A vision and mission statement for a software engineering department can be created by taking into account the goals, values, and purpose of the organization. The vision statement defines what the department aspires/seeks/aims to achieve in the long-term, while the mission statement outlines the department's purpose and what it does to fulfill its vision.

Vision Statement: A vision statement for a software engineering department might look like this: "To become the leading provider of innovative and high-quality software solutions, known for our expertise and customer satisfaction."

Mission Statement: A mission statement for a software engineering department might look like this: "Our mission is to design, develop, and deliver software products that meet the evolving needs of our customers. We strive to constantly improve our skills and processes, and to foster a culture of collaboration and continuous learning."

These statements should reflect the values and goals of the organization, and can be refined and revised over time as the department evolves and changes.

Complex Engineering Problem in Data Communication and networking.

Problem: Design a secure client-server communication system for transferring sensitive data between multiple clients and a central server in real-time.

Objectives:

1. The client-server communication should be encrypted to protect the sensitive data being transferred.
2. The system should be scalable to accommodate multiple clients simultaneously.
3. The server should be able to handle clients connecting and disconnecting dynamically.
4. The server should store the data received from clients securely, and clients should be able to retrieve their data whenever they need.
5. The system should be able to handle failures in the network and recover gracefully.
6. The system should be designed in such a way that the server can process and respond to client requests efficiently.

Requirements:

1. Use the Python programming language to implement the system.
2. Use AES (Advanced Encryption Standard) for encryption and decryption of data.
3. Use TCP (Transmission Control Protocol) for reliable data transfer between clients and server.
4. Use the RSA (Rivest-Shamir-Adleman) algorithm for secure key exchange between clients and server.
5. Use a database (e.g., MySQL) to store the data received from clients at the server.
6. The system should allow clients to connect and disconnect dynamically.
7. The system should be able to handle failures in the network and recover gracefully.
8. The system should be designed in such a way that the server can process and respond to client requests efficiently.

Evaluation Criteria:

1. Security of the data transfer between clients and server.
2. Scalability of the system to accommodate multiple clients simultaneously.
3. Efficient handling of clients connecting and disconnecting dynamically.
4. Efficient storage of data received from clients at the server.
5. Efficient processing of client requests by the server.
6. Ability of the system to handle failures in the network and recover gracefully.
7. User-friendliness of the system.
8. Reliable Data Transfer: TCP (Transmission Control Protocol) can be used for reliable data transfer between clients and server. TCP is a reliable protocol that ensures that the data is transmitted correctly and in the correct order.
9. Dynamic Connection Management: To handle clients connecting and disconnecting dynamically, the server can maintain a list of connected clients. Whenever a client connects, it can be added to the list, and whenever a client disconnects, it can be removed from the list.
10. Data Storage: A database (e.g., MySQL) can be used to store the data received from clients at the server. The database can be designed in such a way that it can store the data efficiently and retrieve it quickly when needed.
11. Failure Handling: To handle failures in the network, the system can be designed in such a way that it can recover gracefully. For example, if the connection between a client and the server is lost, the client can attempt to reconnect after a certain period of time.
12. Efficient Processing: To ensure that the server can process and respond to client requests efficiently, the server can use multithreading. Each client request can be handled by a separate thread, which will run in parallel with other threads.

import socket

import threading

import RSA\_Encryption as RSA

import AES\_Encryption as AES

import mysql.connector

# Initialize the database connection

db = mysql.connector.connect(

host="localhost",

user="root",

password="password",

database="secure\_data\_storage"

)

cursor = db.cursor()

# Create a list to keep track of connected clients

clients = []

# Function to handle incoming clients

def handle\_client(client\_socket, client\_address):

# Generate a unique RSA key pair for each client

public\_key, private\_key = RSA.generate\_keypair()

# Send the public key to the client for encryption

client\_socket.send(public\_key.export\_key())

# Receive the encrypted AES key from the client

encrypted\_aes\_key = client\_socket.recv(1024)

# Decrypt the AES key using the private RSA key

aes\_key = RSA.decrypt(private\_key, encrypted\_aes\_key)

while True:

# Receive encrypted data from the client

encrypted\_data = client\_socket.recv(1024)

# Decrypt the data using the AES key

data = AES.decrypt(aes\_key, encrypted\_data)

# Store the data in the database

query = "INSERT INTO client\_data (client\_address, data) VALUES (%s, %s)"

values = (client\_address, data)

cursor.execute(query, values)

db.commit()

# Send a response back to the client

client\_socket.send("Data stored successfully.")

# Create a server socket

server\_socket = socket.socket(socket.AF\_INET, socket.SOCK\_STREAM)

# Bind the socket to a specific address and port

server\_socket.bind(("0.0.0.0", 12345))

# Listen for incoming connections

server\_socket.listen(5)

print("Server started. Waiting for clients...")

# Continuously accept incoming connections

while True:

client\_socket, client\_address = server\_socket.accept()

print("Accepted connection from", client\_address)

clients.append(client\_socket)

# Start a new thread for each incoming client

client\_thread = threading.Thread(target=handle\_client, args=(client\_socket, client\_address))

client\_thread.start()

# Close the server socket

server\_socket.close()

Client-Side :

import socket

import RSA\_Encryption as RSA

import AES\_Encryption as AES

# Connect to the server

client\_socket = socket.socket(socket.AF\_INET, socket.SOCK\_STREAM)

client\_socket.connect(("localhost", 12345))

# Receive the server's public RSA key

public\_key = RSA.import\_key(client\_socket.recv(1024))

# Generate a unique AES key for this session

aes\_key = AES.generate\_

**Types of Network Protocols**

There are three main types of network protocols. These include [network management](https://www.cdw.com/content/cdw/en/solutions/data-center-and-network-infrastructure/network-management.html) protocols, network communication protocols and [network security](https://www.cdw.com/content/cdw/en/products/networking-products/network-security.html) protocols:

* **Communication protocols** include basic data communication tools like *TCP/IP* and *HTTP*.
* **Management protocols** maintain and govern the network through protocols such as *ICMP*and *SNMP*.
* **Security protocols** include *HTTPS*, *SFTP*, and *SSL*.

Let's take a closer look at each, so you can better understand their role in your network.

**Network Communication Protocols**

Communication protocols are vital to the functioning of a network. In fact, computer networks can't exist without these protocols. These protocols formally describe the formats and rules by which data is transferred over the network. This is a must-have for exchanging messages between your computing systems and in telecommunications, applying to both hardware and software. Communication protocols also handle authentication and error detection as well as the syntax, synchronization and semantics that both analog and digital communications must abide by to function.

* **HTTP**– One of the most familiar protocols, *hyper text transfer protocol (HTTP)* is often referred to as the protocol of the internet. HTTP is an application layer protocol that allows the browser and server to communicate.
* **TCP**– *Transmission Control Protocol (TCP)*separates data into packets that can be shared over a network. These packets can then be sent by devices like switches and routers to the designated targets.
* **UDP**– *User Datagram Protocol (UDP)* works in a similar way to TCP, sending packets of data over the network. The key difference between the two is that TCP ensures a connection is made between the application and server, but UDP does not.
* **IRC**– *Internet Relay Chat (IRC)* is a text-based communication protocol. Software clients are used to communicate with servers and send messages to other clients. This protocol works well on networks with a large number of distributed machines.

## [Network Management Protocols](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

[Network management protocols help define the policies and procedures used to monitor, manage and maintain your computer network, and help communicate these needs across the network to ensure stable communication and optimal performance across the board.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

[Generally, network managers can use a management protocol to troubleshoot connections between host and client devices. Management protocols provide network managers with the host connection's status, availability, packet or data loss, and other related information about the health of the network connection.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

[The policies managed by management protocols can be applied to all devices on the network, including computers, switches, routers and even servers.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

[Two of the most common types of network management protocols include](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[Simple Network Management Protocol (SNMP)](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[and](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[Internet Control Message Protocol (ICMP)](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

* **[SNMP](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)**[–](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[Simple Network Management Protocol (SNMP)](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[is used to monitor and manage network devices. This TCP-based protocol allows administrators to view and modify endpoint information to alter behavior of devices across the network. SNMP relies on the use of agents to collect and send data to an overarching SMNP manager, which in turn queries agents and gets their responses.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)
* **[ICMP](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)**[–](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[Internet Control Message Protocol (ICMP)](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[is primarily used for diagnostic purposes. Managed devices on the network can use this protocol to send error messages, providing information regarding network connectivity issues between devices.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

## [Network Security Protocols](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

[[Network security](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)](https://www.cdw.com/search/Networking/Network-Security/?w=RF)[protocols work to ensure that data in transit over the network's connections stays safe and secure. These protocols also define how the network secures data from any attempts to review or extract said data by illegitimate means. This helps ensure that no unauthorized users, services, or devices access your network data, and this works across all data types and network mediums being used.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

[Usually, network security protocols rely on encryption and cryptography to secure data so that only special algorithms, formulas and logical keys can make this data accessible. Some of the most popular protocols for network security include Secure Socket Layer (SSL), Secure File Transfer Protocol (SFTP) and Secure Hypertext Transfer Protocol (HTTPS).](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

* **[SSL](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)**[– A](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[Secure Socket Layer (SSL)](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[is a network security protocol primarily used for ensuring secure internet connections and protecting sensitive data. This protocol can allow for server/client communication as well as server/server communication. Data transferred with SSL is encrypted to prevent it from being readable.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)
* **[SFTP](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)**[–](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[Secure File Transfer Protocol (SFTP)](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[, as its name might suggest, is used to securely transfer files across a network. Data is encrypted and the client and server are authenticated.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)
* **[HTTPS](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)**[–](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[Secure Hypertext Transfer Protocol](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)*[is the secure version of HTTP. Data sent between the browser and server are encrypted to ensure protection.Which Network Protocol Types are Right for You?](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

## [Which Protocol is Right for You?](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

[After examining the different types of protocols in computer networks, you may be wondering what is best for your business.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

* **[For startups and small businesses](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)**[, TCP and IP communication protocols are widely used and easy to manage.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)
* **[For faster, more efficient file transfer](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)**[, your business may benefit from using FTP protocols instead of relying on HTTP alone.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)
* **[For security](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)**[, HTTPS is ubiquitous and reliable for data transfer over the network.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)
* **[When managing networks](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)**[, SNMP is still very widely used and is made even more efficient when working in conjunction with communication protocols like UDP.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)

[We hope this guide to the different types of network protocols has been helpful. When you're ready to find the best networking solutions for your business, our tech experts are here to address any questions you have. Let us help you make the best decisions for your network communication, security and management needs.](https://www.cdw.com/product/netgear-s350-8-port-gigabit-poe-smart-managed-pro-switch-2-sfp-gs310tp/5404410?enkwrd=5404410" \o "Shop Now" \t "_self)