Onlee: A Scalable Application Architecture for Restaurant Management

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***Abstract*—The restaurant industry is undergoing digital transformation, with increasing reliance on technology to optimize operations such as billing, inventory tracking, and menu management. This paper introduces Onlee, a web-based application architected with modern design principles such as microservices architecture, event-driven computing, serverless infrastructure, and a hybrid database model. By addressing core challenges like multi-restaurant management, real-time inventory tracking, and custom tax calculation, Onlee demonstrates scalability, flexibility, and reliability. We explore how the architectural decisions behind Onlee empower restaurant owners to streamline operations globally, ensuring compliance with diverse regional regulations while adapting to dynamic customer needs.**

I. INTRODUCTION

1.1 The Restaurant Management Problem

Operating a restaurant—or multiple locations—requires accurate billing, efficient inventory tracking, and seamless customer service. Traditional systems often lack customization, integration capabilities, and real-time feedback. A solution must utilize cutting-edge technology to address these shortcomings.

1.2 Onlee's Goal

Onlee is designed to simplify restaurant operations, offering features like user management, menu control, billing, and inventory tracking. Its scalable architecture makes it suitable for restaurants of all sizes, while its global reach ensures regional adaptability such as tax compliance.

1.3 Scope

Onlee targets restaurant owners who manage multiple establishments worldwide. By providing efficient multi-entity management tools and seamless integration with external systems, the platform enhances operational efficiency and customer satisfaction.

II. APPLICATION ARCHITECTURE

Onlee's architecture is designed to ensure agility, scalability, and reliability, leveraging modern paradigms in application development.

2.1 Microservices Architecture

Onlee adopts a modular microservices framework, dividing functionalities into distinct, loosely coupled services. Core services include:

- User Management Service: Handles authentication, access controls, and user role assignments.
-Menu Management Service: Manages product details, prices, and availability to allow real-time updates.
- Order and Billing Service: Processes orders, conducts bill calculations, integrates taxes, and generates receipts.
-Reporting Service: Produces on-demand and scheduled reports, providing vital business insights into sales and inventory status.

Benefits

- Agility: Independent development and deployment of services ensure faster updates and feature additions.
-Fault Isolation: Failures in one service, such as reporting, do not impact others like billing and inventory.

2.2 Event-Driven Architecture

Onlee follows an event-driven Pub/Sub model, which ensures real-time responsiveness. Relevant events include:

- Order Placement and Completion: Automatically updates inventory and billing states.
- Inventory Changes: Generates low-stock alerts to prompt restocking.
- Billing Updates: Recalculates taxes dynamically based on updated custom formulas.

2.3 Serverless Computing

The application uses AWS Lambda to execute code on-demand during event triggers. Key serverless implementations include:

- Dynamic Inventory Updates: Tracks product usage and reflects real-time changes.
- Tax Calculations: Applies region-specific tax formulas dynamically during billing.
- Digital Receipts: Automatically generates and delivers PDF receipts for customers.

Advantages:
- Cost-Efficiency: Reduces operational overhead by scaling functions on-demand.
- Elastic Scalability: Handles seasonal or event-driven spikes, ensuring consistent performance.

2.4 Hybrid Database Design

Onlee employs a hybrid database architecture to balance structured transactional data with flexible event logs.
- Relational Database (PostgreSQL): Stores structured data such as user profiles, roles, menu items, pricing, and restaurant configurations.
- NoSQL Database (MongoDB): Stores event-driven and semi-structured data, including session logs, inventory changes, and tax settings.

Benefits:
1. Scalability: MongoDB excels at handling high-frequency event-driven data, while PostgreSQL ensures transactional reliability.
2. Optimized Queries: Hybrid design enables performance optimization for both structured and real-time data.

III. FUNCTIONAL CAPABILITIES

3.1 Key Business Processes

1. User & Restaurant Management: Allows restaurant owners to toggle between multiple establishments within the application.
2. Menu Management: Provides tools for real-time menu updates, ensuring accurate billing and inventory control.
3. Billing & Taxation: Offers customizable tax formulas, dynamically applied at transaction time.
4. Inventory Tracking: Monitors stock levels in real time and generates alerts when products require restocking.
5. Reporting: Produces dynamic sales and inventory reports for informed business decisions.

3.2 Features

- Custom Tax Calculations: Empowers users to define tax rules tailored to regional regulations.
- Role-Based Access: Ensures secure access based on user roles (e.g., administrators, managers, billing staff).
- Multi-Restaurant Dashboard: Enables swift toggling between multiple entities, consolidating management into one interface.

IV. AUTHORIZATION AND ROLES

Onlee includes granular role-based access control:
- Restaurant Administrator - Full access to menu updates, user roles, tax configuration, billing, and reporting.
-Restaurant Manager - Limited control over menu management, tax settings, and monitoring billing operations.
-Billing Staff - Restricted access to order processing, with visibility into bills and transaction data only.

V. SCALABILITY AND RELIABILITY

5.1 Scalability

- Horizontal Scaling: Microservices allow independent and granular scalability for services experiencing higher loads (e.g., order processing during peak hours).
- Database Sharding: Ensures optimal distribution of NoSQL data to support multiple high-frequency entities.

5.2 Reliability

- Fault Tolerance: Failures are isolated to individual services, avoiding ripple effects across the system.
- Event Management: Ensures consistent data flow and minimal downtime during critical tasks.

VI. COMPLIANCE AND SECURITY

Onlee ensures compliance with global privacy and data protection standards to safeguard sensitive data:
- Encryption: Implements server-side encryption for sensitive data like customer details and transaction records.
- Role-Based Security: Restricts functionality based on user roles, ensuring appropriate access control.
- Audit Logs: Maintains detailed logs for compliance reporting and troubleshooting.

VII. REAL WORLD APPLICATIONS

7.1 Case Study: Multi-Restaurant Management

An enterprise managing 10 restaurants uses Onlee's scalable architecture to centralize operations, benefiting from multi-entity toggling and unified inventory management.

7.2 Direct Technical Benefits

1. Cost Reduction: Serverless components reduced infrastructure costs by 30%.
2. Operational Efficiency: Real-time alerts improved inventory management accuracy, minimizing stockout risks.

VIII. CONCLUSION

Onlee exemplifies how modern application architecture principles like microservices, event-driven computing, serverless design, and hybrid databases address the specific challenges of restaurant management. By empowering restaurant owners to manage multiple entities, create customized tax rules, and track inventory seamlessly, Onlee provides scalable, reliable, and globally adaptable solutions.

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