Multi-requirement Extensions for DHCPv6

(draft-ren-dhc-mredhcpv6-00)

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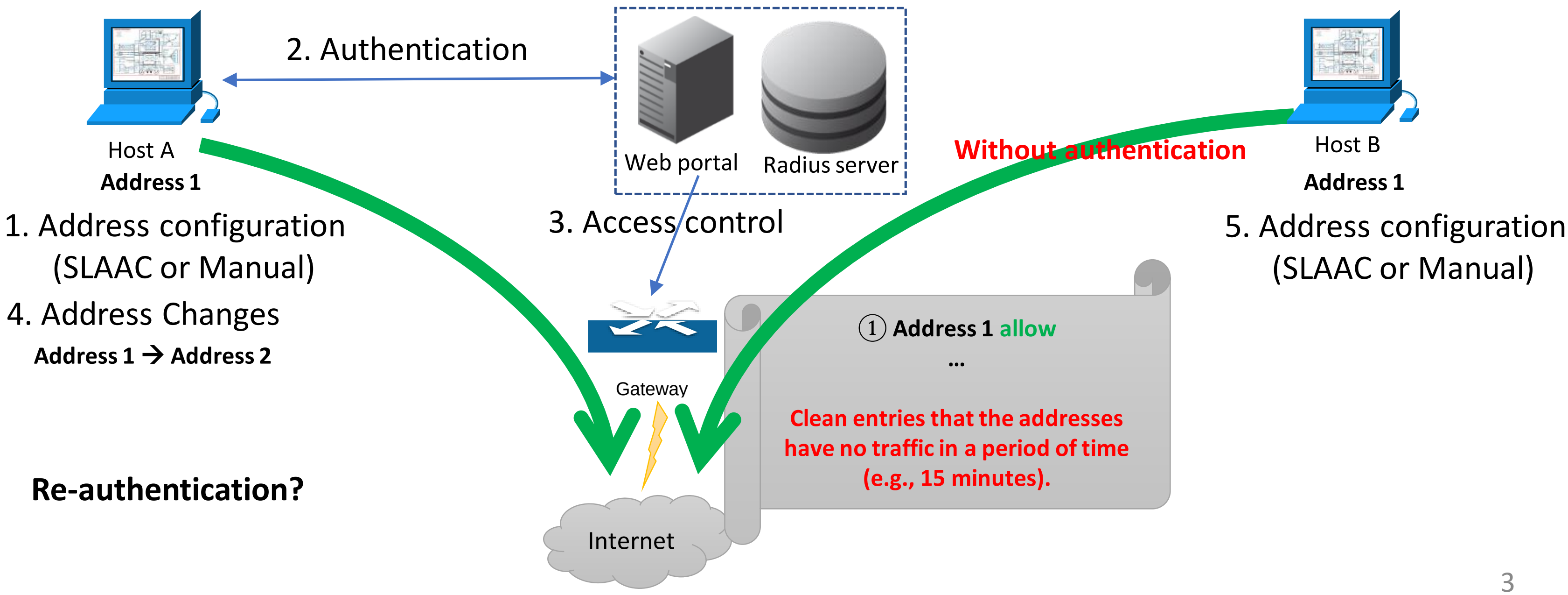
Motivations (1)

- Mixed operation problem of multiple IPv6 address generation mechanisms
  - Diversity and flexibility in address generation mechanisms
    - IEEE EUI-64 [RFC2464], CGA [RFC3972], Temporary [RFC4941], Stable, privacy [RFC7217/RFC7943], …
  - Multiple requirements of address generation
    - Manageability, privacy, transition, traceback, …
  - For SLAAC
    - Different OSes have different default address generation mechanisms.
    - Some address generation mechanisms are not fit for particular network scenarios.
  - For DHCPv6
    - IA_NA, IA_TA options
    - Requirements exist for DHCPv6 servers to configure address generation mechanism for different local networks
  - Conclusion: Mechanisms for configuring address generation mechanisms on requirements are needed.

Motivations (2)

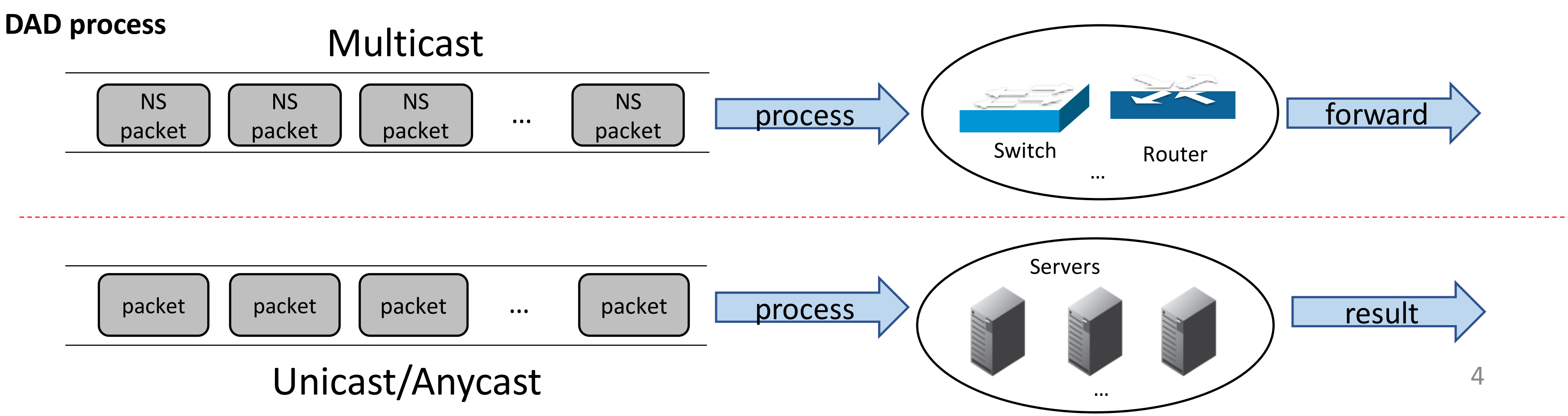
- Synchronization problem with a change in IPv6 addresses
  - Address-related network entities
    - switches, DHCPv6 servers, auditing server, gateway, …
  - DHCPv6: Active leasequery[1] solves a part of this problem.
  - SLAAC and manual: remains unresolved.



1 RFC7653-DHCPv6 Active Leasequery

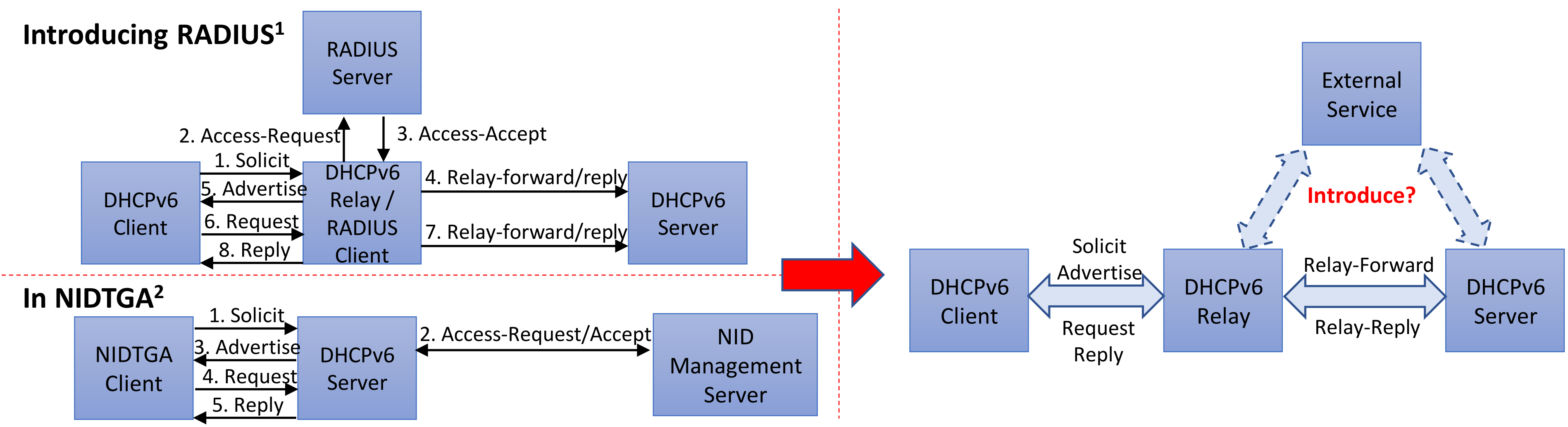
Motivations (3)

- Efficiency problem when processing large-scale concurrent IPv6 address requests
  - Although the size of the current subnet is not very large, the address generation function should be designed to accommodate up to 2^{64} concurrent address generation requirements.
  - DAD method
    - The current DAD process uses multicast NS messages which are handled and forwarded by routers or switches.
    - For large-scale concurrent requests, the concurrent processing mechanism of server clustering techniques can be taken into consideration.



Motivations (4)

- General model problem in introducing external services into the address assignment process
    - As identifiers, IP addresses can be mapped to other requirement spaces to support multiple functions, such as authentication, traceback, transition, and mobility.
    - Some interoperations between DHCP entities and external service entities are designed to provide precise and fine-grained services.



1 RFC7037-RADIUS Option for the DHCPv6 Relay Agent

2 Liu Y, Ren G, Wu J P, et al. Building an IPv6 address generation and traceback system with NIDTGA in Address Driven Network[J]. Science China Information Sciences, 2015, 58(12): 1-14.

Design goals and possible solutions

- Goal 1 and Goal 2 (For motivation 1, 2, 3)
  - Addresses in a network should be generated according to the user or network requirements.
  - All types of address allocation information in a network should be within the central management (SLAAC, DHCPv6, and manual).
  - Solution
    - Define "General Address Generation Type" and "Uniform Address Storage Structure".
    - For DHCPv6, define extensions for new DHCP options and exchange process.
    - For SLAAC, modify Prefix Information Option of RA, and DAD process (also for manual configurations).
- Goal 3 (For motivation 4)
  - General uniform protocol extensions and models for introducing external services into the process of address assignment should be built.
  - Solution
    - Define "External Service Request" and "External Service Reply" between DHCPv6 relay/server and External Service Client/Server.

- See more details in draft-ren-dhc-mredhcpv6-00
https://datatracker.ietf.org/doc/draft-ren-dhc-mredhcpv6/
- Most of the extensions can be achieved by extending DHCPv6 under the premise of changing the current protocols as little as possible.

Comments?

Thank You!

IETF98, Chicago

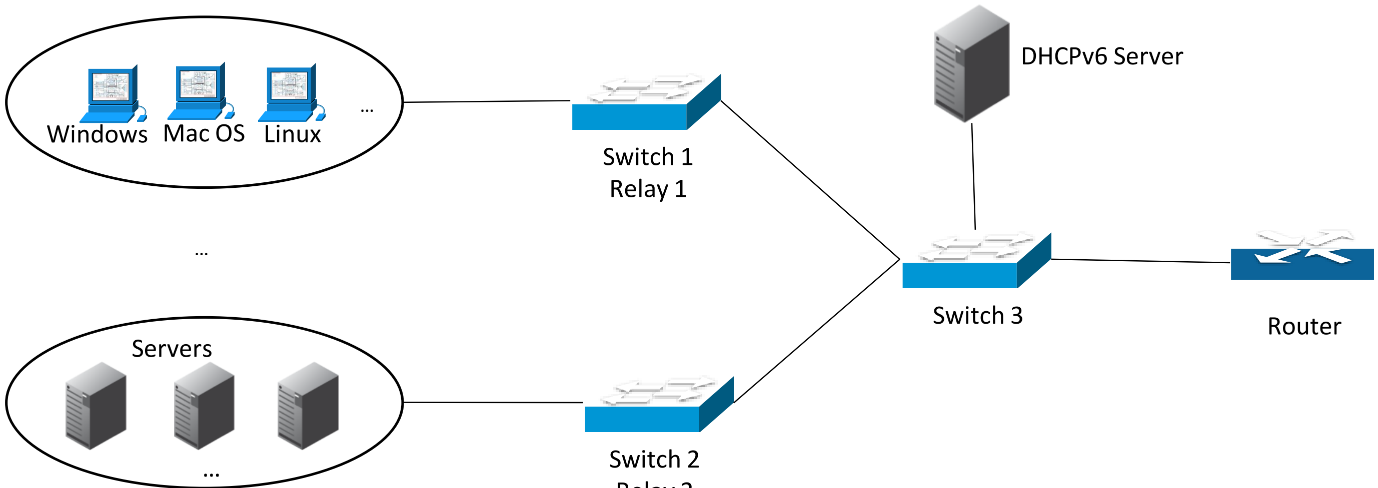
backups

Why generating addresses according to requirements?

- Different networks scenarios have different requirements.
- More and more address generation mechanisms are designed.
- Introducing external services responds to new requirements and help design new mechanisms.

DHCPv6

Prefer Temporary

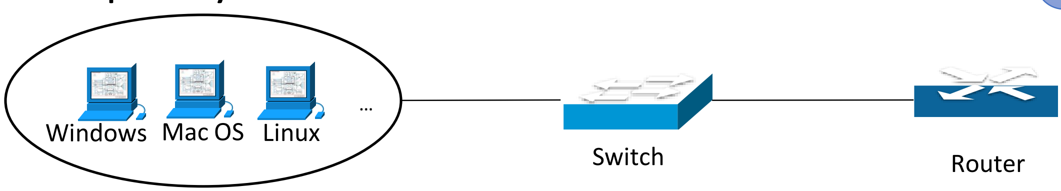


Prefer IEEE EUI-64

Addresses are generated according to requirements.

SLAAC

Temporary + Stable



Just as RFC7217 says,

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It should be noted that temporary addresses can be challenging in a
number of areas.  For example, from a network-management point of
view, they tend to increase the complexity of event logging,
troubleshooting, enforcement of access controls, and quality of
service, etc.  As a result, some organizations disable the use of
temporary addresses even at the expense of reduced privacy
[BROERSMA].  Temporary addresses may also result in increased
implementation complexity, which might not be possible or desirable
in some implementations (e.g., some embedded devices).
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General Address Generation Type

Type (N bits)	**Method**	**Related RFC**
1	IEEE EUI-64	RFC2464
2	CGA	RFC3972
3	Temporary	RFC4941
4	Stable, privacy	RFC7217/RFC7943
…	…	…
2^N-1	…	…

Uniform Address Storage Structure

Items	**Meaning**
address	IPv6 address.
duid	DHCP unique identifier, see Section 9 of [RFC3315].
iaid	Identity association, see Section 10 of [RFC3315].
valid_lifetime	Length of the lease.
expire	Expiration time of the lease.
pref_lifetime	Preferred lifetime.
hwaddr	Hardware/MAC address.
…	…

Synchronization of SLAAC and Manual Configurations

- Option 1
  - All the hosts should support DHCPv6.
- Option 2
  - Hosts only supporting SLAAC should inform central address management entities of their addresses.
  - DHCPv6 is a good example.

Relationship with CASM

- This draft would like to manage all types of the address allocation information in IPv6 networks.
- CASM aims to manage address spaces (IPv4, IPv6, private, multicast, etc.) and design many kinds of interfaces.

Why efficiency problem is a problem?

- IPv6 is designed to have the ability to support a very large subnet (up to 2^{64}).
- When there are too many hosts requesting for addresses, routers or switches will use more resources to handle and forward DAD messages.

Hosts not supporting extensions

- This problem should be discussed, and we need to think more about it in the mailing list.
- If some of the motivations survive this meeting, this can be designed in details.