Simulation of Wire & Wireless Networks

ECE 605: Engineering System Modeling

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Simulation of Wireless Networks

▲ Overview

- ■ Two nodes wireless simulation with DSDV
  - ▶ Parameters and Analysis of Simulation Results
- ■ Three nodes wireless simulation with DSR
  - ▶ Parameters and Analysis of Simulation Results.
- ■ Combine simple Ad-hoc Wireless Network with Wired Network
  - ▶ Parameters and Analysis of Simulation Results.
- ■ Conclusion & Future Work

Simulation of Wireless Networks

▲ Introduction:

- ■ Wireless Networks

  - ▲ centralized networks
    - ■ Peer to base communication
    - ■ Client-server architecture

  - ▲ Decentralized network
    - ■ Peer to peer communication
    - ■ Distributed network
    - ■ Ad hoc Network

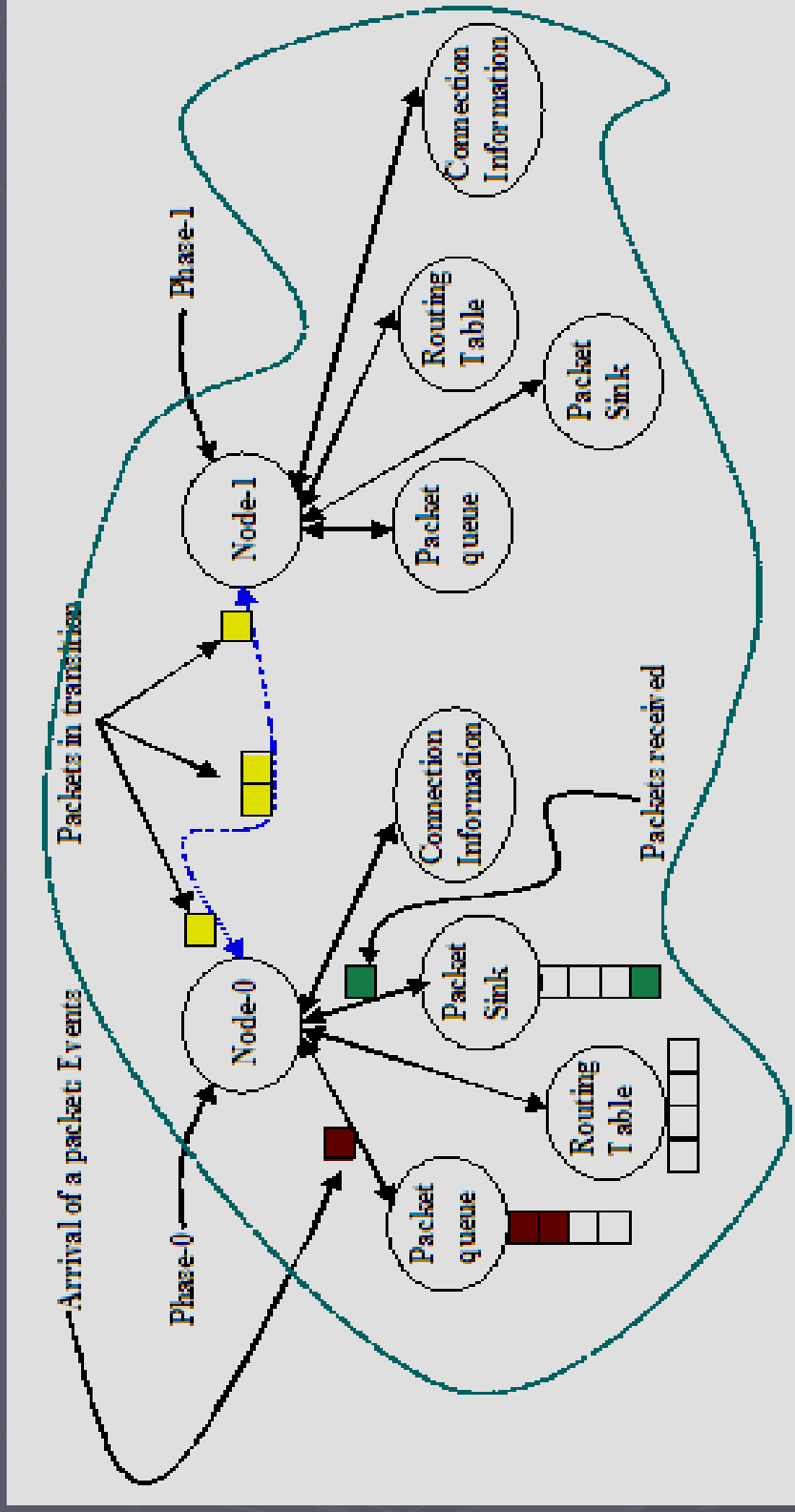# Simulation of Wireless Networks

Two nodes wireless simulation with DSDV

- Started off with 2 mobile nodes (MN)
- MN can move randomly
- Each cellular area has a boundary
- Range specification is required
- Use of network simulator for model this scenario
- Use of declarative modeling approach

Simulation of Wireless Networks

Two Nodes Wireless Simulation with DSDV

- A Declarative approach of modeling

Simulation of Wireless Networks

▲ **Two Nodes Wireless Simulation with DSDV**

▲ Network Components Information

- Channel type   Wireless
- Radio-propagation   One-Two-Way-Ground
- Network interface type   Physical/ Wireless
- MAC type   Mac/ WLAN standard
- Interface queue type   Queue/Drop-Tail/Pre-Queue
- Max packet in IFQ   Length
- Mobile nodes   Number of mobile nodes
- Routing protocol   DSDV/DSR/AODV/TORA

Simulation of Wireless Networks

Parameter description using TCL

- Starting position of MN-0 (5,2)
- Starting location of MN-1 (390, 385)
- MN-1 mobility towards MN-0
  - *$ns_ at 50.0 "$MN_(1) setdest 25.0 20.0 15.0"*
- MN-1 mobility towards starting location
  - *$ns_ at 100.0 "$MN_(1) setdest 490.0 480.0 15.0"*
- Total simulation time (150 sec)
  - *$ns_ at 150.0 "stop"*

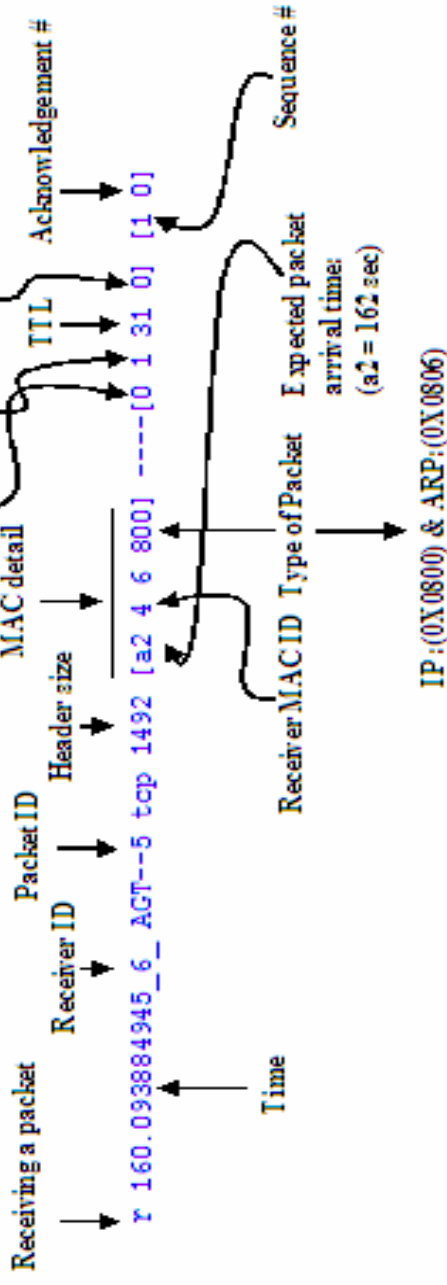# Simulation of Wireless Networks

▶ Movement of Mobile node
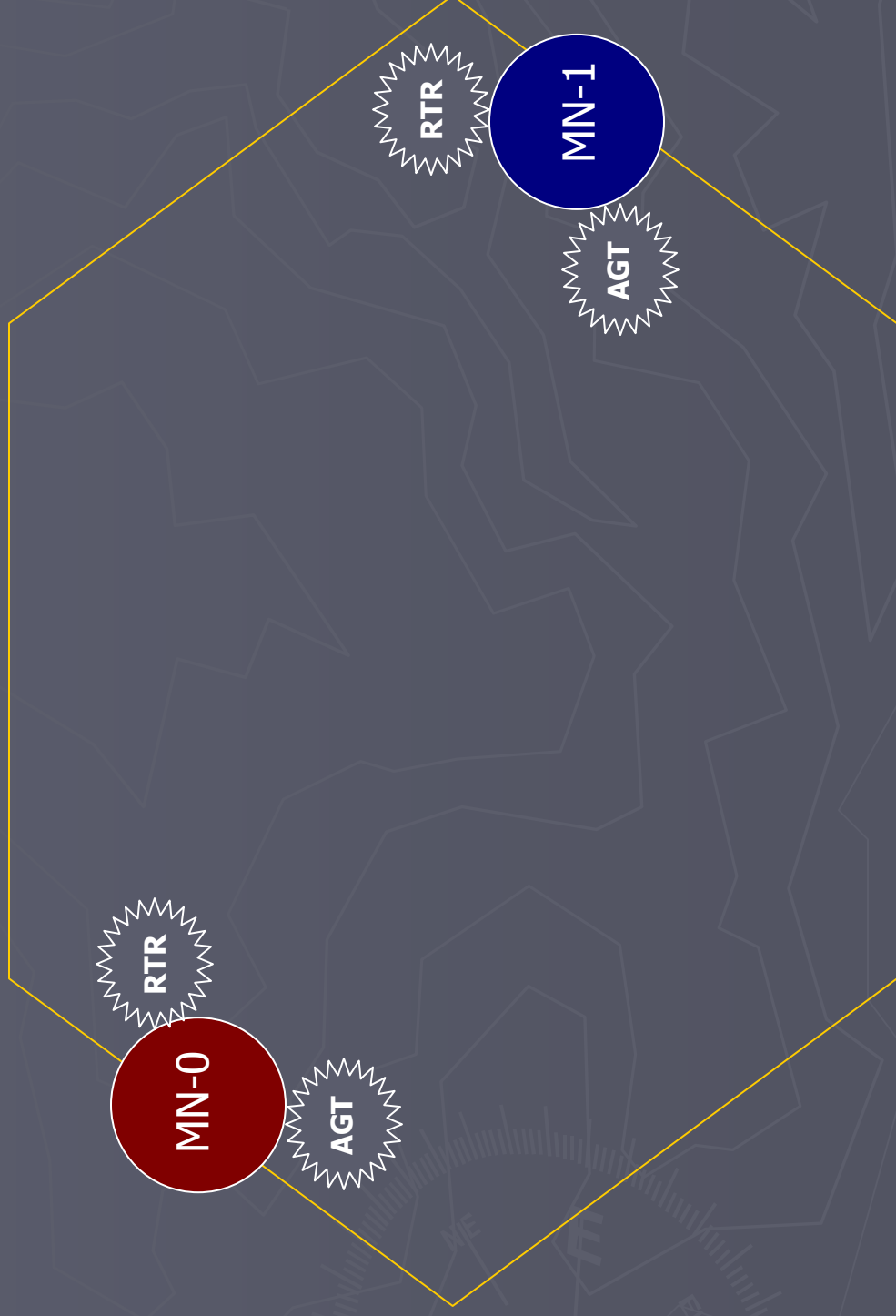
Simulation of Wireless Networks

Analysis of Simulation Results (Trace file)

Trace File Format:

Simulation of Wireless Networks

▲ Analysis of Simulation Results (Trace file-1)

Trace file output (part1):

```
s   0.02929 _1_ RTR  --- 0 message 32 [0 0 0 0]  ------  [1:255 -1:255 32 0]  → connection setup message
s   1.11992 _0_ RTR  --- 1 message 32 [0 0 0 0]  ------  [0:255 -1:255 32 0]  → connection setup message

M  10.0000 0 (5.00, 2.00, 0.00)                              → current location of node-0
M  10.0000 1 (370.0, 360), (25.0, 20.0), 15.00               → current location of node-1

s   10.0000 _0_ RTR  --- 2 tcp 40 [0 0 0 0]  ------  [0:0 1:0 32 0] [0 0] 0 0  → MN-0 sending IP packets
r   10.0030 _0_ AGT  --- 2 tcp 40 [0 0 0 0]  ------  [0:0 1:0 32 0] [0 0] 0 0  → MN-0 stored packets in IFQ

s   12.9411 _1_ RTR  --- 3 message 32 [0 0 0 0]  ------  [1:255 -1:255 32 0]  → connection setup message
s   13.2426 _0_ RTR  --- 4 message 32 [0 0 0 0]  ------  [0:255 -1:255 32 0]  → connection setup message

s   16.0000 _0_ RTR  --- 5 tcp 40 [0 0 0 0]  ------  [0:0 1:0 32 0] [0 0] 0 0  → MN-0 sending IP packets
r   16.0021 _0_ AGT  --- 5 tcp 40 [0 0 0 0]  ------  [0:0 1:0 32 0] [0 0] 0 0  → MN-0 stored packets in IFQ

s   24.7992 _1_ RTR  --- 6 message 32 [0 0 0 0]  ------  [1:255 -1:255 32 0]
s   27.7195 _0_ AGT  --- 7 message 32 [0 0 0 0]  ------  [0:255 -1:255 32 0]

s   28.0000 _0_ AGT  --- 8 tcp 40 [0 0 0 0]  ------  [0:0 1:0 32 0] [0 0] 0 0
r   28.0100 _0_ RTR  --- 8 tcp 40 [0 0 0 0]  ------  [0:0 1:0 32 0] [0 0] 0 0

s   39.0833 _1_ RTR  --- 9  message 32 [0 0 0 0]  ------  [1:255 -1:255 32 0]  → connection setup message
s   40.9189 _0_ RTR  --- 10 message 32 [0 0 0 0]  ------  [0:255 -1:255 32 0]  → connection setup message
```

Note: *No connection will establish between MN-0 and MN-1 till approximately 81.0 seconds.*

Simulation of Wireless Networks

▲ Analysis of Simulation Results (Trace file-2)

Trace file output (Part2):

```
s  76.2309 _0_ RTR  --- 11 tcp 80 [0 0 0 0]   --- [0:0 1:0 32 1] [0 0] 0 0 → MN-0 sending IP packets
s  76.3671 _0_ RTR  --- 12 tcp 80 [0 0 0 0]   --- [0:0 1:0 32 1] [0 0] 0 0 → MN-0 sending IP packets
r  76.3771 _0_ AGT  --- 11 tcp 80 [0 0 0 0]   --- [0:0 1:0 32 1] [0 0] 0 0 → MN-0 sending IP packets
r  76.3981 _0_ AGT  --- 12 tcp 80 [0 0 0 0]   --- [0:0 1:0 32 1] [0 0] 0 0 → MN-0 sending IP packets
D  76.5804 _0_ AGT  --- 2 tcp 80 [0 0 0 0]    --- [0:0 1:0 32 800] [0 0] 0 0 → IFQ is full, MN-0 drops packets

s  81.5030 _1_ RTR  --- 17 message 32 [0 0 0]       --- [1:255 -1:255 32 0] → connection setup message
r  81.5039 _0_ AGT  --- 17 message 32 [0 ffffffff 1 0] --- [1:255 -1:255 32 0] → connection setup message
s  83.2613 _0_ RTR  --- 18 message 44 [0 1 1 0]      --- [1:255 -1:255 32 0] → connection setup message
r  83.3011 _1_ AGT  --- 18 message 44 [1 ffffffff 0 0] --- [0:255 -1:255 32 0] → connection setup message

M  100.0000 1 (25.0,20.0), (490.0, 480.0), 15.00 → current location of node-1

s  100.0017 _0_ RTR  --- 21 tcp 60 [13a 0 0 800]  --- [0:0 1:0 32 1] [0 0] 0 0 → MN-0 sending IP packet
r  100.0119 _1_ AGT  --- 21 tcp 60 [13a 1 0 800]  --- [0:0 1:0 32 1] [0 0] 1 0 → MN-1 receives packet
s  100.1313 _1_ RTR  --- 22 ack 40 [0 1 0 0]      --- [1:0 0:0 32 1] [1 0] 1 0 → MN-1 sends acknowledgement
r  100.1821 _0_ AGT  --- 22 ack 40 [0 0 0 800]    --- [1:0 0:0 32 1] [1 0] 1 0 → MN-0 receives acknowledgement

s  100.3017 _0_ RTR  --- 23 tcp 1060 [13a 0 0 800]  --- [0:0 1:0 32 1] [1 0] 1 0→ MN-0 sending IP packet
r  100.4530 _1_ AGT  --- 23 tcp 1060 [13a 1 0 800]  --- [0:0 1:0 32 1] [1 0] 1 0 → MN-1 receives packet
s  100.4793 _1_ RTR  --- 23 ack 40 [0 1 0 0]        --- [1:0 0:0 32 1] [2 1] 1 0 → MN-1 sends acknowledgement
r  100.5224 _0_ AGT  --- 23 ack 40 [0 0 0 800]      --- [1:0 0:0 32 1] [2 0] 1 0 → MN-0 receives acknowledgement
.....

s  116.8473 _0_ RTR  --- 87 tcp 1060 [13a 0 0 800]  --- [0:0 1:0 32 1] [33 0] 1 0→ MN-0 sending IP packet
r  116.9913 _0_ AGT  --- 87 tcp 1060 [13a 0 0 800]  --- [0:0 1:0 32 1] [33 0] 0 0 → MN-0 stored packets in IFQ
```

Note: Packets are transmitted between MN-0 & MN-1 during 81.000 to 116.0000. Connection remains lost till to the end of simulation

Simulation of Wireless Networks

▲ Three nodes wireless simulation with DSR

- Simulation consists of three MNs
- Random movements of MNs
- Boundary specification 670mX6700m
- Random data flow among three nodes
- Reading random node movements & data flow from available files
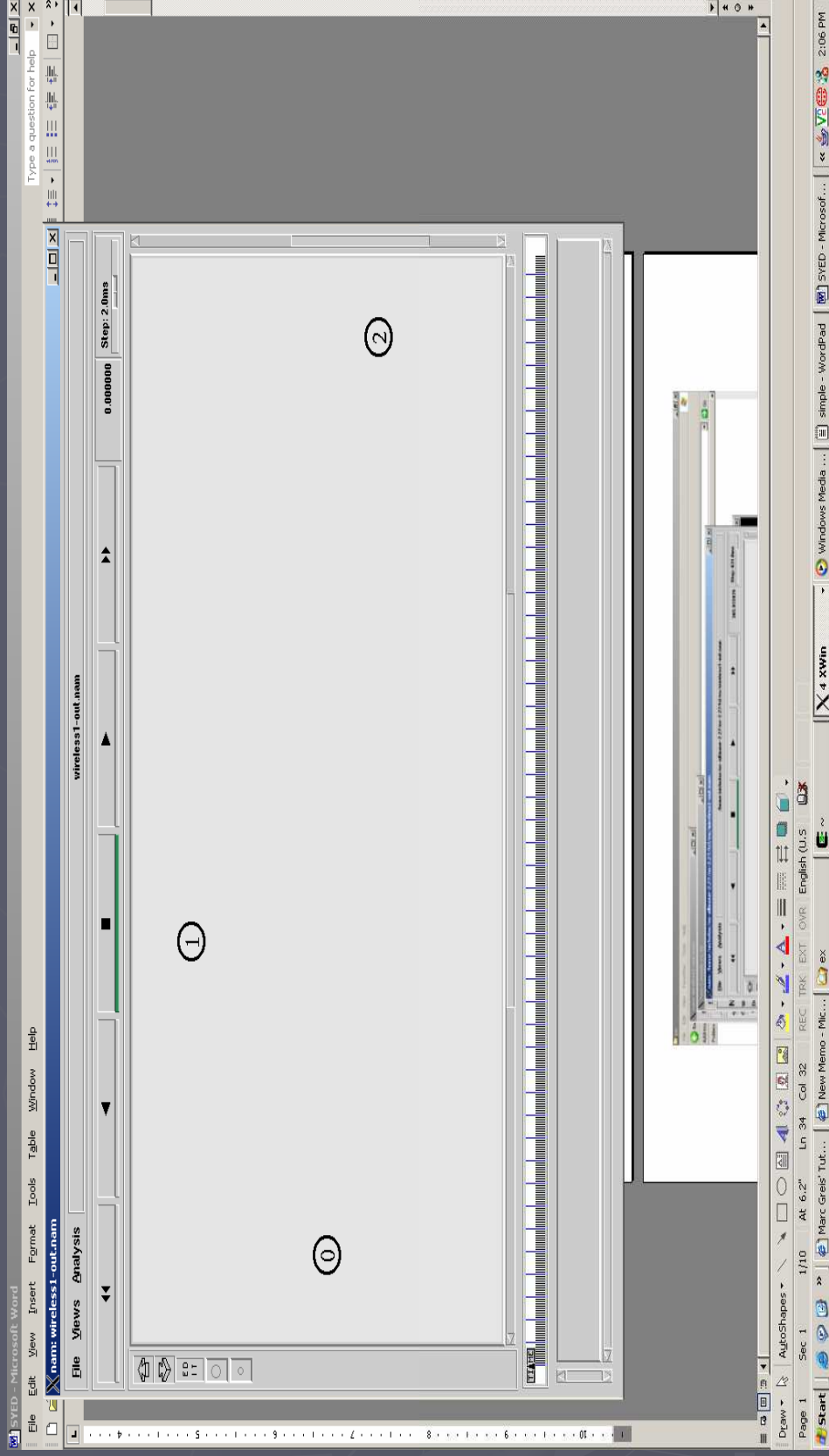
▲ scen-3-test (MN-M) & cbr-3-test (MN-DF)

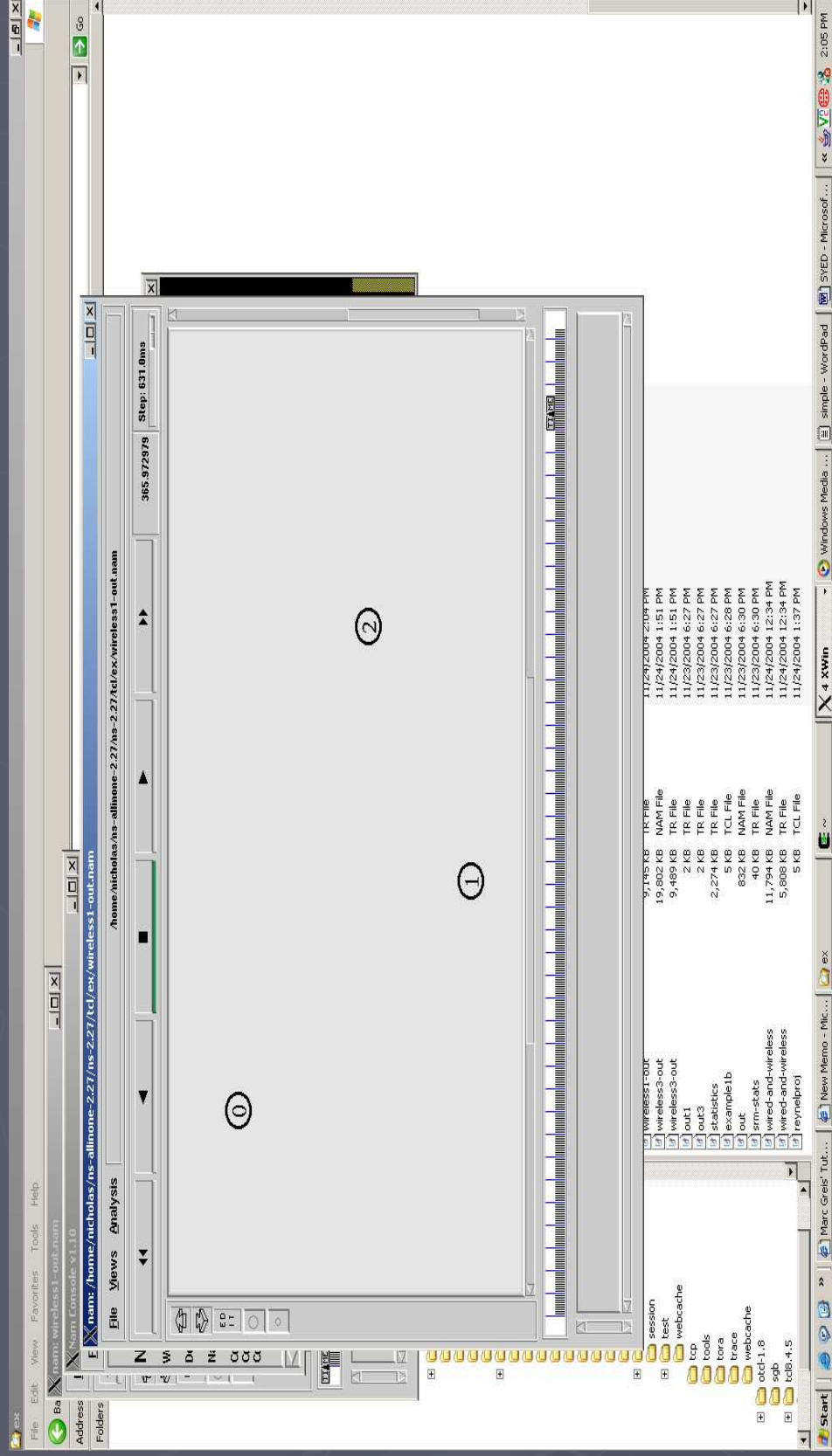# Simulation of Wireless Networks

▶ Random Movement of Mobile Nodes
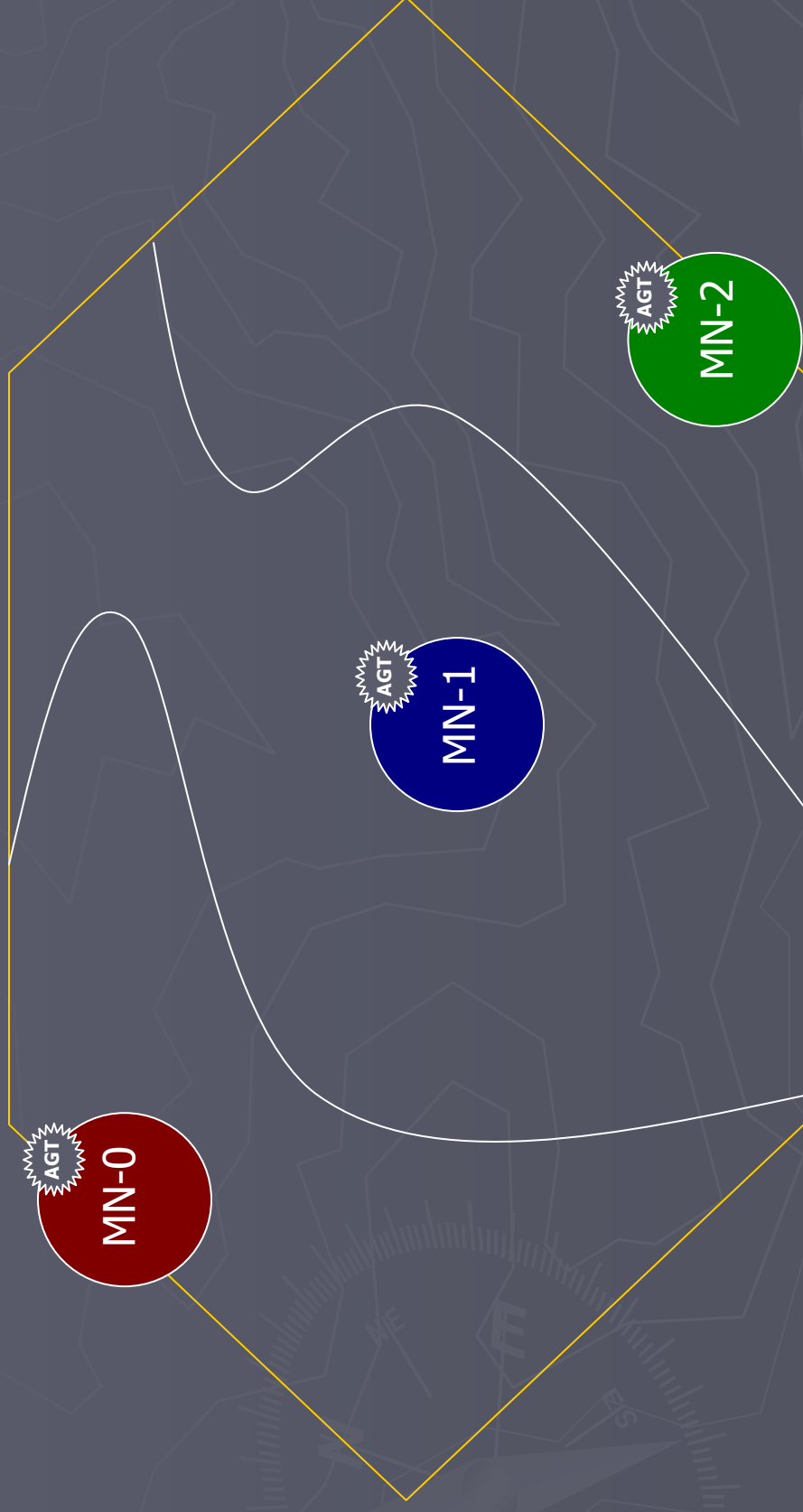
Simulation of Wireless Networks

▶ **Three nodes wireless simulation with DSR**

Simulation of Wireless Networks

▶ **Three nodes wireless simulation with DSR**

Analysis of Simulation Results

Analysis of Simulation Results (Trace File Output):

Movements	Time	MN	Current-Location	Target-Location	Speed
M	33.00000	0	(83.36, 239.44, 0.00),	(89.66, 283.49),	19.15
M	50.00000	2	(591.26, 199.37, 0.00),	(369.46, 170.52),	3.37
M	51.00000	1	(257.05, 345.36, 0.00),	(221.83, 80.86),	14.91

```
s 127.936679222 _0_ AGT --- 0 cbr 512 [0 0 0 0] ----- [0:0 2:0 32 0] [0]
s 127.936679222 _0_ 0 [0 -> 2] 1(0) to 1 [0 |1 2] (0 to 1 to 2)
r 128.006367881 _2_ AGT --- 0 cbr 512 [13a 2 1 800] --- [0:0 2:0 32 2] [0]

s 131.663684440 _0_ AGT --- 4 cbr 512 [0 0 0 0] ----- [0:0 2:0 32 0] [1]
s 131.663684440 _0_ 4 [0 -> 2] 1(0) to 1 [0 |1 2]
r 131.675428586 _2_ AGT --- 4 cbr 512 [13a 2 1 800] --- [0:0 2:0 32 2] [1]

s 133.945590635 _0_ AGT --- 5 cbr 512 [0 0 0 0] ----- [0:0 2:0 32 0] [2]
s 133.945590635 _0_ 5 [0 -> 2] 1(0) to 1 [0 |1 2]
r 133.957974782 _2_ AGT --- 5 cbr 512 [13a 2 1 800] --- [0:0 2:0 32 2] [2]

s 137.188115528 _1_ AGT --- 6 cbr 512 [0 0 0 0] ----- [1:0 2:0 32 1] [3]
s 137.188115528 _1_ 6 [1 -> 2] 1(1) to 2 [1 |1 2]
r 133.194312345 _2_ AGT --- 5 cbr 512 [13a 2 1 800] --- [1:0 2:0 32 2] [3]

.....
```

Note: This cycle of packet transmission continues till the end of simulation.
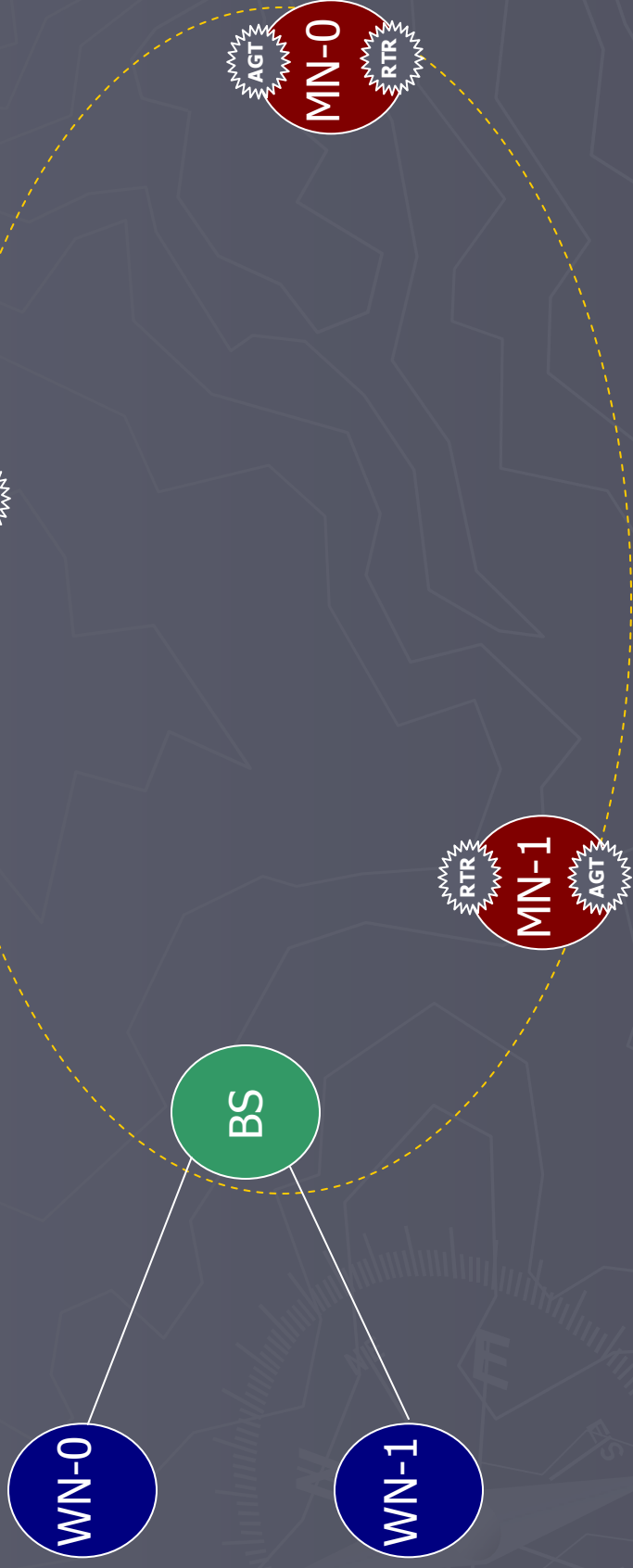
Simulation of Wireless Networks

- Combine simple Ad-hoc Wireless Networks with Wired Networks

  - ▲ Wireless with a wired network
  - ▲ Data transmission between mobile & non-mobile nodes
  - ▲ Three MNs with two Wired Nodes (WN)
  - ▲ Interface through base station (BS)

Simulation of Wireless Networks

- Movement of MNs with WN & BS

Simulation of Wireless Networks

▲ Wired with Ad hoc Network

- Use hierarchical routing for packet transmission
- Routing information is based on WNs connectivity
- MNs have no links
- Packet transmission in MNs is done through routing protocol
- BS can be used to forward packets
- Need to divide in domains

Simulation of Wireless Networks

▲ Wired with Ad hoc Network

- Hierarchical Addressing

  ▲ Addrparams set domain_num_2

    ▪ Define number of domains

  ▲ Set cluster_num 2 1

    ▪ Define number of cluster per domain

  ▲ Addrparams set cluster_num_ $nodes_num 1 1 4

    ▪ Define number of nodes in each cluster for each domain

Simulation of Wireless Networks

- Conclusion & Future Work
  - Working on last simulation (wire + Ad hoc)
  - Trying to combine the simulation results in a single *.tr file.
  - Successful implementation of wire and wireless network.
  - Provide better understanding of packet processing
  - The simulation results can be used to improve the performance
  - Hopping to get good results for the ongoing work

Questions?

Simulation of Wireless Networks