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4G Co-Operative Relay Network using MIMO-OFDM

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Abstract:
MANET are mobile ad hoc networks present in the mobile node which contain a self organizing system which can communicate with the end users without the need of base stations and access points. This is a wireless communication network where the data gets transmitted to multiple receivers. In this paper we will discuss the working of ad hoc networks

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.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. Here, we have taken a simple wireless program in NS2 to explain the students about how to work with wireless networks in NS2. For further guidance and tutoring service on NS2, approach us anytime, we are there for you at 24/7.

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.

III.TECHNOLOGY

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).

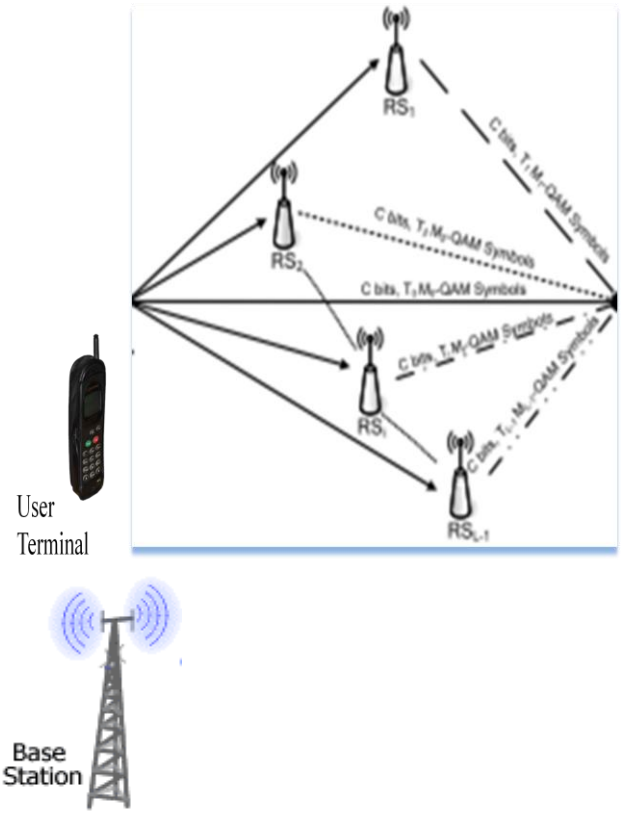

Figure.1. Block diagram of proposed system

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.

IV. TOOLS

- **NS 2.31**

All of them are discrete-event computer network simulators, primarily used in research and teaching. ns-2 is free software, publicly available under the GNU GPLv2 license for research, development, and use. The goal of the ns-2 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.

V. SIMULATION RESULTS

The following result indicates the simulation study of network using the software NS2. In which figure and figure indicates the wimax_aodv.nam (network animator) window simulation of 50 nodes indicated as N1, N2, N3.....N50 moving with different speed and the base station indicated as "BS" at time 2.97 sec and 5.0 sec respectively with the step size of 2.0msec. The circle indicates the coverage area of individual nodes with respect to time of data transfer. Also it shows the nodes with different mobility patterns in which some of the nodes are overtaking to one another and some of the nodes stationary but each node using the secure communication as mentioned in the introduction of this paper.

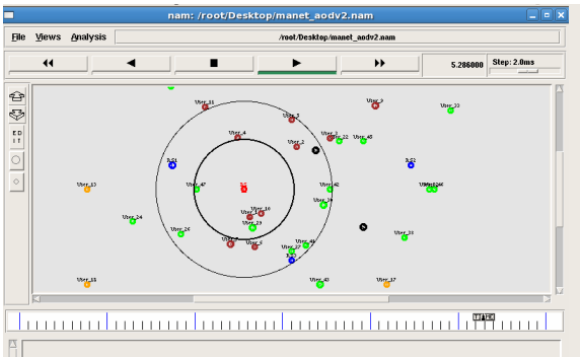

Figure.3. Simulation result at 5.286sec

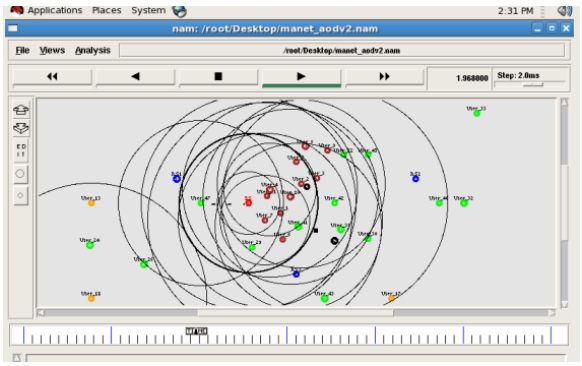

Figure.4. Simulation result at 1.968sec

VI. CONCLUSION

The Relay choice plays an important role in increasing the diversity gain achieved in wireless cooperative communication systems, and therefore it has mostly attracted attention of the many research teams over the past few years. This paper presented a brief description of path to 4G networks, WiMAX and LTE Network architecture and OFDMA technology. It has been observed that the number of wireless broadband subscribers have passed the number of fixed broadband subscribers. So in a world going wireless, the technologies with higher throughputs get importance day by day. For a successful 4G network, coverage and capacity are essential parts. LTE-Advanced and WiMAX 802.16m The possible candidates for a successful 4G deployments are LTE-Advanced and WiMAX 802.16m. So the technology is, it must be affordable in cost and worth deploying in throughput, coverage and capacity.

VII. REFERENCES

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