SER 321 C Session

SI Session

Thursday, June 20th 2024

6:00 pm - 7:00 pm MST

Agenda

- Gradle Review
- Threading Your Server
  - How-To
  - Tracing Execution
- Distributed Systems

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

SER 321

Gradle Review

Which of the following will run the main method in */java/taskone/Server.java* with `gradle runTask1` ?

```
task runServer(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'taskone.Server.runTask1'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

A.

```
task runServer(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'taskone.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

B.

```
task1 runServer(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'taskone.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

C.

```
task runTask1(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'taskone.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

D.

SER 321

Gradle Review

Which of the following will run the main method in */java/taskone/Server.java* with `gradle runTask1` ?

```
task runServer(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'taskone.Server.runTask1'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

A.

```
task runServer(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'taskone.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

B.

```
task1 runServer(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'taskone.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

C.

```
task runTask1(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'taskone.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

D.

SER 321

Gradle Review

Which of the following will run the main method in */java/tasktwo/Server.java* with `gradle runTask2` ?

```
task runTask2(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'taskone.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

A.

```
task runTask2(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'tasktwo.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

B.

```
task2 runServer(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'tasktwo.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

C.

```
task runServer(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'tasktwo.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

D.

SER 321

Gradle Review

Which of the following will run the main method in */java/tasktwo/Server.java* with `gradle runTask2` ?

```
task runTask2(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'taskone.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

A.

```
task runTask2(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'tasktwo.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

B.

```
task2 runServer(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'tasktwo.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

C.

```
task runServer(type: JavaExec) {
  group 'server'
  description 'Creates Server socket waits for messages'

  classpath = sourceSets.main.runtimeClasspath

  main = 'tasktwo.Server'
  standardInput = System.in

  args 8000;
  if (project.hasProperty('port')) {
    args(project.getProperty('port'));
  }
}
```

D.

SER 321
Gradle Review

Which of the following will run the main method in */java/taskone/Client.java* with `gradle runClient` ?

```
task runClient(type: JavaExec) {
  group 'client'
  description 'Creates client socket sends a message to the server'

  classpath = sourceSets.main.runtimeClasspath
  standardInput = System.in

  main = 'taskone.Client'
  standardInput = System.in

  if (project.hasProperty("host") && project.hasProperty('port')) {
    args(project.getProperty('host'), project.getProperty('port'));
  }
}
```

A.

```
task runClient(type: JavaExec) {
  group 'client'
  description 'Creates client socket sends a message to the server'

  classpath = sourceSets.main.runtimeClasspath
  standardInput = System.in

  main = 'taskone.Client'
  standardInput = System.in

  args("localhost", 8000);
  if (project.hasProperty("host") && project.hasProperty('port')) {
    args(project.getProperty('host'), project.getProperty('port'));
  }
}
```

B.

```
task runClient(type: JavaExec) {
  group 'client'
  description 'Creates client socket sends a message to the server'

  classpath = sourceSets.main.runtimeClasspath
  standardInput = System.in

  main = 'taskone.Client'
  standardInput = System.in

  if (project.hasProperty("host") && project.hasProperty('port')) {
    args(project.getProperty('host'), project.getProperty('port'));
  } else if (project.hasProperty("host")) {
    args(project.getProperty('host'), 8000);
  } else if (project.hasProperty("port")) {
    args("localhost", project.getProperty('port'))
  } else {
    args("localhost", 8000);
  }
}
```

C.

```
task runClient(type: JavaExec) {
  group 'client'
  description 'Creates client socket sends a message to the server'

  classpath = sourceSets.main.runtimeClasspath
  standardInput = System.in

  main = 'taskone.Client'
  standardInput = System.in

  if (project.hasProperty('host') && project.hasProperty('port')) {
    args(project.getProperty('host'), project.getProperty('port'));
  } else if (project.hasProperty('host')) {
    args(project.getProperty('host'), 8000);
  } else if (project.hasProperty('port')) {
    args('localhost', project.getProperty('port'));
  }
}
```

D.

SER 321
Gradle Review

Which of the following will run the main method in */java/taskone/Client.java* with `gradle runClient` ?

```
task runClient(type: JavaExec) {
  group 'client'
  description 'Creates client socket sends a message to the server'

  classpath = sourceSets.main.runtimeClasspath
  standardInput = System.in

  main = 'taskone.Client'
  standardInput = System.in

  if (project.hasProperty("host") && project.hasProperty('port')) {
    args(project.getProperty('host'), project.getProperty('port'));
  }
}
```

A.

```
task runClient(type: JavaExec) {
  group 'client'
  description 'Creates client socket sends a message to the server'

  classpath = sourceSets.main.runtimeClasspath
  standardInput = System.in

  main = 'taskone.Client'
  standardInput = System.in

  args("localhost", 8000);
  if (project.hasProperty("host") && project.hasProperty('port')) {
    args(project.getProperty('host'), project.getProperty('port'));
  }
}
```

B.

```
task runClient(type: JavaExec) {
  group 'client'
  description 'Creates client socket sends a message to the server'

  classpath = sourceSets.main.runtimeClasspath
  standardInput = System.in

  main = 'taskone.Client'
  standardInput = System.in

  if (project.hasProperty("host") && project.hasProperty('port')) {
    args(project.getProperty('host'), project.getProperty('port'));
  } else if (project.hasProperty("host")) {
    args(project.getProperty('host'), 8000);
  } else if (project.hasProperty("port")) {
    args("localhost", project.getProperty('port'))
  } else {
    args("localhost", 8000);
  }
}
```

C.

```
task runClient(type: JavaExec) {
  group 'client'
  description 'Creates client socket sends a message to the server'

  classpath = sourceSets.main.runtimeClasspath
  standardInput = System.in

  main = 'taskone.Client'
  standardInput = System.in

  if (project.hasProperty('host') && project.hasProperty('port')) {
    args(project.getProperty('host'), project.getProperty('port'));
  } else if (project.hasProperty('host')) {
    args(project.getProperty('host'), 8000);
  } else if (project.hasProperty('port')) {
    args('localhost', project.getProperty('port'));
  }
}
```

D.

SER 321
Threaded Server

Given the standard server socket steps…

In which step do we introduce **threads**?

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

7. Send Client Socket to thread

JavaThreadSock

SER 321
Threads

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

1

2 & 3-5

9

6

7

8

```java
public static void main(String args[]) throws IOException {
    Socket sock = null;
    int id = 0;
    try {
        if (args.length != 1) {
            System.out.println
                ("Usage: gradle ThreadedSockServer --args=<port num>");
            System.exit( code: 0);
        }
        int portNo = Integer.parseInt(args[0]);
        if (portNo <= 1024)
            portNo = 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();
        }
    } catch (Exception e) {
        e.printStackTrace();
    } finally {
        if (sock != null) sock.close();
    }
}
}
```

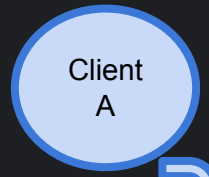
JavaThreadSock

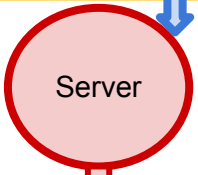
SER 321

Threads

```java
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();
    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/2yDymkn");
      }
```

```java
    // 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();
  }
  // on close, clean up
  System.out.println("Client " + id + " closed connection.");
  in.close();
  out.close();
  conn.close();
} catch (Exception e) {
  e.printStackTrace();
}
}
```






```java
public static void main(String args[]) throws IOException {
  Socket sock = null;
  int id = 0;
  try {
    if (args.length != 1) {
      System.out.println
          ("Usage: gradle ThreadedSockServer --args=<port num>");
      System.exit( code: 0);
    }
    int portNo = Integer.parseInt(args[0]);
    if (portNo <= 1024)
      portNo = 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();
    }
  } catch (Exception e) {
    e.printStackTrace();
  } finally {
    if (sock != null) sock.close();
  }
}
}
```

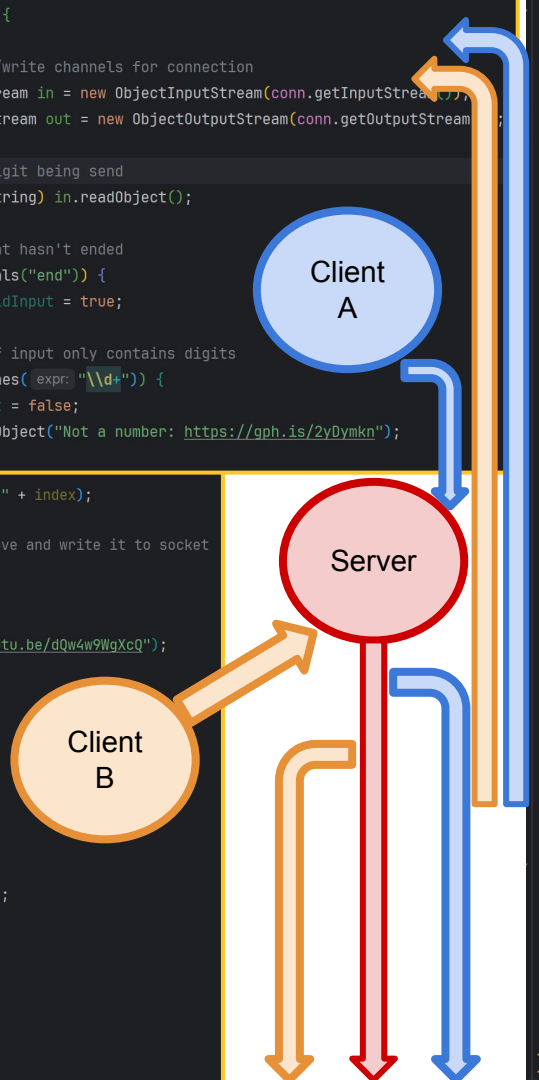
JavaThreadSock

SER 321

Threads

```java
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();
    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/2yDymkn");
      }
```

```java
      // 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();
    }
    // on close, clean up
    System.out.println("Client " + id + " closed connection.");
    in.close();
    out.close();
    conn.close();
  } catch (Exception e) {
    e.printStackTrace();
  }
}
```




```java
public static void main(String args[]) throws IOException {
  Socket sock = null;
  int id = 0;
  try {
    if (args.length != 1) {
      System.out.println
          ("Usage: gradle ThreadedSockServer --args=<port num>");
      System.exit( code: 0);
    }
    int portNo = Integer.parseInt(args[0]);
    if (portNo <= 1024)
      portNo = 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();
    }
  } catch (Exception e) {
    e.printStackTrace();
  } finally {
    if (sock != null) sock.close();
  }
}
}
```

JavaThreadSock

SER 321

Threads

```java
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();
    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/2yDymkn");
      }
```

Client A

```java
      // 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();
    }
    // on close, clean up
    System.out.println("Client " + id + " closed connection.");
    in.close();
    out.close();
    conn.close();
  } catch (Exception e) {
    e.printStackTrace();
  }
}
```

Server

Client B

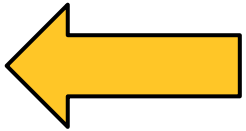
```java
public static void main(String args[]) throws IOException {
  Socket sock = null;
  int id = 0;
  try {
    if (args.length != 1) {
      System.out.println
          ("Usage: gradle ThreadedSockServer --args=<port num>");
      System.exit( code: 0);
    }
    int portNo = Integer.parseInt(args[0]);
    if (portNo <= 1024)
      portNo = 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();
    }
  } catch (Exception e) {
    e.printStackTrace();
  } finally {
    if (sock != null) sock.close();
  }
}
}
```

SER 321
Threaded Server

Now What?

Handle the Client just like before!

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



1

2

3

4

5

4-2 Starter Code

SER 321
Threaded Server

Now What?

Handle the Client just like before!

1. Define Params

```
public SockBaseServer(Socket sock, Game game){  1 usage
    this.clientSocket = sock;
    this.game = game;
    try {
        in = clientSocket.getInputStream();
        out = clientSocket.getOutputStream();
    } catch (Exception e){
        System.out.println("Error in constructor: " + e);
    }
}
```

9. Continue Listening

1 Create input/output streams

2

3

4

5

Assign 3-1 Starter Code 4-2 Starter Code

SER 321
Threaded Server

Now What?

Handle the Client just like before!

```
public void start() throws IOException {  1 usage
    String name = "";
    System.out.println("Ready...");
    try {...} catch (Exception ex) {
        ex.printStackTrace();
    } finally {
        if (out != null)  out.close();
        if (in != null)   in.close();
        if (clientSocket != null) clientSocket.close();
    }
}
```

9. Continue Listening

1 Create input/output streams

2 Check for disconnect

3

4

5

4-2 Starter Code

SER 321
Threaded Server

Now What?

Handle the Client just like before!

1. Define Params
2. Create Socket
6. Wait for Connection
7. Send Client **Socket** to Thread

```
Request op = Request.parseDelimitedFrom(in);
```

1 Create input/output streams

2 Check for disconnect

3 Check Protocol

```
public static buffers.RequestProtos.Request parseDelimitedFrom(java.io.InputStream input)
    throws java.io.IOException {
  return com.google.protobuf.GeneratedMessageV3
      .parseDelimitedWithIOException(PARSER, input);
}
```

4-2 Starter Code

SER 321
Threaded Server

Now What?

Handle the Client just like before!

1. Define Params
2. Create Socket
3-5. Mark Socket to Listen

```
Request op = Request.parseDelimitedFrom(in);
String result = null;

if (op.getOperationType() == Request.OperationType.NAME) {...}
```

8. Close Client Connection
9. Continue Listening

1 Create input/output streams

2 Check for disconnect

3 Check Protocol

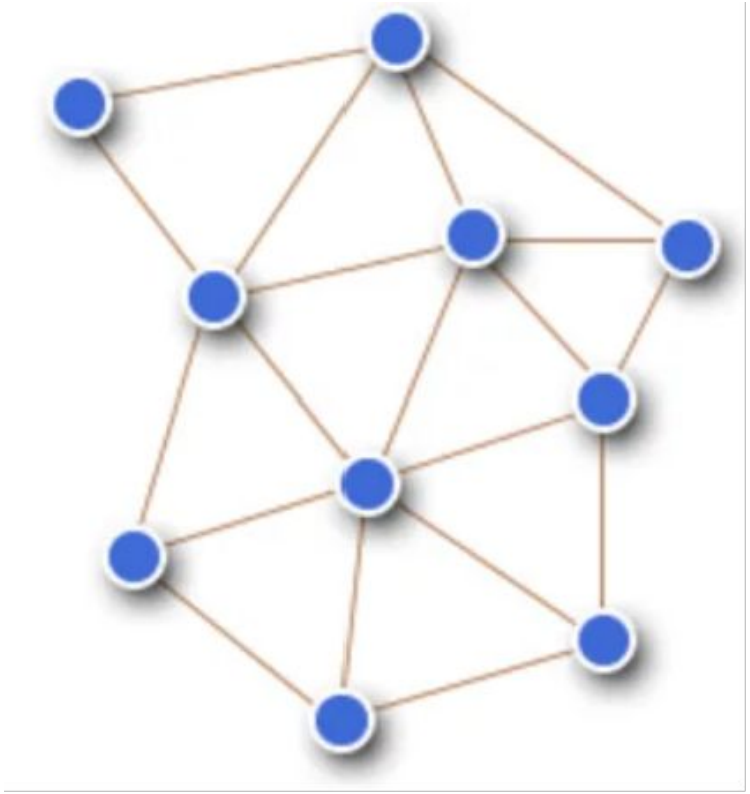
4 Read Headers

5

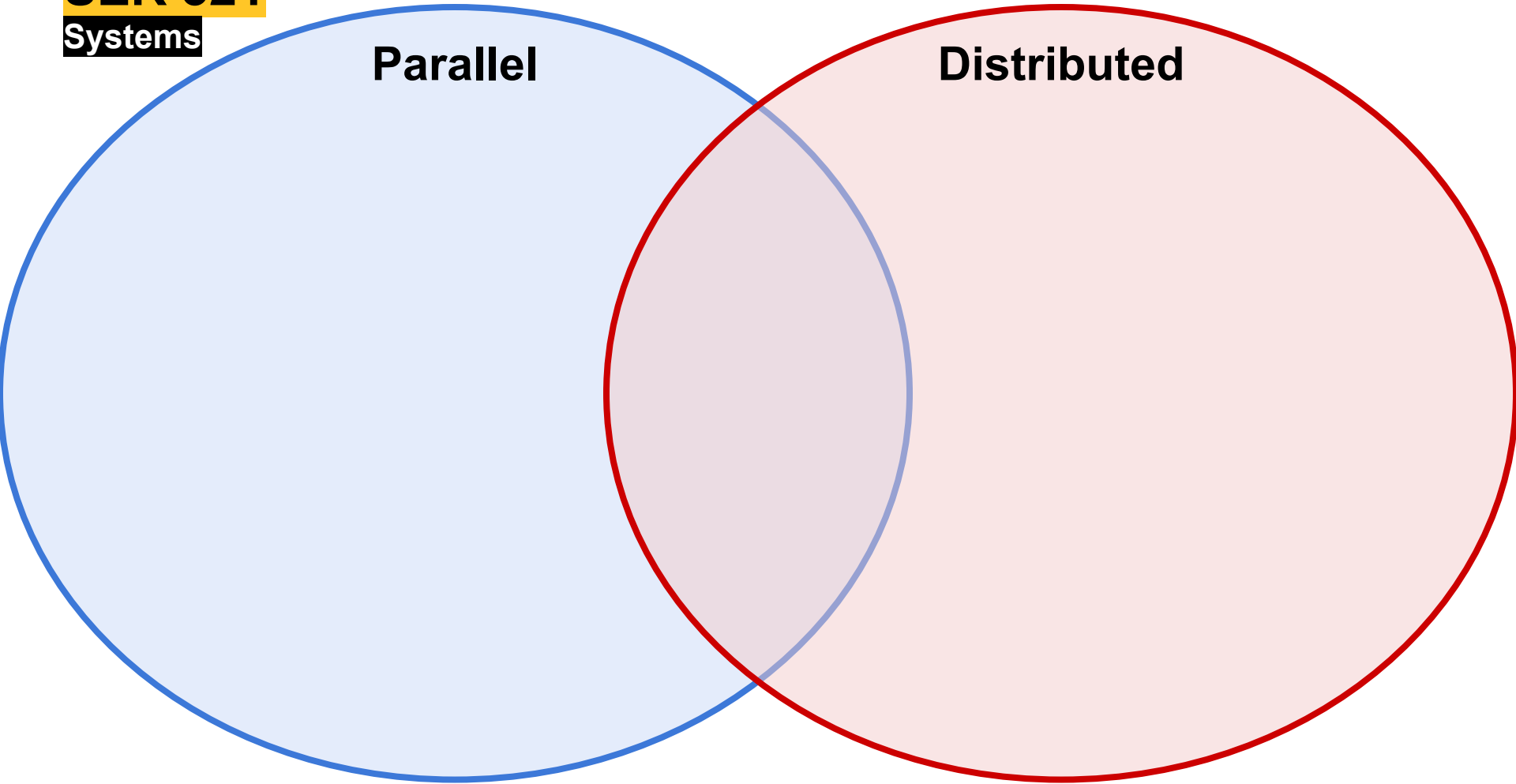
SER 321

Distributed Systems

What do we mean by
"Distributed Systems"
or
"Distributed Algorithms"?



SER 321
Systems



SER 321
Systems

Parallel

- Single computer
- Work split among different *processors*
- Memory is shared ***or*** distributed
- Communicate through *bus*

Distributed

- Many computers
- Work split among different *locations*
- Memory is distributed
- Communicate through *message passing*

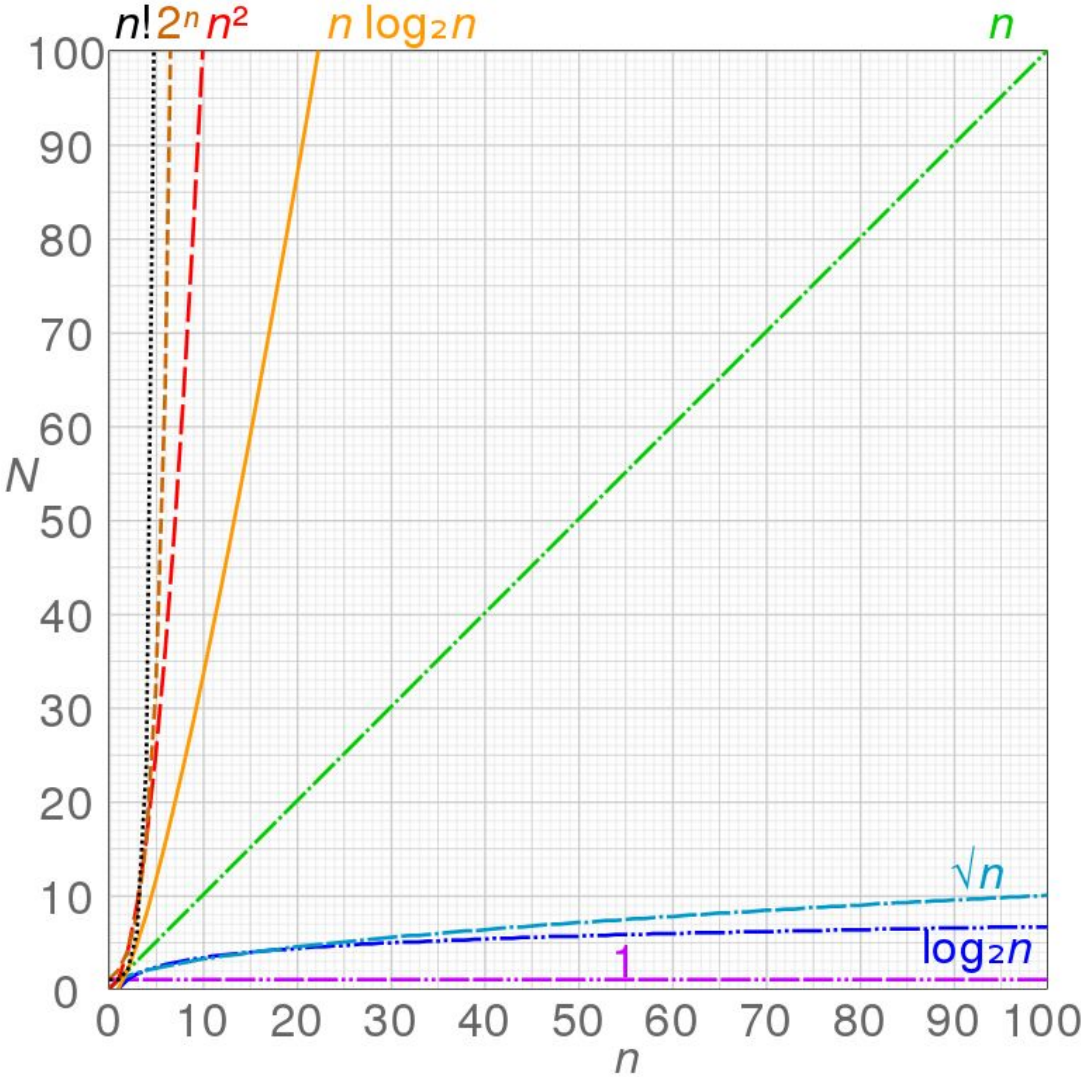
Parallel / Distributed

- Work is partitioned
- Partitions processed individually
- ***Can*** improve performance
- ***Can*** improve speed

SER 321

Distributed Systems

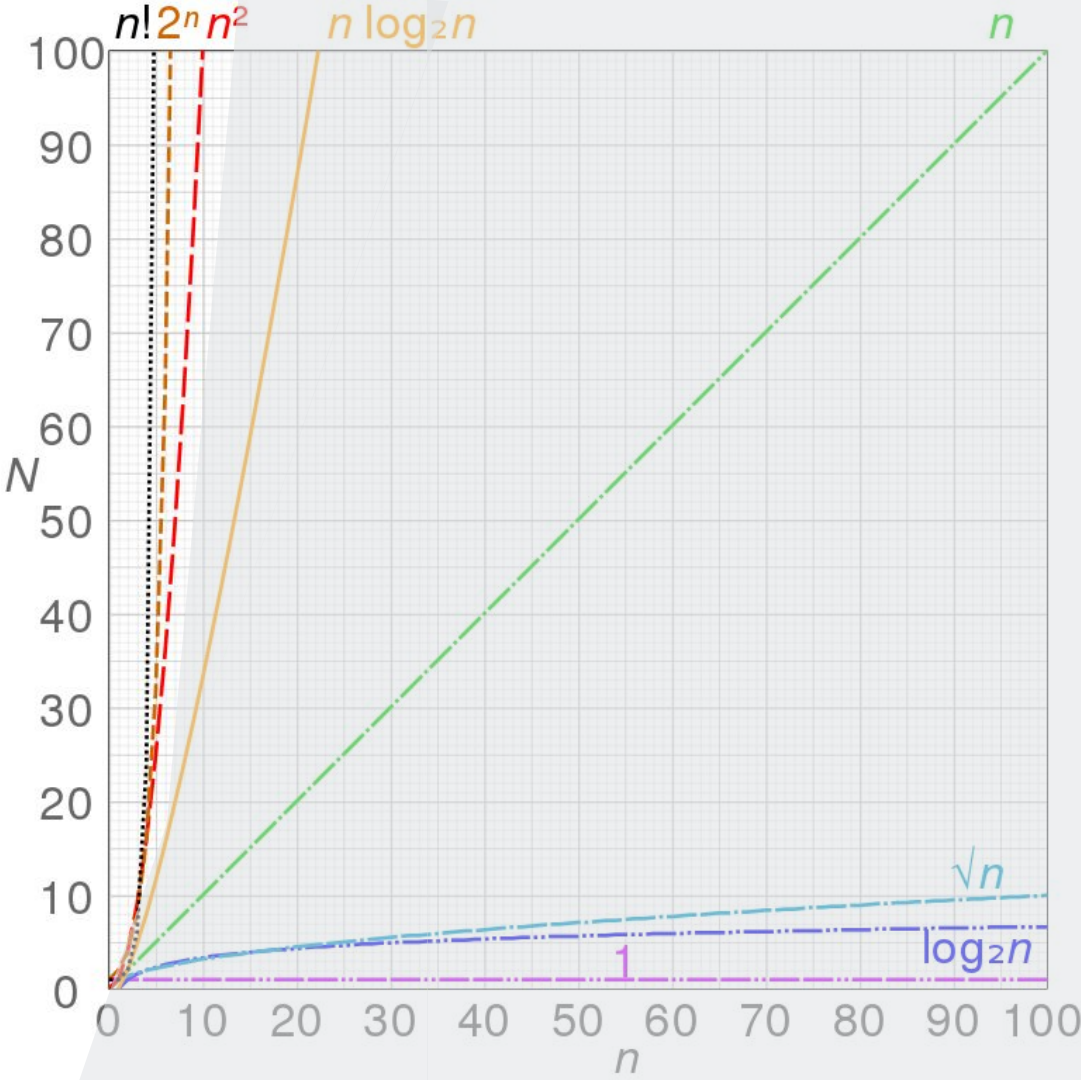
When should we *consider* distributing?



SER 321
Distributed Systems

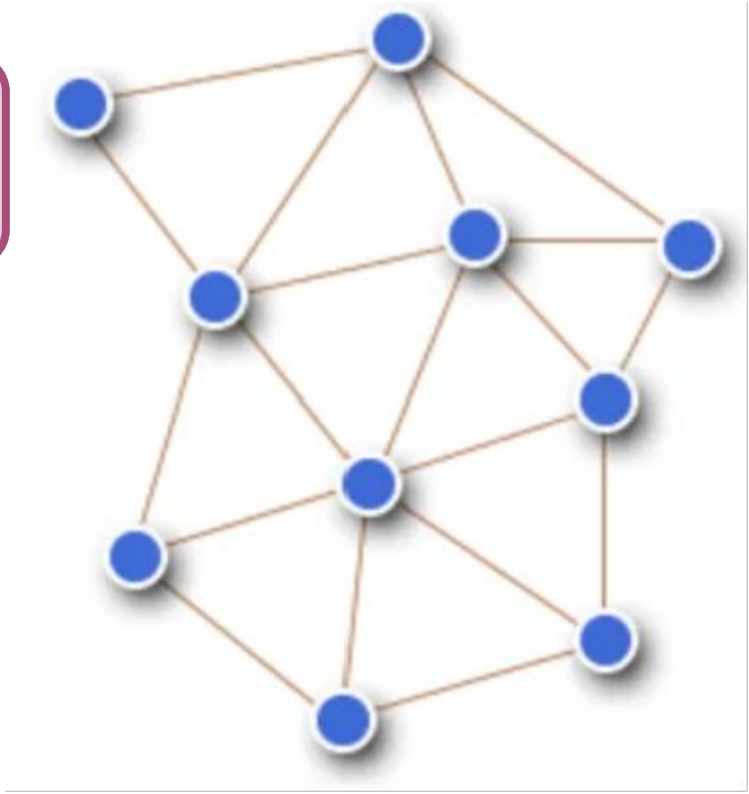
When should we *consider* distributing?

Super Duper Extra Extra Large Orders of Magnitude!



SER 321
Distributed Systems

Remember that we are operating in ***reality***



- Nodes *will* fail
- Web of nodes *will constantly* change
- Network is not *always* reliable
- Latency is *always present*
- The path traversed *changes*
- Some resources *must be shared*
- *You* need to prevent the pitfalls!
  - No deadlocks
  - No starvation
  - No error states

SER 321

Scratch Space

Questions?

Survey:

http://bit.ly/ASN2324

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Upcoming Events

SI Sessions:

- Sunday, June 23rd at 6:00 pm MST
- Monday, June 24th at 6:00 pm MST
- Thursday, June 27th at 6:00 pm MST

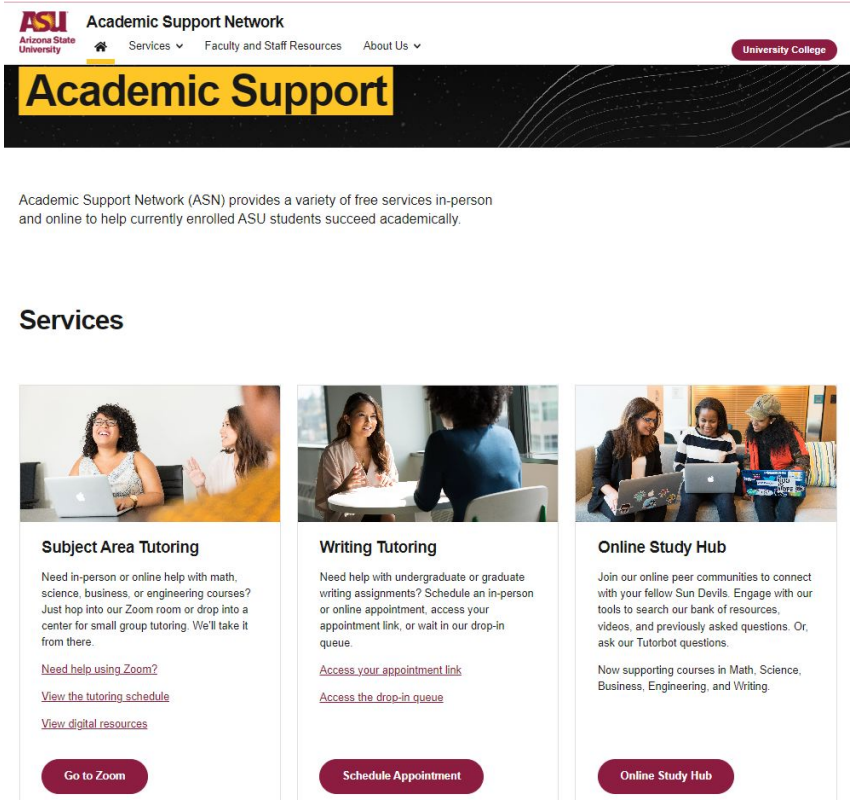
Review Sessions:

- Review Session - **Wednesday**, July 3rd at 6:00 pm MST (2 hr Session)
- Q&A Session - Sunday, July 7th at 6:00 pm MST (Final Session)

More Questions?

Check out our other resources!

tutoring.asu.edu



1 – Go to Zoom

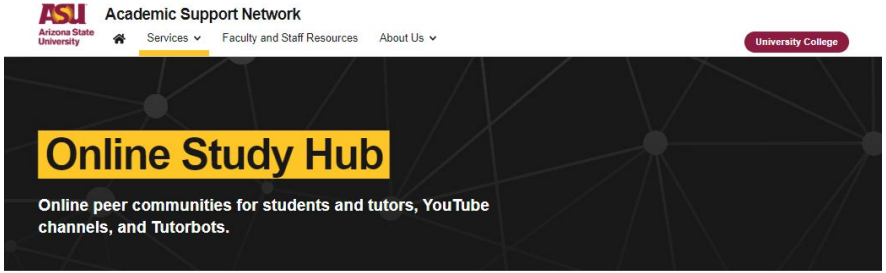
2- Need help using Zoom?
View the tutoring schedule
View digital resources

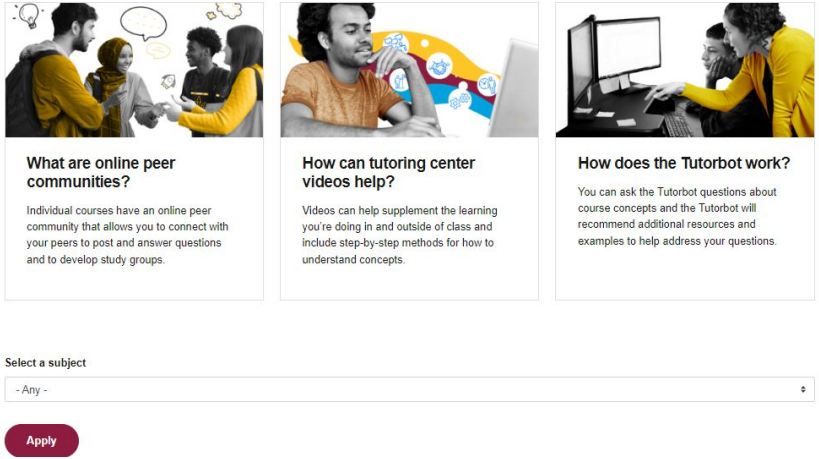
1. **Click on 'Go to Zoom' to log onto our Online Tutoring Center.**
2. **Click on 'View the tutoring schedule' to see when tutors are available for specific courses.**

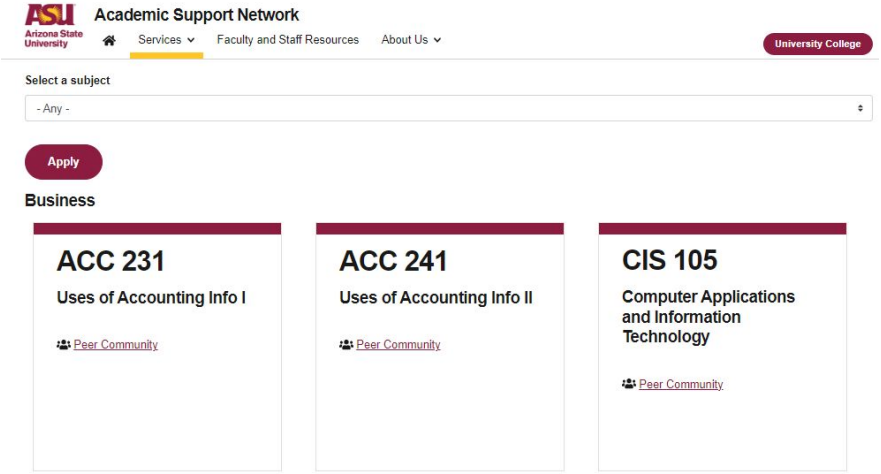
More Questions?

Check out our other resources!

tutoring.asu.edu/online-study-hub



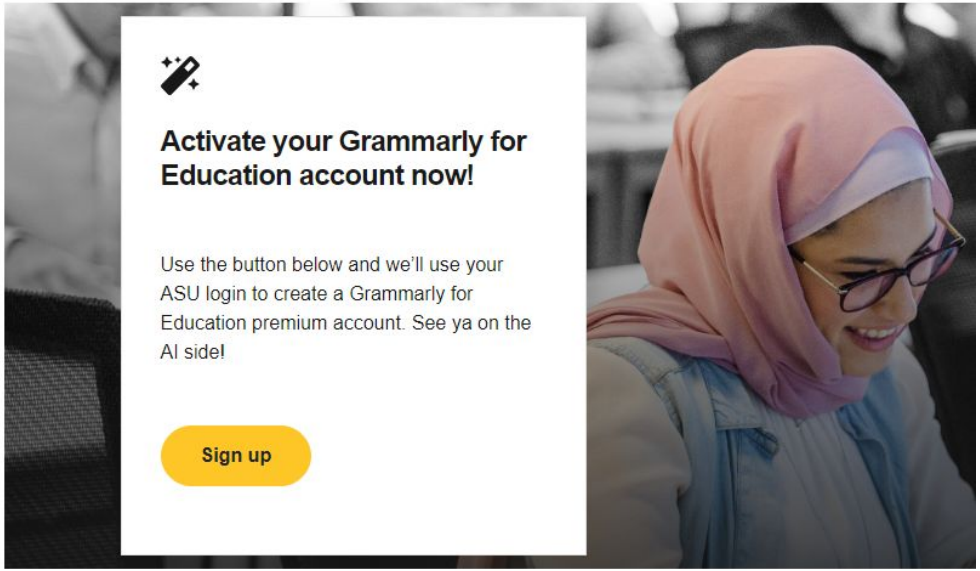




Don't forget to check out the Online Study Hub for additional resources!

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
- Dining Philosophers Interactive
- Austin G Walters Traffic Comparison