Architecture and Framework for IPv6 over Non-Broadcast Access

draft-ieft-6man-ipv6-over-wireless

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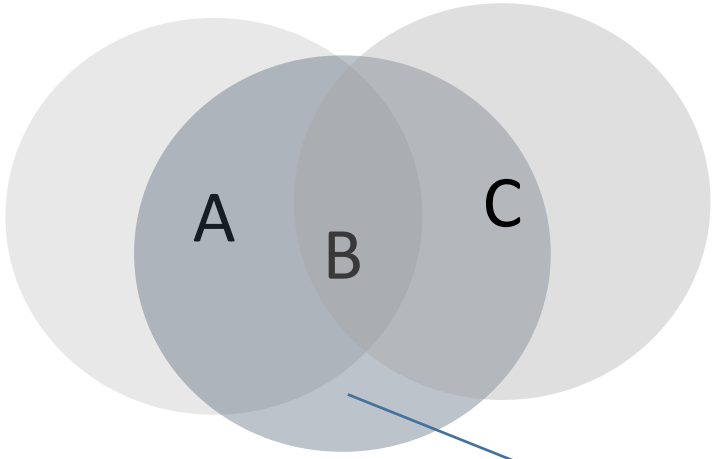
IETF 117

San Francisco

IPv6 ND Unmet Expectations



- IPv6 ND is designed for P2P and Transit Links
  - Wireless is mostly symmetrical and non-transitive
  - Requires extensions for NBMA , 30 years-old unmet promise
- IPv6 ND over MAC-layer transit emulation is not wireless/overlay friendly
  - E.g., over L2R, learning bridges, EVPN, Wi-Fi Infrastructure Mode
  - Broadcast intensive (no support for multicast) vs. BUM
- Other mismatches
  - Fast Roaming ‘11r’ (ND has no sense of order of events)
  - Intermittent Connectivity (occasionally fails 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)

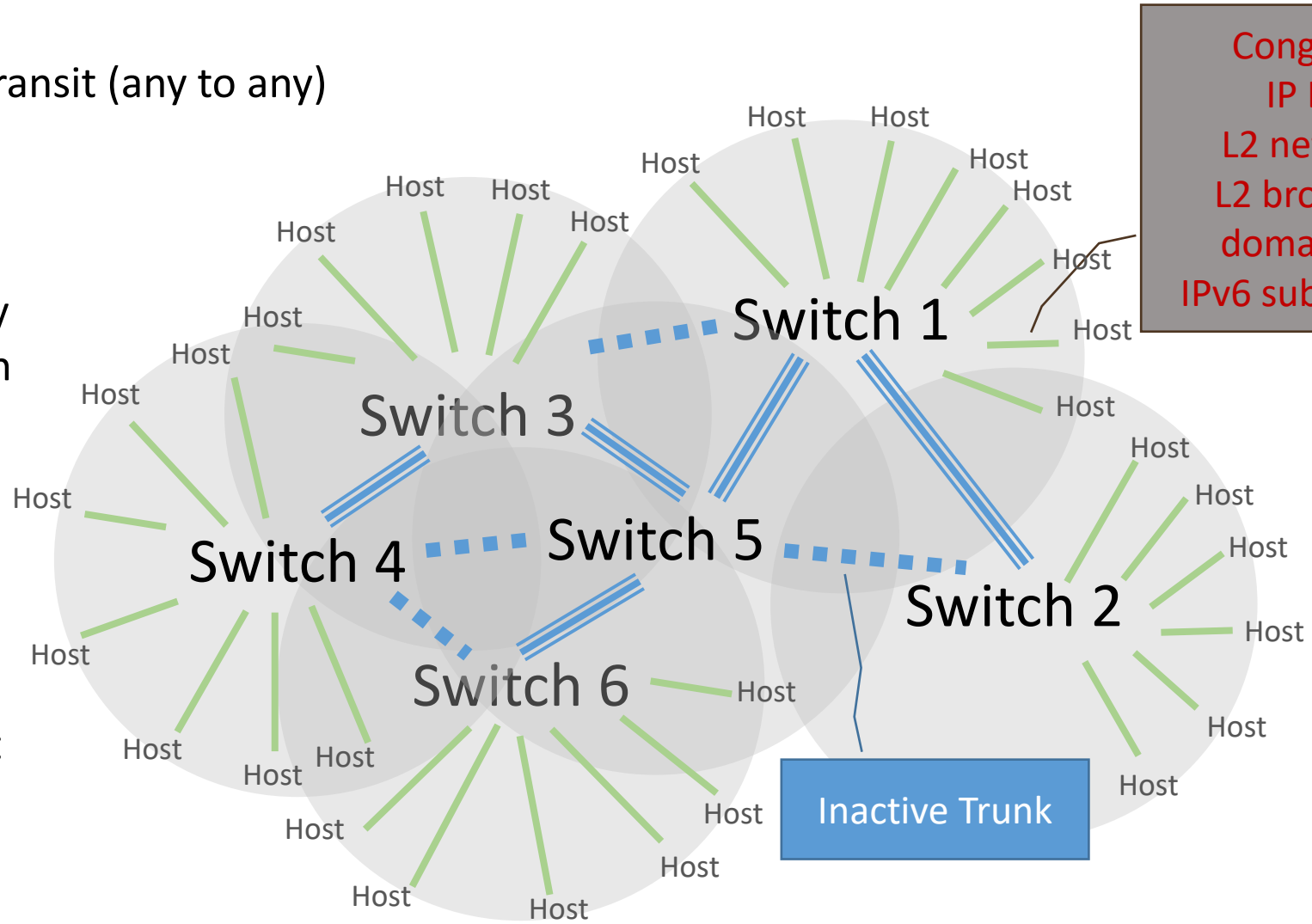
Non transitive:
B can talk to A and C
but A and C cannot
see reach other

Basic IP abstractions for IPv6: taken for granted

- IP Link is Transit (any to any)

- L2 network switched Ethernet
- The switches autonomously form a L2 broadcast domain (e.g., Spanning Tree Protocol)

- IPv6 Subnet deployed over the broadcast domain
- Congruent with L2 broadcast domain



- **This is really IPv4's ways**

That IPv6 ND inherited unwittingly

And it's damn limiting for deploying IPv6 in modern networks

What happened since London?

Conditional Adoption

- Redesigned as an Architecture document, new author (MCR)
- Really 4 docs in one (problem, Architecture, framework, applicability)

6MAN P. Thubert, Ed.
Internet-Draft Cisco Systems
Intended status: Informational 11 October 2022
Expires: 14 April 2023

IPv6 Neighbor Discovery on Wireless Networks
draft-thubert-6man-ipv6-over-wireless-12

Abstract

This document describes how the original IPv6 Neighbor Discovery and Wireless ND (WiND) can be applied on various abstractions of wireless media.

6MAN P. Thubert, Ed.
Internet-Draft Cisco Systems
Intended status: Informational M. Richardson
Expires: 29 December 2023 Sandelman
27 June 2023

Architecture and Framework for IPv6 over Non-Broadcast Access
draft-ietf-6man-ipv6-over-wireless-04

Abstract

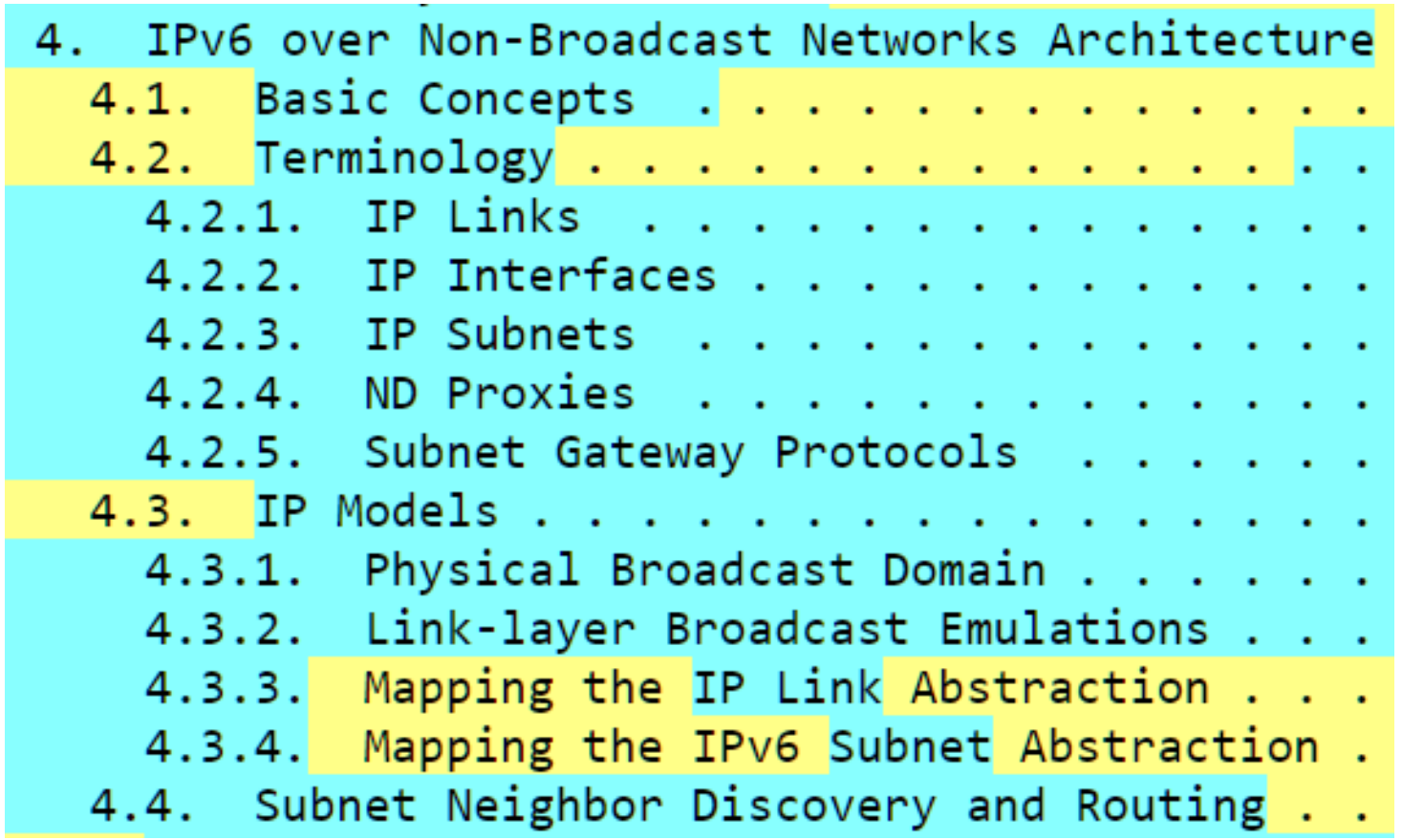
This document presents an architecture for IPv6 access networks that decouples the network-layer concepts of Links, Interface, and Subnets from the link-layer concepts of links, ports, and broadcast domains, and limits the reliance on link-layer broadcasts. This architecture is suitable for IPv6 over any network, including non-broadcast networks, which is typically the case for intangible media such as wireless and overlays. A study of the issues with IPv6 ND over intangible media is presented, and a framework to solve those issues within the new architecture is proposed.

Part 1) Problem statement (pervasive)

- Lack of generally accepted definition and specs
- Broadcast issues
- Silent nodes / BUM
- Not just wasted spectrum
- Woodstock vs. real world
- Affecting the capability to evolve

Part 2) Architecture (decoupling L2 and L3)

- Decoupling is the core need and value
- Need to redefine and reposition L3 concepts
  vs. IPv4-based intuition
- Splitting the broadcast domain => routing inside the subnet
- Concept of SGP also central, proxy a limited alternative
- Thus, the new name “SND”

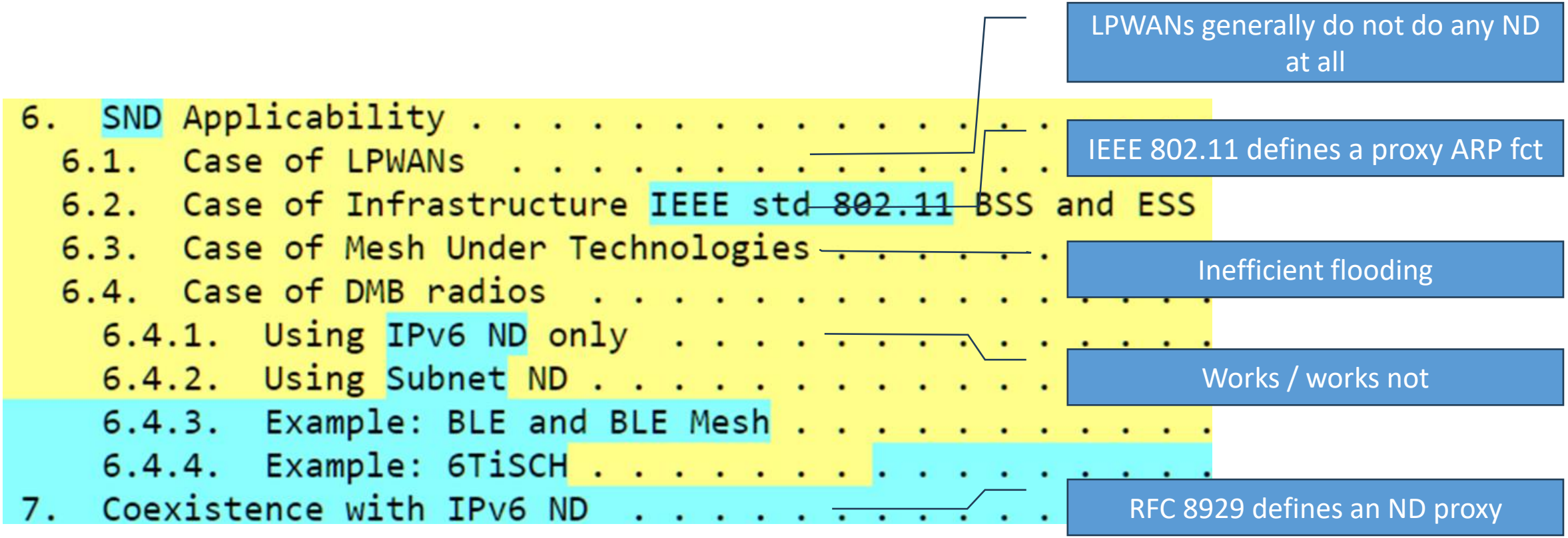


Part 3) Framework (leveraging WiND Design and RFCs)

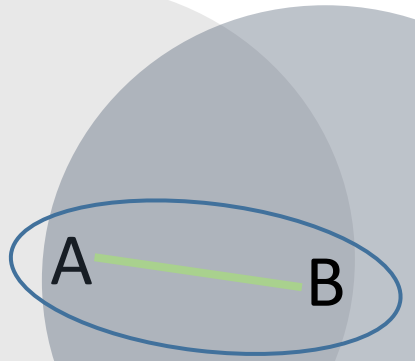
Leveraging original WiND text in adopted document

- Which RFC does what
- GAP analysis?

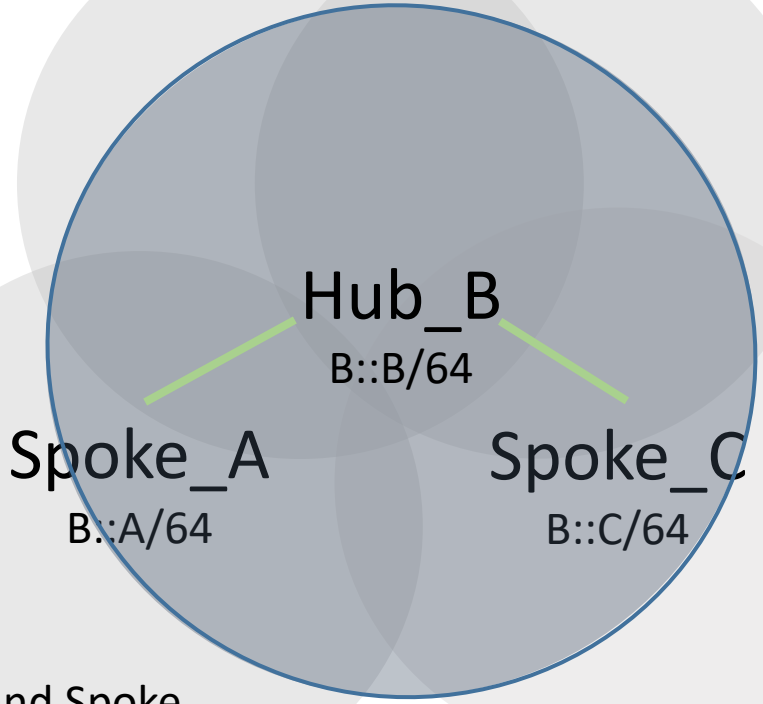
Part 4) Applicability statement (also pervasive)



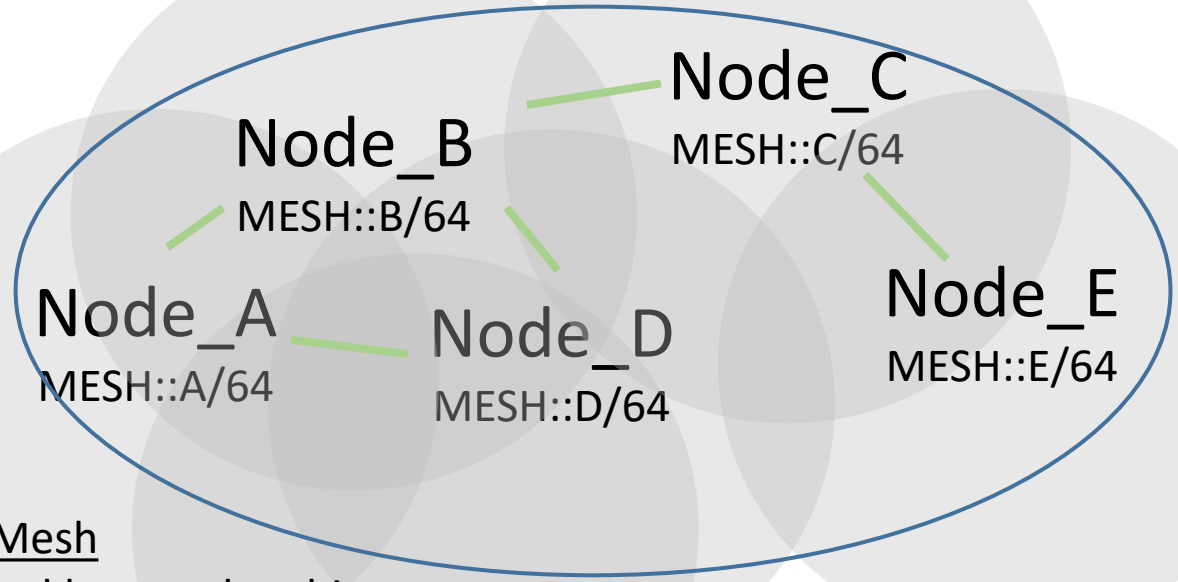
SubNet models



P2P
the simplest subnet model
congruent with IP Link



Hub and Spoke
Subnet Congruent with Hub broadcast domain
HUB_B maintains state for visitors for their registration lifetime and relays packet
Needs not-onlink model and central router



Route-Over Mesh
Subnet defined by membership
requires an IGP inside the subnet

6LoWPAN ND (IPv6 Stateful Address Autoconfiguration)

RFC 6775 (original 6LoWPAN ND)

- Defines ARO for registration and DAD operations for stateful AAC

RFC 8505 (Issued 11/2018)

- The protocol agnostic registration for ULA/GUA for proxy ND and routing services
- Analogous to a Wi-Fi association but at Layer 3: a deterministic and query-able state for all addresses

RFC 8929 (Issued 11/2020)

- Federates 6lo meshes over a high-speed backbone
- ND proxy analogous to Wi-Fi bridging but at Layer 3

RFC 8928 (Issued 11/2020)

- Protects addresses against theft (Crypto ID in registration)

draft-ietf-6lo-multicast-registration

- Extends RFC 8505 for multicast and anycast

draft-thubert-6lo-unicast-lookup

- Provides a 6LBR on the backbone to speed up DAD and lookup
- Coexistence with classical ND

draft-ietf-6lo-prefix-registration

- Extends RFC 8505 for prefixes

Backup