

SER 321 A Session

SI Session

Monday, September 18th 2023

6:00 - 7:00 pm MST

Agenda



Threading Mini-Quiz

Thread Review

Assignment Structure

Running your Assignment

SI Session Expectations

Thanks for coming to the **SER 321** SI session. We have a packed agenda and we are going to try to get through as many of our planned example problems as possible. This session will be recorded and shared with others.

- If after this you want to see additional examples, please visit the drop-in tutoring center.
- We will post the link in the chat now and at the end of the session.
 - tutoring.asu.edu
- Please keep in mind we are recording this session and it will be made available for you to review 24-48 hours after this session concludes.
- Finally, please be respectful to each other during the session.

Interact with us:

Zoom Features



Zoom Chat

- Use the chat feature to interact with the presenter and respond to presenter's questions.
- Annotations are encouraged

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Thread Review

Which of the following correctly enables the Client to start a thread?

A.

```
public class Client implements Thread{
```

B.

```
public class Client makes Thread{
```

C.

```
public class Client extends Thread{
```

D.

```
public class Client permits Thread{
```

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Thread Review

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Thread Review

```
client.start();
```

The code above starts which of the following methods?

A.

```
public void start() {
```

B.

```
public void run() {
```

C.

```
public void thread() {
```

D.

```
public void execute() {
```

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Thread Review

```
client.start();
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The code above starts which of the following methods?

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```
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C.

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```

D.

```
public void execute() {
```


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Thread Review

```
//create threaded server  
ThreadedServer threadedServer = new ThreadedServer(  
//send off to work  
threadedServer.start();
```

Which of the following constructors correctly initializes a ThreadedServer allowing the code above to function?

A.

```
public ThreadedServer(Socket sock) {  
    this.conn = sock;  
}
```

B.

```
public ThreadedServer(Socket sock, int id) {  
    this.conn = sock;  
    this.id = id;  
}
```

C.

```
public ThreadedServer(int id) {  
    this.id = id;  
}
```

D.

```
public ThreadedServer(Socket sock, int id, Performer performer) {  
    this.conn = sock;  
    this.id = id;  
    this.performer = performer;  
}
```

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Thread Review

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//create threaded server
ThreadedServer threadedServer = new ThreadedServer(
//send off to work
threadedServer.start();
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D.

```
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    this.id = id;
    this.performer = performer;
}
```

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Socket Server - No Threads

Make Socket

Wait for connections

Handle the connection

Perform the task

Clean up - what is that again?

in.close();

out.close();

sock.close();

```
public static void main (String args[]) {  
    Socket sock;  
    try {  
        //open socket  
        ServerSocket serv = new ServerSocket( port 8888); // create server socket on port 8888  
        System.out.println("Server ready for 3 connections");  
        // only does three connections then closes  
        // NOTE: SINGLE-THREADED, only one connection at a time  
        for (int rep = 0; rep < 3; rep++){  
            System.out.println("Server waiting for a connection");  
            sock = serv.accept(); // blocking wait  
            // setup the object reading channel  
            ObjectInputStream in = new ObjectInputStream(sock.getInputStream());  
  
            // read in one object, the message. we know a string was written only by knowing what the client sent.  
            // must cast the object from Object to desired type to be useful  
            String s = (String) in.readObject();  
            System.out.println("Received the String "+s);  
            // read in the number, we know it's an integer because that's the second thing sent by the client.  
            Integer i = (Integer) in.readObject();  
            System.out.println("Received the Integer "+ i);  
  
            // generate an output  
            // get output channel  
            OutputStream out = sock.getOutputStream();  
            // create an object output writer (Java only)  
            ObjectOutputStream os = new ObjectOutputStream(out);  
            // write the whole message  
            os.writeObject("Got it!");  
            // make sure it wrote and doesn't get cached in a buffer  
            os.flush();  
        }  
    } catch (Exception e) {e.printStackTrace();}  
}
```

[SockServer](#) from
[JavaSimpleSock2](#) in
examples [Repo](#)

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Threading your Server

Make Socket

Wait for connections

Start Thread

Handle the connection

Perform the task

Clean up

JavaThreadedSock in Sockets



```
ServerSocket serv = new ServerSocket(portNo);  
while (true) {  
    System.out.println("Threaded server waiting for connects on port " + portNo);  
    sock = serv.accept();  
    System.out.println("Threaded server connected to client-" + id);  
    // create thread  
    ThreadedSockServer myServerThread = new ThreadedSockServer(sock, id++);  
    // run thread and don't care about managing it  
    myServerThread.start();  
}
```



```
public ThreadedSockServer(Socket sock, int id) {  
    this.conn = sock;  
    this.id = id;  
}
```



```
public void run() {  
    try {  
        // setup read/write channels for connection  
        ObjectInputStream in = new ObjectInputStream(conn.getInputStream());  
        ObjectOutputStream out = new ObjectOutputStream(conn.getOutputStream());  
  
        // read the digit being send  
        String s = (String) in.readObject();  
    }  
}
```

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Threading

Make Socket

Wait for connections

Start Thread

Handle the connection

Perform the task

Clean up

```
in.close();  
out.close();  
conn.close();
```

```
int index;  
// while client hasn't ended  
while (!s.equals("end")) {  
    Boolean validInput = true;  
  
    // checks if input only contains digits  
    if (!s.matches( expr: "\\d+")) {  
        validInput = false;  
        out.writeObject("Not a number: https://gph.is/2vDymkn");  
    }  
  
    // if it contains only numbers  
    if (validInput) {  
        // convert to an integer  
        index = Integer.valueOf(s);  
        System.out.println("From client " + id + " get string " + index);  
        if (index > -1 & index < buf.length) {  
            // if valid, pull the line from the buffer array above and write it to socket  
            out.writeObject(buf[index]);  
        } else if (index == 5) {  
            // fun surprise for mostly correct  
            out.writeObject("Close but out of range: https://youtu.be/dQw4w9WgXcQ");  
        } else {  
            // really wrong  
            out.writeObject("index out of range");  
        }  
    }  
  
    // wait for next token from the user  
    s = (String) in.readObject();  
}
```

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Assignment Structure

Leader with worker nodes

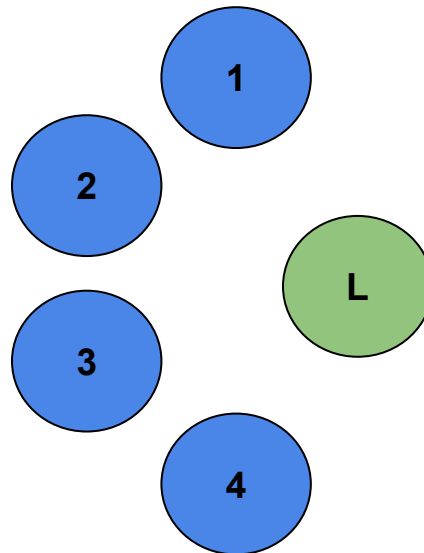
Theoretically each node is a different computer connected to the system scattered over the globe.

We are going to use threads to simulate

Each node receives a portion of the data to perform a task for/on

We are encrypting strings to simulate

Once complete, each node reports back to the leader with the result



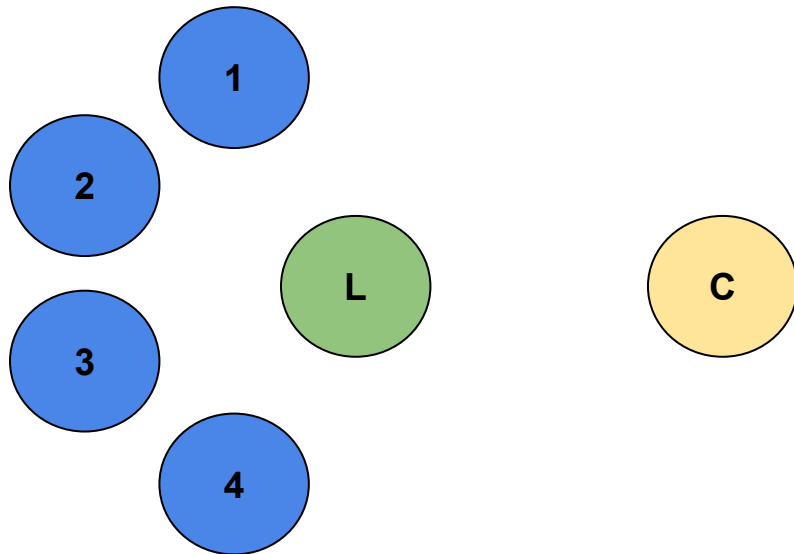
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Assignment Structure

Leader with worker nodes

The leader is responsible for everything

- Data
- Partitioning data
- Nodes
- New nodes
- Unresponsive nodes
- Faulty nodes
- Node responses
- Client communication



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Assignment Structure

Leader with worker nodes

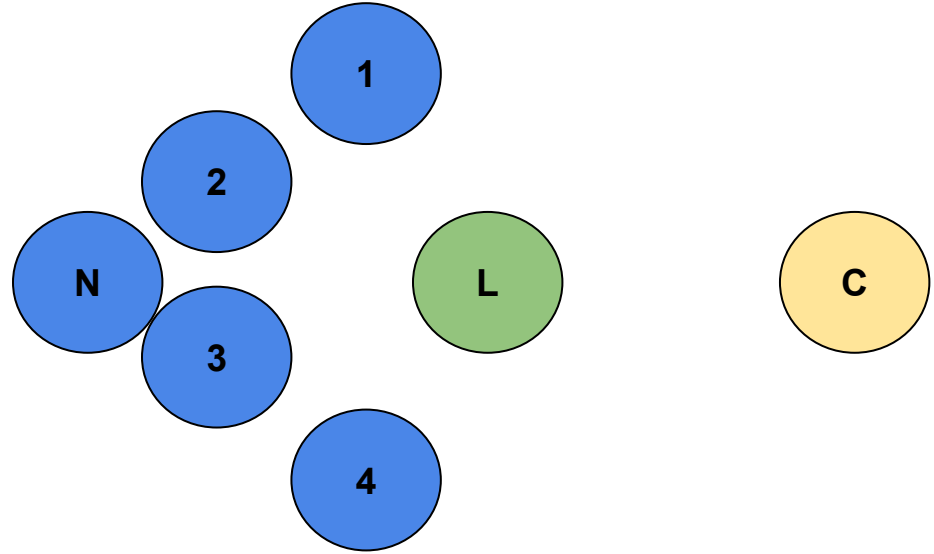
All nodes are identical

Really only need three classes then

Client

Leader

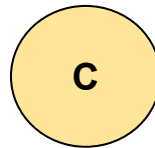
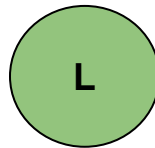
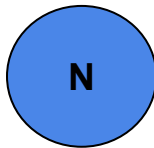
Node



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Assignment Structure

Leader with worker nodes



Need at least three nodes at all times

What if you drop below three?

Send error message to client - graceful!

Need a set max limit for nodes (8)

Nodes are threaded!

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Assignment Structure

Client will communicate with leader
then backs off to wait

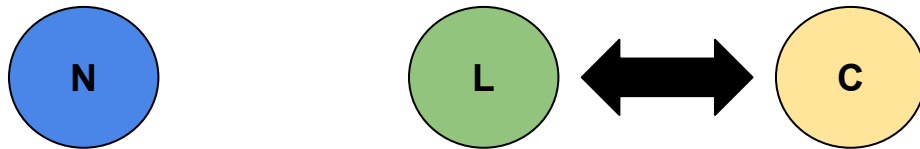
Connection is established

Leader prompts client for a sentence

Client sends sentence

Leader *does work*

Leader sends client the encrypted sentence



Think about the protocol you want to use!

JSON or Protobuf?

Start getting a rough outline together

Two “Areas” to cover

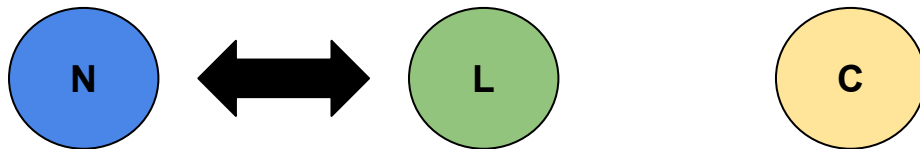
Leader-Client communication

Leader-Node communication

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Assignment Structure

What does the node have to do?



Task 1:

- Receive data
- Encrypt data
- Return data

Both Encrypt steps should **use the same method**

Could have an error in one method and not the other

Task 2:

- Receive data
- Encrypt data
- Check data**
- Return result

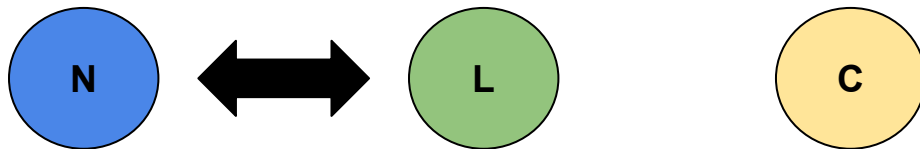
How could we handle this elegantly?

Think in terms of protocol!

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Assignment Structure

Leader *does work*



Overview of Leader's job

- Split the data up for each node
- Send NodeData to each node
- Wait for response
- Receive encrypted data
- Start Consensus
 - Send NodeData and encrypted NodeData to a *new* node
 - Check response
 - If no - previous node was faulty
 - Else continue
 - Once all encryptions have been checked by a second node, continue
- Reassemble data
- Return data to client

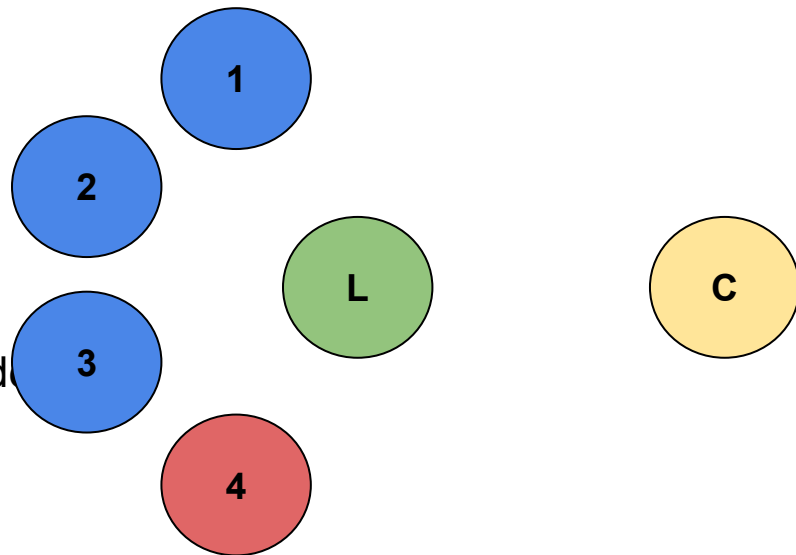
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Running your Assignment

Then start at least 3 nodes First start your leader

You can make a node faulty with the Fault flag

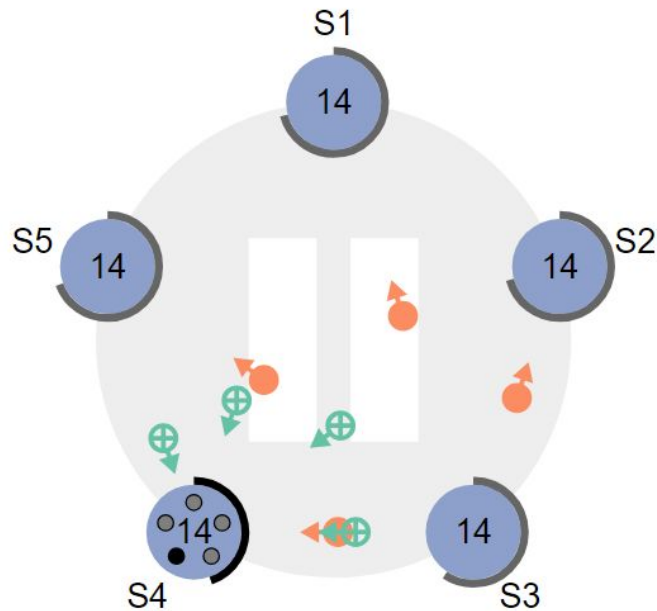
Then start your client



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RAFT

RAFT



	1	2	3	4	5	6	7	8	9	10
S1										
S2										
S3										
S4										
S5										



1/59x

3.160s

Questions?

Survey:

https://bit.ly/asn_survey



Upcoming Events

SI Sessions:

- Wednesday September 20th 2023 6:00 pm MST

Review Sessions:

- TBD

More Questions?

Check out our other resources!

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Additional Resources

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[Examples Repo](#)

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