Survey of Ad Hoc Network Routing Protocols

Team Adhocracy
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Coming Up

- Project Summary
- Results
  - Flooding Algorithm
  - DSR
  - Champ
  - GPSR
- Simulation Inputs/Outputs
- Comparison
- Future Work
- Question/Comments
- References

Project Summary

- Compare three Adhoc routing algorithms
  - DSR
  - Champ
  - GPSR
- Attempt to determine benefits and weaknesses of each algorithm
- Use metrics to determine which one works the best

Flooding Algorithm

- Created a baseline flooding algorithm
- Every data packet is flooded
- Nodes cache seen packets to not retransmit
- In a network without collisions:
  - Guaranteed lowest hops for first packet arrival
  - Lowest loss
  - Highest overhead

Dynamic Source Routing

- Working features so far:
  - Route Discovery (with retransmissions)
  - Route Reply
  - Route caching (originator and target only)
  - Frame propagation via source routes
  - Frame retransmission (timeouts based)
    - Passive Ack
    - Active Ack
  - Route maintenance / route errors

Dynamic Source Routing

- Not Working / Future Work
  - Route error propagation in discovery
  - Most all optimizations except passive ack
    - Intermediate route caching
    - Overhearing route caching
    - Packet salvaging
    - Route shortening
    - Negative information cache

CHAMP

- <u>C</u>ac<u>h</u>ing <u>a</u>nd <u>M</u>ulti-<u>P</u>ath routing protocol.

http://texaspecanfest.com/trophy.jpg

Progress

- RREQ get to Destination
- RREP are generated
  - Don't seem to make it to source
- Things implemented but can't test yet
  - Data forwarding
  - Route Maintenance
- So right now champ is really the worst since it can't actually send a packet.
- Champ paper is really dense.
  - Yet still doesn't say all.

Predictions

- Champ should be more effective then DSR when things move since it can look for moved node at intermediate nodes.

Future Work Champ

- Fix RREP
- Test Data Forward
- Fix Data Forwarding Probably
- Test Route Maintenance
- Fix
- Compare to other algorithms
- Prove that Champ is really the Champ
  - Time will tell

GPSR

- Working features
  - Greedy forwarding
  - Perimeter forwarding
  - Overhearing neighbor updating
  - Beaconing
- Future Work
  - Destination
  - Location determination

Simulation Inputs

- Algorithm
- Transfer Rate
- Power / Idle Power
- Total Nodes / Positions
- Communication / Src to Dest or Random
- Movement / Src to Dest, Random, None
- Area

```
Sim.Routing.GPSR.Algorithm 25 2 0.5 1 100000 0 100 5 400 0 8 0
0
1
GPSR Test 3
```

```
Sim.Routing.GPSR.Algorithm 25 5 0 1 100000 0 100 5 122 1 8 2
2 24 0 0 6 6
0 24 1
GPSR Test 6
```

```
Sim.Routing.GPSR.Algorithm 25 2 0.5 1 100000 0 1000 5 400 0 8 0
0
0 0 24
GPSR Test 2
```

```
Sim.Routing.DSR.DSRRoutingAlgorithm 9 2 0 1 100000 0 1000 51 400 0 8 0
0
0 0 8
DSR Test 1
```

Simulation Outputs

- ## Packets
  - Loss
  - Hops
  - Latency
- ## Frames
  - Size
- ## Power
  - /node
- ## Transmit
  - %working

```xml
- <results>
  - <packets>
      <totalSent>200</totalSent>
      <totalRecieved>200</totalRecieved>
      <loss type="%">0.0</loss>
      <hopsPerPacket>1.0</hopsPerPacket>
      <totalHops>200</totalHops>
      <minPacketHops>1</minPacketHops>
      <distPerPacket>8.217861746415839</distPerPacket>
      <totalDist>1643.5723492831676</totalDist>
      <minPacketDist>4.973199078619064</minPacketDist>
      <timePerPacket>0.009206400000001573</timePerPacket>
      <totalTime>1.8412800000003147</totalTime>
      <minPacketTime>0.004479999999999151</minPacketTime>
  </packets>
  - <frames>
      <totalSent>2681</totalSent>
      <totalRecieved>59720</totalRecieved>
      <size type="bytes">23605</size>
  </frames>
  - <power>
      <total>101.8884</total>
      <perNode>4.0755360000000005</perNode>
  </power>
  - <transmitting>
      <total type="seconds">1.8884000000000007</total>
      <timePerNode type="seconds">0.07553600000000003</timePerNode>
      <percent type="%">0.0188840000000001</percent>
  </transmitting>
</results>
```

Data Comparisons

- Flooding vs All: Hops 155k vs 4k (expected)
- DSR vs. GPSR: Flooding sends larger amounts of data than beaconing
  - Transmit time is longer so DSR uses more power (missing Location awareness power)
- DSR vs GPSR: generally same on Hop count latency
- Champ all overhead thus far
  - For static may be worse then both.
  - Hopefully will be impressive with moving node.

Comparison

- DSR
  - Guaranteed to lose a packet when a route changes
  - Complicated to implement, lots of subtle details
- CHAMP
  - Could out-perform DSR when routes change
- GPSR
  - Best algorithm if its assumptions can be met
  - Simplest to implement after flooding algorithm
  - Doesn't handle retransmissions?
    - 10% noise means <60% delivery rate on 5 hops

Future Work

- Pretty GUI
- More realism
  - More link layer info maybe allow simulation on different link layers.
- Try more algorithms
  - Try to find more that are easy to implement like GPSR
  - Try typical Internet routing algorithm

Comments/Questions

?

References

- Johnson, David B., Maltz, David A., Broch, Josh. 2001. DSR: The Dynamic Source Routing Protocol for Multi-Hop Wireless Ad Hoc Networks. in Ad Hoc Networking, edited by Charles E. Perkins, Chapter 5, pp. 139-172, Addison-Wesley, 2001. Obtained from http://www.monarch.cs.rice.edu/monarch-papers/dsr-chapter00.ps
- ALVIN C. VALERA, WINSTON K.G. SEAH AND S.V. RAO, CHAMP: A Highly Resilient and Energy-Efficient Routing Protocol for Mobile Ad hoc Networks. In Proceedings of the 5th IEEE Conference on Mobile and Wireless Communications Networks (MWCN 2002), Stockholm, Sept 9-11, 2002.
- Karp, B. and Kung, H. T. 2000. GPSR: greedy perimeter stateless routing for wireless networks. In Proceedings of the 6th Annual international Conference on Mobile Computing and Networking (Boston, Massachusetts, United States, August 06 - 11, 2000). MobiCom '00. ACM Press, New York, NY, 243-254. DOI= http://doi.acm.org/10.1145/345910.345953