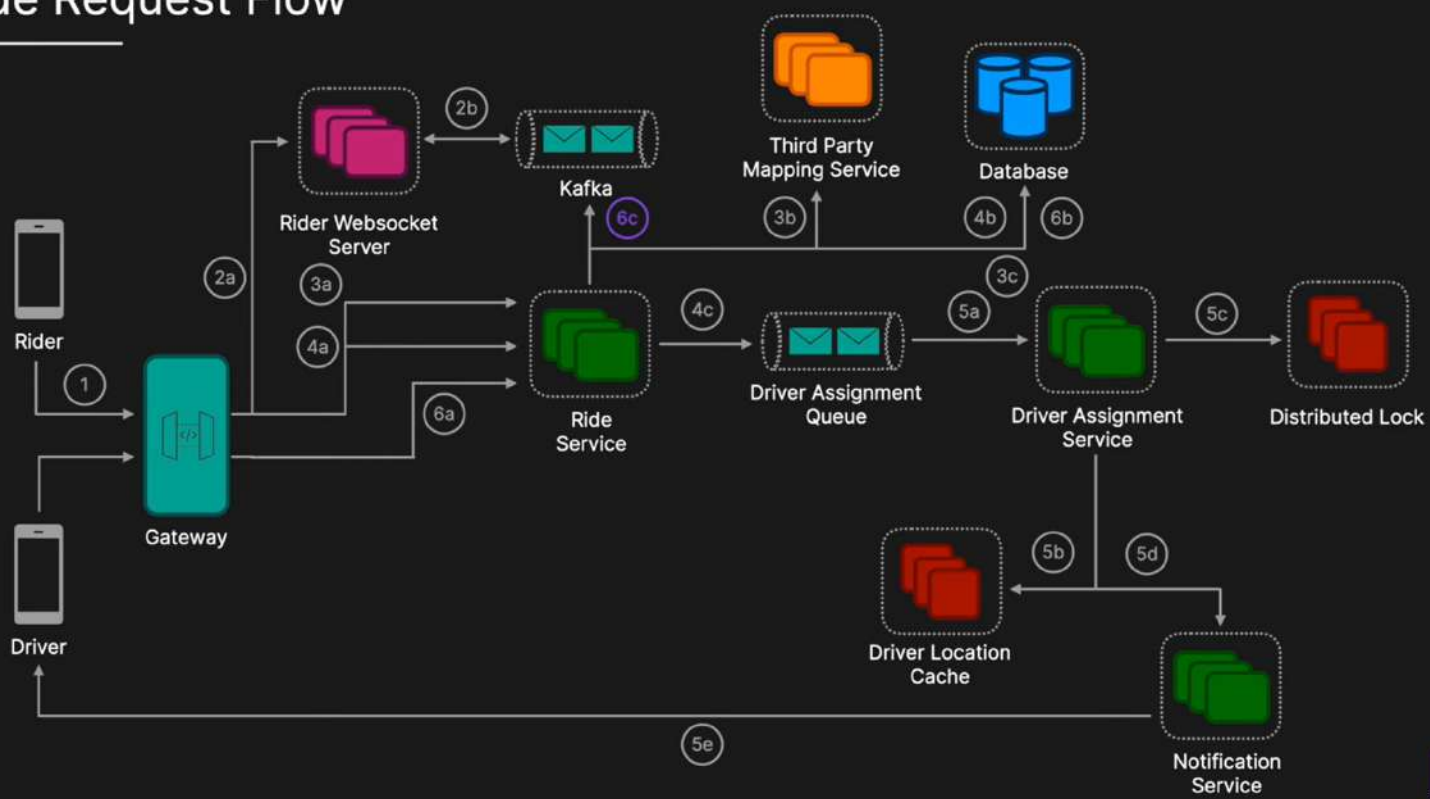


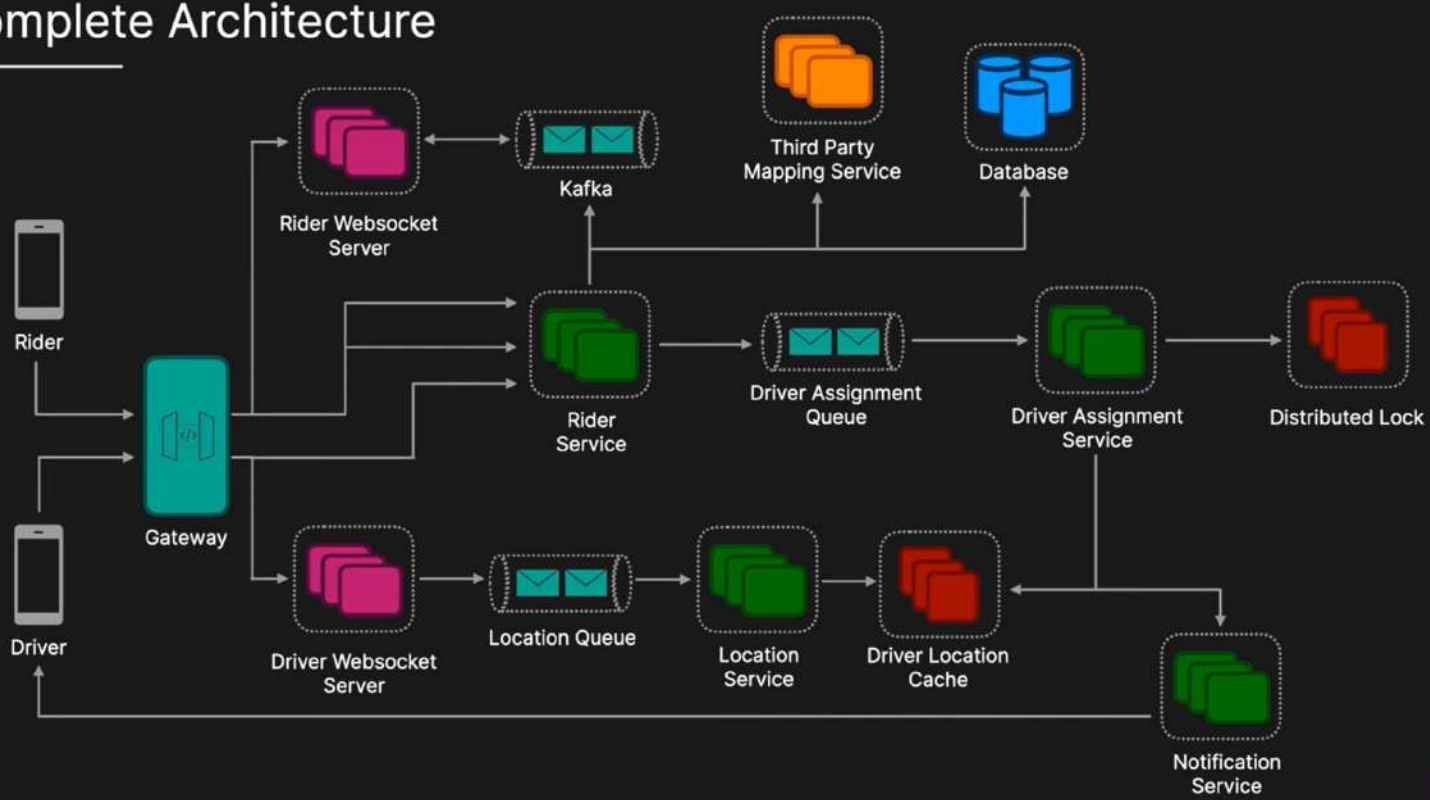
## Additional discussion points

- Scaling
  - Driver Location Redis Cluster
  - PostgreSQL Database
  - WebSocket Servers
- Security
  - Authentication & Authorization
  - Data Encryption
- Monitoring & Logging
  - System Monitoring
  - Centralized Logging

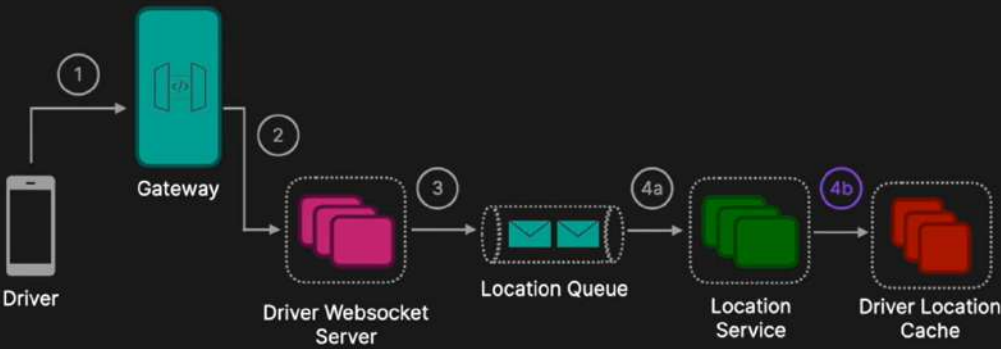
# Ride Request Flow



# Complete Architecture



# Driver Location Update Flow

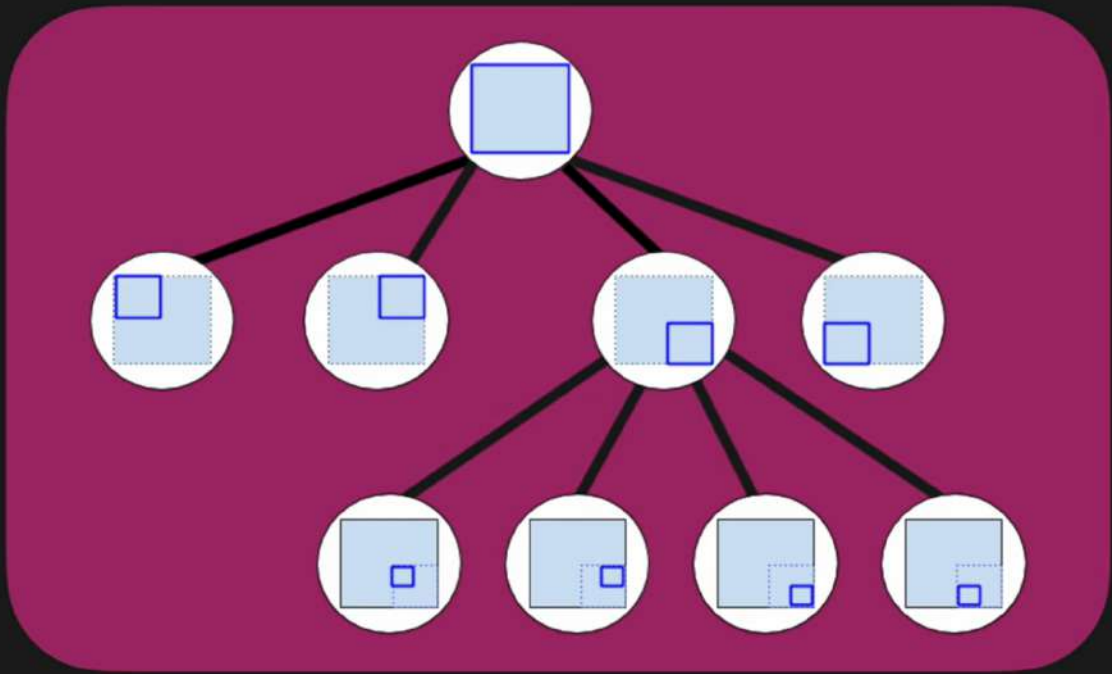


# Geospatial Indexing Techniques: H3 Indexing



H3Geo | Indexing

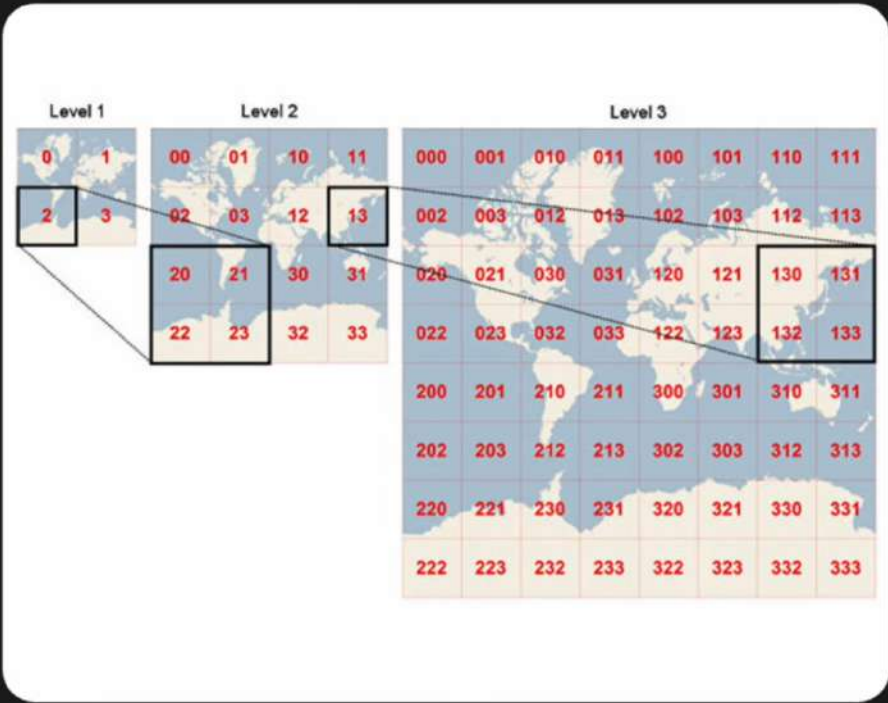
# Geospatial Indexing Techniques: Quadtrees



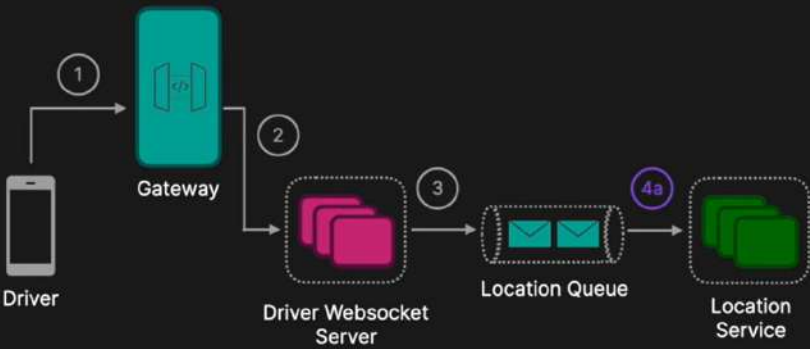
Medium | Partitioning 2D Spaces: An Introduction to Quadtrees



# Geospatial Indexing Techniques: Geohashing



# Driver Location Update Flow





## QUIC (Quick UDP Internet Connections)

### Features

- Transport layer network protocol
- Designed to improve the performance of HTTP/2 and HTTP/3 by running over UDP

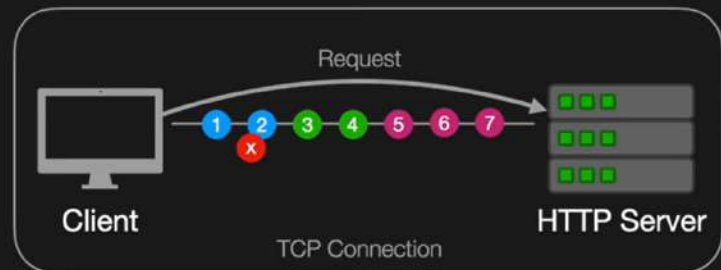
### ✓ Advantages

- Performance
- Security
- Connection Migration

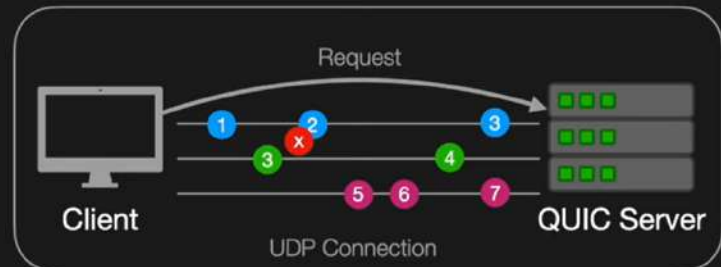
### ✗ Disadvantages

- Complexity
- UDP Limitations
- Adoption

### HTTP/2



### QUIC



● Stream 1   ● Stream 2   ● Stream 3

## QUIC (Quick UDP Internet Connections)

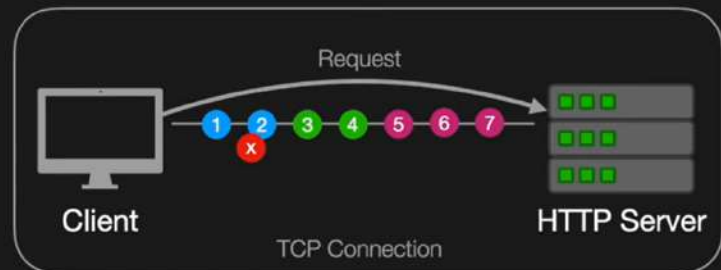
### Features

- Transport layer network protocol
- Designed to improve the performance of HTTP/2 and HTTP/3 by running over UDP

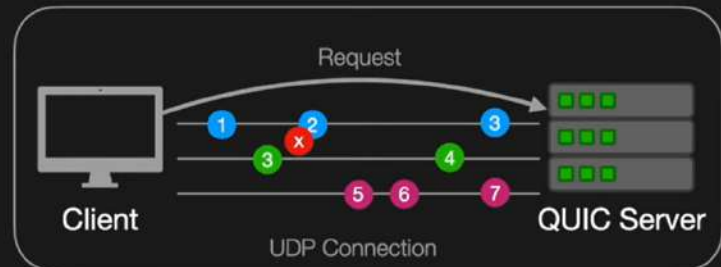
### ✓ Advantages

- Performance
- Security
- Connection Migration

### HTTP/2



### QUIC



● Stream 1   ● Stream 2   ● Stream 3

# WebSockets

## Features

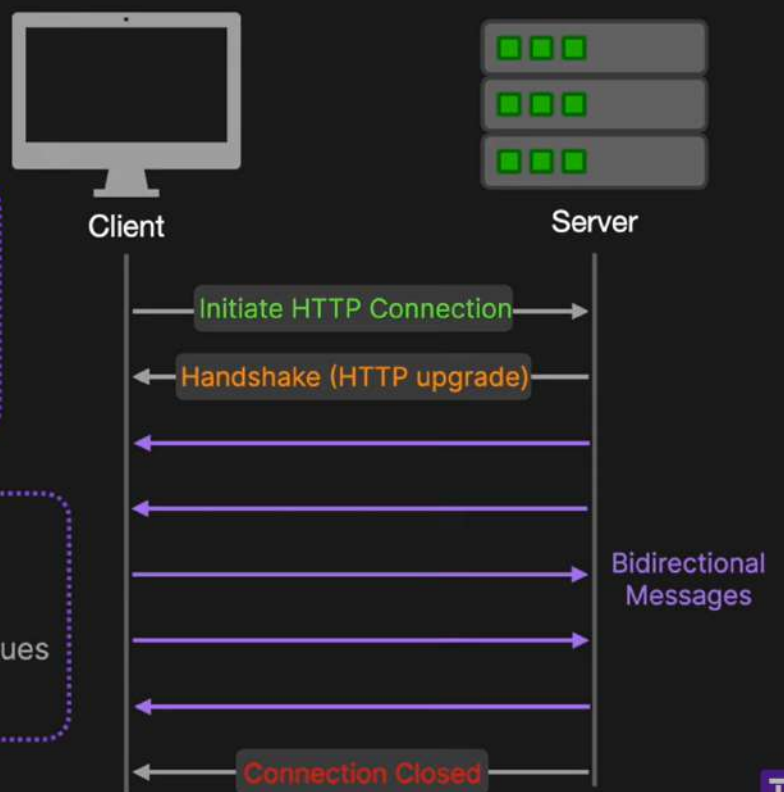
- Full Duplex communication over a single, long-lived TCP connection
- Enables real-time, bidirectional communication

## ✓ Advantages

- Low Latency
- Bidirectional
- Efficiency

## ✗ Disadvantages

- Complexity
- Firewall/Proxy issues
- Scalability



## Server-Sent Events (SSE)

### Features

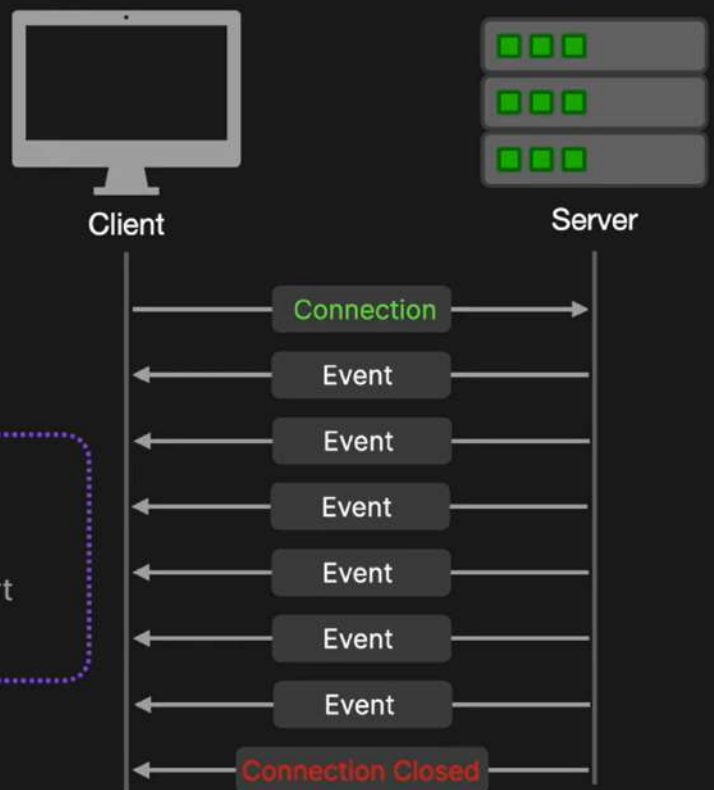
- Unidirectional communication
- Server pushes events to the client over an HTTP connection

### Advantages

- Simplicity
- Efficiency
- Automatic reconnection

### Disadvantages

- Unidirectional
- Browser Support
- Scalability



## Server-Sent Events (SSE)

### Features

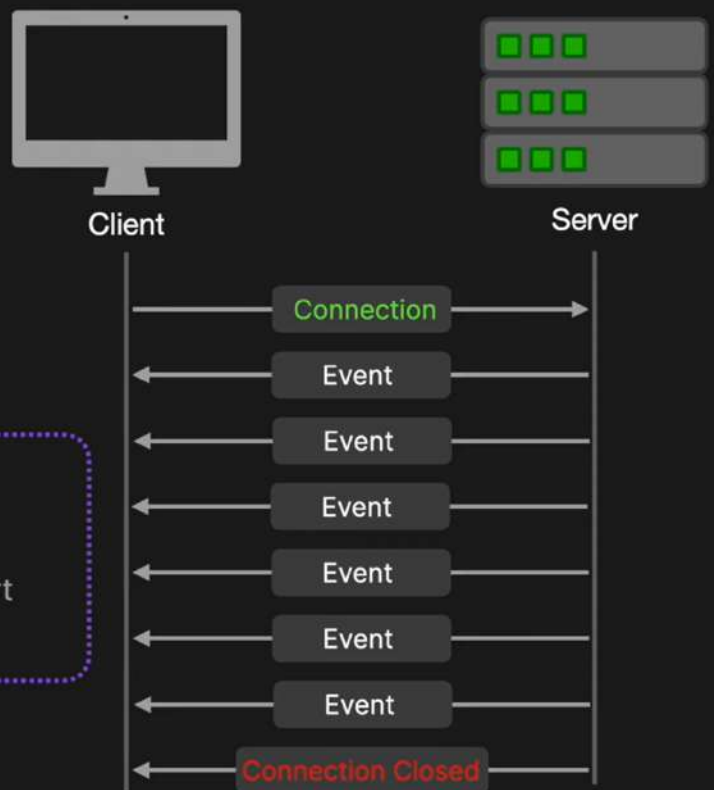
- Unidirectional communication
- Server pushes events to the client over an HTTP connection

### ✓ Advantages

- Simplicity
- Efficiency
- Automatic reconnection

### ✗ Disadvantages

- Unidirectional
- Browser Support
- Scalability



## Long Polling

### Features

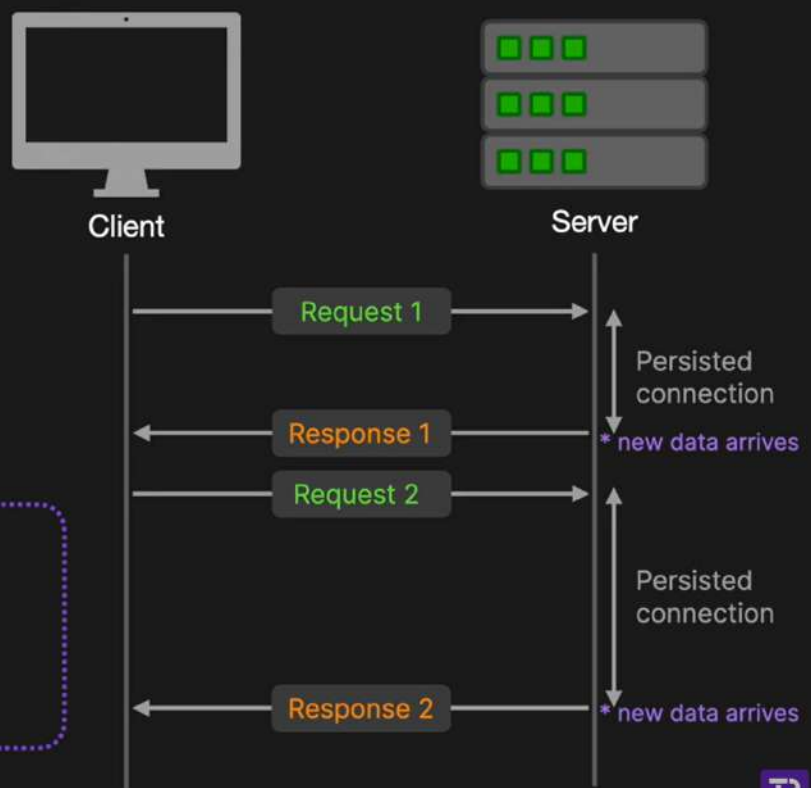
- Client makes an HTTP request to the server
- Server keeps the request open until it has new data or a timeout occurs

### ✓ Advantages

- Compatibility
- Simplicity
- Fallback option

### ✗ Disadvantages

- Latency
- HTTP overhead
- Scalability



# Driver Location Update Flow



Driver

# API Design

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## REST API

### 1. POST `/api/fares/estimate`

- Description: Provides fare estimates based on the rider's pickup and destination locations
- Params: pickup\_location (lat, long), destination\_location (lat, long)

### 2. POST `/api/rides/request`

- Description: Allows a rider to request a ride by selecting a fare.
- Params: pickup\_location (lat, long), destination\_location (lat, long), fare\_id

### 3. PUT `/api/rides/{ride_id}/accept`

- Description: Allows a driver to accept a ride.



# Uber - System Design Interview Question (Ride Sharing Service)

## Data Model

