© 2018 IJSRST | Volume 4 | Issue 3 | Print ISSN : 2395-6011 | Online ISSN: 2395-602X

National Conference on Advances in Engineering and Applied Science (NCAEAS)
29th January 2018
Organized by : Anjuman College of Engineering and Technology (ACET) Nagpur, Maharashtra, India, In association with
International Journal of Scientific Research in Science and Technology

Implementation and Simulation of 4g Co-Operative Relay Network

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ABSTRACT

The Co-operative Communication (CC) is a technology that allows multiple nodes to simultaneously transmit the same data. It can save power and extend transmission coverage. However, prior research work on topology control considers CC only in the aspect of energy saving, not that of coverage extension. Recently, there has been increasing interest in integrating multi-hop relaying functionalities into MANET. Multi-hop wireless networks can potentially enhance coverage, data rates. Throughput and packet delivery ratio are used as performance metrics for contrast. We are comparing the performance when the size of the packet changes, when the time interval between the packets are changed, when mobility of nodes changes. Wireless network are consider that is WiMAX (Worldwide Interoperability for Microwave Access) which is a wireless communication standards based on the IEEE 802.16, it provides multiple physical layer (PHY) and media access control (MAC) options. Till now wi-fi network is used but it operates in the range of 20 meters with the speed 50 Mbps whereas, WiMAX operates upto 50 kilometers with the speed of 70 Mbps. The protocol NS2.3.1 is used and TCL (tool command language) used to generates two files network animator (.nam) and trace file (.tr). Network animator based on animation tool for viewing network simulation traces and real world packet traces, and trace file log every packet, every event that occurred in the simulation and are used for analysis.

Keywords: Wimax Technology, NS-2, 4G-Technology, Manet, Relay Network

I. INTRODUCTION

The approaching 4G (fourth generation) mobile communication systems are projected to solve still-remaining problems of 3G (third generation) systems and to provide a wide variety of new services, from high-quality voice to high-definition video to high-data-rate wireless channels.The term 4G is used broadly to include several types of broadband wireless access communication systems, not only cellular telephone stems. One of the terms used to describe 4G is MAGIC-Mobile multimedia, anytime anywhere, Global mobility support, integrated wireless solution, and customized personal service. As a promise for the future, 4G systems, that is, cellular broadband wireless access systems ,have been attracting much interest in the mobile communication arena. The 4G systems not only will support the next generation of mobile service, but also will support the fixed

wireless networks. This paper presents an overall vision of the 4G features, framework, and integration of mobile communication. The features of 4G systems might be summarized with one word Integration. The 4G systems are about seamlessly integrating terminals, networks, and applications to satisfy increasing user demands. The continuous expansion of mobile communication and wireless networks shows evidence of exceptional growth in the areas of mobile subscriber, wireless network access, mobile services, and applications. An estimate of 1 billion users by the end of 2003 justifies the study and research for 4G systems.

II. PROBLEM IDENTIFICATION

Losses are more in 2G and 3G: In 3G, network based QoS depends on following factor to provide a satisfactorily service as: Throughput, Packet Loss Rate, reliability and delay. Where as in 4G With respect to network quality, many telecommunications providers are promising that there will be enhanced connectivity, and the quality of data that is transmitted across the network will be of the highest possible quality. The main challenge that 4G networks are facing is integrating non-IP based and IP based devices. It is known that devices that are not IP address based are generally used for services such as VoIP. On the other hand, devices that are IP address base are used for data delivery.4G networks will serve both types of devices.

Speed is low in 2G and 3G: 4G speeds are meant to exceed that of 3G. Current 3G speeds are topped out at 14Mbps downlink and 5.8Mbps uplink. To be able to qualify as a 4G technology, speeds of up to 100Mbps must be reached for a moving user and 1Gbps for a stationary user. So far, these speeds are only reachable with wired LANs. The 4G is faster, it is said to be four times faster than its predecessor. This allows for a connection speed more comparable to DSL and home cable networks. It is great news for those completing work and accomplishing important tasks away from their home and office. When uploading large documents and communicating via the internet, a fast connection is important. Whereas 3g doesn't favor such speed as compare to that of 4G.

Low data rate: When the 3G was introduced, cell phone users were finally able to talk and access data at the same time and with higher data rates. This allowed for a better full service for cell phone users wishing to access the internet. And what is even greater is the 4G data rates are expected to be even higher. Users will have the capability of accessing more data at higher speeds while talking on their cell phone. In addition, the fourth generation permits more data transmission of such services as games and multimedia. It also allows a larger amount of internet support.

Guaranteed delivery of data is not possible: Another key change in 4G is the abandonment of circuit switching. 3G technologies use a hybrid of circuit switching and packet switching. Packet switching is a technology that is very prevalent in computer networks but has since appeared in mobile phones as well. With packet switching, resources are only used when there is information to be sent across. The efficiency of packet switching allows the mobile phone company to squeeze more conversations into the same bandwidth. 4G technologies would no longer utilize circuit switching even for voice calls and video calls. All information that is passed around would be packet switched to enhance efficiency.

III. AIM AND OBJECTIVES

To overcome the congestion problem the objective is that to design a such type of wireless network which will be scalable which will have the best optimum performance at any condition. It should increase the efficiency of data transmission rate so that maximum no of transmission will take place and throughput of the network should be achieved at a higher performance.

The aim is to reduce the packet data loss if the packet data loss will be reduces transmission will not taken place and power will save as the packet data loss is decreases, definitely congestion will minimize.

In the proposal algorithm, multiple source destination player sending receiving data at the same time are taken. In these the buffer availability of nodes is checked to detect the consumption in the path. If the buffer value is less than a threshold, packets through that rout are send continuously but if it exist a certain threshold then second condition it checked i.e. checking the no of packet present in a buffer for in destination respectively, if it increase a certain threshold then an alternate path for that particular source destination pair is chosen otherwise the packet will be forwarded through that route.In these way, proposed technique resole the congestion problem and reduce the delay and increase the throughput their by increasing the network performance on the whole.

IV. METHODOLOGY

Network creation using NS2:-Simple Wireless Program in NS2 is the best way to learn about how to code in NS2. NS2 is one of the best simulation tool used by majority of scholars today due to its highlighted features like support for OOPs concept, C++ programming fundamentals, real time emulation support etc. NS2 is used to simulate both wired and wireless networks; here we have focused on wireless network simulation in NS2 due to its wide applicability. Regarding wired simulation in NS2, refer our other articles available in this site.

Protocol implementation:- In the aspect of simulation, the primary component in designing a mobile adhoc network is mobility model while the other components include node configuration, random topology, and communication model. In mobility model, the mobility of a node from a location to another location can be enabled using the keyword “setdest” in Tool Command Language (TCL) script. The specifications for a node’s target location include x-coordinate, y-coordinate along with the speed. Nodes are configured with the components of channel, networking interface, radio propagation model, Medium Access Control (MAC) protocol, adhoc routing protocol, interface queue, link layer, topography object, and antenna type. In dynamic topology, the neighbors of each node vary with the location of that particular node. Nodes in adhoc network communicate using communication model. The sample14.tcl illustrates the design of mobile adhoc network that consists of 3 mobile nodes. The movements of mobile nodes are confined to an area of 500mX500m with the pause time of 3s. Data transmission is established between nodes using UDP agent and CBR traffic. These intermediate routers forward the packets generated by other nodes to their destination.

MIMO implementation:- MIMO uses signal multiplexing between multiple transmitting antennas (space multiplex) and time or frequency. It is well suited to OFDM, as it is possible to process independent time symbols as soon as the OFDM

waveform is correctly designed for the channel. This aspect of OFDM greatly simplifies processing. The signal transmitted by m antennas is received by n antennas. Processing of the received signals may deliver several performance improvements range, quality of received signal and spectrum efficiency. In principle, MIMO is more efficient when many multiple path signals are received. The performance in cellular deployments is still subject to research and simulations. However, it is generally admitted that the gain in spectrum efficiency is directly related to the minimum number of antennas in the link.

OFDM technology:- Orthogonal Frequency Division Multiplexing (OFDM) not only provides clear advantages for physical layer performance, but also a framework for improving layer 2 performance by proposing an additional degree of free- dom. Using OFDM, it is possible to exploit the time domain, the space domain, the frequency domain and even the code domain to optimize radio channel usage. It ensures very robust transmission in multi-path environments with reduced receiver complexity. OFDM also provides a frequency diversity gain, improving the physical layer performance .It is also compatible with other enhancement Technologies, such as smart antennas and MIMO (multiple-input and multiple-output)radar antenna .OFDM modulation can also be employed as a multiple access technology (Orthogonal Frequency Division Multiple Access). In this case, each OFDM symbol can transmit information to/from several users using a different set of sub carriers (sub channels). This not only provides additional flexibility for resource allocation (increasing the capacity), but also enables cross-layer optimization of radio link usage.

V. TECHNOLOGY

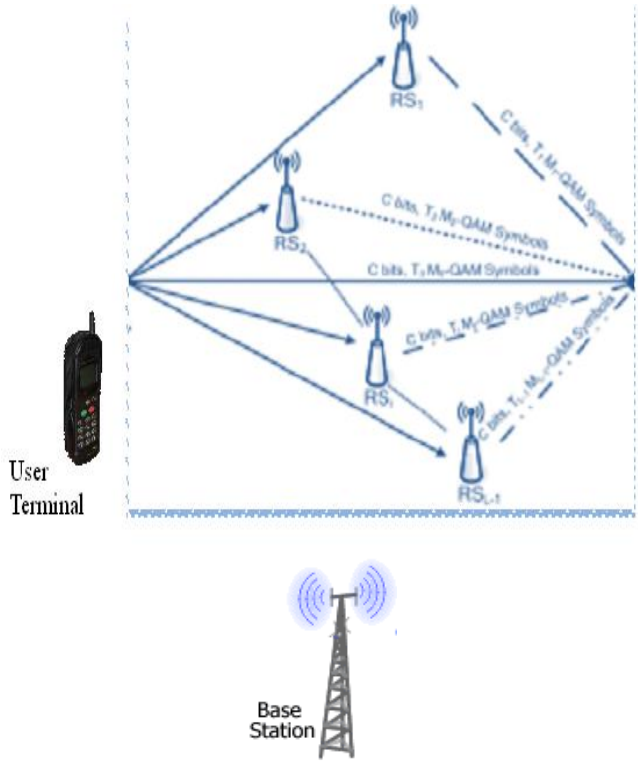

Figure 1. Block diagram of proposed system

MIMO (Multiple I/P Multiple O/P): In radio, multiple-input and multiple-output, or MIMO is a method for multiplying the capacity of a radio link using multiple transmit and receive antennas to exploit multipath propagation. MIMO has become an essential element of wireless communication standards including IEEE 802.11n (Wi-Fi), IEEE 802.11ac (Wi-Fi), HSPA+ (3G), WiMAX (4G), and Long Term Evolution (4G). More recently, MIMO has been applied to power-line communication for 3-wire installations as part of ITU G.hn standard and Home Plug AV2 specification .At one time, in wireless the term "MIMO" referred to the use of multiple antennas at the transmitter and the receiver. In modern usage, "MIMO" specifically refers to a practical technique for sending and

receiving more than one data signal simultaneously over the same radio channel by exploiting multipath propagation. MIMO is fundamentally different from smart antenna techniques developed to enhance the performance of a single data signal, such as beam forming and diversity.

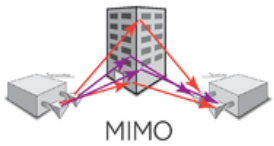

Figure 2. MIMO Technology

AMC (Adaptive Modulation & Coding): Adaptive Modulation and Coding (AMC) in LTE networks is commonly employed to improve system throughput by ensuring more reliable transmissions. Most of existing AMC methods select the modulation and coding scheme (MCS) using pre-computed mappings between MCS indexes and channel quality indicator (CQI) feedbacks that are periodically sent by the receivers. However, the effectiveness of this approach heavily depends on the assumed channel model. In addition CQI feedback delays may cause throughput losses. In this paper we design a new AMC scheme that exploits a reinforcement learning algorithm to adjust at run-time the MCS selection rules based on the knowledge of the effect of previous AMC decisions. The salient features of our proposed solution are: i) the low-dimensional space that the learner has to explore, and ii) the use of direct link throughput measurements to guide the decision process. Simulation results obtained using ns3 demonstrate the robustness of our AMC scheme that is capable of discovering the best MCS even if the CQI feedback provides a poor prediction of the channel performance.

OFDM (Orthogonal Frequency Division Multiplexing): Orthogonal frequency-division multiplexing (OFDM) is a method of encoding digital data on multiple carrier frequencies. OFDM has developed into a popular scheme for wideband digital communication, used in applications such as digital television and audio broadcasting, DSL Internet access, wireless networks, power line networks, and 4G mobile communications. COFDM stands for Coded orthogonal frequency-division multiplexing. It differs from OFDM because in COFDM, forward error correction is applied to the signal before transmission. This is done to overcome errors. COFDM and OFDM are sometimes used as synonyms. OFDM is a frequency-division multiplexing (FDM) scheme used as a digital multi-carrier modulation method. A large number of closely spaced orthogonal sub-carrier signals are used to carry data[2] on several parallel data streams or channels. Each sub-carrier is modulated with a conventional modulation scheme (such as quadrature amplitude modulation or phase-shift keying) at a low symbol rate, maintaining total data rates similar to conventional *single-carrier* modulation schemes in the same bandwidth. The primary advantage of OFDM over single-carrier schemes is its ability to cope with severe channel conditions (for example, attenuation of high frequencies in a long copper wire, narrowband interference and frequency-selective fading due to multipath) without complex equalization filters. Channel equalization is simplified because OFDM may be viewed as using many slowly modulated narrowband signals rather than one rapidly modulated wideband signal. The low symbol rate makes the use of a guard interval between symbols affordable, making it possible to eliminate inter symbol interference (ISI) and utilize echoes and time-spreading (on analogue TV these are visible as ghosting and blurring, respectively) to

achieve a diversity gain, i.e. a signal-to-noise ratio improvement. This mechanism also facilitates the design of single frequency networks (SFNs), where several adjacent transmitters send the same signal simultaneously at the same frequency, as the signals from multiple distant transmitters may be combined constructively, rather than interfering as would typically occur in a traditional single-carrier system.

VI. TOOLS

NS 2.31

All of them are discrete-event computer network simulators, primarily used in research and teaching. ns-3 is free software, publicly available under the GNU GPLv2 license for research, development, and use. The goal of the ns-3 project is to create an open simulation environment for computer networking research that will be preferred inside the research community:

- It should be aligned with the simulation needs of modern networking research.
- It should encourage community contribution, peer review, and validation of the software.

Since the process of creation of a network simulator that contains a sufficient number of high-quality validated, tested and maintained models requires a lot of work, ns-3 project spreads this workload over a large community of users and developers.

History:-In 2006, a team led by Tom Henderson, George Riley, Sally Floyd, and Sumit Roy, applied for and received funding from the U.S. National Science Foundation (NSF) to build a replacement for ns-2, called ns-3. This team collaborated with the project of INRIA at Sophia Antipolis, with Mathieu Lacage as the software lead, and formed a new open source project. In the process of developing ns-3, it was decided to completely abandon backward-compatibility with ns-2. The new simulator would be written from scratch, using the C++ programming language. Development of ns-3 began in July 2006.The first release, ns-3.1 was made in June 2008, and afterwards the project continued making quarterly software releases, and more recently has moved to three releases per year. NS-3 made its twenty first released (ns-3.21) in September 2014.Current status of the three versions is:

- ns-1 development stopped around 2001. It is no longer developed nor maintained.
- ns-2 development stopped around 2010. It is no longer developed, and the last maintenance release was in 2013.
- ns-3 is still developed (but not compatible for work done on ns-2)

Design:-Ns-3 is built using C++ and Python with scripting capability. The ns-3 library is wrapped by Python thanks to the pybindgen library which delegates the parsing of the ns-3 C++ headers to gccxml and pygccxml to automatically generate the corresponding C++ binding glue. These automatically-generated C++ files are finally compiled into the ns-3 Python module to allow users to interact with the C++ ns-3 models and core through Python scripts. The ns-3 simulator features an integrated attribute-based system to manage default and per-instance values for simulation parameters.

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