technology
from seed

A Geographic Unicast Routing Algorithm using no Location Service

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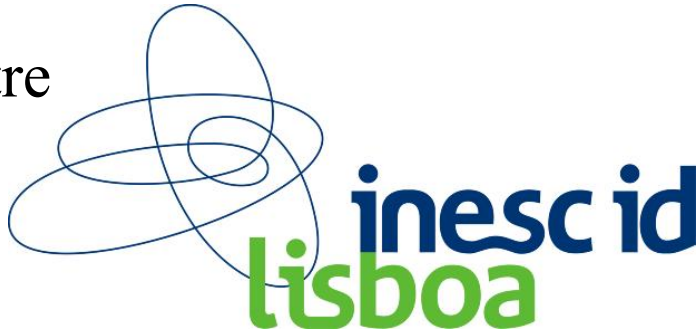


Outline

- Geographic and directional routing
  - Concept
  - Motivation
- Problems to overcome
  - A short state-of-the-art
- Solution
- Conclusion & Future work

Geographical and directional routing - Concept

- Routing in Ad Hoc network is the problem of selecting the next hop.
- Geographical routing means that it relies on the coordinates of the nodes.
- The definition of coordinates enables sending messages using different directions.
- Assuming 1-hop neighbour information, the problem is:
- *Determine the next hop based on the coordinates of the source, destination and neighbours.*

Geographical and directional routing - Motivation

- Routing in Ad Hoc is frequently characterised by broadcast with its associated overhead.
- The introduction of coordinates and directions enables:
  - Unicast transmissions over different interfaces;
  - The possibility to make position-based decisions instead of exchanging additional control information.
- The main objectives of this work was:
  - Reduce overhead;
  - Decrease End-to-End delay.

Problems to overcome

- Routing in Ad Hoc networks has some problems:
  - Use of broadcast in each link for both data and control messages.
  - Broadcast discoveries (i.e. sent to all nodes)
  - Broadcast Storm – Cascading updates sent to all the nodes.

- Geographical Routing presents additional problems:
  - How does the source determines and keeps the coordinates of the destination up-to-date;
  - How to overcome the problem that “closest is not always the best”.
  - Not possible to use a Location Service in an Ad Hoc environment.

State-of-the-art

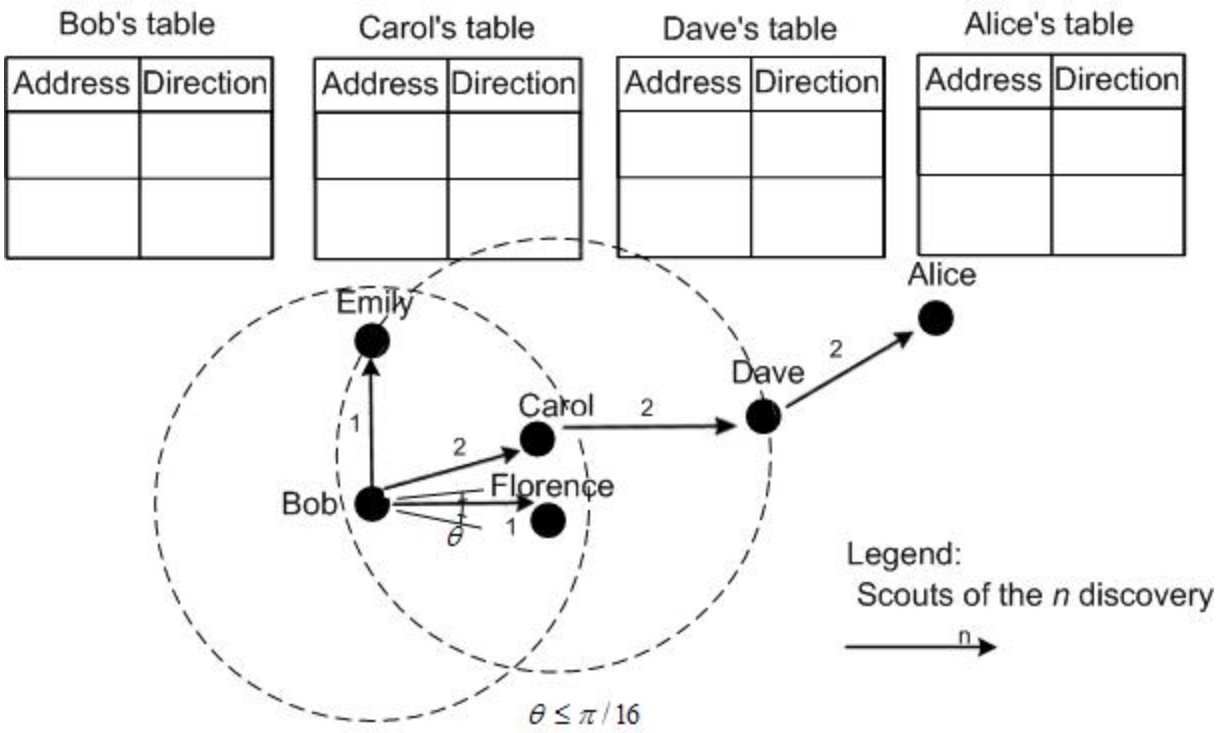
- DSR Dynamic Source Routing
- DSDV Destination-Sequenced Distance Vector
- AODV Ad hoc On-Demand Distance Vector
- OLSR Optimised Link State Routing
- AntHocNet swarm intelligence
- Epidemic Routing
- GPSR Greedy Perimeter Stateless Routing
- ORRP Optimal Reactive Routing Protocol

Solution

- Simple Wide-deploy Algorithm for ad hoc Networks (SWAN)
- Features:
  - Discovery phase based on exploring 8 directions;
  - Proxy state (depends on size of queues);
  - Angle correction technique;
  - Location prediction.

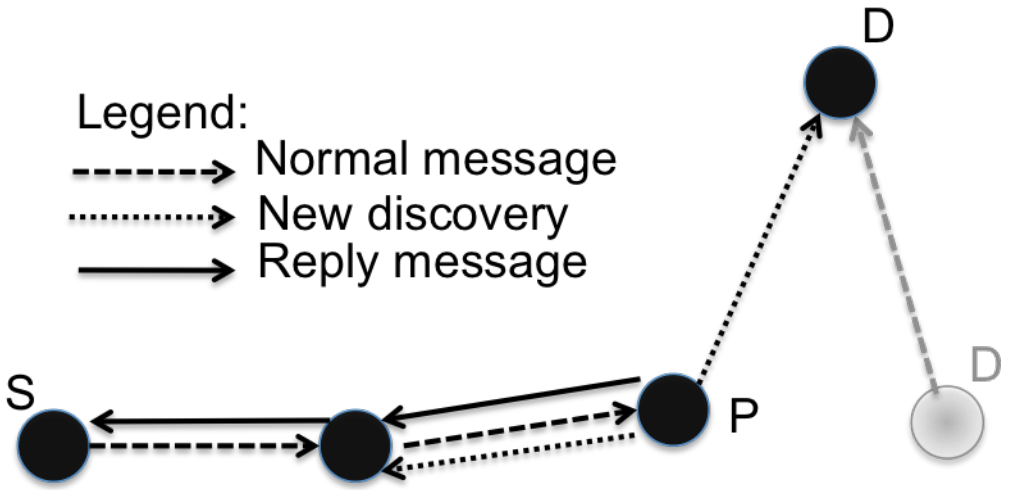
Discovery phase

- Discovery phase:
  - Explore 8 directions:



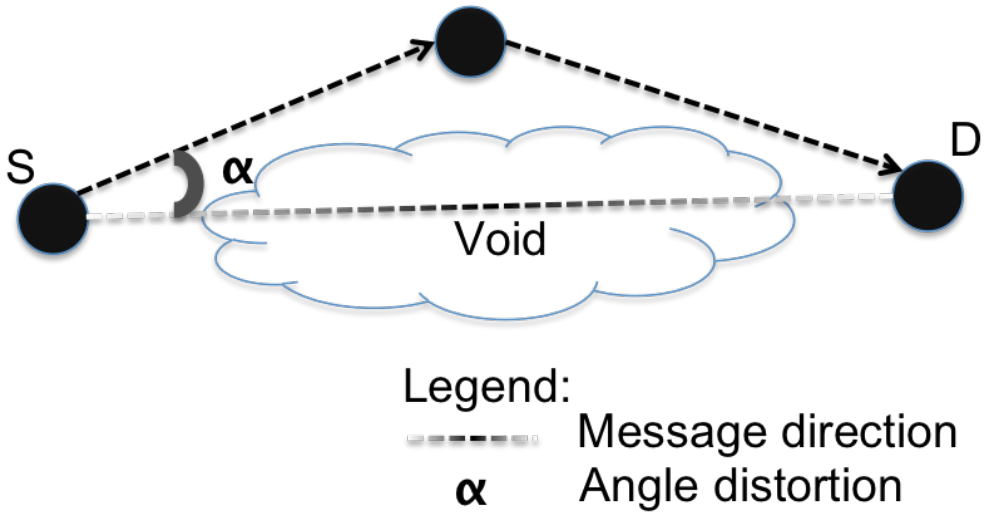
Proxy State

- Proxy State:
  - To avoid discarding messages when there is available queue:



Angle Correction

- Angle correction:
  - To make possible distortions to the forwarding angle:



Location prediction

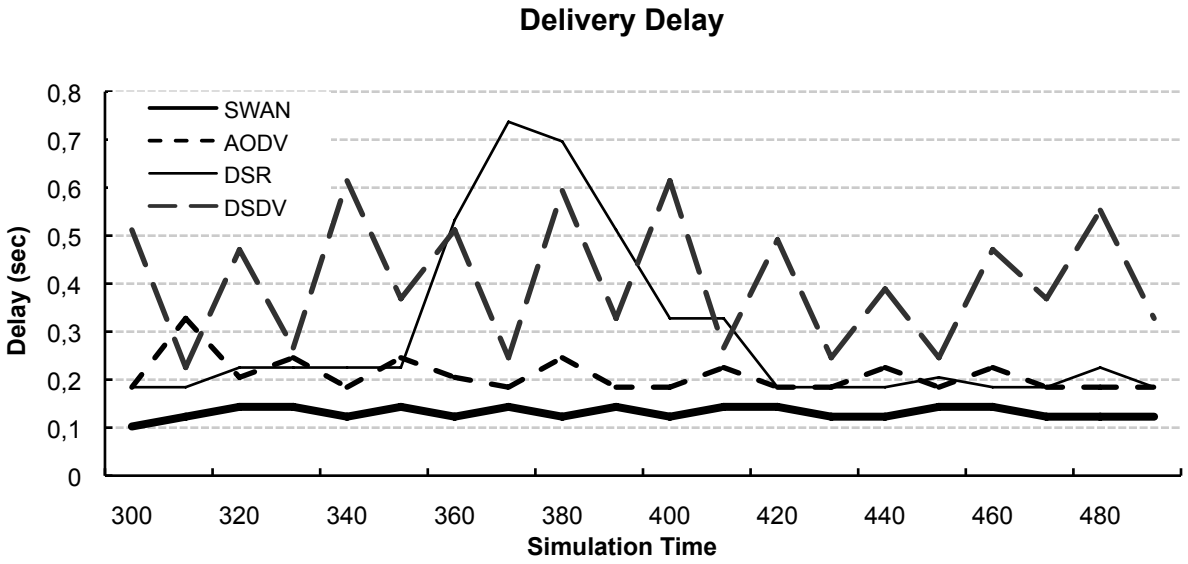
- Location prediction:
  - Inspired on what is done to discard instantaneous trends in stocks .
  - An average movement vector is calculated based on the sampled instant vectors.
  - Use of recursive formula to make easier its calculation.
  - Entries in the forwarding table are updated according to the next predictable position of the destination.
  - The Time-To-Live (TTL) for each entry takes into consideration speed, how accurately is the average vector.
  - For the TTL time, the location prediction is a reasonable assumption.

Experimental Setup

- Setup description:
  - 100 nodes.
  - Antennae range: 100 meters.
  - 1Km x 1Km area.
  - Average 3.6 neighbours at time 0.
  - 2Mb/s transmission rate.
  - 10 information flows.
  - IEEE 802.11 DCF.
  - 128-byte packet per second.
  - Speed of nodes: randomly from 10 to 20 m/s.

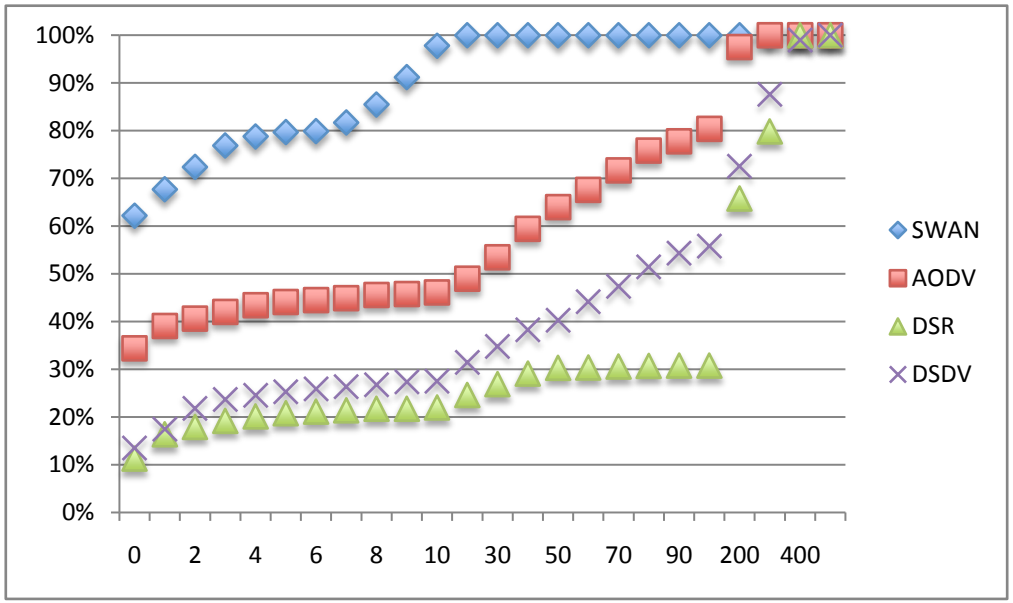
Results

- End-to-End delay:



Results

- Overhead:



Future work

- Study the algorithm in field experiments.
- Improve its coverage for larger networks.
- Improve the performance of the location prediction algorithm.

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