Handoff Execution Technique through NS2

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Abstract - The handoff is the process of transferring an active call or data session from one cell in a cellular network or from one channel to another. In satellite communications, it is the process of transferring control from one earth station to another. Handoff is necessary for preventing loss of interruption of service to a caller or a data session user. Handoff is a process of transferring a mobile station (MS) from one base station (BS) or channel to another. The channel change due to handoff may be through a time slot, frequency band, code word, or combination of these for time-division multiple access (TDMA), frequency-division multiple access (FDMA), code-division multiple access (CDMA), or a hybrid scheme respectively Handoff is also called handover. The proposed protocols which significantly improve the service availability and service continuity for disaster responders have been explained. Open code, so it can be modified and adjusted to very particular requirements. Already include wireless functionalities or easy to generate. Allow to connect the wireless networks in an easy way. Functionalities to have different kind of networks and its components (Public Safety LMR, WCDMA cellular network, WLAN, UMTS).

Keywords - CDMA, TDMA, mobile station, base station, FDMA

I. INTRODUCTION

Handoff is the procedure providing the connection to the backbone network while a mobile terminal is moving across the boundaries of coverage of two wireless points of connection. The complexity of the handoff decision process has led to the examination of a number of traditional and pattern recognition handoff decision algorithms for wireless networks. Traditional algorithms use a received signal strength measurement and an optional threshold, hysteresis, or a dwell timer to determine the handoff decision. Degradation of the signal level, however, is a random process, and simple decision mechanisms result in a ping–pong effect whereby several consecutive handoffs degrade the service provided by the network. Consequently, more complex pattern recognition algorithms are needed to decide on the optimal time for handoff. In these algorithms, the handoff decision receives off line training to create a reference database of possible handoff locations in an environment with an associated handoff "fingerprint" at those locations. This dissertation introduces newly designed neural network and adaptive network based fuzzy inference system (ANFIS) pattern recognition algorithms. To select appropriate algorithms for a specific wireless network, it need to create an analytical framework for performance evaluation. The design of a framework for comparative performance evaluation of different handoff algorithms is a complex problem as different networks have different performance evaluation criteria.

Over the past decade a number of wireless communication networks have emerged for urban and indoor areas to complement the traditional cellular networks. The services provided by these networks are geographically selective. As a result, a wireless communication terminal needs to connect to multiple points of connection and perhaps multiple networks as it moves from one location to another. The method of using different networks with the same terminal for inter-network mobile communications is often referred to as inters technology, heterogeneous, or non-homogeneous networking. Whether the roaming is intranet work within a single technology or inter-network among different technologies, a wireless mobile terminal moving from one location to another needs to change its point of connection to the wired backbone network. The process of supporting the change from one wireless point of connection to another is referred to as handover or handoff. When a mobile terminal moves away from a wireless point of connection, the signal level degrades and there is a need to switch communications to another wireless point of connection. Handoff is the mechanism by which an ongoing connection between a mobile terminal and the network is maintained.

II. BACKGROUND

Choi et al. (2018), recently, WiFi has become an irreplaceable wireless technology to support growing mobile applications and data traffic. Although today's smartphone users often use WiFi on the go, even though the signal quality is severely impaired, the smartphone will not perform WiFi handover to nearby access points (APs). This unwanted smartphone operation is known as a sticky client problem. In this work, they focus on solving sticky client problems with fast WiFi switching. First, we analyze the causes of sticky client problems based on experiments with commercial Android smartphones by focusing on Wi-Fi scanning and switching. Note that smartphones and state-of-the-art APs are equipped with Bluetooth Low Energy (BLE) and we have achieved a convenient solution called BLEND for fast Wi-Fi switching with BLE. The smart phone acquires the information from the nearby AP via the BLE advertising package sent by the AP, and then performs the smart Wi-Fi handover. We implemented BLEND on Android smartphones and demonstrated that BLEND achieves throughput and video bit rates of 61% and 111%, respectively, over commercial Android apps. We also confirmed that BLEND runs negligibly on smartphones.

Majumder & Nath (2019). Wireless IEEE 802.11 networks are a widespread network that provides good low cost connectivity. The mobile node is connected to a receiving location (AP) from which the best signal is received. Currently, every user wants to get the best service from the network domain. Change their location among IEEE wireless 802.11 network users. This is the main reason for switching. Real-time programs should not experience any disturbance when users go to different network coverage. Transfer is a key issue in continued networking services in IEEE 802.11 networks. Various transfer process schemes have been introduced that provide seamless transfer to customers. In this paper, the classification of handover schemes in 802.11 networks has been suggested. These schemes are classified according to the number of radios used. Agrawal et al. (2016). In heterogeneous Wireless communication network, transferring of data between moving nodes can be handled by well-designed mobility management system, in which handover is important factor in maintaining space connection to base station even in high speed. During handover (i.e. mobile node moving from one base station area to another base station area), there is a need to change initial point of connection to a new base station area towards which the mobile node is moving. Currently, in our world all mobile equipment is moving so mobility of equipment becomes necessary, so to overcome this mobility issue there is a method known as handover. Horizontal Handover (HHO) is a symmetric process and occurs within the same technology e.g. between different Wi-Fi scenarios. If it is executed between different technologies, for example, UMTS to WLan, then it is called vertical HO. conventionally a mobile user may roam and accomplish the vertical HO using single criteria, such as received signal strength (RSS). Single criteria vertical handover decision, however, may cause inefficient handoff, unbalanced network load, and service interruption. This paper anticipated a suitable method among the various vertical handover decision algorithms in the environment of three network interfaces: (i) wireless local area network (WLAN), (ii) wideband code division multiple access (WCDMA), and (iii) worldwide interoperability for microwave access (WiMAX) and also some of the vertical handoff decision algorithms are compared with the usual method (RSS). Edward, E. P., & Sumathy, V. (2015). Providing fast and seamless handoff in a pervasive computing environment is one of the recent research issues. The delay incurred due to IP Multimedia subsystem (IMS) re-registration and session re-setup process during vertical handoff (VHO) is still a major bottleneck for Voice Over IP (VoIP) and interactive multimedia services. In the conventional Session initiation Protocol (SIP), handoff performance is very poor due to high handoff delay and packet loss. In this paper, we propose two SIP based schemes, a Context Awareness (CA)-based Pre-registration approach to reduce the IMS Re-registration delay and a novel scheme called Prior-SIP (P-SIP) with a cross layer scheme utilizing Media Independent Handover (MIH) services to reduce the IMS session re-setup delay in a Wi-Fi/Wi-Max heterogeneous environment by defining new SIP messages. They have simulated these scenarios using NS2 and the performance characteristics are studied. We have also analyzed the IMS pre-registration delay and IMS session re-setup delay based on Queuing theory. The simulation and analytical results show that, the proposed solution shows an improvement of 44% in terms of handoff delay and packet loss when compared with previous approaches and was able to maintain 90% throughput during handoff and suits well for supporting real-time applications to mobile users. Dhivya, J. J., & Ramaswami, M. (2017, August). The existence of various heterogeneous networks in the current generation formulates high speed seamless coverage of all types of mobility. Cognitive radio (CR) networks are gleaning attention in the current generation of wireless networks and it is predicted that it will play a vital role in the field of communication in providing an interminable connection. When networks are integrated on the availability of many types, user plays a major role in selecting the best optimal desired network, since each network type has its standalone characteristics from the other. The handoff parameters can also be taken into account for determining ideal networks. This motivates to investigate the significance of various handoff parameters in terms of networks conditions on coadunation of Wi-fi and Wi-Max (WW) in CR networks and the existing integrated WW. The empirical results shows that cognitive based integrated WW networks are effective with minimal complexity in the handoff process compared to the existing integrated WW networks. The performance of various handoff parameters is analyzed on a network simulator and results indicate best performance is obtained in cognitive radio based integrated WW network compared to the existing method.

III. HANDOFF DECISION ALGORITHMS

Several handoff decision algorithms exist and can be utilized to make the correct decision to handoff the ongoing connection.

A. Measurement phase: The measurement of the overall link or communication quality is measured either by the base station, the mobile station or both. The measurement data is processed and evaluated again by one or both of them and appropriate action is taken according to the result of the evaluation; perform handoff or don't. The measured parameters could be: Received useful and total power in up- and downlink, interference levels in up- and downlink, received signal levels from the neighboring reference BS/AP, bit error rates in both up- and downlink, estimate of the distance between the terminal and the BS/AP, and estimate of the terminal velocity.

B. Initiation and resource allocation phase: This phase includes the decision whether a handoff is needed, regardless of the actual availability of a new channel on a target (or on the serving) base station; it is based on processed measurement results or network variables, including offered traffic. Once the need for the handoff is determined, the new channel is selected taking the Actual radio resource availability and network load into account.

C. Execution phase: Once the new channel is selected, the handoff is executed. All of these phases are prone to errors. The measurement results, which the decision phase is based upon, may be incorrect or exposed to noise, thus making the decision inappropriate for the situation. The feedback to the channel reservation enquiries may suffer from erroneous transmission, and the execution of the handoff may also take so much time that the conditions in the target destination may have changed while waiting for the handoff connection. All possible precaution is needed to avoid the aforementioned incidents disturbing the handoff procedure, by choosing a suitable handoff protocol and handoff algorithm which is, by no means, a simple task. Handoff decision algorithms, that execute the aforementioned handoff phases, can be categorized based on the form of input that the algorithm exploits when making the handoff decision.

D. Received Signal Strength: Driven algorithms are those whose initiation and decision phases consider as inputs one or more received signal levels from the neighboring BSs. Quality-driven algorithms are those considering bit error ratio (BER), packet error ratio (PER) or frame error ratio (FER) as input for the decision to be made. Mobility-driven algorithms rely on the estimates of link distance and mobile speed. The connection of a fast-moving vehicle may be switched from small cells to larger cells to avoid frequent handoffs. In reality this class of algorithms is by far the most challenging, as accurate location information is hard to come by, even though location estimation accuracy is rapidly increasing thanks to on going research in this area.

E. Traffic-driven algorithms: The initiation and decision phases take estimates of traffic load (channel occupancy) into account. This type of handoff initiation is essential for equal load sharing among different serving points of access.

Service-driven algorithms: Users for voice and data services are treated separately and the handoff decision based on the service affects the capacity of the network.

History-driven algorithms: Users' behavior is known from usage and movement patterns and the algorithm can make decisions accordingly.

Hong and Rappaport's Traffic Model (Two-Dimensional) - Hong and Rappaport propose a traffic model for a hexagonal cell (approximated by a circle). They assume that the vehicles are spread evenly over the service area; thus, the location of a vehicle when a call is initiated by the user is uniformly distributed in the cell. They also assume that a vehicle initiating a call moves from the current location in any direction with equal probability and that this direction does not change while the vehicle remains in the cell. From these assumptions they showed that the arrival rate of handoff calls is

$$\lambda_H = \frac{P_h(1-B_O)}{1-P_{hh}(1-pf)} \lambda_O \quad (1.1)$$

Where,

Ph = the probability that a new call that is not blocked would require at least one handoff

Phh = the probability that a call that has already been handed off successfully would require

Another handoff

BO = the blocking probability of originating calls

Pf = the probability of handoff failure

ÀO = the arrival rate of originating calls in a cell

The probability density function (pdf) of channel holding time T in a cell is derived as

$$f_t(t) = \mu c^{e^{-\mu c}} + \frac{e^{-\mu c1}}{1+yc}[ft_n(t)+ycf_{th}] - \frac{\mu_c\, e^{-\mu c^1}}{1+yc}[F_{TR}(t)+yc \quad F_{th}(t)]$$

(1.2)

Where,

fTn(t) = the pdf of the random variable Tn as the dwell time in the cell for an originated call

fTh(t) = the pdf of the random variable Th as the dwell time in the cell for a handed-off call

FTn(t) = the cumulative distribution function (cdf) of the time Tn

FTh(t) = the cdf of the time Th

1/□c=the average call duration

Yc= ph (1-BO)/[1-Phh(1-pf)]

IV. SIMULATION & RESULT

Set up of Simulation Environments - We are set up NS2 upon the Linux (Ubuntu) for the simulation tools for the proposed work.

Linux Operating System for the NS2 environment

NS2 For the simulative tool.

A. Simulation Set-Up: The simulation for hand off technique is executed in NS2. The proposed layout is designed in NS2 that facilitate the mobile nodes in a cluster. The desired process is that the mobile node enter into one cluster from other cluster. This paper focus on the implementation of hand off in NS2. The result coming out in graphical pattern which represents the basic technique of Hand off. Qassim Bani Hani, Julius P. Dichter implement an analytical energy detection (ED) model for the transfer process that calculates the energy consumption of each transfer process in the cloud computing environment during the hands off process. Our analytical model examine the time delay, packet drop and packet delivery ratio in graphical form. The simulation environment has been set in NS2 platform. The basic execution for implementing the hand off process in between two static mobile station is shown as below.

B. NS2 architecture - NS2 architecture NS2 provides users with executable command ns which take on input argument, the name of a TCL simulation scripting file. Users are feeding the name of a Tcl simulation script (which sets up a simulation) as an input argument of an NS2 executable command ns. The simulation trace file is created, and is used to plot graph and/or to create animation. Figure 1 shows the basic architecture of NS2. NS2 consists of two key languages:

C++ Object-oriented Tool Command Language (OTcl).

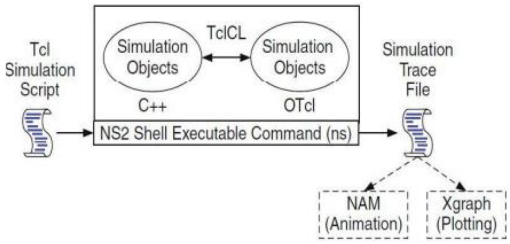

Figure 1: NS2 Basic architecture

While the C++ defines the internal mechanism (a backend) of the simulation objects, the OTcl sets up simulation by assembling and configuring the objects as well as scheduling discrete events (i.e., a frontend). The C++ and the OTcl are linked together using TclCL Mapped to a C++ object, variables in the OTcl domains are sometimes referred to as handles. Conceptually, a handle (n as a Node handle) is just a string in the OTcl domain, and does not contain any functionality. Instead, the functionality (receiving a packet) is defined in the mapped C++ object (class connector). In the OTcl domain, a handle acts as a frontend which interacts with users and other OTcl objects. It defines own procedures and variables to facilitate the interaction. The member procedures and variables in the OTcl domain are called instance procedures (instprocs) and instance variables (instvars), respectively. NS2 provides a large number of built-in C++ objects. It is advisable to use these C++ objects to set up a simulation using a TCL simulation script. After simulation, NS2 outputs either text based or animation based simulation results. There are tools used to interpret these results graphically and interactively.
The tools are

- NAM (Network Anti-Mator)
- X-Graph

Extract a relevant subset of text based data and transform it to a more conceivable presentation for analyzing a particular behavior of the network.

C. Network Simulator 2 - Network Simulator (Version 2), widely known as NS2. NS2 is an open source event-driven simulator designed specifically for research in computer communication networks. Since its inception in 1989, NS2 has continuously gained tremendous interest from industry, academia, and government. Having been under constant investigation and enhancement for years, NS2 now contains modules for numerous network components such as routing, transport layer protocol, application, etc. To investigate network performance, researchers can simply use an easy-to-use scripting language to configure a network, and observe results generated by NS2. Undoubtedly, NS2 has become the most widely used open source network simulator, and one of the most widely used network simulators. Simulation of wired as well as wireless network functions and protocols (Routing algorithms, TCP, UDP) can be done using NS2. In general, NS2 provides users with a way of specifying such network protocols and simulating their corresponding behaviors. Due to its flexibility and modular nature, NS2 has gained constant popularity in the networking research community since its birth in 1989. The group of researchers and developers in the community are constantly working to keep NS2 strong and versatile.

D. NS2 Simulation Steps - The followings show the three key step guidelines in defining a simulation scenario for measuring the handoff delay and optimal radio resource utilization in a heterogeneous mobile wireless network.

Step 1: Simulation Design The first step in simulating a network is to design the simulation. This step, determines the simulation purposes, Interworking public safety LMR/cellular network configuration and assumptions, the performance measures, and the type of expected results.

Step 2: Configuring and Running Simulation This step implements the design in the first step. It consists of two phases: Network configuration phase: In this phase network components (node, IMS architecture) are created and configured according to the simulation design. Also, the events such as handoff from public safety LMR to cellular network are scheduled to start at a certain time. Simulation Phase: This phase starts the simulation which was configured in the Network Configuration Phase. It maintains the simulation clock and executes events chronologically. This phase usually runs until the simulation clock reached a threshold value specified in the Network Configuration Phase.

Step 3: Post Simulation Processing the main tasks in this step include verifying the integrity of the program and evaluating the performance of the simulated network. While the first task is referred to as debugging, the second one is achieved by properly collecting and compiling simulation results.

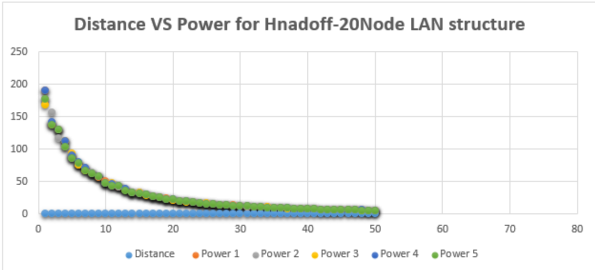

Figure 2: exponential drop drap of power

V. CONCLUSION

In this paper, the experimental results and their significance are discussed. The performances of the proposed schemes and simulations have been used to validate our model. The proposed protocols which significantly improve the service availability and service continuity for disaster responders have been explained. Open code, so it can be modified and adjusted to very particular requirements. Already include wireless functionalities or easy to generate. Allow to connect the wireless networks in an easy way. Functionalities to have different kind of networks and its components (Public Safety LMR, WCDMA cellular network, WLAN, UMTS).

Preferable if it works as a network simulator and not in general with predictive and/or mathematical models. Keeping in mind these preliminary requirements, the chosen simulator was the Networks Simulator NS2. NS is a discrete event simulator, targeted at networking research. As advantages, NS provides substantial support for simulation of Transport Protocols, routing, and multicast protocols over wired and wireless networks. Due to the fact that NS is a tool that is still being developed, it provides the advantage that its code and modules can be modified and added by the user (mainly tcl and C++ programming).

VI. REFERENCE

[1]. R. B. Cooper, Introduction to Queueing Theory, 2nd ed. New York: Elsevier North Holland, 1981.

[2]. J. D. Wells, Cellular system design using the expansion cell layout method, IEEE Trans. Veh. Technol., Vol. VT-33, May 1984.

[3]. H. Akimaru and R. B. Cooper, Tele traffic Engineering. Ohm, 1985.

[4]. D. Hong and S. S. Rappaport, Traffic model and performance analysis for cellular mobile radio telephone systems with prioritized and nonprioritized handoff procedures, IEEE Trans. Veh. Technol., Vol. VT-35, No. 3, pp. 448–461, August 1986.

[5]. S. A. El-Dolil, W. C. Wong, and R. Steele, Teletraffic performance of highway microcells with overlay macrocell, IEEE J. Select. Areas in Commun., Vol. 7, No. 1, pp. 71–78, January 1989.

[6]. M. Gudmundson, Analysis of handover algorithms, Proc. IEEE VTC ’91, pp. 537–542, May 1991.

[7]. R. Steele and M. Nofal, Teletraffic performance of microcellular personal communication networks, IEE PROCEEDINGS-I, Vol. 139, No. 4, August 1992.

[8]. S. Tekinay and B. Jabbari, A measurement-based prioritization scheme for handovers in mobile cellular networks, IEEE J. Select. Areas in Commun., Vol. 10, No. 8, Oct. 1992.

[9]. H. Xie and S. Kuek Priority handoff analysis, Proc. IEEE VTC ’93, pp. 855–858, 1993.

[10]. V. Kapoor, G. Edwards, and R. Snkar, Handoff criteria for personal communication networks, Proc. IEEE ICC ’94, pp. 1297–1301, May 1994.

[11]. Q-A. Zeng, K. Mukumoto, and A. Fukuda, Performance analysis of mobile cellular radio systems with priority reservation handoff procedures, Proc. IEEE VTC ’94, Vol. 3, pp. 1829–1833, June 1994. 24 HANDOFF IN WIRELESS MOBILE NETWORKS stoj-1.qxd 12/5/01 1:29 PM Page 24

[12]. G. P. Pollini, Trends in handover design, IEEE Commun. Magazine, pp. 82–90, March 1996.

[13]. Q-A. Zeng, K. Mukumoto, and A. Fukuda, Performance analysis of mobile cellular radio systems with two-level priority reservation handoff procedure, IEICE Trans. Commun., Vol. E80-B, No. 4, pp. 598–604, April 1997.

[14]. N. D. Tripathi, J. H. Reed, and H. F. Vanlandingham, Handoff in Cellular Systems, IEEE Personal Commun., December 1998.

[15]. Q-A. Zeng and D. P. Agrawal, Performance analysis of a handoff scheme in integrated voice/data wireless networks, Proc. IEEE VTC 2000 Fall, Vol. 4, pp. 1986–1992, September 2000.

[16]. Q-A. Zeng and D. P. Agrawal, An analytical modeling of handoff for integrated voice/data wireless networks with priority reservation and preemptive priority procedures, Proc. ICPP 2000 Workshop on Wireless Networks and Mobile Computing, pp. 523–529, August

[17]. Edward, E. P., & Sumathy, V. (2015). Performance analysis of a context aware cross layer scheme for fast handoff in IMS based integrated WiFi–WiMax networks. Pervasive and Mobile Computing, 17, 79-101.

[18]. Agrawal, A., Jeyakumar, A., & Pareek, N. (2016, April). Comparison between vertical handoff algorithms for heterogeneous wireless networks. In 2016 International Conference on Communication and Signal Processing (ICCSP) (pp. 1370-1373). IEEE.

[19]. Dhivya, J. J., & Ramaswami, M. (2017, August). Analysis of handoff parameters in cognitive radio networks on coadunation of Wifi and Wimax systems. In 2017 IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM) (pp. 190-194). IEEE.

[20]. Choi, J., Lee, G., Shin, Y., Koo, J., Jang, M., & Choi, S. (2018, June). Blend: BLE beacon-aided fast wifi handoff for smartphones. In 2018 15th Annual IEEE International Conference on Sensing, Communication, and Networking (SECON) (pp. 1-9). IEEE.

[21]. Majumder, A., & Nath, S. (2019). Classification of Seamless Handoff Process in Wifi Network Based on Radios. In International Conference on Computer Networks and Communication Technologies (pp. 1055-1065). Springer, Singapore.