INTRANET FOR CORPORATE JOB

A DISSERTATION

submitted in partial fulfilment of the
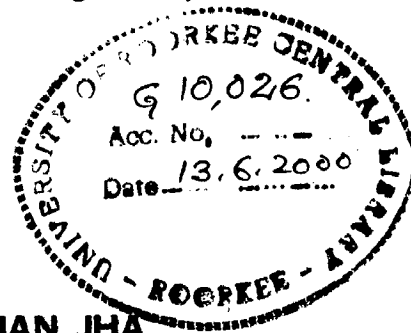*requirements for the award of the degree*
of
MASTER OF ENGINEERING

in

ELECTRICAL ENGINEERING

(With Specialization in System Engineering and Operations Research)

By

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MARCH, 1999

Gratis/

CANDIDATE'S DECLARATION

I hereby declare that the work presented in the dissertation entitled "**INTRANET FOR CORPORATE JOB**", submitted in partial fulfilment of the requirement for the award of the degree of **Master of Engineering,** in **Electrical Engineering,** with specialisation in **System Engineering and Operations Research,** submitted in the Department of Electrical Engineering, University of Roorkee, Roorkee, is an authentic record of my own work, carried out with effect from **August 1998** to **March 1999,** under the guidance of **Prof. M. K. Vasantha,** Professor, Department of Electrical Engineering, University of Roorkee & **Dr. (Ms.) Indra Gupta,** Assistant Professor, Department of Electrical Engineering, University of Roorkee, Roorkee.

I have not submitted the matter embodied in this dissertation for the award of any other degree.

Dated: 23-3-1999

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CERTIFICATE

This is to certify that the above statement made by the candidate is correct to the best of our knowledge.

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ABSTRACT

An Intranet is an organisation's use of WWW (World Wide Web) technology inside that organisation, to distribute information to employees through the organisation's network.

An Intranet has the same look and feel as the WWW in that it combines text, graphics and multimedia into one interface. Recently, many Intranets have been constructed with the aim of integrating internal business applications by applying Internet technology and services for intelligent communication systems and putting management resources to practical use. The distinctive features of Intranets are their seamless connection between internal corporate network and external networks through the Internet etc., single GUI (Graphic User Interface) using a WWW browser, and capability for fast, low-cost installation and reduced maintenance cost. Intranets represent a step towards a paperless office replacing printed documentation with electronic data.

Just as the invention of the telephone, copy machine and fax machine produced great strides in communication, the Intranet has brought a revolution in the field of communication within an organisation. Corporations and businesses are implementing Intranets to combat the competitive pressure of everyday business. The business has now expanded to the global market and the firms that will survive are the ones that can communicate effectively and efficiently. With the rapid growth of technology, organisations need to be quick to respond to change in order to collaborate on ideas in a timely manner. Employees need to have access to company information as well as information on the competition. Being wired is no longer a luxury but rather a necessity to compete and succeed in today's market. By implementing an Intranet, employees can access wealth of knowledge that will allow them to generate new products and services more effectively. An Intranet is truly amazing vehicle for communication. It allows immediate distribution and access to information, and it does this with an easy-to-use GUI that requires minimal training. The Intranet is a very cost-effective means of communication.

In the present dissertation an Intranet has been developed in the Microprocessor and Computer lab, Department of Electrical Engineering, University of

Roorkee. The backbone of the Intranet comprises of one Windows NT server and the LAN connecting it to two Windows 95 clients. The first phase of this dissertation involved installation of an Windows NT server on an HCL-HP infiniti (Pentium - 100 MHz) computer and two Windows 95 clients on two 80486 microprocessor based computers. The physical connection among the computers has been done by constructing a LAN. The topology adopted in the LAN is Bus topology.

In phase II of the work, using these platforms, the communication between the computers (server and clients) has been facilitated by installing the Domino server software on the Windows NT server and the Lotus Notes client software on the Windows 95 clients. Once all the above is done, E-mail facility becomes ready to be used. Lotus Notes offers a powerful mailing facility. Since only two PCs could be used as the network clients in the lab virtual clients have been created by creating many (40) Notes Users. The clients are said to be virtual because in actual practice every user, in an Intranet, is allotted a separate PC. But in the present system the users share the client (PC) and it appears as if there are as many clients as the users. The need of virtual client has been explained in the next paragraph.

Lotus Notes has application developmental tools like forms, views, agents, subforms etc. to realise various operations on the elements of a document of a database. The programming can be done through the use of Notes formula and/or Lotus script language and/or simple functions. The simple functions are nothing but predefined set of Notes formula. The third and last phase of the dissertation work uses these tools to automate three workflow , namely, scheduling of meeting, conferencing and dissertation topic approval process. Notes formulae have been used extensively for programming. The workflow implemented involves many Notes users to have a feel of an Intranet of a big organisation employing many persons. This purpose have been successfully served by the virtual client system.

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Intranet - an insight

1.1. Introduction:

The dawn of the information age happened a long time ago, by today's hyperactive standards. It was not possible in our wildest dream a decade ago that such an explosion of knowledge could take place in the area of communication so fast and in so many diverse interconnected areas. The invention of WWW gave a tremendous boost to the technological research and developmental activities with new technologies emerging before the people at an alarming rate with every passing day.

When the web technology first started out in 90's it was intended - most people perceived it - primarily as a way to transmit information across the internet. But very soon it was realised that it could be used on the internal networks too. The term Intranet refers to the use of Internet technology within an organisation for the private purposes of the organisation. Intranets are company specific and may not have physical connection to the Internet, depending upon the necessity.

Web technology is itself complex but makes things incredibly simple which is the reason of its being so powerful and popular. This is the only technology that gives anybody a way to serve any kind of information to anyone. Web systems help make possible the grand unification of all forms of information, helping us blend document, data, sound, pictures, movies, messages and computer applications in ways we never imagined before.

There are various kinds of two-way communication within a corporation that can be facilitated by the new technologies. These include:

- Surveys and feedback

- Program notification and enrolment

- Progress inquiries and reporting

- Memo distribution, comment and reply

- Spontaneous data entry and data collection

- Interactive database queries

- Product promotion and ordering

Automated office is nothing but a synonym to Corporate Intranet. Since the arrival of new technologies, the office has been evolving continuously incorporating relevant new technologies, as they become available, to improve efficiency or extend the capabilities of the staff. Recent technical advances have had more dramatic impact than anything since invention of typewriter. Office automation is a revolutionary development that represents the natural extension and generalisation of data processing. It is the dramatic reduction of processing, storage and communication costs that is enabling this extension to be made.

To most people, the idea of office automation is an attractive proposition and a welcome step initially. Utilising modern computer and communications technologies to perform or assist with basic office tasks (such as typing, filing, and sending round memos) is inherently attractive. The immediate image conjured up by the term office automation usually involves modern, open-plan workplaces dotted with ergonomically designed office furniture and silent VDUs (Visual Display Units), which automatically carry out the most tedious and repetitive tasks. Unfortunately, the second thoughts bring many doubts - about machines taking job away from humans; about lack of security of computer-held files; about interacting with a computer instead of another person; and so on. However, few people need to be convinced that today's offices could be improved through judicious introduction of the new technologies. When the technology is available it is only sensible to utilise it for good purposes.

The advent of concept of Intranet in a corporation has totally changed the trends. One noticeable trend change is switchover from *"Print then distribute"* to *"Distribute then print (if needed)"*. Recently, many Intranets have been constructed with the aim of integrating internal business applications by applying Internet technology and services for intelligent communication systems and putting

management resources to practical use. Intranets represent a step towards a paperless office replacing printed documentation with electronic data.

1.2. Making The World Shrink:

Over the past few years many major corporations and private organizations have developed their own worldwide networks to tie together remote offices no matter where they are located in the world. Distance has no meaning now. In most cases, these networks have all the characteristics of the Internet and are capable of carrying the same kinds of traffic, too.

Even local or regional businesses with widely scattered branches, offices, or sales networks have their own LANs (Local Area Networks) and WANs (Wide Area Networks) that can carry Internet-like communications. And in most cases, the users of these networks have little idea of what the whole network looks like, how it truly operates, or even that it may already have some components of Internet technology embedded in it – ready to use.

1.3. The Changing Scenario:

Things are starting to change now, thanks to the success of the Internet and World Wide Web. Due to torrent of publicity in the media and trade press in recent years, computer manufacturers and software companies like IBM/Lotus, Microsoft, Novell, DEC, Sun and Oracle have started building increasingly powerful Internet features into their operating systems and software. Many of these companies are leading the way in applying the technologies to their internal and external business communications.

At first, the idea of installing Internet tools on corporate networks was daunting. Though universally available on UNIX systems, the internet tools were not available on PC and Macs (Macintosh systems) until recently. Now, every new operating system or computer sold in retail stores is equipped with basic tools like Web browsers, TCP/IP networking, and other Internet components included as standard features, or easy add-ons. Because of these developments, we are already

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seeing a second Internet revolution – one that promises to bring true and lasting benefits to the enterprise by bringing the information superhighway in-house. This is what anybody means when talking about "the Intranet".

1.4. Sharing The Information:

Most companies are using client-server applications like database management systems (DBMS) and GroupWare. The idea is that people can share files and data using applications that serve as a traffic cop, keeping track of user changes and resolving them in the final version of the data. For example, Oracle software lets multiple users view and edit the same set of data; another software registered as Lotus Notes does roughly the same thing for documents. This is much more productive than giving people access to a document or database one user at a time, or keeping different versions of the same information on each user's machine.

Still, these new client-server systems tend to operate in a closed loop and has pre-designed limited access to various information depending on the user. It's as though one had a phone system where he could only talk to the people in his own department or the team members who work on the same project, without being able to connect to the rest of the company down the hall; or as though someone built an artificial barrier in the middle of the hallway, and one had to ask a gatekeeper for permission to walk through.

1.5. Towards A Well Rounded Business Communications Model:

1.5.1. A Customer Oriented Communications Model:

The business model represented by current WWW is like as shown in fig. 1.1. The Web Server is connected to the customers only and not to the dealers, suppliers and the employees. The dealers, suppliers and the employees use phone, paper and FAX as communication tools. However, the customer is the supreme in the business phenomenon, and the current WWW models rightfully put the customer first. But what about the other people involved in making business successful - the employees, suppliers, and dealers who form the organisational chain that keep the business

Dealers

Phone, fax, paper

Net - scape

Internet

Phone, Paper

Web Server

CORPORATE INFORMATION

Phone, fax

paper

Suppliers

Customers

Client - Server, mainframe, phone, paper

Internal Applica - tions

Employees
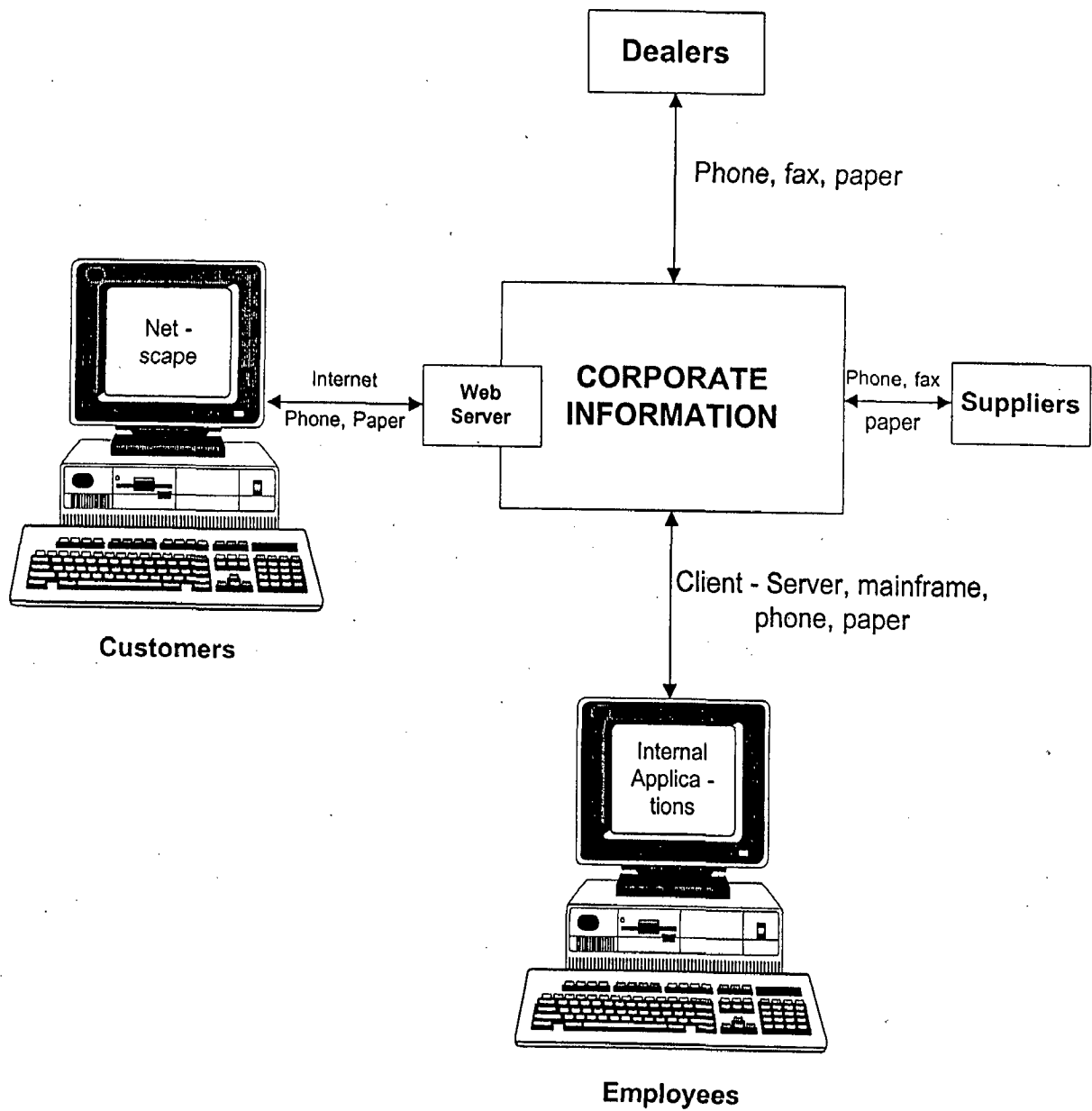
Fig. 1.1: A lopsided business communications model

alive? This, in turn, gave birth to the idea that if the Web technology can be used to smooth the information flow to customers, can't the same be done to benefit the other group. The answer is, of course, "yes".

One concept that often gets lost in all the Internet hoopla is the idea that many corporate LANs and WANs are already turning into miniature versions of the Internet, delivering home pages, data, services, online documents, and other vital information across departmental boundaries to headquarters, manufacturing sites, and field offices throughout the enterprise. This is happening because companies are finding ways to take advantage of Internet tools already built into their desktop computer systems. When it happens, the result is an Intranet because the communications system exists solely within the organisational network, whereas the Internet is more of a communications system between networks. Both the Intranet and Internet, however, use many of the same tools and techniques.

The Intranet is so promising that it is, already, being heavily used by corporate giants like TCS, NIIT, Siemens, Reliance etc. in India and Nortel, Eli Lilly, Levi Stauss and National Semiconductor etc. in USA, as well as many other smaller, technically savvy organisations. These sites are never seen on the World Wide Web, because they are entirely private and shut off from the rest of the world. These companies may also have Web sites on the Internet, but each company's internal web is a separate realm that exists behind the "firewall" – that is, behind the protective layer of security mechanisms that separate the company's internal LANs and WANs from the Internet.

An important concept to remember about Intranets is that an Internet connection is not required. A company can have an internal web or Intranet without ever having an Internet connection or home page on the World Wide Web. All that is needed is a network and a set of desktop computers running the correct protocols and software that enable the Intranet to operate (as described in the next two chapters of this dissertation). It's natural that some companies has nothing to do with the Internet, given the horror stories about security and the like. If so, no problem at all - they can

still use an Intranet for their own internal purposes, without exposing their private networks to the threats posed by full Internet connectivity.

Companies that have taken the plunge and created their own Intranets are finding new ways to cut through the communication snags that traditionally shackle their operations. Once grasped, the potential for this approach is truly amazing. Unlike other client-server applications, which require hands-on involvement by system administrators and programmers, an Intranet allows instant, random and totally unfettered point-to-point communication between any two nodes on the network without login, setup, or special programming.

By installing a web server on a local computer, any department in a company can become an ad-hoc "information center" broadcasting published materials and data to the rest of the network on demand. The published information can then be accessed by any user in the network using web browser software like Netscape and Mosaic. Much of the information are now being delivered through client-server applications using Lotus Notes.

1.5.2.   A Well Rounded Business Communications Model:

Putting Intranet applications at the forefront – and recognising their value – is the first step any company can take toward developing a well-rounded business model. The current web business model, shown in fig. 1.1, focuses on the World Wide Web and customer-centred applications, which is great, because customers really should be the central focus of any business model. But the model appears to be lopsided when looked at all the other ways web technology can be used within the enterprise.

Considering the Intranet as just a component of the overall web system, one can have a better stab at restoring balance to the business model, as shown in Fig. 1.2. The complete model takes into account not only the customer but all the other players who can benefit from better communication with the core of an enterprise, including employees, dealers and suppliers.

Dealers

Net - scape

Internet, dialup
or private network

Engineering
Server

Marketing
Server

Net - scape

Internet

**Corporate
Intranet**

Internet, dialup
or private
network

Net - scape

H.R.
Server

Legacy
Data server

Customers

Suppliers

Internal Web

Internal
Applica -
tions

Employees
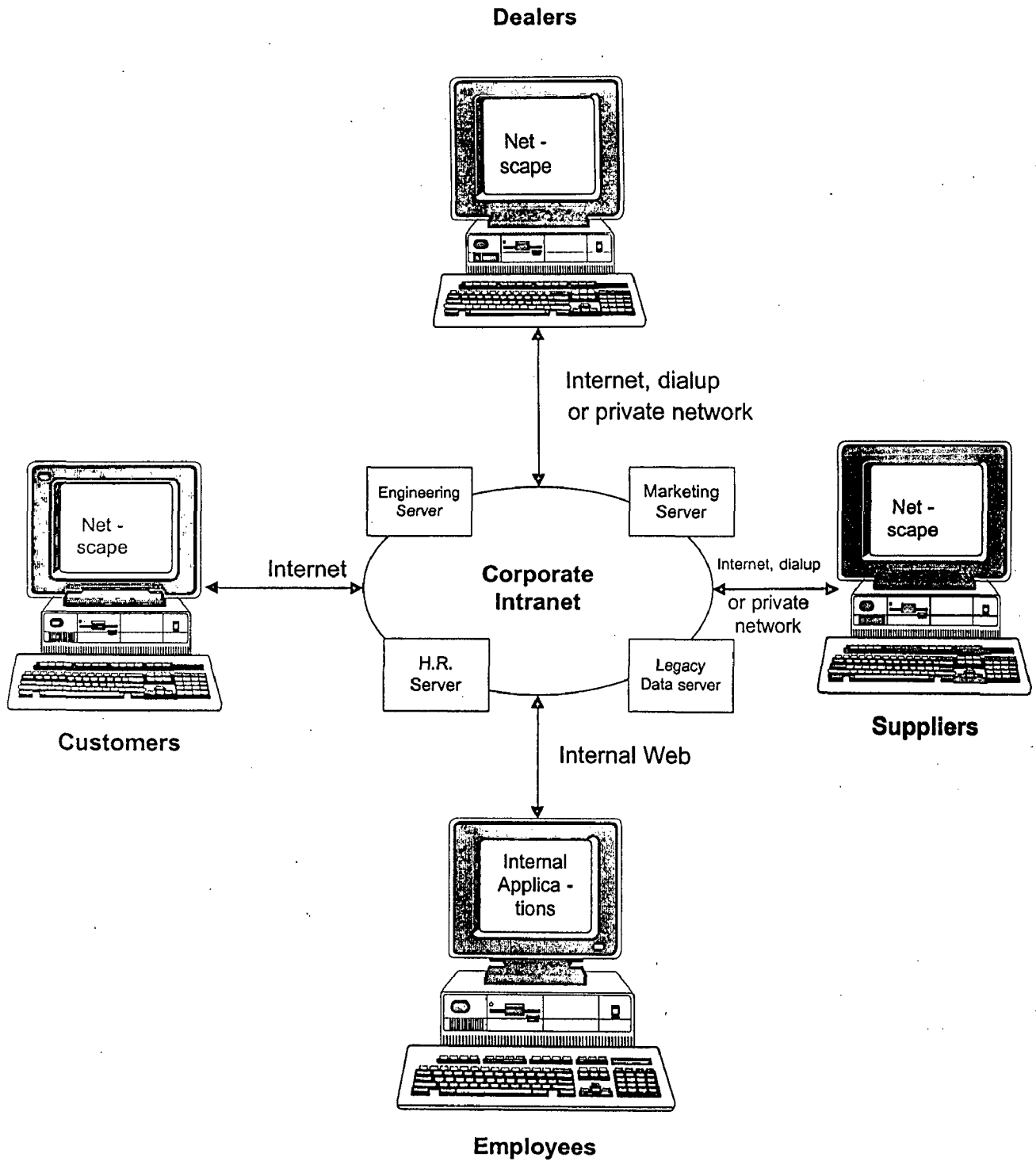
Fig. 1.2: A balanced business communications model

As this model shows, instead of having a single server devoted to customer oriented marketing applications, the organisation might have a group of low-level servers created by different departments of the company to open their channels of information to the rest of the enterprise. At some higher level within the web management structure, the system would be configured so that data from the various servers could be funnelled off through different channels to the appropriate constituent groups that have a stake in the organisation.

For instance, most Human Resource data would go only to employees – except job listings, which might be publicised both internally over the LANs and externally over the Internet. Marketing data might be mainly targeted to dealers and customers, but also could be used by employees internally for reference. IS legacy data and transaction processing systems could be brought into the loop to provide automated information on current business operations to anyone who needs it – with appropriate safeguards to keep parts of it out of the hands of unauthorised users. And external Internet access could be provided to employees for use in researching business topics or competitor information.

1.6. Benefits of Intranet:

The benefits expected to result from Intranet are many and varied, so that almost any type of business should find usage of Intranet advantageous. The benefits can be classified in three main areas:

- Improved productivity

- Cost benefits

- Improved facilities

When reviewing the benefits of Intranet, it is wise to remember that these are potential benefits. An unsuccessful Intranet project, whose system is poorly designed, unsuitable or rejected by the staff, will not bring any advantages.

1.6.1. Productivity enhancement:

Automation of any kind can improve productivity in two ways:

- By reducing the resources needed to do a job

- By increasing output while using the same resources.

With Intranet the aim is usually the later, because redundancy is always undesirable and increased commercial activities are always welcome. Increased output can be achieved by:

- Division of labour

- Automated job support.

Division of labour

Division of labour involves splitting a function into a number of smaller tasks, each of which is performed by an independent person or group. Employees, when such approach adopted, become expert at their own speciality. This is the principle of assembly-line production in industry.

Automated job support

Automation of part of a task allows employees to get through more work, and hence improves their productivity. In Intranet, automated job support is found in the forms of 'management information systems' which decrease the time managers spend gathering information; computer based filing systems; electronic mail distribution, and - most commonly quoted - the use of word processors to automate parts of the typist's function.

1.6.2. The potential for cost benefit:

The Intranet offers great potential for cost benefits. A paperless office management is the direct outcome of the introduction of Intranet to corporate jobs. Savings in support staff, outside services, office space, office equipment and

publishing cost which result in substantial cost reductions and therefore bottom-line savings. The opportunities for cost effective management include the following:

- Word origination - by saving time by switching over from longhand and shorthand to machine dictation.

- Word processing - by saving typing time through use of word processing equipment.

- Word distribution - by centralising and/or automating copying/collating, photo composition/printing and mail/electronic mail.

- Word retention/storage/retrieval - by introducing managed central or distributed filing systems.

- Administrative support - by reducing secretarial staff ratios, establishing centralised administrative services and interfacing special services such as photo composition and micro-graphics to word processing and computer systems.

- Reducing publishing cost: by using web technology to distribute documents momentous gains in productivity and incredible cost savings is experienced. Like the reengineering craze that has marked the client-server revolution, converting many paper-based systems to web systems can save both labour and overhead costs within an organisation.

Let us take the simple example of distributing a company policy and procedures manual to employees. Some companies distribute tons of them: enough to fill an entire wall of shelves. Fig. 1.3(a) presents the whole traditional document distribution process. The author creates the manual using a software like Microsoft Word, saves it to disk, and then prints a master copy on a laser printer.

That is just the beginning of a painstaking process that would make anybody blush. The master copy is sent to the local reproduction centre or an outside company for printing, where hundreds of copies are made. After the document goes through the printing process, it still may need special collating, binding, or handling. Often it is

Author

Microsoft word (e.g.) →Print→ A manual →Copy→ A Manual →Collate & Bind→ A Manual →Sort/ Stuff→ [envelope] →Deliver→ End User

Save / Retrive ↕ Disk
(Stand Alone System)
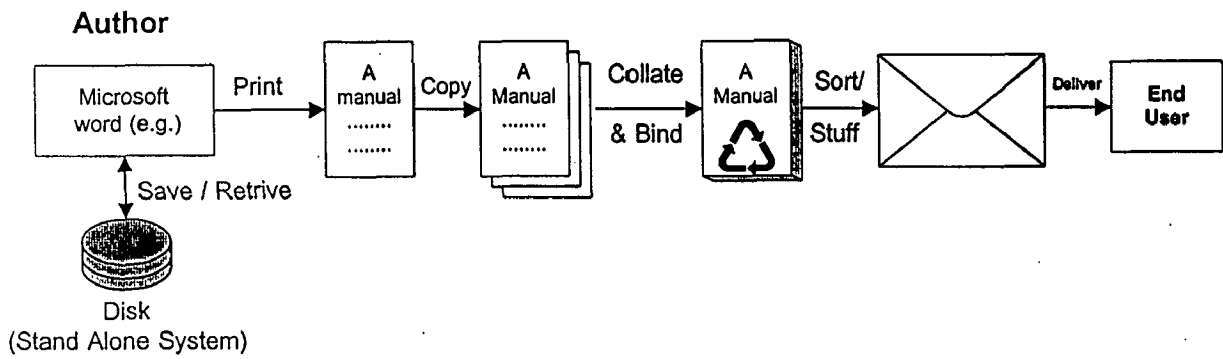
Fig. 1.3(a): Traditional document distribution example

Author

Microsoft word (e.g.)

Save / Retrieve → Disk (Web Server) →Request/ Serve→ Mosaic or Netscape Browser →View→ End User

Save ↘ Disk   Print (as necessary)
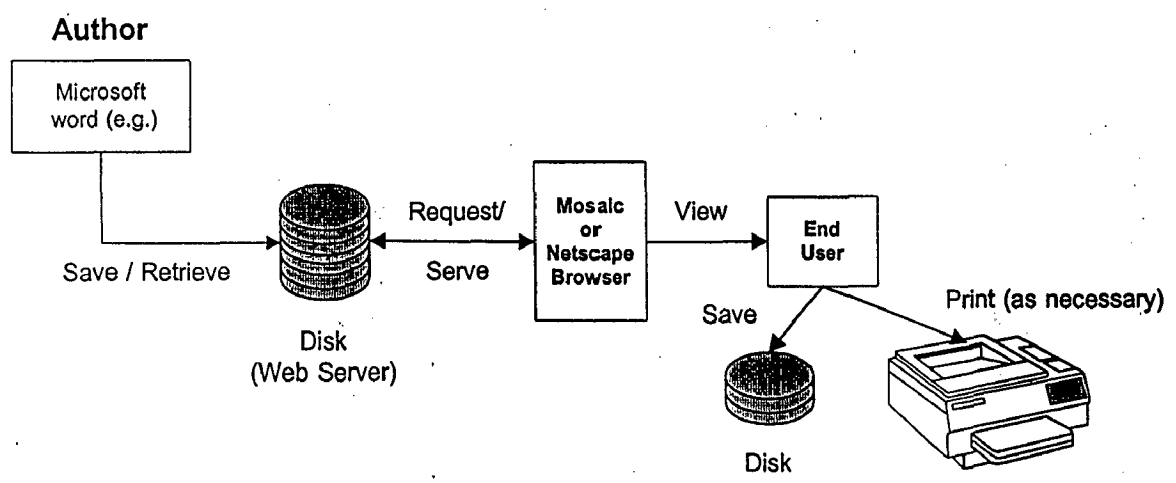
Fig. 1.3(b): Web document distribution

stuffed into a three-ring binder, and boxed for delivery. Once that is done the boxes are loaded onto a truck, where they are whisked off to the mail centre to be prepared for deliver.

At the mail centre, someone must prepare an address label for each box and stick it on before it can be delivered. The boxes are sorted by delivery zone, and then loaded onto truck for delivery through the company's internal mail system, the national postal system, or a private carrier. The end result is that the individual manuals are hand-carried – across the building, across town, across the nation, or around the world – to the individual employees who need them. And if the manuals happen to be updated after sometime then the whole process has to be repeated.

The Intranet offers a very tempting alternative as shown in fig. 1.3 (b). With an Intranet, the author can still create the document using Microsoft Word or any other desktop publishing tool. But as soon as the document gets saved to disk, it's immediately accessible to anyone in the company. Somebody in the engineering section can pull it up on his screen and read it anytime he wants to. Another person in cost sub accounting can read it when he has the time, or when he has a special question. If he prefers to read it on a printed page, he can print it on the spot. And if he finds the information useful and wants to add an excerpt to one of his memos, he can save a copy to disk or cut-and-paste at will. Meanwhile the author can update the manual anytime, and as soon as changes are made and saved to the disk they are immediately visible to anyone reading the document at that moment.

Many companies quote cost benefits obtained through Intranet. Some of the reported examples listed below support the above idea:

- 23 Bell system operating companies claim savings of $150 million in eliminated paper, reduced computer time and storage space since installing a micro-file storage system through Intranet.

- The US Senate now has text editing and typesetting equipment which has reduced costs per Bill from $40 to $3 a page.

- Hewlett-Packard's worldwide communications network, COMSYS, has allowed the company's data transmission volume to increase by more than 100 times while transmission costs have merely doubled.

1.6.3. Improved Technical facilities:

Intranet usually provides extra facilities for the system's users. For example, word processors have automatic editing functions not available on conventional typewriters, electronic mail services usually include an integrated message filing system, electronic filing system have built in indexing facilities, and so on. These additional facilities help staff to do their jobs more quickly, or simply to do them better.

Thus the principal benefits to be derived from the collective facilities of Intranet can be summarised as follows:

- Increased information accessibility

- Increased people accessibility

- Increased control over personal activities

- Increased individual contribution

Through these, corporate and individual effectiveness can be improved.

1.7. Organisation of report:

The report of the dissertation has been structured into the following chapters:

Chapter 1: *Intranet - an insight*

This chapter is the present chapter which introduces the Intranet and explains new trend in the field of communication and sharing of information. It also lists the benefits expected after the installation of an Intranet.

Chapter 2: *The Client - Server model*

This chapter looks into the history of the Intranet and briefly explains how the computer communicate in a network.

Chapter 3: *Windows NT network and LAN*

Installing method of a network, planned to have Windows NT server and Windows clients, has been discussed in this chapter. The chapter also explains briefly the requirements of installing LAN.

Chapter 4: *Lotus Notes Clients abd Domino Server*

The detail description of installation method of Domino server software and Lotus Notes software has been given in this chapter. The hardware required for the servers and clients have also been listed.

Chapter 5: *Using E-mail and development of applications*

This chapter first discusses the fundamentals of Notes database and then method of using E-mail facility provided by the Lotus Notes software. Next, the method of designing and implementing automation of a workflow has been explained through the discussion of step by step approach to automate the three workflow , namely, scheduling of meeting, conferencing and dissertation topic approval process.

Chapter 6: *Conclusion and scope for future work*

The achievements of the dissertation work have been listed in this chapter. The scope for future work has also been explained with some guidelines.

Appendix A: All the acronyms used in this dissertation report have been listed.

Appendix B: Some of the projects on "Intranet for corporate jobs", both in process and implemented, by the TCS and NIIT have been listed to have brief idea of the actual Intranets being installed these days.

Appendix C: The Notes formula used in the dissertation have been explained.

The Client - Server model

2.1. The Networking Revolution:

PCs and Macs were fine sitting on the desk, but unlike the old mainframe dumb terminals they were isolated standalone machines – cut off from the central repository of data hoarded by the department's mainframes. This cut off prevailed until companies like Apple and Novell found ways to connect desktop computers and mainframes together into local area networks (LANs).

The LAN proved to be a convenient way to connect machines on a single floor, or in a small building. But a large organisation might occupy dozens of floors in an office building, be spread out over a campus, or have geographically dispersed activity centres around the world. Each location might have its own LAN, but these were isolated from the rest of the organisation until someone figured a way to connect them together into a wide area network (WAN). Typically, this was done during the initial stages by simply leasing a line from the telephone company and hooking the LANs together through the leased-line connection. Figure 2.1(a) shows the configuration of a simple WAN connecting few LANs.

The technical advancement of the WAN through satellite communication system made it possible to put the entire company on the same network, no matter how scattered its locations. The network could be spread across a state, a country, a continent, or around the world. Thus, it was possible for global multinational companies like IBM, Digital, and Chevron to have their own private world-wide networks tying together business locations scattered all over the world.

Fig. 2.1(a): Wide Area Network
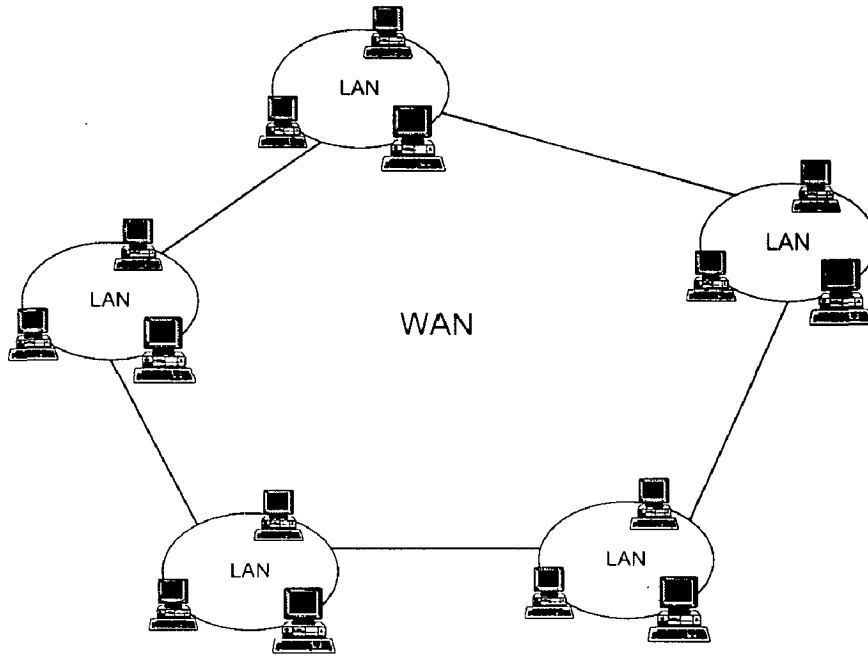
Network Drive Network Printer
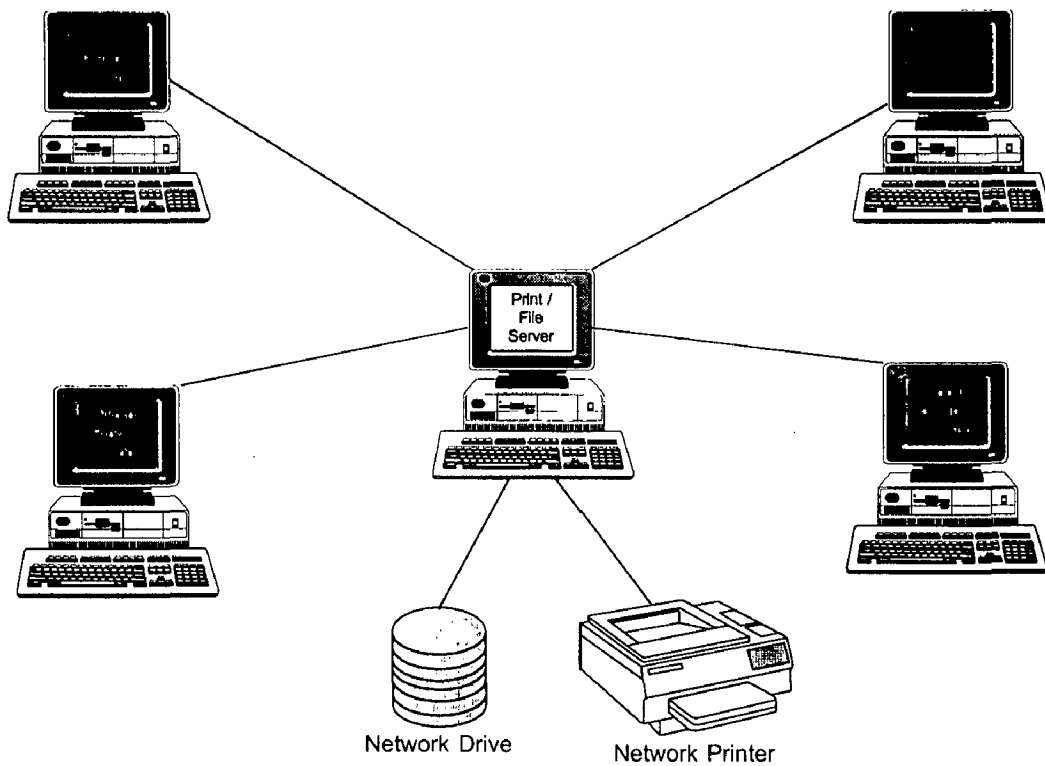
Fig. 2.1(b): Network Printer and File Server

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LANs and WANs made it possible for business to save money by letting widely dispersed desktop computers share expensive resources. The first things that were shared were just hardware components like hard drives and printers. For example, instead of buying an expensive laser printer for each desktop computer, the company might buy one expensive high-speed printer, connect it to a central print server on the network, and let everybody print to it the same way they might print to their local printer or their PC. Companies also set up central hard disks or file servers that could be used to save data the same way anybody does on his local hard disk. Instead of being called Drive C, the network drive(s) might be called D, E, F, P, X or any other letter of the alphabet.

The diagram in Figure 2.1(b) shows a simplified view of a typical print/file server configuration. It is to be noticed that the applications using the server are all self-contained and run strictly on the users' local computers. The print or file server may not run any applications at all, except the utility programs that control the transfer of files to and from its disk drive(s) and printer(s). This kind of setup implies that entire files would have to be shipped across the network for printing or storage.

The creation of file and print servers was followed by the idea that if hardware like printers and drives could be shared over a network, why not share software and data, too. Of course, it wasn't long before people found a way to do that. The result was a new kind of software application known as client-server.

2.2.   Advent of Client - Server model:

Client-server is a way of designing software that takes advantage of the ability to distribute data and processing chores across a network. And in fact, it is this technology that made the Internet and World Wide Web possible and so successful. A simplified version of client - server model is shown in fig. 2.2.

The intention with client-server is that, along with the data itself, the pieces of software that handle the data can be spread out or distributed. Even though different parts of an application are scattered across the network, they can still work together very much like a single standalone program used to do. This isn't hard to imagine, since most standalone computer applications are just a group of different
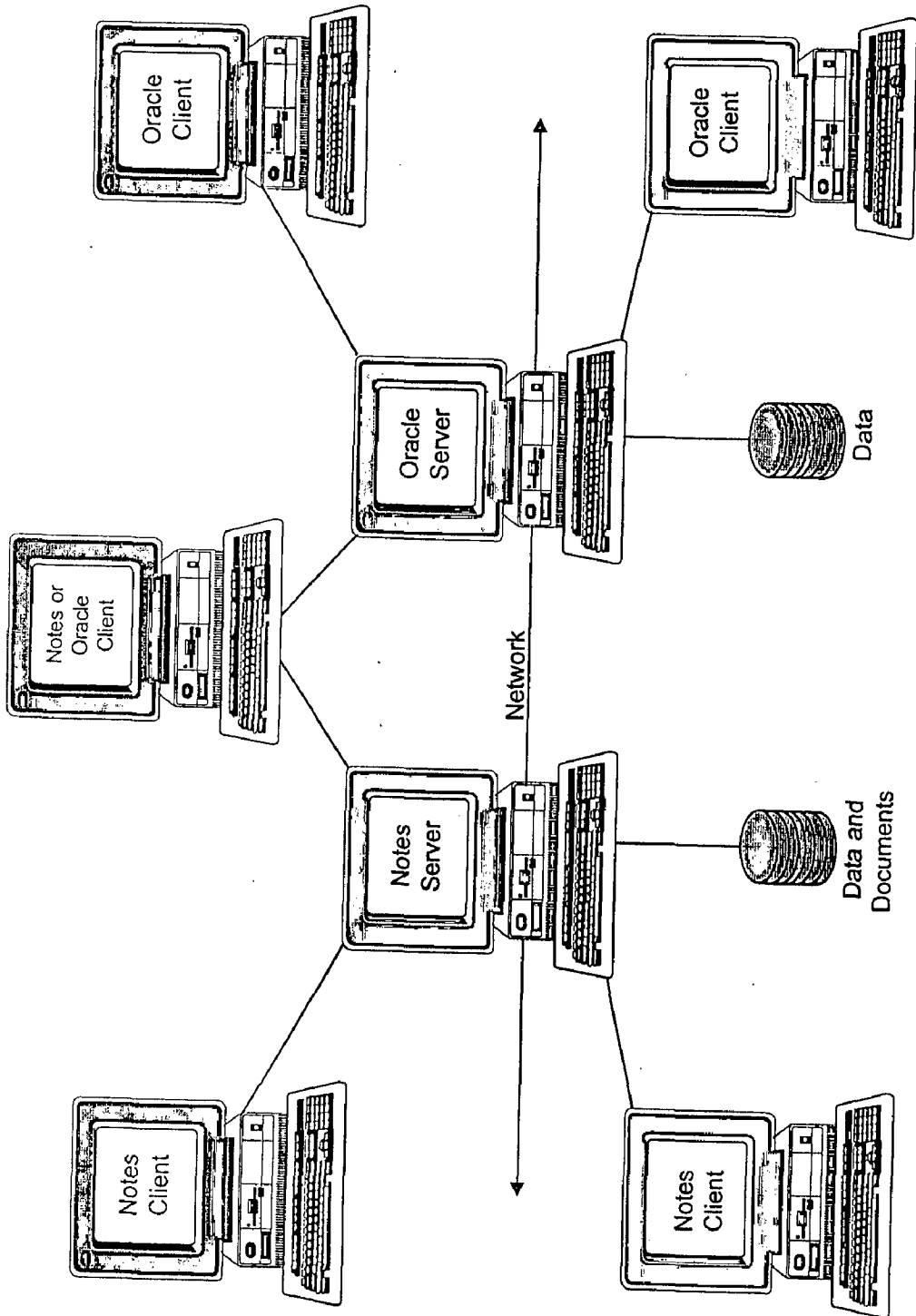
Fig. 2.2: Client - Server Configuration

programs or subroutines masked under the guise of a single product.Let us compare the client-server setup to the file server configuration discussed in the previous section. With a file server, a database program might be run on the local computer and save the files to the network drive. But this causes problems, since one needs a powerful computer to run the database locally, and you must transport the database file en masse across the network every time you want to use it (slowing everybody else down in the process). Compared to client-server, this is a very inefficient way to run a network.

With client-server, instead of running a database locally on each user's machine, one could install the database application and data files on a remote networked computer, then let users access it remotely over the network, as needed. This is what we mean by client-server. The main part of the application runs on a centralised server in another part of the network, and any user can control it using special client software designed for this purpose. Instead of transporting the entire database across the network for anybody to work on it, the server just sends the records the user requests, and client software displays them on the screen. If any changes are made by the user in the records, changes are sent back to the server for processing and inserted into the database.

In Figure 2.2, it is to be noticed that any server can have multiple clients, and any client can be setup to access multiple servers. Thus, if somebody was using both Oracle and Lotus Notes, the client would typically have one client program that works with Oracle and another to work with Lotus Notes. This entire model may change significantly on an Intranet, because one can use single web client software like Mosaic or Netscape to access both.

In one fell swoop, client-server seemed to solve many of the problems of networked computing using desktop machines. Network traffic was reduced because large database files stayed in one place, instead of being shunted across the network. Managers could spend their money on a few powerful servers instead of having to buy everyone the software, drive space, and computing power to run the full application locally. Centralising the database made it easier to back up mission-critical data at the network level. In effect client-server optimised both the network and the individual desktop computers running on it.

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The client-server fit right in with the modern management trend toward employee empowerment, teamwork, and collaboration. Client-server systems and networks became key elements in the re-engineering revolution that took the business world by storm in the early nineties. Corporate planners found they could use these new systems to re-engineer processes, eliminating many unnecessary steps – and jobs – along the way.

The term client can refer to just the software that makes this possible, or the entire combination of local machine, software, and user. Likewise, server can refer to just the application running on the remote machine, or to the entire combination of machine, application, and database.

2.3. From ARPAnet to INTRANET:

The first client - server configuration was called the ARPAnet, since it was developed by the U.S. Government's Advanced Research Projects Agency (ARPA). When it first started in 1970, this fledgling network connected only four universities: Stanford, Utah, and two branches of the University of California. Within a couple of years, the number of connected organisations had increased tenfold, to 40.

Based, in part, on the ARPAnet model, other special-purpose networks formed over the next two decades, with names like Bitnet, Scnet, Usenet, FidoNet, NSFet, and CompuServe. But it wasn't until the early 1980s that someone had the idea of connecting these expanding networks together so that data and messages could be shared freely between them. As these networks began to merge, they formed the beginnings of what is now called "the Internet".

In this sense, the Internet is simply an agglomeration of different networks that once existed on their own but now are all connected together. When it is thought about from a business perspective; it might be said that all these different networks were like separate, isolated LANs until someone connected them together into the WAN called the Internet. In this sense also, any WAN can be considered an internet, because it connects various subnetworks together into a unified system. But if the WAN exists solely inside a private company, it's more likely to be called an intranet.

Connecting networks together into an internet or intranet typically doesn't affect the way people work inside each of the individual subnetworks. It just makes it possible for them to communicate freely with others across the internet (or intranet). It's similar to the idea of placing a phone call between different regions of the country or different parts of the world. Though a different telephone company (or exchange) serves each region, the local networks are all connected so that the call goes smoothly from a point on one regional network to a point on a different regional network.

2.4. An outline of the way computers communicate in a network:

Every type of communication – whether people-based or network-based– requires a protocol to support it.

When anybody makes a phone call, for instance, he always follows a well-known protocol. First, he dials the number and makes a connection. The person on the other end answers the phone by saying "Hello". First one greets the person, states his name and the reason for his call. Then, he takes the turn to speak until he is through. Finally, one person says, "Good-bye", the other says, "Bye", and they both hang up.

On a computer network, there may be dozens of protocols operating simultaneously. One protocol controls the physical transmission of electronic signals. Another opens and closes sessions between the chatting computers. Another controls the way data is packaged and handled. Each component of the transaction, for a nanosecond, takes a turn one by one. These things happen whether the communication occurs on a private LAN or on the Internet.

The key protocol for Internet communication is called TCP/IP, which stands for *Transmission Control Protocol/Internet Protocol.* This sounds excruciatingly technical, but it's not hard to understand.

● TCP handles the packaging and reassembly of data. It splits large messages or data files into smaller packets or datagrams that can be sent across the network more easily and independently. Each data-gram has a size and sequence

number stamped on it, so the computer at the other end will know how large it's supposed to be and where it fits in the puzzle.

- IP creates the "envelopes" which carry each datagram to its destination. On each envelope, it stamps the address of the computer sending the message and the address of the computer that must receive it.

The process is helped along by intelligent machines called *routers*. A *router* contains an internal map of the network, recognizes where the packet is headed, and does its best to send it down the shortest or fastest route to its destination. All of this happens so fast and seamlessly, it looks like the two computers simply connect, exchange data, and disconnect.

A key point to remember is that TCP/IP communications are not limited to the Internet. It is a native protocol that has been used in UNIX-based networks for years, and more recently has started appearing on other platforms such as PC and Mac. Once one has TCP/IP capability on a network, it is possible to run any of the Internet applications.

The phone system uses the dialed number to locate the instrument one was calling and make it ring. Likewise, every computer on the Internet also has a unique "phone number" (IP address) that looks something like this:

202.161.83.11

If the computer is to be connected to the internet the IP address given by the ISP (Internet Service Provider) must be used. However, in an Intranet any IP address can be used that is unique within the organisation.

To make things simpler, computers also use unique identifiers called domain names. For example, on the Internet, a computer named mkv.uor.com might be the computer named "mkv" at the UOR University. On an Intranet, the computer named stu-serv might be the database server in student service.

Windows NT Network and LAN

A Windows NT network comprises of one or more Windows NT server(s) and the clients which may have one of the following operating systems:

1. Windows NT (Workstation)

2. Windows 95

3. Windows for workgroup i.e. windows 3.11

4. Dos (version 3.1 or later)

3.1. Setting up NT Server:

The complete installation of Windows NT server is done in three phases.

3.1.1. Phase I - Getting ready to install:

First of all it should be made sure that the hardware are compatible with the NT. Here are few things to consider when choosing hardware:

CPU: Any 486-class processor or better will meet the requirement but since the Server plays the most important role in the network it is recommended that the CPU should be the best one available. NT Server no longer supports 386. As on date, P-III (500 MHz) is recommended.

RAM: Running NT with less than 16MB RAM is just like deliberately inviting the problems. NT Server needs more memory if more workstation products (software) are incorporated. The general rule with NT is "the more memory, the better".

VIDEO: At least a VGA board should be there in order to load NT Server.

MOUSE AND SERIAL PORTS: It is good to prefer PS/2 type mouse to Serial Mouse because a Serial port is needed for Modem to support the Remote Access Services (RAS) and another Serial port may be needed for some other interfacing. If the mouse is a Serial Mouse then the system will require three Serial ports which gets problematic because most of PC-compatible systems don't really have more than two serial ports.

NETWORK ADAPTER or LAN CARD: The Network Adapter (Ethernet card) is needed if the Server is to be put on the network and it must be compatible with the system. Proper slot (PCI/ISA/EISA) on the Motherboard should be used for the Adapter. 32-bit Ethernet card interface through PCI bus is recommended.

3.1.1.1. Selecting the type of Server:

An NT Server can assume one of three roles in the network:

- A Primary domain controller in a brand new domain

- A backup domain controller in an existing domain

- An ordinary file and/or application Server

This decision is important because once made it can not be changed without doing a completely fresh installation. If a new domain is being created NT Server should be installed as PDC (Primary Domain Controller). If a BDC (Backup Domain Controller) is to be installed there must be an already existing PDC. Setup will reject an attempt to install a BDC if it can't see the PDC in the same domain. Microsoft reckons that only one BDC is required per 2000 users, to support a PDC (which is essential anyway). It is desirable to have at least one BDC, whatever be the number of clients for reliable operation of the network.

3.1.1.2. Starting the NT install program:

There are two ways of installing NT Server (or Workstation):

- Installing from Setup floppies and CD-ROM

- Installing from CD-ROM only

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Installing from Setup floppies and CD-ROM:

In this category, the complete software comes in one CD-ROM along with three floppies.

The NT Server CD-ROM is put into the CD drive and the NT Setup diskette # 1 i.e. "Windows NT Setup boot disk" is inserted into the floppy drive and the system is rebooted. There are two more floppies in the NT box, namely, "NT disk 2" and "NT disk 3" to be inserted at appropriate point of installation process (when prompted). These floppies don't contain all of NT; they contain enough software to kick off the installation process so that the NT installation can take over.

Installing from CD-ROM only:

In the case of Intel users, all the files needed to install NT are in the folder on the CD-ROM itself named *I386*. In this method of installing NT server, after placing CD-ROM in its drive, the *WINNT* or *WINNT32* program is run from *I386* directory. It requires three formatted floppies ready prior to the beginning of installation which are to be inserted as and when prompted. After creating the three floppies in this manner, the system is rebooted with "*NT setup disk # 1*" in place, as in first method of installation.

3.1.2. Phase II - Running the NT install program:

The Setup boot disk is inserted into the drive and the system is rebooted. NT then runs *NTDETECT.COM* which figures out what kind of hardware are there on the system. A message is displayed on the screen "*Windows NT Setup/ Setup is inspecting your computer's hardware configuration*".

It is followed by a blue screen with white letters:

Windows NT Setup

And on the bottom of the screen:

Setup is loading files (Windows NT Executive)....

NT next loads the HAL (Hardware Abstraction Layer), after which it prompts to insert Setup disk number 2. The operator then has to insert NT setup disk # 2 and the installation continues. Some messages on the bottom of the screen appear about what is being loaded which includes -

- *NT config data*

- *Fonts*

- *Locale-specific data*

- *Windows NT Setup*

- *PCMCIA support*

- *SCSI port driver*

- *Video driver*

- *Floppy disk driver*

- *Keyboard driver*

- *FAT file system*

Setup then turns the screen to 50-line mode. It announces how much memory the system has in megabytes and says that the NT Kernel as well as a "*build number*" is loading. The screen then shifts back to normal mode and the "*Welcome to Setup*" message appears. It offers these choices:

- *To learn more, press F1*

- *To set up Windows NT now, press Enter*

- *To repair a damaged installation, press R*

- *To quit, press F3*

At this point, Enter is pressed. Setup disk # 3 is inserted in the drive on being prompted and Enter is pressed again. Setup goes into device detection.

Setup then auto-detects any SCSI adapter in your system which is followed by the listing of following information about the system:

- *Basic PC type*

- *Video system*

- *Keyboard*

- *Country layout for keyboard*

- *Mouse*

Next, NT setup shows the partitions on the system and asks where NT is to be installed. *NTFS* (New Technology File System) partition on the drive should be preferred. NT Setup runs a special version of *CHKDSK* to make sure that the file system is clean. Then Setup prompts to select the directory for NT. The recommended directory, namely, *WINNT*, is fine. Next, a message is displayed - " *Setup will now examine your hard disk(s) for corruption. Press ENTER to run.*"

Then NT Setup copies a bunch of files, just enough to boot the system, to the hard disk. This process takes about ten minutes (on the P-I, 100 MHz system used in this dissertation) and displays a message like the following:

" This portion of setup has completed successfully.

If there is a floppy disk inserted in the drive a:, remove it.

Press ENTER to restart your computer.

When your computer restarts Setup will continue."

The installation disk is popped out and the computer is rebooted. It then boots a kind of mini-NT into a graphical Setup program. First the announcement of *NTDETECT* is seen which runs every time the system reboots. A black screen with white letters appears that tells to press the spacebar to return to the "*Last Known Good*" menu. There is no need to press spacebar here because of absence of any menu to start with. Then the screen turns blue because at this juncture the NT Kernel loads and also the graphical portion.

Then Setup prompts to select the type of installation - *Typical, Portable, Compact, or Custom.* "*Typical*" is the general choice. Next, the licensing choice appears - *per seat or per server.* After the correct choice is made. NT next prompts for a computer name. It should not exceed 15 characters in length. It is better to avoid the blank space in the computer name because it may create problem later on.

Next, the user is prompted to create a administrative password. Then Setup offers a list of components to add to the system (some of which are automatically selected by default and others through mouse), after which phase 2 of Setup then begins which is Network Setup.

3.1.3. Phase III - Network Setup:

NT then prompts: "*Windows NT needs to know how this computer should participate in a network*". The options are:

- *Do not connect this computer to a network at this time*

- *This computer will participate on a network*

  - *Wired to the network*

  - *Remote access to the network*

If the computer is to be a domain controller it has to be on the network. Therefore in that case," *This computer will participate on a network / Wired to the network* " should be chosen. "*Remote access to the network*" is chosen only when the access to the network is through modem and/or satellite communication.

3.1.3.1. Setting Up Network Card:

Next, a network card has to be setup. One of the NT's really appreciable feature is an "auto-detect" system that detects the network card (Ethernet card) installed, correctly most of the time. A dialog box labelled "*Network Adapter Card Detection*" appears. When continued, NT figures out, the vast majority of time, which network card the system has.

On the other hand, if Setup fails to detect the network card, or, in rare instances, if it locks up when tries to detect the network card then Setup should be rerun from phase - I and this time "*Do Not Detect*" is chosen and the network card is chosen from the list, that appears on the screen.

3.1.3.2. Selecting Protocol and services:

Once Setup has detected the network card the mouse is clicked on "*Continue*" to setup the card. After the setup of the card, a dialog box labelled "*Select protocol*" appears with a list of TCP/IP, IPX/SPX etc. The protocols are selected which are likely to be used on the server. Windows NT uses TCP/IP protocol and that is the choice in the present dissertation. Then Setup prompts to select the services to be installed. The services included by default are:

- *RPC configuration*

- *NetBIOS interface*

- *Workstation*

- *Server*

Additional services may also be added later on, after the installation of server. The default services are sufficient in most of the cases.

3.1.4. Video Test Screen:

Finally, NT offers to test the video driver. After the testing of video driver as necessary NT server setup ends and the statement:

"Windows NT server installation complete.

Please reboot the system."

appears on the screen. In response the network administrator RESETS the computer. The computer is now ready to function as a server.

3.2. Creating new user account:

User accounts contain information like the user name, the password, and a description. All of that data are stored in a file called SAM (Security Access Manager)in the PDC's \winnt\system\config directory. User Manager for domains provides the network administrator with the means to create, modify and delete user accounts in the domain, manage groups within the domain etc. User Manager is the program that manipulates the machine's SAM - the user database. A user can have only limited access to the capabilities of the User Manager. To exploit all of the capabilities of User Manager for domains the user should log on as a network administrator (if authorised)

To create new user, under the user menu the New User option is selected; then a dialog box appears. A unique name for the user, small description and password is entered and *Add* tab is chosen. There are five icons, namely, *Groups, Profile, Hours, Logon To* and *Account* in the dialog box which respectively facilitate the assigning of the user to one or more groups, setting up a user profile, permitting logon hours, declaring the machines where the user can log on and date of expiry of user account. This creates a new user for the network.

3.3. Creating shared directories:

Servers have the responsibility to make the files and directories accessible to the network users. Files and directories must first be declared to be shared before network users can access them. Merely setting up a Server doesn't do anything. To share the directory, one should log on as a member of the administrators group. NT can only share the whole directories and not a particular file of a directory.

To share a directory *WinNT Explorer* is opened. Select File and then *New Share*. A dialog box appears in which first all the directories to be shared is selected and then radio button labelled *Shared As* is clicked and then a share name is entered. Clicking *OK* makes the directory shared; all the directories thus selected for sharing shall be known by the common share name and will be available to all the network users in the domain, unless the access has specifically limited to selected users.

3.4. Sharing a printer:

The printers folder can be found by going to the *Control Panel* by way of the *Start Menu*. After opening the printer window *Add Printer* icon is clicked. A dialog box appears where the radio button against "*Network printer server*" should be selected. Next, a port has is selected from the list, to which the printer has to be connected. When prompted to select the printer as "*shared*" or "*not shared* " the "*shared*" radio button should be selected. A test page is printed out, on demand, to confirm that the printer set up is correct. The installation process of network printer on a client is same. Sometimes problem occurs while printing from DOS. In that case, in the printer's properties dialog box (obtained by clicking right mouse button on the printer icon in the printer window) the *Details* tab is selected and then "*Capture printer port*" is clicked and then appropriate port is selected.

3.5. Creating network clients:

Once a Server is set up and the next thing to be done is to set up some workstation to access that server. For this network cards popularly known as Ethernet cards must be installed on all individual computers to be put on the network. A computer having anyone of the operating system - DOS, Windows for workgroup (3.11), Windows 95 or Windows NT workstation software - can become the client of the server. In this dissertation two clients have been created having Windows 95 client as the operating system; procedure to create such a client is discussed below.

In the *Start menu, Settings* is selected and then *Control Panel* and then *Networking* icon is double-clicked. A window appears with one menu page titled "*configuration*" if no client, adapter, protocol and services have been selected so far otherwise three menu pages with titles "*Configuration*", "*Identification*" and "*Access control*" appear. The *configuration* menu page is selected first which has the tabs - *Add, Remove, Properties, Print and File sharing, OK* and *Cancel* and a drop down menu labelled "*Primary network logon*". Clicking on *Add* offers a list of network components in a new dialogue box (with tab *Add* and *Cancel)* - *Client, Adapter, Protocol* and *Services*. First *Client* is chosen and then *Add* is clicked. From the list appearing in the new window *Client For Microsoft Network* is selected. Then it is the turn of Adapter. If none of the names in the list matches with the Ethernet card

installed in the computer *Have Disk* is selected and the correct name is selected from the disk provided by the manufacturer. Then the properties for *Client For Microsoft Network* is set. The box against *Log On To Winnt Domain* is checked and the domain name is entered. Then *Protocol* is selected and *Add* is clicked. The Protocol *TCP/IP* is the right choice in the new window opened thereafter and then by clicking OK window is closed. Then *Properties* is clicked on. It is must to provide all the clients a unique *IP* address such as *202.161.83.11* which can be done here. In a domain only the last number can change. Next, *services* is selected and *Add* tab is clicked. From the list appearing in the new window *File and print sharing for Microsoft networks* is selected and OK is clicked. In the *Primary Network Logon* drop down menu *client for Microsoft Network* should be selected. Clicking on *File And Print Sharing* offers two choices - *I want to be able to give others access to my files* and *I want to be able to allow others to print to my printer*. Choices are made depending upon the requirement. Then *OK* is clicked. In the entry boxes appearing after clicking on *Identification* menu page the name of computer, workgroup and description of the computer are entered in the corresponding boxes. Then *Access control* menu page is clicked and *share level access* option is selected. The computer now becomes ready to be connected to a network as a client.

The network can then be browsed by through *Network Neighbourhood* on the default desktop screen.

3.6. Constructing a LAN:

If PCs are to talk to one another somehow the cables must come together so that signal can be transmitted from one PC to another. The network cables are not ordinary wires. The networks operate at high frequencies.

The manner in which the cables are laid across the land is called the topology of a network. The first thing to decide before installing a LAN is its topology. Designers have developed several topologies for PC networks. Most can be reduced to one of three basic layouts: linear (bus), ring, and star (radial). The names themselves describe how the cables run throughout an installation. The topologies are, however, discussed below:

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- **Linear:** The network with linear cabling has a single backbone, one main cable that runs from one end of the system to the other. Along the way, PCs tap into this backbone through T and BNC connectors to send and receive signals. The PCs link to the backbone with a single cable through which they both send and receive. In effect, the network backbone functions as a data bus, and this configuration is often called a bus topology. Figure 3.1 illustrates a simple network bus.

In the typical installation, a wire leads from the PC to the backbone, and a T-connector links the two. The network backbone has a definite beginning and end. In most cases, these ends are terminated with a resistor matching the characteristic impedance of the cable in the background. That is, a 61 Ω network cable will have a 61 Ω termination at either end which is the case in the present dissertation. These terminations prevent signals from reflecting from the ends of the cable, helping assure signal integrity.

- **Ring:** The ring topology looks like a linear network that's biting its own tail. The backbone is a continuous loop, a ring, with no end. But the ring is not a single, continuous wire. Instead it is made of short segments; chained from one PC to the next, the last connected, in turn, to the first. Each PC thus has two connections. One wire connects a PC to the PC before it in the ring, and a second wire leads to the next PC in the ring. Signals must traverse through one PC to get to the next, and the signals typically are listened to and analysed along the way. Figure 3.2 illustrates a simple ring configuration of a network.

- **Star:** Both linear and ring topologies require a huge length of cable if the computers are widely dispersed. The star topology shines a ray of light into tangled installations. Just as rays blast out from the core of a star, in the star topology connecting cables emanate from a centralised location called a hub, and each cable links a single PC into the network. A popular image for star topology is an old-fashioned wagon wheel—the network hub is the hub, the cables are the spokes, and the PCs are ignored in the analogy. Figure 3.3 illustrates a simple star configuration of a network.

In the most popular network systems based on the star topology, each cable is actually twofold. Each has two distinct connections, one for sending data from the
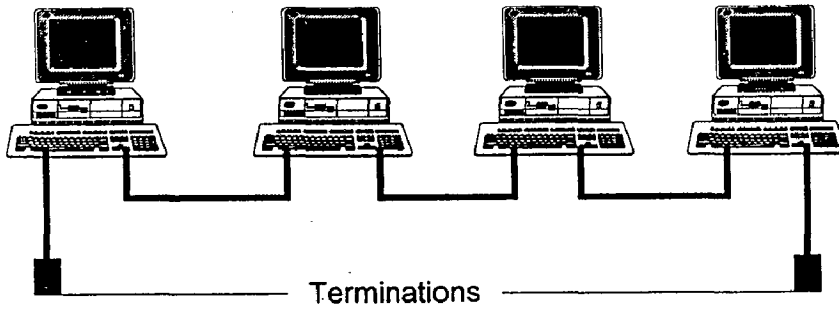
Fig 3.1 Bus Network
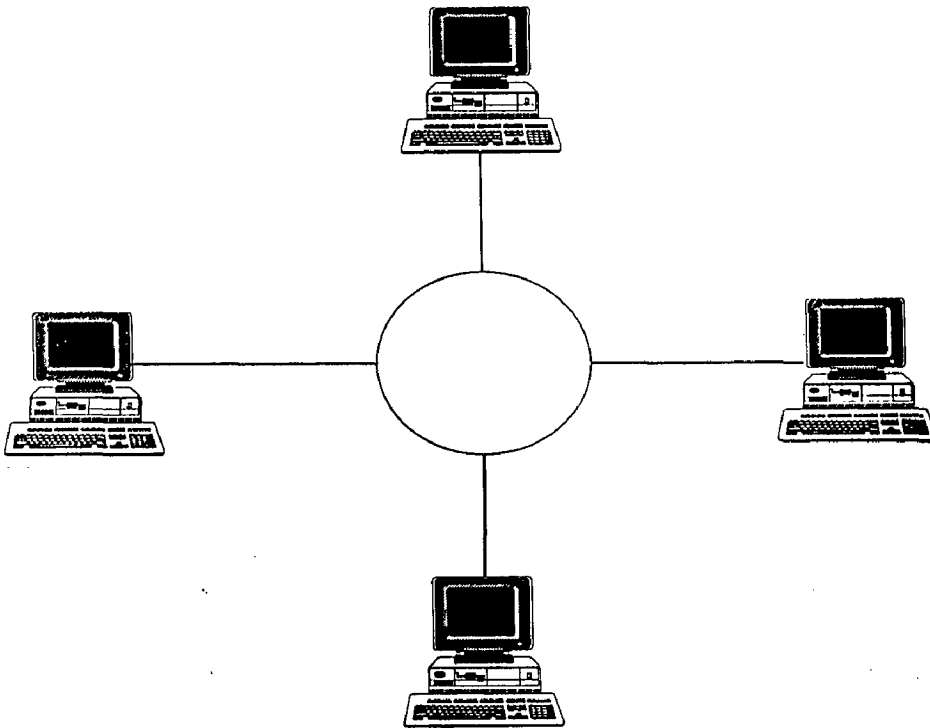
Fig 3.2 Ring Network
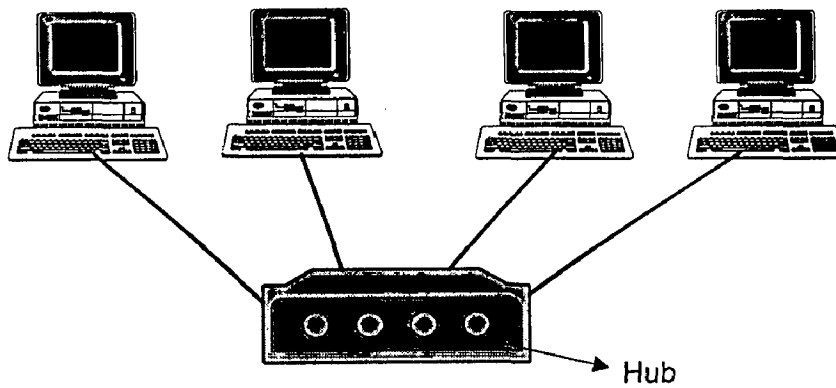
Fig 3.3 Star Network

hub to an individual PC and one for the PC to send data back to the hub. These paired connections are typically packaged into a single cable.

Star-style networks have become popular because their topology matches that of other office wiring. In the typical office building, the most common wiring is used by telephones, and telephone wiring converges at the wiring closet in which is the PBX (Private Branch Exchange, the telephone switching equipment for a business). Star-style topologies require only a single cable and connection for each device to link to the central location where all cables converge into the network hub. As distinct as these three topologies seem, they are really not so different. If the ring is cut at any one place, for example, the result is a linear or bus system (of course, at each end resulting from the cut, terminators are to be placed). Or if the ring is shrunk down to a single point the result is a star. All networks must perform the same functions, so all the varieties should be expected to be functionally the same.

Once the topology is decided the following components are required for constructing a LAN:

- Network cards: One network card per computer is a must.

- Co-axial cable: The length of the cable required depends upon the topology used and how widely dispersed the computers are.

- BNC connectors: The number of BNC connectors needed depends on the topology used. For bus topology, it is 2 X (no. of computers - 1); for ring topology it is 2 X no. of computers and no terminator is required for star topology. The BNC connector connects the cable to the T-connector. The BNC connectors are designed for very high frequencies; up to giga Hz range.

- T - connectors: Co-axial cable is connected to the computers (server and clients) through T and BNC connectors. One T-connector is required per computer.

- Terminators: At each termination point a terminator must be placed. In case of Bus topology two terminators are required.

- Hub: A hub is necessary if star topology is adopted for the network.

To construct a LAN, first the network card or Ethernet card is installed .The network card is installed as explained in the section 3.1.3.1.In the present dissertation *Bus* topology has been adopted as shown in fig. 3.1. Three network cards have been used - one *32 bit card* on the server and one *16-bit card* on each client. As there are three computers, four BNC connectors and three T-connectors have been used. Since the topology is *Bus* two terminators (of impedance 61 Ω) have been placed at the termination points.

3.7. *Summary of the network installed:*

Through the steps explained in the sections 3.1 to 3.5, a Windows NT server has been installed, in the lab, as the primary domain controller of the domain *DOMAIN* (the name of domain is DOMAIN) on an a Pentium (100 MHz) computer and two Windows 95 clients on two 80486 microprocessor based computers. The name of the server computer is *Priya,* the name of the client computers are *Jitu* and *Indra.* These clients and server share their directories and printers; the printer being connected to the server. The physical connection among the computers has been done by constructing a LAN in the light of the section 3.5, the topology adopted being the Bus topology.

4.1. The Internet/Intranet solution:

By extending the power of Notes software to the user of a Web browser, Domino software of Lotus Notes group makes it the premier interactive Web applications server for creating and hosting Internet and Intranet sites. Domino combines the open networking environment of Internet standards and protocols, which were available in web-browser software earlier, with the powerful application development facilities of Notes. And by using Domino, any Web client can participate in Notes applications securely.

Domino offers powerful Web publishing, Web browsing, and Internet/Intranet applications, database replication, authentication, messaging, and security services – fully integrated with Internet protocols – in a single package. With the Domino Mail Access license, even non-Notes mail clients can access Domino servers for mail. And because Domino is cross-platform, it is the software solution for extending business applications to the Internet.

4.2. Powerful tool for sharing information:

Notes is a popular access point for finding and sharing information needed, whether it is located in e-mail, relational databases, or host-based systems; in desktop application; or on the World Wide Web. The Notes database provides a secure, reliable, and scalable means to store, manage, and distribute business information.

Three powerful technologies come together to make Notes the industry's one of the strongest client/server application development platform – a powerful, flexible compound-document database, a rich applications development environment, and a sophisticated messaging system.

4.3. A powerful, flexible compound-document database:

The Lotus Notes document database is a robust object storage facility through which users can access, track, store, and organise information. Documents can contain any number of objects and data types, including text, rich text, numerical text, structured data, images, graphics, sound and motion picture images. A Notes database also contains the information, and rich application-development tools to automate processes related to the application. Integration between Notes databases and traditional databases dramatically enhances the value of an organisation's information assets. In the next chapter, few examples implemented through Lotus Notes formulae (Commands of Notes software) brings out clearly the power of Lotus Notes in automation of an organisation.

4.4. Types of licenses given by Lotus Notes:

Lotus Notes issues three types of licenses for the users of Lotus Notes software.

4.4.1 Lotus Notes Mail Licenses:

Lotus Notes Mail license provides access to the following types of databases:

- A client/server mail database, which stores mail. Notes creates this database automatically from the mail database template.

- Communication and Collaboration databases, which helps work with others in a workgroup. These databases are created using the communications and collaboration database templates.

- Documentation databases, which are online books provided for user's information.

4.4.2. Lotus Notes Desktop Licenses:

The Lotus Notes Desktop license provides unrestricted access to all Notes databases and database templates, including any custom or third-party databases and templates that are available to user.

The Lotus Notes Desktop license does not provide access to design and administration features.

4.4.3. Lotus Notes Licenses:

The Lotus Notes license allows unrestricted access to all types of Notes templates and databases. In addition, user can create a blank database or use an existing database template as a starting point, to design applications. With a Lotus Notes license, one can also perform administrative functions such as registering new Notes users.

In the present dissertation, Lotus Notes License has been used.

4.5. Required hardware and software for Windows servers

Before installing Domino, the Domino-supported hardware, software, and network operating system should be installed. If possible, the recommended equipment should be used, rather than the minimum required, to improve performance and make maintenance easier.

The Lotus Domino server for Windows requires the following hardware and software:

- A PC with an Intel 80486 or Pentium processor or system with a Digital Alpha processor (only if using Windows NT)

- One of the following operating systems:

  - Microsoft Windows 95

  - Microsoft Windows NT version 3.51 or 4.0.

- Minimum memory:

  - 16 MB of RAM for Windows 95.

  - 48 MB of RAM for Windows NT 3.51 or 4.0. (although for small applications 16 MB serves the purpose)

- Recommended memory:

  - 24 MB of RAM for Windows 95.

  - 64 MB of RAM for Windows NT 3.51 or 4.0.

- Minimum disk space:

  - 150 MB for Windows 95

  - 300 MB for Windows NT 3.51 or 4.0

- Recommended disk space:

  - 300 MB for Windows 95

  - 500 MB for Windows NT 3.51 or 4.0

- Disk swap space:

  - 16 MB for Windows 95

  - 64 MB for Windows NT 3.51 or 4.0

- A colour display supported by Microsoft Windows (for example, EGA, VGA, mono VGA, SVGA, IBM 8514A, CGA, or Hercules).

- A mouse (PS/2 type recommended)

- A modem (necessary only if users are to be allowed to dial in to the server).

In the dissertation set up a PC with processor Pentium - I (100 MHz), operating system Windows NT 4.0, 16 MB RAM, 1.2 GB hard disk space, SVGA display and a mouse have been used; modem facility is not available.

4.6. *About the Domino server Install program for Windows:*

The Domino server Install program accomplishes four tasks. It copies and decompresses the Domino server files and administrator (workstation) files into

specified directories, updates the operating system configuration file (WIN.INI), creates the default Domino configuration file (NOTES.INI), and if Windows 95 or Windows NT is being used, updates the Windows Registry Information in HKEY_CLASSES_ROOT and HKEY_LOCAL_MACHINE.

To integrate Domino environment with the Internet, the Domino server Install program installs components for the InterNotes Web Navigator and the Domino Web server. However, additional configuration steps must be completed before using either the Web Navigator or the Domino Web server; these are not necessary for intranet applications.

4.7. Install methods:

Domino offers the following server install methods:

- **Server Install** - It installs all the components needed to run the Domino server for windows. This was the choice in the present dissertation.

- **Customise features** – Manual install lets user select the components to be installed. At minimum the Domino server, Notes Workstation, and · personal data files to run a Domino server must be selected. For Domino Advanced Services, user must also click the Advanced Services tab and select Domino Partitioned Server and Advanced Services and Advanced Services Data for clusters and billing on all platforms.

4.8. Completing pre-install tasks:

These steps should be followed before installing Domino Server:

1.   It should be made sure that the required hardware and software components are in place and working.

2.   Any screen savers should be temporarily disabled and any virus-detection software turned off.

3.   All Lotus applications and any other applications are closed. Otherwise any shared filed may be corrupted, and the install program may not run properly.

4.   If upgrading to Domino :

- All customised template (.NTF), modem (.MDM), script (.SCR), bitmap (.BMP), macro (.MAC), and SmartIcons (.SMI and .TBL) files are copied to a temporary directory.

- NAMES.NSF, NOTES.INI, and ID files are copied to a temporary directory to save your current Notes setup. Using old NOTES.INI files with may affect how Domino runs.

- DESKTOP.DSK file is copied to a temporary directory to save the database icons the user had added to the workspace.

5.   If upgrading to the Domino Advanced Services from any previous release of Notes :

- All references of NOTES.INI and LOTUS.INI from your %Path% should be removed.

- The LOTUS.INI file in the %SYSTEMROOT% directory is edited and the line that contains "Notes=c:\notes\..." is removed.

- The Registry Editor (%SYSTEMROOT\system32\regedt32.exe) is run. In the HKEY_LOCAL_MACHINE window, Software-Lotus-Notes is selected and the vserver entry is deleted.

4.9.   Installing the Domino server for Windows

1.   It should be made sure that the pre-install tasks are completed.

2.   One of the following is done:

- To install Domino from CD-ROM, the Lotus Domino CD-ROM is inserted in the CD-ROM drive.

- To install Domino from a set of disks, the first Domino install disk is inserted in the disk drive.

- To install Domino from a file server, the location of the file server that contains the Domino program files is found.

3. One of the following is done:

- If using Windows NT 3.51, *File-Run* from the Program Manager menu is chosen.

- If using Windows 95 or Windows NT 4.0, *Start-Run* from the Desktop Bar is chosen.

4. Following is entered:

drive:\directory\install

where drive and directory specify the location of the Lotus Domino server for Windows Install program.

5. When prompted through a window, the user should enter his/her name and the company's name, and has to click *Next*. *"Install on a file server"* in the window should not be selected.

6. *"Yes"* is clicked to confirm the names, or *"No"* to re-enter them.

7. If upgrading to Domino, a warning appears indicating that there is already a copy of Notes installed on the hard disk. The warning can be safely ignored because of step-1. *Next* is now clicked.

8. One of the following install methods is chosen :

- *"Server Install"* - to install the files needed to run the Domino server.

- *"Customise features-Manual install"* - to choose the features desired to be installed. This option must be selected to install the Domino server with Advanced Services.

9. The drive and directories where Domino programs files and Domino data files are to reside is entered. By default, the Install program installs the Domino program files in C:\NOTES and the Domino data files in C:\NOTES\DATA. If using Windows 95 or Windows NT 4.0, *"Browse"* is clicked to choose from a list of available drives and directories.

10. If *"Customise features – manual install"* was chosen, the features on the Notes tab is selected that is to be installed. At minimum the *"Domino Server"*, *"Notes Workstation"*, and *"Personal data files"*, options must be selected to run a Domino server.

11. The program folder for the Notes icon and the Domino Server icon is selected or a name is typed to give a new name to the program folder. The default name is Lotus Applications

12. *"Yes"* is clicked to begin copying the files.

13. *"Done"* is selected when installation is complete.

14. If features that create Windows NT Services and Registry entries (such as Single Password Logon, User Synchronisation, Notes Performance Monitor, and Notes Service Install) were installed at step-10, then the computer must be rebooted to activate the features.

15. If any files were saved in the pre-installation step (section 4.8), they should be copied to the data directory.

This completes the installation of Domino server.

4.10. Setting up Domino:

The setting up of a Domino server has been divided into two phases for convenience.

4.10.1.   Phase I:

1. After successful installation of Domino the user should return to the Windows desktop.

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2. From the *Start-Programs-Lotus Applications folder*, the Lotus Notes icon is selected. The Domino server icon should not be selected.

3. *"The Lotus Notes server in your organisation"* is selected and *"OK"* is clicked.

4. A name for the Domino server is entered in the *Server name* box. *Krishna* is the name of the server in this dissertation.

5. The name of organisation is entered in the *Organisation* box. *Baikuntha* is the name of organisation in the dissertation.

6. User should enter his/her last name, first name, and middle initial in the *Administrator boxes*. The user then becomes the administrator of the Domino server. *Priya R Jha is the administrator's name in the dissertation.*

7. A case-sensitive password of 8 to 31 characters in length is entered in the *Administration password* box. This is the administrator's password. The password in the present dissertation is *lotusnotes*. This can be changed, however, as explained in the section 4.19.1.

8. The network protocol the machine uses is entered in the *Network type* box. If the network is already installed and set up, the network protocol automatically appears in the *Network type* field. In the dissertation, TCP/IP has already been selected while installing Windows NT, which appears in the box.

9. If the server uses a modem a port in the *Serial port* box and the type of modem it uses in the *Modem type* box are selected. But the modem should not be attached to the serial port of the computer at this moment otherwise an error message pops up. This is not necessary in this dissertation and therefore left blank.

10. *"Server is also administrator's personal workstation"* is selected if the server is to be used as a workstation too. In this dissertation this has been selected.

11.   "*OK*" is clicked to exit server setup.

NOTE: Steps from 4 to 11 are to be carried in the same window.

12.   A dialog box appears where time zone is selected and "OK" is clicked. The time zone selected for this dissertation is 5.30 Hrs East of GMT.

This completes the phase I of Setup.

4.10.2. Phase II:

To set up phase II of server setup, Advanced Options is clicked and the following is done in the appearing thereafter:

- A Domain name is entered.

- The Network name is specified. Domino assigns Network1 by default.

- An optional two-digit country code is entered. The country code is another way to guarantee uniqueness for an Organisation name.

- "Log all replication events" is selected to record the start and end of replication sessions in the Notes Log.

- "Log all client session events" is selected to record in the Notes Log when users are accessing the server.

- "Create organisation certifier ID" and "Create server ID" are selected to set up a new server. By default, Domino selects these option.

- "Create administrator ID" is selected if a new ID is to be created for the administrator. By default, Domino selects this option.

- A number in the "Minimum admin and certifier password length" field is entered. The default setting is eight characters.

This completes the phase II of set up of Domino server.

4.10.3. Phase III:

After the completion of phase II of server set up the Lotus Notes window is minimised after which following is left to be done to complete the server set up:

- Through *Start - Control Panel - System* a dialog box is opened where the performance is set to none.

- Then the current window is closed and *Server* icon is double-clicked (in the Control Panel window) to open a dialog box where *Maximum throughput through Server* is selected.

- The Lotus Notes window which was minimised at the starting of phase III, is now maximised. The *Address Book* database icon is double clicked. The arrow placed left to the section *Network Configuration* is clicked. A table appears in which in the port column TCPIP is written. The database is then closed.

4.11. Verifying server setup

When the set up is complete, workspace contains of three databases, viz., *Notes Log, Mail and Public Address Book.* To verify that the server is set up, new documents in the Public Address Book is looked for and ID files are examined to see the certificates the ID file contains. For this purpose the following procedure is followed:

1. The Public Address Book is opened. The "About the Public Address Book" screen appears which can be closed by clicking the system *Close* icon or pressing ESC. Then a screen appears containing name of administrator.

2. *File – Database – Access Control* is chosen. The administrator should have access in the Public Address Book.

3. The ESC key is pressed twice to exit from the document and the database.

4. *File – Tools – Server Administration* is chosen. Then Administration - ID File is chosen.

5. The ID file to be examined is selected. By default, Domino places the ID files in the Domino data directory.

6. The password that was specified during the Setup program is entered on being prompted and "*OK*" is clicked.

7. "*Done*" is clicked to finish examining the ID.

8. Through *Start - Programs - Lotus Application* the Domino Server icon is clicked. This starts the Domino server and one by one many informative sentences appear in the window. If one of them tells that an administrator has been found for the domain then the server set up is O.K otherwise it has to be redone.

4.12. Redoing server setup:

If any error is detected while examining setup of the server, following is done to start the server Setup program again:

1. *File – Exit Notes* is chosen.

2. A text editor e.g. NOTEPAD is used to open the NOTES.INI file, which is in the Domino data directory.

3. All lines in this file except the lines beginning with [Notes], KitType, and Directory are deleted.

4. The Domino data directory and DESKTOP.DSK, CERT.ID, SERVER.ID, LOG.NSF and NAMES.NSF files are deleted.

5. The Lotus Notes workstation icon is Double-clicked to restart the server Setup program from phase 1 (section 4.10.1).

4.13. Starting and shutting down the Domino server:

The Domino server must be started so that users can access shared databases and obtain other server services. Keystrokes-strokes and mouse-clicks must be avoided while the Domino server is starting or shutting down.To start the server, the Lotus Domino server icon is double-clicked. To shut down the Domino server, exit or quit is typed at the console and ENTER is pressed. It may take 10 seconds or more for the server to shut down.

4.14. Setting up Notes Workstation (client):

4.14.1. Required hardware and software:

The Notes workstation for Windows requires the following hardware and software:

- A PC with an Intel 80486 or Pentium processor.

- One of the following Microsoft Windows operating systems:

  - Microsoft Windows version 3.1 and MS-DOS or PC-DOS version 3.31 or later.

  - Microsoft Windows for Workgroups version 3.11 or later.

  - Microsoft Windows NT version 3.51 or 4.0.

  - Microsoft Windows 95.

- Minimum memory

  - 6 MB of RAM for Windows 3.1 and Windows for Workgroups 3.11

  - 8 MB of RAM for Windows 95 and Windows NT 3.51 or 4.0

- Recommended memory

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- 8 MB of RAM for Windows 3.1 and Windows for Workgroups 3.11

- 16 MB of RAM for Windows 95 and Windows NT 3.51 or 4.0

- Minimum disk space -50 MB

- Recommended disk space - 60 MB

- A colour display supported by Microsoft Windows (for example, EGA, VGA, mono VGA, SVGA, IBM 8514A, CGA, or Hercules).

- A mouse

In the present dissertation two Notes workstation have been set up each with 80486 processor, Windows 95 operating system, 8 MB RAM, 600 MB hard disk space, VGA display, a mouse and no modem.

4.14.2. Supported networks and protocols:

The Notes workstation for Windows runs with the following network protocols:

- Banyan VINES

- Novell NetWare SPX

- NetBIOS, NetBEUI

- TCP/IP (used in the dissertation)

4.15. Install methods:

The Install program offers the following workstation install methods:

- *Standard Install:* It installs the minimum components needed to run the Notes workstation program for Windows which includes the program data

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files, personal data files, Notes Help Lite, and database templates. This was the choice of the present dissertation.

- *Customise features – Manual install:* It lets user select components to be installed. This option must be selected if it is desired to install full online Help, the documentation databases, or additional Notes templates on the workstation. If these databases are not installed, they can still be accessed by adding the databases to a workspace from the Notes server.

4.16. Completing pre-install tasks:

The steps before installing Notes on a workstation are as follows:

1.   It should be made sure that the required hardware, software, and network components are in place and working.

2.   It should be checked with the Notes administrator to make sure that the person who the Notes workstation will belong to, has been registered as a user, that the Notes server program is running on the server machine, and that the user has an active connection to a server.

3.   All open applications should be closed. Leaving applications open could prevent the Install program from copying files or updating shared files.

4.   Temporarily disabling screen savers and turning off virus-detection software is advisable.

5.   If upgrading to a new release of Notes :

- A backup copy of any Notes data files that you have customised should be created. These files, which are located in the Notes data directory, include template (.NTF), modem (.MDM), script (.SCR), bitmap (.BMP), macro (.MAC) and SmartIcons (.SMI and .TBL) files. Otherwise, Notes writes over these data files during installation.

o   A backup copy of each of the following files : NOTES.INI (located in the Windows directory) and your DESKTOP.DSK, NAMES.NSF, and user ID files (located in the Notes data directory) is created.

4.17. Completing pre-setup tasks:

Before beginning the Notes Setup program, following information should be gathered from the registration server, which is the server that stores the Public Address Book containing user information.

o   **The exact spelling of the home server name:** Home server is the server that stores user's Personal Address Book and Notes mail database. The home server provides the user with a list of servers he/she can access to add databases to a workspace.

The exact spelling of the user name is as it appears on the user ID. User ID is a unique file that identifies the user and provides access to mail and other Notes servers. Before setting up workstation, the user ID and the password that the administrator specified when the user was registered are indispensable.

o   **The exact location of user ID:** The user ID resides either in the Public Address Book on the home server or in a file on a disk. If the user ID is in the Public Address Book, Notes copies it automatically during the setup procedure. If it is on a disk, then the disk should be taken from the Notes administrator.

o   **The name and location of the Notes mail database:** Notes administrator stores mail databases on the home server.

o   **The type of network connection and network protocol.** This information determines how the workstation connects to Notes servers. For example, user can have a network connection, remote connection (via modem), network and modem connections, or no connection. If workstation is to have a network connection to servers, it is needed to

know which protocol the workstation uses to connect to the home server. If workstation is to be dialled into a server from a remote location, the modem type and the phone number for the home server must be known.

4.18. Setting up Notes on a workstation:

1.   After completing the pre-setup tasks before the Setup program is begun by double-clicking the Notes icon on the desktop or from the start menu (*Start -Program - Lotus Application*).

2.   On being prompted, the type of connection the workstation uses to connect to Notes servers is chosen. If the workstation has to be standalone one then *"No connection to a server"* is chosen. If the workstation is connected to the server through LAN then *"Network connection (via LAN)"* is chosen. If the workstation is planned to be dialled into a server from a remote location, *"Remote connection (via modem)"* or *"Network and remote connections"* is selected.

In the present dissertation the two clients are connected to the server through the LAN and therefore *"Network connection (via LAN)"* chosen.

3.   Following is done:

- If the administrator supplied user ID in a file on the hard drive (or network drive) or on a disk, *"User ID supplied in a file"* is selected. If the administrator supplied user ID in the Public Address Book, *"User ID supplied in a file"* is left unselected.

- The correct drive, directory, and file name for the user ID is specified and *"OK"* is clicked.

4.   When a message asking *"Do you want your ID file copied to your data directory"*, *"Yes"* is clicked.

5.   On being asked for a password, the user password that the administrator had created is entered and *"OK"* is clicked.

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6.   If *"Network connection (via LAN)"* was chosen following needs to be done:

- Full user name exactly as the Notes administrator registered is entered. If user ID was supplied in a file, Notes automatically enters the user's name.

- Full name of the home server exactly as Notes administrator specified is typed.

- The correct type of network protocol the workstation uses to connect to Notes servers is entered. To change the default settings for the network type, Setup is clicked. The settings are changed and *"OK"* is clicked.

In this dissertation TCP/IP is the protocol used and the network type is also TCP/IP.

- Then with step 11 of this procedure should be continued.

7.   If *"No connection to a server"* was chosen, full user name is typed exactly as Notes administrator registered. If user ID was supplied to you in a file, Notes automatically enters user's name. The License type is selected and then *"OK"* is clicked.

8.   A time zone is selected.

9.   *"OK"* is clicked when the Notes workstation Setup program is complete.

10.   If upgrading to a new release of Notes and if Notes data files were backed up, these files are copied to the Notes data directory.

11.   *File – Exit Notes* is chosen to quit Notes.

12.   To restart Notes after completion of the Setup program, the Notes icon (through *Start - Program - Lotus Application)* is double-clicked.

4.19. Ways to keep the workstation secure:

To prevent others from tampering with shared databases or accessing personal information on the workstation, the user can:

- Store a backup copy of user ID on a file server, rather than on a disk. Make a backup copy of user ID and ask Notes administrator for the location of a file server where the user can keep the backup copy of user ID.

- Set a password for user ID.

- Lock user ID automatically to prevent other users from using his/her ID to access servers.

4.19.1. Setting password protection for a user ID:

Passwords can consist of any combination of keyword characters. The first character of the password must be an alphanumeric character. Notes passwords are case sensitive. The procedure to change password other than the one supplied by the administrator following is done:

- File – Tools – User ID is chosen.

- "Set Password" is clicked.

- A password is entered and "OK" is clicked.

- The password is retyped and "OK" is clicked and then "Done" is clicked.

4.19.2. Locking your user ID automatically:

If the user wants his/her workstation not to be used by others when he/she is not at there then he/she can use the facility of locking user ID automatically. This is just like putting password in the screen savers of Windows and is done through the following way:

- File – Tools – User Preferences is chosen.

- In the "Lock ID after" box, a number of minutes is typed.

- "OK" is clicked.

If the user wants to leave the workstation for a short period of time, but doesn't want to exit Notes, he/she can lock his/her ID temporarily. To temporarily lock user ID, File – Tools – Lock ID or press F5 is chosen.

4.20. *Summary of Intranet created for this dissertation:*

The Window NT network, installed through the steps of chapter 3, has been modified into an Intranet by setting up a Domino server on the Windows NT server and the Lotus Notes clients on the Windows 95 clients, following the steps explained in the sections 4.1 to 4.19. About 40 users have been created who can use the Intranet with time-multiplexing.

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Using E-mail and Development of Applications

An Intranet has been set up in the Microprocessor & Computer lab for the present dissertation work. This Intranet has a Windows NT server and two Windows 95 clients, set up by the method explained in chapter 3. On the Windows NT server Domino server has been set up and on the Windows 95 clients the Lotus Notes clients have been set up following the steps explained in chapter 4. Although in actual practice every user is allotted individual Notes workstation (clients), in the present dissertation work the Intranet has many users, created to use the two Notes workstation, so that the workflow of a big organisation may be simulated. It is to be noted that any workstation can be used by only one user at a time. In the present set up there are many virtual Notes clients because there are 40 users but only two PCs dedicated for the purpose.

Once the Intranet is installed as above, the E - mail facility is ready to be exploited as it is an in-built feature of Lotus Notes. The method to use this facility is explained in section 5.2. Many workflow of an organisation can be automated using application development capabilities of Lotus Notes. For an example, some of the workflow of Department of Electrical Engineering, U.O.R that can be automated are:

- Scheduling a meeting

- Application for leave

- Dissertation approval process

- Accounting

- Scholarship and contingency approval

- Purchase procedure

- Time - table scheduling

There can be innumerable workflow, which can be automated. In the present dissertation, due to paucity of time, only three of them - Scheduling a meeting, Conferencing and Dissertation topic approval process - have been automated for the Intranet developed in the lab. However, these workflow are just some examples and have not been designed to exactly match the requirement of EED,U.O.R.

Before going for the application development and using E-mail, an outline of Notes database becomes necessary which is the foundation for the development of application programs.

5.1. Constituents of Notes database:

A Notes database has to be designed as the first step to automate any workflow. A database is nothing but a collection of documents, which is its prime constituent. The other constituents such as Forms, Views, Agents facilitate various operations on the documents of a database. The constituents of database are discussed below:

5.1.1. Document:

A *document* is a set of information. The *documents* in Lotus Notes are like *records* in other databases such as in Oracle or dBase. A *document* contains *static text, fields, buttons, hotspots, objects* and *icons*.

Static text are just words that become a permanent part of the document after being composed.

Fields are the places where the information can be added or changed while composing or editing the document. *Fields* may be one of the types: *text, rich text, date, numbers, names, keywords* etc. A field can be declared to have a single or multiple values. A *text* field can contain any combination of characters: alphabets,

digits, punctuation etc. A *keyword* field is a special kind of text field in which possible entries are pre-decided by the person creating the database or having that access. The *keyword* field saves the time because the user has to just pick a value from the list. The selection of a particular choice from that list can be done through use of one of three display type: *radio button, check box, dialog list* as shown in fig. 5.1. Through *radio buttons* only one of the choice can be made. *Check box* facilitates multiple choice and *dialog list* displays a list, to chose from, when the arrow button beside the field is clicked. In the *rich text* field the text can be formatted as per choice i.e. it can be italicised, bold, of large or small font size, in different colours etc. *Date* field can have either date or time or both stored in it. *Number* fields hold number. Non-number characters like slashes, dashes, letters etc. are not allowed in the number field. *Name* fields can hold a person's name.

Buttons provide an attractive way to have some manipulation or execution of a series of statements at the clicking of mouse-left-button, the cursor being viewed on the *button*. In fig. 5.1, a button with label "Save & Exit" is shown.

A *hotspot*, when clicked, displays some pre-programmed information or opens a different document. *Formula pop-ups* and *links* are the examples of hotspots. A *link* is just a quick cross-reference to some other Notes database. A click on the *link* opens the document or the database which the link refers to and on pressing "ESC" or "CTRL+W" once or through "FILE - CLOSE" the view returns to previous document. In fig. 5.1, a link is shown.

A document may contain an *object* through OLE (Object Linking and Embedding) which may refer to a *Lotus 1-2-3 worksheet* or some pages of *MS-Word* or a graphics in *Visio* or likewise. If somebody includes a MS-Excel spreadsheet in an E-mail it looks like an Excel worksheet to the recipient of the mail.

Icons offer another way to include data from other program and are also called as *attachments*. The attachments work in the same way as the OLE objects.

A document is created in an open database through the testing of form (to be discussed in the form section of this chapter) or by opening a document and saving it making any change or through "Edit - Copy + Edit - Paste". The static texts, fields,
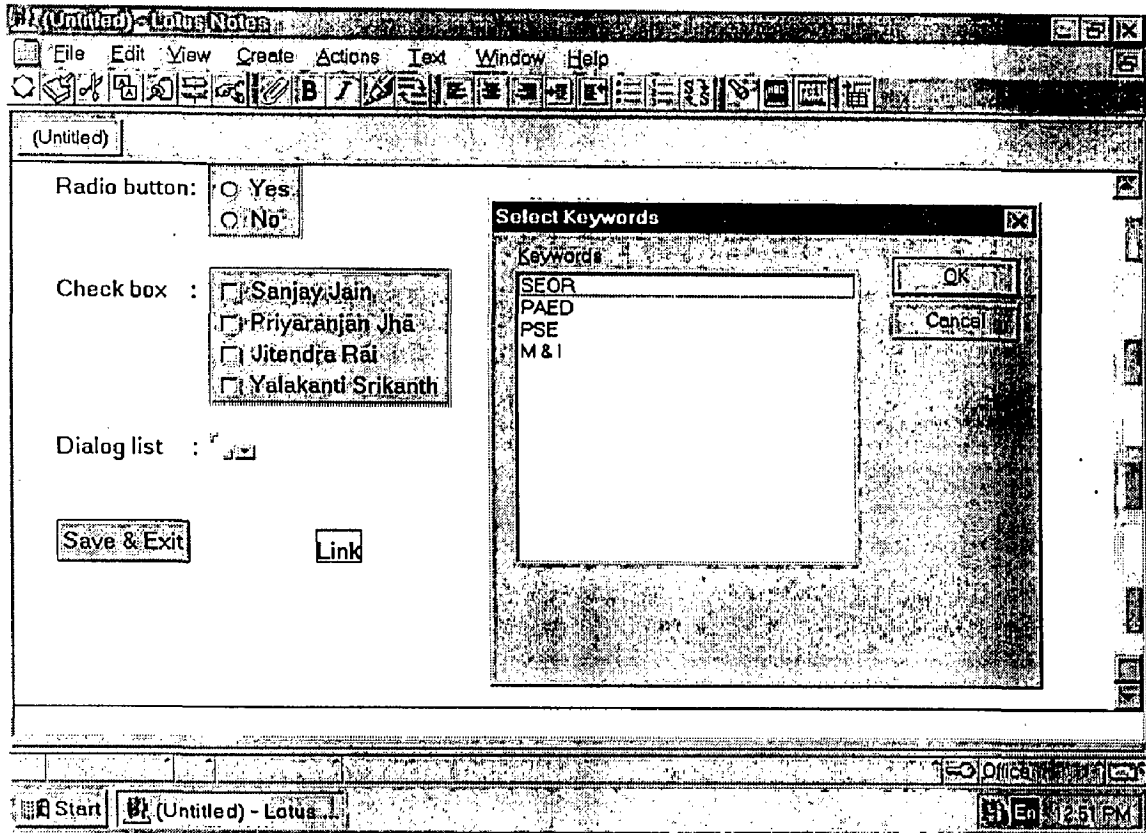
Fig. 5.1 : Fields, Buttons and Link in a document

buttons, hotspots, objects and icons are to be created by the database designer based on the application.

The document can be opened for reading through *"File - open"* from the menu bar or by double-clicking the document or by pressing ENTER when the document after selecting the document. The document can be opened for editing through *"Action - Edit document"* when the document is selected or when it is opened for reading. The document can also be brought in edit mode from read mode by double clicking.

5.1.2. Form:

A form is the layout of a document. It contains fields and other design objects, like buttons, hotspots and graphics. Fields are used to enter and display data. Each field on a form can be one of several data types, such as text, name or number etc. data type. A data type is used to identify how information is stored and determines how Notes editor handles the data. A form is created in an open database through "Create - Design - Form". Then a property box for the form appears where its name is written. A sample form created is shown in fig. 5.2.

5.1.3. View:

A view is a summary of all or selected documents in a database. It is view which determines in what manner the information of the database will be displayed in the view pane. A pane is nothing but a window on the screen. When a database is opened a menu bar, tools bar, navigator pane and view pane appear by default. A preview pane and an action bar are optional. A preview pane is opened through *"View - Preview pane"* from menu bar. An action bar is automatically created when first action button is created while designing the *view* for a problem. In the navigator pane there appears list of constituents of database. The list of contents of the constituent selected in the navigator pane is displayed in the view pane. In the preview pane the contents of the item selected in the view pane appears. A database can have more than one views that display the information stored in the documents in different ways. A View is created through "Create - Design -View" from the menu bar. Then the name
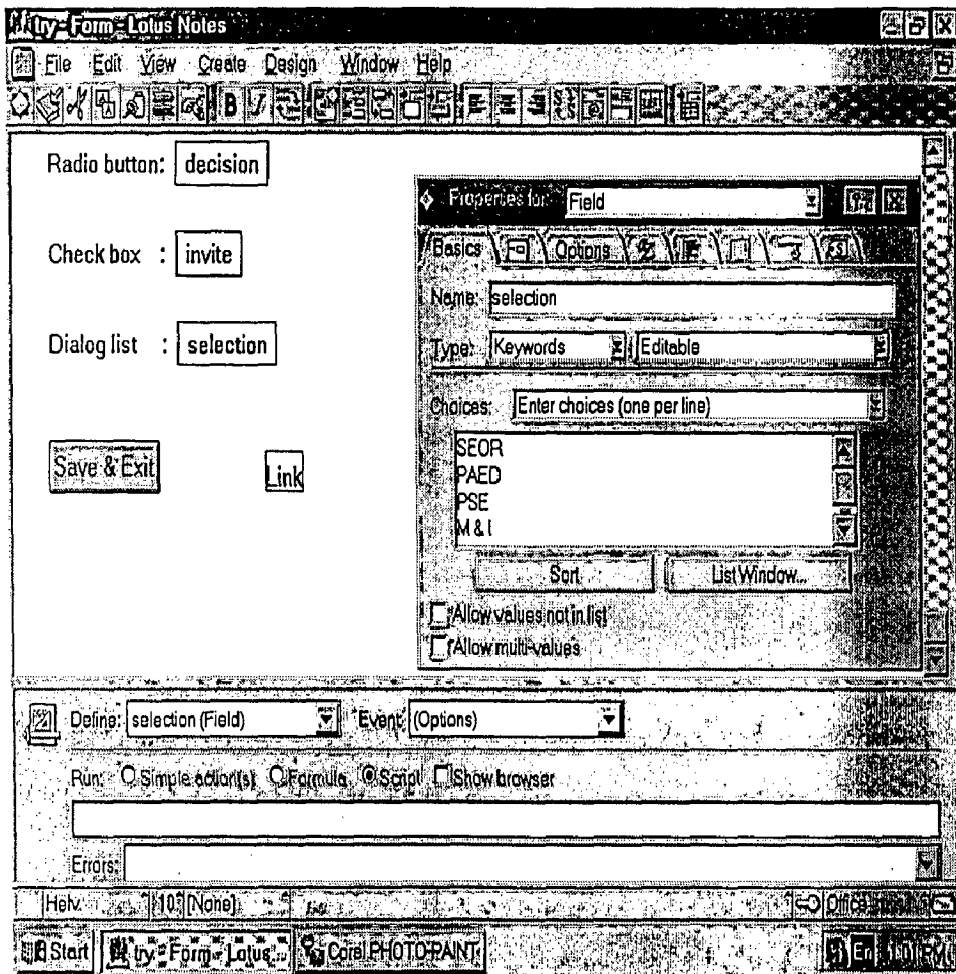
Fig. 5.2 : Layout of a form

and other parameters are entered/chosen in the property box appearing thereafter. A sample view window has been shown in fig. 5.3.

5.1.4. Folder:

A folder is very similar in behaviour to a view and can have all the properties that a view can have. A folder is used to store documents that already exist in the database. All folders in a database are viewed by choosing the *"Folders and Views"* section in the navigator pane. A folder icon immediately follows each folder's name. A database can have private and public folders. A private folder can be used by the single user who creates that folder but a public folder is available to everyone using the database.

A folder is created through *"Create - Folder"*. A window appears in which the name of the folder is entered and the box against the label *"share the folder"* is checked if the folder is to be a shared one, otherwise it becomes a private folder after clicking *"OK"*.

5.1.5. Agent:

An agent is a procedure in a Notes database that is used to carry out one or more tasks, from simple actions such as archiving mail, to complex Notes tasks such as sending reports to other database outside the Notes environment. An agent can be designed by a user or by the database designer and can be designated as private or public (shared) agent. There can be more than one *agent* in a specific automation problem in an Intranet and each *agent* has a specific predetermined tasks to perform.

An agent is created through *"Create - Agent"* from the menu bar and the task to be performed is specified by opening it (by double-clicking) and selecting suitable choices in the window appearing thereafter.

5.1.6. Access Control List:

Every database has an Access Control List or ACL which can be viewed by opening or selecting the database icon on the workspace and choosing FILE - DATABASE - ACCESS CONTROL. The ACL lists all the users, groups, and servers who can access that database. There are several access levels, from *"No Access"* to

File   Edit   View   Create   Actions   Window   Help

New Product | Print | Order | Help | Toy Talk | Clients

▼ ☐ Folders and View

   ☐ Sale Items

   ☐ What's New

   🔍 By Age

   🔍 By Category

   🔍 By Description

   🔍 By Product

   🔍 Posted Orders

  🔍 Agents

▼ 🗎 Design

   🗎 Forms

   🗎 Views

   🗎 Folders

   🗎 Shared Fields

   🗎 Subforms

   🗎 Navigators

   🗎 Script Libraries

   🗎 Other

Product	Supplier	Cost
AlphaDesk	EduStuff	$39.49
Auto Robot	Constructives Ltd.	$39.00
Baby Doll	Basics Ltd.	$36.00
Big Bat	Constructives Ltd.	$12.50
Block House	Constructives Ltd.	$39.99
Bounce the Balls	Basics Ltd.	$23.00
Building Blocks	Constructives Ltd.	$98.99
Color my Windows	SoftService	$29.00
Dartboard	AAA Adventures Inc.	$29.00
Disappearing Frogs	Wonders Unlimited	$14.00
Down on the Farm	EduStuff	$14.00
Easy Keys	EduStuff	$49.99
Farm Family	EduStuff	$24.00
Gear Up	KidStuff	$24.95
Holy Stars! Planetarium	Wonders Unlimited	$39.00
I Got Rhythm Keyboard	Wonders Unlimited	$34.00
Know Way	EduStuff	$17.00
Let's Make Music	Basics Ltd.	$38.39

Office

Start | Catalog - By Pro... | Corel PHOTO-PAINT   1:04 PM

Fig. 5.3 View of a database

"*Manager*" through "*Depositor*", "*Readers*", "*Authors*", "*Editors*" and "*Designer*" levels. At least *Designer* level access is required to have full access to the database.

Different database have their own ACL. The meaning of *No access* level is quite obvious. Users, with *Depositor* level access, can create and save document but can not see any document, including the document they created. With *Reader* level access user can read but can not create document. A user, with *Auther* level access, read and edit the document created by him/her. If *Editor* level access is assigned to any user, he/she can read, create and edit all documents. With *Designer* level access, user can read, create and edit document and can modify the design of the database. And with *Manager* level access a user can read, create and edit document and can modify the design and ACL of the database.

5.2. Using E - mail:

Lotus Notes facilitates a powerful tool for communication through E - mail feature. Fig. 5.4 shows a sample work space containing icons of databases. To open e-mail database the mail database icon is double-clicked. The screen is divided in three parts - navigation pane, view pane and action bar - as in the fig. 5.5.

5.2.1. View pane:

The view pane has three columns - "Who", "Date" and "Subject", as shown in fig. 5.5, which respectively refers to the person who has sent the message or to whom the message has been sent, date of sending the message and the subject of the message.

5.2.2. Navigation pane:

Following information are the part of the navigation pane:

- **Inbox**: Shows the messages sent to the user.

- **Drafts**: Shows the messages that the user had composed but hasn't mailed yet.

- **Sent**: Lists the messages that the user sent to others (the user may also send message to himself/herself to check whether mail is working or not).
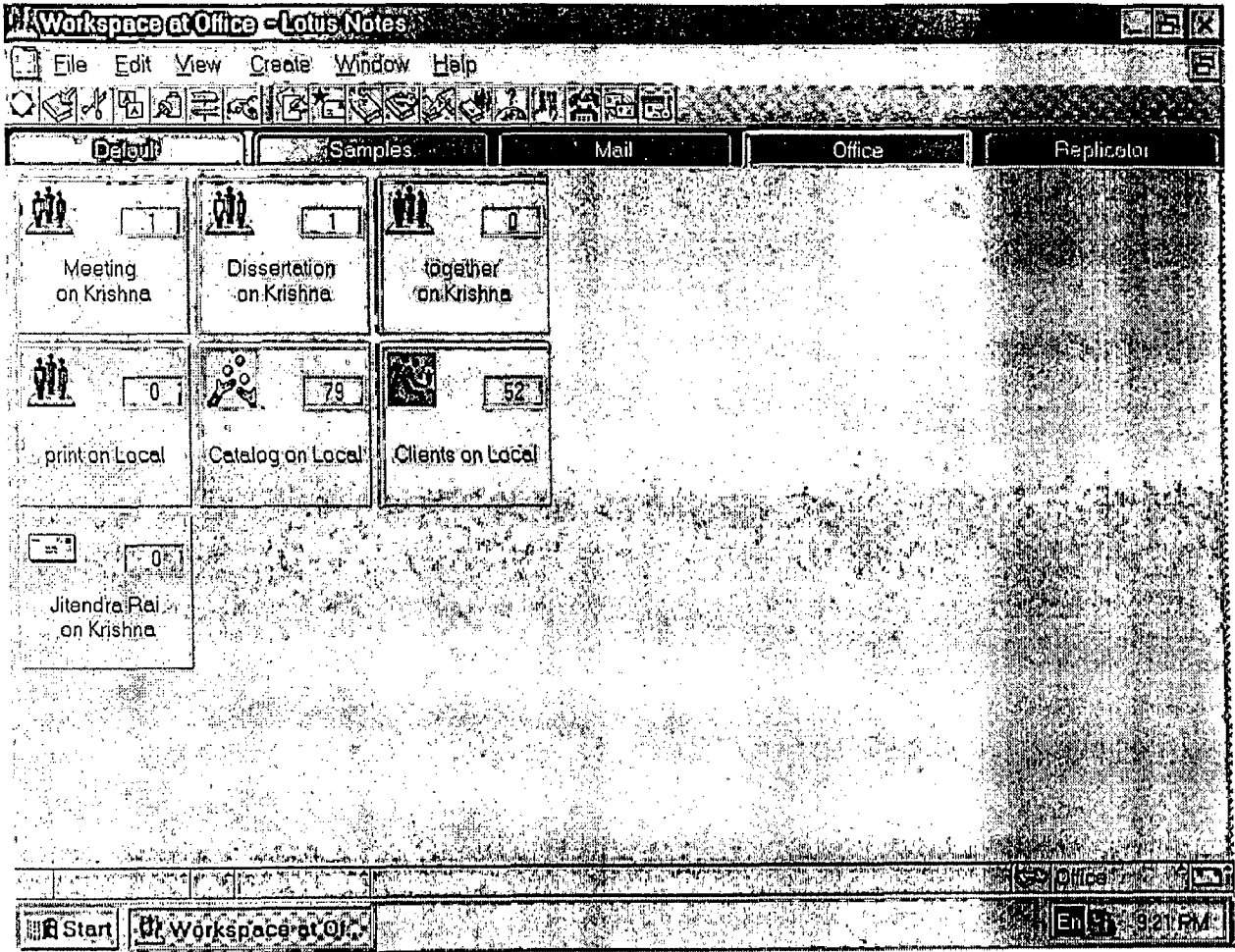
Fig. 5.4 : Workspace with database icons
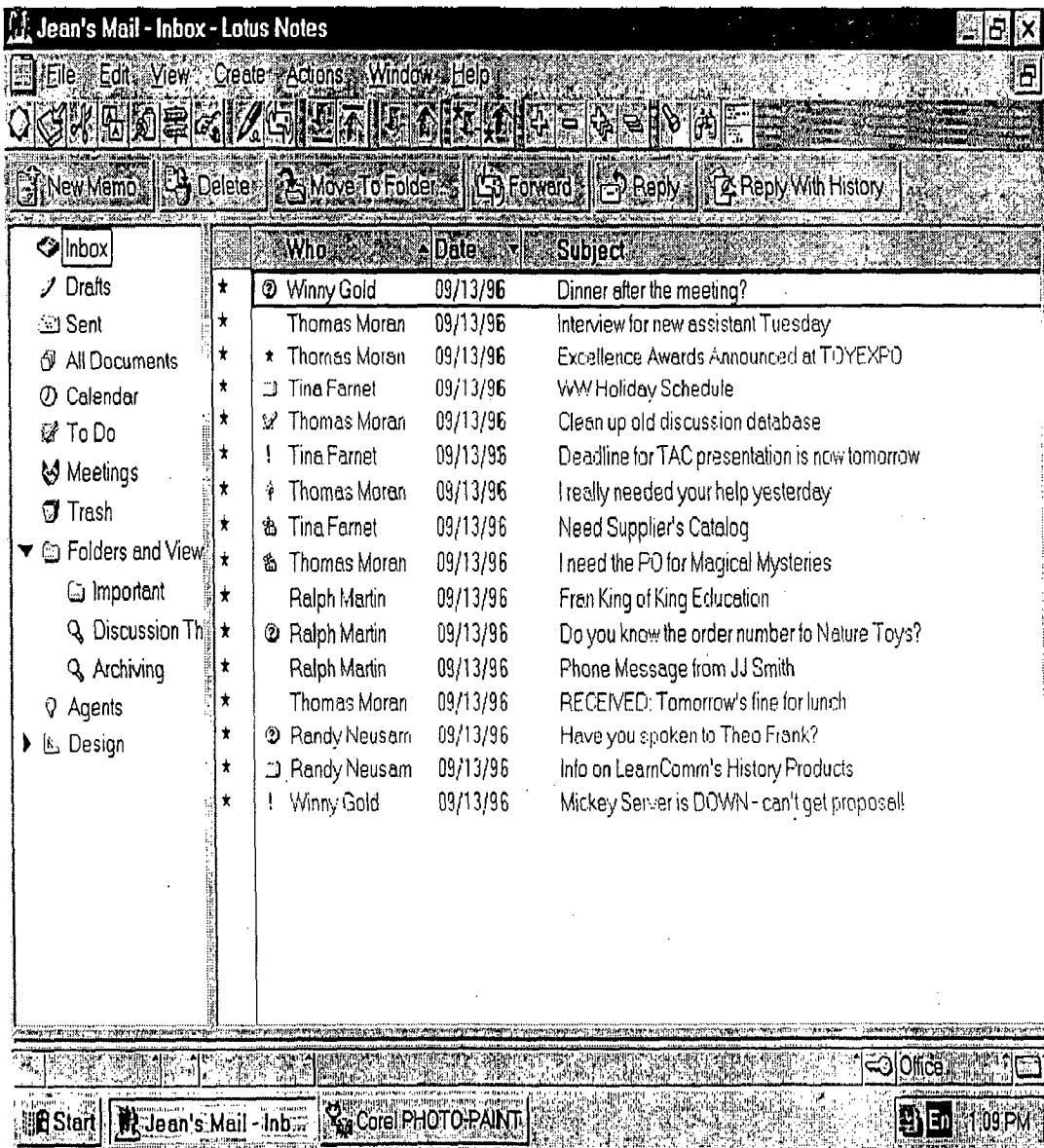
Fig. 5.5: View of opened e-mail database

- **All Documents**: Lists all the messages seen in Inbox, Draft, Sent etc.

- **To Do**: Shows the list of things to be done.

- **Trash**: Shows documents which are marked to be deleted.

- **Archiving**: Shows old messages the user has put away to save space.

- **Discussion Threads**: Shows messages listed together based on their subject.

5.2.3. Action bar:

Following action buttons are there on the action bar which facilitate various mail related activities:

- **New Memo:** It is used to prepare a fresh memo.

- **Delete:** It is used to delete a memo selected by selection bar. To delete many documents (memos) at one stroke all the unwanted memos are selected using mouse (selected memos are marked as √) and then **Delete** button is clicked.

- **Move To Folder:** Using this action button selected documents are stored in a folder. The selection procedure is same as discussed above.

- **Forward:** It is used to forward a particular document or message to some other Notes user.

- **Reply:** It is used to send reply to the person who has sent the message.

- **Reply With History:** When this action button is used to send reply, the previous documents are attached in the form of Doclink with the new message.

5.2.4. Reading a mail:

The view pane presents a summary of documents. Each row of information represents an individual message. Each message is divided into three columns - name of the person who sent the message, the date it was sent and the subject of the

message. By pressing up and down arrow key or with the clicking mouse a particular message can be selected and by pressing "ENTER" or double-clicking the mouse it is opened for reading. The document can be previewed, which may be desirable before opening it for reading, through "View - Document Preview" (selecting it as active i.e. marked as √ by clicking of mouse) through menu bar.

5.2.5.   Making a message:

To write a new memo, the "New Memo" action button on the action bar, shown in fig. 5.5, is clicked. A screen like fig. 5.6 appears. It has, besides default menu, an action bar with action buttons - "Address", "Save As draft", "Send", "Send and File...." and "Delivery options", the user's name, three boxes - "To", "cc"(Courtesy Copy), "bcc"(Blind Courtesy Copy) - for writing recipient's name(s), a box for writing subject i.e. a brief description of the memo and a box for writing the memo. To send someone a copy of memo without letting the rest of recipients knowing about it the name of that person is entered in the bcc box. But if no such secrecy is required the name is written in the cc box.

Address action button is used to select the recipients' name from the address dialog box. **Delivery options** action button is used to choose the delivery priority and importance etc. **Save As Draft** action button, when clicked, saves the current memo which can be reused. **Send** button, when clicked, sends the current memo to the specified persons. **Send and File** facilitates keeping up the records of the memos sent.

5.3.   Automating scheduling of a meeting:

Automating any workflow in an Intranet starts with concept of that workflow followed by design philosophy. As with any other software development, in design philosophy is subdivided into clear cut structures so that these structures can be implemented through the developmental tool available in Lotus Notes. The development tool includes Forms, Views, Agents etc. programmed, as necessary, through Notes Formula or Simple functions or Lotus scripts. In this dissertation, only Notes formulae are used because of non-availability of Lotus script programming guide.

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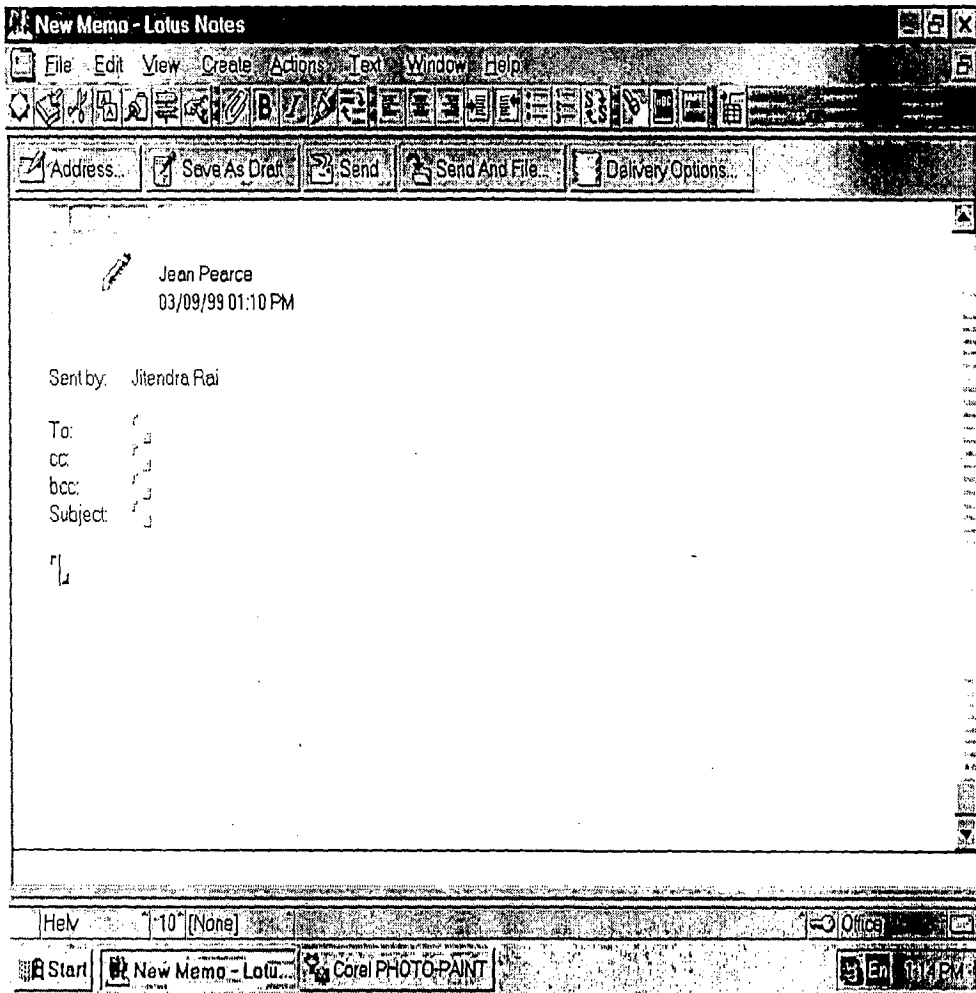
Fig. 5.6 : Sending a new memo

5.3.1. Design philosophy: The meeting workflow to be designed is to have following procedure:

- The meeting co-ordinator opens the meeting database and creates a new meeting document.

- Meeting co-ordinator selects the invitees, meeting date, time, venue and agenda and sends them a mail which includes the document created above.

- The invitee opens the mail and then specifies in the document sent whether he/she is attending or not. If the invitee can't attend the meeting on the said date and time, the reason must be given in the document.

- The meeting co-ordinator opens the document, sees who are attending the meeting and sends them a mail for the confirmation of meeting.

- After the meeting is held the meeting co-ordinator prepares meeting minutes of the meeting in the meeting document and sends it to all the invitees (including those who were absent from the meeting) through a mail. The meeting minutes become the permanent part of the meeting document.

5.3.2. Implementation: The above procedure can be realised through the use of application development elements of Lotus Notes - Forms, Views etc. For this, the designer creates a database for meeting. He/she designs the form(s) that contains necessary and sufficient fields, buttons, hotspots etc. and creates a document through *"Design - Test form"* from the menu bar when the form is open. Then the designer creates view(s) that contains suitable columns. It is very attractive and user-friendly approach to create action buttons in the views, which appear in the action bar. Agents may be created to execute some of the tasks at specified moments. The Access Control List is defined carefully for security. The database should be on the server so that any meeting co-ordinator can use the database to arrange a meeting. It is to be

noted that the meeting co-ordinator should be a Notes user, having access to that server.

The database designed in the present dissertation to realise the above workflow has the name *meeting*. It has a form with name *comingornot* and a view with name *meeting arranged*. There are many fields and buttons in the form and there are three columns and four action buttons, which are discussed in detail that follows.

5.3.2.1. Database: A new database is created through "*File - Database - New* ". A dialog box appears. The server is selected as "*Local*" and the name "*Meeting*" for the new database is entered in the title box. This creates a database named "*Meeting*" and a database icon is added to the current workspace. The database is opened by double clicking the icon. It should be noted that any name can be given to the new database but it should be unique on the server it is being created on.

5.3.2.2. Form: A Form with name "*comingornot*" has been created by the methods discussed earlier in the section 5.1.2. In the navigator pane the arrow placed left to "*Design*" is clicked which displays the list of design elements out of which form is selected. Then the list of forms created so far appears in the view pane. The form "*comingornot*" is double-clicked. A screen appears divided in two parts. In the upper part, a section of form is displayed. The other part is the design pane which has the define box containing the name of fields created so far, the event box containing the list of operations corresponding to the field displayed in the define box and a formula window where either simple function or Notes formula or Lotus script program whichever is applicable is written corresponding to the event in the event box.

The first step is then to create the fields and assign suitable properties to them in the property box through "*Edit - Property*". Out of many tabs available in the property box, "*Basic*", "a_z" and *hide* tabs are very important. In the "*Basic*" tab, field name and type are selected. A box labelled "*Allow multi-values*" present in the window which is clicked to be checked (becomes active) for storing more than one values in that field, if needed. Other options are also available in this tab which depend on the type of field selected. In the "a_z" tab the properties of fonts to be used for the current field are selected. In the hide tab there are many options against the

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label "*Hide paragraph when document is*". Those options are - "*previewed for reading*", "*previewed for editing*", "*opened for reading*", "*opened for editing*", "*printing*", "*copied to the clipboard*". The options are selected through the check boxes placed against each choice. There is one more label "*Hide paragraph if formula is true*". If the check box against this label is checked then only the formula written in the formula window is evaluated and if found TRUE, then only hiding action takes place. Next, if needed, buttons are created through "*Create - Hotspot - Button*". The properties of the buttons are selected as it is done in the case of fields. And again in an identical manner the sequence of instruction is written in Notes formula in the formula window. The following fields, static texts and buttons have been created for the automation of meeting:

Stage: This field is used to refer to the stage of the meeting. The type of field is *Number & Editable*. It is hidden when the document is opened for reading and editing. If stage is 0 the meeting is to be finalised; if stage is 1 the meeting is finalised; if stage is 2 the meeting has been requested; if stage is 3 the meeting has been scheduled or confirmed and if stage is none of 0,1,2 or 3 the meeting has been held. This logic is used to have dynamic title of the meeting document as and when the meeting process gets updated. The default value is 0.

Heading: This field has been used to give dynamic title to the meeting document. The type of field is *Text* and *Computed for display*. Thus it is computed by the following sequence of Notes formula:

@If(Stage=0;"To be finalised";Stage=1;"Finalised";Stage=2;"Meeting
Requested";Stage=3;"Meeting Scheduled";"Meeting Held");

The field value changes as soon as the value of field stage changes. No hiding options are selected because it is desired to see it in all modes - reading, editing etc.

MeetingDate: This field is used to enter the date of meeting. The type of field is *Time* and *Editable*, and the format is *mm/dd/yy*. The date must be entered in the specified format. This field is hidden when the user of the document is not the Meeting Co-ordinator so that nobody other than the meeting co-ordinator can change the date of meeting. It is also hidden when the meeting minutes are to be written It is done through the following formula in the formula window of "*Hide*" tab of field

properties. (The box corresponding to "*hide paragraph if formula is true*" must be checked by clicking, as explained earlier.)

@Text (@Name([CN];@UserName)) != Mcoordintr | Stage >3

MeetingTime: This field is used to enter the time of the meeting. The type of field is *Time* and *Editable*, and the format is *hr/min*. The time must be entered in the specified format. This field is hidden when the user of the document is not the Meeting Co-ordinator or when the meeting minutes are to be written. The hiding formula for this field is:

@Text (@Name([CN];@UserName)) != Mcoordintr | Stage >3

Venue: The field stores the venue of the meeting and its type is *Text* and *Editable*. This field is hidden when the user of the document is not the Meeting Co-ordinator or when the meeting minutes are to be written. The hiding formula for this field is:

@Text (@Name([CN];@UserName)) != Mcoordintr | Stage >3

Agenda: The field stores the agenda of the meeting and its type is *Text* and *Editable*. This field is hidden when the user of the document is not the Meeting Co-ordinator or when the meeting minutes are to be written. The hiding formula for this field is:

@Text (@Name([CN];@UserName)) != Mcoordintr | Stage >3

MCoordintr: This field stores the name of the meeting co-ordinator. The type of field is *Text* and *Computed when composed*. Thus the Meeting co-ordinator is computed only once and this computation is done during the creation of meeting document either during testing of form or by clicking the "*Call A Fresh Meeting*" button on the action bar which is to be discussed later in this chapter. No hiding options are selected. The formula to computed this field is:

@Text(@Name([CN];@UserName))

Phoneno: This field stores the phone number of the meeting co-ordinator. The type of field is *Text* and *Editable* is hidden when the user is other than the

meeting co-ordinator. The value of this field is used in the mails to tell the invitees to make a call on that phone number if he/she wants some more information (the invitees can also use e-mail facility for this purpose). The hiding formula is:

@Text(@Name([CN];@UserName)) != Mcoordintr | Stage >3;

Attending: This field stores the names of the persons going to attend the meeting. The type of field is *Text* and *Editable* and the "*Allow multi values*" box is checked. All the hiding options are selected. In the option tab comma is selected in both the choice boxes "*separate values when user enters*" and "*display separate values with*". The values of this field are edited through the button titled "*Yes, I will attend*" to be discussed later in this section.

NotAttending: This field stores the names of the persons not going to attend the meeting. The type of field is *Text* and *Editable* and the "*Allow multi values*" box is checked. All the hiding options are selected. In the option tab comma is selected in both the choice boxes "*separate values when user enters*" and "*display separate values with*". The values of this field are edited through the button titled "*No, I will not attend*" to be discussed later in this section.

Reason: This field is used to store the reasons of all the persons not to attend the meeting. The type of the field is *Text* and *Computed*. This field is hidden from all persons accept the co-ordinator using the formula:

@Text (@Name([CN];@UserName)) != Mcoordintr

dreason: This field stores the reason of not attending of the current user. The field type is *Text* and *Editable*. The field is hidden when the following formula is TRUE:

Stage = 0 | @IsMember(@Name([CN];@UserName);Attending) |

@IsMember(@Name([CN];@UserName);NotAttending) | Stage >3;

Invitees: This field stores the names of the persons invited in the meeting. The type of field is *Names* and *Editable* and from the drop down menu of "*Choices*" is

"*Use Address Dialog for choices*" is selected. The box against "*Allow multi values*" is checked so that to store the names of more than one users. In the option tab comma is selected in both the choice boxes "*separate values when user enters*" and "*display separate values with*". It is hidden when the document is in the Read mode and the user is not the meeting co-ordinator or when meeting has been finalised using the following formula:

@Text(@Name([CN];@UserName)) != Mcoordintr | Stage > 1;

Minutes: This field is used to allow the meeting co-ordinator to write down the minutes of the meeting held. The type of the field is *Text* and *Editable* and is hidden when the *Stage* is less than 4 and the user is not the meeting co-ordinator. The hide formula written for this field is:

Stage < 4 | @Name([CN];@UserName) != Mcoordintr;

Static texts have been used at various places in the form to make the document user-friendly. The texts are visible only when required.

The static text **"Please double-click the left mouse-button to see the button so that you can convey your decision by clicking on that button."** is displayed to just prompt the user to bring the document in *Edit* mode. The hiding option selected is "*opened for editing*" because it is useless when the mode is Edit.

The static text **"You have already submitted your decision. Thank you."** is displayed when the user who has already conveyed the decision reopens the document. This is hidden when the document is in Read mode and the following formula is true:

!(@IsMember(@Name([CN];@UserName);Attending)|
@IsMember(@Name([CN];@UserName);NotAttending)) | Stage >3;

This formula hides the text if the user is neither the member of field *Attending* nor *NotAttending*.

The static text **"Please convey your decision by clicking appropriate button:"** is for just to tell the user what to do. This is hidden in the Read mode and also if the following formula is true:

Stage = 0 | @IsMember(@Name([CN];@UserName);Attending) |

@IsMember(@Name([CN];@UserName);NotAttending) | Stage > 3;

This text has no use when the meeting is to be finalised i.e. Stage is 0 or when the user has already submitted the decision and the above formula indicates this condition to be true.

The static text **"Please select the persons to be invited from the list appearing after pressing the arrow button:"** is to direct the meeting co-ordinator for such a selection and is hidden when the document is in the Read mode and the user is not the meeting co-ordinator, using the following formula:

@Text(@Name([CN];@UserName)) != Mcoordintr |Stage >1

Buttons: There are four buttons created in the *form (comingornot)* of the meeting document which execute specified instructions. The methodology of creating the buttons have already been discussed in section 5.1.1. The action, implemented through Notes formula, when the buttons are clicked are described below:

Out of the two buttons - **"Yes, I will attend"** and **"No, I will not attend"** when the former button is pressed the name of user is added to the field *Attending* and if the later button is pressed the name of user is added to the field *NotAttending*. The hiding options are same as for the static text *"Please convey your decision by clicking appropriate button"*. The formula used for the button *"Yes, I will attend"* is as written below:

@SetField("Attending";@Trim(Attending:@Name([CN];@UserName)));

@PostedCommand([FileSave]);

@PostedCommand([FileCloseWindow])

The formula used for the button *"No, I will not attend"* is as follows:

@If(dreason != "";"";@Prompt([OK];"";"You must specify the reason of not

attending the meeting."));

@If(dreason!="";@SetField("NotAttending";@Trim(NotAttending:@Name

([CN];@UserName))));"");

FIELD Reason := @If(dreason != ""; (Reason + @NewLine +

@Name([CN];@UserName) + ":" + @NewLine + "   " +

dreason;"");

FIELD dreason := "";

@PostedCommand([FileSave]);

@PostedCommand([FileCloseWindow])

The button when the following formula is TRUE:

Stage = 0 | @IsMember(@Name([CN];@UserName);Attending) |

@IsMember(@Name([CN];@UserName);NotAttending) | Stage > 3;

The Button - **"Finalise"** is used to increment the value of Stage by one so that the meeting status becomes *"Finalised"*. It is checked whether the co-ordinator has selected the persons to be invited by checking whether the field *"Invitees"* is empty. If the field Invitees is empty the co-ordinator is prompted to select the invitees otherwise the document is saved and is closed. The following formula serves the purpose:

FIELD Stage := @If(((Invitees != "") & (Agenda != ""));1;0);

@If(((Invitees != "") & (Agenda != ""));"";@Prompt([OK];"";"You have not
        selected the persons to be invited and agenda of the meeting. Without

that

        the meeting can not be finalised"));

@If(Invitees = "";@Command([EditGoToField];"Invitees");"");

@If(((Invitees != "") & (Agenda != ""));@PostedCommand([FileSave]);"");

@If(((Invitees != "") & (Agenda != ""))@PostedCommand

([FileCloseWindow]);"")

The button is hidden in the read mode and when the following formula is TRUE:

Stage > 0;

Button - Save and Exit: The button is used to save the document and exit when the meeting co-ordinator writes the minutes of the meeting (after the meeting is held). The following formula is used for this button:

@PostedCommand([FileSave]);

@PostedCommand([FileCloseWindow])

The button appears only when minutes are to be written.

5.3.2.3. View - A view with name **meeting arranged** has been created in which four columns have been created through "*Create - Insert new column*" (when the *meeting arranged* view is open). After selecting a column and opening the property box through *Edit - Properties,* the heading, width, multi-value separator etc. for columns are selected. Thereafter moving into the "define box" of the design pane, the columns are selected one by one and out of the three display radio buttons - Simple function, Field and Formula -one is selected for each column depending upon the purpose. The values to be displayed in the column correspond to display selected. The four columns are *Meeting status, Co-ordinator, Attending and Not Attending.* The formula corresponding to the column "*Meeting status*" is as follows:

@If(Stage=0;"To be finalised";Stage=1;"Finalised";Stage=2;"Requested";

Stage=3;"Scheduled";"Held")

The field corresponding to *Co-ordinator* column is *Mcoordintr,* to *Attending* column is "*Attending*" and that to *Not Attending* column is "*NotAttending*".

5.3.2.4. Action bar: When an action is created through "*Create - Action*" an action bar is automatically added to the current view if that is the first action to be created otherwise the new action is added as discussed in section 5.1.3. The action is then selected in the action pane and one of simple functions or formula or Lotus script radio buttons is selected in the design pane and accordingly sequences of instructions

are written in formula window. There are five action buttons in the view "meeting arranged".

1. "Call A Fresh Meeting": This button creates a new document through following formula:

```
@Command([EditCopy]);

@Command([EditPaste]);

FIELD Stage := 0;

FIELD Invitees := "";

FIELD Attending := "";

FIELD NotAttending := "";

FIELD Reason := "Reason of not coming";

FIELD dreason := "";

FIELD Minutes := "";

FIELD Mcoordintr := @Text(@Name([CN];@UserName))
```

2. "Send Mail Notices To Invitees": This button sends mail notices to all the persons in the field "*Invitees*" and a Doclink through which the current document can be accessed and the value of field *Stage* becomes 2 to indicate that the meeting has been requested. It is done by the use of following sequence of formula:

```
Form = "comingornot";

FIELD Stage := 2;

@Command([FileSave]);

@Command([EditMakeDocLink]);

@MailSend(Invitees;"";"";"Meeting RSVP requested";"Your presence is
    requested at a meeting  to be held on " + @Text(MeetingDate) + "at" +
    @Text(MeetingTime) +".The venue of meeting is" + @Text(Venue)+ ".
    The agenda of the meeting is as follows:"+ @NewLine + Agenda +
    @NewLine + ". You can convey your decision by double clicking the
```

document link below." + @NewLine +

"Thankyou.";[ReturnReceipt];[IncludeDoclink])

3. "Confirm Meeting": This button sends the message about the confirmed date of meeting to all the persons going to attend the meeting and the value of field *Stage* becomes 3 to indicate that the meeting has been scheduled. It is done through the following formula:

Form = "comingornot";

FIELD Stage := 3;

@Command([FileSave]);

@Command([EditMakeDocLink]);

@MailSend(Attending;"";"";"Meeting confirmed";"The requested meeting is scheduled to be held on" + @Text(MeetingDate) + "at" + @Text(MeetingTime) +".The venue of meeting is" + @Text(Venue)+ ". The agenda of the meeting is as follows:"+ @NewLine + Agenda + @NewLine + "." + @NewLine + "Thankyou")

4. "Write Meeting Minutes": This action button opens the document for the co-ordinator to write the meeting minutes after the meeting is held. The value of field *Stage* becomes 4 to indicate that the meeting has been held. The following formula is used for this button:

SELECT Form = "merge";

FIELD Stage := 4;

@Command([EditDocument];"1");

@Command([EditGotoField];"Minutes");

5. "Send Meeting Minutes": This button sends the minutes of the meeting to all the persons invited. The following is used for this action button:

Form = "comingornot";

@Command([FileSave]);

@Command([EditMakeDocLink]);

@MailSend(Invitees;"";"";"Meeting minutes";"A meeting coordinated by " + @Text(Mcoordintr) + "was held on " + @Text(MeetingDate) + "." + "The minutes of the meeting are as follows - " + @NewLine + @Text(Minutes))

The workflow of scheduling of a meeting has been shown in fig. 5.7. The 9 - step process illustrates a workflow model, designed to schedule meeting among Notes users, in which a single document serves all the purposes: the persons to be invited are selected by the meeting co-ordinator, the document is sent out to invitees, gives them the date, timing, venue and agenda of the meeting to be held, indicates who is attending the meeting and contains meeting minutes after the meeting is held.

5.4. Conferencing:

The same step by step procedure as explained in automating scheduling of a meeting is also applicable for automating conferencing.

5.4.1. Design philosophy: The workflow of conferencing, to be designed, is to have following procedure:

- The conference co-ordinator selects a topic of discussion and sends mails to all/selected Notes users to take part in the conference at particular date and time.

- Each mail recipient then responds to the mail by conveying the decision whether he/she will be participating in the conference.

- The co-ordinator prepares the list of participants. At pre-specified time the participants open the conference database.

- The participants give their opinion one by one in a cyclic manner. The opinion of the participant is stored against his/her name in the document. The name of the person, having the turn to give opinion, is displayed on the screen.

- If the participant, having the turn, doesn't have any view at the moment writes "*Pass*" and the next person gets the chance to give opinion. In case a participant passes his chance "*No view at present*" is stored in the document against his/her name.

| 1. A new meeting document is created by the meeting coordinator by clicking an action button "Call A Fresh Meeting" and is stored in the meeting database.The document appears in the view pane. The meeting status column is now "To be finalised". |

↓

| 2. The coordinator opens the document and selects the persons to be invited in the meeting, meeting date , time & venue and agenda, and then clicks the button "Finalise". The meeting status then becomes "Finalised" |

↓

| 3. The coordinator sends mail notices to all the invitees by clicking the action button "Send Mail Notices To Invitees".The meeting status then becomes "Requested" |

↓

| 4. The invitees receive a memo with a doclink. The invitees opens the mail from the view pane of mail database and clicks the doclink to see the document. |

↓

| 5. Invitees select either "Yes, I will attend" or "No, I will not attend" button on the document. if the former button is selected by anyone of them his/her name is added to the list of attending and if he/she selects "No, I will not attend" button his/her name is added to the list of not attending. If the invitee is not to attend the meeting he/she has to give a reason. The document is then saved and closed. |

↓

| 6. The meeting coordinator opens the meeting database and selects the view "meeting arranged" to see who is coming to the meeting and who is not. |

↓

| 7. The meeting coordinator confirms the meeting by clicking the action button "Confirm meeting". The meeting status then becomes "Scheduled". |

↓

| 8. After the meeting is held the meeting coordinator clicks the action button "Write meeting minutes" and enters the meeting minutes. After writing he clicks "Save and Exit" button on the document to finish writing meeting minutes.The meeting status then becomes "Held". |

↓

| 9. The meeting coordinator then uses the action button "Send Meeting Minutes" to send meeting minutes to all the invitees. |

Fig. 5.7: Workflow for sceduling meeting

- The co-ordinator has the option of interrupting a participant if he exceeds the time limit.

- The co-ordinator closes the conference when he/she finds, on opening the document, that there are not even two persons who have ideas to share or whenever the predetermined number of cycle is over or whenever the co-ordinator decides to close the conference.

5.4.2. Implementation: To realise the above procedure a database is created which is kept on the server so that it is accessible to all Notes user. The process of making the list of persons willing to participate in the conference is same as finding the persons going to attend the meeting in the section 5.3. So this portion is left in the design of database for conferencing. The design of the database has been done considering that the list of the participants is ready. The conference database created in the present dissertation facilitates a conference among three Notes Users - Jitendra Rai, Yalakanti Srikanth and Vimal k Nimesh. Also, at a time, only one conferencing can be done using this database.

5.4.2.1. Database: A database with name *together* has been created in the similar manner as explained in the section 5.3.2.1.

5.4.2.2. Form: The name of the form created in the dissertation is *merge*. The designer has to create following fields, static texts and buttons in the form:

stage: This field is used to identify where the document is i.e. who has to give the opinion. The type of this field is *Number* and *Editable* for display. The field is always hidden.

close: This field is used as a flag. If it is 1the conferencing is stopped. The type of this field is *Names* and *Editable*. It is always hidden.

topic: This field is used to display the topic of the conference. The type of the field is *Text* and *Computed when composed*. It is determined through the action button "*Select topic*" in the action bar of view "*together*". It is never hidden.

dummy: This field is used to store the views given by the participants. The type of the field is *Text* and *Computed for display*. it is never hidden. Its value is computed through the buttons to be discussed later in this section.

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inturn: This field is used to indicate who is to give the opinion. The type of this field is *Number* and *Computed for display*. It is always hidden. The formula to compute this field is:

@If(@Name([CN];@UserName) = "Vimal k Nimesh"; 1; @Name([CN];

@UserName) = "Jitendra Rai";2;@Name([CN];@UserName) =

"Yalakanti Srikanth";3;111)

cycles: This field stores the number cycles the conference has to be run. The type of field is *Number* and *Computed once composed*. The field is always hidden.

counter: This field counts the number of cycles. The type of field is *Number* and *Editable*. The field is always hidden.

openion: This field is used to take openion of the participant in turn. The type of this field is Text and Editable. It is hidden when the document is opened for reading and when it is not the user's turn to give openion and when the conferencing is closed. The hiding formula is:

(stage != inturn) | close =1

go: It is used as a flag. The type of this field is Number and Editable and is always hidden. The default value is 1.

The static text " **A Conference on**" is written above the topic of the conference. It is never hidden.

The static text "**The views given so far are listed below:**" is just to tell the participants that the texts seen below this line are nothing but the views of participants who have given their views. It is never hidden.

The static text "**The conference has been closed**" appears when the conference co-ordinator closes the conference. It is hidden when the conference is going on or when the topic is to be selected and hence following formula has been used as hide formula:

close = 0;

Button - "Pass": When the participant having the turn doesn't have any view he/she presses this button to pass on over to next participant. The field dummy is then modified by adding the user's name and placing "*No view at present*" against it. The document is then saved and closed. The formula used for this button is:

```
FIELD dummy := dummy + @NewLine + @NewLine +
            @Name([CN];@UserName) + ":" + @NewLine + "
            " + "No view at present";
FIELD counter := @If(stage = 1;counter +1;counter);
FIELD stage := @If(stage = 3;1;stage +1);
FIELD close := @If(counter>cycles;1;0);
@PostedCommand([FileSave]);
@PostedCommand([FileCloseWindow])
```

This button is hidden in Read mode and when it is not the user's turn to give openion or the conference is closed. The hiding formula for this button is:

```
(stage != inturn) | (close = 1)
```

Button - "close": This button is used to close the conference by setting the field close equal to 1. The formula corresponding to this button is :

```
form = "merge";
FIELD close := 1;
```

The button is hidden in the Read mode and when the user is not the meeting co-ordinator, which in the present case is "Priya R Jha". The hiding formula is:

```
@Name([CN];@UserName) != "Priya R Jha"
```

Button - "OK": When the user writes down his/her opinion this button needs to be pressed so that his/her opinion is available to all and the next person, in turn, takes over. If the user doesn't write anything in the *openion* field and presses the OK button gives a warning not to leave it blank and to press pass button instead if the user hasn't any idea at present. If the user has entered his/her opinion then the field dummy is modified by adding this opinion against the user name. The flag *go* is then set to 1, the file is saved and closed. Following formula is used to get all these done:

```
@If(openion = "";@Prompt([OK];"Attention";"You must write down your
        openion before quitting. If you don\'t want to put your openion at present
        CLICK  THE PASS BUTTON";"";"");"");
FIELD go := @If(openion = "";0;1);
FIELD dummy := @If(go=1;(dummy + @NewLine + @NewLine
```

```
+@Name([CN];@UserName)+":"+

@NewLine + "            " + openion);dummy);
```

FIELD openion := @If(go=1;"";openion);

FIELD counter := @If(go=1;@If(stage = 1;counter +1;counter);counter);

FIELD stage := @If(go=1;@If(stage = 3;1;stage +1);stage);

FIELD close := @If(counter>cycles;1;0);

@If(go=1;@PostedCommand([FileSave]);"");

@If(go=1;@PostedCommand([FileCloseWindow]);"")

The button is hidden in the Read mode and when following formula is true:

(stage != inturn) & (@Name([CN];@UserName) != "Priya R Jha") | close =1

5.4.2.3. **View:** A view **"together"** is created in which two columns - *Conference status* and *Person to give opinion* - are created. The value of the column *Person to give opinion* is computed by the following formula:

@If(stage = 0 | close =1; "None";

stage =1;"Mr. Vimal K Nimesh";

stage = 2;"Mr. Jitendra Rai";

stage = 3;"Mr. Yalakanti Srikanth" ;"")

5.4.2.4. **Action bar:** There are four action buttons - **"Call a fresh conference"**, **"Select topic"**, **"Select no. of cycles"** and **"Current state"**.

Call a fresh conference: This action button, when clicked, creates a fresh document. It is to be noted that no new document is created. Only the values stored in various fields of the document is wiped out. It uses following sequence of formula:

Form = "merge";

FIELD stage := 0;

FIELD close := 0;

FIELD topic := "";

FIELD dummy := "";

FIELD openion := "";

It is hidden when the user is someone other than the co-ordinator, Priya R Jha in the present case. The formula used for hiding is:

@Name([CN];@UserName) != "Priya R Jha"

Select topic: This action button is used to select a topic for the discussion. When the button is clicked a window with title "Topic for discussion" appears prompting the user to enter a topic in the box.

Form = "together";

FIELD topic := @Prompt([OKCANCELEDIT];"Topic of discussion";

"Enter a topic for discussion";"");

The hiding formula is same as that for the previous action button.

"Select no. of cycles": This action button is used to select the number of cycles the conference has to be run for the discussion. When the button is clicked a window with title "Number of cycles" appears prompting the user to enter the number of cycles in the box.

Form = "together";

FIELD topic := @Prompt([OKCANCELEDIT];"Topic of discussion";

"Enter a topic for discussion";"");

FIELD stage := 1;

The hiding formula is same as that for the previous action button.

Current state: When this button is pressed the document is refreshed and thus the current state is displayed in the view. Following formula is used:

@Command([ToolsRefreshAllDocs])

The workflow for conferencing is shown in fig. 5.8. The co-ordinator creates a fresh document in the database by clicking the action button *"Call a fresh conference"*. This document is to be shared by all the participants. For this purpose the database must be on the server. The co-ordinator then selects the topic of discussion by writing the topic in a dialog box appearing when the action button *"Select topic"* is clicked. The participants then open the database on their respective Notes clients and select the view *"together"*. There are two columns in this view which informs whether the conference is running or is closed and who is having the turn to give opinion. The participants can read the document to know the opinions of other participants (who have given their opinion). The opinion given by different

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1. The conference coordinator creates a fresh document in the database "together" by clicking the action button "Call a fresh conference" in the view "together".

2. The coordinator then selects the topic of discussion by clicking on the action button "Select topic".Then by clicking on the action button "Select no, of cycles" he/she selects the number of cycles for the conference.

3. The participants open the same database on their Notes workstation and select the view "together". This view always tells who has the turn to give his/her opinion.

4. When a participants finds that it is his/her turn to give openion, he/she double clicks on the document two times to bring the document in Edit mode as explained in section 5.1.1. and then writes the opinion.

5. After finishing up with the writing of opinion the participant clicks "OK" button on the document to save and close the document and if he/she has no ideas to share he/she clicks the button "Pass" so that the next participant takes over. If the participant exceeds the time limit the co-ordinator opens the document, writes "Interrupted" in the opinion box and clicks the OK button.

6. The participants can read the opinions of other participants both the times - when he/she is writing the opinion and when just waiting for his/her turn to come.

7. When everybody has given the opinion i.e. if one cycle is complete the first person in the cycle again gets the turn to give opinion.

8. The coordinator opens the document and if he finds that not more than two participants have the ideas to share or whenever the predecided no. of cycles are over or whenever he/she wants, closes the discussion by clicking on the "Close" button of the document. The participants can, however, see the views of the different participants on that topic by opening the document.

Fig. 5.8: Workflow for conferencing among the Notes Users

participants becomes unchangeable part of the document and can be referred to while the participant has the turn to give his/her opinion. The co-ordinator closes the conference when there are not even two participants to share the ideas or share or whenever the predetermined number of cycle is over or whenever the co-ordinator decides to close the conference.

5.5. *Automating dissertation topic approval process:*

As explained in the sections 5.3 and 5.4 a clear design philosophy is the first step to any workflow and hence the design philosophy for the dissertation topic approval process is as follows:

5.5.1: Design philosophy:

- The students fill up and submit the form for dissertation.

- Meeting of groups is held.

- Date of meeting/date of approval by the group is entered if the dissertation is approved otherwise the student has to review in accordance with the remark put by the group. The student gets the message if the proposed work is rejected.

- On a particular date, the Chairman, PGAPC calls a meeting of members of PGAPC and group representatives to examine the dissertation work proposed by the students and approved by the group leaders.

- The date of approval is entered by the PGAPC if the proposed dissertation is approved otherwise the dissertation has to be reviewed by the guide. The guide is intimated about the rejection of the proposed work.

- Then H.O.D. calls a meeting of members of Board of studies for consideration on the proposed dissertation works approved by the PGAPC.

- The approval of the Board of studies is the final approval. If rejected by the Board it has to be reviewed by the guide.

5.5.2. Implementation: To realise the above procedure the designer creates a database. The following sections explains in detail the whole process of designing.

5.5.2.1. Database: A database with name *dissertation* is created using the same method as in the section 5.3.2.1. The database is kept on the server so that it is available to all the students.

5.5.2.2. Form: The following fields and buttons are created in the form named *FormA:*

stage: This field is used to identify in which stage the form is. The type of field is *Number* and *Editable* and is always hidden.

studentname: This field is used to store the name of student. The type of field is *Text* and *Editable* and choice is made from address dialog list. The field is never hidden.

branch: This field is used to store the name of the branch of the student from the list of four specialisation - SEOR, PAED, PSE and M&I. The type of the field is *keyword* and *Editable*. *Radio* button is chosen as interface and is never hidden.

year: This field is used for entering the year of admission. The type of field is *Text* and *Editable* and is never hidden.

status: This field is used to select one of the three status - *"Part time","Full time"* and *"On extension"*. The type of the field is *keyword* and *Editable* and *Radio* button is chosen as the interface. It is never hidden.

topic: This field stores the topic of the dissertation of the student and is of type *Text* and *Editable*. No hiding options is selected.

outline: This field stores brief outline of the work. It is of type *Text* and *Editable*. No hiding options are selected.

guide: This field stores the names of the guides. It is of type *Names* and *Editable*. The *"Allow multi-values"* box is checked because there can be more than one guide.

gadate: This field is used to store date of approval by the group. The type of the field is *Time* and *Editable*. It is hidden when the status is 0 i.e. the student has not submitted it.

pgapcadate: This field stores the date of approval by the PGAPC. the type of the field is Time and Editable. It is hidden when the status is 0 or 1 i.e. until the group leader has not approved.

remarks: This field is used to enter any remarks other remarks (if any). The type is Text and Editable. It is hidden when the status is 0 i.e. it is hidden from the students. The hiding formula used is:

stage = 0 | decision = "";

i.e. when the document has not been submitted by the student.

decision: This field is used to indicate whether the form has been approved by Group Leader. The type of field is Keyword and Editable. The field is hidden when stage is 0 i.e. the form has not been submitted by the student.

decision_1: This field is used to indicate whether the form has been approved by the Chairman, PGAPCC. The type of field is Keyword and Editable. The field is hidden when stage is 0 or 1 i.e. the form has not been approved by the group leader.

decision_2: This field is used to indicate whether the form has been approved by the Board of Studies. The type of field is Keyword and Editable. The field is hidden when stage is less than 3 i.e. the form has not been approved by the Chairman, PGAPCC.

glname: This field stores the name of group leader of the group the student belongs to. The type is *Text* and *Computed for display*. It is entered by the following formula:

@If(branch="SEOR";"M K Vasantha";branch="PAED";"V K Verma";
branch="PSE";"J D Sharma";branch="M & I";"S C Saxena";"")

PGAPCC: This field stores the name of the Chairman, PGAPCC. The type is *Text* and *Computed for display*. The field is hidden when stage is 1 i.e. the form has not been approved by the group leader.

HOD: This field stores the name of the Head of the department. The type is *Text* and *Computed for display*. The field is hidden when stage is less than 3 i.e. the form has not been approved by the chairman, PGAPC.

author: This field decides who can edit the document at a particular stage and thus provides security. It is necessary, to attain desired result from this field, that the persons expected to open the document should have *Author's* access. The field type is *Text* and *Computed* and the following formula computes its value:

@If(stage=0;studentname;stage=1;glname;stage=2;PGAPCC;stage=3;HOD;"")

Button - "Close": This button is used by the group leader, chairman, PGAPCC and HOD after they take the decision about the approval of the dissertation work. The button is hidden when the document is in Read mode or when it is being filled by the student.The following formula is written for this button:

Form = "FormA";

FIELD stage := @If(stage=1 & decision="Yes";stage+1;stage=2 &

decision_1="Yes";stage+1;stage=3 & decision_2="Yes";stage+1;stage-1);

@If(decision = "No";(@MailSend(studentname;"";"";"dissertation pending";

"Your dissertation have not been approved. Please see the remark for

detail."));"");

@If(decision_1 = "No";(@MailSend(guide;"";"";"dissertation pending";

"The dissertation of a student with name " + studentname + "working

under

your guidance has not been approved. Please see the remark for

detail."));"");

@If(decision_2 = "No";(@MailSend(guide;"";"";"dissertation pending";

"The dissertation of a student with name " + studentname + "working

under

your guidance has not been approved. Please see the remark for

detail."));"");

@PostedCommand([FileSave]);

@PostedCommand([FileCloseWindow])

The value of field stage is computed. The increment and decrement in the value of stage are the indication of the approval and rejection respectively.

Button - "Submit": This button is visible only when it is being filled up by the students. Clicking on this button sets the field stage to 1 i.e. the form has been submitted. The following formula is written for this button:

Form = "FormA";

FIELD stage := 1;

@PostedCommand([FileSave]);

@PostedCommand([FileCloseWindow])

5.5.2.3. View - "FormA": In this view three columns are created - *"Name"*, *"Guide"* and *"Topic"*. The formula for the column *"Name"* is:

@Name([CN];studentname)

The formula for the column "Guide" is:

@Name([CN];guide)

The field selected corresponding to the column *"Topic"* is topic.

5.5.2.4. View - "See progress": In this view four columns are created - *"Person to edit"*, *"Approved by Group leader"*, *"Approved by PGAPCC"*, *"Approved by Board of Studies"*. The fields corresponding to last three columns are respectively decision, decision_1 and decision_2. The formula for the column *"Person to edit"* is:

@If(stage=0;studentname;stage=1;glname;stage=2;"PGAPCC";stage=3;"HOD ";"Not Needed")

Thus the student and guide can easily see whether the topic has been approved and if rejected who is to review it.

5.5.2.5. Action bar:

In the action bar of the view *"Form A"* there are two action buttons - *"Take A New Form A"* and *"Fill Up Form A"*. The *"Take A New Form A"* action button creates a fresh form A. The form with topic *"Blank"* is chosen in the view pane and then the button is clicked. It has the following formula associated with it:

topic="Blank";

@If(topic = "Blank";@Command([EditCopy]);"");

@If(topic = "Blank";@Command([EditPaste]);"");

```
FIELD   studentname := @If(topic =
"Blank";@Name([CN];@UserName);studentname);
FIELD   topic := @If(topic="Blank";"";"Blank");
@If(topic = "";@Command(EditDocument;"1");"")
```

The action button *"Fill Up Form A"* opens the document in the edit mode, if the form belongs to the user, using the following formula:

```
@If(@Name([CN];@UserName) = @Name([CN];studentname);
    @Command([EditDocument];"1");"")
```

The workflow for dissertation topic approval process is shown in fig. 5.9. The first step starts with clicking of the action button *"Take a new form"*. The students then fill up the form and submit. The progress in the process of approval of dissertation can be seen in the view *"See progress"*. In the third, sixth and seventh steps the meetings are arranged in the similar way as in the automation of scheduling of a meeting in section 5.3. To schedule the various meetings the workflow of section 5.3 is used. The messages are sent to the respective persons in case of the rejection of the dissertation. However, in this workflow, because of difficulty in implementing excellent security for the documents it has been assumed that a person at PGAPC chairman or H.O.D. level will have the sense of integrity and responsibility and will not distort the information of the document. Nevertheless, the security implemented in the database allows only the desired person to edit a particular document.

1. A student opens the database "dissertation" on his/her desktop and selects the view "FormA". In this view he/she selects the document with name "A Sample" and clicks the action button "Take A New Form" to take a blank form.

2. The student then selects the form having his/her name in the name column and clicks the action button "Fill Up Form A".The document is opened in Edit mode. The student fills up form A and clicks the "Submit" button on the document to submit the form.

3. The view "See progress" displays the progress of all the documents submitted so far. After step 2, the column "Person to edit" becomes the group leader's name. When the last date to submit the forms passes by, the group leader calls a meeting of group members.

4. The group leader then opens all the documents (forms) of the students of his/ her group one by one and selects the decision from the radio buttons - "Yes" and "No" - against the label "Approved by group".If the form of a student is approved the date of approval is entered. The group leader puts the remarks, if needed.

5. The column "Person to edit" becomes PGAPCC if the decision is "Yes" otherwise it becomes the guide name. If the decision is "No" a mail is sent to the guide notifying that the topic has not been approved and modifications needed are put in the remarks field of the document.The group leader closes the document by clicking the button "Close" on the document.

6. The Chairman,PGAPC then calls a meeting of the members of PGAPC. Then he/she opens the documents one by one and either approves or rejects them at the will of the PGAPC. PGAPCC selects the decision from the radio buttons against the label "Approved by PGAPC". If approved the date of approval is recorded and if rejected the respective guide gets a mail, notifying that he/she needs to review the particular document.

7. The H.O.D. then calls a meeting of the members of the board of studies. The applications approved by the PGAPC are opened by the H.O.D. one by one and the decision of approval or rejection is done by selecting one of the two choices in the radio button against the label "Approved by Board of studies".

8. If the dissertation of a student is approved by the Board of studies, the "person to edit" coloumn of the view becomes "none" and all the columns in the view "See progress"- "Approved by group", "Approved by PGAPC" and "Approved by HOD" - become "Yes".
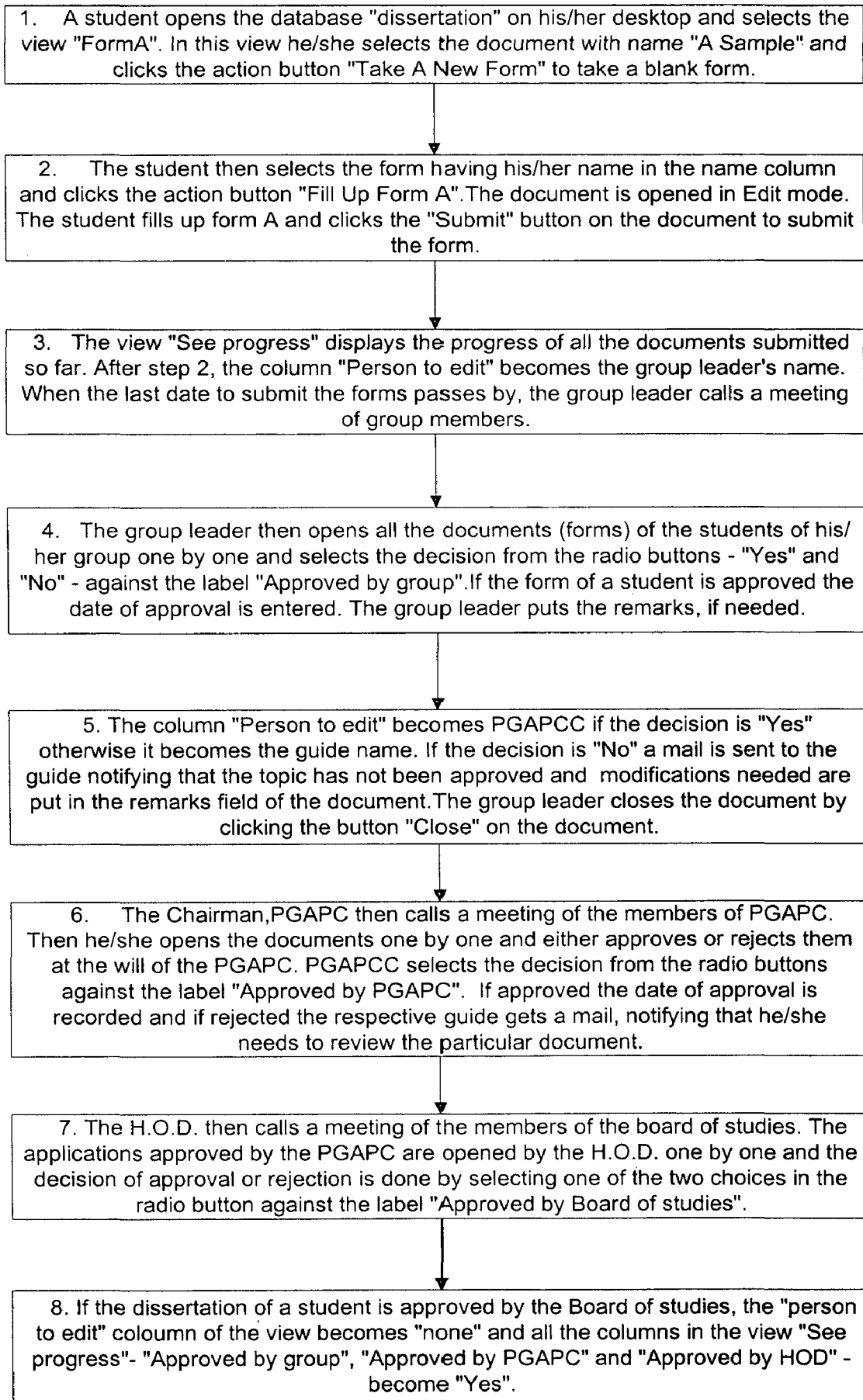
Fig. 5.9: Workflow for dissertation topic approval process

Conclusions and future scope of work

In the present dissertation an Intranet has been developed in the Microprocessor and Computer lab, Department of Electrical Engineering, University of Roorkee. The combination of one Windows NT server and two Windows 95 clients with the physical connection through LAN provides the platform for Intranet development. The first phase of this dissertation involved installation of an Windows NT server on an HCL-HP infiniti (Pentium - 100 MHz) computer and two Windows 95 clients on two 80486 microprocessor based computers. The physical connection among the computers has been done by constructing a LAN; the topology adopted being the Bus topology.

To facilitate the communication between the computers (server and clients) - by installing the Domino server software on the Windows NT server and the Lotus Notes client software on the Windows 95 clients - was the motto of the phase II. Once all the above is done, E-mail facility becomes ready to be used offered by Lotus Notes. Since only two PCs could be used as the network clients in the lab virtual clients have been created by creating many (40) Notes Users. The clients are said to be virtual because in actual practice every user, in an Intranet, is allotted a separate PC. But in the present system the users share the client (PC) and it appears as if there are as many clients as the users. The need of virtual client has been explained in the next paragraph.

This third and last phase of the dissertation work, using the application developmental tools of Lotus Notes like forms, views, agents, subforms etc. various operations on the elements of a document of a database have been implemented. The programming has been done through the use of Notes formula. Notes formulae have been used extensively for programming. The result was the automation of three workflow - scheduling of meeting, conferencing and dissertation topic approval process. The workflow implemented involves many Notes users to have a feel of an

Intranet of a big organisation employing many persons. This purpose have been successfully served by the virtual client system.

The objective of the dissertation - to install a network from scratch, to facilitate communication between the computers which form the network and understanding the design and implementation of automation of some of the workflow - has been successfully achieved. The workflow automated in this dissertation - scheduling meeting, conferencing and dissertation topic approval process - just three examples. It is to be noted that these automated workflow are neither the workflow of any particular organisation nor a generalised workflow. However, the procedure adopted in these examples resemble, to some extent, with those of Department of Electrical Engineering, University of Roorkee. Therefore they can not be expected, in their present form, to serve the exact purpose of an organisation. For example, different organisation may have different way of scheduling of meeting and hence suitable changes are to be made in the meeting database, designed in the present dissertation, to fulfil all the requirements. These examples, however, present a clear picture of the methodology of designing and implementing a workflow. After clearly defining and subdividing the procedure, to be automated, into several steps the database designer needs to find ways to implement each step using the developmental tools provided by the Lotus Notes with proper concern of security. In the present dissertation, Lotus Notes & Domino software has been used to implement the 2nd and 3rd phase of the work. However, HTML (Hyper Text Markup Language) or JAVA language can also be used.

Scope for future work:

The work done in the dissertation has tremendous scope for future development. In fact, it is just the beginning; but at the same time it is a solid foundation. The implementation of foolproof and state-of-the-art automation of workflow in the Intranet of an organisation requires a team effort and can not be developed in one stroke, that is, it has to be achieved in several steps and all these steps will be chained together

- Due to non-availability of Lotus script programming guide, all the programming has been done through the use of Notes Formula. The

programming could be done in very efficient and effective way using Lotus script language which is supported by the Lotus Notes software.

- Hiding technique has been used extensively to implement the security features. By the use of Lotus script, better security can be implemented by programming some of the events related to the field like Input validation, Entering, Exiting etc.

- Agents (a constituent of Notes database) could not been used which can offer great help in automating a workflow.

- By integrating software, which change voice to text and text to voice, with Lotus Notes, audio communication can also be implemented (particularly the audio conferencing).

- Conferencing has been done by putting the database on the server and sharing it among the participants of the conference. By the use of Replication concept it can be done in better way.

- The workflow implemented in the dissertation needs to be modified so that they can be used in an organisation. A huge number of workflow will have to be automated in an organisation to enjoy *true automation*. The ultimate aim is, of course, the *Paperless office*.

References

1. **Ryan Bernard**, *"Corporate Intranet"*, John Wiley & Sons,Inc, 1996.

2. **Donald W. Kroeber**, *"Computer based information systems"*, Maxwell Macmillan International Edition ,

3. **Infotech State Of The Art Report**, *"Office Automation - Analysis"*, Series 8; Number 3

4. **Winn L.Rosch**, *"Hardware Bible"* , TechMedia, 1997.

5. **Mark Minasi, Christa Anderson & Elizabeth Creegan** , *"Windows NT Server 4"*, BPB publications , 1997.

6. **Steve Londergon & Pat Freeland**, *"Lotus Notes Release 4 for Dummies"*, Comdex Computer Publishing, 1996.

7. **Erica Kerwein & Sally Blanning Dejean** , *"Foundation of Lotus Notes 4.0 Application development"*, Comdex Computer Publishing , 1996.

8. **Steve Griswold** , *" Developing Intranet Made easy "*, Galgotia,1998.

9. Install guide for Domino Server

10. Install guide for Lotus Notes Workstation

11. Network configuration guide for Lotus Notes

12. Lotus Notes Programmer's guide

13. Application Developer's guide for Lotus Notes

Note: The references - from serial number 9 to 13 - are the publications of Lotus Notes group

and is not available commercially in the market. However, these books can be downloaded from the internet site Lotus.com.

Appendix A

ACL   Access Control List

ARPAnet   Advanced Research Project Agency network

BDC   Backup Domain Control

DBMS   Database Management System

EISA   Extended International Standard Architecture

HAL   Hardware Abstraction Layer

ISA   International Standard Architecture

LAN   Local area Network

MAC   Macintosh   (computer)

NTFS   New Technology File System

PC   Personal Computer

PCI   Peripheral Component Interface

PDC   Primary Domain Controller

RAS   Remote Access Series

SAM   Security Access Manager

SCSI   Small Computer Systems Interface

TCP/IP   Transmission Control Protocol / Internet Protocol

VDU   Visual Display Unit

WAN   Wide Area Network

WWW   World Wide Web

Appendix B

The various projects based on Development of Intranet based on Lotus Notes and Domino software, listed below, provide a clear understanding of Corporate Intranet.

- **Name of Client**: The National Stock Exchange of India Limited

   Project objective : Lotus Notes Roll Out

   Brief Description: Implementation of a 600 user Notes Network over 6 locations is a single domain network, Implementation of the SMTP MTA for Internet Mail Access. Deployment of Domino Action as a part of the Notes Roll out. Training and call support for all the users.

   Platform:

   Lotus Domino Server (Windows NT)

   Lotus Notes 4.5 Desktop (Windows 95)

   TCP/IP WAN over leased line, VSAT and Dial Up

- **Name of Client**: The Tata Iron and Steel Company, Sales Division

   Project objective: Lotus Notes Roll Out and Notes Development

   Brief Description: Implementation of a 120 user Notes Network over 12 locations in a single domain network. Development of Sales and Marketing System for the Sales offices to report their daily sales, their daily activity reports, payments received and also receiver information on existing inventory levels and dispatches from the factory. The application is also used to monitor and change the price of steel on an hourly basis depending on the market fluctuations.

   Platform:

   Lotus 4.11 Server (Windows NT)

   Lotus Notes 4.11 Desktop (Windows 3.11)

   TCP/IP WAN over VSAT

- **Name of Client:** The Gharda Chemicals Limited

  Project objective: Lotus Notes Development

  Brief Description: Development of an Employee Intranet System covering the personnel and administrative functions. The system maintains the employee information viz. Employee Profile, Remuneration Package, Career Growth in the organization, Skill Levels, etc. Electronic Forms like Leave, Travel Requisition & Expenses, Cash Expenses, Benefits (LTA, Loans) etc. Can be submitted to an automated authorization process. The system also allows the employee to engage in discussion groups, read news wires, and browse through the various public policy documents.

  Platform:

  Lotus Domino Server (Windows NT)

  Lotus Notes 4.5 Desktop (Windows 95)

- **Name of Client:** NEEPCO (North Eastern Electric Power Corp. Ltd.)

  Project objective: Development of Personnel Information System

  Brief Description: The system maintains details on pre-recruitment, recruitment, allocation, transfer and deputation of personnel, promotions, leave record, terminal benefits, allowances and reimbursements etc. It also maintains a database of various company policies and procedures for access to employees.

  The Lotus Notes software delivers the bulk of requirements including the databases, data entry screens, views and generates detail reports of the data entered into the system. The Lotus Reporter software is used to generate the consolidated report which groups together data from several documents, views and forms.

  Platform:

  Lotus Domino Server (Windows NT)

  Lotus Notes 4.5 Designer/ Desktop (Windows 95)

  Lotus Reporter 2.0

- **Name of Client:** Bayer India Ltd.

  Project objective: Deployment of Domino Fax Server.

  Brief Description: Implement of Notes Network across and locations Powai, Thane, Delhi, Hyderabad, Madras, Himmatnagar, Ahmedabad, Calcutta with 7 servers, 350 Notes desktop users and connectivity through dial-up modem.

  Platform:

  Lotus Domino Server R4.6(Novell Netware, Windows NT)

  Lotus Notes Client R4.6

  Domino Fax Server

- **Name of Client:** ICICI Securities (I Sec)

  Project objective: Development of Corporate Finance and Billings Application

  Brief Description: Notes Applications for Corporate Finance Billings.

  Automate the workflow of Corporate Finance Billings Section (Fund Based and Non Fund Based). Evaluate the proposals through a workflow cum discussion process, pass the loan amount and track the recovery of the load. Integration with legacy systems for bill generation and payment details. Generation of MIS associated with the application using Notes Reporter.

  Platform:

  Lotus 4.11 Server (OS/2)

  Lotus Notes 4.11 Desktop (Windows 3.11)

  Lotus Notes Reporter 2.0

- **Name of Client:** Reserve Bank of India

  Project objective: Lotus Notes Roll Out

  Brief Description: Implementation of Notes Network across 9 locations with 9 servers and connectivity through dial-up using a modem.

  Platform:

  Lotus Domino Server R4.6 (Windows NT)

  Lotus Notes Desktop R4.6

- **Name of the client** – Bank Bali, Jakarta

  Project objective – Re-engineering the Bank's Lotus Notes network

  Brief description - Bank Bali already had a Lotus Notes network comprising of 32 Servers and 3,200 Users spread across multiple locations. On a continuous basis Bank Bali was facting network related problem. NIIT analyzed their existing setup and then redesigned and re-deployed their entire Lotus Notes infrastructure with the add-on objective of minimal work disruption. The network was also fine tuned and optimized for a trouble free environment.

  Platform – Lotus Notes (32 Servers, 3200 Users), Windows NT, Client Server Architecture, Multi-location enterprise-wise solution, WAN (Frame Relay / X.25), LAN (ATM & Token Ring).

- **Name of the client** – Texmaco Group, Indonesia

  Project objective – Lotus Notes network planning, design and installation

  Brief description - NIIT did a comprehensive requirement analysis and designed the entire infrastructure of Texmaco's including the LAN, MAN, WAN and Notes network. Replication and related strategies were also detailed. This project is currently under execution.

  Platform – Lotus Notes, various network traffic and pattern analysis tools, C-Mail, Windows NT, Fiber Optic LAN backbone and IP WAN backbone.

- **Name of the client** – Lippo Securities, Indonesia

  Project objective – Integration and design of a Lotus Notes – Fax gateway application database with support for Oracle at the back-end.

  Brief description - Lippo Securities was facing a lot of problem in tracking certain activities which required faxing of documents based on payment terms. In the old system the payment terms were kept in an Oracle database and reminders had to be faxed manually. The new system picks up information from Oracle RDBMS and faxes it accordingly. This system is fully automated.

  Platform – Lotus Notes, Notes Fax Server, Oracle, Windows NT

- **Name of the client** – Siam Bank, Thailand

  Project objective – Develop application(s), and administration of e-banking application based on Lotus Notes

  Brief description - The main aim of this project was to develop applications for E-banking using Lotus Notes as a front end. Lotus Notes server administration and fine tuning Note's performance with DB2 was also taken care of.

  Platform – Lotus Notes, Windows NT, DB2

- **Name of the client** – Prime Minister's Office – Aloha, Singapore

  Project Name – Workflow engine design for Holiday Accommodation and Salary system using Lotus Notes

  Brief description - The initial phase of this project involved analysis, design, construction, testing and commissioning of the Holiday Accommodation Management System. Another module, the Salary Management System was also developed. The entire system was integrated with a voice information response system.

  Platform – PowerBuilder, Oracle, Lotus Domino, Intranet, Windows NT, Unix, Lotus CC Mail, HTML

- **Name of the client** – GOVERNMENT OF SINGAPORE, SINGAPORE

  Project objective – Training Nomination System

  Brief description - The main aim of this project was to plan and design the web site and integrate it with existing back-end systems. This projects also included software and hardware configuration and connectivity with backend database and integration of Lotus Notes with MS-Mail.

  Platform – Lotus Domino, Oracle 7.2, JAVA/ HTML, MS-Mail

- **Name of the client** – RASHTRIYA CHEMICALS FERTILIZERS, MUMBAI

  Project objective – Business application development in client-server architecture and development of workflow and collaborative working applications using Netcentric environment.

  Brief description - After a detailed requirement analysis, a design was prepared based on which the messaging environment architecture and workflow application development is currently being designed with back-end database connectivity. This system also includes a robust replication architecture to ensure smooth data flow between the head office and regional office's and factories.

  Platform – Lotus Domino, Oracle 8.x, Powerbuilder.

- **Name of the client** – NIIT LTD., DELHI

  Project objective – To provide workflow and messaging backbone using Lotus Notes

  Brief description - The main aim of this project is to design and implement messaging infrastructure and strong workflow backbone with Intranet capabilities spanning across multiple locations and multiple hardware/software platforms.

  Platform – Lotus Notes, Windows NT, WAN (Radio link IP based, 500 Users)

Appendix C

The @functions and @commands are the building blocks of notes formulas. @Command can be used in many of database's programmable design elements, including agents, hotspots, buttons, and actions, whereas @functions can be used throughout Notes formulas.

@functions

The @functions provided with Notes are used to build many different kinds of formulas in many objects using different kinds of formulas in many objects using different data types (text, number, time-data, and so on). The boolean data type is returned when the result is true or false. The value 1 equals true; the value 0 is false.

Each @function has a brief description of how it is used, which data type it returns, and how to use the @function in a formula. Although not all @function use arguments, the format for an @function is

@function (argument1; argument2: argumentn...)

1.   @Failure

usage: Returns a supplied message and can be used when a conditional statement isn't met. Used mostly with @success.

Example: @If(value < 25;@failure(" you must enter a value greater than 25.");@success)

In this example, if the field value 1 has a value less than 25, a dialog box will pop up with this message: " you must enter a value greater than 25., no message appears; the value the user enter remains in the field.

2.   @If (condition 1;action 1;condition;action2;...;

condition99;action99;else_action)

usage: Finds the first true condition and runs the action or returns a value.

Example: @If (Price >25;Price < 25;@Failure ("You must choose a value greater than 25.");"0") sets the value of the field price to "0' if the value is not greater or less than 25.

3.   @MailSend@MailSend("sendto";"copyto";"blindcopyto";"subject";"re mark";"bodyfield1";"bodyfield"n'[flag 1];[flagn])

usage: Sends mail to *sendto, copyto* and *blindcopyto*.

4.   @Name ([action];name)

usage: Used to format distinguished (hierarchical) names for display. With this @function, distinguished names can be abbreviated or expanded, or they can returns components of the name. In most cases, you want to display the abbreviated form of a name for the users and expand the name when used in formulas in notes.

Example: @Name([CN];student) gives common portion of the field student if the type of field student is *Names*.

5.   @Newline

usage: Inserts a new line (a carriage return). @Newline does not work in selection hide-when, window title, and form formulas, or inside $prompt, Alternatively, use @char)13) to insert a carriage return using @prompt.

Example: @If (adress2 !="";Adress1 + Newline + Adress2:Adress1) returns the value in Adress2 if Adress2 is not empty; otherwise, Adress1 is returned.

6.   @PostedCommand([command];parameters)

Usage: This replaces the release 3 version of the @command. When used in a formula, @PostedCommand always executes at the end of the formulae, after the other parts of the formulae have been evaluated. When a release 3 database is been compiled in Release 4, all its @Commands are changed to @PostedCommand

7.   @Prompt ([style] :[No Sort]; "Totle";"prompt;
       "defaultChoice";:choicelist")

usage: Prompts the desired message in desired style.

- [OK] style displays the message and an OK button. It uses the [style], "Title"," and "prompt" arguments, and returns "1" for true.

- [Yes/No] style displays the message and Yes and No buttons. It uses the [style], "Title," and "prompt" arguments, and returns 1 for true and 0 for false.

@success

usage: Returns 1 for true. This is used with @IF and @Failure for conditional Variation statements.

Example :@If (Days > 365;@Failure ("Please complete your project in less than one year's time frame.");@success).

@Text (value)

usage: Converts a value to text string. If the value is chosen as a field name the value of that field is converted into text.

@Commands

Notes @Commands are commands that can be used in formulas to perform the actions, including those actions carried out manually using the Notes mane commands. In most cases, an @Commands is named after the mane sequence normally taken to carry out the action. Some @Commands Accept additional parameters.

@Commands([EditCopy])

Runs the menu command *Edit Copy.* At the view level, this copies selected documents to the clipboard. When a document is in edit or design mode, data and objects can be copied to the clipboard. Ina form, subform, view or folder open in design mode, the selected fields, data, or columns are copied to the clipboard.

@Commands([EditCut])

Runs the menu command *Edit Cut.* At the view or the folder level, selected documents are deleted and copied to the clipboard. In documents open edit mode, or a

form, subform, view or folder open in design mode, objects and data are deleted and copied to the clipboard.

@Commands([EditDocument];"mode)

Toggles the current document between the edit and read mode. When a mode isn't specified, the command toggles between read and edit mode. Otherwise, 1 places the document in edit mode, and 0 places it in read mode. Ina view, it opens the document in edit mode, and 0 places it an read mode. In a view, it opens the currently selected document and assumes edit mode if no mode is designated.

@Commands([EditMakeDoclink])

Creates a document link to the current document (either selected in a view or open), which is placed in the clipboard. The doclink can be pasted using the @Commands([EditPaste]).

@Commands([EditPaste])

Runs the menu command *Edit Paste,* which pastes the documents at the view level, the contents of the clipboard at the document level (open in edit mode0, or in a form or subform open in design mode. The documents or data must placed on the clipboard before using this command. When copying rich text data into a text field, formatting and objects in the data will be lost.

@Commands([FileCloseWindow])

Closes the current Notes window, and when necessary Notes will prompt to save the open window. This @Command will always execute at the end of the formula, with or with the use of the 2Posted command or @Commands

@Commands([FileSave])

Runs the menu command *file-save.* Data and objects can be copied to the clipboard. In a form open in document mode