FLASH-OFDM (Fast Low Latency Access with Seamless Handoff – Orthogonal Frequency Division Multiplexing) in 4th Generation Wireless Technology

[1]Nikhil Ranjan, [2]Madhu Thapa, [3]Vandana Bharti, [4]Sonia Chhetri
[1,2]Dept. of MCA, Tula's Institute (An Engineering and Management College), Dehradun, UK, India
[3]Dept. of CSE, Tula's Institute (An Engineering and Management College), Dehradun, UK, India
[4]Dept. of IT, Tula's Institute (An Engineering and Management College), Dehradun, UK, India

Abstract
The 4G is refers to the fourth generation of wireless technology. 4G technology has been designed to be simple. A number of PDA's and notebooks are fabricated with WiMAX chips to acquire 4G signals. In this paper we mainly focus on the working of Fast Low Latency Access with Seamless Handoff – Orthogonal Frequency Division Multiplexing i.e. FLASH-OFDM in the 4G wireless Technology. It also focuses on the various services and the security techniques that are associated with 4G.

Keywords
Generation Wireless Technology, 4G Technology, FLASH-OFDM,

I. Introduction

The user will right away notice that a person can benefit from broadband service anywhere in the coverage zone, we will not are required to be tied to a Wi-Fi spot. Mobile broadband is further more extremely useful for loading movies in the rear seat of a car, or grabbling sizable files in a taxi. According to the 4g working group will have almost all the standards from 2G to 4G implemented. Although legacy systems are in place to adopt existing users, the infrastructure for 4G will be only packet based. 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, whether wireless or over copper wires, used in applications such as digital television and audio broadcasting, DSL broadband internet access, wireless networks and 4G mobile communications. The technology considered to be an early 4G includes FLASH-OFDM i.e. Fast Low Latency Access with Seamless Handoff Orthogonal Frequency Distributed Multiplexing which is a method of encoding digital data on multiple carrier frequencies. It is an innovative air interface technology designed for the delivery of advanced internet services in the mobile environment. This technology is based on the OFDM air link which is wireless access method that combines the attributes of its two predecessors i.e. TDMA and CDMA to address the unique demands posted by mobile users of broadband data and packetized voice applications. As the wireless standards evolved, the access techniques used also exhibited increase in efficiency, capacity and scalability.

II. WI-FI and FLASH-OFDM Compatibility

Wi-Fi extension has become a standard interface for laptop computers, and now it is more and more becoming to mobile handsets, first to PDA's and then to 3G phones. The commercially available Wi-Fi routers with FLASH-OFDM as backhaul, enables the connection of a wide variety of devices to the FLASH-OFDM network. For the mobile device harnessed with both Wi-Fi and FLASH-OFDM connection the technology provides seamless inter technologies hand-off.

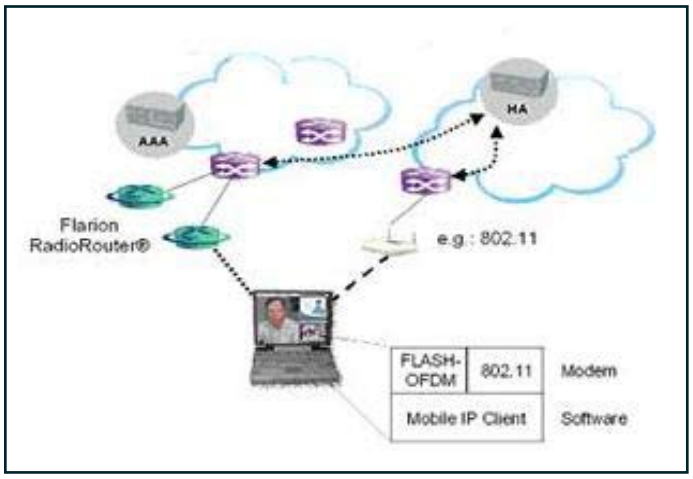

Fig. 1: Wi-Fi – FLASH-OFDM Inter Technology Hand-off

FLASH-OFDM technology is the only really mobile all-IP based broadband on the markets. It doesn't suffer from the Wi-Fi network like heavy system structure slow access times. The manufacturer promises from full mobility, meaning data exchange at a very high speed. FLASH-OFDM uses so called reactive make before break as an enhanced fast mobile IP handoff to ensure the seamless handoff in the situation where naturally a new care-of-address has to be delivered at the same time with physical channel handoff. And this has to be without packet lost.

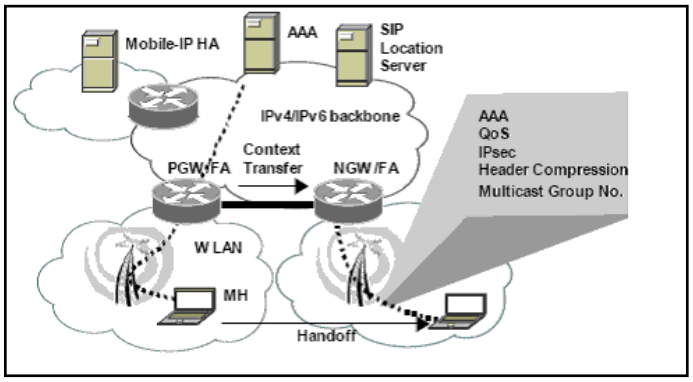

Fig. 2: Context Transfer in IP Based Network

The technology is based on context transfer extension, which is network methodology that aims to reduce the negative impact just like security that cause by simultaneous hand-off and mobile IP change from one network to another.

III. Access Schemes Involved in 4G

The access techniques are become enhanced, efficient and become scalable according to the time. The first generation wireless standards used plain TDMA and FDMA. In the wireless channels,

TDMA proved to be less efficient in handling the high data rate channels as it requires large guard periods to alleviate the multipath impact. Similarly, FDMA consumed more bandwidth for guard to avoid inter carrier interference. So in second generation systems, one set of standard used the combination of FDMA and TDMA and the other set introduced a new access scheme called CDMA. Usage of CDMA increased the system capacity and also placed a soft limit on it rather than the hard limit. Data rate is also increased as this access scheme is efficient enough to handle the multipath channel. This enabled the third generation system to used CDMA as the access scheme IS-2000, UMTS, HSXPA,1XEV-DO, TD-CDMA and TD-SCDMA. The only issue with CDMA is that it suffers from poor spectrum flexibility and scalability. Some of the new access schemes like Orthogonal FDMA (OFDMA), Single Carrier FDMA (SC-FDMA), Interleaved FDMA and Multi-carrier code division multiple access (MC-CDMA) are gaining more importance for the next generation systems. WiMAX is using OFDMA in the downlink and in the uplink. For the next generation UMTS, OFDMA is being considered for the downlink. So in contrast IFDMA is being considered for the uplink since OFDMA contributes more to the PAPR related issues and results in nonlinear operation of amplifiers. IFDMA provides less power fluctuation and thus avoids amplifier issues. Similarly in MC-CDMA is in the proposal for the IEEE 802.20 standard. These access schemes offer the same efficiencies as older technologies like CDMA, which is also be useful for achieving the scalability and higher data rates. One of the other advantage of the above mentioned access techniques is that they requires less complexity equalization at the receiver. Apart from that to improve in these multiplexing systems, improved modulation techniques are being used. Whereas earlier standards largely used Phase-shift keying, more efficient system such as 64QAM are being proposed for use with the 3GPP Long Term Evolution standards. The 3GPP is currently standardizing LTE Advanced as future 4G standard. A first set of 3GPP requirements on LTE Advanced has been approved and the working groups are currently evaluating various proposals for standardization.

IV. FLASH-OFDM Mobile Broadband Network

With reference, Flarion Technologies has developed Orthogonal Frequency Division Multiplexing Access (OFDMA) technology and FLASH-OFDM technology for mobile broadband Internet Protocol services. Its product includes the Radio Router base station, modems ie PC card and desktop modem, embedded chipsets and system software to create an end-to-end FLASH-OFDM network for mobile operators. The FLASH-OFDMA technology to facilitate the design of FLASH-OFDM enabled networks and computing devices, such as notebook PC's, Handheld PC's, personal digital assistants PDA's, web tablets and handsets. The FLASH-OFDM is a Pre-Standard of IEEE 802.20, which is for defining MBWA ie Mobile Broadband Wireless Access to develop specifications for MAN or WAN air interface that is optimized for IP based packet data services. The target is to enable worldwide cost efficient ubiquitous always on network that is interoperable with multi-vendors, offering broadband wireless access.

OFDM is essentially identical to Coded OFDM (COFDM) and Discrete Multi-tone Modulation (DMT) and 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. The 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 rated similar to conventional signal carrier modulation scheme in the same bandwidth. The primary advantage of OFDM over signal carrier schemes is its ability to cope with severe channel conditions without complex equalization filters. Channel equalization is simplified because OFDM may be viewed as using many slowly modulated narrowband signals rather than between symbols affordable, making it possible to eliminate Inter Symbol Interference (ISI) and utilize echoes and time-speeding to achieve a diversity gain i.e. a signal-to-noise-ratio improvement. This mechanism also facilities the design of 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.

V. Operation in FLASH-OFDM

In the wired IP communication system employ a layered network protocol design, made up of layers that perform certain functions in the network. The physical, medium access control (MAC) link and network layers are responsible for network access. FLASH-OFDM takes the same approach and applies it to a wireless medium. The physical layer, also known as the pipe, deals with the physical means of sending data over a communications medium. The MAC layer controls access to that pipe and shares it among many users, while the link layer uses procedures and protocols to carry data across it. Finally, the network link is responsible for routing within the wireless network, as well as for determining how data packets are transferred between modems. FLASH-OFDM is a vertically integrated design spanning the physical, MAC, and link layers, while the network layer and the remaining layers are horizontally layered, inter-networked and purely IP-based, enabling reuse of existing off-the-shelf IP infrastructure equipment and protocols. This all-IP infrastructure is one of many reasons for which FLASH-OFDM is able to delivers a user experience that mirrors a wired broadband connection.

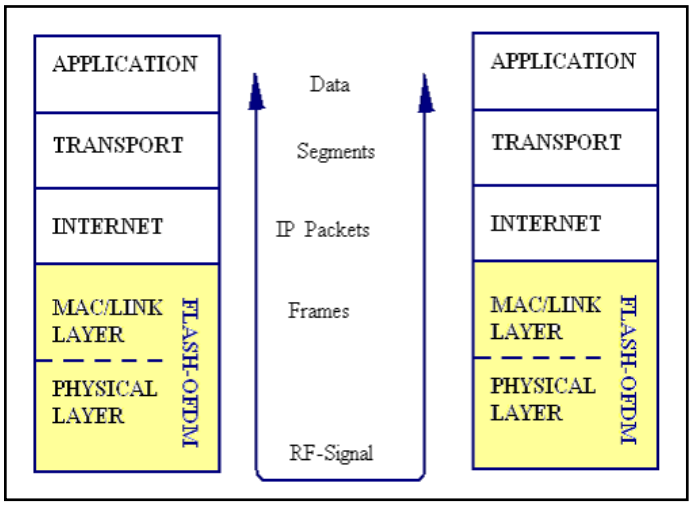

Fig. 2: FLASH-OFDM Deployment in OSI Model Illustration

The various operators are able to connect FLASH-OFDM can be used as a stand-alone network or 2G and 3G operators can use it as data overlay to their existing networks by using Flarion's 3G extension in their base stations.

VI. Security And Services in 4G

Wireless network face additional security challenged compared to the wired networks because the data is travelling over free space.

In layered network system like FLASH-OFDM each layer has to be properly protected. Characteristics to the protection of any kind is that it decreases the system performance, so the methods that are used have to be both reliable and resource saving. FLASH-OFDM provides secure and resource saving radio communication with its proprietary technology solutions.

Virtual Private Network (VPN) is a private network that communicates via publicly used network infrastructure. Talking about WAN's, VPN can be implemented in various ways using facilities provided for network layer. FLASH-OFDM is the first technology that facilitates this feature in mobile. FLASH-OFDM access network supports mutual authentication, thus allowing remote accessibility for VPN protocols.

Voice over Internet Protocol (VoIP) enables voice to be sent over the Internet. All the voice is sent in packets. Voice transfer challenges even via ordinary DSL connection provided TCP/IP supported voice traffic let alone radio channel data traffic. Voice sets strict real time traffic demands to a comparably light data load. This setting sets its demands both to physical and network layers. FLASH-OFDM supports voice traffic by its ability to accommodate Quality of Service ie QoS, that's retailed for voice. That is high enough access priority with comparably low data transfer rates.

FLASH-OFDM's all IP network provides a wide variety of facilities that are not provided by FLASH-OFDM technology itself but rather its ability directly connect to the IP network. By supporting an evolution of varying IP standards together with high functionality radio channel FLASH-OFDM is a facilitator platform for a wide variety of IP based services.

It also support Multicast. In multicast the data is simultaneously being sent to a several interested parties. The motivation for multicast is efficiency in the use of network capacity. Especially important this is in case of wireless channel capability, which is a scarce resource. To mention some application that utilize multicast, they are group push-to-talk, video conferencing, distance learning and distribution of software and news delivery. Native IP multicast is a technology, where a single multicast packet of data is sent to multiple recipients only once in network layer. Attending recipients are registered to multicast session. FLASH-OFDM supports IP multicast in link layer by accommodating a feature that when the recipients are located in the same cell, the download data is sent simultaneously in one data stream to all of them, thus saving radio resources.

VII. Conclusion

People in society continue to demand quicker and easier access to their information. As expectation rise from these consumers, providers will continue to try and upgrade their systems. It seems as if new devices that use wireless networks come out every month, these consumers will continue to buy them. The answer to these consumer is using 4G as a widespread wireless standard while providers bolster the security aspects of their devices. The demand from the wireless society of today has found its solution to delivers their data as quickly as possible and it is fourth-generation technology.

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Nikhil Ranjan is working as an Assistant Professor in the Tula's Institute, Dehradun (An Engineering & Management College), UK, India.

Madhu Thapa is working as an Assistant Professor in the Tula's Institute, Dehradun (An Engineering & Management College), UK, India.

Vandana Bharti is working as a Lecturer in the Tula's Institute, Dehradun (An Engineering & Management College), UK, India.

Sonia Chhetri is working as a Lecturer in the Tula's Institute, Dehradun (An Engineering & Management College), UK, India.