Routing for Diverse Wireless Networks
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Goal: A routing protocol that works well across diverse wireless networks

Diverse Wireless Networks
- Delay Tolerant Networks (DTNs)
- Mobile Ad Hoc Networks (MANETs)
- Static Mesh Networks

Challenge 1: Adapt to various network connectivity

Low Connectivity Network
- Routing Strategy: Replication
  - send replicas of a packet along multiple paths (Path 1, 2, 3) to the destination
  - increase the probability of successful transfer
  - reduce expected delay (up to 8x delay gain over forwarding)

High Connectivity Network
- Routing Strategy: Forwarding
  - choose the best path (e.g., the path with min expected delay)

Question: how to adapt replication/forwarding?

ReGain Design: A Finite State Machine Model

Replication
- When replication hurts
  - Choose path based on expected delay
  - Send replicas of a packet on all paths

Forwarding
- When replication helps
  - Choose path based on their delay distributions
  - Send replicas of a packet on two paths that minimize delay

Multi-path Forwarding
- When load is low
  - Send packets along the path with min expected delay
- When load is high
  - delay-based round robin between multiple paths
  - load is inversely proportional to the path delay

Why delay distribution?
- Delay distribution has strong correlation with replication gain over forwarding
- Delay distribution estimates delay more accurately than expected delay

Why two paths?
- Two paths is able to get most replication gain
- More paths won’t help much

Experimental Setup

Deployment on a 16-node static mesh testbed

Simulation on traces from real DTN testbeds: DieselNet and Haggle

Each node: Apple Mac Mani running Linux 2.6, built-in 802.11a/b/g Atheros/MadWifi card

DieselNet: a vehicular DTN testbed with 40 buses

Haggle: a number of Intel iMotes carried by people in Cambridge, UK

ReGain Result

Compared Routing Protocols:
- Forwarding
  - DTLSR
  - AODV
  - OLSR
  - Replication
  - RAPID
  - Random

Future Work

Implement and evaluate the multi-path forwarding component

Summary

ReGain achieves performance comparable to or better than existing protocols in a variety of network environments
- Under low connectivity network, ReGain achieves up to 4x smaller delay than DTLSR
- Under high connectivity, ReGain has up to 2x smaller delay than RAPID