Name: Harsh Mishra
Roll no: 64
Batch: T21

Aim: To explore the GPG tool of linux to implement email security.

Theory:

PGP (Pretty Good Privacy) is an encryption program that provides cryptographic privacy and authentication for data communication. GPG (Gnu Privacy Guard) is a free software replacement for PGP that implements the OpenPGP standard.

PGP using GPG:

1. **Public and Private Key Pair**:
   PGP uses asymmetric encryption, where each user has a **public key** (shared with others) and a **private key** (kept secret). Messages encrypted with the public key can only be decrypted by the private key, and vice versa.

2. **Data Encryption**:

   - **Symmetric Encryption**: For encrypting the actual message, a random symmetric key (session key) is generated. The message is encrypted with this key using a symmetric algorithm like AES.

   - **Asymmetric Encryption**: The session key itself is then encrypted with the recipient's public key using asymmetric encryption (like RSA). This allows the session key to be securely shared.

3. **Digital Signature**:

   - The sender signs the message with their private key, which helps ensure **authenticity** and **integrity**. This digital signature proves the identity of the sender and verifies that the message hasn’t been tampered with.

   - The recipient can verify the signature using the sender's public key.

4. **Key Management**:

   - GPG uses **keyrings** to manage the public and private keys. Users can add trusted public keys and use them to encrypt data.

   - GPG also supports **key servers**, where public keys can be shared and retrieved.

5. **Web of Trust**:

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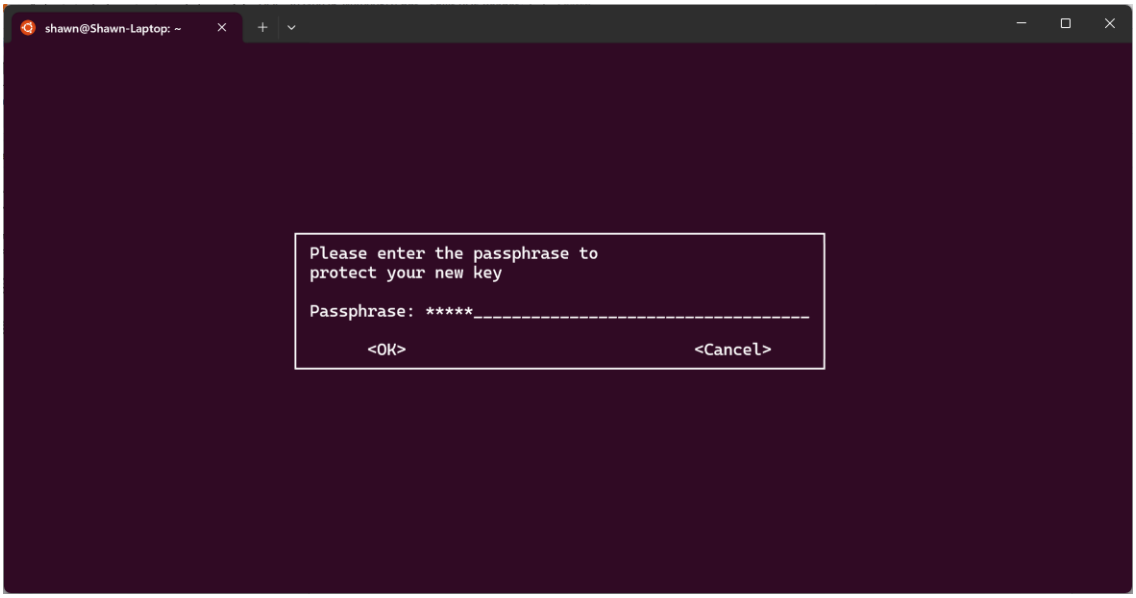
- Unlike centralized systems like SSL, PGP uses a **web of trust** for identity verification. Users sign each other's public keys, building a network of trust without relying on a single central authority.

6. **Message Decryption**:
   - When the recipient receives the message, they use their private key to decrypt the symmetric session key. Once they have the session key, they can decrypt the message.
7. **Passphrase Protection**:
   - To enhance security, private keys are often encrypted with a passphrase, adding an extra layer of protection in case the private key is compromised.

Output:



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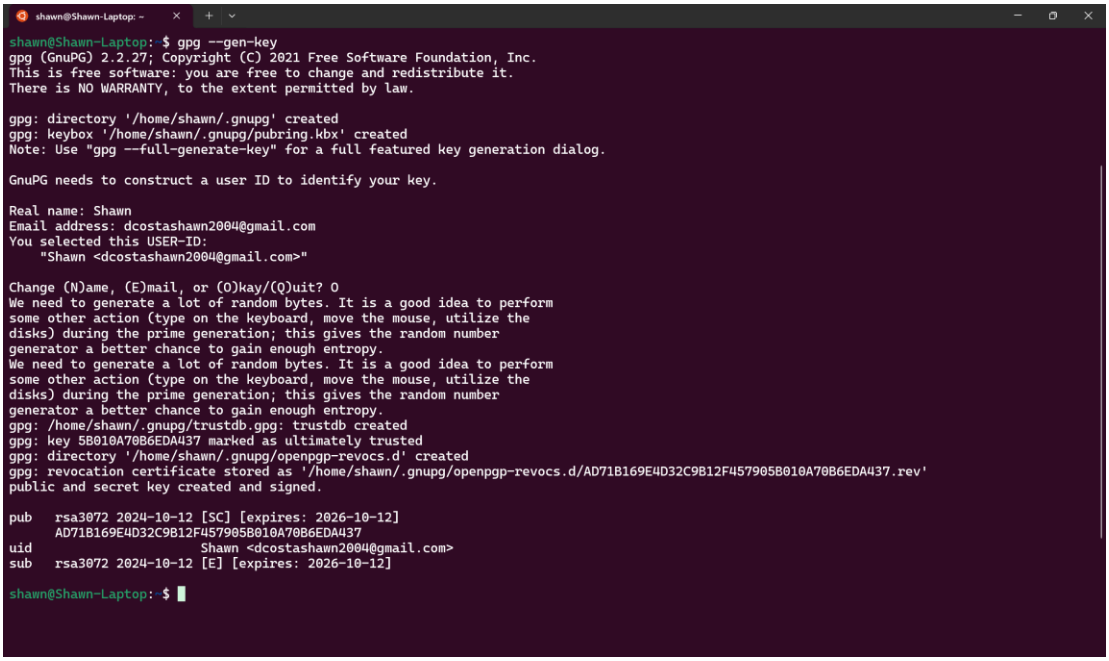

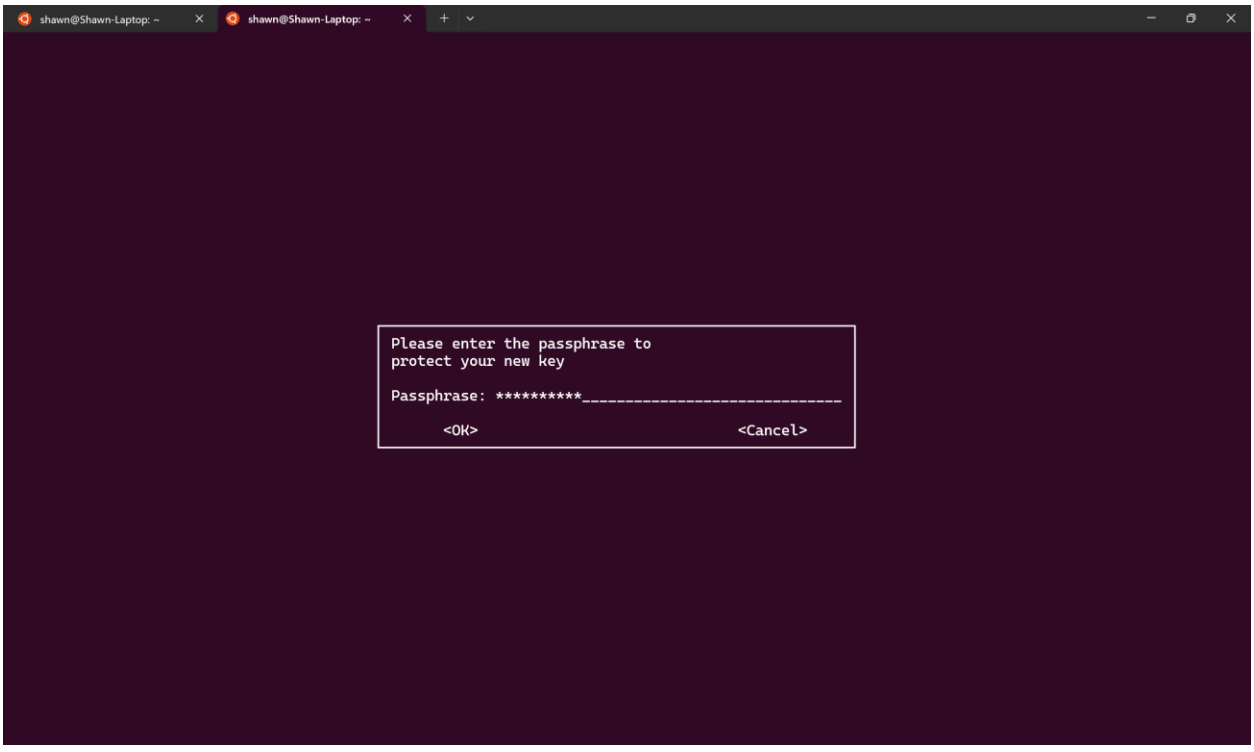

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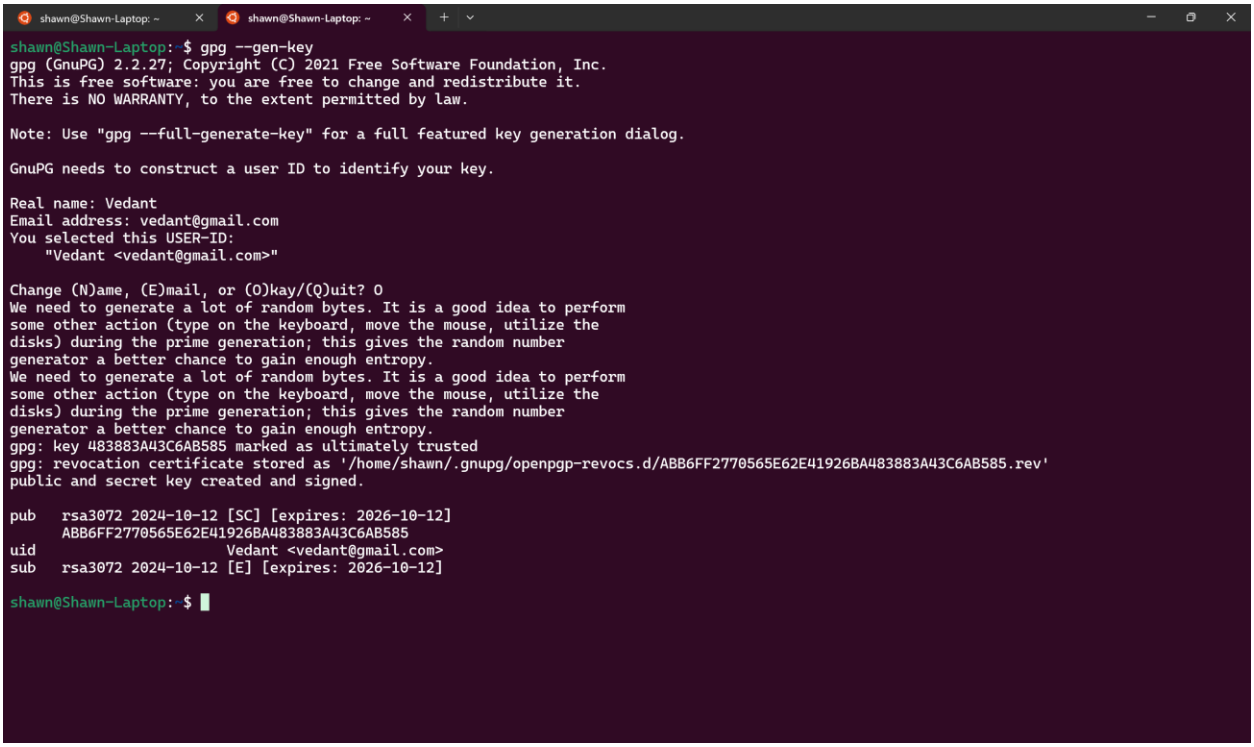


```
shawn@Shawn-Laptop:~$ gpg --export -a Shawn>demo
shawn@Shawn-Laptop:~$ gpg --export-secret-key -a Shawn>demo_private
```

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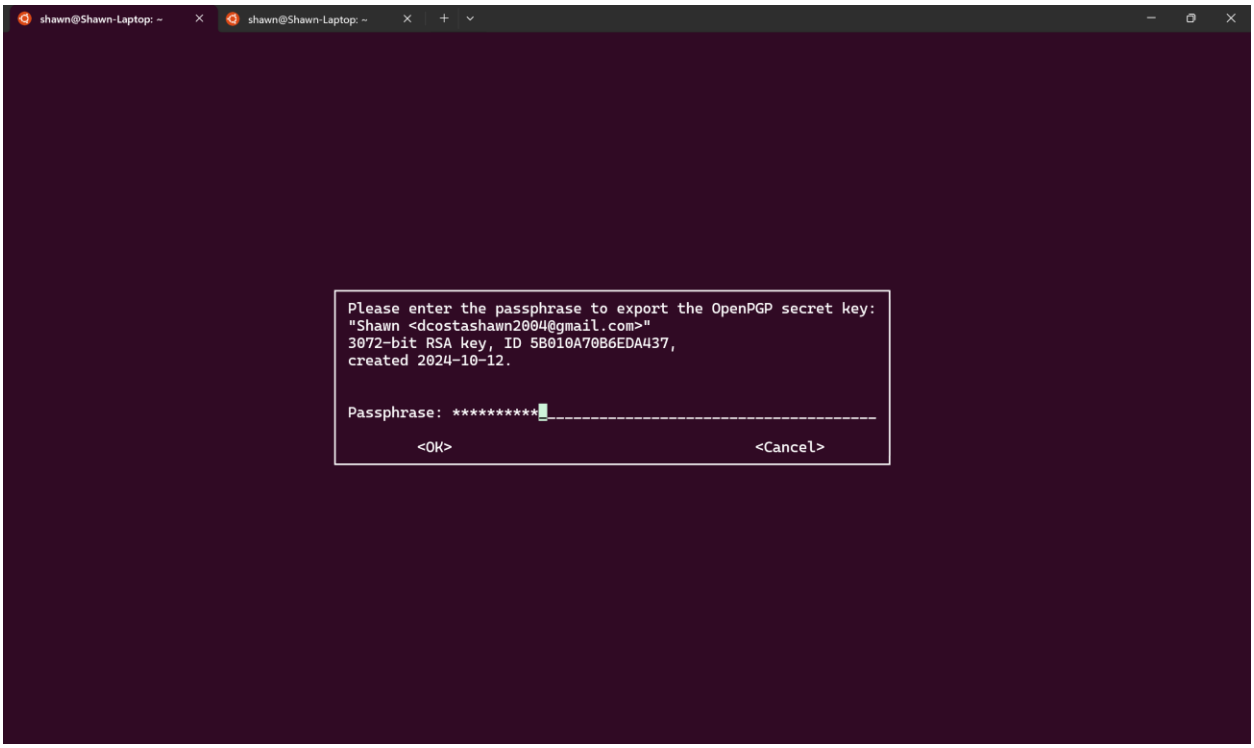


```
shawn@Shawn-Laptop:~$ gpg --fingerprint vedant@gmail.com
gpg: checking the trustdb
gpg: marginals needed: 3  completes needed: 1  trust model: pgp
gpg: depth: 0  valid:   2  signed:   0  trust: 0-, 0q, 0n, 0m, 0f, 2u
gpg: next trustdb check due at 2026-10-12
pub   rsa3072 2024-10-12 [SC] [expires: 2026-10-12]
      ABB6 FF27 7056 5E62 E419  26BA 4838 83A4 3C6A B585
uid           [ultimate] Vedant <vedant@gmail.com>
sub   rsa3072 2024-10-12 [E] [expires: 2026-10-12]
```

```
shawn@Shawn-Laptop:~$ gpg --import demo
gpg: key 5B010A70B6EDA437: "Shawn <dcostashawn2004@gmail.com>" not changed
gpg: Total number processed: 1
gpg:              unchanged: 1
```

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```
shawn@Shawn-Laptop:~$ gpg --list-keys
/home/shawn/.gnupg/pubring.kbx
------------------------------
pub   rsa3072 2024-10-12 [SC] [expires: 2026-10-12]
      AD71B169E4D32C9B12F457905B010A70B6EDA437
uid           [ultimate] Shawn <dcostashawn2004@gmail.com>
sub   rsa3072 2024-10-12 [E] [expires: 2026-10-12]

pub   rsa3072 2024-10-12 [SC] [expires: 2026-10-12]
      ABB6FF2770565E62E41926BA483883A43C6AB585
uid           [ultimate] Vedant <vedant@gmail.com>
sub   rsa3072 2024-10-12 [E] [expires: 2026-10-12]
```

```
shawn@Shawn-Laptop:~$ gpg --sign-key vedant@gmail.com

sec  rsa3072/483883A43C6AB585
     created: 2024-10-12  expires: 2026-10-12  usage: SC
     trust: ultimate      validity: ultimate
ssb  rsa3072/2A3F078961DDA25E
     created: 2024-10-12  expires: 2026-10-12  usage: E
[ultimate] (1). Vedant <vedant@gmail.com>


sec  rsa3072/483883A43C6AB585
     created: 2024-10-12  expires: 2026-10-12  usage: SC
     trust: ultimate      validity: ultimate
 Primary key fingerprint: ABB6 FF27 7056 5E62 E419  26BA 4838 83A4 3C6A B585

     Vedant <vedant@gmail.com>

This key is due to expire on 2026-10-12.
Are you sure that you want to sign this key with your
key "Shawn <dcostashawn2004@gmail.com>" (5B010A70B6EDA437)

Really sign? (y/N) y
```

```
shawn@Shawn-Laptop:~$ vi test.txt
shawn@Shawn-Laptop:~$ gpg --encrypt -r vedant@gmail.com test.txt
gpg: checking the trustdb
gpg: marginals needed: 3  completes needed: 1  trust model: pgp
gpg: depth: 0  valid:   2  signed:   0  trust: 0-, 0q, 0n, 0m, 0f, 2u
gpg: next trustdb check due at 2026-10-12
```

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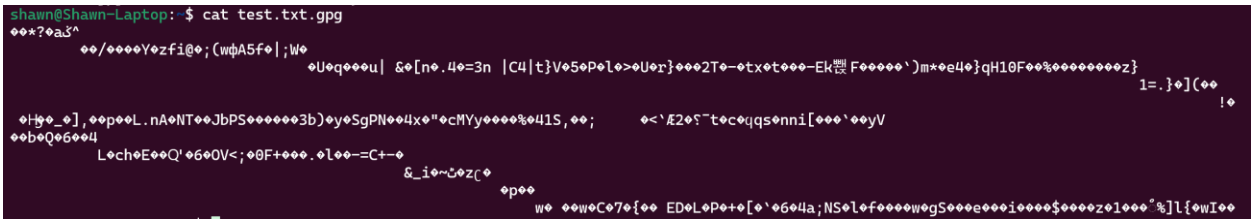

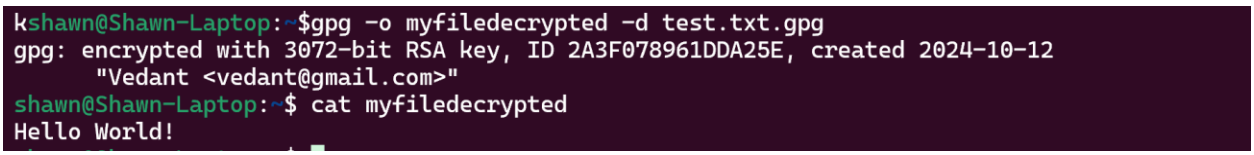

Conclusion: Demonstrated the network security system using open source tools (LO6 is achieved).