Ethernet specification

Table of Contents

1. TERMINOLOGY

- **MAC** : Media Access Control
- **ARP** : Address Resolution Protocol
- **IP** : Internet Protocol
- **ICMP** : Media Access Control
- **VLAN** : Virtual Local Area Network
- **UDP** : User Datagram protocol
- **TCP** : Transmission Control Protocol
- **IPCP** : Ip Command protocol

2. Ethernet protocol list

- Layer 2
    - ARP
    - VLAN
- Layer 5
    - ICMP
    - IPCP

3. MAC_HEADER

Every Ethernet network interface card (NIC) is given a unique identifier called a MAC address. This is assigned by the manufacturer of the card and each manufacturer that complies with IEEE standards can apply to the IEEE Registration Authority for a range of numbers for use in its products.

3.1. introduce

The header features destination and source MAC addresses (each six octets in length), the EtherType field and, optionally, an IEEE 802.1Q tag or IEEE 802.1ad tag
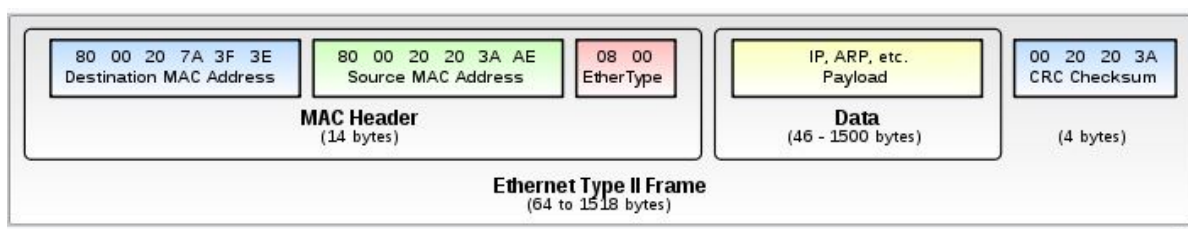
3.2. format introduce

- destination MAC Address

  - The destination MAC Address has 6 bytes .

  - This field contains the address of station for which the data is intended. The left most bit indicates whether the destination is an individual address or a group address. An individual address is denoted by a zero, while a one indicates a group address. The next bit into the DA indicates whether the address is globally administered, or local. If the address is globally administered the bit is a zero, and a one of it is locally administered. There are then 46 remaining bits. These are used for the destination address itself.

  - The ASDM MAC Address is 02:00:00:00:14:01

- Source MAC Address

  - The source address consists of six bytes, and it is used to identify the sending station. As it is always an individual address the left most bit is always a zero.

- Length/Type

  - This field is two bytes in length. It provides MAC information and indicates the number of client data types that are contained in the data field of the frame. It may also indicate the frame ID type if the frame is assembled using an optional format.(IEEE 802.3 only).

  - For our project, we use the ipv4 protocol and 8021q protocol

    - if the protocol is IPV4,The value of this field should be 0x0800

    - if the protocol is VLAN(8021q),The value of this field should be 0x8100

4. ARP TEST

4.1. arp introduce

The Address Resolution Protocol (ARP) is a communication protocol used for discovering the link layer address, such as a MAC address, associated with a given internet layer address, typically an IPv4 address.

4.2. purpose

To ensure link communication between ASDM and Chadoc is normal

4.3. Message

- The Chadoc tool should send ARP request message to ASDM

According to the requirement

1. The Ip address of ASDM is 198.18.36.1

2. The MAC address of ASDM is 02:00:00:00:14:01
    ◦ Internet Protocol (IPv4) over Ethernet ARP packet

Octet offset	0	1
0	Hardware type (HTYPE)	
2	Protocol type (PTYPE)	
4	Hardware address length (HLEN)	Protocol address length (PLEN)
6	Operation (OPER)	
8	Sender hardware address (SHA) (first 2 bytes)	
10	(next 2 bytes)	
12	(last 2 bytes)	
14	Sender protocol address (SPA) (first 2 bytes)	
16	(last 2 bytes)	
18	Target hardware address (THA) (first 2 bytes)	
20	(next 2 bytes)	
22	(last 2 bytes)	
24	Target protocol address (TPA) (first 2 bytes)	
26	(last 2 bytes)	

4.4. Chadoc Test Description

1. Prepare for networking as shown below
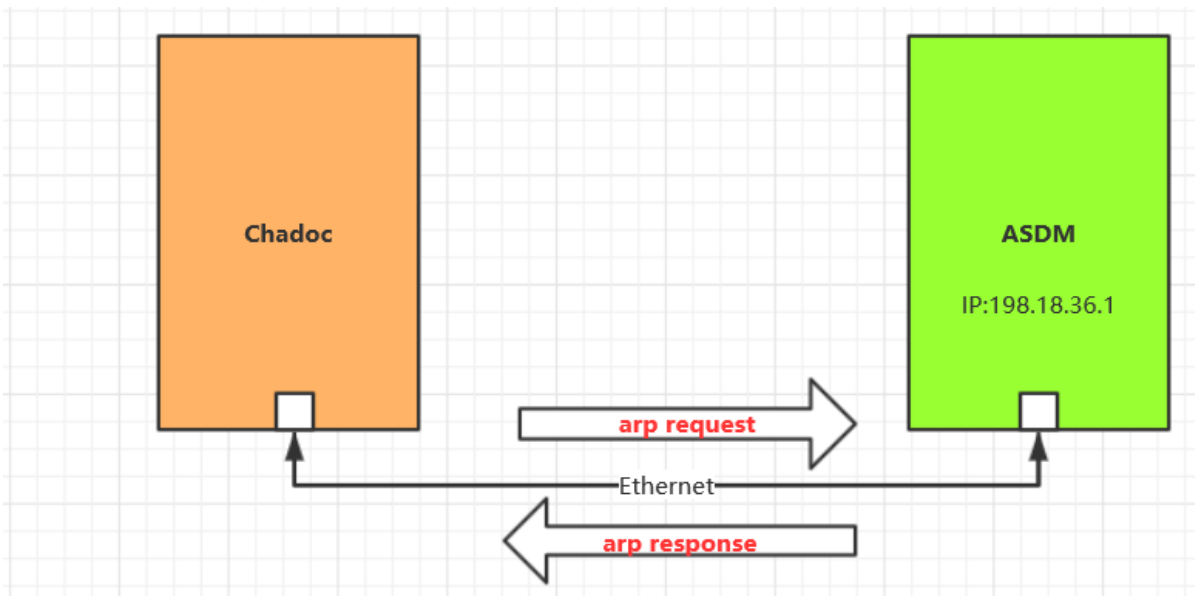
2. Simulate an ARP request message and send to ASDM

Expected Result

- · The Chadoc tool will receive an ARP reply from ASDM
    - ◦ In the ARP reply message ，The ASDM MAC Address is 02:00:00:00:14:01,IP adress is 198.18.36.1

5. VLAN TEST

5.1. introduce

A virtual LAN (VLAN) is any broadcast domain that is partitioned and isolated in a computer network at the data link layer (OSI layer 2)

The protocol most commonly used today to support VLANs is IEEE 802.1Q

5.2. purpose

To ensure that ASDM can receive and sent vlan message.
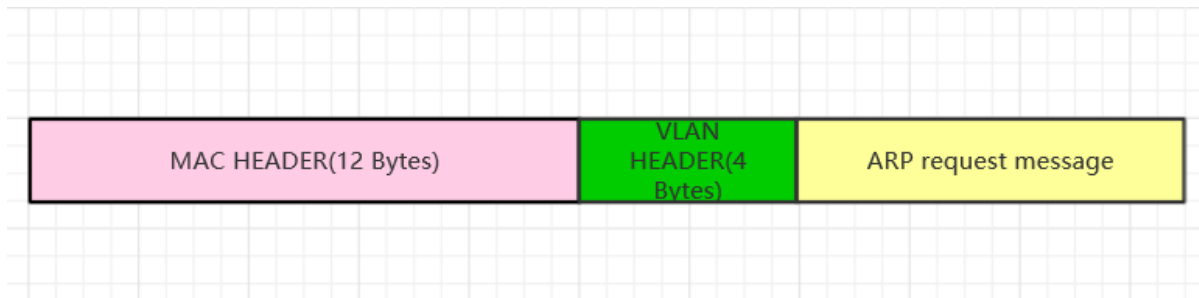
5.3. vlan distribution in ASDM

vlan ID	node name	function
5	VGM-ASDM	Traffic Jam Pilot
6	VGM-ASDM	IPLM

5.4. Chadoc Test Description

1. Simulate an ARP request message with vlan tag 5 (VID set to 5)and send to ASDM

2. Simulate an ARP request message with vlan tag 6 (VID set to 6) and send to ASDM
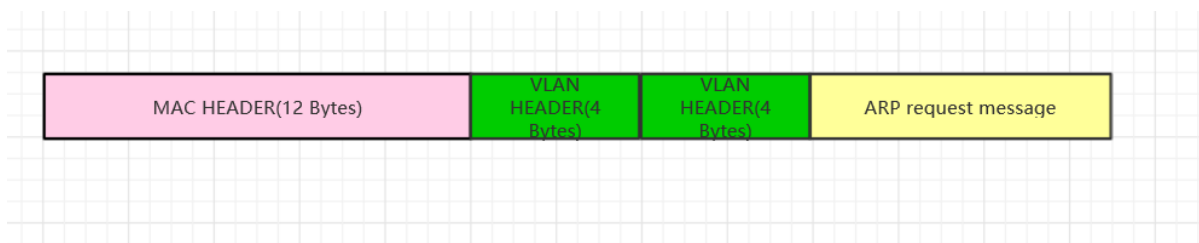
This message as shown bleow

Expected Result

- The ARP reply message could be received by Chadoc

  - In the ARP reply message，The ASDM MAC Address is 02:00:00:00:14:01,IP adress is 198.18.36.1

5.5. Double tagging test

- Need to check ASDM will discard all the Double tagging messages.

This message as shown bleow

5.5.1. Chadoc Test Description

1. Simulate an ARP request message with double vlan tag 5 and vlan x (x will be between 1 and 4095 value)and send to ASDM

2. Simulate an ARP request message with vlan tag 5 and vlan x (x will be between 1 and 4095 value) and send to ASDM

Expected Result

- NO message could be received by Chadoc
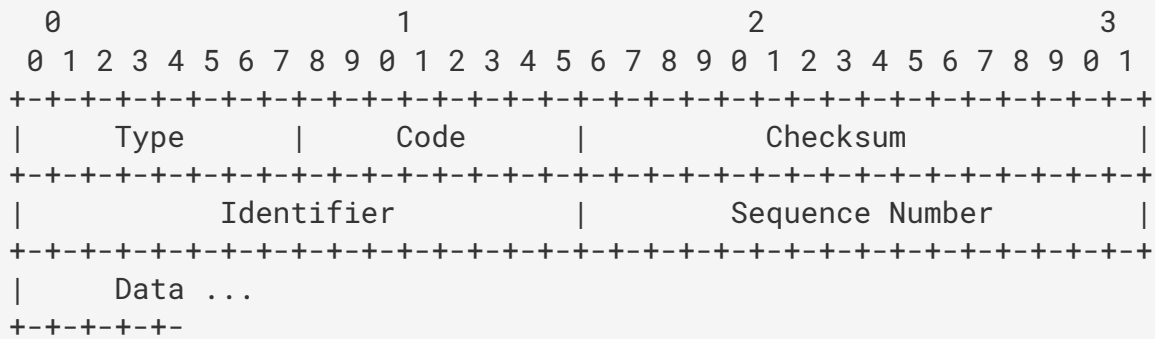
6. ICMP TEST

6.1. introduce

ICMP messages are sent in several situations: for example, when a datagram cannot reach its destination, when the gateway does not have the buffering capacity to forward a datagram, and when the gateway can direct the host to send traffic on a shorter route.

6.2. Ip address of ASDM

According to the requirement

1. The MAC address of ASDM is 02:00:00:00:14:01

2. The IP address of ASDM is 198.18.36.1/255.255.0.0

6.3. Echo Message introduce

```
   0                   1                   2                   3
   0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |     Type      |     Code      |          Checksum             |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |           Identifier          |        Sequence Number        |
  +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
  |     Data ...
  +-+-+-+-+-
```

- IP Fields:

  - Addresses: The address of the source in an echo message will be the destination of the echo reply message. To form an echo reply message, the source and destination addresses are simply reversed, the type code changed to 0, and the checksum recomputed.

- IP Fields:

  - Type

    - 8 for echo message

    - 0 for echo reply message

  - Code

    - 0

  - Checksum

    - The checksum is the 16-bit ones's complement of the one's complement sum of the ICMP message starting with the ICMP Type. For computing the checksum , the checksum field should be zero. If the total length is odd, the received data is padded with one octet of zeros for computing the checksum. This checksum may be replaced in the future.

  - Identifier

    - If code = 0, an identifier to aid in matching echos and replies, may be zero.

  - Sequence Number

    - If code = 0, a sequence number to aid in matching echos and replies, may be zero

◦ Description

▪ The data received in the echo message must be returned in the echo reply message.

```
The identifier and sequence number may be used by the echo
sender
to aid in matching the replies with the echo requests.  For
example, the identifier might be used like a port in TCP or UDP
to
identify a session, and the sequence number might be incremented
on each echo request sent.  The echoer returns these same values
in the echo reply.
```

```
Code 0 may be received from a gateway or a host.
```
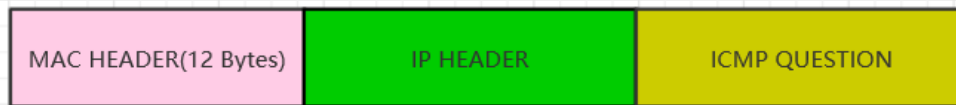
6.4. Chadoc Test Description

1. Prepare for networking as shown below
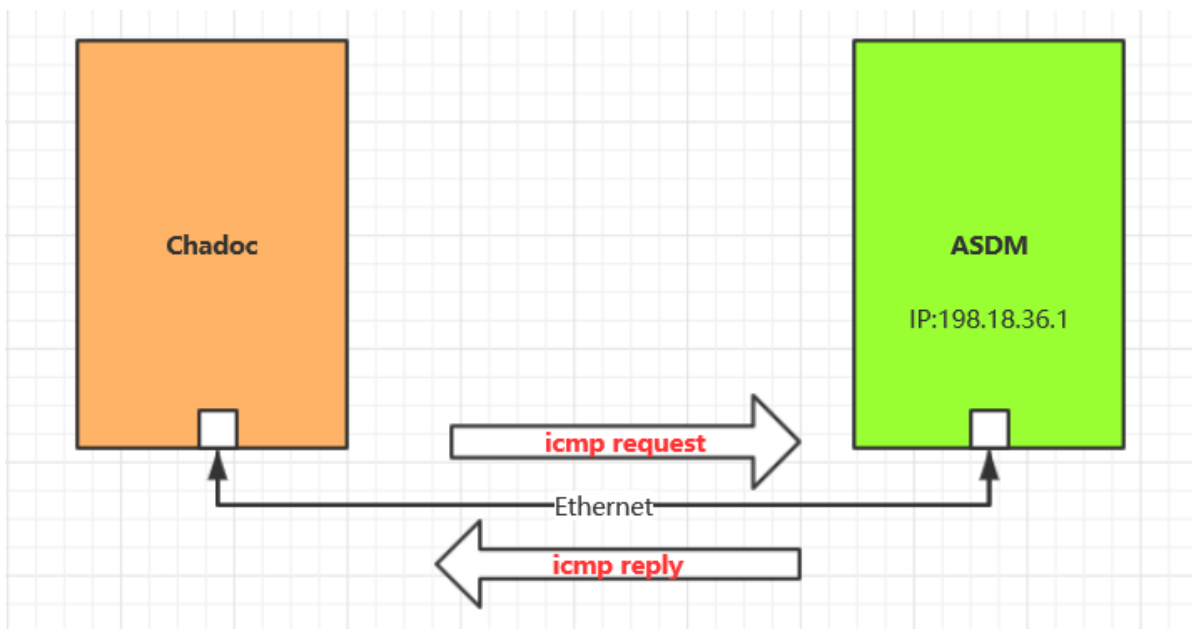
2. Simulate an ARP request message and sent to ASDM

3. Simulate an ICMP request message (destination IP address set to 198.18.36.1) to ASDM
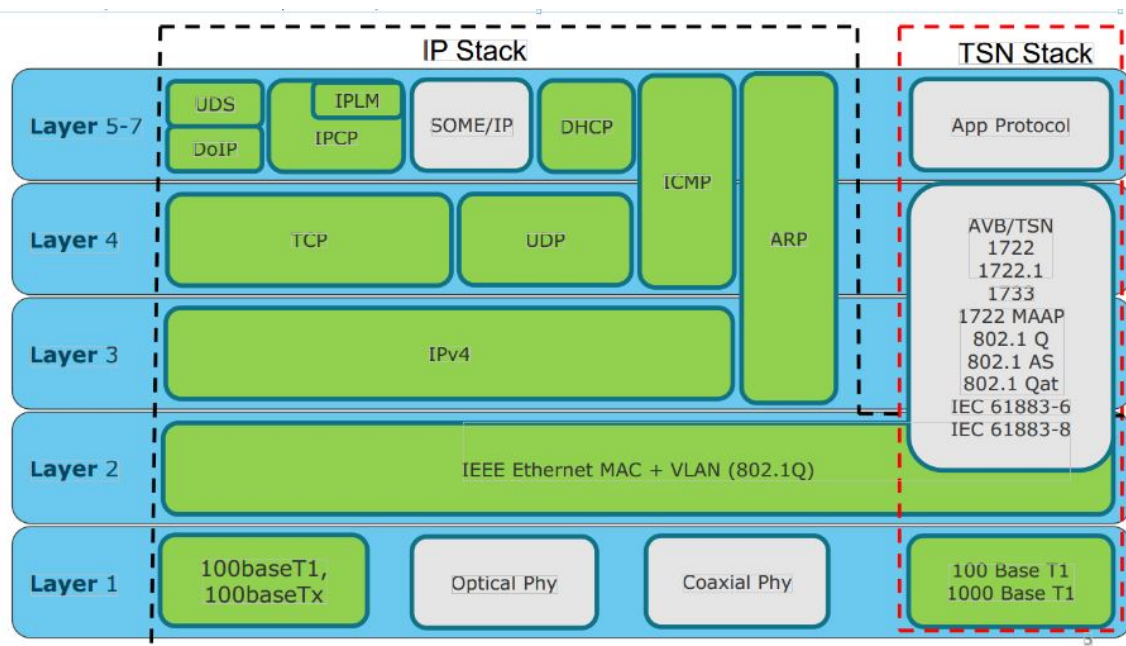
This message as shown bleow

Expected Result

1. For step 2,The Chadoc tool will receive an ARP reply message from ASDM

2. For step 3,The Chadoc tool will receive a ICMP reply message from ASDM
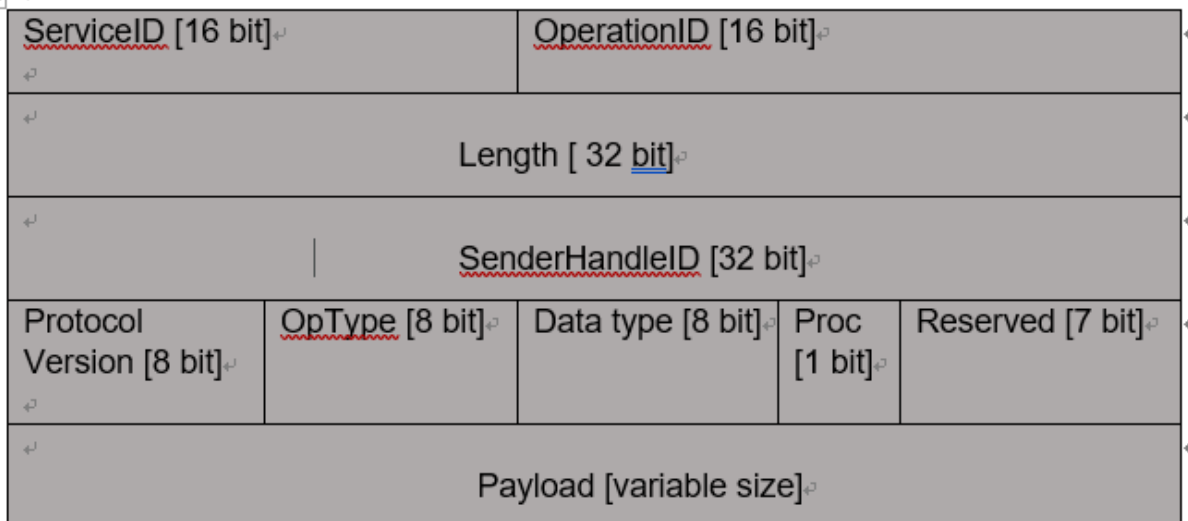
7. IPCP TEST

7.1. introduce

· IPCP use udp protocol and udp port is 50174

7.2. IPCP Header Overview

| ServiceID [16 bit]	OperationID [16 bit]	
Length [32 bit]		
SenderHandleID [32 bit]		
Protocol Version [8 bit]	OpType [8 bit]	Data type [8 bit] / Proc [1 bit] / Reserved [7 bit]
Payload [variable size]		

7.3. IPCP NOTIFICATION MESSAGE

- ServiceID = 0xAE
- OperationID = 0x0001
- Length = (According to the actual data length)
- SenderHandleID = 0xAE010501
- Protocol Version = 0x03
- OpType = 0X05
- DataType = 0x01
- Proc/Reserved = 0x00

7.4. Chadoc Test Description

1. Prepare for networking as shown below
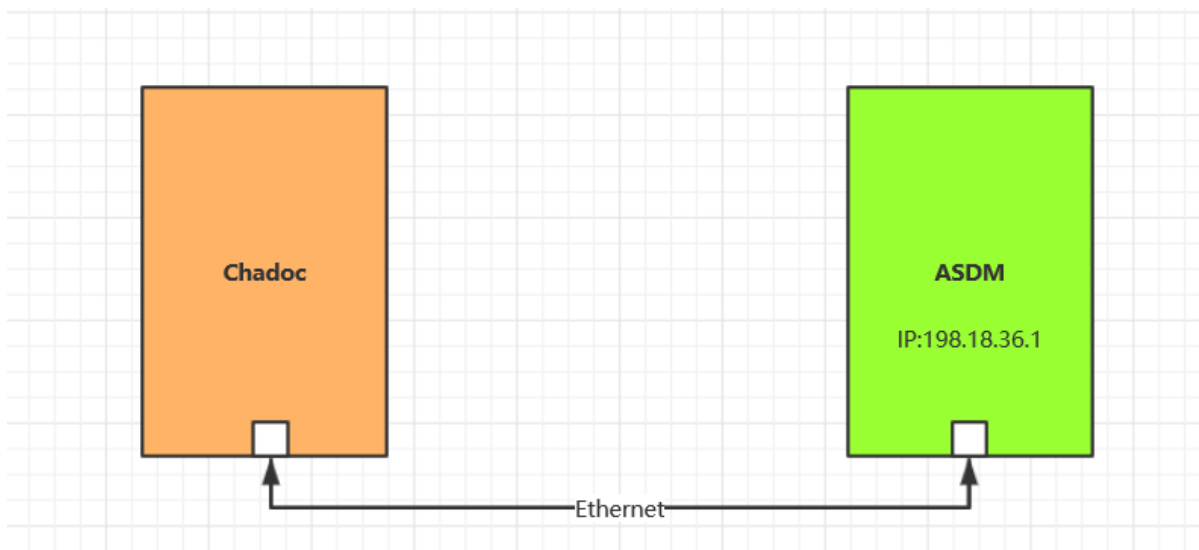
2. power up the ASDM

3. Chadoc tool send an IPCP NOTIFICATION meaasge to ASDM with vlan 5
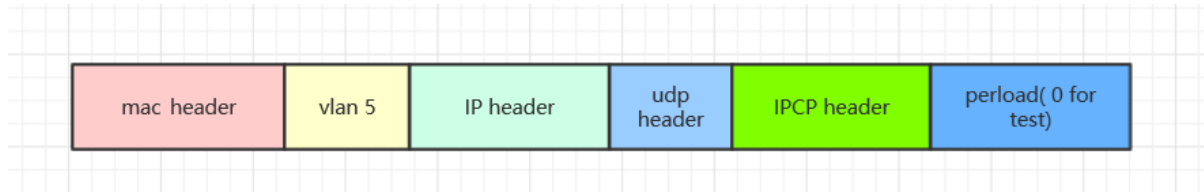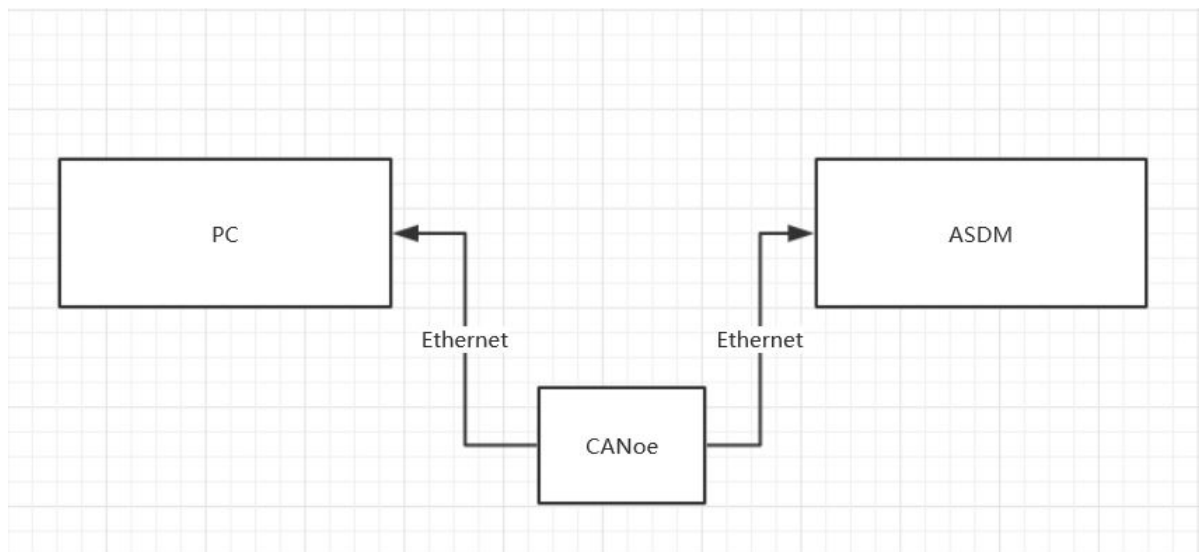

3. repeat step 2

Expected Result

1. For step 2,The Chadoc tool will receive an IPCP SETREQUEST_NORETURN message from ASDM

2. For step 3,The Chadoc tool will receive an IPCP ACK message from ASDM
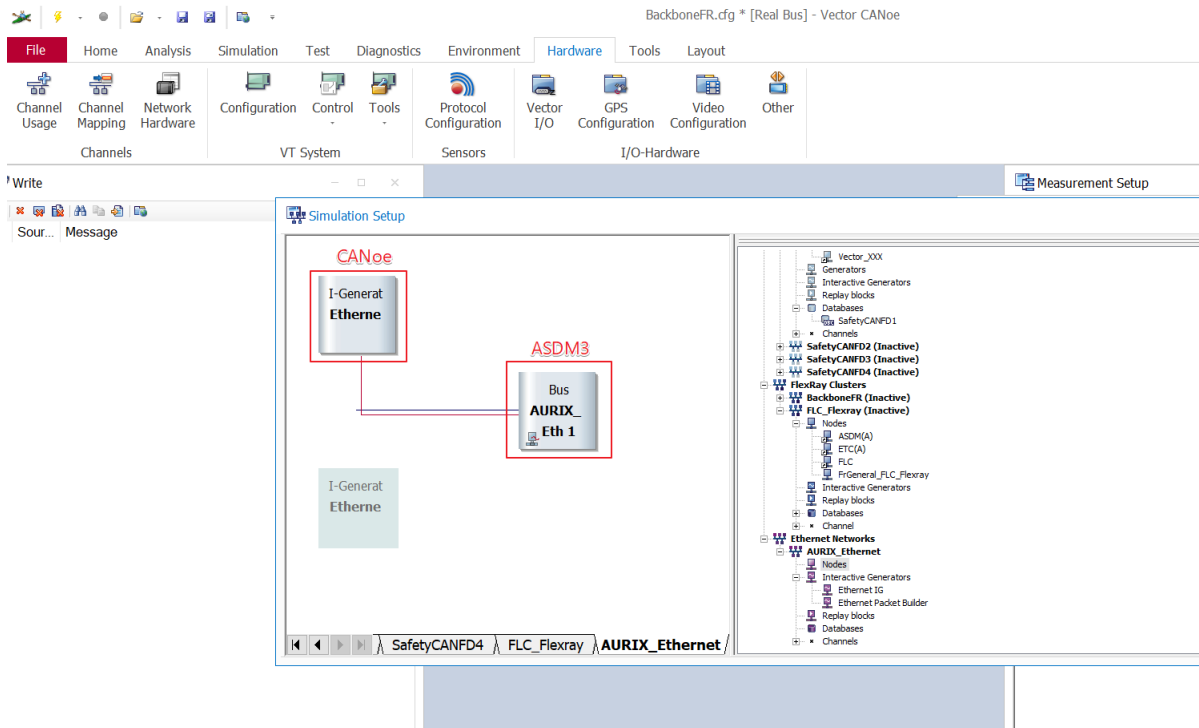
8. example for test ARP/ICMP

8.1. Tools

- Vector VN5610A
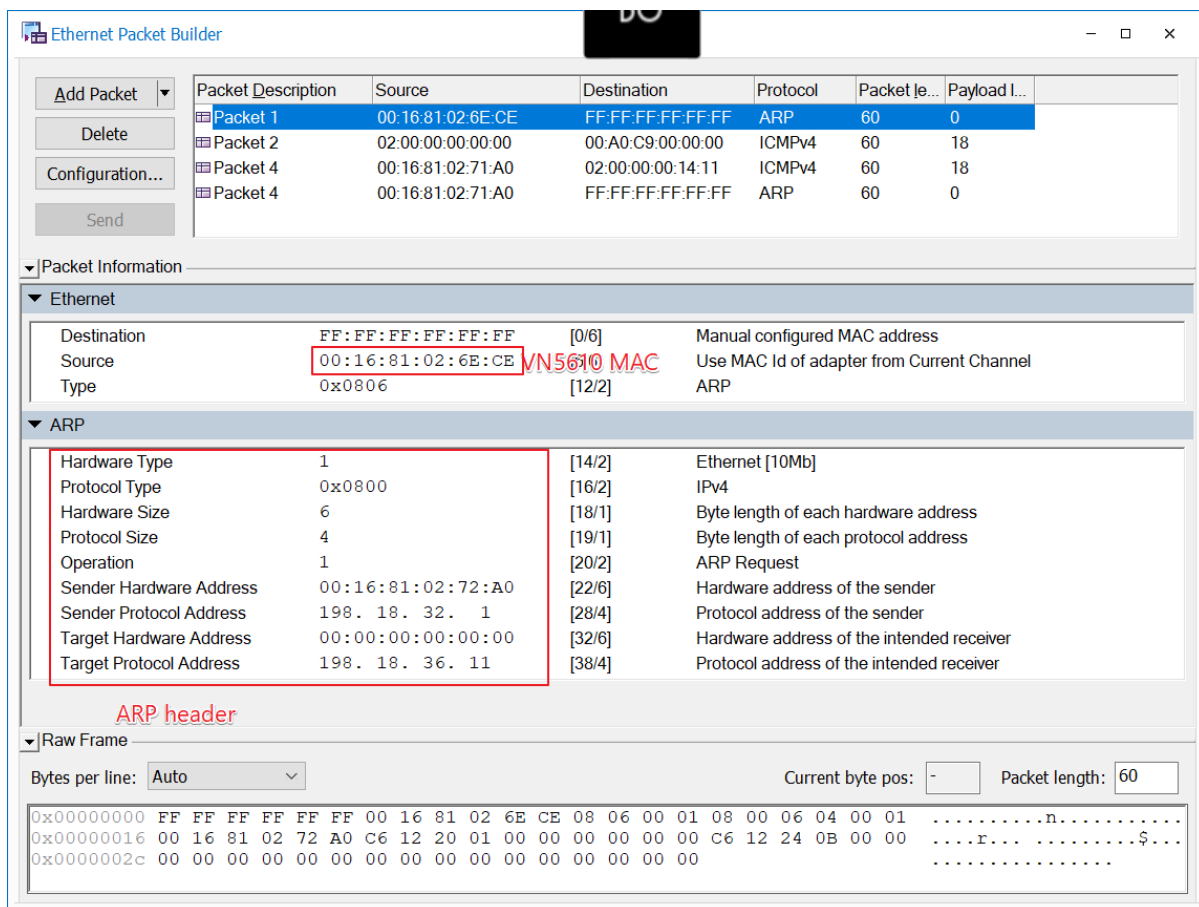- ASDM boards
- PC
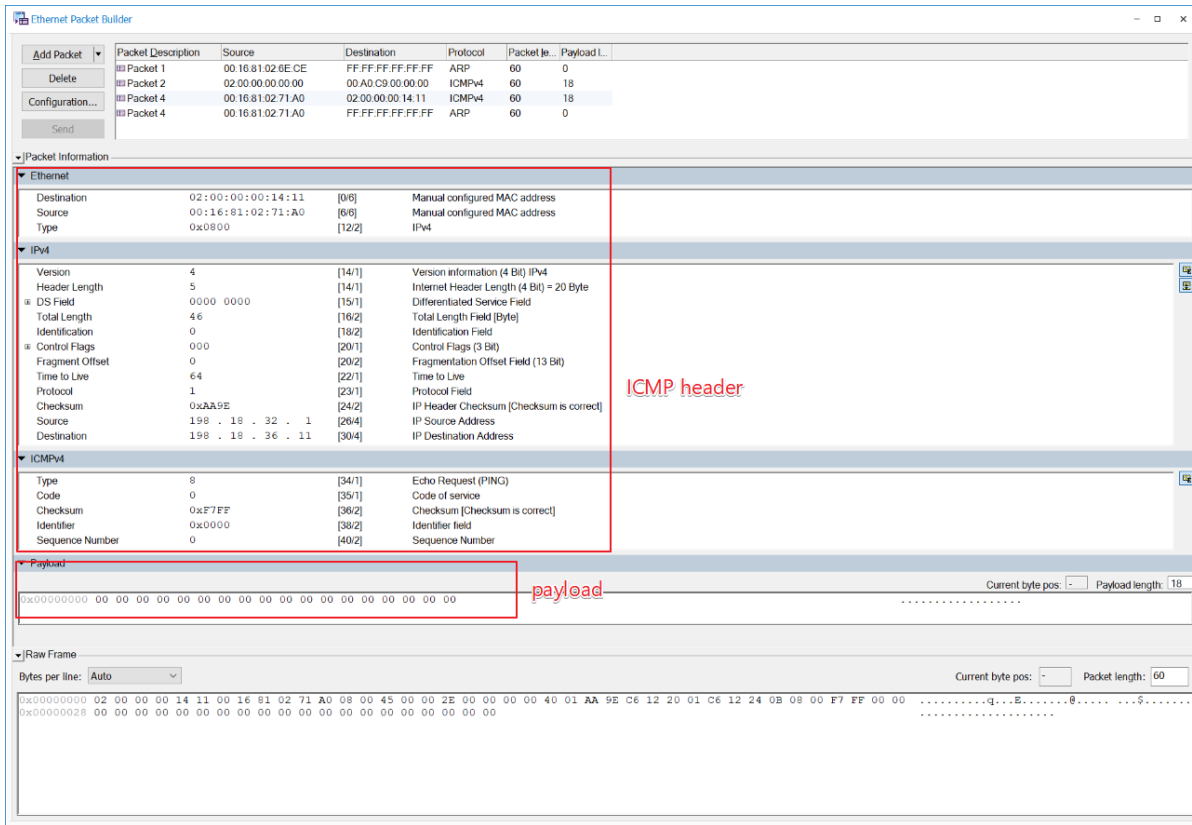- power supply

8.2. Connection

8.3. test step

- Open the software for VN5610A,Power on the ASDM3
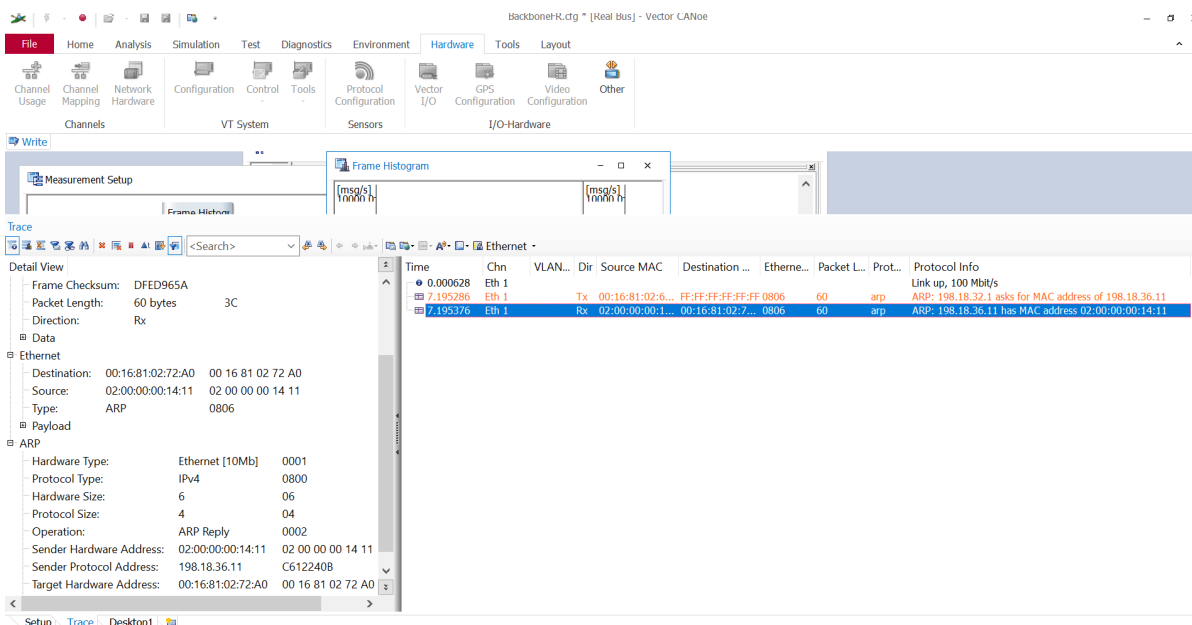

- Config VN5610A and send A arp packet

- config the VN5610A and send a icmp packet

8.4. test result

- The VN5610A receive the arp reply from ASDM

- The VN5610A receive the icmp reply from ASDM

BackboneFR.cfg * [Real Bus] - Vector CANoe

File | Home | Analysis | Simulation | Test | Diagnostics | Environment | Hardware | Tools | Layout

Channel Usage | Channel Mapping | Network Hardware | Configuration | Control | Tools | Protocol Configuration | Vector I/O | GPS Configuration | Video Configuration | Other

Channels | VT System | Sensors | I/O-Hardware

Write

Measurement Setup

Frame Histogram

[msg/s] 10000 h | [msg/s] 10000 h

race

<Search> Ethernet

Detail View

General
- Type: Ethernet Packet
- Channel: Eth 1
- Frame Checksum: C918E72A
- Packet Length: 60 bytes   3C
- Direction: Rx

Data

Ethernet
- Destination: 00:16:81:02:72:A0   00 16 81 02 72 A0
- Source: 02:00:00:00:14:11   02 00 00 00 14 11
- Type: IPv4   0800

Payload

IPv4
- Version: 4   4
- Header Length: 20 bytes   5
- Differentiated Service Field   DSCP=0 ECN=Not-ECT 00
- Total Length: 46 bytes   002E
- Identification: 2   0002
- Control Flags   Don't Fragment 2

Time	Chn	VLAN...	Dir	Source MAC	Destination ...	Etherne...	Packet L...	Prot...	Protocol Info
142.374436	Eth 1		Tx	00:16:81:02:6...	FF:FF:FF:FF:FF:FF	0806	60	arp	ARP: 198.18.32.1 asks for MAC address of 198.18.36.11
142.374506	Eth 1		Rx	02:00:00:00:1...	00:16:81:02:7...	0806	60	arp	ARP: 198.18.36.11 has MAC address 02:00:00:00:14:11
144.745367	Eth 1		Tx	00:16:81:02:7...	02:00:00:00:1...	0800	60	icmpv4	Type 08
144.745558	Eth 1		Rx	02:00:00:00:1...	00:16:81:02:7...	0800	60	icmpv4	Type 00

Setup | Trace | Desktop1

13