A Study of Different Performance Parameters to Reduce Communication Loss in 4G Networks

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Abstract

One of the major objectives is to take a closer look at the different techniques to find an optimal approach to reduce call drop rate and handover failure. Different approaches and schemes will be analyzed to eliminate handover and call drop. The objectives associated with this research paper are to study various parameters for recover above problem in 4G Networks. The main objective of paper is to define vertical handoff in 4G network to minimize call drop rate and to study different handover prioritization schemes to reduce handover failure. To improve the communication loss due to handover failure and analysis of different techniques that are used to reduce call drop rate handover failure NS3 Simulator is used.

Keywords: Handover, 4G, Call Drop, NS3, Cell.

Introduction

Cellular system is designed to provide communications between two moving units, called mobile stations (MS) or it may be between one mobile unit and one stationary unit. A service provider must be able to locate and track a caller, assign a channel in the cell, and transfer the channel from base station to base station as the caller moves out of the range.

To make this tracking possible, each cellular service area is divided regions called **Cell**. Each cell contains antenna and is controlled by a station called **Base Station**. Each base station is controlled by a switching office called **Mobile Switching Center (MSC)**. The MSC coordinates communication between all base stations and telephone control office. It is a computerized office which is responsible for call connecting, calls recording, storing call record information.

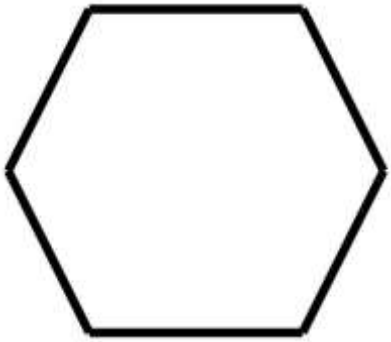
A mobile phone network or cellular is technology that enables peoples to communicate with each other over a great distance by using a device to transmit and receive their voice and messages. Mobile phones have become an important part in our life everyday lives in this area. We have observed advancement in the telecommunications industries since 3 decades. A mobile phone receives or makes

calls through a cell site or transmitting tower. Radio waves are used to transfer signals to and from the cell phone.

A cellular or also known as mobile phone network is used by operator to achieve both coverage and capacity for their subscribers. Large geographical area is divided into smaller areas (called **cells**) to achieve better coverage or to avoid line of sight signal loss and to support a large number or active phones in that area.

Cell

Cellular network is a radio network distributed over land areas called cells and each cell is served by a station called base station. Each cell is represented by hexagonal shape.



Cell use different set of frequencies from its neighboring cells. Normally a practical cell is considered to be a circle but to think on it ideally the boundary portions any cell cannot be captured easily due to gap after integration of more than one cell. So on part hexagon is assumed to be largest area covering the practical cell and capturing the gaps after integration of cells.

Cell size is not fixed and can be increased or decreased depending upon the population of the area. The typical radius of a cell is 1 to 12 mile. High-density areas require more, geographical smaller cells to meet traffic demands than do low-density areas. Once determined, cell size is optimized to prevent the interference of adjacent cell signals. The transmission power of each cell is kept low to prevent its signal from interfacing with those of other cells. A cellular or also known as mobile phone network is used by operator to achieve both coverage and capacity for their subscribers

Base station

Base station subsystem (BSS)

A GSM network comprises many BSSs, each controlled by a base station controller (BSC). The BSS performs all functions necessary to maintain radio connections to an MS, coding/decoding of voice, and rate adaptation to/from the wireless network part. Besides a BSC, the BSS contains several BTSs.

Base transceiver station (BTS)

A BTS comprises all radio equipment, i.e., antennas, signal processing, amplifiers necessary for radio transmission. A BTS can form a radio cell or, using sectored antennas, several cells and is connected to MS and to the BSC. A GSM cell can measure between some 100 m and 35 km depending on the environment (buildings, open space, mountains etc.) but also expected traffic.

Base station controller (BSC)

The BSC basically manages the BTSs. It reserves radio frequencies, handles the handover from one BTS to another within the BSS, and performs paging of the MS. The BSC also multiplexes the radio channels onto the fixed network connections at the A interface.

Handoff

During a mobile call, mobile station moves from one cell to another. When it does, the signal may become weak. To solve this problem, the MSC monitors the level of the signal every few seconds. If the strength of the signal is low, the MSC seeks a new cell that can better accommodate the communication.

Handover

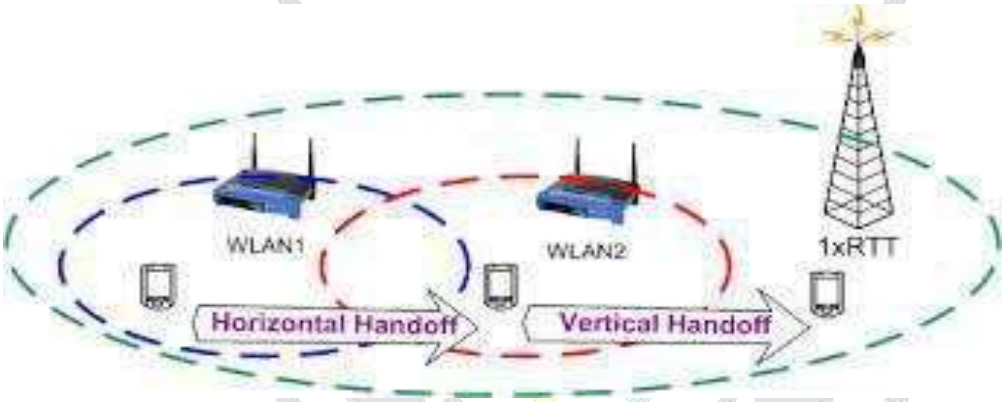
Handover is the process of changing the channel (frequency, timeslot, spreading code etc.) associated with the current connection while call is in process. The search for a new base station and registration without any loss is known as handover. Handover is considered as two types.

Horizontal handover

A mobile node moves with single network from one AP or BS to the other one is called “Horizontal Handover”.

Vertical Handover

A mobile node moves with the different network that is from one BS to the other AP or BS of another network is called “vertical handover”.



Literature Survey

[1]. Prachi P. Patil [1] proposed an algorithm to reduce the call drop problem using vertical handoff in 4G network. The proposed algorithm was based quality of received signal. First find out the number of networks available on the basis of RSS (received signal strength) then select the network higher RSS. Then start the handoff process. The implementation was performed on simulator which provides the results as increase in packet delivery ratio by 95% to 99%. The throughput was increased by 40 bps in simulation results. Other parameters like drop packet, end to end delay, error rate etc. was also decreased in proposed 4G vertical handoff algorithm.

[2]. Sunil Kumar [2] proposed an algorithm for vertical handoff in heterogeneous networks to reduce the call drop rate. The algorithm was implemented on simulator MATLAB 7.0. The simulation results obtained was based on parameter considering and without considering the saturation in a CACN network. The obtained results by simulation was showing less call drop rate as compared to the vertical handover algorithm without considering saturation in a CACN system.

[3]. S.S. Segeran [3] proposed a method to analyze the call drop rate and failed calls. The analysis was performed on the basis of RSS (Received Signal Strength). RSS was measured with the help of an application named 'MyMobileCoverage' and then determine the drop call rate, failed call rate and received signal strength on basis of collected data from the application.

[4]. Vinay Prakash Sriwastava [4] purposed a scheme named as GSM handover prioritization scheme. They purposed some schemes as guard channel prioritization, using auxiliary station, handover queuing prioritization and call admission control and prioritization scheme. Different schemes had different methods of reducing handover failure. A reduced call drop rate was achieved by proposed schemes.

[5]. K.R. Sudhindra [5] defined some major causes for handover failure and call drop. They purposed some solution based their analysis to reduce the call drop. The RF and handoff failure can be eliminated by providing the proper coverage and frequency planning. The LAPD can be reduced by providing stable transmission network.

[6]. Chidera L. Anioke [6] purposed a method to reduce the call drop rate by combining handover prioritization schemes and retrial queues. The guard channel and handover prioritization schemes used to reduce the number of handover failure call dropped and retrial queue was used to reduce the number of blocked incoming calls.

[7]. Miss Poonam B.Bhilare [7] purposed a system with partially and unoverlapped cellular network in order to provide seamless characteristics such as handoff failure, packet loss, handoff and signaling delay with quality of service.

[8]. Parwinder Singh [8] proposed some ideas to reduce the call drop problem. Moving to LTE was good, stopping some type of services was also good to reduce the traffic from a channel for a moment. By providing call priority we may balance the load on traffic channels.

[9]. Nathaniel S. Tarkaa [9] purposed a method to analyze and reduce the call drop rate. Starting with data obtained from networks, mean values were computed for the number of channels, utilization factors and then call arrival rate and call duration. The result was used as a good guide for evaluating and optimizing an operating network.

Each network is defined with certain limitations and strengths. One of such limitation of network is limited range communication. Here the work is defined for such 4G network. To perform the communication, complete network is divided in smaller sub networks where each sub network is controlled by a base station. As the nodes are mobile, there is the requirement to handle the situation of network switching called handoff. Such kind of handoff process gives maximum communication loss. The presented work is defined to provide effective communication in such network.

So far, the studies that have been done for reducing the call drop problem provide different algorithms and approaches to reduce the call drop rate. But the different approaches have different methods and results. The primary motivation of this research is to eliminate both the handover failure and call drop rate in a network. Result of this research concludes the characteristics of good network which has a negligible number of call drop rate.

The conclusion of research work could resolve following problems.

1. How can a base station select its neighbor cell's base station for handover when there is number of network providers available?

2. How researchers can compare different handover prioritization schemes to find optimal solution?

3. How can a network provider achieve max throughput from a network?

4. How to minimize the crop drop problem in 4G network?

5. Different handover schemes are proposed, which one is most suitable for a network?

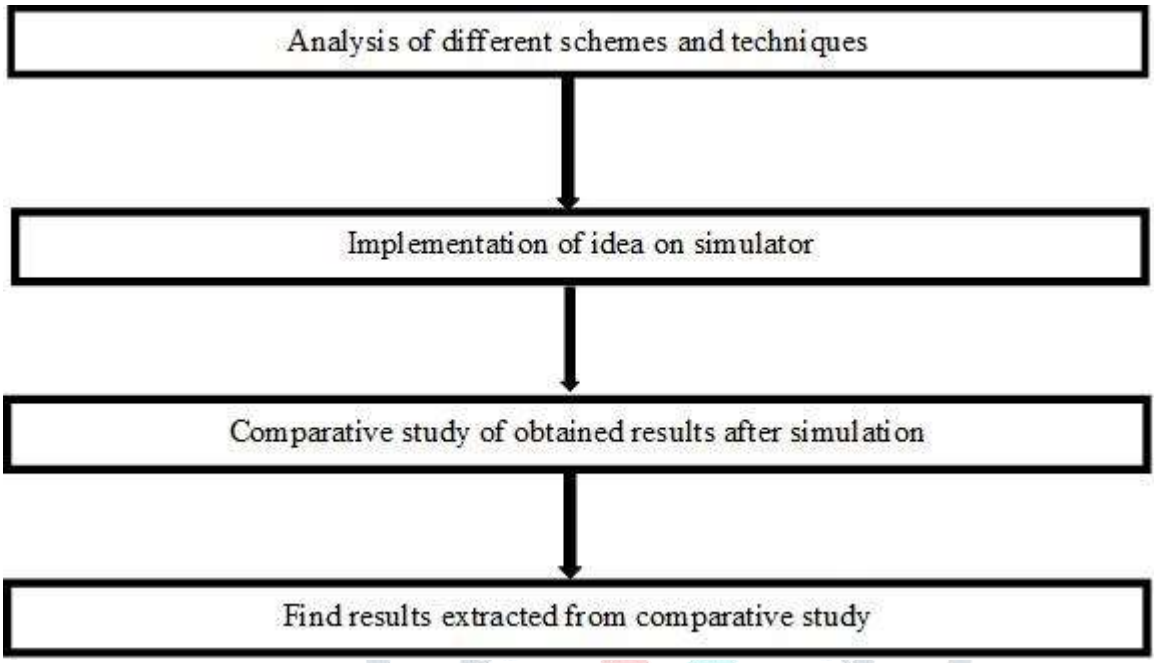
To work with 4G network we need to define a network with a number of nodes and channels. For this we need to collect the information about the network scenario. The scenario includes the information like

- No of Nodes
- Drop Packet
- No. of Channels
- Channel Type
- Propagation
- Transmission Speed
- Packet Delivery Rate
- Throughput

In this Paper we present the proposed methodology for the stated problems. The methodology will discuss the study principles that include:

1. Understanding the related tools.
2. Studying other existing tools and techniques.
3. Implementing the idea using ‘NS-3’ simulators.
4. Comparison of results.
5. Necessary documentation.

Steps to be followed



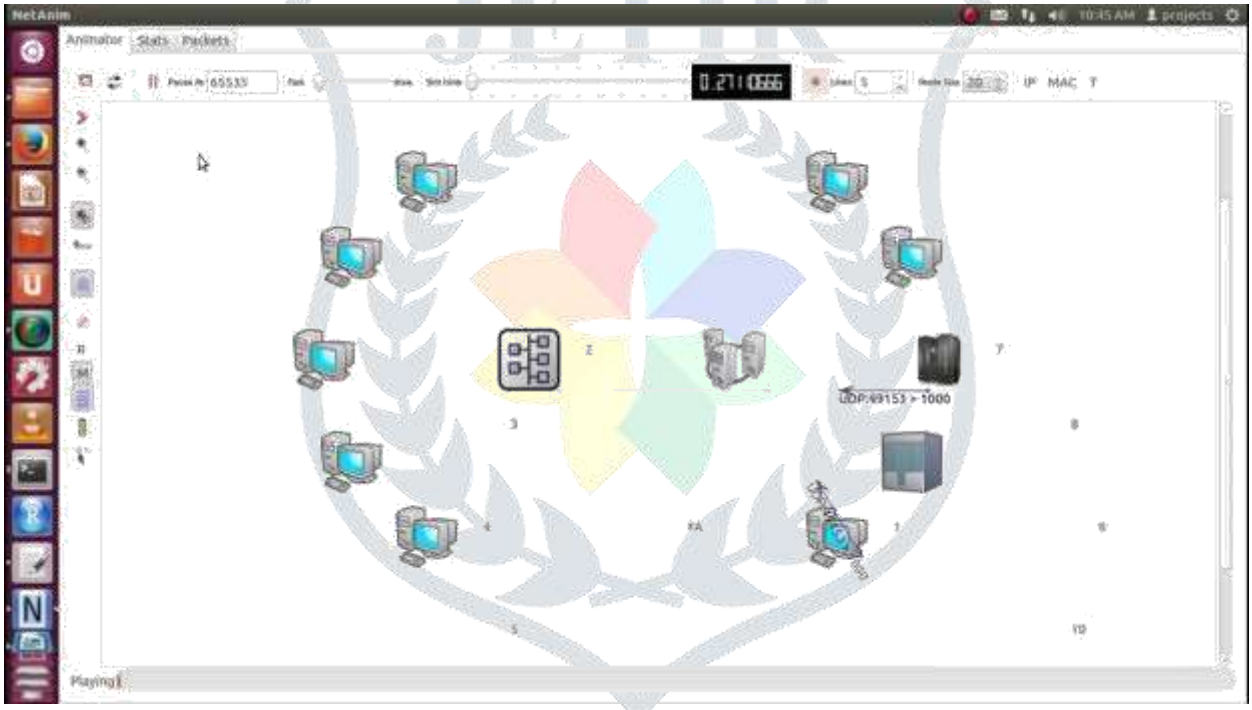
Tools (NS-3)

The simulation work is performed on simulation software named NS-3. It is an open simulation environment for computer networking research that will be preferred. NS-3 is built using C++ and python. Different modules are present in NS-3 to perform different network simulation.

Following are the modules:-

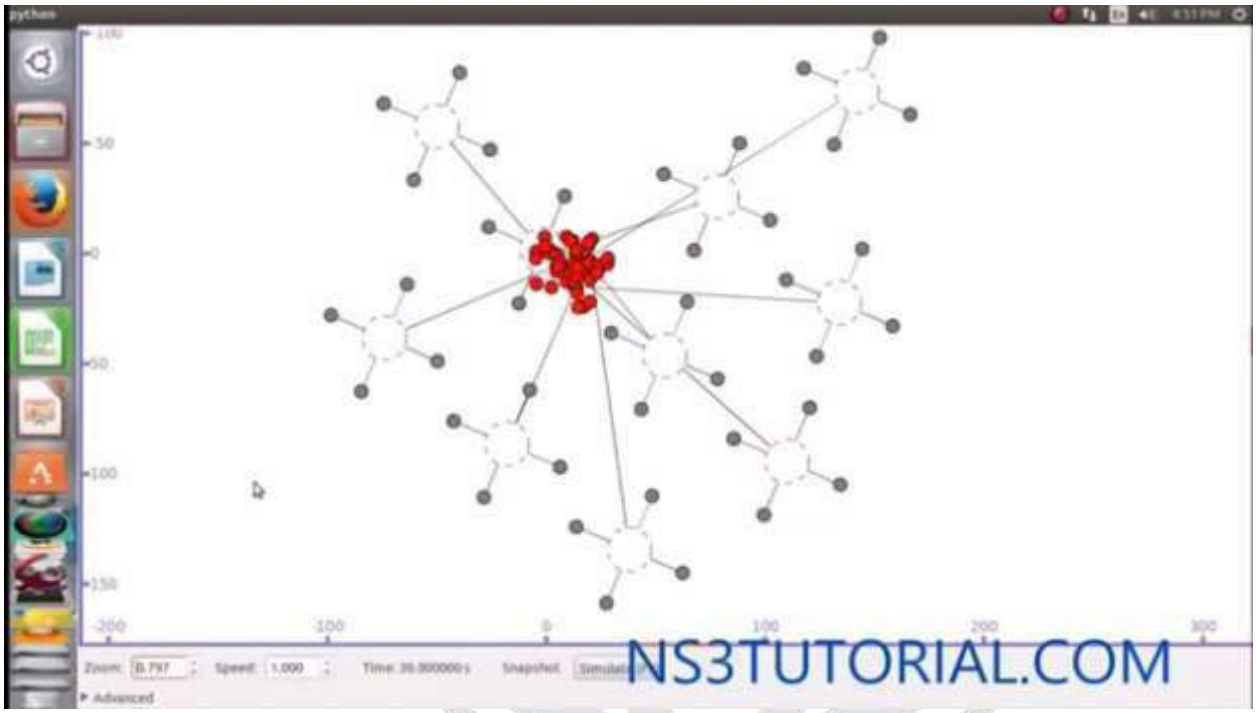
- AODV Routing
- Packet Sink
- BRITE Topology Generator
- CSMA Network Device

- IPv4 Mask Attribute
- IPv6 Address Attribute
- LTE Module
- ICMP Protocol Model
- TCP Model Etc.



A view of NS-3 Framework

Network Formation View on NS-3



Wireless Network View on NS-3 Framework

Conclusion & Future Scope:

In this paper, a various parameters for calculating vertical handoff are defined for 4G LTE heterogeneous network. The proposed algorithm is analyzed on NS-3 simulator. The work can be improved in following aspects. Handoff is performed for heterogeneous network, in future some other metrics can be calculated for further improvements in network which enhanced the quality of a network.

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