

Unique Decision Making Process For Seamless Communication After Disaster

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Abstract: Providing seamless communication between heterogeneous networks persists to be a continuous challenge in a natural or a manmade disaster environment. Efficient Handoff decision schemes are required to improve Quality of service (Qos) and offer reliable communication. The handoff decision depends on many parameters such as Network Bandwidth, RSS, delay, packet loss, power dissipation and power consumption. A plethora of handoff decision algorithms are existing, This paper proposes a Decision Process as a best decision making strategy as it chooses the best attributes such as RSS, Throughput, power consumption, velocity, during Vertical handoff for seamless communication. The efficiency of the proposed algorithm is proved through simulations.

Keywords : Vertical Handoff, seamless communication. Quality of service.

I. INTRODUCTION

Seamless Communication between heterogeneous networks in disaster area is still a problem with no optimal solution. Development in the wireless technology has paved way to facilitate seamless communication between heterogeneous networks. The transition from one network to another when call is in progress is termed as Handoff or handover. Handoff can be of types namely, horizontal or vertical depending upon the point of attachment of the mobile terminal with the within the same network or between different networks.

A. Horizontal handoff:

The handoff occurring within the cells of same networks when the mobile terminal is migrating is horizontal handoff, But this handoff is not suitable for heterogeneous networks.

B. Vertical handoff:

The handoff occurring between cells of heterogeneous networks when the mobile terminal is migrating from one network to another is called vertical handoff.

It is essential to know that a handoff decision is made at the right time for uninterrupted service to the users. Handoff can be decided based on various parameters such as Signal strength, cost, delay, context and policy based.

II. VERTICAL HANDOFF PARAMETERS:

a. Received Signal Strength:

RSS depicts the energy of the signal received. It should be strong enough to maintain the signal quality between the base station and the mobile terminal. The RSS should be above the threshold for the mobile terminal to remain in the existing network. It is easy to measure and directly

associated with Quality of service. It is an essential parameter for vertical handoff decision making.

b. Velocity:

Velocity is another vital parameter for decision making. If the velocity of the mobile terminal is high within a small cell and also travels in an irregular pattern then unnecessary handoff might occur. This also leads to the handoff back to the home network which would occur very shortly.

c. Power consumption:

Power consumption is a critical issue because mobile terminals operate on limited battery power. power depletion might occur even during unnecessary hand off and also due no unnecessary interface activation in during the network discovery.

d. Throughput:

Network throughput is the average amount of data delivered successfully through the communication links. It is measured in bits/sec. Maximum throughput is calculated as

$$\text{Max throughput} = \frac{\text{TCP window size}}{\text{RTT}(\text{data packets})}$$

III. RELATED WORK

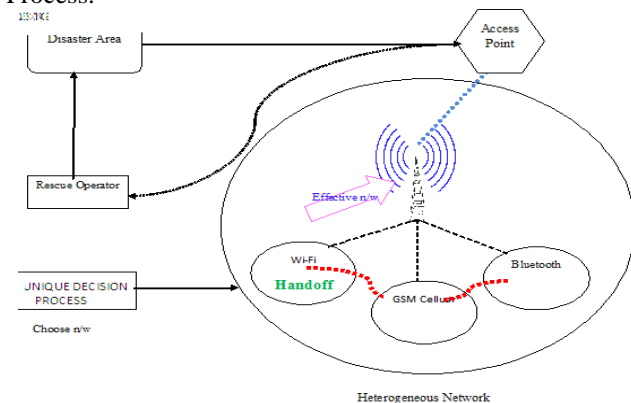
Numerous algorithms have been proposed for the decision process. Handoff decision is based on RSS where this strategy can be applied in a highly mobile environment.[1] handoff decision is based on RSS where this strategy can be applied in a highly mobile environment.[2] This paper proposes cost based decision strategy in which the network is selected based on RSS, bandwidth and cost decreases the possibility of call dropping and call blocking [3].NRS-VDA, efficient strategy that reduces unnecessary handoff which in turn enhances the performance of the whole network..[4] A performance comparison among SAW, TOPSIS, GRA, and the Analytic Hierarchy Process (AHP) for vertical handoff decision is discussed[5] Two vertical handoff models were proposed as Analytic Hierarchy Process (AHP) and the Grey Relational Analysis (GRA) [6] A fuzzy based multiple attribute decision making methods are proposed namely Simple Additive problem (SAW) and Technique for Order Preference by Similarity to Ideal Solutions(TOPSIS) is generated.[7]

The paper is organized into six sections including introduction. Section I gives introduction for

heterogeneous wireless networks and handoff management. Section II gives a detailed description of handoff management along with motivation for handoff decision issue. In section III, handoff parameters is discussed in depth. Section IV covers handoff decision strategies along their pros and cons wherever necessary.. Section V gives the performance evaluation of the unique decision process compared to traditional method Section VI contains conclusion of the study of various handoff strategies and the proposed strategy.

IV. BACKGROUND:

There is a need for an efficient communication and co-ordination among the first responders to save life during disasters. Inefficiencies in the technology during rescue made the communication between the rescue problematic. There is a need to switch between heterogeneous networks for effective communication. Vertical handoff can be the best technique to switch between networks. Though Wireless communication is experiencing a fast growth due to its wide growth in the Terminal deployment in network, providing seamless communication is still a challenge. when mobile terminal is moved from one heterogeneous networks to another when there is an ongoing call but the user is not aware of the handover is called vertical handoff. The access points senses all the networks which are alive after the disaster. From all the existing alive networks, the best network is been chosen by the proposed Decision Process.



The Above figure shows the system architecture of the proposed system. The proposed system suggest the rescue operators to create access points to the areas affected in disaster.. The Vertical Handoff is been performed to switch to those networks so that the information can reach the rescue operators without any delay.

Vertical handoff process is executed in three stages :

i)System discovery ii)vertical handoff decision iii)vertical handoff execution.

i) System Discovery:

The mobile terminal determines which network can be used for communication. The network advertises supported data rates and Quality of Service (QoS) parameters. This phase may be invoked periodically.

ii. vertical handoff decision

The connection should continue using the existing selected network (or) be switched to another network. The decision may depend on various parameters including the type of

application (eg: conversational, streaming, interactive and background), minimum bandwidth and delay, access cost, transmit power and the user’s preference.

iii vertical handoff execution.

The connections in the mobile terminal are re-routed from the existing network to the network in a seamless manner. It includes the authentication, authorization and transfer of user’s context information.

Handoff Decision Process:

Handover Information clustering (System Discovery):

The information framework gathered from the mobile terminal such RSS, network coverage, mobile velocity, data rate, cost, battery power consumption and network latency. This decision process uses the required parameters for deciding whether a handoff is necessary or not. This phase monitors the status of each network based on the parameters (throughput, velocity, power consumption and network load) and analyzed based on the static Score (SSn) obtained.

$$SSn=f(RSSn,Tn,Vn,Pn,)$$

The static score function is the sum of some normalized form of each parameter .The network access function is the sum of n weighted functions. These parameters in network are expressed in terms of weight factors. The static score function with

weight factor is defined as follows:

$$SSn = \sum_{i=1}^4 Ni \times Wi$$

Where TH_{wf} is weight factor for Throughput, V_{wf} is the weight factor of velocity P_{wf} is weight factor for Power Consumption by network interface N_{RSS}, N_{TH}, N_V and N_P represents the normalized score of interface n for RSS, Throughput, Velocity and Power Consumption respectively which are defined as :

The normalization function for Received signal strength is

$$N_{RSS} = \begin{cases} 0, 0 \leq RSS \leq RSS_T \\ \frac{RSS_x - RSS_T}{RSS_{max} - RSS_T}, RSS_x > RSS_T \end{cases}$$

RSSx - received signal strength from candidate base station.

RSS_T- threshold value of the received signal strength

RSS_{max}-maximum signal strength from candidate base station.

The normalization function for Throughput is

$$N_{TH} = \begin{cases} 0, THx > TH_{max} \\ \frac{THx}{TH_{max}}, 0 \leq THx \leq TH_{max} \end{cases}$$

THx - throughput of the network

TH_{max} -maximum throughput supported by the network.

The normalization function for velocity is

$$Nv = \begin{cases} 0, & V_x > V_{max} \\ 1 - \frac{V_x}{V_{max}}, & 0 \leq V_x \leq V_{max} \end{cases}$$

V_x - velocity of the mobile terminal in the network
 V_{max}- Maximum velocity of the terminal in the network

The normalization function for power consumption is:

$$Np = \begin{cases} 1/e^x, & x_i \geq 0 \\ x_i = 2/y_i \end{cases}$$

Y_i - represents the total number of hours of power consumption.

In the above equation the power consumption is represented as the inverse exponential equation to bind the result between zero and one. The power consumption is the reverse to bandwidth(i.e more bandwidth less power consumption)

Handoff decision

The section presents a unique decision model to make handoff with unique decision parameters. The selected decision parameters are monitored with the inputs collected from the network and its Base station(BS). These parameters are analyzed for taking handoff decision. Decision should be made whether to continue with the existing network or change to a new network.

This phase consist of the following steps

1.Candidate network selection

A candidate network CN = { } is a set of all eligible networks.
 whose received signal strength is higher than its threshold value
 velocity threshold is greater than the velocity of mobile station.
 Throughput is greater than the throughput of the existing communication link

These networks are eligible for Handoff

Let N= {An1,An2,An3.....Ank} is the set of available network interfaces.

VT={avt1,vt2,vt3,.....vtk} is the set of threshold values of velocities for a mobile station for the respective networks.

RSST={rsst1,rsst2,rsst3,.....rsstk} is the set of threshold values of received signal strengths of respective networks.

THT = {tht1,tht2,tht3,.....thtk) is a set of threshold values of throughput of respective networks.

RssDft={RssDft1,RssDft2,.....RssDftk} is the set of values of difference between the received signal strength and its threshold value.

2. Priority assignment

Once the candidate networks are selected, a priority PTY is assigned to each candidate network.

PTY={0,1/k,2/k,..j/k,....,1} is the set of priority values for jth network, where j=1..k

Each candidate network is assigned priority based on the RSSDft of each network.

The highest RssDft is given the highest priority since higher indicate that the MT is more nearer to base station (BS) of that network and The Mobile Terminal (MT) can stay for more time in the cell of that network. This in turn reduce the unnecessary decisions, which improves the overall performance of the system.

3.Dynamic Decision

The final decision of selecting a candidate networks from a set of eligible networks from network Initialization module(NI)

A final score “fScore” is calculated for each network i as below-

$$fScore = SS_i * PTY_i$$

Where SS_i is the score calculated by the NI module and PTY is the priority decided by the PA module for the ith network.

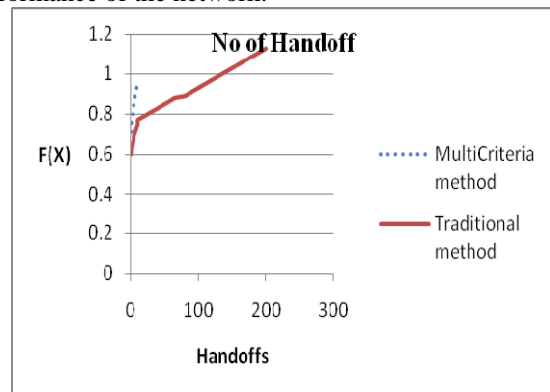
A candidate networks which has highest corresponding value of “fScore” is decided as the “best” network for making handoff.

Handoff execution

When a new network is selected all terminal related information is rerouted to the new network in a seamless manner.

V. PERFORMANCE EVALUATION:

The Performance of the proposed method is evaluated by the no of handoffs performed by simulation. Unnecessary handoff will reduce the throughput which affect the performance of the network.



Analysis on the no of handoff occurred for traditional and proposed method is presented in the graph given. The

proposed algorithm has considerably reduced the no of handoff 90% .This number is achieved through simulation with 100 mobile terminals and call duration of 180 seconds.

VI. CONCLUSION AND FUTURE WORK:

This paper proposes, develop and simulate a unique decision model for performing the handoff to choose the best network at the best time. The proposed decision method adopts a three step decision process namely , candidate network selection, priority assignment and dynamic decision. The priority assignment phase neglects all ineligible networks by assigning priority to all eligible networks based on difference RSS and its threshold, velocity and its threshold and also throughput . In the system discovery phase the information such as throughput, power consumption ,RSS and velocity is gathered. The decision method calculates the score function for all the candidate networks and selects the network having the highest score. Due to its simplicity this unique decision method can be implemented along with any handoff mechanism

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