

SER 321 A Session

SI Session

Thursday, February 13th 2025

7:00 pm - 8:00 pm MST

Agenda



Protobuf Examination

Distributed Systems Overview

Parallel vs. Distributed Processing

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



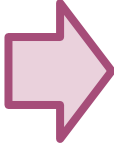
Zoom Chat

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

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Protobuf Examination

Operation Protocol for
ProtocolBuffers in
the example repo



Protobuf Lecture & Walkthrough

```
1 syntax = "proto2";
2
3 package operation;
4
5 option java_package = "buffers";
6 option java_outer_classname = "OperationProtos";
7
8 message Operation {
9     optional string val1 = 1;
10    optional string val2 = 2;
11    optional int32 base = 3;
12    enum OperationType {
13        ADD = 0;
14        SUB = 1;
15        MUL = 2;
16        DIV = 3;
17    }
18    enum ResponseType {
19        JSON = 0;
20        STRING = 1;
21    }
22    optional OperationType operationType = 4 [default = ADD];
23    optional ResponseType responseType = 5 [default = JSON];
24
25 }
```

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Protobuf Examination

What **CLASS** would you use for this?

What **FIELDS** do you add for use?

Can you change the Protobufs for the Assignments?

Protobuf Lecture & Walkthrough

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25 }
```

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Protobuf Examination

Let's request "7 x 8" in Base 10:

```
Operation = Operation.newBuilder()  
    .setVal1(7)  
    .setVal2(8)  
    .setBase(10)  
    .setOperationType(2)  
    .setResponseType(0)  
    .build();
```

Solution

Protobuf Lecture & Walkthrough

```
1 syntax = "proto2";  
2  
3 package operation;  
4  
5 option java_package = "buffers";  
6 option java_outer_classname = "OperationProtos";  
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24  
25 }
```

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Protobuf Examination

As the Server, how would you determine the requested operation type?

Operation request =
 Operation.parseDelimitedFrom(in);

request.getOperationType()

Operation.OperationType =
 request.getOperationType();

Solution

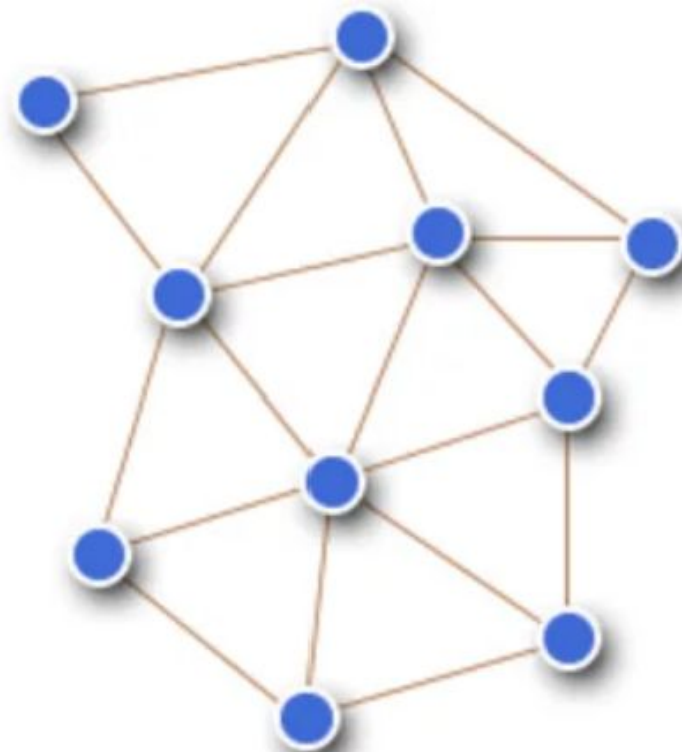
Protobuf Lecture & Walkthrough

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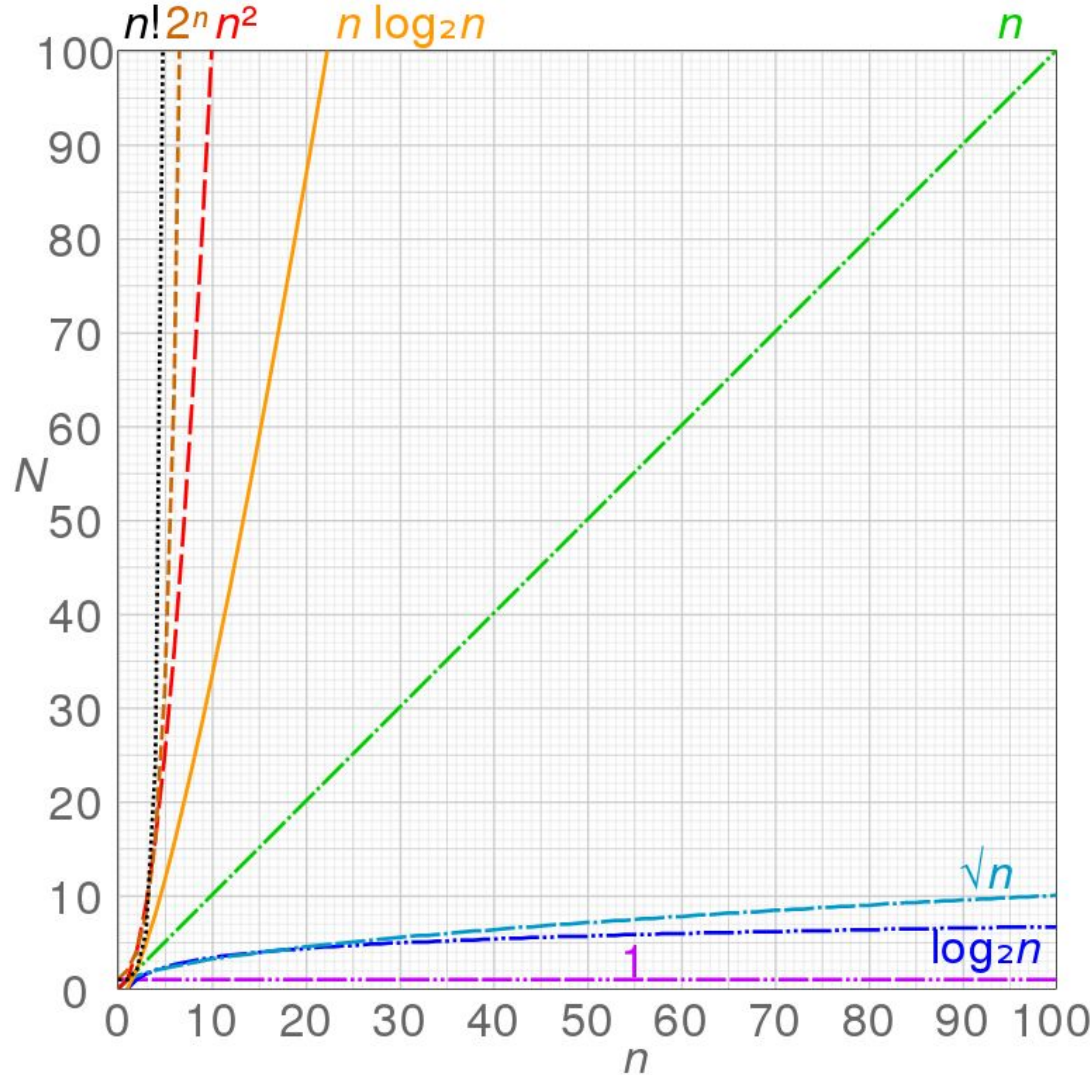
Distributed Systems

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



Distributed Systems

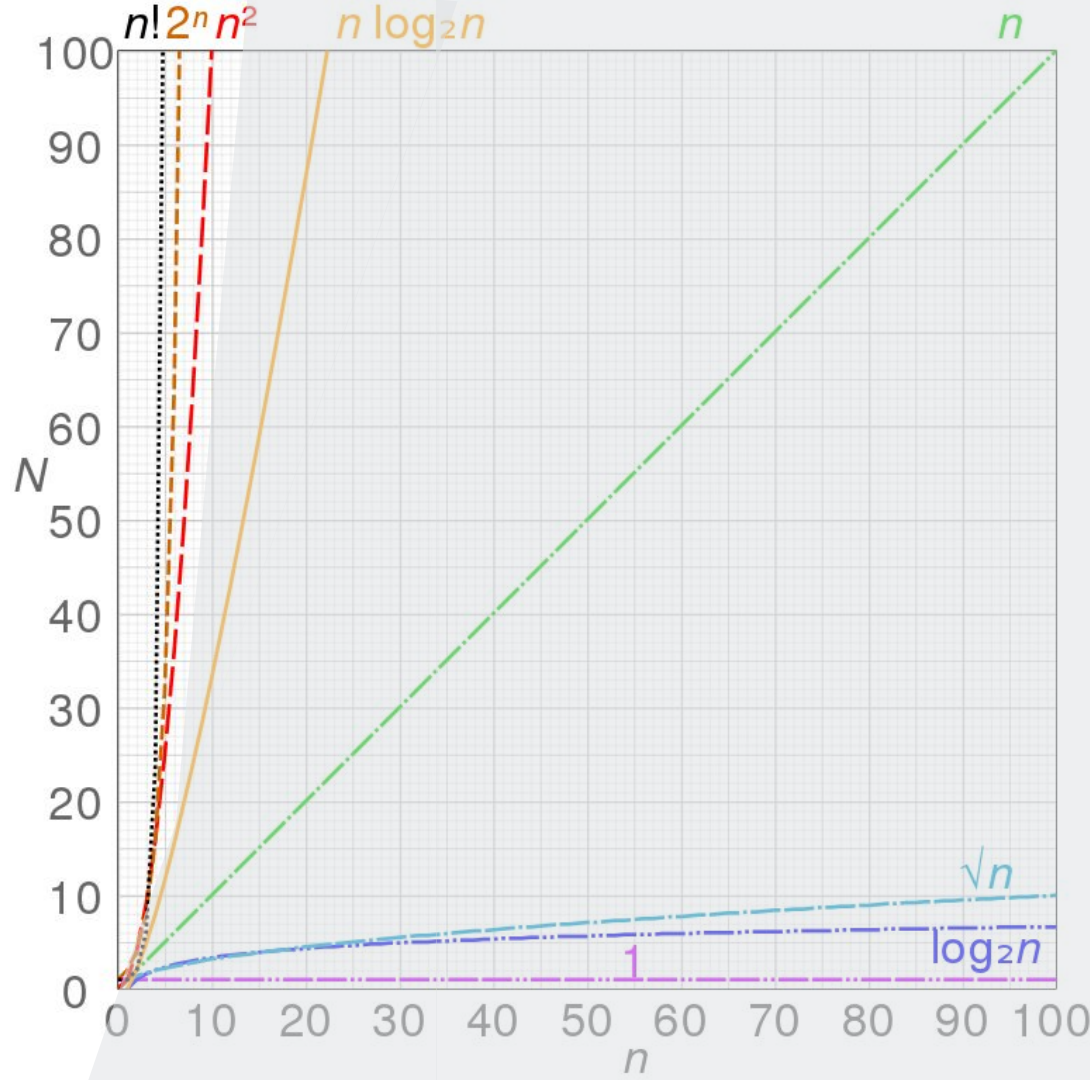
When should
we *consider*
distributing?



Distributed Systems

When should
we *consider*
distributing?

Super Duper Extra Extra
Large Orders of Magnitude!



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Systems

Parallel



A Venn diagram with two overlapping circles. The left circle is light blue with a blue outline and is labeled 'Parallel'. The right circle is light red with a red outline and is labeled 'Distributed'. The intersection of the two circles is shaded with a mix of blue and red. The text 'SER 321' is in a yellow box at the top left, and 'Systems' is in a black box below it.

Distributed

Parallel

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

Distributed

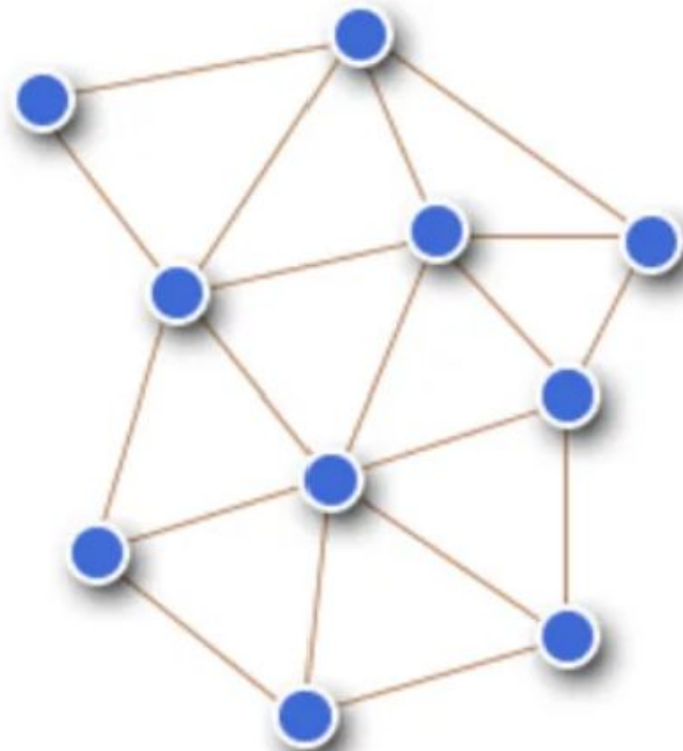
- Work is partitioned
- Partitions processed individually
- **Can** improve performance
- **Can** improve speed
- Many computers
- Work split among different *locations*
- Memory is distributed
- Communicate through *message passing*

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Distributed Systems

Remember that we are operating in *reality*

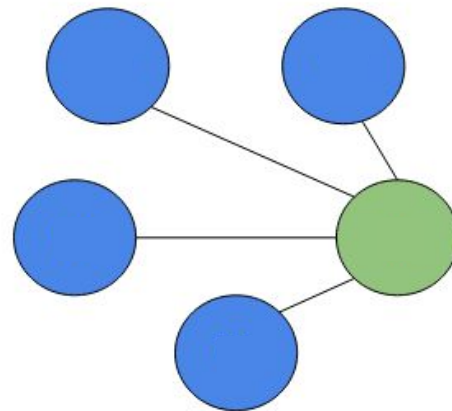
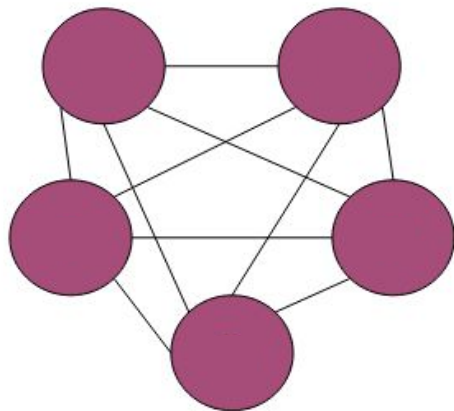
- No global clock
- Nodes *will* fail
- Web of nodes *will constantly* change
- Network is not *always* reliable
- Latency is *always present*
- The path traversed *changes*
- Some resources *must be shared*
- You need to prevent the pitfalls!
 - No deadlocks
 - No starvation
 - No error states



Main and Worker

Peer to Peer

Which is which?



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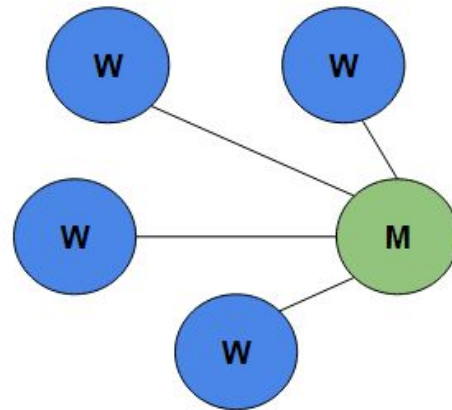
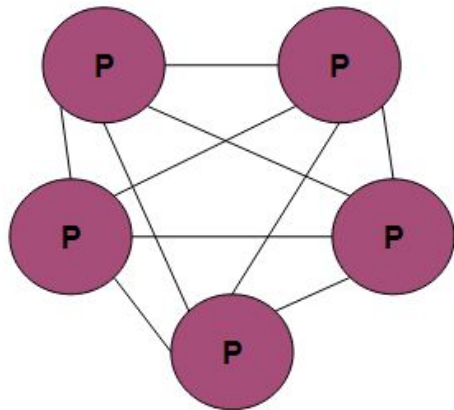
Distributed Systems

Main and Worker

Peer to Peer

Which is which?

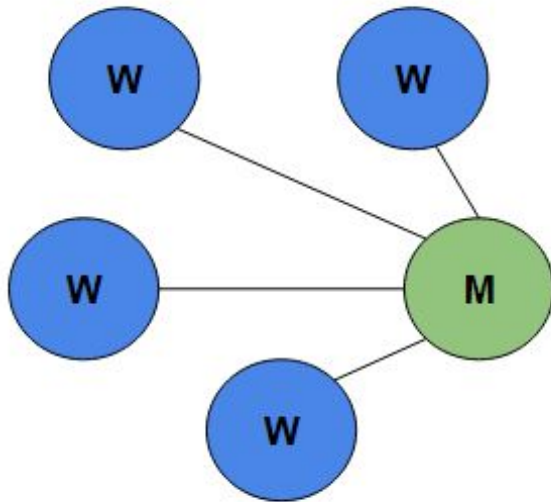
Peer to Peer



Main and
Worker

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Distributed Systems



Pros and Cons

Pros:

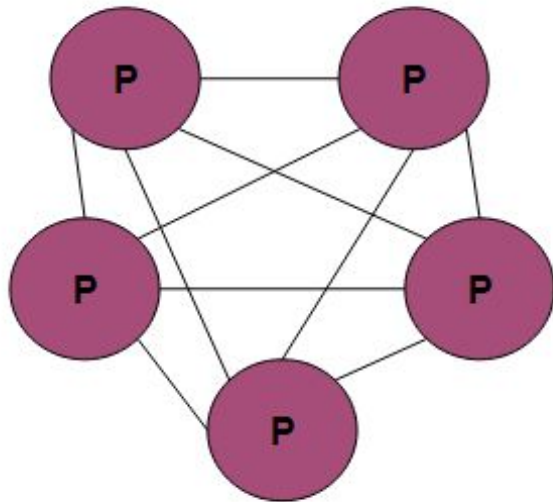
- Straightforward setup
- Logic is centralized
- Communication is linear

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 moment!

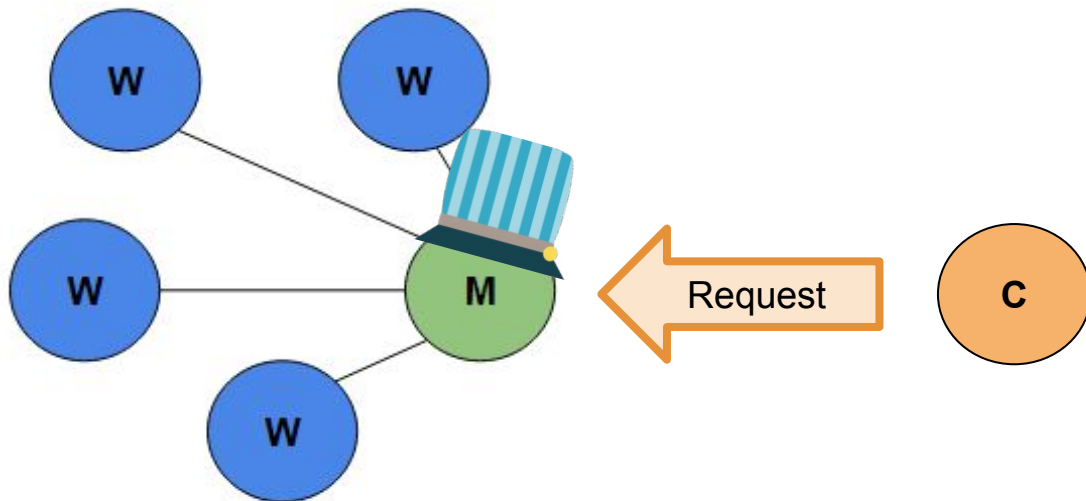
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Distributed Systems

Process Flow!

DATA

Workers
only do
their task
then report
back



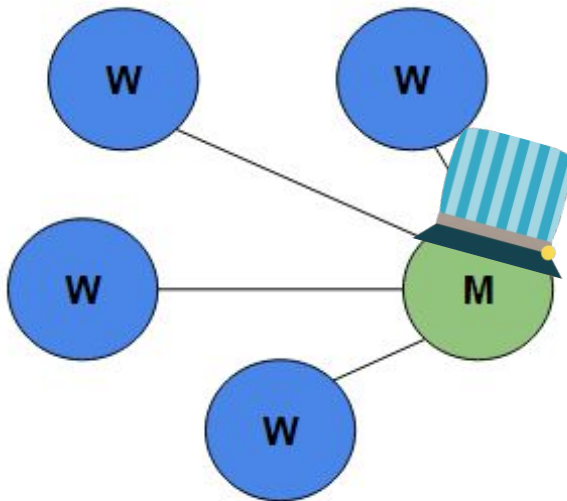
Main is like our server

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Distributed Systems

Process Flow!

Workers
only do
their task
then report
back



DATA



D1

D2

D3

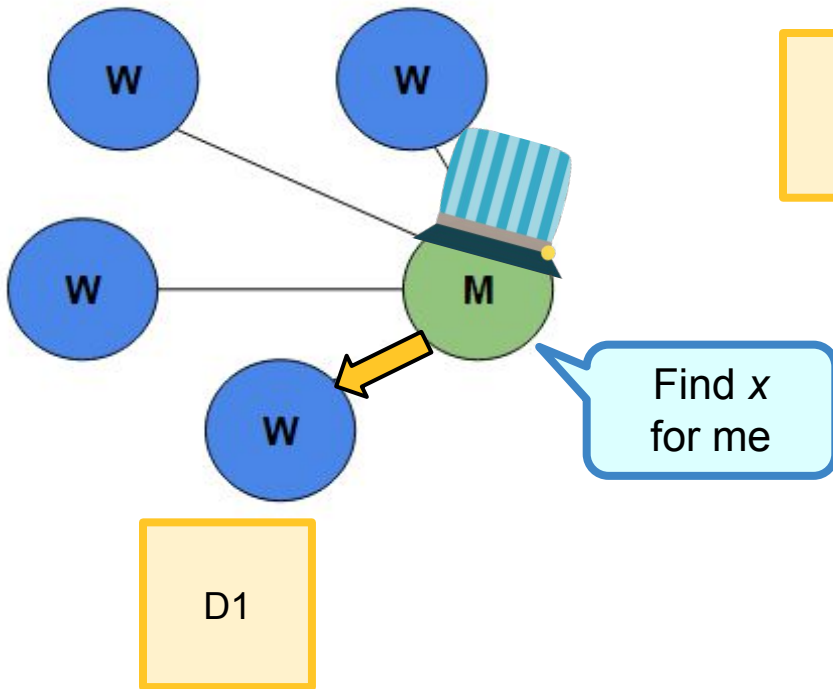
D4

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Distributed Systems

Process Flow!

Workers
only do
their task
then report
back



DATA



D1

D2

D3

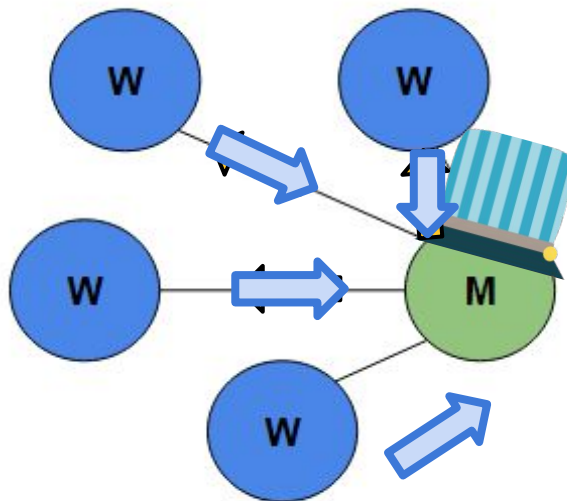
D4

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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

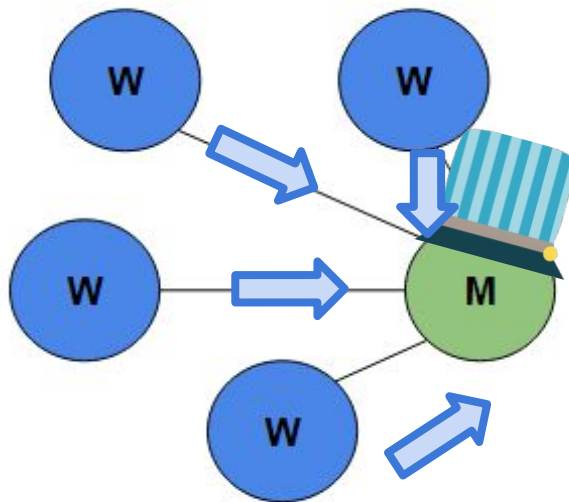
D4
Result

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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



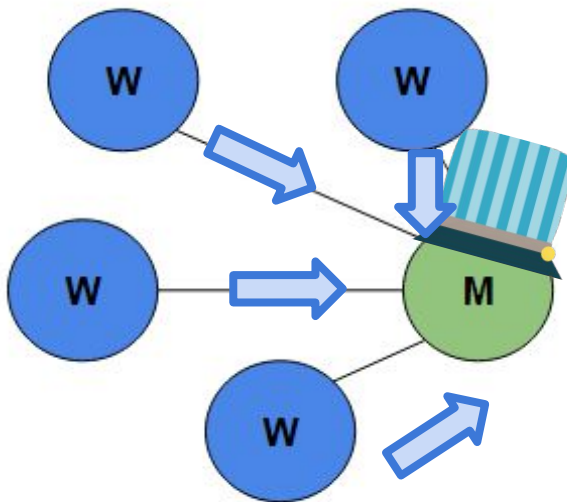
RESULTS

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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?



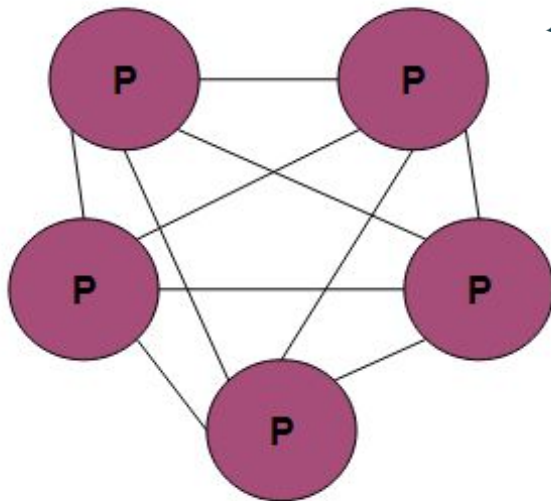
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Distributed Systems

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

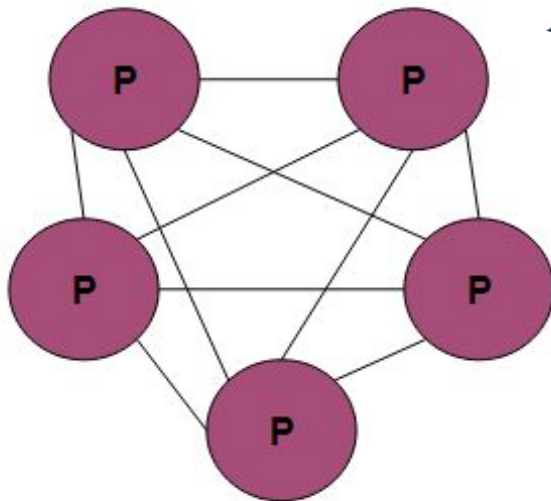
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Distributed Systems

What about Peer to Peer?

We want
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conductor
hat!

A *LEADER*



Leader Election!

DATA



D1

D2

D3

D4

D1
Result

D2
Result

D3
Result

D4
Result



RESULTS

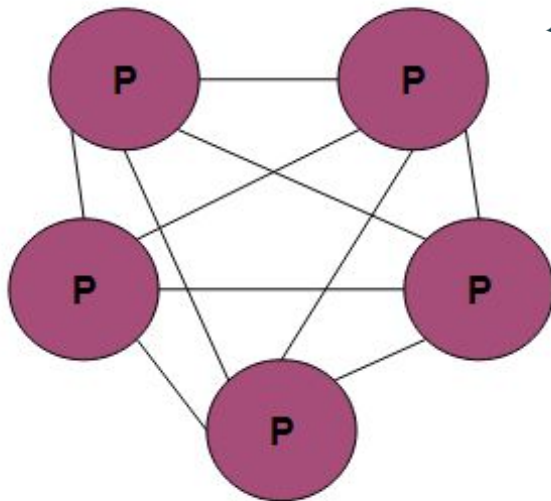
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Distributed Systems

What about Peer to Peer?

We want
someone to
wear the
conductor
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



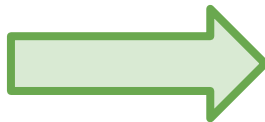
Who's in charge or keeping the beat

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

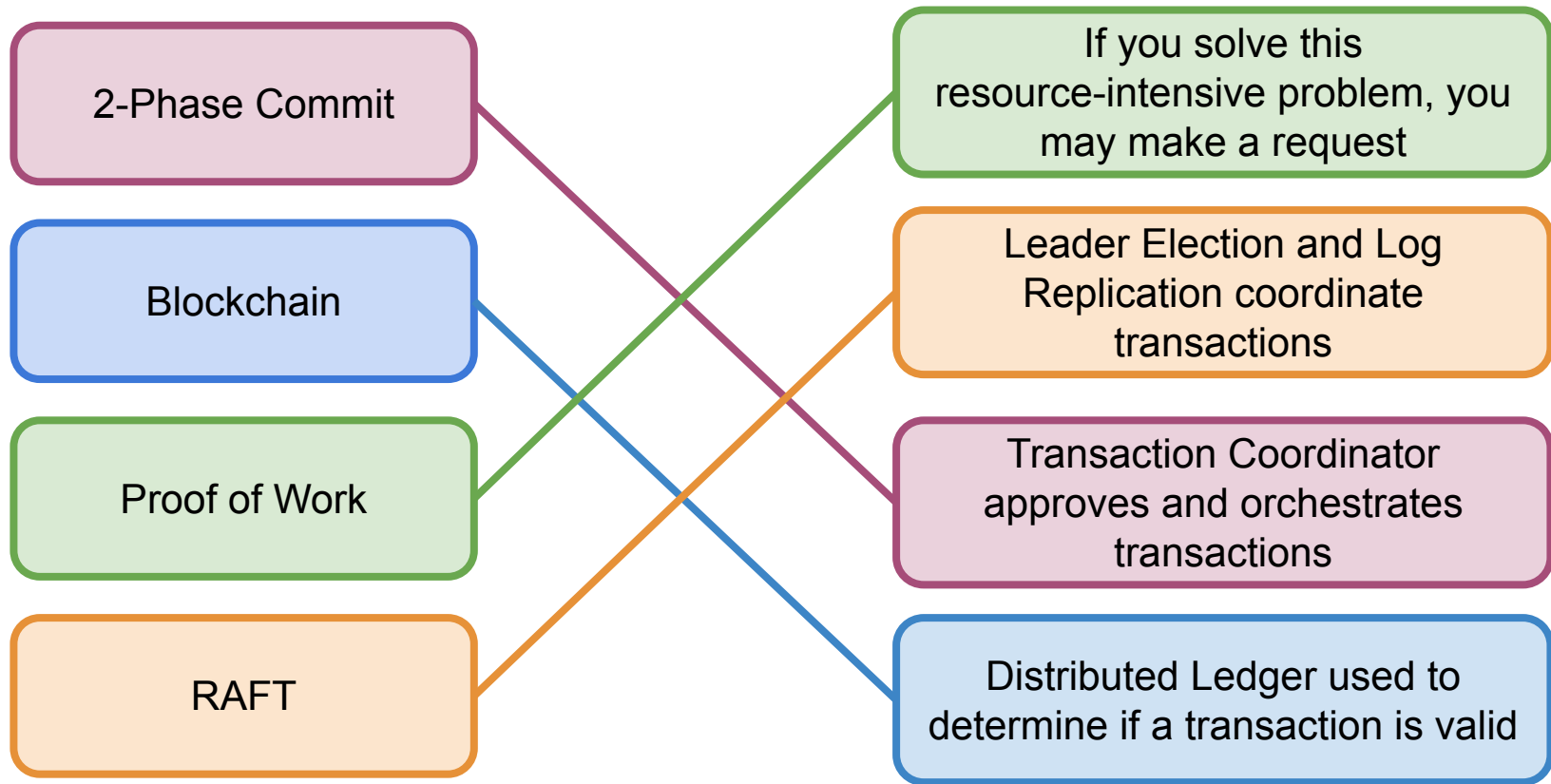
Transaction Coordinator
approves and orchestrates
transactions

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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Scratch Space

Upcoming Events

SI Sessions:

- Sunday, February 16th at 7:00 pm MST
- Tuesday, February 18th at 11:00 am MST
- Thursday, February 20th 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!

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

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

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2. Click on 'View the tutoring schedule' to see when tutors are available for specific courses.

More Questions?

Check out our other resources!

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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.

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Business

ACC 231

Uses of Accounting Info I

 [Peer Community](#)

ACC 241

Uses of Accounting Info II

 [Peer Community](#)

CIS 105

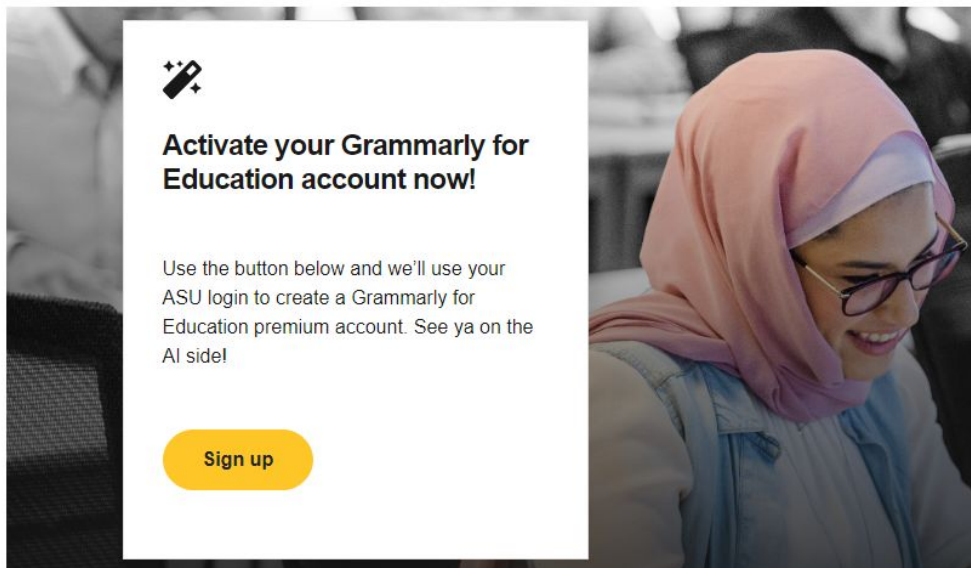
Computer Applications and Information Technology

 [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](#)
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- [Austin G Walters Traffic Comparison](#)