Smart Internet Operating Software (SMART IOS)

Eza Monzaid[1,a*], Asbul Hadi Mat Yunus[1,b], Hanira Razali[1,c]

[1] Centre for Instructor and Advanced Skill Training (CIAST), Jalan Petani 19/1,
Seksyen 19, 40900, Shah Alam, Selangor, MALAYSIA

*Corresponding Author

Email: [a]ezamonzaid78@gmail.com, [b]asbulhadi@ciast.gov.my, [c]hanira@ciast.gov.my

Abstract: Smart Internetwork Operating Software (Smart IOS) project software was developed to facilitate the process of configuring switches and routers within a minimum time through the development of Graphical User Interface (GUI) and VB.net programming script on CISCO devices in particular. This project-based software was developed using Visual Basic Script (.vbs) as the main programming language in the platform support 'Visual Studio Ultimate 2013'. This software may only be used in Microsoft Windows operating systems and does not require internet connection. The software communicates with media devices via serial communication port (COM) on the platform PowerShell (PS). PowerShell is a task automation and configuration management of Microsoft, which consists of a command-line scripting language, built on the .NET Frameworks. The usage of Smart IOS software can help users to configure without having problem to remember the command line and the user can run the configuration on CISCO device via telnet connection or through a wired connection console only.

Keywords: *Smart IOS, PowerShell, software, CISCO device*.

1. Introduction

Recently internet widely used and became one of important communication medium. The growth of internet usage requires smooth technical management in terms of data flow across computer networks. The responsibilities to manage and to ensure the stable operation of organization's IT assets will face variety of network problem. One of network operation problem related with the configuration of the individual routers which controls wide range of parameter that affect the allocation resources.

Configuring a large backbone demand high technical skill and difficult. One of the reasons is the consistent of configuration through routers related with the correct operation of IP network. Besides that, complex configuration option on router provide by vendor such as CISCO which offers over 600 commands. Configuring variety of router products and IOS versions requires knowledge and expertise to manage large network. Frequent changes in large network may occur link failures and traffic fluctuations due to network operation. Limited configuration tools also one of the challenge which involves manual interaction with command line interface or primitive web interlace [1][2][3][4][5].

This project was developed to assist network administrators and focused on CISCO router and switch. The project objectives are to develop Graphical User Interface (GUI) for configuring CISCO switches and routers, develop VB.net programming script for Smart IOS Cisco and to run configuration tests for CISCO switches and routers. The main function of CISCO IOS is to enable network communication through network devices. CISCO IOS provide many services such as encryption, authentication, firewall capabilities, policy enforcement, deep packet inspection, Quality of Service, intelligent routing and unified communication services. PowerShell is an object-oriented programming language and interactive command line shell for Microsoft Windows. PowerShell was design by Microsoft as a way to automate system tasks includes batch processing and system management tools for Microsoft Windows. PowerShell

integrates with the .NET environment include cmdlets, scripts, executable standalone tools and instantiation of standard .NET classes. PowerShell provide over 130 standard command line tools for functions to create scripts in VB, VBScript or C++. IOS uses a Graphical User Interface (GUI) like modern desktop operating systems and this feature allow user to interact easily with the device.

Graphical Internetwork Operating System (IOS Smart) is software developed to simplify and shorten the process of configuring CISCO router and switch. This software may simplify system administrators' configuration job task because it utilizes a GUI without the need to type the command line Command Line Interface (CLI). This software developed using Visual Basic Script (.vbs) in Visual Studio Ultimate 2013 as the software platform and suitable to be applied in Microsoft Windows operating systems only. With this configuration users can create on the device in question in a short time. Users only need to enter the necessary data such as route protocol router (routing protocol) and so on. This software can be used without having access to the internet, only need a cable connection console (console) from the computer to the device to be configured. The use Graphical User Interface (GUI) is also very user friendly and easy to understand (refer Fig. 1).
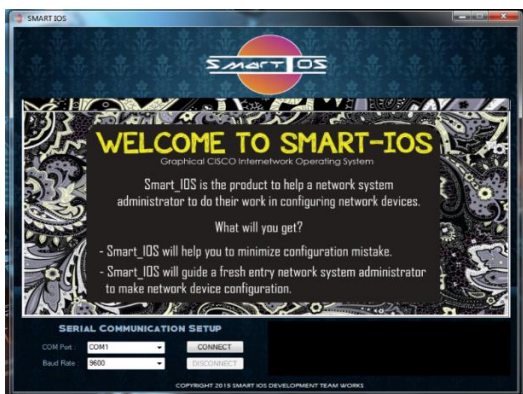

Fig. 1 - The Graphical CISCO Internet Operating System

2. Methodology

Smart IOS Software development involves programming and testing of network devices. The hardware requirement for this project include computer that use Windows 7 as an operating system, CISCO router 1900 series which using serial connection through communication port, CISCO switch 2900 series, Unshielded Twisted Pair (UTP) cable for device and host network connection, DCE/DTE serial cable to make connection between routers and console cable that will enable the device to be configured. While software requirement are Visual Studio Ultimate 2013, packet tracer, Visual Basic (VB) programming, Graphical User Interface (GUI) and Command Line Interface (CLI).

Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. Visual Studio software development platform using Microsoft Windows API, Windows Forms, Windows Presentation Foundation, Windows, and Microsoft Silverlight. It can produce both native code and managed code. Visual Studio includes a code editor supporting IntelliSense (code completion components) as well as code refactoring. Integrated debugger works both as a source-level debugger and a machine-level debugger. Visual Studio also supports different programming languages and

allows the code editor and debugger to support (to varying degrees) nearly any programming language, provides specialized services to language that exists.

Cisco Packet Tracer network simulation program allows user to experiment with network behavior and provide program used to experiment with network simulation, visualization, authoring, assessment, and collaboration capabilities and facilitate the teaching and learning of complex technology concepts. Visual Basic is a programming language designed for creating applications that work with Microsoft's .NET Framework. VB is the language used to create the program and their components based on existing Windows system. VB language integrate easily with windows that form the object code is determined by a programmer. Basically, VB has maintained the old system type and supports the type of log data, although it is now a 64-bit data type instead of 32-bit data.

Generally, GUI is the visual component of that simplifies data changed from device to device. In addition, the GUI displays text and graphics in a program that was designed by a program such as Visual Basic. Command Line Interface (CLI) is an interface mechanism that displays only in written form, where it interacts with the computer's operating system or software according to the instructions given to perform a specific task. Various methods may use to demonstrate the functionality of the buttons in the GUI. For example when available at the click of a button and a menu will appear through text-line interface (TUI). Compared with GUI, CLI is quite difficult to memorize and manage by user.

Based on Fig. 2 it shows the flow of Graphical User Interface (GUI) for IOS Smart development. CISCO IOS function need to examine first and a study on the movement of the programming command line to configure the Cisco network devices are based on the basic configuration steps in routing, DHCP and so on. Next the VB script also must be examine because the most important part of Visual Basic is the ability to create a Windows Forms application that runs locally on the user's computer. Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft which used to develop computer programs for Microsoft Windows, as well as web sites, web applications and web services.

Project prototype than was created based on prototype designed that have been developed before. Next followed by Visual Studio Ultimate 2013 set-up. Visual Basic Script (VBS) can be creating when Visual Studio Ultimate 2013 set-up was successful. Windows Forms Application in Visual Studio has used as the basis for the graphical user interface and to create application using Visual Basic Net framework (VN.net). The original source code can be created through Windows Form Application to enable communication transmission and reception of data from the software to the Cisco network devices. The hardware functionality of the project can be test after combination of Windows Form and VB Script. The IOS Smart applications will be tested in a variety of methods which, users will make the switch or router configuration using IOS Smart as data transmission and making an analysis in terms of time and typing speed between the use of CLI commands and Smart IOS application.
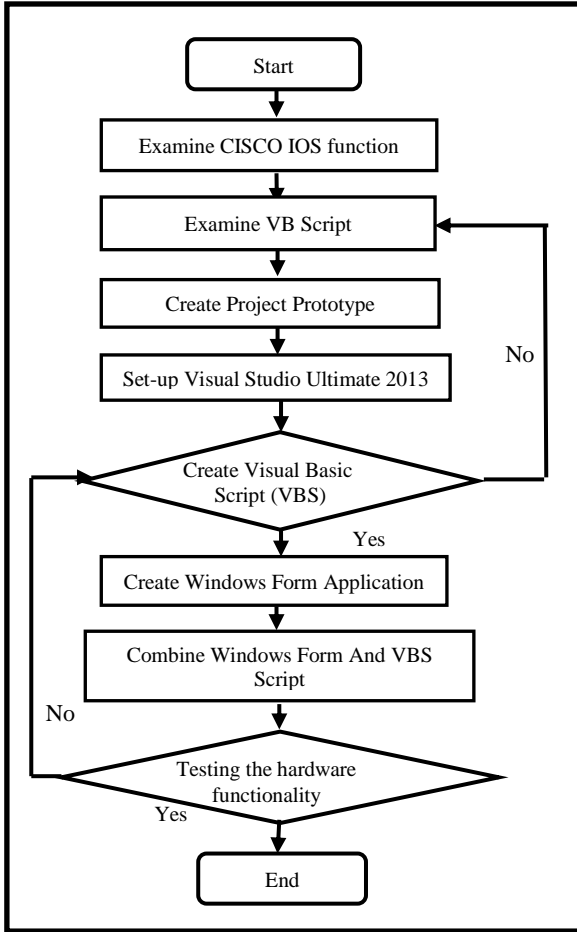
Fig. 2 - Graphical IOS Development Flow Chart

Fig. 3 - Serial Communication Flow Chart

Fig. 4 - Source Code development for data transmission functionality

The relationship between the terminal and the session data transmission via RS232 cable connection in Graphical IOS to network device such as routers and switch shown in Figure 3. Source code development shown in Figure 4 to ensure the Windows Form application will function and can integrate with RS232 cable connection. The source code involves the entire functionality of RS232 connection. Terminal provided by windows will be tested in terms of the opening of the port and port selection available to ensure RS232 connection gain access to the Windows Form.

3. Result

Graphical User Interface (GUI) for IOS Smart applications software that has been developed is still in the new release version. To make configuration of CISCO network media devices, there is a choice Communication Port (COM) which can be selected by the user. Users can choose two main selection of devices to be configured either router or switch (refer Fig. 5). User can configure router device in Graphical IOS in EXEC Mode (refer Fig. 6) using three option which are Enable privileged mode, ping and telnet. EXEC mode is the first level or mode in configuring CISCO router. In this mode, there are several command lines that can be done to continue the configuration on the router device. Two routers of series 1900 and switch 2900 series used to test the configuration. Fig. 7 shows output ping result.
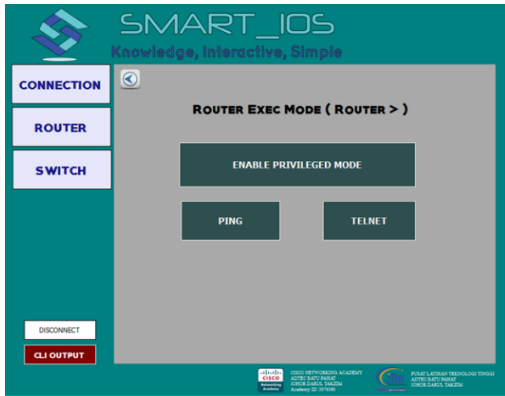

Fig. 5 - Graphical IOS application design

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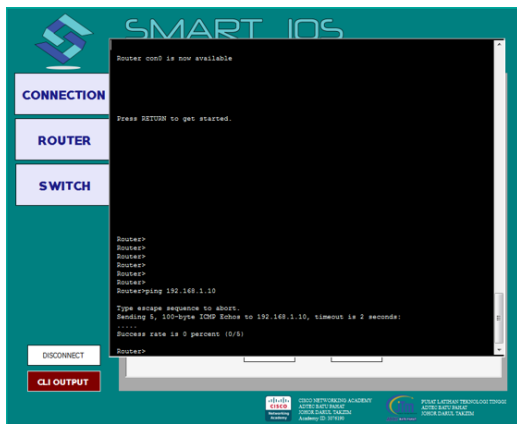**Fig. 6 - Three optional mode in Router EXEC Mode**

Fig. 7 - Output ping result

4.   Discussion

This project was produced to assist the configuration of routers and switches for the Graphical User Interface (GUI) especially for CISCO network device. The configuration of routers and switches typically use software support such as PuTTY, HyperTerminal or same software else for configuration. By our observation, this project can also be used by individuals who want to learn about the process of router or switch configuration. Using this software may able to speed up the process of configuration by simply pressing a button on the interface without having to remember the command line. In addition, Graphical User Interface (GUI) features make this software more user-friendly and may reduce configuration time than usual. The software can be used without accessing to the internet and only require a cable connection console from the computer to the device to be configured.

This project has resulted in two different version that are version for learning and advance version. Learning version includes only configuration on the router. The advance version produced for the configuration of routers and switches, but is still limited in terms of protocol. Learning version can only create a basic configuration on the router as banner, hostname, console and telnet passwords, and also some routing protocols, Open Shortest Path First (OSPF), Routing Information Protocol Version Two (RIPv2) Static Routing and Interior Gateway Enhanced Protocol (EIGRP). This project also can be upgraded in the future with the protocol used by Cisco devices in the future.

5.   Conclusion

In conclusion, GUI was a very convenient used to configure the Cisco network devices as it is hassle-free and users do not have to remember to use their software as a command-line terminal. GUI also allows users to control and enter data into a computer using mouse hand only. Another advantage of Smart IOS that have been developed may reduce the time of CISCO router and switches configuration, can reduce errors while making configuration, free software without internet connection requirement and user friendly software. This software can be used by network administrator or any individual who work in server environment. This software can be upgraded with new version of CISCO brand and cost effective because user does not require internet connection and cost on software license.

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