SER 321 B Session

SI Session

Tuesday, April 22nd 2025

10:00 am - 11:00 am MST

Agenda

- Process Flow Examination
- Consensus!
  - Types and Algorithms
  - RAFT
- Peer to Peer Differences

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
Assignment 5 PSA

No starter code for this assignment

Don’t panic - you have options!

SER 321

Assignment 5 PSA

No starter code for this assignment

Use a previous assignment as a starting point

Use a repo example as a starting point

Build from scratch

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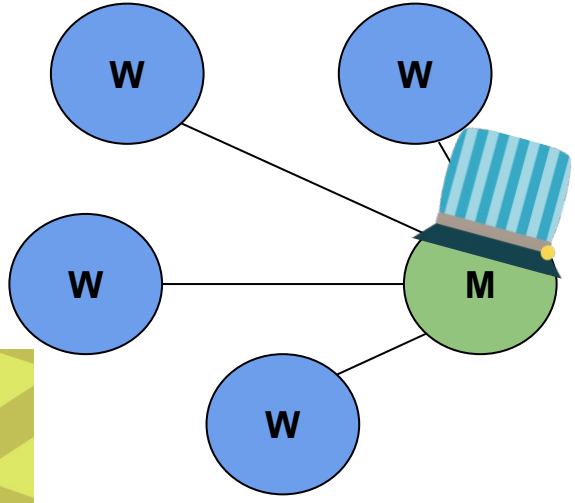
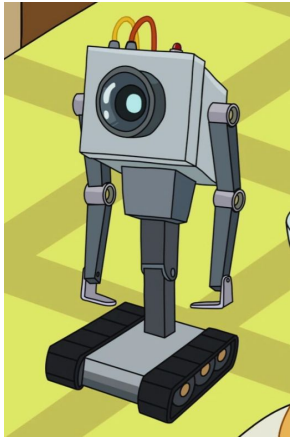
Communication



Workers only do their task then report back

Think worker bees or specialized machinery



Main is in charge of everything

Similar to _____ in our previous implementations

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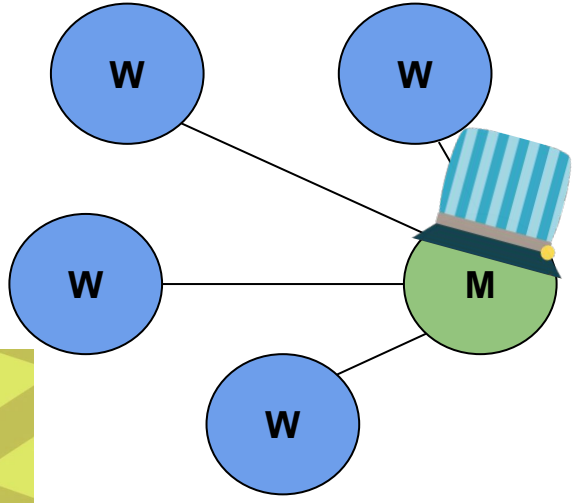
Communication



Request

C

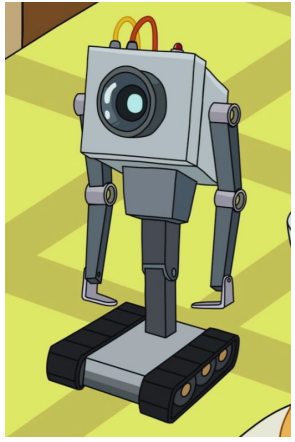
Workers only do their task then report back

Think worker bees or specialized machinery

What about Client Requests? Where do those get handled?

Main is in charge of everything

Similar to _____ in our previous implementations



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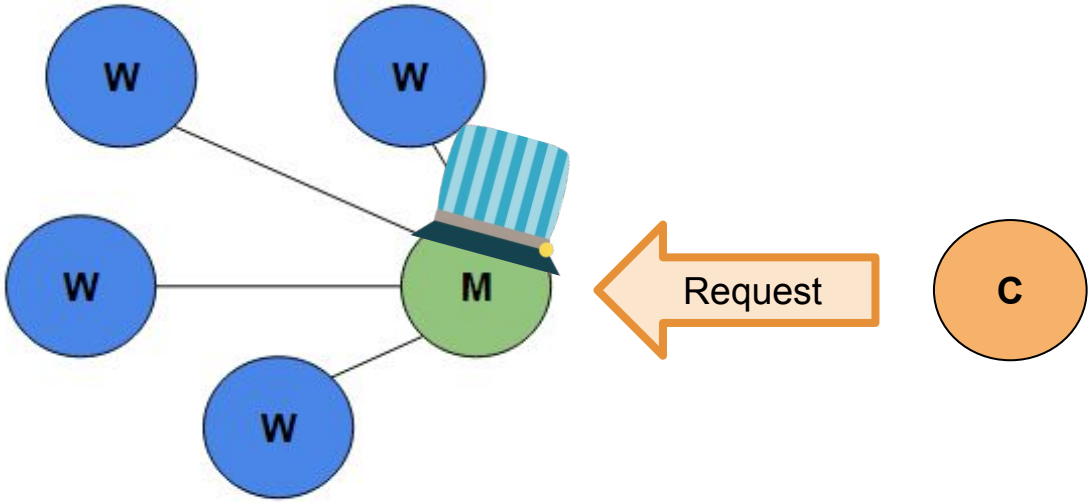
Distributed Systems

Process Flow!

DATA



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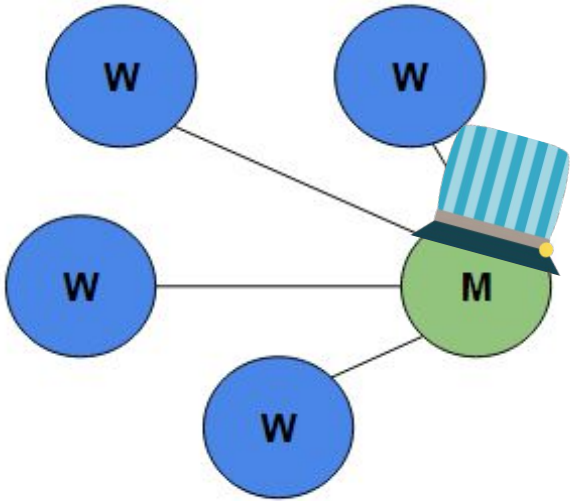
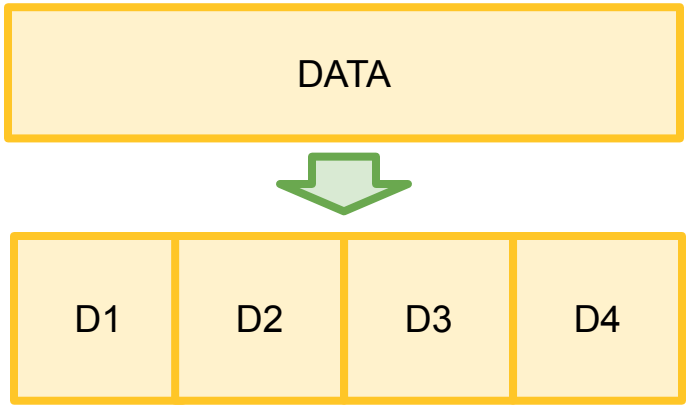
Distributed Systems

Process Flow!

Workers only do their task then report back





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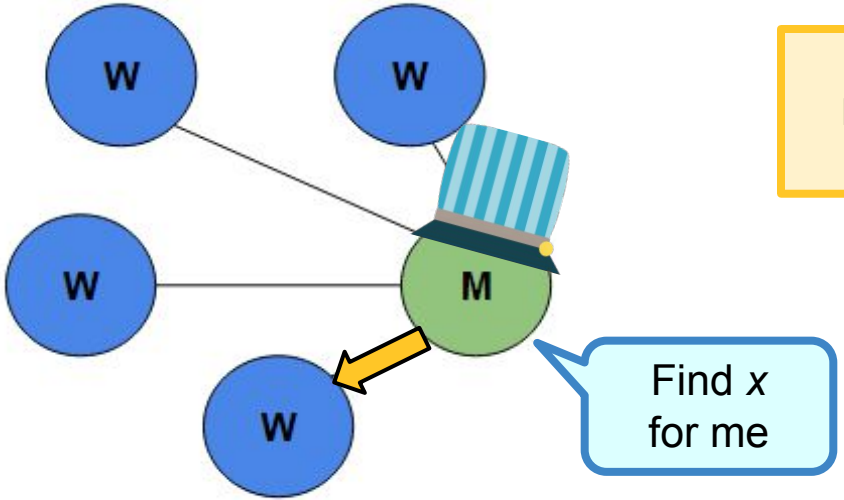
Distributed Systems

Process Flow!

DATA

D1	D2	D3	D4

Workers only do their task then report back



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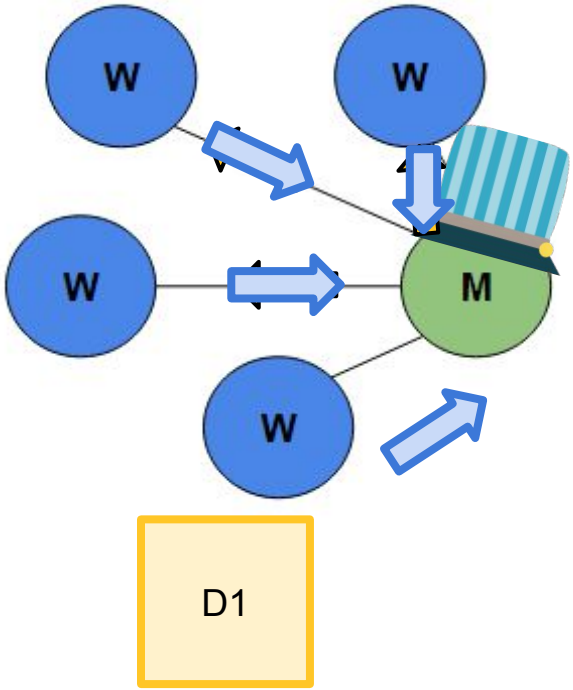
Distributed Systems

Process Flow!

Workers only do their task then report back



DATA

D1 | D2 | D3 | D4

D1 Result | D2 Result | D3 Result | D4 Result

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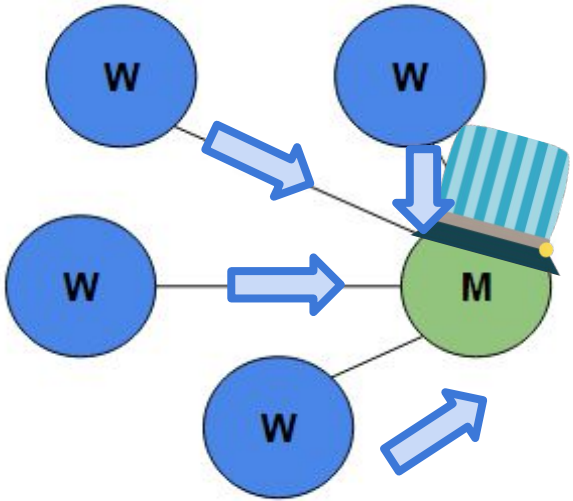
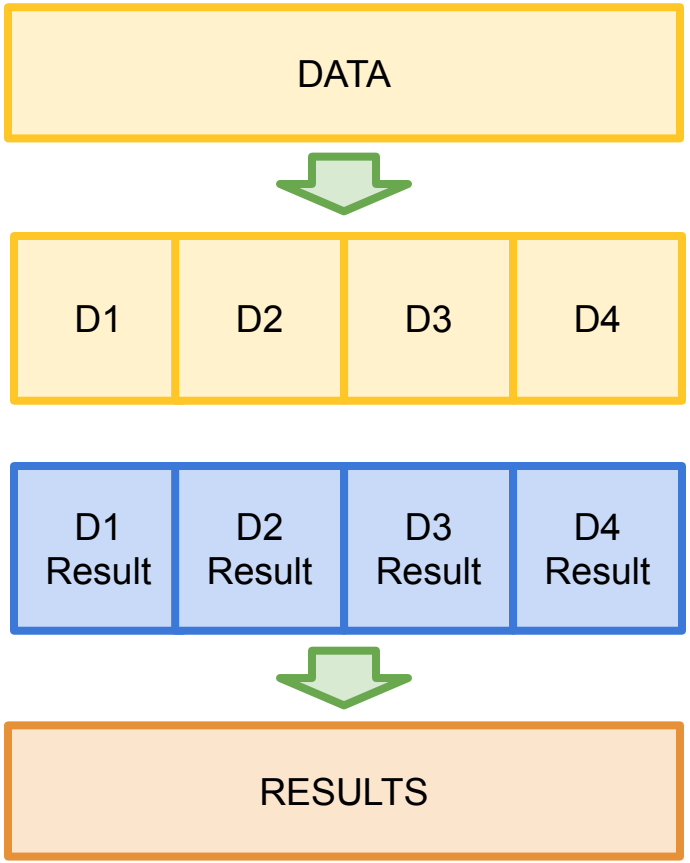
Distributed Systems

Process Flow!

Workers only do their task then report back





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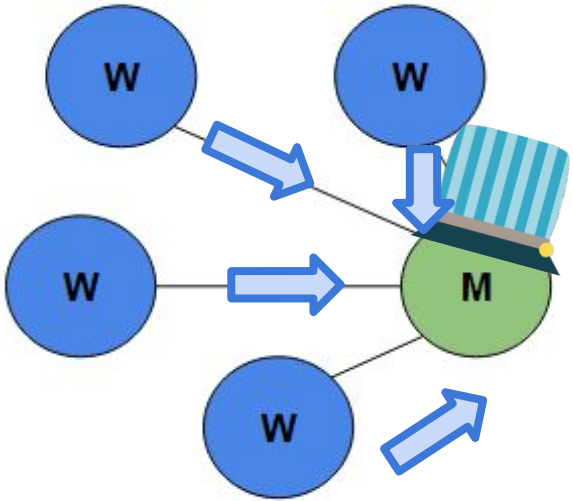
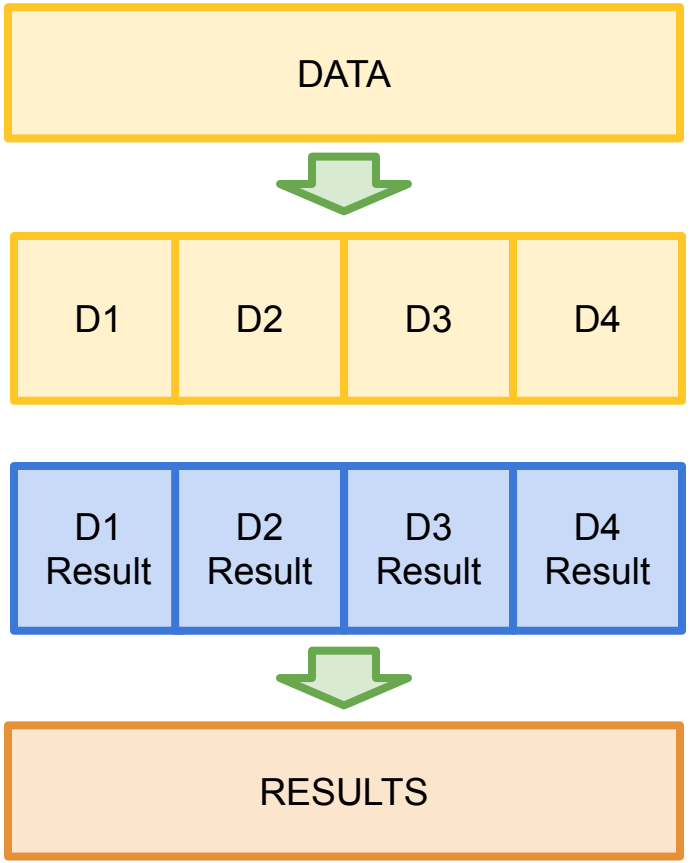
Distributed Systems

Does this look familiar?

How is this different from a parallel processing model?





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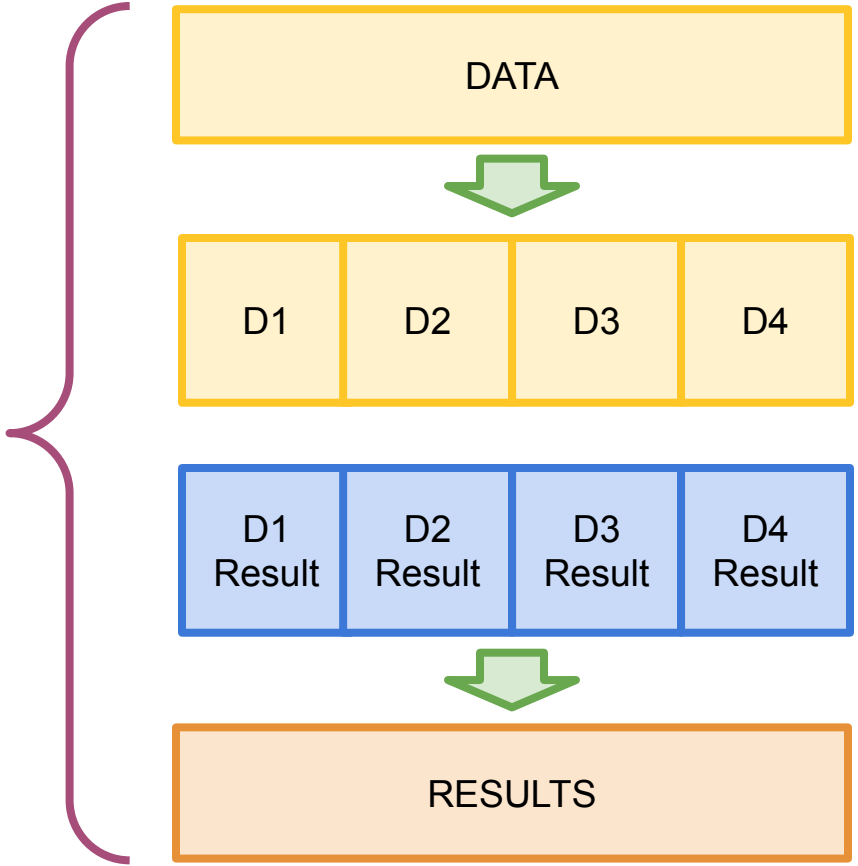
Distributed Systems

What about Peer to Peer?

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



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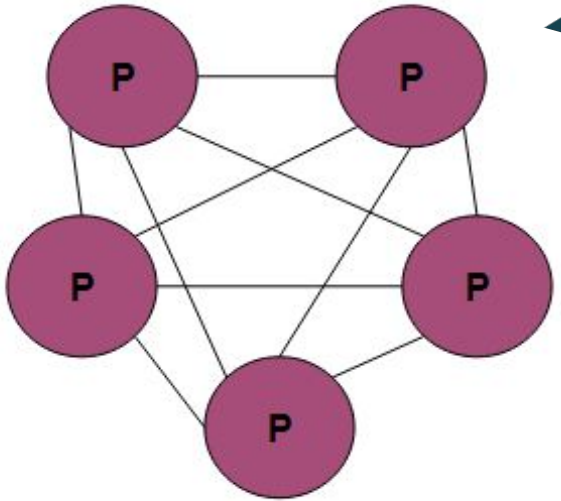
Distributed Systems

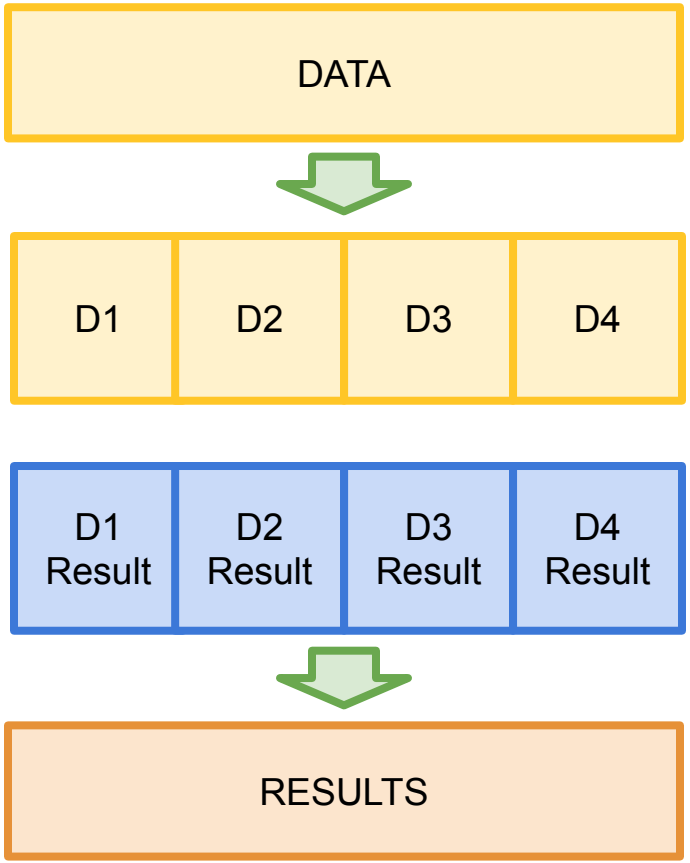
What about Peer to Peer?

We want someone to wear the conductor hat!

A ***LEADER***



How do we choose a leader?



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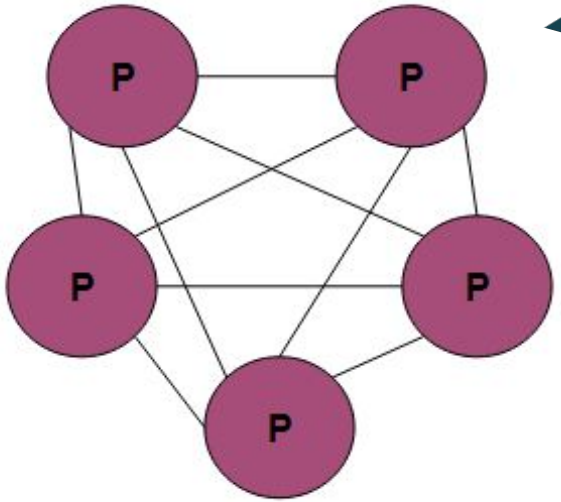

DATA

D1 | D2 | D3 | D4

D1 Result | D2 Result | D3 Result | D4 Result

RESULTS

Leader Election!

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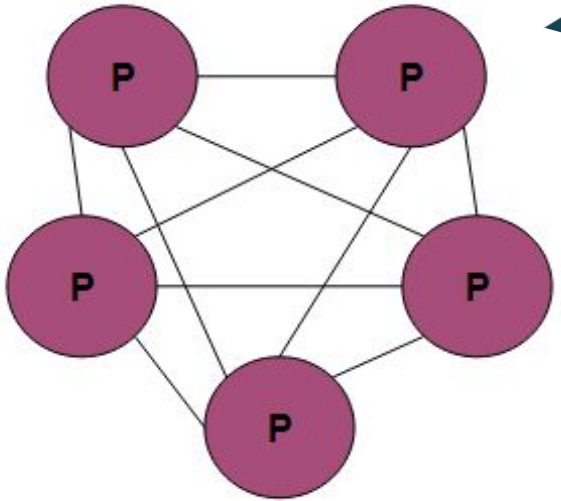
Distributed Systems

What about Peer to Peer?

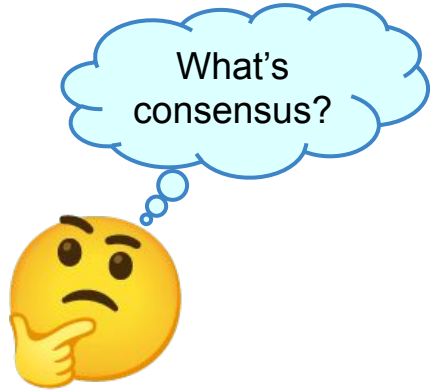
We want someone to wear the conductor hat!

A ***LEADER***



Leader Election!

Type of ***CONSENSUS***



"General agreement or trust amongst a group"

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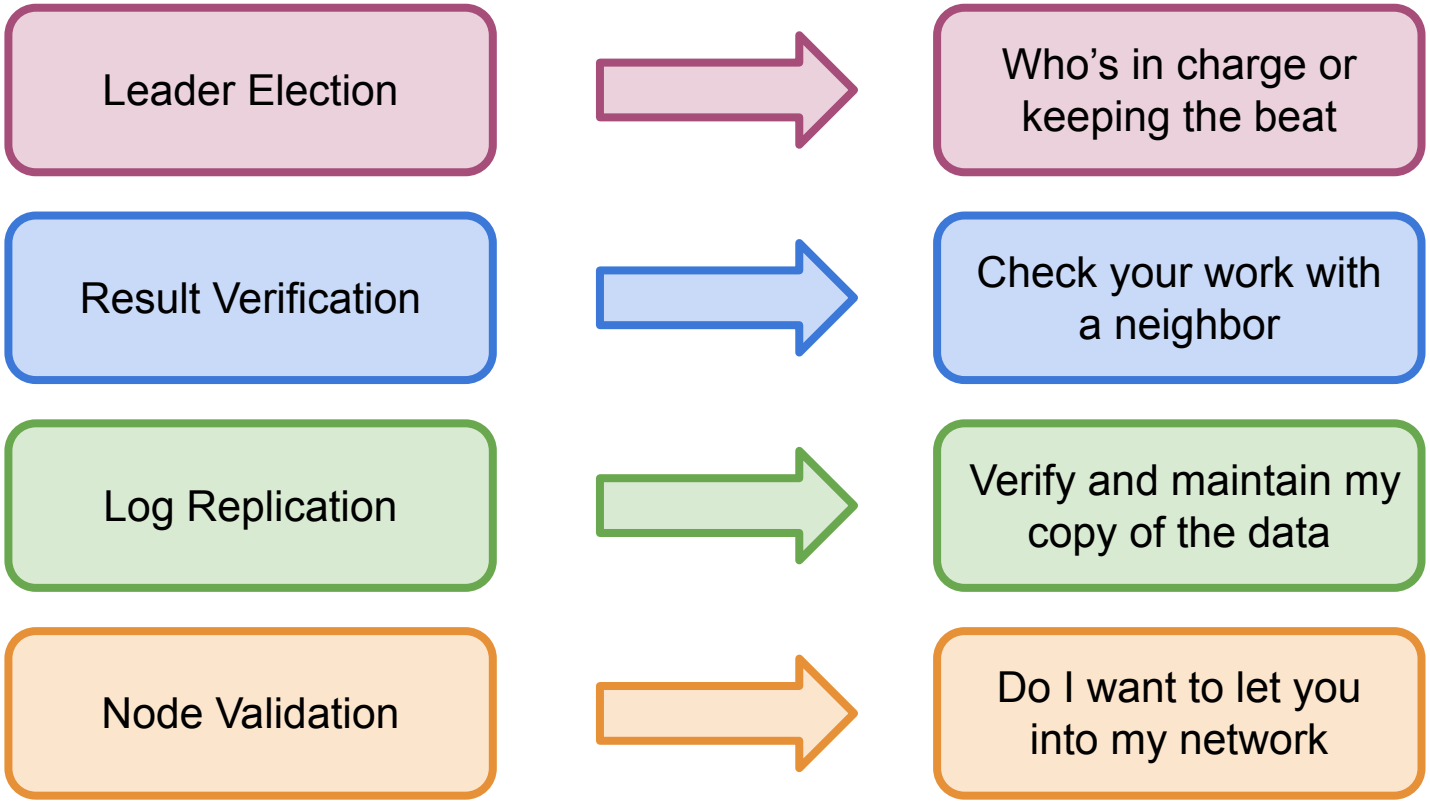
Consensus

"General agreement or trust amongst a group"

Types of Consensus?



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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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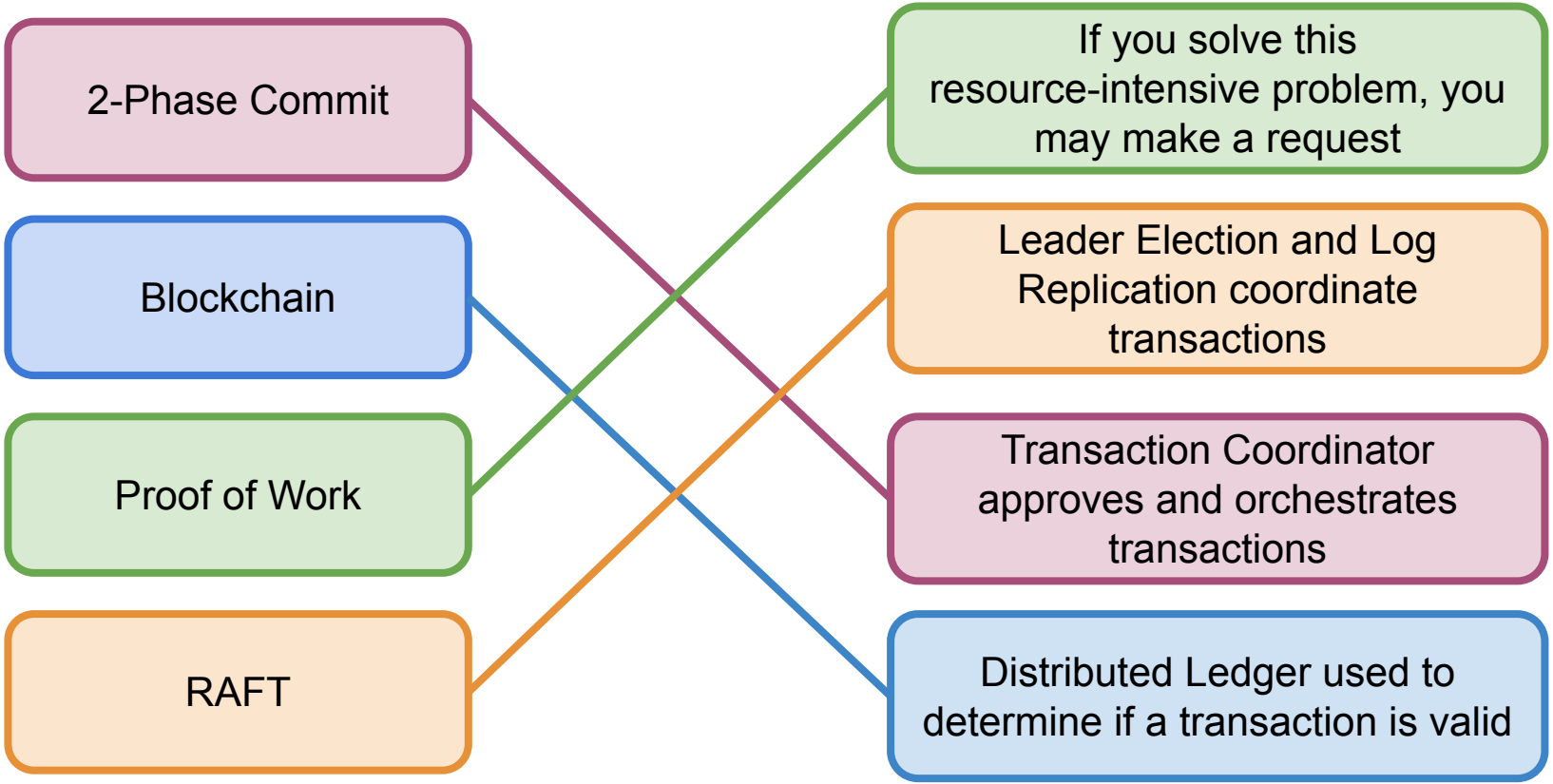
Consensus

Match the Consensus Algorithm to its Description!



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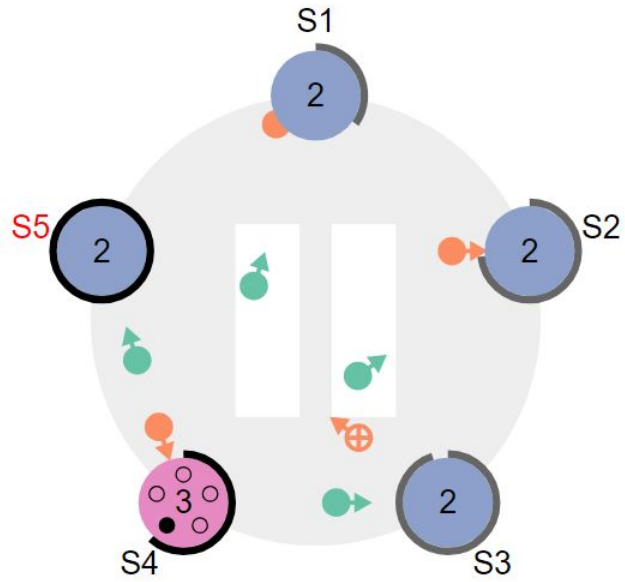
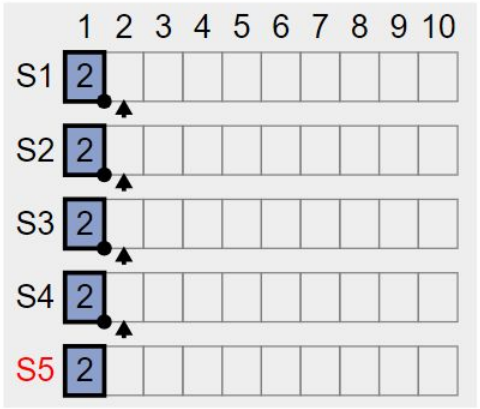
RAFT

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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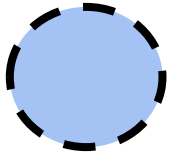
RAFT

Leader Election

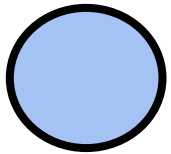
Nodes have 3 states:

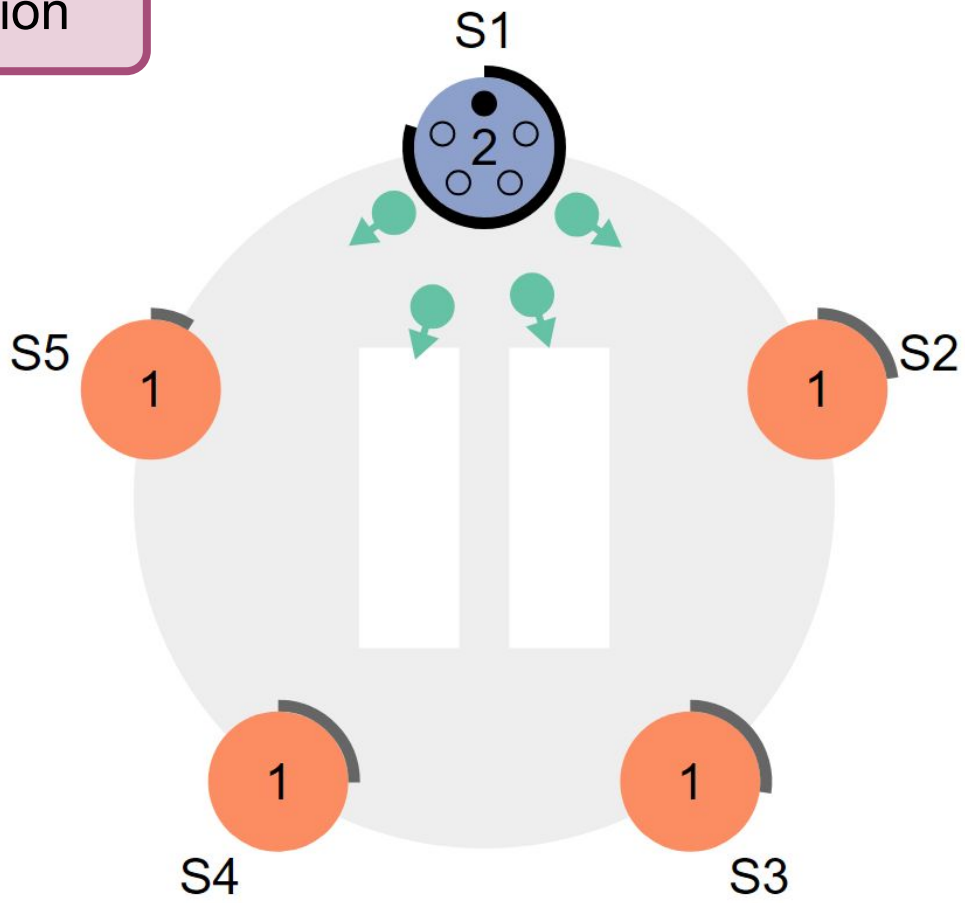
Follower

Candidate



Leader





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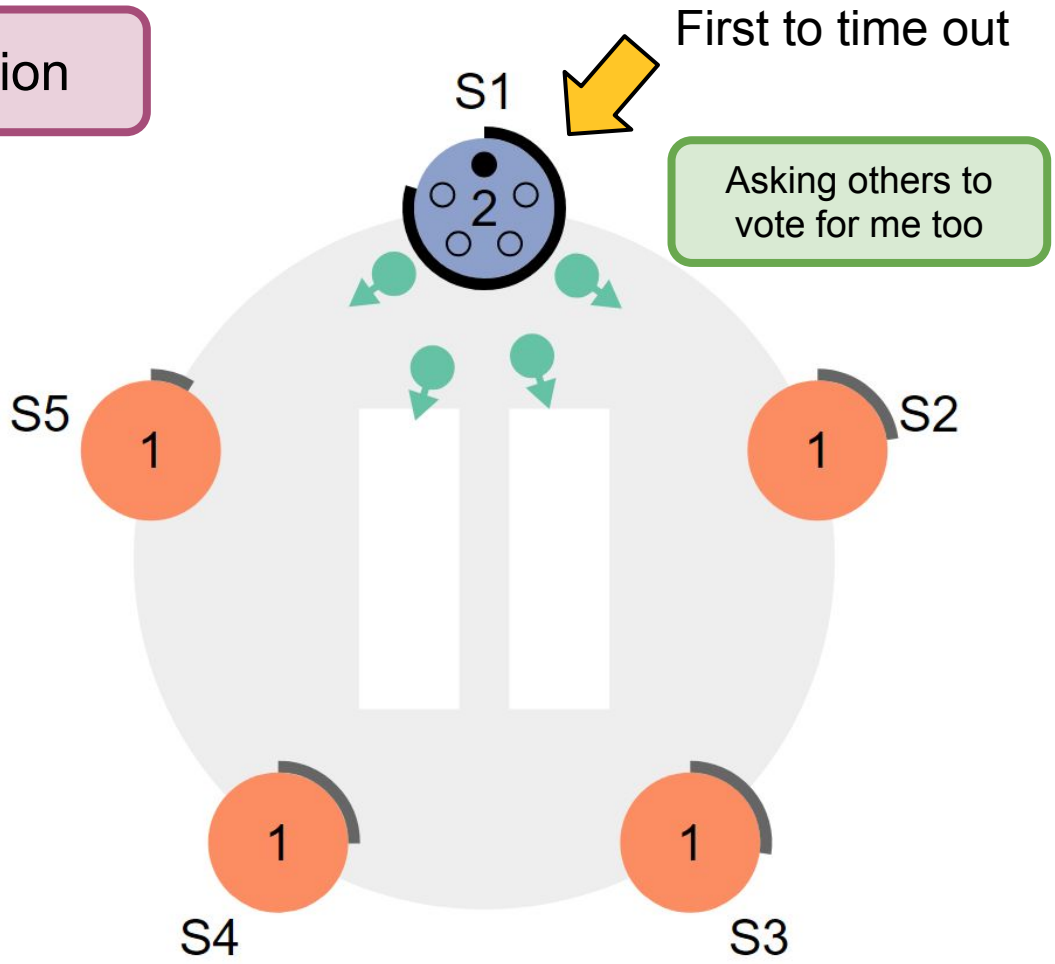
RAFT

Leader Election

This is the first election



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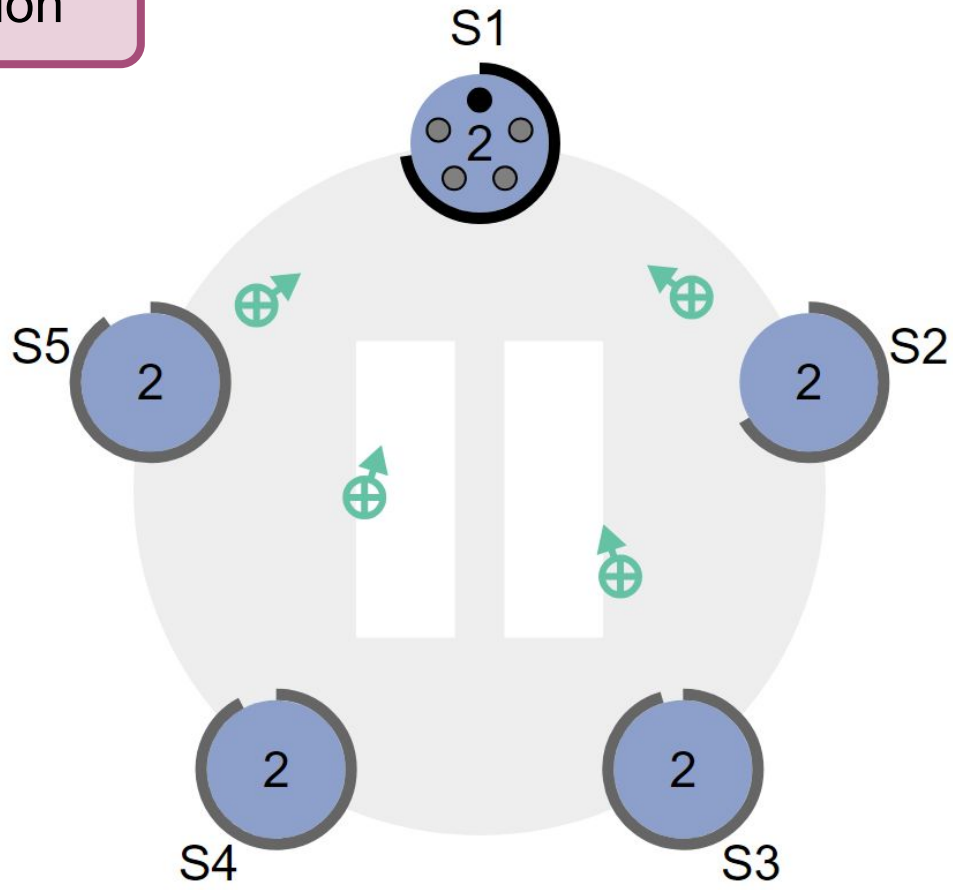
RAFT

Leader Election

Other nodes said sure whatever



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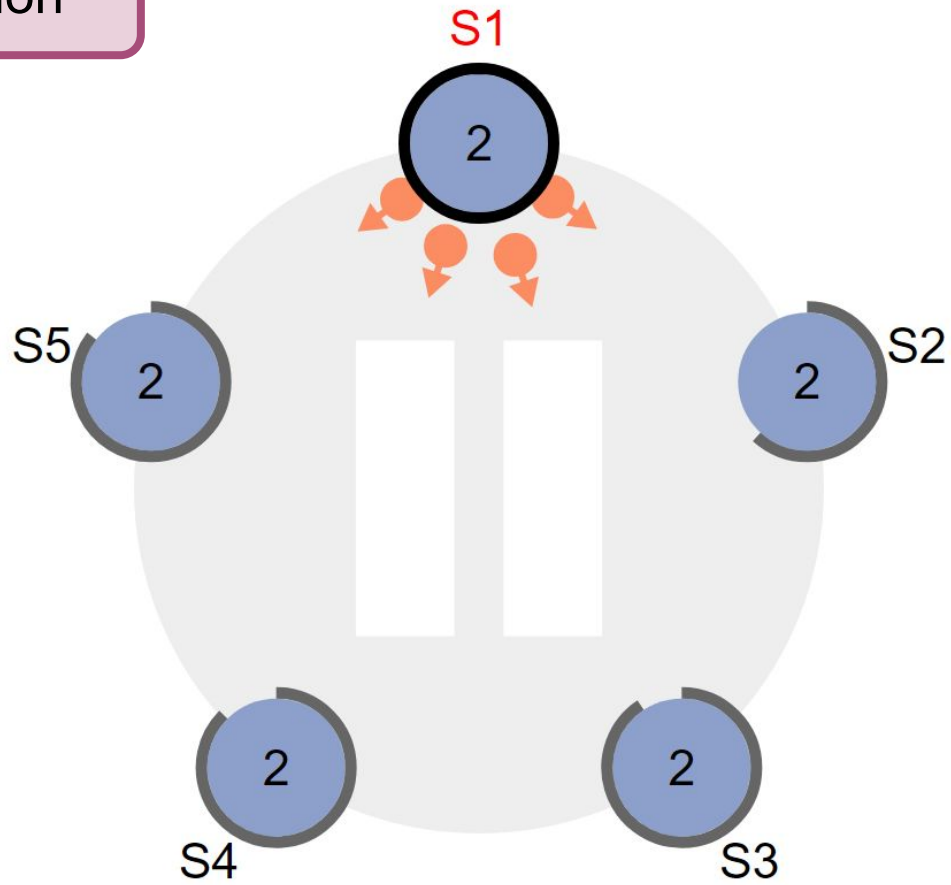
RAFT

Leader Election

Now confirmed as Leader



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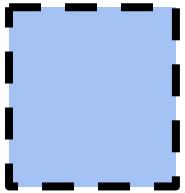
RAFT

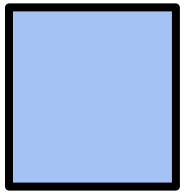
Log Replication

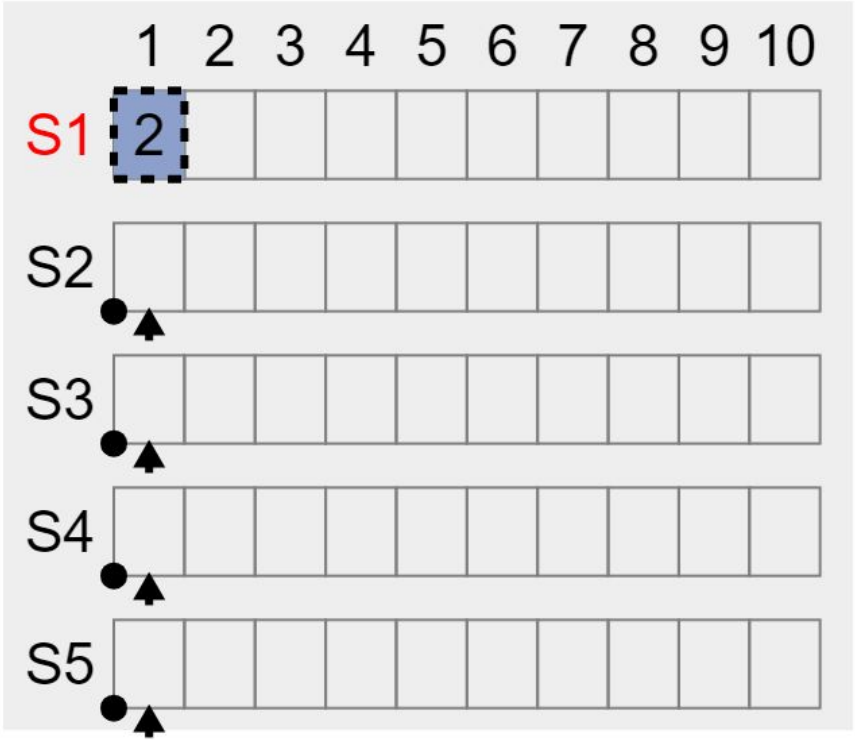
Same Pattern!

Candidate



Added





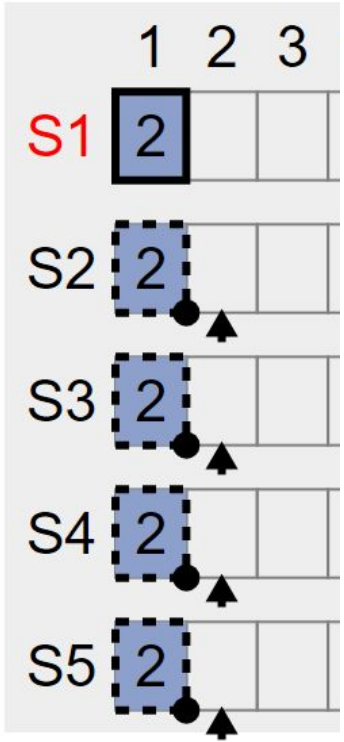
SER 321
RAFT

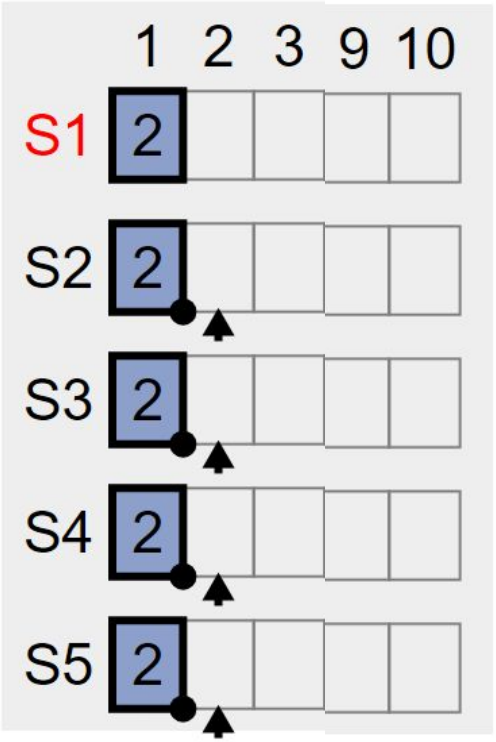
Log Replication

Same Pattern!

Candidate

Added





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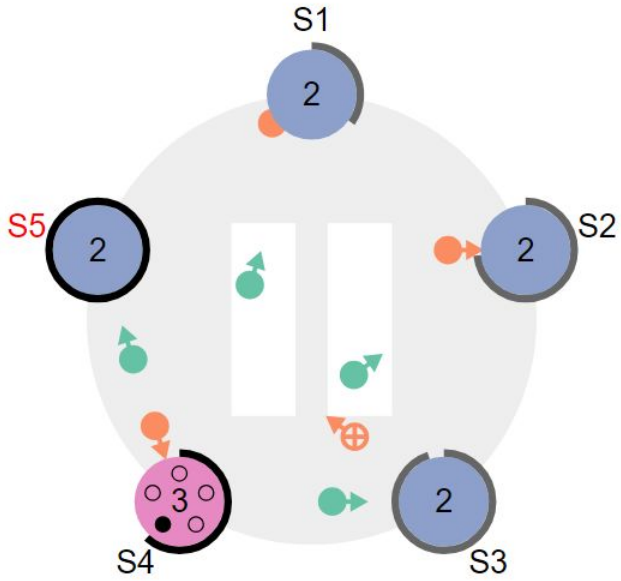
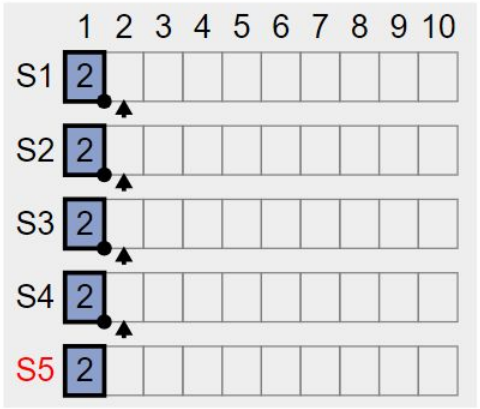
RAFT

RAFT





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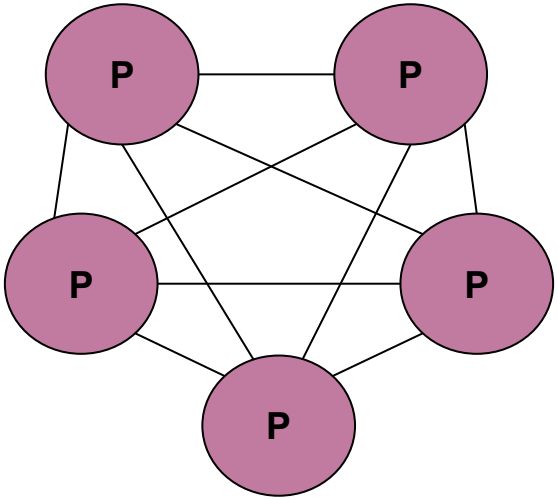
Communication

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



Request is sent/forwarded to the *current leader*

or

Peer that received the request *acts as the leader*

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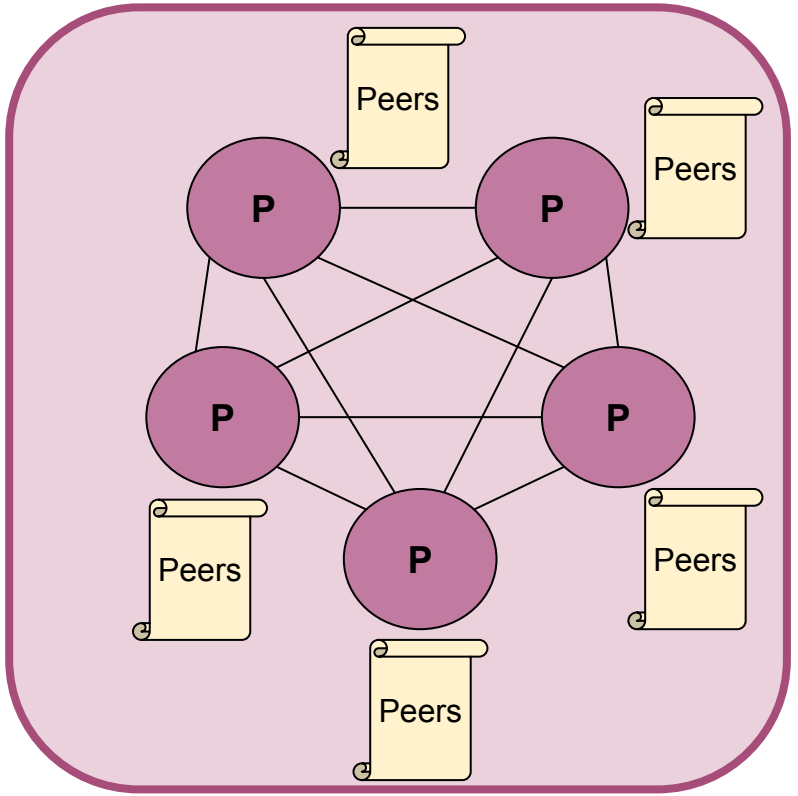
Communication

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



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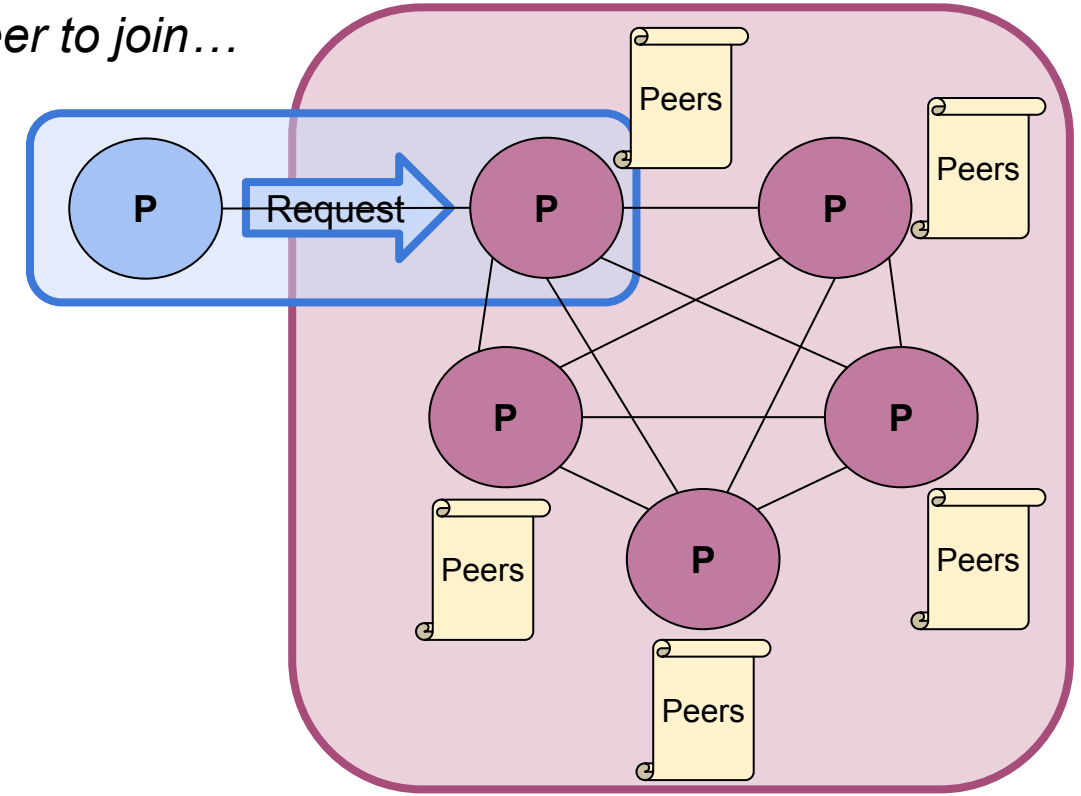
Communication

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

Assuming we want to allow the peer to join…

Is that all?



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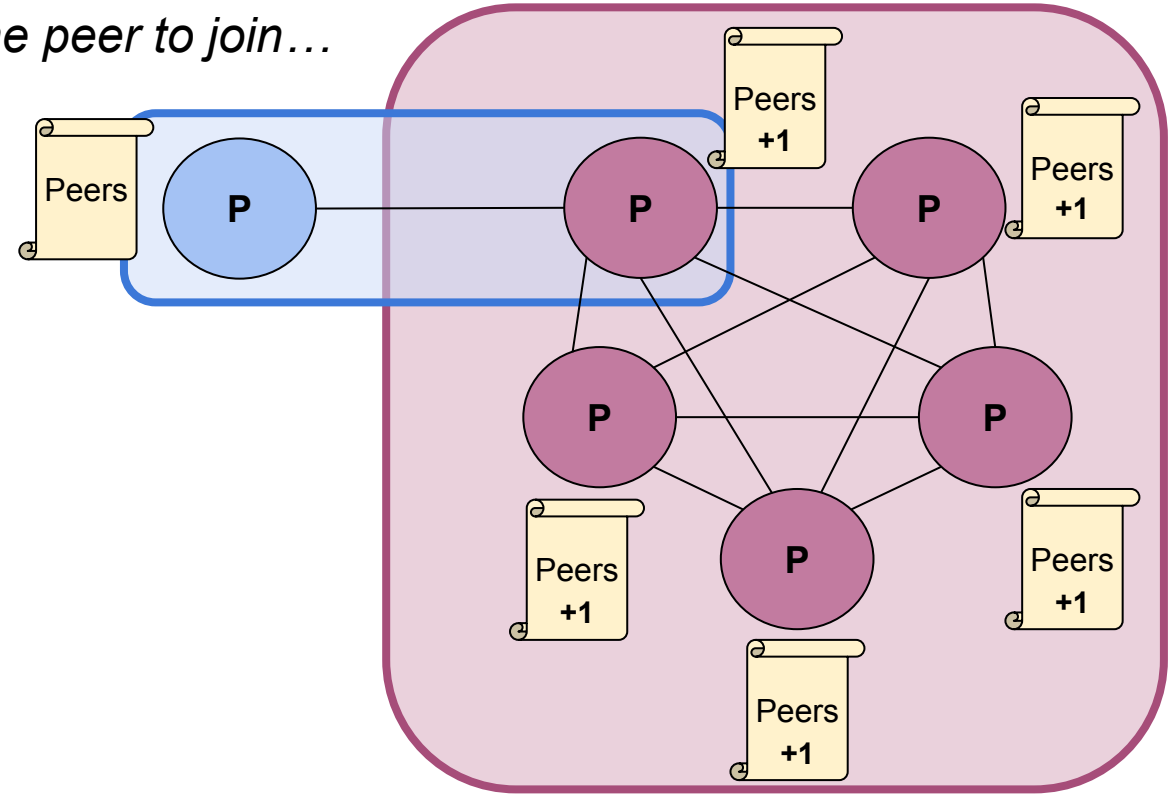
Communication

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

Assuming we want to allow the peer to join…

Three Additional Steps:

1.
2.
3.



SimplePeerToPeer

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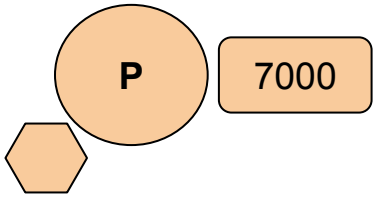
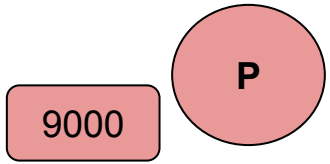
Communication

Remember that the OS allocates a new port for the client socket!

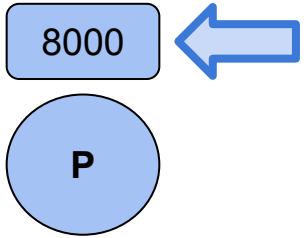
Run With:

```
gradle runPeer --args "Name Port"
```





We are going to take a closer look at the code in a moment!




```
gradle runPeer --args "Peer8000 8000"
```

SimplePeerToPeer

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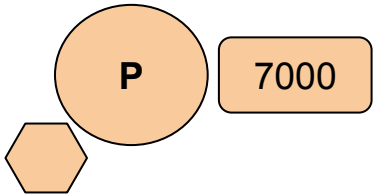
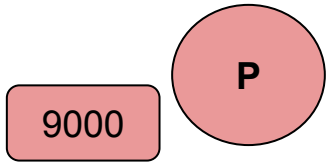
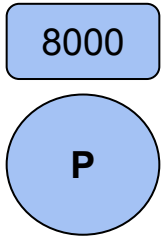
Communication

```
gradle runPeer --args "Peer7000 7000"
```

```
> Task :runPeer
Hello Peer7000 and welcome! Your port will be 7000
> Who do you want to listen to? Enter host:port
<==========----> 75% EXECUTING [21s]
> :runPeer
```








```
gradle runPeer --args "Peer8000 8000"
```

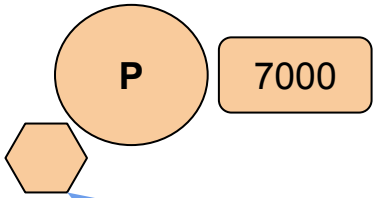
```
> Task :runPeer
Hello Peer8000 and welcome! Your port will be 8000
> Who do you want to listen to? Enter host:port
<==========----> 75% EXECUTING [21s]
> :runPeer
```

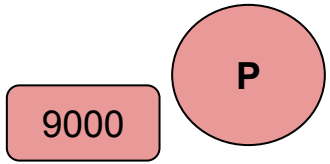
SimplePeerToPeer

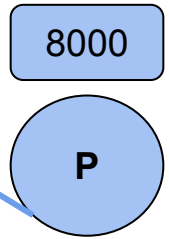
SER 321
Communication

```
gradle runPeer --args "Peer7000 7000"
```

```
> Task :runPeer
Hello Peer7000 and welcome! Your port will be 7000
> Who do you want to listen to? Enter host:port
<==========----> 75% EXECUTING [21s]
> :runPeer
```








```
> Task :runPeer
Hello Peer8000 and welcome! Your port will be 8000
> Who do you want to listen to? Enter host:port
<<===<==<<==<=<==========----> 75% EXECUTING [1m 56s]
> You can now start chatting (exit to exit)
<==========----> 75% EXECUTING [2m 3s]
> :runPeer
```

SimplePeerToPeer

SER 321
Communication

What will happen?

```
> Task :runPeer
Hello Peer7000 and welcome! Your port will be 7000
> Who do you want to listen to? Enter host:port
<==========----> 75% EXECUTING [21s]
> :runPeer
```

```
> Task :runPeer
Hello Peer8000 and welcome! Your port will be 8000
> Who do you want to listen to? Enter host:port
<<===<==<<==<=<==========----> 75% EXECUTING [1m 56s]
> You can now start chatting (exit to exit)
<<<==<=<==========----> 75% EXECUTING [3m 33s]
<==========----> 75% EXECUTING [3m 37s]
hi 7000
```

8000

Why?

9000

P

8000

P

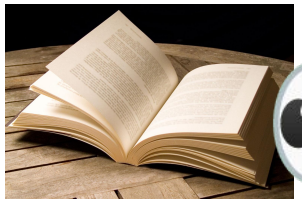
```
PS C:\ASU\SER321\examples_repo\ser321examples\Sockets\S
Starting a Gradle Daemon, 1 busy and 1 stopped Daemons
```

```
> Task :runPeer
Hello Peer7000 and welcome! Your port will be 7000
> Who do you want to listen to? Enter host:port
<==========----> 75% EXECUTING [2m 48s]
> :runPeer
```

7000

```
> Task :runPeer
Hello Peer8000 and welcome! Your port will be 8000
> Who do you want to listen to? Enter host:port
<<===<==<<==<=<==========----> 75% EXECUTING [1m 56s]
> You can now start chatting (exit to exit)
<<<==<=<==========----> 75% EXECUTING [3m 13s]
> :runPeer
hi 7000
```

SER 321
Communication



```
> Task :runPeer
Hello Peer7000 and welcome! Your port will be 7000
> Who do you want to listen to? Enter host:port
<=<====<==<===<----------> 75% EXECUTING [3m 22s]
> :runPeer
localhost:8000
```

P

7000

Telling Peer7000 about Peer8000

8000

P

HEY DUDE,
LISTEN TO THIS!

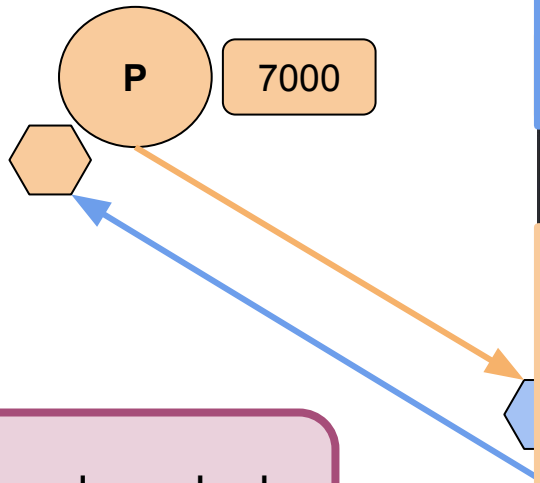
```
> Task :runPeer
Hello Peer8000 and welcome! Your port will be 8000
> Who do you want to listen to? Enter host:port
<<===<==<<==<=<----------> 75% EXECUTING [1m 56s]
> You can now start chatting (exit to exit)
<----------> 75% EXECUTING [2m 3s]
> :runPeer
```

SER 321
Communication

```
> Task :runPeer
Hello Peer7000 a
> Who do you wan
<=<====<==<===<
> :runPeer
localhost:8000
```

```
> Task :runPeer
Hello Peer8000 and welcome! Your port will be 8000
> Who do you want to listen to? Enter host:port
<===<<====<=<=<==========----> 75% EXECUTING [3m 4s]
> You can now start chatting (exit to exit)
[Peer7000]: Hi Peer8000!
<==========----> 75% EXECUTING [4m 4s]
> :runPeer
```

8000




```
PS C:\ASU\SER321\examples_repo\ser321examples\Sockets\
```

```
> Task :runPeer
Hello Peer7000 and welcome! Your port will be 7000
> Who do you want to listen to? Enter host:port
<=<====<==<===<==========----> 75% EXECUTING [3m 43s]
> You can now start chatting (exit to exit)
<<<=<===<==<<==========----> 75% EXECUTING [3m 58s]
<==========----> 75% EXECUTING [4m 1s]
Hi Peer8000!
```

7000

Let's take a closer look at the Code!

SimplePeerToPeer

SER 321
Communication

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

    BufferedReader bufferedReader = new BufferedReader(new InputStreamReader(System.in));
    String username = args[0];
    System.out.println("Hello " + username + " and welcome! Your port will be " + args[1]);

    // starting the Server Thread, which waits for other peers to want to connect
    ServerThread serverThread = new ServerThread(args[1]);
    serverThread.start();
    Peer peer = new Peer(bufferedReader, args[0], serverThread);
    peer.updateListenToPeers();
```

ServerThread

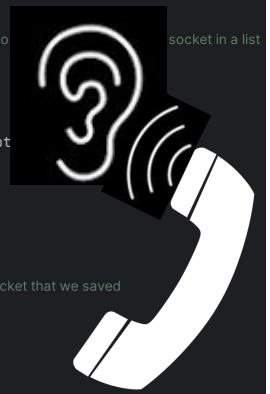
Peer

```java
public class ServerThread extends Thread{
    2 usages
    private ServerSocket serverSocket;
    2 usages
    private Set<Socket> listeningSockets = new HashSet<~>();

    1 usage
    public ServerThread(String portNum) throws IOException {
        serverSocket = new ServerSocket(Integer.valueOf(portNum));
    }

    Starting the thread, we are waiting for clients wanting to  socket in a list
    public void run() {
        try {
            while (true) {
                Socket sock = serverSocket.accept
                listeningSockets.add(sock);
            }
        } catch (Exception e) {...}
    }

    Sending the message to the OutputStream for each socket that we saved
    1 usage
    void sendMessage(String message) {
        try {
            for (Socket s : listeningSockets) {
                PrintWriter out = new PrintWriter(s.getOutputStream(), true);
                out.println(message);
            }
        } catch(Exception e) {...}
    }
}
```



ClientThread

```java
public class ClientThread extends Thread {
    2 usages
    private BufferedReader bufferedReader;

    1 usage
    public ClientThread(Socket socket) throws IOException {
        bufferedReader = new BufferedReader(new InputStreamRead  et.getI
    }
    public void run() {
        while (true) {
            try {
                JSONObject json = new JSONObject(bufferedReader.readLi
                System.out.println("[" + json.getString("username")+"]:    + json.getString( message ));
            } catch (Exception e) {...}
        }
    }
}
```

SimplePeerToPeer

SER 321
Communication

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

    BufferedReader bufferedReader = new BufferedReader(new InputStreamReader(System.in));
    Strin
    Syste

    // st
```

```
public class ClientThread extends Thread {
    2 usages
    private BufferedReader bufferedReader;

    1 usage
    public ClientThread(Socket socket) throws IOException {
        bufferedReader = new BufferedReader
            (new InputStreamReader(socket.getInputStream()));
    }
    public void run() {
        while (true) {
            try {
                JSONObject json =
                    new JSONObject(bufferedReader.readLine());
                System.out.println
                    ("[" + json.getString("username")+"]: "
                        + json.getString("message"));
            } catch (Exception e) {...}
        }
    }
}
```

ClientThread

```
public void updateListenToPeers() throws Exception {
    System.out.println("> Who do you want to listen to? Enter host:port");
    String input = bufferedReader.readLine();
    String[] setupValue = input.split(" ");
    for (int i = 0; i < setupValue.length; i++) {
        String[] address = setupValue[i].split(":");
        Socket socket = null;
        try {
            socket = new Socket(address[0], Integer.valueOf(address[1]));
            new ClientThread(socket).start();
        } catch (Exception c) {
            if (socket != null) {
                socket.close();
            } else {
                System.out.println("Cannot connect, wrong input");
                System.out.println("Exiting: I know really user friendly");
                System.exit(0);
            }
        }
    }
    askForInput();
```

Peer.updateListenToPeers

SER 321

Scratch Space

Upcoming Events

SI Sessions:

- Thursday, April 24th at 7:00 pm MST
- Sunday, April 27th at **6:00 pm** MST - **2 hour Exam Review Session**
- Tuesday, April 29th, at 10:00 am MST - **Q&A Session**

Review Sessions:

- Sunday, April 27th at **6:00 pm** MST - **2 hour Exam Review Session**
- Tuesday, April 29th, at 10:00 am MST - **Q&A Session**

Questions?

Survey:

https://asuasn.info/ASNSurvey

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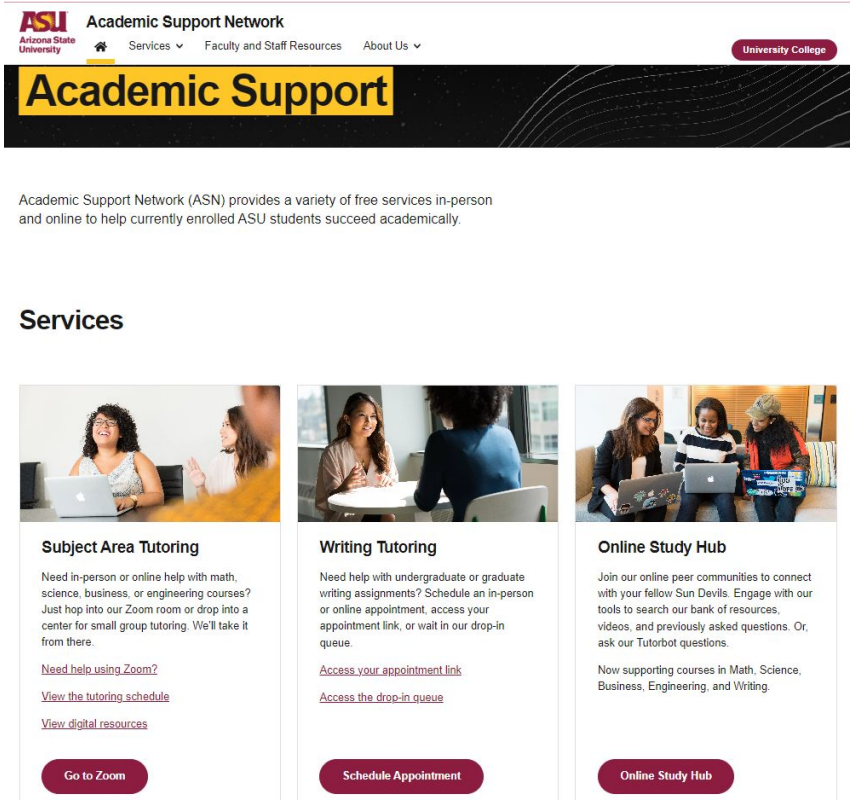
More Questions?

Check out our other resources!

tutoring.asu.edu

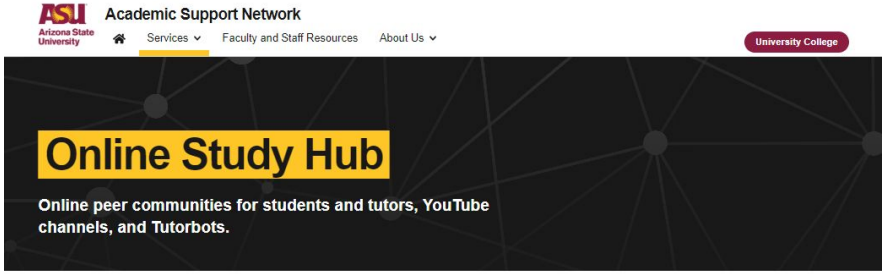


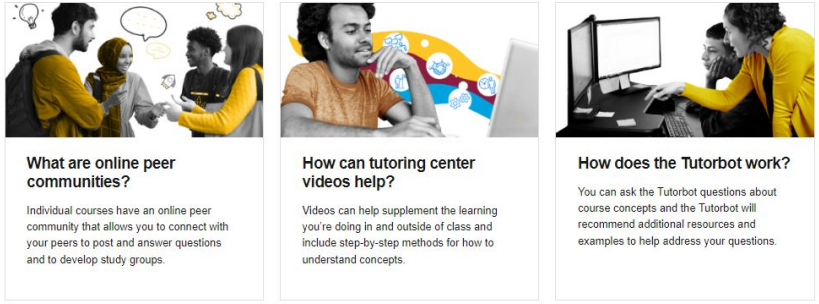
1. **Click on ‘Go to Zoom’ to log onto our Online Tutoring Center.**
2. **Click on ‘View the tutoring schedule’ to see when tutors are available for specific courses.**

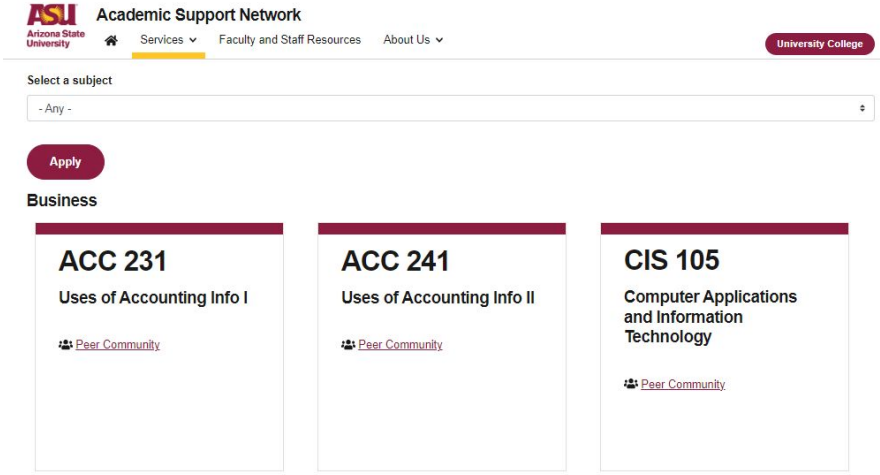
More Questions?

Check out our other resources!

tutoring.asu.edu/online-study-hub



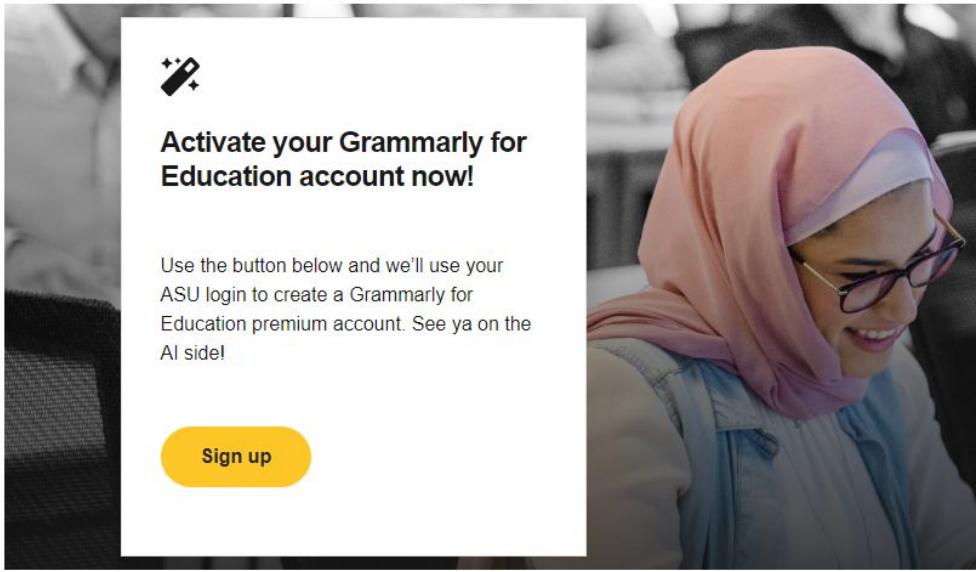




Don't forget to check out the Online Study Hub for additional resources!

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
- RAFT