CMSC 626 Principles of Computer Security

Project

Exercise 4

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1.

a. Team Information:

i. Name: **Faisal Rasheed Khan**

University Id: **VB02734**

ii. Name: **Shrenik PolySetty**

University Id: **AZ61492**

b. Prime Number, P = 1065601
Primitive root, α = 7
Xa = 139278
Xb = 111689
Key = 159571

c.

```
nc -l 12345
nc 130.85.220.34 12345
python3 diffehellman.py  | nc 130.85.220.34 12345
python3 diffehellman.py <vm1pipe | nc 130.85.220.34 12345 >vm1pipe
nc -l 12345 <vm2pipe | python diffehellman.py >vm2pipe
mkfifo vm1pipe
nc -l 12345 | python3 diffehellman.py
python3 diffehellman.py
cat tcpdumpcapture.cap
nano diffehellman.py
ls
ifconfig -a
tcpdump -D
tcpdump -n -i ens160 -w tcpdumpcapture.cap host 130.85.121.106 and port 12345
tcpdump -n -i ens160 -w tcpdumpcapture.cap host 130.85.220.34 and port 12345
tcpdump -n -i ens160 -w tcpdumpcapture.cap host 130.85.121.106 and port 12345
tcpdump -r capture.pcap
tcpdump -n -i ens160 -w vm1capture2.pcap host 130.85.220.34
```

d. The challenges faced were:

- While encrypting and decrypting the key, faced issue because key was of int type text

  Resolved this issue with the help of converting the int to str ,encoding and decoding with ‘utf-8’

- Faced issue while connecting to the other Virtual Machine to send the encrypted plain text using netcat command

  Resolved the issue by passing the command of netcat to subprocess.Popen()

- While encrypting and decrypting the pain text and cipher text, faced issue of unable to decode with ‘utf-8’ as it was in other format

  Resolved by removing unnecessary encoding.

- Faced challenges while using wireshark, tshark as access to install that was not there

  Resolved using tcpdump command

- The tcpdump command was capturing every data incoming

  Resolve by applying proper filters

- For tcpdump command, which interface to use to capture the data was a problem

  Resolved by using this command, tcpdump -D

e. Successfully implemented the Diffe-Hellman Key Exchange Algorithm to encrypt and decrypt the text over the communicating channels between two virtual machines while calculating the shared key with their respective private keys, where keys are generated using prime number, primitive root and private key. Learnt different ways of sending the data via command line arguments or incorporating everything in the python file. Successfully implemented the tcpdump/wireshark capture to capture the real time packets sent/received. Can store tcpdump/wireshark capture using .pcap or .cap extension.

f. References:

CH02-CompSec4e_accessible_L03 (blackboardcdn.com)

How To Use Netcat to Establish and Test TCP and UDP Connections | DigitalOcean

L07-CH21-CompSec4e_accessible (blackboardcdn.com)

Primitive Root - Algorithms for Competitive Programming (cp-algorithms.com)

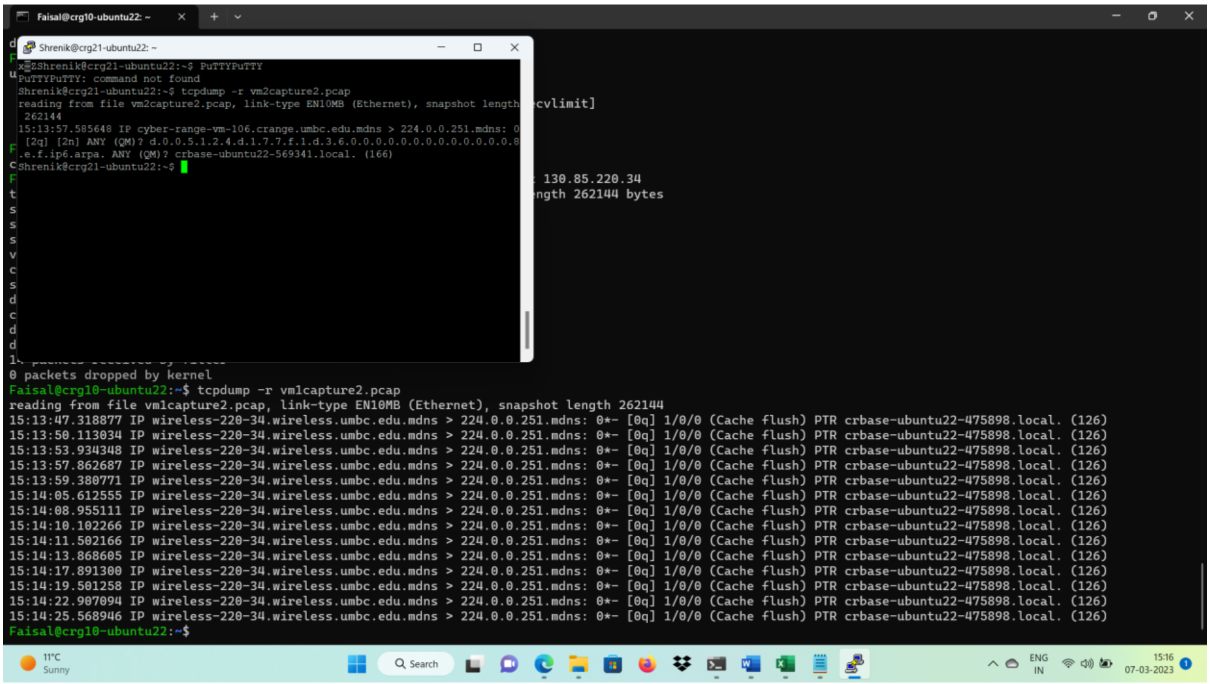
tcp_client.py

tcp_server.py

RC4-KeyGeneration(1).py

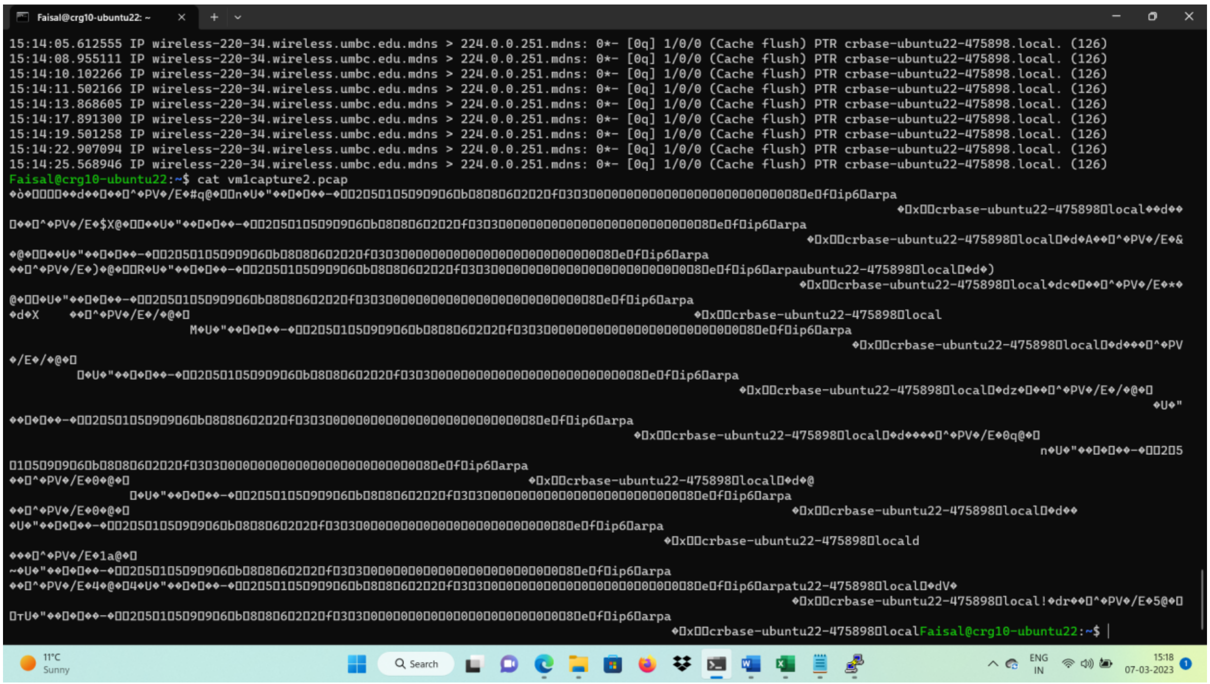
subprocess — Subprocess management — Python 3.11.2 documentation

[Tcpdump Command in Linux | Linuxize](https://linuxize.com/post/tcpdump-command-in-linux/)



```
x▯ZShrenik@crg21-ubuntu22:~$ PuTTYPuTTY
PuTTYPuTTY: command not found
Shrenik@crg21-ubuntu22:~$ tcpdump -r vm2capture2.pcap
reading from file vm2capture2.pcap, link-type EN10MB (Ethernet), snapshot length
 262144
15:13:57.585648 IP cyber-range-vm-106.crange.umbc.edu.mdns > 224.0.0.251.mdns: 0
 [2q] [2n] ANY (QM)? d.0.0.5.1.2.4.d.1.7.7.f.1.d.3.6.0.0.0.0.0.0.0.0.0.0.0.0.0.8
.e.f.ip6.arpa. ANY (QM)? crbase-ubuntu22-569341.local. (166)
Shrenik@crg21-ubuntu22:~$
```

```
cvlimit]
130.85.220.34
ngth 262144 bytes
0 packets dropped by kernel
Faisal@crg10-ubuntu22:~$ tcpdump -r vm1capture2.pcap
reading from file vm1capture2.pcap, link-type EN10MB (Ethernet), snapshot length 262144
15:13:47.318877 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:13:50.113034 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:13:53.934348 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:13:57.862687 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:13:59.380771 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:05.612555 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:08.955111 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:10.102266 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:11.502166 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:13.868605 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:17.891300 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:19.501258 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:22.907094 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:25.568946 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
Faisal@crg10-ubuntu22:~$
```



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15:14:05.612555 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:08.955111 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:10.102266 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:11.502166 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:13.868605 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:17.891300 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:19.501258 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:22.907094 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
15:14:25.568946 IP wireless-220-34.wireless.umbc.edu.mdns > 224.0.0.251.mdns: 0*- [0q] 1/0/0 (Cache flush) PTR crbase-ubuntu22-475898.local. (126)
Faisal@crg10-ubuntu22:~$ cat vm1capture2.pcap
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▯тU◆"◆◆▯◆▯◆◆-◆▯▯2▯5▯1▯5▯9▯9▯6▯b▯8▯8▯6▯2▯2▯f▯3▯3▯0▯0▯0▯0▯0▯0▯0▯0▯0▯0▯0▯0▯0▯8▯e▯f▯ip6▯arpa
                                                                       ◆▯x▯▯crbase-ubuntu22-475898▯localFaisal@crg10-ubuntu22:~$ |
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