



# DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

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## Experiment-2

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**Semester:** 6th

**Date of Performance:** 14/01/26

**Subject Name:** System Design

**Subject Code:** 23CSH-314

- Aim:** To design an online E-commerce platform similar to Amazon/Flipkart for browsing and purchasing products like mobiles, laptops, cameras, and clothes.  
To implement Kafka, Elasticsearch, and a CDC pipeline for real-time data processing, fast search, and scalability.

### 2. Objective:

- To develop a scalable online shopping system for product listing, search, and order management.
- To use Apache Kafka for real-time event streaming and inter-service communication.
- To implement Elasticsearch for fast and efficient product search.
- To integrate a CDC pipeline for real-time synchronization between databases and services.

### 3. Tools Required:

- Programming Language: Java / Python / JavaScript
- Backend Framework: Spring Boot / Express.js / Flask
- Database: MySQL / PostgreSQL / MongoDB
- API Testing Tool: Postman
- Design Tool: Draw.io (for HLD diagrams)
- Web Browser
- ElasticSearch
- Kafka
- CDC connector

### 4. SYSTEM DESIGN / SYSTEM SPECIFICATION:

#### 4.1. Functional Requirements:

- User should be able to search and find the products based on product title or names.
- User should be able to view the details of the product like description, image, available quantity, review, accessed.
- User should be able to select the quantity and move the product/item into the cart.
- User should be able to make the payment and should be able to perform the check out.
- User should be able to check the status of the order.
- System should be able to manage purchase of items having limited stocks.



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## 4.2. Non-functional Requirements:

- Target Scale: 100Million DAU with 10 orders processed per second. Availability – System should be available 24/7
- Consistency & Availability: Here for this system we need both as per the Target Scale. Now we should specifiy that, which part of our system needs what?
- Latency: Required: ~200 ms
- Scaling: Horizontal / VerticalConsistency

## 4.3. Core-Entites of the System:

1. User / Client
2. Product
3. Cart
4. Orders
5. Checkout followed by Payment

## 4.4. API Endpoints Creation:

### 1. GET API Call: Prod\_Search

```
Https://Local_Host/products/search_item = {Search_keywords}  
HTTP Req  
{  
    GET: <iPhone 16>  
}  
HTTP Res  
{  
    <ProductID:iPhone>  
}
```

Now, on front-end if multiple data of respective product is coming in that case the FE becomes faulty -> ultimately increasing the LATENCY.

For that: we can use Pagination 1, 2 ,3 ,4 ,---- SO ON

### 2. GET API Call: View Product Details

```
Https://Local_Host/products/{product_id}  
HTTP Req  
{  
    GET: <Product_id = 17>  
}
```

```
HTTP Res  
{
```



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```
Product_id:17,  
Name: iPhone 17,  
Color: Navy Blue,  
Price: $1099,  
Image Thumbnail: URL_Image  
}
```

### 3. POST API Call: Item add in cart

[Https://Local\\_Host/cart/add\\_products](Https://Local_Host/cart/add_products)

```
HTTP Req  
{  
    Product_id = 17,  
    Product_id = 16  
}
```

```
HTTP Req Header  
{  
    User_id: 04  
}
```

```
HTTP Res  
{  
    Cart_id: 101  
}
```

### 4. PUT API Call: To update any order in the cart

Let's Suppose you want to add one more product into the cart.

### 5. DELETE API Call: To remove any item from the cart

Let's Suppose you want to delete one more product into the cart.

### 6. POST API Call: for check out & Payment [Https://Local\\_Host/checkout](Https://Local_Host/checkout)

```
-> {post body}  
HTTP REQ  
{  
    All products ID's,  
    Total Quantity,  
    Total Price  
}  
HTTP RES  
{
```



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Order\_ID

}

Https://Local\_Host/payment -> {post body}

HTTP REQ

{



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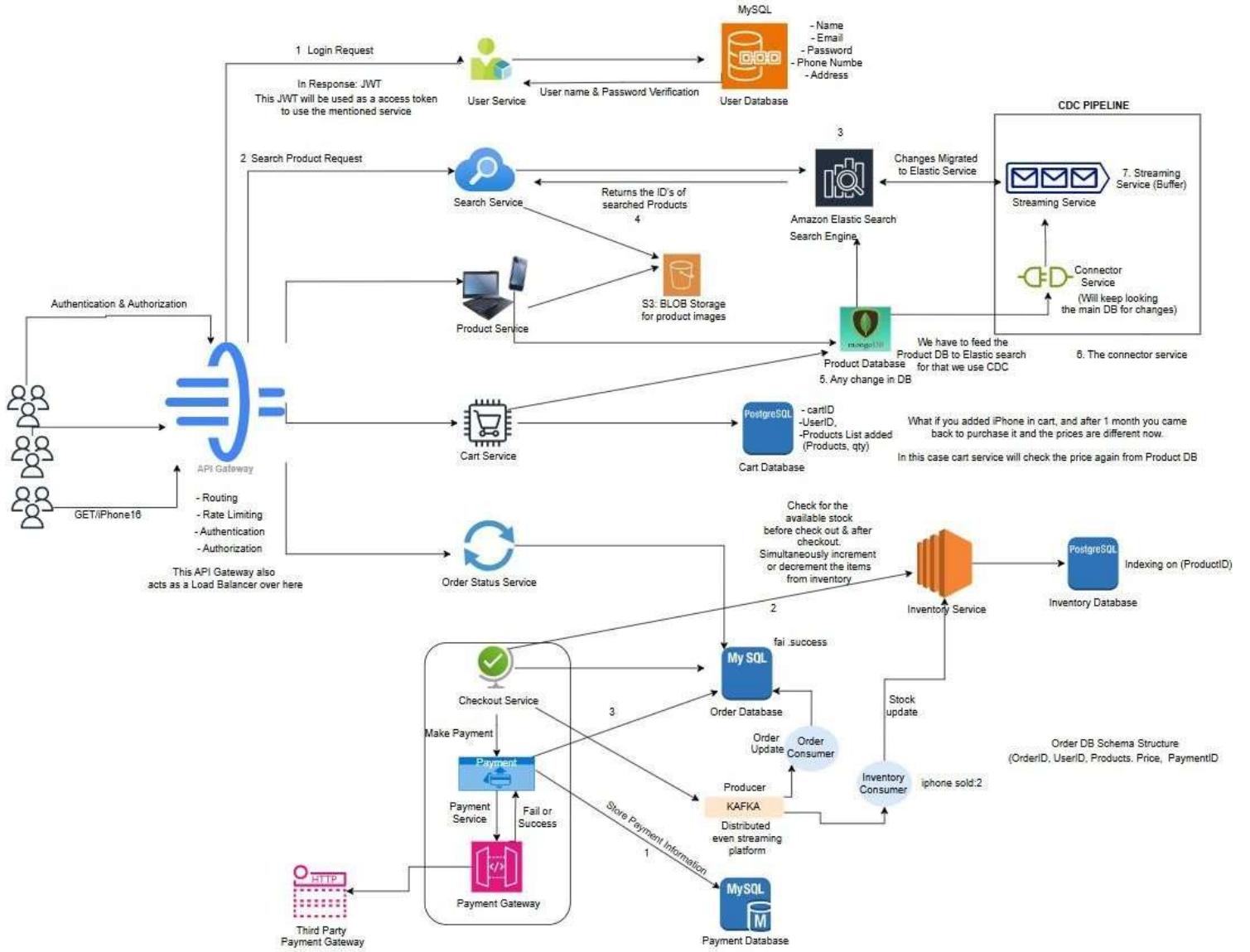
```
Order ID,  
Payment Type,  
Payment Mode  
}  
HTTP RES  
{  
    Confirmation_Status: Succes / Fail  
}
```

## 7.GET API Call: Order Status

[Https://Local\\_Host/orde\\_status = {order\\_id}](Https://Local_Host/orde_status = {order_id})

## 5. HLD(High Level Design):

We have to follow a distributed / micro-services approach not the monolithic one.



## 7. Learning Outcomes

- Understand the design and architecture of a scalable E-commerce platform.
- Gain hands-on experience with Apache Kafka for real-time data streaming.
- Learn to implement fast and efficient search using Elasticsearch.
- Understand Change Data Capture (CDC) pipelines for real-time data synchronization.

- Develop skills in integrating distributed systems for high availability and scalability.