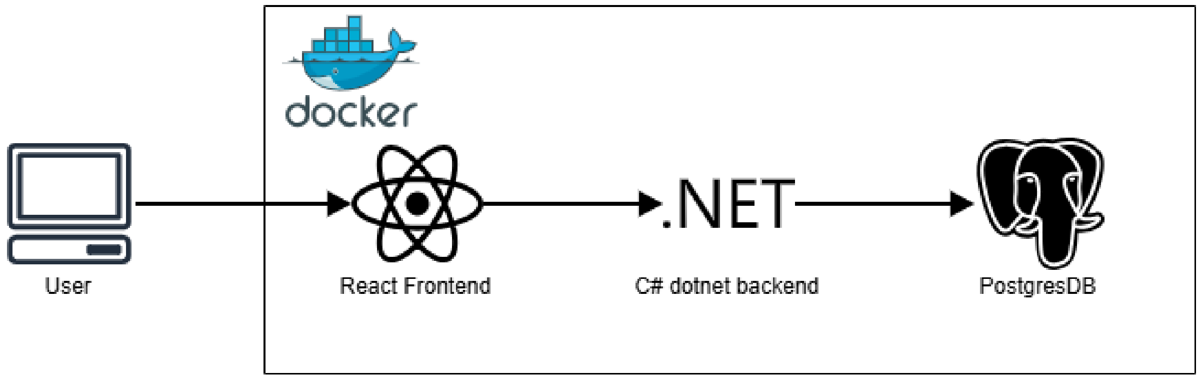
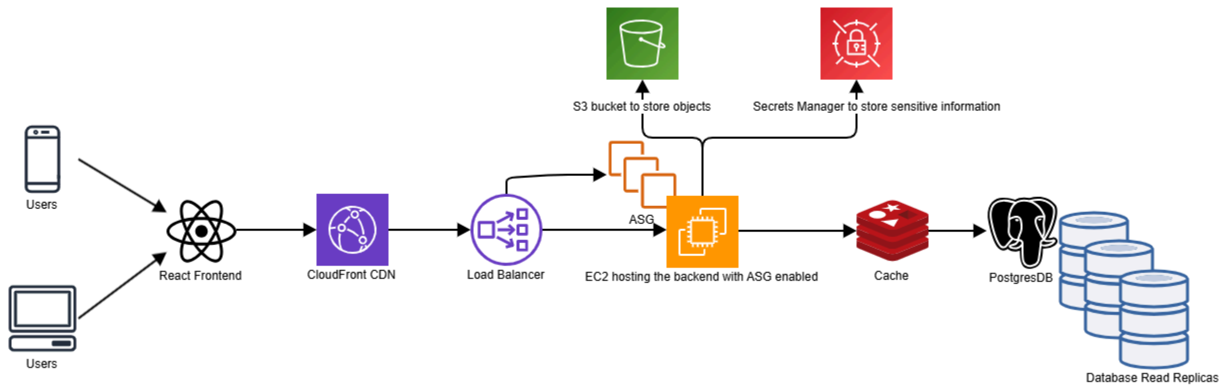
## High-Level Architecture Diagram



### Scalability Strategy


S3 bucket to store objects
Secrets Manager to store sensitive information
Users
Users
React Frontend
CloudFront CDN
Load Balancer
ASG
EC2 hosting the backend with ASG enabled
Cache
PostgresDB
Database Read Replicas

- The Application can be hosted on cloud (Either as server or serverless) to easily **scale based on triggers** (Usage demand, heavy usage hours, etc). A **load balancer** can also be used to limit/route traffic across multiple spawns. Cost wise, this approach will almost always be cheaper than having on-prem servers.
- Since this app handles images and videos, it's ideal to use **object storage** such as S3 to handle such tasks. It's also easy to integrate **CDN** to this for lower latency transfer and content caching.
- The Database should have a standalone **caching system** (Redis, Memcache, etc) to allow more configuration and options that does not require code change (I.e. Lazy-loading, Write-Through)
- As most users are going to use the app to view checklists, the reads will be more than the write. In that case, spawning **database replicas** should suffice. If we find that users are heavily using the writing operation, **database sharding** can also be introduced but it adds extra complexity and data routing management. Having

replicas also **improves Availability and Disaster recovery** especially if deployed **cross-zone, cross-region**

- Other strategies to help with speeding up development is to integrate these workflows: **IaC** (i.e. Terraform), **CI/CD** (i.e. Jenkins, Harness, etc), Remote Notifications (i.e. AWS SNS)

## Component Choice

For the time frame given and to set a realistic goal, the below decision was made

- Decided to use **Docker** to orchestrate the core components frontend, backend, and database since it makes it easier for others to run and test in an isolated environment
- Entity Framework
    - Database operations are mainly handled by the backend in the app and makes it easy to get database work started. Ideally this should be offloaded as a separate responsibility entirely, having a data team to manage and create stored procedures for more complex and efficient queries.
    - EF also tracks context and leaves a **snapshot** which acts as a cache that reduces the number of reads/writes to the database. Although not as configurable and powerful as standalone cache like Redis, it is enough for a showcase within the scope of this project.
    - Context Pooling also increases the performance by taking advantage of **Singleton pattern**
- SignalR library allows multiple users to see live changes on the list, such as CRUD operations and also notifies users
- Integrated a very simple **JwtToken** flow. In this app, only username is used. Realistically, this should be handled by SSO or username with hashed password. All sensitive information such as DB connection string, username/password should be hashed/encrypted, and offloaded to a secure vault, such as AWS Secrets Manager

## Data Models

- **user** - id::uuid, username::varchar
- **todo_list -** id::uuid, user_id(user->id)::uuid, title::varchar
- **todo_item** - id::uuid, list_id(todo_list->id), content::text, media_url::varchar, media_type::int
- **todo_list_share** id::uuid, list_id(todo_list->id)::uuid, user_id(user->id)::uuid, permission::int