Problem Statement of Multi-requirement Extensions for DHCPv6

Gang Ren, Lin He, Ying Liu

Tsinghua University & CERNET

rengang@cernet.edu.cn

he-l14@mails.tsinghua.edu.cn

liuying@cernet.edu.cn

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Background

- IPv6 address generation is closely related to the manageability, security, privacy protection, and traceability of the networks.

- DHCPv6 can be extended by new options, messages, and protocols.

- DHCPv6 server software provides interfaces to allow for user-defined extensions.

- Modifying open-source DHCPv6 servers is difficult.

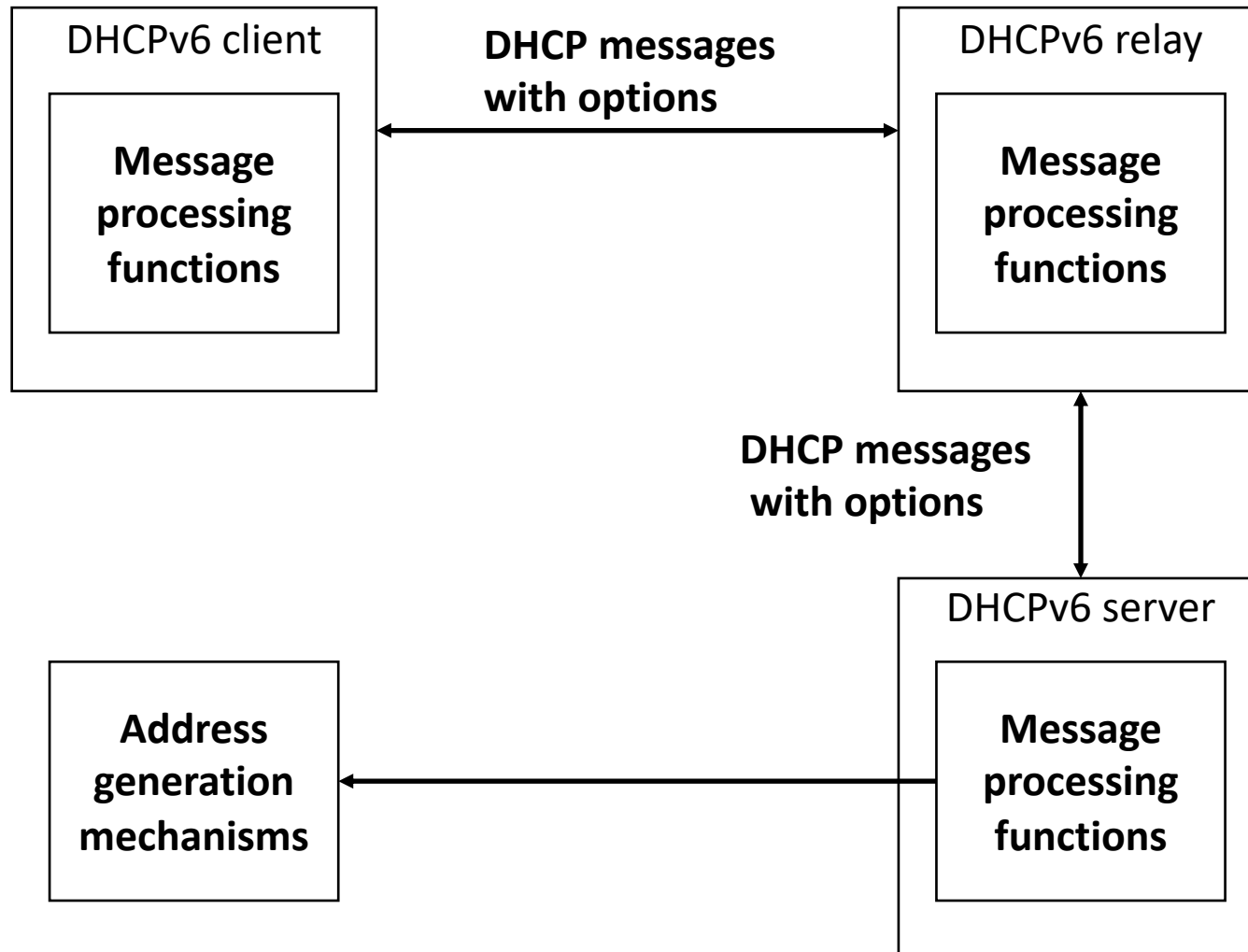- We need a general insight of how to solve the extension problem better.

Current Extension Practices (1)

- Standardized and non-standardized DHCPv6 extension cases
  - Extended options
    - DNS [RFC3646], SNTP [RFC4075], NIS [RFC3898], FQDN [RFC4704], information refresh time [RFC4242], etc.
  - Extended messages
    - Active leasequery [RFC7653], etc.
  - Extended entities
    - Radius server [RFC7037], etc.

Current Extension Practices (2)

- Current DHCP server software cases
  - Cisco CPNR extension APIs
    - Extension points
    - http://www.cisco.com/c/en/us/td/docs/net_mgmt/prime/network_registrar/9-0/dhcp/guide/DHCP_Guide.html
  - Kea DHCP hook mechanism
    - Write callout functions to attach to the hook points
    - https://jenkins.isc.org/job/Kea_doc/doxygen/
  - …

DHCP general model

DHCPv6 client

Message processing functions

DHCP messages with options

DHCPv6 relay

Message processing functions

DHCP messages with options

DHCPv6 server

Message processing functions

Address generation mechanisms

Possible Extensions (1)

- DHCP messages
  - Status: Define new messages
    - e.g., active leasequery
  - Problem: all DHCP messages are in plaintext
    - Lack of privacy protection on messages
    - Privacy Considerations for DHCPv6 [RFC7824]
  - Possible solutions
    - Encryption of DHCP messages

Possible Extensions (2)

- Options
  - Status: Define new options to convey new parameters
    - Vendor-specific information option
  - Problem: parameters may come from users
    - These parameters are uncertain and may change
  - Possible solutions
    - Clients provide interfaces to obtain user parameters
      - Few such interfaces
    - Relays obtain new parameters first and add them into requests
      - Need the support of other protocols

Possible Extensions (3)

- Message processing functions
  - Status: Some servers provide interfaces to allow for user-defined extensions
    - Customize how servers handle and respond to DHCP requests
  - Problem: not all DHCP software consider this extension
    - Clients
    - Relays
    - Servers
  - Possible solutions
    - DHCP software support user-defined extensions

# Possible Extensions (4)

- Address generation mechanisms
  - Status: many IPv6 address generation mechanisms exist
    - Temporary [RFC4941], stable privacy [RFC7217/7943], CGA [RFC3972], HBA [RFC5535]
    - Servers usually generate random IPv6 addresses
  - Problem: different networks may need different address generation mechanisms
  - Possible solutions
    - Allow new-defined and different address generation mechanisms to be configured.

Extension Principles

- Do not change the current DHCP general model
- Use simpler interfaces to define and support more extensions
- TBD

Extension Case

- Requirement: IPv6 addresses generated from user identifiers for accountability and privacy[1]

  - Clients send their user identifiers to servers.

    - 802.1X authentication

    - Relays insert user identifiers into requests

  - Servers generate addresses and assign them to clients.
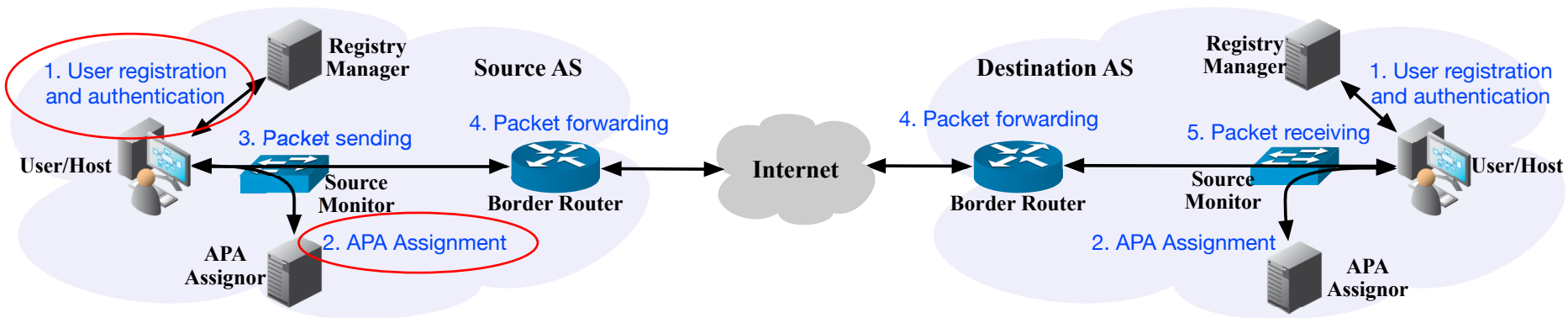
[1] Lin He, Gang Ren, Ying Liu. Bootstrapping Accountability and Privacy to IPv6 Internet without Starting from Scratch[C]//IEEE INFOCOM 2019-IEEE Conference on Computer Communications. IEEE, 2019.

Changes compared with -00

- Thanks for Bernie's valuable comments:
  - Explain the vendor option issue in the document
  - Provide possible directions to solve problems
  - Remove the reference of secure dhcpv6 and options
  - Use reference 3315bis
  - Change the status of the draft to Informational

Comments?

Thank You!

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