SER 321 B Session

SI Session

Sunday, November 5th 2023

7:00 - 8:00 pm MST

Agenda

- Threading Pitfalls
  - Critical Sections
  - Traffic Analogy
- Threading your Server
- Serialization

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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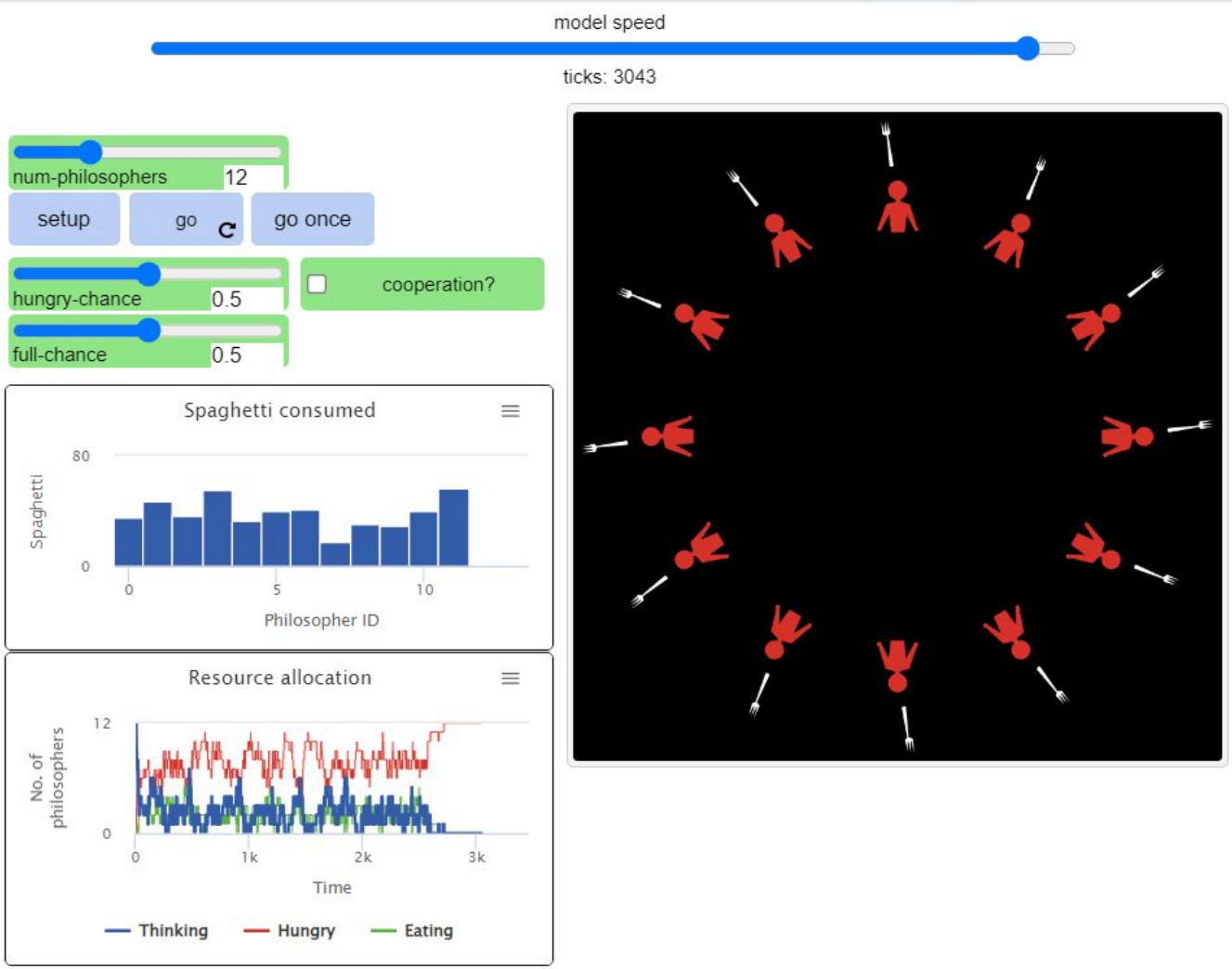
Threading Pitfalls!

Dining Philosophers



Austin Walter's Traffic Comparison

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Threading Pitfalls

- Race Condition

More than one thread accesses a single resource at one time

- Starvation

One thread never gets access to the resource it needs

- Deadlock

A thread is only able to acquire access to part of its resources

Austin Walter's Traffic Comparison

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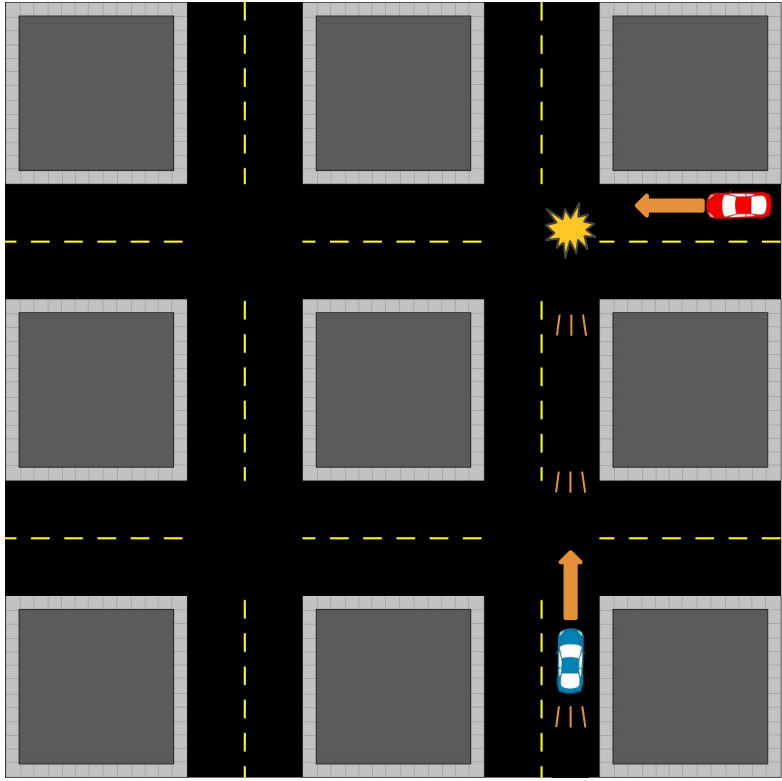

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Threading Pitfalls

- Race Condition → Crash

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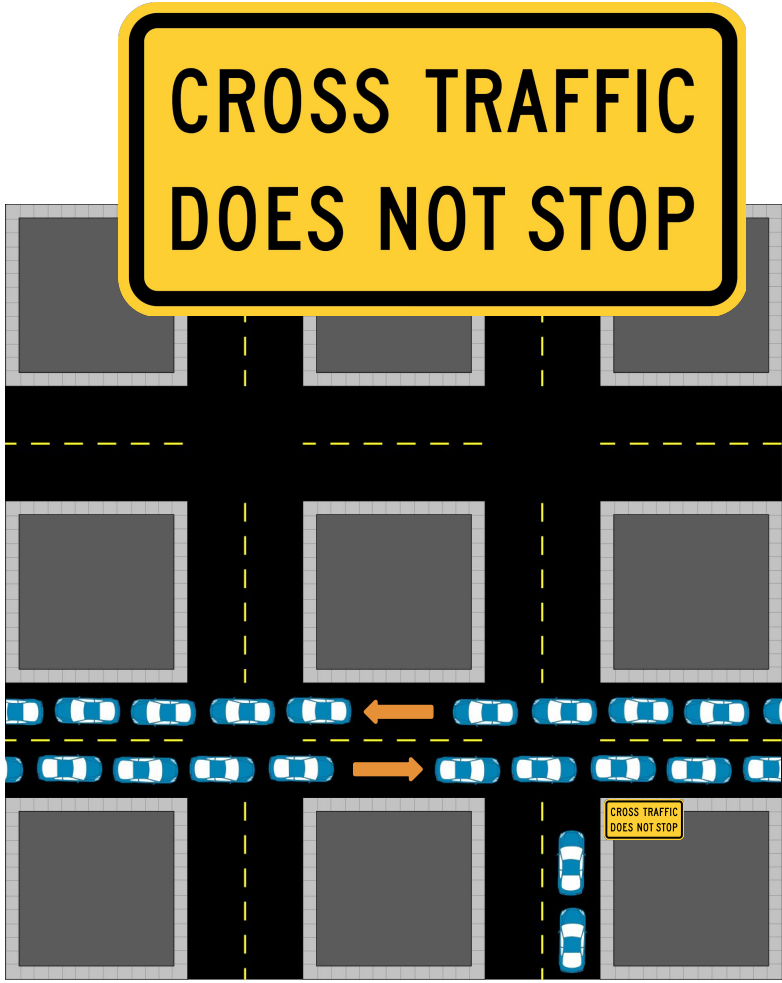
Austin Walter's Traffic Comparison



Austin Walter's Traffic Comparison

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Threading Pitfalls

- Race Condition → Crash

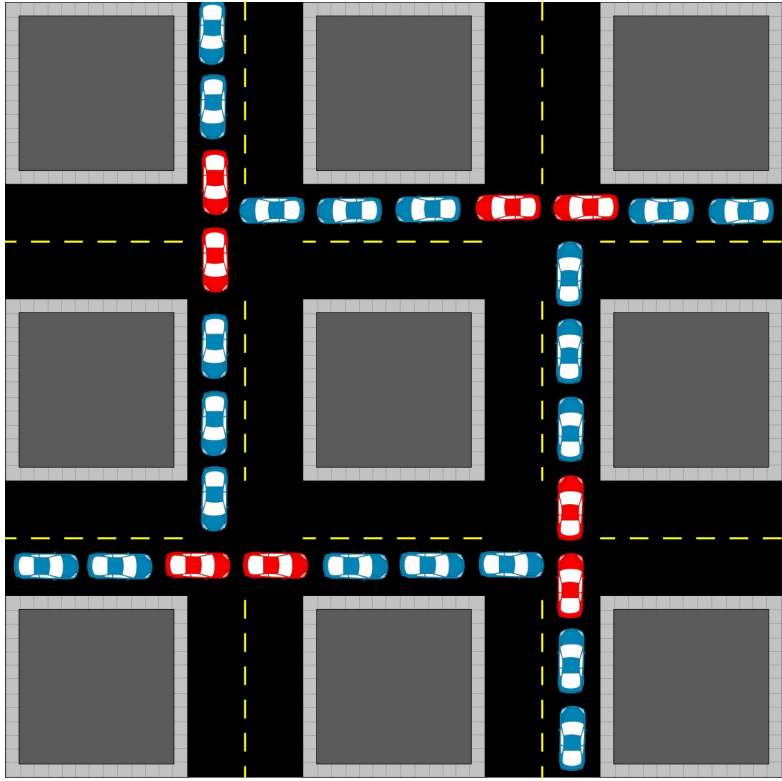
More than one thread accesses a single resource at one time

- Starvation → Cross Traffic

One thread never gets access to the resource it needs

- Deadlock → Gridlock

A thread is only able to acquire access to part of its resources



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Threading your Server

Standard Server Steps

1. Define Params
2. Make socket
3. Establish connection
4. Handle Connection
5. Close Connection

Okay so how do we thread this?

```java
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

Threaded Server Steps

0. `Server extends Thread`
1. Define Params
2. Make socket
3. Establish connection
4.
5. Handle Connection
6. Close Connection

```java
public class ThreadedSockServer extends Thread {
```

SockServer in JavaSimpleSock2

```java
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");
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  // 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());
```

```java
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);
```

JavaThreadedSock in Sockets

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Threading your Server

Threaded Server Steps

0. `Server extends Thread`
1. Define Params
2. Make socket
3. Establish connection
4. Start Thread!
5. Handle Connection
6. Close Connection

```
public class ThreadedSockServer extends Thread {
```

```
Socket sock
try {
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  System.ou
  // only does three connections then closes
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    System.out.println("Server waiting for a connection");
    sock = serv.accept(); // blocking wait
    // setup the object reading channel
    ObjectInputStream in = new ObjectInputStream(sock.getInputStream());
```

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

t 8888

```
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 void run() {
```

JavaThreadedSock in Sockets

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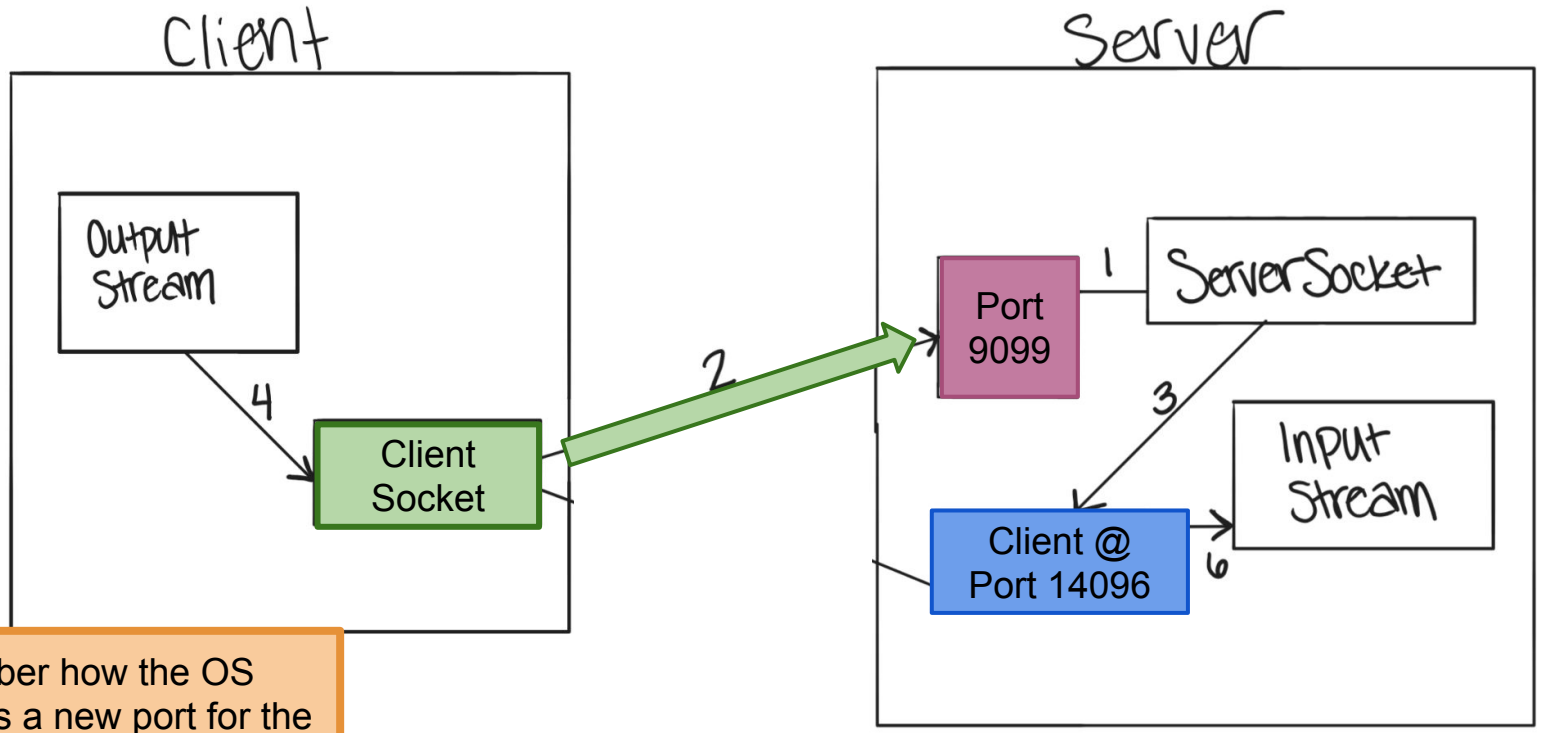
Client Socket

```
Values of the Client Socket Object after Connection:
Inet Address: /127.0.0.1
Local Address: /127.0.0.1
Local Port: 9099
Allocated Client Socket (Remote Port): 14096
```



Remember how the OS allocates a new port for the client?

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Client Socket

```
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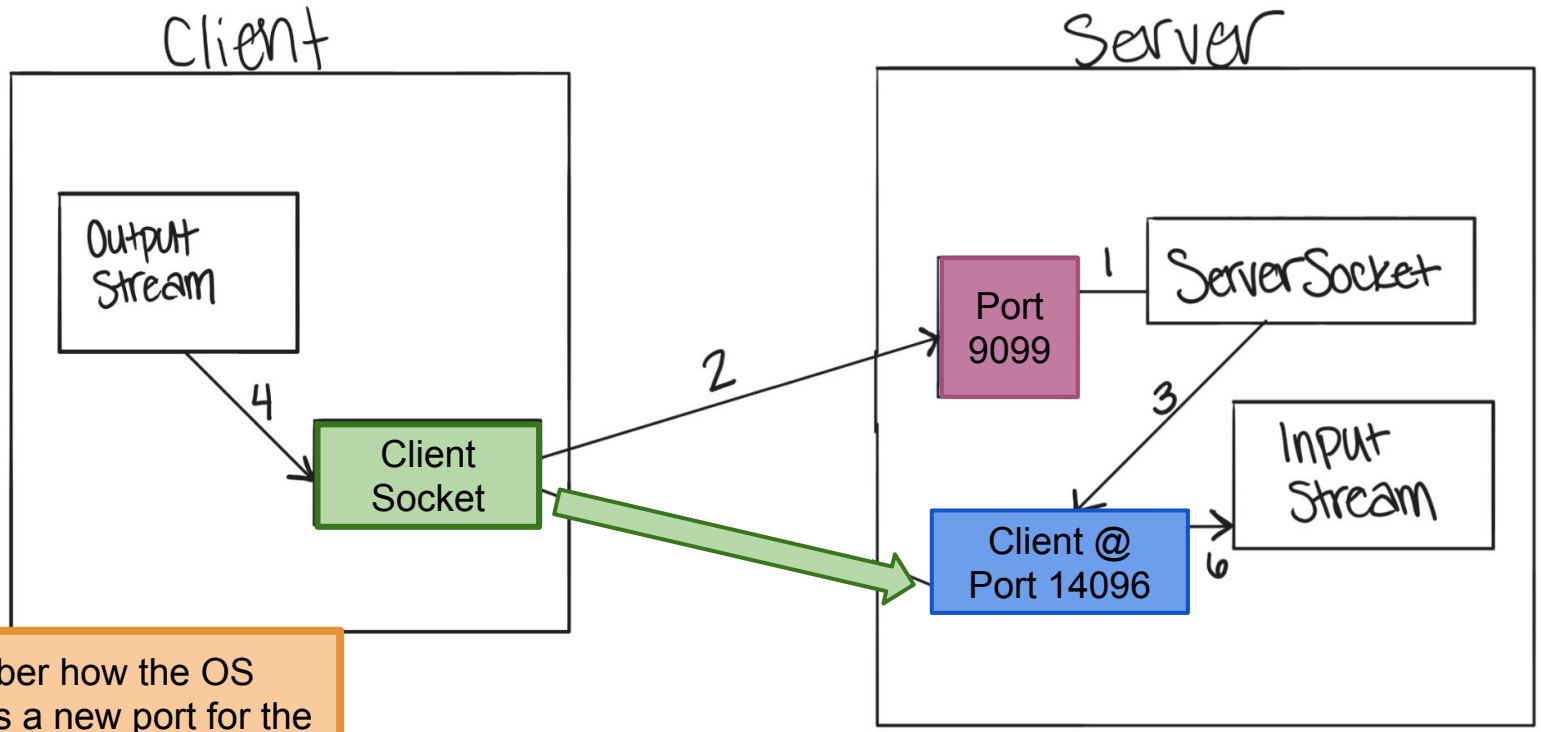

Remember how the OS allocates a new port for the client?

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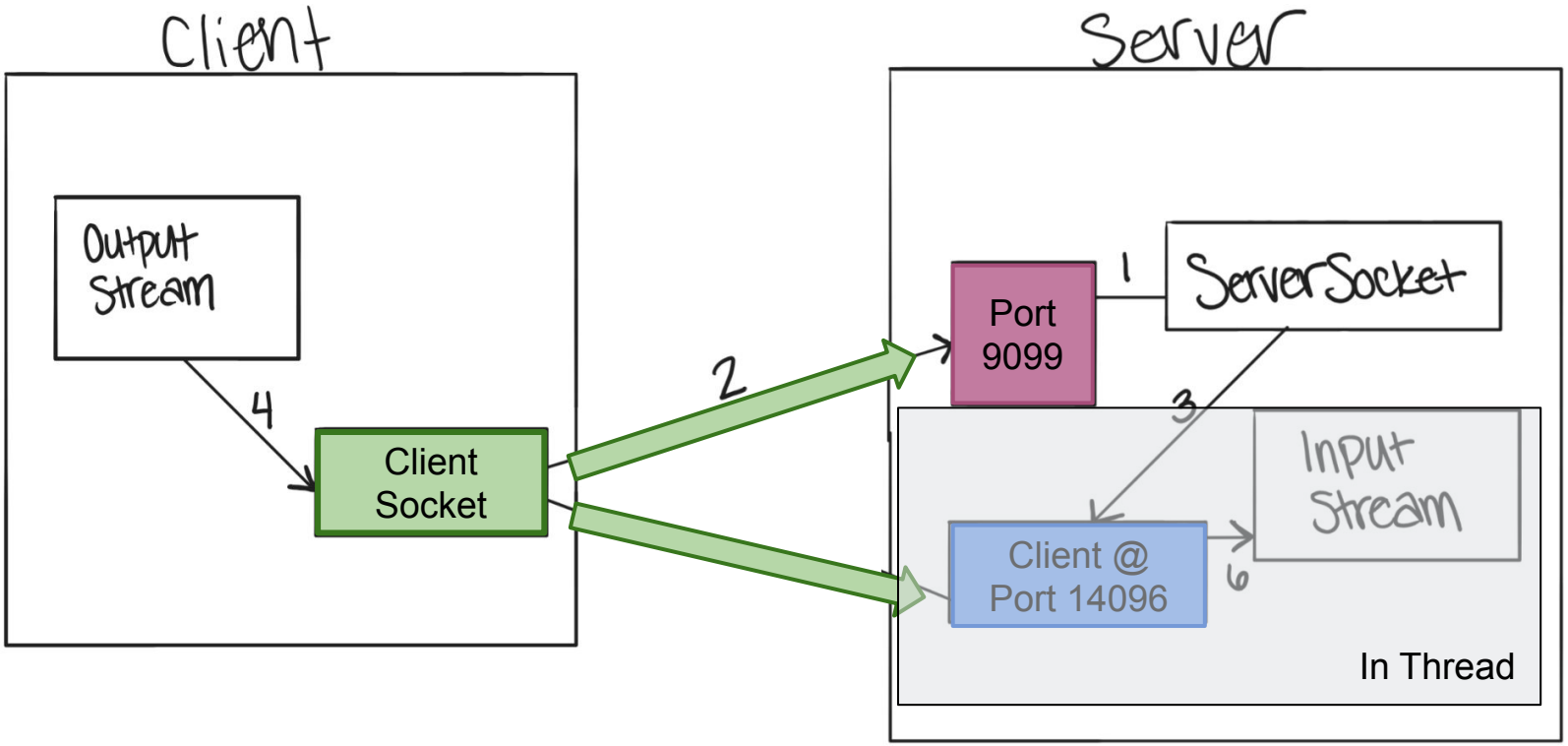
Threaded Server Communication

How do we do that in a threaded server?



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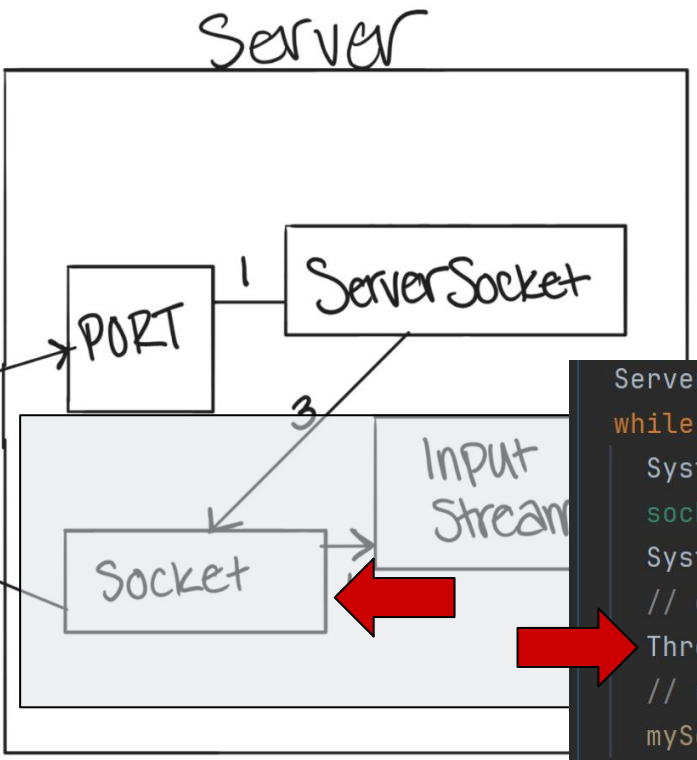
Threaded Server Communication

So how does the communication get passed from the main thread into the Client Thread?




```java
sock = serv.accept();
```

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

```java
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
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}
```

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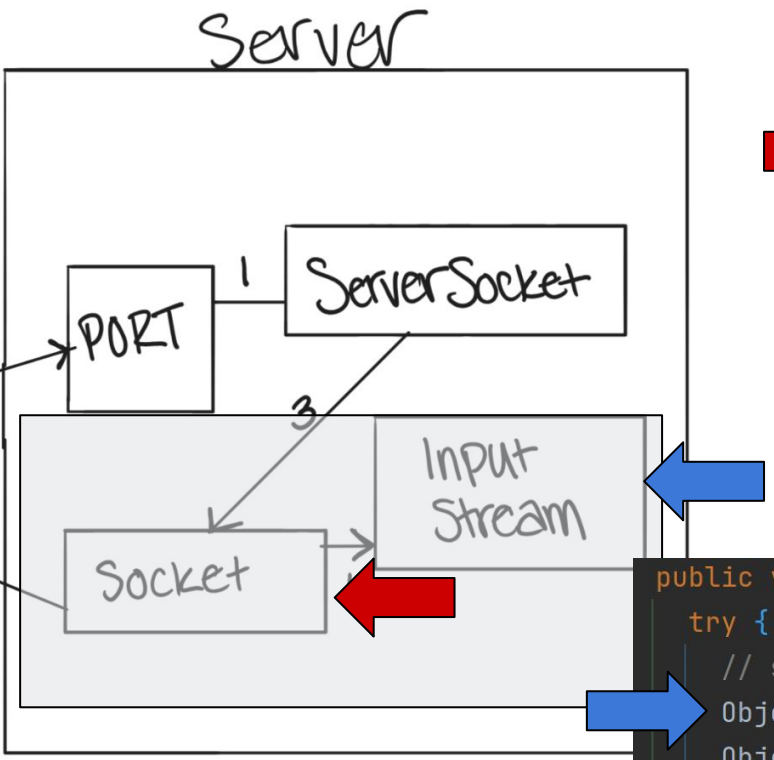
Threaded Server Communication

So how does the communication get passed from the main thread into the Client Thread?




```
sock = serv.accept();
```

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

Now we can just handle the connection as we have been!

```
public void run() {
  try {
    // setup read/write channels for connection
    ObjectInputStream in = new ObjectInputStream(conn.getInputStream());
    ObjectOutputStream out = new ObjectOutputStream(conn.getOutputStream());
```

Questions?

Survey:

https://bit.ly/asn_survey

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Upcoming Events

SI Sessions:

- Monday, November 6th 2023 at 4:00 pm MST
- Thursday, November 9th 2023 at 7:00 pm MST
- Sunday, November 12th 2023 at 7:00 pm MST

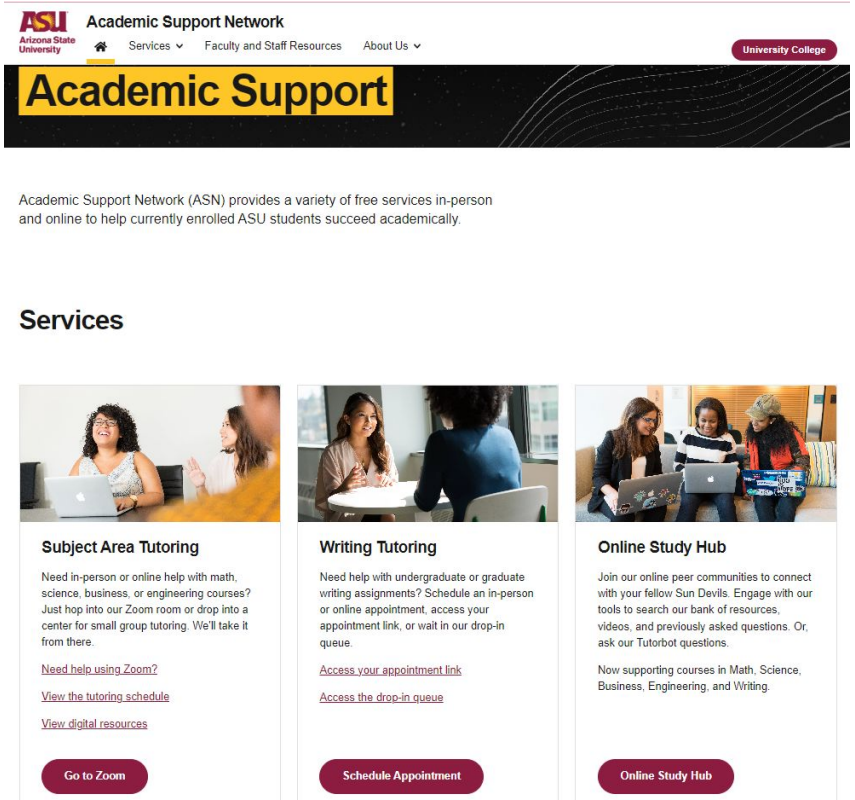
Review Sessions:

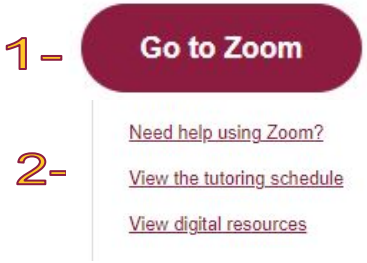
- Planning to post a poll this week!

More Questions?

Check out our other resources!

tutoring.asu.edu



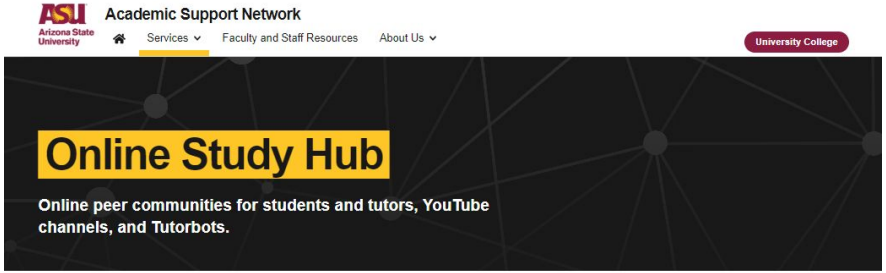


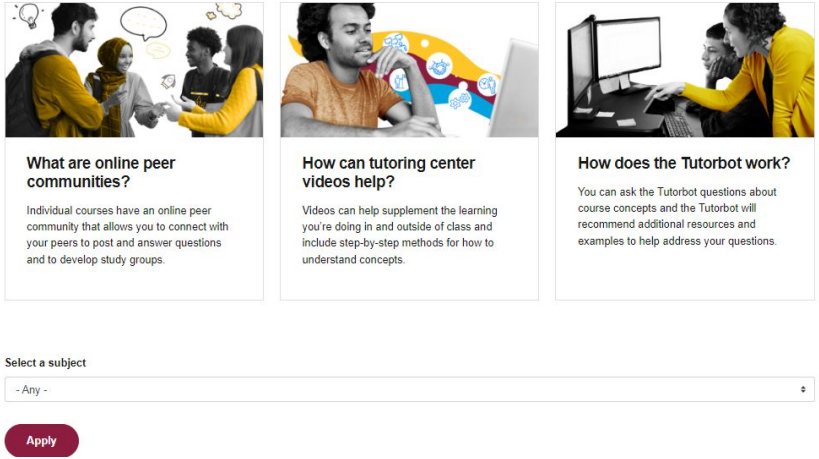
1. **Click on 'Go to Zoom' to log onto our Online Tutoring Center.**
2. **Click on 'View the tutoring schedule' to see when tutors are available for specific courses.**

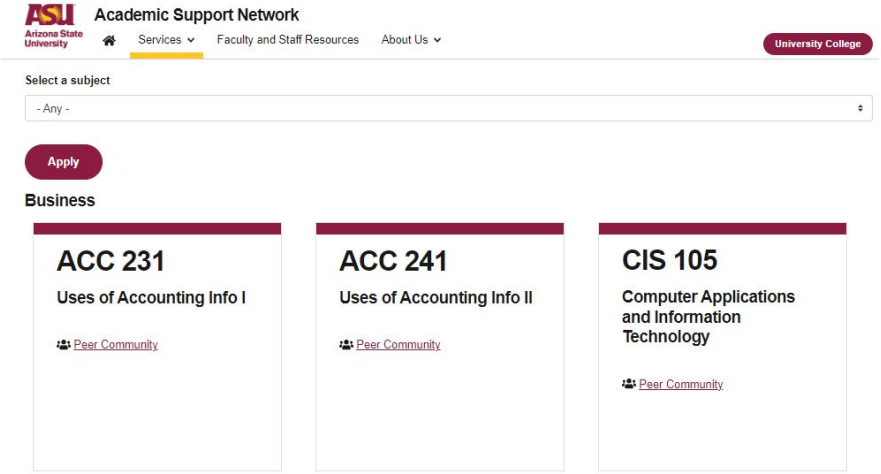
More Questions?

Check out our other resources!

tutoring.asu.edu/online-study-hub







Don't forget to check out the Online Study Hub for additional resources!

Additional Resources

CoureRepo

org.json API Docs

JSON Helper

Dining Philosophers Interactive

Austin Walter’s Traffic Comparison