

Routing in Networks of Varying Connectivity

Andrew Grundy

amg@cs.nott.ac.uk

<http://cs.nott.ac.uk/~amg>

Supervisors:

Dr Milena Radenkovic

Prof Uwe Aickelin



The University of
Nottingham

Overview

- The Problem Domain
- Existing Solutions
- My Work
- The Evaluation
- Questions

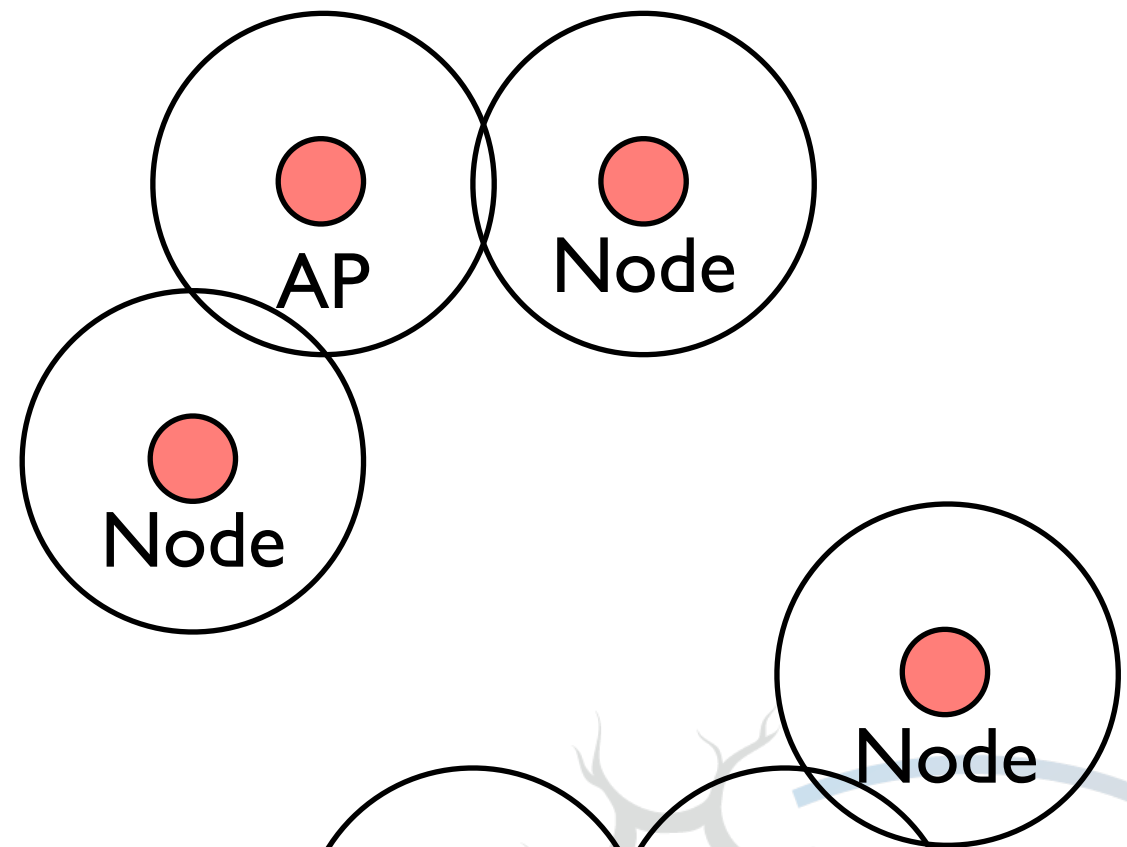


The Problem Domain

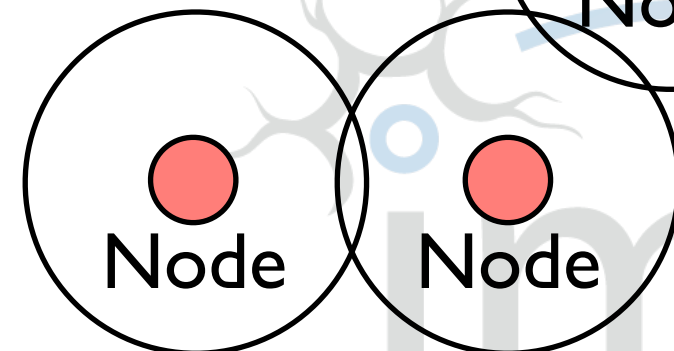
Wired Networks



Wireless Networks



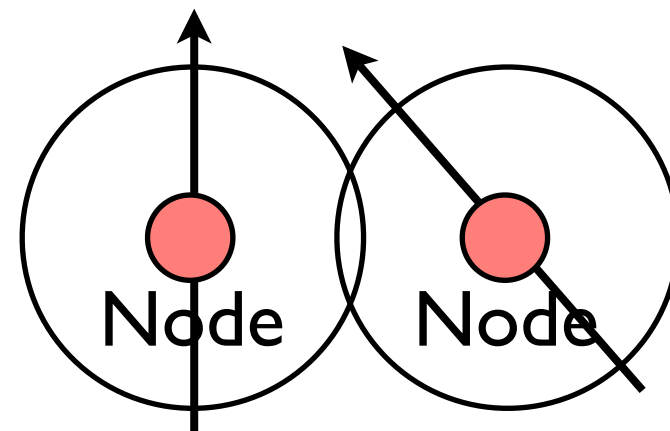
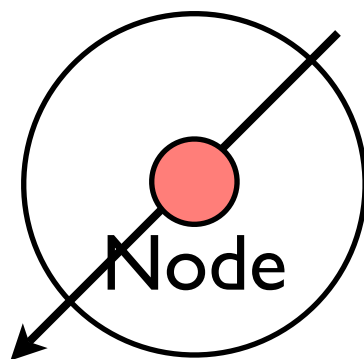
Wireless Ad-Hoc Networks



The Problem Domain

Mobile Wireless Ad-Hoc Networks

Mobile Ad-hoc NETWORK (MANET)



Disconnected Mobile Wireless Ad-Hoc Networks
Disconnection Tolerant Network (DTN)

The Problem Domain

Mobile Ad-hoc NETWORK (MANET)

- End-to-end connectivity is assumed
- Topology is not Fixed
- One-hop set (neighboring nodes) **may change**

Disconnection Tolerant Network (DTN)

- End-to-end connectivity is not assumed
- Topology is not Fixed
- One-hop set is likely to **vary considerably**



Existing Solutions

MANET Routing

Pro-active **Dynamic Source Routing [2]**

Constantly maintain a view of the entire network.

Re-active

Acquire a route **when you need it.**



Existing Solutions

DTN Forwarding [5]

Wait

Hold onto a packet, until you connect to the destination.

Restricted Flood

Beacon the packet hop by hop decrementing the **time to live**.

Controlled Flood

Only **forward to a subset of nodes**, selected based on previous experiences forwarding packets to them.



Existing Solutions

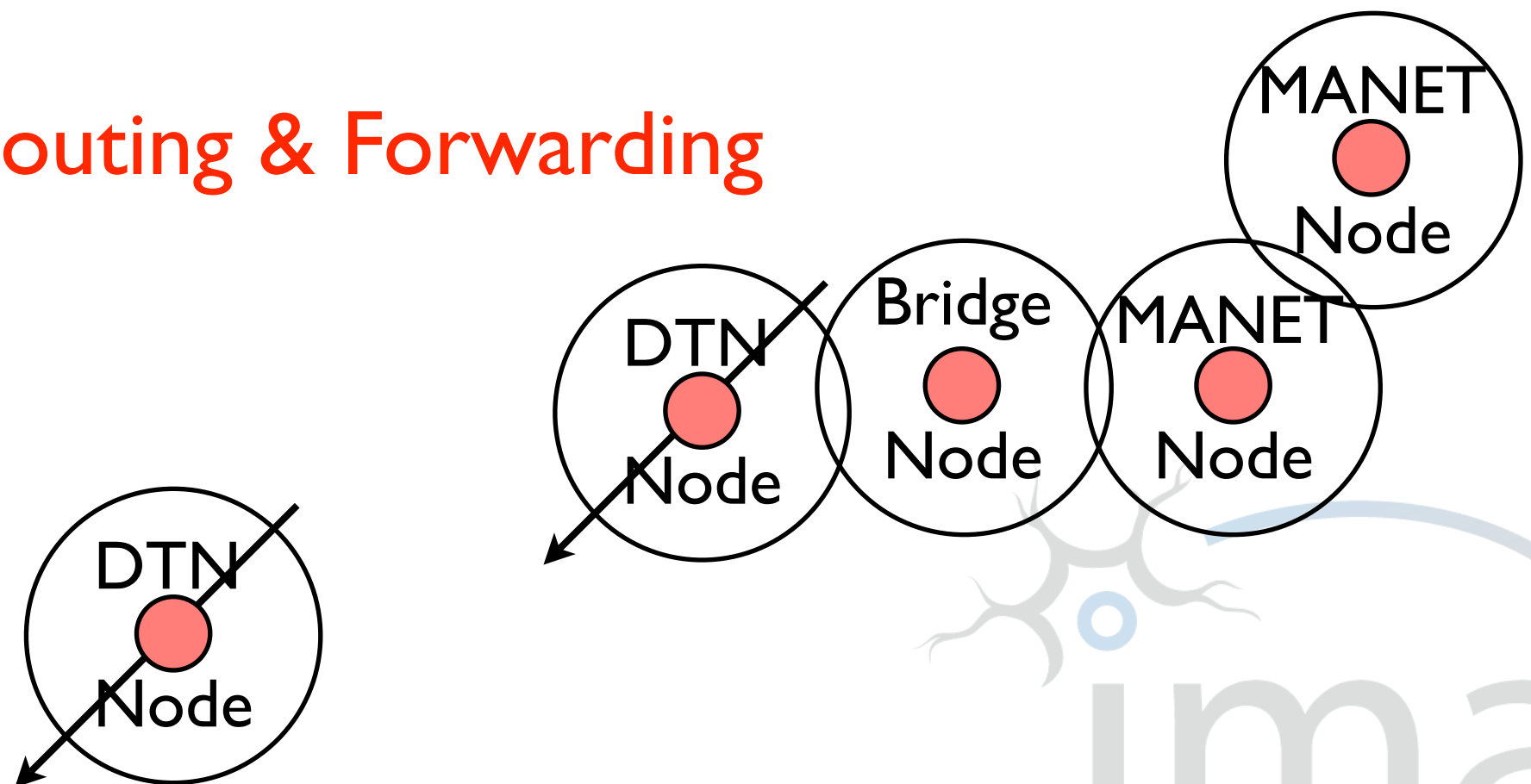
Reactive Routing and Forwarding

Integrating DTN and MANET routing [3]

Two Classifications of Node

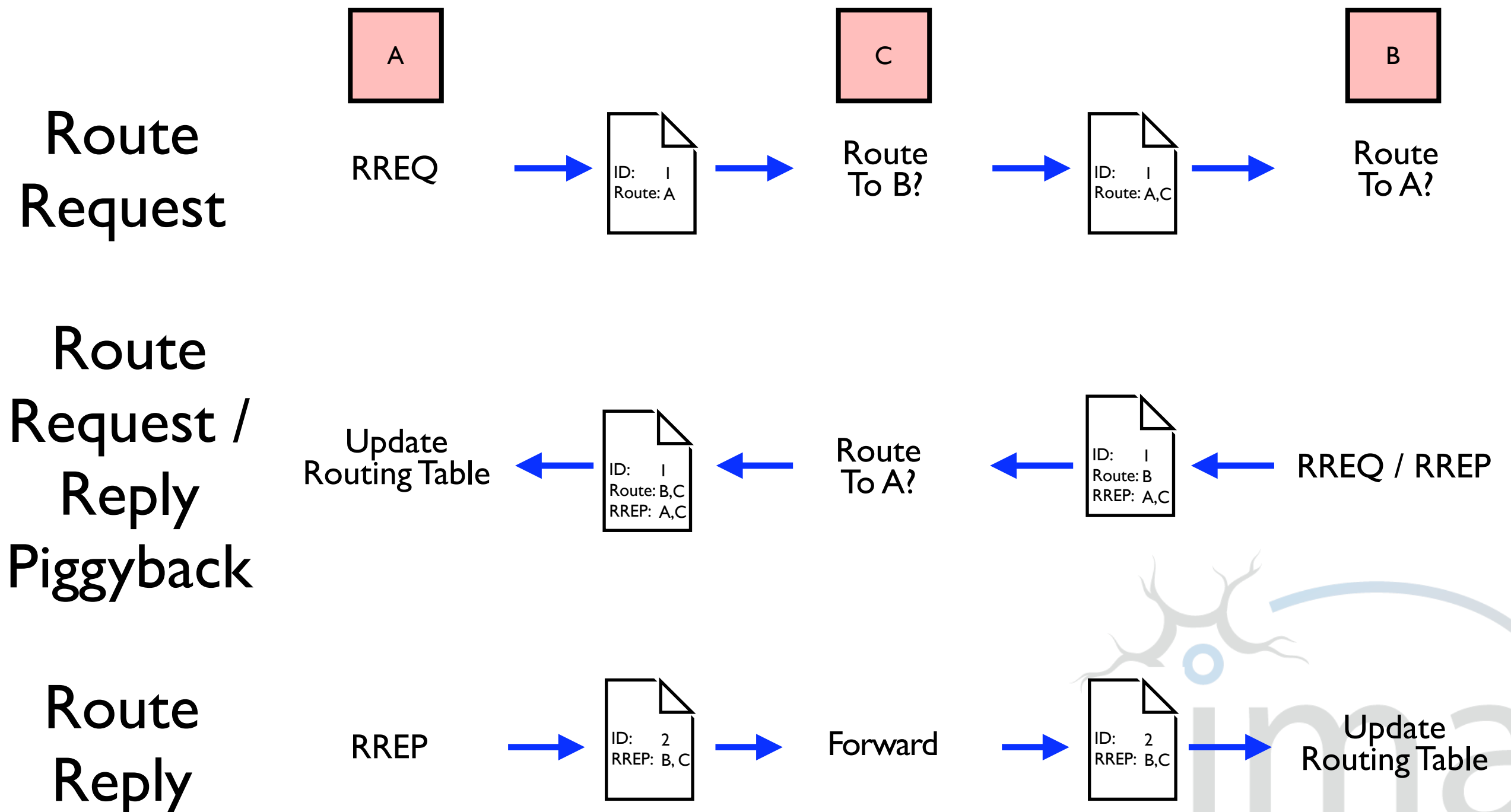
Gently [6]

Proactive Routing & Forwarding

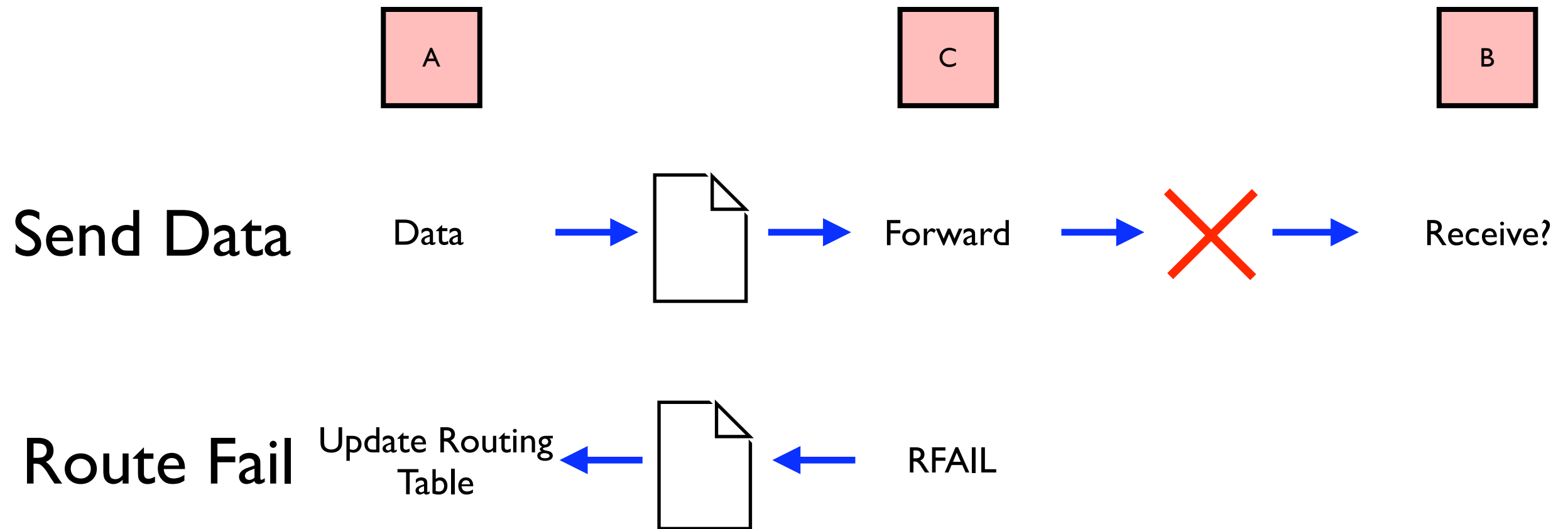


Dynamic Source Routing (DSR)

Route Acquisition



Dynamic Source Routing (DSR) Route Failure



My Work [1]

Why Dynamic Source Routing?

- Disconnection Tolerant Route Acquisition

What are the assumptions?

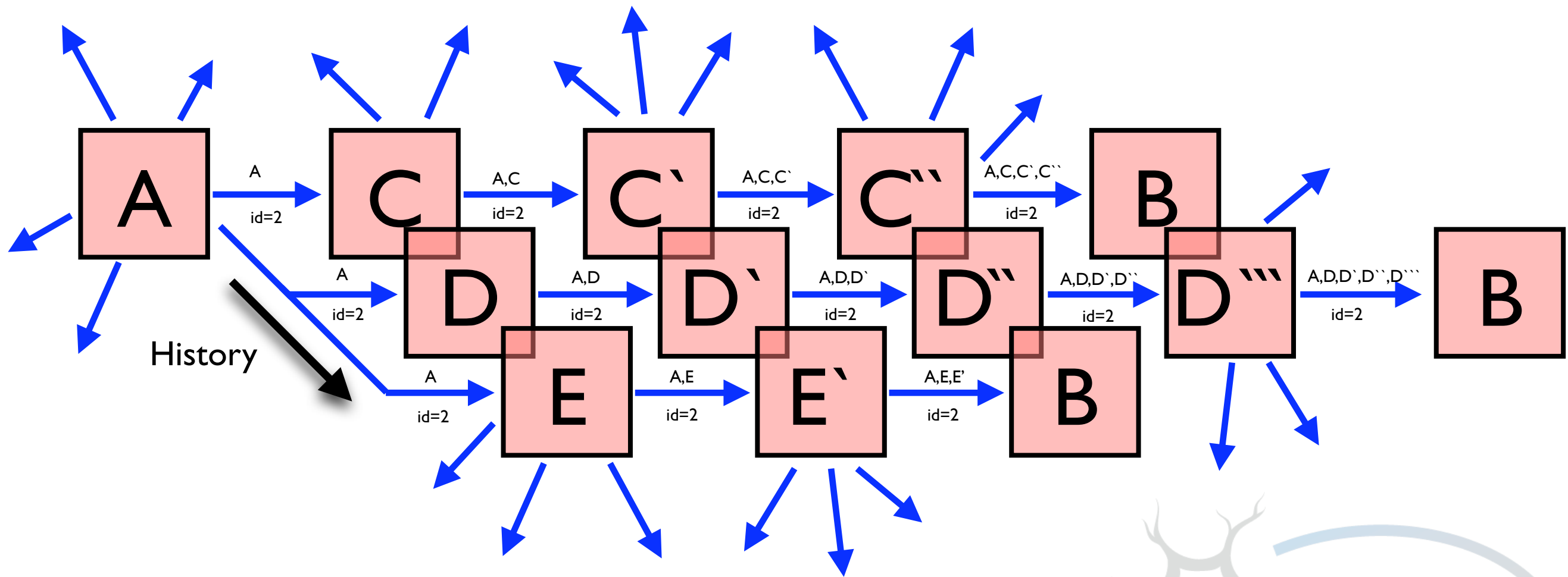
- Disconnection Tolerant Data Forwarding

Why not TCP?

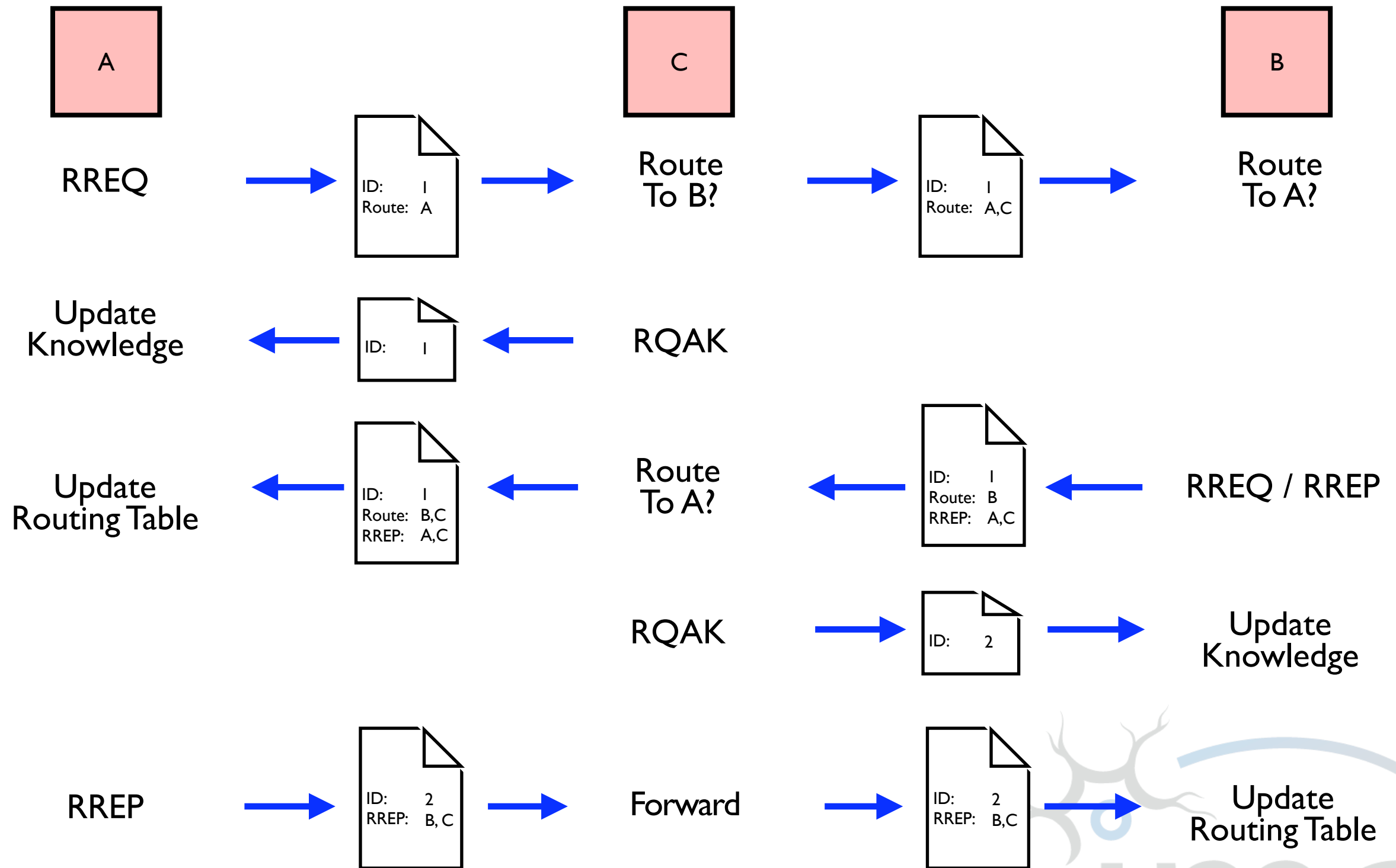
- Packet Scheduling / Duty Cycling

Why is this needed?

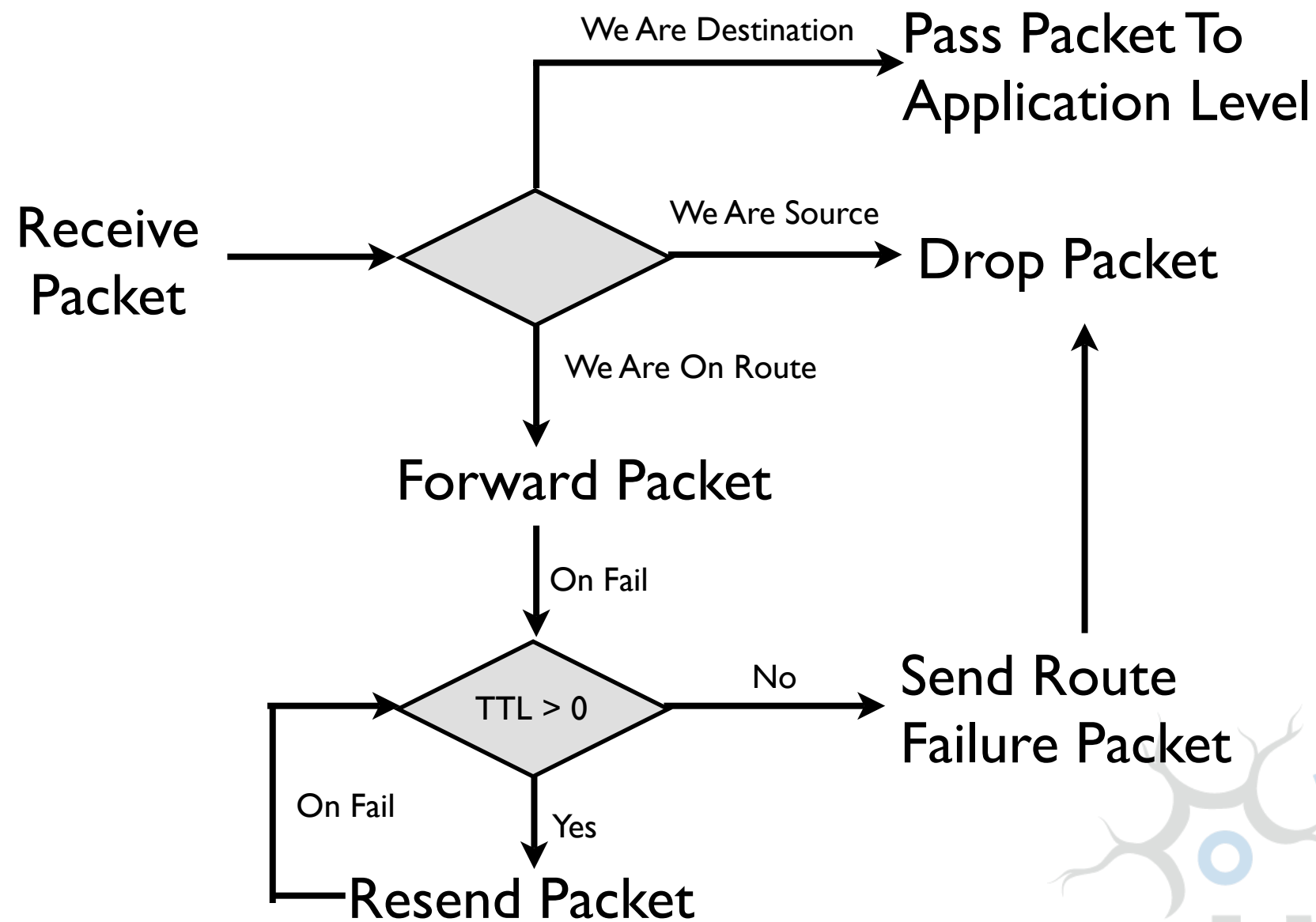
Route Acquisition Over Time



Route Acquisition - Acknowledgement

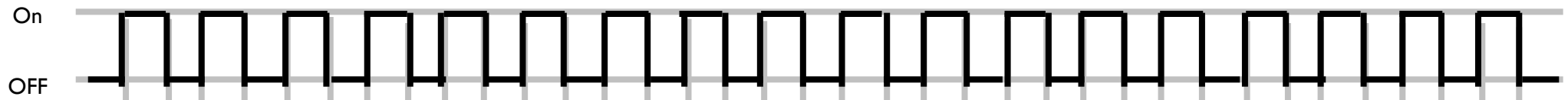


Disconnection Tolerant Data Forwarding

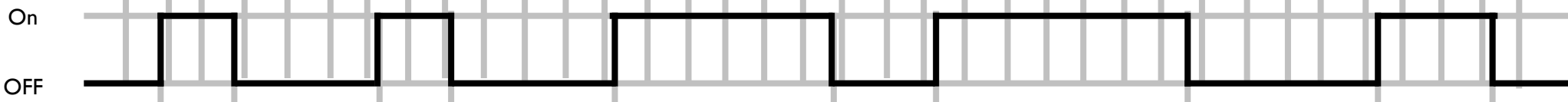


Packet Scheduling / Duty Cycling

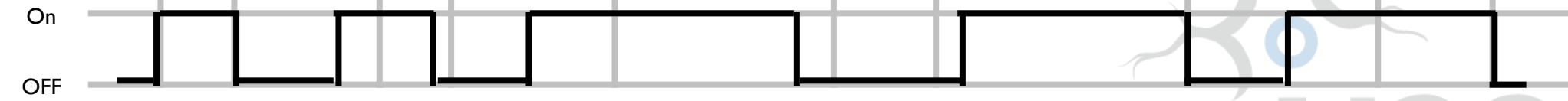
Day 1



Day 2



Day 3



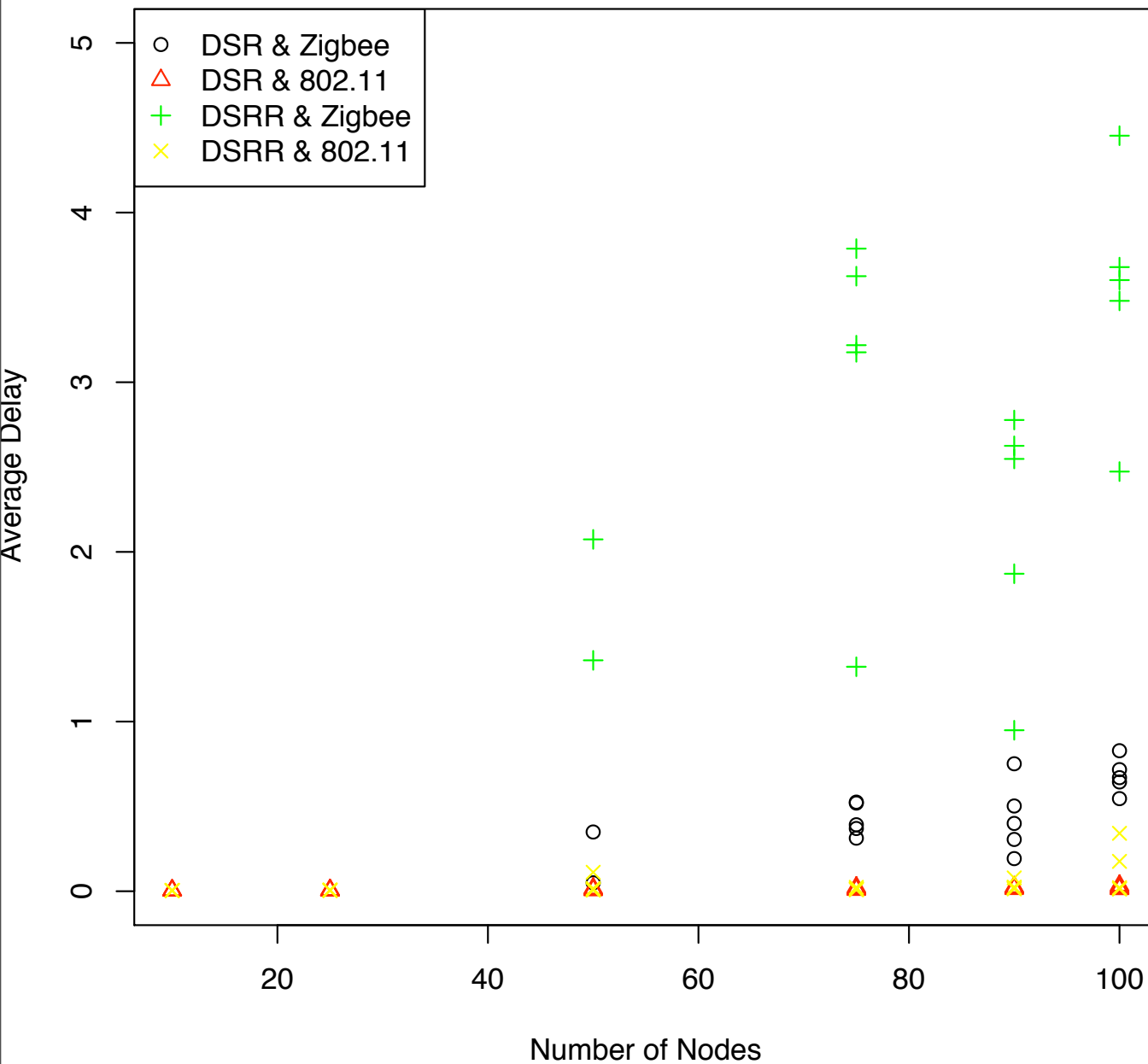
Based on Efficient Node Discovery Algorithm [4]

The Evaluation

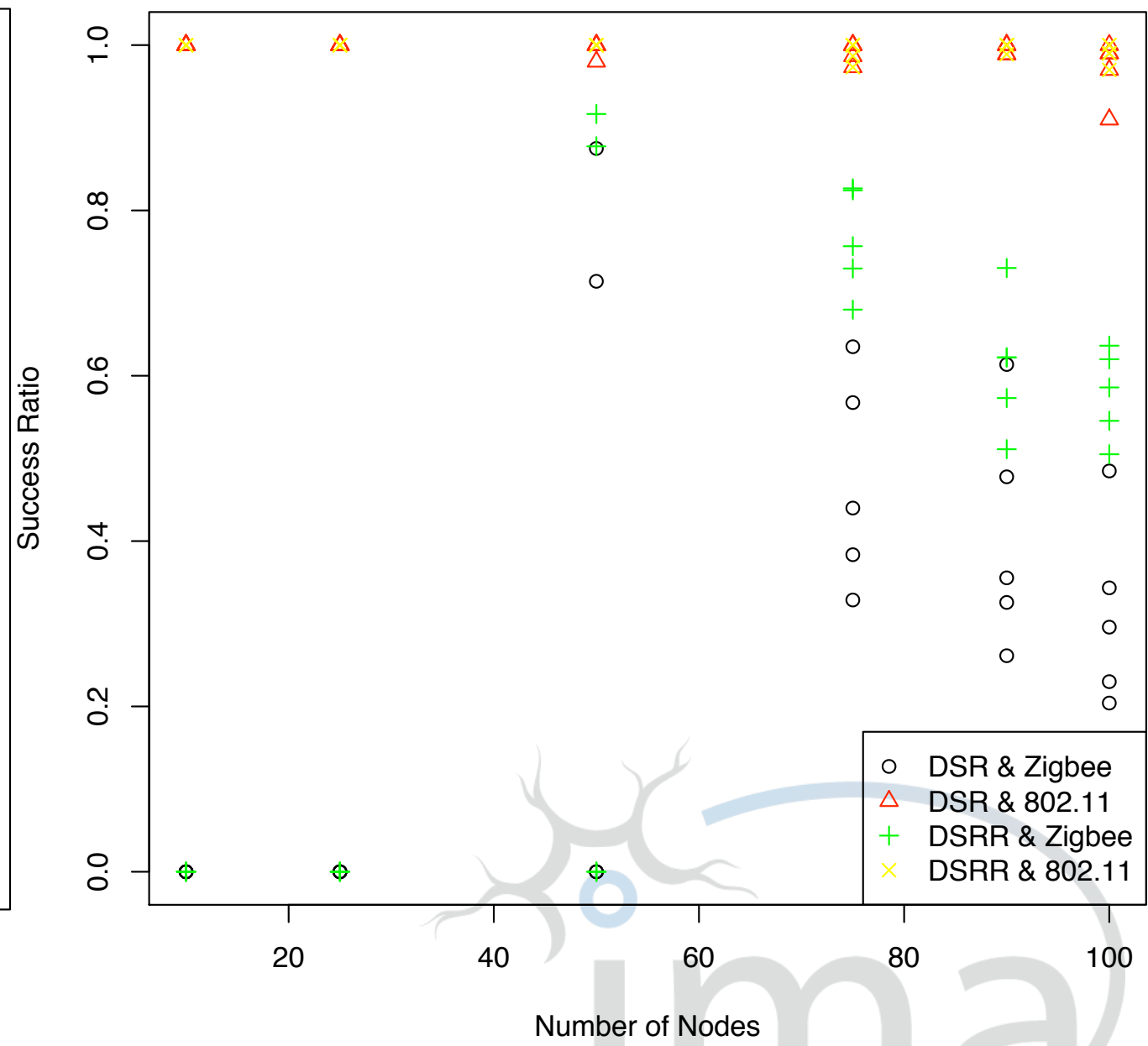


The Evaluation

Average Delay (Seconds)



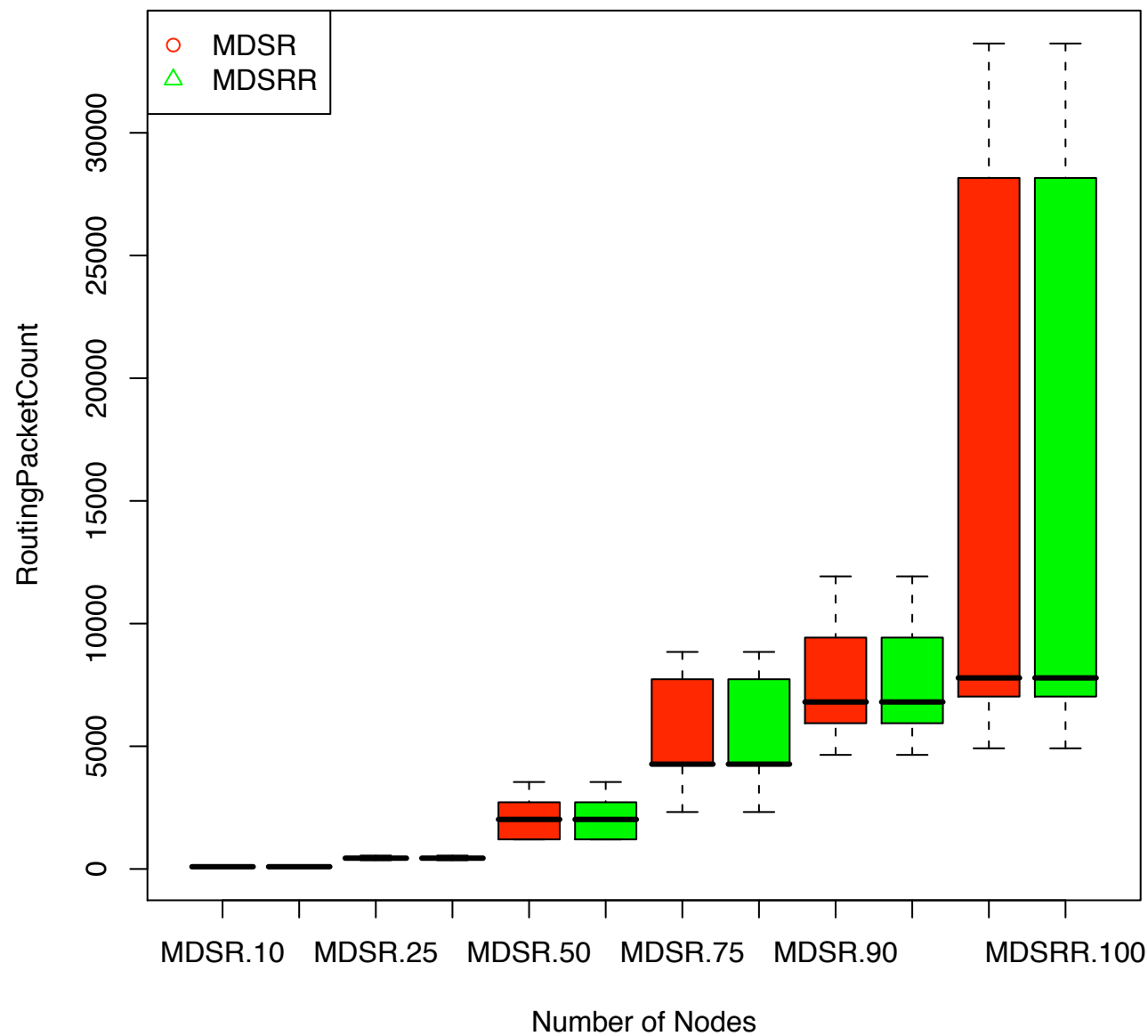
Success Ratio (%)



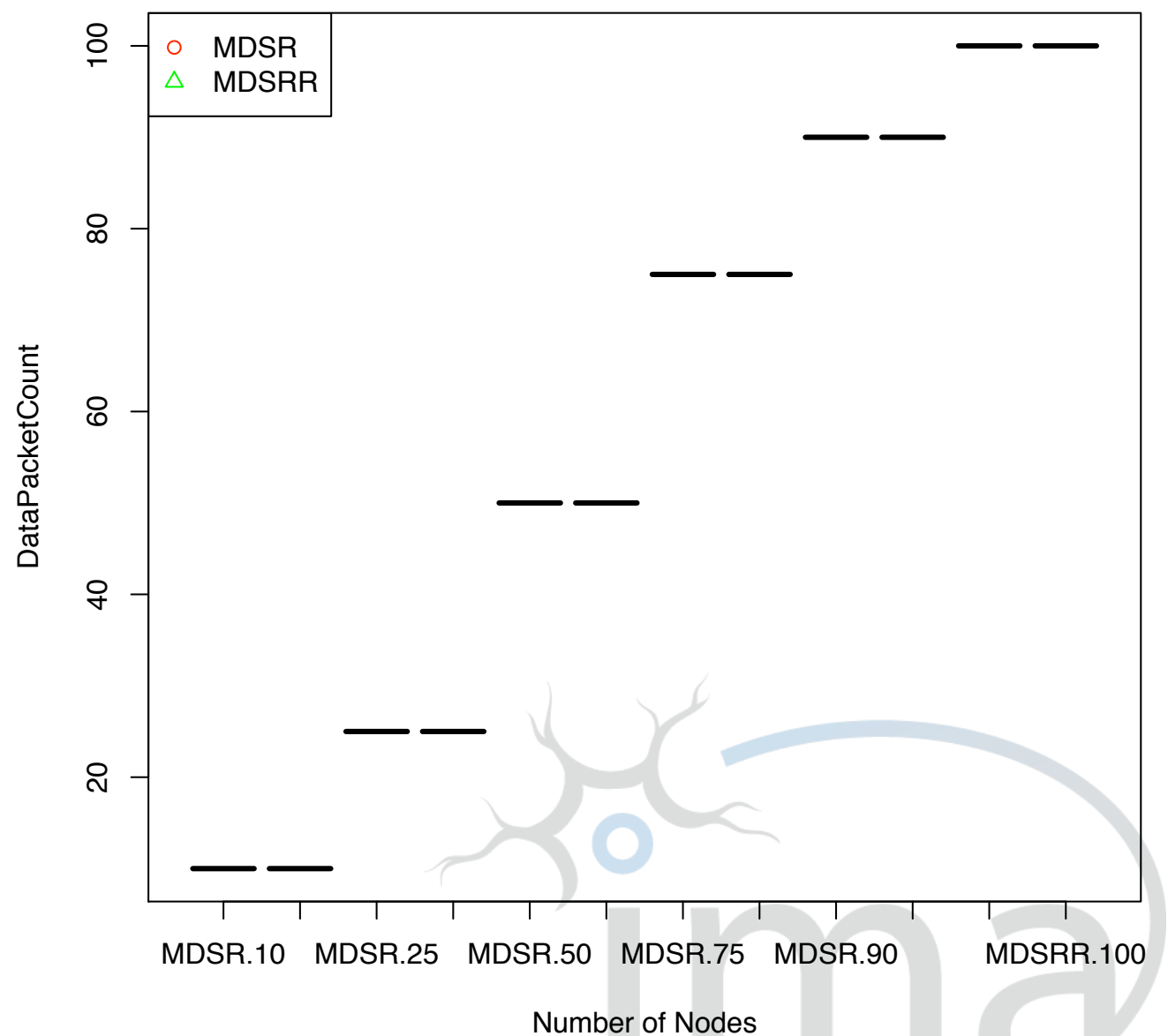
The Evaluation

802.11

Routing Packet Count



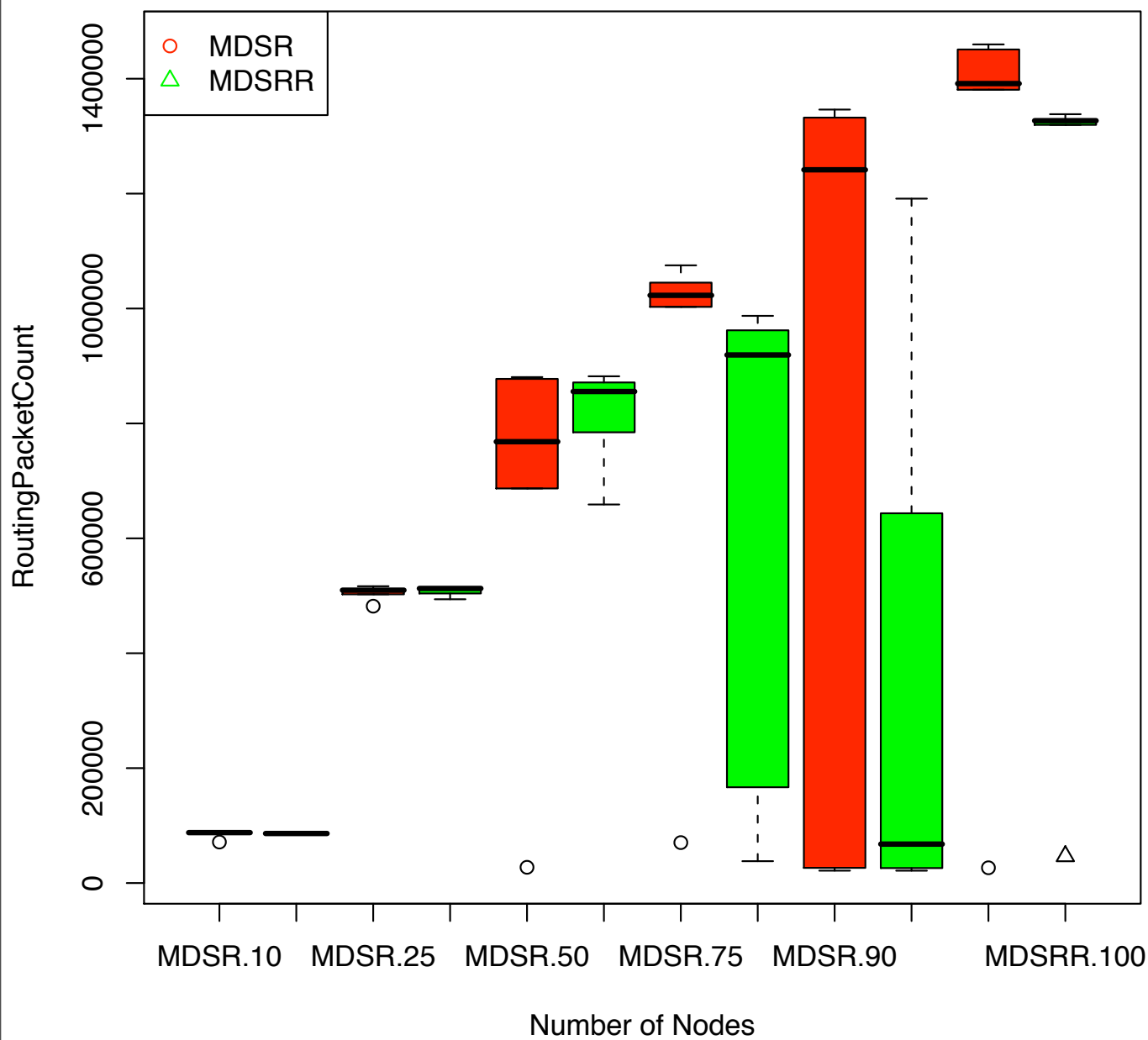
Data Packet Count



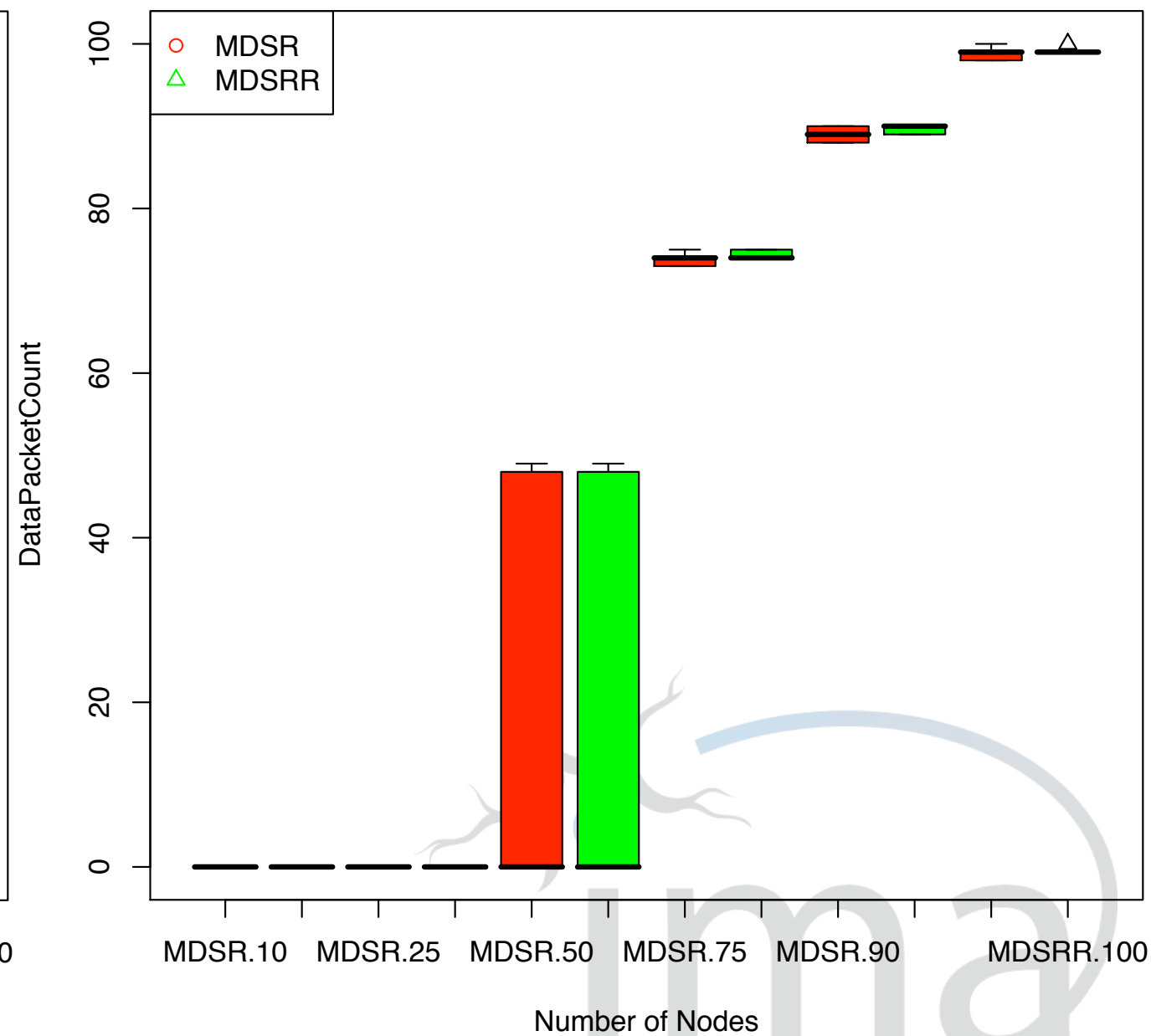
The Evaluation

Zigbee

Routing Packet Count



Data Packet Count



References

1. Andrew Grundy and Milena Redankovic. **Routing In Wireless Networks Of Varying Connectivity**. In The Fifth International Conference on Wireless and Mobile Communications, 2009.
2. D. Johnson, D. Maltz, J. Broch et al., “**DSR: The dynamic source routing protocol for multi-hop wireless ad hoc networks**,” Ad hoc networking, vol. 5, pp. 139–172, 2001.
3. J. Ott, D. Kutscher, and C. Dwertmann, “**Integrating DTN and MANET routing**,” in Proceedings of the 2006 SIGCOMM workshop on Challenged networks. ACM New York, NY, USA, 2006, pp. 221–228.
4. V. Dyo and C. Mascolo, “**Efficient Node Discovery in Mobile Wireless Sensor Networks**,” Lecture Notes in Computer Science, vol. 5067, pp. 478–485, 2008.
5. Z. Zhang, “**Routing in intermittently connected mobile ad hoc networks and delay tolerant networks: Overview and challenges**,” IEEE Communications Surveys & Tutorials, vol. 8, no. 1, pp. 24–37, 2006.
6. M. Musolesi, P. Hui, C. Mascolo, and J. Crowcroft. “**Writing on the clean slate: Implementing a socially-aware protocol in Haggie**”. In World of Wireless, Mobile and Multimedia Networks, 2008. WoWMoM 2008. 2008 International Symposium on a, pages 1–6, 2008.

Thank You!
Any Questions?

Andrew Grundy

amg@cs.nott.ac.uk

<http://cs.nott.ac.uk/~amg>



The University of
Nottingham

