# Multi Hop Optimal Broadcast In Wireless Nodes With Self-Interference Cancellation

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***Abstract*—Transfer of data in a wireless medium is a great challenge in itself. Most of the time it occurs to use several intermediate nodes to send a datum from one node to another node in an intra or inter network. This transmission requires several hops to reach the destination. This is known as multi hop transmission. We propose a framework called as Collaborative Harmonized Open Radio Ubiquitous System (CHORUS) to avoid the interference and collision at the receiver end by use of CSMA/CR technique. Doing this the efficiency and scalability of broadcast service improves by allowing packet collisions. The simulation is done in DOT NET.**

***Keywords*— *Multi hop, CHORUS, CSMA/CR.***

## I. INTRODUCTION

The 802.11-based CSMA/CA model is the backbone of the conventional wireless broadcast protocols, which avoids interference and collision by following the conservative scheduling of transmission of data packets. But the broadcast performance degrades significantly in large-scale networks. Hence requires a better solution to be looked upon. Keeping this in mind, in this paper, we propose a new protocol called Chorus which improves the efficiency and scalability of broadcast service with a MAC/PHY layer that allows packet collisions at the receiver end to occur. The central idea for the collision to be allowed is such that packets carrying the same data can be effectively detected and decoded, even when they overlap with each other and not have considerable signal strength differences. It significantly improves the transmission diversity and spatial reuse in wireless broadcast.
In the Dynamic access to the free spectrum, cognitive radio plays a very vital role. This concept of cognitive design could be extended to vertical/horizontal hybrid scales, wherein the status of multiple systems/layers and behaviours of equipments/human beings can be studied to further improve the efficiency in collaborative ubiquitous environments. [1]

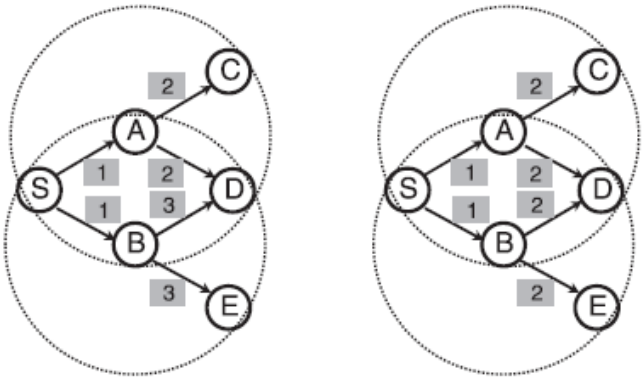
## II. EXISTING SYSTEM

Two factors that define the efficiency of a network is high packet-delivery ratio (PDR) and low latency. The network engineer would always desire to have a node with high PDR and low delay. To improve PDR in a network, nodes act as a relay that forwards and retransmits data packet from the source node to the destination node through various intermediate relay nodes and thereby creating retransmission diversity. But this retransmission of redundant data causes wastage of bandwidth, power and other resources. So it becomes a trade off between the latency and resource usage. The number of transmissions must be kept to minimum, since redundant retransmissions leads to wastage of channel time, and even slowing down the packet's delivery to the edge of the network. Hence a close balance is needed to be maintaining the values of PDR and delay. A typical scenario where CSMA/CA restricts the broadcast efficiency. With CSMA/CA, the delivery of one packet from source S to all other nodes requires at least three time slots. [2] A and B cannot transmit concurrently, even if they have to forward the same packet. Suppose node D in the network had already received the packet, while C and E await its retransmission from A and B, respectively. An obvious collision at D is expected, and an optimal protocol is required that allows A and B to transmit the packet concurrently. However, this is not possible in CSMA/CA, as one of them will defer its transmission immediately upon sensing the other's activity. Chorus is built upon the key insight that packets carrying the same data can be detected and decoded, [2] even when they overlap at the receiver with strength almost equal to each other and thus significantly using transmission diversity and special reuse.

### A. Disadvantages

There are few disadvantages related to the existing system and these can be listed as follows:

- In this type of technique the nodes, to avoid collision, has to wait for its turn to transmit its data packet upon sensing the channel to be busy. Thus there is no guarantee of when and after how long would it get chance to transmit.
- The time slot used by the nodes is also unnecessary. As in one slot only one node can transmit its data to avoid collision.
- Then there are too many control signals involved that uses the resources unnecessarily hence there is lot of wastage in terms of bandwidth and power and other resources. And bandwidth being the sparse quantity we cannot afford it to be wasted.




(a)802.11 (CSMA/CA) (b)Chorus (CSMA/CR)

The above figure shows the difference between the use of two time slots, showing that the chorus technique is more efficient in utilizing the time slots, as to send one data packet from sender (S) to receiver (R) it requires just two time slot whereas for the same scenario conventional CSMA/CA is requiring three.

## III. PROPOSED SYSTEM

Chorus technique overcomes the shortcomings of the conventional method and also has several advantages over it like efficient use of resources, better spatial re-use, efficient collision tolerant protocol, and also has better transmit diversity without consuming extra channel time.
It solves the collision at symbol level interference.

### *A. Chorus Iterative Decoding Algorithm:*

- Interference cancellation resolves overlapped packets by first decoding the one with stronger RSS, treating the weak packet as noise, and then subtracting the decoded strong packet, thus obtaining the weak one.
- It applies to the case where two different packets collide with disparate strengths.

  In Chorus even two packets with similar strengths can be effectively decoded because each sees the other as a complement rather than an interferer.

- The two original packets are recovered from two known sums, similar to solving a linear set of equations. In the physical layer, Chorus uses a collision resolution mechanism similar to ZigZag, but it resolves multiple packets from a single collision, given that the packets are identical.
- In addition, Chorus aims to improve broadcast efficiency in wireless mesh networks, where it exploits transmit diversity and spatial reuse, using MAC-layer cognitive sensing and broadcast scheduling.
- The receiver then uses a match filter to detect the exact arrival time of this preamble. A matched filter is an optimal linear correlate that maximizes the SNR when correlating unknown signals with a known sequence.
- It outputs a peak value whenever the packet preamble is detected, even if the preamble is hidden in a strong noise.
- It operates continuously, so that those preambles overlapping with other packets can still be identified. The number of preambles detected in a run indicates the number of overlapping packets at the receiver.

## IV. ARCHITECTURE AND KEY FEATURES OF CHORUS

The architecture of CHORUS is depicted in Fig 1. All common wireless access networks present in the scenario like LTE/LTE-A, 3G, WiMAX, WLAN etc are attributed with the overlapping feature. This feature of this typical framework enables maximum coverage as well as large scalability over the wide range of permitted services. The cognitive protocol is connected to the backbone of access networks and it runs in the CHORUS server. The requirements are received from the user terminals as and on sensed by the multiple access networks in the environment. This information is then conveyed to the CHORUS server, where further analysis of the received data is done. As a result of which a re-configuration policy is been derived which is being carried out to the multiple access networks to achieve a Coordinated Harmonic and Ubiquitous service to the user terminals.

In order to achieve higher performance gain in the system level and to guarantee acceptability in the system, the overall system status has to be recognized by the CHORUS network. According to channel conditions, the transmission strategy is adapted by single link cognition. AMC i.e. adaptive modulation and coding is one of the most common schemes. To gather information from multiple links in the network, multiple cognition is required. The information that we are considering is the network attributes and parameters that affects the user experience.

Some nodes collaborate to transmit or receive, such as relaying [1] and coordinated multi point processing (CoMP) and the physical layer parameters are shared among the involved links and nodes in the cooperative environment.

The proposed framework enjoys the following features:

- Cognition: It refers to the recognition or rather understanding the property parameters of the entities such as link property which are like single link, multiple links or the whole network.
- Collaboration: Aided by the cognition the entire network cooperates among themselves to form a may be closed network to transmit a particular datum. The collaboration may occur within a single network or may be between different networks when network is spread or divided over heterogeneous networks.
- Ubiquitous: Ubiquitous computing (ubicomp) or can also be called as omnipresent is an advanced computing concept where computing is made to appear everywhere and anywhere. In contrast to desktop computing, ubiquitous computing can occur using any device from any location and in any format. A user interacts with the

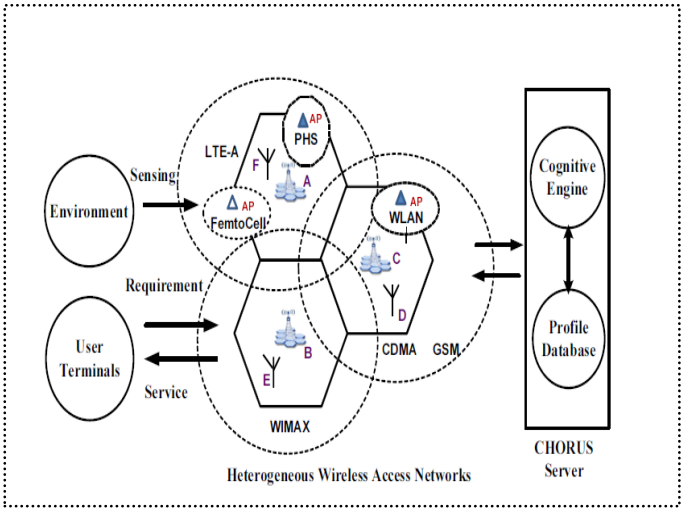
computer, which exists in various forms like laptop computers, tablets and terminals in everyday objects.

- **Harmonic Control:** The nodes are interdependent upon each other to produce the whole process of cognition and form ubiquitous network system with the collaborative feature of the nodes. Harmonization is achieved by various protocols and control laws after cognition.

Fig 1. Architecture of CHORUS

## V. EXPERIMENTAL RESULTS

We evaluate the performance of Chorus in Dot Net




environment. The algorithm was implemented and various results came out that does satisfies the aim of the paper. The aim of the paper which was to broadcast the message optimally is achieved with the implementation of CHORUS in DOT NET programming language and the same is being verified in the experimental results.

### A. SYSTEM REQUIREMENT

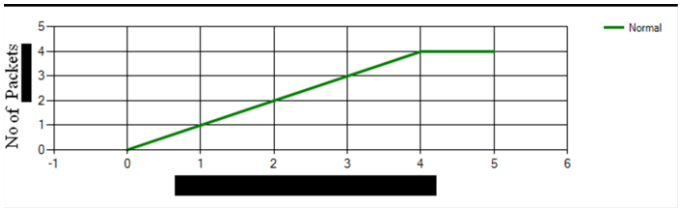
HARDWARE REQUIREMENTS:-

- Processor - Pentium –III
- Speed - 1.1 GHz
- RAM - 256 MB(min)
- Hard Disk - 20 GB
- Floppy Drive - 1.44 MB
- Key Board - Standard Windows
- Mouse - Two or Three Button
- Monitor - SVGA

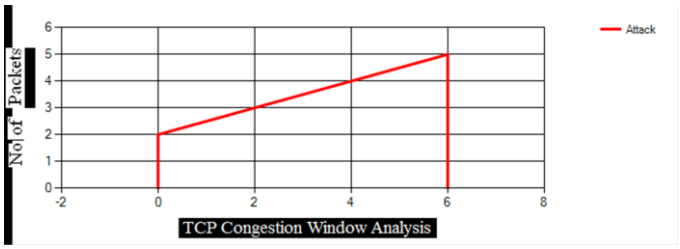
### B. SOFTWARE REQUIREMENTS:-

- Operating System : Windows95/98/2000/XP
- Front End : C#.NET
- TOOL : VISUAL STUDIO 2008

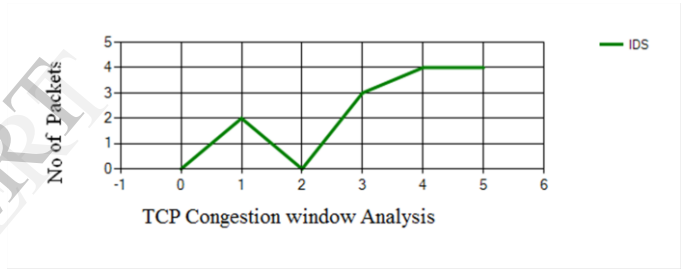
*SNAP SHOTS*




(a) Ideal case scenario when there is no delay or any attacks.




(b) When DDOS is introduced the network is interrupted and hence packet transmission is denied.




(c) Interference is first detected and then resolved at receiver end to transfer the packets.

## VI. CONCLUSION

The feasibility and advantage of collision resolution protocol is exploited with CHORUS, which allows node forwarders with the same outgoing packets to transmit roughly at the same time, and then employs physical-layer iterative decoding to resolve collisions at the receiver. By decoding multiple versions of a packet at once, Chorus achieves transmit diversity and improves loss resilience without any retransmission. More importantly, with its collision-tolerant MAC, Chorus significantly simplifies the CSMA scheduling and improves its spatial reuse.

## VII. REFERENCE

[1] Sheng Zhou, Zhisheng Niu, and Shiro Tanabe,"CHORUS: Collaborative and Harmonized Open Radio Ubiquitous Systems". 01/2012; DOI:10.1109/COMSNETS.2012.6151331 In proceeding of: Fourth International Conference on Communication Systems and Networks, COMSNETS 2012, Bangalore, India, January 3-7, 2012

[2] Xinyu Zhang and Kang G. Shin, Fellow, IEEE." DELAY-OPTIMAL BROADCAST FOR MULTIHOP WIRELESS Networks using self-interference cancellation". IEEE TRANSACTIONS ON MOBILE COMPUTING, VOL. 12, NO. 1, JANUARY 2013

[3] Giovanni Resta, Paolo Santi," Latency and Capacity Optimal Broadcasting in Wireless Multihop Networks", Information Theory, IEEE Transactions on Volume:57 , Issue: 12, Dec. 2011

[4] Gentian Jakllari, Srikanth V. Krishnamurthy , Michalis Faloutsos, and Prashant V. Krishnamurthy," On Broadcasting with Cooperative Diversity in Multi-hop Wireless Network" IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, VOL. 25, NO. 2, FEBRUARY 2007

[5] Dongxu Cao, Student Member, IEEE, Sheng Zhou, Member, IEEE, and Zhisheng Niu, Fellow, IEEE," Optimal Combination of Base Station Densities for Energy-Efficient Two-Tier Heterogenous Cellular Networks". IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, VOL. 12, NO. 9, SEPTEMBER 2013.

[6] Heni KAANICHE and Farouk KAMOUN,"Mobility Prediction in Wireless Ad Hoc Networks using Neural Networks" JOURNAL OF TELECOMMUNICATIONS, VOLUME 2, ISSUE 1, APRIL 2010.
Sudhir G. Akojwar, Rajendra M. Patrikar,"Improving Network Life Time of Wireless Sensor Networks Using Neural Network Based Classification Technique with Cooperation Routing" INTERNATIONAL JOURNAL OF COMMUNICATIONS, Issue 1, volume2, 2008.