SER 321 B Session

SI Session

Sunday, April 20th 2025

7:00 pm - 8:00 pm MST

Agenda

- Distributed System Overview
- Parallel vs. Distributed
- Distributed Properties
- Distributed Structures
- 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:

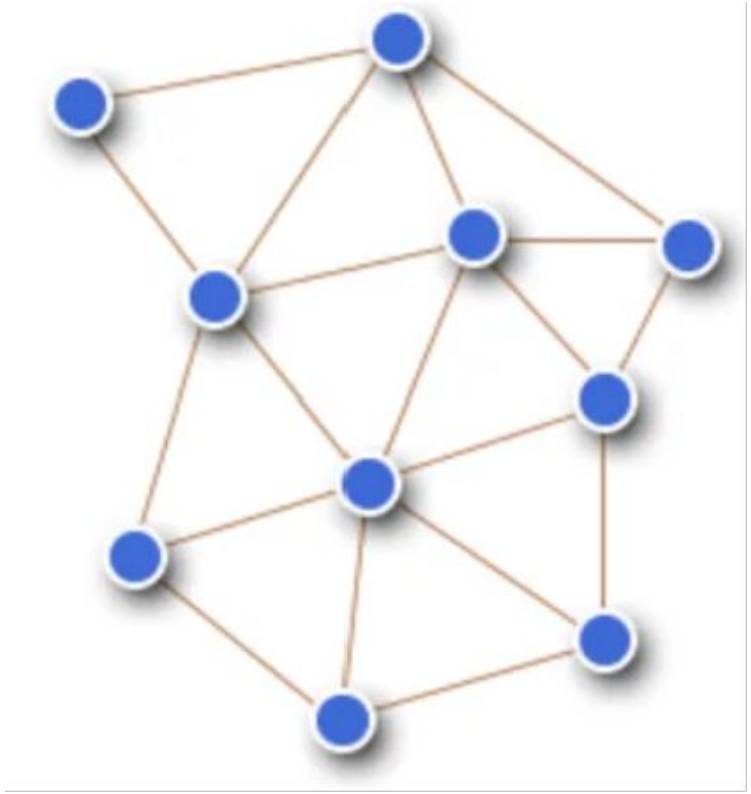
Zoom Features

Zoom Chat

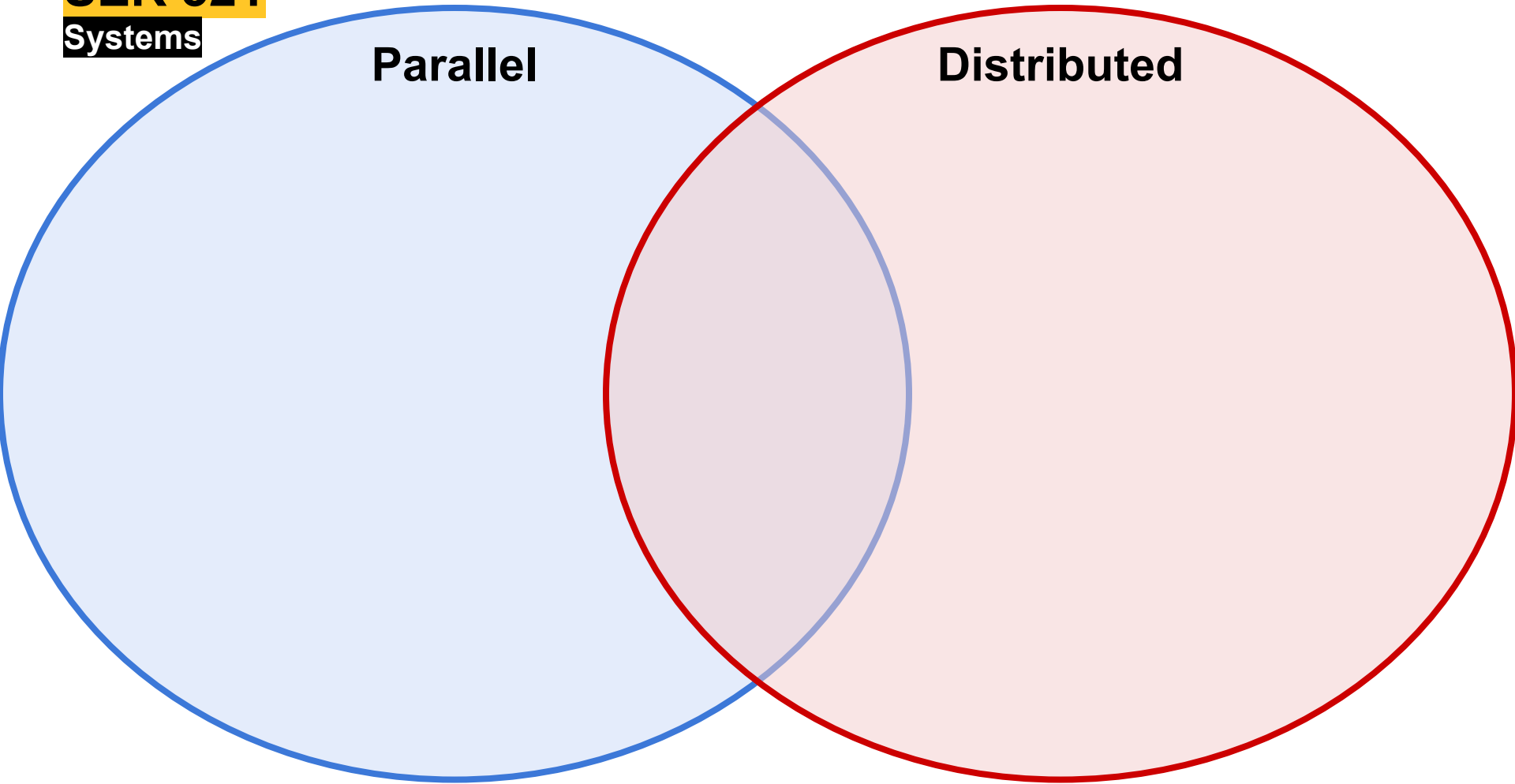
- Use the chat feature to interact with the presenter and respond to presenter's questions.
- Annotations are encouraged

SER 321
Distributed Systems

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



SER 321
Systems



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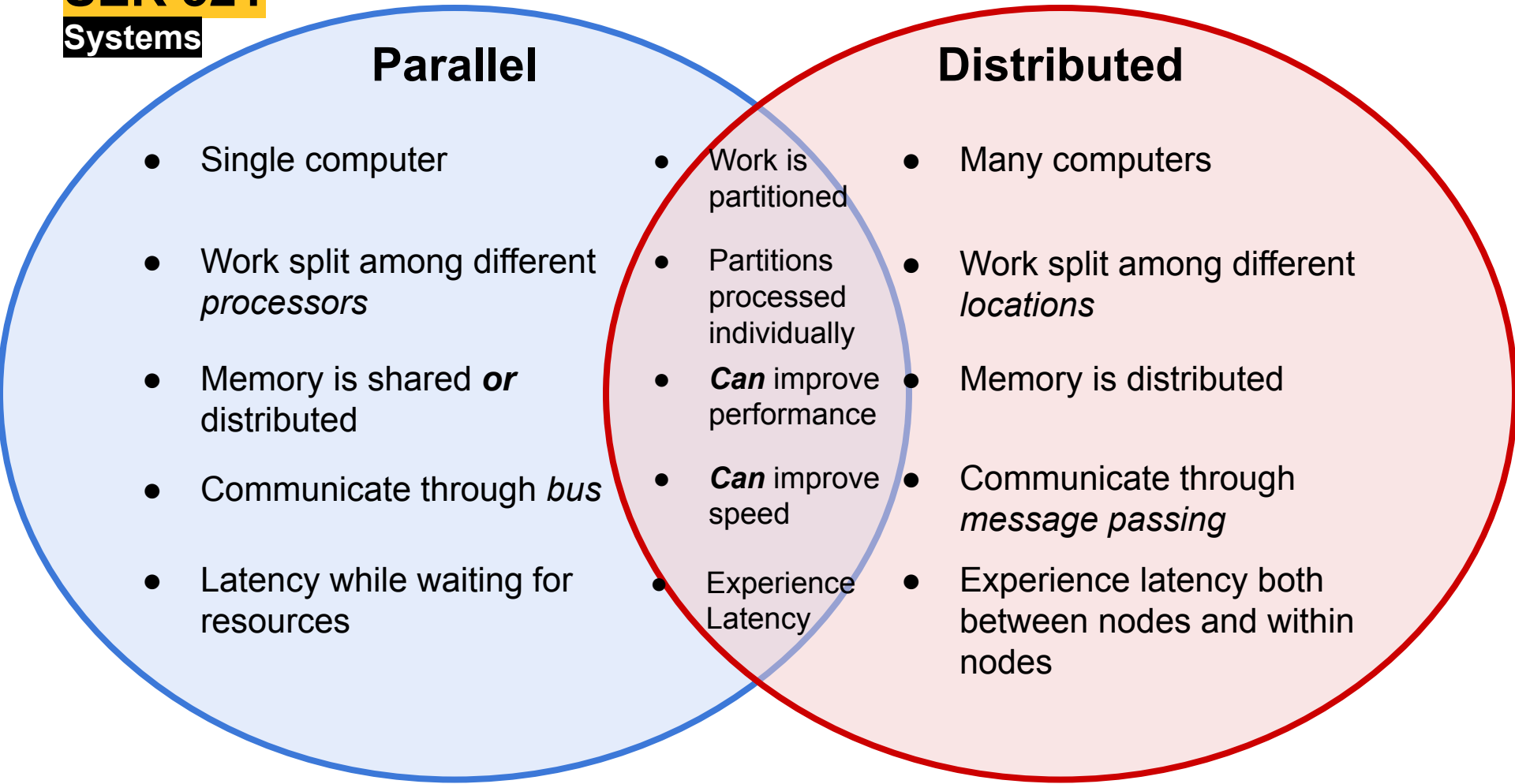
Systems



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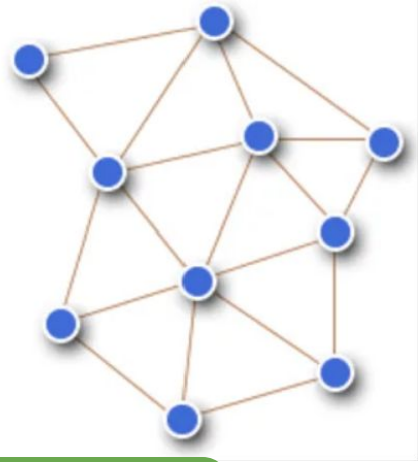
Distributed Systems

Distributed System Properties



Global Clock

No! 👎

Yes! 👍

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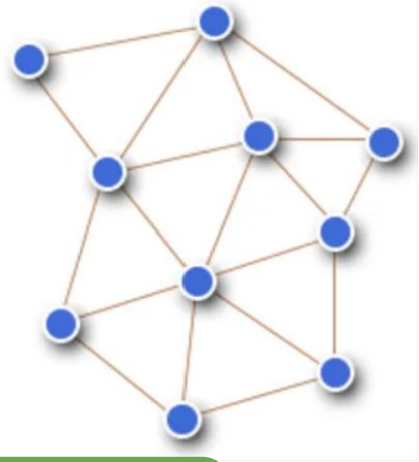
Distributed Systems

Distributed System Properties



Nodes Fail

No! 👎

Yes! 👍

Global Clock

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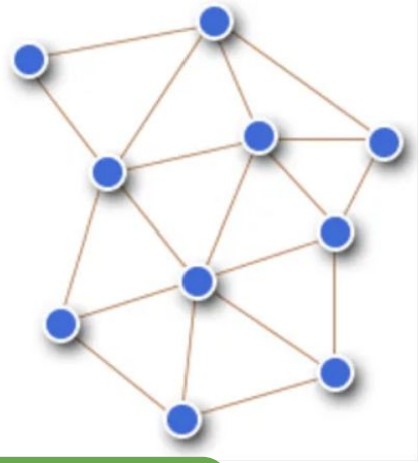
Distributed Systems

Distributed System Properties



Cluster Changes

No! 👎

Global Clock

Yes! 👍

Nodes Fail

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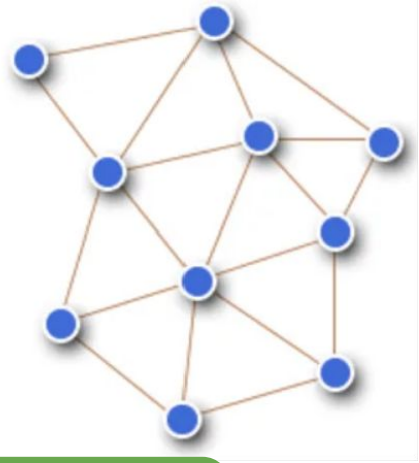
Distributed Systems

Distributed System Properties



Network is Reliable

No! 👎

Global Clock

Yes! 👍

Nodes Fail

Cluster Changes

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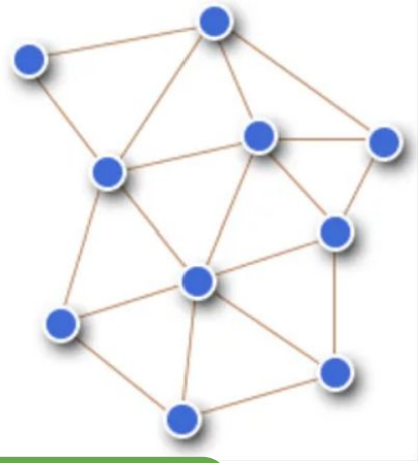
Distributed System Properties



Latency Never Exists

No! 👎

- Global Clock
- Network is Reliable

Yes! 👍

- Nodes Fail
- Cluster Changes

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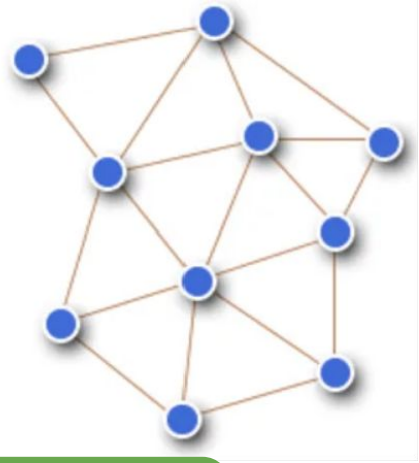
Distributed Systems

Distributed System Properties



Path taken Changes

No! 👎

- Global Clock
- Network is Reliable
- Latency Never Exists

Yes! 👍

- Nodes Fail
- Cluster Changes

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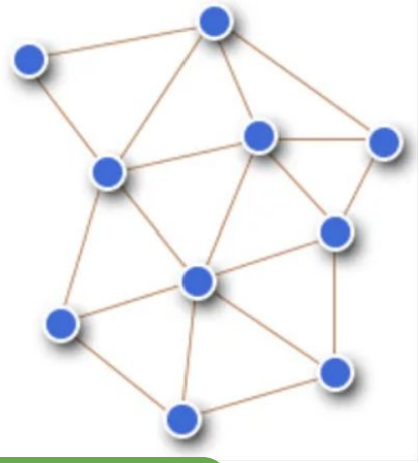
Distributed Systems

Distributed System Properties



Share Common Resources

No! 👎

- Global Clock
- Network is Reliable
- Latency Never Exists

Yes! 👍

- Nodes Fail
- Cluster Changes
- Path taken Changes

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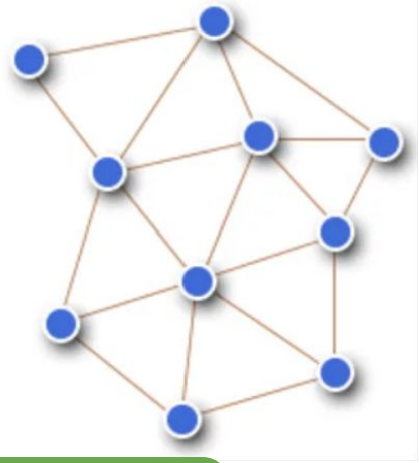
Distributed Systems

Distributed System Properties



Pitfalls handled inherently

No! 👎

- Global Clock
- Network is Reliable
- Latency Never Exists

Yes! 👍

- Nodes Fail
- Cluster Changes
- Path taken Changes
- Share Common Resources

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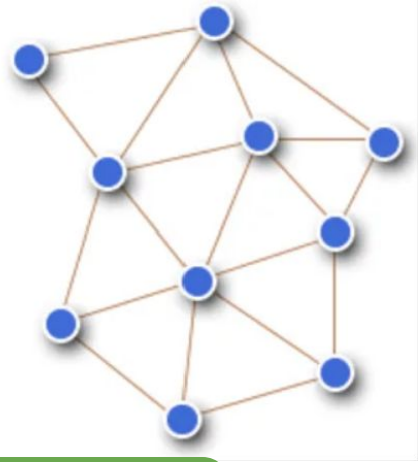
Distributed Systems

Distributed System Properties



No! 👎

- Global Clock
- Network is Reliable
- Latency Never Exists
- Pitfalls handled inherently

Yes! 👍

- Nodes Fail
- Cluster Changes
- Path taken Changes
- Share Common Resources

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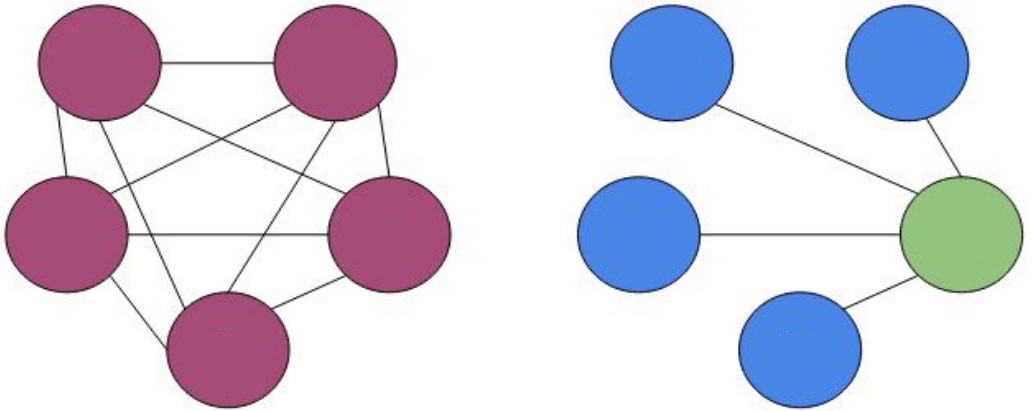
Distributed Systems

Main and Worker

Peer to Peer

Which is which?



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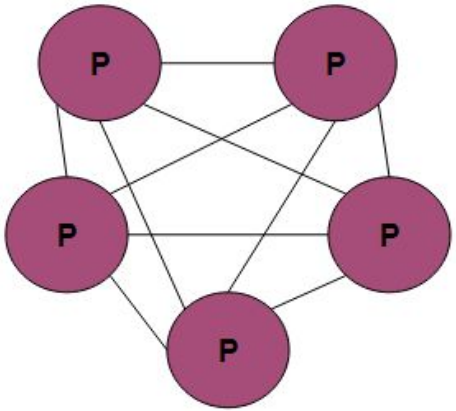
Distributed Systems

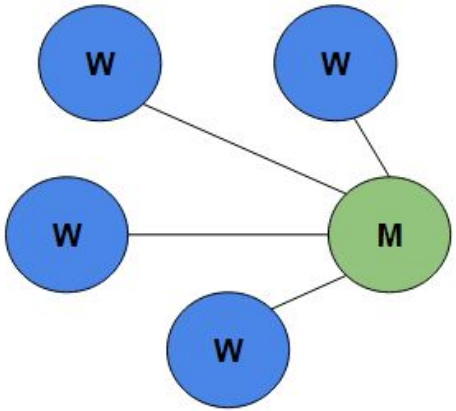
Main and Worker

Peer to Peer

Which is which?

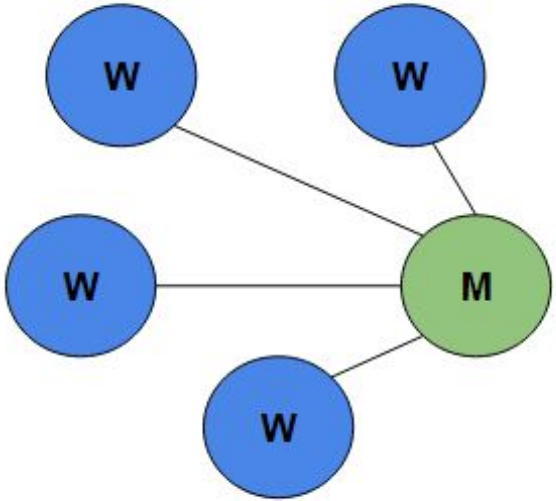
Peer to Peer





Main and Worker

Pros and Cons



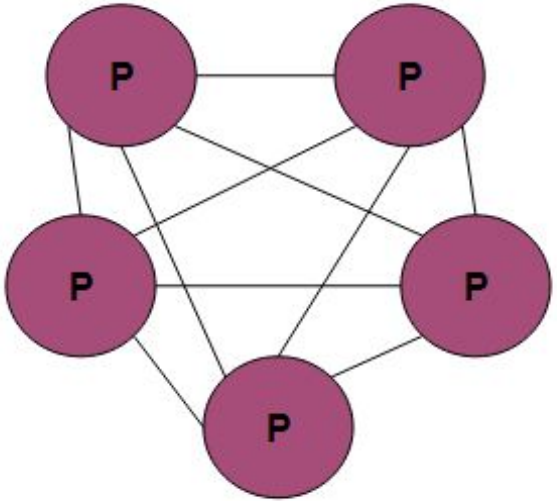
Pros:

- Straightforward setup
- Logic is centralized
- Communication is linear

Cons:

- Single point of failure

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 little bit!

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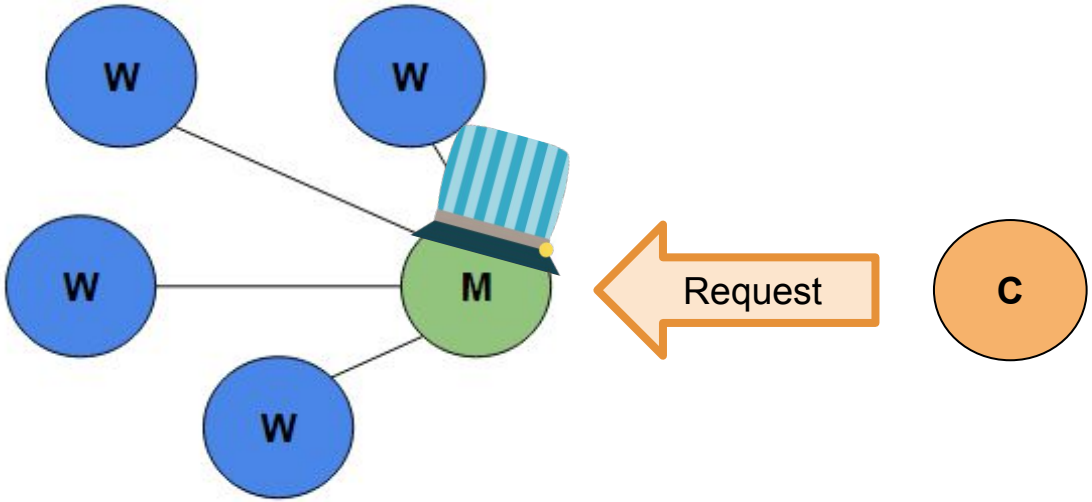
Distributed Systems

Process Flow!

DATA

Workers only do their task then report back



Main is like our server

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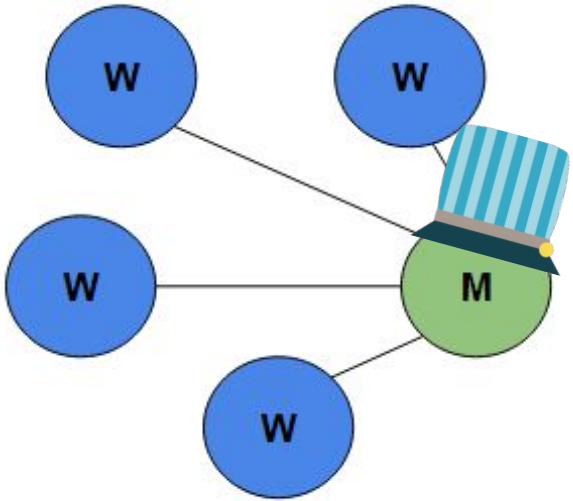
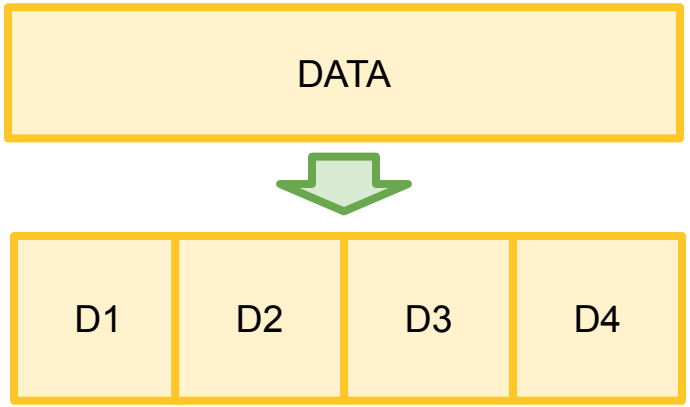
Distributed Systems

Process Flow!

Workers only do their task then report back





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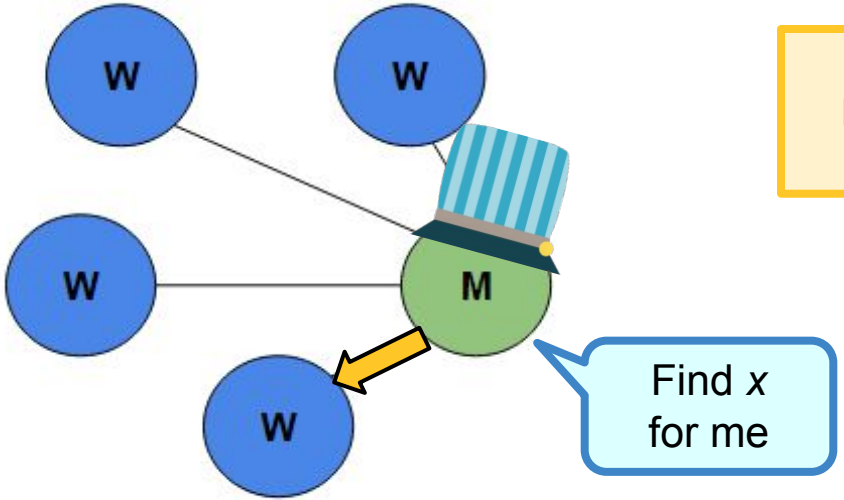
Process Flow!

DATA

D1	D2	D3	D4

Workers only do their task then report back



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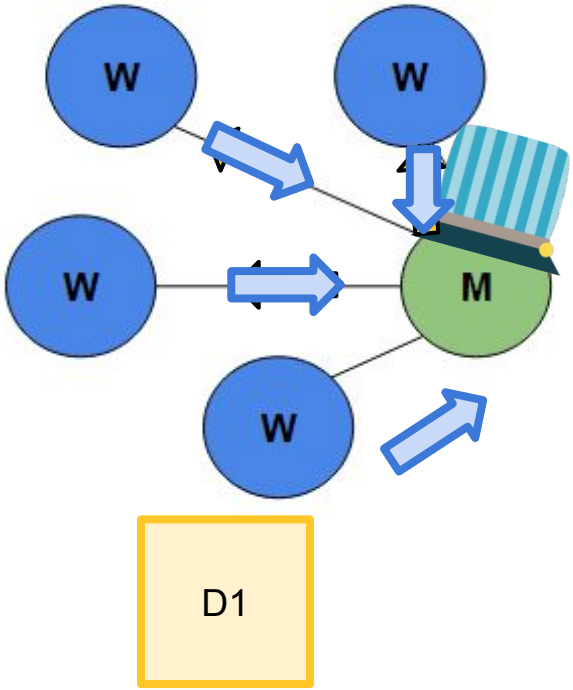
Process Flow!

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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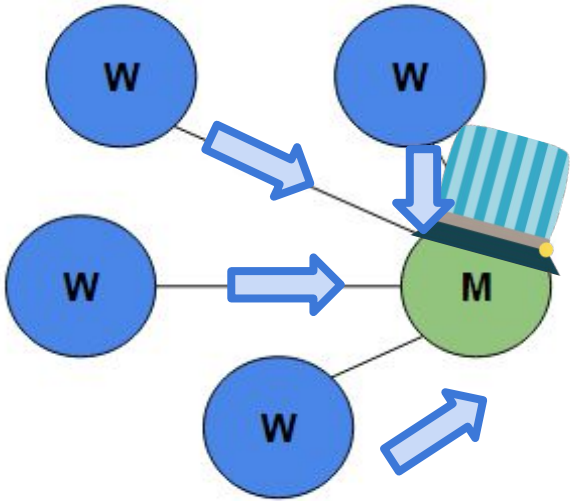
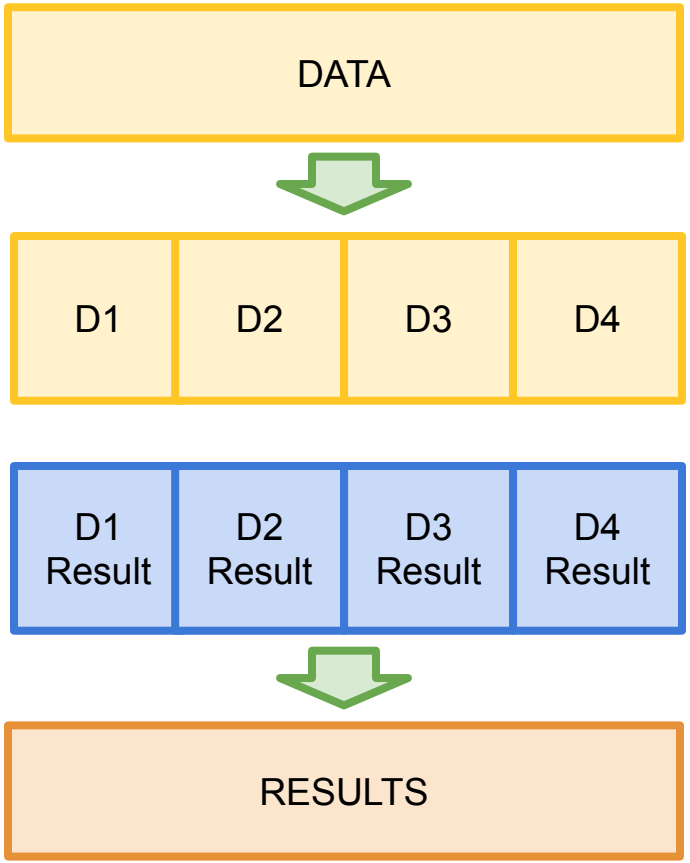
Distributed Systems

Process Flow!

Workers only do their task then report back





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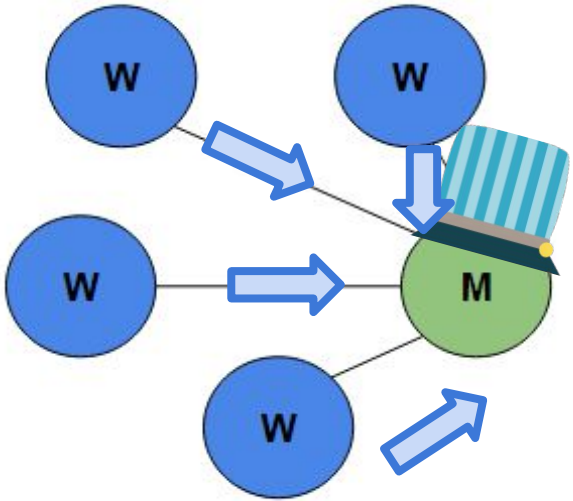
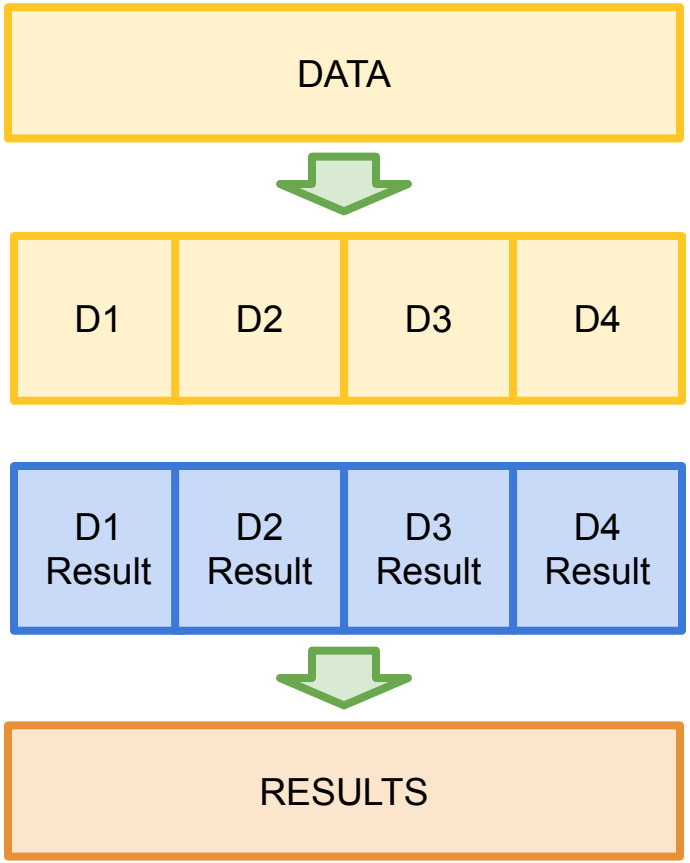
Distributed Systems

Does this look familiar?

How is this different from a parallel processing model?





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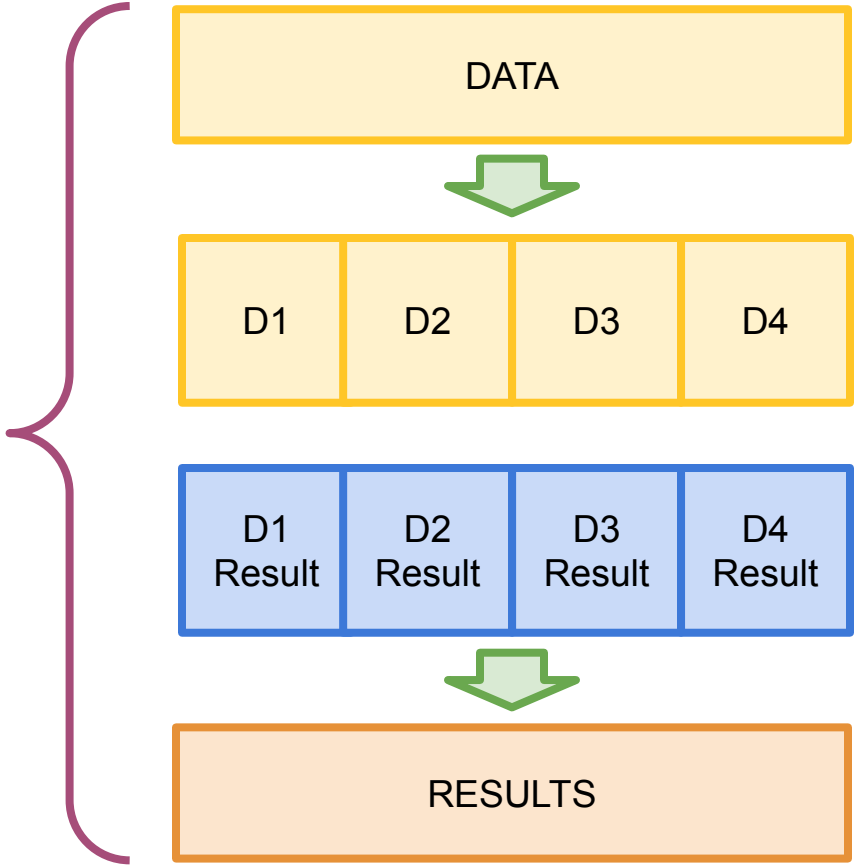
Distributed Systems

What about Peer to Peer?

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



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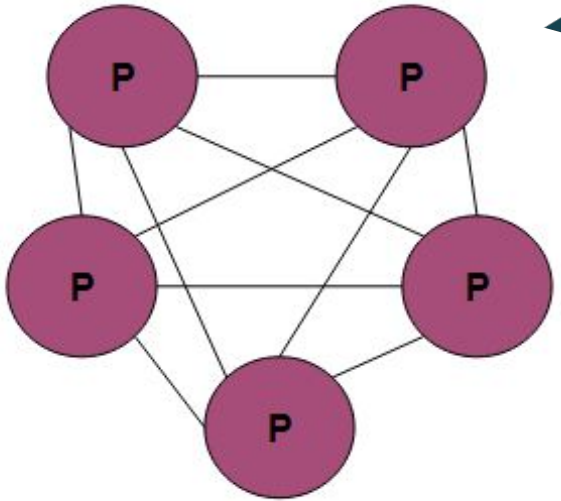
Distributed Systems

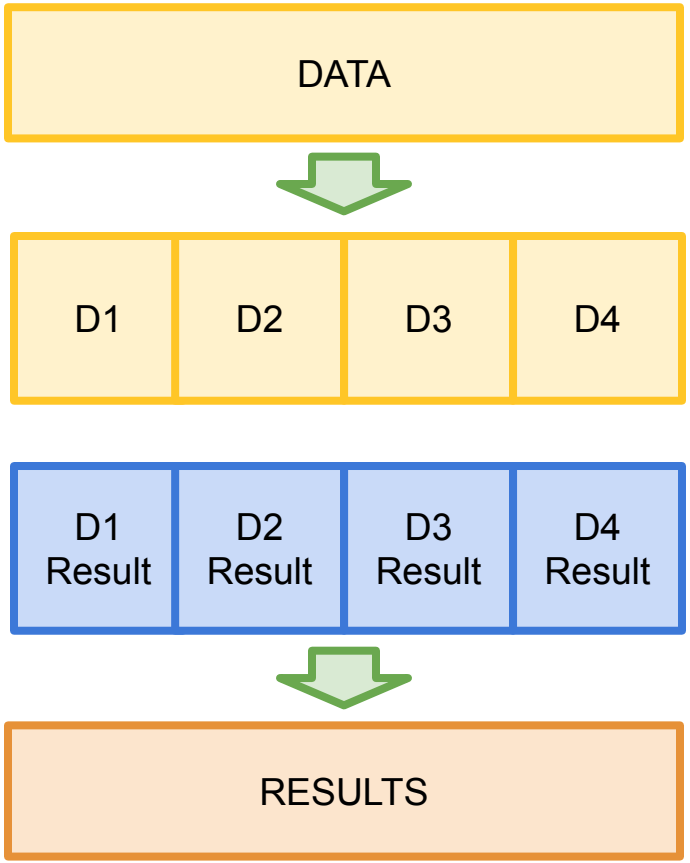
What about Peer to Peer?

We want someone to wear the conductor hat!

A ***LEADER***



How do we choose a leader?



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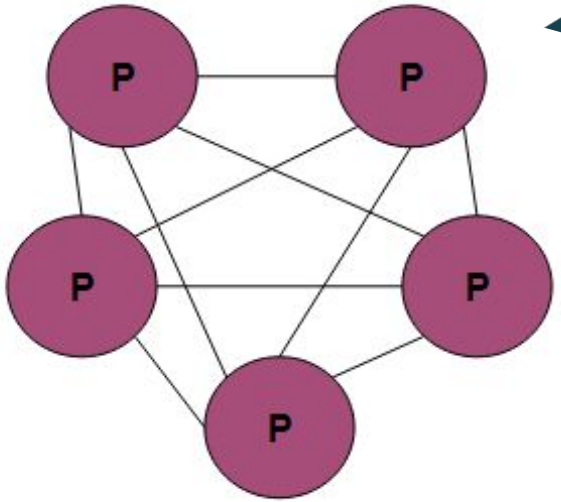

DATA

D1 | D2 | D3 | D4

D1 Result | D2 Result | D3 Result | D4 Result

RESULTS

Leader Election!

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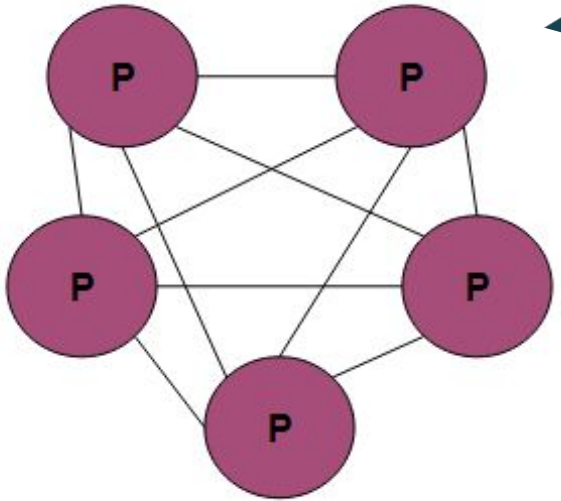
Distributed Systems

What about Peer to Peer?

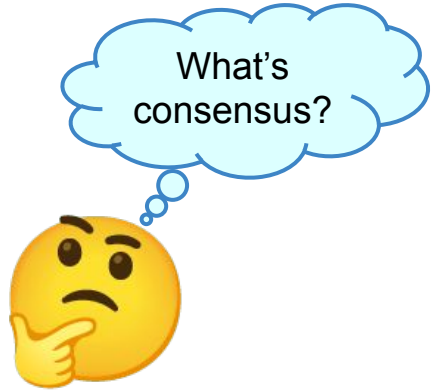
We want someone to wear the conductor hat!

A ***LEADER***



Leader Election!

Type of ***CONSENSUS***



"General agreement or trust amongst a group"

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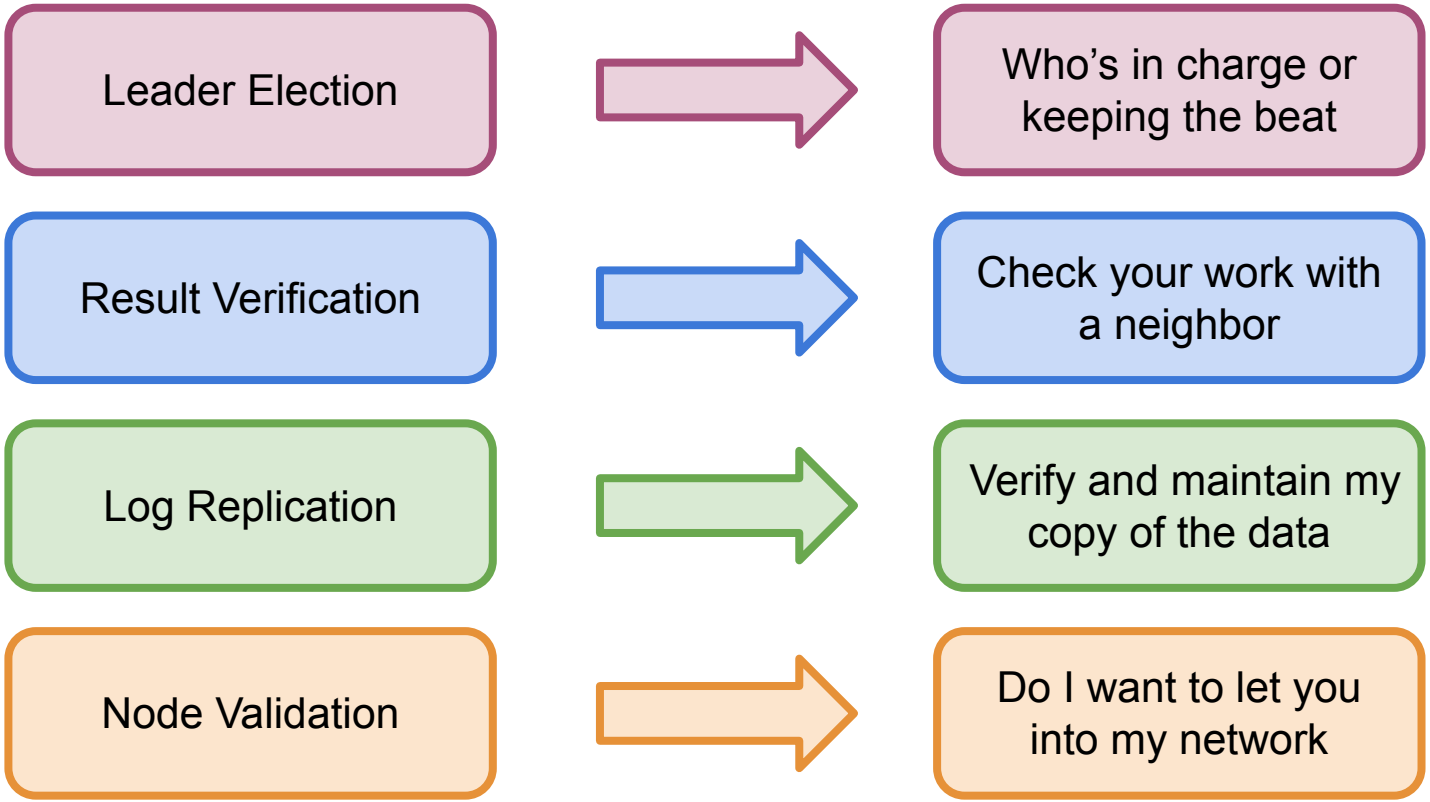
Consensus

"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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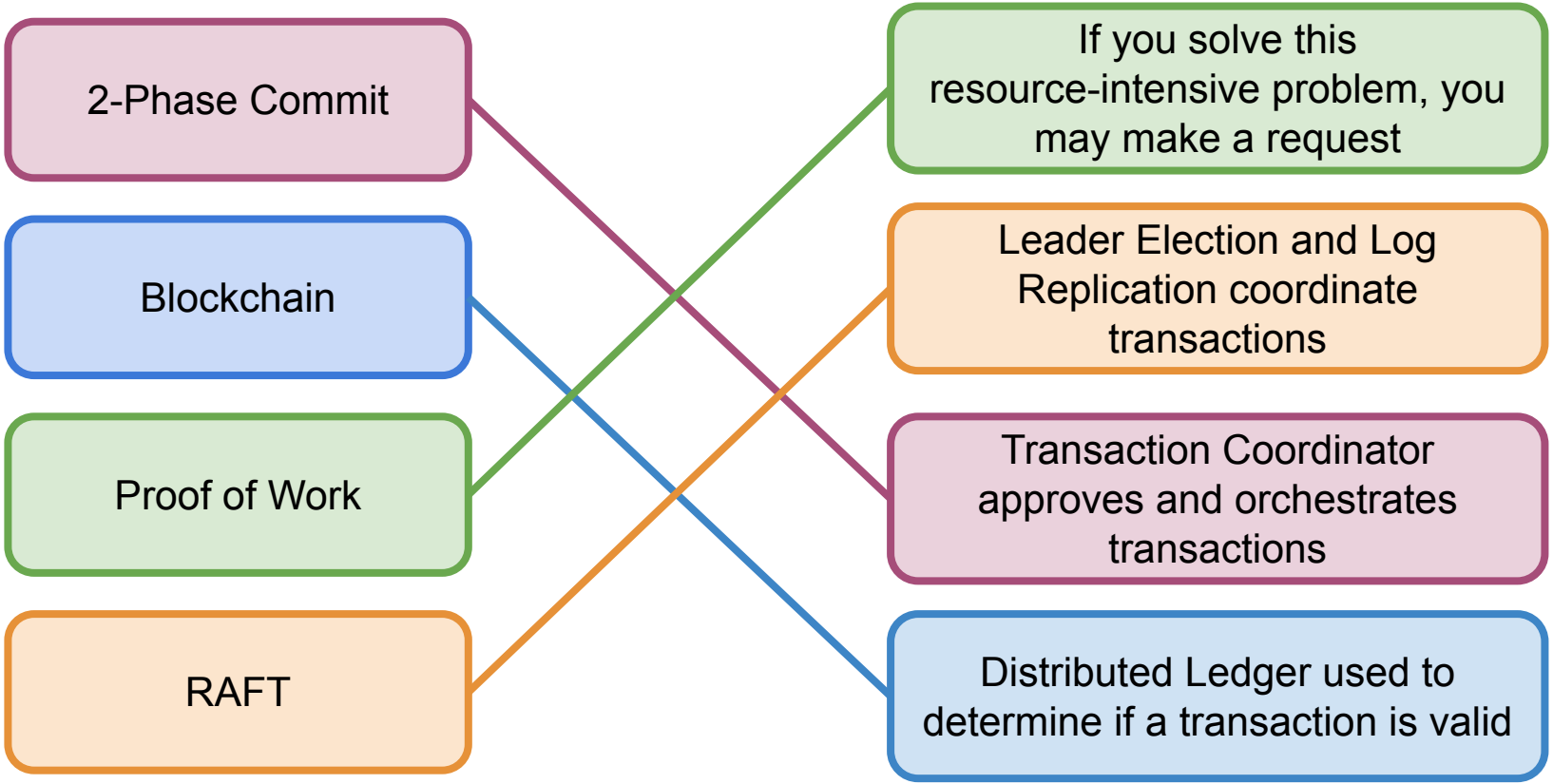
Consensus

Match the Consensus Algorithm to its Description!



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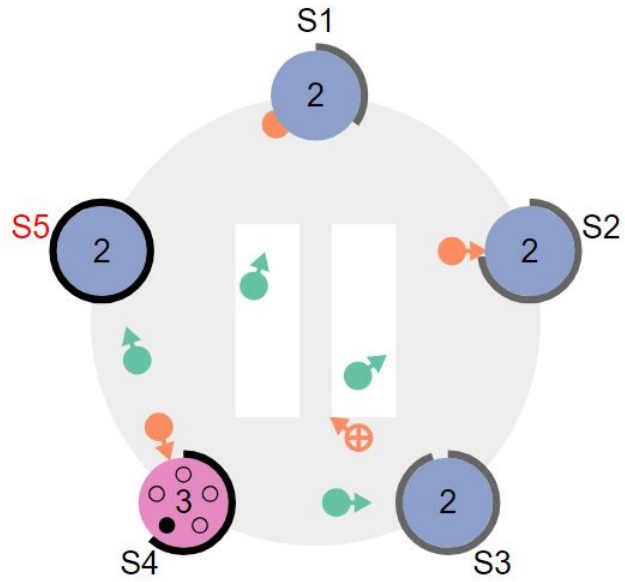
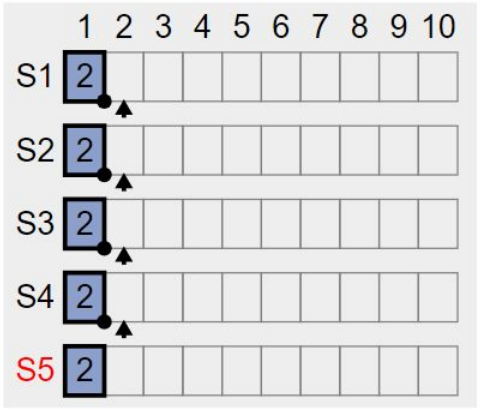
RAFT

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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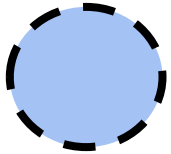
RAFT

Leader Election

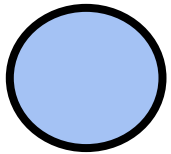
Nodes have 3 states:

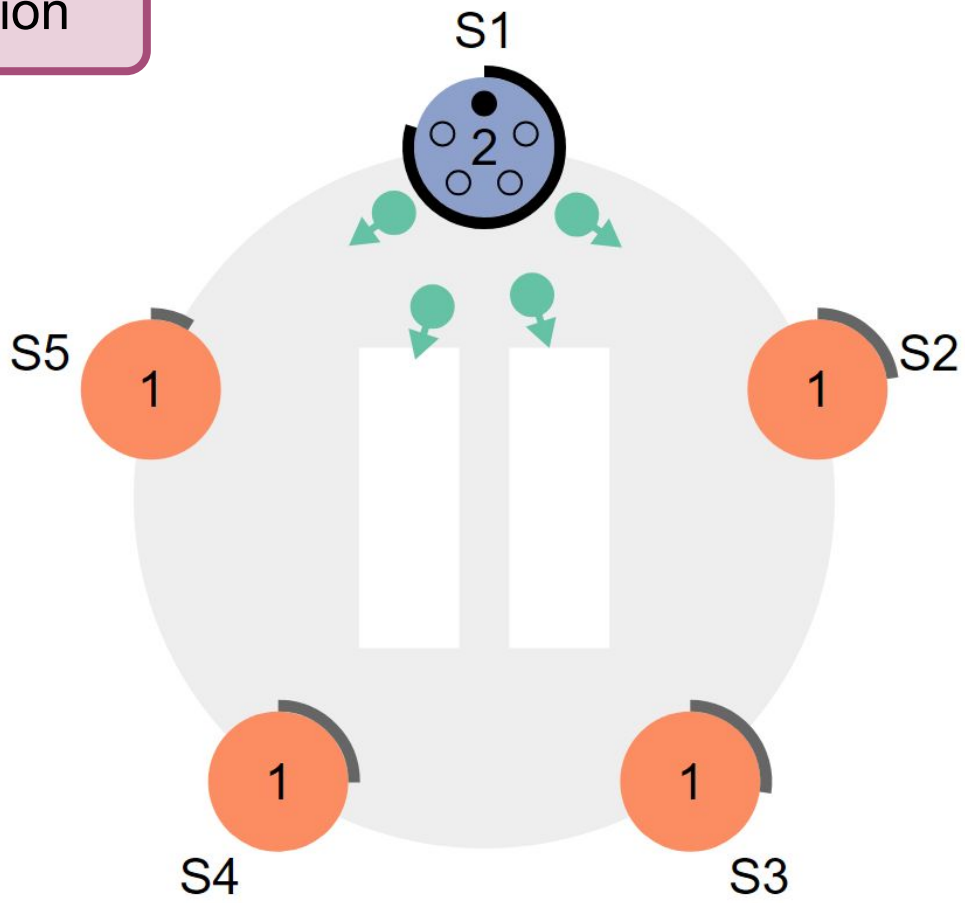
Follower

Candidate



Leader





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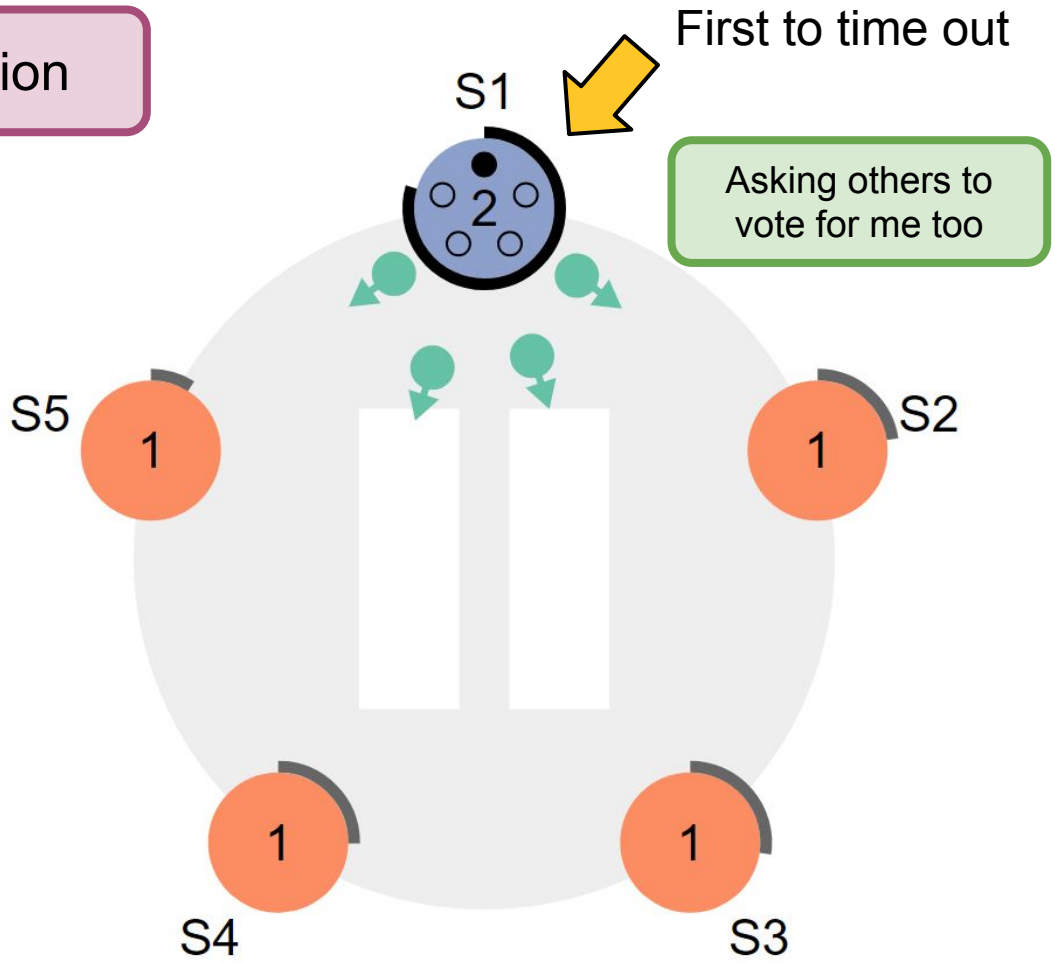
RAFT

Leader Election

This is the first election



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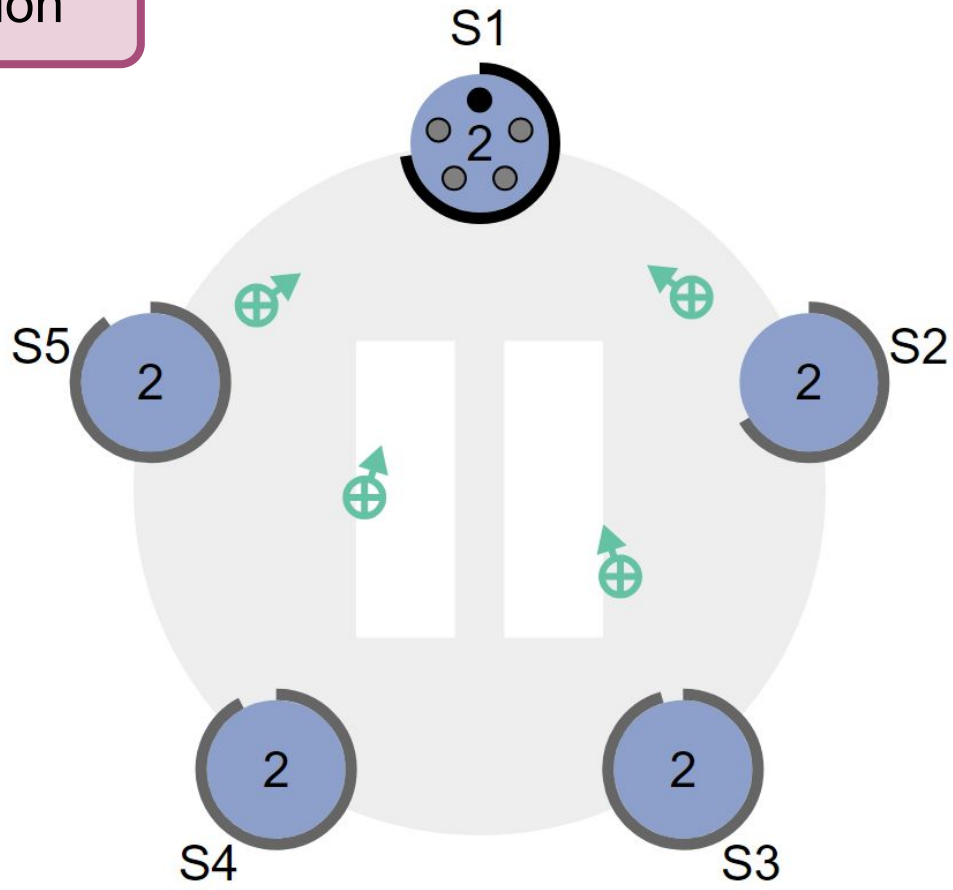
RAFT

Leader Election

Other nodes said sure whatever



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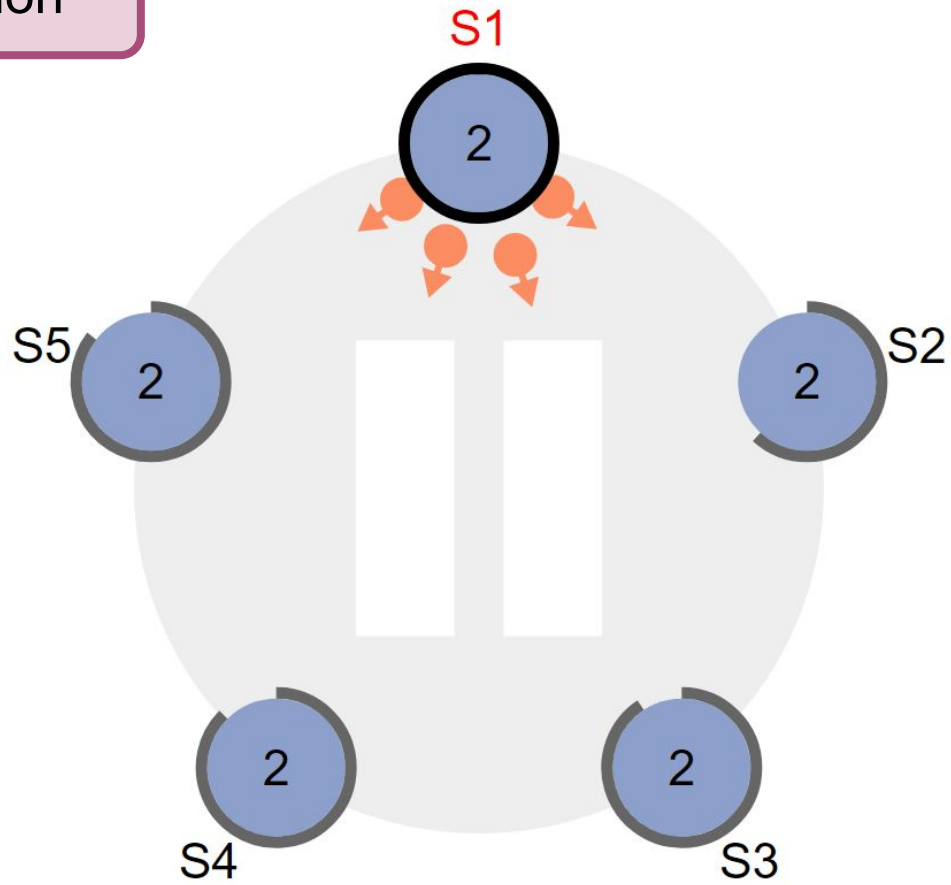
RAFT

Leader Election

Now confirmed as Leader



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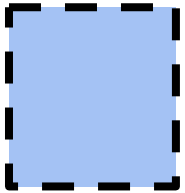
RAFT

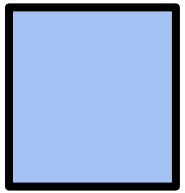
Log Replication

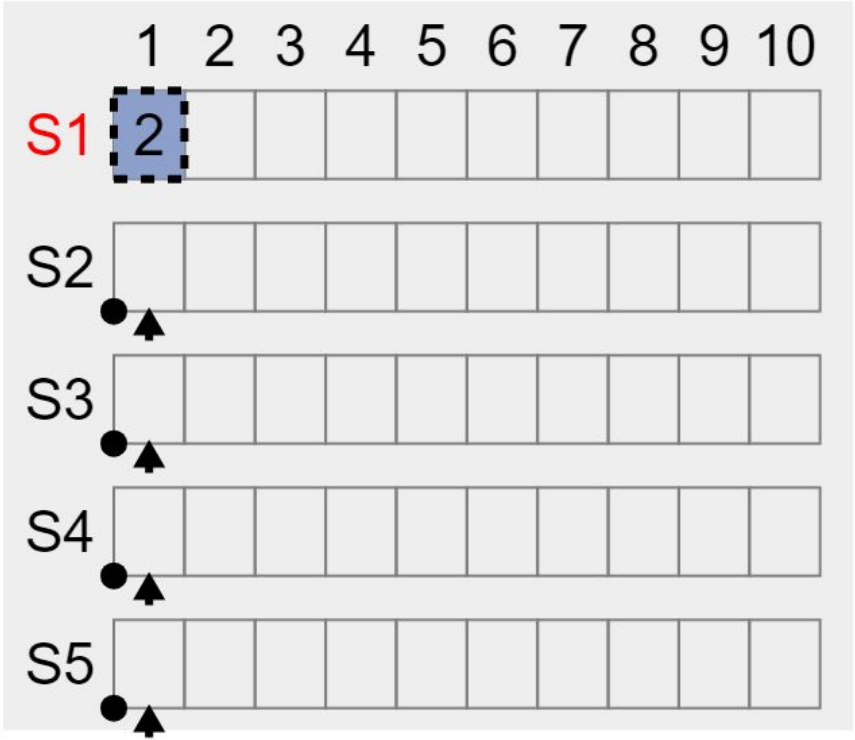
Same Pattern!

Candidate



Added





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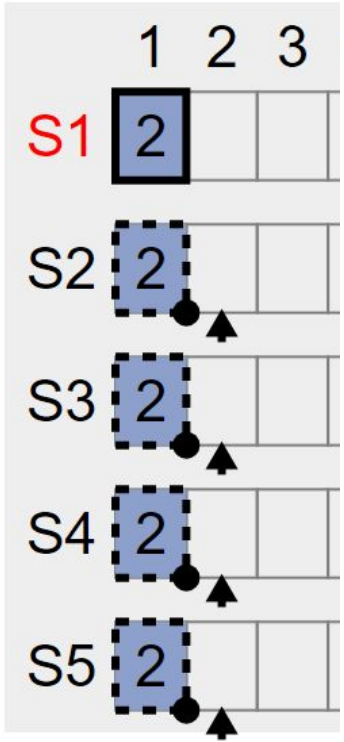
RAFT

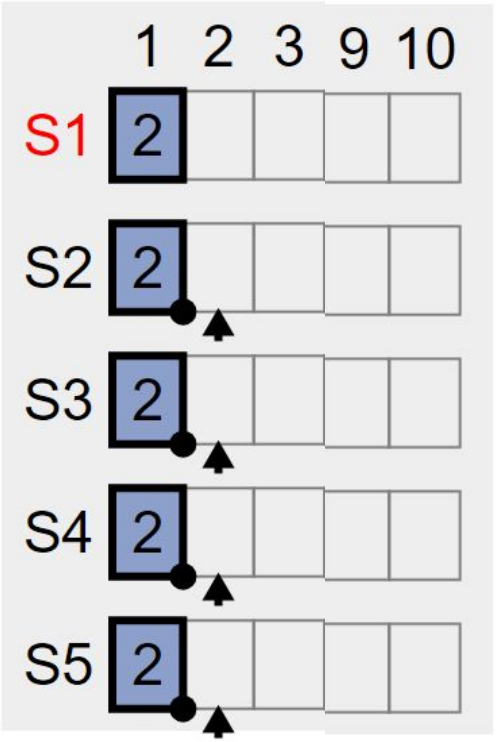
Log Replication

Same Pattern!

Candidate

Added





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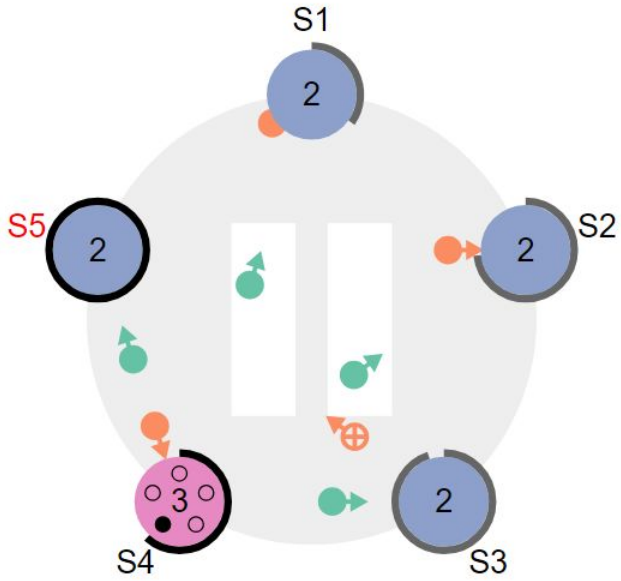
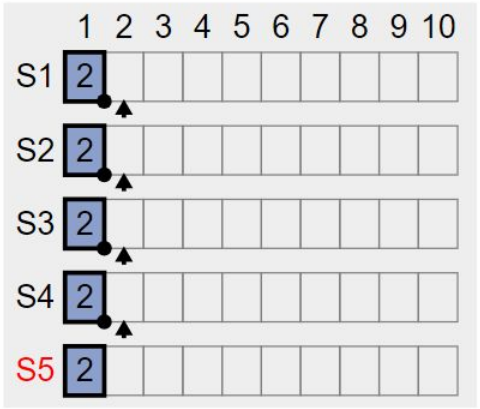
RAFT

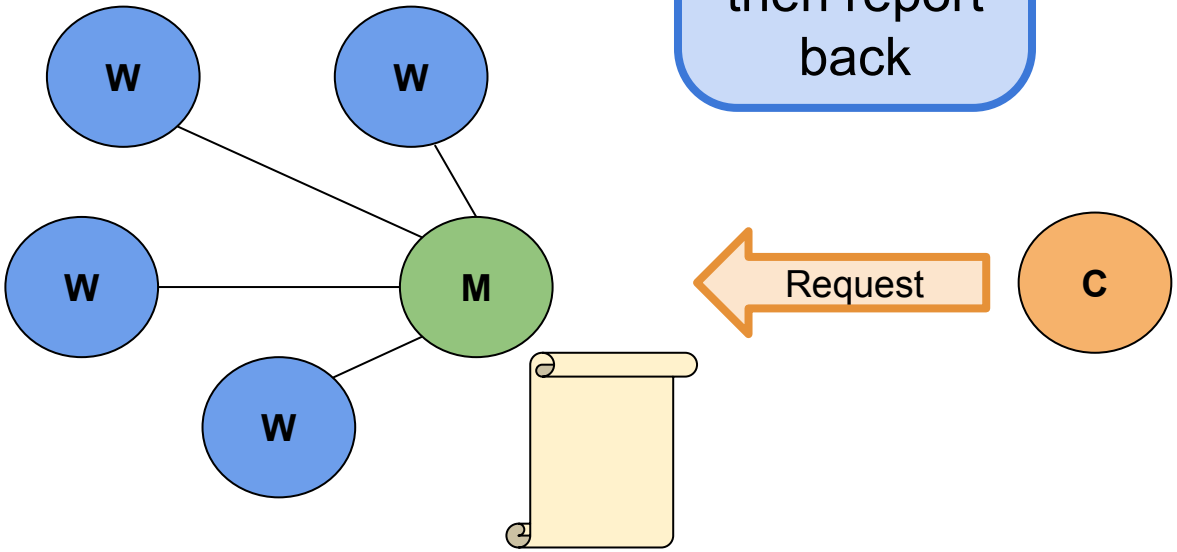
RAFT





SER 321
Communication

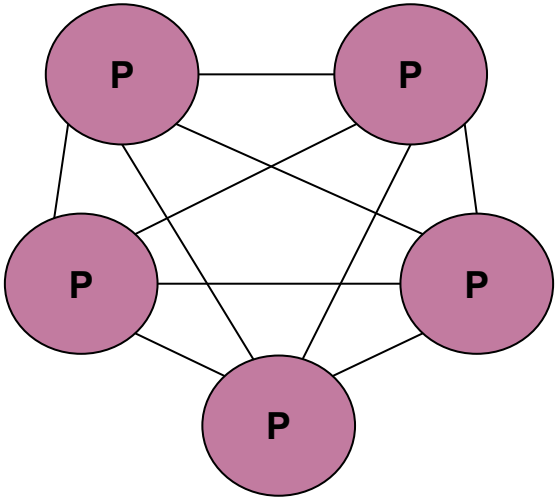
Workers only do their task then report back



Main is in charge of everything

SER 321
Communication

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



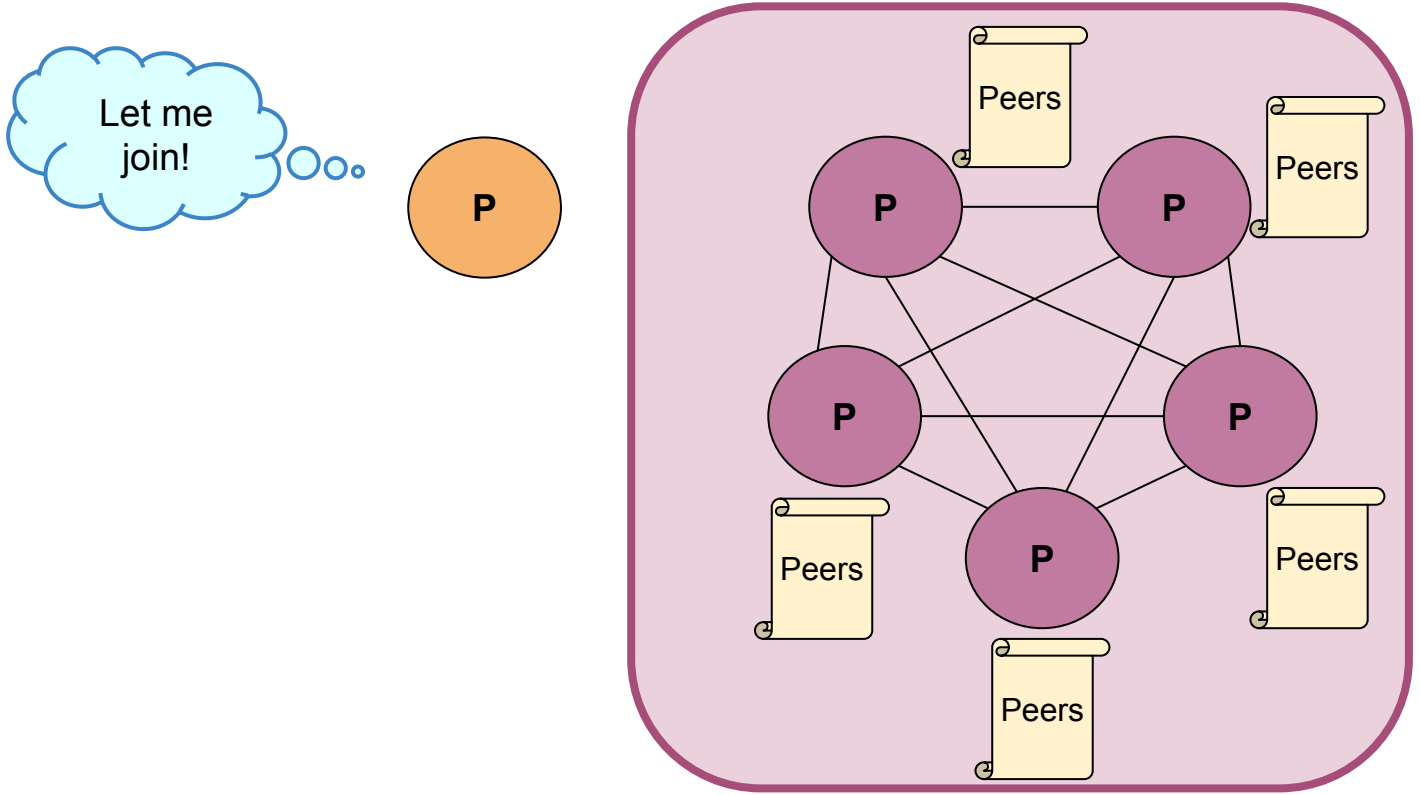
Request is sent to the *current leader*

or

Peer that received the request *acts as the leader*

SER 321
Communication

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

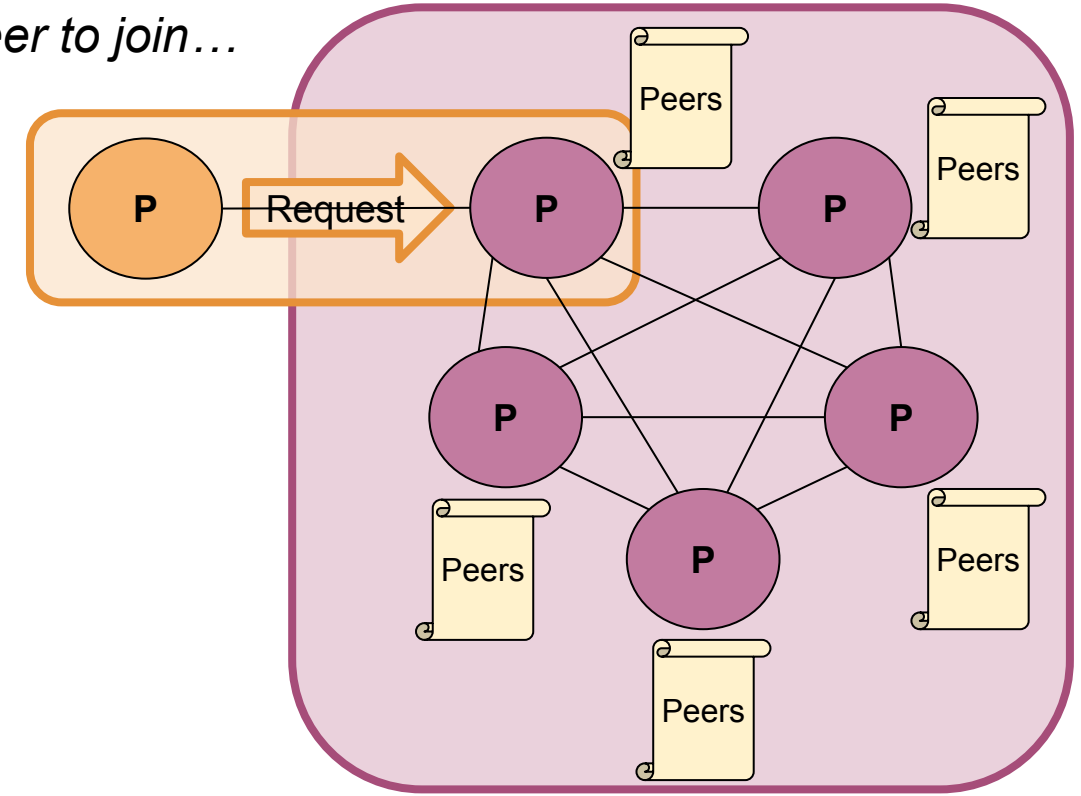


SER 321
Communication

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

Assuming we want to allow the peer to join…

Is that all?



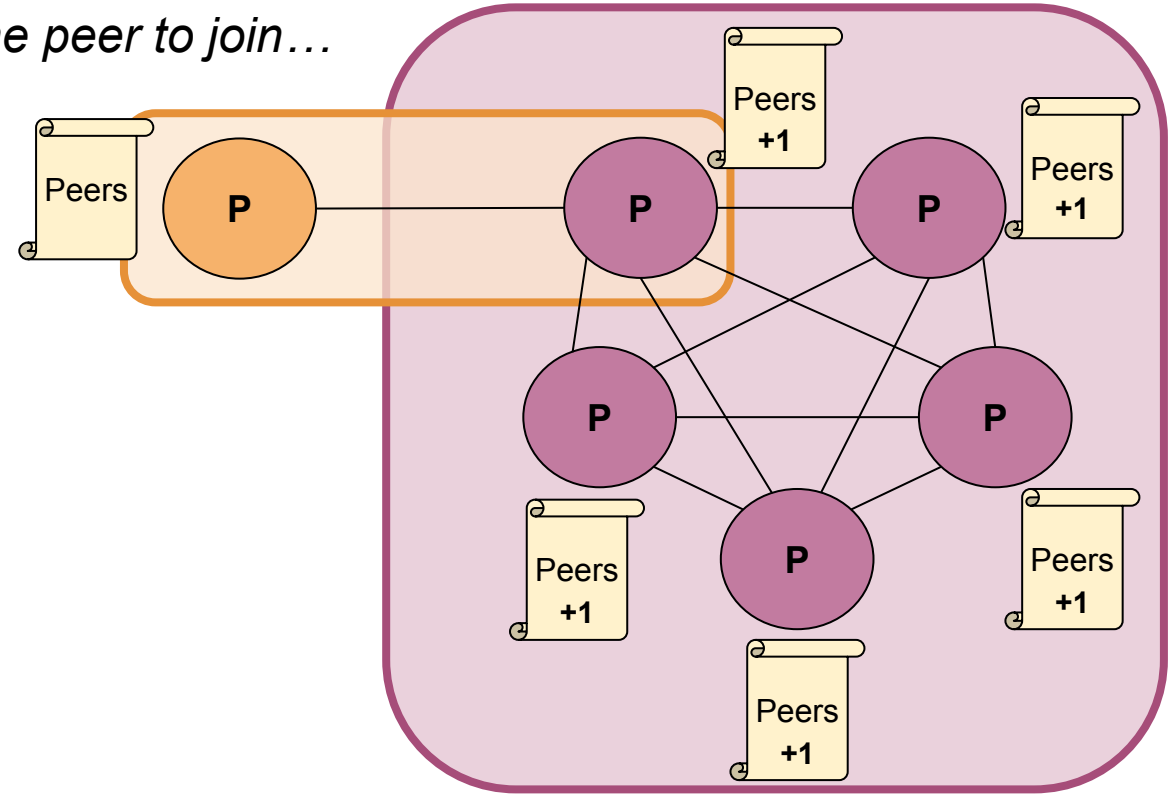
SER 321
Communication

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:

- Sunday, April 20th at 7:00 pm MST
- Tuesday, April 22nd at 10:00 am MST
- Thursday, April 24th at 7:00 pm MST

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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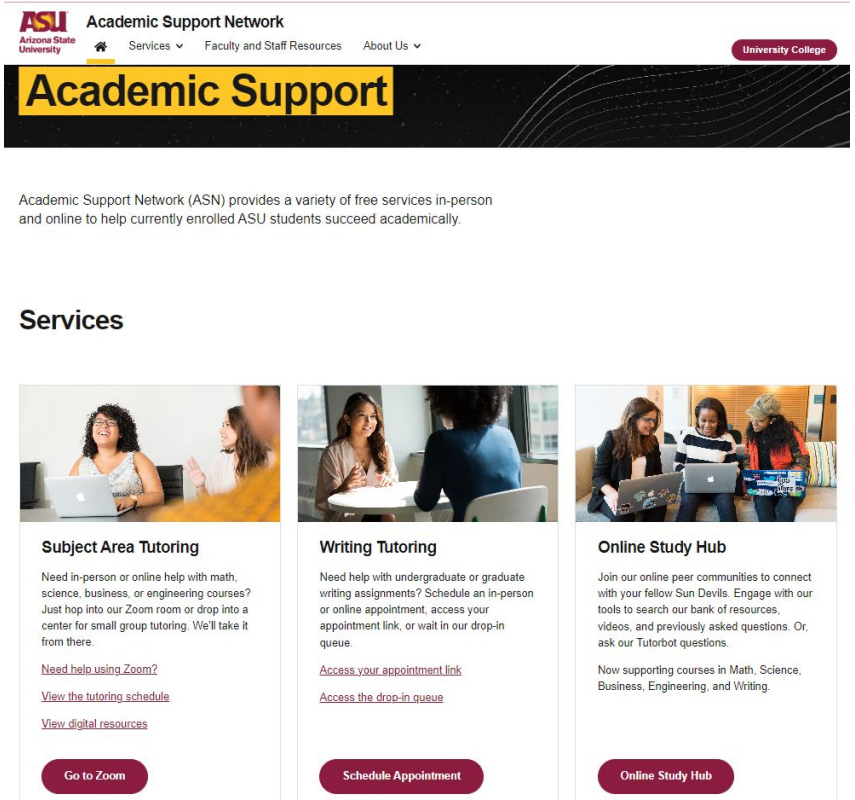
More Questions?

Check out our other resources!

tutoring.asu.edu

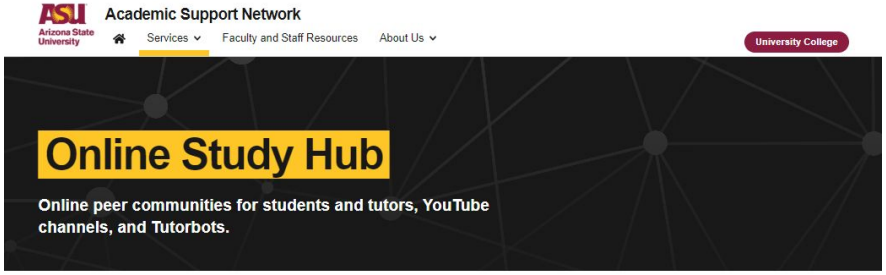


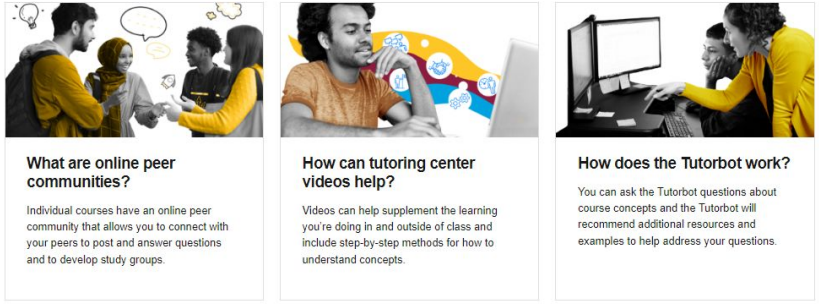
1. **Click on ‘Go to Zoom’ to log onto our Online Tutoring Center.**
2. **Click on ‘View the tutoring schedule’ to see when tutors are available for specific courses.**

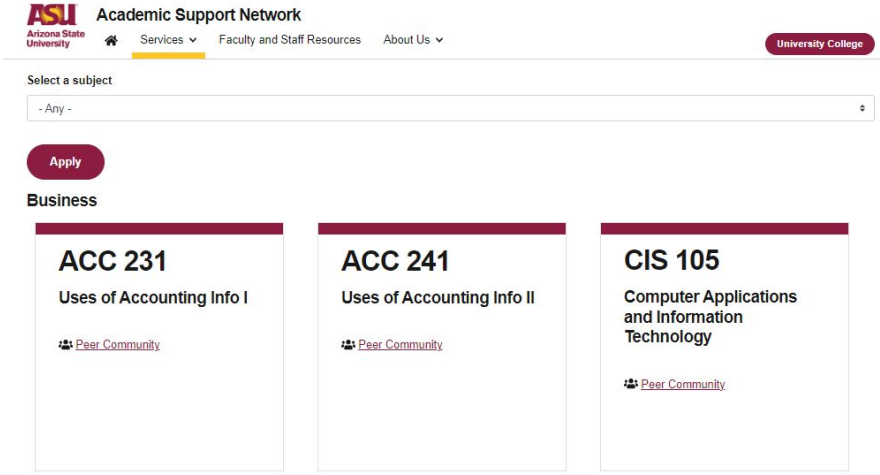
More Questions?

Check out our other resources!

tutoring.asu.edu/online-study-hub



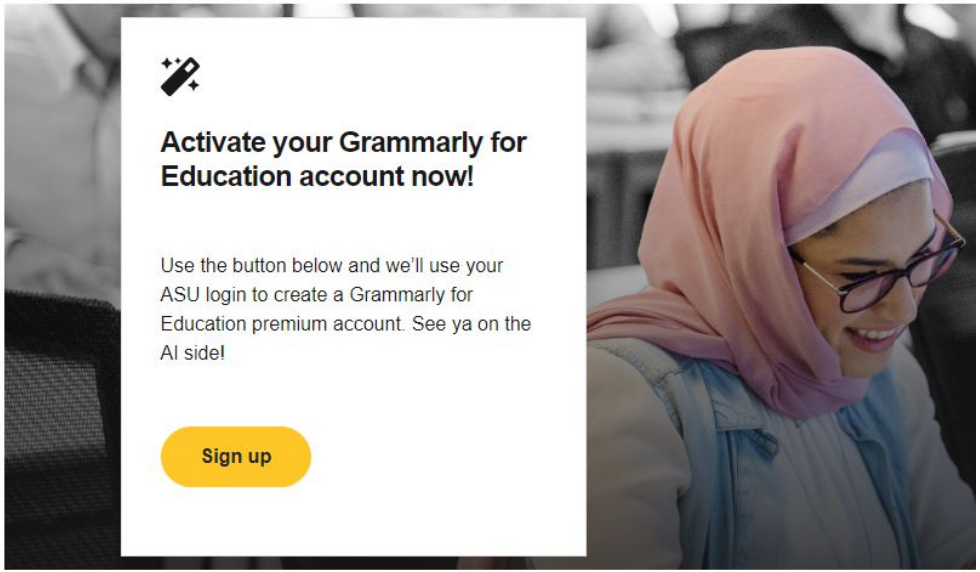




Don't forget to check out the Online Study Hub for additional resources!

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