

CS 315: Computer Networks Lab

Spring 2024-25, IIT Dharwad

Assignment-6

Chidurala Tejaswini

(220010012/CS22BT012)

UDP, Socket Programming & SMTP

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Lab Instructions

Introduction

Part 0: Paste a screenshot of your system IP address, using `ipconfig` (on Windows) or `ifconfig` (on Mac and Linux), and fill out [this Google form](#) to submit the details of your system. The same system must be used to attempt all exercises of this lab.

```
user@sysad-HP-Elite-Tower-600-G9-Desktop-PC:~$ ifconfig
eno1: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.240.118.97 netmask 255.255.248.0 broadcast 10.240.119.255
    inet6 fe80::1d6b:1bfb:2bd6:ef0d prefixlen 64 scopeid 0x20<link>
    ether e0:73:e7:0a:99:9a txqueuelen 1000 (Ethernet)
    RX packets 1428020 bytes 560023912 (560.0 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 150004 bytes 30720298 (30.7 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
    device interrupt 19 memory 0x80900000-80920000

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 206884 bytes 182116195 (182.1 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 206884 bytes 182116195 (182.1 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

wlp0s20f3: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 10.200.179.190 netmask 255.255.248.0 broadcast 10.200.183.255
    inet6 fe80::ddaf:17f1:5c70:a58 prefixlen 64 scopeid 0x20<link>
    ether b0:dc:ef:fb:f1:e4 txqueuelen 1000 (Ethernet)
    RX packets 128853 bytes 101627104 (101.6 MB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 98195 bytes 17730638 (17.7 MB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

Part-1: Wireshark UDP

Do the following:

1. Start Wireshark
2. Flush DNS cache in terminal
3. Use nslookup on www.woodenstreet.com domain
4. Stop the Wireshark.

Answer the following questions:

1. List the different protocols you observe in the trace that use the UDP in the transport layer.

Hint: Select any packet you observe using UDP from the packet listing window then select Apply as Column

We don't need to go into any more details about nslookup or DNS, as we're just interested in getting a few UDP segments into Wireshark. Pick the first UDP segment for the above hostname (by applying DNS in the filter) and expand the UDP fields in the details window.

udp						
No.	Time	Source	Destination	Protocol	Length	User Datagram Protocol
1	0.000000000	10.240.118.74	230.255.255.250	SSDP	215	✓
2	0.313529114	10.240.118.106	224.0.0.251	MDNS	170	✓
3	0.314590356	10.240.118.109	224.0.0.251	MDNS	145	✓
5	0.522327517	10.240.118.92	224.0.0.251	MDNS	169	✓
6	0.523424701	10.240.119.89	224.0.0.251	MDNS	145	✓
7	0.790176991	10.240.118.72	230.255.255.250	SSDP	215	✓
9	1.006377532	10.240.118.74	230.255.255.250	SSDP	215	✓
10	1.167787706	10.240.118.97	142.250.193.142	UDP	495	✓
11	1.189783958	142.250.193.142	10.240.118.97	UDP	75	✓
12	1.202312600	10.240.118.97	142.250.193.142	UDP	76	✓
13	1.487412696	142.250.193.142	10.240.118.97	UDP	1292	✓
14	1.487413038	142.250.193.142	10.240.118.97	UDP	910	✓
15	1.487413108	142.250.193.142	10.240.118.97	UDP	98	✓
16	1.488078560	10.240.118.97	142.250.193.142	UDP	82	✓
17	1.488497919	142.250.193.142	10.240.118.97	UDP	65	✓
18	1.498610386	10.240.118.97	142.250.193.142	UDP	76	✓
19	1.509708725	142.250.193.142	10.240.118.97	UDP	68	✓
20	1.798111275	10.240.118.72	230.255.255.250	SSDP	215	✓
21	2.013768848	10.240.118.74	230.255.255.250	SSDP	215	✓
22	2.164602372	142.250.193.142	10.240.118.97	UDP	79	✓
23	2.170035413	10.240.118.97	142.250.193.142	UDP	76	✓
28	2.805929746	10.240.118.72	230.255.255.250	SSDP	215	✓
29	3.022654127	10.240.118.74	230.255.255.250	SSDP	215	✓
30	3.887082801	10.250.200.3	10.240.119.83	DNS	281	✓
31	4.165553651	10.240.118.215	224.0.0.251	MDNS	276	✓
32	4.165784346	fe80::a249:784c:895b:5dee	ff02::fb	MDNS	296	✓
33	4.166458179	10.240.118.215	224.0.0.251	MDNS	93	✓
34	4.166458543	fe80::a249:784c:895b:5dee	ff02::fb	MDNS	113	✓
35	4.416776228	10.240.118.215	224.0.0.251	MDNS	93	✓
36	4.416776681	fe80::a249:784c:895b:5dee	ff02::fb	MDNS	113	✓
37	4.455745613	10.250.200.3	10.240.119.46	DNS	281	✓
39	4.668844870	10.240.118.215	224.0.0.251	MDNS	93	✓
40	4.668937637	fe80::a249:784c:895b:5dee	ff02::fb	MDNS	113	✓
41	4.921573406	10.240.118.215	224.0.0.251	MDNS	341	✓
42	4.921573737	fe80::a249:784c:895b:5dee	ff02::fb	MDNS	361	✓
43	4.921844675	10.240.118.215	224.0.0.251	MDNS	277	✓
44	4.922087739	fe80::a249:784c:895b:5dee	ff02::fb	MDNS	297	✓
45	5.561485664	10.240.118.97	10.250.200.3	DNS	80	✓
46	5.561833546	10.250.200.3	10.240.118.97	DNS	164	✓
48	6.562288425	10.240.118.20	230.255.255.250	SSDP	215	✓
49	7.569819684	10.240.118.20	230.255.255.250	SSDP	215	✓
51	7.921892891	142.250.193.142	10.240.118.97	UDP	142	✓
52	7.930927597	10.240.118.97	142.250.193.142	UDP	76	✓
55	8.578195593	10.240.118.20	230.255.255.250	SSDP	215	✓
56	8.588429994	10.240.118.20	224.0.0.251	MDNS	82	✓
57	9.586480669	10.240.118.20	230.255.255.250	SSDP	215	✓
58	9.593615174	10.240.118.20	224.0.0.251	MDNS	82	✓
60	10.634416391	10.240.119.108	230.255.255.250	SSDP	215	✓
61	11.601545077	10.240.118.20	224.0.0.251	MDNS	82	✓
62	11.640763530	10.240.119.108	230.255.255.250	SSDP	215	✓
65	12.302953640	10.240.118.40	224.0.0.251	MDNS	285	✓
66	12.303905427	10.240.119.56	224.0.0.251	MDNS	145	✓
67	12.304433320	fe80::87a7:b342:6617:d67d	ff02::fb	MDNS	247	✓
68	12.305324810	fe80::97e2:21c:a3a3:86b2	ff02::fb	MDNS	149	✓
69	12.417576306	142.250.193.142	10.240.118.97	UDP	78	✓
70	12.417911323	142.250.193.142	10.240.118.97	UDP	238	✓
71	12.424585782	10.240.118.97	142.250.193.142	UDP	76	✓
72	12.425005629	10.240.118.97	142.250.193.142	UDP	779	✓
73	12.446859238	142.250.193.142	10.240.118.97	UDP	75	✓
74	12.458347329	10.240.118.97	142.250.193.142	UDP	76	✓
76	12.648889224	10.240.119.108	230.255.255.250	SSDP	215	✓
77	12.783408743	142.250.193.142	10.240.118.97	UDP	1022	✓
78	12.783704899	10.240.118.97	142.250.193.142	UDP	82	✓

udp							
No.	Time	Source	Destination	Protocol	Length	User Datagram Protocol	Info
70	12.048889224	10.240.118.108	239.255.255.250	SSDP	215	✓	M-SEARCH * HTTP/1.1
77	12.782487473	142.250.182.142	10.240.118.97	UDP	182	✓	443 → 47873 Len=980
78	12.783764899	10.240.118.97	142.250.182.142	UDP	82	✓	47873 → 443 Len=40
79	12.785134832	142.250.182.142	10.240.118.97	UDP	101	✓	443 → 47873 Len=50
80	12.794338393	10.240.118.97	142.250.182.142	UDP	76	✓	47873 → 443 Len=34
81	12.805058733	142.250.182.142	10.240.118.97	UDP	66	✓	443 → 47873 Len=26
82	13.658299604	10.240.118.108	239.255.255.250	SSDP	215	✓	M-SEARCH * HTTP/1.1
83	13.962099422	10.240.118.97	142.250.182.142	UDP	71	✓	33401 → 443 Len=29
84	13.983965058	142.250.182.142	10.240.118.97	UDP	66	✓	443 → 33401 Len=26
85	15.841574504	142.250.182.142	10.240.118.97	UDP	676	✓	443 → 33401 Len=634
87	15.841574999	142.250.182.142	10.240.118.97	UDP	66	✓	443 → 33401 Len=24
88	15.848594324	10.240.118.97	142.250.182.106	QUIC	1292	✓	Initial, DCID=aled74b3f23c8a89, PKN: 1, PADDING, PING, CRYPTO, CRYPTO, PADDING, PING
89	15.849045118	10.240.118.97	142.250.182.106	QUIC	118	✓	0-RTT, DCID=aled74b3f23c8a89
90	15.849483867	10.240.118.97	142.250.182.106	QUIC	546	✓	0-RTT, DCID=aled74b3f23c8a89
91	15.849484062	10.240.118.97	142.250.182.142	UDP	76	✓	33401 → 443 Len=33
92	15.894767897	142.250.182.106	10.240.118.97	QUIC	1292	✓	Initial, SCID=eled74b3f23c8a89, PKN: 1, ACK, PADDING
93	15.902749529	142.250.182.106	10.240.118.97	QUIC	1292	✓	Protected Payload (KPO)
94	15.902749847	142.250.182.106	10.240.118.97	QUIC	853	✓	Protected Payload (KPO)
95	15.902875469	142.250.182.106	10.240.118.97	QUIC	229	✓	Protected Payload (KPO)
96	15.902875542	142.250.182.106	10.240.118.97	QUIC	66	✓	Protected Payload (KPO)
97	15.90356247	10.240.118.97	142.250.182.106	QUIC	123	✓	Handshake, DCID=eled74b3f23c8a89
98	15.903780241	10.240.118.97	142.250.182.106	QUIC	73	✓	Protected Payload (KPO), DCID=eled74b3f23c8a89
99	15.924881899	142.250.182.106	10.240.118.97	QUIC	162	✓	Protected Payload (KPO)
100	15.924882144	142.250.182.106	10.240.118.97	QUIC	64	✓	Protected Payload (KPO)
101	15.924428363	10.240.118.97	142.250.182.106	QUIC	73	✓	Protected Payload (KPO), DCID=eled74b3f23c8a89
102	15.954981731	10.240.118.97	142.250.182.106	QUIC	74	✓	Protected Payload (KPO), DCID=eled74b3f23c8a89
106	16.558871049	10.240.118.97	239.255.255.250	SSDP	215	✓	M-SEARCH * HTTP/1.1
107	16.887976398	142.250.182.106	10.240.118.97	QUIC	244	✓	Protected Payload (KPO)
108	16.887976815	142.250.182.106	10.240.118.97	QUIC	68	✓	Protected Payload (KPO)
109	16.888502781	10.240.118.97	142.250.182.106	QUIC	77	✓	Protected Payload (KPO), DCID=eled74b3f23c8a89
110	16.892371219	10.240.118.97	142.250.182.142	UDP	568	✓	33401 → 443 Len=526
111	16.908618151	142.250.182.106	10.240.118.97	QUIC	67	✓	Protected Payload (KPO)
112	16.914314703	142.250.182.142	10.240.118.97	UDP	72	✓	443 → 33401 Len=38
114	16.914379658	10.240.118.97	142.250.182.106	QUIC	74	✓	Protected Payload (KPO), DCID=eled74b3f23c8a89
116	16.923969780	10.240.118.97	142.250.182.142	UDP	75	✓	33401 → 443 Len=33
117	16.106814066	142.250.182.142	10.240.118.97	UDP	143	✓	443 → 33401 Len=99
118	16.106441616	10.240.118.97	142.250.182.142	UDP	76	✓	33401 → 443 Len=36
117	17.118610958	10.240.118.97	142.250.182.142	UDP	73	✓	33401 → 443 Len=31
118	17.118630395	10.240.118.97	142.250.182.142	UDP	86	✓	33401 → 443 Len=36
119	17.118669540	10.240.118.97	142.250.182.142	UDP	383	✓	33401 → 443 Len=321
120	17.124441464	10.240.118.97	142.250.182.142	UDP	397	✓	33401 → 443 Len=355
121	17.127641099	142.250.182.142	10.240.118.97	UDP	68	✓	443 → 33401 Len=26
122	17.135403623	142.250.182.142	10.240.118.97	UDP	73	✓	443 → 33401 Len=31
123	17.141008318	142.250.182.142	10.240.118.97	UDP	72	✓	443 → 33401 Len=30
124	17.141384105	10.240.118.97	142.250.182.142	UDP	74	✓	33401 → 443 Len=32
125	17.145903399	142.250.182.142	10.240.118.97	UDP	73	✓	33401 → 443 Len=30
126	17.154003438	10.240.118.97	142.250.182.142	UDP	75	✓	33401 → 443 Len=33
127	17.202289078	10.240.118.84	239.255.255.250	SSDP	214	✓	M-SEARCH * HTTP/1.1
128	17.329389247	142.250.182.142	10.240.118.97	UDP	148	✓	443 → 33401 Len=186
129	17.329781337	10.240.118.97	142.250.182.142	UDP	76	✓	33401 → 443 Len=36
130	17.338225835	142.250.182.142	10.240.118.97	UDP	65	✓	443 → 33401 Len=23
131	17.331676382	10.240.118.97	142.250.182.142	UDP	80	✓	33401 → 443 Len=31
132	17.331738681	10.240.118.97	142.250.182.142	UDP	76	✓	33401 → 443 Len=30
133	17.338824481	10.240.118.97	142.250.182.142	UDP	75	✓	33401 → 443 Len=33
134	17.348236367	142.250.182.142	10.240.118.97	UDP	1126	✓	443 → 33401 Len=1678
135	17.348339907	142.250.182.142	10.240.118.97	UDP	66	✓	443 → 33401 Len=24
136	17.348486359	142.250.182.142	10.240.118.97	UDP	73	✓	443 → 33401 Len=31
137	17.348847209	10.240.118.97	142.250.182.142	UDP	76	✓	33401 → 443 Len=36
138	17.354097138	10.240.118.97	142.250.182.142	UDP	75	✓	33401 → 443 Len=33
139	17.368271211	10.240.118.97	142.250.182.106	QUIC	393	✓	Protected Payload (KPO), DCID=eled74b3f23c8a89
140	17.370467783	142.250.182.142	10.240.118.97	UDP	66	✓	443 → 33401 Len=26
141	17.413994433	142.250.182.106	10.240.118.97	QUIC	70	✓	Protected Payload (KPO)
142	17.442612124	10.240.118.97	142.250.182.106	QUIC	74	✓	Protected Payload (KPO), DCID=eled74b3f23c8a89

- SSDP
- MDNS
- UDP
- DNS
- QUIC

2. State the total number of fields you observe in the UDP and list them. State the size of each of those fields.

UDP Fields and Their Sizes:

- **Source Port:** The port number on the sending side.
- **Destination Port:** The port number on the receiving side.
- **Length:** Total size of the UDP packet
- **Checksum:** A checksum to verify the integrity of the UDP packet.
- **UDP Payload:** Data that has been sent to the server or received from the server

udp && frame contains woodenstreet							
No.	Time	Source	Destination	Protocol	Length	User Datagram Protocol	Info
45	5.561485664	10.240.118.97	10.250.200.3	DNS	164	✓	Standard query 0x64b6 AAAA www.woodenstreet.com
46	5.561833546	10.250.200.3	10.240.118.97	DNS	164	✓	Standard query response 0x64b6 AAAA www.woodenstreet.com AAAA 2606:4708:10::6816::

```

Frame 45: 80 bytes on wire (640 bits), 80 bytes captured (640 bits) on interface eno1, id 0
  Ethernet II, Src: e8:73:e7:0a:99:9a (e8:73:e7:0a:99:9a), Dst: Cisco:13:e0:82 (bc:d2:95:13:e0:82)
  Internet Protocol Version 4, Src: 10.240.118.97, Dst: 10.250.200.3
  User Datagram Protocol, Src Port: 46480, Dst Port: 53
    Source Port: 46480
    Destination Port: 53
    Length: 46
    Checksum: 0x548e [unverified]
    [checksum Status: Unverified]
    [Stream Index: 11]
    [Timestamps]
    UDP payload (38 bytes)

```

The exact sizes of each field may vary, but typically:

- **Source Port:** 2 bytes
 - **Destination Port:** 2 bytes
 - **Length:** 2 bytes
 - **Checksum:** 2 bytes
 - The total size of the UDP header is usually 8 bytes.
 - UDP Payload which will vary depending on the size of the data we have received.
3. **What does the Length field signify in the UDP?**

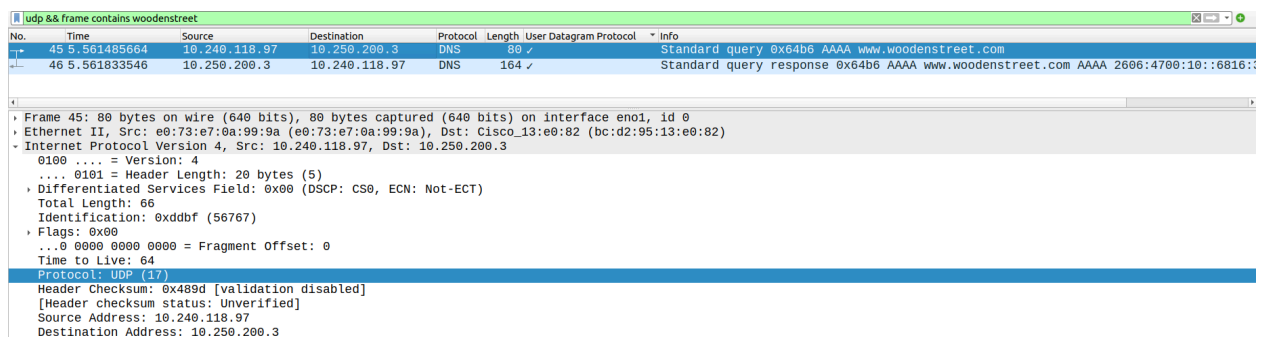
The Length field in the UDP header specifies the length of the entire UDP packet, which includes both the header and the data (payload). The minimum length is 8 bytes (for the header), and it increases as more data is added to the packet.

4. **What is the maximum number of bytes that can be included in a UDP payload?**

The maximum size of the UDP payload can be calculated by subtracting the size of the UDP header from the maximum size of an IP packet.

- The maximum size of an IP packet is typically 65,535 bytes (for IPv4).
- The UDP header is 8 bytes.
- Thus, the maximum number of bytes that can be included in a UDP payload is:-
 $65,535 - 8 = 65,527$ bytes

5. **What is the protocol number for UDP? Give your answer in decimal notation. To answer this question, you'll need to look into the Protocol field of the IP datagram containing this UDP segment.**



No.	Time	Source	Destination	Protocol	Length	User Datagram Protocol	Info
45	5.561485664	10.240.118.97	10.250.200.3	DNS	80	✓	Standard query 0x64b6 AAAA www.woodenstreet.com
46	5.561833546	10.250.200.3	10.240.118.97	DNS	164	✓	Standard query response 0x64b6 AAAA www.woodenstreet.com AAAA 2606:4700:10::6816::

Frame 45: 80 bytes on wire (640 bits), 80 bytes captured (640 bits) on interface eno1, id 0	
Ethernet II, Src: e0:73:e7:0a:99:9a (e0:73:e7:0a:99:9a), Dst: Cisco_13:e0:82 (bc:d2:95:13:e0:82)	
Internet Protocol Version 4, Src: 10.240.118.97, Dst: 10.250.200.3	
0100 = Version: 4	
.... 0101 = Header Length: 20 bytes (5)	
Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)	
Total Length: 66	
Identification: 0xddbf (56767)	
Flags: 0x00	
...0 0000 0000 0000 = Fragment Offset: 0	
Time to Live: 64	
Protocol: UDP (17)	
Header Checksum: 0x489d [validation disabled]	
[Header checksum status: Unverified]	
Source Address: 10.240.118.97	
Destination Address: 10.250.200.3	

In the **IP header**, the **Protocol field** specifies the protocol used in the transport layer.

- The protocol number for UDP is **17** in decimal notation.

Part-2: Socket Programming

```
tejaswinich17@TEJASWINICHIDURALA:/mnt/c/Users/HP/Downloads/PART2$ python3 220010012_server.py
Server listening on 0.0.0.0:12345...
Connected by ('127.0.0.1', 50288)
File received successfully. Extracting required lines...
Extracted lines:
    ALICE'S ADVENTURES IN WONDERLAND

    Lewis Carroll

    THE MILLENNIUM FULCRUM EDITION 3.0

    CHAPTER I

hers would, in the after-time, be herself a grown woman; and how
she would keep, through all her riper years, the simple and
loving heart of her childhood: and how she would gather about
her other little children, and make THEIR eyes bright and eager
with many a strange tale, perhaps even with the dream of
Wonderland of long ago: and how she would feel with all their
simple sorrows, and find a pleasure in all their simple joys,
remembering her own child-life, and the happy summer days.

    THE END

Sent extracted lines to client.
```

```
tejaswinich17@TEJASWINICHIDURALA:/mnt/c/Users/HP/Downloads/PART2$ python3 220010012_client.py
Connected to server.
File sent. Waiting for server response...

Received from server:
    ALICE'S ADVENTURES IN WONDERLAND

    Lewis Carroll

    THE MILLENNIUM FULCRUM EDITION 3.0

    CHAPTER I

hers would, in the after-time, be herself a grown woman; and how
she would keep, through all her riper years, the simple and
loving heart of her childhood: and how she would gather about
her other little children, and make THEIR eyes bright and eager
with many a strange tale, perhaps even with the dream of
Wonderland of long ago: and how she would feel with all their
simple sorrows, and find a pleasure in all their simple joys,
remembering her own child-life, and the happy summer days.

    THE END
```

Part-3: Socket Programming: SMTP

```
user@sysad-HP-Elite-Tower-600-G9-Desktop-PC:~/Downloads/PART3$ python3 220010012_client.py
Enter Email Destination: 220010012@iitdh.ac.in
Enter Subject: CN_ass6
Enter Message: Hello!!
220 smtp.gmail.com ESMTP d9443c01a7336-21f3687c820sm68270295ad.173 - gsmtip

250 smtp.gmail.com at your service

/home/user/Downloads/PART3/220010012_client.py:38: DeprecationWarning: ssl.wrap_socket() is deprecated, use SSLContext.wrap_socket()
  sslClientSocket = ssl.wrap_socket(clientSocket) # Wrap the socket to use SSL/TLS
b'334 VXNlcm5hbWU6\r\n'
b'334 UGFzc3dvcmQ6\r\n'
b'235 2.7.0 Accepted\r\n'
250 2.1.0 OK d9443c01a7336-21f3687c820sm68270295ad.173 - gsmtip

250 2.1.5 OK d9443c01a7336-21f3687c820sm68270295ad.173 - gsmtip

354 Go ahead d9443c01a7336-21f3687c820sm68270295ad.173 - gsmtip

250 2.0.0 OK 1739162777 d9443c01a7336-21f3687c820sm68270295ad.173 - gsmtip

221 2.0.0 closing connection d9443c01a7336-21f3687c820sm68270295ad.173 - gsmtip
```

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220010012@iitdh.ac.in

to me ▾

10:16 AM (2 minutes ago)



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I love computer networks!

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