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
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► 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
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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

MN-0

RTR

AGT

MN-1

RTR

AGT
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► Analysis of Simulation Results (Trace file)

Trace File Format:

- Receiving a packet
- Receiver ID
- Packet ID
- Header size
- MAC detail
- TTL
- Acknowledgement #
- Time
- Receiver MAC ID
- Type of Packet
- Expected packet arrival time:
  (a2 = 162 sec)
- IP: (0x0800) & ARP: (0x0806)
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► 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]  \rightarrow connection setup message
s   1.11992  _0_ RTR   -- 1 message 32 [0 0 0 0]  ---- [0:255 -1:255 32 0]  \rightarrow connection setup message

M   10.0000  0 (5.00, 2.00, 0.00)  \rightarrow current location of node-0
M   10.0000  1 (370.0, 360), (25.0, 20.0), 15.00  \rightarrow 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  \rightarrow 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  \rightarrow MN-0 stored packets in IFQ

s   12.9411  _1_ RTR   -- 3 message 32 [0 0 0 0]  ---- [1:255 -1:255 32 0]  \rightarrow connection setup message
s   13.2426  _0_ RTR   -- 4 message 32 [0 0 0 0]  ---- [0:255 -1:255 32 0]  \rightarrow 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  \rightarrow 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  \rightarrow 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   27.7185  _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]  \rightarrow connection setup message
s   40.9189  _0_ RTR   -- 10 message 32 [0 0 0 0]  ---- [0:255 -1:255 32 0]  \rightarrow 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 (Part 2):

<table>
<thead>
<tr>
<th>s</th>
<th>76.2309 _0_RTR</th>
<th>11 tcp 80 [0 0 0 0]</th>
<th>[0:0 1:0 32 1] [0 0] 0 0</th>
<th>MN-0 sending IP packets</th>
</tr>
</thead>
<tbody>
<tr>
<td>s</td>
<td>76.3671 _0_RTR</td>
<td>12 tcp 80 [0 0 0 0]</td>
<td>[0:0 1:0 32 1] [0 0] 0 0</td>
<td>MN-0 sending IP packets</td>
</tr>
<tr>
<td>r</td>
<td>76.3771 _0_AG1</td>
<td>11 tcp 80 [0 0 0 0]</td>
<td>[0:0 1:0 32 1] [0 0] 0 0</td>
<td>MN-0 sending IP packets</td>
</tr>
<tr>
<td>r</td>
<td>76.3981 _0_AG1</td>
<td>12 tcp 80 [0 0 0 0]</td>
<td>[0:0 1:0 32 1] [0 0] 0 0</td>
<td>MN-0 sending IP packets</td>
</tr>
<tr>
<td>D</td>
<td>76.5804 _0_AG1</td>
<td>2 tcp 80 [0 0 0 0]</td>
<td>[0:0 1:0 32 800] [0 0] 0 0</td>
<td>TFQ is full, MN-0 drops packets</td>
</tr>
<tr>
<td>s</td>
<td>81.5030 _1_RTR</td>
<td>17 message 32 [1 0 0 0]</td>
<td>[1:255 1:255 32 0]</td>
<td>connection setup message</td>
</tr>
<tr>
<td>r</td>
<td>81.5039 _0_AG1</td>
<td>17 message 32 [0 f f f f f 1 0]</td>
<td>[1:255 1:255 32 0]</td>
<td>connection setup message</td>
</tr>
<tr>
<td>s</td>
<td>83.2613 _0_RTR</td>
<td>18 message 44 [0 1 1 0]</td>
<td>[1:255 1:255 32 0]</td>
<td>connection setup message</td>
</tr>
<tr>
<td>r</td>
<td>83.3011 _1_AG1</td>
<td>18 message 44 [1 f f f f f 0 0]</td>
<td>[0:255 1:255 32 0]</td>
<td>connection setup message</td>
</tr>
</tbody>
</table>

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_AG1 | 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_AG1 | 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_AG1 | 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_AG1 | 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_AG1 | 87 tcp 1060 [13a 0 0 800] | [0:0 1:0 32 1] [33 0] 0 0 | MN-0 stored packets in TFQ |

Note: Packets are transmitted between MN-0 & MN-1 during 81.000 to 116.000. Connection remains lost till 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

MN-0

MN-1

MN-2
Simulation of Wireless Networks

► Three nodes wireless simulation with DSR
Simulation of Wireless Networks

- Three nodes wireless simulation with DSR
Simulation of Wireless Networks

► Analysis of Simulation Results

Analysis of Simulation Results (Trace File Output):

Movements Time IN-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, 159.37, 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 _O_ ACT --- 0 chr 512 [0 0 0] ------- [0:0 2:0 32 0] [0]
s 127.936679222 _O_ 0 [0 -> 2] 1(0) to 1 [0 1 2] (0 to 1 to 2)
r 120.006367001 _2_ ACT --- 0 chr 512 [13a 2 1 000] ---[0:0 2:0 32 2] [0]

s 131.663664440 _O_ ACT --- 4 chr 512 [0 0 0] -------[0:0 2:0 32 2] [1]
s 131.663664440 _O_ 4 [0 -> 2] 1(0) to 1 [0 1 2]
r 131.675428596 _2_ ACT --- 4 chr 512 [13a 2 1 000] ---[0:0 2:0 32 2] [1]

s 133.945596825 _O_ ACT --- 5 chr 512 [0 0 0] -------[0:0 2:0 32 2] [2]
s 133.945596825 _O_ 5 [0 -> 2] 1(0) to 1 [0 1 2]
r 133.957974762 _2_ ACT --- 5 chr 512 [13a 2 1 000] ---[0:0 2:0 32 2] [2]

s 137.198116852 _1_ ACT --- 6 chr 512 [0 0 0] -------[1:0 2:0 32 1] [3]
s 137.198116852 _1_ 6 [1 -> 2] 1(1) to 2 [1 1 2]
r 139.194312345 _2_ ACT --- 5 chr 512 [13a 2 1 000] ---[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
Simulation of Wireless Networks

Questions?