

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



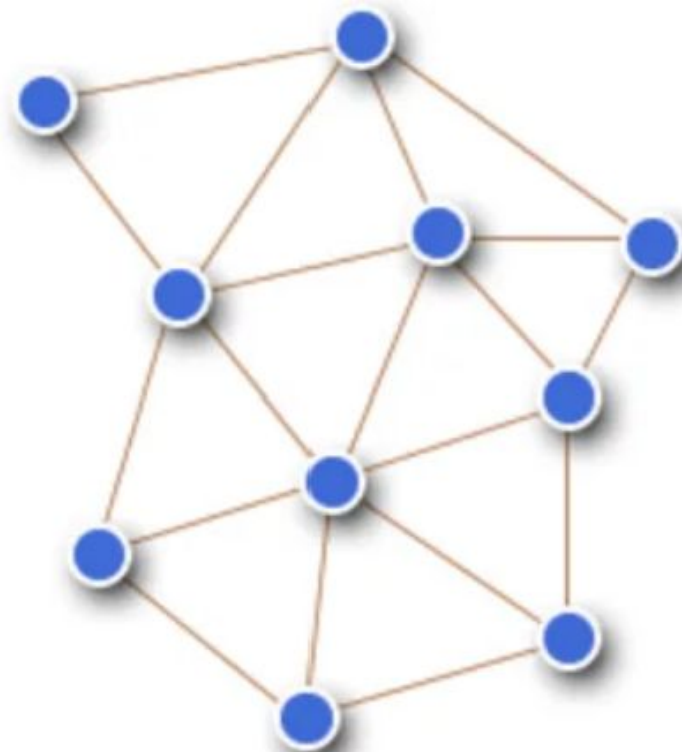
Zoom Chat

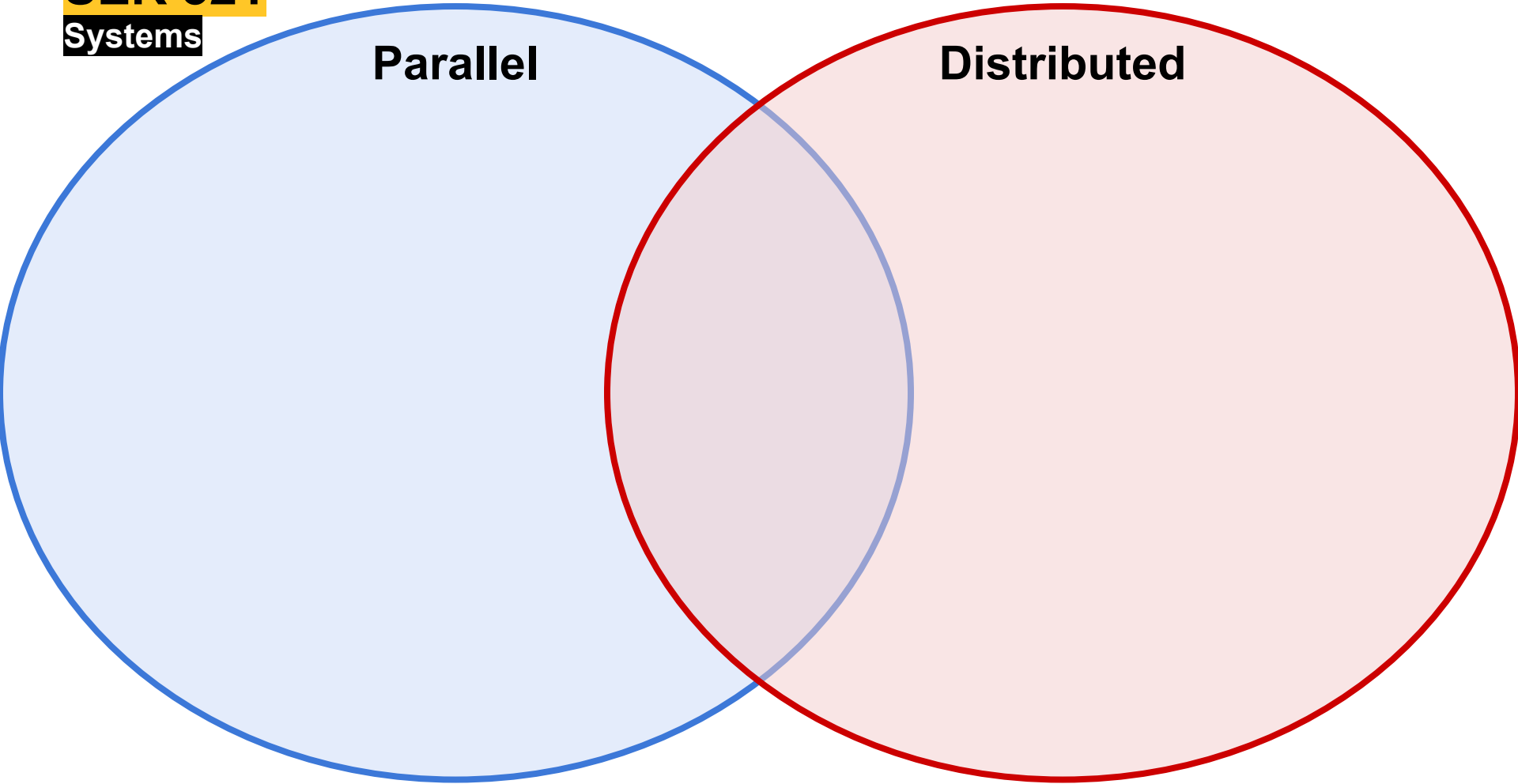
- Use the chat feature to interact with the presenter and respond to presenter's questions.
- Annotations are encouraged

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Distributed Systems

What do we mean by
“Distributed Systems”
or
“Distributed Algorithms”?





Parallel

- Single computer
- Work split among different *processors*
- Memory is shared **or** distributed
- Communicate through *bus*
- Latency while waiting for resources

Distributed

- Work is partitioned
- Partitions processed individually
- **Can** improve performance
- **Can** improve speed
- Experience Latency
- Many computers
- Work split among different *locations*
- Memory is distributed
- Communicate through *message passing*
- Experience latency both between nodes and within nodes

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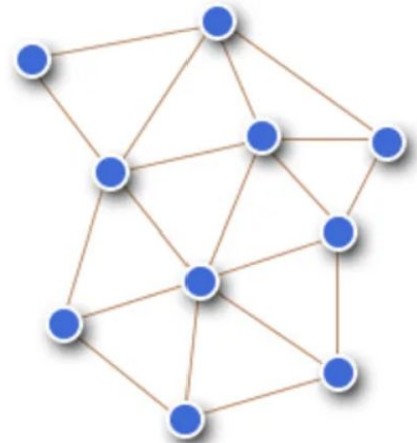
Distributed Systems

Distributed System Properties

Global Clock

No! 👎

Yes! 👍



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Distributed Systems

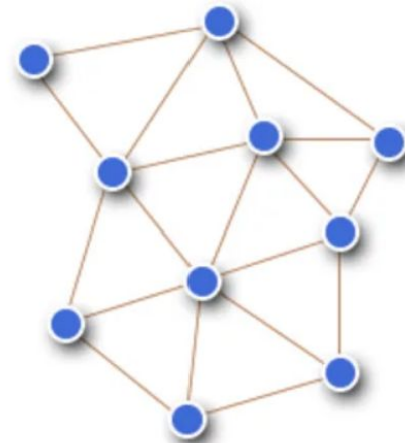
Distributed System Properties

Nodes Fail

No! 👎

Global Clock

Yes! 👍



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Distributed Systems

Distributed System Properties

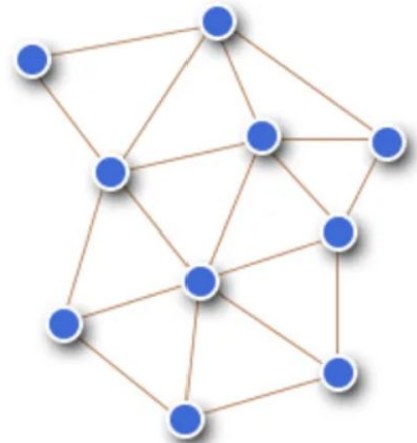
Cluster Changes

No! 👎

Global Clock

Yes! 👍

Nodes Fail



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Distributed Systems

Distributed System Properties

Network is Reliable

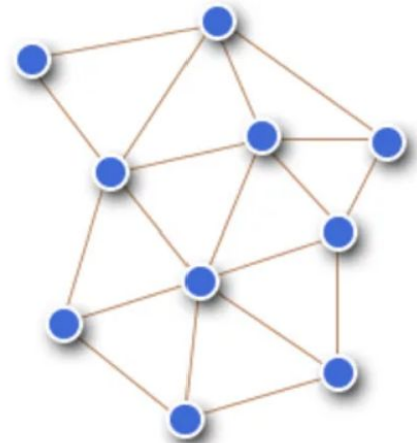
No! 👎

Global Clock

Yes! 👍

Nodes Fail

Cluster Changes



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Distributed Systems

Distributed System Properties

Latency Never Exists

No! 👎

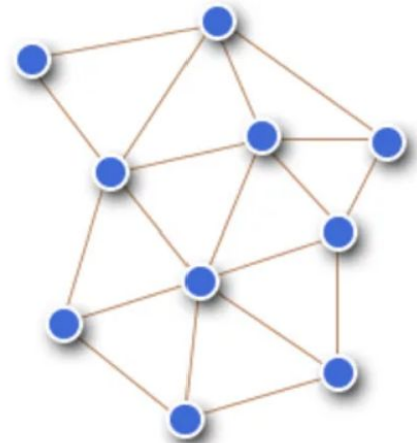
Global Clock

Network is Reliable

Yes! 👍

Nodes Fail

Cluster Changes

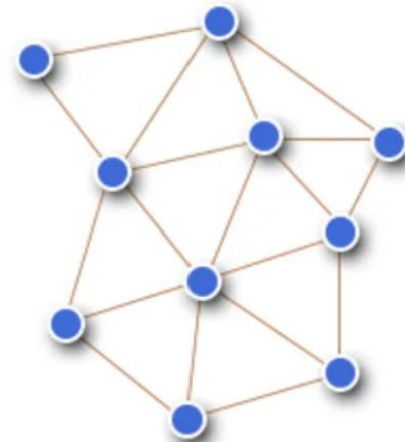


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Distributed Systems

Distributed System Properties

Path taken Changes



No! 👎

Global Clock

Network is Reliable

Latency Never Exists

Yes! 👍

Nodes Fail

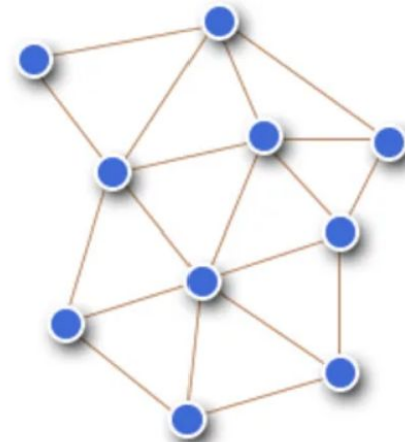
Cluster Changes

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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

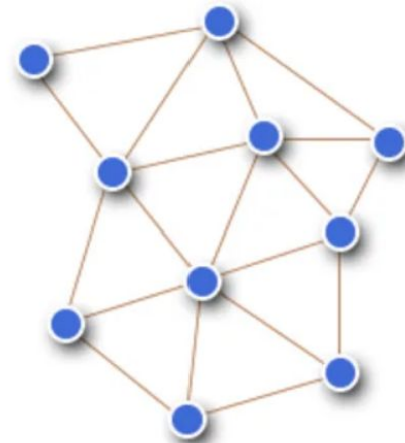
Path taken Changes

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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

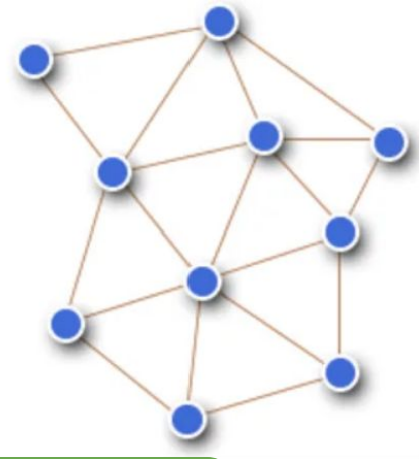
Path taken Changes

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

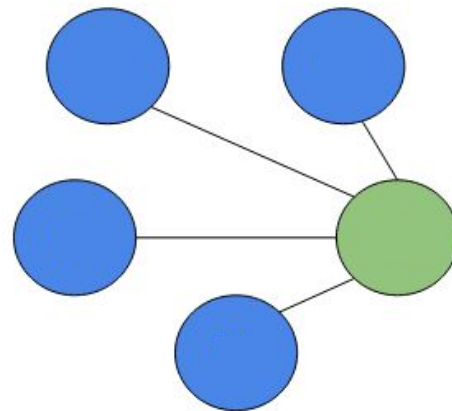
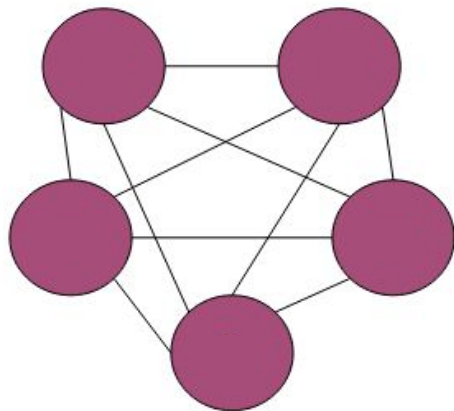
Path taken Changes

Share Common Resources

Main and Worker

Peer to Peer

Which is which?



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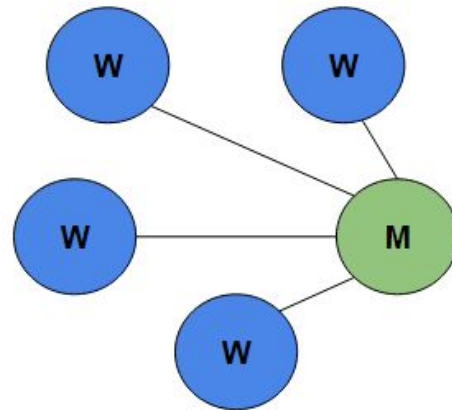
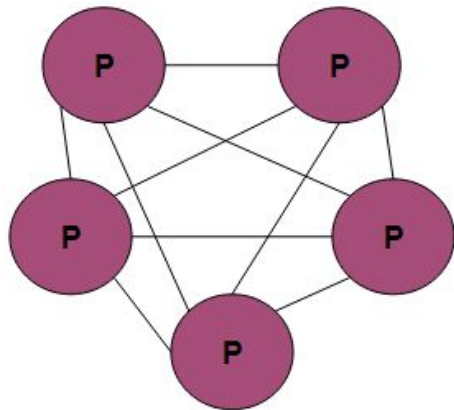
Distributed Systems

Main and Worker

Peer to Peer

Which is which?

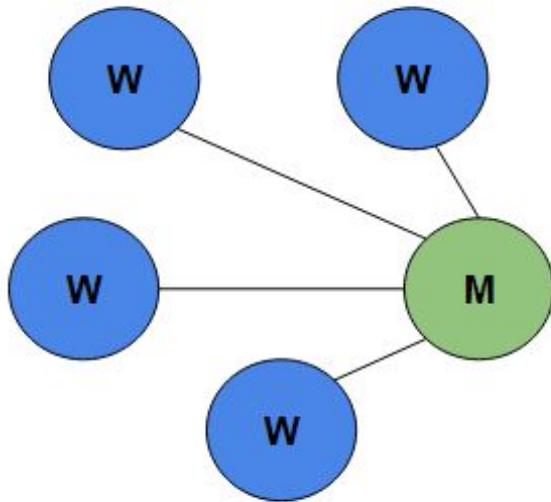
Peer to Peer



Main and
Worker

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Distributed Systems



Pros and Cons

Pros:

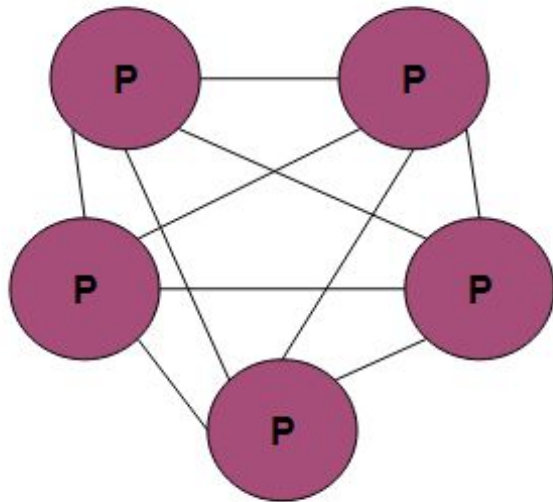
- Straightforward setup
- Logic is centralized
- Communication is linear

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 little bit!

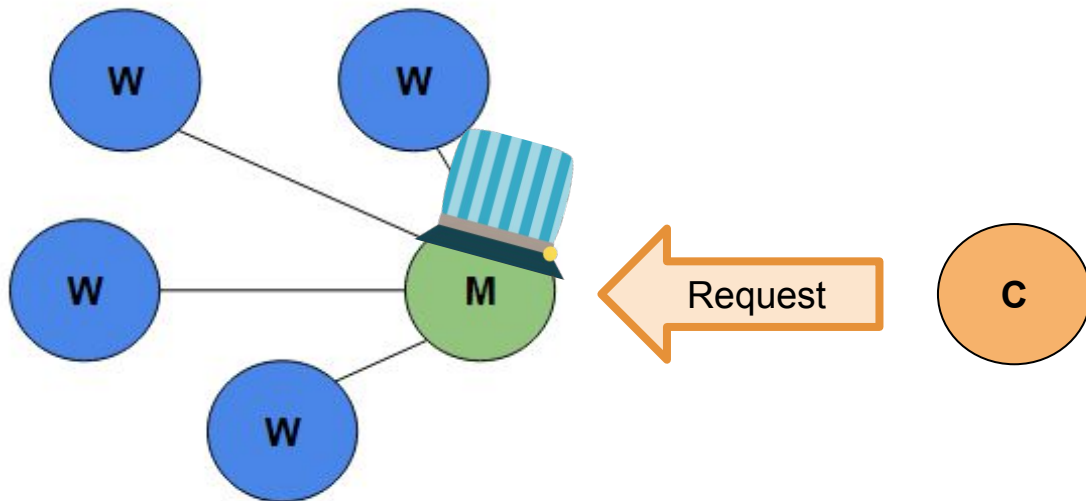
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Distributed Systems

Process Flow!

DATA

Workers
only do
their task
then report
back



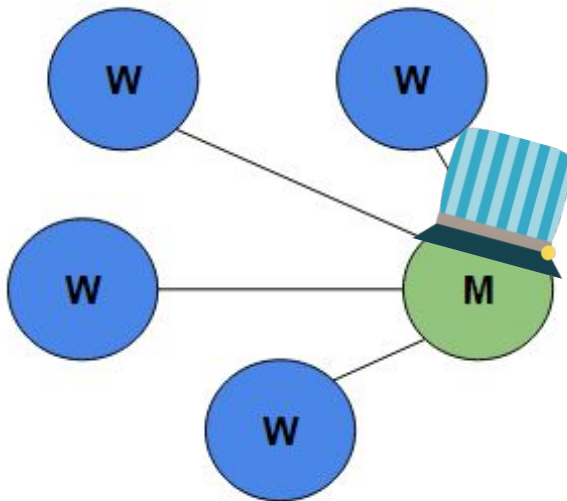
Main is like our server

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Distributed Systems

Process Flow!

Workers
only do
their task
then report
back



DATA



D1

D2

D3

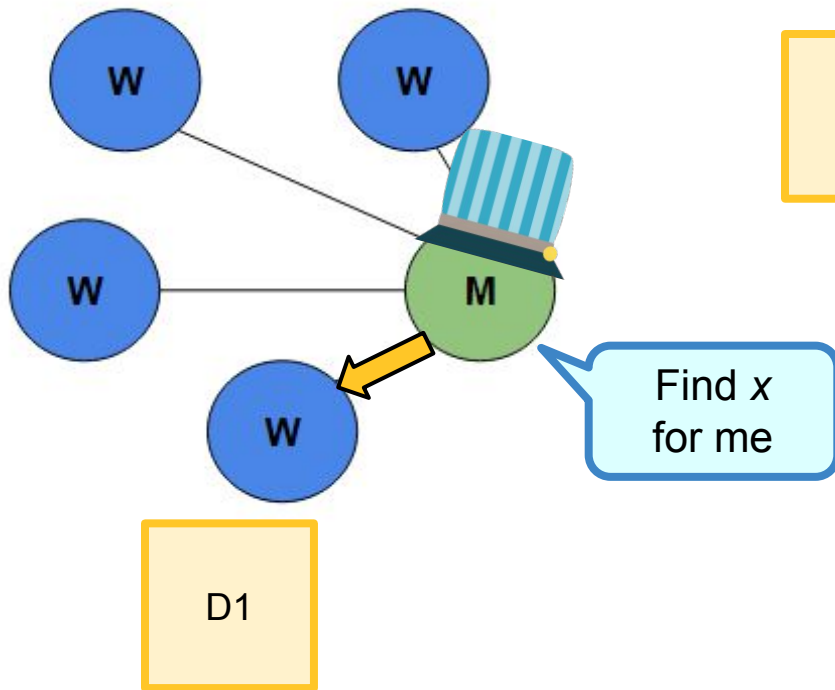
D4

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Distributed Systems

Process Flow!

Workers
only do
their task
then report
back



DATA



D1

D2

D3

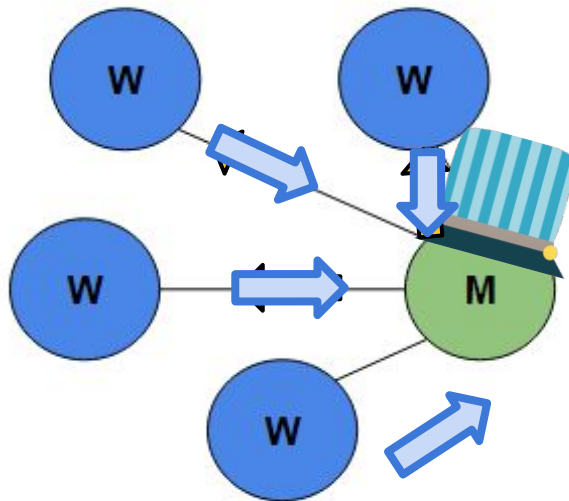
D4

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Distributed Systems

Process Flow!

Workers
only do
their task
then report
back



D1

DATA



D1

D2

D3

D4

D1
Result

D2
Result

D3
Result

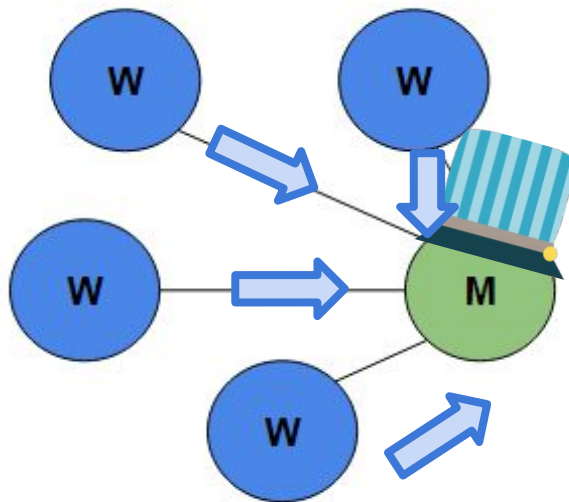
D4
Result

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Distributed Systems

Process Flow!

Workers
only do
their task
then report
back



D1

DATA



D1

D2

D3

D4

D1
Result

D2
Result

D3
Result

D4
Result



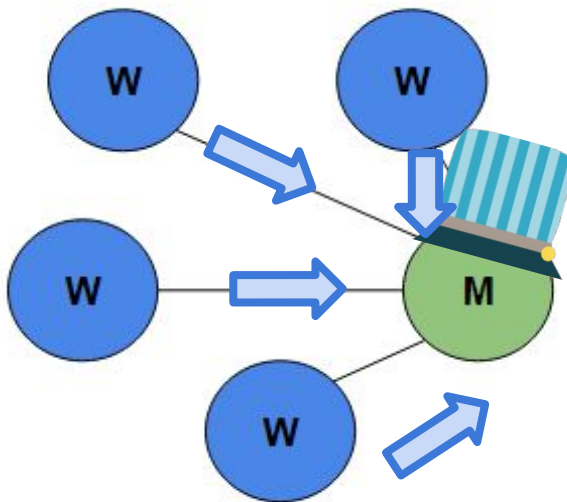
RESULTS

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Distributed Systems

Does this look familiar?

How is this different from a parallel processing model?



D1

DATA



D1

D2

D3

D4

D1
Result

D2
Result

D3
Result

D4
Result



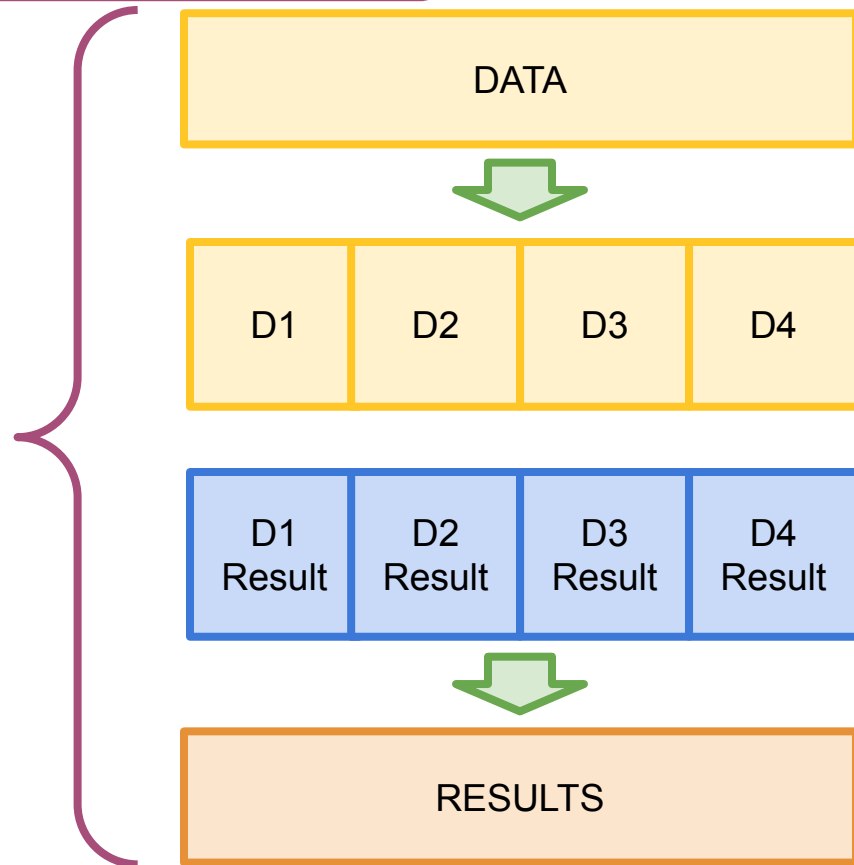
RESULTS

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Distributed Systems

What about Peer to Peer?

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



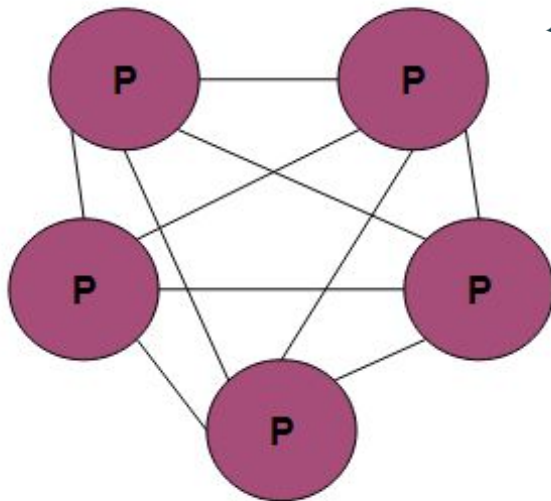
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Distributed Systems

What about Peer to Peer?

We want
someone to
wear the
conductor
hat!

A **LEADER**



How do we choose a leader?

DATA



D1

D2

D3

D4

D1
Result

D2
Result

D3
Result

D4
Result



RESULTS

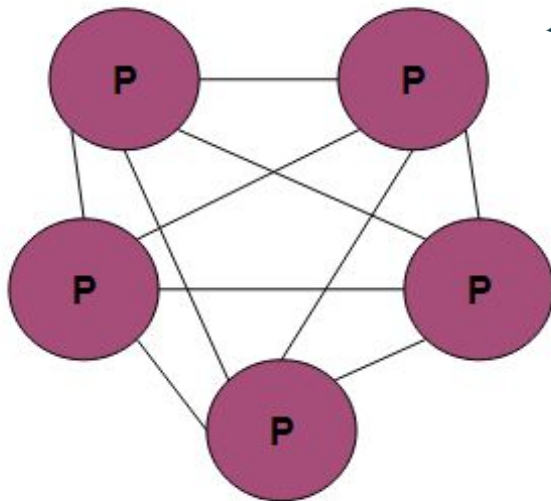
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Distributed Systems

What about Peer to Peer?

We want
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A *LEADER*



Leader Election!

DATA



D1

D2

D3

D4

D1
Result

D2
Result

D3
Result

D4
Result



RESULTS

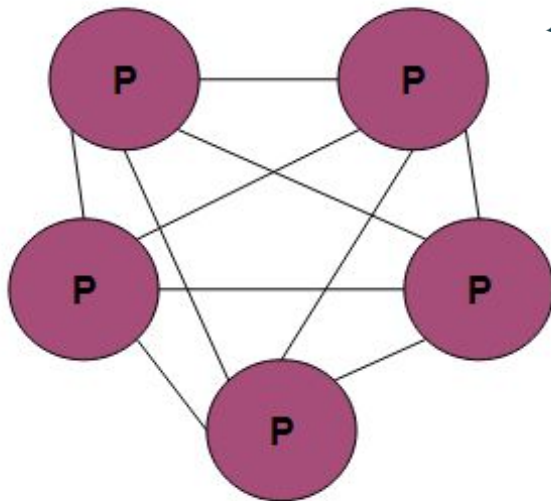
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Distributed Systems

What about Peer to Peer?

We want
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hat!

A **LEADER**



Leader Election!

Type of
CONSENSUS

What's
consensus?



“General agreement or
trust amongst a group”

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Consensus

“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

Blockchain

Proof of Work

RAFT

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

Leader Election and Log
Replication coordinate
transactions

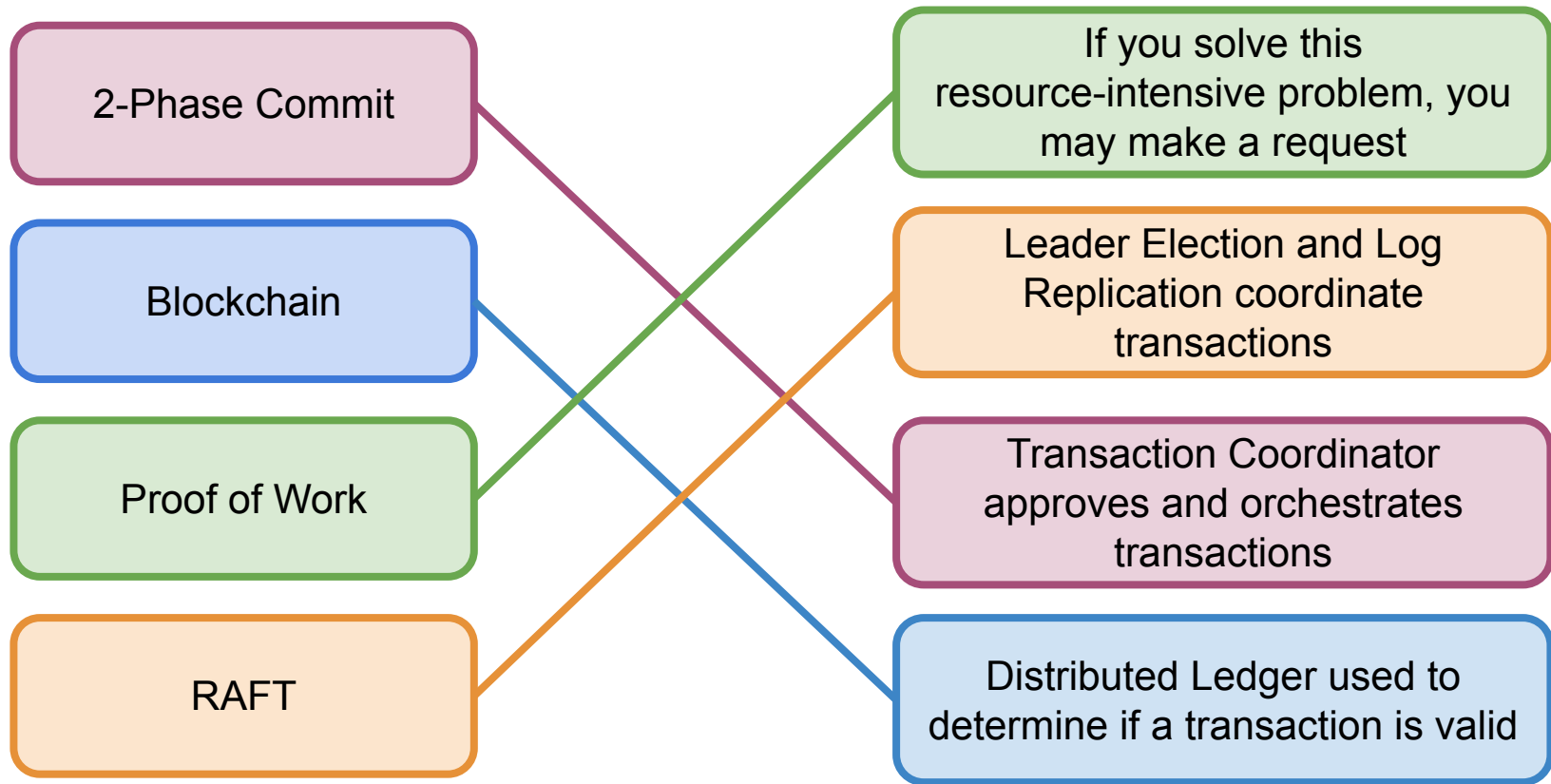
Transaction Coordinator
approves and orchestrates
transactions

Distributed Ledger used to
determine if a transaction is valid

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Consensus

Match the Consensus Algorithm to its Description!



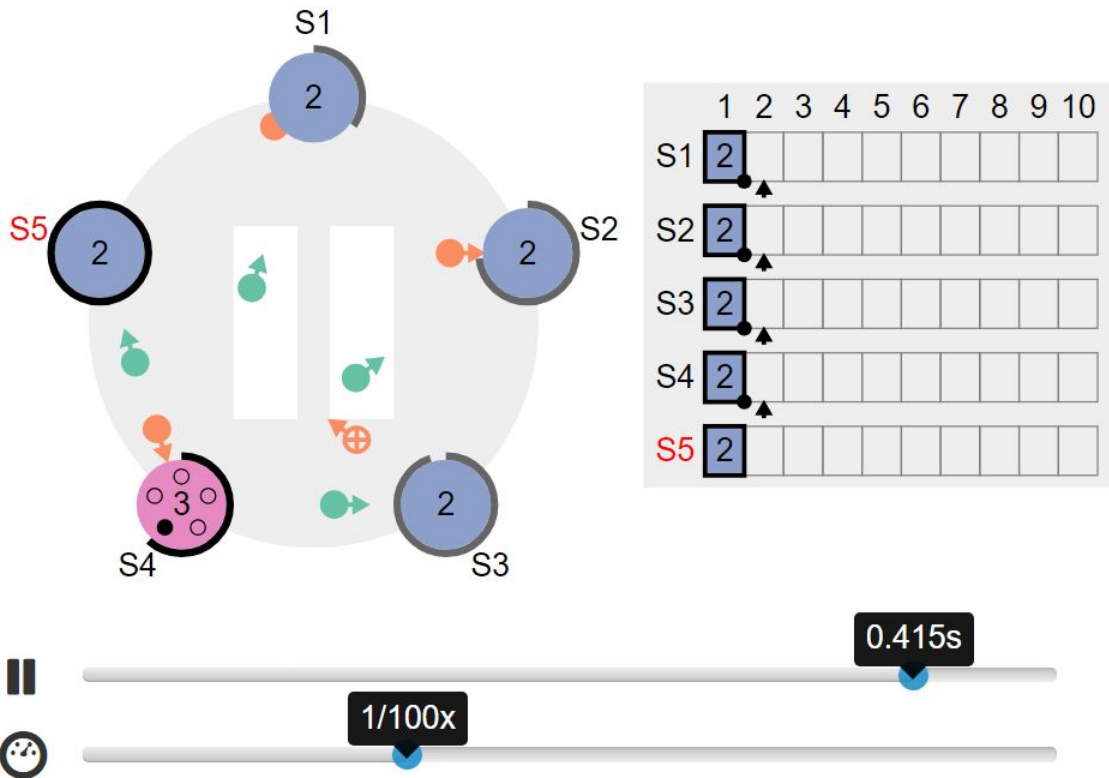
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RAFT

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

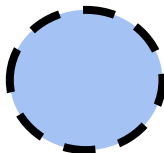
Leader Election

Nodes have 3 states:

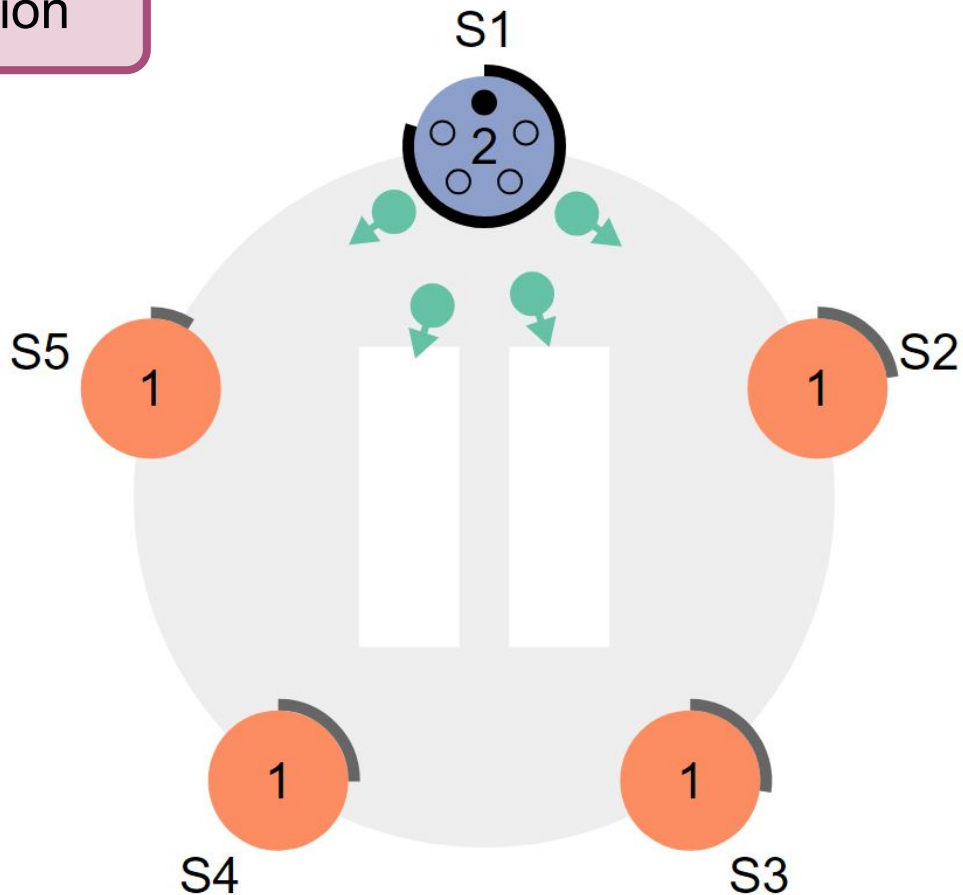
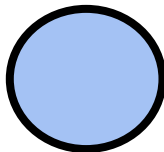
Follower



Candidate



Leader

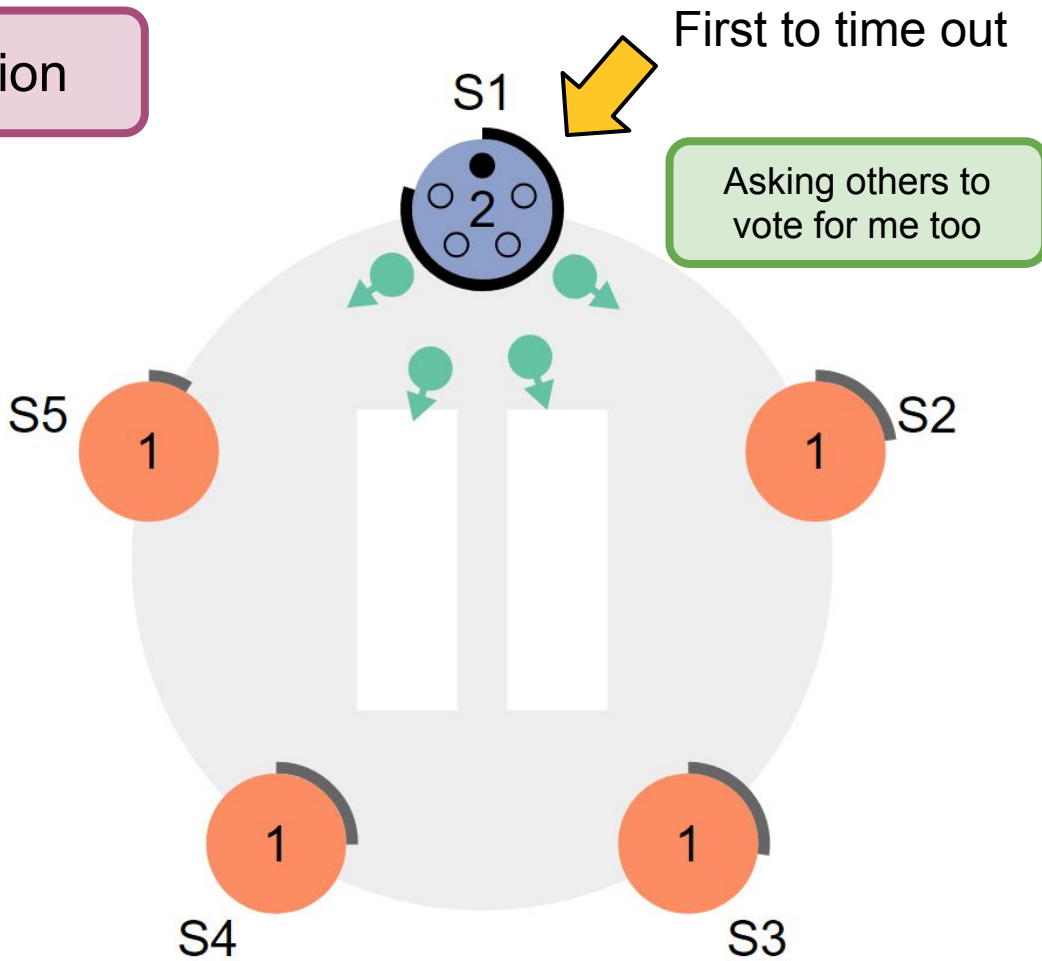


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RAFT

Leader Election

This is the first election

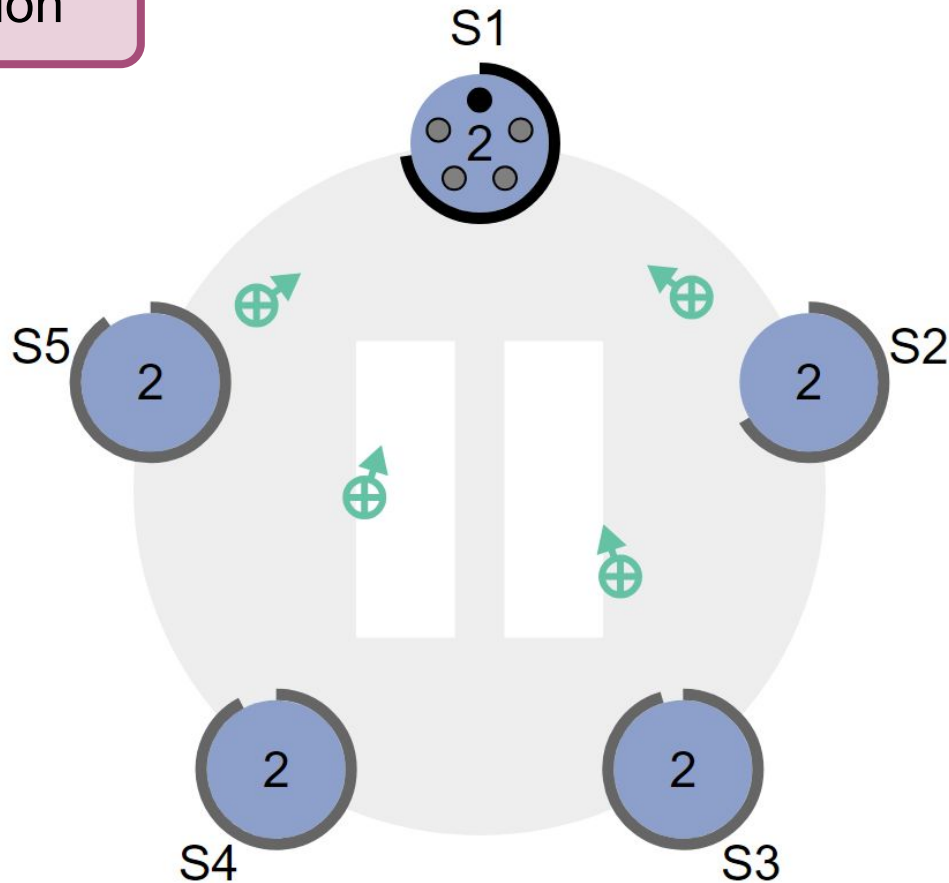


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RAFT

Leader Election

Other nodes said
sure whatever

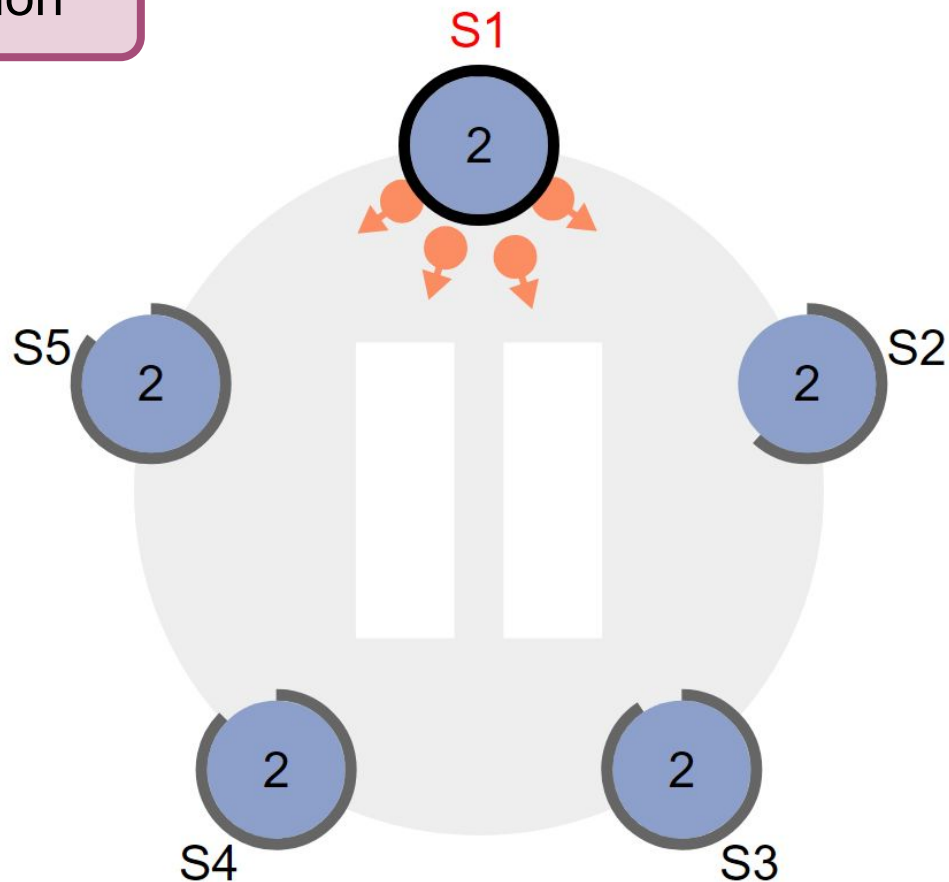


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RAFT

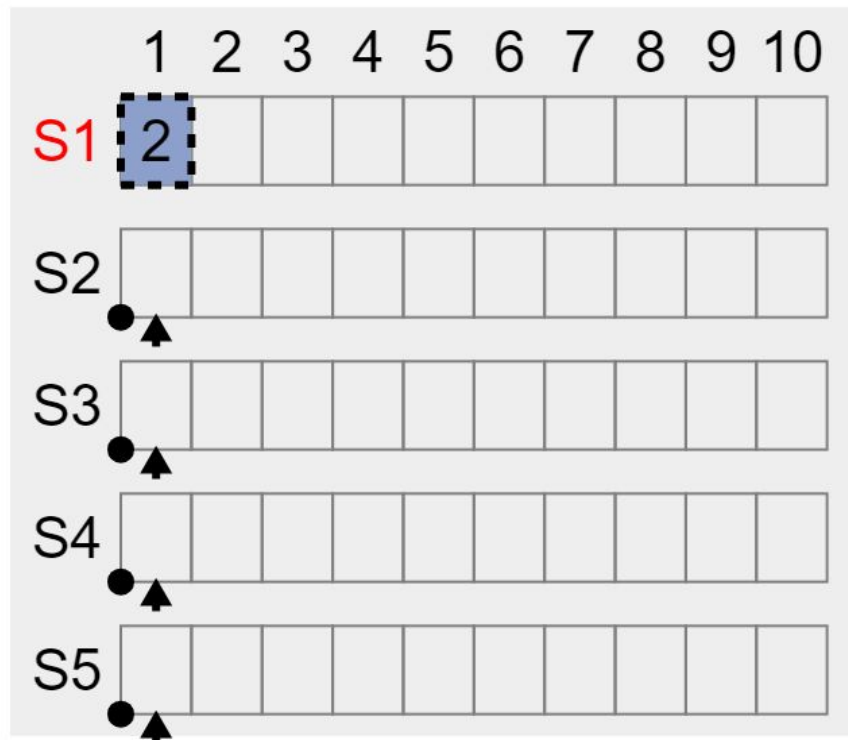

Leader Election

Now confirmed
as Leader



RAFT

Same Pattern!



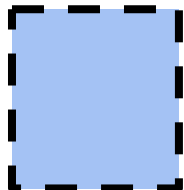
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RAFT

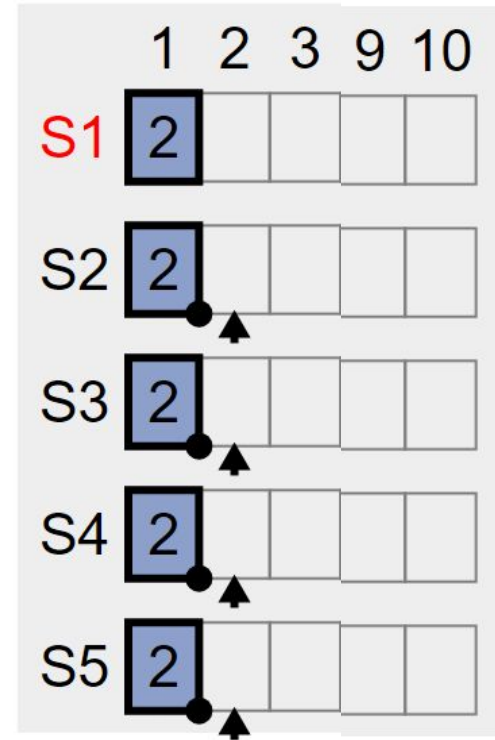
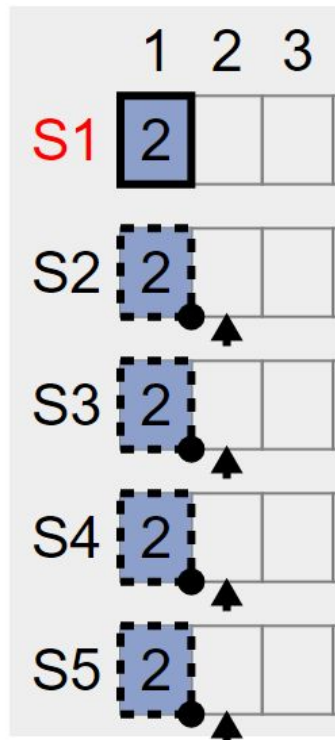
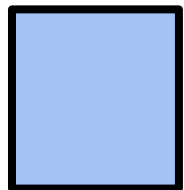
Log Replication

Same Pattern!

Candidate



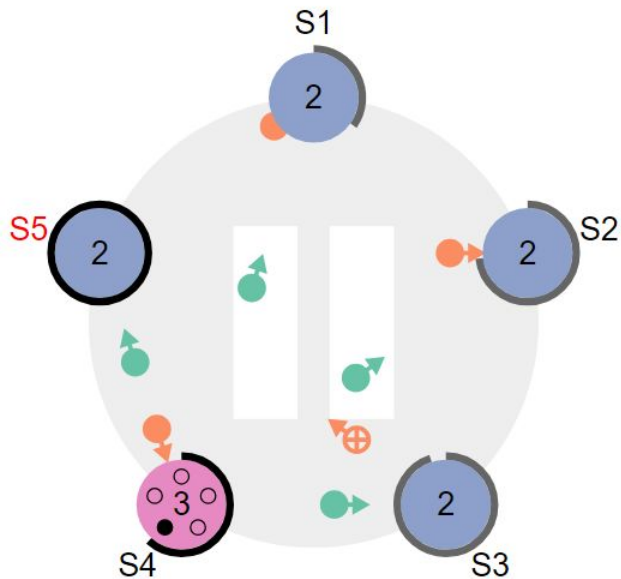
Added



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RAFT

RAFT



	1	2	3	4	5	6	7	8	9	10
S1	2									
S2	2									
S3	2									
S4	2									
S5	2									

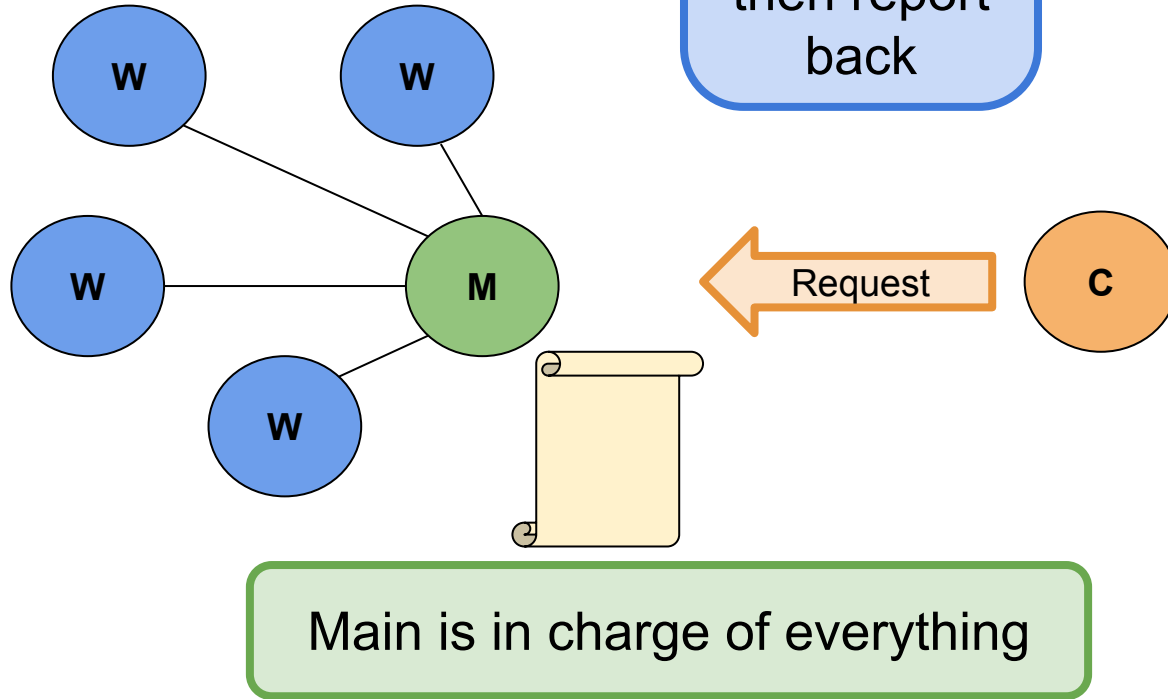


1/100x

0.415s

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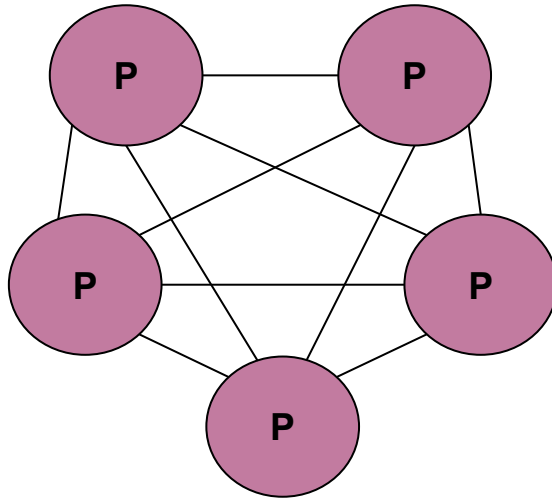
Communication



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Communication

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



Request is sent to the
current leader

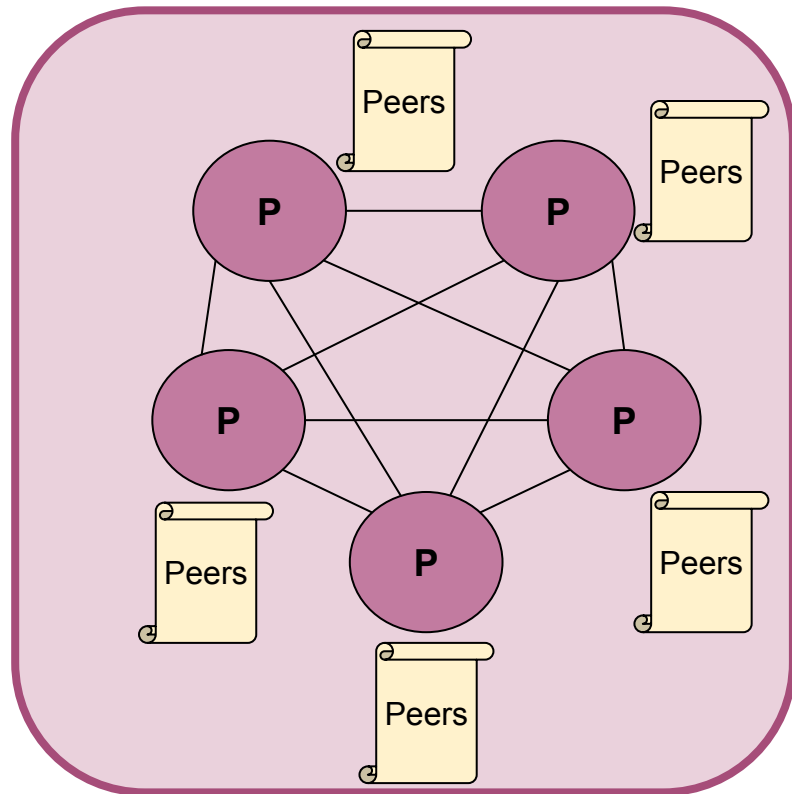
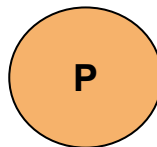
or

Peer that received the
request *acts as the leader*

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Communication

What about *adding* a Peer to the Cluster?



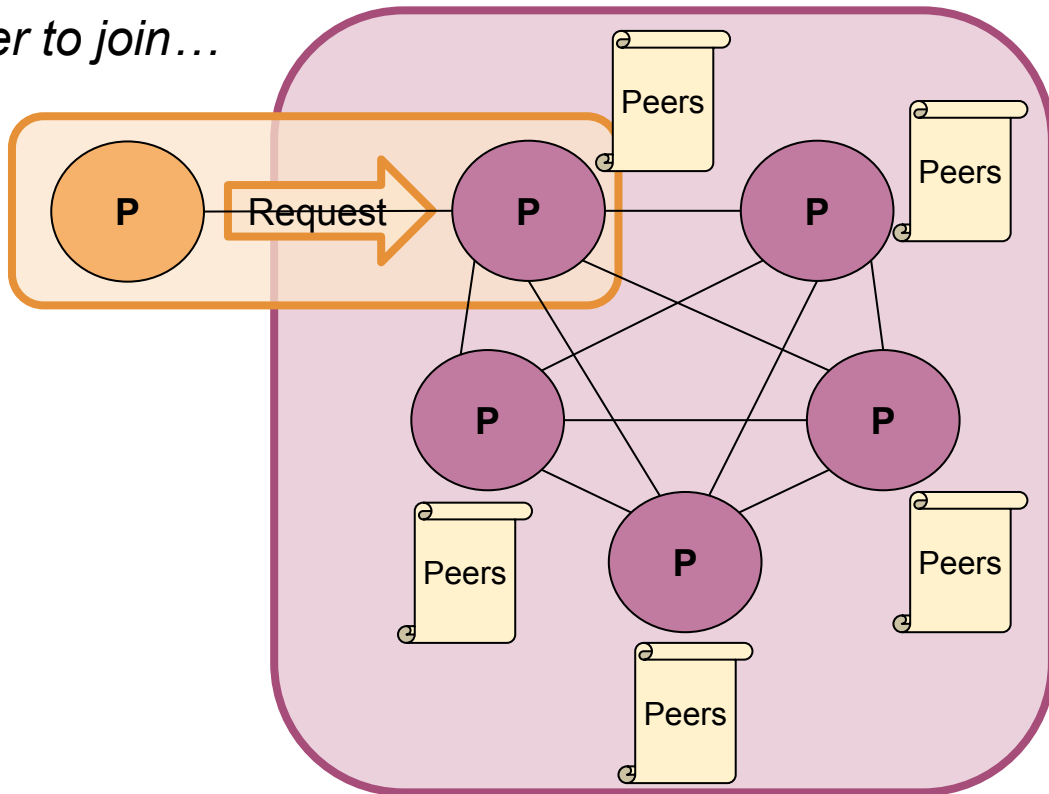
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Communication

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

Assuming we want to allow the peer to join...

Is that all?



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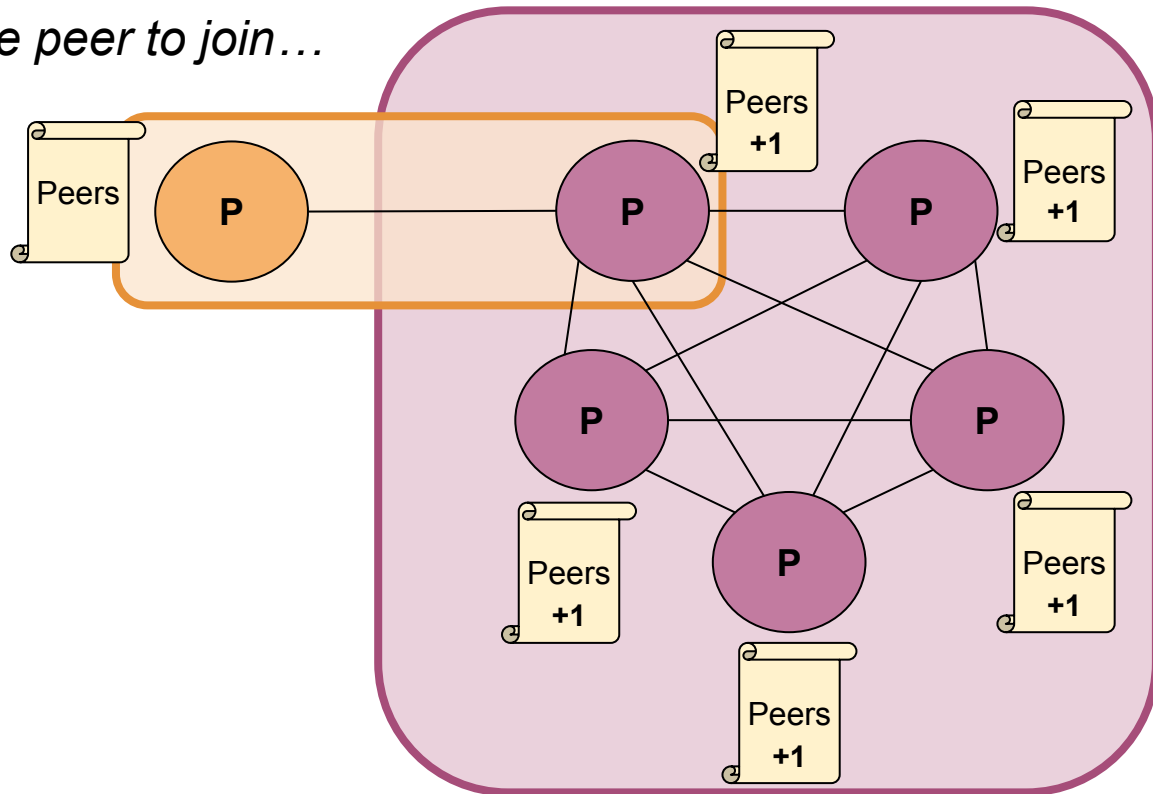
Communication

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

Assuming we want to allow the peer to join...

Three Additional Steps:

- 1.
- 2.
- 3.



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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>



More Questions?

Check out our other resources!

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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.

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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.

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[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-

Go to Zoom

2-

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[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

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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 -

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- Any -

Apply

Business

ACC 231

Uses of Accounting Info I

 [Peer Community](#)

ACC 241

Uses of Accounting Info II

 [Peer Community](#)

CIS 105

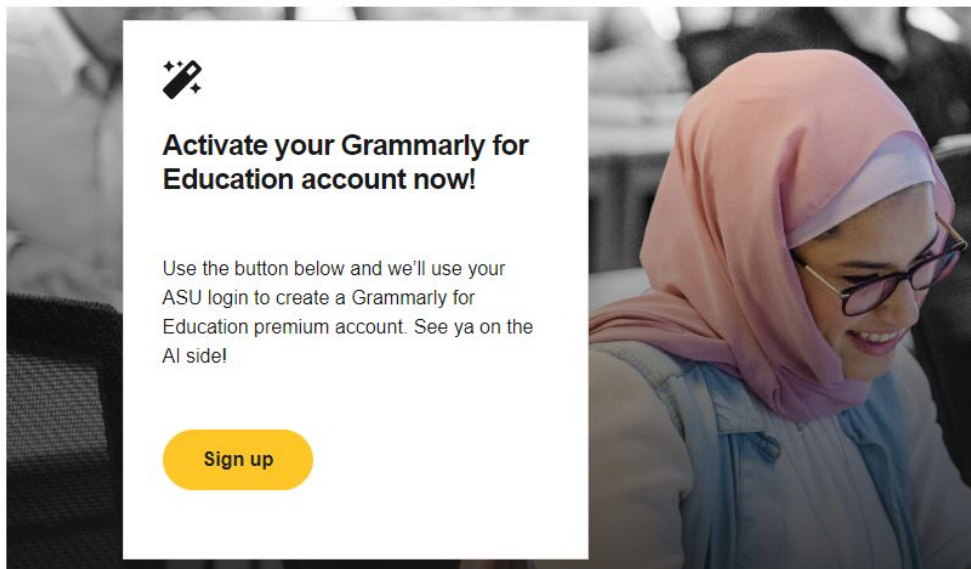
Computer Applications and Information Technology

 [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!



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](#)