

**FACULTY OF COMPUTER SCIENCE AND
INFORMATION TECHNOLOGY
UNIVERSITY MALAYA**

Perpustakaan SKTM

**LEAVE MANAGMENT REPORTING SYSTEM
(LMS REPORTING)**

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ABSTRACT

Leave Management System (LMS) Reporting is an analysis tools that used to generate report. This system is implemented in many large companies to manage their staff attendance and leave. It can generate report base on the ISO standard. Besides, it also helps to analyze staff leave in a more organize method.

This purpose of my thesis is to develop a LMS Reporting that integrate into the FSKTM LMS. As the major function of this system is to generate reports, Crystal Report 9.0 has been chosen to help in generating the dynamic reports. The system is running on the .NET framework and ASP.NET is use to develop the system. For LMS Reporting database, SQL Server 2000 is used store the data and ADO.NET is used to access data.

Basically, LMS Reporting is an application service that allows administrator and staffs in FSKTM to generate the report either in bar chart or table form, based on the users' criteria. This system provides filtering function that allows users to access record in different method such as select by department, name, academic staff, non-academic staff and date. Besides that, this system allows staff to convert their leave balance to cash amount or bring forward leave balance to next year.

As a conclusion, LMS reporting is a tool that helps users to perform the analysis easily. It also generates a report based on the format, criteria and requirements stated by the end users. With these advance features, LMS Report save users time, cost and provide high performance.

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CHAPTER 1: INTRODUCTION

1.1 Project Overview

Leave Management System (LMS) was started in 1999. The purpose of developing this system is to manage the staffs' leaves and attendance. This system allows a staff to apply for leave, to login and logout, to convert staff's leave balance at the end of year and also to apply staff activity. But this system does not provide the reporting functionality. Therefore, the administrator has to analyze staff's leave report manually. This is time consuming and inefficient.

LMS Reporting has been implemented into LMS to cater for the increasing demands of report generating features alongside the current LMS system. This system eventually becomes one of the major supportive modules inside the LMS. LMS Reporting is a powerful tool that allows user to generate different kinds of report.

LMS Reporting system has two main users; they are the administrator and staff. Administrator and staff are allowed to filter its information according to their needs. They are also allowed to generate a graph and then compare it to their record base. The generated reports can be converted into PDF, word document and HTML format, which is very flexible and user friendly. LMS Reporting provides six kinds of reports to users; they are Leave Report, Conversion Report, Activity Report, Attendance Report, Staff Report and Nonworking Date Report.

1.2 Statement of Problem

Problem of current LMS reporting:

Report analysis in FSKTM becomes one of the critical tasks because of the increasing staffs every year. Administrator will face problems when analyzing data because of the complexity of data. Therefore, the reporting tool will be implemented to increase efficiency and minimize human error. Below are problems that faced by the current reporting system:

- **Time consuming and inefficient**

Administrator has to analyze data manually from the database and use excel to generate graphs from the database. It is time consuming and inefficient.

- **Does not abide by the ISO standard**

The current reporting format does not show the analysis clearly every time administrator generates a report. Furthermore, the format of the report does not follow the ISO standard in generating report.

- **Lack of reporting format**

Administrator feels difficult to present their analysis due to limited reporting format. Administrator cannot find the suitable format to present their analysis.

- **Lack of reporting functionality**

Current system does not provide graph analysis for users. Besides, this system also provides poor filtering functions for users and is not user-friendly.

➤ **Current reporting system is costly**

Existing reporting system involves high manpower to analyze reports. Indirectly, this situation will raise the analysis cost.

➤ **Current conversion function does not work**

The conversion function in the current system does not work at all.

1.3 Objectives

The objectives of developing LMS reporting system is:

- **To study the current LMS reporting**

To study the current system and invent a more powerful reporting tool for users.

- **Reduce the amount of work done through the orthodox method**

Users are allowed to generate a report by clicking a button instead of analysis the data manually from database. System will automatically generate the report that users want. This in turn, saves a lot of time.

- **To generate reports according to the ISO Standard**

To develop a report format based on ISO standard to meet the university and faculty requirements.

- **Provide variety of report**

To develop a system that provides a variety of reports to users to make the analysis more accurate. For instance, bar charts, pie charts and table analysis are provided.

- **To generate report according to users' criteria**

Users can generate reports based on their own criteria. For instance, users can choose the report format either in graph or table form. Besides, it can also highlight a record chosen by the user automatically.

- **Reduces human errors, improve the quality in analyzing the report**

The entire records are analysed by this system. Therefore, the mistakes when users performed during analysis are reduced and this can improve the quality and accuracy of the report.

- **To develop a conversion system and conversion reporting system**

To allow staffs to transfer their leave balances, either into cash or to bring forward to following year. Besides, it also allows users to print report.

1.4 Project Scope

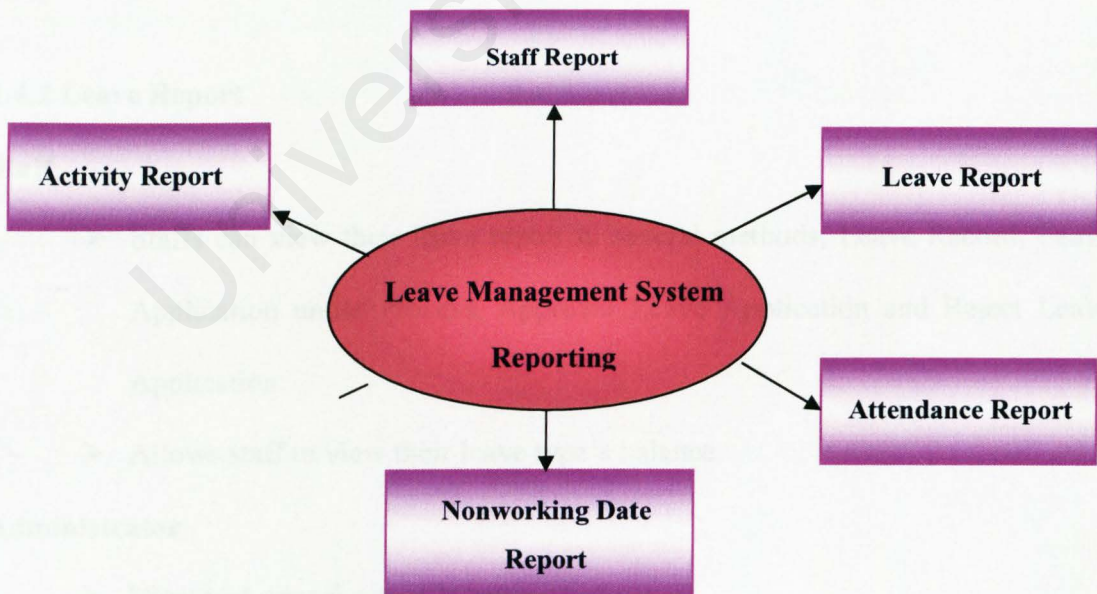


Figure 1.1 Project Scope

Basically LMS Reporting is divided into six main modules that is shown in figure 1.1; They are Staff Report, Attendance Report, Leave Report, Activity Report, Conversion Report and Nonworking Date Report.

1.4.1 Staff Report

Staff

- View and print their information.

Administrator

- View and print staffs' information.

✚ All records are sorted by name.

✚ This function allows administrator and staffs to summarize the report field such as Login name, phone number, and department code in a table.

1.4.2 Leave Report

Staff

- Staffs can view their leave report in several methods; Leave Record, Leave Application under Process, Approval Leave Application and Reject Leave Application.
- Allows staff to view their leave type's balance.

Administrator

- View and print the staff leave.
- Filtering function. Such as select name, date and etc.

- ✚ Administrator and staff can select duration to generate leave report, either in tables, bar graphs or pie charts format and also compare leave types.

- ✚ Records can be sorted by name or date.

1.4.3 Attendance Report

Staff

- Staffs are allowed to view and print their own attendance.

Administrator

- Administrator can view and print staff attendance summary and also attendance detail.

- ✚ Filtering function. Select attendance by date.

- ✚ The system can highlight staff record when staffs' attendances are poor.

- ✚ Records can be sorted by name or date.

- ✚ Generate a bar graph or a pie chart to analyze the staff attendance.

1.4.4 Activities Report

Staff

- View and print.

- Allowed cancellation and editing of their own activity.

Administrator

- Allowed to view and print staff activity

- Filtering function.

- ✚ Records are sorted by name or date.

1.4.6 Nonworking Date Report

- Nonworking day report is a function that allows staffs and administrator to view or print the entire year's holiday.
- Administrator is allowed to edit a nonworking day.

1.5 Expected Outcome

- System can perform some basic function to meet some important criteria such as stability, consistency, reliability and user friendly.
- System will be able to generate reports such as bar charts and pie charts to make user's work easier.
- Provide a flexible reporting function that allows users to generate reports based on the format, criteria and requirements stated by the end users
- System should be able to convert staffs' leave balances to either cash or to carry it to the following year.
- The final implementation should allow future enhancements as well as additional modules to extend the system's functionalities.

1.6 Project Schedule

In order to organize the development phase of the system, a schedule is essential to develop the system in a more proper manner where the development phase follows a

certain time frame allocated. Below is a Gantt chart on the development phase scheduled along the intended time frame for each phase of the system.

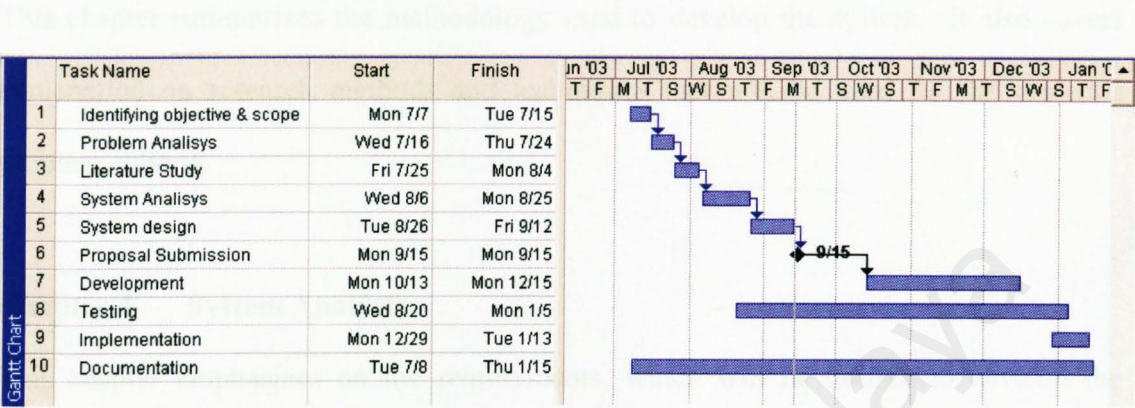


Figure1.2: Project Schedule

1.7 Chapter Overview

This report is further divided into chapter as below:

Chapter 1 Introduction

This chapter serves as an introduction to the entire project. This chapter includes project overview, problem of statement, objectives, project scope, expected outcome, project schedule and chapter overview.

Chapter 2 Literature Review

This chapter focuses on the analysis of the current system, compared to the proposed system. Mainly, it consists of discussions on the World Wide Web and the analysis of existing procurement systems. It also includes consideration on some of the development tools and technologies for the project.

Chapter 3 Methodology

This chapter summarizes the methodology used to develop the system. It also covers explanation on research methods and techniques that will be used for the project's problem solving.

Chapter 4 System Analysis

This chapter emphasizes on the requirements, which will be needed to develop the project. It includes lists of the software and hardware specifications. Functional requirements of the system are expressed in use case diagrams. Besides, non-functional requirements are also included in this chapter.

Chapter 5 System Design

This chapter explains the conceptual and technical design of the system. It covers the context diagram, DFD, ER-diagram, database design and user interface design.

1.8 Project Summary

This chapter serves as an introduction to the entire project. Project overview explains the feature and advantages of LMS reporting system, while the statement of problems highlights the problems and obstacles faced by current LMS reporting system. In addition, relevant and associated topics are being discussed; the topics included are project objectives, project scope, expected outcome, problem of statement and project schedule.

Next chapter is the combination of literature review and literature research. It focuses on the analysis and comparison among existing system. Besides, brief explanation is given on research topics, such as development models, system architecture, application platform, servers, programming languages and database technologies.

CHAPTER 2: LITERATURE REVIEW

2.1 Definition of Literature Review

Literature review is summarizes, interprets and evaluates existing published material or information in order to establish a current knowledge of subject. Literature review help to resolve a controversy, establish the need for additional research, and define a topic of inquiry.

Beside, the main purpose of the literature review is to guide or help researchers to use the best way to analysis information have found, access it, synthesize and evaluate it according to the gilding concept. This can help researcher find new ideas or skill to develop the system though the information their have found and analysis.

2.2 Information collection techniques

It is important to find or collect information from various sources to seek further understanding whit the new system. The information after analysis by researchers can help them more understand why the system need. My information findings sources are generally divided into 4 namely internet, printing document, analyzing pass year thesis and discussions with friends and lecture.

2.2.1 Internet

Internet surfing is the main source because of the high speed and up-to-date information. Internet surfing also can help research to find latest technologies trend and development

skills. Beside, relevant information on reporting, client-server and programming tools are been obtained.

2.2.2 Printing Documents

Reference books like software engineering and system analysis design also important to develop on mythology and system design. They can be found from library. These two books provide sufficient information to gain a better understanding about the concept of choose the right methodology and develop system design like drawing DFD diagram.

2.2.3 Analyzing Pass Year Thesis

Pass year thesis have been done by student can be used to identify any potential mistake and to gain some skills on software development.

2.2.4 Discussion With friends and lecturer

Useful advises have been given for each section meeting conduct with my supervisor. Discussion is an effective way to find out the mistake or error in system and find out the solution.

2.2.5 Discussion with end user

Have a discussion with end user to ensure the user requirement. Beside, it also can help me to more understand about my system.

2.3 Current System

2.3.1 Case Study 1: Dynamic Sample Company (<http://www.dynamic.com.hk>)

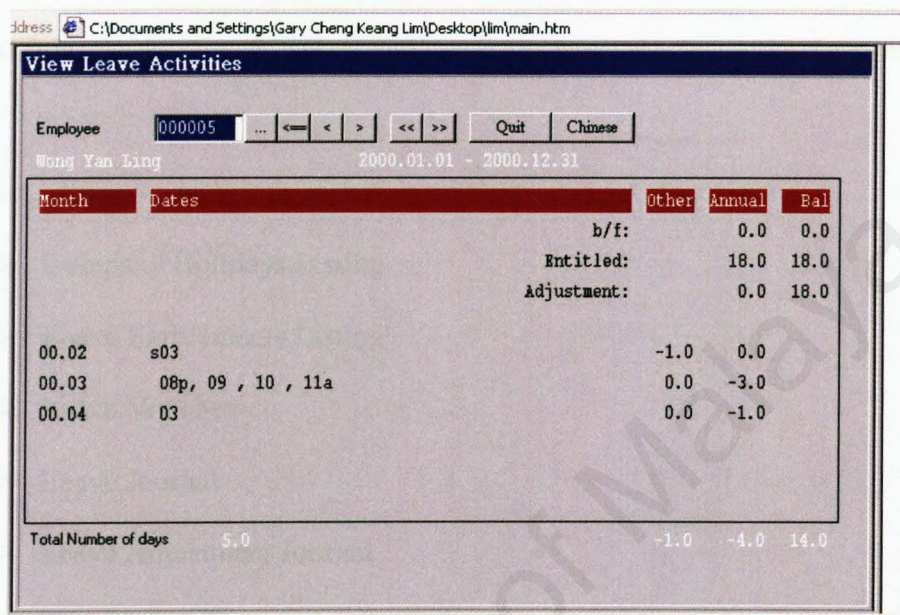


Figure 2.1: Leave Activity Report

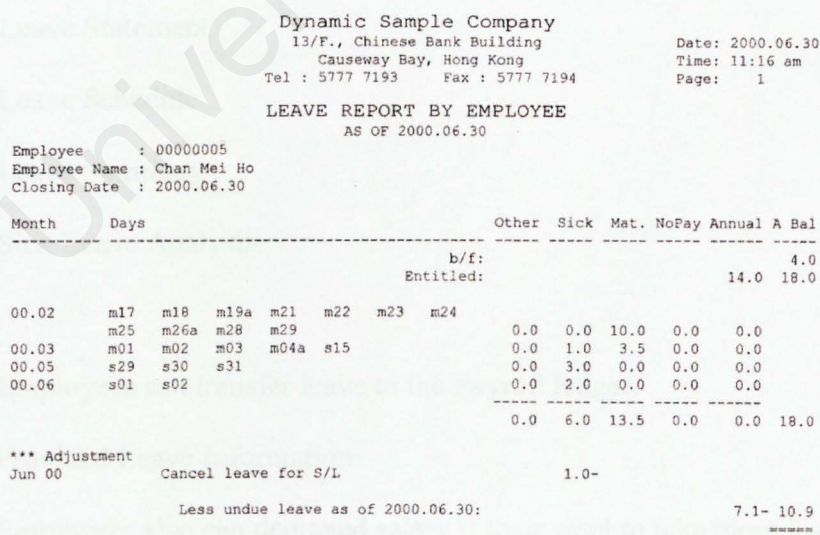


Figure 2.2: Leave Report in word document format

This ledger facilitates the management of employees' holidays. This module is used in conjunction with the Payroll ledger. When the user chooses to transfer the transactions to the Payroll ledger, the Program calculates the amount that should be added to or deducted from the employees' salary and generates payment transactions automatically.

Features:

- Company Holidays Listing
- Leave Entitlements Listing
- Leave Voucher
- Leave Journal
- Leave Adjustment Journal
- Termination Transaction Listing
- Termination Statement
- Leave Report
- Leave Statement
- Leave Schedule
- Leave Summary
- Sick Leave Analysis

Pros:

- Employees can transfer leave to the Payroll ledger.
- Provided Leave Information
- Employees also can deducted salary if their want to take more leave.

Cons:

- Dull and not well designed user interface.
- No graph analysis.
- Employees from different departments are mix together, it hard to find a specify data.
- This system is not allows users to choose the specify duration to generate report. It has to start at 1st January to the date users are generate the report.
- Report only can print out as document format. It does not provide E-mail service to send report to employees.
- Report contents are representing by number. It hard to understand by many users.
- Poor filtering function.
- Interface is not user friendly.

2.3.2 Case Study 2: Report Starter Kit (<http://www.asp.net/ReporsStarterKit>)

Sales by Territory

<u>TERRITORY NAME</u>	<u>SALES</u>
<u>Bellevue</u>	\$105,420.00
<u>Bentonville</u>	\$109,456.50
<u>Chicago</u>	\$18,104.80
<u>Edison</u>	\$21,965.20
<u>Fairport</u>	\$105,222.40
< Prev Next >	
1 of 3	

Figure 2.3 Territory Table

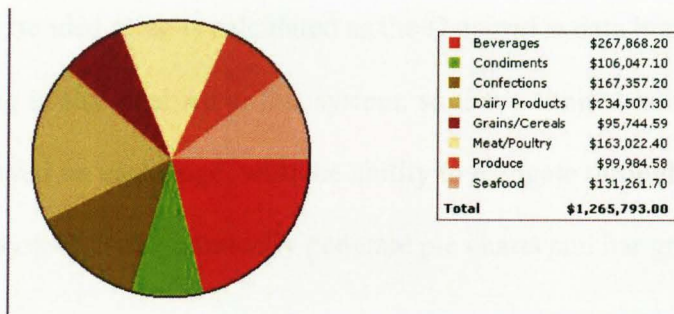


Figure 2.4 pie chart

Category Meat/Poultry				
Product	Units In Stock	Quantity Per Unit	Unit Price	Extended Price
Alice Mutton	0	20 - 1 kg tins	\$39.00	\$0.00
Mishi Kobe Niku	29	18 - 500 g pkgs.	\$97.00	\$2,813.00
Pâté chinois	115	24 boxes x 2 pies	\$24.00	\$2,760.00
Perth Pasties	0	48 pieces	\$32.80	\$0.00
Thüringer Rostbratwurst	0	50 bags x 30 sausgs.	\$123.79	\$0.00
Tourtière	21	16 pies	\$7.45	\$156.45

Figure 2.5 Category Meat/Poultry Table

This case study is taking from report starter kit. This web site have many example of report like crosstab report, drilldoen report, hierarchical report, masterdetail, simple report and text report.

Pros:

- The system provides function that allow user to select duration such as year or month to generate the report.
- Automatically highlight the record based on custom criteria. Like Products are out of stock (designated with a quantity of zero) will be displayed in red.
- Sorting feature is used to sort the data, either in ascending or descending order.

- The extended price is calculated as the Datagrid is data binding.
- Paging is also enabled in this system, so that a limited number of records can be displayed on each page, with the ability to navigate through the pages of data.
- This system can dynamically generate pie charts and bar graphs.

Cons:

- Pie Chart does not show the percentage of sales
- Not well in designing the interface.
- This system did not provide search engine.
- Report can't send by e-mail.

2.3.3 Case Study 3: ERPWEB (<http://www.erpweb.com/home.html>)

Leave Applications under process of Approval

LEAVEAPPID	CONTACTNOS	APPDATE	LEAVETYPE	DAYSAPPLIED	FROMDATE	TODATE
3	3333	06/15/2001	AnnualLeave	2	06/13/2001	06/14/2001
4	567555	07/12/2001 5:23:06 PM	AnnualLeave	1	07/19/2001	07/19/2001

Approved Leave Applications

LEAVEAPPID	CONTACTNOS	APPDATE	LEAVETYPE	DAYSAPPLIED	FROMDATE	TODATE
1	67767	06/15/2001	SickLeave	1	06/11/2001	06/11/2001

Leave Applications On hold

LEAVEAPPID	CONTACTNOS	APPDATE	LEAVETYPE	DAYSAPPLIED	FROMDATE	TODATE
------------	------------	---------	-----------	-------------	----------	--------

Rejected Leave Applications

LEAVEAPPID	CONTACTNOS	APPDATE	LEAVETYPE	DAYSAPPLIED	FROMDATE	TODATE
3	3333	06/15/2001	AnnualLeave	2	06/13/2001	06/14/2001

Figure 2.6 ERPWEB Leave report

CLAIMS Register

Header Note

2 Documents found.

Register Index Page 1 of 1

CLAIMSID	Employee	CLAIMDATE	FROMDATE	TODATE	DESTINATION	PURPOSE	ADVANCEAMT	TOTALN	ACTION
1	JACKY	06/24/2001	06/22/2001	06/25/2001	NEWYORK	BUSINESSVISIT	1000	4000	PRINT
2	HASH	06/07/2001	06/14/2001	06/15/2001	MUMBAI	OFFICIAL	0	2000	PRINT

Rules:Footer Note

07/20/2001 4:25:20 PM

Search

Search

in Column:

CLAIMSID

Figure 2.7 ERPWEB Claim Register

ERPWEB sample reporting system. Usually this system will use by company to manage the company staff attendance, over time claim form staff. Staffs also can claim for the extract income when they go work at out station they can claim for their petrol. Company also can view back staff profile with this system.

Pros:

- This system is provide calendar to user, it save user time instead of type in the specific date.

- System allows administrator to print, fax, E-mail and save the report has been generated.
- System provides search engine to allow administrator and staffs to search information their need.
- Integrate leave application from and leave report together.
- It provides login system so every staffs have their own user name and password this can avoid them to view other staff profile.
- Staffs can claim extract income when they go to out station to work.
- Employees can check or generate their personal file.

Cons:

- This system does not provide graph analysis.
- This System is weak in filtering, such as staffs from different department are mix together.
- This system only can generate personal profile; it can't generate all staff profile in a time.
- This system does not provide function to highlight the characteristic of data.
- This system is not user friendly.

2.4 Architecture

2.4.1 Mainframe Architecture

Mainframe Architecture is the earlier mainframe software architecture. With this software architecture all intelligence is within the central host computer. Users can interact with the host through a terminal that capture keystrokes and send that information to the computer by using PCs and UNIX workstation. Mainframe software architecture is not tied to a hardware platform.

Limitation of this software architecture is this software does not easily support graphic user interface (GUI) or access to multiple databases from different location. In the last few years, mainframe has found a new use as a server in distributed client/server architecture.

2.4.2 File Sharing Architecture

File Sharing Architecture allows server downloads files from the shared location to the desktop environment with original PC networks. The requested user job is then run including logic and data in the desktop environment. The limitation of file sharing architecture is work when shared usage is low, update contention is low and the volume of data to be transferred is low.

Overall, File sharing software architecture provides low ability and usability to users. In order to solve this problem PC LAN (local area network) computer changed because the capacity of the file sharing was strained as the number of online user grew (it can only

satisfy about 12 users simultaneously) and graphical user interfaces (GUIs) became popular (making mainframe and terminal displays appear out of date). PCs are now being used in client/server architectures

2.4.3 Client/Server Architecture

Client/server Architecture was emerged as a result of the limitation of file sharing architecture. This approach introduced a database server to replace the file server. Using a relational database management system (DBMS), user queries could be answered directly. Furthermore, the multi-user updating through a GUI front and to shared database has been improvised. The client/server architecture reduced network traffic by providing query responses rather than total files transfer. Remote Procedure Calls (RPCs) or standard query language (SQL) statements are typically used to communicate between the client and server in client/server architecture.

2.4.4 Report Deployment Scenarios

Crystal Reports for Visual Studio .NET works in a single-tier, two-tier, and three-tier architecture on both Windows Forms and Web Forms platforms.

2.4.5 Understanding Tiers

Think of tiers as forming a progression in terms of scalability. A single-tier application requires that all report components be installed on the user's machine and relies on the client machine for processing. A three-tier application requires only a browser on the user's machine; the application resides on a Web server and accesses a Report Web Service via HTTP. Changes to the application can be made centrally. Furthermore, any

changes to the Report Web Service are reflected immediately, because the application communicates directly with the Report Web Service.

In these scenarios, tiers are defined based on where the Crystal Reports components, or architecture, reside. The type of database being used by the report can also add an additional tier.

2.4.5.1 Single-Tier Applications

A Windows application that contains a local report is based on a single-tier approach where all components are installed on each user's machine. Report components, including the report file (.rpt file) and the Report Engine, are installed with the executable file on the user's machine.

Single-Tier has its own advantages; it is simplicity. Single-Tier application doesn't need to handle any network protocols, so their code is simpler. Such code also benefits from being part of an independent operation. It doesn't need to guarantee synchronization with faraway data, nor does it need exception-handling routing to deal with network failure, bogus data from a server, or a server running different versions of a protocol or program.

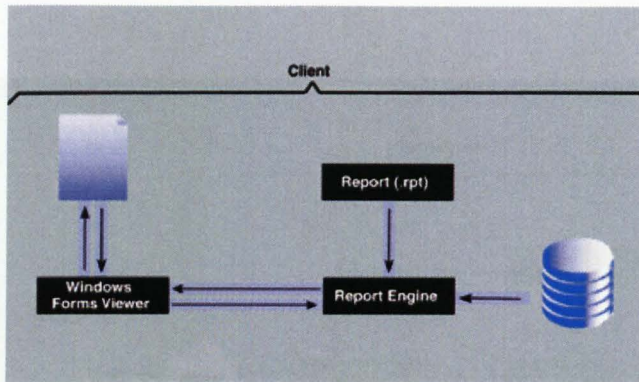


Figure 2.8: Single-Tier Applications

Scalability

Windows applications with local reports are best suited for small-scale deployment since the application is installed on each user's machine. Use this type of deployment when you need to rely heavily on client-side processing. If any changes to the report are required, the application needs to be reinstalled on the user's machine.

2.4.5.2 Two-Tier Applications

Two-Tier architecture was distributed into two layers: client (requester of services) and web server (provider of services). Figure 2.9 depicts the two-tier software architecture. When developers develop a Web application that hosts a local report (.rpt file), the processing is based on a two-tier relationship where any events raised on the client are handled on the Web server.

When a client requests a report from a web server, the Report Engine will get the data from the report (.rpt) and generate a report format that is requested. The Web Forms Viewer will change this report to HTML format that can be viewed by the client.

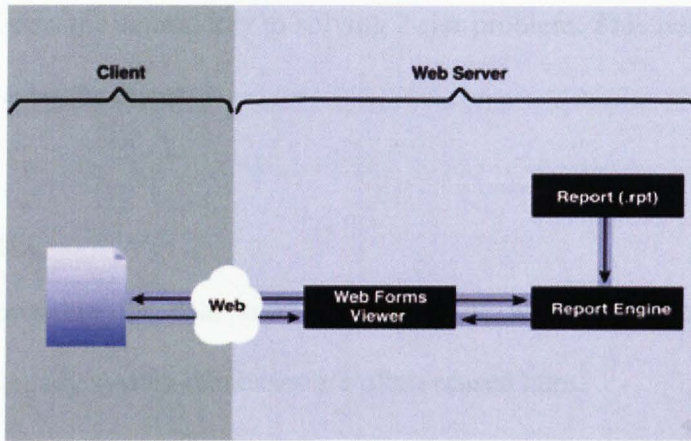


Figure 2.9: Two-Tier Applications

Scalability

Users require only a browser on their machines. All report components reside on the server and can be updated centrally.

2.4.5.3 Three-Tier Applications

Three-Tier Application is distribute to thee layers: client, web server and reporting server show at figure 2.10.

Client:

Client is responsible for the presentation of data, receiving user event and controlling the user interface. The actual reporting logic such as calculating added value tax has been moved to a web server.

Web Server:

This level now forms the central key to solving 2-tier problem. This tier protects the data from direct access by the client.

Reporting Server:

This tier is responsible for data storage. Beside the widespread relational database system, existing legacy system databases are often reused here.

A Report Web Service is a Crystal report that has been published, or exposed, for consumption by an application. Over the Internet, a Windows or Web application can connect to a Report Web Service, consume the exposed Crystal report, and display the report for users by hosting it in a report viewer.

Developer can use a Report Web Service that is part of his/her architecture, or developer can access a Report Web Service that is part of another architecture — such as his/her business partner's architecture.

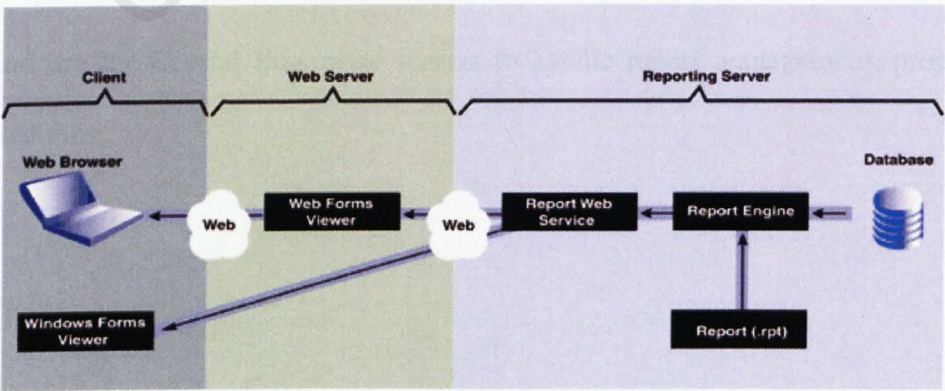


Figure 2.10: Three-Tier Architecture

Scalability

Depending on the type of application, users require only a Windows Forms Viewer or a Web browser to view Report Web Services. All other report components reside with the Report Web Service on a remote server. Any changes made to the Report Web Service are reflected immediately in the application.

2.4.5.4 Enterprise Applications

If you are distributing an application that needs to support report viewing and delivery across a large company, you may require more than one report engine to handle all users' report queries.

Crystal Enterprise provides organizations with a scalable, secure Web-based management and delivery system for Crystal .rpt files to any authorized user, inside the organization or beyond.

Using Visual Studio .NET, you can build applications that can access Crystal Enterprise servers. This enables you to build a small client that you can distribute to thousands of users and use the Crystal Enterprise servers to handle report management, processing, and scheduling.

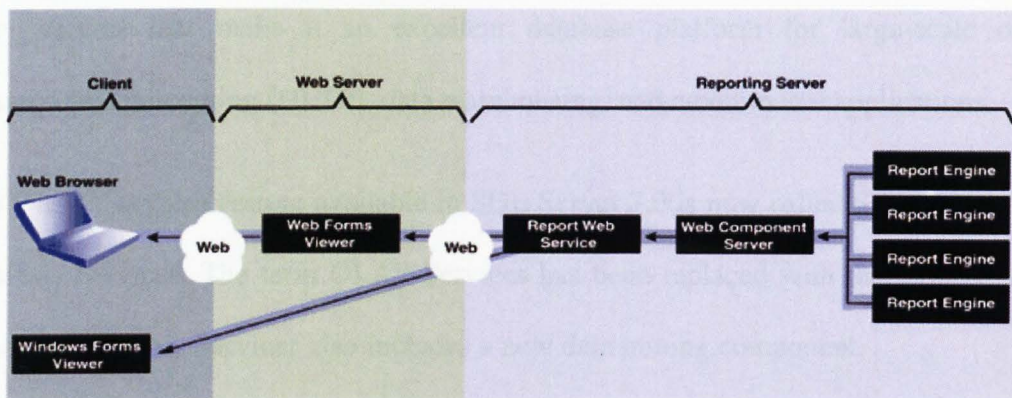


Figure 2.11: Enterprise Application

Scalability

Crystal Enterprise allows organizations to scale up (add more processors) or scale out (add more physical machines) to meet growing user demands. This system delivers web speed performance for both on-demand and scheduled reports. Crystal Enterprise is designed to scale to the enterprise and deliver rich, interactive reports to a broad range of users.

2.5 DEVELOPMENT DATABASE SERVER

Database Server is a place to store structured collection of data. It allows user to add, access, and process data stored in a computer database, a database server is needed. There are several database servers available currently: Microsoft SQL Server 2000, Oracle

2.5.1 Microsoft SQL Server 2000

Microsoft SQL Server 2000 extends the performance, reliability, quality, and ease-of-use of Microsoft SQL Server version 7.0. Microsoft SQL Server 2000 includes several

new features that make it an excellent database platform for large-scale online transactional processing (OLTP), data warehousing, and e-commerce applications.

The OLAP Services feature available in SQL Server 7.0 is now called SQL Server 2000 Analysis Services. The term OLAP Services has been replaced with the term Analysis Services. Analysis Services also includes a new data mining component.

The Repository component available in SQL Server 7.0 is now called Microsoft SQL Server 2000 Meta Data Services. References to the component now use the term Meta Data Services. The term repository is used only in reference to the repository engine within Meta Data Services.

Microsoft SQL Server 2000 introduces several server improvements and new features:

➤ **XML Support**

The relational database engine can return data as Extensible Markup Language (XML) documents.

➤ **Federated Database Servers**

SQL Server 2000 supports enhancements to distributed partitioned views that allow you to partition tables horizontally across multiple servers. This allows you to scale out one database server to a group of database servers that cooperate to provide the same performance levels as a cluster of database servers.

➤ **Backup and Restore Enhancements**

SQL Server 2000 introduces a new, more easily understood model for specifying backup and restores options. The new model makes it clearer that you are

balancing increased or decreased exposure to losing work against the performance and log space requirements of different plans.

➤ **Scalability Enhancements for Utility Operations**

SQL Server 2000 enhancements for utility operations include faster differential backups, parallel Database Console Command (DBCC), and parallel scanning.

➤ **SQL Profiler Enhancements**

SQL Profiler supports size-based and time-based traces, and includes new events for Data File Auto Grow, Data File Auto Shrink, Log File Auto Grow, Log File Auto Shrink, Show Plan All, Show Plan Statistics, and Show Plan Text.

Table 2.1 shows the requirement of SQL Server 2000:

Hardware	Requirements
Processor	Pentium 166 MHz or higher
Memory	32 MB RAM (minimum for Desktop Engine), 64 MB RAM (minimum for all other editions), 128 MB RAM or more recommended
Hard disk space	270 MB (full installation), 250 MB (typical), 95 MB (minimum), Desktop Engine: 44 MB Analysis Services: 50 MB minimum and 130 MB typical English Query: 80 MB

Table 2.1 Minimum Requirements for QSL Server 2000

Cons:

- SQL Server 2000 does not provide equivalent functionality for high availability or data protection.
- SQL Server 2000 requires more investment in storage hardware for summary management.
- SQL Server 2000 does not support stored procedures in any language except their proprietary Transact-SQL language, so they can not write the complex business logic that is supported by Java.

2.5.2 Oracle 9i

Based in Redwood, California, Oracle Corporation is the largest software company whose primary business are database products. The Oracle9i Database is the current release of Oracle's information management solution, providing industry-leading solutions that allow organizations to efficiently store, manage, integrate and use business information. The Oracle9i Database has been designed to provide the most complete and low cost solution for any business information management requirement, and the solution has been provided by Oracle9i is:

- Provide proven performance, scalability, and capacity on demand for any business requirement.
- Guarantee that critical business information is available when needed.
- Secure and protect the privacy of sensitive business information.
- Reduce the time it takes for a business to make better business decisions.

- Enable an organization to develop and deploy business solutions quickly.
- Do more for less.

Oracle9i Database supports all known platforms, including Windows-based platforms, AIX-Based Systems, Compaq Tru64 UNIX, HP 9000 Series HP-UX, Linux Intel, Sun Solaris and so on. Table 2.2 is minimum requirement to install Oracle 9i under the Intel or compatible platforms table 2.3 is for UNIX system:

Hardware	Requirements
Processor	Pentium 166 MHz or higher
Memory	RAM: 128 MB (256 MB recommended) Virtual Memory: Initial Size 200 MB, Maximum Size 400 MB
Hard disk space	140 MB on the System Drive plus 4.5 GB for the Oracle Home Drive (FAT) or 2.8 GB for the Oracle Home Drive (NTFS)

Table 2.2 Minimum Requirements for Intel or Other Platform

Hardware	Requirements
Memory	A minimum of 512 MB RAM
Swap Space	A minimum of 2 x RAM or 400 MB, whichever is greater
Hard disk space	4.5 GB

Table 2.3 Minimum Requirements for UNIX System

2.5.3 Microsoft Access 2000

Microsoft Access 2000 is a powerful relational database application with which a desktop user can efficiently create and manipulate database systems. Access targets the desktop category and works best for individuals and workgroups managing megabytes of data. For multi-user access to the same database, Access uses file-server architecture, rather than client-server architecture. Access is included in the Professional and Developer Editions of Microsoft Office.

As a leader in the desktop database category, Microsoft Access makes it easy for users to find and manage their data to make better business decisions. With strong integration with Microsoft Office, Access offers a similar appearance and functionality to that found in the popular Microsoft Word and Excel applications. For general business users, Access provides easy-to-use wizards throughout, such as the Database Wizard for getting up and running quickly, and the Simple Query Wizard for easily finding information from the data. More advanced users appreciate the power behind the Microsoft Visual Basic for Applications (VBA) programming language, programmable toolbars, and the freely distributable run-time version of Access available with the Office Developer Edition. The combination of ease of use and power in Access makes it the top choice among developers who frequently use Access as a front end to SQL Server in a client-server scenario.

Access has two major components. The first contains an application development environment for Visual Basic for Applications programmers that include forms

technology, reports, and database administration. In addition, as mentioned earlier, there is also the user interface (UI) common to both Access and the other Office applications. The second component in Access, and the main topic of this paper, is the data engine. Before Access 2000, users and developers were using the Jet data engine, whether they knew it or not. In the next version, users and developers will be given a choice of data engines. They can continue with an improved version of the default Access data engine (Jet 4.0), or MSDE, a new data engine option in Access 2000.

The Table below shows these two potential enterprise requirements and how each of the data engines compares.

Requirement	SQL Server (use MSDE if these are future requirements)	Microsoft Access (Jet)
Scalability	SMP support	No SMP support
	Virtually unlimited number of concurrent users	Maximum of 255 users
	Terabyte levels of data	2 GB of data
	Transaction logging	No transaction logging
Business Critical	7X24 support and QFE	No 7X24 support
	Point-in-time recovery	Recoverable to last backup

	Guaranteed transaction integrity	No transaction logging
	Built-in fault tolerance	No built-in fault tolerance
	Security integrated with Windows NT	No integrated security with Windows NT
Rapid Application Prototyping	Access is UI for both engines and offers WYSIWIG database tools and built-in forms generation.	

Table 2.4 Enterprise Requirements for SQL Server and Microsoft Access

2.6 DEVELOPMENT PLATFORM (Operating System)

2.6.1 Windows 2000 Server

Microsoft Windows 2000 Server is the multipurpose network operating system for businesses of all sizes. Windows 2000 Server lets developers share files and printers reliably and securely, choose from thousands of business applications compatible to run today on Windows 2000 Server and build Web applications and connect to the Internet.

Building on the solid Internet technologies delivered in Windows NT Server 4.0, Windows 2000 Server provides a well-integrated package containing the application development environment, security, and scalability you need to get more out of existing applications. Plus can build new and versatile solutions using the most complete set of Internet technologies available. Windows 2000 Server provided user to use the Web to securely connect employees, customer, and suppliers anywhere in the word, build internet line-of-business application that help business run more efficiently, share select

information without compromising confidential data and expand users' network environment as their application needs evolve.

The following describes the features and benefits of Windows 2000 server

➤ **Networking Services**

Windows 2000 Server adds enhanced VPN support through IP Security (IPSec) and L2TP support, network QoS control, Dynamic DNS, native ATM and gigabit Ethernet support, enhanced routing, and improved telephony services. Many key network services are integrated with Active Directory for policy management and central control.

➤ **Storage Services**

Windows 2000 Server adds hierarchical storage management, dynamic volume management, disk defragmentation, encrypting file system, content indexing and searching, distributed link tracking, and sparse file support.

➤ **Printer Services**

Windows 2000 Server adds support for the Internet Printing Protocol and browser access to print servers.

➤ **Desktop and Application Management**

Windows 2000 Server, through IntelliMirror management technologies, goes beyond the basic services provided in NetWare 5.0 by adding group policy management that doesn't require an additional burden on the directory, including

automatic data synchronization and hardware independent software deployment and maintenance.

➤ **Web Services**

Windows 2000 Server adds process accounting and CPU throttling, distributed authoring and versioning, and Digest Authentication.

➤ **Application Services**

Windows 2000 Server adds enhanced component services with support for load balancing and improved performance.

2.6.2 Microsoft Windows NT Server 4.0

Microsoft Windows NT Server 4.0, Terminal Server Edition adds Microsoft Windows-based Terminal support to the Windows NT Server operating system and a “super-thin client” to the Windows operating system. In the multi-user Windows NT environment, a “super-thin client” allows users to run the Windows desktop operating system and Windows-based applications completely on the server. Terminal Server will provide users access to 16- or 32-bit Windows-based applications from any of the following types of desktops:

- A class of low-cost hardware commonly referred to as Windows-based a terminal, which is marketed by third-party hardware vendors.

- For any existing 32-bit Windows desktop operating system, such as Windows 95, Windows NT Workstation, and even Windows NT Server (running the 32-bit Terminal Server client as a window within the local desktop environment).
- In older 16-bit Windows-based desktops running the Windows 3.11 (Windows for Workgroups) operating system (running the 16-bit Terminal Server client as a window within the local desktop environment).
- In X-based terminals, Apple Macintosh, MS-DOS® operating system, Networked Computers, and UNIX-based desktops (using the Citrix MetaFrame add-on).

2.6.3 Microsoft Window XP Professional

Windows XP Professional delivers new standard in reliability, security, easy to use and high performance of the operating system. Windows XP professional provide high efficient and dependent computing experience. Windows XP Professional is built on the core software code used in Windows 2000 and Windows NT Workstation. This code, known as the NT kernel, makes Windows XP more powerful, secure, and stable than Windows Me, Windows 98, or Windows 95.

With the dependable new Windows architecture, this operating system provides some significant advantages compare to other operating system include:

➤ **Superior Operation System Technology**

This system provides preemptive multitasking, fault tolerance, and system memory protection, this feature help user to prevent and resolve problems, and to keep system run smoothly.

➤ **Ability Ti Recover Work**

Provide an ability to recover work in many cases, if any program crashes before work can be saved.

➤ **System Memory Protection**

This feature help prevent poorly written software from making your computer unstable.

Windows XP Professional has increase its performance drastically compares with Windows 98 Second Edition, and meets the performance of windows 2000 on commercial benchmarks. This operating system not only launches application faster, in most cases, it will make the entire system start up much more quickly. Security features in Windows XP Professional protect sensitive and confidential data both on computer and while users are transmitting over a network or the Internet. Beside, it supports for the latest security standards and enhanced virus protection, Windows XP also protects user's computer from some of the more common types of Internet attacks.

Windows XP Professional has enhance a new look to its intuitive, task-based design, and makes it easier to use. Beside, this operating system help users to faster their work in

short time, find item in a snap, and arrange file and folders in a way that makes sense to users.

2.6.4 Linux

Linux is a free Unix-like operating system. Since its conception, the Linux project has received contributions from thousands of software developers around the world, most notably a very robust networking subsystem, and kernel-level implementations of the TCP/IP protocol suite.

Linux's low cost, robustness, and adherence to open networking standards have made it a favorite choice for such applications as network firewalls, IP Network Address Translation (NAT) and IP Masquerading, and even Virtual Private Networks (VPN's). While all of these applications solve different problems, they all require some common functionality from the Linux networking subsystem. Specifically, applications require that network packets be intercepted before entering the operating system's protocol stack. The packets may need to go through complex filtering (firewalls) and modification (NAT) before entering the protocol stack. The packets must be processed very quickly and efficiently, since in a typical networking configuration, packets will enter the protocol stack on the order of megabits per second (Mbps) or faster.

Linux is a reliable, secure operating system. In addition to being cost-effective, it is constantly being updated and refined with the latest technologies. As Linux gains greater acceptance throughout the computing industry, more and more companies are supporting Linux via both application and hardware compatibility.

2.7 Development Server

Web Server are software that can provide user to serve content over the internet using the Hyper Text Markup Language (HTML). Some web server software runs on only one computer operating system, while other run on several operating system. Two leading Web servers are Apache HTTP Server, the most widely-installed Web server, and Microsoft's Internet Information Server (IIS). And also iPlanet Enterprise Server will become more popular in future.

2.7.1 Apache HTTP Web Server

Apache is an ongoing group software development effort. This software has been developed by Rob McCool when he is working at the University of Illinois at the National Center for Supercomputing Applications (NCSA) in 1994.

Apache HTTP server dominates the web, in part, because it is free and performs very efficiently. It is powerful enough that IBM has licensed it for its own WebSphere application server package. Apache is more widely used than all other Web Servers combined. Apache can run on many operating systems including AIX, FreeBSD-UNIX, HP-UX, Linux, Microsoft Windows, SCO-UNIX, and Solaris. And also hardware that supports them. Apache has a built-in search engine and HTML authoring tools, and supports FTP.

Apache has wizards available to create new sites and directories, and the server provides for multiple logs that can be automatically cycled and archived.

➤ **Cycling**

Cycling a log means replacing the oldest log with the newest, thus recycling the space it occupies.

➤ **Archiving**

Save it, perhaps on a backup storage device. The log entries conform to the established, standard NCSA common log format log which many servers adhere.

Apache's application development tools support CGI and proprietary APIs. Is also supports server-side technologies for generating dynamic web pages. Beside, apache support ODBC standard and can access Oracle, Sybase, Microsoft SQL Server, and IBM's DB2 databases.

2.7.2 Microsoft Internet Information Server

Microsoft Internet Information Server (IIS) comes bundled with Microsoft's Windows 2000 Sever and Windows XP operating systems. IIS server equally well as an internet web server or as a public Web server program, and thus it is popular for both public sites and corporate internet sites. A robust and capable Web server program, IIS is suitable for any size site.

IIS includes an integrate search engine that allows user to create customized search forms with a variety of tools, include ASP.net, ASP, activeX Data Objects, and SQL

queries. IIS supports FTP, allowing users to download files and data from the IIS server site using the FTP protocol.

IIS creates log files in a standard format. Like most other Web server products, IIS supports automatic cycling or archiving of log files. The Microsoft Management console(MMC), which is include in IIS, provide central server management from any server and the Network. IIS also permits administration from a remote browser.

IIS's inclusion of ASP's provide an application in which HTML pages, ActiveX components, and scripts can be combined to produce dynamic Web pages. IIS's database support includes ODBC and Microsoft SQL.

2.7.3 IPlanet Enterprise Server

iPlanet Enterprise server remains essentially the high performance product of Netscape but with a raft of Java enhancements that reflect the partnership with Sun in the Alliance. The resulting product ought to be an expeditious upgrade for current Enterprise Web Server users and a serious contender in at least any situation where performance features or Java support are paramount.

The previous review of iPlanet Enterprise server in Server Watch covers Netscape Enterprise Server v3.6; this review looks at 4.0 as the current rev with 4.1 just around the corner. iPlanet Enterprise server is available as a download or CD, and runs on Windows NT and multiple Unix platforms (Linux support will be available in version 4.1, Macintosh version SOL).

iPlanet Directory Server that provides LDAP 3.0 directory services for user and group management. iPlanet Enterprise server has integrated with the directory to support password policies and dynamic groups. The choice of LDAP may help iPlanet Enterprise server (and the Alliance) compete with systems, like Microsoft IIS, that use a directory native to the operating system (e.g., Active Directory). Other tools for Websites-in-the-large include cluster management for multiple remote servers, dynamic log rotation (to change logs without stopping the server), SNMP support, and support for multiple processors (Unix).

Like most other server programs, iPlanet supports dynamic application development, including CGL and most up-to-date Java including: Java Servlets 2.1, Java Server Pages .92, a native JVM, JavaScript 1.4, and remote debugging. Its ODBC conformance means that iPlanet Enterprise Server provides connectivity to a number of database products as well.

2.8 Development Tools

With the assisting of authoring tools, the process of system development will become easier and faster.

2.8.1 Crystal Report

Crystal Reports has been in the visual studio box since 1993 and now Crystal Reports has been choused by Visual Studio.NET as a standard reporting tool, it brings the ability to create interactive, presentation-quality content — which has been the strength of

Crystal Reports for years — to the .NET platform. With more than 4 million licenses shipped, Crystal Reports is the leader among Windows report writer and is powering the future of the web.

With Crystal Reports for Visual Studio.NET, developers can host reports on web and Windows platforms and publish Crystal Reports as Report web Services on a Web server. For example, developers can create a web application that enables users to drill down on a chart and filter its information according to their needs. Developers can quickly create a complex and professional-looking report. Instead of coding, Crystal Reports Designer interface to create and format the report developers' need. The powerful Report Engine processes the formatting, grouping and charting criteria that developers specify.

Using the Crystal Report Experts, developers can quickly create reports based on the development needs:

- Choose from report layout options ranging from standard reports to form letters, or build your own report from scratch.
- Display charts that users can drill down on to view detailed report data.
- Calculate summaries, subtotals, and percentages on grouped data.
- Show TopN or BottomN results of data.
- Conditionally format text and rotate text objects.

Crystal Reports for Visual Studio .NET is an integrated component of the Visual Studio .NET development environment. This integration provides developers and users with the following reporting benefits.

For Developers

Choose the Language and Project

Use the programming language of developers' choice and access the Crystal Report Designer from any project.

Use Zero Client (Web) and Rich Client (Windows) Report Viewers

Crystal Reports for Visual Studio .NET provides two report viewers with which developers can view their report in their application: use the Web Forms Viewer for Web applications and the Windows Forms Viewer for Windows applications.

Customize Viewers to Interact with Other Controls

Initialize properties of the Web Forms Viewer and the Windows Forms Viewer when design. Or, set up Web Forms Viewer or Windows Forms Viewer to interact with other controls at runtime. With runtime customization, users can view different reports, or change the format, data selection, or export options of an existing report.

Rich Object Model

The Report Object Model exposed by the Report Engine allows developer to add code to the source file of the Windows Forms page to enable the Windows Forms Viewer control to interact with other controls in the same page. For example, the Windows Forms control can interact with a button or combo box to provide users with export and report formatting options.

For Users

View Crystal Reports over the Web

When developers develop a Web application that hosts a report or a Report Web Service, all processing occurs on the server. Users require only a Web browser. All report functionality works as well on the Web as it does in a Windows application.

Access Seamlessly Integrated Reports

Users need not know that they are accessing a report when they click a chart in a Web or Windows application. The report viewer control can be one of the many controls in the application.

Interact Easily with Reports

Because Crystal Reports for Visual Studio .NET can interact with other controls, users are able to filter report information by clicking a button or selecting from a combo box.

Export Reports

Users can export reports to Microsoft Word and Excel formats as well as PDF, HTML, and Crystal Reports for Visual Studio .NET formats.

2.8.2 Visual Studio.NET Enterprise

Visual Studio .NET is a complete set of development tools for building ASP Web applications, XML Web services, desktop applications, and mobile applications. Visual

Basic .NET, Visual C++ .NET, and Visual C# .NET all use the same integrated development environment (IDE), which allows to share tools and facilitates in the creation of mixed-language solutions. In addition, these languages leverage the functionality of the .NET Framework, which provides access to key technologies that simplify the development of ASP Web applications and XML Web services. Features of Visual Studio include:

Language Enhancement

Microsoft Visual Basic, Microsoft C++, and Microsoft JavaScript have all been updated to meet your development needs. Additionally, a new language, Microsoft C#, has been introduced. These languages leverage the functionality of the .NET Framework, which provides access to key technologies that simplify the development of ASP Web applications and XML Web services.

Web Forms

Web Forms are an ASP.NET technology that developers use to create programmable Web pages. Web Forms render themselves as browser-compatible HTML and script, which allows any browser on any platform to view the pages. Using Web Forms, developers create Web pages by dragging and dropping controls onto the designer and then adding code, similar to the way that developers create Visual Basic forms.

XML Web Services

XML Web services are applications that can receive requests and data using XML over HTTP. XML Web services are not tied to a particular component technology or object-calling convention and can therefore be accessed by any language, component model, or operating system. In Visual Studio .NET, you can quickly create and include XML Web services using Visual Basic, Visual C#, JavaScript, Managed Extensions for C++, or ATL Server.

XML Support

Extensible Markup Language (XML) provides a method for describing structured data. XML is a subset of SGML that is optimized for delivery over the Web. The World Wide Web Consortium (W3C) defines XML standards so that structured data will be uniform and independent of applications. Visual Studio .NET fully supports XML, providing the XML Designer to make it easier to edit XML and create XML schemas.

2.8.3 Macromedia Dreamweaver MX

Macromedia Dreamweaver gives developers the productivity of a visual web page layout tool, the control of an HTML text editor and support for new web technologies, all in a software package.

Developers can use it to create web sites visually, with confidence that HTML being generated is concise and always editable. It includes advanced features that take

advantage of the latest innovations on the web, such as dynamic HTML and CSS, while still ensuring that web pages work well in a variety of web browsers. All of the code generated by it is carefully created to work on as many platforms and browsers as possible.

Others features include easy integration of Active X components, Java applets, Plug-ins for improved web page interactivity. It also integrates seamlessly with other components of Macromedia, such as Flash Movies, Shockwave, and Fireworks, which are essential for the development of interactive web pages.

2.8.4 Macromedia Flash MX

Macromedia Flash MX is the latest professional standard authoring tool for producing high-impact Web experiences. Whether you are creating animated logos, Web site navigation controls, long-form animations, entire Flash Web sites, or Web applications, you'll find the power and flexibility of Flash ideal for your own creativity.

New features in Flash MX enhance the approachability, creativity, and power of Flash. Designers who require a higher level of control and integration with industry-standard design tools now have an unparalleled creative application for creating media-rich content.

Powerful new features build on this creativity, giving application developers access to new capabilities that make Flash MX a robust and exciting application development

environment. Developers can work with advanced scripting and debugging tools, built-in code reference, and predefined components to rapidly deploy rich Web applications.

2.8.5 Adobe Photoshop 7.0

Adobe Photoshop 7.0 is used as drawing, painting and designing purposes. Users can retouch an image, apply special effects, swap details between photos, introduce text and logos, adjust color balance, and even add color to a grayscale scan. All these functions are included under a set of user-friendly editing tools in Adobe Photoshop 7.0. It contains graphical icons to represent every functions of each button. Besides that, it also provides many shortcut keys that are easier and save time for users and for those who do not like to use mouse.

2.9 Report Data Access Technology

Crystal Reports connects to databases through database drivers. Each driver is written to handle a specific database type or database access technology.

2.9.1 Pull and Push Models

To provide the most flexible data access for developers, Crystal Reports database drivers are designed to provide both a pull and a push model of data access.

2.9.1.1 Pull Model

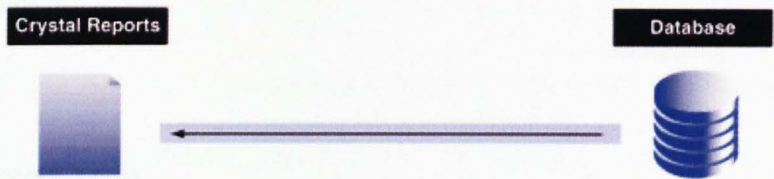


Figure 2.12: Pull Model

In a pull model, the driver will connect to the database and pull in data on demand. With this model, both the connection to the database, and the SQL command that is performed to get the data, are handled by Crystal Reports itself and do not require any coding from the developer. If no special code is written at runtime, the pull model is used.

2.9.1.2 Push Model



Figure 2.13: Push Model

By contrast, the push model involves the developer writing code to connect to the database, performing a SQL command to create a recordset or dataset that matches the fields in the report, and passing that object to the report. This method enables you to

build connection-sharing into your application and to filter the data before Crystal Reports receives it.

2.9.2 Data Access Tools

A few of the Microsoft Data access strategy and technology is reviewed and considered to enable communication and access to database.

2.9.2.1 ODBC (OPEN DATABASE CONNECTIVITY)

ODBC is a standard database access method developed by Microsoft Corporation. The goal of ODBC is to make it possible to access any data from any application, regardless of which database management system (DBMS) is handling the data. It is not just database program such as Access, dBase, Oracle, SQL Server and DB2 that created the data. For example, by using ODBC, developer also can access a database file using Microsoft Word.

ODBC manages this by inserting a middle layer, called a database *driver*, between an application and the DBMS. The purpose of this layer is to translate the application's data queries into commands that the DBMS understands. For this to work, both the application and the DBMS must be *ODBC-compliant* -- that is, the application must be capable of issuing ODBC commands and the DBMS must be capable of responding to them. Since version 2.0, the standard supports SAG SQL.

2.9.2.2 ActiveX Data Objects (ADO)

ADO is an application program interface from Microsoft that lets a programmer writing Windows applications get access to a relational or non-relational database from both Microsoft and other database providers. ADO is designed to eventually replace *Data Access Objects (DAO)* and *Remote Data Objects (RDO)*. Unlike RDO and DAO, which are designed only for accessing relational databases, ADO is more general and can be used to access all sorts of different types of data, including web pages, spreadsheets, and other types of documents.

Like Microsoft's other system interfaces, ADO is an object-oriented programming interface. It is also part of an overall data access strategy from Microsoft called Universal Data Access. Active Data Object (ADO) is the Microsoft's newest high-level interface for data objects that most applications developers will use. ADO provides consistent access to data for creating a front-end database client or middle-tier business object using an application, tool, language, or even an Internet browser. ADO is the single data interface for developers creating 1 to n-tier client/server and Web-based data-driven applications.

2.9.2.3 ActiveX Data Object.NET (ADO.NET)

ADO.NET is not a revision of Microsoft ActiveX data Object (ADO), but a new way to manipulate data that is an disconnected data and XML. Although ADO is an important data access tool within ASP, it does not provide the entire necessary feature for developing robust and scalable web application. In spite of ADO's rich object model and

relative ease of use, it is connected by default, relies on an OLE DB provider to access data, and it is entirely Component Object Model (COM)-based.

ADO.NET has been designed to work with disconnected datasets. It reduce network traffic. Ado.net has uses XML as the universal transmission forma. This guarantees interoperability as long as the receiving component runs on a platform where an XML parser is available. When the transmission occurs though XML, it is no longer necessary that the receiver be a COM object. The receiving component has no architectural restrictions whatsoever. Any software component can share ADO.NET data, as long it uses the same XML schema for the format of transmitted data.

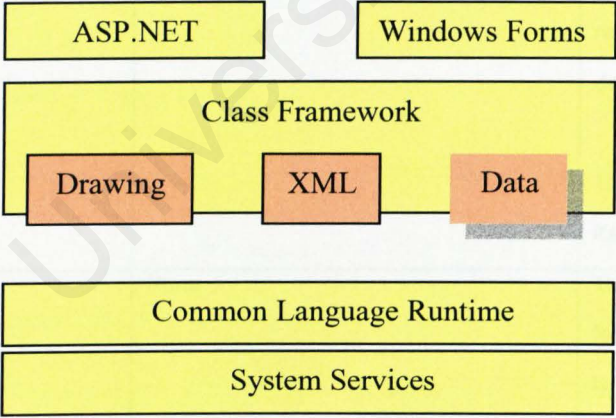


Figure 2.14: ADO.NET

2.9.3 Database Drivers Shipped with Crystal Reports for Visual Studio .NET

Table below is show the database drivers shipped with crystal report:

Database Driver	Accessible Database	Data Access Method
OleDb	Any database that has an OleDb Provider.	Supports both pulling data from the database and pushing data into the report from an ADO recordset.
ODBC	Any database that has an ODBC driver	Supports both pulling data from the database and pushing data into the report from an RDO recordset.
Access/Excel	Microsoft Access databases and Microsoft Excel workbooks	Supports both pulling data from the database and pushing data into the report from a DAO recordset.
ADO.NET	Any database with a managed provider	Supports pushing data into the report from an ADO.NET dataset. This driver will not pull data on its own
Field Definition	None This special driver is used to create reports based on only a schema without actual data	This driver is included mainly for backward compatibility and is only used during the report creation process. At runtime, a report created with it must be passed a recordset or dataset.

CDO (Crystal Data Object)	None. This special driver accesses data that does not reside in a traditional database.	This driver is included mainly for backward compatibility. This driver supports pushing data into a report from a CDO recordset only; it will not pull data on its own. Use the Crystal Data Object library to populate a CDO recordset. Note This driver is not available during report creation time. Choose one of the other available drivers to create the report.
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Table 2.5: Database Drivers Shipped with Crystal Reports for Visual Studio .NET

2.10 DEVELOPMENT LANGUAGE

2.10.1 Active Server Pages (ASP)

ASP is a server-side scripting technology. ASP is indeed HTML page with an .asp extension. ASP allows for HTML and a scripting language such as VBScript, JavaScript or Perl to be interspersed in a Web page. When a browser requests an ASP page, the Web server generates a page with HTML code and sends it back to the browser.

One of the most important features about ASP is that it allows user to easily access data and put it on a Web page. User can simply display data from an ODBC-compliant database, or use ASP to make decisions about what to display on a Web page. User can then format the results in any way that they please.

Another important ASP feature is the ability to use cookies to store and retrieve information. The Request object has a Cookie collection, and user can use this in data processing.

2.10.2 ASP.NET

Active Server Page.NET, or ASP.NET, is Microsoft's latest version of its popular dynamic Web programming technology, ASP.NET however, is much more than a simple upgrade from classic ASP: A new programming model and plethora of brand-new tools are just two of the many new features of ASP.NET.

A Microsoft server-side Web technology, ASP.NET takes an object-oriented programming approach to Web page execution. Every element in an ASP.NET page is treated as an object and run on the server. An ASP.NET page gets compiled into an intermediate language by a .NET Common Language Runtime-compliant compiler. Then a JIT compiler turns the intermediate code to native machine code, and that machine code is eventually run on the processor.

The new features in ASP.NET make designing dynamic Web pages quicker and easier than ever before. For example, ASP.NET offers developers a number of powerful Web Controls, which are HTML-like tag that provide useful functionality, such as displaying a calendar, showing a random banner advertisement, and displaying an HTML table whose rows and columns contain data from a database. These Web Controls allow developers to provide rich, W3C-compliant HTML with minimal amount of coding.

2.10.3 Java server pages (JSP)

Java Server Page (JSP) is a web-scripting technology that can mix static HTML content with server-side scripting to produce dynamic output. By default, JSP uses Java as its scripting language; however, the specification allows other languages to be used, just as ASP can use other languages (such as JavaScript and VBScript). While JSP with Java will be more flexible and robust than scripting platforms based on simpler languages like JavaScript and VBScript.

JSP provides a number of server-side tags that allow developers to perform most dynamic content operations. So developers who are only familiar with scripting, or even those who are simply HTML designers, can use JSP tags for generating simple output. Advanced scripter or Java developers can also use the tags, or they can use the full Java language if they want to perform advanced operations in JSP pages.

2.10.4 JavaScript

JavaScript is Microsoft's extended implementation of ECMAScript (ECMA262), an international standard based on the Netscape's JavaScript and Microsoft's JavaScript languages. JavaScript is implemented as a Windows Script engine. This means that it can be "plugged in" to any application that supports Windows Script, such as Internet Explorer, Active Server Pages, and Windows Script Host. It also means that any application supporting Windows Script can use multiple languages - JavaScript, VBScript, Perl, and others.

JavaScript (and the other languages) can be used for both simple tasks (such as mouseovers on Web pages) and for more complex tasks (such as updating a database with ASP or running logon scripts for Windows NT). Windows Script relies on external "object models" to carry out much of its work. For example, Internet Explorer's DOM provides objects such as 'document' and methods such as 'write ()' to enable the scripting of Web pages.

2.10.5 HYPERTEXT PREPROCESSOR (PHP)

PHP was created sometime in 1994 by Rasmus Lerdorf. During mid 1997, PHP development entered the hands of other contributors. Two of them, Zeev Suraski and Andi Gutmans, rewrote the parser from scratch to create PHP version 3 (PHP3). Today, PHP is shipped standard with a number of Web servers, including RedHat Linux.

PHP is an interpreted server-side scripting language for web servers. It was designed to support simple, fast server-side extension for web development. The syntax of PHP is fairly simple, and very similar to that of Perl, with some aspects of Bourne shell, Javascript, and C. Because PHP is embedded within tags, the author can jump between HTML and PHP (similar to ASP and Cold Fusion) instead of having to rely on heavy amounts of code to output HTML. And, because PHP is executed on the server, the client cannot view the PHP code.

PHP offers excellent connectivity to most of the common databases (including Oracle, Sybase, MySQL, ODBC and many others). PHP also offers integration with various external libraries, which allow the developer to do anything from generating PDF documents to parsing XML. PHP can perform any task that any CGI program can do,

but its strength lies in its compatibility with many types of databases. Also, PHP can talk across networks using IMAP, SNMP, NNTP, POP3, or HTTP.

2.10.6 Comparisons of JSP, ASP and ASP.NET

Table below shown the comparison of JSP, ASP, and ASP.NET

Language in page	Java	VBScript, Jscript	Multiple Languages
OS Platform	Unix, Microsoft Windows, MacOS, Linux	Windows 9X,NT, other platform requires third-party ASP porting products.	Windows 9X, NT, other platform requires third-party ASP porting products.
Support Wed Server	Any Web Server, including Apache, Netscape and IIS	IIS, personal web server(PWS), Other server with third-party products	IIS, personal web server(PWS), Other server with third-party products
Support database	Any ODBC and JDBC compliant database	Any ODBC compliant database	Any ODBC and JDBC compliant database
Portability	Good	Fair	Good
Scalability	Good	Good	Good
Component Support	JavaBeans, Enterprise JavaBeans	COM component	Custom-written component
Learning Curve	High(Java)	Medium (VBScript, Javascript)	Medium
Price	Free	License software	License software

Table 2.6: Comparison of JSP, ASP, and ASP.NET

2.11 Chapter Summary

Literature review is an important approach to gather system requirements and knowledge of current software development technologies. Therefore, review of literature has been carried out to gain a better understanding and clearer foreground of ideas regarding LMS reporting system.

In the analysis of existing system, several case studies were being done to achieve some guidelines in developing the proposed system. Good features of those systems were studied and will be adopted in the proposed system. In the mean while, weaknesses of the current system will be analyzed in order to improve the new system performance.

Apart from that, technology reviews has been done to gain guidance in the development tools and development strategies selection process. Evaluation and comparison among several similar technologies has been carrying out to select the suitable and ideal development tools for this system. The summaries of the chosen tools will be discussed in next chapter.

CHAPTER 3: METHODOLOGY

3.1 System Development Life Cycle

The System Development Life Cycle is the process of developing information systems through investigation, analysis, design, implementation, and maintenance. The System Development Life Cycle (SDLC) is also known as Information Systems Development or Application Development. Below are the steps involved in the System Development Life Cycle.

- **Feasibility study:** Establishes a high-level view of the intended project and determines its goals.
- **Systems analysis and requirements:** Refines project goals into defined functions and operation of the intended application. Analyzes end-user information needs.
- **Systems design:** Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudocode and other documentation.
- **Implementation:** The real code is written here
- **Integration and testing:** Brings all the pieces together into a special testing environment, then checks for errors, bugs and interoperability.
- **Acceptance, installation, deployment:** The final stage of initial development, where the software is put into production and runs actual business.
- **Maintenance:** changes, correction, additions, and moves to a different computing platform. This, the least glamorous and perhaps most important step of all, goes on seemingly forever.

1.2.2 Methodology Consideration

Nowadays, systems are so big and complex that teams of architects, analysis, programmers, testers and users must work together to create the millions of lines of custom-written code that drive our enterprises. To manage this, a number of system development life cycle (SDLC) models have been created: waterfall, V-Model, fountain, spiral, build and fix, rapid prototyping, incremental, and synchronize and stabilize.

3.2 Methodology Consideration

System development methodology is a collection of techniques, procedures, tools and documentation aids which can help developers to implement a new information system. System development methodology consists of phases, which consist of a set of a sub phases.

It is very important for developers to choose the correct methodology for their project because it will ensure the consistency and the reproducibility to the project. Which the correct methodology, it can complete development within lowest possible cost keeping the highest quality and achieve the fastest turn-around. Overall, it can make the development cycle as efficient as possible.

Another point is to make future maintenance easier and faster. The development cycle for each and every project is some way unique, depending on system requirements and their unique operating environment. Design and development methodology also varies depending on the software, hardware technologies chosen.

3.2.1 Benefits of Good Methodology

Define a good methodology before the project start will be able to provide the effective ways for system development. It should be a framework to development staff.

Some benefits offers by a good methodology:

- Increase the system quality by forcing the developer to produce flexible systems and adequate documentation.
- Provides a standard framework to developer does not have to reinvent the wheel for each project.
- Each method or tool in the methodology results in successful completion of each development task.
- Improve communication among management, analyst, programmers, users and other stakeholders by providing a communication base.
- Facilitates planning and controlling the project.
- Reviews procedures are available to identify any errors, inconsistencies and discrepancies during development.
- Provide better understanding of user needs and validation of user needs.
- Provide the management with tools to review project progress and checklist to access tasks and deliverables.

3.2.2 System Development Methodology: V-Model

To develop this system, V-Model methodology had been chosen as framework to guide me to choose the suitable techniques from the initial requirements stage through the final testing stage and help me to plan, manage, control and evaluate the project. Beside, V-model helps me to ensure every development stages are complete and correct before go to next stage.

The process of verification and validation is an attempt to catch as many errors as possible within the development life cycle, otherwise know as “stage containment”.

Each successive stage of testing ensures that the specifications defined in the deliverable of the corresponding stage have been implemented. This is achieved by the early development of test requirements. Figure 3.1 shows V-Model methodology:

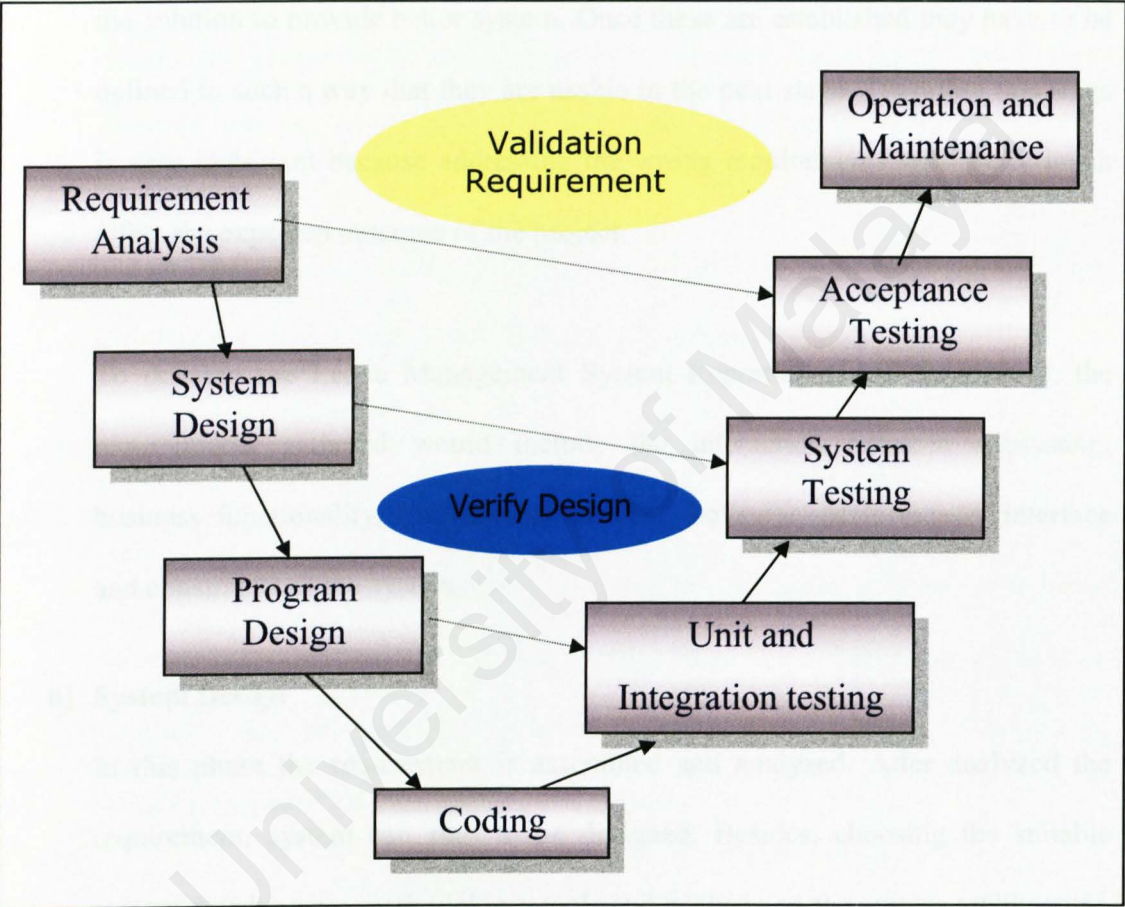


Figure 3.1: V-Model

The descriptions of the model are as follow:

a) Requirement Analysis

By analyzing and understanding the market requirement, problem can be identified. Objective and the scope of the system are defined in order to develop a system that act as solution to the problem. Analysis the current system and find the solution to provide better system. Once these are established they have to be defined in such a way that they are usable in the next stage. Therefore this stage is very important because addressing the wrong requirements will pretty much affect the expected outcome of the project.

To develop the Leave Management System Reporting (LMS Reporting), the requirements gathered would include the interaction between subsystem, business functionality, information retrieval, behavior, performance, interface and constraints of the system.

b) System Design

In this phase the requirement is assembled and analyzed. After analyzed the requirement, system can start to be designed. Besides, choosing the suitable system development methodology, tools and analysis on the system architecture, functional requirement and non-functional requirement are also made during this phase.

For this project, system design focuses on distinct attributes of the modules in LMS Reporting. The overall system architecture, content design, interface

representation, data structure, conceptual design and technical of LMS Reporting are also required in this stage.

c) Program Design

Design the program of the system. Design the integration of the entire program. Design the programs to provide the best the best functions of the system. Analysis is being done to check the functionality of the program.

In this phase each module to be developed in the LMS reporting has been visualize into the diagrams such as DFD, ER diagram.

d) Coding

Coding is the process translating the design specifications into source code. The source code may require interpreter or compiled and linker to convert them into an executable program. The coding written must have appropriate comments, consistent and integrity of the terms used. Determine what programming language provides the best result to the system.

During this phase, set of programs in LMS Reporting module will be created based on the project design. The system modules will be coded under ASP.NET with Crystal Report Tool and Microsoft SQL Server 2000 will be used.

e) Unit and Integration Testing

After all the programs (each program is called a unit) have been created, the Unit and Integration Testing phase will take place. In this phase, all the hardware and

software will be integrated and tested in order for it to function properly and ensure every unit meets its specification. If the unit doesn't meet its specification or faulty occurs we should go back to the Program Design phase to verify again.

requirements needs to be done on the Requirements Analysis phase, to ensure that the system has implemented all the requirements in the specification.

During this phase, LMS Reporting will be fully tested and implement the system into the real environment.

f) Operation and Maintenance

After the system has been accepted, maintenance will take place to make sure the system always in good condition. Maintenance involves correcting errors that have gone undetected before that is in earlier stages of the life cycle. To improve the system implementation, adding performance or functional enhancement to fulfill the users' requirement or business demand.

Although LMS Reporting is put into practical use, but it still need some simple changes to correct the undetected errors. All those changes can be made in this phase.

3.3 Chapter Summary

This chapter examines the software development life cycle (SDLC) methodology, the adopted information gathering methods, and concludes on selected issues and

3.2.3 Justification of Methodology

The reasons V Mode is chosen as the development methodology:

The V-Model framework emphasizes from the initial requirement stage through the final testing stage. It focuses on testing through the development life-cycle, early development of test requirement and early detection of errors. If any errors occur, developers only have to change the problem stage and don't have to change the entire system. This can save developers time and development cost.

Before work proceeds to the next stage, the subsystem of each stage need to be verified and validated to ensure that they are met all verification and validation requirements. Each successive stage of testing ensures that the specifications defined in the deliverable of the corresponding stage have been implemented. This is achieved by the early development of test requirements.

V Model forces analysis and planning before actions are taken. The process forces analysis to be done and to precisely define the requirements of the system. It is much easier to build something if that something is known. It forces a discipline process to avoid the pressures of writing code long before it is known what is to be built.

3.3 Chapter Summary

This chapter explores in the software development life cycle (SDLC), methodology being adopted, information gathering methods, and conclusion on selected tools and technologies in development environment.

Relevant information on the chosen project methodology, V-model is given in details, with compact conclusion and justifications of its characteristics, the advantages that it provides its phases, and its various workflows.

CHAPTER 4: SYSTEM ANALYSIS

4.1 Introduction

A good system analysis produces a good software development. Before start to develop a system, the objective must be understood well by eliciting the functional and non-functional requirement of the system. After understanding the entire requirement, analysis is conducted to choose the appropriate tools architecture, model or requirement to develop a system.

4.1.1 Functional Requirement

Functional requirement for a system describe the functionality or services that the system is expected to provide. It also describes how the system behaves when given a certain stimuli.

Activity Report

This system will allow staff and admin to print out their report. Staff can print out their own activity report with type in the duration that they want. Staff also can edit and cancel their own activity before the activity. For admin, they can access all staff's activity and select staff that they want to print. This system also can generate bar chart to make analysis job easier.

Administrator

- Administrator can view and print the staff activities.

- Administrator is allowed to view the staff activity by name, department, academic staff, non academic staff or the entire staff leaves report and also search by date.

Staff

- Staffs are allowed to view and print.
- Staffs are allowed to cancel and edit his/her own activity.
- System prompts out message to inform staff one day before activity.

✦ For this module records are sort by name or date.

Staff Report

This system is allows staff an administrator to access to view the staff personal information and print out as a report. However, staff is only allows to view their own personal information only.

Administrator

- Administrator can view and print staffs information.
- Records are filter by name, department, non-academic staff and academic staff.

Staff

- Staffs are allowed to view and print their own information.

✦ The entire records of this module are sorted by name.

✦ This function allows administrator and staff summarize the report field such as Login name, phone number, department code in a table

Leave Report

Basically this module allows users to check their leave status. Beside, this module also provides different types of graph analysis.

Staff

- Staffs can check status of leave whether is it approves their supervisor or not.

There are four tables "Leave Applications under process of Approval", "Approved Leave Applications", "Leave Applications On hold" and "Rejected Leave Applications". When staffs apply a leave, they will automatically inside the process table waiting for approve. If not approve they will put in to second approve status. And then either send back to approve table or reject table when the application is reject.

- Allows staff to view their leave type balance.

Administrator

- Administrator is allowed to view and print the report only.
- System provides filtering function to allow users search record by name, date, department, non academic staff and academic staff.

✦ Administrator and staff can select duration to generate leave report in either table, bar graph or pie chart format.

✦ It also can generate a graph to show the comparison between leave types.

✦ The entire records of this module are sorted by name and date.

Attendance Report

Attendance record - This table will content the detail of every staff like what time staff will login and logout. Date that staff absence the reason why they are absence or late.

Attendance summary - This table contents the summary of staff attendance. Staffs can view the total day staffs' present, absent, late in, early out and work day.

Staff

- Staffs are allowed to view and print their own attendance record and also Attendance summary.

Administrator

- Administrator can view and print staff attendance summary and also attendance record.
- Filtering function is provided. Administrator can select record by date, name, department, non academic staff and academic staff.

- ✦ The system can highlight staff record when staffs attendances are poor.
- ✦ Records can sort by name or date.
- ✦ This function can generate a bar graph or pie chart to analysis the staff attendance between month and year.
- ✦ It also can generate graph to show the comparison between departments.

Nonworking Date Report

This function only content holiday date in the entire year. Staff just can view and print this report. However administrators are gave an opportunity to edit holiday and print.

4.1.2 Non-Functional Requirements

Reliability

This system should be able to produce an accurate and can be trusted by the user. System should able to performing reliability operations for user. For example, whenever what user do or request, System should be able to response and implement the requirement accurately, such as system have to inform user what is happening whenever what action user have been taken.

Usability

System should be design in user-friendly method and usable by the type of user. The system must be understood by the user with is an appropriate user interface. Besides, its must have sufficient documentation to the user so that user can understand well in this system. This system is build regarding to user ability, environment and needs.

Efficient

Efficiency is the ability of a process or procedure can be called, accessed and functioning to produce outcome or output at an acceptable or credible speed. System can be called or accessed in an unlimited number of time and produce usable outcome to the user. the system implementation whenever the user need it.

Robustness

Robustness is refers to how efficiency the system to handle or to avoid problem. This system must be able to continue its implementation no matter what problem that system face.

Maintainability

The system should be developed in such a way that it may understand, correct, adapt and evolve, to meet customer needs, changing of environment or if an error is encounter.

Security

This system should be including the security policy like network security, access authorizations, virus protection and disaster recovery. This system must take in creating a security policy is to determine what assets to protect and from whom, for example, staff personal information must be protects from other staffs to access it. System also has to determine who should have access to various part of system and who should not whit provide username and password before being allowed access into the system.

4.2 Development Platform/Tools Choose

- Platform : Window 2000 Server
- DBMS : SQL Server 2000
- Web server : Microsoft IIS 5.0
- Web Browser : Microsoft Internet Explorer 6
- Application Language : ASP.NET
- Development Tools

- Microsoft Visual Studio .NET
- Crystal Report 8

4.2.1 Development Platform – Windows 2000 Server

After a details study on the several operating system available, Window 2000 Server was chosen as the platform due to several advantages that are distinct when compared to other operating systems. The reasons of choosing Windows 2000 Server are because of its portability, manageability, security, compatibility, scalability, extensibility, and so on the results are shown in Table 4.1

Premise	Description
Portability	Run on different hardware platforms with minimal changes.
Manageability	Windows 2000 is easier to deploy, manage, and support. Centralized management utilities, troubleshooting tools, and support for self-healing applications all make it simpler for administrators and users to deploy and manage desktop and laptop computers.
Security	It could be locked down through software, meeting the NSA's C2-level criteria. It also authenticates users before they gain access to resources on a computer or the network.
Scalability	It would support symmetric multiprocessing (SMP).
Extensibility	It could be easily expanded, by writing to a well-defined Application Programming Interface (API).

Performance and scalability	Window 2000 Server supports Simple Mail Protocol (SMP) on computers that are configured with multiple microprocessors. It also supports multitasking for system processes and programs.
Developments Tools	Various development tools have been created for Windows users. Some of these have helped to speed up the software development process
Networking and communication services	Provides built-in support for the most popular network protocols, including TCP/IP and IPX/SPX.

Table 4.1 Advantages of Microsoft Window Server 2000

4.2.2 Database Management System – Microsoft SQL Server 2000

Here are some reasons why I choose Microsoft SQL Server 2000:

- SQL Server provides powerful and scalable support for large database and complex queries.
- Features provided by SQL Server ensure easy-to-use for database administrators in building, managing and deploying business applications.
- The data transformation services make it easy to import, export and transform heterogeneous data using OLE Database, Open Database Connectivity (ODBC) or text-only files.
- Replication enhancements in SQL Server 2000 allow for queued updating subscribers and easier setup.
- With the Enterprise Manager, I can easily defined tables, create users, and set table and column permission graphically.

4.2.3 Web Server – Microsoft Internet Information Server (IIS 5.0)

The reason Microsoft Internet Information Server has been chosen:

- Designed to be scalable from single-processor to multiprocessor architectures.
- User-level and object-level security integrated into the windows NT Advanced Server directory service.
- Private communication technology (enhanced SSL) included.
- Logging included for all services. Includes basic text file format with auto rollover and extended logging to any ODBC data source such as Microsoft SQL Server.
- Centralized administration from single location for multiple servers, including secure administration over the internet with or without SSL.
- Configuration service, including TCP/IP port and time-outs; multiple virtual roots, including roots located on other computer over the network; home page location; and default name.
- Multiple virtual web servers running with only one administrative unit and one operating system process.
- Logon, logoff, and per-directory welcome text configurable.

4.2.4 Web Browser: Microsoft Internet Explorer 6

Here are some reasons why I choose Microsoft Internet Explorer 6:

- The enhanced stability of Internet Explorer 6, it will greatly enhance their browsing experience.
- Internet Explorer is a platform to build and deploy Web-based solutions.

- Internet Explorer has provided new features and evolved the platform in response to feedback and requests from developers and content creators.
- The platform has increased its level of extensibility, supporting script-based behaviors, binary behaviors, as well as layout and custom rendering behaviors.
- The unique level of extensibility provided by Internet Explorer enables me to develop rich applications, as well as extend the core functionality provided by Internet Explorer in a reusable manner.

4.2.5 Application Language: ASP.NET

I choose ASP.NET because ASP.NET:

- Web applications written in ASP.NET are fast, efficient, manageable, scalable, and flexible, also easy to understand and code.
- ASP.NET can take advantage of all that .NET has to offer, including support for around 20 or more .NET language from c# to perl.NET, and the full set of .NET Framework software libraries.
- Components and Web applications are all compiled .NET object written in the same language, and they offer the same functionality, so no need to leave the APS environment for purely functional reason.

4.2.6 Development Tools

Microsoft Visual Studio .NET

- Visual Studio.NET is Microsoft Integrated Development Environment (IDR) for creating, running and debugging program written in variety of .NET programming language.

- Visual Studio.NET support Crystal Report 8
- Web Forms can render themselves as browser-compatible HTML and script, which allows any browser on any platform to view the pages.

4.2.7 Crystal Report 8

- Crystal Reports for Visual Studio .NET provides developers with data visualization and analysis capabilities through seamless integration within all the Visual Studio languages targeting .NET.
- It uses an open and flexible architecture, with standards like XML, to allow developers to share reports and information over the Web.
- Can use any programming language to access the Crystal Report Designer from any project.
- With runtime customization, users can view different reports, or change the format, data selection, or export options of an existing report.
- Once developers have chosen the development framework, Crystal Reports provides them with the report viewer appropriate to both their application and development language. These report viewers are also customizable in that developers can change the appearance and the available options of the toolbar.

4.3 Hardware and Software Requirement

4.3.1 Server Requirement

Hardware Component	Requirement
Processor	Intel Pentium III 450 MHz/AMD 450 MHz processor or above.
Memory	128 Mb of RAM or higher
Hard Disk Space	Minimum of 6GB of hard Disk Space
Other Computer Devices	Computer Sound Card, Graphic Card, Network Interface Card.

Table 4.2 Server Hardware Component

Software Components	Requirements
Operating System	Windows server 2000
Web server	Microsoft IIS
Database server	Microsoft SQL server 2000
Server Scripting Technology Connector	ASP.NET
Programming Language	VB.NET
Window Component	.NET Framework, service pack 2 or higher
Web Page Development and Publishing Tools	Microsoft FrontPage, Microsoft Visual studio.NET
Graphic Design Tools	Photoshop v 7

Table 4.3 Server Software Requirements

4.3.2 Client Requirements

Hardware Component	Requirements
Processor	Intel Pentium II/AMD 200Mhz minimum
Memory	64 MB RAM
Other Related Devices	Compatible Graphic Card, Compatible Sound Card, 56K Modem/ compatible Network Interface Card.

Table 4.4 Client Hardware Requirements

Software Components	Requirements
Operating System	Windows 95/98/ME/2000/NT/XP or Workstation
Internet Browser	Internet Explorer v 6 or other compatible browsers.

Table 4.5 Client Software Requirements

4.4 Chapter Summary

This chapter emphasizes on the functionalities of the system, which have been categorized into functional requirements and non-functional requirements. Apart from that, hardware requirements and software requirements during development are discussed.

CHAPTER 5: SYSTEM DESIGN

5.1 Introduction

System Design is a process to find a solution from a problem, the description of solution is also called design. System design in an Information Technology environment context would not a complete success if there does not involve identifying goals, alternatives of strategic steps during processes such as design, making decisions and solving problem.

System Design also is a phase of the V-Model that the entire requirements for the system are translated into system characteristics. The requirements for system are regarding to the analysis that had been discussed in the previous chapter. System design includes the following issues:

- System Architecture Design
- System Functionality Design
- Database Design
- User Interface Design

5.2 System Architecture Design

The system architecture that is used in this system is three-tier application shows at figure 5.1. This architecture requires only a browser on the user's machine and divided into three layers; client, web server and reporting server. Client-tier is layer that allows user to request report for the reporting server through web server. Beside Client-tier also

responsible for the presentation of data, receiving user events and controlling the user interface. The application resides on a Web server and accesses a Report Web Service via HTTP through Web Form Viewer.

The Web Forms Viewer is an ASP.NET Web Forms control running inside Microsoft Internet Information Server (IIS). The Viewer's main function is to host and update Crystal report pages in HTML on the client machine. This Crystal Reports control works in the same way as other Web application controls in the Visual Studio .NET environment: the control on the server side renders itself into HTML and sends the HTML to the client. To host the requested report page in HTML, the Web Forms Viewer control interacts with either the Report Engine on the local Web server or the Report Web Service on a remote server.

Inside Reporting Server, the Report Web Service is a Crystal report published as a Web Service — that is, the report's interfaces (for example: its classes, objects, methods, properties, and return values) are available in XML and can be transmitted across the Internet. Other applications can access and use the report and its data without needing anything other than the ability to read XML. For example, developers can create a Crystal report that shows their company's current orders broken down by region. If developers expose this report as a Web Service, the company that manufactures the goods can add this Report Web Service to its application and see new orders immediately. Report Engine is responded to access the data that users want in database and report format at the Report (.rpt)

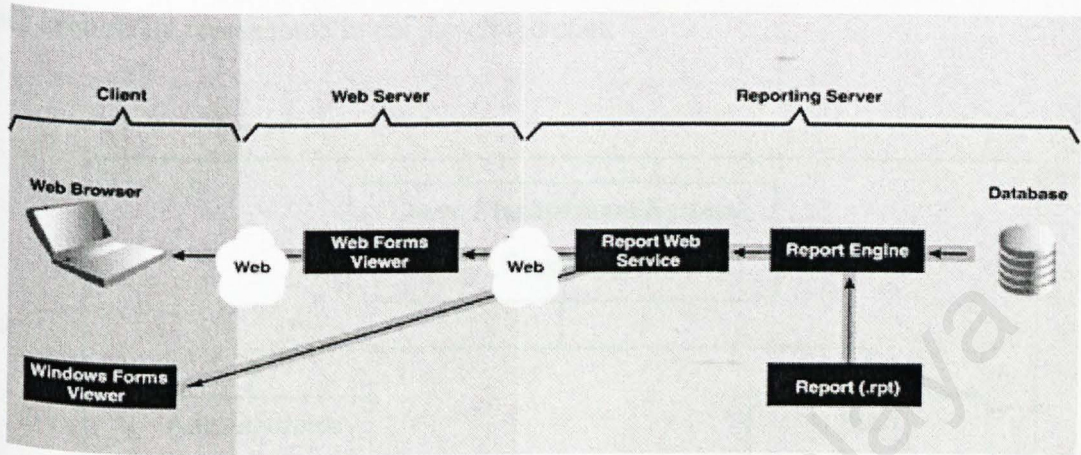


Figure 5.1: Three-Tier Architecture

5.3 System Functionality Design

5.3.1 System Structure Chart

The purpose of system structuring is to describe the features of the system, the component of the system and the relativity between sub-systems. Thus, this system structuring is the initial design process of identifying the sub-systems which specified in earlier functional specification. Subsequently, a framework for sub-system control and communication is established.

The system is structured into a number of principle sub-systems. By decomposing the system into a set of interacting sub-system, structure chart is used to depict the high level extraction of a specified system. The usage of structure chart is to comprehend the sub-systems visually and describe the interaction between independent sub-systems.

This system is divided into two main component; Administrator and Staff. The details of each section are represented in the structured chat.

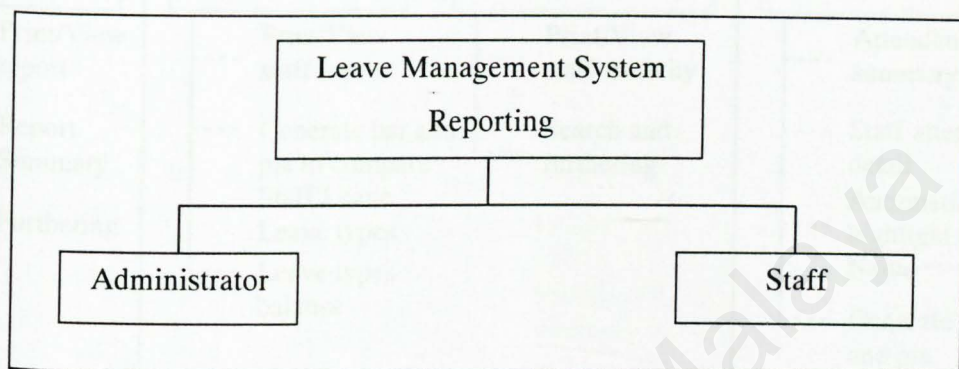


Figure 5.2: Structure chart of System

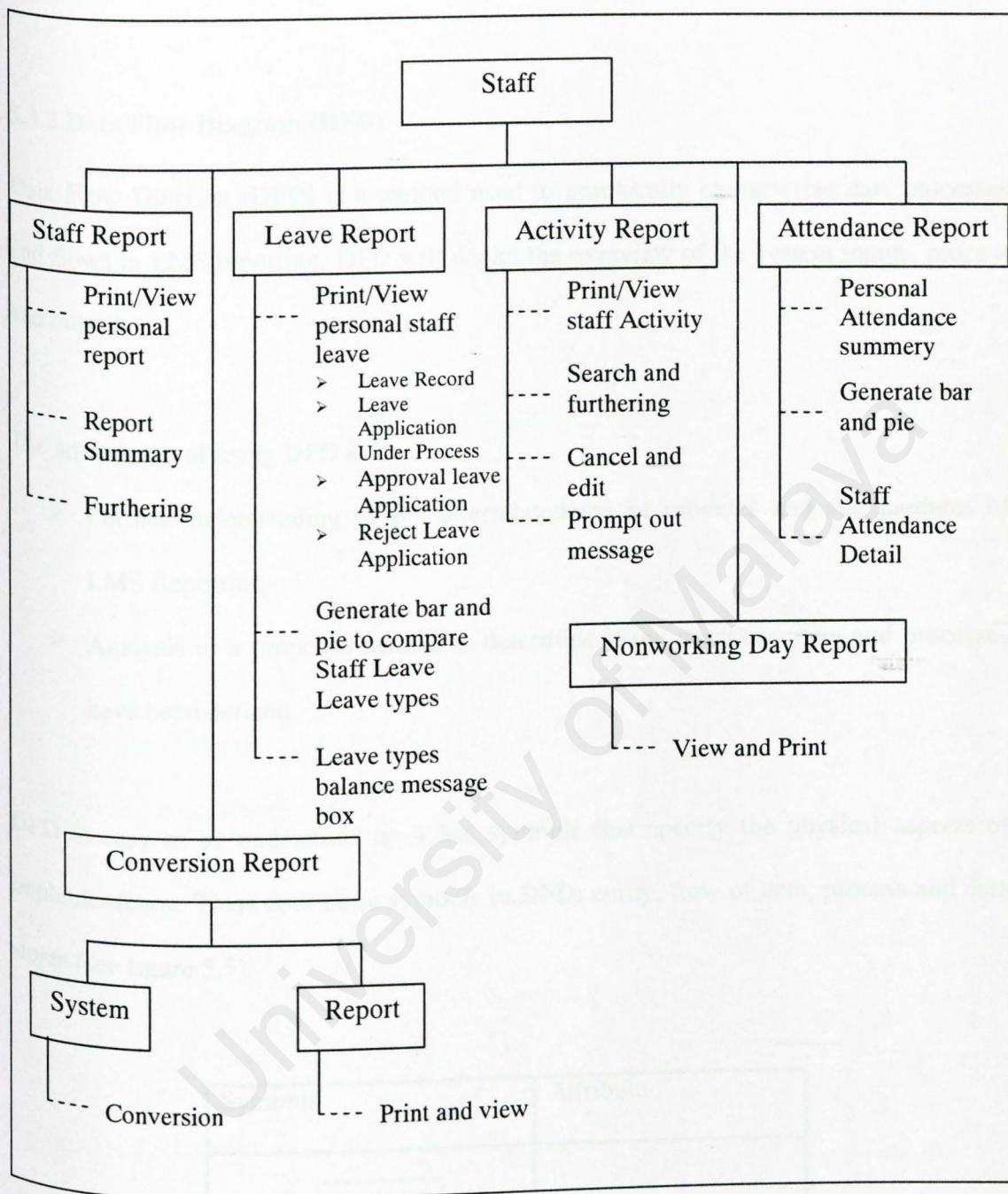


Figure 5.4: Structure chart of Staff

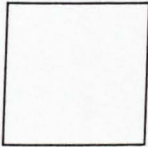
5.3.2 Data Flow Diagram (DFD)

Data Flow Diagram (DFD) is a method used to graphically characterize data processes and flows in LMS reporting. DFD will depict the overview of the system inputs, process and outputs.

The advantages of using DFD are:

- Further understanding of the interrelatedness of modules and sub modules of LMS Reporting.
- Analysis of a proposed system to determine if the necessary data and processes have been defined.

DFD is easy to be understood as it has symbols that specify the physical aspects of implementation. There four basic symbols in DFD: entity, flow of data, process and data stores (see figure 5.5).

Symbols	Attribute
	Entity
	Flow of Data

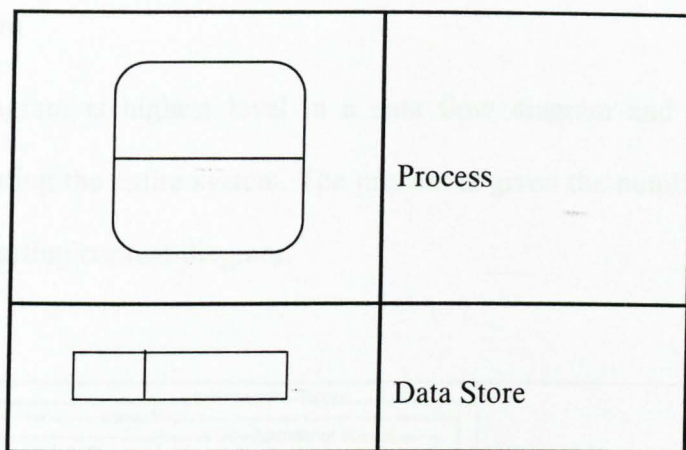


Figure 5.5: Component of DFD

The convention, which is used to design DFD are based on the work by C.Gane and T.Sarson. The data flow is conceptualized with a top-down perspective. So, the Context Level Diagram will be drawn, followed by the Diagram 0. Diagram 0 is an overview process of all the major modules in LMS Reporting that includes all the data stores, entities and process involved.

Context Diagram

The context Diagram is highest level in a data flow diagram and contains only one process, representing the entire system. The process is given the number zero. Figure 5.5 shows LMS Reporting context diagram.

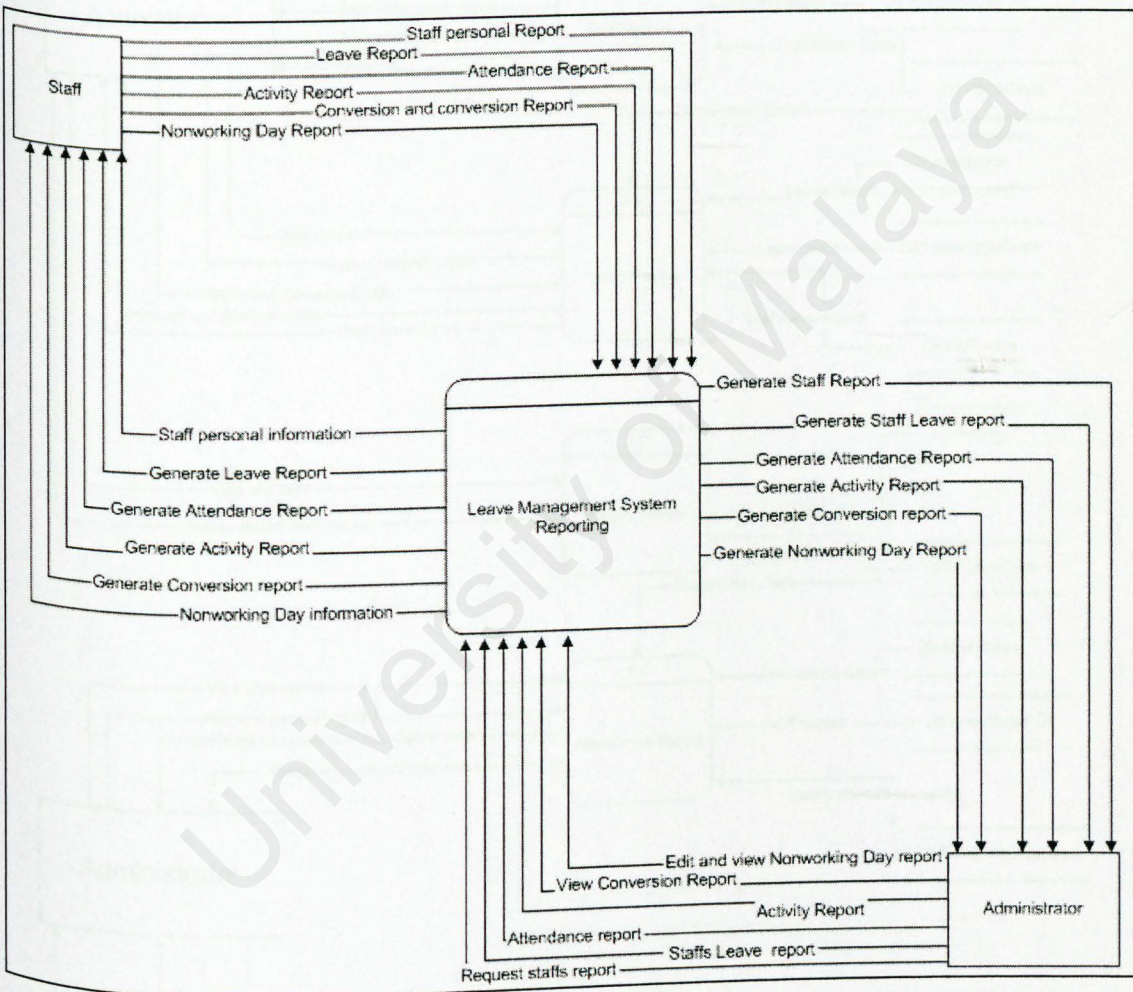


Figure 5.6 LMS Reporting Context Diagram

Zero Diagram

Zero Diagram is the explosion is context diagram. LMS Reporting separates the main process to many small processes to make the system clearer in this diagram.

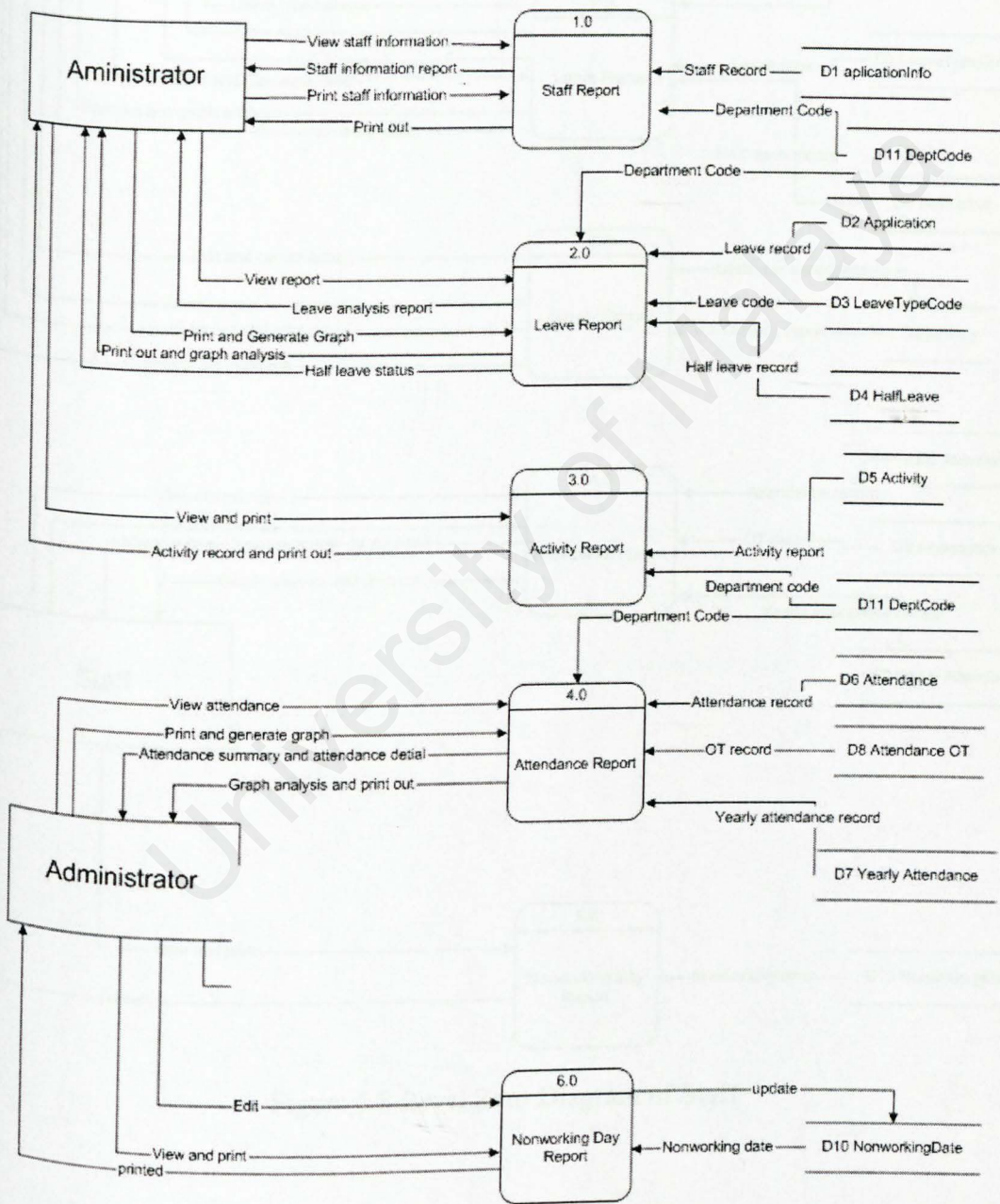


Figure 5.7 Level Zero Diagram of Administrator

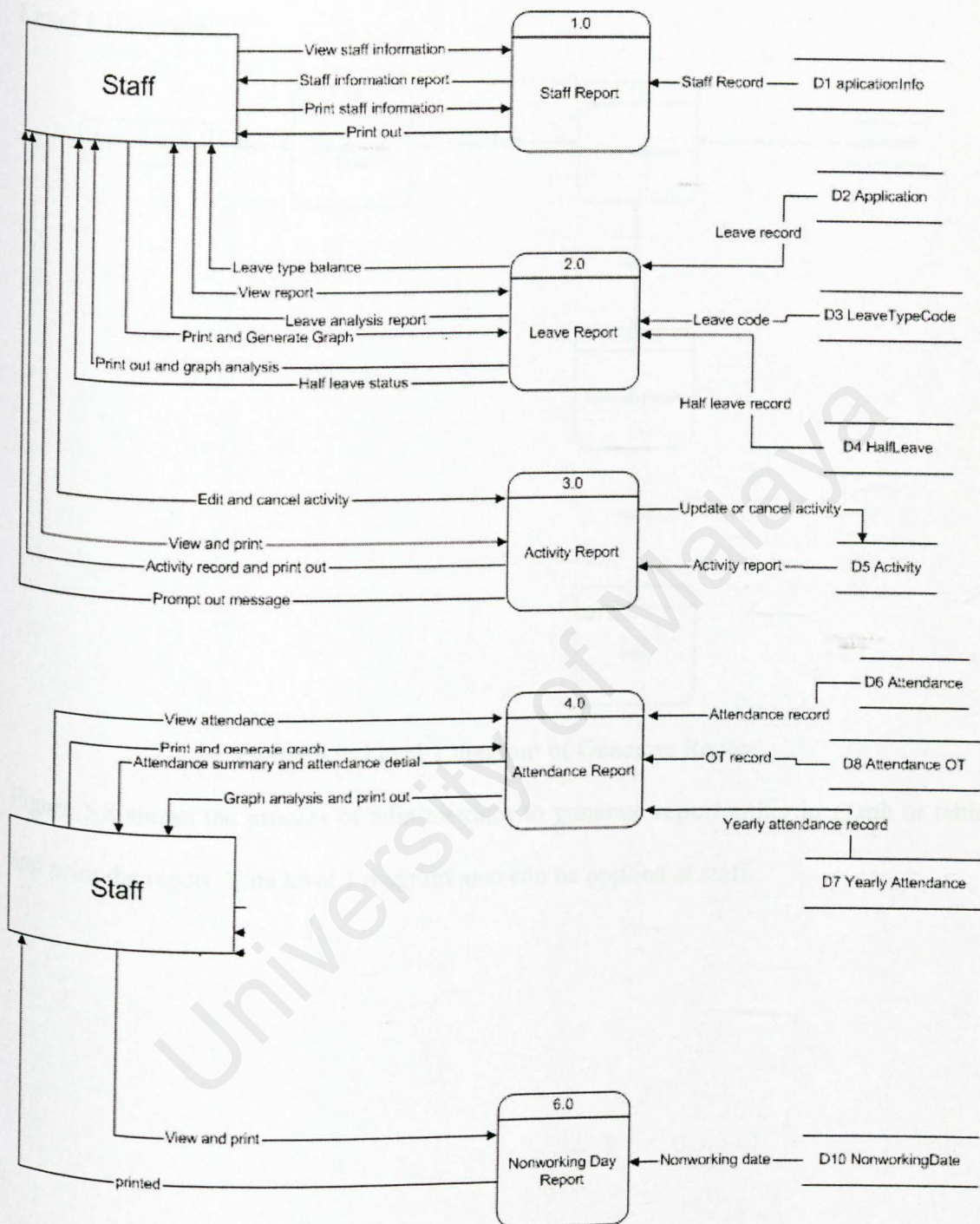


Figure 5.8 Level Zero Diagram of Staff

Level 1 Diagram

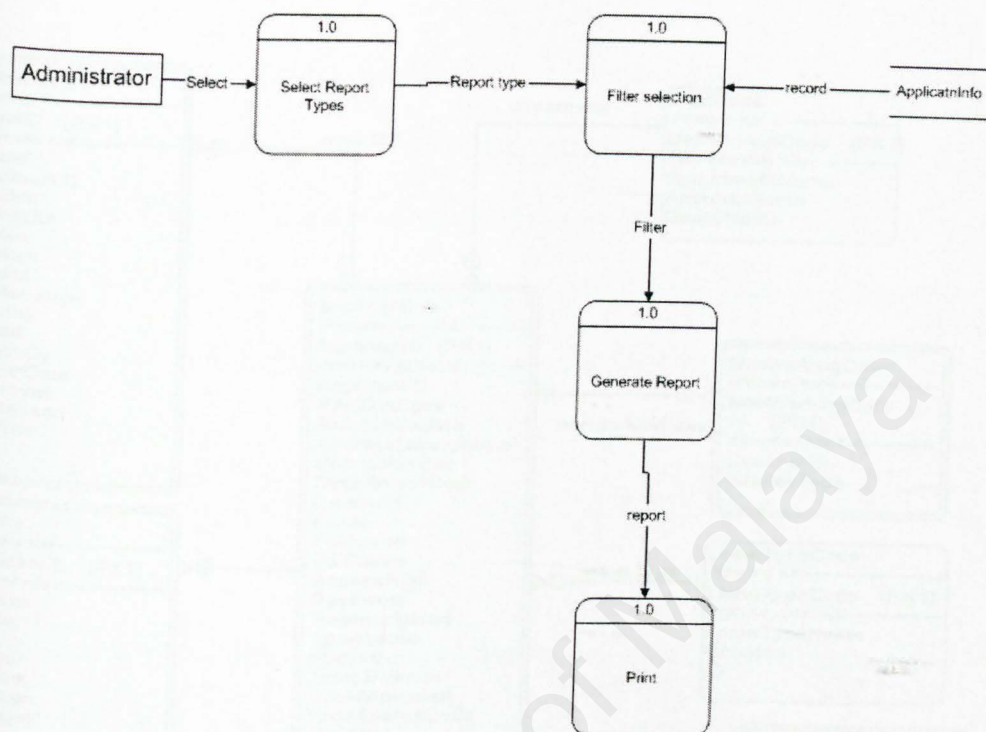


Figure 5.9: Level 1 diagram of Generate Report

Figure 5.8 shows the process of administrator to generate report either in graph or table and print the report. This level 1 diagram also can be applied at staff.

ER-diagram

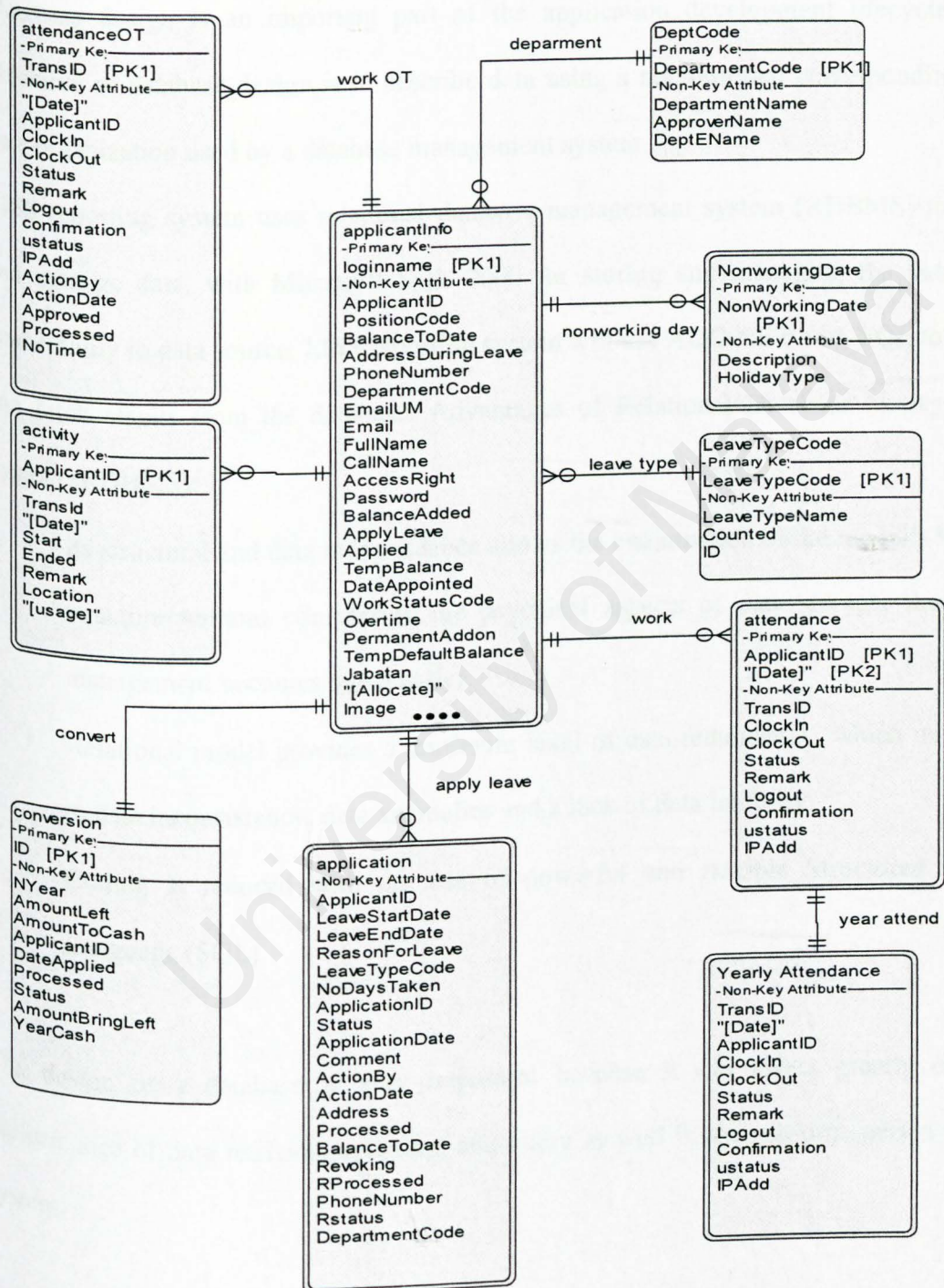


Figure 5.10 ER Diagram

5.4 Database Design

Database design is an important part of the application development lifecycle. The objective of database design is to describe data using a notation that corresponding to a data organization used by a database management system.

LMS reporting system uses relational database management system (RDBMS) to store and manage data, with Microsoft SQL 2000 for storing and managing the data. For connectivity to data source, LMS reporting system will use ADO.NET with SQL to query and fetch results from the database. Advantages of Relational Database Management System (RDBMS):

- Its structural and data independence allows the examination of the model's logical structure without considering the physical aspects of data storage, thus data management becomes much easier.
- Relational model provides a minimum level of data redundancy, which will lead to data inconsistency, data anomalies and a lack of data integrity.
- Coding is reduced with the use of powerful and flexible Structured Query Language (SQL).

The design of a database is very important because it can affect greatly on the performance of data retrieval, updating, and query as well in the run-time period of the system.

5.5 Data Dictionary

A database is self-describing: it contains, in addition to the user's source data, a description of its own structure. This description is called a data dictionary (also called a metadata). Data dictionary defines the field, field type and descriptions of each table.

The Activity table shows in Table 5.1 stores information or description of the staff activity.

Table Name: Activity

Primary key: Start, [Date]

Foreign key: ApplicantID

Field Name	Type	Len	Allow Null	Description
TransId	decimal	9	N	Staff translation ID
[Date]	datetime	8	N	Activity Date
Start	char	5	N	Activity Start
Ended	char	5	Y	Activity end
Remark	nvarchar	255	N	Note
Location	nvarchar	100	N	Activity Location
ApplicantID	int	4	N	Staff ID
[usage]	int	4	Y	usage

Table 5.1: Activity table

The applicantInfo table shows in Table 5.2 stores personal information.

Table Name: applicantInfo

Primary key: LoginName

Field Name	Type	Len	Allow Null	Description
LoginName	varchar	30	N	Staff Login Name
ApplicantID	int	4	N	Staff ID
PositionCode	varchar	20	N	Staff position Code
BalanceToDate	int	4	Y	Staff Leave Balance
AddressDuringLeave	varchar	100	Y	Address during leave
PhoneNumber	varchar	20	Y	Staff Office Phone Number
DepartmentCode	varchar	10	Y	Staff Department Code

EmailUM	varchar	40	Y	Staff Email (UM)
Email	varchar	40	Y	Staff Email
FullName	varchar	50	N	Staff Full Name
CallName	varchar	50	Y	Staff Call Name
AccessRight	varchar	10	Y	User status (Administrator or user "staff ")
Password	varchar	20	N	Staff Password
BalanceAdded	int	4	Y	Add Balance
ApplyLeave	bit	1	N	Leave Status
Applied	bit	1	N	Leave Has Been Taken
TempBalance	int	4	Y	Staff temporary balance
DateAppointed	datetime	8	Y	Staff Appointed
WorkStatusCode	varchar	20	Y	Staff Work Status Code
Overtime	int	4	N	Staff Overtime
PermanentAddon	int	4	Y	Permanent add on
TempDefaultBalance	int	4	Y	Staff temporary default balance
Jabatan	varchar	10	Y	Staff Department
[Allocate]	int	4	N	Staff allocate
Image	nvarchar	50	Y	Staff Picture
TypeApplicant	char	1	Y	Type application
PresentAddress	nvarchar	500	Y	Staff Present Address
PermanentAddress	nvarchar	500	Y	Staff permanent Address
FlagSameAddress	char	1	Y	Staff present address = permanent address "Y" else "N"
HomePhoneNumber	nvarchar	20	Y	Staff Home Phone Number
MobilePhoneNumber	nvarchar	20	Y	Staff Mobile Phone Number
NewIC	nvarchar	20	Y	Staff New IC
Gender	char	1	Y	Staff Gender
DOB	datetime	8	Y	Staff Date Of Birth
HeirName	nvarchar	100	Y	Heir Name
HeirContactNumber	nvarchar	20	Y	Heir Contact number
HeirAddress	nvarchar	500	Y	Heir Address
Qualification	nvarchar	200	Y	Staff Qualification
Website	varchar	70	Y	Staff Website
Website2	varchar	70	Y	Staff Website2

Table 5.2 applicantInfo table

The Application table shows in Table 5.3 stores staff leave information.

Table name: Application

Primary key: ApplicationID

Foreign key: ApplicantID

Field Name	Type	Len	Allow Null	Description
ApplicantID	int	4	N	Staffs applicant ID
LeaveStartDate	datetime	8	Y	Staff leave Start (date)
LeaveEndDate	datetime	8	Y	Staff leave end (date)
ReasonForLeave	varchar	2000	Y	Reason for leave
LeaveTypeCode	nvarchar	10	Y	Leave type code
NoDaysTaken	int	4	Y	Leave duration
ApplicationID	int	4	N	Staff application ID
Status	nvarchar	20	Y	Leave application status
ApplicationDate	datetime	8	Y	Leave application date
Comment	varchar	50	Y	Comment
ActionBy	nvarchar	50	Y	Action by
ActionDate	datetime	8	Y	Date action
Address	nvarchar	100	Y	Address
Processed	int	4	Y	Status of process
BalanceToDate	int	4	Y	Staff leave balance
Revoking	bit	1	N	Leave application revoking
RProcessed	int	4	Y	Leave application reprocess
PhoneNumber	varchar	20	Y	Staff phone number
Rstatus	varchar	20	Y	Leave application restates
DepartmentCode	varchar	10	Y	Department code

Table 5.3: Application table

The Attendance table shows in Table 5.4 stores staff attendance record.

Table Name: Attendance

Primary Key: [Date], TransID

Foreign key: ApplicantID

Field Name	Type	Len	Allow Null	Description
TransID	decimal	9	N	Staff translation ID
[Date]	datetime	8	N	Current Date
ApplicantID	int	4	N	Staff applicant ID
ClockIn	char	5	Y	Time work
ClockOut	char	5	Y	Time back

Status	nvarchar	20	Y	Attendance status
Remark	nvarchar	4000	Y	Remark
Logout	char	1	Y	Logout status “Y” or “N”
Confirmation	bit	1	N	Confirmation
ustatus	bit	1	N	Status
IPAdd	nvarchar	20	Y	Address login

Table 5.4: Attendance table

The AttendanceOT table shows in Table 5.5 stores staff overtime record.

Table Name: AttendanceOT

Primary key: TransID , Date

Foreign key: ApplicantID

Field Name	Type	Len	Allow Null	Description
TransID	decimal	9	N	Staff translation ID
[Date]	datetime	8	N	Current date
ApplicantID	int	4	N	Staff applicant ID
ClockIn	char	5	Y	Time work
ClockOut	char	5	Y	Time back
Status	nvarchar	20	N	Attendance status
Remark	nvarchar	4000	Y	Remark
Logout	char	1	Y	Logout status “Y” or “N”
confirmation	bit	1	N	Confirmation
ustatus	bit	1	N	Status
IPAdd	nvarchar	20	Y	Address login
ActionBy	nvarchar	150	Y	Action by who
ActionDate	datetime	8	Y	Date action
Approved	int	4	N	Approved status
Processed	int	4	N	Process status
NoTime	int	4	N	OT time

Table 5.5: AttendanceOT table

The conversion table shows in Table 5.6 stores staff attendance record.

Table Name: conversion

Primary key: ID

Foreign key: ApplicantID

Field Name	Type	Len	Allow Null	Description
NYear	int	4	N	Year
AmountLeft	int	4	Y	Leave amount balance
AmountToCash	int	4	Y	Total Amount can transfer to cash
ApplicantID	int	4	Y	Staff applicant ID
DateApplied	datetime	8	Y	Date applied
ID	int	4	N	Conversion ID
Processed	int	4	N	Process status
Status	varchar	20	Y	Conversion status
AmountBringLeft	int	4	N	Amount leave that bring to next year
YearCash	int	4	N	Amount transfer to cash

Table 5.6: conversion table

The DeptCode table shows in Table 5.7 stores department code record.

Table Name : DeptCode

Primary key : DepartmentCode

Field Name	Type	Len	Allow Null	Description
DepartmentCode	varchar	10	N	Department Code
DepartmentName	nvarchar	50	N	Department Name
ApproverName	nvarchar	50	Y	Approver Name
DeptEName	nvarchar	50	Y	Department Name (English)

Table 5.7: DeptCod table

The HalfLeave table shows in Table 5.7 stores staff half leave record.

Table Name: HalfLeave

Primary Key: TransID, [Date]

Foreign key: ApplicantID

Field Name	Type	Len	Allow Null	Description
TransID	decimal	9	N	Staff translation ID
ApplicantID	int	4	N	Staff applicant ID
[Date]	datetime	8	N	Half leave date
TypeLeave	nvarchar	50	N	Type leave

Reason	nvarchar	100	N	Reason
OTUse	int	4	N	OT time
Approved	int	4	N	Status approved
ActionBy	nvarchar	50	Y	Take action by
ActionDate	datetime	8	Y	Action date
Processed	int	4	N	Process status
Revoking	int	4	N	Rework
RApproved	int	4	N	Re-approved
RProcessed	int	4	N	Reprocessed
NoDay	int	4	N	Number of half leave

Table 5.8: HalfLeave table

The LeaveTypeCode table shows in Table 5.8 stores staff attendance record.

Table Name: LeaveTypeCode

Primary Key: LeaveTypeCode

Field Name	Type	Len	Allow Null	Description
LeaveTypeCode	varchar	10	N	Leave Type Code
LeaveTypeName	varchar	50	Y	Leave Type Name
Counted	bit	1	N	Number of yearly leave
ID	int	4	N	ID

Table 5.9: LeaveTypeCode table

The NonworkingDate table shows in Table 5.9 stores Nonworking date record.

Table Name: NonworkingDate

Primary Key: NonWorkingDate

Field Name	Type	Len	Allow Null	Description
NonWorkingDate	datetime	8	N	Nonworking Date
Description	nvarchar	50	Y	Description
HolidayType	nvarchar	10	Y	Holiday Type

Table 5.10: NonworkingDate table

The Yearly Attendance table shows in Table 5.10 store staff yearly attendance record.

Table Name: Yearly Attendance

Primary Key: [Date]

Foreign key: ApplicantID,TranID

Field Name	Type	Len	Allow Null	Description
TransID	decimal	9	N	Staff translation ID
[Date]	datetime	8	N	Date
ApplicantID	int	4	N	Staff applicant ID
ClockIn	char	5	Y	Time work
ClockOut	char	5	Y	Time back
Status	nvarchar	20	Y	Status
Remark	nvarchar	4000	Y	Remark
Logout	char	1	Y	Logout status "Y" or "N"
Confirmation	bit	1	N	Confirmation
ustatus	bit	1	N	Status
IPAdd	nvarchar	20	Y	Address login

Table 5.11: Yearly Attendance table

5.6 Interface Design

The design and creation of web pages has gone through several revolutions, yet it still presents a sizeable challenge to even the most skilled graphic designers. A great site is one that meets the needs of organization sponsoring it while creating an interesting and useful destination for the browsers.

An interactive graphical user interfaces is an important requirement for a successful web application. Therefore, effort in designing, specifying and implementing a user interface plays a significant role in application development.

The interface design must be able to help users to get information they need in and out of the system addressing the following objective:

- **User friendly**

Designed forms will allow users to input data easily. It contains combo box to allow users search for information. Besides, the interfaces enable users to take the corrective action once an error has been recognized. It also allows the user to return to the home page in every page.

- **Simple, clarity and interactivity**

The system will be kept simple and are designed in a manner that allows users to find what they are looking for in only a few steps effortlessly.

➤ Consistency

For LMS reporting system, the interface design will stress on the consistency format for command input, data display, menu selection and control objects placing. Besides, consistent icons, graphic identity schemes, and graphic or text-based overview can give user confidence that they can find what they are looking for without wasting time.



Figure 5.11 LMS reporting main page

5.7 Chapter Summary

This chapter explains the conceptual and technical design of the system. System architecture topic explains the three-tier client/server architecture that has been adopted in LMS reporting system. Then, System Structure Chart, context diagram and DFD diagram have been drawled. In addition, database design is shown by ER diagram, along with the respective data dictionary. Interface design section discusses the UI design principles adopted by the author, along user interface.

Chapter 6 SYSTEM IMPLIMENTATION

6.1 Introduction

System implementation in software development is a process to convert system requirements into program codes. The initial stage of system implementation involves setting up the development environment. This includes setting up development tools to facilitate the system implementation. Generally, the development environment is suited according to different development phases, which can be categorized into system design, system development and report writing process.

6.1.1 Development Tools Implementation

Windows XP professional	Operating System
SQL Server 2000	Database management system
Microsoft Visual Studio.NET	Main tool to create the Web Form, Crystal report, dataset and module file.
Dreamweaver MX	Editor for HTML and interface design.
Adobe Photoshop 7.0	Editor for image file.
Microsoft Internet Explorer 6	Browser for application.
Crystal Report 9.0	Create report file

6.2 System Coding

6.2.1 Database Implementation

A data provider in the .NET Framework serves as a bridge between an application and a data source. SQL server .NET data provider provides connectivity to Microsoft SQL Server version 7.0 or later using the SqlConnection object. So, I use this object

to connect to my database. The SQL Server .NET Data Provider support a connection string format that is similar to the OLE DB (ADO) connection string format.

Specify The Connection String in the web config file

```
<appSettings>  
  <add key="dbconn"  
value="server=GARY;database=LAMS;uid=sa;password=gary;"/>  
</appSettings>
```

Import the namespaces

```
Imports System.Data.SqlClient
```

Create the new connection

```
Dim conn As SqlConnection = New _&  
SqlConnection(ConfigurationSettings.AppSettings("dbconn"))
```

Figure 6.1 Create a new connection using SQL Server .NET Data Provider

After establishing a connection to a data source, I execute commands and return results from the data source using a command object. I create a command using the command constructor, which take optional argument of an SQL statement to execute at the data source, a connection object, and a transaction object.

The command object exposes several Execute methods I use to perform the intended action. When returning result as a stream of data, use ExecuteReader to return a DataReader object. Use ExecuteScalar to return a singleton value. Use ExecuteNonQuery to execute commands that do not return rows.

```
Dim strqry As String = New String("Select a.CallName,  
a.FullName,a.BalanceToDate ,b.ApproverName,a.TempBalance from  
ApplicantInfo a, Approver b where a.ApplicantID='123' and  
b.DepartmentCode=a.DepartmentCode ")
```

```
Dim cmd As New SqlCommand(strqry)
```

```
cmd.Connection = conn  
conn.Open()
```

```
Dim dataread = cmd.ExecuteReader()
```

```

Try
    MyDatalist.DataSource = dataread
    MyDatalist.DataBind()
Catch
End Try
dataread.Close()
conn.Close()

```

Figure 6.2 using the command object and ExecuteReader method

I also using the Command object with a stored procedure. I set the CommandType property of the command object to StoredProcedure. With a CommandType of StoredProcedure, I use Parametr property of the command to access input and output parameter and return value. The parameter property can be accessed regardless of the Execute method called.

```

conn.Open()
Dim strqry As String = New String("LMS_Name")
Dim cmd As New SqlCommand(strqry, conn)
cmd.CommandType = CommandType.StoredProcedure
Dim ApplicantID As SqlParameter =
cmd.Parameters.Add("@ApplicantID", SqlDbType.Int, 4)
ApplicantID.Value = Session("UID")
Dim reader As SqlDataReader
reader =
cmd.ExecuteReader(CommandBehavior.CloseConnection)
Dim fullname As String
Dim callname As String

If reader.Read Then
    fullname = reader("FullName").ToString
    callname = reader("CallName").ToString

End If
Dim name As String = " " & callname & " " & fullname
conn.Close()

```


Figure 6.3 Using the Stored procedure

The dataset object is central to supporting disconnection, distributed data scenarios with ADO.NET. The DataSet is a memory-resident representation of data that provides a consistent relational programming model regardless of the data source.

```
conn.Open()

Dim DS As DataSet
Dim MyCommand As SqlDataAdapter
Dim cmd2 As String = "SELECT Year(LeaveStartDate) as Year1 FROM
Application Group By Year(LeaveStartDate) ORDER BY
Year(LeaveStartDate)"

MyCommand = New SqlDataAdapter(cmd2, conn)
DS = New DataSet
MyCommand.Fill(DS, "Application")

Me.DropDownList1.DataSource = DS.Tables("Application").DefaultView

DropDownList1.DataBind()

conn.Close()
```

Figure 6.4 Using the Dataset

6.2.2 MODULE IMPLEMENTATION

6.2.2.1 Coding Approach

All the pages are developed in web Forms. The term Web Forms refers to a set of classes in the .NET Framework that provides support for building web applications. With the visual Studio .NET IDE's built-in awareness of Web Forms, building web pages now has (nearly) the same drag-and-drop simplicity as building form-based desktop application. In the ASP.NET framework, .aspx files can contain standard HTML tags (which are sent to browser), web forms tags (which represent Web

Forms classes and are interpreted by the ASP.NET runtime, rather than being sent to the browser), and code written in one of the .NET language.

ASP.NET pages are compiled. Even if an .aspx contains only HTML, it is still compiled. This is quite interestingly done. During the compilation process, ASP.NET reads the .aspx file and creates a class of outputting the HTML founding the file. If the .aspx file contains embedded Visual Basic .NET (or other .NET language) code, this code is compiled into the class.

The compiled class that represents an ASP.NET web page is a .NET class. As such, it must inherit from some other class. By default, classes created by ASP.NET inherit from page class. This means the generated classes have all the capabilities that are built into the Page class.

If desired, ASP.NET pages can specify a class from which to inherit, as long as the specified class itself ultimately inherits from the page class. This is the foundation for separating a page's code from its HTML. Code is placed in a class that inherit from the page class. The web page then specifies a directive indicating its compiled class should derive from the custom class, rather than directly from page class. This technique is referred to as code behind. The .vb file that contains the web-base definition is referred to as the code-behind file. The class from which the web page class inherits is called the code-behind class. These concepts are explained more fully throughout this chapter.

```
<%@ Page Language="vb" AutoEventWireup="false" Codebehind="A_activity.aspx.vb"
Inherits="LMSReporting.A_activity" %>
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.0 Transitional//EN">
<HTML>
  <HEAD>
    <title>A_activity</title>
    <meta name="GENERATOR" content="Microsoft Visual Studio .NET 7.1">
    <meta name="CODE_LANGUAGE" content="Visual Basic .NET 7.1">
    <meta name="vs_defaultClientScript" content="JavaScript">
    <meta name="vs_targetSchema"
content="http://schemas.microsoft.com/intellisense/ie5">
  </HEAD>
  <body leftMargin="0" topMargin="0" MS_POSITIONING="GridLayout">
    <form id="Form1" method="post" runat="server">
```

Figure 6.5 web forms Designer in HTML. View

The page directive at the beginning of the file provides information about how ASP.NET should process the page. The Page directive shown specifies the following setting < Language="vb" Specifies which language compiler to use when compiling embedded code in this file.

AutoEventWireup="false"

Determine how events generated by server-side controls are handled.

Codebehind="A_activity.aspx.vb"

Specifies the name of the code-behind file.

Inherits="LMSReporting.A_activity"

Specifies the name of the class from which this page should inherit. This must be the name of a class defined in the given code-behind file. In this example, the class name is A_activity in a namespace called LMSReporting

6.2.2.2 Scripting Language

For the client script, I use the JavaScript. JavaScript is simple to use, lightweight, and dynamic. Developers can easily code functionality for interactive applications inside a web page. The most noticeable difference between JavaScript and VBScript is the syntax. The syntax for JavaScript is similar to the syntax for the C++ programming language. Since VBScript is a subset of Visual Basic for Applications, VBScript follows the visual basic for applications syntax.

```
<A
onclick="window.open('calendar.aspx?TextBox=StartDate','cal','width=180,height=135,left=270,top=180')" href="javascript;">
```

Figure 6.6 Using JavaScript

Chapter 7 TESTING

7.1 Introduction

The main function of testing is to establish the presence of defects in a program and to judge whether the program is usable in real application. Nevertheless, testing can only demonstrate the presence of errors. It cannot show that there is no error in the program. Therefore, a more suitable approach must be chosen to reduce the possibility of errors in a program.

Bottom-up approach is adopted in system testing for Leave Management Reporting System. Each module at the lowest level of the system hierarchy is tested individually. Then, all the tested modules would be related to the next module testing. This approach is repeated until all the modules are tested successfully.

7.2 Testing Process

In general, the testing process of Leave Management Reporting System can be shown in the following figure. All the details will be further explained in subsequent sub-sections.

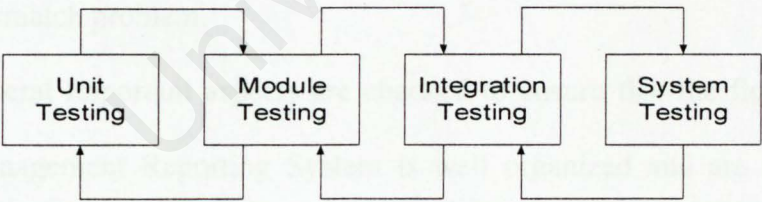


Figure 7.1 Testing Process

7.3 Types of Testing

7.3.1 Unit Testing

Unit test is the process to test the individual component to ensure that they function properly. Each component is tested independently without the interference from

other system components. Unit test is performed concurrently with the development process.

By using the debug feature provide by Visual Studio NET, codes are reviewed line by line to discover any syntax error as well as semantic error. If errors are discovered, they are corrected immediately.

7.3.2 Module Testing

Module testing is performed without other system modules. A module consists of a collection of dependent components to perform a particular task or function. Different possible test cases are applied to the module and the test results would be verified. Unusual results will be analyzed and they would help in debugging sub-modules in order to produce the desired output.

7.3.3 Integration Test

Integration test is needed when all modules are integrated. The main focus in integration test is to navigate the interfaces repeatedly to detect any interface mismatch problem.

Several important aspects are checked to ensure that the flow of the data in Leave Management Reporting System is well organized and are user friendly to all the system users.

7.3.4 System Test

The sub-systems are integrated to make the entire system. Therefore, the main purpose in system testing is to find errors that result from unanticipated interactions

between sub-systems. Besides, it is used to validate whether the system meets its functional and non-functional requirement.

However, in system testing has a very different objective to ensure that the system does what the customer wants. To understand how to meet these objective where fault in the system come from.

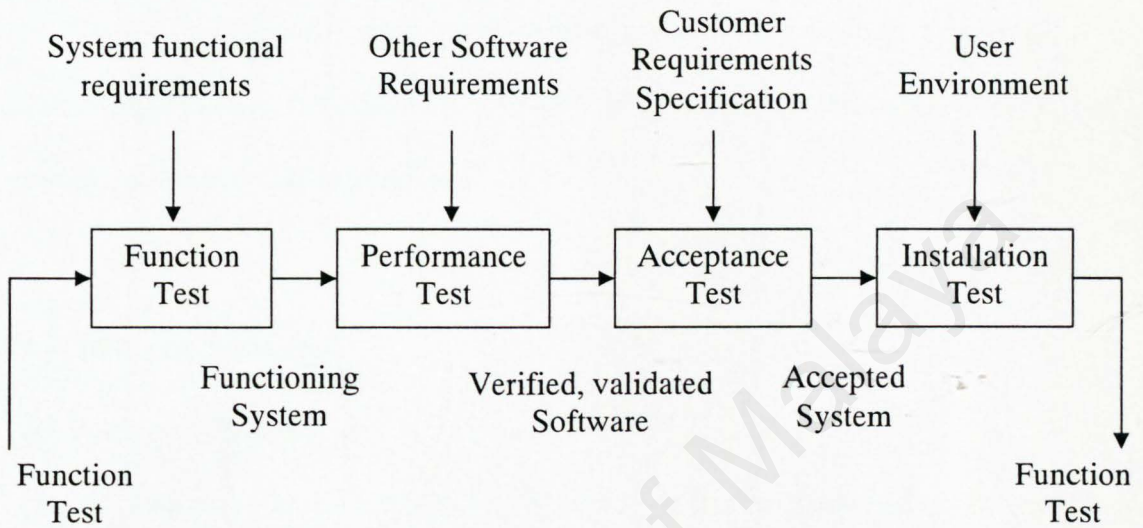


Figure 7.2 Steps in the Testing Process

There are several step used in testing system:

- Functional testing: Check that the integrated system problems its functions as specified in the requirements.
- Performance testing: Compares the integrated components with the nonfunctional system requirement. These requirements including security, function are performed.
- Acceptance testing: Allow customer to test the system for this step, I presented my system to my supervisor and ask some useful command from him.

- Installation testing: Allow the users to exercise system functions and document additional problem that result from being at the actual site. For this

step, I get a hand from my course mate to help me.

Chapter 8 System evolution and conclusion

8.1 Evolution

Evaluation is the ultimate phase of developing a system and an important phase before delivery the system to the end users. Evaluation was related to user environment, attitudes, information priorities and several other concerns that are to be considered carefully before effectiveness can be concluded. At all phases of the system approaches, evaluation is a process that occurs continuously, drawing on a variety of sources and information.

8.2 System Strength

➤ Platform Independent

One of the many reasons ASP.NET was chosen is to give flexibility to the system to be able run in any operating system or platform and accessed through any internet browser in any platform independent to realize wide accessibility.

➤ Report and Graph Generator

The main objective of Leave Management Reporting System is to allow staff and administrator in FSKTM to generate graph and report easily without wasting their time to convert data from database to excel format.

➤ Coding Reusability and compatibility

.NET technology recognizes codes reusability. Subsequently, .NET can import namespace and use it. Besides that, .NET also recognizes include uncton where one file's codes can be recall into another file. This elements repetitive codes and increase performance.

➤ Expansion and Scalability

Leave Management Reporting System and realizes there might be a need for expansion in the future. Therefore Leave Management reporting System to be highly scalable.

8.3 Problems Encountered and solutions

➤ Difficulties in choosing a development technology, programming and tools

Advises and views were sought from project supervisor, course mates and Forum Room for instance Yahoo Crystal Report .Net Group and Crystal Decision web site or help file to engage new skill.

➤ Database Testing

The current LAMS database is too large is take time to check whether the data have been calculated are accurate or not.

➤ Inexperience in the chosen programming language

I borrowed a book from friend to study ASP.NET and also downloaded Crystal Report E-Book. Those references have become my main resource to assist me throughout the coding process. Besides, MSDN library also helps me a lots in my coding process.

8.4 Future Enhancements

- High Light and search function have to implement to allow user high light and search the record they wish to search without wasting their time.
- Add in more graphs function to make this system more powerful.
- Report can automatically remain user about their activity before the activity occurs.

- Enhance the current database so that more user friendly.

8.5 CONCLUSION

I learn a lot throughout the process of doing this thesis. This includes knowledge in .NET technology, monitoring database, implementing graphics into system and so on.

After finished developing the system, I begin to realize that even though programming skills and techniques are import in development good software engineering techniques must also be applied. Here, theories and knowledge gained throughout the course of IT studies like system analysis, design and software engineering were literally put into practice.