Future Cooperative Wireless Networks

Prashasti Nagar[1], Ritu Mehta[2], Pankaj Rathi[3]

Electronics & Communication Engineering, Shrinathji Institute of Technology & Engineering, Nathdwara Rajasthan, Inda[1]
Electronics & Communication Engineering, Shrinathji Institute of Technology & Engineering, Nathdwara Rajasthan, India[2]
Electronics & Communication Engineering, Shrinathji Institute of Technology & Engineering, Nathdwara Rajasthan, India[3]
[1]prashastinagar20@gmail.com,[2]jain.ritu2893@gmail.com,[3]rathi.panks@gmail.com

Abstract – Existing wireless networks are constructed for coexistence rather than for cooperation. For instance, in current cellular networks different transmitters are orthogonal to each other, e.g. using TDMA, CDMA or FDMA methods. There are some basic problems which comes in the path of proper establishment of communication. The aim of this paper is to develop cooperative techniques to be used in 3G and 4G cellular mobile networks and in wireless home networking. The schemes are required to fulfill the demands of 4G systems as define by International Telecommunication Union (ITU). Recent researches suggest a huge potential for performance increase in cooperative communication networks. The concept developed in this paper should be applicable specifically for LTE and LTE-Advanced network.

Index term : 3G,LTE,4G,MIMO,CDMA,TDMA,FDMA,IMS

I. INTRODUCTION

The density of nodes in mobile communication networks as well as the requirement for data throughput has increased steadily in last decades. Since the available frequency spectrum is limited and bandwidth is a scarce resource, future communication systems are expected to utilize it as efficient as possible. In future system, increased spectral efficiency as well as improved link reliability become even more important. Today's continuously growing demands, extensive efforts bare made to develop new standards for the evolution of existing third generation 3G techniques. The next steps in development of futures cellular networks are the implementation of 3GPP Long Term Evolution (LTE) Technology and its upcoming fourth generation (4G) successor LTE- Advanced. The LTE Advanced offers higher bandwidths as compared to 3G technologies, but carrier frequencies is expected to be increased. Since transmission at higher frequencies may reduce coverage range due to increased attenuation, concepts to mitigate this effect are required to fulfill the demands on 4G systems also at the cell edges. Such cooperatives schemes can include cooperation among several base stations or between mobile user equipment in order to form distributed multiple input multiple output (MIMO) arrays to achieve higher spectral efficiency and / or data rates. Other schemes make use of one of several relay stations that increase data rates over larger distances. Such costs might be reduced by sophisticated cooperative schemes relay based concept and multi node cooperation are expected to be key enablers for high spectral efficiency, large coverage, and low latency.

II. RELATED WORK

3g Technology: 3g is the third generation of mobile phone standards and technology, superseding 2g, and Preceding 4g. It is based on the international telecommunication union (itu) family of Standards under the international mobile telecommunications programme, imt-2000. 3g technologies enable network operators to offer users a wider range of more advanced services while achieving greater network capacity through improved spectral efficiency. Services include widearea wireless voice telephony, video calls, and broadband wireless data, all in a mobile environment. The notebook is connected to the wireless access point using a pc card wireless card. A videophone is a telephone which is capable of both audio and video duplex transmission. 3g technologies make use of TDMA and CDMA. 3g (third generation technology) technologies make use of value added services like mobile television, GPS (global positioning system) and video conferencing. The basic feature of 3g technology is fast data transfer rates. 3g technology is much flexible, because it is able to support the 5 major radio technologies. These radio technologies operate under CDMA, TDMA and FDMA.CDMA holds for IMT-DS.

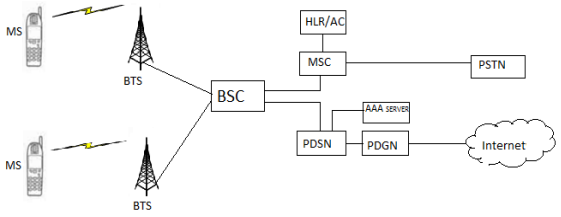

Fig 1: 3G CDMA2000

The LTE Network : while LTE aims for an all-IP simplified infrastructure, in point of fact LTE must interwork with the 3G network, web transmission Subsystems (IMS), and different pre-existing components. It most affects the radio access network and packet core network. The LTE Network consists of updates or replacements for several parts already within the wireless network.

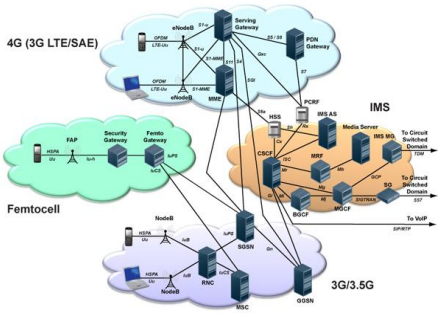

Fig 2: The LTE Network

4G Technology: 4G, Which refers to all-IP packet-switched networks, Mobile ultra-broadband (gigabit speed) access and Multi-carrier transmission. Pre-4G technologies such as mobile wi-max and first-release 3G Long Term Evolution (LTE). It is basically the extension in the 3G technology with more bandwidth and services offers in the 3G. The expectation for the 4G technology is basically the high quality audio/video streaming over end to end Internet Protocol. If the Internet Protocol (IP) Multimedia sub-system movement achieves what it going to do, nothing of this possibly will matter. Wi-max or mobile structural design will become progressively more translucent, and therefore the acceptance of several architectures by a particular network operator ever more common.

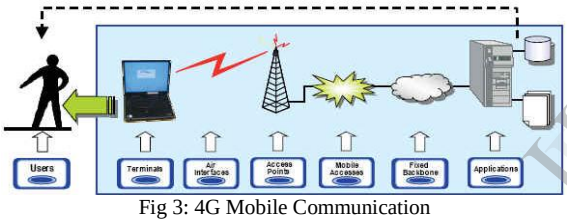

Fig 3: 4G Mobile Communication

4G LTE-Advanced. initially offered in major cities, airports and elect regional areas in Oct 2011, Telstra\'s 4G network offers significantly faster speeds, lower latency, and reduced network congestion. The 4G network is predicated on LTE-Advanced - 3GPP long run Evolution. LTE may be a series of upgrades to existing UMTS technology and will be unrolled on Telstra\'s existing 1800MHz frequency band. This new network boosts peak downloads hastens to 100Mbps and 50Mbps transfer, latency reduced from around 300ms to but 100ms, and significantly lower congestion. For a lot of technical details on peak 4G speeds check up on our quickest 4G speed guide

Fig 4: 4G LTE-Advanced

III.TECHNIQUES INVOLVED:

Multiple-Input and Multiple-Output (MIMO): This is an antenna technology which uses multiple channels in radios to provide the functions of both the transmitter and receiver of data signals sent over the network. It provides high spectral efficiency and link reliability facilitating significant increase in the data throughput and radio link usage without additional bandwidth and transmission power. This high efficiency is due to the availability of an independent path in a rich scattering environment for each transmitter and receiver antennas in the radio.

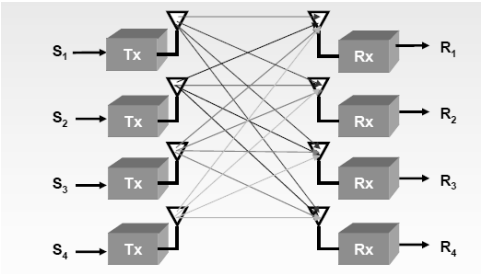

Fig 5: MIMO

FDMA: One frequency is used for downlink and one combine for uplink. This can be called frequency division duplexing (FDD). That allocated frequencies try is not employed in constant cell or adjacent cells during the call so as to reduce the co channel interference. Albeit the user may not be talking, the spectrum can\'t be reassigned as long as a call is in place. Different |completely different users can use constant frequency in the same cell except that they must transmit at different times.

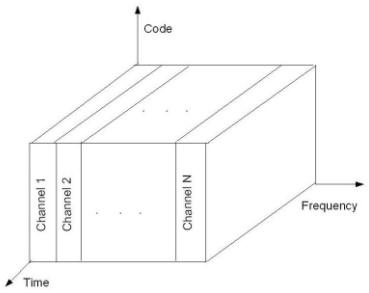

Fig 6: Basic concept of FDMA

TDMA:
In digital systems, continuous transmission isn\'t required because users do not use the assigned bandwidth all the time. In such cases, TDMA is a complimentary access technique to FDMA. world Systems for Mobile communications (GSM) uses the TDMA technique. In TDMA, the complete bandwidth is offered to the user but just for a finite period of time. In most cases the available bandwidth is divided into fewer channels compared to FDMA and therefore the users square measure assigned time slots during which they have the entire channel bandwidth at their disposal.
TDMA requires careful time synchronization since users share the bandwidth within the frequency domain. the quantity of channels area unit less, inter channel interference is nearly negligible. TDMA uses completely different time slots for transmission and reception. this kind of duplexing is stated as Time division duplexing (TDD).

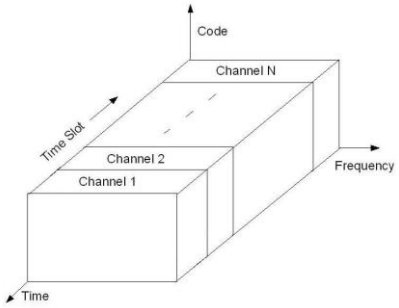

Fig 7: Basic concept of TDMA

CDMA: In CDMA, the same bandwidth is occupied by all the users, however they are all assigned separate codes, which differentiates them from each other. CDMA utilize a spread spectrum technique in which a spreading signal (which is uncorrelated to the signal and has a large bandwidth) is used to spread the narrow band message signal.

It can be seen from the article in the cellular telecoms area of this site that when extracting the required data from a DSSS signal it was necessary to have the correct spreading or chip code, and all other data from sources using different orthogonal chip codes would be rejected. It is therefore possible to allocate different users different codes, and use this as the means by which different users are given access to the system.

The scheme has been likened to being in a room filled with people all speaking different languages. Even though the noise level is very high, it is still possible to understand someone speaking in your own language. With CDMA different spreading or chip codes are used. When generating a direct sequence spread spectrum, the data to be transmitted is multiplied with spreading or chip code. This widens the spectrum of the signal, but it can only be decided in the receiver if it is again multiplied with the same spreading code. All signals that use different spreading codes are not seen, and are discarded in the process. Thus in the presence of a variety of signals it is possible to receive only the required one.

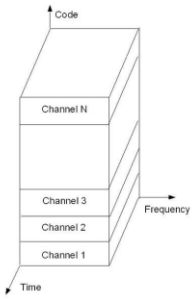

Fig 8: The basic concept of CDMA

OFDMA is the form of multiple access scheme that is being considered for the fourth generation cellular technologies along with the evolutions for the third generation cellular systems (LTE for UMTS / W-CDMA and UMB for CDMA2000). As the name implies, OFDMA is based around OFDM. This is a technology that utilises a large number of close spaced carriers. Orthogonal Frequency Division Multiplex (OFDM) is a form of transmission that uses a large number of close spaced carriers that are modulated with low rate data. Normally these signals would be expected to interfere with each other, but by making the signals orthogonal to each other there is no mutual interference. The data to be transmitted is split across all the carriers to give resilience against selective fading from multi-path effects

The second system came about with the transition to digital schemes for cellular technology. Here digital data could be split up in time and sent as bursts when required. As speech was digitised it could be sent in short data bursts, any small delay caused by sending the data in bursts would be short and not noticed. In this way it became possible to organise the system so that a given number of slots were available on a give transmission. Each subscriber would then be allocated a different time slot in which they could transmit or receive data. As different time slots are used for each subscriber to gain access to the system, it is known as time division multiple access. Obviously this only allows a certain number of users access to the system. Beyond this another channel may be used, so systems that use TDMA may also have elements of FDMA operation as well.

FDMA is the most straightforward of the multiple access schemes that have been used. As a subscriber comes onto the system, or swaps from one cell to the next, the network allocates a channel or frequency to each one. In this way the different subscribers are allocated a different slot and access to the network. As different frequencies are used, the system is naturally termed Frequency Division Multiple Access. This scheme was used by all analogue systems.

All signals that use different spreading codes are not seen, and are discarded in the process. Thus in the presence of a variety of signals it is possible to receive only the required one. In this way the base station allocates different codes to different users and when it receives the signal it will use one code to receive the signal from one mobile, and another spreading code to receive the signal from a second mobile. In this way the same frequency channel can be used to serve a number of different mobiles.

IV Conclusion

This tutorial describes cooperative wireless networks, especially on the performance of network layer. We have mainly analyzed and compared the performance of end-to-end reliability, energy consumption, throughput and delay of wireless cooperative communication. In our view, these benefits make cooperative wireless networks capable of combating radio unreliability and meeting future application requirements of high-speed and high-quality services with high energy efficiency. The acquired new insights on the network performance could also provide a precise guideline for the efficient designs of practical and reliable communications systems. Hence these results will potentially have a broad impact across a range of areas, including wireless communications, network protocols, radio transceiver design and information theory.

V Future Work

These satellite networks consist of telecommunication satellite network, Earth imaging satellite network and navigation satellite network. The telecommunication satellite is used for

voice, data, internet, and video broadcasting; the earth imaging satellite networks is for weather and environmental information collection; and the navigational satellite network is for global positional system (GPS) .The four different countries which developed these satellite systems are; the GPS by USA, the COMPASS system developed by China. The Galileo system by EU, and the GLONASS system developed by Russia. In 6G handoff and roaming will be the big issue because these satellite systems are different networks and 6G has four different standards. So the handoff and roaming must take place between these 4 networks but how it will occur is still a question.

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