Implementation of Multicast Reliable ETT based Routing on VOIP Codecs over WMNs

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Abstract— Wireless Mesh Networks have emerged to be a new cost-effective and performance-adaptive network paradigm for the next generation wireless Internet. Targeting primarily for solving the well-known last mile problem for broadband access, WMNs aim to offer high-speed coverage at a significantly lower deployment and maintenance cost. In this proposed work we have experimentally analyze the impact of different voice codecs (compression of audio signals) on wireless multihop multichannel mesh network. Here, we simulated and compared four different voice codecs against Reliable multicast routing and WCETT protocols using network simulator such as ns2.

Key words: WMNs, WCETT, ETT, VoIP

I. INTRODUCTION

A. Definition

Wireless Mesh Network (WMN) is a highly growing wireless technology for several rising and commercially fascinating applications such as broadband networking in homes or corporate offices, networking with community and neighbourhood, coordinated network management, intelligent transportation systems. Internet service providers (ISPs) and other end-users are gaining rapid boost to instigate robust and reliable wireless broadband service accessible at a reasonable cost.

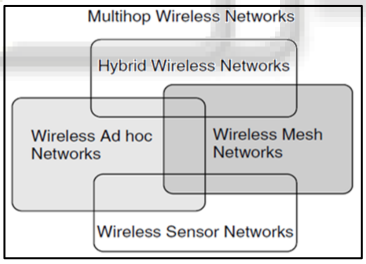

Fig. 1: Classification of multi hop wireless networks.

B. Vision

Wireless networking is a promising expertise that allows users to access information and services electronically, in spite of their geographic arrangement. The use of wireless communication between mobile users has become increasingly popular due to recent performance advancements in computer and wireless technologies. This has led to lesser prices and higher data rates, which are the two major reasons why mobile computing is likely to see progressively more widespread use and applications [13].

C. Motivation

In the recent past, there has been a tremendous proliferation of VoIP services in both the scientific and industrial communities. One of the majors reasons for the steady growth of VoIP is cost savings that achieved by VoIP by using existing data infrastructures along with easy deployment benefits. Providing VoIP users with true mobile phone services along with the freedom of roaming requires wide area wireless coverage, and multi-hop wireless mesh networks have been considered a practical solution for wide area coverage.

D. Differences between Ad-hoc Wireless Networks and Wireless Mesh Networks

Issue	Wireless Ad Hoc Networks	Wireless Mesh Networks
Network topology	Highly dynamic	Relativity static
Mobility of relay nodes	Medium to high	Low
Energy constraint	High	Low
Application Characteristics	Temporary	Semipermanent or permanent
Infrastructure Requirement	infrastructure less	Partial or fully fixed infrastructure
Relaying	Relaying on mobile nodes	Relaying on fixed nodes
Routing performance	Entirely distributed on-demand routing favoured	Fully distributed or partly dispersed with table-driven or hierarchical routing
Deployment	Easy to deploy	Some planning required

Table 1: Comparison between the wireless ad hoc networks and WMNs.

E. Characteristics of WMNs

Some of the benefits and characteristics of wireless mesh networks are mentioned as follows:

- Advanced Wireless Radio Technologies
- Integration and Interoperability of Heterogeneous Networks
- Increased Reliability
- Low Installation Costs
- Large Coverage Area
- Automatic Network Connectivity
- Mobility Support. [12]

II. RELATED WORK

Francesca Martelli et al. [1], evaluates the performance of VOIP voice compression algorism in terms of both throughput and jitter through on-the-road measurements, investigating also the effects of inter-vehicle distance and speed on VoIP performance. Simulation marks of their learning show that VoIP performance is fairly poor, especially due to an exceptionally large number of lost packets under all projected set-up.

Q Liu et al. [2], the authors developed three-step solution starts by constructing a set of routing trees and seek to balance the traffic among tree links. In the second step, it performs interface allocation for each node in the tree with the objective of balancing traffic load among the links served by every node. Ultimately, it performs channel allocation and antenna orientation to smallest interference while covering all the anticipated neighbours of the node.

S Khan et al. [3], To prefer a routing path in WMNs, the routing algorithm necessitates to consider network topology, and the routing path assortment is to twist with resource allocation, interference lessening and rate edition in multiple hops. An MR-MC routing protocol not only require to select a path between different nodes, but it also require to select the most effective channel or radio node on the path.

Ravi Shankar Ramakrishnan et al. [4] Converged IP networks look for to incorporate voice, data, and video on the similar infrastructure. The authors have described the a variety of codecs in VoIP performance and analysed three generally used narrow band codecs namely G.711, G.723 and G.729 using peer-to-peer network circumstances. It can be examined from the imitation results that G.711 is an idyllic solution for PSTN networks with PCM format. G.723 is used for voice and video conferencing however provides lower voice quality. Music or tones such as DTMF cannot be transmitted reliably with G.723 codec. G.729 is predominantly used in VoIP applications for its low bandwidth necessity.

Yusuke Hiwasaki et al. [5], The algorithm of ITU-T G.711.1, a wideband scalable codec of G.711 projected by ETRI, France Telecom, Huawei Technologies, Voice Age and NTT, was superior. G.711.1 is intended to attain a very short stoppage and low complication. The bit stream has an embedded structure where the core layer is generated by a G.711 compatible codec utilized with a noise shaping feedback. On top of the core layer, there are two enhancement layers: a lower band enhancement layer for the refinement signal encoded with a dynamic bit-allocation, and another one for higher band encoded with an interleaved CSVQ in MDCT domain. The emphasis in the codec design was on complexity.

H Skalli et al. [6], There are two main methods to measure interference. The first is based on topology characteristics, for example by counting number of neighboring nodes using the same channel The second is based on measuring traffic load carried in neighborhood rather than only the number of neighboring nodes using the same channel .

L Chen et al. [7], the authors planned a joint topology control and routing (JTCR) protocol for MR-MC networks to formulate use of together channel multiplicity and spatial reusability, which concentrate on communal topology manage and routing problem in an IEEE 802.11-based MR-MC wireless mesh networks. An Equivalent Channel Air Time Metric (ECA TM) was developed to quantify the difference of various adjustment candidates.

J Tang et al. [8], the authors scrutinized interference-aware TC and QoS routing in multi-channel wireless mesh networks based on IEEE 802.11 with lively traffic. They described an original definition of co-channel interference to accurately capture the influence of the interference.

P. Bahl et al. [9], In such architecture, every mesh router is equipped with multiple NICs and each NIC can operate on multiple frequency channels. In MR-MC architecture, multiple transmissions/receptions can take place simultaneously, and adjoining links allocated to dissimilar channels can carry traffic free from interfering. However, MR-MC architecture use poses some new issues. In general, these issues include topology control, power control, channel allocation, link scheduling, and routing.

A. Raniwala et al. [10], IEEE 802.11a band assign 3 and 12 non-overlapping frequency channels, respectively. Though still there exist significant interference between these standard non-overlapping channels in the current IEEE 802.11 hardware, this problem can be handled by providing better frequency filters in hardware for multi-channel use. So, the use of single-radio multiple-channels (SR-MC) has been proposed to enhance the performance of WMNs.

KN Ramachandran et al. [11] In MR-MC WMN, along with power control (PC), TC is linked with channel assignment (CA) in many ways. In handling the connectivity concern in MR-MC WMNs, the CA verdict can in reality modifies the network topology, which is a main differentiation between the SR-MC networks. The trouble of TC in MR-MC WMNs has automatically been handled in juxtaposition with CA.

III. Proposed work

A. Problem Definition

Multi radio Multi channel Wireless Mesh Network uses multiple network interfaces per node allows simultaneous transmission and reception on different interfaces tuned to different channels, which can substantially improve multi hop throughput. A VoIP system consists of an encoder-decoder pair and an IP transport network. The preference of voice codec is vital for the reason that it has to vigorous the particularities of the transport network. Compressing voice signals even as observance the quality perceived by users at acceptable levels represents a daunting confront. The methods that have been proposed for the compression of audio signals, which are referred to as voice codecs. Voice codecs are the algorithms that facilitate the scheme to bear analog voice over digital lines. There are several codecs, varying in complexity, bandwidth needed and voice quality. The more bandwidth a codec necessitates, in general the better voice superiority is One problem that arise in the delivery of high-quality speech is network competence in a linear topology; capacity degrades with the number of hops. Thus, the major problem in a multihop network is performance degradation with increasing number of hops. A simple idea for improvement would be to just increase the number of interfaces in each node. A naive use of multiple interfaces in a string would be to use one interface on a channel for the forward traffic and a second interface on a second channel for the reverse traffic, which should provide double capacity.

B. Objective of proposed work

The main objective of this proposed work is to experimentally analyze the impact of different voice codecs (compression of audio signals) on wireless multihop multichannel mesh network. The detailed objectives of this research are mentioned as here under.

- To study about various techniques used in routing schemes of multi radio multichannel wireless mesh network.
- Implementing reliable multicast routing protocol that provides alternate paths with support of intermediate nodes and it reduces the RREQ frequency. Advertised Hop Count is used to store extra information for each alternate path such as next hop, last hop, Queue length, Residual energy, importance factor and time out. in ns2.
- Implement Connected Low Interference Channel Assignment scheme as channel assignment scheme and VOIP module that support different voice codecs namely G.711, G.723.1, G.729A and GSM.AMR over ns2 simulator.
- Simulate and compare four different voice codecs against Reliable multicast routing and WCETT protocols using network simulator such as ns2.
- Get the results to ensure Imperceptibility and evaluate reliable and efficient speech compress codec and routing scheme over MR-MC WMNs.

IV. RESEARCH METHODOLOGY

A. *Network Simulator 2 (NS2)*

Network Simulator-2 (ns-2) is an open source, discrete event network simulator.

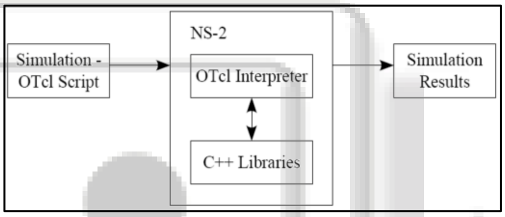

Fig. 2: Data flow for One Time Simulation.

V. RESULTS AND DISCUSSION

A. *Simulation Environment*

Parameter	Value
Simulation area	1500m x 1000m
Antenna	Omni antenna
No. of nodes	30
No. of interfaces/ node	2
No. of channels/ node	2
Voice codecs	G.711, G.723.1,G.729A and GSM.AMR
Max queue length	50
Traffic	FTP
Routing protocol	Reliable multicast routing protocol, WCETT
Transport Layer	UDP
Channel Assignment Strategies	CLICA

Table 2: Shows the simulation environment

B. *Impact of voice codecs on PDR*

Figure 2 shows the effect of VOIP codecs on packet delivery ratio against proposed reliable multicast and WCETT roting schemes.Simulation results shows that for different VOIP codec schemes, proposed reliable multicsting scheme gives better performace for other WCETT routing schmes. From figure 2, it is observed that audio G.723.1 compression scheme takes gives better packet delivery ratio than other schemes against proposed multicasting schemes over MRMC WMNs.

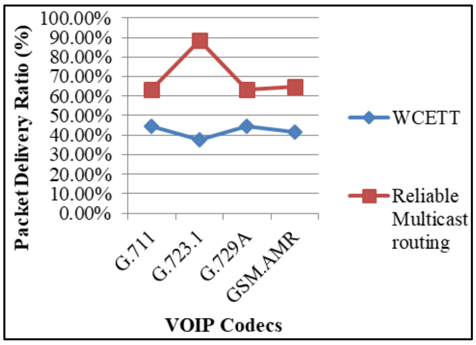

Fig. 2: PDR for different VOIP codecs against Reliable multicast and WCETT protocols.

C. *Impact of voice codecs on Average End to End Delay*

Figure 3 shows the Average delayfor different VOIP codecs under proposed multicast and WCETT routing protocol. Simulation results shows that audio G.723.1 and G.729A compression scheme takes longer time than G.711 and GSM.AMR schemes against both protocols for MRMC wireless mesh network.

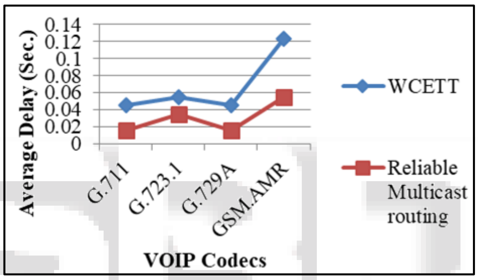

Fig. 3: Average delay for different VOIP codecs against Reliable multicast and WCETT protocols.

D. *Impact of voice codecs on Routing Overhead*

Figure 4 shows the routing overhead for different audiocompression strategies under multicast routing and WCETT protocol.Simulation results shows that proposed routing protocol gives better performace for WCETT routing scheme. IT is also observed that G.711 and G.729A having lower routing overhead as compare to other VOIP codec schemes.

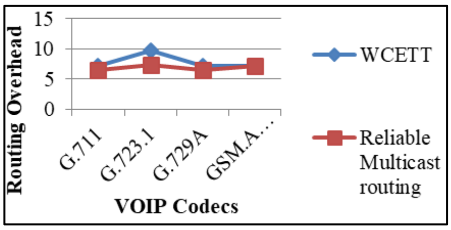

Fig. 4: Routing overhead for different VOIP codecs against Reliable multicast and WCETT protocols.

E. *Impact of voice codecs on Throughput*

Throughput is the proportion of total amount of delivered or received data packets to the total period of simulation time. Figure 5 shows the impact of narrow band voice codecs on the throughput for proposed multicast reliable routing and WCETT protocols on MRMC WMN environmrnt. Simulation results shows proposed routing protocol that gives better performance for G.729A and GSM.AMR.

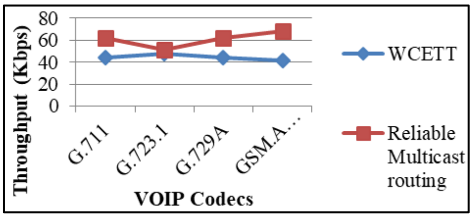

Fig. 5: Throughput for different VOIP codecs against Reliable multicast and WCETT protocols.

VI. CONCLUSION AND FUTURE SCOPE

In this paper, we have studied the problem of routing and channel assignment and presented an alternative approach to store multiple primary paths in a single route discovery cycle to reduce the effect of interface constraint and other importance factor. A key issue to be addressed in multi-radio mesh network architecture is the Channel assignment problem that involves assigning (mapping) channels to radio interfaces to achieve efficient utilization of available channels.

Proposed scheme provides alternate paths with support of intermediate nodes and reduces the RREQ frequency. In this work, the effect of four different VOIP audio compression strategies namely G.711, G.723.1, G.729A and GSM.AMR is examined on to evaluate the performance. We have identified the key challenges associated with VOIP is to choice efficient voice codec for radio interfaces in a multi-radio wireless mesh network.

Performance in multihop wireless networks is known to degrade with the number of hops for UDP traffic. From simulation results, it is observed that VOIP audio compression scheme namely G.729A and G.723.1voice compression codecs has best all-round performance under CLICA channel allocation scenario for proposed multicast routing protocol.

Further, in this direction the future work is to consider other VOIP narrow band audio compression schemes such as GMS.EFR, G.726, G.729D/E, GSM.FR and GSM.HR etc. and other mesh routing protocols.

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