



WELCOME TO
systemSprint
STARTS AT 7:05PM



blue	white	yellow	blue	red
green	yellow	blue	green	black
yellow	red	blue	green	yellow
red	yellow	red	white	green
blue	green	red	yellow	black
blue	black	blue	black	white
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red	yellow	blue	white	blue
red	yellow	blue	yellow	green



LETS TALK SYSTEM



WTF IS SYSTEM DESIGN



~~WTF~~

WHY IS SYSTEM
DESIGN!!!



System design is the process of defining the architecture, interfaces, and data for a system that satisfies specific requirements.



THANK YOU

JOIN US *and bring your friends :)*

EVERY **MONDAY 7:00 PM** AT **ILC S231**



Feedback

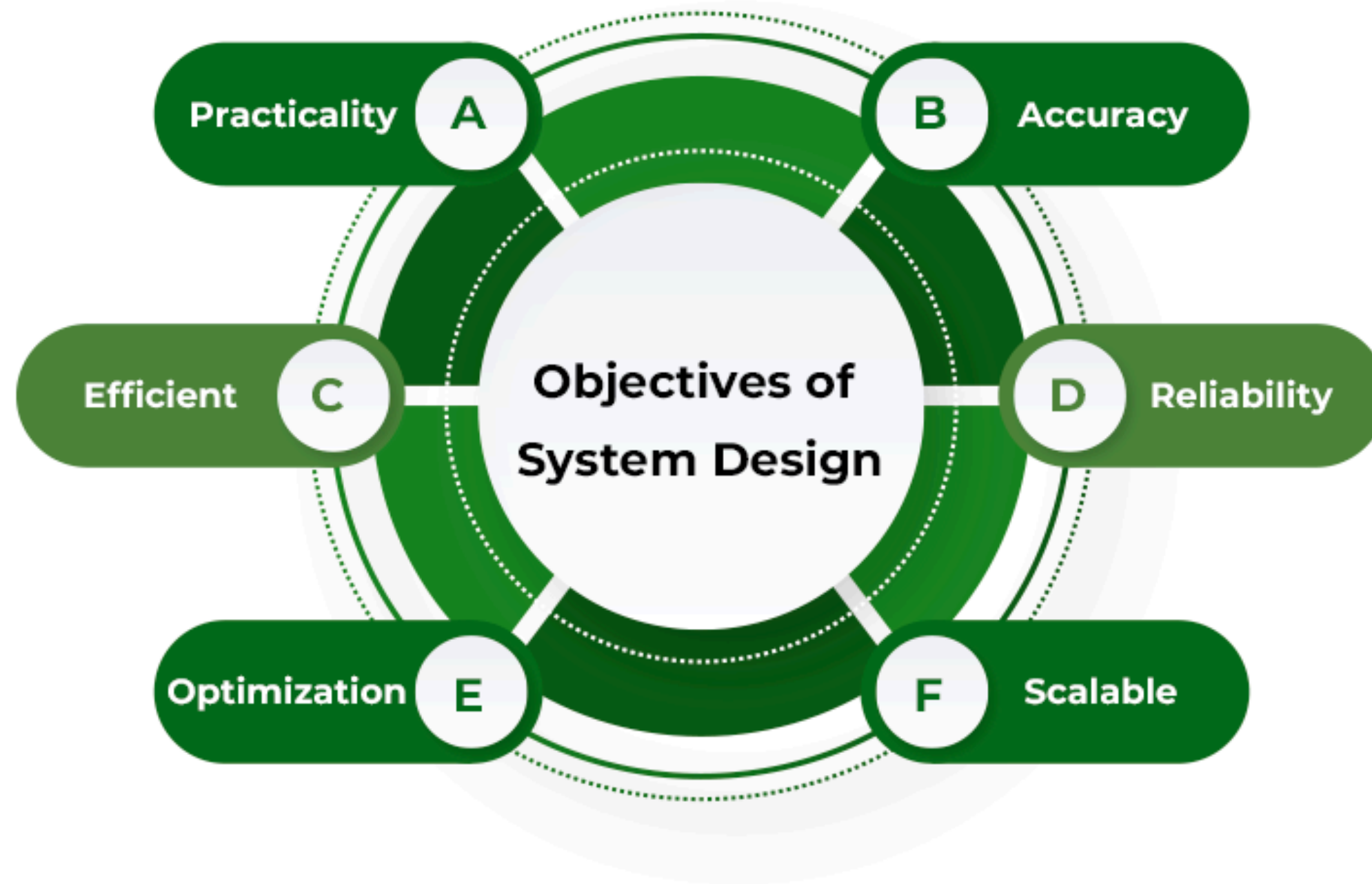


Resource GitHub

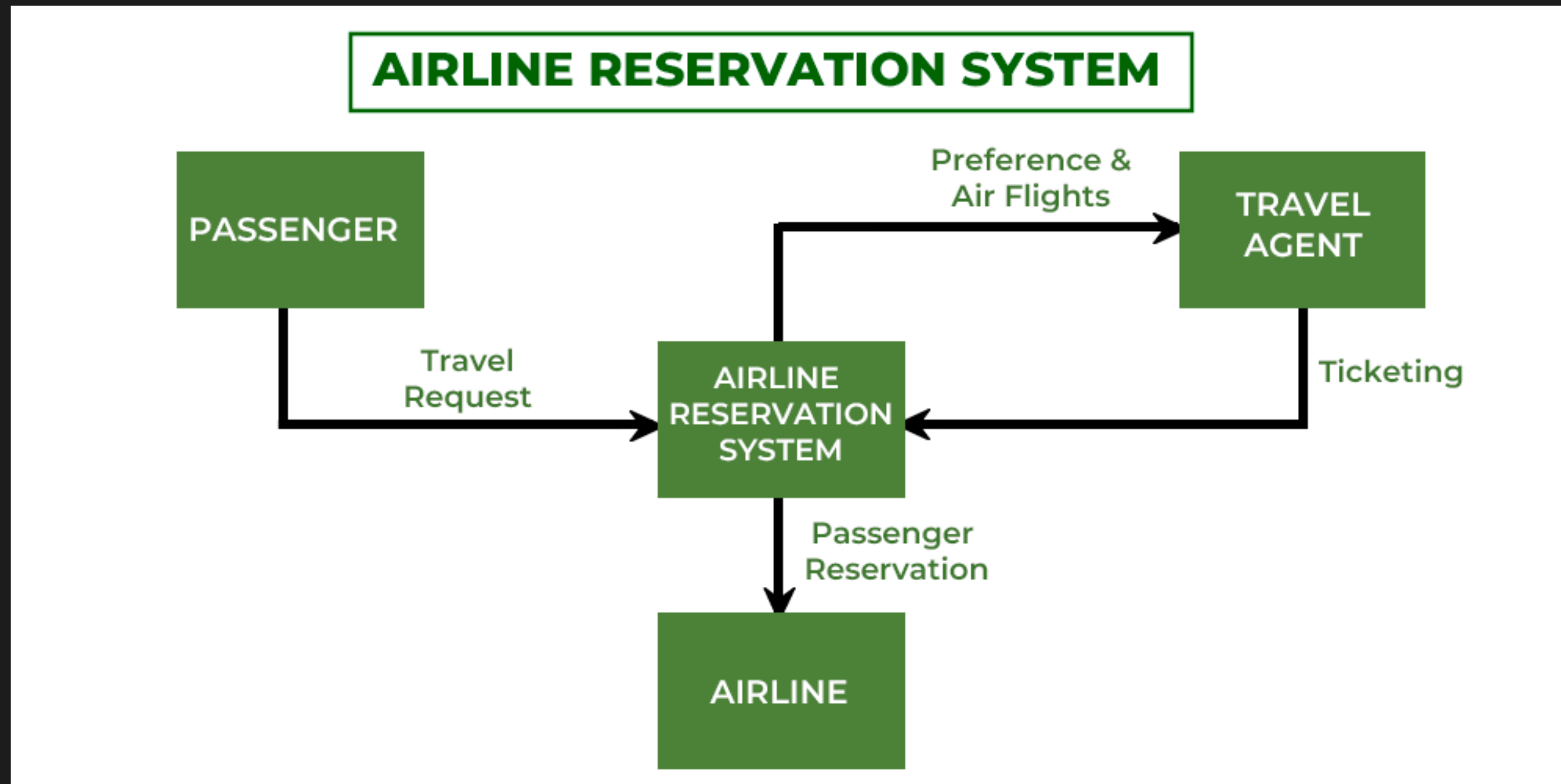
CIS⁵UFT

JK LOL!!!

WHY DO WE NEED SYSTEM DESIGN



EXAMPLE



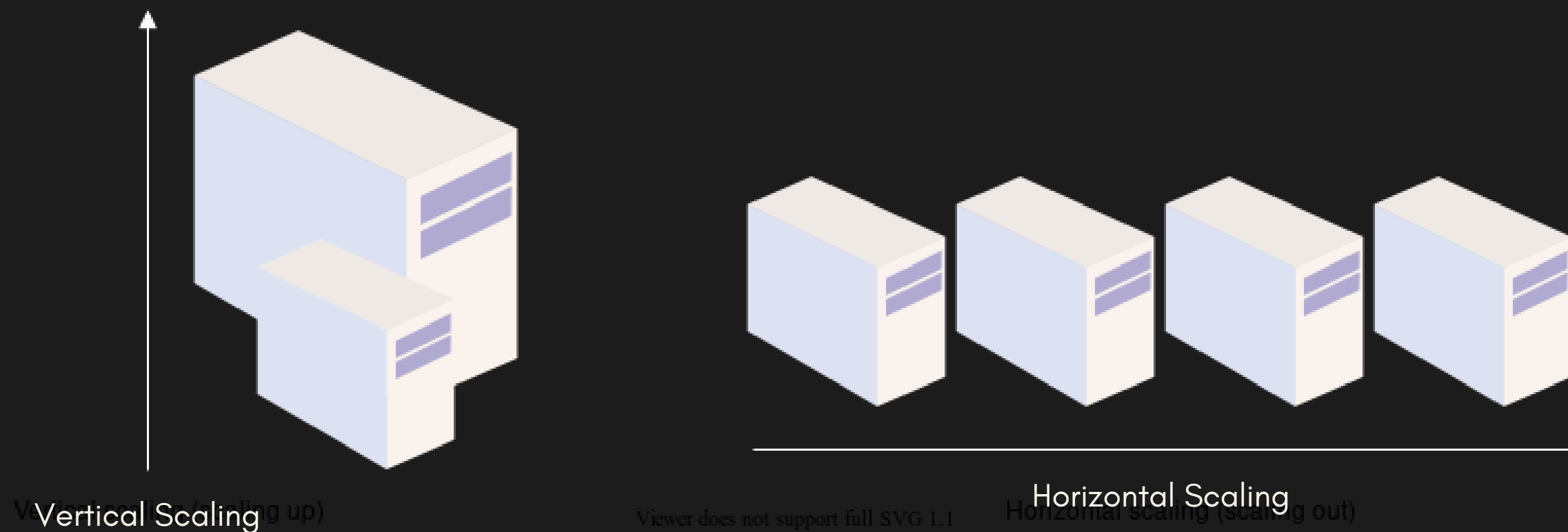


LETS DIVE DEEP

UNDERSTANDING SCALABILITY

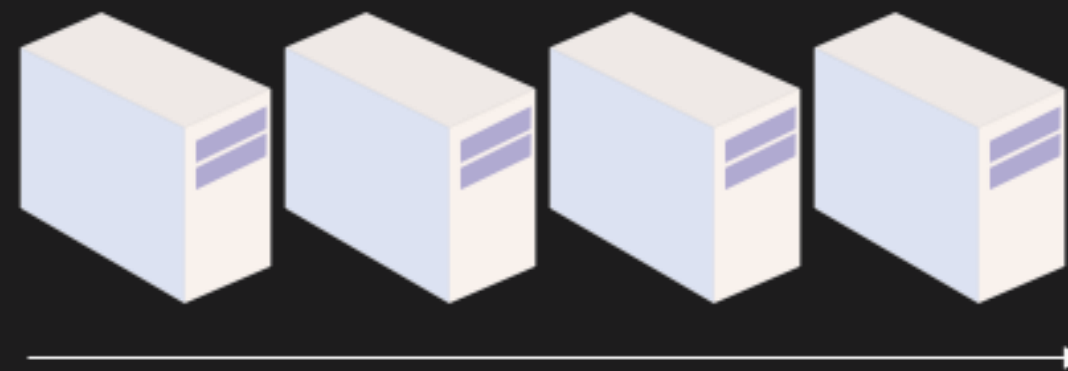
SCALABILITY

- Essential for applications to maintain performance under increased loads.
- Involves enhancing computing power to support more users, data, and transactions.



HORIZONTAL SCALING

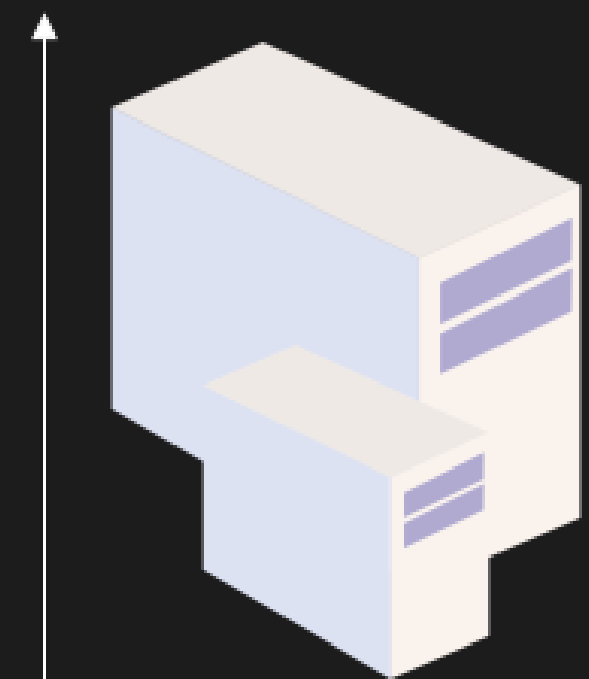
- Adds more machines or instances to the pool to distribute the load.
- Facilitates redundancy and failover, enhancing system reliability.
- More flexible; can scale according to demand fluctuations.
- Complexity in management and integration can increase.



Horizontal scaling (scaling out)

VERTICAL SCALING

- Involves upgrading existing hardware (CPU, RAM, storage).
- Simpler to implement, with no need for modifying the application for distributed environments.
- Has physical and technological limits; not always feasible for long-term growth.
- Downtime may be required for hardware upgrades.



Vertical scaling (scaling up)



LOAD BALANCER

- Distributes large volume of incoming requests/workloads across multiple servers.
- Prevents any single server from being overloaded

Types of Load Balancers:

- Layer 4: Network layer, based on IP/port.
- Layer 7: Application layer, based on request content.
- Global: Across geographic locations.
- Application-Specific: For protocols like HTTP/HTTPS.



DATABASES



SQL

- **Structured with predefined schemas like phone books.**
- **Data stored in rows and columns; each row is a single entity, columns are data points.**
- **Popular SQL databases: MySQL, Oracle, MS SQL Server, SQLite, PostgreSQL, MariaDB.**
- **SQL is used for data manipulation and supports complex queries with joins.**



NoSQL

- **Unstructured with dynamic schemas, accommodating diverse data types.**
- **Types include Key-value stores (Redis, DynamoDB), Document databases (MongoDB, CouchDB), Wide-column databases (Cassandra, HBase), Graph databases (Neo4J, InfiniteGraph).**
- **Flexible data models, suitable for unstructured data and rapid development.**
- **Emphasizes scalability, distributed computing, and ease of replication.**



CHOOSE A DB

- **Data Structure:** SQL for structured, NoSQL for unstructured data.
- **Scalability:** SQL for vertical, NoSQL for horizontal scaling.
- **Query Complexity:** SQL excels in complex relationships; NoSQL for simplicity.
- **ACID vs BASE:** SQL follows ACID for integrity; NoSQL opts for BASE for performance.
- **Development:** NoSQL for speed and flexibility; SQL for stable schema environments.


































#GCPSketchnotes
07.10.2021

@PVERGADIA THECLOUDGIRL.DEV

Which Database should I use?



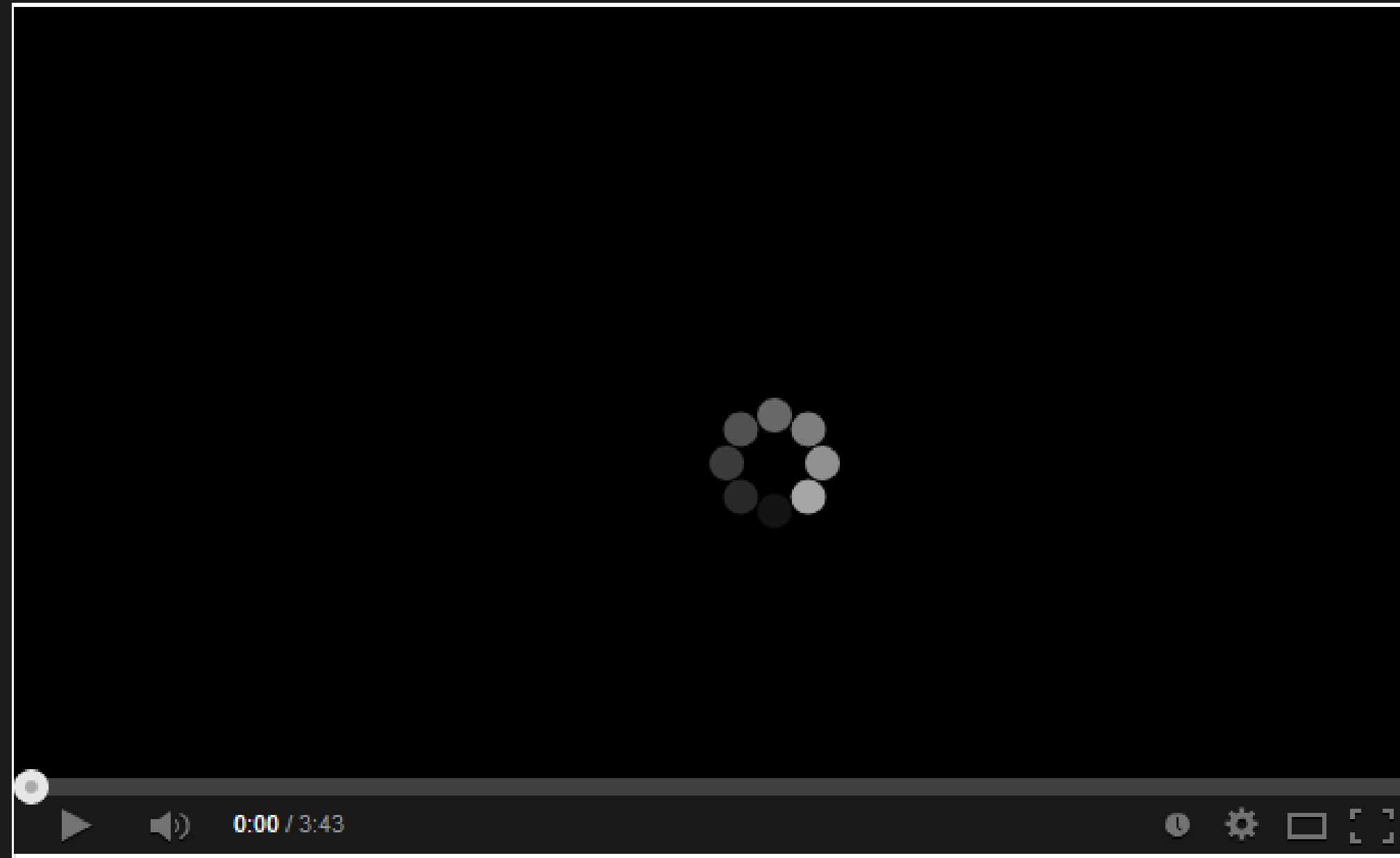
RELATIONAL			NON-RELATIONAL (NO SQL)		IN MEMORY
 Cloud SQL Managed MySQL, PostgreSQL, SQL Server	 Cloud Spanner Cloud-native with large scale, consistency, 99.999% availability	 Bare Metal Lift and shift Oracle workloads to Google Cloud	 Firestore Cloud Native, serverless, NoSQL document database, backend-as-a-service, global strong consistency, 99.999% SLA	 Cloud Bigtable Cloud-native NoSQL wide-column store for large scale, low-latency workloads	 Memory Store Fully managed Redis and Memcached for sub-millisecond data access
Good For:			Good For:		Good For:
General purpose SQL DB	RDBMS+ scale, HA, HTAP	RDBMS+ scale, HA, HTAP	Large scale, complex hierarchical data	Heavy read + write, events	In-memory and Key-value store
Use Case:			Use Case:		Use Case:
 Web frameworks  ERP  CRM  Ecommerce and web  SaaS application	 Gaming  Global financial ledger  Supply chain/inventory management	 Legacy applications  Data center retirement	 Mobile/web/IoT applications  Real-time sync  Offline sync  Personalized apps	 Personalization  Adtech  Recommendation engines  Fraud detection	 Caching  Gaming  Leaderboard  Social chat or news feed  Session store  Personalization  Adtech



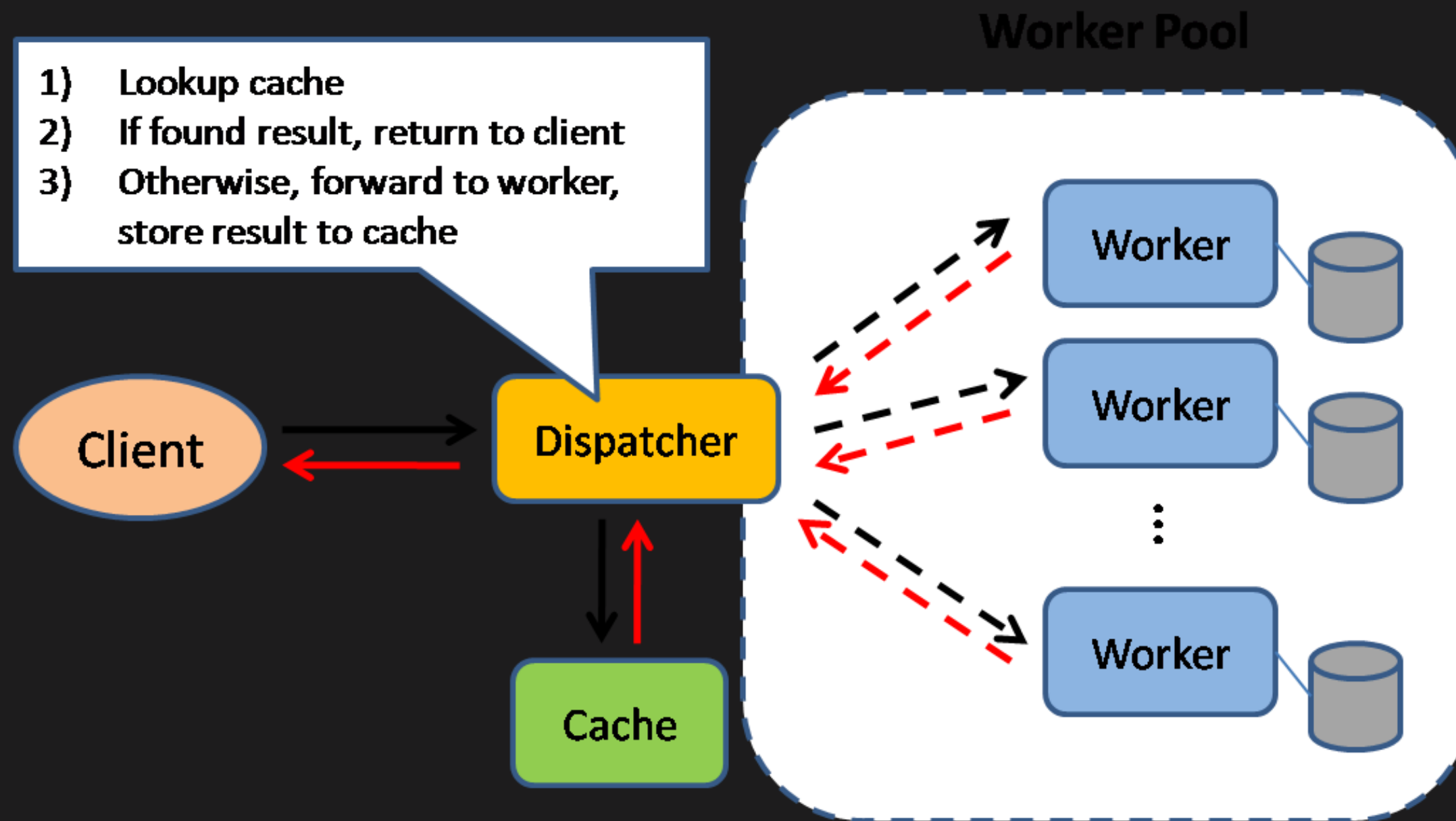
WTF IS CACHE?



PERFORMANCE



HOW DOES IT WORK???

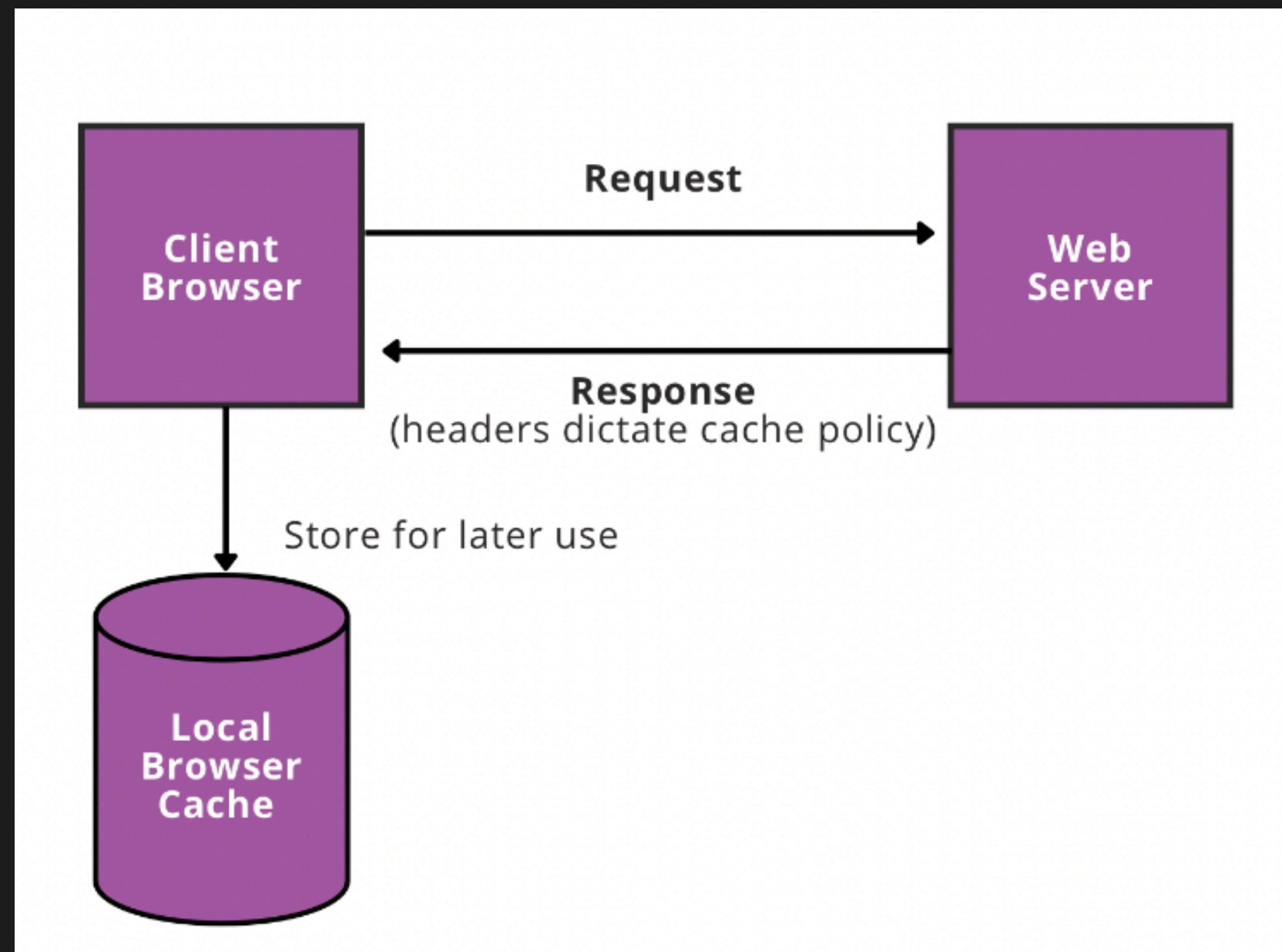




CLIENT SIDE CACHING

- Client-side caching occurs in the user's browser, where resources like images, scripts, and stylesheets are stored after the first visit to a website.
- On subsequent visits, the browser can load these resources from its cache rather than downloading them again from the server, which saves time and bandwidth.

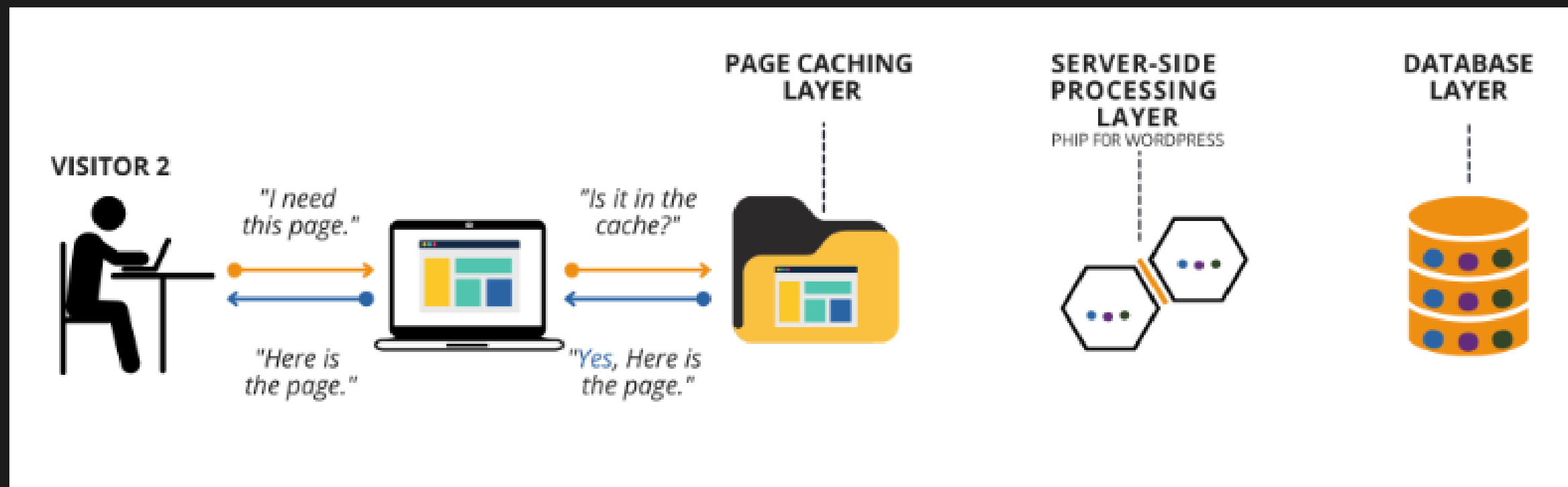
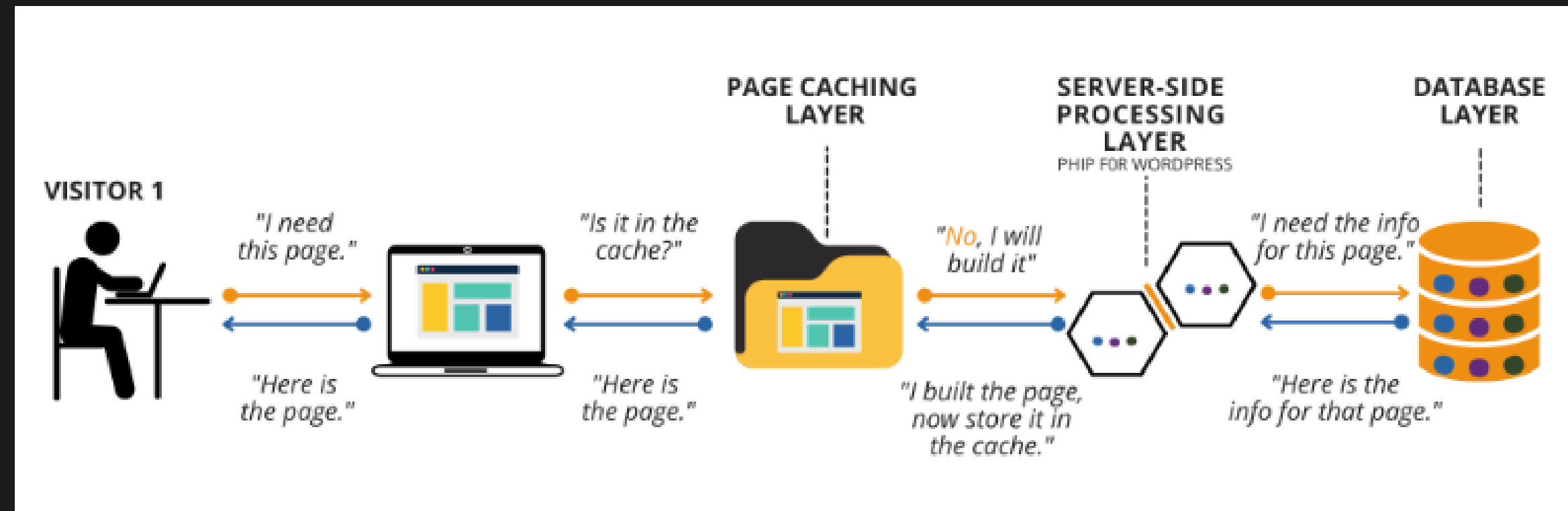
CLIENT SIDE CACHING





SERVER SIDE CACHING

- Server-side caching involves storing pre-generated responses to user requests on the server.
- When a user requests a webpage, the server can quickly deliver the stored response without having to generate it from scratch.





API???



WHAT EVEN IS AN API?

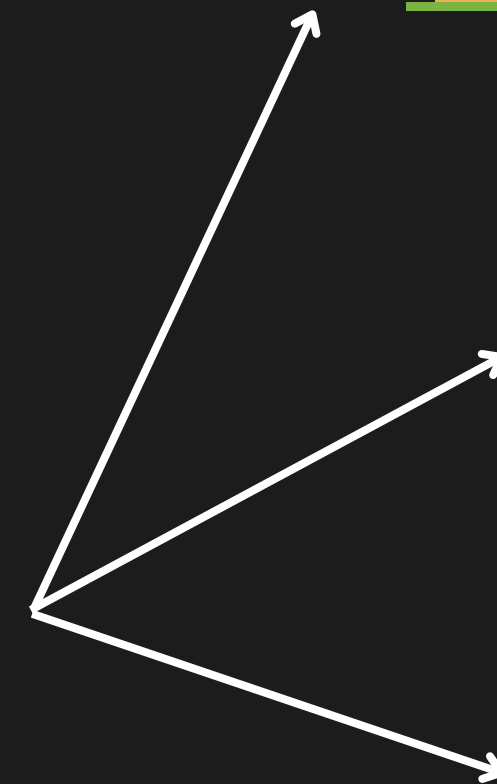
- APPLICATION PROGRAMMING INTERFACE
- LET'S BREAK IT DOWN:
 - “INTERFACE”: A MIDDLEMAN, A BROKER
 - UI - USER INTERFACE --> INTERFACE BETWEEN THE USER AND THE WEBSITE/APP
- AN API IS SIMPLY THE MIDDLEMAN BETWEEN TWO RUNNING APPLICATIONS/SERVICES.



REAL-LIFE EXAMPLE OF “API”



trivago





LET'S LOOK AT THE ACTUAL USAGE OF API

- OPERATIONS WITH APPLICATIONS?
- WHAT HAPPENS WHEN A USER IS CREATED?
- WHAT ABOUT A LIKED INSTAGRAM POST? A COMMENT? YOU DELETED YOUR STORY?
- THESE OPERATIONS CAN BE DEFINED AS “CRUD”



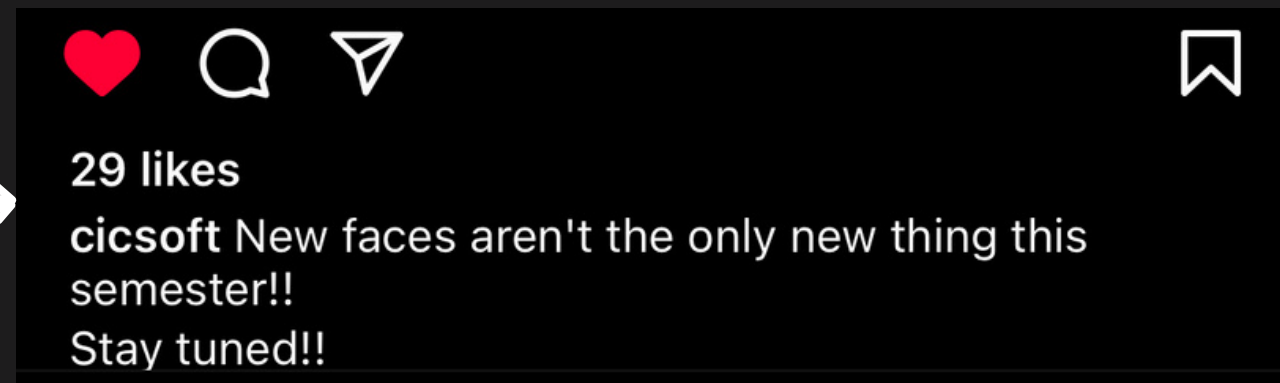
CRUD

- CREATE

- READ

- UPDATE

- DELETE





RESTFUL API

- THINK OF IT AS A SET OF NOT-SO-STRICT RULES
- THE “NORM” FOR DESIGNING AN API.
- RESTFUL APIs ARE BASICALLY DOING “CRUD” THROUGH:
 - GET
 - POST
 - PUT
 - DELETE
- there are more, but these are the most important.
- guess what the 4 above mean?



RESTFUL API PRACTICES

- **DATA:** what format is this data? anyone knows the full form?

```
"relationships": {
  "author": {
    "links": {
      "self": "http://example.com/articles/1/relationships/author",
      "related": "http://example.com/articles/1/author"
    },
    "data": { "type": "people", "id": "9" }
  },
  "comments": {
    "links": {
      "self": "http://example.com/articles/1/relationships/comments",
      "related": "http://example.com/articles/1/comments"
    },
    "data": [
      { "type": "comments", "id": "5" },
      { "type": "comments", "id": "12" }
    ]
  }
}
```



RESTFUL API PRACTICES

- WHAT HAPPENS TO THIS DATA AFTER THE REQUEST IS COMPLETED?

```
"relationships": {
  "author": {
    "links": {
      "self": "http://example.com/articles/1/relationships/author",
      "related": "http://example.com/articles/1/author"
    },
    "data": { "type": "people", "id": "9" }
  },
  "comments": {
    "links": {
      "self": "http://example.com/articles/1/relationships/comments",
      "related": "http://example.com/articles/1/comments"
    },
    "data": [
      { "type": "comments", "id": "5" },
      { "type": "comments", "id": "12" }
    ]
  }
}
```

- STATELESSNESS: poof. gone.



RESTFUL API PRACTICES

- **ENDPOINT NAMING:**
 - **example.com/surveys**
 - **example.com/surveys/shivenpatel**
 - **example.com/surveys**



API RATE LIMITING

- IMAGINE YOUR LIGHT SWITCH.
- SWITCH IT ON AND OFF A THOUSAND TIMES, AND YOU MIGHT JUST BURN THE HOUSE DOWN.
- MAKE SURE YOUR API DOESN'T BURN YOUR APPLICATION.
- RATE LIMITING IS IMPORTANT TO PREVENT DOWNTIME AND KEEP YOUR APP SECURE.



API SECURITY

- AUTHENTICATION TOKEN
- API KEYS

T-Mobile API Breach (2022): T-Mobile has reported a breach of 37 million current postpaid and prepaid customers.

LinkedIn API Breach (2021): In June 2021, a significant data breach exposed user information. It resulted in the compromise of data stored on the platform for information on approximately 700 million users.

Facebook Data Breach (2019): More than 530 million names, and Facebook IDs, was compromised in a data breach. Facebook applications that were publicly exposed were affected by the attack. This allowed them to acquire access to user data.



ACTIVITY TIME



GROUPS

- Make groups
- Introduce yourselves, talk about your favorite Large Scale Product!

GOOD LUCK!

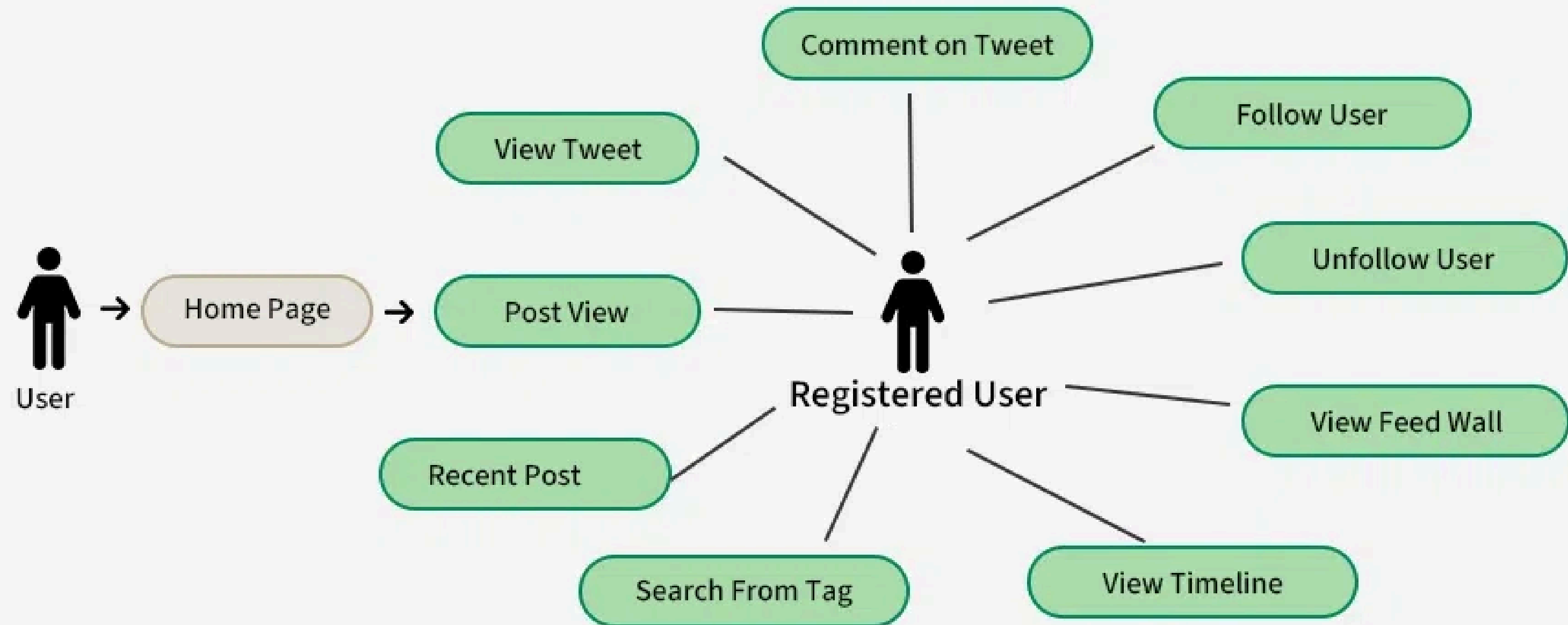


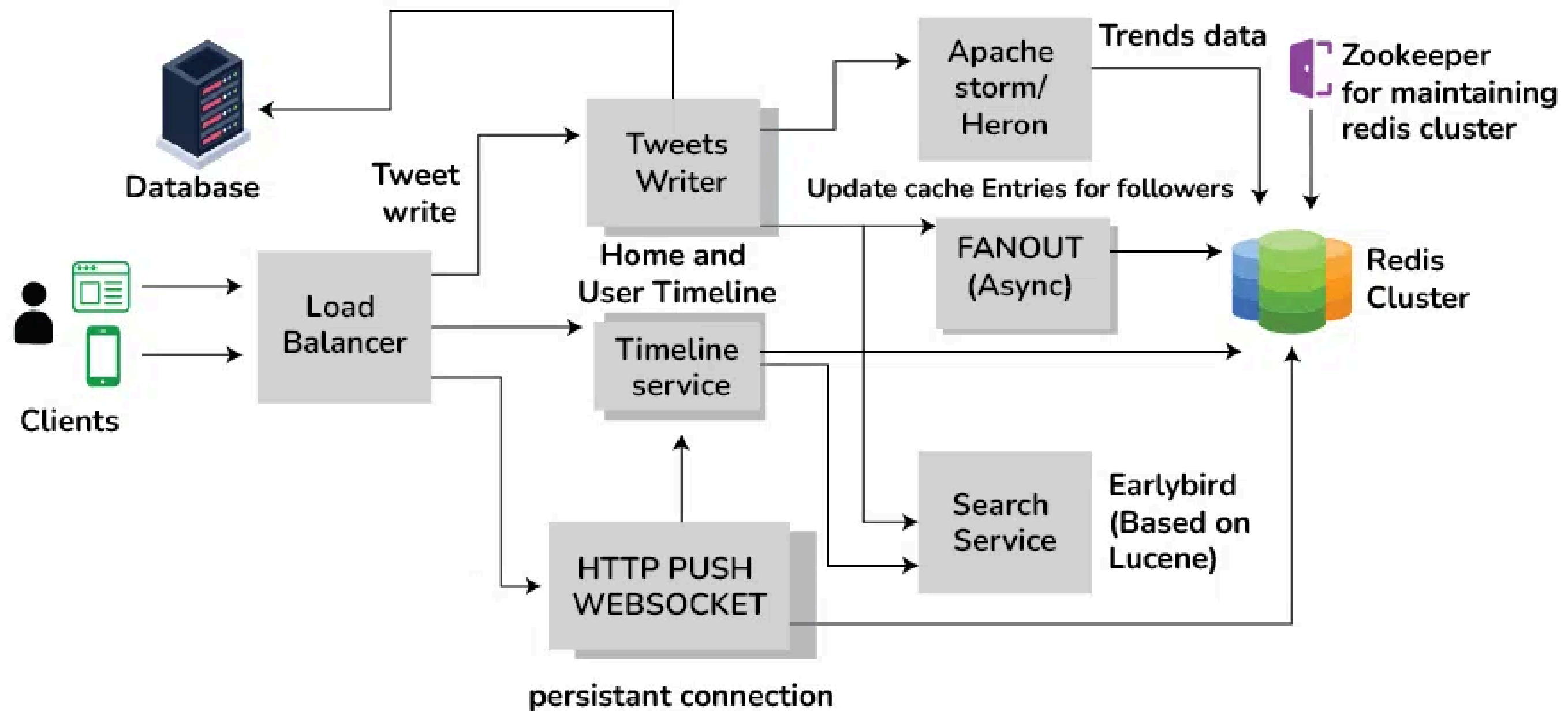
DESIGN X (FORMERLY TWITTER)

Problem: Build a system that shows users a feed of posts from other users they follow, with the ability for users to post new content.

Requirements:

- **Users should see a mixture of recent and popular content.**
- **Feed should update in real-time as new posts are made.**
- **Implement mechanisms to prevent spam and abuse.**
- **Provide personalized content based on user interests and interactions.**
- **Scale to support millions of users and posts.**







PREPARING FOR A SYSTEM DESIGN INTERVIEW

- Familiarize yourself with system design principles and patterns. Books such as "Designing Data-Intensive Applications" by Martin Kleppmann and "System Design Primer" by Donne Martin can be helpful for learning about these concepts.
- Practice system design questions and exercises. There are many websites and resources that offer practice system design questions, such as LeetCode and InterviewBit. You can also try working on personal projects or participating in hackathons that focus on system design.



- [] Review key concepts and technologies related to system design. This may include topics such as databases, networking, distributed systems, and scalability.
- [] Practice communicating your thought process and explaining your design choices. This is an important skill in system design interviews, as you may be asked to justify your design choices and discuss trade-offs.
- [] Research the company and the role you are applying for. Familiarize yourself with the company's products, services, and technology stack, as well as the specific responsibilities and requirements of the role you are applying for.
-



WHAT CAN I BE ASKED IN SUCH INTERVIEW

During a system design interview, you may be asked to:

- **Define the problem and requirements for the system**
- **Break down the system into smaller components**
- **Determine the interfaces and dependencies between components**
- **Identify and evaluate trade-offs and constraints**
- **Design and justify the overall system architecture**



Write us Feedback through our website





RESOURCE HUB





THANK YOU

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Feedback



Resource GitHub