CHAPTER 1
INTRODUCTION

1.1 Overview

Virtual Private Network (VPN) solution is a communication technology to create a secure private path in the Internet to transmit crucial data. It is an extension of a private network that encompasses links across the Internet. In business organizations, VPN is widely used to enable a secure remote access and data transfer to the organization server and other computer systems through the Internet. Virtual Private Networking can be deployed to establish secure connection from a single computer to a remote server or securely connecting two private inter-network over the Internet.

VPN enables data transfer between two computers to traverse through the public network such as the Internet in a manner that emulates the properties of a point-to-point private link. Data is encapsulated with a protocol header to provide routing information. Encryption is deployed to the data packet to make it indecipherable.

One example of a VPN implementation is deploying tunneling capability of Internet Protocol Security (IPSec) to transparently move private data across the public Internet. It treats entire packets from a private inter-network as payload data that must be transported across a public transport network.
VPN implementation between two inter-networks involves deployment of two VPN gateways, which acts as one end of a "tunnel". The VPN gateway encapsulates the entire packets it receive from a private inter-network in new Internet Protocol (IP) packets before they travel across the public Internet. The new packets, carrying the private source and destination addresses, are simply directed to a second VPN gateway that protects the other end of the transmission. The receiving gateway then recognizes and disassembles the encapsulated packet before passing its contents on to the correct address on the private inter-network.

To deploy a virtual private networking across the busy public Internet, a variety of different network devices and software products can act as VPN gateways, including VPN access servers, VPN routers, and computers with VPN client software installed.

One of the benefits of a VPN implementation is organization members from all over the world can dial up to the Internet and gain access to their organization Local Area Network (LAN) and enjoy the privilege as any other network member. Data can be retrieved and sent securely over the Internet as the VPN applies a tight security measurement. Geographical barrier is no longer a problem to securely disseminate information.

Examination management in education can benefit from VPN solution technology to securely implement online assessment. VPN gateway can be installed between the examination provider and the examination center to ensures the examination
questions and responses be transferred in a private channel over the Internet. Examination questions from the examination provider server can be accessed via the Internet with proper authentication, encryption and encapsulation technology applied by the VPN gateway. Examination candidates can sit for their examinations by connecting the Internet from any location by deploying VPN remote access to the examination provider server. Data will be transmitted between the candidates and examination organizer server as an encrypted message and channeled through a control tunnel. The examination organizer server will deploy a special coded program to check the students' answers and to publish the marks. These make the management of examination secure, more efficient, fast and reliable. A lot of high-risk tasks involving security and confidentiality of examination materials normally done manually such as the delivery, storage, marking of question papers, and the maintenance of score sheets are then taken care of by the networked computer. Problems such as question leakage before examinations, dishonesty and mismanagement are therefore minimized.

This research intends to investigate into the implementation of a secure online assessment for Information Technology subject.
1.2 Objectives

Objectives of the project are:

1. To identify the potential usage of the VPN over the Internet as a medium for retrieval and submission of Information Technology examination paper at Sijil Pelajaran Malaysia level.

2. To identify potential threats in the course of using the VPN as the medium for retrieval and submission of Information Technology examination paper at Sijil Pelajaran Malaysia level.

3. To identify and select the most suitable technique to implement the VPN as the medium for retrieval and submission of Information System paper at Sijil Pelajaran Malaysia (SPM) level.

1.3 Scope of the System

The system concentrates on security management of an on-line examination, multiple delivery of the questions, question interface design and the automation of examination marking. The focus of the system includes:

1. Establishing a Virtual Private Network or a tunnel between the Examination Center Local Area Network and The Examination-Syndicate of Malaysia server. The Chief Invigilator of an examination center will make a dial up to the LPM server to establish Point-To-Point Tunneling Protocol (PTPP) connection. After the connection is
successful, every machine in the Examination Center may be able to access the Examination Question website.

2. Authentication of examination candidate. Candidates' identity will be authenticated by matching their user ID and password keyed in with the record in The Examination Syndicate of Malaysia system database, which resides in the examination server. After such authentication, the candidate will receive an online-examination web page.

3. Multiple deliveries of examination questions. Candidates undergoing a session of examination may get different sets of examination papers.

4. Data transfer security. Data transmitted between the Examination Syndicate server and The Examination Center will be in encrypted form and will be encapsulated with tunneling control header.

5. User-friendly question navigation. All questions are located in a single web page. Candidates are free to navigate through the question before submitting the correct answer.

6. Marking and scoring of the examination by a server side program.
1.4 System Design Methodology

Rapid Prototyping Model is applied in developing this on-line examination web page. An electronic examination model is built using Visual Basic programming language. Prototyping is very useful as a tool for quickly gathering specific information of user requirements. It is a working model representative. Most of the main characters of the final system are rapidly built to allow user and developer to come to an understanding of what the final product will be. Essential function and operational portion of the desired system will be included to represent the final system. The main prototype character usually consists of data input screen, user interface and report. It is important to ensure the prototype incorporate enough representative functions to allow users to understand that they are interacting with a real system.

One of the benefits of prototyping is the user may experience and use the system at the early stage. User will react to the prototype and provide useful information to the developer. User is expected to articulate suggestions of addition or deletion of the features being tried and propose innovation to the prototype. A prototype will generally be modified several times until the user and developer are satisfied with the outcome of the desired software. It is much easier to do modification at the early stage rather than modifying a complete system. Development of the system will proceed if the user agrees with the modified model.
Figure 1.1: Rapid Prototyping
1.5 Project Schedule

A structured approach is used in project scheduling. The project is divided into three major phases: analysis, design and implementation. The tasks include in analysis phase are literature review on virtual private networking, data gathering on the existing examination system and on intended on-line examination, and identifying suitable web editor and web server to develop and implement the new system. In design phase, web page layout is designed with emphasis on data entry design, input design and page navigation design. The implementation process focuses on project testing and evolution. The Gantt chart below shows the project scheduling in detail.

![Gantt Chart]

*Figure 1.2: Project schedule Gantt chart*