Covert Communications

Reliable Covert Communications over IP with AES 128 Encryption

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Objective:

- Communicate by sending data over any IP protocol without using the data fields in any packet
- Provide CIA using any encryption algorithms
- Handshake like protocol for initiating and terminating the communications
- Provide Reliability for the communication

Basic Covert Communication

The data (a character) is hidden in the **fragmentation offset** field in the IP header. The Field is 12 Bit long larger than the required 8 Bit for sending an ASCII character. This layer would be a good choice for the covert communication because the field would be of no sense to the receiver unless it is expecting a larger packet with the identification field.

Validity of the packet and choosing the correct sender

In a network with multiple hosts, the traffic would be enormous and filter argument in the scapy sniff function for accepting only IP's from the expected receiver is a good choice. Also to separate the covert communication over the other traffic from the same sender, the protocol field in the IP packet can be used to with an undefined protocol number. Here the Protocol number 150 which is not defined according to the iana is used for distinguishing.

Server Code:

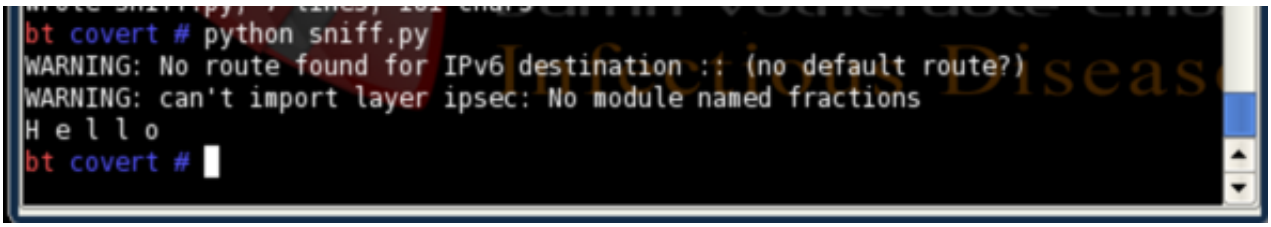
```
from scapy.all import *
for c in "hello":
    val = hex(ord(c))
```

```
    pkt = IP(dst="10.10.111.104",proto=150,frag=val)
    send(pkt,inter=0.5)
```

Client Code for Listening:

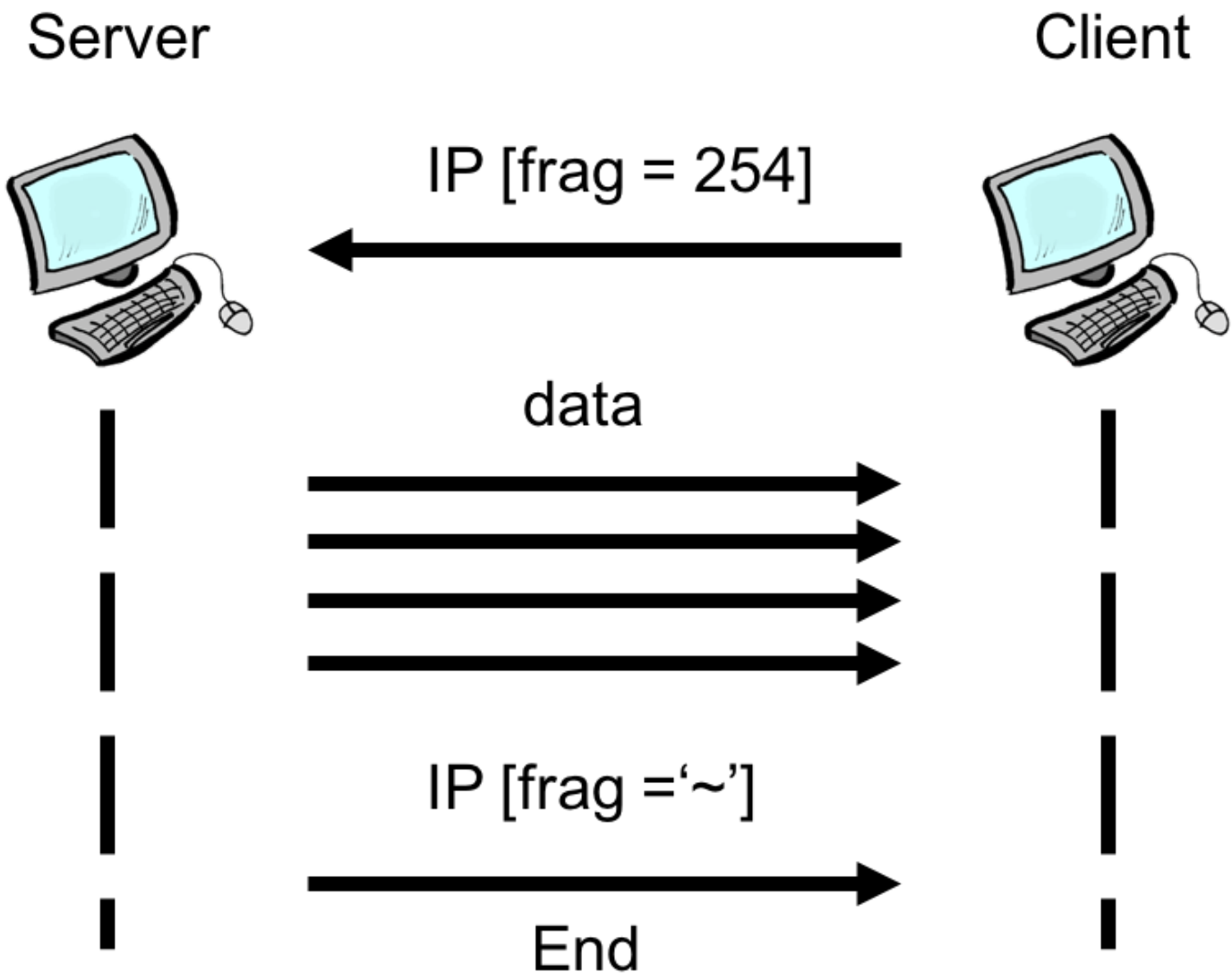
```
from scapy.all import *
lfil  = lambda(r): IP in r and r[IP].proto == 150
p = sniff(count =5,filter = "src host 10.10.111.103",lfilter = lfil)
[chr(c[IP].frag) for c in p]
```

Screenshot of the result:



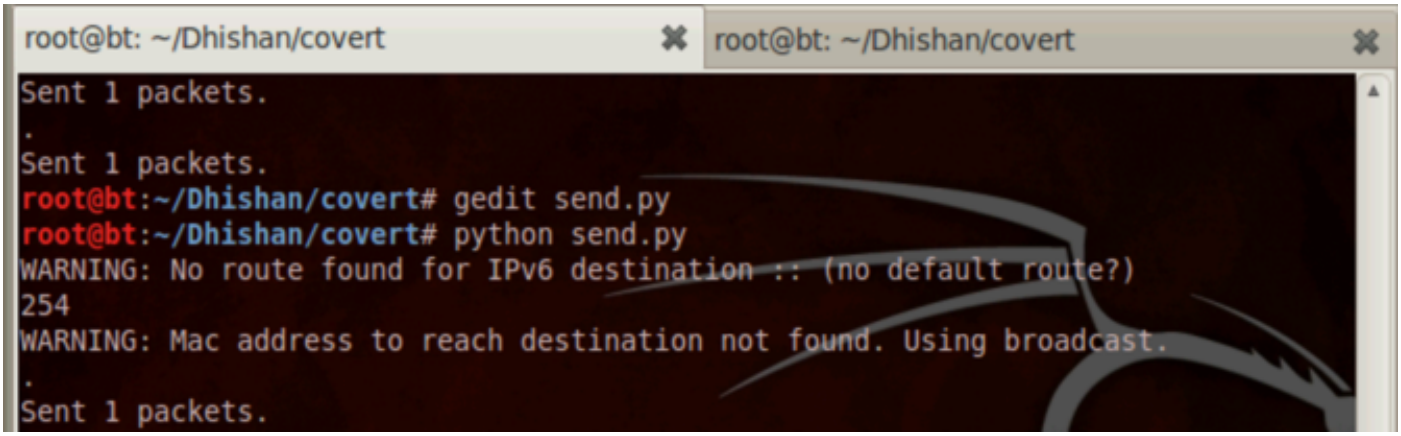
Handshake for initiating and Termination

Block Diagram:

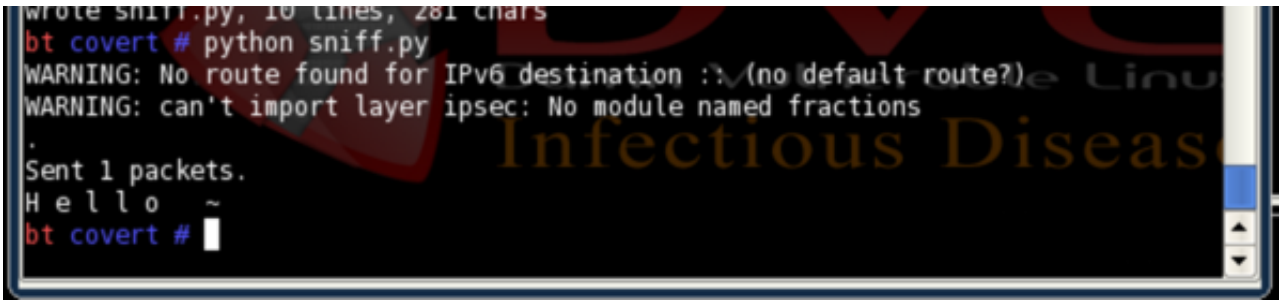


The Client Sends a decimal value of 254 in the fragment offset field informing the server that it is Listening for the message. The server sends an '~' character at the end of the message in the fragmentation offset field indicating the end of the communication.

Screenshot of the Result Sent `254`



Screenshot of the Result Recieved ~

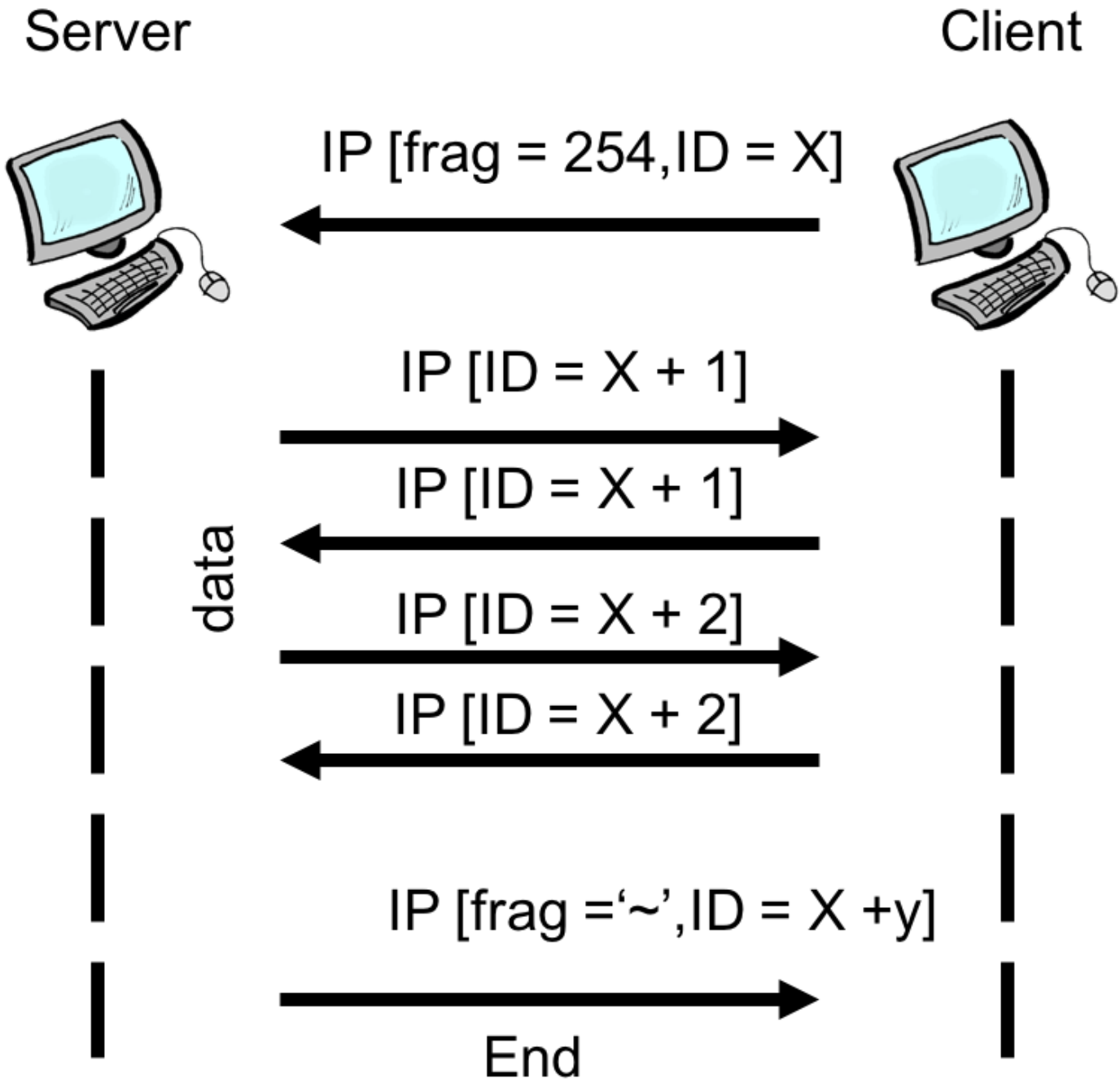


Reliability

Since the communication is over IP where there is no reliability, A system where data reception is acknowledged is required. The identification field in the IP layer could be used for this purpose.

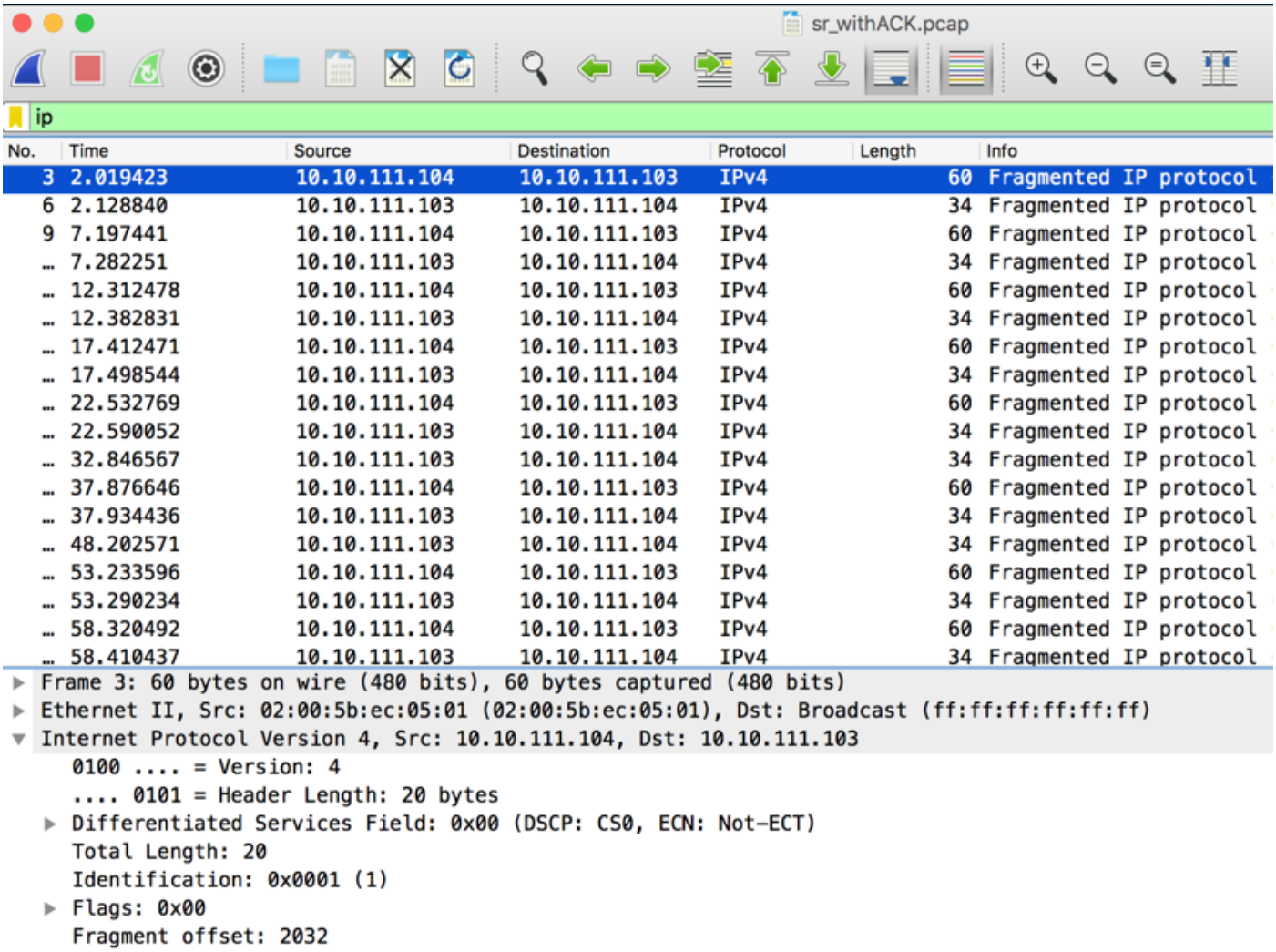
The Client sends an initial identification number in its initial Handshake and then for each packet the server sends the identification field is incremented by one. The server waits for the acknowledgement of the packet with the same identification value as the previous packet before sending the new packet. The clients waits for 10 seconds for the new packet, if packet is lost, an duplicate acknowledgement for the previous data received is sent indicating the non reception of any further packets.

Working Block Diagram:



Screenshot of the Exercise:

Wireshark Capture:



Encryption

Confidentiality, Integrity and Authenticity, are bare minimum for any secure communication. AES-128 symmetric key encryption is used here. With a fairly simple python PyCrypto library the encryption is straight forward. A 16 byte - 128 bit key, and an 128 bit IV are used for AES CBC mode.

Following is the Server Script:

```
from scapy.all import *
from Crypto.Cipher import AES
lfil = lambda(r): IP in r and r[IP].proto == 150
a=sniff(count=1,filter="src host 10.10.111.104",lfilter = lfil)
print a[0][IP].frag
encryption_suit = AES.new('netsec  favorite',AES.MODE_CBC,'vector8 vector1
0')
message = encryption_suit.encrypt("This is a secret message dhishan")
```

```
message += "~";
print message
ident = a[0][IP].id
if(ident != 20):
    print "Error!"
for c in message:
    rcv = 1
    val=ord(c)
    pkt = IP(dst="10.10.111.104",id=ident+1,proto=150,frag=val)
    while(rcv):
        send(pkt)
        p = sniff(count=1,filter="src host 10.10.111.104",lfilter = lfil,ti
meout = 10)
        if(len(p) != 0 and p[0][IP].id == ident+1):
            ident +=1
            rcv = 0
```

Following is the Client Script:

```
from scapy.all import *
from Crypto.Cipher import AES
import time
ident = 20
send(IP(dst="10.10.111.103",id=ident,proto=150,frag=0xFE))
lfil  = lambda(r): IP in r and r[IP].proto == 150
flag = 1
str=""
char1=0
while(flag):
    p = sniff(count=1,filter = "src host 10.10.111.103",lfilter = lfil)
    if(p[0][IP].id == ident + 1):
        ident +=1
        str +=chr(p[0][IP].frag)
    time.sleep(5)
    send(IP(dst="10.10.111.103",id=ident,proto=150,frag=p[0][IP].frag))
```

```
    if p[0][IP].frag == 126:
        flag = 0
str = str[:-1]
decrypt_suite = AES.new('netsec  favorite',AES.MODE_CBC,'vector8 vector10')
message = decrypt_suite.decrypt(str)
print message
```

Screenshot of the Experiment