SER 321 A Session

SI Session

Tuesday, January 28th 2025

11:00 am - 12:00 pm MST

Agenda

- OSI Review
- TCP vs. UDP Matching
- Sockets!
  - Requirements & Steps
  - Port Examination

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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OSI Model

Unit	Layer	What we are *really* talking about
Data		
Data		
Data		
Segment		
Packet	Network	
Frame	Data Link	
Bits	Physical	

Sender
Sender Address

Recipient
Recipient Address

Content/Payload Info

Transmission Info

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OSI Model

Unit	Layer	What we are *really* talking about	
Data	Application		Content/Payload Info
Data	Presentation		
Data	Session		
Segment	Transport		
Packet	Network		Transmission Info
Frame	Data Link		
Bits	Physical		

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OSI Model

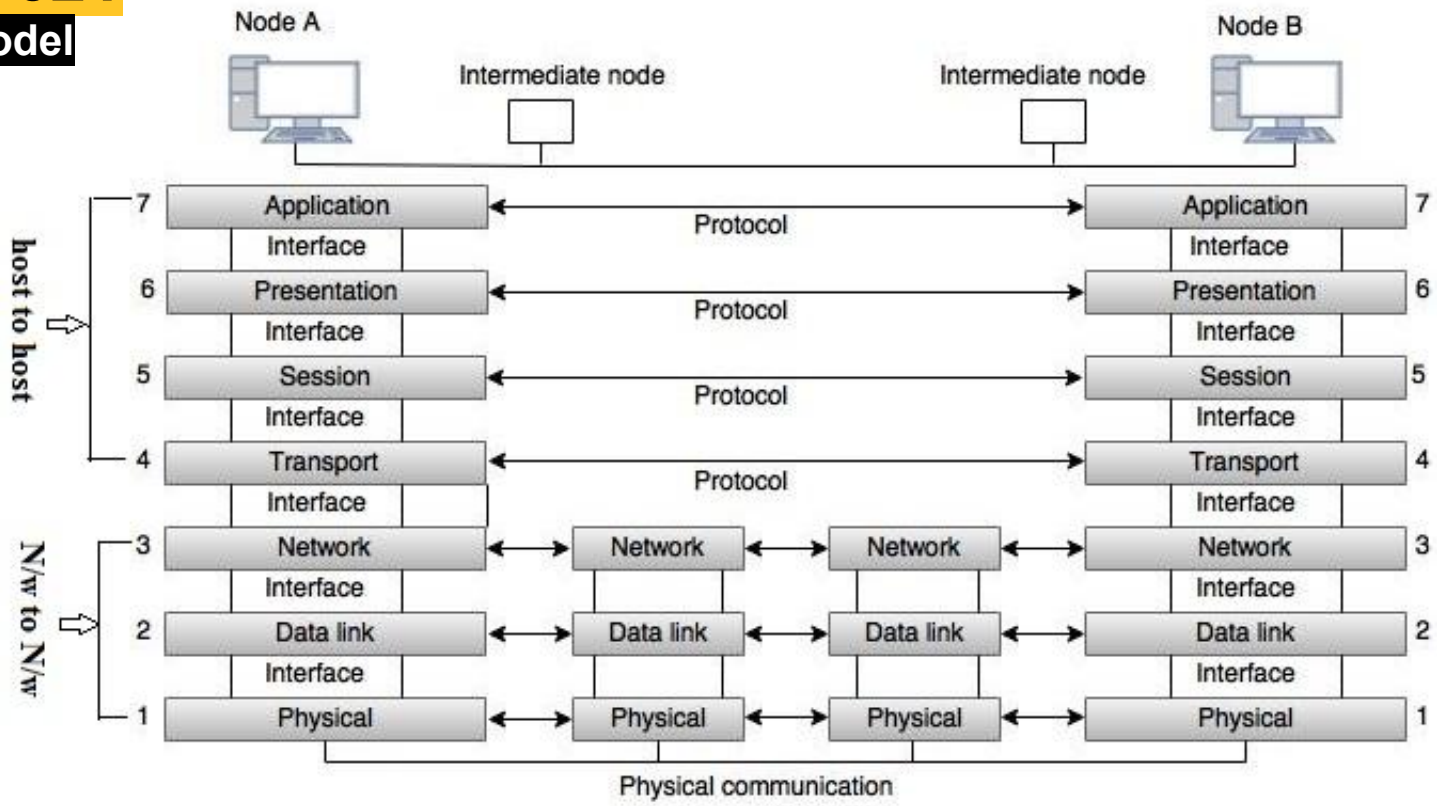

Fig: OSI Model

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TCP vs. UDP Matching

Unreliable

TCP

OR

UDP

SER 321

TCP vs. UDP Matching

Connection-Oriented

TCP

Reliable

OR

UDP

Unreliable

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TCP vs. UDP Matching

Uses Streams

TCP	OR	UDP
Reliable		Unreliable
Connection-Oriented		Connectionless

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TCP vs. UDP Matching

Has Less Overhead

TCP	OR	UDP
Reliable		Unreliable
Connection-Oriented		Connectionless
Uses Streams		Uses Datagrams

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TCP vs. UDP Matching

Has Less Overhead

TCP	OR	UDP
Reliable		Unreliable
Connection-Oriented		Connectionless
Uses Streams		Uses Datagrams
Has More Overhead		Has Less Overhead

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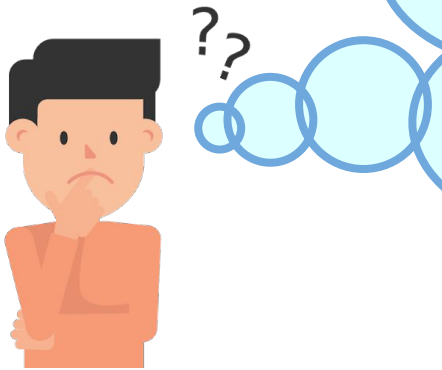
Sockets!

What do we need for a client/server connection?



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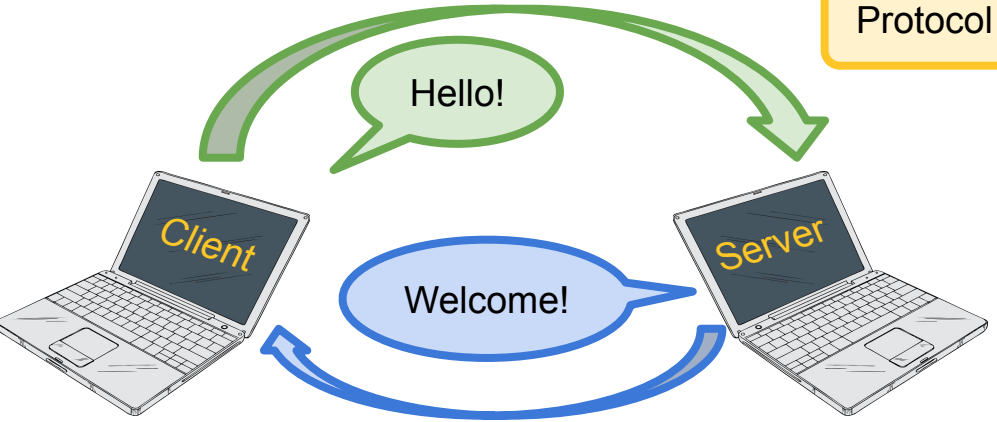
Sockets!

Sockets allow our client and server to communicate!

Need to define **3 properties** before usage

Location	IP or DNS	142.251.46.206	www.google.com
Connection Semantics	TCP or UDP	Connection Oriented	Connectionless
Message Format	Protocol Specs	Synchronous	Asynchronous
		Stateless	Stateful
		Binary	Text
		Headers	No Headers



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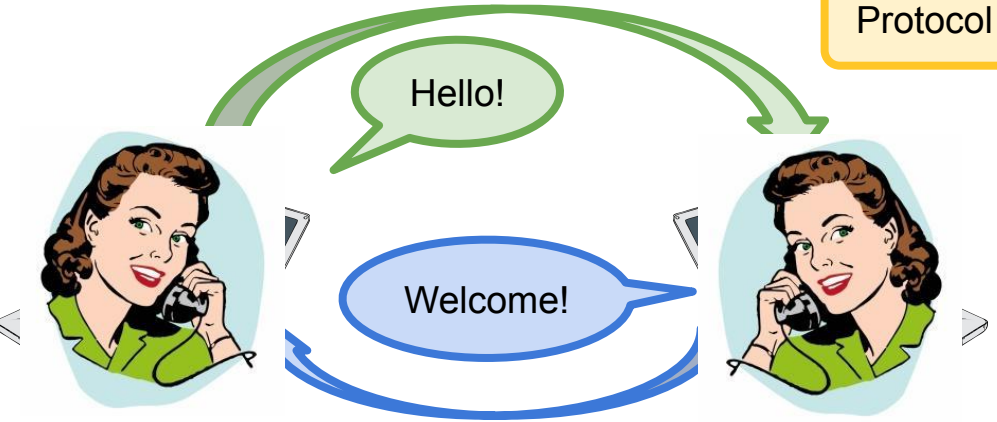
Sockets!

Sockets allow our client and server to communicate!

l to define **3 properties** before usage

Person	IP or DNS	142.251.46.206	www.google.com
Conversation Flow	TCP or UDP	Connection Oriented	Connectionless
Conversation Content	Protocol Specs	Synchronous	Asynchronous
		Stateless	Stateful
		Binary	Text
		Headers	No Headers



SER 321
Client Socket

Steps for the **Client Socket**

1.

2.

3.

4.

5.

6.

7.

8.

SER 321
Server Socket

Steps for the **Server Socket**

1.

2.

3.

4.

5.

6.

7.

8.

9.

SER 321
Server Socket

Java handles a few steps for us…

1. Define Params
2. Create Socket
3. **C ONLY** Create a struct for the address

3-5. Mark Socket to Listen

5. Mark Socket to Listen for Connections
6. Wait for Connection
7. Handle Client Connection
8. Close Client Connection
9. Continue Listening for Connections

Assign 3-1 Starter Code

SER 321
Server Socket

1. Define Params
2. Create Socket
3-5. Mark Socket to Listen
6. Wait for Connection
7. Handle Client Connection
8. Close Client Connection
9. Continue Listening

```java
public static void main (String args[]) {

  if (args.length != 1) {
    System.out.println("Expected arguments: <port(int)>");
    System.exit( status: 1);
  }

  try {
    port = Integer.parseInt(args[0]);
  } catch (NumberFormatException nfe) {
    System.out.println("[Port|sleepDelay] must be an integer");
    System.exit( status: 2);
  }

  try {
    //open socket
    ServerSocket serv = new ServerSocket(port);
    System.out.println("Server ready for connections");

    /** Simple loop accepting one client and calling handling one request. */

    while (true){
      System.out.println("Server waiting for a connection");
      sock = serv.accept(); // blocking wait
      System.out.println("Client connected");
```

1

2 & 3-5

9

6

Assign 3-1 Starter Code

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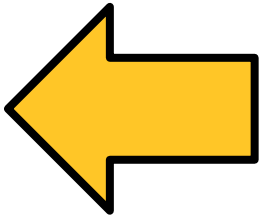
Server Socket

What needs to be done here?

1. Define Params
2. Create Socket
3-5. Mark Socket to Listen
6. Wait for Connection
7. Handle Client Connection
8. Close Client Connection
9. Continue Listening



1

2

3

4

5

Assign 3-1 Starter Code

Echo_Java

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Server Socket

What needs to be done here?

Is input
from the client
or
to the client ?

1. Define Params

```
// setup the object reading channel
in = new ObjectInputStream(sock.getInputStream());

// get output channel
OutputStream out = sock.getOutputStream();

// create an object output writer (Java only)
os = new DataOutputStream(out);
```

```
clientSock = sock.accept(); // blocking wait
PrintWriter out = new PrintWriter(clientSock.getOutputStream(), autoFlush: true);
InputStream input = clientSock.getInputStream();
System.out.println("Server connected to client");
```

1

2

3

4

5

Assign 3-1 Starter Code

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Server Socket

What needs to be done here?

```
static void overandout() {
  try {
    os.close();
    in.close();
    sock.close();
  } catch(Exception e) {e.printStackTrace();}

}
```

```
  try {
    s = (String) in.readObject();
  } catch (Exception e) {
    System.out.println("Client disconnect");
    connected = false;
    continue;
  }
```

1 Create input/output streams

2

3

4

5

Assign 3-1 Starter Code

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Server Socket

What needs to be done here?

```java
JSONObject res = isValid(s);

if (res.has( key: "ok")) {
  writeOut(res);
  continue;
}

JSONObject req = new JSONObject(s);

res = testField(req,  key: "type");
if (!res.getBoolean( key: "ok")) {
  res = noType(req);
  writeOut(res);
  continue;
}
```

```java
public static JSONObject isValid(String json) {
  try {
```

```java
static JSONObject testField(JSONObject req, String key){
  JSONObject res = new JSONObject();

  // field does not exist
  if (!req.has(key)){
    res.put("ok", false);
    res.put("message", "Field " + key + " does not exist in request");
    return res;
  }
  return res.put("ok", true);
}
```

```java
      return res;
    }
  }
  return new JSONObject();
}
```

Assign 3-1 Starter Code

Echo_Java

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Server Socket

What needs to be done here?

```
int numr = input.read(clientInput, off: 0, bufLen);
```

```
String received = new String(clientInput, offset: 0, numr);
System.out.println("read from client: " + received);
out.println(received);
```

```
if (req.getString( key: "type").equals("echo")) {
  res = echo(req);
} else if (req.getString( key: "type").equals("add")) {
  res = add(req);
} else if (req.getString( key: "type").equals("addmany")) {
  res = addmany(req);
} else {
  res = wrongType(req);
}
writeOut(res);
```

1 Create input/output streams

2 Check for disconnect

3 Check Protocol

4

5

Assign 3-1 Starter Code

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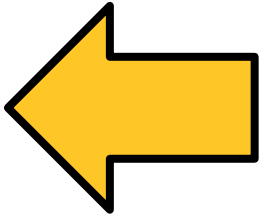
Server Socket

What needs to be done here?

1. Define Params
2. Create Socket
3-5. Mark Socket to Listen
6. Wait for Connection
7. Handle Client Connection
8. Close Client Connection
9. Continue Listening



1 Create input/output streams

2 Check for disconnect

3 Check Protocol

4 Read Headers

5 Handle Accordingly

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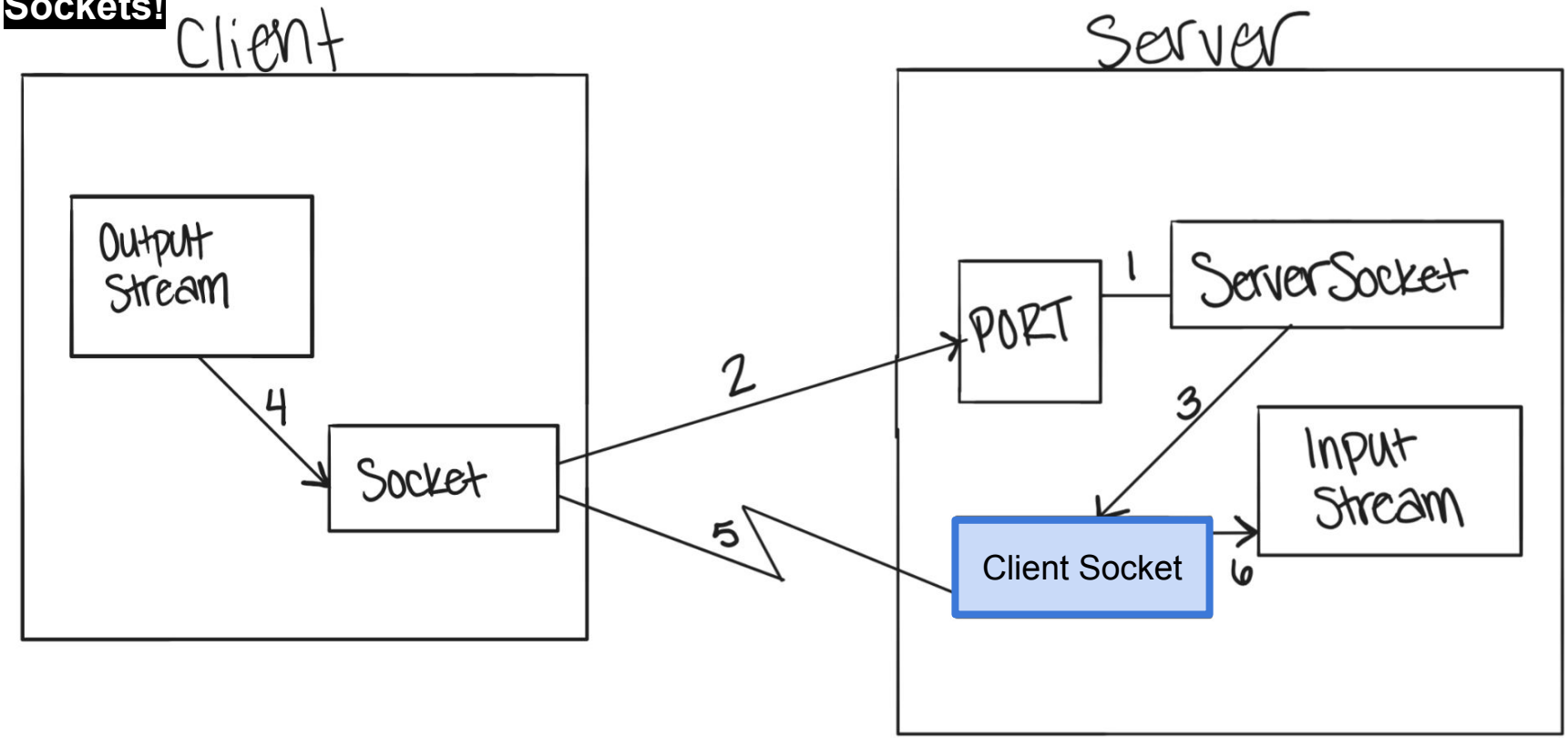
Sockets!



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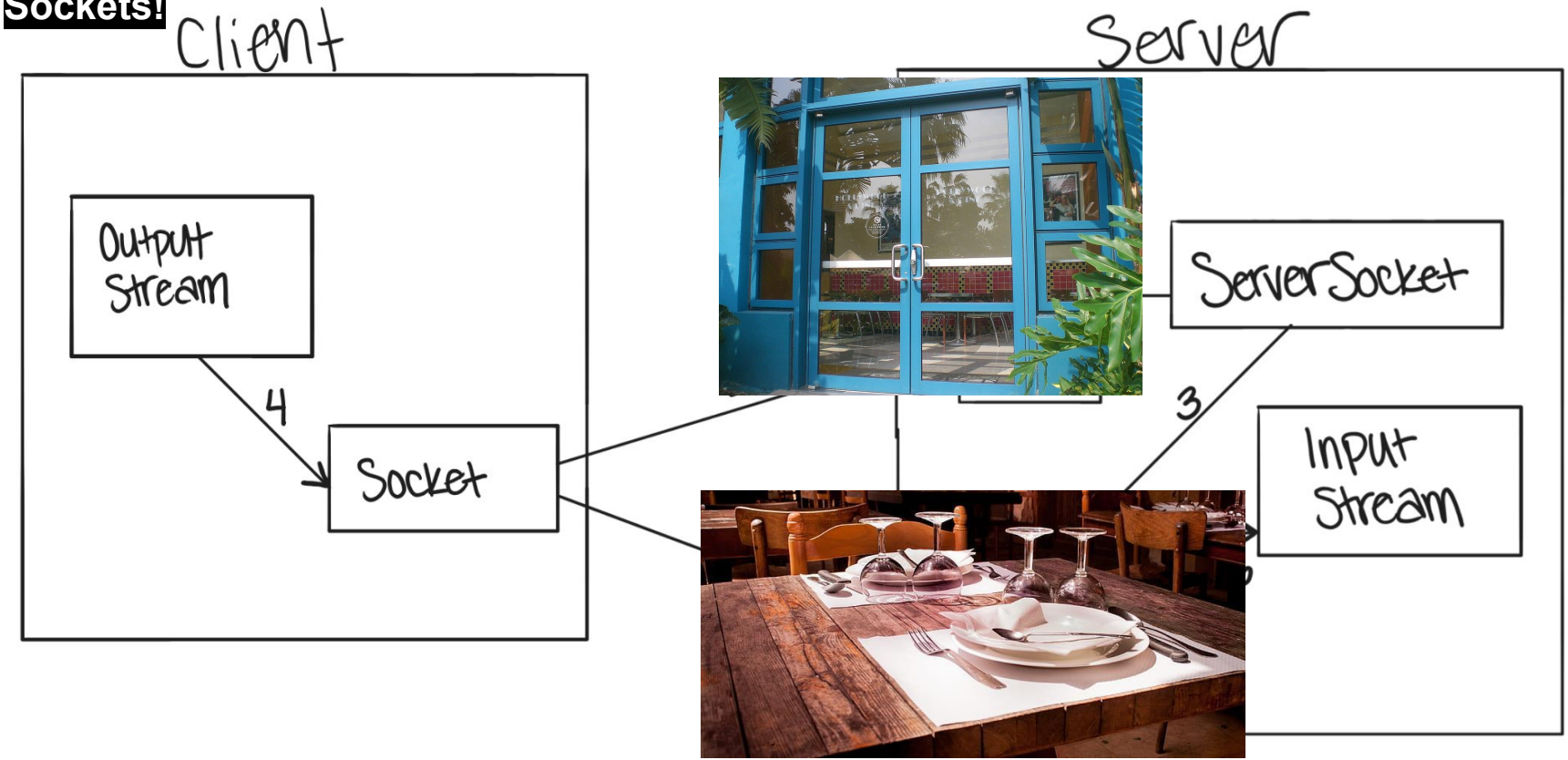
Sockets!



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Sockets!

Original

Sockets/Echo_Java

```java
try {
        if (args.length != 1) {
                System.out.println("Usage: gradle runServer -Pport=9099");
                System.exit( status: 0);
        }
        int port = -1;
        try {
                port = Integer.parseInt(args[0]);
        } catch (NumberFormatException nfe) {
                System.out.println("[Port] must be an integer");
                System.exit( status: 2);
        }
        Socket clientSock;
        ServerSocket sock = new ServerSocket(port);
        System.out.println("Server ready for connections");

        int bufLen = 1024;
        byte clientInput[] = new byte[bufLen]; // up to 1024 bytes in a message.
        while(true) {
                System.out.println("Server waiting for a connection");
                clientSock = sock.accept(); // blocking wait
                PrintWriter out = new PrintWriter(clientSock.getOutputStream(),  autoFlush: true);
                InputStream input = clientSock.getInputStream();
                System.out.println("Server connected to client");
                int numr = input.read(clientInput,  off: 0, bufLen);
                while (numr != -1) {
                  String received = new String(clientInput,  offset: 0, numr);
                  System.out.println("read from client: " + received);
                  out.println(received);
                  numr = input.read(clientInput,  off: 0, bufLen);
                }
```

Client

```java
String host = args[0];
Socket server = new Socket(host, port);
System.out.println("Connected to server at " + host + ":" + port);
InputStream input = server.getInputStream();
OutputStream output = server.getOutputStream();
BufferedReader stdin = new BufferedReader(new InputStreamReader(System.in));
```

SER 321

Sockets!

Modification

Sockets/Echo_Java

```java
try {
        if (args.length != 1) {...}
        int port = -1;
        try {
                port = Integer.parseInt(args[0]);
        } catch (NumberFormatException nfe) {
                System.out.println("[Port] must be an integer");
                System.exit( status: 2);
        }
        Socket clientSock;
        ServerSocket sock = new ServerSocket(port);
        System.out.println("Server ready for connections");
        System.out.println("Server is listening on port: " + port);
        System.out.println("-----");
        System.out.println("Values of the ServerSocket Object:");
        System.out.println("Inet Address: " + sock.getInetAddress());
        System.out.println("Local Port: " + sock.getLocalPort());

        int bufLen = 1024;
        byte clientInput[] = new byte[bufLen]; // up to 1024 bytes in a message.
        while(true) {
                System.out.println("Server waiting for a connection");
                clientSock = sock.accept();             // blocking wait

                PrintWriter out = new PrintWriter(clientSock.getOutputStream(), autoFlush: true);
                InputStream input = clientSock.getInputStream();
                System.out.println("Server connected to client");
                System.out.println("-----");
                System.out.println("Values of the Client Socket Object after Connection:");
                System.out.println("\tInet Address: " + clientSock.getInetAddress());
                System.out.println("\tLocal Address: " + clientSock.getLocalAddress());
                System.out.println("\tLocal Port: " + clientSock.getLocalPort());
                System.out.println("\tAllocated Client Socket (Port): " + clientSock.getPort());

                int numr = input.read(clientInput, off: 0, bufLen);
```

Client

```java
String host = args[0];
Socket server = new Socket(host, port);
System.out.println("Connected to server at " + host + ":" + port);
System.out.println("Values of the Socket Object for the Server:");
System.out.println("\tHost: " + server.getLocalAddress());
System.out.println("\tPort: " + server.getPort());
System.out.println("\tLocal Port: " + server.getLocalPort());
InputStream input = server.getInputStream();
OutputStream output = server.getOutputStream();
BufferedReader stdin = new BufferedReader(new InputStreamReader(System.in));
```

SER 321

Sockets!

```
> Task :runServer
Server ready for connections
Server is listening on port: 9099
-----
Values of the ServerSocket Object:
Inet Address: 0.0.0.0/0.0.0.0
Local Port: 9099
Server waiting for a connection
<==========----> 75% EXECUTING [10s]
> :runServer
```

Client

```
Socket server = new Socket(host, port);
System.out.println("Connected to server at " + host + ":" + port);
System.out.println("Values of the Socket Object for the Server:");
System.out.println("\tHost: " + server.getLocalAddress());
System.out.println("\tPort: " + server.getPort());
System.out.println("\tLocal Port: " + server.getLocalPort());
InputStream input = server.getInputStream();
OutputStream output = server.getOutputStream();
BufferedReader stdin = new BufferedReader(new InputStreamReader(System.in));
```

Sockets/Echo_Java

```
try {
        if (args.length != 1) {...}
        int port = -1;
        try {
                port = Integer.parseInt(args[0]);
        } catch (NumberFormatException nfe) {
                System.out.println("[Port] must be an integer");
                System.exit( status: 2);
        }
        Socket clientSock;
        ServerSocket sock = new ServerSocket(port);
        System.out.println("Server ready for connections");
        System.out.println("Server is listening on port: " + port);
        System.out.println("-----");
        System.out.println("Values of the ServerSocket Object:");
        System.out.println("Inet Address: " + sock.getInetAddress());
        System.out.println("Local Port: " + sock.getLocalPort());

        int bufLen = 1024;
        byte clientInput[] = new byte[bufLen]; // up to 1024 bytes in a message.
        while(true) {
                System.out.println("Server waiting for a connection");
                clientSock = sock.accept();             // blocking wait

                PrintWriter out = new PrintWriter(clientSock.getOutputStream(), autoFlush: true);
                InputStream input = clientSock.getInputStream();
                System.out.println("Server connected to client");
                System.out.println("-----");
                System.out.println("Values of the Client Socket Object after Connection:");
                System.out.println("\tInet Address: " + clientSock.getInetAddress());
                System.out.println("\tLocal Address: " + clientSock.getLocalAddress());
                System.out.println("\tLocal Port: " + clientSock.getLocalPort());
                System.out.println("\tAllocated Client Socket (Port): " + clientSock.getPort());

                int numr = input.read(clientInput, off: 0, bufLen);
```

SER 321

Sockets!

Sockets/Echo_Java

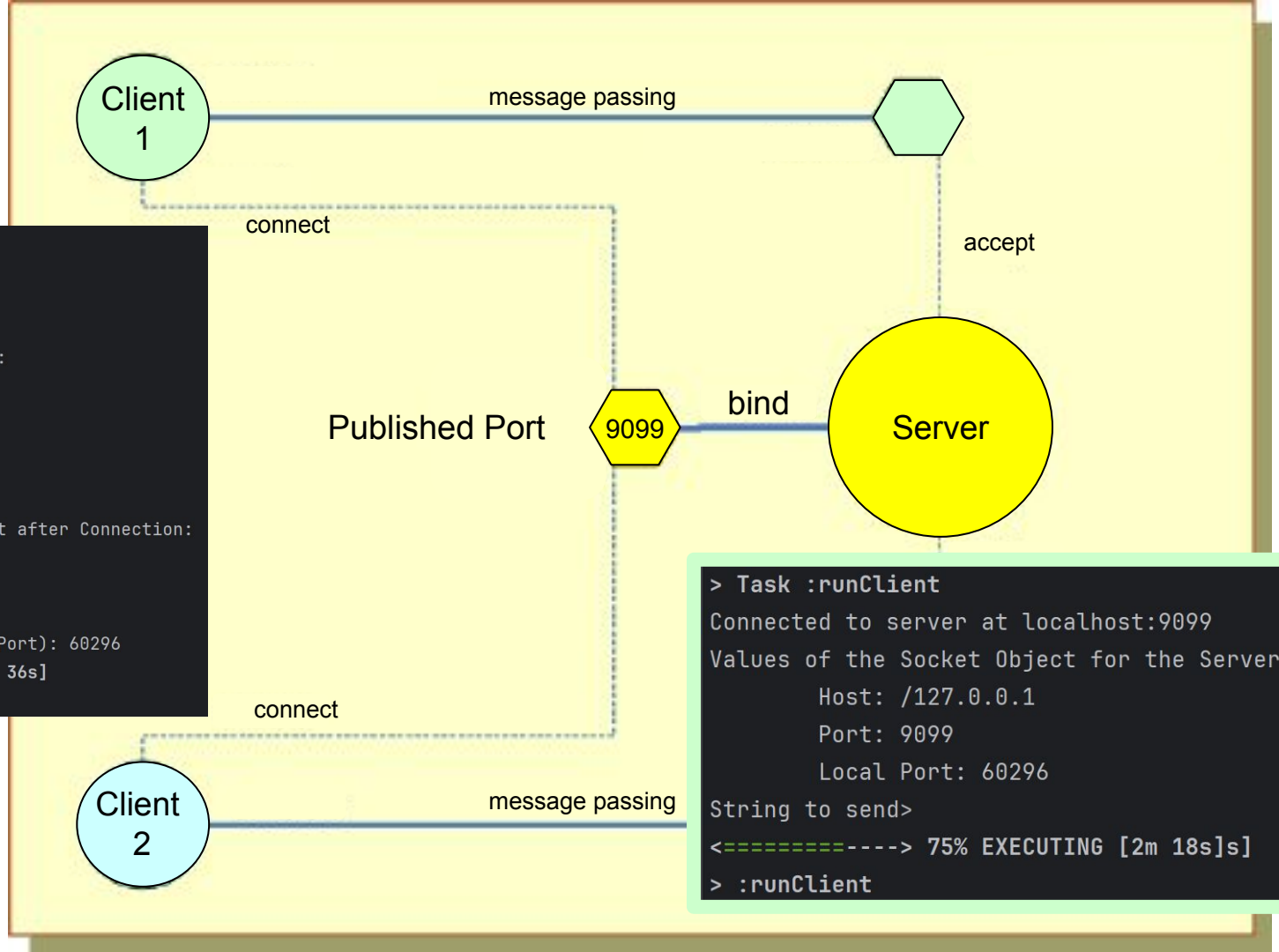
```
> Task :runServer
Server ready for connections
Server is listening on port: 9099
-----
Values of the ServerSocket Object:
Inet Address: 0.0.0.0/0.0.0.0
Local Port: 9099
Server waiting for a connection
Server connected to client
-----
Values of the Client Socket Object after Connection:
        Inet Address: /127.0.0.1
        Local Address: /127.0.0.1
        Local Port: 9099
        Allocated Client Socket (Port): 60296
<==========----> 75% EXECUTING [1m 13s]
> :runServer
```

```
> Task :runClient
Connected to server at localhost:9099
Values of the Socket Object for the Server:
        Host: /127.0.0.1
        Port: 9099
        Local Port: 60296
String to send>
<==========----> 75% EXECUTING [31s]
> :runClient
```

```
try {
        if (args.length != 1) {...}
        int port = -1;
        try {

        } catch

        }
        Socket
        ServerS
        System.
        System.
        System.
        System.
        System.
        System.

        int buf
        byte cl
         hile(t
                System.out.println("Server waiting for a connection");
                clientSock = sock.accept();             // blocking wait

                PrintWriter out = new PrintWriter(clientSock.getOutputStream(), autoFlush: true);
                InputStream input = clientSock.getInputStream();
                System.out.println("Server connected to client");
                System.out.println("-----");
                System.out.println("Values of the Client Socket Object after Connection:");
                System.out.println("\tInet Address: " + clientSock.getInetAddress());
                System.out.println("\tLocal Address: " + clientSock.getLocalAddress());
                System.out.println("\tLocal Port: " + clientSock.getLocalPort());
                System.out.println("\tAllocated Client Socket (Port): " + clientSock.getPort());

                int numr = input.read(clientInput, off: 0, bufLen);
```

SER 321
Sockets!

```
> Task :runServer
Server ready for connections
Server is listening on port: 9099
-----
Values of the ServerSocket Object:
Inet Address: 0.0.0.0/0.0.0.0
Local Port: 9099
Server waiting for a connection
Server connected to client
-----
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 (Port): 60296
<=========----> 75% EXECUTING [2m 36s]
> :runServer
```




```
> Task :runClient
Connected to server at localhost:9099
Values of the Socket Object for the Server:
        Host: /127.0.0.1
        Port: 9099
        Local Port: 60296
String to send>
<=========----> 75% EXECUTING [2m 18s]s]
> :runClient
```

Design of an RFID Vehicle Authentication System: A Case Study for Al-Nahrain University Campus - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Client-and-Server-Socket-Ports_fig4_282671198

Assign 3-1 Starter Code

SER 321

JSON

Which of the following would be a valid response?

```
{
    "type" : "echo", -- echoes the initial response
    "ok" : <bool>, -- true or false depending on request
    "echo" : <String>,  -- echoed String if ok true
    "message" : <String>,  -- error message if ok false
}
```

Echo General Response

A.
```
{
    “type” : “echo”,
    “echo” : <String>
}
```

B.
```
{
    “type” : “echo”,
    “ok” : false,
    “echo” : <String>
}
```

C.
```
{
    “type” : “echo”,
    “message” : <String>
}
```

D.
```
{
    “type” : “echo”,
    “ok” : true,
    “echo” : <String>
}
```

Assign 3-1 Starter Code

SER 321

JSON

Which of the following would be a valid response?

```
{
    "type" : "echo", -- echoes the initial response
    "ok" : <bool>, -- true or false depending on request
    "echo" : <String>,  -- echoed String if ok true
    "message" : <String>,  -- error message if ok false
}
```

Echo General Response

Why are the others invalid?

A.
```
{
    “type” : “echo”,
    “echo” : <String>
}
```

B.
```
{
    “type” : “echo”,
    “ok” : false,
    “echo” : <String>
}
```

C.
```
{
    “type” : “echo”,
    “message” : <String>
}
```

D.
```
{
    “type” : “echo”,
    “ok” : true,
    “echo” : <String>
}
```

Assign 3-1 Starter Code

SER 321

JSON

Which of the following would be a valid response?

```
{
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    "ok" : <bool>, -- true or false depending on request
    "echo" : <String>,  -- echoed String if ok true
    "message" : <String>,  -- error message if ok false
}
```

Echo General Response

A.
```
{
    “type” : “echo”,
    “ok” : false,
    “echo” : <String>
}
```

B.
```
{
    “type” : “echo”,
    “ok” : false,
    “message” : <String>
}
```

C.
```
{
    “type” : “echo”,
    “ok” : false
}
```

D.
```
{
    “type” : “echo”,
    “ok” : true,
    “message” : <String>
}
```

Assign 3-1 Starter Code

SER 321

JSON

Which of the following would be a valid response?

```
{
    "type" : "echo", -- echoes the initial response
    "ok" : <bool>, -- true or false depending on request
    "echo" : <String>,  -- echoed String if ok true
    "message" : <String>,  -- error message if ok false
}
```

Echo General Response

Why are the others invalid?

A.
```
{
    “type” : “echo”,
    “ok” : false,
    “echo” : <String>
}
```

B.
```
{
    “type” : “echo”,
    “ok” : false,
    “message” : <String>
}
```

C.
```
{
    “type” : “echo”,
    “ok” : false
}
```

D.
```
{
    “type” : “echo”,
    “ok” : true,
    “message” : <String>
}
```

SER 321
Connections

Connections!

SER 321

Scratch Space

Upcoming Events

SI Sessions:

- Thursday, January 30th at 7:00 pm MST
- Sunday, February 2nd at 7:00 pm MST
- Tuesday, February 4th at 11:00 am MST

Review Sessions:

- Tuesday, February 25th at 11:00 am MST - **Q&A Session**
- Thursday, February 27th at 7:00 pm MST - **Exam Review Session (2hrs)**

Questions?

Survey:

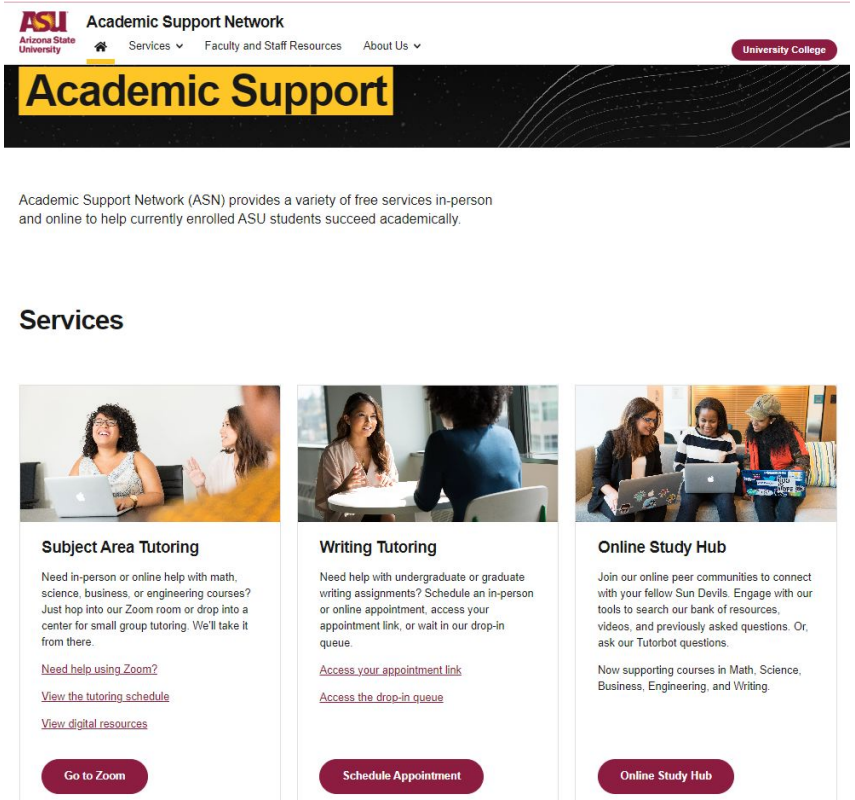
https://asuasn.info/ASNSurvey

40

More Questions?

Check out our other resources!

tutoring.asu.edu



1 – Go to Zoom

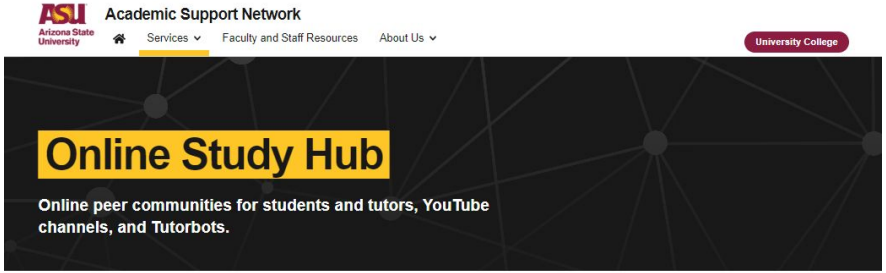
2- Need help using Zoom?
View the tutoring schedule
View digital resources

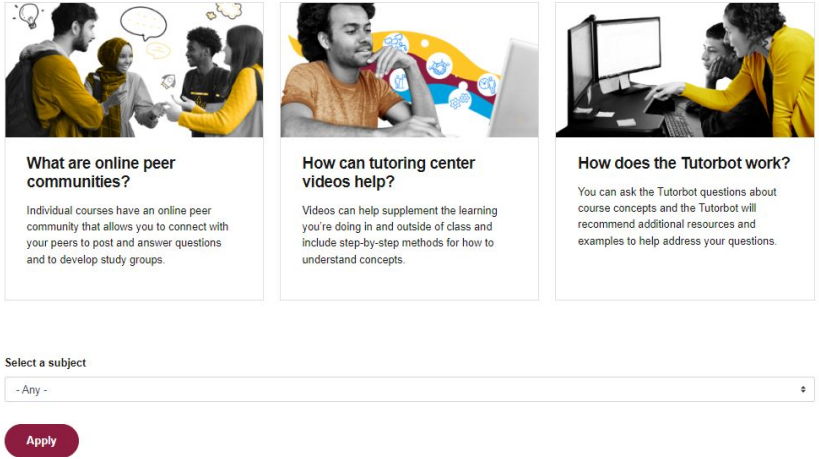
1. **Click on 'Go to Zoom' to log onto our Online Tutoring Center.**
2. **Click on 'View the tutoring schedule' to see when tutors are available for specific courses.**

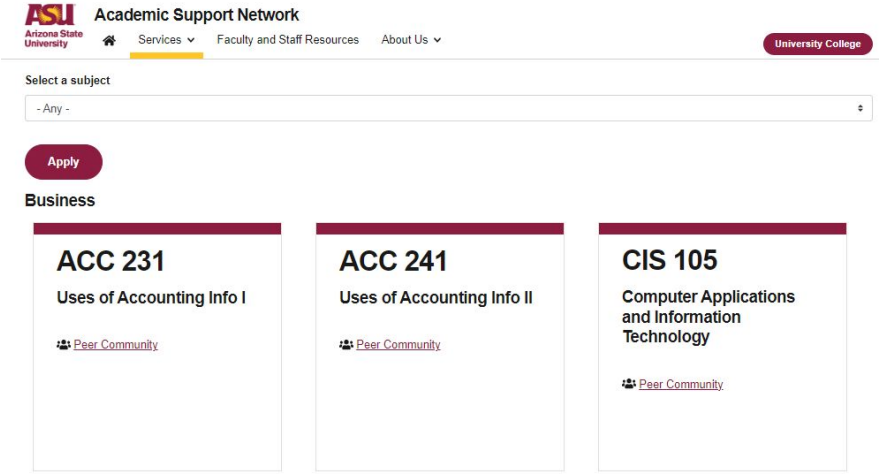
More Questions?

Check out our other resources!

tutoring.asu.edu/online-study-hub



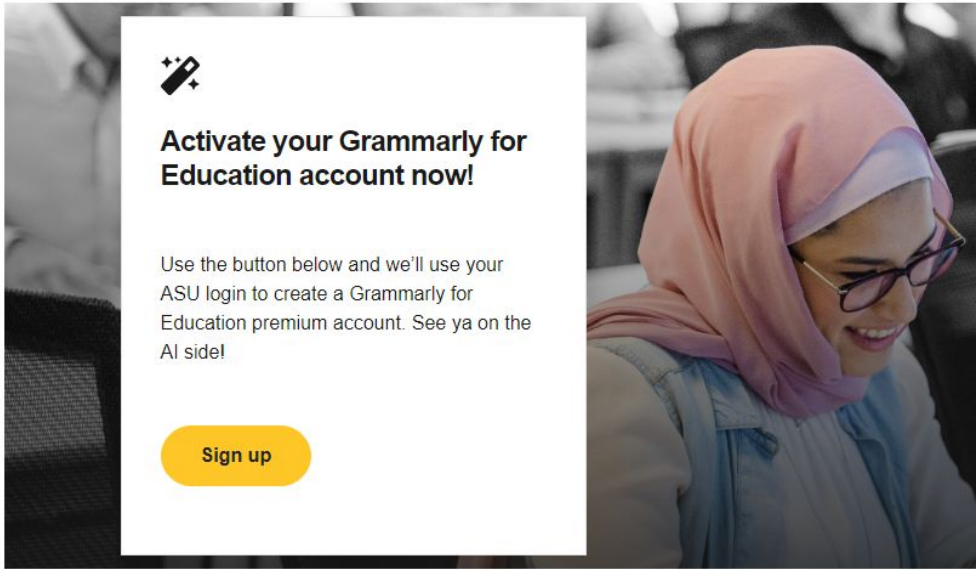




Don't forget to check out the Online Study Hub for additional resources!

Expanded Writing Support Available

Including Grammarly for Education, at no cost!



tutoring.asu.edu/expanded-writing-support

*Available slots for this pilot are limited

Additional Resources

- Course Repo
- Gradle Documentation
- GitHub SSH Help
- Linux Man Pages
- OSI Interactive
- MDN HTTP Docs
  - Requests
  - Responses
- JSON Guide
- org.json Docs
- javax.swing package API
- Swing Tutorials