Travel Tracker

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Deliverable Version 1.0

Chapter 1

Purpose

Travel Tracker is evolving from its previous semester version into a production-ready, cloud-native web application. Our goal is to take the existing vacation planning platform, designed to streamline budgeting, itineraries, and travel logistics, and re-architect it for scalability, resilience, and real-world deployment. This semester’s focus is on transitioning the application from a containerized environment using Docker Compose to a fully orchestrated environment using Kubernetes.

Travel planning can be complex, as it involves coordinating various aspects, including budgeting, flights, lodging, and activities. Travel Tracker already centralizes these features in one place. Our next step is to ensure that the platform can scale to production workloads while maintaining security, performance, and availability.

In addition to this Kubernetes transition, we envision Travel Tracker evolving into a richer, more intelligent platform for travelers. Planned enhancements include:

- **AI Recommendations:** Suggest hotels, activities, or destinations tailored to a user’s budget and preferences.

- **Improved UI/UX:** A polished, user-friendly design to make the application visually appealing and easy to navigate.

- **Automated Testing:** Improve quality assurance and streamline deployments.

- **Trip Sharing and Group Planning:** Let users collaborate with friends or family on shared itineraries.

- **Advanced Uploads:** Enable users to upload travel documents such as tickets or confirmations, creating a central hub for all their travel information.

High-Level Architecture

At a high level, our new architecture consists of multiple independently deployed services running on a Kubernetes cluster:

- **Frontend Pod (React.js):** Hosts the user-facing interface of Travel Tracker, exposing it via a Kubernetes Service for stable access and easy scaling.

- **Backend Pod (Flask/Python):** Handles API requests, authentication, and business logic, communicating securely with the database, AI services, and external APIs.

- **Database Pod (MongoDB):** Stores user data, trip information, and expenses. This will be provisioned as a StatefulSet with persistent volumes to ensure data durability.

- **External Services Integration (Exchange Rate API):** Provides real-time currency conversion as a third-party service integrated into the backend.

- **AI Recommendation Service:** A planned microservice running in its own pod, designed to interface with large language model APIs to generate travel suggestions and personalized recommendations.

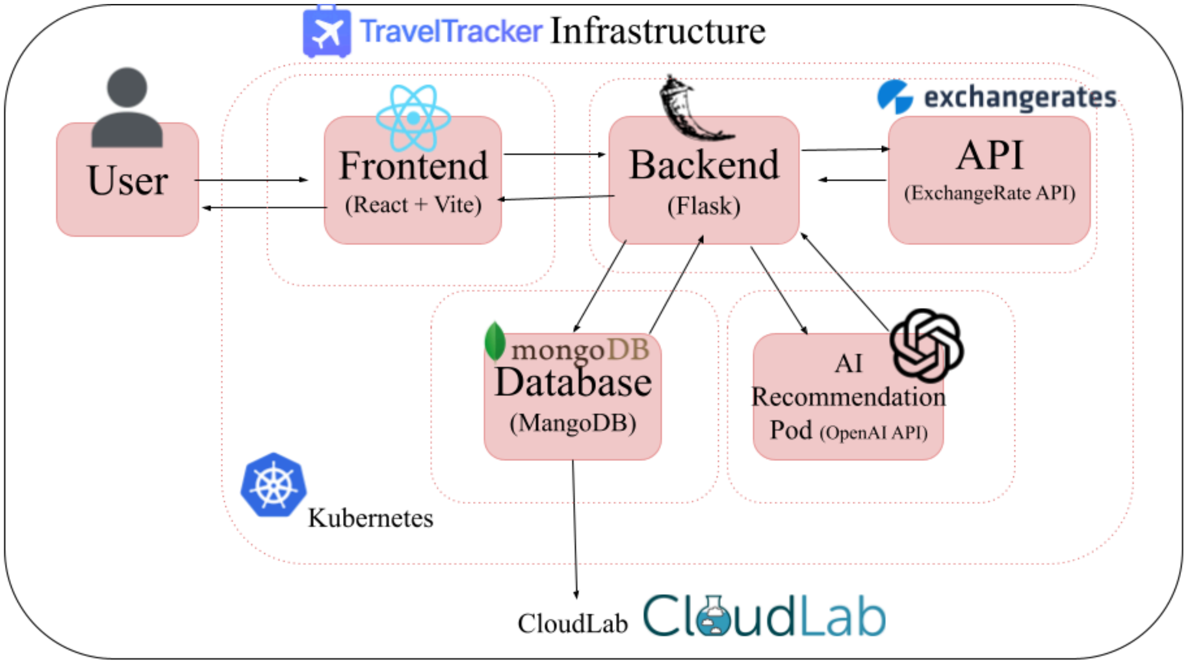
- **ConfigMaps and Secrets:** Manage application configuration and credentials securely within the cluster.

- **Persistent Volumes:** Ensure data durability for MongoDB and other stateful components.

- **Horizontal Pod Autoscaling:** Automatically adjusts the number of pods in response to load, ensuring reliability under varying traffic.

This architecture transforms Travel Tracker from a simple three-container setup into a modern, cloud-native deployment. The use of Kubernetes allows for rolling updates, zero-downtime deployments, self-healing, and easier scaling, features that are essential for a production-ready application. By also incorporating AI recommendations, improved UI/UX, automated testing, trip sharing, and advanced uploads, Travel Tracker aims to go beyond its original scope and deliver a powerful, intelligent, and collaborative travel planning platform for users.

Architecture



Key Features:

- **User Authentication (Sign-up/Login)**
  - Users can create an account and log in securely using JWT authentication.
  - Ensures data privacy and secure access.
- **Vacation Budget Management**
  - Users can create a trip budget and track flight, hotel, food, and activity expenses.
  - The budgeting tool ensures expenses stay within limits
- **Expense & Banking Tracker**
  - Users can manually enter their income, expenses, and recurring payments. It helps in tracking finances efficiently.
- **Real-Time Currency Conversion**
  - Integrated with an *ExchangeRate API* to provide up-to-date currency conversions.
  - Users can convert expenses and budgets into different currencies.
- **Trip Itinerary & Activity Planner**
  - Users can add and organize their travel itineraries, including flights, hotel stays, and activities.
  - It helps users plan each day efficiently.
- **Notes & Additional Travel Info**
  - Users can add custom notes related to their trip.
  - A personalized section for important travel details.
- **Backend Data Storage & Management**
  - All user data, trip details, and transactions are securely stored in *MongoDB.*
  - Provides fast data retrieval and storage.
- **User Interface**
  - Elegant and user-friendly UI designed with *React.js*.
  - Simple navigation between budgeting, itinerary, and expenses.
- **Secure API Communication**
  - *Flask* handles all API requests, authentication, and interactions with MongoDB.
  - Ensures smooth data flow between the front end and the back end.
- **AI Recommendations (Planned):**
  - A dedicated AI Recommendation Service will suggest hotels, activities, or destinations based on a user’s budget and preferences.

- **Trip Sharing & Group Planning (Planned):**
    - Allows users to share trips with friends or plan group vacations collaboratively.
- **Automated Testing (Planned):**
    - Full unit and integration test coverage to ensure smooth deployment, testing, and quality assurance.
- **Advanced Uploads (Planned):**
    - Users will be able to upload images or tickets for flights, enabling advanced trip planning and creating a hub for all travel-related information.

Chapter 2

Implementation

React: The client side of our application will be developed using **JavaScript** and **React**. This allows for functionality for user experience for easy logins, a clean user interface, and robust performance. Users can access and manage their trip details, such as budget, excursion plans, and notes. After logging in, users can input trip details stored in their user profiles. This data is synchronized with the Python-based backend through API calls. Changes in currency exchange rates will be up-to-date and displayed to the user through the ExchangeRate API. Users can monitor, edit, and save their trip plans and updates in real time.

Key Frontend Features:

- *Login/Signup Pages:* Secure authentication interfaces for user registration and login.
- *Tracker Page:* Users can log expenses, track budgets, and manage allowances. A drop-down menu allows users to convert finances into various currencies.
- *Travel Planner Page*: Users can create, manage, and edit vacation plans. The budgeting feature automatically compares expenses against the allocated budget and integrates with the currency conversion tool for international trips.
- *Currency Conversion Tool*: Real-time currency conversion using the ExchangeRate API for accurate budgeting and financial tracking.
- *Trip Sharing:* Planned addition of a feature allowing users to share trips with friends or plan group vacations.
- *Advanced Uploads:* Planned ability for users to upload travel documents, tickets, and confirmations to build a complete travel hub.
- *AI Recommendations*: Planned integration of an AI-powered recommendation system to suggest hotels, activities, and destinations based on user budget and preferences.

MongoDB: MongoDB will handle user data. Each user profile will be stored, including username and password, and user inputs for budget, flight information, stay information, itinerary planning, personal notes, and interests.

Python: The backend will be developed using Python to manage server-side logic. Python will talk to the client about user data and communicate with the ExchangeRate API. This will use Flask. The back end will interact with MongoDB for data storage and retrieval.

API: To provide real-time currency conversion, we will integrate the **ExchangeRate API**. This API supplies up-to-date exchange rates for various global currencies, ensuring that users can accurately budget for international trips.

Key API Functions:

- *Currency Conversion*: Fetch current exchange rates based on user-selected currencies.
- *Automated Updates*: Regularly update exchange rates to reflect the latest market changes.
- *Integration with Expense Tracker*: Convert user-entered expenses into different currencies using API data.
- *Chat AI Recommendations (OpenAI):* Generate personalized travel suggestions based on user input and trip details.

Kubernetes Deployment: This semester, we will transition our Docker Compose setup into a Kubernetes cluster. Each service, frontend, backend, database, and planned AI recommendation service, will run as a separate Kubernetes Deployment with Horizontal Pod Autoscaling for scalability. Ingress will manage external access, and ConfigMaps/Secrets will handle configuration securely. Persistent storage will be provisioned for MongoDB to ensure data durability. This migration will make Travel Tracker production-ready with rolling updates, self-healing, and fault tolerance.

Automated Testing: We will begin implementing a test suite of unit and integration tests across the backend and frontend to ensure stable deployments and catch regressions early. This will lay the foundation for a continuous integration/continuous deployment (CI/CD) pipeline tied to Kubernetes.

AI: As part of this semester's expansion, we plan to integrate a Chat AI Recommendation Service into Travel Tracker to enhance personalization and streamline trip planning. This service will run as a dedicated microservice within our Kubernetes cluster and will communicate securely with the backend. We intend to use OpenAI's API to power this feature, leveraging its large language models to generate tailored suggestions for hotels, activities, and destinations based on a user's budget, preferences, and trip details. By integrating OpenAI into our architecture, we will be able to provide conversational, context-aware recommendations directly within the Travel Tracker interface, turning it into an interactive planning assistant rather than just a static tool.