PN-ACG-791

Case Management System
Platform Definıtıon Study
Systems Research Egypt
Contract No 263-C-00-95-00134-00
Admınıstratıon of Justıce Support Proȷect
AMIDEAST/ AOJS Caıro
November 1998

Administration Of Justice Support Project
AOJS

CASE MANAGEMENT SYSTEM
PLATFORM DEFINITION STUDY

Systems Research Egypt

Subcontract no 132-SC-3-SRE

November 1998

Limited Edition for AOJS

PART I

RECOMMENDATIONS

CONTENTS

INTRODUCTION

The Justice system in Egypt is a pyramidal structure that starts with 230 Partial Courts, that feed into 22 Courts of First Instance, which in turn escalate to 9 Courts of Appeal There is one court of last resort, which is the Court of Cassation

AOJS is concerned only with three pilot courts that represent the two middle levels of the system, Courts of First Instance and Courts of Appeal The recommendations made in this section apply to the following specific courts

- North Cairo Court of First Instance (NCCFI)
- Ismailia Court of First Instance (ICFI)
- Ismailia Court of Appeal (ICA)

The first section of this recommendation will deal with the system configuration proposed for the largest court in the project North Cairo Court of First Instance, which despite its size, represents a straight forward choice The Two smaller courts, Ismailia Court of First Instance and Ismailia Court of Appeal, present another problem related to size and proximity Therefore the recommendation of the platform for these two courts will be presented in the second section of this report

The recommendations made here are intended for use in the preparation of detailed specifications for the procurement activity of hardware and software

In this section, platform definition is dealt with in three main areas

- Network Components
  - Switches
  - Gateways
  - Cabling
- Hardware
  - Servers
  - Client Workstations
  - Printing Equipment
- Software
  - Operating Systems
  - Middleware
  - Database

North Cairo Court of First Instance (NCCFI)

One should not underestimate the cultural and managerial effect of the introduction of automated Case Management Systems (CMS) in North Cairo Court of First Instance (NCCFI) Judging from precedent of automation of other government departments (Traffic, Passport etc), the initial applications will become but a small part of a court wide information network Already MOJ has plans to introduce Electronic Archiving at NCCFI It is for this reason that the design of the information infrastructure at the court must allow for substantial growth through layered additions and expansions These additions and expansions can occur above, at the same level and below the current proposed applications This needs to be done without incurring higher costs than planned, through judicious selection of alternatives To bring the above point in perspective, it is helpful to review the current size of NCCFI During the past few years NCCFI has experienced an annual growth of approximately 10%

Information for 1996

Description	Volume
Total Number of Active Cases	88,252
Number of New Cases	68,494
Cases Dealt With During 12 Months	70,517
Number of Circuits	32
Number of Court Clerks	450

A general survey of automated systems in the US, where most courts are using second and third generation implementations, has revealed that the ratio of Client PCs to the number of workers is very close to 1 1 However this rule of thumb is not applicable in the case of pilot courts in Egypt for two reasons

a The nature of clerical work in Egypt has led to inflated head counts

b Automation will be introduced to a specific number of administrative departments and units only and not the whole court

A preliminary estimate puts the total number of PC clients at 150 – 160 units

Initially Automation in the pilot courts will concentrate on the following areas and functions

- Case Initiation
- Case Processing
- Deposits
- Claims
- Typing Pool
- MIS – Decision Support

Other application areas may evolve in the future

NETWORK INFRASTRUCTURE

Network Infrastructure design should be cognizant of the fact that automation of the case management activities will create a ripple effect for other applications throughout the court in later years This means that Local Area Network implemented during the project duration will become but a small segment of the overall court network that is three times as large This kind of expansion may cause substantial loss of investment in the first segment as it becomes limiting factor because of its technology bandwidth or topology It is for this reason that the design of the network infrastructure should

- Use the most up-to-date technology available today in an attempt to reduce obsolescence
- Network components should enable reasonable expansion during the life of the project Local switches should have at least 10-15% free ports where possible
- Network topology should also be flexible enough to permit restructuring resulting from expansion or relocation of clients

Technology

Although 10 Mbps Ethernet is still available on the market the price deferential between it and 100 Mbps components is now negligible if not nonexistent This puts forward a very strong case for the use of 100 Mbps components throughout the network, except in the case where 10 Mbps is built-in in Client PCs

Enterprise Switch

A high performance enterprise switch featuring high-speed trunking technologies, redundant architecture, dynamic virtual LAN allocation and a broad variety of interface modules The Switch should be designed for complete interoperability and investment protection

Internet/Extranet Gateway

Access to the Internet and the MOJ Extranet will be affected through a Router that would connect the court with an Internet Service Provider (ISP) and/or other MOJ Intranets such as those envisioned for NCJS and JIC

Fiber Optic Backbone

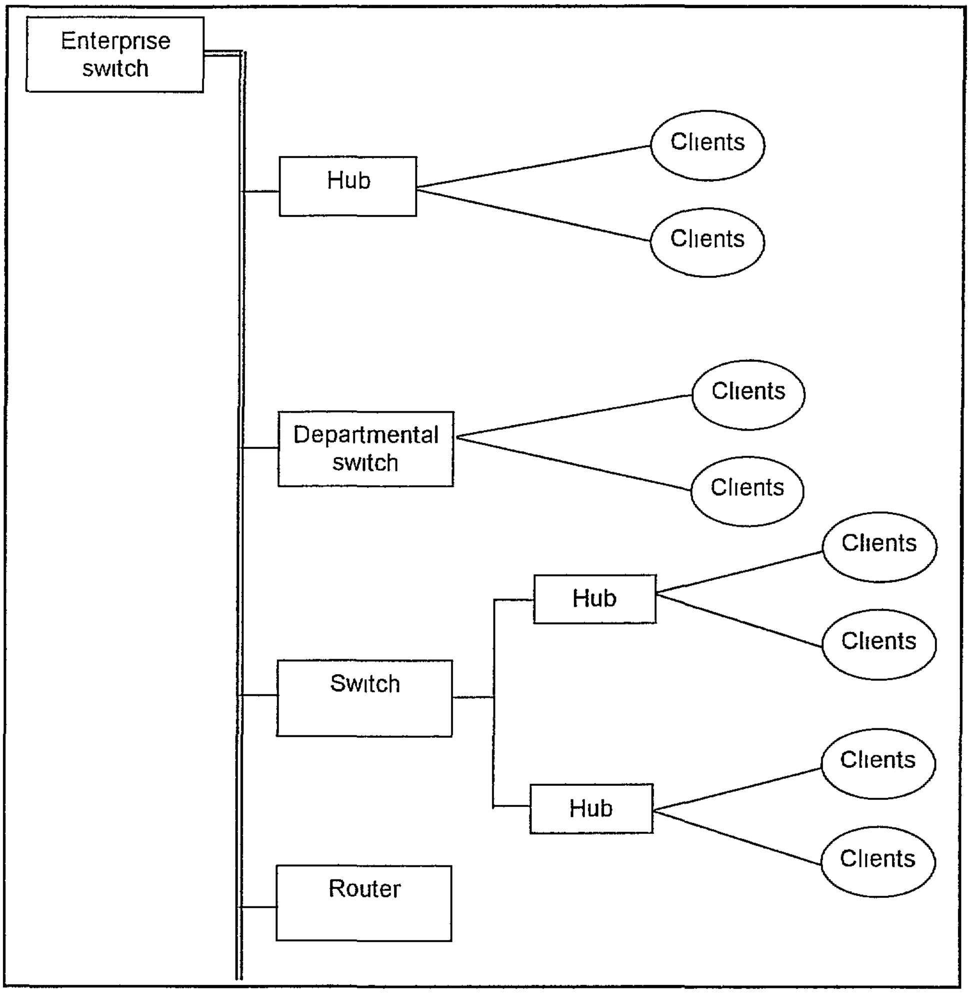
Current plans call for relocating most automated functions in the new building in NCCFI of campus However some functions and the office of the Chief Justice of the court remain in the old building This together with fact that the design of these buildings did not take into consideration network cabling result in a fairly complicated cabling arrangement A fiber Optic backbone linking both buildings and extending throughout all floors will be necessary

Floor / Workgroup switches
Network extension from the Fiber Optic backbone to the different floors or workgroups would be affected through cascading switches and or Hubs as the need maybe The guiding principal is to deliver suitable bandwidth to PC clients

Internet Gateway
Access to the Internet and the MOJ's own Intranet / Extranet is a must This connection must be fast and reliable, it should be available whenever the court applications are running Connectivity to an Internet Service Provider (ISP) should be made through a high performance Router The provision of Internet services and the creation of Intranet /Extranet is the responsibility of MOJ

Structured Cabling
The nature of Buildings in NCCFI makes cable laying, fault troubleshooting and repairs rather difficult It is for this reason the selection of a high quality structured cabling system is highly recommended

Generic Network Layout



HARDWARE

Once Case Management Applications are successfully in the court, it will be very difficult to operate without them This will complicate the design of the server configuration and the selection of hardware

Mission Critical Applications
Case Management Application is considered to be the Mission Critical application at the court It is expected to be available whenever the court is open for business (Usually 12 Hours X 6 Days)

Load Variance
In addition to the gradual increase of volume, Work load at the court exhibits two types of seasonality There is a definite variance between two extended periods October-June and July-September Also there is marked variance during the working day where there are two peak periods 9-10 and 13-15 Therefore the proposed configuration must provide not only future expansion but also adequate computing headroom to handle peek periods

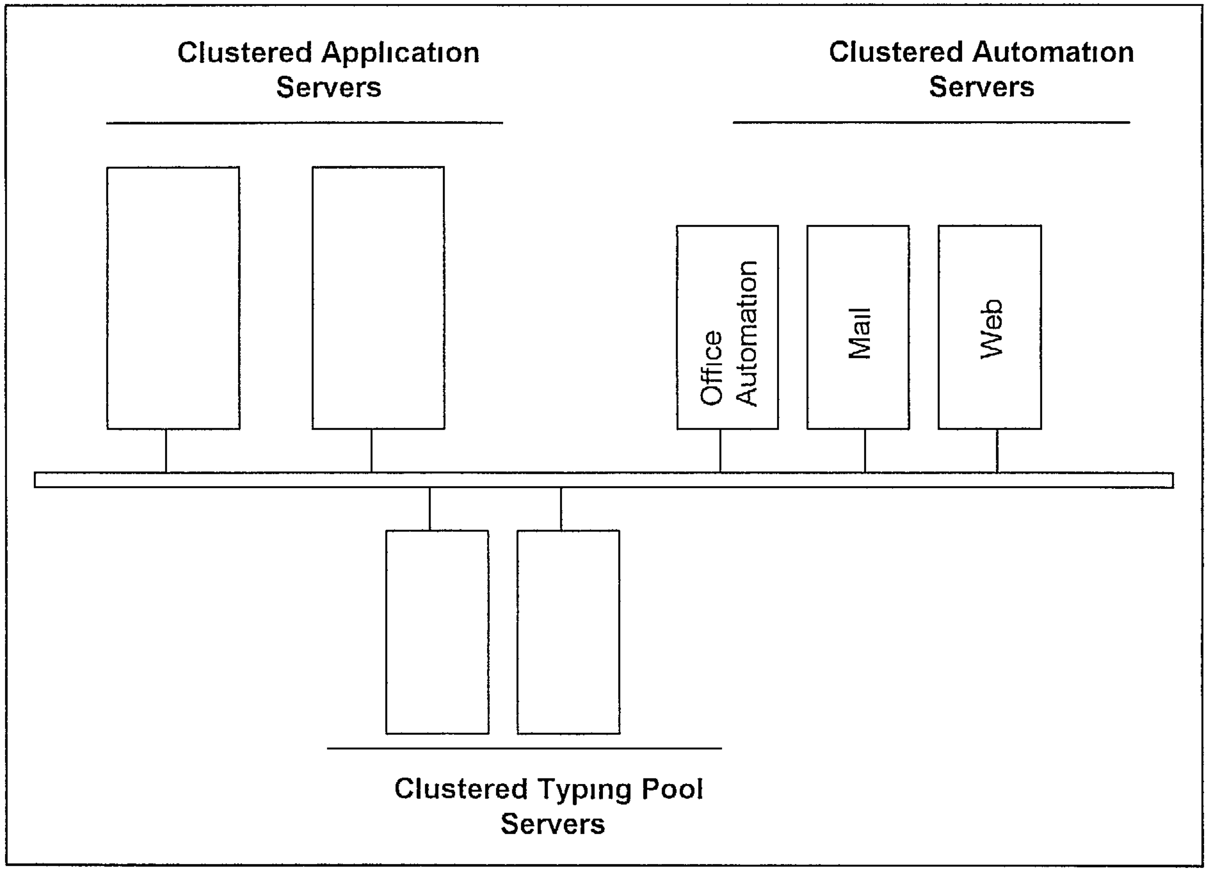
Case Management Application
Case Management applications will need to be mounted on servers that provide high availability and strong scalability This could be achieved through a cluster arrangement using scalable SMP servers These servers must have adequate performance that is estimated to be 4000 TPC-c on a single processor

Typing Pool
The typing pool at North Cairo must produce upwards of 700 decisions daily during peek periods The average daily load is approximately 300 Decisions It is for this reason that a clustered arrangement is also recommended However considerably lower power server (Typical Workgroup servers) will be specified

Office Automation
In addition to the above two functional areas, the information system at the North Cairo Court of First Instance will also have some traditional Office Automation (OA) functions These are best served through an independent server of similar specification to those used in the typing pool This Server will host the following

- Electronic Mail Server
- Web Server
- Network Print Server

The following diagram illustrates the hardware configuration proposed for NCCFI


Clustered Applıcatıon Servers
Clustered Automatıon Servers
Office Automatıon
Maıl
Web
Clustered Typıng Pool Servers

SERVERS

From the above discussion, it becomes clear that the information infrastructure will contain two classes of servers one to handle the Case Management Applications and the other to handle the Typing Pool and office automation These two types of servers are different only in their computing power

APPLICATION SERVERS

The application servers are expected to host the main mission critical application at the court, which are the Case Management Systems As such these servers must provide both high availability (At least 12 X 6) and scalability

Architecture

Symmetrical Multiprocessor (SMP) Architecture for the individual server These servers should be configured into two or more clusters

Processor Type

Both performance Headroom' and the reliability derived from the use of UNIX operating system seem to indicate the use of RISC processor server Industry Standard (Intel) based servers from certain vendors such as Compaq and HP can also be used if they provide the necessary performance minima The deciding factor will be budgetary considerations

System Memory

Memory size directly affects system performance Where possible the Largest memory size should be specified The following is considered Minimum

Memory Type	ECC
Memory Size	512 MB
Level 1 Cache	32 KB
Level 2 Cache	256 KB

Storage

Because of the clustering arrangement, it may be necessary to use a Shared RAID storage unit between the two application servers The capacity of Storage should reflect the expanding nature of the database, its mirrored image and temporary work areas

Interface	SCSI-2, UltraSCSI, RAID
Number of Spindles	5
Capacity	50 GB

Expansion

As mentioned earlier Application servers should provide considerable expandability to cater for expected increase in data volumes and computational complexity

Processors	4 Way SMP RISC, 8 Way Industry Standard
Memory	3 GB
Slots	7
Storage	200 GB

Communication

The Server must accommodate the following protocols

Ethernet 10/100 Mbps
FDDI 100 Mbps
ATM 25/155 Mbps
ISDN
X 25
Token-Ring 4/16 Mbps

Fault Recovery

Automated server recovery is an essential feature of the application servers This could be achieved through the clustering arrangement or through proprietary hardware recovery options provided by the vendors

Performance

TCP-C 4000 tpmC on a single processor, rising to
12000 tpmC on 4 SMP

TYPING POOL SERVERS
OFFICE AUTOMATION SERVER

The Typing Pool and Office Automation servers will host mostly industry standard applications High performance and scalability are not such critical factors here, while availability and reliability is

Architecture
Symmetrical Multiprocessor (SMP) Clustering may only be needed for the typing pools servers

Processor Type
Industry Standard (Intel Based)

System Memory
Memory Type ECC
Minimum Memory Size 256 MB
Level 1 Cache 32 KB
Level 2 Cache 512 KB

Storage
Interface SCSI-2, UltraSCSI, RAID
Number of Spindles 3
Capacity 30 GB

Expansion
Expansion capabilities of these servers are not so extensive

Processors 2 Way SMP
Memory 512 MB
Slots 4
Storage 200 GB

Communication
The Server must accommodate the following protocols

Ethernet 10/100 Mbps
FDDI 100 Mbps
ATM 25/155 Mbps
ISDN
X 25
Token-Ring 4/16 Mbps

Fault Recovery
Simple Back-up procedures except in the case of clustered typing pool servers

Performance
Not applicable

Clients

It is virtually impossible to guard against obsolescence in the area of personal computing This is largely due to the rapid and continuous development in the relevant technologies So rather than chase the specifications that seem to continuously change, we will take the opposite view of defining a set of semi-stable user requirements

Processor

Performance in a business environment is not entirely dependent on processor speed However in the current development cycle All microprocessors below Pentium II should be ignored However leading edge speeds in this chip are not necessary Hence Second tier speeds (such as 300 MHz) or low cost implementations such as Celeron Chip would suffice This would substantially reduce acquisition cost in 1998/1999

Bus

The Choice of Pentium II with a speed of 300 MHz will enable selection of equipment with the latest bus implementation running at 100 MHz This may provide a definite advantage if PC Clients will be used to handle images of documents in the future However the choice of low cost versions of Pentium II such as Celeron will restrict the bus speed to 66 MHz which is adequate for regular business applications

Memory

Two factors that seem to act against each other are at work here On the one hand the cost of memory is dropping continuously On the other Memory requirements of operating systems and various clients are forever climbing At the present time this points to memory capacities between 32 and 64 MB In the light of recent announcements by Microsoft that no further updates for Arabic support on Windows 9x, and that those interested in later developments must upgrade to Windows NT with Arabic support, it becomes prudent to recommend 64 MB memory size

Level 1 and Level 2 Cache availability and size will be determined by the choice made for the processor The presence of both at the largest possible size is of course desirable

Display Module

2D accelerated graphics adapter with 4 MB of memory is adequate 3D graphics acceleration or AGP is not required 17 Monitor capable of 1024 x 768 resolution, 75 Hz Refresh rate minimum is recommended over 15 "

Storage

Storage requirements at the client PC can easily be satisfied by the entry level capacities currently available on the market However we strongly recommend the use of a high performance storage adapter such as Ultra ATA which while considerably less expensive than SCSI, provides similar performance

I/O Ports

Since further developments may bring about the use of newer peripherals such as bar-code scanners label printers, the availability of Enhanced Parallel Port (EPP) and Universal Serial Bus (USB) ports is a must

Client Management

In a client server environment, the administration, Maintenance and support of client workstations is a major undertaking System Administrators must perform many functions ranging from BIOS updates to OS and software updates to monitoring the health of the systems In a physically large site this could be daunting

A number of tools are currently available that enable the administrators to perform these tasks remotely from the administration console These tools are available from brand name vendors as well as independent vendors In order to be able to make use of the full features of these tools, the PCs must be Desktop Management Interface DMI compliant The Current release of MDI is 2 0

Generic Specifications

Item	Specifications
Processor	Pentium II – 300 MHz
Bus	PCI – 100 MHz
Cache Memory	L1 16 KB L2 256 KB
Main Memory	64 MB
Storage	Adapter Ultra ATA Hard Disk 4 GB
Display	Adapter D2 Acceleration 4 MB RAM Monitor 17 Inch
I/O Ports	Universal Serial Port Enhanced Parallel Port
Management	DMI 2 0 Compliant

Printers

The printing requirements of the court are quite complex and cover a wide range of printing technologies and capabilities There is an essential need to handle preprinted forms and numbered documents There is also the need to produce neat, letter quality documents and reports Printing court documents is also subject to a number of control and security measures

Documents, Receipts and Reports

All documents requiring the presence of a serial number (Payment Receipts Document Receipt, Notices Etc) Will require multi-part continuous Stationery This could best be served with Impact printer conforming to the following specification

Specifications	
Printhead	24 pin
Carriage Width	80 Col
Speed (Draft Mode)	400 cps

Registers, Ledgers and Reports

The Case Management application is expected to generate hardcopy of a variety of statistical reports as well as many registers and ledgers This can best be served with a high-speed draft printer that is capable of multifotm paper handling capabilities

Specifications	
Printhead	9 pin
Carriage Width	136 Col
Speed (Draft Mode)	1000 cps

Letter Quality Documents

Court Decisions, executive reports and other communication documents are expected to be printed on high resolution laser printers that can also print watermarks and other security signatures

Specifications	
Technology	Laser
Resolution	600 dpi
Paper Sizes	A4, Legal, A3
Speed	16-24 PPM

COMMUNICATION

At the present time there is no coherent data communication infrastructure blueprint at MOJ into which the proposed systems at the pilot courts can be fitted Currently remote sites connect to JIC through a variety of methods (X 25, Leased Lines, Dial up) The selection of one method over the other seems to be haphazard or entirely dependent on factors outside JIC The subject of global MOJ communication must be addressed sometime in the future by MOJ, however for the purposes of project work at the pilot courts limited communication capability is required

Functionality

Information exchange

There is a limited but definite need for information exchange between the pilot courts, the JIC and the MOJ This is mostly in one direction upwards from the courts to JIC and MOJ The ability to remotely log-on from JIC and MOJ on to the certain applications while beneficial cannot be justified financially or technically There is no need for Peer-to-Peer communication between the courts right now except in the case of Ismailia Court of First Instance and the Ismailia Court of Appeal These two courts are physically contiguous

User Support / Application Maintenance

The above functions will require a reliable and continuous connection that is available with little human intervention (that rules out dial-up connections)
User support through remote diagnostics, Help Desk, or email

System Administration

A number of system monitoring and administration functions will be carried out centrally This will also require a continuous and secure connection between the pilot court sites and MOJ

The above requirements can be met through a relatively inexpensive Virtual Private Network (VPN) This VPN between the pilot courts and the JIC equipment and infrastructure is the responsibility of MOJ

Firewall

Firewall services can now be had through hardware only solutions, software only solutions or a combination of both Because of the sensitivity of court information and the need for its availability during working hours, we recommend a firewall of hardware/software combination

A Firewall provides users, including remote users and JIC support staff, with secure, authenticated access to court information resources using multiple authentication schemes Authentication services securely validate that the users attempting to make a connection are who they say they are before the communication is allowed to proceed

Authentication services are fully integrated into the court-wide security policy and can be centrally managed through the network administrator console All authentication sessions can be monitored and tracked through a graphical user interface The Firewall should provide three authentication methods

1 User Authentication
Firewall should provide transparent User Authentication access privileges on a per user basis for FTP, TELNET, HTTP, and RLOGIN, regardless of the user's IP address All packets of the session should be intercepted and inspected by the firewall on the gateway

2 Client Authentication
Client Authentication enables an administrator to grant access privileges to a specific user at a specific IP address In contrast to User Authentication, Client Authentication is not restricted to specific services, but provides a mechanism for authenticating any application, standard or custom The administrator can determine how each individual is authenticated, which servers and applications are accessible, at what times and days, and how many sessions are permitted

3 Transparent Session Authentication
Transparent Session Authentication can be used to authenticate any service on a per-session basis After the user initiates a connection directly to the server, the firewall gateway, located between the user and the destination, intercepts the connection recognizes that it requires user-level authentication, and initiates a connection with a Session Authentication Agent The Agent performs the required authentication, after which firewall allows the connection to continue to the requested server if permitted

Authentication Schemes

The firewall must provide a number of industry standard authentication schemes such as

1 SecurID
2 S/Key
3 OS Password

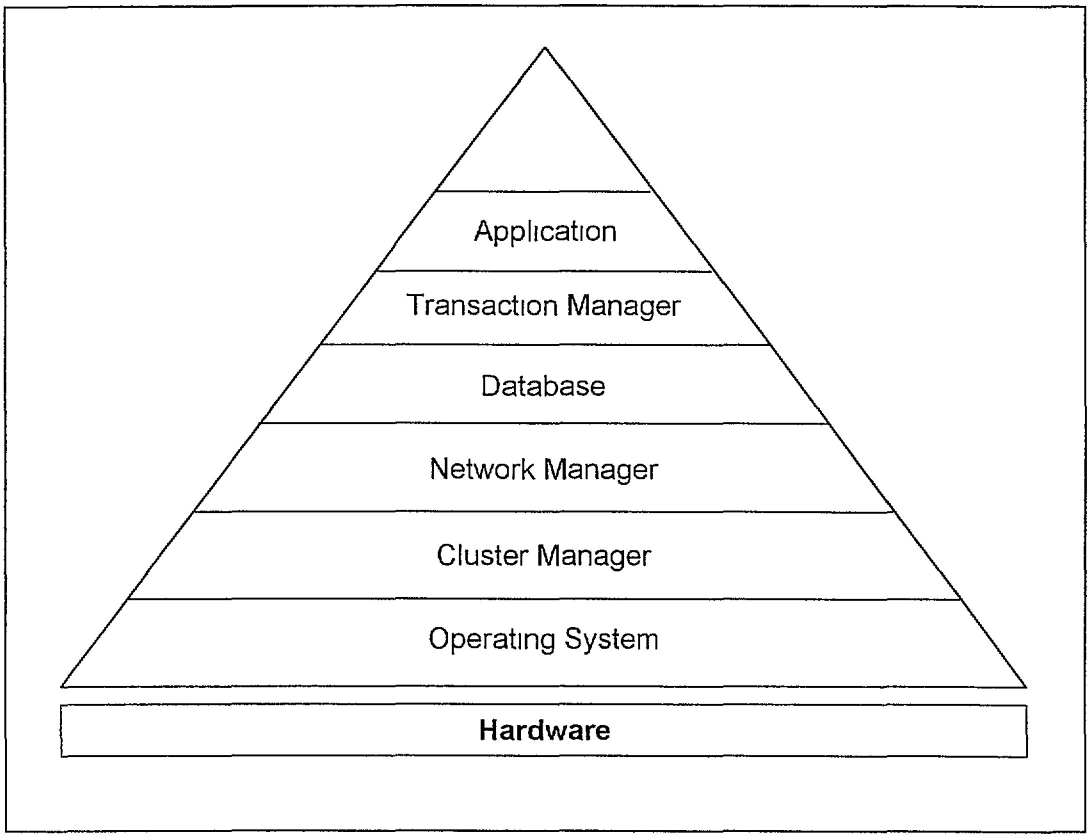
In addition to being challenged for a response defined by an Axent or RADIUS servers

SOFTWARE

Layered on top of the hardware platform described above is a software platform made of the following layers and components

- Operating Systems
  - Enterprise server
  - Departmental Server
  - Desktop Workstation
- Middleware
  - Clustering
  - Back-up
  - Security
  - Network Management
- Database
  - Database Engine
  - Transaction Manager
- Application systems

This can best be viewed by the following diagram



Operating Systems

The ideal situation in operating systems is to have just one OS across the court, i e in the server room as well as on the desktop Although Win NT makes a claim for that kind of versatility, industry wide consensus seems to indicate that NT still falls short is such areas as Reliability High Availability and scalability

Case Management Application Server

Whether RISC or Industry Standard (Intel) servers are acquired the recommendation made here is for the use of UNIX as the operating system for the CMA servers Most RISC hardware vendors have their own implementation of UNIX (HP, IBM NCR and SUN) Industry Standard hardware vendors also package several versions of mainstream UNIX implementation

Departmental Servers

Departmental servers such as the typing pool or any future extensions of tangential applications such as Service department of the lower courts which are usually off the main court building are recommended to run Win NT This also applies to Workgroup, office automation and Web servers

Desktop Workstations

The importance of the desktop operating system lies in the fact that it is the final link between the applications and the end user On it resides the client modules of the database as well as any personal productivity and office automation tools As such it should provide a friendly interface in addition to rock solid reliability

At the present time two desktop operating systems support Arabic these are Microsoft Windows 95 and Microsoft Windows NT release 4 0 The choice between these two operating systems is easy on technical and financial backgrounds If budget permits the higher cost NT should be selected otherwise Win 95

Year 2000 Compliance

It is important to specify in software procurement documents that all software components should be Y2K compliant

Middleware

On top of the operating system reside a number of software layers and components that provide much needed enterprise wide functions and services There exists on the market a bewildering array of these products The selection of any of these products must be done with an eye on overall integration and system performance The following are the essential layers and functions

Clustering

The argument developed in Part II of this report has highlighted the fact that some form of clustering technique will have to be used to deal with issues of High Availability and Scalability The selection of the particular tool for clustering (whether hardware/software or software only) will depend on the choices made for Server hardware and network management layer The following is a general guideline

- Mission Critical Application Use of open high performance clustering solution that allows two or more nodes
- Departmental Servers Lower cost proprietary solutions, usually hardware based

In selecting the clustering arrangement it is essential to take into consideration the performance of the particular solution Short Failover times are crucial in a high demand production environment

Security

Even in its current manual state, where all documents are the personal responsibility of the Court Clerks and where everything is kept under physical lock and key, Court Administrators and Chief Justices are very concious and sensitive to all aspects of security The automated system must be perceived to provide a high level of security for court business or its acceptance and final success will be jeopardized

System security will be realized by

The operating System The OS should provide for at least C2 certified This can be satisfied by UNIX on the CMA servers and NT on the desktop

Open Software Components These components or optional layers should provide appropriate security in the following areas

Access Control
Authentication
Content Security
Encryption

Internet/Intranet security

Application security requirements should be handled through built in functionality in the database engine and through application design functions

Backup

The definition of the Backup component must take into consideration the operating environment that will prevail at the site Factors such as the expertise of the system administrators time needed to recover the data within working hours, as well as security aspects directly affect the set of specifications that need to exist in the backup product The following subset of services and features are considered minimum requirements

- High Degree of Automation
- Industrial Strength Performance
- Extensive Client Server Support
- Fast Disaster Recovery
- Remote Management Capabilities
- Automated Cataloging
- Extensive Reliability measures (Redundancy Checks etc)
- Encryption and other Security Measures

Bundled Backup Software is usually deficient in some of these aspects That is why it may be necessary to acquire suitable software from a third party

Network Management

Ultimately, the proposed platform will be replicated in seven courts of appeal and 24 courts of first instance spread geographically across the country This vast network is modeled by three pilot courts that are spread geographically over a wide area Experience has shown that many of the reliability issues and the problems encountered by the end users stem directly from loose or none existent management of Data Centers and Networks It is for this reason that a strong network management layer is recommended as an essential part of this platform Network management for AOJS will have to perform on two levels

Distributed Functions

These functions will reside on the local servers at the courts They should provide the following functions and services

- LAN Management
- Operations monitoring and logging
- Virus protection
- Storage management
- Software Distribution
- Configuration Security and Management
- Client Asset Management

Centralized Functions

These functions will reside at JIC to provide centralized control and support They should provide the following functions and services

- WAN Management
- Software Distribution
- Directory Management
- Event Management
- Remote Control
- Help Desk

Database

Perhaps the most significant layer in this platform is that of the Data Base Engine and its associated utilities and tools As indicated before the Case Management Application is truly the most important component within the Court System and the MOJ at large It is expected that several other applications will grow around CMS and need to communicate with it These applications will be on a variety of platforms and use many different tools It is for these reasons that Oracle Release 8 0 has been selected to provide the application Database Engine The following information is derived from independent consulting and research organizations such as Data Quest, IDG, Forrester Research The Gartner Group and TPC

Position & Openness

Oracle maintains the leading position in a field that includes some very successful and powerful players such as Sybase, DB2 Informix MS SQL Server among others This is evident from the following

- Oracle is most widely used on UNIX platforms (60 2%)
- Oracle is most widely used on Windows NT (42 5%)
- Oracle is most widely used RDBMS in general (26 5)

In addition to the above, Oracle Data Base server and tools work on nearly 100 platforms this permits for greater freedom of choice of system hardware and software

Total Cost of Ownership (TCO)

A recent study from the independent organization Business Research Group has concluded that Oracle enjoys the lowest TCO among all its competitors Total Cost of Ownership is calculated taking into consideration cost of the initial system cost of labor (in terms of training needs & productivity) in addition to the cost of 3-4 years of operation (based on Administration, system & application maintenance) This becomes an important factor in the light of the strategic objective of AOJS which is the inevitable replication of the CMA in other courts

Integrated Environment

Oracle is unique among its competitors in providing a vertically integrated environment where all engines tools and utilities are obtainable from one vendor This includes an effective CASE tool, powerful development tools in addition to several services, layers and servers that provide High Availability Scalability Tuning Internet and Management functions In addition to the above, there exists in the market place a large number of alternative tools and utilities for special purposes

A High Level of Standard Features

Unlike many other database engines, Oracle Data Base server is provided complete with all necessary modules that make it operational straight out of the box This includes TP engine, Distribution, Advanced Replication, 64-bit VLM engine, Parallel Query, bit-mapped indexing, star query, Security Server, Enterprise Manager among others Add-ons in Oracle case are only needed to achieve specific requirements such as clustering or additional system management functions

Strong Local Support

Oracle operates in Egypt through a wholly owned subsidiary This operation is one of the few prominent software distribution success stories Oracle Egypt has a visible market presence and provides top grade local support

Recommended Components

Oracle Database Server This server comes in two classes Workgroup Class, which permits 100 Concurrent Users is lower in cost than the Enterprise Edition class, which permits a much larger number of users However several vital features such as Clustering cannot be had on the Workgroup edition Therefore we recommend the use of Oracle Database Server Enterprise Edition In addition to the database engine two other Oracle components are strongly recommended, these are

- Oracle Parallel Server Provides high availability functionality for the database engine

- Oracle Tuning Pack enables developers and system administrators to fine-tune the performance of the Database under actual operating conditions

Acquisition Timeline

There is no real advantage for acquiring the platform detailed above in one step On the contrary, there are some definite disadvantages resulting from logistical and training considerations It is therefore important to consider spreading the acquisition over the life of the project or even beyond the formal termination date In this case MOJ can simply build upon the infrastructure laid down by AOJS Using typical development and implementation times the following time line has been developed as a preliminary planning tool

Phase One Pilot Implementation

First phase procurements must insure the acquisition of sufficient equipment and tools for the following functions

Network Extension

The complete LAN infrastructure i e the cabling and the enterprise Switch must be included in this phase Floor and departmental switches or HUBs could be left to later phases and could be added on As-Needed basis

Development and Testing

Application servers should be acquired with basic configuration i e with one processor Clustering features and software must also be included in phase one as this will be needed in testing failover procedures and performance tuning

Initial Training

An Adequate number of Client workstations to be used for initial training of prospective users must also be included in this phase Phase one installation should also support field testing and conversion

(

Phase Two Production Environment

Second phase procurements must bring up the equipment and software to the level needed for an effective and stable production environment This should include

Hardware Upgrade

The addition of a second processor and memory extension to 512 MB maybe needed at this stage
The devolution of Office Automation and Web services onto a separate server

Network Management

At this phase network management software layer should be added Network management services will be needed for the effective, monitoring and administration of such a complex and growing environment

Network Extension & Client Workstations

As implementation of CMA and associated modules are spread throughout the court an appropriate number of Client workstations should be added This may necessitate the extension of the LAN connections through the addition of Floor and departmental Switches and HUBs

THE ISMAILIA COURT OF FIRST INSTANCE
THE ISMAILIA COURT OF APPEAL

These two courts represent a special situation In size, they are typical of 50% of the courts in the Egyptian Justice System They exist in the same campus, however they are completely independent from on another Geographically they are at such a distance from JIC so as to make support from Cairo not practical or cost effective

In light of the above, the definition of a platform for these two courts must be approached with care and creativity

Option One Separate Computing Facilities

In this option a separate installation of the appropriate size is to be made in each of these courts In this case the size and power of the application servers will be much smaller that those specified for the NCCFI The main advantage of this option is the maintenance of the institutional independence of these two court The main disadvantage in the creation of a computing facility of some complexity but of a relatively small size

Option Two One Shared Computing Facility

In this option, one large scale computing facility is to be created to serve both courts This option realizes some economies but most importantly it streamlines and reduces the support effort The main disadvantage of this solution is that it violates the conceptual independence of these two courts and also the parameters of distributed processing

The Nature of the site

The Ismailia Court of First Instance and the Ismailia Court of Appeal are low rise purpose built courthouses that reside in the same campus north of Ismailia City While these recent buildings were still designed without adequate attention to Computer installation and cabling they will raise very few serious problems There is ample place in each building for server rooms LAN cables will have relatively short runs through corridors and skylights The two buildings are not more that 25 Meters apart greatly facilitating the extension of a backbone fiber optic cable in case that the second option is adopted

However we strongly recommend the adoption of the first option

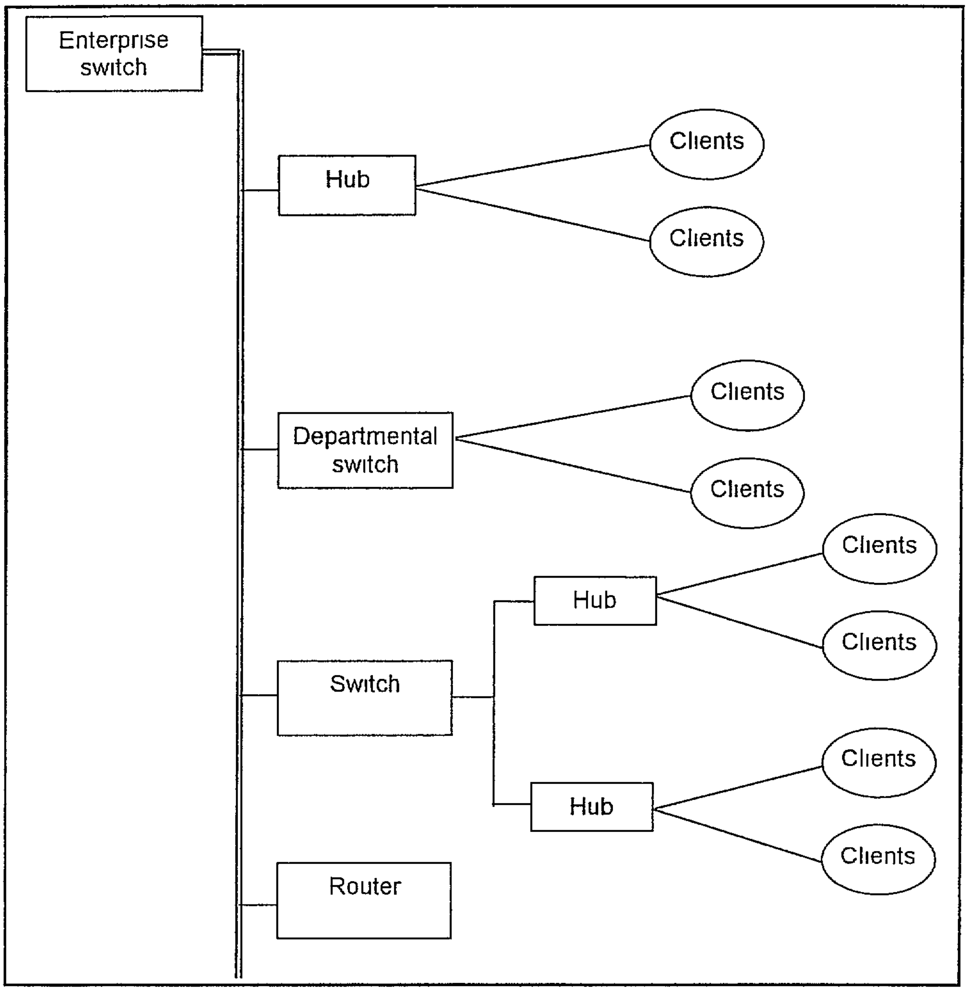
Optıon One Separate Computıng Facılıtıes

Because these two courts are very sımılar ın sıze, theır computıng platforms wıll be ıdentıcal ın confıguratıon

Network Infrastructure

Network Infrastructure desıgn should subject to the same argument presented ın sectıon one of thıs report as far as Technology, The Use of Swıtched connectıons rather than HUBs The provısıon of Internet/Extranet Gateway the layıng of a Fıber Optıc Backbone and Structured cablıng

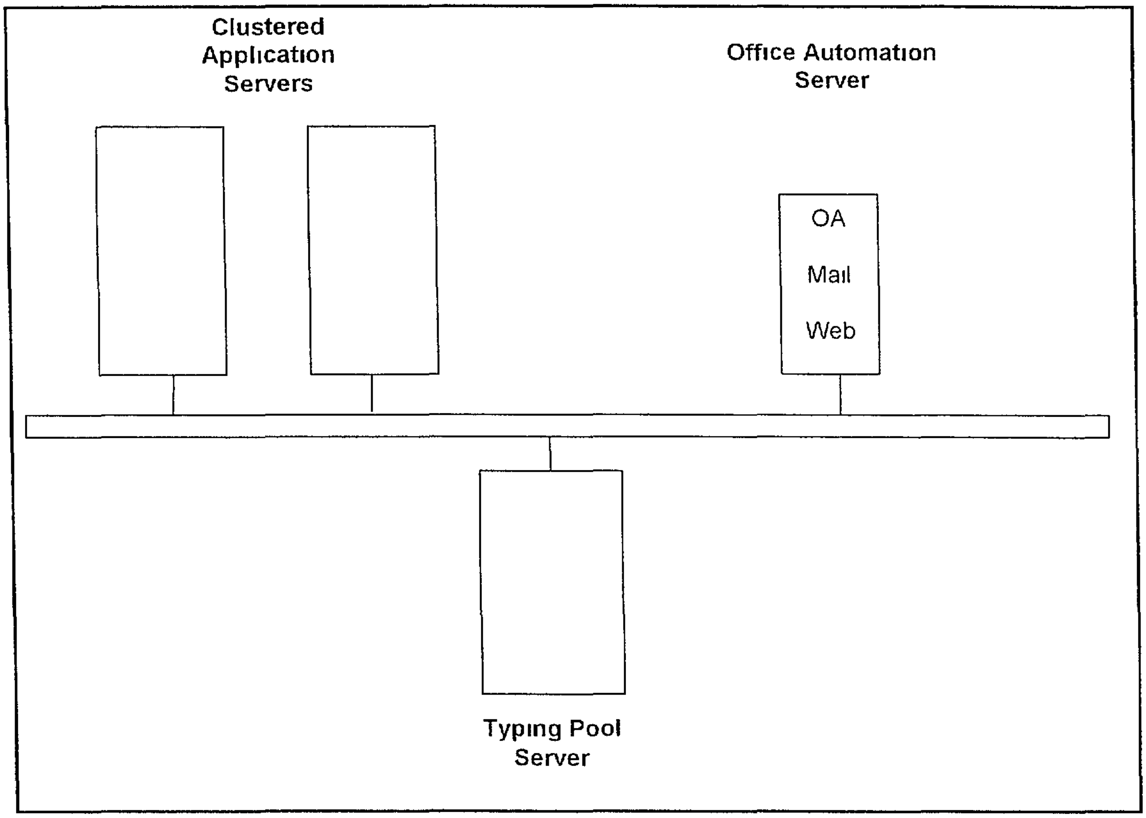
Generıc Network Layout



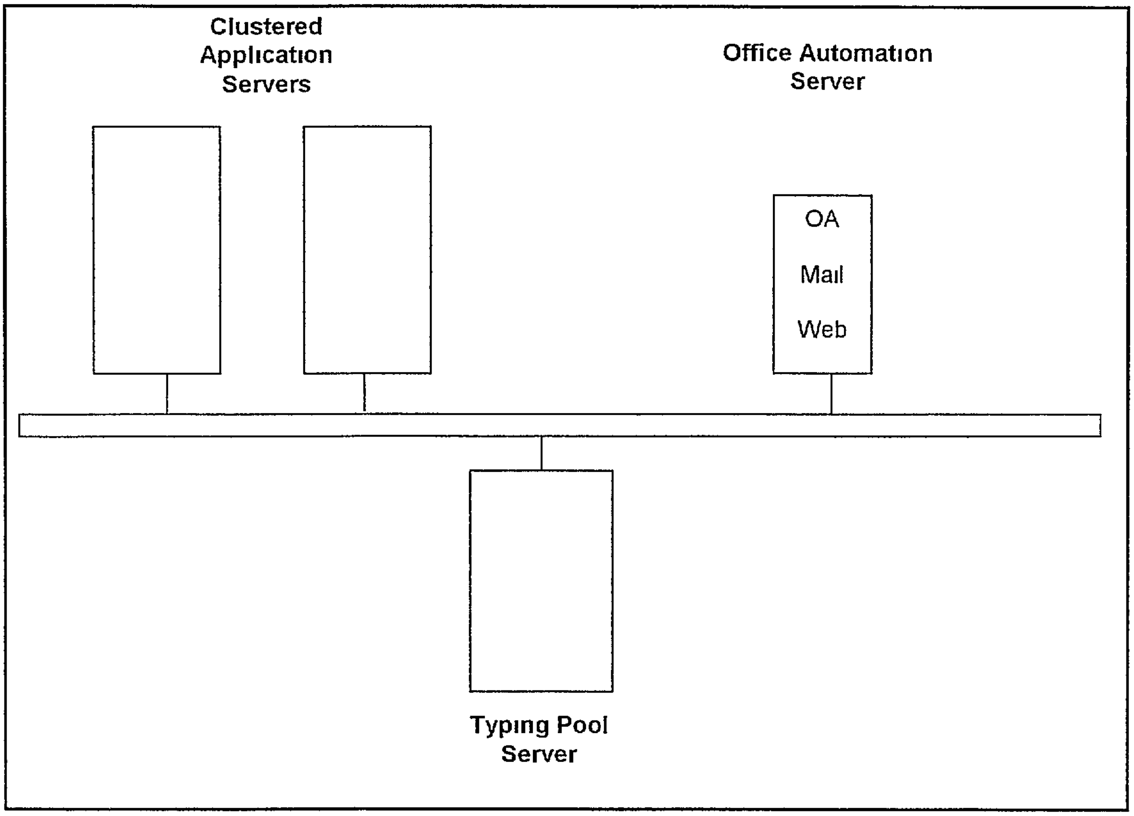
Hardware

In this option, each of the two courts will have identical system configuration

Hardware Configuration for Ismailia Court of First Instance



Hardware Configuration for Ismailia Court of Appeal



SERVERS

From the above discussion, it becomes clear that the information infrastructure will contain two classes of servers, one to handle the Case Management Applications and the other to handle the Typing Pool and office automation These two types of servers are different only in their computing power

Application Servers

Item	Specification
Architecture	Symmetrical Multiprocessor (SMP) Architecture for the individual server These servers should be configured into two or more clusters
Processor Type	Both performance "Headroom" and the reliability derived from the use of UNIX operating system seem to indicate the use of RISC processor server Industry Standard (Intel) based servers from certain vendors can also be used if they provide the necessary performance minima The deciding factor will be budgetary considerations
System Memory	Memory Type ECC Minimum Memory Size 512 MB Level 1 Cache 32 KB Level 2 Cache 256 KB
Storage	Because of the clustering arrangement it may be necessary to use a shared RAID storage unit between the two application servers The capacity of Storage should reflect the expanding nature of the database its mirrored image and temporary work areas Interface SCSI-2, UltraSCSI, RAID
Expansion	Processors 2 Way SMP RISC 4 Way (Intel) Memory 3 GB Slots 5 Storage 200 GB
Communication	Ethernet 10/100 Mbps FDDI 100 Mbps ATM 25/155 Mbps ISDN X 25 Token-Ring 4/16 Mbps
Fault Recovery	Automated server recovery is an essential feature of the application servers
Performance	TCP-C 3000 tpmC on a single processor rising to 7000 tpmC on 4 SMP

Typing Pool Server
Office Automation Server

Item	Specification
Architecture	Symmetrical Multiprocessor (SMP) Architecture for the individual server These servers should be configured into two or more clusters
Processor Type	Both performance "Headroom" and the reliability derived from the use of UNIX operating system seem to indicate the use of RISC processor server Industry Standard (Intel) based servers from certain vendors can also be used if they provide the necessary performance minima The deciding factor will be budgetary considerations
System Memory	Memory Type ECC Minimum Memory Size 512 MB Level 1 Cache 32 KB Level 2 Cache 256 KB
Storage	Because of the clustering arrangement it may be necessary to use a shared RAID storage unit between the two application servers The capacity of Storage should reflect the expanding nature of the database, its mirrored image and temporary work areas Interface SCSI-2, UltraSCSI RAID
Expansion	Processors 2 Way SMP RISC, 4 Way (Intel) Memory 3 GB Slots 5 Storage 200 GB
Communication	Ethernet 10/100 Mbps FDDI 100 Mbps ATM 25/155 Mbps ISDN X 25 Token-Ring 4/16 Mbps
Fault Recovery	Automated server recovery is an essential feature of the application servers
Performance	TCP-C 3000 tpmC on a single processor rising to 7000 tpmC on 4 SMP

Clients

The Client workstation specifications will not differ from those of NCCFI

Generic Specifications

Item	Specifications
Processor	Pentium II – 300 MHz
Bus	PCI – 100 MHz
Cache Memory	L1 16 KB L2 256 KB
Main Memory	64 MB
Storage	Adapter Ultra ATA Hard Disk 4 GB
Display	Adapter D2 Acceleration 4 MB 17 Inch
I/O Ports	Universal Serial Port Enhanced Parallel Port
Management	DMI 2 0 Compliant

Printers

The printing requirements of these two courts are identical to those of NCCFI The same argument and specification apply here

COMMUNICATION

A gateway to a small Virtual Private Network is recommended This could be achieved through a router and a leased line to an ISP (Usually IDSC or the MOJ itself)

Firewall

The need for a firewall within this site is just as valid as in the case of NCCFI A standard firewall solution should be adopted

SOFTWARE

By definition, the software component within this platform must be identical across all sights So the discussion developed for the NCCFI platforms applies here *in totto* This discussion dealt with the following components

- Operating Systems
  - Enterprise server
  - Departmental Server
  - Desktop Workstation
- Middleware
  - Clustering
  - Back-up
  - Security
  - Network Management
- Database
  - Database Engine
  - Transaction Manager
- Application systems

ACQUISITION TIMELINE

The acquisition time line for these two sites is entirely dependent on the logistics of AOJS It is however important to note here that while the physical acquisition could be carried out in one step to benefit form the economies of ordering and shipping actual implementation should be staggered at least 3-4 Months

Option Two One Shared Computing Facility

The combined volume of work in these two courts is approximately 60 % of that of NCCFI In this option a system configuration similar to that recommended in the first section of this report will be more than adequate

Network Infrastructure

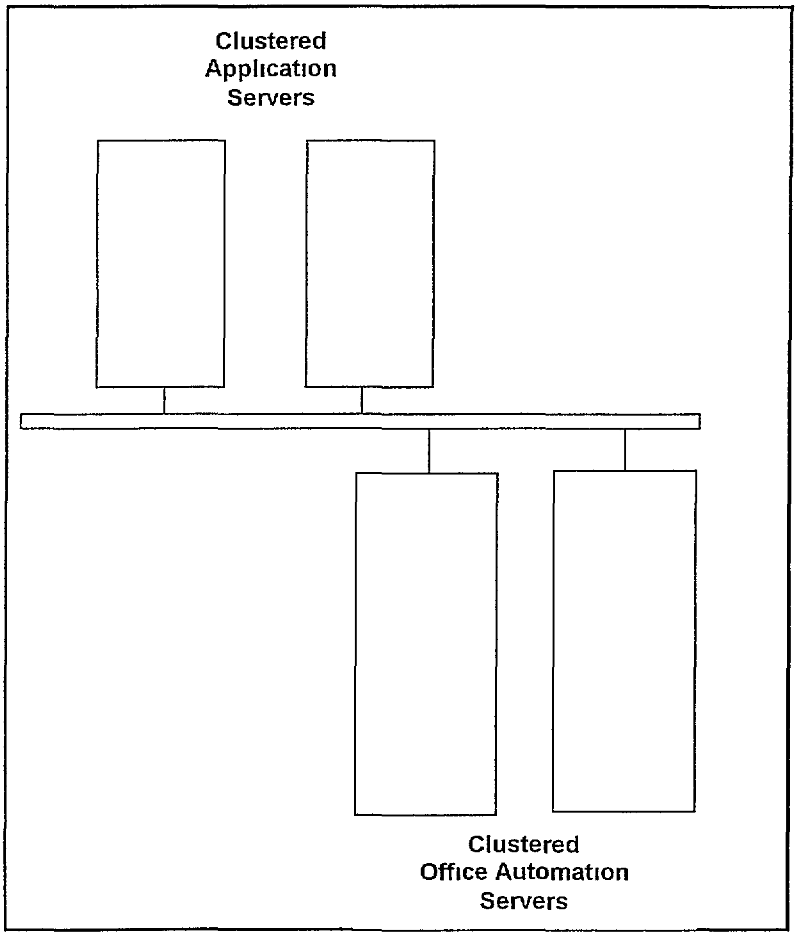
Network Infrastructure design should subject to the same argument presented in section one of this report as far as Technology, The Use of Switched connections rather than HUBs The provision of Internet/Extranet Gateway, the laying of a Fiber Optic Backbone and Structured cabling

Network Layout

The final network layout will depend on the location of the joint application servers and the path taken by the fiber optic backbone Departmental servers will be located within the departments they serve

Hardware

The following diagram illustrate the Hardware Configuration of a Single Shared Computing Facility


Clustered Application Servers
Clustered Office Automation Servers

SERVERS

From the above discussion it becomes clear that the information infrastructure will contain two classes of servers one to handle the Case Management Applications and the other to handle the Typing Pool and office automation These two types of servers are different only in their computing power

Application Servers

Item	Specification
Architecture	Symmetrical Multiprocessor (SMP) Architecture for the individual server These servers should be configured into two or more clusters
Processor Type	Both performance "Headroom' and the reliability derived from the use of UNIX operating system seem to indicate the use of RISC processor server Industry Standard (Intel) based servers from certain vendors can also be used if they provide the necessary performance minima The deciding factor will be budgetary considerations
System Memory	Memory Type ECC Minimum Memory Size 512 MB Level 1 Cache 32 KB Level 2 Cache 256 KB
Storage	Because of the clustering arrangement it may be necessary to use a shared RAID storage unit between the two application servers The Capacity of Storage should reflect the expanding nature of the database its mirrored image and temporary work areas Interface SCSI-2, UltraSCSI RAID
Expansion	Processors 4 Way SMP RISC 4 Way (Intel) Memory 3 GB Slots 5 Storage 200 GB
Communication	Ethernet 10/100 Mbps FDDI 100 Mbps ATM 25/155 Mbps ISDN X 25 Token-Ring 4/16 Mbps
Fault Recovery	Automated server recovery is an essential feature of the application servers
Performance	TCP-C 6000 tpmC on a single processor rising to 11000 tpmC on 4 SMP

Typing Pool Servers

Office Automation Server

Item	Specification
Architecture	Symmetrical Multiprocessor (SMP) Architecture for the individual server These servers should be configured into two or more clusters
Processor Type	Both performance "Headroom" and the reliability derived from the use of UNIX operating system seem to indicate the use of RISC processor server Industry Standard (Intel) based servers from certain vendors can also be used if they provide the necessary performance minima The deciding factor will be budgetary considerations
System Memory	Memory Type ECC Minimum Memory Size 512 MB Level 1 Cache 32 KB Level 2 Cache 256 KB
Storage	Because of the clustering arrangement, it may be necessary to use a shared RAID storage unit between the two application servers The capacity of Storage should reflect the expanding nature of the database, its mirrored image and temporary work areas Interface SCSI-2, UltraSCSI, RAID
Expansion	Processors 2 Way SMP RISC, 4 Way (Intel) Memory 3 GB Slots 5 Storage 200 GB
Communica-tion	Ethernet 10/100 Mbps FDDI 100 Mbps ATM 25/155 Mbps ISDN X 25 Token-Ring 4/16 Mbps
Fault Recovery	Automated server recovery is an essential feature of the application servers
Performance	TCP-C 3000 tpmC on a single processor rising to 7000 tpmC on 4 SMP

Clients

The Client workstation specifications will not differ from those of NCCFI

Generic Specifications

Item	Specifications
Processor	Pentium II – 300 MHz
Bus	PCI – 100 MHz
Cache Memory	L1 16 KB L2 256 KB
Main Memory	64 MB
Storage	Adapter Ultra ATA Hard Disk 4 GB
Display	Adapter D2 Acceleration 4 MB 17 Inch
I/O Ports	Universal Serial Port Enhanced Parallel Port
Management	DMI 2 0 Compliant

Printers

The printing requirements of these two courts are identical to those of NCCFI The same argument and specification apply here

Communication

A gateway to a small Virtual Private Network is recommended This could be achieved through a router and a leased line to an ISP (Usually IDSC or the MOJ itself)

Firewall

The need for a firewall within this site is just as valid as in the case of NCCFI A standard firewall solution should be adapted

SOFTWARE

By definition, the software component within this platform must be identical across all sights So the discussion developed for the NCCFI platforms applies here *in totto* This discussion dealt with the following components

- Operating Systems
  - Enterprise server
  - Departmental Server
  - Desktop Workstation
- Middleware
  - Clustering
  - Back-up
  - Security
  - Network Management
- Database
  - Database Engine
  - Transaction Manager
- Application systems

ACQUISITION TIMELINE

The acquisition time line for these two sites is entirely dependent on the logistics of AOJS It is however important to note here that while the physical acquisition could be carried out in one step to benefit form the economies of ordering and shipping actual implementation should be staggered at least 3-4 Months

PART II

TECHNOLOGY WHITE PAPERS

List of White Papers

- Availability and Scalability Solutions for a Business that Needs them

- Virtual Private Networks

- UNIX or NT The Operating System Dilemma

- Enterprise Management Systems An Overview

- User Interface Design

- Overview of Oracle 8

- Computer Aided Software Engineering CASE

AVAILABILITY AND SCALABILITY:

SOLUTIONS FOR A BUSINESS THAT NEEDS THEM

AN SRE WHITE PAPER
PART OF PLAN DEFINITION STUDY

INTRODUCTION

Many in the Information Technology field have been watching with concern the escalating importance of computer systems in the regular execution of business In the days of batch processing, a central computer system could be out of commission for days before its impact would begin to tell on routine operations This is no longer the case Online Transaction Processing, especially of mission critical applications has made the availability of computer systems a must Automated Tellers are a good case to illustrate this

AVAILABILITY

WHAT IS AVAILABILITY?

We say a system is highly available if it functions properly at all times when it is needed by users However, "all Times" does not translate into 100% availability for that is the realm of the very costly Non-Stop-Systems It simply means the possibility to continue user operations after a short switch-over break, even at reduced performance

WHY AVAILABILITY?

The integration of computer functionality into regular business and technical operations in areas such as banking, financial services hospital management, has reached such a level that many of these business would grind to a holt without their computer systems A number of recent studies have identified certain patterns of dependence It is interesting to note that some breakdown periods are as short as 3 seconds It is even more interesting to note that many analysts believe that the maximum downtime that could be tolerated is to hours

0-3 SECONDS

Some applications have very low tolerance to computer system breakdowns Examples of this are Air Traffic Control Systems, Stock Exchanges

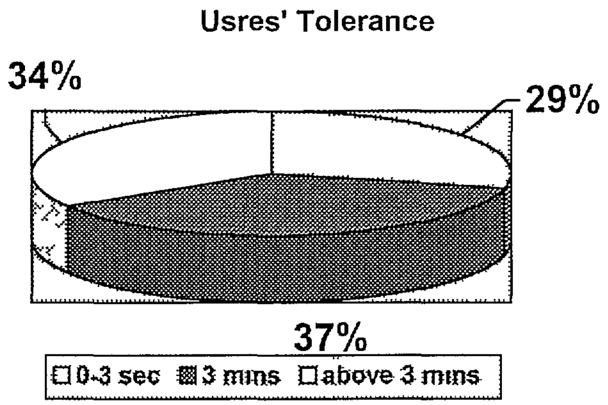
UP TO 3 MINUTES

A number of applications that we come into contact with on daily basis are in this group Banks Airline Reservation systems and Hospitals will tolerate breakdowns of up to 3 minutes Anything longer than that will cause severe disruptions

Longer than 3 Minutes

Other mission critical applications such as insurance claims, permit processing and all other Forms Processing applications can tolerate a little longer delay However they all expect the resumption of service within the same working day

This is illustrated in the following diagram



Levels of Availability

Industry analysts and standards organizations have defined five different levels of availability Two of them are in the stand-alone servers and Three are implemented using clustering Each one of them implements the previous levels plus some additional features

In Stand-alone servers

Level One

Level one availability defines some basic ideas to make the system a bit more fault tolerant These includes features like

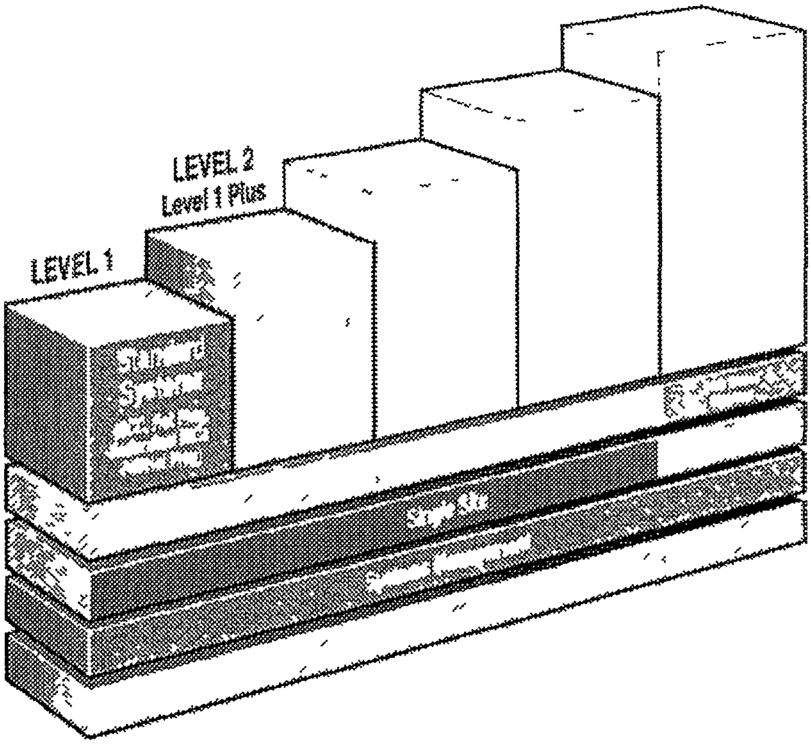
- Redundant cooling fans that continue to cool the server even when one fan fails
- Redundant power supplies to enable the server to continue to receive power even if one power supply could fail
- Error Checking and Correction (ECC) memory that prevents single-bit, "soft" memory errors from propagating into double-bit, "hard" memory failures that would cause a complete system outage
- Hot-pluggable cards, including PCI Hot Plug cards that allow customers to make a dynamic change of a failed card, without needing to quit applications and/or shut down the server before making the repair
- Software also plays a key role in Level 1 HA The ability to install the server and any software programs

quickly and easily is also important in increasing computer uptime

Level Two

Level two availability defines more complicated features concerned mainly with *data availability* to protect the system against wider range of faults that increase its uptime Those include

- Hardware RAID technology such as Compaq SMART (Self-Monitoring, Analysis, and Reporting Technology) and SMART-2 controllers and drive arrays
- Improved data high availability by the use of Fiber Channel-based storage solutions to the market Fiber Channel storage solutions bring to customers benefits such as very high performance very large storage capacities, ease of capacity expansion, configuration flexibility, dynamic configuration changes and enhanced data high availability



In the context clusters of servers a cluster is defined as

> *"any group of independent systems working together as a single system A client interacts with a cluster as though it were a single server "*

Clustering could be either for availability (which is shown in this section) or scalability (as described in a later section)

Level Three

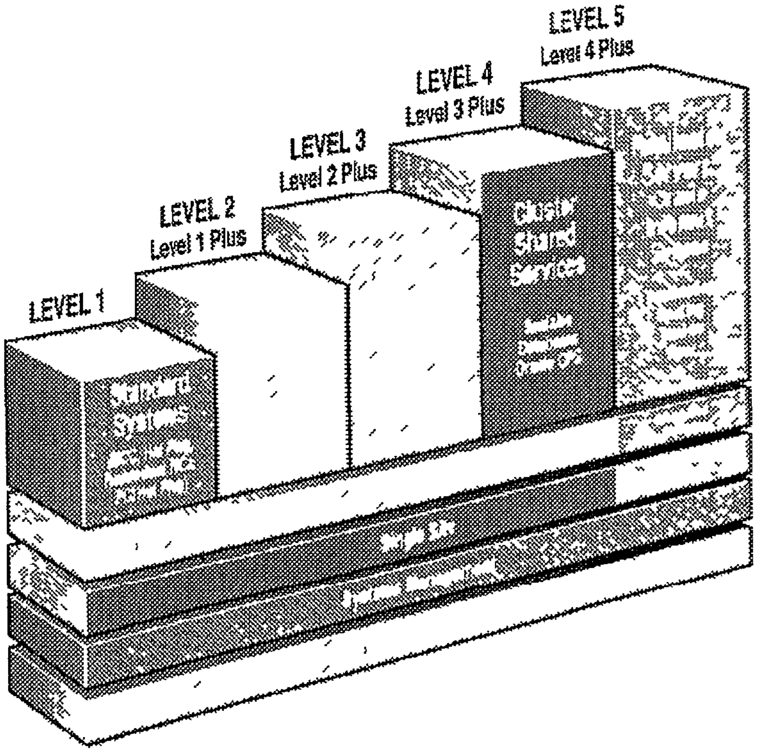
Level three availability puts the starting block for clustering utilization for availability It is basically the use of two active servers each of them is serving its community of end-users Yet, both servers are connected together and monitor the health of each other Where any one of them failed either partially or completely, the cluster management software *automatically* detects the failure and passes immediately ownership of software applications, disk, and network resources to the other node (the healthy one) keeping the service of the system available to end users

Level Four

This level is mainly used for scalability and will be discussed later in this paper

Level Five

This level introduces what is known as Geographically Dispersed Clusters (GDC's) This is where the nodes participating in a cluster are not located physically near each other as it is the case with most clusters This is because a power failure in the area would bring the closely situated servers in a cluster down, and thus leading to bringing the whole system down Similarly, natural disasters such as floods and Earthquakes would bring down a cluster with the near servers Thus, Compaq has suggested the idea of (GDC's) as a solution, where the nodes of a cluster are distributed city to city, or state to state, or region to region and still work as a single cluster



Technical issues of the implementation of clustering for availability

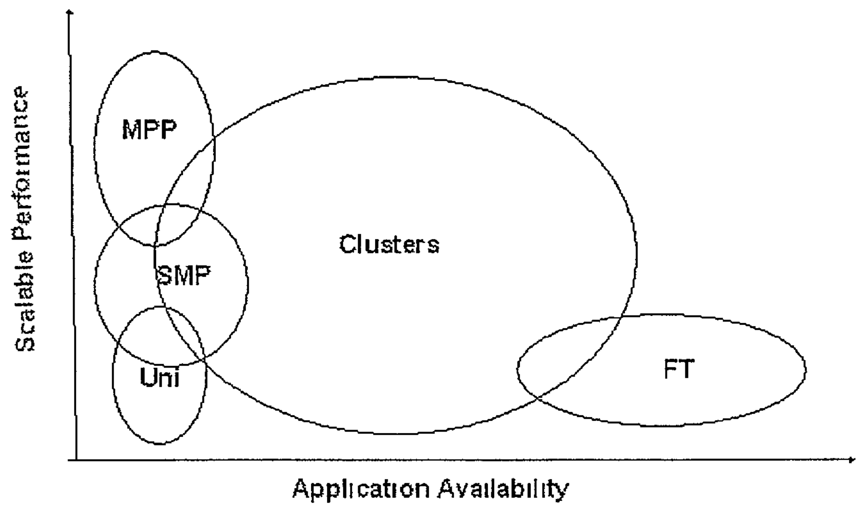
A technical definition of clustering can be given which fits the pragmatics of why people would cluster systems

> *"A cluster is a collection of physically attached whole computers, each with its own processor(s), dynamic memory, private I/O subsystems and network addresses These computers can share a common set of resources such as disks, applications and data, logical network addresses, security passwords, managed by a common management layer This management layer, called a cluster manager, monitors and reacts to collective system events either hardware, operating system, or application generated, and takes action(s) which keep applications and data available for the user community "*

The following figure shows how clustering relates to other computer technologies such as Symmetric Multi-Processing (SMP), Massively Parallel Computing (MPP) and Fault

Tolerant Computing (FT), where "Uni" is a uni-processor system

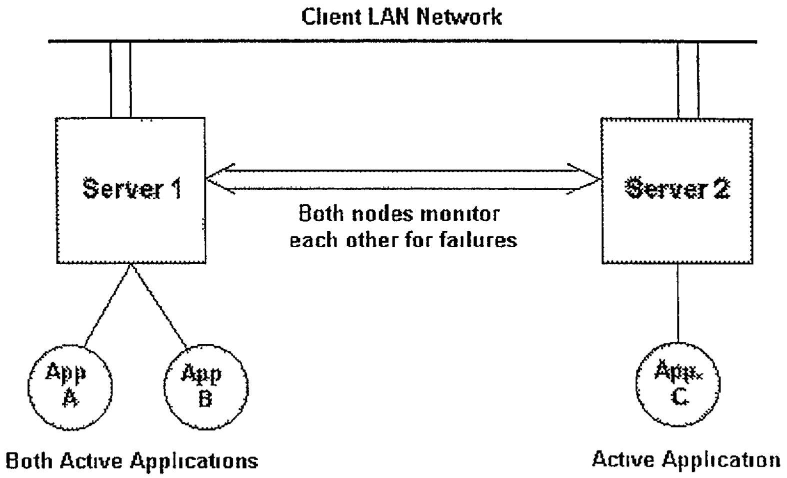
Where Do Clusters Fit?



There are mainly two approaches for implementing clustering for availability The first is the **Active-Passive Clustering** where two nodes (servers) are participating in the cluster but only one of them is *active* and serving the clients and is constantly monitored by the other idle *passive* node If the active node fails for any reason the passive one takes over and continues servicing the clients as if nothing happened

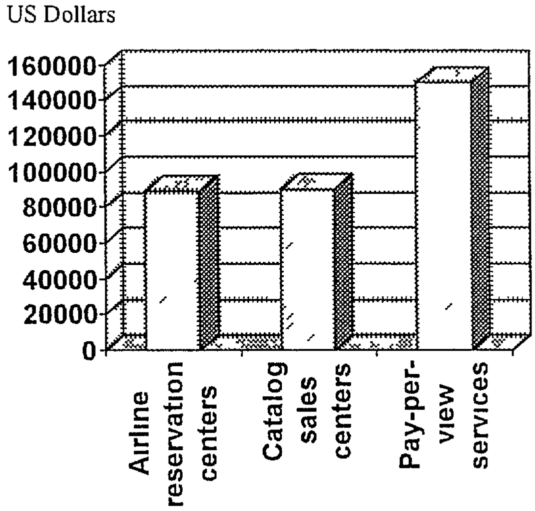
The second approach known as the **Active-Active Clustering** Where both nodes participating in the cluster are *active* and serving clients and at the same time monitor each other for failures, where if any one of them fails the other one takes over and continue the work regularly, (see the figure below) Thus, providing overall better application performance plus a higher level of availability

Active - Active Cluster



What type of business needs clustering?

Since clustering is an expensive solution for availability, small business that can tolerate few hours of downtime would not find it practical However, large mission critical business, for which an hour of downtime would be tremendously costly will find clustering relatively a cheap solution To further demonstrate that here is a graph that shows the cost of downtime of an hour for some mission critical business



As for retail brokerage houses the cost could reach **$6 45 million** (that is why it could not be put on the graph)

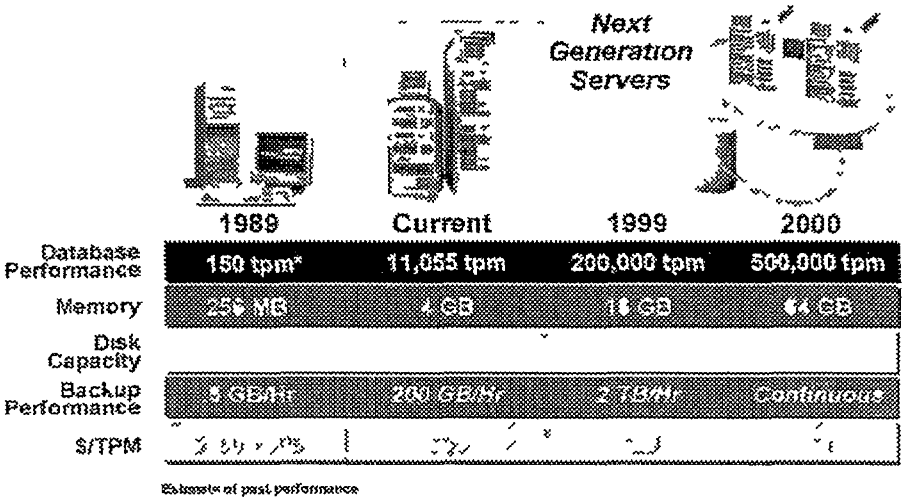
SCALABILITY

WHAT IS SCALABILITY?

A scalable system is a system designed to support an increase in the number of clients without degradation in performance, or when the system is designed to utilize its resources in favor of a better application performance

WHY SCALABILITY?

Scalability is an essential feature in many systems that need high transactions per minute operations, like huge databases, automatic control and real time systems The following figure illustrates the performance of the database servers in 1989, current, 1999, and 2000



LEVELS OF SCALABILITY

IN STAND-ALONE SERVERS

Scalability in stand-alone servers has not been stressed upon for there are few things that can be done using only one server including

- Introducing new high performance processors such as, Merced (64-bit) based servers
- The use of multiprocessor servers that uses 2-, 4-, 8-processors with SMP capabilities
- Fiber channel-based storage products and backup libraries

In clusters of servers

For clusters of servers Compaq defines a level of its 5-levels of high availability for scalability

Level four

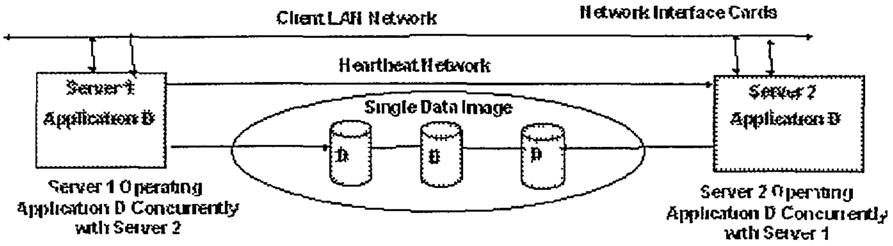
> *"In contrast to high availability clusters, in which each node is active on its own separate application workload, each node in a scalability cluster is active on a separate "instance" (or "copy") of the same application Since more than one node is now working on the same application, more computing resources can be applied to the same application, thus increasing the performance "*

Technical issues of the implementation of clustering for scalability

Scalable clusters require some unique software that does not exist in the NT environment today except from Oracle Corporation in the form of their Oracle Parallel Server Database offering This form of clustering truly shares data across the clustered servers In this shared data configuration both servers can access the same data (tables) concurrently and provide application support to users signed on to any server in the cluster The difference between this approach and the Active-Active/Mutual Takeover approach is that no server owns the data, the "Cluster" owns the data The uniqueness in this approach is a locking technique called a Distributed Lock Manager (DLM) which will restrict access to certain areas of the data table(s) if another user or application has accessed that data for update purposes

This DLM is used by Oracle system applications in a parallel server environment only and does cause some performance overhead when these locks are passed between the servers and each server maintains a Lock Table where these common locks are issued and released This is part of the overhead that can take performance away from the application(s) in a standalone configuration But it provides a seamless growth path as well as increased availability in the event of a server or application failure in that the lock table is active and can be recovered quickly, and the data tables do not need to be transferred as in the Active-passive and Active-Active configurations Therefore application takeover is quicker but overall application performance compared to a single server may be lower This type of cluster is sometimes called a **Shared Everything or Shared Disk Cluster** and below is an example

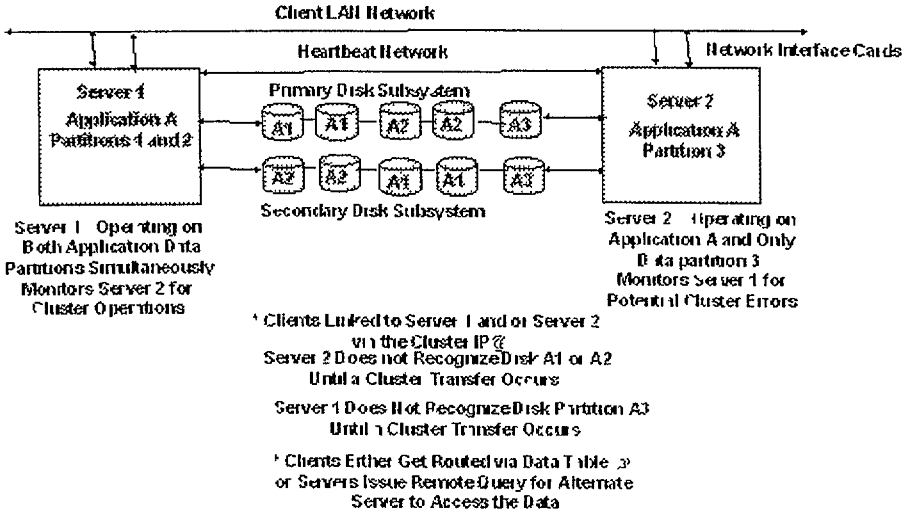
Shared Disk Cluster Configuration



- Servers Operate Same Application But Share Common Data
  Applications Read, Update Common Data Through A Distributed Lock Manager
- Cluster Manager Operates Through Heartbeat Communications
  Dedicated Network Recommended for Distributed Lock Traffic
- DBMS Maintains Lock Caches and Issues and Releases Locks Across the network
  Performance Dictated by Lock Manager Efficiency Network Efficiency
- Clients Transparently Routed to Either Server 1 or 2 By Cluster Manager

Another emerging form of Scalable Clustering is the **Shared Nothing or Parallel Cluster** It operates using a parallel form of database where each server or server pair owns a section or segment of the data and transaction requests will be passed through a high speed messaging network which is common to all the nodes in a cluster This approach is being developed by Informix, Sybase, and IBM, to name some of the parallel database offerings that are emerging today The main difference between **Shared Nothing** approach and **Shared Everything** approach is the Distributed Lock Management operation compared to a High Speed Messaging Data Request Again, this is not an application requirement but a database engine requirement Below is an example of a Shared Nothing Cluster

Shared Nothing Cluster Configuration


Client LAN Network
Heartbeat Network
Network Interface Cards
Server 1
Application A
Partitions 1 and 2
Primary Disk Subsystem
A1
A1
A2
A2
A3
A2
A2
A1
A1
A3
Secondary Disk Subsystem
Server 2
Application A
Partition 3
Server 1 Operating on Both Application Data Partitions Simultaneously Monitors Server 2 for Cluster Operations
Server 2 Operating on Application A and Only Data partition 3 Monitors Server 1 for Potential Cluster Errors
* Clients Linked to Server 1 and or Server 2 via the Cluster IP @
Server 2 Does not Recognize Disk A1 or A2 Until a Cluster Transfer Occurs
Server 1 Does Not Recognize Disk Partition A3 Until a Cluster Transfer Occurs
* Clients Either Get Routed via Data Table @ or Servers Issue Remote Query for Alternate Server to Access the Data

Two Competitive Solutions

R/6000 Model F50 server from IBM

The R/6000 Model F50 is the proposed solution by IBM to

One- to four-way PowerPC 604e* with X5 cache system

- Delivers exceptional price/performance needed for commercial applications
- Offers processor scalability and performance with two processor speeds

Up to 3GB of SDRAM memory

- Provides very fast performance to reduce disk paging and accommodate application requirements

ECC L2 cache, eight-way set assoc

- Provides reliable performance with few cache misses for increased throughput

Hot-swappable disk bays

- Designed to enable system managers to swap disks without powering down the system
- Provide outstanding reliability availability and serviceability

THREE INDIVIDUAL PCI I/O BUSES

- Enhance I/O throughput and reduce many typical application I/O bottlenecks

INTERNAL RAID STORAGE

- Helps protect data without purchasing external disk subsystems

ULTRA SCSI DISK SUPPORT

- Doubles data transfer rate over SCSI-2 up to an impressive 40MB/second for data-intensive applications
- Helps improve multiple disk access performance

SSA RAID DISK SUPPORT

- Increases disk performance up to 80MB/second for transaction-intensive applications
- Provides higher disk capacity than traditional SCSI
- Helps improve data availability

SERVICE PROCESSOR

- Enhances reliability and availability, as well as remote diagnostics and maintenance

AMPLE EXPANSION SLOTS AND BAYS

- Provide flexibility options and a rich networking configurability

GRAPHICS WORKSTATION

- Supports advanced MCAD with POWER GXT800P 3D graphics accelerator

AIX OPERATING SYSTEM

- Provides a wealth of multi-user communications and systems management technologies
- Complies with major industry standards
- Provides an AIX binary compatible environment where most AIX 4 2 and Version 4 3 applications already running on other RS/6000 systems can run unmodified
-

E2000 PLATFORM ARCHITECTURE FROM COMPAQ

The E2000 platform architecture is an approach by Compaq to come up with highly available and highly scalable system that address the needs of the most demanding enterprise requirements Some of the features of the E2000 platform architecture are listed below

SYSTEM AREA NETWORK (SAN)

It is a specialized network optimized for the reliability and performance requirements of clusters The characteristics of this network are optimized to facilitate the interconnect of multiple industry-standard servers in clusters to address highly scalable and high-availability applications The leading interconnect technology, ServerNet, allows systems and I/O devices to communicate at tremendous speeds in order to keep the systems tightly synchronized and enable the performance scalability required in high performance systems The ServerNet interconnect also offers full redundancy capability to eliminate any single points of failures in high-availability system configurations This technology is being driven as a multi-vendor industry standard by Compaq, and Tandem fully licensing it to the industry By configuring industry-standard servers, I/O, and storage components into E2000 Architecture SAN-based systems, unprecedented levels of scalability and high availability can be achieved

The Virtual Interface (VI) Architecture

That addresses standards-based messaging protocols and transports for communicating between computer systems in a SAN-based clustered environment This industry initiative led by Compaq, Microsoft, and Intel has defined a hardware independent set of protocols and application programming interfaces (APIs) that standardize the interface between operating systems and the SAN interconnects The VI Architecture forms an integral component for SAN-based clustered systems and its specification was released in December 1997 Through the VI APIs, the E2000 Architecture provides for OS vendors' hardware abstraction layers that standardize and simplify the development of more scalable high-availability operating systems and distributed applications

PCI Hot Plug

It offers higher availability by enabling users to upgrade and repair their systems without service interruption Compaq innovated these industry-standard PCI extensions Customers can either replace failed, redundant I/O components or add system capacity (such as disk arrays or NICs) without interrupting system operation in high-availability environments (adding system capacity in a Microsoft Windows NT environment requires NT 5 X)

Fiber Channel

This provides unprecedented scalability in performance (100 Mb/sec bandwidth), distance (1-10 Km), capacity (multiple Terabytes), and connectivity (many storage devices)

Compaq belongs to the Fibre Channel American National Standards Institute (ANSI) committee and has actively worked to enhance the technology as the key industry-standard data storage interconnect Compaq has co-developed with

Hewlett-Packard the key Fiber Channel chipset components and is currently conducting broad customer valuation of a wide range of Fiber Channel-based storage products to be delivered in volume in 1998 These Fiber Channel-based products are a key element of the E2000 Platform Architecture and allow large amounts of primary and secondary (backup) storage to be attached to a single server or shared by multiple servers in a cluster

Virtual Private Networks

An SRE White Paper
Part of Plan Definition Study

INTRODUCTION

WHAT IS A VIRTUAL PRIVATE NETWORK?

A Virtual Private Network (VPN) uses public IP networks to extend the corporate network out to distant offices Thus, a VPN is simply an Intranet that can be accessed remotely

Virtual Private Networks make the corporate network highly scalable by increasing its network span They also allow remote network users to access their corporate Intranet In addition, they allow establishment of easy means of communication between business partners, thus allowing easy establishment of Extranet

When planning to implement a VPN, issues such as connectivity and security are of major concern and must be addressed properly

VPNs are flexible They can allow all the branches of the corporate to access the network resources of each other, or specify which branches have access to which network resources In addition, VPNs are platform independent Computer systems only need to run on an IP network and have remote software to be incorporated into a VPN

In an Extranet VPN, each company manages its own VPN equipment A portion of the VPN must be first configured by the company, and then the needed subset of configuration information is exchanged with business partner VPN

WHAT ARE THE ADVANTAGES OF USING A VPN?

SAVING COSTS

Costs of remote access equipment and connection, such as the expensive leased line connections, can be saved, while at the same time providing reliable corporate dial-up access

Enterprise managers can typically save from 20 to 40% for site-to-site domestic networks, and 60 to 80% for traveling and telecommuting employee access In addition to saving on-line charges, WAN equipment and personnel costs are dramatically less expensive with a VPN solution

SAVING EFFORT AND TIME

Network managers will spend less time and effort in buying, installing, and configuring remote access servers and modem racks, working with telephone companies to install lines, and supplying sufficient ports for increasing numbers of telecommuters, and most importantly keeping up with fast-changing technology

AVAILABILITY

Accessing a company's VPN is easy for network users and customers with the increase of Internet points of presence worldwide

SCALABILITY

Enterprise managers can take advantage of VPNs They allow reliable corporate dial-up access and getting connected with a fast growing number of customers, employees, with neither large financial overhead nor delay in establishing connections They also facilitate getting connected with business partners by establishing secure Extranets

SECURITY

For enterprise managers, security is a great advantage of using VPNs over using the Internet for an enterprise The Internet was not designed with security in mind, making VPNs with their security layers, an inevitable solution

VPN MARKET GROWTH

VPN market was around $205M in 1997, with estimated 100% annual growth up till year 2001 This market includes VPN products, systems integration, and Internet/Network Service Provider services

Furthermore VPN is a great opportunity of Service Providers 92% of Service Providers plan to offer VPNs by March 1998

VPN IMPLEMENTATION

WHAT IS THE SUCCESSFUL VPN SOLUTION?

The first step in planning a VPN is to determine the connectivity requirements between corporate offices telecommuters, and traveling employees In addition, potential security risks and define a corporate security policy must be defined

Then, the network administrator should install a VPN solution that can map the corporate security policy to the network This solution can be totally accomplished by network administrator or can be acquired from a VPN service provider

Implementing and using VPNs should be as transparent as possible for users network managers, and service providers A sound VPN solution should not modify the desktop in any way Furthermore, it should be able to support existing investments in new or legacy systems, applications, and network components

Access control is by far the most important point to consider when establishing a VPN Once it is achieved other issues like scalability and ease of use can be tackled

VPN solution must be chosen to survive the market's rapid changes, through open standards and a plug-and-play architecture that could easily incorporate the latest authentication and encryption standards

VPN solution must offer easy administration tools

- Dynamic access control to easily customize what content flows in and out of the network and to whom
- Ease of integration with existing equipment must exist through a flexible infrastructure
- A scalable architecture that facilitates rapid changes in a networking environment
- Intelligent auditing to monitor and log network traffic
- Multiple encryption options, such as RC4, DES, and Triple DES
- User-based authentication and support for multiple authentication methods
- The ability to filter objectionable content
- Affordability, which varies considerably depending on the level of security
- VPN solution must offer ease of use for network users
- Single sign-on, which prevents the end-user from having to re-authenticate each time a new application is launched
- Ease of use through centralized management and a transparent client

ISSUES IN VPN IMPLEMENTATION

COMPATIBILITY AND STANDARDS

The popular emerging VPN standards are PPTP (Point-to-Point Tunneling Protocol), L2TP (Layer 2 Tunneling Protocol), and IPSec (IP Security), with the latest being the most popular and supported, because it has security built in IPSec is a general initiative to add security services to the IP protocol Many VPN companies either support or plan to support IPSec Of the three standards, IPSec is the only protocol being driven by major network users

All VPN equipment must be IPSec compliant to ensure compatibility

SECURITY AND PERFORMANCE ISSUES

VPN communications must

- Encrypt data for privacy—outsiders are not allowed to read the data This is done using access keys Since decryption keys are the most important to maintain the VPN's security, secure environment for exchanging access keys must be present
- Prohibit modification of data—outsiders are not allowed to alter the data This is done using mathematical transformations which slow down performance
- Ensure correct user authentication—outsiders are not allowed to be considered as insiders
- Be optimized for security measures, such as encryption, hashing, authentication, and key management, to avoid degradation in performance

Performance of VPNs depends on two factors

- The speed of transmissions over either the Internet or a public IP backbone network
- The efficiency of VPN processing at each end of the connection

Performance must be powerful enough to meet business needs, while not sacrificing security aspects that add large overhead on VPNs Performance is highly affected by encryption/decryption process, data encapsulation, and data compression

Therefore, standalone hardware-based VPN products deliver both the best performance and tightest security, while software-based solutions are sufficient for small and medium scale companies with lower security requirements

CHOOSING VPN SERVICES

Most VPN applications in the United States will use Triple DES encryption and compression, which is prohibited outside the States The alternative in this case is 56-bit DES

If the network on which the VPN will be built already supports encryption prior to applying the VPN, then VPN compression services are no longer needed

Compression or encryption can be neglected when implementing applications that deal with public data, such as news reports where secrecy may not be vital but data alteration is disastrous Still data authenticity is desired

Network Management

VPNs must include tools for the network manager and service providers to manage security, performance, and costs Tools must allow network managers to

- Install and provision equipment in a secure fashion
- Scale the VPN when the requirements grow beyond its current capabilities
- Track problems beyond their own borders
- Establish Extranet relationships with a variety of business partners

Task Distribution between Network Managers and Services Providers

Service providers may only supply the Internet or IP network bandwidth needed to handle VPN traffic, leaving the rest of VPN implementation to network managers Alternatively, service providers can offer more products and services, including design, management, service, and training for the corporate VPN

Some VPN service offerings for service providers may include

- Selling basic Internet access and bandwidth, or IP network services, the enterprise customer handles all VPN products and operations
- Selling compulsory VPNs embedded in POP equipment
- Offering VPN hardware and software bundled with VPN bandwidth and services
- Designing the customer's VPN solution
- Operating the total VPN solution for the customer, including design, equipment installation and service, and help desk support (100% outsource)

Security may have to be kept in-house, while costly help desk services may be off-loaded to the service provider In-house security may require that the network management staff include a security expert

Some VPN implementations, such as PPTP compulsory mode, cannot be achieved without involving the service provider IPSec, for example, is transparent to the service provider

"VPNs are about partnerships, and the most important VPN partnership for many organizations will be the one they establish with their VPN service provider "

UNIX OR NT

THE OPERATING SYSTEM DILEMMA

AN SRE WHITE PAPER
PART OF PLAN DEFINITION STUDY

INTRODUCTION

Prior to 1993, the decision on which operating system to use in a mission critical application was an easy one If you were not going with a proprietary platform, Then you went with UNIX This has changed with the release of Microsoft Win NT

Not unexpectedly, Microsoft quickly established itself as the dominant Operating System Vendor, following its shift of tactical focus from the Desktop to the Server Room and the Internet Meanwhile, traditional UNIX vendors (IBM, NCR SUN etc) are either joining NT by offering customers a choice of UNIX or NT with their hardware platforms, or fighting NT by introducing inexpensive versions of their own operating systems With UNIX and NT available as viable options, end users will decide which operating systems work best in their own situations However the selection criteria is rather complex On the surface the comparison pits the ease of use and the low cost of NT verses the reliability and performance of UNIX In reality many other factors are involved One also has to bear In mind that vendor statements is always clouded by hype

THE ARGUMENT FOR NT

NT has been on the market for five years, and in this time, its popularity has mushroomed in certain market segments However, because of initial bugs, few applications, and performance problems, NT did not attain the immediate success anticipated by Microsoft at its introduction in 1993 Nonetheless, after the improved NT 3 5 release, and even better 4 0 release, many users now consider NT a viable option to UNIX What makes NT good enough to rival UNIX?

- **First**, Microsoft has a reputation for delivering easy-to-use software that tends to dominate the market as evidenced by its position In the desktop operating system market End users immediately relate to NT as a comfortable operating system because it runs the familiar Windows interface Users feel safe making an NT decision
- **Second,** NT is technically superior to anything the company has ever produced Like UNIX, NT is a 32-bit multitasking operating system Further, just like UNIX vendors, Microsoft is currently developing a 64-bit version In addition, the more recent 4 0 upgrade, was a considerable improvement over the original versions, with better performance and connectivity options A future release (Win NT 5 0) is scheduled for mid 1990 It

ıs expected to brıng consıderable enhancements ın avaılabılıty and scalabılıty

- **Thırd**, NT provıdes a non-UNIX growth path for Mıcrosoft's lower-end operatıng systems Before NT, UNIX was the best alternatıve for upgradıng But now, many users who want to move from MS-DOS or Wındows belıeve ıt ıs easıer to expand to NT because they can contınue to use the same vendor (Mıcrosoft) and the same ınterface (Wındows)
- **Fınally,** although NT runs on fewer systems (at the present tıme on the x86 Intel famıly and DIGITAL Alpha), Intel systems are the domınant hardware ın the small to medıum range wıth ındıcatıon of ıt becomıng much more scalable ın the near future Thus, NT can now play ın the broad server market, and ıs beıng supported as eıther a replacement for UNIX or a strategıc alternatıve, by major hardware companıes that used to support only UNIX, such as NCR and Data General

POSITIONING

NT ıs conceıved as a powerful clıent/server upgrade to MS-Wındows that targets the Network Operatıng System (NOS) and the Workgroup and Departmental servers But because of ıts success ın these areas ıt also developed aspıratıons to become an Enterprıse-wıde operatıng system

NT's most promınent advances have been wıth fırst tıme users of NOS Here ıt ıs makıng major gaıns ın market share agaınst Novell Netware and Banyan Vınes among others Workgroups and small departments (up to 60 concurrent users) are adoptıng NT as the OS of choıce These segments were not major UNIX users anyway

Most large organızatıons are, especıally those wıth substantıal ınvestments ın legacy systems, are not actually goıng so far as to replace theır entıre corporate envıronment wıth NT NT ıs beıng adopted where MS LAN Manager or Novell Netware were beıng used Also where offıce automatıon applıcatıons are ıntroduced ın Workgroups

Very few large mıssıon crıtıcal applıcatıons were reported ported or developed from scratch usıng NT as the basıc operatıng system There are a number of reasons for thıs that wıll be examıned later Thıs however does not exclude NT from thıs area altogether But a prudent waıt an see attıtude has prevaıled ın larger data processıng shops untıl the release of NT 5 0 and ıts stabılızatıon by the year 2000

NT ON THE DESKTOP

NT has successfully cut into the desktop market This may become particularly true in the Arabic Speaking world where Microsoft had announced that it will no longer provide Arabic support in its Windows 9x product This means that Windows 95 is the last Desktop operating system with Arabic support PC hardware vendors will face the dilemma of which OS to bundle with their systems after the release of Windows 98 Win NT 4 0 with Arabic support is a stable product that has been available since late 1997 But it has not been widely adopted in the Egyptian market yet However this maybe only a matter of time

SOME SUBJECTIVE FACTORS FOR NT

EASY TO USE

NT's Windows interface means there is a shorter learning curve for NT than for traditional UNIX Microsoft stresses that there is only one version of NT Compared to many versions of UNIX It is true that in organizations with several different UNIX platforms there are some incompatibilities not present in NT In addition, NT proponents say that with Microsoft you need only comply with Microsoft's standards, while with UNIX, you must comply with many different, sometimes conflicting, standards Microsoft's solution certainly reduces labor-intensive integration efforts, but by allowing Microsoft to set industry standards, users may eventually lose out on better technology and solution from companies other than Microsoft

4 0 UPGRADE SOLIDIFIES NT'S TECHNICAL MERITS

The race between NT and UNIX is not really over technical merits - it is more of a marketing/loyalty issue However, only good operating systems can compete with UNIX NT is good and getting better The NT 4 0 release raises NT's capabilities It includes an improved task manager, administration wizards, and better performance Its new Windows 95 GUI makes NT look and act very close to Windows 95, and makes it easier to use the two operating systems together The new task manager gives detailed information about the applications and processes, including memory and CPU usage The administrative tools are easier to use than already simple previous versions, especially with a new wizard that eases management of user accounts groups, file and folder access, adding printers, modems, network clients, and managing licenses Diagnostic tools are much better, they can be run remotely or locally and include information on system resources, network usage, and device drivers

CRITICAL ISSUES AGAINST NT

While the above favorable review of NT's merits may be compelling, so are UNIX's To make a enlightened judgment, it is important to take a realistic view of potential problems

IS NT OPEN?

The reason many people moved to UNIX is because it is an open system It frees the end user from single-vendor demands, delays, and unfulfilled promises Microsoft has asserted that NT is an "open" system because it will run on multiple architecture However, NT really is only available for DIGITAL Alpha and Intel platforms, with Alpha architecture not expected to survive long after the year 2005 And Microsoft recently dropped support on the PowerPC chip earlier it dropped its support of MIPS processors So, since Microsoft is the only vendor supplying NT, it is really a proprietary product Nonetheless, being open is mainly a perception Many people argue that NT is really open because the operating system can be purchased from multiple sources-directly from Microsoft as well as a multitude of hardware partners Being "open" may not really matter in this case, as long as it is available from many sources

RELIABILITY

Perhaps the most glaring drawback of NT is its perceived lack of bulletproof reliability The industry wide impression (only slightly subjective) is that NT is not as reliable as proprietary operating systems (MVS, VMS, etc) or UNIX

In this context, NT is certainly reliable enough for Workgroup and departmental applications, where if it crashes, a simple restart will have everybody working again in a matter of minutes The problem becomes significant if NT is used to run mission critical applications using multi gigabyte databases A crash in this case might take several hours to bring the application back on line This may not be a feasible operating mode

HIGH AVAILABILITY

At the present time NT s cluster capability is limited to two servers There is talk of a near future enhancement to four servers by the end of this year (1998) The provision of high availability through clustering is one of the essential foundations of the platform at the courts Two-node clustering is too restricting and does not provide the necessary "headroom" for growth

SCALABILITY

The indisputable fact is that Microsoft NT is not as scalable as UNIX UNIX runs on everything from small embedded-systems to portables to Massively Parallel Systems (MPP) to supercomputers The Standard Microsoft NT scales only from a uniprocessor to a 4 way Symmetrical Multi Processor set up Some vendors (Such as NCR and Sequent Computer) have developed their own enhancements that permit higher scalability But the fact remains that NT will not match UNIX in scalability till 2002 and beyond

Microsoft recent press releases have promised eight-way scalability by the end of 1998 This usually takes 24 months to mature

SUPPORT OF DISTRIBUTED PROCESSING

In a distributed computing environment such as that envisioned for the courts, global directory services is an essential functionality The current release of NT has some support of enterprise wide directory services but it falls far short of those provided by Netware or UNIX, to the extent that Novell has successfully targeted NT users with a product that provides Netware like directory services The next release of NT (NT 5 0) is expected to only partially improve on the current situation

UNIX RESPONSE TO NT

UNIX vendors have responded to NT as both a threat and an opportunity UNIX vendors have grown up in a continually changing market, which has made them adept at successfully responding to new elements These vendors handle competition by enchanting their products, making strategic alliances, and cooperating with new players Many UNIX operating systems vendors have also formed cooperative alliances with Microsoft Many UNIX applications vendors are porting their software to NT, allowing them to play in both the UNIX and NT markets In addition, most UNIX hardware vendors - including the major ones such as Hewlett-Packard IBM, DIGITAL, and Data General, have also made deals with Microsoft, to provide NT along with UNIX and their proprietary operating systems

Traditional UNIX vendors continue to upgrade their environments to keep up with the industry They all have graphical user interfaces, client/ server versions, and symmetric multiprocessing capabilities And most will have 64-bit implementations within the next year Most UNIX operating systems are developed and maintained by hardware developers, but there are a few vendors that, like

Mıcrosoft, do not develop theır own hardware boxes, rather they generally develop theır operatıng systems to run on Intel processors In thıs case, these UNIX software developers have hıghly developed relatıonshıps wıth hardware partners

SCO tradıtıonally domınates the Intel UNIX market, and accordıng to some estımates one-thırd of all UNIX systems are based on an SCO operatıng system Over the past couple of years, the Lınux operatıng system a UNIX clone, has quıckly emerged to be a very popular systems for Intel processors (ıt also runs on other processors ıncludıng SPARC and Alpha) Lınux fınally made the UNIX operatıng systems ınexpensıve (ıt ıs avaılable for free over the Internet), and ıt could be the next great operatıng systems trend that threatens to overtake Mıcrosoft's control of the lower end of market Followıng on the Lınux success SCO recently ıntroduced a promotıon that provıdes educatıonal and noncommercıal end users wıth free SCO UNIX

Distribution and Support

Dıstrıbutıon Channels and hence support, are quıte dıfferent between UNIX and Mıcrosoft Mıcrosoft's tradıtıonal dıstrıbutıon channel ıs through retaılers, but wıth Wındows NT, Mıcrosoft has developed powerful hardware partners that sell NT along wıth theır systems In comparıson whıle hardware partners are also ımportant ın most Intel-based UNIX successes, many Intel-based UNIXes are dıstrıbuted through Value-Added Resellers (VARs) and system ıntegrators through whıch customers purchase an entıre busıness solutıon, rather than just an operatıng system and some off-the-shelf applıcatıons From a professıonal poınt of vıew, UNIX support tends to be of a hıgher calıber than that of NT

RISC Connection

RISC technology has provıded defınıte advantage ın cost and performance ın the ıntermedıate range server market Servers based on RISC chıps have consıstently out-performed their Intel based competıtıon especıally ın Hıgh Avaılabılıty and Scalabılıty Almost all RISC servers run on UNIX Dıgıtal Alpha ıs the only RISC server that provıdes the choıce of UNIX or NT

UNIX / NT Coexistence

One of the major efforts goıng forth ın the UNIX market ıs to make UNIX and NT capable of workıng together For the most part, UNIX vendors have taken an *ıf you can t beat em, then joın 'em"* strategy Thus there ıs a huge rıse ın NT/UNIX solutıons especıally among vendors that have experıence ın developing interoperability software In addition the majority of UNIX vendors have become "Microsoft-friendly," and either offer customers an option of UNIX or NT, or offer them UNIX with interoperability solutions to plug UNIX and NT systems into a single environment

Some Subjective Factors for UNIX

Proven, Solid, and Growing

UNIX is popular, advanced, and proven It has been in existence for almost 30 years, and in that time, it has gained a large base of UNIX professionals as well as thousands of applications and utilities It has gained widespread use over the past few years with the advent of RISC technology and the growth of open systems In addition, it has developed into a robust, reliable operating system

Contrary to some people's thinking, UNIX continues to evolve and improve Recent surveys point out that UNIX will continue to be in demand over the next few years So, while NT is making news as the up-and-coming operating system, UNIX is certainly continuing to advance, with better interoperability, easier-to-use features, bleeding-edge Internet software, and a mountain to third-party software vendors that continue to make their UNIX-based offerings better Thus, rather than standing still, UNIX is becoming increasingly attractive

Strong Server

Unix is a proven server operating system, capable of handling enterprise-wide computing and downsizing operations The operating system is extremely scalable, and is especially popular as a major server operating system, where it serves other UNIX as well as Microsoft clients UNIX is a proven solution for large databases, enterprise computing, and OLTP (especially since NT has no time server, which is necessary for transaction processing) Many people still believe it will take too long for NT to become as robust as UNIX, especially for server operations

Development Advantages

Another UNIX advantage is its development capabilities Large organisations downsizing from mainframes and purchasing server-grade computers are more concerned with what happens to their internally developed software, than with shrink-wrapped software (shrink-wrap is one of Microsoft's advantages) Internally developed software packages are generally considered mission critical because they run the organisation's business, shrink-wrapped word processors and spreadsheets are simply considered Add-Ons UNIX has become known as an excellent development platform capable of facilitating mission-critical applications, as well as supporting word processors and spreadsheets In contrast, NT has yet to gain credibility as a development platform for mission-critical enterprises

FEATURES COMPARISON* NT AND UNIX

Feature	NT	UNIX
Bits	32 (64 in 1988)	32 or 64
Hard Disk (MB)	70	40 to 200
Memory (MB)	12	2+
Multiprocessing	Yes	Yes
Multiuser	No	Yes
Multitasking	Yes	Yes
Processor Architectures	Intel Alpha	All (Intel Alpha MIPS SPARC Power Motorola)
Security	C2	C2 to B1
Journaled life system	Yes	Yes
Mirrored Disk	Yes	Yes
Disk Striping	Yes	Yes
Clustering	Few	Some
Scalability	Hi end PV to Mid server	Embedded to mainframe
Momentum	Excellent	Stable
Server price	Low	Mid to high

THE VIEW FROM SOME VENDORS

Several vendors have developed tactics that give users a choice

- SCO and several other UNIX vendors have taken a Windows-friendly strategy, providing UNIX customers with interoperability and systems management capabilities for networks of both UNIX and Microsoft Windows and NT
- Some hardware manufacturers are leaving it up to the customer to choose between the two operating systems Several vendors ship systems that support both NT and UNIX
- Increasingly application vendors are supporting both NT and UNIX
- Products are available that facilitate centralized management of both UNIX and NT products
- Interoperability products from independent software vendors are available that provide emulation TCP/IP or porting tools, so that UNIX and NT operating systems and/or applications can be used in mixed environments

CONCLUSION

Every end user environment is different and needs are different and changing The selected Operating System must insure meeting these diverse and changing requirements A dispassionate view of the market highlights an emerging trend While NT is definitely still growing, UNIX continues to hold strong

Many large organisations have realised that it is just about impossible to standardize on one operating system, there are just too many variables in business to bet everything on one solution In addition, every operating system has its own strengths and weaknesses So logically, purchasing decisions are based on the best system that meets current needs Vendor loyalty is playing a minor part in today's purchasing plans, rather, usability is the key purchasing factor

Small to Medium Users like NT because it is inexpensive, supported by many hardware vendors, and easy to use and manage, but they don't like NT because it is still unstable and it is not as scalable as UNIX Corporate Users like UNIX because it is very scalable, is mature and stable, it has sophisticated management capabilities, and it is reliable They don't like UNIX because it costs too much and is complex to learn and manage

There is little doubt that Microsoft NT and future operating systems from Microsoft will continue to hold an important place in the computer world, but the likelihood of its killing UNIX is small UNIX has been around for a long time and has a huge installed base of satisfied users UNIX vendors keep making the operating system better by including more advanced technologies, making it increasingly user friendly and reducing prices

Larger organizations have been using NT as an add-on to their enterprise-wide strategy The trend for distributed multiplatform environments leaves plenty of room for multiple operating systems, Including NT In the enterprise scenario, many different operating systems including UNIX and NT perform specific tasks for which they are best suited NT as well as UNIX Are often used interchangeably as departmental servers, while UNIX is replacing the enterprise mainframe NT's most logical fit within a midsize or smaller organization is as an upgrade to networks growing beyond their MS-Windows capabilities It also fits well into the network operating system (NOS) space as a replacement for Microsoft's old LAN Manager or Novell's NetWare

ENTERPRISE MANAGEMENT SYSTEMS:

AN OVERVIEW

AN SRE WHITE PAPER
PART OF PLAN DEFINITION STUDY

What is System Management?

"Many companies are just beginning to realize the full benefits of true enterprise-wide systems management," said Stephen Sprinkle, Managing Director of Service Lines for Deloitte Consulting

Today's business computing continues to move toward a network-server centric model, with powerful distributed servers providing the communications and functionality backbone for thin clients

This in fact increases enterprise systems complexity and diversity In general, relying on individual device management products with loosely engineered technical and human integration schemes will not yield sufficiently satisfactory results

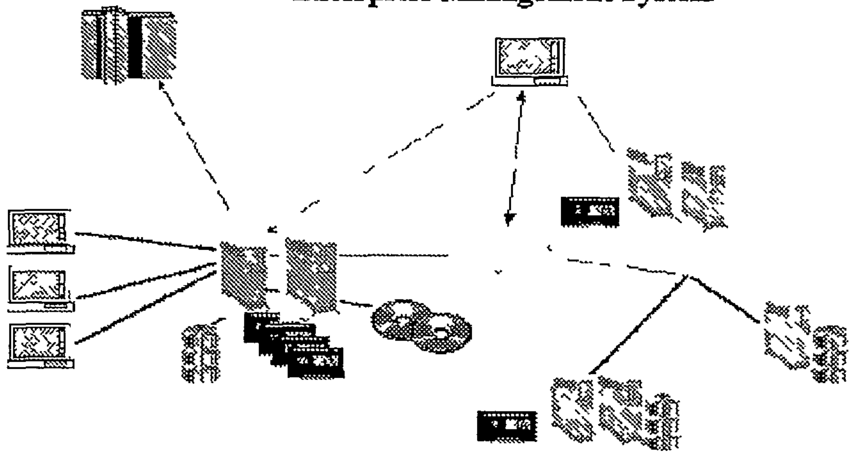
Therefore, enterprise management solutions are of essential importance for every enterprise, since enterprises cannot work fully productive without being entirely manageable

The primary role of a system management solution is to make administration of the IT environment easy and provide control over the diverse IT infrastructure of an enterprise

Choosing the right management solution improves network performance with positive business impact and implications in such areas as improving mission-critical application performance providing better customer service performance with attendant satisfaction, furthering electronic commerce by providing efficient 24x7 point-of-sale systems and increasing internal productivity which leads to faster time to market

In addition it will provide real-time management of network configuration shrink problem resolution times and maintenance interruptions, automate responses to potential device failure conditions, automate responses to slowdowns in service delivery, and enhance ease of use

An enterprise management solution is simply combining the robustness and dependability of traditional management disciplines with the openness and flexibility required by today's distributed enterprise



Enterprise Management System

WHY SYSTEM MANAGEMENT?

To enable successful enterprise management a solution must be established that addresses the challenges facing IT organizations today, while preparing them for the challenges of tomorrow

NEW RESPONSIBILITIES CREATED BY NEW TECHNOLOGY

With the rapid change in communication means and expanding commercial interests outside the domestic scope, many technology initiatives and new communication elements are being introduced to the IT landscape

Therefore, the "global" enterprise must participate in a whole set of new technologies whose use has become inevitable in the IT environment E-mail, GroupWare, video conferencing are examples of these technologies Networks are an essential component in any computer system today, with their expansion leading to new determinant technologies, such as Internet, Intranet and mobile computing

Management solutions' performance must not be negatively affected by the existence of these new technologies On the contrary, their performance must increase to accommodate the rapid technology changes They must function with optimum levels of serviceability, reliability, security, availability and scalability

HETEROGENEOUS NATURE OF CURRENT SYSTEMS

The most suitable description of today's IT systems is being heterogeneous

Different business requirements create different business solutions To accommodate every industry requirements within varying degrees of resources and budgets, large degree of diversity in computer realm had to exist

Furthermore, new technologies must be introduced to improve old defective technologies, with no tendency to abandon old systems due to financial expenses For example while TCP/IP is the common systems implementation currently the majority of mission-critical systems is still running on traditional networks like SNA, DECnet, and IPX

In addition, both quantity and complexity of components in every IT enterprise is tremendously increasing than ever happened, given the introduction of Internetworking and increasing production of distributed applications, desktops and probably various platforms

The result is an extensively diverse and heterogeneous computer system in every enterprise, ranging from dissimilar hardware components and multi-protocol networks to different operating systems and heterogeneous database applications Even one operating system can have variations within itself, like for example the different implementations of UNIX

To control this dilemma of heterogeneous systems most IT organizations have resorted to fragmented management solutions Two security packages may exist in one system to accommodate two different technologies This situation is common in almost all elements in an IT infrastructure, which in turn creates a new variety in system management solutions that need to be managed

Management solution, therefore must encompass varieties complexity and multitude of components existing in every enterprise and overcome their negative effects to provide reliable administration of IT infrastructure

BUSINESS MANAGEMENT CHALLENGES

"*Doing more with less*," has become the primary business management principle Cost-cutting measures are not uncommon in today's enterprise

Management is always at a challenge to survive in the dynamic IT environment with the least possible costs

New methods of systems management, therefore must be introduced with more self-management and built-in capabilities to face the demand of the increasing requirements and decreasing resources in a highly changing environment such as that of IT's

FEATURES OF A SUCCESSFUL SYSTEM MANAGEMENT SOLUTION

ABLE TO MANAGE ALL COMPUTING RESOURCES

With all these diversities in even a simple IT environment, a system management solution that manages fragments of the enterprise IT infrastructure is not acceptable any more The most powerful advantage in System Management solutions is their ability to manage all these diversity of computing resources in an IT environment

A successful solution, therefore, must embrace every technology used in promoting the IT organization's business, whether they are traditional or new Router management, network discovery, database performance and space management, and application response time must be considered by the Management solution as well as the traditional disciplines like tape, help desk, security, and workload

And, to put it precisely, the successful System Management solution must not only afford administering all the enterprise's resource, but also provide all its services on all platforms

PROVIDES LARGE DEGREE OF AUTOMATION

The real power of a sophisticated system management solution comes from not just providing troubleshooting and control tools for reactive action but, more importantly, from allowing the administrator to automate internal management processes This provides a proactive system that is able to react to unexpected situations before they grow into problems

Therefore, a solution with large degree of automation provides administration staff with the initiative necessary to manage the system, and prevents the staff's being always reactive to emerging problems

One added benefit of these capabilities is exploring how the IT environment behaves under various situations and circumstances Also, while much has been promoted about the ability of the various products and tools to provide proactive management the fact remains that the bulk of the work to be done remains in the hands of the administrator Thus, any staff changes highly affects system performance, because the collective experience gained from facing common problems in the organization topology is held to a large degree within the administrators not with in the organization itself Highly automated management systems avoid such a problem

EXTENSIBLE AND CUSTOMIZABLE SOLUTION (OPEN ARCHITECTURE)

Given the requirement of managing all computing resources in an enterprise and the highly heterogeneous collection of hardware and software components in an enterprise IT infrastructure It remains unlikely that any single vendor can offer the best management tools across all available components or management functions

In addition, most corporations already have a significant resource investment in their existing management structure Even if deemed affordable, typically, there exists neither an interest nor the inclination to discard legacy systems

Therefore, a key success in any management system is being base on an open architecture

In this architecture, IT organizations should expect to be able to select the best management tools for their particular environment and operating style while using existing integration hooks to build a complete solution

Such architecture must be completely open, extensible and customizable to reflect an organization's unique business needs It acts like a solid foundation for the enterprise management solutions It allows third-party and in-house applications to be built upon easily Furthermore it offers the opportunity for integration at all levels— not just at the user interface or the event console— so that management functions may work easily with functions developed by others

Open architecture can be accomplished by establishing a complete Software Development Kit (SDK) providing all the necessary tools, libraries, and APIs required to integrate any management function within this architecture by a third-party

BASED ON OBJECT TECHNOLOGY

A determinant factor in achieving an efficient extensible and scaleable open architecture is using Object Technology By implementing management solutions using Object Oriented Development the solution will be easily extensible for long time even if it were implemented by multiple vendors on a large span of time

Object-oriented technology can be used from a high level of the system down to its bottom, from the user interface to the management repository, for example

As a matter of fact, the object repository is the core of the management solution In addition to its driving the various user interfaces, it stores management information, the objects to be managed, and the methods to manage them And what is more important, it stores the management policies that are enforced by the management functions

MUST PROVIDE AN "END-TO-END" COVERAGE OF IT INFRASTRUCTURE

Systems Management, from a traditional perspective, deals with a specific management resource, network performance or storage for example Such systems are called "point products," since they are designed to deal only with one product, and hence allowing the enterprise to control it regardless of the performance of the remaining components of the system

The drawbacks of such traditional systems are obvious They require many solutions for many resources While every management solution may effectively manage its own resource and provide detailed monitoring of its resource's performance, managing the overall performance— which is a determinant factor for every business— may be a complex task If some deficiency in the system is present, it would be difficult to point out where it exactly lies when every management solution is indicating that its resource is perfectly working

Under traditional System Management means, an enterprise-wide management is not existent, and hence performance improvement on the enterprise scale is by no way accomplishable

In a successful System Management solution, all IT resources have to be managed in their entirety A reliably efficient system can only be achieved by comprehensively managing all aspects of IT, from network devices to databases, business applications, and Internet, in addition, from small hardware components such as desktop systems and all the way to mainframes

Such a new technique is called "end-to-end" management It is based on managing the system as a whole to improve large-scale productivity

WELL INTEGRATED

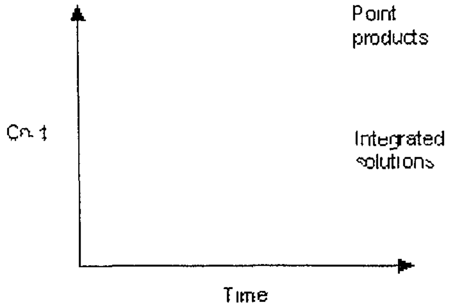
With the end-to-end Systems management technique, "integration" becomes an important issue

It is essential to manage all the organization's computing resources, furthermore, end-to-end management requires that management must be done for the organization infrastructure as a whole, regardless of the varieties in nature between IT infrastructure components and whether they are old or new technology

If a System Management solution is not well integrated a large probability of the system's failure may exist The huge diversity of resources and their large number make integration of the System Management solution an inevitable characteristic of the enterprise management solution

If the system was not well integrated duplicate investment must be done in order to manage different components and technologies which contradicts with the concept of "end-to-end" System Management, and most importantly creates a huge financial overhead for the enterprise

Therefore, the enterprise system management must be stand alone, consistent, and well integrated to compensate the diversity of its underlying components This, in effect, maximizes functional operability and minimizes costs providing key competitive advantages in today's market



Cost of Integrated Solutions vs Non-Integrated Solutions (or Point Products)

MUST FIT WELL WITHIN THE ORGANIZATION

In general large organizations have different administrators using a variety of hardware and software to accomplish their tasks If the solution design complements the existing organizational architecture and methodology it will typically be faster to implement and more quickly adopted

This can be achieved through a consistent interface across multiple platforms in accordance with conventional application interface wisdom Thus administrators can move across platforms without having to relearn the application basics

Furthermore integration between components of the management solution itself is vital to hide differences between platforms and hardware implementations thus making IT infrastructure highly manageable with no deep knowledge of real specification of the organization s system

BASED ON MANAGER/AGENT ARCHITECTURE

Providing end-to-end coverage requires a highly scaleable infrastructure to efficiently manage the diverse and large scope of IT components, whose number may range from hundreds to hundreds of thousands

Such a challenging requirement can only be addressed through flexible and intelligent multilevel architecture We believe that an architecture that is modeled as manager/agent model is the best in this case

In this architecture, "agents" must be able to monitor resources and take actions according to the direction of "managers" In addition to this flexibility, "agents" must be intelligent by themselves They must be able to correlate information and take automatic actions Such flexibility and intelligence are critical to the efficient management of large environments

The "manager/agent" architecture enables management functions from multiple enterprise management solutions to be developed and deployed in manager/agent configurations that best suit the needs of each individual IT organization

FLEXIBLE

Products that are difficult to adapt to changing conditions do not constitute good strategic choices for highly dynamic organizations

Product flexibility defines the ease with which the solution can adapt to changes in its operating and management environment

Such potential for adaptation can be achieved through the use of existing networking technology, by changing network topology, or by changing management domains

Management solutions must be accompanied with software toolkits to allow the enterprise operations staff to create adapters for homegrown or legacy solutions Vendor of management system must also actively participate in supporting new technologies (e g frame relay, ATM, new redundant routing protocols implementation of switching technology instead of routing)

Hence, administrators are allowed to create their own agents and protocol adapters And proprietary or newly acquired hardware and software can be added and integrated into the overall management scheme

Furthermore, the solution should be able to react to changes in the enterprise IT topology For example, with the installation of new routers, the new topology information should automatically propagate to all maps without administrative effort

And from administrative standpoint, management domains should be simple to define, set up and change Then management views can easily be adjusted to reflect changing informational needs as reporting relationships responsibilities and interaction evolve over time

MUST PROVIDE MEANS TO EVALUATE IT INFRASTRUCTURE FROM A BUSINESS-ORIENTED VIEW

The ideal solution must also provide a means to examine and evaluate the effectiveness of an IT infrastructure from a business perspective

Most of the case, enterprise management tools evaluate resources from a technical point of view, while being far from the perspective of the business manager For example managers can hardly understand the relevance between management functions (such as events, performance security, or workload) and business processes (such as service, accounts receivable, sales, and human resources)

Consequently, business decisions concerning the rudimentary business issues can rarely be addressed, which increases the potential for gaps in enterprise management coverage

The situation is becoming even worse by the growing number of technology suppliers, the complexity of the topology, the volume of data sources, and the semantic differences associated with metrics from diverse tools

As a result, attempting to evaluate how well an IT infrastructure is serving business goals has become the greatest question facing business managers today

In order to address these needs, enterprise management solutions must begin to answer business-impact questions Are we able to process orders? Why is accounting slow? How secure is my customer information? After all, enterprise management exists to support the organization's business processes, not visa versa

For example, to answer a simple question like "Why is order processing slow?" one must analyze the performance of 1) the applications that support order processing, 2) the databases and systems they run on, and 3) the network that connects them

Management solution must enable IT organizations do such a business-oriented survey With end-to-end management of all IT resources, and with information correlation across those resources, the system can provide an accurate answer to business managers queries

AVAILABLE FOR SMALL AND LARGE SCALE ENTERPRISES

Both large and small organizations must be able to acquire an enterprise management solution that best suits its needs

Scalability and extensibility require that a solution selected for an organization's current topology must anticipate potential future growth However, the system should not be overwhelmed by future expansion, thus creating a large scale requirements and facilities that constitutes huge burden on the system

For example, the footprint of a management solution suitable for a large, multiprocessing server would be excessive for a Windows desktop

Availability for a multitude of different-scale systems, while ensuring scalability by offering a large potential for growth is the key success for enterprise management solutions

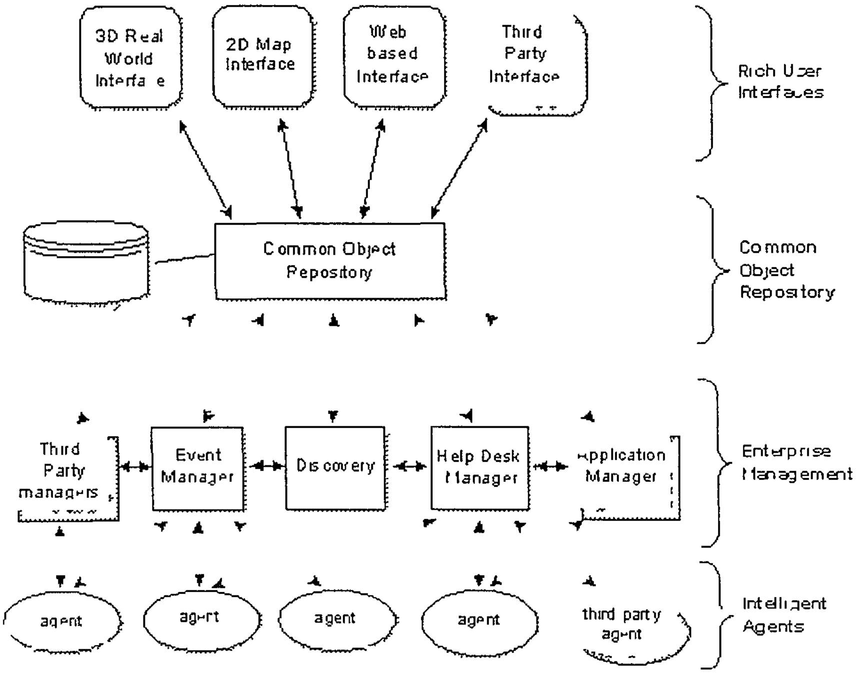
PROVIDES RICH MANAGEMENT FUNCTION

Delivering an "end-to-end" coverage of IT infrastructure in an open, extensible architecture that is object-oriented, as well as providing IT infrastructure evaluation tools are not the best you can reach in an enterprise management system

A wide range of rich and robust management functions for administering various IT resources must be delivered

From network discovery to scheduling, from multi-platform security to database agents, from Web-server management to workload balancing, from storage management to network performance, and from software delivery to firewall technology,

Such management functions offer rich management capabilities that support each other through their integration within the open, object-oriented architecture



A simple architecture describing the successful
Enterprise Management System

Features of an Enterprise Management Solution

Discovery

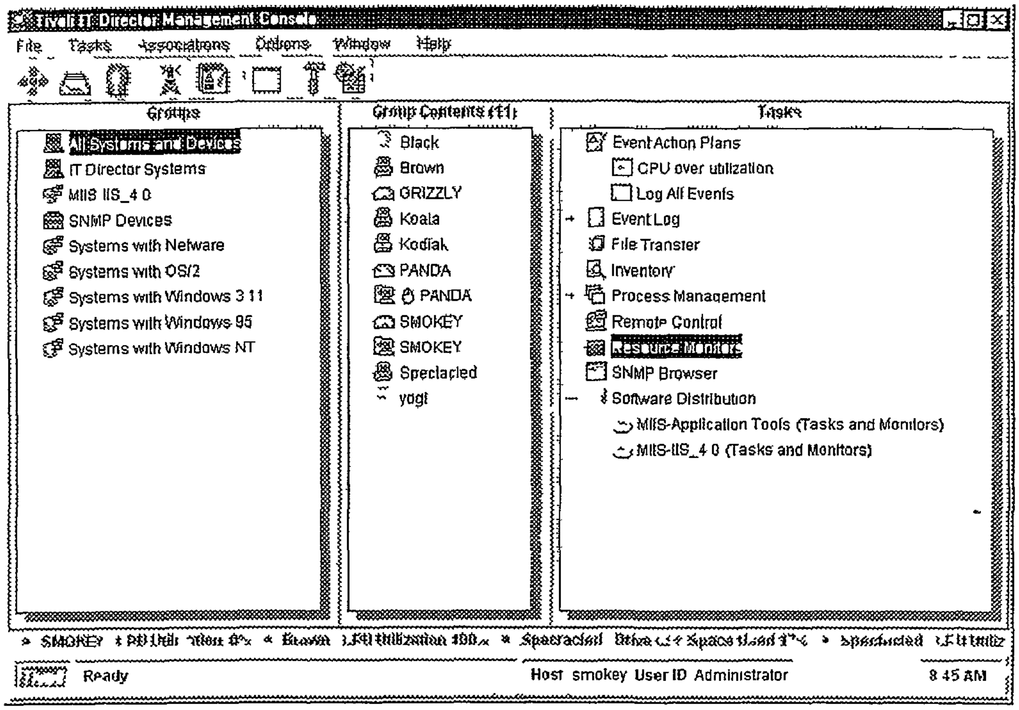
Automated discovery mechanisms are the key to maintaining accurate information on thousands of nodes The ideal solution must be able discover either the whole network or individual subnets Flexibility of discovery process is essential The solution should specify certain criteria according to which the process is executed, for example specifying DHCP ranges, hostname or object identifier strings to be specifically included or excluded during the discovery process as well as restricting discovery by the number of router hops

Additionally, discovery process can be scheduled to occur on a periodic basis in order to automatically discover new nodes The system can demand from its administrator to create a separate job schedule to automatically initiate a discovery task Alternatively, it can directly track unrecognized object Ids, inconsistent IP subnet masks and name conflicts and notify the administrator to immediately identify and correct problem nodes

DEVICE COLLECTIONS

Day-to-day operations require the ability to group and display a subset of the discovered network resources Device specialists require views of similar devices – such as all routers – while help-desk staff require views that group many diverse nodes relating to a single business process

To achieve balance between the two different views, the solution may group network resources that share common attributes into Collections or Objects Once an Object has been defined, the system searches its topology database for the rest of the devices satisfying the Object rules and creates a submap containing all of the device icons When new devices are discovered, they are automatically compared to the collection rules and added into the appropriate Object This allows administrators to create device views and groups for their staff that are automatically updated by the system



A graphical user interface illustrating how to group many devices in various Collections (or Objects)

MONITORING

Monitoring nodes and elements is essential in any network management solution Monitoring process includes status and configuration checking, and comparing MIB data with threshold values in order to discover problems

Furthermore, the administrators must be able to set and modify thresholds that generate alarms when exceeded

The system may distribute thresholds and file monitoring options for the defined Object

CONFIGURATION

Maintaining current configuration information on all the devices in a network constitutes one of the challenges of network management Policy-based management can simplify the administration of large numbers of similar devices by automatically maintaining correct configurations Management solution should be able set configurations for groups of devices at once, eliminating the need to configure each device individually

When new devices are introduced to the topology the management system can automate their configuration by applying configuration policies to newly-discovered devices when they are added to the Object

PROBLEM NOTIFICATION AND TRACKING

Prompt event notification and tracking problems through to resolution becomes critical as more IT departments take on service level agreements Multiple alarm and event notification features must be present including color-coded map icons paging and email

Notification criteria and event priority can be defined by the number of events received in a specified time or by the length of time an event remains outstanding

In addition to its ability to diagnose the problem the solution should allow administrators to open problem tickets and track problems Integration is an important factor here since many organization already use diagnostic and problem fixing tools And the management system must take advantage of their functionality

ALARM FILTERING & CORRELATION

Alarm filtering is providing the capability to suppress multiple alarms from a single event, as well as 'unimportant' alarms such as PC failures being sent to the router expert

On the other hand alarm correlation is allowing administrators to build rules based on experience that relate multiple alarms to identify and locate the primary problem causes resulting in improved resolution times

In addition, Objects containing collective information about a certain category of similar products can be used to facilitate providing filtering and correlation rules so that they can be dynamically applied on a group of network devices

PERFORMANCE MANAGEMENT

Performance management presents a diverse functional area At the most basic level, it concerns all tasks involved in improving network service delivery

A management system should provide tools to collect and store performance data in SQL databases and provide statistical calculation, reporting and graphing tools

In addition, use of industry standard databases also allows administrators a choice of more sophisticated third-party report generators

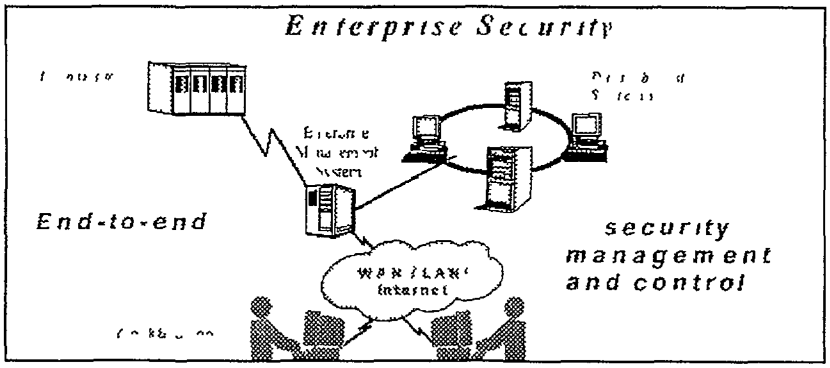
SECURITY

As with any management system, security represents a primary concern Unauthorized network configuration changes can lead to disastrous consequences

A management system should provide internal security services that authenticate users with administrator privileges and control user or group access to various platform resources on the basis of both date and time It also should customize the user interface so that users can view only the applications and menu items specified for individuals, groups of operators or job function

In addition, a management system should allow different operators to manage the network without having to restart or otherwise interrupting its processes An administrator, at the end of his work day, should be able to activate a window lock that allows the running processes to continue

Only an authenticated operator can remove the lock and continue working Thus, ownership of running processes changes to the new administrator without requiring a restart Using such a technique, providing protection against unauthorized access is achieved



USER INTERFACE DESIGN

AN SRE WHITE PAPER
PART OF PLAN DEFINITION STUDY

INTRODUCTION

User interface is the means by which an application communicates with the user and, more importantly, the user communicates with the application

An inevitable reality of application development is that the user interface is the system to the users What users want is for developers to build applications that meet their needs, but at the same time they should be easy to use

A common mistake in software development is putting enormous weight on algorithm, data structure, and code development to optimize performance of the system, while neglecting some simple standards in user interface design On the other hand, some developers spend some time in user interface design, but think that they are artistic geniuses, and create too many patterns forcing users to follow their own standards

Therefore, this paper presents the significance of user interface design, introduces some guidelines and standards to design an effective user interface, and discusses some points in user interface development process

It is worth mentioning that it is no longer necessary to discuss the advantages of Graphical User Interface (GUI) over prompt, or shell, interface Anyone can realize the striking factors in favor of GUI by using any interactive application running under systems supporting GUIs, such as Microsoft Windows, Macintosh, Linux, or OS/2 For example, those who have used a graphical Internet browser and a text-based browser do not need a paper telling them the advantages

Hence, this paper will not manifest advantages of GUI, and the intended readership is assumed to be already familiar with GUI development Rather, the paper focuses on certain standards, which when applied will lead to an effective user interface design

WHY STUDY USER INTERFACE DESIGN?

To put it straight for most people the user interface is the software Effort invested in designing a powerful interface is the most, and probably the only, recognizable effort spent in an application from the users' perspective Thus, the acceptance and effectiveness of an application are determined primarily by its interface design An effective interface makes users attracted to it, which increases their satisfaction with the application

Furthermore, the value of user interface design should not be underestimated An application that is difficult to use won't be used at all Although the functionality that an application provides to users is important, the way in which it provides that functionality is just as important It won't matter how technically superior the software is, or what functionality it provides If the users don't like it they simply won't use it The point to be made is that the user interface of an application will often make or break it

Moreover, investing time and effort in user interface design guarantees more profit and less costs The more intuitive the user interface the easier it is to use and the easier it is to use the more it is likely that people buy it Also, an efficient user interface reduces support costs because people will need less help to use it The better the user interface the easier it is to train people to use it, reducing training costs A good user interface allows people who understand the problem domain to work with the application without having to read the manuals or receive training

Finally, studying user interface design principles can help to produce a product that meets people's expectations while accepting their limitations regarding computer domain A product that does not meet the users' expectations will hardly be used Also if the application requires too much from users to operate it, users will be less likely to use it An important note is that some design principles cannot be met in all of the principles all of the time In that case compromises have to be made based on which principle or set of principles is most important for users in the context of the problem domain

USER INTERFACE DESIGN PRINCIPLES

This section presents effective design principles and considerations that should be adopted by developers to create an excellent human interface The principle mainly can be grouped in the following topics

- Reducing the user's Information Load
- Putting the User in Power
- Being friendly
- Aesthetic Appeal

REDUCING THE USER'S INFORMATION LOAD

People are better at recognizing information than recalling information Therefore a good UI avoids overloading the user's memory For example, the user should not be expected to recall a set of complex commands or options Rather a list of commands, options, or data should be presented to allow the user to select from the list instead of recalling the commands, options, or data from memory

In general, considering the user's general capabilities, experience, and limitations in the areas of perception, memory, learning, reasoning and attention plays a large role in the success of a UI Application developer must be sensitive to the user's capabilities and limitations rather that trying to coerce the user to adopt to his UI conventions

ANALOGIES

People like analogies When using analogies people do not have to deduce how an application should work, and what they should do in order to perform a certain task This reduces the time required to finish their job In addition, using analogies make the amount of training on an application less, since people already know some concepts used by the application in advance

Use analogies and metaphors involving concrete, simple and plain ideas Make sure that analogies are closely related to users environment If users are not familiar with these analogies, they must learn the concepts presented by them, which disables analogies' power By using simple and familiar analogies, users have a set of expectations driven from their own world to apply to computer environments

For example, when people want to dispose of a paper, it is put in the trashcan, and hence it makes sense to people to do the same on a computer That is how the idea of deleting a file from a disk by dragging it to the wastebasket or trash icon emerged

An application interface must be intuitive The screen should become a visual metaphor for the real world Objects displayed on the screen can be manipulated in ways familiar objects in the real world are manipulated And the user interface behaves as the user expects based on his or her experience with objects in the real world

The desktop of an application is the primary and most essential analogy It should represent all what is needed by the application user to perform his tasks by including related tools and documents Menus are another useful analogy People can choose operations from menus the same way they choose make their choices from restaurant menus

Although computer concepts should be as much analogous to real world concepts as possible, perfect analogy may be misleading For example, although trash icon exists on computer desktops, people do not put trashcans on their desktops in reality Also, people do not put menus on the edge of their desks similar to their position in computer applications Using the icon *trash* and the term *menu* reminds users with their functions and how to use them

Therefore, the purpose of an analogy is to indicate functionality, but not to limit it Analogies should not impose real world constraints on computer concepts For example, a paper file folder has a limited storage capacity, but a computer folder may hold a vast amount of files A balance between the analogy's use, and the application's ability to extend this use must be reached

Consistency

In addition to using analogies, consistency is another important factor in reducing the information load on the user A consistent interface refers to the similarity in appearance and layout of the components Consistency in the interface allows people to transfer their skills and previous experience from one situation to any other It also allows the users to build an accurate mental model of the way the application works, and accurate mental models lead to lower training and support costs Furthermore, Consistency is essential within an application as well as across multiple ones

Consistency is essential in two main areas visual appearance and behavior If the visual interface is consistent people can easily learn the graphic language of the interface, and later on recognize it if it is seen again For example, if the "OK" button always has a specific shape, users do not have to wonder what it is each time they see it All the buttons must be put in consistent places on all of the windows Same wording in labels and messages, and a consistent color scheme throughout the application are of a great visual weight

Additionally, consistency in the behavior of the interface means that people need only to learn a skill only once If an item produces a certain effect when it is double-clicked then similar items must produce the same sort of thing when they are also double-clicked By following this rule, when people are faced with a new application or a new similar task they already know how to perform it

Not only the typical user, who works with several applications, benefits from consistency, but also the software developer He can reduce the amount of learning required from a user to master a new application, since the user has prior experience with other applications also, reusability is another advantage of consistency for the software developer The standard elements of an application can be reapplied to another application thus capturing commonality while increasing productivity and product quality

An efficient user interface must be consistent within itself, with earlier versions of the application, with your operating system interface standards, and in its use of analogies Consistent design produces an application that is predictable in appearance and behavior throughout its display of information, its manner of manipulating information, and its method of navigation Finally the application must be consistent with people's expectations In fact, matching people's expectations is the most difficult kind of consistency to achieve With your wide audience having diverse expertise ranging from normal users to experts, it's difficult to meet the expectations of everyone Therefore, compromises have to be made between consistency and users' expectations and needs

Note that consistency is a means to an end, which is providing the user with ease of learning and reduction of errors, rather than an end itself So if perfect consistency is impossible or impractical for the user, the designer must make consistency compromises based on knowledge of the users' tasks, environment, and background The interface should be consistent in whichever way seems more natural to the users

Setting Standards

The only way to ensure consistency within the application and across multiple applications is to set design standards and then stick to them The best approach is to adopt an industry standard and then fill any missing guidelines that are specific to the users' needs Industry standards, such as the ones set by IBM, Microsoft, and Macintosh, will often define 95%-99% of the users' requirements By adopting industry standards you not only take advantage of the work of others but also increase the chance that the application will look and feel like other applications that users purchase or build

In addition to industry standards, there are other standards you normally define because they are application-dependent, for example the way users enter data or navigate throughout the application The new standards must be explained well And if the application is well consistent, and standards are followed, explaining the rules would be enough This is a lot easier than explaining in detail exactly how to use each and every feature in an application step by step

Noun-then-Verb

The desktop metaphor brings along another significant principle the users' ability to first see *what* they are working with and second perform *actions* on what they see Normally, what users are interested in is the object they are working on, and then they are concerned about what they are going to do with this object This can be paraphrased as the "noun-then-verb" principle

The user interface designer should follow the same pattern Users should be allowed to select an object of interest (the noun), then the possible set of operations (the verb) to perform on must be available to him to be chosen Inapplicable actions on the selected object should not be allowed Therefore, users who are unsure of what to do next can refresh their memory by scanning through the menus to look for available commands without having to remember any particular command or name

In addition to choosing operations from menus on the selected object, users may perform these operations metaphorically For example, by dragging an object from a place to another, the user can execute a command on that object In this case, the interface must disallow the user to perform this operation and give him a suitable feedback For example if the user closes an application without saving changes to a file, he should be notified and allowed to save it before exiting the application

WYSIWYG, WHAT YOU SEE IS WHAT YOU GET

Most people want to feel that what they are doing is what is actually being done by the computer If a user is writing a paper, he wants to see a blank sheet of paper with text lines, title, pictures and colors the same way he would see it if he writes it manually People normally are not sure about whether the application is doing what they want it to do What you see is what you get (WYSIWYG) technique is the most successful way to inform people that the application matches their needs As the term implies, the application appearance must reflect its contents of data or the output it will produce exactly as it is going to be produced

The user should be in charge of both the content and the format of what he is producing When the user makes changes to the document, the results must be quickly and directly displayed The user is not expected to make mental calculations of how the document shown on the screen will look like after applying his operations

WYSIWYG technique is important not only for the application's output but also in the application itself Features of an application should be seen to the user to indicate its availability People should be able to see what they need when they need it For example menus present lists of commands so that people can see their choices instead of having to remember and type command names

People should be able to find all the available features in an application If some options need to be hidden users should be given information about where they can find more choices An example of this is wizards which reveal relevant information to users in steps They show the most likely selected options while at the same time providing a way for the user to get more choices

PUTTING THE USER IN POWER

DIRECT MANIPULATION

Direct manipulation is manipulating objects on the application's desktop It is used as a way of assigning specific tasks to be performed by the application Direct manipulation technique lies in contrast to the old way of assigning tasks typing text commands on a prompt Its main advantage is that it provides people with the feeling of direct control over the application's tasks and data, which are represented by objects

An essential factor must be considered when applying direct manipulation principle in an application The application's objects must constantly reflect their internal state If an object is selected, it must be highlighted The effects of applying a certain operation on an object must be immediately sensed by the user For example, after dragging a file from a folder to another, it is not enough that the file is physically located in the new folder It is essential that it appears in the new folder Furthermore, during the operation of dragging the file, the object representing the file itself must be visible throughout the whole operation

Next to reflecting users' actions, applications must provide feedback to users Feedback is present in an application if it gives users clues about the operation that is carried out or why it cannot be executed Users demand from the application to highlight what they care about in every single operation For example, the inapplicable operations should not be allowed from the first place Also, if an operation may cause dramatic changes, users should be notified before executing them, and allowed to discard them

USER CONTROL

People learn best when they're actively engaged Therefore, users should be allowed to initiate and control actions, not the computer The users should always be free to choose which applications and which windows they will work in, and to rearrange windows in the work space to suit their own taste and needs When working in an application, the user should be afforded the widest possible freedom of action It is inappropriate for an application to arbitrarily restrict what the user can do If an action makes sense, it should be allowed

On the other hand, at certain situations the computer seems to have the upper hand It "takes care" of the user, offering only those alternatives that are judged good' for the user or that "protect" the user from having to make detailed decisions If this is the main approach of the application, the computer eventually will act and the user will merely react within a limited set of options

The key is to create a balance between providing users with powerful capabilities and preventing them from performing destructive operations For situations in which a user may destroy data accidentally, the application may help him by providing warnings to notify users of a potentially undesirable situation and still allow them to proceed if they confirm that this is what they want This approach protects" users but allows them to remain in control

Being Friendly

Feedback and Dialog

Users should be always informed about what's happening with the application they are working on In performing an operation, the user wants to know, see and possibly feel the result of the operation For example when the user drags a file to the trash icon the trash then must appear to be filled with something to indicate the file s existence inside the trash Highlighting an object to indication selection producing a sound to verify an activity, changing a pointer to an hour glass to indicate that an action is in process are all examples of feedback

It is essential that feedback is provided as immediate as possible Receiving immediate and tangible feedback increases the user's rate of learning, since he knows the exact consequences of each of his actions This also reduces the amount of errors produced by the user since he can perceive what is going on exactly when it happens If he performs a task in a wrong way, he can immediately change the way he is doing that task once he sees different results that what he expects

When a user initiates an action, a visual or auditory indicator should be provided that your application has received the user's input and is operating on it Furthermore timing of operations is significant factor in users' satisfaction of an application As much information as possible should be provided to the user about how long his operation may take When the application is processing a task and cannot respond to user input, the user must know about any delays, why they occur, and how long they'll take Also, whenever possible tell the user how to get out of the current situation

Wording Messages and Labels

Feedback is not only visual, it may be presented in natural language Messages and labels are examples of feedback that may be very effective in some situations The text displayed on the application's desktop is a primary source of information for the users If the text is worded poorly then the interface will be poorly perceived by the users

Therefore, direct, clear, and simple messages that can be easily understood is the most effective type of feedback Most people would not know what to do, if they saw the message "The computer unexpectedly crashed ID = 13 " It would be very helpful if the message spelled out exactly which situation caused the error—for example, not enough memory was available for the computer to complete the task—so that the user could understand how to avoid the situation in the future

Using full words and sentences, as opposed to abbreviations and codes makes the message text easier to understand Error messages should be worded positively, and should not imply that the user is at fault, instead they state the problem objectively and offer the available possible solutions Furthermore, messages should imply that the user is in control, and provide insight into how to use the application properly For example, the message "An account number should be 8 digits in length" is much more friendly than "You have input the wrong information"

Moreover, messages should be worded consistently and displayed in a consistent place on the screen Although the messages "The person's first name must be input " and "An account number should be input " are separately worded well, together they are inconsistent In light of the first message, a better wording of the second message would be "The account number must be input" to make the two messages consistent

Forgiveness

Forgiveness means that actions on the computer are generally reversible It also means that the application tolerates or accepts user actions that do not conform precisely to system specifications without negative consequences to the user

People should be encouraged to explore an application by building forgiveness in it They need to feel that they can try things without damaging the system This helps people learn the application faster, since they feel comfortable learning and using the application

The users' ability to reverse the undesirable actions via the "undo" operation, and redo actions that have been undone enhances the users' sense of the application's forgiveness

Confirmation of destructive actions, warning against actions that result in an unexpected loss of user information, are actions that protect the users from destroying their data accidentally

It is normal to find that at certain times it is not applicable to give users access to all the functionality of an application It is best in this case to disable inapplicable operations by dimming them, rather than not displaying them By dimming things when they shouldn't be used people can start building an accurate mental model as to how the application works Users should not only know what is currently available to them, but also what is not available

In addition, it is quite common to define a default button on every screen, the button that gets invoked if the user presses the Return/Enter key This button should have no negative side effects or destructive actions, for example deleting a file or a piece of data In this case, if the user accidentally hits the Enter/Return key, when he does not mean to, negative consequences may arise Also, people expect the default button to represent the most common and preferred action in the situation, and sometimes they hit the Enter/Return key without thinking of the consequence

Although the use of alert boxes is preferred in case of warning the user before performing any destructive operations, frequent appearance of alert boxes during a normal session is a strong indication that something is wrong with the application design If the application's options are presented clearly and feedback is appropriate and timely, normal use of the application should not produce too many warnings In other words using an application should be relatively error-free

PERCEIVED STABILITY

People need some sort of stability in an application The stability here does not refer to physical attribute of the application rather it represents the way people think about perceive and behave with the application Applications are becoming more complex, since they address complex problems In order for people to cope with this complexity they need some stable reference points To introduce some stable reference points the user interface should provide a computer environment that is understandable, familiar and predictable

The desktop of an application is an important reference point for people It provides a familiar two-dimensional space on which objects are placed To maintain this illusion of stability, a number of consistent graphics elements should be defined on the desktop, such as the menu bar, window borders and so on Note that what is important here is the *perception* of stability, not stability in any strict physical sense

To give users a conceptual sense of stability, the interface provides a clear, finite set of objects and a clear, finite set of actions to perform on those objects Even when particular actions are unavailable, they are not eliminated from a display but are merely dimmed

AESTHETIC APPEAL

Aesthetic appeal means that information, data and objects are well organized and consistent with principles of visual design Since people spend a lot of their time working while looking at the computer screen, applications should to be appearance-pleasant This simply means that things should look good on the screen and the display technology is of high quality An efficient interface combines powerful and accessible functionality with a pleasing appearance

In addition, if the interface design is highly visual, the user sees, rather than recalls, how to proceed, which reduces the information load on him Also, the interface should facilitate the user's tasks rather than calling attention to itself The best interface is often the one that is hardly noticed

PLEASANT LOOKING

Graphics—icons, windows, dialog boxes, and so on—are the basis of effective user interface The representation should be visually pleasing and simple User acceptance and satisfaction with the application rests mainly on creating an elegant aspect of the visual representation Color, font, shape, size, arrangement, space, and other components of visual communications affect the aesthetic appeal of the user interface Their wise use leads to effective and efficient user interface

Color should be used sparingly in an applications Also they should be used consistently so that users have a common look and feel throughout the application Also, color generally does not port well between platform – what looks good on one system often looks poor on another system We have all been to presentations where the presenter said "it looks good on my machine at home " Also, when using color screens should still be readable The best way to do this is to follow the contrast rule Use dark text on light backgrounds and light text on dark backgrounds

Old English fonts might look good on the covers of William Shakespeare's plays, but they are really hard to read on a screen Fonts that are easy to read, such as serif fonts like Times Roman should be used Again, consistency in using fonts is essential, and the number of fonts should be small A screen using two or three fonts effectively looks a lot better than a screen that uses five or six

When a screen has more than one editing field, they should be organized in a way that is both visually appealing and efficient Data fields should be left align with their labels being aligned to the right For columns of data it is common practice to right justify integers, decimal align floating point numbers, and left justify strings

NUMBER AND APPEARANCE OF ELEMENTS

In addition, the number of elements and their behaviors should be limited to enhance the usability of the interface Too many windows in a screen and dozens of buttons in dialog boxes overload the user with complex icons It is preferable for the overall density of the screen not to exceed 40% whereas for local density within groupings not to exceed 62%

Furthermore, each object needs to have a distinct appearance that the user can easily recognize and quickly understand At the same time the style of the interface needs to graphically unify these elements and ensure a consistent and attractive appearance at any screen resolution

Information must be organized in a meaningful way to help the user focus on his essential tasks Items that are logically connected should be grouped together on the screen to communicate that they are connected, whereas items that have nothing to do with each other should be separated Grouping, or ungrouping, objects can be done by leaving whitespace between collections of items Another way is to put boxes around each group of objects

APPEARANCE AND FUNCTIONALITY

The meaning of standard items should not be changed It is always advisable not to confuse the user by non traditional use of objects, for example, by using checkboxes for both multiple choices and at the same time for exclusive choices

Standard icons should be maintained, if nonstandard symbols are add to objects, the meaning may be clear to the application developer but to other people the symbols may appear as something different and distracting When new symbols are needed, they must indicate the meaning of their function through representation and analogy principle

In addition, graphics should be meaningful Users expectations must be put in mind when designing graphics People expect from symbols to perform functionality in a much similar way to what they indicate For example, push buttons must appear as though they push in, rather than slide sideways Indicators in sliders slide along to change values

These behaviors map to people's expectations of how these elements behave

Furthermore, the visual elements should be immediately recognizable, ideally because they relate to real-world analogies, and should be arranged so that their functions are comprehensible The objects should be designed so that the user can easily differentiate members of a class from another

Customizable Appearance

Finally, the application interface should be highly customizable Users like to feel free to change the appearance of their computer environments This allows them to work according to their own style and displays their individuality This also supports the principle of putting the user in power as well, since the user is in control of the appearance of his application

Another advantage of customizable interface is reducing the burden on the designer of trying to create an interface that appeals to every user When a user sets up his or her computer environment in his favorable layout, it should stay that way until the user changes it By offering customizable interface the developer supports both novices and experts Some interfaces are well suited to beginners who just need something that works, while other interfaces offer complex functionality for expert users

User Interface Design from Development Perspective

Design Decisions

Including or eliminating features in the application's interface is an important decision It is not always beneficial to add more elaborate features of user interface You need to weigh the costs, which are not all financial, against the potential benefits

Every time a feature in the application is added, the application gets larger and slower with its interface getting more complex Furthermore, large amount of time is spent in development and documentation rather than refinement of existing features Potential user errors could possibly increase Also, every new feature can have a negative impact on the existing features

Here you find useful discussion about factors that should be token into consideration when adding features to the product

Features Inspired by Market Pressures

Competition is highly intense in computer industry This could be a disadvantage for the computer designer, but it can be easily exploited If the developer thinks about users of his applications and keep their interests foremost when making his design decisions, his product will be the most competitive in the market Moreover, market pressures, can lead to implementing features in products even with limited resources

Additionally, application designers may take advantage of critics of reviewers, since reviewers' expectations are in favor of people's needs Most often reviews include information on whether or not applications have distinguished and new features, which may create large audience for the application Therefore, market reviews are a good guidance to the application's potential success and their advice should be followed

Feature Cascade

Deciding to implement a certain feature is not easy The decision is not simply based on whether the feature can be implemented or not, but on the additional development efforts growth in size, and reduction in running speed that the features would take Therefore, there must be a compromise between the features of the application and the costs, not necessarily financial of those features First the core of requirements should be satisfied then extra features may be added after careful examination because they can often add complexity to the application

The 80 Percent Solution

The 80 percent solution means that your design meets the needs of at least 80 percent of your users It is only useful when the application development is constrained by time, resources, or the design has some problems The design should be usable by the majority of user If some obstacles emerge, the design can accommodate the needs of only the majority of users, leaving the special features needed by the rest for later development

Simplifying Complex Interface Design

The best approach to developing software that is easy to use is to keep the design as simple as possible The general design guideline that *simple design is good design* applies directly to the discipline of human-computer interactions

The challenge that users desire is to solve their problems using the tools that you design to facilitate their work The more you can do to simplify the interface and your product for your users, the more likely it is that you will build a product that meets their needs and expectations

Using Progressive Disclosure

Progressive disclosure is a technique used to reduce the complexity of user interface designs It basically rests on presenting the most common choices to users while hiding the more complex ones In this way, the application can be used by novice users without sacrificing the powerful features for advanced users

Progressive disclosure can be implemented for dialog boxes by initially presenting the most common options in the dialog box If users want to see more choices, a "More Choices" button is included in a corner of the dialog box When the button is clicked the dialog box expands displaying more information, and the button name changes to "Fewer Choices " Such a method is very clear and predictable

Another way to use progressive disclosure is including expandable toolbars A toolbar containing the most common functionality is initially displayed in the application Other uncommon toolbars are not displayed, rather their presence is just indicated by small tabs below the left side of the expanded toolbar If the user needs any of the hidden toolbars, he clicks on its tab to be expanded and used Therefore, the user knows the existence of additional functionality, and uses it only when needed

Implementing Preferences

Preference settings are user-defined parameters that the application remembers from session to session Including preferences is a way for the application to offer choices to users about how the application runs Preferences often affect the behavior of the application or attributes of the content created with the application

Users needs are the most essential factor in deciding what to include in the preferences It is not a good idea to create one large dialog box including all the preferences that you can think of Instead, flexible features should be implemented as a part of the application with the special cases of a behavior or an attribute being eliminated

A preference should be a setting that the user changes *infrequently* Choices that happen to change many times in a work session, should be implemented as operations in menus or other interface elements that may be easily accessible to users In this way users have the flexibility to easily choose their preferred method of working

INVOLVING USERS IN THE DESIGN PROCESS

The best way to ensure that the applications meets the needs of the target audience is by exposing the interface design to users' examination This can be done in every phase of the design process to help reveal the efficient parts that may be repeated as well as the poor points where improvement can be done

Examining the application interface saves lots of time and money in addition to saving the application users from frustration People inevitably find some undiscovered flaws if they were exposed to a product And hence, significant improvements can be added to the application during its evolution, which saves time and money

By identifying and focusing on users' needs and experiences, easy-to-use products will emerge, which translates into competitive advantages increased sales and enhanced customer satisfaction

DEFINING THE APPLICATION'S AUDIENCE

This is the first step in involving users in the design process defining the users and understanding the target audience To create a product that people can and will use, study the people who make up your target audience

By determining what these people are like, how they might use the product, you can find out what features the product should include Also if users have any similar products, you can add features they would desire in your product that is not in any other similar one

It's useful to create scenarios that describe a typical day in the life of a person who may use the application Think about the different work spaces tools, and constraints and limitations that people deal with Visits to real environments in which the application's audience work are of much help

The product should be developed with people and their capabilities, not computers and their capabilities, in mind

Furthermore the computer should be accessible to everyone who chooses to use it There are likely to be members of the target audience who are different from the "average user Users will undoubtedly vary in their ages styles, and abilities They may also have physical or cognitive limitations linguistic differences or other differences you need to consider A place should be found in you're the application for their special needs

ANALYZING USERS' TASKS

The second step is to analyze the tasks users will be doing with the application

It is necessary to do a task analysis for each task the users may do It also helps to note how the users manual, or old, system works and imagine how the new application may improve performing these tasks

The most successful task analysis is the one that classifies and breaks down the task into small steps The designer should imagine a scenario in which a user uses the product Each task a person might perform in that scenario is listed and then broken apart into its component steps that will be exactly done in the application These steps should be tested on someone to get useful feedback

Building Prototypes

For the third step, a prototype of the application is to be implemented using the information collected about users, their skills and the optimum way in which they should perform their tasks

Prototyping is the process by which you develop preliminary versions of your design to verify its workability Creating storyboards is one technique to construct prototypes of your design You draw out the steps your users will go through to accomplish a task using your product Another technique is to build a simulation of the product in prototyping software that animates some features or demonstrates how the product will work

Observe Users' Reactions

The user observation is the fourth step, which lets you test the workability of the prototype by watching and listening carefully to, and possibly collecting data about, users as they work with the prototype

Testing should be organized and focused on each task Limiting the scope of the test helps indicating specific problems Also, categorize people before starting the test It is useful to know how do people from different backgrounds react to the prototype For example, what are the problems of expert users as well as the problems the novice ones face?

One test of the prototype is by no means enough Collecting observations from the first observation helps improving the prototype Then a second observation is conducted to check the improvements over the first prototype This process continues until the developer feels confident that the application fully addresses the needs of its target audience

OVERVIEW OF ORACLE 8

AN SRE WHITE PAPER
PART OF PLAN DEFINITION STUDY

INTRODUCTION

The primary purpose of a database is to enable groups of people to share information A good database makes this shared access to information easy, fast, economical, reliable and secure For the past 20 years, Oracle has played a leading role in the development of database functionality and services

ORACLE CORPORATION

Oracle Corporation is the largest supplier of database software and the second largest supplier of business applications in the world Their products include Oracle8 database, development tools and decision support tools

Their strategy for their database business is simple decrease the total cost of ownership of mission-critical database applications while increasing the quality of services

Oracle employs more than 30,000 dedicated professionals who provide their clients with products, consulting, education and support in more than 140 countries around the world

ORACLE EGYPT

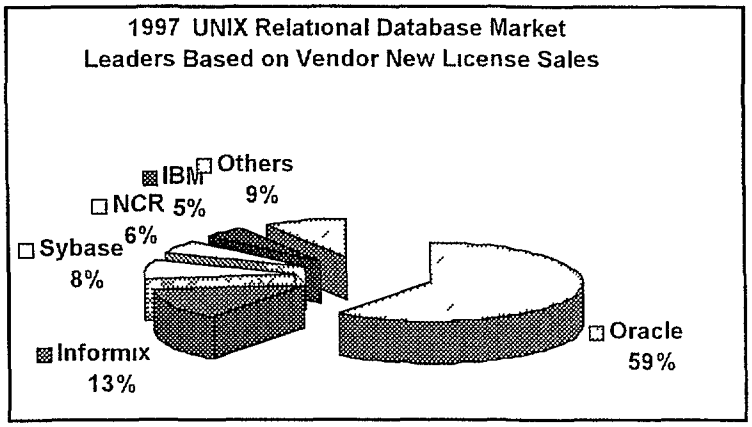
Oracle has a strong presence in Egypt, through a wholly owned subsidiary that provides in-depth technical support and educational services

ORACLE LEADS IN RELATIONAL DATABASE UNDER UNIX AND WINDOWS NT

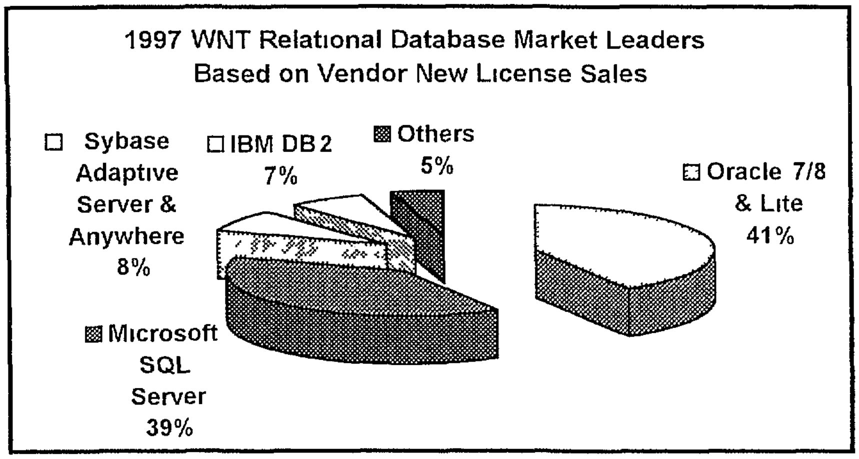
Independent surveys on market shares of database market leaders in 1997 has revealed that Oracle has about 60% of the market under UNIX compared with 13% for Informix and 4 6% for IBM

Under NT, Oracle has a share of 41 5 % compared with 38 8% for Microsoft SQL Server and 7% for IBM DB2

Source Dataquest (March 1998)



Source Dataquest (March 1998)



ORACLE 8 COMPONENTS

ORACLE8 DATABASE SERVER

Oracle8 is a breakthrough platform for TP systems and is designed to provide more business benefits than ever before Oracle8 is engineered to provide high scalability to meet the new user demands, high throughput over networked environments, enhanced manageability, and higher availability

While Oracle8 has the capabilities to support large user populations and large quantities of data it also is extremely practical for smaller departmental systems Oracle8 is highly optimized for Windows NT operating system and provides more functionality to this market than many of its competitors

Oracle8 manages large amounts of information securely reliably, and economically over computer networks Oracle8 is a versatile information platform that enables high-speed transactions, better business decisions, and sophisticated object-relational applications Built on a foundation of proven technology, Oracle8 is designed to lower organizations' computing costs, manage all types of data, and deliver faster information access to all kinds of users

ORACLE8 SCALABILITY

Oracle8 is a robust object-relational database that can accommodate a small single-user system to a massive business-critical system supporting thousands of users Such scalability is an increasingly important requirement, since the movement toward thin software clients and network computing brings a vast number of new users to the Internet, Intranets, and Extranets

DATA TYPE SUPPORT

Oracle8 is built to support large amounts of data —up to tens of terabytes of data The database can be distributed across multiple systems or stored centrally in one large system, while being flexible enough to work with small, single-user systems With this database it is possible to manipulate every type of data found in an enterprise —including text, spatial, image, video, and time-series —as well as traditional structured data

EXTENSIVE FUNCTIONAL SUPPORT

No matter what the complexity of the job at hand, Oracle8 can get the job done faster, providing the foundation for a faster overall IT architecture

- **Faster Development** Object-relational technology speeds development of complex applications, while built-in queuing speeds development of message-based applications
- **Faster Queries** Decision-support applications run dramatically faster due to Oracle8's patented new query algorithm And Oracle8 has the most complete parallel query technology in the current industry
- **Faster Transactions** Server-based queuing removes the wait time associated with peak-traffic transactions by storing updates for later delivery
- **Faster Replication** Replication speeds are an order of magnitude faster due to parallel propagation
- **Faster Management** Bulk data management is also performed in parallel for high-speed operations
- **Faster Customization** Data Cartridges provide a very fast way for you to tailor your database functionality

TOTAL COST OF OWNERSHIP

Oracle8 is the most cost effective and highly available data server in industry By automating a large amount of backup and recovery operations, Oracle8 significantly reduces labor requirements, while virtually eliminating the cost of error-induced downtime Independent studies have found that Oracle database software on Windows NT provides the lowest TCO per customer site and more twice the economics of scale over Microsoft's SQL server database software The survey conducted by the Business Research Group (BRG)—a technology, research and consulting firm based in Newton, Massachusetts—included 300 Windows NT customers and covered more than seventy-five discrete elements which comprise total cost of ownership Oracle bested Microsoft on the elements that were most critical to overall cost of ownership, such as number of sites supported by each database installation, transaction volume and upgrade costs

The study concluded that Oracle supported more than twice as many sites per database as Microsoft—a key factor which provided Oracle customers with a 54% lower total cost of ownership per site Oracle's product offering weighted in at $54,000 per site compared to Microsoft s whopping $117,000

HIGH AVAILABILITY FOR MISSION-CRITICAL APPLICATIONS

Oracle8's availability architecture is extremely sophisticated Oracle initially introduced symmetric cluster access using Oracle Parallel Server in Release 6 2 in 1989 As a result of customer feedback, Oracle has continually refined its high-availability architecture to decrease down time and reduce disruptive outages The following high availability features are supported by Oracle8 include the following

Standard recovery on a single node

- Automatic recovery of changes made by committed transactions
- Automatic rollback of uncommitted transactions
- Failover to a spare node
- Oracle Failsafe detects node failures and transfers database execution to a spare node

Failover to a peer node

- Oracle Parallel Server allows continued data access from peer nodes after a node failure

Optimized roll-forward recovery

- The checkpoint interval parameter limits the redo between checkpoints
- The checkpoint timeout parameter limits the time between checkpoints
- The max dirty buffers parameter limits IOs at recovery time

- Incremental checkpoints minimize redo application during recovery

Optimized roll-back recovery

- Deferred transaction recovery takes roll-back out of the critical path of crash recovery
- Row level locks are preserved through crashes
- Consistent read of un-recovered data lets readers see un-recovered data
- Time-slicing of rollback across all transactions minimizes the time to release locks

Optimized recovery of bulk operations

- Direct writes bypass the effects of bulk operations on checkpoints
- The redo for bulk operations is skipped at recovery time
- Freeing of block ranges makes the roll-back for bulk operations fast

Scalable recovery

- Redo application is automatically parallelized
- Undo application is automatically parallelized

Preservation of ongoing work by users

- Transparent application Failover makes node failures invisible to end users

Distributed caching of all data

- Data skew after fail over is eliminated
- Read intensive data is always accessible during recovery
- Peer nodes have pre-warmed caches after Failover

Failover to replica site

- Snapshots allow creation of read only replicas
- Symmetric replication allows creation of up-datable replicas
- Standby database replicates entire database using redo logs

ORACLE8 TOOLS AND UTILITIES

ORACLE8 OBJECTS OPTION

Oracle8 Objects Option represents a breakthrough in data modeling that allows you to represent, access, manipulate, and store data as business objects The Objects Option makes Oracle8 Enterprise Edition the most advanced object-relational data server in the industry No other data server can match the functional richness of object technology combined with the reliability, scalability, availability and manageability of Oracle8

ADVANCED NETWORKING OPTION

Oracle Advanced Networking Option integrates your Oracle database with network services, and propels basic client/server connectivity to enterprise-wide, client/server networks The Oracle Advanced Networking Option provides a comprehensive and reliable suite of security features to protect an enterprise

It offers the following features

Enterprise-Ready Client/Server

Deploying and running mid- and high-end client/server systems requires solutions for configuring and managing networks to secure data passage, to provide strong user authentication, and to afford single sign-on and centralized privilege management

Securing the Internet

To enable businesses to fully embrace the Internet, companies must feel secure about exposing their internal networks and corporate databases Advanced Networking Option ensures data privacy and integrity between Web servers and corporate databases To further strengthen this technology, all leading firewall vendors now support Net8™ and SQL*Net® and allow for secure Net8 connections through firewalls

Network Encryption Services

Oracle Advanced Networking Option uses encryption and integrity checks to protect data transmitted across exposed wiring, LANs, WANs and microwave and satellite links

Ensuring Network Privacy

Advanced Networking Option provides the capability to select the encryption algorithm that meets specified security and performance requirements Encryption can be requested by the client, the server, or both

Tamper-Proof Data

The Oracle Advanced Networking Option makes it virtually impossible for an intruder to modify, add, or delete data without detection If a modification is detected, the operation is terminated and an entry is made to the system log files

NETWORK AUTHENTICATION SERVICES

For maximum flexibility, the Oracle Advanced Networking Option includes support for a number of different authentication services Single Sign-on Services, Kerberos-Based Authentication and Centralized Password Store

Token and biometric authentication services

Token and biometric authentication offers security far stronger than conventional passwords providing higher assurance of valid user identity

The Oracle Advanced Networking option integrates the Oracle environment with the security, directory and transport services provided by Open Software s Foundation (OSF) Distributed Computing Environment (DCE)

ORACLE PARALLEL SERVER

Oracle Parallel Server enhances performance and availability for business applications Whether you are deploying a computing super center or distributed servers, this option makes for faster and more reliable transactions

Furthermore, Oracle Parallel Server allows your universal data server to distribute its workload across a cluster, so if a node fails, it automatically reconfigures the remaining instances to continue processing

In addition, it is unique in its ability to implement cluster solutions for business-critical applications It also offers

High Applications Availability

With Oracle Parallel Server, applications are insulated from systems failures, providing higher applications access to all users

Openness and Flexibility

Oracle Parallel Server is available on many different mainframe platforms and on Intel NT and UNIX

Oracle Parallel Server is part of Oracle8's complete solution for customers who demand rapid response, consistent service, and support for their mission-critical applications

PARTITIONING OPTION

Partitioning allows users to have much more control in managing tables and indexes, since all maintenance operations can be directed at individual partitions, rather than being restricted to tables and index names

Large amounts of data complicate administrative tasks and affect the availability of the database, since most administrative tasks must be performed in a small time window to minimally affect the performance of online operations Oracle8 Partitioning Option dramatically improves the manageability, performance, and scalability of your applications

MANAGEMENT PACKS

The growing user population, ever-expanding data volumes and constant change are just a few of your challenges Oracle Management Packs help you automate repetitive mundane tasks, optimize for performance, plan for resource utilization, implement change, and most importantly reduce your total cost of ownership

Oracle change Management Pack is the simple solution for managing complex change in the Oracle environment

Oracle Diagnostics Pack provides advanced monitoring, diagnosis, and planning for the Oracle environment

Oracle tuning Pack provides expert performance management for the Oracle environment

DEVELOPMENT TOOLS

DESIGNER/2000

Oracle Designer delivers a dramatic increase in productivity for database application developers by providing a RAD-like intuitive, task-oriented environment to model and generate server DDL, client/server and Web-based applications exploiting the power and portability of Java and HTML user interfaces Extended repository depth along with integrated new modeling and generation tools automate the construction of the full range of functionality required for complete generation of enterprise applications

DEVELOPER/2000

Oracle Developer is Oracle's award winning development environment for building enterprise class database applications for Client/Server and the Web

It provides a set of integrated and productive builders that allow developers to construct sophisticated and multi-lingual database forms, reports and charts These components use powerful declarative capabilities to create applications from database definitions

ORACLE REPORTS

Database Publishing and Reporting for the Enterprise

In today's fast-moving, competitive business world up to date information is needed for the accurate, expedient decision making requirements of an often geographically distributed workforce The timely distribution of information must be reliable, cost effective and accessible to everyone who requires it

Oracle Reports provides an easy to use design environment That means your developers are productively producing Reports in no time!

The multi-tier deployment environment provides the ability to centralize report execution in a manageable, scalable architecture that requires no complex install of software on users PCs Report data is dynamically displayed in the users web browser, allowing the availability of up to the minute reports from anywhere on your Intranet, Extranet or even the Internet

ORACLE JDEVELOPER

Oracle JDeveloper is Oracle's new component-based development tool for building server-centric network computing applications in Java With JDeveloper, developers can use Java to build 2-tier and 3-tier database applications for the industry's leading data management and application servers

Oracle JDeveloper is based on the industry-leading compiler and language technology in JBuilder™ from Borland International, Inc , and has been optimized for developers building network computing applications with the Oracle Data Server and Oracle Application Server

Oracle JDeveloper simplifies database programming with easy access to JDBC and built-in support for SQLJ, an industry standard for embedding SQL statements in Java JDeveloper's data-aware components and data form wizards accelerate database application development, allowing developers to focus on the business-specific logic in their applications

Oracle JDeveloper offers complete support for building and deploying Java applications with Oracle Application Server 4 0 With JDeveloper and the application server's JWeb Cartridge, developers can build

Middle-tier Java servlet applications that generate dynamic HTML for browser clients in Internet environments With JDeveloper and the application server's JCORBA cartridge, developers can build CORBA-compatible Enterprise Java Beans components for IIOP Intranet applications

Oracle JDeveloper is based on industry standards including JavaBeans, CORBA, IIOP, and JDBC Through JDBC, JDeveloper applications can run against databases from any vendor And with CORBA/IIOP and Enterprise Java Beans support, applications can connect to non-Java and other legacy applications JDeveloper's component-based approach encourages maximum productivity and code reuse, and makes it simple to create and deploy both visual and non-visual components

Oracle JDeveloper is available today as part of Oracle JDeveloper Suite, a comprehensive suite of development tools for building component-based, server-centric network computing applications in Java

Oracle Web Support

Web-Centric Applications Trend

Most new applications development has adopted a web centric approach This is in response to the current shift in workgroup paradigm and the perceived advantages of such approach These advantages are

A reduction in application administration costs

Increasing administration costs are a side effect of the move to client/server Program executables and files must be installed on each client to run client/server applications, and that software must not only coexist with other applications, but must also be upgraded and maintained on every client

A reduction in resource requirements

Client/Server applications typically require meaningful amounts of RAM over and above the requirements of the windowing environment under which they are running In addition, they can be greedy consumers of often-limited disk space

Web applications generally have lower resource requirements Since the "body" of web applications executes on an application server, less RAM is required on the desktop to execute the application Also, the application is installed on an application server, reducing client disk space requirements

Application Portability

Client/server developers have struggled with the complexities of deploying applications that run on more than one windowing platform The difficulties arise from visual as well as operational differences between these environments In many cases, applications have to modify for each platform, making the task of maintaining them even more challenging

Public Access

Any user anywhere can share all public data on the web application regardless of where he is Focused detailed information can easily be provided to any user at any time all over the world

Oracle Tools and Web Applications

Oracle's tool set delivers on the benefits of the web and overcomes its shortcomings in a number of different ways

REDUCE MAINTENANCE COSTS

Neither WebServer applications generated by Designer/2000 nor Developer/2000 web applications require the installation of applications on client machines in order to operate They enable centralized management and easy administration Both products are also perfectly positioned to run on network computers

REDUCE RESOURCE REQUIREMENTS

Since applications are executed on servers, hard disk space and RAM requirements are lowered on each client machine, significantly reducing the cost of hardware required to support an organization's applications

RUN ON ALL MAJOR PLATFORMS

Developer/2000 applications run on Windows, Windows 95/NT, Motif, Macintosh, character mode terminals and now, under web browsers as ell, adopting the native look-and-feel of each platform Web Server applications utilize HTML and JavaScript and run in a browser on any platform, which supports these standards

SUPPORT FOR STANDARDS

All of Oracle's tools support and take advantage of web standards Designer/2000 generates HTML applications Developer/2000 provides for client/server applications to be converted to Java, HTML, and along with Power Objects, supports the embedding of OCX and Active X controls inside applications

ELIMINATE THE LEARNING CURVE

Oracle's tools are built for productivity Designer/2000's unique ability to generate web applications without writing a single line of code is unmatched in the industry Developer/2000 and Power Objects use a familiar drag-and drop development approach coupled with exceptional database integration to deliver highly functional data processing applications that can scale to meet even the rigorous demands of the internet

SUPPORT TRANSACTION PROCESSING

Developer/2000 is an accomplished database development environment enabling the processing of complex enterprise transactions Power Objects makes database interaction extremely simple for tactical transaction processing Both tools bring this processing power to the web without being constrained by its current limitations Regardless of whether users need transaction processing on Intranets, or whether support for electronic commerce is required, Oracle has the tools to deliver the goods

ORACLE HIERARCHICAL IMPLEMENTATIONS

Oracle 8 has three main implementation levels, these are

- Personal Oracle
- Workgroup Oracle
- Enterprise Oracle

DIFFERENCES BETWEEN ORACLE8 AND THE ORACLE8 ENTERPRISE EDITION

The following tables explain the features and options in Oracle8 and the Oracle8 Enterprise Edition

AVAILABILITY OF ORACLE8 FEATURES

Feature	Oracle 8	Oracle 8 Enter-prise Edition	Notes and References
Systems Management and Availability			
Enterprise Manager	Yes	Yes	
Enterprise Manager Performance Pack	No	Yes	
Server Managed Backup and Recovery	Yes	Yes	
Recovery catalog for online backup	Yes	Yes	
Online recovery	Yes	Yes	
Incremental backup and recovery	No	Yes	
Parallel backup and recovery	No	Yes	Oracle8 can only allocate one recovery manager channel at a time thus limiting the parallelism to one stream The Oracle8 Enterprise Edition allows unlimited parallelism
Legato Storage Manager	Yes	Yes	
Point in-time tablespace recovery	No	Yes	
Fail Safe for Oracle8 on NT	Yes	Yes	This feature is available on Windows NT

Datawarehouse/VLDB Features			
Bit-mapped indexes	No	Yes	
Star Query optimization	Yes	Yes	In Oracle8 star query processing is the algorithm that utilizes B-tree indexes In the Oracle8 Enterprise Edition the parallel bitmap index join algorithm can also be utilized
Parallel Execution	No	Yes	
Parallel Load	No	Yes	
Parallel Query	No	Yes	
Parallel DML (insert update and delete)	No	Yes	This feature requires the Partitioning Option
Parallel index scans	No	Yes	This feature requires the Partitioning Option
Parallel Bitmap Star Joins	No	Yes	
Parallel Index Build	No	Yes	
Parallel Analyze	No	Yes	This feature requires the Partitioning Option
Programming Interfaces			
Oracle Call Interface	Yes	Yes	
Objects for OLE	Yes	Yes	
ODBC driver	Yes	Yes	
Pro*C/C++	Yes	Yes	This feature is available at extra cost as part of Oracle Programmer
Object Features			
object references (REFs)	Yes	Yes	
object collections	Yes	Yes	
nested tables	Yes	Yes	
variable arrays (varrays)	Yes	Yes	
object views	Yes	Yes	
Distributed Features			
Distributed queries	Yes	Yes	
Distributed transactions	Yes	Yes	
Two-phase commit	Yes	Yes	
XA	Yes	Yes	
Heterogeneous Services	Yes	Yes	
Basic Replication	Yes	Yes	
Read-only snapshots	Yes	Yes	
Subquery subsetting	Yes	Yes	
Primary key based snapshots	Yes	Yes	
Internal triggers	Yes	Yes	
Replicated LOBs	Yes	Yes	
Advanced Replication	No	Yes	
Updatable snapshots	No	Yes	
Multimaster replication	No	Yes	
Conflict detection and	No	Yes	

resolution			
Replication Manager	No	Yes	
Parallel propagation	No	Yes	
Minimized communication	No	Yes	
Networking Features			
Oracle Names	Yes	Yes	
Oracle Connection Manager	No	Yes	
Connection Pooling	Yes	Yes	
Connection Multiplexing	Yes	Yes	
MultiProtocol Connectivity	No	Yes	
Oracle Security Server	Yes	Yes	
Other Features			
Advanced Queuing	No	Yes	Advanced Queuing supports two types of message payloads RAW and structured (where the structure is specified by an object type) Without the Objects option users can only use RAW queues Both single-consumer and multi-consumer RAW queues are available without the objects option
Reverse key indexes	Yes	Yes	
Password management	Yes	Yes	
Index organized tables	Yes	Yes	
PL/SQL stored procedures triggers	Yes	Yes	
INSTEAD OF triggers	Yes	Yes	This feature can be used with relational views as well as object views Object capabilities require the Objects option
External procedures	Yes	Yes	
National Language Support	Yes	Yes	
LOB support	Yes	Yes	
Data Cartridges (extended datatype support, available at extra cost)			
ConText Cartridge	Yes	Yes	The ConText Cartridge offers full text retrieval
Video Cartridge	Yes	Yes	
Image Cartridge	No	Yes	
Visual Information Retrieval Cartridge	No	Yes	
Time Series Cartridge	No	Yes	Note To add functions or types to the Time Series Cartridge requires the Objects option
Spatial Data Cartridge	No	Yes	

AVAILABILITY OF ORACLE8 OPTIONS

Feature	Oracle 8	Oracle 8 Enterprise Edition	Notes and References
Oracle8 Options (available only for the Oracle8 Enterprise Edition, at extra cost)			
Objects Option	N	Y	The Objects option allows data to be represented accessed manipulated and stored as business objects It allows the definition of object types and all features that use object types including object tables object views the object cache extended Oracle Call Interface features the object features of Pro*C extended SQL and PL/SQL support of object capabilities No CREATE TYPE ALTER TYPE or CREATE OR REPLACE TYPE statements are possible without this option Note INSTEAD OF triggers are available with the Oracle8 Enterprise Edition even without the objects option and can apply to relational views Also note that LOBs (large objects) are included in both Oracle8 and the Oracle8 Enterprise Edition
Partitioning Option	N	Y	The Partitioning option allows the definition of partitions of tables and indexes This feature is useful for OLTP and Data Warehousing users Note that this option is required for parallel index scans and parallel DML (insert update and delete) Note also that partition views a feature of Oracle7 release 7 3 is included in the Oracle8 Enterprise Edition without this option No CREATE PARTITION statements are possible without this option
Advanced Networking Option	N	Y	The Advanced Networking option provides client/server server/server network security using encryption and data integrity checking as well as enhanced user authentication services
Enterprise Manager Performance Pack	N	Y	The Oracle Enterprise Manager Performance Pack provides an

12

			advanced set of tools for managing database environments It consists of six applications for advanced diagnostics monitoring and tuning of Oracle environments
Parallel Server Option	N	Y	The Parallel Server option allows multiple nodes of a loosely coupled system (such as a cluster or massively parallel platform) to share access to a single database for increased scalability and availability It includes client side failover and on some platforms inter node parallel query

COMPUTER AIDED SOFTWARE ENGINEERING

CASE

AN SRE WHITE PAPER
PART OF PLAN DEFINITION STUDY

Introduction

Throughout history the most significant productivity advances in manufacturing or building processes have come about when human skills were augmented by powerful tools Similarly, the productivity of architects and designers is improved when they are supported by CAD systems which take over tedious drawing chores and which check for design errors and omissions This also the case for system developers, designers, analysts, and managers who need tools (CASE) to support then during the development life cycle

This paper is organized as follows, section 1, the case is defined Section 2 CASE classification is presented Section 3 the CASE architecture is discussed Section 4 CASE integration is discussed Section 5 CASE benefits are discussed Section 6 CASE cost is discussed Section 7 the CASE justification is discussed

CASE Definition

CASE is the consistent application of methodology to systems development activities, and techniques CASE "tools" are programs (software) that automate or support one or more phases of a systems development life cycle The technology is intended to accelerate the process of developing systems and to improve the quality of the resulting systems

CASE Classification

A classification of CASE according to the breadth of support for the software process is

- **Tools** that support individual process tasks
- **Workbenches** that support phases or activities They consist of different tools with a degree of integration
- **Environments** that support all or at least substantial part of the software developing process They include several different workbenches

CASE tools can also be classified according to the phases in which they automate or assist developers

CASE Tools for Systems Planning

CASE tools will help analysts and consultants capture, store, organize and analyze models of the business These models will help the information systems planners define and prioritize

- Business strategies that are being (or will be) implemented
- Complementary information systems and information technology strategies to be implemented
- Databases that need to be developed
- Networks that need to be developed
- Applications that need to be developed around the databases and networks
-

CASE Tools for Systems Analysis and Design

CASE tools will also help system analysts better express users' requirements, propose design solutions, and analyze the information for consistency, completeness, and integrity This information help analysts

- Define project scope and system boundaries
- Model and describe the current information system
- Model and describe users' business requirements for a new information system
- Prototype requirements for the purpose of discovery or verification
- Design a computer-based information system that will fulfill the user's business requirements
- Prototype specific design components (such as screen and reports) for the purpose of verification and ease-of -use
-

CASE Tools for System Design and Implementation

Application programmers and other system implementers can use CASE tools to improve their productivity and quality It also helps them to quickly generate application software This include

- Quickly test and debug their program code
- Automatically generate program code from analysis and design specifications
- Design and automatically generate special or detailed system design components like screens and reports
- Automatically generate complete application code from analysis and design specifications

CASE Tools for System Support

CASE tools have a significant role in the support of maintenance activities for production information systems They help analysts, designers, and programmers react to inevitable, ever-changing business and technical environment This include

- Helping programmers restructure existing or old program code to be more maintainable

- Helping programmers and analysts react to changing user requirements
- Helping analysts and programmers reengineer programs to accommodate newer technology (such as changing the DBMS)
- Helping analysts and programmers determine when the costs of maintaining a system exceed the benefits of maintaining it
- Helping analysts recover any suitable information from obsolete programs as a preface to taking that information back to high level CASE tools and redeveloping a major, new information system

CASE Tools that Support Cross Life Cycle Activities

Such tools support activity across the entire system development life cycle They include project management tools that help managers plan schedule report on, and manage their projects and resources

- Process managers that provide the necessary on-line guidance and expertise with applying the right CASE tools and facilities at the right time
- Estimation that attempts to accurately assess the size of the project and then estimate the time and cost to complete the project
- Documentation with the deployment of CASE technology creates a wealth of documentation through the development process It offers this documentation at various points of the project These documentation becomes work product or deliverable in the project

CASE Architecture

CASE architecture is composed of two major parts a database called repository and a set of facilities and functions

The Repository

The real power of a CASE tool is its repository not its GUI and other impressive looks A repository is a developers database It is a place where developers can store diagrams descriptions, specifications, application programs, and any other working by-products of the system development

Such repository may be local to each tool or integrated in the I-CASE (Integrated-CASE) where all the CASE tools use the same repository The local repository may be shared among a workgroup in a network environment which allows different developers to share and exchange information about the system under development On the other hand central repository is a database for all the past, present, and future information systems, databases, networks, and technologies for an entire organization of the current projects-in-progress This central repository helps developers to have a consistent and updated information about every single step made during the development process

FACILITIES AND FUNCTIONS

These facilities and functions provide the repository data (Input), and represent its contents (Output)

- **Graphics facilities** are used to diagram or model information systems using various techniques
- **Description facilities** are used to record, delete, edit, and output non-graphical information and specification
- **Prototyping facilities** are used to analyze or design components such as inputs, outputs, screens, or forms
- **Inquiry and reporting facilities** are used to extract information and specifications out of the repository
- **Quality assurance facilities** are used to analyze graphs, descriptions, and/or prototypes for consistency, completeness, and conformance to generally accepted rules of the system development
- **Decision support facilities** are used to analyze information in the repository to provide support for decisions, for example identify the scope of the project and which data entity is stored in which database
- **Documentation facilities** are used to assemble graphs, repository descriptions, prototypes, and quality assurance reports into formal documents or deliverables
- **Transform facilities** are used to automate or assist the transformation of something into another form, for example a business oriented model transformed into a technically-oriented data model
- **Generators** automatically translate user requirements and/or technical designs into working applications and programs
- **Data-sharing facilities** provide export and import repository information between different local repositories of the same CASE, between different CASE systems, or between the CASE and non-CASE systems such as word processors, spreadsheets
- **Security and version control facilities** maintain integrity of repository information For example, to lock some data that should not change, tacking changes done by developers since certain checkpoints (version control)
- **Housekeeping facilities** are used to establish user accounts, project directories, user privileges, tool

defaults and preferences, backup and recovery, and so forth

CASE INTEGRATION

The principal benefit of integration is that specialized tools can be combined to provide wider support for activities With an integrated system, training costs are potentially reduced as existing software is reused when new systems are added If CASE system user interface is integrated learning time and user error rate are likely to be reduced

When integrating a design workbench with a documentation workbench, the documentation is automatically generated by the design tools and can be formatted neatly and included in system documentation workbench

When integrating specification, design and programming tools with a configuration management (CM) workbench, the output from the tools can be managed using the CM system The organization can keep track of different changes, versions releases and so on

Five levels of integration are applied to workbenches and environments

- **Platform Integration** means that tools or workbenches to be implemented can run on the same platform
- **Data Integration** means that different CASE tools can exchange data (import/export or shared-repository)
- **Presentation Integration** means that the tools in a system use a common metaphor or style and a set of common standards for user interaction
- **Control Integration** is concerned with providing mechanisms for one tool in a workbench or environment or start and stop other tools, a tool can call on services provided by another tool in the system
- **Process Integration** means that the CASE system has embedded knowledge about the process activities their phasing, their constraints and tools needed to support these activities The CASE system participates actively in scheduling of these activities and in checking that the required activity sequence is maintained

BENEFITS OF CASE

Like any other tool CASE tools can be misapplied or not used to its fullest potential However when properly used CASE tools can result in the following benefits

INCREASED PRODUCTIVITY

CASE automates many of the most tedious clerical activities of developers It reduces the time needed to complete many tasks, especially those involving diagramming and associated specifications Estimates of improved productivity through application of CASE technology range from 35 to more than 200 percent

Unfortunately, CASE technology never immediately manifests itself, as there is a learning curve True productivity gains usually come after using the technology on several projects If management is looking for early tangible benefits, it should focus its attention on quality

IMPROVED QUALITY

Quality is measured in many ways How the information system fulfills user requirements? Can it easily adapt to ever-changing requirements? How many bugs are in the applications? Can applications be easily modified or reused?

CASE can eliminate or substantially reduce omissions and defects that would prove very costly to correct during system implementation or support Assuming analysts, designers, and programmers are applying very efficient developing techniques, CASE tools can provide almost immediate quality improvement benefits In contrast, if poor techniques are used, CASE tools merely help you to develop poor quality systems much faster

BETTER DOCUMENTATION

An early benefit of CASE tools is high-quality documentation CASE tools also make it easier to maintain that documentation Indeed, we have also noticed an increased willingness of developers to maintain documentation if they are provided with CASE tools

REDUCED LIFETIME MAINTENANCE

The net benefit of higher system quality and better documentation should be reduced costs and effort required for maintaining systems This, in turn, creates more time and resources for new systems development

Most information systems shops are unable to find enough time to do all the new system development (or major development) project that are proposed They simply spend too much time, effort, and resources to maintain existing systems By reducing the amount of time spent on maintenance, a shop creates equivalent time to reengineer older applications, and focuses efforts on new applications that can return greater value and competitive advantage to the business

METHODOLOGIES THAT REALLY WORK

True CASE success depends on properly using a methodology and true methodology success depends on properly using a CASE

CASE has made it possible to realize the benefits of various methodologies insistence on higher precision and detailed specifications

COST OF CASE

CASE is very expensive The cost of outfitting every systems developer with a preferred CASE tool kit is still prohibitive to many And the cost of CASE mainly comes from

HARDWARE AND SYSTEMS

- CASE tools require a high performance graphics workstation
- A high-resolution graphics display is needed
- They also require Network and file servers
- If the target application platform is mainframe or minicomputer, you may need a communication adapter and terminal emulation software
- Better CASE tools require a sophisticated operating system
-

SOFTWARE

In addition to the software cost, there is a hidden cost of extended maintenance contracts It buys you free upgrades to new versions and may give you access to hot line for on-line support

TAINTING AND CONSULTING

The proper application of CASE tools generally requires some degree of training CASE consulting industry has evolved to support users of CASE tools Representative services include

- Orientation of management and staff to CASE technology
- Selection of the standard CASE toolkit and/or methodology
- Integration of CASE tools into your methodology

- Customization of your methodology to support selected tools
- Adaptation of your CASE tools to support what is required by your methodology
- Pilot project supervision or guidance

JUSTIFICATION FOR CASE

A study has made to evaluate the benefits of CASE The analysis is based on a worst case assumption with overestimated costs and under estimated tangible benefits The result of this study was that CASE yields a positive return on investment So with more realistic values the benefits will be more, and then you cannot afford not to take advantage of this technology

ORACLE DESIGNER/2000 RELEASE 2 0

Its tool set provides an integrated CASE environment for developing enterprise-wide and client server applications

It spans every phase of the software development life cycle from business modeling to deployment Its repository-driven approach allows any or all of its components to be used for rapid development of scaleable, cross-platform, distributed applications

The reverse engineering and design capture capabilities provide 100% reverse engineering of application logic as well as 100% generation

Its CASE architecture uses the central repository that is shared in a multi-user environment The functions and facilities described at the CASE architecture are all supported in the Designer/2000 except it has a rudimentary decision support facility

It has a high degree of integration as it supports the five levels of CASE integration The application development life cycle support is accommodated by a powerful tool for documentation that generates very useful reports from the repository for documentation and also for quality assurance

DESIGN GOALS OF DESIGNER/2000 TOOLSET

- **Graphics throughout the life cycle** Diagrams show components and their connect along with reports, utilities, and generators provide a sound framework for system engineering

- **Flexible business modeling** Both object-oriented and entity-relationship business modeling techniques are supported
- **Generation for the Web and Client/Server** A single definition for a module or entire application can be deployed to the Web or client/server environment
- **Design Capture** Server design for a wide set of databases can be captured and regenerated This allows the migration of databases from legacy systems into Oracle 8 database Also Visual basic and Developer/2000 applications can be captured into the Designer/2000 repository
- **Round-trip Engineering** Applications generated from Designer/2000 to Developer/2000 can be altered outside the Designer and these changes are recaptured into the Designer repository for more refinement and regeneration
- **Repository Management Facilities** A Repository Administration Utility is provided to manage different projects to be stored in the repository and object definition to be shared among projects
- **Powerful Default Database and Application Design Transformers** A Database Design Transformer can produce database schema from an entity-relationship model Also an Application Design Transformer can produce module definition for screens reports, and menus from a functional and data flow models
- **Repository Flexibility and Open Interfaces** New object can be defined using a dialog interface These objects can be handled and accessed using Matrix Diagram or the Repository Object Navigator The new object may be an object used by any other design tools, which enables tailoring the repository to be used in a heterogeneous environment including tools from other vendors
- **Desktop Integration** The modeling toolset provides close and direct integration with familiar desktop environment
- **Diagram Management and Synchronization** A broadcast mechanism is used to notify users working on a certain object that this object has been changed, in order for out-of-date object to get updated to reflect the new changes

DESIGNER/2000 PRODUCT OVERVIEW

ORACLE PROCESS MODELER

The process modeler within Designer/2000 directly supports process modeling techniques, which helps organization to visualize understand and radically improve their fundamental business processes An organization can gain significant competitive advantage by understanding how these business processes work and exploring the opportunities to perform them more effectively Cost reductions, quality improvements along with opportunities to use technology to greater advantage are all possible outcomes of process activities

BUSINESS ANALYSIS AND REQUIREMENT MODELING TOOLS

- **Entity relationship Diagram** Entity Relationship Diagram supports the creation, display and manipulation of all entity and relationship properties including attributes Properties of attributes are displayed using default symbols for mandatory, optional and uniquely identifying attributes The diagram supports transferable relationships
- **Object Type Modeling** It uses an open standard for object modeling which is Unified Modeling Language (UML) Using the Type Modeler the designer can create either object types or value types Value types can be thought of as specialization of a built-in type such as number or string Value types are available to allow the concept of domains
- **Function Hierarchy Diagram** It represents the activities carried out by a business It uses the technique of Function Decomposition, whereby a high-level statement of an enterprise or department is broken down into progressively more detailed functions
- **Data Flow Diagram** It shows who data flows through an organization's business areas For a specific business function, each diagram illustrates the source and the destination of data, where it is stored and how information is transferred
- **The Repository Object Navigator** It provides a way of viewing and manipulating objects in the repository and administration of applications This tool displays elements stored in the repository in a hierarchical fashion
- **Matrix Diagram** It is a general-purpose cross-reference tool that is used to support object scooping, impact analysis, network planning and quality control

ORACLE DESIGN EDITOR

- **Module Diagram** It provides a way of creating and manipulating the tables and columns used by a module, giving the developer a complete graphical environment for creating and generating code Links between tables are foreign keys used to define master detail relationships

- **Preference Palette** It is used to provide the look-and-feel of the application It allows users to set view, and manipulate user preferences used by Oracle Forms, Web Server, Visual Basic, and Report Generators in a highly graphical and intuitive form
- **Module Logic Editor** It aids writing of application code by supporting the developer with known and correct constructs to define Packages, Procedures, Triggers Cursors, and Functions

ORACLE DESIGNER/2000 GENERATORS

- **Forms Generator** It creates screens layouts client-side application logic, and database access definitions Generator preferences allow sophisticated use of user interface objects in a consistent and productive manner
- **Oracle WebServer Generator** It generates applications for the Web These will run using Oracle Web Application Server The generated application will run on an industry standard browser
- **C++ Generation** Using the Object Type Model as its base, it generates C++ classes that provide transparent persistency for these objects
- **Visual Basic Generator** It generates fully functional, data-oriented Visual Basic applications, based on module and database design specifications
- **Oracle Report Generator** It generates fully bitmapped graphical reports using data stored in the repository by the System designer Data Module Diagram, and Preferences Palette The generator creates layouts and database access routines required for Developer 200 reports
- **Oracle Server Generator** It creates all server-side components from the information held in the repository SQL DDL is created for table designs defined using system Designer This includes the basic table and column information along with server-side validation of foreign key, constraint, primary key etc It also generates and reverses engineers Oracle RDB, DB2/2, MS SQL Server, Sybase, ANSI SQL DDL, and ODBC databases