Information Security

Public Key Infrastructure

Ambreen Kanwal

University of Sahiwal

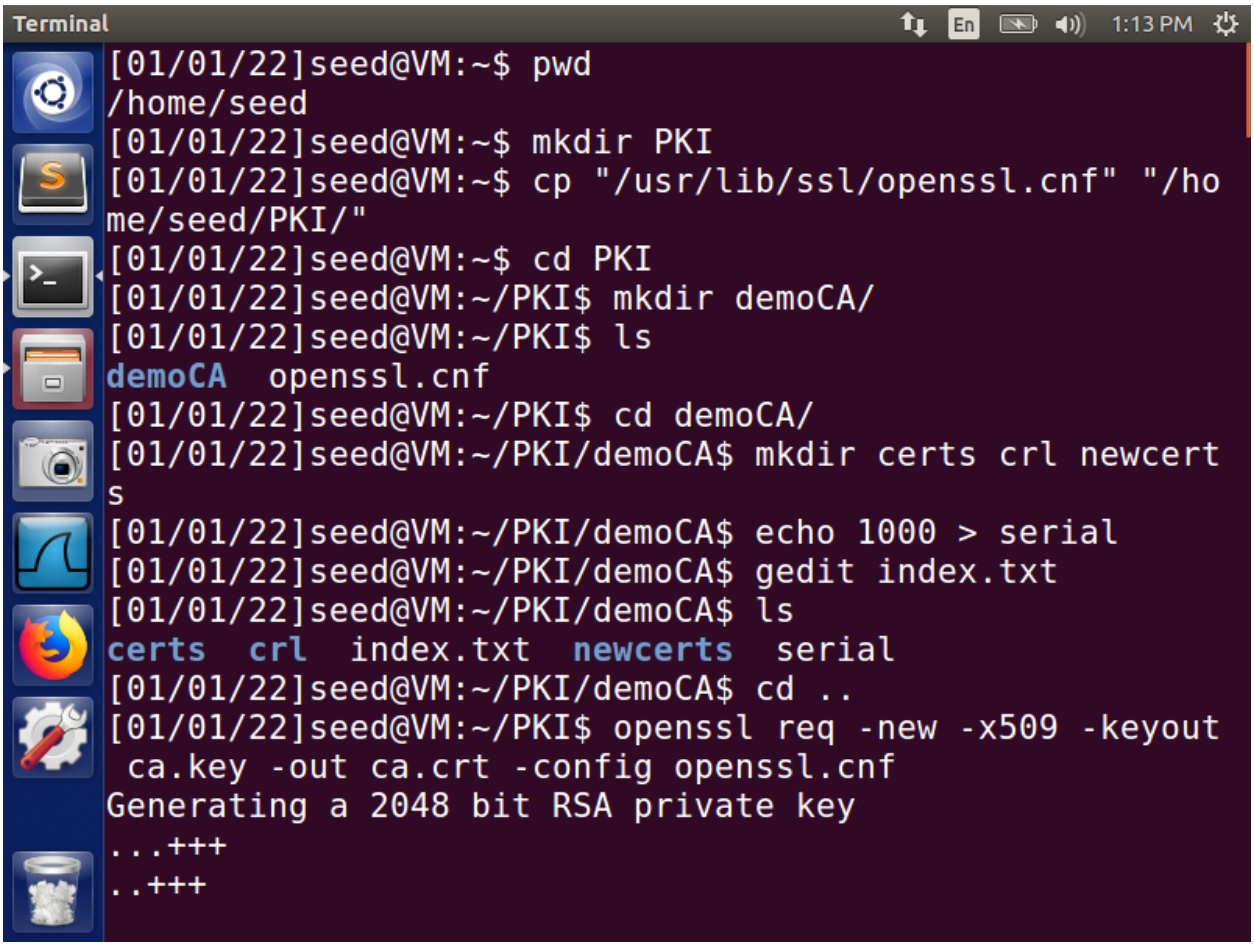
Public Key Infrastructure

Lab Tasks

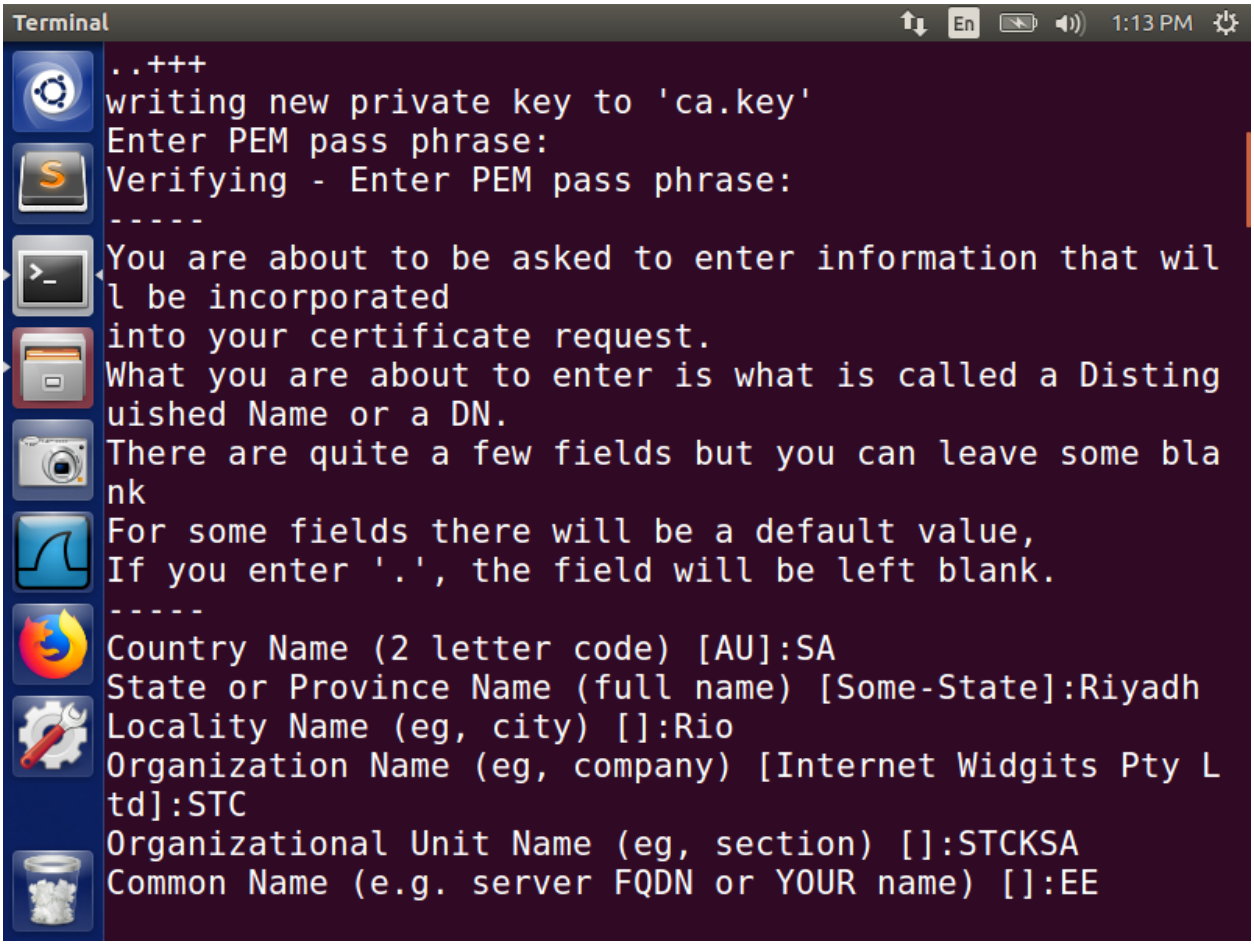
Task 1: Becoming a Certificate Authority (CA)

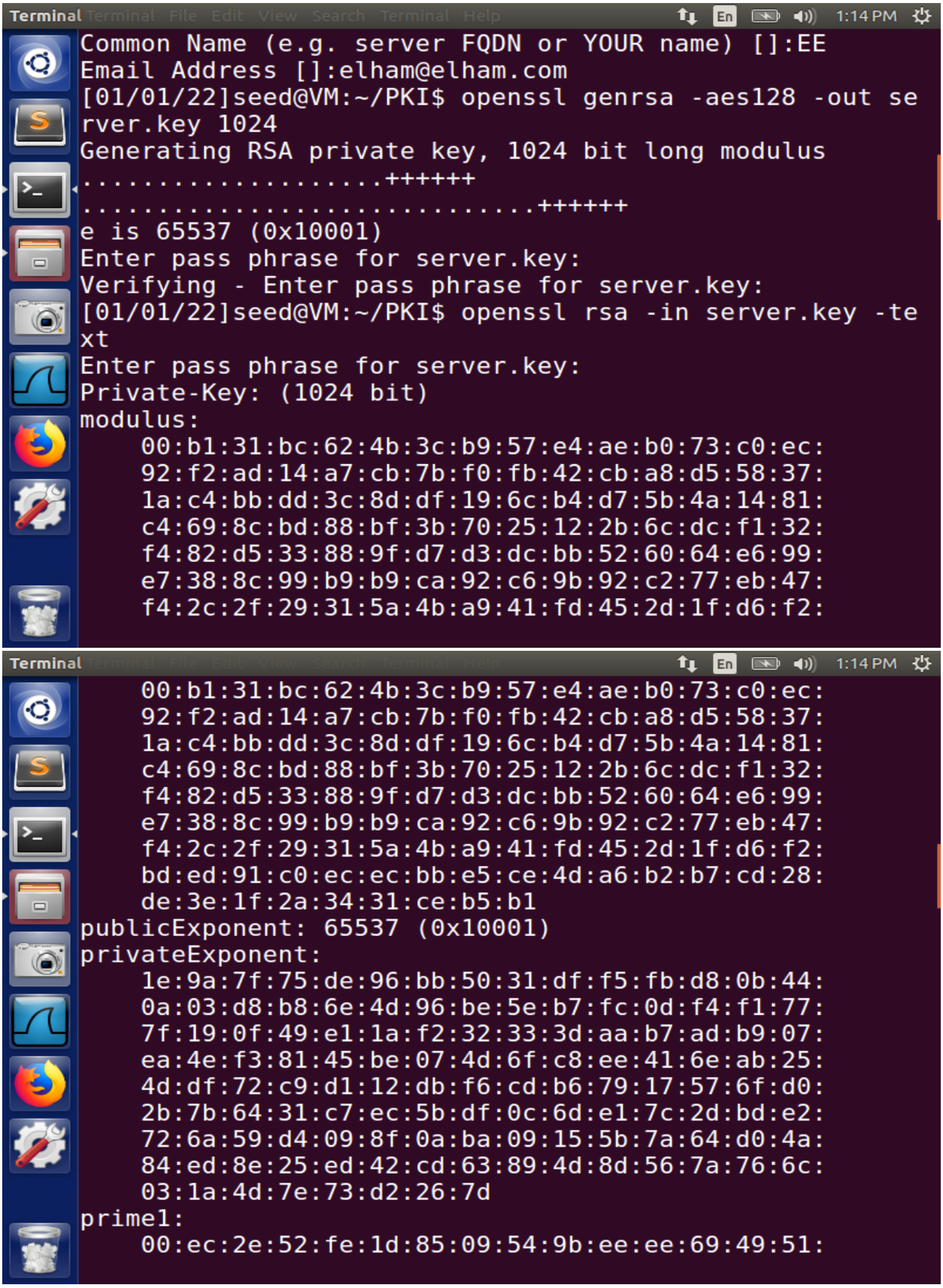
You can run the following command to generate the self-signed certificate for the CA:

$ openssl req -new -x509 -keyout ca.key -out ca.crt -config openssl.cnf

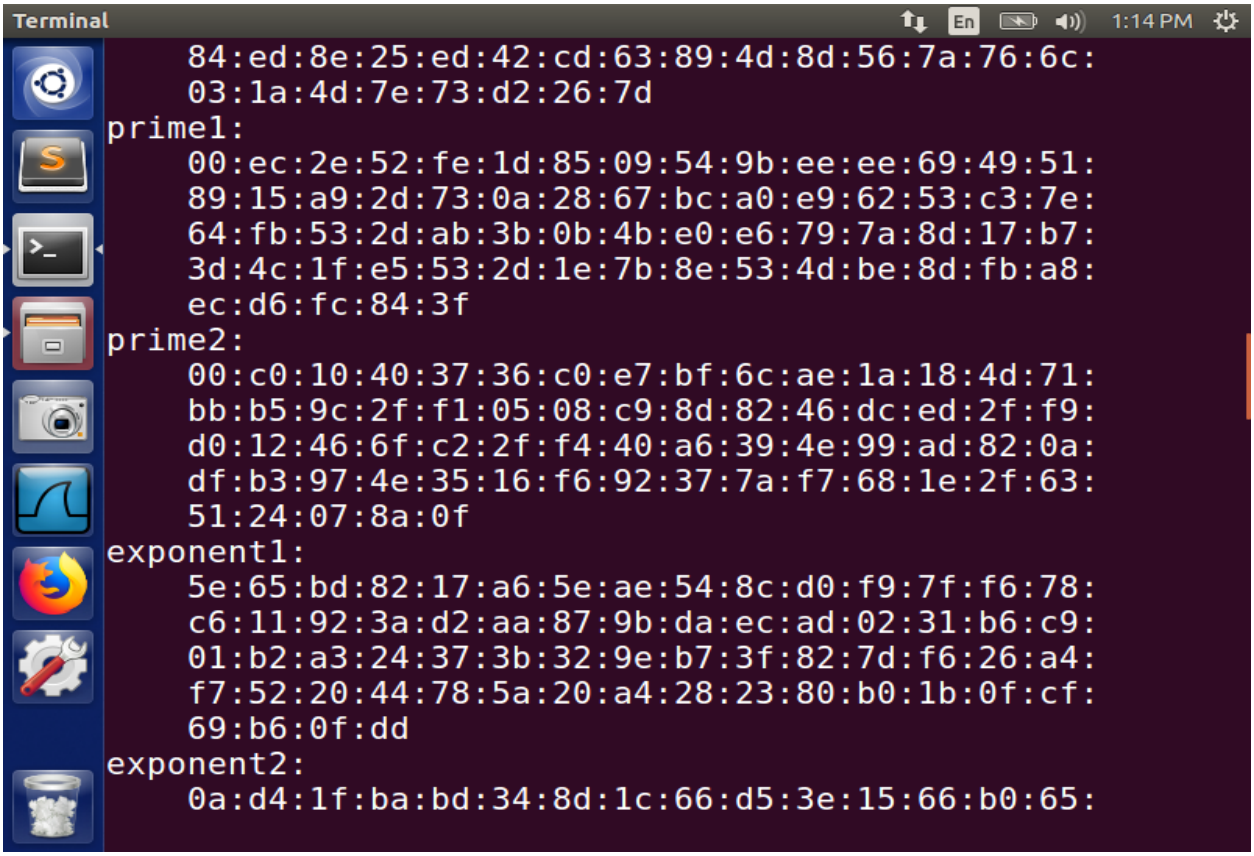


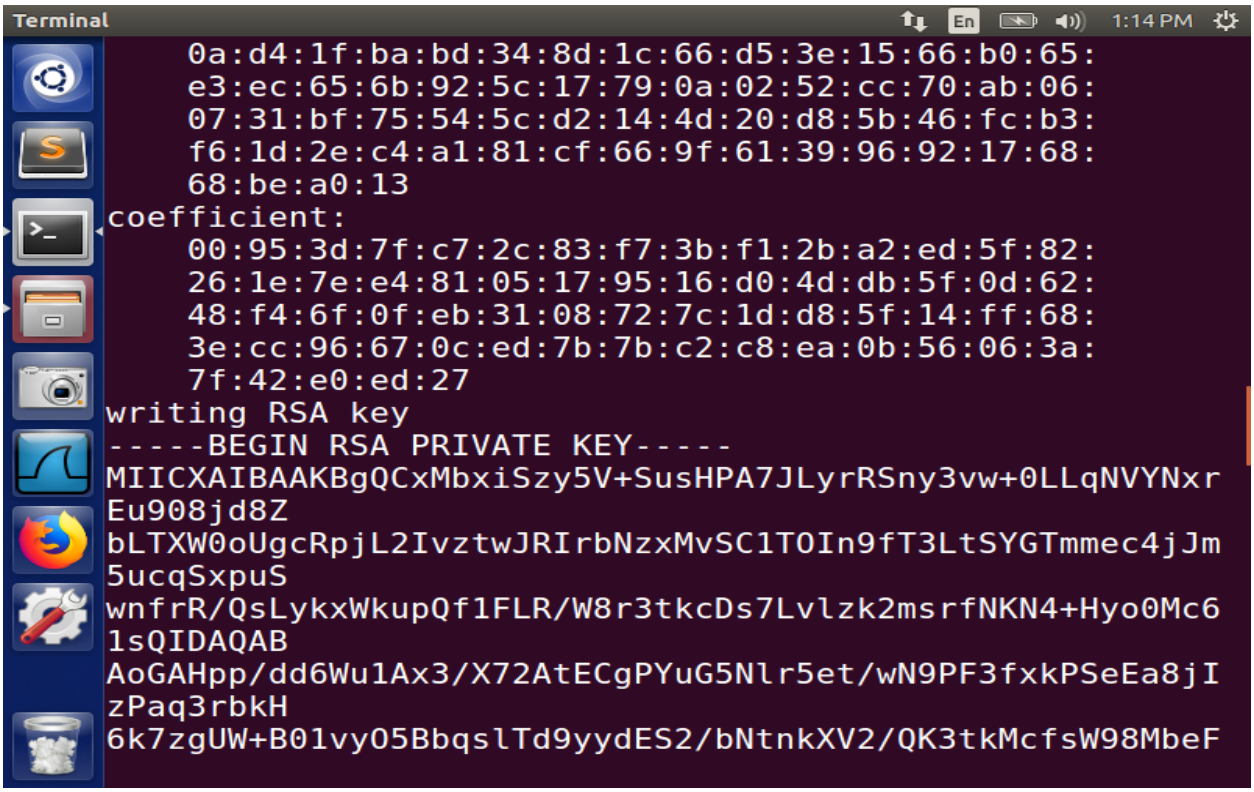
You will be prompted for information and a password. Do not lose this password, because you will have to type the passphrase each time you want to use this CA to sign certificates for others. You will also be asked to fill in some information, such as the Country Name, Common Name, etc. The output of the command are stored in two files: ca.key and ca.crt. The file ca.key contains the CA's private key, while ca.crt contains the public-key certificate.




Terminal
Terminal File Edit View Search Terminal Help
En
1:14 PM
Common Name (e.g. server FQDN or YOUR name) []:EE
Email Address []:elham@elham.com
[01/01/22]seed@VM:~/PKI$ openssl genrsa -aes128 -out se
rver.key 1024
Generating RSA private key, 1024 bit long modulus
.....++++++
.....++++++
e is 65537 (0x10001)
Enter pass phrase for server.key:
Verifying - Enter pass phrase for server.key:
[01/01/22]seed@VM:~/PKI$ openssl rsa -in server.key -te
xt
Enter pass phrase for server.key:
Private-Key: (1024 bit)
modulus:
00:b1:31:bc:62:4b:3c:b9:57:e4:ae:b0:73:c0:ec:
92:f2:ad:14:a7:cb:7b:f0:fb:42:cb:a8:d5:58:37:
1a:c4:bb:dd:3c:8d:df:19:6c:b4:d7:5b:4a:14:81:
c4:69:8c:bd:88:bf:3b:70:25:12:2b:6c:dc:f1:32:
f4:82:d5:33:88:9f:d7:d3:dc:bb:52:60:64:e6:99:
e7:38:8c:99:b9:b9:ca:92:c6:9b:92:c2:77:eb:47:
f4:2c:2f:29:31:5a:4b:a9:41:fd:45:2d:1f:d6:f2:

Terminal
En
1:14 PM
00:b1:31:bc:62:4b:3c:b9:57:e4:ae:b0:73:c0:ec:
92:f2:ad:14:a7:cb:7b:f0:fb:42:cb:a8:d5:58:37:
1a:c4:bb:dd:3c:8d:df:19:6c:b4:d7:5b:4a:14:81:
c4:69:8c:bd:88:bf:3b:70:25:12:2b:6c:dc:f1:32:
f4:82:d5:33:88:9f:d7:d3:dc:bb:52:60:64:e6:99:
e7:38:8c:99:b9:b9:ca:92:c6:9b:92:c2:77:eb:47:
f4:2c:2f:29:31:5a:4b:a9:41:fd:45:2d:1f:d6:f2:
bd:ed:91:c0:ec:ec:bb:e5:ce:4d:a6:b2:b7:cd:28:
de:3e:1f:2a:34:31:ce:b5:b1
publicExponent: 65537 (0x10001)
privateExponent:
1e:9a:7f:75:de:96:bb:50:31:df:f5:fb:d8:0b:44:
0a:03:d8:b8:6e:4d:96:be:5e:b7:fc:0d:f4:f1:77:
7f:19:0f:49:e1:1a:f2:32:33:3d:aa:b7:ad:b9:07:
ea:4e:f3:81:45:be:07:4d:6f:c8:ee:41:6e:ab:25:
4d:df:72:c9:d1:12:db:f6:cd:b6:79:17:57:6f:d0:
2b:7b:64:31:c7:ec:5b:df:0c:6d:e1:7c:2d:bd:e2:
72:6a:59:d4:09:8f:0a:ba:09:15:5b:7a:64:d0:4a:
84:ed:8e:25:ed:42:cd:63:89:4d:8d:56:7a:76:6c:
03:1a:4d:7e:73:d2:26:7d
prime1:
00:ec:2e:52:fe:1d:85:09:54:9b:ee:ee:69:49:51:

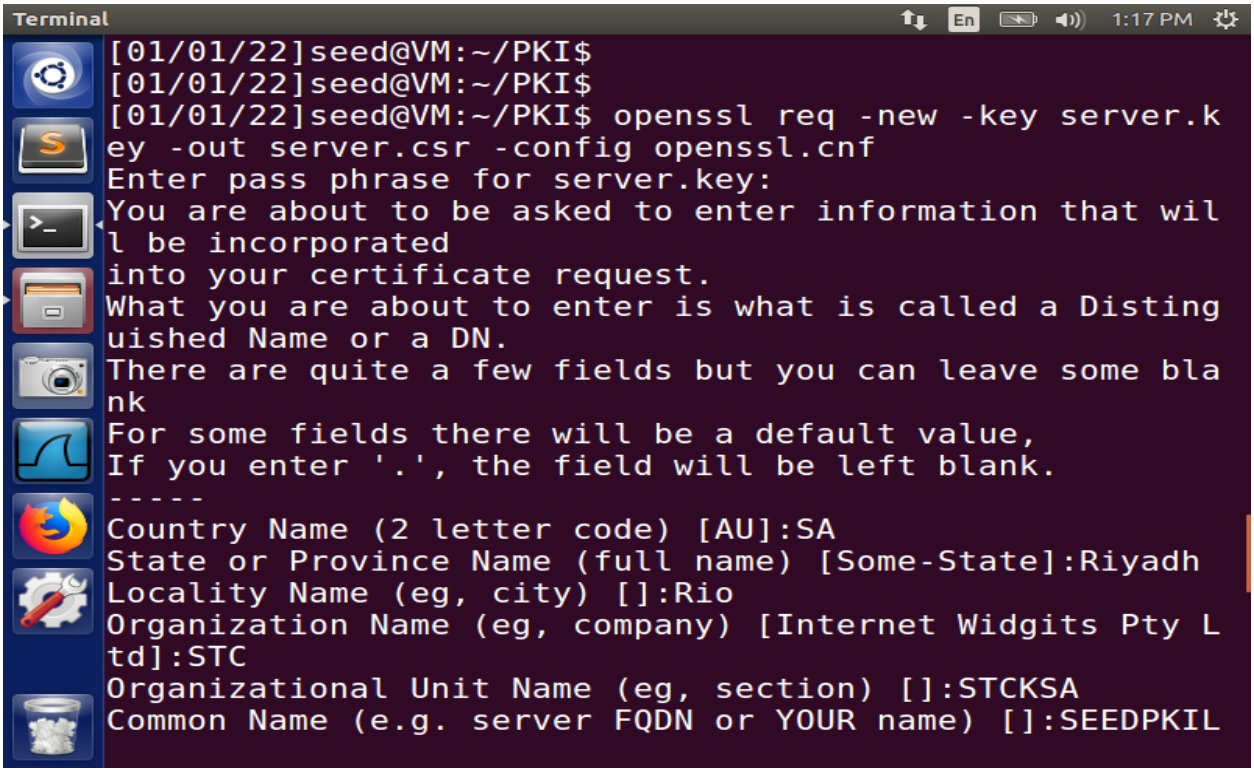

Terminal
En
1:14 PM
84:ed:8e:25:ed:42:cd:63:89:4d:8d:56:7a:76:6c:
03:1a:4d:7e:73:d2:26:7d
prime1:
00:ec:2e:52:fe:1d:85:09:54:9b:ee:ee:69:49:51:
89:15:a9:2d:73:0a:28:67:bc:a0:e9:62:53:c3:7e:
64:fb:53:2d:ab:3b:0b:4b:e0:e6:79:7a:8d:17:b7:
3d:4c:1f:e5:53:2d:1e:7b:8e:53:4d:be:8d:fb:a8:
ec:d6:fc:84:3f
prime2:
00:c0:10:40:37:36:c0:e7:bf:6c:ae:1a:18:4d:71:
bb:b5:9c:2f:f1:05:08:c9:8d:82:46:dc:ed:2f:f9:
d0:12:46:6f:c2:2f:f4:40:a6:39:4e:99:ad:82:0a:
df:b3:97:4e:35:16:f6:92:37:7a:f7:68:1e:2f:63:
51:24:07:8a:0f
exponent1:
5e:65:bd:82:17:a6:5e:ae:54:8c:d0:f9:7f:f6:78:
c6:11:92:3a:d2:aa:87:9b:da:ec:ad:02:31:b6:c9:
01:b2:a3:24:37:3b:32:9e:b7:3f:82:7d:f6:26:a4:
f7:52:20:44:78:5a:20:a4:28:23:80:b0:1b:0f:cf:
69:b6:0f:dd
exponent2:
0a:d4:1f:ba:bd:34:8d:1c:66:d5:3e:15:66:b0:65:


Terminal
En
1:14 PM
0a:d4:1f:ba:bd:34:8d:1c:66:d5:3e:15:66:b0:65:
e3:ec:65:6b:92:5c:17:79:0a:02:52:cc:70:ab:06:
07:31:bf:75:54:5c:d2:14:4d:20:d8:5b:46:fc:b3:
f6:1d:2e:c4:a1:81:cf:66:9f:61:39:96:92:17:68:
68:be:a0:13
coefficient:
00:95:3d:7f:c7:2c:83:f7:3b:f1:2b:a2:ed:5f:82:
26:1e:7e:e4:81:05:17:95:16:d0:4d:db:5f:0d:62:
48:f4:6f:0f:eb:31:08:72:7c:1d:d8:5f:14:ff:68:
3e:cc:96:67:0c:ed:7b:7b:c2:c8:ea:0b:56:06:3a:
7f:42:e0:ed:27
writing RSA key
-----BEGIN RSA PRIVATE KEY-----
MIICXAIBAAKBgQCxMbxiSzy5V+SusHPA7JLyrRSny3vw+0LLqNVYNxr
Eu908jd8Z
bLTXW0oUgcRpjL2IvztwJRIrbNzxMvSC1TOIn9fT3LtSYGTmmec4jJm
5ucqSxpuS
wnfrR/QsLykxWkupQf1FLR/W8r3tkcDs7Lvlzk2msrfNKN4+Hyo0Mc6
1sQIDAQAB
AoGAHpp/dd6Wu1Ax3/X72AtECgPYuG5Nlr5et/wN9PF3fxkPSeEa8jI
zPaq3rbkH
6k7zgUW+B01vyO5BbqslTd9yydES2/bNtnkXV2/QK3tkMcfsW98MbeF

Task 2: Creating a Certificate for SEEDPKILab2021.com

Generate public/private key pair.

$ openssl genrsa -aes128 -out server.key 1024



The server.key is an encoded text file (also encrypted), so you will not be able to see the actual content, such as the modulus, private exponents, etc. To see those, you can run the following command:

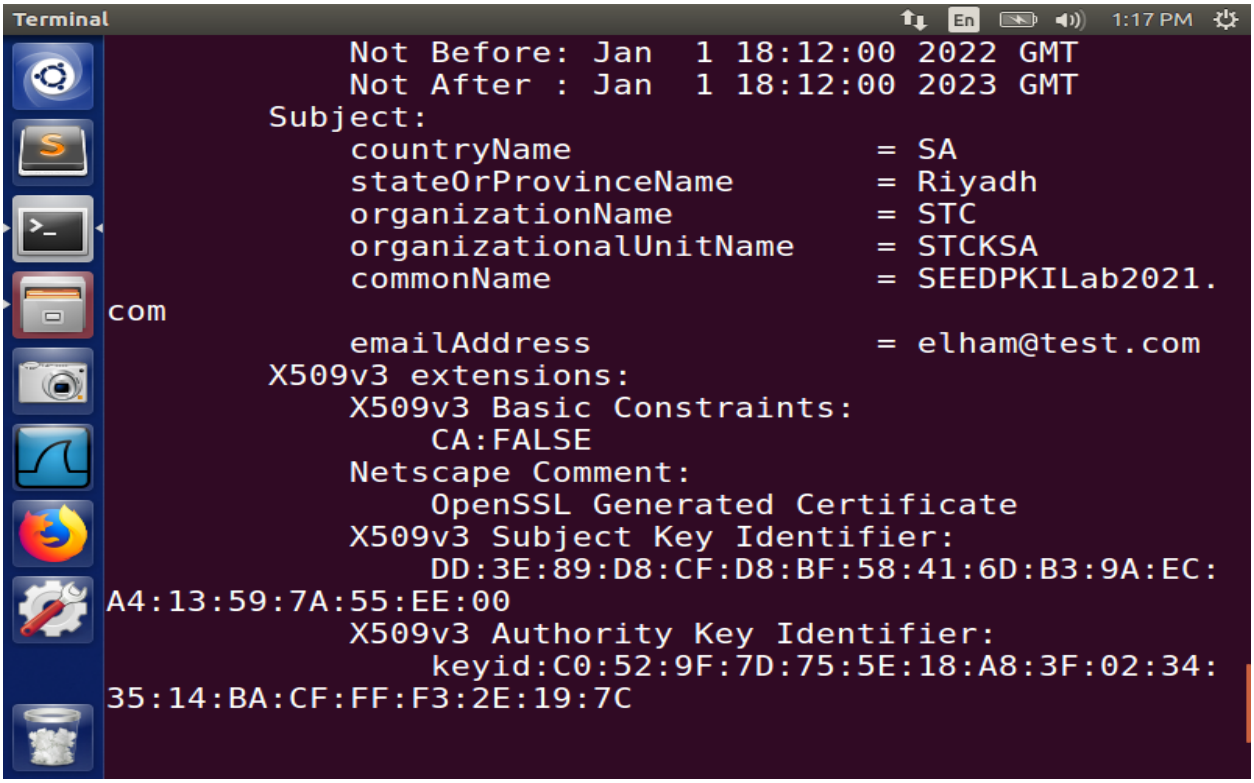
$ openssl rsa -in server.key -text

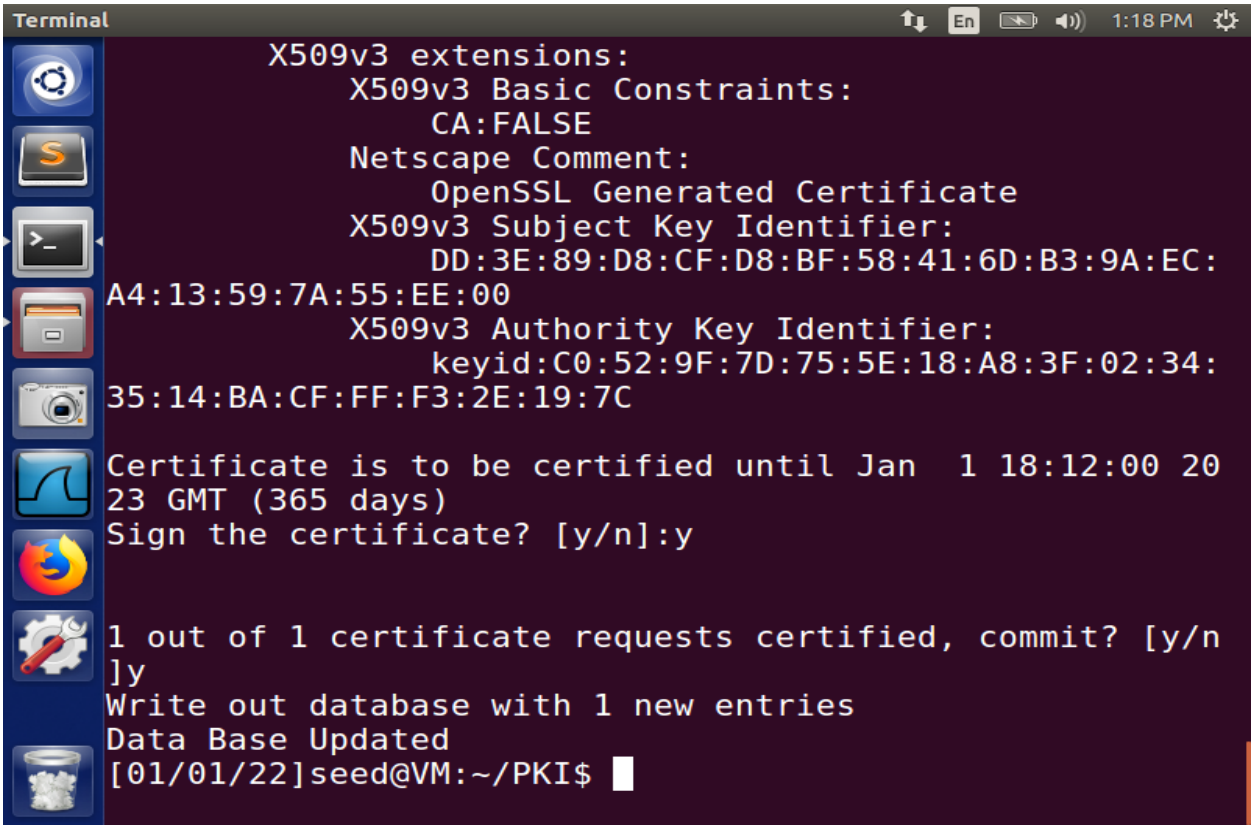
please use SEEDPKILab2021.com as the common name of the certificate request.

$ openssl req -new -key server.key -out server.csr -config openssl.cnf

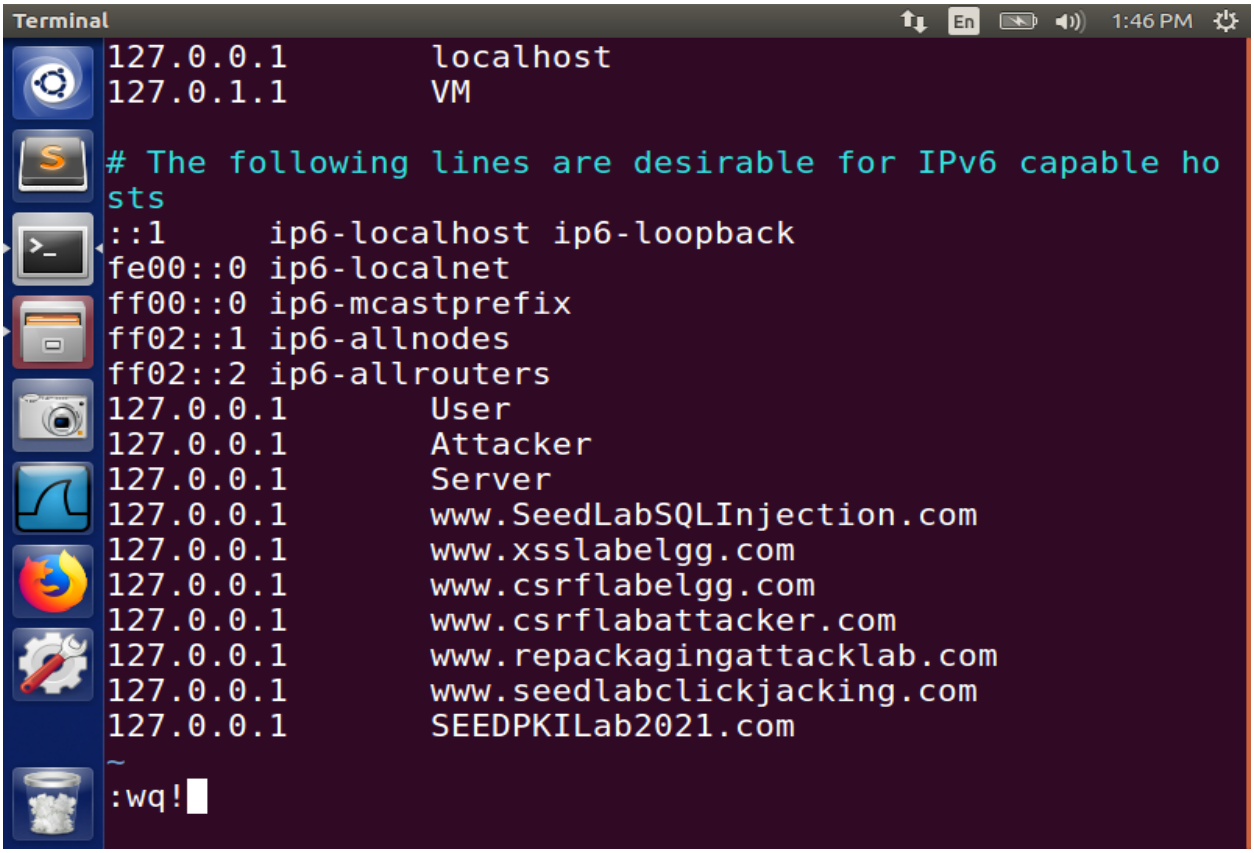
The following command turns the certificate signing re-
quest (server.csr) into an X509 certificate (server.crt), using the CA's ca.crt and ca.key:

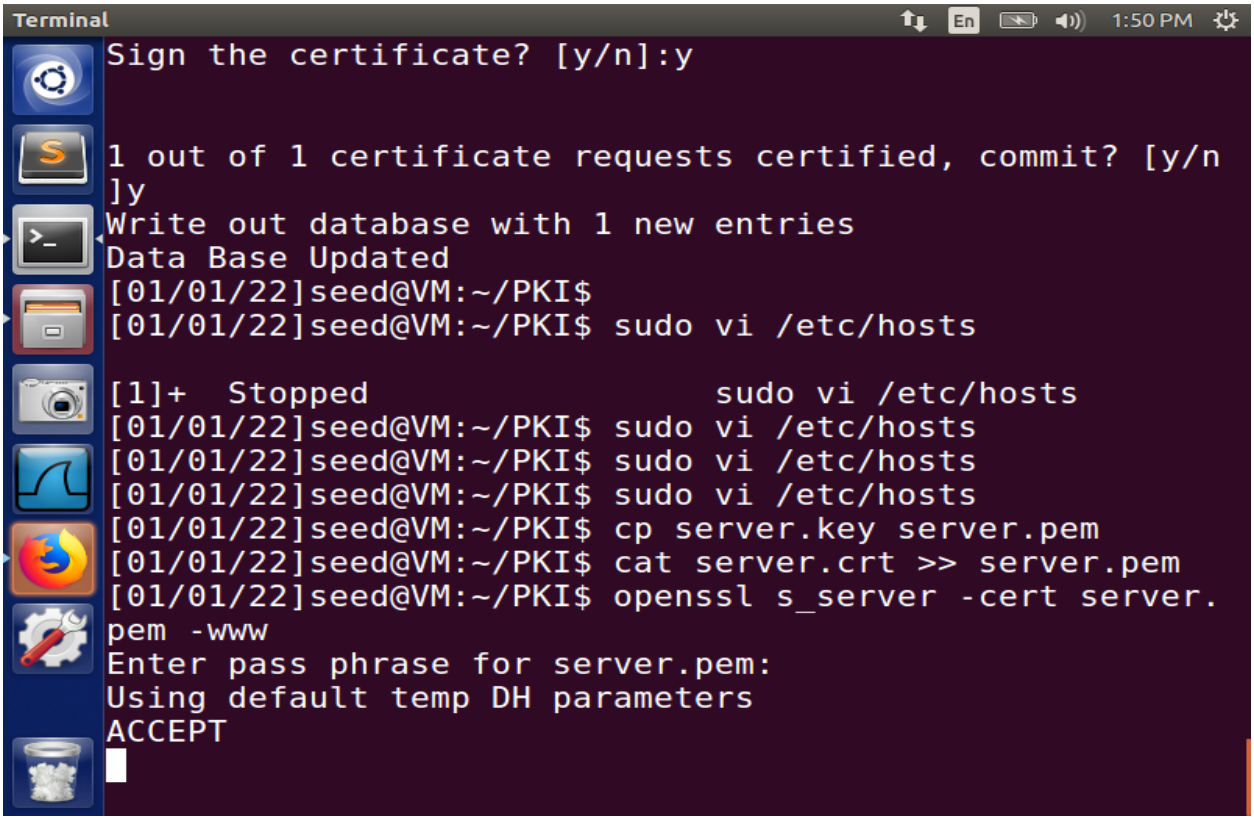
$ openssl ca -in server.csr -out server.crt -cert ca.crt -keyfile ca.key -config openssl.cnf

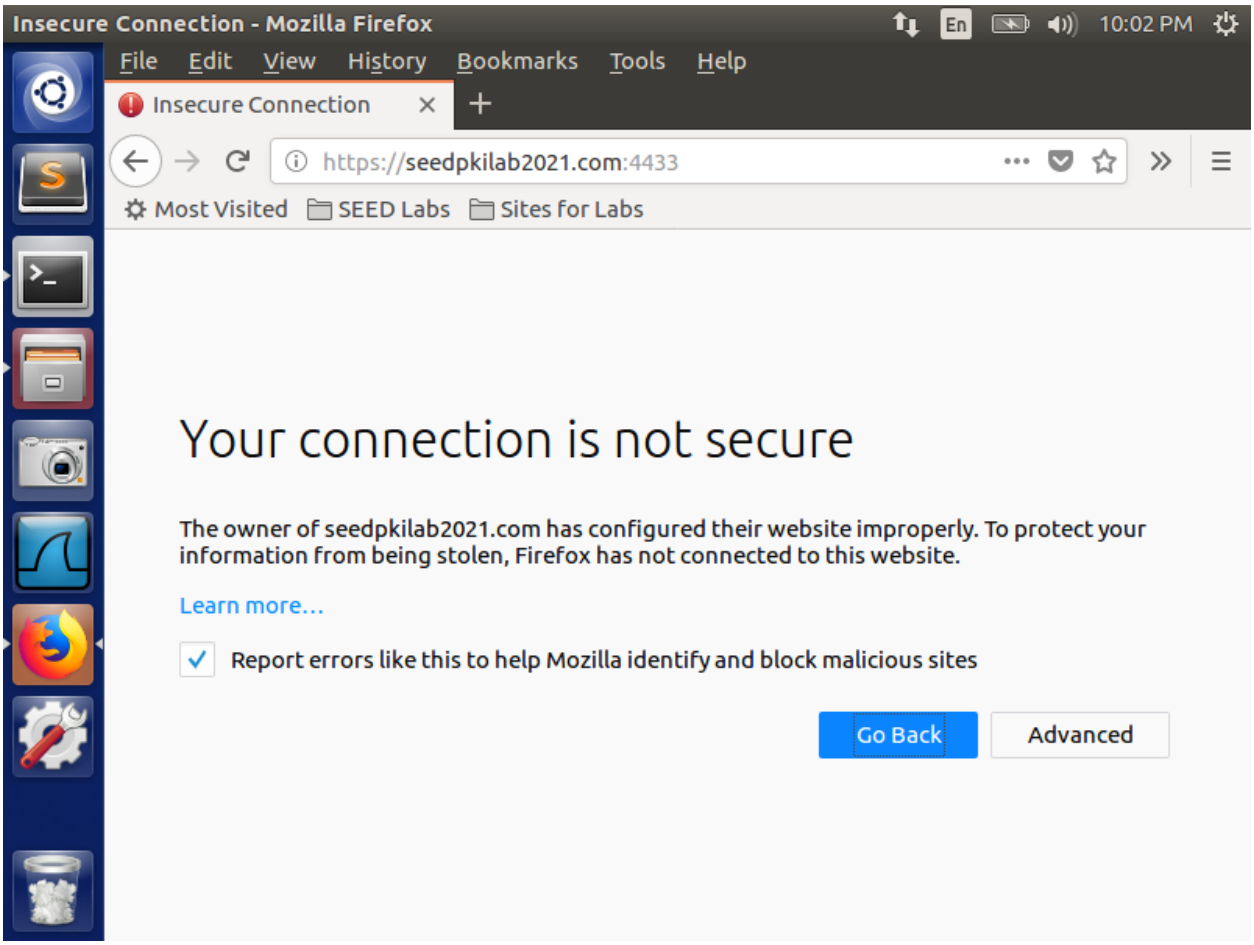

Terminal
En
1:17 PM
Not Before: Jan 1 18:12:00 2022 GMT
Not After : Jan 1 18:12:00 2023 GMT
Subject:
countryName = SA
stateOrProvinceName = Riyadh
organizationName = STC
organizationalUnitName = STCKSA
commonName = SEEDPKILab2021.
com
emailAddress = elham@test.com
X509v3 extensions:
X509v3 Basic Constraints:
CA:FALSE
Netscape Comment:
OpenSSL Generated Certificate
X509v3 Subject Key Identifier:
DD:3E:89:D8:CF:D8:BF:58:41:6D:B3:9A:EC:
A4:13:59:7A:55:EE:00
X509v3 Authority Key Identifier:
keyid:C0:52:9F:7D:75:5E:18:A8:3F:02:34:
35:14:BA:CF:FF:F3:2E:19:7C


Terminal
En
1:18 PM
X509v3 extensions:
X509v3 Basic Constraints:
CA:FALSE
Netscape Comment:
OpenSSL Generated Certificate
X509v3 Subject Key Identifier:
DD:3E:89:D8:CF:D8:BF:58:41:6D:B3:9A:EC:
A4:13:59:7A:55:EE:00
X509v3 Authority Key Identifier:
keyid:C0:52:9F:7D:75:5E:18:A8:3F:02:34:
35:14:BA:CF:FF:F3:2E:19:7C
Certificate is to be certified until Jan 1 18:12:00 20
23 GMT (365 days)
Sign the certificate? [y/n]:y
1 out of 1 certificate requests certified, commit? [y/n
]y
Write out database with 1 new entries
Data Base Updated
[01/01/22]seed@VM:~/PKI$

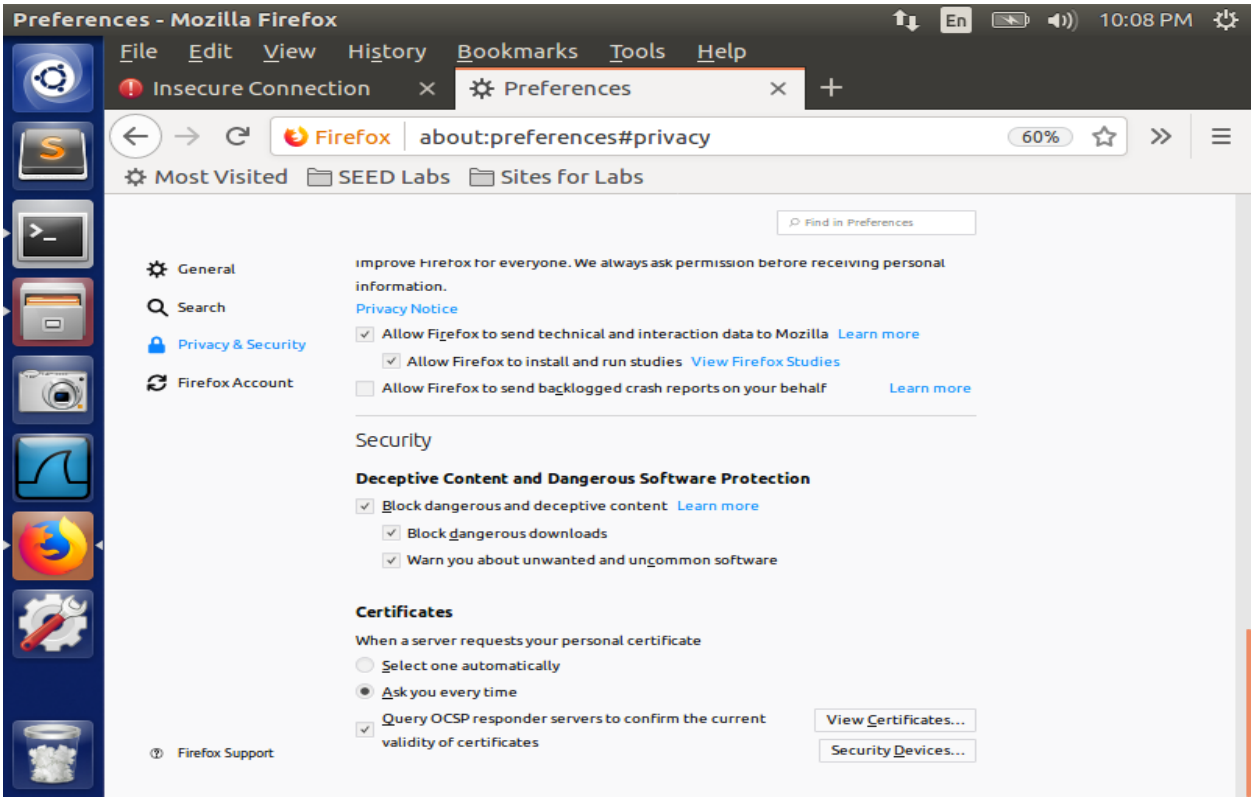
Task 3: Deploying Certificate in an HTTPS Web Server

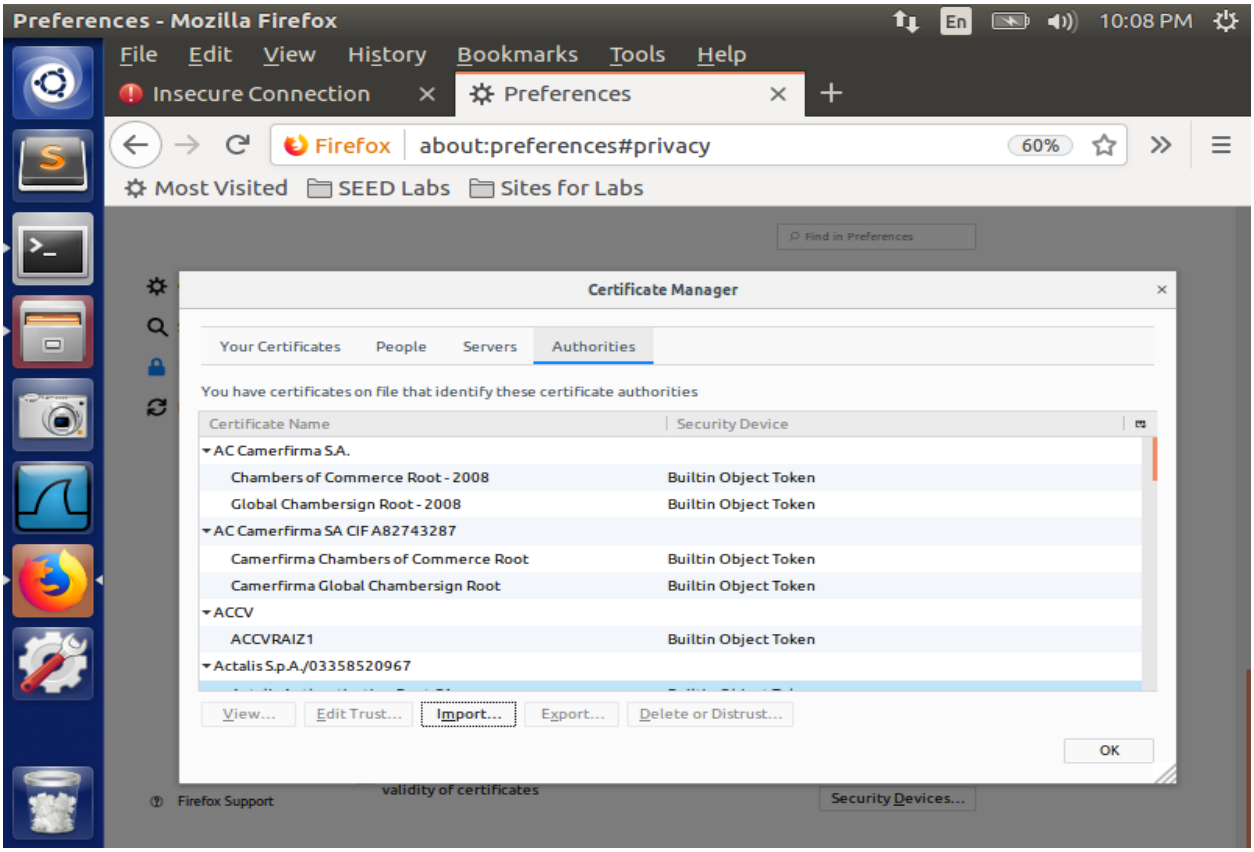


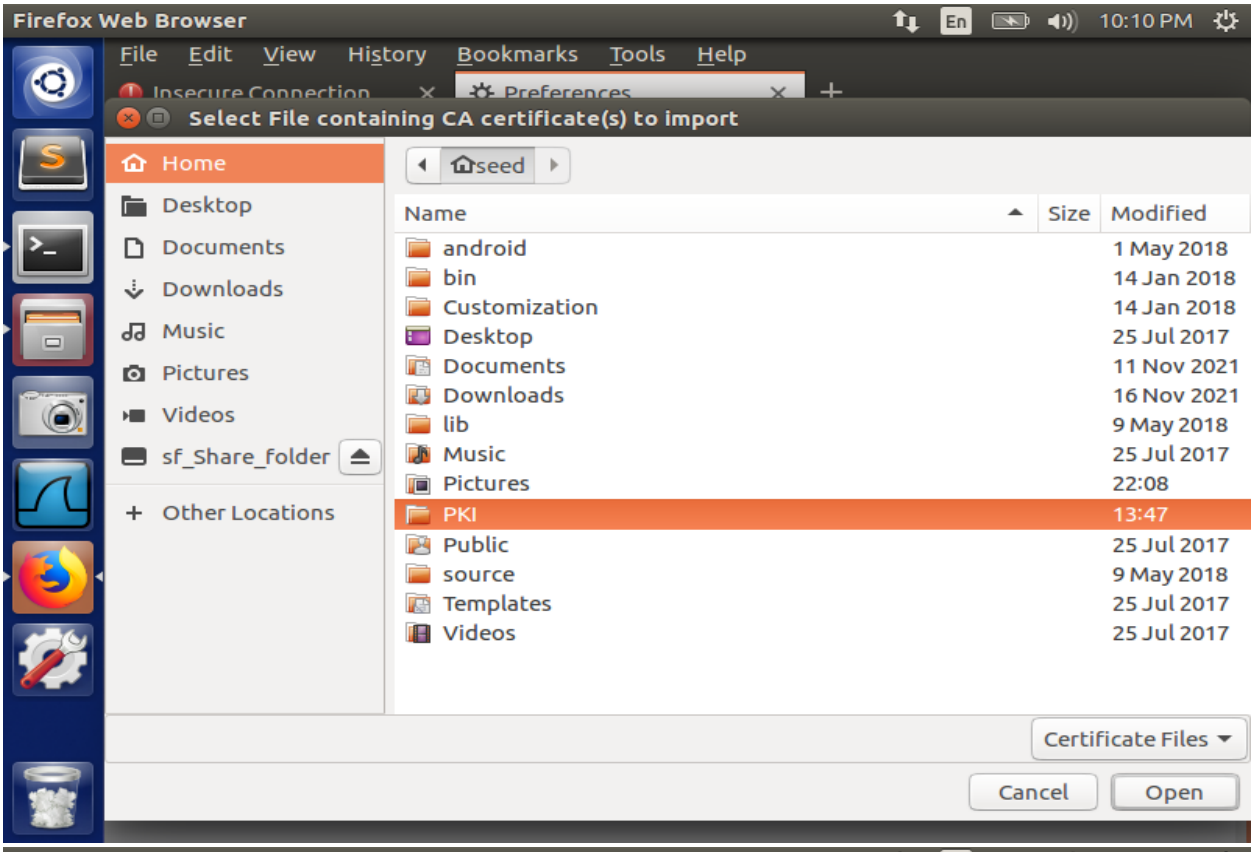


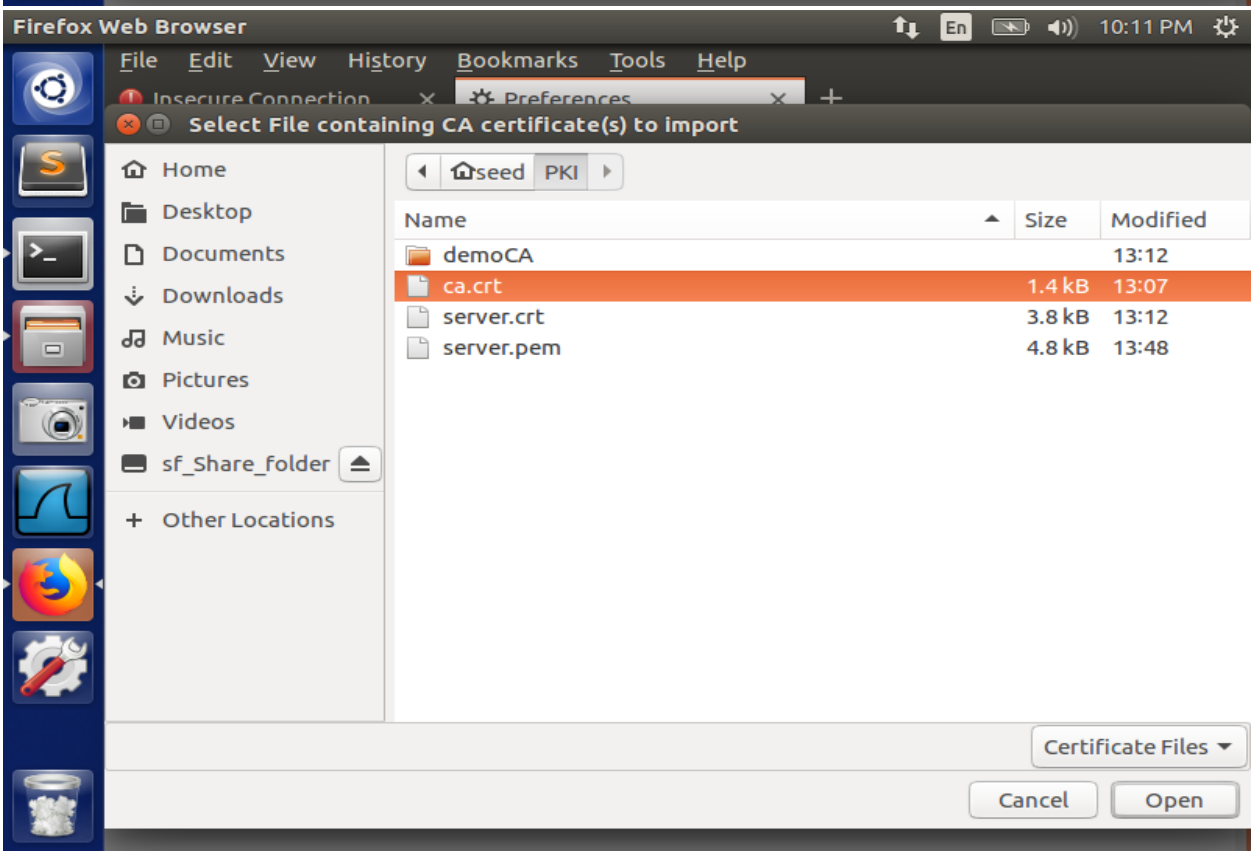


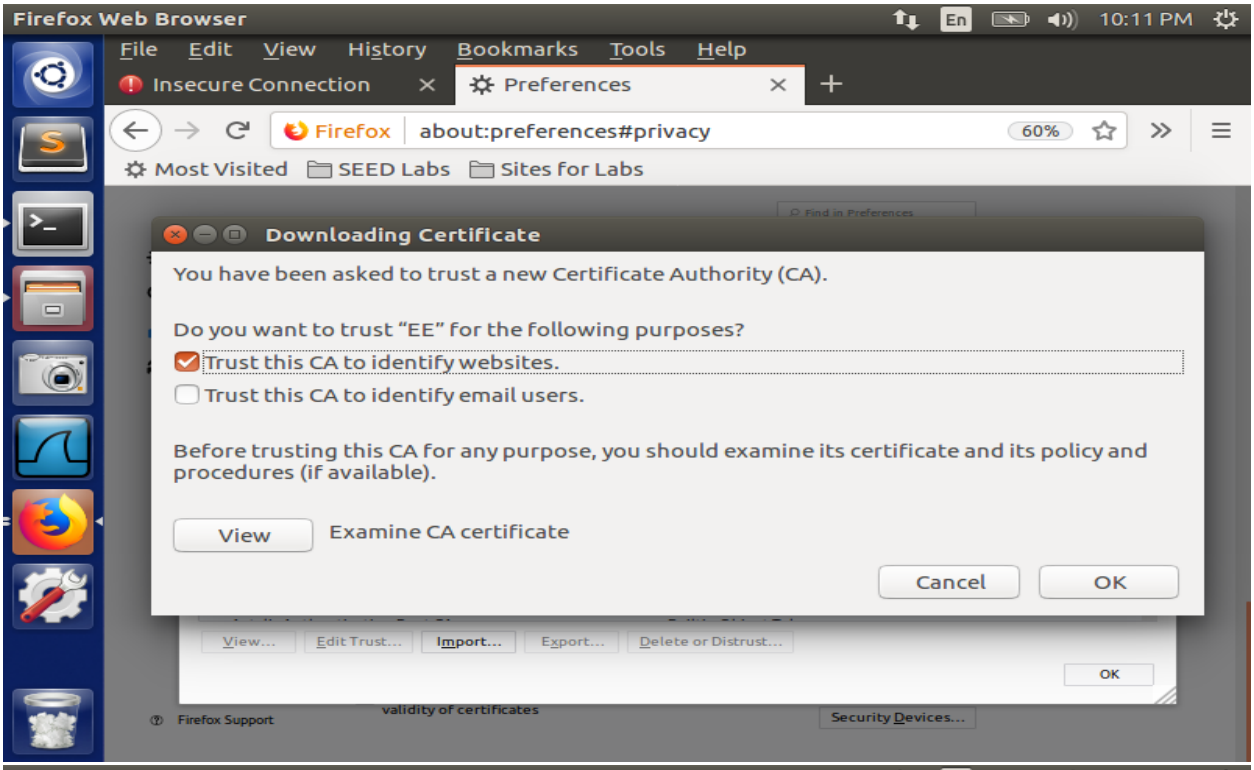

```
[01/01/22]seed@VM:~/PKI$ sudo vi /etc/hosts
[01/01/22]seed@VM:~/PKI$ sudo vi /etc/hosts
[01/01/22]seed@VM:~/PKI$ sudo vi /etc/hosts
[01/01/22]seed@VM:~/PKI$ cp server.key server.pem
[01/01/22]seed@VM:~/PKI$ cat server.crt >> server.pem
[01/01/22]seed@VM:~/PKI$ openssl s_server -cert server.
pem -www
Enter pass phrase for server.pem:
Using default temp DH parameters
ACCEPT
ACCEPT
ACCEPT
ACCEPT
```

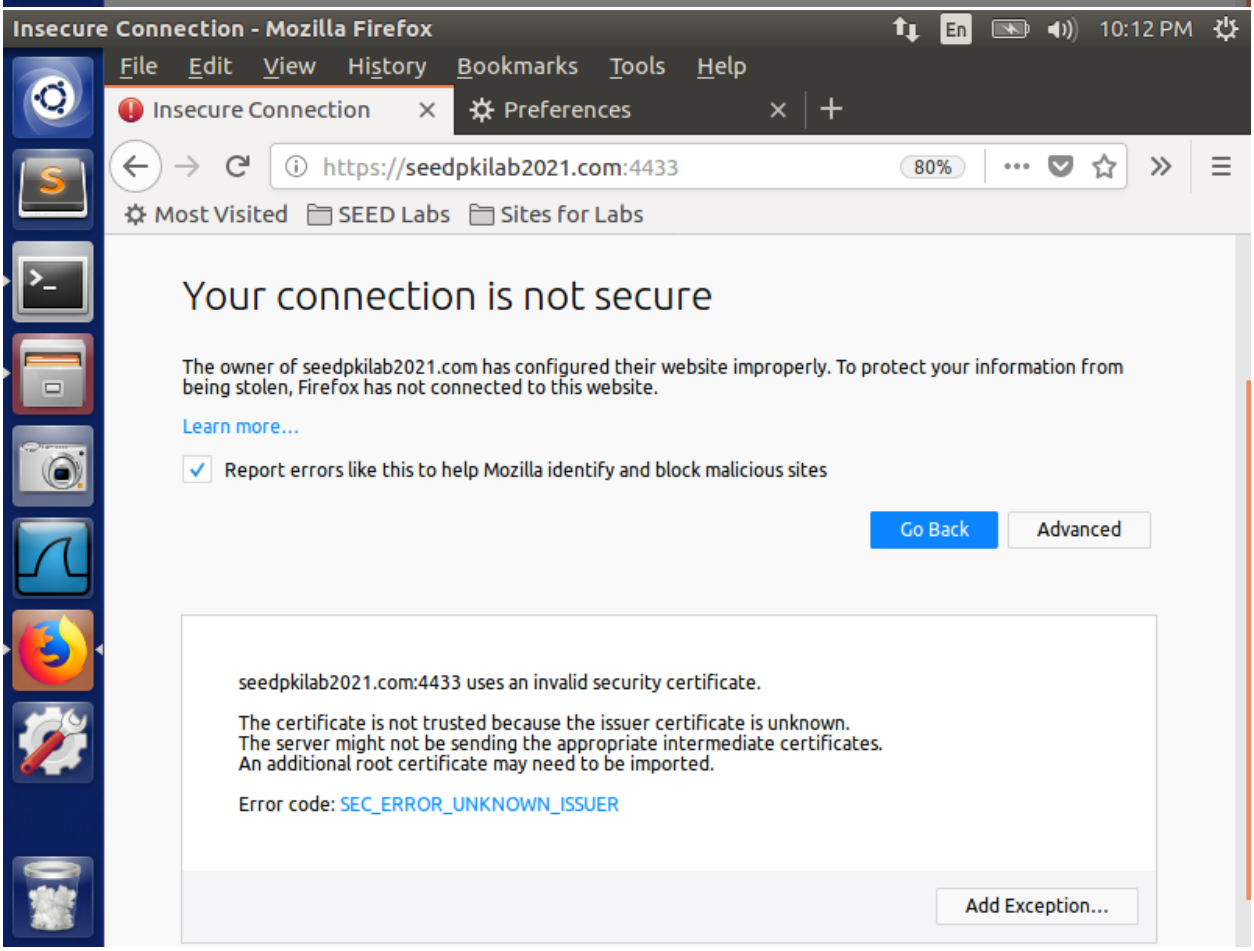

Preferences - Mozilla Firefox
10:08 PM
File Edit View History Bookmarks Tools Help
Insecure Connection
Preferences
Firefox about:preferences#privacy
60%
Most Visited SEED Labs Sites for Labs
Find in Preferences
General
Search
Privacy & Security
Firefox Account
Improve Firefox for everyone. We always ask permission before receiving personal information.
Privacy Notice
Allow Firefox to send technical and interaction data to Mozilla Learn more
Allow Firefox to install and run studies View Firefox Studies
Allow Firefox to send backlogged crash reports on your behalf Learn more
Security
Deceptive Content and Dangerous Software Protection
Block dangerous and deceptive content Learn more
Block dangerous downloads
Warn you about unwanted and uncommon software
Certificates
When a server requests your personal certificate
Select one automatically
Ask you every time
Query OCSP responder servers to confirm the current validity of certificates
View Certificates...
Security Devices...
Firefox Support

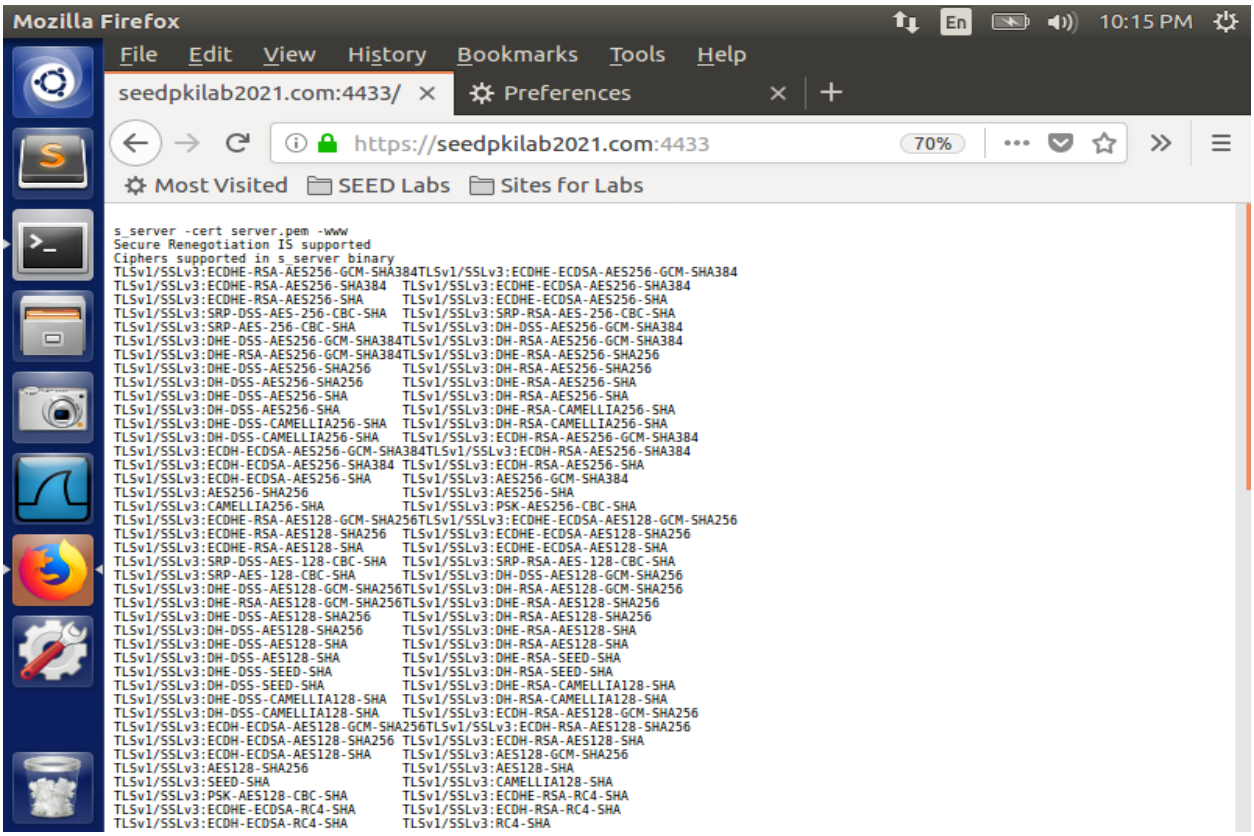

Preferences - Mozilla Firefox
10:08 PM
File Edit View History Bookmarks Tools Help
Insecure Connection
Preferences
Firefox about:preferences#privacy
60%
Most Visited SEED Labs Sites for Labs
Find in Preferences
Certificate Manager
Your Certificates People Servers Authorities
You have certificates on file that identify these certificate authorities
Certificate Name
Security Device
AC Camerfirma S.A.
Chambers of Commerce Root - 2008 Builtin Object Token
Global Chambersign Root - 2008 Builtin Object Token
AC Camerfirma SA CIF A82743287
Camerfirma Chambers of Commerce Root Builtin Object Token
Camerfirma Global Chambersign Root Builtin Object Token
ACCV
ACCVRAIZ1 Builtin Object Token
Actalis S.p.A./03358520967
View... Edit Trust... Import... Export... Delete or Distrust...
OK
validity of certificates
Security Devices...
Firefox Support

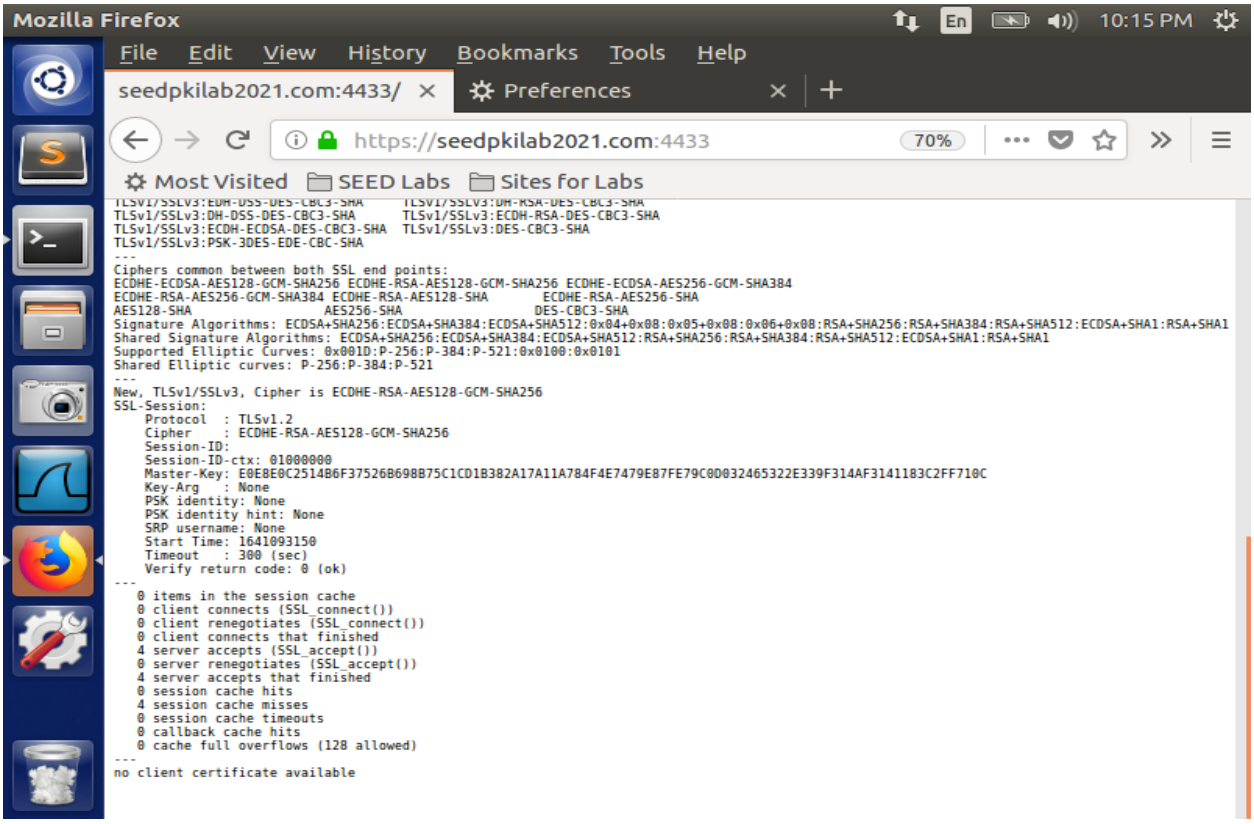

Firefox Web Browser
En
10:10 PM
File Edit View History Bookmarks Tools Help
Insecure Connection
Preferences
Select File containing CA certificate(s) to import
Home
Desktop
Documents
Downloads
Music
Pictures
Videos
sf_Share_folder
Other Locations
seed
Name
Size
Modified
android 1 May 2018
bin 14 Jan 2018
Customization 14 Jan 2018
Desktop 25 Jul 2017
Documents 11 Nov 2021
Downloads 16 Nov 2021
lib 9 May 2018
Music 25 Jul 2017
Pictures 22:08
PKI 13:47
Public 25 Jul 2017
source 9 May 2018
Templates 25 Jul 2017
Videos 25 Jul 2017
Certificate Files
Cancel
Open


Firefox Web Browser
En
10:11 PM
File Edit View History Bookmarks Tools Help
Insecure Connection
Preferences
Select File containing CA certificate(s) to import
Home
Desktop
Documents
Downloads
Music
Pictures
Videos
sf_Share_folder
Other Locations
seed
PKI
Name
Size
Modified
demoCA 13:12
ca.crt 1.4 kB 13:07
server.crt 3.8 kB 13:12
server.pem 4.8 kB 13:48
Certificate Files
Cancel
Open


Firefox Web Browser
10:11 PM
File Edit View History Bookmarks Tools Help
Insecure Connection
Preferences
Firefox about:preferences#privacy
60%
Most Visited SEED Labs Sites for Labs
Downloading Certificate
You have been asked to trust a new Certificate Authority (CA).
Do you want to trust "EE" for the following purposes?
Trust this CA to identify websites.
Trust this CA to identify email users.
Before trusting this CA for any purpose, you should examine its certificate and its policy and procedures (if available).
View
Examine CA certificate
Cancel
OK
View... Edit Trust... Import... Export... Delete or Distrust...
OK
Firefox Support
validity of certificates
Security Devices...

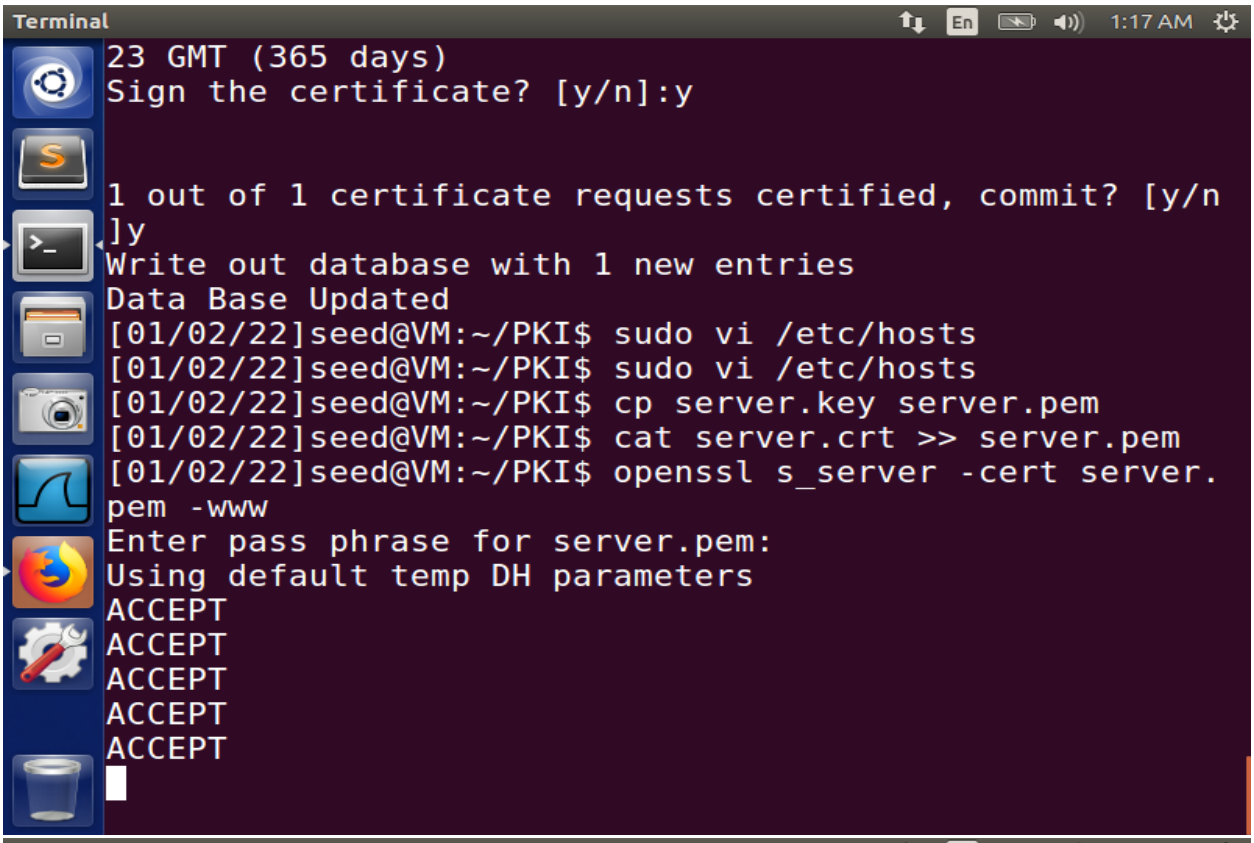

Insecure Connection - Mozilla Firefox
10:12 PM
File Edit View History Bookmarks Tools Help
Insecure Connection
Preferences
https://seedpkilab2021.com:4433
80%
Most Visited SEED Labs Sites for Labs
Your connection is not secure
The owner of seedpkilab2021.com has configured their website improperly. To protect your information from being stolen, Firefox has not connected to this website.
Learn more...
Report errors like this to help Mozilla identify and block malicious sites
Go Back
Advanced
seedpkilab2021.com:4433 uses an invalid security certificate.
The certificate is not trusted because the issuer certificate is unknown.
The server might not be sending the appropriate intermediate certificates.
An additional root certificate may need to be imported.
Error code: SEC_ERROR_UNKNOWN_ISSUER
Add Exception...

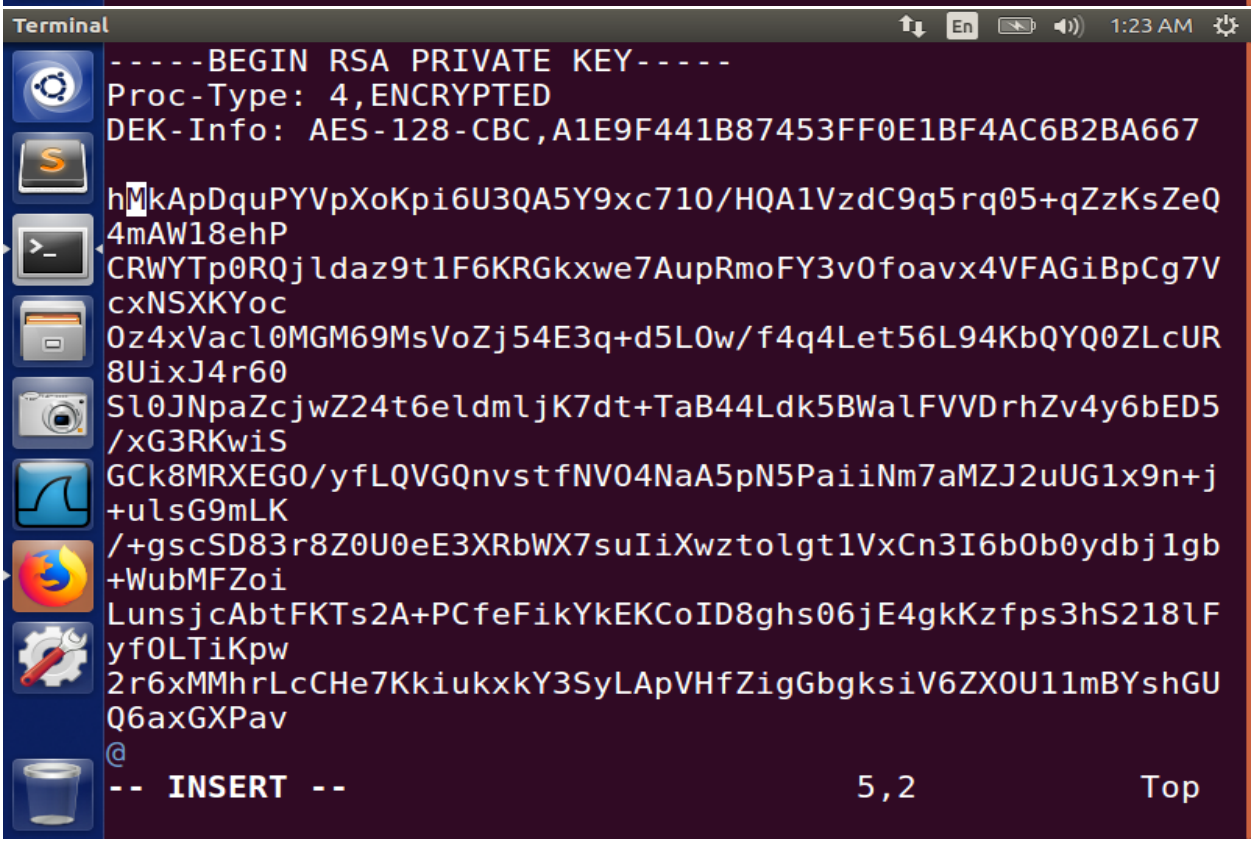

Mozilla Firefox
10:15 PM
File Edit View History Bookmarks Tools Help
seedpkilab2021.com:4433/
Preferences
https://seedpkilab2021.com:4433
70%
Most Visited
SEED Labs
Sites for Labs
s_server -cert server.pem -www
Secure Renegotiation IS supported
Ciphers supported in s_server binary
TLSv1/SSLv3:ECDHE-RSA-AES256-GCM-SHA384TLSv1/SSLv3:ECDHE-ECDSA-AES256-GCM-SHA384
TLSv1/SSLv3:ECDHE-RSA-AES256-SHA384 TLSv1/SSLv3:ECDHE-ECDSA-AES256-SHA384
TLSv1/SSLv3:ECDHE-RSA-AES256-SHA TLSv1/SSLv3:ECDHE-ECDSA-AES256-SHA
TLSv1/SSLv3:SRP-DSS-AES-256-CBC-SHA TLSv1/SSLv3:SRP-RSA-AES-256-CBC-SHA
TLSv1/SSLv3:SRP-AES-256-CBC-SHA TLSv1/SSLv3:DH-DSS-AES256-GCM-SHA384
TLSv1/SSLv3:DHE-DSS-AES256-GCM-SHA384TLSv1/SSLv3:DH-RSA-AES256-GCM-SHA384
TLSv1/SSLv3:DHE-RSA-AES256-GCM-SHA384TLSv1/SSLv3:DHE-RSA-AES256-SHA256
TLSv1/SSLv3:DHE-DSS-AES256-SHA256 TLSv1/SSLv3:DH-RSA-AES256-SHA256
TLSv1/SSLv3:DH-DSS-AES256-SHA256 TLSv1/SSLv3:DHE-RSA-AES256-SHA
TLSv1/SSLv3:DHE-DSS-AES256-SHA TLSv1/SSLv3:DH-RSA-AES256-SHA
TLSv1/SSLv3:DH-DSS-AES256-SHA TLSv1/SSLv3:DHE-RSA-CAMELLIA256-SHA
TLSv1/SSLv3:DHE-DSS-CAMELLIA256-SHA TLSv1/SSLv3:DH-RSA-CAMELLIA256-SHA
TLSv1/SSLv3:DH-DSS-CAMELLIA256-SHA TLSv1/SSLv3:ECDH-RSA-AES256-GCM-SHA384
TLSv1/SSLv3:ECDH-ECDSA-AES256-GCM-SHA384TLSv1/SSLv3:ECDH-RSA-AES256-SHA384
TLSv1/SSLv3:ECDH-ECDSA-AES256-SHA384 TLSv1/SSLv3:ECDH-RSA-AES256-SHA
TLSv1/SSLv3:ECDH-ECDSA-AES256-SHA TLSv1/SSLv3:AES256-GCM-SHA384
TLSv1/SSLv3:AES256-SHA256 TLSv1/SSLv3:AES256-SHA
TLSv1/SSLv3:CAMELLIA256-SHA TLSv1/SSLv3:PSK-AES256-CBC-SHA
TLSv1/SSLv3:ECDHE-RSA-AES128-GCM-SHA256TLSv1/SSLv3:ECDHE-ECDSA-AES128-GCM-SHA256
TLSv1/SSLv3:ECDHE-RSA-AES128-SHA256 TLSv1/SSLv3:ECDHE-ECDSA-AES128-SHA256
TLSv1/SSLv3:ECDHE-RSA-AES128-SHA TLSv1/SSLv3:ECDHE-ECDSA-AES128-SHA
TLSv1/SSLv3:SRP-DSS-AES-128-CBC-SHA TLSv1/SSLv3:SRP-RSA-AES-128-CBC-SHA
TLSv1/SSLv3:SRP-AES-128-CBC-SHA TLSv1/SSLv3:DH-DSS-AES128-GCM-SHA256
TLSv1/SSLv3:DHE-DSS-AES128-GCM-SHA256TLSv1/SSLv3:DH-RSA-AES128-GCM-SHA256
TLSv1/SSLv3:DHE-RSA-AES128-GCM-SHA256TLSv1/SSLv3:DHE-RSA-AES128-SHA256
TLSv1/SSLv3:DHE-DSS-AES128-SHA256 TLSv1/SSLv3:DH-RSA-AES128-SHA256
TLSv1/SSLv3:DH-DSS-AES128-SHA256 TLSv1/SSLv3:DHE-RSA-AES128-SHA
TLSv1/SSLv3:DHE-DSS-AES128-SHA TLSv1/SSLv3:DH-RSA-AES128-SHA
TLSv1/SSLv3:DH-DSS-AES128-SHA TLSv1/SSLv3:DHE-RSA-SEED-SHA
TLSv1/SSLv3:DHE-DSS-SEED-SHA TLSv1/SSLv3:DH-RSA-SEED-SHA
TLSv1/SSLv3:DH-DSS-SEED-SHA TLSv1/SSLv3:DHE-RSA-CAMELLIA128-SHA
TLSv1/SSLv3:DHE-DSS-CAMELLIA128-SHA TLSv1/SSLv3:DH-RSA-CAMELLIA128-SHA
TLSv1/SSLv3:DH-DSS-CAMELLIA128-SHA TLSv1/SSLv3:ECDH-RSA-AES128-GCM-SHA256
TLSv1/SSLv3:ECDH-ECDSA-AES128-GCM-SHA256TLSv1/SSLv3:ECDH-RSA-AES128-SHA256
TLSv1/SSLv3:ECDH-ECDSA-AES128-SHA256 TLSv1/SSLv3:ECDH-RSA-AES128-SHA
TLSv1/SSLv3:ECDH-ECDSA-AES128-SHA TLSv1/SSLv3:AES128-GCM-SHA256
TLSv1/SSLv3:AES128-SHA256 TLSv1/SSLv3:AES128-SHA
TLSv1/SSLv3:SEED-SHA TLSv1/SSLv3:CAMELLIA128-SHA
TLSv1/SSLv3:PSK-AES128-CBC-SHA TLSv1/SSLv3:ECDHE-RSA-RC4-SHA
TLSv1/SSLv3:ECDHE-ECDSA-RC4-SHA TLSv1/SSLv3:ECDH-RSA-RC4-SHA
TLSv1/SSLv3:ECDH-ECDSA-RC4-SHA TLSv1/SSLv3:RC4-SHA

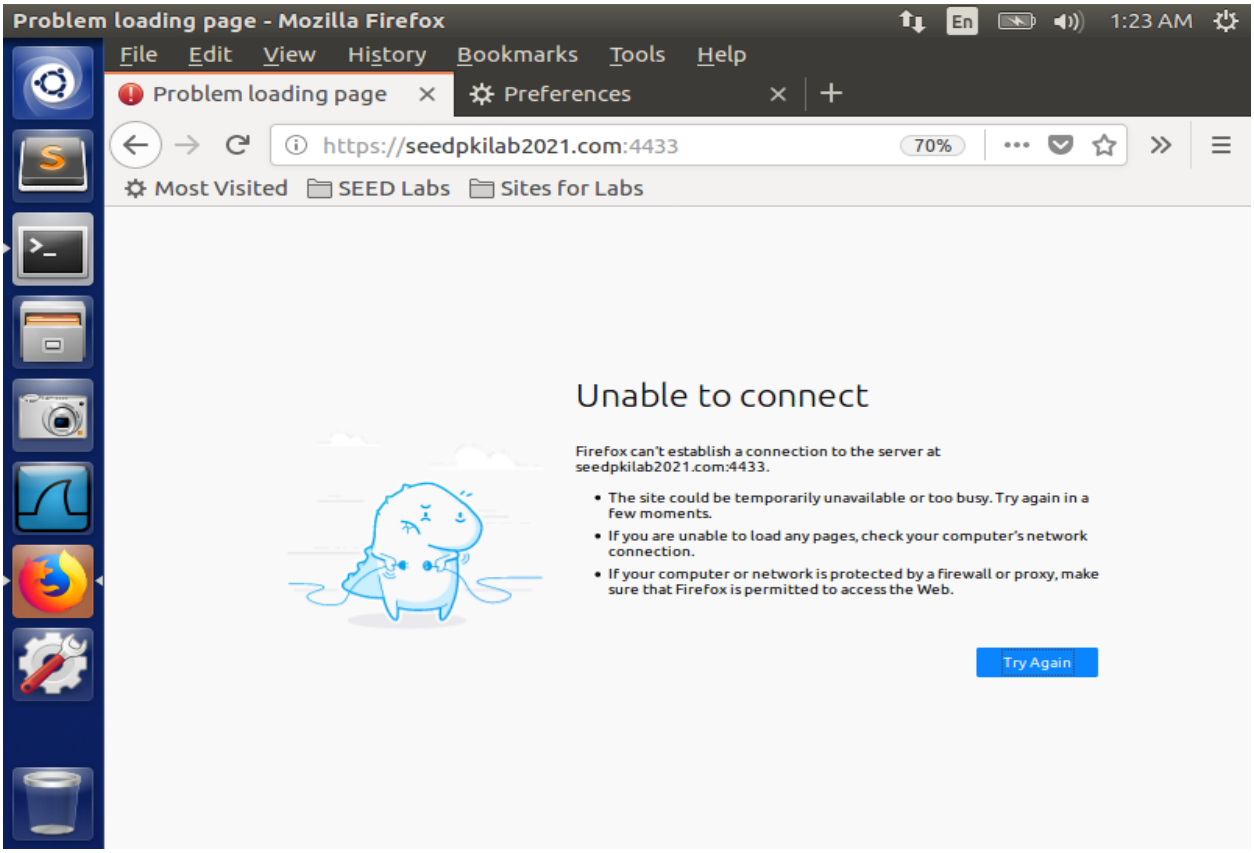

Mozilla Firefox
10:15 PM
File Edit View History Bookmarks Tools Help
seedpkilab2021.com:4433/
Preferences
https://seedpkilab2021.com:4433
70%
Most Visited
SEED Labs
Sites for Labs
TLSv1/SSLv3:DH-DSS-DES-CBC3-SHA TLSv1/SSLv3:ECDH-RSA-DES-CBC3-SHA
TLSv1/SSLv3:ECDH-ECDSA-DES-CBC3-SHA TLSv1/SSLv3:DES-CBC3-SHA
TLSv1/SSLv3:PSK-3DES-EDE-CBC-SHA

Ciphers common between both SSL end points:
ECDHE-ECDSA-AES128-GCM-SHA256 ECDHE-RSA-AES128-GCM-SHA256 ECDHE-ECDSA-AES256-GCM-SHA384
ECDHE-RSA-AES256-GCM-SHA384 ECDHE-RSA-AES128-SHA ECDHE-RSA-AES256-SHA
AES128-SHA AES256-SHA DES-CBC3-SHA
Signature Algorithms: ECDSA+SHA256:ECDSA+SHA384:ECDSA+SHA512:0x04+0x08:0x05+0x08:0x06+0x08:RSA+SHA256:RSA+SHA384:RSA+SHA512:ECDSA+SHA1:RSA+SHA1
Shared Signature Algorithms: ECDSA+SHA256:ECDSA+SHA384:ECDSA+SHA512:RSA+SHA256:RSA+SHA384:RSA+SHA512:ECDSA+SHA1:RSA+SHA1
Supported Elliptic Curves: 0x001D:P-256:P-384:P-521:0x0100:0x0101
Shared Elliptic curves: P-256:P-384:P-521

New, TLSv1/SSLv3, Cipher is ECDHE-RSA-AES128-GCM-SHA256
SSL-Session:
Protocol : TLSv1.2
Cipher : ECDHE-RSA-AES128-GCM-SHA256
Session-ID:
Session-ID-ctx: 01000000
Master-Key: E0E8E0C2514B6F37526B698B75C1CD1B382A17A11A784F4E7479E87FE79C0D032465322E339F314AF3141183C2FF710C
Key-Arg : None
PSK identity: None
PSK identity hint: None
SRP username: None
Start Time: 1641093150
Timeout : 300 (sec)
Verify return code: 0 (ok)
---
0 items in the session cache
0 client connects (SSL_connect())
0 client renegotiates (SSL_connect())
0 client connects that finished
4 server accepts (SSL_accept())
0 server renegotiates (SSL_accept())
4 server accepts that finished
0 session cache hits
4 session cache misses
0 session cache timeouts
0 callback cache hits
0 cache full overflows (128 allowed)
---
no client certificate available

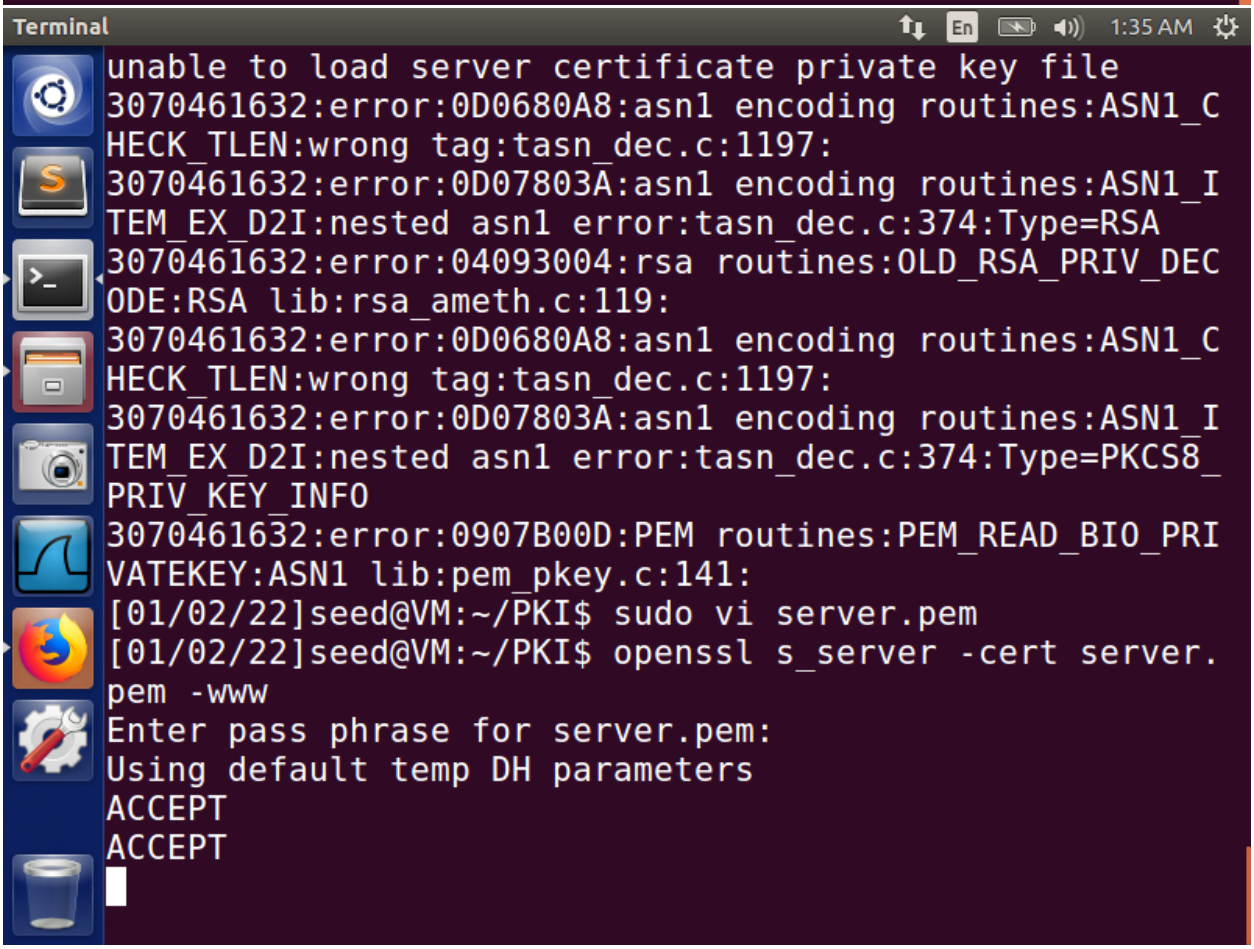

Terminal
En
1:17 AM
23 GMT (365 days)
Sign the certificate? [y/n]:y
1 out of 1 certificate requests certified, commit? [y/n
]y
Write out database with 1 new entries
Data Base Updated
[01/02/22]seed@VM:~/PKI$ sudo vi /etc/hosts
[01/02/22]seed@VM:~/PKI$ sudo vi /etc/hosts
[01/02/22]seed@VM:~/PKI$ cp server.key server.pem
[01/02/22]seed@VM:~/PKI$ cat server.crt >> server.pem
[01/02/22]seed@VM:~/PKI$ openssl s_server -cert server.
pem -www
Enter pass phrase for server.pem:
Using default temp DH parameters
ACCEPT
ACCEPT
ACCEPT
ACCEPT
ACCEPT

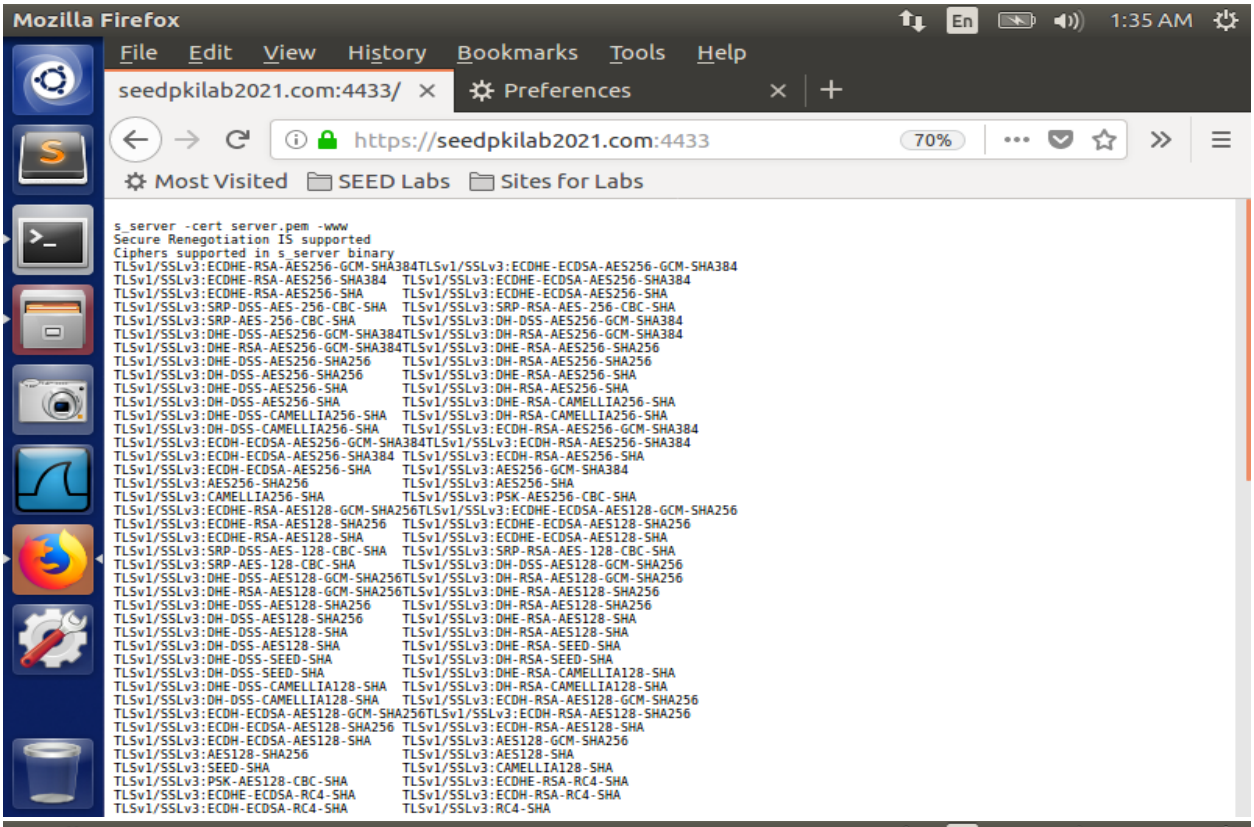

Terminal
En
1:23 AM
-----BEGIN RSA PRIVATE KEY-----
Proc-Type: 4,ENCRYPTED
DEK-Info: AES-128-CBC,A1E9F441B87453FF0E1BF4AC6B2BA667
hMkApDquPYVpXoKpi6U3QA5Y9xc71O/HQA1VzdC9q5rq05+qZzKsZeQ
4mAW18ehP
CRWYTp0RQjldaz9t1F6KRGkxwe7AupRmoFY3vOfoavx4VFAGiBpCg7V
cxNSXKYoc
Oz4xVacl0MGM69MsVoZj54E3q+d5LOw/f4q4Let56L94KbQYQ0ZLcUR
8UixJ4r60
Sl0JNpaZcjwZ24t6eldmljK7dt+TaB44Ldk5BWalFVVDrhZv4y6bED5
/xG3RKwiS
GCk8MRXEGO/yfLQVGQnvstfNVO4NaA5pN5PaiiNm7aMZJ2uUG1x9n+j
+ulsG9mLK
/+gscSD83r8Z0U0eE3XRbWX7suIiXwztolgt1VxCn3I6bOb0ydbj1gb
+WubMFZoi
LunsjcAbtFKTs2A+PCfeFikYkEKCoID8ghs06jE4gkKzfps3hS218lF
yfOLTiKpw
2r6xMMhrLcCHe7KkiukxkY3SyLApVHfZigGbgksiV6ZXOU11mBYshGU
Q6axGXPav
@
-- INSERT --
5,2
Top

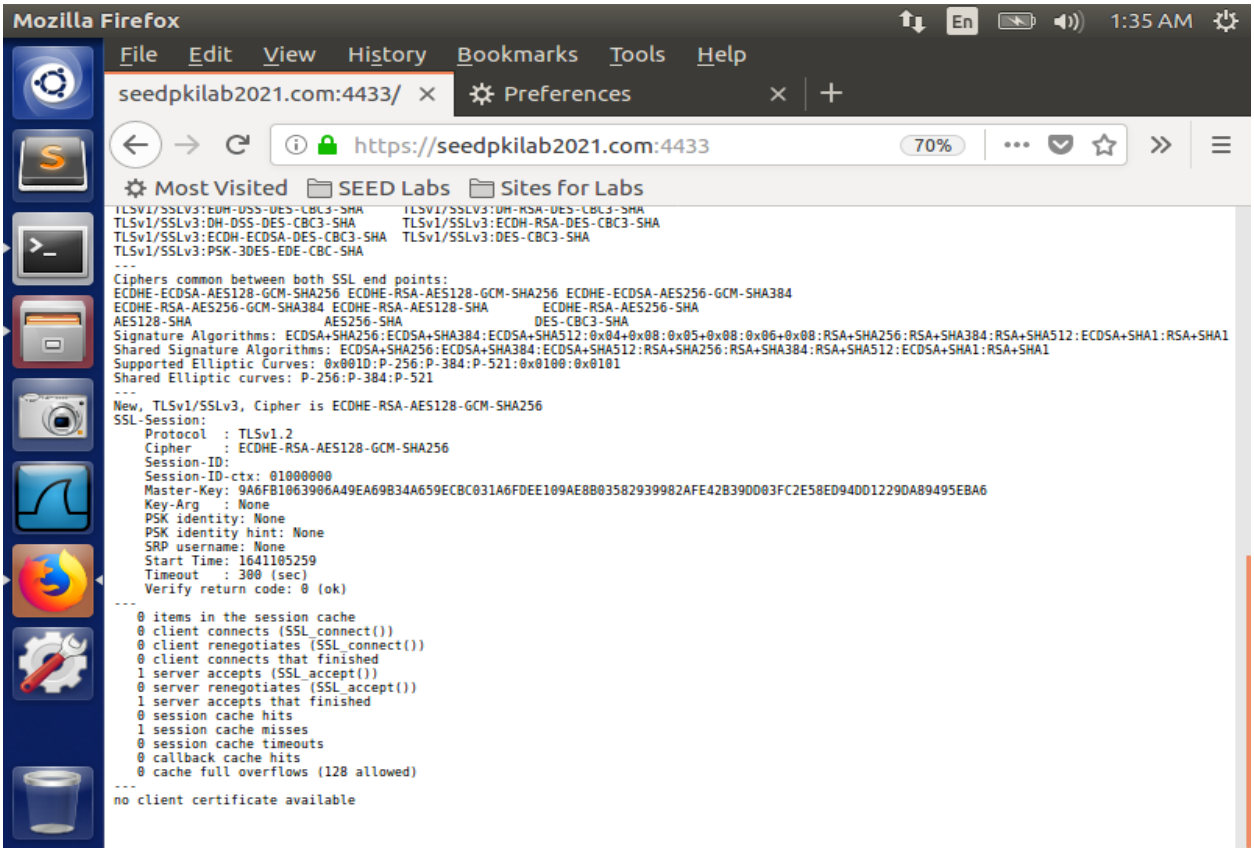



```
[01/02/22]seed@VM:~/PKI$ openssl s_server -cert server.
pem -www
Enter pass phrase for server.pem:
unable to load server certificate private key file
3070461632:error:0D0680A8:asn1 encoding routines:ASN1_C
HECK_TLEN:wrong tag:tasn_dec.c:1197:
3070461632:error:0D07803A:asn1 encoding routines:ASN1_I
TEM_EX_D2I:nested asn1 error:tasn_dec.c:374:Type=RSA
3070461632:error:04093004:rsa routines:OLD_RSA_PRIV_DEC
ODE:RSA lib:rsa_ameth.c:119:
3070461632:error:0D0680A8:asn1 encoding routines:ASN1_C
HECK_TLEN:wrong tag:tasn_dec.c:1197:
3070461632:error:0D07803A:asn1 encoding routines:ASN1_I
TEM_EX_D2I:nested asn1 error:tasn_dec.c:374:Type=PKCS8_
PRIV_KEY_INFO
3070461632:error:0907B00D:PEM routines:PEM_READ_BIO_PRI
VATEKEY:ASN1 lib:pem_pkey.c:141:
[01/02/22]seed@VM:~/PKI$
```

```
[01/02/22]seed@VM:~/PKI$ sudo vi server.pem
[01/02/22]seed@VM:~/PKI$ openssl s_server -cert server.
pem -www
Enter pass phrase for server.pem:
Using default temp DH parameters
ACCEPT
ACCEPT
```

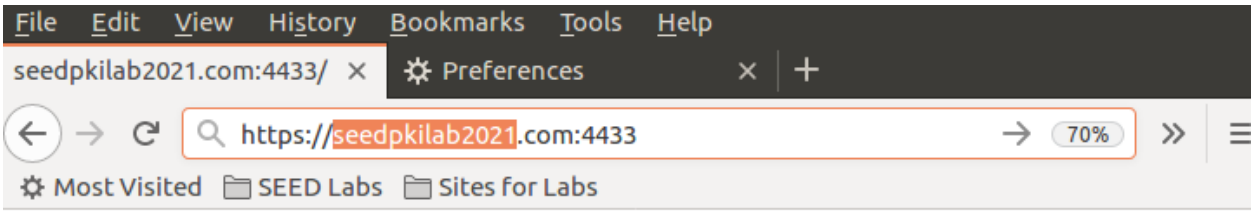


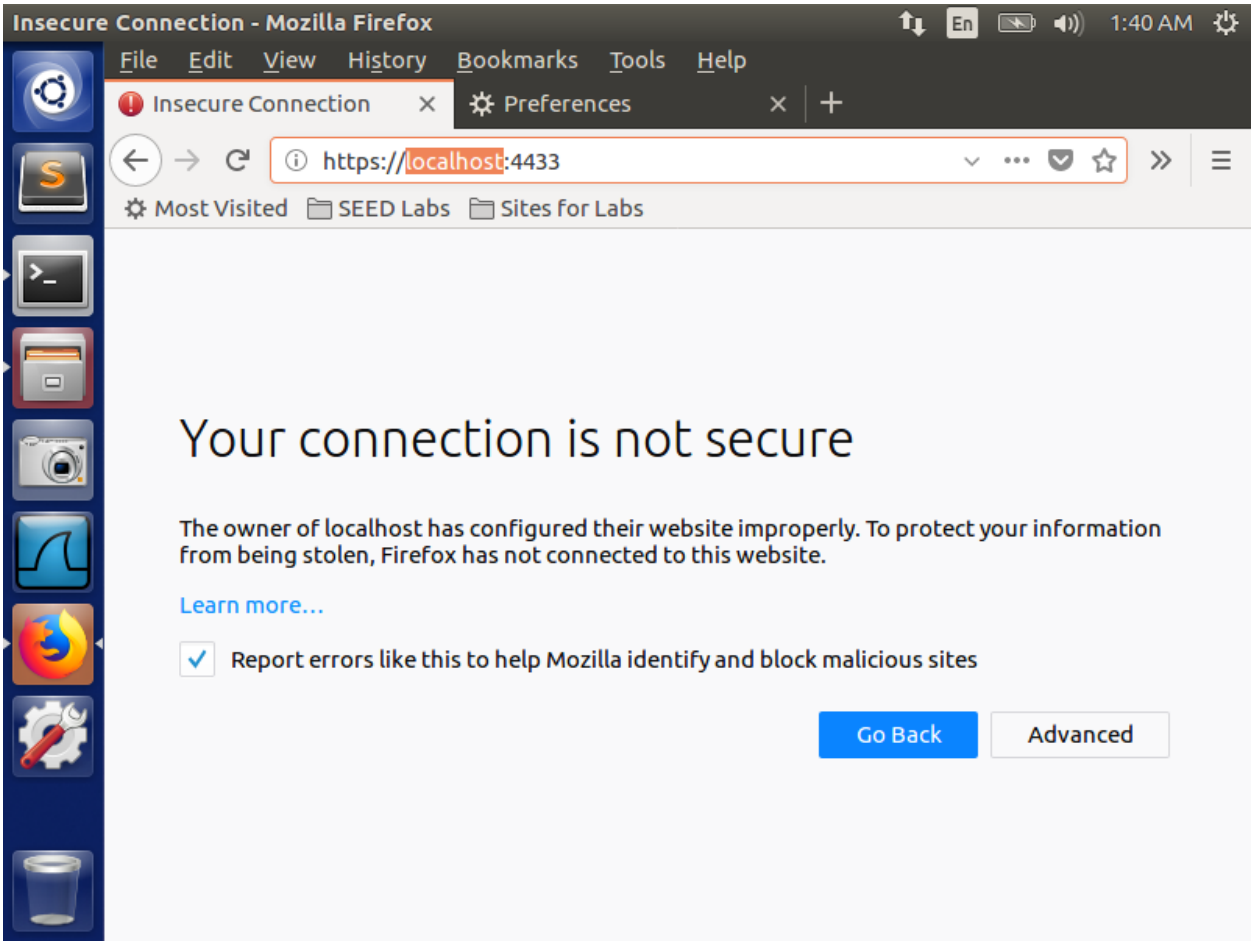

Mozilla Firefox
1:35 AM
File Edit View History Bookmarks Tools Help
seedpkilab2021.com:4433/
Preferences
https://seedpkilab2021.com:4433
70%
Most Visited
SEED Labs
Sites for Labs
s_server -cert server.pem -www
Secure Renegotiation IS supported
Ciphers supported in s_server binary
TLSv1/SSLv3:ECDHE-RSA-AES256-GCM-SHA384TLSv1/SSLv3:ECDHE-ECDSA-AES256-GCM-SHA384
TLSv1/SSLv3:ECDHE-RSA-AES256-SHA384 TLSv1/SSLv3:ECDHE-ECDSA-AES256-SHA384
TLSv1/SSLv3:ECDHE-RSA-AES256-SHA TLSv1/SSLv3:ECDHE-ECDSA-AES256-SHA
TLSv1/SSLv3:SRP-DSS-AES-256-CBC-SHA TLSv1/SSLv3:SRP-RSA-AES-256-CBC-SHA
TLSv1/SSLv3:SRP-AES-256-CBC-SHA TLSv1/SSLv3:DH-DSS-AES256-GCM-SHA384
TLSv1/SSLv3:DHE-DSS-AES256-GCM-SHA384TLSv1/SSLv3:DH-RSA-AES256-GCM-SHA384
TLSv1/SSLv3:DHE-RSA-AES256-GCM-SHA384TLSv1/SSLv3:DHE-RSA-AES256-SHA256
TLSv1/SSLv3:DHE-DSS-AES256-SHA256 TLSv1/SSLv3:DH-RSA-AES256-SHA256
TLSv1/SSLv3:DH-DSS-AES256-SHA256 TLSv1/SSLv3:DHE-RSA-AES256-SHA
TLSv1/SSLv3:DHE-DSS-AES256-SHA TLSv1/SSLv3:DH-RSA-AES256-SHA
TLSv1/SSLv3:DH-DSS-AES256-SHA TLSv1/SSLv3:DHE-RSA-CAMELLIA256-SHA
TLSv1/SSLv3:DHE-DSS-CAMELLIA256-SHA TLSv1/SSLv3:DH-RSA-CAMELLIA256-SHA
TLSv1/SSLv3:DH-DSS-CAMELLIA256-SHA TLSv1/SSLv3:ECDH-RSA-AES256-GCM-SHA384
TLSv1/SSLv3:ECDH-ECDSA-AES256-GCM-SHA384TLSv1/SSLv3:ECDH-RSA-AES256-SHA384
TLSv1/SSLv3:ECDH-ECDSA-AES256-SHA384 TLSv1/SSLv3:ECDH-RSA-AES256-SHA
TLSv1/SSLv3:ECDH-ECDSA-AES256-SHA TLSv1/SSLv3:AES256-GCM-SHA384
TLSv1/SSLv3:AES256-SHA256 TLSv1/SSLv3:AES256-SHA
TLSv1/SSLv3:CAMELLIA256-SHA TLSv1/SSLv3:PSK-AES256-CBC-SHA
TLSv1/SSLv3:ECDHE-RSA-AES128-GCM-SHA256TLSv1/SSLv3:ECDHE-ECDSA-AES128-GCM-SHA256
TLSv1/SSLv3:ECDHE-RSA-AES128-SHA256 TLSv1/SSLv3:ECDHE-ECDSA-AES128-SHA256
TLSv1/SSLv3:ECDHE-RSA-AES128-SHA TLSv1/SSLv3:ECDHE-ECDSA-AES128-SHA
TLSv1/SSLv3:SRP-DSS-AES-128-CBC-SHA TLSv1/SSLv3:SRP-RSA-AES-128-CBC-SHA
TLSv1/SSLv3:SRP-AES-128-CBC-SHA TLSv1/SSLv3:DH-DSS-AES128-GCM-SHA256
TLSv1/SSLv3:DHE-DSS-AES128-GCM-SHA256TLSv1/SSLv3:DH-RSA-AES128-GCM-SHA256
TLSv1/SSLv3:DHE-RSA-AES128-GCM-SHA256TLSv1/SSLv3:DHE-RSA-AES128-SHA256
TLSv1/SSLv3:DHE-DSS-AES128-SHA256 TLSv1/SSLv3:DH-RSA-AES128-SHA256
TLSv1/SSLv3:DH-DSS-AES128-SHA256 TLSv1/SSLv3:DHE-RSA-AES128-SHA
TLSv1/SSLv3:DHE-DSS-AES128-SHA TLSv1/SSLv3:DH-RSA-AES128-SHA
TLSv1/SSLv3:DH-DSS-AES128-SHA TLSv1/SSLv3:DHE-RSA-SEED-SHA
TLSv1/SSLv3:DHE-DSS-SEED-SHA TLSv1/SSLv3:DH-RSA-SEED-SHA
TLSv1/SSLv3:DH-DSS-SEED-SHA TLSv1/SSLv3:DHE-RSA-CAMELLIA128-SHA
TLSv1/SSLv3:DHE-DSS-CAMELLIA128-SHA TLSv1/SSLv3:DH-RSA-CAMELLIA128-SHA
TLSv1/SSLv3:DH-DSS-CAMELLIA128-SHA TLSv1/SSLv3:ECDH-RSA-AES128-GCM-SHA256
TLSv1/SSLv3:ECDH-ECDSA-AES128-GCM-SHA256TLSv1/SSLv3:ECDH-RSA-AES128-SHA256
TLSv1/SSLv3:ECDH-ECDSA-AES128-SHA256 TLSv1/SSLv3:ECDH-RSA-AES128-SHA
TLSv1/SSLv3:ECDH-ECDSA-AES128-SHA TLSv1/SSLv3:AES128-GCM-SHA256
TLSv1/SSLv3:AES128-SHA256 TLSv1/SSLv3:AES128-SHA
TLSv1/SSLv3:SEED-SHA TLSv1/SSLv3:CAMELLIA128-SHA
TLSv1/SSLv3:PSK-AES128-CBC-SHA TLSv1/SSLv3:ECDHE-RSA-RC4-SHA
TLSv1/SSLv3:ECDHE-ECDSA-RC4-SHA TLSv1/SSLv3:ECDH-RSA-RC4-SHA
TLSv1/SSLv3:ECDH-ECDSA-RC4-SHA TLSv1/SSLv3:RC4-SHA


Mozilla Firefox
1:35 AM
File Edit View History Bookmarks Tools Help
seedpkilab2021.com:4433/
Preferences
https://seedpkilab2021.com:4433
70%
Most Visited
SEED Labs
Sites for Labs
TLSv1/SSLv3:EDH-DSS-DES-CBC3-SHA TLSv1/SSLv3:DH-RSA-DES-CBC3-SHA
TLSv1/SSLv3:DH-DSS-DES-CBC3-SHA TLSv1/SSLv3:ECDH-RSA-DES-CBC3-SHA
TLSv1/SSLv3:ECDH-ECDSA-DES-CBC3-SHA TLSv1/SSLv3:DES-CBC3-SHA
TLSv1/SSLv3:PSK-3DES-EDE-CBC-SHA

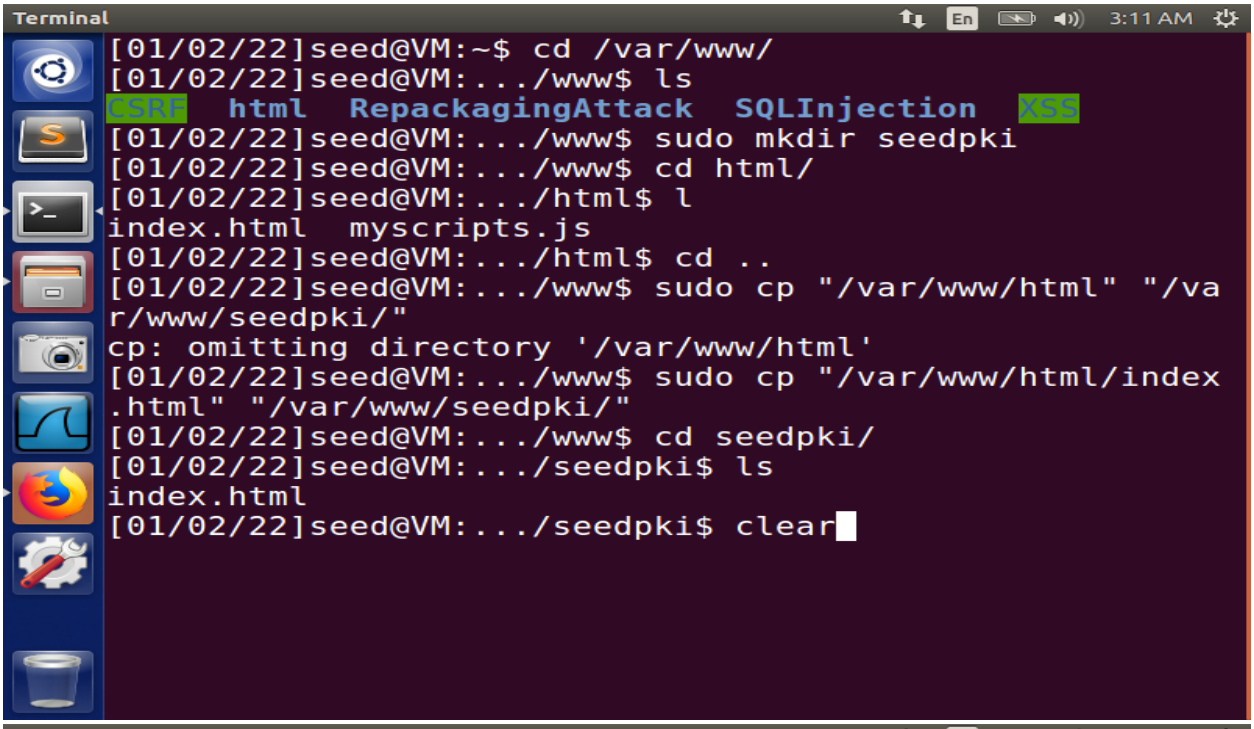
Ciphers common between both SSL end points:
ECDHE-ECDSA-AES128-GCM-SHA256 ECDHE-RSA-AES128-GCM-SHA256 ECDHE-ECDSA-AES256-GCM-SHA384
ECDHE-RSA-AES256-GCM-SHA384 ECDHE-RSA-AES128-SHA ECDHE-RSA-AES256-SHA
AES128-SHA AES256-SHA DES-CBC3-SHA
Signature Algorithms: ECDSA+SHA256:ECDSA+SHA384:ECDSA+SHA512:0x04+0x08:0x05+0x08:0x06+0x08:RSA+SHA256:RSA+SHA384:RSA+SHA512:ECDSA+SHA1:RSA+SHA1
Shared Signature Algorithms: ECDSA+SHA256:ECDSA+SHA384:ECDSA+SHA512:RSA+SHA256:RSA+SHA384:RSA+SHA512:ECDSA+SHA1:RSA+SHA1
Supported Elliptic Curves: 0x001D:P-256:P-384:P-521:0x0100:0x0101
Shared Elliptic curves: P-256:P-384:P-521

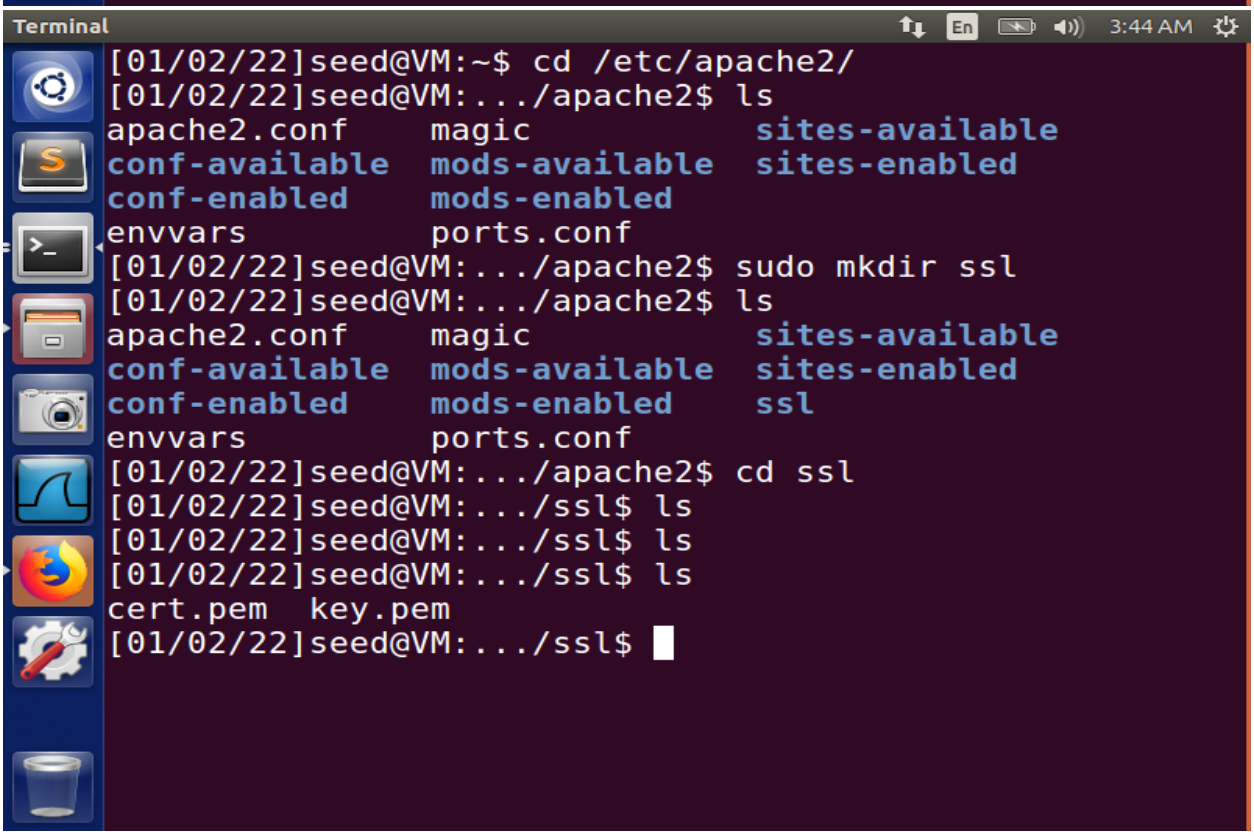
New, TLSv1/SSLv3, Cipher is ECDHE-RSA-AES128-GCM-SHA256
SSL-Session:
Protocol : TLSv1.2
Cipher : ECDHE-RSA-AES128-GCM-SHA256
Session-ID:
Session-ID-ctx: 01000000
Master-Key: 9A6FB1063906A49EA69B34A659ECBC031A6FDEE109AE8B03582939982AFE42B39DD03FC2E58ED94DD1229DA89495EBA6
Key-Arg : None
PSK identity: None
PSK identity hint: None
SRP username: None
Start Time: 1641105259
Timeout : 300 (sec)
Verify return code: 0 (ok)
---
0 items in the session cache
0 client connects (SSL_connect())
0 client renegotiates (SSL_connect())
0 client connects that finished
1 server accepts (SSL_accept())
0 server renegotiates (SSL_accept())
1 server accepts that finished
0 session cache hits
1 session cache misses
0 session cache timeouts
0 callback cache hits
0 cache full overflows (128 allowed)
---
no client certificate available

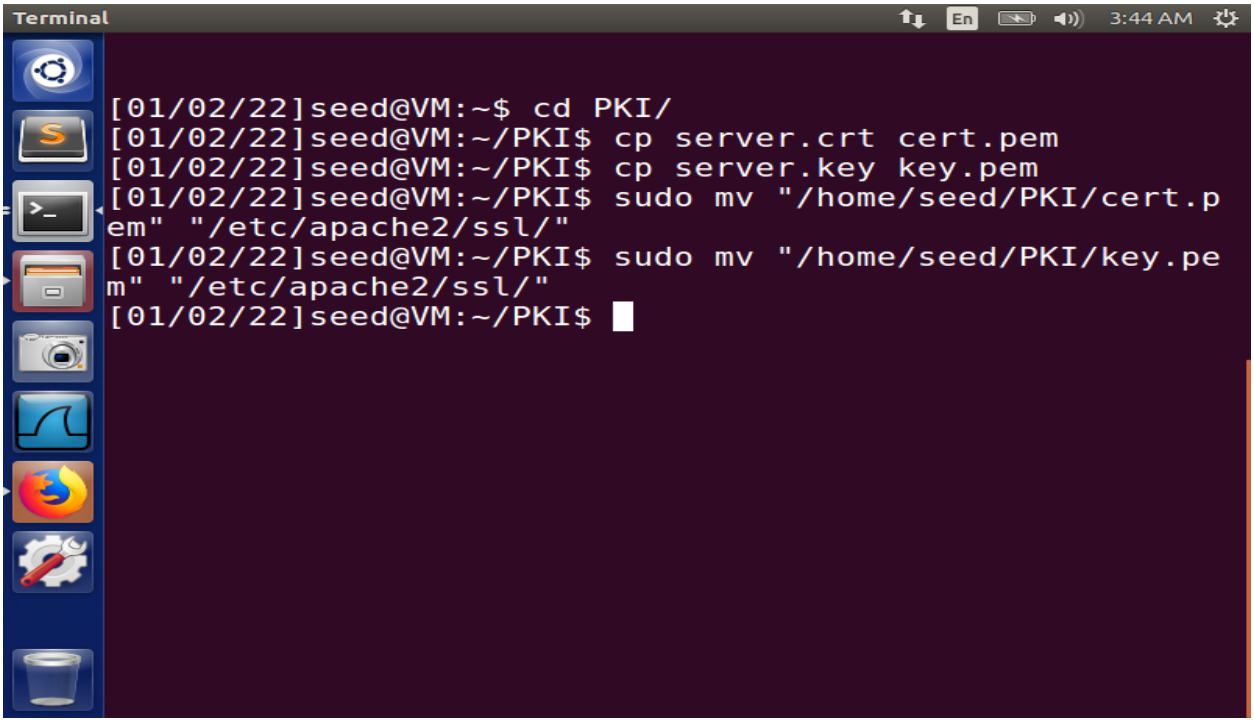

File Edit View History Bookmarks Tools Help
seedpkilab2021.com:4433/
Preferences
https://seedpkilab2021.com:4433
70%
Most Visited
SEED Labs
Sites for Labs

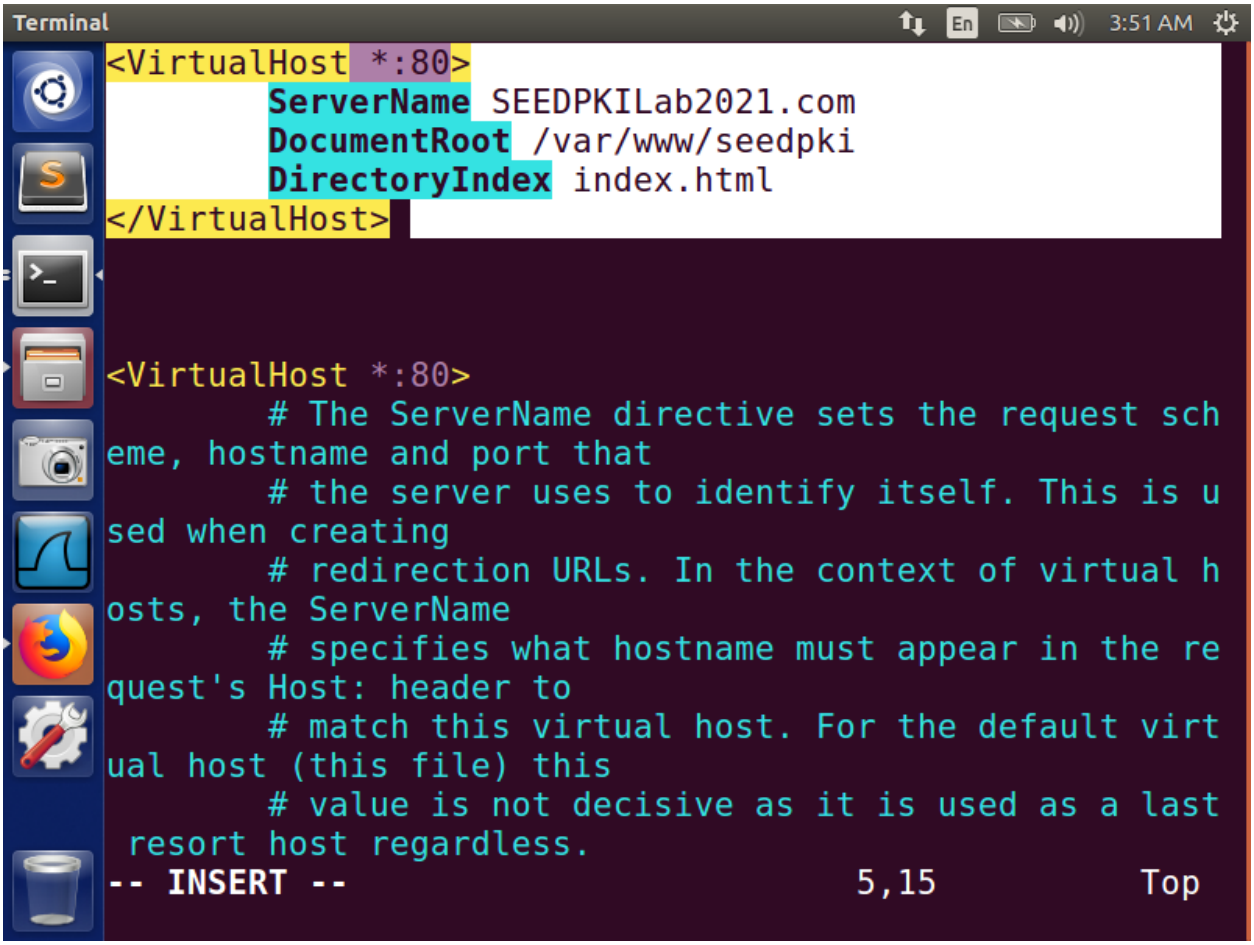

Insecure Connection - Mozilla Firefox
1:40 AM
File Edit View History Bookmarks Tools Help
Insecure Connection
Preferences
https://localhost:4433
Most Visited
SEED Labs
Sites for Labs
Your connection is not secure
The owner of localhost has configured their website improperly. To protect your information from being stolen, Firefox has not connected to this website.
Learn more...
Report errors like this to help Mozilla identify and block malicious sites
Go Back
Advanced

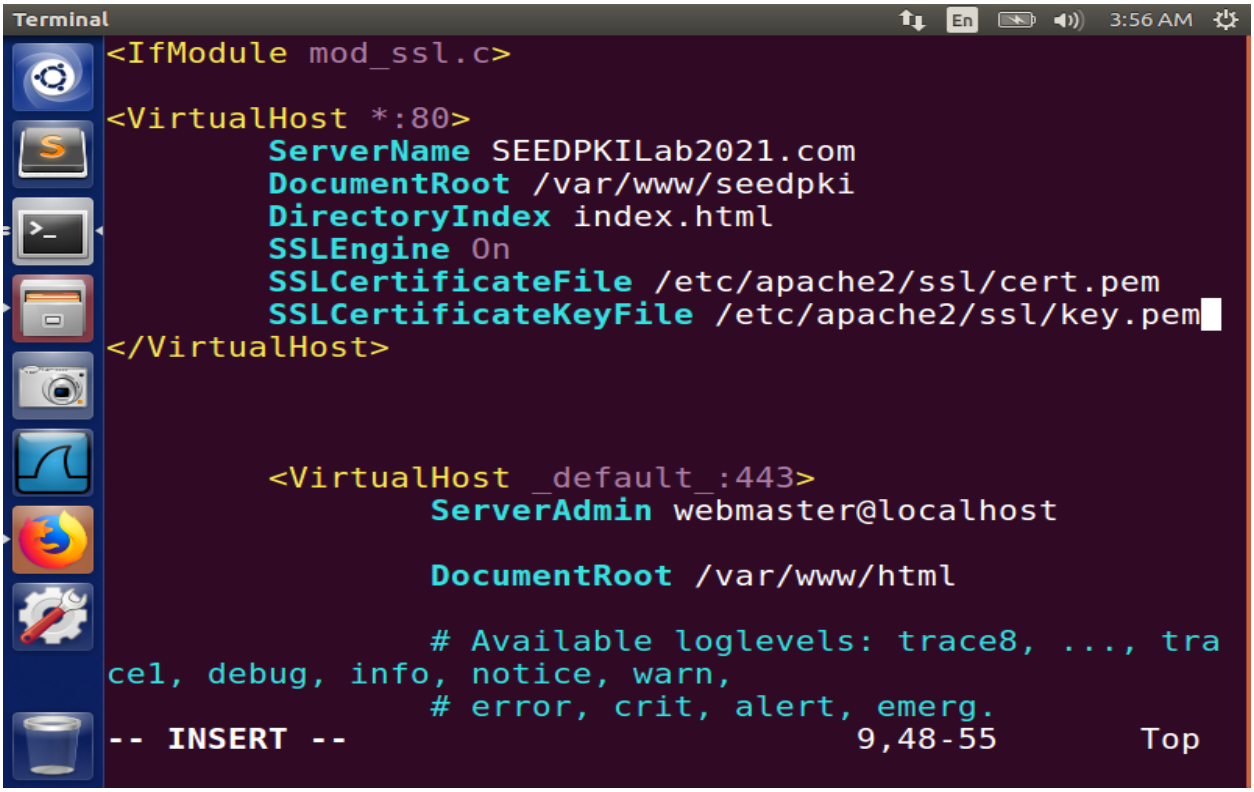
Task 4: Deploying Certificate in an Apache-Based HTTPS Website

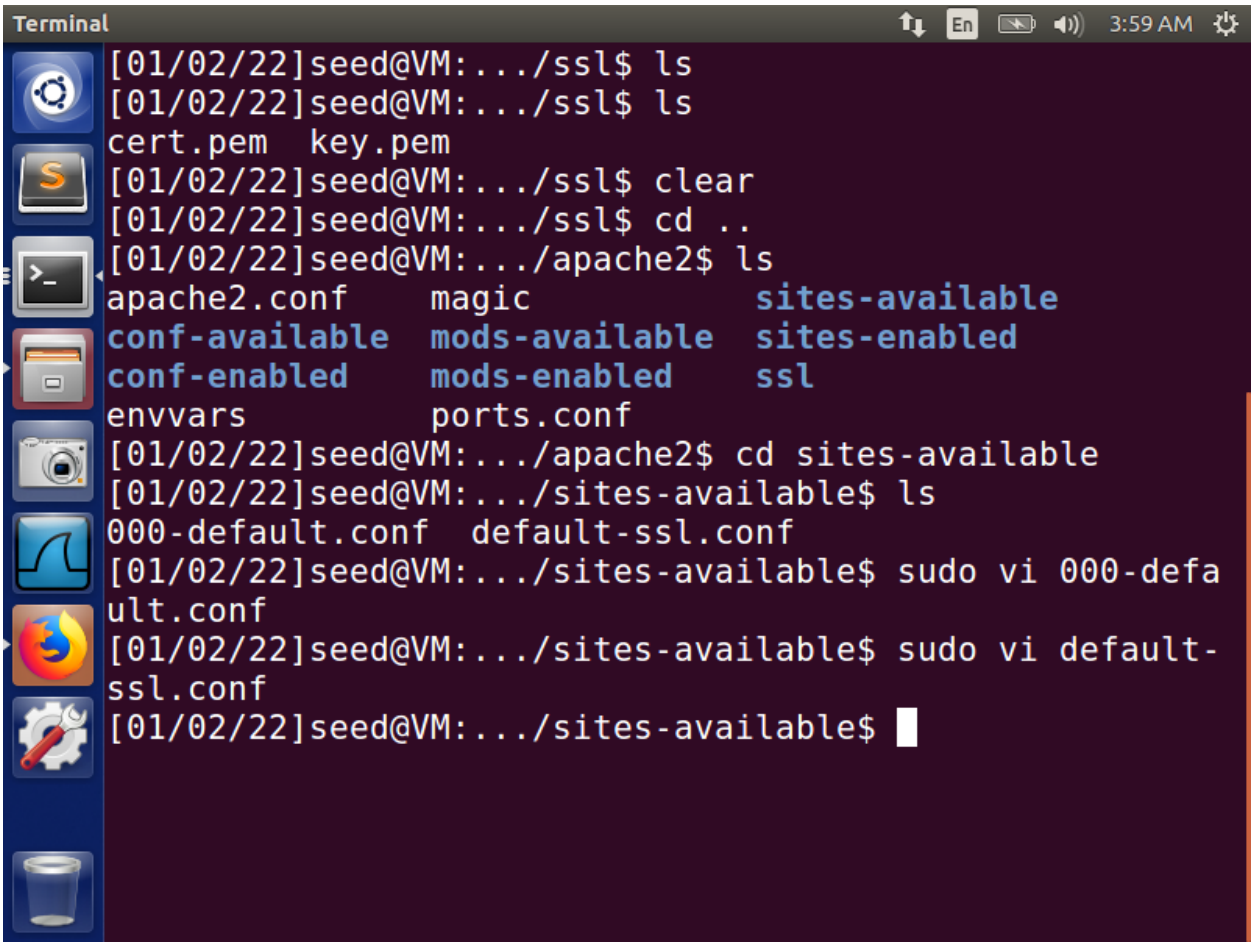


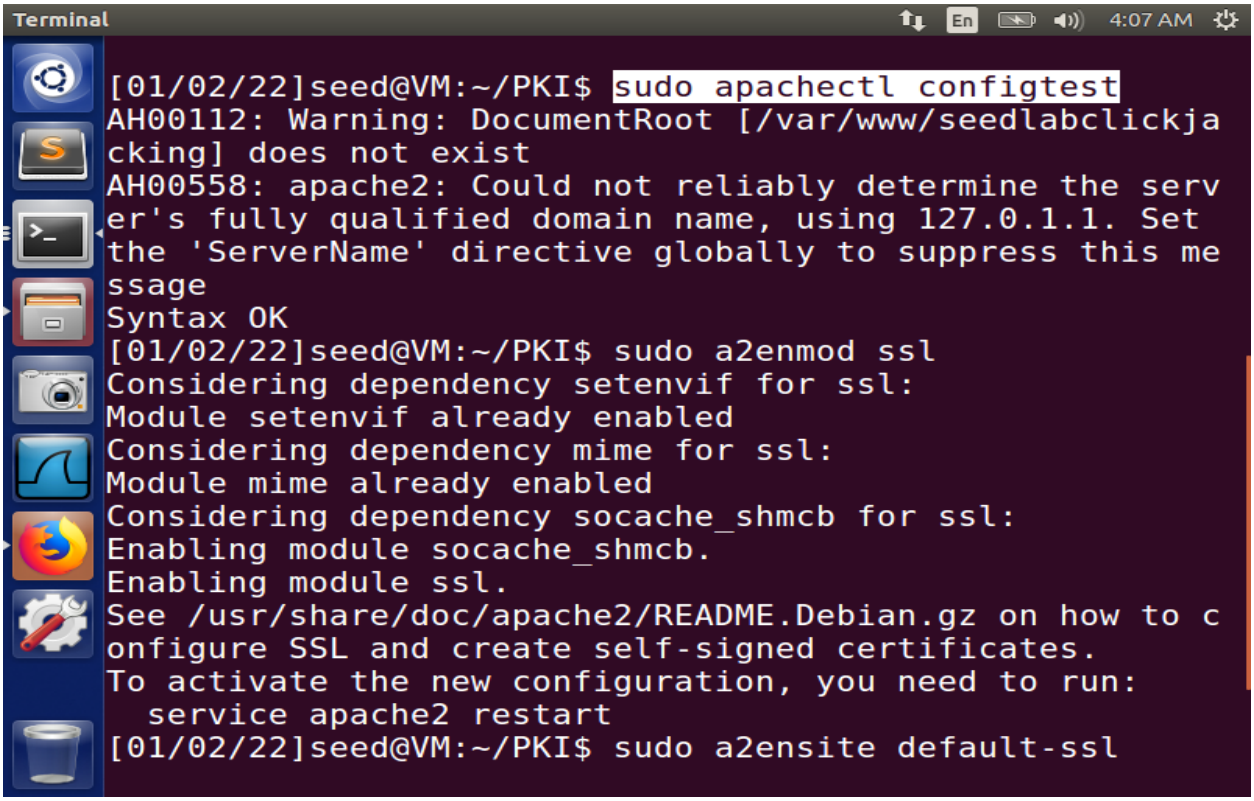


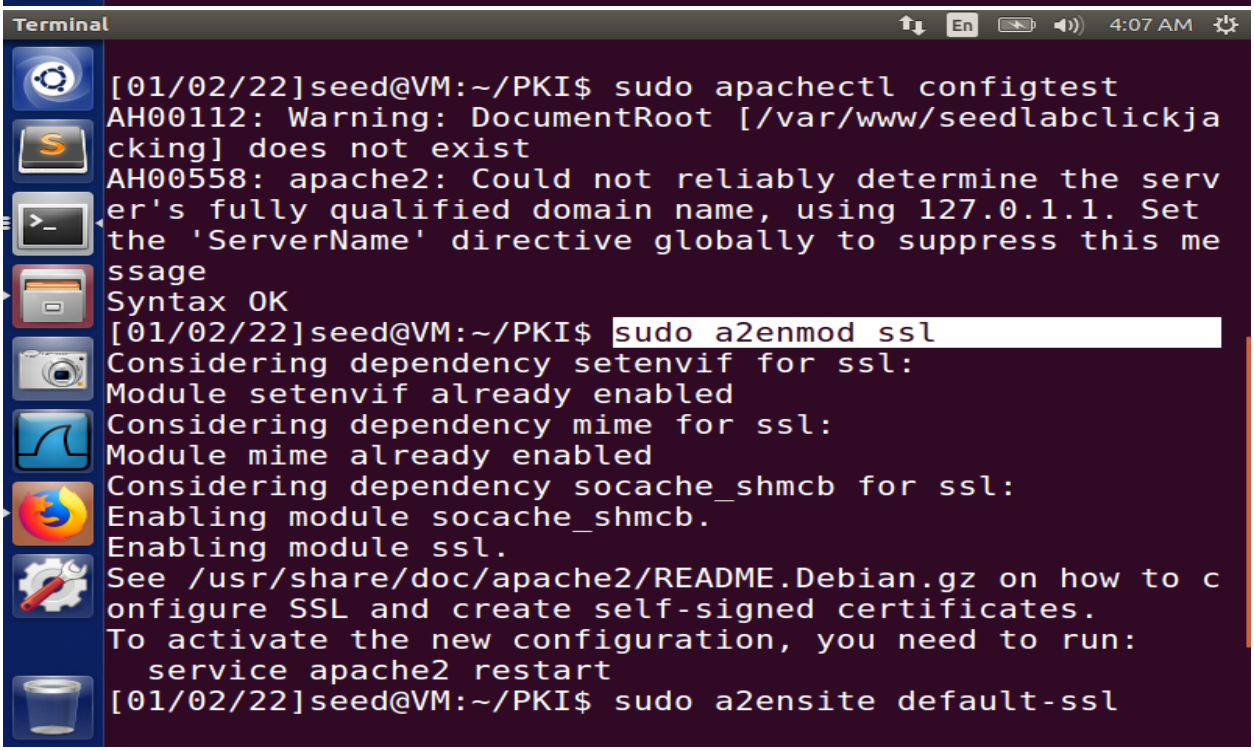

Terminal
En
3:44 AM
[01/02/22]seed@VM:~$ cd PKI/
[01/02/22]seed@VM:~/PKI$ cp server.crt cert.pem
[01/02/22]seed@VM:~/PKI$ cp server.key key.pem
[01/02/22]seed@VM:~/PKI$ sudo mv "/home/seed/PKI/cert.p
em" "/etc/apache2/ssl/"
[01/02/22]seed@VM:~/PKI$ sudo mv "/home/seed/PKI/key.pe
m" "/etc/apache2/ssl/"
[01/02/22]seed@VM:~/PKI$


Terminal
En
3:51 AM
<VirtualHost *:80>
ServerName SEEDPKILab2021.com
DocumentRoot /var/www/seedpki
DirectoryIndex index.html
</VirtualHost>
<VirtualHost *:80>
The ServerName directive sets the request sch
eme, hostname and port that
the server uses to identify itself. This is u
sed when creating
redirection URLs. In the context of virtual h
osts, the ServerName
specifies what hostname must appear in the re
quest's Host: header to
match this virtual host. For the default virt
ual host (this file) this
value is not decisive as it is used as a last
resort host regardless.
-- INSERT --
5,15
Top


Terminal
En
3:56 AM
<IfModule mod_ssl.c>
<VirtualHost *:80>
ServerName SEEDPKILab2021.com
DocumentRoot /var/www/seedpki
DirectoryIndex index.html
SSLEngine On
SSLCertificateFile /etc/apache2/ssl/cert.pem
SSLCertificateKeyFile /etc/apache2/ssl/key.pem
</VirtualHost>
<VirtualHost _default_:443>
ServerAdmin webmaster@localhost
DocumentRoot /var/www/html
Available loglevels: trace8, ..., trace1, debug, info, notice, warn,
error, crit, alert, emerg.
-- INSERT -- 9,48-55 Top


Terminal
En
3:59 AM
[01/02/22]seed@VM:.../ssl$ ls
[01/02/22]seed@VM:.../ssl$ ls
cert.pem key.pem
[01/02/22]seed@VM:.../ssl$ clear
[01/02/22]seed@VM:.../ssl$ cd ..
[01/02/22]seed@VM:.../apache2$ ls
apache2.conf magic sites-available
conf-available mods-available sites-enabled
conf-enabled mods-enabled ssl
envvars ports.conf
[01/02/22]seed@VM:.../apache2$ cd sites-available
[01/02/22]seed@VM:.../sites-available$ ls
000-default.conf default-ssl.conf
[01/02/22]seed@VM:.../sites-available$ sudo vi 000-default.conf
[01/02/22]seed@VM:.../sites-available$ sudo vi default-ssl.conf
[01/02/22]seed@VM:.../sites-available$


Terminal
En
4:07 AM
[01/02/22]seed@VM:~/PKI$ sudo apachectl configtest
AH00112: Warning: DocumentRoot [/var/www/seedlabclickjacking] does not exist
AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Syntax OK
[01/02/22]seed@VM:~/PKI$ sudo a2enmod ssl
Considering dependency setenvif for ssl:
Module setenvif already enabled
Considering dependency mime for ssl:
Module mime already enabled
Considering dependency socache_shmcb for ssl:
Enabling module socache_shmcb.
Enabling module ssl.
See /usr/share/doc/apache2/README.Debian.gz on how to configure SSL and create self-signed certificates.
To activate the new configuration, you need to run:
service apache2 restart
[01/02/22]seed@VM:~/PKI$ sudo a2ensite default-ssl


Terminal
En
4:07 AM
[01/02/22]seed@VM:~/PKI$ sudo apachectl configtest
AH00112: Warning: DocumentRoot [/var/www/seedlabclickjacking] does not exist
AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Syntax OK
[01/02/22]seed@VM:~/PKI$ sudo a2enmod ssl
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Module setenvif already enabled
Considering dependency mime for ssl:
Module mime already enabled
Considering dependency socache_shmcb for ssl:
Enabling module socache_shmcb.
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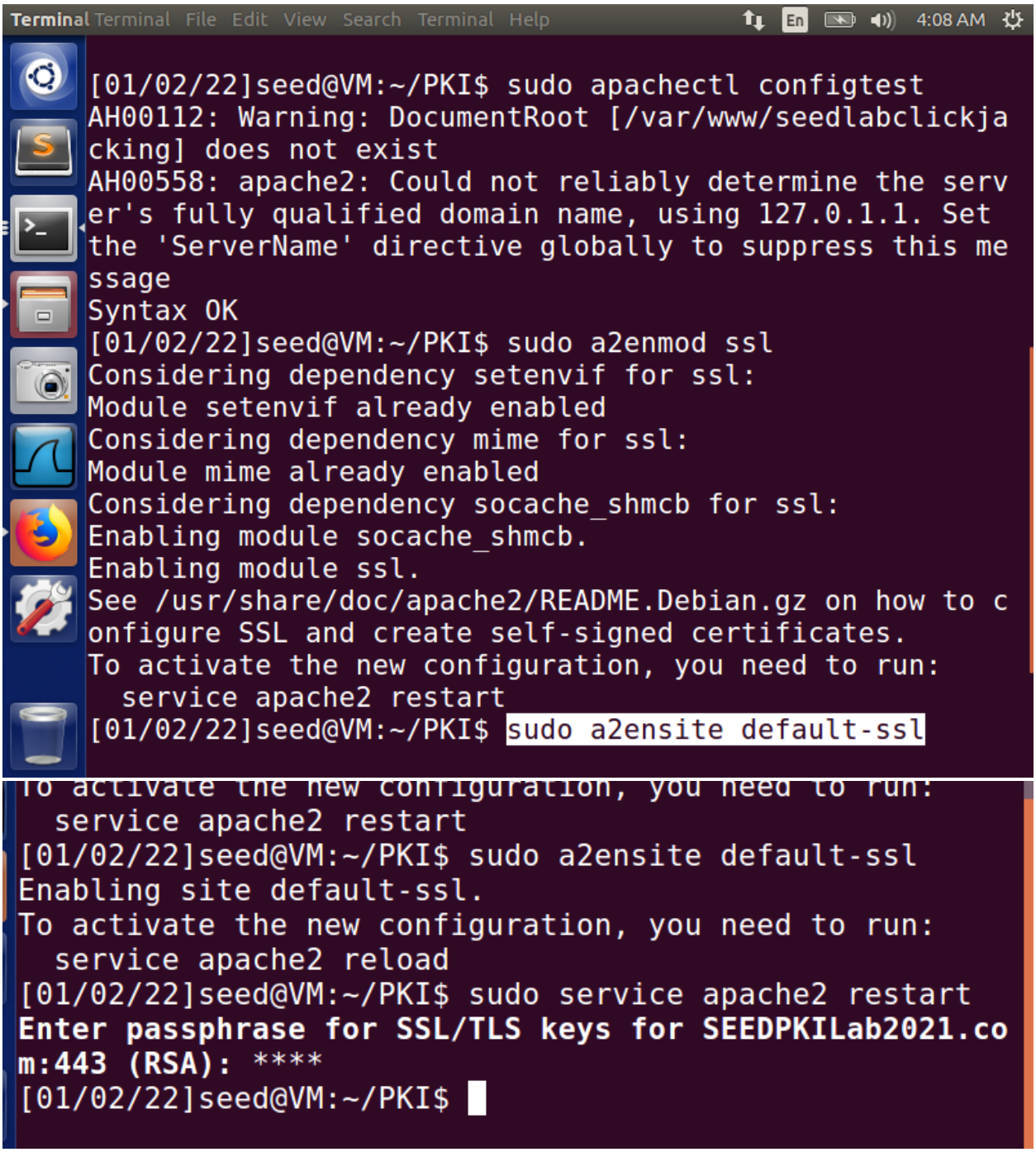
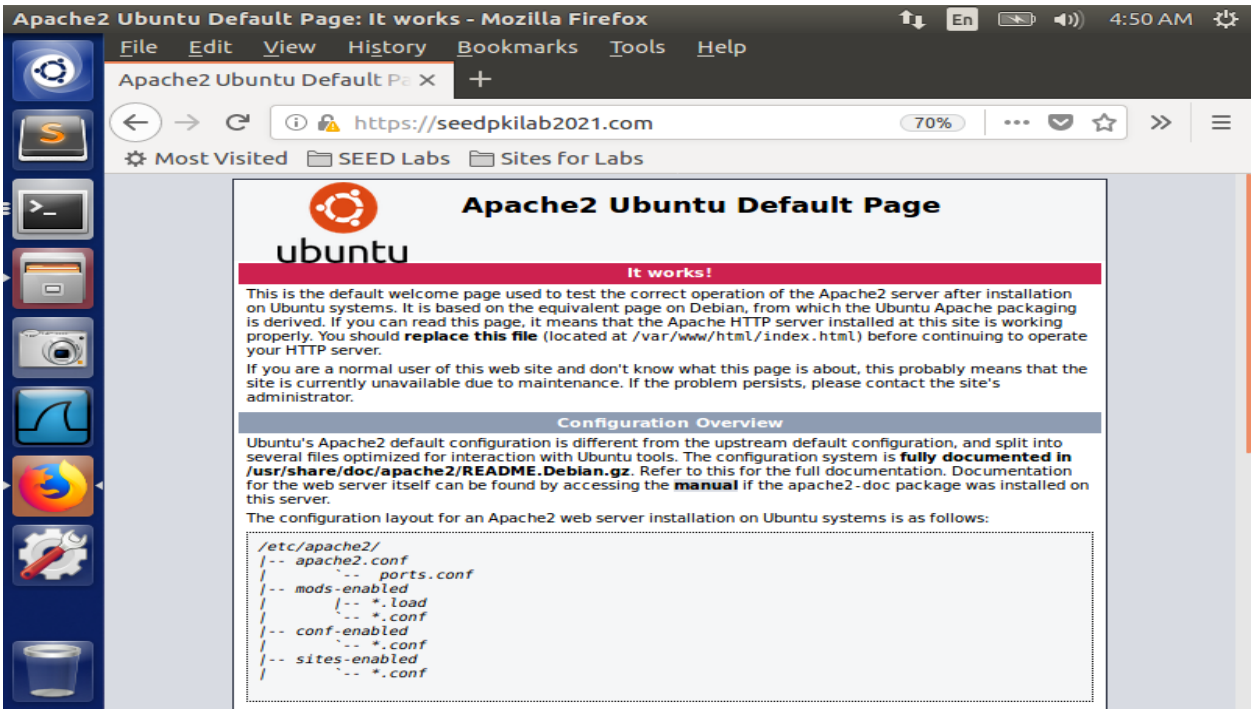
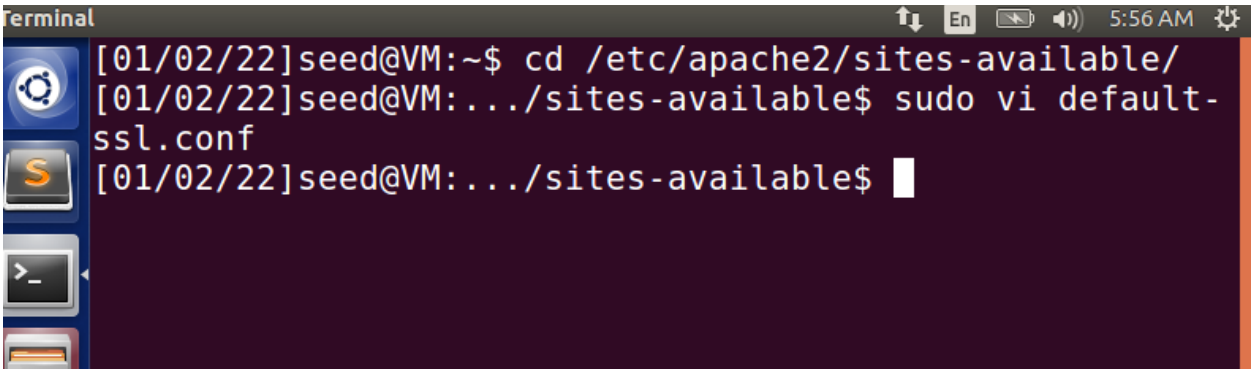
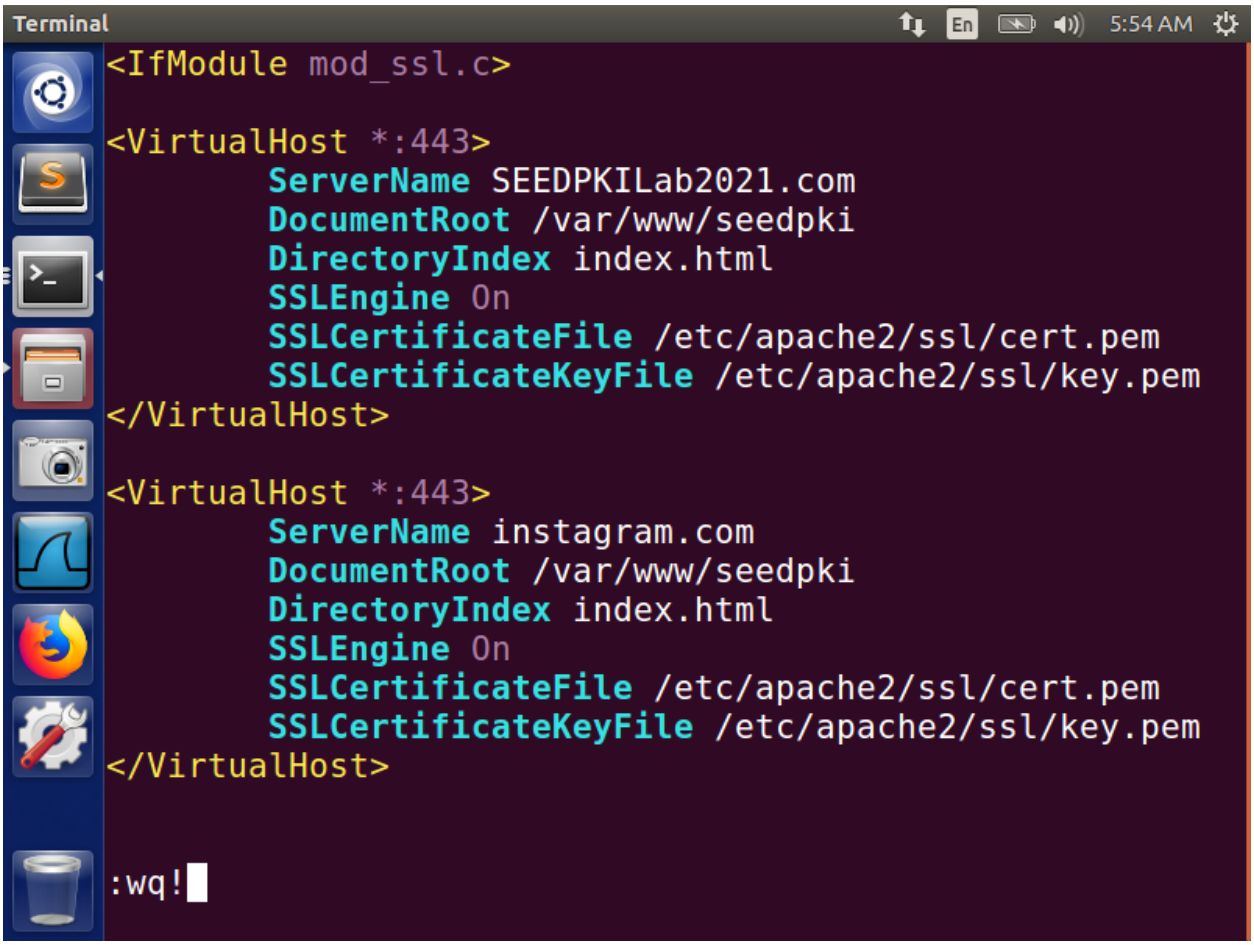
[01/02/22]seed@VM:~/PKI$ sudo a2ensite default-ssl

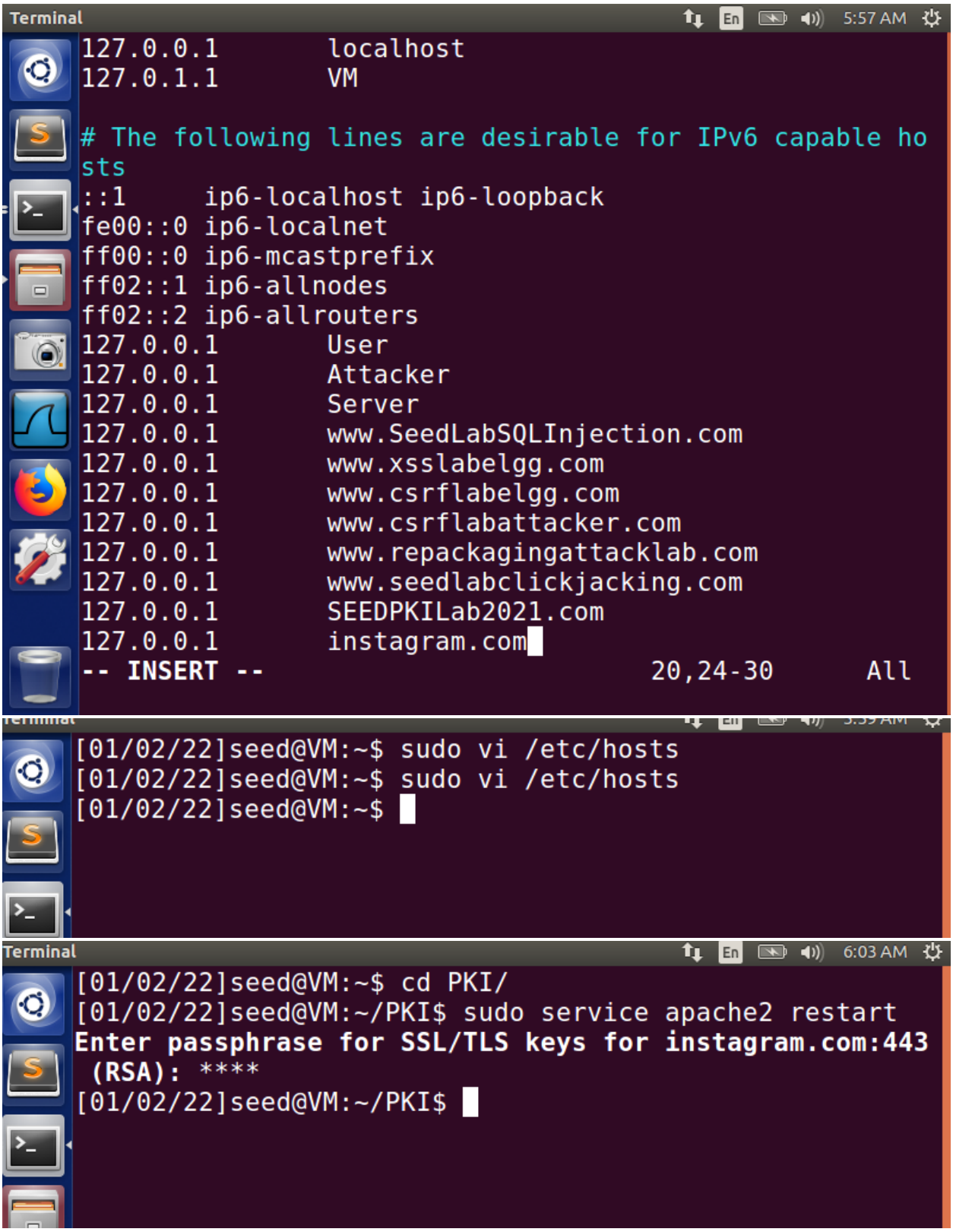

Terminal Terminal File Edit View Search Terminal Help
En
4:08 AM
[01/02/22]seed@VM:~/PKI$ sudo apachectl configtest
AH00112: Warning: DocumentRoot [/var/www/seedlabclickjacking] does not exist
AH00558: apache2: Could not reliably determine the server's fully qualified domain name, using 127.0.1.1. Set the 'ServerName' directive globally to suppress this message
Syntax OK
[01/02/22]seed@VM:~/PKI$ sudo a2enmod ssl
Considering dependency setenvif for ssl:
Module setenvif already enabled
Considering dependency mime for ssl:
Module mime already enabled
Considering dependency socache_shmcb for ssl:
Enabling module socache_shmcb.
Enabling module ssl.
See /usr/share/doc/apache2/README.Debian.gz on how to configure SSL and create self-signed certificates.
To activate the new configuration, you need to run:
service apache2 restart
[01/02/22]seed@VM:~/PKI$ sudo a2ensite default-ssl
To activate the new configuration, you need to run:
service apache2 restart
[01/02/22]seed@VM:~/PKI$ sudo a2ensite default-ssl
Enabling site default-ssl.
To activate the new configuration, you need to run:
service apache2 reload
[01/02/22]seed@VM:~/PKI$ sudo service apache2 restart
Enter passphrase for SSL/TLS keys for SEEDPKILab2021.com:443 (RSA): ****
[01/02/22]seed@VM:~/PKI$



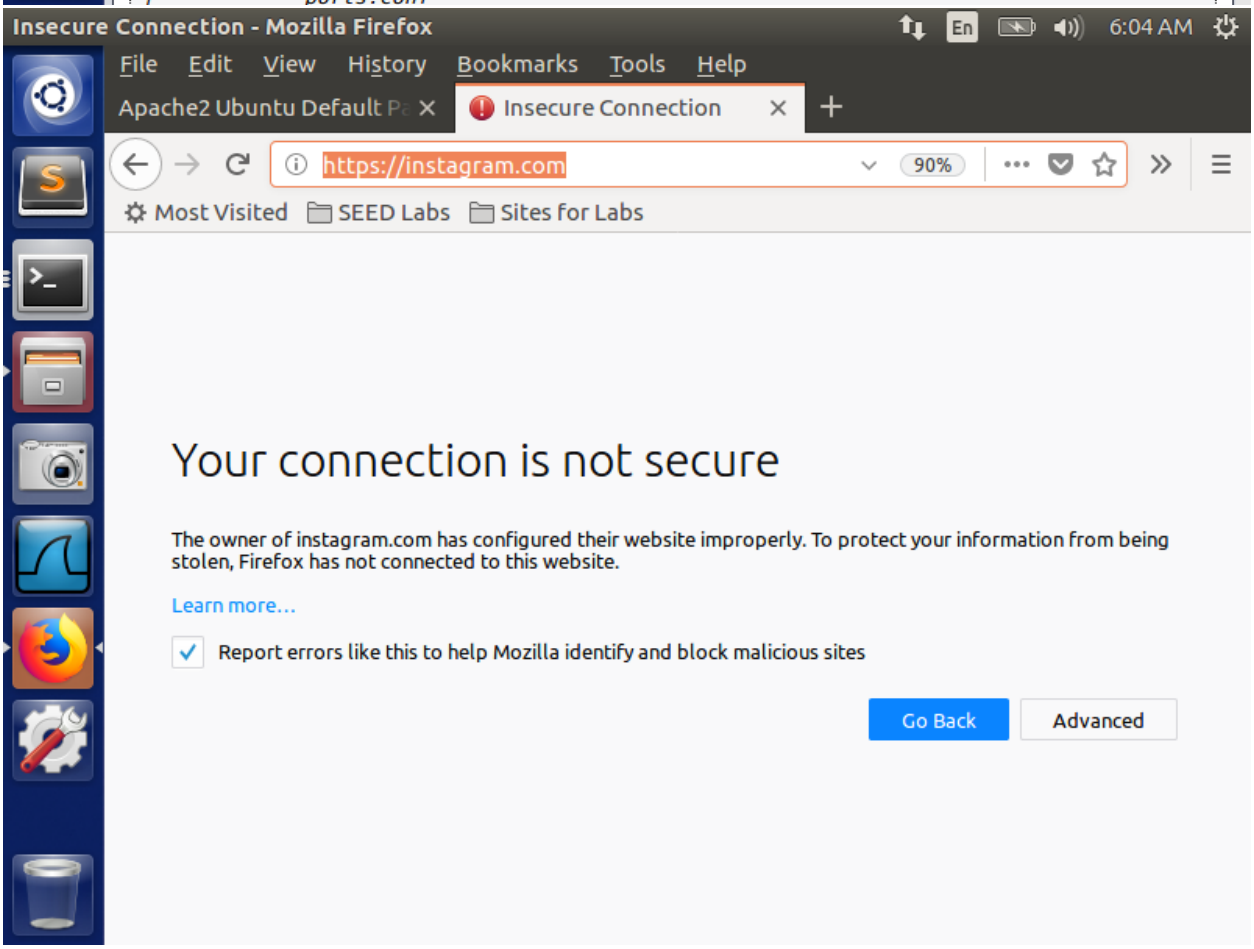
Task 5: Launching a Man-In-The-Middle Attack



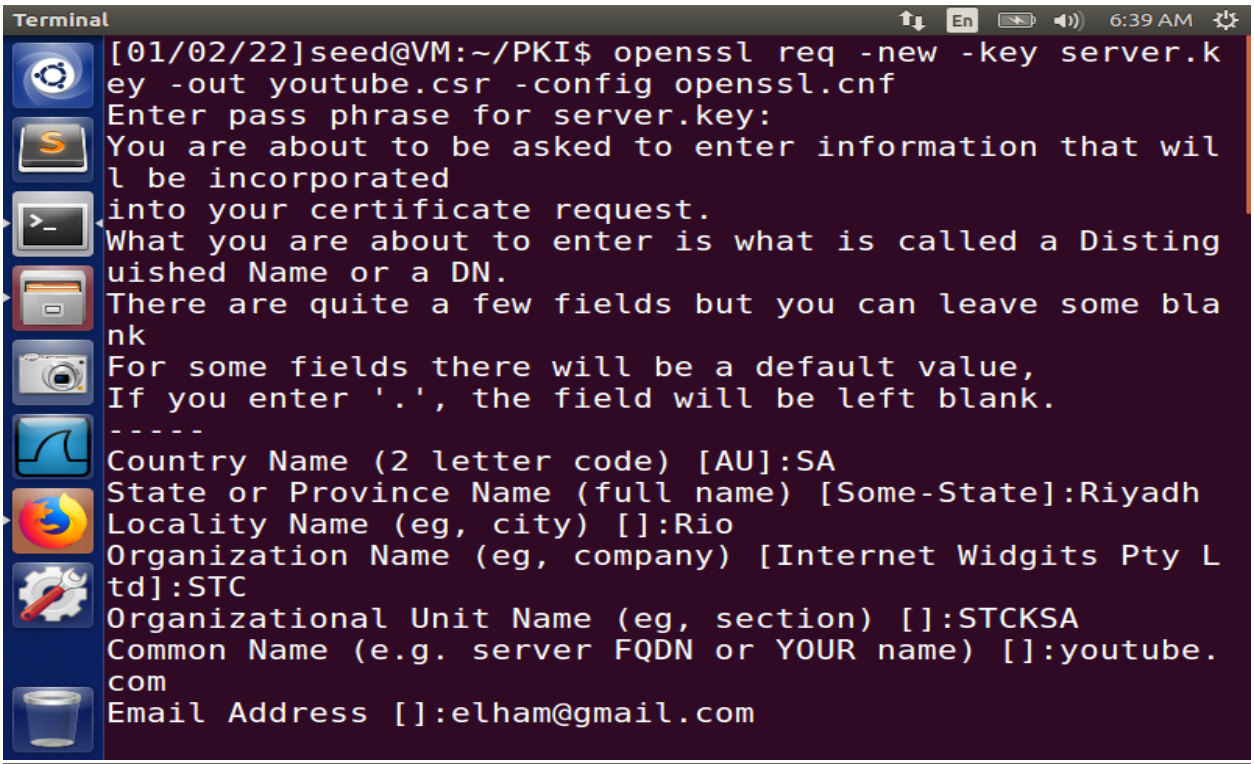

Terminal
En
5:54 AM
<IfModule mod_ssl.c>
<VirtualHost *:443>
ServerName SEEDPKILab2021.com
DocumentRoot /var/www/seedpki
DirectoryIndex index.html
SSLEngine On
SSLCertificateFile /etc/apache2/ssl/cert.pem
SSLCertificateKeyFile /etc/apache2/ssl/key.pem
</VirtualHost>
<VirtualHost *:443>
ServerName instagram.com
DocumentRoot /var/www/seedpki
DirectoryIndex index.html
SSLEngine On
SSLCertificateFile /etc/apache2/ssl/cert.pem
SSLCertificateKeyFile /etc/apache2/ssl/key.pem
</VirtualHost>
:wq!

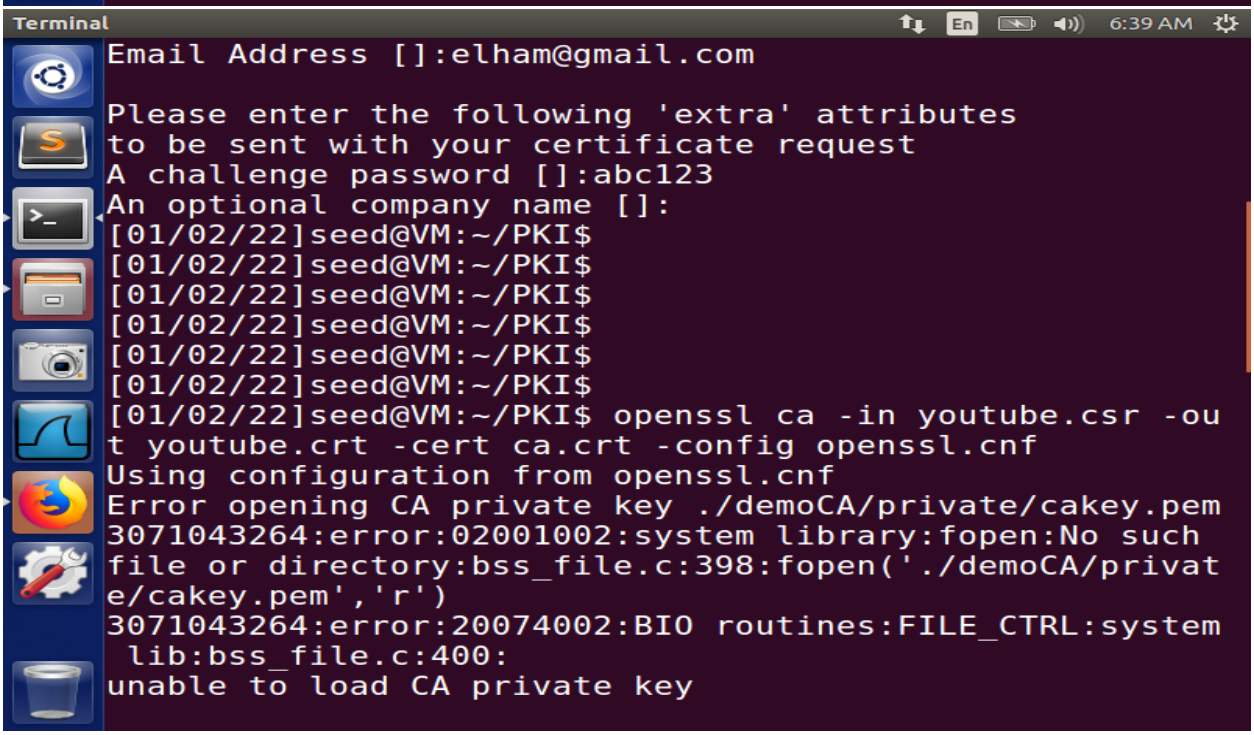

Terminal
En
5:57 AM
127.0.0.1 localhost
127.0.1.1 VM
The following lines are desirable for IPv6 capable hosts
::1 ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
127.0.0.1 User
127.0.0.1 Attacker
127.0.0.1 Server
127.0.0.1 www.SeedLabSQLInjection.com
127.0.0.1 www.xsslabelgg.com
127.0.0.1 www.csrflabelgg.com
127.0.0.1 www.csrflabattacker.com
127.0.0.1 www.repackagingattacklab.com
127.0.0.1 www.seedlabclickjacking.com
127.0.0.1 SEEDPKILab2021.com
127.0.0.1 instagram.com
-- INSERT -- 20,24-30 All
[01/02/22]seed@VM:~$ sudo vi /etc/hosts
[01/02/22]seed@VM:~$ sudo vi /etc/hosts
[01/02/22]seed@VM:~$
Terminal
En
6:03 AM
[01/02/22]seed@VM:~$ cd PKI/
[01/02/22]seed@VM:~/PKI$ sudo service apache2 restart
Enter passphrase for SSL/TLS keys for instagram.com:443 (RSA): ****
[01/02/22]seed@VM:~/PKI$

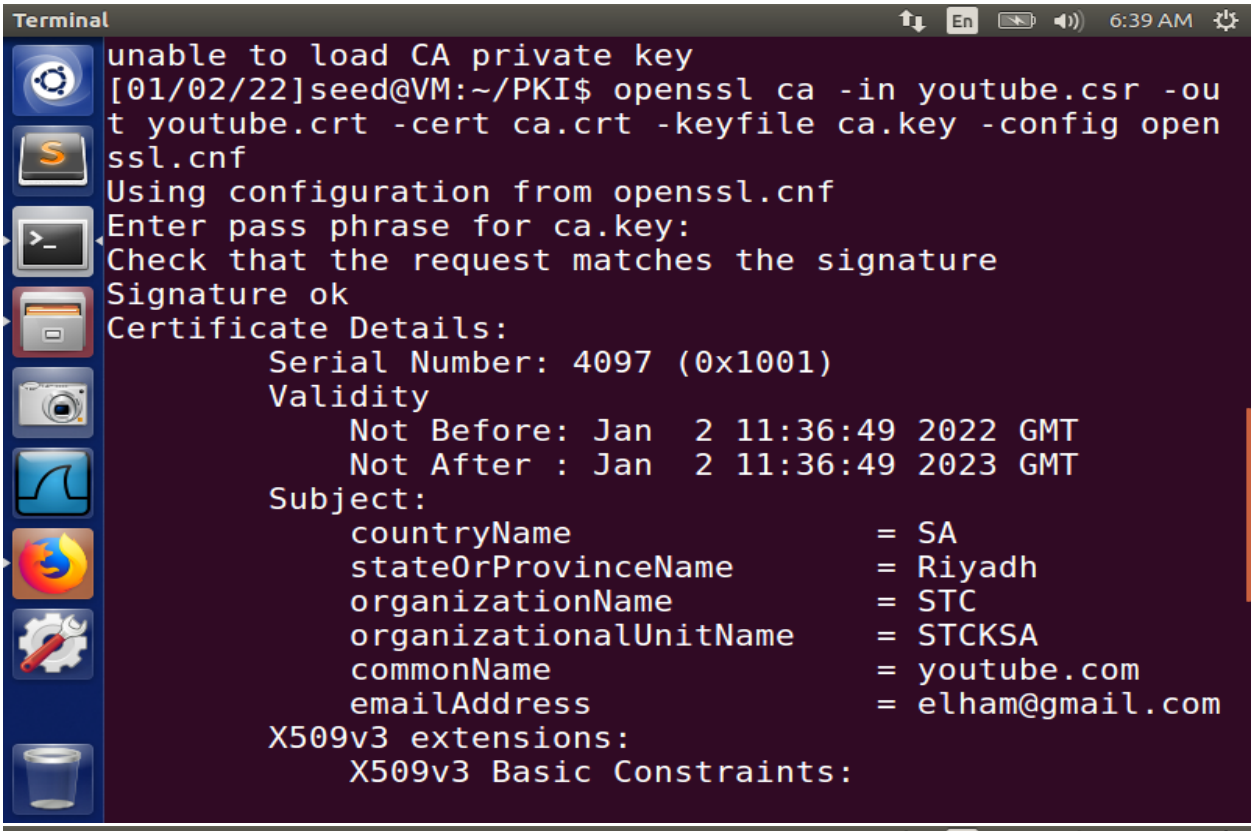

Apache2 Ubuntu Default Page: It works - Mozilla Firefox
6:03 AM
File Edit View History Bookmarks Tools Help
Apache2 Ubuntu Default Pa
instagram.com
90%
Most Visited
SEED Labs
Sites for Labs
ubuntu
Apache2 Ubuntu Default Page
It works!
This is the default welcome page used to test the correct operation of the Apache2 server after installation on Ubuntu systems. It is based on the equivalent page on Debian, from which the Ubuntu Apache packaging is derived. If you can read this page, it means that the Apache HTTP server installed at this site is working properly. You should replace this file (located at /var/www/html/index.html) before continuing to operate your HTTP server.
If you are a normal user of this web site and don't know what this page is about, this probably means that the site is currently unavailable due to maintenance. If the problem persists, please contact the site's administrator.
Configuration Overview
Ubuntu's Apache2 default configuration is different from the upstream default configuration, and split into several files optimized for interaction with Ubuntu tools. The configuration system is fully documented in /usr/share/doc/apache2/README.Debian.gz. Refer to this for the full documentation. Documentation for the web server itself can be found by accessing the manual if the apache2-doc package was installed on this server.
The configuration layout for an Apache2 web server installation on Ubuntu systems is as follows:
/etc/apache2/
|-- apache2.conf
| `-- ports.conf

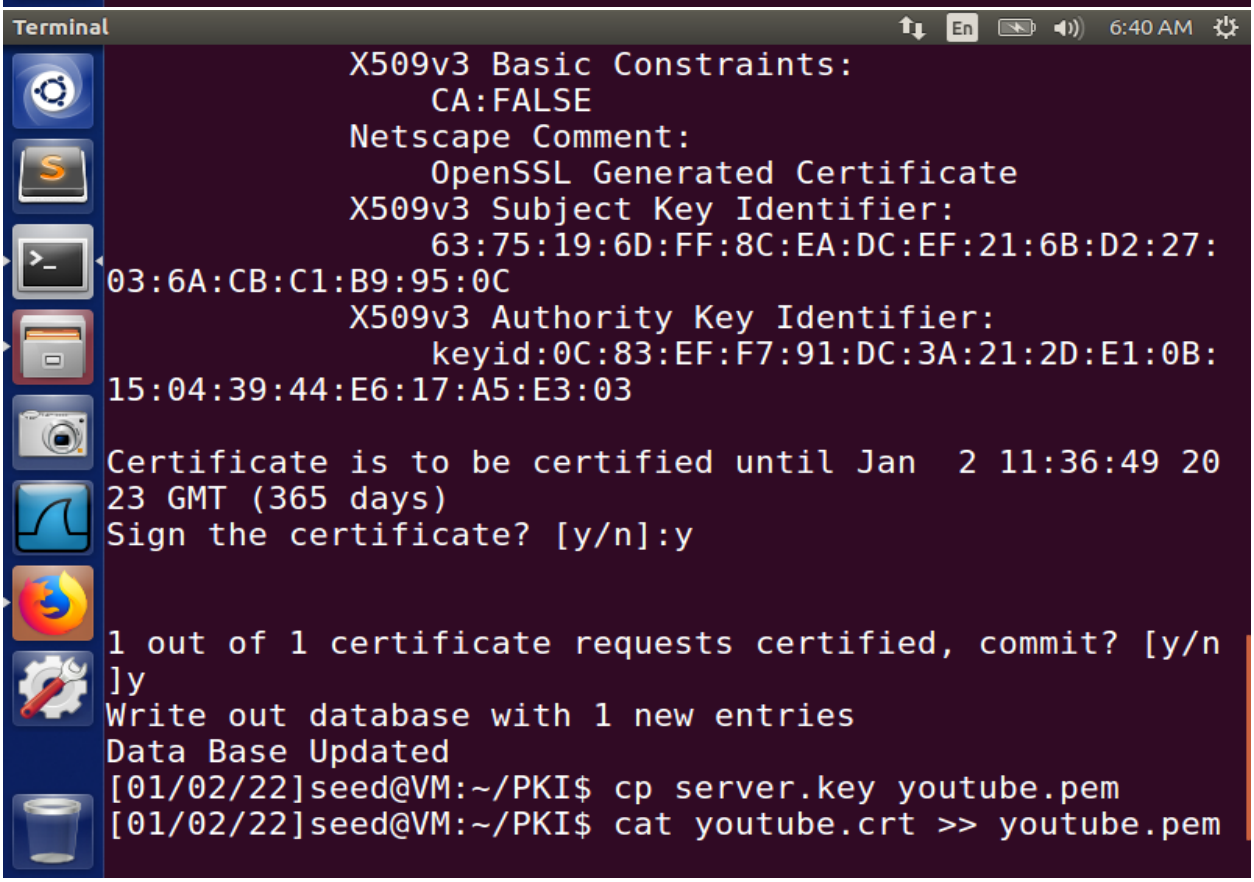

Insecure Connection - Mozilla Firefox
6:04 AM
File Edit View History Bookmarks Tools Help
Apache2 Ubuntu Default Pa
Insecure Connection
https://instagram.com
90%
Most Visited
SEED Labs
Sites for Labs
Your connection is not secure
The owner of instagram.com has configured their website improperly. To protect your information from being stolen, Firefox has not connected to this website.
Learn more...
Report errors like this to help Mozilla identify and block malicious sites
Go Back
Advanced

Task 6: Launching a Man-In-The-Middle Attack with a Compromised CA

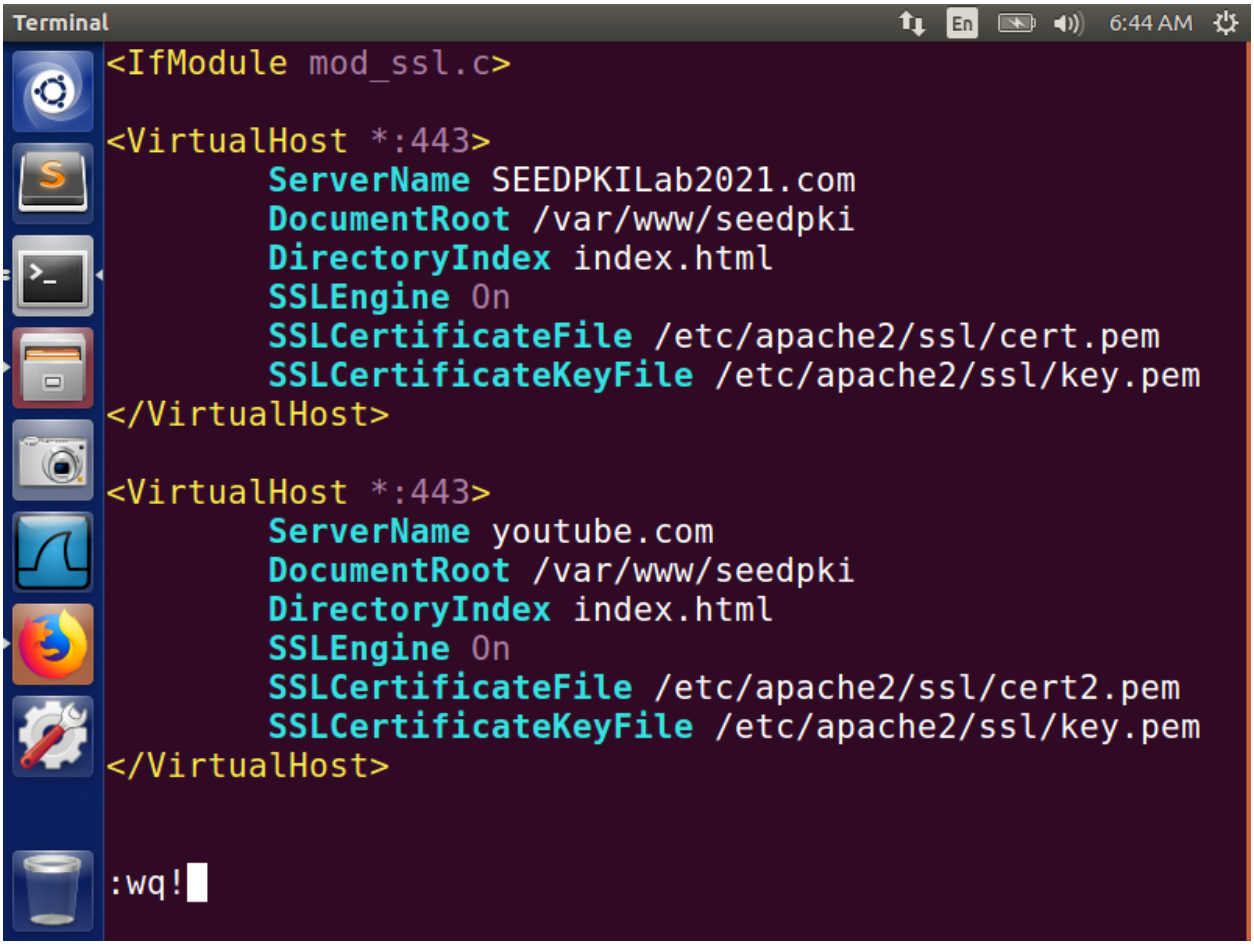


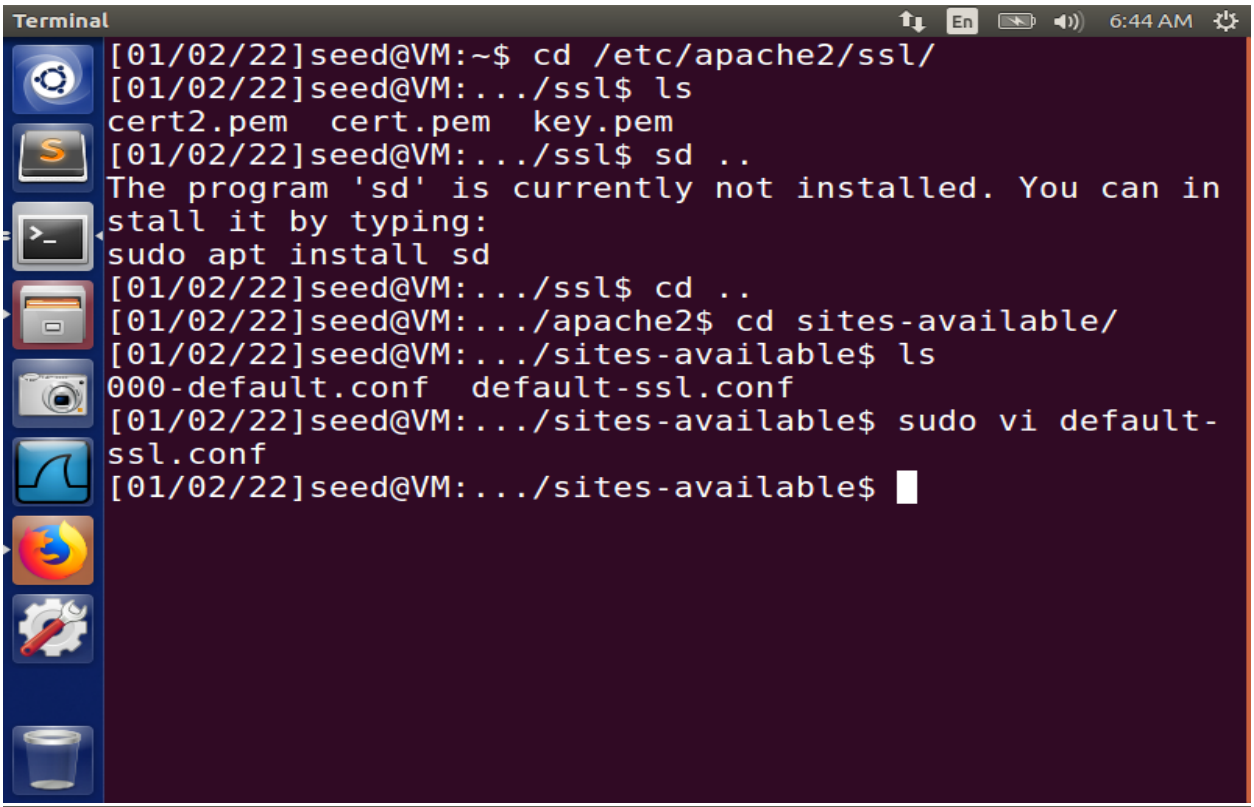


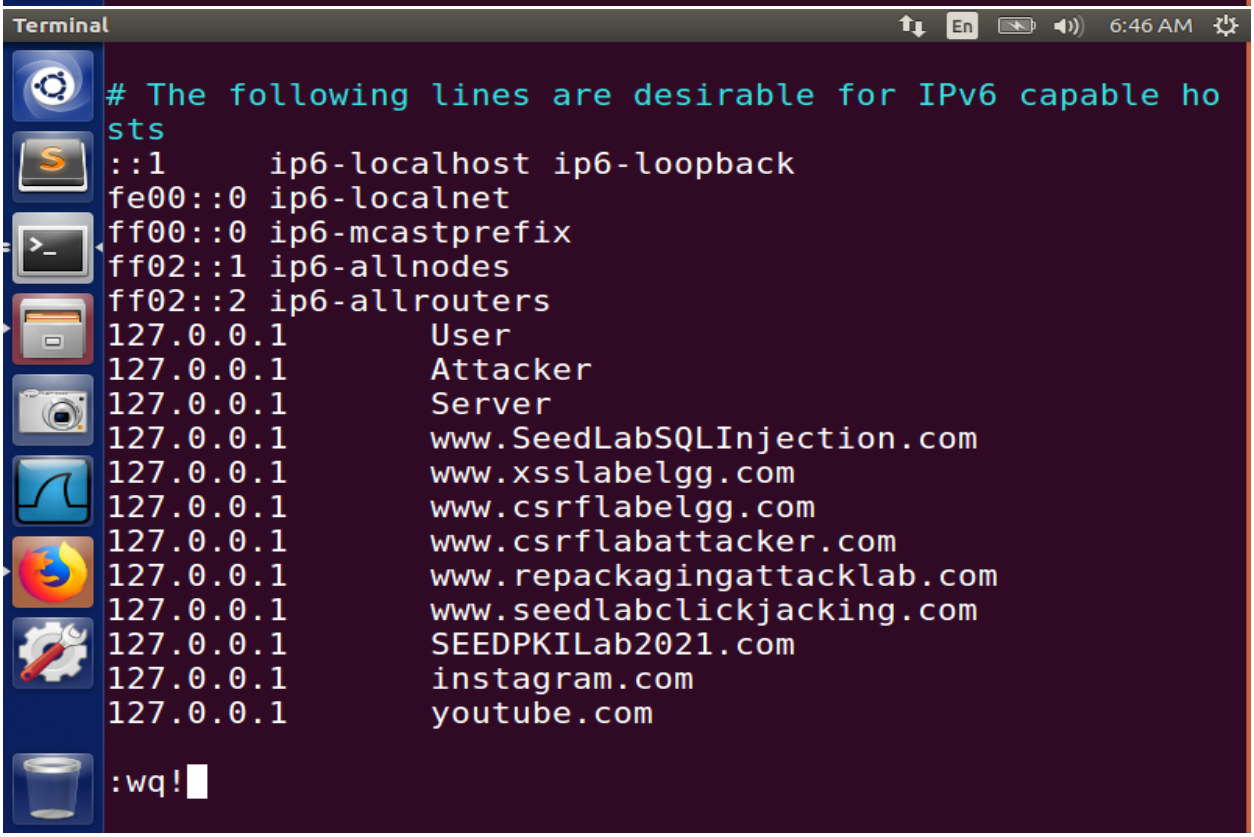

Terminal
En
6:39 AM
unable to load CA private key
[01/02/22]seed@VM:~/PKI$ openssl ca -in youtube.csr -ou
t youtube.crt -cert ca.crt -keyfile ca.key -config open
ssl.cnf
Using configuration from openssl.cnf
Enter pass phrase for ca.key:
Check that the request matches the signature
Signature ok
Certificate Details:
Serial Number: 4097 (0x1001)
Validity
Not Before: Jan 2 11:36:49 2022 GMT
Not After : Jan 2 11:36:49 2023 GMT
Subject:
countryName = SA
stateOrProvinceName = Riyadh
organizationName = STC
organizationalUnitName = STCKSA
commonName = youtube.com
emailAddress = elham@gmail.com
X509v3 extensions:
X509v3 Basic Constraints:

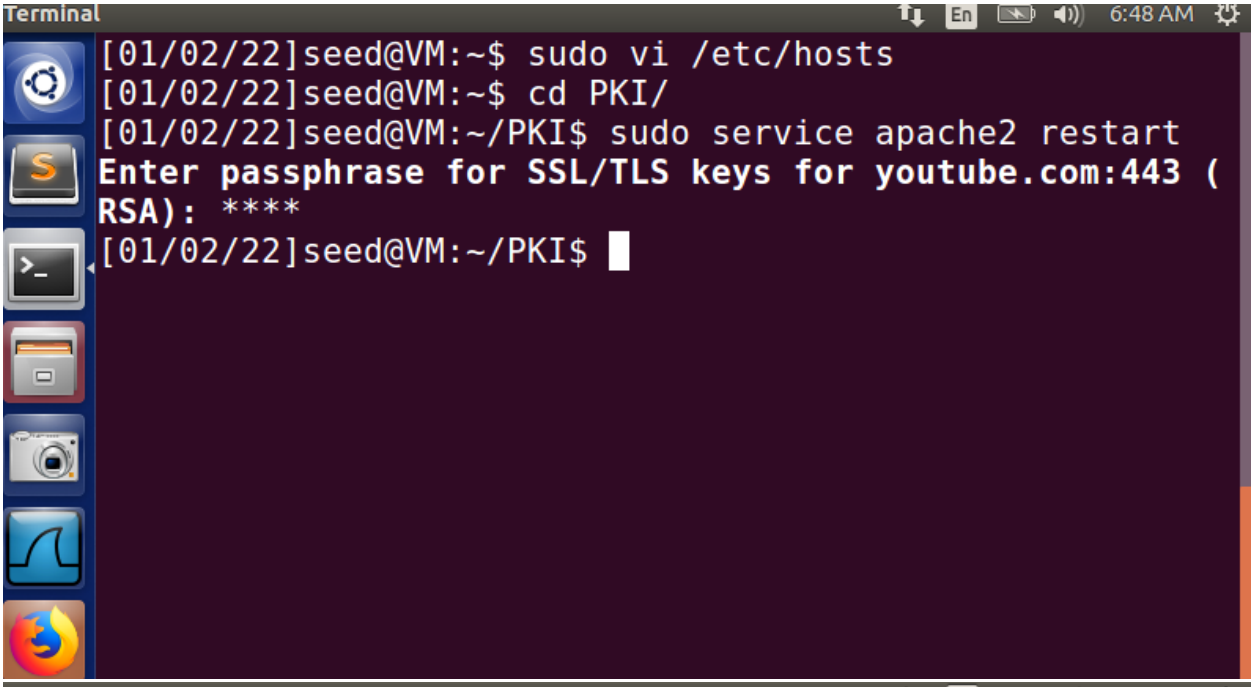

Terminal
En
6:40 AM
X509v3 Basic Constraints:
CA:FALSE
Netscape Comment:
OpenSSL Generated Certificate
X509v3 Subject Key Identifier:
63:75:19:6D:FF:8C:EA:DC:EF:21:6B:D2:27:
03:6A:CB:C1:B9:95:0C
X509v3 Authority Key Identifier:
keyid:0C:83:EF:F7:91:DC:3A:21:2D:E1:0B:
15:04:39:44:E6:17:A5:E3:03
Certificate is to be certified until Jan 2 11:36:49 20
23 GMT (365 days)
Sign the certificate? [y/n]:y
1 out of 1 certificate requests certified, commit? [y/n
]y
Write out database with 1 new entries
Data Base Updated
[01/02/22]seed@VM:~/PKI$ cp server.key youtube.pem
[01/02/22]seed@VM:~/PKI$ cat youtube.crt >> youtube.pem

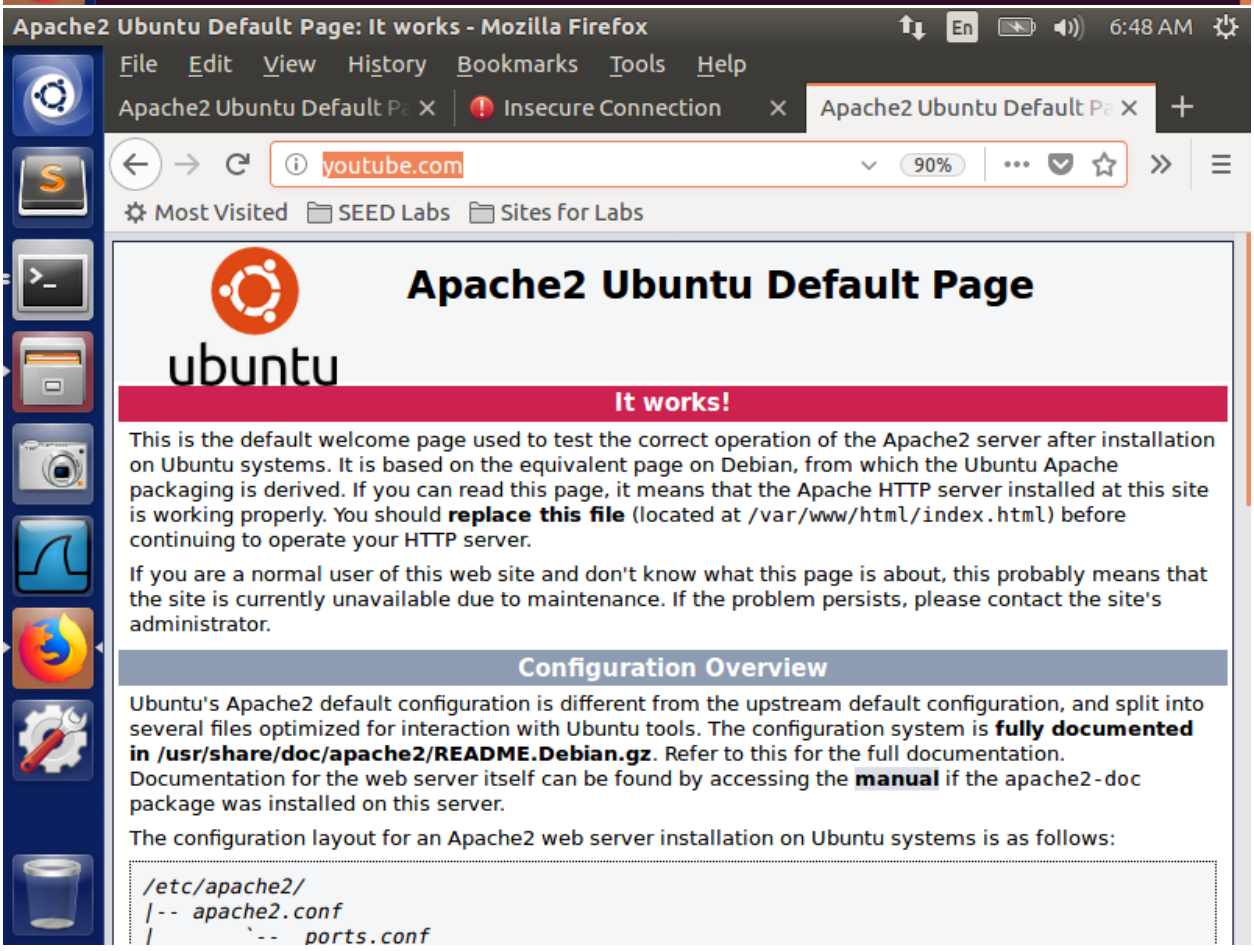
```
Certificate is to be certified until Jan  2 11:36:49 20
23 GMT (365 days)
Sign the certificate? [y/n]:y


1 out of 1 certificate requests certified, commit? [y/n
]y
Write out database with 1 new entries
Data Base Updated
[01/02/22]seed@VM:~/PKI$ cp server.key youtube.pem
[01/02/22]seed@VM:~/PKI$ cat youtube.crt >> youtube.pem
[01/02/22]seed@VM:~/PKI$ cp youtube.crt cert2.pem
[01/02/22]seed@VM:~/PKI$ sudo mv "/home/seed/PKI/cert2.
pem" "/etc/apache2/ssl/"
[01/02/22]seed@VM:~/PKI$
```




Terminal
En
6:44 AM
[01/02/22]seed@VM:~$ cd /etc/apache2/ssl/
[01/02/22]seed@VM:.../ssl$ ls
cert2.pem cert.pem key.pem
[01/02/22]seed@VM:.../ssl$ sd ..
The program 'sd' is currently not installed. You can in
stall it by typing:
sudo apt install sd
[01/02/22]seed@VM:.../ssl$ cd ..
[01/02/22]seed@VM:.../apache2$ cd sites-available/
[01/02/22]seed@VM:.../sites-available$ ls
000-default.conf default-ssl.conf
[01/02/22]seed@VM:.../sites-available$ sudo vi default-
ssl.conf
[01/02/22]seed@VM:.../sites-available$


Terminal
En
6:46 AM
The following lines are desirable for IPv6 capable ho
sts
::1   ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
127.0.0.1   User
127.0.0.1   Attacker
127.0.0.1   Server
127.0.0.1   www.SeedLabSQLInjection.com
127.0.0.1   www.xsslabelgg.com
127.0.0.1   www.csrflabelgg.com
127.0.0.1   www.csrflabattacker.com
127.0.0.1   www.repackagingattacklab.com
127.0.0.1   www.seedlabclickjacking.com
127.0.0.1   SEEDPKILab2021.com
127.0.0.1   instagram.com
127.0.0.1   youtube.com
:wq!


Terminal
En
6:48 AM
[01/02/22]seed@VM:~$ sudo vi /etc/hosts
[01/02/22]seed@VM:~$ cd PKI/
[01/02/22]seed@VM:~/PKI$ sudo service apache2 restart
Enter passphrase for SSL/TLS keys for youtube.com:443 (
RSA): ****
[01/02/22]seed@VM:~/PKI$


Apache2 Ubuntu Default Page: It works - Mozilla Firefox
En
6:48 AM
File Edit View History Bookmarks Tools Help
Apache2 Ubuntu Default Pa
Insecure Connection
Apache2 Ubuntu Default Pa
youtube.com
90%
Most Visited
SEED Labs
Sites for Labs
Apache2 Ubuntu Default Page
ubuntu
It works!
This is the default welcome page used to test the correct operation of the Apache2 server after installation on Ubuntu systems. It is based on the equivalent page on Debian, from which the Ubuntu Apache packaging is derived. If you can read this page, it means that the Apache HTTP server installed at this site is working properly. You should replace this file (located at /var/www/html/index.html) before continuing to operate your HTTP server.
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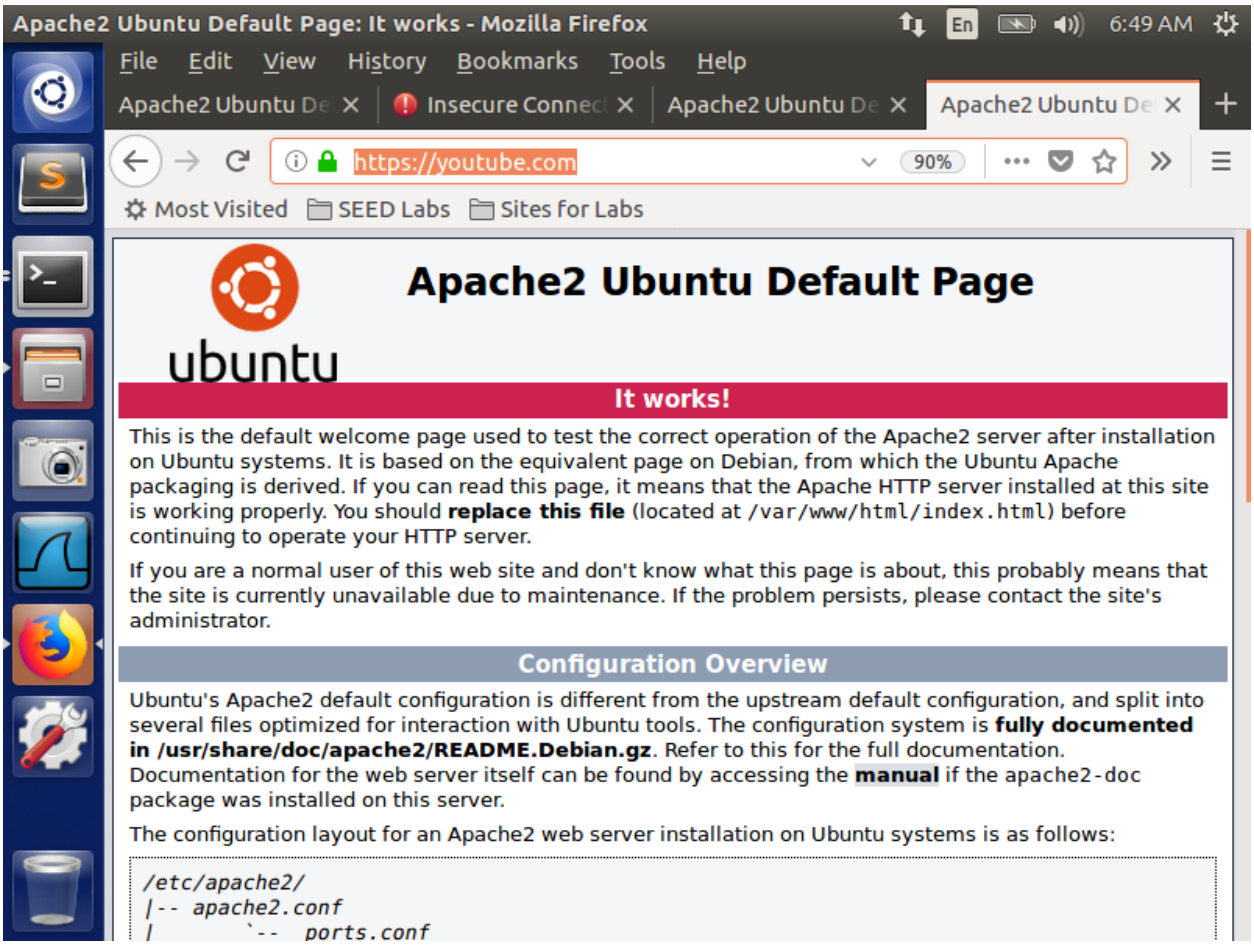
/etc/apache2/
|-- apache2.conf
| `-- ports.conf


Apache2 Ubuntu Default Page: It works - Mozilla Firefox
6:49 AM
File Edit View History Bookmarks Tools Help
Apache2 Ubuntu De
Insecure Connec
Apache2 Ubuntu De
Apache2 Ubuntu De
https://youtube.com
90%
Most Visited
SEED Labs
Sites for Labs
ubuntu
Apache2 Ubuntu Default Page
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|-- apache2.conf
| `-- ports.conf