Linux networking and firewalls report

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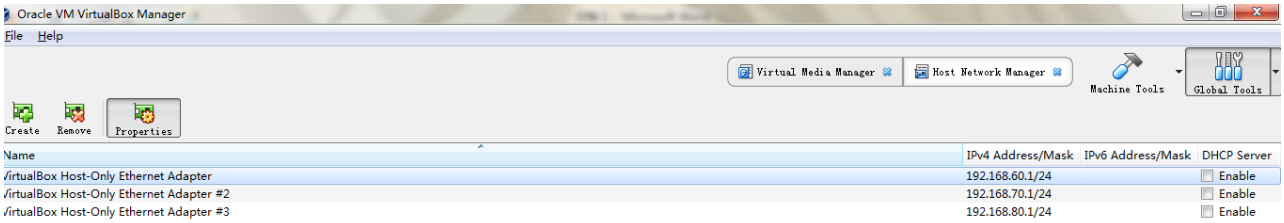
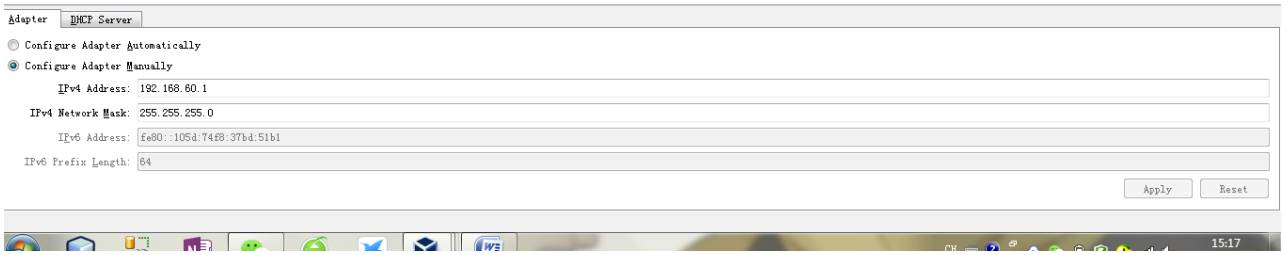
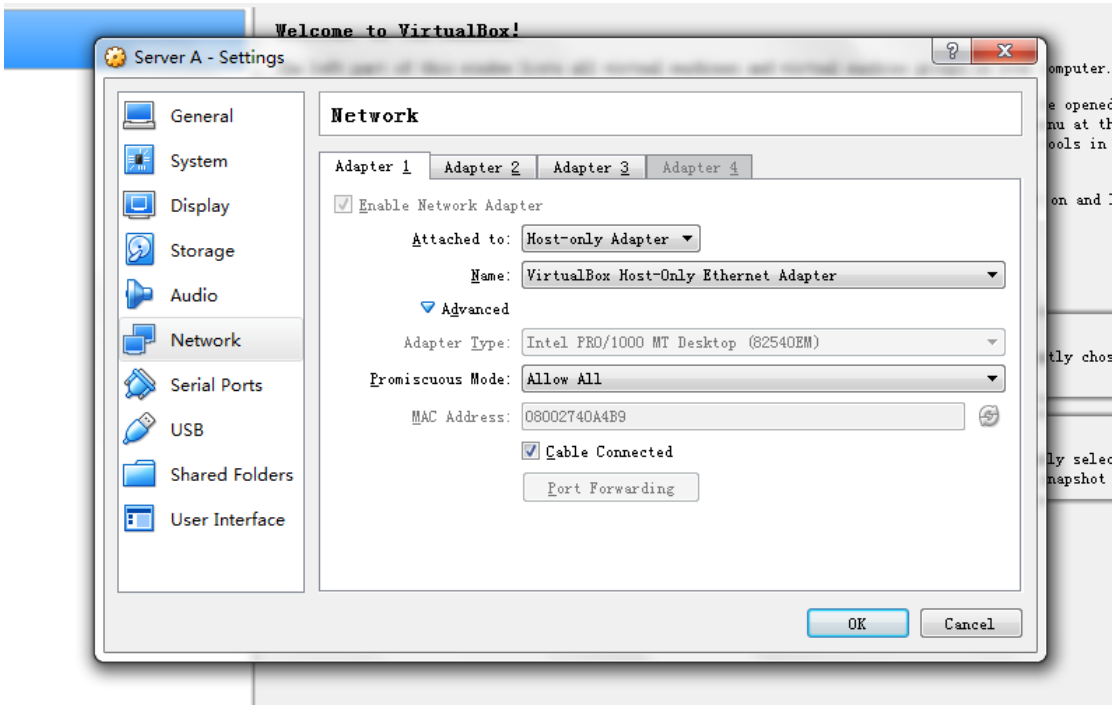
Setting VirtualBox appliance

Firstly I followed the instruction and set three IP addresses following the introduction:





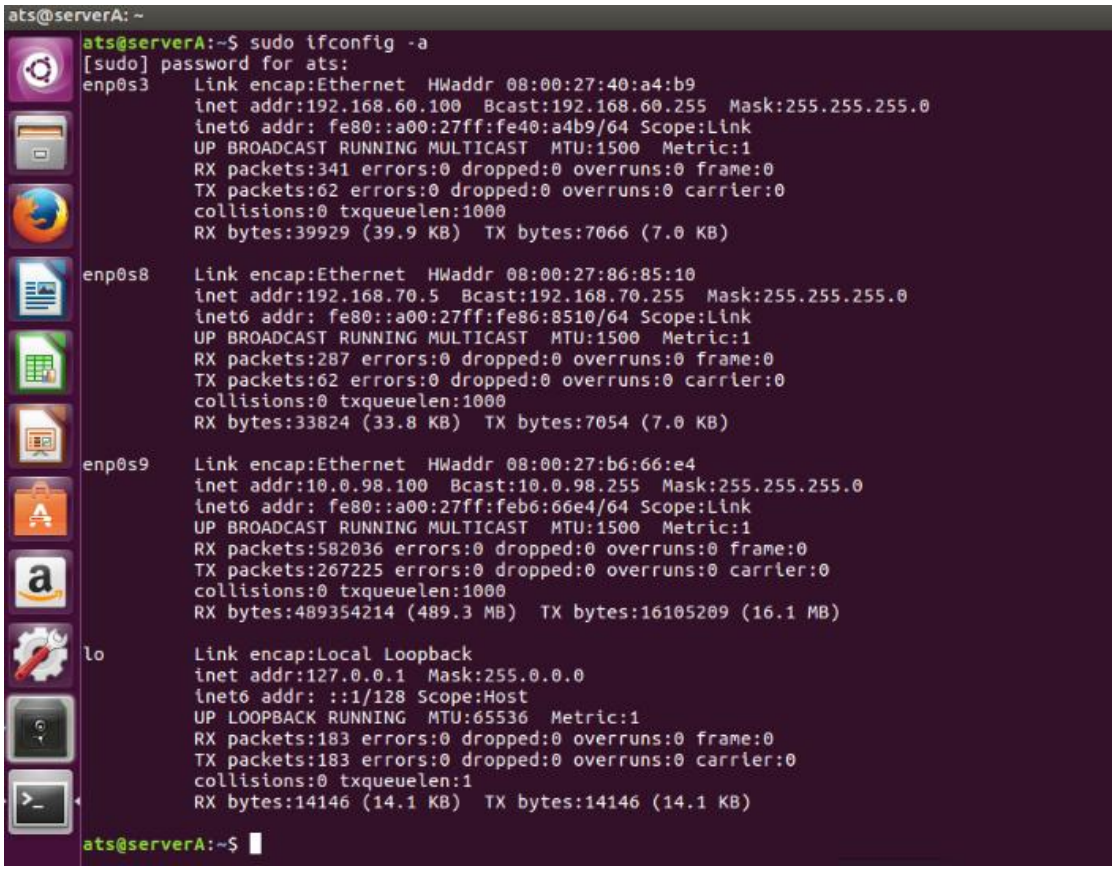
And Then I set Server A to use Host-only Adapter:



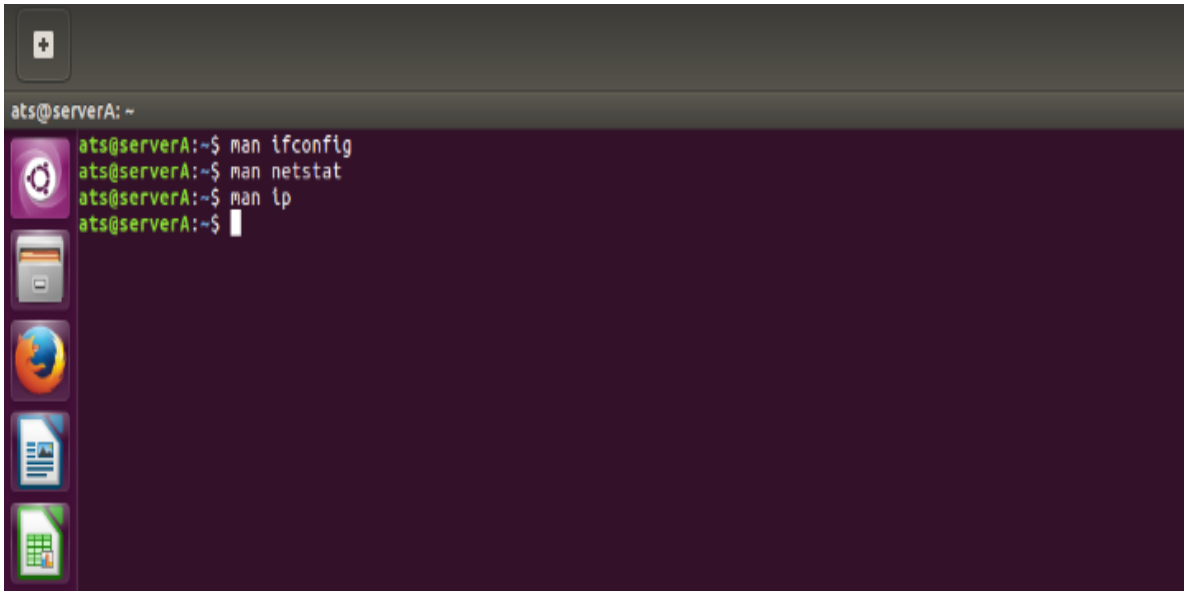
Now, let's start my Server A, and begin the Task1.

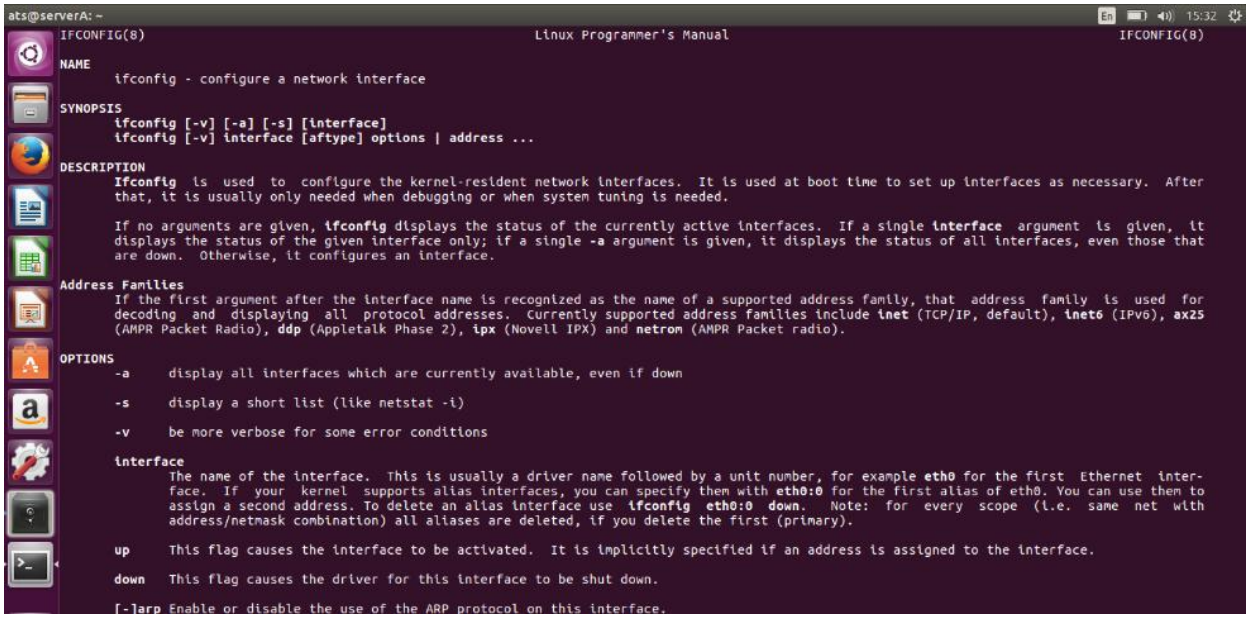
Task1:MAC address

Command ifconfig is used to show the network interface configuration. Command netstat is used to show the information of network connection, router table and network interface.

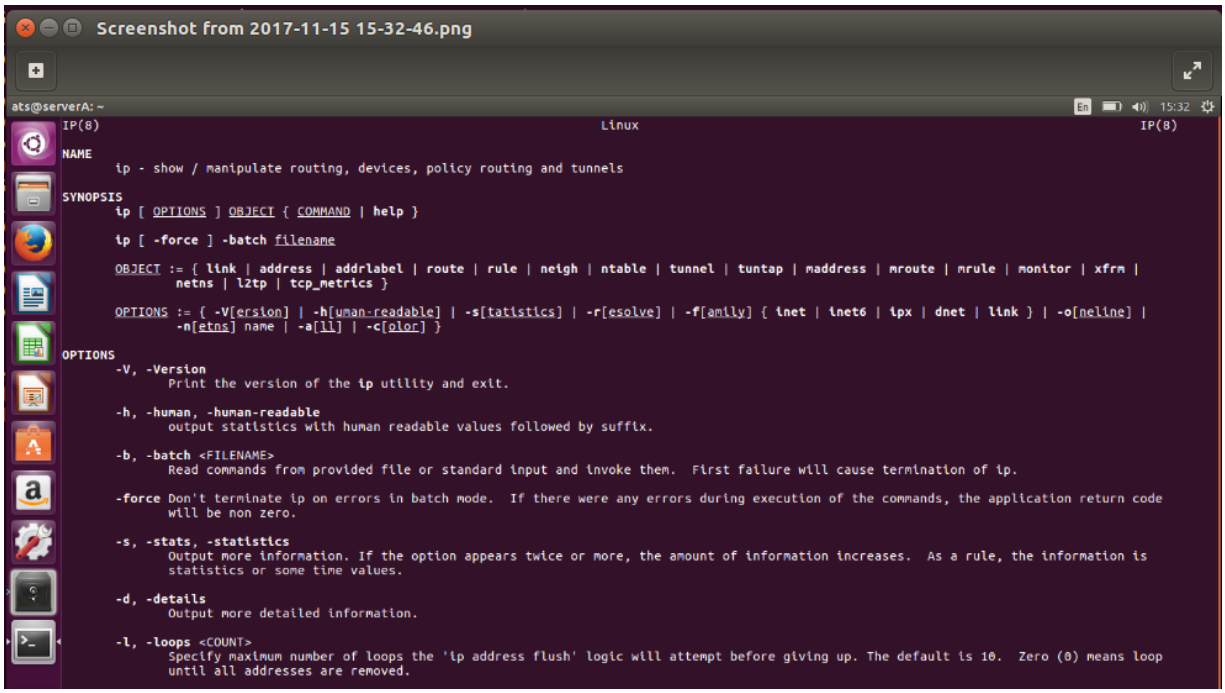


Linux man command is the abbreviation of manual, its man pages can help to check some reference information.

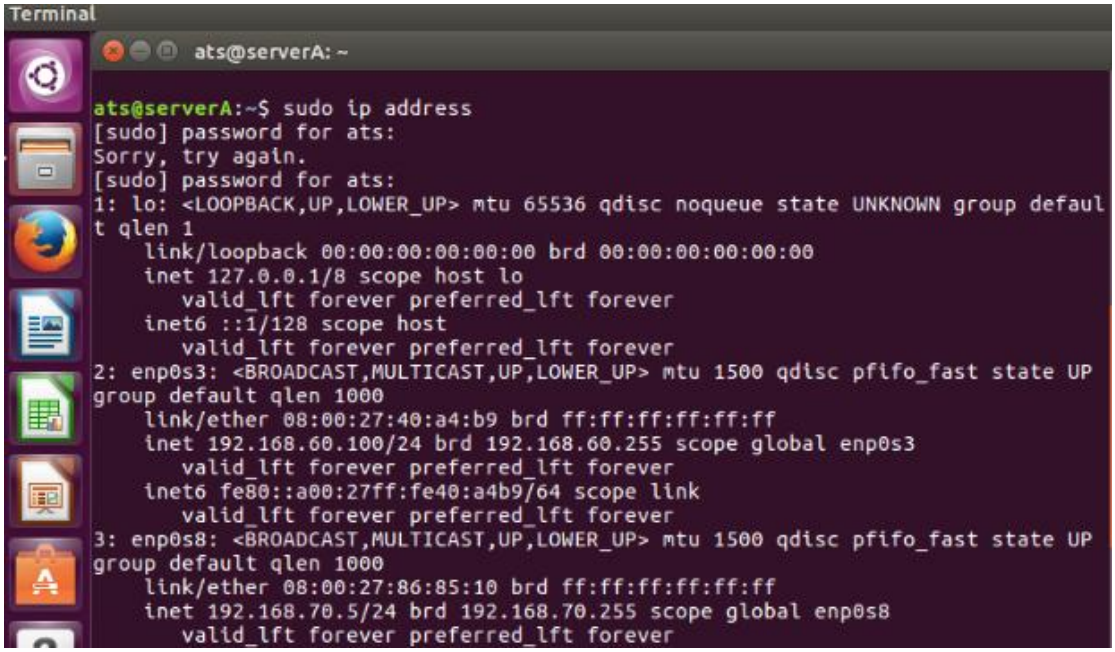


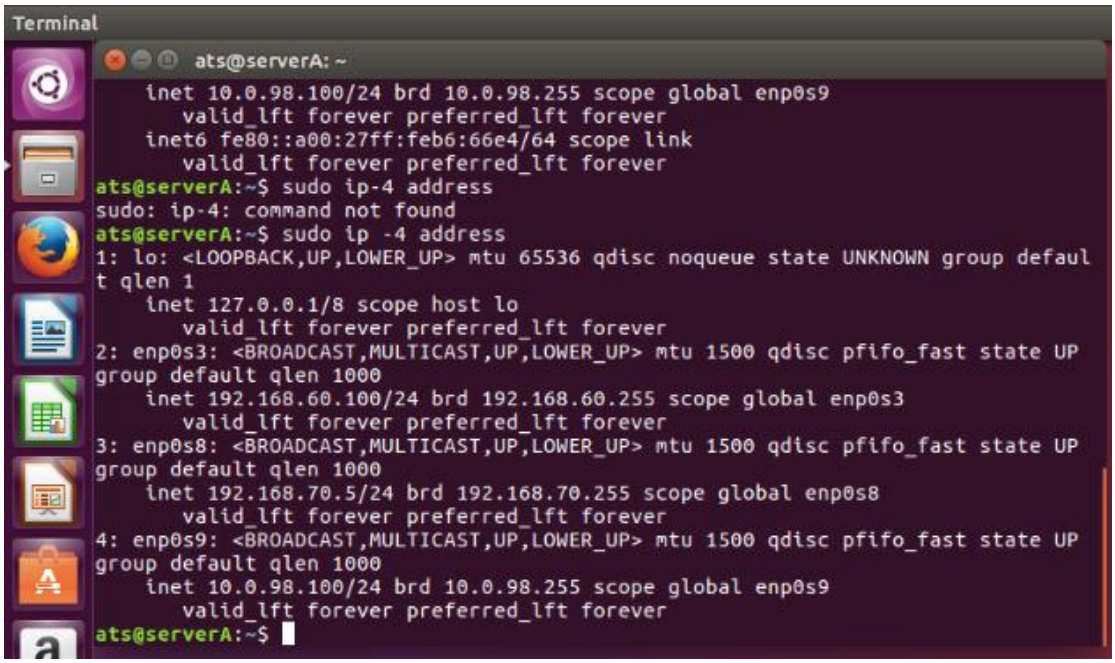

ats@serverA: ~
IFCONFIG(8) Linux Programmer's Manual IFCONFIG(8)
NAME
ifconfig - configure a network interface
SYNOPSIS
ifconfig [-v] [-a] [-s] [interface]
ifconfig [-v] interface [aftype] options | address ...
DESCRIPTION
Ifconfig is used to configure the kernel-resident network interfaces. It is used at boot time to set up interfaces as necessary. After that, it is usually only needed when debugging or when system tuning is needed.
If no arguments are given, ifconfig displays the status of the currently active interfaces. If a single interface argument is given, it displays the status of the given interface only; if a single -a argument is given, it displays the status of all interfaces, even those that are down. Otherwise, it configures an interface.
Address Families
If the first argument after the interface name is recognized as the name of a supported address family, that address family is used for decoding and displaying all protocol addresses. Currently supported address families include inet (TCP/IP, default), inet6 (IPv6), ax25 (AMPR Packet Radio), ddp (Appletalk Phase 2), ipx (Novell IPX) and netrom (AMPR Packet radio).
OPTIONS
-a display all interfaces which are currently available, even if down
-s display a short list (like netstat -i)
-v be more verbose for some error conditions
interface
The name of the interface. This is usually a driver name followed by a unit number, for example eth0 for the first Ethernet interface. If your kernel supports alias interfaces, you can specify them with eth0:0 for the first alias of eth0. You can use them to assign a second address. To delete an alias interface use ifconfig eth0:0 down. Note: for every scope (i.e. same net with address/netmask combination) all aliases are deleted, if you delete the first (primary).
up This flag causes the interface to be activated. It is implicitly specified if an address is assigned to the interface.
down This flag causes the driver for this interface to be shut down.
[-]arp Enable or disable the use of the ARP protocol on this interface.

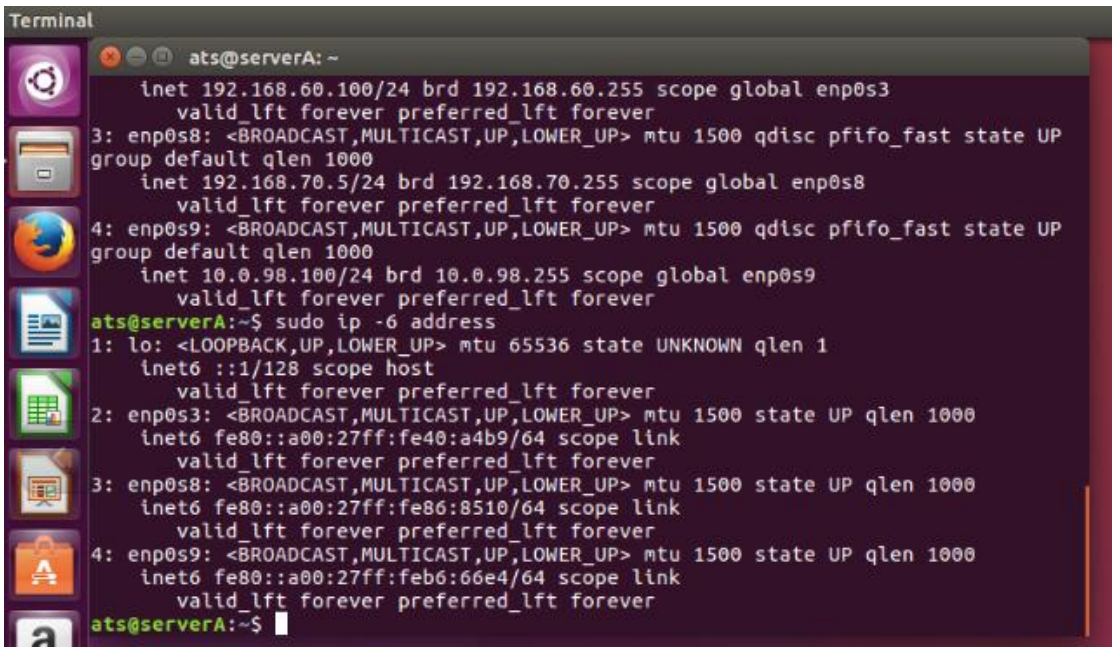

Screenshot from 2017-11-15 15-32-34.png
ats@serverA: ~
NETSTAT(8) Linux Programmer's Manual NETSTAT(8)
NAME
netstat - Print network connections, routing tables, interface statistics, masquerade connections, and multicast memberships
SYNOPSIS
netstat [address_family_options] [--tcp|-t] [--udp|-u] [--raw|-w] [--listening|-l] [--all|-a] [--numeric|-n] [--numeric-hosts] [--numeric-ports] [--numeric-users] [--symbolic|-N] [--extend|-e[--extend|-e]] [--timers|-o] [--program|-p] [--verbose|-v] [--continuous|-c]
netstat {--route|-r} [address_family_options] [--extend|-e[--extend|-e]] [--verbose|-v] [--numeric|-n] [--numeric-hosts] [--numeric-ports] [--numeric-users] [--continuous|-c]
netstat {--interfaces|-i} [--all|-a] [--extend|-e[--extend|-e]] [--verbose|-v] [--program|-p] [--numeric|-n] [--numeric-hosts] [--numeric-ports] [--numeric-users] [--continuous|-c]
netstat {--groups|-g} [--numeric|-n] [--numeric-hosts] [--numeric-ports] [--numeric-users] [--continuous|-c]
netstat {--masquerade|-M} [--extend|-e] [--numeric|-n] [--numeric-hosts] [--numeric-ports] [--numeric-users] [--continuous|-c]
netstat {--statistics|-s} [--tcp|-t] [--udp|-u] [--raw|-w]
netstat {--version|-V}
netstat {--help|-h}
address_family_options:
[-4] [-6] [--protocol={inet,unix,ipx,ax25,netrom,ddp}[,...]] [--unix|-x] [--inet|--ip] [--ax25] [--ipx] [--netrom] [--ddp]
DESCRIPTION
Netstat prints information about the Linux networking subsystem. The type of information printed is controlled by the first argument, as follows:
(none)
By default, netstat displays a list of open sockets. If you don't specify any address families, then the active sockets of all configured address families will be printed.
--route , -r
Display the kernel routing tables. See the description in route(8) for details. netstat -r and route -e produce the same output.



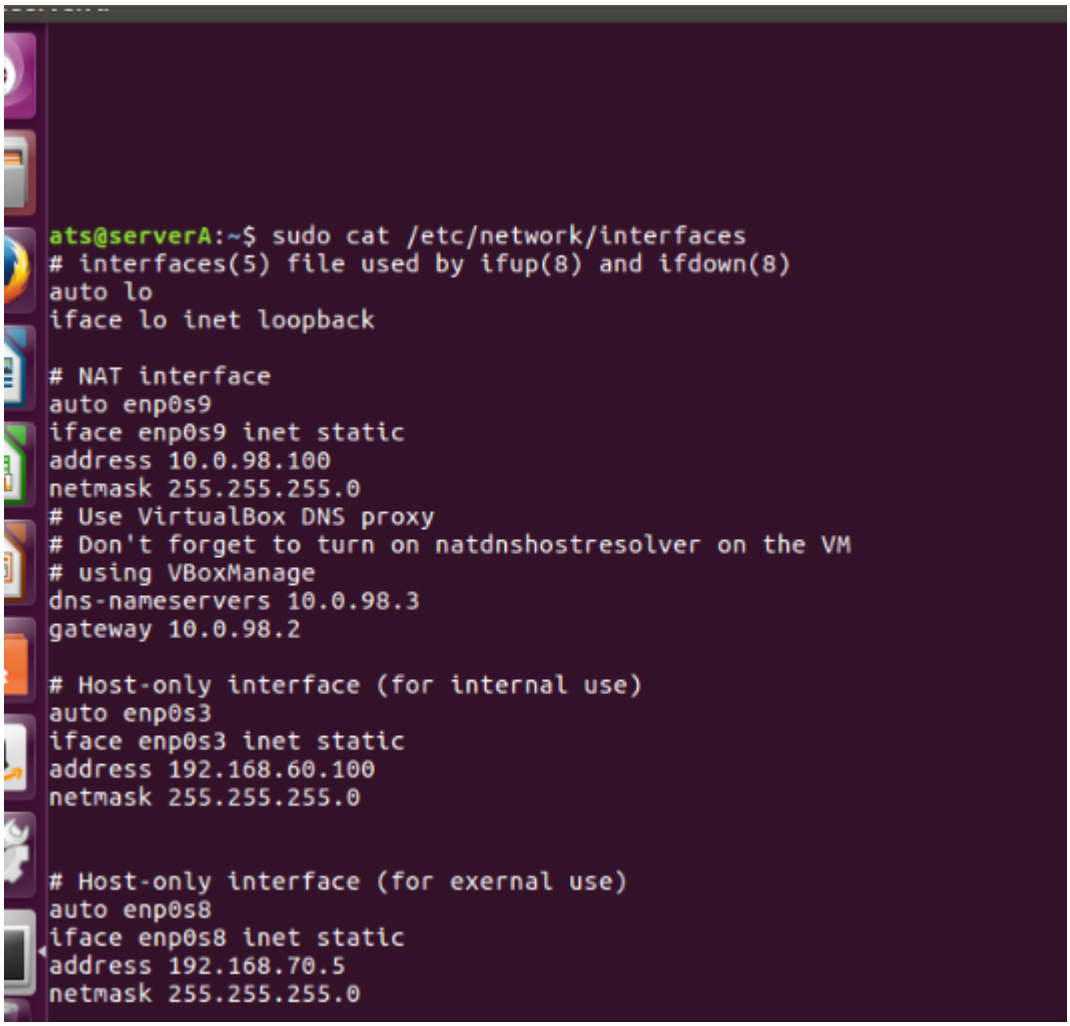
Task2: Network interfaces




Terminal
ats@serverA: ~
inet 10.0.98.100/24 brd 10.0.98.255 scope global enp0s9
valid_lft forever preferred_lft forever
inet6 fe80::a00:27ff:feb6:66e4/64 scope link
valid_lft forever preferred_lft forever
ats@serverA:~$ sudo ip-4 address
sudo: ip-4: command not found
ats@serverA:~$ sudo ip -4 address
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group defaul
t qlen 1
inet 127.0.0.1/8 scope host lo
valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP
group default qlen 1000
inet 192.168.60.100/24 brd 192.168.60.255 scope global enp0s3
valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP
group default qlen 1000
inet 192.168.70.5/24 brd 192.168.70.255 scope global enp0s8
valid_lft forever preferred_lft forever
4: enp0s9: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP
group default qlen 1000
inet 10.0.98.100/24 brd 10.0.98.255 scope global enp0s9
valid_lft forever preferred_lft forever
ats@serverA:~$

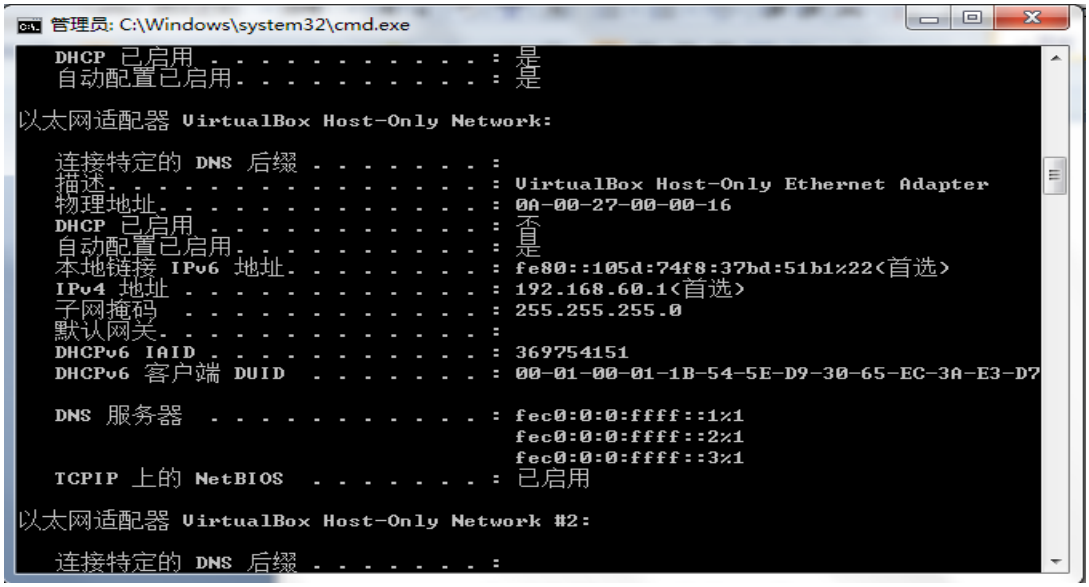

Terminal
ats@serverA: ~
inet 192.168.60.100/24 brd 192.168.60.255 scope global enp0s3
valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP
group default qlen 1000
inet 192.168.70.5/24 brd 192.168.70.255 scope global enp0s8
valid_lft forever preferred_lft forever
4: enp0s9: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP
group default qlen 1000
inet 10.0.98.100/24 brd 10.0.98.255 scope global enp0s9
valid_lft forever preferred_lft forever
ats@serverA:~$ sudo ip -6 address
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 state UNKNOWN qlen 1
inet6 ::1/128 scope host
valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 state UP qlen 1000
inet6 fe80::a00:27ff:fe40:a4b9/64 scope link
valid_lft forever preferred_lft forever
3: enp0s8: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 state UP qlen 1000
inet6 fe80::a00:27ff:fe86:8510/64 scope link
valid_lft forever preferred_lft forever
4: enp0s9: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 state UP qlen 1000
inet6 fe80::a00:27ff:feb6:66e4/64 scope link
valid_lft forever preferred_lft forever
ats@serverA:~$

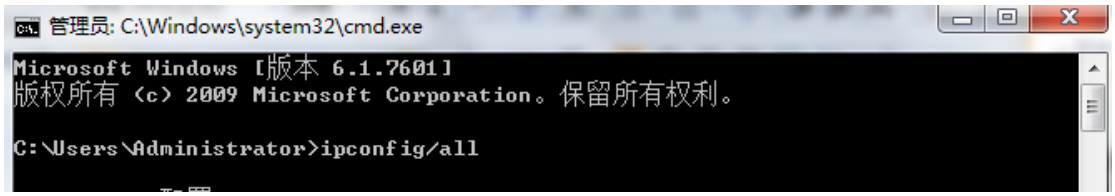
Task3:IP addresses, netmasks and subnet



Server A IP:192.168.60.100 , the IP address is assigned to the NAT interface emulated internally by VBox. The NAT engine from VirtualBox is completely decoupled from the any NAT that will configure on the VM.

Task4: Host-only interfaces

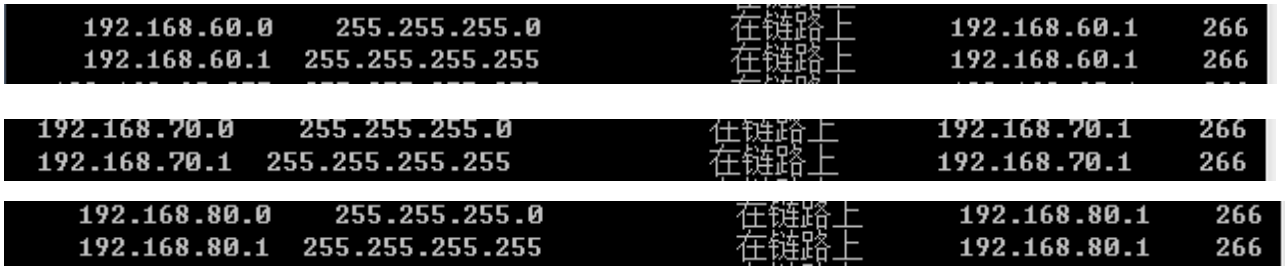




Because my host is Windows, so I wrote ipconfig /all in the CMD, then it showed information. The above screenshot is the host-only interface in the guest.

Task5: Routing tables in the host OS

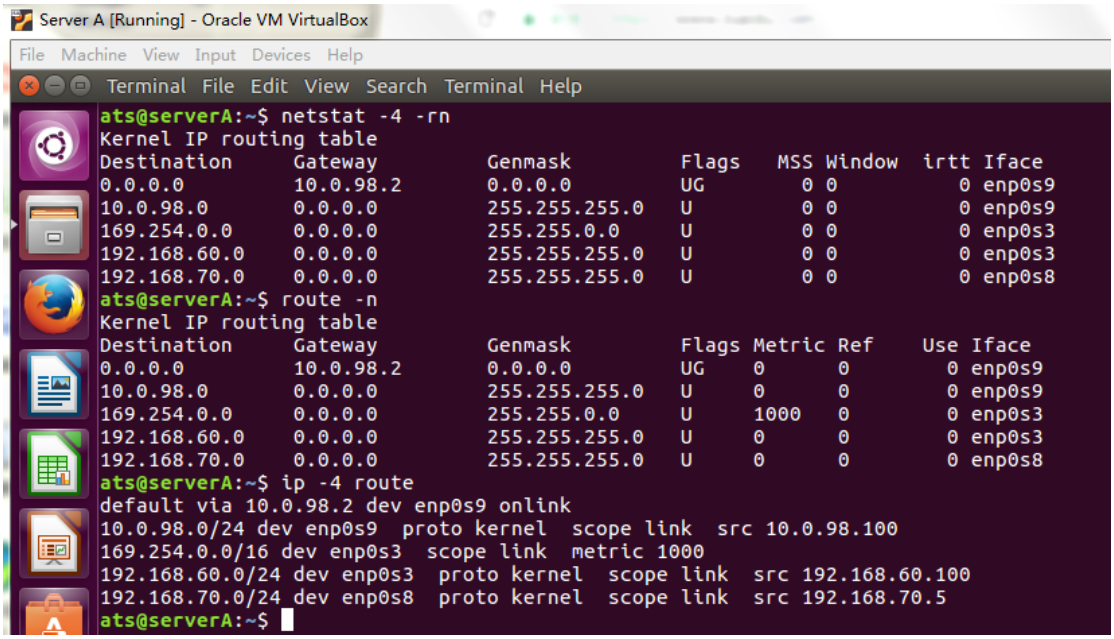
route -4 PRINT



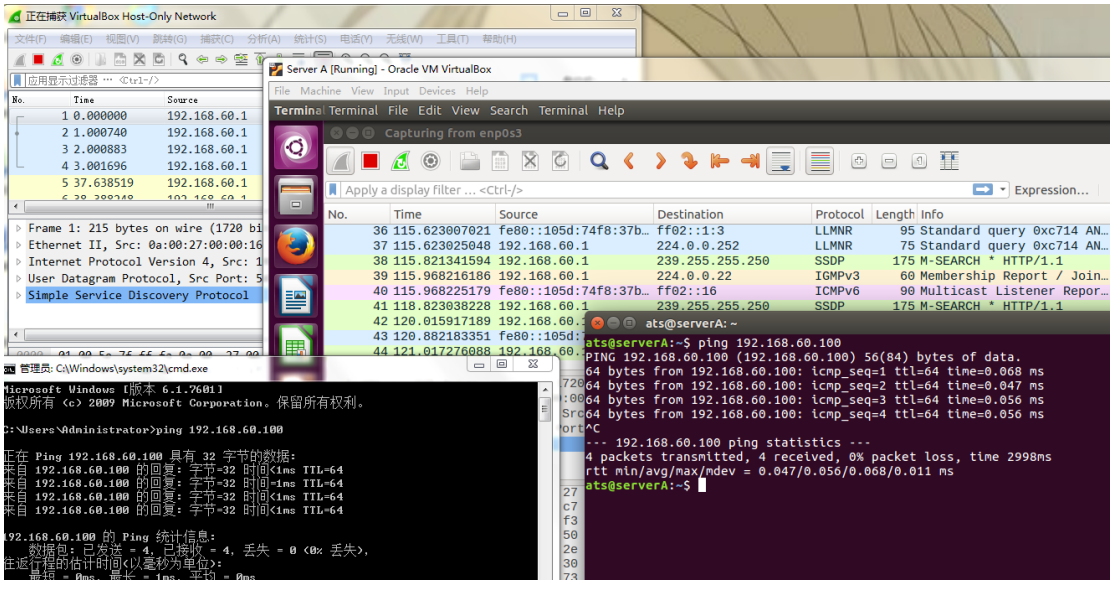
This command is to show the router table's information.

Task6: Routing tables in the guest OS

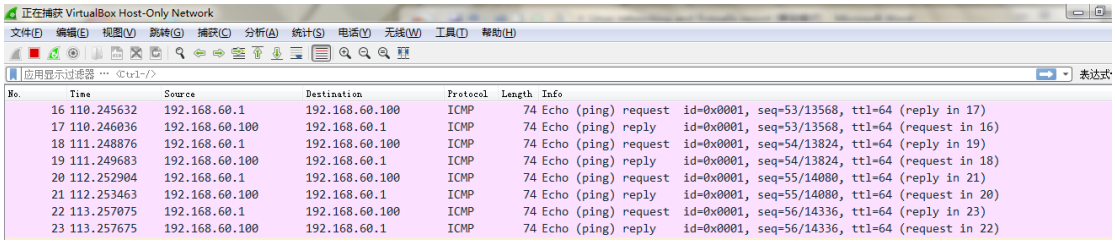
The gateway is NAT interface.

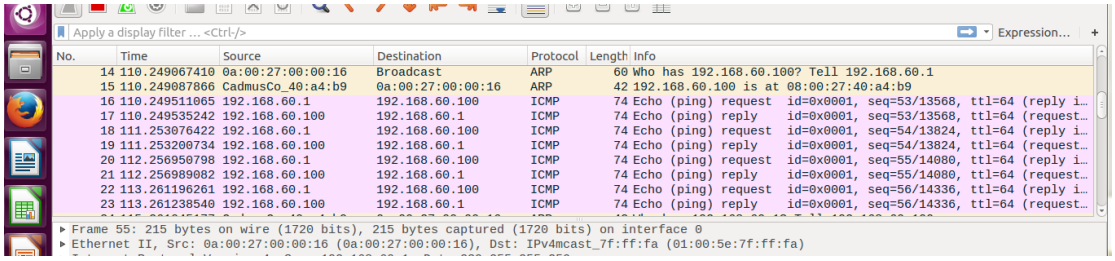


Task7: Ping the host-based host-only interface



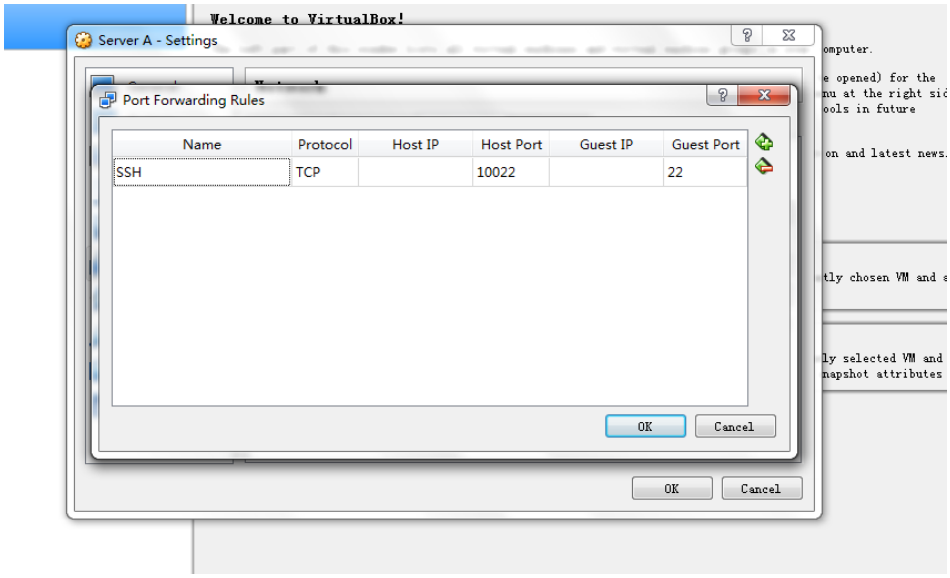
Obviously, it is identical.

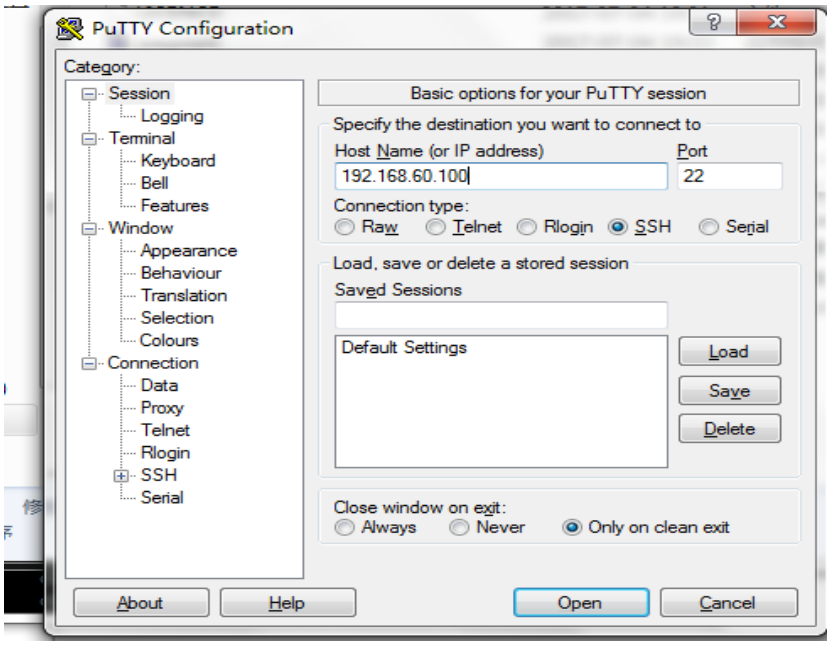




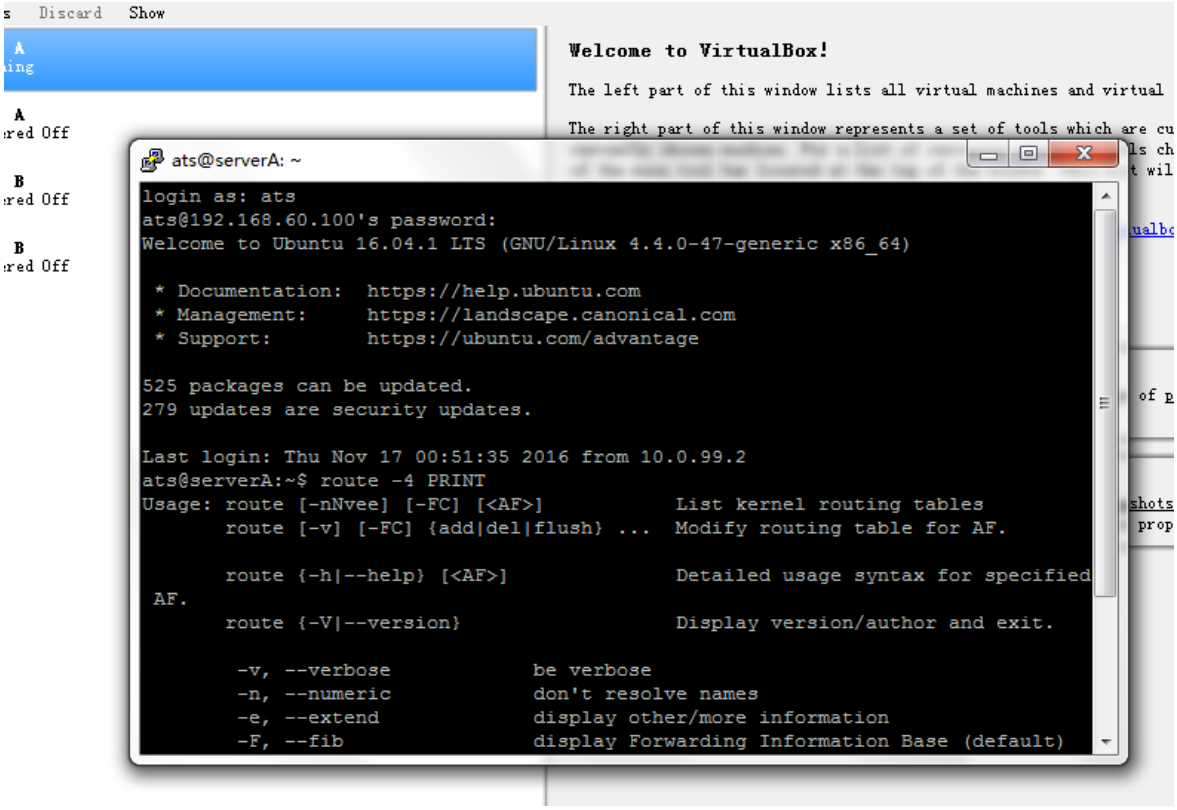
Task8: ssh into VM via localhost

My host is Windows, so I download putty to implementing the ssh.

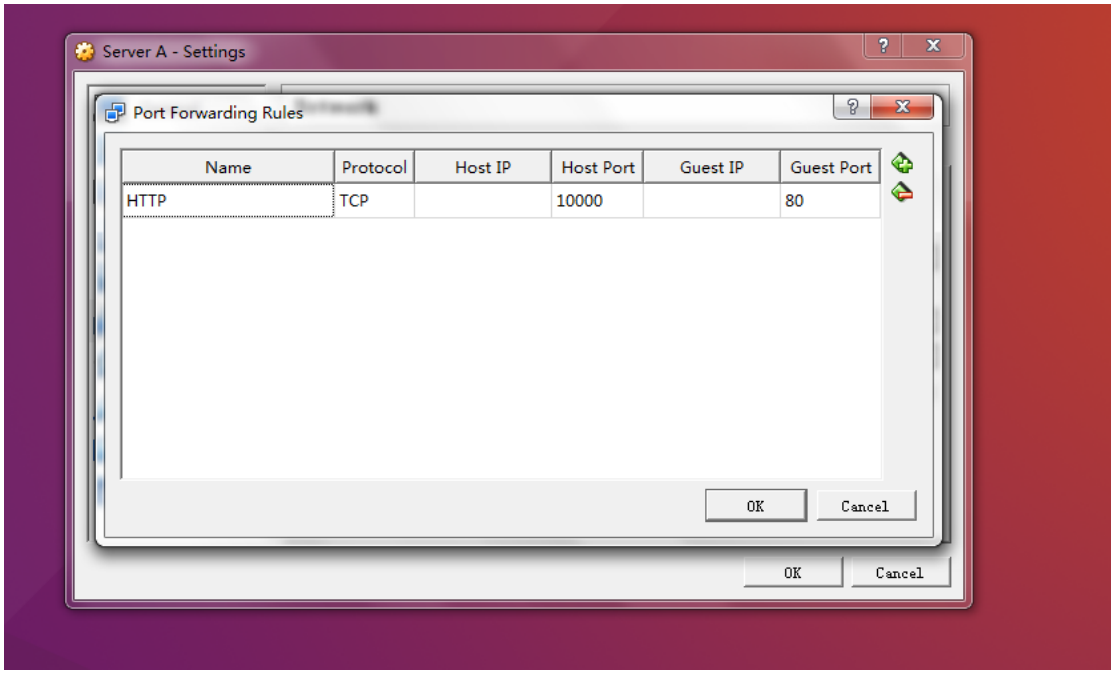


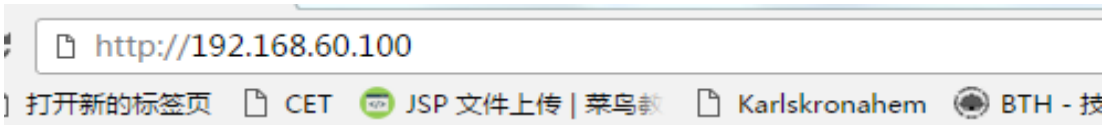


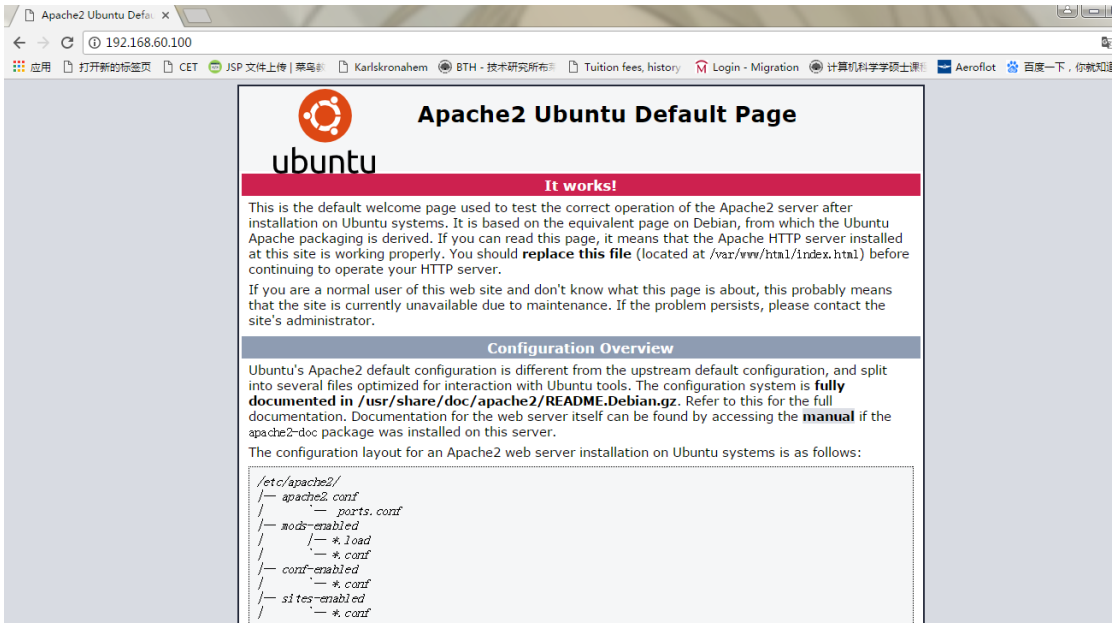
I input the serverA IP,and ssh default port is 22 , then I like the default port, then the black window prompt password, I input the ats password, then successfully login in.

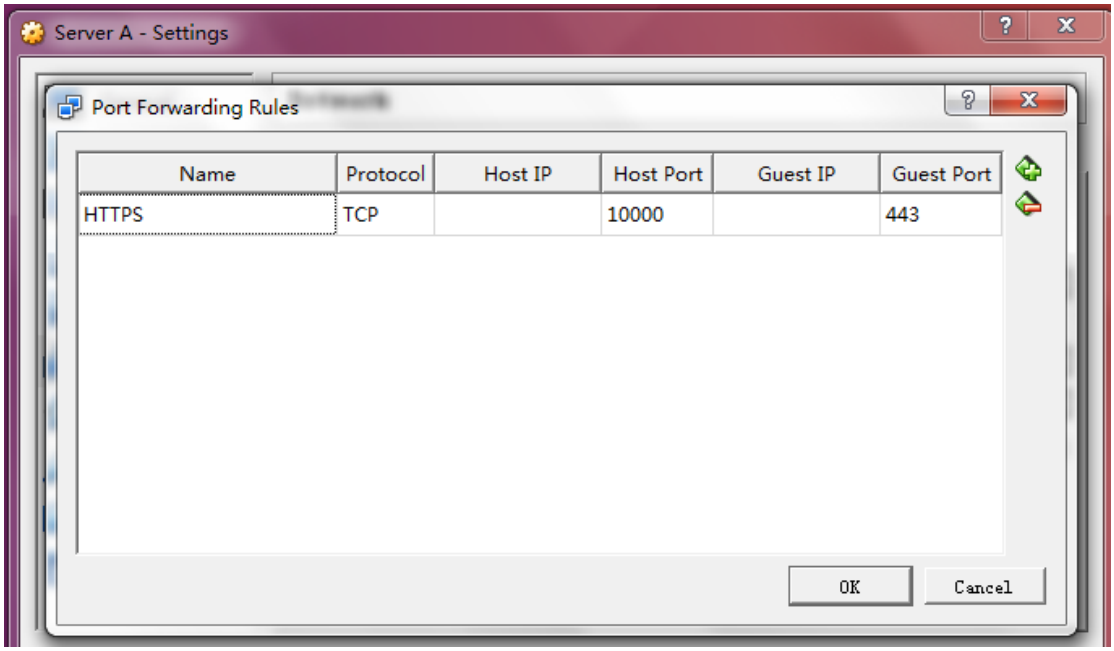


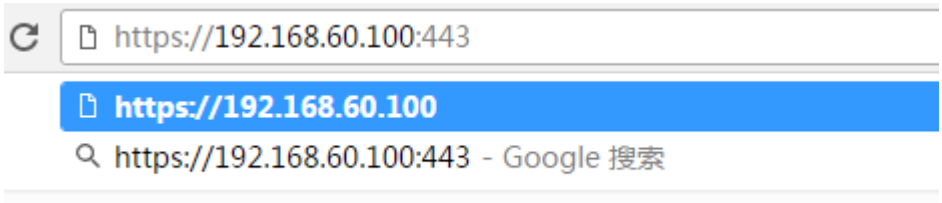
Task9:Add forwarding rules for HTTP and HTTPS in VirtualBox

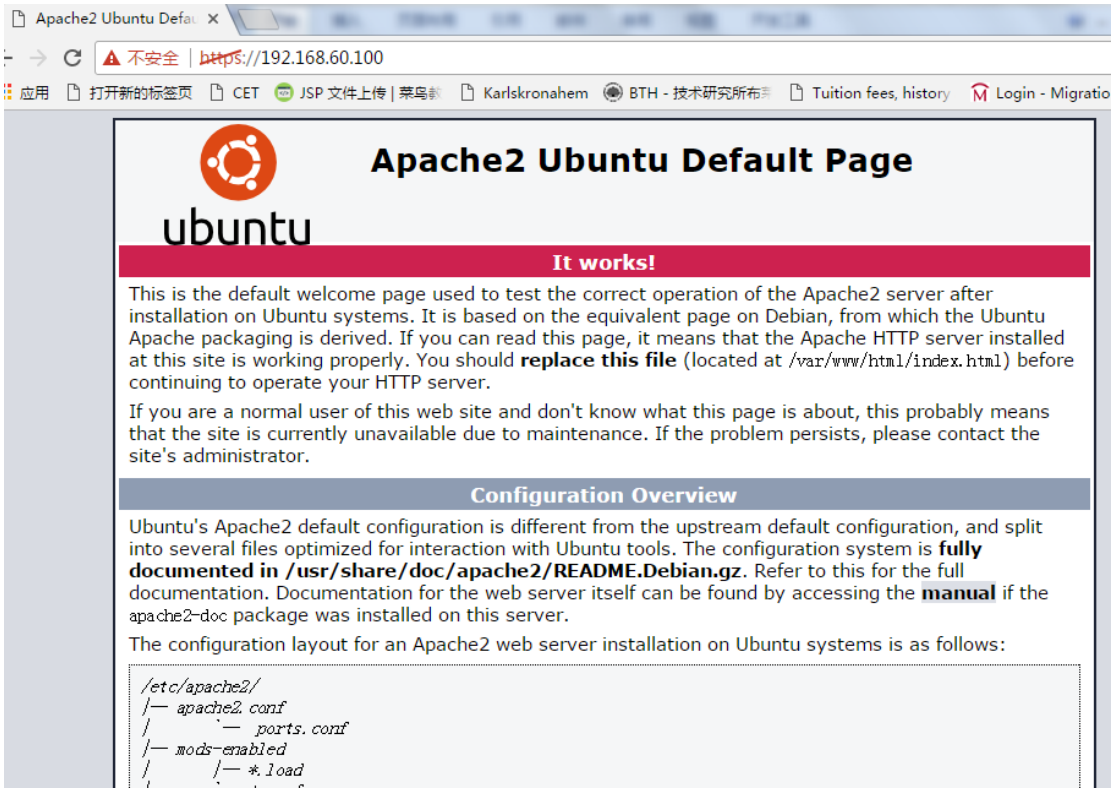








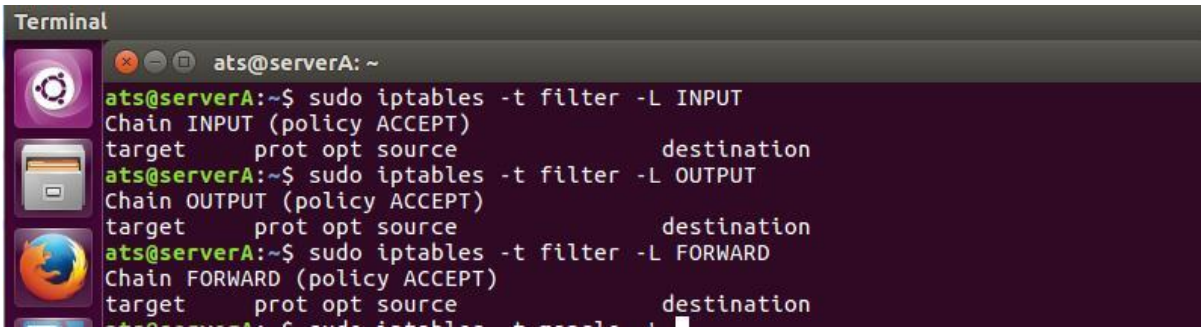




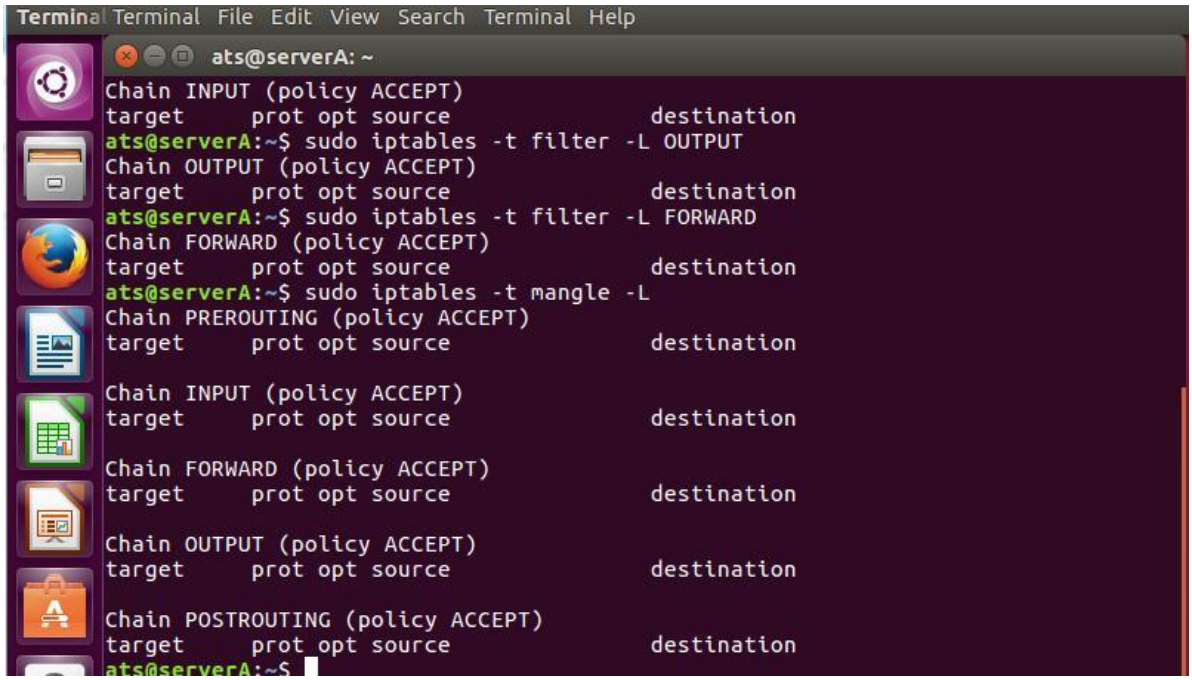
I changed the HTTPS, but Chrome may set something and show unsecure, but it was accessible.

Task10:Default firewall policy and rules

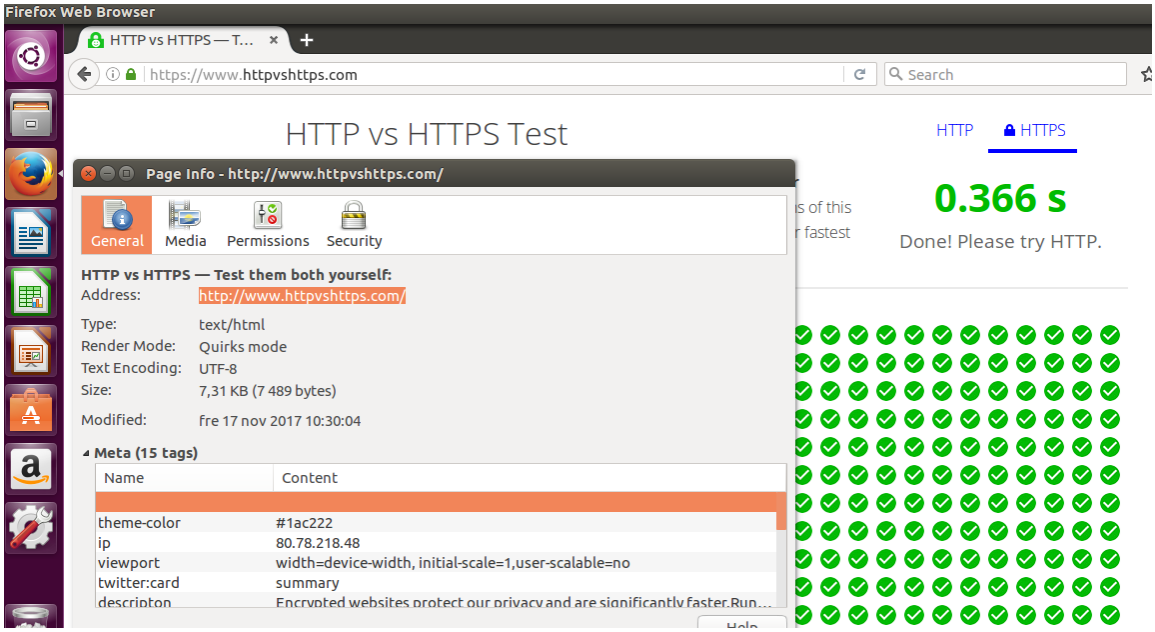
My rule : sudo iptables -L chain_name
Default is filter table.



Filter table: Filter packet.
NAT table:nat function(map port/IP).
Mangle:specific packets' modification.
INPUT chain: after through the router table ,its destination is this machine.
OUTPUT chain: generate the packet from the machine and ready to go outside.



```
ats@serverA:~$ sudo iptables -t nat -L
Chain PREROUTING (policy ACCEPT)
target     prot opt source               destination

Chain INPUT (policy ACCEPT)
target     prot opt source               destination

Chain OUTPUT (policy ACCEPT)
target     prot opt source               destination

Chain POSTROUTING (policy ACCEPT)
target     prot opt source               destination
ats@serverA:~$
```

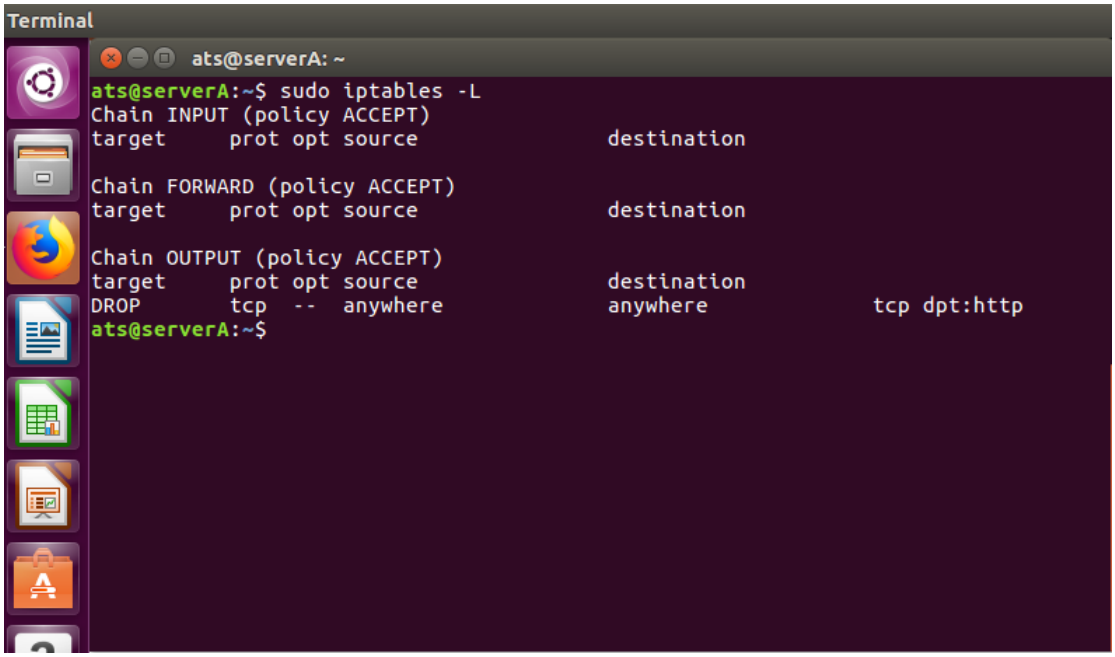


Task11:Block HTTP-browsing in the guest OS

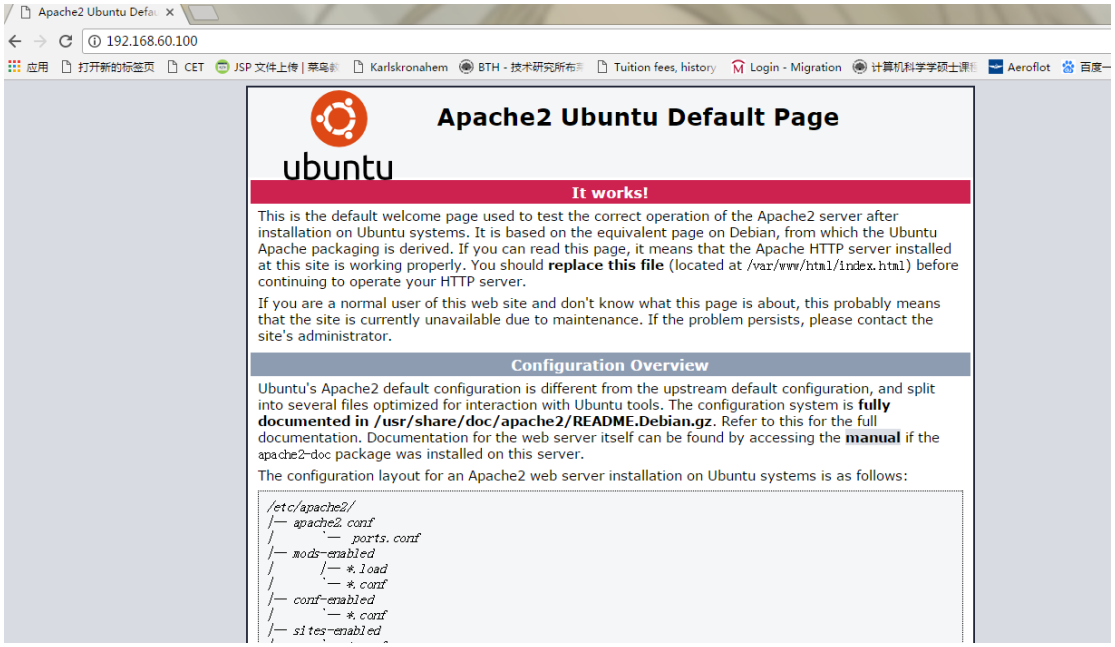
I blocked http-browsing in the guest OS by setting OUTPUT in DROP rule.

```
ats@serverA:~$ sudo iptables -A OUTPUT -p tcp --dport 80 -j DROP
ats@serverA:~$ sudo iptables -L
```

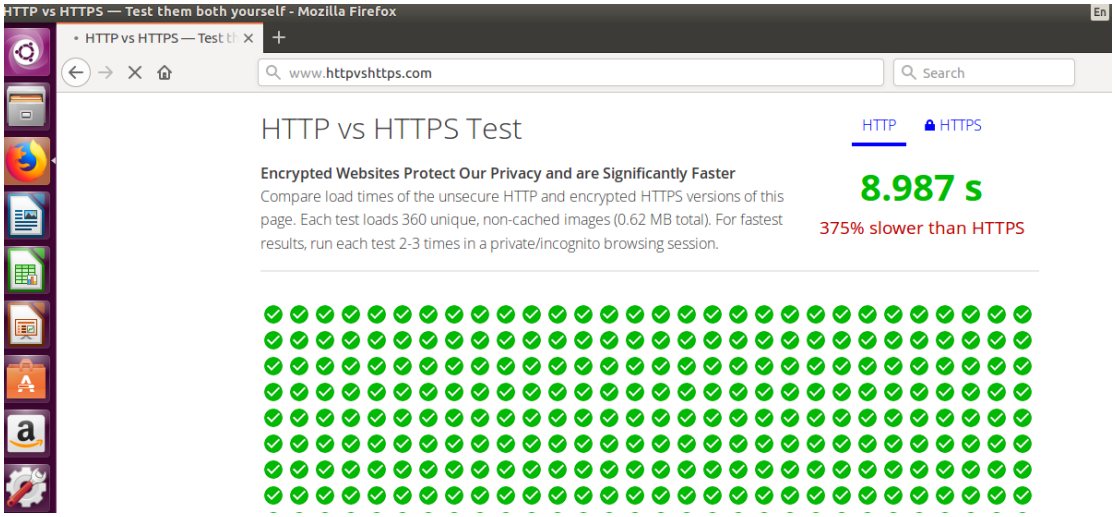
I made sure this rule have added in the chain.



I can browse in my host with HTTP.



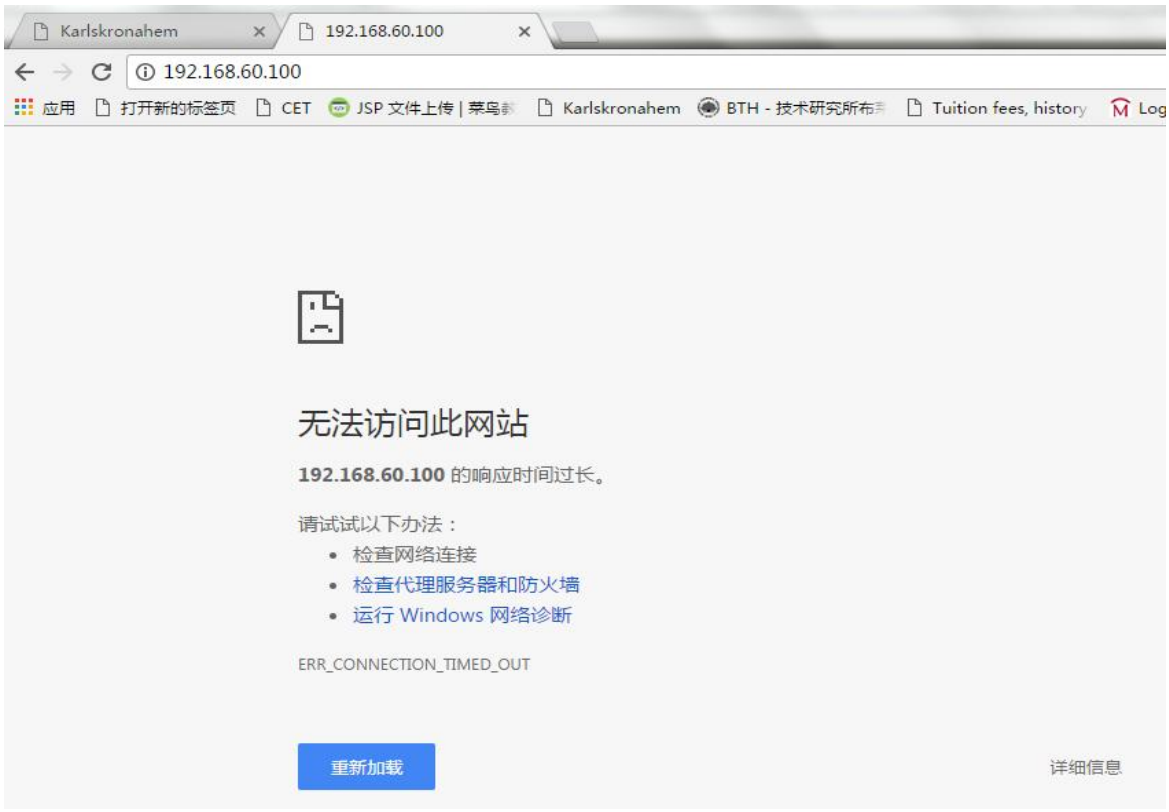
But look at my guest, it shows 375% slower than HTTPS, because it has already blocked by me.

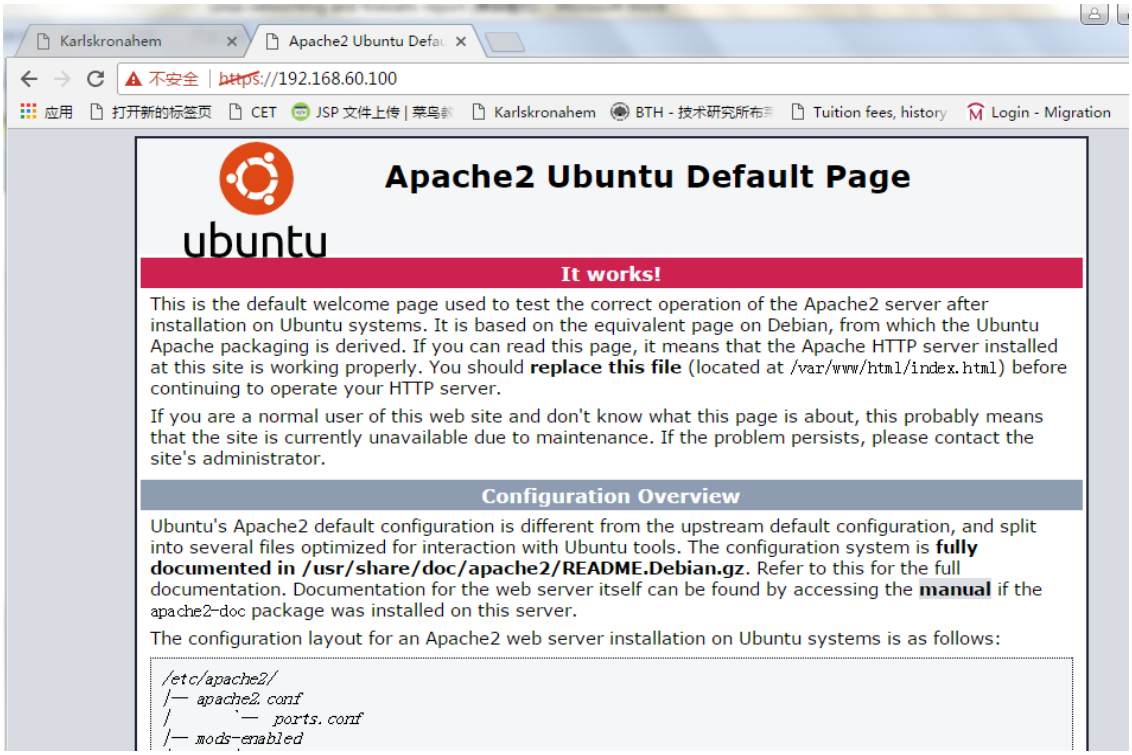


Task12:Block Apache web server from serving content over HTTP

I used DROP in INPUT chain to block only http. Http's port is 80.

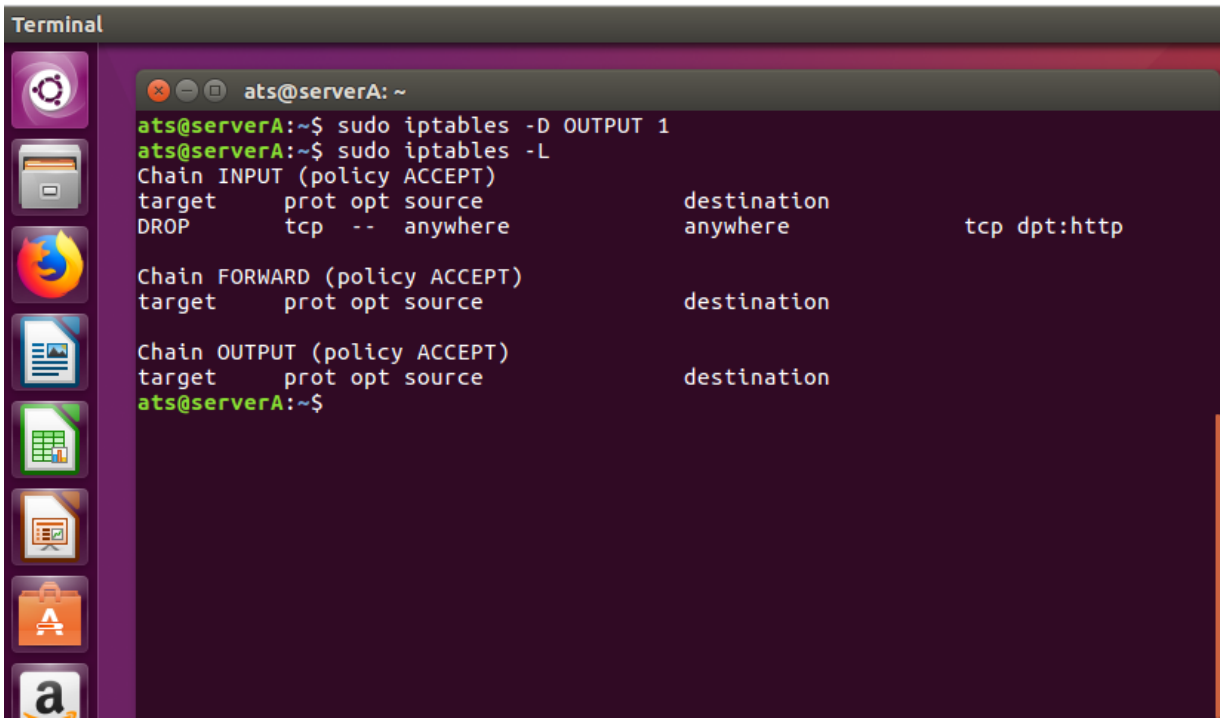
```
ats@serverA:~$ sudo iptables -A INPUT -p tcp --dport 80 -j DROP
ats@serverA:~$ sudo iptables -L
```

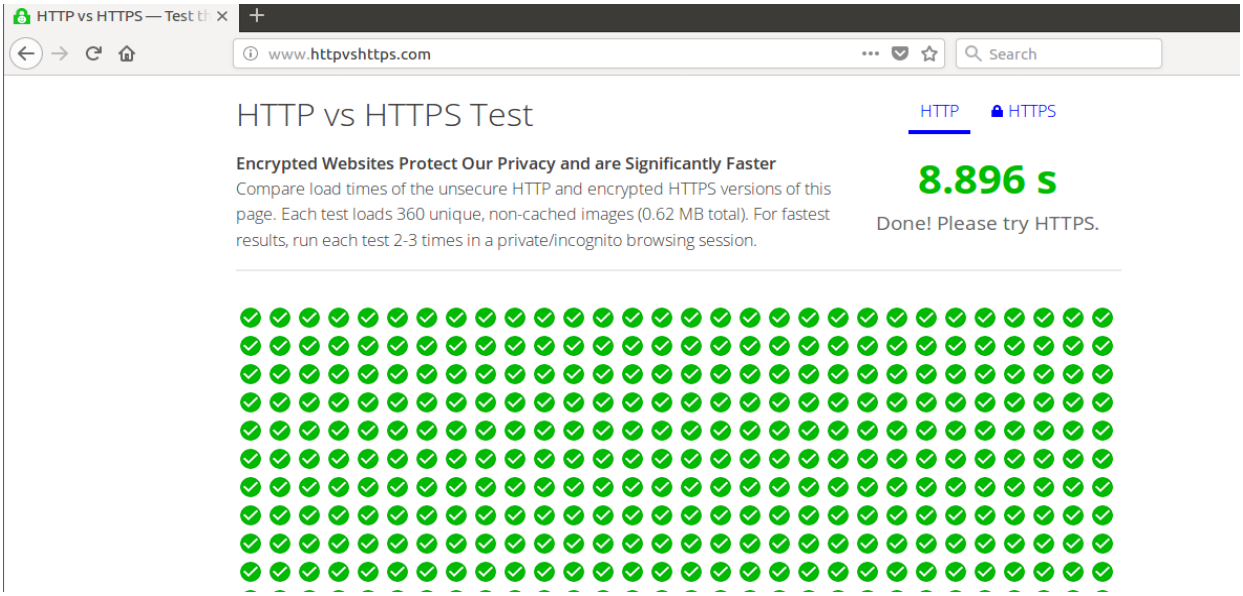




Task13:Unblock HTTP-browsing in the guest OS

Unblock the task11, I used delete -D and it is the first rule, so I wrote -D 1.





Task14:Use firewall.sh to configure the firewall

I copy the firewall.sh.template file at the same directory, and named it firewall.sh.

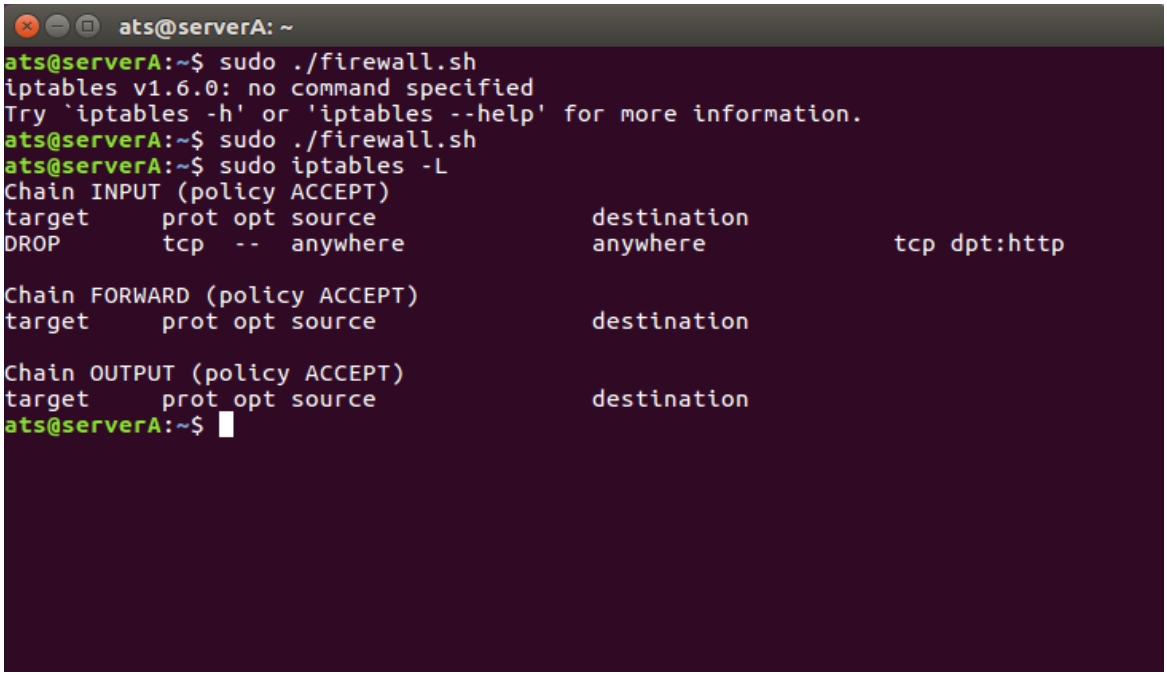
```
ats@serverA:~$ cp firewall.sh.template firewall.sh
```

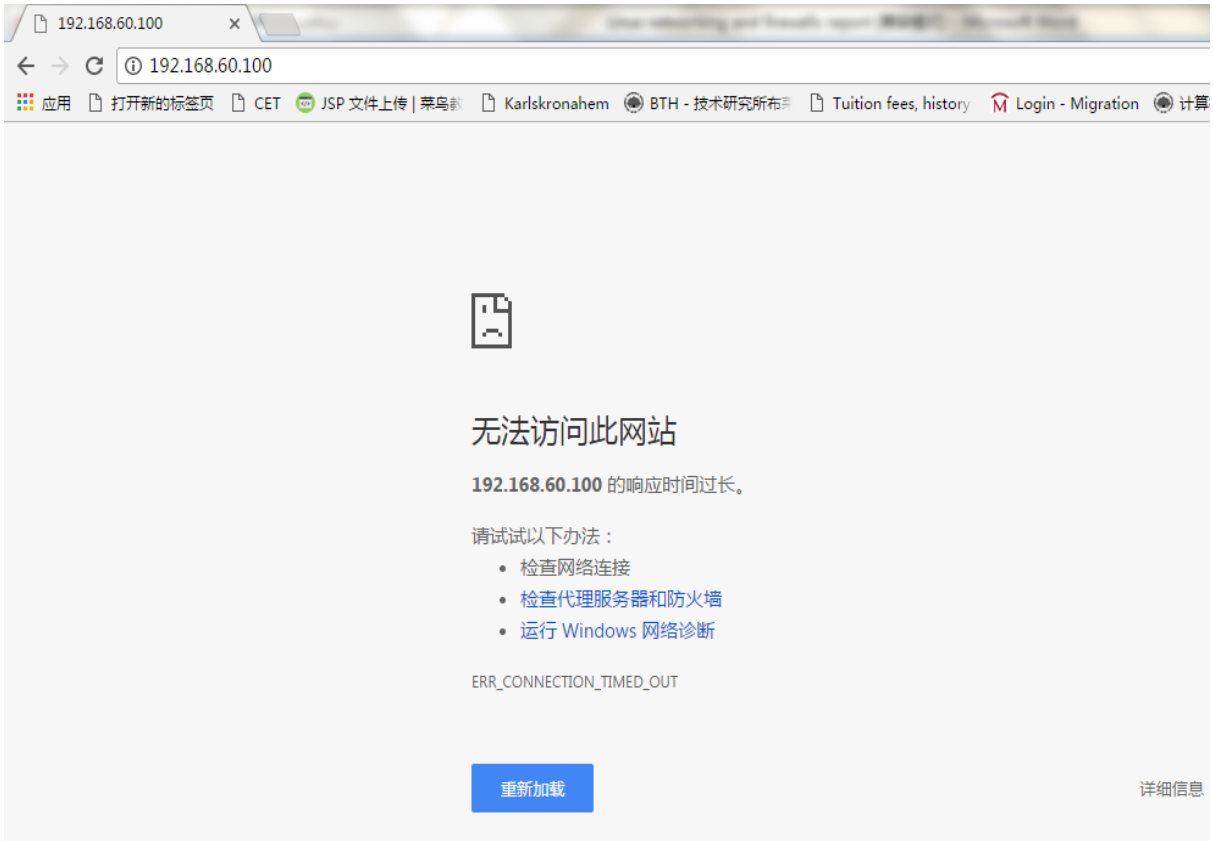
To keep the state I had in Task13, I wrote the rule like following:

firewall.sh (~/) - gedit

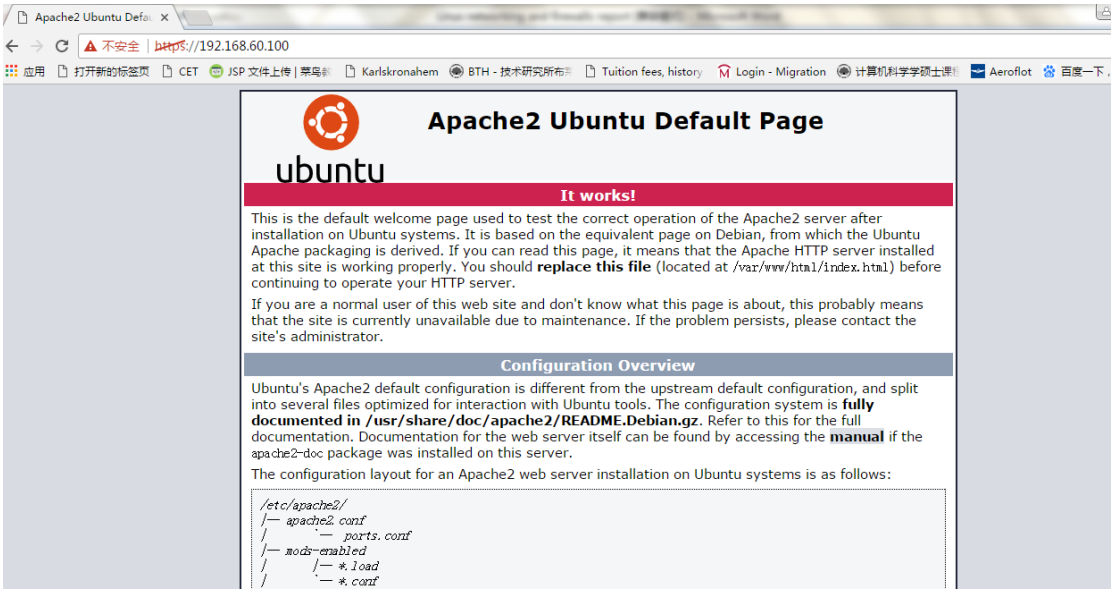
Open

```
# Default policy is to send to a dropping chain
$IPT -t filter -P INPUT ACCEPT
$IPT -t filter -P OUTPUT ACCEPT
$IPT -t filter -P FORWARD ACCEPT


# Create logging chains
#$IPT -t filter -N input_log
#$IPT -t filter -N output_log
#$IPT -t filter -N forward_log

# Set some logging targets for DROPPED packets
#$IPT -t filter -A input_log -j LOG --log-level notice --log-prefix "input drop: "
#$IPT -t filter -A output_log -j LOG --log-level notice --log-prefix "output drop: "
#$IPT -t filter -A forward_log -j LOG --log-level notice --log-prefix "forward drop: "
#echo "Added logging"

# Return from the logging chain to the built-in chain
#$IPT -t filter -A input_log -j RETURN
#$IPT -t filter -A output_log -j RETURN
#$IPT -t filter -A forward_log -j RETURN



# These rules must be inserted at the end of the built-in
# chain to log packets that will be dropped by the default
# DROP policy
#$IPT -t filter -A INPUT -j input_log
#$IPT -t filter -A OUTPUT -j output_log
#$IPT -t filter -A FORWARD -j forward_log
$IPT -A INPUT -p tcp --dport 80 -j DROP
```


ats@serverA: ~
ats@serverA:~$ sudo ./firewall.sh
iptables v1.6.0: no command specified
Try `iptables -h' or 'iptables --help' for more information.
ats@serverA:~$ sudo ./firewall.sh
ats@serverA:~$ sudo iptables -L
Chain INPUT (policy ACCEPT)
target prot opt source destination
DROP tcp -- anywhere anywhere tcp dpt:http
Chain FORWARD (policy ACCEPT)
target prot opt source destination
Chain OUTPUT (policy ACCEPT)
target prot opt source destination
ats@serverA:~$

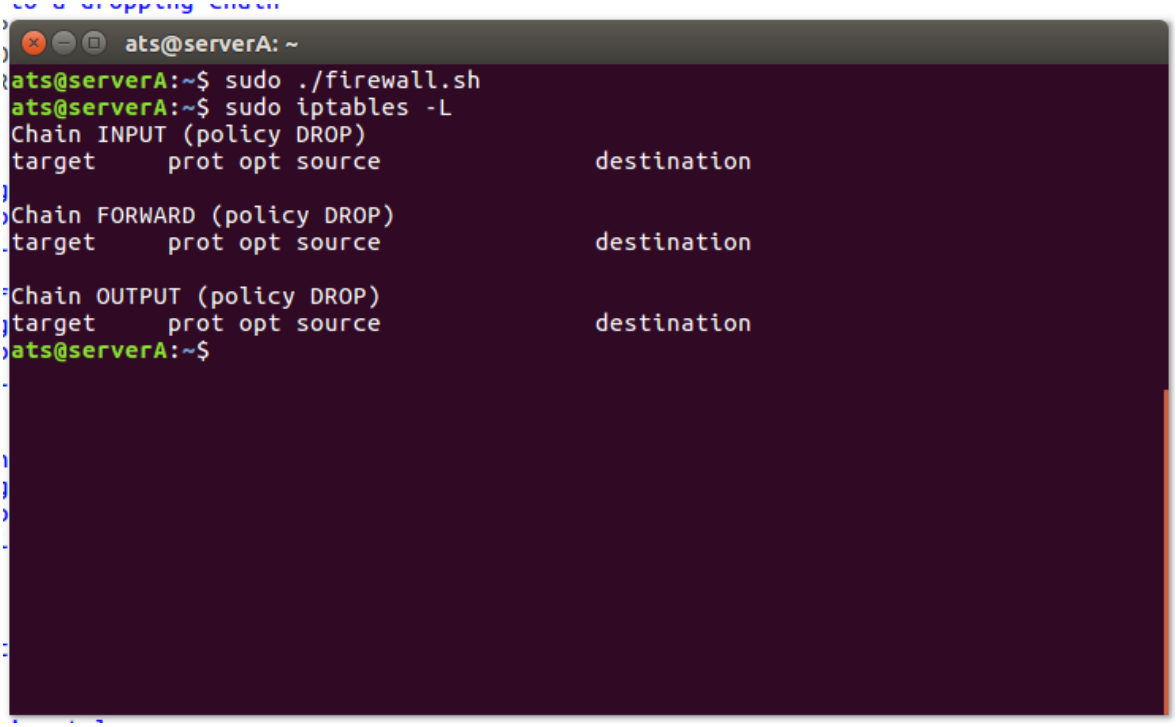

192.168.60.100
192.168.60.100
应用
打开新的标签页
CET
JSP 文件上传 | 菜鸟
Karlskronahem
BTH - 技术研究所布
Tuition fees, history
Login - Migration
计算
无法访问此网站
192.168.60.100 的响应时间过长。
请试试以下办法：
检查网络连接
检查代理服务器和防火墙
运行 Windows 网络诊断
ERR_CONNECTION_TIMED_OUT
重新加载
详细信息

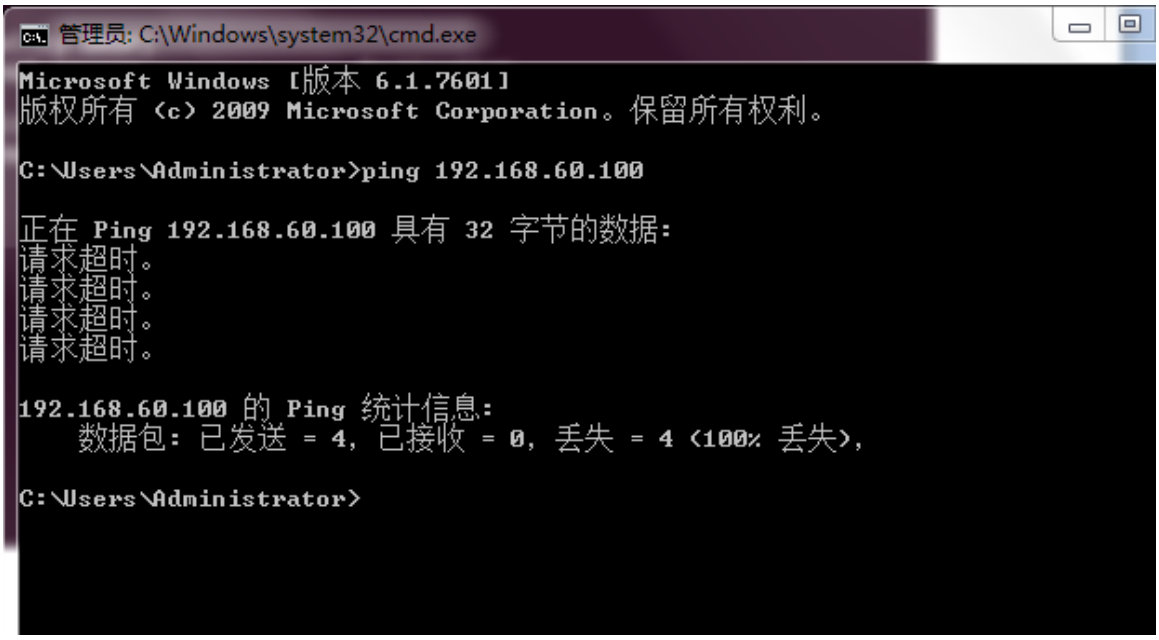
Then accessed in my host ,and checking!

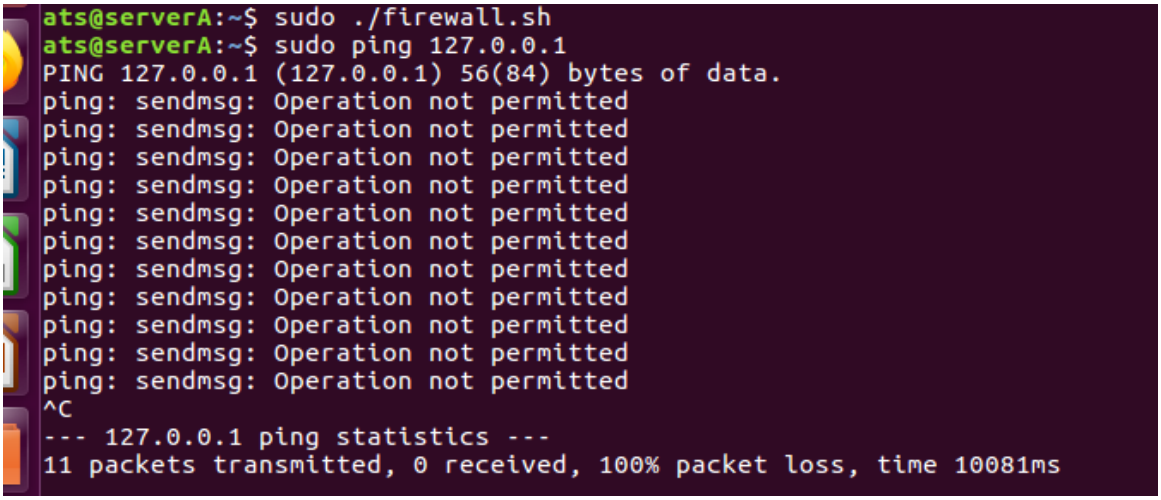


Task15:Change default firewall policy to DROP

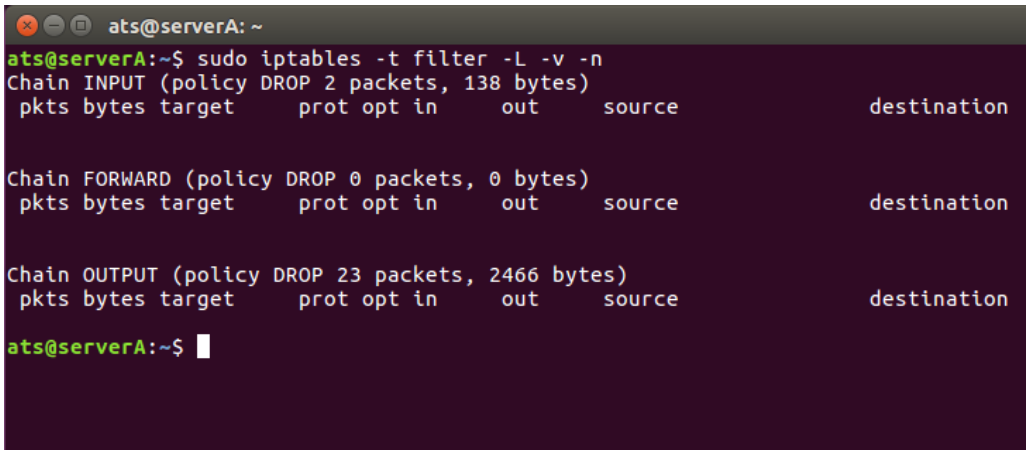
```
# Default policy is to send to a dropping chain
$IPT -t filter -P INPUT DROP
$IPT -t filter -P OUTPUT DROP
$IPT -t filter -P FORWARD DROP
```







Task16:Logging DROPPED packets



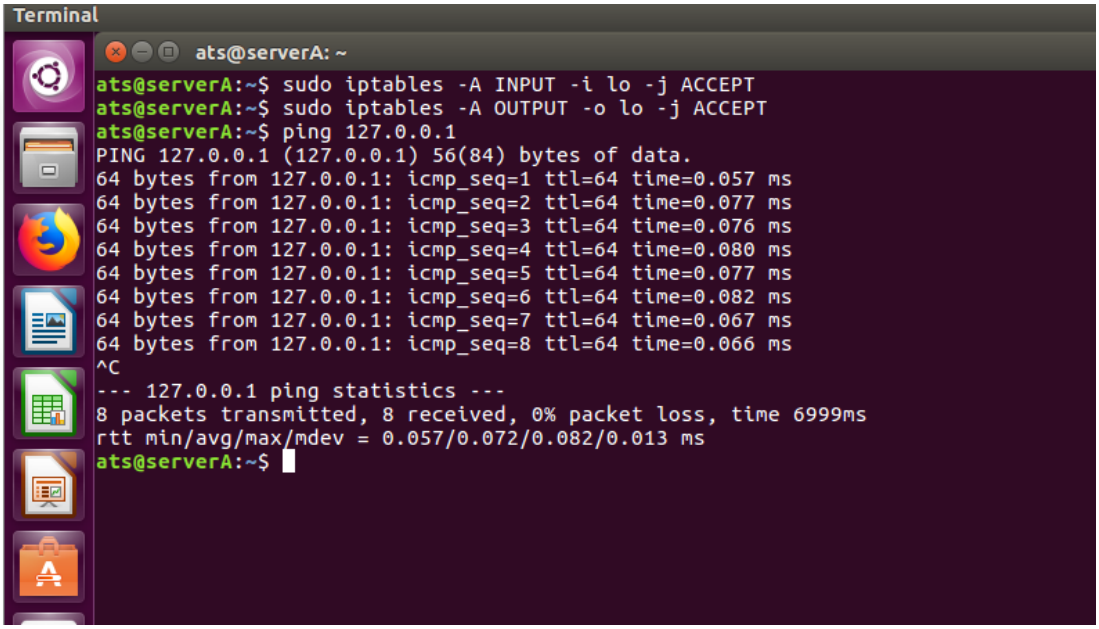
```
# Default policy is to send to a dropping chain
$IPT -t filter -P INPUT DROP
$IPT -t filter -P OUTPUT DROP
$IPT -t filter -P FORWARD DROP


# Create logging chains
$IPT -t filter -N input_log
$IPT -t filter -N output_log
$IPT -t filter -N forward_log

# Set some logging targets for DROPPED packets
$IPT -t filter -A input_log -j LOG --log-level notice --log-prefix "input drop: "
$IPT -t filter -A output_log -j LOG --log-level notice --log-prefix "output drop: "
$IPT -t filter -A forward_log -j LOG --log-level notice --log-prefix "forward drop: "
echo "Added logging"

# Return from the logging chain to the built-in chain
$IPT -t filter -A input_log -j RETURN
$IPT -t filter -A output_log -j RETURN
$IPT -t filter -A forward_log -j RETURN



# These rules must be inserted at the end of the built-in
# chain to log packets that will be dropped by the default
# DROP policy
$IPT -t filter -A INPUT -j input_log
$IPT -t filter -A OUTPUT -j output_log
$IPT -t filter -A FORWARD -j forward_log
```

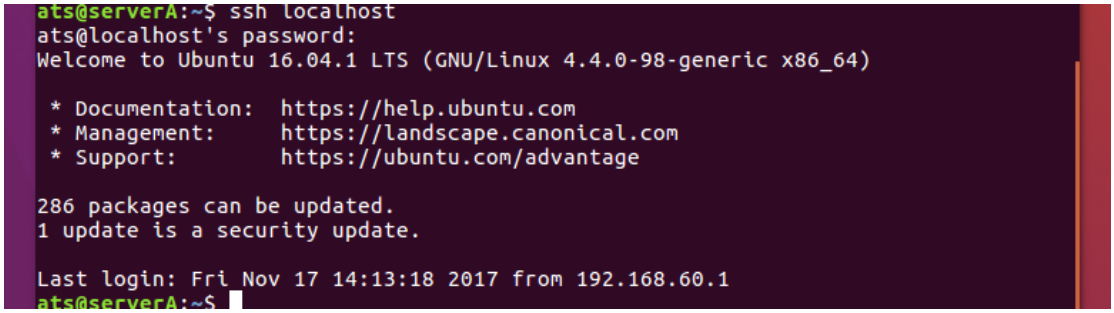
```
ats@serverA:~$ ping 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
ping: sendmsg: Operation not permitted
ping: sendmsg: Operation not permitted
ping: sendmsg: Operation not permitted
ping: sendmsg: Operation not permitted
^C
--- 127.0.0.1 ping statistics ---
4 packets transmitted, 0 received, 100% packet loss, time 2999ms
```

```
ats@serverA: ~
DST=224.0.0.251 LEN=146 TOS=0x00 PREC=0x00 TTL=255 ID=27992 DF PROTO=UDP SPT=53
=5353 LEN=126
 13:00:48 serverA kernel: [  748.765974] output drop: IN= OUT=enp0s8 SRC=192.16
 DST=224.0.0.251 LEN=146 TOS=0x00 PREC=0x00 TTL=255 ID=21300 DF PROTO=UDP SPT=5
T=5353 LEN=126
 13:00:48 serverA kernel: [  748.768174] output drop: IN= OUT=enp0s3 SRC=192.16
00 DST=224.0.0.251 LEN=146 TOS=0x00 PREC=0x00 TTL=255 ID=59834 DF PROTO=UDP SPT
 DPT=5353 LEN=126
 13:01:24 serverA kernel: [  785.006668] output drop: IN= OUT=enp0s9 SRC=10.0.9
 DST=10.0.98.3 LEN=60 TOS=0x00 PREC=0x00 TTL=64 ID=28502 DF PROTO=UDP SPT=36354
 LEN=40
 13:01:24 serverA kernel: [  785.006752] output drop: IN= OUT=enp0s9 SRC=10.0.9
 DST=10.0.98.3 LEN=60 TOS=0x00 PREC=0x00 TTL=64 ID=28503 DF PROTO=UDP SPT=36387
 LEN=40
 13:01:24 serverA kernel: [  785.006792] output drop: IN= OUT=enp0s9 SRC=10.0.9
 DST=10.0.98.3 LEN=60 TOS=0x00 PREC=0x00 TTL=64 ID=28504 DF PROTO=UDP SPT=54794
 LEN=40
 13:01:24 serverA kernel: [  785.006817] output drop: IN= OUT=enp0s9 SRC=10.0.9
 DST=10.0.98.3 LEN=60 TOS=0x00 PREC=0x00 TTL=64 ID=28505 DF PROTO=UDP SPT=37108
 LEN=40
 13:02:37 serverA kernel: [  857.862463] input drop: IN=enp0s3 OUT= MAC=01:00:5
0:fb:0a:00:27:00:00:16:08:00 SRC=192.168.60.1 DST=224.0.0.251 LEN=69 TOS=0x00 P
```

I think is the default policy is DROP and the packets are dropped, so it blocking my ping.

Task17:Enable traffic from loopback interface





Task18:Allow Server A to ping the other interfaces

I added rules and ping the traffic initiated from ServerA. Because the request-echo is 8 and reply echo is 0, so I used the two numbers. And I pointed out the initiated source ip, and accept the icmp protocol.

```
#Task 18 Allow ServerA to ping the other interfaces
$IPT -A OUTPUT -s 192.168.60.100 -p icmp --icmp-type 8 -m state --state NEW,ESTABLISHED,RELATED -j ACCEPT
echo "add echo ICMP Echo Request..."
$IPT -A INPUT -d 192.168.60.100 -p icmp --icmp-type 0 -m state --state ESTABLISHED,RELATED -j ACCEPT
echo "add echo ICMP Echo Reply..."
```

```
ats@serverA:~$ ping 192.168.60.100
PING 192.168.60.100 (192.168.60.100) 56(84) bytes of data.
64 bytes from 192.168.60.100: icmp_seq=1 ttl=64 time=0.152 ms
64 bytes from 192.168.60.100: icmp_seq=2 ttl=64 time=0.123 ms
64 bytes from 192.168.60.100: icmp_seq=3 ttl=64 time=0.231 ms
64 bytes from 192.168.60.100: icmp_seq=4 ttl=64 time=0.141 ms
64 bytes from 192.168.60.100: icmp_seq=5 ttl=64 time=0.136 ms
64 bytes from 192.168.60.100: icmp_seq=6 ttl=64 time=0.237 ms
64 bytes from 192.168.60.100: icmp_seq=7 ttl=64 time=0.076 ms
64 bytes from 192.168.60.100: icmp_seq=8 ttl=64 time=0.251 ms
64 bytes from 192.168.60.100: icmp_seq=9 ttl=64 time=0.232 ms
64 bytes from 192.168.60.100: icmp_seq=10 ttl=64 time=0.129 ms
64 bytes from 192.168.60.100: icmp_seq=11 ttl=64 time=0.133 ms
64 bytes from 192.168.60.100: icmp_seq=12 ttl=64 time=0.137 ms
^C
--- 192.168.60.100 ping statistics ---
12 packets transmitted, 12 received, 0% packet loss, time 10999ms
rtt min/avg/max/mdev = 0.076/0.164/0.251/0.057 ms
```

Task19:Allow Server A to ping all hosts

To ping the host I need it have DNS service, so I accept port 53. Then accept icmp echo.

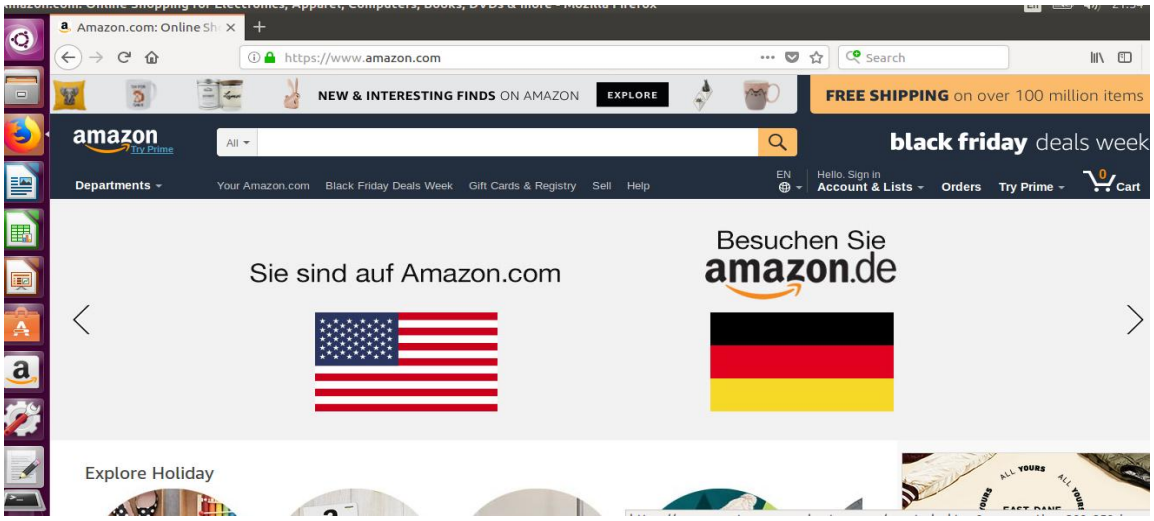
```
#Task19 :Allow Server A to ping all host
$IPT -A OUTPUT -p udp --dport 53 -j ACCEPT
$IPT -A INPUT -p udp --sport 53 -j ACCEPT
$IPT -A INPUT -p udp --dport 53 -j ACCEPT
$IPT -A OUTPUT -p udp --sport 53 -j ACCEPT

$IPT -A OUTPUT -p icmp --icmp-type 8 -j ACCEPT
$IPT -A INPUT -p icmp --icmp-type 0 -j ACCEPT
$IPT -A INPUT -p icmp --icmp-type 8 -j ACCEPT
$IPT -A OUTPUT -p icmp --icmp-type 0 -j ACCEPT
```

```
ats@serverA:~$ sudo ./firewall.sh
Added logging
ats@serverA:~$ ping bth.se
PING bth.se (213.52.129.125) 56(84) bytes of data.
64 bytes from c6386.cloudnet.se (213.52.129.125): icmp_seq=1 ttl=47 time=113 ms
64 bytes from c6386.cloudnet.se (213.52.129.125): icmp_seq=2 ttl=47 time=40.6 ms
64 bytes from c6386.cloudnet.se (213.52.129.125): icmp_seq=3 ttl=47 time=42.6 ms
64 bytes from c6386.cloudnet.se (213.52.129.125): icmp_seq=4 ttl=47 time=42.7 ms
64 bytes from c6386.cloudnet.se (213.52.129.125): icmp_seq=5 ttl=47 time=42.3 ms
64 bytes from c6386.cloudnet.se (213.52.129.125): icmp_seq=6 ttl=47 time=47.0 ms
64 bytes from c6386.cloudnet.se (213.52.129.125): icmp_seq=7 ttl=47 time=113 ms
64 bytes from c6386.cloudnet.se (213.52.129.125): icmp_seq=8 ttl=47 time=57.4 ms
^C
--- bth.se ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7014ms
rtt min/avg/max/mdev = 40.660/62.545/113.820/29.924 ms
ats@serverA:~$ nslookup bth.se
Server:         10.0.98.3
Address:        10.0.98.3#53

Non-authoritative answer:
Name:   bth.se
Address: 213.52.129.125

ats@serverA:~$ host bth.se
bth.se has address 213.52.129.125
bth.se has IPv6 address 2a01:7e00::f03c:91ff:fe18:15af
bth.se mail is handled by 20 bth-se.mail.protection.outlook.com.
```

Task20:Enable stateful firewall

Stateful packet can supply stateful packet inspection. I added rules to enable TCP connection to be established to any destination, so used the sentence "—ctstate NEW,ESTABLISHED,RELATED".

```
#Task20:Enable stateful firewall
$IPT -A OUTPUT -p udp --dport 53 -j ACCEPT
$IPT -A INPUT -p udp --sport 53 -j ACCEPT
$IPT -A INPUT -p udp --dport 53 -j ACCEPT
$IPT -A OUTPUT -p udp --sport 53 -j ACCEPT

$IPT -A OUTPUT -p icmp --icmp-type 8 -j ACCEPT
$IPT -A INPUT -p icmp --icmp-type 0 -j ACCEPT
$IPT -A INPUT -p icmp --icmp-type 8 -j ACCEPT
$IPT -A OUTPUT -p icmp --icmp-type 0 -j ACCEPT
$IPT -t filter -A INPUT -p tcp -m conntrack --ctstate NEW,ESTABLISHED,RELATED -j ACCEPT
$IPT -t filter -A FORWARD -p tcp -m conntrack --ctstate NEW,ESTABLISHED,RELATED -j ACCEPT
$IPT -t filter -A OUTPUT -p tcp -m conntrack --ctstate NEW,ESTABLISHED,RELATED -j ACCEPT
```

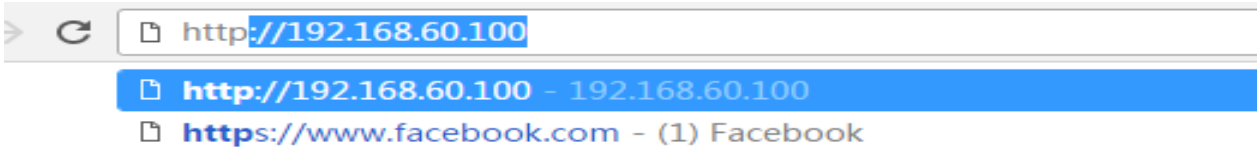


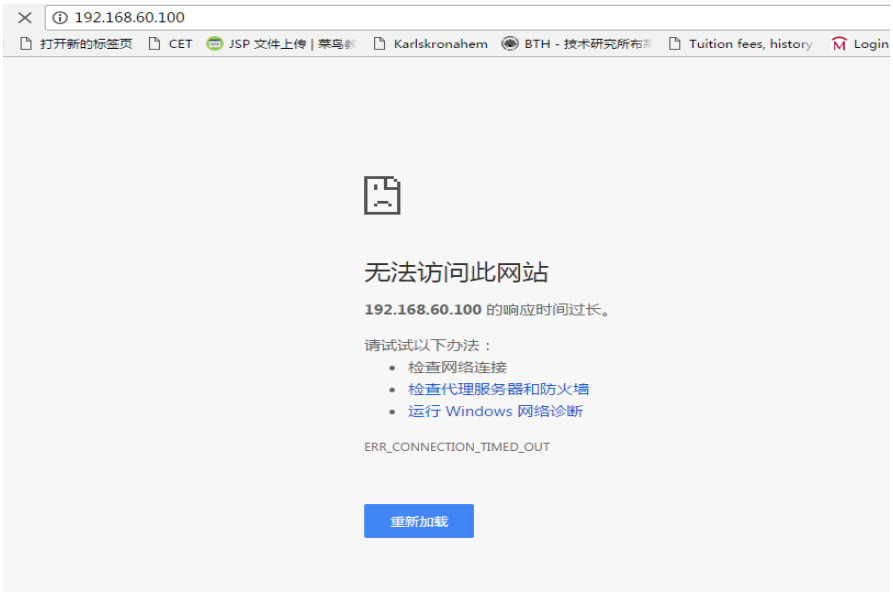
Task21:Enables SSH and HTTPS content from apache2 server for web browser on host

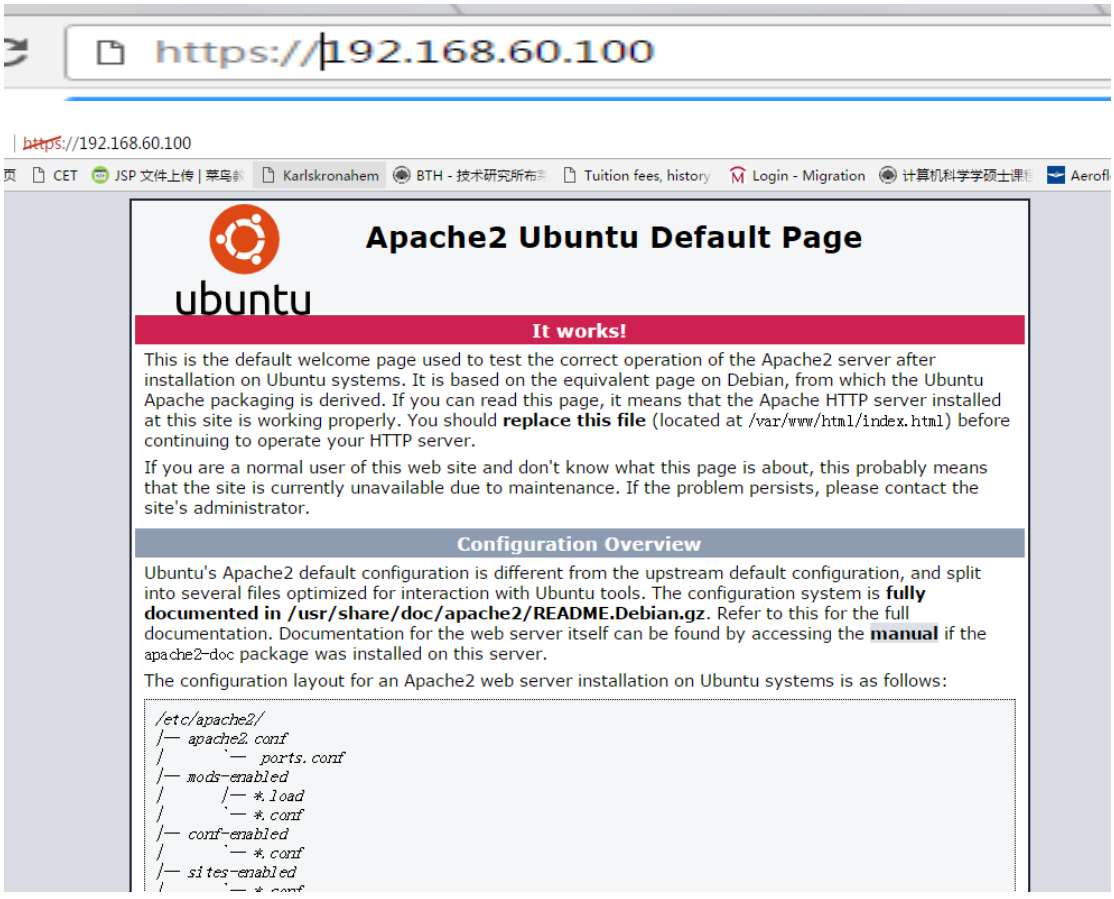
Just enable ssh and https, then I thought the multiport should be used.

```
#Task21:Enable SSH and HTTPS content from apache2 server for web browser on host
$IPT -A INPUT -p tcp -m multiport --dport 22,443 -j ACCEPT
$IPT -A OUTPUT -p tcp -m multiport --sport 22,443 -j ACCEPT
```

```
ats@serverA:~$ sudo ./firewall.sh
Added logging
ats@serverA:~$ sudo iptables -L
Chain INPUT (policy DROP)
target     prot opt source               destination
input_log  all  --  anywhere             anywhere
ACCEPT     tcp  --  anywhere             anywhere             multiport dports ssh,https

Chain FORWARD (policy DROP)
target     prot opt source               destination
forward_log  all  --  anywhere             anywhere

Chain OUTPUT (policy DROP)
target     prot opt source               destination
output_log  all  --  anywhere             anywhere
ACCEPT     tcp  --  anywhere             anywhere             multiport sports ssh,https

Chain forward_log (1 references)
target     prot opt source               destination
LOG        all  --  anywhere             anywhere             LOG level notice prefix "forward drop: "
RETURN     all  --  anywhere             anywhere

Chain input_log (1 references)
target     prot opt source               destination
```




192.168.60.100
打开新的标签页
CET
JSP 文件上传 | 菜鸟
Karlskronahem
BTH - 技术研究所布
Tuition fees, history
Login
无法访问此网站
192.168.60.100 的响应时间过长。
请试试以下办法：
检查网络连接
检查代理服务器和防火墙
运行 Windows 网络诊断
ERR_CONNECTION_TIMED_OUT
重新加载


https://192.168.60.100
https://192.168.60.100
CET
JSP 文件上传 | 菜鸟
Karlskronahem
BTH - 技术研究所布
Tuition fees, history
Login - Migration
计算机科学学硕士课
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.
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
|-- mods-enabled
| |-- *.load
| `-- *.conf
|-- conf-enabled
| `-- *.conf
|-- sites-enabled

Task22:Ping Server A from Client A

First time, I tried ping serverA from clientA to verified the lab instruction, that's true, it was unsccuessful.

```
ats@clientA: ~
ats@clientA:~$ ping 198.168.60.100
connect: Network is unreachable
ats@clientA:~$
```

But serverA can ping ClientA.

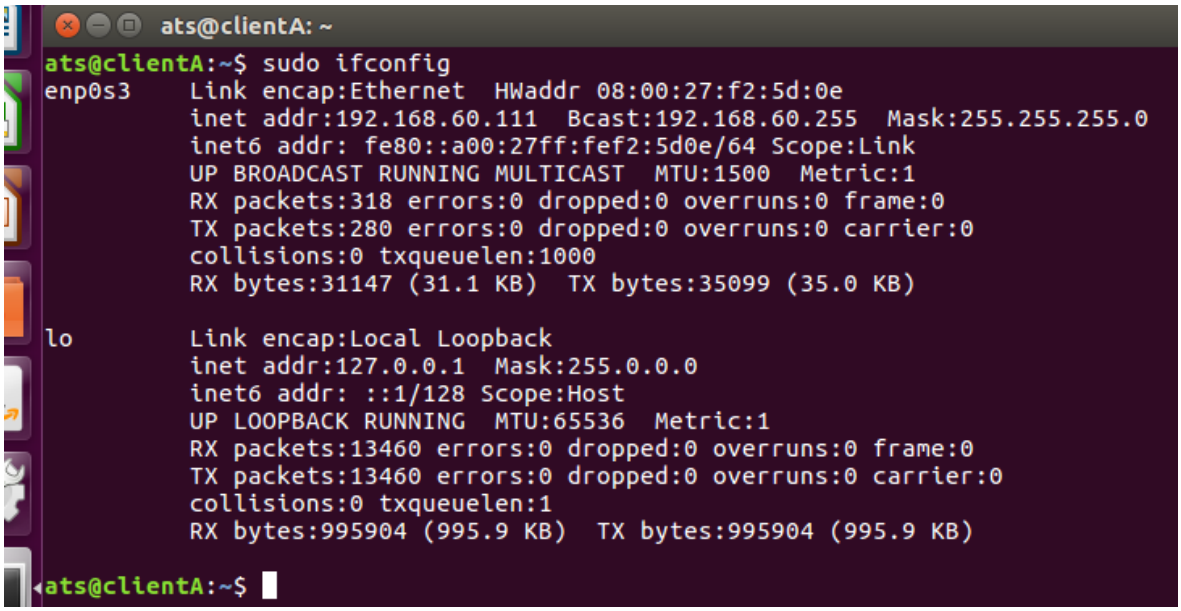
```
s@serverA: ~
ats@serverA:~$ sudo ./firewall.sh
Added logging
ats@serverA:~$ ping 192.168.60.111
PING 192.168.60.111 (192.168.60.111) 56(84) bytes of data.
64 bytes from 192.168.60.111: icmp_seq=1 ttl=64 time=3.32 ms
64 bytes from 192.168.60.111: icmp_seq=2 ttl=64 time=0.999 ms
64 bytes from 192.168.60.111: icmp_seq=3 ttl=64 time=1.40 ms
64 bytes from 192.168.60.111: icmp_seq=4 ttl=64 time=0.991 ms
64 bytes from 192.168.60.111: icmp_seq=5 ttl=64 time=0.989 ms
^C
--- 192.168.60.111 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4008ms
rtt min/avg/max/mdev = 0.989/1.541/3.327/0.907 ms
ats@serverA:~$
```

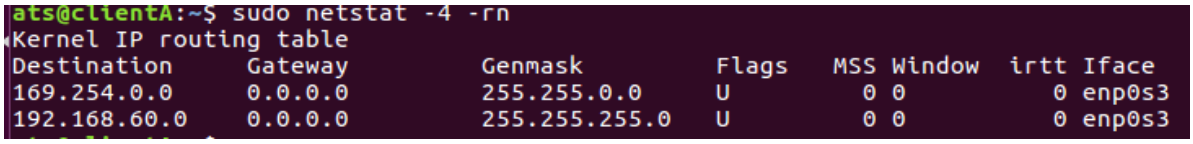
Then I thought it's the firewall rules in ServerA impeded the ClientA to ping, so I pointed out the specific IP address and tried whether it would work.

```
#Task22:Ping ServerA from ClientA
$IPT -A OUTPUT -s 192.168.60.111 -d 192.168.60.100 -p tcp -j ACCEPT
```

```
ats@clientA: ~
ats@clientA:~$ ping 192.168.60.1
PING 192.168.60.1 (192.168.60.1) 56(84) bytes of data.
64 bytes from 192.168.60.1: icmp_seq=1 ttl=128 time=1.75 ms
64 bytes from 192.168.60.1: icmp_seq=2 ttl=128 time=1.03 ms
64 bytes from 192.168.60.1: icmp_seq=3 ttl=128 time=0.482 ms
64 bytes from 192.168.60.1: icmp_seq=4 ttl=128 time=2.54 ms
64 bytes from 192.168.60.1: icmp_seq=5 ttl=128 time=0.767 ms
64 bytes from 192.168.60.1: icmp_seq=6 ttl=128 time=0.579 ms
64 bytes from 192.168.60.1: icmp_seq=7 ttl=128 time=0.949 ms
^C
--- 192.168.60.1 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6008ms
rtt min/avg/max/mdev = 0.482/1.158/2.541/0.685 ms
ats@clientA:~$
```

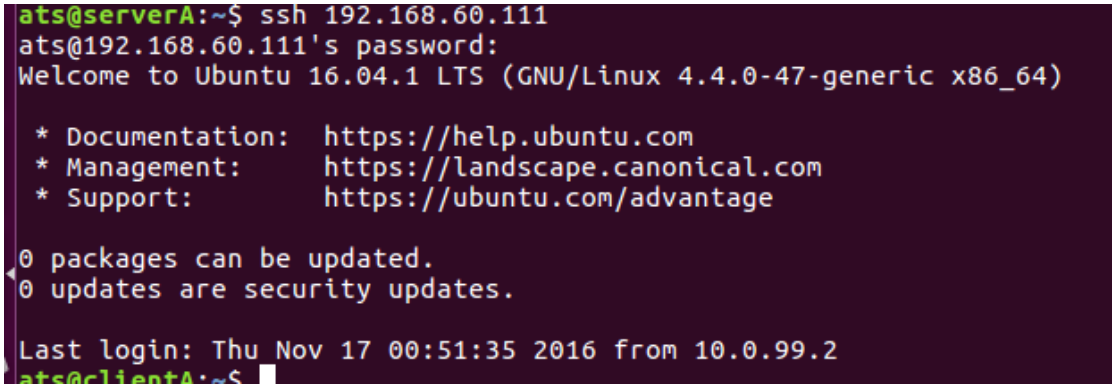
I learned some information about ClientA.





Task23:SSH from Client A to Server A

Yes,ServerA can ssh ClientA.

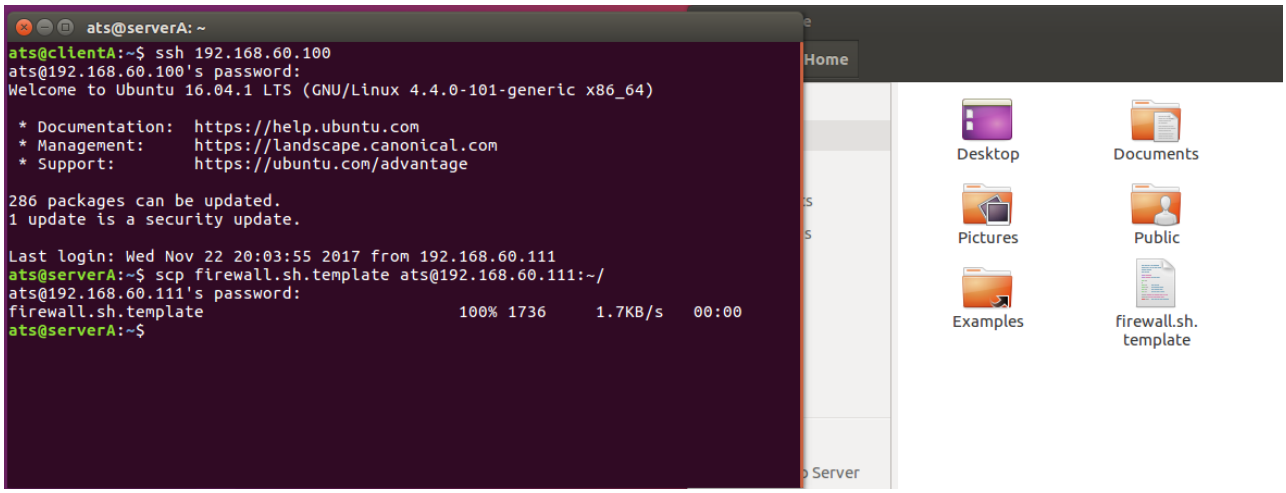


How to let clientA ssh serverA, I also figured it's the firewall rules' problem, then I tried to let serverA accept port 22,ssh default port is 22. Then it works.

```
ats@clientA:~$ sudo iptables -A INPUT -p tcp --dport 22 -j ACCEPT
ats@clientA:~$ sudo iptables -A OUTPUT -p tcp --sport 22 -j ACCEPT
ats@clientA:~$ ssh 192.168.60.100
The authenticity of host '192.168.60.100 (192.168.60.100)' can't be established.
ECDSA key fingerprint is SHA256:W+LPjhGRAjAU6ZmmVMzlgjvytXF4mC2eXKlDqKC5O5U.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.60.100' (ECDSA) to the list of known hosts.
ats@192.168.60.100's password:
Permission denied, please try again.
ats@192.168.60.100's password:
Welcome to Ubuntu 16.04.1 LTS (GNU/Linux 4.4.0-101-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

286 packages can be updated.
1 update is a security update.

Last login: Mon Nov 20 22:43:41 2017 from 192.168.60.1
```

截图(Alt + A)

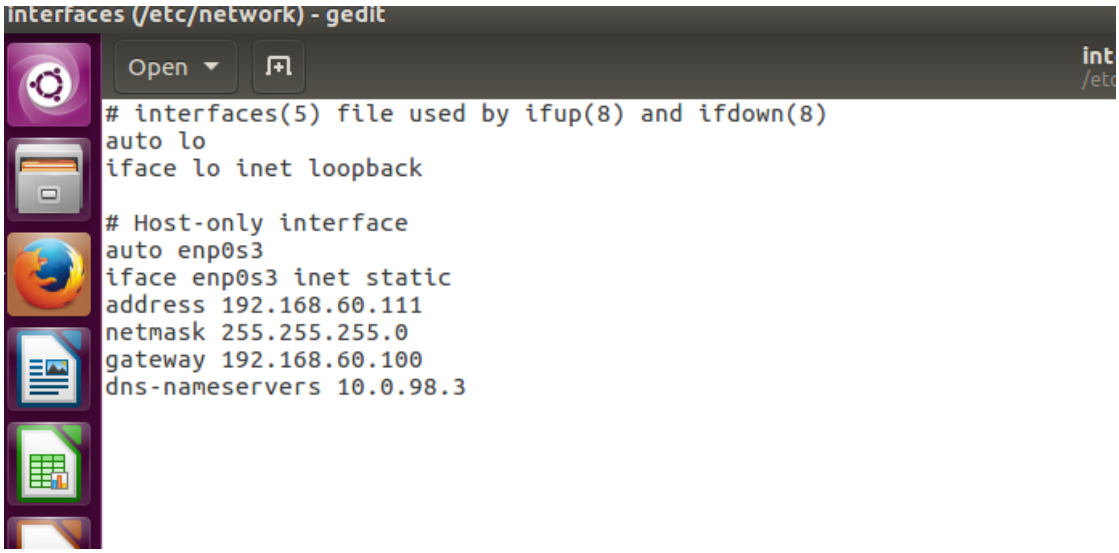
And followed the instruction,I tried the scp command.



Task24:Add gateway and DNS server to Client A

The following screenshot I used gedit command to add gateway and DNS for ClientA. The adding order is really important, at first time I added them before clientA's IP address and netmask, then check in route –n, you will not see the gateway. And such simple problem actually stucked me for several days.

```
ats@clientA:~$ sudo gedit /etc/network/interfaces

** (gedit:2165): WARNING **: Set document metadata failed: Setting attribute met
adata::gedit-position not supported
ats@clientA:~$
```



Task25:Enable IP forwarding on Server A

```
ats@serverA:~$ sudo sysctl -w net.ipv4.ip_forward=1
net.ipv4.ip_forward = 1
ats@serverA:~$ sudo syscltl -p
sudo: syscltl: command not found
ats@serverA:~$ sudo sysctl -p
ats@serverA:~$
```

I used wireshark to narrow down the problems, it showed "who has 192.168.60.100?Tell 192.168.60.111", and also showed ARP problem. ARP protocol is to analyse the IP address to MAC address which using in DataLink Layer. I configured the ClientA didn't know the ARP of ServerA, so I added the rules in clientA's terminal.

No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000000	192.168.60.111	10.0.98.3	DNS	74	Standard query 0x3bef A www.google.com
2	5.005655056	192.168.60.111	10.0.98.3	DNS	74	Standard query 0x3bef A www.google.com
3	5.011045229	CadmusCo_f2:5d:0e	CadmusCo_40:a4:b9	ARP	42	Who has 192.168.60.100? Tell 192.168.60.111
4	5.011977216	CadmusCo_40:a4:b9	CadmusCo_f2:5d:0e	ARP	60	192.168.60.100 is at 08:00:27:40:a4:b9
5	10.011800805	192.168.60.111	10.0.98.3	DNS	74	Standard query 0x7270 A www.google.com
6	15.014666622	192.168.60.111	10.0.98.3	DNS	74	Standard query 0x7270 A www.google.com
7	21.155081158	192.168.60.1	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
8	22.155870801	192.168.60.1	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
9	23.156007808	192.168.60.1	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1
10	24.156774547	192.168.60.1	239.255.255.250	SSDP	215	M-SEARCH * HTTP/1.1

```
▸ Frame 3: 42 bytes on wire (336 bits), 42 bytes captured (336 bits) on interface 0
▸ Ethernet II, Src: CadmusCo_f2:5d:0e (08:00:27:f2:5d:0e), Dst: CadmusCo_40:a4:b9 (08:00:27:40:a4:b9)
▸ Address Resolution Protocol (request)
```

```
ats@clientA:~$ route -n
Kernel IP routing table
Destination     Gateway         Genmask         Flags Metric Ref    Use Iface
0.0.0.0         192.168.60.100  0.0.0.0         UG    0      0        0 enp0s3
169.254.0.0     0.0.0.0         255.255.0.0     U     1000   0        0 enp0s3
192.168.60.0    0.0.0.0         255.255.255.0   U     0      0        0 enp0s3
ats@clientA:~$ sudo arp -s 192.168.60.100 08:00:27:40:a4:b9
[sudo] password for ats:
ats@clientA:~$
```

Task26:Change iptables to forward packets

HIF=enp0s3
HIP=192.168.60.100
NIF=enp0s9
NIP=10.0.98.100

Let's Accept FORWARD traffic:

```
#Task26:Change iptables to forward packets

$IPT -t filter -A FORWARD -i $HIF -j ACCEPT
$IPT -t filter -A FORWARD -i $NIF -m conntrack --ctstate ESTABLISHED,RELATED -j ACCEPT
```

Task27:Enable SNAT on Server A

Let all the traffic from ClientA go to ServerA, then ServerA let this traffic go to external network by using external gateway, the both VMs surf net through the host.

```
#Task27:Enable SNAT on Server A
$IPT -t nat -A POSTROUTING -j SNAT -o $NIF --to $NIP
```

```
ats@clientA:~$ sudo /etc/init.d/networking restart
[ ok ] Restarting networking (via systemctl): networking.service.
ats@clientA:~$ ping www.google.com
PING www.google.com (216.58.209.132) 56(84) bytes of data.
64 bytes from arn09s05-in-f132.1e100.net (216.58.209.132): icmp_seq=1 ttl=51 time=224 ms
64 bytes from arn09s05-in-f132.1e100.net (216.58.209.132): icmp_seq=2 ttl=51 time=16.9 ms
64 bytes from arn09s05-in-f132.1e100.net (216.58.209.132): icmp_seq=3 ttl=51 time=17.9 ms
^C
--- www.google.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 16.988/86.394/224.230/97.465 ms
```

Then, I can access the www.google.com!