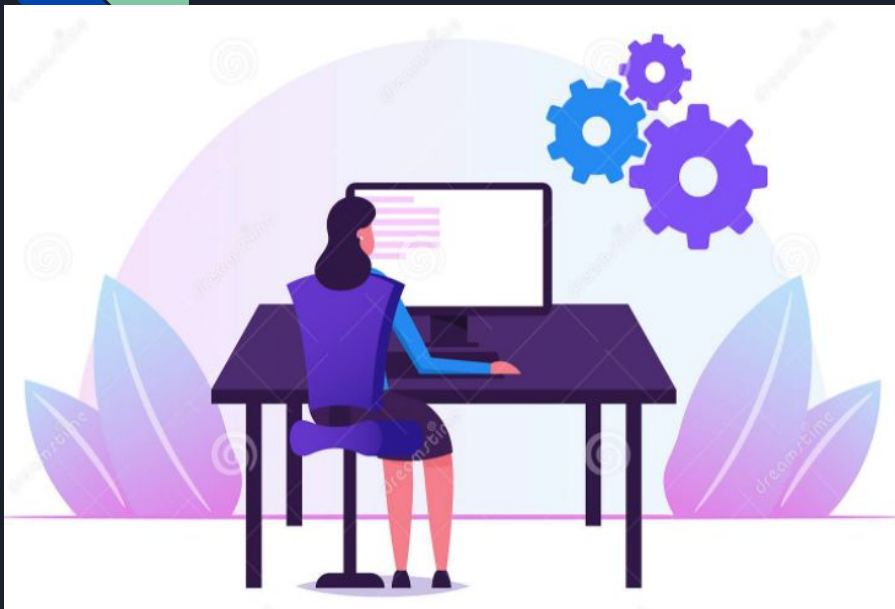


Welcome!



WWCode Digital + Backend Study Group

Nov 17, 2022

- We'll start in a moment :)
- We are **RECORDING** tonight's event.
- We may plan to take screenshots for social media.
- If you are comfortable, turn the video ON. If you want to be anonymous, then turn the video off.
- We'll introduce the hosts & make some time for Q&A at the end of the presentation.
- Feel free to take notes.
- Online event best practices:
 - Don't multitask. Distractions reduce your ability to remember concepts.
 - Mute yourself when you aren't talking.
 - We want the session to be interactive.
 - Use the 'Raise Hand' feature to ask questions.
- **By attending our events, you agree to comply with our [Code of Conduct](#).**

Check out:

- [Technical Tracks](#) and [Digital Events](#)
- Get updates – join the [Digital mailing list](#)
- Give us your feedback – take the [Survey](#)



Backend Study Group

- Welcome from WWCode!
- Our mission: Empower diverse women to excel in technology careers.
- Our vision: A tech industry where diverse women and historically excluded people thrive at any level.



Harini Rajendran

Lead, Women Who Code San Francisco

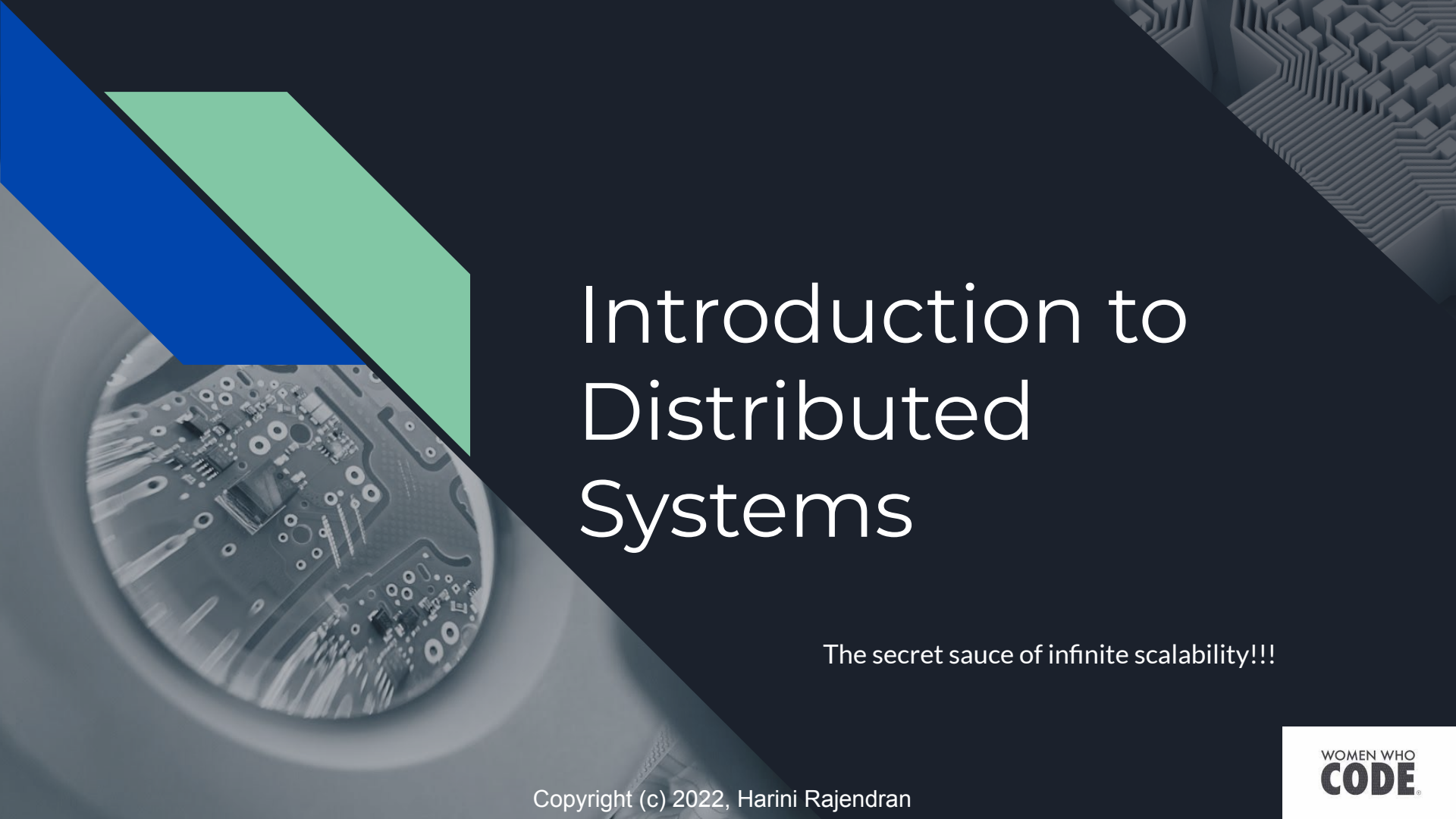
<https://www.linkedin.com/in/hrajendran/>



Anjali Bajaj

Volunteer, Women Who Code San Francisco

<https://www.linkedin.com/in/anjali-bajaj/>



Introduction to Distributed Systems

The secret sauce of infinite scalability!!!

Agenda

What is Distributed Systems

Why Distributed Systems

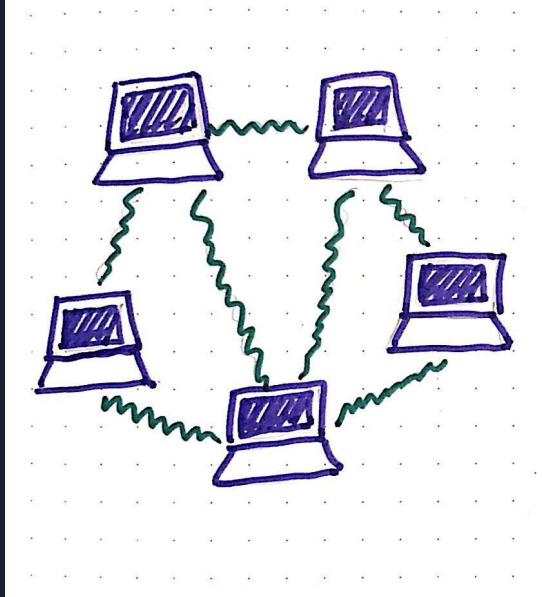
Characteristics of Distributed Systems

Challenges of Distributed Systems

Distributed Systems Categories

Q & A

What is Distributed Systems



A group of computers working together but appears as a single computer to the end user.



What is Distributed Systems

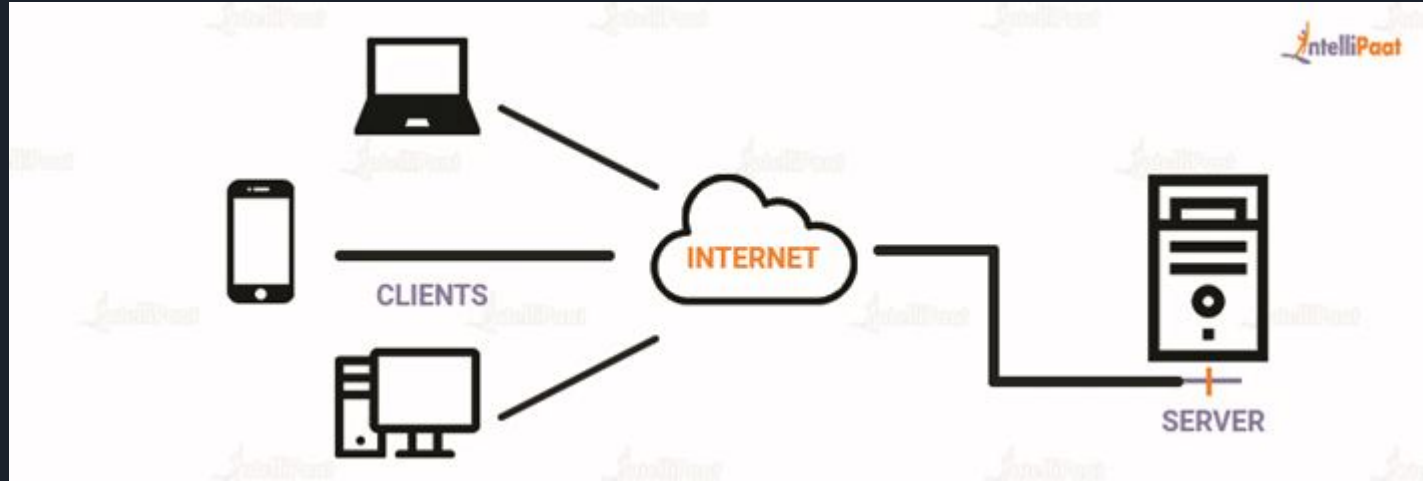
- Shared state, operate concurrently
- Can fail independently without affecting the whole system's uptime. No Single Point of Failure
- The devices split up the work, coordinating their efforts to complete the job more efficiently than if a single device had been responsible for the task.
- All components are connected by a network for communication with each other



Types of Distributed Systems Architecture

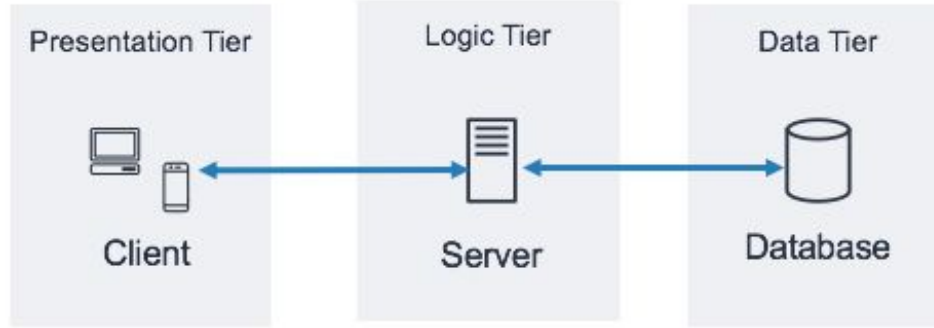
- Client Server
- Multi Tier
- Peer to Peer

Client Server Architecture



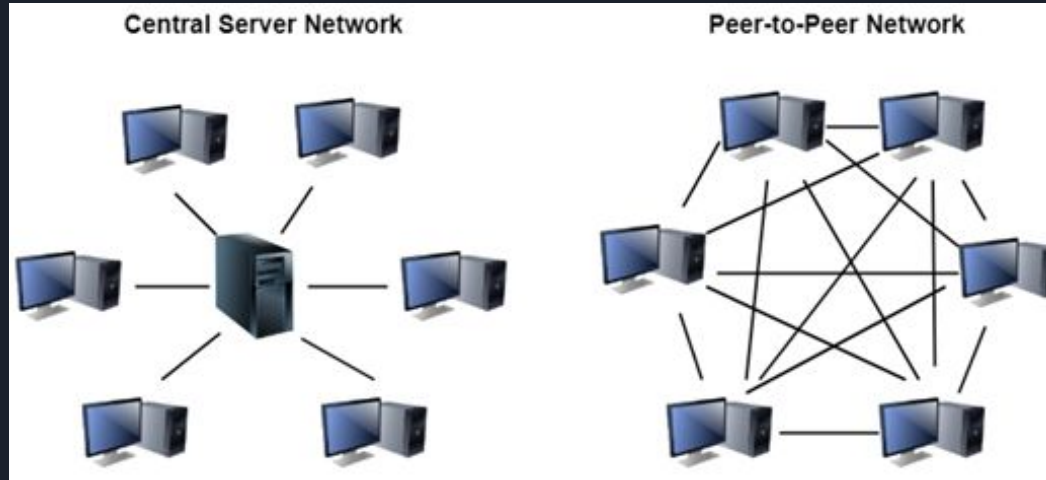
- Many clients (remote processors) request and receive service from a centralized server (host computer).
- Server does all heavy-lifting
- Ex: Printers in library

Multi Tier Architecture



- Presentation Tier -> Application Tier -> Data Tier
- These tiers can be scaled up/down independently
- Each tier can be developed concurrently by different team of programmers in different programming languages

Peer to Peer Architecture



- No centralized or special machine that does the heavy lifting and intelligent work
- All the decision making and responsibilities are split up amongst the machines involved
- Each could take on client or server roles.
- Blockchain is a good example of this.

Why Distributed Systems

Vertical Scaling

Add more resources to the same server



vs.

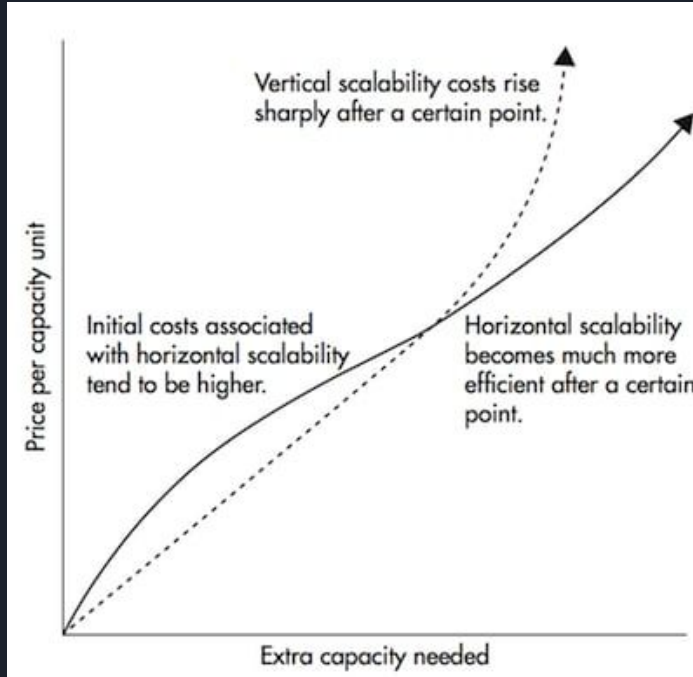
Horizontal Scaling

Add more servers



Vertical scaling vs. Horizontal scaling

Why Distributed Systems



- Enables indefinite scaling(theoretically)
- Cheaper to scale because of commodity hardware
- Computation speed
 - Parallel computation on multiple computers
- No more single point of failure



Characteristics of Distributed Systems

- Scalability
 - Scalability is the capability of a system, process, or network to grow and manage increased demand.
 - Horizontal and vertical scaling
 - Reasons for scaling: Increased data volume, Increased workload
- Reliability
 - Reliability is the probability a system will not fail in a given period
 - The system will continue to work even when one or more components fail
 - Cheap commodity hardware - Failed nodes can be replaced easily
 - Achieved through redundancy of software components and data
- Availability
 - Availability is when a system remains operational to perform its required function in a specific period
 - Percentage of time a system is operational



Characteristics of Distributed Systems

- Efficiency
 - Latencies (Response time)
 - Throughput (Number of requests handled)
 - Decisions to scale the system up are usually based on these factors
- Serviceability or Manageability
 - Ease of maintenance and operations
 - Speed at which the system can be maintained or repaired
 - High maintenance can result in low availability
 - Ease of diagnosis, sufficient logging, sufficient operational metrics, intelligent monitoring and alerting, etc



Challenges of Distributed Systems

- Increased opportunities for failure
 - In a poorly designed system, a single node crash can bring the whole system down
 - Fault tolerance is not foolproof
- Scalability and performance are not linear
 - 2x number of nodes doesn't mean 2x performance
 - Designing a distributed system with linear scalability is super complicated and has to take into account load balancing, bandwidth management, redundancy management, etc
- Security is complex
 - A single weak link in one node can expose the whole system to attack



Distributed Systems Categories

- Distributed Datastore
- Distributed Computing
- Distributed File system
- Distributed Messaging
- Distributed Ledger
- Distributed Applications



Distributed Systems Categories

Datastore

Apache Druid, Elasticsearch, Cassandra, DynamoDb

Computing

Hadoop MapReduce, Apache Spark, Apache Storm, Apache Flink, Apache Samza, Kafka streams

File System

HDFS - Hadoop Distributed File System

Messaging

Apache Kafka, Rabbit MQ, Amazon Kinesis

Ledger

Blockchain, Bitcoin

Applications

BitTorrent, Netflix, google.com, Most modern large scale systems

Backend Study Group



WWCode Slack Handle: Harini Rajendran



<https://www.linkedin.com/in/hrajendran/>



Resources and References:

- <https://www.techtarget.com/searchsoftwarequality/definition/3-tier-application>
- <https://www.confluent.io/learn/distributed-systems/>
- <https://www.toolbox.com/tech/cloud/articles/what-is-distributed-computing/>
- https://github.com/WomenWhoCode/wwcsf-backend-study-group/blob/main/meetupevents/2-3-2022/SQL%20vs%20NoSQL%20databases_WWCode_Backend%20Study%20Group_2-3-2022.pdf
- <https://github.com/WomenWhoCode/wwcsf-backend-study-group/blob/main/meetupevents/4-14-2022/Introduction%20to%20Apache%20Kafka.pdf>
- <https://dev.to/mukulalpha/system-design-101-everything-to-know-about-distributed-systems-2hd6>
- <https://www.freecodecamp.org/news/a-thorough-introduction-to-distributed-systems-3b91562c9b3c/>
- <https://pipeandpiper.co.uk/2021/08/16/what-is-cryptocurrency/>

Backend Study Group:

- Presentations and session recordings found here: WWCode YouTube channel

You can unmute and talk or use the chat.