SER 321 A Session

SI Session

Sunday, February 16th 2025

7:00 pm - 8:00 pm MST

Agenda

- Thread Tracing Review
- Distributed System Properties
- Distributed Structures Review
- Process Flow Examination
- Consensus

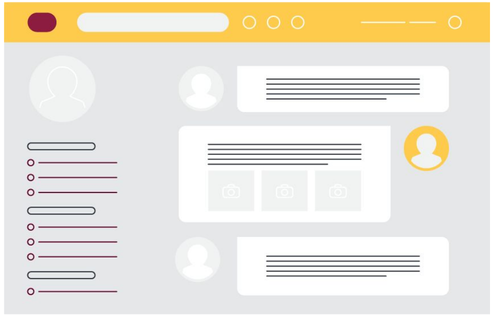
SI Session Expectations

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

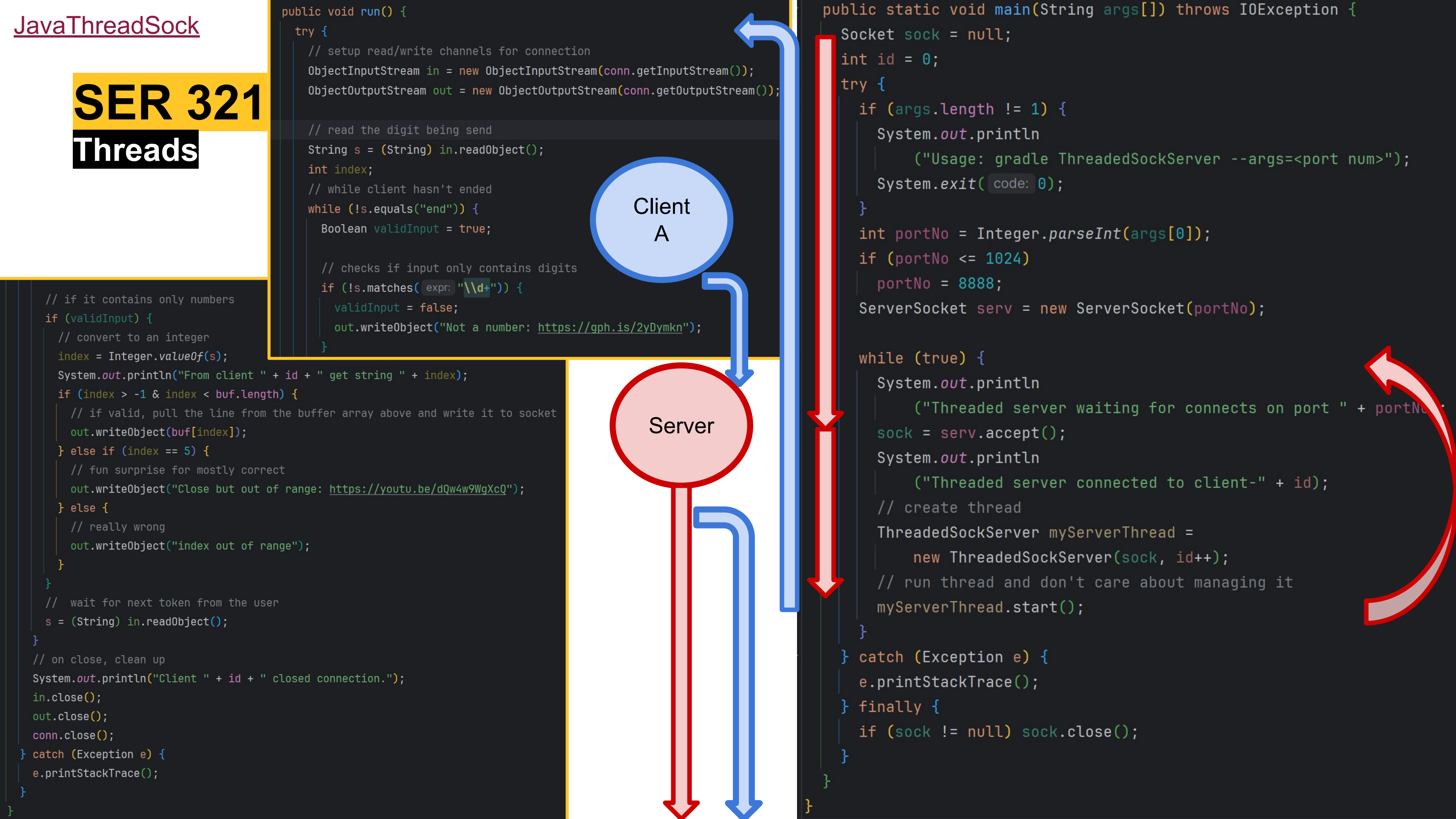


Zoom Chat

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

JavaThreadSock

SER 321
Threads



```
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");
      }
```

```
      // 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");
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      }
      //  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();
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```
public static void main(String args[]) throws IOException {
  Socket sock = null;
  int id = 0;
  try {
    if (args.length != 1) {
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          ("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) {
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          ("Threaded server waiting for connects on port " + portN
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      // create thread
      ThreadedSockServer myServerThread =
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      // run thread and don't care about managing it
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JavaThreadSock

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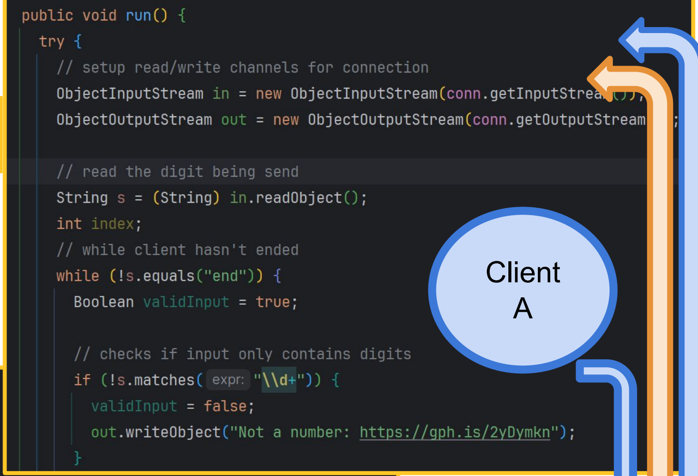
Threads



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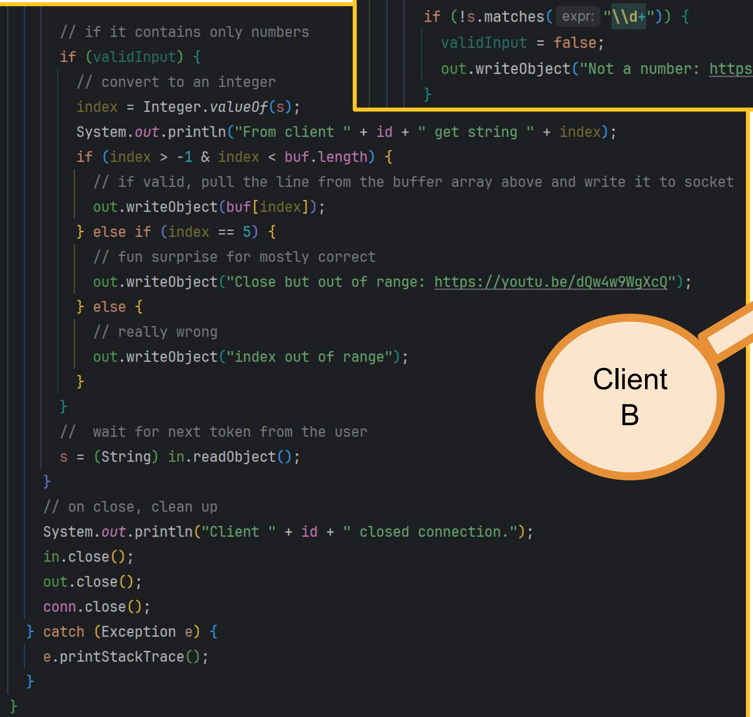

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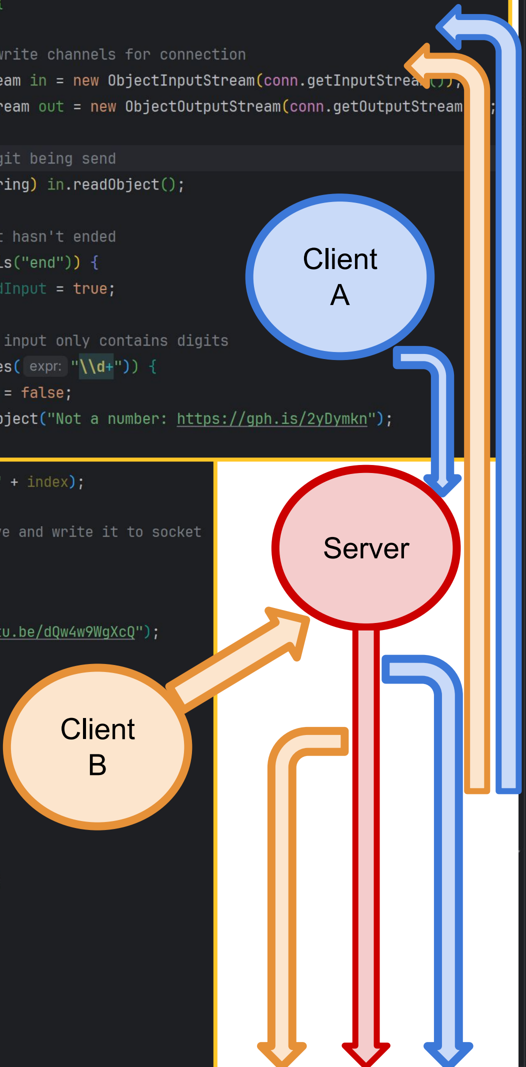

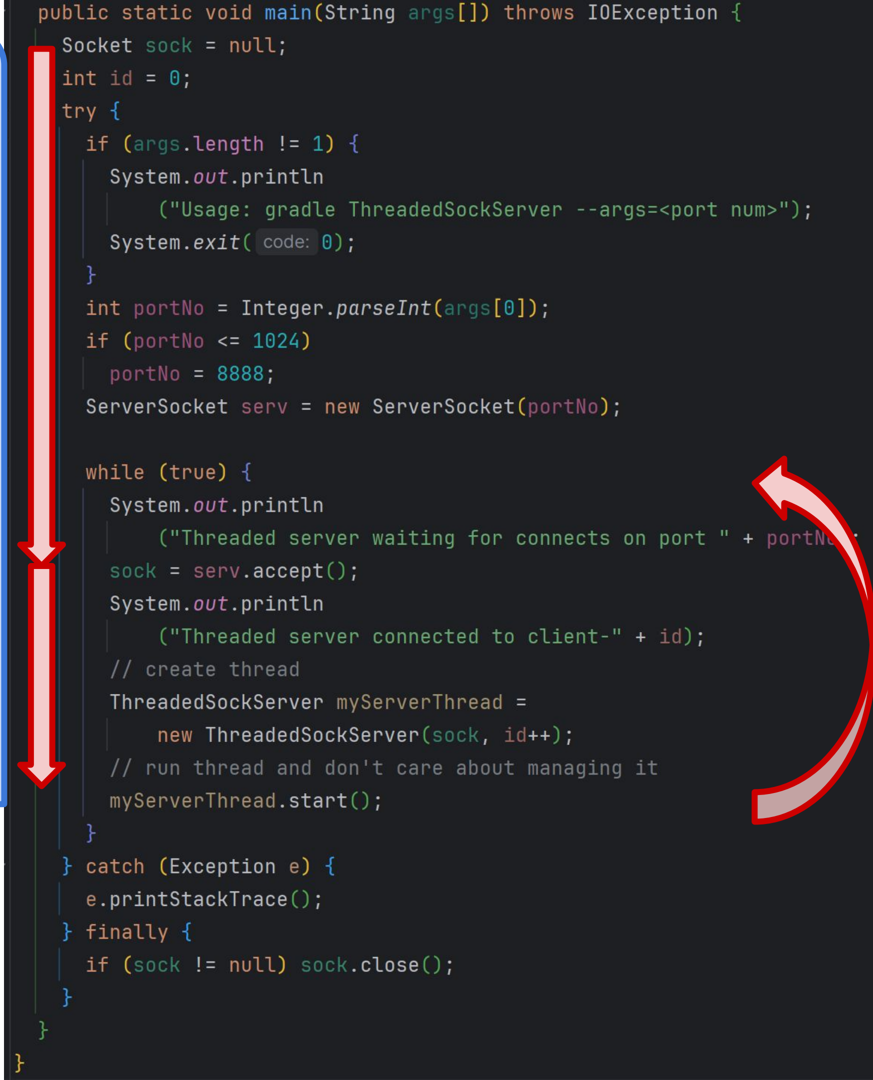

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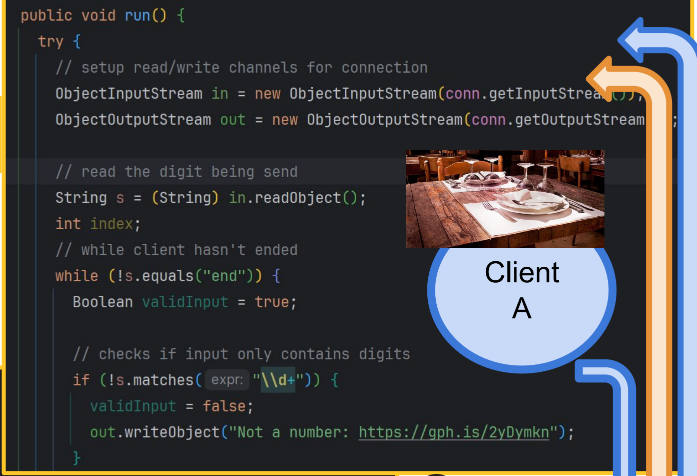
JavaThreadSock

SER 321 Threads



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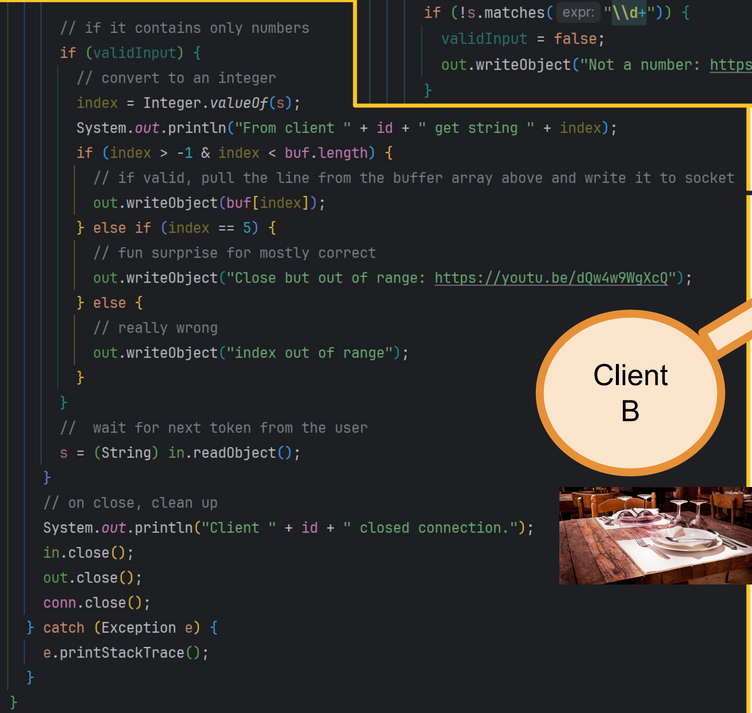

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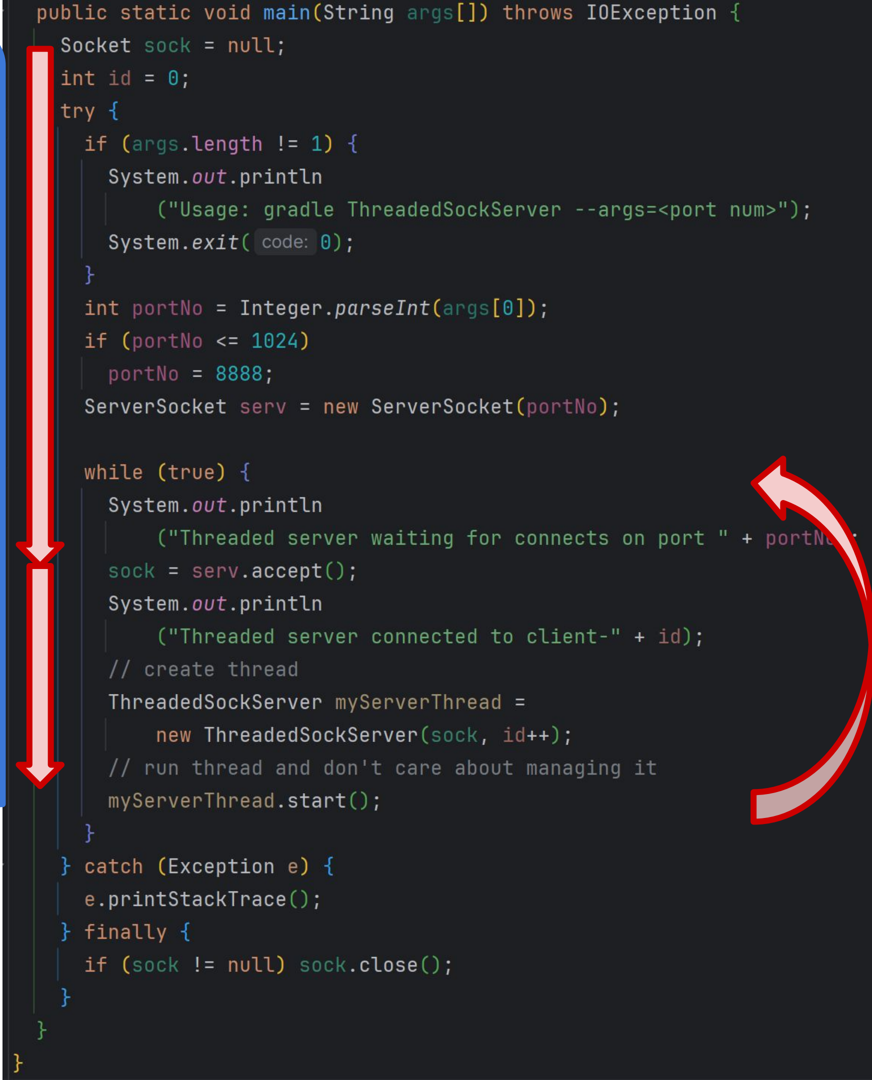

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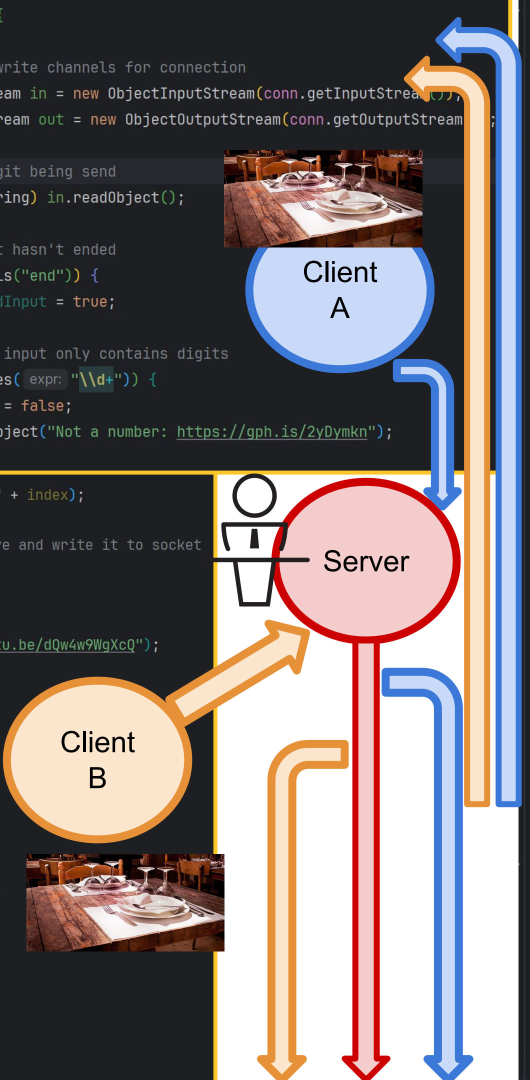

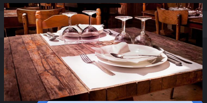

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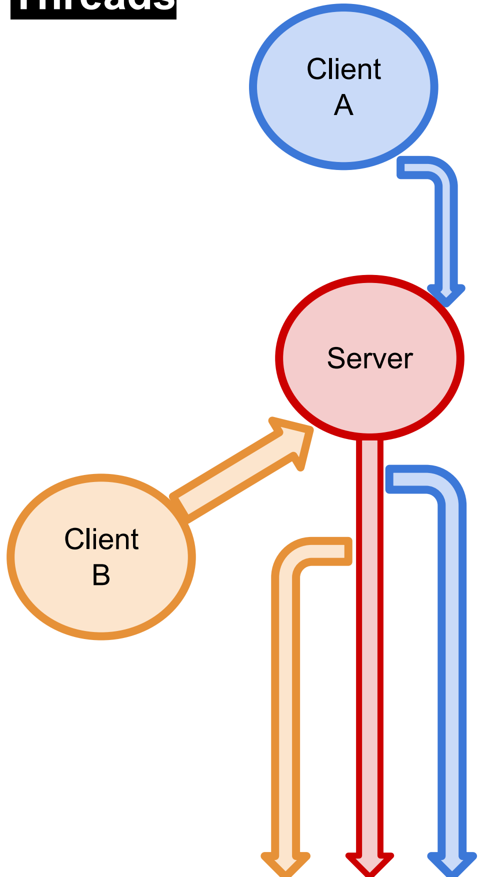
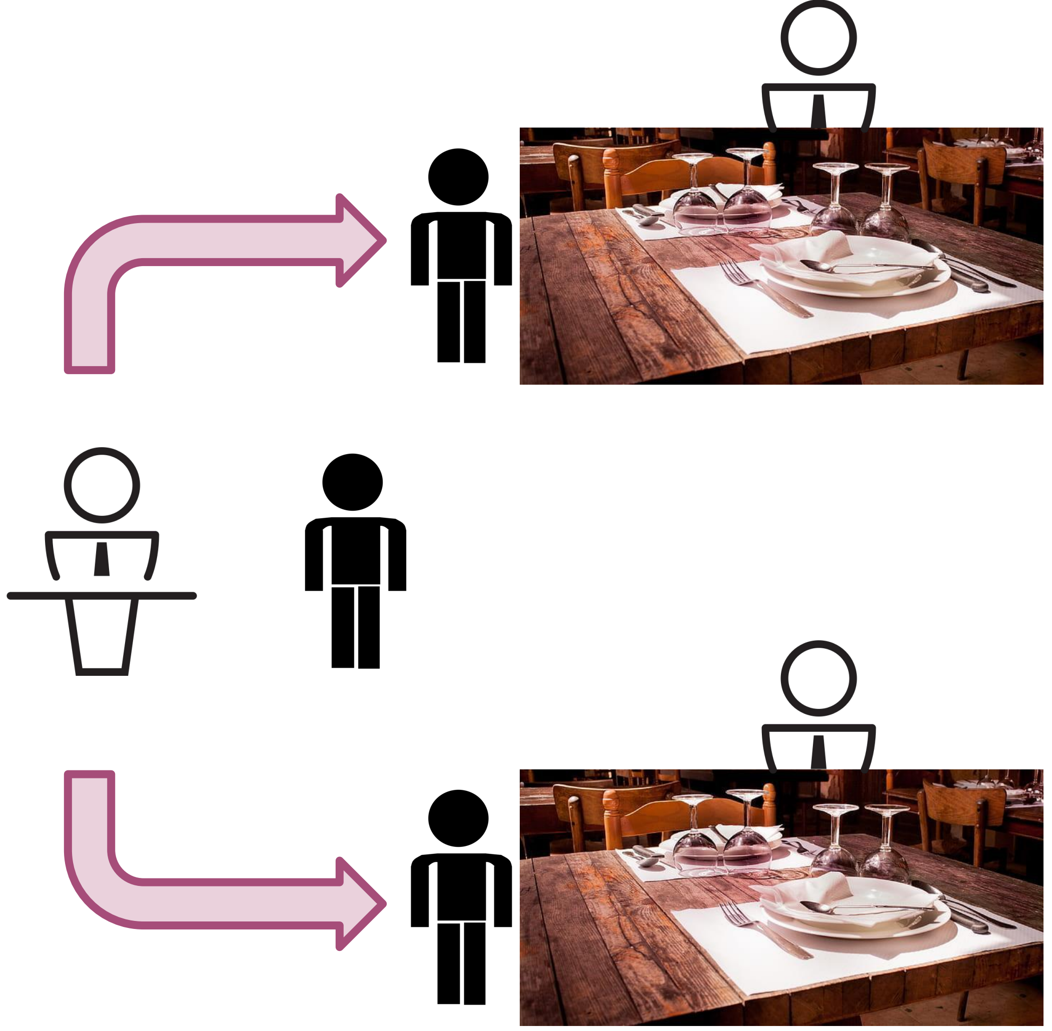
Threads

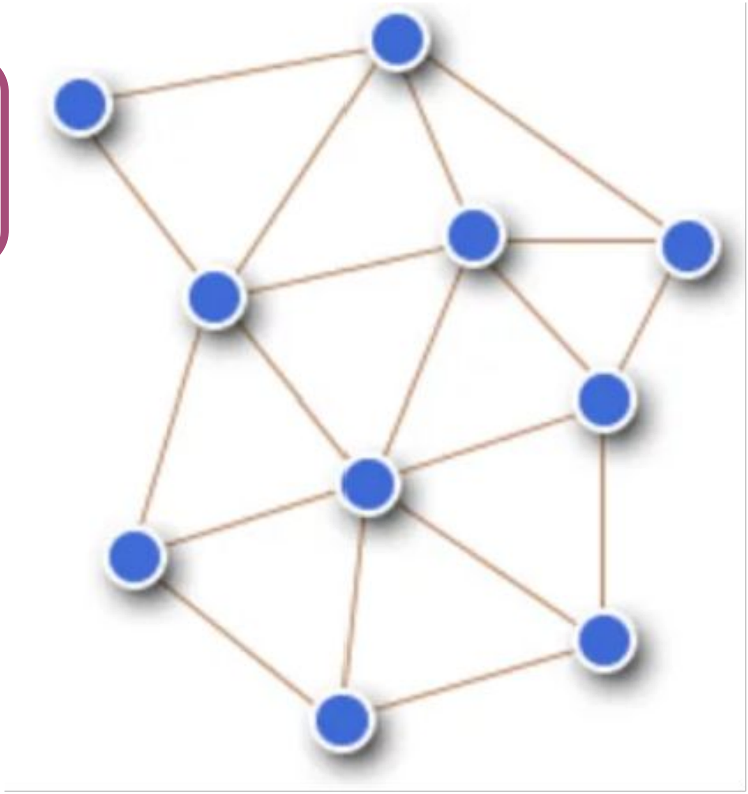




SER 321
Distributed Systems

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

- *No* global clock
- 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



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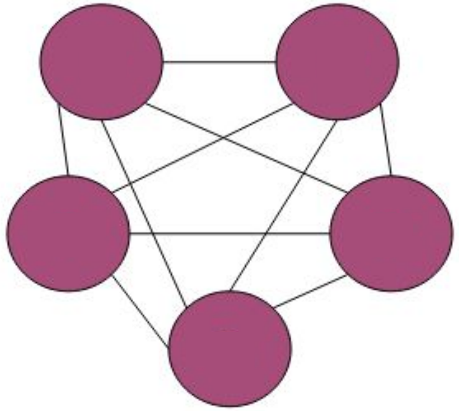
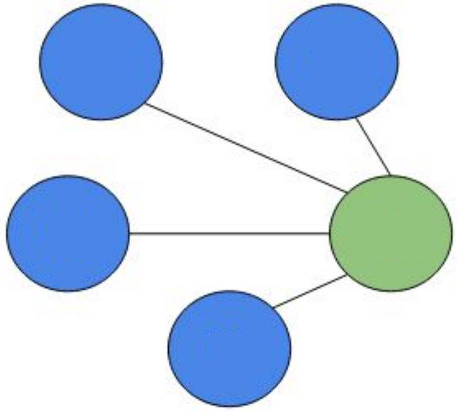
Distributed Systems

Main and Worker

Peer to Peer

Which is which?





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Distributed Systems

Main and Worker

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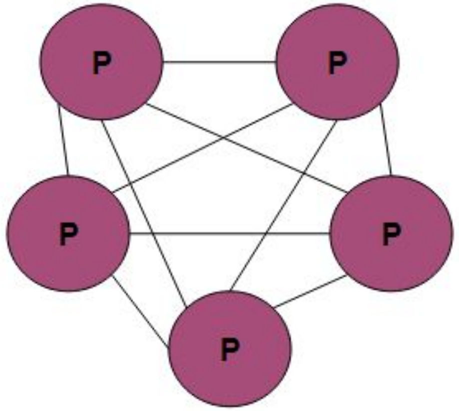

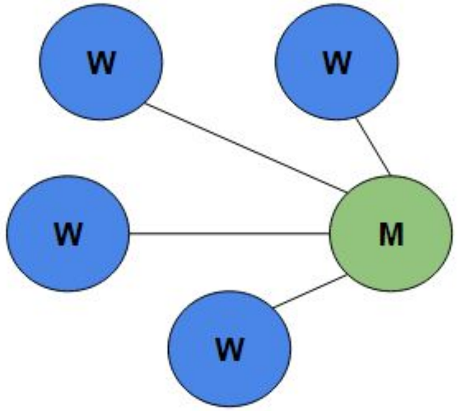

Main and Worker

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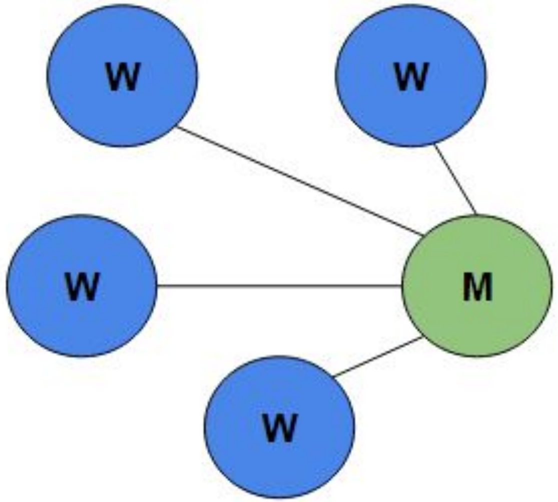
Distributed Systems

Pros and Cons



Pros:

- Straightforward setup
- Logic is centralized
- Communication is linear

Cons:

- Single point of failure

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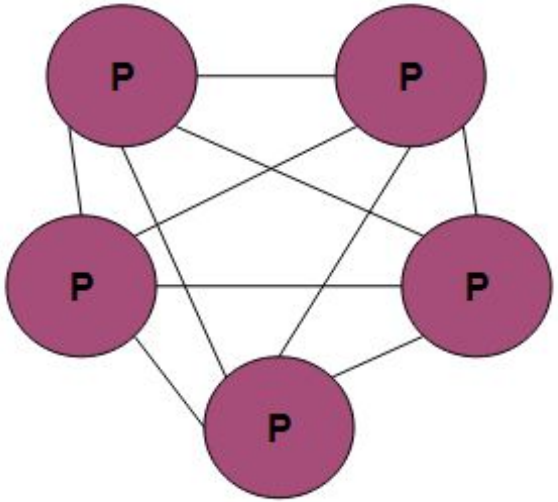
Distributed Systems

Pros and Cons



Pros:

- Peers can join or leave as needed
- Robust - no single point of failure

Cons:

- Communication is more *complex*
- Setup is not as straightforward
- Client connections are handled *differently*

We will cover this in a moment!

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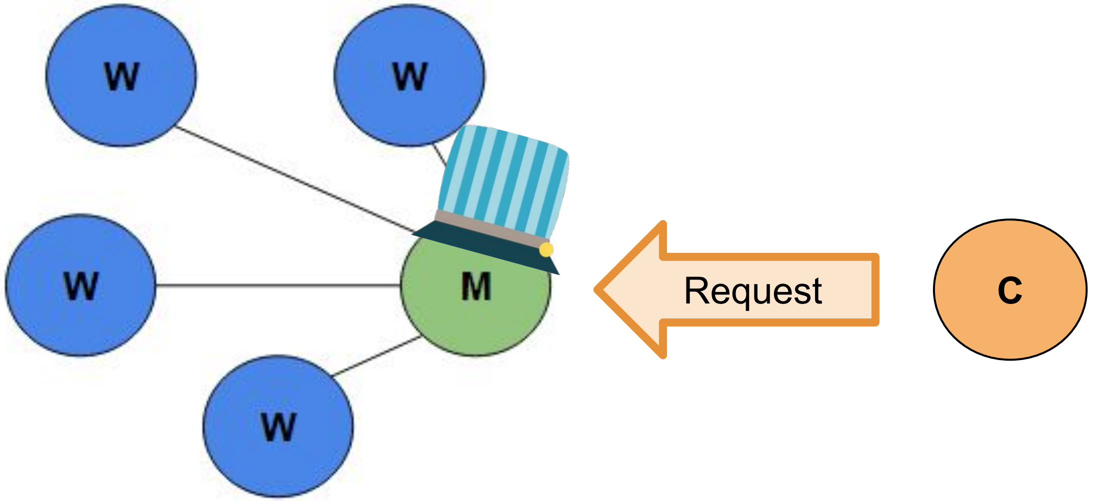
Distributed Systems

Process Flow!

DATA

Workers only do their task then report back



Main is like our server

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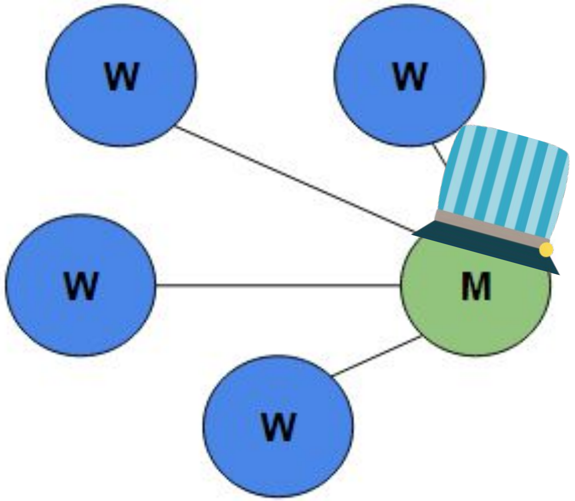
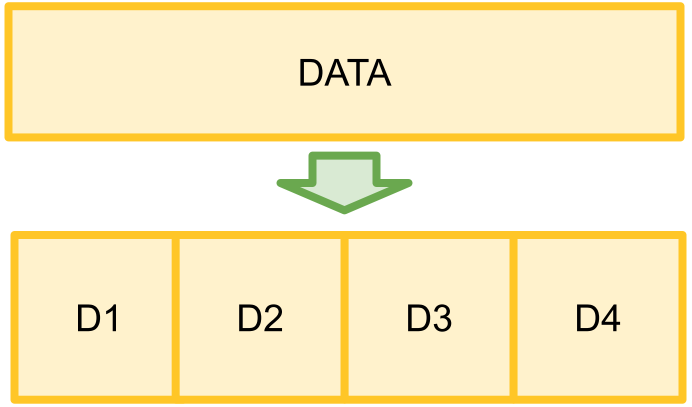
Distributed Systems

Process Flow!

Workers only do their task then report back





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Distributed Systems

Process Flow!

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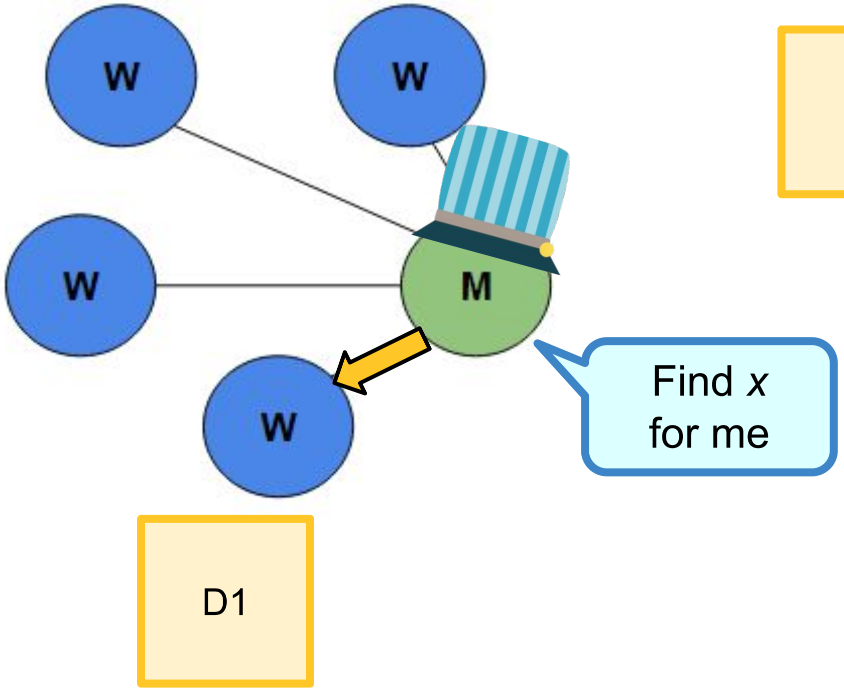

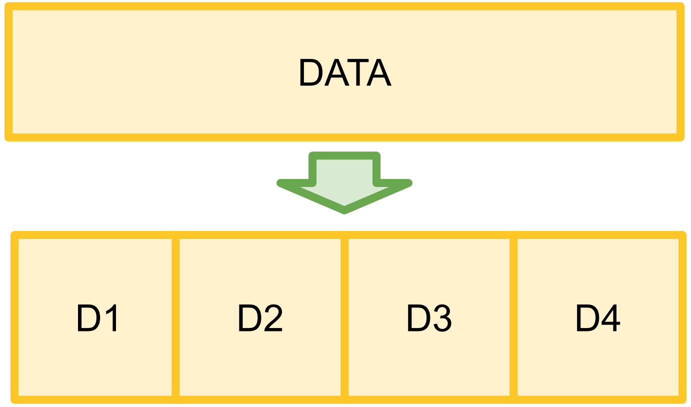

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Distributed Systems

Process Flow!

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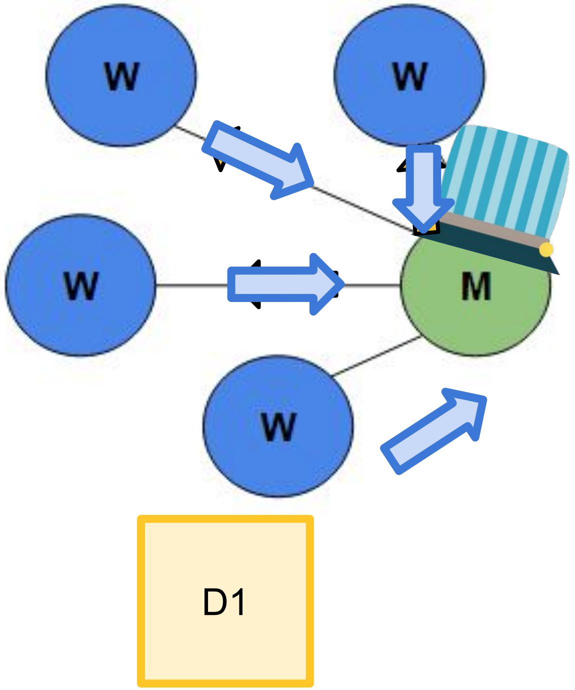

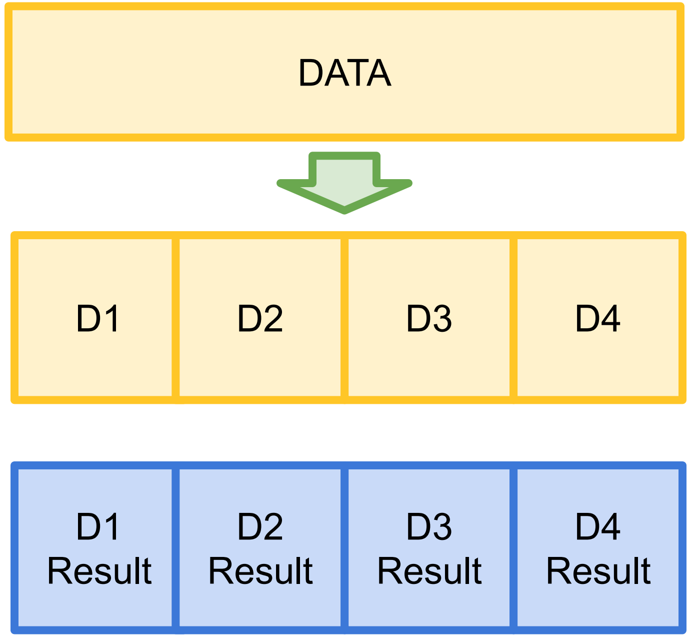

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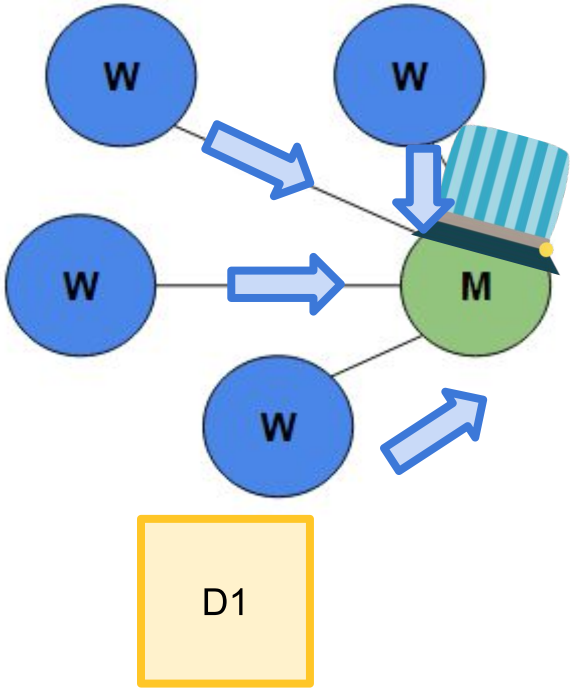
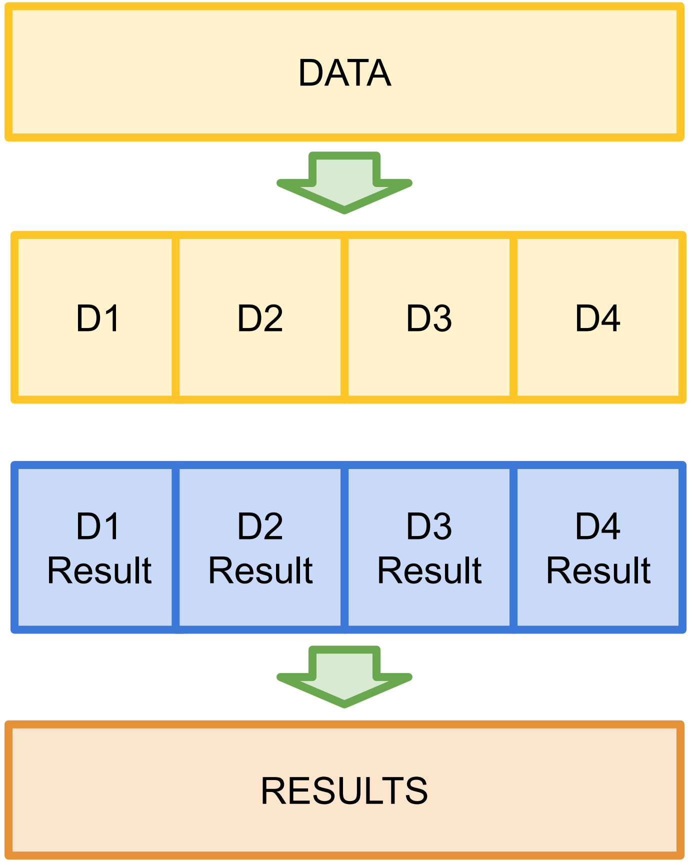
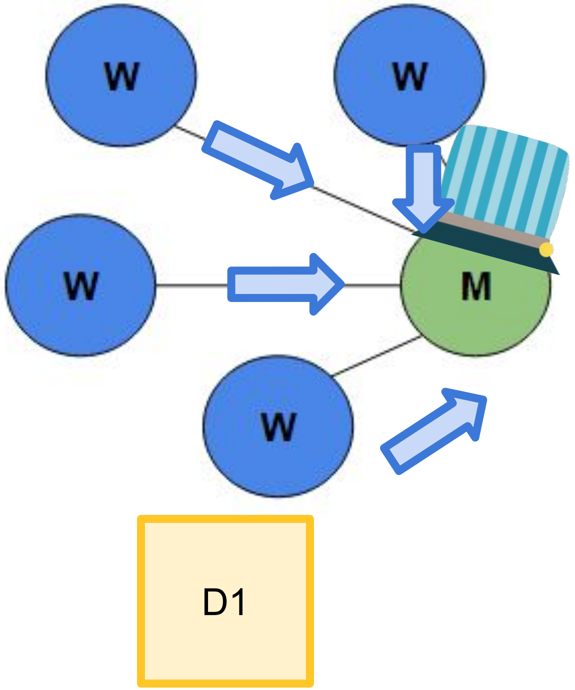
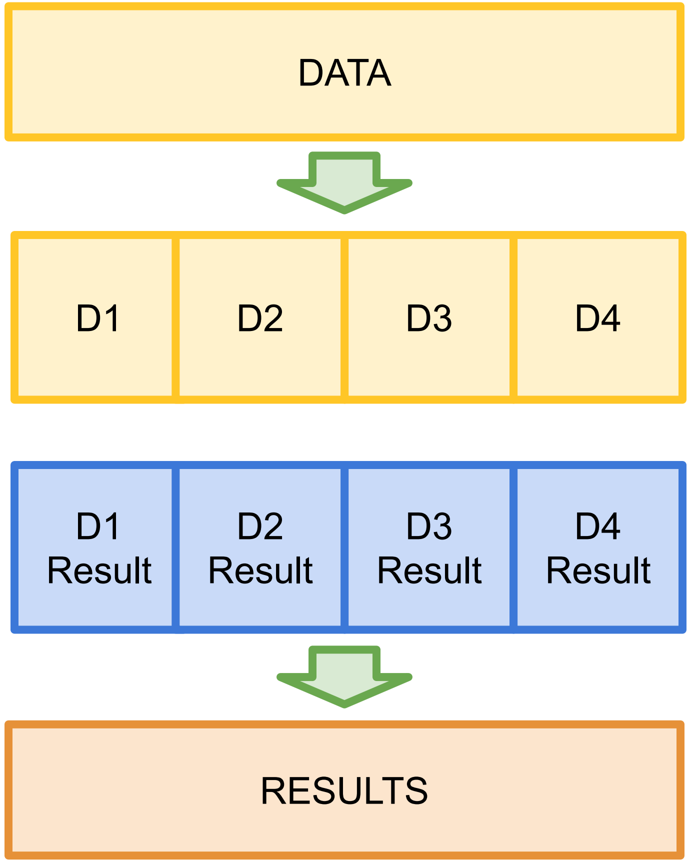




Does this look familiar?

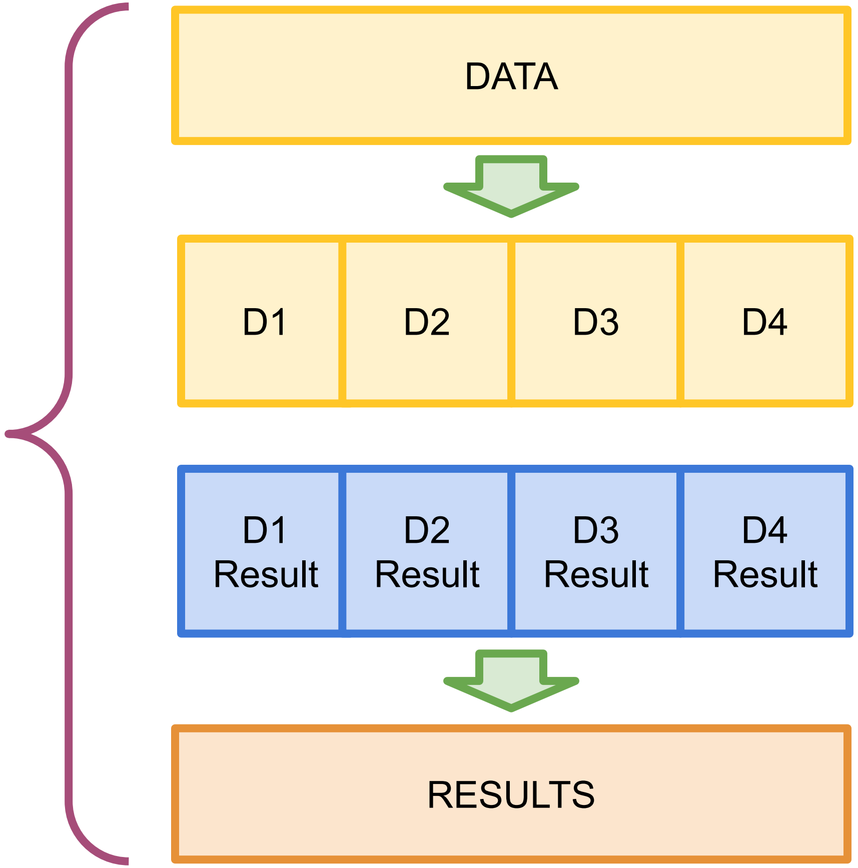
How is this different from a parallel processing model?





What about Peer to Peer?

Would this sequence *(the data handling)* change in the different structure?



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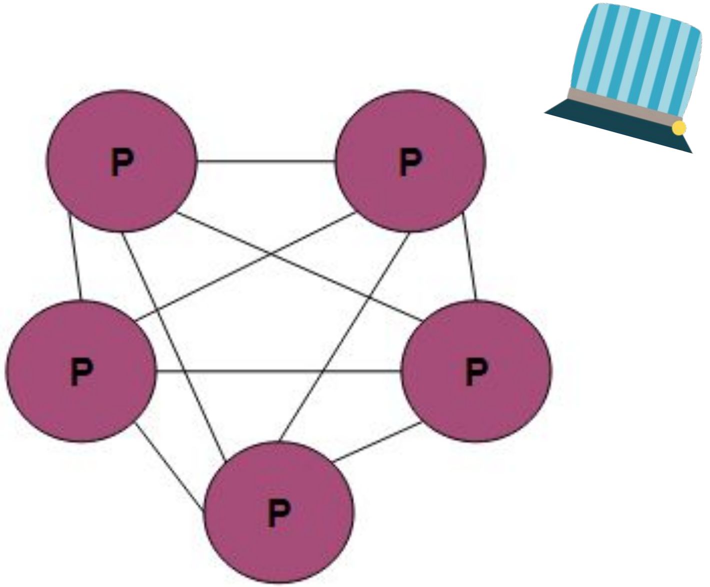
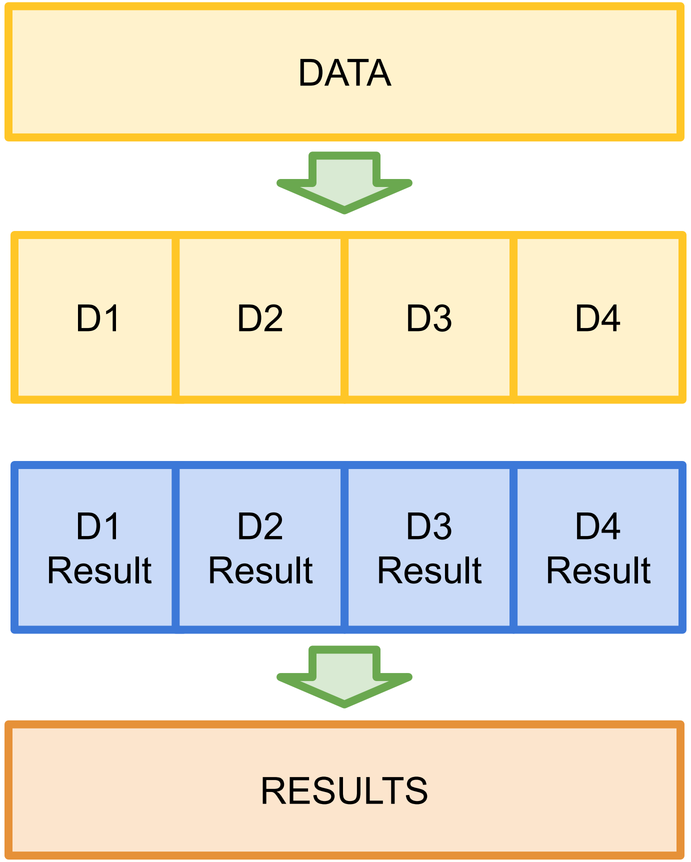
What about Peer to Peer?

We want someone to wear the conductor hat!

A ***LEADER***





How do we choose a leader?

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What about Peer to Peer?

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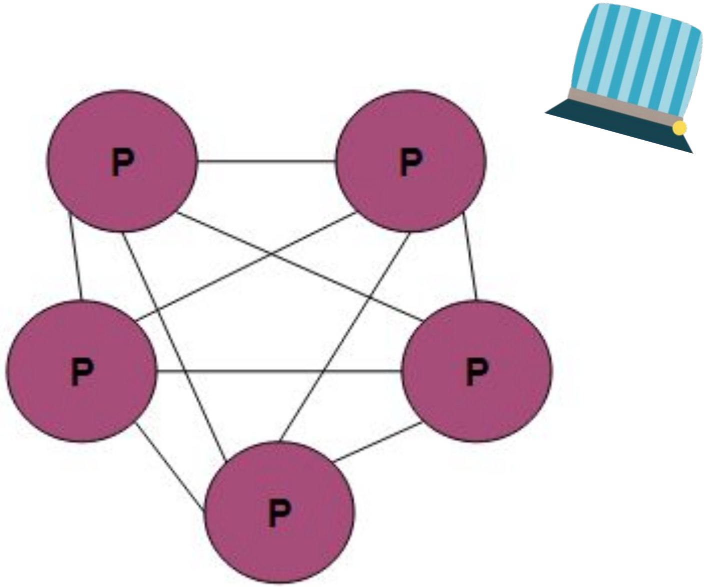

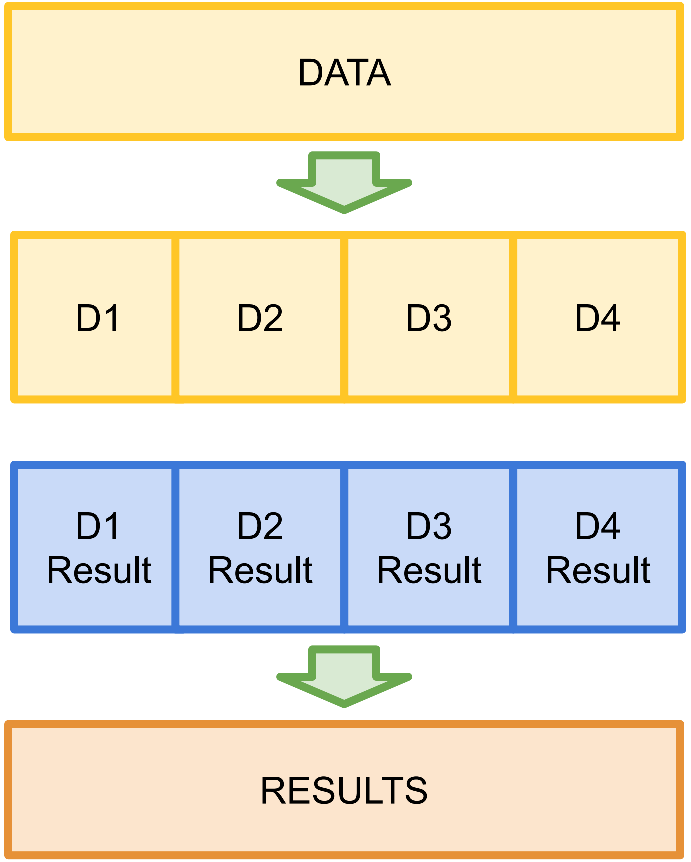

Leader Election!

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Distributed Systems

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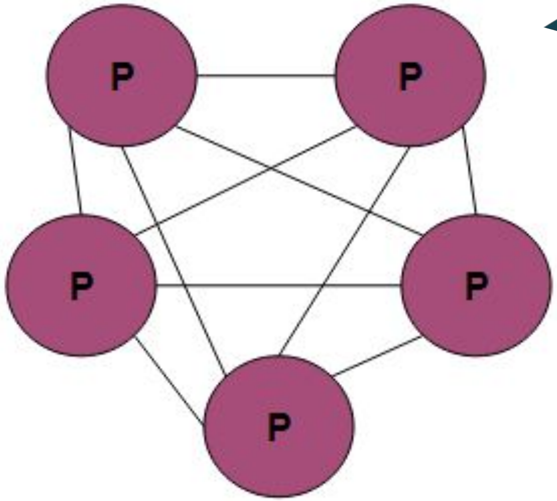

Leader Election!

Type of ***CONSENSUS***

What's consensus?

"General agreement or trust amongst a group"

“General agreement or trust amongst a group”

Types of Consensus?

Leader Election	Who’s in charge or keeping the beat
Result Verification	Check your work with a neighbor
Log Replication	Verify and maintain my copy of the data
Node Validation	Do I want to let you into my network

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Consensus

Match the Consensus Algorithm to its Description!

2-Phase Commit	If you solve this resource-intensive problem, you may make a request
Blockchain	Leader Election and Log Replication coordinate transactions
Proof of Work	Transaction Coordinator approves and orchestrates transactions
RAFT	Distributed Ledger used to determine if a transaction is valid

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Consensus

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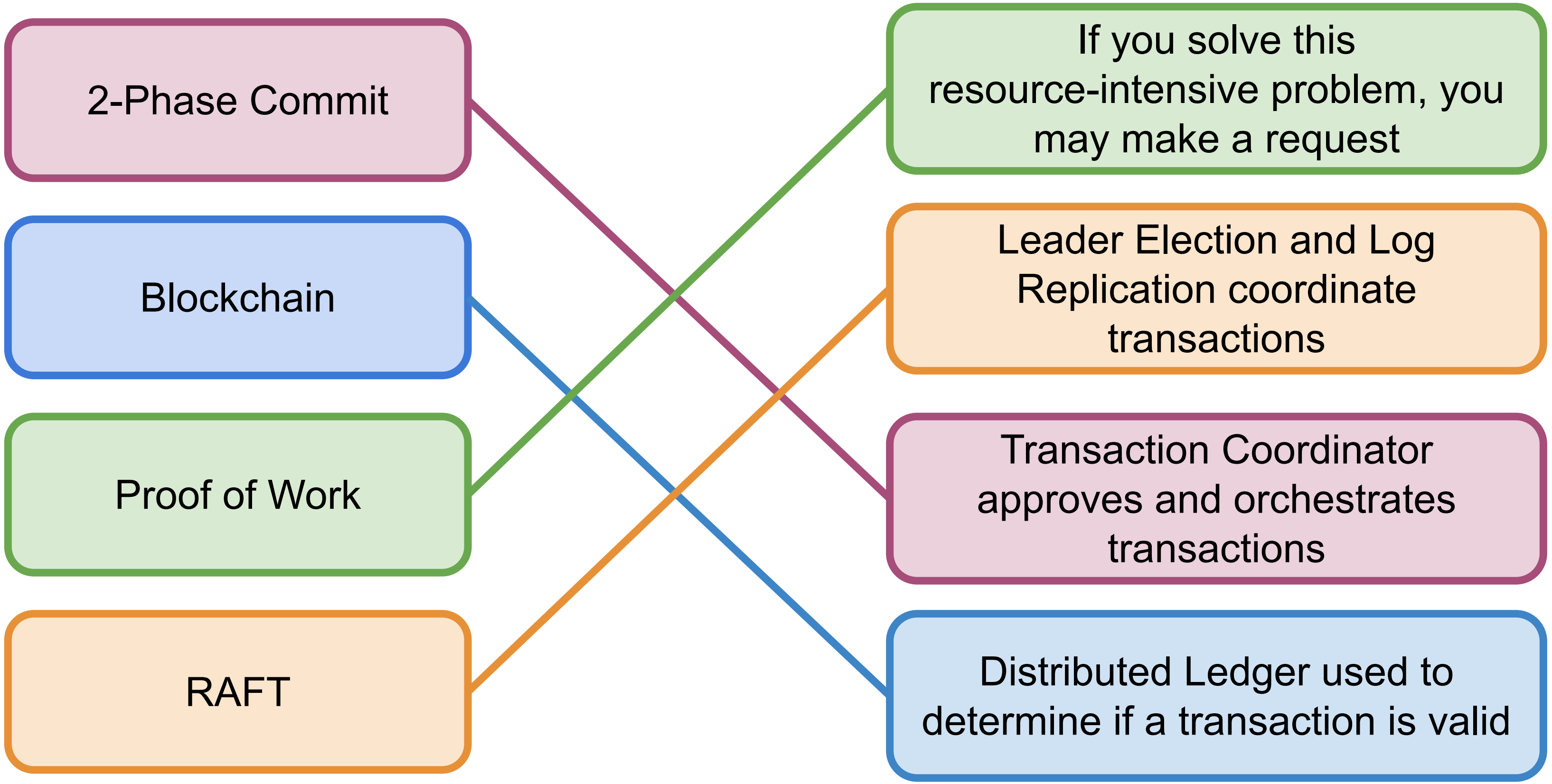

2-Phase Commit

Blockchain

Proof of Work

RAFT

If you solve this resource-intensive problem, you may make a request

Leader Election and Log Replication coordinate transactions

Transaction Coordinator approves and orchestrates transactions

Distributed Ledger used to determine if a transaction is valid

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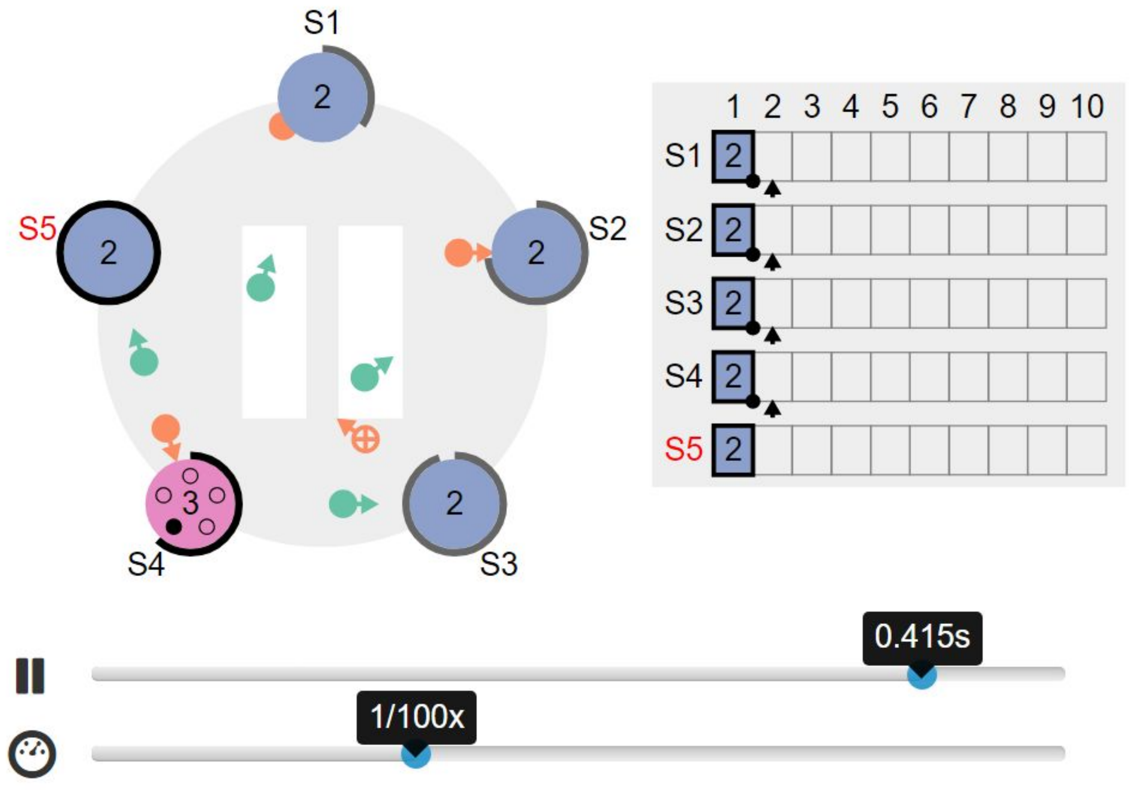
RAFT

RAFT is a great consensus example!

Leader Election

Log Replication



The Secret Lives of Data is a different visualization of Raft. It's more guided and less interactive, so it may be a gentler starting point.

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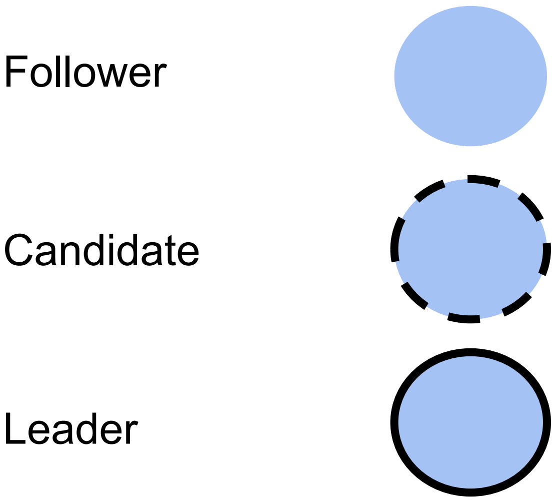
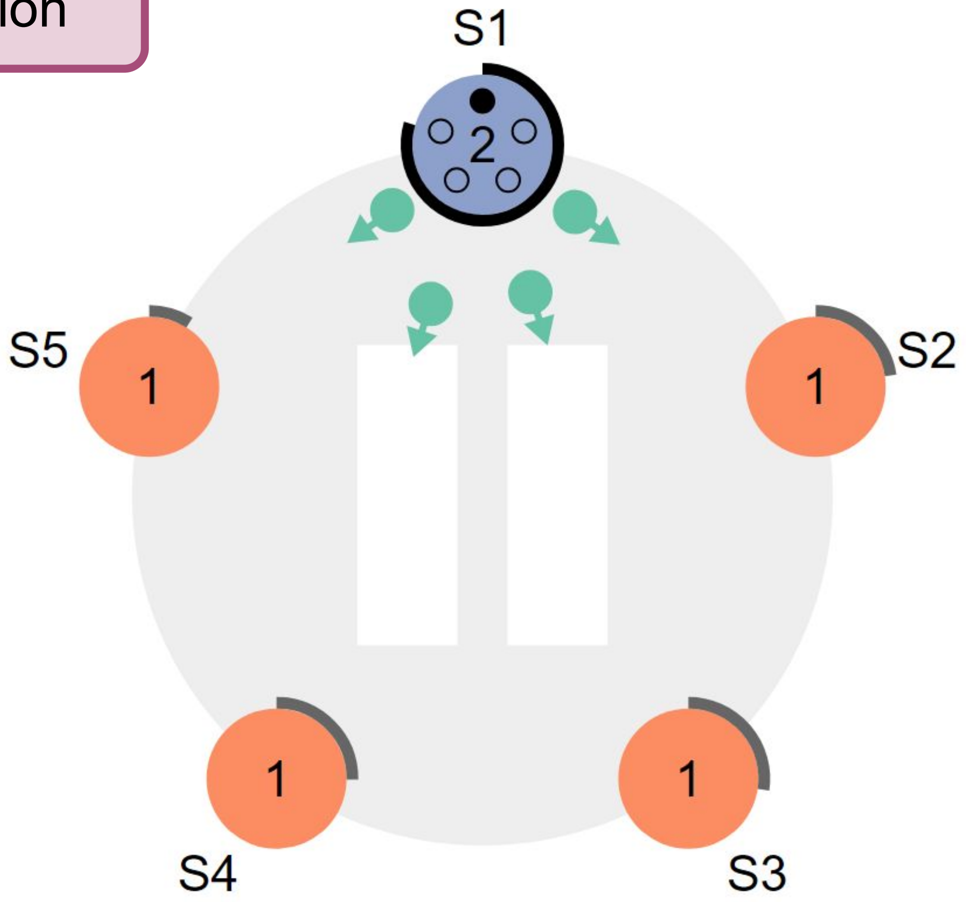
RAFT

Leader Election

Nodes have 3 states:





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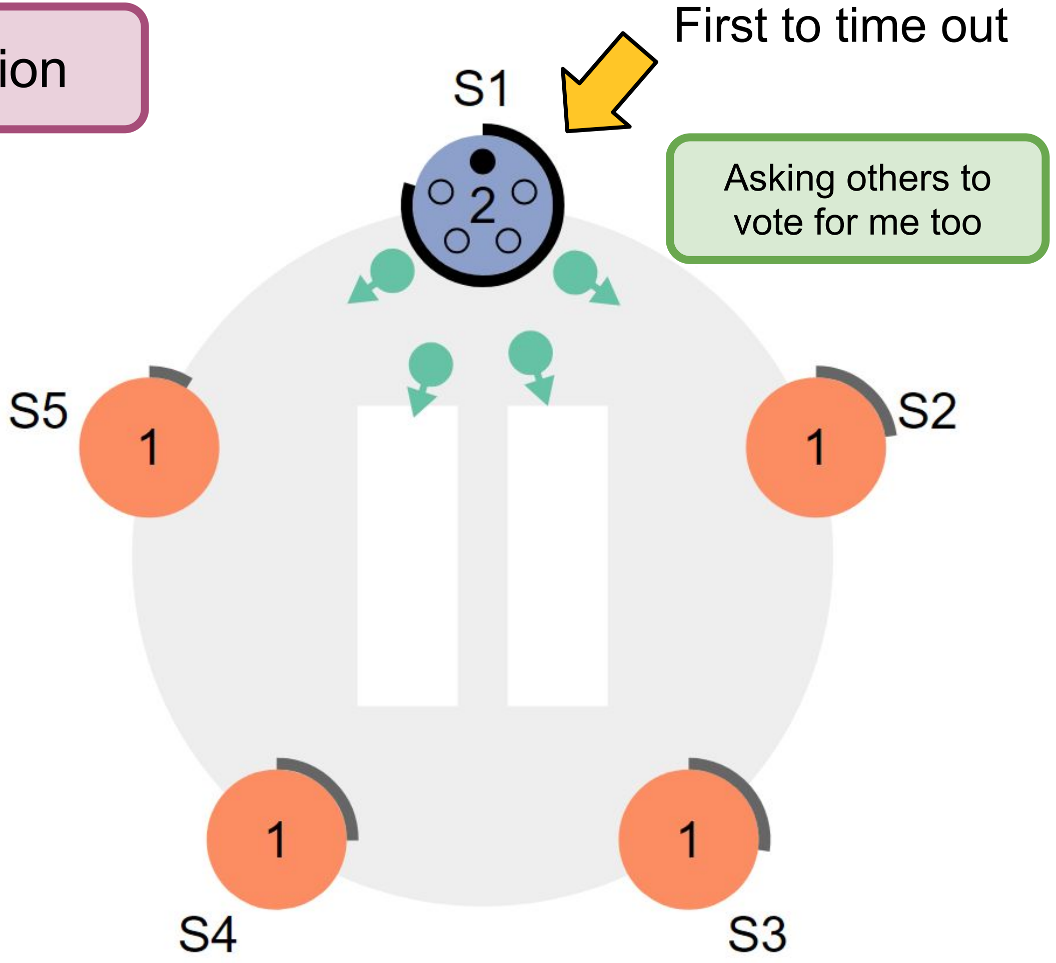
RAFT

Leader Election

This is the first election



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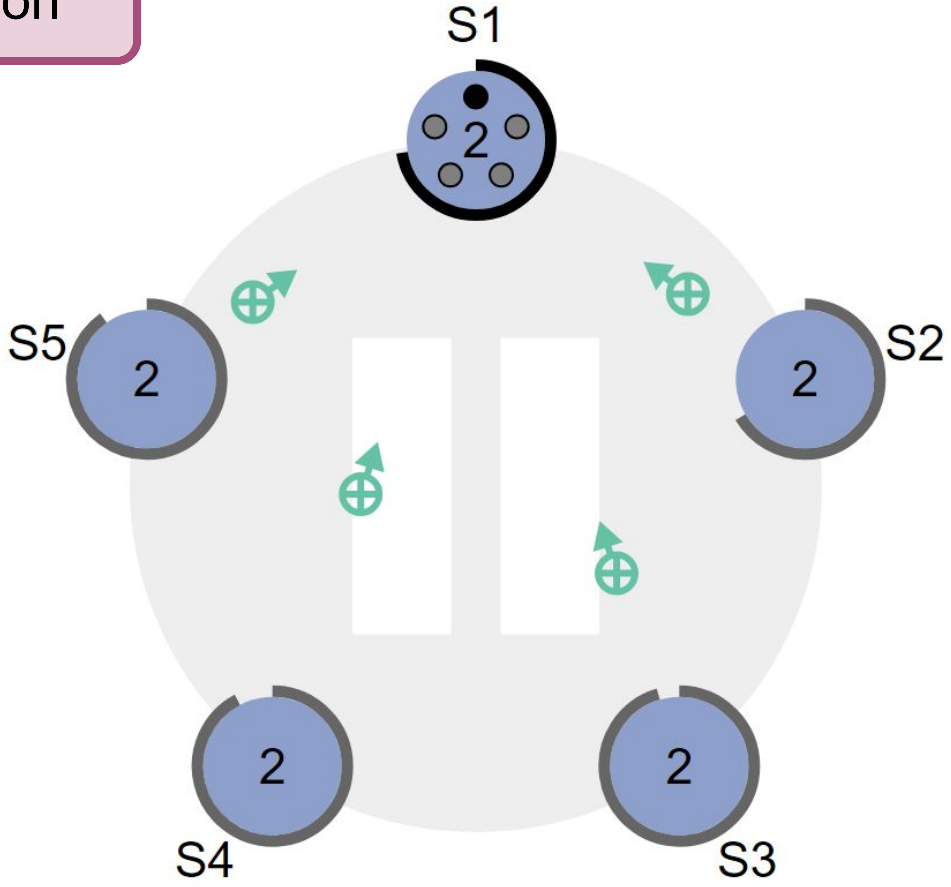
RAFT

Leader Election



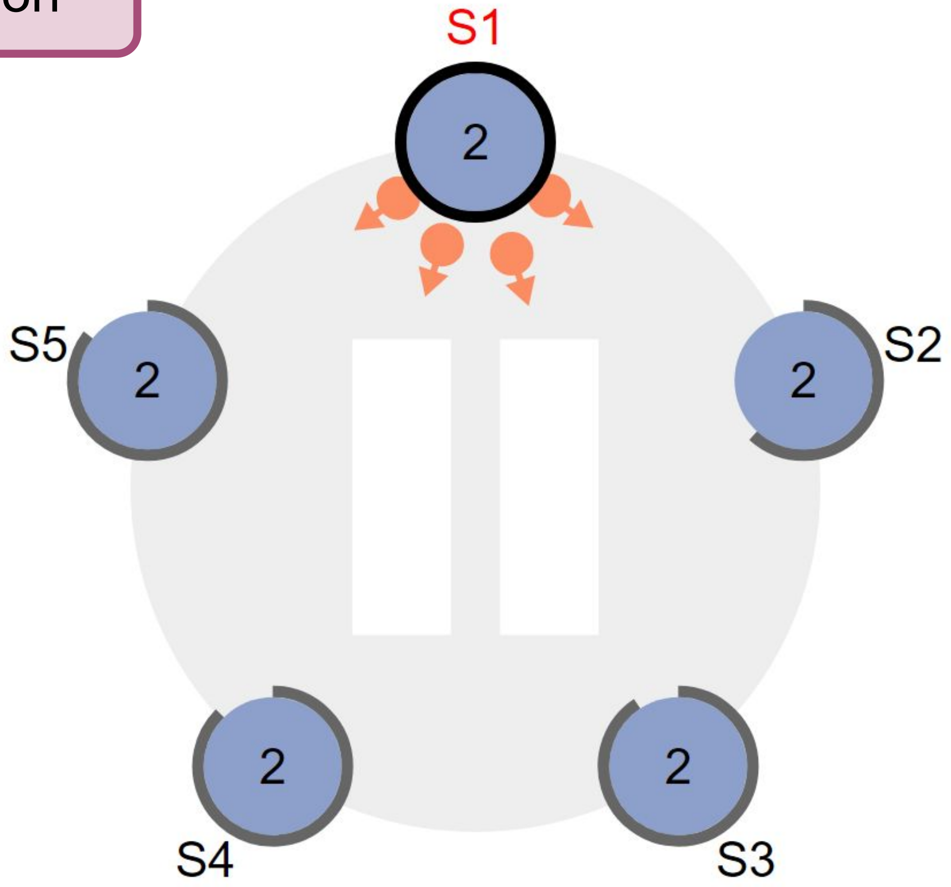
Other nodes said sure whatever

SER 321

RAFT

Leader Election

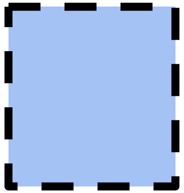
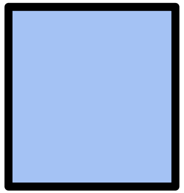
Now confirmed as Leader

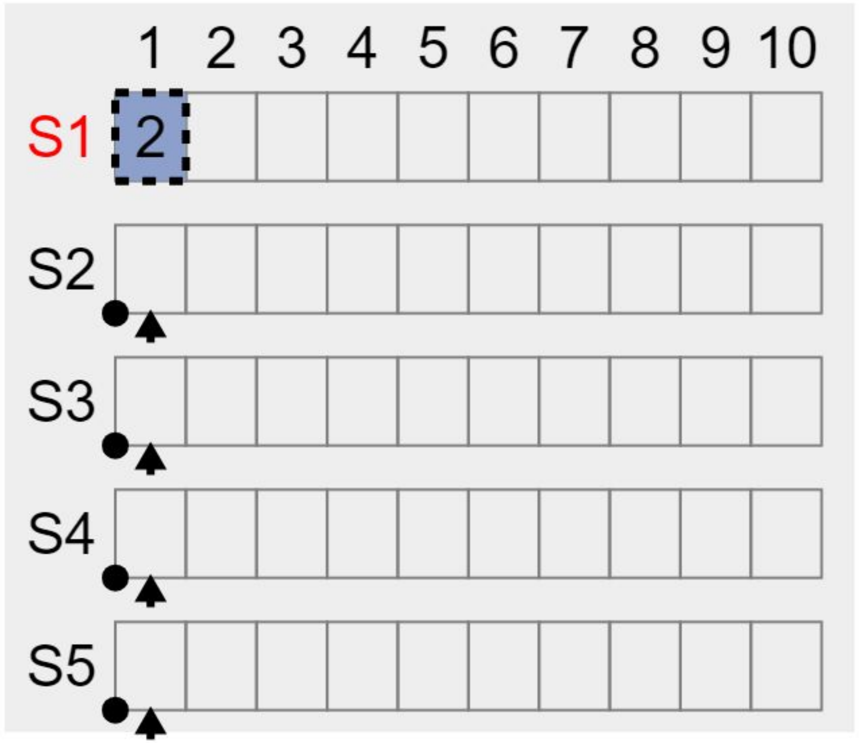


SER 321
RAFT

Log Replication

Same Pattern!

Candidate	
Added	



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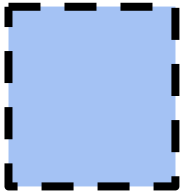
RAFT

Log Replication

Same Pattern!

Candidate



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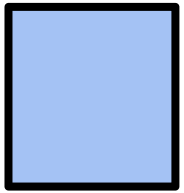
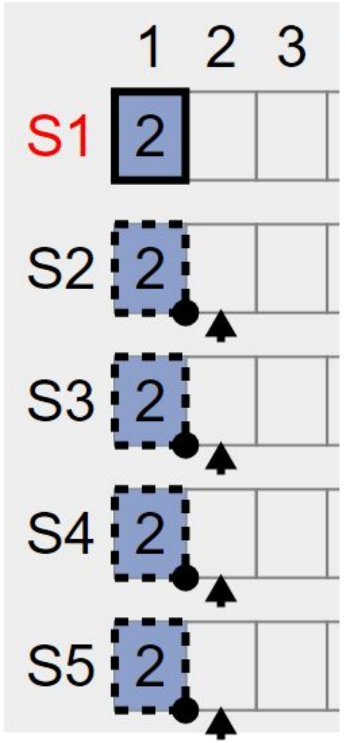
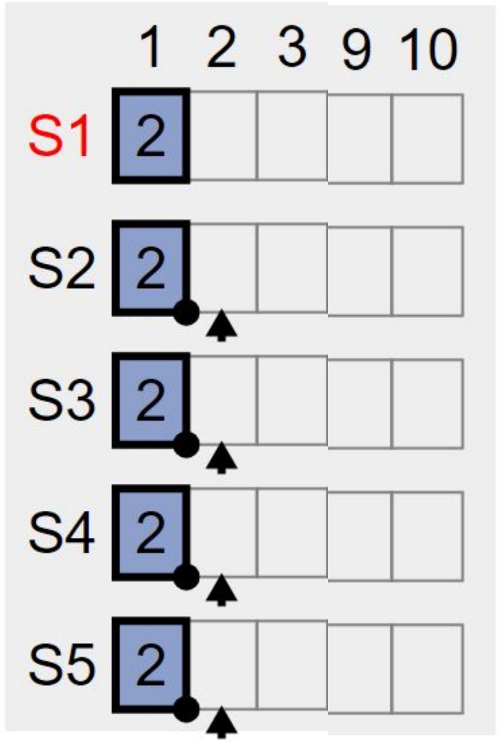
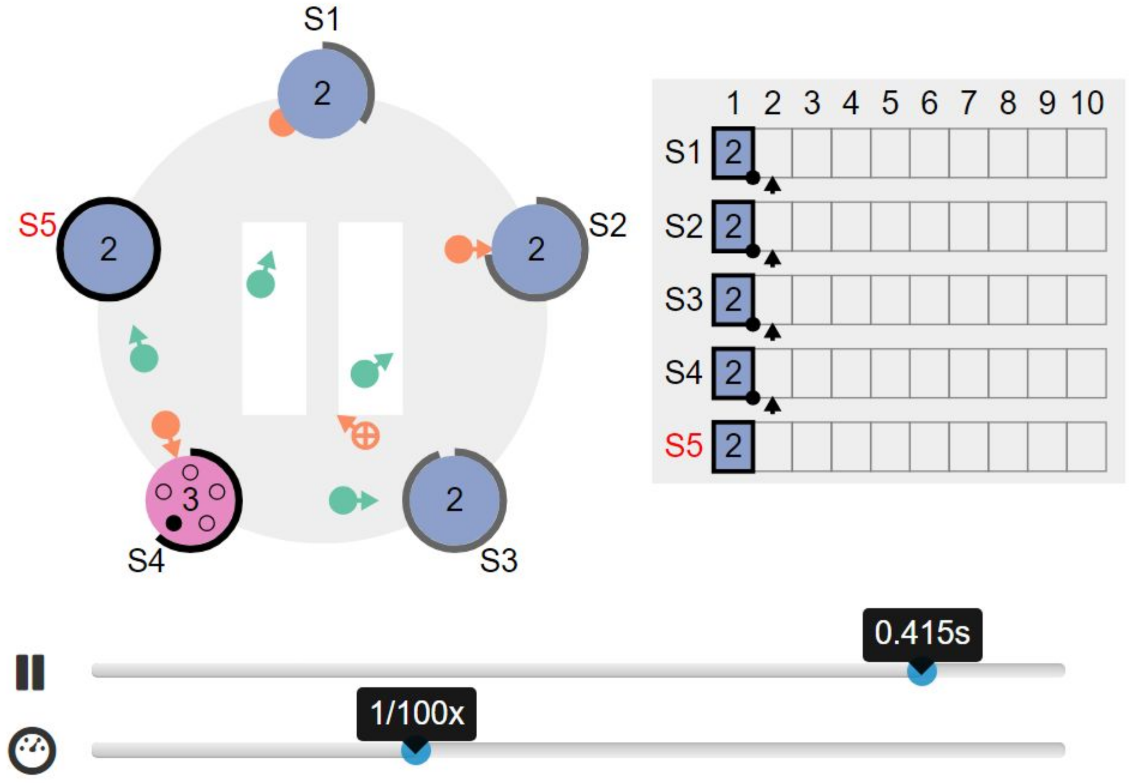


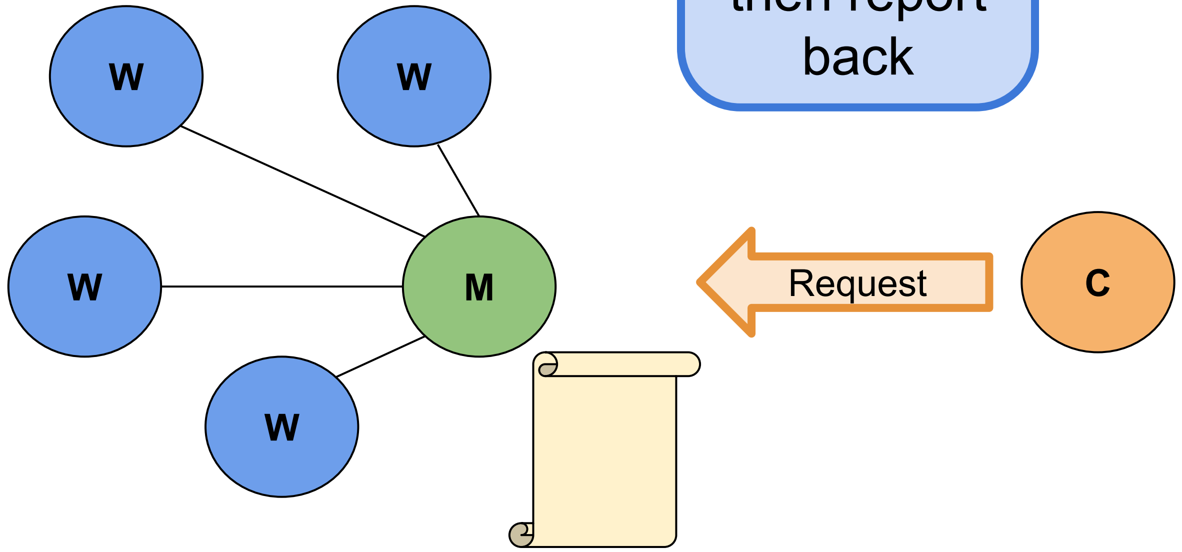




SER 321
RAFT

RAFT

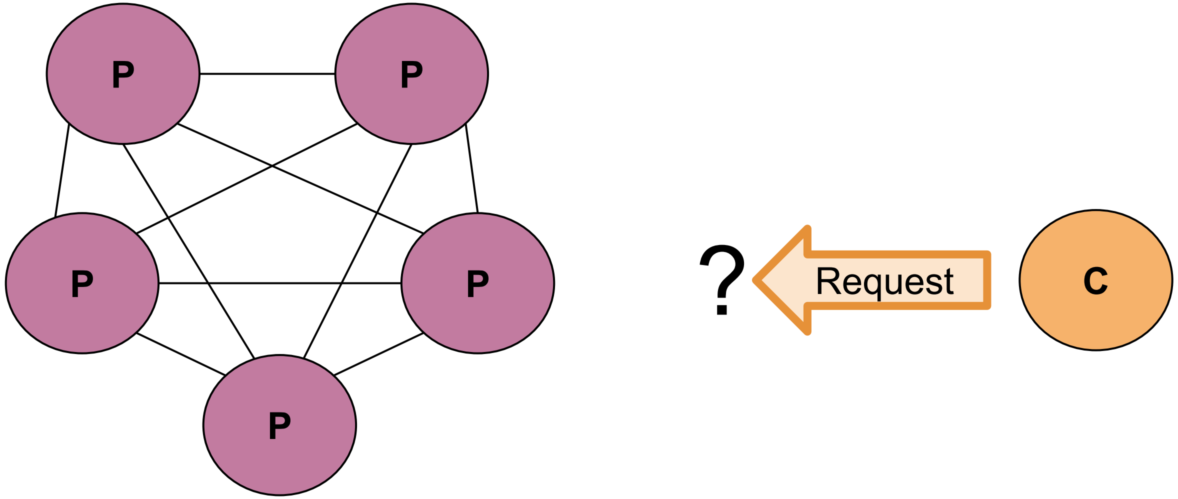




Workers only do their task then report back

Main is in charge of everything

How do we handle the client in a Peer to Peer system?

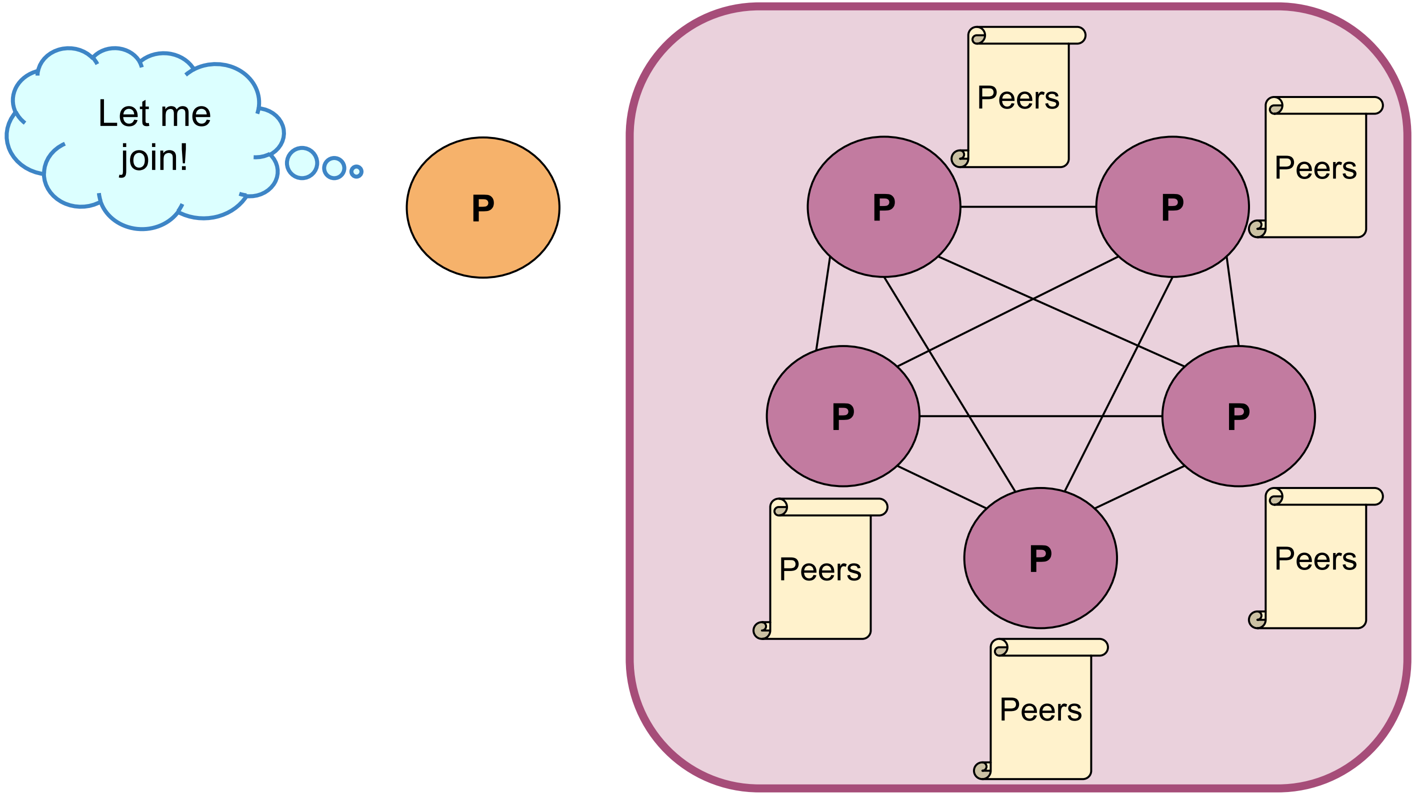


Request is sent to the *current leader*

or

Peer that received the request *acts as the leader*

What about *adding* a Peer to the Cluster?

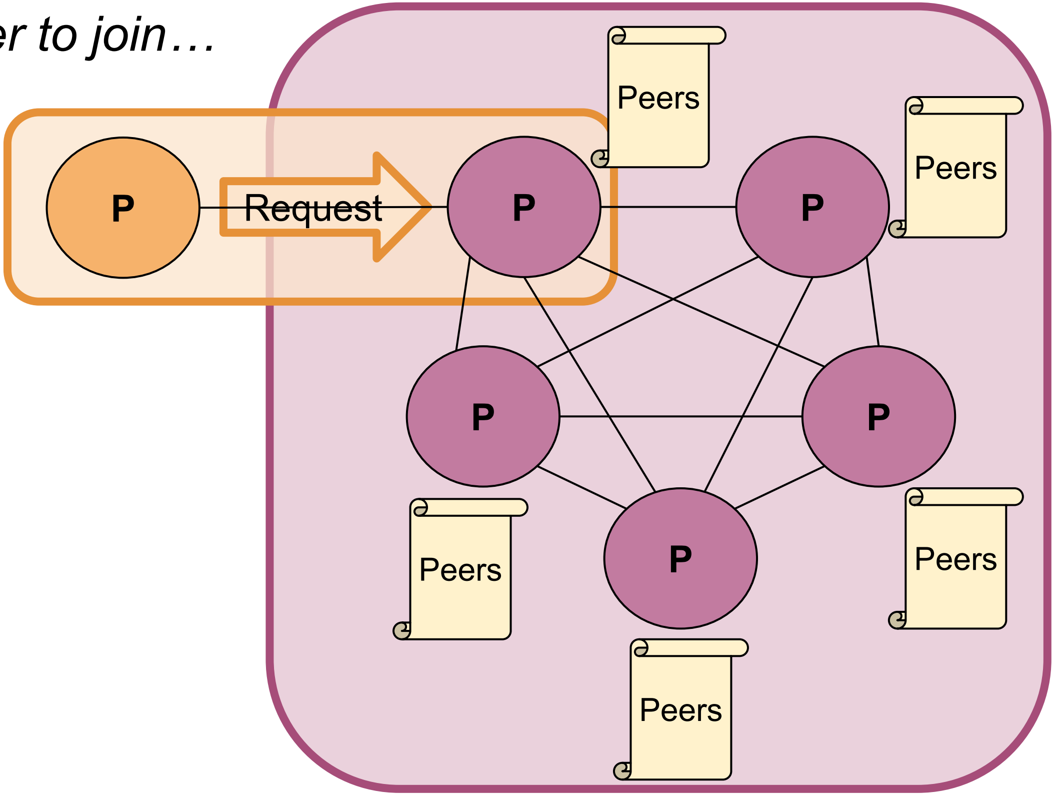


SER 321
Communication

What about ***adding*** a Peer to the Cluster?

Assuming we want to allow the peer to join…

Is that all?



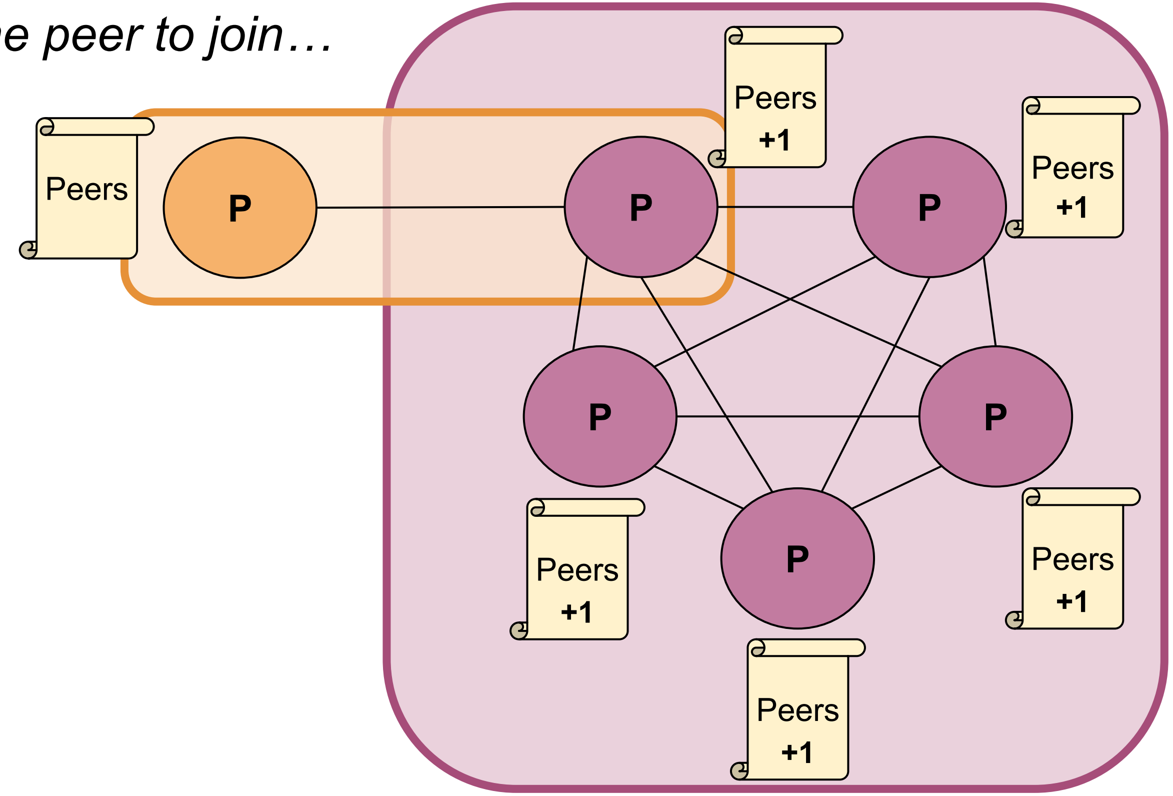
SER 321
Communication

What about ***adding*** a Peer to the Cluster?

Assuming we want to allow the peer to join…

Three Additional Steps:

1.
2.
3.



SER 321

Scratch Space

Upcoming Events

SI Sessions:

- Tuesday, February 18th at 11:00 am MST
- Thursday, February 20th at 7:00 pm MST
- Sunday, February 23rd at 7:00 pm MST

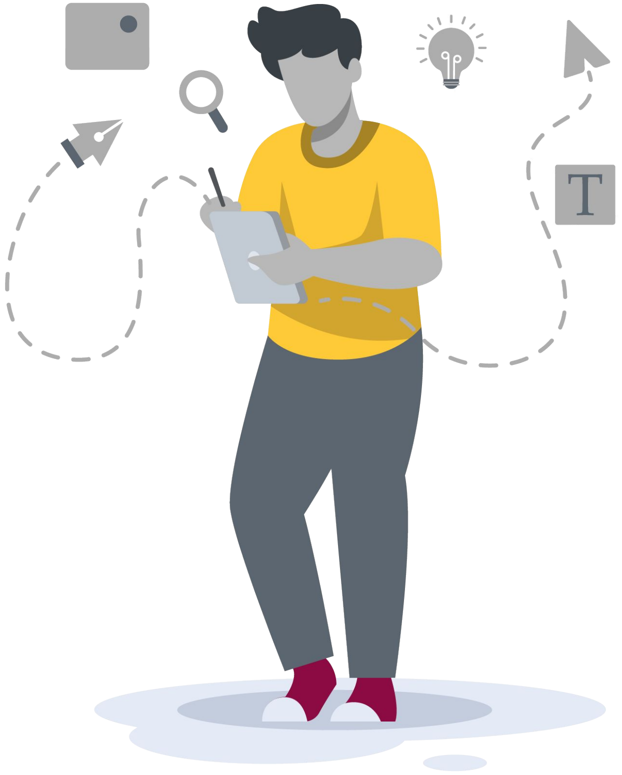
Review Sessions:

- 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:

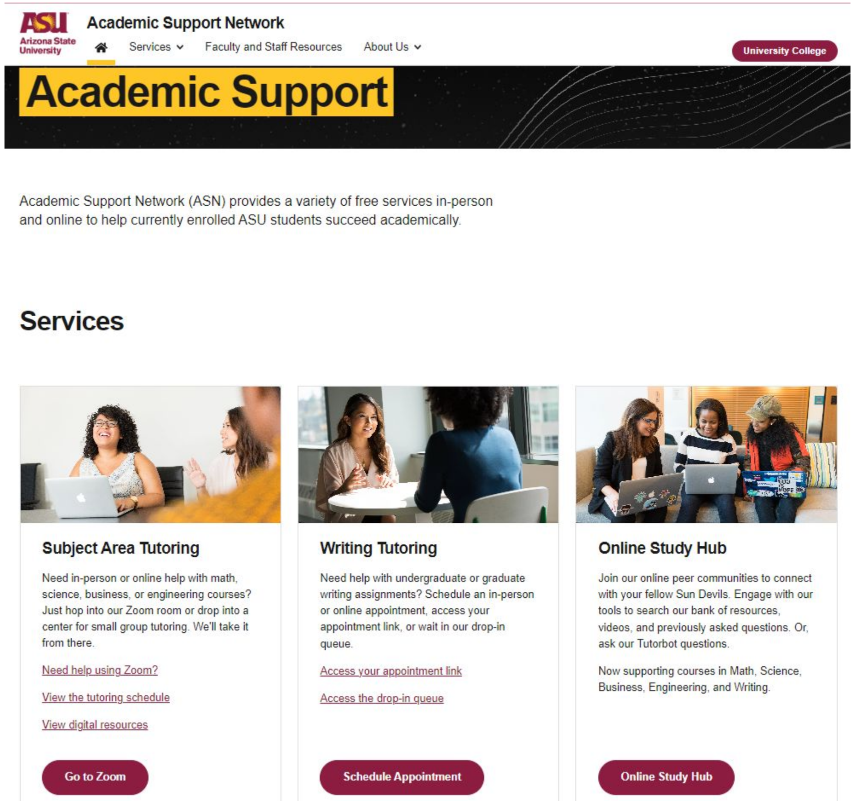
https://asuasn.info/ASNSurvey



More Questions?

Check out our other resources!

tutoring.asu.edu


Academic Support Network

Services | Faculty and Staff Resources | About Us | University College

Academic Support

Academic Support Network (ASN) provides a variety of free services in-person and online to help currently enrolled ASU students succeed academically.

Services

Subject Area Tutoring

Need in-person or online help with math, science, business, or engineering courses? Just hop into our Zoom room or drop into a center for small group tutoring. We'll take it from there.

Need help using Zoom?

View the tutoring schedule

View digital resources

Go to Zoom

Writing Tutoring

Need help with undergraduate or graduate writing assignments? Schedule an in-person or online appointment, access your appointment link, or wait in our drop-in queue.

Access your appointment link

Access the drop-in queue

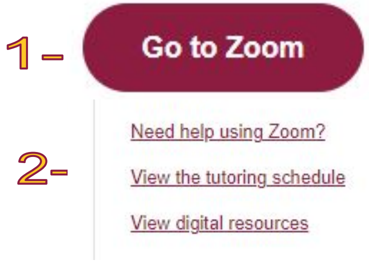
Schedule Appointment

Online Study Hub

Join our online peer communities to connect with your fellow Sun Devils. Engage with our tools to search our bank of resources, videos, and previously asked questions. Or, ask our Tutorbot questions.

Now supporting courses in Math, Science, Business, Engineering, and Writing.

Online Study Hub

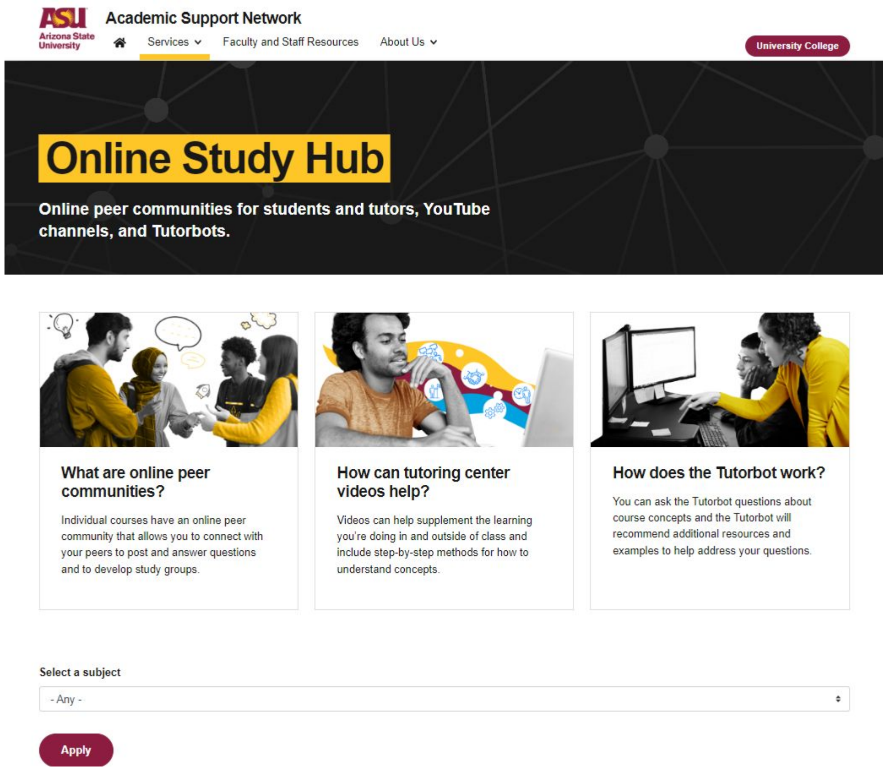


1. **Click on 'Go to Zoom' to log onto our Online Tutoring Center.**
2. **Click on 'View the tutoring schedule' to see when tutors are available for specific courses.**

More Questions?

Check out our other resources!

tutoring.asu.edu/online-study-hub



Online Study Hub

Online peer communities for students and tutors, YouTube channels, and Tutorbots.

What are online peer communities?

Individual courses have an online peer community that allows you to connect with your peers to post and answer questions and to develop study groups.

How can tutoring center videos help?

Videos can help supplement the learning you're doing in and outside of class and include step-by-step methods for how to understand concepts.

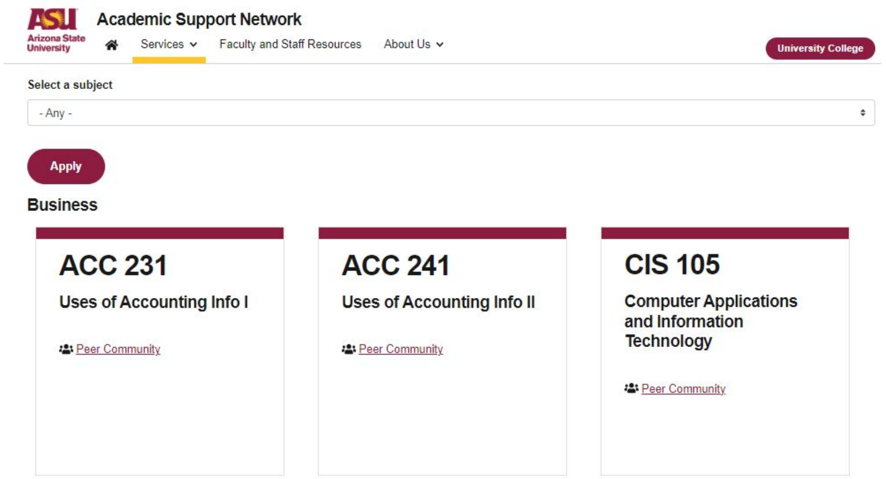
How does the Tutorbot work?

You can ask the Tutorbot questions about course concepts and the Tutorbot will recommend additional resources and examples to help address your questions.

Select a subject

- Any -

Apply



Select a subject

- Any -

Apply

Business

ACC 231

Uses of Accounting Info I

Peer Community

ACC 241

Uses of Accounting Info II

Peer Community

CIS 105

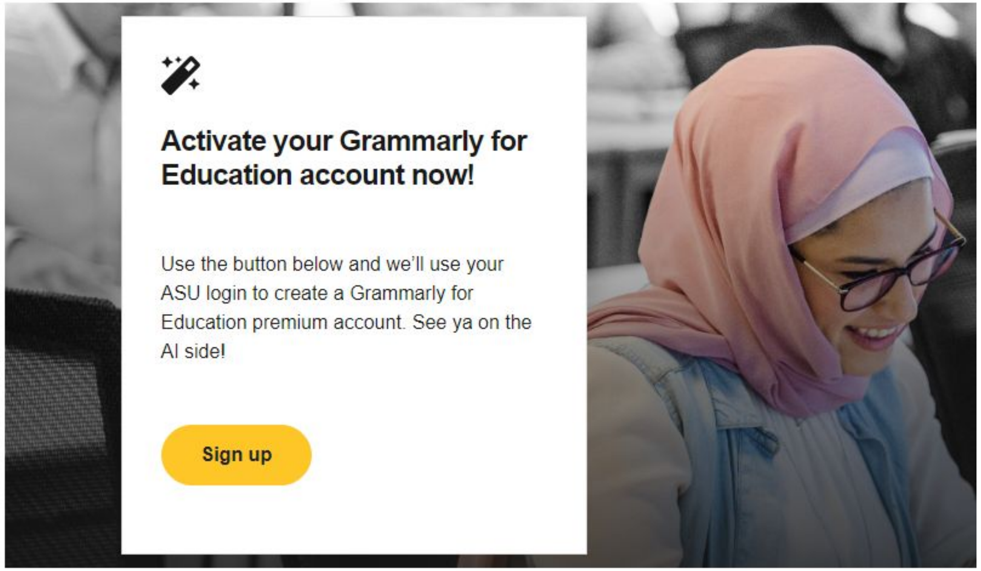
Computer Applications and Information Technology

Peer Community

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

Expanded Writing Support Available

Including Grammarly for Education, at no cost!



Activate your Grammarly for Education account now!

Use the button below and we'll use your ASU login to create a Grammarly for Education premium account. See ya on the AI side!

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
- RAFT