

Mobility-induced Location Errors and its Effects on Location-based Routing : Improvement using Mobility Prediction

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Objective

- Study the effect of inaccurate location information caused by node mobility on location-based routing protocol
- Introduce a mobility prediction scheme (MP) to reduce the performance degradation caused by node mobility

Approach

- Perform initial simulations with GPSR varying some critical parameter values
 - Maximum node speed, Beacon interval and mobility pattern
- Analyze the actual effect of node mobility for each combination of parameter variable setting on different mobility model and identify the cause of performance drop from inaccurate location information.
- Suggest a mobility prediction scheme as a solution to the identified problems

Mobility Models

- Random Waypoint (RWP)
- Freeway (FWY)
- Manhattan
- Reference Point Group Mobility (RPGM)

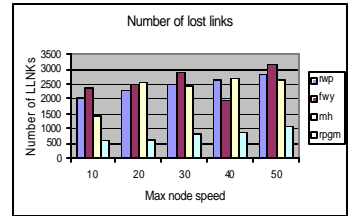
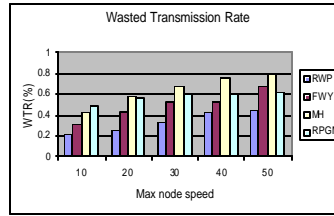
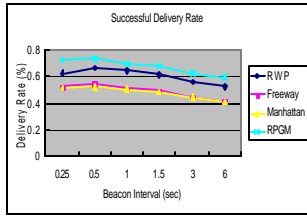
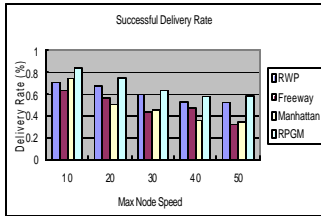
Parameters

- Beacon interval
 - 0.25, 0.5, 1.0, 1.5, 3.0, 6.0 sec
- Maximum node speed
 - 10, 20, 30, 40, 50 m/sec

Metric used

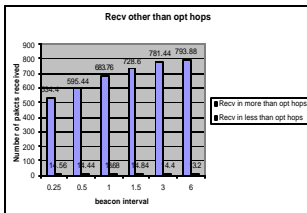
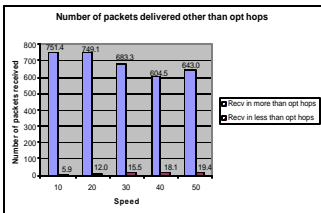
- Successful Delivery Rate (SDR): the number of packets successfully delivered to the destination node over the total number of packets transmitted
- Wasted Transmission Rate (WTR): the number of transmission efforts made for dropped packets during the delivery over the total number of packet transmission
- Number of Lost Link (LLNK): the number of lost link problem observed during the packet forwarding

Analysis on the effect of node mobility



- Mobility model over various maximum node speed (speed 10 shows best result)

- Mobility model over various beacon intervals (bint 0.5 shows best result)



Positive effect of node mobility

- the number of packets delivered via less-than-optimal hops increases as the maximum speed of nodes increases (adapted in DLP)

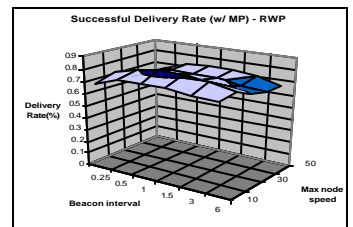
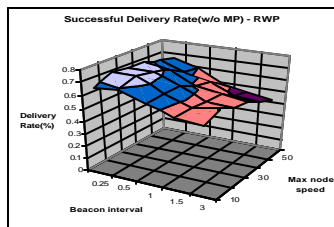
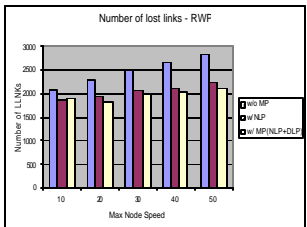
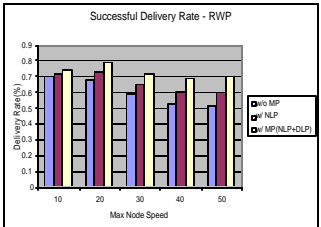
Identified Problems

(1) Node mobility
(2) Asymmetric Link

Loop Problem

- Link Problem (LLNK)**
 - Caused by 'Node Mobility and 'Asymmetric link' between nodes
- LOOP Problem**
 - Caused by 'Node Mobility

Improvement on location-based routing (Mobility Prediction)



- SDR comparison

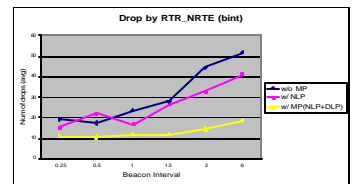
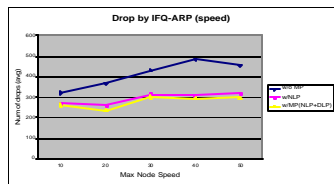
- Number of LLNKs

- SDR w/o MP

- SDR w/ MP (performance levels up)

Mobility Prediction (NLP+DLP)

- Neighbor location Prediction (NLP): Remedy for Link
 - calculate estimated location of every neighbor location and check its radio transmission range when a node finds next hop node for each packet
- Destination location Prediction (DLP): Remedy for LOOP
 - Modification to GPSR algorithm: each node search for the destination node in its neighbor list
- Benefits from adding MP to GPSR
 - The number of LLNK drops 17.5% for RWP, 15.2% for FWY, 14.3% for MH and 6% for RPGM with NLP
 - 'Asymmetric link' problem can be also addressed. GPSR can be used among nodes with different radio transmission range with NLP
 - With MP (NLP plus DLP), the amount of wasted transmission (WTR) is reduced 18.6% for RWP, 37.2% for FWY, 15.2% for MH, 16.45% for RPGM and the SDR levels up even with higher mobility and longer beacon interval cases as figure SDR w/ MP shows (18.4% improvement in SDR on average)



- Drop by IFQ-ARP (reduced by NLP)

- Drop by RTR_N RTE (reduced by DLP)

Future Work

- Mobility prediction scheme will be updated, and it will be introduced for the location services as well as other forwarding strategies than GPSR
- The location information from GPS will be also adjusted with NLP
- The effect of node density on the performance of location-based routing protocol will be investigated