

Multi-Channel MAC protocol in Ad Hoc Networks

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Outline :

- Introduction
- Existing Multi-Channel MAC protocol
 - Single transceiver scheduling
 - Multiple transceiver mechanism
- Discussion

Introduction

- The 802.11 standard is initially for a single channel
 - Exposed terminal problem
 - No QoS guarantee
 - Hidden terminal problem be solved by RTS/CTS
 - Throughput inefficiently

Introduction

- The throughput bound (single channel vs. multi-channel)[1]

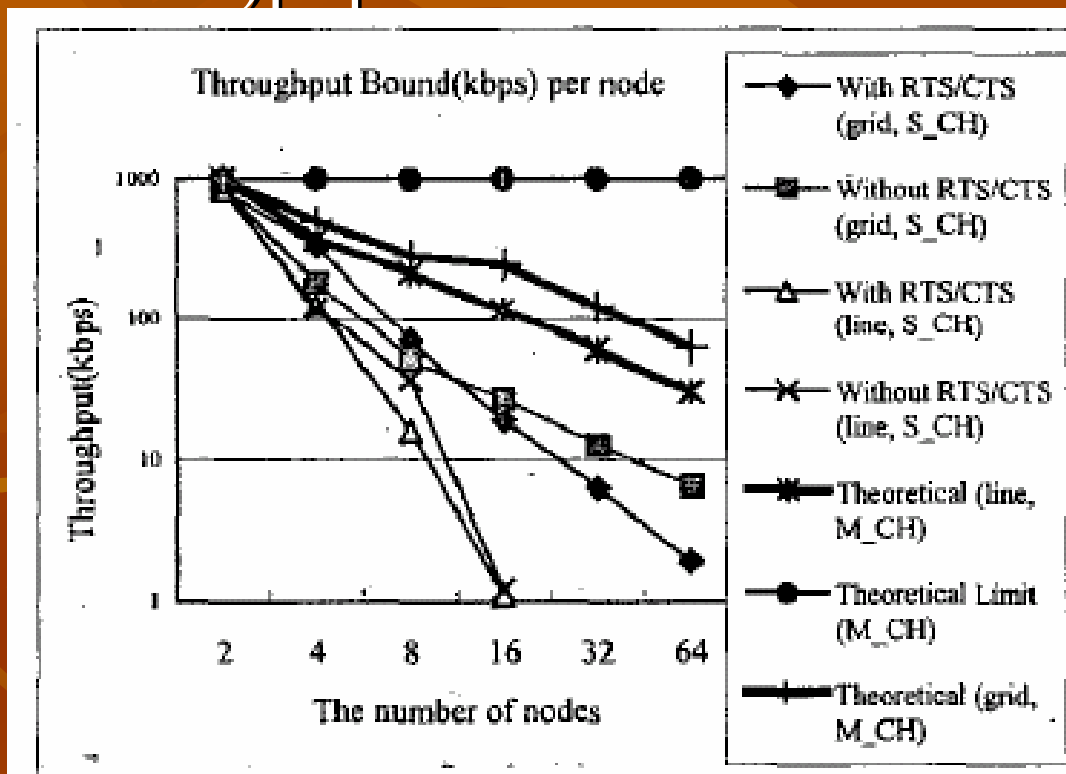


Fig.7: The throughput bound for multiple channels

Introduction

- Two scheme to implement multi-channel
 - Multi-transceiver per node
 - A common control channel
 - N data channel
 - Transmit data and receive control signal currently
 - Using channel selection scheme base on single transceiver node
 - The 802.11 device is equipped with on half-duplex transceiver
 - The transceiver is switching channel dynamically , but it only transmit or listen on one channel at a time

Multi-Channel MAC

- Single transceiver
 - Channel scheduling Algorithm (CSA)[2]
 - $A(X)=\{x_1, x_2, \dots, x_n\}$
 - $X_i = \{S_i, d_i, l_i\}$
 - S_i : Source Identify
 - D_i : Destination Identify
 - L_i : Transmission period
 - CSA sort by transmission period
 - Channel assigned with shortest transmission period first

Multi-Channel MAC

Multi-Channel MAC(MMAC) protocol[3]

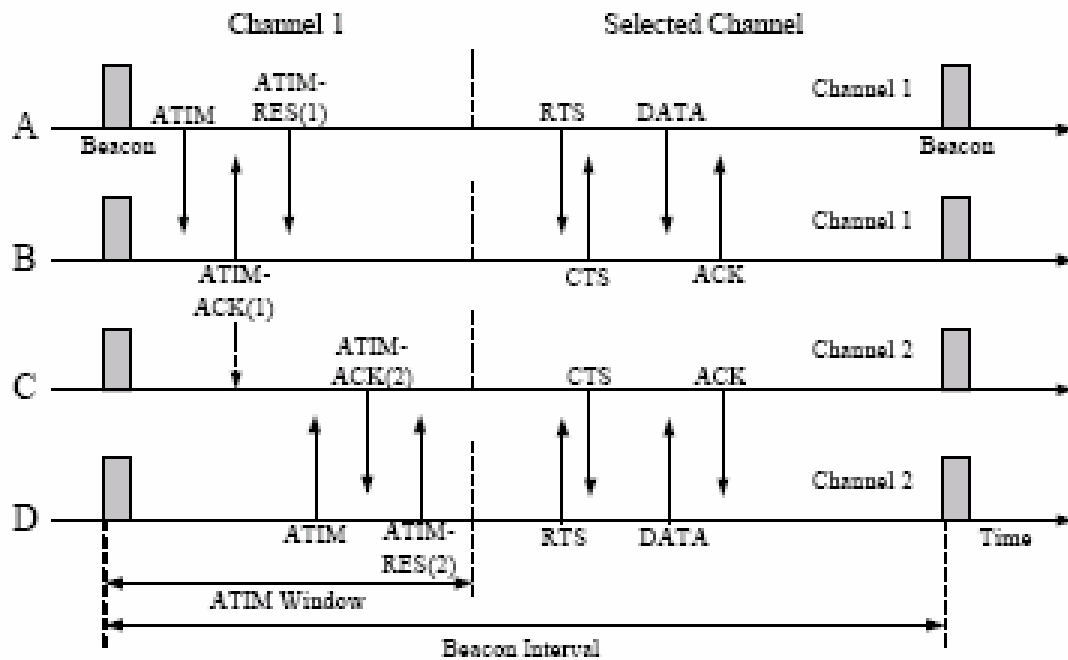
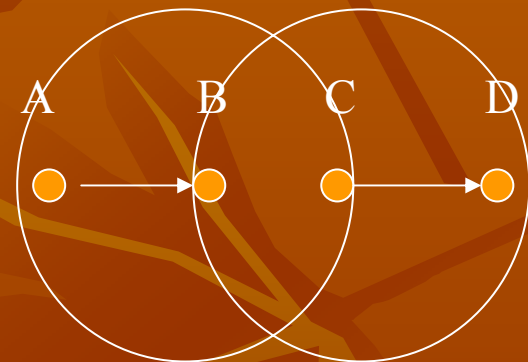


Figure 4: Process of channel negotiation and data exchange in MMAC.



Multi-Channel MAC

- Multiple transceiver
 - A control channel and data channel [4]
 - A control channel and N data channel[5]
 - M neighbor , N data channel , $M=N$

Neighbor's id	Channel number of the neighbor
...	...

- Channel utilization inefficiently

Multi-Channel MAC

- M neighbor , N data channel , $M > N$ [6][7][8]

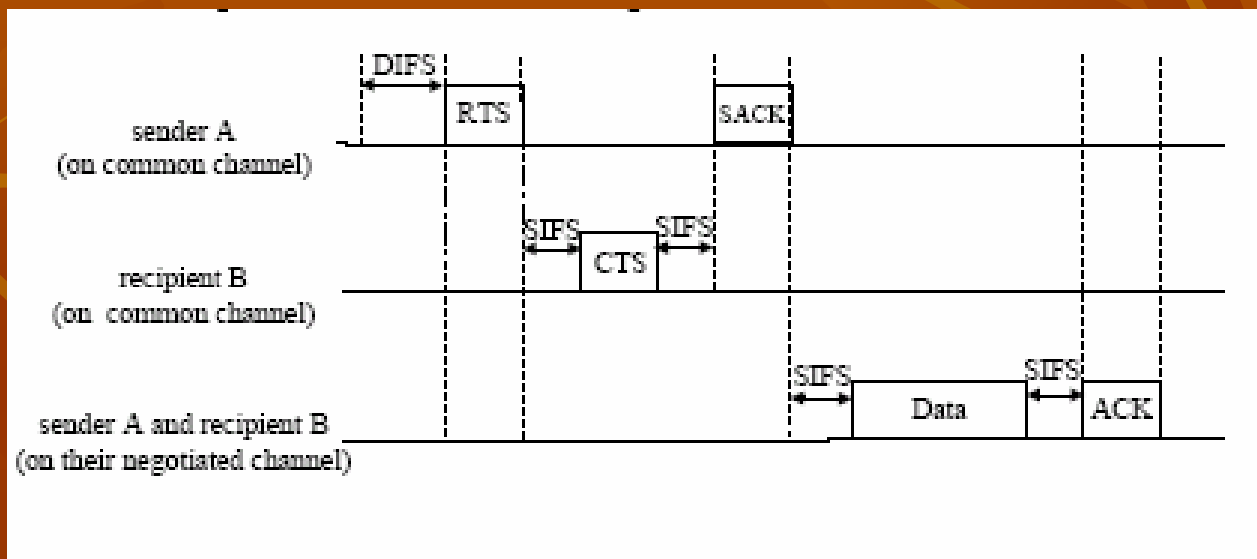
MULTI-CHANNEL TABLE

Channel Number	Maximum Transmission Time	Channel Allocation Vector
1	2 units	1 unit
2	5 units	4 units
...
N	M units	0 unit

- Select channel from channel pool
- Dynamic assign channel
- While receive a RTS , receiver check free_channel list

Multi-Channel MAC

- Negotiation[9]
 - AACA with Multiple designated transmission channel
 - AACA with Receiver designated transmission channel



Discussion

- What challenge in Multi-channel is ??
 - Need create neighbor state list
 - How many channel be transmitted currently?
 - How many channel be divided which get high throughput?
 - How many transceiver be accommodated in a antenna?

Discussion

- How to design a MAC that suit with in wireless network
 - Single transceiver single channel
 - Single transceiver multi-channel
 - Multi transceiver multi-channel

Protocol version	Type	Subtype	To DS	From DS	More Frag	Retry	Pwr Mgt	More Data	WEP	Order
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Protocol version	Control	Subtype	0	0	0	0	Pwr Mgt	0	0	0
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Reference

1. Capacity Evaluation of Multi-Channel Multi-Hop Ad hoc networks
2. A new Multichannel Access Protocol for IEEE 802.11 Ad hoc networks
3. Multi-Channel MAC for Ad hoc Networks: Handling Multi-Channel Hidden Terminals Using A Single Transceiver
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Reference

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