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THESIS

INTRANET IMPLEMENTATION IN A CONTEXT OF WEB TECHNOLOGY DISCOVERY

by

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March 1999

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**INTRANET IMPLEMENTATION IN A CONTEXT OF
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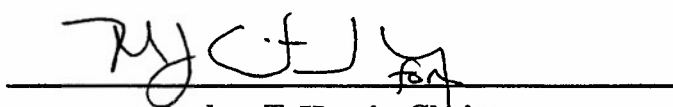


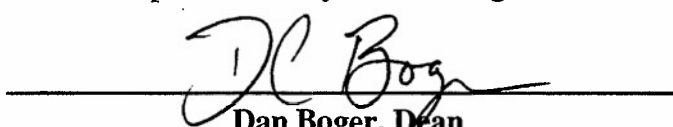
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ABSTRACT

This thesis presents a model of intranet implementation for a military facility within the context of an organization that is in the process of discovering Web technology and the browser as a central communication application. It surveys the genesis and evolution of intranet technology, examines the interface between emerging technology and organizational culture, specifies software and hardware components, and offers recommendations on intranet security and the requirements for successful information technology implementation. Intranet pages built with Microsoft Front Page 98 and a connection from back-end to front-end constructed with ColdFusion Application Server 3.1 are presented.

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LIST OF ABBREVIATION

AFB	Air Force Base
ARP	Address Resolution Protocol
ASP	Active Server Page
AVI	Audio Video
ATM	Asynchronous Transfer Mode
CAN	Campus Area Network
CAU	Controlled Access Unit
CERN	European Particle Research Center
CGI	Common Gateway Interface
CFML	ColdFusion Markup Language
CIO	Chief Information Officer
COTS	Commercial-Off-The-Shelf
CPU	Central Processing Unit
DoN	Department of the Navy
DNS	Domain Name Server
DOS	Disk Operating System
FAQ	Frequently Asked Questions
FDDI	Fiber Distributed Data Interface
FTP	File Transfer Protocol
GIF	Graphics Interchange Format
GUI	Graphical User Interface
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
ID	Identification
INPO	Information Network Program Office
IRC	Internet Relay Chat
IP	Internet Protocol
IPT	Networking Integrated Product Team
IS	Information System
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
IT	Information Technology
JPG	Joint Photographic Experts Group
LAN	Local-Area Network
LDAP	Lightweight Directory Access Protocol
MAC	Macintosh
MAC	Medium Access Control
MAN	Metropolitan Area Network
MAU	Multistation Access Unit
MIIS	Microsoft Internet Information Server
NIC	Network Interface Cards
NPS	Naval Postgraduate School
NT	New Technology
ODBC	Open Database Connectivity
OS	Operating System
PC	Personal Computer
PPP	Point-to-Point Protocol
RFC	Request For Comment
PSTN	Public Switch Telephone Network

PVN	Private Virtual Network
RAM	Random Access Memory
SMTP	Simple Mail Transfer Protocol
SOP	Standard Operating Procedure
SQL	Standard Query Language
TCP	Transmission Control Protocol
TXT	Text
URL	Uniform Resource Locator
UTP	Untwisted Pair
VRML	Virtual Reality Markup Language
WAN	Wide Area Network
WYSIWYG	What You See Is What You Get
WWW	World Wide Web

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I. INTRODUCTION

A. OBJECTIVE

This thesis will analyze the usage of web technology in an organization by establishing an intranet as a mean of information system. The development will include designing database as a back-end for personnel records, building Web pages, and analyzing middleware. Ultimately database will be integrated using middleware to front-end using Internet technology so the users can update, add, query or view the database with their Web browsers.

B. BACKGROUND

The birth of the World Wide Web (WWW) in 1990 came and went almost totally unnoticed by the rest of the world. As far back as early 1989, Tim Berners-Lee, a then-unknown researcher at the European Particle Research Center (CERN) was writing proposals about a new method people could use to transfer information between computers. The new method took advantage of the Hypertext concept proposed years earlier, and already being written into on-line publishing applications like WinHelp. The innovations that Berners-Lee and his colleagues proposed came in two parts; Hypertext Markup Language (HTML)¹ and Hypertext Transfer Protocol (HTTP)². [Bernard, 1996].

The "Web" refers to all those interconnected data sources; everybody gets there via Internet. Web technology developments stand a good chance of radically transforming enterprise networks. But what are new and different are the Internet applications, principally the set of intra-enterprise capabilities available to PC or workstation users via the use of web technology. Using this web technology, the applications will be virtually tied together to utilize the software integrity. It is in need of the software integration to combine all of the applications in web technology employment.

¹ HTML is a way of marking text so it could be published easily online with embedded hyperlinks, font changes, pictures, and other features.

² HTTP is a communication method that could be used by clients and servers to exchange hypertext documents over a network.

The Web is the premier Internet application that makes people can access resources around the world. However, an organization can use the Internet technology to build information system inside the organization. Internet technology makes people easier to access any information within an organization because client computers only need Web browsers and point to hyperlink available on the Web page and information is on their fingertip.

C. RESEARCH QUESTIONS

The following research questions establish a framework for this thesis.

1. What is web technology?

This question pertains to all Web technology development and as a tool to improve communication, business processes and profitability within the organization.

2. Can the database management system fulfill the demand of the organization?

This question assumes a database is used for developing a database on-line transaction.

3. Is an intranet feasible to support an information system in an organization?

This question has many political implications and may be difficult to answer objectively.

D. EXPECTED BENEFITS

This thesis is not intended to offer a panacea for a military information system. It does, however, explore the areas such as the benefit of building and implementing an intranet within the organization. It begins with an explicit understanding of the objectives being sought. The primary focus is on implementing Web technology.

II. INTRODUCTION TO INTRANET

A. INTERNET

The Internet gets most of the attention, but the computer technology revolution going on inside organizations today is use of Web technology to create enterprise-wide intranets. In this chapter, the background of intranet will be introduced. Between 1994 and 1995 someone in the media called internal use of Internet technology for corporate intranet and the name stuck [Hills, 1997].

The Internet is series of computer networks spread around the world, connecting government, military, educational and commercial institutions, as well as private citizens to a wide range of computer services, resources, and information. According to Picard [1998], the Internet is a series of inter-connected local area networks in which a group of routers around the world all tight together. A core of the Internet is made up of a high-speed line and at the edge of the Internet is a boundary connected with a medium-speed line. Internet is based on TCP/IP (Transmission Control Protocol/Internet Protocol) stack to communicate. All users get a TCP/IP address administered by the Internic. The Internic is a private company that has a sole contract from the US government to manage the TCP/IP and domain names for the world. TCP/IP address blocks are allocated by the ISP (Internet Service Provider). Currently, Internet version 4, IP addresses are divided into five classes (A to E). It is important to understand that these divisions were conceived for the Internet Architecture Board (IAB) to ease the management of IP addresses; they have less immediate significance for the network manager. Class A and B addresses are not available anymore while class D and E are not for general use [Washbunrs and Evans, 1996]. Eventually the IP address scheme version 4 will be changes to IP address version 6. The IP address scheme version 6 idea is to extend the address range. This project is called "the Internet II".

B. INTRANET

An intranet is a contained collection of computers and networks within an organization (it may span the globe), connecting an organization's members to a range of computer services, resources, and information using a Web browser such as Microsoft Internet Explorer, Netscape Navigator, or Mosaic [May, 1998]. An intranet is an internal

web that uses an open standards, protocols and technologies such as TCP/IP and HTML (Hypertext Markup Language)-that unite different systems into a unified information architecture, even though the computers that are linked together use many different hardware and software platforms. Figure 1 shows the typical intranet infrastructure.

INTRANET PHYSICAL VIEW

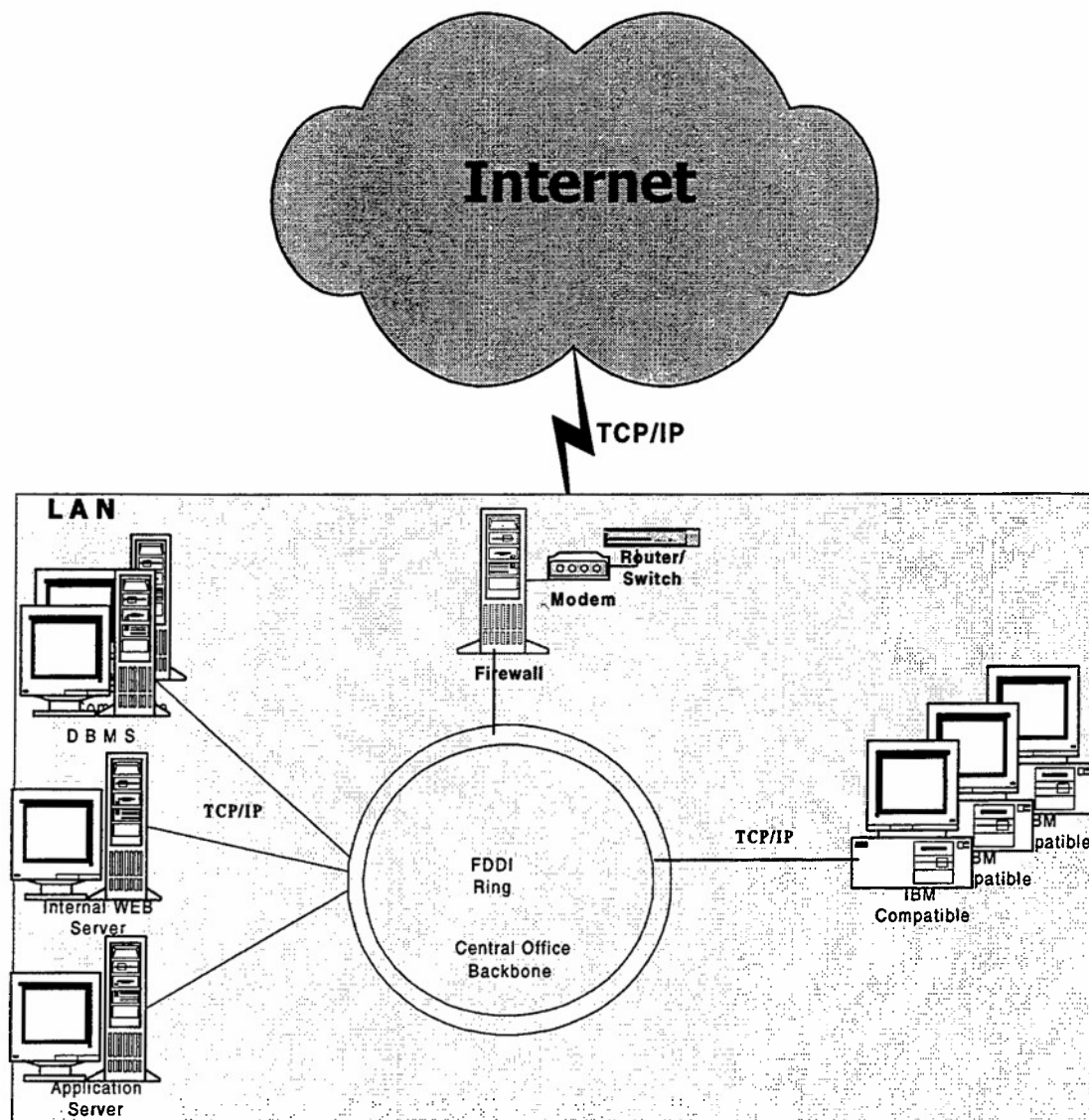


Figure 1. Intranet Physical View

Although an intranet can potentially connect internal users to the Internet, the converse is generally not true without proper authorization. This means that an intranet is

insulated by a firewall and in effect is invisible to external users of the Web. Connectivity to an intranet via the Web is possible however, once the proper security measures are in place. In fact, this is one of the main advantages of an intranet, it will allow internal users a quick means of contacting others and instant access to all kinds of internal from practically anywhere in the world. [Adelaja, Bryan, and Yao, 1996]

The main difference between the Internet and an intranet is in the terminology not in technology. Both intranet and Internet use the same technology, a TCP/IP network to carry the traffic. TCP/IP stack is the primary protocol used for data transmission on the Internet and intranet. [May, 1996]

There are several differences and commonality between the intranet and the Internet as shown in Table 1.

PARAMETER	THE INTERNET	AN INTRANET
Security	Low (None/Some)	High
Speed	Low/Medium	High
Services	Almost unlimited	Specified by Organization
Access Control	None or limited. Public encouraged to visit.	Account Name and Password. Generally no external (public) access.
Membership	Unlimited.	Population of Organization
Reliability	Low	High (Mission Critical)
Control	Low (None)	High
Compatibility	High	High

Table 1. The Difference and Commonality between an intranet and the Intranet

C. GROWTH OF INTRANET

Figure 2 includes everything related to an intranet or Internet as well as the growth of domain, users, and access providers. The x-axis lists the years from 1990 to 1995 and estimates for 1996 to 1998. The y-axis reveals the amount of the Internet and intranet growth related to Internet hosts, domains, servers, and users.

Campbell [Hills, 1997] predicts that there were 100,000 intranet web servers in 1995, and that this number will grow to 4.7 million by the year 2000. He also said that there were approximately 10 million Web browsers in use in 1995, and he estimates that number will be 40 million in 1996 and 180 million in the year 2000.

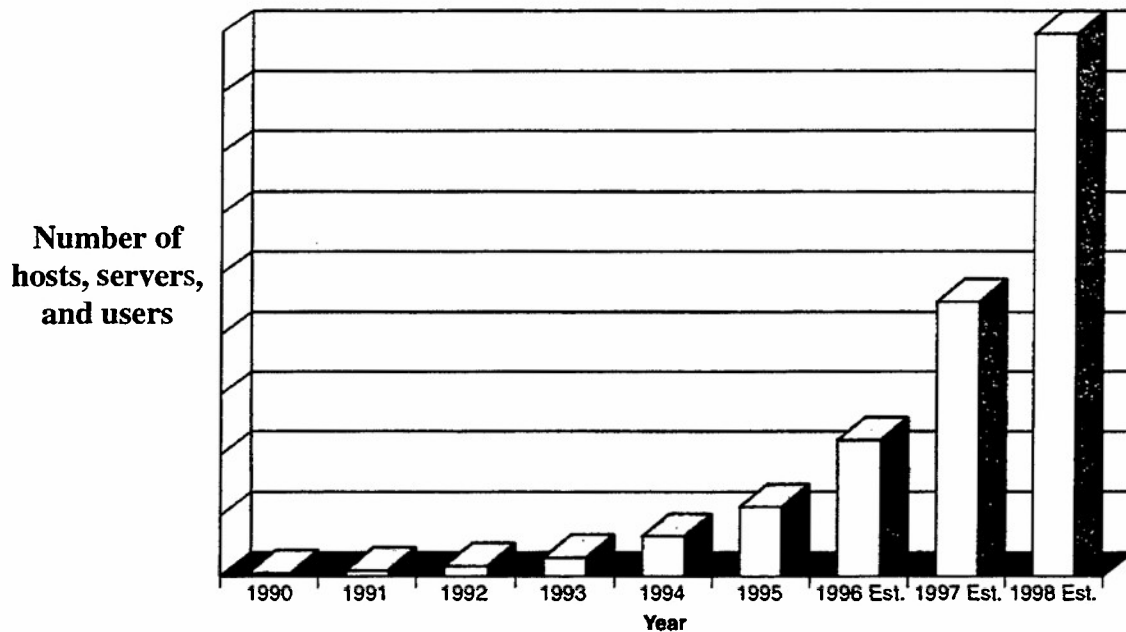


Figure 2. Growth of an Intranet and the Internet [Hills, 1997]

Internet and intranet have dramatically expanded. An intranet spending will outpace Internet expenditures by more than four to one, reaching \$400 million in 1995, \$1.2 billion by 1997 and up to \$7.8 billion by 1998. Purchases for web server hardware and software alone are expected to reach over \$5 billion by the year 2000. Driving these outlays is a shift toward an access-driven environment that can deliver information in a neutral content-type to the end user. Approximately 15 million users currently have adequate Internet technology available to support the implementation of intranets and will increase significantly by 1998. [Potter, 1996]

D. BENEFITS OF INTRANET

An intranet is not only for communication but also for collaboration within the organization provides several benefits over proprietary networks such as a LAN. With an intranet, universal communication is reliable using the same standards protocol. Users only need Web browsers on their desktop computers to interact with others.

An intranets provide tangible benefits, including cost savings, time savings and improved productivity. They provide even more significant intangible benefits, such as better decision making, more collaboration and improved knowledge sharing [Hills,

1997]. To give an idea how an intranet will benefit organization here are just a few of the possible reasons why the organization will setup an intranet:

1. Tangible Benefits of Intranets

To start an intranet, the organization needs a Web server, browsers for clients and building the web pages. The Web server is fast and easy to manage. When the initial server is up and running the intranet is ready to go. Since browsers are provided for free and many people have used them, it is not difficult to open a browser and surf an intranet. An intranet provides fast access to information. Rather than wasting time to get it from file cabinet or making a phone call, users can have the most up to date information in their finger tips. [Hills, 1997] Here are some of tangible benefits of intranet:

- fast and easy to implement
- cheap to implement
- easy to use
- saves time
- provides operational efficiency
- saves cost
- based on open standards
- connect and communicate among disparate platforms
- put users in control of their data
- secure
- scalable
- flexible
- provide the richness of multimedia
- leverage your infrastructure and applications investment
- supports push technology
- collects data as well as distributing it

2. Intangible Benefits of Intranets

Information is valuable, and things may happen slowly when the information to make a decision is not available. An intranet can provides critical communication to

organization at the same time. An intranet also enable coordination and collaboration of workgroups or team such as video teleconferencing or chat. [Hills, 1997]

- provide better communication
- provide access to accurate information
- capture and share knowledge and expertise
- provide better coordination and collaboration
- provide for creativity and innovation
- provide new business opportunities
- provide new business partnerships through access by suppliers and customers

III. INTRANET COMPONENTS

A. INTRANET COMPONENTS

An intranet is similar to LAN (Local Area Network) using client/server model. The only difference is that an intranet uses Web technology as the main component. Although these components are not required fully implemented but some of them should exist within an organization. Some of the major components of an intranet suggested by Hills [1997] are:

- Network Infrastructure
- Electronic Mail
- Internal Web
- Newsgroups
- Chat
- FTP
- Telnet

B. NETWORK INFRASTRUCTURE

A network enables the exchange of information in electronic form among individuals, groups, and organizations. The network provides the communication mechanism between connected users. This is achieved through a combination of hardware and software. Computers and peripheral devices are interconnected via a physical medium, such as copper cables and/or fiber-optic cables. Building a network is a process of selecting cost-effective components to meet the requirements of the users. More than one option is normally available for these components. Different technology choices can be made to solve the same problem. Making the right choice can be difficult because technology is advancing at a rapid pace. Competition among vendors should reduce costs. At the same time, there is a race to increase performance that typically increases costs. Thus, it is important to understand the requirements of the organization so that valid technology tradeoffs can be made to arrive at a cost-effective solution. [IPT and DoN INPO, 1997]

1. Network Categories

The category of network employed is distinguished by the geographical coverage of the network. A LAN is restricted in coverage to within a small geographical area, such as might be associated with a workgroup. The members of the workgroup may be co-located in a single building, or in a small number of buildings in close proximity. Several LANs can be interconnected within a building or buildings to extend connectivity and reduce contention for resources.

A Campus Area Network (CAN) covers a larger geographical area than a LAN, on the order of a few miles. A Metropolitan Area Network (MAN) would cover an area the size of a small city. A Wide Area Network (WAN) provides connection between sites in diverse locations [IPT and DoN INPO, 1997]. An intranet is a local or wide area network using the Internet technology such as TCP/IP and World Wide Web Protocols. So the software and hardware for LAN is similar to the one for an intranet.

For an organization with approximately 500 people connected to the network and geographically spreads in range of 0.5 mile local area network with fiber in the backbone is sufficient to cover the traffic around the network.

2. Network Architecture

Just as there several different ways to cable LAN, there are also several different forms a network can take. These different shapes are known as Network Architecture or Topology.

a. Star Topology

Star topology derives its name from the arrangement of devices so that they radiate from a central point. At the central point we usually see a device generically called a *hub* (Figure 3). Star topologies do require more cable than a simple bus topology, but most use a relatively inexpensive type of cable called *twisted pair cabling* which helps control costs of wiring. The hubs themselves require expense and the level of that expense is directly attributable to how complex a hub is needed. Star topology systems offer better troubleshooting and management capabilities, but require more physical resources than a comparable bus system. Another advantage of star topology is that network administrator can give certain nodes higher status than others. The star

architecture also makes it easier to have centralized diagnostics of all network functions. Because all messages come through the central computer. [Schatt, 1993]

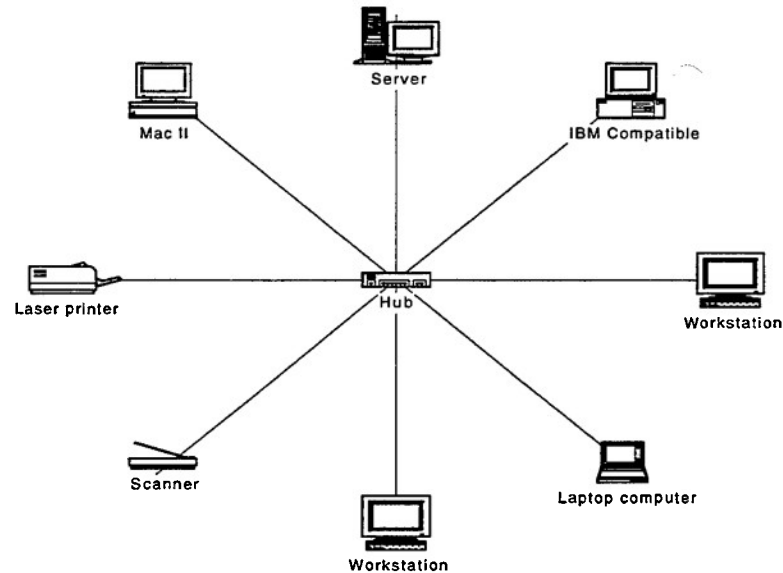


Figure 3. Star Topology

b. Bus Topology

In bus topology, all devices share a common wire to transmit and receive data through in the bus topology (Figure 4). This approach is very economical as a single cable is cheaper to purchase than several individual cables for each device. Additionally, a single cable is easier to install than several cables. These apparent advantages of the bus topology are offset, however, by the difficulty in troubleshooting a problem in this layout scheme. Unlike the star topology in which dozens of cable can cause logistical problems when they congregate near the central computer, bus cabling is simple. Another advantage of the bus topology is that the failure of a single workstation does not cripple the rest of the network. [Schatt, 1993] In summary, the key strength for the bus topology is its minimal use of cable and ease of installation. Its major drawback is its difficulty to troubleshoot.

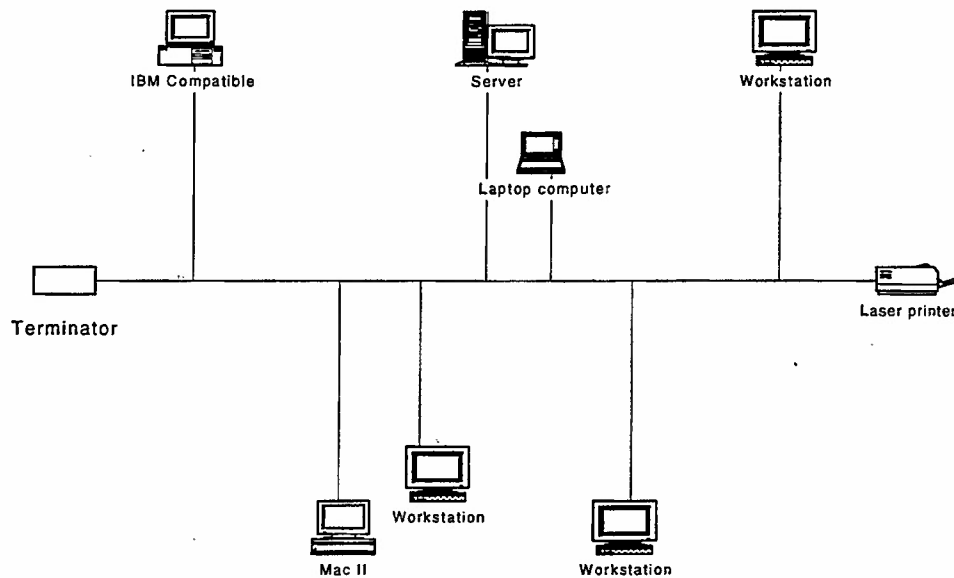


Figure 4. Bus Topology

c. Ring Topology

The ring topology combines advantages of the star and the bus. A workstation assumes the role of monitoring all network functions. The failure of one workstation does not result in the failure of the entire network [Schatt, 1993]. Ring Topology describes the logical layout of token ring and FDDI networks. A token is a stream of data that circulates through the network stations when they are idle. If a station has a message to transmit, it waits until it receives a "free token." The "free token" becomes a "busy token," transmitting a frame immediately following the token. The frame contains the full message or part of the message the station wishes to send. While the station is transmitting the message the token is busy, so other stations that want to send must wait. The receiving station copies the data to the frame and the frame continues around the ring until it gets to the station that transmitted the original message. That station then purges the "busy token" and inserts a new "free token" and the process starts over with a new station transmitting a message.

In this scheme, a ring is created to which each device attaches (Figure 5). The logical creation of a ring allows information on such a LAN to travel in one direction. Since only one device is allowed to transmit at a time, collisions are not a problem on ring systems. Of course there are always problems that can occur like bad network cards or hub units that will bring a ring topology LAN to a grinding halt, but they are often very resilient. Typical ring system network interface cards (NICs) contain the ability to perform what is known as *signal regeneration*. This means information received by them is copied and retransmitted at a higher amplification. Since every piece of data traveling around a ring must visit each device, the signal gets regenerated numerous times. This feature allows for greater distances between nodes and increased chances that good data will completely traverse the ring [Coulter, 1997].

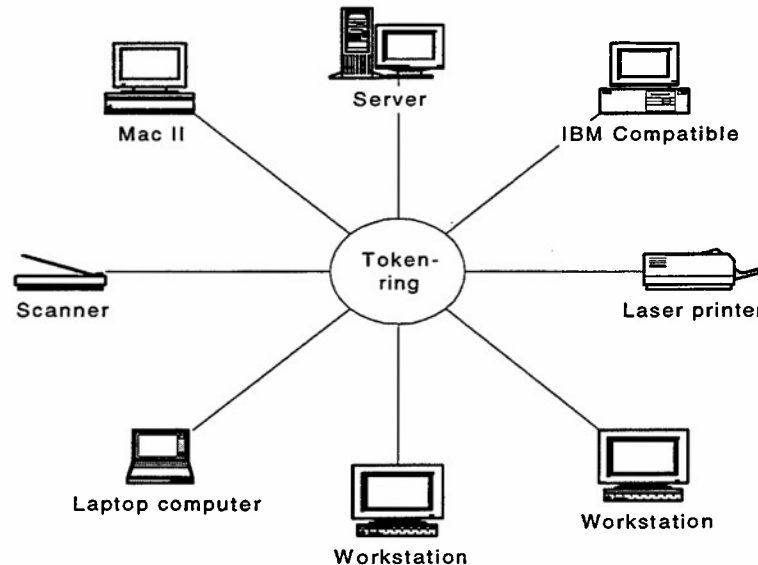


Figure 5. Ring Topology

3. Network Components

A local area network can be composed of several components. This section deals with what those components are focusing on terminology and functionality.

a. Servers

Server is a generic term applied to any machine running a "service" application. That service being performed might include access to shared files (file server) or access to shared printers (print server). There are other types of servers besides file and print servers. *Communication servers* offer access to remote devices outside of a network. That access might be to a mainframe or minicomputer, or other networks, workstations or servers. Typically, a machine that allows multiple users to share one or more modems for external connections is called a *modem server*. Modem servers are becoming increasingly popular today as more and more companies find the need to access external information or e-mail services. [Coulter, 1997]

Another type of server is known as a *database server*. This device assists users in interacting with databases by coordinating the data sent to the local workstation. It takes a burden off the local PC by filtering out all but required data, which also reduces LAN traffic. [Coulter, 1997]

A print server's role is important in the shared peripheral environment as it carries out the crucial task of making sure data from an application successfully reaches its temporary holding tank (queue) and subsequently the printer for which it was destined. [Coulter, 1997]

b. Workstations

In PC-based local area networking, a workstation refers to a machine that will allow users access to a LAN and its resources while providing intelligence on-board allowing local execution of applications. Workstations may allow data to be stored locally or remotely on a file server. [Coulter, 1997] Workstation as a client computer can be a thin or a fat client depending on the usage inside the organization. Most people like fat client because they also want to control their own computers. However, thin client will ease the management for administrator.

c. Network Interface Cards (NIC)

The NIC is obviously a crucial component to networking. It allows a device to participate on the network. Token ring LANs require token ring NICs, Ethernet LANs require Ethernet NICs, etc [Coulter, 1997]. Every NIC has its own MAC (Medium

Access Control) address or physical address consists of 48 bits number. MAC is configured into the hardware of network card so every packet will go to destination in according to this number.

d. Hubs

Hubs are a crucial element to all star topology LANs. Hubs serve as a central device through which data bound for a workstation travels. The data may be distributed, amplified, regenerated, screened or cut off. Hubs have different names depending on the type of LAN. In token ring LANs they are referred to as Multistation Access Units or Controlled Access Units (MAUs or CAUs). In 10BASE-T Ethernet, they are referred to as concentrators. In ARCnet they are simply called hubs. Hubs vary in their capabilities and sophistication. ARCnet passive hubs are inexpensive and only split signals among several devices. Other hub units cost several thousands of dollars providing state-of-the-art remote management and diagnostic capabilities. [Coulter, 1997] Other type of the newest hub is smart switch. This switch acts as a router to deliver messages in the networks. Smart switch will be able to determine the short route to destination because it has routing table built in that can learn.

e. Peripherals

The idea of a network is to share peripherals such as printers, scanners, modems, plotters, and CD-ROM among the users. Peripherals include any device that would ordinarily be attached to a computer. LANs allow many of these devices to be shared among several workstations.

f. Software

There are two main types of software used in an intranet environment - operating systems and applications. In the Windows environment there are at least two operating systems used. They are Windows NT server operating system (OS) residing on and operating the file server and Windows 9x, Workstation, DOS, OS/2, or Macintosh on the client computers.

C. ELECTRONIC MAIL

Electronic mail was one of the earliest functions on the Internet, and in many ways is the basis of much of the web technology. The content standards for mail and the web technology are shared. Mail is an important tool for Intranet applications because it provides the major form of push [Tellen, 1997].

Electronic Mail or e-mail allows people to send messages electronically to anyone in the world who has an e-mail address established. E-mail is used to limit to text files but the e-mail software right now can manipulate picture, voice or even video. E-mail is generally an organizations first intranet application. It provides the opportunity to communicate from one person to another or to many people [Hills, 1997].

D. INTERNAL WEB

The internal web is not synonymous with an intranet. It is only a part of an intranet but it is the important part. The internal web is simply using Web tools inside the organization. It makes the information inside the organization easy to access. What the users need to know is how to use a mouse to point and click. If they can do that, then any information they need will be available at their fingertips. [Hill, 1997]. By building the search tools in the internal web, the users can locate any information they need without difficulties. The internal web consists of two major components.

1. Web Server

Web server is the heart of an intranet. It is the computer that contains all the web pages and use the Hypertext Transfer Protocol. Web server will process the request and send the needed page to a client or web browser. [Hill, 1997]

2. Web Browser

The second component of the internal Web is the browser or client. The main function of the web browser is to act as a graphical user interface (GUI) between the user and the web server [Hill, 1997]. The basic of Web technology takes advantage of the hypertext concept HTTP and HTML. The client computer needs Web browser to read HTML file and translates it into readable format. One of the browsers' software from Microsoft called Microsoft Internet Explorer is provided for free. Microsoft Internet

Explorer enables you to connect to the Internet to gain access to the vast stores of information on these computers. Whether you're searching for information or having it delivered to your. The other popular browser is from Netscape called Netscape Communicator.

E. NEWSGROUPS

Newsgroup is a discussion in the Internet or an intranet. The users can publish the information so everyone accessing the newsgroup can read the current content. This form of communications also reduces the congestion of hardware resources because the users check a newsgroup instead of everyone being sent the same e-mail. In addition to that, newsgroup enables people to post their interest in different topics or categories in the form collaboration. Finally, newsgroup can act as a knowledge base for corporate information when they conduct thread discussion on-line. [Hill, 1997]

F. CHAT

Internet Relay Chat (IRC) allows someone from one computer to type messages on the keyboard and has that messages instantly appear on someone else's computer. It is very good for quick conversations because it closes to real time discussion [Gralla, 1996]. On an intranet, chats can take the place of long-distance phone calls between locations. They allow you to communicate ideas more quickly than through e-mail. Chats facilitate brainstorming sessions for participants who can convene at the same time, but not at the same place. You can schedule a chat about any topic of common interest and anyone can participate. You can also use chat for impromptu conversations [Hills, 1997].

G. FTP

File transfer protocol (FTP) provides you a repository of information that is readily accessible. Anyone with FTP can log in to the repository and download what they need to their computer. FTP works well for transferring files that are too large to send by e-mail [Hills, 1997]. FTP enables you to transfer files back and forth from your machine to the remote machine or from one remote machine to another remote machine thousand miles away.

H. TELNET

Telnet provides access to resources that reside on remote mainframes. Users run Telnet on their local machines but they have to know before hand the IP Address of remote computer they want to connect to. Telnet does not provide graphical user interface (GUI) so users have to know the correct syntax that is usually in Unix environment operating system. Once they are connected to the remote machine, they can call applications and run them as if they are sitting on that computer (remote).

IV. ISWAHJUDI AFB

A. ISWAHJUDI AFB

Iswahjudi³ Air Force Base (AFB) is located in Madiun, East Java - Indonesia (Figure 6). The mission is to prepare, develop and operate all assets under its command and to maintain air superiority. Iswahjudi AFB operates and maintains different types of fighter aircraft. Iswahjudi has LAN and WAN connected to an Air Force headquarters in Jakarta but mostly for aircraft maintenance and supply.

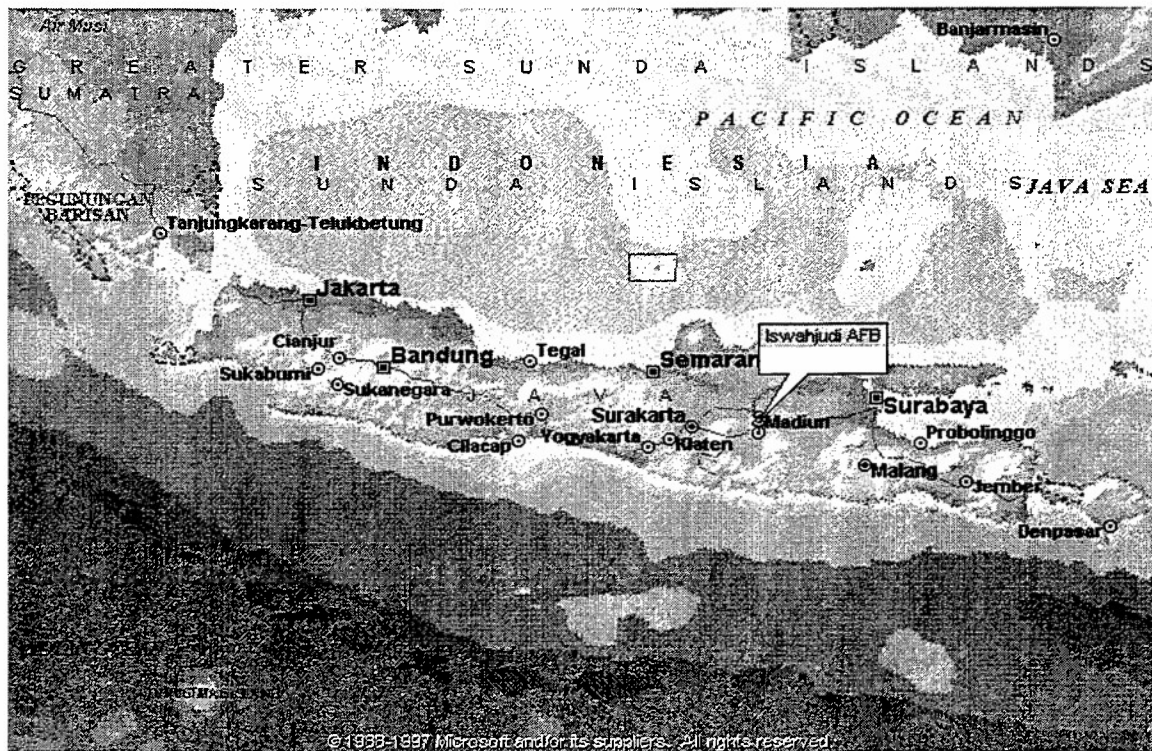


Figure 6. Iswahjudi AFB Location. [Virtual Globe, 1998]

³ Iswahjudi is the name of Air force Base in Indonesia often called "The Home of Fighters"

B. THE USAGE OF INTRANET FOR ISWAHJUDI AFB

Electronic mail may be the biggest communications advance since the invention of the phone [Adelaja, Bryan, and Yao, 1996]. People exchange the information seamlessly at the low cost. Indonesian Iswahjudi AFB can use the intranet as a means of communication as well as collaboration. After an intranet is established, Iswahjudi AFB can use simple Web pages created using HTML editor to access information from a central server. Messages can be stored, filed, managed, and forwarded quickly. However users will still be able to respond concurrently. Some intranet features that are relevant to Iswahjudi AFB:

- Home pages for all divisions: Every division can publish their own web pages for information sharing.
- Database for personnel records: Build personnel database and make it available on-line to every computer connected to the server. Username and password needed to gain access to database. For security reasons, not all personnel can update or add data to database.
- E-mail: Use e-mail as a mean of communication for daily activity because e-mail can reach everyone in the network without simultaneous availability.
- Manual/Standard Operating Procedure (SOP): Publish SOPs using standard HTML so they can be accessed via Web browser.
- Report standard for daily, monthly, quarterly, and yearly report: By making it available on-line, everyone can gain access to report standard. When the real report is generated, it complies with standardization required by organization.
- Training schedules such as daily flying schedule.
- Announcement such as news event.
- Phone book: Iswahjudi does not need to print phone book anymore because it is available on the Web and is up to date. This is one of the examples of a paperless office.
- Organization charts: To find out the organization structure, click the browser and point it to organization charts.
- Map: If you are new to Iswahjudi AFB, print out Iswahjudi AFB map from the Web.

- Frequently Asked Questions (FAQ): FAQ can reduce burden on administration staff in answering the same questions.
- Personal classified ads: Let people put their classified ads on the Web for personal benefits but this should be controlled carefully otherwise a lot of junks will be on the Web.

C. BENEFITS TO ISWAHJUDI AFB

Cutting costs is the most crucial issue for government agency since the government does not produce a profit. The best cost-cutting feature an intranet has offered is its ability to reduce publication costs within an organization. Iswahjudi AFB, like other organizations, conducts communication and collaboration everyday. With the intranet, the information pool will be easy to set up. An intranet will cut down the time spent on routine communication tasks. For example, if headquarters wants to send an announcement for the entire organization, a secretary only needs to sit down in front of computer and launch an e-mail program.

1. Attractive Interface

The use of client browsers with one standard window's interface, offers an easy integration with other applications, such as electronic mail, videoconferencing, and hot links within messages. As a single interface to a variety of information sources, the browser is cost-effective (it is free), highly efficient, and very easy to use.

2. Paperless Data

Intranets have also lowered costs by eliminating printed phone books. Iswahjudi AFB does not need to print phone books for distribution to divisions. However, the reduction of printing is not as big as it seems. Research shows that reading from a PC monitor is 20 to 30% slower than that from a hard copy. Monitors are simply difficult to read. As a result, a lot of information on the corporate intranet will be printed out [Slevin, 1997]. But it will still reduce the demand for paper because not all people need the same information, so only those who need it will print it. In fact, the information can be easily updated so every person will get the latest information.

3. Quick and Easy Distribution

An intranet has a Web server, which is designed to take advantage of Internet technology. This Web server will eliminate the need to replicate databases by providing users with easy access to source data. With database on-line, users can easily create forms for collecting registration information for upcoming training classes or seminars. In fact, database software such as Oracle, Informix, SQL Server, and Microsoft Access can provide tools for more sophisticated database applications. Once more, an intranet takes the human intervention out of the registration process, allowing the information to move more quickly from originator to end-user of that information.

4. Consistency Of Information

With intranet, the information exchange in organization is much easier. Information is also easy to update because it is distributed in standard format and published from single location. The consistency of information is maintained throughout the organization.

5. Gateway to the Internet

An intranet does not need to be connected to the Internet. But because of intranet uses the same technology as the Internet, the organization only needs specific gateway software to connect an intranet to the Internet.

D. COST CATEGORIES

An intranet will run smoothly if the infrastructure is well defined. It consists of hardware and software systems that enable, support, and monitor the transmission of data over the network and humanware who will setup and maintain the intranet itself.

1. Hardware

Iswahjudi AFB needs a set of computers with Internet cards installed for server and client. The server is the computer that makes information available to the web. The client is the computer with software that retrieves and displays information from Web servers [Chandler, 1995]. The computers act as servers such as file and print server, application server, Internet/intranet server, messaging server, remote access services

server and firewalls. Firewalls are only needed for connection to the Internet. The other computers are also required as client computers depend on how many the end users will access the intranet. Printers and scanners are the peripherals used to provide the users with hard copy. The requirement for hardware installed for an intranet depends on how the organization will use it. It is required to have dedicated server for each application so the highest possible performance can be reached. A firewall server should not be combined with other servers because hackers may be able to exploit bugs in the software to bypass the security functions of firewalls.

Iswahjudi AFB with offices spread along a wide area already has LAN and WAN infrastructure. But Iswahjudi still need computers with NICs, hubs, bridges, untwisted pair (UTP) cables or fiber, connectors, and router/smart switch to comply with an intranet requirement. These components should be arranged with planning in advance before an intranet can be established. Figure 7 illustrates several hardware connections of intranet in LAN model.

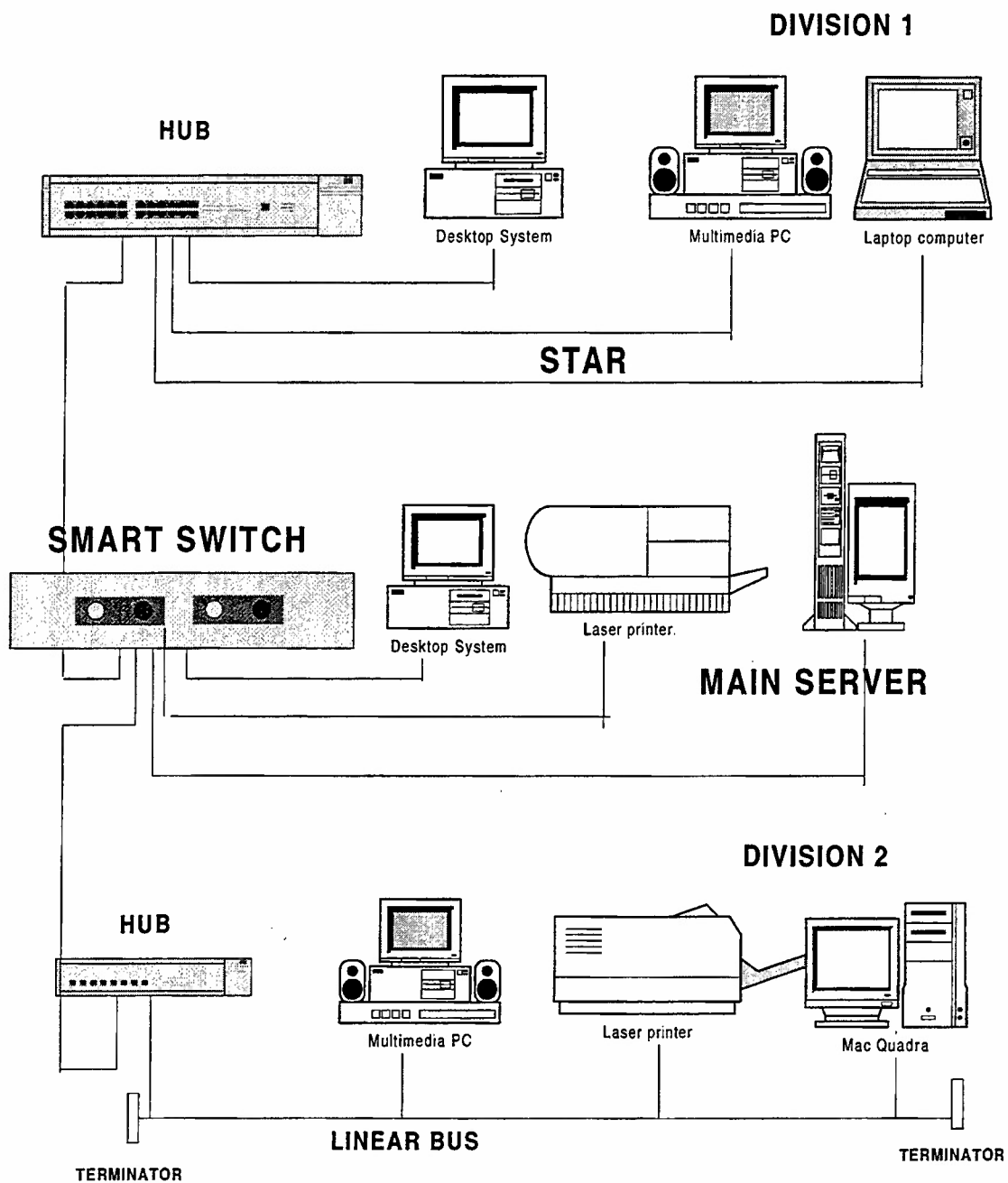


Figure 7. Hardware Connections

2. Software

Since an intranet is a local area network that uses TCP/IP, it needs the operating systems that can run in the network and have the TCP/IP protocol. There are several network operating systems available in the market such as Windows 95, Windows NT, Unix, Macintosh and Novell NetWare 4.0 (Novell NetWare version below 4.0 do not have TCP/IP).

Web server and Web browser software are the heart of an intranet. Various COTS (Commercial-Off-The-Shelf) products are available for free such as Microsoft Internet Information Server and Internet Explorer respectively. In considering these software choices, It is better to have products from specific vendors to reduce management difficulties.

To provide enhance capability with database application through the Web, middleware application is also required. For content creation of homepage, Iswahjudi AFB needs HTML editor. Front page 98, Hot Dog, or Adobe Pagemill can be used to create a homepage.

3. Humanware

Often the last things considered is the amount of human capital any project will entail. Questions of setup, maintenance, management of content, as well as training and documentation should be factored into the intranet implementation. The need for greater technical skills is not as necessary with intranets in comparison to many proprietary client-server solutions. This opens up the possibility of greater enterprise-wide involvement by more individuals. It's not just for information systems folk anymore. [Potter, 1996]

4. Social Cost

To develop a culture feel, in which the information should be considered as a corporate asset, employees must be empowered and traditional power struggle must be resolved. Changing the culture of the organization to make information a corporate asset requires changing fundamental needs and values of individuals in an organization. It requires changing mental models. Sharing or withholding information is one of main methods people use to maintain status in the eyes of others. Mental models involving

power and control are some of the most difficult to change, because managers themselves are often afraid of losing their power as they empower their employees. The success of intranet tool for information sharing depends on changing the power base of information, changing the way information is valued in the organization and changing the mental models [Bridges, 1993].

E. INTRANET CHALLENGE

An intranet also has some challenges and risks because of its capabilities in rapid technology improvement. Intranet's administrator faces many issues once it is deployed within organization. They have unleashed a technology that gives new meaning to the word client/server. By putting up an intranet that allow employees to publish basically whatever they want, the IS manager has lost some control on the information that will be shared in the organization. The IS manager of an intranet faces some of the same issues as a manager of a LAN. [Gandhi, Hsieh, Miao, and Williams, 1997]

1. Security Risks

Providing robust security services is a challenge faced by information systems teams that are building full-service intranets or connecting to the public Internet. Information System teams want to provide such services as single-user login, message privacy, and access control for safeguarding confidential documents. These services need to be provided a cross platforms (Windows, Macintosh, Unix, etc.) and be application independent (Web server, Web client, mail server, news servers, directory server, proxy server, etc.). Fortunately, industry-standard solutions to these challenges are emerging. Cryptography plays a pivotal role in these standard solutions. [Gandhi, Hsieh, Miao, and Williams, 1997]

2. Potential of Chaos

There are individuals who try to publish their own Web page without following an organization policy. The key characteristic of Internet technology is its ability to shift control of electronic information management from the technology specialist back to the information creators, and control of information flow from the information creators to the information users. If the user has the ability to easily publish and retrieve or view the

information, this can cause chaos in information. Management control is needed to reduce this challenge.

3. Information Overload

According to Miller [1956], we are limited in the amount of new information we can retain in short-term memory to "seven plus or minus two" chunks. If the movement of information from short-term to long-term memory is not successful, we experience information overload. Confusion ensues and information already in short-term memory may be lost as the capacity of short-term memory (threshold) is exceeded.

Since the threshold for short-term memory is determined by new information awaiting a connection with existing information, it is important to recognize the variety of experience levels of the users in organization. The threshold for some people may be lower if information being introduced is new.

4. Waste of Productivity

Once an intranet has been established, people may surf an intranet or the Internet and not get their work done. People play with their new toys for the first few days. After that they will settle down and use the Web more appropriately. [Hills, 1997]

5. Cultural Environment/Change

Management challenge in information technology is how the culture change⁴ affects the use of information. Users should move from traditional paper-based work processes to paperless processes. The users should be flattered to embrace the new era of communication and collaboration. In order to urge people to use an intranet, the will power from the top is very dominant. Although an intranet provides users with a network instrument, there is significant consideration of the user's capability to interpret and use information. People need to be trained to be information processors to manipulate, filter and refine information.

⁴ The way organization does things around in order to succeed. It is the essential way, or fundamental method of operation, chosen by an organization.

IS managers may find their entire world shifting around them once again, as the internal web becomes the dominant environment for delivering data and applications. The entire method of application design and delivery may require a new phase of reengineering with a focus on more modular, applet-based information systems, and a more serious look at ways of integrating the entire information stream, including data, documents, multimedia, and applications.

V. INTRANET ANALYSIS

A. INFRASTRUCTURE

Since Iswahjudi already has LAN and WAN connected to Air Force headquarters, an intranet can use this infrastructure to connect computers in every division. The requirement for infrastructure including hardware and software depends on how many users and what application will be used in deployment. It is also important to consider the amount of CPU, RAM, and Disk Storage resources. Table 4 shows how many subnets needed to design a network using client load metrics from Tables 2 and 3 [Strebe, Perkins, and Chellis, 1997]. This analysis includes hardware components but exclude the cabling. The author tries to introduce software and middleware requirements to build an intranet.

1. Estimating Client Load

To design a network, we need to estimate load capacities of networks. Tables 2 and 3 illustrate the metrics to compare different network technologies and relate them to client computer requirements.

CLIENTS	METRIC	EXPLANATION
Macintosh	1	As a basis for network metric
DOS	2	MS-DOS machines tend to run simpler application software that does not demand much from a network
Windows	3	Windows is more complex than DOS
Power Macintosh	3	PowerPC is very fast so it hits the network hard because of the speed
UNIX X-Terminal	3	Diskless
Windows 9x	4	Typically runs on fast client computer
OS/2	4	Similar to Windows 9x
NT Workstation	5	Multitask multiple network applications
UNIX Workstation	5	Usually used by bandwidth-intensive users
Diskless DOS	6	Must use network for every I/O command
Diskless Windows	9	Demand more bandwidth
TCP/IP Print Server	10	Every document will go across the network when it sent to print server

Table 2. Load Requirements of Network Clients

NETWORK	CAPACITY	EXPLANATION
Ethernet (10 Mbps)	100	The most common network data link technology (use as a basis of comparison)
Token Ring (16 Mbps)	200	Single Token Ring can support roughly twice as many computers as a single Ethernet
Fast Ethernet 100 Mbps	500	Although the bit rate is ten times of Ethernet but there is a delay involved in resolving collisions
FDDI (100 Mbps)	1,000	Ten Ethernet networks can be connected in a single FDDI ring
FiberChannel (1 Gbps)	10,000	Perfect backbone technology in campus environment
ATM-155 OC-3	1,000	Switched network technology. 80% of bit rate can be used for traffic
ATM OC-12	4,000	At 622 Mbps, ATM OC-12 is sufficient for the most demanding backbone application
ATM OC-48	16,000	At 2.2 Gbps is used for MAN (high speed link)
ATM OC-192	48,000	At 8.8 Gbps is used for major trunks between metropolitan areas by telephone companies

Table 3. Load Capacities of Network Technologies

2. A Network Design Example

To calculate load versus capacity, we should allow 25% of network growth added to the total sub-networks to achieve maximum performance. Given the following information and using the method from tables 2 and 3, we can determine how many Ethernet or Fast Ethernet sub-networks we need to support these clients.

CLIENTS	NUMBER	LOAD	TOTAL	ETHERNET	FAST ETHERNET
DOS	10	2	20	100	500
Windows 9x	75	4	300		
NT Workstation	50	5	250		
Power Macintosh	25	3	75		
OS/2 Workstation	10	4	40		
UNIX Workstation	5	5	25		
TCP/IP Print Server	4	10	40		
Total Load			750	8 subnets	2 subnets
Total Load 25% Growth			937,5	10 subnets	2 subnets

Table 4. Sub-Networks Results

B. HARDWARE

The design of the network will determine the majority of the hardware requirements for an intranet together with the software requirements. It varies in complexity depending on the design objectives of the intranet. Miastkoski [1998] suggested that combination of a Pentium II-300 or Pentium II-333, 64 MB of RAM, and 4GB hard drives will provide adequate power for up to 50 users. They can share files and printers, send e-mail, and deploy a small application such as accounting or a basic intranet. On the other hand, if organization has more users connected, runs more-demanding application such as full-fledged database, or wants to use the box as an Internet server, it should increase the RAM to at least 128 MB and increase hard drive capacity.

SERVER	PRICE	CPU	RAM (MB)	HARD DRIVE
Compaq ProSignia Model 4300	\$2440	PII-300	32	4GB wide Ultra SCSI
Dell PowerEdge 2300	\$3166	PII-333	64	4GB wide Ultra SCSI
Digital Server 1210	\$2582	PII-300	64	4GB wide Ultra SCSI
Gateway NS-7000 333	\$2582	PII-333	64	4GB Ultra SCSI
Hewlett-Packard NetServer E50	\$2589	PII-333	64	4GB wide Ultra SCSI
IBM Netfinity 3000 8467616U	\$2579	PII-300	64	4GB wide Ultra SCSI
Micron NetFrame 3100	\$4299	PII-300	64	4GB wide Ultra SCSI
NEC Express5800 ES1200	\$2247	PII-266	32	4GB wide SCSI

Table 5. Budget Servers [Miastkoski, 1998]

C. SOFTWARE

1. Server Operating System

A server operating system is the primary component in an intranet. Most of Iswahjudi AFB computers are equipped with Windows operating system such as Windows 95 and Windows 98. Windows NT server developed by Microsoft Corporation is a server operating system which is optimized to provide network services to client computers. As a server operating system, Windows NT belongs at the heart of network. Windows NT is true 32-bit operating system, and it provides a 32-bit environment for windows program to run. The best usage of Windows NT server is to provide file and print services, route mail, and support back-end database servers and Internet host packages in and out local area network. The first version of Windows NT released to the

public in 1993 as Windows NT Advance Server version 3.1. In 1996, Microsoft released Windows NT server version 4. NT 4 is boosted to support the World Wide Web and the Internet with the Internet Information Server as a web server. [Strebe, Perkins, and Chellis, 1997]

2. Web Server

The World Wide Web is built upon a protocol called Hypertext Transport Protocol (HTTP). HTTP is designed to be small, fast protocol that is well suited for distributed multimedia information systems and hypertext jumps between sites. The Web consists of pages of information on hosts running web-server software. This computer is referred to "Web Server." Actually this is not correct, the computer is not web server but the software itself is a web server. Web server is a program that serves up web pages upon request. When users at a specific address request a specific file, web server tries to retrieve that file and send it back to user. The requested file might be the HTML source code for web page, a GIF or JPG images, AVI files or VRML. This is also called "pull technology," it is the web browser that determines what should be requested, not the web server. [Forta, 1998]

The Web servers are continually emerging, each must be evaluated on flexibility, cost, and ease of use. Currently, Netscape FastTrack Server is best a no-frills server. Netscape Enterprise Server and Microsoft Internet Information Server (free with NT 4.0 server) are more powerful. They each contain security features, search engines, and ability to interact with databases.

Microsoft's IIS (Internet Information Server) 4.0 is free, although it requires NT Server to run. Seamless integration into the NT environment and the ASP (Active Server Pages) application engine make it a formidable power. Microsoft Internet Information Server complies with the HTTP 1.1 standard, including features such as PUT and DELETE, the ability to customize HTTP error messages, and support for HTTP headers. Also, with support for Virtual Host Headers, you can run many Web sites on a single computer running Windows NT Server. This is critical for most Internet Service Providers, and useful for corporate intranets that want to host multiple intranet sites on the same server

Enterprise Server 3.5.1 from Netscape Communications Corp. offers performance on par with IIS, as well as native database connectivity, CORBA Common Object , Java,

and a number of other tools for extending its server capabilities. Its cross-platform consistency is an especially big win for today's mixed environments.

O'Reilly and Associates Inc. WebSite Professional 2.0 offers many of the extensibility hooks found in IIS and a good bundle of tools for Web server administrators. While the product has improved much since the prior release, the competition seems to have surpassed WebSite on most fronts.

Turning to Unix, Netscape and The Apache Group are at the forefront. The consistency of Netscape's implementation across various platforms, before we even get into some of its terrific features, is a big plus for heterogeneous networks serving Web content from a variety of platforms.

The Apache server delivers the ultimate in flexibility and extensibility. Its modular design allows a Web administrator to build an application-specific binary, specially suited for the requirements of that installation. There's no sissy GUI or other hand-holding with Apache, and the end users' level of technical expertise usually makes these unnecessary. [LAN, 1998]

Tables 3 and 4 show the price comparison between Netscape Fast Track and Microsoft Internet Information Server. This prototype is developed using Windows NT server 4.0 as a server and Microsoft Internet Information Server 4.0 as a Web server with IP Address 131.120.178.243.

	FASTTRACK SERVER FOR WINDOWS 95	PEER WEB FOR NT WS	NETSCAPE FASTTRACK SERVER	NETSCAPE ENTERPRISE SERVER	MICROSOFT IIS 4.0
Operating System					
Windows 95	\$209				
NT Workstation 4.0		\$319	\$319	\$319	
NT Server 4.0					\$809
Web Server	\$295	Free	\$295	\$995	Free
Content Creation, Application Development, and Management Tools					
Netscape Navigator Gold 2.0	Free		Free	Free	
Microsoft FrontPage		\$149			Free
Netscape LiveWire	\$200				
Netscape LiveWire Pro, which includes: All LiveWire functionality ODBC and native database connectivity Informix On-line Workgroup Server for LiveWire applications Crystal Reports			\$695	\$495 (with Enterprise Server)	
MS Visual Basic		\$499			\$499
MS SQL Server					\$849
Internet Database Connector License for SQL Server					\$2995
Technical Support	Free installation and setup	\$450	Free installation and setup	Free installation and setup	\$450
TOTAL	\$704	\$1417	\$1309	\$1809	\$5602

Table 6. Comparison Web Server [Gandhi, Hsieh, Miao, and Williams, 1997]

SERVER	10 CLIENTS	100 CLIENTS	1000 CLIENTS	10,000 CLIENTS
Netscape SuiteSpot	\$4,410	\$ 8,140	\$ 32,905	\$ 230,395
Microsoft BackOffice	\$4,889	\$23,998	\$170,199	\$1,296,000

Table 7. Netscape and MIIIS per clients [Gandhi, Hsieh, Miao, and Williams, 1997]

3. Web Browser

Web browsers are client programs used to access web sites and pages. The web browser has the job processing received pages, parsing HTML code, and displaying the page to the user. The browser will attempt to display graphics, tables, forms, formatted text, or whatever the page contains. The most popular web browsers now in use are Microsoft Internet Explorer, Netscape Navigator and Mosaic. Unfortunately these web browsers support different HTML tags. The same web page often looks different on different browsers because every browser renders and displays web page objects differently. For this reason it is better to test web pages using multiple browsers to ensure the final output appears as intended. [Forta, 1998]

4. Middleware

An intranet is similar to client/server computing concept. The client server computing is a type of network relationship in which a node runs front-end (client) software to access the software running on a server. [Schatt, 1996]. There are three building blocks of client/server computing. The client, the server and the middleware [Edwards, Harkey, and Orfali, 1994]. The client handles the user interface, translates the user's request and sends the user request to the server. When the server responds, client presents the results to the user. On the other side, the server listens for the client's request and processes it then returns the result back to the client. The middleware building block runs on both the client and server sides of an application [Edwards, Harkey, and Orfali, 1994]. Microsoft offers Active Server Page (ASP) to connect legacy database to the web browsers. While others have different approaches such as ColdFusion application server from Allaire Corp, Tango from Everyware Corp, and Common Gateway Applications (CGI) as the first middleware created using Perl language. For the purpose of the prototype two types of middleware are discussed:

a. Active Server Pages

An extension of Microsoft's Active Platform suite of technologies, Active Server Pages exist in order to give web developers the choice between server-side or client-side, parsing when dealing with web scripting languages such as JavaScript/Jscript or VBScript. In many instances, it is preferable to have these scripts run on the server, so that they can access data which is local to the server (as in the case of a local, dedicated database system), and present web pages to the client as standard HTML. This data can be viewed with any web browser regardless of whether or not the browser itself supports the scripting language. Clearly, this makes the delivery of dynamic web content much more flexible, allowing for greater personalization and fresh content. [Powell, 1998]

b. ColdFusion Application Server

ColdFusion from Allaire Corp. is the component of the ColdFusion rapid application development system that provides the foundation for integrating browser, server, and database technologies into powerful Web applications. Application Server offers comprehensive support for deploying scalable Web applications and integrates with ColdFusion Studio, the visual development environment for ColdFusion.

ColdFusion gives professional developers a powerful tool for creating dynamic Web applications and interactive sites. Unlike other approaches to Web application development, ColdFusion uses a flexible server-side markup language that seamlessly integrates with HTML called ColdFusion Markup Language (CFML). [Allaire, 1998]

Language (CFML) in addition to HTML. CFML gives the ability to control the behavior of applications, integrate a wide range of server technologies, and dynamically generate the content that is returned to the Web browser. When a page in a ColdFusion application is requested by a browser, it is automatically pre-processed by the ColdFusion Application Server. Based on the CFML in the page, the Application Server executes the application logic, interacts with other server technologies, and then dynamically generates an HTML page which is returned to the browser. The diagram below (Figure 7) shows what happens when a Web browser requests a page in a ColdFusion application.

When a user requests a page in a ColdFusion application by submitting a form or clicking a hyperlink, the user's Web browser sends an HTTP request to the Web

server via the Internet or Intranet. The Web server passes the data submitted by the client and the requested page to the ColdFusion Application Server either through a server API or CGI. ColdFusion pages are automatically compiled and cached in memory, so processing is very fast and scaleable even under high loads.

ColdFusion reads the data from the client and processes the CFML used in the page. Based on the CFML, the ColdFusion Application Server executes the application logic and interacts with a wide range of server technologies. ColdFusion dynamically generates an HTML page and returns it to the Web server. The Web server returns the page to the user's Web browser (Figure 8). [Allaire, 1998]

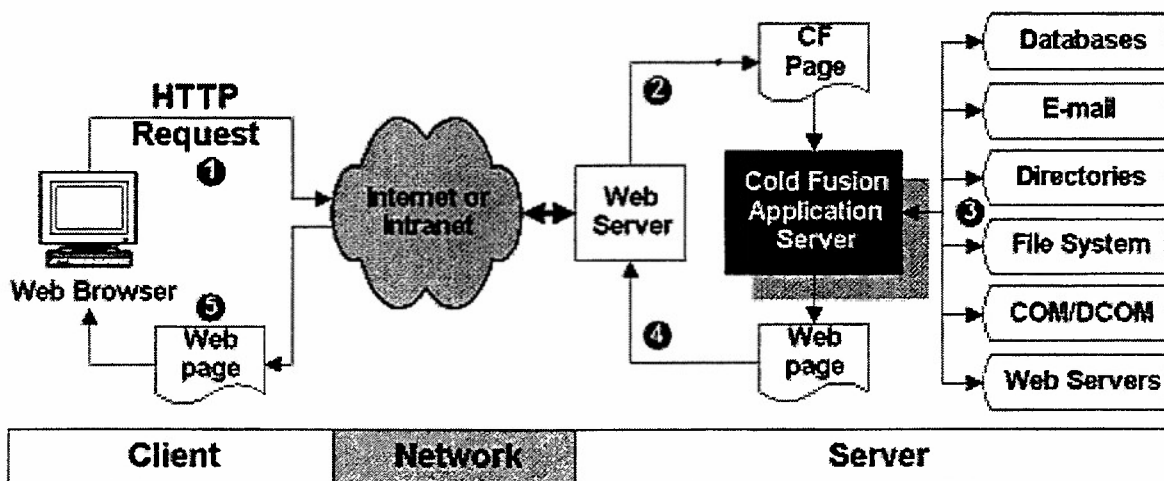


Figure 8. ColdFusion Diagram. [Allaire, 1998]

According to Powell [1998] Allaire's ColdFusion and Microsoft's Active Server Pages (ASP) are two high-end tools contesting for market share in the professional Web application development arena. In the summer 1998, Microsoft came out with Version 6.0 of Visual InterDev as a Web application development software. Allaire Inc also released ColdFusion 4.0, sets the stage for a rematch in this battle of the heavyweights. Powell's team installed the application servers on a pair of Pentium II-300Mhz servers with 128M bytes RAM running Windows NT 4.0 with IIS 4.0. Access and SQL-Server databases were installed on the same server. The sample application included static HTML pages, database generated pages, basic JavaScript for update form validation, a local search engine and graphic navigational elements.

After working with both development environments, they found that Visual InterDev excels in management of the site development process and scripting. But

ColdFusion Studio, Allaire's IDE for ColdFusion, has the edge over Visual InterDev with respect to HTML coding and basic database integration. This time, ColdFusion's improved coding tools and database connectivity features make it the overall winner.

As for the application servers themselves, ColdFusion Server now is ahead of ASP. Allaire's new version of the application server addresses performance and scalability issues on almost every level. To improve database access speed, the Enterprise version of the ColdFusion server now supports not only Open Database Connectivity database connections, but also OLE databases and native drivers for Oracle and Sybase, as well as stored procedures. Actually we don't need to choose between ASP and ColdFusion because we can use both products on a single site, although we can't run them on the same page. ASP is an NT-centric environment, while ColdFusion Server runs on NT, Solaris and soon, Linux.

The best approach may be to exploit the strengths of each product. For many, the choice of one technology or another boils down to familiarity or personal preference. For the purposes of this prototype I use ColdFusion Application Server 3.1 and 4.0 running on Windows NT 4.0 with Internet Information Server 4.0.

5. Database

A database is a centralized place where information of all kinds is stored. Databases simplify the collection and maintenance of data and facilitate querying and displaying data in a wide variety of formats. The actual data in a database is organized into tables, which are collections of information that relate to a particular topic. Each table has many fields, each of which is a particular type of information, such as a first name, address, zip code and phone number. Using tables, a lot of information that is related in simple or complex ways can be organized and managed. This database might have a table called 'tblPersonnel' that contains fields such as the person's first name, last name, rank, ID number, address, city, state, zip code, and phone number. The most serious problem with the database is data integrity. A collection of data has integrity if the data are logically consistent, that is, if they mesh together logically. If data items differ, they will produce inconsistent result (Kroenke, 1997).

Microsoft Access database as a relational database management system provides the easiest way to relate tables in logical way so the information can be presented efficiently [Prague and Irwin, 1997]. Multiple tables simplify data entry and reporting by

decreasing the input of redundant data because not all the records have all the values. Also by separating data into multiple tables within database, the system is easier to maintain because all records of a given type are within the same table.

The strategic rationale for distributed databases is not solely to save money, improve reliability, or improve performance but to position the I/T data assets so that they can endlessly reconfigure themselves in harmony with constantly shifting business environment diversity. It is desirable to evaluate the impact of life-cycle database maintenance on the design. Is the design easy to evolve with the changing times and circumstances, or having built this design, are you stuck with it and have contradicted your own intent? There are basically five actions that can be taken against the scenario database designs and their internal objects: [Boar, 1996]

- You may wish to add new objects (e.g., data elements, tables, partitions, replicated databases, etc).
- You may wish to modify existing information objects (e.g., change the size of data element or the data type of a data element).
- You may wish to delete information objects (e.g., remove a data element or a table).
- You may wish to resize the objects (e.g., resize partition).
- You may wish to move the objects (e.g., change the physical location of a replication database).

D. ORGANIZATION WILL POWER

1. Change

When we think about change we focus on the need to create a vision and strategy for the change. But even more challenging is what follows the strategy and vision; this is the implementation in which three broad roles involve:

a. Change Strategies

Change strategies is the early work that should be decided before change is started. Upper management identifies the need for change, creates a vision of the desired outcome, decides what change is feasible, chooses who should sponsor, and defends it.

b. Change Agents

Change agents are the CIO and an intranet team who make change happen by managing the day to day process of change. They must respond to the vision from above and the responses from below.

c. Change Recipients

This is the largest group including those who must adopt and change. They determine whether the change will hold. [Jick, 1995]

Change does not occur by following a well-defined path; rather it is a laborious journey on hands and knees toward an elusive goal with many wrong turns and missed opportunities. Only rarely does an organization know exactly where it is going and how to get there. No matter how much thought has gone into the change effort, there will be unforeseen external, uncontrollable and powerful forces that will have a profound impact on the success of the change effort.

2. Reaction to Change

No organization can institute change if its staffs will not, at the very least, accept the change. No change will work if the whole organization does not help in the effort to accept the culture change. In fact, the staffs who have the power to transform every niche of organization need to reach the change. There will be reaction to change from staffs at Iswahjudi AFB when they have to deal with the new information system. According to Jick [1993], there are four stages in which the organization will face when there is a change in an organization.

a. Shock Stage

The first phase what is called "Shock" stage. The staff members are afraid to lose their jobs. They will feel unsafe and timid because they have to do things in a different way. They have to learn a new thing in order to succeed but it takes time.

b. Defensive Retreat Stage

The defensive retreat makes the personnel uncomfortable because they feel the commander or chief information officer is always around them to watch what they do

with the new thing. The crews still have the conventional feeling of working with papers and typewriter or phone for communication. They are not used to sharing information. The fear of sharing information is one of the most difficult disadvantages to deal with. Intranets scare those middle managers who always have hoarded information and refused to share it with their subordinates. These managers are afraid that their jobs are in jeopardy if everyone has information [Hills, 1997].

c. Acknowledgement Stage

The third phase acknowledgement where the personnel begin exploring the pros and cons of the new situation. Each "risk" that succeeds builds the confidence and they are ready for the final gate. The leader should learn that cleaning up and changing operations was not just a matter of fighting but also of winning respect, helping people accomplish improvements. If the upper management works well the organization will feel that the upper manager support them to make their life easier. They acknowledge what the management does for the organization accomplishment.

d. Adapt and Change Stage

The final phase is called "adapt and change." In this phase, the staffs feel the effort comes into its own. They adapt the new way of thinking and working. They are back to high gear where they belong before. There will be a growing sense at the organization that change was possible.

3. Action Plan

An intranet represents a significant departure from computing paradigms that have prevailed for the last 15 years. And in breaking the paradigm, they open up new opportunities for enterprises (the now popular intranet term is "intraprise") to change the business practices. [Gregory and Reingruber, 1996]. This paradigm will have the payoff when the managers manage the result, not people and empowered people are not afraid to try new things. To make sharing and cooperation become the norm, become the culture of organization, and cross-functional teams will become the way of doing projects in the future needs to develop an adaptive culture. There are four steps suggested by Baxley adapt the culture change [1996]:

a. Internalize the Organizational Vision and Values

Iswahjudi AFB has a vision, values, and shared beliefs that affect people's behavior. In an adaptive culture, staffs not only understand the vision but also act on it. This makes a real difference in how they do their work. To achieve this level of personnel activism, one method is to tie people performance evaluations to the goals of the organization, the operation units and the IT department. Another is for IT executives to internalize the vision and values and demonstrate them in their deeds.

b. Communicate

In some cases, people are confident in their IT leadership, sometimes simply because they understand and agree with the company's vision and direction. The CIO as the change agent should make Iswahjudi adaptive culture strong by initiating top down communication.

c. Be Externally Focused

IT department should develop a strong external focus. Do not be too busy talking to each other and play with the new toy. All command under Iswahjudi AFB Commanding Officer need to become leaders who can empower the whole organization.

d. Encourage Innovations and Appropriate Risk-Taking

In this situation, people are generally afraid to take risks because of the fear of failure and punishment. In an adaptive culture, staffs are willing to take risks and think creatively. Encourage the people to take risk as long as it is considerable. Since crews are more in-tune with the vision, they know in their hearts the right risks to take. The quantum leaps of improvement can occur as a result of these innovations.

VI. INTRANET PROTOTYPE FOR ISWAHJDUI AFB

A. BACKGROUND

Record numbers of personnel are generating a surge in the Indonesian Air Force chain of command at the Iswahjudi AFB. The information flows slowly because the data for every activity are kept in separate places. Iswahjudi AFB does not have advanced computerization. Manual paper work is still common and familiar in all aspect of activities. Most data are available in flat files including the personnel records. In the past, a flat file from word processor or spreadsheet was used to provide a means of looking up individuals and viewing their personnel status over time. This file was of limited value because little to no personnel information was contained in the record. More over, the flat file is difficult to maintained and updated. Few individuals actually used this file because it went out of date and became obsolete.

Over the years there has been a continuing need for a file that would not just do what the previous file did but would support a host of other user requirements such on-line transaction using Web browser. This prototype is meant to choose the right middleware to integrate data files using web technology. The database will consist of all personnel records from eleven divisions at Iswahjudi Air Force Base. This enables users to store, modify, and pull out information from the database. It will affect how quickly and flexibly the data can be extracted as useful information. The DBMS includes form and report to enables users to enter data and get the output respectively. This prototype includes the integration of database using web technology to front-end so the data input and/or output can be done using a Web browser on an intranet. Security will involve PCs and servers that have both LAN and modem connections. It is designed to limit damage to the corporate LAN through modem connections. One way is to use passwords for access to input or update by authorized personnel only. The other users will be able to query the database but still need the password because the data are confidential to the military operation.

B. DATABASE MANAGEMENT SYSTEM

The author used Microsoft Access Professional 7.0 as the Database Management System. There are three databases used to build the prototype. The first database

maintains all the personnel records. The other two databases are used to handle the authentication for the user to access the database on-line using Web browser. The purpose of building three separate databases is to make sure each database does not interfere with each other during transaction.

1. Personnel Database

The personnel database consists of 25 tables to hold all personnel histories for eleven divisions. A complete listing of the tables and relationship are in Appendix A. To simplify updating and managing data entries there exists one or more tables for each entity. This database has 70 forms to facilitate data entry and obtain the reports. The familiar interface is built to make this database as a "stand alone" package. Database queries are automated through self-explanatory menus that issue a query and produce reports at the click of a button. Later in this chapter the author will explain the on-line transaction using middleware.

2. Authentication Database

There are two databases built to handle authentication in on-line transaction:

a. Administration Database

Administration database only has one table to handle authentication for on-line transaction. The table contents all the usernames and passwords to gain access to the Iswahjudi database main page. The values in the attributes username and password are compared to the login name and password entered by the user. If both user entered values match those in the user table, access to the main page is granted otherwise the message "try again" will appear.

b. Data Entry Database

Data entry database also has one table to handle authentication for on-line transaction. This table provides the access to data entry page for personnel records, flight hour data entry, and personnel detail data. The purpose of this authentication is to give only to specific users access for data entry and personnel detail. This authentication is used as the second barrier to the database.

C. WEB ACCESS

In the Web's architecture, the browser comprises the GUI tier; the Web server is the middle tier containing application logic with ties to back-end databases; and application servers are the third tier [Hill, 1997]. Users only need Web browser that has familiar interface to access database. By using Web access to database, the client machine does not need database networking software. Web also makes information available to anyone on an intranet without worrying kind of platforms are used.

The interaction of database to the Web browser, ColdFusion Application Server 4.0 plays the major role. The ColdFusion Application Server integrates the Web server (Microsoft Information Server 4.0) with the ODBC (Open Database Connectivity). ODBC driver is needed for database interaction. The ColdFusion Application Server runs as a multi-threaded system service and handles all the dynamic processing. HTML (Hypertext Markup Language) is used to allow users to specify links to documents inside Iswahjudi intranet. These links specifications are then interpreted by a Web browser which enables users to access pages as universal clients. A web browser can do all this with the single click of a mouse. Besides, the document has "hyperlink" from any document to any number of other documents or data files distributed across a network. File structure is on Appendix B.

1. Mainpage

Iswahjudi mainpage (Figure 9) is the main gate to entire sites at Iswahjudi AFB. Microsoft Front Page 98 is used to build all the pages. From the mainpage, user can tailor the information provided by using buttons and hyperlinks. The hyperlinks will bring the user to specific page including the search engine.

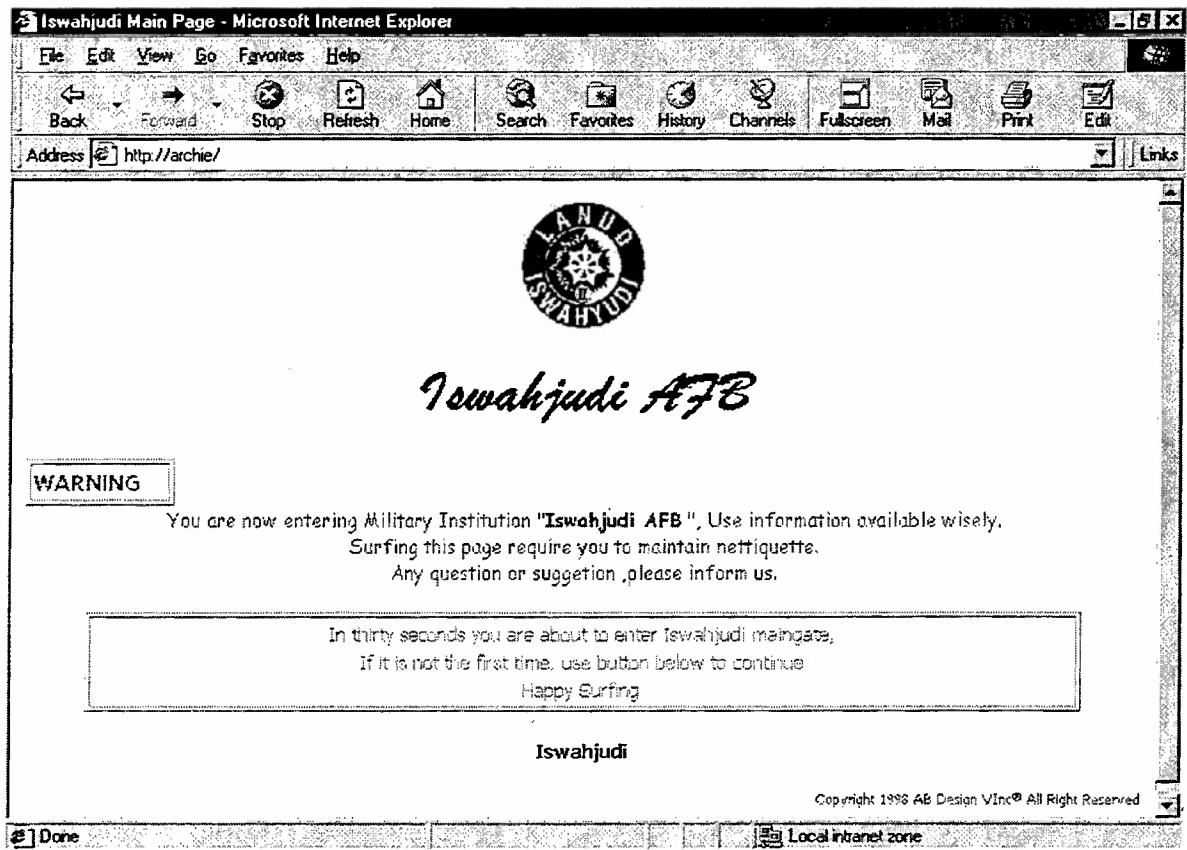


Figure 9. Iswahjudi Main Page

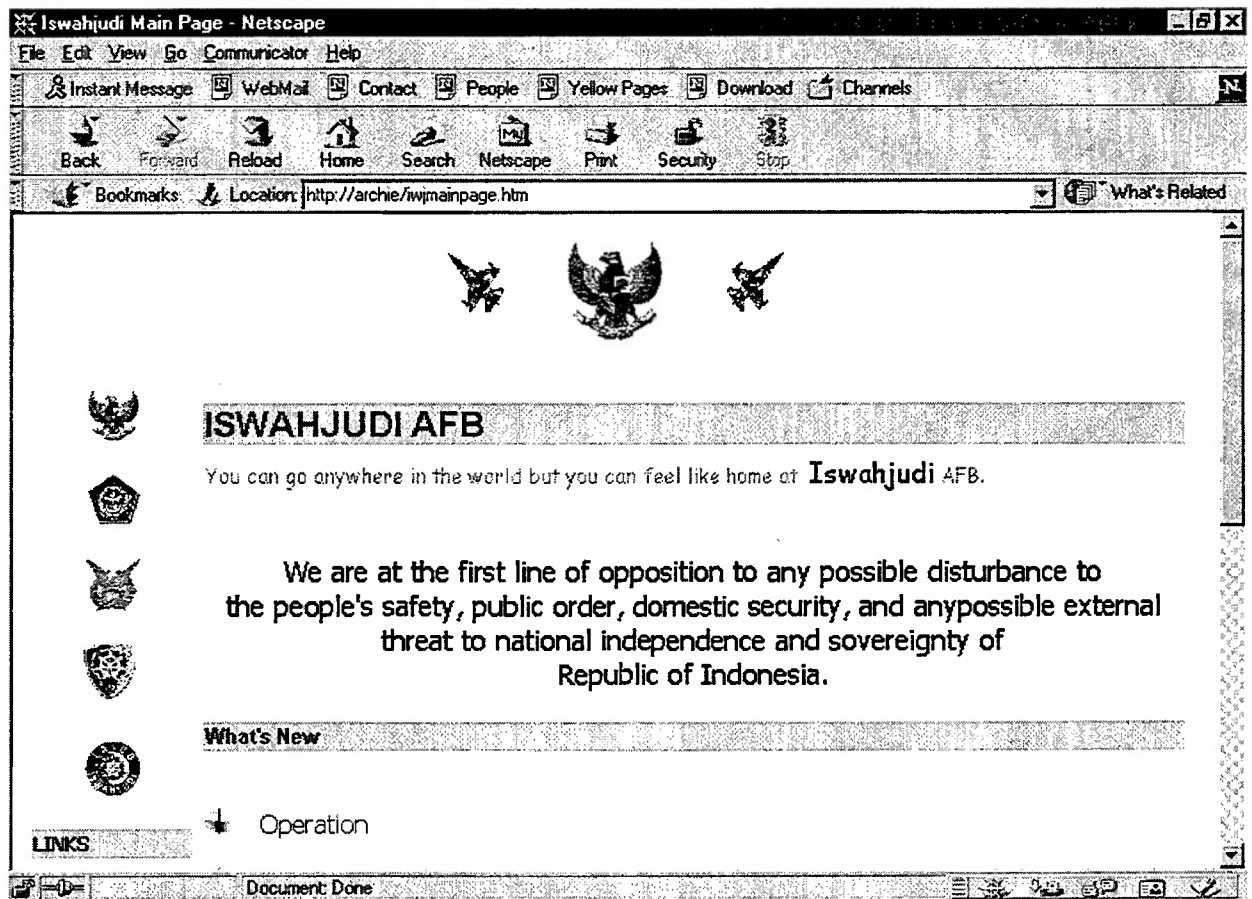


Figure 10. Iswahjudi Hyperlinks

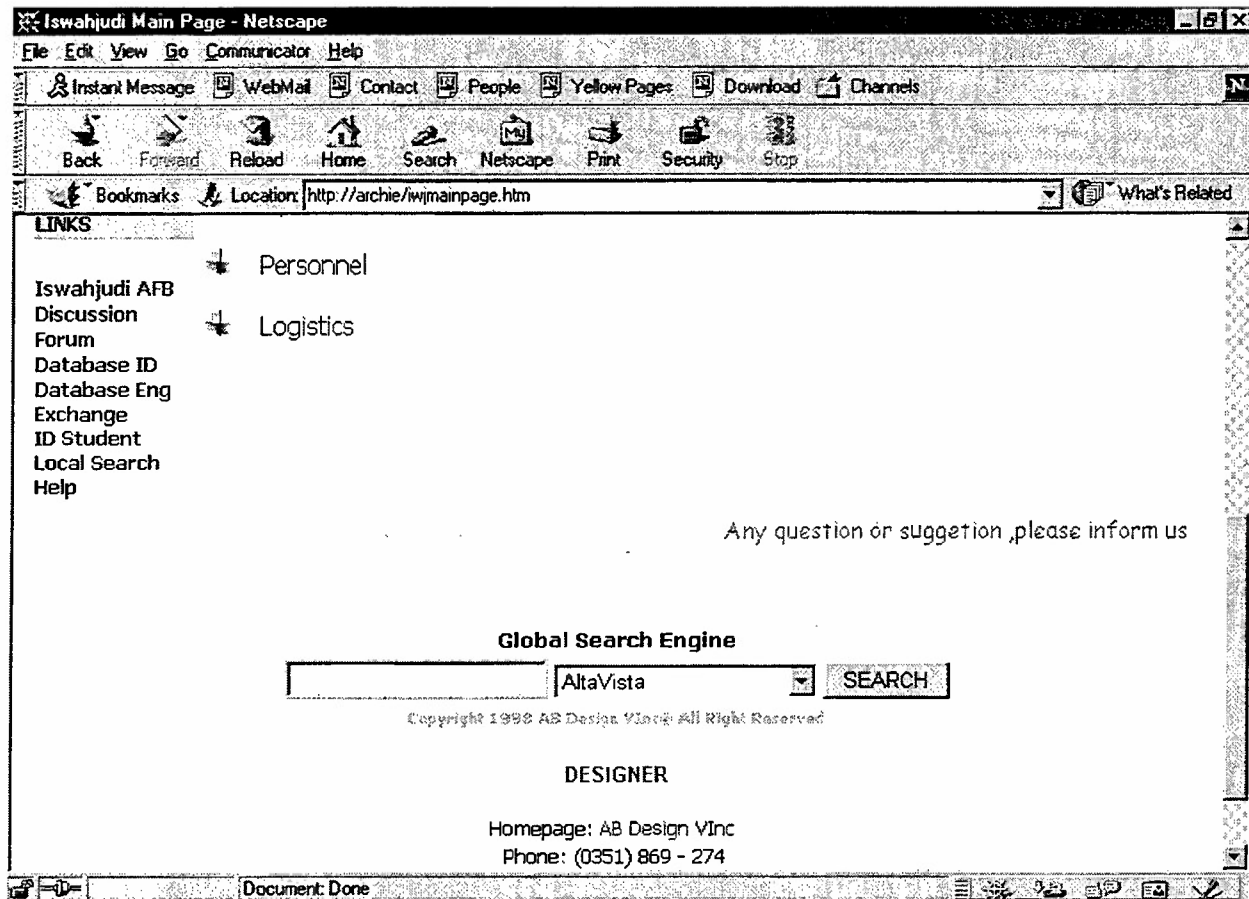


Figure 11. Iswahjudi Hyperlinks cont'd

2. Search Engine

Search engine for this intranet uses Verity's Search97 technology which is integrated with ColdFusion Application Server. It supports for searching binary file format such as word processing files, spreadsheet, text-based files. Verity's search functionality centers around a concept of a collection. A Verity collection is, quite simply, a mass of documents that Verity tracks and makes searchable [Forta, 1998]. There are four pages to handle this search engine. The search form, result, index, and openfile. Before the user can find specific files the Verity collection should be indexed.

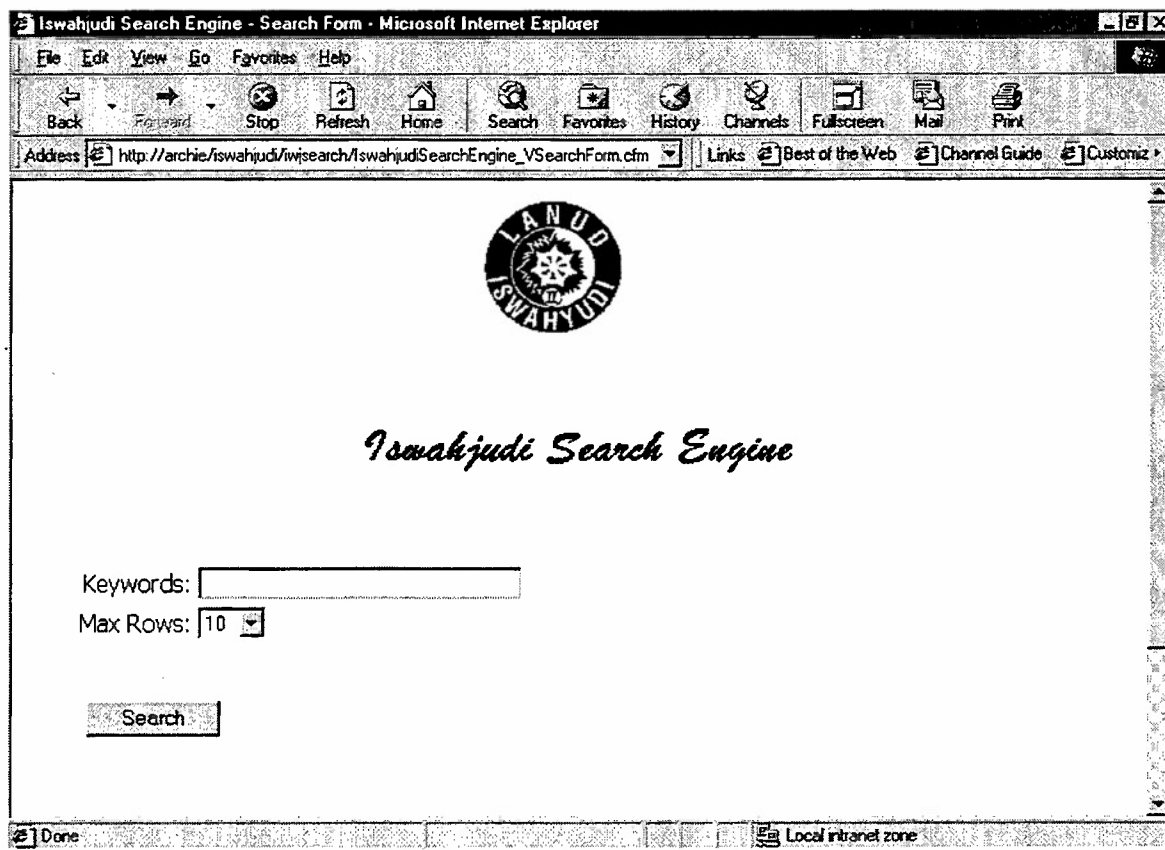


Figure 12. Iswahjudi Search Engine

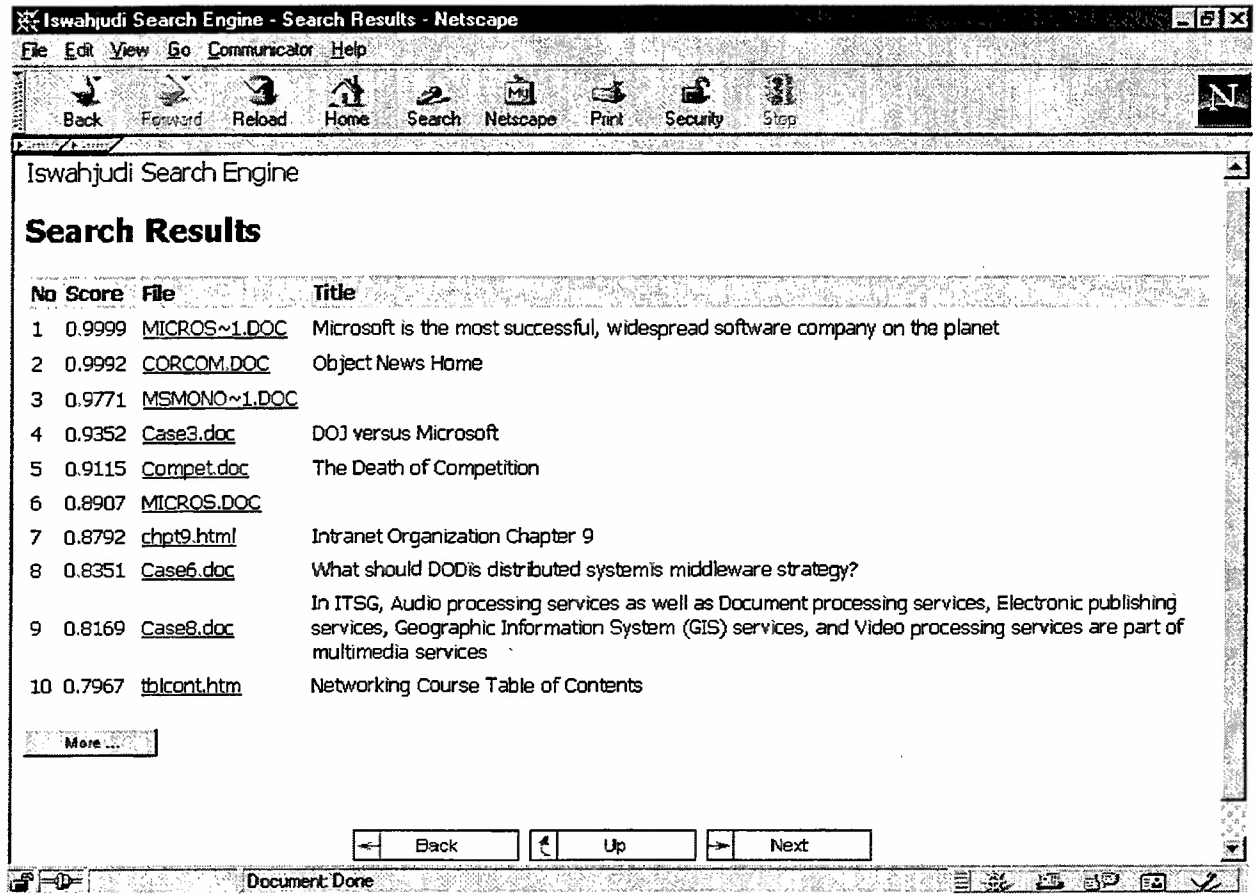


Figure 13. Iswahjudi Search Engine Result

3. Discussion Forum

Microsoft Front Page 98 has the facility to accommodate discussion forum. swahjudi discussion forum is used to discuss everything from general to specific. Access to discussion forum does not need passwords so everyone can post his message and anyone can answer it. This discussion forum is similar to Newsgroup.

4. Database

Before building Web pages for database on-line transaction, Microsoft Access database should be registered to ODBC. ColdFusion recognizes this registered database. ColdFusion Application Server provides a wizard to build data entry or query pages from tables and queries in a database. Actually, we do not need to build fancy database to make it available on-line because ColdFusion builds applications by combining standard HTML with a straightforward server-side markup language, the ColdFusion Markup Language. ColdFusion is an ODBC client so it uses standard database language SQL (Standard Query Language). In Microsoft Access, ColdFusion uses Access driver. In fact, most of codes implemented in CFML tags are standard SQL as seen in Appendix C.

Database on-line transaction Supports SQL queries or other interactive retrieval, display, and updating of database information. When users access database page, they are required to pass the usernames and password in Login page. Not all the users can make data entry or query the database, it depends on an authorization listed in authentication database. This on-line transaction also available for record updated. When user makes an entry to a database, user IP address and time when user makes an entry will be logged and e-mail will be sent to administrator.

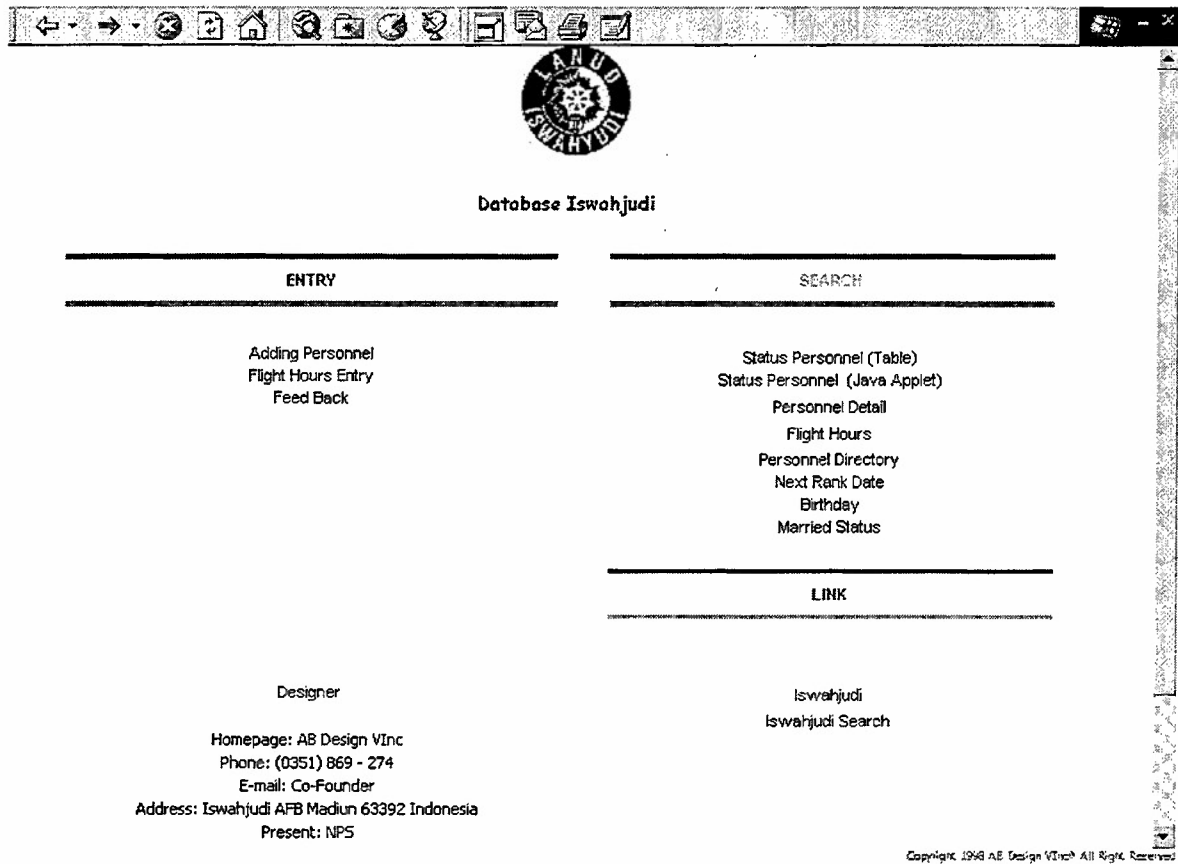


Figure 14. Iswahjudi Database Main Gate

This prototype includes all the personnel reports as we can see from Figure 15. On the left frame, there are three choices for data entry, data update, and data query. When user clicks on one bullet in data entry, hyperlink will bring user to the entry page where the user can add records. While the button under data query is used to query the result or other transaction such as detail personnel data, rank history, military education, etc. Other page has the ability to delete the records from database (Figure 16) but this feature should be implemented very carefully because once the record has been deleted from database, the user can not undo the operation.

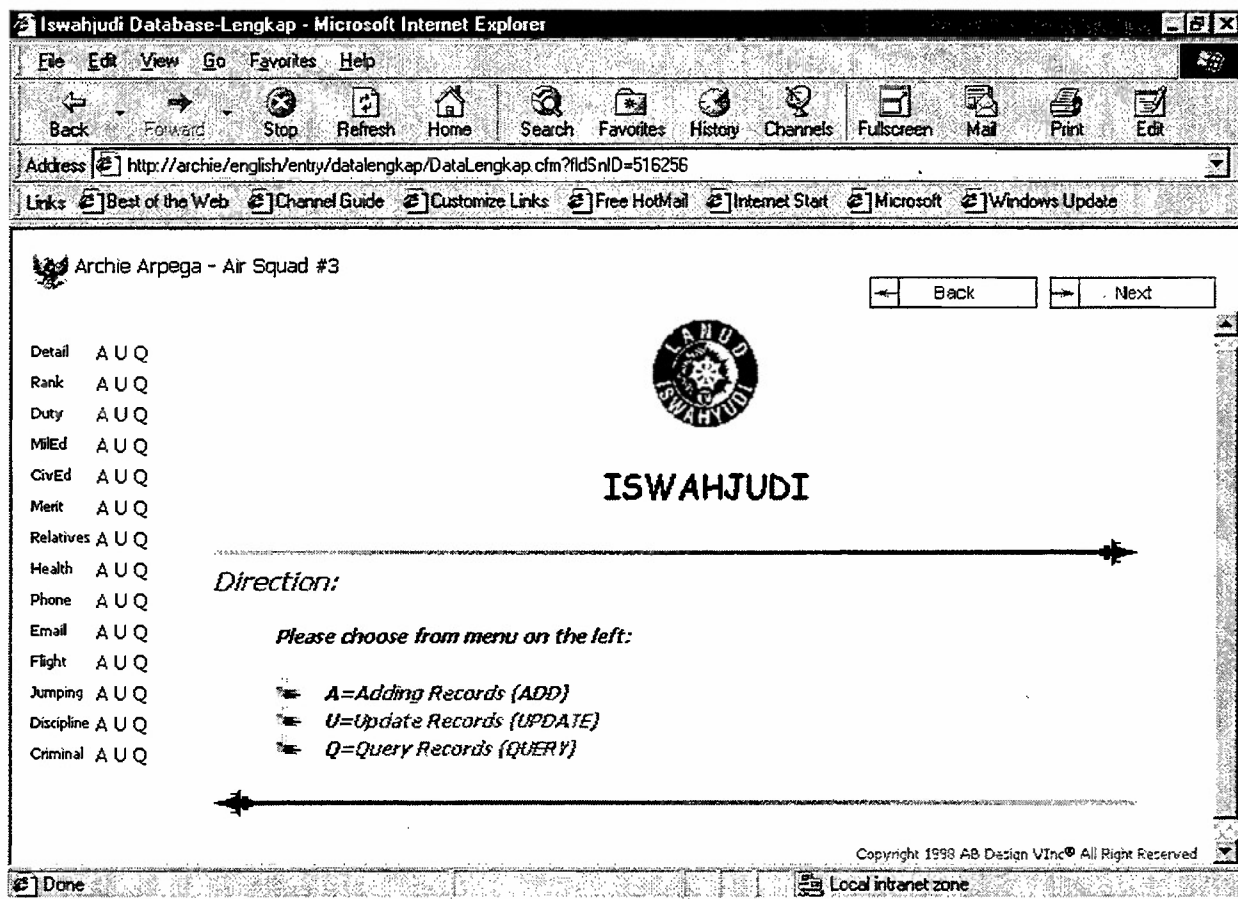


Figure 15. Data Entry and Drill Down Query



ISWAHJUDI

Be Alert You can not UNDO deleted records...

Personnel			
NAME	DIVISION	STATUS	CHOICES
Abradan Kirno	Depo Ammo 60	FOB5	Edit OR Delete
Adam Rangkuti	Operation	FOB1	Edit OR Delete
Akupuntur	Avi Squad #01	FOB1	Edit OR Delete
Amrullah Asnawi	Logistics	FOB2	Edit OR Delete
Aneka Roma	Train Squad #103	FOB7	Edit OR Delete
Arbi Romorangkit	Hospital	FOB1	Edit OR Delete
Archie Arpega	Air Squad #3	FOB1	Edit OR Delete
Armando	Air Squad #3	FOB1	Edit OR Delete
Armando Soga	Hospital	FOB1	Edit OR Delete
Arsad	Personnel	FOB6	Edit OR Delete
Arumaroka	Logistics	FOB2	Edit OR Delete
Add Personnel			

NUMBER OF PERSONNEL = 11

Wednesday, 03 February 1999, 22:56:21

[<](#) Back

[Next >](#)

Figure 16. Add, Update, and Delete Page

Archie Arpega - Air Squad #3

Back Next

Detail Records of Archie Arpega

Detail	A U Q	NAME :	Archie Arpega
Rank	A U Q	RANK :	Letkol
Duty	A U Q	CORP :	Pnb
MilEd	A U Q	SN ID :	516256
CivEd	A U Q	DIVISION :	Air Squad #3
Ment	A U Q	POSITION :	Komandan
Relatives	A U Q	STATUS :	FOB1
Health	A U Q	TITLE :	SD
Phone	A U Q	DATE DUTY :	11 March 1995
Email	A U Q		
Flight	A U Q		
Jumping	A U Q		
Discipline	A U Q		
Criminal	A U Q		
		OFF PHONE :	1087
		HMO PHONE :	1986

Wednesday, 03 February 1999, 22:53:56

Figure 17. Detail Personnel Records



ISWAHYUDI

NAME	<input type="text"/>
RANK	<input type="text"/>
CORP	<input type="text"/>
POSITION	<input type="text"/>
DIVISION	<input type="text"/>
GROUP	<input type="text"/>
STATUS	<input type="text"/>
MAX ROW	10 <input type="text"/>

SEARCH RESET

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Figure 18. Typical Query Form

NO	NAME	RANK	CORP	ID	POSITION	DIVISION	STATUS
1	Losgiutri	Kapten	TEK	548754	Kasiman	Headquarter	FOB3
2	Nogodino	KoloneI	TEK	504222	Kadislog	Logistics	FOB1
3	Amrullah Asnawi	Mayor	TEK	506598	Kasiharpes	Logistics	FOB4
4	Sonnyarto	Kapten	TEK	502132	Kasilogic	Logistics	FOB1
5	Senen Lagi	Letda	TEK	565666	Logistics	Logistics	FOB1
6	Harmono Rusman	Letda	TEK	486556		Logistics	FOB1
7	Tukang Barang	Serka	TEK	502333		Logistics	FOB1
8	Lobo	Prada	TEK	1230333		Logistics	FOB1
9	Arumaroka	I/b	TEK	1524215421		Logistics	FOB1
10	Eric Zellars	Letkol	TEK	562154		Air Squad #3	FOB1
11	Armando	Peltu	TEK	565245		Air Squad #3	FOB2
12	Zaeroni	Sertu	TEK	530333	Anggota	Air Squad #3	FOB1
13	Joko Cahyono	Serda	TEK	589625		Air Squad #14	FOB1
14	Gupala	Kapten	TEK	514254		Train Squad #103	FOB1
15	Konata	Letda	TEK	564254		Train Squad #103	FOB1
NEXT 15							

NUMBER OF PERSONNEL = 26

Friday, 15 January 1999, 06:47:03

Back Next

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Figure 19. Query Result

D. TRAINING

What makes the Web browser so useful is that it is intuitive and requires no training: just point and click. Except for the persons who operate personnel database as a stand alone application. Iswahjudi personnel database has an encouraging graphical user interface that make it easy to administer. However, trained administrators and webmasters are needed to maintain the whole intranet.

E. SITE MAINTENANCE

Probably the best way to manage an intranet may be to have an internal vanguard team that functions as consultants and advisors to the rest of the organization on web technology. It is likely that such a team might be assembled from the ranks of IS, network services, or other groups that have an IT orientation. Or you may want to pick individuals from various disciplines, such as technical communications, marketing communications, database services, corporate communications, and IS. [Bernard,1997] The responsibilities of an internal vanguard team could be quite diverse, but would probably include:

- promoting the use of web technology within the organization
- helping train employees in how to use the technology;
- developing standards and templates for web page design to promote a more consistent interface and level of quality
- developing standards and templates for offline tools that feed content into the web
- researching and recommending productivity tools that will help automate web publishing and programming functions
- dealing with software licensing and distribution for various common web tools, such as browser and servers
- evaluating and critiquing the contribution of different departments to the overall Web
- answering questions and providing support functions such as a 24-hour help center or on-line discussion groups where people can get their questions answered

- advising departments on innovative ways to apply web technology to specific applications
- providing the technical expertise where needed to develop more advanced applications such as interactive forms, CGI programs, and database integration
- keeping track of changes in the Web, possibly by certifying Web sites or providing a registration form
- creating and maintaining high-level menus or search tools that provide a centralized path for accessing all Web resources
- assisting in managing the overall Web, including broken link analysis and usage reporting
- an internal consulting group set up to perform these tasks can help promote organization goals without creating a centralized bureaucracy. At first it may be that such a group exists independently of IS, since in many cases an Intranet is considered a foreign concern to IS. It may be that someday this evolves into a department that actually swallows the IS function completely

VII. INTRANET SECURITY

A. THE STATE OF SECURITY

The security of organization computer network is a term that has both a business meaning and a technical meaning. Security depends on proper administration of systems, client and server, as well as observation of related business procedures, physical access control and audit functions. Today's corporate networks are built from many different computer and operating systems. Operating systems are working together and many times open links from a system to another do exist. Thus a break-in into one system may give access to another systems also. Two small security defects in different systems that look very harmless alone can lead into great security threat when put together in a certain environment [Laamanen, 1998]. By opening a host system to Web users means being ultra-prepared and never letting down the guard. In addition to that, organization must impose guidelines for themselves and their employees to prevent from improper use of technological resources. Many times because there are no guidelines so no one knows what is right and what is wrong. The most network break-ins come from inside the organization. It gets more dreadful when considering that more and more sensitive data is traversing organization Web sites. Especially when integrating an intranet with a legacy system - a host typically loaded with highly confidential, proprietary organization information - that fact gets downright frightening [Blass, 1998]. To understand security means we must understand the points of vulnerability.

Security strategies should not be based on current or future products or technology. They need to be based on the functional needs and risks of the organization. The toughest part of developing a security strategy is determining what needs to be secured, and from whom. Security is not free. Every time the security level is tightened, the organization pays in terms of increased complexity of access, increased response time and reduced communication. As stated above, security is a balance of value, risk and practicality. Before developing a strategy it is important to understand something about the concept of risk. [Tellen, 1998]

As Intranets become the primary computing infrastructure in organizations, the issue of availability becomes increasingly important. In a very real sense, the network now is the computer, and all the requirements we had for single image systems apply to the distributed systems and network interconnections that make up the Intranet. If a part

of the system between the user and the information the user needs is not working, the enterprise function in which the user is engaged is in jeopardy.

B. INTRANET SECURITY

When an intranet is connected to the Internet, an intranet becomes more vulnerable. In olden days, brick walls were built between buildings and wood houses so that if a fire broke out, it would not spread from one building to the next. Quite naturally, these brick walls were called firewalls. In today's modern networks, such as the Internet, a similar approach can be used to guard the valuable network resources against the hazards ("fire") that result in loss of competitive or other vital information. The devices that prevent the network and resources from this "fire" on the outer "walls" of the network are called firewalls [Anan, 1998].

Firewall is hardware and software combinations that block intruders from access to an intranet while still allowing people on an intranet to access the resources of the Internet. Servers and routers are the primary components of firewalls. Most firewalls use some kind of packet filtering. In packet filtering, a screening router or filtering router looks at every packet of data travelling between an intranet and the Internet [Gralla, 1996]. Routers play a major role in firewalls. Routers are the first filtering from the Internet to an intranet. Every transaction from both sides must pass the routers.

Proxy servers are another important tool in the fight of intranet security. They allow people on an intranet to get to the Internet resources but proxy servers act as a kind of go-between. The proxy servers evaluate the request against authorization database and if the request is acceptable, the proxy contacts the Internet. The returning page also passes through proxy server from the Internet and passes it to the person who requested it. Proxy server also can keep a record of all transactions, and provides a trail to track any kind of attacks. [Gralla, 1996]

Another kind of server for intranet security is a bastion server. A bastion server is configured especially to resist attacks. Frequently, it is put on its own subnetwork, known as a perimeter network. That way, if the bastion server is attacked and broken into, an intranet is still shielded. [Gralla, 1996]

Finally, viruses are a major concern to organization running an intranet. Viruses can naturally spread between different operating systems. They can reproduce always when the application is started. Of course the file system permissions can be set in such a

way that the harm will be minimized. Viruses are usually spread between users through e-mail attachments or unknown resource software. Administrators should be on the look out for a new strain of computer virus that can wreak havoc on the networks [Burns, 1999]. Remote Explorer virus is the first new class of virus that can readily move across the networks found in January 1999. This virus encrypts executable, text and HTML files on NT system rendering the files unreadable. Unlike typical virus strains, Remote Explorer can transport itself from one networked machine to another without the user's help. To protect the computers from viruses, administrators should always check for the new patch from vendors or joint the newsgroups available in the Internet.

The rationale for installing firewall is almost always to protect a private network against intrusion. In most cases, the purpose of the firewall is to prevent unauthorized users from accessing computing resources on a private network, and often to prevent unnoticed and unauthorized export of proprietary information. In some cases export of information is not considered important, but for many corporations it is a major factor. Many organizations will want simply to address the problem by not connecting to the Internet at all.

C. ISWAHJUDI ON-LINE SECURITY

Before opening a Web-to-host link, make sure intranet has been appropriately secured. This means addressing the issues of authentication, authorization, accounting and availability - not only in terms of policy but also in practice. For example, require passwords for all network access. Make guest accounts a thing of the past. Assign each login ID to one person only. Make sure network activities logged by Web servers are attributable to specific individuals. One way to meet accountability conditions is using passwords protected for specific pages. One login ID does not mean full access to the whole network. ColdFusion Application Server 4.0 development services also provide the infrastructure for secure remote development across an intranet. It uses Integrated Authentication System in existing user authentication systems in Lightweight Directory Access Protocol (LDAP) directories and Windows NT.

Iswahjudi intranet prototype is using two databases to handle usernames and passwords. The first database controls authorized personnel to access the main page but the user can only do simple query such as to find out how many personnel are on base or how many people who got married. The second database is used to authorize the user to

data entry and detail query. Login ID might be the same but passwords are different, so only specific user can make data entry to database or access to personnel detail data.

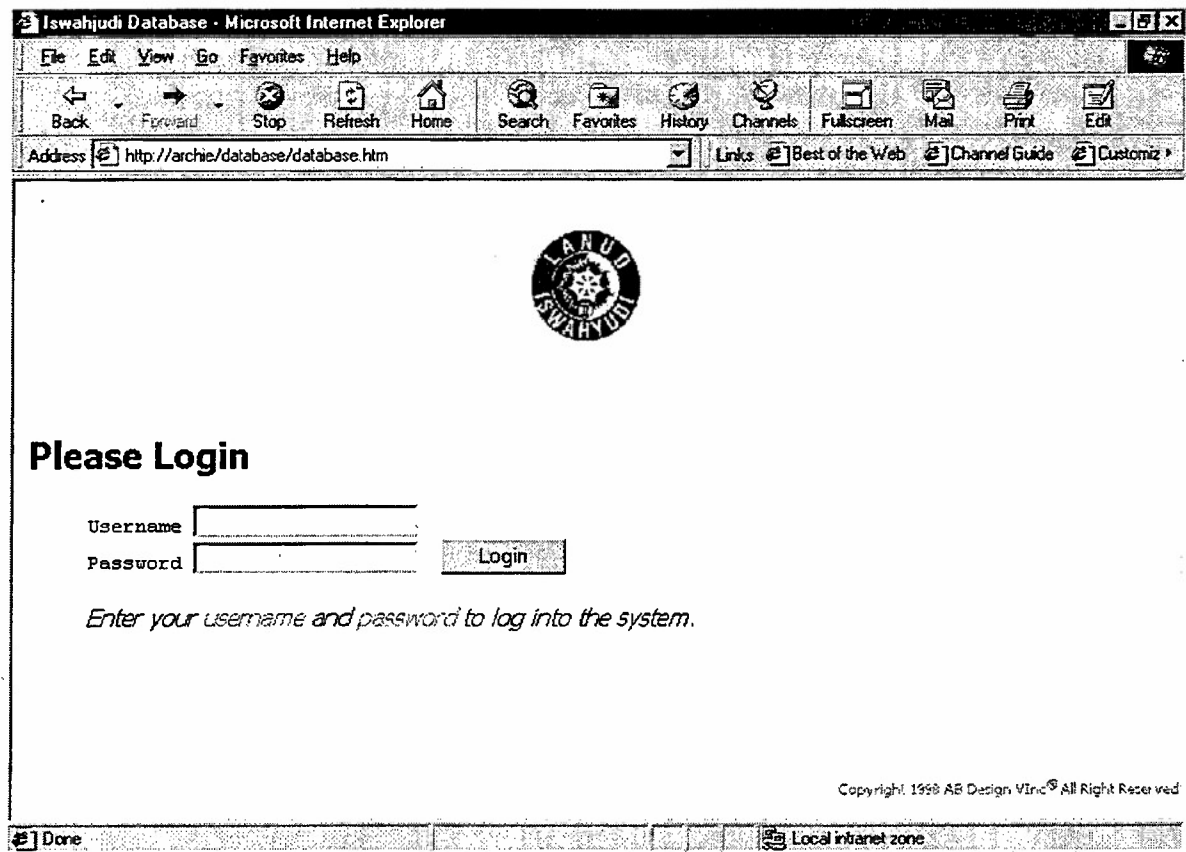


Figure 20. Authentication Page

Whenever user accesses ColdFusion pages (CFM extension) via Web browser, there is one file called APPLICATION.CFM will check the user's host. This type of authorization is to make sure the user's host is within the boundary of the IP addresses approved by application.cfm. If the user's host is not authorized, the message "Unauthorized Host Detected" will come up and the page automatically backs off within twenty seconds. When unauthorized detected, e-mail will be sent to administrator telling that there is an unauthorized entry to the page with the user's IP address, time detected, and the user's browser. There is also e-mail generated by ColdFusion Application Server when there is an unauthorized entry to Coldfusion page. This e-mail can be applied if organization network has an e-mail server and the name of e-mail server should be registered to ColdFusion Application Server through ColdFusion administration page.

Below is the e-mail generated by ColdFusion when there is an unauthorized host detected to CFM page.

Subject: Unauthorized Detected
Date: Fri, 8 Jan 1999 21:46:02 -0800
From: detector@abdesign.com
To: aasnawi@nps.navy.mil

Hi AM..
Unauthorized Detected at 08-Jan-99 09:46 PM
Client IP address is 131.120.50.220
Client browser is Mozilla/4.5 [en] (Win98; I)
Virtually,
AB Design VInc

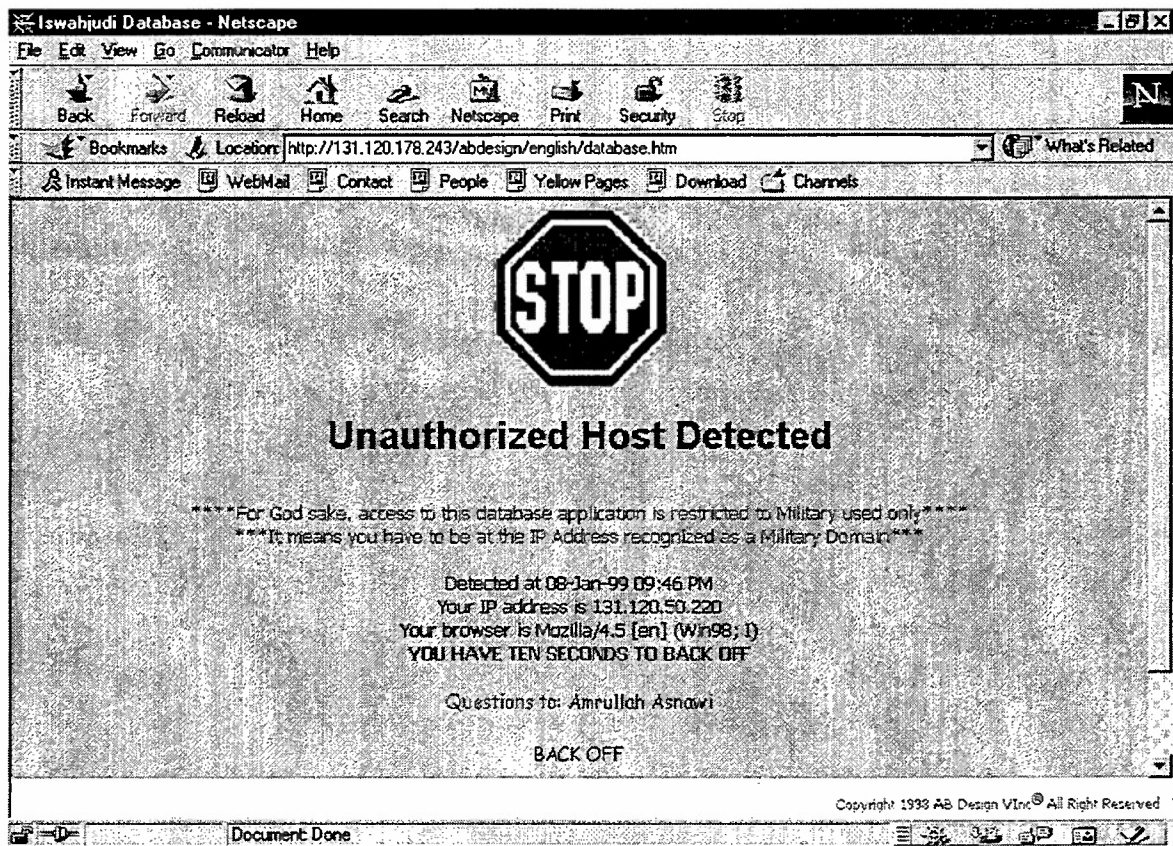


Figure 21. Unauthorized Host Detected Page

D. SECURITY SUMMARY

To reduce the attack to an intranet, Tallen [1998] suggested:

- view security pragmatically, based on the consequences and likelihood of a failure
- have an official policy and plan
- publicize expectations and sanctions
- monitor and audit continuously
- visibly prosecute violators
- use outside experts to provide a broader experience base and remove blinders

VIII. CONCLUSIONS

A. SUMMARY

An intranet makes the information system decentralized. People can access any information available on-line without knowing where the information is stored. Using Web technology, people are empowered to deliver information inclusively. Empowerment is making people help themselves, which means they have knowledge, tools, and techniques to do what need to be done to make the system work.

An internal web can provide an excellent way to unify the remote operations of an organization and increase the ease, frequency, and quality of inter-departmental communication. But this will not happen on its own without careful planning. The administrator should pay close attention and take responsibility for developing an overall web strategy. The one fact most agree on, however, is that choosing the right tools is critical to the success of Web technology environment. When it comes to web technology selection, as a professional, the application must be transparent to the entire data-sharing to be considered successful and it must provide added value for the organization. Working within this paradigm, network must accept information or data and translate it with guaranteed delivery.

The need to organize information in such a way using Web technology can provide a quick answer to a multitude of questions such as human resources, training schedule, report standard, new event, and etc. Information from such a resource leads to the reconciliation of long-standing pay and benefit issues. Perhaps the greatest value of this project is the practical implementation of the on-line database. Database could also be a reporting system that could produce manpower aggregation useful for official reporting.

Web technology is not designed for security flawless. When computers are connected, they are vulnerable to the hackers from inside or outside organization. Applying security in several layers will make hackers take longer time to break-in. So the concept of computer security using Web technology must be able to protect the inside information from unauthorized access. Passwords and IP address protecting scheme is only small software protection besides firewall and proxy server. An encryption is also suggested to protect confidential information when it is sent via the network.

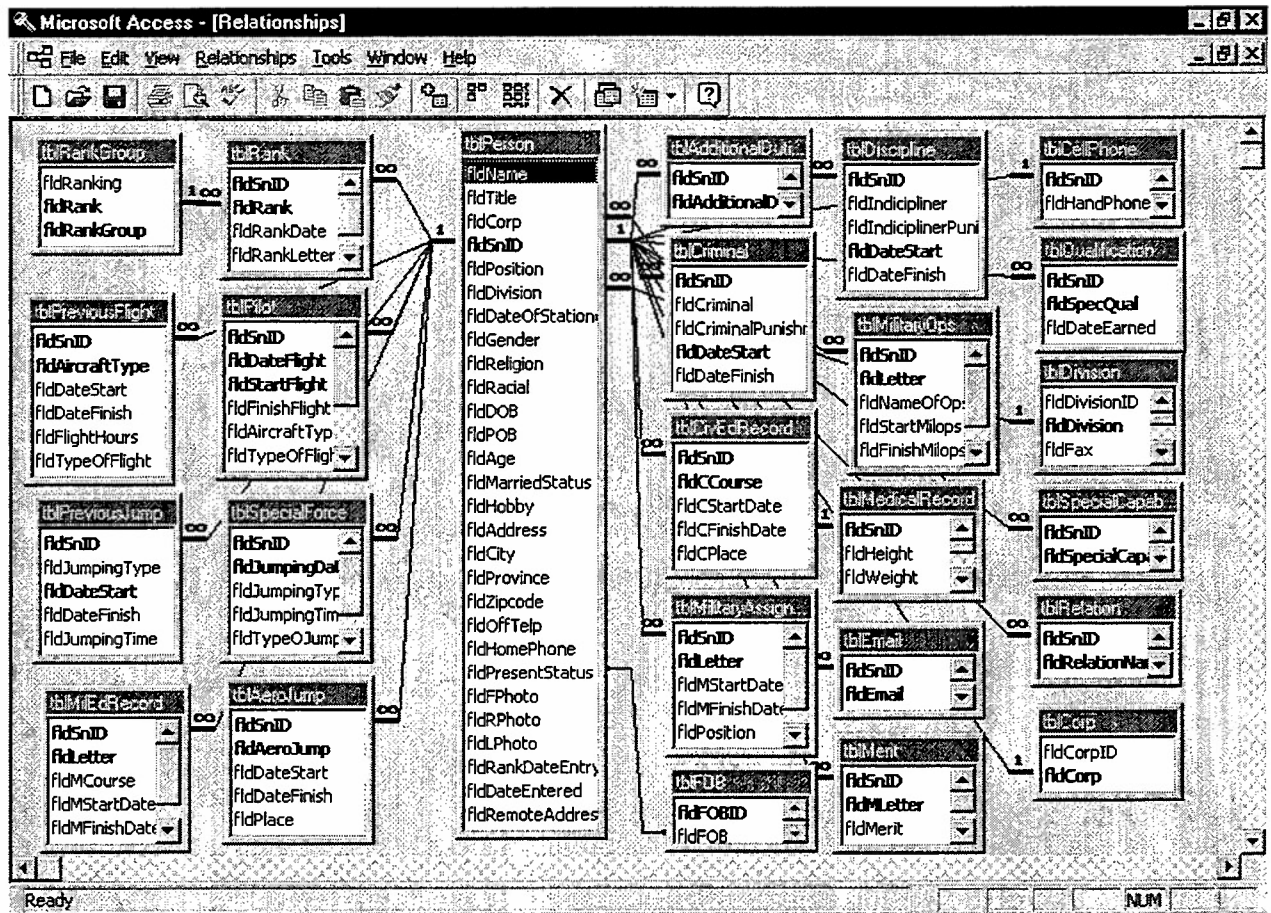
Top management needs to take a strong and active leadership role in developing strategies to gain a benefit from information technology. The value of information technology is high today and is expected to be even more important in the future. Computers are potentially more powerful than ever because they can be linked to virtually any source of stored information through modems that convert the data, graphics like photos and text, into electronic signals.

B. FUTURE RESEARCH

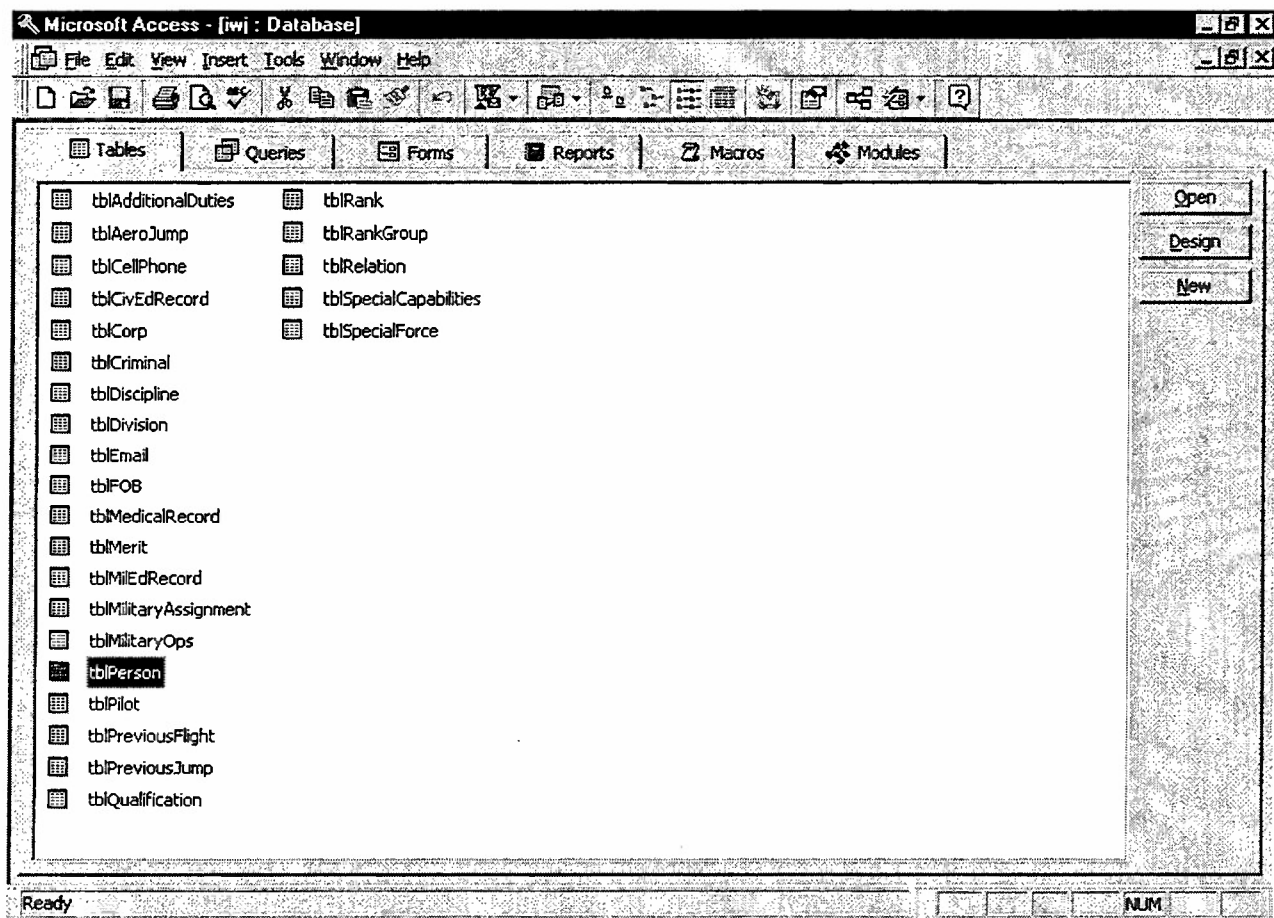
In building the prototype, the author uses access database from Microsoft Corp. In the event that the records become big, access database is not sufficient enough to handle high transaction. Upsizing Microsoft access database to SQL Server to expand the database might be a good choice if we want to stick to Microsoft product, otherwise migrate to Oracle is also preferred.

Another area for future research is connecting Iswahjudi AFB intranet to the Internet using Private Virtual Network (PVN) to enhance the information technology parallel with the growing of Web technology. Private Virtual Network allows an intranet to communicate with another intranet usually called extranet using public switch telephone network (PSTN) but provides privacy, preclude unauthorized access, and prevents denial of service.

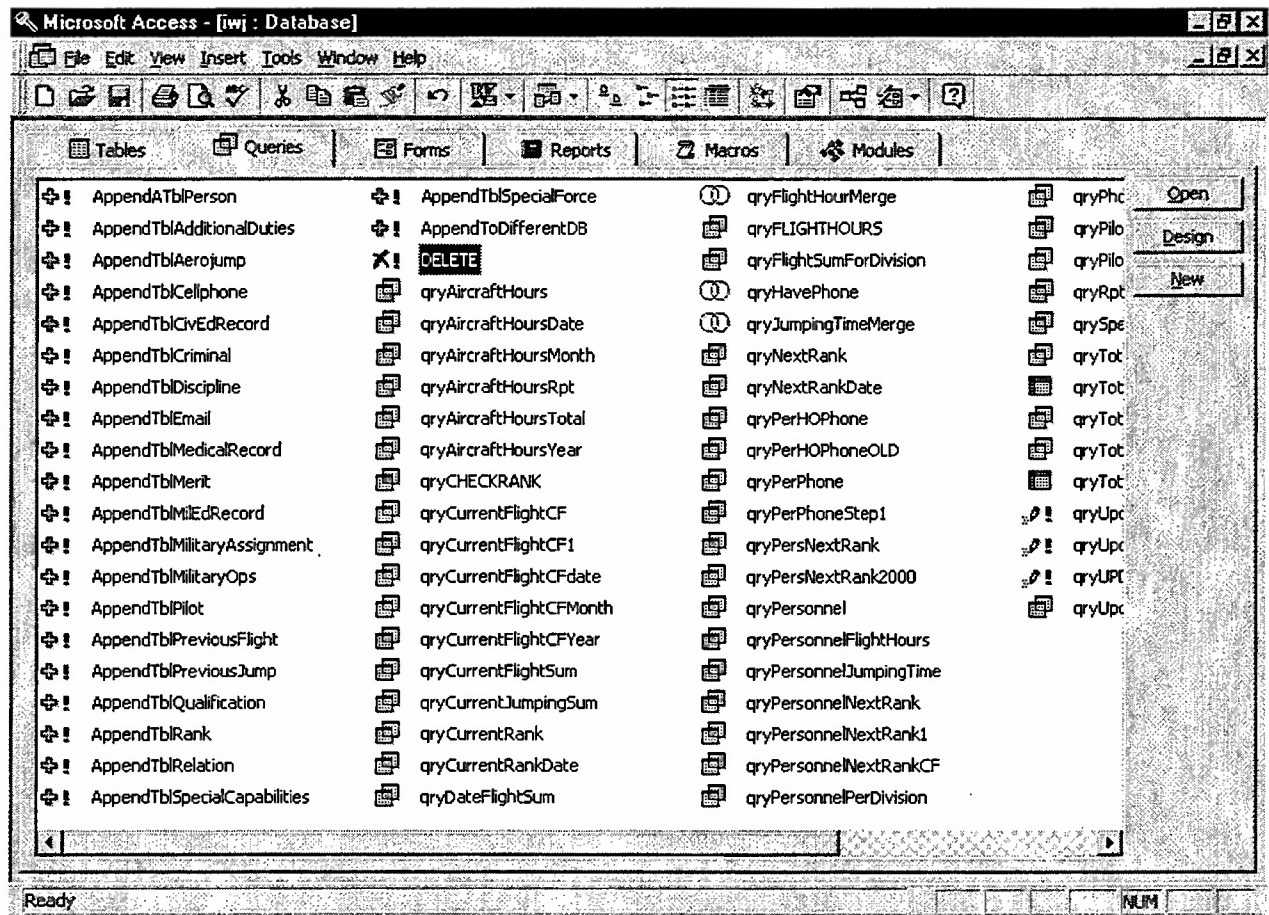
APPENDIX A: DATABASE



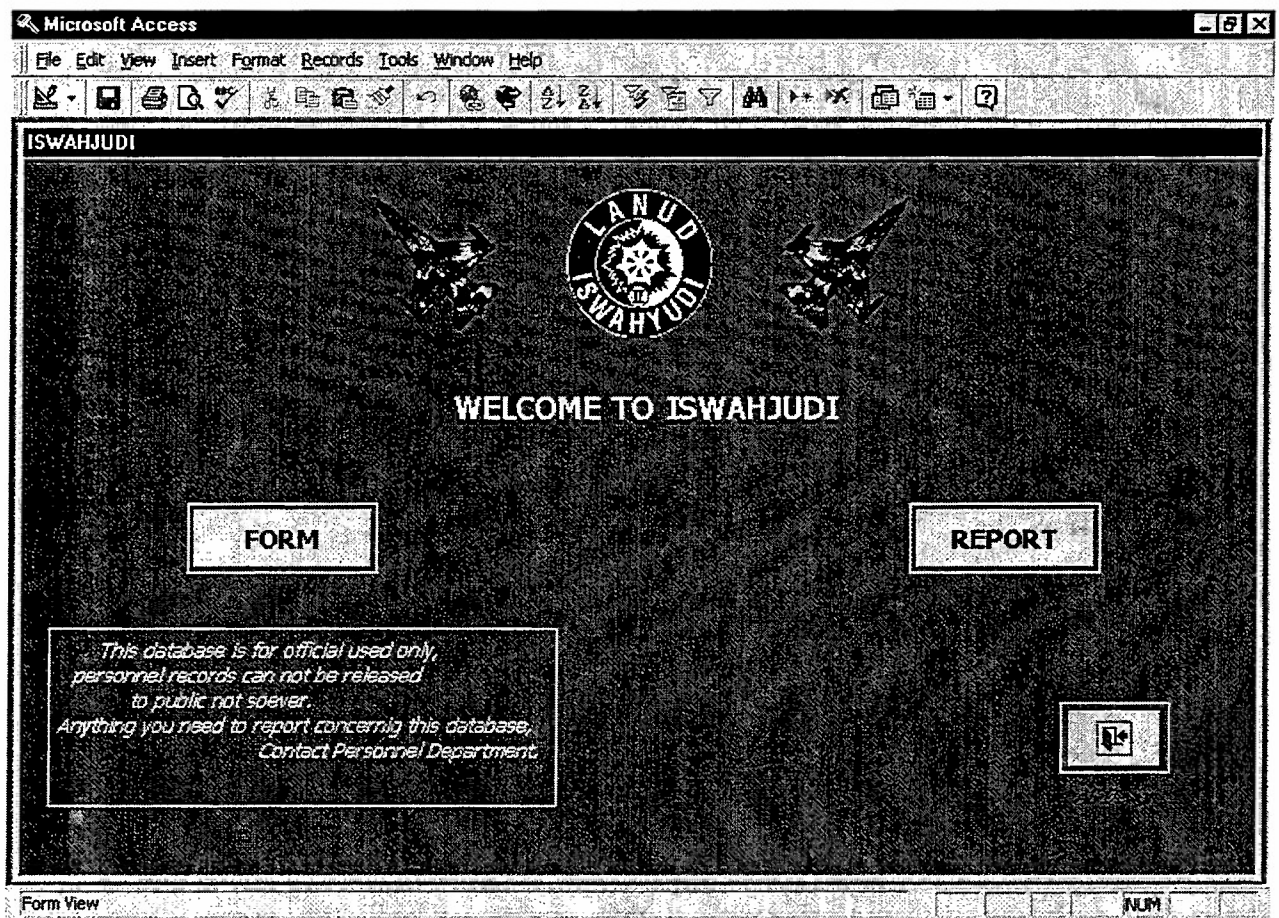
Iswahjudi Database Relationship



Database Tables



Database Queries




Database Mainpage

Microsoft Access

File Edit View Insert Format Records Tools Window Help

ISWAHJUDI

 PERSONNEL RECORDS ENTRY

DIV #1		
DIV #2	DIV #5	
DIV #3	DIV #6	DIV #9
DIV #4	DIV #7	DIV #10
	DIV #8	DIV #11
		DIV #12

Form View


CAPS NUM

Form Menu

Microsoft Access

File Edit View Insert Format Records Tools Window Help

REPORT

 PERSONNEL REPORT

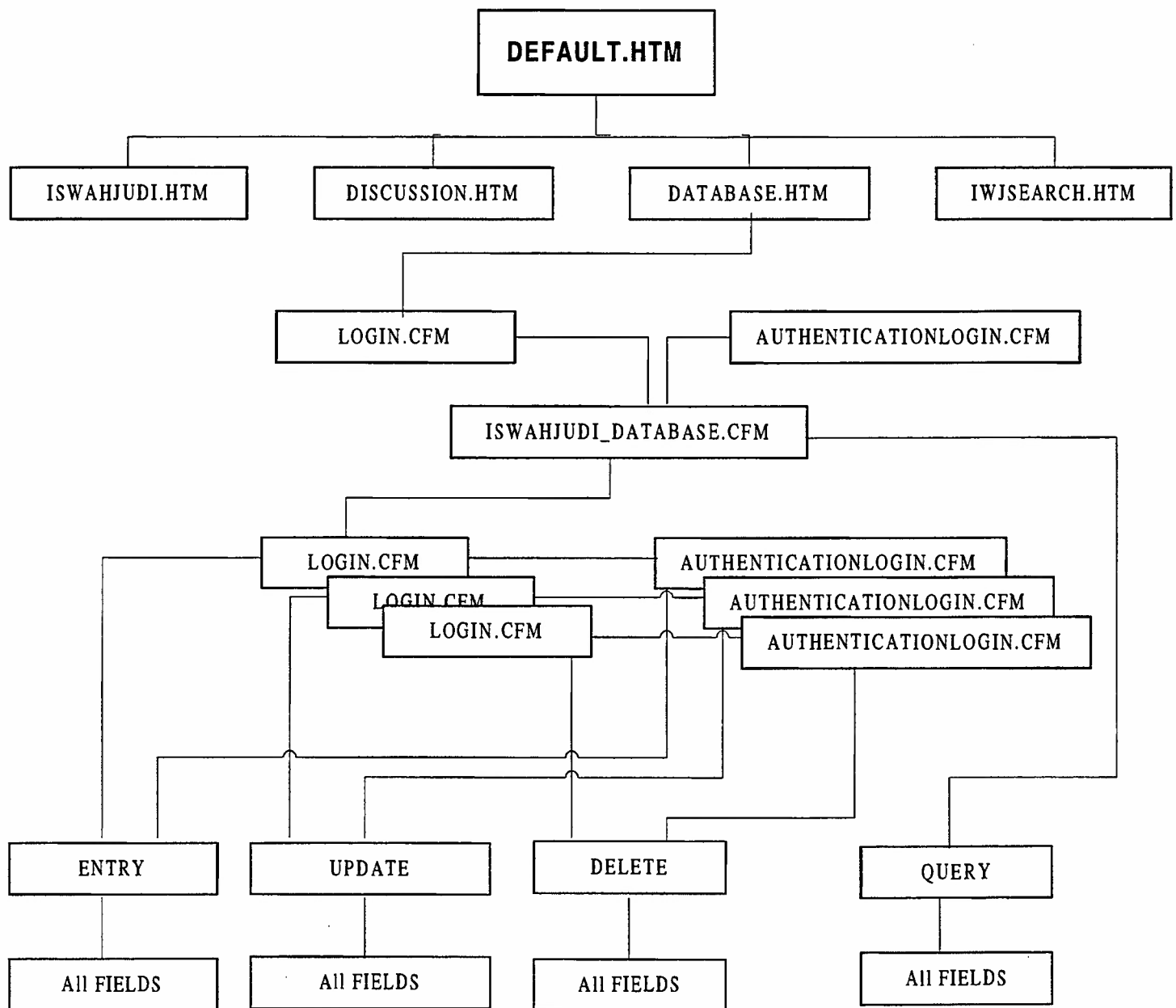
DETAIL	FLIGHT	1 Status 2 Birthday 3 Rank Promotion 4 Specialization
STATUS	JUMP	
DIRECT	VIEW	
LABEL	FLIGHT BY DATE	
RANK	JUMP BY DATE	
RANK BY DATE	PRINT	
	A/C HOURS	

Form View

NUM

Report Menu

APPENDIX B: FILE STRUCTURE



APPENDIX C: COLDFUSION SOURCES CODE

```
<!------->
FILE NAME      : AUTHENTICATIONLOGIN.CFM
AUTHOR         : Amrullah Asnawi
DATE           : March 1999
PROJECT        : Master Thesis in Master of Science in Information Technology Management
                  at Naval Postgraduate School Monterey, California, USA
GRADUATION     : March 1999
DESCRIPTION    : Check whether the Username and Password are from client cookies or whether they are
                  coming from the login form. This file should be included in protected file.
-->
<CFIF #ParameterExists(FORM.Username)# IS "YES" AND #ParameterExists(FORM.Password)# IS
"YES">
    <CFQUERY NAME="GetUserRecord" DATASOURCE="adm">
        SELECT * FROM Users, Clients
        WHERE Username = '#FORM.Username#' AND
        Password= '#FORM.Password#'
    </CFQUERY>

    <DBCOKIE NAME="Username" VALUE="#FORM.Username#" EXPIRES=1>
    <DBCOKIE NAME="Password" VALUE="#FORM.Password#" EXPIRES=1>

<CFELSEIF #ParameterExists(Cookie.Username)# IS "YES" AND #ParameterExists(Cookie.Password)#
IS "YES">
    <CFQUERY NAME="GetUserRecord" DATASOURCE="adm">
        SELECT * FROM Users
        WHERE Username = '#Cookie.Username#' AND
        Password= '#Cookie.Password#' </CFQUERY>

<CFELSE>
    <CFQUERY NAME="GetUserRecord" DATASOURCE="adm">
        SELECT * FROM Users WHERE User_ID = 0 </CFQUERY>
</CFIF>
<!------->
    Check whether user record was found. If not force a new login.
-->
<CFIF #GetUserRecord.RecordCount# IS NOT 0>
    <CFSET Client_ID = #GetUserRecord.Client_ID#>
<CFELSE>
    <CENTER>
    <B><font face="Tahoma" color="Red">***Maaf!!! Kemungkinan <font
color="Blue">Username</font> atau <font color="Blue">Password</font> anda salah***<br>
    COBA LAGI</font></B>
    </CENTER>
    <DBINCLUDE TEMPLATE="login.cfm">
    <CFABORT>
</CFIF>
```

```

<!-------
FILE NAME      : LOGIN.CFM
AUTHOR         : Amrullah Asnawi
DATE           : March 1999
PROJECT        : Master Thesis in Master of Science in Information Technology Management
                  at Naval Postgraduate School Monterey, California, USA
GRADUATION     : March 1999
DESCRIPTION    : Perform authorization to log into the system
----->

<HTML>
<HEAD><TITLE>Login</TITLE></HEAD>
<BODY>
<br>
<p align="center"><img SRC="/images/iswahjudi.gif" width="75" height="75" alt="Lambang kejayaan
Lanud Iswahjudi"> </p>

<CENTER><H1>ISWAHJUDI</H1></CENTER>

<H2><font face="Tahoma" color="Blue">Please Login</font></H2>

<!-------
The below login form checks for the existence of Username and Password cookies
and pre-fills then into the login form if it exists.
----->

<FORM ACTION="iswahjudi_database.cfm" METHOD=POST>
<PRE>
    Username <INPUT TYPE="text" NAME="UserName"
                  <CFIF #ParameterExists(Cookie.Username)# IS
"Yes">VALUE=<CFOUTPUT>#Cookie.Username#</CFOUTPUT>"</CFIF>>
    Password <INPUT TYPE="password" NAME="Password"
                  <CFIF #ParameterExists(Cookie.Password)# IS
"Yes">VALUE=<CFOUTPUT>#Cookie.Password#</CFOUTPUT>"</CFIF>> <INPUT
TYPE="submit" VALUE=" Login ">
</PRE>

<BLOCKQUOTE>
<I>
    Enter your <font color="Red">username</font> and <font color="Fuchsia">password</font> to
log into the system.
</I>
</BLOCKQUOTE>
</FORM>

</BODY>
</HTML>

```

<!------->

FILE NAME : FOB.CFM
AUTHOR : Amrullah Asnawi
DATE : March 1999
PROJECT : Master Thesis in Master of Science in Information Technology Management
at Naval Postgraduate School Monterey, California, USA
GRADUATION : March 1999
DESCRIPTION : Search FORM for personnel status

----->

```
<html>

<head>
<title>Status Personil</title>

</head>

<body>

<p align="center"> </p>

<h3 align="center"><font color="#0000FF" face="Tahoma">ISWAHJUDI</font></h3>

<p></p>

<!--<CFINCLUDE TEMPLATE="authenticatelogin.cfm"> -->

<form ACTION="/fobnama.CFM" METHOD="POST">
<INPUT TYPE="hidden" NAME="StartRow" value="1">
  <div align="center"><div align="center"><center><table width="669">
    <tr>
      <td ALIGN="right" width="120"><div align="left"><p><font
color="#00FF40"><b>NAMA</b></font></td>
      <td width="540"><div align="left"><p><input TYPE="text" NAME="tblPerson__fldName"
SIZE="15" MAXLENGTH="40"></td>
    </tr>
    <tr>
      <td ALIGN="right" width="120"><div align="left"><p><font
color="#00FF40"><b>PANGKAT</b></font></td>
      <td width="540"><div align="left"><p><input TYPE="text" NAME="qryCurrentRank__fldRank"
SIZE="8" MAXLENGTH="40"></td>
    </tr>
    <tr>
      <td ALIGN="right" width="120"><div align="left"><p><font
color="#00FF40"><b>KORP</b></font></td>
      <td width="540"><div align="left"><p><input TYPE="text" NAME="tblPerson__fldCorp" SIZE="6"
MAXLENGTH="40"></td>
    </tr>
  </tr>
</div>
</div>
</form>
```

```
  |
```



```

        <option> </option>
        <option>FOB1</option>
        <option>FOB2</option>
        <option>FOB3</option>
        <option>FOB4</option>
        <option>FOB5</option>
        <option>FOB6</option>
        <option>FOB7</option>
    </select></td>
</tr>
<tr>
    <td ALIGN="right" width="120"><div align="left"><p><font color="#00FF40"><b>MAX
BARIS</b></font></p></div></td>
    <td width="540"><div align="left"><p><select NAME="MaxRows" SIZE="1">
        <option>10</option>
        <option>15</option>
        <option>20</option>
        <option>25</option>
        <option>50</option>
        <option>100</option>
    </select></p></div></td>
</tr>
</table>
</center></div><div align="center"><center><p></p>
</center></div></div><div align="center"><center><p><br>
<input TYPE="submit" VALUE="C A R I" name="Search"> <input TYPE="reset" VALUE="RESET"
name="Reset"></p>
</center></div>
</form>
</body>
</html>

```



```

<!-------
FILE NAME      : FOBNAMA.CFM
AUTHOR        : Amrullah Asnawi
DATE          : March 1999
PROJECT       : Master Thesis in Master of Science in Information Technology Management
               : at Naval Postgraduate School Monterey, California, USA
GRADUATION    : March 1999
DESCRIPTION   : Perform search result from database to find personnel status
----->

```

```

<!--<CFSET MaxRows = 10>-->

```

```

<!-- Initialize all fields if they do not exist --->

```

```

<CFPARAM NAME="StartRow" DEFAULT="1">
<CFPARAM NAME="fldName" DEFAULT="">
<CFPARAM NAME="fldRank" DEFAULT="">
<CFPARAM NAME="fldCorp" DEFAULT="">
<CFPARAM NAME="fldDivision" DEFAULT="">
<CFPARAM NAME="fldPosition" DEFAULT="">
<CFPARAM NAME="fldPresentStatus" DEFAULT="">
<CFPARAM NAME="fldRankGroup" DEFAULT="">

```

```

<CFQUERY DATASOURCE="iwj" NAME="fobnama">

```

```

    SELECT tblPerson.fldName,qryCurrentRank.fldRank,tblCorp.fldCorp,
           tblPerson.fldSnID,tblPerson.fldDivision,tblPerson.fldPresentStatus,
           tblPerson.fldPosition, tblRankGroup.fldRankGroup

```

```

    FROM tblPerson,qryCurrentRank,tblRankGroup, tblDivision, tblCorp

```

```

    WHERE qryCurrentRank.fldSnID = tblPerson.fldSnID AND qryCurrentRank.fldRank =
           tblRankGroup.fldRank AND tblDivision.fldDivision = tblPerson.fldDivision AND
           tblCorp.fldCorp = tblPerson.fldCorp

```

```

    <CFIF #tblPerson__fldName# IS NOT "">
    AND tblPerson.fldName LIKE '#tblPerson__fldName#%'
</CFIF>

```

```

    <CFIF #qryCurrentRank__fldRank# IS NOT "">
    AND qryCurrentRank.fldRank LIKE '#qryCurrentRank__fldRank#%'
</CFIF>

```

```

    <CFIF #tblPerson__fldCorp# IS NOT "">
    AND tblPerson.fldCorp LIKE '#tblPerson__fldCorp#%'
</CFIF>

```

```

<CFIF #tblPerson__fldDivision# IS NOT "">
    AND tblPerson.fldDivision LIKE '#tblPerson__fldDivision#%'
</CFIF>

<CFIF #tblRankGroup__fldRankGroup# IS NOT "">
    AND tblRankGroup.fldRankGroup LIKE '#tblRankGroup__fldRankGroup#%'
</CFIF>

<CFIF #tblPerson__fldPresentStatus# IS NOT "">
    AND tblPerson.fldPresentStatus LIKE '#tblPerson__fldPresentStatus#%'
</CFIF>

<CFIF #tblPerson__fldPosition# IS NOT "">
    AND tblPerson.fldPosition LIKE '#tblPerson__fldPosition#%'
</CFIF>

ORDER BY tblDivision.fldDivisionID, tblRankGroup.fldRanking, tblCorp.fldCorpID

</CFQUERY>

<!--Now assemble the HTML of the Results Page -->

<HTML>
<HEAD><TITLE>ISWAHJUDI</TITLE></HEAD>
<BODY>
<CENTER><IMG SRC="/images/iswahjudi.gif" width="75" height="75"
alt="Lambang kejayaan Lanud Iswahjudi"></CENTER>
<br>
<CENTER><H1>ISWAHJUDI</H1></CENTER>
<br>

<H5><font face="Tahoma" color="Navy">Status Personil</font></h5>
<hr align="CENTER" size="2" width="750" color="FF0000">

<center>
<TABLE BORDER = "1">
<TR bgcolor="cccccc">
<TH><b>NO</b></TH>
<TH><b>NAMA</b></TH>
<TH><b>PANGKAT</b></TH>
<TH><b>KORP</b></TH>
<TH><b>NRP/NIP</b></TH>
<TH><b>JABATAN</b></TH>
<TH><b>KESATUAN</b></TH>
<TH><b>STATUS</b></TH>
</TR>

<CFOUTPUT QUERY="fobnama" STARTROW = "#StartRow#" MAXROWS = "#MaxRows#">
<CFSET PrevStart = StartRow - MaxRows>
<CFSET NextStart = StartRow + MaxRows>
<TR>

```

```

<font face="Tahoma">

<TD>#Evaluate(CurrentRow)#</TD>
<TD>#Trim(fldName)#</td>
<TD>#Trim(fldRank)#</td>
<TD>#Trim(fldCorp)#</td>
<TD>#Trim(fldSnID)#</td>
<TD>#Trim(fldPosition)#</td>
<TD>#Trim(fldDivision)#</td>
<TD>#Trim(fldPresentStatus)#</td>

</tr>

</CFOUTPUT>
<TR>

<CFSET NextStart = StartRow + MaxRows>
<CFSET PrevStart = StartRow - MaxRows>

<TD COLSPAN="4" ALIGN="LEFT" >
<CFIF PrevStart GTE 1>

<CFOUTPUT>

<FORM ACTION="fobnama.CFM" METHOD="POST">
<INPUT TYPE="hidden" NAME="StartRow" VALUE="#PrevStart#">
<INPUT type="hidden" name="MaxRows" value="#MaxRows#">
<!--<INPUT type="hidden" name="StartRow" value="#Evaluate(StartRow - MaxRows)#">-->
<INPUT TYPE="hidden" NAME="tblPerson__fldName" VALUE="#tblPerson__fldName#">
<INPUT TYPE="hidden" NAME="qryCurrentRank__fldRank" VALUE="#qryCurrentRank__fldRank#">
<INPUT TYPE="hidden" NAME="tblPerson__fldCorp" VALUE="#tblPerson__fldCorp#">
<INPUT TYPE="hidden" NAME="tblRankGroup__fldRankGroup"
VALUE="#tblRankGroup__fldRankGroup#">
<INPUT TYPE="hidden" NAME="tblPerson__fldPosition" VALUE="#tblPerson__fldPosition#">
<INPUT TYPE="hidden" NAME="tblPerson__fldDivision" VALUE="#tblPerson__fldDivision#">
<INPUT TYPE="hidden" NAME="tblPerson__fldPresentStatus"
VALUE="#tblPerson__fldPresentStatus#">
<input TYPE="submit" VALUE="PREVIOUS #MaxRows#">
</FORM>

</CFOUTPUT>
</CFIF>

<TD COLSPAN="4" ALIGN="RIGHT" >
<CFIF NextStart LTE fobnama.RecordCount>

<CFOUTPUT>

<FORM ACTION="fobnama.CFM" METHOD="POST">
<INPUT TYPE="hidden" NAME="StartRow" VALUE="#NextStart#">
<INPUT type="hidden" name="MaxRows" value="#MaxRows#">
<!--<INPUT type="hidden" name="StartRow" value="#Evaluate(StartRow + MaxRows)#">-->

```

```

<INPUT TYPE="hidden" NAME="tblPerson__fldName" VALUE="#tblPerson__fldName#">
<INPUT TYPE="hidden" NAME="qryCurrentRank__fldRank" VALUE="#qryCurrentRank__fldRank#">
<INPUT TYPE="hidden" NAME="tblPerson__fldCorp" VALUE="#tblPerson__fldCorp#">
<INPUT TYPE="hidden" NAME="tblRankGroup__fldRankGroup"
VALUE="#tblRankGroup__fldRankGroup#">
<INPUT TYPE="hidden" NAME="tblPerson__fldPosition" VALUE="#tblPerson__fldPosition#">
<INPUT TYPE="hidden" NAME="tblPerson__fldDivision" VALUE="#tblPerson__fldDivision#">
<INPUT TYPE="hidden" NAME="tblPerson__fldPresentStatus"
VALUE="#tblPerson__fldPresentStatus#">
<input TYPE="submit" VALUE="NEXT #MaxRows#">
</FORM>

</CFOUTPUT>
</CFIF>
</TD>
</TR>
</TABLE>
</center>
<hr align="CENTER" size="2" width="750" color="0000FF">
<CFOUTPUT>
<blockquote>
<h5><font face="Tahoma">JUMLAH PERSONIL = #fobnama.RecordCount#</font></h5>
</blockquote>
</CFOUTPUT>

<CFOUTPUT>
<blockquote>
<p><small><font color="blue" face="Tahoma">#DateFormat(now(), "DDDD, DD MMMM YYYY")#,
#TimeFormat(now(), "HH:MM:SS")#</font></small></p>
</blockquote>
</cfoutput>
<!--Inform user that no results were retrieved if no records found-->
<center>
<CFIF #fobnama.RecordCount# IS 0>
<H3><font face="" color="Red">Personil yang anda cari tidak ada di database</font></H3>
<P><font face="Tahoma" color="Teal">Silahkan melanjutkan perjalanan dengan memilih tombol
dibawah ini</font></p>
</CFIF>

<p><a href="../../database.htm" target="_top"></a>

<a href="/iswahjudi/iswahjudi.htm" target="_top"></a></p>

</center>

</BODY></HTML>

```

APPENDIX D: CHECKLIST TO BUILD AN INTRANET

This checklist provides a good guide for business to build an intranet. However, non-business oriented organization can use some points of this checklist to implement Web technology. Organization should also conduct further study in advance to get maximum boost performance of an intranet to satisfy the needs [Hills, 1997].

1. Determine and develop infrastructure needs:
 - a. Identify needs
 - 1) People with skills to administer and support TCP/IP
 - 2) Network infrastructure to support the level of traffic expected
 - 3) Additional bandwidth
 - 4) Outsourcing to get bandwidth on demand
 - 5) Network management tool to document and analyze an intranet
 - b. Remote locations and remote users
 - 1) Ways for remote locations and remote users
 - a) Dedicated leased line
 - b) Non-dedicated dial-up or switched access
 - (1) Dial-up analog modem
 - (2) ISDN (Integrated Services Digital Network)
 - (3) Frame relay
 - (4) ATM (Asynchronous Transfer Mode)
 - 2) Other technologies for remote access
 - a) Dedicated leased line
 - b) ADSL
 - c) Cable modem
 - d) DBS
 - 3) Virtual Private Networks (VPNs)
 - a) To link remote locations
 - b) To allow suppliers and customers to access an intranet
2. Determine security need and implement security
 - a. Security methods
 - 1) Firewalls

- 2) Encryption
 - b. An intranet and the Internet security policy should be stated including regular virus scanning and virus protection tools
3. Evaluate and select an ISP (Internet Service Provider)
- a. Locate
 - 1) The list
 - 2) Ask for feedback on the Usenet group, alt.internet.services
 - 3) Commerce Net's ISP directory
 - b. Evaluate-eight criteria
 - 1) Orientation: Does this provider focus on the needs of businesses?
 - 2) Quality of service: Is the service reliable, available, and high performance?
 - 3) Points of presence: Is the network point of presence close to the site?
 - 4) Service product range: Does the ISP provide a wide range of services that will meet all of the needs?
 - 5) Value-added capabilities: What value-added capabilities do they offer
 - 6) Support: Do they have 24-hour-per-day, 7-day-per-week network operation center? Do they have personnel who focus only on the needs of business customers? Do they provide all the services your need?
 - 7) Experience: How long have they been an ISP? Is this their main business? How many business customers do they have and are those customers happy?
 - 8) Cost: Determine the range of prices and select a provider that is not at either extreme
4. Select and install hardware and software
- a. Servers
 - 1) Hardware-get the biggest server you can afford
 - 2) Software-types of servers you may need:
 - a) Domain Name Server (DNS)
 - b) Web HTTP server
 - c) Proxy server
 - d) Simple Mail Transfer Protocol (SMTP)

- e) File Transfer Protocol (FTP) server
 - f) Transaction server
 - b. Browsers
 - 1) Should be available for all the platforms you have to support
 - 2) Should include all the features you need, such as:
 - a) E-mail
 - b) Newsgroup
 - c) FTP
 - d) Telnet
 - e) Plug-ins and add-ons
 - f) Security
 - g) Virtual reality tools
 - h) Latest version of HTML support
 - i) ActiveX controls, JavaScript, and VBScript
 - c. Search tools
 - d. Document authoring tools-WYSIWYG or not?
 - e. Document conversion tools
 - f. Document databases
 - g. Database query tools
- 5. Plan for maintenance of an intranet
 - a. Consider your needs for monitoring and maintenance of your intranet
 - b. Provide tools and training for administrator

APPENDIX E: REQUEST FOR PROPOSAL (RFP)

We have seen that a company must conduct a thorough needs analysis before it can begin the process of inviting vendor proposals. The organization first determines which software was currently being used, and then which software it plans to use under network conditions. To ensure complete compatibility, the organization also surveys its present computer workstations and printers.

Because of the limitations inherent in many networks, the organization also determines the maximum size of the networks, the potential for expansion, and the type of information and size of files that it wants to transmit over a network. It also determines the security measures it might want to require to ensure only authorized access. Now the organization can develop a formal RFP.

In order to receive viable vendor proposals, the organization must provide enough information in a logical order. Schatt [1996] suggested the basic outline for the heart of the RFP:

1. Hardware
 - a. Microcomputers
 - 1) What is currently on hand (brand, configuration)
 - 2) Additional workstations required for networks
 - a) Compatible to run which program?
 - b) How much RAM is required?
 - c) Number of disk drives required
 - (1) For security reasons, do you prefer no disk drives and auto-boot ROM chip?
 - (2) If disk drives are required, what size and capacity (1.44MB, ZIP 100MB, or ZIP 1 GB)?
 - d) If a hard disk required:
 - (1) Size (MB)
 - (2) Mounted in what kind of microcomputers
 - (3) Formatted in which version of operating system
 - e) Monitors and monitor adapter cards required:
 - (1) Capable of what resolution
 - (2) What size

- (3) Capable of running certain graphics program
 - (4) Other feature required
- f) Other I/O cards required:
 - (1) Parallel or serial or COM cards cables
 - (2) PCMCIA
 - (3) SCSI
 - (4) Sound
 - (5) Multifunction cards
 - (6) Accelerator cards
- b. File servers
 - 1) Size required
 - 2) Processing speed
 - 3) System fault tolerance
 - 4) Number of tape backup units
 - 5) CD-Writers
 - 6) Other features
- c. Network Components
 - 1) How many NIC cards?
 - 2) HUB
 - 3) Routers/Switches
 - 4) Bridges
 - 5) UTP cable
- d. Backbone network required to connect multiple LAN
 - 1) Description of bridges/switches to be connected
 - 2) Processing speed
- e. Bridges to other networks
 - 1) Other networks to be connected
 - 2) Adapter cards and cabling required
- f. Gateways to mini/mainframe environments
 - 1) Local or remote connections
 - 2) Protocols (TCP/IP, Netware Link)
 - 3) Number concurrent sessions required
 - 4) Terminal emulation
 - 5) Local printer emulation

- 6) Amount of activity to be handled
- g. Minicomputers
 - 1) Currently on hand (brand, configuration)
 - 2) Need to integration information with LAN
- h. Mainframe computers
 - 1) Currently on hand (brand, configuration)
 - 2) Need to integration information with LAN
- i. Printers
 - 1) Currently on hand (brand, buffers, accessories)
 - 2) Additional printers needed
 - a) How many printers
 - b) Brand and Speed
 - c) Type (laser, dot-matrix, etc)
 - d) Color or BW
 - e) Compatibility with which mayor printer drivers
 - f) Protocols (DLC)
 - g) Length of distance from workstations
- j. Modem
 - 1) Currently on hand (brand, speed, special features)
 - 2) Additional modems needed
 - 3) Transmission mode required (simplex, half, or full duplex)
 - 4) Interconnection (point to point or multiple drops)
 - 5) Special features (voice, caller ID)
- k. Plotters
 - 1) Currently on hand (brand, configurations, special features)
 - 2) Additional plotters needed
- l. Scanners
 - 1) Currently on hand (brand, resolution, special features)
 - 2) Additional scanners needed
 - a) Resolution, flatbed
 - b) Use to scan graphics or texts
 - c) Which programs need access to this data
- m. Power protection (UPS)
 - 1) Currently on hand (brand, capability)

- 2) Voltage regulation
- 3) Limits, sags, surges
- 4) Battery backup

2. Software

a. Operating systems and utility program

- 1) Which operating system required
 - a) Windows NT, Windows 9x, Mac, Unix, or Linux
 - b) Are there currently multiple operating systems existing
- 2) Electronic mail
 - a) Menu-driven
 - b) Needs auto-reply or auto-responder e-mail?
 - c) MIME type standard

b. Network management

- 1) Password protection
- 2) Perform diagnostics
- 3) Database support (records all nodes in the networks)
- 4) Remote management
- 5) Handle multiple operating systems

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