Multicast in MANETs

The story so far

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IETF-114

The MANET Charter

- MANET last rechartered in 2016

- W.r.t. multicast, the current charter contains the following work item:
    - Multicast MANET protocol framework based on Simplified Multicast Forwarding [RFC 6621] for scoped forwarding within MANET networks. As part of this framework the WG will produce a well defined MANET multicast forwarding information base (FIB).

- A motivation for the multicast FIB work is given in a presentation by (then-chair) Justin Dean at IETF-96 (Berlin, 2016), see:
https://www.ietf.org/proceedings/96/slides/slides-96-manet-1.pdf

- The WG did not work on this item

What went before?

- RFC 6621, Simplified Multicast Forwarding (Experimental, 2012)
  - Mechanisms for Duplicate Packet Detection
  - Algorithms for Relay Set selection (Appendix A, B, C)
- Several expired individual I-Ds, including:
  - On-Demand Multicast Routing Protocol (ODMRP) for Ad Hoc Networks (https://www.ietf.org/archive/id/draft-gerla-manet-odmrp-05.txt)
  - Elastic Multicast Routing Protocol (https://www.ietf.org/archive/id/draft-adamson-elasticmcast-00.txt)

What makes multicast in MANETs challenging?

- Links can be non-transitive and/or asymmetric
  - B hears A and C hears B does not imply that C hears A
- Nodes often have only one radio interface
  - B retransmits packet received from A over the same interface to reach C; this retransmission is likely to be heard by A as well; hence need for DPD
  - Rules out protocols that do not allow the incoming interface in the outgoing interface list (OIL)
  - Rules out protocols that perform an RPF check based on interface
- Node mobility leads to frequent topology changes
  - Prevailing school of thought has been that maintaining group membership in the nodes causes too much churn; hence (smart) flooding

General node and link model

Node A — host, router, radio

Node B

Node C
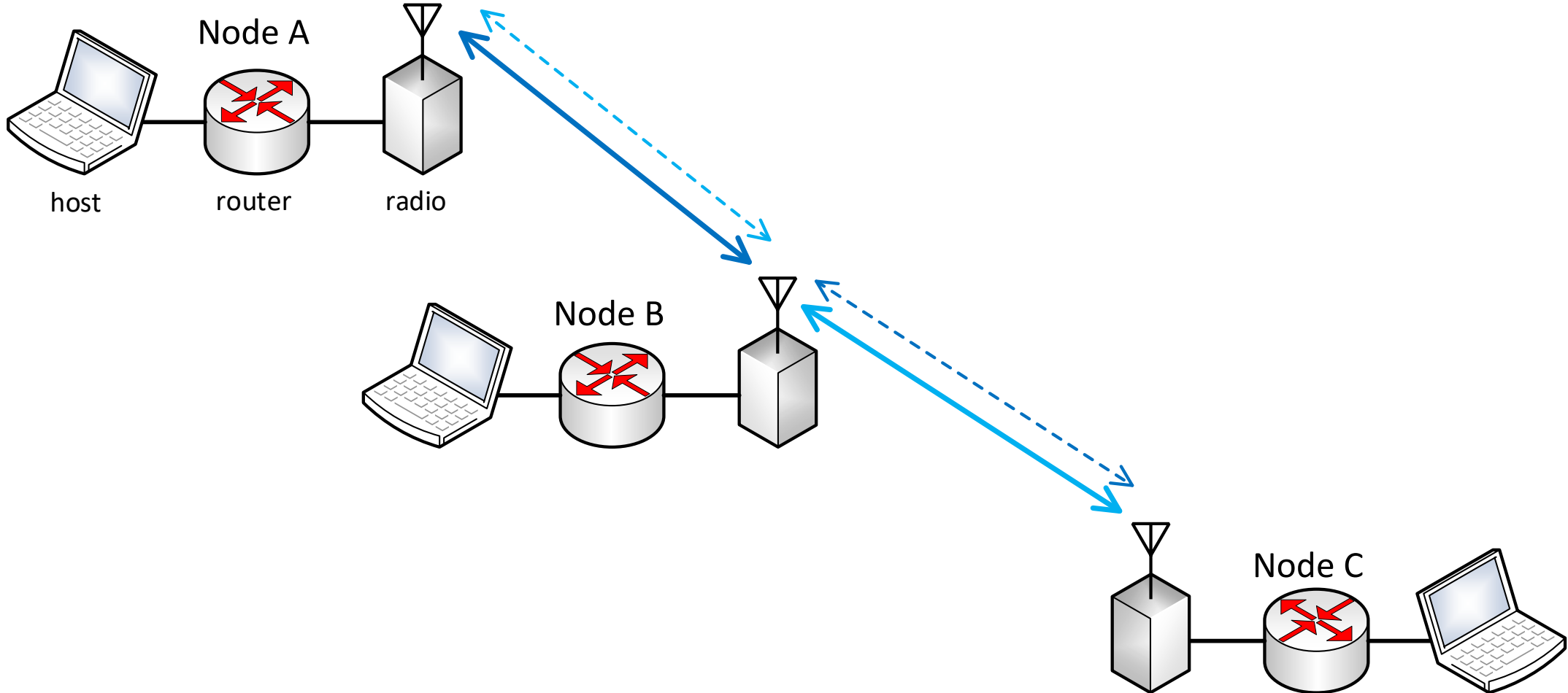
Other assumptions

- Radio link capacity is rather limited; routers can therefore be software-based without negatively impacting throughput
  - The links are the bottleneck, not the processor
  - This is also reflected in the DLEP flow control extensions: the modem (radio) throttles the router, not the other way around

Do we actually need multi-hop multicast support at the IP layer?

- Data-link layer / Physical layer technologies now exist that aim to make the MANET look to the IP layer like a well-behaved single link, for example:
  - IEEE 802.11 Mesh (see Donald Eastlake's presentation)
  - Synchronized Collaborative Broadcast / Barrage Relay™
- But what about the heterogenous radio technology / federated MANET case?

MANET over heterogeneous radio technology
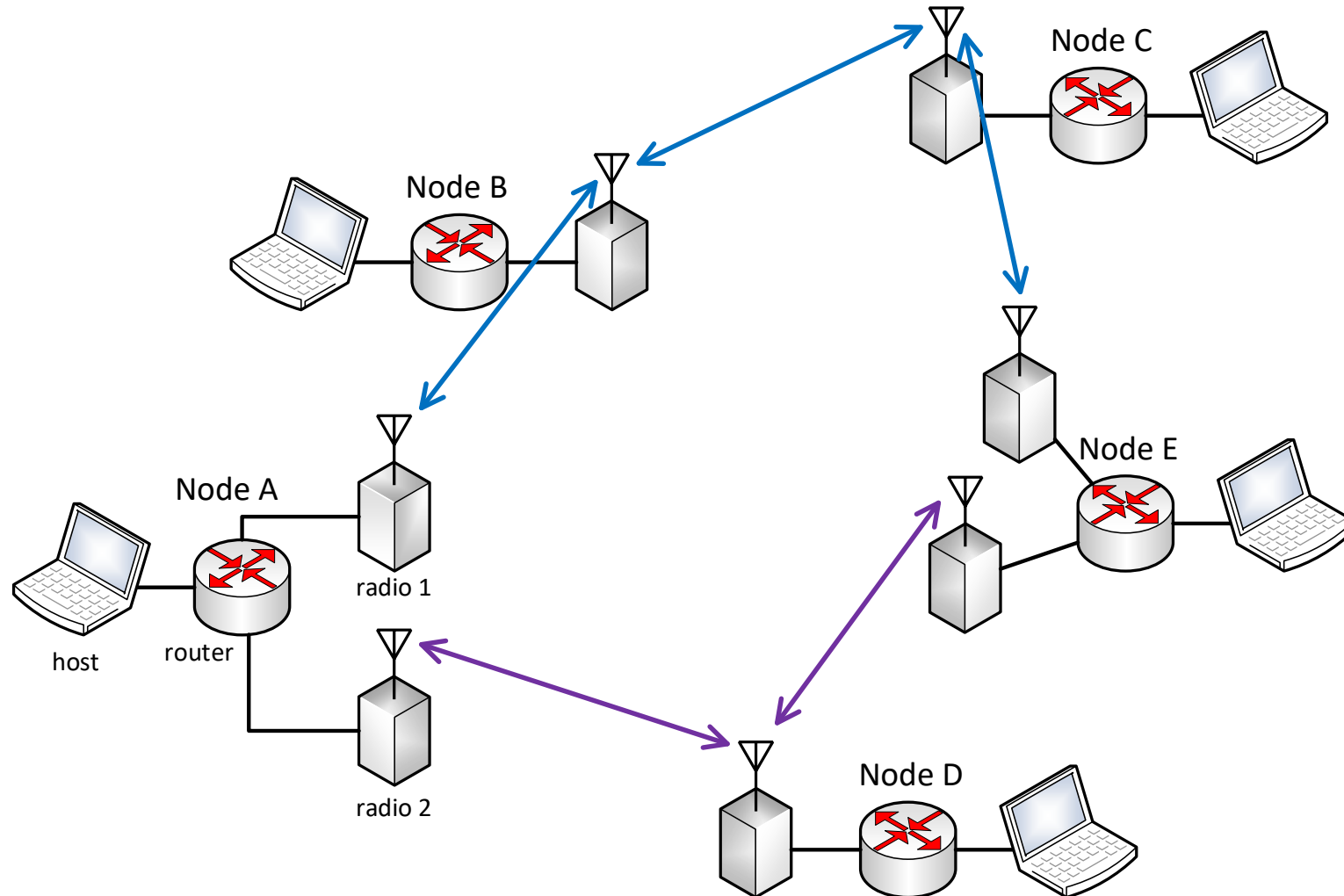
SMF Shortcomings

- From Justin Dean's presentation at IETF-96
  - Design results in implementations in user space → poor performance
  - Packets are disseminated to the entire MANET
  - No knowledge of group membership
  - Relay Set selection algorithms do not support multiple interfaces well
    - Forwarding on none or all
  - Forwarding rules are not well defined for multiple interfaces
    - DPD per interface? Incoming/outgoing?
    - DPD method managed manually
- Work has since been done at NRL to improve their implementation (see most recent post of Brian Adamson to the MANET ML), however with little exposure to the MANET WG

Thanks!

Questions?