IPv6 over Wireless and Wireless ND (WiND)

draft-thubert-6man-ipv6-over-wireless

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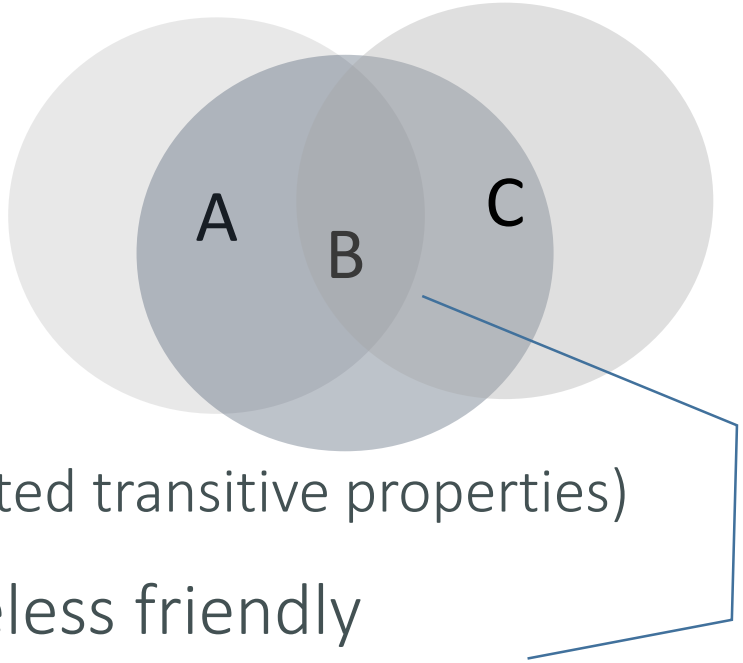
6lo standard work

A proactive setting of proxy/routing state to avoid multicast due to reactive Duplicate address detection and lookup in IPv6 ND

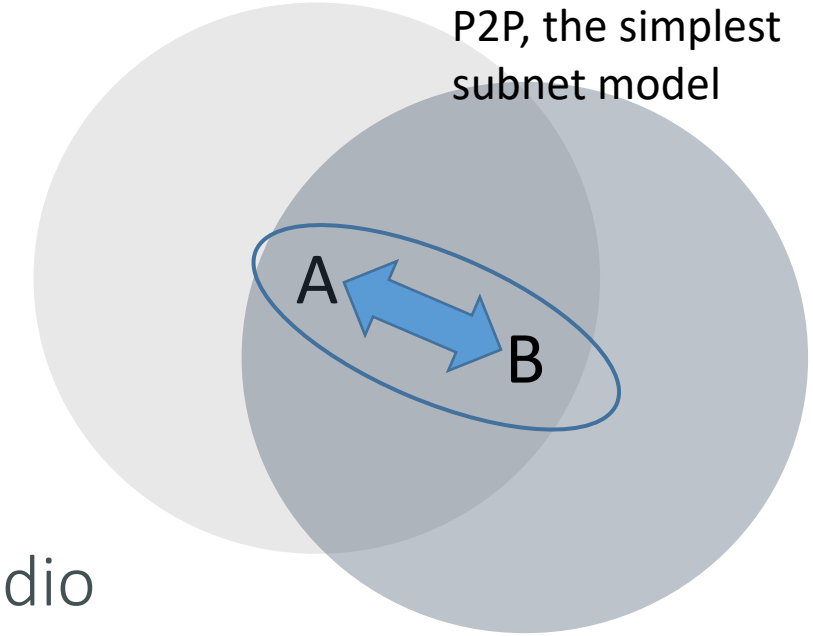
- RFC 8505 (Issued 11/2018)
  - The registration mechanism for proxy and routing services
  - Analogous to a Wi-Fi association but at Layer 3
- draft-ietf-6lo-backbone-router (WGLC complete 1/25)
  - Federates 6lo meshes over a high-speed backbone
  - ND proxy analogous to Wi-Fi bridging but at Layer 3
- draft-ietf-6lo-ap-nd (WGLC complete 3/26)
  - Protects addresses against theft (Crypto ID in registration)
- draft-thubert-6lo-unicast-lookup
  - Provides a 6LBR on the backbone to speed up DAD and lookup
- draft-thubert-6man-ipv6-over-wireless (new draft)
  - IPv6 ND vs. WiND applicability to wireless networks

Unmet expectations



- IPv6 ND is designed for P2P and Transit Links
  - Wireless is usually reflexive but natively non-transitive
  - Requires extensions for NBMA (without MAC-layer emulated transitive properties)
- IPv6 ND over MAC-layer transit emulation is not wireless friendly
  - E.g., over L2R, learning bridges, Wi-Fi Infrastructure Mode
  - Broadcast intensive (no support for multicast)
- Other mismatches
  - Fast Roaming ‘11r’ (ND has no sense of order of events)
  - Intermittent Connectivity (fails all of NUD, DAD and lookup)
  - Fast Initial Link Setup ‘11ai’ (ND is reactive, causes loss of first packets)
  - Increased sensitivity to DoS attacks (Use ND to trigger broadcasts remotely)

Link and Link Local



- A plain radio Interface connects to a physical radio broadcast domain (vs. a MAC-layer emulated broadcast domain)
- An IPv6 bidirectional Link can be created where radio broadcast domain overlap enough that A sees B and B sees A.
- LLAs need to be unique for a communicating pair for a lifetime.
- The IPv6 Link is usually reflexive though often asymmetrical
- The IPv6 Link is usually not transitive unless special measures taken
- As a node moves, it meets other nodes and IPv6 Links are formed

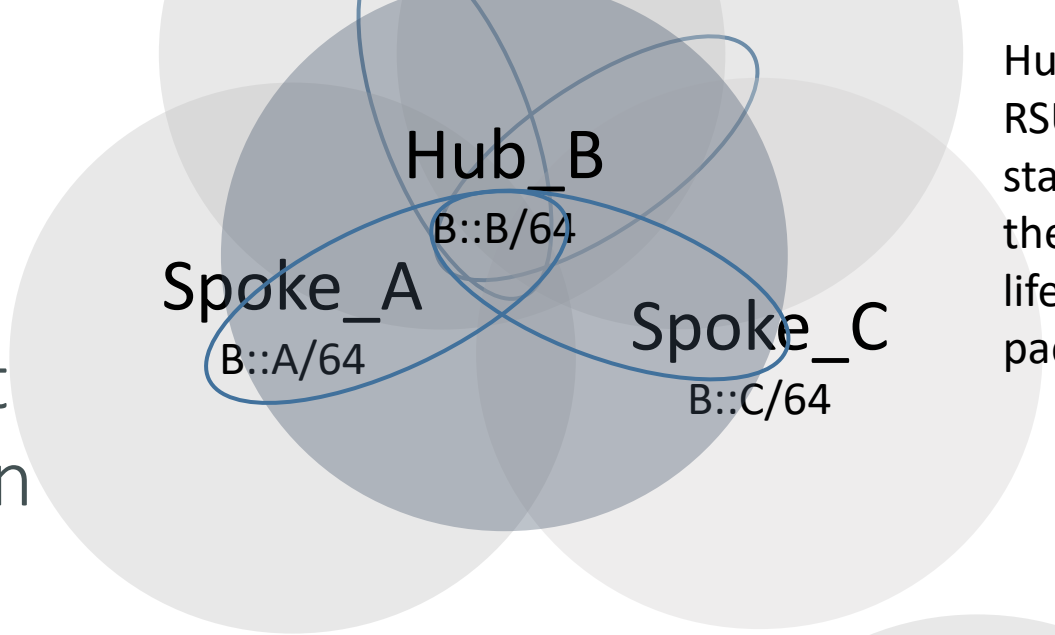
=> no way to do DAD once and for all on a radio interface

NBMA SubNet models

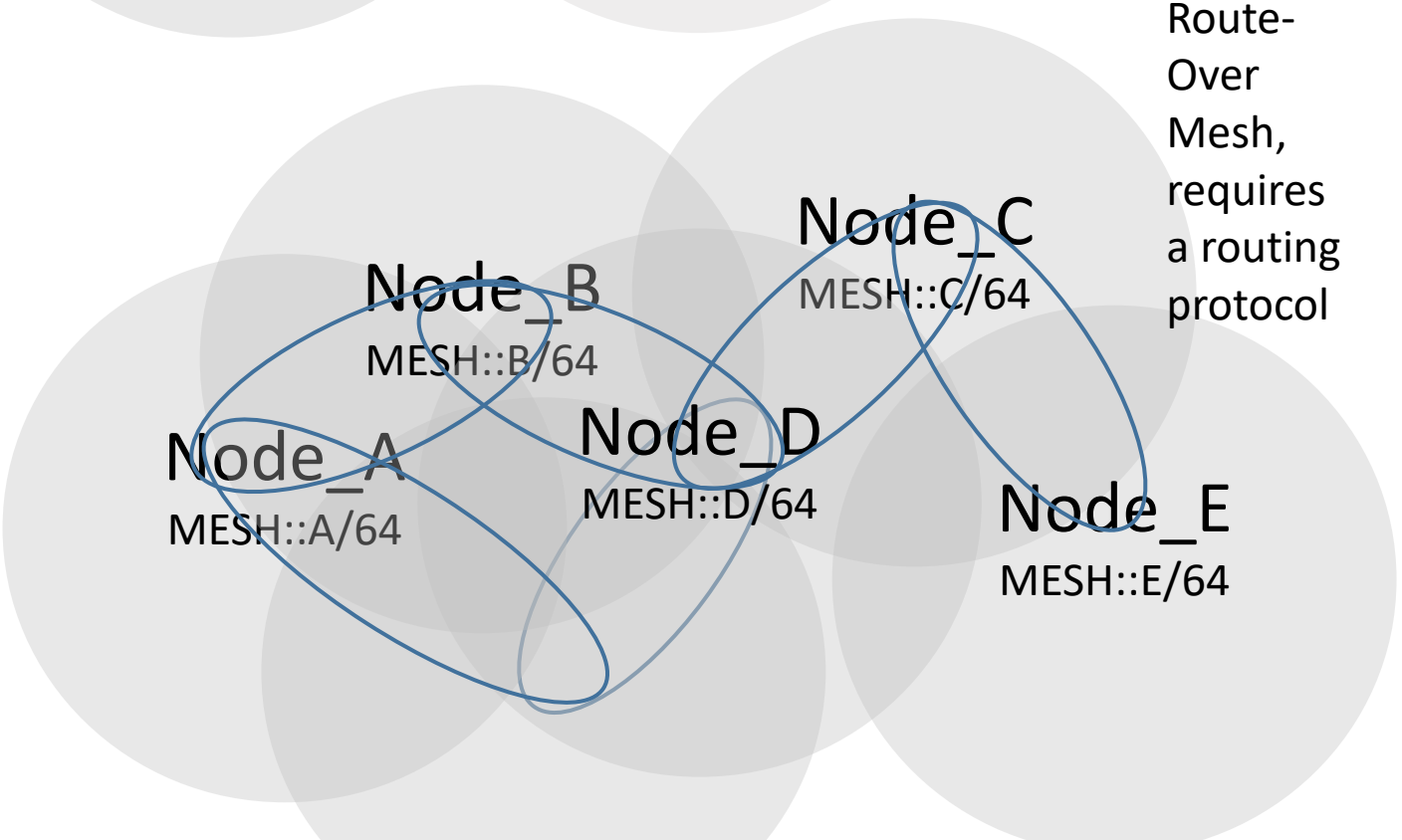
A subnet may overlap - or not with a radio broadcast domain

- A P2P subnet is smaller
- Hub and Spoke matches the radio bcast domain of the Hub
- A route-over mesh is larger

A central registrar for the subnet for DAD, collapsed and reachable over multihop on the Hub if H&S.



Hub and Spoke RSU_B maintains state for visitors for their registration lifetime and relays packet

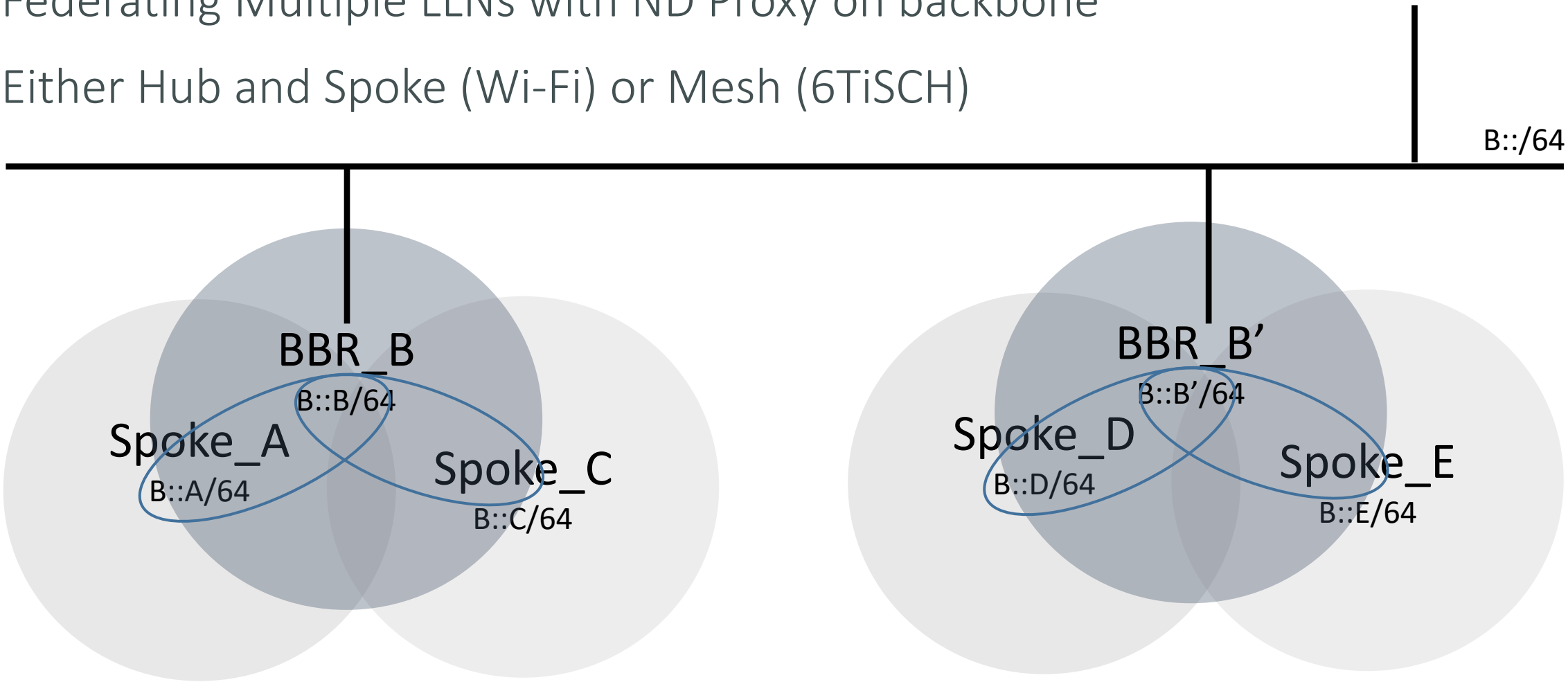


Route-Over Mesh, requires a routing protocol

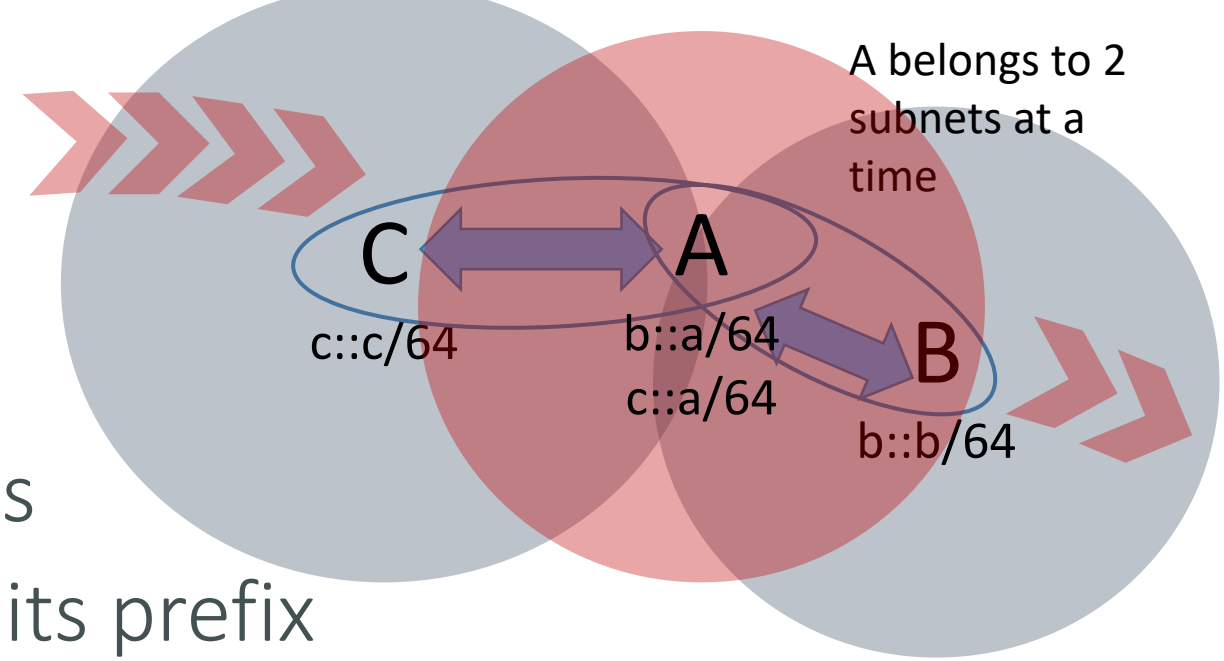
Heterogeneous MultiLink Subnet

Federating Multiple LLNs with ND Proxy on backbone

Either Hub and Spoke (Wi-Fi) or Mesh (6TiSCH)



Other Things to Adjust



- Matching source IP to router
  - E.g., 1 car attached to 2 RSUs
  - Each RSU enforcing SAVI for its prefix
  - Providing reachability back to a CoA based on its prefix
- Aggressive DNA (Detecting Network attachment)
  - Rapid discovery (advertisement interval option in RA)
  - Permanently assess reachability of DRL and prune rapidly
  - May reuse a GUA if come back within reg. lifetime

RFC 8505 registration vs. 802.11 association

- Association allows a proactive setting of the bridging state
  - Allows the APs to eliminate broadcast lookups
  - Compares to reactive learning bridge
- WiND
  - Reproduces the association model at L3
  - Leverages the state for address protection and SAVI
  - Routing inside the subnet replaces bridging
  - Proxy ND at the wire / wireless edge

Status

- Triggered by IPWAVE IPv6-over-OCB, need a baseline for wireless
- Inherit from 10 years of work at 6lo, millions of nodes deployed
- draft-thubert-6man-ipv6-over-wireless-03 out
- Discusses radio broadcast domain, native and emulated
- Introduces WiND, compares to ND on native MAC (no emulation)
- Discusses applicability / use cases
- Next rev on host and routers behavior, e.g., matching router.

Questions to the group

- Archiving value -> should we publish ?
- Transfer WiND to 6MAN for maintenance and extensions?
- Generalize RFC 8505 (and WiND suite) over non-6lo Link ?