CS 240

#12: Networking: OSI Model and HTTP

Computer Systems

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OSI Model

The Open Systems Interconnection (OSI) model is a 7-layer view of networking that abstracts and encapsulates the functionality of each component of networking.

OSI Layer 1: _____

OSI Layer 2: _____

OSI Layer 3: ______

```
00 4500 00c6 1e1f 4000 4006 152e ac16 b4a3
10 12dc 95a6 ...
```

IPv4, Packet Length: 0x00c6 (198 bytes); Source IP: ac.16.b4.a3 (172.22.180.163); Destination IP: 12.dc.95.a6 (18.220.149.166)

OSI Layer 4: _____

```
    10
    ...
    bafa 0050 0f60 c9b4 356a 523f

    20
    8018 01f6 079e 0000 0101 080a 8146 30a0

    30
    31d4 daac

...
```

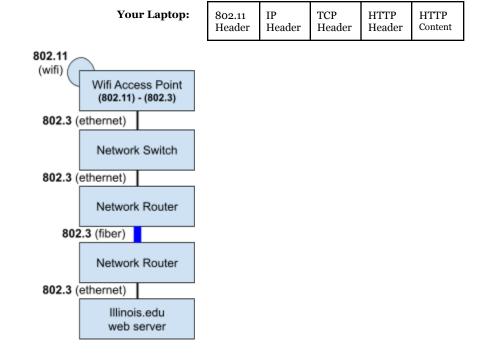
Port :0x<u>bafa</u> (47866) connecting to Port :0x<u>0050</u> (80); Checksum 0x<u>079e</u>; Timestamp: 0x<u>814630a0</u> (2168860832)

OSI Layer 5, 6, and 7: _____

```
4745 5420 2f20 4854 5450 2f31
                                              GET / HTTP/1.1\r\n
    2e31 <u>0d0a</u> 5573 6572 2d41 6765 6e74 3a20
                                              User-Agent: Wget/1.20.3
    5767 6574 2f31 2e32 302e 3320 286c 696e
                                               (linux-gnu)\r\n
   7578 2d67 6e75 29<u>0d</u> <u>0a</u>41 6363 6570 743a
                                              Accept: */*\r\n
   202a 2f2a 0d0a 4163 6365 7074 2d45 6e63
                                              Accept-Encoding:
    6f64 696e 673a 2069 6465 6e74 6974 790d
                                              identity\r\n
    0a48 6f73 743a 2077 6166 2e63 732e 696c
    6c69 6e6f 6973 2e65 6475 0d0a 436f 6e6e
    6563 7469 6f6e 3a20 4b65 6570 2d41 6c69
                                              waf.cs.illinois.edu\r\n
   7665 <u>0d0a</u> <u>0d0a</u>
сØ
                                              Connection: Keep-Alive\r\n
                                               r\n
```

Full Packet Journey

Consider an HTTP request you are making from your browser to **waf.cs.illinois.edu** (just as I did using **tcpdump**). Assuming we start from your laptop on a WiFi network:



Network Layer (Layer 3) Protocol: Internet Protocol (IP)

- The **network layer** provides _____ communication.
- When on the Internet, every host relies on the **IP protocol**:
 - o IP (IPv4) Address:
 - o IPv6 Addresses:

Two protocols for com			imunications:						
	1.								
	2.								
Features of TCP and UDP:									
Feature / Metric				UDP					
Communication Between Processes: HTTP Web Services One of the primary ways that processes will communicate is via "web services" applications that communicate using the HTTP protocol. The HTTP protocol has two parts: Protocol Part #1:									
R	1	POST /extract HTTP/1.1\r\n							
E	2	Host: localhost:5000\r\n							
Q U	3 4	User-Agent: curl/7.68.0\r\n Accept: */*\r\n							
E	5	Content-Length: 3046796\r\n							
S	6	\r\n							
Т	•••	{ 3,046,796 bytes payload }							

Transport Layer (Layer 4) Protocols:

<u>Request</u> Packet Organization:Line Delineation:

- Start Line (Line 1): HTTP method (verb), target, and version
- Request Headers (Lines 2+):
- Payload (or sometimes just the "Data"):

Protocol Part #2:

R	1	HTTP/1.0 200 OK\r\n				
Е	2	Content-Length: 3044143\r\n				
S	3	Content-Type: image/gif\r\n				
Р	4	Last-Modified: Mon, 28 Sep 2021 21:16:13\r\n				
0	5	Cache-Control: public, max-age=43200\r\n				
N	6	Expires: Tue, 24 Mar 2022 09:16:12 GMT\r\n				
S	7	ETag: "1601327773.0845277-3044143-32865"\r\n				
Е	8	Server: Werkzeug/0.16.1 Python/3.8.2\r\n				
	9	Date: Mon, 28 Sep 2020 21:16:12 GMT\r\n				
	10	\r\n				
	•••	{ 3,044,143 bytes of content }				

In general, the request and response follows the same format with only one major exception:

- Response "Status Line" (Line 1):

1xx	2xx	3xx	4xx	5xx
Informational	Success	Redirection	Client Error	Server Error
100: Continue	200: OK 201: Created 	304 : Not Modified	400: Bad Request 404: File Not Found	500: Internal Server Error