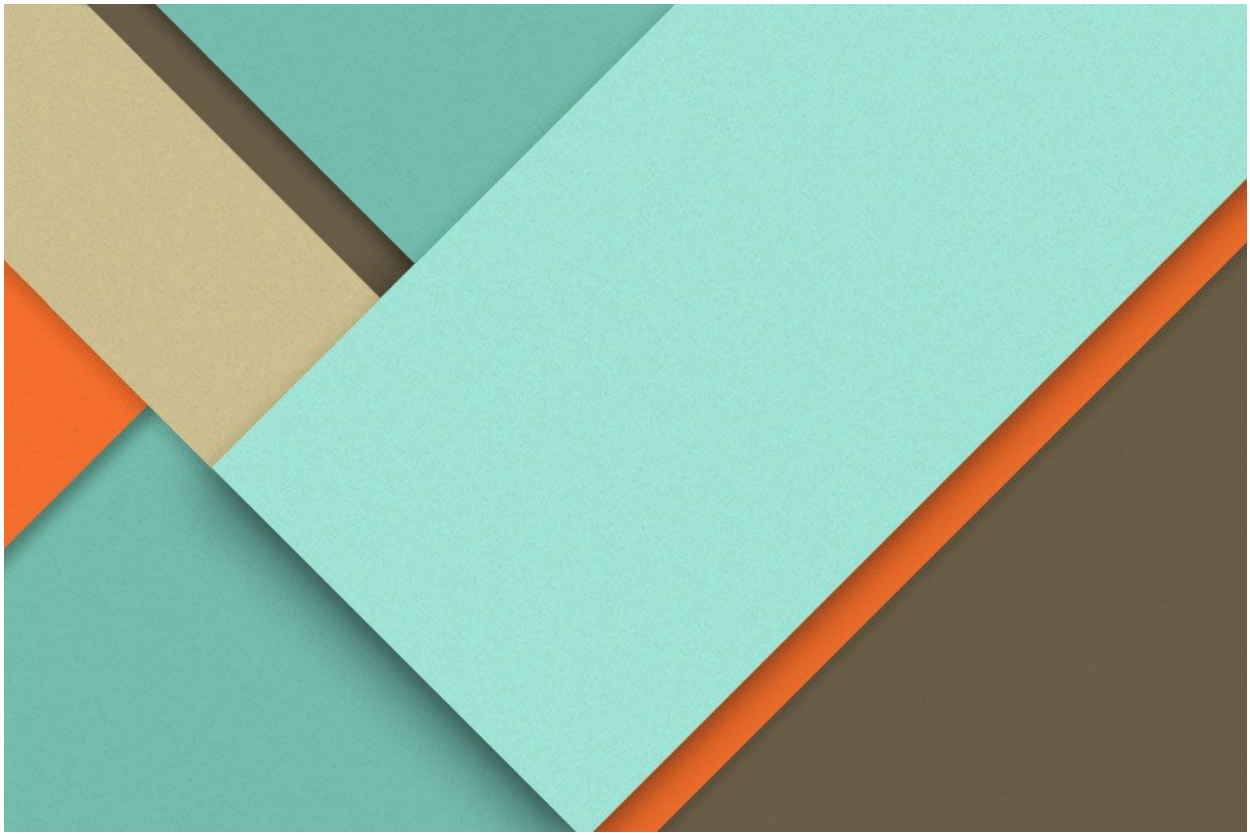

TLS Assignment

23.04.2019

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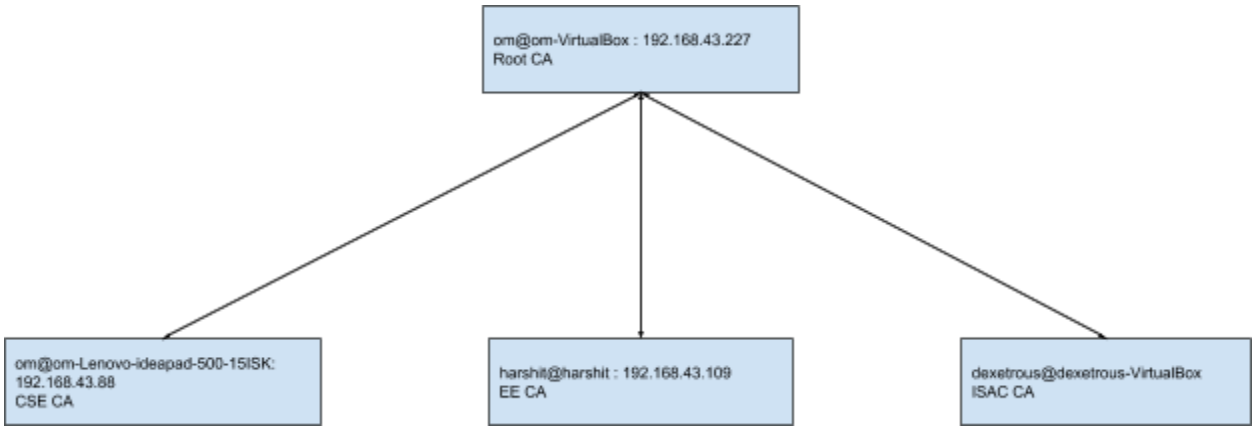
Names of the Students in the group: Om Sitapara, Harshit Patel

Date: 23/04/2019

Signature: OS, HP

Question - 1:

Here



Here are the screenshots for the transfer.

- Sending EE csr:

```
harshit@harshit:~$ scp ee.csr om@192.168.43.227:/home/om/
The authenticity of host '192.168.43.227 (192.168.43.227)' can't be established.
ECDSA key fingerprint is SHA256:19nngAJ416PCqvpzn8SFPSKfYF+a7e6RXRLyxWKjyNc.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.43.227' (ECDSA) to the list of known hosts.
om@192.168.43.227's password:
ee.csr                                        100% 1029    72.3KB/s   00:00
```

- Receiving EE.pem by root:

```
om@om-VirtualBox:~$ scp ee.pem harshit@192.168.43.109:/home/harshit/
The authenticity of host '192.168.43.109 (192.168.43.109)' can't be established.
ECDSA key fingerprint is SHA256:YZcl45iIf1PVb4i2eZWihp8p8Dn59FCm7XnyOFvmbGg.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.43.109' (ECDSA) to the list of known hosts.
harshit@192.168.43.109's password:
ee.pem                                        100% 1314    18.7KB/s   00:00
```

Similarly here are the other screenshots of transfer and signing:

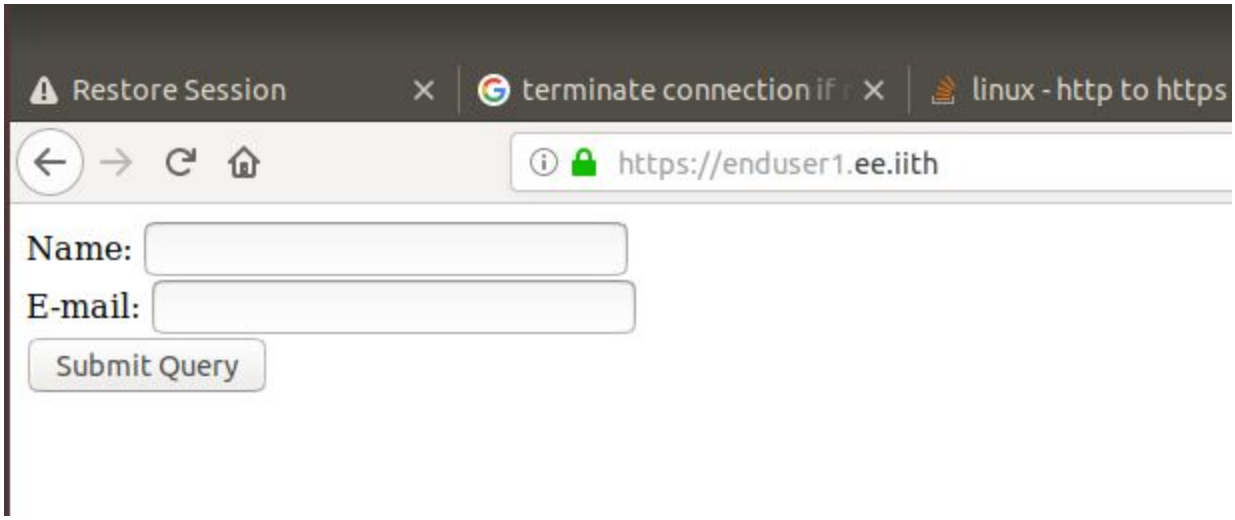
```
om@om-VirtualBox:~$ scp isac.pem dexetrous@192.168.43.95:/home/dexetrous/
The authenticity of host '192.168.43.95 (192.168.43.95)' can't be established.
ECDSA key fingerprint is SHA256:SxgNwd36lQKNRhuiuNeoJkH4eL07Fk3lW3taxP848SE.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.43.95' (ECDSA) to the list of known hosts.
dexetrous@192.168.43.95's password:
isac.pem                                      100% 1322    65.6KB/s   00:00
```

```
dexetrous@dexetrous-VirtualBox:~$ scp isac.csr om@192.168.43.227:/home/om/
The authenticity of host '192.168.43.227 (192.168.43.227)' can't be established.
ECDSA key fingerprint is f3:2d:88:65:69:37:2d:0d:77:7a:b9:28:be:6c:24:ed.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.43.227' (ECDSA) to the list of known hosts.
om@192.168.43.227's password:
isac.csr                                      100% 1041     1.0KB/s   00:00
```

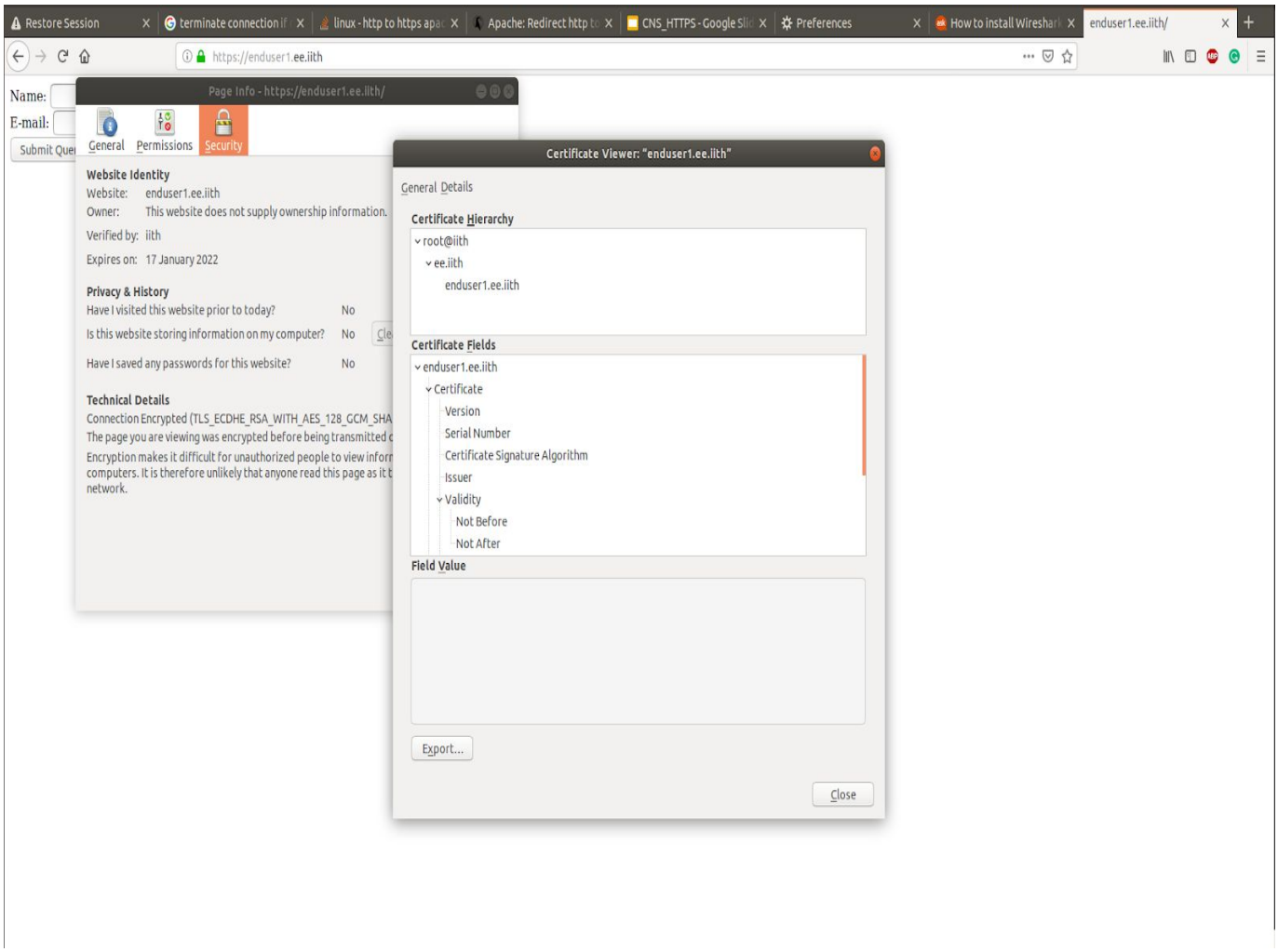
Question-2

For this part we have hosted a website called enduser1.ee.iith on ip 192.168.43.109. We have made this server to redirect all traffic to https. Now on ip 192.168.43.88 we did the following things:

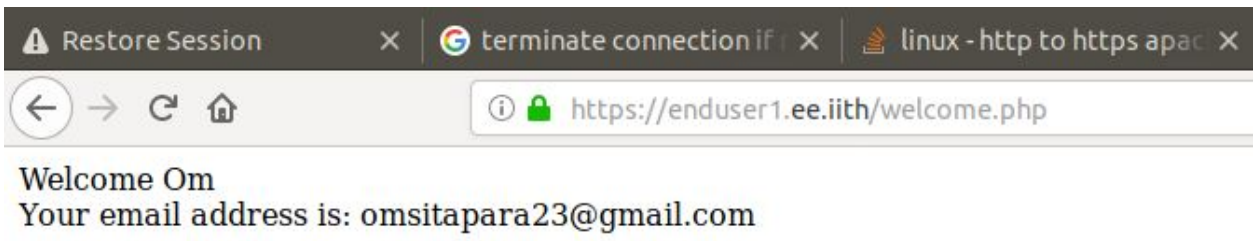
- Installed the **root CA** of iith
- Added the entry **192.168.43.109 enduser1.ee.iith** in **/etc/hosts/** for accessing the site using name (performing local dns)
- Now accessing the site it opens like this:



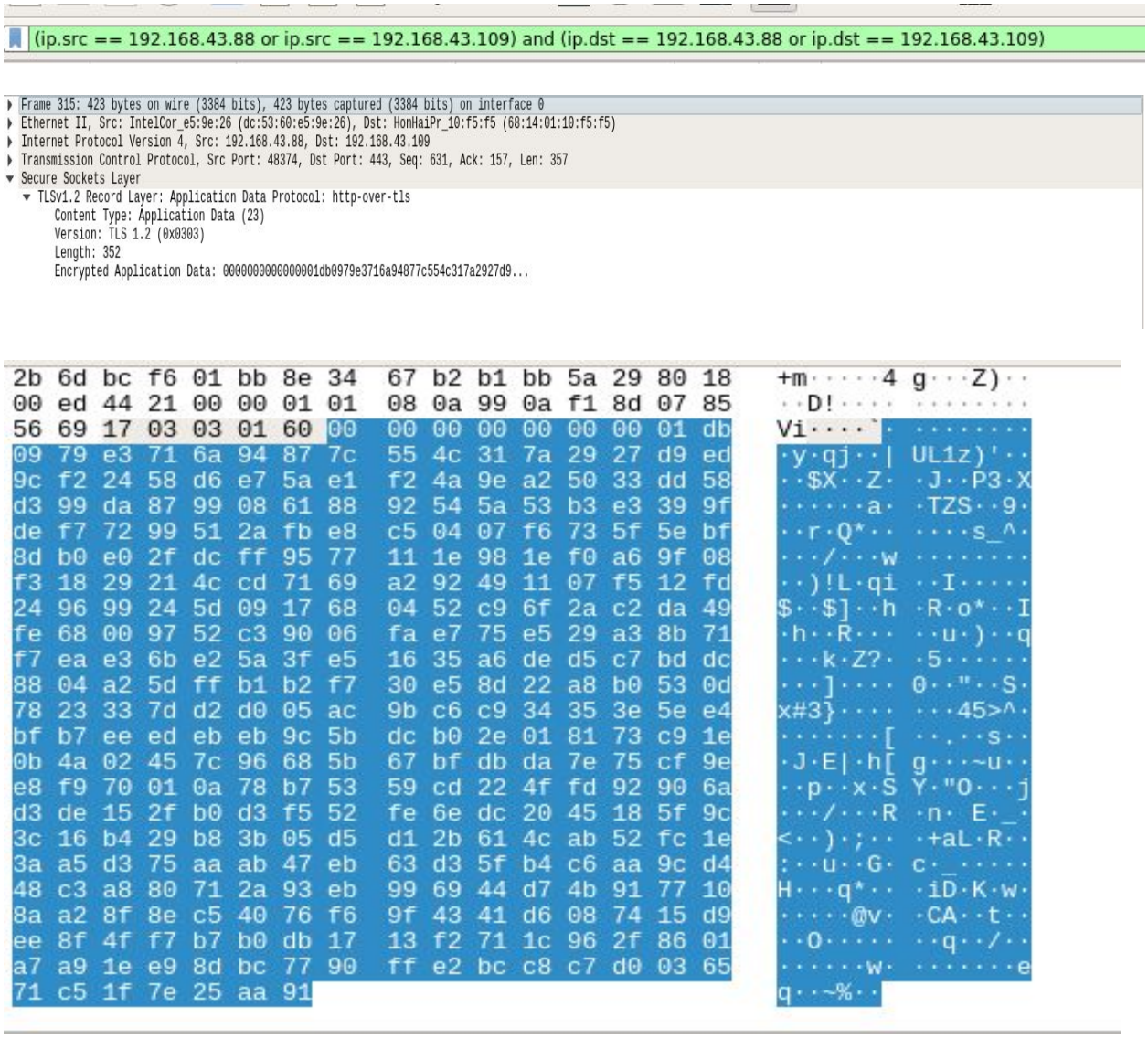
- The certificate can be viewed :



- Now entering the name and password : This shows that the server has received the entered data



- The messages passed are encrypted :



Question-3

We have 3 code files:

Peer.cpp

clientSSL.cpp

serverSSL.cpp

Command to run : g++ peer.cpp -o peer -lssl -lcrypto -lpthread

./peer

This will ask to be server or client. Now set the fields asked accordingly.

In the code for each peer, I have loaded openssl algorithms:

OpenSSL_add_all_algorithms();

And the error strings using

SSL_load_error_strings();

Then we have created a **SSL_CTX*** named **ctx** and passed the method created for each peer into this context. For each peer, mode for **SSL_CTX_set_verify()**

Is set to **SSL_VERIFY_PEER.**

Verify location is set using: **SSL_CTX_load_verify_locations()**

Which will be used to verify the received certificate.

Next certificate file and key(to check if certificate matches the key) are loaded into the SSL context.

Then a TCP connection is created using connect() and accept().

After the TCP connection is established we create a SSL connection using this tcp connection using **SSL_connect()** and **SSL_accept()**.

Then the certificates are verified for the other peer. Suitable errors are generated if the verification process fails.

After the verification succeeds, each peer creates 2 threads for sending and receiving messages.

Messages are send using SSL_write() and received using SSL_read().

To terminate the SSL session and close it both the peers have to send “exit” message.

Demonstrating the chat application:

PEER1 sends certificate : enduserEE1.pem , uses key enduserEE1.key

Certificate to verify : eechain.pem

PEER1 sends certificate : enduserEE.pem , uses key enduserEE.key

Certificate to verify : eechain.pem

Note: eechain.pem is a chain of EE CA and root CA

Here are the screenshots for the chat:

```
harshit@harshit:~/Documents/CNS Prog$ g++ peer.cpp -o peer -lssl -lcrypto -lpthread
harshit@harshit:~/Documents/CNS Prog$ ./peer
Enter your choice :
1 for Server, 2 for Receiver
1
Enter Port No :3000
Enter certificate(enduser) to send :enduserEE1.pem
Enter private key(enduser) path :enduserEE1.key
Enter certificate to verify with :eechain.pem
Enter PEM pass phrase:
4
Certificate validation completed :
Start chatting:


hi I am peer 1
   hi i am peer 2

how are you
   ca va. et toi?

Nice, CNS is fun
exit   exit
```

```
om@om-Lenovo-ideapad-500-15ISK:~/Downloads$ ./peer
Enter your choice :
1 for Server, 2 for Receiver
2
Enter Port No :3000
Enter certificate(client) to send :enduserEE.pem
Enter private key(enduser) path :enduserEE.key
Enter certificate to verify with :eechain.pem
Enter PEM pass phrase:
connected
Certificate validation completed :
Start chatting:


   hi I am peer 1

hi i am peer 2
   how are you

ca va. et toi?
   Nice, CNS is fun

exit
   exit
```

Now here we can see that the peers send the request for others certificate after they send their own certificate:

```
192.168.43.109  192.168.43.88   TLSv1.2  3363 Server Hello, Certificate, Server Key Exchange, Certificate Request, Server Hello Done
192.168.43.88   192.168.43.109  TCP        66 50460 → 3000 [ACK] Seq=177 Ack=3298 Win=35840 Len=0 TSval=2571756416 TSecr=130304108
192.168.43.88   192.168.43.109  TCP      1514 50460 → 3000 [ACK] Seq=177 Ack=3298 Win=35840 Len=1448 TSval=2571756430 TSecr=130304108
192.168.43.88   192.168.43.109  TLSv1.2  1514 Certificate [TCP segment of a reassembled PDU]
```

Here we can see that the message are transfered in an encrypted fashion: