Open Source Mobile Network

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Abstract — **We present the development and testing of a cellular network built on open source technologies. This network supports voice calls and text messages within the network or between networks. The main objective of this work is to develop a stand-alone mobile network consisting of one base station and a switch, the access to which can be controlled as required. The mobile network is also connected to public networks. The designed network is based on Global System for Mobile Communications (GSM). Our work includes the configuration of the embedded hardware components, selection and integration of the proper software combination, testing of compatible versions of the software, hardware-software integration within the embedded system, and interconnecting the systems via the Internet. The key contribution and novelty of the project is the development of a stand-alone mobile network base station/ switch using the Universal Software Radio Peripheral (USRP) and a Banana Pi device.**

Keywords— Software defined radio, open source, mobile communication, switching

I. INTRODUCTION

The tendency of creating one's own mobile network using Software Defined Radios (SDRs) has been increasing among the research community as well as in the commercial sector. The main objective of this work is to develop a stand-alone mobile network, the access to which can be controlled as required. The mobile network should be connected to commercial networks.

There are two main components in this architecture, the radio front-end hardware and a suite of open source signal processing, communication and control software. The Universal Software Radio Peripheral (USRP), a SDR Device is used as the radio front-end that provides the air interface for the mobile stations. This hardware is controlled by a set of open source software which is implemented and integrated in a single board computer, namely a Banana-Pi board. A software telephone Private Branch Exchange (PBX) implementation allows the registered phones to communicate with each other and also allows to get connected to the Public Switched Telephone Network (PSTN) or Voice over IP (VoIP) service providers. Therefore, two different stand-alone systems are interconnected through the Internet by establishing a Session Initiation Protocol (SIP) trunk. Fig. 1 shows the hardware /software architecture of the base station.

The main communicator between the hardware and the software is the USRP Hardware Driver (UHD Drive). GNU Radio provides the runtime signal processing and communicating with external hardware.
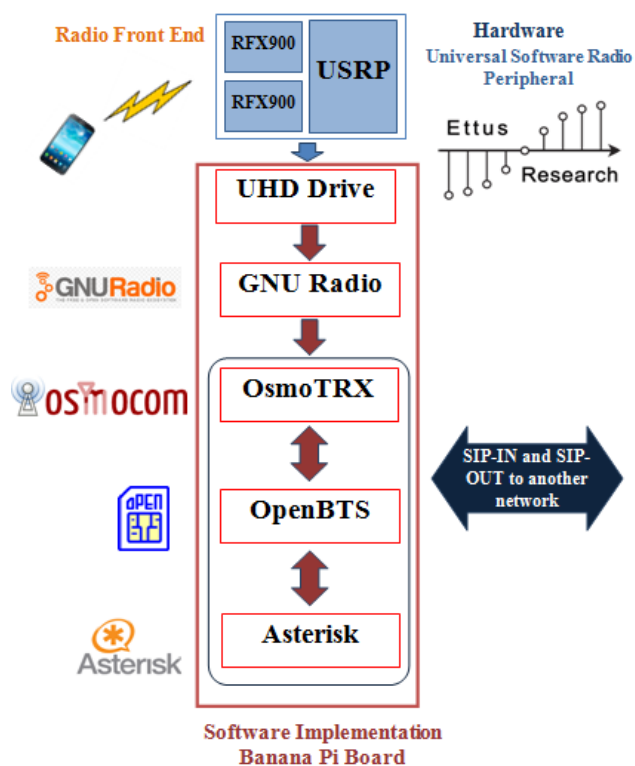

Fig. 1. Overall Network Architecture describing components of Hardware Platform and Software

OpenBTS software is a Linux based application. Also it allows SDRs to present a GSM air interface for GSM-Compatible mobile phones to be used as SIP clients in VoIP networks. OpenBTS has all the configuration parameters of a base station. OsmoTRX is an SDR transceiver that implements the physical layer of a Base Transceiver Station (BTS). OsmoTRX is based on transceiver code from the OpenBTS project. Asterisk is a software telephone PBX implementation which allows the registered phones to communicate with each other and also allows to get connected to PSTN or VoIP service providers. OpenBTS uses Asterisk to register each connected mobile user overs it's Subscriber Identity Module (SIM) as a SIP Client.

After setting up two stand-alone networks, two public Internet Protocol (IP) addresses are assigned to the systems.