ARP Cache Poisoning

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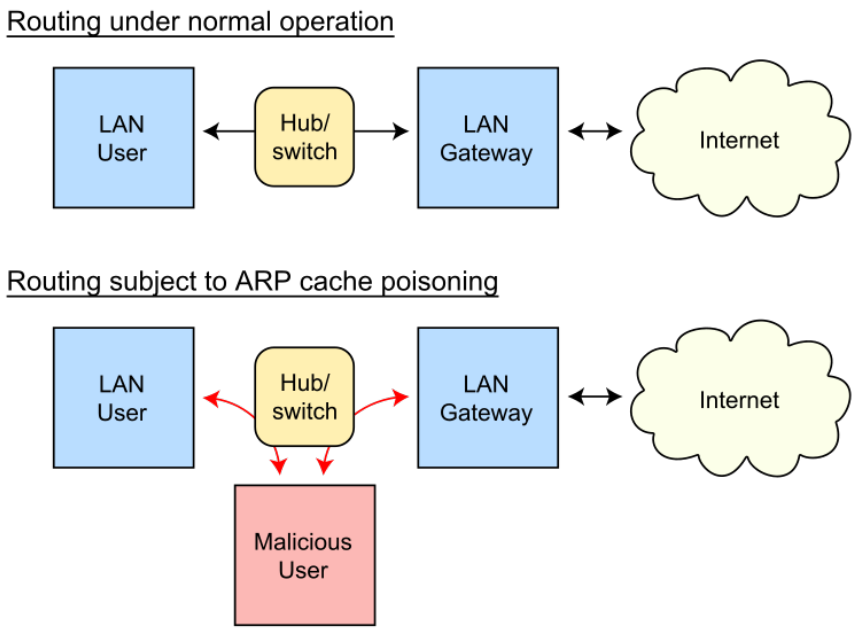
1 Introduction to ARP Cache Poisoning

ARP Cache Poisoning is a technique by which an attacker sends (spoofed) Address Resolution Protocol (ARP) messages onto a local area network. Generally, the aim is to associate the attacker's MAC address with the IP address of another host, such as the default gateway, causing any traffic meant for that IP address to be sent to the attacker instead.



ARP poisoning attack

2 Effect of ARP Cache Poisoning

ARP Cache Poisoning can create many unusual behavior in network. Some of them are

- ☐ Denial of service
- ☐ Man in the middle,
- ☐ Session hijacking
- ☐ Stop all traffic

3 How ARP Works??

The Address Resolution Protocol (ARP) is used communications protocol for resolving Internet layer addresses into link layer addresses.

When an Internet Protocol (IP) datagram is sent from one host to another in a local area network, the destination IP address must be resolved to a MAC address for transmission via the data link layer. When another host's IP address is known, and its MAC address is needed, a broadcast packet is sent out on the local network. This packet is known as an ARP request. The destination machine with the IP in the ARP request then responds with an ARP reply that contains the MAC address for that IP.

4 ARP vulnerabilities

ARP is a stateless protocol. Network hosts will automatically cache any ARP replies they receive, regardless of whether network hosts requested them. Even ARP entries that have not yet expired will be overwritten when a new ARP reply packet is received. There is no method in the ARP protocol by which a host can authenticate the peer from which the packet originated. This behavior is the vulnerability that allows ARP spoofing to occur.

5 How ARP Cache Poisoning Works

The basic principle behind ARP spoofing is to exploit the lack of authentication in the ARP protocol by sending spoofed ARP messages onto the LAN.ARP spoofing attacks can be run from an attacker's machine that is connected directly to the target LAN.

The goal of the attack is to associate the attacker's host MAC address with the IP address of a target host, so that any traffic meant for the target host will be sent to the attacker's host.

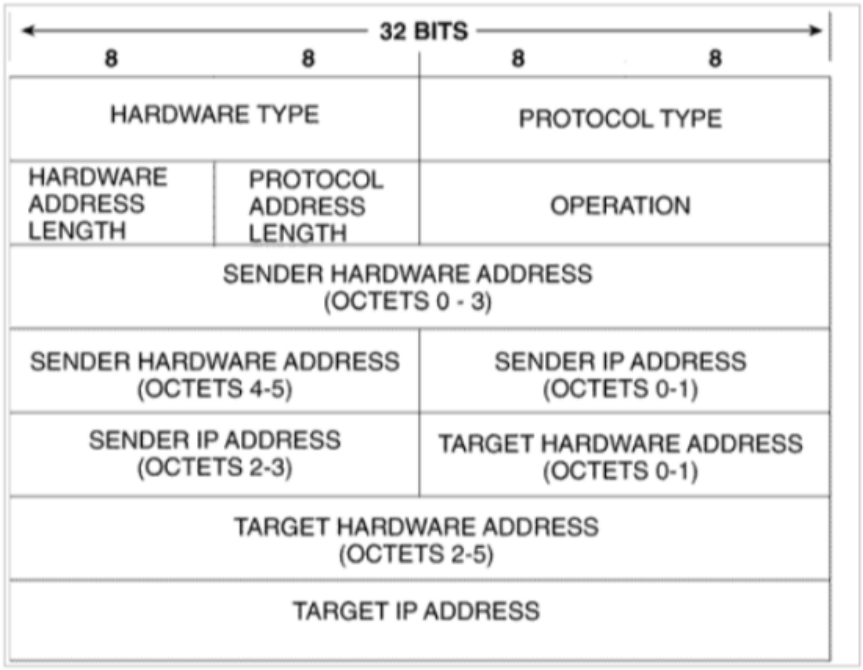
The attacker may choose to do three tasks

1. Launch a denial-of-service attack
2. Inspect the packets (spying)
3. Modify the data before forwarding it (man-in-the-middle attack)

6 ARP Request and Reply Message

The purpose of Address Resolution Protocol (ARP) is to find out the MAC address of a device in your Local Area Network (LAN), for the corresponding IPv4 address, which network application is trying to communicate.

Following are the fields in the Address Resolution Protocol (ARP) Message Format.



ARP message format

Hardware Type: It specifies the type of hardware used for the local network transmitting the ARP message.

Protocol Type: Each protocol is assigned a number used in this field.

Hardware Address Length: This is the length in bytes of a hardware (MAC) address.

Protocol Address Length: Length in bytes of a logical address (IPv4 Address). IPv4 addresses are 4 bytes long.

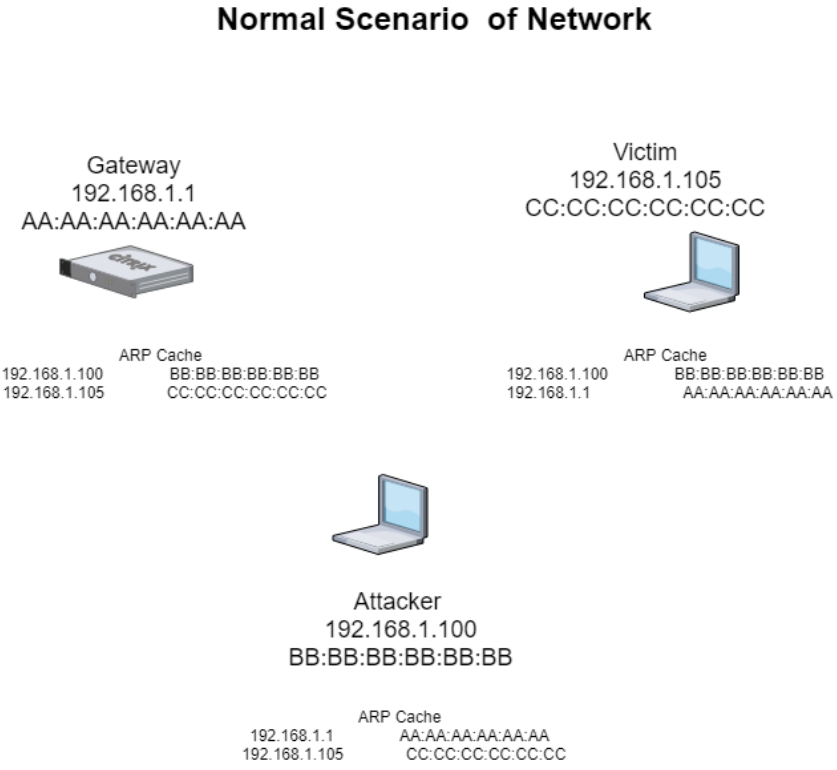
Opcode: It the nature of the ARP message. 1 for ARP request and 2 for ARP reply.

Sender Hardware Address: MAC Address address of the device sending the message.

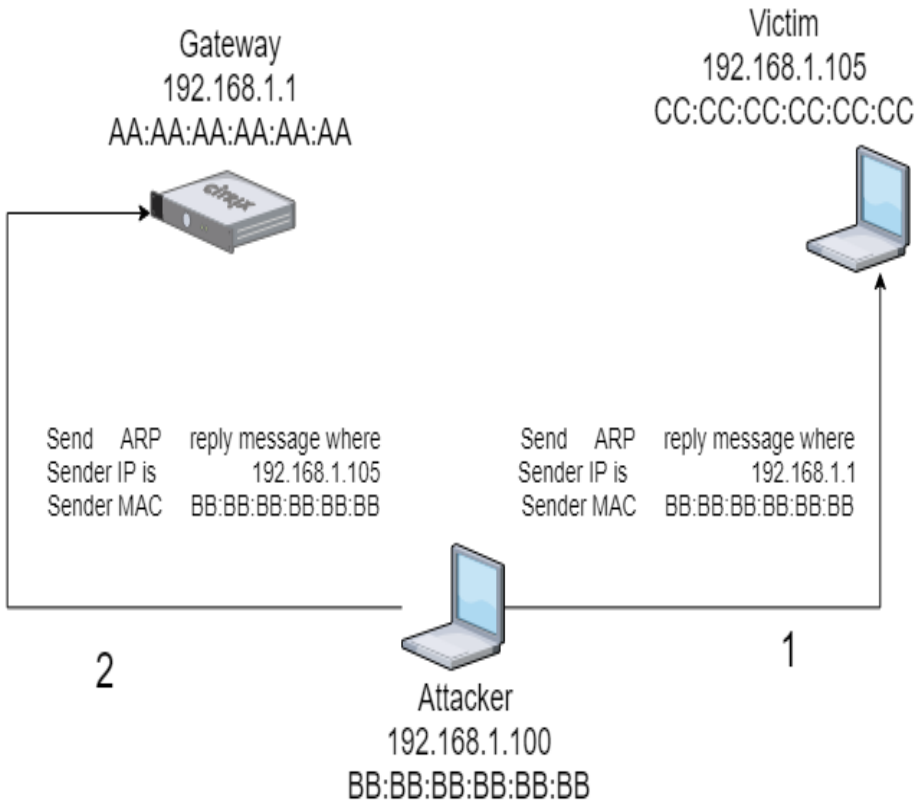
Sender Protocol Address: IP of the device sending the message

Target Hardware Address: MAC Address of the intended receiver. This field is ignored in requests.

Target Protocol Address: IP of the intended receiver.



Normal Scenario

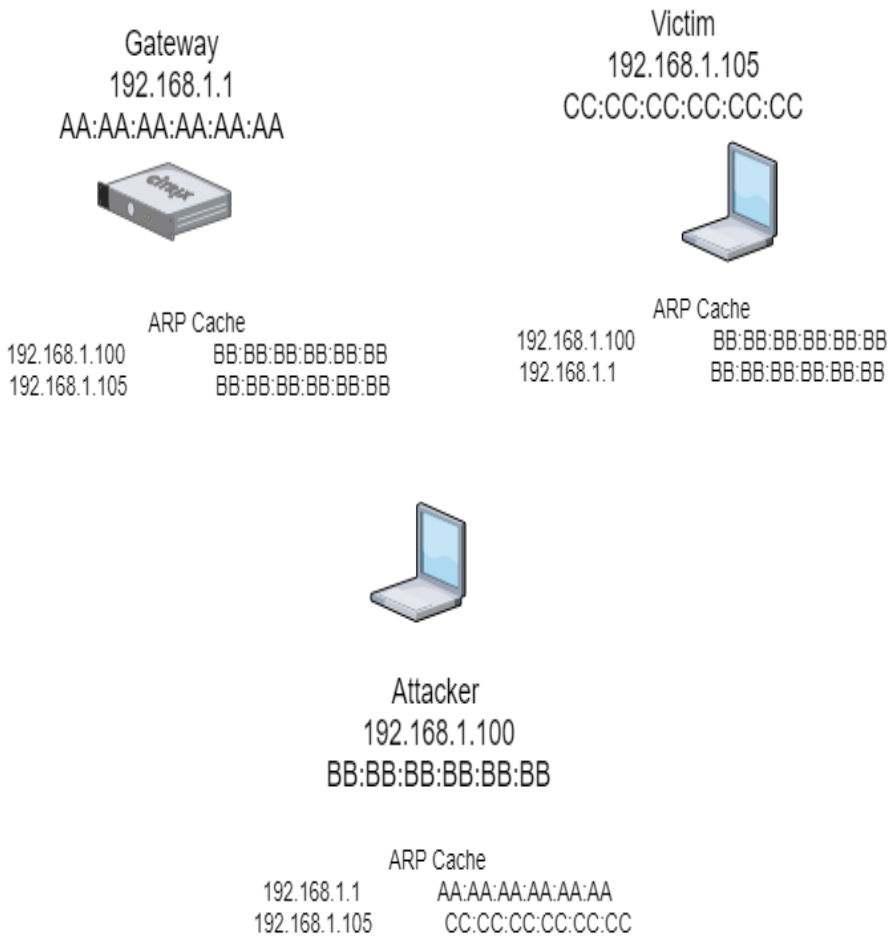


Timing Diagram of Attack

7 How The Attack Works

Sending malicious ARP packets to a default gateway on a LAN in order to change the pairings in its IP to MAC address table. ARP Protocol translates IP addresses into MAC addresses. ARP Poisoning attacks are extremely easy to carry out as long as the attacker has control of a machine within the target LAN or is directly connected to it.

The attack itself consists of an attacker sending a false ARP reply message to the default network gateway, informing it that attacker's (here it is me)



ARP Cache after Attack

MAC address should be associated with my target's IP address (and vice-versa, so my victim's MAC is now associated with the attacker's (my) IP address). Because ARP Poisoning attacks occur on such a low level, users targeted by ARP Poisoning rarely realize that their traffic is being inspected or modified. Besides Man-in-the-Middle Attacks, ARP Poisoning can be used to cause a denial-of-service condition over a LAN by simply intercepting or dropping and not forwarding the target's packets.

8 Why It Should Work

ARP is a stateless protocol.Because the ARP protocol was designed purely for efficiency and not for security.

- Network hosts will automatically cache any ARP replies they receive, regardless of whether network hosts requested them. Even ARP entries that have not yet expired will be overwritten when a new ARP reply packet is received.
- There is no method in the ARP protocol by which a host can authenticate the peer from which the packet originated. This behavior is the vulnerability that allows ARP Cache Poisoning to occur.