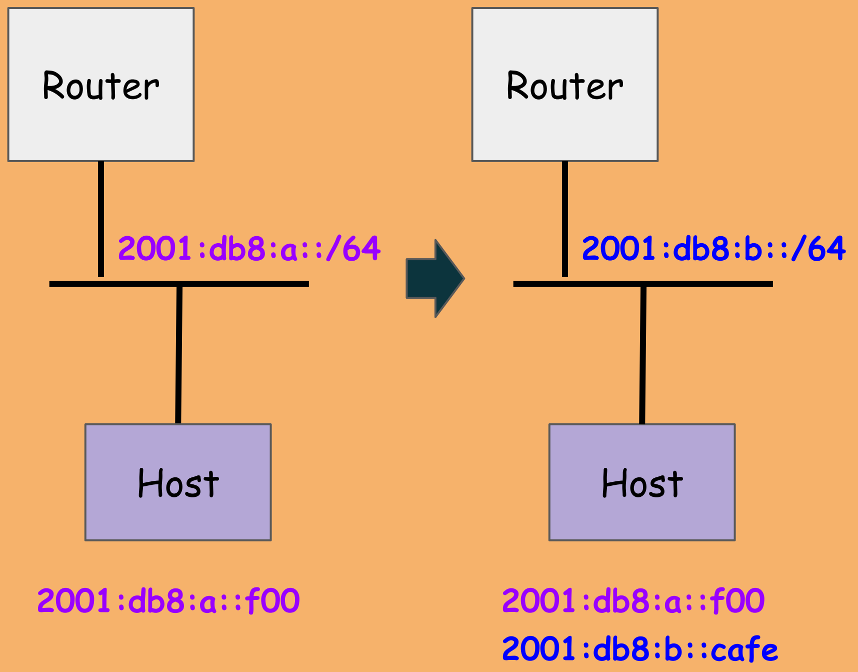
Using Prefix-Specific Link-Local Addresses to Improve SLAAC Robustness

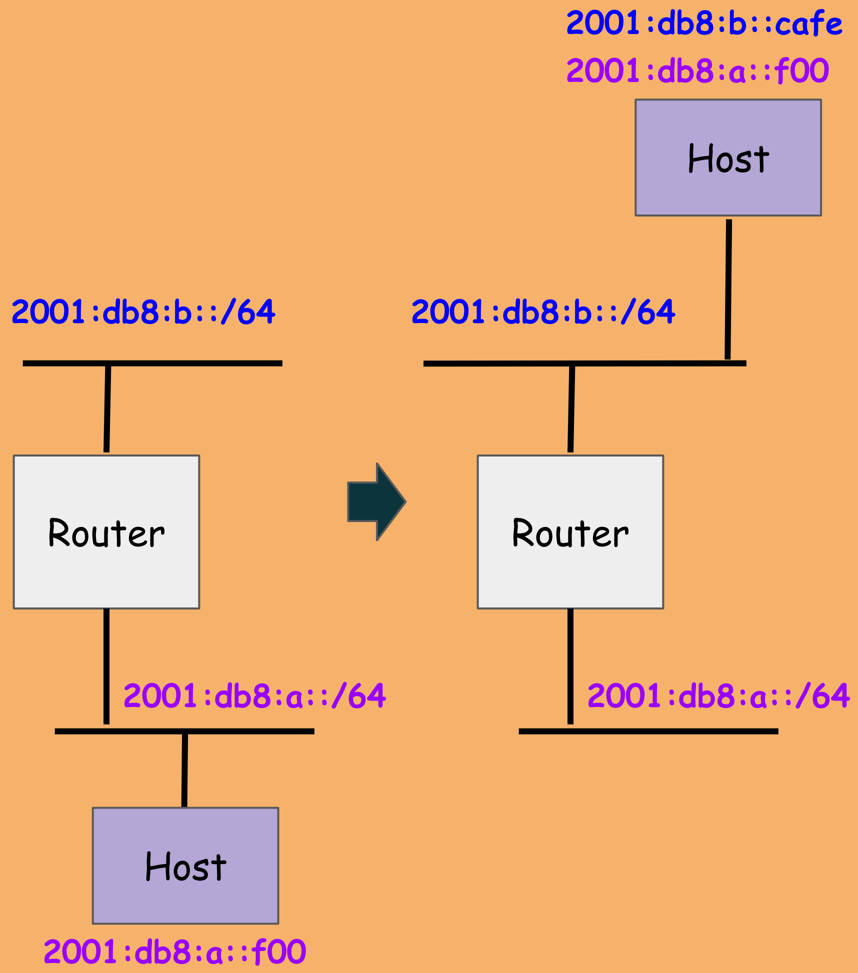
draft-link-6man-gulla

Jen Linkova, IETF122, March 2025, Bangkok

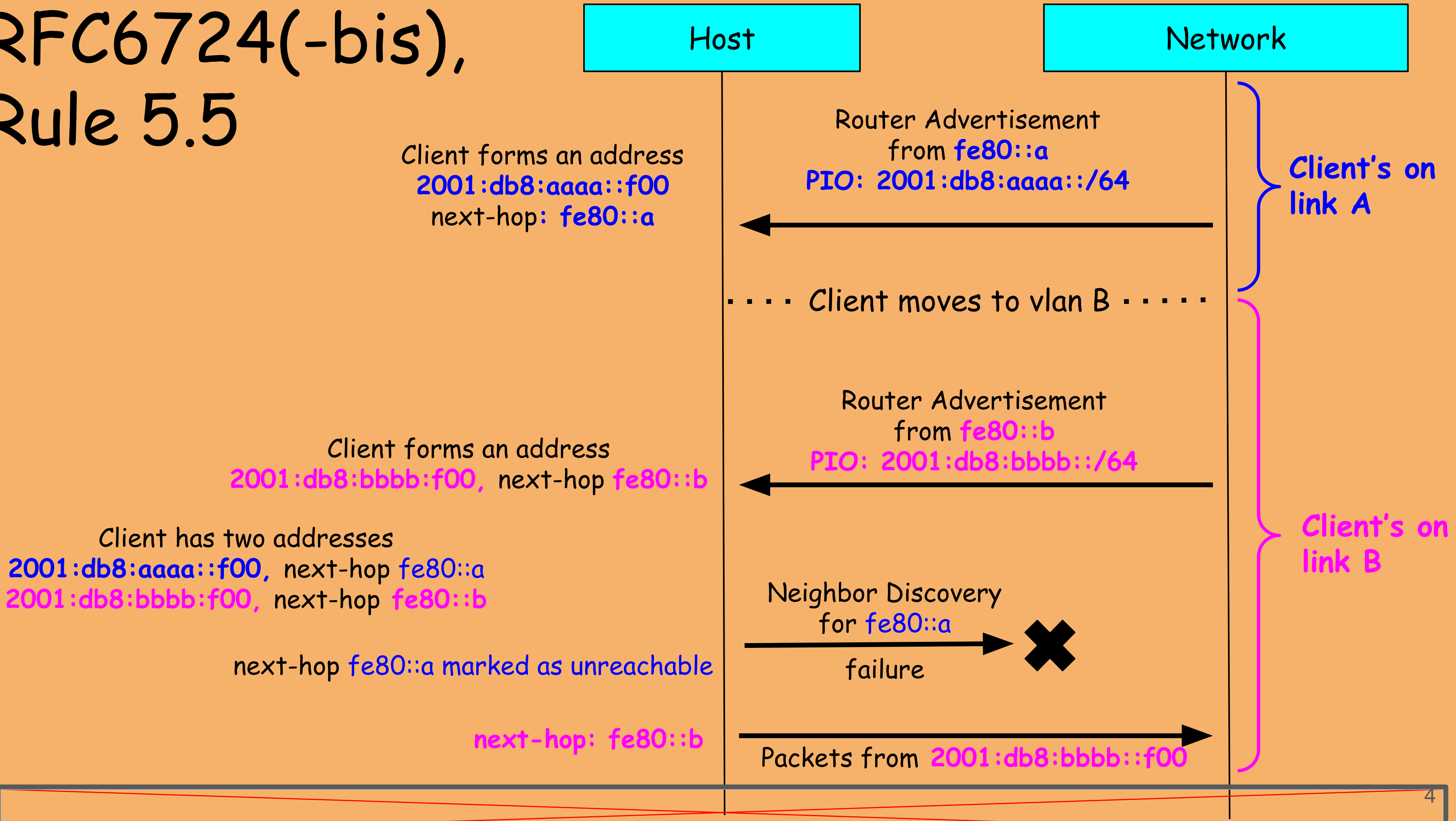
Recap (if needed)

Renumbering Scenarios

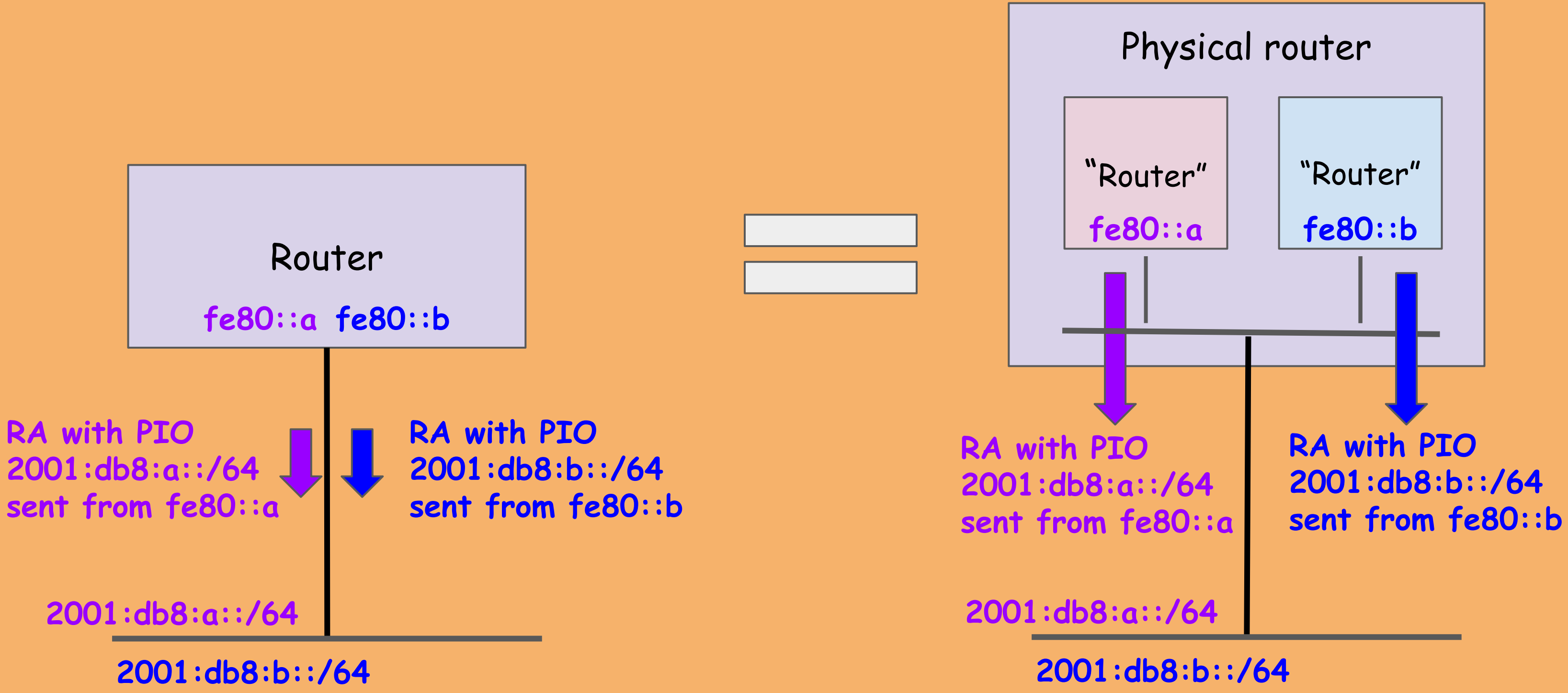




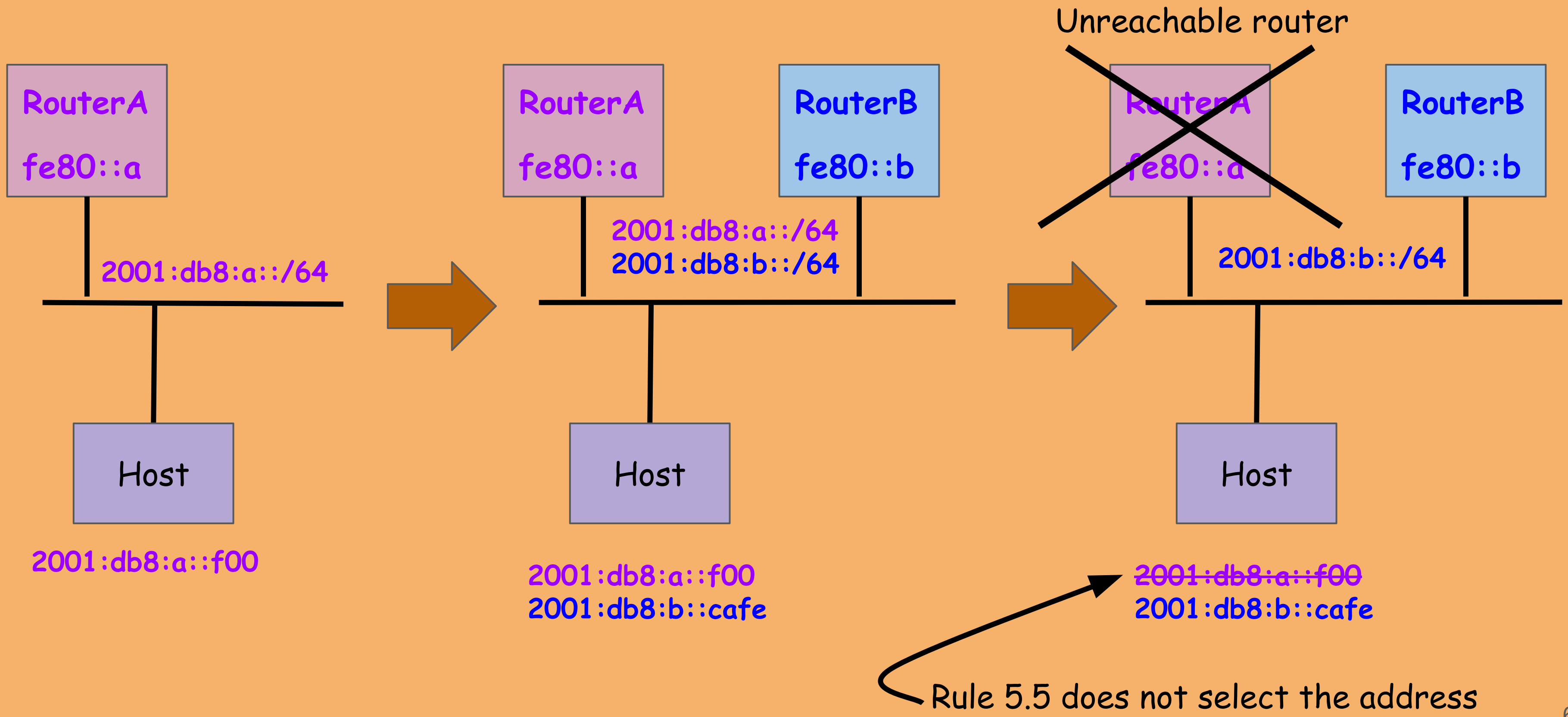
RFC6724(-bis), Rule 5.5



Proposed Solution: Prefix-Specific Link-Local Address



Proposed Solution and Flash Renumbering (Rule 5.5)



Proposed Solution: Details

For each ***$prefix*** in AdvPrefixList:

- Generate an interface ID as per RFC7217 (or it can be configured manually)
  - Using ***$prefix*** as the 'Prefix' parameter
- Assign a new link-local address with the generated ID
- Send RAs as per RFC4861
  - Limiting AdvPrefixList to ***$prefix***
  - Using that link-local as a source

Simplified Case of Managed Devices

```
furry@flatwhite> show configuration interfaces ae1.42
family inet6 {
    address 2001:db8:abc:cafe::2/64 {
        vrrp-inet6-group 101 {
            virtual-inet6-address 2001:db8:abc:cafe::1;
            virtual-link-local-address fe80::2001:db8:abc:cafe;
        }
    }
}
furry@flatwhite>
```

Concerns Raised

Routers w/o Multiple LLAs Support

- Text updated to say that this feature is ONLY applicable for routers supporting multiple link-local address
- Any router running VRRPv3 supports multiple LLAs already (one per group)

“I have routers with 10 prefixes!”

- Solution Applicability Section added
    - Proposed mechanism is optional
    - SHOULD be configurable, MUST be disabled by default, but..
    - MAY be enabled on interfaces prone to flash renumbering
        - AdvPrefixList contains prefixes from DHCPv6-PD.

You are going to send so many RAs!

- Networks with 10 prefixes/interface might not need this
- Common case of "a single global prefix being renumbered" doesn't increase the number of RAs (doubles if an ULA prefix is present)

- Send a PIO for each prefix in a separate RA, using that dedicated link-local address as a source. When populating fields in each RA as per Section 6.2.3 of [RFC4861], AdvPrefixList is treated as containing one specific prefix only. When the AdvPrefixList contains multiple prefixes, so multiple RAs need to be sent, the router SHOULD minimize the time interval between them. Doing so reduces the energy consumption of battery-powered devices that must awaken to receive those RAs. Ideally, all RAs shall be sent together, as a bundle, so MaxRtrAdvInterval and MinRtrAdvInterval are applied to the whole bundle.

“THE link-local address of the router” in RFC4861

“the link-local address” mentioned 7 time.

5 cases covered by the draft:

- RA format: “source address: MUST be the link-local address assigned to the interface from which this message is sent”
- Redirect message format
- 3 times in Section 6.2.8

More text needed: Section 8 (Redirect function): 2 times

Partially covered, but more text might be needed about “For dynamic routing, this requirement implies that all IPv6 routing protocols must somehow exchange the link-local addresses of neighboring routers.”

Open Question

- Current proposal: “when a prefix is removed, the LLA disappears”
  - Helps devices supporting rule 5.5
- SLAAC-renum and RFC9096: Any prefixes that were previously advertised …that have now become stale, MUST be advertised with zero lifetimes”
  - Helps all devices in case of renumbering, *if* the router is aware of old prefixes
  - Doesn’t help if the device moves between the links

Open Question: There is no conflict, actually

- SLAAC-renum/RFC9096 assumes that AdvPrefixList contains deprecated (stale) prefixes
- This draft:
  - sends an RA from a dedicated LLA for each prefix in AdvPrefixList

Open Question: Document Status

- Currently: proposed standard
  - Updated RFC4861 and RFC8028
- Shall it be experimental (with RFC8028 update done separately?)

Next Steps

- Is it a good idea?
- Comments/suggestions?
- Adoption?