Unicast Lookup for WiND

draft-thubert-6lo-unicast-lookup

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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

NEW DRAFT

Unmet expectations

- An IPv6 subnet should scale (like above 10K Nodes)
  - Required in case of IOT and overlays serving VMs
  - Already works in route-over mesh (deployed e.g., in Smartgrid applications)
  - Impaired by broadcast storms in case of broadcast emulation
  - Need to eliminate per node broadcast (as used in DAD and AR)
- Overlays need a Map resolver for the tunnel endpoints
  - Problems with snooping (silent node, missed packets, rapid movements…)
  - Need a solid state (contract with lifetime and maintenance), not a cache
  - Need a standard way to populate the resolver, a natural side effect of ND

Status

- https://tools.ietf.org/html/draft-thubert-6lo-unicast-lookup-00
  - Unicast registration and lookup via NS/NA
  - (indirect) Address Mapping messages derived from EDAR / EDAC
  - A new Status "Not Found" in NA(EARO) and Address Mapping Confirm
  - 6LBR signals itself by new "B" bit in 6CIO (RFC 7400) in RA msgs
  - (Other) Routers use Authoritative Border Router Option (RFC 6775)
  - Anycast address for 6LBR ala MIP-HA?

- Next Questions
  - Generalize WiND to non-6lo networks?
  - Transfer to 6MAN?

General Design

```
                  +------+           +------+        +------+
      (default) |      |      6LBR |      |      |  | IPv6
      Router  |      |           |      |      |  | Node
                  +------+           +------+        +------+
                      |     Backbone side    |                |
      ---+-------+-----------------+---+------------+----+-----
             |                         |                |
         +------+                  +------+         +------+
         | 6BBR |                  | 6BBR |         | 6BBR |
         |      |                  |      |         |      |
         +------+                  +------+         +------+
            o     Wireless side  o   o   o           o  o
         o  o   o   o          o o   o   o   o      o   o   o  o o
        o   o  o  o  o          o   o   o   o  o     o   o   o o o
         o     o   o  o          o        o  o        o   o    o
           o      o  o            o    o                o    o o

            LLN                      LLN                  LLN
```
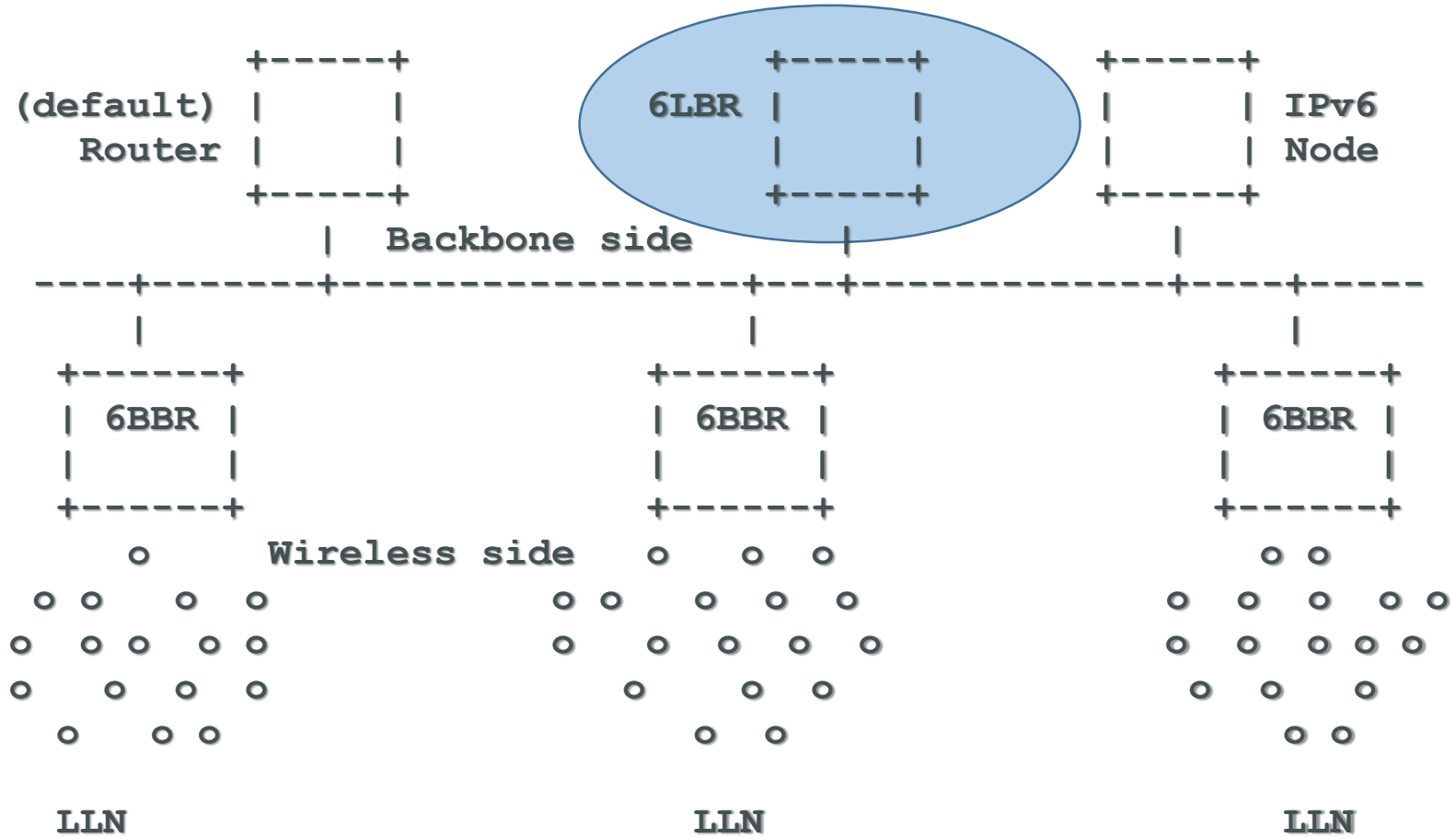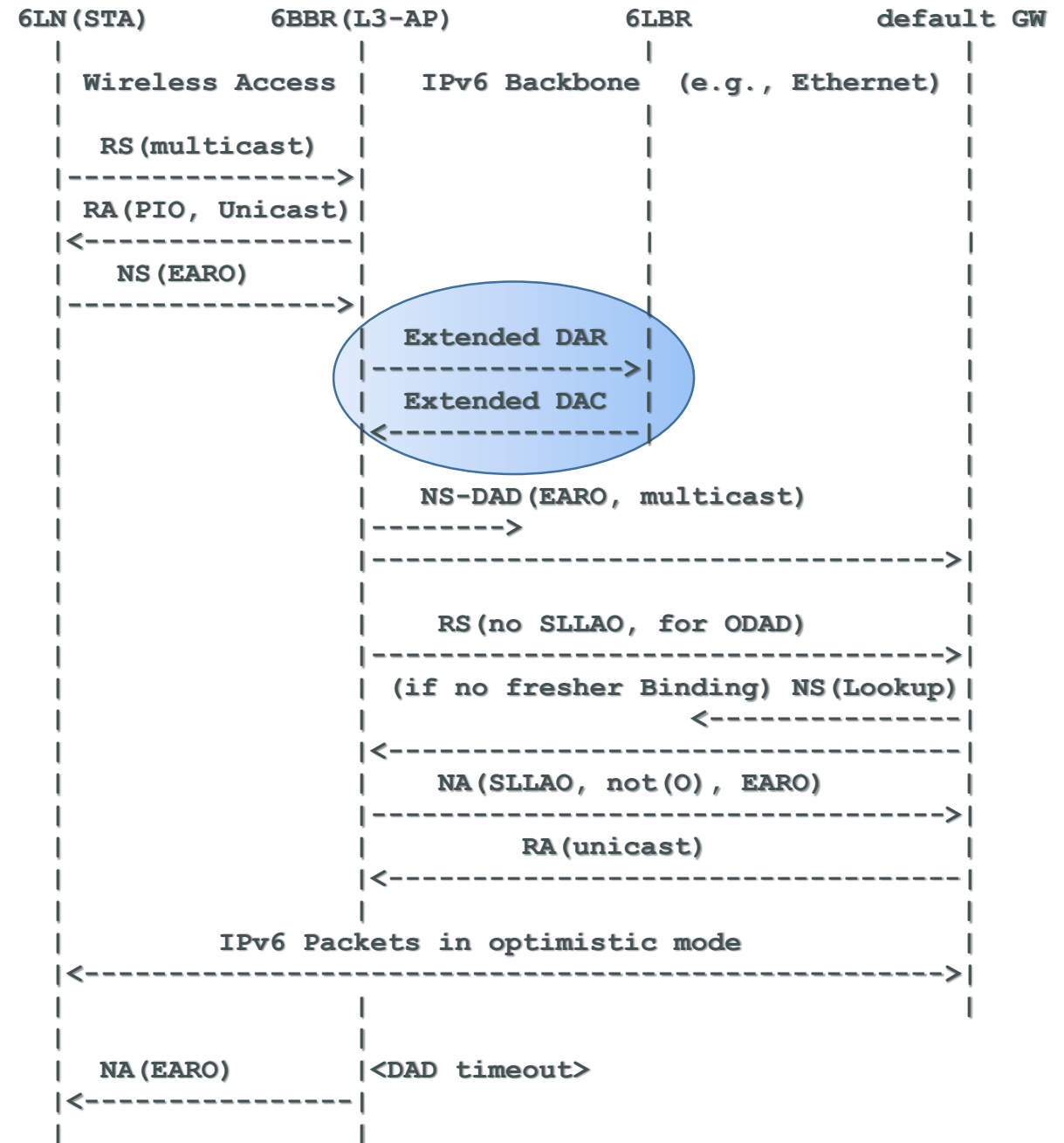
Place a 6LBR (RFC 6775 / RFC 8505) on the backbone (designed for DAD not AR)

Centralizes the registrations for all nodes in the subnet that register

Additions to use 6LBR for Address Resolution as a unicast request

Within WiND General Design

- Registration for guaranteed service
  - Even with intermittent connectivity
  - DAD protection on behalf for lifetime
  - Extensible for lookup

- Routing vs. Bridging Proxy
  - Bridging advertises the SLLA of the 6LN
  - Routing hides the 6LN and routes
  - Routing keeps L2 stable

- Model
  - Link is broadcast domain
  - Subnet <> Link
    => Not on-link and routing

```
6LN(STA)           6BBR(L3-AP)              6LBR              default GW
   |                    |                     |                     |
   | Wireless Access    |  IPv6 Backbone  (e.g., Ethernet) |
   |                    |                     |                     |
   |  RS(multicast)     |                     |                     |
   |------------------->|                     |                     |
   | RA(PIO, Unicast)   |                     |                     |
   |<-------------------|                     |                     |
   |   NS(EARO)         |                     |                     |
   |------------------->|                     |                     |
   |                    |    Extended DAR     |                     |
   |                    |-------------------->|                     |
   |                    |    Extended DAC     |                     |
   |                    |<--------------------|                     |
   |                    |                     |                     |
   |                    |  NS-DAD(EARO, multicast)                  |
   |                    |-------->|           |                     |
   |                    |------------------------------------------>|
   |                    |                     |                     |
   |                    |  RS(no SLLAO, for ODAD)                   |
   |                    |------------------------------------------>|
   |                    | (if no fresher Binding) NS(Lookup)        |
   |                    |                     |<------------------->|
   |                    |<----------------------------------------->|
   |                    |  NA(SLLAO, not(O), EARO)                  |
   |                    |------------------------------------------>|
   |                    |       RA(unicast)                         |
   |                    |<------------------------------------------|
   |                    |                     |                     |
   |        IPv6 Packets in optimistic mode                         |
   |<------------------------------------------------------------->|
   |                    |                     |                     |
   |  NA(EARO)          |<DAD timeout>        |                     |
   |<-------------------|                     |                     |
   |                    |                     |                     |
```

Address Mapping Messages

```
+--------------+-----------------------------+-----------+
| Code Prefix  | Meaning                     | Reference |
+--------------+-----------------------------+-----------+
| 0            | Duplicate Address Detection | RFC 6775  |
| 1            | Address Mapping             | This RFC  |
| 2...15       | Unassigned                  |           |
+--------------+-----------------------------+-----------+
```

Table 2: New Code Prefixes for ICMP type 157 DAR message

```
+--------------+-----------------------------+-----------+
| Code Prefix  | Meaning                     | Reference |
+--------------+-----------------------------+-----------+
| 0            | Duplicate Address Detection | RFC 6775  |
| 1            | Address Mapping             | This RFC  |
| 2...15       | Unassigned                  |           |
+--------------+-----------------------------+-----------+
```

Table 3: New Code Prefixes for ICMP type 158 DAC message

No new ICMP type, extend existing 157/158 used for DAR / DAC (RFC 6775)

Use different ICMP Code – which is split in code prefix and suffix (RFC 8505)

Also support for unicast NS(Lookup) which requires the 6LBR to be on link