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PROTYPE IMPLEMENTATION OF INFORMATION SERVER FOR SEAMLESS NETWORK HANDOVER OVER IPTV APPLICATION

Rajina R. Mohamed*, Wahidah Hashim, Sera Syarmila Sameon

System and Networking Department, College of Information Technology, University Tenaga Nasional, Malaysia

*Corresponding author
rajina@uniten.edu.my

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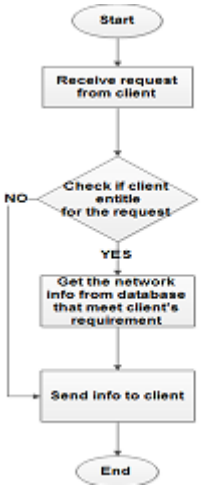
Graphical abstract



Abstract

The use of mobile phone increases exponentially in our daily activities because it is light, mobile and handy that can be used anytime and anywhere. Checking emails, updating our daily status and diary, reading the latest news and online purchasing requires continuous network connection as well as a battery that can last. But sometimes the performance of internet speed is too weak where users are experiencing some problems and eventually leads to network disruption. Hence, users should be given the option to choose the internet connection or internet service provider that offer better service at that time moreover during an emergency. In this paper, we propose a development of Information Server to provide information to consumers about the available network surrounding within a reasonable time upon requested. This method is applied in the user terminal to allow the user freedom to decode on the best network handover.

Keywords: Information server, network handover

1.0 INTRODUCTION

Wireless technology supported the use of mobile application in daily activities. Mobility is no longer a limitation as it enabled many transactions to be carried out immediately regardless of time and place. However, accessibility of a service provider can be limited due to size of users, geographical, physical such as building, quantum of subscribers, and also weather barrier. For example, users who subscribes to a data plan can also get Wi-Fi connectivity on their mobile phone. If the mobile phone is in a Wi-Fi coverage area, usually by default it will be connected to a Wi-Fi regardless of Wi-Fi signal strength. This situation can create problems for the user to continue the application seamlessly if the signal strength become fluctuate, especially for real-time application. To avoid the problem, user either has to manually disable the Wi-Fi or the mobile data setting so that the connection will not be vacillated. Figure 1 depicts the scenario of having difficulty with internet connection that support the previous problem.

Alice is watching on-line video conference about crucial discussion on pre-launch product, which is being held in Dubai via her mobile phone connected to the Wi-Fi at Building 1. Suddenly, Alice gets an important call from the Chief technology Officer based at Building 2. Alice has to respond promptly but in the same time Alice does not want to miss the points in that meeting. Thus, Alice keeps watching the conference while moving to leave the area toward the Building 2. After half way through, Alice

experiences distortion on her video conference and missed the important points in the discussion.
Recognizing this problem, there should be a facility for users to handoff from one service provider to another service provider that provides better service while using a real-time application or online application. Handoff or handover is considered "seamless" when the application is being executed remains running without any interruption [1]. Online video streaming and voice communication is one of the real-time applications that subject to the underlying network and message delivery are expected in timely-fashion [2].

Figure 1 Scenario of poor internet connection while moving

Hence, to solve the problem, we have proposed a method that allow the subscriber to make a decision to select a service provider that suits the needs. This method uses server information through independent media functionality [3]. This function has information services which provide useful information for mobile device to maintain the connectivity of all applications especially on-line applications that running on the mobile device. In our proposal, the method is applied in the user terminal to allow the user to decide for network handover. The rest of this paper is organized as follows. In the section 2, the overview of Media Independent Handover (MIH) while Section 3 provides the implementation of the proposal and discuss the finding. Finally in Section 4 we conclude the paper.

1.1 Previous Research Works

A number of information server development has been proposed in order to find relevant information for network handover.

In [4], using Media Independent Information Service (MIIS) to obtain information on the local area network to make the process of vertical handover between UMTS and WiMAX. Mussabir *et al.* [5] exploited 802.21 Information Services (IS) to create a heterogeneous network information container in order increase the information retrieval for neighborhood networks while in [6] proposed Moving-information Server which was implementing in NEMO where MIS store new elements of available networks and update the list of known networks mapped with the location. Proposal in [7] also used MIIS legal information in the server to speed up the search process for the handover. According to some literature, Information Server provides a fast and easy way to process information storage, search and filtering to perform handover from one network to the other network.

2.0 MEDIA INDEPENDENT HANDOVER

There are three phases in vertical handover, i.e. handover information gathering, handover decision, and handover execution [8]. Each needs in each phase in each other. The initial information required in the vertical handover is network properties, mobile devices, access points, and user preferences, where this information is important to make the decision to handoff. Normal information required for the current phase of information gathering is the throughput, cost, packet loss ratio, handoff rate, Received Signal Strength (RSS), Signal Noise Ratio (NSR), and Carrier to Interference Ratio (CIR), Signal to Interference Ratio (SIR), Bit Error Ratio (BER), distance, location, and QoS parameters [9]. This information is needed to determine when and where to handoff in the execution phase and the decision phase is to proceed the execution itself while ensuring the smooth transfer process. All these three phases are offered in the Media Independent Handover (MIH), which can be used to handoff among heterogeneous network. Sending and receiving of messages are carried by the Independent Handover Function [ref] which is standardized by IEEE 802.21 which specifies Media Independent Information Server (MISS) to support some of the necessary information for a network handoff from one network to another network. [10].

3.0 SYSTEM ARCHITECTURE AND USAGE SCENARIO

Information System (IS) development in our prototype was tested on IPTV applications. IPTV application used to view the application as a service process is not interrupted when the handover occurs from one connection to another. Generally, IS built containing information about the available network with their signal strength. Search for information about network and signal created by the IS are based on signal strength and distance. In this case, the signal strength to be a priority, then the distance was. Two wireless

access points are used as a simulation for seamless handoff between one networks to another.

3.1 Design and Development

Our development is divided into two main parts i.e. the development of IS and the setting up of IPTV client. In our development, IS is referred to Network Information Server (NIS).

a. Network Information Server

The NIS was developed using C programming language. NIS was programmed to collect and store the surrounding wireless access point information between IPTV Client. The IPTV client will receive the surrounding network information from NIS, and then it will store the information into the database. It works more on completing query and response message between client and server which contains the network information required. All information about wireless access point information should be stored in MySQL database which can be updated from time to time. The NIS was able to send the information about wireless access point to the client once requested.

b. Setting Up of IPTV Server and Client

VLC media player was modified in such a way to act as IPTV content server. IPTV client was developed in Linux environment using C programming language and integrated with MySQL. As mentioned earlier, it was developed as to see the continuous service when the network is handoff between one networks to another. This client was able to request the information from information server and will select the best wireless access points according to the threshold. In our proof-of-concept, we have set the signal strength threshold to be more than 50%. Two conditions were taken into consideration in order for the client to find the best access point. The first condition was based on signal strength and the secondly was based on distance. In this case, the distance between access point and IPTV client should be less than 5 meters. Furthermore, this IPTV client was developed to function as a switch from one network to another based on an algorithm.

3.2 Prototype Implementation

Our prototype was implemented with the following scenarios:

1. IPTV client was watching a TV that was streamed from IPTV server
2. At certain time, Alice experience the signal strength is weak, thus she requests information from NIS by pressing a searching button from her mobile phone
3. NIS responded to Alice with a list of available networks and its' signal strength
4. Alice will select the best AP base on signal strength.

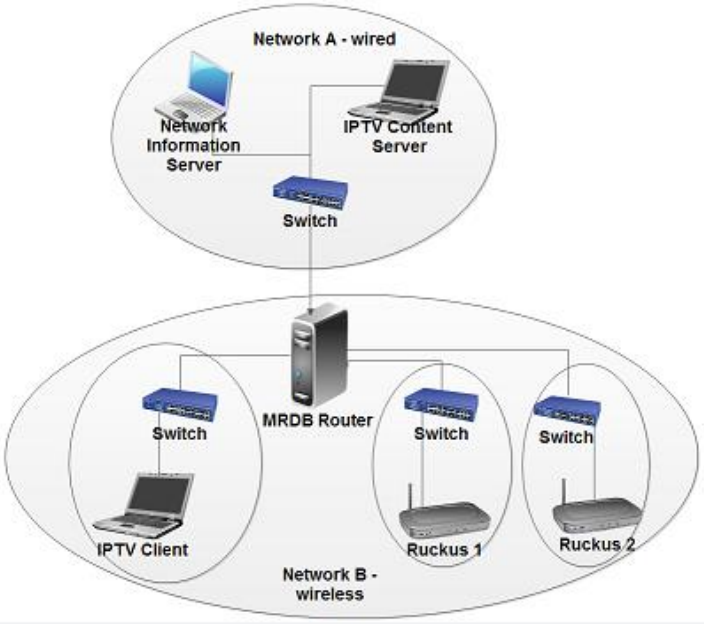


Figure 2 Prototype testbed

Our test bed consists of the following equipment: Three laptops – One Laptop equipped with Ubuntu 8.04.3 and configured as an IPTV client. The second laptop equipped with Fedora 8 and configured as IPTV Content Server, Windows Vista TM Business laptop was developed as IS server while a desktop of Fedora 9 was configured with MRD6 [11] as a router. Three access points of Ruckus ™ Wireless ZF2925 [12] were used as a simulation for a switching between one network to another, while four switches was used in order to extend internet connection. Figure 2 illustrates our test bed that was carried out during our experiment. Network Information Server (NIS) and IPTV content server is connected to a wired network, while IPTV client is connected to wireless connection. The following steps were done to run this application:

1. Starts IPTV content server and NIS
2. Start IPTV client
3. Press the NIS button

Figure 3 and Figure 4 shows the flowchart of NIS request response from the view of NIS and client. NIS response to the client's request if the client is entitled to make a request, otherwise no information will be

returned. Client will make a request for the network information if the client experiences any distortion. Once information obtained from NIS, client will select the best AP with the best signal strength and re-connect the connection while the streaming is not suspended at all. Once information obtained from NIS, client will select the best AP with the best signal strength and resume the connection while the streaming is not suspended at all.

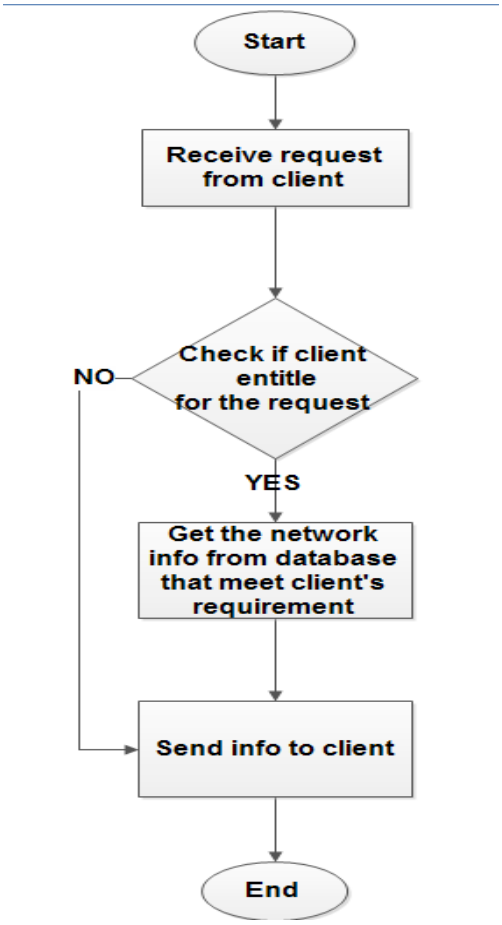


Figure 3 Flowchart from the view of NIS

Table 1 shows the signal strength of the Ruckus 1 and Ruckus 2 with their signal strength respectively. The signal strength of Ruckus 1 is better rather than Ruckus 2, thus, Ruckus 1 was selected. The main function of NIS is to provide information to users when users experiencing bad distortion while connecting to a wireless network. By providing NIS, user can select the appropriate access point in order to continue the service. As such, the process of handover must be very fast to minimize interruptions.

One of the character of seamless service is for the user should not recognize or aware of the changes in the scenario to his/her communication during and after handover. In order to satisfy this characteristic; we measured the handover timing as well as packet loss in our experiment. The experiment was completed more than 10 times to see the consistency of the result to satisfy the QoS requirement for video streaming, packet loss must be less than 2% [13]. In Table 2, shows the time measure (in seconds) when the network was handoff between Ruckus 1 to Ruckus 2 with packet loss. The timing was measured right after the button of searching is pressing to get the info from NIS. Manual test was also done among the users. A few users were asked to record any distortion or any network interruption during the viewing of a video. The rate of user's perception is based on: 1 – Poor, 2- Some Interruption, 3 – Good with minimal distortion, 4 – Good. Average rating by user is 3 to indicate that the application was running in an acceptable condition even during network handoff.

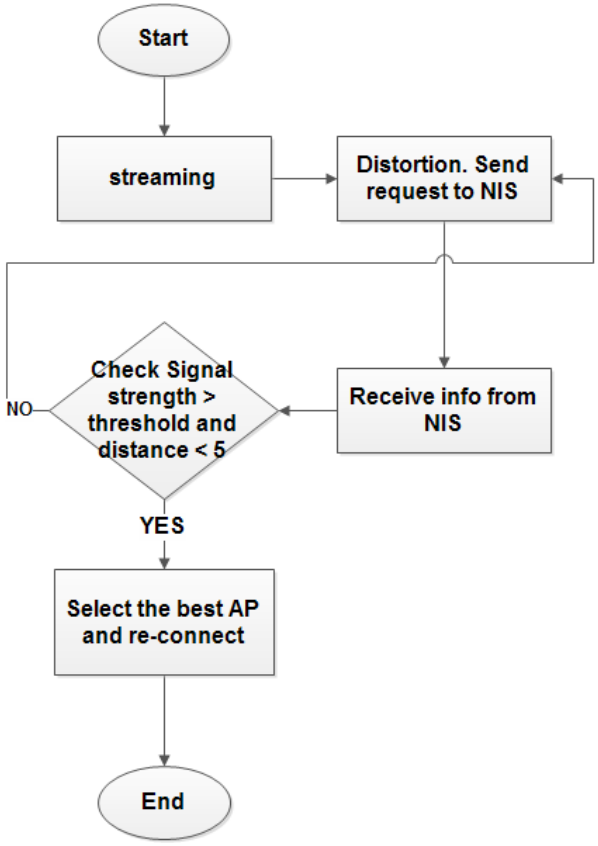


Figure 4 Flowchart from the view of IPTV client

Table 1 Signal strength of the Ruckus and Distance

Ruckus/Signal Strength	Sjgnal strength (dbm)	Distance (in Metre)	Decision of Selection
Ruckus 1	-40 dbm	< 5 m	Selected
Ruckus 2	-60 dbm	> 5 m	-

4.0 CONCLUSION

Network Information Server was developed and integrated with VLC and MySQL in order to see the capability of information system in providing a list of network that can be selected by the user. The

decision of handover can be made by user based on their preference such as cost and privilege. This NIS was applied to IPTV application to see the seamless of the video streaming streamed by IPTV server. The result obtained showed that user/client can request the list of network from NIS, can select the best network provided by NIS and also can continue the service without any interruption. Through this preliminary study, we can conclude that IS can help users to get the ongoing service mainly on online application without a need to reconnect and re-run the application. In future research, design and architecture will be further improved where the NIS will detect the weaknesses of the current connection and will give recommendation to the user to make a handoff. Test cases also will be varies to get a more precise result.

Table 2 Handover time, packet loss and user perception rate

No of Testing (Press the button)	Handover time (in Seconds, s)	Packet loss	User perception rate (any interruption/distortion)
1	0.12	0.08%	3
2	0.143	1.00%	2
3	0.10	0.04%	4
4	0.09	0.9%	3
5	0.09	0.04%	4
6	0.10	0.08%	3
7	0.08	1.12.%	2
8	0.12	1.06%	2
9	0.123	0.082%	3
10	0.11	0.083%	3

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