Setting up Remote Support System for Nuclear Power Plant Simulators

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1. Introduction

As of 2009, KHNP has currently seven full scope simulators that are used for training of NPP (Nuclear Power Plant) operators. KEPCO RI has been assigned the maintenance of the simulators through the project, "Setting up the integrated maintenance service platform of NPP simulators" to establish the Integrated Management and Maintenance System of Simulator Facility for NPP operators' training since July in 2008. KEPCO RI, located in Daejeon, has dispatched 3 engineers to each training center near NPP site(Kori, Youngkwang, Wolsung, Ulchin) for daily maintenance work of simulators since Jan. in 2009. They have been in charge of daily simulator start-up/shutdown, simple S/W and H/W maintenance, and instructor support for class and test. KEPCO RI set up Simtech in Daejeon, the headquater for simulator maintenance. Simtech consists of KEPCO RI engineers and 4 engineers from subcontractors. Engineers at Simtech have been working on simlulator core cycle update in accordance with core cycle change in NPP, design change application to simulator to keep up the simulator with its reference plant and periodic performance test support, high level DR (Discrepance Report) settlement and etc. In case of high level DR which instructors, operators or simulator operation personnel in KHNP issue for malfunction in simulator, Simtech engineers in Daejeon recreate phenomena of DR, analyze and find a solution before visiting each training center. However, in case that urgent support is needed for simulator at site, there are some difficulties in supporting it timely due to geographical limitation because Simtech is located far from each NPP training center. To overcome the difficulty, setting up Remote Support System for NPP simulators is taken into consideration as an alternative.

Fig. 1. Concept of Remote Support System for Simulators

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2. Environment for Remote Network

For setting up environment for remote support network, connecting between Simtech and each site, selected is a VPN (Virtual Private Network) which uses a public telecommnunication infrastructure to provide remote offices or individual users with secure access to their organization network at a much lower cost. A firewall is installed at each site for security to prevent unauthorized internet users from accessing private networks connected to the internet. Every user can access to other systems through VPN client.

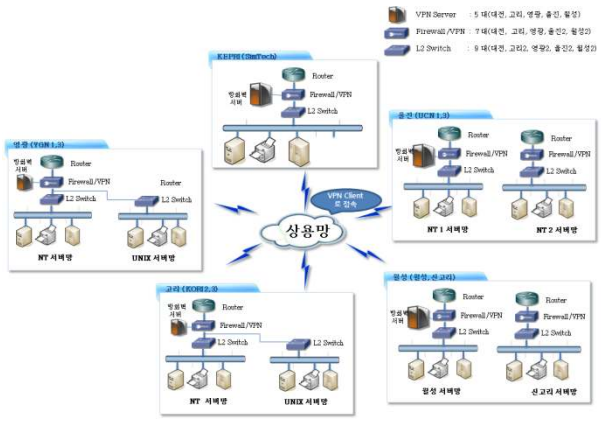

Fig. 2. Remote Network for NPP simulators

3. Network System

3.1 Network System at Simtech

The VPN at Simtech in Daejeon has capability to accommodate 50 VPN clients. The other functions are the same as VPN at sites.

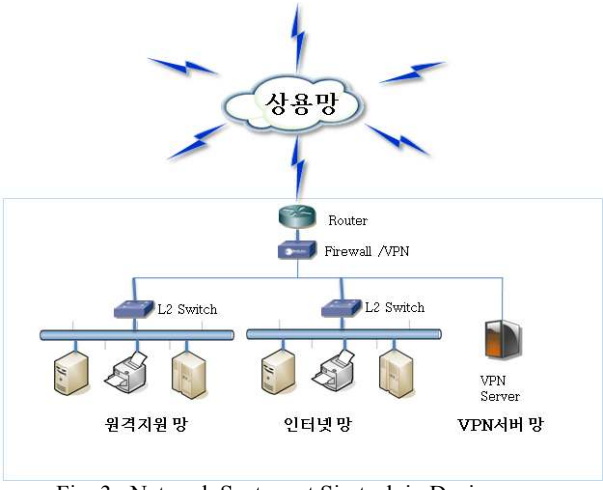

Fig. 3. Network System at Simtech in Daejeon

The network through firewall is divided into three parts for remote support, internet and VPN server, connecting directly or through L2 switch.

3.2 Network System at Site

Every network system at site as well as Simtech has one router and firewall except Ulchin site which has two two routers and firewalls because two simulators are located apart phisically farther than 50 m. In this case, it is more economical and convenient to use separate router and firewall.

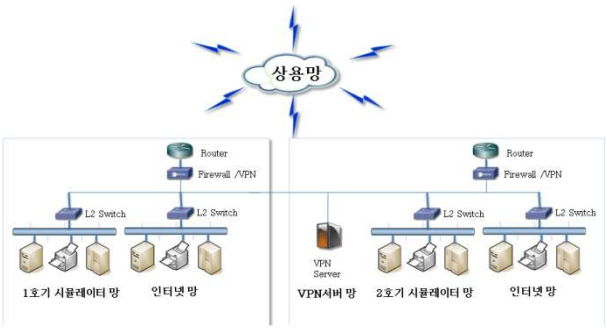

Fig. 4. Network System at Ulchin site

3.3 Setting up Remote Management System

A Guardian Absolute Series manufactured by Ahn Lab are selected as firewall S/W. Every firewall system for remote management is installed as follows;

1) To connect firewall device and notebook (or PC) for setup with a serial cable
2) To log on using terminal program from notebook
3) To connect notebook to firewall device with a cross cable
4) To set up the basic password, connecting through console
5) To set up adminhost to access to notebook from console window
6) To set up the interface IP outside firewall from GUI
7) To set up the gateway of firewall from GUI
8) To create an object to access from outside

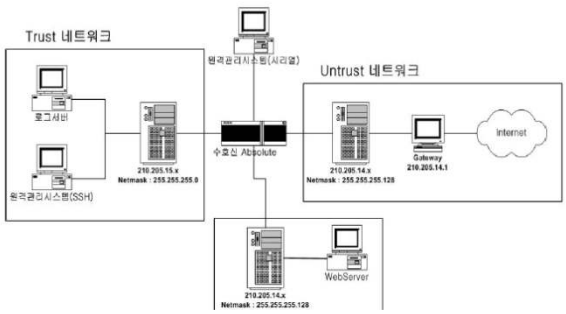

Fig. 5. Remote Manamgent System for Firewall Setup

The Remote Management System consists of 4 ports as Abs0~Abs3. Abs0 is the trust network which should should be set with an internally authorized IP. Abs1 is the untrust network which will be connected from outside and should be set with an externally authorized IP. Abs2 is used in case of organizing DMZ. It should be set with another externally authorized IP. Abs3 is a port to connect PC or notebook with a cross cable for installation and system setup.

4. Selection of Commercial Network Service for Remote Support System

4.1 Considerations For Network Service Selection

The remote support system for NPP simulators is decided to use commercial network service using VPN. Three commercial network services are adopted as a canditate such as KT, SK telecom and LG telecom. Two items should be considered for selecting appropriate network service for remote support system as follows;

- Whether the network service reaches to every site
- Whether the network service provides separate VPN network for information protection

4.2 Result of Network Service Selection

From two considerations mentioned in 4.1 for network service selection, two tests have been carried out. As you see in the table 1 & 2, Only KT network reaches every site and fortunately KT as well as SK provides separate VPN network product product. From the result of two tests, KT network service has been selected for remote support system for NPP simulators.

Table 1. Result on Possibility to connect through Commercial Network Service from sites

	Kori	Ulchin	Wolsung	Youngkwang
KT	O	O	O	O
SK	X	O	X	X
LG	O	X	X	X

Table 2. Result on Separate VPN Network Support

	VPN network
KT	O
SK	O
LG	X

5. Conclusions

Remote Support System for 7 NPP simulators has been set up to overcome geographical limitation and to support simulators' maintenance timely in case of urgent situation in simulator. The system has VPN using commercial network service and KT is selected as a network service provider from tests.

REFERENCES

[1] D. H. Hwang, K. H. Chung, "Simulator Maintenance Engineer Qualification Program", Technical Memo, KEPCO RI, TM.F02.P2010.030, April 28, 2010.