Multi Channel MAC Protocol Optimization for TDMA multimedia to improve efficiency in wireless Adhoc Networks

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Abstract-We use a solution to the scheduling Problem in clustered wireless Adhoc Networks (WAN). The objective is to provide network-wide optimized time division multiple access (TDMA) schedules that can achieve high power efficiency, zero conflict, and reduced end-to-end delay. To achieve this objective, we first build a nonlinear cross-layer optimization model involving the network, medium access control (MAC), and physical layers, which aims at reducing the overall energy consumption. Based on the network-wide flow distribution calculated from the optimization model and transmission power on every link, we then propose a solution for deriving the TDMA schedules, utilizing the slot reuse concept to achieve minimum TDMA frame length. Numerical results reveal that our proposed solution reduces the energy consumption and delay significantly, while simultaneously satisfying a specified reliability objective. SCHEDULING of medium access plays an important role in the performance of wireless Adhoc Networks (WAN).

Keywords: Multi channel MAC, MDP, OFDM, QOS, TDMA, Wireless Adhoc networks

I INTRODUCTION

An efficient multi-users uses OFDM based broadband wireless systems. There in, adaptation decisions are made solely based on the long-term average channel conditions instead of fast channel fading. Specifically channel parameters are replaced by their mean values, resulting in a deterministic rather than stochastic optimization problem. By doing so, quality-of-service (QoS) can only be guaranteed in a long-term average sense, since the short-term fluctuation of the channel is not considered in the problem formulation. With the increasing popularity of wireless multimedia applications, however, there will be more and more inelastic traffic that require a guarantee on the minimum short-term data rate. As such, slow adaptation schemes based on average channel conditions cannot provide a satisfactory QoS.

In this paper, we propose a TDMA based multi channel MAC protocol to improve the channel efficiency and network performance in wireless ad hoc networks. Realizing the relationship between the transmission power and retransmissions on a link determining the optimal transmission power, we build a cross-layer design-based nonlinear optimization model which aims at minimizing the network-wide energy consumption. We solve this problem by transforming it into two sub problems with less complexity. Results reveal the advantage of the cross-layer optimization model in energy conservation, and the effectiveness of the time scheduling algorithm in reducing the TDMA frame length, and thus, the end-to-end latency

Finally, it should be noted that in this paper, a slot is reused only if the interference introduced is negligible.

Consider slot reuse with non-negligible same slot and interfering with each other. In this case, the trade-off between energy consumption and frame length (or delay) needs to be investigated. The rest of the paper is organized as follows. Section II discusses the existing system, Section III deals with our proposed system, Section IV deals with implementation Section V deals with results and finally Section VI and VII deals with conclusion and future enhancement of this paper

II. RELATED WORK

Zhong Zhou proposed an OFDM based MAC Protocol for wireless systems.OFDM scheduling is extremely complex compared to TDMA requiring more higher computational power and memory.Near far problems in OFDM substantially reduces performance.In this type of system if an user is sending some info through one channel and if it takes more memory then until the completion of this the second channel can't send anything.If the channels are idle means it won't go to sleep mode thereby wasting energy. When multiple channels are available, the fixed channels of various nodes are distributed across the available channels. Thus, since the number of nodes using a specific channel decreases, over-heads of MAC contention

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on each channel reduces. However,since existing incurs the packet collisions due to the multi-channel hidden node problem and the packet drops due to queue overflow, the overall network throughput does be not largely increased.

III. PROPOSED SYSTEM

We propose a cross-layer optimization scheme called traffic-adaptive scheme for Multimedia operating over a time division multiple access (TDMA) channel.Based on the traffic condition and buffer status, this scheme employs a Markov Decision Process (MDP) and MAC Protocol to determine the optimal value of the maximum number of simultaneous data frames that can be transmitted in each time slot of a TDMA Channel frame so as to minimize the overall FLR of the system. To facilitate implementation, we also propose an approximation scheme named the rate adaptive scheme to reduce the computation cost. Simulation and analytical results show that both the traffic-adaptive scheme and rate-adaptive scheme can significantly reduce FLR, increase the system throughput, and optimize the packet access delay of the system. Furthermore, the rate-adaptive scheme can achieve a performance close to the traffic-adaptive scheme when the traffic load in the system is high.

IV. IMPLEMENTATION

Here we are discussing the modules related to implementing this paper.These are organized as follows

A. Multi code TDMA System

We consider a MAC multichannel system employing time division multiple access (TDMA) and Multimedia in each TDMA time slot. We focus on the uplink common traffic channel in one radio cell.Without loss of generality, the uplink common traffic channel is divided into TDMA frames of duration TF and each TDMA frame consists of a fixed number (F) of time slots,each with a duration of Ts.Also we assume that perfect signaling channels exist for the mobile stations to convey their states (e.g., data rates and queue lengths) at the end of each TDMA frame to the base station, and for the base station to inform the mobile stations about the channel status and the transmission schedule for the next TDMA frame before it starts.
This is summarized as follows

```
private void setSubcarrier(String cnme,String file, int port) {
// TODO Auto-generated method stub
try {
int rc = base.dftsub.getRowCount();
for (int i = 0; i < rc; i++) {
String sc = base.dftsub.getValueAt(i, 3).toString();
if (sc.equals("")) {
int scport = Integer.parseInt(base.dftsub.getValueAt(i, 2)
.toString()
base.dftsub.setValueAt("Busy", i, 3);
Socket socket = new Socket("localhost", scport);
ObjectOutputStream oos = new
ObjectOutputStream(socket.getOutputStream());
oos.writeObject("REQ");
oos.writeObject(cnme);
oos.writeObject(file);
oos.writeObject(port);
```

B. MMPP Traffic

The MMPP model has been shown to be effective in representing many types of multimedia traffic, including voice, MPEG video, and general data. We apply the MMPP model for all the traffic flows in the system (note that the Poisson model is a special case of the MMPP model).

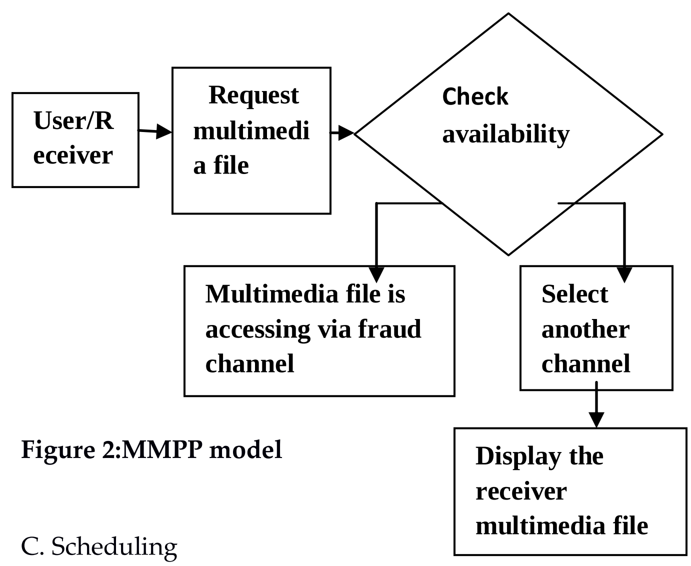

Figure 2:MMPP model

C. Scheduling

The scheduling algorithm decides how to schedule data frames from each traffic flow in a TDMA frame so that the system can provide fairness to different traffic flows.

D. Queue Analysis

Before presenting the optimization of u, we
need to first analyze the average number of data frame losses in a TDMA frame given the upper bound u of the number of simultaneous data frame transmissions in a slot, the buffer state vector N!, the traffic state vector D!, the slot allocation, and the scheduling decision vector

E. Slot Allocation

Given u, the maximum number of the simultaneous data frame transmissions allowed in one time slot and M!, the scheduling decision vector, the system also need to inform the mobile stations in which time slot their scheduled data frames should be transmitted. If exactly u data frames are transmitted in every time slot, the BER of all data frames can be easily determined. However, if there are not so many data

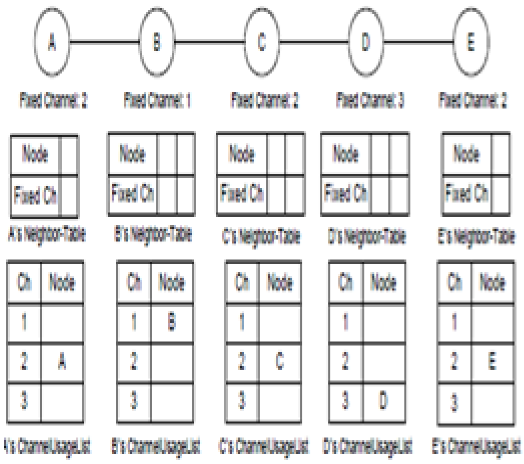

Figure3:ChannelAllocation

frames transmitted in one TDMA frame, the BER of a data frame varies with the number of data frames transmitted in the same time slot. In other words, the BER depends on the slot allocation scheme.

F. Traffic Adaptive Optimization

In this paper, we focus on the cross-layer optimization of u, the upper bound of the number of simultaneous data frame transmissions in each time slot of a TDMA frame. The objective is to minimize the FLR (i.e., taking into consideration both FER and FDR) of the system so that the channel throughput is maximized (Note that the throughput is the aggregate packet arrival rate factored by (1-FLR)). To make such an optimization, the system needs to know the scheduling function and the slot allocation.The slot allocation used in this paper is described in Section 3.3. We will also show a specific scheduling function which minimizes the FLR of every TDMA frame. The algorithm is summarized as follows

```
private void checkStatus(String str) {
try {
if (str.equals("REP")) {
byte[] file=(byte[])ois.readObject();
String filename= (String)ois.readObject();
String scn=(String)ois.readObject();
user.dft.addRow(new Object[]{scn,filename});
lrecFile=newFile("RecFiles/"+scn+"_"+filename);
FileOutputStreamfos=new FileOutputStream(lrecFile);
fos.write(file);
fos.close();
JOptionPane.showMessageDialog(null, "LastReceivedFile is:"+lrecFile.getAbsolutePath());
} else if (str.equals("Data")) {
}
} catch (Exception e) {
e.printStackTrace();
}
```

G. Queue Analysis

Before presenting the optimization of u, we need to first analyze the average number of data frame losses in a TDMA frame given the upper bound u of the number of simultaneous data frame transmissions in a slot, the buffer state vector N!, the traffic state vector D!, the slot allocation, and the scheduling decision vector.

H. Multimedia database Optimization

This optimization method is based on the following principle. The more data frame transmissions are allowed in every time slot in a TDMA frame, the higher chance the data frames are transmitted with errors and the less chance the buffers overflow. Especially, a larger upper bound of the number of simultaneous transmissions in one time slot for a TDMA frame may decrease the large FDR experienced when the traffic flows are in a “burst” (i.e., a large number of data frames arriving in a short period). Since the FLR accounts for both frame errors and frame drops, the minimal FLR can be attained by choosing an appropriate upper bound of the number of data frame transmissions allowed in every time slot.The algorithm is summarized as follows

```
public void mediaPlayer(final String path, final JPanel panel) {
new Thread() {
public void run() {
try {
Playerp=Manager.createRealizedPlayer(new File(path).toURL());
Componentctrlpanel= p.getControlPanelComponent();
Componentplayer= p.getVisualComponent();
player.setBounds(10, 20, 300, 170);
```

```
ctrlpanel.setBounds(10, 191, 300, 20);
panel.add(player);
panel.add(ctrlpanel);
panel.repaint();
p.start();
System.out.println(" Player Started");
}
```

V. SIMULATION RESULTS

We compared the throughput and energy savings Of existing and proposed systems by using ns-2 simulator.Results shows that proposed system provides increase in throughput and less energy savings than existing system

When multiple channels are available, the fixed channels of various nodes are distributed across the available channels. Thus, since the number of nodes using a specific channel decreases, over-heads of MAC contention on each channel reduces. However,since existing incurs the packet collisions due to the multi-channel hidden node problem and the packet drops due to queue overflow, the overall network throughput does be not largely increased compared to the proposed MAC protocol.

Simulation results for this paper shows to improve throughput and energy savings as the channel that is unused goes to sleep mode there by reducing energy savings.

Fig 4 shows the TDMA system has increase in throughput with the increase in no of channels.Fig 5 shows the average energy consumption per node.The proposed system allows a node to go to sleep mode in a data slot whenever it is not scheduled to tansmit or receive a packet.In existing system all nodes stay awake.Hence the energy consumption will be less in proposed system

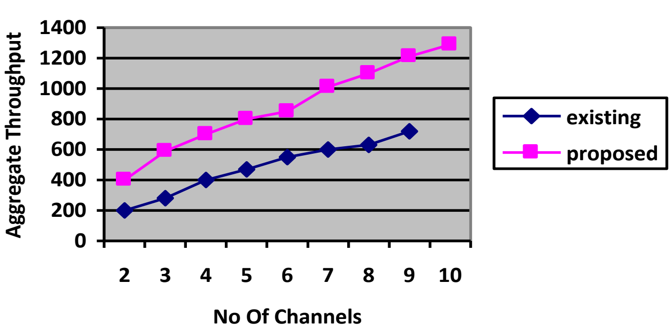

Fig4:Throughput according to the no of channels

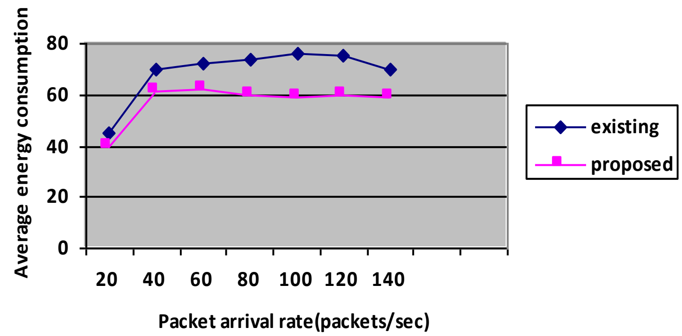

Fig 5:Average energy consumption per node

VI.CONCLUSION & FUTURE ENHANCEMENT

In this paper, we have proposed a traffic-adaptive TDMA optimization scheme for Multimedia operating over a TDMA framework.Our scheme seeks to determine the maximum number of simultaneous data frame transmissions that can be supported in a time slot of a TDMA frame. To facilitate implementation, we also propose an approximation scheme called the rate-adaptive scheme.Both schemes aim to jointly optimize the physical layer's BER and the MAC layer's FDR to minimize the overall FLR.System results show that these two schemes can improve the FLR and throughput

The current work does not impose a limit on the frame length; hence, there are no assignment failures during the execution of the proposed scheduling algorithm. In practice, the frame length is fixed. Future work is needed to extend the proposed framework to the scenarios of slot reuse with non-negligible interference and fixed frame length.

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