ABSTRACT:

Open BTS is a software based GSM access point which allows GSM compatible mobile phones to be used as SIP endpoints in voice over IP. Software define radio or SDR, the platform on which open BTS is implemented, is a radio communication system in which components that are generally implemented on hardware, are instead implemented by means of a software on a computer or an embedded system. The high cost and the intricacies of setup of traditional base station makes people in sparsely populated low income rural areas unable to have access to the services of mobile communication system. However, the open BTS and software defined radio platform together solve this problem, by enabling an easy and low cost deployment of a BTS, and providing a framework for installing the various software needed to establish a 2G network and provide short messages and short communication services.

INTRODUCTION:

The past few decades have witnessed a remarkable development in the area of digital mobile networks. The expansion of mobile services and radio has changed the way we communication and transmit information. It is known that the deployment of the traditional GSM base - station requires signal towers and expensive RF equipment [1]. High development cost and low profits make local telecom providers reluctant to build GSM towers in geographically isolated areas or the less populated areas. Due to this reason, providing network connectivity in low-populated and low income rural areas is in constant research.

Even though the concept of "Software Defined Radio" was first proposed in 1991, their origin can be traced back to the 1970s in the defense in both the U.S. and Europe. SDR is a radio communication technology which relies on Software defined wireless communication protocols instead of hardwired implementations [6]. Frequency band, air interface protocol and functionality can be upgraded with software download instead of a complete hardware replacement [2].

Furthermore, GNU Radio is an open-source software development toolkit that provides a signal processing blocks to implement software radios, based on which new communication algorithms, such as novel code/decode or modulation/demodulation schemes can be easily implemented through software programming. GNU radio can be developed over many kinds of hardware platforms, among them the most popular is the Universal Software Radio Peripheral (USRP). Based on GNU Radio and USRP, a simple GSM base-station that provides communication services for mobile users has been built quickly. Another advantage of this simple base station is flexible to build up and remove. In this paper, the details of adopting the USRP platform has been built to build up a simple GSM base station that works on 900MHz. After installing and compiling the necessary software on the PC and running that software with USRP B200 equipment, the GSM station can provide automatic user-registration, short message and voice

communication service for mobile users. Based on the built demo system, extensive tests for its performance can be conduct.

LITERATURE SURVEY:

The term SDR stands for software-defined radio. A radio that defines in software its modulation, error correction, and encryption processes, exhibits some control over the RF hardware, and can be reprogrammed is clearly a software-defined radio. Thus, it is a radio that is substantially defined in software and whose physical layer behavior can be significantly altered through changes to its software. The functionality of conventional radio architectures is usually determined primarily by hardware with minimal configurability through software [3]. The hardware consists of the amplifiers, filters, mixers (probably several stages), and oscillators. The software is confined to controlling the interface with the network, stripping the headers and error correction codes from the data packets, and determining where the data packets need to be routed based on the header information. Because the hardware dominates the design, upgrading a conventional radio design essentially means completely abandoning the old design and starting over again. In upgrading a software-defined radio design, the vast majority of the new content is software and the rest is improvements in hardware component design.

The software-defined radio provides a flexible radio architecture that allows changing the radio personality, possibly in real time, and in the process somewhat guarantees a desired Quality of Service. The flexibility in the architecture allows service providers to upgrade the infrastructure and market new services quickly. This flexibility in hardware architecture is combined with the flexibility in software architecture, through the implementation of techniques like object oriented programming that provides software-defined radio with the ability to seamlessly integrate itself into multiple networks with wildly different air and data interfaces. In addition, software-defined radio architecture gives the system new capabilities that are easily implemented with software [4]. For example, typical upgrades may include interference rejection techniques, encryption, voice recognition and compression, software-enabled power minimization and control, different addressing protocols, and advanced error recovery schemes. Such capabilities are well-suited for 3G and 4G wireless requirements and advanced wireless networking approaches [5].

Literally, Open BTS is an open Base Transceiver Station, where a BTS is the telecom equipment which is closest to the mobile phone. On an end-user point of view, with OpenBTS, GSM phones can call each other, send SMS to each other etc. OpenBTS replaces the traditional GSM operator network switching subsystem infrastructure, from the Base Transceiver Station (BTS) [8]. Instead of forwarding call traffic through to an operator's mobile switching center (MSC) the calls are terminated on the same box by forwarding the data onto the Asterisk PBX via SIP (Session Initial Protocol) and Voice-over-IP (VoIP). OpenBTS consists of a Universal Software Radio Peripheral (USRP) board, connected on a USB port of a Linux box

running Asterisk, SM (SIP Message) Queue, SIP (Session Initial Protocol) Authserve and OpenBTS. The OpenBTS (Base Transceiver Station) is an effort to construct an open-source Unix application that uses the Universal Software Radio Peripheral (USRP) to present a GSM air interface ("Um") to standard GSM handsets and uses the Asterisk software PBX to connect calls.

The OpenBTS uses the USRP hardware to receive and transmit the GSM signalling. The Asterisk is used to interface the GSM calls between the cellular phones under the OpenBTS network [7]. The GNU Radio is a free software development toolkit that provides the signal processing runtime and processing blocks to implement software radios using readily-available, low-cost external RF hardware (in this case the USRP B200). The USRP (Universal Software Radio Peripheral) is a hardware designed by Ettus Research which allows general purpose computers to function as high bandwidth software radios. In essence, it serves as a digital baseband and IF section of a radio communication system. There are several daughterboard's that can be used with the USRP covering from DC to 5.9 GHz. In this project, USRP (Universal Software Radio Peripheral) bus series B200 has been used, in that there is an analog device AD9364 RFIC which itself performs the functions of daughter board.

A Base Transceiver Station (BTS) is a piece of equipment that facilitates wireless communication between user equipment (UE) and a network. UEs are devices like mobile phones (handsets), computers with wireless Internet connectivity. The network can be that of any of the wireless communication technologies like GSM (Global System for Mobile Communication), CDMA, wireless local loop, Wi-Fi or other wide area network (WAN) technology. GSM network exists before Open BTS. A GSM network is a complex system composed by several components. The last mile of this system is the BTS (Base Transceiver Station). The BTS is responsible to transmit and receive the RF (Radio Frequency) signals to the user terminal (cell phone, modem, etc). The BTS's (Base Transceiver Stations) are controlled by a BSC (Base Station Controller) that is connected to the MSC/VLR (Mobile Switching Center/Visitor Location Register).

Basically, the MSC/VLR is responsible to authenticate the user against the database (HLR - Home Location Register, AuC - Authentication Center). There are numerous handsets and service providers available in the market. Hence the buyers can choose from a variety of options by using GSM supporting handsets. They come with a variety of plans with cheaper call rates, free messaging facility, and limited free calls and so on. The quality of speech signal in GSM is better and also better secured than CDMA (Code Division Multiple Access). A number of value-added services such as GPRS (General Packet Radio Service) are making GSM a perfect choice. The consumption of power is less in GSM mobiles. With the tri-band GSM, one can use the phone anywhere around the world. The per-unit charge on roaming calls is higher in GSM than in CDMA. Calls made through GSM mobiles phones can be tampered.

METHODOLOGY:

The combination of the ubiquitous GSM air interface with VoIP backhaul could form the basis of a new type of cellular network that could be deployed and operated at substantially lower cost than the existing technologies. The main goal of proposing this system is to have all functions of BTS, BSC and MSC collapsed in the OpenBTS. Also one needs to make the OpenBTS able to connect to another OpenBTS. The conventional way of the OpenBTS project to do this is by operating each BTS as an access point to the IP-Network, with a GSM Um interface to connect the mobile sets (MS). The Um interface handled by the GSM side of the OpenBTS to manage connections of the MSs to the BTS. The software modules of the GSM side are the GSM stack, with its 3–layer model, and the transceiver, which acts as a baseband modem, both running on the host processor. The radio hardware is implemented on the USRP and external RF components. The software for the IP side is composed of a SIP message handler and VoIP soft switch, the Asterisk. A GSM/SIP protocol processor module reacts to the messages, including MM and CM messages, and translates the MM and CM messages between the GSM and SIP sides, completing the software suite of the OpenBTS. Non-local calls are routed by the ASTERISK soft switch as VoIP traffic through the IP-Network to the other BTS. Such architecture requires an IP-network access at each BTS location, which is a costly solution for isolated rural areas. Hence the BTS has been proposed by the use of a VoIP/GSM gateway with the name Open BTS.

CONCLUSION:

The proposed system can be deployed in rural areas at low cost. The system provides high quality of service to the voice signals. GSM is a good choice precisely because it is old and presently running from many years. As per statistics 80% of the world's carriers are using GSM. So, creating a 2G network where GSM phones starts to operate by using Open BTS network is more advantageous. Open BTS which provides a framework to create 2G network and Asterisk for switching of voice calls to the specified destination, are used. SM Queue is designed for delivering text messages and SIP Authserve for registration and to provides authentication by collecting the data of the subscribers has been designed. SM Queue, SIP Authserve and Asterisk are implemented on USRP (Universal Software Radio Peripheral) which is a hardware tool on a platform called as Software Defined Radio. 2G network was been identified in all GSM supporting handsets included in the experimental setup. The hand sets were identified with different 2G network names like Test SIM and 00101 based on the SIM module and firmware structure.

OpenBTS is a step towards the concept of SDR. OpenBTS could be considered as one of the cheapest telecommunications systems nowadays and achieving the dream of the original founders of OpenBTS to offer the poor uncovered areas in Africa with the mobile technology at a price they can afford. The whole system costs not more than 1500$. The proposed system not only offers the GSM network but also supports various communications standards within

the range of frequencies it could support. OpenBTS used state-of-the-art software and hardware components, namely OpenBTS, SIP Authserve, SM Queue, Asterisk and USRP software and hardware platforms respectively by using a USRP-B200 to give the hope to billions of people to communicate with a very reasonable price using un-modified handsets.

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