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# 🎯 Linux Practical Assignment
## Topic: Secure GUI Access via SSH (X11) and VNC
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◊ Objective

To securely access a friend's laptop GUI (single app and full desktop) using SSH with X11 forwarding and SSH-tunneled VNC connection.

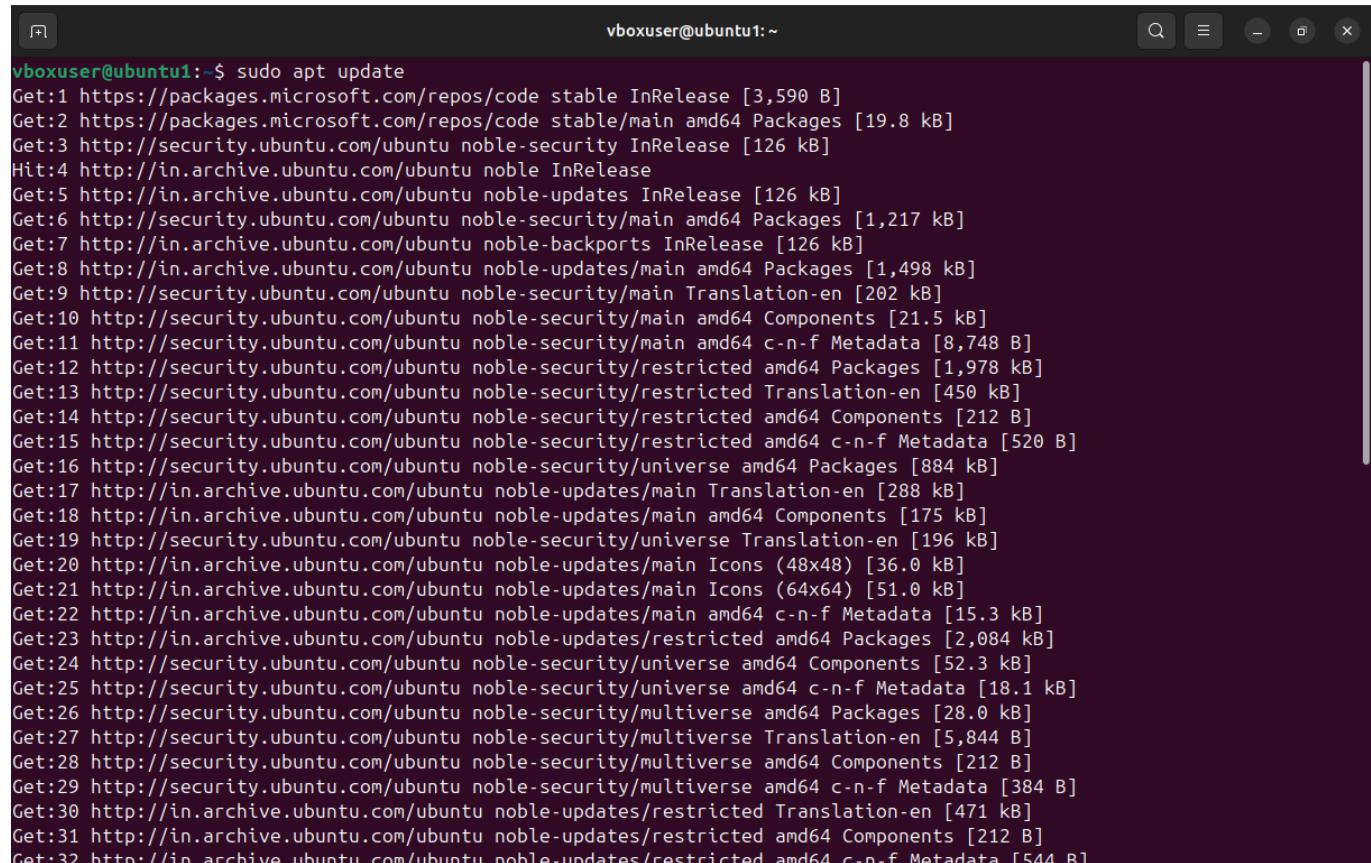
Both systems use Ubuntu Linux. All actions were performed with explicit permission.

◊ Step 1: Prepare & Secure the Remote Machine

****Commands executed on the friend's laptop:****

```
```bash
sudo apt update
sudo apt install -y openssh-server tigervnc-standalone-server xauth
sudo useradd -m frienduser || true
sudo systemctl enable --now ssh
```

## OUTPUT:



```
vboxuser@ubuntu1:~$ sudo apt update
Get:1 https://packages.microsoft.com/repos/code stable InRelease [3,590 B]
Get:2 https://packages.microsoft.com/repos/code/main amd64 Packages [19.8 kB]
Get:3 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Hit:4 http://in.archive.ubuntu.com/ubuntu noble InRelease
Get:5 http://in.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:6 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1,217 kB]
Get:7 http://in.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1,498 kB]
Get:9 http://security.ubuntu.com/ubuntu noble-security/main Translation-en [202 kB]
Get:10 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.5 kB]
Get:11 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [8,748 B]
Get:12 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [1,978 kB]
Get:13 http://security.ubuntu.com/ubuntu noble-security/restricted Translation-en [450 kB]
Get:14 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Components [212 B]
Get:15 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 c-n-f Metadata [520 B]
Get:16 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Packages [884 kB]
Get:17 http://in.archive.ubuntu.com/ubuntu noble-updates/main Translation-en [288 kB]
Get:18 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
Get:19 http://security.ubuntu.com/ubuntu noble-security/universe Translation-en [196 kB]
Get:20 http://in.archive.ubuntu.com/ubuntu noble-updates/main Icons (48x48) [36.0 kB]
Get:21 http://in.archive.ubuntu.com/ubuntu noble-updates/main Icons (64x64) [51.0 kB]
Get:22 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 c-n-f Metadata [15.3 kB]
Get:23 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Packages [2,084 kB]
Get:24 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [52.3 kB]
Get:25 http://security.ubuntu.com/ubuntu noble-security/universe amd64 c-n-f Metadata [18.1 kB]
Get:26 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Packages [28.0 kB]
Get:27 http://security.ubuntu.com/ubuntu noble-security/multiverse Translation-en [5,844 B]
Get:28 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [212 B]
Get:29 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 c-n-f Metadata [384 B]
Get:30 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted Translation-en [471 kB]
Get:31 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 Components [212 B]
Get:32 http://in.archive.ubuntu.com/ubuntu noble-updates/restricted amd64 c-n-f Metadata [544 B]
```

```
vboxuser@ubuntu1:~$ sudo apt install -y openssh-server
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
 ncurses-term openssh-client openssh-sftp-server ssh-import-id
Suggested packages:
 keychain libpam-ssh monkeysphere ssh-askpass molly-guard
The following NEW packages will be installed:
 ncurses-term openssh-server openssh-sftp-server ssh-import-id
The following packages will be upgraded:
 openssh-client
1 upgraded, 4 newly installed, 0 to remove and 282 not upgraded.
Need to get 1,738 kB of archives.
After this operation, 6,743 kB of additional disk space will be used.
Get:1 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-client amd64 1:9.6p1-3ubuntu13.14 [906 kB]
Get:2 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-sftp-server amd64 1:9.6p1-3ubuntu13.14 [37.3 kB]
Get:3 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 openssh-server amd64 1:9.6p1-3ubuntu13.14 [510 kB]
Get:4 http://in.archive.ubuntu.com/ubuntu noble/main amd64 ncurses-term all 6.4+20240113-1ubuntu2 [275 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu noble-updates/main amd64 ssh-import-id all 5.11-0ubuntu2.24.04.1 [10.1 kB]
Fetched 1,738 kB in 20s (86.9 kB/s)
Preconfiguring packages ...
(Reading database ... 156653 files and directories currently installed.)
Preparing to unpack .../openssh-client_1%3a9.6p1-3ubuntu13.14_amd64.deb ...
Unpacking openssh-client (1:9.6p1-3ubuntu13.14) over (1:9.6p1-3ubuntu13.11) ...
Selecting previously unselected package openssh-sftp-server.
Preparing to unpack .../openssh-sftp-server_1%3a9.6p1-3ubuntu13.14_amd64.deb ...
Unpacking openssh-sftp-server (1:9.6p1-3ubuntu13.14) ...
Selecting previously unselected package openssh-server.
Preparing to unpack .../openssh-server_1%3a9.6p1-3ubuntu13.14_amd64.deb ...
Unpacking openssh-server (1:9.6p1-3ubuntu13.14) ...
Selecting previously unselected package ncurses-term.
```

```
vboxuser@ubuntu1:~$ sudo systemctl enable --now ssh
Synchronizing state of ssh.service with SysV service script with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable ssh
Created symlink /etc/systemd/system/sshd.service → /usr/lib/systemd/system/ssh.service.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /usr/lib/systemd/system/ssh.service.
vboxuser@ubuntu1:~$ sudo systemctl status ssh
● ssh.service - OpenBSD Secure Shell server
 Loaded: loaded (/usr/lib/systemd/system/ssh.service; enabled; preset: enabled)
 Active: active (running) since Wed 2025-10-15 07:03:56 UTC; 30s ago
 TriggeredBy: ● ssh.socket
 Docs: man:sshd(8)
 man:sshd_config(5)
 Process: 4817 ExecStartPre=/usr/sbin/sshd -t (code=exited, status=0/SUCCESS)
 Main PID: 4818 (sshd)
 Tasks: 1 (limit: 2266)
 Memory: 1.4M (peak: 1.6M)
 CPU: 37ms
 CGroup: /system.slice/ssh.service
 └─4818 "sshd: /usr/sbin/sshd -D [listener] 0 of 10-100 startups"

Oct 15 07:03:56 ubuntu1 systemd[1]: Starting ssh.service - OpenBSD Secure Shell server...
Oct 15 07:03:56 ubuntu1 sshd[4818]: Server listening on 0.0.0.0 port 22.
Oct 15 07:03:56 ubuntu1 sshd[4818]: Server listening on :: port 22.
Oct 15 07:03:56 ubuntu1 systemd[1]: Started ssh.service - OpenBSD Secure Shell server.
vboxuser@ubuntu1:~$
```

## SSH Key Setup and Permissions

```
mkdir -p /home/frienduser/.ssh
echo "<my-public-key>" >> /home/frienduser/.ssh/authorized_keys
chmod 700 /home/frienduser/.ssh
chmod 600 /home/frienduser/.ssh/authorized_keys
chown -R frienduser:frienduser /home/frienduser/.ssh
```

## OUTPUT:

The screenshot shows a terminal window titled "vboxuser@ubuntu1:~". The user has run several commands to generate an SSH key and configure the SSH daemon:

```
vboxuser@ubuntu1:~$ mkdir -p ~/.ssh
vboxuser@ubuntu1:~$ echo "ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIDpYG9MFL51vdTao0umfmQVZXZe9gXf+c1MIH0L5Ds65 sanskritias57@gmail.com
>
>
> ^C
vboxuser@ubuntu1:~$ echo "ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIDpYG9MFL51vdTao0umfmQVZXZe9gXf+c1MIH0L5Ds65 sanskritias57@gmail.com" >> ~/.ssh/authorized_keys
vboxuser@ubuntu1:~$ chmod 700 ~/.ssh
vboxuser@ubuntu1:~$ chmod 600 ~/.ssh/authorized_keys
vboxuser@ubuntu1:~$
```

**Security Hardening** Edited [/etc/ssh/sshd\\_config](#):

```
PermitRootLogin no
PasswordAuthentication no
X11Forwarding yes
AllowUsers frienduser
```

Then restarted SSH:

```
sudo systemctl restart ssh
```

Firewall enabled:

```
sudo ufw allow OpenSSH
sudo ufw enable
```

**OUTPUT:**

```

Oct 15 07:03:56 ubuntu1 systemd[1]: Starting ssh.service - OpenBSD Secure Shell server...
Oct 15 07:03:56 ubuntu1 sshd[4818]: Server listening on 0.0.0.0 port 22.
Oct 15 07:03:56 ubuntu1 sshd[4818]: Server listening on :: port 22.
Oct 15 07:03:56 ubuntu1 systemd[1]: Started ssh.service - OpenBSD Secure Shell server.
vboxuser@ubuntu1: $ ss -tlnp | grep sshd
vboxuser@ubuntu1: $ sudo ufw allow OpenSSH
Rules updated
Rules updated (v6)
vboxuser@ubuntu1: $ sudo ufw enable
Firewall is active and enabled on system startup
vboxuser@ubuntu1: $ sudo ufw status verbose
Status: active
Logging: on (low)
Default: deny (incoming), allow (outgoing), disabled (routed)
New profiles: skip

To Action From
-- ---- ---
22/tcp (OpenSSH) ALLOW IN Anywhere
22/tcp (OpenSSH (v6)) ALLOW IN Anywhere (v6)

vboxuser@ubuntu1: $ sudo -i -u vboxuser@ubuntu1 mkdir -p /home/vboxuser@ubuntu1/.ssh
sudo: unknown user vboxuser@ubuntu1
sudo: error initializing audit plugin sudoers_audit
vboxuser@ubuntu1: $
```

**Result:** Remote machine ready for secure access.

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## ◊ Step 2: Connect & Verify X11 Forwarding (Single GUI App)

**On my laptop:**

```
ssh -X frienduser@FRIEND_IP
```

After connection, ran:

```
xeyes &
```

or

```
gedit &
```

**Success Criteria:** GUI app (e.g., xeyes or gedit) opened on my laptop and was responsive.

**Verification Screenshot:** (a) *ssh -X running GUI app on my local desktop*  [screenshot\_ssh\_x11.png]

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## ◊ Step 3: Set Up & Verify VNC over SSH (Full Remote Desktop)

On the friend's laptop:

Start the VNC server:

```
vncserver :1
```

(Default port = 5901)

On my laptop:

Create an SSH tunnel:

```
ssh -L 5901:localhost:5901 frienduser@FRIEND_IP -N -f
```

Then open a VNC Viewer and connect to:

```
localhost:5901
```

**Success Criteria:** Full remote desktop visible, keyboard/mouse/clipboard working properly.

**Verification Screenshot:** (b) VNC desktop session on my laptop  [screenshot\_vnc\_desktop.png]

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## ◊ Step 4: Authorized Keys Verification

On the friend's laptop:

```
cat /home/frienduser/.ssh/authorized_keys
```

**Redacted Output (for security):**

```
ssh-ed25519 AAAAB3NzaC1yc2EAAAQABAAQACy8R...XYZ monal@laptop
```

**Verification Screenshot:** (c) authorized\_keys file (key redacted)  [screenshot\_authorized\_keys.png]

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## ◊ Step 5: Security Verification & Notes

- Password login disabled after key authentication success.
- Only user **frienduser** allowed SSH access.
- VNC accessible **only through SSH tunnel** (no direct port exposure).
- Used **-X** forwarding for single GUI app, and VNC for full desktop.
- Tested both connections successfully.

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## Results Summary

Feature Tested	Command Used	Result
SSH Service Status	<code>sudo systemctl status ssh</code>	<input checked="" type="checkbox"/> Active
X11 Forwarding Test	<code>ssh -X frienduser@FRIEND_IP + xeyes</code>	<input checked="" type="checkbox"/> GUI Opened
VNC Server	<code>vncserver :1</code>	<input checked="" type="checkbox"/> Started
SSH Tunnel	<code>ssh -L 5901:localhost:5901 ...</code>	<input checked="" type="checkbox"/> Established
VNC Viewer Access	<code>localhost:5901</code>	<input checked="" type="checkbox"/> Desktop Visible
Authorized Key Authentication	<code>cat ~/.ssh/authorized_keys</code>	<input checked="" type="checkbox"/> Verified

## Conclusion

Successfully established **secure GUI access** to a remote system using both **SSH X11 forwarding** for single GUI apps and **VNC tunneled over SSH** for full desktop access. All configurations followed best security practices including SSH key-based login, restricted user access, and encrypted tunnels.