A SAVI Solution for DHCP

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draft-ietf-savi-dhcp-01(02).txt

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Outline

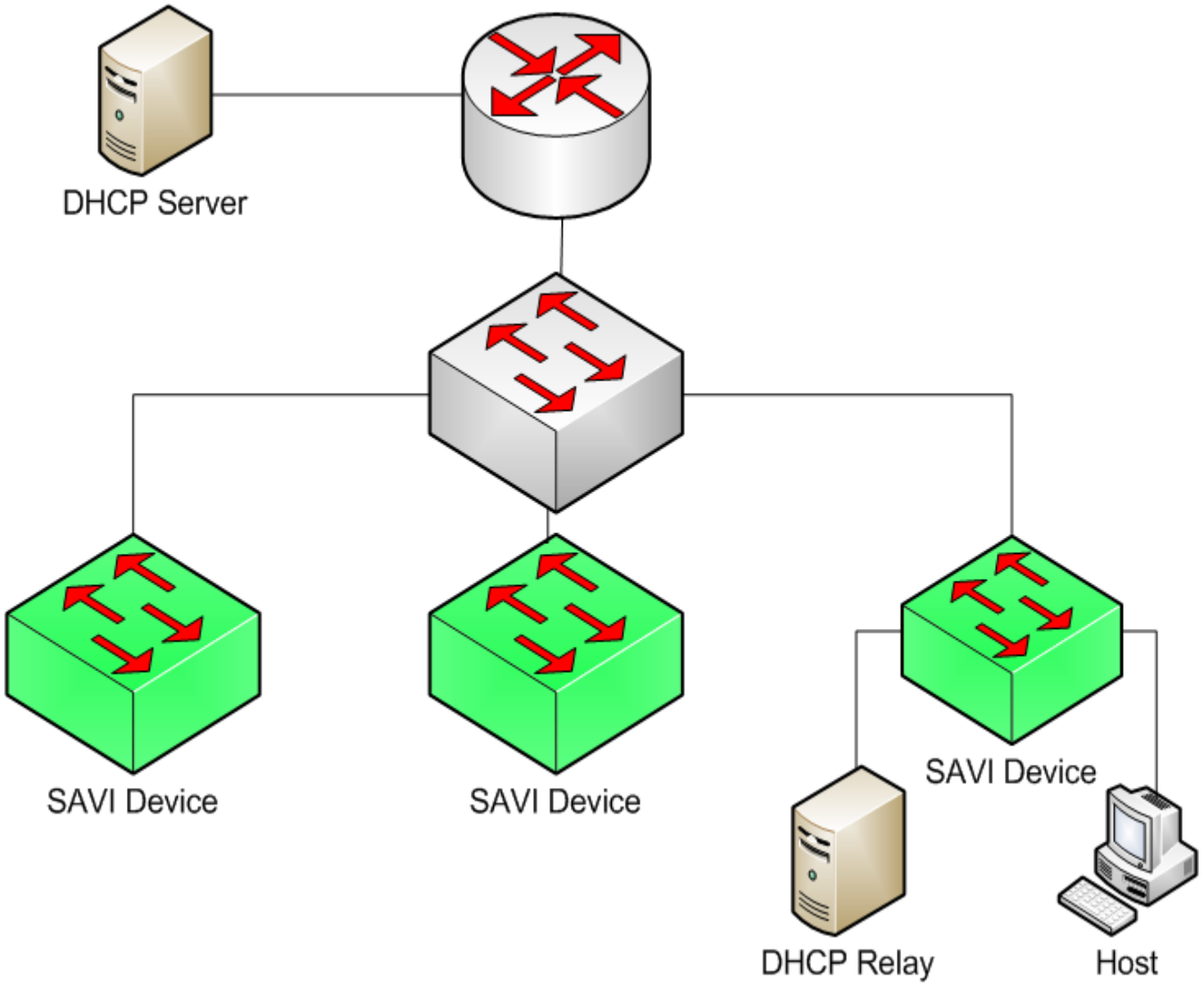
- Solution Basis
- Additional Features in 01(02) Version
- Next Step

Solution Basis

Basis and Related Protocols

- A control packet snooping based solution. Data packet snooping is used as supplement.
- *Stage 1: DHCP Address Assignment*
  - DHCPv4(RFC2131)
  - DHCPv6(RFC3315, stateful)
- *Stage 2: Duplicate Detection*
  - IPv4 Address Conflict Detection(RFC5227)
  - IPv6 Duplicate Address Detection(RFC4862)
- Optional Data Trigger function to handle some cases:
  - Will be discussed in 2nd part of this PPT

Typical Scenario



The Router or SAVI device may also play the role of DHCP Relay (or even DHCP server) In implementation.

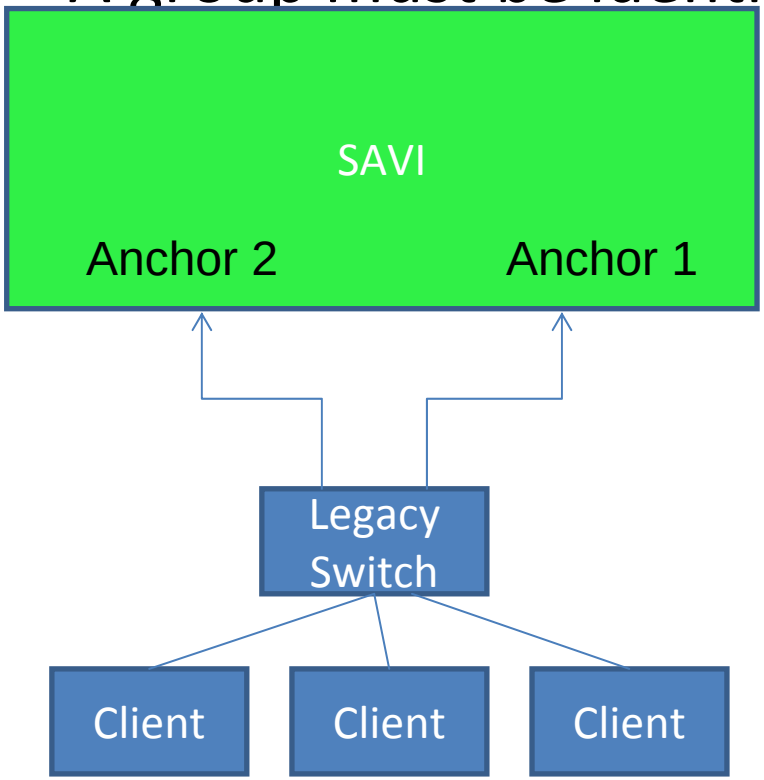
Anchor Attributes

- **Attribute**: Configurable features of anchor (anchor could be a port at a switch)
- An anchor may be configured to one or more compatible attributes, depending on the requirement of administrator

Attribute	Action
SAVI-Validation	Snooping & Filtering
SAVI-SAVI	No binding and no filtering, tursted
SAVI-DHCP-Trust	Trust DHCP server type message
SAVI-LocalGroup(Optional)	Share binding entries at multiple anchors
SAVI-DataTrigger(Optional)	Allow data triggered binding process

SAVI-LocalGroup Attribute

- Handle the scenario that multiple anchors used by the same group of clients.
  - A group must be identified by name or index



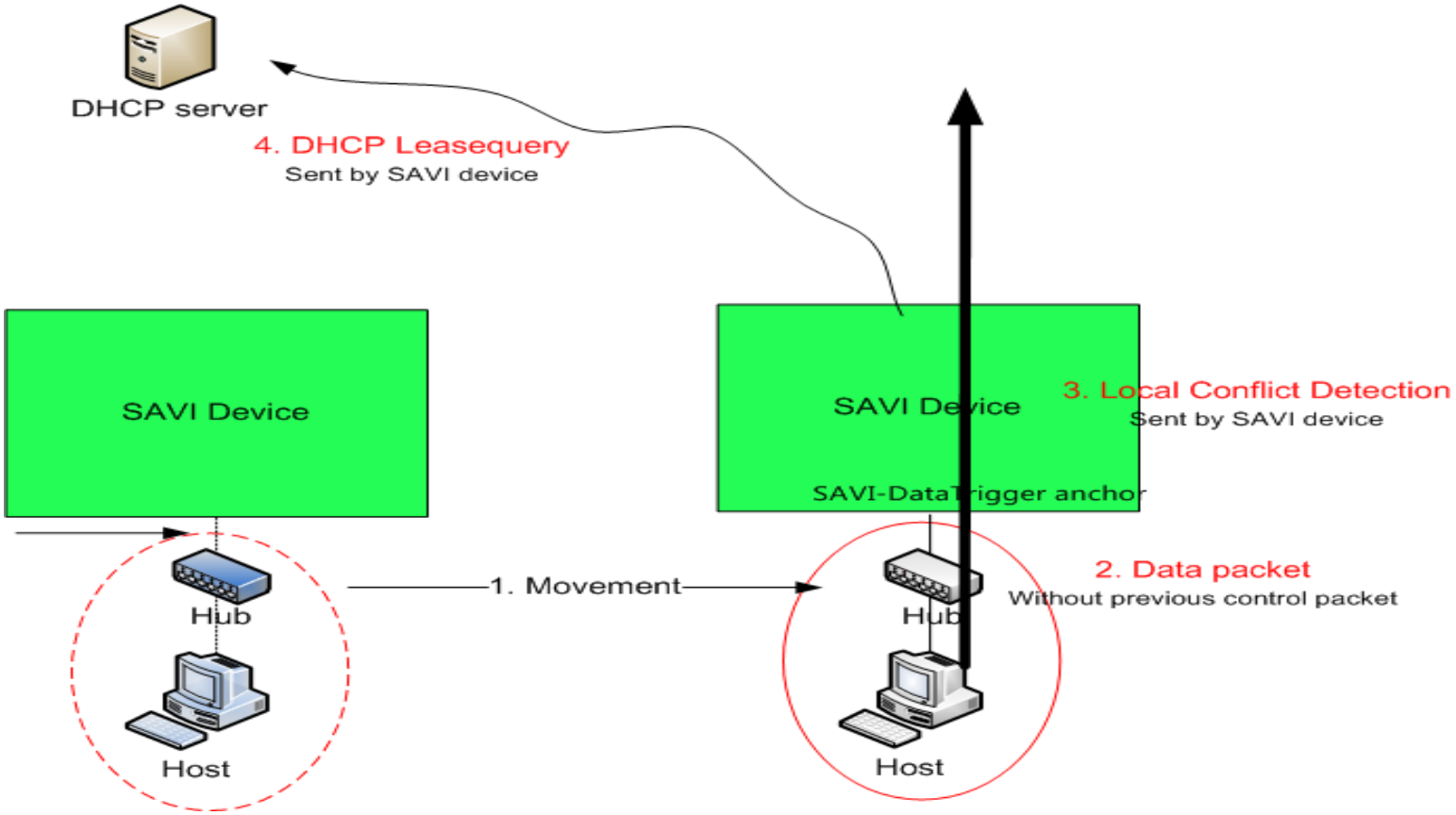
Group 1: anchor 1, anchor 2

Or

Anchor 1:
SAVI-LocalGroup group 1
Anchor 2:
SAVI-LocalGroup group 1

SAVI-DataTrigger Attribute

- Handle special case
  - Local link movement
  - Link layer topo change or layer-2 path change



Compatibility between Attributes

	SAVI-Validation	SAVI-SAVI	SAVI-DHCP-trust	SAVI-LocalGroup	SAVI-DataTrigger
SAVI-Validation	–	N	Y	Y	N
SAVI-SAVI	N	–	N	N	N
SAVI-DHCP-trust	Y	N	–	Y	Y
SAVI-LocalGroup	Y	N	Y	–	Y
SAVI-DataTrigger	N	N	Y	Y	–

Conceptual Data Structures

- Control Plane: Binding State Table(BST)
  - Keep state and lifetime
  - Key on anchor and(or) address
  - Entry: *Anchor | *Address | State | Lifetime |Other
- Data Plane: Filtering Table(FT)
  - Used for filtering only(for instance, ACL)
  - Key on anchor
  - Entry: *Anchor | Address
- BST and FT can be combined or separated in implementation.

Prefix Configuration

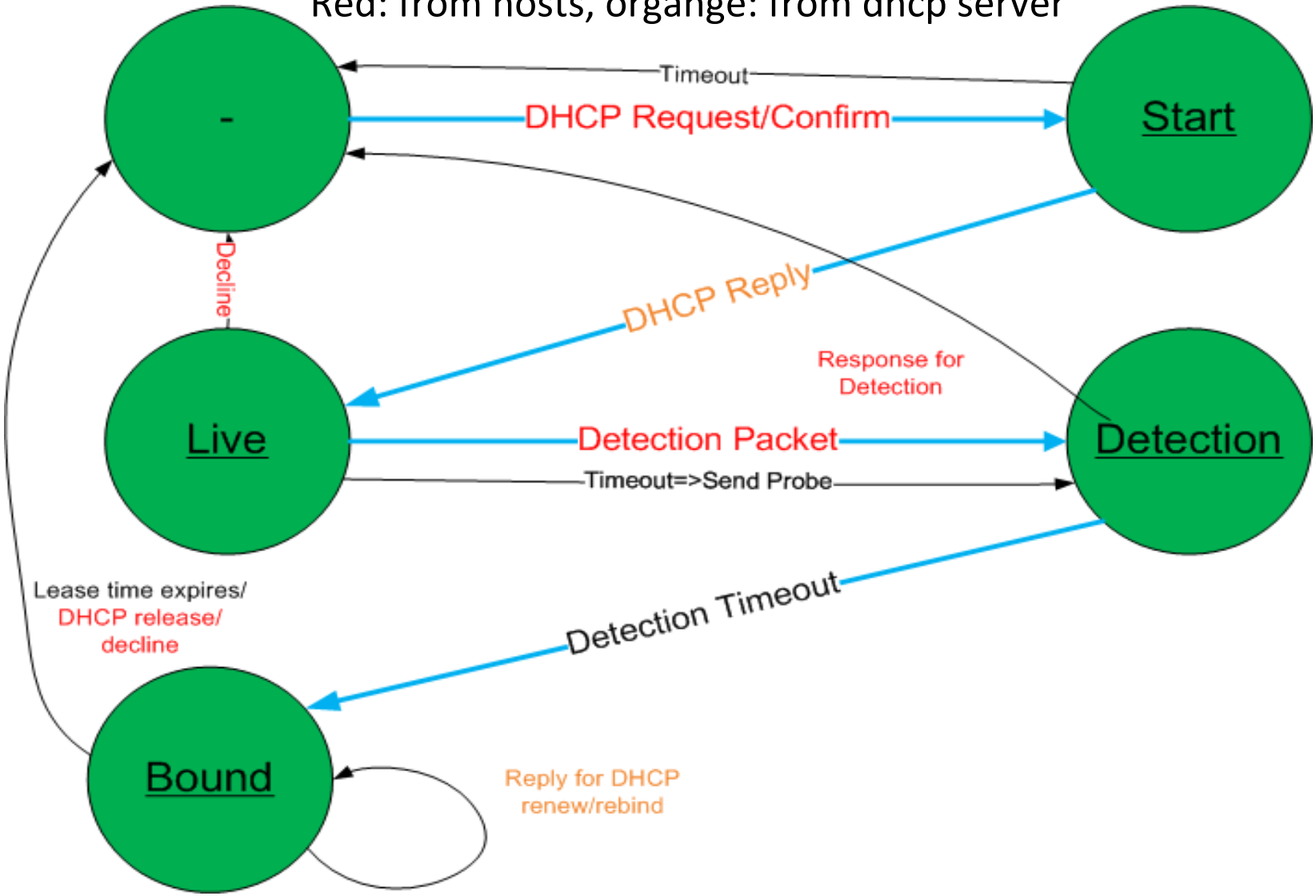
- Prefix scope can be learnt by
  - Automatically from RA or DHCP-PD
  - Manually configuration
- Optional configuration
  - entirely trust the DHCP server

States of binding

- START A DHCP request (or a DHCPv6 Confirm, or DHCPv6 Solicitation with Rapid Commit option) is received from host, and it may trigger a new binding.
- LIVE A DHCP address is acknowledged by a DHCP server.
- DETECTION A gratuitous ARP or Duplicate Address Detection NSOL has been sent by the host (or SAVI device).
- BOUND The address has passed duplicate detection and it is bound with the anchor.

State Transit Diagram

Red: from hosts, organge: from dhcp server



State transit table

State	Packet/Event	Action	Next State
-	Request/Confirm	Set up new entry	START
START	ACK /Reply	Record lease time	LIVE
*START	ACL/Reply	Recording lease time. Send probe	DETECTION
LIVE	DAD NS/Gratuitous ARP	-	DETECTION
LIVE	DECLINE	Remove entry	-
LIVE	Timeout	Send ARP Req/NS	DETECTION
DETECTION	Timeout	-	BOUND
DETECTION	ARP RESPONSE/NA	Remove entry	-
DETECTION	DECLINE/RELEASE	Remove entry	-
BOUND	RELEASE/DECLINE	Remove entry	-
BOUND	Timeout	Remove entry	-
BOUND	Reply on RENEW/REBIND	Set new lifetime	BOUND

Filtering Specification

- For anchor with SAVI-Validation attribute:
  - Data packet:
    - Check if <anchor, source address> in Filtering Table
  - Control packet(DHCP, NDP, ARP):
    - DHCPv4 Discovery: source address MUST be all zero
    - DHCPv4 Request: source address MUST be all zero or a bound address
    - DHCPv6 Request/Confirm: source address MUST be a bound address (either SLAAC or DHCP or manual)
    - DHCP Reply/Ack MUST be from port with SAVI-DHCP-Trust Attribute
    - NSol/ARP Request: source address MUST be a bound address (or unspecified address in case of DAD NS)
    - NAdv/ARP Reply: source address and target address MUST be bound addresses.

Binding Removal

- If the lifetime of a binding entry expires
- If the host is off-link
- If a local link movement is confirmed
  - Local link movement may be confirmed when address is assigned to another anchor and no conflict (DAD is successful)

Additional Features in 01(02) Version

Handle Anchor Off-Link Event

- If an anchor with SAVI-Validation is off-link
  - Keep the entry for a short period (for cable connection unstable case).
  - If the anchor turns on-link during the period, keep the bindings.
  - After the period, if it's still off-link, delete the bindings.

Binding Number Limitation

- Avoid DoS exhausting the Binding State Table
  - Three choices
  - Set the upper bound of binding number for each anchor with SAVI-Validation.
  - Reserve a number of binding entries for each anchor with SAVI-Validation attribute and all anchors share a pool of the other binding entries.
  - Limit DHCP Request rate per anchor, using the bound entry number of each anchor as reverse indicator.

CONFIRM triggered binding

- CONFIRM message is replied with status of address but not lease time.
- The SAVI device should retrieve the lease time of the bound address using LEASEQUERY, if the address is not assigned, the binding should be removed.

State Restoration

- The SAVI device may lose binding states because of scheduled or unexpected reboot
  - If the switch directly connects to hosts, then bindings will be recovered by hosts
  - There were lots of discussions on mailing-list for remote switch reboot, we have 3 optional ways
  - The bindings should be stored into non-violate storage regularly or manually (proposed by Mikael)
  - Or upstream router send NS triggered by 801.ag then savi-device binds by NA (proposed by John)
  - Or use the optional data triggered probes during a short period after reboot (see next pages)

Data Trigger Procedure(1)

- Data trigger function is enabled on anchor with SAVI-DataTrigger attribute
- Whenever a packet whose source is not in the Filtering Table is received, the SAVI device:
  - Drop the packet in case the address is bound on another anchor.
  - Send a DHCP LEASEQUERY message, and wait for the result. (The data packet should be forwarded or discarded during the waiting time, but not stored)

Data Trigger Procedure(2)

- If SAVI device is pure layer 2 switch with no layer 3 address
  - If stateless address is also permitted (not dhcp-only)
    - Use DAD to check whether the address is being used by another anchor. Allow the address if no conflict.
    - Then rebind the address if DHCP renew/rebind is received.
  - If not
    - User recover binding by repair the network connections
    - Or configure a short DHCP lease time. Then user can repair binding automatically.

Next Step

Next Step

- Plan to submit savi-dhcp-02 officially based on feedbacks from IETF77
- Please provide comments during the meeting or in the mailing-list
- Solution had been implanted by multiple vendors and being deployed in CNGI-CERNET2 (will be reported in my next PPT)
- May consider to ask for last call in IETF78

Thank you very much!