Development of KREOENT-based Wi-Fi Service for International Roaming Services

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Abstract

The rapid development of wired and wireless network technologies and emergence of diverse smart devices, there has been a rising demand for decent infrastructure in which people can work without time and space constraints using their mobile device. Some advanced countries including the U.S., Canada and Europe already provide environment in which wired and wireless networks can be accessed anytime and anywhere through a simple integrated authentication process, and research resources can be shared.

In Korea, a global WiFi roaming access service system has been established. Under this system, the KREONET allows teachers and researchers to get access to the wired/wireless network anytime and anywhere through one-time integrated authentication. This study examines the development of application of an eduroam-based global WiFi roaming service system which could be the ground for global smart roaming environment. In chapter 2, related studies are described. In chapter 3, the development of an eduroam-linked '.kr eduroam' service system is explained.

Keywords: eduroam, Global Roaming, wifi

Introduction

In the past, people would get access to the Internet to get information, use VoIP or enjoy some entertainments. However, recent development of wired & wireless network technologies and emergence of diverse smart devices have changed people's work patterns and made them get out of their office more frequently. However, domestic wired and wireless network environment is limited for teachers and researchers to handle their duties because of different network access environment, complicated authentication system and poor data security. In fact, the absence of environment for mutual exchange and cooperation for teachers and researchers is the main cause, and global smart roaming environment is must-have infrastructure which can cope with these problems. In other words, there should be an environment in which teachers and researchers can get access to the wired or wireless network through one-time integrated authentication process anytime and anywhere. This new envi-ronment may accelerate technology convergence, promote academic R&D and strengthen global cooperation. In turn, a smart education environment which pursues future-oriented research activities could be developed.

Eduroam [2][3] is global WiFi roaming access services developed for international research & education communi-ties. Users can get access to the services in their college or research institute using their account which includes their organization's name. This study briefly reviews eduroam and summarizes keduroam, WLAN sharing service which is now test-operated by colleges in Korea. Then, a future direc-tion is discussed.

Overview of eduroam

Eduroam is an international roaming service for users in research and education. It's been provided since 2003, and now approximately 60 countries participate in this service. The students, researches and staff from an organization which applied for eduroam can get access to the Internet using the WLAN when they visit an eduroamed college or institute. Eduroam users can get access to the network in an eduroamed institute and could acquire additional resources according to the visiting institute's internal policy.

The eduroam program was launched by a mobility task force team (TF-Mobility) at TERENA in 2003. To provider a network-access roaming through a research and education network, the task force team fabricated a testbed to prove a possibility of combining RADIUS-based infrastructure using 802.1X standard technology.
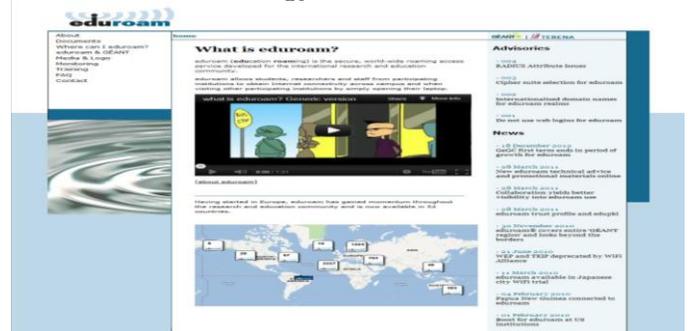

Fig. 1 Website of Eduroam

An initial test was conducted by an institute in each of five countries: the Netherlands, Finland, Portugal, Croatia and the U.K. Later, education and research network institutes in other European countries have joined the program. As a result, it has become larger gradually. In addition, people started to use the term 'eduroam'. The eduroam is operated by North American/Asia-Pacific/European Association or Global Eduroam Governance Committee led by seven representatives appointed by the TERENA based on the candidate recommendation from each group. TERENA has also provided support to GeGC Secretariat. The eduroam infrastructure is developed based on 802.1X standard and RADIUS proxy server layer. Each layer's RADIUS server sends 'Certificate of User Qualification' to the user's institute to authenticate the user and test effectiveness.

In terms of major functions, user authentication is carried out using hierarchical RADIUS server (institute ↔ country ↔ world) ad proxy functions. If accessed by the eduroamed institute using a WiFi network, the institute's RADUS server is used. If accessed by other institutes using a WiFi network, on the contrary, the RADIUS server of 'access institute ↔ country ↔ eduroamed institute' or 'access institute ↔ country ↔ country ↔ country ↔ eduroamed institute' is used. (Figure 2)
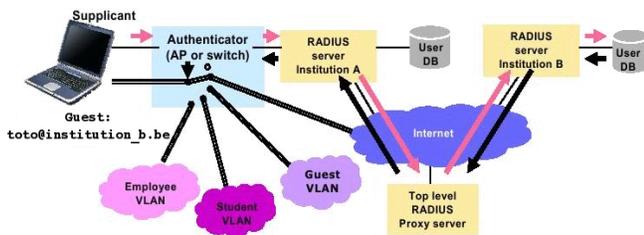
Fig. 2 Operational Mechanism of Eduroam

In terms of features, with a single eduroam account which includes the institute's name (ex: guest@kisti.re.kr), users can get access to the WiFi network of colleges and research institutes from approximately 60 eduroamed countries including, Asia-Pacific, Europe and North America. The eduroam system provides diverse functions (ex: education, technical support, server monitoring, etc.) through its website. (Figure 3)

The eduroam authenticates a user through RADIUS servers which are hierarchically structured and provides the roaming service which supports user's mobility using the proxy function of the RADIUS servers. Table 1 shows the elements for eduroam service and their function.[8]

In all institutes (ex: college, etc.) that want to participate in the eduroam, it is connected from their RADIUS server to

their National Top-Level RADIUS (NTLR) server. The NTLR server is generally operated by National Research and Education Network (NREN). The NTLR server keeps a total list of eduroamed institutes, and based on which, national roaming is guaranteed.
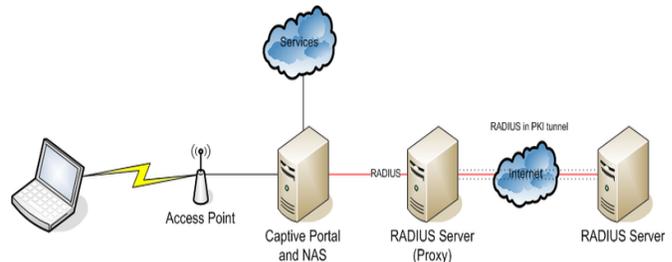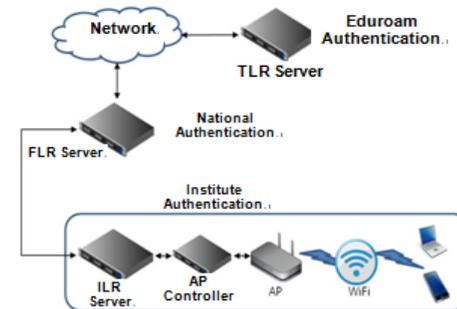

Fig. 3 RADIUS-based WiFi Roaming Authentication

To roam a user's request to the correct country, a local top-level RADIUS server is needed. At present, two key eduroamed regions are Europe and Asia-Pacific area.

Fig. 4 Hierarchical RADIUS Server Structure of Eduroam

The Europe Top-Level RADIUS (ETLR) is operated by NREN in the Netherlands and Denmark. The hierarchical eduroam RADIU structure is shown in the figure below. If Korea joins eduroam, the Korea top-level domain could be secured, and institutes would be added under the domain.

Table 1. Elements of Eduroam and their Functions[8]

Elements	Function
User terminal	Terminal to access the eduroam service
Access Point (AP)	A device which delivers a user's access request to AP controller or Institution Level RAIDUS (ILR) and sends back the result to the user

AP controller	A device which centrally manages many APs. It generally performs the function of Network Access Server (NAS)
Institution Level RADIUS (ILR)	A RADIUS authentication server which is deployed by an institute operating the eduroam service and which provides authentication service to a user at a wireless access network of the institute. An access request from a user who belongs to other institutes is passed to the upper layer's Federation Level RADIUS (FLR)
Federation Level RADIUS (FLR)	A RADIUS authentication server which is deployed by the Roaming Operator (RO) of an eduroamed country and it contains the information about its ILRs and the Top Level RADIUS (TLR) An access request from a user coming from a foreign country is passed to the TLR
Top Level RADIUS (TLR), overall eduroam authentication)	A RADIUS authentication server having information about all eduroamed countries

Eduroam which started in Europe has developed into a global education and research community. It is now spread around the globe including eduroam Europe, eduroam Asia-Pacific, eduroam Australia, eduroam Canada and eduroam USA. In eduroam Europe, Europe eduroam services are provided through country-level cooperation in 37 countries. The eduroam service activities include supply of instruments, service monitoring and user support. The eduroamed countries include Australia, China, Hong Kong, Japan, Taiwan, New Zealand (hosted by Australian AARNET) and Papua New Guinea (PNG sites (Divine World University) hosted by Australian AARNET). Eduroam's local and global distributions and eduroam Korea are shown in Figure 3 below:

KREONET-based eduroam services

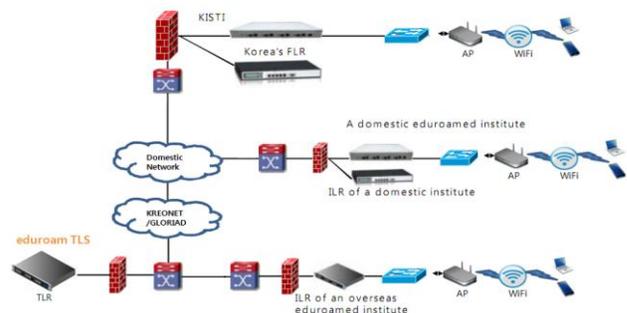For domestic eduroam service, the KREONET signed an agreement for eduroam with the TERENA, the top-level service authority. After being named 'Roaming Operator (RO)' in Korea, it has established an eduroam service system. At present, Korean eduroam services are provided in three types: First, it s domestic roaming service which permits users to get access to the WiFi network in other eduroam institutes in Korea. The KREONET has constructed an authentication server in Daejeon and Seoul and supported all roaming services among domestic eduroamed institutes. Second, the KREONET has provided overseas eduroam services to domestic eduroam service users visiting overseas eduroam websites. In other words, if a user from a domestic eduroam service institute visits an overseas eduroam service-enabled website, he/she can get WiFi roaming services through his/her domestic eduroam account. Third, roaming services are provided to eduroam users from overseas eduroamed institutes. If an overseas eduroam service user visits an eduroamed region in Korea, he/she can get WiFi roaming services through their overseas eduroam account.

Fig. 5 Domestic and Global Eduroam Services

Figure 5 above reveals a roaming service authentication procedure when a domestic user from an eduroamed institute attempts to use roaming services in an overseas eduroam website using their eduroam account. The eduroam utilization rate has gradually increased, and the utilization rates are shown in Table 2:

Fig. 6 Domestic and Overseas Eduroam User Authentication

Procedure

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Table 2. Use of Global Smart Roaming Services (2014)

| Month | Use of Eduroam | | Domain Name |
	No. of Global Roaming Authentications	Users	
Jan.	1,020	21	※ Top 10 global roaming authentication domains
Feb.	2,398	44	.kr 63745
Mar.	4,047	84	.uk 3741
Apr.	5,792	83	.edu 2860
May	6,142	79	.de 1863
Jun.	9,796	99	.ca 1253
Jul.	17,484	104	.se 685
Aug.	15,414	189	.nl 549
Sep.	13,338	156	.dk 524
Oct.	4,174	91	.au 292
Total (Average)	79605 (7960)	950 (95)	.be 131

Fig. 7 Eduroam-Keduroam Linkage

Eduroam and k-eduroam integrated services

In 2012, Korean Public and National College Information Association (a local domain network agreed to reduce infrastructure expansion costs by sharing WLAN among colleges to promote mutual exchange and collaboration among them) conducted a study on how to share public and national WLAN and launched demonstration service titled 'k-eduroam' in April 2012. For this service, Chonnam National University now plays a top-level server's role. The eduroam and keduroam integrated services were launched in August 2014, and since then, eduroam has been linked with 26 public and national universities in Korea. Therefore, mutual exchange and cooperation have been improved through global roaming services among domestic and overseas researchers and domestic colleges and facilitated domestic and overseas global roaming services.

Conclusion and future work

This study explained the development of the KREONET-based global WiFi roaming services which allow teachers and researchers in Korea to get access to work environment and research resources in a fast and safe manner through a wired/wireless network without any time and space constraints. For this, the global WiFi roaming access service 'eduroam' was linked to build an international education and research community. In connection with keduroam, then, global roaming services were provided. The KREONET has nearly 180 member institutes throughout 18 local network centers. If these institutes share their WiFi network infrastructure and research resources with others through eduroam, and wireless environment can be shared around the globe as well, there might be a considerable synergy effect. In the future, there will be a further study on suggestion of domestic model for global smart roaming, design of software platform and construction of service system.
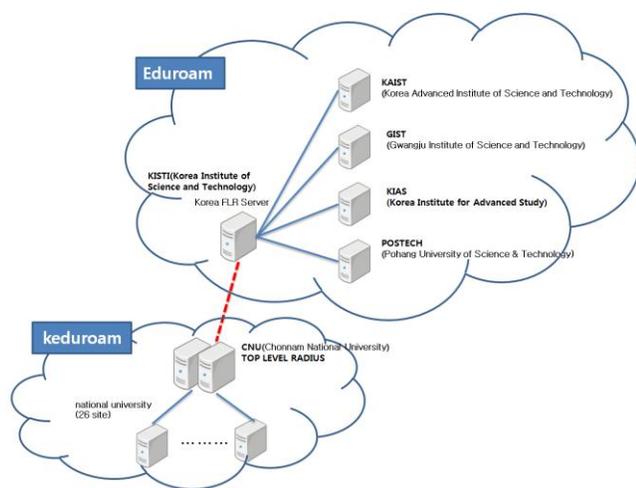
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