Mini project report on

Secure File Sharing System

Submitted in partial fulfilment of the requirements for the award of degree of

Bachelor of Technology

in

Computer Science & Engineering

UE20CS352 –OOADJ Project

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NOTE: Please add appropriate description for all diagrams where ever required. Only important class implementation needs to be added to IMPLEMNTATION SECTION.

INTRODUCTION

A safe file sharing system is an essential tool in today's communication and collaboration. It enables individuals and organisations to securely exchange files and information over the internet while safeguarding sensitive data from unauthorised access, modification, or theft.

The primary goal of a secure file sharing system is to ensure the shared data's confidentiality, integrity, and availability. The protection of data from unauthorised access is referred to as confidentiality. The term "integrity" refers to the fact that the data remains unchanged during transmission or storage. The availability of data means that authorised users can access it when they need it.

A secure file sharing system achieves these goals by combining encryption, access controls, authentication, and other security mechanisms. Encryption ensures that the data is unreadable and unusable to anyone who does not have the correct key. Access controls limit authorised users' access and prevent unauthorised access. The authentication process ensures that only authorised users have access to the data.

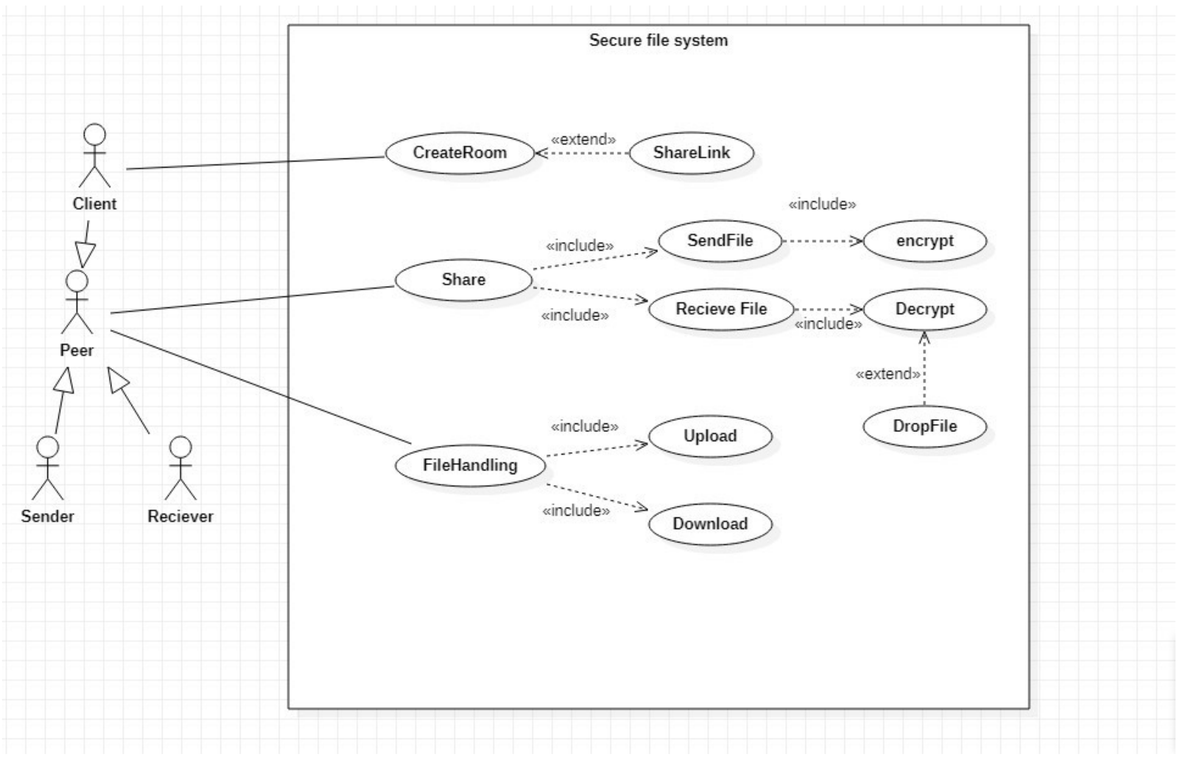
Project Description

The aim of the project is to build an end-to-end secure file sharing system which mimics the P2P architecture. Files are shared via a room which is created by the client. The invite link of the sharing platform which in this case is a room is created for the peers who want to access and download files. The link has to be submitted by each peer to join the network to send or receive the files. The files being sent are encrypted with AES (Advanced Encryption Standard) encryption algorithm. On the sender side the file is encrypted using the secret key before sending the file.

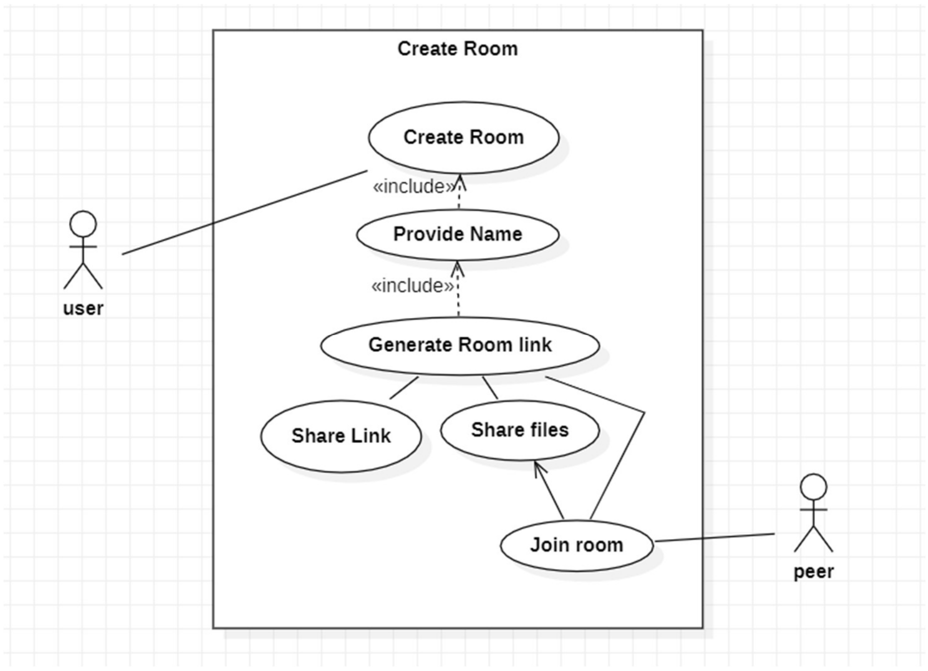
The encrypted files are decrypted on the receiving end using the secret key available in the room to validate the file. After the decryption the file is downloaded on the receiving end. In order to account for the file not being corrupted, the concept of checksum is used to verify the integrity of the file. The encrypted file here is being sent to the peers in the room using different sockets in the local system presently. All the files being sent/transmitted in the room are stored in the mongodb database for future reference of the ongoing session. Each user is assigned a database to keep track of his files used in the session.

Analysis and Design Models

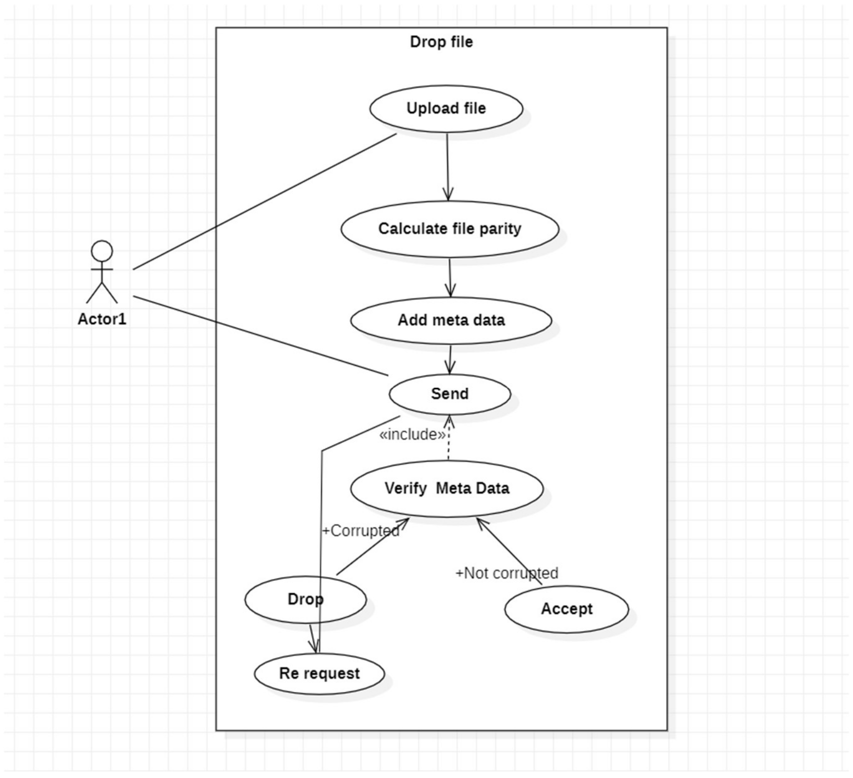
1. Use Case Diagram:



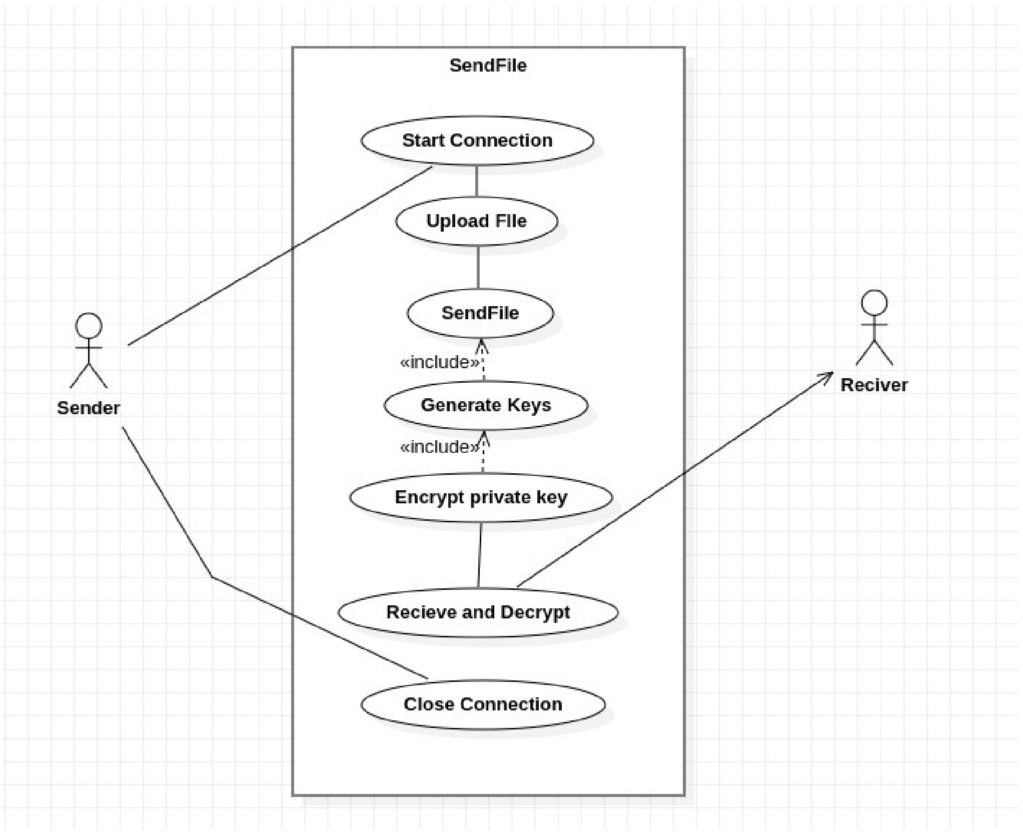
(a) Create Room Use Case:



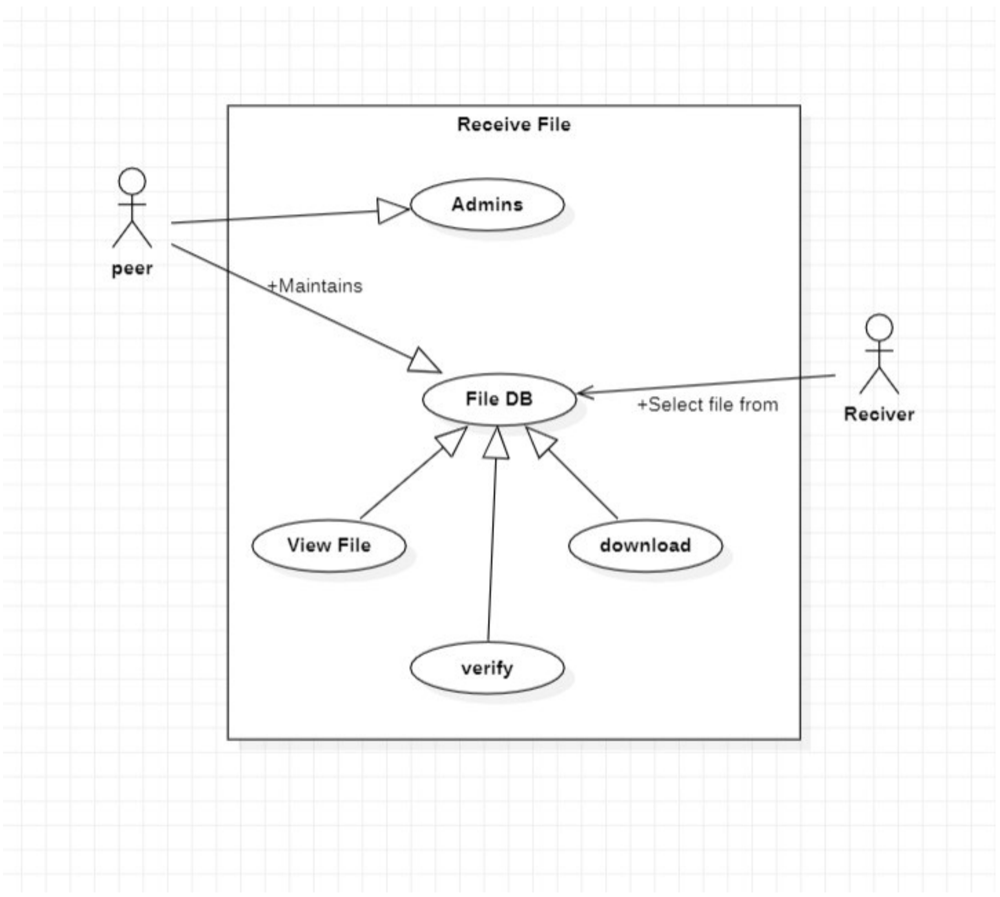
(b) Drop File Use Case:



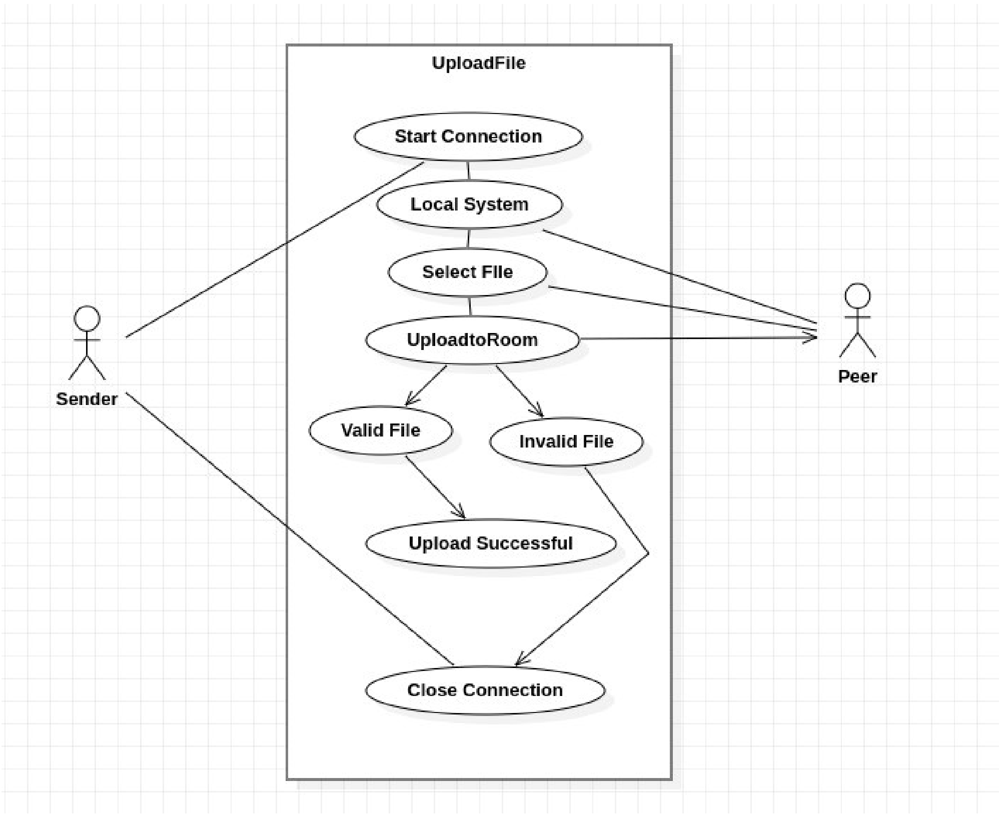
(c) Send File Use Case:



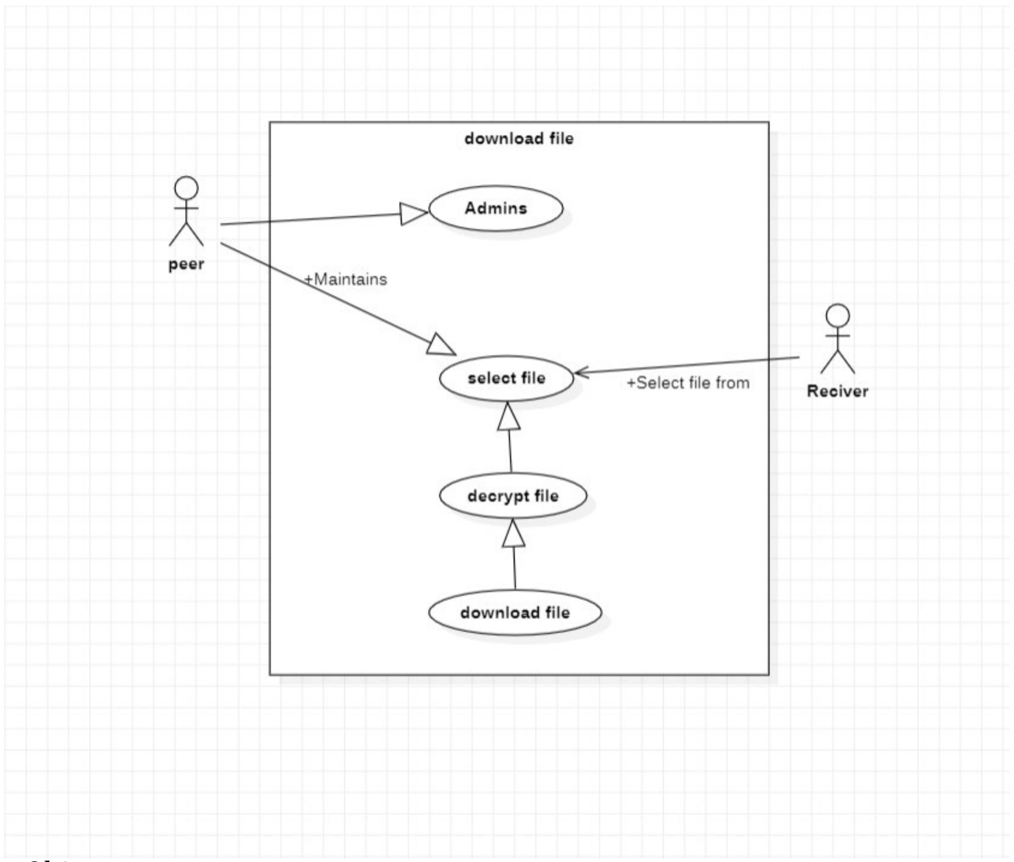
(d) Receive File Use Case:



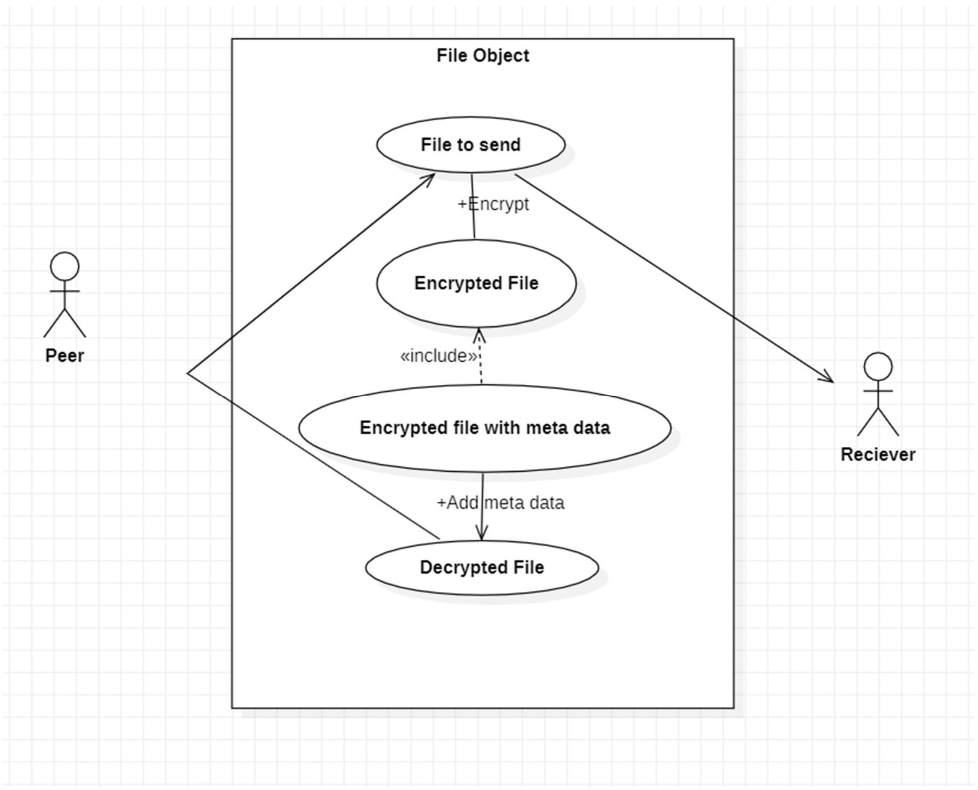
(e) Upload File Use Case:



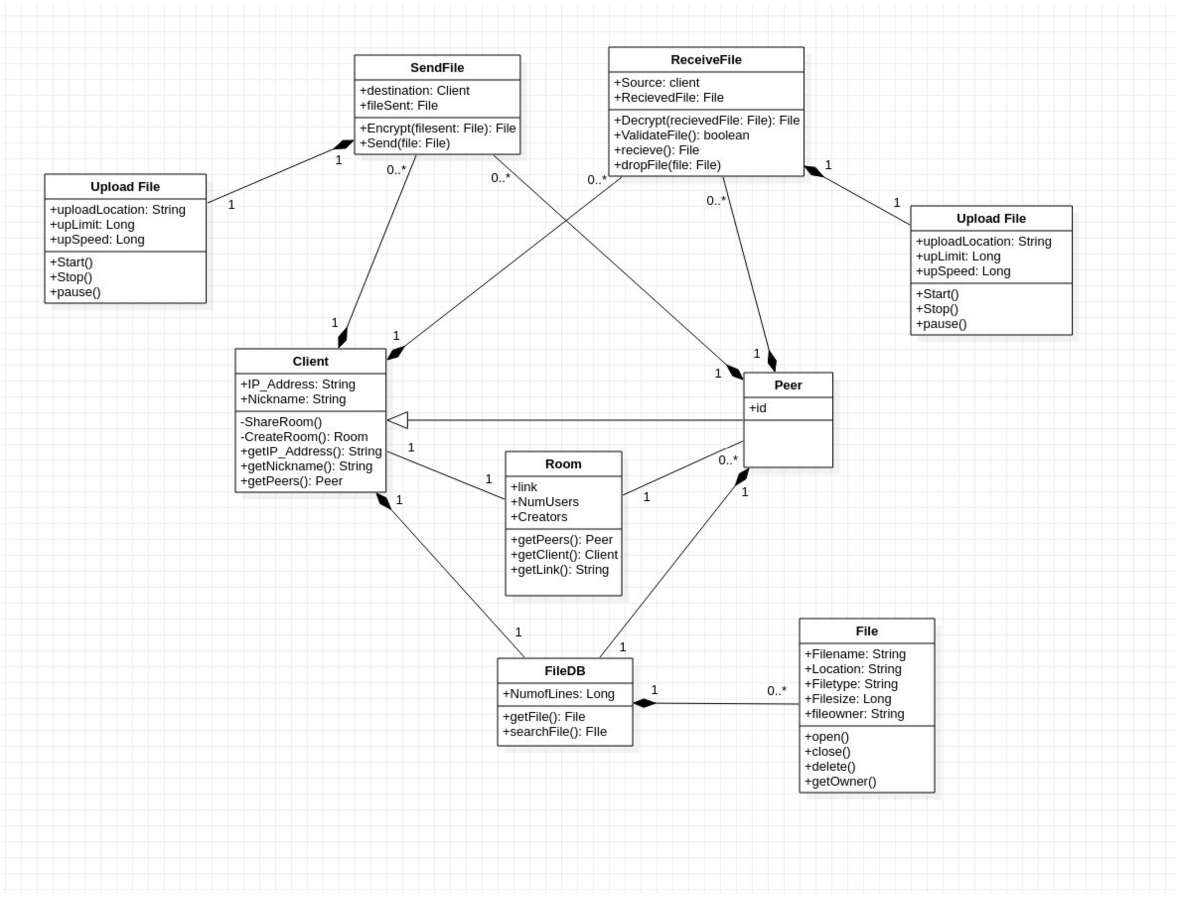
(f) Download File Use Case:



(g) File Object

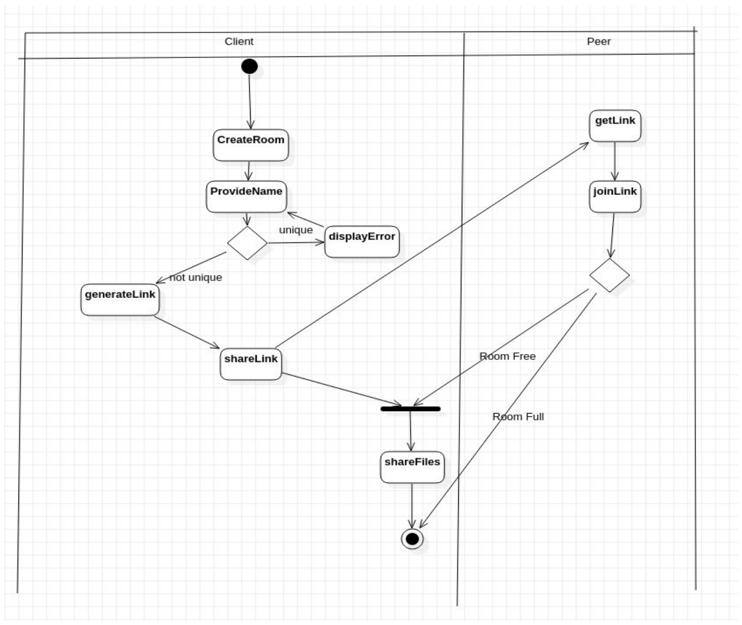


2. Class Modelling diagram:



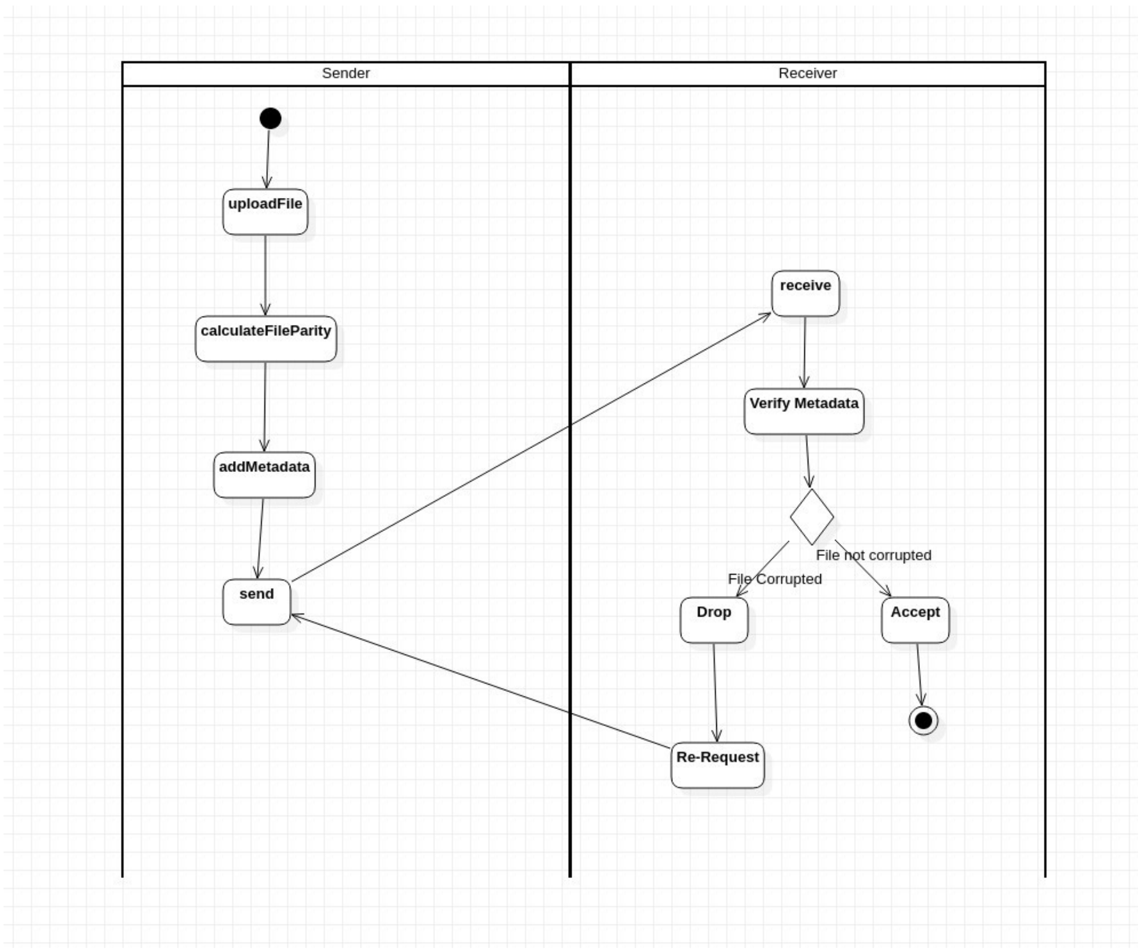
3.Activity diagram for the use-cases implemented

(a) Create Room Use Case:



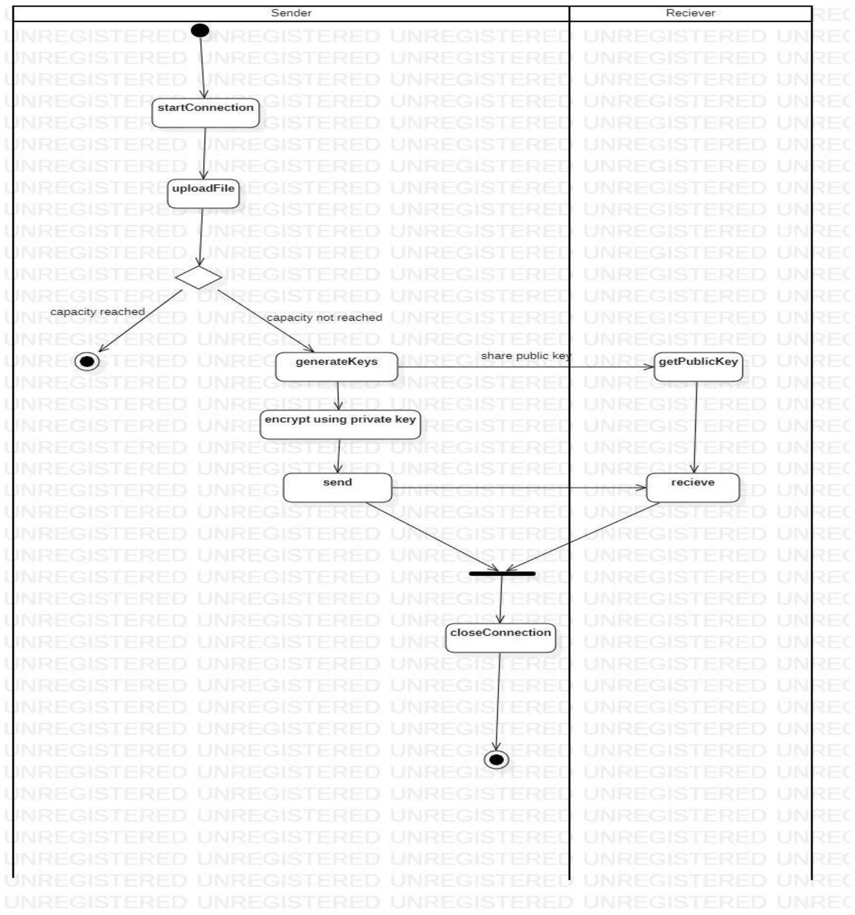
1. Name: CreateRoom
2. Summary:Create a room where peers can share files
3. Actor:Client/Peer
4. Preconditions: The Client has entered the platform
5. Description:
    - Click on “create room”
    - Click on “generate room link”
    - Click on “share link” and share it with other peers and the peers can join the room if the room limit has not been exceeded
6. Exceptions: The room limit exceeds
7. Post-condition: Peers can join and share files

(a)Drop File Use Case



1. Name: DropFile
2. Summary: On receiving the file, drop the file if it was corrupted during transfer.
3. Actor: Receiver/Peer
4. Preconditions: File is uploaded and is ready to be sent over the network
5. Description:
    - Calculate the file parity at the sender side, which upon received at the receiver side is used to verify the integrity of the file
    - It is added as metadata of the file
    - It is encrypted, sent over the network and received on the other side, and decrypted.
    - The metadata appended to the file is used to check the integrity of the file
    - If the file is found to be tampered, it is dropped immediately and a new request to resend the file goes to the sender, else accept the file.
6. Exceptions: The file doesn't reach the receiver side
7. Post-condition: Receiver can download the files

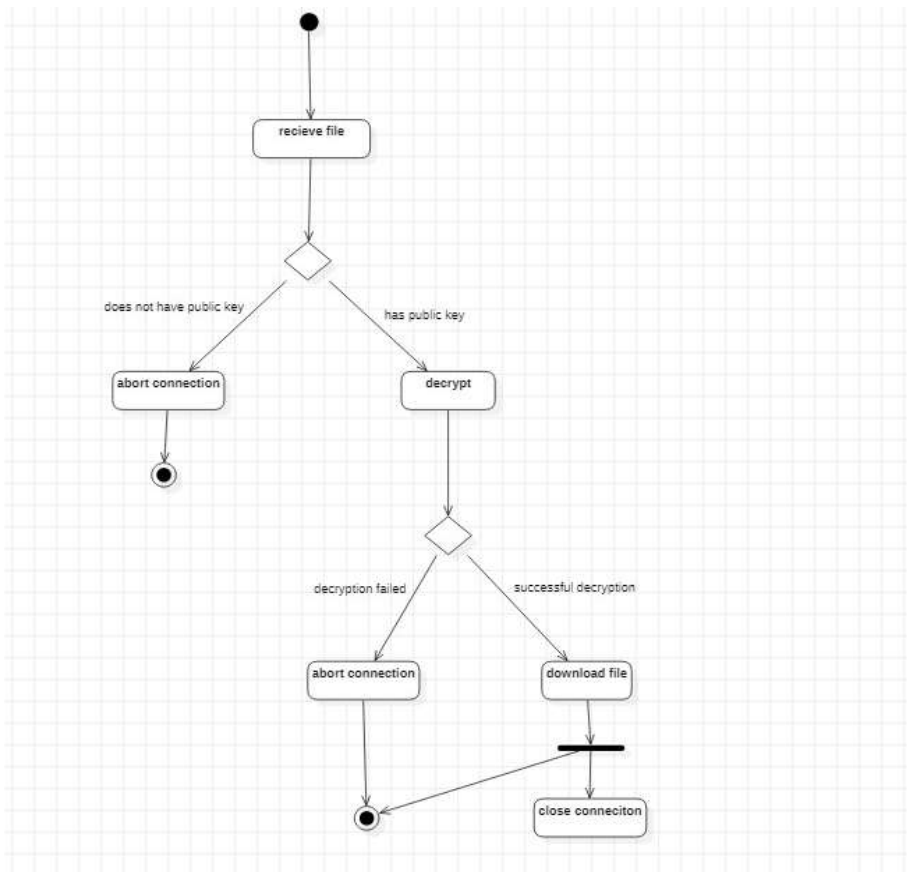
Send File Use Case:



1. Name: SendFile
2. Summary: Prepare the file to be sent over the network
3. Actor: Sender/Peer
4. Preconditions: The file is uploaded onto the platform
5. Description:
   - On starting the connection, keys generated for secure transmission i.e encryption
   - Share the public key to the receiver
   - Encrypt the file with the key already generated
   - Send the file to the receiver
   - Receive at the receiver side
   - Close connection
6. Exceptions: File doesn't exist in the DB

Post-condition: Receiver can receive the sent file

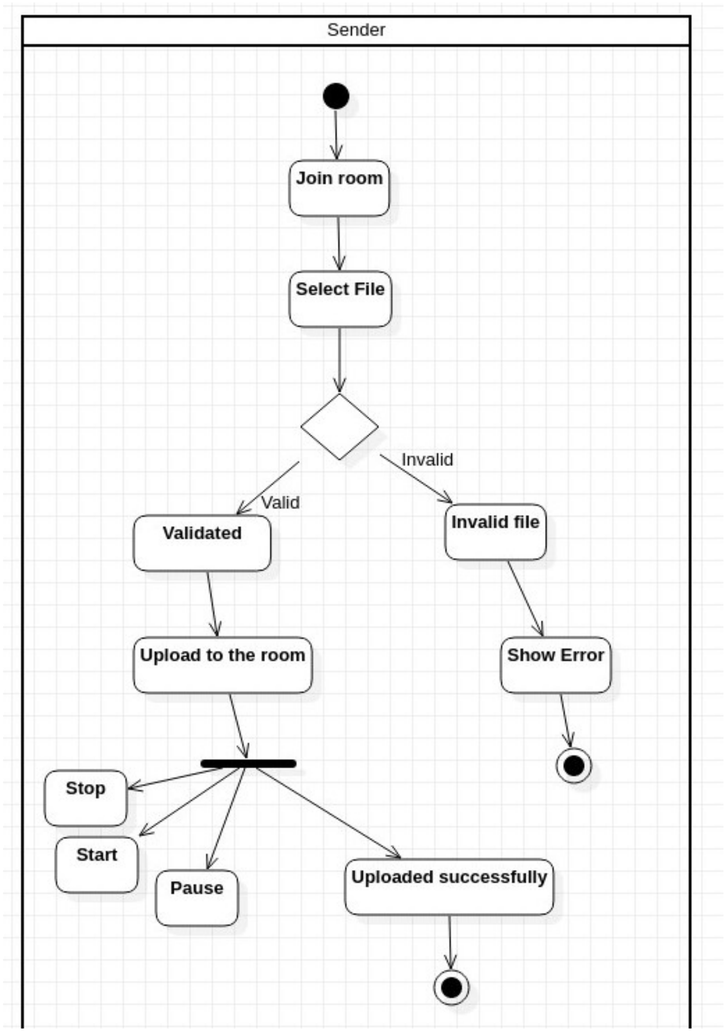
Receive File Use Case:



1. Name: Receive File
2. Summary: Receive the file sent over the network.
3. Actor:Peer/Receiver
4. Preconditions: The Sender has pushed a file to the fileDB
5. Description:
    - Click on “receive” file
    - Click on “verify” to verify the contents of the file by decrypting the file using the public key of the sender.
    - Click on “download” to download the file after successful verification.
6. Exceptions: Verification fails.

Post-condition: The file can now be downloaded by the receiver.

Upload file use case:



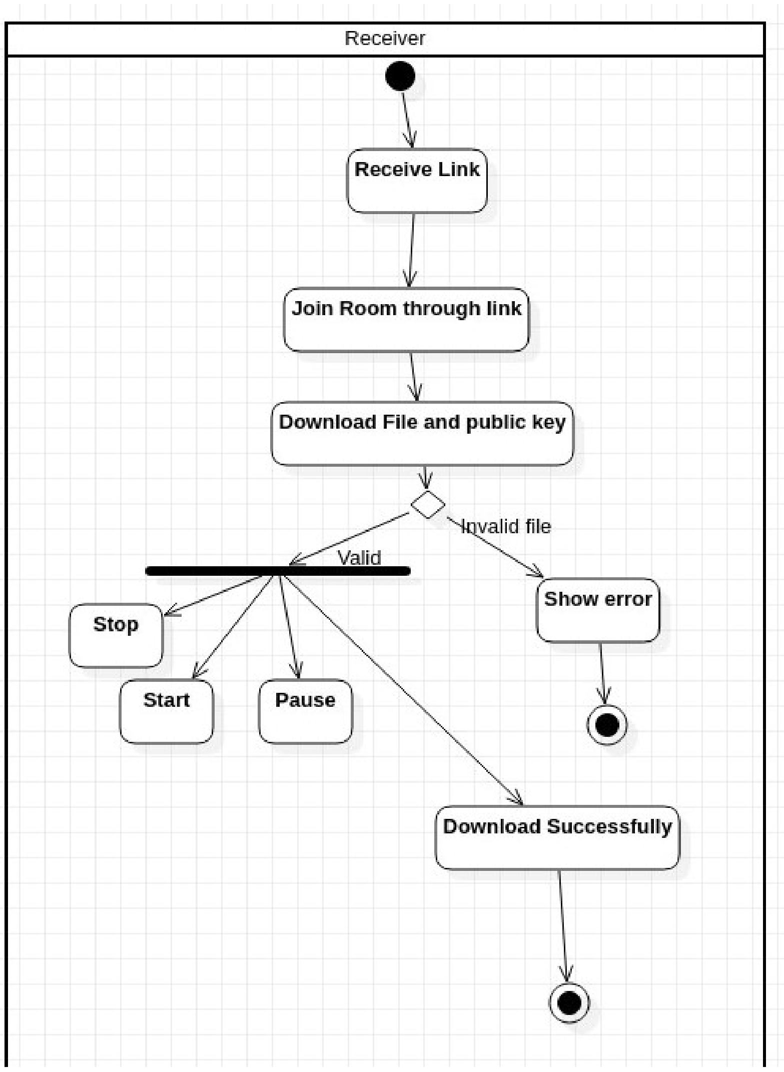
1. Name: Upload File use case
2. Summary: Select the file and upload the file in the FileDB
3. Actor: Client/Peer
4. Pre-conditions: The Client has entered the platform
5. Description:

- Click on “upload” to upload the file -Select the file from the peer local system.
- Click on “OK” to start uploading.
- The uploading actions have start, pause and stop options.

6. Exception - File is invalid or corrupted.

Post-condition - Send the file for encryption.

Download File use Case:

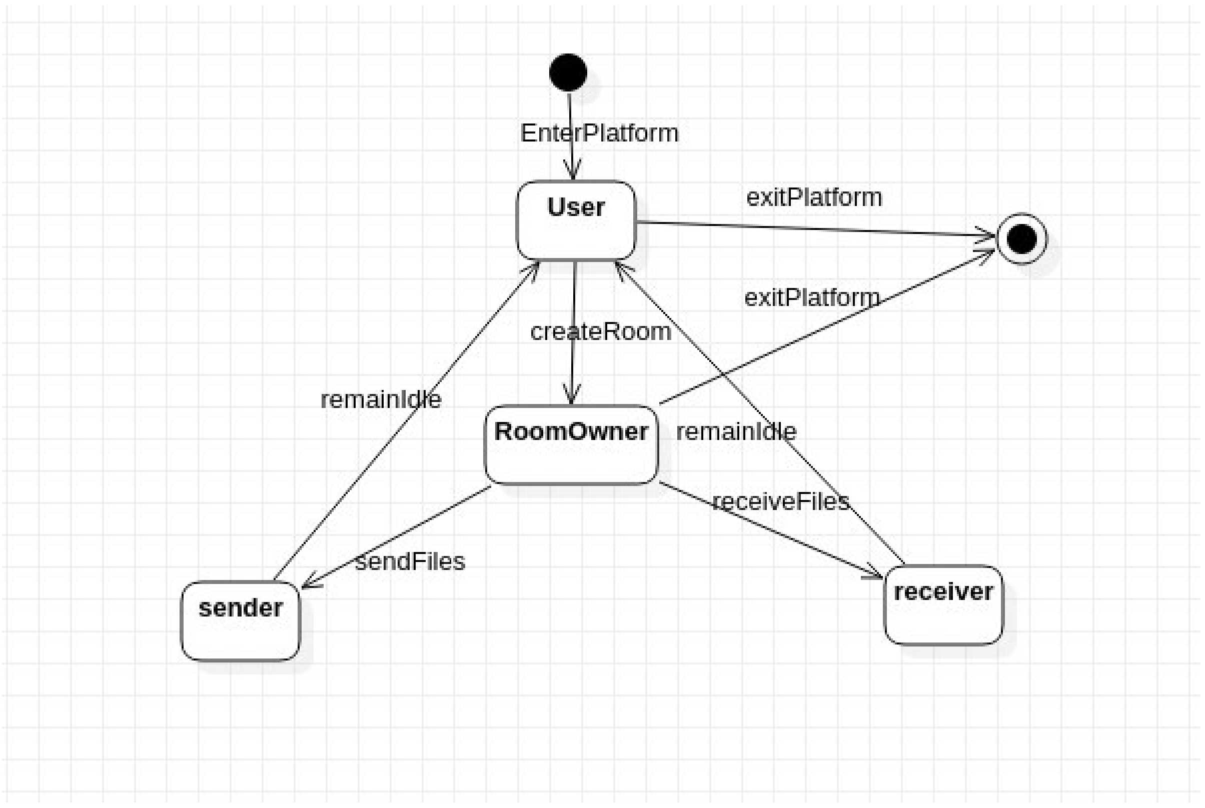


1. Name: Download File use case
2. Summary: Download the shared file in the room
3. Actor: Receiver/Peer
4. Pre-conditions: The file had been received and verified by decryption.
5. Description:

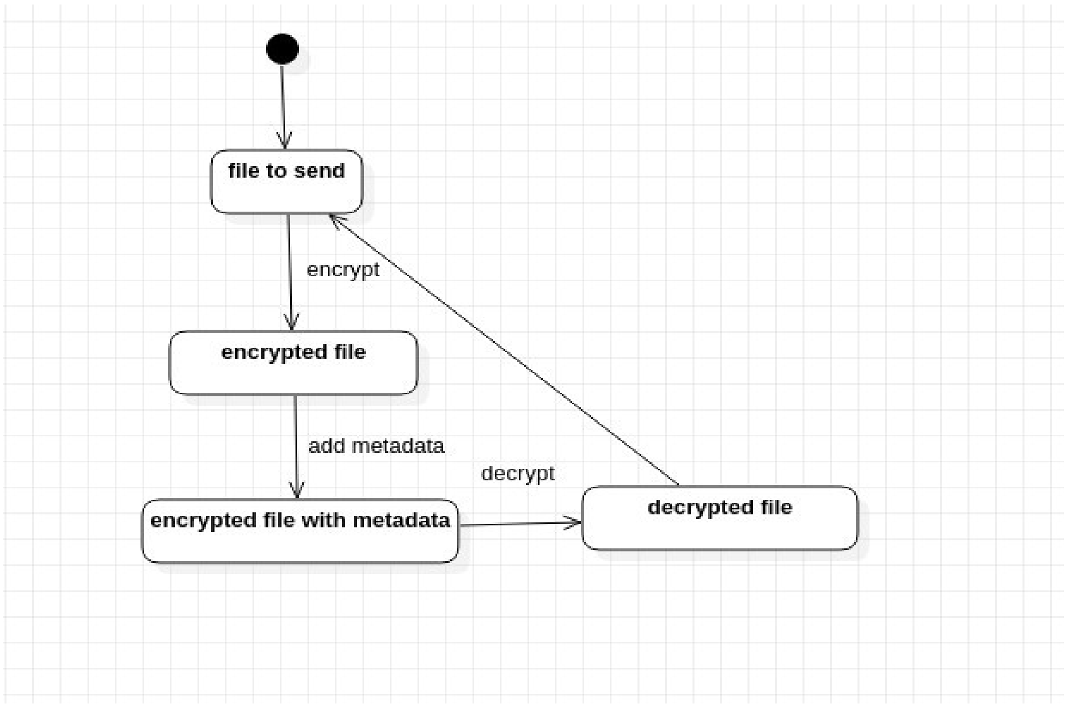
- Click on “download” to download the file.
- Select the destination to download in the peer’s local system.
- Click on “OK” to start downloading.
- The downloading actions have start, pause and stop options.

6. Exception - File is invalid or corrupted (verification failed).
7. Post-condition - The peer can continue being in the room to share and receive files.

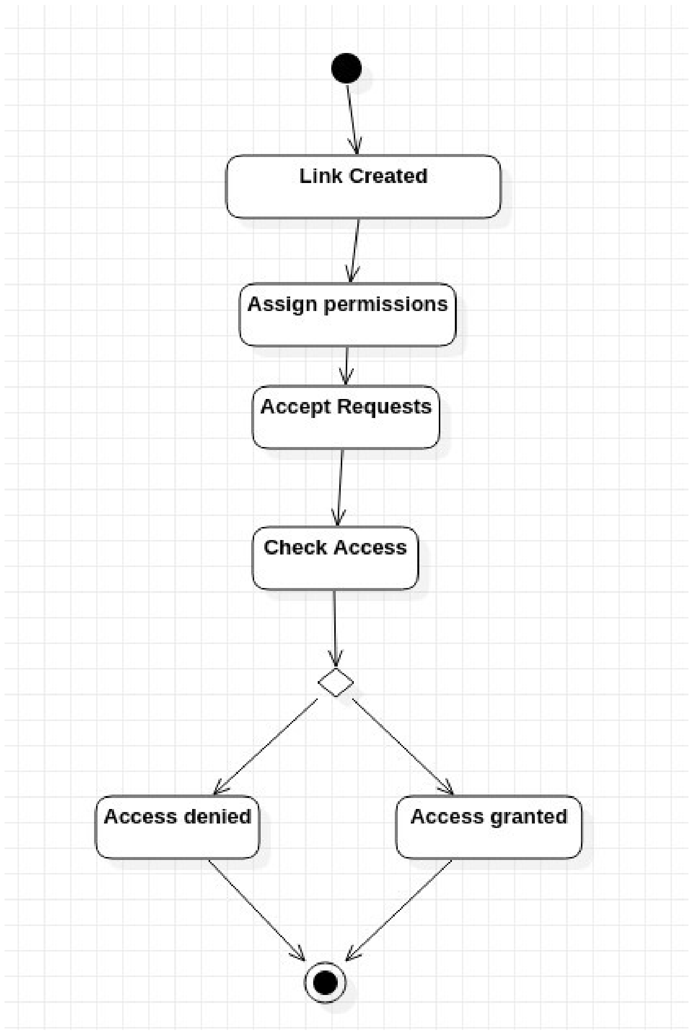
State diagram for the classes with temporal behaviour Client Object



File Object



Link accessibility



Tools and Frameworks Used:

1. MVC: model-view-controller

The Model-View-Controller (MVC) framework separates an application into three main logical components Model, View, and Controller.

Three important MVC components are:

- Model - It includes all the data and its related logic
- View - Present data to the user or handles user interaction
- Controller - An interface between Model and View components **Using: Spring MVC Framework -**

Model - Classes: ● - Client

- - Crypto
- - ReceiveFile
- - SendFile
- - Peer
- - Room

Controller - Classes

- - FileController

Views - HTML files with minimal vanilla javascript.

3. Maven

- Maven is used to handle the dependencies in the java project using POM (project object model).
- It helps in downloading the dependencies, which refers to the libraries or JAR files specific to the versions required in the project.

4. Database - MongoDB

- MongoDB is a NoSQL database that uses JSON-like documents with optional schemas.

- As a document database, MongoDB makes it easy for developers to store structured or unstructured data.
- In this project it is used to store the files. Each peer has a database that stores the file sent to him.

Design Principles and Design Patterns Applied:

1. **Design principles: The following SOLID principles were kept in mind while coding the project:**
   - **S - Single Responsibility Principle (SRP)**
     - All files in the model have only one logical responsibility. Eg: Classes like send File and receive File only take the responsibility of sending and receiving files respectively. Hence encrypting and decrypting is delegated to another class called Crypto.
   - **O - Open-Closed Principle (OCP)**
     - Class peer inherits the properties of client class by extending its properties.
     - Class Custom Multipart File implements Multipart File with additional functionalities.
   - **L - The Liskov Substitution Principle (LSP)**
     - A client object can be replaced with a peer object without any flaws.
   - **I - Interface Segregation Principle (ISP)**
     - There are no interfaces or classes with functionality which overburden them or ones which are not used by the client.
   - **D - Dependency Inversion Principle (DIP)**
     - There is no high-level class that directly depends on classes at lower levels

Design Patterns:

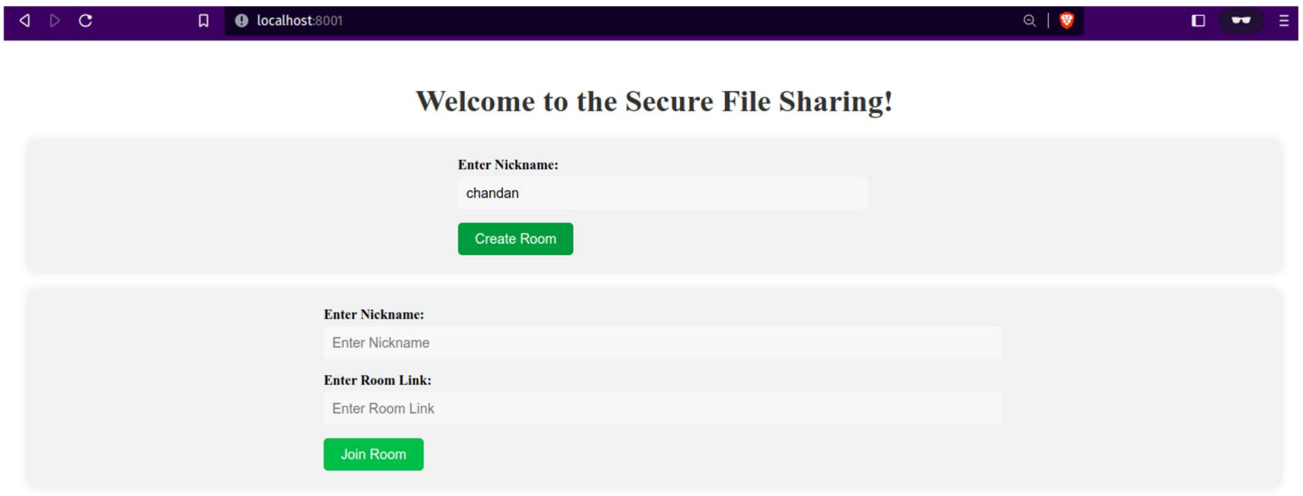
- **Singleton - classes that use singleton:**
    a. SendFile
    b. ReceiveFile
- **Factory -**
    a. UserFactory that creates:
    b. Peer
    c. Client

Implementation:

https://github.com/yoyozaemon/File-Sharing-System

RESULTS SCREENSHOTS

Screenshot1

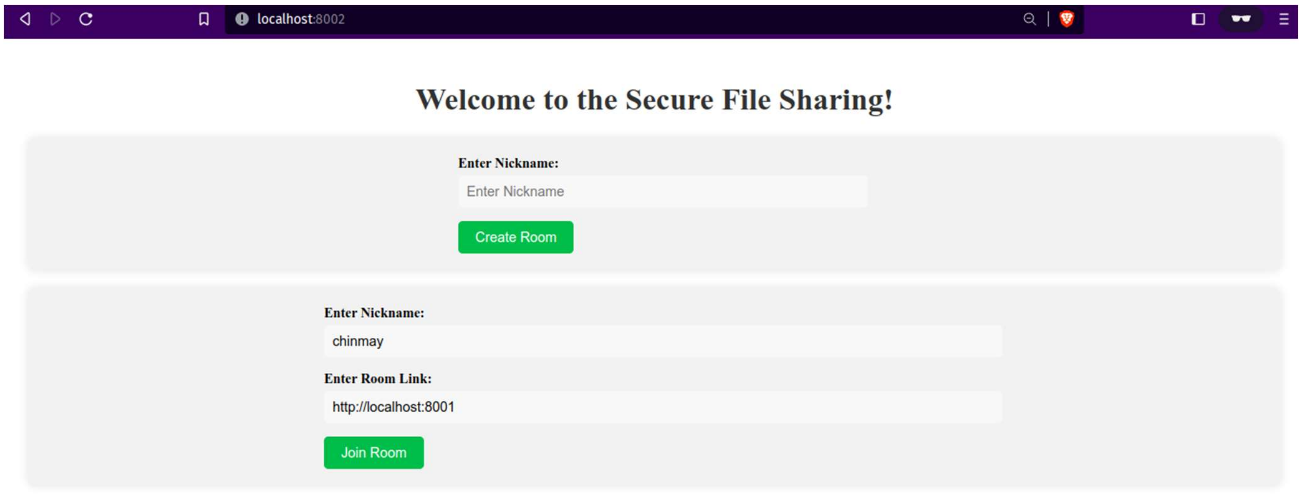

localhost:8001

Welcome to the Secure File Sharing!

Enter Nickname:
chandan
Create Room

Enter Nickname:
Enter Nickname
Enter Room Link:
Enter Room Link
Join Room

Screenshot2



Welcome to the Secure File Sharing!

Enter Nickname:

Enter Nickname

Create Room

Enter Nickname:

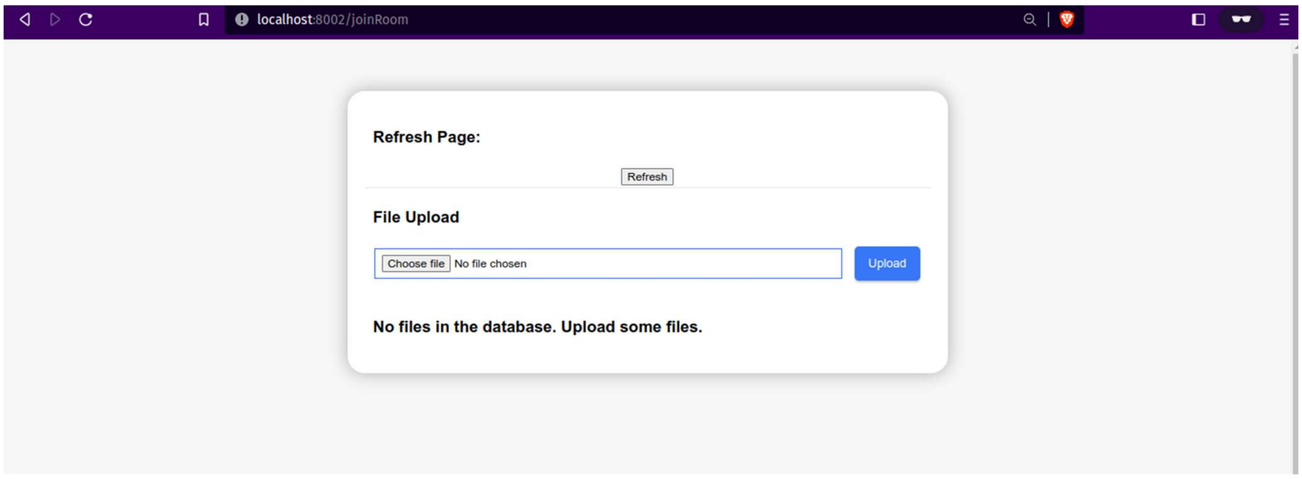
chinmay

Enter Room Link:

http://localhost:8001

Join Room

Screenshot3



Refresh Page:

Refresh

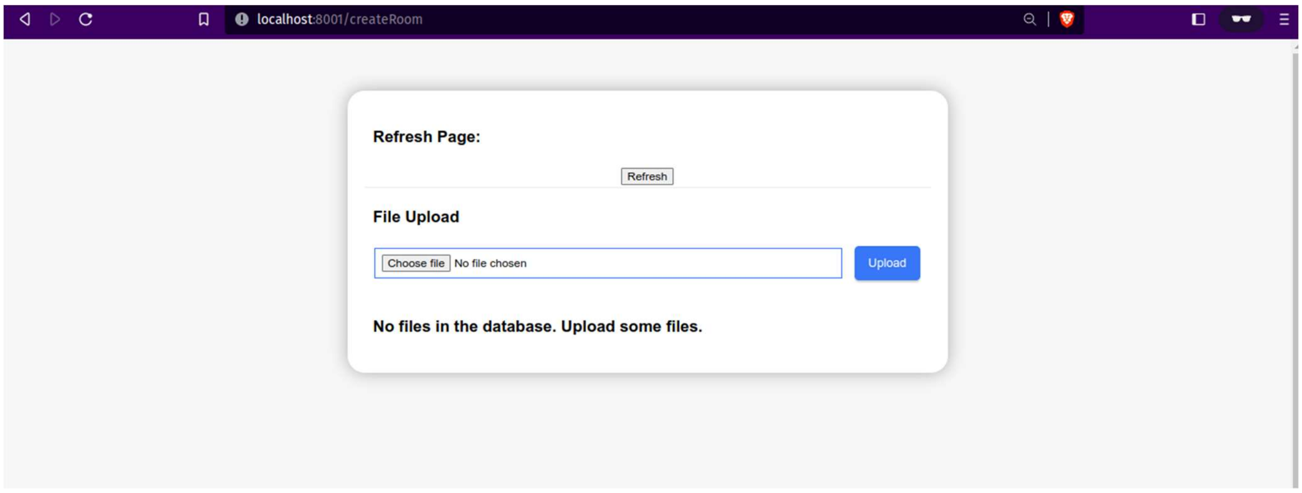
File Upload

Choose file No file chosen

Upload

No files in the database. Upload some files.

Screenshot4



Refresh Page:

Refresh

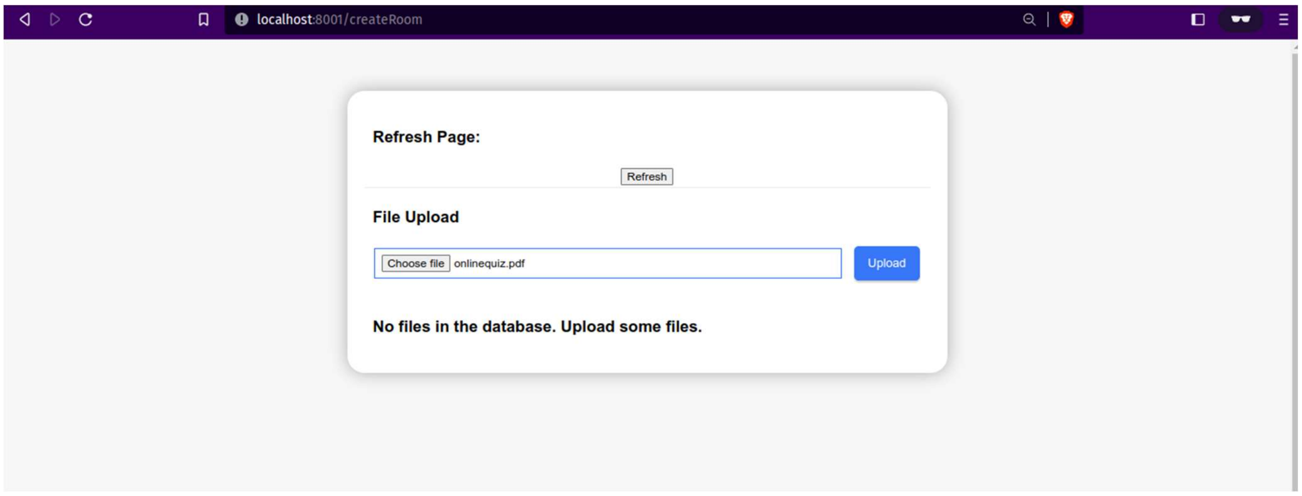
File Upload

Choose file No file chosen

Upload

No files in the database. Upload some files.

Screenshot5


localhost:8001/createRoom

Refresh Page:

Refresh

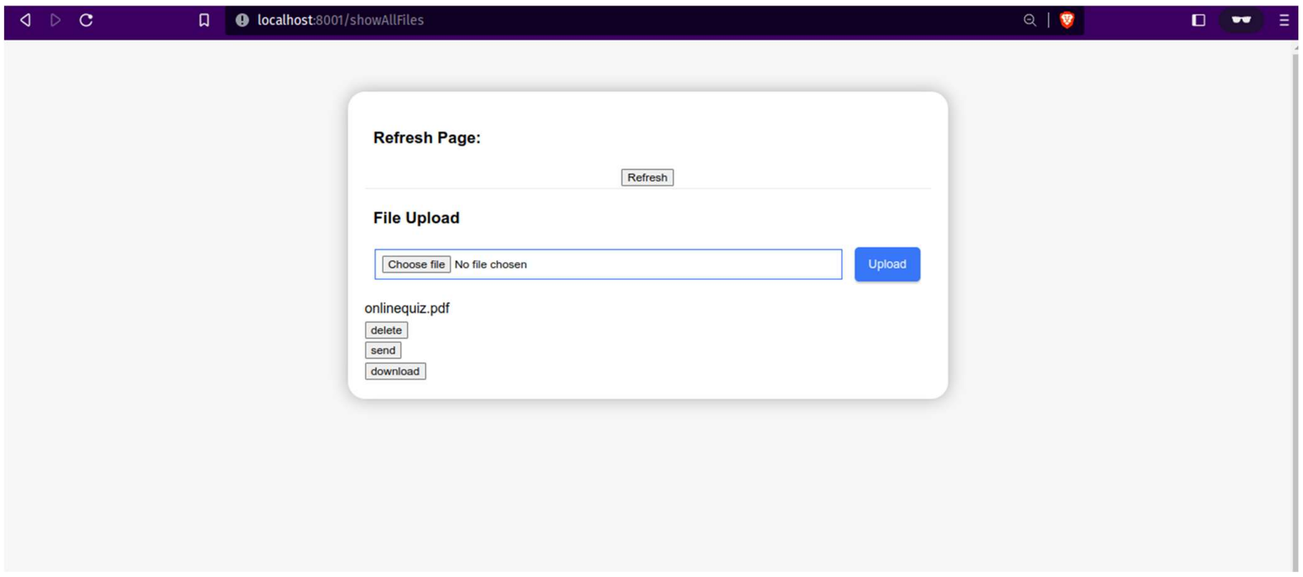
File Upload

Choose file onlinequiz.pdf

Upload

No files in the database. Upload some files.

Screenshot6


localhost:8001/showAllFiles

Refresh Page:

Refresh

File Upload

Choose file No file chosen

Upload

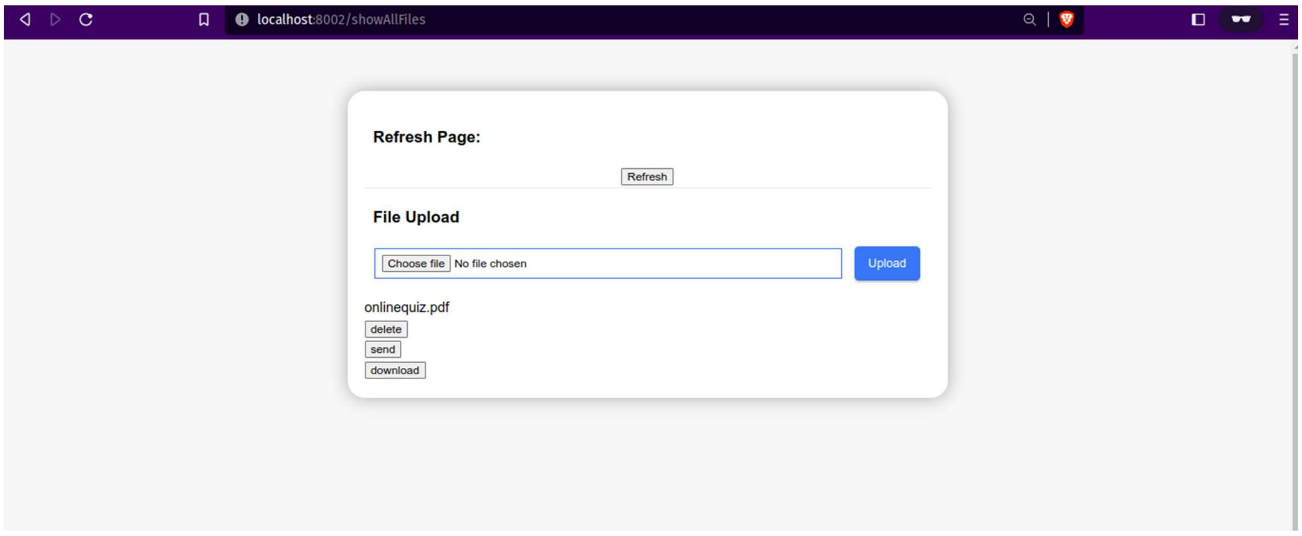
onlinequiz.pdf

delete

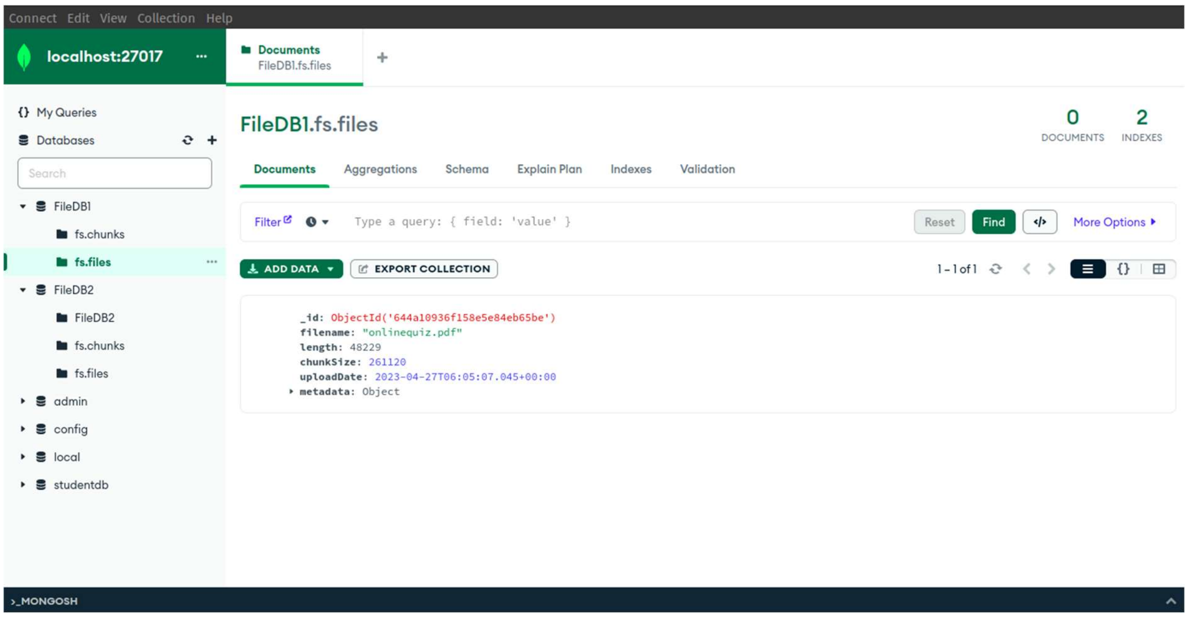
send

download

Screenshot7

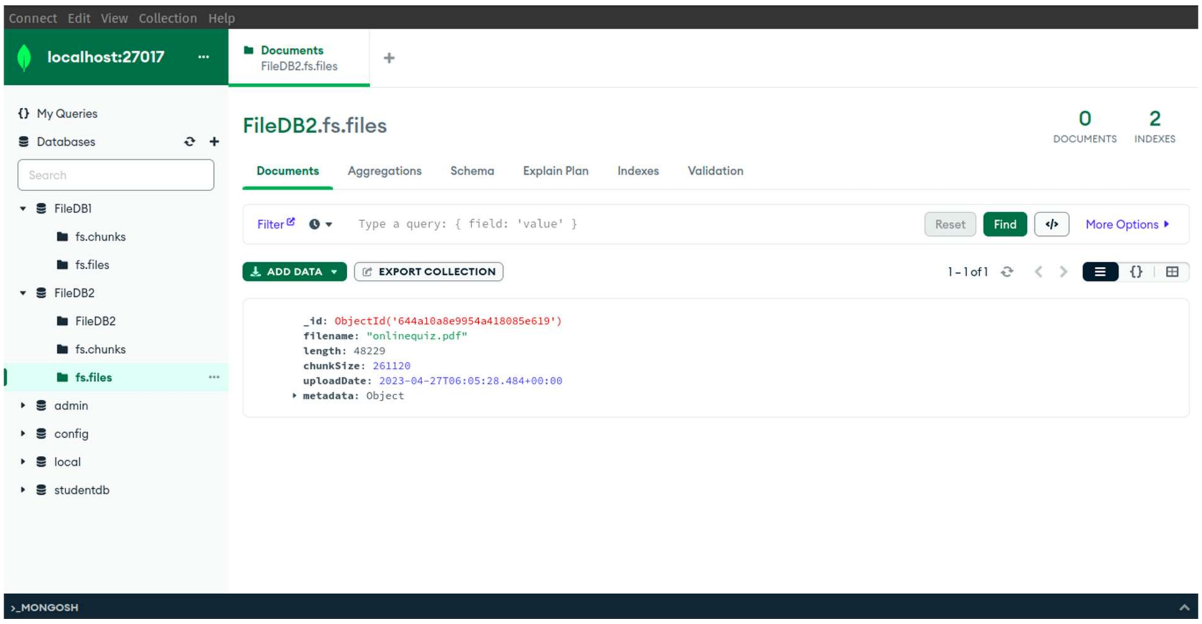


Screenshot8



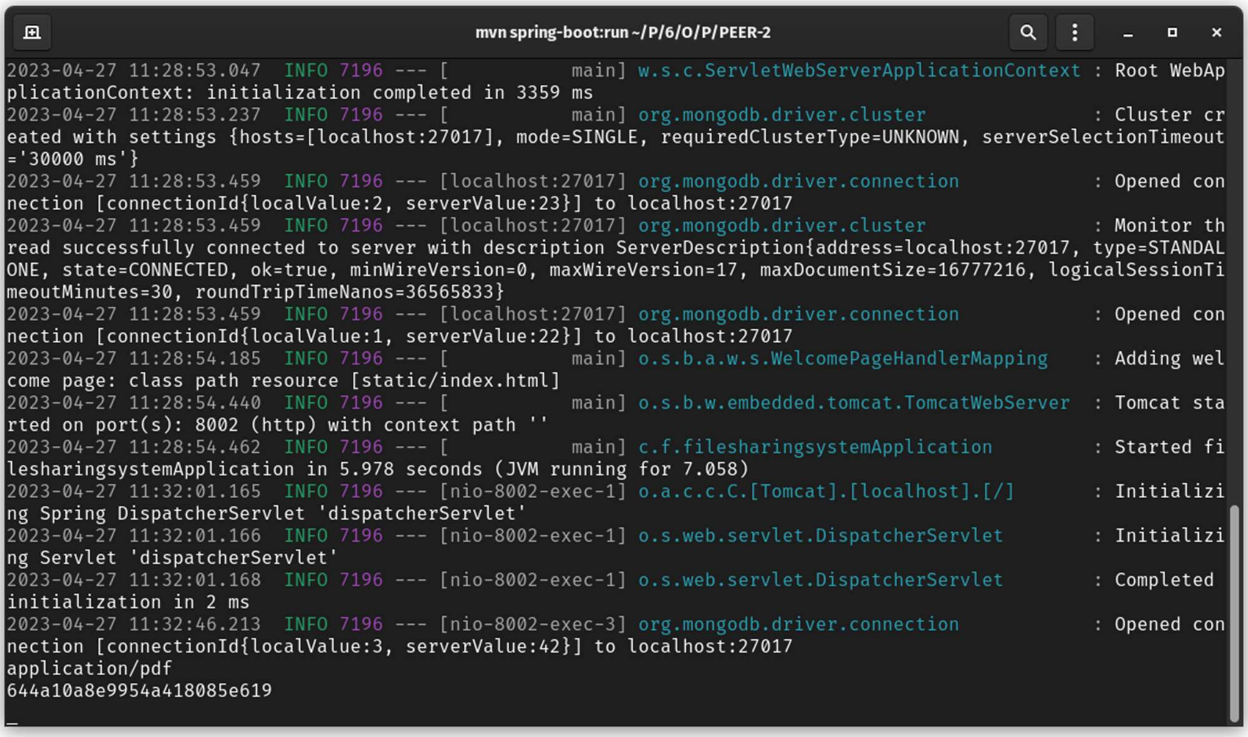
```
_id: ObjectId('644a10936f158e5e84eb65be')
filename: "onlinequiz.pdf"
length: 48229
chunkSize: 261120
uploadDate: 2023-04-27T06:05:07.045+00:00
▸ metadata: Object
```

Screenshot9



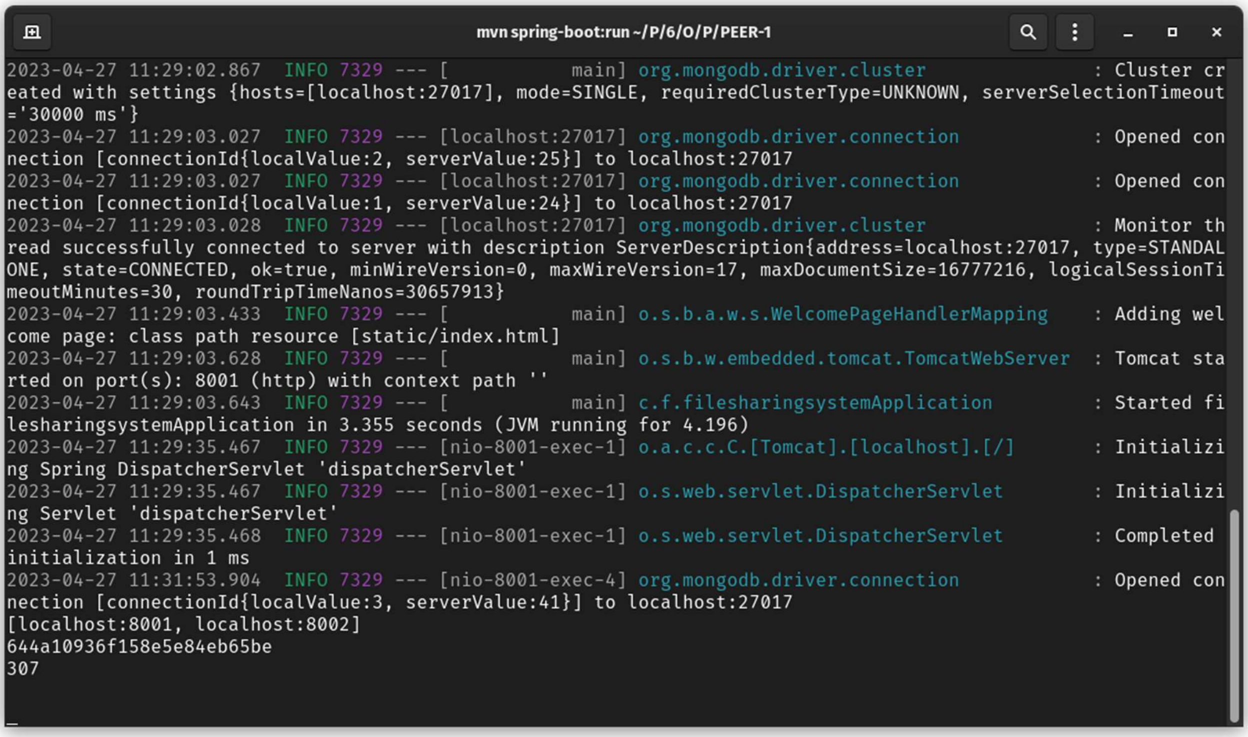
```
_id: ObjectId('644a10a8e9954a418085e619')
filename: "onlinequiz.pdf"
length: 48229
chunkSize: 261120
uploadDate: 2023-04-27T06:05:28.484+00:00
metadata: Object
```

Screenshot10



```
2023-04-27 11:28:53.047  INFO 7196 --- [           main] w.s.c.ServletWebServerApplicationContext : Root WebAp
plicationContext: initialization completed in 3359 ms
2023-04-27 11:28:53.237  INFO 7196 --- [           main] org.mongodb.driver.cluster               : Cluster cr
eated with settings {hosts=[localhost:27017], mode=SINGLE, requiredClusterType=UNKNOWN, serverSelectionTimeout
='30000 ms'}
2023-04-27 11:28:53.459  INFO 7196 --- [localhost:27017] org.mongodb.driver.connection            : Opened con
nection [connectionId{localValue:2, serverValue:23}] to localhost:27017
2023-04-27 11:28:53.459  INFO 7196 --- [localhost:27017] org.mongodb.driver.cluster               : Monitor th
read successfully connected to server with description ServerDescription{address=localhost:27017, type=STANDAL
ONE, state=CONNECTED, ok=true, minWireVersion=0, maxWireVersion=17, maxDocumentSize=16777216, logicalSessionTi
meoutMinutes=30, roundTripTimeNanos=36565833}
2023-04-27 11:28:53.459  INFO 7196 --- [localhost:27017] org.mongodb.driver.connection            : Opened con
nection [connectionId{localValue:1, serverValue:22}] to localhost:27017
2023-04-27 11:28:54.185  INFO 7196 --- [           main] o.s.b.a.w.s.WelcomePageHandlerMapping    : Adding wel
come page: class path resource [static/index.html]
2023-04-27 11:28:54.440  INFO 7196 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat sta
rted on port(s): 8002 (http) with context path ''
2023-04-27 11:28:54.462  INFO 7196 --- [           main] c.f.filesharingsystemApplication         : Started fi
lesharingsystemApplication in 5.978 seconds (JVM running for 7.058)
2023-04-27 11:32:01.165  INFO 7196 --- [nio-8002-exec-1] o.a.c.c.C.[Tomcat].[localhost].[/]       : Initializi
ng Spring DispatcherServlet 'dispatcherServlet'
2023-04-27 11:32:01.166  INFO 7196 --- [nio-8002-exec-1] o.s.web.servlet.DispatcherServlet        : Initializi
ng Servlet 'dispatcherServlet'
2023-04-27 11:32:01.168  INFO 7196 --- [nio-8002-exec-1] o.s.web.servlet.DispatcherServlet        : Completed
initialization in 2 ms
2023-04-27 11:32:46.213  INFO 7196 --- [nio-8002-exec-3] org.mongodb.driver.connection            : Opened con
nection [connectionId{localValue:3, serverValue:42}] to localhost:27017
application/pdf
644a10a8e9954a418085e619
_
```

Screenshot11



```
2023-04-27 11:29:02.867  INFO 7329 --- [           main] org.mongodb.driver.cluster               : Cluster cr
eated with settings {hosts=[localhost:27017], mode=SINGLE, requiredClusterType=UNKNOWN, serverSelectionTimeout
='30000 ms'}
2023-04-27 11:29:03.027  INFO 7329 --- [localhost:27017] org.mongodb.driver.connection            : Opened con
nection [connectionId{localValue:2, serverValue:25}] to localhost:27017
2023-04-27 11:29:03.027  INFO 7329 --- [localhost:27017] org.mongodb.driver.connection            : Opened con
nection [connectionId{localValue:1, serverValue:24}] to localhost:27017
2023-04-27 11:29:03.028  INFO 7329 --- [localhost:27017] org.mongodb.driver.cluster               : Monitor th
read successfully connected to server with description ServerDescription{address=localhost:27017, type=STANDAL
ONE, state=CONNECTED, ok=true, minWireVersion=0, maxWireVersion=17, maxDocumentSize=16777216, logicalSessionTi
meoutMinutes=30, roundTripTimeNanos=30657913}
2023-04-27 11:29:03.433  INFO 7329 --- [           main] o.s.b.a.w.s.WelcomePageHandlerMapping    : Adding wel
come page: class path resource [static/index.html]
2023-04-27 11:29:03.628  INFO 7329 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer  : Tomcat sta
rted on port(s): 8001 (http) with context path ''
2023-04-27 11:29:03.643  INFO 7329 --- [           main] c.f.filesharingsystemApplication         : Started fi
lesharingsystemApplication in 3.355 seconds (JVM running for 4.196)
2023-04-27 11:29:35.467  INFO 7329 --- [nio-8001-exec-1] o.a.c.c.C.[Tomcat].[localhost].[/]       : Initializi
ng Spring DispatcherServlet 'dispatcherServlet'
2023-04-27 11:29:35.467  INFO 7329 --- [nio-8001-exec-1] o.s.web.servlet.DispatcherServlet        : Initializi
ng Servlet 'dispatcherServlet'
2023-04-27 11:29:35.468  INFO 7329 --- [nio-8001-exec-1] o.s.web.servlet.DispatcherServlet        : Completed 
initialization in 1 ms
2023-04-27 11:31:53.904  INFO 7329 --- [nio-8001-exec-4] org.mongodb.driver.connection            : Opened con
nection [connectionId{localValue:3, serverValue:41}] to localhost:27017
[localhost:8001, localhost:8002]
644a10936f158e5e84eb65be
307
```