# System Design v1


- 1. Analysis of the existing system and its limitations.
  - Scalability
  - Performance & Crash Issue
  - UI: Outdated, UX: Not a Seamless User Experience.
  - UI: Lacks Responsiveness and Real-time
  - CI/CD & Source Contorl : Built with mixed
- 2. Proposed architectural changes and system proposals from FE perspective.
  - Architecture
  - Frontend
  - Backend
  - Authentication
- 3. Description of the development approach, including container level (C4 model) flows, integration points, and third-party integration options if applicable.
  - Frontend
  - Real-Time Updates
  - Third-party Integrations
  - Container level (C4 model)
- 4. Advantages and disadvantages of each approach, including trade-offs, costs, and potential risks.
  - Advantages
  - Disadvantages
- 5. Any necessary diagrams to illustrate the proposed system design.


# 1. Analysis of the existing system and its limitations.

## Scalability

- `Monolithic architectures` are difficult to scale. When the users grows, code complexity increases, adding new features can slow down the application and impact performance.

## Performance & Crash Issue

- This is a typical problem with `monolithic architectures`, which can be CPU-bound and have difficulties scaling horizontally.

## UI: Outdated, UX: Not a Seamless User Experience.

- Bad UI/UX will not attracted to user even feature is the best of industry.

## UI: Lacks Responsiveness and Real-time

- For the e-commerce platform, to purchat of product is top one priority, if the platform is not corretly present the product will affect user's intent of purchatment.

## CI/CD & Source Contorl : Built with mixed

- It's not easy to control development life cycle for multiple requirement.
- Dependencies are high, every change has to deploy the entire application.

# 2. Proposed architectural changes and system proposals from FE perspective.

## Architecture

- I propose to rearchitect the system into a `Microservices architecture`.

## Frontend

- This will allow the backend and frontend to be `developed`, `deployed`, and `scaled independently`.
- The frontend will be a `single-page application (SPA)` developed with a modern JavaScript framework, such as Angular, React or Vue.
- To improved user experience by allowing for `real-time updates` using technologies like `WebSockets`.

## Backend

- The backend will be several independent services based on business logic with its own database.
  - e.g. **ProductService**: Manages product details and SKU searches. `(ProductService > ProducDB)`
  - e.g. **UserService**: Manages user accounts and authentication. `(UserService > UserDB)`

## Authentication

- To use `JWT(JSON Web Token)` as session authentication on API server and it's `stateless` fulfil the `Microservices architecture`

# 3. Description of the development approach, including container level (C4 model) flows, integration points, and third-party integration options if applicable.

## Frontend

- The frontend will be a modern `SPA` developed using Angular, React or Vue. This will provide a more responsive user experience.
- The application will communicate with backend services via `REST APIs` with `JWT`.

## Real-Time Updates

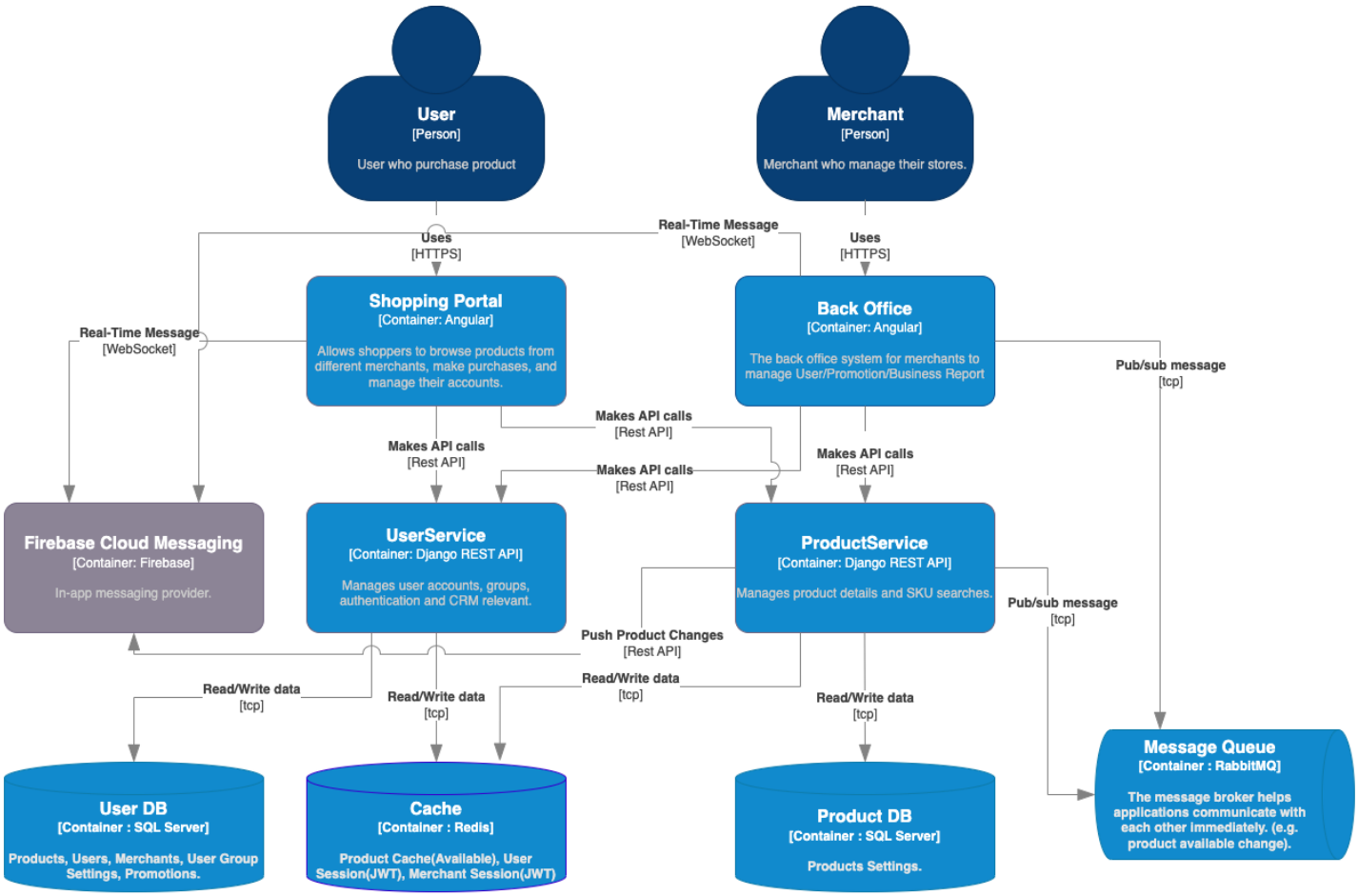
- For real-time updates, we can use `WebSockets`.
- The Product Service can push product availability updates to the frontend in real-time.

## Third-party Integrations

- **Email**: For email feature, we can integrate with a third-party service like `SendGrid`.

- **Real-Time & In-app communication**: For Real-Time & in-app communication, we can use a service like `Firebase Cloud Messaging`.
- **SMS**: For SMS and SNS channels, we can use services like `Twilio`.

# Container level (C4 model)




**[Containers] GoGoShop**
Diagram short description

# 4. Advantages and disadvantages of each approach, including trade-offs, costs, and potential risks.

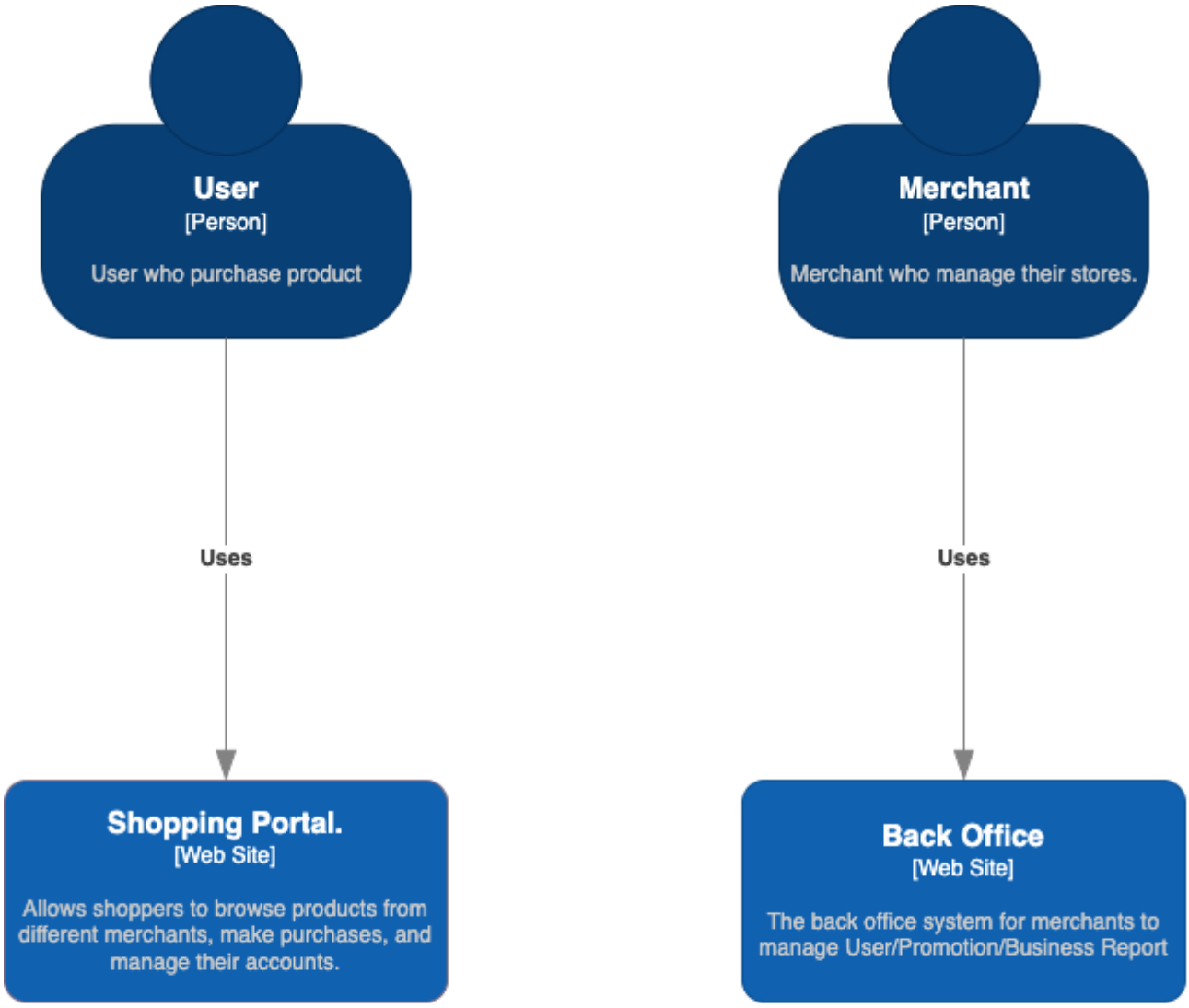
## Advantages

- **Scalability**: The Microservices architecture allows each service to `be scaled independently`.
- **Performance**: Microservices allow for `better resource utilization`, leading to improved performance.
- **Real-Time Updates**: By using `Firebase`, we can reduce develop real-time mechanism and hosting new servers then could provide real-time updates to users for multiple platforms (web/app), improving user experience.
- **Email**: By using `SendGrid`, we can reduce mail server hosting.

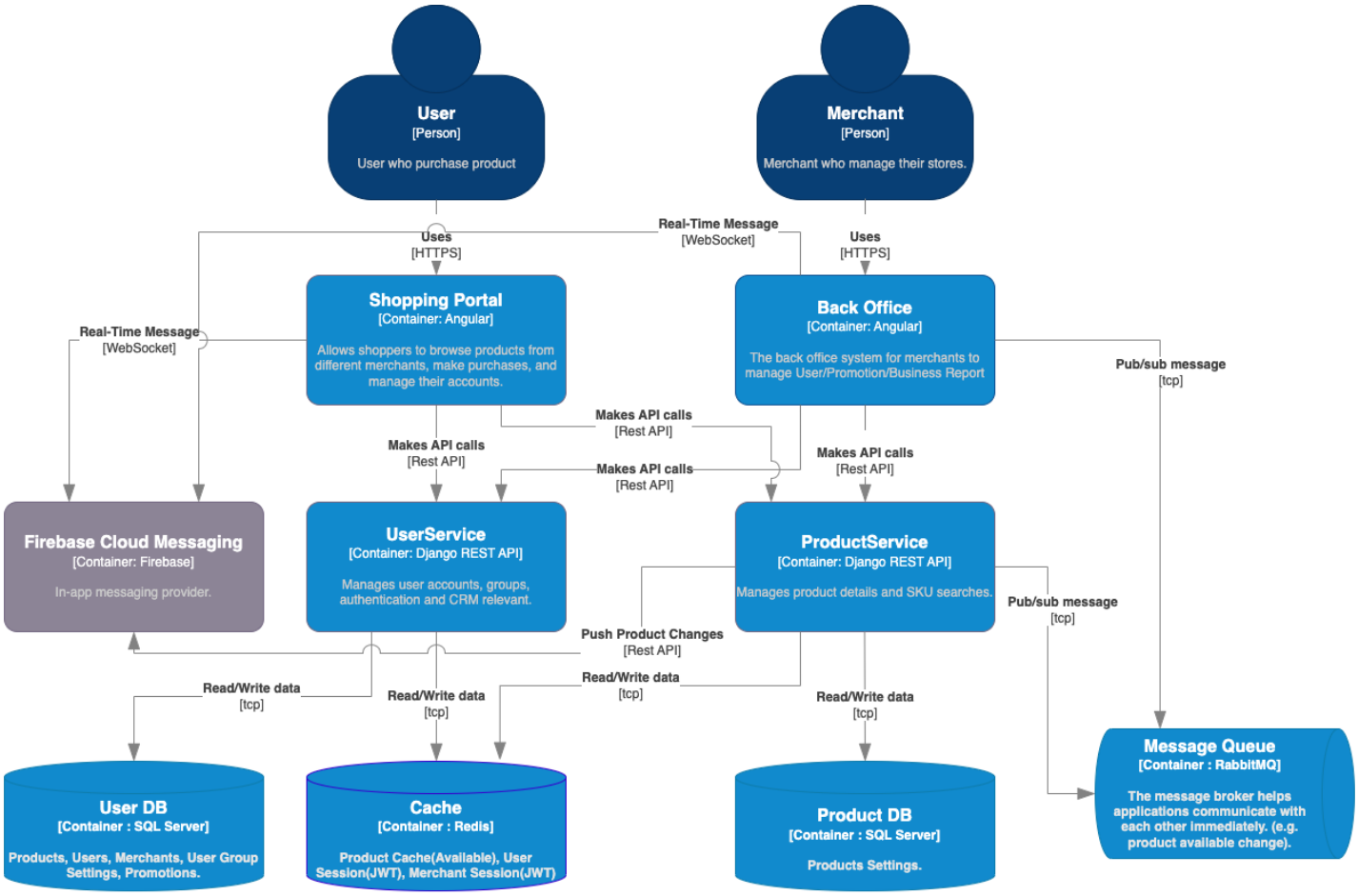
## Disadvantages

- **Increased Complexity**: The Microservices architecture is `more complex` than a monolithic architecture. We will need to `manage multiple services and databases`, and handle inter-service communication.
- **Data Consistency**: Maintaining `data consistency across services` can be challenging. We need to design the system carefully to handle this.
- **Costs**: While we will get improved performance and scalability, there might be `increased costs` associated with `hosting` and `managing` multiple `services and databases`.
- **3rd-party Costs**: need a further anaysis for cost between using 3rd-party or devlop and own by us.
- **SMS**: Due to we would have `email & in-app messaging feature` therefore, that can set low priority and might postpone to next phase, to consider `development effort` and `maintaining cost`.

# 5. Any necessary diagrams to illustrate the proposed system design.




**[System Context] GoGoShop**
Diagram short description

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