Wireshark IP Packet Analysis: FastAPI File Upload

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Introduction

This report analyzes an IP packet captured using Wireshark, focusing on the structure and content of the IP header. The capture was performed during a file upload to a FastAPI application on localhost.

1 FastAPI File Upload

FastAPI File Upload Implementation

To implement file upload in FastAPI, the following steps were taken:

```python
from fastapi import FastAPI, File, UploadFile
from fastapi.responses import HTMLResponse

app = FastAPI()

@app.post("/uploadfile/")
async def create_upload_file(file: UploadFile = File(...)):
    content = await file.read()
    return {"filename": file.filename}

@app.get("/")
async def main():
    content = """
    <html>
        <body>
            <form action="/uploadfile/" enctype="multipart/form-data" method="post">
                <input name="file" type="file">
                <input type="submit">
            </form>
        </body>
    </html>
    """
    return HTMLResponse(content)
```

This code defines a FastAPI application with a file upload endpoint. The form in the HTML allows users to select and upload a file to the server.

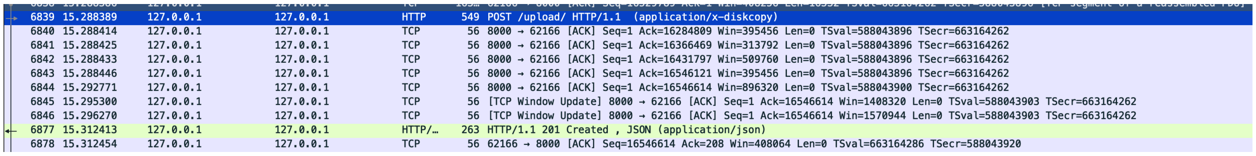
2 Packet Capture Details

Capturing the Packet with Wireshark

The packet capture was performed using Wireshark with the following steps:

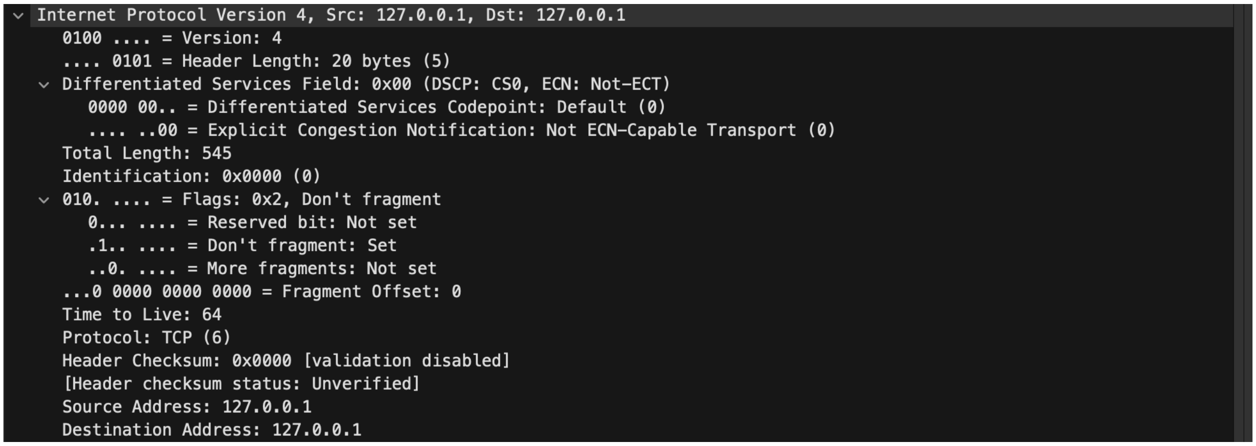
1. Start Wireshark and select the network interface used for localhost communication (e.g., ”Loopback: lo0” on Linux).
2. Begin the packet capture.
3. Perform the file upload to the FastAPI application by accessing the HTML form and submitting a file.
4. Stop the packet capture once the upload is complete.
5. Filter the captured packets to isolate the relevant IP packet(s) using a display filter such as ‘ip.src == 127.0.0.1 ip.dst == 127.0.0.1‘.

The captured packet details are analyzed in the following sections.



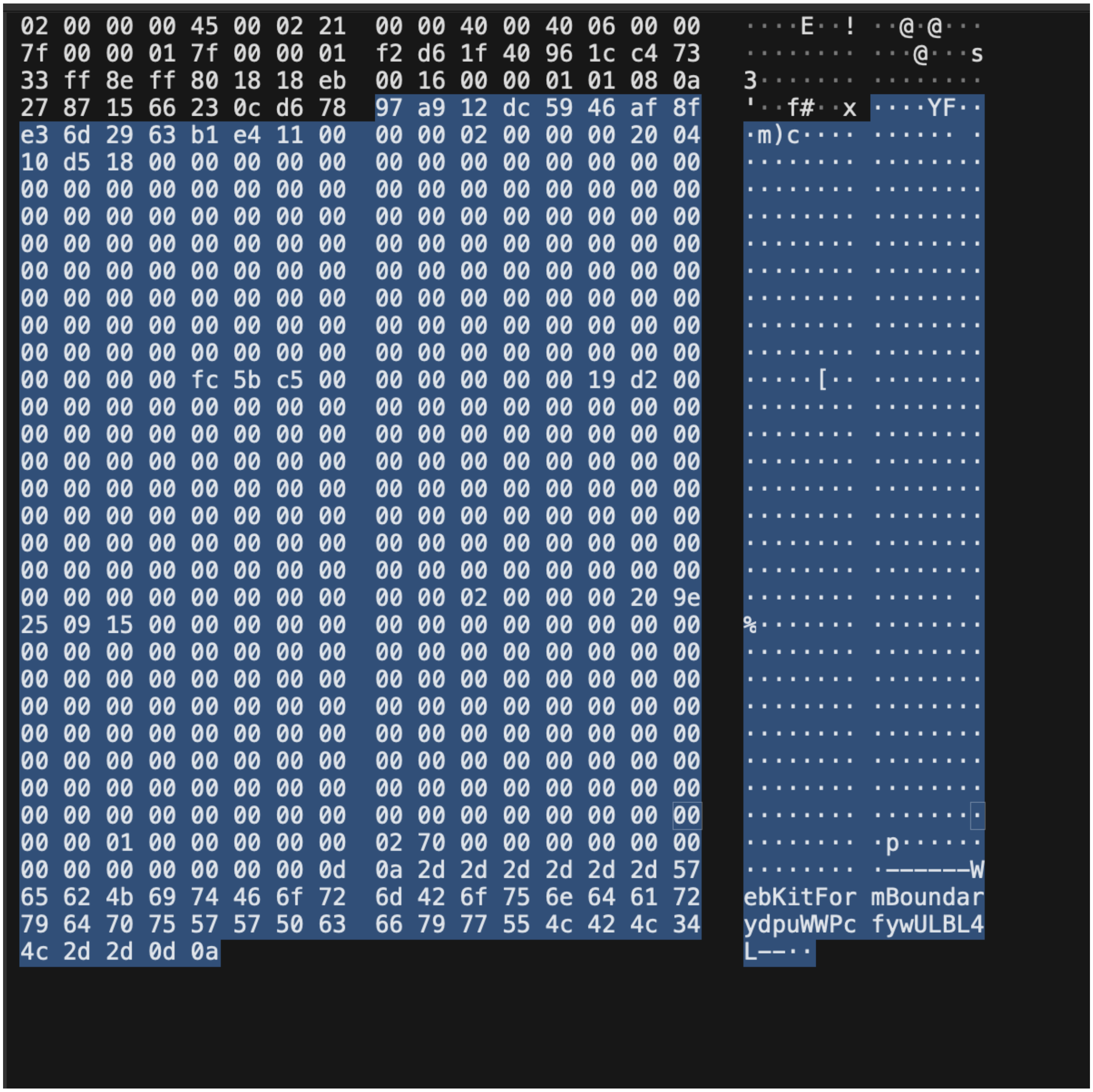
```
6839 15.288389  127.0.0.1  127.0.0.1  HTTP     549 POST /upload/ HTTP/1.1  (application/x-diskcopy)
6840 15.288414  127.0.0.1  127.0.0.1  TCP       56 8000 → 62166 [ACK] Seq=1 Ack=16284809 Win=395456 Len=0 TSval=588043896 TSecr=663164262
6841 15.288425  127.0.0.1  127.0.0.1  TCP       56 8000 → 62166 [ACK] Seq=1 Ack=16366469 Win=313792 Len=0 TSval=588043896 TSecr=663164262
6842 15.288433  127.0.0.1  127.0.0.1  TCP       56 8000 → 62166 [ACK] Seq=1 Ack=16431797 Win=509760 Len=0 TSval=588043896 TSecr=663164262
6843 15.288446  127.0.0.1  127.0.0.1  TCP       56 8000 → 62166 [ACK] Seq=1 Ack=16546121 Win=395456 Len=0 TSval=588043896 TSecr=663164262
6844 15.292771  127.0.0.1  127.0.0.1  TCP       56 8000 → 62166 [ACK] Seq=1 Ack=16546614 Win=896320 Len=0 TSval=588043900 TSecr=663164262
6845 15.295300  127.0.0.1  127.0.0.1  TCP       56 [TCP Window Update] 8000 → 62166 [ACK] Seq=1 Ack=16546614 Win=1408320 Len=0 TSval=588043903 TSecr=663164262
6846 15.296270  127.0.0.1  127.0.0.1  TCP       56 [TCP Window Update] 8000 → 62166 [ACK] Seq=1 Ack=16546614 Win=1570944 Len=0 TSval=588043903 TSecr=663164262
6877 15.312413  127.0.0.1  127.0.0.1  HTTP/…   263 HTTP/1.1 201 Created , JSON (application/json)
6878 15.312454  127.0.0.1  127.0.0.1  TCP       56 62166 → 8000 [ACK] Seq=16546614 Ack=208 Win=408064 Len=0 TSval=663164286 TSecr=588043920
```

Figure 1: Packet file-upload



```
Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
  Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
    0000 00.. = Differentiated Services Codepoint: Default (0)
    .... ..00 = Explicit Congestion Notification: Not ECN-Capable Transport (0)
  Total Length: 545
  Identification: 0x0000 (0)
  010. .... = Flags: 0x2, Don't fragment
    0... .... = Reserved bit: Not set
    .1.. .... = Don't fragment: Set
    ..0. .... = More fragments: Not set
  ...0 0000 0000 0000 = Fragment Offset: 0
  Time to Live: 64
  Protocol: TCP (6)
  Header Checksum: 0x0000 [validation disabled]
  [Header checksum status: Unverified]
  Source Address: 127.0.0.1
  Destination Address: 127.0.0.1
```

Figure 2: Header Fields



```
02 00 00 00 45 00 02 21  00 00 40 00 40 06 00 00   ····E··! ··@·@···
7f 00 00 01 7f 00 00 01  f2 d6 1f 40 96 1c c4 73   ········ ···@···s
33 ff 8e ff 80 18 18 eb  00 16 00 00 01 01 08 0a   3······· ········
27 87 15 66 23 0c d6 78  97 a9 12 dc 59 46 af 8f   '··f#··x ····YF··
e3 6d 29 63 b1 e4 11 00  00 00 02 00 00 00 20 04   ·m)c···· ······ ·
10 d5 18 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 fc 5b c5 00  00 00 00 00 00 19 d2 00   ·····[·· ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 02 00 00 00 20 9e   ········ ······ ·
25 09 15 00 00 00 00 00  00 00 00 00 00 00 00 00   %······· ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00   ········ ········
00 00 01 00 00 00 00 00  02 70 00 00 00 00 00 00   ········ ·p······
00 00 00 00 00 00 00 0d  0a 2d 2d 2d 2d 2d 2d 57   ········ ·------W
65 62 4b 69 74 46 6f 72  6d 42 6f 75 6e 64 61 72   ebKitFor mBoundar
79 64 70 75 57 57 50 63  66 79 77 55 4c 42 4c 34   ydpuWWPc fywULBL4
4c 2d 2d 0d 0a                                     L--··
```

Figure 3: Hex

3 IP Header Data

IP Header (20 bytes)

```
45 00 02 21 00 00 40 00 40 06 00 00 7f 00 00 01 7f 00 00 01
```

4 IP Header Analysis

Field	Value (Hex)	Value (Decoded)	Explanation
Version	4	4	IPv4
IHL	5	5	Header length 20 bytes
DSCP	00	0	Default (CS0)
ECN	0	0	Not ECN-Capable Transport
Total Length	02 21	545 bytes	Packet size
Identification	00 00	0	Packet identifier
Flags	010	Don't Fragment	DF bit set
Fragment Offset	0000	0	No fragmentation
TTL	40	64	Max hops before discard
Protocol	06	6 (TCP)	Next level protocol
Header Checksum	00 00	0	Checksum (invalid/disabled)
Source IP	7f 00 00 01	127.0.0.1	Localhost
Destination IP	7f 00 00 01	127.0.0.1	Localhost

Table 1: IP Header Fields

5 Detailed Field Explanations

Field Descriptions

- **Version (4 bits)**: 4 indicates IPv4.
- **IHL (4 bits)**: 5 * 4 = 20 bytes, standard IPv4 header length.
- **DSCP (6 bits)**: 0 indicates default traffic class.
- **ECN (2 bits)**: 0 means ECN is not being used.
- **Total Length (16 bits)**: 545 bytes for the entire IP packet.
- **Identification (16 bits)**: 0, unused in this non-fragmented packet.
- **Flags (3 bits)**: 010 - Don't Fragment bit is set.
- **Fragment Offset (13 bits)**: 0, as the packet is not fragmented.
- **TTL (8 bits)**: 64, typical initial value for many systems.
- **Protocol (8 bits)**: 6 indicates TCP as the next layer protocol.
- **Header Checksum (16 bits)**: 0, indicating checksum is invalid or disabled for loopback.
- **Source IP (32 bits)**: 127.0.0.1, localhost address.
- **Destination IP (32 bits)**: 127.0.0.1, localhost address.

6 Analysis

Packet Analysis

This packet represents loopback communication for a FastAPI file upload:

- The packet is using the loopback interface (127.0.0.1).
- It's a TCP packet (protocol 6), likely part of the HTTP communication for the file upload.
- The total length (545 bytes) suggests this packet contains a portion of the data being uploaded.
- The Don't Fragment flag is set, which is common for local communications.
- The TTL of 64 is standard for many operating systems for loopback traffic.
- The header checksum is 0, which is normal for loopback interfaces where checksum validation is often disabled.

This packet likely represents a data transfer segment of the file upload process, carrying a portion of the file content.

7 Conclusion

Summary

This analysis demonstrates the structure and content of an IPv4 header from a captured packet during a FastAPI file upload process. The packet shows typical characteristics of loopback communication, with TCP as the transport protocol. The 545-byte total length indicates that this packet is carrying a significant amount of data, likely a chunk of the file being uploaded. To fully analyze the entire file upload, additional packets from the capture would need to be examined to observe the complete data transfer process.