A SAVI Solution for WLAN

draft-bi-savi-wlan-23

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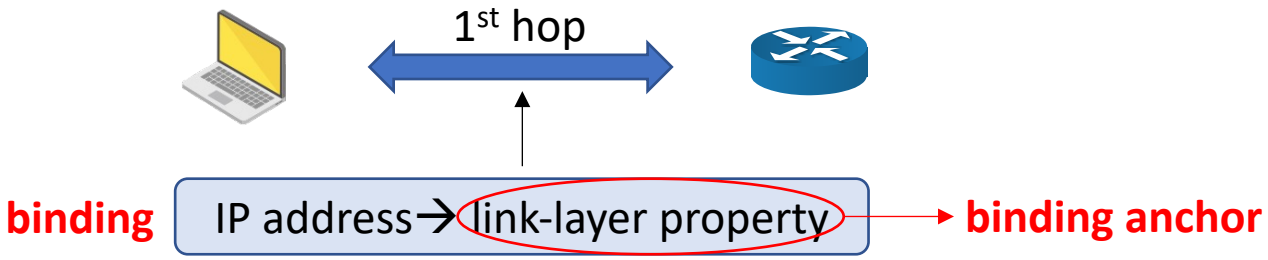
Outline

- Background
- Solution Overview
- Next Step

Background

SAVI goals and framework

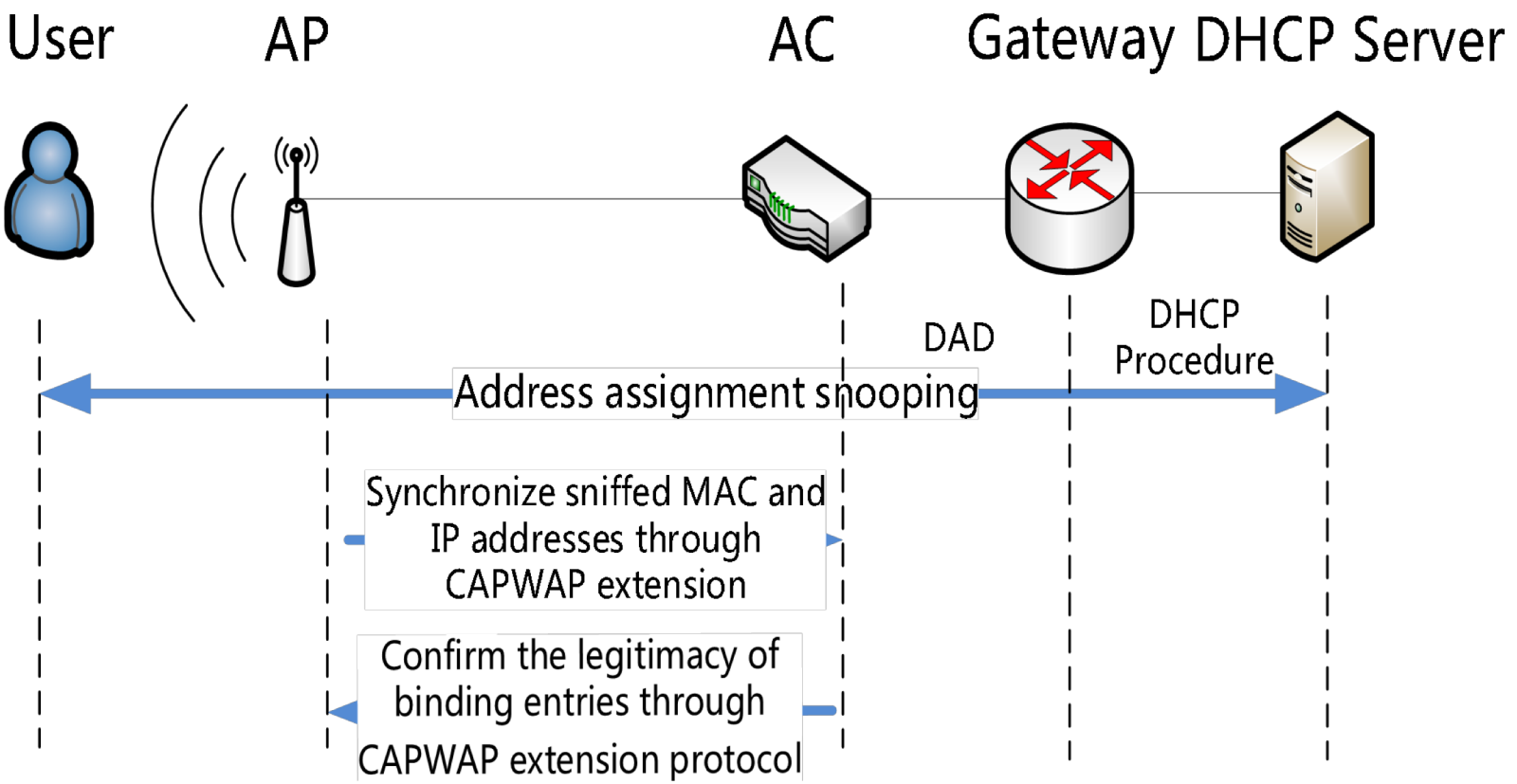
- Goals
  - ensure that hosts attached to the same IP link cannot spoof each other's IP addresses without disrupting legitimate traffic
- Framework for SAVI solutions



1. derive legitimate IP address from on-link traffic
2. bind legitimate IP address to link-layer property
3. enforce binding

Solution Overview

SAVI for WLAN



Two data structures

- IP-MAC Mapping Table
  - maps IP addresses to their corresponding MAC addresses
  - used in the control process
  - An IP address can have only one corresponding MAC address.
  - Different IP addresses can be mapped to the same MAC address.
- MAC-IP Mapping Table
  - maps MAC addresses to the corresponding IP addresses
  - used for filtering
  - A MAC address can be mapped to multiple IP addresses.
- The MAC-IP mapping table and the IP-MAC mapping table can be maintained separately on different devices.
- A synchronization mechanism must be used between these two tables to ensure the consistency of the bindings.

Binding anchor

- Banding anchor: MAC address
  - secured by 802.11i or other mechanisms

- If the MAC address is unprotected, an attacker can spoof the MAC address to pass validation successfully.

Binding creation

- Static:
  - All the static IP-MAC address pairs are configured into the IP-MAC mapping table with the mechanism enabled.
- DHCP[RFC7513]:
  - snoops on the DHCP address assignment process between the attached host and the DHCP server.
- SLAAC [RFC6620]:
  - snoops Duplicate Address Detection procedure or Address Resolution procedure between attached hosts and neighbors.

Binding clearing

- Three types of situations:
  - A host leaves explicitly this access point.
    - All entries in the MAC-IP mapping table associated with this MAC address MUST be cleared.
  - A DHCP RELEASE message is received from the owner of the corresponding IP address.
    - This IP entry in the IP-MAC mapping table and the corresponding entries in the MAC-IP mapping table MUST be cleared.
  - A timeout message of the AC's client idle-time is received.
    - All entries in the MAC-IP mapping table related to the MAC address MUST be cleared.

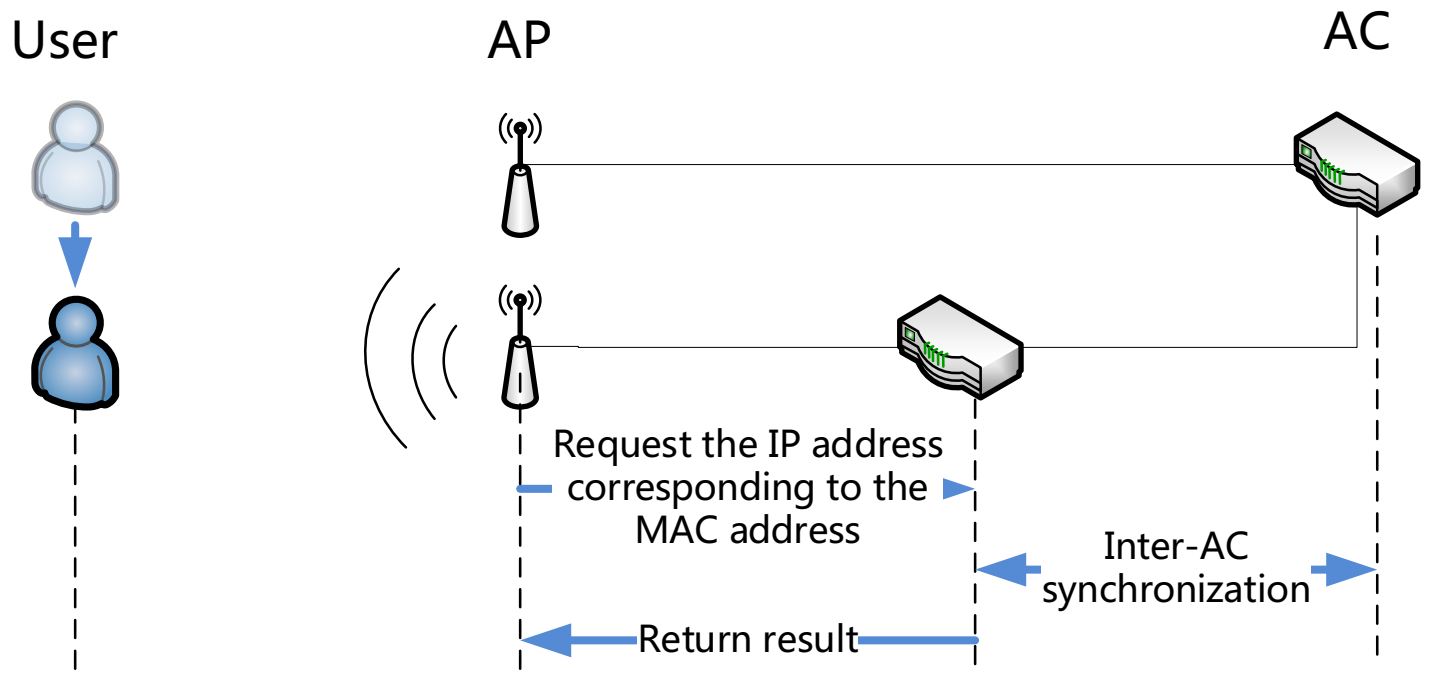
Source address validation

- Look up the MAC address in the MAC-IP mapping table and check if the MAC-IP pair exists.
  - If exists, forward the packet,
  - Otherwise, go the next step.
- Look up the IP address in the IP-MAC mapping table and check if the IP address exists.
  - If exists, check whether the MAC address in the entry is the same as that in the frame.
    - If so, forward the packet.
    - Otherwise, drop the packet.
  - If not, drop the packet.

Deployment scenarios (1)

- Scenario 1: Centralized WLAN (FIT Access Points and Access Controllers)
  - AP filtering
    - AC maintains IP-MAC Mapping Table while AP maintains MAC-IP Mapping Table and perform address snooping
  - AC filtering
    - AC maintains both MAC-IP and IP-MAC Mapping Table and performs both address snooping and packet filtering
    - All the packets must be forwarded to AC firstly.

Mobility Solution



Deployment scenarios (2)

- Scenario 2: Autonomous WLAN (FAT Access Points)
  - FAT AP maintains both MAC-IP and IP-MAC Mapping Table and performs both address snooping and packet filtering.

MAC address randomization and SAVI

- In WLAN, random MAC addresses are mainly used for discovering wireless networks, accessing networks and communicating.
  - **Discover wireless network**
    - Use probe request frames to discover wireless networks. This does not affect the establishment of SAVI binding anchors.
  - **Access networks and communicate**
    - Random MAC addresses are used to send and receive packets.
    - In 802.11i wireless networks, the key used for communication is tied to the MAC address, and the random MAC address does not change during communication.
    - Usually, in the same wireless network, the random MAC address does not change when you re-access the wireless network to ensure roaming experience.
    - If the MAC address changes, the access needs to be rechecked.
- In summary, the anchor point of SAVI binding is stable during one access, and the SAVI function will work well.

Next Step

Next Step

- Where to promote this work?
  - madinas?
  - intarea?

- Solicit comments and refine the draft

Comments?

Thank You!

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