Course Project Report

A Cloud-Powered Newsfeed Application : Microservices Approach

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Abstract

BreakingNews reimagines the software architecture in the realm of digital news consumption, employing a sophisticated microservices architecture hosted on cloud. This report delves into the innovative design and technological framework that propels BreakingNews. The application can be broken into manageable units, enhancing flexibility and facilitating modularization. From secure authentication processes and streamlined subscription transactions to a centralized subscription management system and dynamically tailored content delivery, BreakingNews encapsulates user-centricity, efficiency, and adaptability. This report explores the nuances of BreakingNews' robust technology stack, cloud-native computing approach, and how each microservice is meticulously engineered for specific functionalities such as user management, content retrieval, cart management and payment gateway. Effective communication between them is ensured through well-defined APIs. Cloud-native computing serves as a backbone to cater multiple users and provide a seamless user experience.

Introduction

1.1 Background

BreakingNews is not just a news platform; it represents a modern approach to news delivery, meticulously crafted through a sophisticated microservices architecture hosted on the cloud. The profound impact of this app on user-centricity, efficiency, and adaptability have been discussed in the introduction.

1.2 Objectives

The primary objective of this report is to unravel the intricacies of BreakingNews, providing an in-depth analysis of its technological underpinnings. By employing a microservices architecture, BreakingNews reimagines the software landscape, breaking down the application into manageable units.

This chapter introduces the key objectives:

- **Innovative Design and Technological Framework:**

Unraveling the architecture that propels BreakingNews, delving into the microservices design, and understanding its impact on digital news consumption.

- **User-Centricity, Efficiency, and Adaptability:**

Exploring how BreakingNews encapsulates these principles, from secure authentication to streamlined subscription transactions, centralized subscription management, and dynamically tailored content delivery.

- **Robust Technology Stack and Cloud-Native Approach:**

Investigating the technology stack that powers BreakingNews and understanding how cloud-native computing serves as the backbone for scalability and user experience.

- **Microservices Engineering for Specific Functionalities:**

Examining how each microservice ensures separation of concerns, serves specific functionalities such as user management, content retrieval, cart management, and payment gateway.

- **Effective Communication through APIs:**

Understanding the role of well-defined APIs in ensuring seamless communication between microservices, contributing to the overall efficiency of BreakingNews.

1.3 Scope of the Report

This report's scope encompasses a detailed examination of BreakingNews, focusing on its microservices architecture, user-centric design, and the technological stack that powers its innovative approach to news delivery. The scope extends to the specific functionalities of each microservice and the integration of cloud-native computing principles for a scalable and seamless user experience.

1.4 Structure of the Report

The subsequent chapters will delve into BreakingNews, with Chapter 2 pivotal aspects of BreakingNews' technological foundation: Microservices Architecture and Cloud-Native Computing, Chapter 3 outlining the methodology employed in the analysis, and subsequent chapters presenting findings and insights on various facets of BreakingNews. The report will conclude with key features of this application and future directions for potential enhancements.

Microservices Architecture and Cloud-Native Computing

2.2 Microservices Architecture

Microservices architecture is a fundamental paradigm shift in software design, distinct from traditional monolithic architectures. It is characterized by breaking down the application into small, independent, and manageable units known as microservices. Each microservice is dedicated to a specific business capability, fostering modularity, flexibility, and scalability.

Advantages of Microservices Architecture:

- **Modularity and Manageability:**

  Microservices enable the application to be divided into smaller, independently deployable units, enhancing ease of management and maintenance.

- **Scalability:**

  The application can scale specific microservices based on demand, ensuring optimal resource utilization and responsiveness.

- **Flexibility and Independence:**

  Microservices operate independently, allowing changes to one microservice without affecting others, fostering flexibility in development and deployment.

- **Technology Diversity:**

  Different microservices can be developed using varied technologies, enabling the application to leverage the most suitable technology for each functionality.

- **Fault Isolation:**

  Issues in one microservice do not cascade to others, ensuring fault isolation and system robustness.

Application in BreakingNews:

BreakingNews leverages microservices to enhance flexibility, scalability, and efficiency. Each microservice serves specific functionalities such as user management, content retrieval, cart management, and payment gateway.

2.3 Cloud-Native Computing

Cloud-native computing is a methodology that utilizes cloud services to build and run applications. It embraces principles such as containerization, orchestration, continuous integration, and continuous deployment for efficient, scalable, and agile application development.

Principles of Cloud-Native Computing:

- **Containerization:**

  BreakingNews employs containerization, encapsulating the application in a lightweight, portable container for consistency and efficiency across various environments.

- **Scalability:**

  Cloud-native principles ensure BreakingNews can scale horizontally to handle increased user demand efficiently.

2.4 Difference Between Microservices and Other Architectures

While traditional monolithic architectures rely on a single, tightly integrated codebase, microservices architecture divides the application into smaller, independently deployable units.

Methodology

3.1 Technological Framework

Chapter 3 delves into the core technological framework that powers BreakingNews. This section provides a brief description of various key technologies employed, and mentioning the role each plays in contributing to the platform's innovative design, efficiency, and user-centricity.

3.1.1 ReactJS:

ReactJS serves as the cornerstone of BreakingNews' frontend development. It is a JavaScript library for building user interfaces, renowned for its efficiency and ability to create dynamic and responsive user experiences. ReactJS facilitates the real-time updates and intuitive interfaces that define BreakingNews' user interaction.

3.1.2 NodeJS:

NodeJS forms the backbone of BreakingNews' backend microservices architecture. As a server-side JavaScript runtime, NodeJS enables the development of scalable and efficient server applications. BreakingNews leverages NodeJS for its flexibility and non-blocking, event-driven architecture, ensuring optimal data processing and communication between microservices.

3.1.3 Auth0:

Authentication is a critical aspect of BreakingNews, and Auth0 plays a pivotal role in ensuring a secure and seamless Single Sign-On (SSO) experience. Auth0 provides robust authentication and authorization services, enhancing BreakingNews' security and user authentication processes.

3.1.4 RazorPay:

BreakingNews integrates RazorPay for seamless and secure payment transactions. RazorPay is a payment gateway that enables BreakingNews users to purchase news subscriptions with

confidence and ease. This integration ensures a streamlined and trustworthy payment experience within the BreakingNews platform.

3.1.5 AWS (Amazon Web Services):

AWS serves as the cloud infrastructure for BreakingNews, providing a scalable, reliable, and secure foundation. The use of AWS EC2 instances hosts microservices, ensuring efficient computing. S3 storage facilitates secure and scalable storage for media and user data, while RDS manages relational databases, ensuring efficient data organization.

3.1.6 Docker Technology:

In addition to the key technologies mentioned, BreakingNews leverages Docker as a fundamental component of its technological framework. Docker is a containerization platform that encapsulates applications and their dependencies into containers, ensuring consistency across different environments.

3.1.7 API-Driven Communication:

BreakingNews relies on well-defined APIs to facilitate effective communication between its microservices. APIs ensure seamless data exchange, contributing to the overall agility and responsiveness of the BreakingNews system

3.2 Architecture Overview

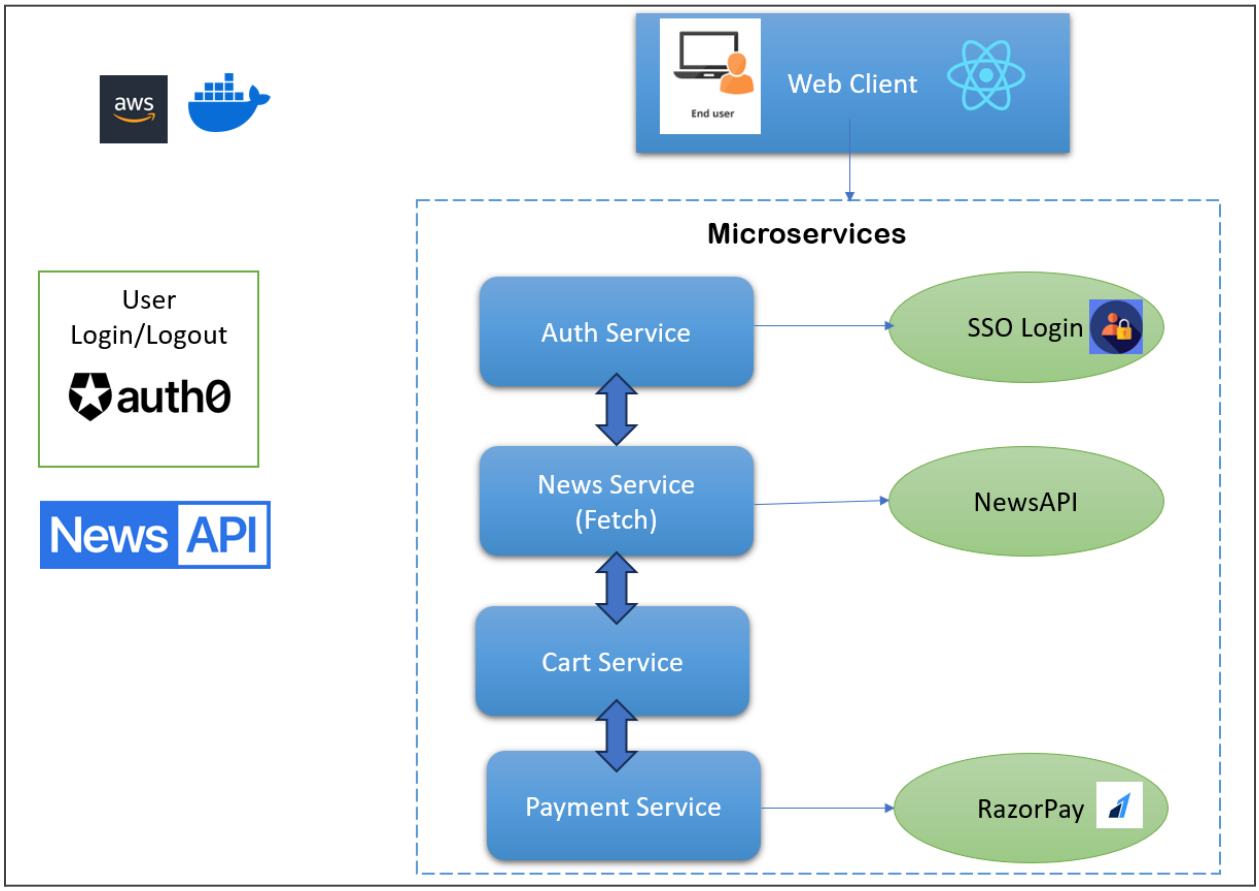


Fig 1: Application Architecture of BreakingNews

3.2.1 Microservice Details

3.2.1.1. Authentication Microservice (Login/Logout):

Auth0 is used for secure authentication with Single Sign-On (SSO) capabilities.

Functionality:

- Handles user authentication, login, and logout processes.
- Leverages Auth0 for secure and streamlined Single Sign-On.

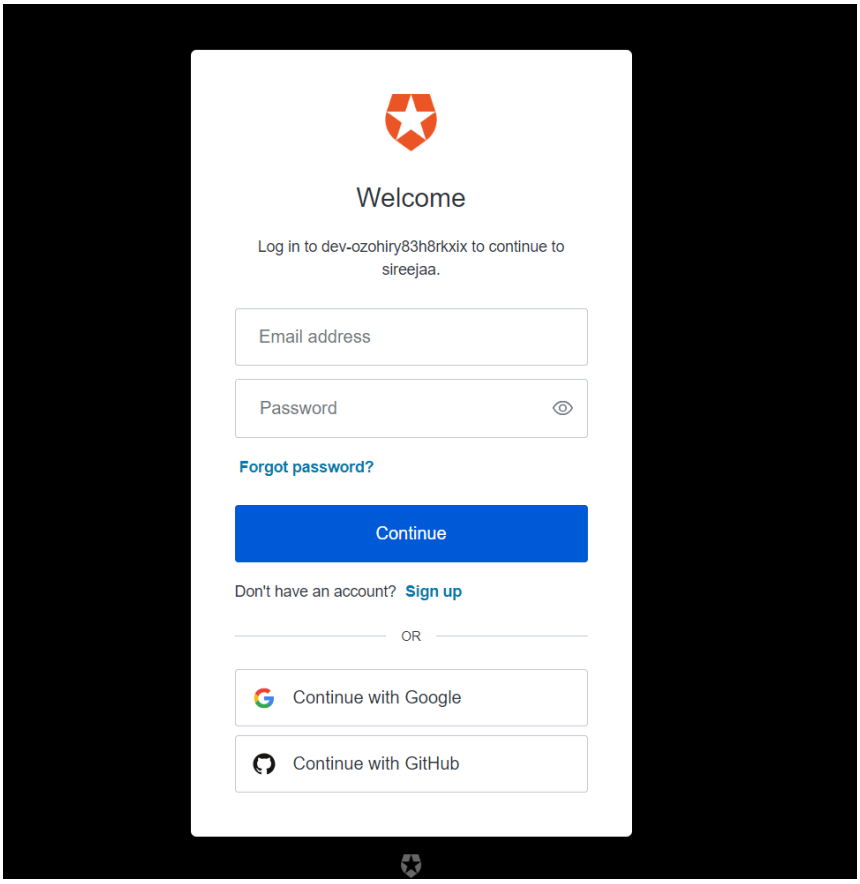
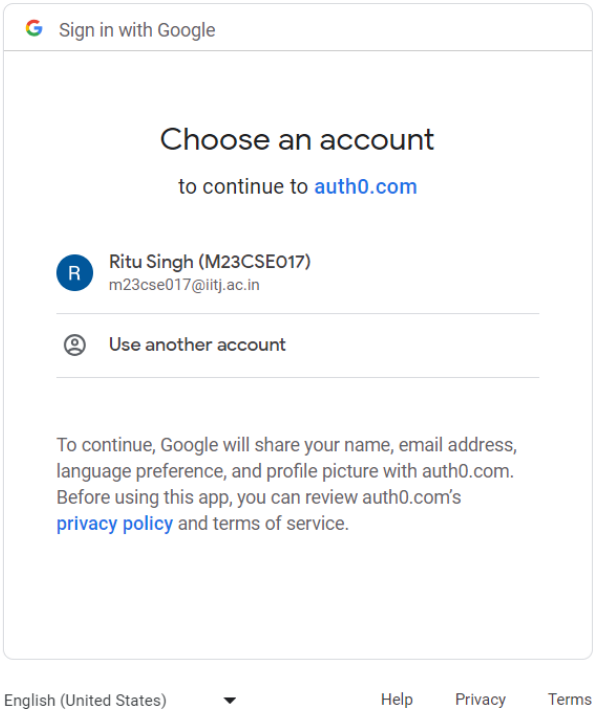


Fig 2: User login module using Auth0 with SSO capability



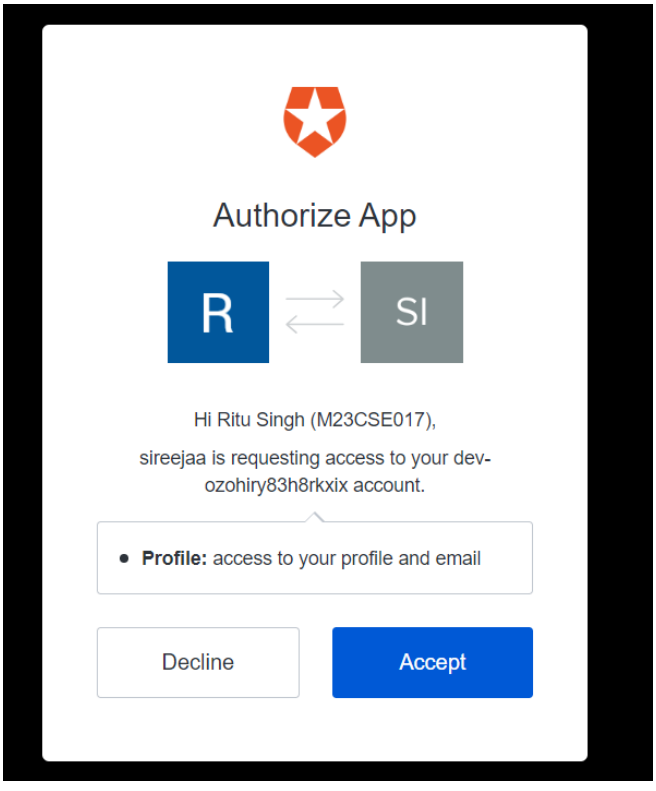


Fig3: Access permissions for User Authentication

3.2.1.2. Cart Microservice:

Functionality:

- Manages user subscriptions in a centralized cart.
- Allows users to add, modify, and review news subscriptions for purchase.

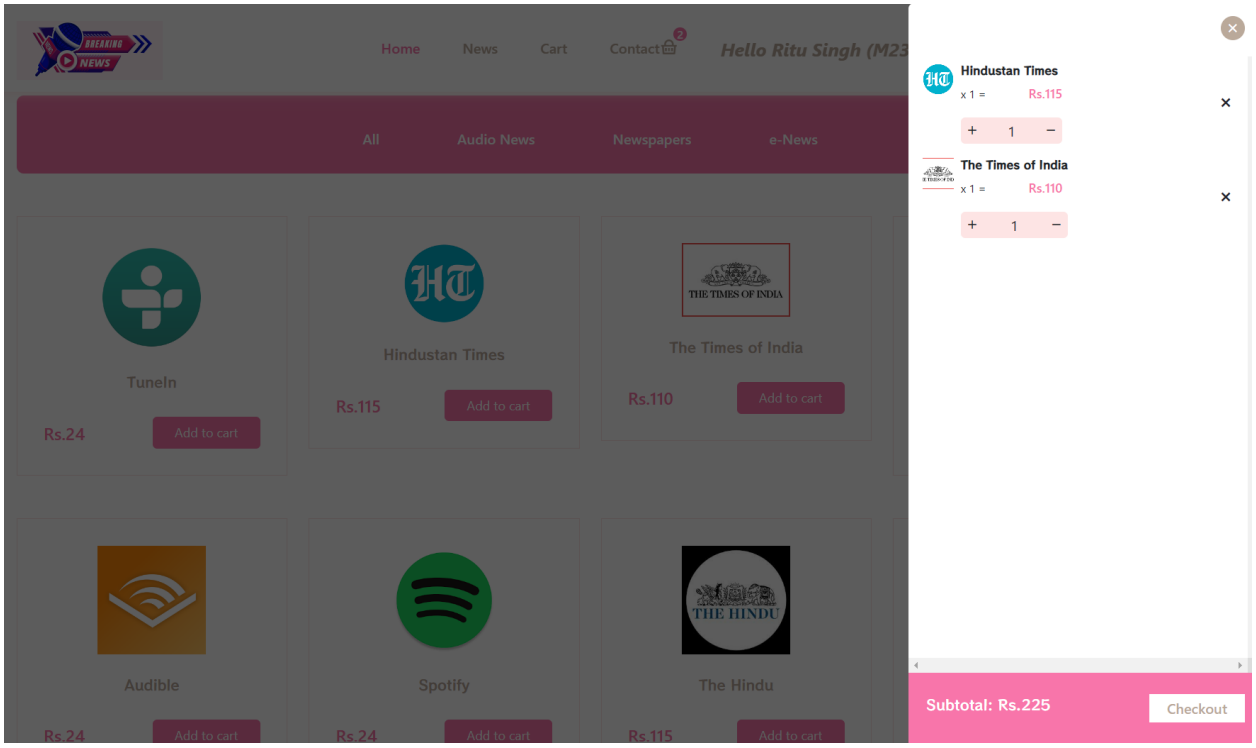


Fig 4: Centralized User Cart Screen

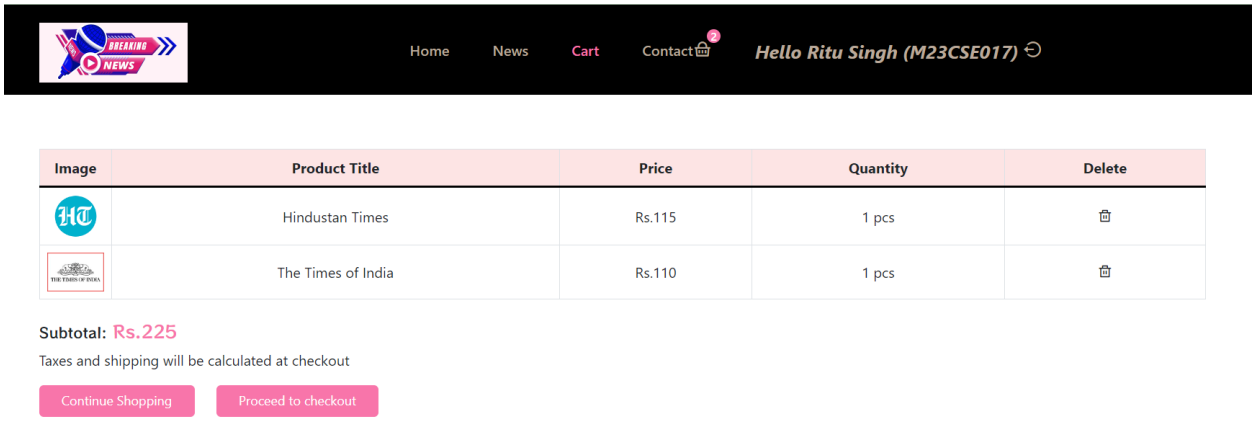


Fig 5: Cart Summary Screen

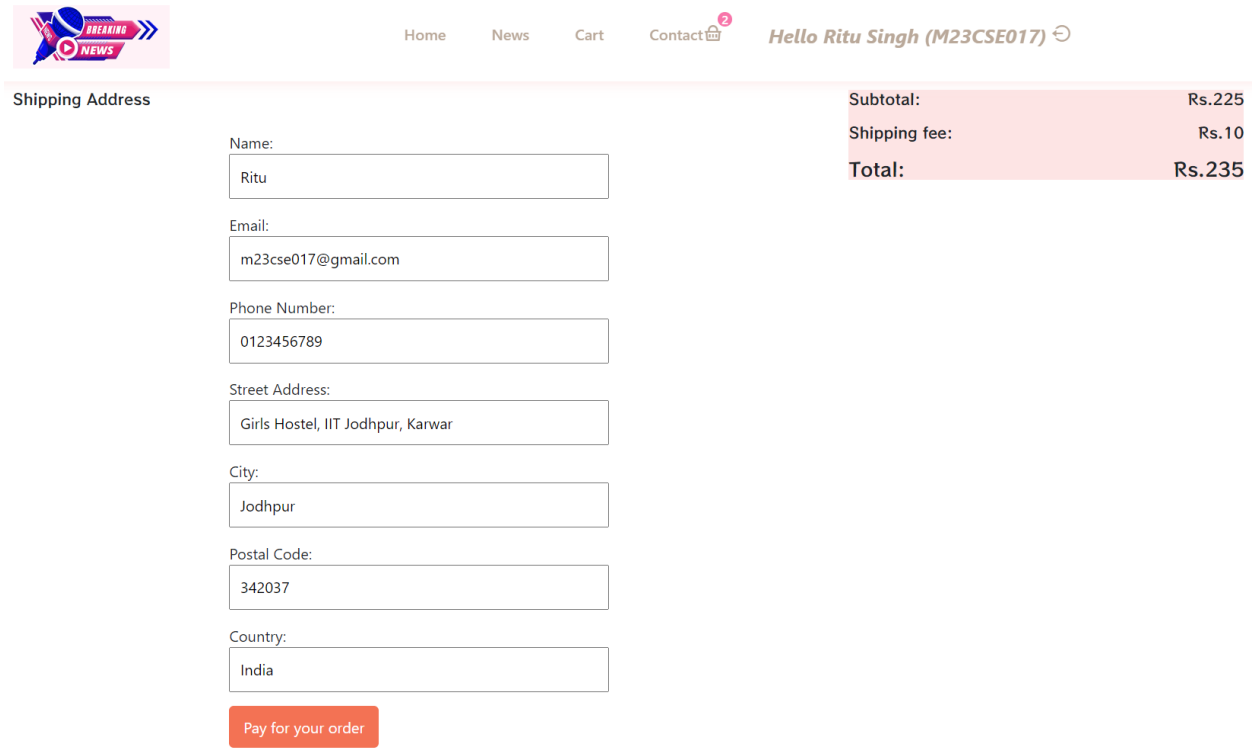


Fig 6: User proceeding for checkout

3.2.1.3. Payment Microservice:

RazorPay integration for secure and efficient payment transactions.

Functionality:

- Facilitates the checkout process for news subscriptions.
- Integrates RazorPay for seamless and secure payment transactions.

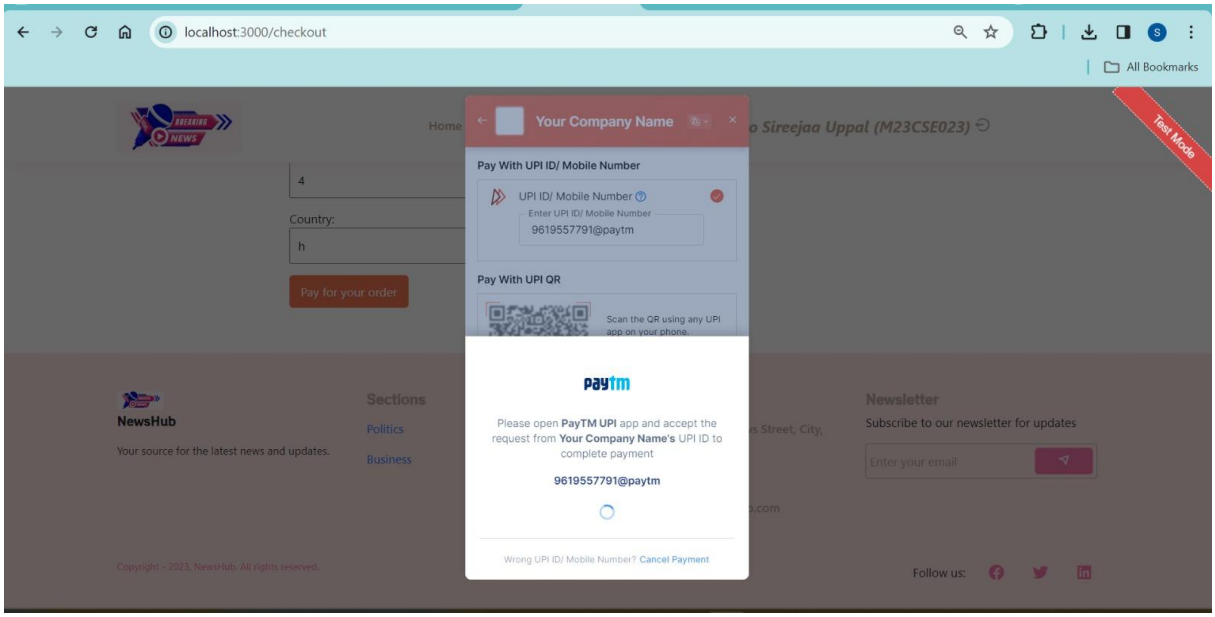


Fig 7: Payment Screen post order filling Shipping details

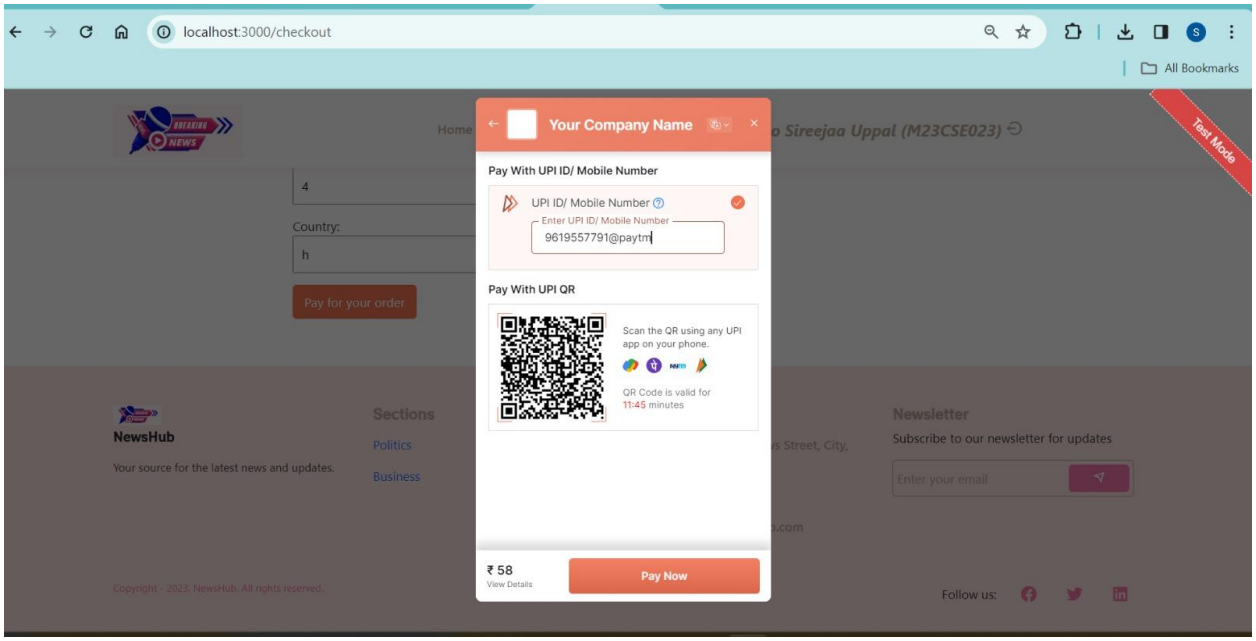


Fig 8: Payment Screen filling UPI ID details

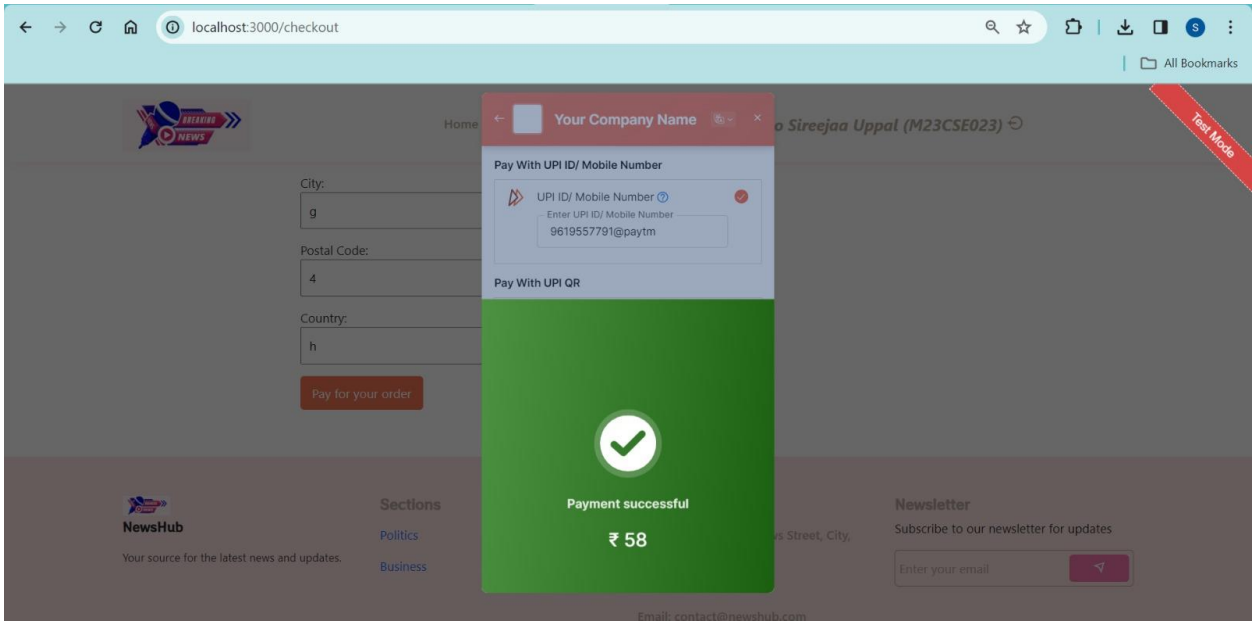


Fig 9: Payment Successful Screen after making the payment

3.2.1.4. News Fetch Microservice:

Utilizes NEWSAPI to fetch news content.

Functionality:

- Retrieves news content based on user preferences and selected categories.
- Integrates NEWSAPI for real-time and dynamic news updates.

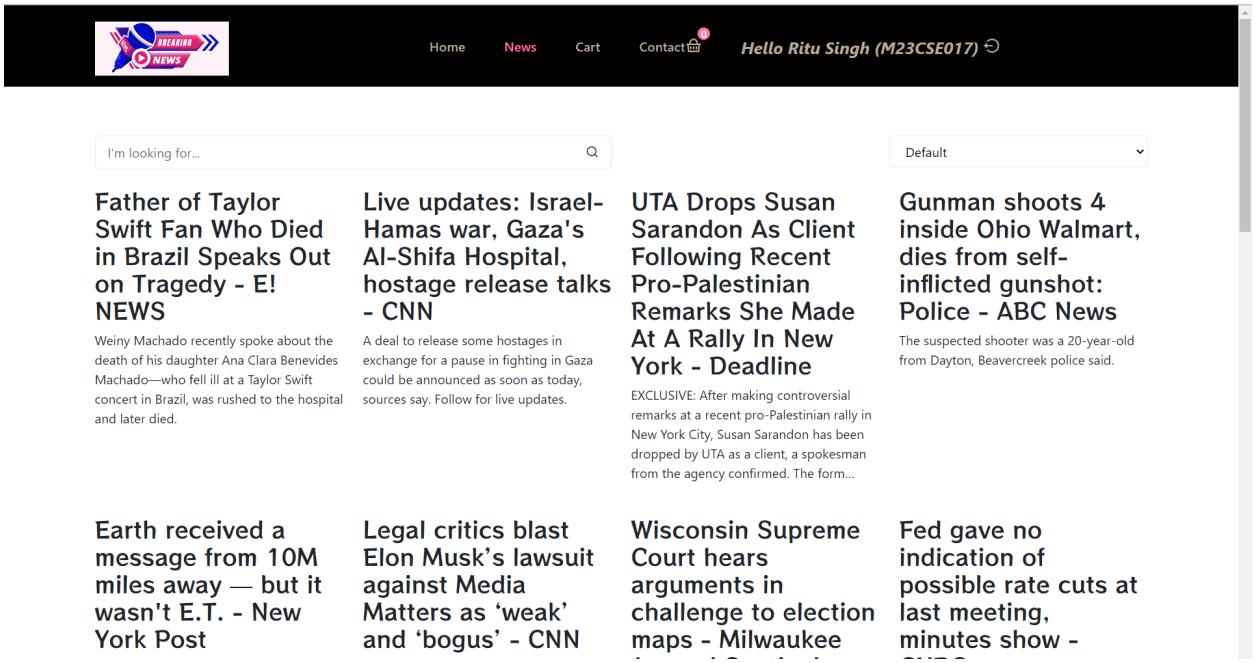


Fig 8: Curated News based on User's preferred category

3.2.2. Communication Between Microservices:

All microservices communicate with each other via well-defined APIs. Authentication Microservice communicates with the Cart and Payment microservices to synchronize user data securely. The Cart Microservice interacts with the Payment Microservice during the checkout process. The News Fetch Microservice provides real-time news updates based on user preferences.

3.2.3 Frontend-Backend Relationship:

ReactJS serves as the frontend library, offering a dynamic and user-friendly interface.

NodeJS is employed for the backend, ensuring efficient data processing, API handling, and overall server-side functionality.

3.2.4 External Integrations:

Auth0 is integrated for secure user authentication and Single Sign-On.

RazorPay is seamlessly integrated for secure payment transactions during news subscription purchases.

NEWSAPI is utilized to fetch real-time news content based on user preferences.

3.2.5 Containerization and Deployment:

The entire BreakingNews application is containerized using Docker.

Docker containers encapsulate the application microservice, ensuring consistency and portability across various environments.

The containerized application is deployed on AWS (Amazon Web Services) for scalable, reliable, and secure hosting.

3.2.6. Conclusion

BreakingNews' microservices architecture, coupled with external integrations and containerization, forms a robust and scalable platform for digital news consumption. The modular design allows for efficient development, deployment, and maintenance, while the choice of technologies ensures a seamless and secure user experience. The deployment on AWS further enhances the platform's reliability and scalability, making it a dynamic and user-centric news application.

Findings

4.1 User-Centric Design

BreakingNews places a strong emphasis on user-centric design, providing an intuitive and engaging experience for users. The integration of ReactJS on the frontend allows for dynamic and responsive interfaces. The user-centric design is further enhanced by the Authentication Microservice, which seamlessly integrates Auth0 for secure Single Sign-On, streamlining the login and logout processes.

4.2 Secure Transactions

Security is paramount in BreakingNews, particularly in transactions related to news subscriptions. The Payment Microservice, integrated with RazorPay, ensures secure and efficient payment transactions. Users can confidently proceed with checkout, knowing that their financial information is handled with industry-standard security measures. This secure transaction process is a key aspect of the application, contributing to user trust and satisfaction.

4.3 Efficient Subscription Management

The Cart Microservice is central to BreakingNews' efficient subscription management. Users can add, modify, and review multiple news subscriptions within a centralized cart. The seamless integration with the Payment Microservice allows for a smooth checkout process. This microservices architecture ensures that subscription management is user-friendly, flexible, and capable of handling diverse user preferences.

4.4 Tailored News Delivery

BreakingNews' dynamic and tailored news delivery is facilitated by the News Fetch Microservice. Leveraging the NEWSAPI, this microservice retrieves real-time news content based on user preferences and selected categories. The News Fetch Microservice is designed to deliver content that is not only relevant but also aligns with each user's individual interests. This personalization contributes significantly to the overall user experience.

4.5 Robust Technology Stack

The technological stack underpinning BreakingNews, including ReactJS, NodeJS, Auth0, RazorPay, and AWS, forms a robust foundation for the platform's operations. ReactJS enables a responsive and dynamic user interface, while NodeJS ensures efficient server-side processing. Auth0 and RazorPay contribute to secure authentication and transaction processes, respectively. AWS, as the hosting infrastructure, ensures scalability, reliability, and optimal resource utilization.

4.6 Cloud-Native Agility

BreakingNews demonstrates cloud-native agility through its deployment on AWS. The use of containerization with Docker enhances agility by ensuring consistency across different environments. The adoption of cloud-native computing principles, such as container orchestration and continuous integration/deployment, enables BreakingNews to adapt quickly to changing user demands. This approach ensures that the platform remains agile, scalable, and responsive in the ever-evolving landscape of digital news consumption.

4.7 Microservices Engineering for Specific Functionalities

Each microservice within BreakingNews is meticulously engineered to serve specific functionalities. The Authentication Microservice handles user authentication, the Cart Microservice manages subscriptions, the Payment Microservice facilitates secure transactions, and the News Fetch Microservice retrieves real-time news content. The effective communication between these microservices, facilitated by well-defined APIs, ensures a cohesive and integrated user experience.

4.8 Conclusion

Chapter 4 highlights the technical findings of BreakingNews, showcasing its commitment to user-centric design, security, efficient subscription management, and tailored news delivery. The robust technology stack, cloud-native agility, and microservices engineering collectively contribute to the application.

Chapter 5: Conclusion and Future Directions

5.1 Summary of Findings

This chapter provides a comprehensive summary of the key findings and insights gathered throughout the analysis of the application. The technological examination revealed a user-centric design, secure transaction processes, efficient subscription management, and dynamically tailored news delivery. The robust technology stack, cloud-native agility, and microservices engineering collectively contribute.

5.2 Contributions

The adoption of a microservices architecture, coupled with a user-centric design, ensures a seamless and personalized experience for users. The integration of Auth0 and RazorPay

enhances security and streamlines authentication and payment processes. BreakingNews' deployment on AWS, containerization with Docker, and adherence to cloud-native computing principles contribute to its scalability, reliability, and overall agility.

5.3 Future Directions

As BreakingNews continues its journey of innovation, several avenues for future development and enhancement emerge:

- **Advanced Personalization:**

  Further enhance the News Fetch Microservice to provide even more personalized news content, leveraging advanced algorithms and user behavior analysis.

- **Enhanced Security Measures:**

  Explore additional security measures and technologies to fortify user data protection, ensuring the highest standards of security in an ever-evolving threat landscape.

- **Integration of Emerging Technologies:**

  Investigate the integration of emerging technologies, such as machine learning and natural language processing, to augment content recommendations and user interaction.

- **Global Expansion:**

  Consider expanding BreakingNews to a global audience by incorporating multilingual support and tailoring news content to diverse cultural preferences.

- **User-Generated Content:**

  Explore features that allow users to contribute and share their content, fostering a sense of community engagement within the BreakingNews platform.

- **Continuous Optimization:**

  Implement continuous optimization practices, including performance tuning, load testing, and infrastructure enhancements, to ensure BreakingNews maintains peak performance even during periods of high user demand.

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Conclusion

BreakingNews redefines news consumption through a scalable microservices architecture hosted on AWS, prioritizing a user-centric design. Auth0-powered authentication and RazorPay integration ensure secure and streamlined subscription transactions, fostering user trust.
The Cart Microservice centralizes subscription management, seamlessly integrating with RazorPay for an efficient user experience. The Fetch News Microservice tailors content dynamically, providing users with relevant and up-to-date information aligned with their preferences. A robust technology stack, featuring ReactJS, NodeJS, Auth0, RazorPay, and AWS, contributes to scalability, reliability, and cost-efficiency. Embracing cloud-native computing, BreakingNews ensures efficient orchestration, containerization, and continuous integration for adaptability. BreakingNews is not just a news platform; it's an innovative, secure, and user-centric experience that evolves with the ever-changing information landscape.