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Performance Evaluation and Measurement for Energy Efficient Wireless Networks

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Abstract

Growth of high-data-rate applications is increasing day by day, more energy is consumed in wireless networks to guarantee quality of service. The data rate expected to meet in latest 4G is up to 1Gbps. Increasing energy efficiency in wireless communications network has attracted the attention recently. In this research different performance metrics that are to be measured and analyzed viz. no. of nodes used, power transmission by nodes, wireless channel type, energy efficiency (in bits/joule) data rate in bits per channel use, SNR (signal-to-noise ratio), power transmission (Pt), subcarrier bandwidth, protocol & throughput. The various performance measurements are on the basis of optimal metrics analysis for the wireless communication system to be selected. The parameters measured and reported are power transmission of 5-10 dB, energy efficiency in bits per Joule as 4×10^{20} , data rate in bits per channel use as 4, SNR as 10dB, probability of error as 10^{-4} , distance between nodes as 100m, FFT size as 512, protocol as Medium Access Control (MAC), throughput as 50%.

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Keywords: wireless; communication; Energy-efficient; wireless; network.

1 Introduction

The idea of wireless communications is indispensable for the full "wiring" and the provision of various telecommunications services to users everywhere: at home, in the vehicle, in institutions, in universities etc. [1]. The data transfer rate in wireless networks is less than as compared to wired networks, and also suffer from problems such as security and protection, and the problems of overlapping waves Interference.

Wireless communication was founded at the turn of the 20th century with the invention of radio. Since then, the power of fastest communication over long distance has transformed society and made the world a smaller place. Most recently, cell phones have turned traditional radio broadcasting medium and one-way model into two-way

conversations. With technologies like 4G LTE, Wi-Max, Wi-Fi etc., computer data networks have brought wireless communications into the 21st century [2].

1.1 Background

Increasing the energy efficiency in wireless communication networks has attracted the attention recently. new network architectures like heterogeneous networks, distributed antennas, multi-hop cellular, etc., as well as radio and network resource management schemes like various cross layer optimization algorithms, dynamic power saving, multiple radio access technologies coordination, etc. have been proposed to overcome this issues. More than 50% of the energy is consumed by the radio resources, where 50-80% energy is used by the power amplifier (PA), it is pointed out that the energy bill accounts for approximately 32% in India[2].

Energy-efficient circuit design, high-efficiency PA, digital signal processing (DSP) technologies, advanced cooling systems, adequate EE metric and energy consumption models, adaptive traffic pattern and load variation algorithms, and energy-efficient network resource management, as well as MIMO and OFDM techniques, are the highlights of energy-efficient wireless communications. The Fig 1 shows wireless communication network which has various wireless networks such as wireless mesh network, wireless sensor network, mobile ad-hoc network and how it can be interconnected.

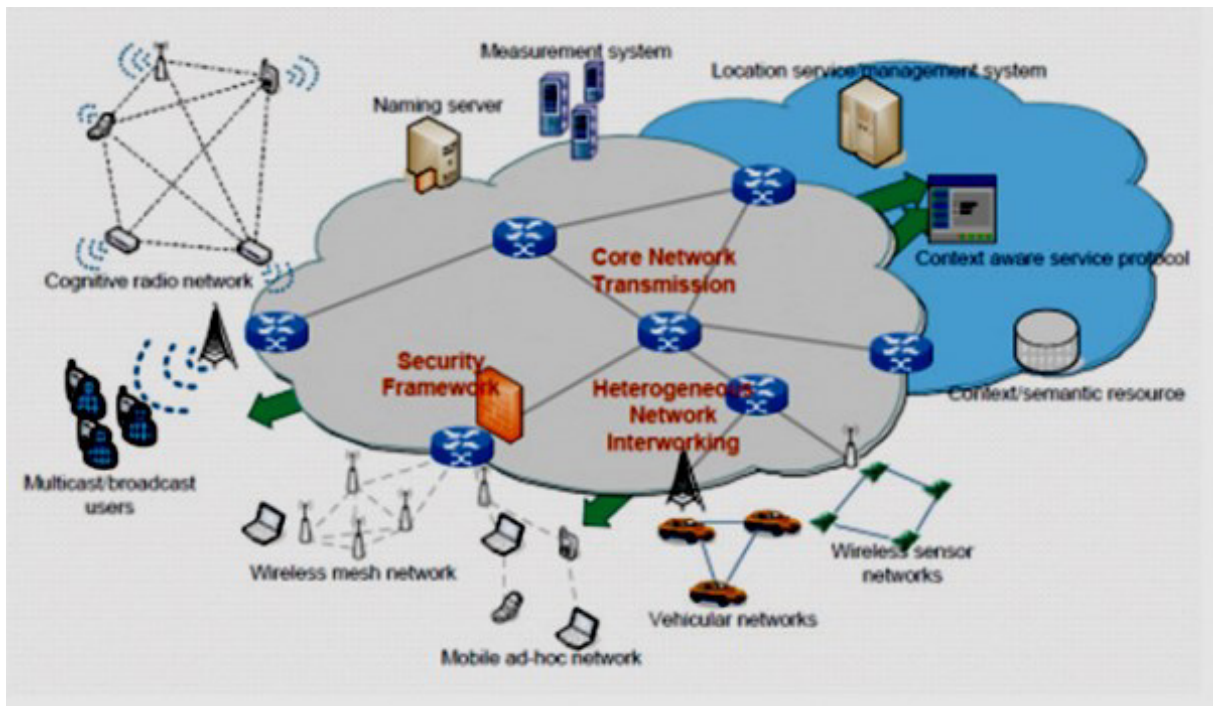


Fig 1 Wireless communication network

1.2 Motivation

The motivation behind research work is to measure optimal performance of wireless communication network using various metrics. In wireless communication network there are many systems are available such as Bluetooth networks, Wi-Fi networks, cellular networks etc.

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