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Aim: Implementation of 2-Phase Protocol

Theory:
The two-phase commit protocol breaks a database commit into two phases to ensure correctness & fault tolerance in a distributed database system

* Phase I - prepare Phase
- After each slave has locally completed its transaction, it sends a "DONE" message to the controlling site
- when the controlling sit has received "DONE" message from all slaves, it sends a "Prepare" message to slaves
- The slaves vote on whether they still want to commit or not
- If a slave ~~commits~~ wants to send an commit it sends "Ready" message
- otherwise, it sends "Not Ready" message

* Phase II : Commit/Abort Phase
- After each controlling site has recovered "Ready" message from all slaves:-
  1. The controlling site sends "Global commit" msg to slaves
  2. The slaves apply the transaction & send a "Commit Ack" message to controlling site

Disadvantages:

1] The major disadvantage of the Two-phase commit protocol is faild when co-ordinator site failure may result in blocking, so a decision either to commit or abort Transaction (T) may have to be postponed until co-ordinator recovers again.

2] consider a scenario if a Transaction (T) holds lock on data items of active sites, but amid the execution, if coordinator fails and the active states keep no additional log-record except <need T T> like <abort> or <commit> So, it becomes impossible to determine what decision has been made to <commit> / <abort>

Conclusion:

Thus, we successfully studied and implemented the 2-phase protocol.

Code:

Client

```
import java.io.*; import java.net.*;
public class Client implements Runnable
```

```
{
    static Socket clientSocket = null;
static PrintStream os = null;      static
DataInputStream is = null;     static
BufferedReader inputLine = null;     static
boolean closed = false;     public static
void main(String[] args)
    {
        int port_number=1111;            String
host="localhost";          try {
clientSocket = new Socket(host, port_number);
            inputLine = new BufferedReader(new
InputStreamReader(System.in));
            os = new PrintStream(clientSocket.getOutputStream());
is = new DataInputStream(clientSocket.getInputStream());
        } catch (Exception e)
        {   System.out.println("Exception occurred : "+e.getMessage());
}

        if (clientSocket != null && os != null && is != null)
        {
            try
{
                new Thread(new Client()).start();
while (!closed)
                {
                    os.println(inputLine.readLine());
                }
                os.close();
is.close();
                clientSocket.close();
            } catch (IOException e)
            {
                System.err.println("IOException:  " + e);
```

```
        }
    }
}
@SuppressWarnings("deprecation")
public void run()    {
    String responseLine;
    try
    {
        while ((responseLine = is.readLine()) != null)
        {
            System.out.println("\n"+responseLine);
            if (responseLine.equalsIgnoreCase("GLOBAL_COMMIT")==true
|| responseLine.equalsIgnoreCase("GLOBAL_ABORT")==true )
            {
                break;
            }
        }
        closed=true;
    }
    catch (IOException e)
    {
        System.err.println("IOException:  " + e);
    }
}
}
```

Server

```
import java.io.*; import
java.net.*; import
java.util.*;

public class Server {     boolean closed = false,
inputFromAll = false;
    List<ClientThread> thread;
    List<String> data;
    List<String> decision;

    Server() {
        thread = new ArrayList<ClientThread>();
        data = new ArrayList<String>();
        decision= new ArrayList<String>();
}   public static void main(String args[])
```

```
    {
        Socket clientSocket = null;
        ServerSocket serverSocket = null;
int port_number = 1111;         Server
server = new Server();         try
{
            serverSocket = new ServerSocket(port_number);
        } catch (IOException e) {
            System.out.println(e);
        }
        while (!server.closed)
        {             try {
clientSocket = serverSocket.accept();
                    ClientThread clientThread = new ClientThread(server,
clientSocket);
                    (server.thread).add(clientThread);
                    System.out.println("\nNow Total clients are : " +
(server.thread).size());
                    (server.data).add("NOT_SENT");
(server.decision).add("NOT_SENT");
clientThread.start();
            } catch (IOException e) { }
        }
try {
            serverSocket.close();
        } catch (Exception e1) { }
    }
}
class ClientThread extends Thread
{
    DataInputStream is = null;
   String line;
```

```
String destClient = "";
 String name;
 PrintStream os = null;
 Socket clientSocket = null;
 String clientIdentity;
 Server server;
```

```
    public ClientThread(Server server, Socket clientSocket)
    {
        this.clientSocket = clientSocket;
this.server = server;
    }

    @SuppressWarnings("deprecation")
public void run()
    {         try {             is = new
DataInputStream(clientSocket.getInputStream());             os = new
PrintStream(clientSocket.getOutputStream());
os.println("Enter your name.");             name = is.readLine();
clientIdentity = name;             os.println("Welcome " + name + "
to this 2 Phase
Application.\nYou will receive a vote Request now...");
os.println("Send Ready or Not Ready after local transaction..");
            while (true)
            {
                line = is.readLine();
if (line.equalsIgnoreCase("NOT READY"))
                {
                    System.out.println("\nFrom '" + clientIdentity
                            + "' : NOT READY\n\nSince NOT READY we will not
wait for inputs from other clients.");
                    System.out.println("\nAborted....");

                    for (int i = 0; i < (server.thread).size(); i++) {
                        ((server.thread).get(i)).os.println("GLOBAL_ABORT"
);
                        ((server.thread).get(i)).os.close();
                        ((server.thread).get(i)).is.close();
                    }
break;
```

}

```
            if (line.equalsIgnoreCase("READY"))
    {
```

```
                    System.out.println("\nFrom '" + clientIdentity + "' :
READY");
                    if ((server.thread).contains(this))
                    {
                        (server.data).set((server.thread).indexOf(this),
"READY");
                        for (int j = 0; j < (server.data).size(); j++)
                        {
if
(!(((server.data).get(j)).equalsIgnoreCase("NOT_SENT")))
                            {
                                server.inputFromAll = true;
continue;
                            }
else{                                   server.inputFromAll =
false;
                                System.out.println("\nWaiting for inputs
from other clients.");                                  break;
                            }
}
                        if (server.inputFromAll)
                        {
                            System.out.println("All Ready..");
                        }
                    }
                }
                os.println("VOTE_REQUEST\nPlease enter COMMIT or ABORT to
proceed : ");                line = is.readLine();                if
(line.equalsIgnoreCase("ABORT"))
                {
                    System.out.println("\nFrom   '"   +   clientIdentity
+  "'  :  ABORT\n\nSince  ABORT  we  will  not  wait  for  inputs  from  other
clients.");
                    System.out.println("\nAborted....");

                    for (int i = 0; i < (server.thread).size(); i++) {
((server.thread).get(i)).os.println("GLOBAL_ABORT"
```

```
);
                    ((server.thread).get(i)).os.close();
```

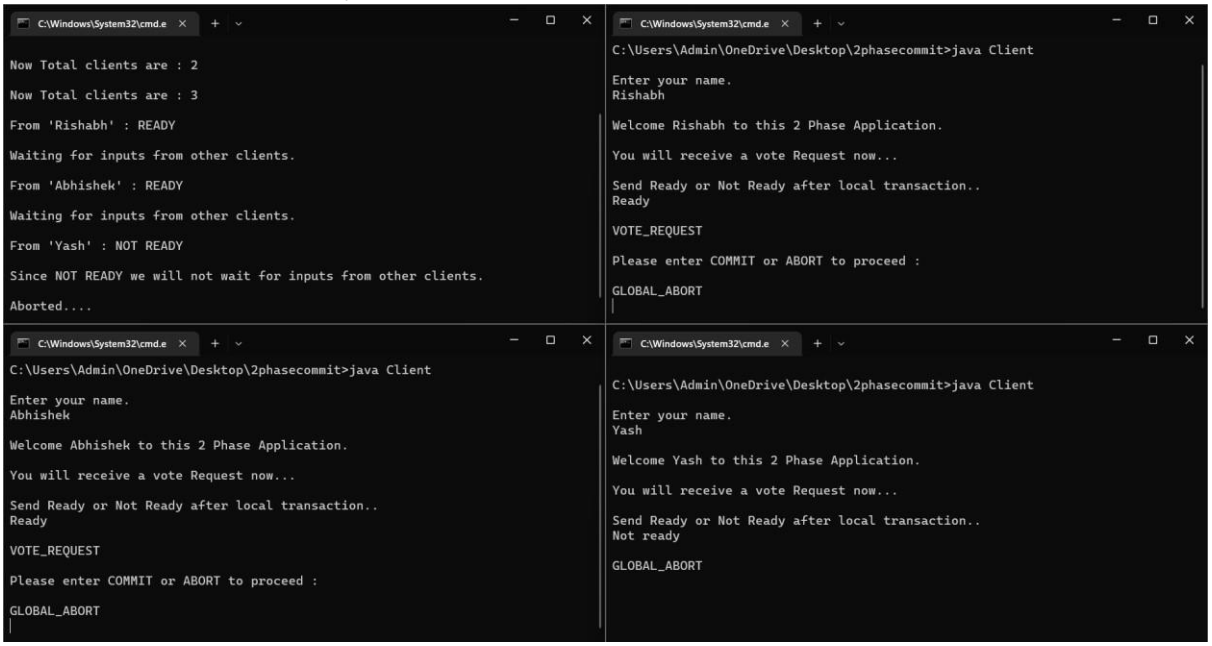
```
                        ((server.thread).get(i)).is.close();
                    }
break;
                }
                if (line.equalsIgnoreCase("COMMIT")){
                    System.out.println("\nFrom '" + clientIdentity + "' :
COMMIT");
                    if ((server.thread).contains(this))
                    {
                        (server.decision).set((server.thread).indexOf(this
), "COMMIT");
                        for (int j = 0; j < (server.decision).size(); j++)
                        {
if
(!(((server.decision).get(j)).equalsIgnoreCase("NOT_SENT")))
                            {
                                server.inputFromAll = true;
continue;
                            }
else{                                   server.inputFromAll =
false;
                                System.out.println("\nWaiting for inputs
from other clients.");                                  break;
                            }
}
                        if (server.inputFromAll){
                            System.out.println("\n\nCommited....");
for (int i = 0; i < (server.thread).size(); i++)
                            {
                                ((server.thread).get(i)).os.println("GLOBA
L_COMMIT");
                                ((server.thread).get(i)).os.close();
                                ((server.thread).get(i)).is.close();
                            }
break;
                        }
                    }
                }
            }
```

```
            server.closed = true;
            clientSocket.close();
        } catch (IOException e) { }

    }
}
```

Output:

Scenario: One "not ready”



Scenario: all ready but one “Abort”

```
From 'Yash' : READY
All Ready..

From 'Rishabh' : COMMIT

Waiting for inputs from other clients.

From 'Abhishek' : COMMIT

Waiting for inputs from other clients.

From 'Yash' : ABORT

Since ABORT we will not wait for inputs from other clients.

Aborted....
```

```
Enter your name.
Rishabh

Welcome Rishabh to this 2 Phase Application.

You will receive a vote Request now...

Send Ready or Not Ready after local transaction..
Ready

VOTE_REQUEST

Please enter COMMIT or ABORT to proceed :
Commit

GLOBAL_ABORT
```

```
Enter your name.
Abhishek

Welcome Abhishek to this 2 Phase Application.

You will receive a vote Request now...

Send Ready or Not Ready after local transaction..
Ready

VOTE_REQUEST

Please enter COMMIT or ABORT to proceed :
Commit

GLOBAL_ABORT
```

```
Enter your name.
Yash

Welcome Yash to this 2 Phase Application.

You will receive a vote Request now...

Send Ready or Not Ready after local transaction..
Ready

VOTE_REQUEST

Please enter COMMIT or ABORT to proceed :
Abort

GLOBAL_ABORT
```

Scenario: all ready and all commit

```
Waiting for inputs from other clients.

From 'Yash' : READY
All Ready..

From 'Rishabh' : COMMIT

Waiting for inputs from other clients.

From 'Abhishek' : COMMIT

Waiting for inputs from other clients.

From 'Yash' : COMMIT


Commited....
```

```
Enter your name.
Rishabh

Welcome Rishabh to this 2 Phase Application.

You will receive a vote Request now...

Send Ready or Not Ready after local transaction..
Ready

VOTE_REQUEST

Please enter COMMIT or ABORT to proceed :
Commit

GLOBAL_COMMIT
```

```
Enter your name.
Abhishek

Welcome Abhishek to this 2 Phase Application.

You will receive a vote Request now...

Send Ready or Not Ready after local transaction..
Ready

VOTE_REQUEST

Please enter COMMIT or ABORT to proceed :
Commit

GLOBAL_COMMIT
```

```
Enter your name.
Yash

Welcome Yash to this 2 Phase Application.

You will receive a vote Request now...

Send Ready or Not Ready after local transaction..
Ready

VOTE_REQUEST

Please enter COMMIT or ABORT to proceed :
Commit

GLOBAL_COMMIT
```

Conclusion:

Thus, we successfully studied and implemented 2PL protocol.