



# **RFC 8981: Temporary Address Extensions for IPv6 SLAAC**

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# Introduction

# Temporary addresses

- **Traditional SLAAC addresses had bad privacy properties**
  - The Interface Identifier embedded the underlying MAC address
  - This could be exploited as a super-cookie for host-tracking
- **Concept of temporary addresses was later introduced**
  - Use randomized temporary addresses for client-like operations
  - Regenerate temporary addresses over time
- **Temporary addresses mitigated the most pressing problem**
  - Exposing one's identity when e.g. browsing the web

# RFC 4941: How it works

- **Temporary addresses configured in addition to stable addresses**
  - Randomized IID regenerated on a periodic basis
- **Lifetime of temporary addresses is artificially limited**
  - Preferred Lifetime: TEMP\_PREFERRED\_LIFETIME (1 day)
  - Valid Lifetime: TEMP\_VALID\_LIFETIME (1 week)

# RFC 4941: How it works (II)

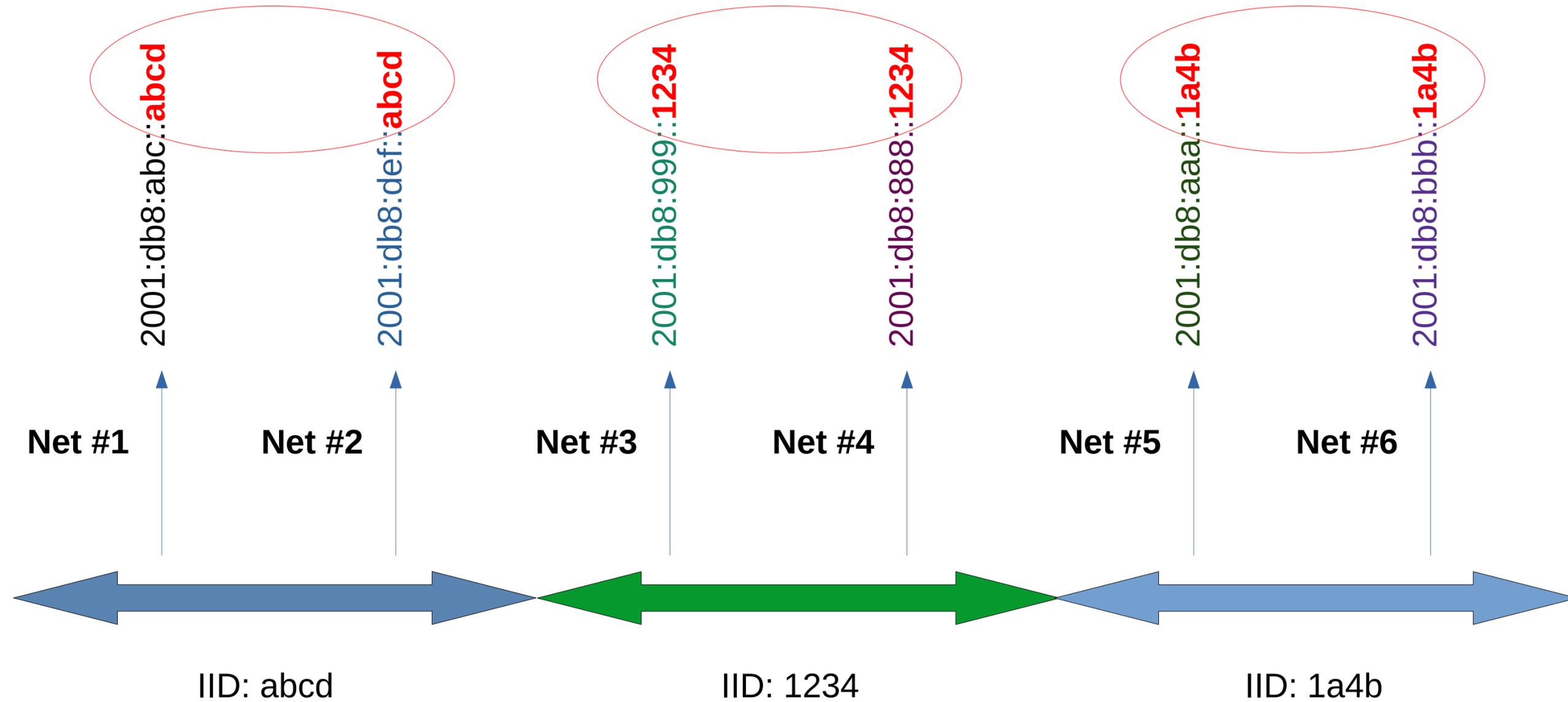
- **Number of concurrent addresses:**
  - $\text{TEMP\_VALID\_LIFETIME} / \text{TEMP\_PREFERRED\_LIFETIME} = 7$
- **Temporary addresses disabled by default**

# Issues associated with RFC 4941

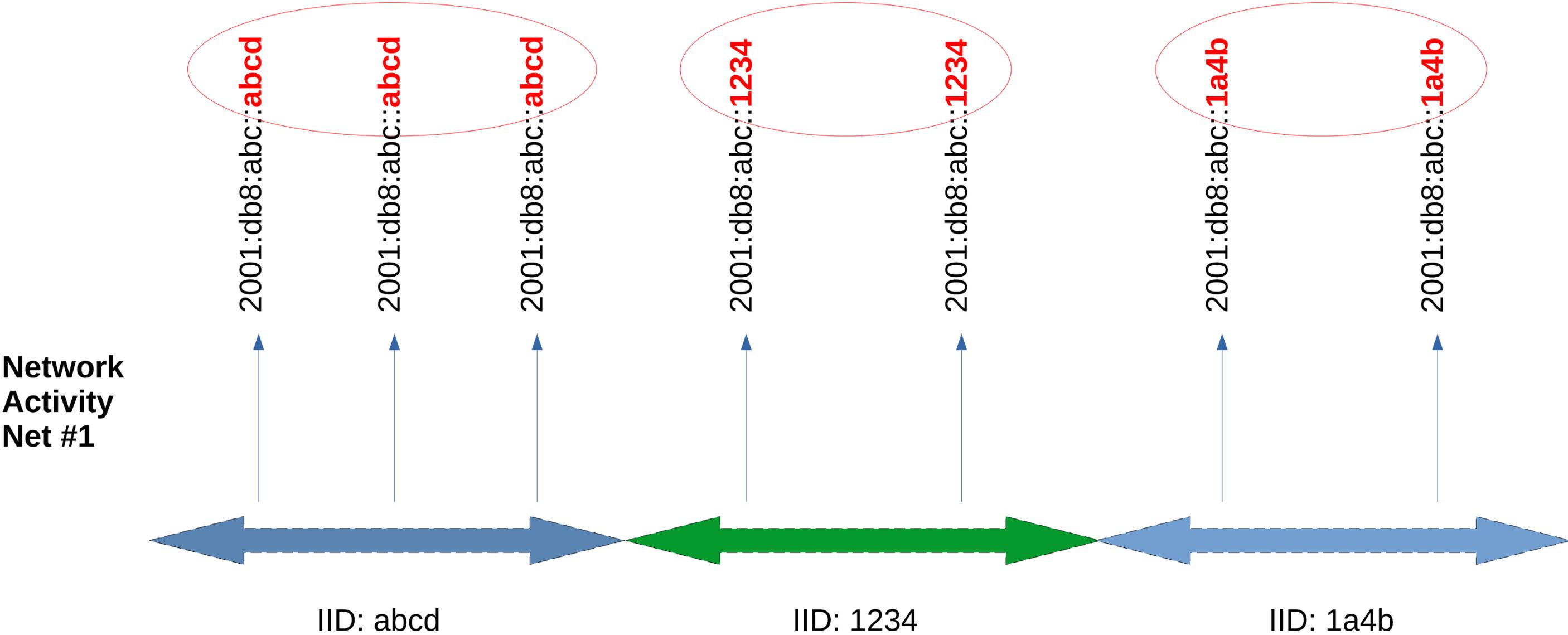
# IID changed only on a time-basis

- **Hosts change the IID only on a time-basis**
  - IIDs are regenerated at a fixed periods of timeMay employ the same IID on different networks
  - May employ the same IID for different prefixes (multihoming scenario)
- **Correlation is possible**
  - Time-based correlation
  - Space-based correlation
  - Multi-homing correlation

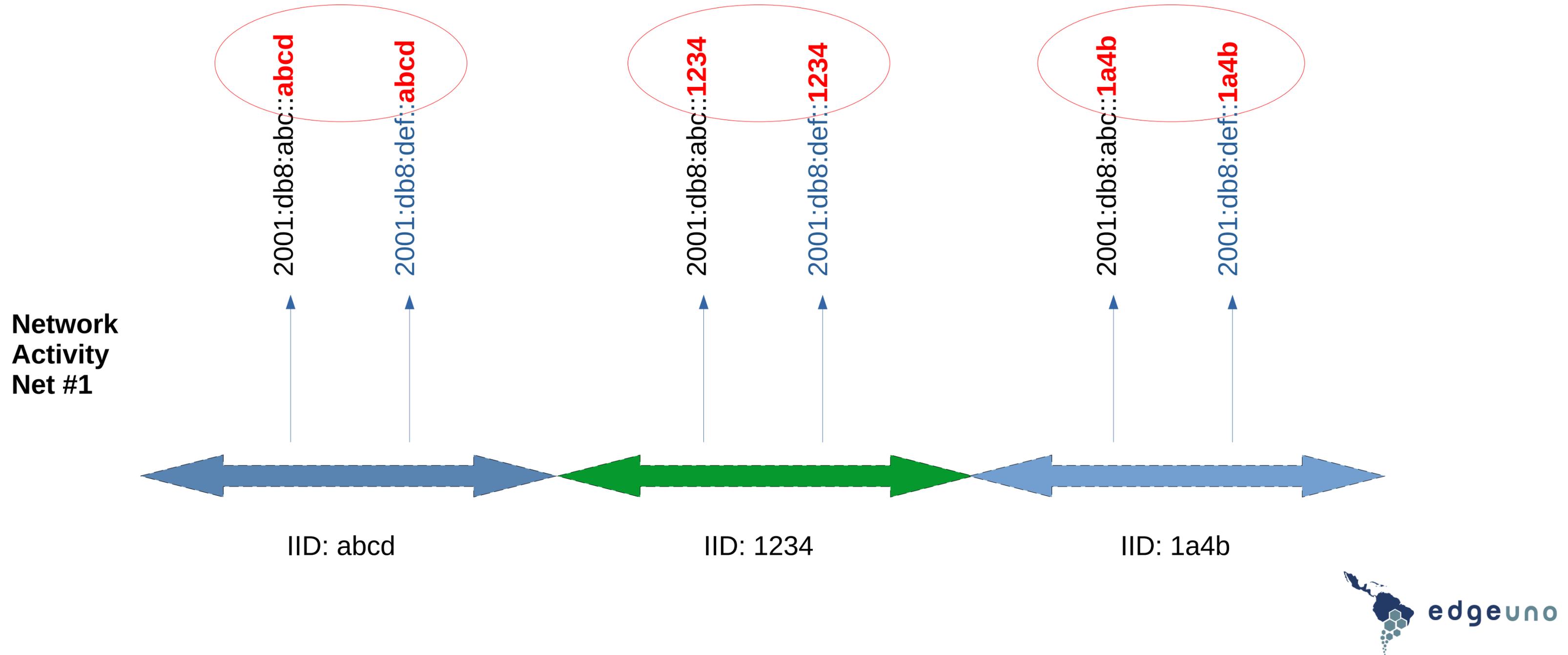
# Space-based correlation



# Time-based correlation



# Multi-homing correlation



# Address lifetime is too long!

- **Default TEMP\_VALID\_LIFETIME probably too long**
  - 1-week lifetime is too stable!
- **Too many concurrent addresses for the general case**
  - $\text{TEMP\_VALID\_LIFETIME} / \text{TEMP\_PREFERRED\_LIFETIME} = 7$
- **Not nice for some network devices**
  - Think Neighbor Discovery inspection

# Stable addresses are required

- RFC4941 requires stable addresses along temporary addresses
- But e.g. mobile devices could benefit from temporary-only!

# Temp addresses disabled by default

- RFC4941 recommends that temporary addresses be disabled by default
- Most popular implementations go against this recommendation

# **RFC 8981: Revision of RFC 4941**

# RFC 8981: Change log

- **Each temporary address employs a different randomized IID**
  - IID are not reused
- **Addresses are renewed at randomized intervals**
  - Anywhere  $[0.6 * \text{Preferred Lifetime}; \text{Preferred Lifetime}]$
- **New default lifetimes:**
  - Preferred Lifetime: 1 day
  - Maximum Valid Lifetime: 2 days
  - Maximum number of concurrent addresses: 3

# RFC 8981: Change log (II)

- **Stable addresses are not required**
- **Temporary addresses enabled by default**

# RFC 8981: Implementation status

- **OpenBSD's slaacd(8)**
  - Full implementation!
- **Linux kernel**
  - Most of it – except randomized lifetimes
- **FreeBSD kernel**
  - Patch submitted in April 2020 – but not yet committed
  - Care to help?

# Conclusions

# Conclusions

- **RFC 8981 has benefited from recent research in this area**
  - All known issues from RFC 4941 have been addressed
- **Simultaneous work on implementations reduced the “time to market”**
  - RFC 8981 was published in February 2021
  - At least one full RFC 8981 existed by that time

# Questions?

# Thanks!



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