3.5.6 Resource distribution

Since CIS consists of numerous PCs and servers, automated management function of software resources increases the system integrity and reduces the maintenance cost.

Software resources include package software and user-developed CIS application both for the CIS Main Server and the CIS clients.

The operational control server manages all the software resources of CIS. Figure 3.5.6-1 shows the mechanism of resource distribution.

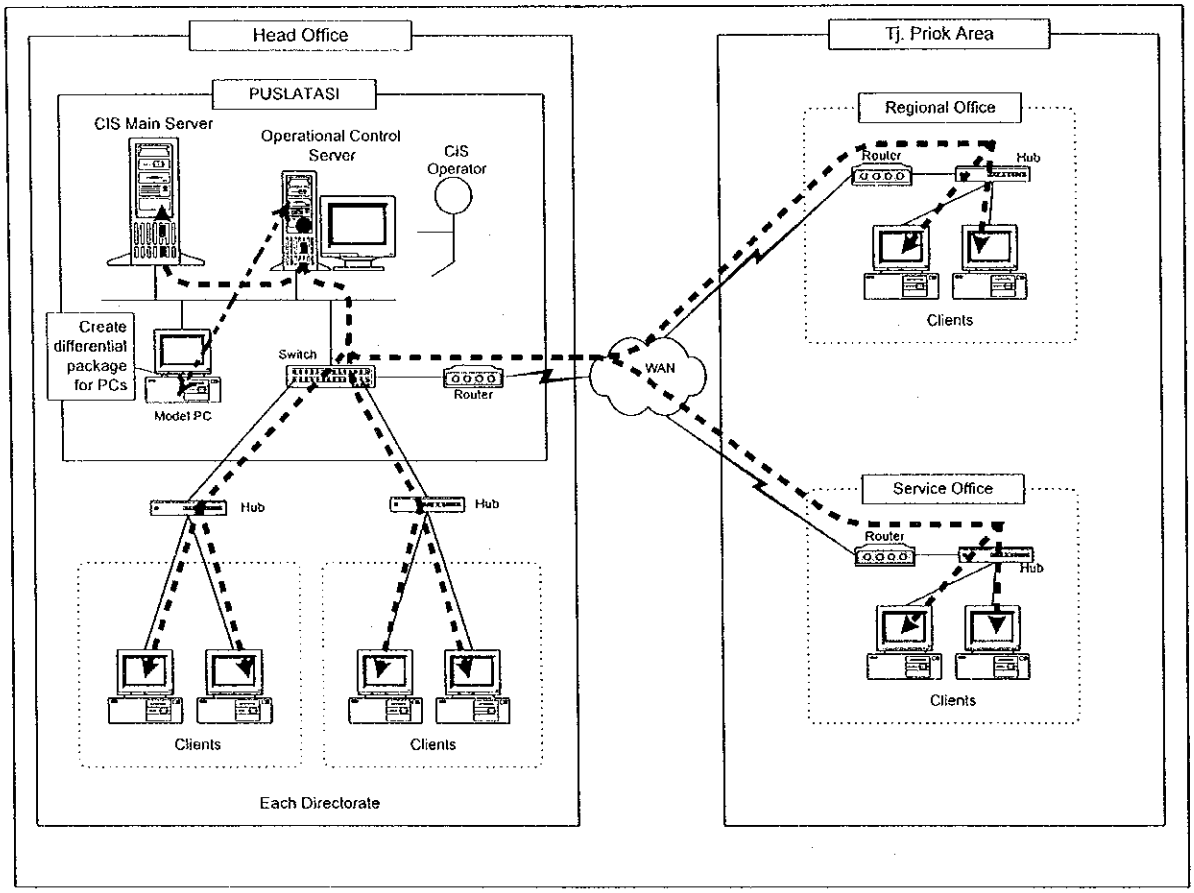


Figure 3.5.6-1: Mechanism of resource distribution

This subsection explains resource distribution in four topics:

1) Resource registration to the operational control server

2) Resource distribution

3) Resource version management

4) Off-line distribution

When Regional Servers are installed in the second and later stage of CIS, resources to them are distributed just like to the CIS Main Server. The Regional Servers also relay the resources to the CIS clients in each region.

3.5.6.1 Resource registration to the operational control server

All the resources have to be registered to operational control server at first. Resources are produced on development environment, which is not included in the Figure 3.5.6-1.

These tasks are involved in the registration:

- Upload the software resource to the operational control server
- Compression of resource
- Definition of target system (i.e. for the CIS Main Server or for the CIS clients)
- Version registration of the resource

  Older versions of resources are kept in the operational control server.
- Creating differential package

  For the resources of CIS clients, the differential package between most recent version and newly registered version is created using model PC. The model PC is installed in PUSLATASI. Resulted differential package is registered in operational control server.

3.5.6.2 Resource distribution

After registration, the operational control server distributes resources to destinations.

These tasks are involved in distribution:

- Specifying destination

  Determine the target system.
- Specifying object

  Select the resources to be sent and specify its version.
- Distribution

  Sending the resources through network and installing the resources on the target machine.
- Checking result

  Confirm whether sending and installing on the target system is succeeded or not.

All these tasks are controlled from the operational control server.

3.5.6.3 Resource version management

The operational control server keeps several versions of registered resources. The server also has functionality of investigating version of installed resources in each component of CIS through network.

When the version of installed resources are different among the CIS clients, such functions should be used to match the version.

That situation can be caused in following cases:

- Some of clients are not operating at the time of distribution
- Disk system of client is crashed and system should be re-installed on that client

3.5.6.4 Off-line distribution

Above discussions are based on on-line resource distribution. If on-line distribution is not available, off-line distribution method is used instead. Restriction of bandwidth of WAN is one example of the reason.
In the first stage of CIS, off-line distribution is not included in the design.

Following explanation of off-line distribution is regarding user developed application software. For ready-made software packages, they should be directly installed on each target machine in case of off-line distribution.
At the off-line distribution, these procedures should be performed:

1) Create target environment in PUSLATASI
   Construct actual environment including distribution resource for clients or Regional Server.
2) Copy the resource to distribution media
   Distribution media must be portable. Magnetic tapes for Regional Servers will be selected. One possible suggestion for clients is CD-R, which can be read from each client.
3) Send the media to destination
   Physically send the distribution media to the destination DJBC office by mail or other means.
4) Copy the resource from distribution media to target machine
   Manual copy of the resource from distribution media to target machine is required.

3.5.7 Job management

This subsection explains management of execution of business processes of CIS. The business processes are distributed between the CIS Main Server and the CIS clients. The CIS Main Server performs fundamental function of business processes while the CIS clients provide interface for end users.

Figure 3.5.7-1 shows scope of job management function in CIS.

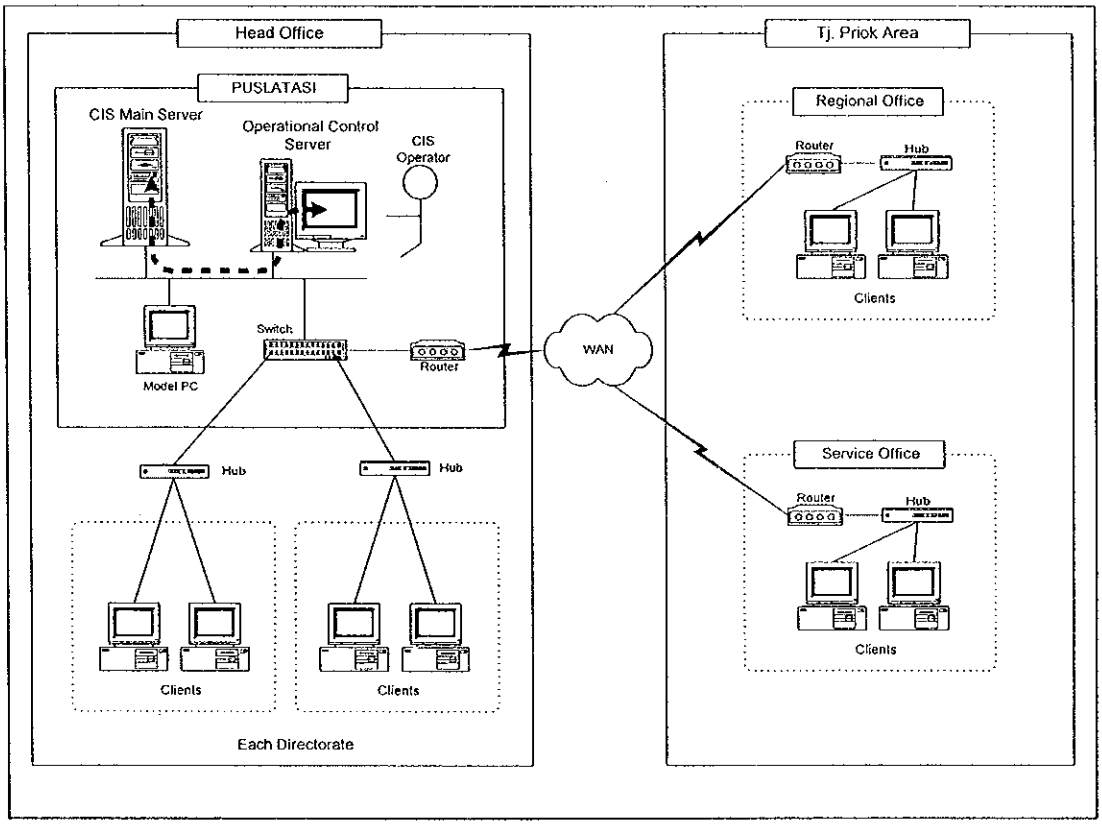


Figure 3.5.7-1: Scope of job management

The operational control server manages jobs on the CIS Main Server. Business processes on each client (CIS user program) are out of centric job management scope. The client processes are automatically started up when the power of the client is turned on. Powering on / off of each client is left to end users.

The operational control software enables management from the operational control server. The software is running both on the operational control server (server component) and the CIS Main Server (client component), which are communicating each other.

When Regional Servers are installed in the second and later stage of CIS, jobs on them are managed by operational control server just as the CIS Main Server.

Followings are the topics regarding job management:

- Scheduling
- Management of fixed jobs

3.5.7.1 Scheduling

Activities of the CIS Main Server are scheduled on the operational control server.

Basically activities are arranged in daily schedule, but the activities with yearly, monthly, or weekly schedules should also be managed.

These kinds of activities can be scheduled:

- Powering on / off

  This is potentially possible but the CIS Main Server operates 24 hours a day, 365 days a year.

- Start up system services or applications

  System services are basic functionality supplied by the CIS Main Server. Networking functions, e-mail server or file transfer protocol are the examples of system services.

  Applications include the CIS database and other ready-made products.

- Execution of user jobs

  Predefined user jobs should be executed on the scheduled period. Details of this topic is explained in the next sub-subsection.

3.5.7.2 Management of routine jobs

Fixed, repeatedly executed jobs are also called batch processes. For the mechanism of execution of them, refer to 3.9.2.

Routine jobs are managed through these steps:

1) Design job nets

   Routine jobs are implemented as job nets. A job net represents a unit of business process. Each job net consists of one or more smaller job steps, which are implemented as discrete user programs. Job nets should be designed in program structure design phase.

   Followings should be determined on designing job nets:

   - Job steps included in the job net

     Break down larger business process into smaller parts.

- Order of execution of each job step

  Arrange each job step in order. The orders don't have to be sequential; sometimes they become networks with direction (so that they are called job net). In these job nets, more than one job step can be executed at the same time.

  The restriction is that every job net has to have start job step and end job step. Infinite loop within job net must be avoided.

  For the example of job net, refer to Figure 3.9.2.4-1.

- Error management of each job step

  There are several choices of error management:

  i) Just report failure

  ii) Retry the same job step

  To avoid infinite loop, maximum number of retrying should be defined.

  iii) Start up recovery process

  In this case, the recovery process (job step) must be specified. Recovery job steps are executed only if the job step is failed. Following job step after execution of recovery job step must be also defined (e.g. re-execute from originally failed job step or resume execution from the succeeding job step).

- Execution schedule

  Define starting condition of the job net. They can be specific time, completion of preceding job net, creation of specific file and so forth.

2) Job net execution control

Once job nets are defined, they are automatically executed on the CIS Main Server.

The CIS operators monitor and control job nets on the screen of operational control server.

These functions are provided by operational control software:

- Monitoring job net status

  To monitor statuses of job nets on time scale. Examples of statuses are:

  - Waiting: The job net is waiting for the starting condition.
  - Executing: The job net is running.
  - Completed: The job net is finished successfully.
  - Warning: The job net is finished with warning message.
  - Abnormally terminated: The job net is not finished because of failure.
  - Paused: The job net is paused during execution by operator.

- Execution control

  Operator can manually control the execution of each job net. Examples of manual operations are:

  - Re-execution after abnormal termination
  - Abortion
  - On-demand execution
  - Pausing

- History management

  Operator can check the execution history of each job net. Started time, finished time, execution statuses will be contained in the history.

- Job queuing

  Each job net is in waiting queue before they start execution. The CIS operator can manage the concurrency, that is number of job nets executed simultaneously, to increase the total performance while keeping the load of the CIS Main Server at proper level.

3.6 Expandability Design

CIS will be implemented gradually from its centric part (first stage) to marginal parts (second and third stage). This section explains the expected coverage of CIS in the second and third stage, and the expandability of the system designed for the first stage.

3.6.1 Expandability requirements

This subsection explains requirements for the future coverage of CIS. Descriptions are comparatively qualitative.

3.6.1.1 Area

CIS will cover wider area of DJBC offices in the future stages. The detail of this topic is discussed in 3.1.

The major differences between the first stage and later stages are:

- All the Regional Offices will be covered by CIS.
  CIS will be installed in all the Regional Offices of DJBC (12 offices) until the end of third stage. One Regional Server will be installed in each Regional Office.
  Every Regional Server will be connected to Main Server through WAN and will manage clients within the Regional Office and Service Offices under the administration of the Regional Office.
- Some of the Service Offices will be covered by CIS.
  The clients of CIS will be installed in some of large Service Offices. These clients will be connected to Regional Server in the Regional Office, which administrates the Service Office.
- The networking within CIS will spread nationwide.
  The offices of DJBC that CIS will cover spread almost all over Indonesia. Since CIS networking depends on public network services, proper network service should be chosen for each office. For currently available public network services, refer to 3.8.1.3.

3.6.1.2 Amount of data

This sub-subsection explains amount of data that will influence on estimation of storage capacity. The data is classified into system area and database area. The estimation of system area takes into account the size of product file, log file, swap file and so on. Estimation for the database area includes the growth of number of records. For details of estimation of database capacity, refer to 1.8.8.

Table 3.6.1.2-1 shows the estimated data amount of CIS in the first five years.

Table 3.6.1.2-1 Estimated data amounts in CIS

Requirement	Initial	1st year	2nd year	3rd year	4th year	5th year
Database (GB)	—	19.6	20.7	21.9	23.3	24.7
System (GB)	20	—				
Total amount of data (GB)	20	39.6	60.3	82.3	105.6	130.2

3.6.1.3 Other functional requirements

CIS will connect with other major computer systems in DJBC mutually. Although it is beyond CIS scope, DJBC has to consider following functions to build up CIS:

- Integrated management of CIS, CFRS, and other major computer systems in DJBC

  The management of CIS and other systems as a whole, not as the separate systems, is required.

- Dial up connection to central system management server.

  For troubles occurred at out of the regular operating period (e.g. at night), report of the incident may be sent to maintenance staff from CIS through pager or other public media. To respond such incident from outside of DJBC, remote operation of CIS will be required.

3.6.2 Expandability of CIS at the first stage

3.6.2.1 Hardware

- Server

This part explains quantitative capacity of the Main Server of CIS in the first stage. This server will continuously be used in CIS without replacement.

Table 3.6.2.1-1 shows comparison between maximum configuration and designed configuration for the Main Server at the first stage.

Table 3.6.2.1-1: Comparison between maximum configuration and first stage configuration of the Main Server

Item	Maximum	First stage
Number of CPU (processor)	14	4
Memory	14GB	1 GB
Disk storage	4TB (4096 GB) using 18 Fibre channel adapters (*)	200 GB using 1 Fibre channel adapter
Number of network adapter	15 (100Base-TX) (*)	4 (100Base-TX)

Note: Sum of numbers of fibre channel adapter and network adapter is up to 18.

- CPU / Memory

  For the first stage, the Main Server is designed to have 4 processors. As for UNIX systems, adding processor and/or memory can increase performance of data processing. There are enough margins for expansion of processor and memory in the Main Server.

  Table 3.6.2.1-2 shows particulars of current memory estimation. Regarding database memory estimation, refer to 1.8.9.

Table 3.6.2.1-2: Details of memory estimation in the first stage

No.	Details		Size (MB)	Remarks
1	Kernel Memory		40	—
2	Application Memory	Oracle	772	—
		Operational control software	42	—
		File transfer package	14	—
3	Buffer cache Memory		60	—
4	Free memory		90	—
Total			1018	1 GB = 1024 MB

- Disk storage

  The estimated number of 200GB in above table does not match with the estimation in Table 3.6.1.2-1. Actual disk capacity becomes 1.5 – 2 times larger than data amount managed by the system. This comes from RAID configuration used by the Main Server and overhead of file system of operating system (OS). Detailed configurations are discussed in 1.8.8.2.

- Network adapter

  There are enough margins for expansion of network adapters.

- Clients

The factor that determines necessary resource of clients is not the size of whole system, but the size of application programs run on each client. Some additional functions will be implemented into CIS in the second stage.

Table 3.6.2.1-3 shows comparison between maximum configuration and designed configuration for the clients at the first stage.

Table 3.6.2.1-3: Comparison between maximum and first stage configuration of clients

Item	Maximum	First stage
Memory	384 MB	64 MB
Disk storage (internal)	4 GB	4 GB
Disk storage (external)	Optional	None

Size of internal disk storage already reaches its maximum configuration, but this is not regarded as restriction of the practical size of client application. The reason is that:

- Actual size of CIS application is predicted much smaller than the capacity of current hard disk.
- Clients do not store large amount of data within them. Instead, clients retrieve partial, much smaller amount of information from the database on the server, then operate them.

In case clients require more disk storage for some reason, external disk storage can be added to each client.

As for memory, there are enough margins for expansion.

- Network

The Main Server of CIS will be interconnected with up to 12 Regional Servers through WAN. To increase concurrency of communications among different connections, adding network facilities, such as router, is required. Each network facility will be dedicated for small number of WAN connections. Then each network facility will be connected to one network adapter added to the Main Server. As previously mentioned, the Main Server has enough expandability of network adapter. In conclusion, higher performance network can be build up on the network of first stage.

3.6.2.2 Software

This sub-subsection explains capabilities of software packages of first stage to work properly even in larger system.

- Server

The essential product of the Main Server is Oracle RDBMS. Logical limitation of data amount for Oracle RDBMS (terabyte order) is by far larger than currently estimated size, about 130 GB. But careful consideration for physical implementation of database is still required.

- Clients

  The operation of client software itself does not influenced by the size of whole system as far as the server processes work properly. Software packages installed at the first stage will need no replacement as the result of expansion of CIS.

3.7. Network Design

3.7.1. Circumstances and general network design

CIS will cover all Indonesia and therefore, it is important to understand the WAN service available in Indonesia. PT Telkom provides WAN services in Indonesia, and in more limited areas PT Lintas Arta also provides similar services.

On April 1996, one of the biggest Telecommunication Service Company in Indonesia (PT Telkom) launched T-2001, the monumental and ambitious program to provide excellent telecommunication service at home. PT Telkom claimed that by 2001, they would connect all 27 provinces in Indonesia with Super Highway telecommunication facilities.

PT. Lintasarta, in cooperation with PT Telkom, provides 64 Kbps synchronous digital data transfer service and 19.2 Kbps asynchronous digital data transfer service. The Integrated Services Digital Network (hereafter referred to as ISDN) that has the capability to transmit data, voice and image simultaneously with high speed and good quality is also available in Indonesia.

Up to now both companies have been providing some products with distinct characteristics. The following table shows telecommunication service products in Indonesia that may support the networking needs of CIS.

Table 3.7.1-1: Telecommunication service product suitable for computer network (1/2)

No.	Product Name	Characteristic	Provided by
1	Pasopati (ISDN)	Suitable for LAN to LAN interconnection Currently available in Jakarta, Bandung, Surabaya, Medan, and Batam Speed : 64 Kbps	TELKOM
2	Leased Line	Use of TELKOM-Net (provided by TELKOM) Covering almost all over Indonesia Suitable for LAN to LAN interconnection Speed : 64 Kbps ~ 512 Kbps	TELKOM LINTAS ARTA
3	DINAccess Dedicated Network Access	Using TELKOM-Net facilities Suitable for LAN to LAN interconnection High speed data transfer Closed User Group Speed : 19.2 Kbps ~ 2 Mbps	TELKOM

Table 3.7.1-1: Telecommunication service product suitable for computer network (2/2)

No.	Product Name	Characteristic	Provided by
4	VINAccess Virtual Network Access	Using TELKOM-Net facilities Cost effective LAN to LAN interconnection File Transfer Virtual Private Network Speed : 19.2 Kbps ~ 2 Mbps Need Frame Relay Access Device (FRAD)	TELKOM
5	RINAccess Remote Intelligent Network Access	Using TELKOM-Net facilities Dial Virtual Private network Speed : 33.6 Kbps ~ 56 Kbps per port Protocol : PPP	TELKOM
6	VSAT-LINK	Available in all areas covered by the Palapa Satellite Point-to-point/point-to-multipoint communication Minimum of 0.5 second propagation delay. Speed: Up to 2Mbps Subject to regulations for installing antenna (2.4m to 4.5m in diameter)	TELKOM, LINTAS ARTA

In selecting one or combinations of the above products to build WAN for CIS, it is important to consider the operational cost as well as the line capacity to carry the traffic and its ability to sustain the connection (line reliability).

3.7.1.1 Host and domain name

Full host name for the CIS servers, clients, and networking devices will be in the form of "MachineName.Office.Region.CIS.DJBCDomain"

- "DJBCDomain" is existing domain that DJBC uses to identify their network. Maybe: beacukai.go.id.
- "CIS" is sub-domain of DJBC network to identify that a particular computer belongs to the CIS network. This is because CIS will be a somewhat closed network, and the CIS clients and servers are not multi-purpose computers that handle other DJBC operation.
- "Region" is to identify the region where this particular computer exists. Region here refers to region number used by DJBC.
- "Office" is to identify the actual office location where the computers or the network devices reside.
- "MachineName" is the actual name of the computer or network device.

Figure 3.7.1.1-1 shows the hierarchical representation of a complete host name.

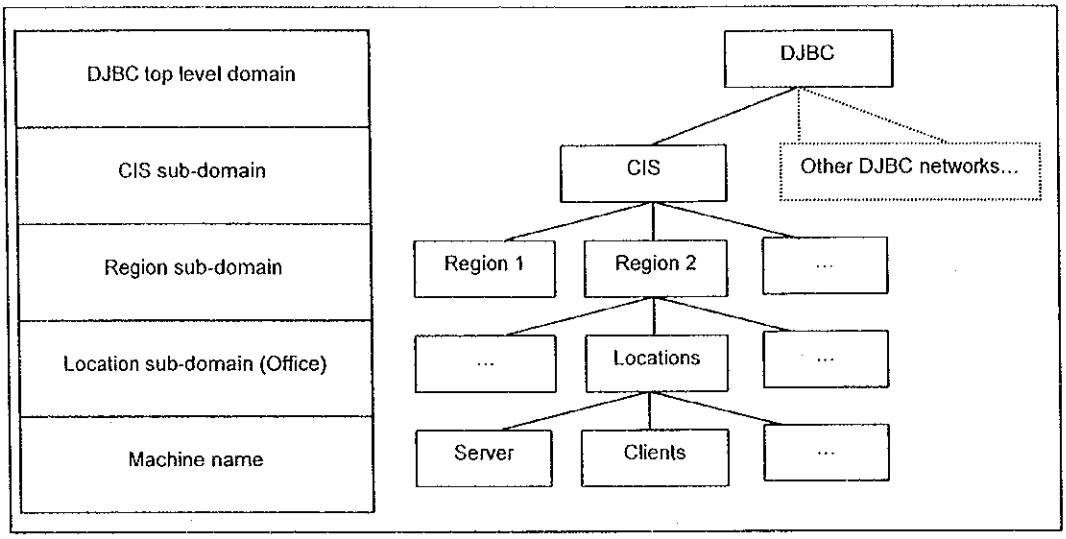


Figure 3.7.1.1-1: Hierarchical of domains in CIS

Table 3.7.1.1-1 explains an example of rules for Region, Office, and Machine name.

Table 3.7.1.1-1: Example of rules for assigning region, office, and machine name

Item	Rule	Example
Region	Contains three alphanumeric characters in the form of: R<0-1><0-9> The first character is so the domain does not start with a number. The second and third characters identify the region number.	R04 for Jakarta Region. For Head Office R00 can be used to make it consistent.
Office	Use location name or mnemonic abbreviation of the location. To differentiate Regional Offices from Service Offices, office location can start with initial R for Regional Offices and S for Service Offices	R-Priok for Regional Office in Tanjung Priok.
Machine Name	Contains four characters alphanumeric in the form of <A-Z><A-Z><0-1><0-9> The first two characters identify the hardware role, MS for Main Server, RS for Regional Server, WS for Workstation, RX for Routers, SX for Switches, and HX for Hubs. The last two characters are used for counter that starts with 01.	MS01 for Main Server, RX01 for router.

3.7.1.2 IP address

The CIS computers should use IP addresses that belong to the same network. The CIS network will then be divided into regions, and networks inside the regions are further divided into offices. Within offices, optionally, IP address can be subnetted further into division or section network.

In assigning IP addresses, the final configuration of WAN is crucial. By looking at the final WAN configuration, IP addresses can be allocated to offices in such a way that will simplify routing information in routers connecting all the offices in CIS.

The IP addresses configuration explained below is based on WAN configuration found in Figure 3.7.1.2-1. More detail explanation on WAN configuration can be described in later part of this document, the figure here is to help explaining the IP address configuration.

Tentatively, DJBC will use the IP address of 194.6.0.0 for CIS. With this IP address, DJBC potentially can have up to 254 class-C networks for Regional and Service Offices, and each network may have 254 individual addresses.

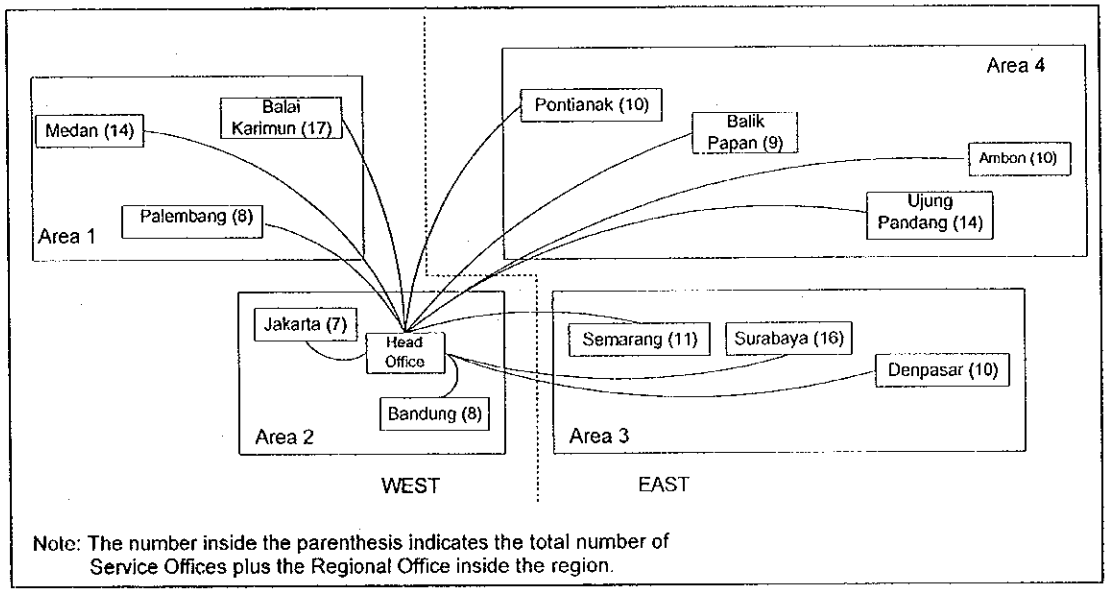


Figure 3.7.1.2-1: DJBC WAN

Because of the way IP address works, it is not recommended to just divide the IP address evenly into 12 regions nor it is recommended to just assigned the first available IP address for Region I to Region XII. Instead, first the IP addresses will be divided equally into two address spaces, West Backbone and East Backbone. The backbones are further divided into four areas each with 64 class-C networks. Each area is then divided into four equal address spaces for each region. Refer to Table 3.7.1.2-1 for the actual allocation of IP address space.

Table 3.7.1.2-1: IP address by Region

CIS	BackBone	Area	Region	
194.6.0.0	West 194.6.1-127.0	Area 1 194.6.1-63.0	Medan	194.6.1-15.0
			Palembang	194.6.16-31.0
			Balai Karimun	194.6.32-47.0
			Balai Karimun	194.6.48-63.0
		Area 2 194.6.64-127.0	Head Office	194.6.64-79.0
			Jakarta	194.6.80-95.0
			Bandung	194.6.96-111.0
			Free IP address	194.6.112-127.0
	East 194.6.128-254.0	Area 3 194.6.128-191.0	Surabaya	194.6.128-143.0
			Free IP address	194.6.144-159.0
			Semarang	194.6.160-175.0
			Denpasar	194.6.176-191.0
		Area 4 194.6.192-254.0	Pontianak	194.6.192-207.0
			Balik Papan	194.6.208-223.0
			Ujung Pandang	194.6.224-239.0
			Ambon	194.6.240-254.0

Note: Balai Karimun is allocated two address spaces because potentially the region will need 17 networks for all of its Service Offices and Regional Office.

Although currently there is no plan to connect all service offices in each region to CIS, using the above IP address allocation scheme makes it possible for all service offices to connect to CIS. The next table shows the actual IP addresses that can be used by all the offices currently in plan to connect to CIS.

Table 3.7.1.2-2: IP address for office connected to CIS (1/2)

Office	IP Address (Netmask: 255.255.255.0)
Head Office	194.6.64.0
Regional Office I, Medan	194.6.1.0
Service Office Belawan	194.6.8.0
Regional Office II, Balai Karimun	194.6.32.0
Regional Office III, Palembang	194.6.16.0
Regional Office IV, Tanjung Priok	194.6.80.0
Service Office Tanjung Priok I	194.6.81.0
Service Office Tanjung Priok II	194.6.82.0
Service Office Tanjung Priok III	194.6.83.0
Regional Office V, Bandung	194.6.96.0
Service Office Gede Bage	194.6.104.0
Service Office Soekarno Hatta II	194.6.97.0
Regional Office VI, Semarang	194.6.160.0
Service Office Tanjung Emas	194.6.168.0
Regional Office VII, Surabaya	194.6.128.0
Service Office Tanjung Perak	194.6.132.0

Table 3.7.1.2-2: IP address for office connected to CIS (2/2)

Office	IP Address (Netmask: 255.255.255.0)
Regional Office VIII, Denpasar	194.6.176.0
Regional Office IX, Pontianak	194.6.192.0
Regional Office X, Balik Papan	194.6.208.0
Regional Office XI, Ujung Pandang	194.6.224.0
Regional Office XII, Ambon	194.6.240.0

3.7.1.3 User Account

User accounts described here are those accounts on the server machines handled by the operating system, not user accounts that belong to Oracle system. These user accounts are divided into two categories:

- User account for system operation

  This type of account includes:

  - Necessary user accounts required by the applications to run the system, e.g. user accounts for Oracle and other third party products. Usually this type of user accounts is automatically created by the applications upon installation. However, the system administrators should confirm the security on these accounts and limit their accessibility and privileges.
  - Operator user accounts. These user accounts are used by CIS operators to log in to the CIS server whenever necessary to perform their tasks.
  - System administrator user accounts. These user accounts have unlimited access to the server, therefore only limited number of people should have access to this type of accounts. Passwords for administrator should be changed regularly and hard to guess.

- User account for e-mail system (NI/NHI notification)

  This type of account is required for access to e-mail system for NI/NHI notification. This type of account should have limited access to the server, namely only access for retrieving e-mails, and access to other services or functions of the server should be blocked. This limitation can be implied by the operating system.

The length of user accounts is limited to only eight characters and can not start with a digit. The user accounts must also be unique inside one computer system.

1) Operator user accounts

Operators must have their own user account instead of all CIS operators using the same account. The advantages of using separate accounts are:

- Passwords are responsibility of each operator. Shared passwords can be widely known even by non-operators, which may lead to security breaches.
- Log of operators' activities that effect the systems is more accurate.
- If for any reason one of the operators stops being an operator, the corresponding user account can be disabled without the need to change the password for other operators.

In creating and managing operator accounts the following guidelines can be used.

Table 3.7.1.3-1: Guidelines for operator accounts

Item	Description	
Account name	Combination of operator's last and first name can be used for the account name. For example using up to first 7 character of operator's last name and use the last character for first name initial. For example: abua for operator named Ali Abu.	
Account group	In Unix system, every account must belong to a group. It is strongly recommended to create a common group for all operators.	
Password criteria	Length:	From 5 to 8 characters
	Composition:	Alphanumeric
	Age:	No expiration
	Others:	Must not be simple permutations of account name.
Other	Access should be limited to only operator tasks related. No "root" access.	

2) System Administrator accounts

Similar to operator accounts, System Administrators must also have their own user accounts instead of collectively use "root" account. Table 3.7.1.3-2 explains the guideline for creating and managing system administrator accounts.

Table 3.7.1.3-2: Guidelines for system administrator accounts

Item	Description	
Account name	Combination of system administrator's last and first name can be used for the account name. For example using upto first 7 characters of system administrator's last name and use the last character for first name initial. For example: abua for system administrator named Ali Abu.	
Account group	In Unix system, every account must belong to a group. It is strongly recommended to create a common group for all operators. The system administrator may also belong to the same group as root account.	
Password criteria	Length:	From 5 to 8 characters
	Composition:	• Alphanumeric. • Must contain at least one numeric character and two alphabets.
	Age:	Expired on monthly basis
	Others:	• Must not be simple permutations of account name.
Other	Root access must be limited only to this type of account.	

3) E-mail accounts

E-mail accounts are not intended for private use of individual users, rather for NI/NHI notification only for heads and staffs of certain directorate, sub-directorate, divisions, and sections. According to the current requirement, the complete e-mail addresses need to identify the following information:

- Designation of the intended user: Director, Head, or Staff.
- Organizational unit of the intended user: P2 Directorate and Division, Intelligent Sub-Directorate and Section, Enforcement Sub-Directorate, Service Office, Manifest Section.
- Region of the intended user: Region 1 to 12.
- Location of the intended user: Service Office, Regional Office, and Head Office

Since the region is identifiable in the domain part, the user accounts do not need to include region information.

One possible method to form user accounts for NI/NHI notification is as follow:

Table 3.7.1.3-3: E-mail accounts

Character	Used for	Example	
1	Organizational unit	P	for P2
		I	for Intelligence
		E	for Enforcement
		S	for Service Office
		M	for Manifest and Information
2	Designation of the recipient	D	for Director
		H	for Head
		S	for Staff
3	Type of office	H	for Head Office
		R	for Regional Office
		S	for Service Office (O can be replaced with digit for multiple Service Office in same location)
4 – 8	Location of the office	JKT	for Jakarta
		TJP	for Tanjung Priok
		TJP1	for Tanjung Priok I
		TJP2	for Tanjung Priok II
		TJP3	for Tanjung Priok III
		MDN	for Medan
		BLW	for Belawan
		BDG	for Bandung
		SH2	for Soekarno Hatta II
		GB	for Gede Bage
		SMG	for Semarang
		TJE	for Tanjung Emas
		SBY	for Surabaya
		TJPE	for Tanjung Perak
		BK	for Balai Karimun
		PLB	for Palembang
		DPS	for Denpasar, Bali
		PON	for Pontianak
		BP	for Balik Papan
		UP	for Ujung Pandang
		AMB	for Ambon

Looking at the above rules and referring to rules on host and domain name, below are some examples on complete e-mail addresses.

DJBC can extend the e-mail accounts and e-mail address, following these rules.

Table 3.7.1.3-4: Example of complete e-mail addresses

In real life	E-mail address
Director of P2	PDHJKT@kpdjbc.r00.cis.djbc.go.id
Head of Intelligent Sub Directorate	IHHJKT@kpdjbc.r00.cis.djbc.go.id
Officials in Intelligent Sub Directorate	ISHJKT@kpdjbc.r00.cis.djbc.go.id
Head of Enforcement Sub-Directorate	EHHJKT@kpdjbc.r00.cis.djbc.go.id
Officials in Enforcement Sub Directorate	ESHJKT@kpdjbc.r00.cis.djbc.go.id
Head of P2 Division in Regional Office IV	PHRTJP@r-priok.r04.cis.djbc.go.id
Head of Intelligent Section in Regional Office IV	IHRTJP@r-priok.r04.cis.djbc.go.id
Officials in Intelligent Section in Regional Office IV	ISRTJP@r-priok.r04.cis.djbc.go.id
Head of Service Office in Tanjung Priok II	SHSTJP2@r-priok2.r04.cis.djbc.go.id
Head of Manifest Information Section in Service Office of Tanjung Priok II	MHSTJP2@r-priok2.r04.cis.djbc.go.id
Officials in Manifest Information Section in Service Office of Tanjung Priok II	MSSTJP2@s-priok2.r04.cis.djbc.go.id

3.7.2. LAN design

3.7.2.1 Development network

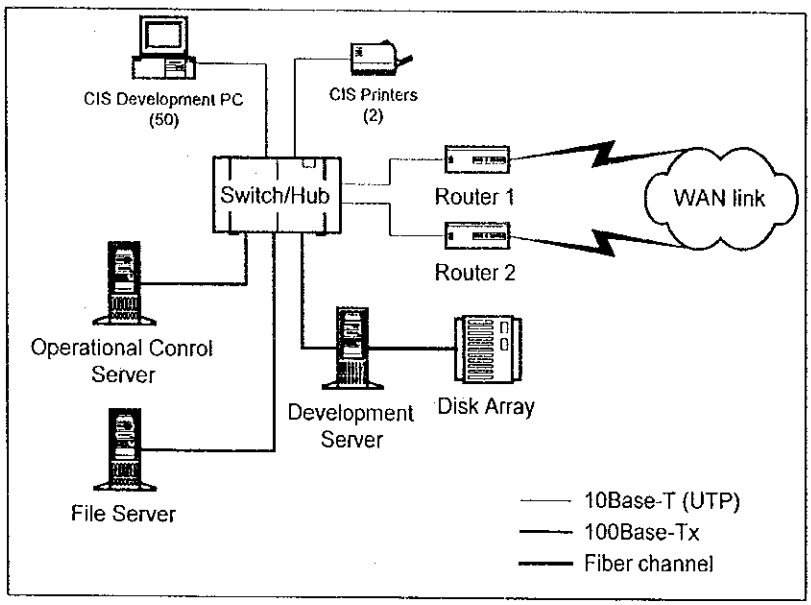


Figure 3.7.2.1-1: Configuration of LAN for CIS development

Characteristic of the development network:

- Closed network; isolated from existing networks in Head Office.
- A pair of routers will be used to simulate CIS in a Wide Area Network.
- File server is used to store non-database related working files. The file server will provide a mean for users to share files and centralized back-up process.
- Connections to the servers will use 100Base-Tx and other connections will use 10Base-T.

3.7.2.2 Head Office

The next figure shows the top view of logical LAN configuration for building A, B, and C in Head Office, integrated with current network.

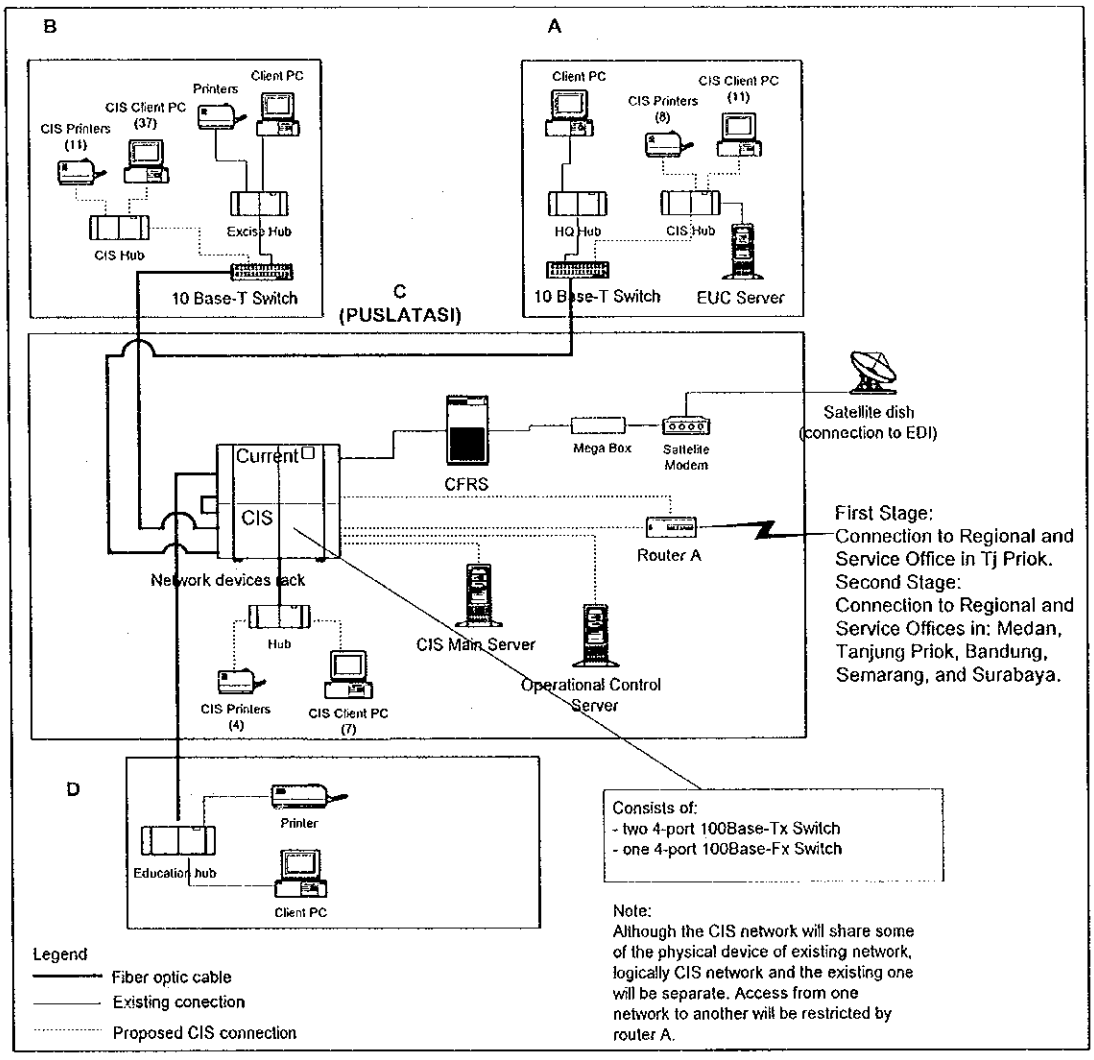


Figure 3.7.2.2-1: Top view of logical LAN configuration for Head Office

The next figure illustrates in more detail the LAN in building C and the view of backbone that formed by series of switch modules installed in network device rack. The switch modules are connected to each other via a switch/hub chassis. For more information regarding the design and each component, refer to Table 3.7.2.2-1.

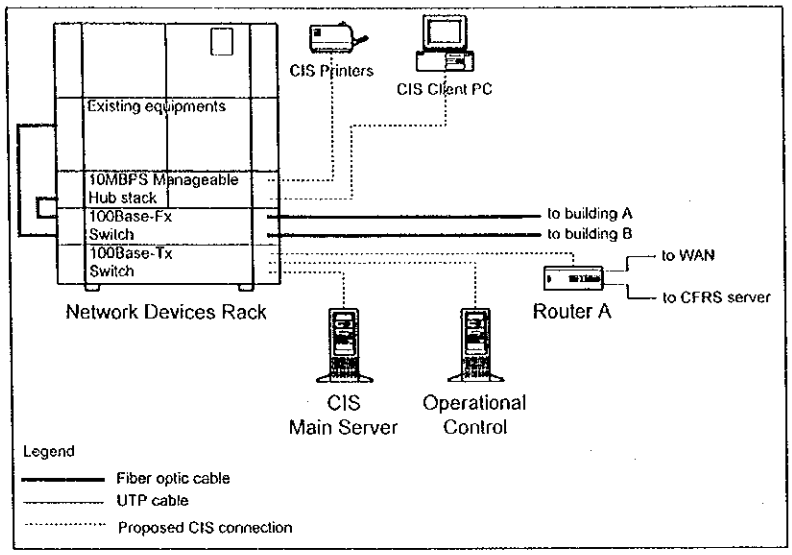


Figure 3.7.2.2-2: Proposed Logical LAN configuration for PUSLATASI

Table 3.7.2.2-1: Proposed CIS LAN configuration for Head Office (1/2)

Item	Location	Description
Connection from PCs and printers to hub	All buildings	UTP cables for 10Mbps connection. Some of the locations for the PC have cabling already installed and are available for CIS use. However, other locations do not have any cabling installation and will require major cabling works.
CIS Hub	Building A,B, and C	Manageable and stackable hubs with: • 10Base-T ports (RJ-45) to connect to PCs and networked printers.
Inter-building fiber optic cables	—	These fiber optic cables are existing connections from building C to building A and B. Currently the bandwidth of these connections is 10Mbps. To accommodate the CIS network, these connections must be upgraded to be able to provide bandwidth of 100Mbps. It is possible to increase the bandwidth without replacing the cables.
Switch/Hub chassis	Building C	This switch/hub chassis will contain the switch modules explained below. The chassis is existing equipment DJBC currently has. The additional modules for CIS will be set to form a completely separate network. The switch modules in this chassis will form the backbone of the CIS LAN in Head Office.

Table 3.7.2.2-1: Proposed CIS LAN configuration for Head Office (2/2)

Item	Location	Description
100Base-Fx switch	Building C	4-port 100Base-Fx (100Mbps) switch module. This switch module extend the CIS network to building A and B through existing fiber optic cable installation. This switch module must have port partitioning feature to partition its ports into multiple VLAN that are separated logically. This is necessary so the existing CFRS network and the CIS network can share the interbuilding fiber cable.
10Base-T Switch	Building A and B	16 ports 10Base-T Switch with 100Base-Fx uplink. These switches work together with the 100Base-Fx switch in Building C to provide inter building fiber optic link. These switches must have port partitions feature that is compatible with the 100Base-Fx switch in Building C. CIS network and existing CFRS network can be logically separated.
Fast Ethernet segment switch	Building C	8-port Fast Ethernet (100Base-Tx) segment switch module (or two modules of 4-port Fast Ethernet segment switch). This switch connects to CIS Main Server, Operational Control server, and the router.
Connection from servers to Fast Eternet switch	Building C	UTP cable, 100Mbps.
Router	Building C	This router must contain: • One 10-BaseT port (for connection to CFRS network). • One 100-BaseT port (for connection to CIS network). • Serial ports (for WAN connections). • ISDN ports (for WAN connections). Connection to/from existing the CFRS network will be limited only to pre-scheduled data transfer between the CFRS server and the CIS Main Server.
Connection from router to Fast Ethernet switch	Building C	UTP cable, 100Mbps

The side-view figure of Head Office will illustrate the location and the number of PCs to be installed in each floor of the building. The lines depicting the connections are only to indicate that the equipment are connected to each other and do not necessarily represent a bus-type connection. The network devices such as switches and hubs are not included in the picture for simplicity.

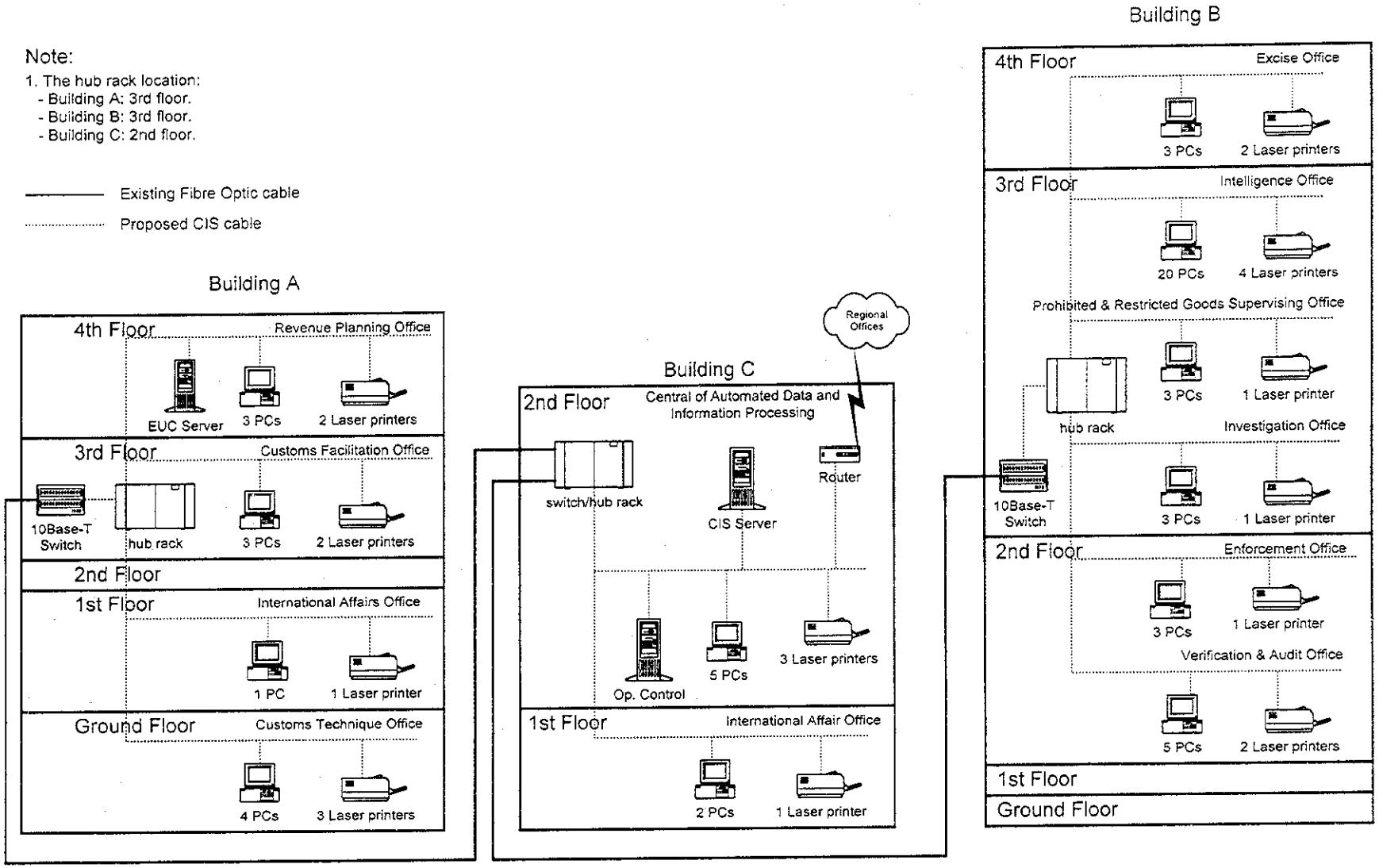


Figure 3.7.2.2-3: Side view of Head Office LAN

3.7.2.3 Offices in Tanjung Priok area

For top view and side-view of offices in Tanjung Priok, refer to from Figure 3.7.2.3-1 to Figure 3.7.2.3-4. The next table will explain the characteristics of each component in the configuration.

Table: 3.7.2.3-1: Characteristics of LAN in Tanjung Priok offices

Item	Location	Description
Connection from PCs and printers to hub rack	All buildings	UTP cables for 10Mbps connection. Some of the locations for the PC have cabling already installed and are available for CIS use. However, other locations do not have any cabling installation and will require major cabling works.
Hub rack	Regional Office	Consists of manageable and stackable hubs with: • 10Base-T ports (RJ-45) to connect to PCs and networked printers. • 100Base-T port for connection to the Regional Server.
Hub rack	Service Offices	Consists of manageable and stackable hubs with: • 10Base-T ports (RJ-45) to connect to PCs and networked printers.
Router	Regional Office	This router must contain: • One 10-BaseT port (for connection to CIS network). • Serial ports (for WAN connections). • ISDN ports (for WAN connections).
Router	Service Offices	This router must contain: • Two 10-BaseT port (for connection to CIS and CFRS network). • Serial ports (for WAN connections). • ISDN ports (for WAN connections). Connection to/from existing the CFRS network will be limited only to pre-scheduled data transfer between the CFRS server and the CIS Main Server.

During the investigation in Tanjung Priok area, the JICA Study Team learned that DJBC had plan to move one of the Service Office to Koja area in the future. However, since the building itself has not been constructed it is virtually impossible to design based on the plan. Therefore, the design by the JICA Study Team is based on current condition of the Regional and Service Offices.

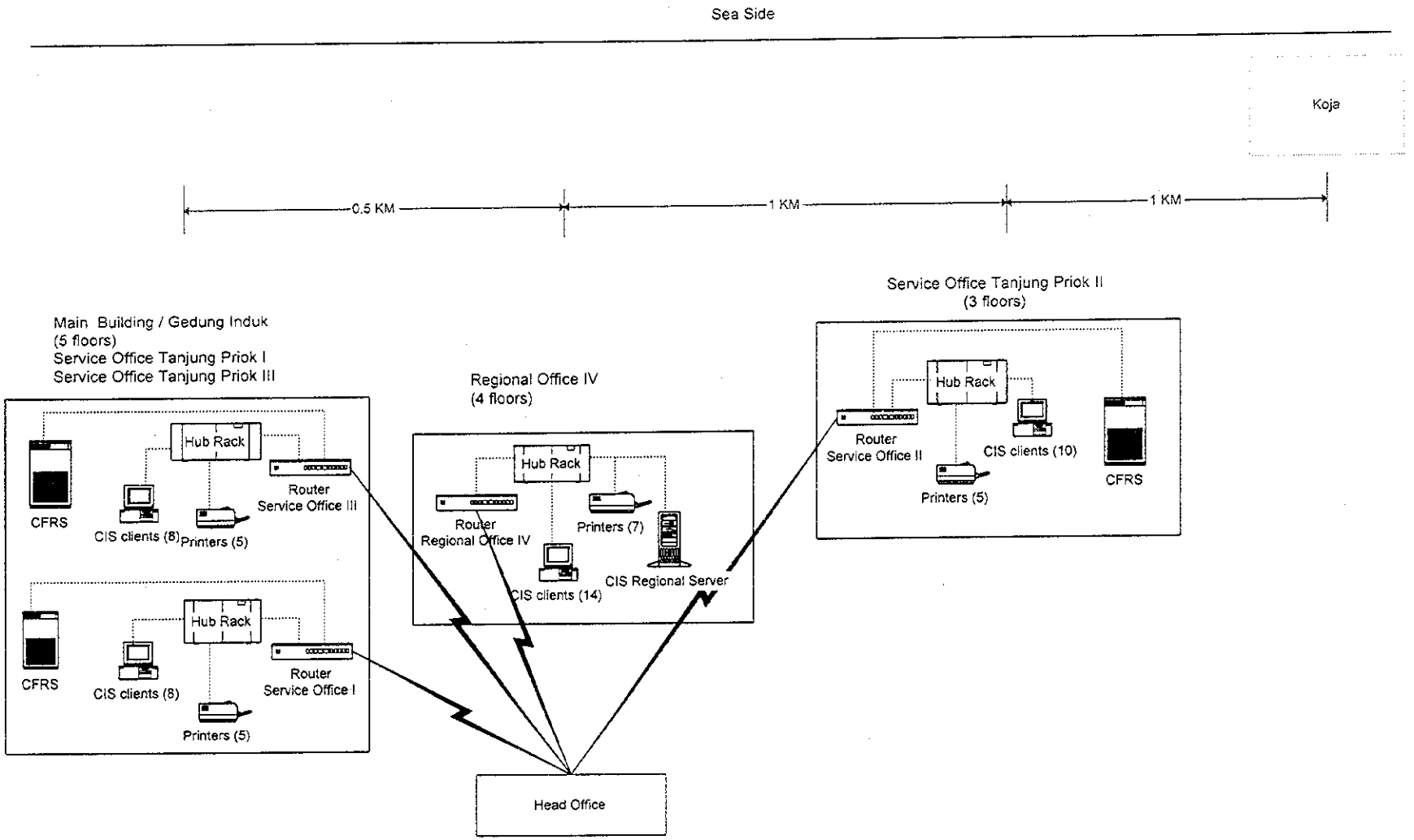


Figure 3.7.2.3-1: Top view of LAN for offices in Tanjung Priok area

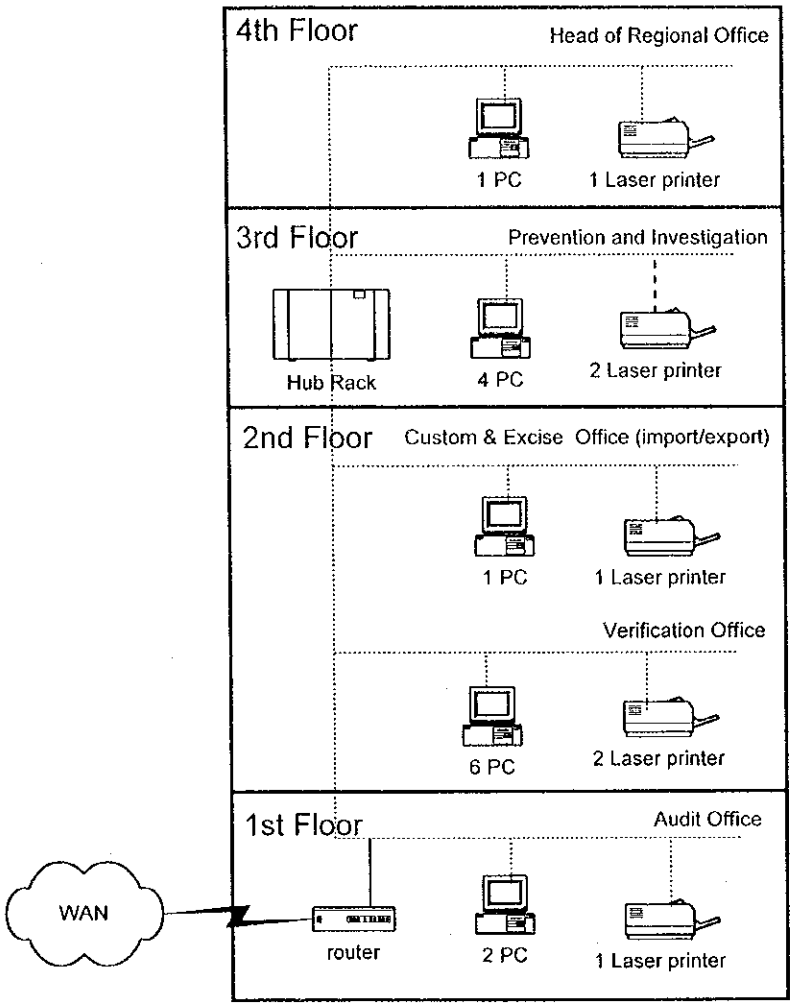


Figure 3.7.2.3-2: Side view of Regional Office IV

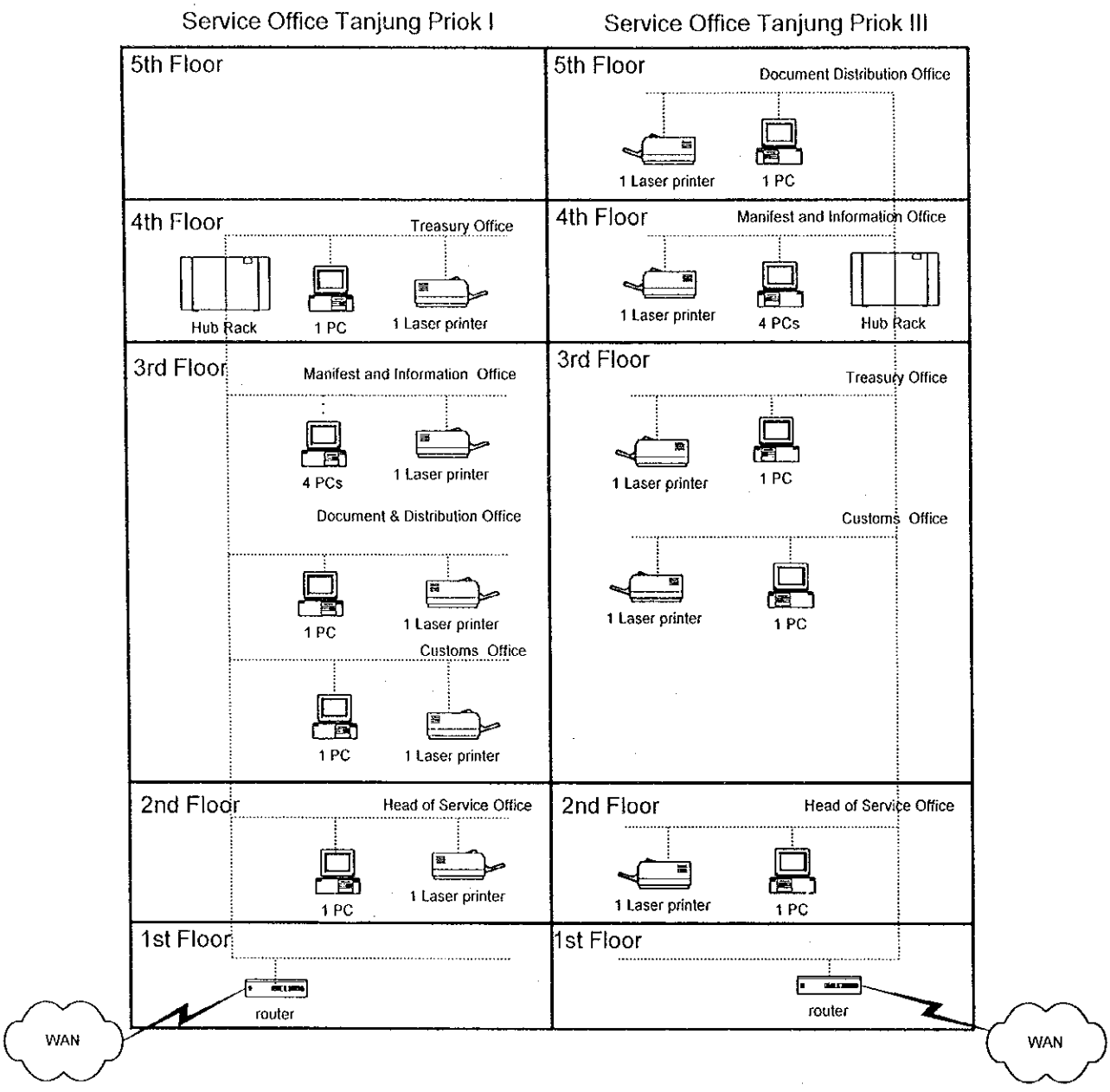


Figure 3.7.2.3-3: Side view of Service Office Tanjung Priok I and III

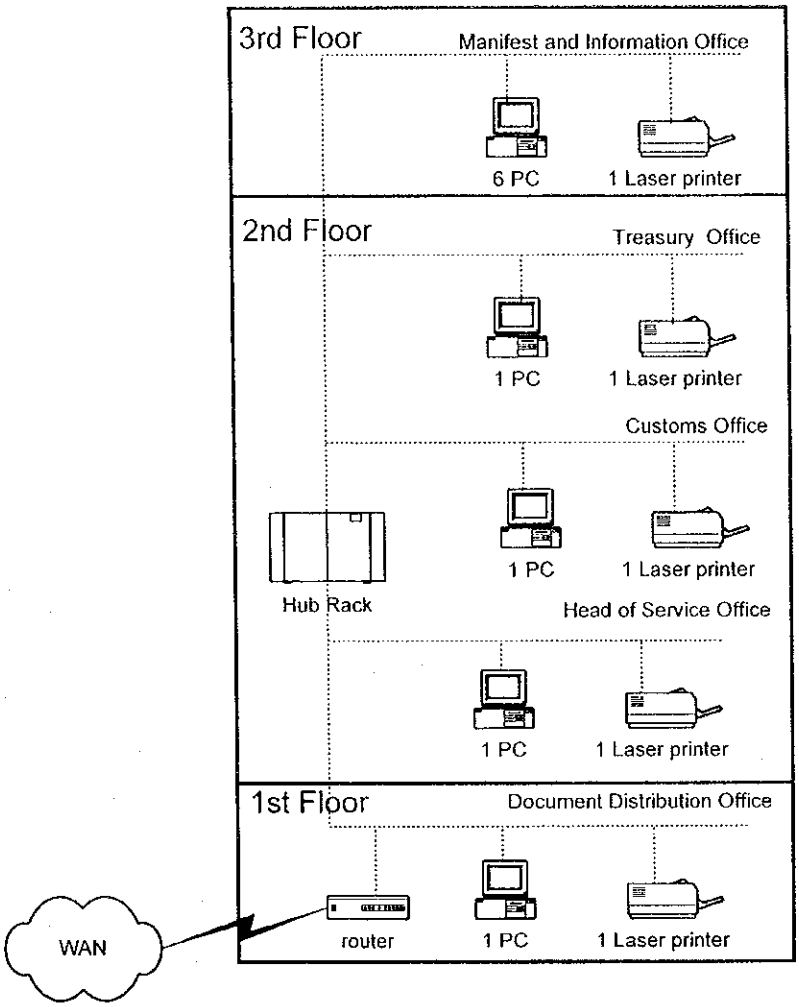


Figure 3.7.2.3-4: Side view of Service Office Tanjung Priok II

3.7.3 WAN design

3.7.3.1 Available network services

For the most parts, CIS network will be connected using VSAT. This is due to wide coverage of VSAT service that uses satellite as the link, and is the only possible mean to reach DJBC offices in smaller towns across Indonesia. Where terrestrial cable connections are possible, the JICA Study Team employs digital leased connection as the WAN link in the design. The table below compares the network services used in CIS design.

Table 3.7.3.1-1 Network services

Characteristic	VSAT	Digital Leased Connection	ISDN
Availability	All area in Indonesia	Limited area in Jakarta, Bandung and Surabaya.	Limited area in Jakarta
Bandwidth	19.2 Kbps – 2 Mbps	19.2 Kbps – 2 Mbps	64 Kbps – 1 Mbps
Connection characteristic	Digital	Digital	Digital
	Point-to-point/ point-to-multipoint	Point-to-point	Point-to-point
	On-line 24 hours	On-line 24 hours	On-line on demand
Provider	PT Telkom, PT Lintas Arta	PT Telkom, PT Lintas Arta	PT Telkom
Costs	Most expensive	Less expensive	Based on usage.
Other	Require installation of satellite dish in each of the premise. Propagation delay of 500ms on each transmit	—	Delay in establishing the connection.

The JICA Study Team designs the WAN for CIS based on current condition of network services available in Indonesia. From the study, the JICA Study Team learned that PT Telkom had terrestrial cable installation started for Sumatera and Kalimantan. In the future, terrestrial connection may be available for CIS and may change the WAN design for second and third stage drastically and reduce the overall costs.

3.7.3.2 First stage WAN

In the first stage, CIS will be implemented in Head Office, Regional Office IV (Tanjung Priok), Service Office Tanjung Priok I, II, and III. Therefore, connections are made from the Service Offices straight to the Head Office.

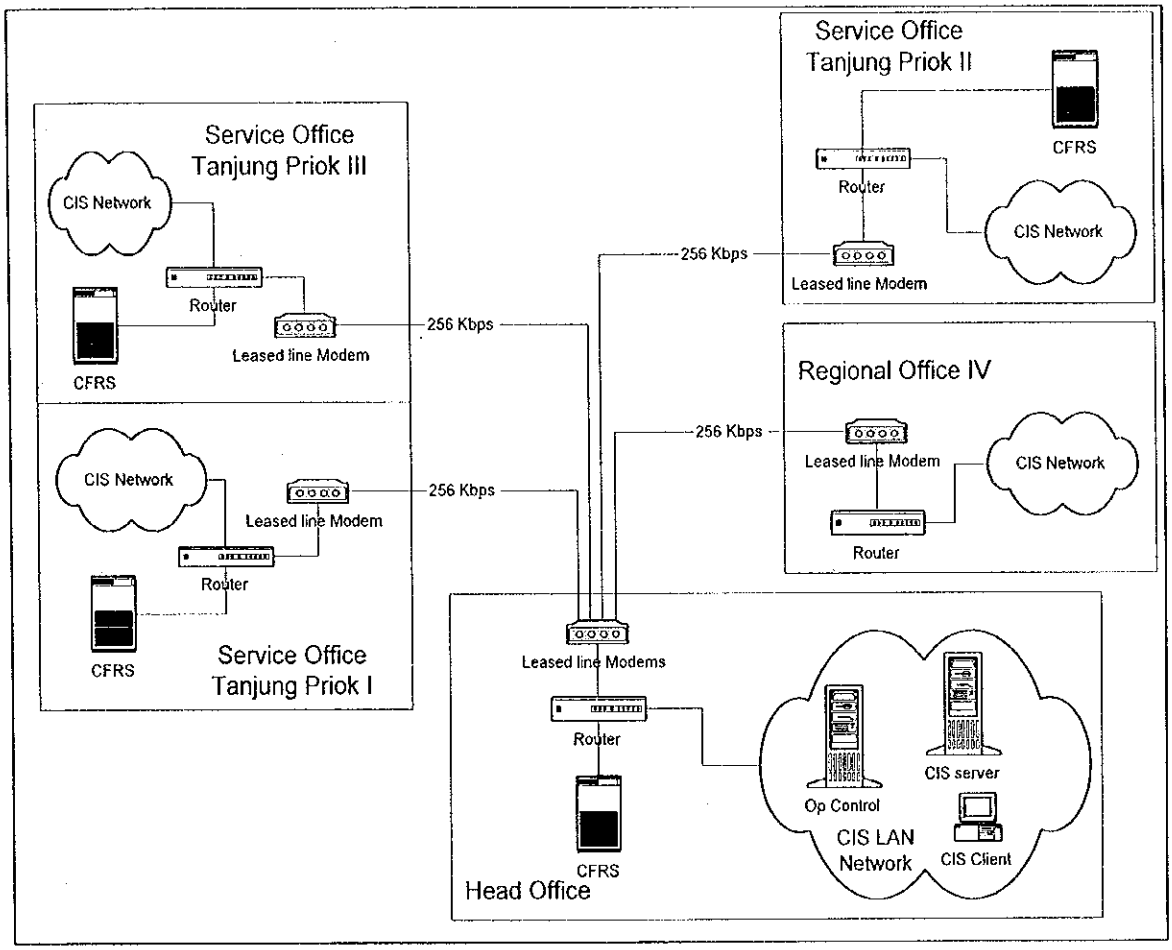


Figure 3.7.3.2-1: First stage WAN

Based on its study (refer to 3.4.2.2), JICA Study Team concluded that the minimum bandwidth requirement for connections going to Tanjung Priok area is 256 Kbps.

The router in each Service Office will act as a gateway between the CIS Wide Area Network and the CIS Local Area Network in the corresponding office, and the CFRS network in the corresponding office. This router holds a critical role in the overall network, especially the security because from this router traffic outside of CIS can flow in. Therefore, it is necessary to limit access to and from the CFRS server for the purpose of pre-scheduled data transfer only. This is to protect CIS from any unsecured connection coming in from the CFRS network and vice versa.

Table 3.7.3.2-1: Proposed CIS WAN configuration in first stage

Item	Location	Description
Router	Head Office	This router must contain: • One 10-BaseT port (for connection to CFRS network). • One 100-BaseT port (for connection to CIS network). • Four Serial ports (for WAN connections). • Four ISDN ports (for WAN connections). Connection to/from existing CFRS network will be limited only to pre-scheduled data transfer between the CFRS server and the CIS Main Server. This router must be upgradeable to accommodate additional connection in later stages
Router	Regional Office	This router must contain: • One 10-BaseT port (for connection to the CFRS network). • One Serial ports (for connections to Head Office). • One ISDN ports (for backup connections). This router must also upgradeable to accommodate connections from Service Offices in second stage
Router	Service Offices	This router must contain: • One 10-BaseT port (for connection to CFRS network). • One 10-BaseT port (for connection to CIS network). • One Serial ports (for connections to Head Office). • One ISDN ports (for backup connections). Connection to/from existing CFRS network will be limited only to pre-scheduled data transfer between CFRS server and CIS Main Server.
Leased Digital Line	Head Office to Regional Office and Service Offices	Each line must have minimum bandwidth of 256Kbps (determined from study found in Performance Estimation).
ISDN Line	Head Office, Regional Office, Service Offices	Regional Office and Service Offices each will have on BRI ISDN line, while Head Office will have four BRI ISDN lines that act as a backup line. Bandwidth of each line is 128Kbps.

3.7.3.3 Second stage WAN

In second stage, there will be 5 Regional Offices and 5 Service Offices connected to CIS. To draw them altogether would result in a picture that will not fit in a page. Therefore, the layout of second stage WAN is divided into three parts. Figure 3.7.3.3-1 illustrates the overall connection in second stage, and details of connections are described in the next figures.

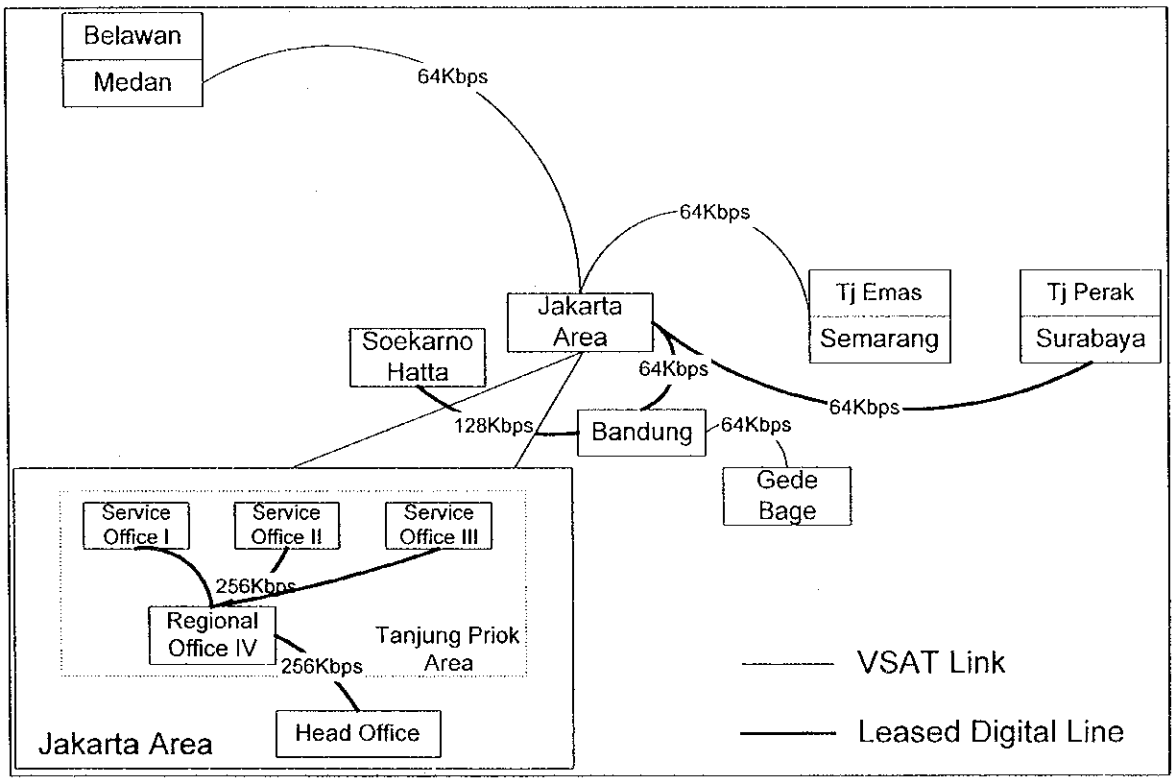


Figure 3.7.3.3-1: Proposed WAN layout in second stage

The use of VSAT link is due mainly to unavailability of other less expensive terrestrial link that can provide reliable data connection with enough bandwidth for CIS use. In some cases, this VSAT link is not efficient in cost, for example the link from Gede Bage to Bandung.

Possible alternatives to these VSAT links are to use:

- Analog-analog telephone line. This is a regular telephone line that uses analog modem on both ends to provide the link. Multiple lines can be aggregated to provide higher bandwidth. Theoretical bandwidth per line is peak at 33 Kbps, however, the actual data transfer rate maybe less, depending on the line quality.
- Analog-digital telephone line. This setup requires a digital connection on one end, usually the central office. Theoretical bandwidth per line is 56 Kbps downstream (from Regional Office to Service Office) and only 31 Kbps upstream (from Service Office to Regional Office). The actual speed may vary, depending on the line quality.

However, JICA Study Team cannot verify the quality of the telephone lines in each of the region. The quality of the telephone lines in those areas may not meet the standard to provide a reliable data link, therefore in this report, JICA Study Team will use VSAT connections where verifiable data grade terrestrial connections do not exist.

For connection using leased line, the configuration is explained below.

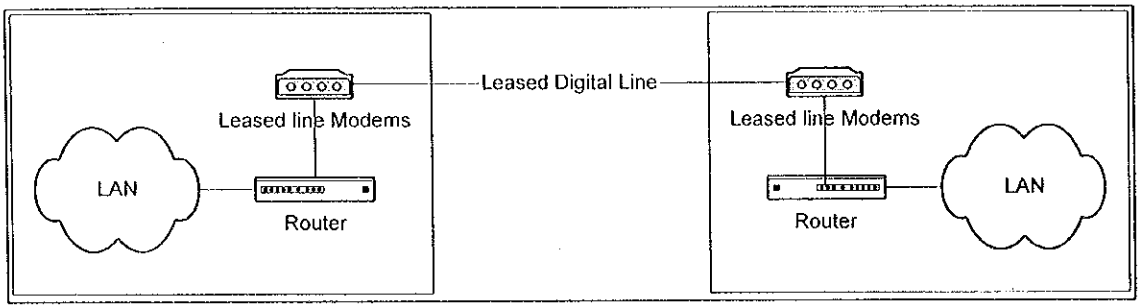


Figure 3.7.3.3-2: Leased Digital Line connection

One pair of leased line modems is required for each connection. However, only one router is required providing the router has enough ports for connection to the leased line modem.

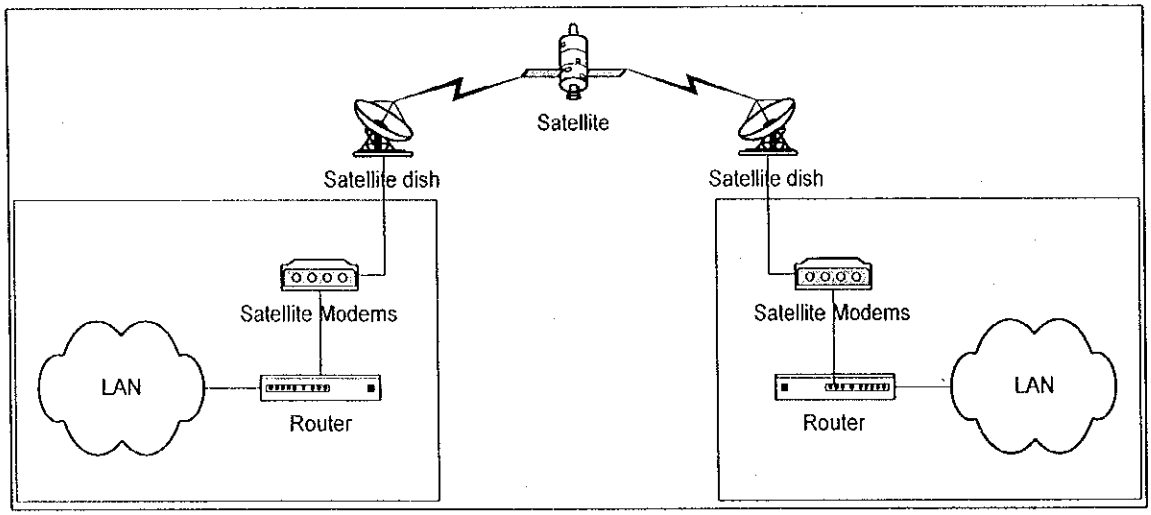


Figure 3.7.3.3-3: VSAT connection

In a VSAT connection, each location that will use VSAT link must have one satellite dish installed. With multiple VSAT links, no additional satellite dish is required. However, with each VSAT link additional satellite modem is required, therefore the link is independent to other links sharing the same satellite dish.

In second stage, Regional Office in Tanjung Priok will have its own regional server. Therefore, logical and physical connection of Tanjung Priok Service Offices will be changed from connecting directly to the Head Office to connecting to their Regional Office. The next figure illustrates WAN links for Tanjung Priok area in second stage.

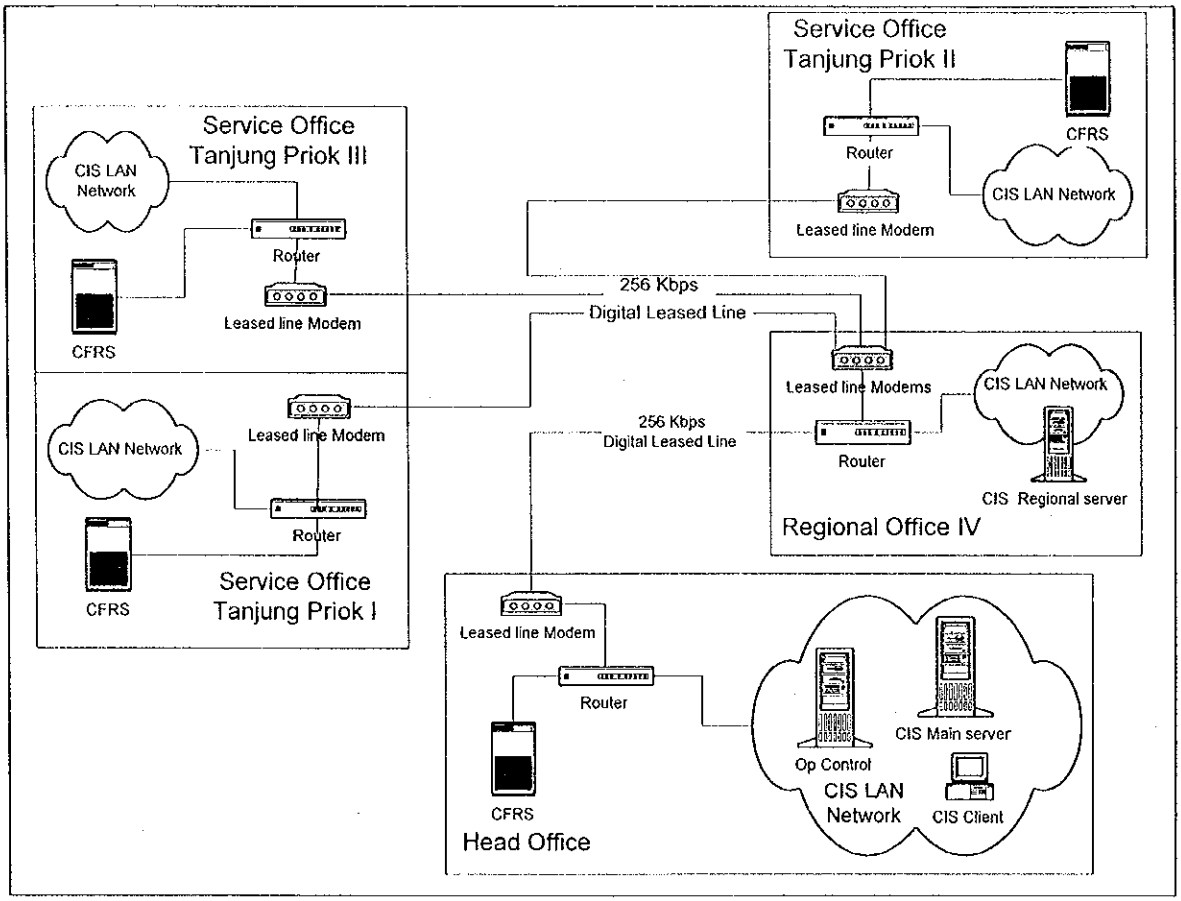


Figure 3.7.3.3-4: Proposed WAN configuration for Tanjung Priok area in second stage

3.7.3.4 Third stage WAN

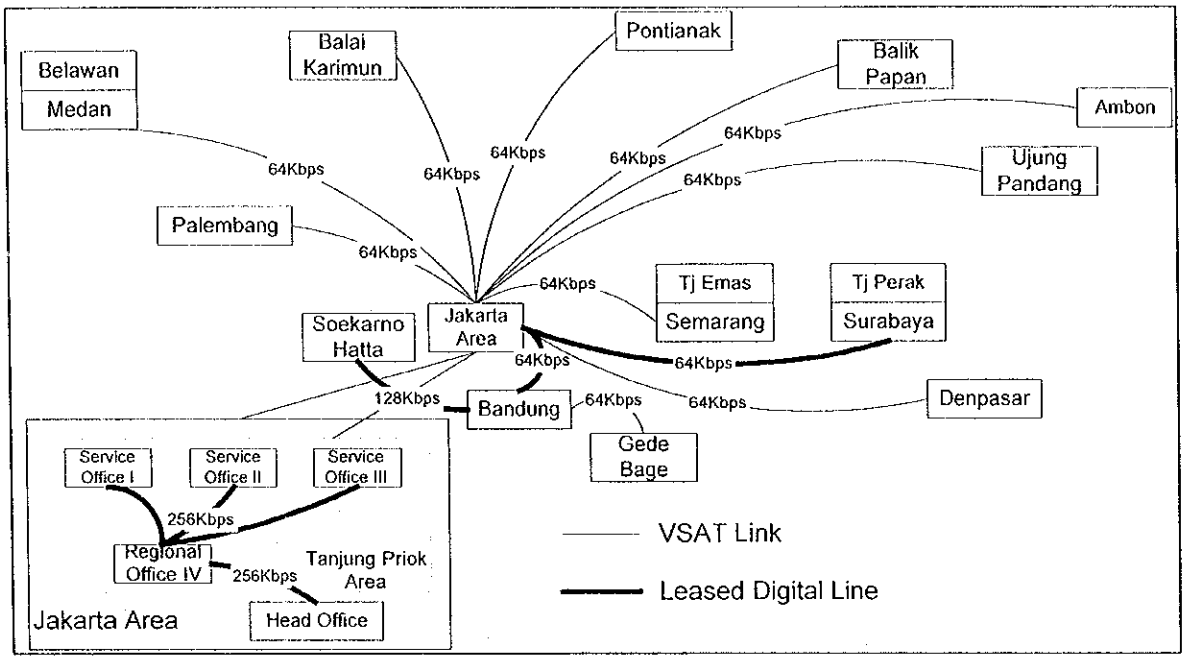


Figure 3.7.3.4-1: CIS WAN final layout

Currently, all Regional Offices to be connected in the third stage are reachable only using satellite links. However, the picture of available services in Indonesia may change when the third stage is scheduled to start. This may change the configuration of the CIS WAN from a star topology with Head Office as the center to a more distributed backbone configuration.

3.7.3.5 Development phase environment

During development, WAN connection will be used mainly for testing purposes, as the connections will loop back to the development network. Purpose of the testing connection is to gauge the response time using actual WAN links.

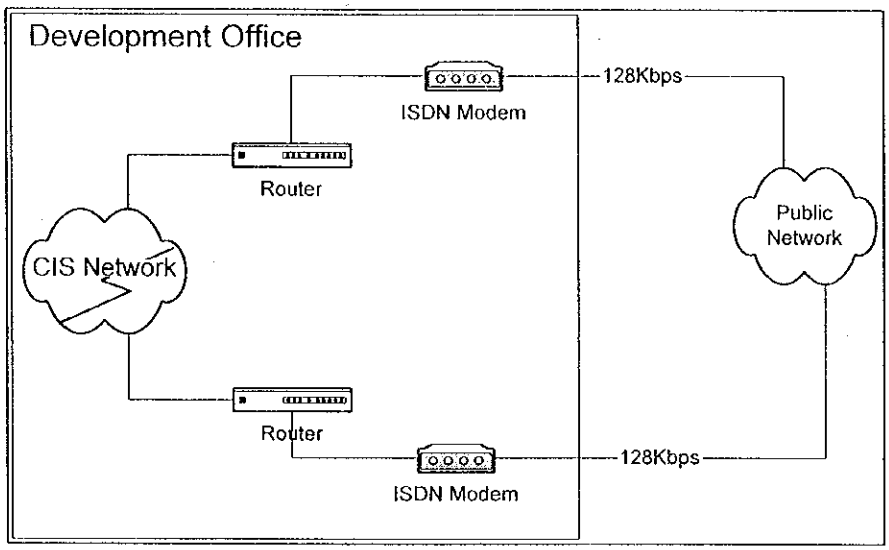


Figure 3.7.3.5-1: Proposed WAN layout for development

3.8 Facility Design

3.8.1 Circumstances

To support CIS, correct configuration and combination of Hardware, Software, and Networking equipment and design must be carefully considered. While this subsection describes some background and summary of the system, the rest of the section will describe the selection and configuration of each of the area in more detail.

3.8.1.1 Hardware

DJBC has selected a multi processor dual (one active, one backup) computer system to act as the Main Server system, because such system features high-performance processors and high-reliability that CIS will need. To save cost, some Regional Offices will utilize the existing servers as the Regional Servers, by upgrading them to meet the requirements. PC based environments are selected for the client, because PC is the most widely accepted and familiar client computing platform in Indonesia.

3.8.1.2 Software

1) Basic Software

   To provide a robust application, CIS must run on a robust operating system. In addition, the operating system must be compatible with the high performance server specified above. These features can only be found in UNIX based operating system. DJBC has selected Oracle for the database management system due to its high performance in handling large amount of data and the high quality and availability of development tools. For clients' operating system, the familiar operating system such as Windows is selected.

2) Development Software

   Since the selected DBMS is Oracle, the development tools selected are also from Oracle. Besides the database development tools, the development phase will also require programming and compiling tools.

3) Operational Control Software

   Another component that is critical and must exist to ensure CIS operation is Operation Control type of software.

3.8.1.3 Network

Overall configuration of the CIS network is explained in 3.7.

This sub-subsection lists requirements and network devices in the first stage.

3.8.2 Hardware

3.8.2.1 Hardware requirement

This section explains the requirements for the Main Server to be installed at the Head Office, Regional Servers at Regional Offices and client PC to be installed at each office.

1) Main Server

The basic requirements for the Main Server are as follow:

Table 3.8.2.1-1: Main Server requirement

Component	Specification	Remarks
CPU	Dual computer system (one active, one backup)	—
Processor	Multi processors (4) per CPU	—
Memory	Minimum of 1 GB per CPU	—
Disk Controller	Fiber Channel Adapter	For connection to Disk Array.
Disk	Array disk capable of RAID 0+1, RAID 5 Hot swap-able	Minimum space is 200GB.(*)
Backup Device	DLT Tape Library	For high speed and high capacity backup
	Quarter Inch Cartridge	For portability across systems
Power Supply	Single power supply with UPS system	—
Network Interface	Duplicated 100MBps Network Interface Card per CPU	—
Other Device	CD-ROM, High speed line printer	—

Note: The requirement for space is physical space. Whether the disk array will use RAID 0+1 or RAID 5 or combination of both will be determined in the production phase.

2) Regional Servers

There will be three types of Regional Servers, depending on the volume of data in the area. Regional Server I is to be installed in an area with excessively high volume of data, Regional Server II in middle volume area and Regional Server III in low volume area.

The life cycle of server machine technology is usually a couple of years. This configuration should be re-checked before starting the first stage.

The following table shows the requirements for Regional Servers. The requirements are common for all type of Regional Servers where it is not specifically mentioned in the remarks.

Table 3.8.2.1-2: Regional Server requirement

Component	Specification	Remarks
CPU	Single computer system	For Regional Server I, II, III
Processor	Multi processors (4)	For Regional Server I
	Multi processors (2)	For Regional Server II
	Single processor	For Regional Server III
Memory	1 GB	For Regional Server I
	512 MB	For Regional Server II
	256 MB	For Regional Server III
Disk Controller	Fiber Channel adapter	For connection to Disk Array (for Regional Server I and II)
Disk	Array disk capable of RAID 0+1, RAID 5 Hot swap-able	Minimum space: (*) Regional Server I : 100GB Regional Server II, III: 40GB
Backup Device	DLT Tape	For high speed and capacity backup
	Quarter Inch Cartridge	For portability across systems
Power Supply	Single power supply with UPS	—
Network Interface	Single 100MBps NIC	—
Other Device	CD-ROM	—

Note: The requirement for space is physical space. Whether the disk array will use RAID 0+1 or RAID 5 or combination of both will be determined in the production phase.

3) Development server

Development server is required to have the same type of processors as other CIS Servers since all the binary execution files for such servers are created on the development server. The JICA Study Team proposes the configuration of development server to be the same as the Regional Server type II.

4) Operational control server

The operational control server is essential facility of the whole CIS operation. High reliability and support of the operational control software are required.

Table 3.8.2.1-3 shows requirement for the operational control server.

The life cycle of PC technology is usually a couple of years. This configuration should be re-checked before starting the first stage.

Table 3.8.2.1-3: Operational Control Server requirement

Component	Specification	Remarks
CPU	PC server Dual processor	—
Memory	192MB	—
Disk Controller	Ultra-Wide SCSI	—
Disk	UW-SCSI Hard Disk, 8GB	—
	3.5" Floppy Disk	—
Network Interface	Single 10MBps NIC	—
Other Devices	DAT drive CD-ROM	—

5) EUC server

The EUC server is installed in end user's site in Head Office. Large capacity of disk storage is required. Since high reliability is not very much required, personal computer at reasonable price will be used as the EUC server. For mechanism of EUC server, refer to 3.9.6. Table 3.8.2.1-4 shows the EUC server requirement.

The life cycle of PC technology is usually a couple of years. This configuration should be rechecked before starting the first stage.

Table 3.8.2.1-4: EUC Server requirement

Component	Specification	Remarks
CPU	Personal Computer	—
Memory	192MB	—
Disk Controller	Ultra-Wide SCSI	—
Disk	UW-SCSI Hard Disk, 45GB	—
	3.5" Floppy Disk	—
Network Interface	Single 10MBps NIC	—
Other Devices	CD-ROM	—

6) Client

Table 3.8.2.1-5 shows the PC Client requirement.

The life cycle of PC technology is usually a couple of years. This configuration should be rechecked before starting the first stage.

Table 3.8.2.1-5: PC client requirement

Component	Specification	Remarks
CPU	Personal Computer	—
Memory	64MB	—
Disk Controller	Single EIDE	—
Disk	EIDE Hard Disk, 4GB	—
	3.5" Floppy Disk	—
Network Interface	Single 10MBps NIC	—
Other Devices	CD-ROM, Laser printer	—

3.8.2.2 Hardware configuration

This sub-subsection describes the configuration for the server machines in the development and first stage. The life cycle of server machine technology is usually a couple of years. This configuration should be re-checked before starting the first stage.

1) Main Server

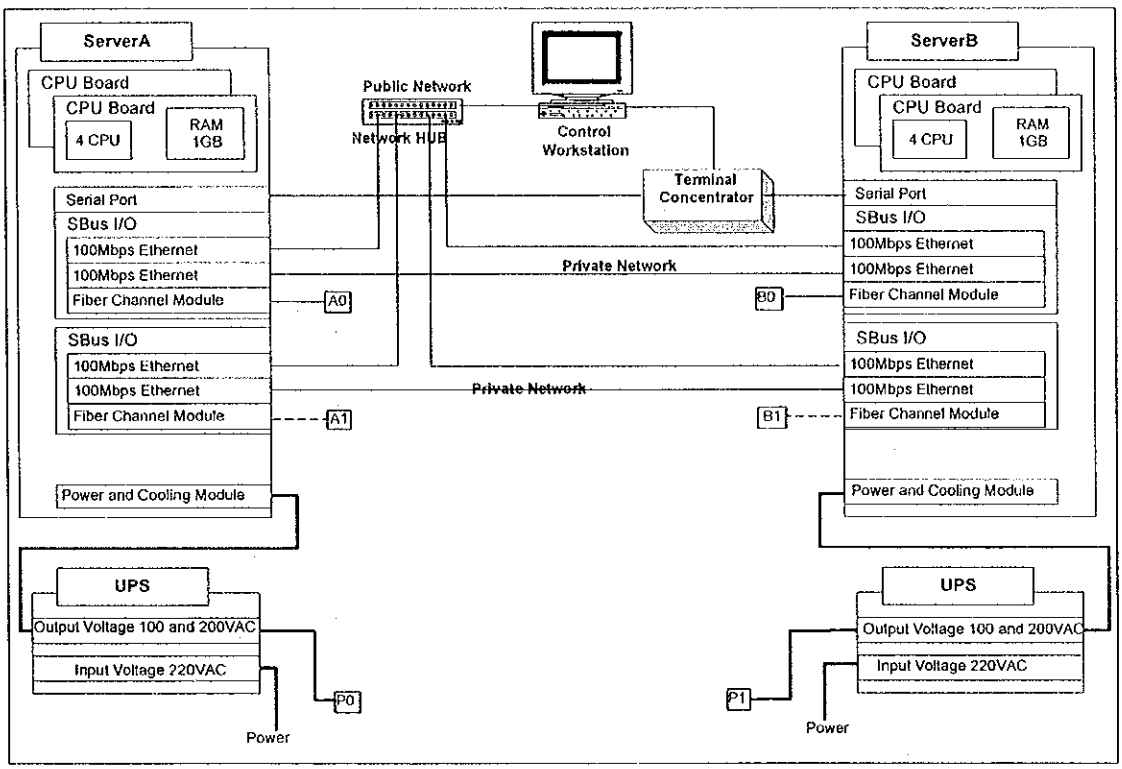


Figure 3.8.2.2-1: Main Server hardware configuration

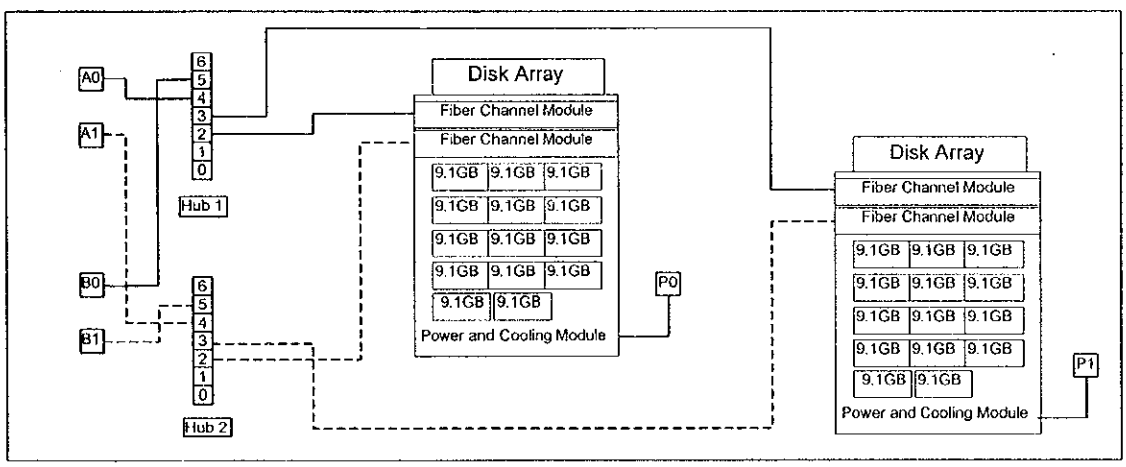


Figure 3.8.2.2-2: Connection to disk arrays

This High Availability System is structured by combination of two disk arrays and two system nodes. The nodes are connected by two fast ethernet connections to check whether the other system operates normally. Two internal connections are required in this case to avoid single point of failure in the internal connection, which will bring the whole system down.

The control workstation is used for configuring and monitoring both nodes and acts as the console for both nodes. Therefore, each node does not have its own keyboard, mouse, and monitor.

Connections from the nodes to the disk arrays will be done through a fiber-optic hub specifically for connections to multiple disk arrays. In the figures above, connections from Server A to the disk array is denoted by A0 and A1, where the main connection is A0 and backup connection is A1. Main connection for Server B is denoted by B0 and backup connection for Server B is denoted by B1.

Upon detecting trouble in the active node (main node), the backup node can take over the processes, so that the operation can be resumed with minimal interruption. The troubled node can then be brought down for maintenance.

2) Development Server

Next figure illustrates the configuration of the Development Server. The Development Server is constructed using a single system and a disk array as the storage system

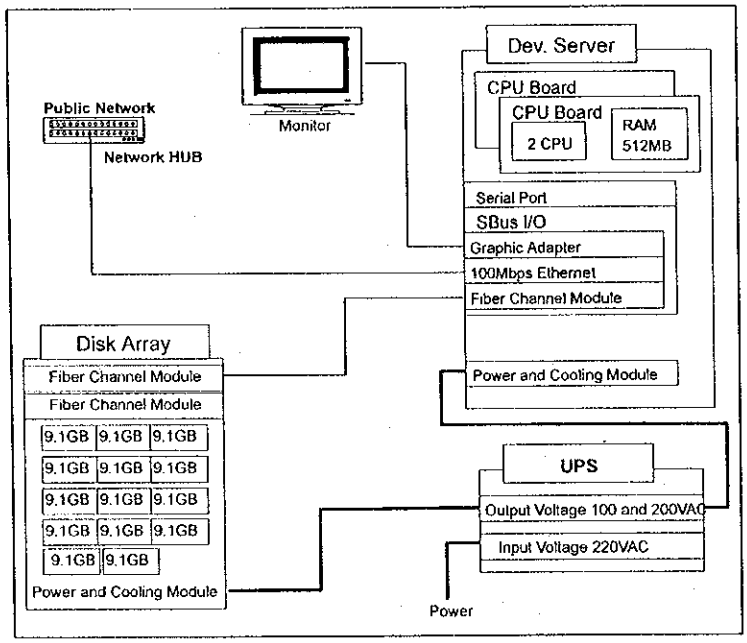


Figure 3.8.2.2-3: Development Server hardware configuration

3) Operational Control Server

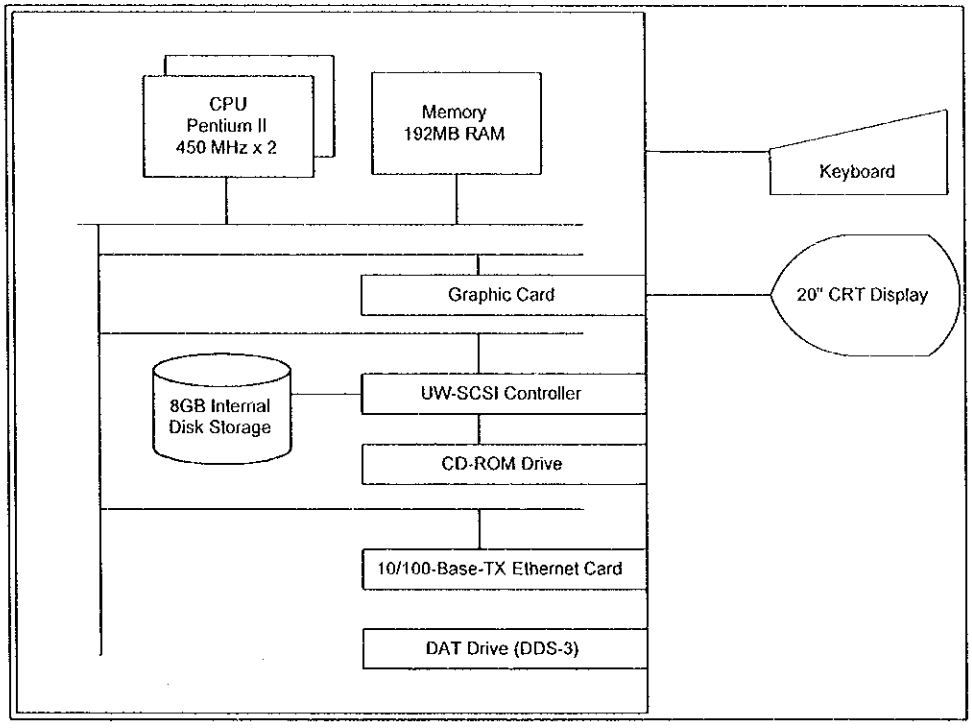


Figure 3.8.2.2-4: Operational Control Server hardware configuration

4) EUC Server

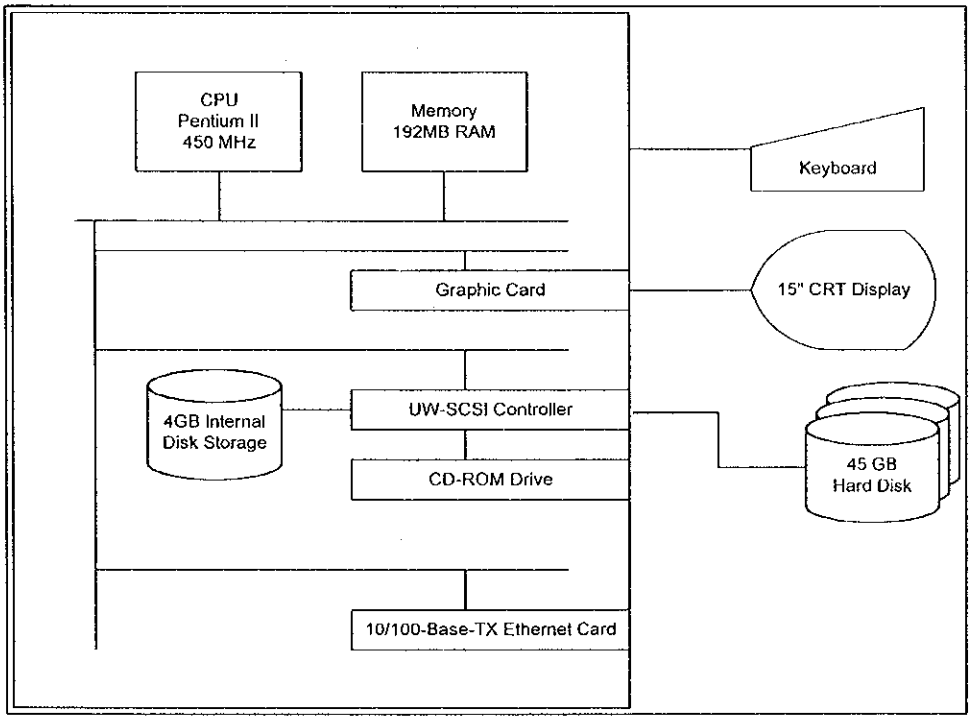


Figure 3.8.2.2-5: EUC Server hardware configuration

5) PC Clients (for end users and development)

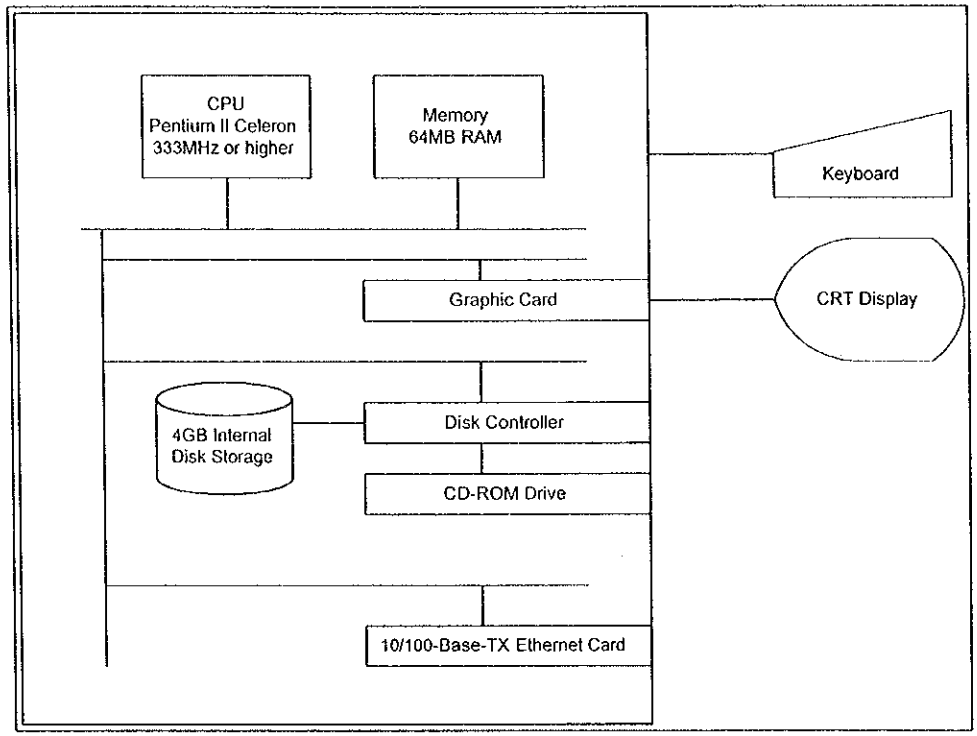


Figure 3.8.2.2-6: PC clients hardware configuration

3.8.2.3 List of hardware devices and equipment.

This sub-subsection describes list of hardware devices and equipment for the first stage. Table 3.8.2.3-1 shows one possible instance of hardware configuration. It includes the Main Server and its components, Operational Control Server, End User Computing Server, PCs for CIS clients, and other devices except for network devices which are listed in later part of this document.

Table 3.8.2.3-1: One possible instance of hardware configuration (1/2)

No	Item	Specification
1	Main Server (Dual System)	• Processor: Multi Processor(4CPU) • Memory: 1GB • Network Interface: dual 100Mbps Ethernet / node • Internal storage: 18GB / node • Other: CD-ROM, QIC tape device, floppy disk, Terminal Concentrator
2	Control Workstation	270MHz UltraSPARC II, 64 MB DRAM, 256 KB cache, 4.3 GB int disk, floppy disk, 24xCDROM, onboard PGX graphic
3	Disk Array (Main Server)	• Host interface: Sbus Dual Loop Fiber Channel Adapter • RAID configuration: Host Based RAID 0,1,0+1,5 • I/O Throughput: 100MB/sec using Fiber Channel Adapter • Other: Support multiple hosts connection
4	Backup Device	• DLT library • Backup rate: 5MB/sec (up to 10MB/sec with 2:1 compression) 18GB/hour (up to 36GB/hr with 2:1 compression) • Backup capacity: 35GB/cartridge (70GB with 2:1 compression) • Number of cartridge: Up to 8 cartridges, providing 280GB (up to 560 GB with 2:1 compression) • Interface: Differential Fast/Wide SCSI-2
5	Line Printer	• Full cabinet line impact printer • Speed: 1400 LPM • Interface: RS-232/RS-422; Centronics parallel interface
6	Operation Control Server	• Processor: Dual 450 MHz Pentium II (SMP) • Memory: 128MB RAM • Storage: 8GB Ultra-wide SCSI Hard Disk • CD-ROM: 24x CD-ROM Drive • Network: 10/100Mbps Ethernet Adapter • Tape Drive: DAT Drive (DDS-3) • Other: 20" Color Monitor, Keyboard, Mouse

Table 3.8.2.3-1: One possible instance of hardware configuration (2/2)

No	Item	Specification
7	End User Computing server	• Processor: Single 450 MHz Pentium II • Memory: 128MB RAM • Storage: 4GB Ultra-wide SCSI internal hard disk 45GB Ultra-wide SCSI external hard disk. • CD-ROM: 24x CD-ROM Drive • Network: 10/100Mbps Ethernet Adapter • Other: 15" Color Monitor, Keyboard, Mouse.
8	Desktop PC	• Processor: 333 MHz Intel Pentium Celeron or higher • Memory: 64 MB RAM • Storage: 4 GB internal Hard Disk Drive • FDD: 1.44 MB FDD • I/O interface: 9/25 pin serial port, 25 pin bi-directional, PS/2 6 pin for keyboards and mouse • Video: PCI Graphic Card, 4MB VRAM • Network: 10/100-Base-TX Ethernet Card • Other: CD ROM drive, 15" Color monitor , Keyboard, Mouse
9	UPS	• Input Voltage: 220VAC, Single Phase,50/60Hz • Output Voltage: 100 to 240 VAC, Single Phase,50/60Hz • Standby Time: 20Minutes • Capacity: 8 KVA for Main Server 4 KVA for Regional Server I 2 KVA for Regional Server II and Development Server 1.4 KVA for Op. Control and EUC server Central UPS system for PC clients
10	Laser Printer	• Speed: up to 16 pages per minute. • Resolution:600x600 dpi • Interfaces: Bi-tronics Parallel, Ethernet capable interface. • Memory: 8MB • Maximum Paper Size: 11.7" x 17.7" • Minimum Paper Size: 3.9" x 5.8" • Protocol: Support TCP/IP
11	Development Server	• Processor: Multi Processor(2CPU) • Memory: 512 MB • Network Interface: 100Mbps Ethernet • Internal storage: 9GB • Other: CD-ROM, QIC tape device, floppy disk
12	Disk Array (Development Server)	• Host interface: Sbus Fiber Channel Adapter • RAID configuration: Host Based RAID 0,1,0+1,5 • I/O Throughput: 100MB/sec using Fiber Channel Adapter
13	Backup Device (Development Server)	• Single DLT drive • Backup rate: 5MB/sec (up to 10MB/sec with 2:1 compression) 18GB/hour (up to 36GB/hr with 2:1 compression) • Backup capacity: 35GB/cartridge (70GB with 2:1 compression) • Interface: Differential Fast/Wide SCSI-2

3.8.3 Software

This subsection describes software packages and their functions that will be used for developing CIS. The software packages consist of:

- Basic Software Packages.
- Development softwares.
- Operational Control Software

3.8.3.1 Software requirement

This sub-subsection describes required functions of the softwares in CIS. Listed in Table 3.8.3.1-1 to Table 3.8.3.1-5 are the categories of softwares required for CIS implementation and development along with brief explanation of functions and features.

Table 3.8.3.1-1: Software functions for the main and regional servers (1/2)

Item	Function
Basic Software	
Operating System	• Operating system performs basic tasks, such as handling input and output, managing files and controlling peripheral devices. • Responsible for system security. • Multi-user. Allow multiple users to run program simultaneously • Multiprocessing. Support running a program on multiple CPU • Multitasking. Allows more then one program to run concurrently. • Multithreading. Allows different parts of single program to run concurrently.
Database	• Software for RDBMS. It creates the database and supports database management function. • Data partitioning. Tables and indexes by dividing them up into smaller pieces. Each partition can be stored on a separate set of storage devices. • Security. Users authorization. Separate users from Operating System users. • Integrity. Maintain the integrity of the database. • Relational. • Backup, restore and recovery of data.
Operational Control Software	• Monitor activities and trouble shoot any problems • Turn-on/off the server power automatically. • Job scheduling. • Backup and recovery. • Remote administration.

Table 3.8.3.1-1: Software functions for the main and regional servers (2/2)

Item	Function
Others	
FTP Tool	• Sending files to and from other system.
Mail server	• Responsible for forwarding e-mail to correct destination • Storing e-mails for retrieval by users. • Conform to SMTP and IMAP standards.

Table 3.8.3.1-2: Software functions for Development Server (1/2)

Item	Function
Basic Software	
Operating System	• Operating system performs basic tasks, such as handling input and output, managing files and controlling peripheral devices. • Responsible for system security. • Multi-user. Allow multiple users to run program simultaneously • Multiprocessing. Support running a program on multiple CPU • Multitasking. Allows multiple programs to run concurrently. • Multithreading. Allows different parts of single program to run concurrently.
Database	• Software for RDBMS. It creates the database and supports database management function. • Data partitioning. Tables and indexes by dividing them up into smaller pieces. Each partition can be stored on a separate set of storage devices. • Security. Users authorization. Separate users from Operating System users. • Integrity. Maintain the integrity of the database. • Relational. • Backup, restore and recovery of data.
Development Software	
Programming language	• A vocabulary and set of grammatical rules for instructing a computer to perform specific task. • It usually refers to high-level language, such as BASIC, C and C++. • Checking syntax and semantic program instruction. • Tracing and debugging program instruction. • Compile. Transform source code into object code.

Table 3.8.3.1-2: Software functions for Development Server (2/2)

Item	Function
Operational Control Software	• Monitor activities at the server. • Manage the trouble shooting at the server. • Turn-on/off the server power automatically. • Job scheduling. • Backup and recovery. • Remote administration.
Others	
FTP Tool	• Sending files to and from other system.
Mail server	• Responsible for forwarding e-mail to correct destination • Storing e-mails for retrieval by users. • Conform to SMTP and IMAP standards.

Table 3.8.3.1-3: Software functions for Operational Control Server

Item	Function
Basic Software	
Operating System	• Operating system perform basic task, such as recognizing input and output, keeping track of files and controlling peripheral devices. • Responsible for system security. • Multiprocessing. Support running a program on more than one processor • Multitasking. Allows more then one program to run concurrently. • Multithreading. Allows different parts of single program to run concurrently.
Operational Control Software	• Centric management of whole system. • Backup and recovery. • Monitor activities of CIS components. • Monitor network traffic. • Resources distribution • Management of jobs on the CIS Main Server
Others	
Anti Virus	• Protect the operational control server from viruses. • Clean the operational control server from virus infection.

Table 3.8.3.1-4: Software functions for EUC server

Item		Function
Basic Software		
	Operating System	• Operating system perform basic task, such as recognizing input and output, keeping track of files and controlling peripheral devices. • Responsible for system security. • Multiprocessing. Support running a program on more than one processor • Multitasking. Allows more then one program to run concurrently. • Multithreading. Allows different parts of single program to run concurrently.
	Database	• Software for RDBMS. It keeps partial copy of the CIS main database and provides the data for end user computing within the site. It also supports database management function. • Security. Users authorization. Separate users from Operating System users. • Integrity. Maintain the integrity of the database. • Relational. • Backup, restore and recovery of data.
Operational Control Software		• Monitor and control the activity of database on the EUC server. • Send status of EUC server to the operational control server. • Turn-on/off the power automatically. • Job scheduling.
Others		
	Anti Virus	• Protect the EUC server from viruses. • Clean the EUC server from virus infection.

Table 3.8.3.1-5: Software functions for PC client (1/2)

Item		Function
Basic Software		
	Operating System	• Operating system perform basic task, such as recognizing input and output, keeping track of files and controlling peripheral device. • Responsible for security. • Multitasking. Allows more then one program to run concurrently.
	Database Access Tools	• Connectivity between database server and client • Data manipulation. Add, edit, update and delete data. • Indexing data. • Query data. Select, join (inner join/outer join)

Table 3.8.3.1-5: Software functions for PC client (2/2)

Item		Function
Development Software		
	Programming Language	• A vocabulary and set of grammatical rules for instructing a computer to perform specific task. • It usually refers to high-level language, such as BASIC, C and C++. • Checking syntax and semantic program instruction. • Tracing and debugging program instruction. • Compile. Transform source code into object code.
	Development tools.	• A programming package that enables a programmer to develop application for a specific platform. • Scaleable application server. • Database-driven integrated forms, reports and charts. • Multi-language translation. • Project builder; query builder, schema builder and report builder. • Graphical User Interface.
Operational Control Software		• Send jobs from client to server. • Send status of client to server. • Monitor trouble happen at the Client. • Turn-on/off the power automatically. • Job scheduling. • Monitor network equipment from server. • Backup and recovery.
Others		
	Anti Virus	• Protect PC from viruses. • Clean PC from virus infection.
	E-mail client	• Functions as the front end for sending or receiving e-mails for notification of NI/NHI. • Conform to SMTP and IMAP standards.

Note: The Development Softwares are only for development PCs.

3.8.3.2 Software configuration

Figure 3.8.3.2-1 shows configurations of the basic software package. This figure illustrates a combination of basic software for each type of machine: Main Server, the Regional Server, and client.

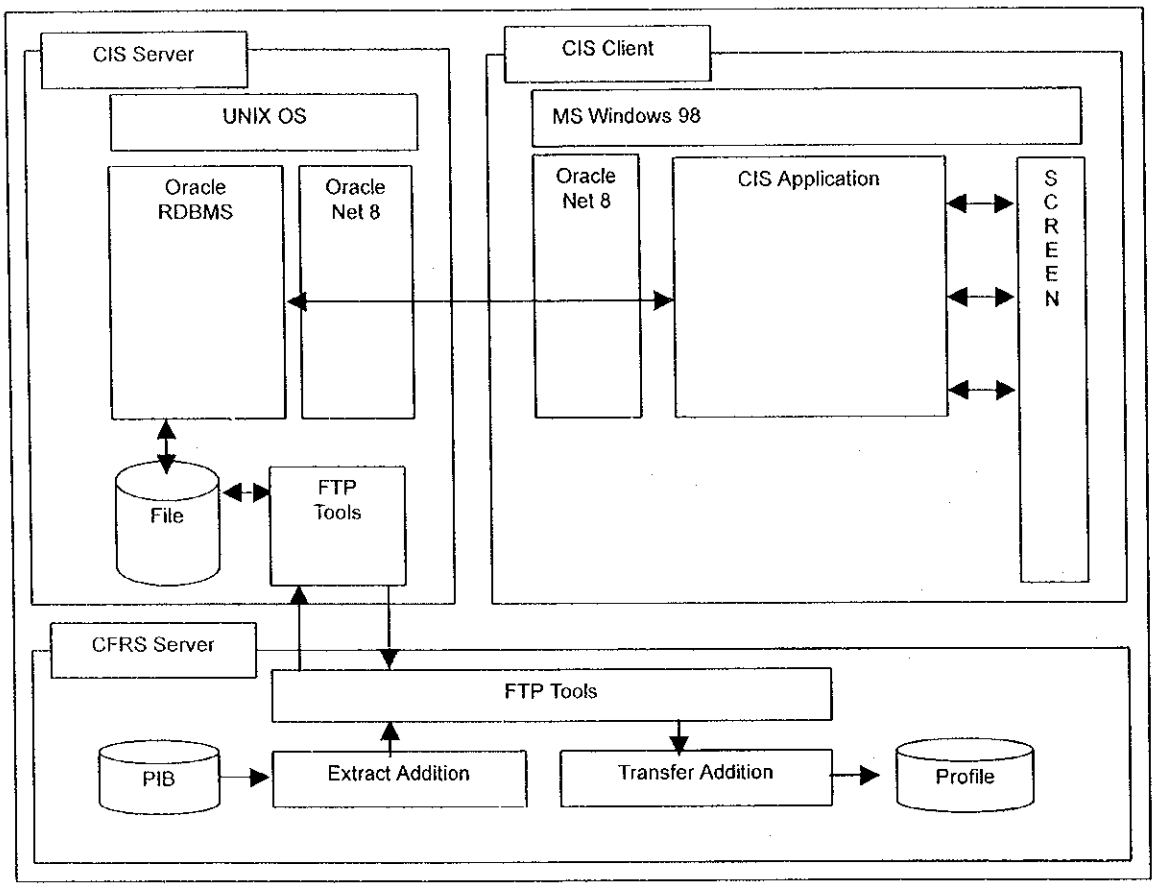


Figure 3.8.3.2-1: Required functions of basic software packages

In CFRS side, FTP tools should be investigated. It is recommended to use FTP tools to exchange the PIB, PIBT, PEB, and profile data.

Figure 3.8.3.2-2 shows configurations for the development software packages. This figure illustrates a combination of development software for server and client.

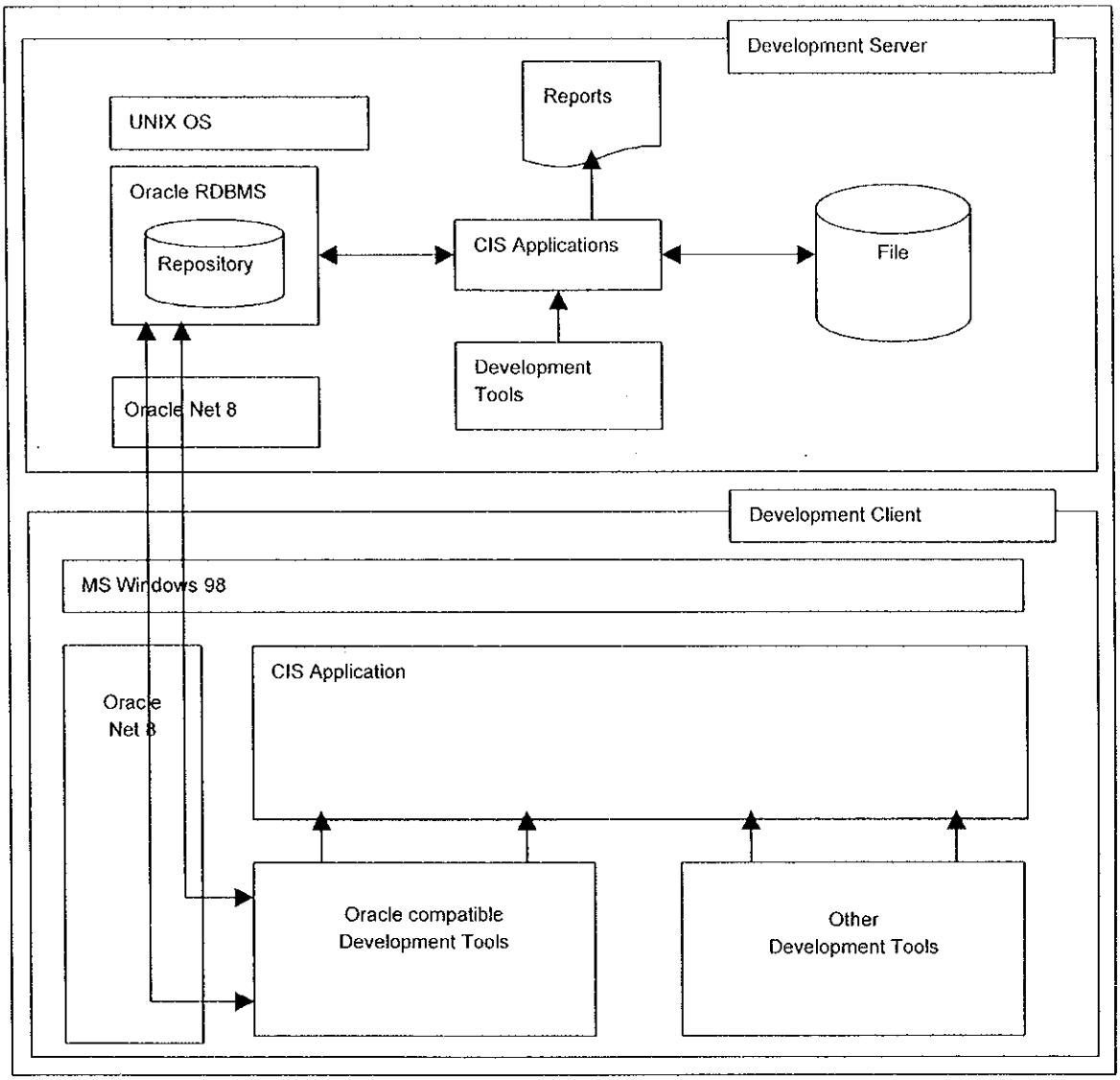


Figure 3.8.3.2-2: Configuration for development software packages

Figure 3.8.3.2-3 shows configurations of operational control software packages. This figure illustrates a combination of development software for each type of machine: Main Server, Regional Server, and client.

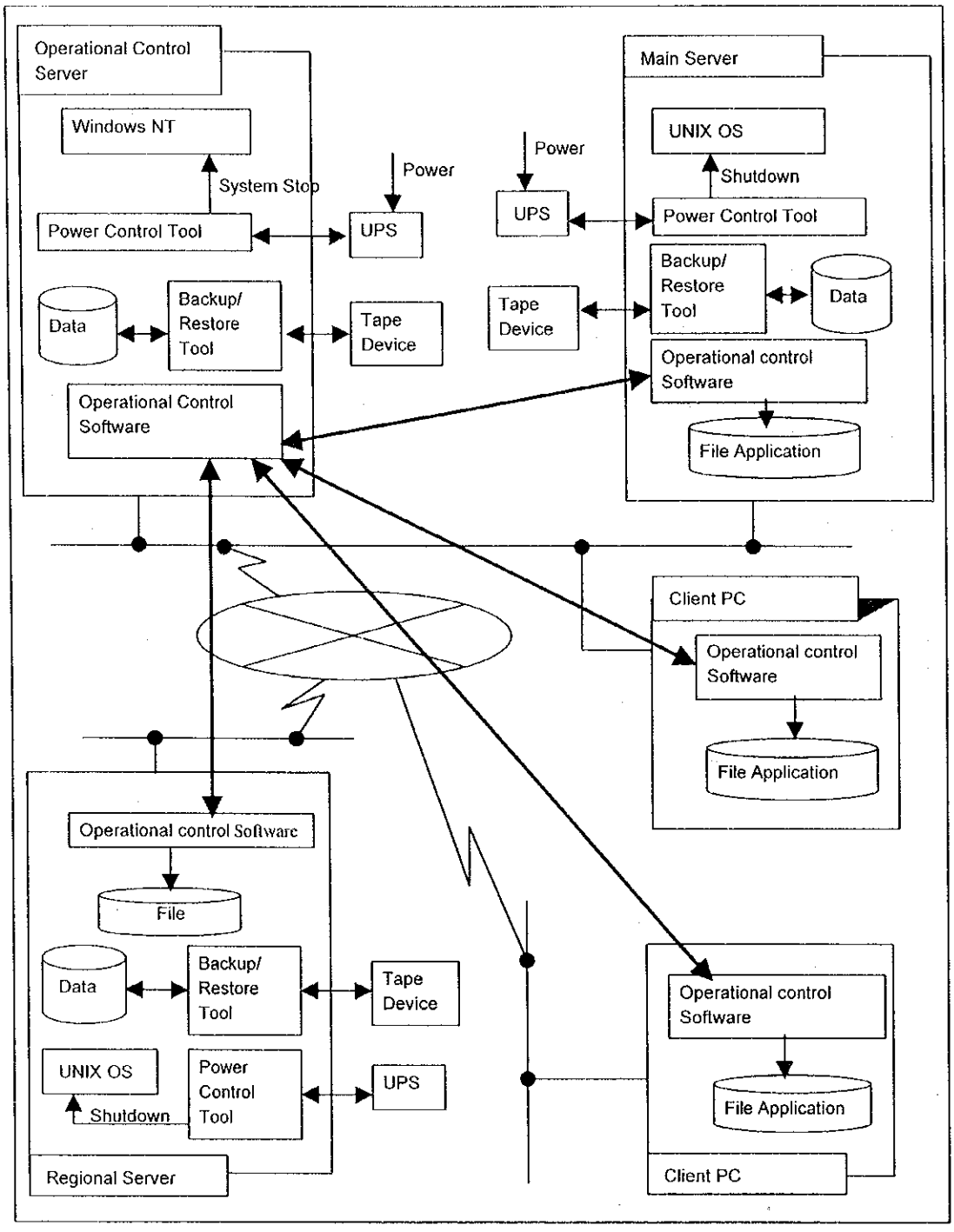


Figure 3.8.3.2-3: Configuration for operational control software

3.8.3.3 List of software packages

This sub-subsection describes the software packages. Lists of software packages are shown in Table 3.8.3.3-1 and Table 3.8.3.3-2.

Table 3.8.3.3-1: Example list of software packages for Main Server

Category		Product
Basic Software	Operating System	UNIX Operating System
	Database	Oracle8 Enterprise Edition
		Net 8
	Disk Management	Volume manager
	Backup	Backup device control software Backup management tool
Dual System Software	—	Cluster management software
Maintenance Software	Operational Control Software	Operation Control Tool
		Trouble Control Tool
		Resources Distribution Tool
		Network Control Tool
		Job Control Tool
		Power Control Tool
Other	—	FTP Tool
		E-mail Server (SMTP and IMAP)

Note: The cluster management software is only for the Main Server.

Table 3.8.3.3-2: Example list of software packages for Development Server

Category		Product
Basic Software	Operating System	UNIX Operating System
	Database	Oracle8 Enterprise Edition
		Net 8
	Disk Management	Volume manager
	Backup	Backup device control software Backup management tool
Development Software	Language	Oracle Programmer
Maintenance Software	Operational Control Software	Operation Control Tool
		Trouble Control Tool
		Resources Distribution Tool
		Network Control Tool
		Job Control Tool
		Power Control Tool
Other	—	FTP Tool
		E-mail Server (SMTP and IMAP)

Table 3.8.3.3-3: Example list of software packages for Operational Control Server

Category		Product
Basic Software	Operating System	Windows NT
	Backup	Backup device control software Backup management tool
Maintenance Software	Operational Control Software	Operation Control Tool
		Trouble Control Tool
		Resources Distribution Tool
		Network Control Tool
		Job Control Tool
		Power Control Tool
Other	—	Anti virus

Table 3.8.3.3-4: Example list of software packages for EUC Server

Category		Product
Basic Software	Operating System	Windows NT
	Database	Oracle8 Enterprise Edition
		Net 8
	Backup	Backup device control software Backup management tool
Maintenance Software	Operational Control Software	Operation Control Tool
		Trouble Control Tool
		Resources Distribution Tool
		Network Control Tool
		Job Control Tool
		Power Control Tool
Other	—	Anti virus

Table 3.8.3.3-5: Example list of software packages for PC clients

Category		Product
Basic Software	Operating System	Ms Windows 98
	Database	Oracle 8 Personal Edition
Development Software	Language	MS Visual C++
		Visual Basic
	Tools	Oracle Designer/2000
		Oracle Developer/2000
Other	—	Anti Virus
		Operational control Software
		E-mail client

Note: The Development Softwares are only for development PCs.

Development tool is the most important component for designing and developing CIS. "Designer/2000" is specified as the development tool in CIS development project because among others only "Designer/2000" can take over the information from design phase. Below is the result of JICA Study Team evaluation.

1) Points of Evaluation

Considering characteristic of the project, four points are evaluated:

i) Function

Data sharing function is critical in this project because there are several working teams, 5 operation analysis-and-design teams and 2 design formulation teams. Hence, centralized design data is recommended.

ii) Usage

In selecting the methodology for operation surveys and analyses in this project, both "Process Oriented Approach (hereinafter referred to as POA)" and "Data Oriented Approach (hereinafter referred to as DOA)" are evaluated. POA focuses on the operation contents while DOA focuses on the data used in the operation.

iii) Operability

Since Windows 95 Operating System is popular in Indonesia, it is considered to use PC running Windows 95 as the development equipment in this project. Therefore, the development tool selected must be available for Windows 95 platform.

iv) Compatibility with Oracle

Several existing databases at the DJBC are based on Oracle, therefore, it is important that the CASE tool is compatible with Oracle.

2) Evaluation result

Table 3.8.3.3-6: Comparison of CASE tools

	ER/Win	Designer/2000	SILVERRUN	Power Designer
OS	Windows95/NT	Windows95/NT	Windows95/NT	Windows95/NT
RDBMS	Oracle, Informix, Microsoft SQL, Sybase.	Oracle	Oracle, Informix, Microsoft SQL, Sybase.	Oracle, Informix, Microsoft SQL, Sybase.
Design Theory	DOA	DOA	DATARUN	Data Architect
Data sharing	—	Repository	Repository	Central dictionary

3) Conclusion

Oracle Designer/2000 is the most suitable software for this project for the following reasons:

i) It has group supporting function based on repository function.

ii) It has DOA theory.

iii) It can be operated in a Windows 95 environment.

iv) It has high compatibility with Oracle.

v) DJBC has used Oracle product for current system.

Moreover, since it is also possible for the data designed by Designer/2000 to continue to be developed by Developer/2000, the design in this project can be modified easily.

3.8.4 Network

3.8.4.1 Network requirement

This subsection includes the requirements for network devices and their list for the first stage. The descriptions include both LAN and WAN.

The network configuration in the first stage and the outline of the CIS networking in the second and later stages are in 3.7.

Table 3.8.4.1-1: LAN requirement for the first stage

Component	Specification	Remarks
LAN Devices (PUSLATASI, Head Office Building C)	• Support switching technology to provide 100Mbps connections to each server (Main Server and Operational Control Server), main router, and to each network segment (building A, B, and C). • Provide fiber optic link to building A and B • Provide 10Base-T connections to CIS clients and printers • Support management via SNMP and remote • Support Virtual LAN to separate CIS network from existing network	The Main server requires four 100Base-Tx ports.
LAN Device (Head Office, Building A and B)	• Support 10Base-T connections to CIS clients and printers • Provide 100Mbps up-link with fiber optic connection to building C • Support Virtual LAN to separate CIS network from existing network • Support management via SNMP and remote	—
LAN Device (Tanjung Priok Regional Office)	• Support 10Base-T connection • Support management via SNMP and remote • Provide 100Base-Tx port for connection to Regional Server	—
LAN Device (Tanjung Priok Service Office)	• Support 10Base-T connection • Support management via SNMP and remote	—

Table 3.8.4.1-2: WAN requirement for the first stage

Component	Specification	Remarks
WAN Device (PUSLATASI)	• Support for 100Base-T (for CIS LAN) • Support 10Base-T (for connection to CFRS LAN) • 4 ports Synchronous Serial • 4 ports ISDN BRI (modules) • Support SNMP	Synchronous Serial ports are for leased lines, and ISDN ports are for backup ISDN lines.
WAN Device (Jakarta Regional Office, IV)	• Support for 10Base-T (for LAN) • 1 port Synchronous Serial • 1 port ISDN BRI • Expansion slots to accommodate 3 additional WAN connection.	The additional WAN connections are for Service Offices from the 2nd stage onward.
WAN Device (Tanjung Priok Service Offices)	• Support for 2 Ethernet connections (for CIS network and CFRS network) • 1 port Synchronous Serial • 1 port ISDN BRI	—

3.8.4.2 List of hardware devices and equipments

Table 3.8.4.2-1 shows the hardware devices and equipment for the first stage.

Table 3.8.4.2-1: List of hardware devices and equipment for the first stage (1/2)

No.	Item	Specification
1	Switch (PUSLATASI)	• Segment switch, 100Base-TX Ethernet ports (8 ports) • Segment switch, 100Base-Fx (4 ports, fiber optic) • Support VLAN
2	Switch (Head Office, Building A and B)	• Segment switch, 10Base-T with 100Base-Fx up-link, support VLAN (fiber optic up-link)
3	HUB (PUSLATASI)	• 10Base-T Ethernet ports (24 ports) with one 100Base-TX port for up-link
4	HUB (Head Office, Building A and B)	• 10Base-T Ethernet ports (24 ports), stackable.
5	Main Router (PUSLATASI)	• 10Base-T Ethernet (1 port) • 100Base-Tx Ethernet (1 port) • ISDN BRI (4 ports) • Synchronous/Asynchronous Serial (4 port)
6	Remote Router (Tanjung Priok Regional Office)	• 10Base-T Ethernet (1 port) • ISDN BRI (1 port) • Synchronous/Asynchronous Serial (1 port)

Table 3.8.4.2-1: List of hardware devices and equipment for the first stage (2/2)

No.	Item	Specification
7	Remote Router (Tanjung Priok Service Offices)	• 10Base-T Ethernet (2 ports) • ISDN BRI (1 port) • Synchronous/Asynchronous Serial (1 port)
8	Hub (Regional and Service Offices)	• 10Base-T Ethernet ports (24 ports) • 100Base-T Ethernet ports (1 port)

3.9 Common Processing Means

3.9.1 Means for online processes

3.9.1.1 Circumstances

Online processes deal with user operations of CIS.

This guideline is settled in view of these points:

- Efficiency

  On-line processes should be efficient both for reducing needed system resource and for providing users with good performance.

- Productivity

  Excessively elaborate means should be avoided for proper productivity.

3.9.1.2 Definition of online processes

Online processes in CIS are thus defined.

1) Characteristics

The online processes of CIS follow client-server model. Requests from users on clients are processed in the server, and the result of each request is sent back to the client.

This process may occur simultaneously from different users.

2) Choosing method of connection between clients and server

There are two major connecting methods in client-server computing model:

- Remote Database Access (hereinafter referred to as RDA)
- Online Transaction Processing (hereinafter referred to as OLTP) monitor system

Table 3.9.1.2-1 shows characteristics of RDA method and OLTP monitor method.

Table 3.9.1.2-1: Characteristics of RDA and OLTP (1/2)

Item	RDA	OLTP	Remarks
Productivity	High	Low	OLTP system requires programming both for the clients and the server.
Performance	High-Low	High	Performance of RDA-based system depends on the style of query (request) from the clients to the server.

Table 3.9.1.2-1: Characteristics of RDA and OLTP (2/2)

Item	RDA	OLTP	Remarks
Compatibility with Oracle D/2000	High	Low	Oracle D/2000 series provide automated development funcions only for RDA-based system.

Because of its productivity and matching with the development tool, namely Oracle Designer/2000 and Developer/2000, the JICA Study Team designs CIS as RDA-based system.

To improve the performance of the RDA-based system, there are some matters requiring attention. For the basis, every request (query) from the clients to the server is described in the structured query language (hereinafter referred to as SQL) in RDA-based system.

- Use of stored procedures

  Instead of sending whole SQL from the client to the server every time, queries should call procedures already stored in the database to reduce the load of RDBMS and network.

- Standardization of SQL

  Every expression of procedure must follow the coding standard of SQL that will be available in product stage. This provides these advantages to the system:

  - Efficient expression of process

    By following the standards, inefficient expression of SQL is avoided.

  - Reduction of interpret load of RDBMS

    During execution of each SQL, Oracle RDBMS interprets SQL statement into executable form of information. The results of interpretations are cached in memory and repeatedly used when the identical SQL comes to the server. In this case, no interpretation is required. To maximize this feature, the SQL statements of same function must be expressed in a consistent way.

3) Disposition of functions

- Clients:
  - Interaction with user (displaying application windows, receiving input from keyboard / mouse)
  - Retrieval of information that is local to a client, such as codes and messages

This reduces the network traffic and enables the client processes to display messages to operators in case of network failure or server failure.

- Communication to the server (requesting registration, update, deletion, and retrieval of the CIS transaction information / receiving the result of request)

- Server:
  - Communication to clients (receiving requests from clients / sending the result of requests to clients)
  - Access to the database to fulfill requests from the clients

4) Disposition of processes

Figure 3.9.1.2-1 shows the outline of disposition of online processes.

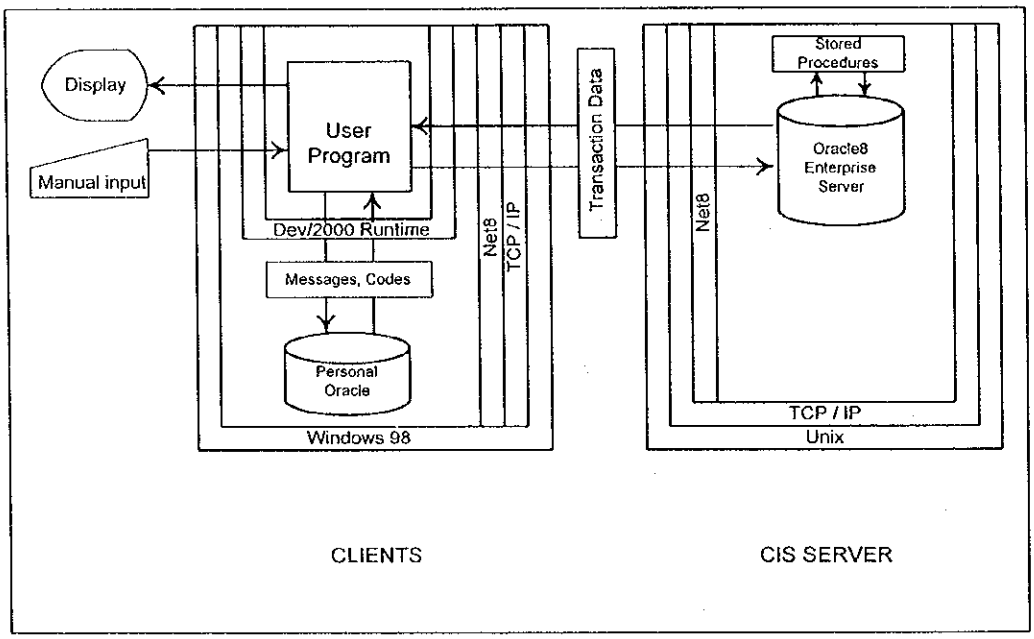


Figure 3.9.1.2-1: Dispositions of online processes

- Clients:

  User programs run on Oracle Developer/2000 Runtime.

  - Interaction with user

    This function is managed by user program and Developer/2000 runtime.

  - Retrieval of information that is local to a client, such as codes and messages

    This function is managed by user program, Developer/2000 runtime, and Personal Oracle server.

  - Communication to the server

    This function is managed by user program, Developer/2000 runtime, and Net8.

- CIS Server:
  - Communication to clients (receiving requests from clients / sending the result of requests to clients)
  - Access to database

    These two functions are managed by Oracle database engine and the middleware, Net8.

    The queries from the clients start up specific stored procedure in the database server.

3.9.1.3 Policy for transaction design

Transaction is defined as the fundamental unit of data access to the shared database.

In following explanations, a pseudo-code expression is used to illustrate transaction scope and flow of operations. In the pseudo-code, operations enclosed by "BEGIN transaction" and "END transaction" make up one transaction (which are also enclosed by bracket, "["). "END transaction" can be two types of termination of transaction: One is COMMIT (modifications in the transaction are reflected onto the database), and the other is ROLLBACK (all the modifications in the transaction are cancelled). Accesses to database are described in SQL-like statements in capital letters.

There are several key concepts on transaction design:

1) Types of data access
2) Choosing isolation level
3) Scope of transaction

1) Types of data access

There are four types of data access to shared database such as:

i) Registration

This operation adds new record(s) into the database.

ii) Update

This operation overwrites existing record(s) in the database.

iii) Deletion

This operation removes existing record(s) from the database.

iv) Retrieval

This operation extracts information of existing record(s) from the database.

2) Choosing isolation level

Each transaction should be performed in isolation: i.e. Free from the side effect of other transactions performed in the same database concurrently. To implement isolation, exclusive use of shared resource, such as records or table itself in the database must be permitted for the transaction. This exclusive use of resource is called locking. However, locking reduces overall performance of the database by prohibiting the execution of transactions other than only one transaction in action. To increase performance of overall database, weakening the intensity of isolation is required.

The objective of locking can vary from each single record level to entire table level. For online processes, record level locking is preferred to increase the concurrency of the processes.

Several levels of isolation are defined as a standard of SQL for this isolation versus performance trade-off.

In Oracle database management system, three levels of isolation implemented: read committed, serializable, and read lock for update. These isolation levels are set at the beginning of each transaction.

Figure 3.9.1.3-1 shows the basic idea of each isolation level.

i) Read committed

This isolation level guarantees the transaction "Read Committed" functionality: retrieval operation provides only committed data in database ("dirty read" is prohibited).

"Repeatable Read" functionality (repeated reads of identical record in one transaction provide same value) is not guaranteed. For example: [a] a record is retrieved by one transaction, [b] other transaction(s) modify the same record and commit, [c] first transaction retrieves the same record again. [d] the results of [a] and [c] are different.

For this reason, this isolation level is not recommended for the transactions including retrieval and update to the same record.

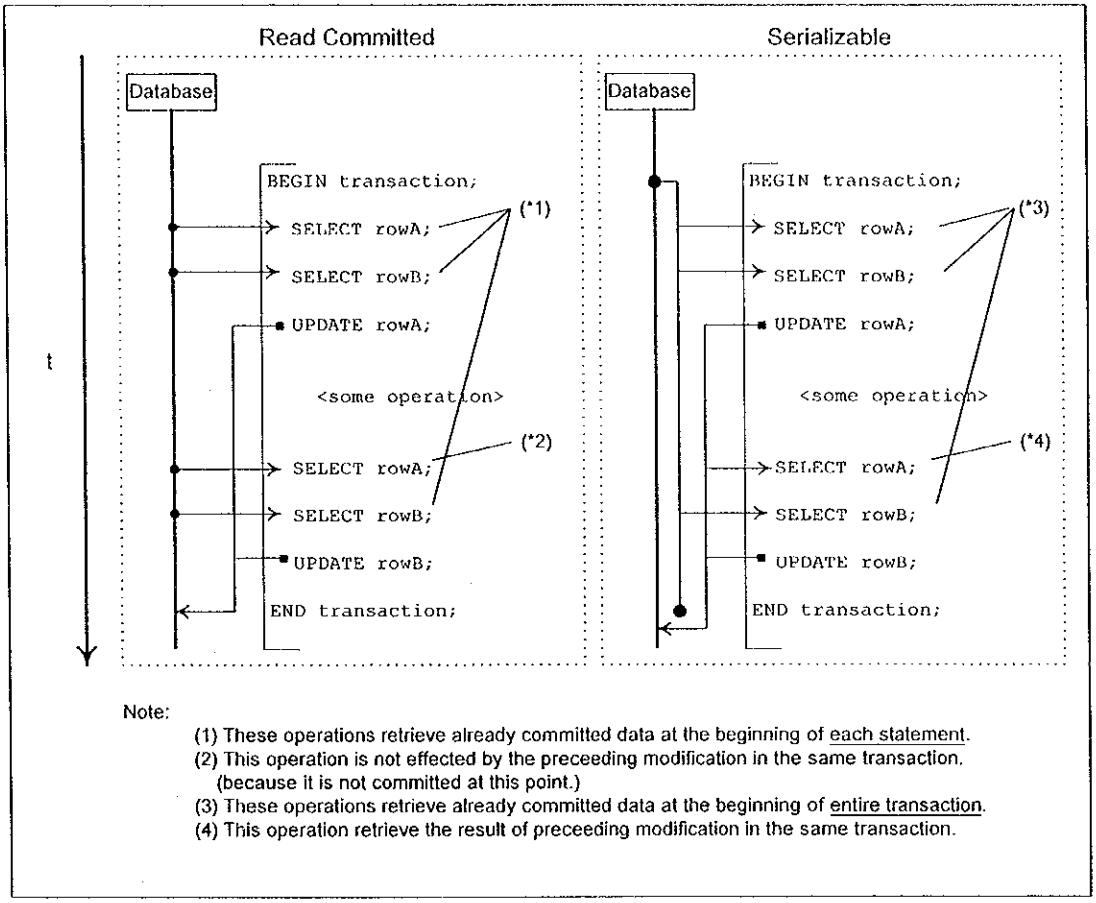


Figure 3.9.1.3-1: Options of isolation levels

ii) Serializable

This isolation level guarantees the transaction "Repeatable Read" functionality in addition to "Read Committed".

Transaction of this level can be logically regarded as running alone in the system: all transactions run one by one in the database (serially), not simultaneously. All the retrievals in one transaction provide the same value with the ones at the beginning of transaction unless they are modified in the transaction itself.

This level of isolation is recommended for the transactions including modification operation.

One point in using this level of transaction is the management of modification collisions. Transactions are logically regarded as running serially, but actually they run simultaneously. For example: [a] one transaction retrieves a record, [b] other transaction(s) modify the same record and commit, [c] the first transaction tries to modify the record and commit. In this case, the step [c] fails because of the step [b]. Oracle returns

"Cannot serialize access for this transaction" error for this situation. The only way to break through this situation is to roll back the transaction.

iii) Read lock for update (refer to Figure 3.9.1.3-2)

This is one alternative to reduce cost of rolling back in the transactions of serializable isolation level in case of collision.

This type of transaction is based on read committed isolation level. The difference is that records are locked at the first retrieval using SQL command, "SELECT .... FOR UPDATE". Therefore, the transaction can use the retrieved data as the basis of later update. Note that this locking is not performed at the beginning of whole transaction.

Targets of this type of transaction are the business processes where simultaneous modification on the same record from multiple users is expected. The merit is that application program can notify operator about the collision before the operator edits the record (in serializable transactions, the collision is notified after edit).

The point in using this type of transaction is management of modification collisions.

For example: [a] one transactions locks record(s), [b] other transaction(s) try to lock the same record or [b'] other transaction(s) try to delete the same record(s). In step [b], the latter transaction can either wait for the locked records or immediately give up the locking. In step [b'], the only way for latter transaction is to wait for release of lock. In this case, application program must cancel the waiting after some period (timeout).

Another point is management of deadlocks. If this type of transaction encounters deadlock, Oracle returns "Deadlock detected" error to the transaction. The application program must roll back the transaction.

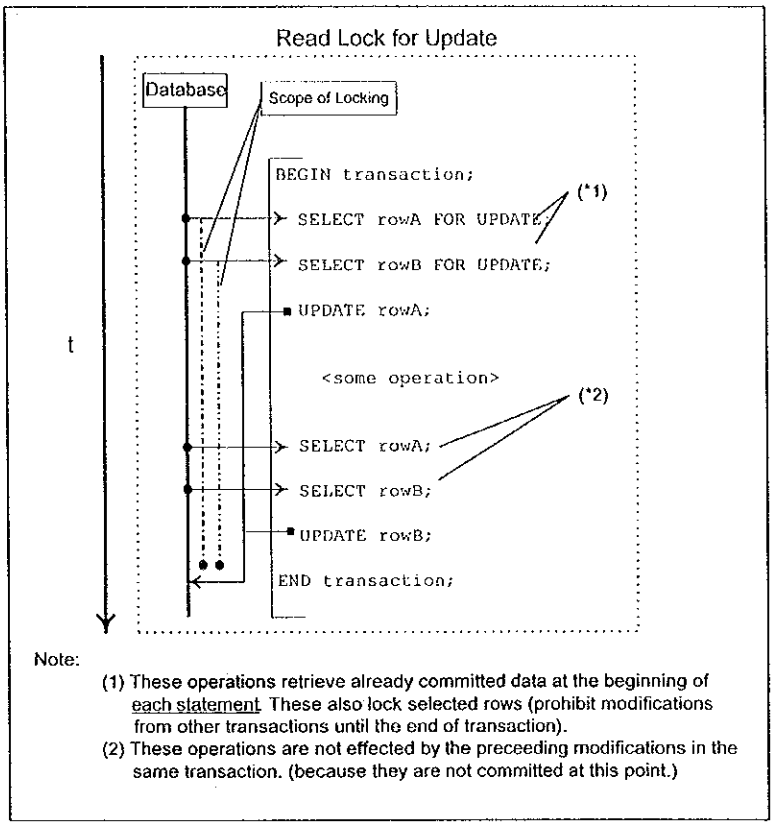


Figure 3.9.1.3-2: Options of isolation levels

Table 3.9.1.3-1 shows the summary of comparison between these isolation levels.

Table 3.9.1.3-1: Comparison between isolation levels (1/2)

Item	Read committed	Serializable	Read lock for update
Transaction level referential consistency	Not guaranteed	Guaranteed	Not guaranteed
Continuous data locking	None	Implicit	Explicit
Policy of management of modification collision	Later update is blocked until release of the locking.	After commitment of preceding transaction, modification or commitment of same record by later transaction is rejected. Immediately notified with "Can't serializable" error.	Later locking is blocked until release of the locking / immediately failed (optional).

Table 3.9.1.3-1: Comparison between isolation levels (2/2)

Item	Read committed	Serializable	Read lock for update
Management of modification collision	Wait for locking release.	Rollback an entire transaction.	Wait for locking release or Fail the locking and rollback an entire transaction.
Management of deadlocks	Necessary	Not necessary (detected as "Can't selialization" error)	Necessary
Recommendation	• For retrieval transactions	• For ordinary modification transactions • For retrieval transactions require strict referential consistency	• For modification transactions where frequent collision of modification is expected

3) Scope of transaction

Here the alternatives and recommendations of transaction scope in accordance with the flow of business processes are shown.

For the standardization of windows, e.g. window name and its flow, refer to1.2.

i) Operation within single window.

Figure 3.9.1.3-3 shows the recommended transaction scope of this type of business process.

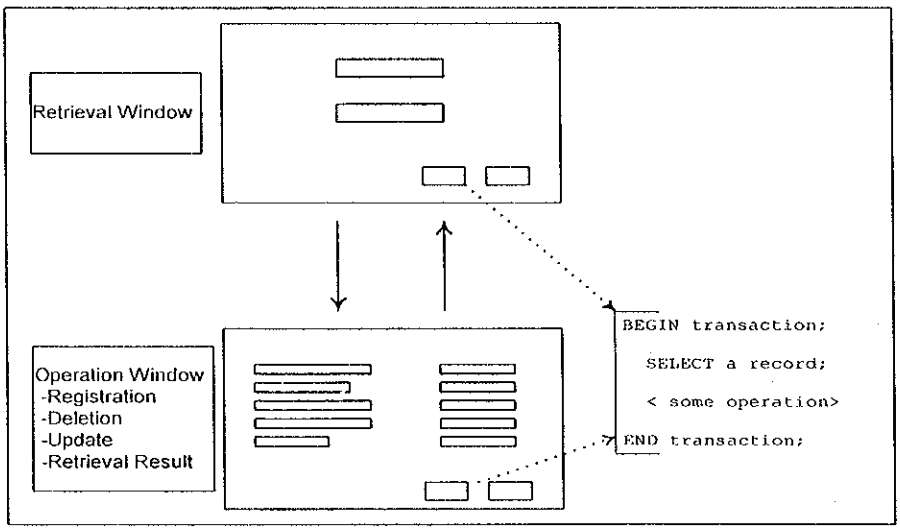


Figure 3.9.1.3-3: Operation within single window

For this type of business process, data operations should be enclosed within single transaction in "Operation Window".

ii) Operation across multiple windows

The following discussion assumes to be applied to retrieval business processes or processes that operate tables in master-detail type relationship. Windows that consist of series of pages, move from one to another with "previous / next page" function (used to display large record), must be regarded as single logical window already discussed above.

In these type of business processes, summary of plural master records (case of retrieval operation) or master record and detail records (case of master-detail relationship data) are retrieved from database in the first window. At this step, application program should retrieve minimal information of each table (columns with management information such as primary key and essential columns displayed on the window). Then, single record is selected from them, and then all the necessary columns of the record will be retrieved from database for further operation.

Figure 3.9.1.3-4 shows the two alternatives of transaction scope for this type of operation.

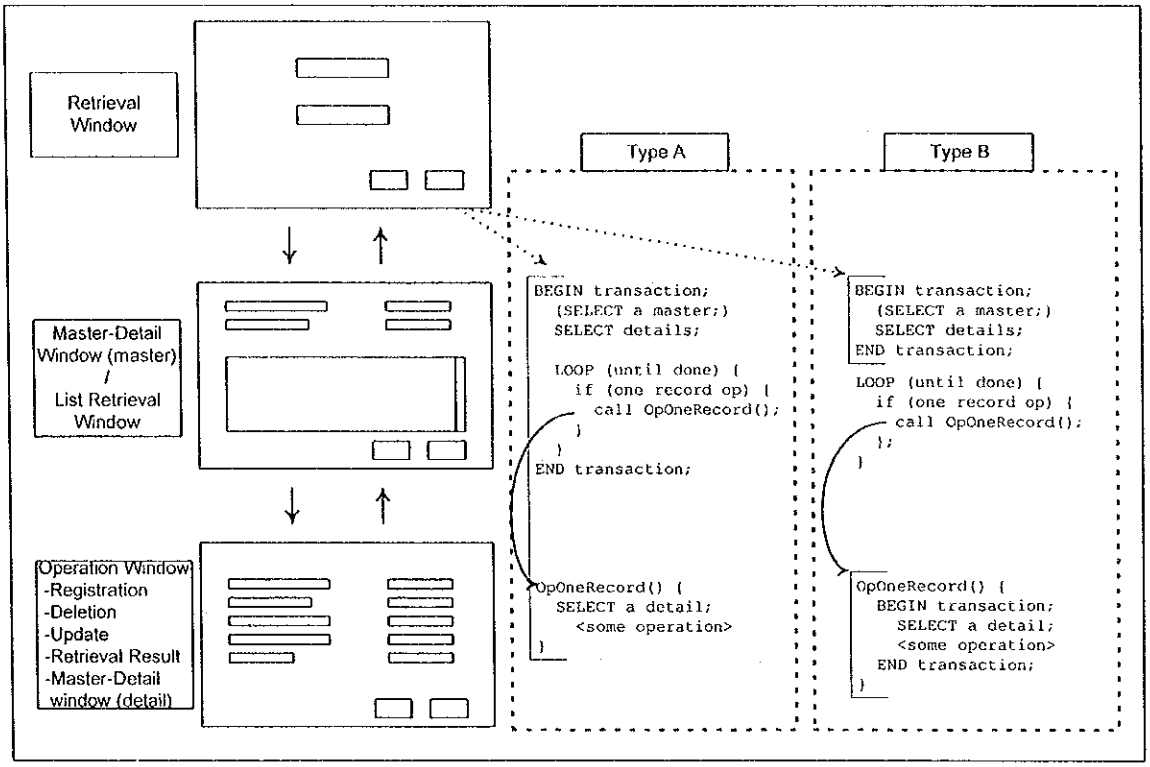


Figure 3.9.1.3-4: Two alternatives of transaction scope for operations across windows

In type A design, two windows are enclosed in one transaction. In type B design, on the other hand, operations in these two windows are enclosed in two separated transactions. Some operations in the first window are moved to outside of transactions in addition. The comparison between these two types of transaction design is summarized in Table 3.9.1.3-2.

Table 3.9.1.3-2: Comparison between two types of transaction scope design (1/2)

Item	Type A	Type B
Cost of locking	NG All the selected rows in List Retrieval Windows are locked until the end of whole business process.	OK Only one record is locked at one point of time.
Referential data consistency	OK None of the selected rows is influenced by other transactions if the isolation level is properly selected (see discussion of isolation level below).	NG Influences of data modification during non-transactional operation cannot be controlled.

Table 3.9.1.3-2: Comparison between two types of transaction scope design (2/2)

Item	Type A	Type B
Cost of retrying mistook / failed operation	NG All the modifications (may be done on multiple records) are cancelled and must be retried in case operational mistake or failure.	OK Operator retries the modification on only one record in case operational mistake or failure.
Recommendation	EXCEPTIONAL For business processes where referential data consistency is strictly required.	RECOMMENDED For ordinary business processes.

Type B design is recommended for ordinary business process. Only for business processes that require strict referential data consistency, type A design should be applied.

Detailed guidelines for transactions for business processes are discussed in the following development phase.

3.9.1.4 Policy for error handling

This sub-subsection explains overview of guideline for the online processes (user programs) to handle the error in CIS. There are several points that errors may occur on the server, network, and the clients (refer to Figure 3.9.1.2-1).

1) Server

There are only the Oracle RDBMS and the middleware on the server as online processes. Monitoring and treatment of errors on these products are discussed in 3.5.4 and 3.5.5.

2) Clients

Table 3.9.1.4-1 describes:

i) Points of error occurrence

ii) Anticipated incidents at each point

iii) Expected handling by server processes (RDBMS, middleware)

iv) Guideline for handling for user programs

Table 3.9.1.4-1: Points of error occurrence and handling (1/2)

Category	Detail	Incident	Handling and expected result (upper: server / lower: client)
Server	OS	OS crash	• Transaction underway is automatically rolled back by RDBMS after re-start.
			• Client programs detect the incident and display message to operator.
	RDBMS	RDBMS failure	• Transaction underway is automatically rolled back by RDBMS after re-start.
			• Client programs detect the incident and display message to operator.
	Stored procedure	Failure during executing stored procedure	• Stored procedures send message relating to the situation to client programs.
			• Client programs identify the message and start up proper recovery process.
Network	—	Network failure	• Middleware on the server detects inexistence of response from the client and kill the server process bound to the client. • Transaction underway is automatically rolled back.
			• Client programs detect the incident and display message to operator.
Client	OS	OS crash	• Middleware on the server detects inexistence of response from the client and kill the server process bound to the client. • Transaction underway is automatically rolled back.
			• Unable to handle.

Table 3.9.1.4-1: Points of error occurrence and handling (2/2)

Category	Detail	Incident	Handling and expected result (upper: server / lower: client)
Client	Middleware	Middleware failure	• Middleware on the server detects inexistence of response from the client and kill the server process bound to the client. • Transaction underway is automatically rolled back.
			• Client programs detect the incident and display message to operator.
	Personal Oracle	Personal Oracle failure	• No operation is necessary.
			• Unable to display codes / messages to operator. • User program rolls back the transaction underway and terminate itself.
	User Program	User program hang up	• Middleware on the server detects inexistence of response from the client and kill the server process bound to the client. • Transaction underway is automatically rolled back.

3.9.2 Means for batch processes

3.9.2.1 Circumstances

Batch processes deal with periodical, centralized operations of CIS.

This guideline is settled in view of these points:

- Efficiency

  Most of batch processes run at scheduled period (e.g. at nighttime). To reserve enough time for expandability and reliability (re-run the processes in case of failure), batch processes should be efficiently designed.

- Productivity

  Excessively elaborate means should be avoided for proper productivity.

3.9.2.2 Definition of batch processes

Batch processes in CIS are defined in following ways:

1) Characteristics of centralized / scheduled operation

   Batch processes deal with the centralized operation on usually large amount of information, such as summarizing statistical information from raw data or exchanging bulk of data with other systems. Batch processes are executed in scheduled period.

2) Classification of batch processes

   Batch processes are classified into these categories:

   i) Intersystem communication processes

      These processes manage data transmission between CIS and other systems.

      Example: Data exchange processes between CIS and CFRS

   ii) Update processes

      These processes update database by newly brought-in data into CIS.

      Example: PIB registration process

   iii) Referential processes

      These processes refer database to create summarized information.

      Example: PIB statistical data creation process

   iv) Database management processes

      Example: data backup process

3) Disposition of processes

   Figure 3.9.2.2-1 shows the outline of disposition of batch processes.

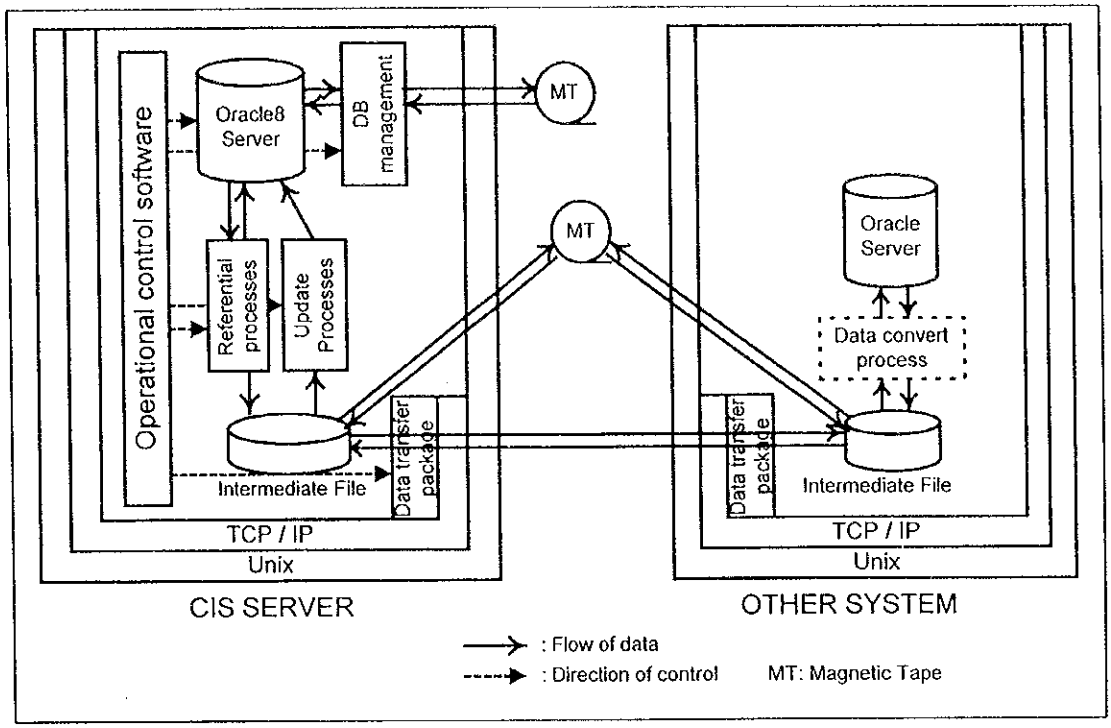


Figure 3.9.2.2-1: Disposition of batch processes

- Operational control software

  This package software controls Oracle database and all the batch processes on the server. Scheduled execution, monitoring, retry in case of failure of processes will be supported.

  For more information, refer to 3.5.7.

- Intersystem communication processes

  Data are transferred through online connection or offline media (e.g. magnetic tape).

  Data transfer package will be used in online communication.

  Detailed discussion on these processes is in 3.9.5.

- Update processes

  These processes update database by new data from other system.

- Referential processes

  These processes create summarized information from existing database. Some of the results are stored in the database as summary or statistic table and others are stored out of database as intermediate files.

- Database management processes

  These processes backup / recover database and manage database (e.g. re-creation database for performance).

  Details of these processes are described in 1.8.6.

3.9.2.3 Scheduling

Batch processes are executed during offline operation period in a day, i. e., nighttime. Batch processes are organized in the schedule according to their characteristics of operation.

1) General schedule

Figure 3.9.2.3-1 shows general schedule of one off-line operation period.

Offline operation period is divided into batch operation time and spare time. In order to guarantee retry in case of failure, batch operation time is required to be shorter than a half of offline operation period.

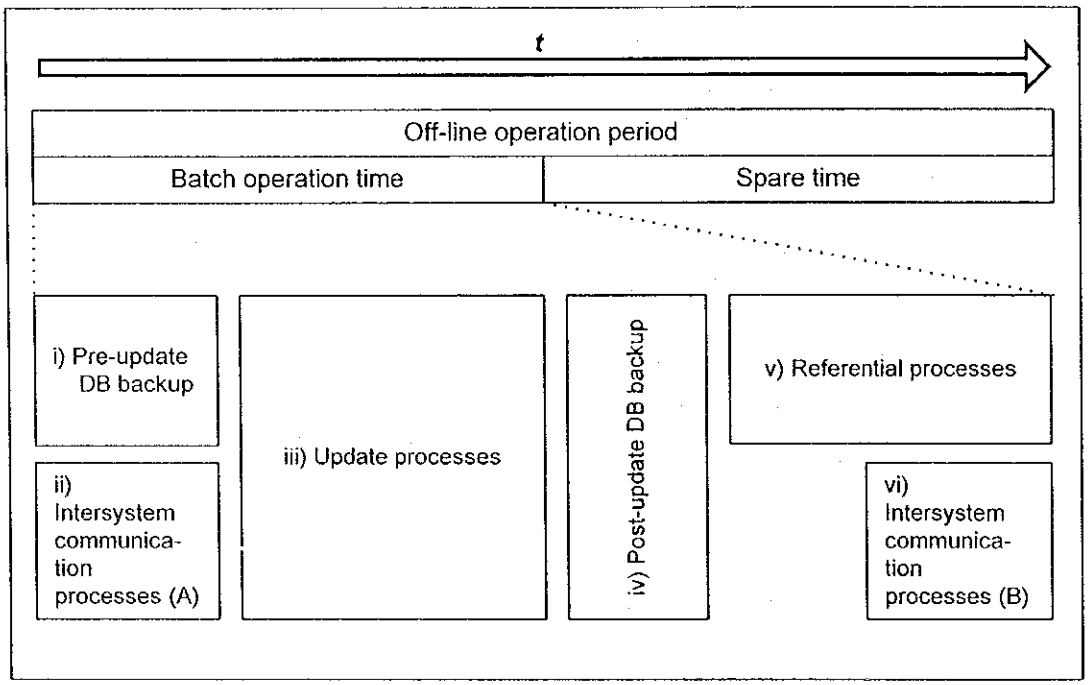


Figure 3.9.2.3-1: General schedule of batch processes

Following groups of processes are placed in the batch operation time:

i) Pre-update DB backup

The results of preceding online operations are backed up.

ii) Intersystem communication processes (A)

At the same time with pre-update DB backup, data from other systems are transferred into CIS. The transferred data are stored as normal file; e.g. ASCII, CSV, or other forms of file. The data are not imported into the database at this point.

Transmission can be either online (through network) or offline (by magnetic media).

iii) Update processes

The CIS database is updated with the data transferred into CIS.

iv) Post-update DB backup

Updated DB is backed up.

v) Referential processes

Summarized / statistical information is created from updated DB.

vi) Intersystem communication processes (B)

Required data from CIS to other systems are transferred.

Transmission can be either online (through network) or offline (by writing information on magnetic media).

Note that the necessity of backup processes depends on operation of DB. In some operating mode, the DB can store information for recovery during updating.

2) Scope of retry

When processes fail on execution, they should be retried by following predetermined procedure. To simplify recovery procedure, retrying should be done within process groups shown in Figure 3.9.2.3-1.

In case of database crash, the database should be recovered from latest backup before retrying failed processes.

3.9.2.4 Guidelines for process design

Guidelines for design of batch processes are divided into two categories. First one concerns to relationship between user-developed batch processes and operational control software. Second one shows database access policies to improve efficiency.

1) Process structure

Each batch process should be divided into simple modules with single function. Each single function in batch process is called job. Generally, several jobs make up one batch process (job net). Figure 3.9.2.4-1 shows concept of job net.

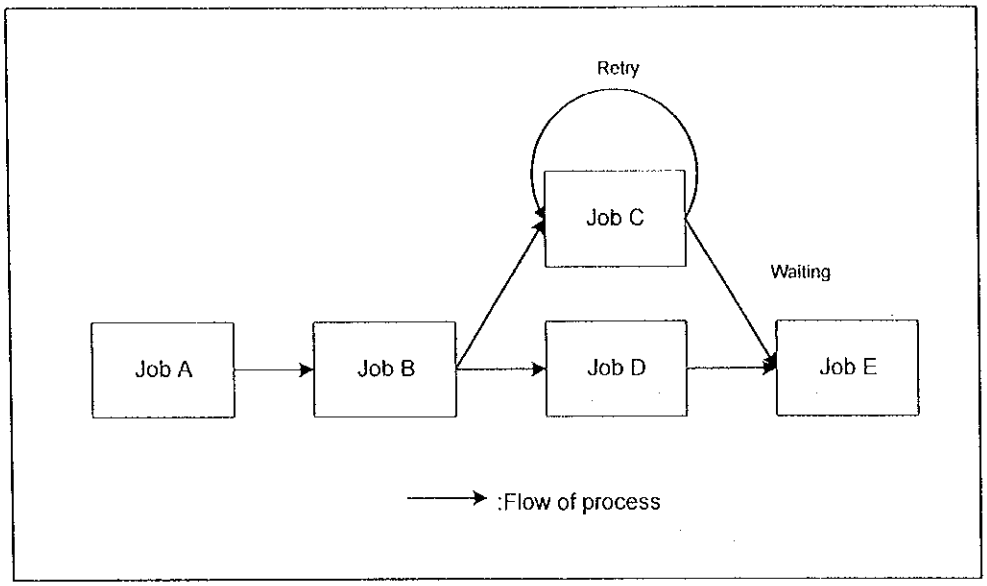


Figure 3.9.2.4-1: Concept of Job Net

In this example, one batch process (job net) consists of five jobs. At first Job A and job B are executed sequentially. Then job C and D are executed simultaneously. Job C is programmed to retry in case of failure. After both of job C and D are completed, job E is executed.

In job net, management of job flow (shown as arrows in Figure 3.9.2.4-1) is performed by operational control software. Each job (user process) is developed in 3GL (e.g. C, C++, COBOL) or shell script.

Figure 3.9.2.4-2 illustrates relationships between operational control software and user processes.

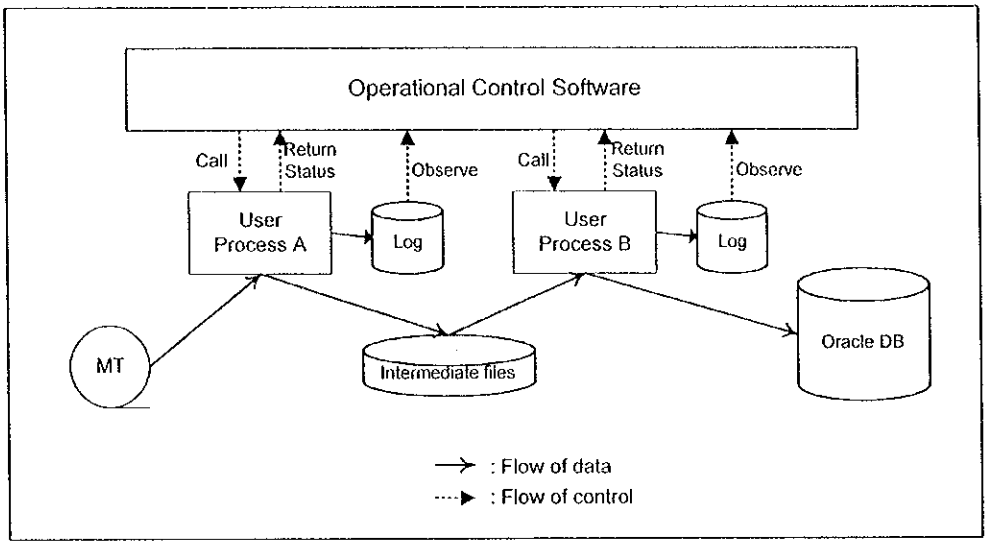


Figure 3.9.2.4-2: Operational control software and user process

The guidelines regarding structure of user processes are follows:

- Each user process should perform single function

  Each user process is required to perform single function. Complicated operation management, such as conditioned branch to other job must be performed by operational control software. This provides visibility of job management (by GUI of operational control software), and increases flexibility and ease of maintenance.

- Each user process should return status to operational control software

  Result of execution of user processes must be notified to operational control software by returning execution status. This information is used to manage the flow of following jobs in the same job net.

  Generally, these four statuses represent result of execution:

  i) Normal

     User process was successfully executed.

  ii) Warning

     Some abnormal situation was detected through execution of the process. The execution of the process was, however, completed.

  iii) Failed (able to retry)

     The execution of process was failed because of some errors. The process can be retried without special recovery process.

iv) Failed (unable to retry)

The execution of process was failed because of some errors. The process requires special recovery processes before retrying.

- Each user process should output log

  User process should output information regarding each execution into log file. Operational control software observes the log of each process. Especially in case of process failure, the log files give information to investigate the cause of failure and the information that to what point the job is performed (e.g. number of processed data).

2) Database access

Policies of database access for batch processes differ from those of online processes. It comes mainly from the amount of data each process manages at one time and concurrency of the processes. For detailed discussion of concept of transaction, refer to 3.9.1.

Below is the list of guidelines for database access:

- Use long transaction scope.

  Instead of committing each modification, commit to database after some amount of modification is made on the database. Definite size of commit unit should be determined after tuning on actual database in product phase.

- Apply specific rollback segment.

  As the result of following the guideline above, each batch process requires larger space of rollback segment than that of online processes. Prepare dedicated rollback segment for such processes and explicitly apply it to ensure proper space.

- Drop index during updating.

  Updating indexed tables impose the database with heavy load. If amount of update on such table is large enough, follow this procedure: [a] Drop index from the table. [b] Update table. [c] Re-create index.

  This produces the same result with lower database load.

- Utilize set operation functions of SQL.

  Batch processes should utilize set operation function of SQL to extract high performance from the database engine.

  - Set operation

    Operations to the same kind of records in tables, or operations to gather statistical information, such as number of records, sum, average, standard deviation, and so forth,

should be described as one operation to the specified set in the database. Repeating the same SQL in the loop should be avoided.

- Merge / sort operation

  Operation contains several joins, or sorts of tables must put them together into one SQL command instead of creating temporary tables step by step.

3.9.2.5 Guidelines for error handling

This sub-subsection explains basic guideline for the batch processes to handle the error in CIS. There are several points that errors may occur on the server and network (refer to Figure 3.9.2.2-1). For the errors occur on the components other than user process, such as OS or RDBMS are discussed in 3.2.7 and 3.5.5.

Table 3.9.2.5-1: Points of error occurrence and handling (1/2)

Category	Incident	Handling and expected result (Upper: OS or package software lower: user process)
OS	OS crash	• The data before running the process is restored from backup after re-start.
		• Unable to handle.
Operation control software	Operation control software failure	• Manual operation is required for recovery.
		• Unable to handle.
Data transfer software	Data transfer software failure	• Retry the transfer for some fixed times.
		• User processes have no relation to the incident.
RDBMS	RDBMS failure	• The data before running the process is restored from backup after re-start.
		• Record the information regarding the incident into log file. • Return the information to operational control software.

Table 3.9.2.4-1: Points of error occurrence and handling (2/2)

Category	Incident	Handling and expected result (Upper: OS or package software lower: user process)
User process	User process failure	Operation control software starts up defined recover processes following the information from the failed process.
		User processes should gather the information regarding the failure. Before the termination, the process should return and record the information both to operational control software and into log file.

3.9.3 Means for printing process

3.9.3.1 Overview

One of the requirements for CIS is to be able to produce printouts. Therefore, CIS must provide a mean for users to print. Two types of printing scheme that will be used in CIS are client and server printing. Each method is used to satisfy different printing requirements.

Server printing is used to print out reports in bulk volume or reports that consist of a large number of records. This type of reports cannot be printed on relatively slow laser printers available for the CIS clients.
To provide CIS with such function, high-speed printers will need to be installed on the server. There are several options for installing high-speed printers, each option has it's own advantages and disadvantages. For CIS, the recommended configuration is to use high-speed impact printer on each of the CIS server. This method has the following advantages:

- High-speed impact printers are relatively less expensive.
- The server computers can process the print jobs faster than the clients can without the need of additional hardware.
- Print jobs can be scheduled to start during off-hours.

Client printing is used to print out more smaller and frequent reports. In CIS, this type of printing requirement will be accomplished by the client machines. This method has several advantages:

- Printers can also be used to print data from other applications
- Printing function is localized. Therefore, offices without a CIS server do not need to cross the WAN for printing.
- Resources are widely distributed to avoid bottleneck in a centralized server printer. Client printers installed in each office provide higher availability for end users than server printer does.

3.9.3.2 Configuration for server printing process

Figure 3.9.3.2-1 illustrates the printing process that will be implemented in CIS

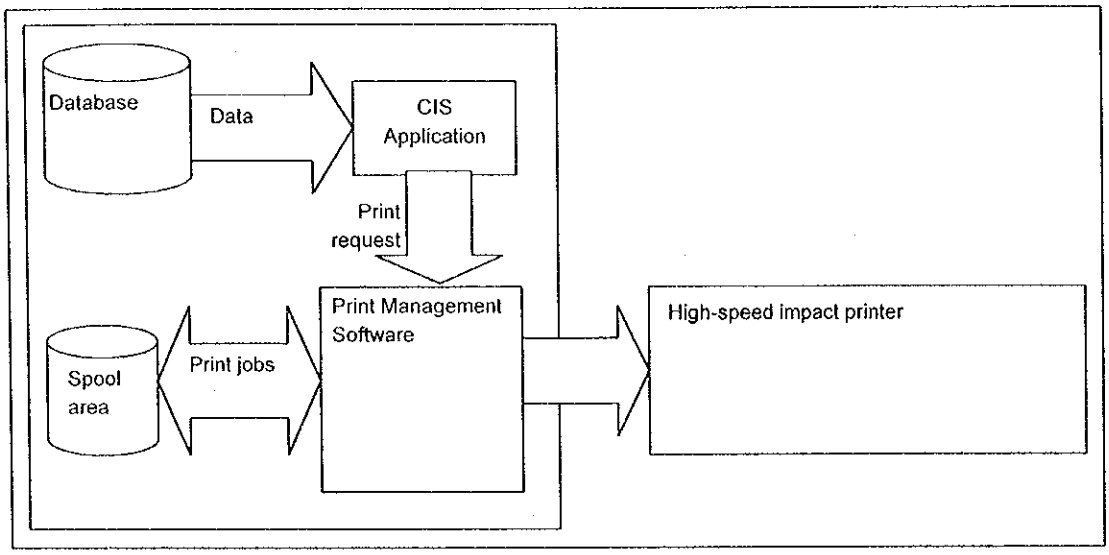


Figure 3.9.3.2-1: Server printing

The above printing process will not be accomplished by the CIS application but by print management software. The CIS application will only submit the print job to the print management software, and for the CIS application the printing process is finish. Once submitted to the print management software, the print job will be spooled and sent to the printer. The print management software will handle any error that happens afterward, such as paper jam, out of paper, off-line. In that case, an appropriate error message will be displayed and the operator will need to clear the error and the print management software will resume the printing process. In the case of a lost print job, the operator will need to re-print the report from the CIS application.

The following are minimum required functions in the CIS server printing:

- Print job scheduling for batch printing.
- Recover from error by re-printing spool file
- Ability to interrupt print-job.
- Notification for users on printing events, such as error or finish printing.
- LPD/LPR compatible.

3.9.3.3 Configuration for client printing process

The printing process is illustrated below.

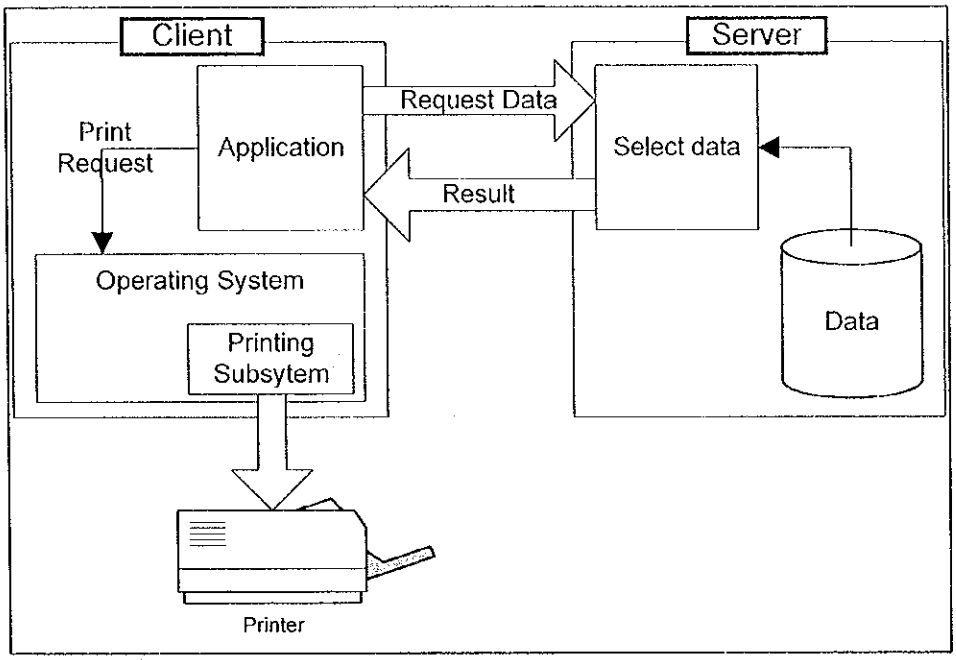


Figure 3.9.3.3-1: Client printing

There are two points that need clarification in the printing process:

- The printer can be a networked printer or a printer physically attached to the client machine. However, printing will only be limited to the printer inside the corresponding local network. Printing to other locations across the WAN should be restricted.
- The operating system handles the actual printing process. Once the print-job is submitted by the CIS application to the operating system, the printing process is done from the CIS application standpoint. Any subsequent errors are not handled by the CIS application, but are handled by the operating system instead. It is the task of the operating system to find the appropriate printer (in the network, if it is a networked printer) and handle any subsequent errors. Such errors may include, out of paper, turned off, disconnected, and so forth.

3.9.4 Means for sending/receiving e-mails

3.9.4.1 Circumstances

One of DJBC's activities is to exchange information on NI/NHI. Currently, NI/NHI are circulated in all DJBC offices in Indonesia by means of letter, telephone, and/or facsimile. DJBC requires that CIS provide a means to notify NI/NHI changes to the end users of CIS in DJBC offices.

There are several means of communication and messaging system, and each has its own advantages and disadvantages. After carefully considering the cost, performance, ease of maintenance, and flexibility, the JICA Study Team recommends the use of an e-mail system that is modeled after the Internet technology, as the NI/NHI notification function.

3.9.4.2 Components of an e-mail system

In an Internet model, e-mail system consists of three components:

1) Mail Delivery/Transport Agent (MTA)

   This component is responsible for delivering e-mails to correct destinations. This component resides on the mail server.

2) Post Office Server

   This component is responsible for handling requests from users to access their mailboxes. Currently, there are two major protocols to handle users' requests: POP and IMAP. POP provides an off-line model, and IMAP provides an on-line model. This component resides on the mail server. To receive e-mails from other server, the Post Office Server itself needs the Mail Transport Agent.

3) Mail User Agent (MUA)

   This component is used by the user to access the Post Office server and read their e-mails. The Mail User Agent also has an e-mail editor to compose e-mail messages.

Figure 3.9.4.2-1 illustrates the interactions among the above components and steps in sending and receiving e-mails. To deliver the message, the MUA contacts the MTA. The MTA then spools the e-mail first before transferring it to the destination Transport Agent or a gateway Transport Agent. When the MTA receives e-mail destined for users in its server, it will store the e-mail in the Incoming Mail Spool. E-mail user then contacts the Post Office server to retrieve their e-mails from the Incoming Mail Spool.

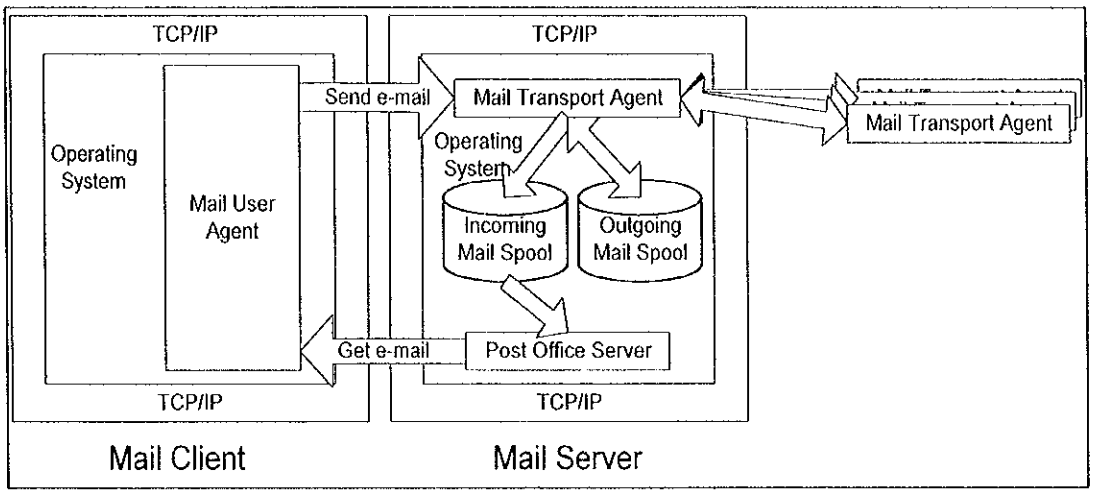


Figure 3.9.4.2-1: E-Mail system components

3.9.4.3 MAPI

MAPI is Microsoft implementation of an application program interface that provides access to messaging services. MAPI provides resources to programmer for cross-platform messaging that is independent of the operating system and underlying hardware and that makes applications mail-aware. MAPI is made up of a set of common application programming interfaces and a dynamic link library.

There are three common types of MAPI applications:

- Electronic mail clients
- Message-enabled applications
- Message-aware applications

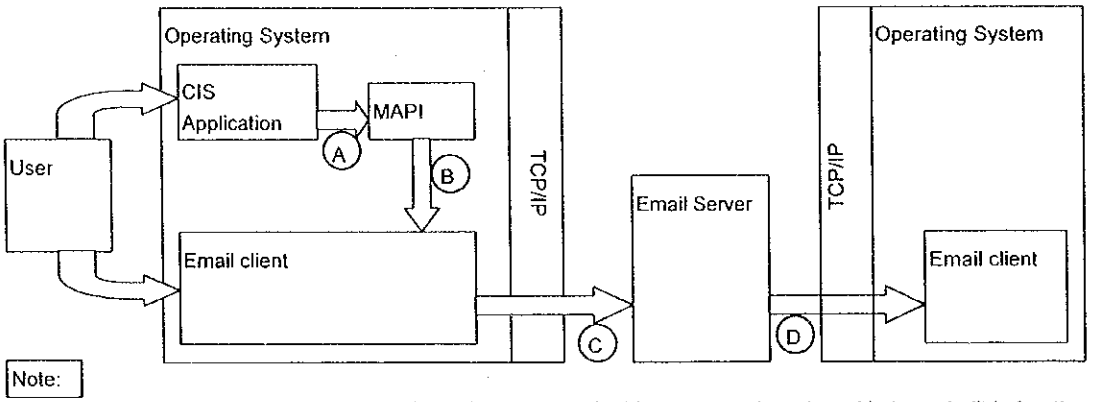
Electronic mail clients and Message-enabled applications are applications that provide a more complex messaging services as their basic functionality.

The most basic MAPI service is the ability to provide a program with interface for sending mail. The feature provides the user a way to send output to some other e-mail address, in a way similar to a print feature that allows sending out output to a print device. Usually, this feature manifests itself in a send button or a send menu item.

Adding this most basic form of MAPI service to an application makes it "MAPI-aware" or Message-aware. Message-aware applications do not have e-mail services as a basic part of their functionality, but provide the service as an added feature. Message-aware applications usually treat e-mail services just like any other storage or output location, such as disks drives, printers, and modems.

3.9.4.4 Connection with the CIS application

The CIS application will not have its own e-mail application or service for NI/NHI notification. Rather, the CIS application will be developed as a "MAPI aware" application. The CIS application will provide send-report feature that will call an e-mail application and pass the necessary information for sending. The next figure explains the flow of sending NI/NHI notification through e-mail.



Note:

A. MAPI calls from the CIS application developed by Developer/2000 are automatic and provided as a built in function by Oracle.

B. MAPI will then opens e-mail client and include the result of the CIS report as an attachment.

C. When the send button is clicked, e-mail client application will send the e-mail to the e-mail server. Depending on the destination, the e-mail server will then forward the e-mail to the correct server.

D. The e-mail will be spooled and the recipient can retrieve it to their computer.

Figure 3.9.4.4-1: Operational flow

In connecting applications developed by using Oracle tools, several parameters must be considered. They are listed in Table 3.9.4.4-1.

Table 3.9.4.4-1: Parameters in connecting with e-mail through MAPI

Variable Name	Value	Description
DESTYPE	"Mail"	• Sends the output to the mail users specified in DESNAME. The report can be sent via e-mail to any mail system that is MAPI compliant or has the service provider driver installed. The report is sent as an attached file. • If DESTYPE is set to Printer, File, or Mail, the Print Job dialog box will appear after you accept the Runtime Parameter Form, unless it is suppressed. After the Print Job dialog box is accepted, the report is executed and the output is sent to the printer (specified in File-->Choose Printer), file, or mail id. • The appearance of the dialog box varies between operating systems.
DESNAME	<UserID>	Is the name of the output device. In this case it refers to the mail user id.
MODE	"BITMAP" "DEFAULT" "CHARACTER"	Specifies whether to run the report in character mode or bitmap. This enables you to run a character-mode report from bit-mapped Oracle Reports or vice versa.

3.9.4.5 Required software

To realize the above function, application for each of the components mentioned above is required.

- Mail Transport Agent.

  In most cases, a UNIX operating system distribution will include this application. The most widely used software in this category is Sendmail. For CIS, the MTA must conform to SMTP/MIME standard for delivery of e-mail using TCP/IP transport with attachment.

- Post Office Server.

  This type of applications is also included in most UNIX distribution, with options whether to install or not.

- Mail User Agent.

  This type of applications is the most visible to the end users. Example of this type of application is Messenger from Netscape, Exchange and Outlook from Microsoft, Eudora, and so on. The requirement for CIS use is that these applications are:

  - MAPI compliant
  - Support SMTP for message delivery
  - Support IMAP for message checking

- Support MIME for attachment.

For actual software used, refer to 3.8.3.

3.9.4.6 Account design

According to the results of hearing, the accounts for e-mail are limited only for NI/NHI notification use. The accounts need not to be assigned to individuals. The accounts should be assigned for each office as a unit. Therefore the accounts will be shared among the officers in the same office with the exception of the head of the office.

The user accounts will not be the same as the CIS user accounts. E-mail user accounts will be handled by the operating system.

Complete explanation on account design can be found in General Network Design.