

Network Simulator Test Engine for Huawei eNSP and Cisco GNS3

By

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A PROPOSAL

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION SYSTEM (HONS)

BUSINESS INFORMATION SYSTEM

Faculty of Information and Communication Technology

(Perak Campus)

JAN 2014

UNIVERSITI TUNKU ABDUL RAHMAN

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ACKNOWLEDGEMENTS

I would like to take this opportunity to express my sincere thanks and appreciation to my supervisors, Dr. Choo Peng Yin who has given me this bright opportunity to engage in a commercialized and having user-base IT project. This Final Year Project had brought me advantages in my internship and future career as this Project had added value when interview by companies for internship. I have learned a lot of new things while doing this project. Whenever I face problem, Dr. Choo always will provide guidance and suggestion regarding the problem issues. His invaluable advice and consideration throughout the progress of doing this Final Year Project are greatly appreciated. A million thanks to you.

Besides, I would like to thanks my academic advisor, Mr. Albert Yong who given me a lot of useful advices regarding my final year project, future career and studies in university. Finally, I must say thanks to my parents and my family for their love, support and continuous encouragement throughout the course.

ABSTRACTS

Network Simulator Test Engine is defined as software that enables the lab trainer or instructor to conduct practical tests or interactive guided lab with network simulators (Huawei eNSP and Cisco GNS3). This test engine will be able to help user to debug and give instance feedback on configuration done in eNSP. Besides, this project also able to help lecturers to perform guided lab and practical test. Furthermore, this project also included socket programming to send the result marks of student to a server PC (lecturer), this features allow lecturer to obtain their student marks instantly and keep track of their progress during each exercise or test.

Purpose of this software is mainly to will improve the teaching quality and student learnability regarding networking subject. Besides, it also will reduce the workload of lecturer when conduction lab or practical test. This software is stand-alone software which can execute on windows platform and do not require to modifying the Huawei eNSP and Cisco GNS3 software.

Evolutionary prototyping methodology is used in this project as this is a newly idea, therefore it required rapidly develop a prototype to show clearer concept of this project. Since rapid application development (RAD) approach is more suitable for this project to support poof-of-concept and able to get early stage feedback from users before full completing of the project. After repeatedly went through the phases such as planning, analysis, design, implementation, and testing, the prototype will become fully functional software that fulfills the requirement or objective of this project.

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LIST OF ABBREVIATIONS

<i>ACL</i>	Access Control List
<i>CBL</i>	Computer Based Learning
<i>CBT</i>	Computer Based Training
<i>DHCP</i>	Dynamic Host Configuration Protocol
<i>eNSP</i>	Enterprise Network Simulation Platform
<i>GNS3</i>	Graphical Network Simulator
<i>HCDA</i>	Huawei Certified Datacom Associate
<i>HWIC</i>	High-Speed WAN Interface Card
<i>HSRP</i>	Hot Standby Router Protocol
<i>IOS</i>	Internetwork Operating System
<i>IP</i>	Internet Protocol
<i>LAN</i>	Local Area Network
<i>LTS</i>	Long Term Support
<i>NIC</i>	Network Interface Controller
<i>OS</i>	Operating System
<i>PC</i>	Personal Computer
<i>RAD</i>	Rapid Application Development
<i>WBT</i>	Web Based Training

1.1 Introduction

In the context of this project, a “Network Simulator Test Engine” is defined as software that enables the lab trainer or instructor to conduct practical tests or interactive guided lab with network simulators (Huawei eNSP and Cisco GNS3). This test engine will be able to help user to debug and give instance feedback on configuration done in eNSP. Besides, this test engine also able to help lecturers to perform guided lab and practical test on eNSP. Currently, eNSP does not support those functions (test and guided lab) and those functionalities will have great impact to lecturers, students and others eNSP (and GNS3) users. With this interactive guided lab, user will find it more interesting and easy to learn during practical session since user able to know the correctness of their works and the test engine also will notify lecturers regarding which students is unable to follow the teaching pace. This will improve the teaching quality and student learnability regarding networking subject.

During practical test or lab test, lecturer able to prepare question and let student to take the assessment by using this test engine. Student only required to open the instruction that pre-prepared by lecturer and start doing the assessment. Student able to check their answer and get instance feedback on the correctness of what they have done. On the other hand, student result or marks will automatically sent to lecturer client computer over a LAN connection and lecturer able to export student result to external format such as PDF or Excel. This function will reduce the workload of lecturer which they don't required to walk around and mark down every individual student marks.

1.2 Motivation

The main aims of this project is to develop a software that help to solve the difficulties process of conducting lab and practical test using Huawei eNSP and GNS3. Currently both network simulator eNSP and GNS3 does not provide the checking and interactive lab functionality, this project will create stand-alone software that able to check the correctness of user works, provide interactive guided lab to improve learning process regarding networking courses and let users having better experience in using network simulator like Huawei eNSP and GNS3.

Moreover, this project also will ease the process of conducting HCDA (Huawei Certified Datacom Associate) training program. As HCDA training program duration is quite short, and trainers have to rush in order to finish all teaching materials in the short period, without the checking ability of trainee works, it will consume a lot of time during the process of troubleshooting all trainee works. This project will give users instance feedback regarding their correctness of works.

Last but not least, this project provides marks registration which means this software able to sent users current marks to a server PC (lecturer or trainer PC). This software allows lecturers or trainers to keep track of students or trainees progress and approach to specific person who unable to solve the problem on time.

1.3 Problem Statement

After some analysis and research on similar product in the market such as Packet Tracer version 5.3.3 for IT in the literature review of Chapter 2, Packet Tracer Activity Wizard did provides good assessment functionalities in which it allow user to create a networking scenarios for practical test purpose. It able to give instance feedback to user regarding which assessment item is correct or wrong. However, it doesn't provide guidance for user and instruction given by Packet Tracer is in less interactive ways. For instance, it doesn't have the functionality to provide step by step guided lab instruction and give support during mistake made by user.

Besides, Packet Tracer is not able to communicate to real devices like eNSP and GNS3 does. For example, eNSP and GNS3 allow user to connect a real router to the network simulator and let the virtual router communicate with the real router. Since there is a demand for others network simulator tools like eNSP and GNS3, we cannot solely depend on Packet Tracer. Therefore, there is a need to for this project to increase the learning process of using network simulator tools like Huawei eNSP and GNS3 since they does not provide the checking functionalities like what Packet Tracer does.

1.4 Project Scope

This project is to develop standalone software that can perform the functionality of checking networking configuration in eNSP, guided lab with interactive video instruction to users and student marks registration module which will send students marks or task status to lecturer computer to notify lecturer regarding the progress and marks of students without the needs of modifying the eNSP software code.

This project will be developed using visual basic programming language because it suitable for rapid application development (RAD) approach. This project is able to install and execute in windows base operation system such as Window XP, Vista, and 7 without the needs of extra hardware.

1.5 Project Objective

- 1.5.1 Able to read in input generated by eNSP and GNS3 and compare with the pre-loaded sample answer then show the result to user.
- 1.5.2 Written Test module which allows lecturers to create Multiple Choice Question and Text input question as a package with practical labs. Students answer will be automatically check by system after they submit their answer. Calculated marks will sent to Server.
- 1.5.3 Lecturers able to choose initial topology network, answer topology network and lectures also able to choose which assessment items to be assessed for practical test mode.
- 1.5.4 Connectivity testing between two nodes. Able to check whether end devices are connected to each other with correct cables.
- 1.5.5 Student marks registration module which will sent students marks or task status to lecturer computer to notify lecturer regarding the progress and marks of students.
- 1.5.6 Lecturers are able to get students marks immediately during or directly after the test and able to export to external format (e.g. PDF or Excel).

1.6 Impact, significance and contribution

This project will have great impact to education field regarding networking. Currently, there is no similar test engine product that able to check the work result of network simulator eNSP and GNS3. By having this software, students who are in networking field will have better experience in networking since having more interactive lab and checking function that allow student to get instance feedback regarding their work progress. This software will increase teaching quality among university and student learnability regarding networking subject will also be increased.

Besides, this project also will reduce the heavy workload of lecturers. With the help of this software, lecturers do not have to waste a lot of precious time on troubleshooting and checking students work. Lecturers also able to get rid of repeating similar practical lab process and change to a more interactive practical lab process by using this software.

Lastly, this project will contribute to world community by sharing this new idea can be added to network simulator such as Huawei eNSP and GNS3 to increase the value of the software as a network simulator. A network simulator is mainly used for education, training and testing purpose, it will be better if the network simulators have the functionality of checking of works and instance feedback of their answer. This will also increase the interest of pupil regarding networking and attract more users to use the network simulator.

2.1 Literature Review

2.1.1 Review on Linear learning/Computer based learning (E-Learning)

Computer based learning (CBL) is using of computers as a main component of the e-learning environment, for instance, in a place or venue which computers are used for educational purposes. This concept can be view as being unique from the use of computer in different ways where learning is at least a peripheral element of the experience. (Dr.Sivanthi et al., 2010)

Computer based training (CBT) refers to self-paced learning activities assessable through a computer or other devices such as portable handheld devices. It can be instructor-led and includes media in different forms. For example, animation, audio, image, streaming video and text. CBT mostly presents it content in a linear format and delivers it content via CD-ROM. Due to this reason; CBT is always used to teach static processes like completing mathematical equations or using software. Computer based training and Web Based Training (WBT) can be used interchangeably, the main difference is that WBTs are delivered using a web browser via Internet while CBTs are typically delivered via CD-ROM. (Dr.Sivanthi et al. 2010)

Assessing learning in a CBT is often comes from various form such as multiple choice questions which can be easily marked by a computer. Others good examples are interactive means, radio button, drag-and-drop functionality and simulation. Assessments are be easily marked and recorded via online software. The software is able to provide instance feedback, completion status to users and users usually are able to print a hardcopy of their result in the form of certificates. (Dr.Ravichandran et al. 2010)

CBTs provide extraordinary learning methodology via learning stimulus which is different from traditional learning methodology such as instruction, textbook and manual. For instance, CBTs provide user-friendly solutions for fulfilling the requirement of continuing education. Students are able to acquire more knowledge and skills through these methods which are much more conducive to individual learning preferences, instead of limiting students to reading printed manuals or attending courses. (Dr.Sivanthi et al. 2010)

CBTs are good choices to improve or enhance the learning process by including videos or animations in learning materials. Besides, CBTs is able to distribute to a wide range of users easily and at low cost once the development is done. (Dr.Ravichandran et al. 2010)

However, CBTs impose some disadvantages as well. During the creation of efficient and effective CBTs requires large number of resources. The development tools for CBTs such as Flash and Adobe Director is more complex and subject to capability of teacher able to use it. Moreover, CBTs will limit the content that able to present and assessment that able to perform when there is lack of human interaction. Nowadays, many learning or educational organizations are began to use smaller CBT/WBT activities which include interactive components and online discussion as part of an e-learning program. (Kanev et al., 2009)

2.1.2 Review on Cisco Packet Tracer Activity Wizard (version 5.3.3)

Cisco Packet Tracer is a network simulator which have activity wizard, an assessment tool that allow user to create a networking scenarios for practical test purpose. It able to give direct feedback to user regarding which assessment item is correct or wrong. However, it doesn't support the function of providing guidance for user and instruction give is in word form which is less interactive. Besides that, Cisco Packet Tracer is unable to send assessment marks of individual to specify client or server, lecturers are require to approach to every individual student to record down theirs marks.

Furthermore, if unfortunately some problems occur during the assessment time for instance, system crash or computer restarted. Student might have to redo the assessment since Packet Tracker does not provide the ability to save their marks. This brings a lot of problems to both lecturers and students. Students have to request lecturer to help them mark down this current marks in the middle of practical test in case anything happened. This process had increased the workload of lecturers and students are unable to concentrate on the assessment. The following figure 2.1 and 2.2 showing pictures of activity wizard.

Chapter 2: Literature Review

The screenshot shows the 'Activity Results' window in Cisco Packet Tracer. The window title is 'Cisco Packet Tracer - C:\Users\Shu\Desktop\Degree\Degree Sem3 (2012 may)\Data Comm\UCCN1003-trial test 01-(b).pka'. The main heading is 'Activity Results' with a 'Time Left: 00:09:44'. Below the heading, it says 'You did not complete the activity. Please close this window and try again.' There are three tabs: 'Overall Feedback', 'Assessment Items', and 'Connectivity Tests'. The 'Assessment Items' tab is active, showing a tree view of the network configuration and a table of results. The table has columns for 'Assessment Items', 'Status', 'Points', and 'Component(s)'. The results show that all items are 'Incorrect 1' and 'Points' are 0. A summary on the right shows 'Total Points : 0', 'Completed Items : 0', and 'Required Items : 16'. A table below the summary shows 'Component Correct/Total Points' with values: Ip (0/12, 0), Other (0/4, 0), and Connectivity Tests (0/1, 0). A 'Close' button is at the bottom right.

Assessment Items	Status	Points	Component(s)
Network			
PC0			
Default Gateway	Incorrect 1		Ip
DNS Server IP	Incorrect 1		Ip
Ports			
FastEthernet			
IP Address	Incorrect 1		Ip
Link to Router0	0		Other
Connects to FastEther...	Incorrect 1		Other
Subnet Mask	Incorrect 1		Ip
Router0			
Ports			
FastEthernet0/0			
IP Address	Incorrect 1		Ip
Link to PC0	0		Other
Connects to FastEther...	Incorrect 1		Other
Subnet Mask	Incorrect 1		Ip
FastEthernet0/1			
IP Address	Incorrect 1		Ip
Link to Server0	0		Other
Connects to FastEther...	Incorrect 1		Other
Subnet Mask	Incorrect 1		Ip
Server0			
Default Gateway	Incorrect 1		Ip
DNS Server	0		Ip

Figure 2.1 Assessment item and points had achieved (Cisco)

The screenshot shows the 'PT Activity' window with the title 'PT Activity: 00:08:04'. The main heading is 'Design and Connectivity test'. Below the heading, it says 'Design a network with 3 network elements :'. The instructions are:

- 1) a 1841 router (Router0)
- 2) a server (Server0)
- 3) a PC (PC0)

Connectivity instructions:

- Connect PC0 to fa0/0 of Router0.
- Connect Server0 to fa0/1 of Router0

PC0 spec:

- 1) IP = 172.16.50.1/24
- 2) Gateway = 172.16.50.254
- 3) DNS = Server0 IP

Server0 spec:

- 1) IP = 172.16.40.1/24
- 2) Gateway = 172.16.40.254
- 3) DNS service [www.123.com = Server0 IP]

Connectivity test:

- PC0 ping www.123.com

Time Left: 00:08:04

Completion: 0%*

Buttons: Top, Check Results, Reset Activity, <, 1/1, >

Figure 2.2 Instruction gives by lecturer (Cisco)

2.1.3 Review on Cisco Packet Tracer (version 6 beta)

A latest version 6 beta of Cisco Packet Tracer has been release in year 2013; it is an improved version of 5.3.3 with new features such as IOS 15, HWIC-2T, HWIC-8A modules, 3 new Cisco routers and most important features that related to this project is improvement on Activity Wizard which this project will benchmark with. However, this project proposal started before the release of Cisco Packet Tracer version 6 beta therefore the primary comparison of this project will base on version 5.3.3.

Improvement made on Activity Wizard in version 6 beta will be considered for future enhancement of this project. The table below show the change log Cisco Packet Tracer version 6 beta.

	New features of Cisco Packet Tracer (version 6 beta)
General Improvement	<ul style="list-style-type: none"> • Improvements on Activity Wizard • Improvements on Variable Manager • Support current LTS version of Ubuntu and stopped support for Fedora • IOS 15 • HWIC-2T and HWIC-8A modules • CAB-HD8-ASYNC cable • IPv6 in IP Configuration under Desktop • Terminal server for routers • PC Firewall for IPv4 and IPv6 • Servers with 2 NICs • Circling tool
Protocol Improvement	<ul style="list-style-type: none"> • HSRP for IPv4 and IPv6 • IPv6 DHCP • IPv6 tunnel over IPv4 • IPv6 DHCP binding • Send command for routers • ACL sequence numbers
New Devices	<ul style="list-style-type: none"> • Routers: <ul style="list-style-type: none"> - Cisco 1941 - Cisco 2901 - Cisco 2911

Table 2.1 Change log of Cisco Packet Tracer version 6 beta

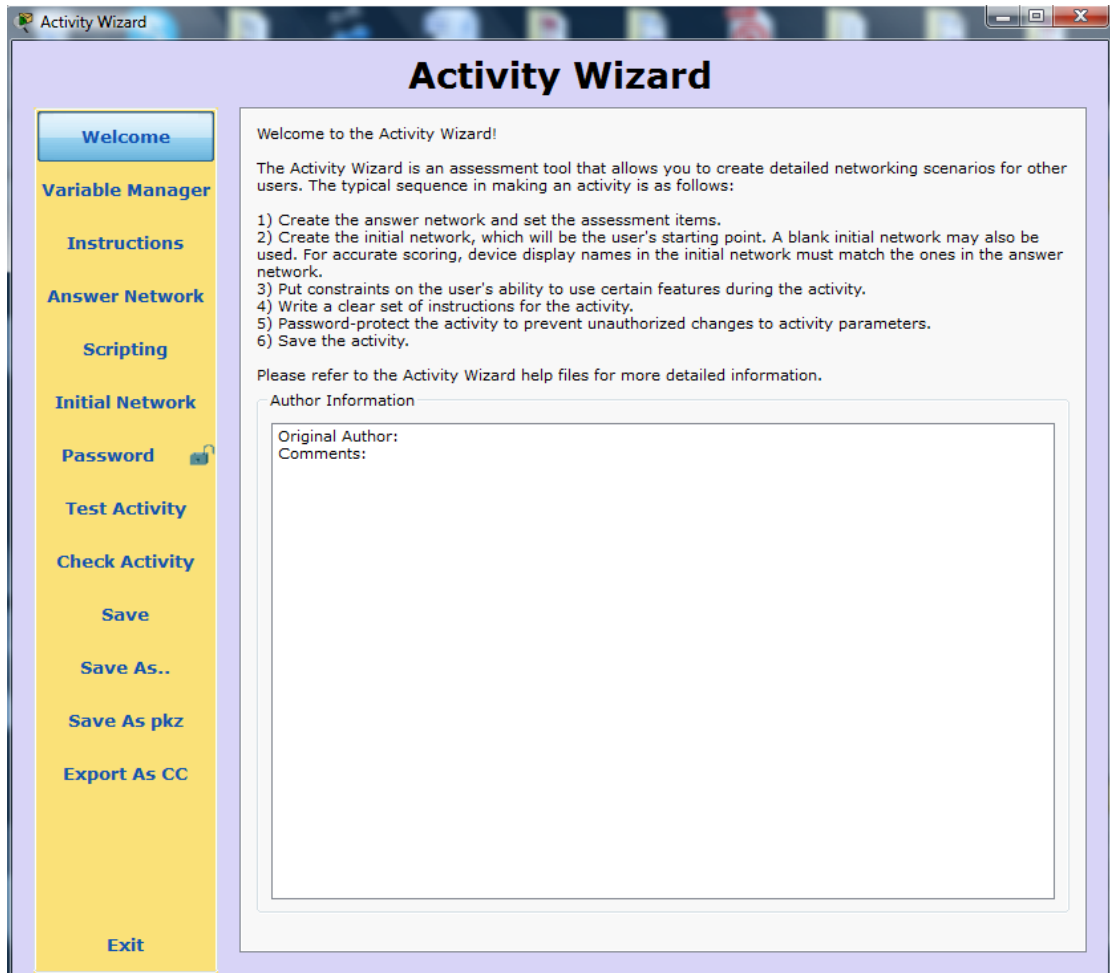


Figure 2.3 Activity Wizard of Cisco Packet Tracer version 6 beta (Cisco)

2.2 Strength and weakness analysis

	Strength	Weakness
Computer Based Learning (CBT)	Provide user-friendly solutions such as interactive menu	Required large number of resources
	Enhance the learning process by providing video or animation	Unable to embedded into external software and perform practical assessment base learning
Packet Tracer Activity Wizard (5.3.3)	Provide direct feedback to user regarding correctness of assessment item	Unable to send assessment marks of individual to specify client or server
	Able to provide good connectivity test between 2 nodes	Unable to provide interactive learning environment
		If system crash during the assessment, user have to restart the assessment.

Table 2.2 Strength and weakness of CBT and Packet Tracer

2.3 Comparison features of similar product with Network Simulator Test Engine

Features	Packet Tracer Activity Wizard (version 5.3.3)	Network Simulator Test Engine
Instance feedback regarding assessment item	✓	✓
Connectivity links between 2 nodes	✓	✓
Support practical test	✓	✓
Assessment duration counter	✓	✓
Written Test such as MCQ and fill in the blanks	✗	✓
Simple and ease of use.	✗	✓
Marks registration module (Marks of user able to sent to a specific server)	✗	✓
Export students marks	✗	✓
Support guided lab	✗	✓

Table 2.3 Features comparison between similar products

3.1 Methodology and tools

This project will use evolutionary prototyping methodologies since this type project is new and less similar project to show the concept of this project. Therefore, prototyping approach is selected to rapidly develop a prototype to show clearer concept of this project. Rapid application development (RAD) approach is more suitable for this project support poof-of-concept and able to get early stage feedback from users before full completing of the project.

Evolutionary prototyping has the ability to iterate the process of analysis, design and implementation on the previous prototype and provide refinements to the system. The iteration process continues in a cycle until it satisfied the requirements of stakeholders and they agree that the system provides sufficient functionality to be installed and be used in the environment. (Hoffer et al. 2011) The figure 4.1 below will show the development phases of evolutionary prototyping.

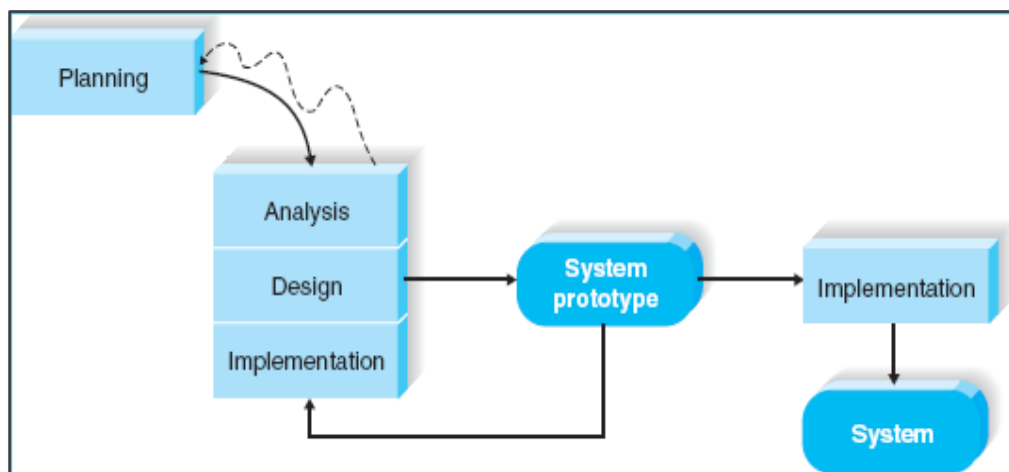


Figure 3.1 System Development Life Cycle of Evolutionary Prototyping Methodology (Hoffer et al. 2011)

3.2 Implementation Issues and Challenges

Every project has its own difficulties and challenges during implementation. Overcome those issues and challenges and complete the project before deadline is a must. The main challenges faced during this project is regarding finding references, because this project idea is new and combining e-learning materials to a networking related field cases is rare. This project is required to figure out how to check the result of an external source network simulator without modifying the specific software. Besides, due to RAD approach as the methodology of this project, time is a big challenge. The software prototype is required to develop in a short period of time and test by end users to gain users experiences and feedback. Feedback from end users is important to future enhancement of my project and proof-of-concept as this is a new idea.

3.3 Project Timeline

Project planning phases act as an important role for a project. During development process of a project, time is a crucial factor; therefore scheduling the development task is required in order to ensure the project able to finish within deadline. Uncertainty might happen during the development process, specific action must be taken to solve the problem and ensure the project able to successfully develop. This section shows the timeline of this project, hopefully this project able to develop according to what has been planned.

Chapter 3: Methodology

3.3.1 Project Timeliness for Project One

There are total eight available weeks to complete the project one which includes the first four chapters of the project thesis. Gantt chart below show the timeline used for project one start from project introduction and ends with project one presentation.

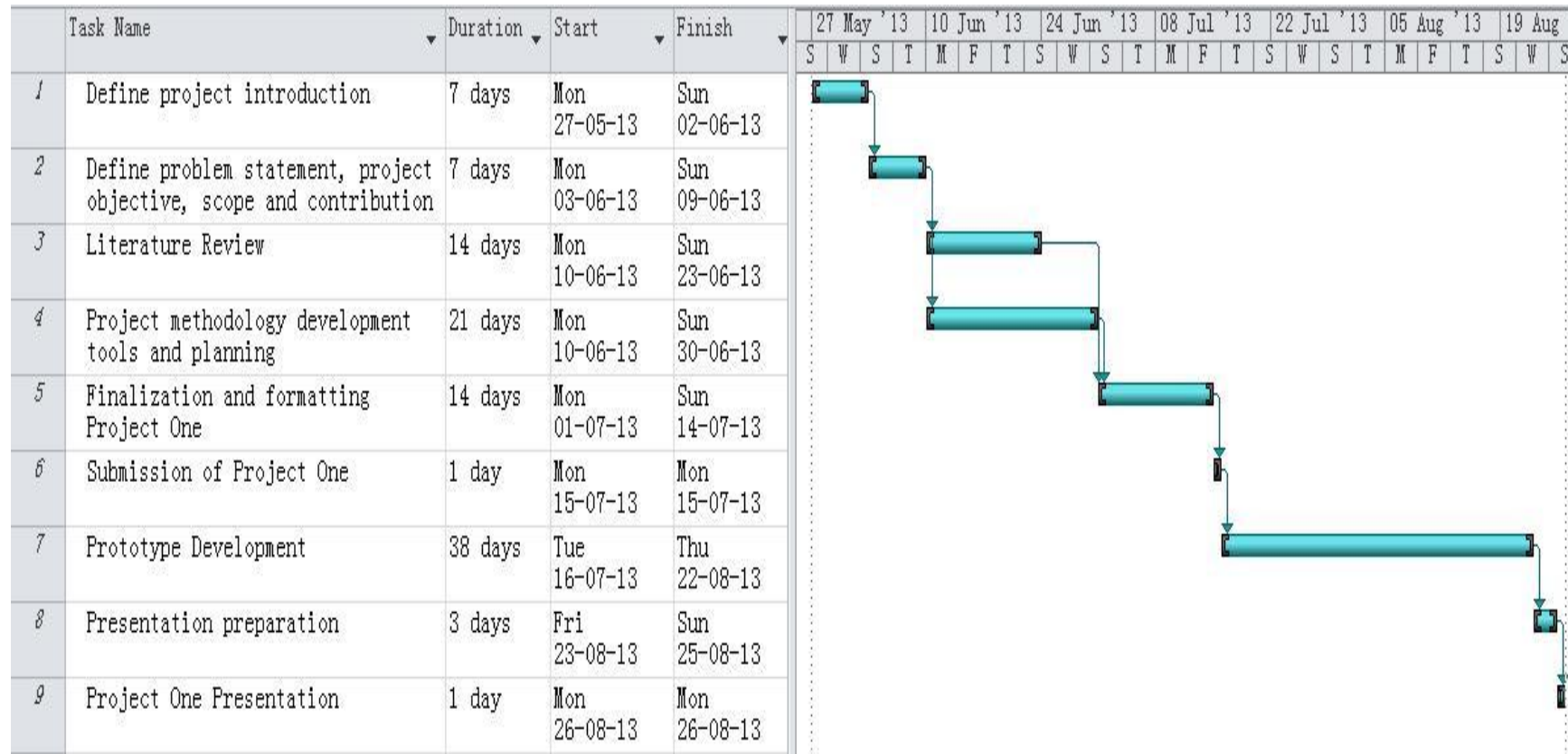


Figure 3.2 Gantt chart for Final Year Project I

Chapter 3: Methodology

3.3.2 Project Timeliness for Project Two

There are total thirteen available weeks to complete the full project thesis. Gantt chart below show the timeline used for full project thesis start from familiar with development methods and tools and ends with Final Year Project presentation.

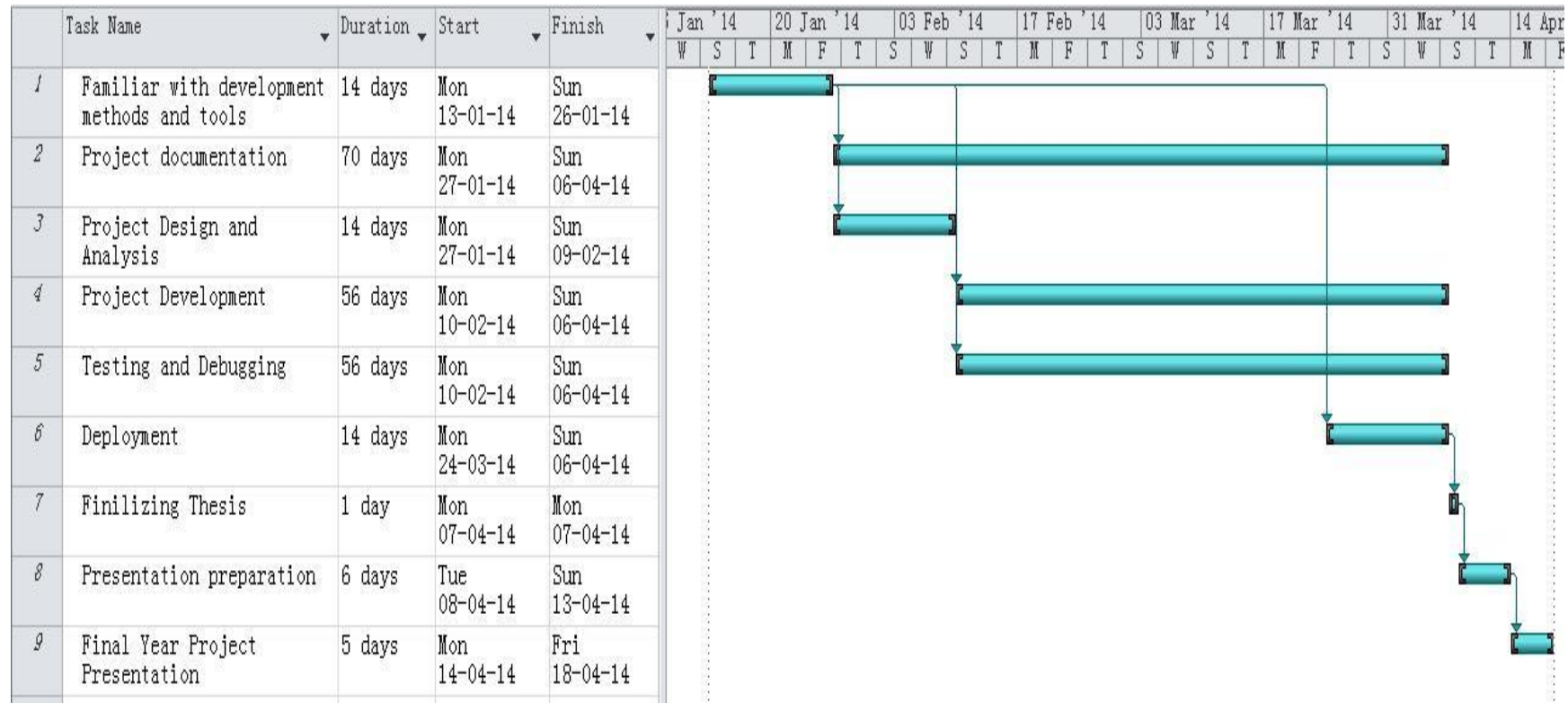


Figure 3.3 Gantt chart for Final Year Project II

3.4 Requirement specifications

3.4.1 User requirement

Category	Software requirement
Framework	.NET framework 4.0 or above
Operating System	Windows XP, Vista, 7
Related Software	Huawei eNSP version 1.0.216
	Huawei eNSP version 1.0.320
	GNS3 version 0.8.3.1

Table 3.1 Software required by users

This project Network Simulator Test Engine is able to run in all Windows platform, however it required .NET framework 4.0 or above. Besides, users also required to install related software in order to use this software. This project supports 2 types of network simulator tools which are Huawei eNSP version 1.0.216, 1.0.320 and GNS3 version 0.8.3.1.

3.4.2 General Flowchart

This project will have 2 versions; one is student version and lecturer version (Administrator). Lecturer version will have extra functionalities but the work flow of the project is almost similar between this 2 versions. After the software is started, a main page will prompt out if the configuration has been done once; if not a configuration page will prompt out instead of main page.

Next, students able to select which practical lab or guided lab they want from a list of pre-loaded sample. Students able to check their work result with the answer and marks of the students will show in a list. While for guided lab, students have to follow step by step the instruction and complete a part before can move to another. Whenever check marks button is pressed, a copy of marks will send to a specific server pc and marks will be shown in server pc list.

Lecturers (Administrator) have more privilege which able to perform extra function such as create lab assessment or guided lab, receive student's marks list by turn on server services and export marks list to Excel/PDF format. Figures below will show the main page and configuration page of this project and general system flowchart of 2 version of this project including student and lecturer version.

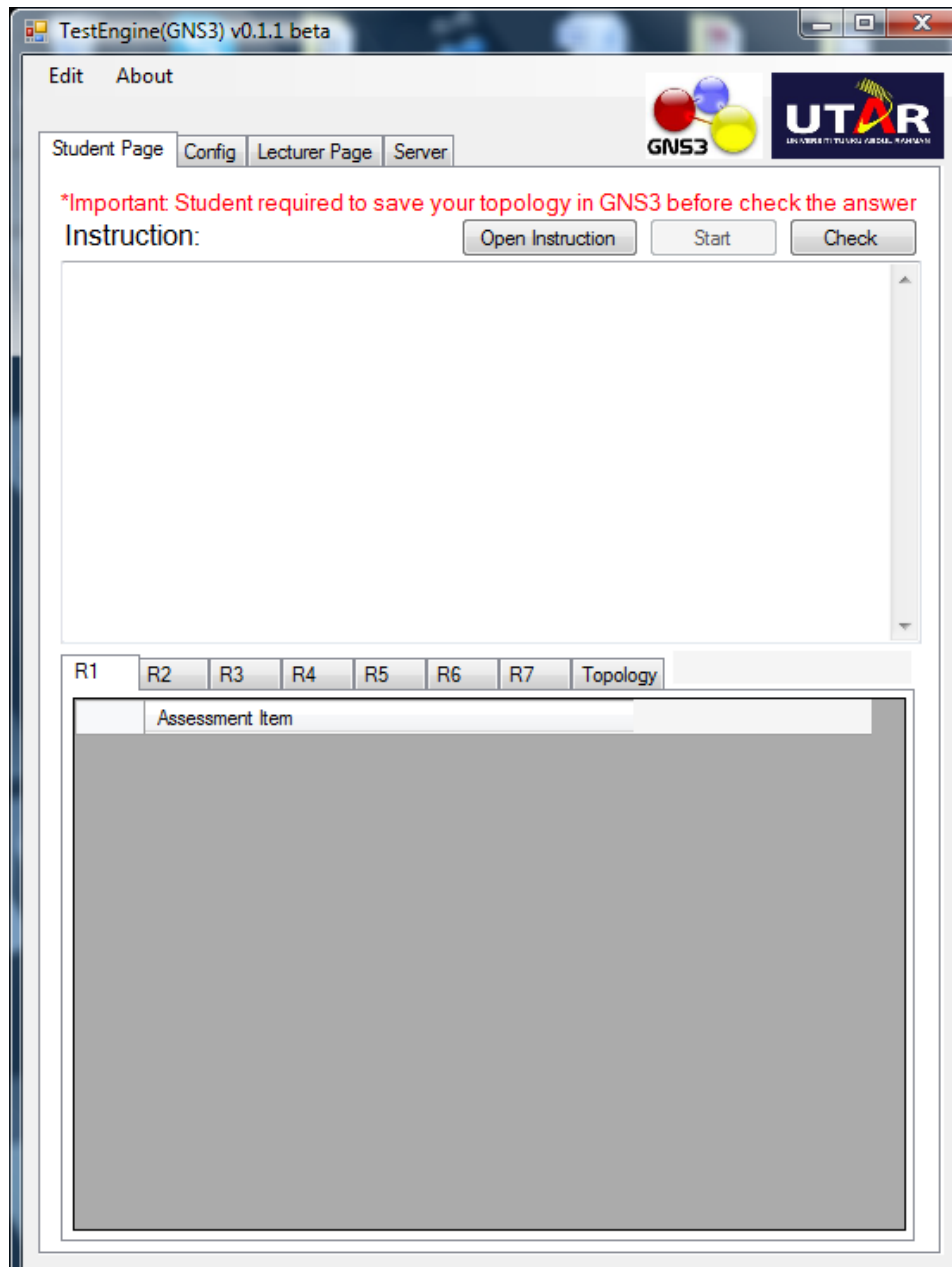


Figure 3.4 Main page design of Test Engine

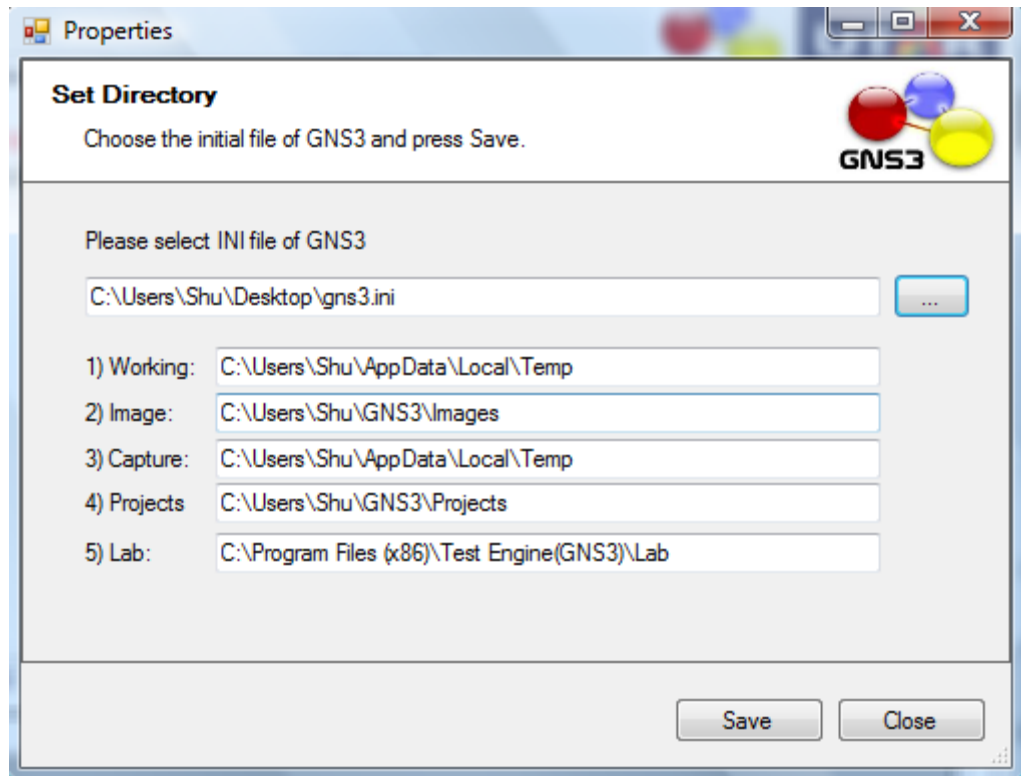


Figure 3.5 Configuration page of Test Engine

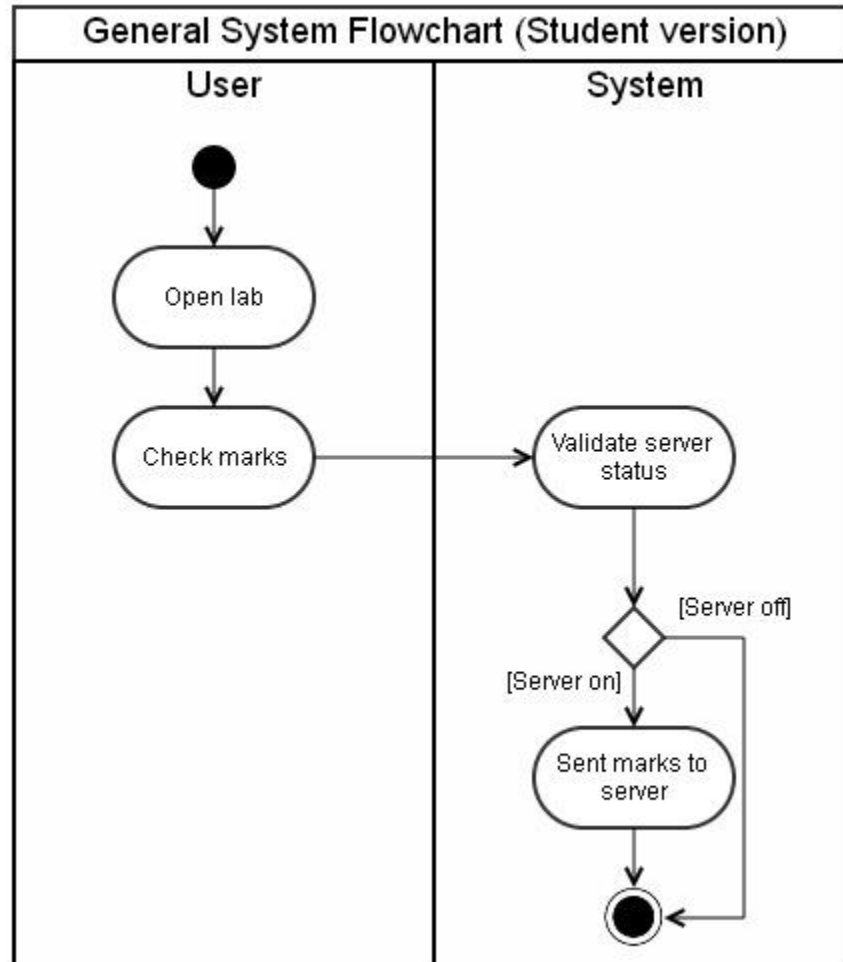


Figure 3.6 General System Flowchart of Test Engine (student version)

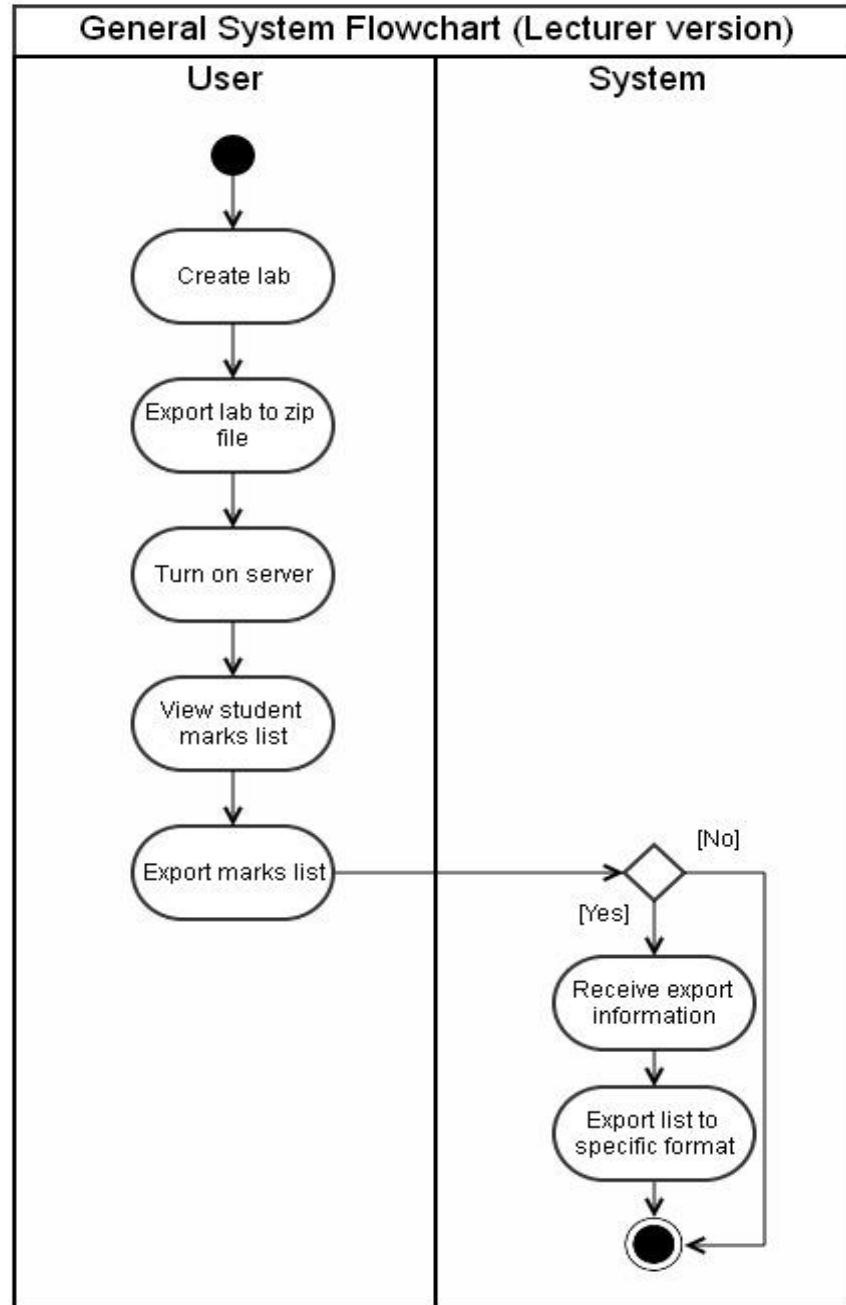


Figure 3.7 General System Flowchart of Test Engine (lecturer version)

3.4.3 Use Case Diagram

Network Simulator Test Engine

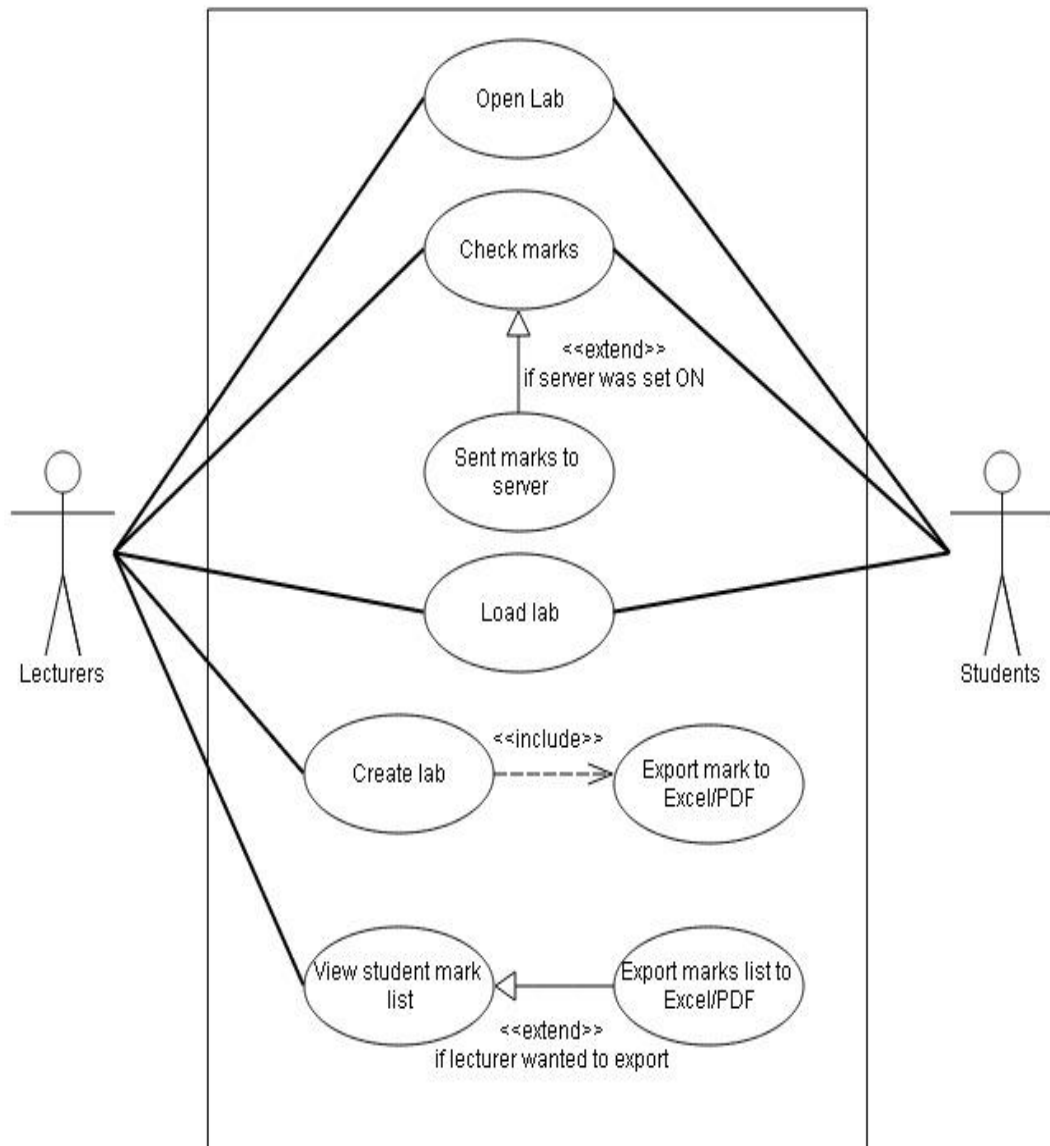


Figure 3.8 Use Case Diagram

3.5 Development Tools

To develop a software, it is required some basic requirement including hardware and software. Without both either one of the requirement, software could not be developed. Software basically is required to support the development process or documentation of this project and hardware is required to support software development tools used during the development process of the project.

3.5.1 Hardware

Since this project is to develop stand-alone software that does not required outstanding hardware specification, therefore in this project will just used a standard laptop to develop the software. This project doesn't require any external hardware to support the development of this project. The table below shows the laptop that will be used during the development process of this project.

Laptop Model	HP Pavilion DV6
Processor	Intel® Core™ 2 Duo CPU P7450 @ 2.13GHz
System Type	64-bit Operating System
Memory	4.00 GB
Storage	300 GB
Graphics	Intel HD 3000

Table 3.2 Laptop Hardware Specification

3.5.2 Software

Among the development process of this project, numerous of software is needed to develop the software, documentation, testing and so on. The table below shows the software specification will be used during the development process of this project.

Category	Software Name	Functionality/Purpose
Operating System	Windows Vista Home Premium	Laptop OS platform
Development tools	Microsoft Visual Studio 2010 Professional	Visual Basic development platform
Virtual Machine	VMware Player	Software compatibility testing
Documentation	Microsoft Word 2007	Report Documentation
	Microsoft Power Point 2007	Presentation Preparation
	Microsoft Project 2010	Gantt Chart
Framework	.NET framework 4.0	To support Visual Basic development

Table 3.3 Laptop Software Specification

4.1 Feedback from Users

Due to this project required proof-of-concept, therefore a quick prototype of the network simulator test engine for Huawei eNSP and GNS3 has been developed. This prototype network simulator test engine (GNS3) version 0.1.1 beta has been tested by UTAR students who talking UCCN2243 Internetworking Principles and Practice during practical assessment (April 2013). Besides, an improved version of prototype network simulator test engine (eNSP) has been tested during HCDA (Huawei Certified Datacom Associate) training program at KDU, Penang (May 2013). After the testing, a survey form is distributed to get feedback from users regarding my prototype for future enhancement. The survey form will be attached in Appendix A.

Chapter 4: Test Result

The graphs below show the feedback of UTAR students regarding network simulator test engine (GNS3) version 0.1.1 beta

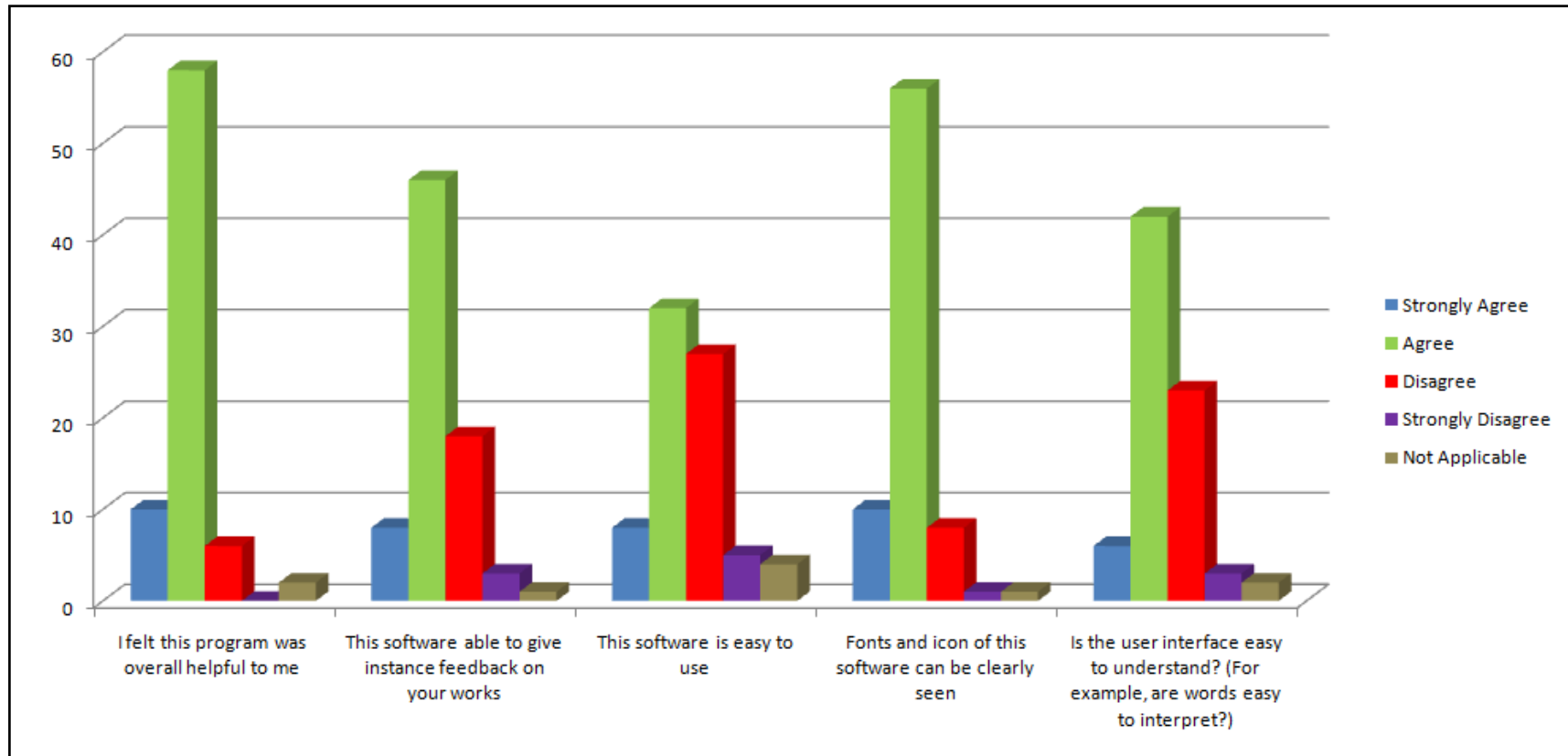


Figure 4.1 Graphs shows the feedback of UTAR students regarding project prototype

Chapter 4: Test Result

The graphs below show the feedback of HCDA trainee regarding prototype network simulator test engine (eNSP) version 0.1.1 beta

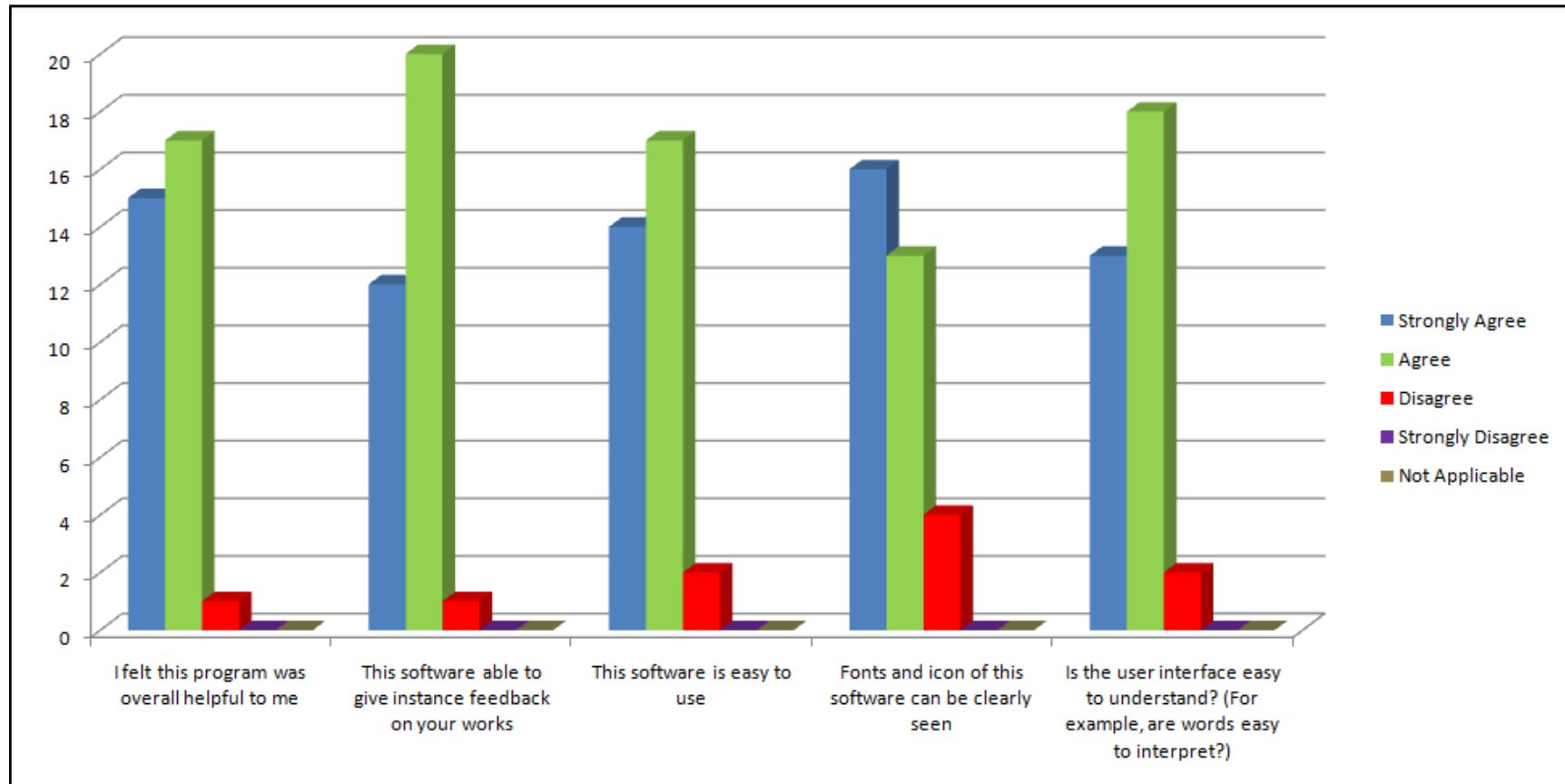


Figure 4.2 Graphs shows the feedback of HCDA trainee regarding project prototype

4.2 Prototype Objective Achieved

Objective	Test Engine (eNSP) v0.1.1 beta	Test Engine (GNS3) v0.1.1 beta
Able to compare pre-loaded sample answer with user works	✓	✓
Lecturers able to create practical test module	✓	✓
Marks registration module	✗	✓
Export student marks	✗	✗
Written Test module	✗	✗
Connectivity links between 2 nodes	✗	✗

Table 4.1 Objective Achieved by Prototype

4.3 Sample Screenshot of Network Simulator Test Engine Prototype

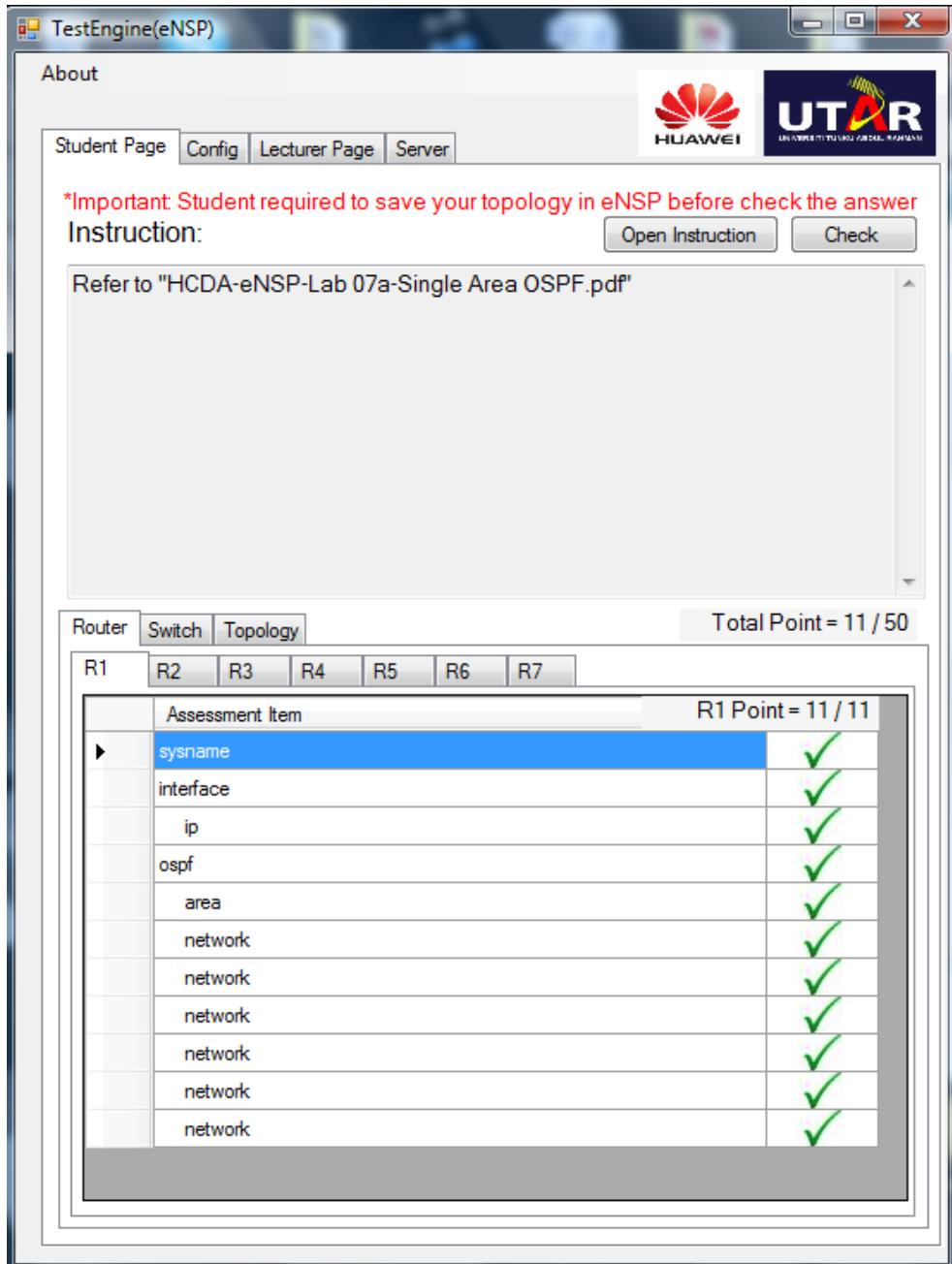


Figure 4.3 Test Result of Network Simulator Test Engine Prototype

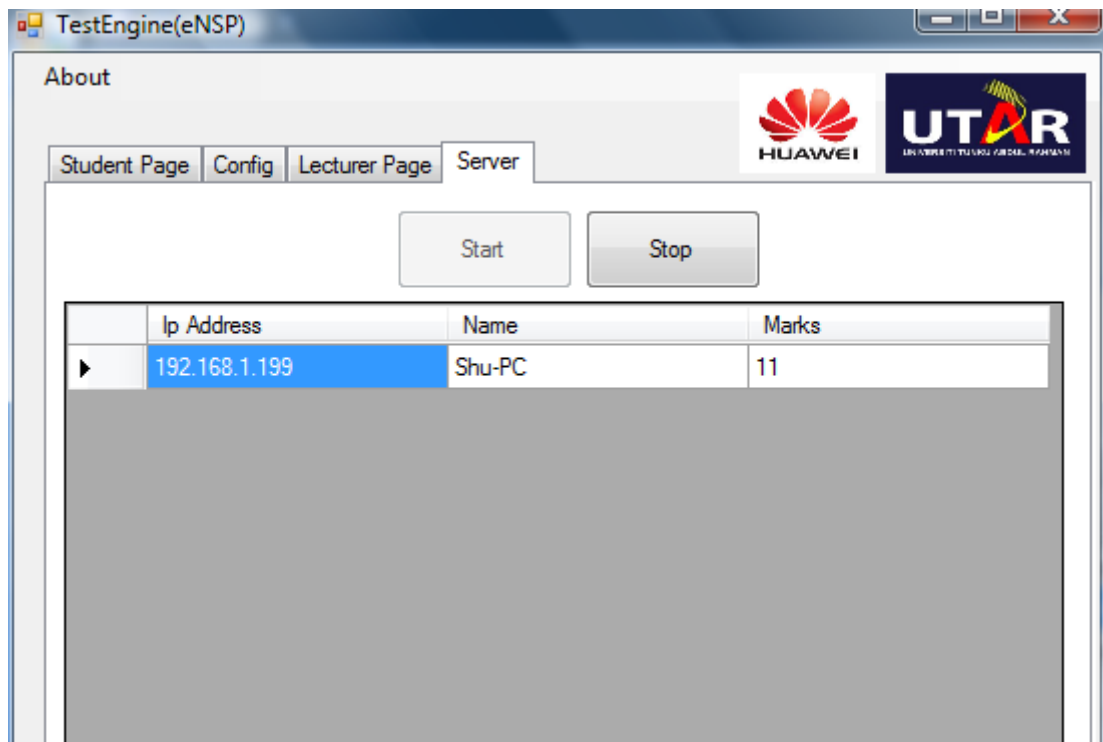


Figure 4.4 Server page that record list of students' marks

5.1 System Design

The design of a system plays an important role because it is the most critical factor that affecting the quality of the system. The purpose of this chapter is to refine the interface design and the process flow of the prototype developed during Project I. The refinement process will base on user feedback to make the system flow more smoothly and more user-friendly. Besides, it also enforces the interactivity between user and the system.

5.2 Interface Design

a. Main Form

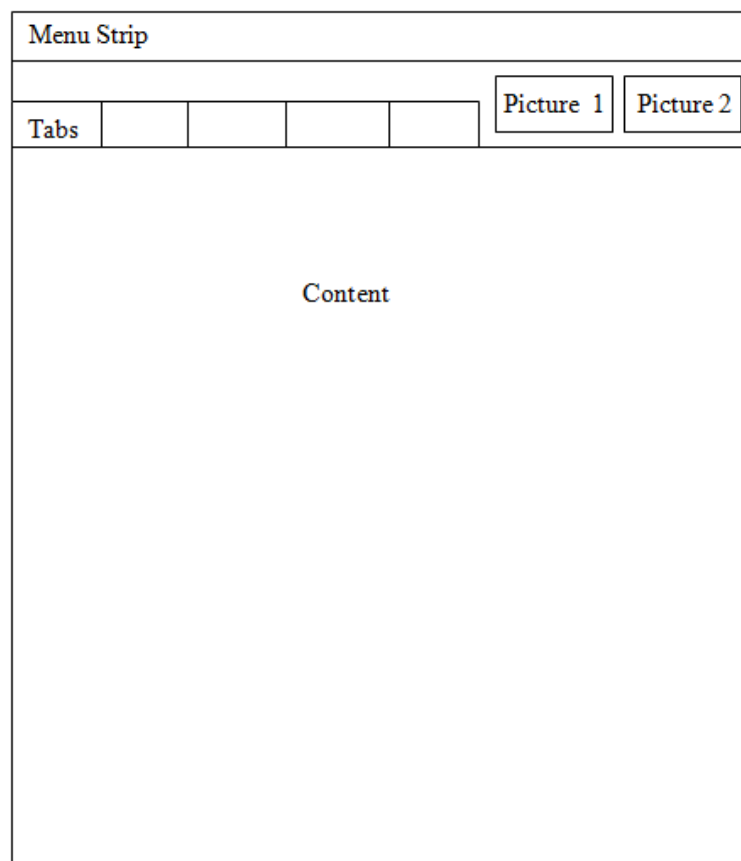


Figure 5.1 Main Form Interface Design

Description

Division	Description
Menu Strip	Menu strip bar that includes Edit, About and Version which allow user to set system properties and target network simulator version.
Tabs	Consist of 5 tabs for lecturer version and 3 tabs for student version which is Student Page, Test Question, Config, Lecturer Page and Server.
Picture 1	Display the logo of Hua Wei.
Picture 2	Display the logo of UTAR.
Content	Specific content base on selected tab.

Table 5.1 Description of Main Form

b. Student Page

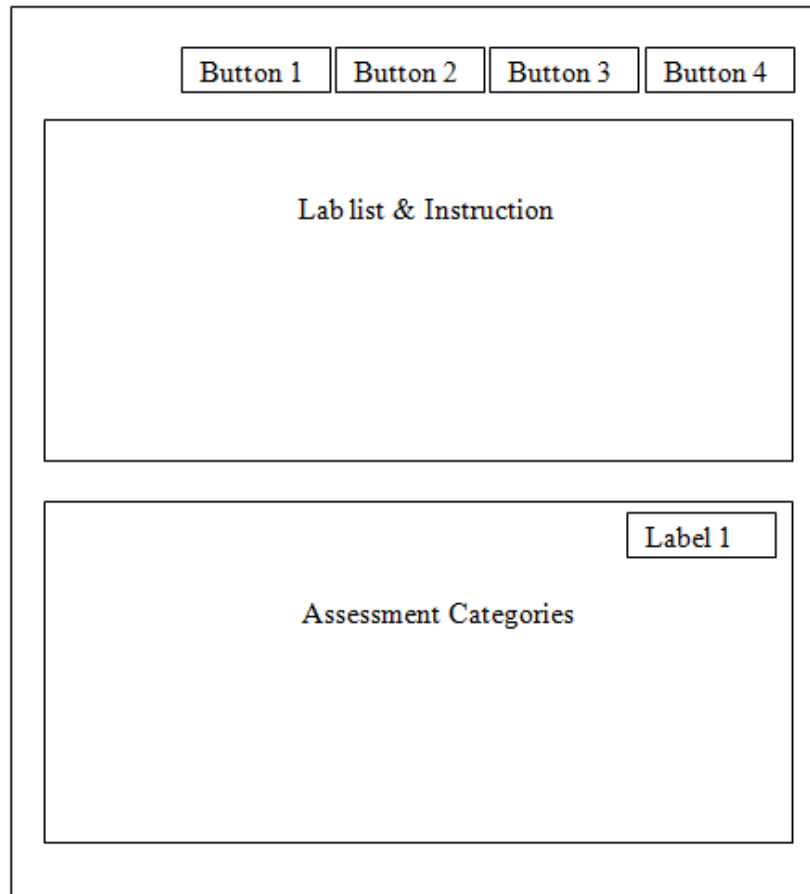


Figure 5.2 Student Page Interface Design

Description

Division	Description
Button 1	Load button that will allow user to load lab package file (zip) into the system.
Button 2	Open Instruction button that allow user to open specific lab after loaded.
Button 3	Start/Continue button that allow user to start the lab or test (Start the network simulator)
Button 4	Check/Sent Marks button, check the correctness of user works and sent their marks to Server.
Lab list & Instruction	Display lab list to allow user to open specific lab by double clicking the lab instruction. After opened the lab, it will display the Instruction regarding the lab.
Label 1	Display marks achieve and total marks when user press Check button.
Assessment Categories	Assessment categories tabs that includes Router, Switch, WLAN and Topology. In each tab will display all assessment item and their correctness.

Table 5.2 Description of Student Page

c. Test Question

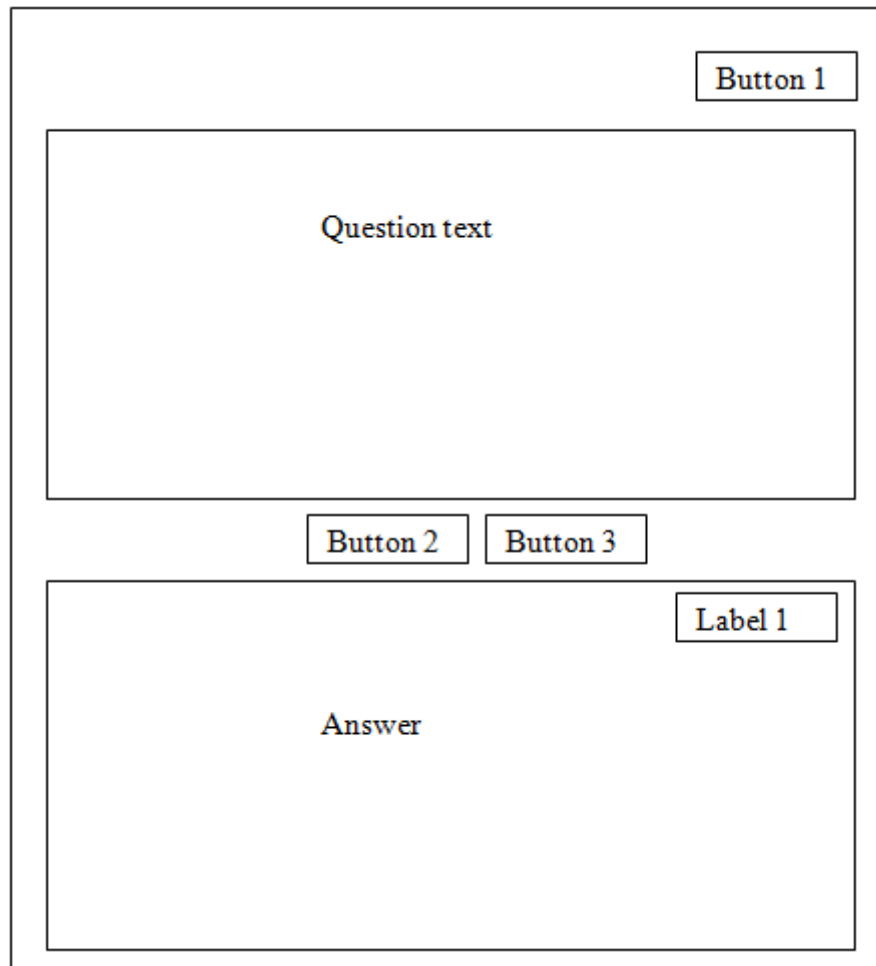


Figure 5.3 Test Question Interface Design

Description

Division	Description
Button 1	Submit button allow user to submit their answer after they completed test questions.
Button 2	Previous button which allow user to navigate to the previous question.
Button 3	Next button which allow user to navigate to the next question.
Question Text	Display question text to user.
Answer	Allow user to select or enter their answer.
Label 1	Display marks achieve and total marks when user press Submit button if lecturer allow user to see their marks during test question creation.

Table 5.3 Description of Test Question

d. Lecturer Page

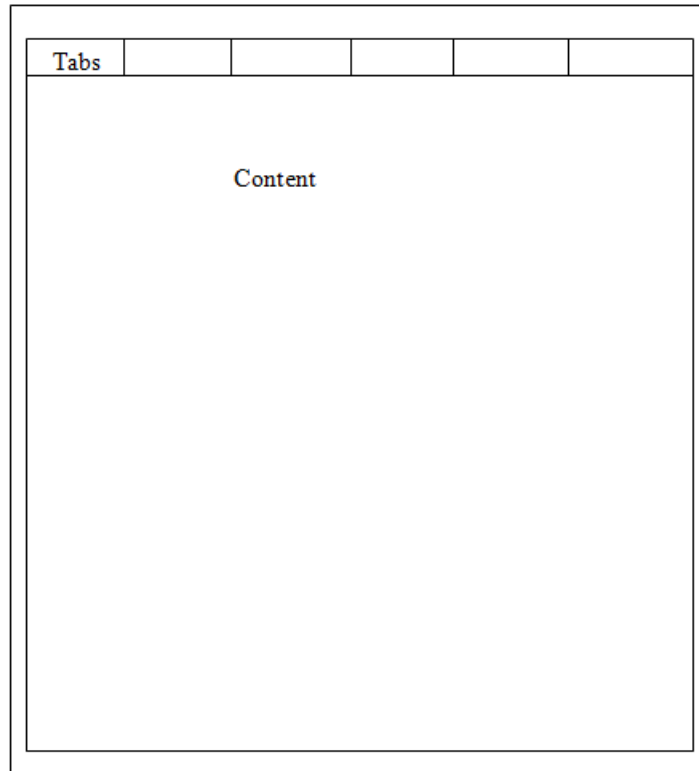


Figure 5.4 Lecturer Page Interface Design

Description

Division	Description
Tabs	Consist of 7 tabs which are Instruction, Load initial topo, Load answer topo, Router cfg, Switch cfg, WLAN cfg and Test Creation.
Content	Specific content base on selected tab.

Table 5.4 Description of Lecturer Page

e. Instruction Tab

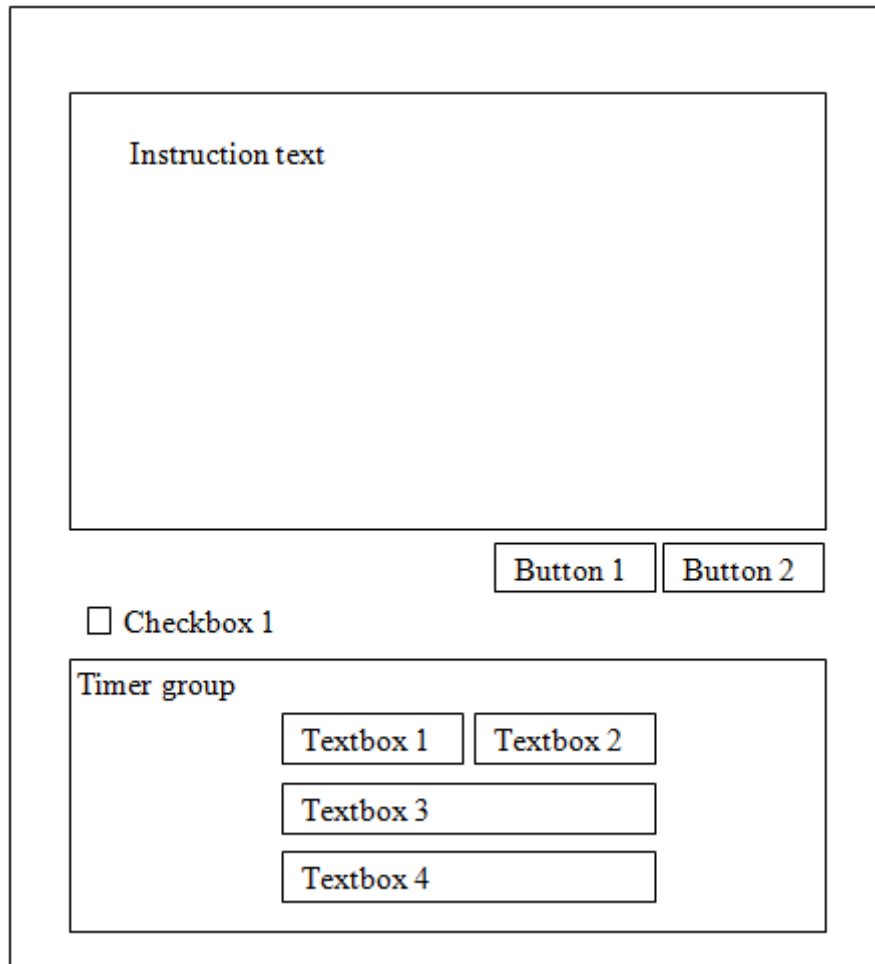


Figure 5.5 Instruction Tab Interface Design

Description

Division	Description
Instruction text	Allow user to enter instruction text which to be saved later.
Button 1	Open button which allow user to open saved lab.
Button 2	Save button which allow user to save the lab into package (zip).
Checkbox 1	Include Timer checkbox. When user checked, system will show Timer group and allow user to enter Timer for the lab.
Timer group	Groupbox which contains Textbox 1, 2, 3 and 4.
Textbox 1	Textbox allow user to enter Hours.
Textbox 2	Textbox allow user to enter Minutes.
Textbox 3	Textbox allow user to enter Passphrase which after allow user to extend timer during lab incase required.
Textbox 4	Textbox of Confirm Passphrase.

Table 5.5 Description of Test Question

f. Load Topology and Configuration files

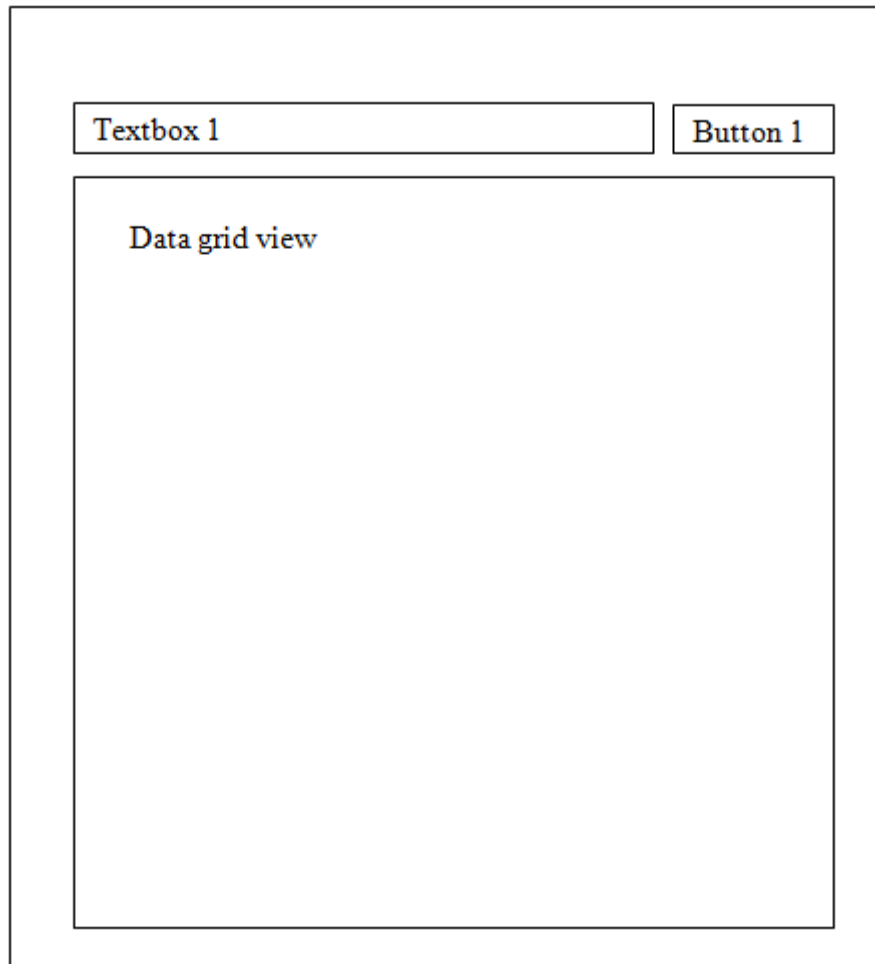


Figure 5.6 Load Topology and Configuration files Interface Design

Description

Division	Description
Textbox 1	Textbox the display the paths of selected topology or configuration file.
Button 1	Select button which prompt Open File Dialog and allow user to select topology or configuration file.
Data Grid View	Data grid view that allow user to select which assessment item to be test on by checking the assessment item.

Table 5.6 Description of Load Topology and Configuration files

g. Test Creation Tab

The diagram shows a rectangular frame containing the following elements:

- Top row: A text input field labeled "Textbox 1" followed by a button labeled "Button 1".
- Second row: A text input field labeled "Textbox 2" followed by a button labeled "Button 2".
- A larger rectangular box below the second row, titled "Configuration group", containing two unchecked checkboxes:
 - Checkbox 1
 - Checkbox 2

Figure 5.7 Test Creation Tab Interface Design

Description

Division	Description
Textbox 1	Textbox the display the paths of selected Test Question file.
Textbox 2	Textbox the display the paths of selected Test Answer file.
Button 1	Select button which prompt Open File Dialog and allow user to select Test Question file.
Button 2	Select button which prompt Open File Dialog and allow user to select Test Answer file.
Configuration group	Groupbox which contains Checkbox 1 and 2.
Checkbox 1	Separate Module checkbox, allow user to only save the test question without create topology lab.
Checkbox 2	Show result to Student Immediately checkbox, allow student to view their marks obtained if checked.

Table 5.7 Description of Test Creation Tab

h. Test Question Creation

Figure 5.8 Test Question Creation Interface Design

Description

Division	Description
Menu Strip	Menu strip bar that includes File which allow user to open and save created Test Question.
Listbox	Display question number and Add links to allow user to add new question.
Textbox 1	Allow user to enter question text which to be saved later.
Combobox 1	Allow user to select type of question to be created. (e.g. Text and Multiple Choice)
Answer	Allow user to enter and select question answer which to be saved later.

Table 5.8 Description of Test Question Creation

i. Server Tab

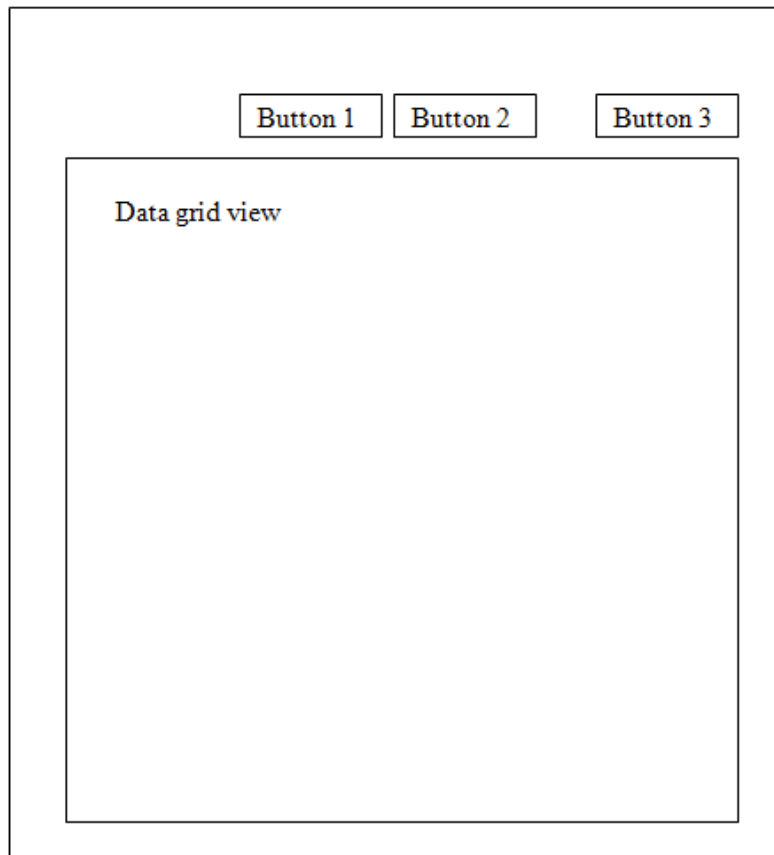


Figure 5.9 Server Tab Interface Design

Description

Division	Description
Button 1	Start button which allow user to start the services of server.
Button 2	Stop button which allow user to stop the services of server.
Button 3	Export button which allow user to export contents in data grid view to Excel file.
Data Grid View	Display client name and their respective marks.

Table 5.9 Description of Server Tab

6.1 Implementation

This chapter will state a clear view of system implementation phase which starts from software installation to the end of programming part. The system implementation phase proceeds base on the user requirement, hardware requirement and software requirement which stated in chapter 3.

6.2 Software Installation

Numerous of software are needed to be installed before proceed to the system development. Software such as Microsoft Visual Studio 2010 Professional, Huawei eNSP version 1.0.216, 1.0.320 and GNS3 version 0.8.3.1 are needed to be installed.

6.2.1 Installation of Microsoft Visual 2010 Professional

Since Microsoft Visual Studio 2010 Professional is a licensed integrated development environment (IDE) from Microsoft, it does have a cost. Microsoft does provide 90 days of trial and also having “Express” version at no cost. The installer able to downloaded from Microsoft website

<http://www.visualstudio.com/downloads/download-visual-studio-vs>. However, the installed is also available from UTAR lab. The steps of installing Microsoft Visual Studio 2010 Professional using executable file are listed below:

- a. Go to the folder which contains Microsoft Visual Studio 2010 Professional; double click on setup.exe executable file.
- b. Click on Install Microsoft Visual Studio 2010 at the pop up installation form.
- c. Next is loading installation form, it will auto load all required installation components. After the loading done, click on Next.
- d. Select features to install, default check all including C#, C++, Visual Basic, Visual Web Developer and F#. Select feature install path and press Install.

- e. It will install a long list of items. After installing Microsoft .Net framework, the installation will request for a restart. After restarting, the installation will automatically continue. Once all of the components were installed, press Finish.

6.2.2 Installation of Huawei eNSP (Network Simulator)

Huawei eNSP is network stimulation software by Huawei. It is a freeware which able to download at Huawei website

<http://support.huawei.com/ecomunity/bbs/10143905.html>. The steps of installing Huawei eNSP using executable file are listed below:

- a. Double click on setup.exe executable file. (e.g. eNSP V100R002C00B320 Setup.exe)
- b. Select setup language and click Ok.
- c. Click Next then select installation path and click Next.
- d. Enter the name of the eNSP folder which will display in start menu later. Click Next.
- e. Check the “Create a desktop icon” if wanted to create a shortcut icon on desktop. Click Next.
- f. Huawei eNSP required some additional software to work together with it such as WinPcap, Wireshark and VirtualBox. Check uninstalled software to install required software as a package during installation of eNSP. Click Next and Install.
- g. Once all of the required software was installed, press Finish.

6.2.3 Installation of GNS3 (Network Simulator)

GNS3 (Graphical Network Simulator) is an open source software that simulate complex networks using Cisco IOS emulator. GNS3 installer is able to download from <http://www.gns3.net/download/>. The steps of installation and configuration of GNS3 source are available at <http://www.gns3.net/documentation/gns3/quick-start-guide-for-windows-users/>. The steps of installing GNS3 using executable file are listed below:

- a. Find the file you download and double-click on it to begin installing GNS3.
- b. The GNS3 Setup Wizard will begin. Everything else is a matter of clicking on next or agree buttons.
- c. GNS3 depends on several other programs to operate. Those dependencies include WinPCAP, Dynamips and Qemu and these components along with GNS3 are all chosen by default for installation. The default location to install GNS3 is also chosen for you.
- d. Moreover note that if needed, WinPcap Setup Wizard will be launched for you to install it, this dependency is required for GNS3 to communicate with real networks through a physical network internal controller. The installation for WinPcap will begin. However, if you have a previous version of WinPcap on your computer, the wizard will ask to remove the older version and will then install the newer version.
- e. You have now completed the installation of GNS3. Click the *Start* button, *All Programs*, *GNS3*, and then choose *GNS3* out of the list of applications installed. You'll see the main GNS3 window. We'll discuss its panes in a later step, but first we have to configure the location for a Cisco IOS.

The steps of defining Cisco IOS files are listed below:

- a. As mentioned earlier, you must provide your own Cisco IOS to use with GNS3 due to licensing issues. GNS3 is meant to be used in a lab environment for testing and learning. Once you have obtained your own copy of a Cisco IOS for one of the supported platforms, you are ready to continue. Supported platforms are Cisco 7200, 3600 series (3620, 3640 and 3660), 3700 series (3725, 3745) and 2600 series (2610 to 2650XM, 2691).
- b. On the *Edit* menu, choose *IOS image and hypervisors*. Then under the *IOS Images* tab, click ... and then find your Cisco IOS file and click *Open*. The file will appear as your Image file. Next, click the drop-down arrow next to *Platform* and choose the platform that corresponds to your IOS file.
- c. Now click the drop-down arrow next to *Model* and choose the model corresponding to your IOS file. For now, we'll accept the default values that remain. However, there is a very important value called the IDLE PC value that we will want to include. We'll get to that later. Click the *Save* button and then the *Close* button. This will return you to the default GNS3 window. It's time to create our very first simple topology.

7.1 System Testing

System testing is the last phase of software development. In this phase, numerous of testing is carry out to ensure the system able to run smoothly without bugs and errors; technical or logical error. The result of each testing is captured and will be shown in Appendix A.

7.2 Create Lab Exercise

This is to test about creating a lab exercise with timer.

Testing Object	Testing Procedure	Test Result
User input required items and save the lab exercise into package (zip format).	<ol style="list-style-type: none"> 1. Enter all required fields: Instruction, Timer, Initial topology, Answer topology, Router cfg, Switch cfg and WLAN cfg. 2. Click on save button to save the lab. 	The lab exercise had been saved into zip file located in targeted path.
Status : Pass		

Table 7.1 Create Lab Exercise Test Table

7.3 Open Created Lab Exercise

This is to test about opening a lab exercise which created earlier.

Testing Object	Testing Procedure	Test Result
User required to open lab exercise which created earlier.	<ol style="list-style-type: none"> 1. Click on open button to the specific lab exercise. 2. Check on every field and make sure all fields' data match with the previous saved lab exercise. 	The lab exercise had been successfully opened and data display match with the previous saved lab exercise.
Status : Pass		

Table 7.2 Open Created Lab Exercise Test Table

7.4 Create Test Question

This is to test about creating a test question in Lecture Page.

Testing Object	Testing Procedure	Test Result
User input required and save the test question into .tq format.	<ol style="list-style-type: none"> 1. Click on Test Creation tab and Test Question Creation form will pop up. 2. Enter question title, type and answer. 3. Save the test question. 	The test question had been saved into .tq format file located in targeted path. Test Question and Test Answer textbox will automatically get saved path upon closing.
Status : Pass		

Table 7.3 Create Test Question Test Table

7.5 Open Created Test Question

This is to test about opening a test question which created earlier.

Testing Object	Testing Procedure	Test Result
User required to open test question which created earlier.	<ol style="list-style-type: none"> 1. Click on Test Creation tab and Test Question Creation form will pop up. 2. Click File, Open and select the previous saved test question. (.tq format) 3. Check on every field and make sure all fields' data match with the previous saved test question. 	The test question had been successfully opened and data display match with the previous saved test question.
Status : Pass		

Table 7.4 Open Created Test Question Test Table

7.6 Check Student Page Functionality

This is to test about loading a lab exercise package into the system, open the lab, start the lab exercise and check the correctness of the work.

Testing Object	Testing Procedure	Test Result
User required loading the lab package (zip format) into the system, opening the instruction and checking the correctness of the answer base on the instruction.	<ol style="list-style-type: none"> 1. Click on Load button at Student Page and select lab exercise package. (zip format) 2. Click on Open Instruction button or double click on the Lab list to select the loaded instruction file (.ins format) 3. Click on Start button and configure the network base on the instruction. 4. Click on Check button to check the correctness. 	The loading, opening instruction and checking the correctness of the answer able to done successfully.
Status : Pass		

Table 7.5 Student Page Functionality Test Table

7.7 Check Server Functionality

This is to test about server functionality whether it able to get client information and export the information into Excel file.

Testing Object	Testing Procedure	Test Result
User starts the server and export client information into Excel file.	<ol style="list-style-type: none"> 1. Click on Start button at Server tab. 2. At client side, enter Server IP address and Server Port accordingly under Config tab. 3. Click on Check button at Student Page, system will automatically sent marks to server and update on data grid view on Server tab. 4. Click Export button to export information in data grid view to Excel file. 	The Server able to start and receive client information. Successfully export information to Excel file.
Status : Pass		

Table 7.6 Server Functionality Test Table

8.1 Project Impact and Contribution

After completing this project, I decided to release eNSP Student version to public to gather feedback and impact of my project. I create some lab packages and uploaded the package together with software installer to Huawei forum. (Links:

<http://support.huawei.com/ecomunity/bbs/10186303.html>)

Response of public is quite good and having good impact to world communities. Most of respondents comment it was great tools to improve the learning process of Networking as currently no similar software provide this functionality for Huawei eNSP and GNS3. The forum thread of my post even marked as “Recommend” by forum moderator. I will attach some screen captured from the forum regarding comments of this project.

The screenshot shows a forum post by user 'dianshu' dated 2014-04-12 16:02. The post title is 'eNSP 模拟测验器 v0.3.2 beta 和 测验包2'. The main content is titled 'eNSP 模拟测验器 v0.3.2 beta' and describes the software's purpose: 'eNSP 模拟测验器支持版本: v1.2.00.XXX (包括v.1.2.00.330, v.1.2.00.320, v.1.2.00.310, ...)' and '该软件可用于ENSP模拟试验或ENSP模拟实习软件给HCDA和HCDP. 该软件可以被看作是一种HCDA和HCDP的教学辅助, 特别是在实验室上.' It also includes instructions for use and a network diagram.

The network diagram, labeled 'Figure 8.1 Forum Thread', shows a topology with three routers (AR1, AR2, AR3) and four PCs (PC1, PC2, PC3, PC4). AR1 is connected to AR2 and AR3. AR2 is connected to AR3. PC1 and PC2 are connected to HUB1, which is connected to AR1. PC3 and PC4 are connected to HUB2, which is connected to AR2. IP addresses are assigned to various interfaces: AR1 (200.1.1.0/30), AR2 (200.1.2.0/30), AR3 (200.1.3.0/30), PC1 (192.168.3.128/26), PC2 (192.168.12.0/27), PC3 (192.168.5.192/28), and PC4 (192.168.14.0/29). A DHCP server is also shown connected to AR2.

Figure 8.1 Forum Thread



Figure 8.2 User Comments (1)



Figure 8.3 User Comments (2)



Figure 8.4 User Comments (3)

Besides some users comments from the forum thread, I also received email requesting I release the instruction version as he is the trainer for networking which related to Huawei eNSP network simulator. Furthermore, he also gives some valuable comments regarding this project. He did mention about this project will able to help him solve difficulties of monitoring progress and correctness of his students as the class size is quiet large.

你好，

看到你在华为社区论坛上发布的ensp模拟器测试软件正是我需要的东西，我现在讲华为设备配置的课程，但对于学生的掌握情况想通过软件进行测试，尤其是操作配置的测试。但学生人数很多，一般情况下都是一个一个检查，这就导致效率很低。你的软件我觉得会对我有很大帮助，不知道导师版什么时候可以放出。再就是用软件进行考试时，操作配置的考试能否实现不同的学生分发的试题是不同的？学生登录服务器考试时，最好以姓名登录，这样成绩可以知道是谁的，不知道这个是否需要先注册用户名否？还有软件的标签，菜单最好是中文的，符合国情。期待软件早日放出。

Figure 8.5 Email Comments and Request by user (1)

Chapter 8: Project Impact and Contribution

Hello,

See you posted on Huawei's community forum ensp simulator testing software exactly what I need, I'm speaking of course of Huawei device configuration, but for students to grasp the situation want to test the software, especially the operating configuration of the test. But a lot of students, under normal circumstances are checked one by one, which leads to low efficiency. Your software I think it would help me a lot, I do not know what time tutor version can be released. Then when the exam software, operating configuration of the exam students can achieve different distribution of questions is different? When students log server exam, preferably in the name of the registry, so the results can know who is, do not know whether you need to register a user name any? There are software labels, menus best Chinese, in line with national conditions ☺. Look forward to an early release of the software.

Figure 8.6 Email Comments and Request by user (1 English Translated)

您好，

我不是华为员工，是他们的产品用户。为了教学需要，原本也想写一个操作配置的考核软件，今天看到您的测试器，我觉得比我自己想的要好很多，所以我就想偷一下懒*^_^*。还有我认为这个测试软件应该分为自测和考试两部分。自测用于自己练习，发现学习的缺漏。考核用于培训时的最后检验，考核时应该可以设定时间限制，时间到自动检验答案，学生如果提前检验答案等同提前交卷，一旦检验答案就不能再进行修改。以上都是我的一些拙见，有不妥之处还请您谅解。

Figure 8.7 Email Comments and Request by user (2)

Hello,

I am not a Huawei employees, users of their products. For teaching needs, originally wanted to write an operating configuration assessment software, today see your tester, I feel better than I think a lot, so I steal what lazy *^_^*. There I think this test should be divided into self-test software and examination in two parts. Self-test for their own practice, discovery learning gaps. Assessment for final inspection training, and assessment should be set when the time limit, the time to automatically test answers, students test answers in advance if an assignment is equivalent to advance, once no longer be modified test answers. These are some of my humble opinion, there is something wrong, please forgive me.

Figure 8.8 Email Comments and Request by user (2 English Translated)

In few days, the software had received around 20 downloads from public and thread has been marked as “Recommended” by forum moderator. I also received prestige point by forum moderator for posting contribution thread.



Figure 8.9 Number of Software downloads, views and comments

9.1 Conclusion

To conclude, this project is to develop software that helps to solve the difficulties process of conducting lab and practical test related to networking field using Huawei eNSP and GNS3. Since similar product like packet tracer does not provide interactive guided lab and there is a demand for other network simulator such as Huawei eNSP and GNS3, there is a need to develop this project to solve the current problem.

With the help of this project, workload of lecturers will be reduced, students will more interested in learning networking subject and ease the process of troubleshooting while doing practical lab. This project will combine e-learning, assessment item checking, written test module and marks registration module to form a network simulator test engine to solve the troublesome problem and make the learning process smoother and more interesting.

Last but not least, this project having impact and contribution to world communities as GNS3 and Huawei eNSP is using worldwide. This project will able smoothen their teaching and learning process of networking. Networking trainer or instructor able to easily monitor progress their student and the correctness of their works.

BIBLIOGRAPHY

- Andrew.cmu.edu. n.d.. *UML Use Case Diagrams: Tips*. [online] Available at:
<http://www.andrew.cmu.edu/course/90-754/umlucdfaq.html> [Accessed: 1 Jul 2013].
- Cisco (n.d.) *Cisco Packet Tracer*. [online] Available at:
http://www.cisco.com/web/learning/netacad/course_catalog/PacketTracer.html
[Accessed: 1 Apr 2013].
- Dr.Ravichandran, K. and Venkata Subrahmanyam, C. (2013) Technology &Online Distance Mode of Learning. *Department of Entrepreneurship Studies , Madurai Kamaraj University*, 2 (1), p.5. Available at:
<http://www.ijhssi.org/papers/v2%281%29/Version-2/B210513.pdf> [Accessed: 21 Mar 2013].
- Dr.Sivanthi (2010) ONLINE EDUCATIONAL SYSTEM . *ONLINE EDUCATIONAL SYSTEM (e-learning)*, 3 (4), p.3-4. Available at:
http://www.sersc.org/journals/IJUNESST/vol3_no4/3.pdf [Accessed: 21 Mar 2013].
- Forums.mydigitallife.info. 2013. *Cisco Packet Tracer 6*. [online] Available at:
<http://forums.mydigitallife.info/threads/43553-Cisco-Packet-Tracer-6> [Accessed: 1 Jul 2013].
- Gordon Mcmillan (1990) *Socket Programming HOWTO — Python v2.7.3 documentation*. [online] Available at:
<http://docs.python.org/2/howto/sockets.html> [Accessed: 21 Mar 2013].

Bibliography

- Kanev, K. et al. (2009) A Framework for Collaborative Learning in Dynamic Group Environments. *International Journal of Distance Education Technologies*, 7 (1), p.58-77. [Accessed: 1 Apr 2013].
- Learningnetwork.cisco.com. n.d.. *IPv6 with Packet Tracer. - The Cisco Learning Network*. [online] Available at: <https://learningnetwork.cisco.com/thread/52628> [Accessed: 1 Jul 2013].
- Office.microsoft.com. 2007. *Work with the Gantt Chart view - Project - Office.com*. [online] Available at: <http://office.microsoft.com/en-001/project-help/work-with-the-gantt-chart-view-HA010275135.aspx> [Accessed: 30 May 2013].
- Steve Litt (2001) *Socket Programming*. [online] Available at: <http://www.troubleshooters.com/codecorn/sockets/> [Accessed: 2 Apr 2013].
- Studynotes.net. 2012. *Networking Terms / StudyNotes*. [online] Available at: <http://www.studynotes.net/Glossary-Networking-Terms> [Accessed: 1 Jul 2013].

Feedback form

Title: Test Engine for GNS3 v0.1.1 beta

Developed by: Tan Cian Shu

Supervised by: Dr.Choo Peng Yin

Name of Evaluator:

Course:

Date:

Running this software on which operating system (OS)?

(Windows XP , Windows Vista , Windows 7 , Linux , Unix)

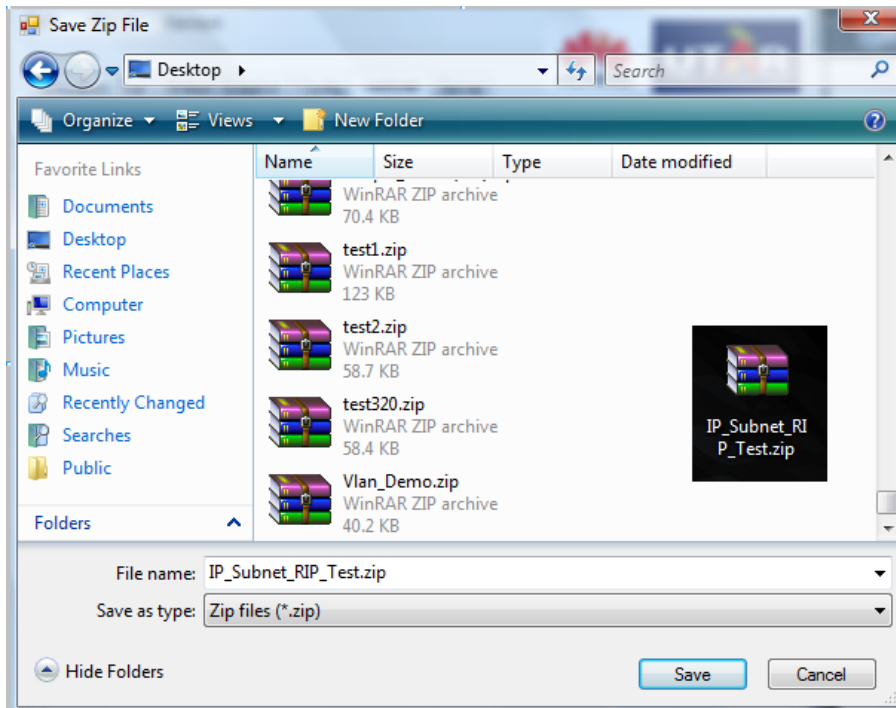
Respond to the following statements in regards to this software:

No.	Description	Strongly Agree	Agree	Disagree	Strongly Disagree	Not Applicable
1.	I felt this program was overall helpful to me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	This software able to give instance feedback on your works.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	This software is easy to use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Fonts and icon of this software can be clearly seen.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Is the user interface easy to understand? (For example, are words easy to interpret?)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

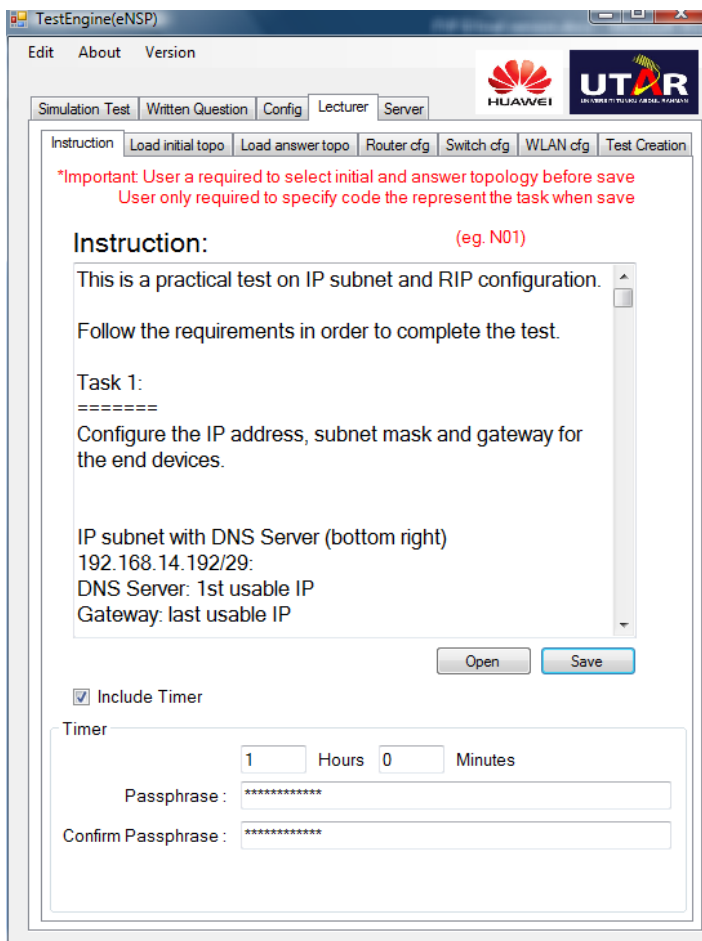
Comments:

Appendix B

Create Lab Exercise

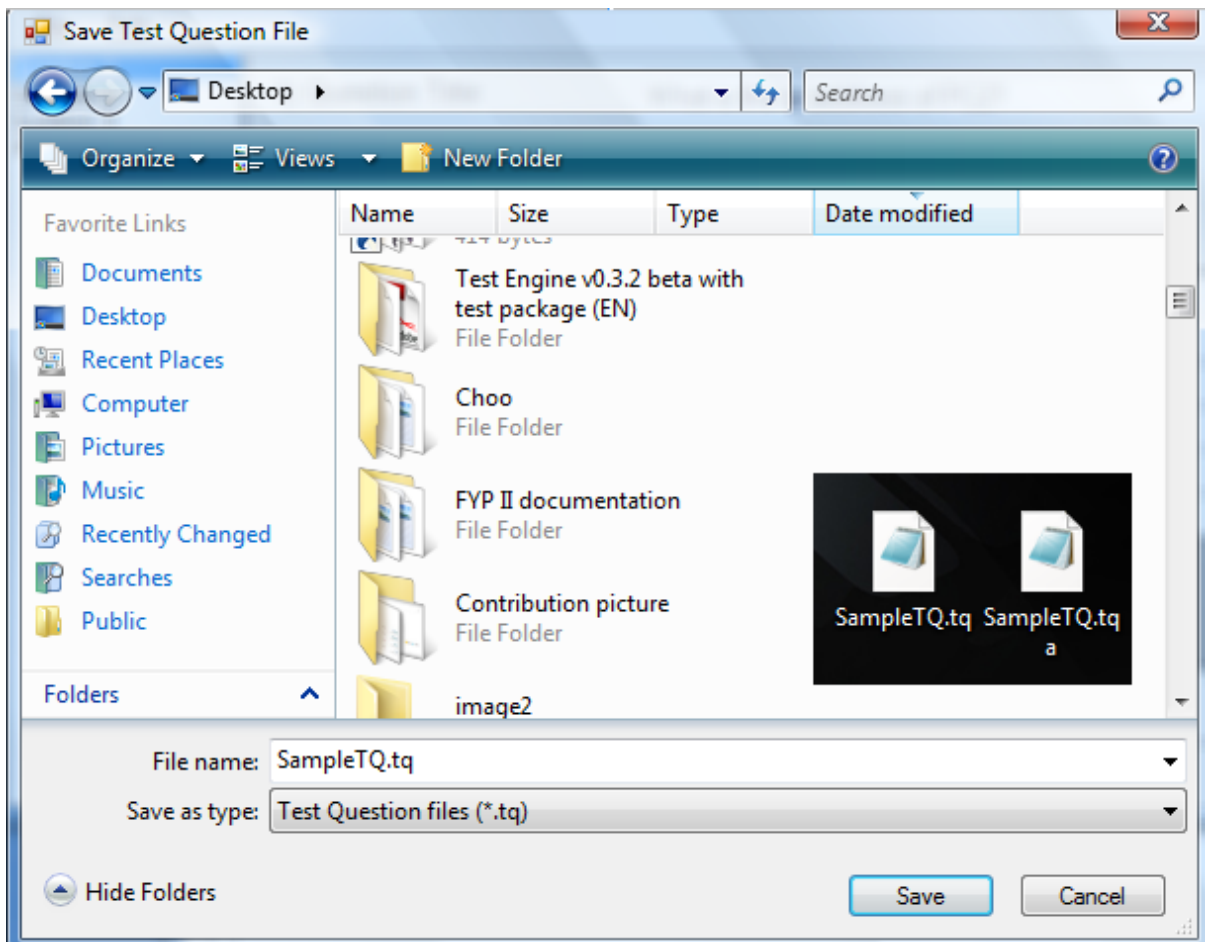


Open Created Lab Exercise

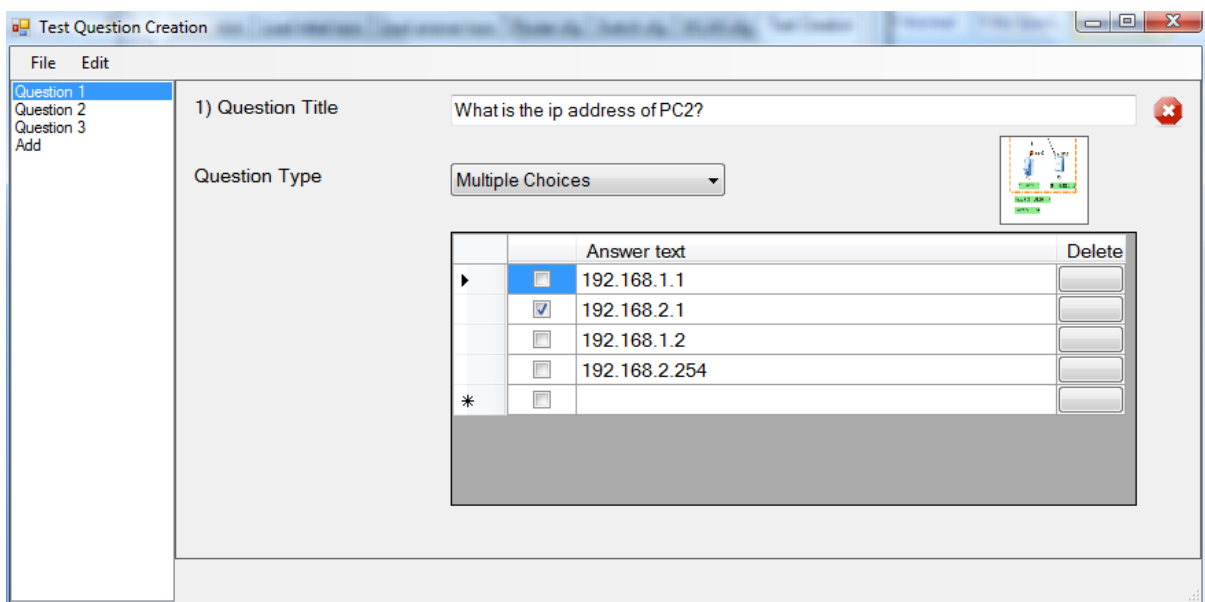


Appendix B

Create Test Question



Open Created Test Question



Appendix B

Check Student Page Functionality

0 hours 58 minutes 14 seconds

Edit About Version

Simulation Test Written Question Config Lecturer Server

***Important: Student required to save your topology in eNSP before check the answer**

Instruction:

This is a practical test on IP subnet and RIP configuration.

Follow the requirements in order to complete the test

Task 1:
=====

Configure the IP address, subnet mask and gateway for the end devices.

IP subnet with DNS Server (bottom right)
192.168.14.192/29:

Router Switch WLAN Topology Total Point = 3 / 57

Assessment Item	Topo Point = 3 / 15
PC5	✓
IP Address	✗
Subnet Mask	✗
Default Gateway	✗
DNS 1	✗
PC1	✓
IP Address	✗
Subnet Mask	✗
Default Gateway	✗
DNS 1	✗
PC2	✓
IP Address	✗
Subnet Mask	✗
Default Gateway	✗

Check Server Functionality

0 hours 57 minutes 44 seconds

Edit About Version

Simulation Test Written Question Config Lecturer Server

IP Address:

Port No:

Username	PC Name	Lab Marks	Test Marks
Anonymous	Shu-PC	3/57	

Network Simulator Test Engine

User Guide

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Appendix C

1.0 Software Installation

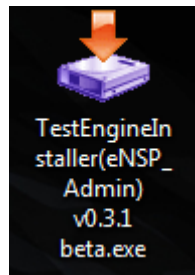


Figure 1.1 Software Installer

Step 1: Double click the Software Installer.

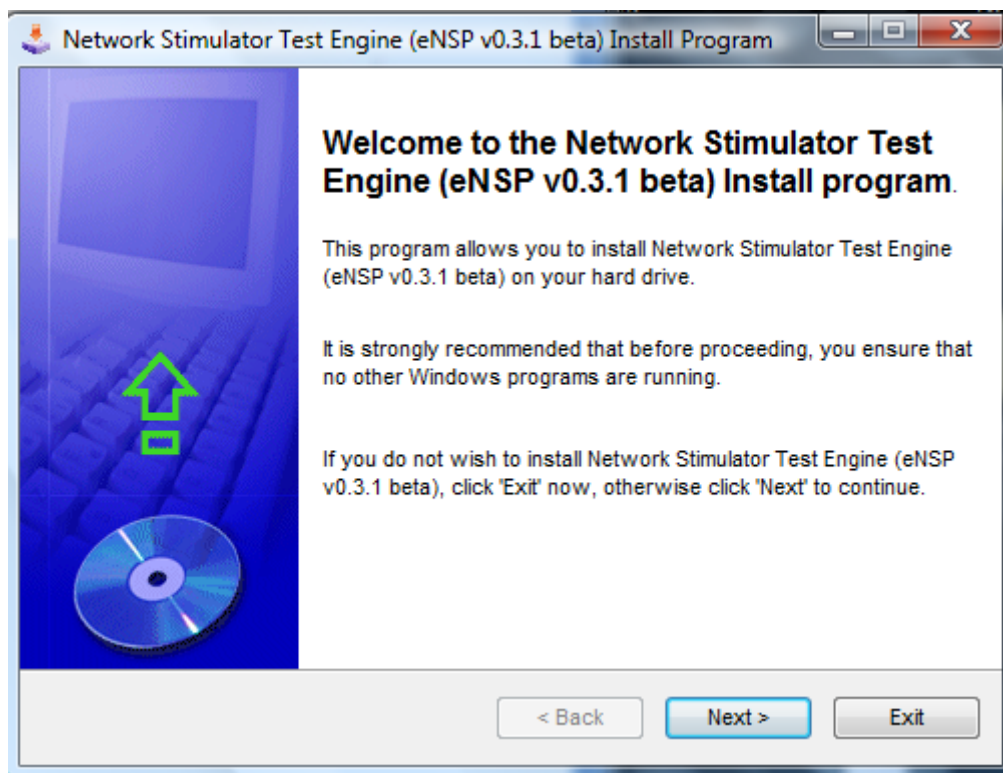


Figure 1.2 Installation page 1

Step 2: Click Next.

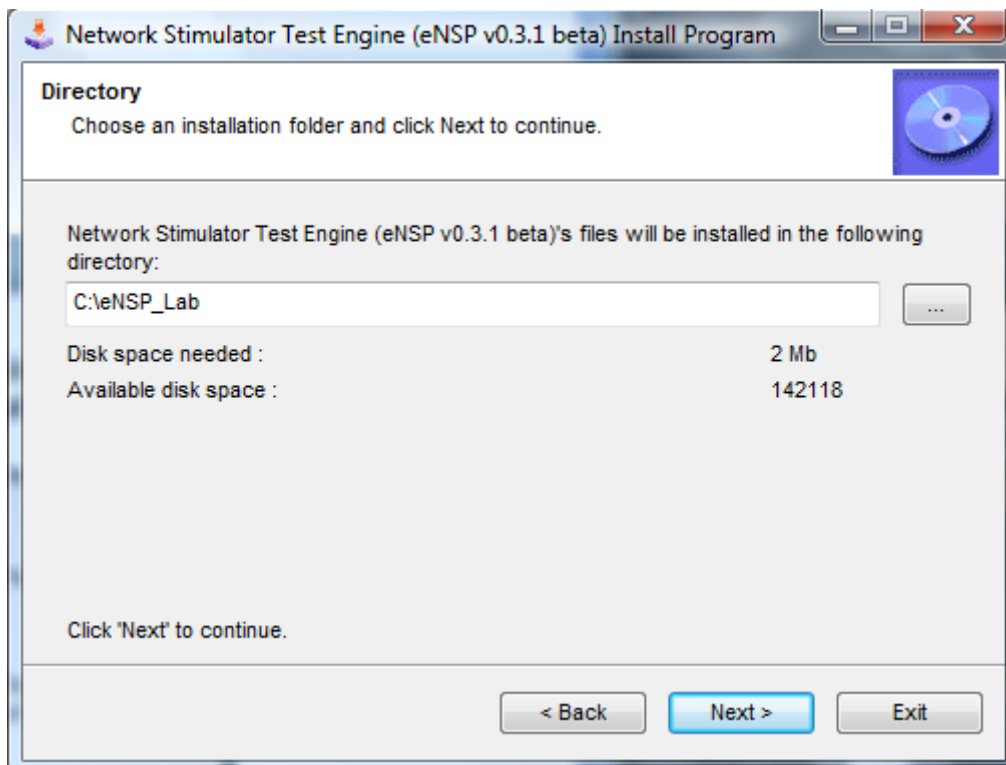


Figure 1.3 Installation page 2

Step 3: Select installation directory then click Next.

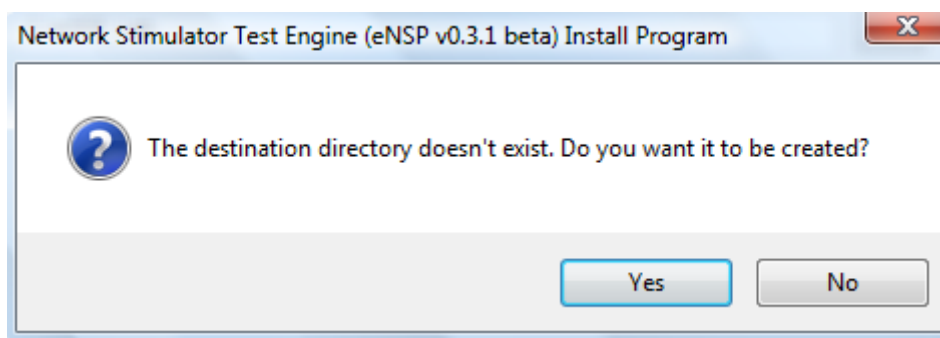


Figure 1.4 Confirmation Create Directory

Step 4: Click Yes.

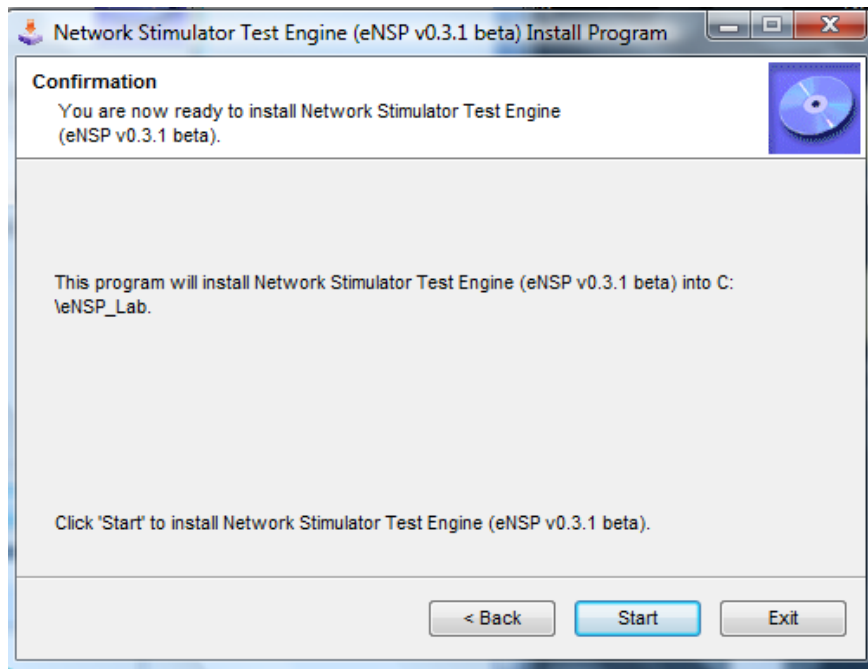


Figure 1.5 Start Installations

Step 5: Click Start to start the software installation.

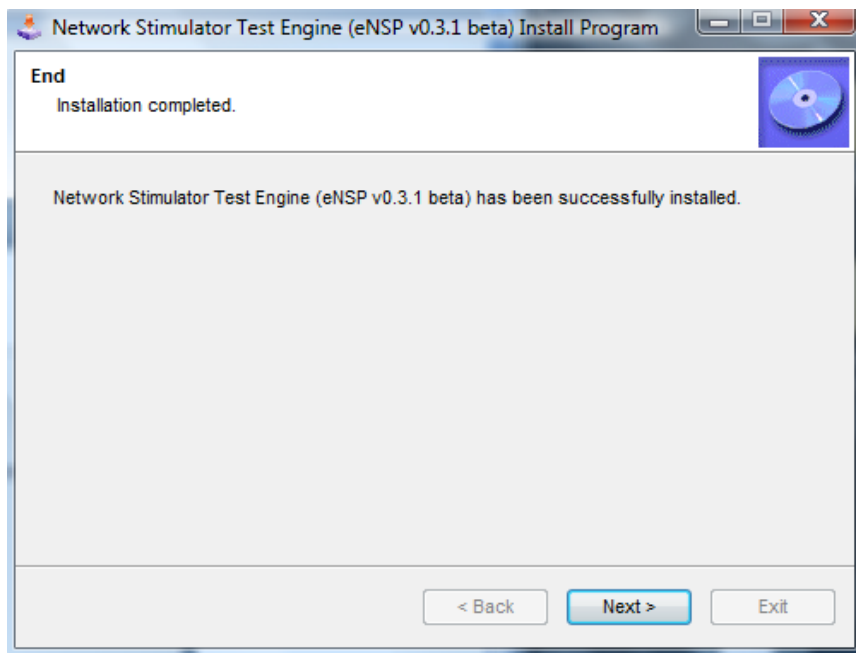


Figure 1.6 Successfully Installed

Step 6: Click Next then click Finish.

Appendix C

2.0 Application Example

2.1 General Setup

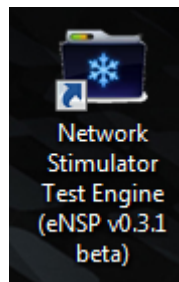


Figure 2.1 Software shortcut at Desktop

Step 1: Double click the icon to start the software.

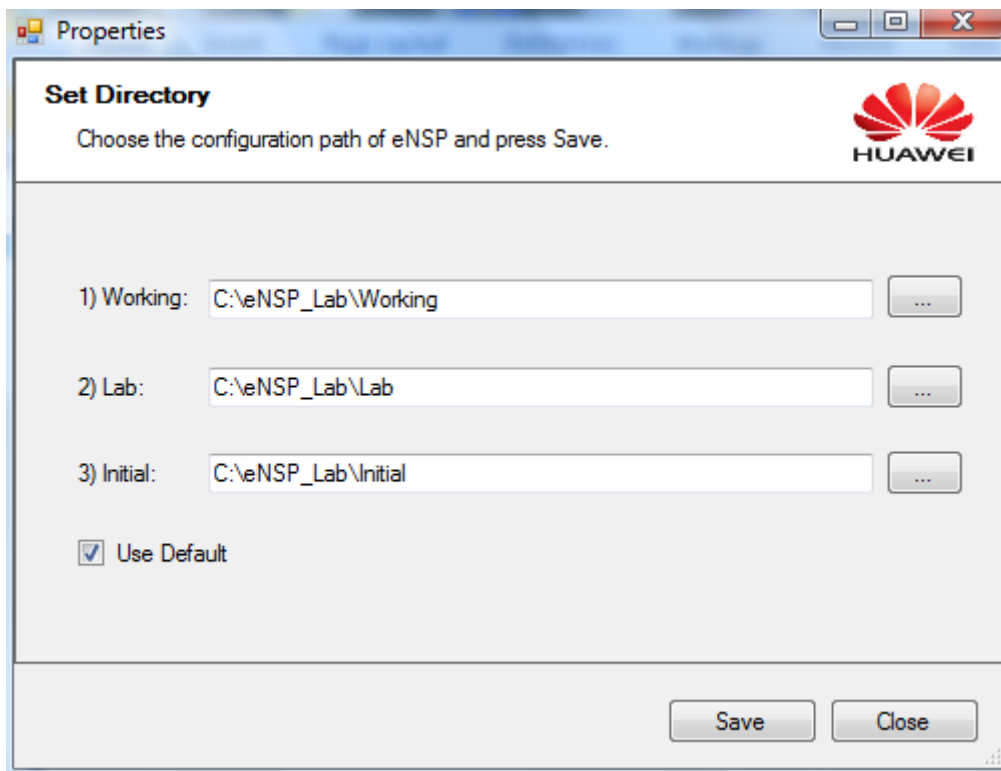


Figure 2.2 Properties page

Step 2: Properties page will prompt when the software is first time running. Select Working, Lab and Initial folder paths or Check the User Default check box to select default paths. Click Save.

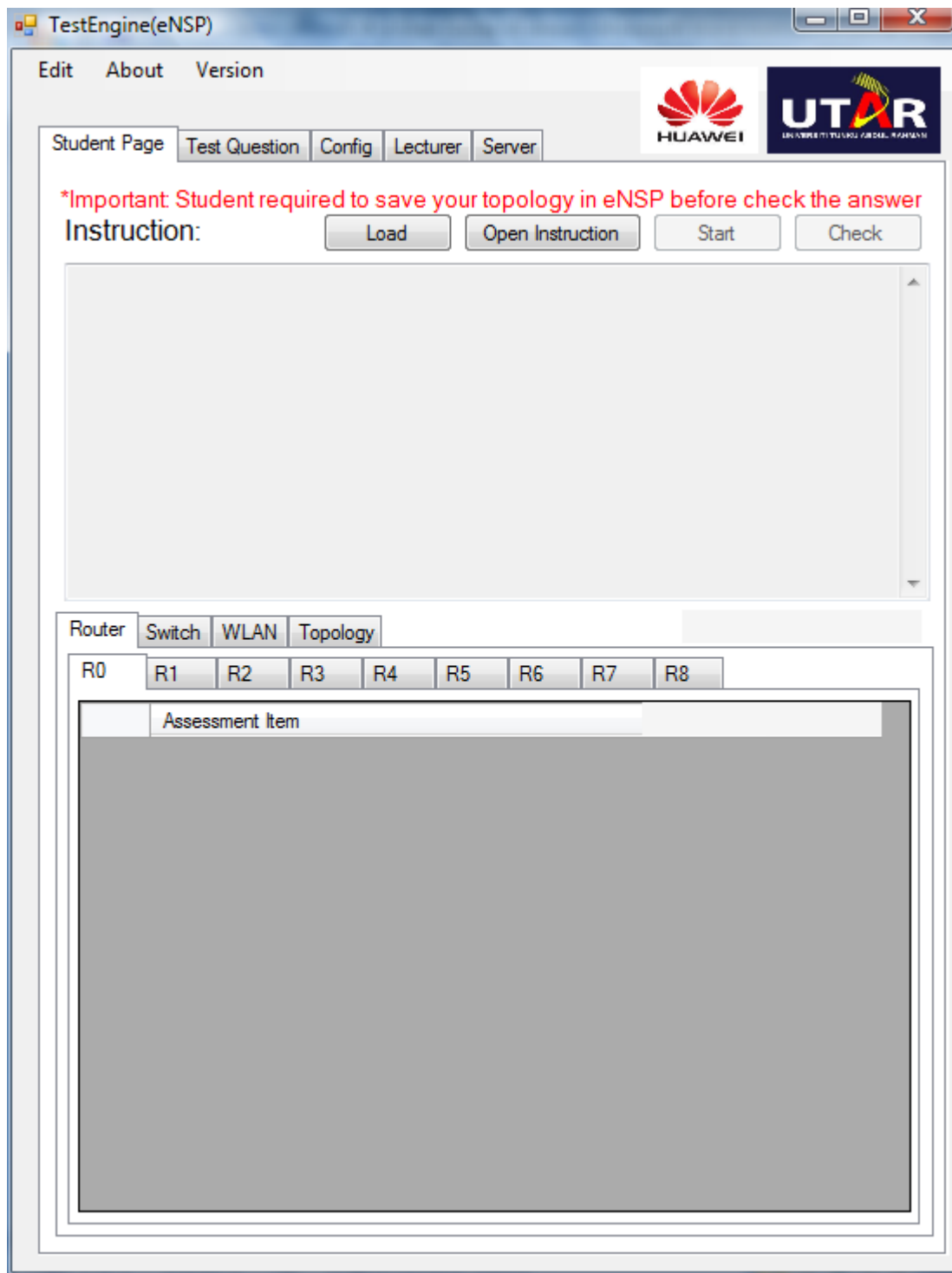


Figure 2.3 Software main page

Step 3: Software main page will prompt after setting Properties.

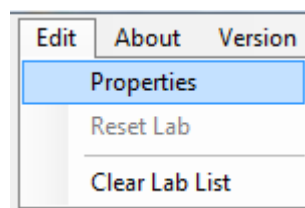


Figure 2.4 Menu Strip Edit -> Properties

Step 4: User allow opening Properties form from the Menu Strip.

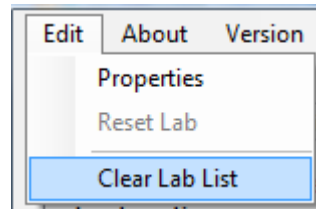


Figure 2.5 Menu Strip Edit -> Clear Lab List

Step 5: User allow clearing all lab list from the Menu Strip.

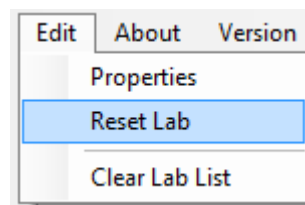


Figure 2.6 Menu Strip Edit -> Reset Lab

Step 6: User allow resetting specific lab from the Menu Strip. Note: Reset Lab only enable when user opens a lab.

2.2 Lab creation

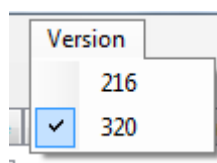


Figure 2.7 Menu Strip Version

Step 1: User MUST select the correct version of Hua Wei eNSP before start creating labs.

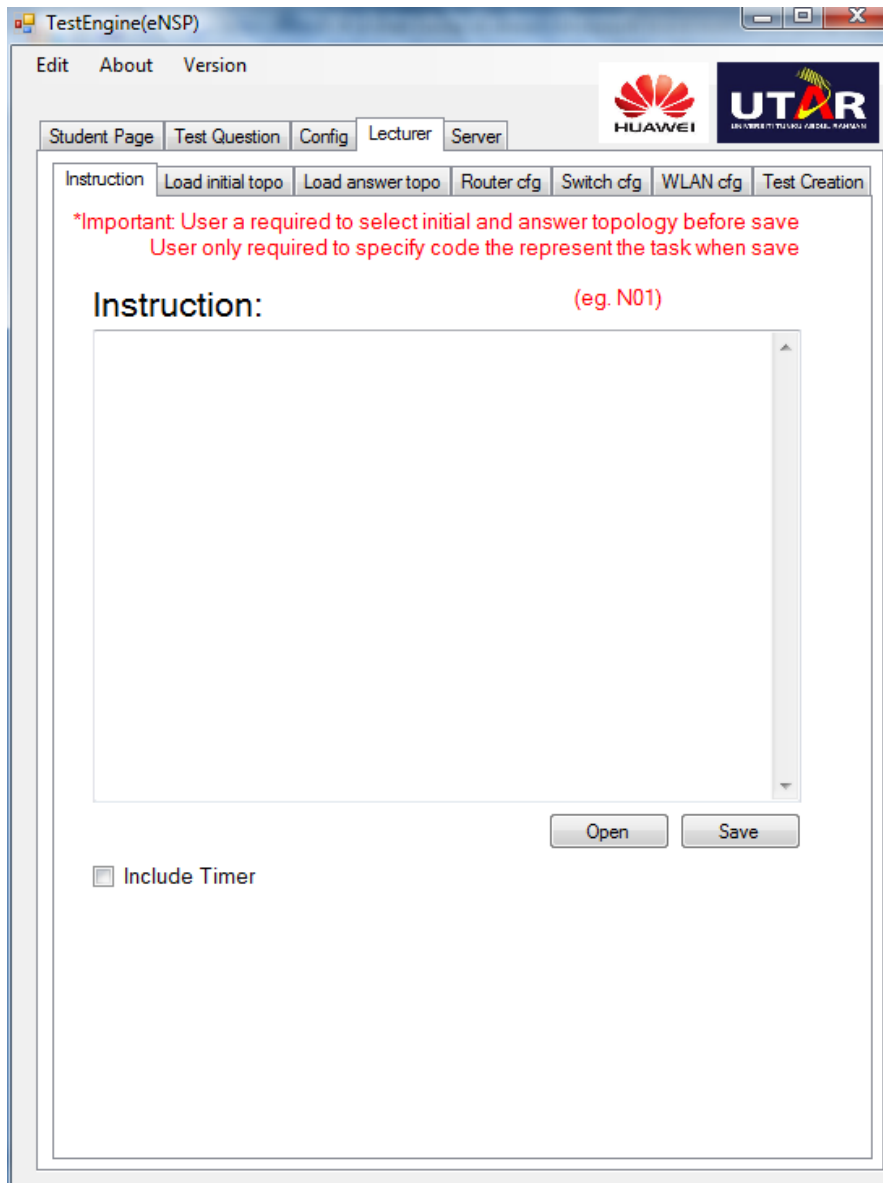


Figure 2.8 Software main page (Lecturer)

Step 2: Select Lecturer tab.

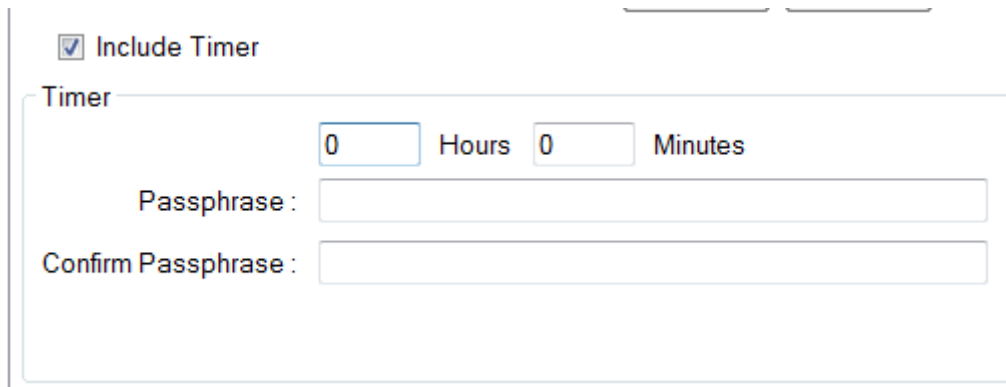


Figure 2.9 Include Timer

Appendix C

Step 3: Check Include Timer check box if requires countdown timer in the labs. Timer group will shown and require user to enter timer duration and passphrase. Passphrase is for extend timer during lab test in case required.

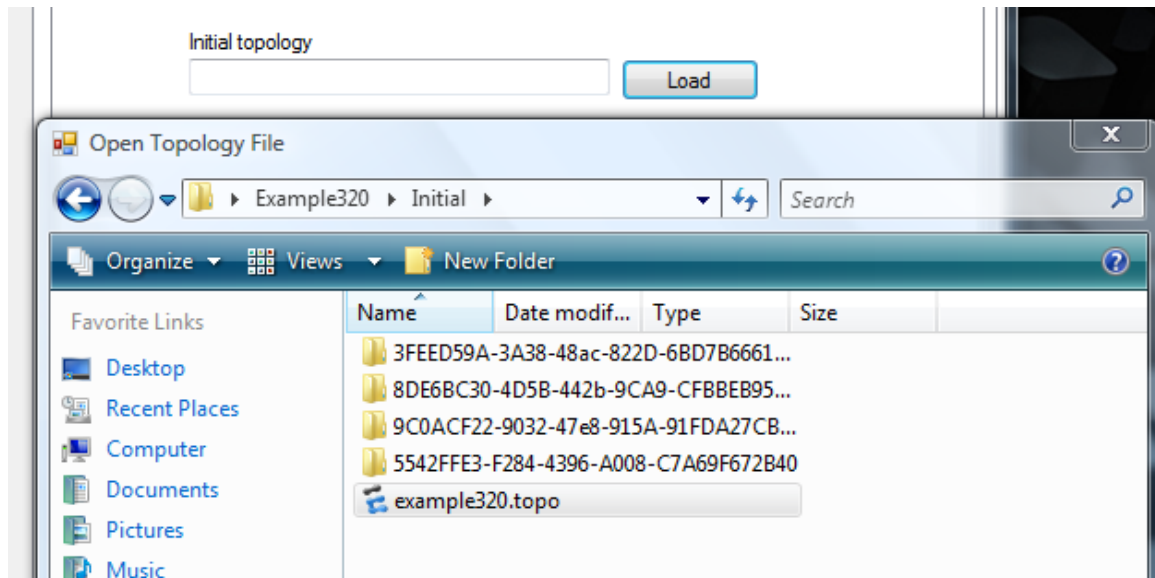


Figure 2.10 Load Initial Topology

Step 4: Click on Load button on Load Initial Topo tab. Select Initial topology (e.g. “example320.topo”). Make sure that initial router or switch folder (e.g. “3FEED59A-3A38-48ac-822D-6BD7B6661796”) are in the same directory.

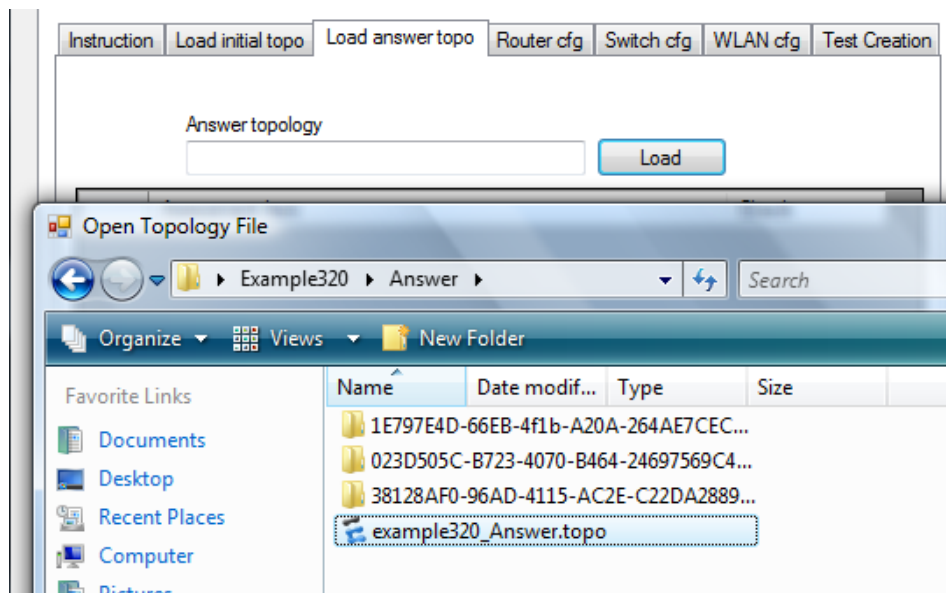


Figure 2.11 Load Answer Topology

Step 5: Click on Load button on Load Answer Topo tab. Select Answer topology (e.g. “example320_Answer.topo”).

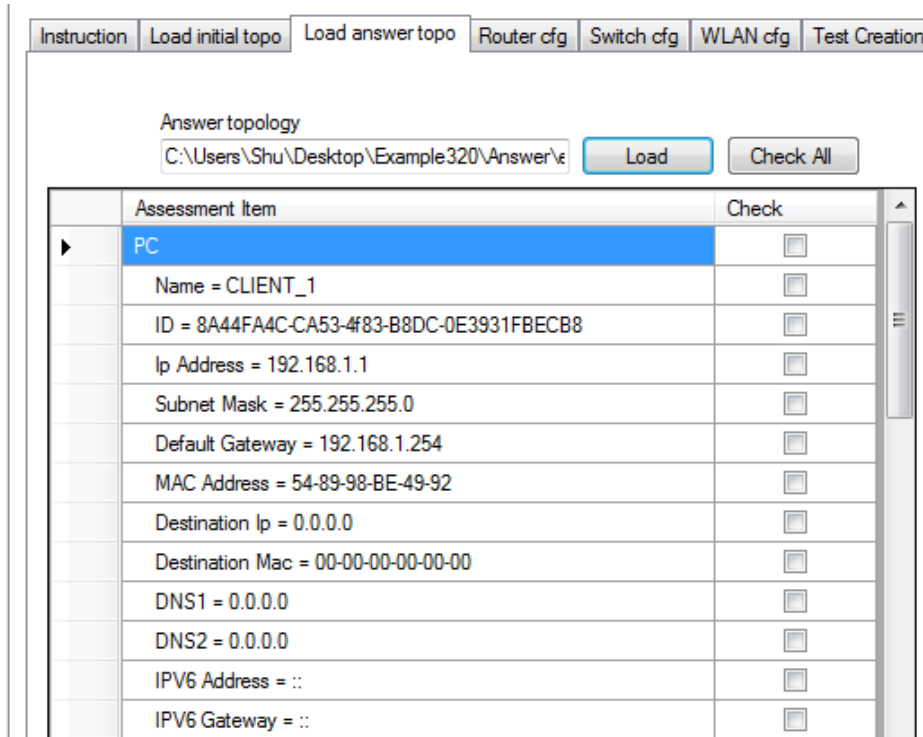


Figure 2.11 Select Assessment Item

Step 6: Check the check box beside Assessment items in the data grid view to select item to be assessed in the lab.

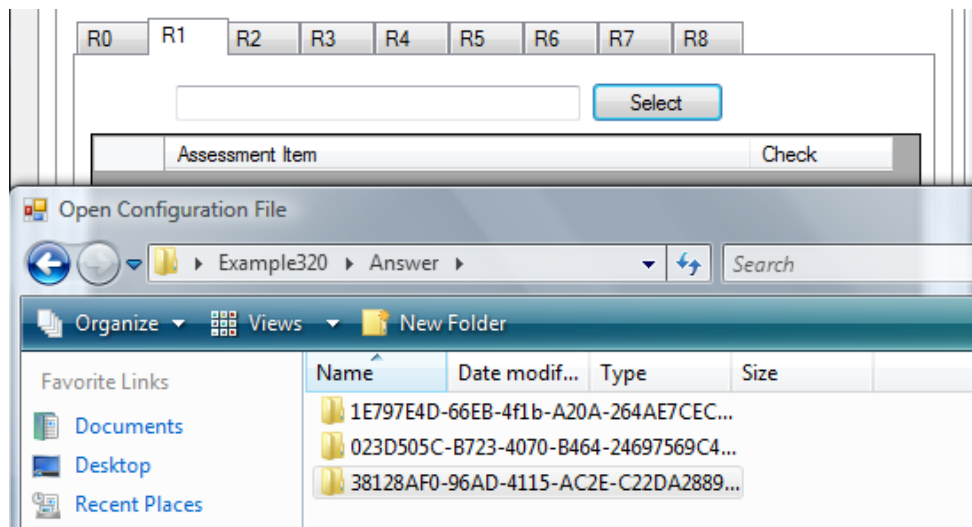


Figure 2.12 Router tab (VERSION 320)

Step 7: Click the Select button and select specific folder for specific router. Folder name is corresponding to its ID. (* ID can refer from Answer Topology Page as shown below)

Router AR1220	<input type="checkbox"/>
Name = AR1	<input type="checkbox"/>
ID = 38128AF0-96AD-4115-AC2E-C22DA288902D	<input type="checkbox"/>

Figure 2.13 Answer topology page

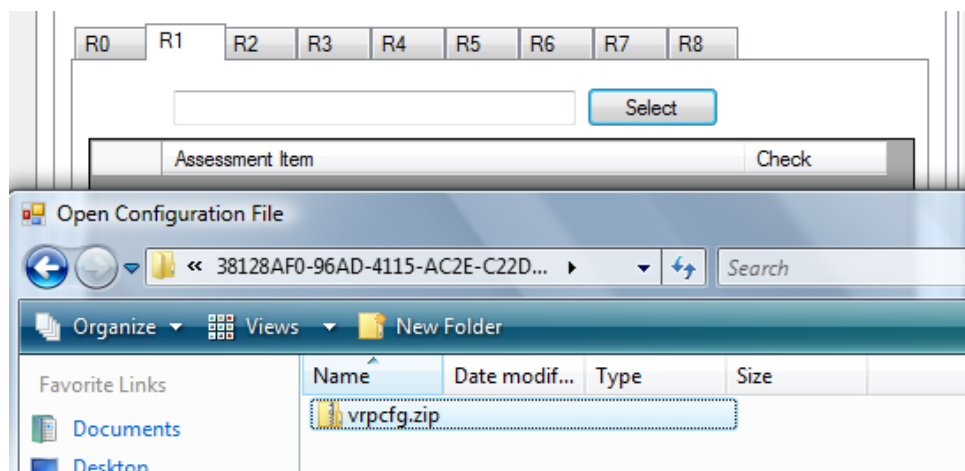


Figure 2.14 Select “vrpcfg.zip” file inside the folder

Step 8: Select “vrpcfg.zip” file in the specific folder. (*Same goes to WLAN for VERSION 320)

Note: For version 216, it will be same as switch which shown below.

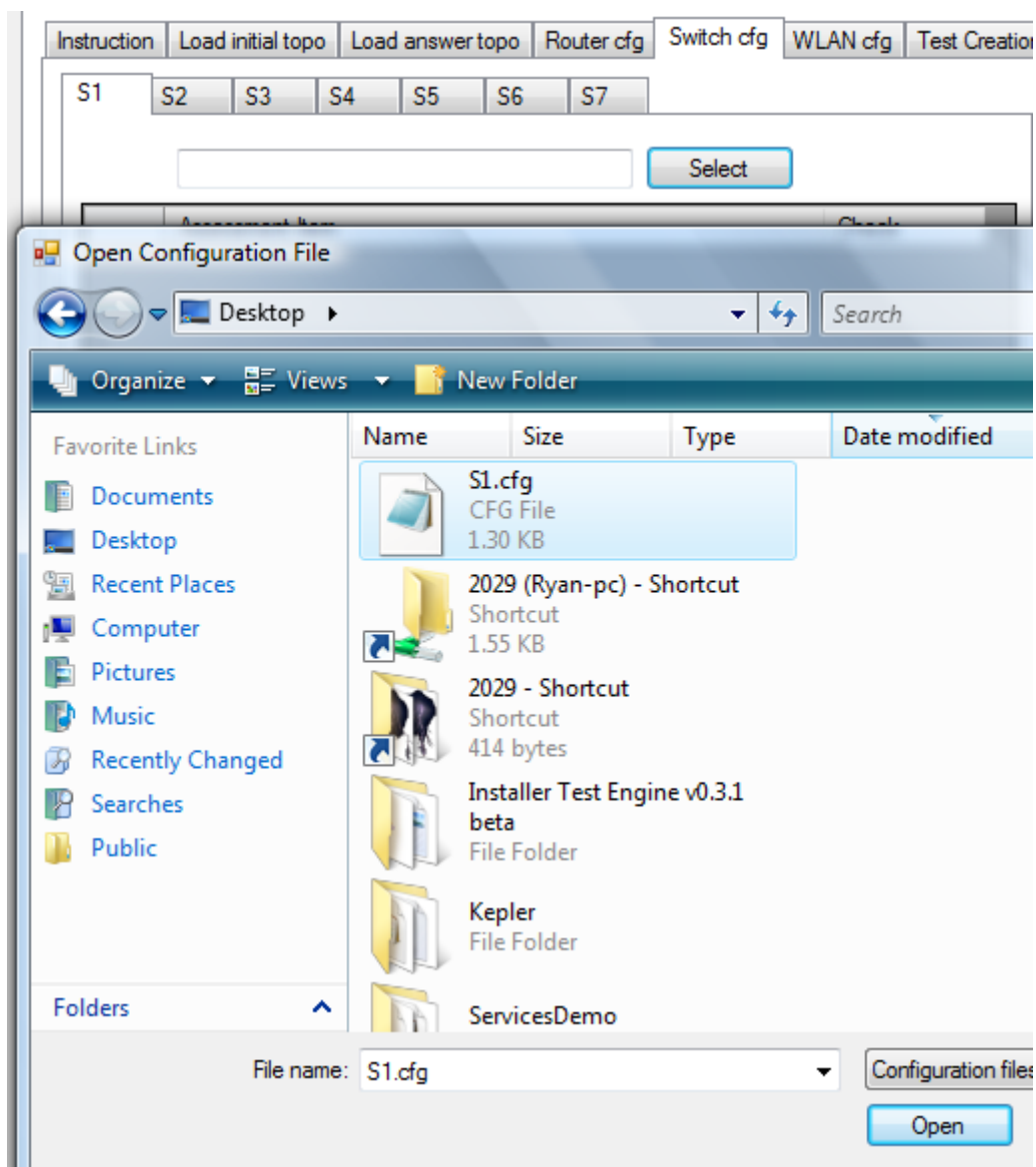


Figure 2.15 Switch tab (VERSION 216 & 320)

Step 9: Click the Select button and select specific configuration file (e.g. “S1.cfg”).

Export configuration file from Hua Wei eNSP

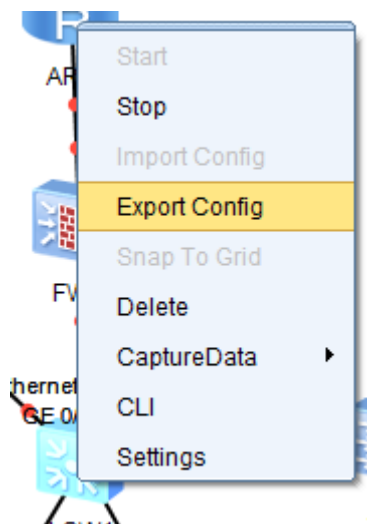


Figure 2.16 Export Config

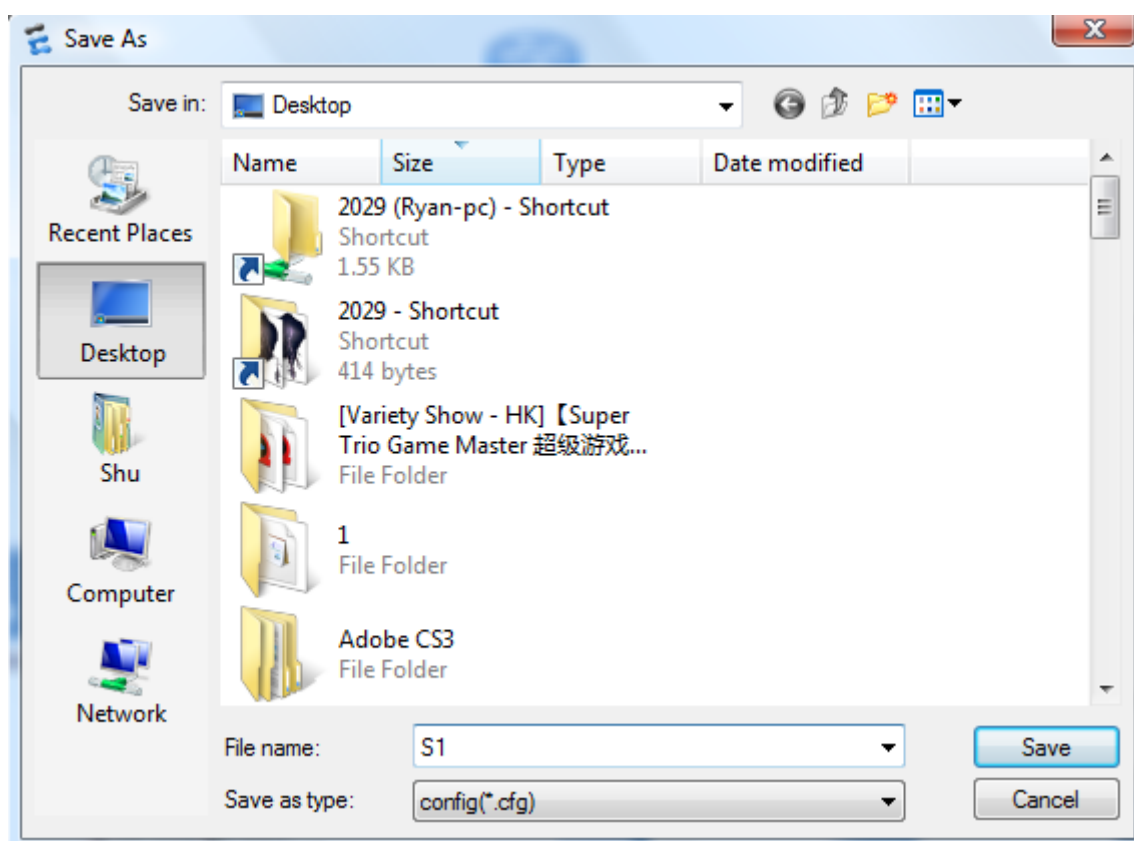


Figure 2.17 Save cfg file

Right click specific switch or router, select Export Config, save the configuration file. (.cfg format)

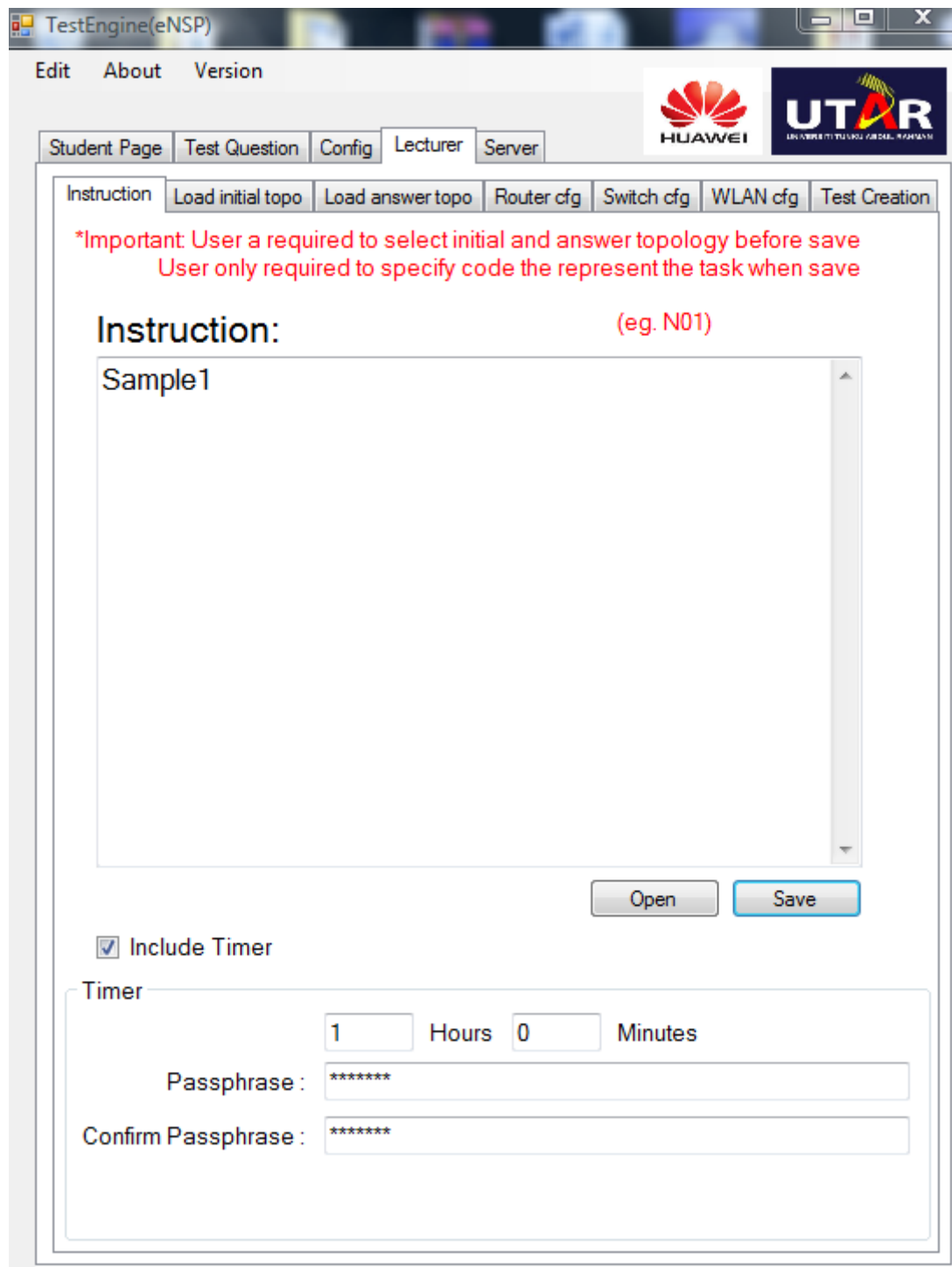


Figure 2.17 Instruction tab

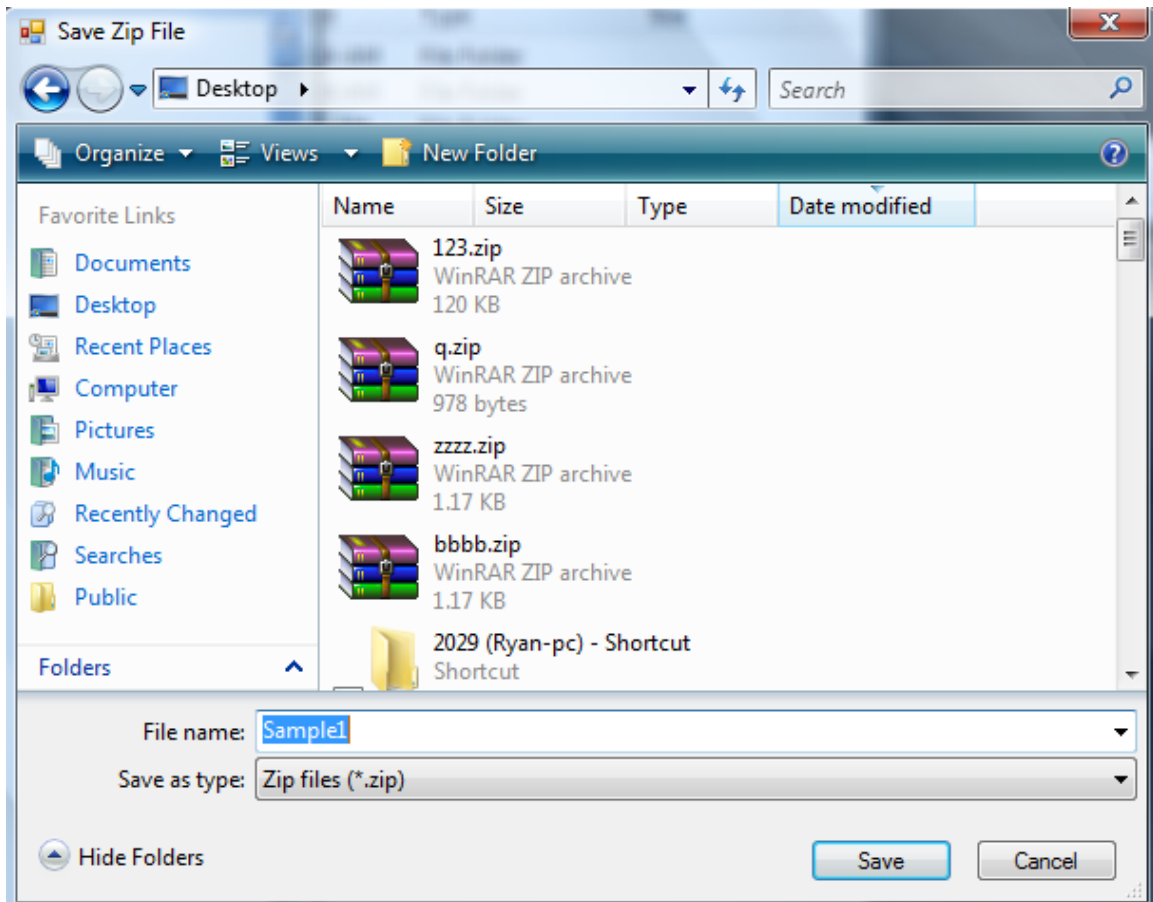


Figure 2.17 Save Lab

Step 10: After enter all required fields, Click Save button at Instruction tab to save the lab as a package. (e.g. “Sample1.zip”)

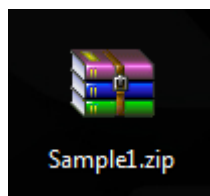


Figure 2.18 Sample1.zip

2.3 Open Saved Lab

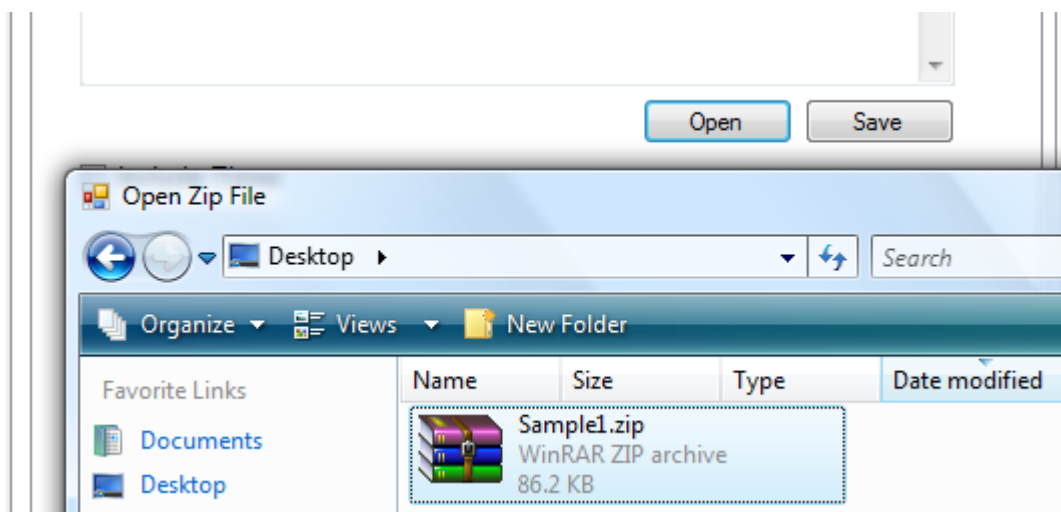


Figure 2.17 Open Saved Lab

Step 1: Click Open button at Instruction tab to open saved lab package. (e.g. “Sample1.zip”)
All saved data will be loaded into the software.

Appendix C

2.4 Test Creation

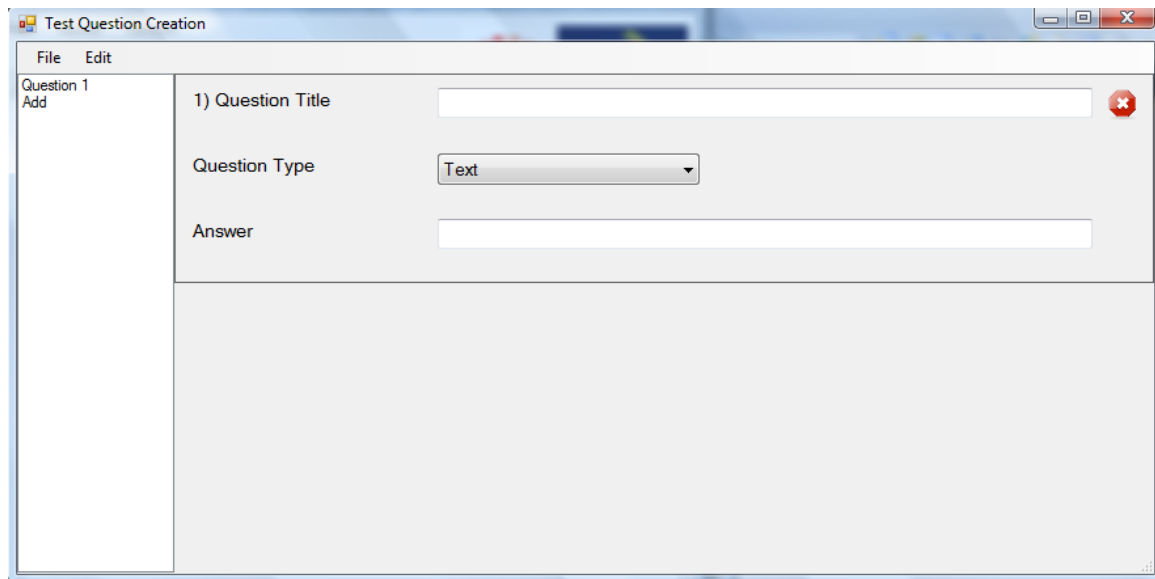


Figure 2.18 Test Creation (Question Type "Text")

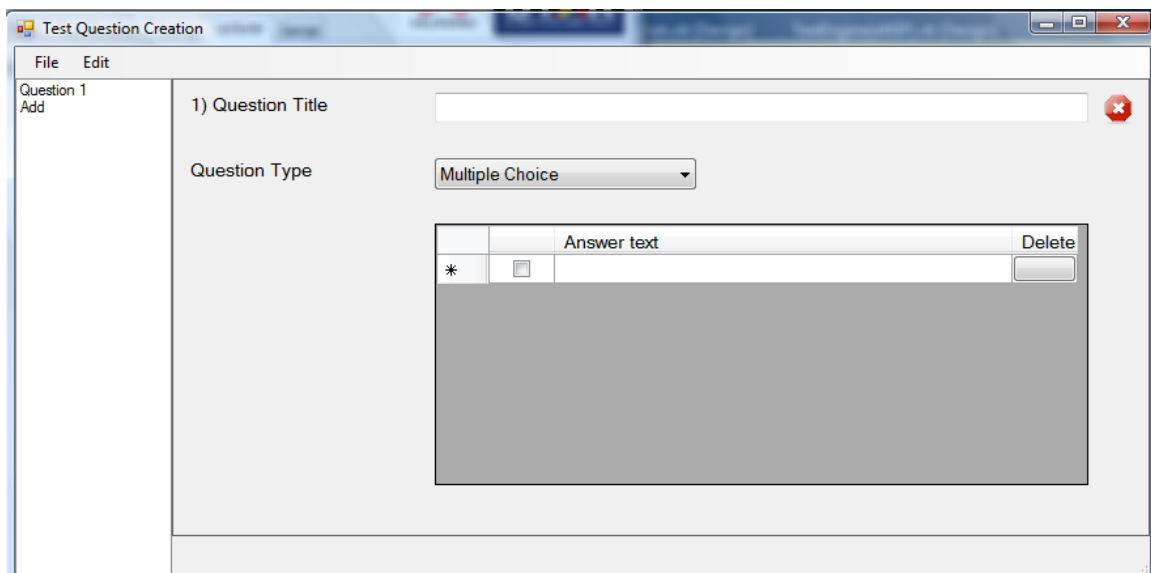


Figure 2.19 Test Creation (Question Type "Multiple Choice")

Step 1: Click on Test Creation tab, Test Question Creation form will prompt. User allows creating plain text or multiple choice questions (MCQ).

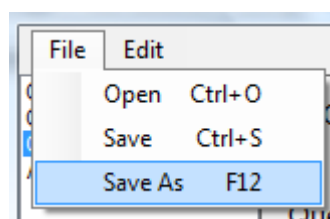


Figure 2.20 Menu Strip File -> Save As

Step 2: Click on Save As to save the test question. User also able to save by pressing shortcut key F12 for Save As and Ctrl+S for Save.

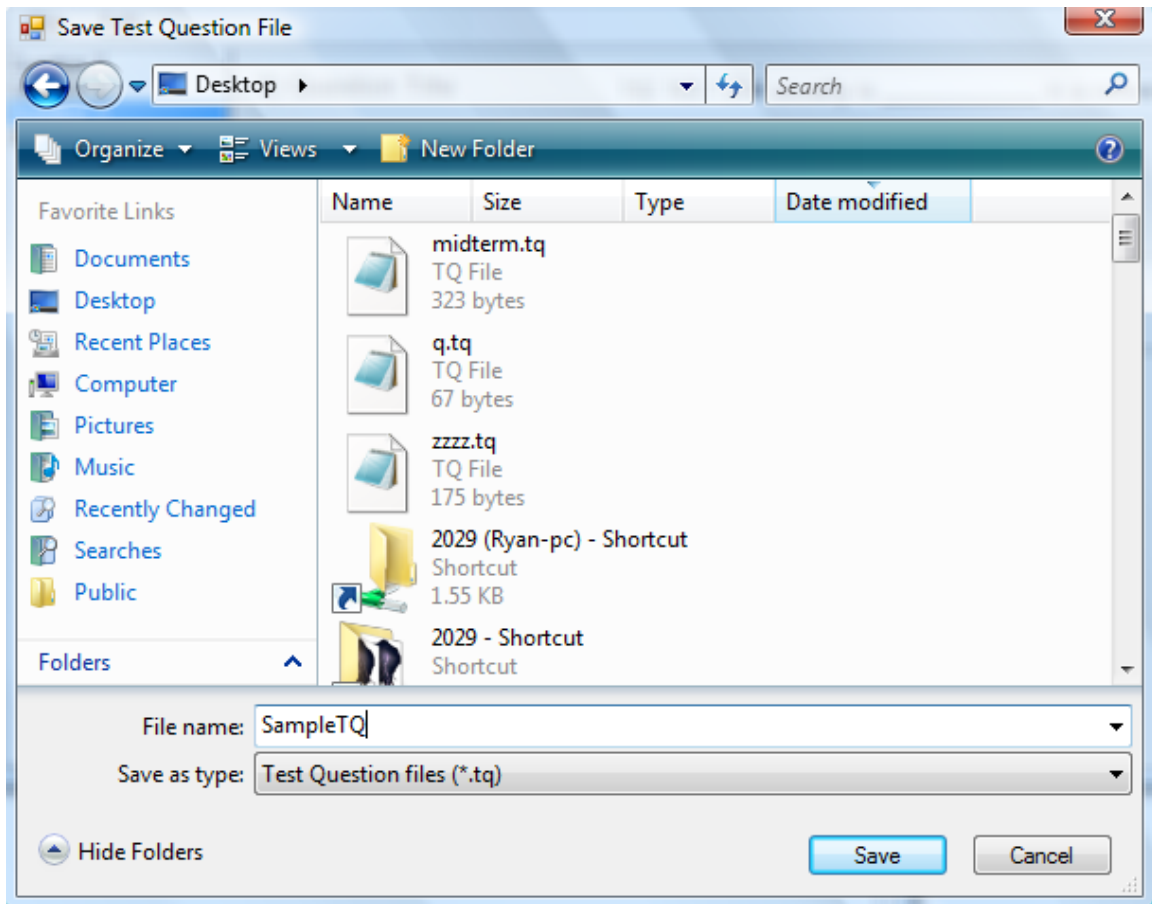


Figure 2.21 Save Test Question

Step 3: The test question will be save into 2 file, which is .tq and .tqa format. (e.g. “SampleTQ.tq” and “SampleTQ.tqa”)

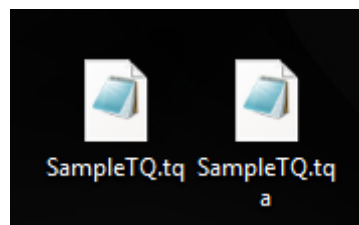


Figure 2.22 SampleTQ.tq and SampleTQ.tqa

Additional function

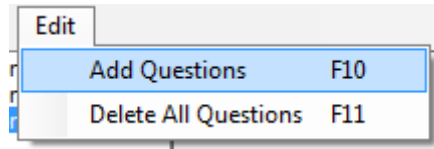


Figure 2.23 Menu Strip Edit ->Add Questions

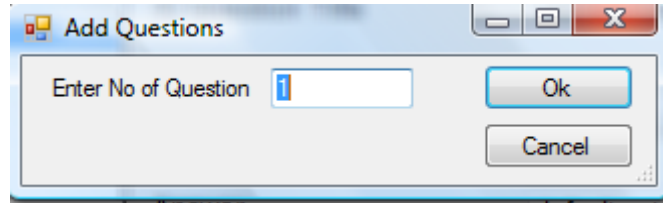


Figure 2.24 Add Questions form

Allow user to add multiple questions at once by clicking Add Question or shortcut key “F10”. Add Questions forms will prompt and request user to enter No of Question to be added.

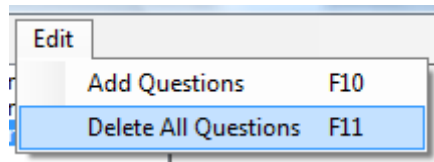


Figure 2.25 Delete All Questions

Allow user to delete all questions in the list by clicking Delete All Questions or shortcut key “F11”.

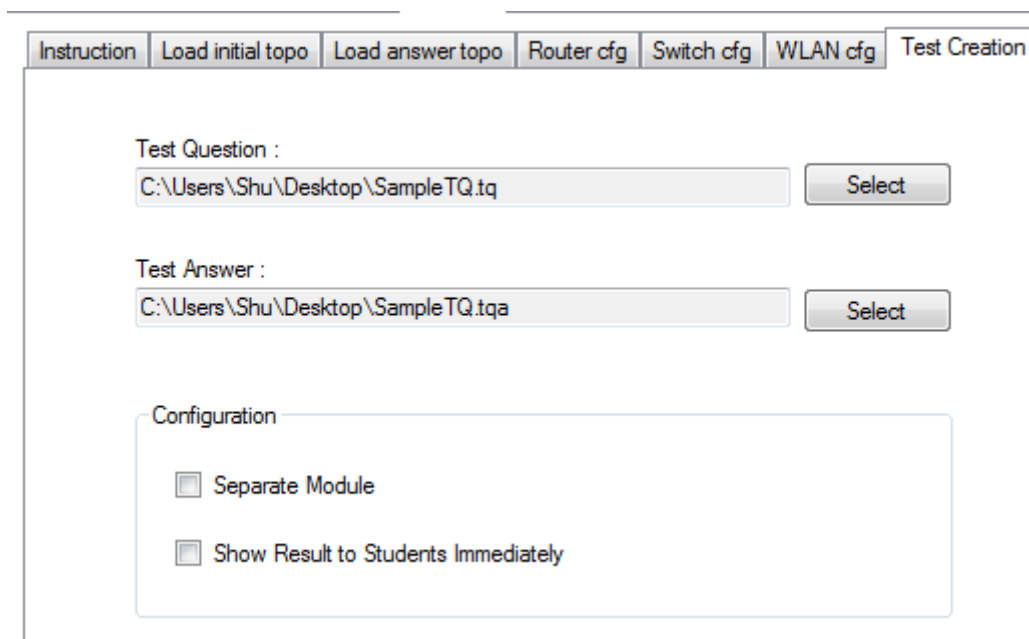


Figure 2.26 Test Creation tab

Step 4: After saving the test question, user can close the Test Question Creation form. Upon closing, the software will auto detect previous saved paths. However, users are giving the authority to change the paths for flexibility.

Step 5: Under configuration part, users are allow to specify to save the test question as separated module (not integrate with practical labs) and display result to students after they submitted as shown below.

		Previous	Next	Marks = 3 / 3
No	Selected Answer			
▶ 1	192.168.1.1	✓		
2	3700	✓		
3	default gateway	✓		

Figure 2.26 Test Question tab after submitted

2.5 Server Page

Student Page	Test Question	Config	Lecturer	Server	HUAWEI	UNIVERSITI TEKNOLOGI MALAYSIA
IP Address:	192.168.56.1	Start	Stop	Clear	Export	
Port No:	8088					
Username	PC Name	Lab Marks	Test Marks			

Figure 2.26 Server tab

Step 1: Server IP Address is auto detected on form load and default port no is set to 8088. However, users are giving the authority to change the IP Address and Port No for flexibility and incase Port No had been utilized by others application.

Step 2: Clicking Start button to start the server services and allow server to received packet sent by client.

Appendix C

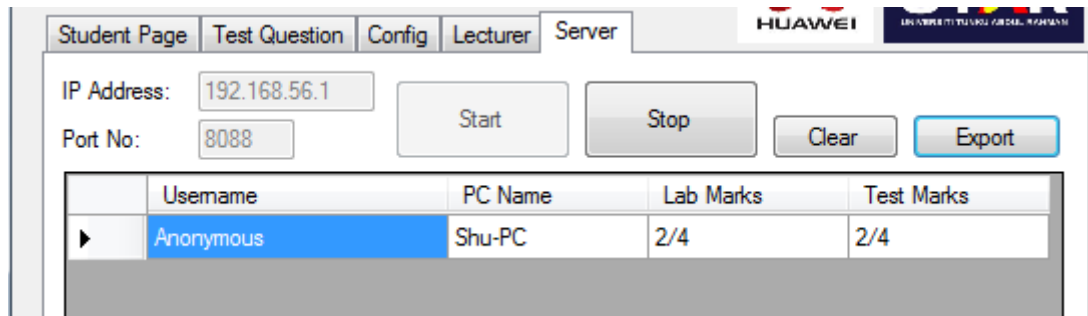


Figure 2.27 Server received information packet from client

Step 3: Upon receiving information packet from client, the software will auto update the data grid view table.

Step 4: Clicking Stop button to stop the server services.

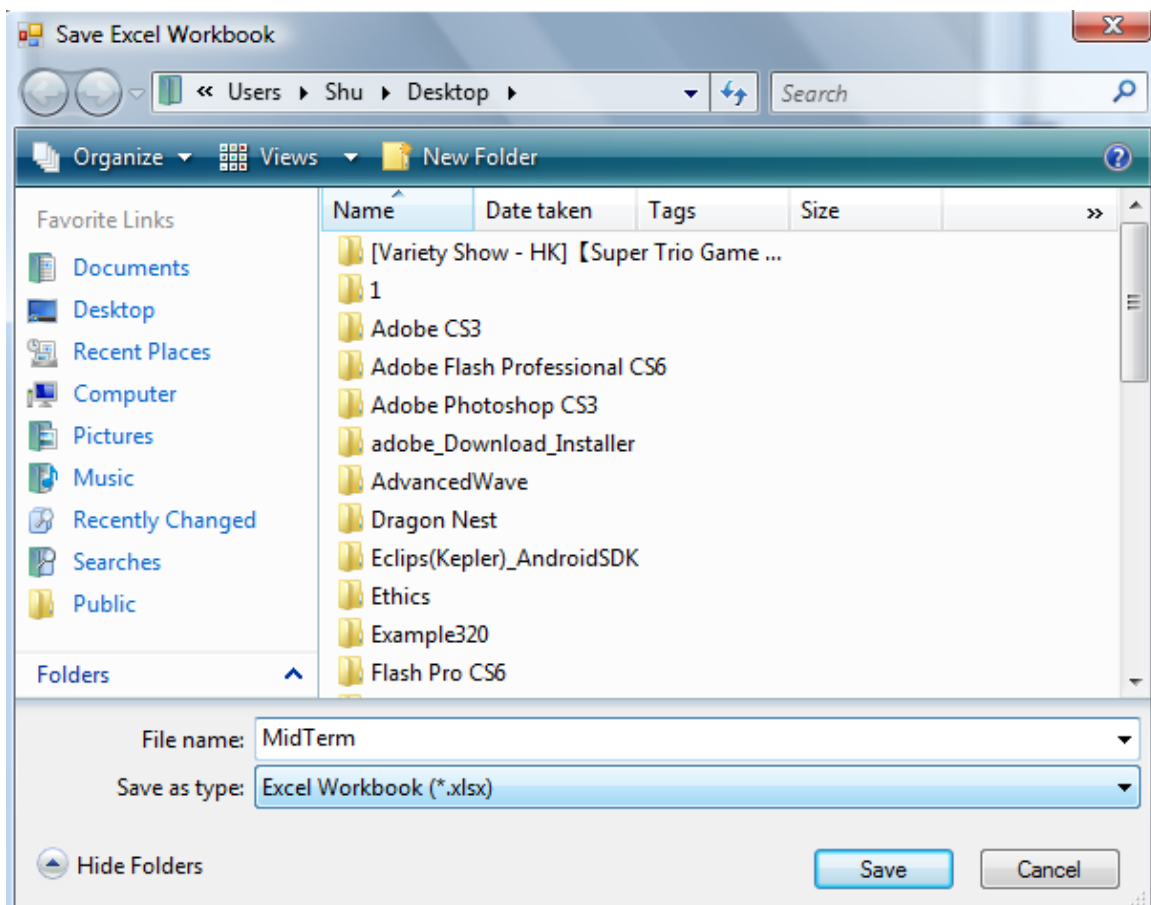


Figure 2.27 Export information into Excel format

Appendix C

Step 5: The information in the data grid view are able to Export into Excel file by clicking the Export button.

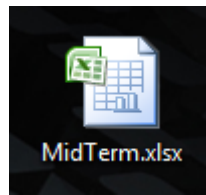


Figure 2.28 MidTerm.xlsx

A screenshot of the Microsoft Excel application window. The title bar reads 'MidTerm.xlsx ...'. The ribbon shows 'Home', 'Insert', 'Page Layout', 'Formulas', 'Data', 'Review', 'View', and 'Tea'. The ribbon tabs are 'Clipboard', 'Font', 'Alignment', 'Number', 'Styles', and 'Cells'. The active cell is A1, containing the text 'Username'. The spreadsheet data is as follows:

	A	B	C	D
1	Username	PC Name	Lab Marks	Test Marks
2	Anonymous	Shu-PC	2/4	2/4
3				
4				

Figure 2.29 Data inside MidTerm.xlsx

2.6 Load Lab Package

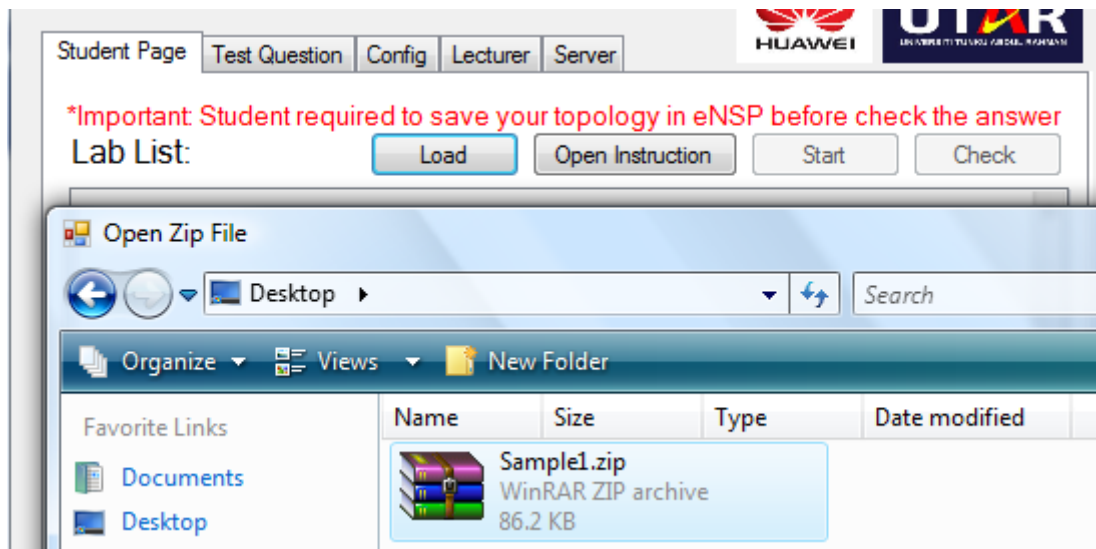


Figure 2.30 Load Lab package

Appendix C

Step 1: Click on load button at Student Page and select previous saved lab package. (e.g. Sample1.zip) A successfully loaded message box will show if the loading process is done successfully.

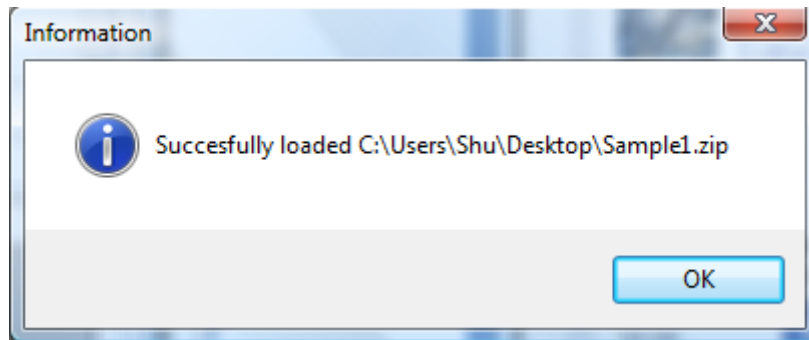


Figure 2.31 Successfully loaded message box

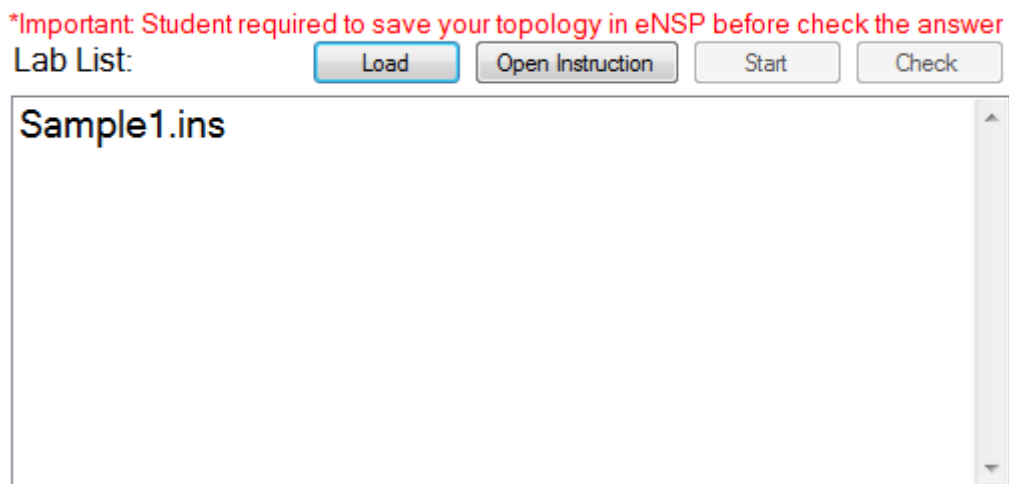


Figure 2.32 Lab List

Step 2: After successfully loaded the lab, the lab instruction file (.ins) will be display on the Lab List.

2.7 Start the lab

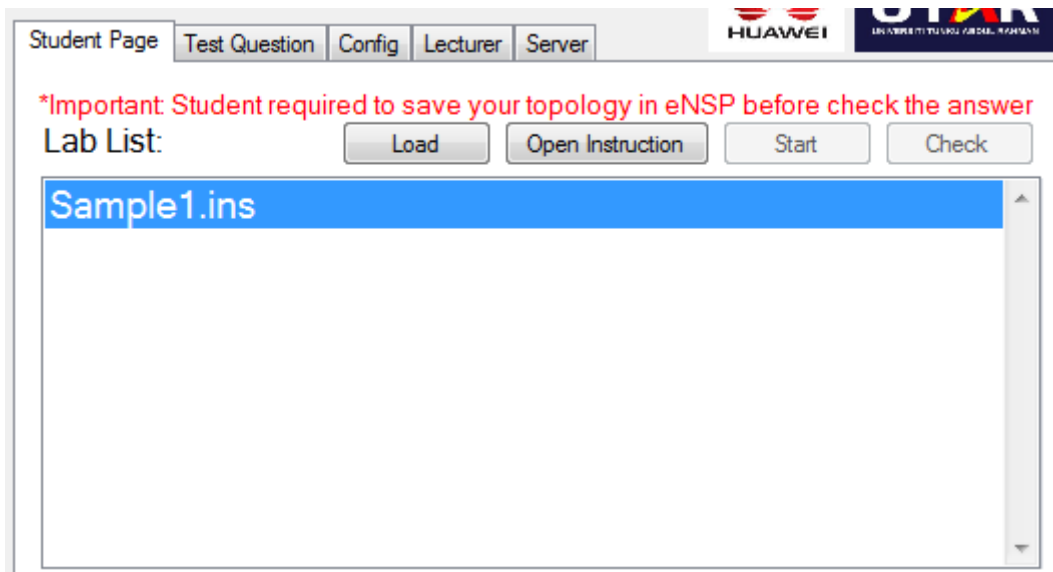


Figure 2.33 Double click on Lab List

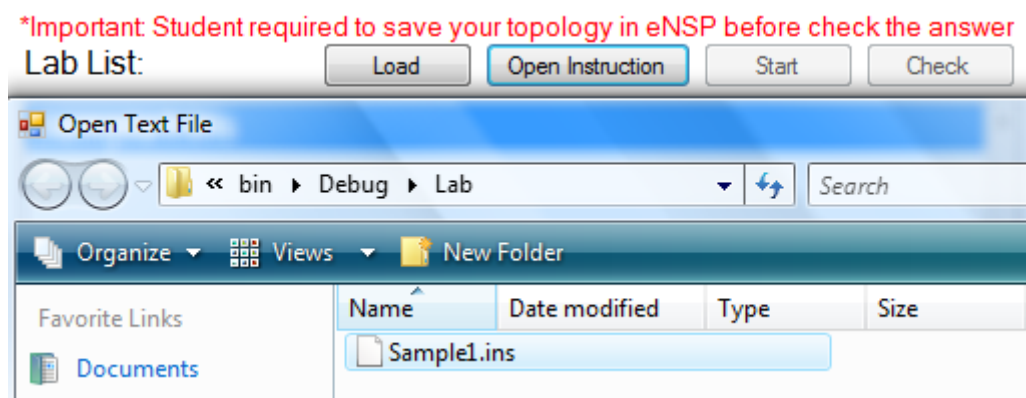


Figure 2.34 Click on Open Instruction

Step 1: There are 2 ways to open a Lab exercise, which is double click on Lab instruction inside the Lab List and Click on Open Instruction and select specific lab on the Open File Dialog. A successfully opened message box will show if the lab exercise is successfully opened.

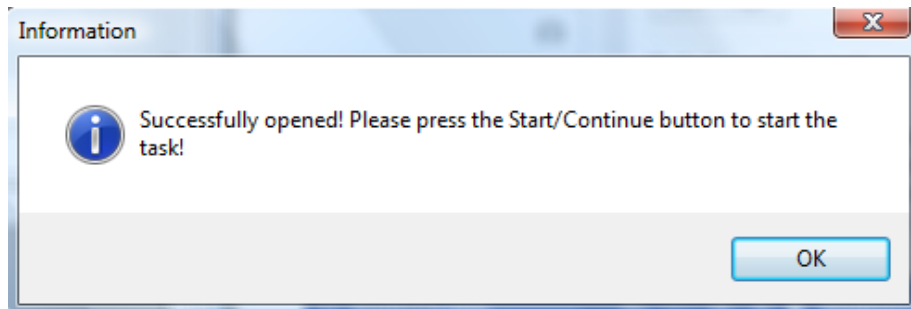


Figure 2.35 Successfully opened message box

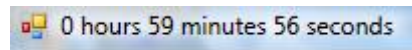


Figure 2.36 Countdown timer

Note: If the lab exercise of time constraints, top left of the software will display the countdown timer. User are not allow to continue the lab if the time ran outs.

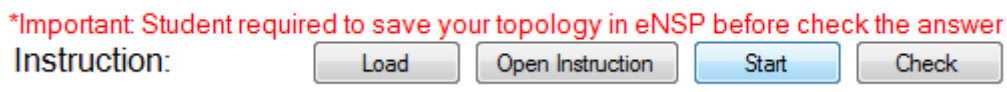


Figure 2.36 Start the lab

Step 2: Clicking the Start button to start the lab exercise automatically. The lab exercise will opening in eNSP as shown below.

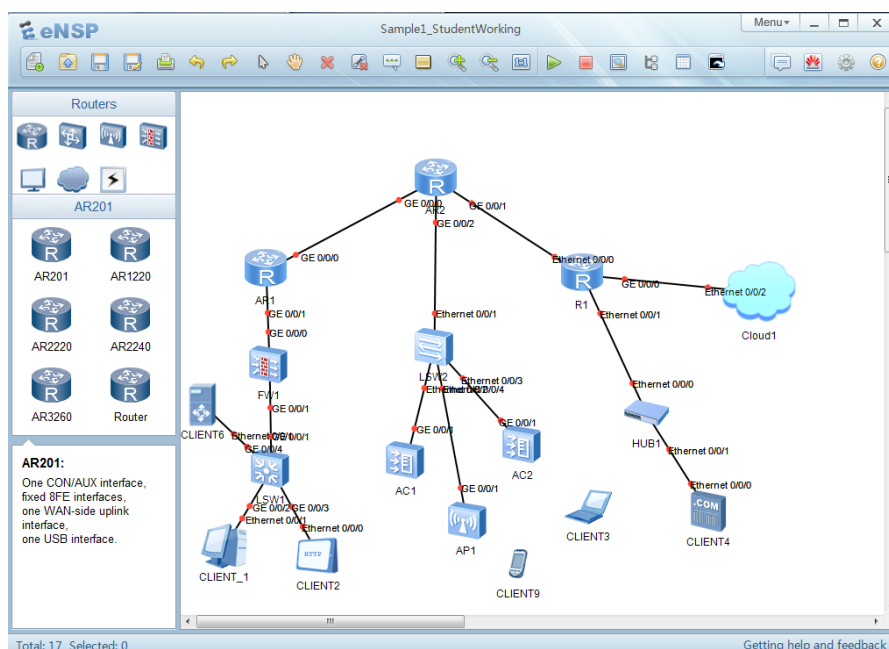


Figure 2.37 Sample1 eNSP lab exercise

Appendix C

***Important: Student required to save your topology in eNSP before check the answer**

Instruction:

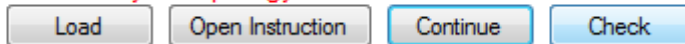
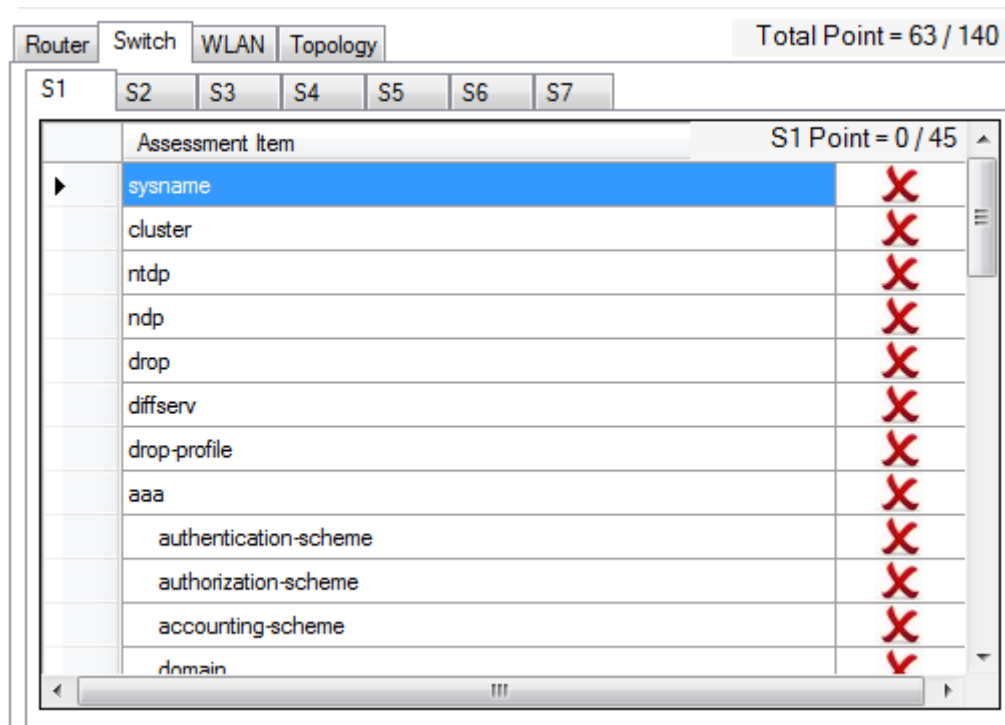


Figure 2.38 Check answer

Step 3: After configure the network base on given instruction, user able to check their answer by clicking Check button. The result will display to user as shown below.

The screenshot shows a software interface with tabs for Router, Switch, WLAN, and Topology. The 'Switch' tab is active, showing a list of switches S1 through S7. A pop-up window for 'S1' displays a table of assessment items. The table has two columns: 'Assessment Item' and 'S1 Point = 0 / 45'. All items in the table have a red 'X' in the second column, indicating they are incorrect. The items listed are: sysname, cluster, ntdp, ndp, drop, diffserv, drop-profile, aaa, authentication-scheme, authorization-scheme, accounting-scheme, and domain.

Assessment Item	S1 Point = 0 / 45
sysname	X
cluster	X
ntdp	X
ndp	X
drop	X
diffserv	X
drop-profile	X
aaa	X
authentication-scheme	X
authorization-scheme	X
accounting-scheme	X
domain	X

Figure 2.39 Data grid view that display Assessment items and correctness of each item

2.8 Config page

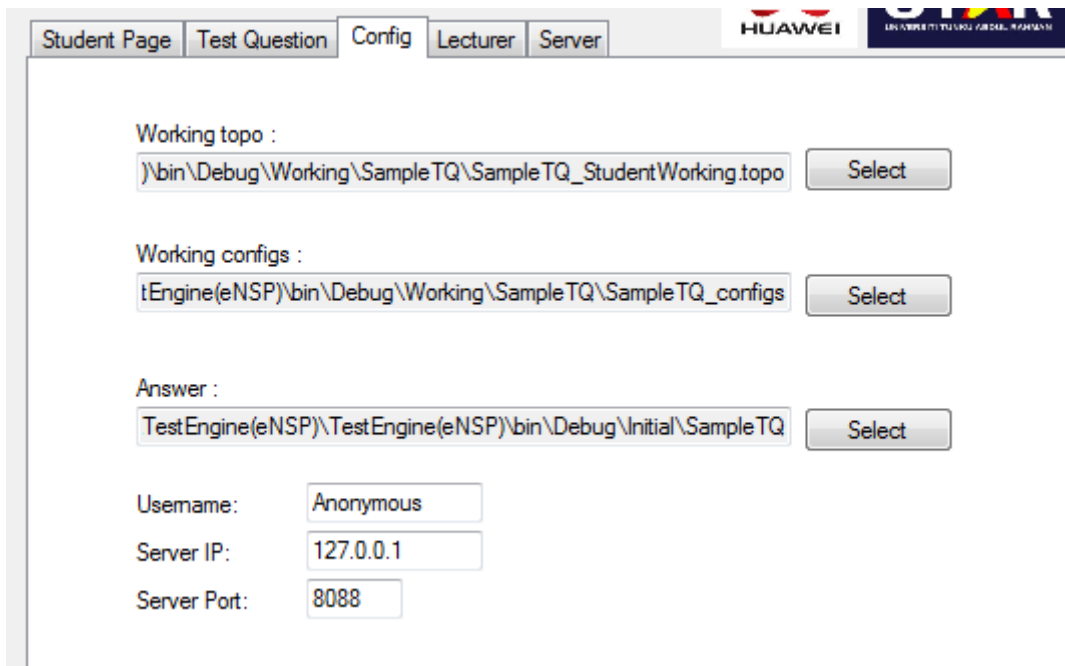


Figure 2.39 Config page

Working topo, configs and Answer paths will be auto assign whenever a lab is opened. However, users are giving the authority to change the paths for flexibility. Users are required to enter Username, correct Server IP and Server Port in order to sent their marks to Server.

2.9 Extend Timer

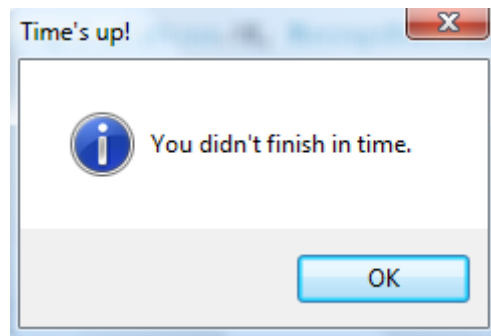


Figure 2.40 Time's up message box

Appendix C

Step 1: When countdown timer time ran out, Time's up message box will show and users are not allowed to continue to do the lab exercise. However, system provides the flexibility to extend timer only with the correct passphrase during creating of lab exercise. (e.g. In case PC lag, restarted or other acceptable reason to extend the timer)

Step 2: By pressing Ctrl + Alt + P to prompt the Extend Timer form. After enter correct passphrase, user allows to enter number of time to be extended as shown below.

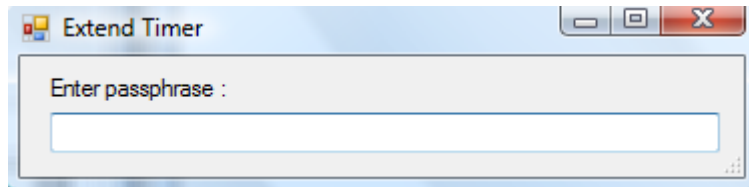


Figure 2.41 Enter passphrase

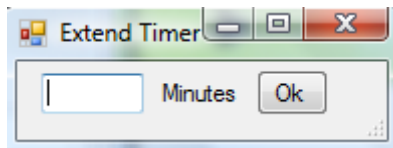
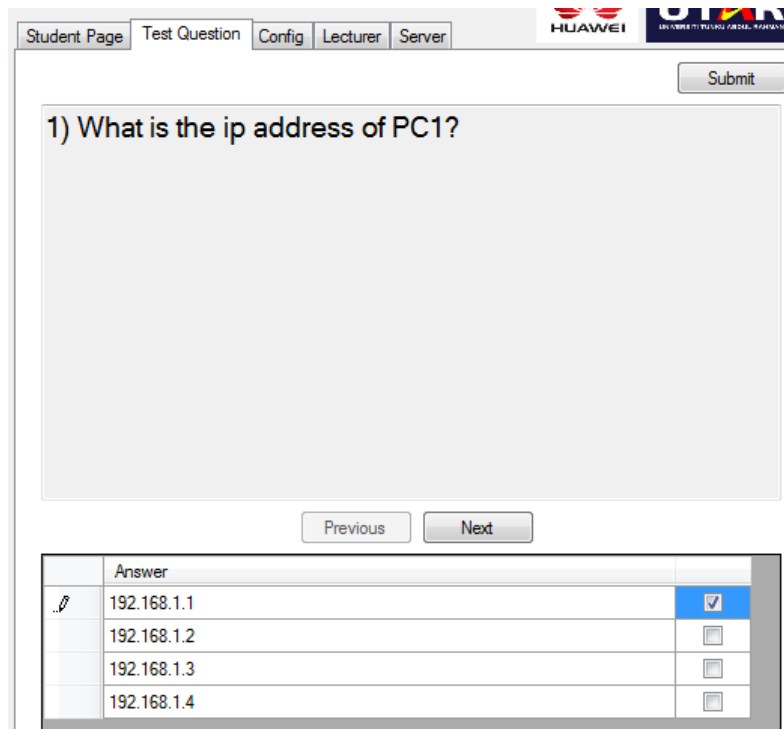


Figure 2.42 Enter number of time to be extended

Step 3: Press Ok and countdown timer will be extended base on the minutes entered. Users are allowed to continue the lab exercise.

Appendix C

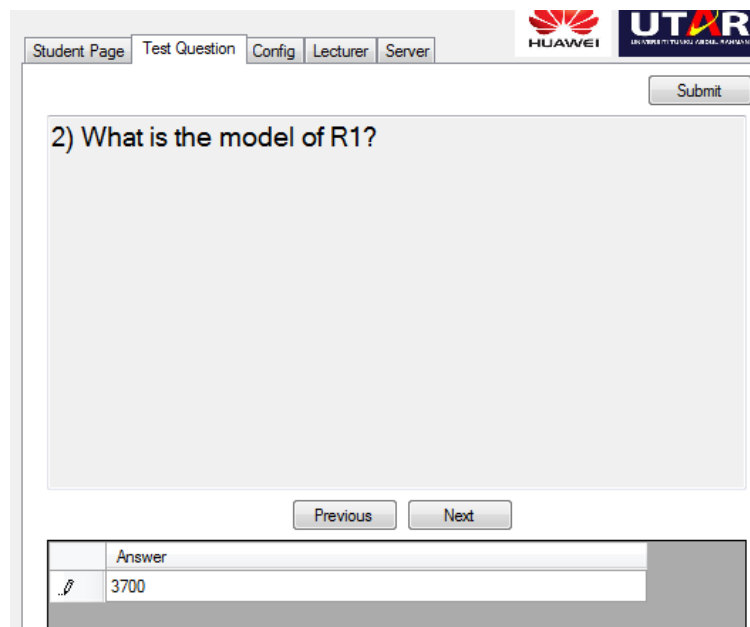
2.10 Test Question



The screenshot shows a web-based test interface. At the top, there are navigation tabs: 'Student Page', 'Test Question', 'Config', 'Lecturer', and 'Server'. To the right are logos for 'HUAWEI' and 'UTAR' (Universiti Tunjangan Kuala Lumpur). A 'Submit' button is located in the top right corner. The main question area contains the text '1) What is the ip address of PC1?'. Below the question are two buttons: 'Previous' and 'Next'. At the bottom, there is a table for the answer options.

	Answer	
<input type="checkbox"/>	192.168.1.1	<input checked="" type="checkbox"/>
<input type="checkbox"/>	192.168.1.2	<input type="checkbox"/>
<input type="checkbox"/>	192.168.1.3	<input type="checkbox"/>
<input type="checkbox"/>	192.168.1.4	<input type="checkbox"/>

Figure 2.43 Test Question (Multiple Choices)



The screenshot shows a web-based test interface similar to the previous one. It features the same navigation tabs, logos, and 'Submit' button. The question is '2) What is the model of R1?'. Below the question are 'Previous' and 'Next' buttons. At the bottom, there is a table for the answer.

	Answer
<input type="checkbox"/>	3700

Figure 2.44 Test Question (Plain Text)

Step 1: There are 2 type of question might be asked: Multiple Choices or Plain Text. User are able to navigate throughout the question by Previous and Next button. Submit button is click when users finish the test question and the decision is not able to revert.