hard drive activity. Because these LEDs are visible on the front of
the unit, you do not have to remove the cover to see them. Refer to the
COMPAQ Server Manager/R Administrator's Guide.

COMPAQ Server Manager/R

COMPAQ Server Manager/R gathers system hardware information from the
COMPAQ hard drives and COMPAQ drive arrays. COMPAQ drive arrays
include the following:

■   Internal storage, managed by the COMPAQ 32-Bit Intelligent Drive
    Array Controller

■   The COMPAQ Intelligent Array Expansion System, managed by the
    32-Bit Intelligent Array Expansion System Controller

    The hard drive storage objects monitored by the COMPAQ Server
    Manager/R include:

■   IDE drives or ESDI drives

■   Physical volumes in the COMPAQ drive arrays

■   Logical volumes (as defined by the COMPAQ EISA Configuration
    Utility) of the COMPAQ drive arrays

■   Logical drives (as defined by the MS OS/2 hard drive partitions)

Optimizing the Hard Drive Subsystem

Modifying the hard drive subsystem can improve performance. From the hardware perspective, installing a faster and more efficient hard drive subsystem, adding physical hard drives, or, in some cases, using multiple hard drive controllers can improve performance. From the software perspective, you can implement changes at the design level (designing forms and views to minimize reindexing and recalculation, and so on).

From the systems level, you can also separate the Lotus Notes server from the file server in the LAN Manager environment. For example, only the files to execute the Lotus Notes server processes (executables and DLLs) need to reside on the Lotus Notes server. The actual databases can reside on a file server on the network that is specifically tuned for resource-sharing. .

If you decide to separate the Lotus Notes server from your file server, you must consider the following cautions:

■   If your network or networked file server has problems, your Lotus Notes users might not have access to the data on the networked file server. This might include your dial-in users if they are trying to get to the same databases as your LAN connected users.

■   You must implement proper network security to ensure that another user who has direct access to sensitive data on the file server does not compromise the Lotus Notes security.

Lotus Notes database files on a server should reside on a HPFS or HPFS386 partition, regardless of where you store the files. This provides a performance improvement when compared to a FAT partition. This is especially true for databases with documents that are constantly being modified, for example, an account tracking database.

! **IMPORTANT:** HPFS partitions by themselves are not a guarantee of improved performance. For example, testing in the Compaq Integration labs shows that, in a SQL Server environment, HPFS degrades performance when compared to FAT. Therefore, we strongly recommend against mixing and matching file systems and applications. As a general guideline, use FAT for relational databases such as SQL Server, and use HPFS for dynamically changing files such as Lotus Notes.

Chapter 18
Monitoring and Optimizing System Memory

The following tools and utilities can be used to monitor system memory.

MEM Utility

Source: CompuServe
Public Domain: Yes
File Size: 25,680 bytes

MEM is a Microsoft OS/2 Presentation Manager utility that displays the largest contiguous block of system memory available. It periodically updates the display window according to a user-selectable interval (1, 10, 30, or 60 seconds).
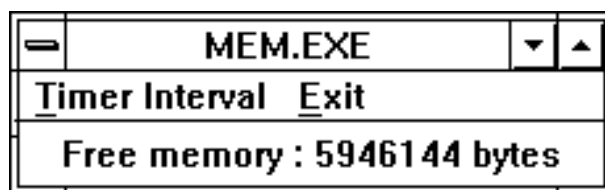
Figure 18-1.   MEM screen

The MEM utility is helpful in determining when system memory might be getting too low. This program, when used as a "high water" mark, can alert the administrator to check if swapping is taking place and/or let the administrator know when to add more memory to the system.

The MEM utility displays only the *largest contiguous block of free memory,* and ignores other free memory fragments that may exist.

SWAPPER.DAT file

The *SWAPPER.DAT* file, typically located in the C:\OS2\SYSTEM directory, indicates if swapping has occurred since the system started. If the *SWAPPER.DAT* file is larger than its default size, swapping has occurred. The current size of the file determines the largest amount of memory written to the hard drive.

The time and date of the file indicate the time when a swap out of memory to disk occurred. However, swapping can occur without the time and date of the *SWAPPER.DAT* file changing. If the current size of the *SWAPPER.DAT* file can accommodate swapping, the file size does not change. Consequently, the time stamp also does not change. The date and time changes only when MS OS/2 needs to swap more than the current *SWAPPER.DAT* size can accommodate.

Therefore, you cannot accurately determine current swapping activity by looking at the size and stamp of the *SWAPPER.DAT* file. However, it is an *early warning* that you might need to add more memory. A swap monitor tool provides a better picture of swapping activity.

COMPAQ SERVER Manager/R

The COMPAQ Server Manager/R enables you to monitor the following aspects of system memory:

■ *Lack of Refresh* -- monitors the dynamic RAM (DRAM) refresh cycle and reports if RAM refresh occurs. RAM chips only keep the electric charges that represent information for a short while, so charges must be refreshed at regular intervals. Failure to perform refresh cycles results in loss of data stored in memory.

■ *Memory Parity* -- monitors memory parity errors that occur in a monitored system. Memory parity errors occur when the system detects that it incorrectly transferred information.

■   *Total Memory* -- reports the total amount of memory installed in the system. This includes all RAM on the system board, or on the system memory board, and additional RAM from memory expansion boards installed in the system.

If a lack of refresh or memory parity occurs, the COMPAQ Server Manager/R can automatically alert the system administrator. Automatic alerts require a proper configuration of the COMPAQ Server Manager/R. Refer to the *COMPAQ Server Manager/R Administrator's Guide* for further information.

Optimizing the System Memory

The easiest way to avoid swapping is to add more memory. If you already have 16 megabytes of installed memory and swapping still occurs, you might need to adjust the applications running on the server. For example, you might need to split the Lotus Notes server and LAN Manager file server into two separate computers; or, you might need to move the mail routing functions of a Lotus Notes server into another computer.

Lotus recommends a server with 16 megabytes of RAM for any organization with a large Name and Address Book (over 15,000 users).

You can also make the following changes to optimize memory:

■   Do not use the MS-DOS compatibility box in your MS OS/2 server. To remove the MS-DOS compatibility box, update your *CONFIG.SYS* file as follows, then reboot for the changes to take affect:

```
REM PROTECTONLY=NO
PROTECTONLY=YES
REM RMSIZE=640
REM C:\OS2\EGA.SYS
REM C:\OS2\DOS.SYS
```

■ Do not load device drivers for devices that are not present in your system. For example, if you do not have or plan on using a CD-ROM device, you can disable the related driver under MS OS/2 Version 1.3 as follows:

```
REM DEVICE=C:\OS2\SUPPORT\DENON.VSD
REM DEVICE=C:\OS2\SUPPORT\STDCDROM.VSD
REM DEVICE=C:\OS2\SUPPORT\CDROM.TSD
REM IFS=C:\OS2\SUPPORT\CDFS.IPS
```

> **!** **IMPORTANT:** When using Microsoft OS/2 Version 1.3, do not disable the following line if you are using the Microsoft LADDR architecture (the default):
>
> RUN=C:\OS2\SUPPORT\LOGWRITE.EXE
>
> This activates the Microsoft LADDR logger.

Chapter 19

Monitoring and Optimizing the Network

The following programs available with Microsoft LAN Manager can assist you to monitor the condition of the network. Microsoft Visual Basic Toolkit for LAN Manager also provides you with the ability to build Microsoft Windows programs as front-ends to interact with Microsoft LAN Manager. In addition, the COMPAQ Server Manager/R and third-party network protocol analyzers for both LANs and WANs provide you information on network status.

NET ERRORS

The NET ERRORS command or the NET ADMIN full screen interface can display the contents of the LAN Manager error log. The network error log contains a history of errors from the WORKSTATION or SERVER services running at the server. The error log provides a good indication of thresholds exceeded, such as the number of Big Buffers or the number of Request Buffers that were requested but not available.

You can view the error log locally or remotely. Refer to the *Microsoft LAN Manager Administrator's Guide* for more information. You can also obtain information about network errors by entering the command:

    NET HELPMSG NET####

where #### represents the error number.

You can also refer to the *Microsoft LAN Manager Installation Guide* for an explanation of LAN Manager errors.

Implementing Lotus Notes on Compaq Servers with Microsoft LAN Manager

Writer: **Project:** *Monitoring and Optimizing the Network* **Comments:**
File Name:LNCHAP19.DOC **Last Saved On:***10/2/95 2:15 PM*

NET STATISTICS

Microsoft LAN Manager provides built-in network statistics checking utilities for system administrators to use in understanding the functional and performance characteristics of a given network. You can obtain Workstation and Server Statistics through the NET ADMIN full screen interface or by using the command:

NET STATISTICS [WORKSTATION|SERVER]

You can view network statistics locally or remotely. Refer to the *Microsoft LAN Manager Administrator's Guide* for more information.

The Workstation Statistics section supplies network information on:

Table 19-1
Workstation Statistics

Network I/Os Performed	Sessions Started
*Network Errors	*Sessions Starts Failed
Bytes Sent	Sessions Disconnected
Bytes Received	Sessions Reconnected
Connections Made	*Times Buffers Exhausted Big Buffers Request Buffers
*Connections Failed	

The items with asterisks (*) are key values to watch.

The Server Statistics section monitors the same areas found in the Workstation section with the addition of:

Table 19-2
Server Statistics

*Mean Response Time (msec)	Sessions Accepted
*Files and Pipes Accessed	Sessions Timed Out
Comm Devices Accessed	*Sessions Errored Out
Print Jobs Spooled	Password Violations
*Network Errors	Permissions Violations
*System Errors	

The items with asterisks (*) are key values to watch.

Review the following parameter considerations:

■ The mean response time should be below 100 milliseconds. The mean response time of 100 milliseconds is *not* a strict value in determining if your system is performing adequately. However, the value of 100 milliseconds is a "high water" mark to help you determine if further investigation is necessary. Overall response time at the workstations is also a consideration.

■ If Request Buffers are exhausted, then increase their value contained in the [server] section of the *LANMAN.INI* file (numreqbuf = *xx*). Increase the Request Buffers value by five, and observe if these buffers are sufficient. Repeat by increasing the values if necessary.

■ Network, system, and session errors should be zero. Connections failed and sessions start failed should also be zero. If any errors do occur, investigate and resolve the problems to ensure a reliable operation and good performance.

■ The number of sessions must be sufficient to support the expected number of simultaneous users. Users will notice performance degradation as the Lotus Notes server tries to reuse sessions among users if the number of available sessions are too low.

Implementing Lotus Notes on Compaq Servers with Microsoft LAN Manager

Writer: **Project:** *Monitoring and Optimizing the Network* **Comments:**
File Name:LNCHAP19.DOC **Last Saved On:**10/2/95 2:15 PM

Microsoft Visual Basic Toolkit for LAN Manager

Microsoft Visual Basic Toolkit for LAN Manager (VBLM) is a toolkit that lets your build Visual Basic applications to interact with the Microsoft LAN Manager. This toolkit is built on top of the Microsoft LAN Manager Application Programming Interface (API). This toolkit provides you with:

■ Programming tools necessary to communicate via the LAN Manager API. These include definitions (functions, structures, and constants) as well as functions (to manage LAN Manager buffers and error messages, and interfaces to LAN Manager functions).

■ Sample applications to incorporate VBLM functions into an application.

   The sample applications are useful in monitoring your Microsoft LAN Manager network from an administrator's workstation running under Microsoft Windows. They are:

■ *Performance Graph* application that lets you graph various parameters such as CPU utilization at a server over time. (This CPU utilization graph is subject to the same issues with the CPUMETER utility described earlier.)

■ *Alarm Station* application lets you define events you will monitor on one or more servers. You can select different network statistics and combine them into events. If any statistic exceeds a threshold condition established by you, the corresponding event can trigger an action log to a file, send a pop-up message, and so on.

■ *Logging* application lets you store performance data for offline analysis.

■ *Home Directory Setup* application lets you create and maintain user groups and accounts.

   You can use the above applications as templates to build your own Visual Basic applications to monitor the network.

COMPAQ Server Manager/R

COMPAQ Server Manager/R gathers the following information from both Microsoft LAN Manager and Microsoft OS/2:

- Software Versions - both MS OS/2 and LAN Manager

- Swapper Size (this can trigger the requirement to add more memory)

- Names - both User Name and Server Name

- Server Services

- Heuristics - both workstation and server heuristics

- Domains

- Automatic Disconnect

- Request Buffers

- Error Log Size

- Session Time Out

- Data Buffers

- Server Stopped

The following items provide information about various events that occurred since the last time the server started, or since the last time the server statistics were reset:

- System Errors

- Password Errors

- Average Response Time

- Percent Network Control Block (NCB) Errors

- Sessions

- Connections

Network Protocol Analysis Tools (LAN)

Network protocol analyzers serve a variety of purposes, including finding hardware and software faults, routing and addressing problems, isolating bad cables, and monitoring and optimizing network performance.

Listed below are six network protocol analyzers that are representative of the tools that are available for LAN trouble shooting and performance optimization. The six analyzers are by no means an exhaustive list. All have unique features, which may include:

■ Bit-slice processor that monitors physical level network characteristics such as token rotation time on IEEE 802.5 networks

■ A graphical approach to configuration with the MS OS/2 Presentation Manager

■ Use of standard network interface controllers

For specific information about pricing and the protocols supported by the following six tools, contact the manufacturers directly:

FTP Software, Incorporated   **LANWatch**
338 Main Street
Wakefield, MA 01880

Phone: (617) 246-0900
Phone: (617) 246-0901 - FAX

Hewlett-Packard Company   **HP4972A**
5070 Centennial Blvd.
Colorado Springs, CO 80919

Phone: (719) 531-4000

Network General Corporation   **Sniffer**
4200 Bohannon Drive
Menlo Park, CA 94025

Phone: (415) 688-2700

Novell, Incorporated   **LANalyzer**
2180 Fortune Drive
San Jose, CA 95131

Phone: (408) 434-2300

ProTools, Incorporated   **PROTOLYZER**
14976 NW Greenbrier Parkway
Beaverton, Oregon 97006-5733

Phone: (503) 645-5400

NOTE: The above vendor information is provided for informational purposes, and is not an endorsement of vendor product.

Implementing Lotus Notes on Compaq Servers with Microsoft LAN Manager

Writer: Project: Monitoring and Optimizing the Network Comments:
File Name:LNCHAP19.DOC Last Saved On:10/2/95 2:15 PM

When using protocol analyzers for network performance monitoring, compare average and current values for the following measurements.

❑   Percentage of Network Utilization -- This particular measurement provides a good indication of the amount of network bandwidth available. It usually provides an indication of how much growth potential is available within the present cabling and network topology. For example, every group of ten new users added to the existing cabling scheme might raise the average network utilization by five percent.

■   CRC Errors, Long and Short Frames, and Collisions

❑   Frame errors cause retransmissions and generally degrade network performance. Five different frame error situations can occur:

❑   A bad Frame Check Sequence (FCS) indicates that bit errors occurred that affected the Cyclic Redundancy Check (CRC).

❑   Misaligned Frames occur when the number of bits in the received frame is not an integral number of bytes, and the frame also has a bad FCS.

❑   Jabbers (Long Frames) are frames that exceed the maximum allowable frame length.

❑   Fragments (Short Frames) are frames less than the minimum frame length.

❑   Collisions result from the simultaneous transmission of two stations and occur in 802.3 networks.

The source of these network errors is often a defective network interface controller on the network.

Network Protocol Analysis Tools (WAN)

The requirements for a Wide Area Network (WAN) protocol analyzer can differ greatly from a LAN network analyzer. Network protocol analyzers for WANs must incorporate support for a variety of WAN protocols such as T1, X.25, SDLC, frame relay, ISDN, and SS7 to name a few. Also, since WAN errors can be one time events that are difficult to reproduce, protocol analyzers must offer sophisticated "trigger" mechanisms to capture and play back the error conditions. Support for remote capture and logging is another important feature.

A comprehensive look at WAN analyzers is beyond the scope of this document. However, several recent publications provide evaluations of network analyzers, some of which are combinations of LAN/WAN analyzers. A good reference book with tips on selecting a network analyzer and troubleshooting inter-networking problems is "Troubleshooting Internetworks Tools, Techniques and Protocols" by Mark A. Miller, P.E.

The book is published by:

M&T Books
411 Borel Avenue, Suite 100
San Mateo, CA 94402-3522

Listed below are some well-known vendors for WAN protocol analyzers. However, this is not an exhaustive list. Please contact the vendors directly for more detailed information.

GN Navtel	**Datatest series**

6611 Bay Circle, Ste. 190
Norcross, GA 30071

Phone: (404) 446-2665

Hewlett-Packard Company	**HP4954A**

5070 Centennial Blvd.
Colorado Springs, CO 80919

Phone: (719) 531-4000

Telenex Corp.	**Interview series**
(Unit of General Signal Corp.)	
13000 Midlantic Drive. P.O. Box 869	
Mt. Laurel, NJ 08054	

Phone: (609) 234-7900

Tekelec   **Chameleon 32**
26580 W. Agoura Road
Calabasas, CA 91302

Phone: (818) 880-7900, ext. 7975

Wandel & Goltermann, Inc.   **Data Analyzer series**
2200 Gateway Centre Blvd.
Morrisville, NC 27560

Phone: (919) 460-3300

NOTE: The above vendor information is provided for informational purposes, and is not an endorsement of vendor product.

Optimizing the Network

One of the key characteristics of the client-server processing environment is its low network utilization. This low network utilization means that the network is almost never a bottleneck, and that the network optimization usually does not attribute to the increased performance. However, you can optimize the following list of components, if necessary.

■   Upgrade the current Network Interface Controller (NIC) to a faster and more efficient one, if possible. Upgrading to a bus master network interface controller can relieve the system processor from supervising the transfer of data between the NIC and system memory.

■   Evaluate the number of sessions in your LAN Manager configuration. If the number of sessions is too low, the Lotus Notes server performance degrades as it reuses its sessions among users.

Chapter 20
Monitoring and Optimizing MS OS/2

This chapter discusses the available monitoring and optimizing tools for MS OS/2.

PSTAT Utility

Source: Supplied with Microsoft OS/2 Version 1.21 or higher
Author: Microsoft Corporation
File Size: 18,047 bytes (the actual size may vary with different versions of Microsoft OS/2)

PSTAT is a utility supplied with Microsoft OS/2 Version 1.21 or higher. It provides information on semaphores, processes and threads, process and thread priorities, Dynamic Link Libraries (DLL), shared memory, and process state (Ready, Frozen, or Blocked). PSTAT provides information to help you determine when your system might require more threads, and to be aware of the amount of activity occurring.

The following table shows a list of the information displayed by PSTAT.

Table 1-1
PSTAT Information

Process and Thread Information	System Semaphore Information
Process ID	Owning Process
Parent Process ID	Index
Session ID	Number of References
Process Name	Number of Requests
Thread ID	Flag
Priority	Semaphore Name
Block ID	
State	
Name Shared Memory Information	**Run-Time Link Libraries**
Handles	Process Name
Selectors	Process ID
Number of References	Session ID
Shared Memory	Library List

You can use the following parameters with the PSTAT command:

■ /C -- displays information about each of the current processes and threads

■ /S -- displays system semaphore information for each thread in the system

■ /L -- displays the run-time linked libraries for each process in the system

■ /M -- displays the named-shared memory information for each process in the system

■ /P:pid -- displays information about a particular process, which is identified by its process identification number

You can get additional information about PSTAT by entering the following Help command at the MS OS/2 command prompt:

    HELP PSTAT

Periodically, count the number of threads being executed (use the PSTAT /C option). If this number is close (within five percent) to the system limit of threads (THREADS= statement in your *CONFIG.SYS* file), the system might need more threads.

Sometimes, you can improve performance by increasing the number of threads available to the system. Keep in mind that if your computer is both a LAN Manager file server and a Lotus Notes server, the number of threads required might be greater than the default value of 128. A suggested value is 256 threads.

However, remember the following points when deciding to increase or decrease this value:

■ The maximum number of threads available with Microsoft OS/2 Version 1.21 is 512. The maximum number of threads available with Microsoft OS/2 Version 1.3 is also 512.

■ Each thread has memory allocated. Setting the THREADS = value too high consumes memory unnecessarily. Each additional thread requires 64 bytes to execute.

COMPAQ Server Manager/r

COMPAQ Server Manager/R enables you to monitor the following aspects of
Microsoft OS/2:

■ *MS OS/2 Trap Errors* -- These errors occur when an application causes
a system processor error or an unrecoverable operating system error.
When a trap error occurs, the application that caused the error
terminates, and the server console displays a message with information
about that error. The COMPAQ Server Manager/R retains a copy of the
trap errors for further evaluation.

■ *Logical Drives*-- This item provides the following information about
existing logical drives (C through Z) defined on the server:

❏ Summary Information

❏ Logical Drive Information

❏ Logical Drive - Percent Used

Optimizing Microsoft OS/2

Optimizing Microsoft OS/2 and the file system cache is done through the *CONFIG.SYS* file. Modify parameters such as THREADS, FAT cache size (DISKCACHE), and HPFS cache size (CACHE) according to the needs of the environment.

You can disable the FAT cache size by removing or remarking out the "DISKCACHE=" line in your *CONFIG.SYS,* and rebooting the server for the changes to take effect. You may disable FAT cache under the following conditions:

■　All your data files accessible over the network reside on HPFS partitions.

■　Your Lotus Notes databases are also on HPFS partitions only.

■　Your bootable (FAT) partition contains only the operating system files required to boot the operating system and initialize the network.

The value for your HPFS cache depends on the specific configuration of your Lotus Notes server and the other applications it is running. As a rule, if your server is a dedicated Lotus Notes server with 16 megabytes of memory, you can allocate from 2 to 4 megabytes of memory to your HPFS or HPFS386 cache for good performance.

Chapter 21

Monitoring and Optimizing the Lotus Notes Server

Tools for monitoring a Lotus Notes server can range from the simple to the complex. Currently, Lotus Development Corporation has few tools to monitor the server. Therefore, some large organizations have written customized monitor tools using the Lotus Notes API. Solutions for remote monitoring are available outside of Lotus Notes.

Lotus Notes Server Console

The Lotus Notes server console is a familiar tool to any Lotus Notes system administrator. This is a full screen OS/2 application that provides some rudimentary commands to monitor the status of the server. The server console commands are documented in the *Lotus Notes Administrator's Guide.* To prevent a lot of messages from cluttering up the console, the default setup turns off messages about replications and sessions. However, during initial testing of a server, it might be useful to enable these messages by adding the following lines to the *NOTES.INI* file on the server:

```
LogReplications = 1
LogSessions = 1
```

It is also possible to set these values through the server console as follows:

```
>SET CONFIG "LogReplications = 1"
>SET CONFIG "LogSessions = 1"
```

NOTE: If you set the values through the server console, the Lotus Notes server automatically updates *NOTES.INI* for you.

When these values are set, it is possible to monitor the status of replication sessions as they happen, and user sessions being open and closed.

It is also possible to monitor the status of any port by doing a "Show Port *portname*" command, as in:

```
>SHOW PORT LAN0
```

Lotus Notes Server Log File (LOG.NSF)

The *LOG.NSF* contains a valuable record of session information for the systems administrator. This database contains all server events, such as replications performed, mail routed, phone call activity, and so on. Refer to the *Lotus Notes Administrator's Guide* for details about the log file. Some information is also provided in the *Lotus Notes Site Planning Guide.*

One important fact about the default settings on the log file is that documents are automatically deleted after seven days. Although this is a good way of keeping the log file size to a reasonable limit, there are times when you may not want this to happen automatically. For example, because the log file contains valuable information about every session, you might want to extract this information for trends analysis. There are two ways to extract this information.

■   If you want to increase the time period before the Lotus Notes server automatically deletes documents, you can modifying the following line in the *NOTES.INI* file (the example is given assuming that you want to increase the period to 30 days):

> Log=LOG.NSF, 1, 0, 7, 8000   <- Change this line to
>
> Log=LOG.NSF, 1, 0, 30, 8000

■   If you would like to keep the default settings of the *NOTES.INI* file, but still keep the historical data, you may replicate the log file to another database. For example, create a replica copy of the log file to a database called *CUMLOG.NSF* (for cumulative log file). Then, on the *LOG.NSF* database, *be sure to check* the box that says "Do not replicate deletions to replicas of this database." This can be found in the user interface window for Replication Settings for the log file. This prevents the automatic deletions of the *LOG.NSF* database from replicating to the *CUMLOG.NSF* database. However, you are now responsible for ensuring that the *CUMLOG.NSF* database does not grow unacceptably large.

Since the *LOG.NSF* file is a Lotus Notes database, just like any other database, it is possible for you to customize the views to suit your requirements for export to another program. For example, if you would like to export the columns in a view directly to a spreadsheet, you can set up columns in a view to match the report in the spreadsheet. You can now export the view from Lotus Notes in a Lotus 123 worksheet format and import it into your spreadsheet.

Using this technique, it is possible to export a report of phone call activity (user name, call time, call duration, number of bytes sent and received, and so on) to a spreadsheet for analysis. Once the data is in the spreadsheet, it is possible to calculate the inter-arrival times and service completions times to estimate the number of COM ports your server needs. For further details on this analysis, refer to Appendix B, "Planning for Dial-In Access."

Important points to remember:

■   Perform your analysis offline using a spreadsheet or a database program. Although it is possible for Lotus Notes to do some of the calculations in the view itself, this is not desirable. First, it degrades performance on the server when it has to do intensive calculations. Second, database and spreadsheet products have far more sophisticated tools for manipulating the data.

■   Your custom views can either be public (part of the log file), or private (visible only to you). However, there are limitations to the size of private views, because they are stored in your *DESKTOP.DSK* file. There is a limit of 50 megabytes on the size of the *DESKTOP.DSK* file.

■   You cannot use DDE to update cells automatically in a spreadsheet based on the contents of the log file, since Lotus Notes is only a DDE client, and not a DDE server.

■   You must write an API program that extracts the data from the log file and imports them into the destination program, if you would like to dynamically update a spreadsheet or a database engine like Microsoft SQL Server.

Receiving Server Statistics via LOTUS NOTES E-Mail

You can receive Lotus Notes server statistics via Lotus Notes e-mail. To enable this feature, you must first perform the following steps:

1. Create a database with the name *STATS.BOX* on the Lotus Notes server based on the "Mail Router Mailbox" template.

2. Verify that the STATS program is loaded. To verify this, go to the Lotus Notes server console and type the following at the console prompt:

    >SHOW TASKS

    The screen displays a list of all the active tasks on the server, including STATS. You can load the task dynamically, if you do not see this task listed by typing the following at the console prompt and then repeating the SHOW TASKS command:

    >LOAD $STATS
    >SHOW TASKS

3. Create a person record in the Name and Address Book entry. Use the Lotus Notes server name as the first name, and the word STATS as the last name. For the mail file in this person record, point to the *STATS.BOX* file created in Step 1.

To receive statistics via e-mail, you must compose an e-mail addressed to the *person* whose record you created above. Leave the subject field empty. Send the e-mail, but remember to *sign* it before you send it. The server will reply to you. If you enter the word HELP in the subject field before sending the mail, you will receive additional information on the options available to you.

Other Tools

As mentioned earlier, if you need to do sophisticated analysis of the log file, you must use tools such as spreadsheets and database programs to do your analysis. Also, if you need to analyze information in real time, you will need a program that can extract information from the log file and export it to the proper destination program. If you are already using Microsoft SQL Server in your environment, we recommend that you use this database engine to analyze your data because APIs for both Lotus Notes and Microsoft SQL Server are published and commonly understood.

NOTE: Although the current version of Lotus Notes does not provide any means to remotely monitor a server, other solutions are available. For details, refer to Chapter 22, "Remote Monitoring Tools."

Forest & Trees from Channel Computing, lets you query, view, and graph data sets from a number of sources, including Microsoft SQL Server, Lotus Notes and a variety of popular database and spreadsheet program formats. The product comes with some ready to use views for analyzing the Lotus Notes log file. You can customize these to generate special reports, if you wish. The following is a feature summary:

■　Data sources include spreadsheets, database files, database servers and host systems (IBM's AS/400).

■　SQL Query Language support and query creation.

■　Information presented as *views* that can contain queries, formulas or DDE links to a variety of data source providers.

■　Reporting capabilities with built-in scheduling and report generation.

■　Application development tools.

For further details, contact the vendor at:

Channel Computing, Inc.
53 Main Street
Newmarket, NH 03857

Phone: (603) 659-2832

Optimizing the Lotus Notes Server

There are a few areas to optimize a Lotus Notes server. These involve both system administration and database design.

■ Carefully adjust the number of applications concurrently running with Lotus Notes in a server. For example, running Lotus Notes and Microsoft SQL Server concurrently in the same computer is not a good idea, because each must maximize its use of critical systems resources, especially memory. However, it is possible to concurrently run a Lotus Notes server and a LAN Manager file server in the same computer, provided that you primarily use the computer as a Lotus Notes server and the LAN Manager functions are only for administrative purposes.

Use only *one* application per server, whether it is Lotus Notes, Microsoft SQL Server, and so on, as a general rule. This does not include any other utility programs that you must run on the server to monitor and maintain it.

■ Evaluate the tasks executed by the Lotus Notes server in conjunction with its role. For example, a hub server does not have to rebuild indexes, because it only serves as an intermediary for replication. You can improve the performance on the hub server by eliminating the execution of the UPDATE and UPDALL tasks. For details, refer to the *Lotus Notes Site Planning Guide*.

■ Look at replication schedules. A critical area of performance is the replication times between servers. If all the servers are going to replicate to or from a hub server at the same time, performance at the hub degrades. You must carefully plan the times when servers will replicate among each other, taking into account time zone differences, if necessary.

■ From the database design side, incorrect or inappropriate design is probably the biggest cause of bad performance. For instance, avoid too many calculations in a view if you can do them offline in another program. Also, avoid designs that cause frequent reindexing of the data. For details, refer to the *Lotus Notes Database Administrator's Guide*.

Chapter 22
Remote Monitoring Tools

This chapter contains descriptions of some remote monitoring tools available to you.

COMPAQ Server Manager/R

COMPAQ Server Manager/R is a system management tool designed to monitor and provide information about COMPAQ EISA-based personal computers and personal computer systems. COMPAQ Server Manager/R combines intelligent system monitoring, alerting, and remote console capabilities to help manage computer systems used as network servers and multiuser hosts.

The following figure shows the main components of COMPAQ Server Manager/R.
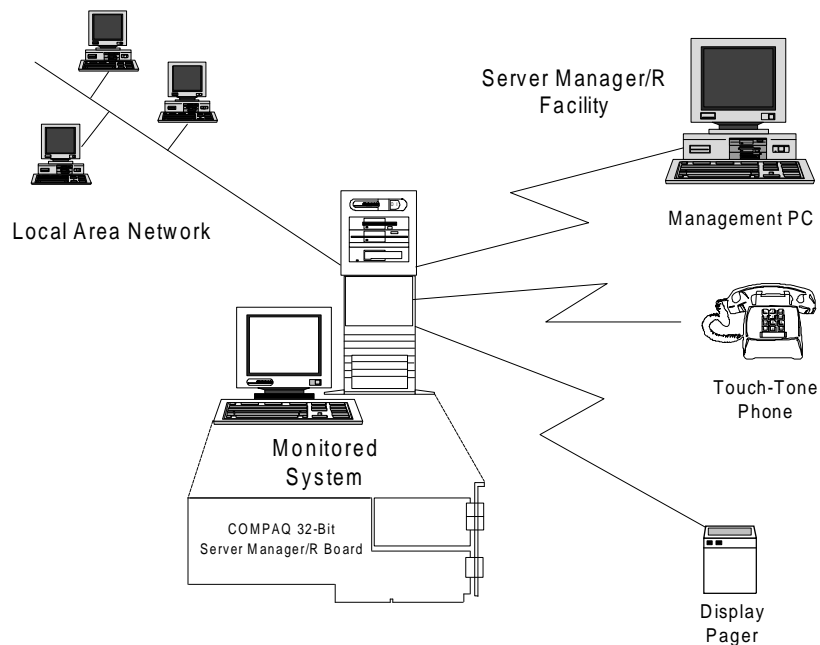
Figure 22-1.   COMPAQ Server Manager/R

COMPAQ 32-Bit Server Manager/R Board

When installed in a COMPAQ EISA-based system (known as the *monitored system),* the COMPAQ 32-Bit Server Manager/R board gathers and records information about system components and drive storage devices associated with that system.

The hardware design features of the Server Manager/R board include the following:

■ 32-Bit EISA bus master implementation -- provides hardware monitoring and remote console support

■ COMPAQ Enhanced 2400-Baud Internal Modem with V.42 Support -- allows for communications and alert delivery

■ NiCd Battery -- provides power to the COMPAQ 32-Bit Server Manager/R board when system power is unavailable

■ Battery-Backed RAM Storage -- stores system information for viewing even when system power is unavailable

■ Temperature and Voltage Sensors -- monitors internal temperature and system power

■ Serial Interface -- supports up to 9600-bps communications

■ Voice Synthesizer -- supports the delivery of voice-based alert messages to touch-tone telephones

The dedicated processor allows extensive system monitoring with minimal impact on system performance. The integrated modem allows the COMPAQ 32-Bit Server Manager/R board to notify you when alert conditions occur, and the battery ensures that Server Manager/R is accessible and retains information even when the monitored system has lost power.

The Server Manager/R support software allows Server Manager/R
to communicate with the operating system to gather information about events
occurring on the monitored system. For example, with the appropriate Server
Manager/R support software installed on the
monitored system, Server Manager/R can track such aspects of the
system as available hard drive space, software errors, and operating
system configuration. The Server Manager/R support software allows Server
Manager/R to provide a comprehensive view of the system condition that
includes both hardware and software status.

SERVER Manager Facility/r (SMF)

The COMPAQ Server Manager Facility/R (SMF) is a Microsoft Windows-
based software application that you can use to monitor information the Server
Manager board provides.

The SMF runs on a computer other than the monitored system. This computer,
called the *management PC*, receives information from the Server Manager/R
board through a modem or a direct connection.

SERVER manager Collector/r (SMC)

This utility provides historical collection and trend analysis to the Server
Manager/R. The SMC is a Microsoft Windows application that periodically
collects data provided by the Server Manager/R. You can use this data to
determine historical trends within a monitored system. The SMC stores the
collected data in ASCII files. You can analyze the data and create reports by
using any application that can manipulate ASCII files. Included with the SMC
is a sample report generator macro that you can use with Microsoft Excel to
generate reports. SMC has the following features:

■ Collect data from multiple monitored systems

■ Collect periodic or continuous data

■ Collect all or selected objects and items from the Server Manager/R

■ Execute automatically any application after data is collected

■ Generate automatically and print reports using the report generator macro.

NOTE: The use of the report generator macro requires Microsoft Excel 3.0 or higher, which is not included.

❏ Computes averages, deviation, and standard deviation on monitored items

❏ Ability to highlight items

❏ Prints graphs

■ Supports modem or direct connect

■ Coexists with SMF

Using the COMPAQ SERVER Manager/r

If a problem occurs with the hardware or operating system of the monitored system, Server Manager/R can send an alert message about the problem to designated person(s) or management PCs. The alert message notifies the administrator that a situation has occurred that requires attention. Server Manager/R can send alerts to the following devices:

■ Management PCs running the SMF software

■ Supported pagers

■ Touch-tone telephones

Even if you are not near the monitored system, Server Manager/R allows you to respond to a problem. Using the SMF Remote Console feature, you can remotely manage and operate monitored systems from the management PC. The Remote Console feature lets you see the screen of the monitored system and use the keyboard of the management PC as though it was the keyboard of the monitored system.

In addition, you can reset the monitored system from the management PC using a cold or warm boot. You can also remotely operate any text-based application on the monitored system at the management PC. For instance, with the proper setup, you can run utilities, such as the COMPAQ Diagnostics Utility, on the monitored system from the management PC.

Benefits

In summary, Server Manager/R provides you with the following benefits:

■ Improved ability to identify actual and potential system problems

■ Ability to alert a system administrator when a problem occurs

■ Ability to operate a Lotus Notes server remotely through the remote console

■ Ability to obtain information about system the configuration

Other Monitoring Tools from Compaq for Microsoft LAN Manager and IBM LAN Server

Many accounts have requested that Compaq provide additional systems management functionality, along with the COMPAQ Server Manager/R, as part of the value added to the COMPAQ SYSTEMPRO Line.

The nature of these requests focuses on enhanced alerting capability that encompass not only the information provided by the Server Manager/R, but also the applications running on the server for the Microsoft LAN Manager and IBM LAN server environments. These applications can include in-house as well as commercial client-server applications such as Microsoft SQL Server and Lotus Notes.

Compaq has committed to provide these accounts with methods necessary to achieve enhanced alerting capability. In particular, a Compaq monitor provides a set of generic APIs that allows alerts to be generated either out of band through the Server Manager/R for disaster situations or in-band through the existing network for normal operation. This Compaq monitor is really a *monitor-of-monitors* that masks the alerting details from the monitors. Compaq suggests that accounts develop, maintain, and support the monitors for their individual applications. This provides individual accounts with the flexibility to customize application-level alerts. Compaq can provide consulting assistance in the alert definitions.

If you would like further information on using this support to monitor your Lotus Notes server, please contact your Compaq representative, that is, your Compaq Field Systems Engineer (FSE) or Major Account Manager (MAM).

Chapter 23
Backups and Fault Tolerance

Designing and executing an appropriate backup strategy is an important part of maintaining a Lotus Notes server. As mentioned previously, in Chapter 12, "Defining a Backup Strategy" replication alone is not a replacement for backup.

If all your files (executable files, as well as database files) are on the same computer, you must adopt a backup strategy for that computer. If only your executable files are on the Lotus Notes server and your critical database files are on a second computer, that is, a file server, you may consider backing up only the file server. If you choose this option, you must consider the time it takes for you to recover if your Lotus Notes server fails, or must be taken down for maintenance.

Compaq provides the following tape drive options for backing up your Lotus Notes server:

■   COMPAQ 150-/250-Megabyte Tape Drive

■   COMPAQ 320-/525-Megabyte Tape Drive

■   COMPAQ 1.3-/2.0-Gigabyte Digital Audio Tape (DAT) Drive

Compaq recommends Sytos Plus Tape Backup Software from Sytron Corporation, which is available for the Microsoft MS OS/2 Standard Version 1.21, as published by Compaq and Microsoft OS/2 Version 1.3 operating systems. The *Sytos User's Guide for MS OS/2* available with the backup software provides a discussion of adopting an appropriate backup strategy.

When a Lotus Notes server is active, it locks the *LOG.NSF* (Log file), and *NAMES.NSF* (Name and Address Book) database files. To backup these files, a preferred method is to shutdown the Lotus Notes server, execute your backup process, and bring it back up again. For a detailed look at your options, refer to Chapter 12, "Defining a Backup Strategy."

Backups and fault tolerance are two ways of protecting your information from failure. To complement your backup strategy, you must consider implementing some form of fault tolerance (either hardware or software). A brief discussion of these options follows.

Hardware Fault Tolerance

Hardware fault tolerance is a feature of both the COMPAQ 32-Bit IDA Controller and the COMPAQ 32-Bit IDA Expansion Controller. The key features of hardware fault tolerance are:

■ Hardware fault tolerance requires no system processor supervision to implement the data protection. All operations are supervised by a dedicated processor that is built into the disk controller. It is also completely transparent to the operating system.

■ Automatic recovery in case of drive failure, a feature of hardware fault tolerance, can take place as a dedicated or a background activity. A dedicated recovery takes place *before* the operating system can boot, and the background recovery takes place *while* the server is operational.

■ Hardware fault tolerance is based on the logical volumes, which are defined by the COMPAQ EISA Configuration Utility. Consequently, a large amount of storage (50 percent of the logical volume for hardware mirroring and 25 percent of the logical volume for data guarding) becomes inaccessible as a result of the implementation.

Data Guarding

Data guarding is a feature of the COMPAQ Intelligent Drive Array, and cannot be implemented on the COMPAQ Intelligent Array Expansion System. To attach to the COMPAQ Intelligent Drive Array Controller you must have four or eight drives, data guarding uses 25 percent of the total logical volume capacity to store the parity information for the remaining 75 percent of storage. The parity value calculations have an adverse impact on performance, especially in a write-intensive environment.

Hardware Mirroring

Hardware mirroring is a feature of both the COMPAQ Intelligent Drive Array and the COMPAQ Intelligent Array Expansion System. It duplicates data across two sets of drives using a single disk controller. Mirroring requires an even number of drives so that you can attach it to the disk controller. Hardware mirroring uses 50 percent of the total logical volume capacity for the duplicate data.

Microsoft LAN Manager Fault Tolerance

Microsoft LAN Manager offers a software-based alternative to hardware fault tolerance. Microsoft LAN Manager Version 2.0 allows you to mirror and duplex disk subsystems *other* than COMPAQ drive arrays. Microsoft LAN Manager Version 2.1 allows you to mirror and duplex COMPAQ drives as well.

The key features of Microsoft LAN Manager-based fault tolerance are:

■   Microsoft LAN Manager-based fault tolerance is implemented through software, and relies on the system processor for its implementation. As a result, the system processor utilization increases and the overall system performance is less than optimal.

■   Microsoft LAN Manager fault tolerance does not offer an automatic recovery in case of a drive failure. After you correct the failure, you must manually remirror the partition(s).

■   Microsoft LAN Manager fault tolerance is based on the logical drives (partitions), which are defined by the operating system. Consequently, Microsoft LAN Manager fault tolerance allocates 100 percent of the size of each logical drive you choose to mirror or duplex to the secondary mirror. Your total storage capacity becomes reduced by the size and number of logical drives mirrored or duplexed.

■   Microsoft LAN Manager fault tolerance requires the logical drive(s) you select to be formatted as HPFS386.

Controller Duplexing

Controller duplexing is a feature of Microsoft LAN Manager fault tolerance, and with Microsoft LAN Manager Version 2.1, it is supported on both the COMPAQ Intelligent Drive Array and the COMPAQ Intelligent Array Expansion System. Controller duplexing duplicates data across two sets of drives using two disk controllers, and offers extra protection against a disk controller failure.

Appendix A
Case Study: Information Dissemination Using Lotus Notes

This case study provides you with an example of solving a real-world business problem using Lotus Notes. Like most business problems, there are several methods to achieve the desired solution. Many factors, both technical and business related, contribute to the final decision at a particular time. Therefore, as you read this case study, you might come up with an alternative solution for your needs. Still, you can benefit from this example by applying some of the principles, insights, and lessons in this case study to your particular implementation.

Project Overview

The basis for this study is experience at Compaq Computer Corporation in developing a tool for information dissemination. The project began when Compaq felt the need to provide a support mechanism to meet increased requests for information about complex environments. The industry echoed these sentiments. Consequently, management initiated the formation of a team to design and develop a means of providing timely technical information to a variety of audiences.

Today, a system of databases developed using Lotus Notes provide online reference information on configuring and performance tuning COMPAQ products in a variety of connectivity environments. Additionally, users can gain real-time access to trouble shooting tips and techniques, advanced technical information, product bulletins, press releases, and so on. They can also download software to trouble shoot or fix problems on-site.

The system uses security features of Lotus Notes to ensure that users can access only authorized information. For example, Compaq has developed Integration ToolKits, which are documents for configuring and optimizing COMPAQ products (servers and workstations) in different networking environments.

Forming a Project team

The project team consisted of a small group of individuals with the following skill sets:

■ Strong systems integration background and perspective

■ In-depth knowledge of existing and emerging technologies

■ Knowledge of networking principles, telecommunications, and systems management

■ Experience in database design and development

■ Knowledge of electronic data publishing guidelines, styles, and issues

■ User and customer oriented experience in service and support

■ Strong oral and written presentation skills

The balance of skill sets among the team proved to be an important factor in the timely completion of the project.

The project team first identified major system requirements:

■ Accessibility over a geographically distributed area, including international support

■ Database capabilities

■ Built-in security

■ Ability to download software

The project team made presentations of the requirements and overall milestones to several departments such as Systems Engineering, Sales, Marketing, Customer Support, and Information Systems. In addition, the team held discussions with Compaq field engineers and external audiences at a biannual forum sponsored by Compaq. These discussions confirmed the need for a production-level system within six months.

Gaining Approval

The presentations generated strong management support for the project. Throughout the early development phase, the team stressed five key system advantages:

■ Timely technical information

■ Access from anywhere in the world

■ Centralized point of delivery for advanced technical information

■ Ability to search Compaq databases and retrieve a solution to a customer problem

■ Ability to download patches, drivers, and utilities to fix a problem on-site

Additionally, after the final decision to use Lotus Notes as the implementation tool, the project team highlighted several of its important features at prototype demonstrations:

■ Database replication

■ Laptop access

■ Information import ability from multiple sources

The ability of the team to quickly develop prototypes had a positive impact on audience reaction for the choice of Lotus Notes.

The team discussed the coordination of the project with other groups involved in similar activities at Compaq. With the goal of announcing the online facility within six months, the team developed close working relationships with other departments, such as:

■ *Corporate Communications:* to develop manuals and promotional material

■ *Customer Service and Support:* to establish problem escalation procedures

■ *Information Systems:* to provide and coordinate telecommunication facilities

■ *International Systems Engineering:* to develop and coordinate international implementation

■ *Legal:* to resolve licensing and contractual issues

■ *Marketing:* to coordinate deliverables

■ *Training:* to develop training materials for system administrators, database designers and end-users

The project team worked in close cooperation with other departments to leverage existing resources and expertise from other teams. The level of cooperation the team received ensured the success of the project. Several factors contributed to getting this level of cooperation.

■ Shared expertise among teams and project team members

■ Experienced members knew whom to contact in other departments for support.

■ Team members presented early prototypes of the system in many different forums. The presentation focused on the plan for implementation:

❏ What information?

❏ Audience?

❏ How?

■ Strong support from upper management and direction from middle management got the project completed on time. Management commitment for ultimate choice of Lotus Notes was strong for several reasons:

❏ Experienced information system managers viewed Lotus Notes as a flexible and rapid application development tool to develop certain classes of business critical applications.

❏ The team demonstrated the ability to quickly develop applications by using existing templates for prototype databases.

❏ Many features of Lotus Notes, that is, database replication, laptop access, global connectivity to servers over the corporate network, and so on, were considered important for corporate-wide applications.

❏ Management recognized the importance of the role of Lotus Notes in the emerging groupware marketplace.

Information Gathering and Strategy Planning

Using feedback from the presentations and discussions, the team further refined the system requirements. They began by tabulating the information components, priorities, and existing distribution methods. Questionnaires and interviews with potential users helped the team to rank priorities based on timeliness and usefulness.

Most users felt that the most important requirement was the ability to download software to fix problems on-site. Although reference information available was useful, such as configuration and optimization information in the Integration ToolKits, users first wanted the available trouble shooting tools. The team then filtered the requirements based on priorities of the requested features and the feasibility of achieving them in the desired time frame of six months.

The team investigated two approaches for implementation. Plan A would host the data in a centralized location at headquarters. Plan B would distribute updates to regional centers and international subsidiaries for localized access.

The team identified advantages and disadvantages of both plans as shown in the table that follows.

Table 1-1
Comparison of Plan A and Plan B

| Plan A: Data Hosted at Headquarters | | Plan B: Updates Sent to the Regions | |
Advantages	Disadvantages	Advantages	Disadvantages
Simpler to manage	Ignores access methods for international users	In line with corporate strategy of supporting distributed applications	Reliable control and management of remote servers is a concern
Transmission costs incurred only for access to the server	Increased hardware and support costs for additional users	Supports international access	Increased hardware and support costs for additional servers
Reduced training costs	System is more susceptible to down time than Plan B	Added reliability of distributed processing	Additional cost of transmission of updates

After analysis, the team decided to explore Plan B, which seemed more in line with the Compaq strategy for distributed processing solutions and provided stronger international support. At the same, since manageability of remote servers and training costs for remote administrators and personnel was a concern, the team looked for solutions that would have the flexibility to combine the benefits of both plans.

System Features

The project team, by consensus, classified system features as "Required," "Desired," and "Non Critical," and then collated the features into four broad areas:

■ Compliance with corporate strategic direction

■ Database functionality

■ Communications functionality

■ System reliability

The team awarded solutions three points for each "Required" feature, two for each "Desired" feature, and one for each "Non-Critical" feature. The team did not award any points to a solution that lacked a feature.

The team considered various environments: Character based MS-DOS, MS-DOS with Microsoft Windows, MS OS/2, and SCO UNIX with X/Windows. Early in the investigation, the team eliminated the SCO UNIX solution because research indicated that the user base was primarily MS-DOS and MS OS/2 based.

The team also debated the need for a Graphical User Interface (GUI) front-end, with the consideration that a GUI would implicitly increase the minimum hardware requirements. Although research showed that potential users rated GUI as only preferable, but not critical, the team decided to keep an open mind on the subject. Some members believed that the market was moving swiftly toward GUIs, such as Windows, and that the debate would be irrelevant at the end of the implementation period.

The team spent some time identifying and researching products that met general requirements. Each team member collected information on two or three products, and the team held a number of meetings to go over the criteria. After rating each solution, the team applied the additional criteria of price and availability to compare the top choices. The table that follows summarizes the features that the team evaluated.

Table A-2 Features Ratings		
Required	**Desired**	**Non-Critical**
Compaq strategic direction:		
Reaction to Compaq priorities	Support for systems integration	
	Down-sizing support	
Database Functionality:		
Access control to data	Calls to external programs	Automatic user profiles
Query capabilities	Function key operation	Built-in billing features
Speed of search	Graphics	Integration with other front ends
Accuracy	Multiuser support	
Ease of data preparation/input	View large documents	
Reporting	Works with multiple servers	
Audit trail		
Stability of product		
WAN/Network compatible		
View query results		
Communications Functionality:		
Security	TCP/IP	
Reliability		
Supports large file transfers		
Complies with industry standards		
Asynchronous access		
X.25 support		
Event coordination		
Trouble shooting ease		
Remote management		
Works with different carriers		
LAN support		

The team compared the points earned by the products to each other, as well as with the "ideal" product. Those solutions that clearly fell short of the system requirements were quickly eliminated.

The team decided to eliminate a third-party mainframe-based solution when discussion revealed concern about the time needed to set up and maintain this solution. A few members had reservations about the security implications of third-party handling of confidential information. Some members expressed doubts about third-party response time to Compaq priorities. For example, although PC front-ends were available, certain functions would have to use a dumb terminal user interface for the mainframe solution. Some expressed concern about the time it might take to convert a friendlier interface. Finally, the team decided that an external mainframe solution did not fit in with the down-sizing philosophy Compaq was advocating to its customers.

After analysis, the team chose Lotus Notes for the following reasons:

■   Ease of data preparation and input

    The data existed in different formats. Lotus Notes had features that simplified import from native formats, such as Microsoft Word and Lotus AmiPro.

■   In-house expertise

    Members of the Integration Engineering group were familiar with Lotus Notes because of the Version 2.0 beta-testing on the COMPAQ SYSTEMPRO.

■   Availability of the product

    Lotus Notes had been shipping Version 1.1 of their product for more than a year. Some corporations had successfully deployed Lotus Notes in geographically dispersed regions.

■ Banyan VINES and Windows support direction

Although there are other networking environment LANs at Compaq, the company uses a Banyan VINES network for corporate-wide use. At the time of the project, the Banyan support being planned for Lotus Notes was an important factor, even though the only supported LAN environments were NetBIOS LANs.

NOTE: Today, Lotus Notes supports VINES as a native transport protocol. In addition, the beta version of Lotus Notes (Version 2.0) supported the Windows 3.0 environment.

■ Importance of systems integration

The project team viewed the project and Lotus Notes as an important application because of the systems integration focus on Compaq platforms. Most members considered the value of systems integration experience with Lotus Notes to be very important, even though the original analysis considered this to be a desirable, but not required feature.

The project team arranged prototype demonstrations to senior management and gained approval to adopt Lotus Notes as the implementation choice.

Pilot Implementation

Once Compaq chose Lotus Notes, the team moved quickly to begin a pilot implementation. The intent was to show proof of concept.

A team of potential end-users came to corporate headquarters for training on the kick-off date. They configured their individual laptop computers with Lotus Notes software and participated in a "hands-on" training session to solve test problems. Initially, the system had three databases, which are still a part of the system today. These databases provided users with the ability to download software to diagnose and fix problems on-site. Additionally the users had the ability to reference technical tips and techniques online.

The initial installation used Lotus Notes Version 1.1. The lab setup consisted of three servers. The primary server had two 9600-baud modems attached to its serial ports. Only one phone line would be considered essential for the initial level of traffic, but the team set up two lines as part of a cyclical rotary group from the local exchange carrier. This ensured the pilot group would get a busy signal less than one percent of the time. Although the server was located in a development lab, the team considered it to be a production-level unit and used it exclusively for data access.

For example, the team established maintenance procedures for backups and virus scans early in the implementation. Backup procedures ran every night, with progressive backups from Monday through Thursday, and a full backup on Friday. Tape rotation ensured a two-week window of backups. Virus scans ran every Friday before the backup. Most of these procedures are still carried out in their entirety.

The backup server was used for data input. This allowed the team to add and modify trial databases on the backup server without affecting the primary. Once the team approved a database design, the database designer would make a replicated copy on the primary server. The new database was then accessible by the pilot participants.

The test server was used exclusively for test purposes, such as testing new hardware (like multiport boards) or new software releases. This server also played a role in the maintenance of the network, as described later. The figure that follows illustrates the initial setup. The roles of these servers have survived to this day.
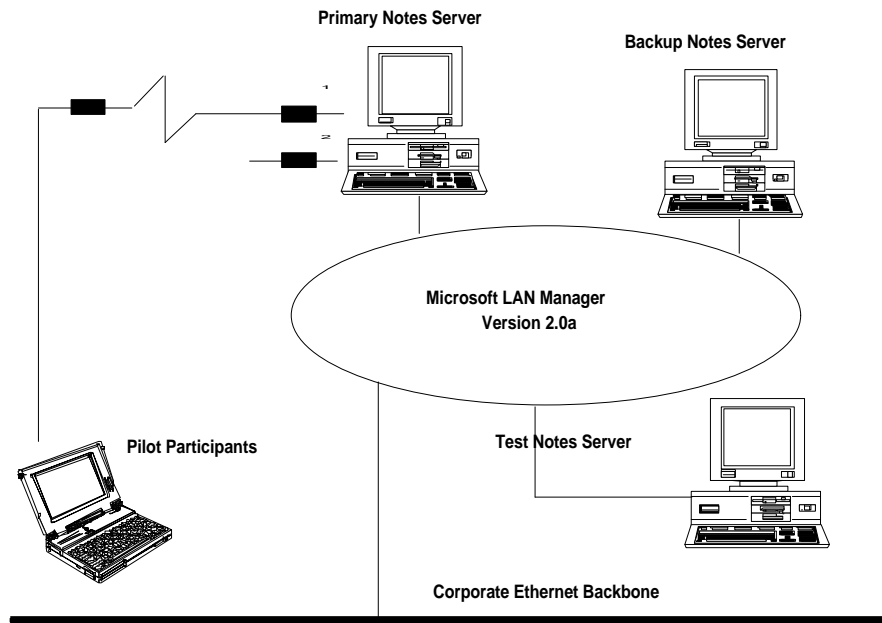
Figure A-1.   Pilot Network Setup

Microsoft LAN Manager Version 2.0a provided the base network operating system to connect the servers and workstations. As mentioned before, the only available options were NetBIOS-compatible LANs. The team chose Microsoft LAN Manager because the server setup shared lab space with the integration team for that network operating system. The integration team provided in-house assistance for network-related issues. The network topology was Ethernet, because team members wanted to connect to the lab servers from their offices using the wiring available throughout the building.

The server setup used several features of Microsoft LAN Manager. The primary Lotus Notes server was also a file server and served as the domain controller to validate any logon access. The test Lotus Notes server acted as a backup controller. Copies of the installation files on the file server enabled users to set up Lotus Notes directly over the network. A network replication feature allowed a copy of the entire Lotus Notes directory on the primary server to reside on a backup directory on the test server. Not only did this provide an extra level of backup, it allowed the test server to act as a standby and take on the role of the primary server, if required. The test server, rather than the backup server, played the standby role in the network because its background networking operations would not interfere with data input.

Initial Findings

Within a month of the pilot implementation, feedback from the participants and anticipation of system growth resulted in changes to the initial setup. The first change occurred early in the pilot.

Team members used their PCs connected to Lotus Notes servers through NetBIOS sessions under Windows 3.0. Because they also used these units for access to the corporate VINES network, the setup needed to run both protocols. Due to specific limitations with the network boards, the protocols could not run simultaneously. Team members had to reboot when switching from Banyan VINES to Microsoft LAN Manager, and vice-versa. This was not an optimal solution, especially when the next stage of the project involved campus-wide access.

Two solutions were possible: find a way for both protocols to coexist or implement the Lotus Notes support for Banyan VINES. Lotus Notes support for Banyan VINES required Version 2.0 and Banyan Version 4.10 or higher. However, the corporate network was based on an older revision of the Banyan network operating system at that time. Initially, network administrators hesitated to upgrade without rigorous testing, but after further discussion, the team and the network administrators decided to adopt the second approach. This was more in line with the long-term plan.

Two immediate changes resulted. First, the team converted all of the servers and clients to a beta release of Lotus Notes, Version 2.0. The change had to be total, since the project team felt that there were would be too many scheduling difficulties when mixing both versions of Lotus Notes. Fortunately, with a small number of test users, the total change was not too difficult.

Second, the network administrators agreed to upgrade selected parts of the corporate network to minimize the impact of the new revision of Banyan VINES. On the server side, a mixture of Microsoft LAN Manager-based Lotus Notes servers, Banyan VINES-based servers, and dual protocol servers allowed access from a variety of client protocols. This exercise provided the team with an understanding of setting up and managing a mixed protocol network of Lotus Notes servers.

NOTE: Today, better solutions for running multiple protocol stacks on one board are available. Many manufacturers and network vendors support mechanisms to load multiple protocol stacks.

The next finding involved dial-up access. Originally, the participants had a Direct Inward Dial (DID) number to connect to the servers. This posed a problem for those users who wanted to avoid the personal or customer site long distance charges to the server.

Attempts to use credit card access to the server failed in both the auto-dial and manual-dial cases. In the auto-dial case, modems must be capable of buffering greater than 40 characters. The large buffer allows the connection record in Lotus Notes to store the entire credit card authorization sequence. Older modems typically have a 40 character buffer limit, which is not adequate for auto-dial. In the manual-dial case, Lotus Notes Version 2.0 fixed a timing issue noticed with the previous version.

Expanding the facility beyond the pilot forced the team to consider other alternatives for remote access, as the following table shows.

Table A-3
Remote Access Alternatives (Lotus Notes Version 1.x, 2.x)

Method	Advantages	Disadvantages
Direct Inward Dial (DID)	Easy to use and implement	Long distance costs borne by the user. Need large modem buffers to allow auto-dial support for credit card access. Credit card method is required when the user is on the road.
800 number access	Easy to use and implement	Encourages abuse by users and hackers. Potential high cost.
900 number access	Overcomes 800 number problems.	Customer sites can block 900 number calls. Low acceptance for 900 numbers.
800 number dial-back	Increases security and reduces hacker abuse.	Users usually not in a fixed location. No support in Lotus Notes for providing a call back number. Cost (including maintenance and auditing).
Distributed Lotus Notes servers in metropolitan areas to provide local phone call access.	Simplifies access to local phone call	Initial cost Remote maintenance
X.25/X.29 PAD access	Added security features of X.25. Detailed usage and billing possible from the provider. Local phone calls for access. Very popular internationally.	Reduced availability of high speed dial-in bps rates Calls restricted to inbound only (dial out of a network is difficult. However, this is not a requirement for Lotus Notes). Not supported by Lotus Notes during the implementation period.

The team selected the direct-dial option, because of the precedent set with similar bulletin boards. The team believed that most users would view the long-distance charges as the normal cost of doing business. For a long term solution, the team held discussions with some Value-Added Network (VAN) vendors to investigate packet switched access. However, without support in the existing version of Lotus Notes for dialing out to a PAD for access, these discussions were unproductive.

Input from the pilot participants resulted in other changes, as well. First, they confirmed that 2400 baud is too slow for communications involving graphics. The team decided that the minimum acceptable configuration would be 2400 baud with compression features. A 9600-baud modem was a far better choice. On the basis of these decisions, the team decided to invest in a bank of high-speed modems capable of a variety of speeds, compression, and error correction methods. The team declined to adopt a modem-pooling alternative, specifically because existing Lotus Notes documentation showed that the server did not support such arrangements.

The high-speed modems were not only rack-mountable, but they also had a very important feature: a hardware switch generated a busy signal to the local exchange carrier to cause a call to rotor over to the next modem in the hunt group. This feature was invaluable when taking down a modem for maintenance, because it did not impact service to the other ports.

The next change was to expand the initial set of three databases to sixteen. This was a direct result of feedback from the pilot participants. The participants felt that we needed to expand the original set of databases to add overall value, that is, with limited information available through Lotus Notes, the users felt that they would not have any incentive to use the system. At their suggestion, the team added databases providing Integration ToolKit information, technical reference material, and pre-sales information. The flexibility of Lotus Notes to incorporate various sources of data proved to be a valuable asset in expanding the system without significant impact on the project delivery schedule.

Feedback from the participants also drove changes in the database design. Extensive use of the DocLink feature of Lotus Notes helped users to quickly move from one piece of related information to another without spending too much time searching for items over a modem. The team also optimized the location of databases on the Lotus Notes desktop to facilitate searches. In addition, a "What's New" database highlighted recent additions to the system.

The Project Evolves

The next phase of the project called for a systems test. The goal was a functional system to stress-test the entire system with Compaq employees and selected external audiences. The team intended to exercise all components of the system: connectivity to the servers, accessibility and ease of use of the data, and trouble-escalation procedures.

The team increased capacity on the primary server with a modem bank and a multiport board. They tested the databases for appropriateness of design, which included direct help from Lotus Development Corporation. Several Compaq field engineers began to use the system. At the same time, the team enabled access for the first non-Compaq employees.

The next steps involved the eventual transition of the servers to a 7-day, 24-hour machine-room environment. These plans included setting up Lotus Notes to work with Microsoft LAN Manager and TCP/IP software from 3COM. TCP/IP is important for routing to work properly over the corporate network of routers. Although some servers were on a Banyan VINES network, the team decided to leave the dial-in access servers on the Microsoft LAN Manager network. Reasons for this decision included:

■   A Microsoft LAN Manager file server and a Lotus Notes server can coexist in the same unit. Though this setup can have a minor impact on performance, it has the advantage of being self-contained. The file server services allows an administrator to remotely administer the Lotus Notes server using standard LAN Manager procedures. With a Banyan implementation, the Lotus Notes server would have to be an MS OS/2 workstation that could not share its files across the network.

■   Banyan support was new to Lotus Notes. There was a comfort-level in going ahead with a mature implementation, that is, Microsoft LAN Manager for servers with external exposure.

■   Some operations and management personnel expressed concern about connectivity between the corporate network and any servers meant for access by non-Compaq employees.

The following figure illustrates this process and the current server setup:
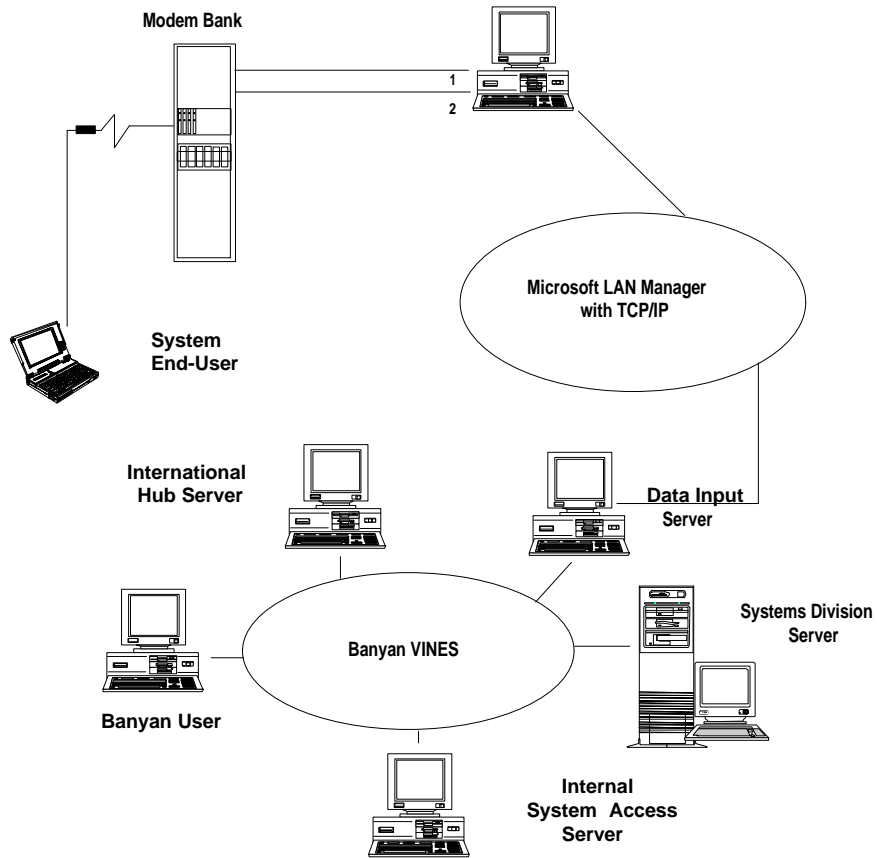
Figure A-2. Network Setup for System Test

The team enhanced the system in several other areas. The project team helped to develop a user's manual for installation and access. The training department developed a computer-based tutorial. A special licensing agreement with Lotus enabled Compaq to license copies of the client-software with a COMPAQ installation program that pre-configured the desktop with the databases. The Lotus Notes software and COMPAQ installation program were released with part numbers, for duplication and inclusion in the binder with the manual.

The team organized the databases into five logical areas on the screen:

■ What's New database that gives the history of changes, additions, and announcements

■ Online help database (actually an online version of the user's manual)

■ Four Integration ToolKits (Banyan, Novell, Microsoft, and SCO)

■ Problem solutions area (Patches, Drivers, & Utilities, Technical Reference Notes, Service Communiqués, Version Information, and Quick Reference Guide)

■ Technical reference and general information area (Application Notes, Product Bulletins, Technical Communiqués, Solution Stories)

With these modifications, the initial stages were complete. The team was ready to announce the project. After coordination among the project team, Marketing and Public Relations, the announcement finally took place approximately six months after the team began its work.

The project needed further refinements, even after the announcement. The original team had to transfer various responsibilities and functions to other departments. A transition team took over this task. This team included representation from many departments. The transition team began to identify major responsibilities for each area.

Representatives from different areas throughout Compaq contributed input to ensure that the change to a production-level system was as smooth as possible. The transition team:

■   Developed and collected documentation on database design

■   Publishing activities:

 ❑   Systems implementation and operations

 ❑   ID administration

 ❑   Problem escalation procedures

■   Installed a new set of servers and hardware in a computer room environment

■   Set up the hardware and planned for a cut-over date

■   Met weekly to review status

Over the next several weeks, the team helped to transition responsibilities and functions to the appropriate areas within Compaq. The activities of the transition team included planning, documentation, and training. The final task of the cut over to a production level system took place approximately a year after the project started. The change was transparent to end-users because of careful planning and coordination.

Going International

A team from International Systems Engineering was responsible for the international implementation. This group was involved with the project from the early stages. After the domestic system converted to Lotus Notes Version 2.0, the international team obtained the international version and set up a few test sites in parallel with the domestic implementation efforts.

A critical factor in the success of the international implementation was the ability of the international team to identify administrators in different subsidiaries and countries around the world, train them, and set up their servers. The ISE team pre-configured most of the international servers at corporate headquarters, loaded the setup on tapes, and shipped them to the respective champions. In this way, new Lotus Notes servers were up and running with a minimum of long-distance trouble shooting. Munich became the European hub, since it serves as the Compaq European headquarters. In the Pacific Rim, Australia became the first to come on-board with Singapore and Japan following.

The biggest technical challenge of the international implementation was determining the replication method. Some countries were satisfied with weekly updates of the data on tape. Most countries initially chose online replication with modems. Unfortunately, reliably connecting various brands of international modems proved to be an obstacle. Finally, the team leveraged the globally-connected Banyan VINES corporate network to replicate all the international servers.

Overall Project Findings

The team at Compaq gained valuable knowledge during the development
cycle of this project.

■   Strong upper level management commitment is critical to the success
     of groupware technology such as Lotus Notes.

     The importance of upper-level management commitment cannot be
     emphasized enough. It is natural for organizations to balk at the initial
     investment for groupware. The role of upper management is to evaluate the
     benefits of increased productivity, decreased development time, and so on.
     Once the costs are justifiable, support from all levels is necessary to ensure
     successful implementation and return on investment.

     Compaq commitment from upper management for the project was strong,
     because of the strategic need to build an online repository of technical
     reference and problem solving information. Additionally, Lotus Notes
     generated strong support because experienced information system managers
     viewed it as a flexible and rapid application development tool. They
     considered many features of Lotus Notes, such as database replication, laptop
     access, and global connectivity as important.

■   Plan to standardize, standardize, standardize.

This point is easy to ignore with an interactive and flexible product like Lotus Notes. Often, people read the manuals, experiment with a few templates, and soon have an application up and running. That is the easy part. The problem arises when the same persons want to share this information with other groups. Without established corporate standards, it is equally easy for other individuals to achieve their overall goal through different routes, causing confusion. This is true for both database design and systems administration. Unless an organization checks this trend early in the implementation, it can be expensive. Often, administrators must reestablish standards at all levels (application templates, access control lists, data formats, and so on), at the cost of lost productivity and user frustration.

At Compaq, we found that interest within the corporation for Lotus Notes grew rapidly as the deployment of the project progressed. We quickly realized the importance of working through a series of steps in fine-tuning our administrative standards to developing a framework that suits the needs of users, developers, and administrators. This effort has been one of the critical success factors in fielding a suite of Lotus Notes applications world-wide.

■   Be positioned to manage growth.

Our experience with the rapid growth rate of Lotus Notes corporate-wide parallels that of the published case studies of some other organizations. Developing standards early is one way to structure growth. Other factors that an organization must consider are:

❏   How will the existing infrastructure of network and server management, new development, trouble-reporting, support, and training be utilized?

❏   What are the critical components, both hardware and software?

❏   What is the impact of failure?

As the project history shows, a team can anticipate major issues in deploying Lotus Notes. Understanding these issues early is critical in developing corporate-wide Lotus Notes applications.

■ Develop a well-balanced corporate team to coordinate implementation.

Although Lotus Notes applications can be developed, implemented, and modified more rapidly than with traditional development tools, the success of the overall system implementation hinges on following the established *systems approach.* This means allocating sufficient time for requirements analysis, planning and design, training, testing, and so on.

You must choose a group of individuals with broad spectrum of skill sets who can successfully implement a large scale system. In this respect, Lotus Notes is no different that developing other corporate wide projects. Additionally, because electronic group interaction is an integral part of Lotus Notes, you must be sure to include on your team, persons with the appropriate background in organizing and presenting information effectively. These persons are key individuals for performing a thorough user requirements analysis.

The ability of the project team members to leverage each others expertise, as well as to draw upon the resources and skills of other groups within the corporation proved to be a critical element in the rapid deployment of the project.

■ Where possible, identify and train localized or regional administrators with prior networking experience.

The global implementation of the project would not have been possible without the support of key individuals at the subsidiaries. The international team included individuals who closely cooperated on both sides of the Atlantic in Houston and Munich. These individuals identified and trained the appropriate personnel, helped in the setup of the servers, and coordinated local support from international Lotus offices.

■ Provide end-user training.

In addition to training systems administrators and database designers, it is important to provide end-user training both on effectively using Lotus Notes as well as your particular application. This is particularly true for the implementation of your first application, that is, when your users have no prior exposure with Lotus Notes. On the basis of our experience at Compaq, end-user training has the following benefits:

❏ Your users become more effective in using the system, and thereby increase their productivity.

❏ As they quickly familiarize themselves with the system, they can provide you with early feedback to improve your system.

❏ Training minimizes potential user frustration, and consequently, increases usage of your system.

❏ Training reduces support calls.

■ Address the speed of access issue.

Experience shows that for acceptable performance, users strongly prefer 9600-baud modems over 2400-baud modems with compression. Though Lotus Notes' client-server technology minimizes traffic across a phone line, online GUI search applications involve much interaction, including graphics. Therefore, the traffic pattern is sometimes comparable to text-based systems over a low-speed line. While the modems on our servers can connect at high speeds, most users still only have 2400-baud modems; some without compression. Continually finding ways to improve the speed of remote access remains an important consideration of our corporate implementation of Lotus Notes.

■ Provide local access.

Though long-distance charges are not always limiting, feedback suggests that our users now expect to be able to access data either locally (on a LAN) or with a local phone call.

Conclusion

In conclusion, it is important to differentiate between our experience with Lotus Notes as an application development platform and the project itself.

The corporate experience with Lotus Notes has been positive. This project gave visibility to Lotus Notes within the corporation. As it gained more exposure, the demand for this technology and the number of applications increased significantly and rapidly. Other groups, particularly those involved with corporate information services, started to consider Lotus Notes for certain classes of critical business applications. We used our experience with this project to successfully implement Lotus Notes applications world-wide in several areas throughout our organization.

With our implementation of Lotus Notes corporate-wide, we have the ability to create and distribute information in one tool. This eliminates the time-consuming task of translating information among multiple tools and reduces development time and paper work. Our world-wide corporate network facilitates our ability to share and access information anytime, anywhere. Additionally, because of the nature of the databases, we have the flexibility to share subsets or combinations of information with the mix of audiences we support. We have used this flexibility to support a variety of applications that include interaction with both Compaq and non-Compaq audiences.

During the project implementation, we gained valuable knowledge through the findings discussed earlier. Primarily, we realized the importance of standards and training, and meeting user expectations. The dial-up speed of access remains an important issue to our remotely connected users. The best solutions available today are providing high-speed modems at both the server and the clients, and optimizing the databases for dial-up access (for example, minimizing reindexing, reducing the number of graphics and figures that must transmit across a phone line, and so on).

In summary, we feel that while Lotus Notes is a good choice as a groupware tool, it needs to incorporate more features for database development, systems management and remote access before you can fully use it as a truly distributed application development platform. We are looking toward newer releases of Lotus Notes to address requirements such as full-text search capabilities, enhanced capabilities for server monitoring, and value added network access.

Appendix B
Planning for Dial-In Access

This chapter provides the analyst with some techniques to estimate the server resources required to support dial-in users. The techniques involve a discussion of queuing theory principles. Therefore, a background in mathematics is helpful in understanding the information that follows. Either use this information in detail as a reference, or browse through it to understand overall methodology.

Determining the Number of Dial-In Ports Per Server

You can model any system with dial-in ports in queuing theory terms as a *loss* system. In such a system, when users try to access the server and find the system busy, they must go away and return later. Users are *lost* to the system because there is no queue to hold them until they find a free port.

A typical design goal is to define a *Class of Service*, that is, some mathematical quantity to measure the level of service provided. In the case of a dial-in server, you must answer the question, "How many busy signals are acceptable?" In theory, you would require an infinite number of ports to ensure that no one ever gets a busy signal. This is not practical. Therefore, you must make a tradeoff between system capacity and an acceptable level of busy signals. On the basis of common usage, you can define *Class of Service* as "95 percent success in gaining access to the system." Mathematically, this is

Probability (Busy signal) <= 0.05

Mathematicians and systems analysts have studied this probability in queuing theory terms and have documented it for some of the most common mathematical models of real-world systems. Intuitively, this probability is a function of:

- The arrival rate of the users

- The service completion rate (how long they stay on the system)

- The number of available ports

Queuing theory refers to the ratio of the service completion rate to the arrival rate as the *utilization ratio*. A queuing system faces more stress as the value of this ratio increases. To provide a given *Class of Service* for a specific utilization ratio, a dial-in system requires a minimum number of ports. Mathematically, if λ is the expected number of user arrivals per unit time, and μ is the expected number of service completions per unit time per port, the utilization ratio is given by λ/μ where:

$$\frac{1}{\text{Average (Interarrival times)}}$$

and

$$\frac{1}{\text{Average (Service completions)}}$$

Inter-arrival times are measured time intervals between consecutive arrivals of users. For example, if you stood at the entrance of a queue at a bank and clocked the arrival time of customers, the inter-arrival times would be the time differences between the arrival of the first customer to the second, from the second to the third, and so on.

Service completion times are the times necessary to complete a transaction, and includes the time the user spends in the queue. Using the bank example above, the service completion time would be the amount spent by a customer waiting in the queue, plus the time spent at the teller window. The dial-in server is a special case where there is no queue, and consequently no waiting time.

Typical analyses of queuing systems assume exponentially distributed inter-arrival times and service completion times. Mathematicians often refer to the exponential distribution as the *M* or *Memoryless* distribution. This arises from the fact that any event (such as the arrival of a user) is not dependent upon a previous event.

Analysts refer to the dial-in type of queuing system as an M/M/m *loss* system, where *M* denotes exponentially distributed inter-arrival and service completion times and *m* is the number of ports. For such a system, you can calculate the probability of a busy signal using Erlang's formula.

$$P(busy) = \frac{\left(\frac{I}{m}\right)^n / n!}{\sum_{i=0}^{m} \left(\frac{I}{m}\right)^i / i!} \quad n = m$$

Figure B-1 plots the probability of a busy signal at utilization ratios of 1, 2, and 3. In addition, the plot for a utilization ratio of 2.2 illustrates a typical system with *average* utilization.
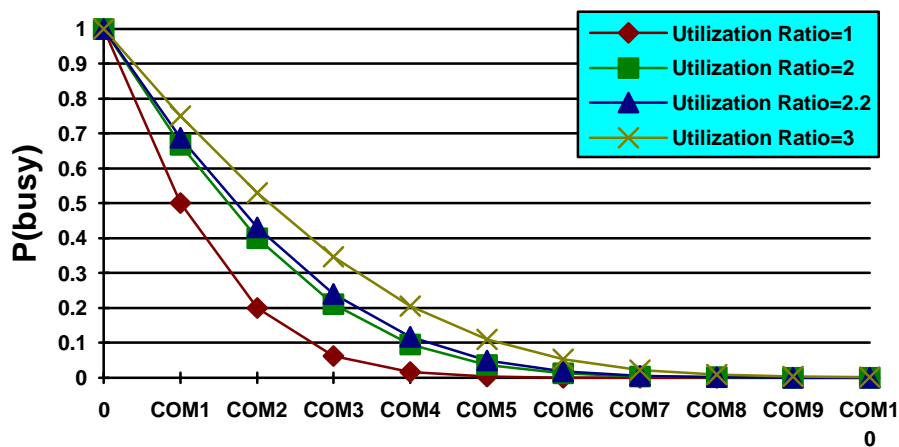
Figure B-1. Probability of a Busy Signal

Figure B-1 shows that for a traffic level defined by a utilization ratio of 2.2, the number of ports required for a 95 percent success rate is five (COM5). This is where a line drawn at P(busy) = 0.05 intersects the curve for a utilization ratio of 2.2.

How do you determine the utilization ratio in practice? Reviewing the definition, utilization ratio is

$$\frac{l}{m} = \frac{\frac{1}{\text{Average (Interarrival times)}}}{\frac{1}{\text{Average (Service completions)}}} = \frac{\text{Average (Service completions)}}{\text{Average (Inter arrivaltimes)}}$$

Therefore, to compute this ratio you must determine the average values of the service completion times and the inter-arrival times. You can either do this subjectively or experimentally. Initially, you must estimate these values because you do not have an actual system in place to measure them experimentally.

For example, if you estimate the expected system usage to be 10 minutes at a time, the call length duration is the average service completion time. Similarly, if you estimate that the expected number of calls per hour is four, the inter-arrival time estimate is 15 minutes. The utilization ratio is then

$$- = \frac{\text{Average (Service completions)}}{\text{Average (Interarrival times)}} = \frac{10 \text{minutes}}{15 \text{minutes}} = 0.66$$

If you refer to Figure B-1, notice that this is less than the probability curve for a utilization ratio of one, and therefore you need a system with only three COM ports.

Once the system is in use for some time, you can take actual measurements to determine the average values and apply them to the model above. You can use this technique to justify increasing system capacity (such as adding more COM ports or additional servers) based on actual usage.

Estimating the Average Values After Measurement

Once you have implemented your system and it has reached some kind of *steady state,* that is, you have not significantly added any new users, it is possible for you to compute the average values from measurements.

The log file *(LOG.NSF)* on a dial-in Lotus Notes server provides the measurements you need. The view titled "Phone Calls" provides you with incoming call detail. Lotus Notes records every connection to the server in the log file with a time stamp and the call duration. The call duration is the same as the service completion time. Computing the inter-arrival time involves extra calculation, as shown by the following.

Suppose you have three calls with time stamps as shown in Table B-1.

Table B-1
Computing Inter-Arrival Times

Caller	Start Time	Inter-arrival time
Caller 1	10:00:00 am	
		00:01:02
Caller 2	10:01:02 am	
		00:00:03
Caller 3	10:01:05 am	

The inter-arrival time between Caller 1 and Caller 2 is one minute, two seconds. The inter-arrival time between Caller 2 and Caller 3 is just three seconds.

NOTE: A recommended method for performing such analysis is to export the log file contents to either a spreadsheet or a database program. You can then perform the analysis and computations offline. These programs offer greater flexibility in manipulating the data.

After these calculations, you have a series of numbers representing service completions and inter-arrival times. Before manipulating this data further, you must filter out calls made during off-peak hours. The best way to determine the peak versus off-peak hours is to graph the number of calls during a 24 hour period as shown in Figure B-2.
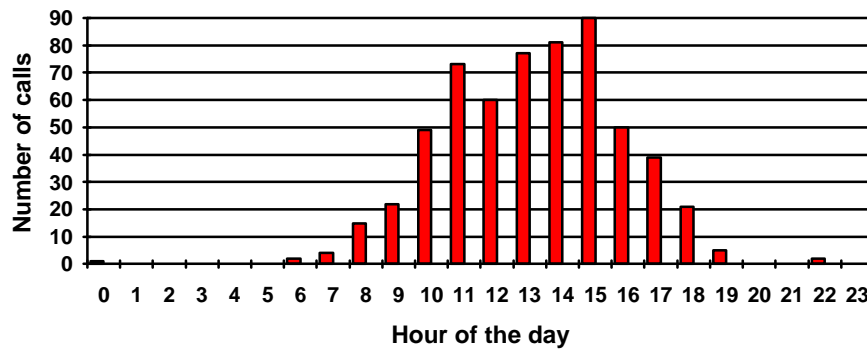
Figure B-2.   Distribution of Calls During a 24 Hour Period

As Figure B-2 shows, the number of calls starts to rise around 8:00 am and tapers off around 8:00 p.m. You can consider this window of time to be the peak-time. Any calls outside this window are off-peak. To get good results, it is important that you analyze trends over a period of time. For example, you might observe the peak-hour trends over a daily, weekly, and monthly basis to get an accurate idea of peak-time period. Calls to a server from users across different time zones will have a broader peak-time window when compared to calls from users in a single time zone.

After you have filtered out calls in the off-peak period, you can collect the remaining inter-arrival times and the service times into frequency histograms. The actual data values and common sense will dictate the interval you must use to set up the histograms. For example, setting up one minute intervals is not appropriate, if the data shows that the call lengths range from ten minutes to an hour. Figure B-3 shows a sample histogram of inter-arrival times.
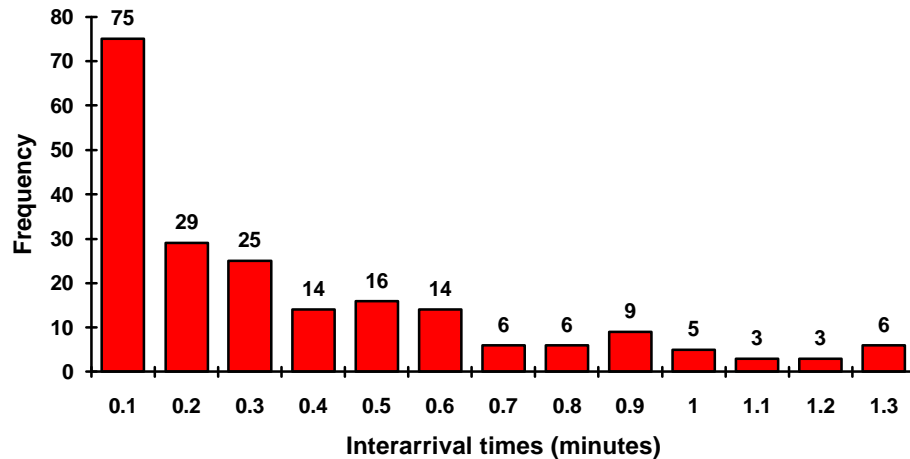
Figure B-3. Sample Histogram of Inter-Arrival Times

As the histogram shows, the inter-arrival times appear to be exponentially distributed. You can now use the method of moments to approximate the parameter of the distribution:

Given x = 0.33 (i.e., average of 3 calls / minute)

You have $\theta = 0.33$, where x is an estimate of the average, and θ is the actual parameter.

You can now use a Chi-square (χ^2) goodness of fit test to check the hypotheses:

H_0: f(t) = 3 e^{-3t} for t > 0

        = 0   otherwise

H_1: not H_0

The Chi-Square test passes, meaning that you can assume that the inter-arrival time distribution is exponential with a rate of three calls per minute. You can perform similar analysis to estimate the service time distribution and apply the results in the calculation of the utilization ratio. Once you know the utilization ratio, you can plot the probability P(busy) to determine the number of COM ports you need for your current traffic level.

Determining the Number of Ports for a Specified Number of Users

Another important question is, "What is the number of ports required for X users?," where X can be any number such as 50, 100, or 500 users. Intuitively this depends upon traffic, but the exact relationship is not always obvious. Fortunately, analysis of probability provides a solution. This is illustrated by an example.

Suppose you are the analyst at a hypothetical organization called Major Accounts Corporation. This corporation has a sales force of 150 people who need to dial up a Lotus Notes server to track account status. Your sales personnel spend their time both on the road (70 percent) and at their regional office (30 percent). When a sales person is on the road, there is a two percent chance for that person to access your system every hour. This percentage is four percent from the regional office to update records and browse through new account status.

You can express these percentages in probability terms as:

P(access | on the road) = 0.02

P(access | at the office) = 0.04

Since the events of being on the road or at the office are mutually exclusive, the overall probability of access is:

P(access) =

P(access|on the road) x P(on the road) + P(access|at the office) x
P(at the office) =

0.02 x 0.7 + 0.04 x 0.3 = .026, or 2.6%.

Mathematicians have proved that if the arrival of calls at a server constitutes a Poisson process, the corresponding inter-arrival times are exponentially distributed. Consequently, the assumption of exponentially distributed inter-arrival times in Erlang's formula implies that calls to the server can be represented by a Poisson distribution.

The Poisson distribution is actually a limiting form of a binomial distribution where the number of trials *(n)* tends to a large value, the probability of success *(p)* tends to zero and the product $n \times p$ remains constant. The binomial probability law applies to events that have a binary outcome: either *success* or *failure*. Each experiment, that is, measuring if the event is a success or a failure, is referred to as a trial.

If you define access to the system as a *success,* the probability of failure is 1 - P (access) or .974. This is for one sales person's activity. Therefore for 150 people (*n* trials), you can calculate the expected number of calls per hour by using the formula for the mean of the binomial probability:

Mean = Number of trails x P(success) =150 x .026 = 3.9 calls/hour

This is approximately four calls per hour. If you assume that the typical call lasts for ten minutes, you can use the previous analysis technique to calculate that your utilization ratio is 0.66. For this traffic level, you require three ports. However, the basis for this requirement is the fact that you needed to round up the minimum number of ports to the nearest integer value. As Figure B-1 shows, you can increase the utilization ratio from 0.66 to 1, and still keep the required number of ports at the same level (three ports).

Increasing the utilization ratio to one is the same as increasing the number of calls per hour to six, assuming that the call length remains the same at ten minutes per call. This translates to a user population of approximately 231 people. As this illustrates, the relationship between calls/hour and number of people is not linear. The calls per hour increased from 4 to 6 (50 percent), yet the number of people increased from 150 to 231 (54 percent).

Given existing traffic patterns, you can support a maximum of 231 people with three COM ports. Any further increase in traffic or number of users necessitates adding additional capacity to maintain the same *Class of Service* (95 percent availability). This example shows you how to plan for growth. It is not necessary to add additional ports until you get close to the threshold of 231 users.

The Value of Analysis

Why would you want to perform this kind of analysis? The answer is simple: cost reduction and optimization.

Suppose you were told by a consultant that you require a port for every 50 users (this is the same as the initial estimate of three ports for a group of 150 users in the previous example). If you now plan to roll out the system to 500 people, the initial reaction might be that you need 500/50 or ten ports. However, by applying the analysis, you can see that the number of calls per hour would be:

500 x 0.026 = 13 calls/hour

Therefore, the expected value of inter-arrival time is 4.6 minutes, which results in a utilization ratio of approximately 2.2. Even with this increase in the utilization ratio, Figure B-1 shows that to maintain your *Class of Service,* you would need only five ports, or a savings of 50 percent over the initial estimate. If you assume a cost per port of $1,500 (including hardware, software and maintenance), you have just saved $7,500.

Appendix C
Decision Making Under Uncertainty

The information below provides some insights into decision making under uncertainty. Often, a Lotus Notes implementation involves a substantial initial investment. Yet, the desired results are not always guaranteed. How do you, the analyst, make the appropriate decision?

The techniques involve a discussion of operations research principles. Therefore, a background in mathematics is helpful in understanding the information that follows. You can either use this information in detail as a reference, or you can browse through it to understand overall methodology.

Decision Making

Often, the implementation decision must occur prior to a deadline set by your management to achieve specific business goals. Various business factors such as competitive pressures may cause your management to accelerate the desired time frame to achieve these goals. Usually, there are two choices: increase investment in the existing system or implement a new strategy such as Lotus Notes. For either alternative, the consequences can be uncertain. Which alternative is your best investment when the outcome is unknown? Determining the answer is the challenge of decision making under uncertainty.

As a result of studies in the public sector by systems analysts, decision makers and engineers, you can apply techniques developed by these studies to the analysis of a large-scale implementation of Lotus Notes.

Consider the example where you are the systems analyst of a hypothetical organization called the Major Accounts Corporation. This corporation has subsidiaries and regional offices throughout North America, Europe, and the Asia-Pacific region. Your management (at Major Accounts Corporation) must decrease the time taken to generate a world-wide account status report. The existing procedures require a lot of coordination. Because there are time zone differences, and some sites are in remote locations, it takes up to eight working days to generate this report. From a competitive perspective, the ideal time for this report is two working days. However, a turn-around time of six working days is satisfactory.

You look at a proposal to implement the account tracking system using Lotus Notes. Your alternative is to explore ways to improve the existing system with better training and modifications to the in-house mail package. Each alternative has the following set of possible outcomes: productivity may increase, decrease, or remain the same.

After initial investigation, you determine that the cost of implementing Lotus Notes will be \$400,000. Due to your unfamiliarity with this product and its appropriateness to the system, you associate an amount of uncertainty with Lotus Notes. You represent this uncertainty by the three hypothesis shown in the table that follows.

Table C-1
Uncertainty Represented in Hypothesis

H_1:	The "advantageous" hypothesis	Lotus Notes will increase productivity to improve account tracking.	Probability that H_1 is true = 0.8
H_2	The "no change" hypothesis	Lotus Notes will not have any impact on account tracking.	Probability that H_2 is true = 0.15
H_3	The "harmful" hypothesis	Lotus Notes will cause productivity to decrease.	Probability that H_3 is true = 0.05

Additionally, you are not sure about the outcome for *either* alternative. Regardless of which alternative you choose, productivity may increase, stay the same, or decrease. Each of these outcomes has some probability of coming true.

Is the $400,000 a wise investment? To answer this question, you might perform the following analytical steps:

Step 1: Build a Decision Tree

Summarize your choices with the decision tree shown in the figure that follows.
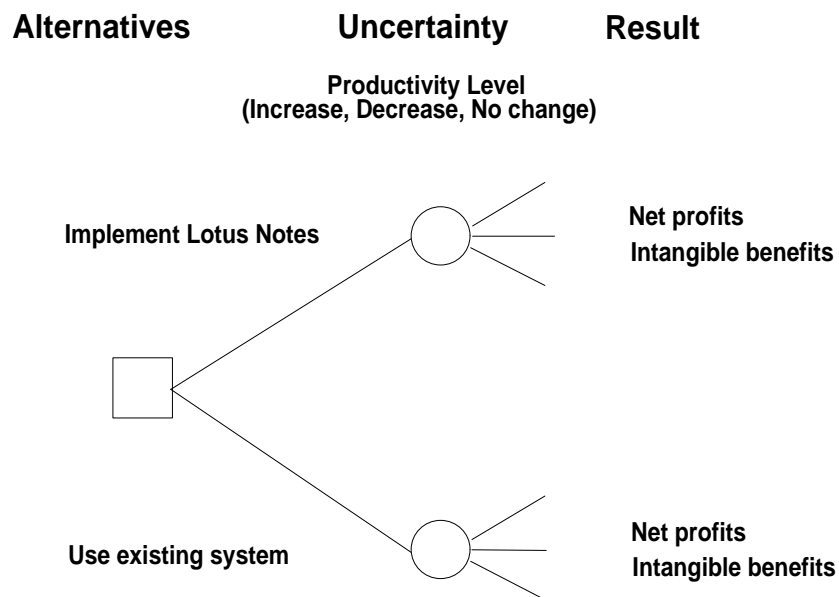
Figure C-1. Decision Tree

The decision tree uses a square to depict a decision node (where a set of choices must be made) and a circle to depict a probabilistic node (where each outcome has a probability of coming true).

Step 2: Assign Probabilities to the Probabilistic Nodes

Because the outcome for either alternative is uncertain, you must assign a probability to each outcome. You may assign these probabilities either subjectively, objectively, or experimentally.

For your analysis, you define a 25 percent increase in productivity to be equivalent to reducing the time to generate the account report from eight working days to six working days. To assist in your analysis of probabilities, you might seek the opinions of your colleagues and other analysts in similar situations. To identify the probabilities, you can use the following notation.

$P(O_1)$ = Probability of Outcome 1, that is, productivity increases by 25 percent.

$P(O_2)$ = Probability of Outcome 2, that is, productivity remains the same.

$P(O_3)$ = Probability of Outcome 3, that is, productivity decreases by 25 percent.

NOTE: Outcomes are quantified with a specific value, such as a productivity increase of 25 percent.

After discussion, you assign probabilities as shown in the matrix below. The probabilities follow the usual mathematical notation, that is, $P(A|B)$ reads as "Probability of A given B has occurred."

$$
\begin{bmatrix}
P(O_1|H_1) & P(O_2|H_1) & P(O_3|H_1) \\
P(O_1|H_2) & P(O_2|H_2) & P(O_3|H_2) \\
P(O_1|H_3) & P(O_2|H_3) & P(O_3|H_3)
\end{bmatrix}
=
\begin{bmatrix}
0.9 & 0.08 & .02 \\
.05 & .7 & .25 \\
.05 & .22 & .73
\end{bmatrix}
$$

For example, the matrix shows that $P(O_1|H_1) = 0.9$. In other words, the probability of Outcome 1 (productivity increases by 25 percent) coming true, given that Hypothesis 1 (Lotus Notes will increase productivity) is also true, is 0.9. This is the same as a 90 percent chance of success.

You can now compute the individual probabilities of $P(O_1)$, $P(O_2)$, and $P(O_3)$ by using the formula:

$$P(O_i) = \sum_{j=1}^{3} P(O_i | H_j) \times P(O_j) \quad \text{for } i = 1, 2, 3$$

which results in

$$\left[P(O_3) \right] \quad \left[.1095 \right] \quad \text{for the Lotus Notes}$$

implementation

Because of your familiarity with the existing system, you do not associate any uncertainty with it. You can directly assign probabilities for the three possible outcomes as shown:

$$\left[P(O_3) \right] \quad \left[.15 \right] \quad \text{for the existing system}$$

Step 3: Estimate the Value of the Outcomes

Once you assign the probabilities, you must estimate the expected profits (in dollar amounts) of the three outcomes. The table that follows illustrates possible estimated values:

Table C-2
Estimated Values of the Outcomes

Outcome	Profits	Rationale
Outcome 1: Productivity increases by 25%	$1500K	Increased productivity boosts profits
Outcome 2: Productivity remains the same	$700K	Expected profits at existing productivity levels
Outcome 3: Productivity decreases by 25%	$150K	Minimum expected profit levels

NOTE: The profit estimates depend only on the outcomes, not the alternative chosen to achieve them. In Outcome 3, the $150,000 represents the minimum expected profits, despite the decrease in productivity.

Step 4: Evaluate the Decision Tree

Knowing the probabilities and the estimated profits, you can evaluate the nodes of the tree as shown in the figure above. The formula shown below calculates the results at a probabilistic node.

$$\text{Expected Value} = \sum_{i=1}^{n} P(O_i) \times \text{Expected Value for } O_i$$

Using this formula, the expected value at the probabilistic node for the Lotus Notes implementation is:

$1500K x 0.733 + $700K x 0.1575 + $150K x 0.1095 = $1226.175K.

However, you must subtract the cost of implementing Lotus Notes, that is, $400,000 to get the net expected value of $826.175K. Using a similar calculation, you can calculate the net expected value for the existing system to be $657.5K. In this case, your recommended alternative to your management at Major Accounts Corporation is to implement Lotus Notes.

NOTE: In this calculation, you have ignored intangible benefits.

Alternatives	Uncertainty Productivity Level	Result
Implement Notes $826.175K	Increases 0.7333	$1500K
	No change 0.1575	$700K
	Decreases 0.1095	$150K
Use existing system $657.5K	Increases 0.05	$1500K
	No change 0.8	$700K
	Decreases 0.15	$150K
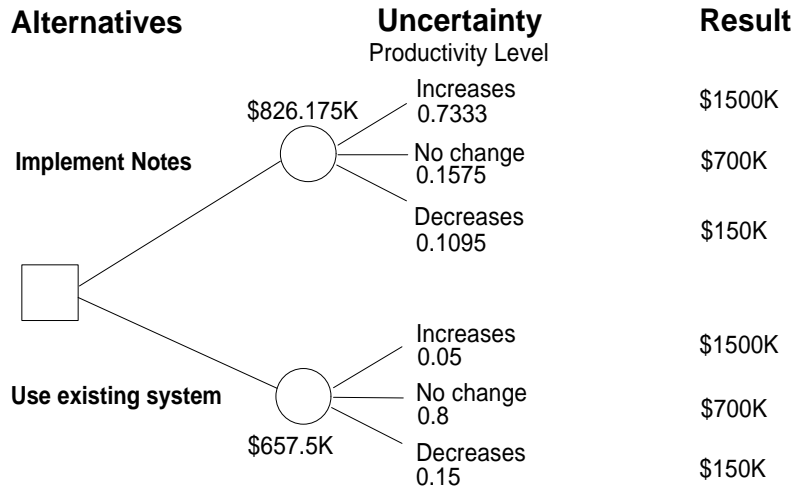
Figure A-2. Evaluation of the Decision Tree

You can also calculate the benefits to costs' ratio. The net benefits (between the two alternatives) are \$826.175K - \$657.5K. The net implementation costs are \$400,000 assuming that the cost of improving the existing system is negligible. Therefore, the benefits to costs ratio is:

$$\frac{\text{Benefits}}{\text{Costs}} = \frac{\$826.175 - \$657.5}{\$400}K = 0.42$$

In making the decision to implement Lotus Notes, management at Major Accounts Corporation must consider this ratio to be acceptable in return for the reduction in the report generation time.

Step 5: Calculate the Value of the Intangibles

So far, your analysis covered only the tangible benefits, that is, expected profits. However, consider the possible *value* of intangible benefits. Even though intangible benefits are by definition immeasurable, place a *value* on them by assigning them a percentage value based on the expected profits.

For example, you decide that when productivity increases by 25 percent after the Lotus Notes implementation, the *value* of intangible benefits enhanced corporate reputation and value of experience with Lotus Notes by 30 percent of the net profits. However, if productivity does not increase you do not gain the benefits of enhanced corporate reputation. You still might gain a benefit from the knowledge of Lotus Notes (possibly to design a different application), so you estimate a *value* of five percent of the net profits. The table that follows shows these estimates:

Table C-3
Estimated Percentage - Value of Intangible Benefits

Outcome	Intangible Benefits (as a % if Net Profits)	Value	Rationale
Productivity increases by 25%	30% of \$1500K	\$450K	Increased prestige plus value of experience
Productivity remains the same	5% of \$700K	\$35K	Value of experience alone
Productivity decreases by 25%	0% of \$150K	\$0K	Decrease in productivity nullifies everything else

You decide that there are no intangible benefits, by improving the existing system (since you are not implementing anything new). On the basis of these estimates, you can evaluate the decision tree by including intangible benefits, as the figure that follows illustrates.

Alternatives	Uncertainty	Result
	Productivity Level	

Implement Notes
$1161.537K

Increases 0.7333 — $1500K +$450K
No change 0.1575 — $700K +$35K
Decreases 0.1095 — $150K

Use existing system
$657.5K

$657.5K

Increases 0.05 — $1500K
No change 0.8 — $700K
Decreases 0.15 — $150K
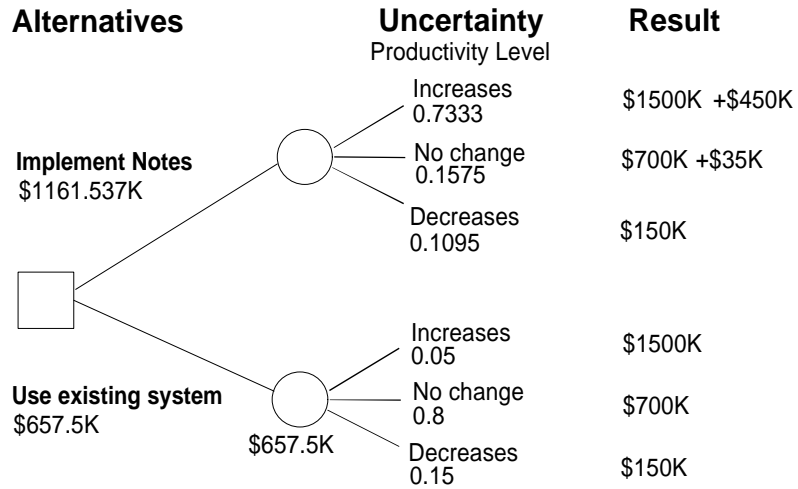
Figure A-3.   Evaluation of the Decision Tree (with Intangible Benefits)

Once again, the better alternative is to implement Lotus Notes. However, it is important to note the value of the intangible benefits. By comparing the calculations before and after incorporating the intangible benefits, you have:

Value of intangible benefits = $1161.5375K - $826.175K, that is, $335.3625K

As before, a benefit cost analysis yields:

$$\frac{\text{Benefits}}{\text{Costs}} = \frac{\$1161.5375 - \$657.5}{\$400}K = 1.26$$

As this analysis shows, intangible benefits play an important role in the decision making. When they are factored into the analysis, the benefit cost ratio goes up from 0.42 to 1.26. The total benefits go up from $826.175K to $1161.5375K or an increase of 40 percent.

Determining the Value of Information

In many cases, decision makers seek additional information to help reduce their uncertainty. This might be in the form of hiring a consultant or conducting a pilot test. In either case, getting more information means additional cost. The decision maker must weigh the value of information against the expected result.

For example, suppose that the management of Major Accounts Corporation wants to hire a consultant who guarantees to predict with 100 percent accuracy, exactly which hypothesis (H_1, H_2 or H_3) will come true. You, as the analyst, must make a recommendation on the value of hiring this consultant.

Even though you cannot predict what the consultant's answer will be, you can assign probabilities to his predictions. These probabilities are identical to the ones you assigned to hypothesis H_1, H_2 and H_3, assuming that you think that the consultant will exactly agree with your estimates. As before, you construct a decision tree as illustrated in the following figure.

Alternatives   **Uncertainty**   **Result**

Productivity Level

Increases
0.9 $1500K

$992.5K

No change
0.05 $700K

Notes

Decreases
0.05 $150K

H1
P(H1)=0.8

$657.5K

Increases
0.08 $1500K

$243K

No change
0.7 $700K

Notes

Decreases
0.22 $150K

H2
P(H2)=0.15

$657.5K

Get
Information

Increases
0.02 $1500K

(85.5K)

No change
0.25 $700K

Notes

Decreases
0.73 $150K

H3
P(H3)=0.05

$657.5K

Don't Get
Information

Increases
0.7333 $1500K

$826.175K

No change
0.25 $700K

Notes

Decreases
0.73 $150K

$657.5K

Figure C-4.   Determining the Value of Information (Hiring a Consultant)

As before, you subtract the amount of $400,000 when evaluating the net expected outcome. You can summarize the preferred outcomes as illustrated by the dotted lines in the Figure C-4.

■ If H_1 is true, implement Lotus Notes for an expected net outcome of $992.5K.

■ If H_2 is true, use the existing system for an outcome of $657.5K.

■ If H_3 is true, use the existing system for an outcome of $657.5K.

The expected outcome, assuming that management obtains the information is:

$992.5K x 0.8 + $657.5K x 0.15 + $657.5K x 0.05 = $925.5K

Without the information, the outcome is as before, $826.175K. Therefore, the value of the information is:

$925.5K-$826.175K = 99.325K.

This gives you an idea of how much to recommend to management to pay the consultant.

Fine Tuning the Analysis

The example with Major Accounts Corporation illustrates the analysis technique of making decisions under uncertainty. Yet, there are a number of subjective judgments that you must make. Usually, you start with a range of values. The decision making process involves repeating the steps with different values to determine when you would recommend a different alternative. In other words, at some crossover point you prefer a new alternative.

NOTE: Decision theory refers to this process as determining the *utility function.* The utility function refers to the risk averse or risk prone nature of the decision maker.

To illustrate utility functions, consider a situation where you are faced with choosing between two lotteries. In lottery *A*, you have an equally likely probability of winning $100 or getting $0. In lottery *B*, you have a guaranteed outcome of $50. Although the expected outcome is the same for both lotteries, that is, $50. If you are risk averse like most people, you prefer lottery *B*. If the probabilities of lottery *A* are such that the odds of winning are higher than 50 percent, at some point you tend towards choosing lottery *A*.

To fine tune your analysis, you must reevaluate your recommended alternative by incorporating an estimated range of values into your analysis. For example, if the probability of hypothesis H_1 coming true changes from 0.9 to 0.8, what would be your preferred alternative? What would it be if this probability changes to 0.7? Even after changing the probability value, if your analysis still points to the Lotus Notes implementation as your preferred alternative, you can be confident that your analysis is valid despite variation in your assumptions.

Index

A

Administrative requirements   5-3

B

Backup strategy
    designing and executing for LAN
        Manager   24-1
    fault tolerance   12-3
    tape drive options,
        recommendations   24-1
Backup strategy, defining   12-1
Backup strategy, tape backup   12-1
Business perspective, defined   1-2

C

COMPAQ 32-Bit Server
    Manager/R Board
    components   23-2
    dedicated processor   23-2
    integrated modem   23-2
    NiCd battery   23-2
    support software and   23-3
COMPAQ modems
    Enhanced 2400-bps Internal
        Modem, using   14-7
    Enhanced 9600-bps Internal
        Modem, using   14-8
    support, about   14-7

COMPAQ products
    network client recommendations   7-3
    PORTABLE client
        recommendations   7-4
    server recommendations   7-1
COMPAQ Server Manager
    Collector/R, defined   23-3
COMPAQ Server Manager
    Facility/R, defined   23-3
COMPAQ Server Manager/R
    alert messages and   23-4
    benefits   23-5
    illustrated   23-1
    monitoring tool, system
        management   23-1
    other Compaq monitoring tools
        and   23-6
    Remote Console feature and   23-4
    remote server management   7-2
    SMC and   23-3
    SMF and   23-3
    system management, COMPAQ
        EISA-based computer
        systems   23-1
    system management, COMPAQ
        EISA-based PCs   23-1
COMPAQ SYSTEMPRO, security
    features   9-2
Connection records
    mail routing   11-1
    replication   11-1
    setting up   11-1