VEERABABU KONDRA, RAJKUMAR MEDAPATI / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 2, Issue 1,Jan-Feb 2012, pp.881-886

Identifying the Possibilities of Mpt's & Mpr's Using Many to Many Communications in MANETS

VEERABABU KONDRA
MTECH STUDENT
PRAGATI ENGINEERING COLLEGE,SURAMPALEM,KAKINADA(A.P),INDIA

RAJKUMAR MEDAPATI
ASSOCIATE PROFESSOR
PRAGATI ENGINEERING COLLEGE,SURAMPALEM,KAKINADA(A.P),INDIA

ABSTRACT

A mobile ad-hoc network (MANET) is a self-configuring infrastructure less network of mobile devices connected by wireless links. In this Paper collaboration-driven approach has been introduced to share the available bandwidth in wireless ad hoc networks which can be called as many-to-many communication. Concurrent multi-packet transmissions (MPTs) and multipacket receptions (MPRs) are possible using many-to-many communication. Many-to-many communication also permits one-time multi-copy relaying of the same packet, which reduces the packet delivery delay compared to single-copy relaying without any penalty in capacity. Our scheme is based on the integration of multi-user detection and position-location information with frequency and code division in mobile ad hoc networks (MANETs). Transmissions are divided in frequency and codes according to node locations, and successive interference cancellation (SIC) is used at receivers to allow them to decode and use all transmissions from strong interfering sources. Consequently, the interference is divided into constructive interference (COI) and destructive interference (DEI).

KEYWORDS-MANETS, Many to Many, MPT's, MPR's, Transmission.

I. INTRODUCTION

The protocol stacks of wireless ad hoc networks implemented or proposed to date have been designed to try to *avoid* interference. Hence, communication protocols used in wireless ad hoc networks today are meant to support reliable communication among senders and receivers that are *competing with* one another for the use of the shared bandwidth. This "competition-driven" view of bandwidth sharing has had profound implications on network architectures and methods used to access the channel and disseminate information. Gupta and Kumar showed that, in a wireless connected network with static nodes, the throughput for each node degrades as the number of nodes increases under the competition-driven view of networking. That is, it scales as $\Theta(1/\sqrt{n}\log(n))$, 1 where n is the number of nodes in the network.

A **wireless ad-hoc network** is a decentralized type of wireless network. The network is ad hoc because it does not rely on a preexisting infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, and so the determination of which nodes forward data is made dynamically based on the network connectivity. In addition to the classic routing, ad hoc networks can use flooding for forwarding the data.

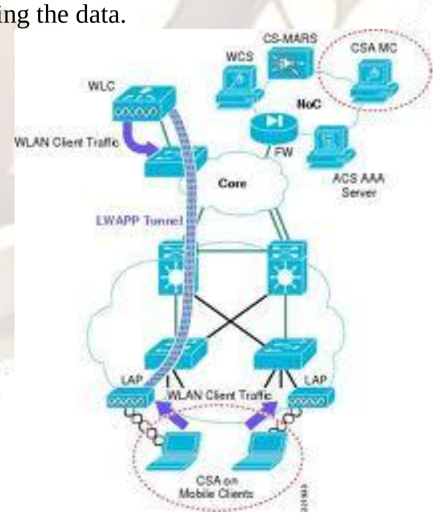

Fig 1: A Wireless Adhoc Network

The decentralized nature of wireless ad-hoc networks makes them suitable for a variety of applications where central nodes can't be relied on, and may improve the scalability of wireless ad-hoc networks compared to wireless managed networks, though theoretical and practical limits to the overall capacity of such networks have been identified. Minimal configuration and quick deployment make ad hoc networks suitable for emergency situations like natural disasters or military conflicts. The presences of a dynamic and adaptive routing protocol enable ad-hoc networks to be formed quickly. Wireless ad hoc networks can be further classified by their application:

- mobile ad-hoc networks (MANET)
- wireless mesh networks (WMN)
- wireless sensor networks (WSN)

II. PREVIOUS WORK

The term *cell* denotes the set of nodes located inside a defined area of the network. The *receiver range* of a node is defined as the radius, measured from the node, which contains all other nodes of the same cell. The *cluster* associated with a given node is the set of cells reached by the receiver range of this node.

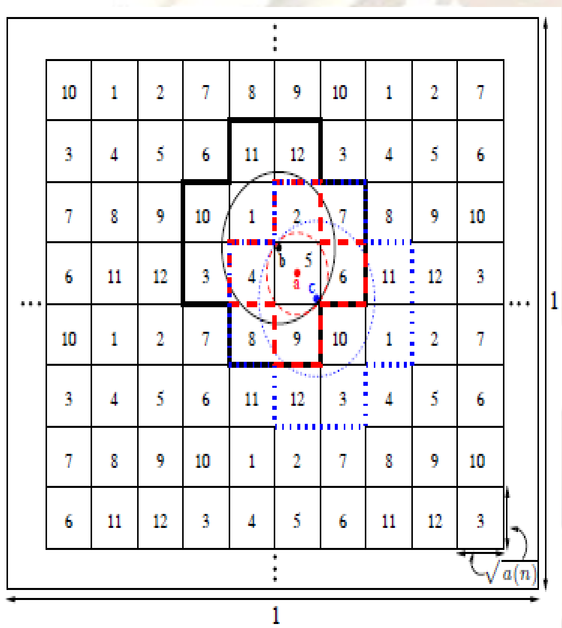

Fig 2. Cells numbering in the unit square network

As in Fig 2, we consider that the communication occurs only among those nodes that are close enough (i.e., in same cell), so that interference caused by farther nodes is low, allowing reliable communication. In other words, the receiver chooses the closest nodes because they present the best channel, in a respective order, due to the assumption of the simple path propagation model, i.e., the receiver takes advantage of multiuser diversity . Our model resembles the one introduced by Grossglauser and Tse , who consider a packet to be delivered from source to destination via onetime relaying. The position of node *i* at time *t* is indicated by *Xi*(*t*). Nodes move according to the *uniform mobility model*, in which the steady-state distribution of the mobile nodes ais uniform.

III. SYSTEM OVERVIEW

In this Paper we mainly concentrate on the following four modules:
1. Bandwidth Allocation and Data Packet Forwarding
2. Channel Access
3. Interference in a Data Channel
4. Hybrid FDMA/CDMA Data Transceiver

1. BANDWIDTH ALLOCATION AND DATA PACKET FORWARDING

In our specific implementation of many-to-many communication, we use two types of channels. Control channels are used by nodes to obtain such information as the identities of strong interference sources, the data packets expected by destinations, and the state of data channels (by virtue of training sequences). Nodes employ conventional digital transceivers for the control channels. Data channels are used to transmit data taking advantage of SIC at the receivers. Thus, there are two separate transmitter (receiver) circuits in each node. One circuit is intended to transmit (receive) control packets, and the other is used to transmit (receive) data packets. Both circuits operate in different time and frequency with respect to each other as in Fig 3.

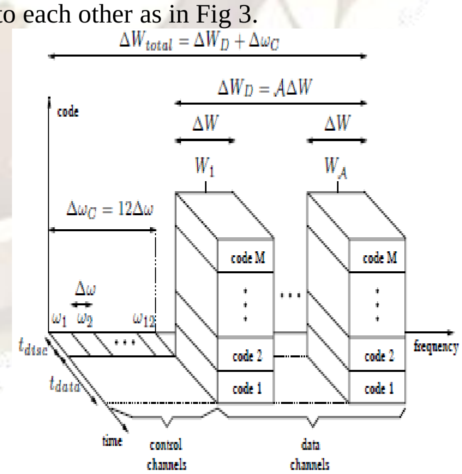

Fig 3. Data and control channels spectra for the network.

2. CHANNEL ACCESS

Access to the channel is controlled by the signaling that takes place over the control channels. Such signaling occurs simultaneously in all cells, without suffering high interference from each other because of the different frequency assignment and consequent safe guard-zone separation.

The signaling among the nodes in the same cell must be one-to-many and cannot assume knowledge of who the nodes in a cell are, because nodes are mobile. Each node needs to inform the other nodes in its present cell about its own presence in the cell, plus other control information access to the channel is divided in time into a discovery phase and a data-transmission phase. The period of "neighbor discovery" tdisc and the period for transmission of data tdata are constant and independent of the number of nodes in the network (n). Together, they compose a "communication session."

3. INTERFERENCE IN A DATA CHANNEL

The interference in the data channel at a node j, regarding node i transmitting to node j through Wj, is defined as the signals coming from all transmitting nodes in the network, via Wj , except node i. It can be decomposed in the following two types.

(a) Destructive Interference (DEI) :for the node j comes from nodes, transmitting in Wj , outside the receiver range of j. DEI constitutes the part of the interference that will not be decoded.

(b) Constructive Interference (COI) :comes from nodes, transmitting in Wj , within the receiver range of j. By construction (see Section III-A), the nodes within the receiver range of j, transmitting in Wj , use different codes. COI constitutes the decodable part of the interference.The SNIR can be written as follows

$$SNIR = \frac{P_{ij}(t)g_{ij}(t)}{BN_0 + \underbrace{\frac{1}{M}\sum_{\substack{k \in range \\ k \neq i}} P_{kj}(t)g_{kj}(t)}_{COI} + \underbrace{\frac{1}{M}\sum_{\substack{k \notin range \\ C_k \neq C_i}} P_{kj}(t)g_{kj}(t) + \sum_{\substack{k \notin range \\ C_k = C_i}} P_{kj}(t)g_{kj}(t)}_{DEI}}.$$

4. HYBRID FDMA/CDMA DATA TRANSCEIVER

The basic decoding scheme of the CDMA-SIC data receiver scheme in which the decoding is performed successively from the strongest signal to the weakest. The use of training sequences obtained through the control channels allow to obtain a local estimation of the wireless channel. Thus, with the simple path propagation model assumed, the strongest signal decoded first comes from the closest neighbor to node j (not necessarily in the same cell of j but in the cluster it perceives), while the weakest signal of interest (decoded last) is the farthest node to node j in the cell node j is located as in Fig 4.

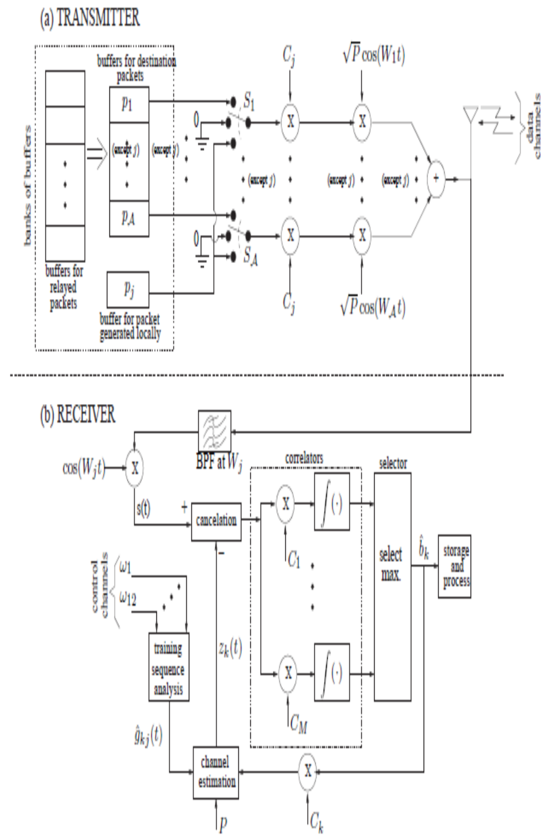

Fig 4: Hybrid FDMA/CDMA data transceiver scheme for node *j*. (a) FDMA/CDMA transmitter.
(b) CDMA successive interference cancellation receiver.

IV. DESIGN & IMPLEMENTATION OF SYSTEM

Design is a meaningful engineering representation of something that is to be built. Software design is a process through which the requirements are translated into a representation of the software. Design is the place where quality is fostered in software engineering. Design is the perfect way to accurately translate a customer's requirement in to a finished software product. Design creates a representation or model, provides detail about software data structure, architecture, interfaces and components that are necessary to implement a system.

Class Diagram:

UML Class diagram shows the static structure of the model. The class diagram is a collection of static modeling elements, such as classes and their relationships, connected as a graph to each other and to their contents

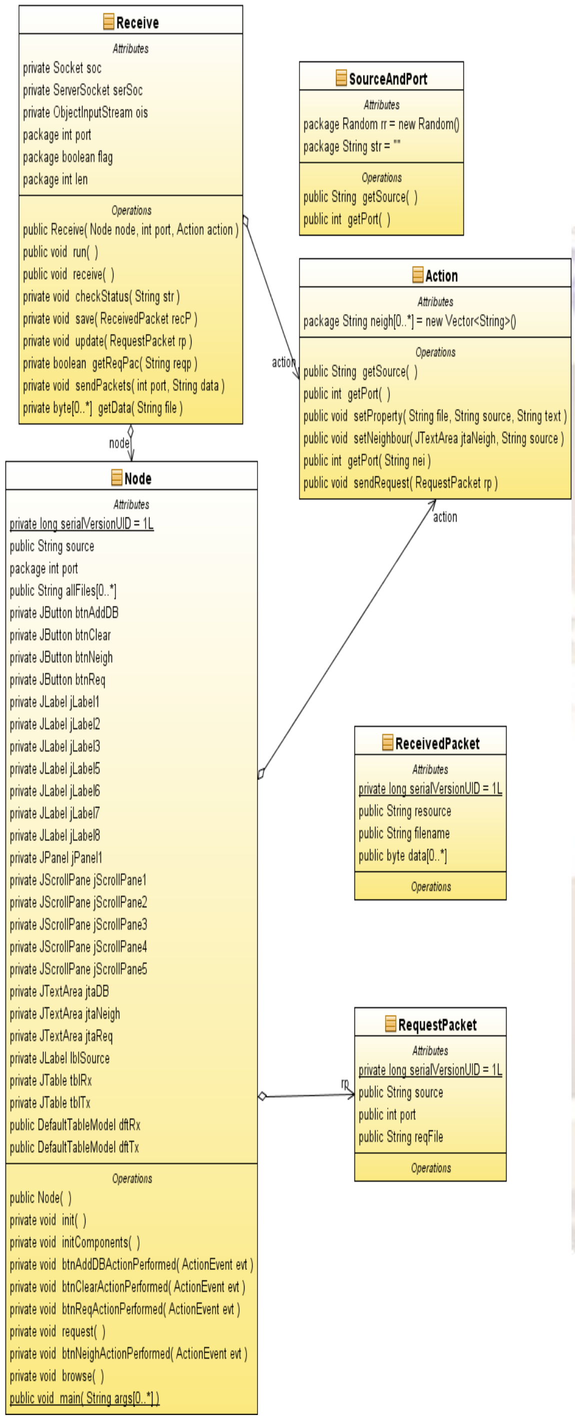

Fig 5: The inter-operational class Diagram

Use Case Diagram:

A use case diagram is a graph of actors, a set of use cases enclosed by a system boundary, communication (participation) associations between the actors and users and generalization among use cases. The use case model defines the outside (actors) and inside (use case) of the system's behavior.

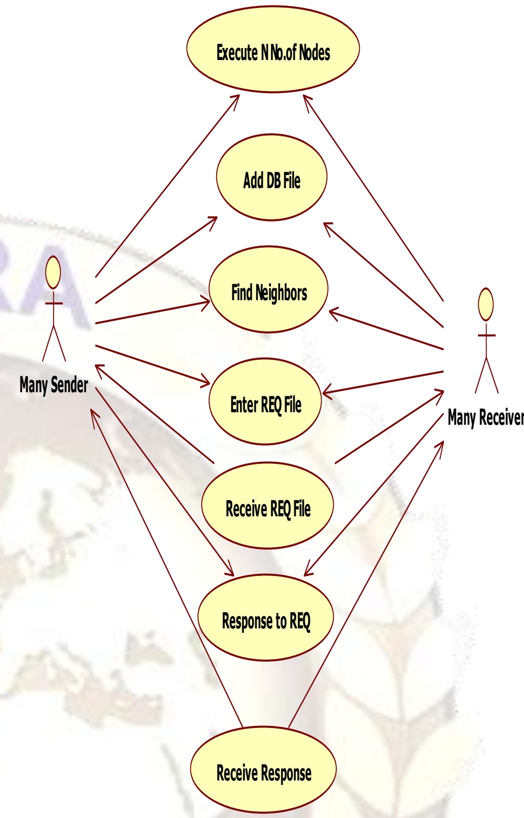

Fig 6:The Inter-operational use case Diagram

Pseudo code representation of action class is as follows:

```
public void sendRequest(RequestPacket rp) {
try {
for (int i = 0; i < neigh.size(); i++) {
int nPort = getPort(neigh.get(i));
Socket socket = new Socket("localhost", nPort);
ObjectOutputStream oos = new
ObjectOutputStream(socket.getOutputStream());
oos.writeObject("REQ");
oos.writeObject(rp);
}
} catch (UnknownHostException e) {
e.printStackTrace();
} catch (IOException e) {
e.printStackTrace();
}}}
```

Pseudo code representation of Receive class is as follows:

```
private void sendPackets(int port, String data) {
try {
```

```
Thread.sleep(2000);
ReceivedPacket recP = new ReceivedPacket();
recP.resource = node.source;
recP.filename = data;
recP.data = getData(data);
Socket socket = new Socket("localhost", port);
ObjectOutputStream oos = new
ObjectOutputStream(socket.getOutputStream());
oos.writeObject("Data");
oos.writeObject(recP);
} catch (Exception e) {
e.printStackTrace();
}    }
```

V. RESULTS

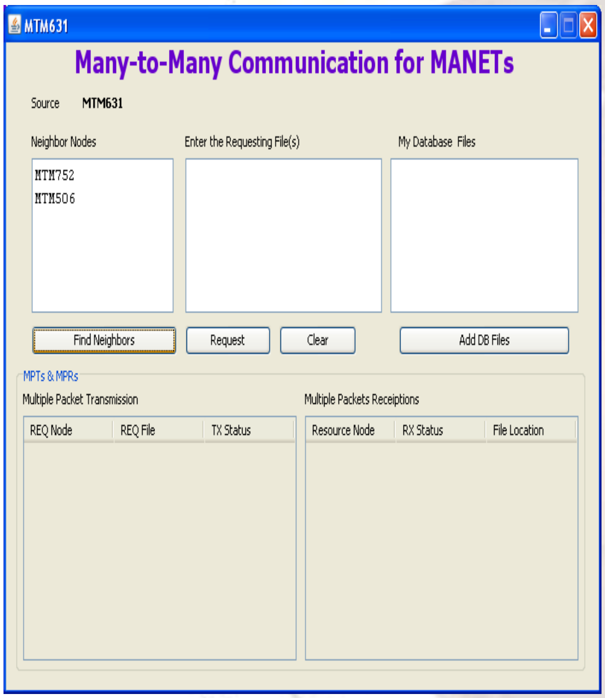

Fig 7: to find the neighbour nodes

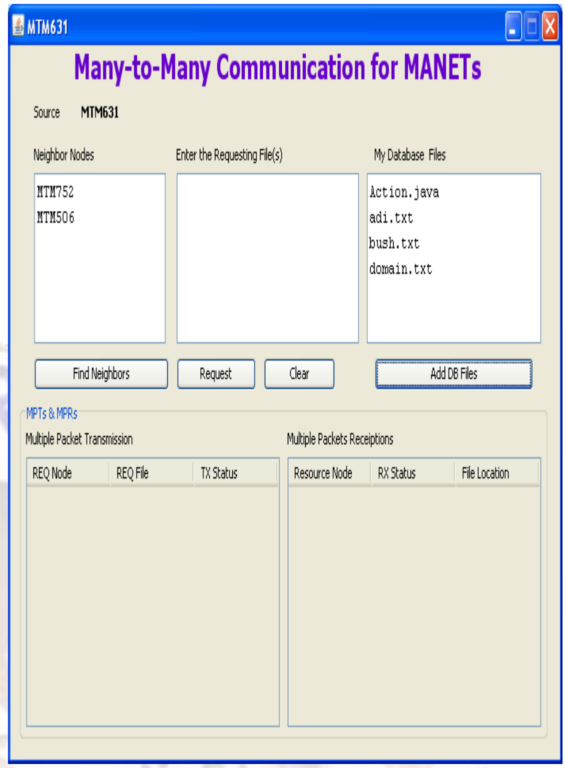

Fig 8: Adding database files to the neighbour nodes

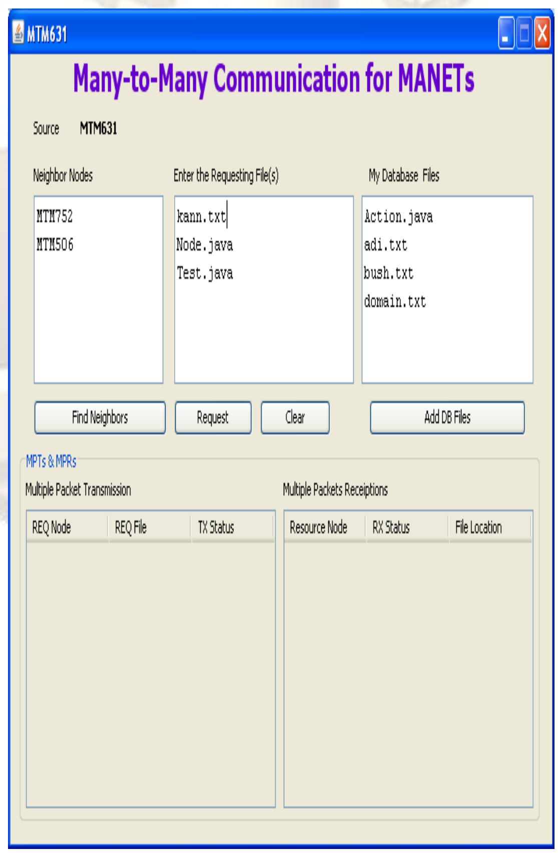

Fig 9: Entering the request file

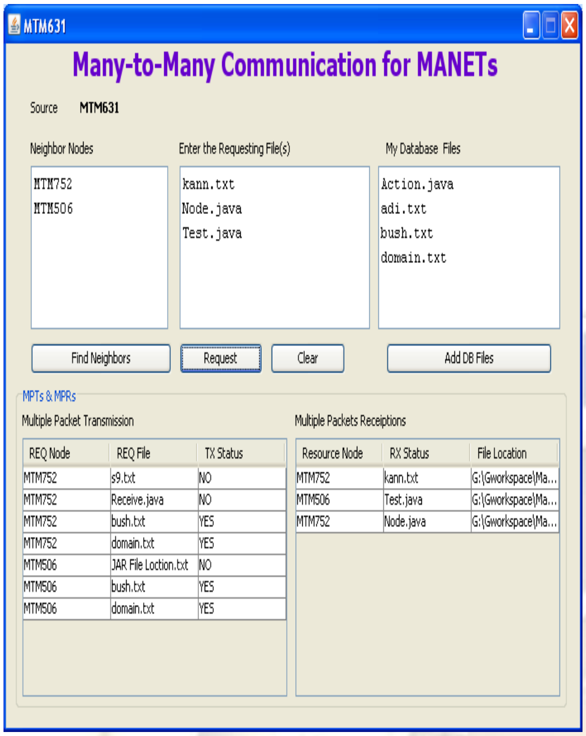

Fig 10: identifying multi-packet transmissions (MPTs) and multipacket receptions (MPRs)

VI. CONCLUSION

It was shown that the Shannon capacity and per source destination throughput can increase in wireless ad hoc networks by employing mobility, FDMA/CDMA, SIC, and onetime relaying of packets taking advantage of many-to-many communication among nodes. Such performance is attained by using successive interference cancellation and distinct codes among close neighbors, which is enabled by running a simple neighbor-discovery protocol. Accordingly, interference from close neighbors is no longer harmful, but rather endowed with valuable data. Many-to-many communication employs multi-packet transmissions (MPTs) and multi-packet receptions (MPRs) which can provide significant improvement in scaling laws for future networks. Also, because multicopy relaying of packets is employed, the delay performance is improved and follows the description given in. The overall improvement in the network performance is obtained at a cost of increased processing complexity in the nodes.

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