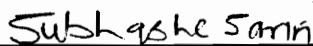# An Infrastructure for Integrated Document Management

by

Mandhir Chadha

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Master of Engineering

in
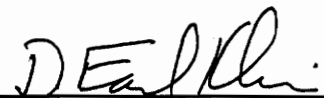
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(Abstract)

In any industrial environment, information flow and control can greatly influence the efficiency of the enterprise. While the technology to create and transfer these electronic documents has been developed, little has been done towards the management of these functions. Advanced networks and file manager systems allow distributed access and control but fail to provide a measure of discipline of how these documents should be categorized and manipulated.

No matter what the level of technology involved, in order to truly integrate an enterprise, all documentation and information flow must be controlled and monitored. Existing document control systems are either customized for a particular industry or are too proprietary for common use. A generic and flexible document management system would not only be useful in the manufacturing function of the enterprise but would also help integrate it with the business

function on a macro level. Such a system should also allow users to exchange data with other users in a simple manner. This would help promote the integration of engineering teams as complete workgroups would be able to share data and information in an integrated fashion.

In some cases, where a high degree of automation is required and possible, several intelligent applications should be able to share and transfer data autonomously without the intervention of human operators. Further, since the philosophy of information control is not limited to the bounds of the manufacturing realm, the same system could be used in a non-manufacturing environment as well.

This projects presents a flexible and modular infrastructure to allow distributed information sharing and application integration. A software system, built for the Windows environment on PC's is provided to demonstrate the utility and capabilities of this infrastructure. A prototype autonomous module has also been included in this work to demonstrate the ability to plug in and integrate similar independent software applications under the developed software system. This prototype provides a template for future development of similar applications based on the developed infrastructure and software system. The software system uses shared directories to achieve distributed data management.

<u>Acknowledgments</u>

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1.0 Introduction and Project Objectives

1.1 The Need for Information Integration

Global competition and instant communication have brought about a renaissance in manufacturing. Along with a thrust to integrate all aspects of a business using computer technology, there is a need for shorter product life cycles and a greater emphasis on project management. The emphasis is therefore on efficiency and the integration of all functions in an enterprise to improve results. This is the drive behind most large companies that implement information technology (IT).

Information technology pertains to all aspects of a business, not just areas that deal with manufacturing. It includes business and production planning, plant operations, research and development, finance and accounting, sales and marketing, and administration. It addresses the total information requirements of the company from the development of a business plan to the shipment of a product and follow up support to a customer. It should be remembered however that the eventual objective of information technology is not total automation or integration but the running of a profitable business.

Information technology is one of the primary building blocks of Computer

Integrated Manufacturing, a fundamental requirement of which is a model to support the life cycle of the product. Product models first gained acceptance in the context of international efforts to develop a neutral format for the transfer of product data between computer aided systems that is capable of representing product data for all sectors of engineering as well as all aspects of the life cycle.[3]

Currently, much work has been done to integrate pockets of computer aided activity as there is a consensus that the real benefits of an enterprise of automation technology will be truly achieved only then. This integration implies the integration of the organization's information and its flow. Tremendous advancements in information technology have led to a new approach to manufacturing.

Recently, there has been much interest in systems that promote and allow whole workgroups to share and work on common data. Software systems like Lotus Notes are versatile at collecting unstructured data like text, documents, images and multimedia and providing group level access. The success of Notes has attracted several software companies to join the groupware bandwagon. Pro - Engineer, for example, provides a completely integrated environment for

Figure 1. An Information Flow Network for a Manufacturing Environment

design engineers working in a team. Different aspects of the part design can be carried out by several engineers even simultaneously while the system keeps track of data inconsistencies and misfits. Engineers can view the entire design or work individually from remote workstations in a collective environment. Pro - Engineer does not come cheap. A single license can cost as much as $25,000. While the implementations and applications differ, such systems share the ability to flatten information hierarchies by automating information acquisition and distribution.

Increasingly complex and uncertain manufacturing environments require the development of information processing systems that are capable of providing the flexibility and pliability that industry needs to survive in highly competitive world markets. Unfortunately, traditional system development approaches tend to create highly inflexible and unreliable systems that are inappropriate in situations where requirements cannot be predicted or where requirements are subject to rapid and constant change.

An example of information flow in a manufacturing environment is shown in Figure 1. It illustrates how an enterprise can be subdivided into functions with the information flow represented as the flow between these functions. Also clearly evident from the figure are the differences in responsibilities of the functions shown. For example, the central portion of the figure represents the

hard-core manufacturing aspects, the top portion represents the accounting and/or clerical aspects and the bottom portion, forecasting and other managerial responsibilities. The darker flow lines represent heavy information flows, while the dotted lines represent the occasional ones. Similarly, the darker nodes represent heavy information traffic areas in comparison to the nodes depicted in a lighter shade. It is important to understand that the figure does not represent an ideal flow of information within a manufacturing environment. Rather it provides one example of the flow in an organization. Realistically, information can usually flow from every possible source of information to every possible destination in an organization, making the flow pattern a mesh of interconnected nodes. Keeping this in mind, an integrated system should allow information to be sent or received from any user within the enterprise.

1.2 Information Integration Concerns

The need to integrate information flow has never been greater. Information is now considered the most important asset of an organization. With the concepts of client server technology, electronic information is easily available in a distributed environment. Developers are creating software that allows information to be routed through a list of recipients in a specified order. Products that allow multiple users to operate on the same document or CAD drawing are also gaining popularity.

Advancements in information technology have led to the development of several powerful products for PC platforms. The approach taken to design these systems has been rather different from the traditional one that suggests that the system be designed keeping current information requirements in mind. Attention is now being focused on developing flexible infrastructure that allow enhancements or modifications to previously developed systems in a simple manner. This is made possible by using an object oriented development paradigm and by incorporating flexibility and modularity into the system design. Although it might appear that flexibility increases the development cost of the system, yet time and time again it has been found that information costs rise with the degree of product individualization. It is important that a careful analysis of the information flows within an enterprise and its environment, of the relation of information, flexibility, corresponding system structures and costs be made prior to the design phase. This is because the characteristics of information and corresponding tools define the structures of the system and the overall costs. The structure of the information processing system is a crucial factor of success and must be flexible enough to cope with organizational flexibility.

While much has been achieved in the area of information sharing, little has changed in the means available for information management. Tools to promote personal and distributed file management would go a long way in

promoting information integration. Again, flexibility remains the primary design issue for these tools. Products should be able to adapt to the user rather that the user having to adapt to the product.

Another area of information technology that promises rich rewards is the development of an information highway for autonomous applications. These applications have the capability of listening for messages or commands over the network and carrying out the appropriate tasks without human intervention. For example, each time a new forecasting model is generated, an autonomous optimization module can process the relevant information and return the result to the required personnel. The possibilities are indeed endless as any application would be capable of activating any other application, and sending it appropriate commands. One can imagine that somewhere in the future, it will be possible for completely autonomous software packages to operate in an integrated fashion.

1.3 Project Objectives

It is the objective of this project to provide an infrastructure for integrated document management. A software system will be developed to demonstrate the power and utility of personal and distributed file management, information routing and autonomous application integration. Flexibility in its design will help to reduce the need for subsequent changes, while modularity will help to make necessary changes simple. A prototype application capable of autonomous

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operation will also be developed to demonstrate the ability to integrate independent remote application modules. This prototype will also provide a programmers template for the future development of autonomous modules.

While there are several software packages that conceptually provide the functionality to share information, they do little towards distributed file management, and information routing. More importantly, none of the current systems provide the means to connect autonomous applications in an integrated fashion.

1.4 Summary of Contents

Chapter two provides background information on information systems, electronic documentation, document management and Work Flow, as well as some current trends and products within the information technology industry. The problem addressed in this report is also defined clearly. A detailed list of requirements for the software system to be developed based on the proposed infrastructure is also given.

Chapter three presents several state-of-the art concepts of information technology. These include Client Server, Work Flow, Document Management, and Background Processing.   It also presents issues related to the design considerations for the software system.

Chapter four identifies the various components of the software system

and describes the various functionalities it provides. It also explains the means by which information can be shared in a distributed environment and how the developed software system provides the desired functionalities.

The prototype autonomous application is discussed in chapter five while chapter six presents possible enhancements, future considerations and conclusions.

2.0 Background, Trends and Problem Definition

2.1 Background Information

2.1.1 Information System Failures

Historically, it appears that failure rather than success is the outcome of information system implementation in industry[5]. From the findings to date, the most significant problem with these systems is their lack of flexibility. Adapting to changes in manufacturing strategy, new information requirements and integration with intelligent stand- alone modules prove to be the main problem areas. The key to full exploitation of such systems does not lie in the implementation of a particular system but in the development of flexible infrastructures within which the system can easily respond to change[1].

2.1.2 Current Distribution of Information Processing

Almost every manufacturing company employs a number of computer based applications. Unfortunately, due to the myriad of suppliers, most of these applications are unable to communicate with each other. One of the objectives of Computer Integrated Manufacturing (CIM), has been to eliminate these 'islands of automation'. Standards have helped to reduce the problem of

integration to some degree but more work is needed on this front. Even after most of the difficulties of physical interconnection between different host computers have been overcome by networking strategies utilizing Manufacturing Automation Protocol (MAP), inter-working of applications and of file/data transfer between proprietary distributed databases proves to be a substantial problem. Where companies have been able to integrate functions, typically in design, engineering and production, it has been accomplished using two or more disparate databases, usually provided by a single vendor. Few vendors are able to provide integration beyond traditional manufacturing system applications, to other business systems. The answer to many of these problems would appear to lie in developing a means to transfer information between different applications, usually over a network, in an integrated fashion.

2.1.3 Information Processing Infrastructures

Manufacturing infrastructures can be defined as the "controls, procedures, systems and communications combined with the attitudes, experience and skill of the people involved"[8]. Alternatively, they can be defined as the policies, procedure and organization by which manufacturing accomplishes its work, specifically production and inventory control systems, cost and quality control systems, work force management policies and organizational structure[6].

The development of infrastructures that address the computing, informational, technical and organizational factors in an integrated manner would provide flexibility and adaptability to the system. The infrastructure would also facilitate the continual evolution of the system as the organizational needs change.

The implications on the design of information systems are revolutionary. Traditional methods involving the specification of the design of the system are questioned because of the difficulty of defining the requirements when the requirements are highly dynamic. The focus of attention must therefore be directed at ensuring that the means are available for coping with a variety of potential demands on the system. This can only be achieved through the development of an appropriate flexible infrastructure.

Such an infrastructure should allow changes in the way information is input into the system, processed and then outputted. It should provide a simple means to achieve the desired results, allowing for future changes in the system. An information system built using such an infrastructure could be modified or upgraded using a systematic procedure. The keyword remains flexibility. Though frequently used as a selling slogan, much current information technology software still eludes the concepts of flexibility.
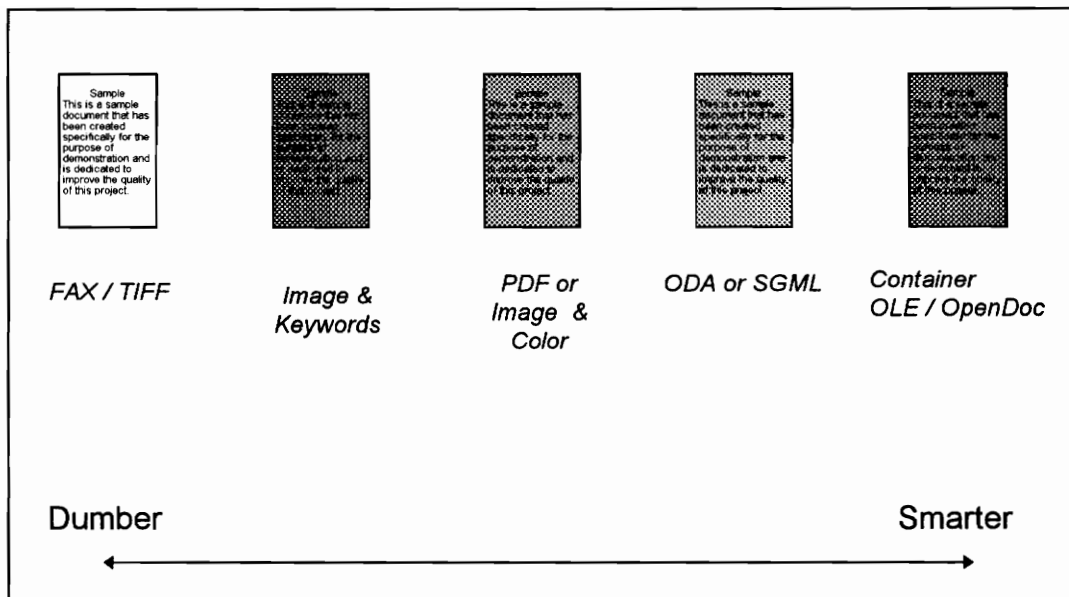
Figure 2. Spectrum of Document Types [7]

2.1.4 Electronic Documentation

It is estimated that 98 percent of business computer users use word processing software on their personal computers[7]. Further, according to Frank Gilbane, editor of the Gilbane report on "Open Information And Document Systems", at least eighty percent of corporate electronic information is in the form of electronic documents.

These documents are not merely the electronic equivalent of traditional paper documents. Modern systems allow objects like graphics, audio and even

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video segments to be embedded or linked into the structure of the document. Examples of such technologies are Microsoft's Dynamic Data Exchange (DDE), Object Linking and Embedding (OLE, pronounced O-lay) and the OpenDoc standard from Apple and IBM. These provide Windows applications the capability of sharing data across applications and instances of applications. For example a spreadsheet created using Microsoft's EXCEL can be imbedded into a document created using Microsoft Word. Simply clicking on the spreadsheet that appears in the documents activates the application it was created in. Figure 2 provides a spectrum of document types and illustrates the range of intelligence that can be imbedded into a document.

2.1.4.1 Benefits of Electronic Documentation

Electronic documents provide several additional functionalities that are difficult and sometimes impossible using paper. These include the following.

- *Built in intelligence.*

  Documents can contain information about their origin and identity as well as the knowledge required to render, duplicate and manipulate them. These functionalities would help save valuable time and resource.

- *Quick and easy distributed access.*

  With electronic documents being stored on a server, immediate

access to any number of clients is theoretically possible. This is made possible due to the advances in networking and client server technology.

- *Automatic routing (Work Flow).*

  Documents can be made intelligent enough to be aware of their identity and final destination. Documents that follow the set path through the enterprise can be electronically routed, automating the transfer procedure and reducing delays and problems.

- *Data duplication and redundancy checks.*

  Duplicity is a serious problem with paper documents. For example, It is possible for obsolete versions of a CAD drawing to exist and be used. Documents that change constantly or unexpectedly are more susceptible to this.

- *Enterprise workgroup document creation and editing.*

  Recent technological advances have made it possible for entire workgroups to create or modify electronic documents simultaneously. For example, Pro Engineer, a CAD system developed and marketed by Parametric Technologies, makes it possible for an entire team of engineers to work on the same design from different locations. Several word processor systems

also allow the same flexibility and functionality.

- *Increased security checking.*

    It is possible to have advanced security checks built into documents. These checks would make it next to impossible for unauthorized personnel to gain access to a document.

- *Cheaper backup and storage.*

    The costs of storing or backing up a large number of documents in the paper medium can be substantial. Moreover, paper documents have a limited life after which they have to be reproduced. Though many people are more comfortable with using the paper medium for archiving their documents, the reliability of electronic documents has gone up tremendously.

2.1.5 Document Management

Document management has received much attention in the past few years. This technology deals with the management of 'documents' within an organization and has already been implemented at various levels of complexity in most organizations. The definition of what qualifies as a document is not clear. The most suitable definition for a document would seem to be 'any information used for the process of decision making, report writing or archiving.'

In its simplest form, document management can be performed using

paper documents, folders and file cabinets. This is the system that has been practiced for many years now. In its most complex form, electronic documents completely replace paper documents. 'Electronic Document Management Systems' (EDMS) can be defined as systems that organize document production, manage storage, manage access and oversee document flow. Such a system allows a user to search for a document based on keywords associated with that document. Though these systems traditionally supported text based documents, many new products are beginning to support alternate (unstructured) information like fax, voice and even video. Frequently, document management systems manage documents within the structure of a document database or file hierarchy. Correctly implemented, EDMS enable workgroups to function independently but in concert with the overall expectations of the enterprise.

2.1.5.1 EDMS and Work Flow

People in discrete parts manufacturing easily understand entities that move through the system. Sub-assemblies, machines, people and resources are all tangible things that can be touched and felt and are constituents of all manufacturing facilities. It is however less clear to see why document management is important for the operation of a manufacturing facility. It has been observed that industries are finally beginning to treat their documentation

as a resource. In this age of electronic documents that permit multiple accesses to various aspects of the same manufactured part, it becomes of paramount importance that discrete parts manufacturing people understand the concepts of electronic document management.

Increasingly, vendors are producing tools to automate the flow of information within an enterprise. In many business work groups, certain activities always follow a set routing procedure. That routing may be administrative - for example, the filing of a raw material request. The concept of Work Flow allows the management of the sequence of tasks, responsibilities, and events that often revolve around a document. It can automate the flow of the document according to a predetermined route for action, review, approval etc. In addition, it can streamline tasks by allowing for parallel processing, in which more than one person can act on the same document. The concept of Work Flow is analogous to the concept of project management, only applied to documents. It is understandable that the philosophical similarities between discrete parts manufacturing, work flow and electronic document management make it relatively simple for manufacturing personnel to grasp its concepts with ease. It is a concept that helps bring about concurrent engineering approach to documentation.

The relationship between electronic document management systems and

Work Flow is of both an umbrella and a subset nature. Practically, today organizations are adding Work Flow as an integral component of many document management systems.

2.1.5.2 Document Management Concerns

There are several software tools to electronically create and send information electronically over networks. These range from simple E- Mail systems to more advanced office management systems that attach documents to a folder and electronically forward it to the desired destination. While these tools successfully address the issues of document transfer they do little towards their management. Further, tools to route information in workgroups are only just emerging.

There is only going to be an increase in the use of electronic documentation as time goes by. The explosion of electronic documents has already spilled onto servers and information networks like the Internet. It is a common fact that average users have trouble with creating directories and arranging electronic folders, much less remembering where they placed their files. Awkward file naming conventions like the 8.3 filename allowed by DOS only serve to make matters worse. It is common to find that companies find it difficult to track intellectual assets like memos, letters and documents while they have no problem tracking their corporate assets. Indeed the need for powerful

document management tools has never been greater[7].

2.1.6 Business Process Re-Engineering and Groupware

Corporations are also embracing business process re-engineering (BPR) to streamline corporate practices. The combination of revamped processes and advanced technology has created a large market for groupware applications. These products enable collaborative computing, in which geographically and functionally dispersed users can share information and work as a team. Concurrent engineering, in which similar disparate users create products in parallel, and Work Flow systems also fall within the boundaries of collaborative computing.

Technically, groupware can provide varied types of information across platforms to users within varied lines of business - a tall order, considering today's heterogeneous computing environments. Culturally, groupware provides all users equal access to information. This enables it to flatten the corporate hierarchies that exist in many companies today. Some of the benefits that can be achieved due to this are given below.

- Managers are able to concentrate on running their business; they can automate information access, allowing any user to 'plug in' to the requisite data.

- Businesses can enhance the quality of information to promote

accurate and timely business decisions.

- Users at remote locations can gain and share information, so workgroups can be formed based on functionality desired irrespective of the geographic limitations that so often preclude team building.

2.1.6.1 Potential Benefits of Groupware

On a system level, groupware products demand resources. The move to client server environments is all the rage, but many companies are finding out that it costs money to make the appropriate changeover in the required software and hardware systems. Further from an administrative perspective, the prospect of thousands of byte-laden documents jamming up the local area network (LAN) is not an appealing one.

On a more personal level, there will always remain individuals that cannot function to their fullest capacity in a team environment. It will be most difficult for these individuals to make the changeover to groupware products.

Even with these negatives, the groupware market is expected to blossom into a multi billion dollar business. There are four prime reasons for this expectation.

- *Process Re-Engineering:* Groupware products effectively automate re-engineered procedures. Work Flow applications and document

management systems enable users to make decisions based on the latest information, in any format.

- *Time - Based competition:* Companies that can work faster and smarter than the competition can deliver products and services more quickly and will always remain successful. A corporation that has eliminated information delivery hierarchies will find itself in a stronger position in comparison to one that has not.

- *Concentration on core competencies:* Streamlining companies are forced to out source some functions. Collaborative technology allows a company to concentrate on its core business and easily share information with external partners.

  Becoming a learning organization: Companies are realizing that in order for them to be successful, they must foster creativity. Executives must collaborate with employees to keep communication channels open so that the company can quickly adapt to change through the rapid, automatic dissemination of information and results.

Documents can be defined as objects created by personnel to control the processes that turn resources into products or services. These objects also serve as repositories of information from a variety of information sources and

storage media. Much of this information is not in a format suited to the task requirements of a specific process. It must be either translated and will usually require the skills of an individual. These objects help guide personnel in their tasks and are usually the result of information gathering and synthesis.

The control for initiation, operation, completion of processes as well as the regulation of acquisition of resources, is provided by documents. They also represent the time based flow of resources through processes to create products or services. By looking at how documents progress, it is possible to identify locations where they get queued up for unreasonable periods, where processes are overloaded and if the processes are adequate. This scenario is very similar to the viewpoint of discrete parts manufacturing. It follows then that document flow might be considered as an assembly of documents that must all be present before the document flow can continue [4].

A document management system is not just responsible for CAD drawings but the associated documents and product data. It also manages the process data necessary to drive the Work Flow environment. To accomplish this, it must manage data associated with application files and the links needed to initiate those applications as part of a process routing. It must manage the authorization lists not just to access data, but also to applications that process and generate data.

2.2 Types of Data

The form of data within the product model falls into two main categories. The first category is used by people and the second by software and machines. As the software must be aware of the form of data which it will use, the structure of this data must be fixed in the product model. The data used by people on the other hand is typically on a higher level of abstraction and may be changed to suit individual needs. Such data structures will be defined in terms of the fixed data structures.

Data can be further classified to be product specific, company specific or reference data. Product specific data is data which applies to a specific and single product. An example of this type of data would be the geometry of a product. Company specific data applies to more than one product. An example of this would be the manufacturing processes used to make the product. Standard material properties are an example of reference data. No matter what the type of data, it is clear that in order to provide the desired flexibility, the infrastructure should allow for the transport of any kind of information.

2.3 Current Trends and Products In Industry

It appears that in the past, many industries used systems that were specially designed for them, rather than off the shelf systems. One reason for this was that no single product appeared to provide the functionality that was

needed. Even the more powerful systems from IBM and AT&T were inflexible and more than often, the company would end up adapting their functioning to the design and structure of the information system being used. Further, most systems required large and expensive mainframe computers to operate. However, with the advancements in information technology and computer hardware, much generalized software for information sharing and transfer is being developed by independent vendors for both personal computers and workstations.

2.3.1 Microsoft Mail [11]

Microsoft Mail 3.2 for PC networks is the current version of the full implementation of MS Mail. This software provides the ability to send mail with attachments to other users on the system. User E-mail accounts are maintained in a group of files that are collectively called the postoffice. All files belonging to the postoffice are stored in sub directories under the root postoffice directory. The administrator of the system creates a workgroup postoffice directory for the system. Only the administrator can add, delete or edit user accounts. The administrator usually maintains a separate account for administrative messages.

Mail allows the user to compose a mail message comprising of text and

Table 1. CMC and Simple MAPI function calls

CMC Function	Simple MAPI Function	Description
CMC_Logon	MAPILogon	Establishes a session with the messaging service
CMC_Logoff	MAPILogoff	Terminates a session with the messaging service
CMC_Free	MAPIFree	Frees the memory allocated by the messaging service
CMC_Send	MAPISendMail	Sends a standard Mail message. Messages can be sent without any user interaction or can be prompted via a common user interface
CMC_SendDocs	MAPISendDocs	Sends a standard Mail message. This call always prompts with a dialog box for the recipient's name and other sending options. It is primarily intended for use with a scripting language such as a spreadsheet macro
CMC_List	MAPIFindNext	Lists information about messages meeting certain criteria
CMC_Read	MAPIReadMail	Reads a mail message
CMC_ActOn	MAPISavemail, MAPIDeleteMail	Saves or deletes a particular mail message
CMC_LookUp	MAPIAddress, MAPIDetails, MAPIResolveName	Handles addressing chores such as creating addresses, looking up addresses, and resolving friendly names with E-mail names.
CMC_Configuration		Determines information about the installed CMC service

attached files. These attached files are displayed as icons and can be viewed by maximizing the appropriate icon. The attached files cannot however be password protected and the mail message composed cannot be routed in a specific path. Mail does provide the ability to send composed messages as 'Urgent' messages. It is not clear if such messages actually have a higher priority as far as network resources are concerned.

Mail is based on the Microsoft Messaging API (MAPI) which is one of the components of the Microsoft Open Services Architecture (WOSA). MAPI consists of three main categories of functions that are described below.

- *Simple MAPI:* Consists of twelve basic functions limited to receiving, transmitting and forwarding messages. See Table 1 for a list of Simple MAPI functions.

- *Common Mail Call:* This set of functions deals with providing an interface to mail API's of other software publishers. See Table 1 for a list of Common Mail Call (CMC) functions.

- *Extended MAPI:* This is a set of object oriented functions that permit the creation and manipulation of a large number of complex messages, as well as routing information and structured addressing. Messages, folders, and attachments are objects that can be accessed through MAPI object structures.

Currently, the use of Common Mail Call (CMC) and Extended MAPI functions is made complicated as the programmer has to convert C function prototype declarations and data structures to Visual Basic syntax. This is no simple task. Jennings [2] states that "Forewarned is forearmed when it comes to profiting from the development on MAA's and MEA's based on Microsoft Mail as Microsoft Mail is currently a moving target." He goes on to say that it might be advantageous for Visual Basic database developers to wait for Calvin and Hobbes or perhaps Torque or even EMS before investing the time required to learn the intricacies of Simple and Extended MAPI. [2]

2.3.2 Lotus Notes [10]

Currently, groupware projects are being implemented, usually departmentally, on PC LANs, using products such as Lotus Notes. One of the first of this class of groupware software packages, Notes allows users to share information and work together in teams or work groups. It uses another industry proposed standard, Vendor Independent Messaging (VIM) for its E-mail applications. Although Notes is not good at accessing structured legacy data (which comprises 70% of corporate date), it is very versatile at collecting unstructured data like text, documents, images and multimedia, and making it accessible and useable.

The following information was obtained from the Lotus Notes marketing

brochure. The Notes Server requires a 200MB or larger hard drive (300MB recommended), 24MB of RAM (32MB recommended) and Novel Netware 3.11 or 3.12. The starter pack costs $895.00 (for 2 licenses) with the applications bundle costing another $695.00. cc:Mail, an E- mail package from the same company costs $3295.00 (100 user license).

2.3.3 Oracle Mail and Oracle Alert [9]

Oracle Mail and Alert utilize the Oracle relational database management system (RDBMS) to maintain user accounts and provide messaging. Oracle Mail is a portable, distributed electronic mail system built on and integrated with the Oracle RDBMS. In conjunction with Oracle Alert, Oracle Mail becomes a powerful tool for automating processes that have traditionally taken up valuable staff time. Oracle Mail runs on virtually every major computer, operating system and network, providing transparent communication to users anywhere in the organization. Further, since it is based on an open RDBMS architecture, Oracle Mail integrates with data management applications to facilitate the flow of business information throughout the organization.

Oracle Alert allows reminders of past due and pending design changes to be automatically sent to engineers. The system can also generate electronic mail messages for subcontractors, estimating when a job will reach their shop. Each work center impacted by a routing change can receive an electronic mail

warning. Alert can also inform the required users of changing or exceptional conditions at the crucial points in the manufacturing process. Alerts can also be tailored to suit specific needs by defining the time periods or events that trigger them and by customizing messages and distribution lists. Information about Oracle products mentioned here was obtained from Oracle marketing brochures.

2.3.4 Oracle Office [9]

Oracle Office Version 2.0, the next generation of Oracle's messaging software, provides the messaging infrastructure for enterprise workgroup computing. It includes electronic mail, an integrated calendar/scheduler, an integrated proofreader, and advanced directory services. Based on Oracle 7 cooperative server technology, Office runs on LANs, UNIX systems, minicomputers and mainframes. A scaleable, enterprise wide messaging system, it utilizes data servers to handle messages, networks to transport messages, and gateways to access external messaging systems.

Oracle Office Mail enables users to share, exchange and manage information. Users can send simple or complex mail notes by attaching files of any type to messages. When a user opens an attached file, Office automatically invokes the right application. Oracle claims to be the only electronic mail system that can span heterogeneous environments without gateways. Electronic messaging features in Office include:

- Reply, reply with original and forward message.

- Carbon copy, blind carbon copy

- Expiration date

- Deferred delivery date

- Return Receipt: delivered, read and non -delivered

- Priority Mail

- Unlimited attachments of any type

2.3.5 Calvin and Hobbes [2]

Calvin and Hobbes is an expanded version of Microsoft Electronic Forms Designer that has not been released as yet. Calvin is reported to be a Visual basic toolkit that provides additional progress monitoring and Work Flow routing functionality. Hobbes is a collection of standard templates for Work Flow related forms.

"The objective of Calvin and Hobbes is to provide a development environment that rivals the forthcoming Lotus Workgroup tools. If Microsoft releases Calvin and Hobbes with full OLE 2.0 compliance, including OLE automation capabilities, in mid 1994, the product is likely to be a strong contender in the forthcoming Work Flow application war."[2] At the time of this writing, the expected version of Calvin and Hobbes had not been released.

2.3.6 Customized Systems [12]

Many companies choose to develop customized systems for messaging and information transfer between users. This is because they can include all their desired functionalities into the software product in its design phase. This

| FactoryLink Apps (Some Cases) |
| XWindows to Promis GUI |
| Custom GUI Screens |
| PROMIS TTC APIs |
| DECMessageQ |
| DEC PathWorks (till Jan. 95) |
| TCP/IP |
| NETWARE Client (Undecided) |
| Custom C Applications (Still under development) |

| ARTEC Serial Port Applications | ARTEC Data Engine | ABKT Driver |

Token Ring

Oracle
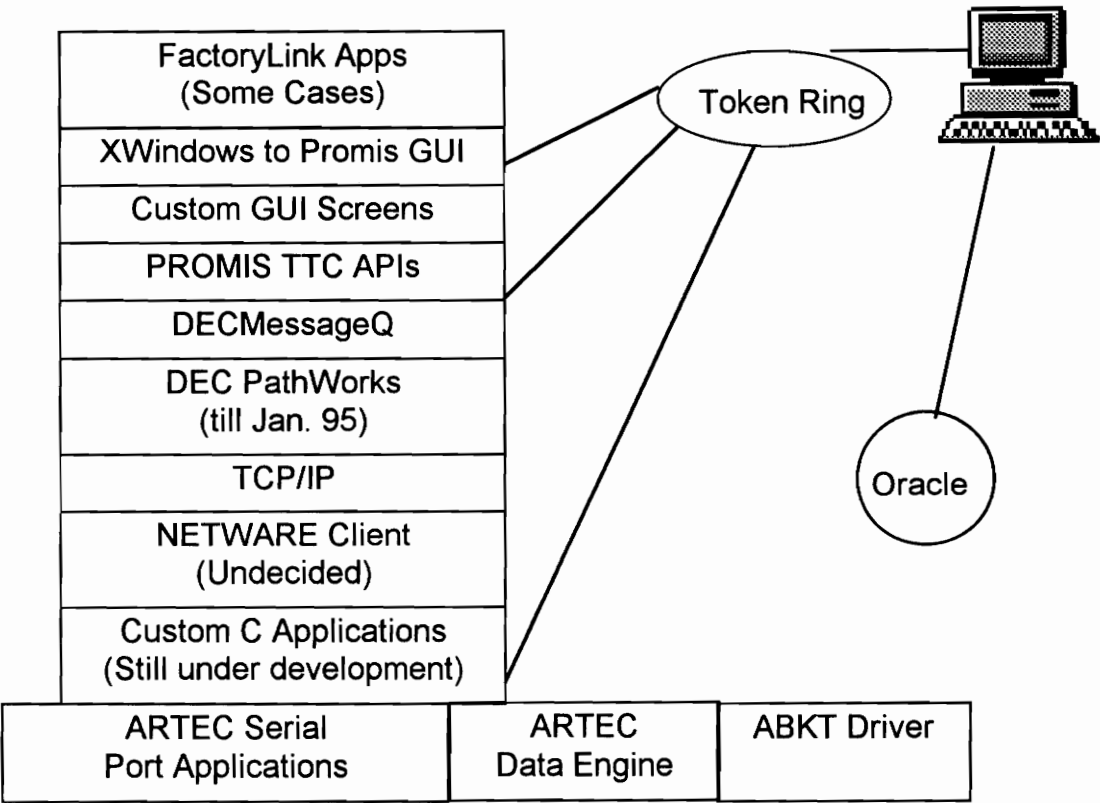
Figure 3. An example of a proposed Information System Structure

would imply less altering of their normal methods of operation as they would not have to work according to the specifications of an externally developed software product.

To illustrate the point, an example of Worthington Steel's proposed shop floor BIS system architecture is provided in Figure 3. This diagram and other information about the system under consideration was obtained directly from Worthington Industries. As evident, the proposed information system uses several independent software packages to provide the desired functionality. Unfortunately, the proposed system design is highly optimistic in it's expectations. Worthington will find that integrating software from different vendors, across platforms is indeed a formidable task. For example the proposed system shown above runs under IBM/s OS/2 while the corporate information system in place utilizes Microsoft Windows and Microsoft Mail. With personal computers becoming almost as powerful as workstations, and advancements in operating system technology, much ready made, flexible software will soon be available.

2.4 Problem Definition and Scope

The problem addressed in this project is to create a flexible infrastructure that provides an environment for distributed information flow. The functionality pertains to the ability to allow for future additions, enhancements or

modifications in a non - complicated fashion.

A software system based on this infrastructure is then to be developed to demonstrate the concepts, power and utility of document management. It should incorporate the ability to allow remote, intelligent applications to communicate with other system users over the information network. The system should also provide messaging functionality between system users (applications or personnel).

Tools to manage the production, viewing and storing of electronic documentation in a secure fashion should be provided. The concept of Work Flow is to be incorporated by allowing information to be exchanged or routed in folders, across a workgroup.

A prototype of an autonomous application should also be developed to demonstrate the ability to integrate such applications. This prototype will also provide a programmer's template for further autonomous application development.

Specifically, the following functionalities are to be incorporated into the software system to be developed:-

- The proposed infrastructure should be dynamic and provide for information flow in a manufacturing environment.

- The system should be based on client server technology and allow

for an unlimited number of users to be added onto it as clients.

- Users should be able to exchange or share information with other users. The type of information can vary from simple messages to a complex collection of files.

- Assuming that these files are stored in slots in 'folders', the number of slots should be dynamic to allow any number of attachments to the folder.

- Any user should have the ability to create folders. Further, a distinction should be made between personal folders that cannot be shared with other users and ones that can be.

- The system should allow the user access to the slots in a folder; i.e. it must provide adequate tools to view the contents of attached files and documents.

- The system should provide the capability to protect the contents of a vacated slot with a password. This would permit different users in a workgroup to receive the same folder but only view the files or documents that they are authorized to.

- It should allow applications to be added as users to the system. This would allow the transfer of data and information between stand alone applications that need to communicate with other

stand alone applications or regular users. The ability to send messages / commands to appropriate applications to process and return or forward information would allow applications to be plugged in as the system grows in complexity. This will provide a means to deal with new types of data or information as the need arises.

- The user should have the capability to search for appropriate folders based on pre-defined keywords. There should be no limit on the number of keywords that can be attached to a folder.

- Once the appropriate folder has been located based on a keyword, the system should allow the user to access the folder directly. Added functionality like folder deletion and automatic sending would also be a useful feature.

- DSM should allow folders to be routed within a workgroup. This would allow documents in progress to flow through the system automatically as each member adds to it in succession.

- The route of such a folder should be modifiable at any remaining stage in the route. To preserve the sanctity of a predetermined route however, this functionality should be password protected by the original owner of the folder in question.

- Such folders should have the capability of being suspended. This means that the user would not have to forward a received routed folder before closing it. Rather, it could be held as a suspended folder and then forwarded at a later time.

- Folders should be protected with passwords to prevent unauthorized access. However if the current user of the system happens to be the owner of the folder in question, the system should contain sufficient intelligence to not prompt for a password.

- The folder should possess the ability to provide information about itself and the files / documents attached to it.

- The system should be user friendly and have a graphical user interface (GUI) to promote ease of use.

3.0 System Design

3.1 Method of Approach

In order to provide the desired functionalities with the desired level of flexibility, the infrastructure was carefully molded in discrete parts. Correspondingly, the system consists of a unison of 'managers'. This allowed the complex procedure to be broken down in to smaller tasks and helped reduce the complexity of design. Various aspects of the system were attributed to 'Sub - Managers' that carried out the required tasks and then passed control back to the System Manager. This plug and place method not only proved successful in meeting the identified demands but also proved to be an efficient method of providing hooks for future development. For example, the 'Security Manager' is responsible for ensuring valid authorization before conducting any actions. Right from the moment a user logs into the system, the security manager keeps track of functions that the user is permitted to make and prevents access to certain functionalities. Another sub manager for example, the 'Network Manager' is responsible for setting up adequate network links upon startup.

As the infrastructure was developed from ground zero, it was possible to tightly integrate the various sub-managers, under the control of the System

Manager. The basic framework of the system is closely analogous to the concept of nested menus, common in many popular software systems today.

3.2 Technologies used for System Development

The infrastructure utilizes concepts from four key technologies to provide the desired capabilities. These are described below:-

3.2.1 Client Server Technology:

DSM utilizes the client - server approach as system mailboxes are created and maintained on a server that is accessed by all the nodes of the system. All data pertaining to users are also stored in the server. When a login attempt is made, the 'Security Manager' on the local node access this information on the server to verify the authenticity of the users password.

3.2.2 Work Flow Techniques:

DSM supports routed folders. These folders demonstrate the concepts of work flow. A detailed description of these folders can be found under the documentation on folder types.

3.2.3 Document Management:

The ability to store information in slots of folders, search for folders based on a search criterion, to view the contents of a folder and to share the folder and

its contents with other users, provides a rich means of document management. It should be kept in mind though that DSM does not limit the user to store only text documents as the term Document Management might suggest. Rather, it allows the user to attach any kind of file to a folder (on the Windows operating system) and to view and modify it (provided the required viewing software is available).

3.2.4 Background Processing:

The developed system carries out background processing to check the users mailbox without apparently interrupting the user. While it is true that Windows does not provide true background processing or multi tasking, it is still a big step ahead of DOS that does not provide any such capability. Since no user would appreciate being interrupted periodically while the 'Mail Manager' checks the users mailbox, the Autochecker processing routines have been kept as simple and efficient as possible. No mail is retrieved until the user explicitly chooses to do so. This keeps the time taken by the system to check the users mailbox to a minimum, thereby causing minimum inconvenience. (It should be noted that the time taken to check a users mailbox is also dependent on the speed of the local and the server machine.) All application modules designed for this system will also carry out similar background processing activities.
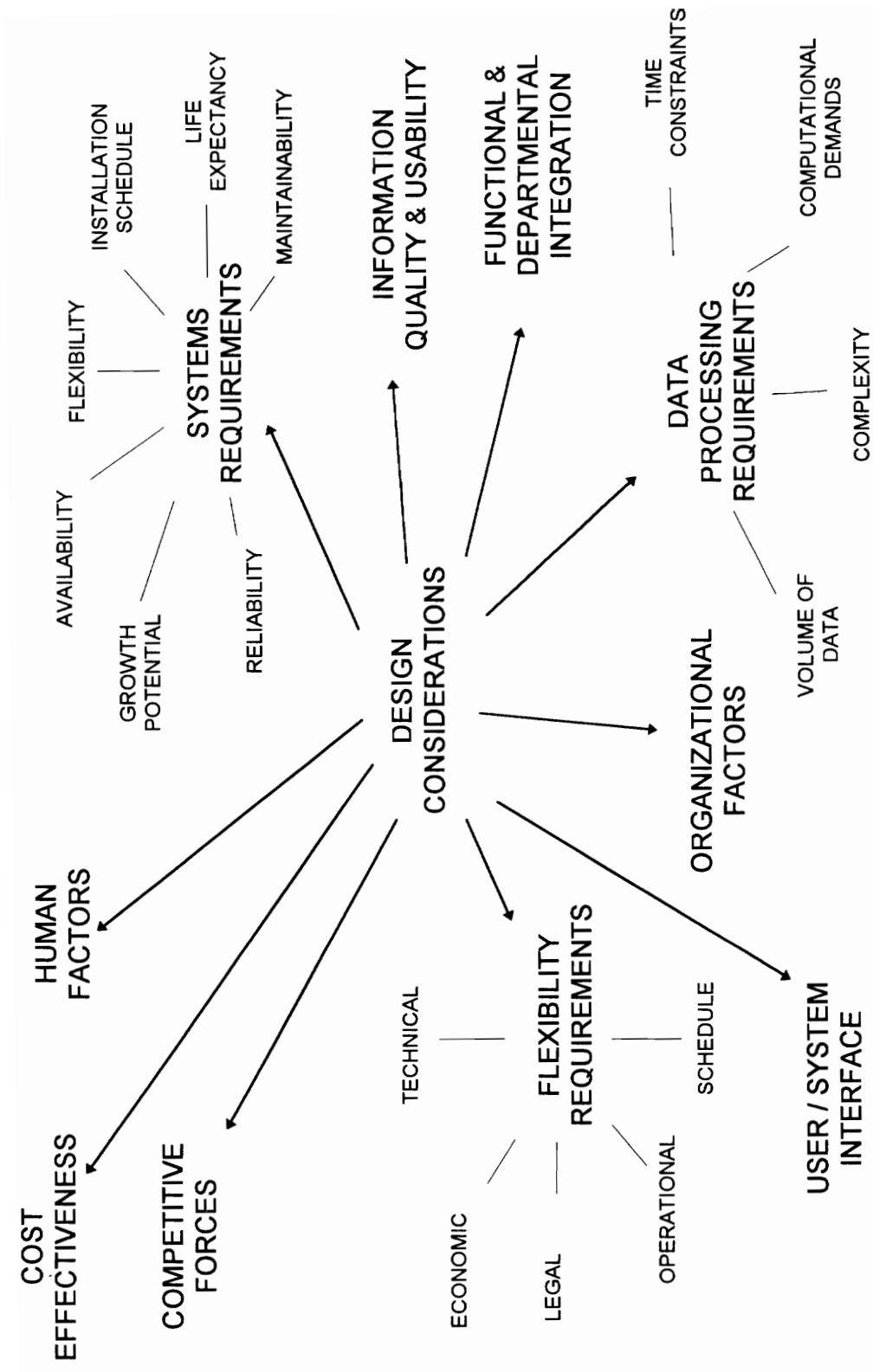
Figure 4. Design Considerations for an Information System

They will periodically check their personal mailbox for commands and/or messages that have been sent to them.

3.3 Design Considerations in an Information System

The design considerations for an information system are shown in Figure 4. Although the Document System Manager is not an information system in itself, it is the foundation for one. It allows information to be transferred between distributed users while allowing applications to be plugged in as required. The ability to plug in applications is what makes the Document System Manager so versatile. Applications that process shop floor information and inform appropriate personnel when need be would provide many qualities of traditional information systems. This is why the system design should incorporate the design considerations for traditional information systems, as shown in the figure.

3.3.1 The User Interface

The user interface employed in a system makes a big difference in its quality. The interface allows the transfer of information between the operator of a system and the system itself. This transfer consists of both input and output functionalities. The interface should allow information to be entered in a flexible, convenient and simple fashion. Adequate information should be provided to the

user to make the process as unmistakable as possible. Messages should be employed to guide the user in the event that an input error occurs. Information should not have to be entered in a fixed order. Instead the user should have the ability to enter the required information in any order, and return to modify data that has already been input.

3.3.2 Time Constraints

The system should not take up excessive computational resources. Naturally, this would depend on the hardware being used, but the user should be able to carry out routine tasks on the local node machine, without any inconvenience. The ability to configure the system to modify the resources used could be a much desired functionality.

3.3.3 Organizational Factors

The system should be able to connect to any department in the organization, allowing information to be transferred to any user. All system users should similarly be able to receive information.

3.3.4 Data Processing Requirements

The system should not pose a limit on the amount of data that has to be transferred for processing. It should also not limit the type of data that is to be transferred. This would mean that the system is capable of transferring text,

images, audio or even video information.

3.3.5 Functional and Departmental Integration

The system should promote functional and departmental integration. It should allow information to be shared or routed between the members of a workgroup, promoting system integration.

3.3.6 Human Factors

The system should be designed in a modular fashion. This would facilitate further development as and when required. Even in the event that parts of the developed system need to be replaced, there should be no need to build the entire system from ground zero. Instead, it should be possible to simply plug out the sections that need to be modified or replaced. Modularity would also make it simpler to introduce further enhancements and functionalities.

The choice of development software is always crucial for long term success. For example, very few vendors use FORTRAN to produce applications anymore. The development software should be dynamic and capable of providing the required tools to build the desired functionality into the system. From a more relevant standpoint, the software used to develop a system in an academic environment should not have a steep and lengthy learning curve. This would attract future students to build on the developed system.

3.3.7 Cost Effectiveness

The system should be cost effective. This not only implies that it should be as inexpensive as possible to produce, but also that it should take as little time and resource as possible. These considerations remain true even after the system has been designed and developed, as changes will always be desired. In terms of an academic environment, the costs of development software and licensing should be low and the development environment easy to master.

3.3.8 System Growth Potential

This is one of the most important design considerations for any system. Due the rapidly changes in technology, information needs have changed constantly and considerably over the last decade and it is more than likely that they will continue to do so. Keeping this in mind, it is important that the system be designed in a manner that is conducive to growth and modification. Flexibility is the key word in this case. Not only should the system be flexible in its functioning, but also in its design. A flexible design will facilitate future changes and allow growth.

3.4 Primary Building Blocks of an Integrated System

Figure 5 illustrates the primary building blocks of an integrated system. These building blocks are described in the section that follows.
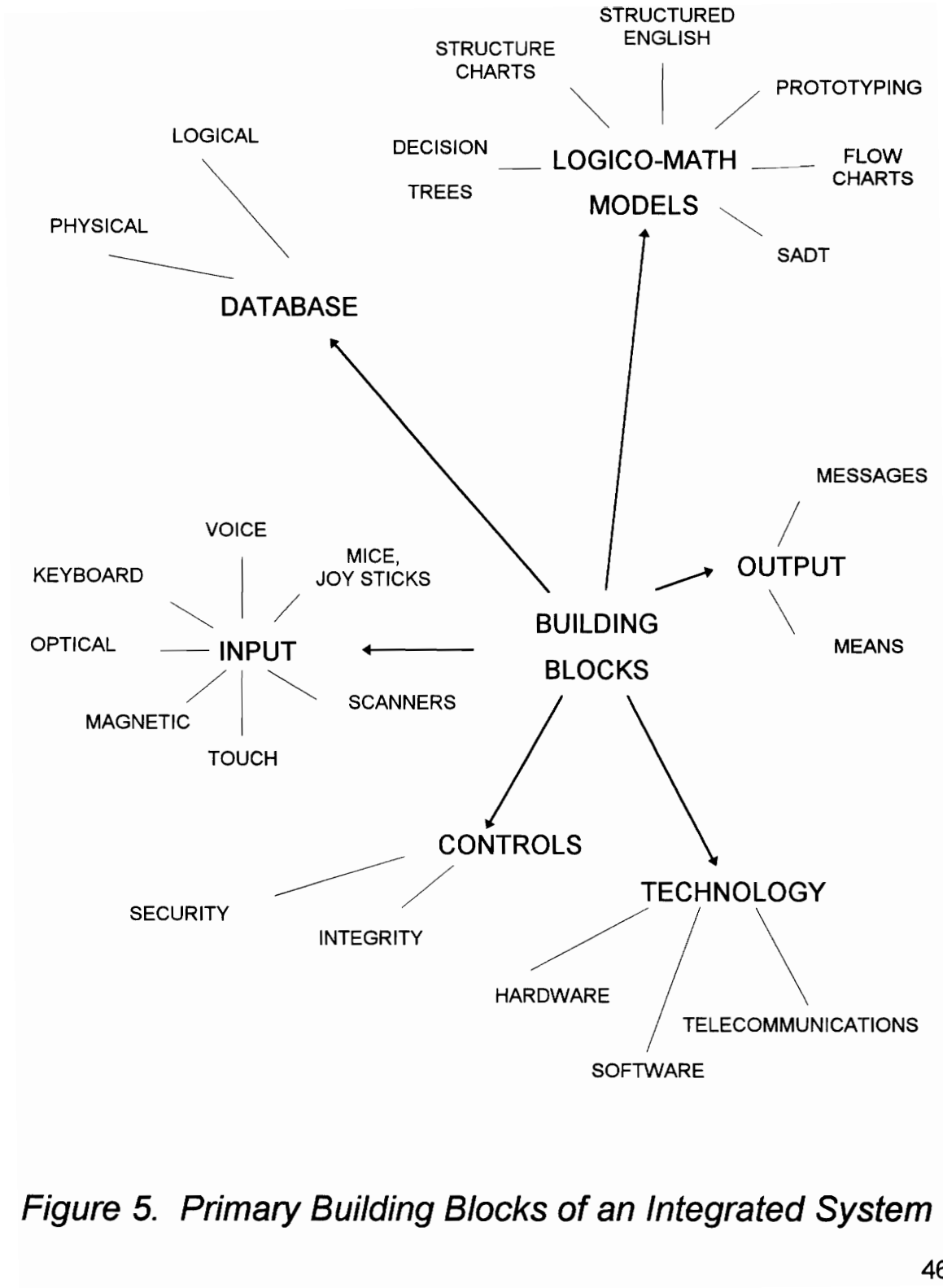
Figure 5. Primary Building Blocks of an Integrated System

3.4.1 Input

This building block is responsible for the transfer of information between the users of the system and the system itself. The various input devices are also shown in the figure.

3.4.2 Output

This block is responsible for the transfer of information between the system and its users. Appropriate formats for outputted data should be used. Output should be presented in a user friendly manner.

3.4.3 Technology

This block is concerned with the hardware and software used for operation as well as telecommunication aspects. Operating hardware, platform, and network architecture and protocol are addressed here.

3.4.4 Security

This block is responsible for all security aspects of the system. Information security and integrity should be maintained at all costs. Protected information should not be accessible to unauthorized users.

3.4.5 Logical / Math Models

These models represent the processing capability of the system. These are more relevant to the system being designed and would reside in the

applications being developed.

3.4.6 Database

A database has to be maintained to keep track of the different users on the system. While this database is stored in one central location as the physical database, it is available to all local nodes connected to the system, as a logical database.

3.5 Choice of Hardware Platform

Given the facilities of the lab, there were two options for choosing the hardware platform. The first was the SUN platform and the second, 486 PC platform. The latter was chosen as the hardware platform for the following reasons:-

- Over the past several years the personal computer industry has witnessed nothing short of a revolution. PC technology has become more powerful, with top of the line systems competing with work-stations in terms of computational and processing speeds.

- The technology has also become significantly cheaper. Top of the line Pentium systems cost in the neighborhood of $2500.00

- There is a large variety of development software available for the PC platform. With the capability of these systems to run UNIX

efficiently, many organizations are choosing PC's over work-stations due to lower costs and upgrade ability.

- The hardware and software resources available in the lab at the time this research was conducted mandated that development take place for and on the PC platform.

3.6 Choice of Operating System

The Document System Manager was built on the Windows platform. While UNIX does provide much of the required functionality, application development software for the UNIX platform is limited. Further, as PC's were chosen as the hardware platform, it only made sense to consider more popular PC operating systems. The factors that led to the choice of Windows as the operating system are presented below:-

- Windows provides a multi - tasking environment. For an application like the Document System Manager, such an environment is a must. The reason for this is that the system must be constantly aware of incoming messages and folders. Non multi - tasking systems would have to be dedicated to the purpose of information flow and this would be an unreasonable demand.

- There is a large variety of Windows software available for networking applications. While this project is not concerned with

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networking aspects, it does need to be built on a foundation that is capable of utilizing the power and flexibility that many network packages provide. At an increased level of complexity, intelligent applications that are capable of listening over networks would be able to autonomously activate their processing functions when commanded to by remote users. This can only be achieved using background processing, a feature that Windows provides.

- Windows provides more memory for applications than DOS. This allows for larger and faster applications.

- Windows provides a graphical user interface for input and output operations. This makes the application user friendly.

3.7 Choice of Software Development Technique

To a large extent the choice of development technique was governed by the choice of the development platform, Windows. This environment supports event driven and object oriented programming.

3.7.1 Event Driven Programming

Event driven programming also known as EDP primarily deals with the occurrence of events and the actions that take place due to those events. The Windows operating environment is event driven. Every action is considered an

event and can have different consequences.

3.7.2 Object Oriented Programming

As the size of a program grows, it can become extremely difficult and even impossible to manage. This is one of the biggest problems with traditional programming techniques. Object oriented programming (OOP) techniques appear to be the solution to this problem. Much has been heard about the OOP paradigm in regard to how it revolutionizes the process of software development. While many authors have said that object oriented programming renders structured programming techniques obsolete, this is not true. OOP merely enforces a development structure to the program in order to manage its complexity. The difference lies more in the conceptualization of the task to be programmed than in the programming style. Object oriented programs map real world situations better, making it easier to build large programs. An object oriented program can be described as a collection of objects communicating between each other with a defined protocol. At the heart of such a program lies the 'Object', hence the name 'Object Oriented Programming'.

An Object can be described as a collection of data and methods. Objects communicate with other objects using 'Messages' that invoke the appropriate 'Methods'. Much of the work involved in building an object oriented program has to do with developing the message passing terminology.

3.8 Choice of Development Software

There were several development software platforms to choose from. These included Visual C++, Turbo C++, Toolbook, Visual Basic and Foxpro. The prototype system was eventually developed using Visual Basic. The reasons for this are as follows :-

- Visual basic for Windows provides excellent user interface tools.

- It is relatively simple to learn and can be mastered in a relatively short period. Both Visual C++ or Turbo C++ provide the required tools but have a steep and long learning curve.

- It is based on object oriented constructs and provides support for the Microsoft Messaging Applications Programmers Interface (MAPI). This is important as future work on this project might well incorporate the functionality provided by MAPI.

4.0 The Document System Manager (DSM) Described

4.1 Introduction

The Document System Manager (DSM) provides a means to link stand alone applications in an integrated fashion. These stand alone applications communicate using input and output data that is provided in appropriate files.

Besides allowing applications to communicate and automatically transport data between each other as well as informing the appropriate operators to run their applications, DSM also provides the ability for personnel to personnel communication. This is an important functionality as often there is a need for this kind of communication in the workplace. For example, the operator of the scheduling application might want to communicate with the operator of the forecasting module. It is entirely possible that some data needs to be exchanged or that the results of the new schedule run need to be reported back to the operator of the forecasting application. This is achieved by sending a folder to the appropriate person. This folder can contain any kind of document containing any kind of information. Folders can be categorized to be of several types as described in section 4.3.

It is conceivable that in the future, intelligent applications will be capable

of autonomous operation. Such applications could listen for messages or commands over a network, process required information and return results to the required personnel without the interference or help of an operator. DSM provides the information highway and environment for such applications. A sample application, DATE (see chapter 5.0) that does minor processing of received messages, has been developed and included in the project to demonstrate the concept. This module periodically checks its system mailbox for messages. When a message arrives, the application picks it up, processes its contents and then proceeds as directed in the message.

DSM makes use of the concept of client server technology to connect remote users together in an integrated fashion. These users can be personnel or application programs. The system has been designed to incorporate the ability to add devices on the shop floor like robots or PLC's as users as well, though this capability is not developed in the current version of DSM.

The primary components of DSM are the system server containing the user mailboxes and the local nodes. These have been discussed in greater detail in the sections that follow. In-depth technical details pertaining to their construction as well as the logic for the various system functionalities can be found in the programmers manual that is an accompanying document. One such functionality, the search routine, is illustrated in figure 7, later in this chapter.

4.2 System Components

The system is built up of one primary central server and several secondary distributed nodes. It is possible to have more than one server, but it is not possible for a local node to be connected to two servers simultaneously. Though future enhancements can include this capability without significant alteration of the code. The current technical limit to the number of users per server is 99,999 users.

4.2.1 The Server

The system server acts as a postoffice for all the users registered on the system. Each user has a unique mailbox assigned to their account. Each time a user is added to the system, a new mailbox is created for that user. Similarly destroying a users account removes the mailbox associated with that account.

4.2.2 The Local Node

Each local node needs to be made aware of the location of the server before the system can be activated. This is normally done automatically by utilizing information stored in the local configuration file at the local node. In the event that this information is invalid, the system shifts to manual mode and requests the user to locate the server. The current version of DSM supports the server directory name 'dsm_serv'.
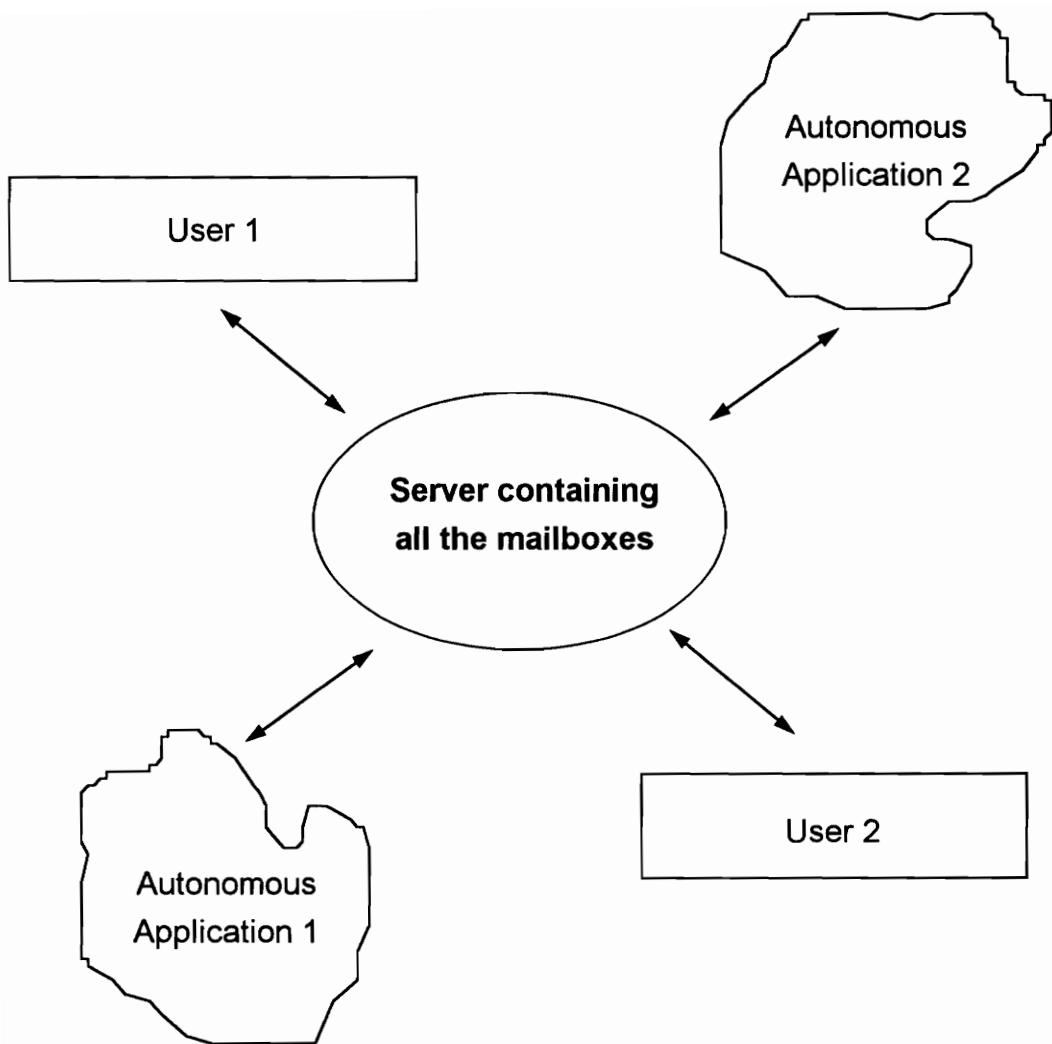
Figure 6. Centralized Server makes distributed information accessible.

Once the connection to the server is successfully made, the local node downloads information about the current user to verify authorization. This is the responsibility of the Security manager. Once the Security manager has cleared the user for logon, the System manager displays the main DSM system menu and toolbar. The user has now got access to the system. If the user supplied the administrator login and password, he or she will have access to every possible DSM command. Non administrative users do not have access to special administrative functions like adding or deleting users etc. When the system is activated, the Autochecker is active. This means that the local node is constantly and periodically checking the current users mailbox on the server for new mail. In the event that unread mail is already present at the time of logon, or if new mail arrives after logon, appropriate messages are displayed to the user. The Autochecker can be deactivated by issuing the appropriate command from the Mailbox menu or clicking on the appropriate toolbar icon.

As each local node checks the current users mailbox on the central server, whose location is constant, it is possible to connect distributed users to the system and exchange information between them. Though the current version of DSM does not have an active server application, future versions may well incorporate such technology. The concepts of exchanging information between independent applications such as the server application and the local

node application have been demonstrated and documented in this project as the concepts of exchanging information and communicating with the sample application. (See Chapter 5.0)

4.2.3 The User's Mailbox

All user mailbox accounts are stored on the server. While it is not necessary to dedicate a machine for the DSM system server, it is recommended. This will ensure the integrity of the user mailbox accounts.

All mailboxes are created and maintained under the 'adds' sub-directory under 'dsm_serv'. When a new user is added by the administrator, a new mailbox directory is created by the local node on the server, and the login-file is automatically updated. The administrator has a personal mailbox for administrative messages. It is recommended that a separate user mailbox be created for regular mail for the administrator.

The deletion of a user account by the administrator results in the destruction of the users personal mailbox and any unread mail or messages. It is important to remember that once a users account is deleted, deleted mail and messages cannot be recovered. DSM maintains the mailboxes in a dynamic fashion. There is no need to pack the login database periodically, even if users are added or deleted regularly. This is made possible by dynamically numbering a mailbox as it is created or destroyed. This implies that the directory used to

store a particular users mailbox will not necessarily remain constant. DSM stores the correct directory name associated with the users mailbox in the main login-file, along with other user login data. This is also why the login file is constantly updated when users accounts are created or destroyed. To the user however the mailbox structure is completely transparent. Other users are referred to by their login names. DSM automatically builds the appropriate link between a users login name and the associated mailbox by searching the login file. A detailed description of the construction of the server system and user mailboxes can be found in the DSM Programmers Manual. Figure 6 illustrates the ability to make distributed information available using a centralized server.

4.3 Folders Described

DSM utilizes folders as containers for document management and to transport information. Any number of files can be attached to a folder that can then be sent to other users. The system does not impose any restrictions on the type of files that can be attached.

While there are several similarities between the folders used in DSM and subdirectories, the former provides some powerful additional features. The differences between folders and sub-directories have been provided in Table 2.

4.3.1 Types of Folders

4.3.1.1 Personal Folders

These folders are meant to store information that is personal to the user and is not meant to be shared with other users. It might be desirable to store all the (electronic) documents associated with a particular project within a folder. For example, all the design specification files, CAD drawing files and route sheet files for a redwood cabinet might be stored in a folder titled " Redwood

Table 2. A comparison between Folders and Subdirectories

Folders	*Subdirectories*
Provide means to store multiple files	Provide means to store multiple files
Provide search functionality based on pre-defined keywords.	Do not provide search functionality based on pre-defined keywords.
Provide means to protect specific attached files.	Do not provide means to protect specific attached files.
Allow routing of information flow in a pre-defined sequence.	Do not allow routing of information flow in a pre-defined sequence.
Make it simple to send files to other recipients.	Special software is required to send entire subdirectories.
Promote the concepts of Document Management.	Do not promote the concepts of Document Management.

Cabinet 234 ". This provides an organized method for storing grouped data in a simple manner. DSM allows the creation, modification and deletion of such folders.

4.3.1.2 Shared Folders

Shared folders provide all the capabilities of personal folders but also allow the folder to be shared with other users. They are analogous to batch mailings where several recipients get a copy of the mail message. DSM facilitates Electronic Document Interchange (EDI) by allowing files to be transferred electronically inside folders in this manner. Since the folder can contain messages in addition to files, they can also be used for simple mail messages.

4.3.1.3 Routed Folders

These folders move from recipient to recipient within a workgroup. Information contained in the folder is carried along the pre-determined route. Users have the ability to modify the remaining sections of a route if required. When a recipient receives a routed folder, the system permits one of three actions. The folder can either be forwarded to the next recipient in the list, suspended, to be worked on at a later time, or discarded completely. The last recipient in the list does not have the ability to forward the folder for obvious reasons.

4.3.1.4 Suspended Folders

It is not necessary for a user to work on and forward a routed folder that has been received immediately upon opening it. Instead, the user can 'suspend' the folder to work on it at a more convenient time. Suspended folders are stored at the local node rather than at the server. The system manager informs the user about the number of suspended folders through the mailbox status screen under the main system toolbar.

Suspended folders can be opened or sent just like regular folders, only there are independent commands that provide these functions. The search manager also has the capability of searching suspended folders for the specified keyword.

4.3.1.5 Urgent Folders

These folders take priority over non - urgent folders. DSM has the ability to display a list of all urgent folders that have been received since the last time the system was activated.

4.3.1.6 Registered Folders

These folders automatically return a verification receipt to the sender when they are opened. This allows personnel to check if a folder was actually delivered and when it was opened. These folders can also be of the urgent type.

4.3.2 Folder Properties

4.3.2.1 Foldername

All Folders have to have a name before they can be stored as individual files or within a database. This name is not confined by the limitations of the DOS operating system (i.e. They can contain spaces, or any other characters.) However, the maximum valid length of a Foldername is 15 characters. When the input field associated with the Foldername is empty, the 'save to file' and 'store in database' buttons are automatically disabled, thereby preventing the associated functionalities. When storing the folder in a database, DSM automatically checks existing Folders for a duplicate Foldername and does not allow the action to be completed.

The Foldername is also the key field used to search through Folder databases for a specific folder. In the event that the specified folder is not located, DSM accordingly notifies the user and asks if the user would like to create a new folder with the specified Foldername. To enter text into the Foldername Box, the user simply clicks on it with the mouse or tabs through the various fields until the Foldername Box is active.

4.3.2.2 Folder level Password

The folder level Password is meant to provide blanket security to the contents of the entire Folder. This Password is required before the user can

view the contents of the folder. It is important to note that it is applicable to Folders that have been received from another user or department as well as Folders that have been created and stored by the user whether Personal or Shared. While browsing entire Folder databases, only the Folders having Passwords that match the specified default password will be displayed in entirety. For all other Folders, only the Foldername will be displayed. If the Folder Password was left blank, there is no security enforced on it and it will be accessible to all users.

The Password input field does not directly display the characters entered by the user, again for security reasons. Instead it displays a " * " for each character entered. The only limitation on the Password field is that is can be a maximum of 15 characters long. To enter text into the Password Box, the user simply clicks on it with the mouse or tabs through the various fields until the Password Box is active.

4.3.2.3 *Folder* Type

The Folder Type radio buttons are used to identify the type of Folder being created. The user has a choice between a Personal Folder, a Shared Folder or a Routed Folder. Only one apparent changes are visible on the screen for the Personal Folder or the Shared Folder. If the Password input box is empty, DSM automatically places the current users login password in the

Password input box if the user chooses a the Personal Folder type. However, the user can overwrite the displayed password if so desired. If the user subsequently chooses the Shared Folder type, this password is automatically removed from the Password input box. This has been done to preserve the sanctity of the users login password.

To choose the type of Folder, the user simply clicks on the circular radio button alongside the appropriate name using the mouse.

4.3.2.4 Comments

The Comments input box allows the user to enter comments or a message as appropriate. For example, the Comments field could contain descriptors for the files that are attached to the Folder. If the Folder is of the Shared type, the Comments box could contain a message to the recipient in addition to the descriptors. Input to this box is at the discretion of the user.

The Comments input box is scrollable by means of the scroll bar on its right side. The user can scroll vertically to view portions of text that are currently not visible. To enter text into the Comments Box, the user simply clicks on it with the mouse or tabs through the various fields until the Comments Box is active.

4.3.2.5 Attached Files

The Attached Files list box contains a list of all the files that are attached to the current Folder being displayed. It serves as both an input box as well as

an output box. When the user Attaches a file, DSM automatically updates this box to reflect the addition of the new file. The user can also highlight a filename in this box and click on the Remove button, removing the file from the list of attached files. It should be noted that, since Application Folders cannot have attached Files, the Attached Files list box is not visible for Application type Folders.

To highlight a filename in the Attached Files list box, the user simply clicks on the appropriate name with the mouse.

Attached files can be password protected to provide selected viewing,. To protect an attached file, the user highlights the file and clicks on the 'Protect' button. The system prompts for a password for the file. After a valid password has been supplied, the name of the file in the list appears in capital letters. Also, highlighting this file will convert the 'Protect' button text into 'Unprotect'. Clicking on this button removes the password protection on the attached file.

4.3.2.6 Owner

The Owner field reflects the owner of the folder. DSM automatically defaults the owner to the login name of the current user. However, the user can overwrite this name if so desired. To overwrite the currently displayed owner, the user simply clicks on the Owner filed box with the mouse and enters the new Owner name.

Care should be taken while assigning the owner field of the folder. When a user other than the stored owner attempts to open the folder, DSM prompts for the folder password and will not allow access without the correct password. The password in not required in case the user attempting to open the folder is the stored owner of that folder.

4.3.2.7 Folder Created On

The Created On field is an output field that reflects when a Folder was created (saved the last time). The user is not able to modify this field in any way. DSM automatically adds the current time and date for a new Folder and updates the time and date when an existing Folder is modified and re-saved or re-stored.

4.3.3 Folder Functions

4.3.3.1 Creating a New Folder

New folders can be created by choosing the 'New' command from the 'Folder' menu or by clicking on the appropriate icon from the system toolbar. This action brings up the Folder manager that displays the default folder template. A new folder is always created as a personal folder initially. This can be changed by clicking on the appropriate 'Folder Type' radio button. For more information on this topic, see the Users Manual.

4.3.3.2 Opening an existing Folder

Existing folders can be opened for editing or modification by choosing the 'Open' command from the main system menu followed by 'Local Folder'. (Suspended folders can be opened by choosing 'Suspended Folder'.) This prompts the Folder manager to display the specified folder. For more information on this topic, see the Users Manual.

4.3.3.3 Deleting an existing Folder

Folders can be deleted when obsolete, by choosing the 'Delete' command from the 'Folder' menu, followed by either 'Local Folder' or 'Suspended Folder'. This command also deletes the keywords and recipients that may be stored within the folder. For more information on this topic, see the Users Manual.

4.3.3.4 Attaching Files to a Folder

Any type of file can be attached to a folder by clicking on the 'Attach' button on the folder template screen. This brings up the attach file dialog that allows the user to choose the appropriate file to attach. Attached files show up in the 'Attached Files' list. For more information on this topic, see the Users Manual.

4.3.3.5 Removing Attached Files

Any attached files can removed by single clicking on the appropriate file-name in the 'Attached Files' list, followed by a click on the 'Remove' button. The

file name is automatically removed from the list and the file from the folder. For more information on this topic, see the User's Manual.

4.3.3.6 Viewing or Modifying Attached Files

The user has the ability to view files attached to the folder by either double clicking on the file name or by choosing the appropriate filename with a single click followed by a click on the 'View' button. The System manager attempts to activate the appropriate application needed to view the file. In the event that the application is not available, a appropriate message is displayed to the user. Once the user has completed viewing or modifying the desired file, the application can be terminated to return to DSM. For more information on this topic, see the Users Manual.

4.3.3.7 Protecting and Un-Protecting Attached Files

Each attached file can be protected with a unique password. To protect an attached file, the user single clicks on the desired attached file name from the 'Attached Files' list, followed by a single click on the 'Protect' button. Once the specified file is protected, it will appear in capital letters in the 'Attached Files' list. To remove the password protection on an attached file, the user chooses the required file name from the 'Attached Files' list by single clicking on the appropriate list element, followed by a click on the 'Un-Protect' button. Note that this is the same button as the 'Protect' button, only the text on the button

changes as protected or unprotected attached files are highlighted in the 'Attached Files' list. Once the password protection is removed, the name of the attached file appears in small letters in the 'Attached Files' list. For more information on this topic, see the Users Manual.

4.3.3.8 Building a Work Flow or Route

Routed folders carry information about recipients within themselves. Actual recipient names are stored in a recipients file that is transported along with the folder file. Routes can be updated at any point by supplying the 'Route Password'. To create or modify a route, the user clicks on the 'Recipients' button. This activates the Recipients manager that allows additions or deletions to the recipients list. In the case of routed folders, recipient names that have already received and forwarded the current folder appear in capital letters. All other recipient names appear in small letters. For more information on this topic, see the Users Manual.

4.3.3.9 Searching for Folders

DSM provides the user with the capability of searching for a specified keyword among multiple folders. Folders can have any number of keywords associated with them. These keywords can be added, deleted or edited at any time by opening the folder and clicking on the 'Keywords' button. This action activates the Keyword manager that allows the mentioned actions on the

keywords associated with the folder.

To initiate a folder search, the user activates the Search manager by choosing the appropriate command from the 'Folder' sub - menu or by clicking on the appropriate icon on the system toolbar. Next, the desired keyword would be entered, followed by a click on the 'Search' button. All folders found to contain the specified keyword in the specified search path would show up in the 'Found in' list. The user then has the capability to 'Open', 'Send' or 'Delete' any folder in the 'Found in' list. The Search manager also provides the capability of searching suspended folders for the specified keyword. For more information on this topic, see the Users Manual.

4.3.4 Sending a Folder

Folders can be sent either open or closed. To send an open folder, the user opens the folder to send and clicks the 'Send' button. This activates the Send manager. Closed folders can either be sent by choosing the 'Send' command from the 'Folder' sub - menu or by clicking on the 'Send' button after highlighting a found folder in the Search manager screen. This action also activates the Send manager. In the event that there are invalid recipients or, there are no recipients stored with the folder, appropriate messages are displayed to the user.

Folders can be sent as urgent folders by choosing the 'Send as Urgent

Folder' option from within the Send manager. They can also be sent as 'Return Requested Folders' by choosing the 'Send as Return Requested Folder' option. If the original files are to be sent then the user clicks on the 'Send Originals' radio button option. If copies are to be sent then the 'Send Copies' option should be chosen. If the contents of the folder, i.e. the attached files are to be sent as read only files, then the user chooses the 'Send Contents as Read Only' option. Once the desired options have been chosen, the folder is sent by clicking on the 'Send' button. For more information on this topic, see the Users Manual.

4.4 System Users

DSM identifies personnel with their login id, which is unique for every individual, much like their social security number. In certain situations, different departments might want to assign one machine as the DSM client, and make it universally available to everyone within the department. To achieve this, DSM has the capability to run in the multi user mode. However, to ensure data integrity and security, authorization accounts and appropriate passwords are required to operate DSM. If so desired, DSM can be easily configured to run in a single user mode as well. Additionally, in the multi user environment, certain key administrative functionalities like modifying the administrative password or adding and deleting users from the system database, are permitted only to the

administrator.   If the system is being used by a non-administrator, the appropriate menu choices simply get disabled, preventing unauthorized access. After three invalid login attempts, DSM automatically shuts down with a prompt to see the system administrator displayed on the screen.

Once the login procedure has been completed successfully, the DSM main screen is activated. At this time the system checks for any new folders that might have arrived while the system was inoperable. If any such folders are present, DSM prompts the user and inquires if he would like to view them. At this point the user also has the flexibility to sort the folders according to his / her choice. Folders can be sorted according to arrival time (and date), priority urgent) or type (shared or application).

DSM automatically checks for the arrival of new folders and prompts the user of the system when a folder does arrive. However, it might be desirable to turn off the folder checking in certain situations. This is possible with DSM. The user then has the ability to manually check for new folders. Another functionality that DSM possesses is its check interval sensitivity. This is configurable and allows the system administrator to change the system's sensitivity to new folders. One advantage of this might be an increased speed performance of the system, especially if DSM is actively monitoring application communication.

4.5 DSM Delivers

DSM allows applications to be registered as system users, providing each of them with a unique mailbox. This allows them to receive communication from other registered system users. This mailbox system allows person to person, person to application, application to person and application to application communication in a distributed environment, thus promoting information integration.

The concepts of Work Flow are incorporated into the system by the 'Routed Folder' type that allows files to routed according to a pre-defined list of recipients. Unauthorized access to information is prevented by using several levels of password protection. For example, users have to be registered into the system before they can use it. Each user is assigned a unique login name and has an associated password. Further protection is provided by the folder level password that ensures that folders can only be opened by people who are authorized to do so. Further, the ability to password protect specific attached files provides for a convenient and secure manner to share information with other users. This password is required before a user can view a protected attached file.

DSM provides a simple means for messaging between users. The same format is used to communicate with the prototype autonomous application, also
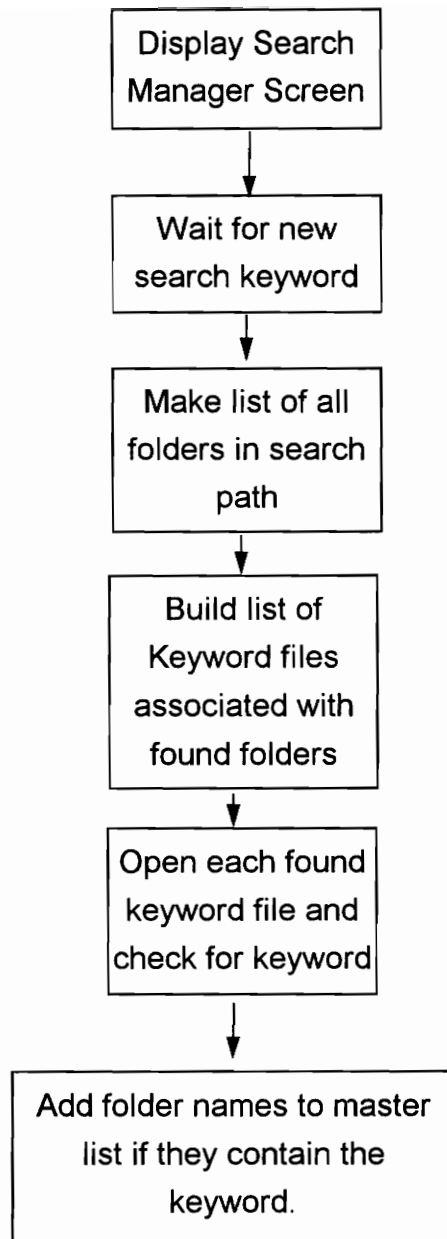
```
┌─────────────────┐
│  Display Search │
│ Manager Screen  │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│   Wait for new  │
│  search keyword │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│  Make list of all│
│ folders in search│
│       path      │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│    Build list of │
│  Keyword files  │
│  associated with │
│  found folders  │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│  Open each found │
│ keyword file and │
│ check for keyword│
└─────────────────┘
         │
         ▼
┌─────────────────────┐
│ Add folder names to master│
│  list if they contain the │
│        keyword.     │
└─────────────────────┘
```

Figure 7. Logic Diagram for DSM's Search Routine.

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developed as part of this project (See Chapter 5.0).

Searching for appropriate folders is made simple by the 'Search Manager' provided with DSM. All folders found in the specified search path are checked for keyword files. Those found to have associated keyword files are added to a temporary list. This list is then used to check the various files for the specified keyword. Files not containing the keyword are removed from the list, leaving a list of folders containing the specified keyword. Any folder from this list can subsequently be opened, deleted or sent. Figure 7 presents a diagram of the logic used to build the search routine. For more technical details on DSM see the programmers manual.

5.0 The DSM Application Template Example (DATE)

5.1 Introduction

The DSM Application Template Example (DATE), included in this project, provides an example for the development of future DSM compliant applications. As described earlier, DSM allows applications to be added as users of the system and assigns regular mailboxes to them. People can then communicate with these applications as and when required.

Pushing this technology one step further, two DSM applications can communicate with each other, interchange data and invoke other applications as and when required. Indeed the possibilities are limitless. To demonstrate this powerful capability, DATE was created and included with this project.

5.1 DATE's Design

DATE was designed to demonstrate the exchange of information between independent applications. Although DATE's processing capabilities are very limited, it does demonstrate adequately the concepts it was designed to demonstrate. The design of the application mirrors the design of DSM's Mail Manager. In fact, due to the modularity of DSM's code, much of the original code pertaining to the Mail Manager is present in DATE's code. Other common

areas of code are the Security Manager and the Message Manager.

On activation, DATE checks for a valid DSM mailbox that has been assigned to it. In the event that such a mailbox is not successfully located, the user is informed that DATE is not registered as a DSM user. At this point the administrator of the system would be informed. When DATE's Connection Manager verifies that its mailbox has been successfully located, the application initializes its working parameters and displays the message "Charging Batteries ..." on the Application Monitor. Once the initialization sequence is complete, this message is replaced by the familiar "Listening ..." message. At this point there are two actions taking place. DATE's Mail manager checks its mailbox on the server periodically to see if a new message has arrived. Simultaneously, the Connection manager also checks for a valid connection to the server. This is necessary as it is possible for the server to go off line. If this were to happen, DATE would display a warning message to the user and terminate itself.

Once a message is sent to DATE, its Mail manager is responsible for picking up the message and passing it on to the appropriate sub - manager. Once it has completed this activity, it goes back to checking its mailbox for new messages. Other sub - managers like the Processing manager also have the capability of activating the Mail manager as and when needed. As DATE responds to DSM messages, it is possible for the Processing manager to extract

sender information from the message. The next step is to identify the nature of the message. This is achieved by comparing the message statement with a stored list of valid DATE commands. In the event that no match is found in the list, the Process manager commands the Mail manager to send a reply to the original sender. This standard message includes a list of the valid DATE commands. DATE's application monitor also reflects the applications internal activity state. Appropriately then, the message "Unknown command from <sender name>" is displayed on the monitor screen.

5.2 Valid DATE Commands

5.2.1 Respond

This command simply demonstrates DATE's capability to respond to a message. Upon receiving this command the application monitor displays the message, "Responding to <sender name>". The processing manager then commands the Mail manager to send back a response containing the message, "Well, Hello to you too!".

5.2.2 Activate <application name>

This command instructs DATE to activate an application at its local node. The word 'Activate' must be followed by an appropriate executable application name. In the event that the application cannot be activated successfully, the

message "Invalid Activation Request" is displayed on the application monitor and a message saying ."Your request to activate <application name> could not be carried out" is returned to the original sender.

5.2.3 Process <number>.

This command demonstrates DATE's ability to process numeric information sent to it. The Processing manager simply adds 100 to the original number sent and then commands Mail manager to send the result back to the original sender. In the event that the command 'Process' is not followed by a number, the message "Invalid Process Request from <user name>" is displayed on the application monitor and the message "The command Process must be followed by a number" is returned to the original sender via the Mail manager.

5.2.4 Page <user>

Once DATE's Processing manager receives a 'Page <user>' command, it accesses the main DSM directory and retrieves the mailbox of the user to be paged. It then commands the Mail manager to send a message to this user, requesting appropriate action.

5.2.5 Terminate

When a user sends DATE the 'Terminate' command, its Mail manager passes the message to the System manager instead of the Processing manager.

The system manager then issues the appropriate commands for application shutdown.

5.3 The Template

DATE provides a convenient template for development of future DSM compliant applications. Programmers would need to modify only the Processing manager, while utilizing the provided Mail, Connection and System Managers as is. This is because all such applications would need to contain code to locate and connect to their mailboxes as well as to check their mailboxes for new messages or commands. These functions are carried out by the Mail and Connection Managers. DATE's System manager is merely responsible of activating the appropriate sub - manager when required to do so. Even in the event that a more complex application design is needed, the template provides an excellent example of the methods used to connect to the appropriate mailbox and check for new mail or messages.

6.0 Future Work and Conclusions

6.1 System Enhancements

Presented below are some possible enhancements to the current system.

6.1.1 DATE's Messaging Format

The message or mail format may change in a real application. DATE currently uses DSM's messaging format but this is not necessarily the best way to exchange information between applications.

6.1.2 Multiple Sever Connections

The current version of DSM allows each local node to connect to only one server. Future versions might incorporate the ability to connect to multiple servers, allowing access to external LAN's as well. This is not necessarily the only means to achieve this, but is one possibility worth considering. Another advantage of the capability of connecting to multiple servers is that different groups of users can have local servers on a network and also have access to external servers.

6.1.3 Active Server application

The current version of DSM does not support an active server application

that takes care of messaging and its related responsibilities. Instead these functions are left to the local nodes. They download the required information from the server and handle all messaging functionalities. In the true sense then, the server only acts as a central store house of information with no internal processing. It would prove useful for future versions of DSM to incorporate an active server application that was responsible for polling local mailboxes on each node rather than the other way around. This would free up resources at each local node for more important tasks. It would also remove the interruptions, however small, on the local machine.

6.2 Future Considerations

Future applications could run on artificial intelligence paradigms, silently listening for activation or processing commands. These applications could process supplied information autonomously, activating other applications as and when required, exchanging information and data with them, and finally supplying the required personnel the desired information or results. Indeed the possibilities are almost limitless. Depending on the requirements, complex and powerful systems consisting of independent add-on application modules, become easy to build. As a concept and methodology, the techniques used to create DATE and DSM are extremely powerful and will find much use in the years to come.

6.3 Conclusions

DSM provides a means to exchange information between people, and applications or both. Such systems will only gain importance as technology improves. The goal to make more information accessible to more users in a convenient manner will always remain in the foreseeable future. The concepts demonstrated in this project show one possible application of current technology. DATE provides an example template for the development of applications based on the current version of DSM. The methodologies used and document in the development of both DSM and DATE provide an invaluable tool for future development of any system based on similar functionality. This project acts as a starting point for the development of an integrated information and document management system. While it is difficult to predict the direction that information technology will take in the future, the need for an integrated information system will never diminish.

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Appendix A
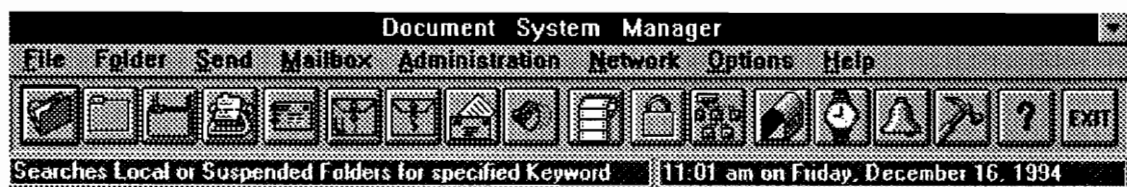
Document System Manager

User Manual

Table of Contents

Installation

Installation of Document System Manager takes place like any regular windows software product. To begin installation, run 'setup.exe' from the floppy drive. The setup program will then ask you to verify the destination directory for the system. At this point choose the default directory ('c:\dsm') by simply pressing the 'Okay' button on the screen. The setup program will also automatically create the required group within program manager. Setup is complete when it displays the "Installation is Complete message". In the event that setup fails to display this message, try to reinstall the package.

Contents of the DSM Group

The DSM group will contain three icons. The first, a yellow folder is the icon for the main DSM executable program. This is the software that runs on the client side of the system and accesses the server as and when needed. There is also a prototype of an intelligent module that is capable of listening for commands over the DSM system network. This module can be activated by double clicking on the 'ear' icon. The functionality of this module is described later in the documentation. The third icon in the group runs the configuration utility for the system. This allows users to update their local machines (clients) when the location or name of the server changes for any reason. DSM checks the configuration file to locate the server every time the system is activated by double clicking on the DSM icon (or any other means of activation on a Windows program). In the event DSM fails to locate the server as specified in the configuration file it informs the user and then displays a screen that allows the user to manually find the server directory.

The Configuration Utility

The configuration utility supplied with DSM makes it possible to activate the system without having to specify the location of the server each time it is initiated. The configuration file contains information about the required network connections and DSM attempts to make the appropriate links on startup. In the event that the location of the server root directory changes, the configuration utility can be used to update the configuration file. It also contains the information required to gain access to the server root directory. This information includes the location of the directory, the required password and the local drive letter to use to connect to the resource. Any and all of these parameters can be changed using the configuration utility.
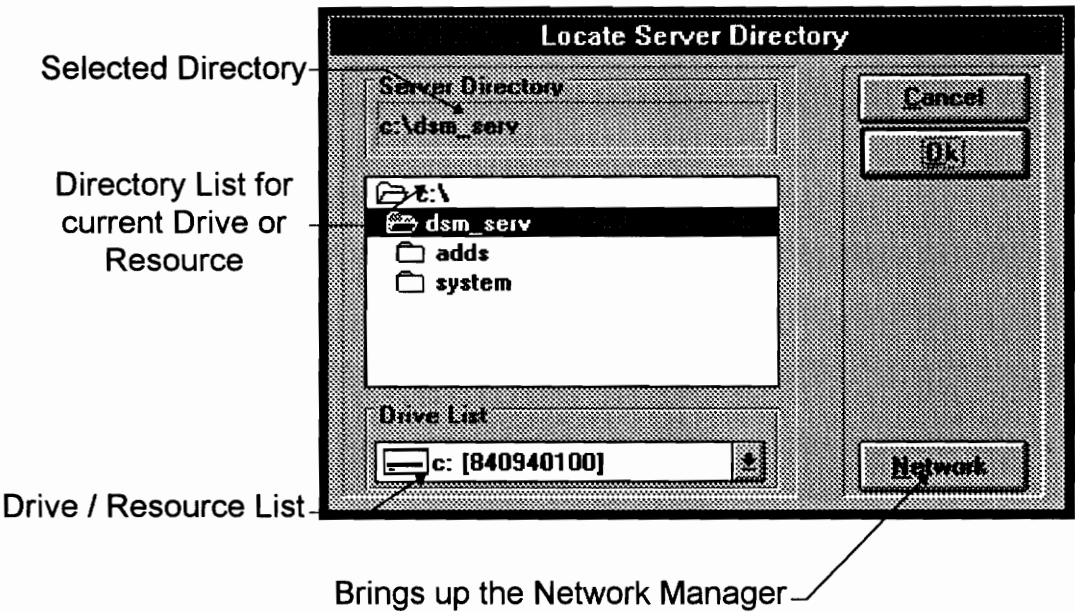
Activating DSM for the first time

After installation is complete, activate DSM by double clicking on the DSM icon. On startup, DSM will check for valid parameters within its local configuration file and if possible attempt to build the appropriate network links. Since this would be the first time that DSM was activated, the system automatically creates a Login database and sets the first user up as the system administrator. The system prompts for the entry of a first and last name for the administrator. When these are correctly entered, the user can click on the 'Done' button with the mouse pointer to gain access to the main system menu. Any subsequent Login attempts into the system by the administrator must be done with the same Login name and password. The administrator has the option of logging into the system from any workstation that is connected to the system network.

Locating the Server

In the event that the information in the local configuration file is invalid, DSM will prompt the user to locate the server resource directory manually. This is achieved rather simply by choosing the appropriate directory from the screen displayed below.

If the server is already connected to the local node as a shared resource, choose the unique drive letter associated with it from the drive list. The directory list is automatically updated and reflects the directories available through the resource. If the server is not already connected to the local node as a shared resource, click on the 'Network' button. This brings up the Network manager screen which connects the server to the local node as a shared resource.

Selected Directory

Directory List for current Drive or Resource

Drive / Resource List

Locate Server Directory

Server Directory

c:\dsm_serv

Cancel

Ok

📂 c:\
📂 dsm_serv
📁 adds
📁 system

Drive List

💾 c: [840940100]

Network
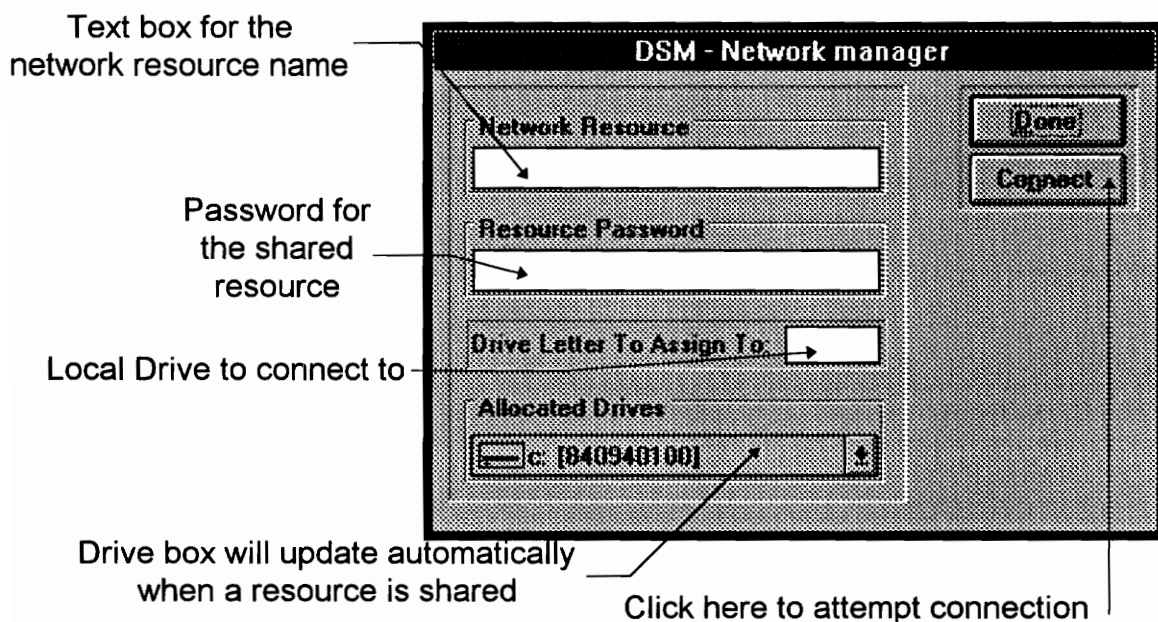
Brings up the Network Manager

Once the server root directory 'dsm_serv' has been located and is the selected directory as shown below, click on the 'OK' button. In the event that the server

directory was incorrectly chosen, DSM will return to this screen for the correct directory.
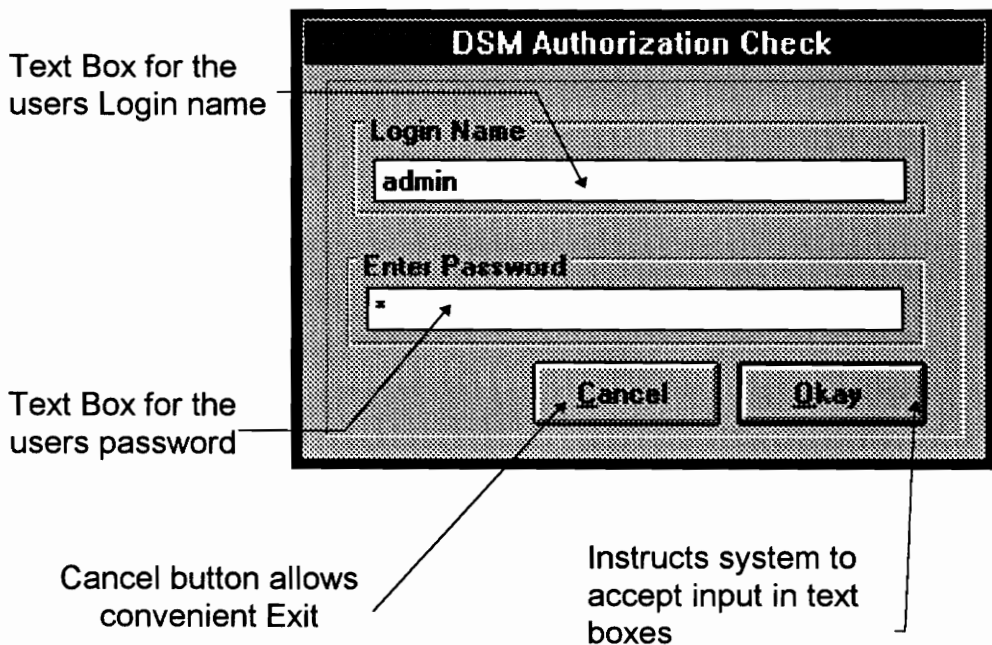
The Network Manager Screen

The network manager provides a means to connect to shared resources over the network. Similar functionality is provided by 'File Manager' in Windows for Workgroups 3.11. Connecting to a resource with the Network Manager is a simple matter. Enter the resource name, resource password and local drive letter to assign in the appropriate text boxes and click on the 'Connect' button. DSM will attempt to make the connection and will inform the user if it fails to do so.

Once the connection has been successfully made, it can be checked by clicking on the drive list and observing the specified drive letter in the list. To return to the previous screen, simply click on the 'Done' button.

Text box for the
network resource name

DSM - Network manager

Done

Network Resource

Connect

Password for
the shared
resource

Resource Password

Local Drive to connect to

Drive Letter To Assign To.

Allocated Drives

c: [940940100]

Drive box will update automatically
when a resource is shared

Click here to attempt connection

The Authorization Check

Once DSM has successfully located and connected to the server, it displays the Authorization Check screen displayed below. The user enters a valid Login name and corresponding password and clicks on the 'Okay' button. DSM verifies the existence of the Login name and cross checks the supplied password with that stored in the Login database. In the event of an invalid Login name or password, a message is displayed prompting the user to supply valid data. After four invalid attempts, DSM shuts down after displaying a message to see the system administrator.

Text Box for the
users Login name

DSM Authorization Check

Login Name

admin

Enter Password

Text Box for the
users password

Cancel

Okay

Cancel button allows
convenient Exit

Instructs system to
accept input in text
boxes

Security Manager Messages

Login not found

The message shown alongside is displayed when an invalid Login name is entered into the Login name text box in the Authorization check screen. The

DSM - Security Manager

Login not found !

OK

user gets a total of 4 invalid Login attempts before the system shuts itself down automatically.

Password Mismatch

The message shown alongside is displayed when an incorrect password is entered for a valid Login name. The user gets a

DSM - Security Manager

Password Mismatch !

OK

total of 4 invalid Login attempts before the system shuts itself down automatically.

Administrator Login

The message shown alongside is displayed when a successful administrative Login has been completed. The administrator

Admin Login Successful

Administrator Login successful !

OK

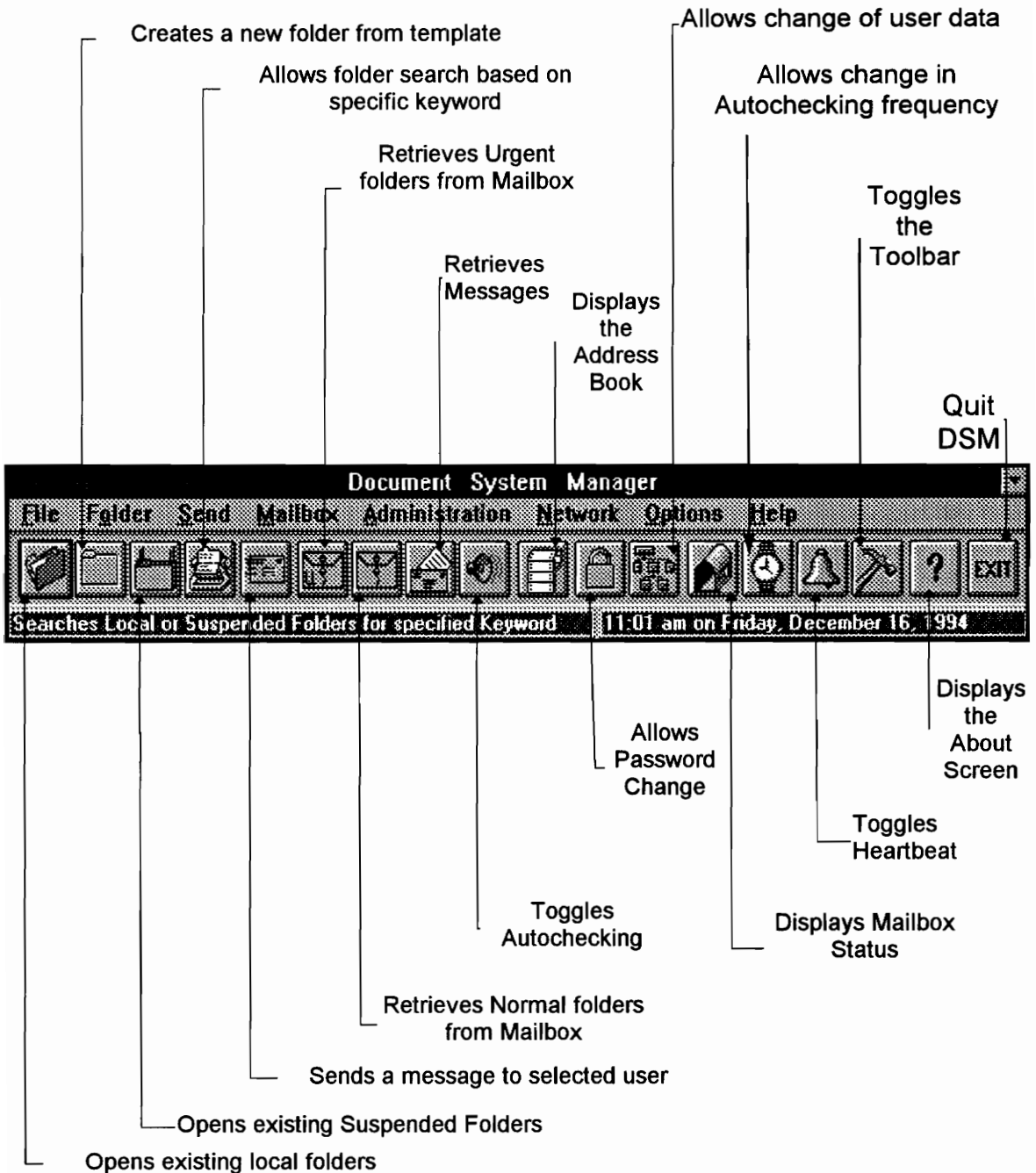has access to special functions like 'Add User', 'Modify User Account' etc.

User Login

The message shown alongside is displayed when a successful user Login has been completed. The user has no access to administrative functions.

User Login Successful

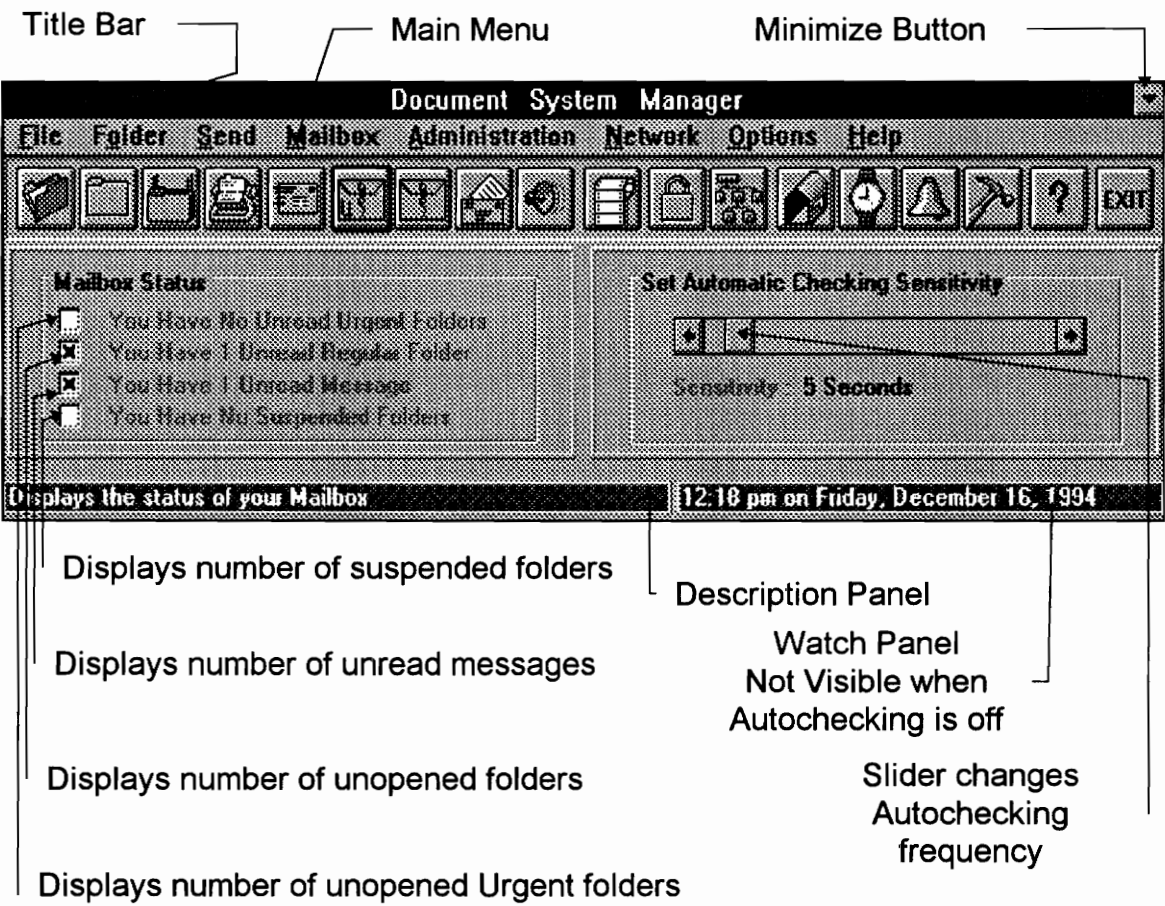**i** User Login successful !

OK

The System Toolbar

The diagram below describes the various commands available from the main DSM toolbar. Each command can be accessed by clicking on the appropriate icon name on the toolbar shown below.
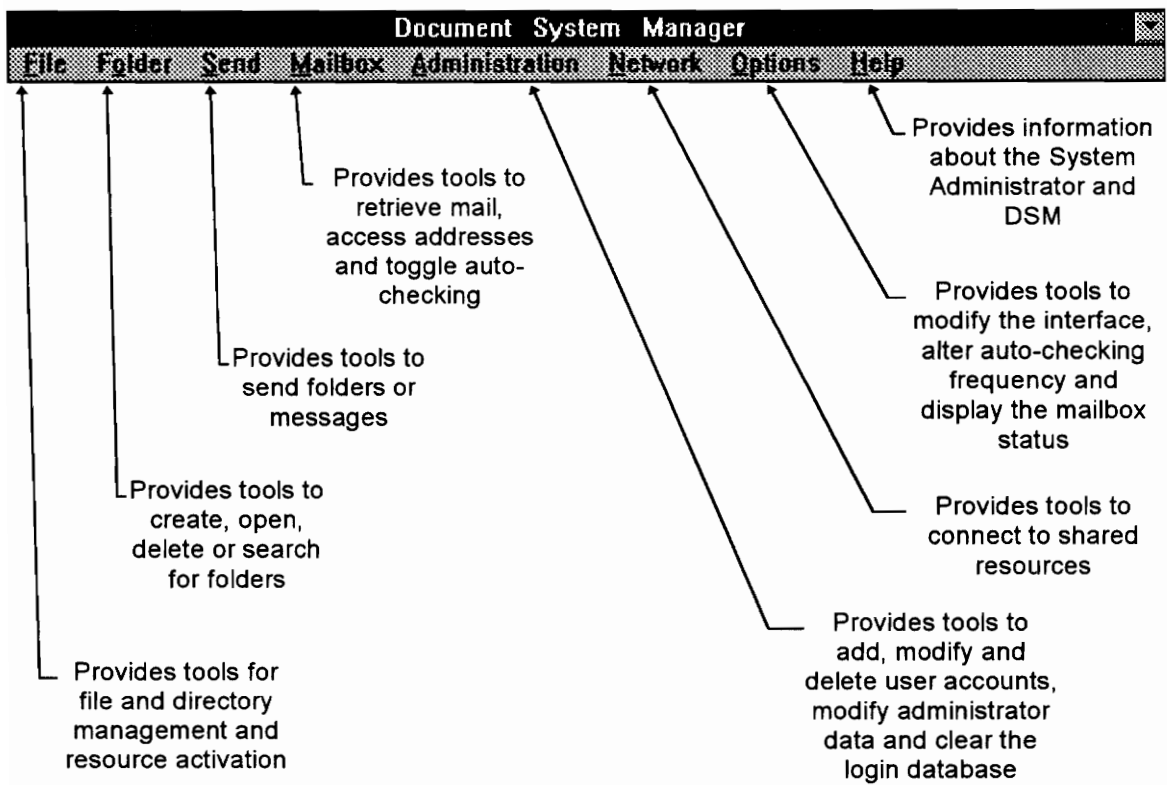
Creates a new folder from template

Allows folder search based on specific keyword

Retrieves Urgent folders from Mailbox

Retrieves Messages

Displays the Address Book

Allows change of user data

Allows change in Autochecking frequency

Toggles the Toolbar

Quit DSM

Document System Manager

File   Folder   Send   Mailbox   Administration   Network   Options   Help

Searches Local or Suspended Folders for specified Keyword   11:01 am on Friday, December 16, 1994

Allows Password Change

Displays the About Screen

Toggles Heartbeat

Toggles Autochecking

Displays Mailbox Status

Retrieves Normal folders from Mailbox

Sends a message to selected user

Opens existing Suspended Folders

Opens existing local folders

The Main Interface Screen

The diagram below describes the main DSM screen with the mailbox status and sensitivity controls visible. Various portions of the interface portray specific and important information about the current operating parameters of the system. On startup, only the system menu and toolbar are visible. To view the mailbox status and sensitivity controls click on the appropriate icons on the toolbar or chose the appropriate commands from the 'Options' menu. A detailed description of all the commands is provided in the sections that describe the various menus.

Title Bar   Main Menu   Minimize Button

Document System Manager

File Folder Send Mailbox Administration Network Options Help

Mailbox Status
You Have No Unread Urgent Folders
You Have 1 Unread Regular Folder
You Have 1 Unread Message
You Have No Suspended Folders

Set Automatic Checking Sensitivity
Sensitivity   5 Seconds

Displays the status of your Mailbox   12:18 pm on Friday, December 16, 1994

Displays number of suspended folders

Displays number of unread messages

Displays number of unopened folders

Displays number of unopened Urgent folders

Description Panel

Watch Panel
Not Visible when
Autochecking is off

Slider changes
Autochecking
frequency

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The DSM Menu System

The Main Menu Bar

The diagram below describes the various menus available from the main DSM menu screen. Each sub - menu can be accessed by clicking on the appropriate menu name on the menu bar shown below.

```
Document  System  Manager                          ▨
File  Folder  Send  Mailbox  Administration  Network  Options  Help
```

Provides tools to
retrieve mail,
access addresses
and toggle auto-
checking

Provides information
about the System
Administrator and
DSM

└ Provides tools to
send folders or
messages

Provides tools to
modify the interface,
alter auto-checking
frequency and
display the mailbox
status

└ Provides tools to
create, open,
delete or search
for folders

Provides tools to
connect to shared
resources

└ Provides tools for
file and directory
management and
resource activation

Provides tools to
add, modify and
delete user accounts,
modify administrator
data and clear the
login database

The File Menu

The diagram below describes the various commands available from the File menu. Each command can be activated by clicking on the appropriate name on the menu bar shown or by using the appropriate accelerator key.

Document System Manager

File Folder Send Mailbox Administration Network Options Help

Create Directory
Remove Directory

Delete File
Rename File

Run

Associate Extension

Exit

Set Automatic Checking Sensitivity

Sensitivity 5 Seconds

——Creates a new directory as specified.

——Removes the specified directory

——Removes the specified file

——Renames the specified file

——Allows activation of any resource

——Associates extensions with applications

——Terminates the Document System manager

File Menu Commands

Create Directory

This commands permits the user to create a directory under any existing directory. All regular Windows restrictions apply for the name and creation of the directory.

Name of the Directory to Create

Drive List

Directory List for current Drive

Parent for new Directory
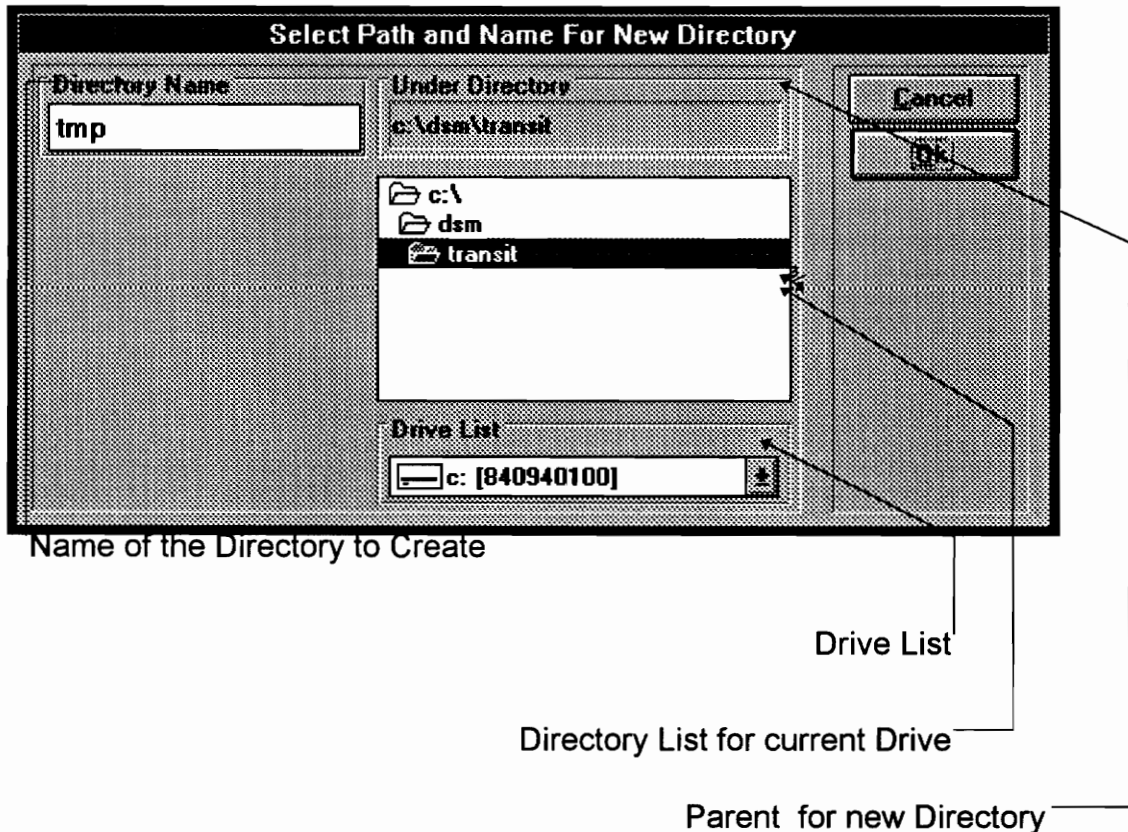
To create a new directory, enter a valid directory name in the 'Directory Name' text box, select the parent directory for the directory to be created by double clicking on the appropriate name in the directory list. If the directory is to be created on a drive other than the current one, the active drive can be changed by clicking on the appropriate letter in the drive list. Clicking the 'Cancel' button terminates the 'Create Directory' command without actually creating the

directory. Clicking the 'OK' button instructs the system to create the specified directory, terminate the command and return to the main DSM screen.

Remove Directory

This commands permits the user to remove an existing directory. All regular Windows restrictions apply for the name and creation of the directory.

Directory to Remove

Directory List

Drive List

Select Directory to Remove

Directory to Remove
c:\dsm

Cancel

OK

c:\
dsm
folders
icon
messages
transit

Drive List
c: [840940100]
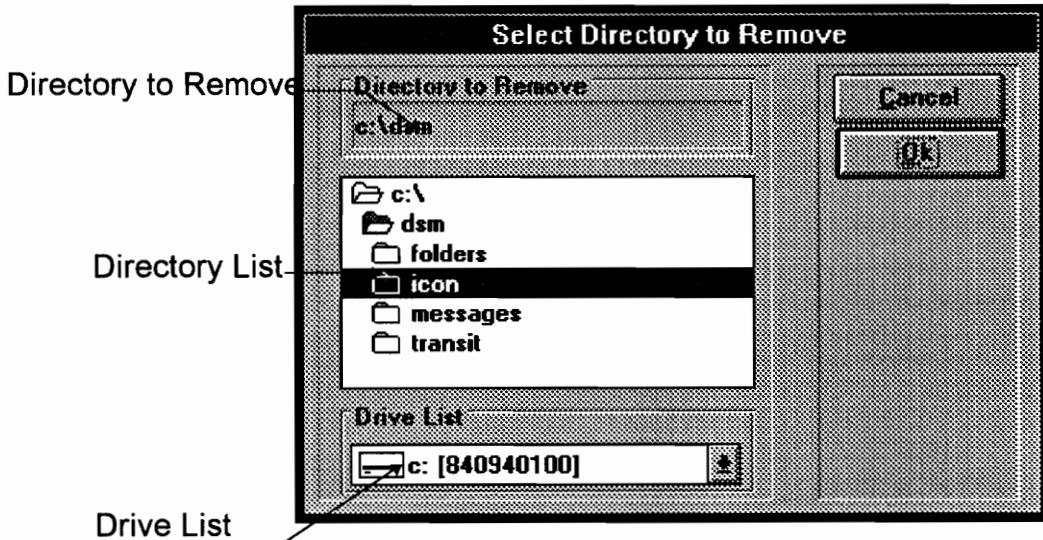
To delete a directory, select it by double clicking on the appropriate name on the directory list. This action will bring up the selected directory name on the 'Directory to Remove' display panel. If the name displayed is correct, click on the 'OK' button to remove the specified directory. Clicking on the 'Cancel' will abort the function and return control to the main DSM menu screen.

In the event that an attempt is made to delete a directory that is not empty, DSM will display the message shown alongside.

DSM - System Manager

Directory not Empty

OK
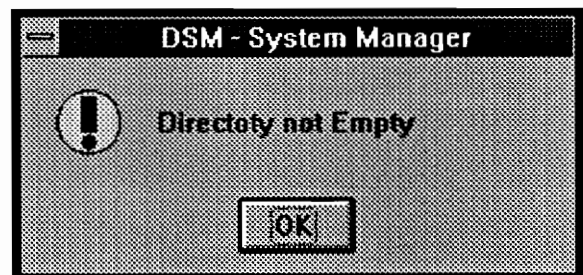
Delete File

To delete a file, either double click on the appropriate filename, or single click on it followed by a click on the 'OK' button. The system will ask for a confirmation on the delete command at this point. Clicking on the ''No' button will terminate the command.

Double click on the file to be deleted
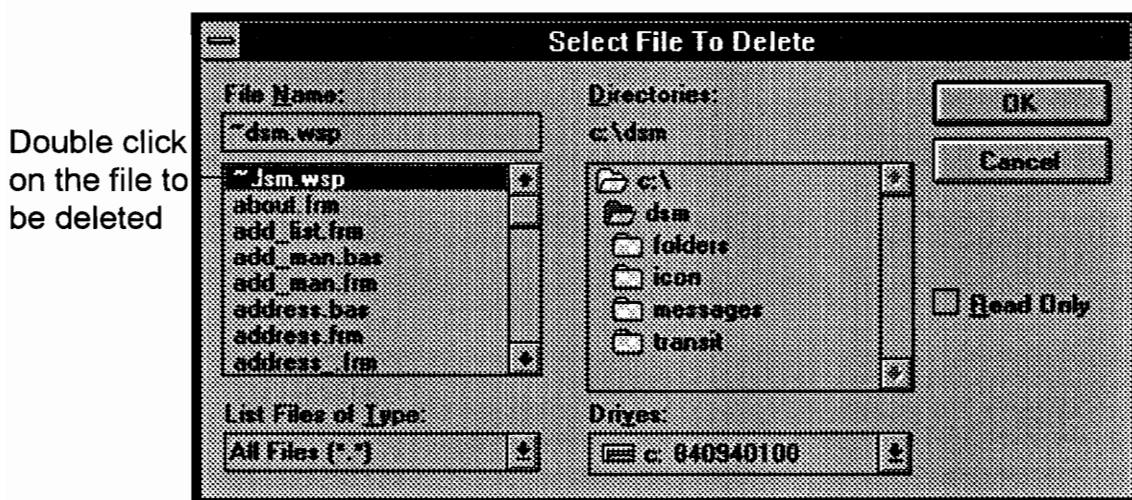
Rename File

To rename a file, first select the required file by double clicking on the appropriate filename from the file list. Then enter the new name for the file in the 'File Name' text box and click on the 'OK' button.

Enter new name for the file and click on the 'OK' button
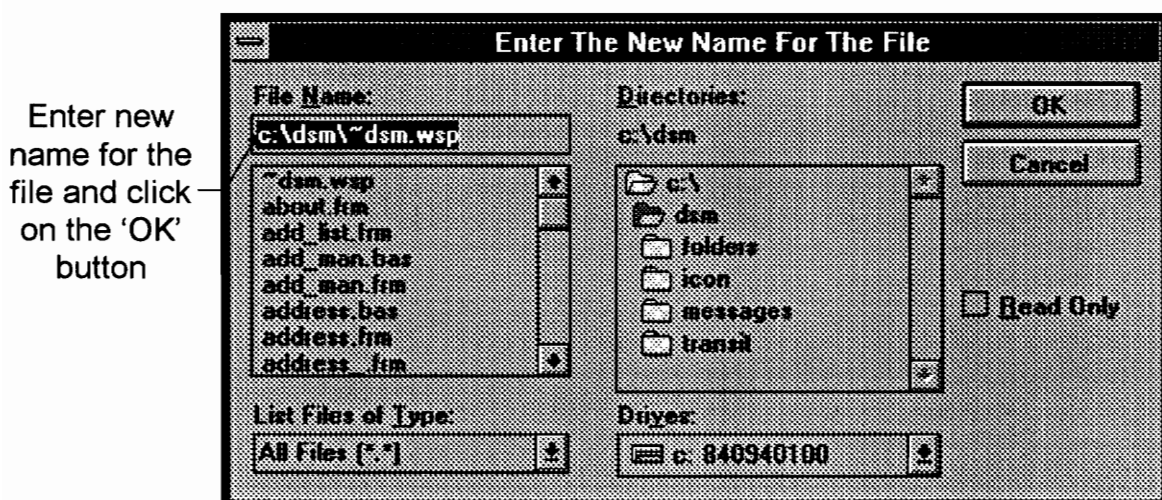
Run

DSM allows the user to launch any executable from within its own environment, asynchronously. To run an application, double click on the appropriate executable name from the file list in the 'Select Application' to Run' dialog box.

Double click
on the
appropriate —
executable
name
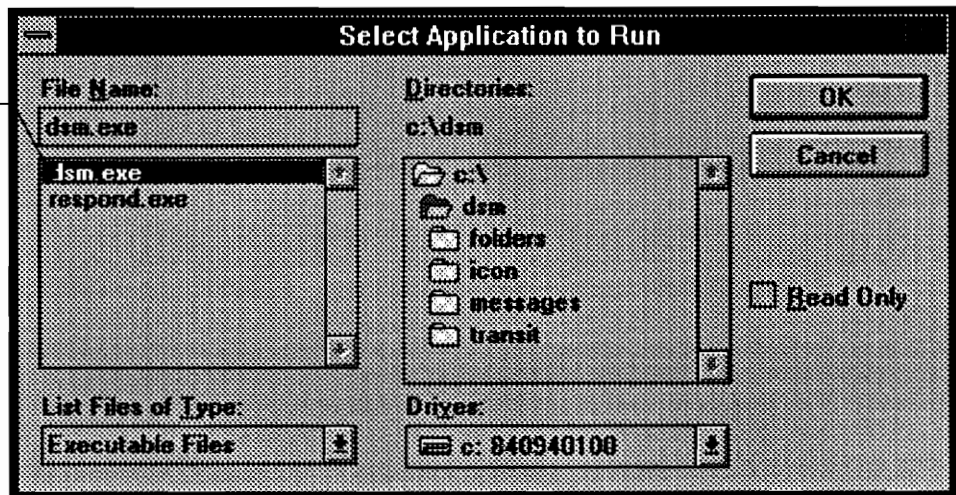
Exit

To terminate DSM, choose the 'Exit' command from the File menu or click on the 'Exit' icon on the toolbar. DSM then
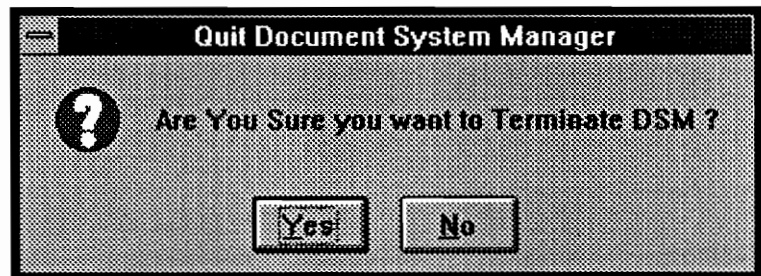
asks for a confirmation on the 'Exit' command. If the 'No' button is clicked, control is returned to the main DSM menu, whereas if the 'Yes' button is clicked, control is returned to Windows and the application terminates.

The Folder Menu

The diagram below describes the various commands available from the Folder menu. Each command can be activated by clicking on the appropriate name on the menu bar shown or by using the appropriate accelerator key.

Creates a new folder

Deletes Local folders

Opens local or suspended folders

Deletes Suspended Folders

Deletes local or suspended folders

Allows folder search based on specific keyword
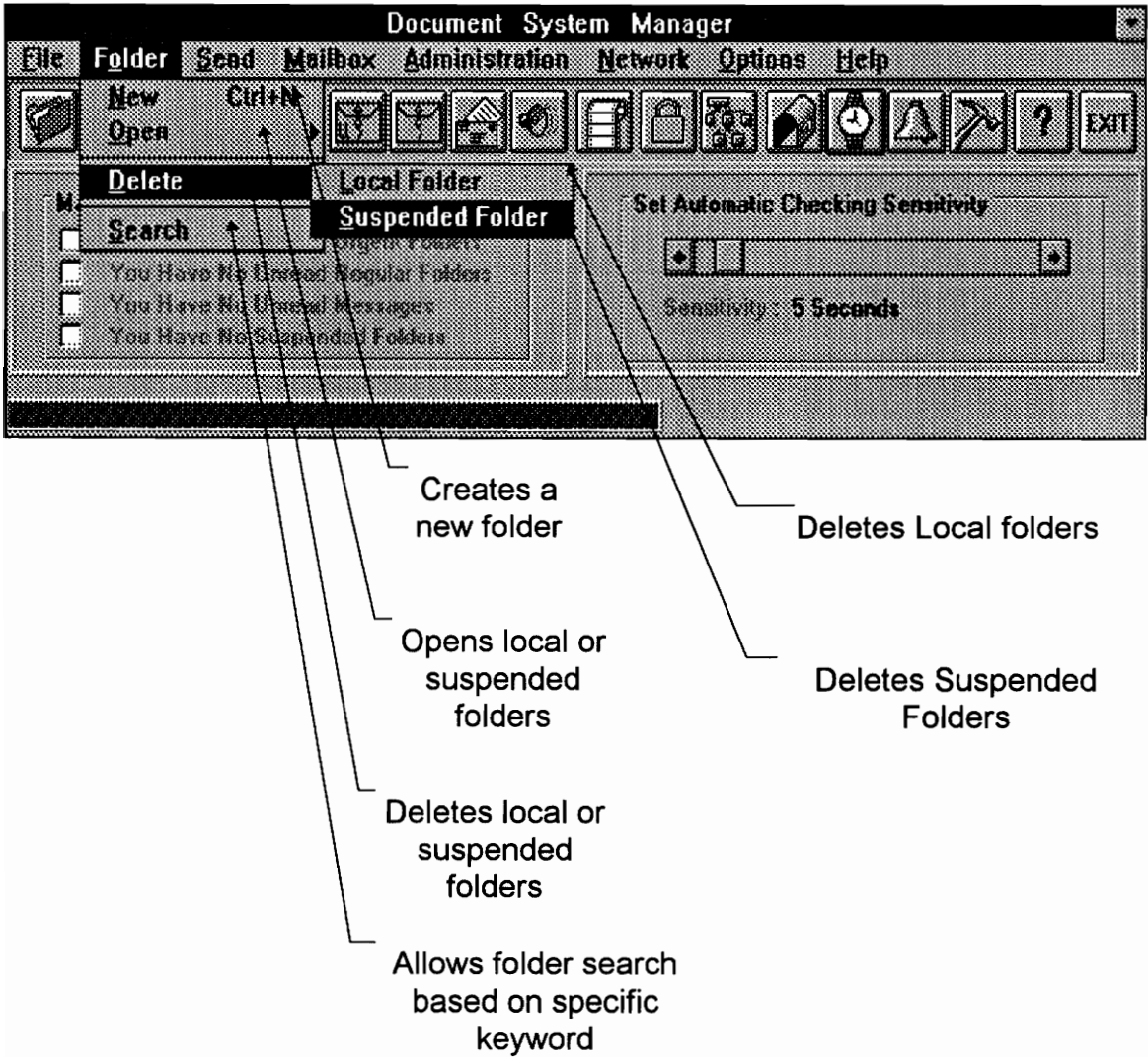
New Folder

This command allows the user to create a new folder. DSM provides an empty default folder to begin with. The user then customizes it to suit the requirements. For more information on the different types of folders see the section on 'Types of Folders'. A detailed description of the New Folder screen is also provided in the following section.

Open Folder

This command allows the user to open an existing local or suspended folder. On clicking on this function, a sub menu is displayed to the right of the folder menu, containing the elements 'Local Folder' and 'Suspended Folder'. Clicking on the first type will display the screen shown below. The user chooses the required folder name from the displayed dialog box by either double clicking on the appropriate name or by single clicking on it and then clicking on the 'OK' button.

Text box for the folder to open
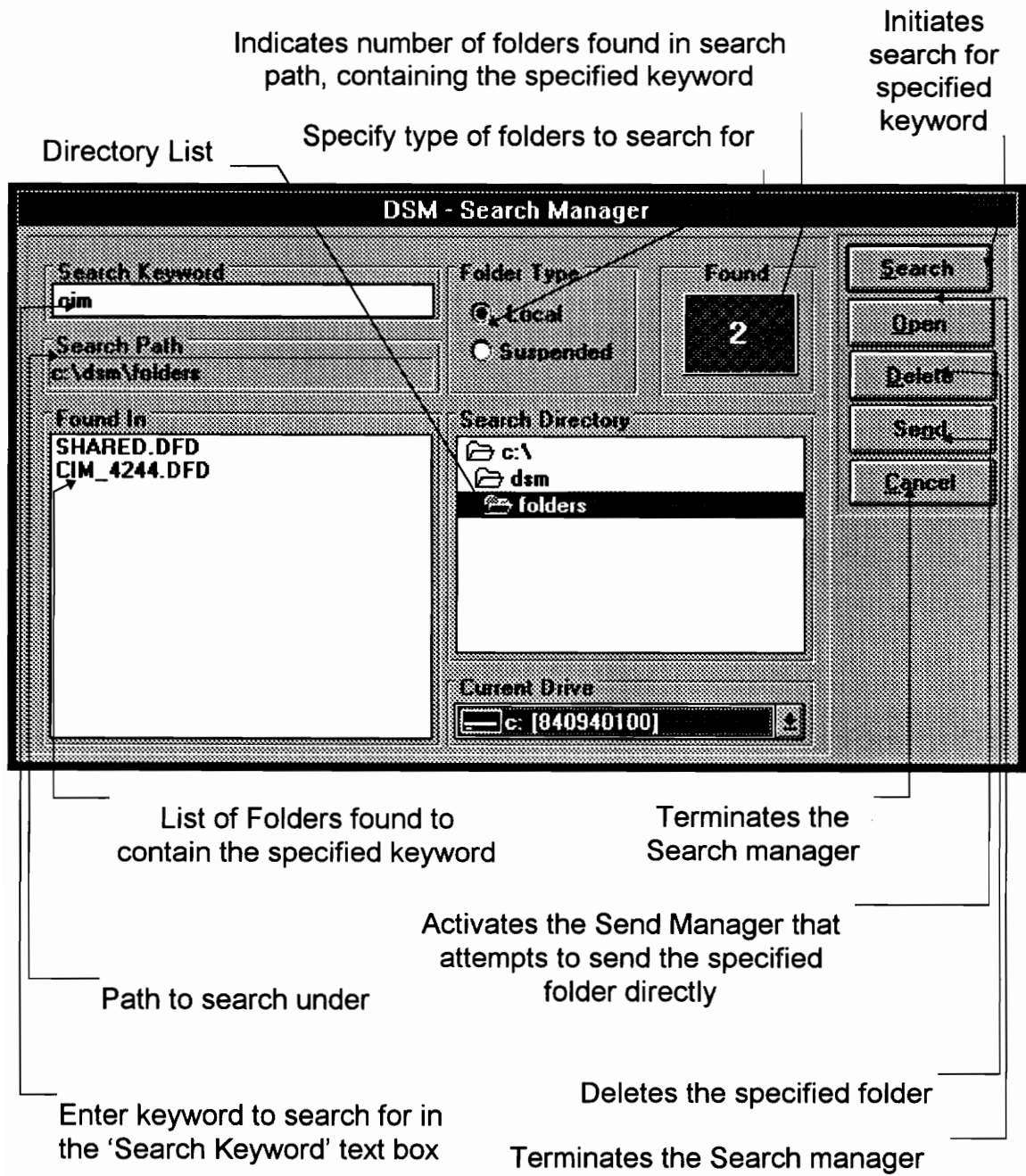
Double clicking on the required name selects it

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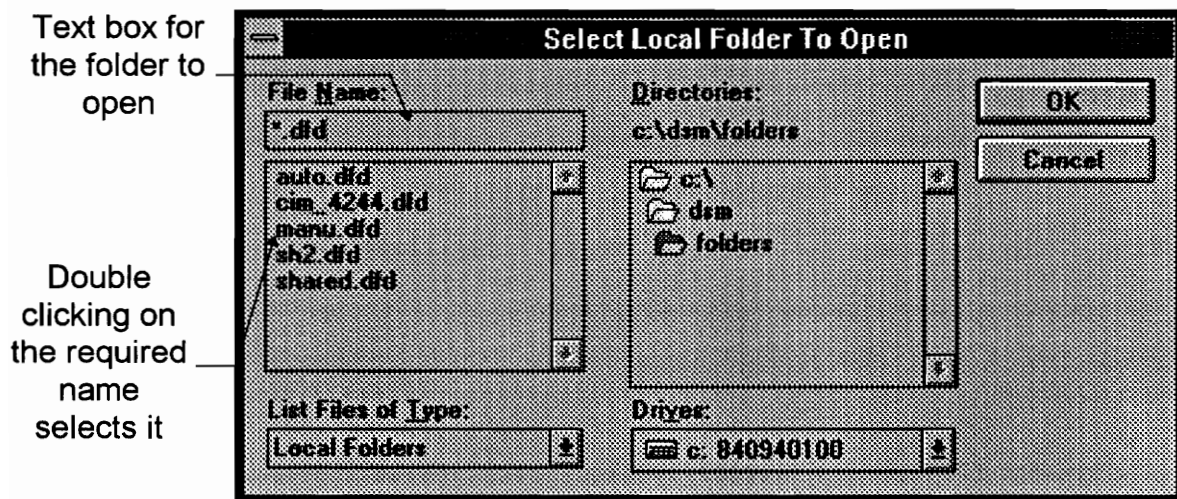
If the folder being opened is password protected and the current user is different than the owner of the folder, the Security manager prompts the user for the folder password. The password request screen is shown alongside

DSM - Security Manager

Enter Password

...

Cancel   OK
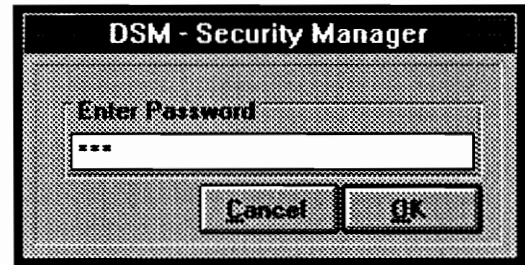
In the event that the entered password differs from the folder password, DSM prompts the user to contact the owner of the folder for the correct password and terminates the command. Both the password request

DSM - Security Manager

Incorrect Folder Password!
Contact 'mike' for correct Password

OK

and the password mismatch screens are shown alongside.
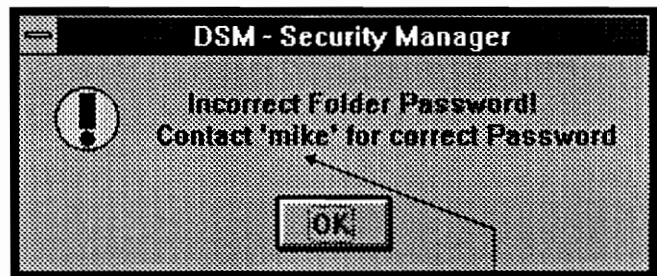
Name of the owner
of the folder

Delete Folder

This command allows the user to delete an existing local or suspended folder. On clicking on this function, a sub menu is displayed to the right of the folder menu, containing the elements 'Local Folder' and 'Suspended Folder'. Clicking on the first type will display the screen shown below. The user chooses the required folder name from the displayed dialog box by either double clicking on the appropriate name or by single clicking on it and then clicking on the 'OK' button.

Text box for the folder to delete

Double clicking on the required name selects it
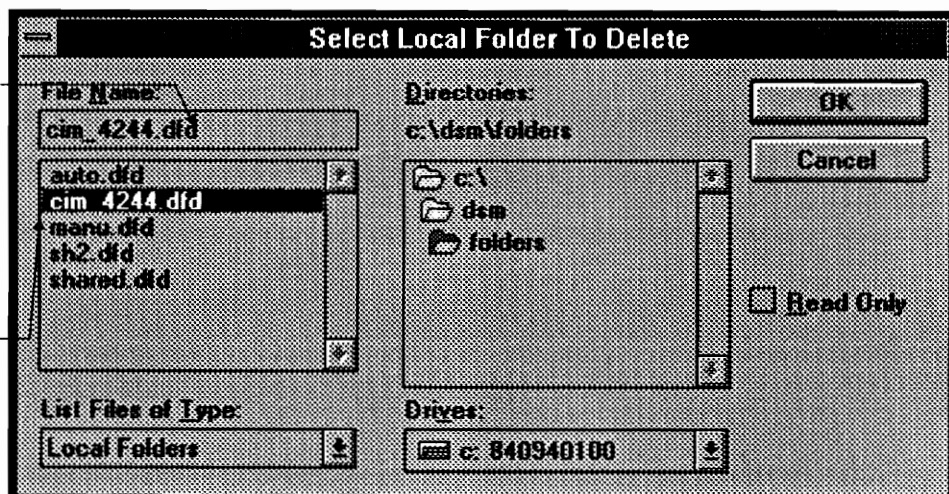
Upon selection the appropriate folder to delete, DSM displays a confirmation screen as shown in the diagram alongside. Clicking on 'NO' will abort the command and return control to the parent screen.
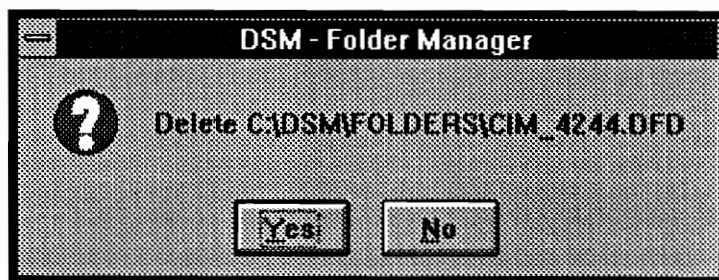
Search

The DSM Search manager provides a convenient and efficient way to search for folders based on previously stored keywords. Shown below is the Search manager screen. A detailed explanation of its operation is provided in the section that follows.

Indicates number of folders found in search path, containing the specified keyword

Initiates search for specified keyword

Directory List

Specify type of folders to search for

DSM - Search Manager

Search Keyword
cim

Folder Type
○ Local
○ Suspended

Found
2

Search
Open
Delete
Send
Cancel

Search Path
c:\dsm\folders

Found In
SHARED.DFD
CIM_4244.DFD

Search Directory
🗁 c:\
🗁 dsm
📂 folders

Current Drive
c: [840940100]

List of Folders found to contain the specified keyword

Terminates the Search manager

Activates the Send Manager that attempts to send the specified folder directly

Path to search under

Deletes the specified folder

Enter keyword to search for in the 'Search Keyword' text box

Terminates the Search manager

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Initiating a Search

To initiate a search for folders containing the specified keyword in the desired search path, enter the keyword in the 'Search Keyword' text box, update the 'Search Path' panel to show the desired path by double clicking on the appropriate drive and directory lists and click on the 'Search' button. To modify the search path, click on the drive box to choose the desired drive, then on the desired search directory from the directory list. Double clicking on the directory list updates the 'Search Path' panel automatically.

Folder Type Option

The Search manager provides the option of searching for the specified keyword in either local or suspended folders. To choose either type, simply click on the displayed name on the Search manager screen.

Opening a Folder

To open a folder displayed in the 'Found In' list in the Search manager, click on the desired folder name and then click on the 'Open' button.

Deleting a Folder

To delete a folder displayed in the 'Found In' list in the Search manager, click on the desired folder name and then click on the 'Delete' button.

Sending a Folder

To send a folder displayed in the 'Found In' list in the Search manager, click on the desired folder name and then click on the 'Send' button.

Terminating the Search manager

To terminate the search manager, click on the 'Cancel' button. Control will be returned to the main DSM system menu.

The Send Menu

The diagram below describes the various commands available from the Send menu. Each command can be activated by clicking on the appropriate name on the menu bar shown or by using the appropriate accelerator key.
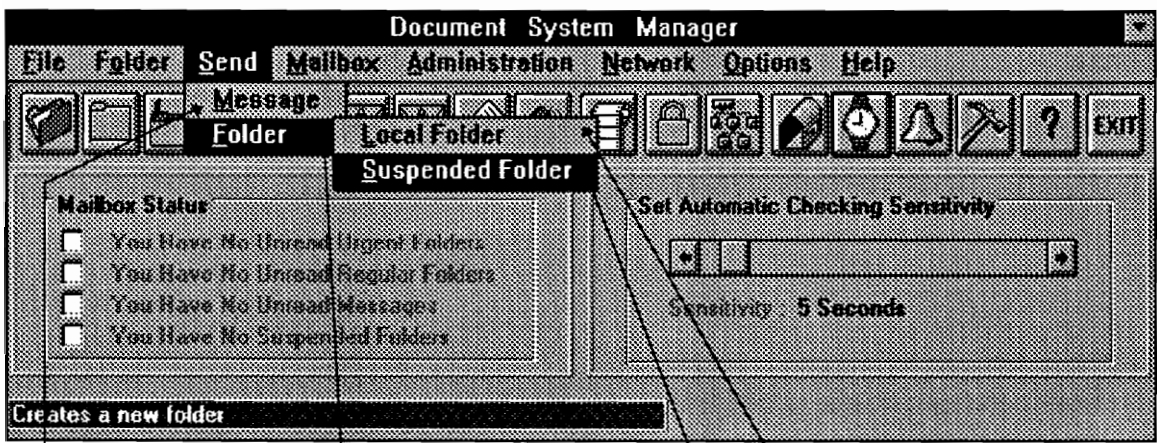
Activates the Mail manager to send a message to a user

Activates the sub menu alongside

Instructs DSM to send a Local folder

Instructs DSM to send a Suspended folder

Send Message

DSM allows users to send and receive messages from other system users over the network. It is important to remember that DSM permits applications to be added to the system as users. This enables these applications to receive and respond to messages over the network.

To send a message to any type of user, select the appropriate user loginname from the list of users displayed by DSM. A figure of the 'Select User' screen is shown alongside. A user can be selected by either double clicking on the appropriate name in the list or by single clicking and then clicking on the 'Select' button. To abort the 'Send Message' command, click on the 'Cancel' button.
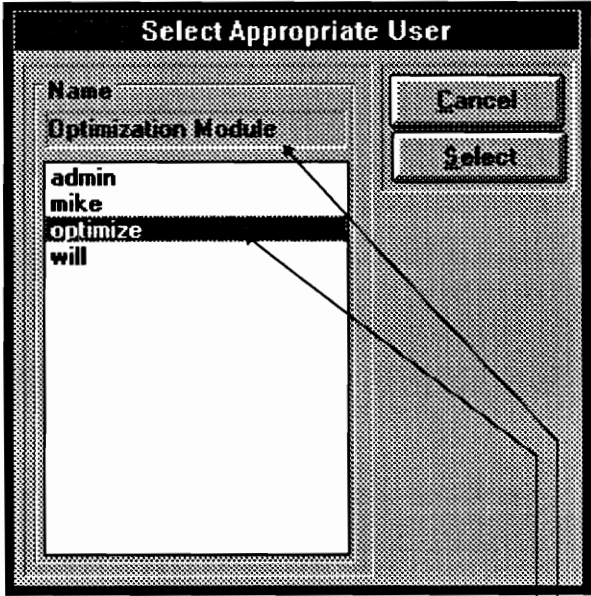
Double click on appropriate name

'Name' panel displays the full name of the highlighted recipient

Once the appropriate user has been selected, DSM displays the 'Send Message' screen shown on the next page. At this point the user has the option of loading a previously saved message by clicking on the 'Load' button or entering a new message as appropriate.
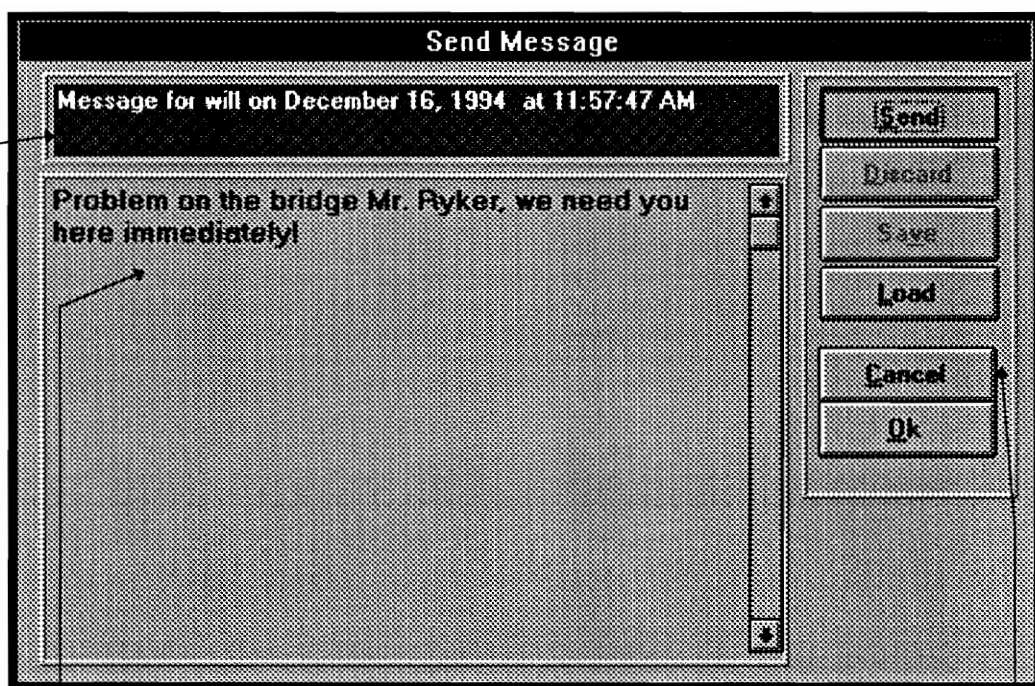
Enter message to send and then
click on the 'Send' button

Aborts the 'Send
Message' command

Panel displays information about message

Shown below is the screen that DSM displays when the user opts to load a
previously stored message.
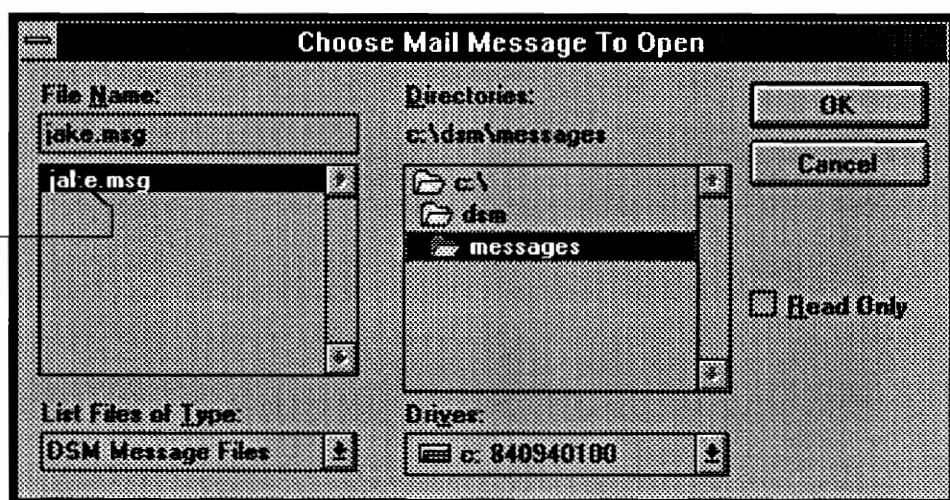
Double click
on the
appropriate
message
name

Send Folder

The 'Send' - 'Folder'' command opens up a second level sub menu that lets the user choose to send either a local or a suspended folder without opening. This functionality is also provided from within the Search manager screen. To send a folder, first choose the desired type from the sub menu. At this point DSM will display a dialog box prompting for the folder to send. If the specified folder has not gone any recipients stored within it, the System manager informs the user and the command terminates. The dialog box displayed to allow the required choice to be made is shown below.
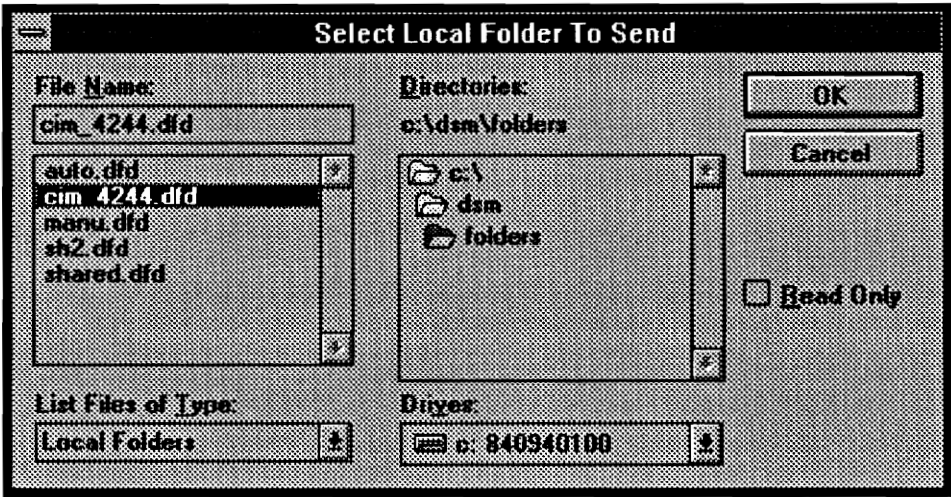
Once the desired name is provided by double clicking on the appropriate name in the file list or by single clicking on the name followed by clicking on the 'OK' button, and the recipients list has been validated, DSM displays the Send manager. This screen allows the user to make several choices about the folder being sent. A figure of this screen along with a description of its functionality are provided in the following section.

The Send Manager

The Send manager allows the user to make a choice between sending original files verses sending only copies. If original copies need to be sent, DSM automatically makes a backup and stores the copies in its backup directory.

The folder can be sent as a read only folder, an urgent folder, a return receipt folder or any combination of these types. Clicking on the appropriate check boxes and radio buttons will toggle the required modes of transmission.

The Send manager also displays the name of the next recipient in the case of routed folder transmissions. This is illustrated in the figure below.

Complete list of recipients

Choice between sending Originals or copies of attached files

DSM - Send Folder

Final Recipient List

admin
mike

Sending Options

○ Send Original Files
⊙ Send Copies of Files

☒ Inform Owner On Opening
☐ Send Contents As Read Only
☒ Send As Urgent Folder

ADMIN

Cancel   Send

Send folder options; Return Receipt requested, read only and urgent

Panel displaying the name of the next recipient for the routed folder being sent

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To send the folder, choose the required options and click on the 'Send' button. DSM will automatically send the folder out and return control to the parent screen.

The Mailbox Menu

The diagram below describes the various commands available from the Mailbox menu. Each command can be activated by clicking on the appropriate name on the menu bar shown or by using the appropriate accelerator key.
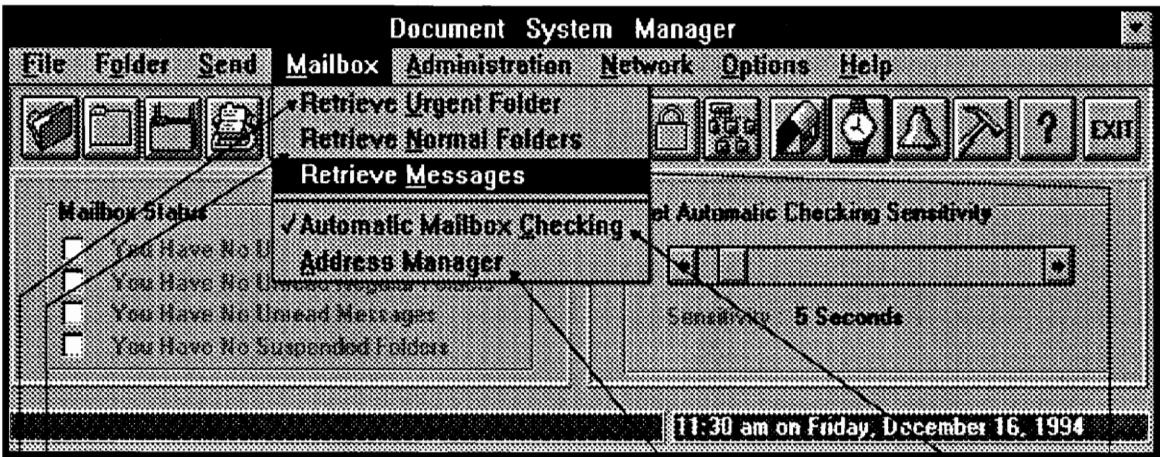
Provides access to information on all the users registered on DSM

Toggles the Autochecker

Retrieves Unread Normal Folders from the users mailbox

Retrieves Unread Urgent Folders from the users mailbox

Retrieves Unread Messages from the users Mailbox

In the event that the user receives an urgent folder and the Autochecker is active, the message shown alongside is displayed.

DSM - Mail Manager

ⓘ You Have New Urgent Mail

`OK`

In the event that the user receives a regular folder and the Autochecker is active, the message shown alongside is displayed.

DSM - Mail Manager

ⓘ You Have New Mail

`OK`

In the event that the user receives a message and the Autochecker is active, the message shown alongside is displayed.

DSM - Mail Manager

ⓘ You Have A New Message

`OK`

Retrieve Urgent Folder

This command allows the user to retrieve an Urgent Folder from the mailbox. To keep from interrupting the user while working on another application, DSM takes a minimal amount of time for its checking procedure. The Autochecker only check the mailbox for new mail; it does not automatically retrieve it for the user.

The figure below shows the dialog box displayed by DSM that lets the user choose which folder to retrieve in the event that there is more than one. Simply double clicking on the appropriate name will initiate the procedure to retrieve the urgent folder. To abort the procedure for any reason, the user clicks on the 'Cancel' button. This would terminate the 'Retrieve Urgent Folder' command and return control to the main DSM system menu.
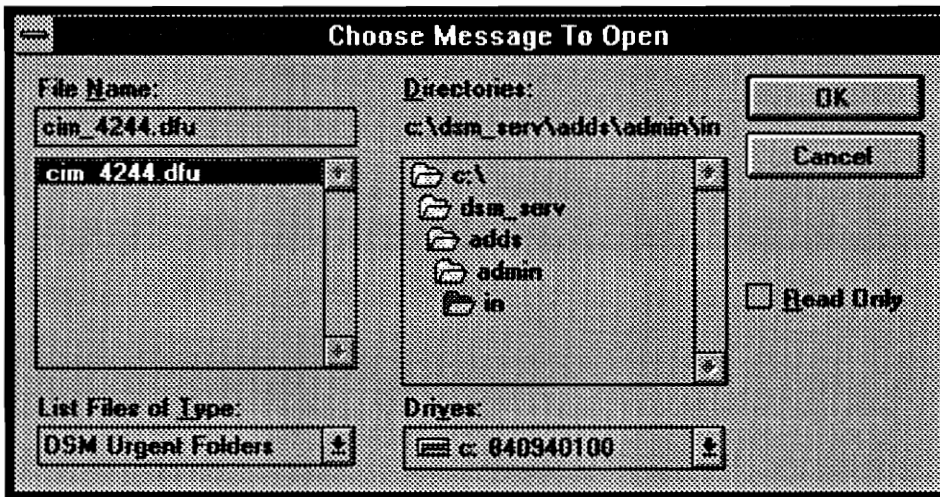
Retrieve Normal Folder

This command allows the user to retrieve a Normal Folder from the mailbox. To keep from interrupting the user while working on another application, DSM takes a minimal amount of time for its checking procedure. The Autochecker only check the mailbox for new mail; it does not automatically retrieve it for the user.

The figure below shows the dialog box displayed by DSM that lets the user choose which normal folder to retrieve in the event that there is more than one. Simply double clicking on the appropriate name will initiate the procedure to retrieve the normal folder. To abort the procedure for any reason, the user clicks on the 'Cancel' button. This would terminate the 'Retrieve Normal Folder' command and return control to the main DSM system menu.
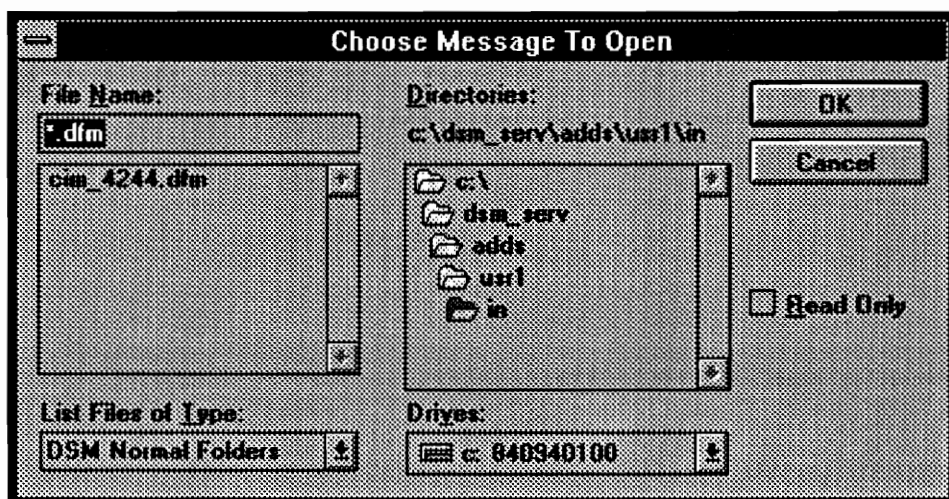
Retrieve Messages

This command allows the user to retrieve a Message from the mailbox. To keep from interrupting the user while working on another application, DSM takes a minimal amount of time for its checking procedure. The Autochecker only check the mailbox for new mail; it does not automatically retrieve it for the user.

The figure below shows the dialog box displayed by DSM that lets the user choose which message to retrieve in the event that there is more than one. Simply double clicking on the appropriate name will initiate the procedure to retrieve the message. To abort the procedure for any reason, the user clicks on the 'Cancel' button. This would terminate the 'Retrieve Message' command and return control to the main DSM system menu.
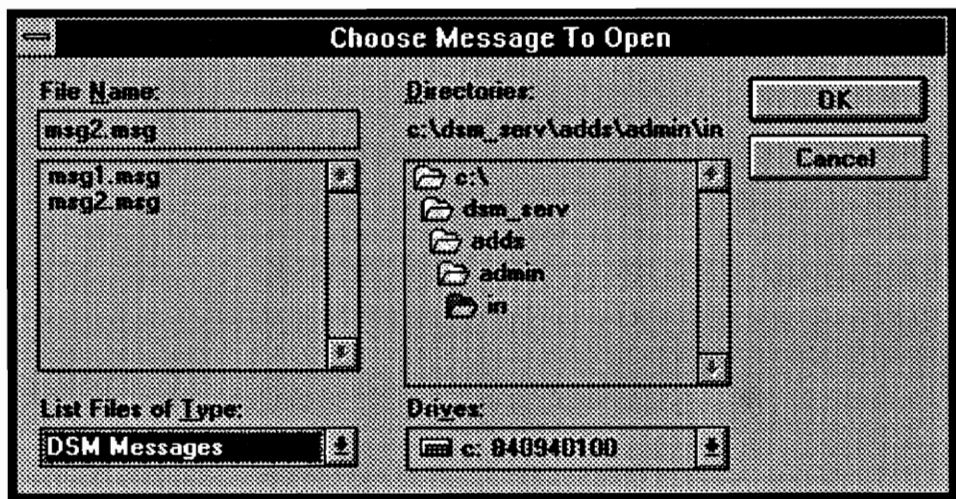
Automatic Mailbox Checking

This command enables the Autochecker to be activated or deactivated whenever necessary. To activate the Autochecker, simply click on the command in the 'Mailbox' menu. If the Autochecker was previously disabled, it will enable itself at this point, the watch panel will become visible and a check will appear in front of the command in the menu. If it was already active, it will deactivate itself, the watch panel will become invisible and the check mark will disappear.

Address Manager

The Address manager provides information about all registered users. This information can be helpful when the recipient for the information is not know due to the large size of the organization. The Address manager screen is shown below and a detailed description of its commands is provided in the following section.

Users Password

Users Last name

DSM Address Manager

Login Name
mike

Password
****

First Name
Mike

Last Name
Smith

Department
ISE

Telephone
231-6895

FAX
231-6656

Comments
Contact Mike for questions on the Windows Network or if your system is not able to connect to the server through the config file.

Mailbox Address
c:\dsm_serv\adds\usr1

Clear
Previous
Next
Cancel
Done

Displays additional information on the user

Users Fax Number

Users Telephone Number

Terminates Address manager

Users Department

Displays Next User

Users First name

Displays Previous User

Users Login name

The Administration Menu

The diagram below describes the various commands available from the Administration menu. Each command can be activated by clicking on the appropriate name on the menu bar shown or by using the appropriate accelerator key.

Allows the Administrator to clear the Login database
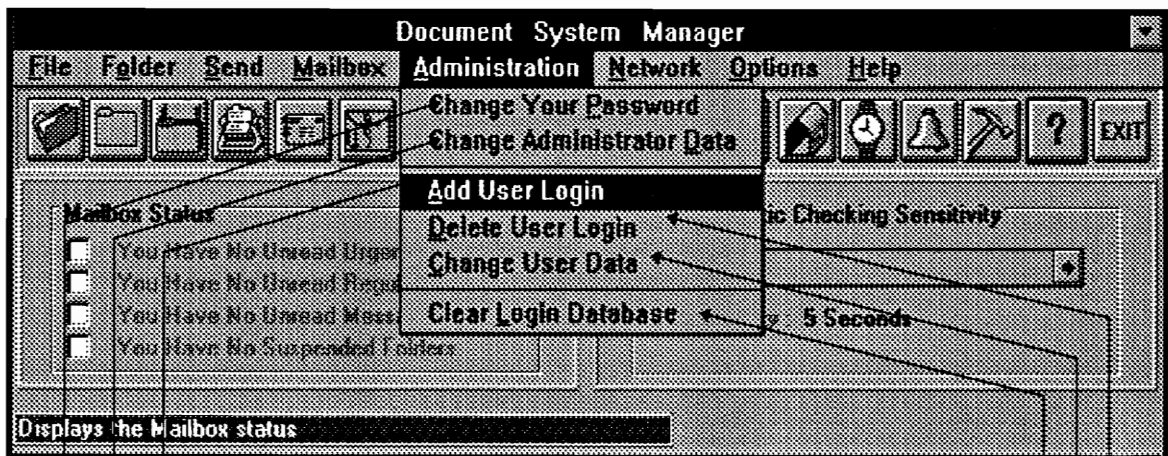
Allows the Administrator to add a new user

Allows the Administrator to update or modify administrator information
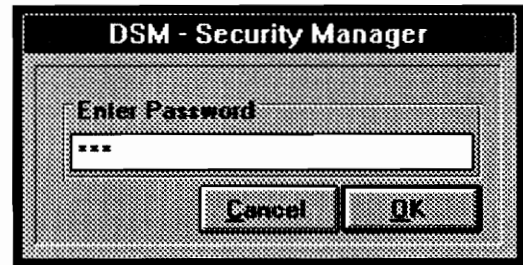
Allows the Administrator to modify user account

Allows the current user to make a password change

Allows the Administrator to Delete a registered user

Change Your Password

This command enables the current user to change his or her Login password. The Security manager prompts the user to enter the new password twice to check for consistency.

To confirm the change, DSM displays the message shown alongside.
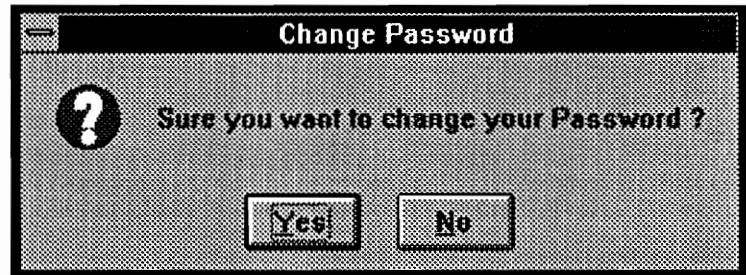
If the two passwords do not match then the command is aborted after displaying an appropriate message to the user.
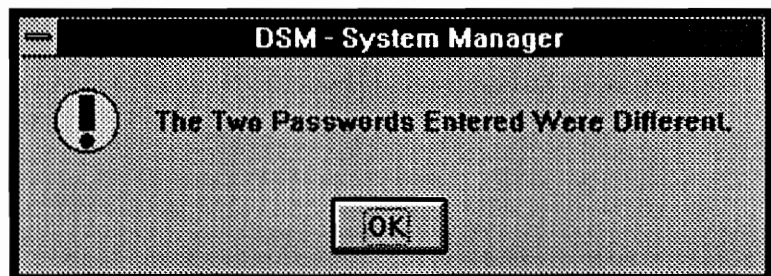
This is the only administrative command that is accessible to the user. Only the administrator has access to the remaining administrative functions.

Change Administrator Data

This command permits the administrator to change the data associated with the administrator's Login account. For instance, the password, First and Last name, Department, etc.

To abort the command click on the 'Cancel' button. To commit the changes to disk, click on the 'Done' button on the screen shown below.

Administrator's Last name

Change Administrator Data

Login Name	Password
admin	*
First Name	Last Name
Jane	Doe

Clear
Previous
Next
Cancel
Done

Department
SE

Telephone	FAX
1-6895	1-6656

Comments
Jane is the system Administrator

Mailbox Address
c:\dsm_serv\adds\admin

Displays additional information on the Administrator's

Administrator's Fax Number

Makes Changes permanent

Administrator's Telephone Number

Aborts Command

Administrator's Department

Clear all boxes of data

Administrator's First name

Administrator's Login name

Add User Login

This command permits the administrator to add a user Login into the system.

To abort the command click on the 'Cancel' button. To commit the changes to disk, click on the 'Done' button on the screen shown below.

To add a new user, first add a unique Login name in the 'Login Name' box, followed by a password in the 'Password Box'. Next enter at least a first or last name, or both, followed by information in the other fields. Click on Done to commit the addition to disk.

It is important to remember that the Login Name, Password and either the First Name or the Last Name are mandatory fields for adding a new user. Other information like Department, telephone Number, Fax Number and Comments are

not essential. Their purpose is to help identify and locate other users on the system.

Delete User Login

The ADMINISTRATOR has the ability to delete any registered user at any time. It is important however that the user targeted for deletion be logged off at the time this command is activated. Deleting a user is paramount to removing the users mailbox from the server and removing access rights to the system. All unread mail that the user might have had in the mailbox will be deleted. Once a user has been successfully deleted, there is no way to retrieve any deleted mail.

The Delete user screens are similar in appearance and working to the 'Modify User Data' screens. The first screen (shown below), allows the administrator to choose the user to be deleted.

To choose a user for deletion, select the appropriate Login Name from the list of users displayed by DSM. A user can be selected by either double clicking on the appropriate name in the list or by single clicking and then clicking on the 'Select' button. To abort the 'Send Message' command, click on the 'Cancel' button.
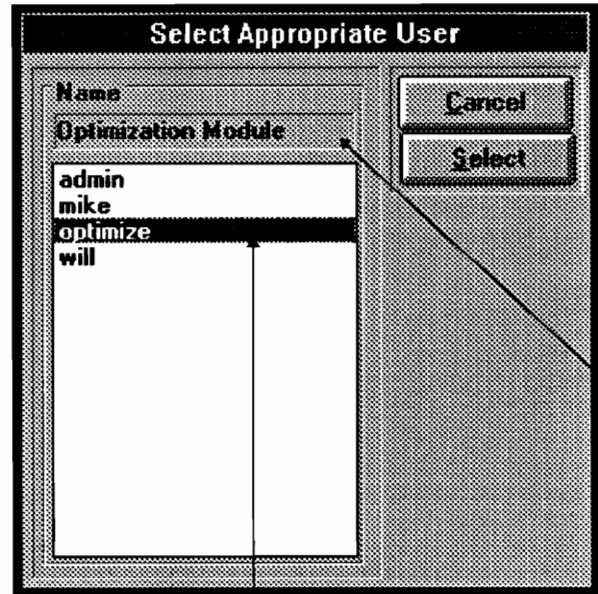
Double click on appropriate name

'Name' panel displays the full name of the highlighted recipient

Once the appropriate user has been selected, DSM displays the 'Delete User' screen shown below. The fields on the 'Delete User' screen will display the information stored for the user targeted for deletion. At this point the administrator has the option of aborting the command by clicking on the 'Cancel' button. Clicking on the 'Done' button will confirm that the visible account for deletion.

On clicking on the 'Done' button DSM will prompt for a confirmation with the message alongside. Clicking on the 'Yes' button will delete the users

account targeted for deletion.

On successful deletion of the user, DSM will display the message shown alongside.

Change User Data

The administrator has the ability to change the Login data associated with any user. Again, keeping simplicity in mind, the input screen is the same as the one used in the add user and delete user commands. The difference is that the administrator has the ability to make changes to the displayed fields. It is important to note that the Login Name of a user cannot be changed. This command is useful when data pertaining to a user has to be updated, or when passwords need to be changed.

DSM requires the administrator to confirm the command before committing changes to disk. The confirmation screen is
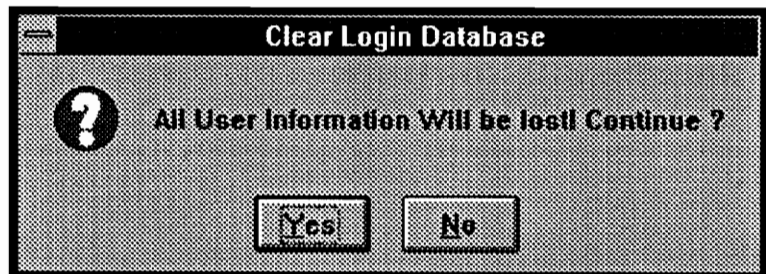
shown in the figure alongside.

Clear Login Database

One of the most powerful functions at the disposal of the administrator is the 'Clear Login database' command. It enables the clearing of all user accounts keeping only the administrative account intact. It is important to note that all unreceived mail in any users mailbox will be permanently deleted. Utmost caution should be used when using this command. There is no way to retrieve deleted mail within deleted mailboxes.

DSM prompts the administrator for a confirmation before proceeding with the 'Clear Login Database' command.
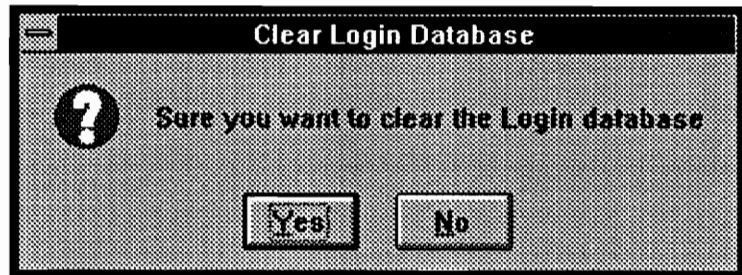
Due to the severity of the command, DSM warns the administrator and prompts for confirmation one more time before finally clearing the Login database.

The Network Menu

The diagram below describes the various commands available from the Network menu. Each command can be activated by clicking on the appropriate name on the menu bar shown or by using the appropriate accelerator key.
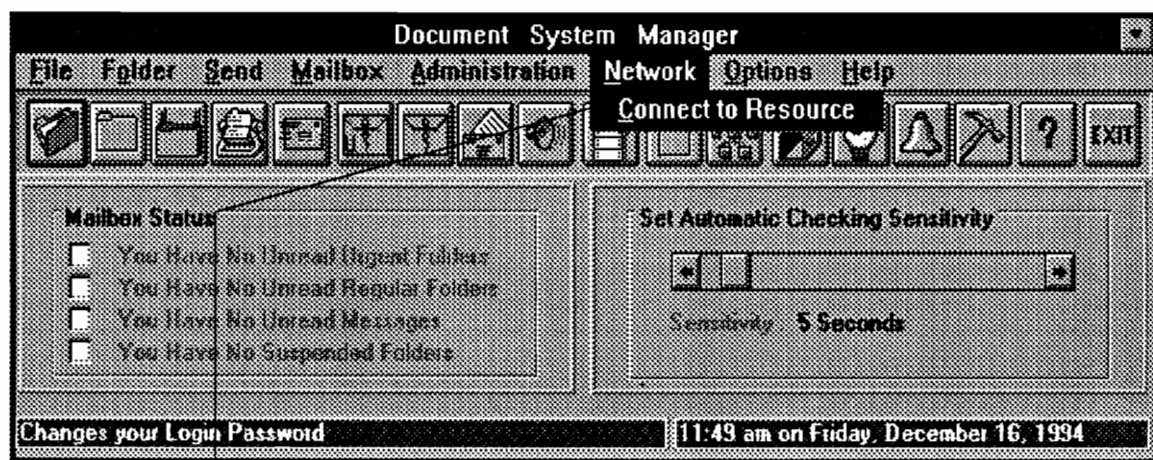
Brings up the Network manager
that allows the user to connect to
a shared resource

Connect To Resource

This command provides a means to connect to shared resources over the network. Similar functionality is provided by 'File Manager' in Windows for Workgroups 3.11. Connecting to a resource with the Network Manager is a simple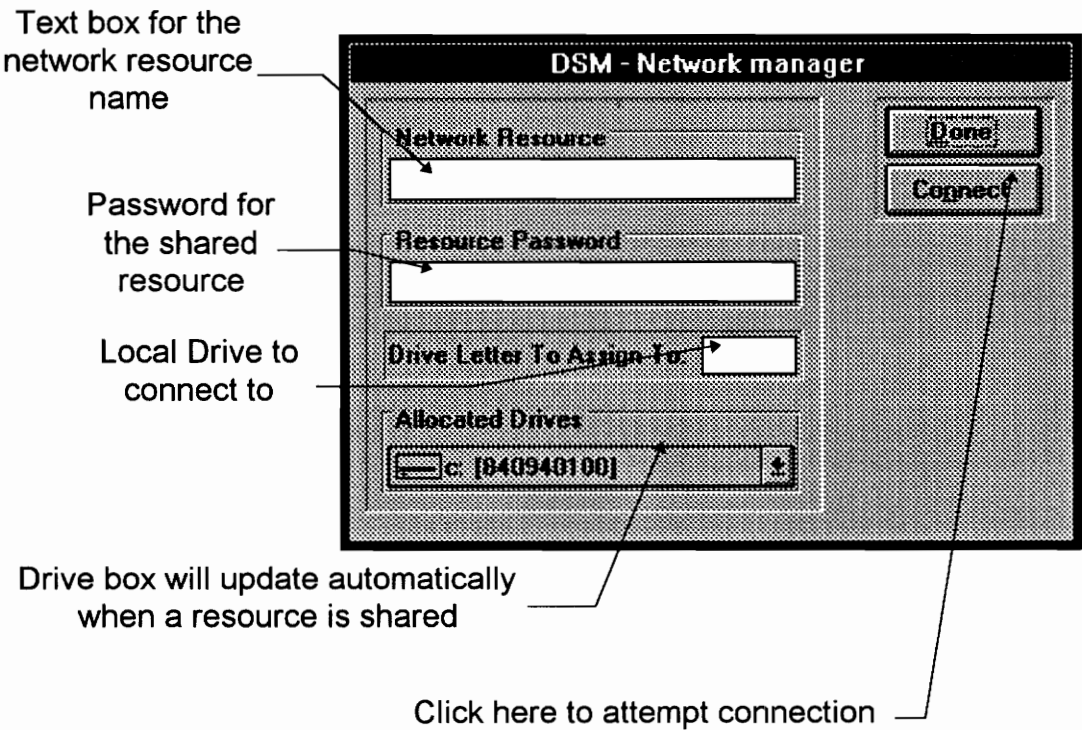 matter. Enter the resource name, resource password and local drive letter to assign in the appropriate text boxes and click on the 'Connect' button. DSM will attempt to make the connection and will inform the user if it fails to do so.

Once the connection has been successfully made, it can be checked by clicking on the drive list and observing the specified drive letter in the list. To return to the previous screen, simply click on the 'Done' button.

Text box for the
network resource
name

Password for
the shared
resource

Local Drive to
connect to

DSM - Network manager

Network Resource

Done

Connect

Resource Password

Drive Letter To Assign To

Allocated Drives

c: [840940100]

Drive box will update automatically
when a resource is shared

Click here to attempt connection

The Options Menu

The diagram below describes the various commands available from the Options menu. Each command can be activated by clicking on the appropriate name on the menu bar shown or by using the appropriate accelerator key.

Displays the toolbar if checked

Displays the mailbox status if checked
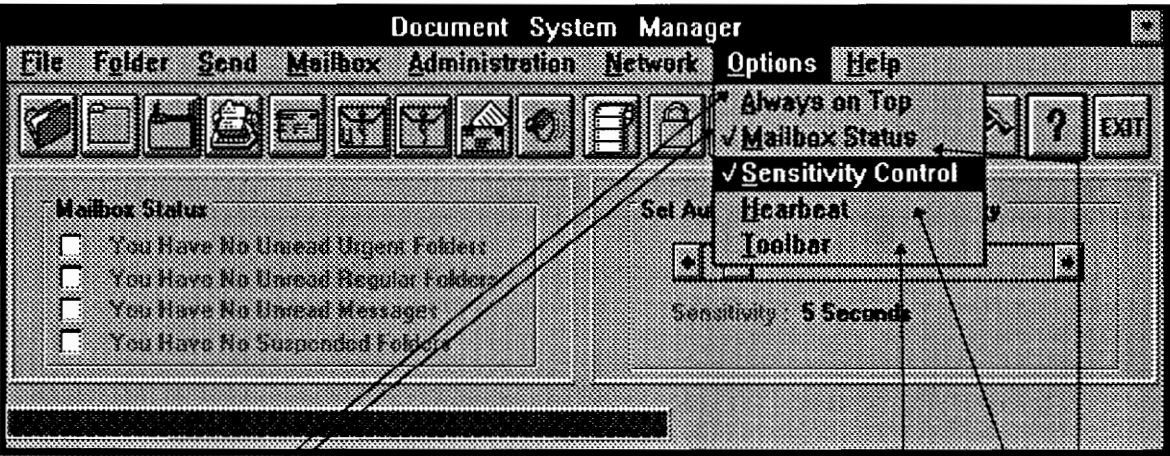
Keeps the main DSM menu always on top if checked

Causes the mouse pointer to convert into an hourglass every time DSM Autochecks the users mailbox

Displays the sensitivity control scroll bar if checked

Always on Top

This command keeps the main DSM system interface screen on top of any windows that might be visible on the desktop. A check mark along the function in the 'Options' menu signifies that the command is currently active. To deactivate the command, simply click on it. The check mark will disappear and the screen will no longer remain always on top.

Mailbox Status

The Mailbox Status display area provides much important information to the user. The command enables the user to toggle the status screen as and when desired. A check mark beside the command on the 'Options' menu signifies that the command is active.

The topmost check box and associated text display the number of unread urgent folders in the users mailbox. The next check box displays the number of unread regular folders. The third check box displays the number of unread messages while the last check box displays the number of suspended folders.

The 'mailbox Status' display is visible on the preceding page and shows that the user has no unread mail, messages or suspended folders.

Sensitivity Control

Activating this command makes visible the 'Set Automatic Checking Sensitivity' scroll bar. This is shown in the figure on the next page. The user can increase or decrease the sensitivity of the local node as desired. Increased sensitivity would mean that the Autochecker is active more often. Depending on the

hardware and other applications, it might be preferable to reduce the sensitivity of the Autochecker.

To decrease the sensitivity, slide the scroll bar pointer to the right. The corresponding sensitivity in seconds will be displayed along the 'Sensitivity' label. It must be remembered that it is not necessary for the Autochecker to be active to increase or decrease its sensitivity.
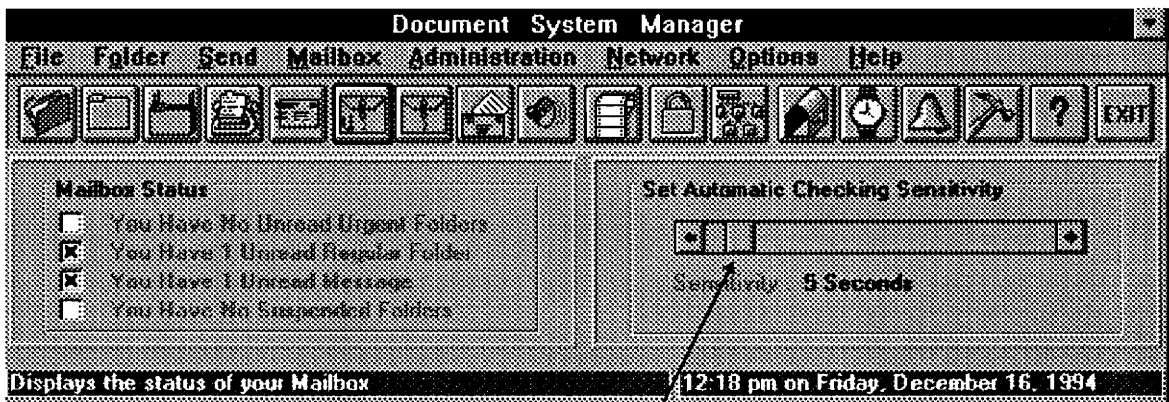
Move pointer to
modify sensitivity

Heartbeat

If the user desires to observe the moment when the Autochecker actually checks the mailbox, the 'Heartbeat' command must be active. This serves as a reminder and or confirmation that DSM is actually active. On fast hardware, the heartbeat is demonstrated with a slight flicker of the mouse pointer while in slow hardware, the mouse pointer actually momentarily changes into an hourglass. To activate the command, simply click on the command name in the 'Options' menu. A check besides the command name signifies that the command is already active. Similarly to deactivate an active heartbeat, simply click on the command name on the menu and the check mark will disappear and the heartbeat will terminate.

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Toolbar

This command allows the user to make the main system toolbar invisible. This can prove useful when DSM is active in the background with the user working on another application. The system menu takes up a minimal amount of space and can even be moved to suit individual preferences. A check mark along the command name in the 'Options' menu signifies that the tool bar is visible. To remove the toolbar, simply click on the command name. This will remove both the check mark and the toolbar. A diagram of the toolbar and its functionality is provided on the next page.

Creates a new folder from template

Allows folder search based on
specific keyword

Retrieves Urgent
folders from Mailbox

Retrieves
Messages

Displays
the
Address
Book

Allows change of user data

Allows change in
Autochecking frequency

Toggles
the
Toolbar

Quit
DSM

Document System Manager

File Folder Send Mailbox Administration Network Options Help

Searches Local or Suspended Folders for specified Keyword   11:01 am on Friday, December 16, 1994

Displays
the
About
Screen

Allows
Password
Change

Toggles
Heartbeat

Toggles
Autochecking

Displays Mailbox
Status

Retrieves Normal folders
from Mailbox

Sends a message to selected user

Opens existing Suspended Folders

Opens existing local folders