A Simulator for Evaluating MAC Proposals
Why?

- Wireless networks have different characteristics
  - Large signal strength variations
  - Interference from hidden nodes
  - Dynamic topologies
- Discussion of wireless MAC layers has been heated
  - Past experiences have led to strongly-held opinions
  - Little quantitative information has emerged
- 802.11 needs objective methods for evaluating MACs
  - Simulation provides an economical method

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Objectives
Wireless MAC Simulator

- Wide variety of test environments
- Transportable to many computing platforms
  - Written in C
  - Minimize & isolate machine dependencies
- Code publicly available
- Test against previously published results

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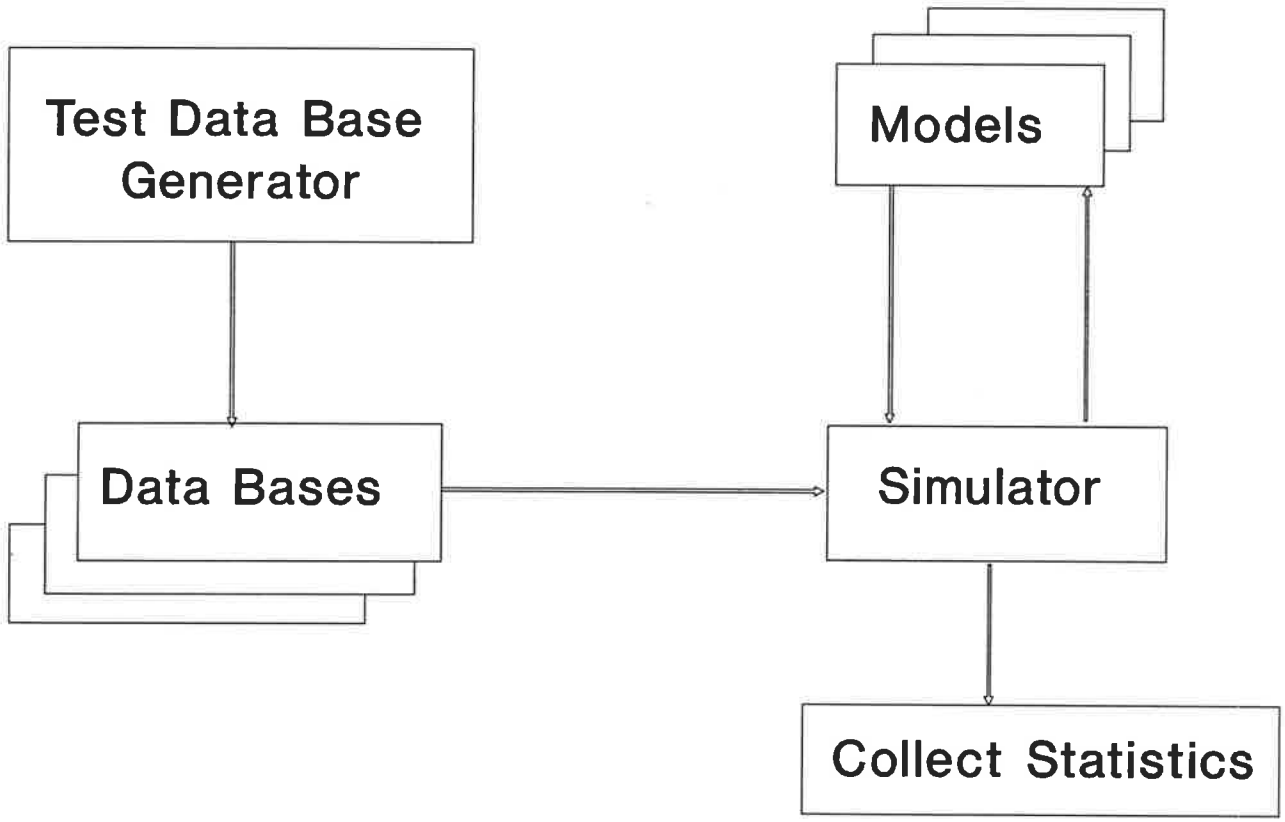
Structure
Wireless MAC Simulator



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Data Base Description
Wireless MAC Simulator

- Many data bases may be created
- Packet size distribution by node
- Connectivity by node
- Traffic generation rate by node
- Number of nodes
- Time slots per maximum length packet
- Time slots for propagation & carrier detect delay

Simulator Description
Wireless MAC Simulator

- Startup
  - Reads data base, parses ,creates program data base
  - Initializes variables
  - Setup display
- Models
  - Model created for each MAC to be simulated
  - Called by simulator each time slot
  - Implemented as state machines
  - Calculates actions each time slot
- Simulator
  - Each time slot calls model for each node
  - Calls statistics update

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Simulator Support
Wireless MAC Simulator

- Statistics generator
  - Provides support functions to model
  - Presents bar-graph display of network state
  - Reports cumulative statistics
- Data base generator
  - Creates scenarios for simulation

Network Node Information Structure
Wireless MAC Simulator

Maintained for each network node:

State
Probability of transmission
Fraction of traffic load
Probability of small packet
Current packet size
Current destination node
How long packet has been transmitting
Connectivity to each other node
Probability of each other node as destination

Simulator Program Flow
Wireless MAC Simulator

```
startup (read data base file and initialize variables)
select MAC, slot size (if slotted),
model
  while not stopped
    count rounds
    for each node
      run MAC (state machine-if packet is ready, choose
                          packet size, destination &
                          apply MAC rules to send
                         -update state, collision count,
                          success count
                         -update how long transmitted
    for each node
      determine if a collision is occuring
        (by checking connectivity model to other sending
        nodes)
    update screen
```

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Development Status
Wireless MAC Simulator

- The simulator is incomplete.
  - This is an interim report
  - Features and models are being added
- ALOHA & Slotted ALOHA models agree with prior work
- Next steps:
  - Test against P-persistent CSMA results
  - Experiment with new MAC proposals
  - Evaluate effects of client-server model
  - Evaluate capture effects

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```
Simple ALOHA using network 75.net
5204596 rounds
25715 packets
9720 successes  (37.799 %)
15995 collisions (62.201 %)

S = 0.187
G = 0.494


     .1       .2       .3       .4       .5       .6       .7       .8       .9       1
      |        |        |        |        |        |        |        |        |       |
S             ^
G                                          ^

Long attempts = 25715
Long successes = 9720 (37.799%)
Short attempts = 0
Short successes = 0 (0.000)
Node 61 lost a 100 round packet to node 0
Elapsed time = 08:35:24.04.  Program returned (13).  Press any key.
```