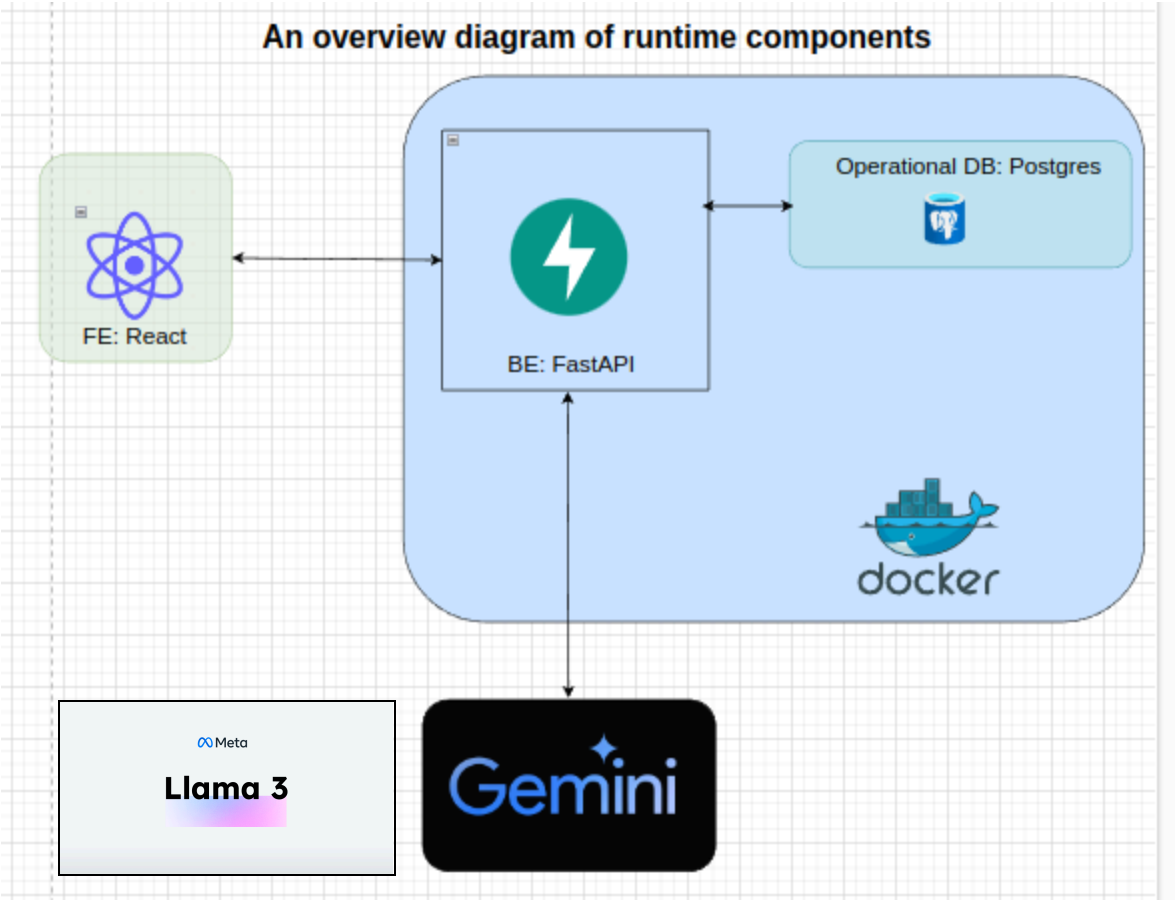
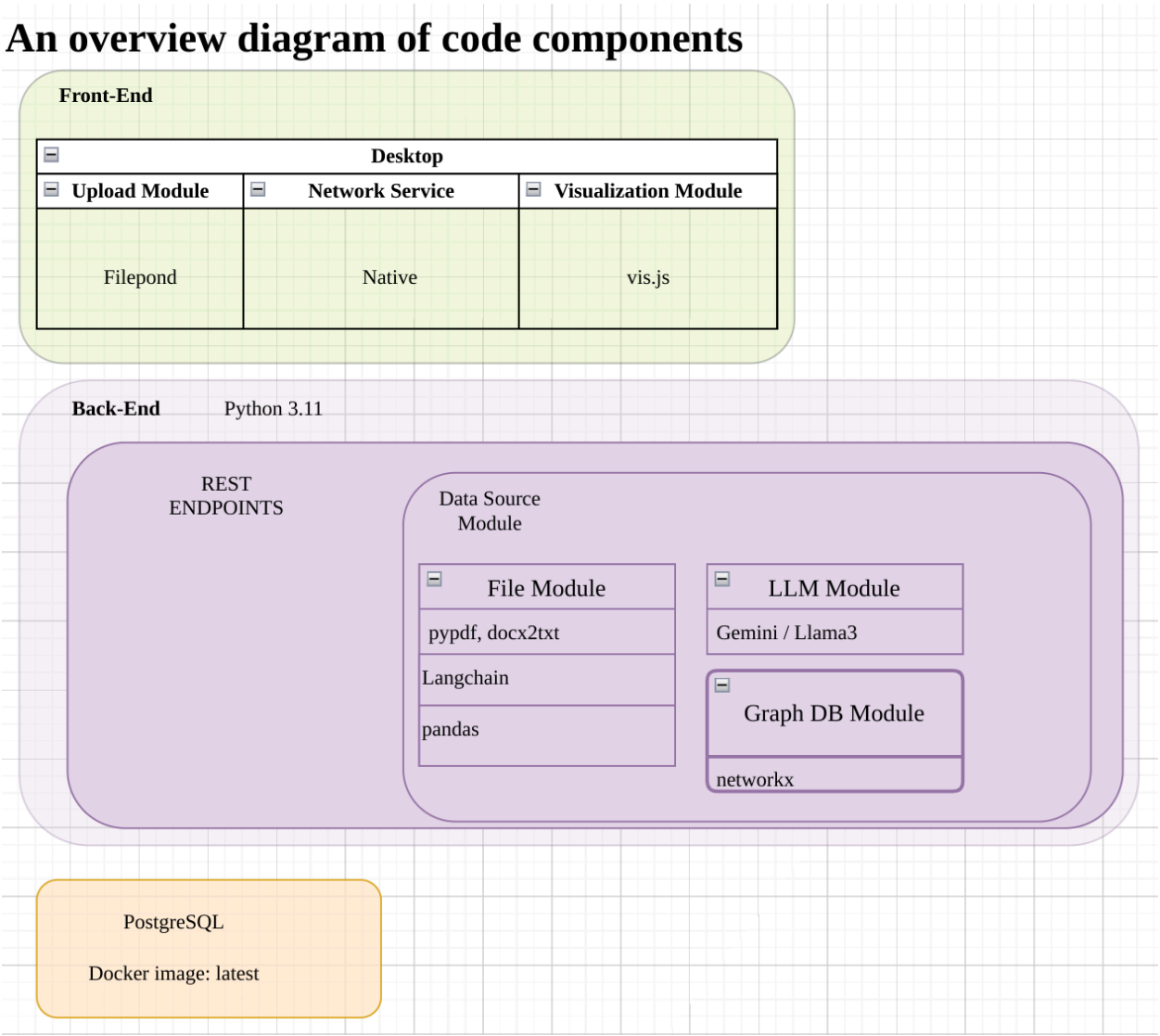

An overview diagram of runtime components
FE: React
BE: FastAPI
Operational DB: Postgres
docker
Meta
Llama 3
Gemini

An overview diagram of code components



A summary of the underlying technology stack

The whole application is a web app. It has its **FE** (UI) and a **monolithic BE** with all its services containerized with **Docker.**

Front-end:
We are using **React** with its libraries

- Upload module: We are using **Filepond**
- Networking/Communication: **Native**
- Visualization module: We are going to use **vis.js** to show the user the knowledge graph

Back-end:
The backend part is built around the **Python** ecosystem. The main app uses **FastAPI** as a web framework**.**
The supporting services will be the following:

Operational DB → **PostgreSQL**: Fast, reliable, scalable database.

LLM → We employ **Gemini or Llama3**, large language models from Google and Meta, due to their large context window and fast processing speed, as our application handles a high volume of requests. Among many features, it exposes an endpoint that we can use to interact with a model.

We will use a pre-train LLM model, **Gemini or Llama3,** to get a meaningful relation between the data. Using different prompts, select values for nodes and edges for meaningful graph

Packages which help in working with PDFs are:
pypdf: Read pdf and transform it into a string.
LangChain: Is a framework designed to simplify the creation of applications using large language models. It also has other helper functionalities. Our use case is for text chunk creation to be fed to the LLM and in the future to make calls and build a Chatbot.

Pandas: Is a Python package for pre-processing and manipulating datasets.

Development and Deployment:
Docker: For consistent development environment and isolation
Git: Used for version control and efficient collaboration.

A textual explanation of the diagrams and choices

Based on the team's experience and initial requirements for the project, we decided on the below architectural & tech stack decisions to deliver within the deadline a final product.

Architectural Decisions:
Front-end: This layer handles the user interactions with the application. It makes it easy for the user to upload documents and interact with the graph.

Back-end: This is the logic layer, handling the data processing, for each document and creating the Graph. We agreed on a monolithic approach with supporting services since it is the fastest and easiest implementation to deliver an MVP.
Technology Choices:
The main technology used is reliable, open source, and offers great scalability.

React: Chosen for robust ecosystem, it is a component-based architecture. Effective UI and better user interaction.
vis.js: offers an easy, aesthetic way to display graphs.
Python: The main language is Python since it was per the client's request. This led to the tech stack described above. It is easy to use and has extensive libraries and is well-suited to develop backend logic.
FastAPI: Essential for handling requests and interacting with the database has asynchronous support and is easy to learn.
Gemini: aligns well with our budgetary constraints due to its availability through Google's free credit. Additionally, it has a large context window and can be accessed quickly via the API.
Llama3: aligns well with our budgetary constraints due to its open source availability.

Interaction Between Components:
The front-end communicates with the back-end through RESTful APIs. The back-end utilizes the LLM for processing the text chunks to create entities (nodes) & relations (edges) for the graph. Database, an operational one to save info. about the uploaded PDFs.

Scalability and Maintenance:
With a monolithic approach, it's easy to maintain and work as a team with different experiences.

Also, the app is very easy to scale horizontally or vertically. The only problem is if one of the services/modules needs to be scaled the whole app needs to be scaled. In the future having module separations helps to later substitute them with their service for a microservices architecture.