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DHT Routing for Scalable Ad Hoc Networks

Outline

Introduction

- scenario
- motivations

DHT-based Routing

- key idea
- address space

Augmented Tree-based Routing (ATR) protocol

- address space overlay

Performance analysis

Ad-Hoc Networks

Ad hoc Network:

- bandwidth constraints
- multi-hop communication strategy
- flat paradigm
- eventually, mobile devices

Motivations

Traditional ad-hoc routing protocols:

- don't scale efficiently when the number of nodes in the network grows

  static addressing

  routing address equals node identity

- assume axioms contradicted by actual experimental measures

  free-space or two-ray ground propagation model

  time-invariant channels

- exhibit low tolerance against route failures

  shortest-path approach

  looking for only one route, the shortest

Dynamic addressing

Static addressing routing:

- node identity equals routing address

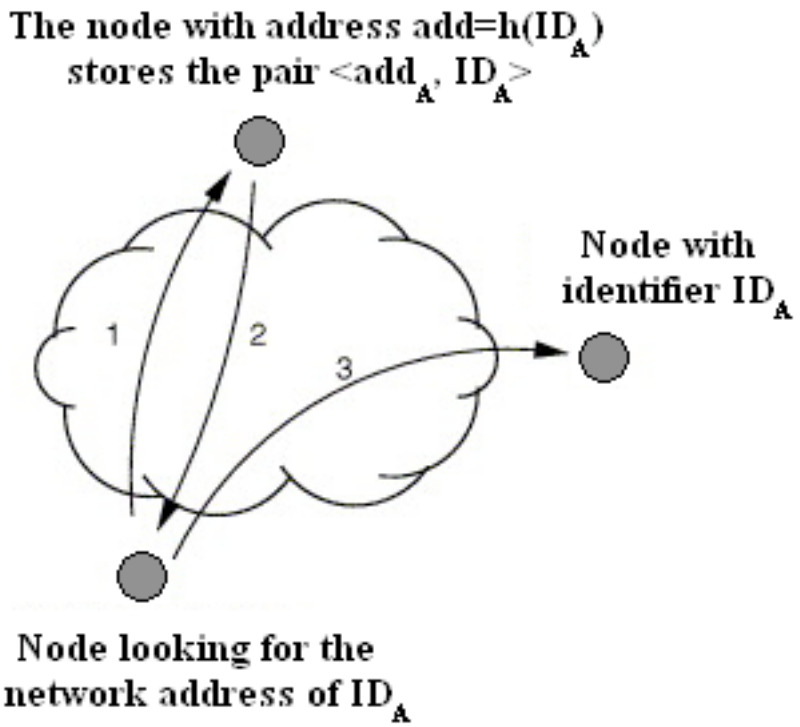
Dynamic addressing routing:

- the time-invariant node identity is separated from the network address, which is transient and reflects the node topology position inside the network

The mapping between identity and network address is provided by a Distributed Hash Table.

Network-layer DHTs introduces new issues with respect to application-layer DHTs (p2p).

Address Discovery

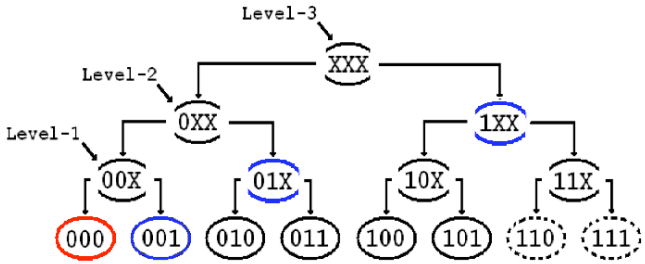


Augmented Tree-based Routing

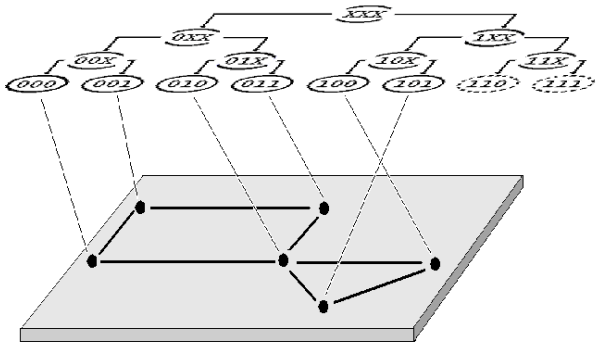
Key issue:

- *hierarchical distance-vector*
- *multi-path*: there are available multiple routes to reach a destination
- *tuned for hostile channels*: it selects the routes basing on link-quality metric
- ip compliant
- independent from link-layer technology
- unicast approach

Address Space Overlay



(a)



(b)

Prefix constraint:

nodes, whose routing addresses share the same prefix, form a connected sub-graph in the network topology.

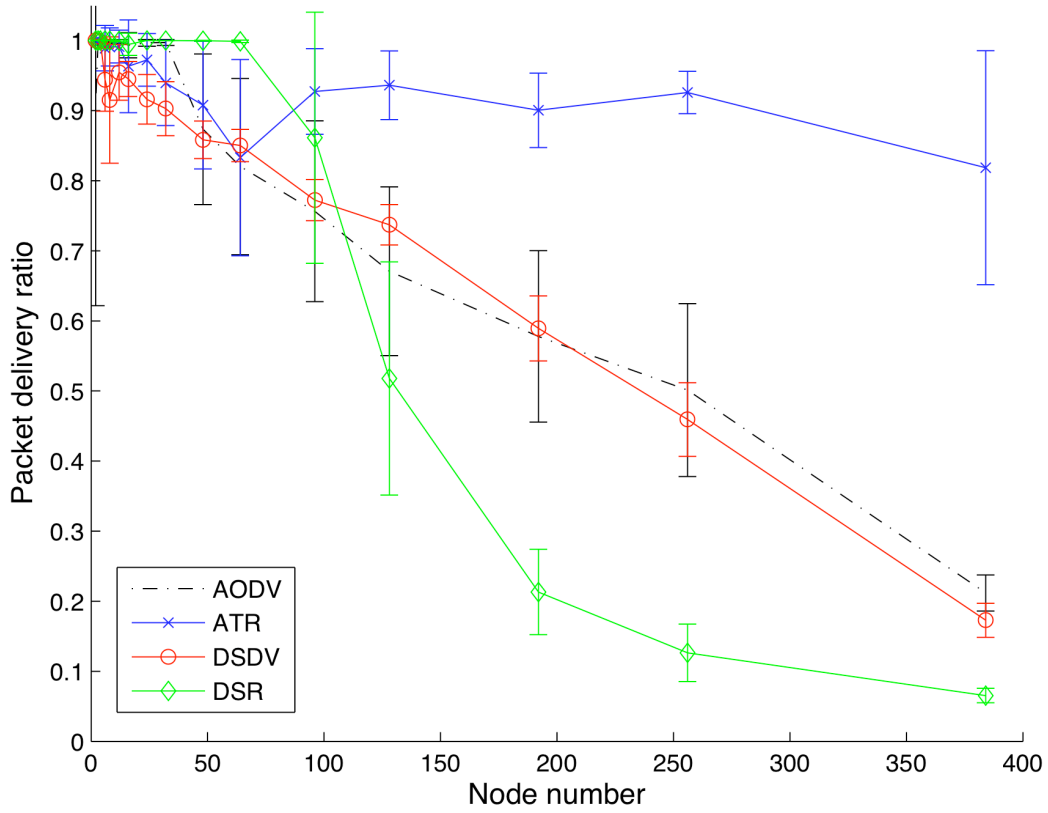
Simulation setup

- Network Simulator 2.31
- realistic channel model to simulate a 802.11b network:
  - long-term fading effects
  - interference due to colliding frames (SINR)
- significant workloads:
  - data flows scale taking into accounts the theoretical capacity scaling bounds for static scenarios

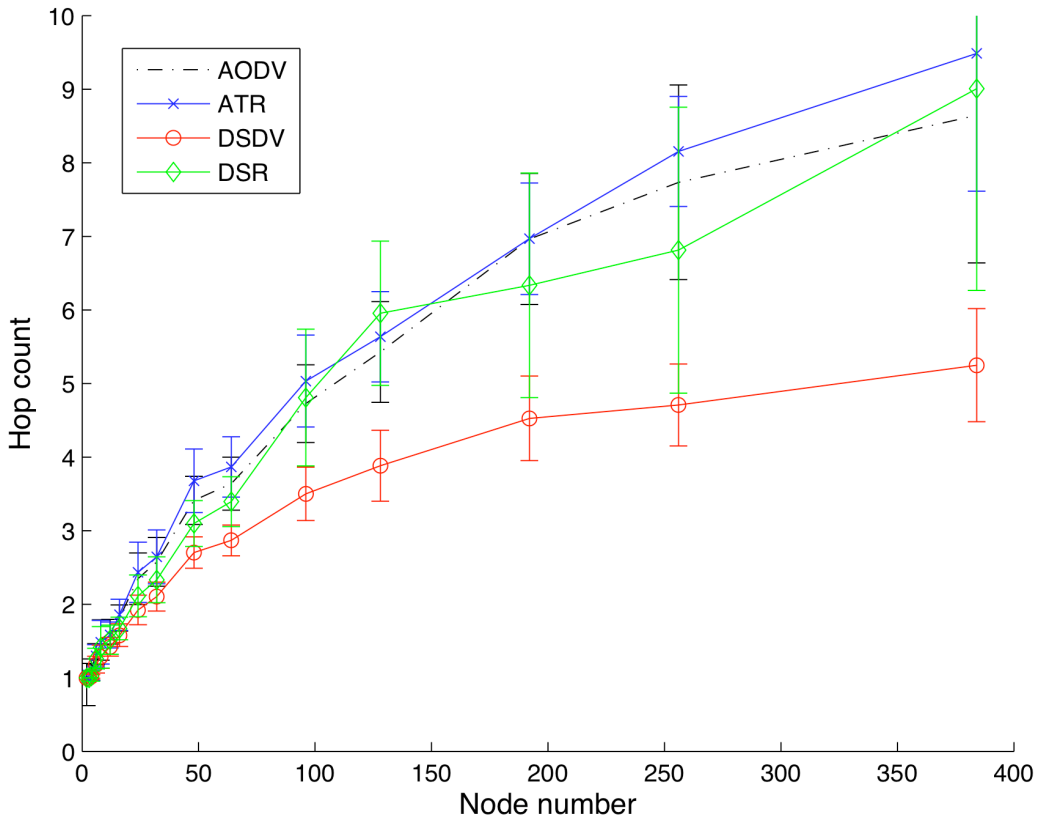
$$O(n\sqrt{n}), \text{ where } n \text{ is the node number}$$

- node density constant

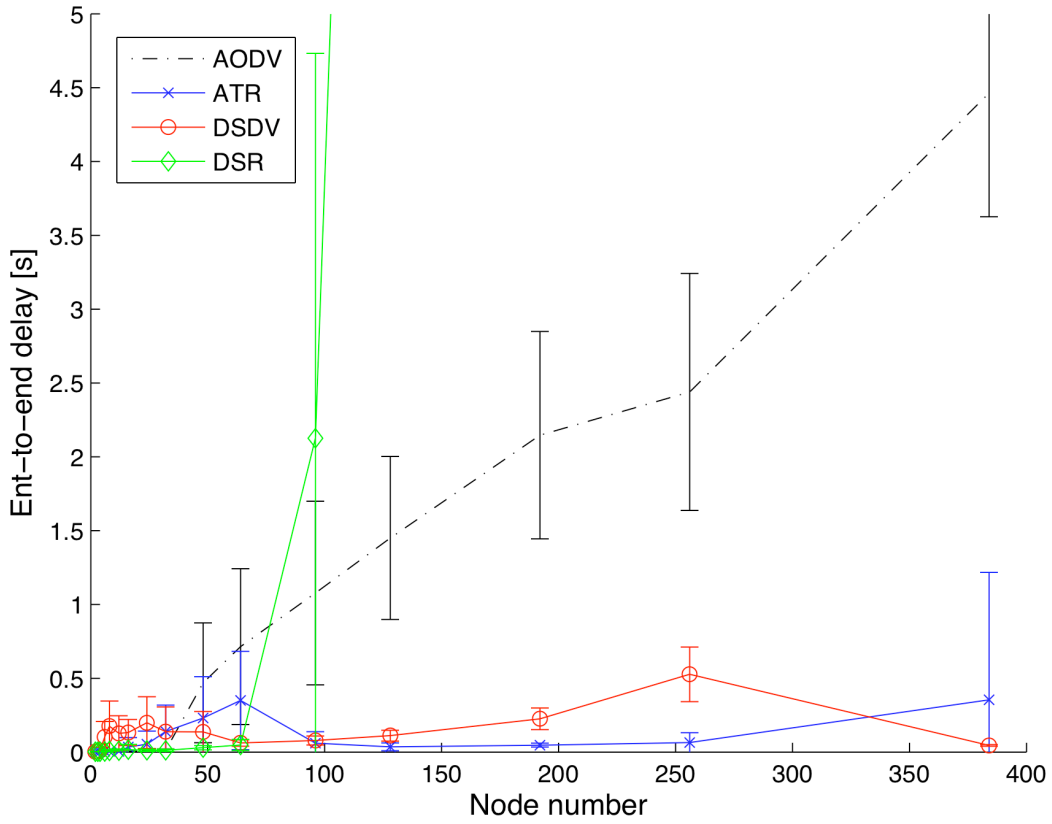
Packet Delivery Ratio



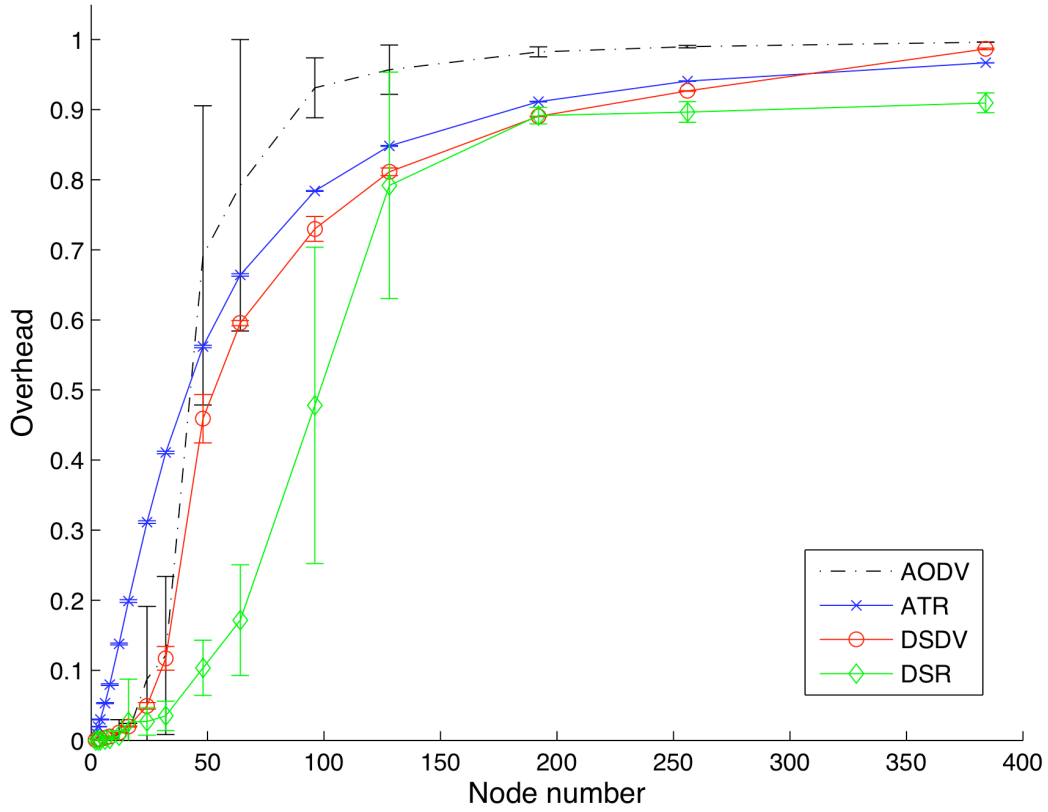
Hop count



End-to-end delay

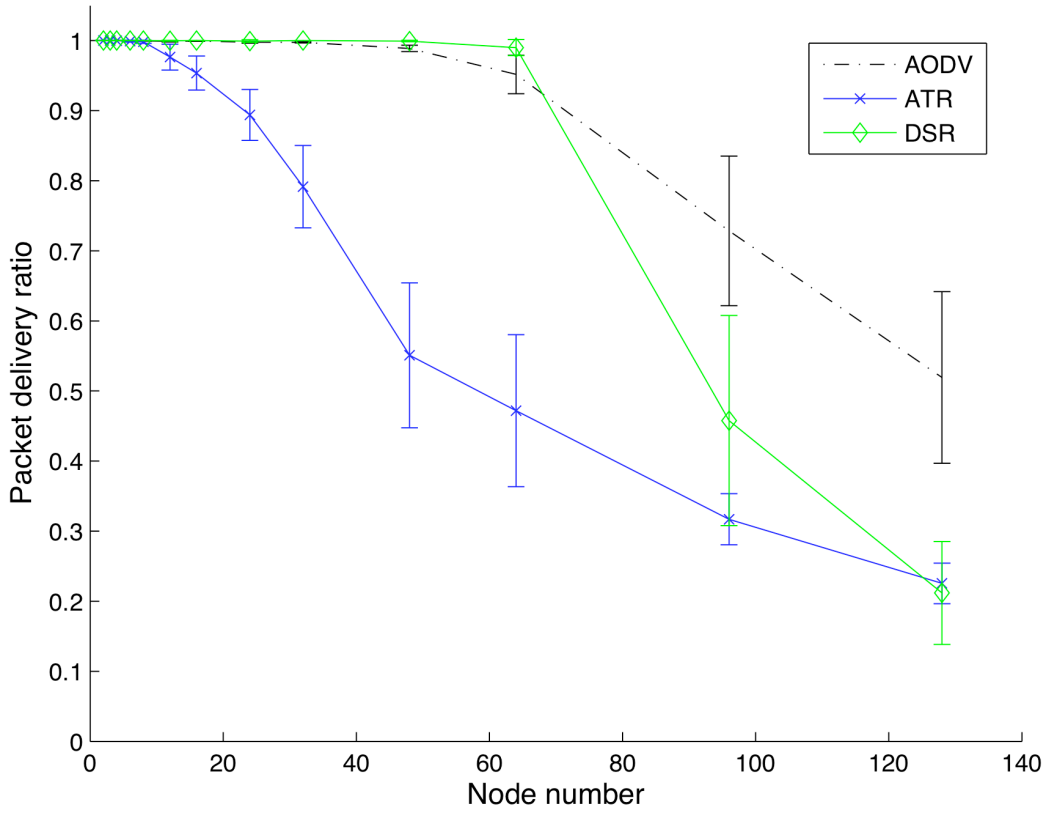


Overhead

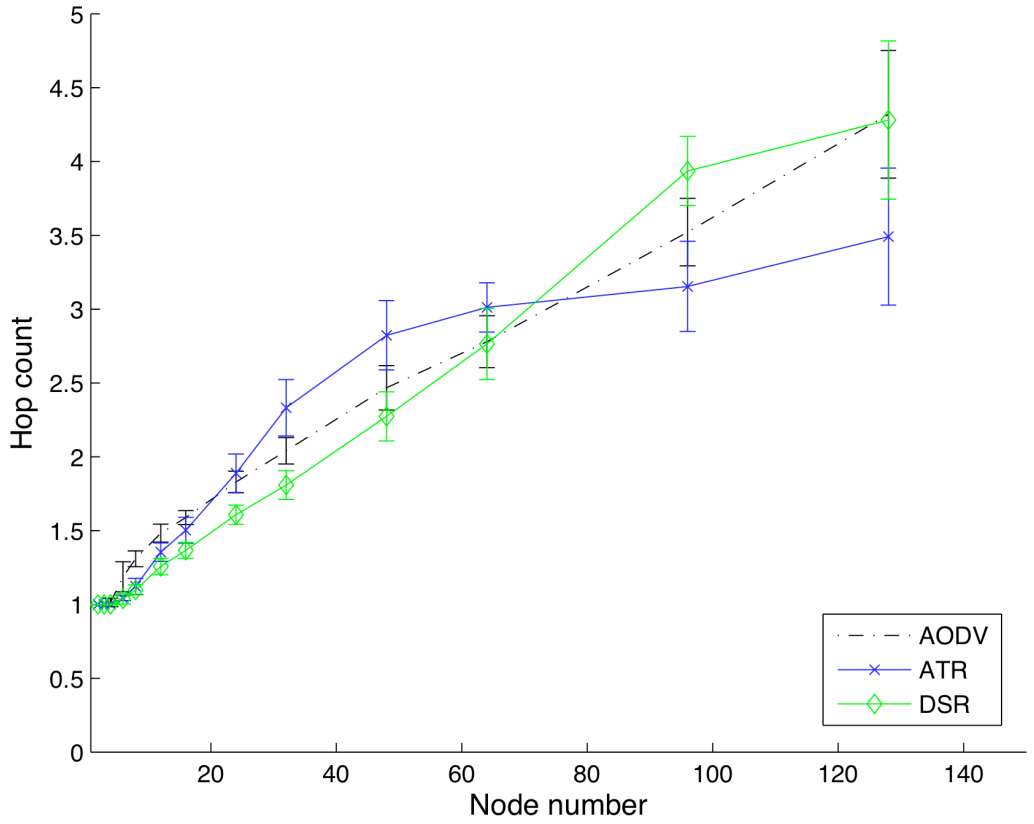


Thanks for your attention

Packet Delivery Ratio



Hop count



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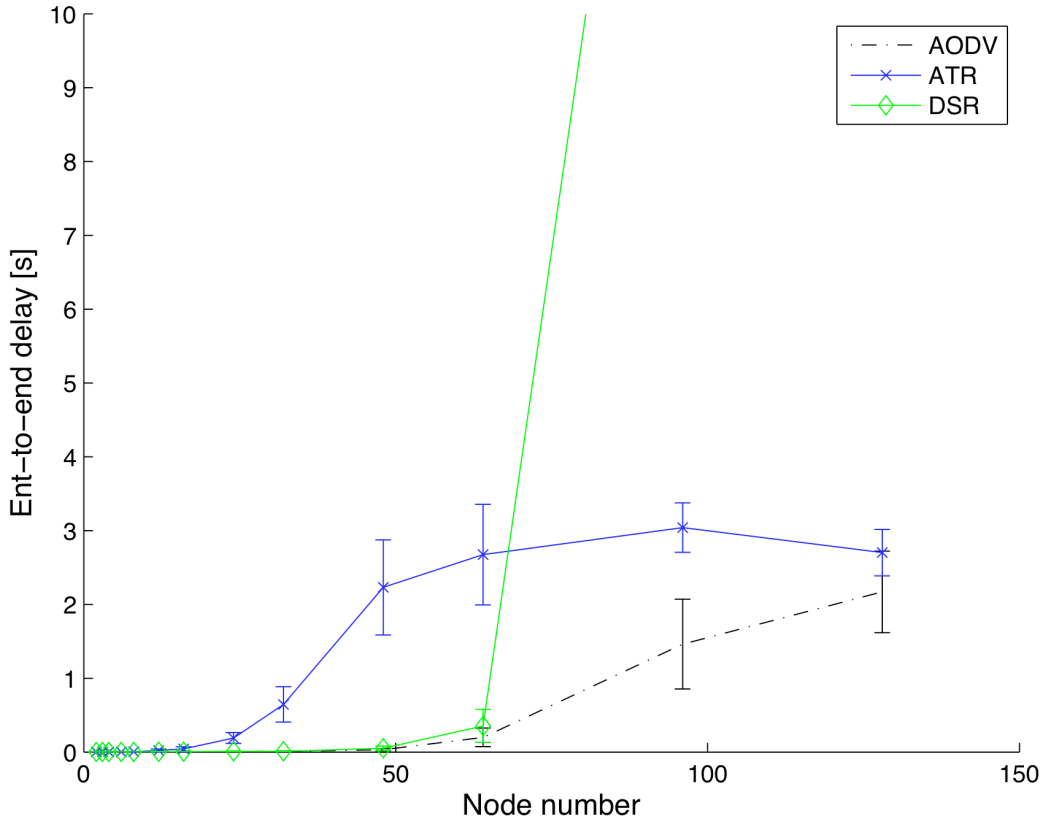

Overhead