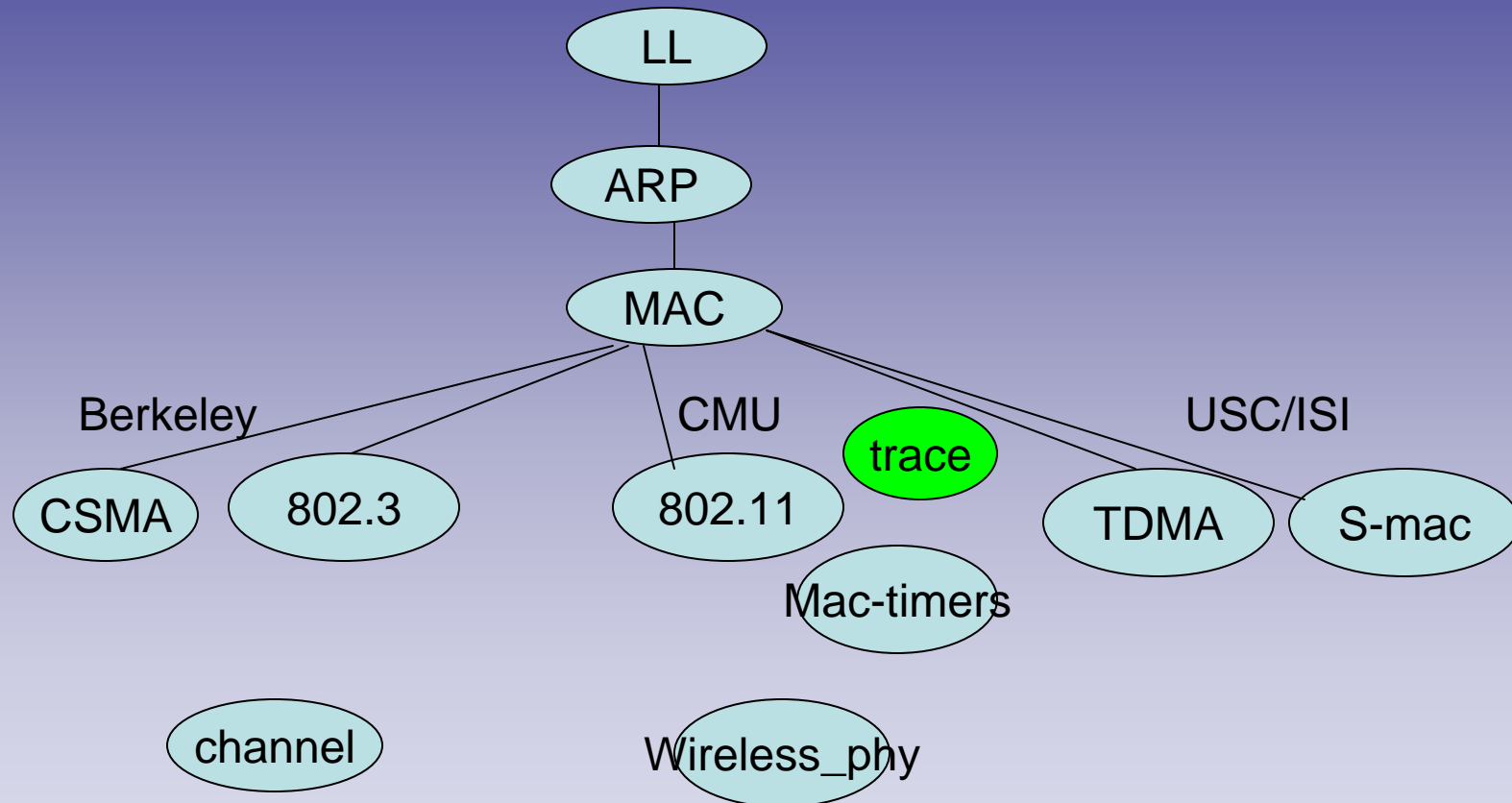# ns-2 Wireless Simulation Tutorial

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06/20/03
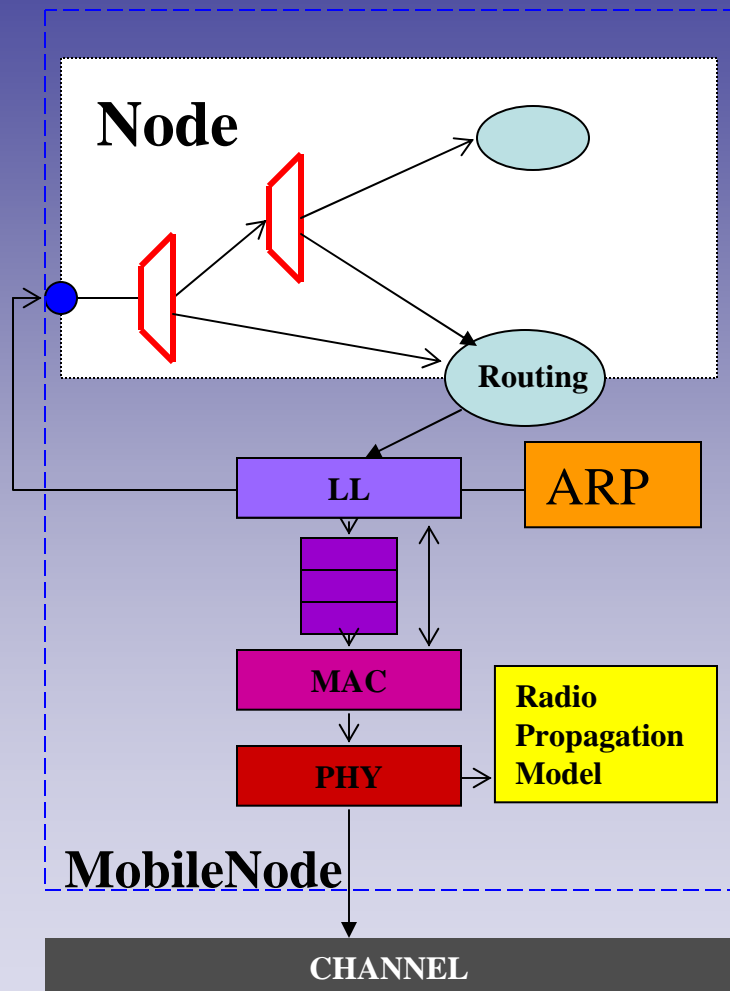
WINLAB, Rutgers Univ.

Everything under /ns-2.26/mac/

- LAN is within Berkeley Architecture, WLAN cannot create with "newLan" command
- Ethernet could be created as a LAN with common bandwidth and delay.

Network Components inside a "mobilenode"

Node

Routing

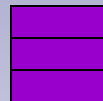ARP

LL

MAC

Radio Propagation Model

PHY

MobileNode

CHANNEL

Classifier:Forwarding

Agent: Protocol Entity

Node Entry

LL   **LL**:Link layer object

IFQ:Interface queue
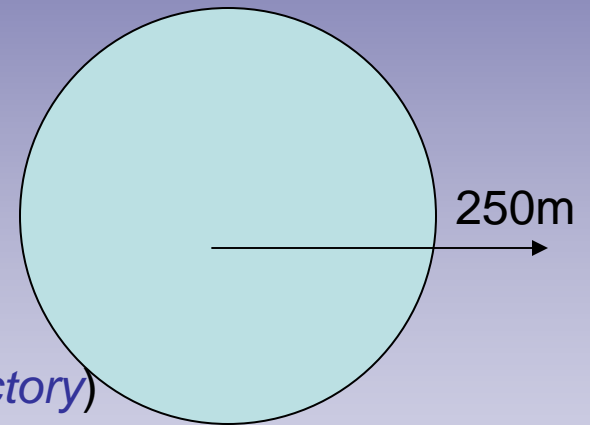
MAC   **MAC**:Mac object
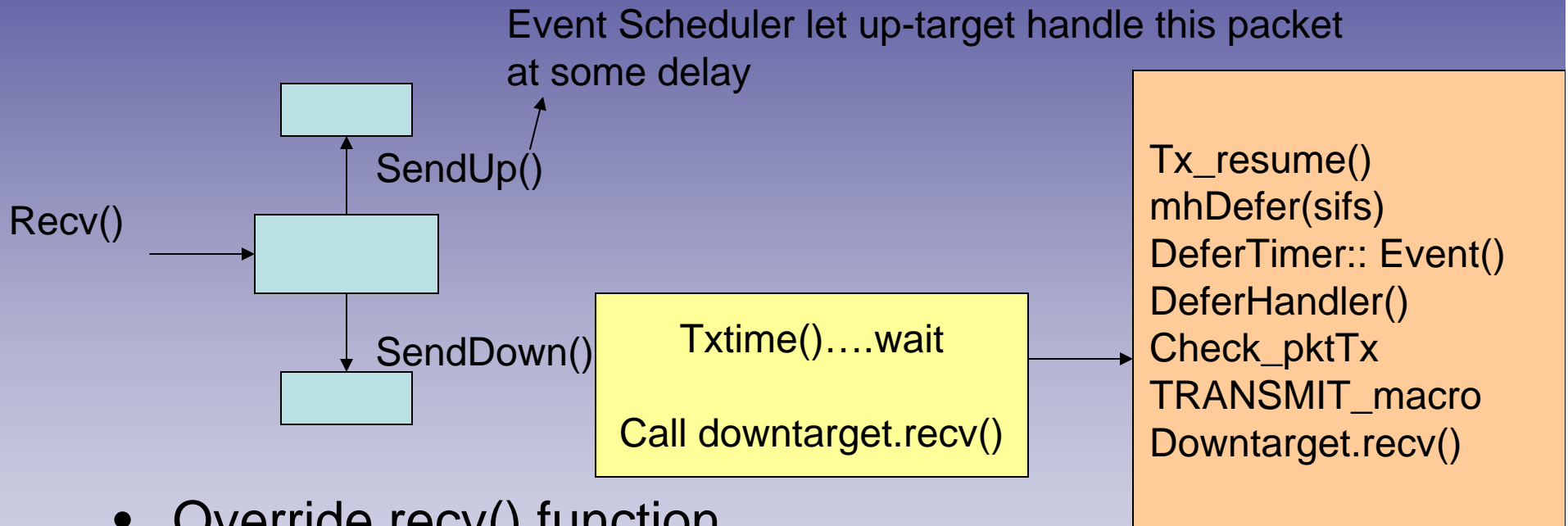
PHY   **PHY**:Net interface

Wireless Channel and MAC

- Duplicate packets to all mobile nodes attached to the channel except the source itself.

- It is the receiver's responsibility to decide if it can receive the packet

- Default data-rate for 802.11: 1Mbps!
  - Bandwidth specified as "2e6" is not used!
  - Only DCF is in the package
  - Download PCF code….

- Propagation Model: (*In /ns-2.26/mobile/ directory*)
  - Antenna: Unit Gain Omni-directional
  - Free Space, TwoRayground and "Shadowing"
  - By set RxThresh in "*ns-default.tcl*" (**Phy/WirelessPhy set RXThresh 3.625e-10**)

250m

Implement a MAC protocol

MAC Class

Event Scheduler let up-target handle this packet at some delay

SendUp()

Recv()

SendDown()

Txtime()....wait

Call downtarget.recv()

Tx_resume()
mhDefer(sifs)
DeferTimer:: Event()
DeferHandler()
Check_pktTx
TRANSMIT_macro
Downtarget.recv()

- Override recv() function
- Implement new state machine (adding internal member variable and functions), timers!
- Define new packet headers
- Event Scheduler

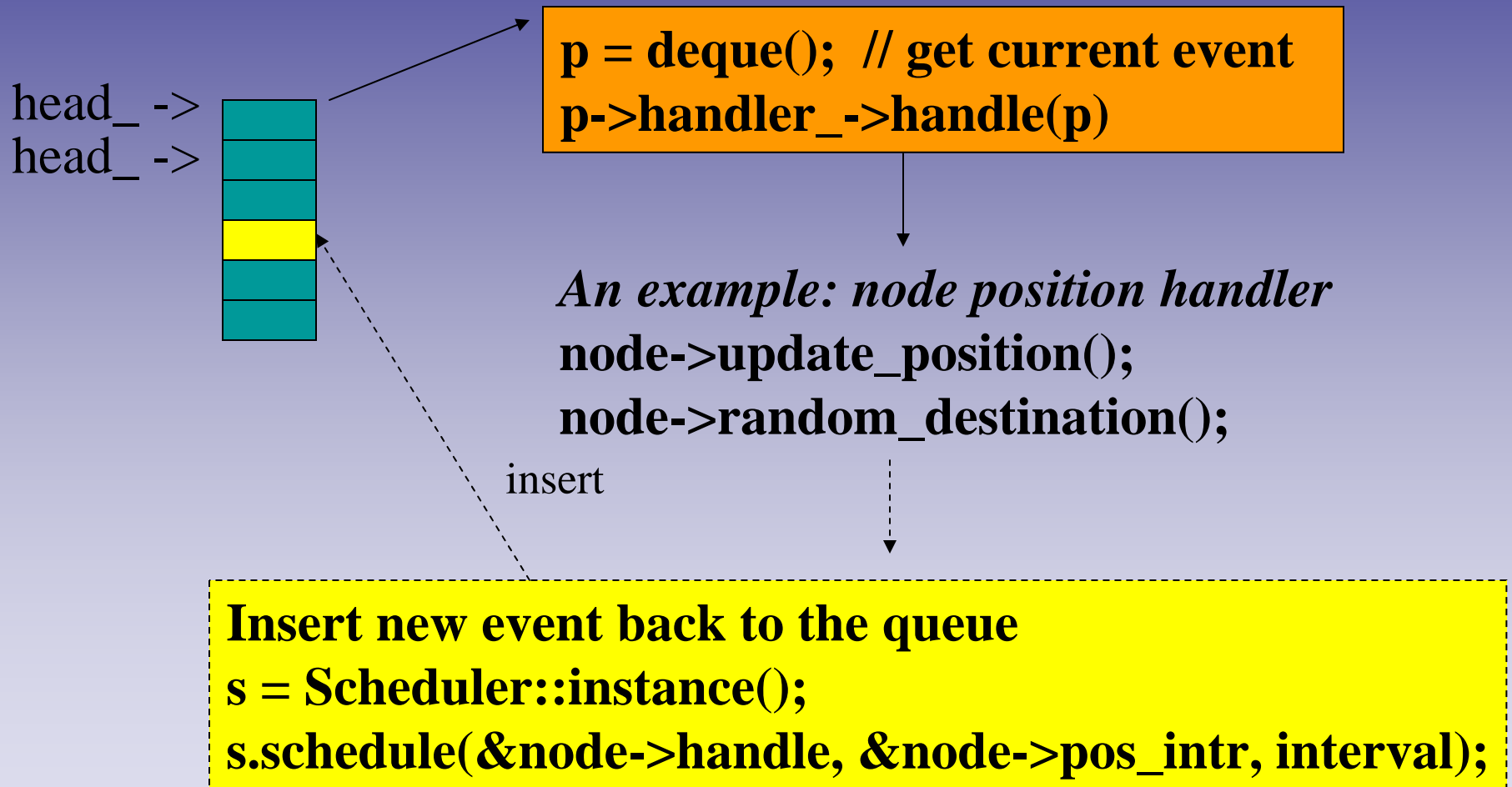# Extending NS Packet Format to support wireless simulation

header
data

cmn header
ip header
………..
LL
MAC 802_11
ARP
………..

ts_
ptype_
uid_
size_
iface_
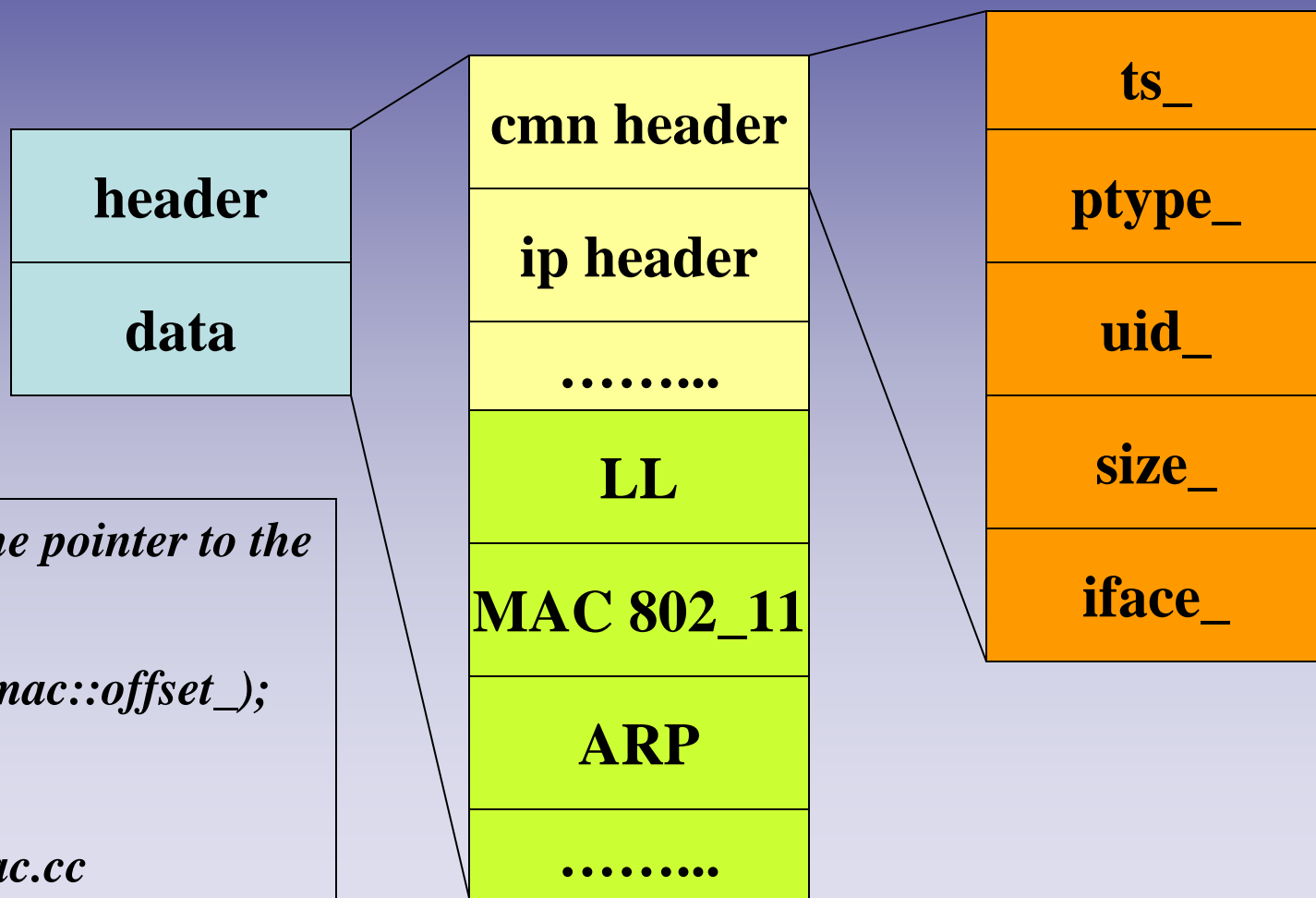
Example: Get the pointer to the Mac header:

p->access(hdr_mac::offset_);

Source: ns-2/mac.cc

Discrete Event Scheduler

head_ ->
head_ ->

p = deque(); // get current event
p->handler_->handle(p)

An example: node position handler
node->update_position();
node->random_destination();

insert

Insert new event back to the queue
s = Scheduler::instance();
s.schedule(&node->handle, &node->pos_intr, interval);

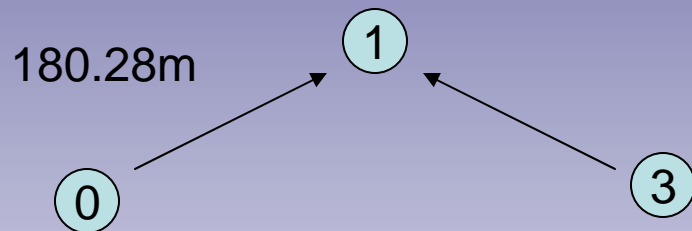# Simulation Example 1
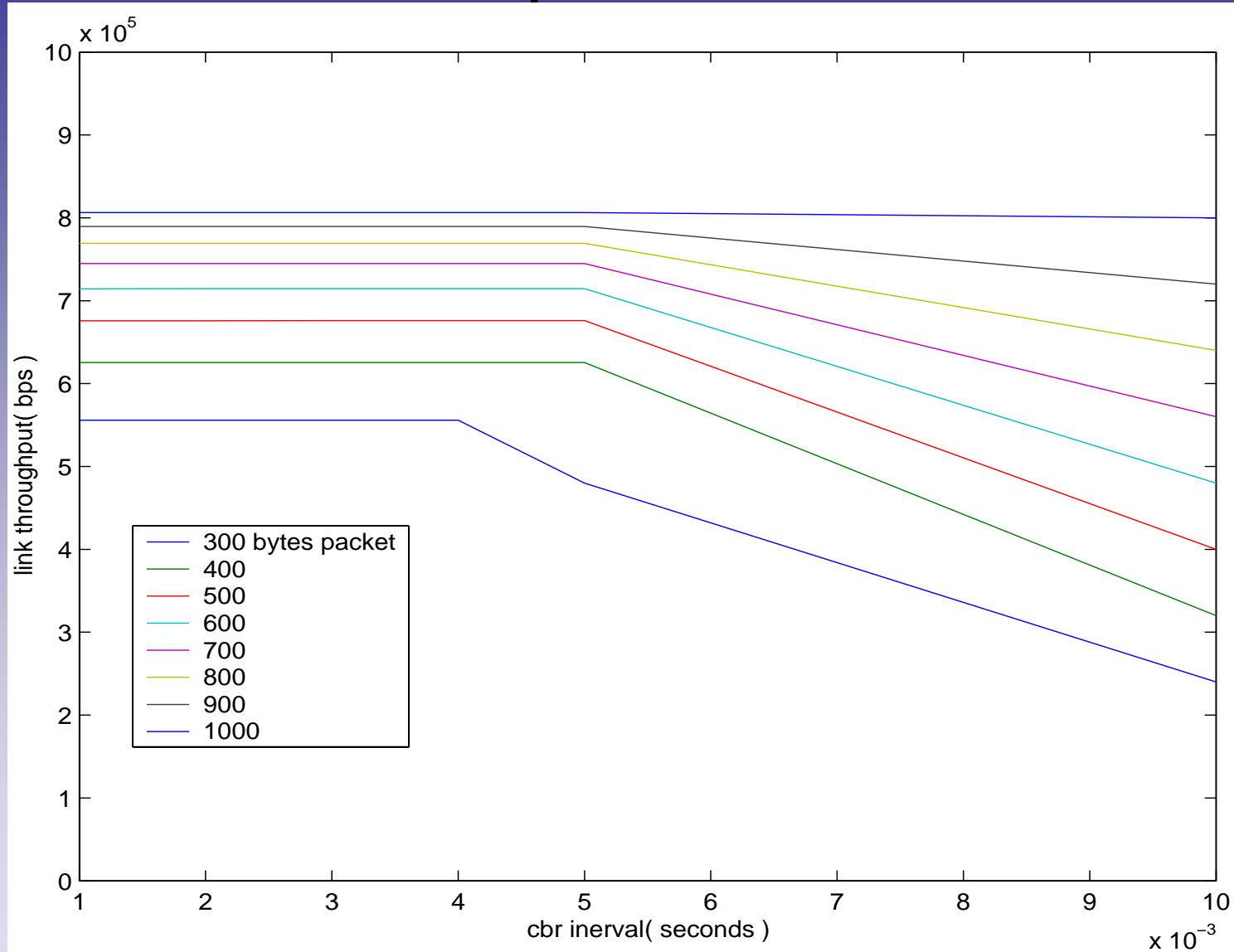
- Throughput between 2-nodes in 802.11

"Hidden node"---Collision Trace

s 10.900655000 _0_ MAC --- 22 cbr 672 [13a 1 0 800] ------- [0:0 1:0 32 1] [9] 0 0

s 10.900655000 _3_ MAC --- 23 cbr 672 [13a 1 3 800] ------- [3:0 1:1 32 1] [9] 0 0

D 10.900655601 _1_ MAC --- 23 cbr 672 [13a 1 3 800] ------- [3:0 1:1 32 1] [9] 0 0

D 10.906031601 _1_ MAC --- 22 cbr 672 [13a 1 0 800] ------- [0:0 1:0 32 1] [9] 0 0

180.28m

(1) (0) (3)

Collision was detected after a propagation delay.(180.28m/3e8 = 0.601us)

The second packet is also dropped after the full reception of the packet.

(delay = 672bytes/1Mbps = 5.376ms)

Note: CMU trace does not support many headers. Add PT_EXP… by yourself and recompile

Potential 802.11 Bug in ns2
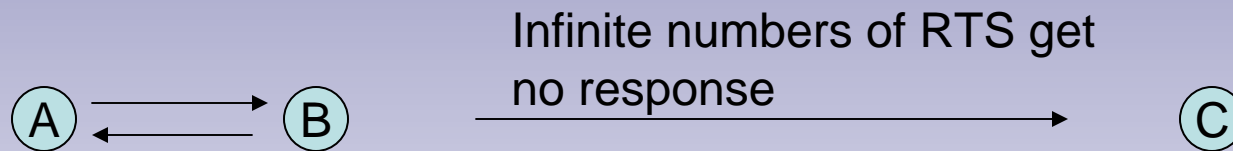
- In "Mac802_11::recvDATA"

{.....

 ssrc =0; //short retry-count set to 0

}

Infinite numbers of RTS get
no response

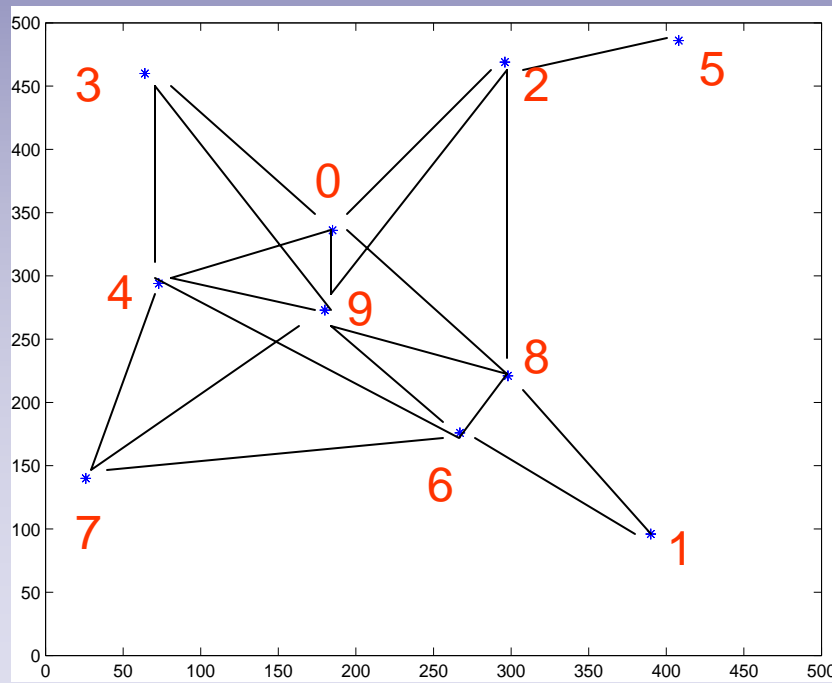A → B   C

Reason: SSRC cannot reach 7 because it was reset after a A-B DATA exchange

Topology Generation

- Install and use **GT-ITM** (Sun-version)
- Downlaod "**sgb2ns**" tool
  - Modify Makefile "LIBS= -lm –lgb-linux"
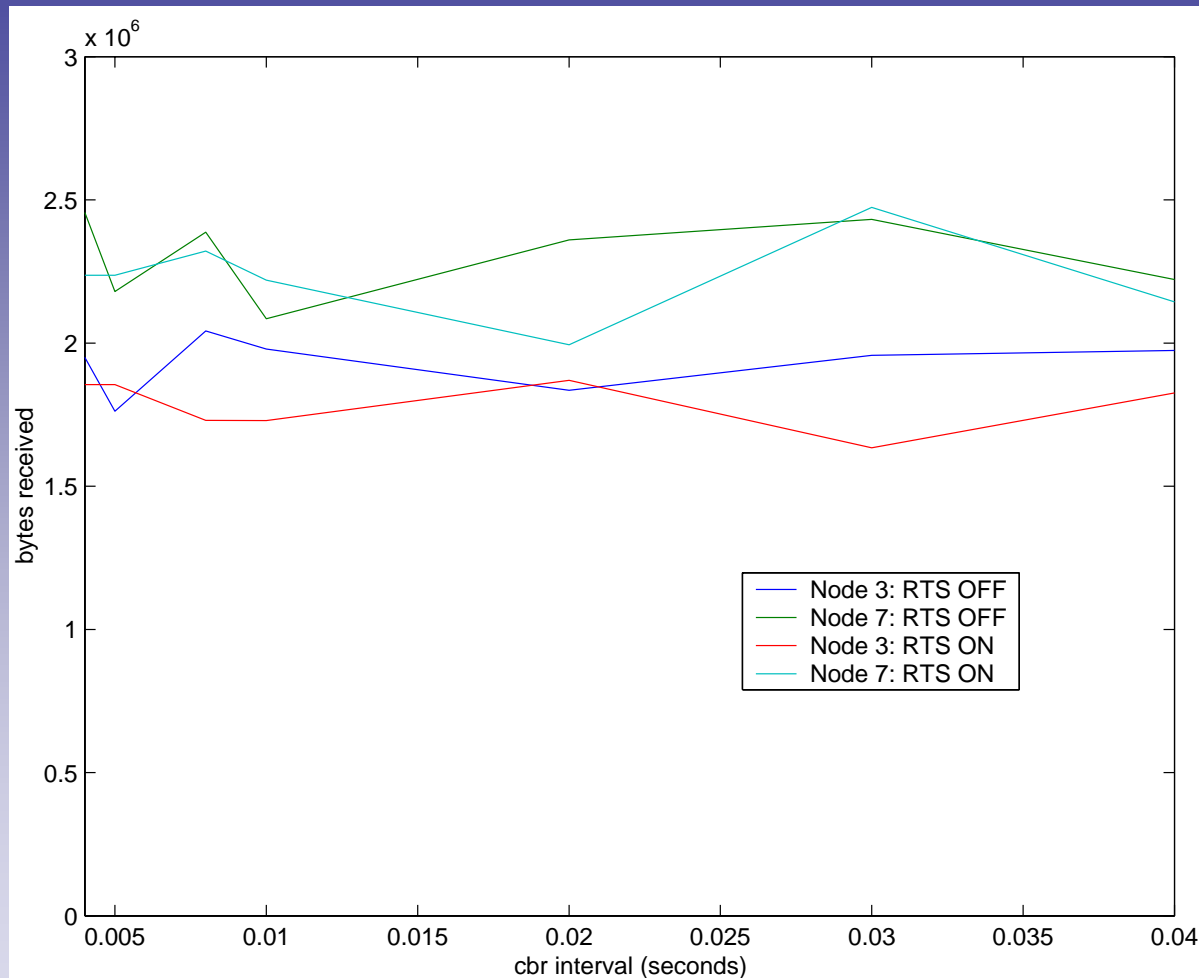- For wireless topology, link (edge) is self-limited.

ITM specification files
geo 3
10 500 3 0.2

Two unidirectional connections:
Node 1 to 3
Node 5 to 7

Tip: Discover Neighbors : Running DSDV routing protocol

Simulation Example 2

Parameters:

Routing Protocol: DSDV
IFQ Length: 50,
Date-rate: 1Mbps,
Packet size: 1000 bytes
Packet rate: 25~200 pps
Test Time: 150s
Route Estab. Time: 30-50s

Analysis: RTS/CTS does not improve throughout in multi-hop wireless network

Post-processing:

- NAM

- AWK: Extract info from Trace

```
BEGIN { counter = 0 }
/r/ && /_1_/ && /AGT/  {   counter += ($8- 20)
                   size = $8 - 20 }
END {  print (size , counter*8/40) >> "thru.dat"}
```

```
Begin {FS = ","}
/"[0123456789]"/ { print $3,$4 >>"pos.dat"}
```

Next Step….

1. Representing physical channel characteristics:

      Introducing Two-state Markov Model into wireless channel

      By modify propagation model or WirelessPhy Class

2. Implementing Channel-state based scheduler in MAC

Questions?