User Management System (Multi-Tier Architecture)

We will build a User Management System with the following core features:
- ✓ User login
- ✓ User dashboard to list all users.
- ✓ User Add/Edit/Delete operations

This solution will be multi-tier architecture

Tier 1: Frontend (Angular)

- ✓ Developed using Angular
- ✓ Key pages:
  - Login Page
  - User Dashboard With user's list and Add, Edit and Delete button
  - Add/Edit page
- ✓ Authenticated via UserId + Password
- ✓ Connects to backend via HTTP services
- ✓ Dockerized for containerized deployment
- ✓ Will be accessible on http://localhost:8080

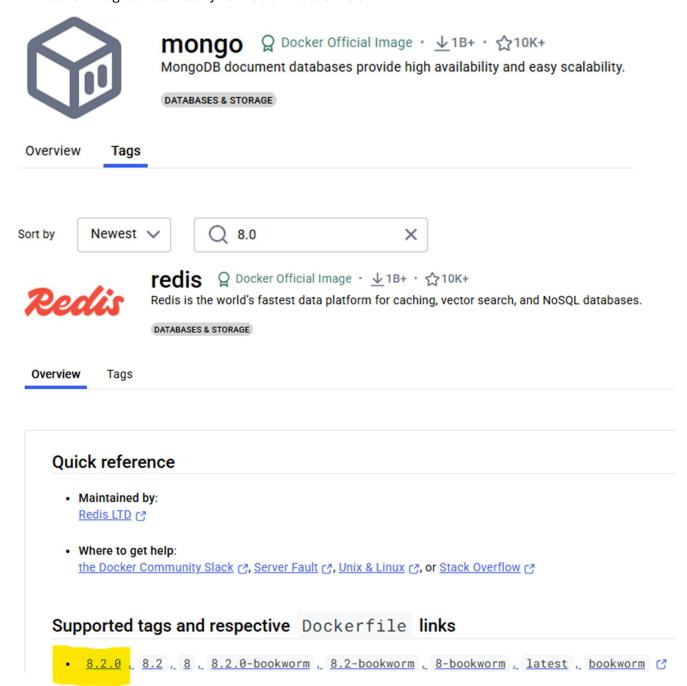### Tier 2: Backend API (Node.js + Express)

- ✓ RESTful API built using Node.js and Express
- ✓ Validate user credentials for login and business logic
- ✓ Routes for:
  - POST /login - user authentication
  - POST /add - create user
  - GET /users - list all users
  - GET /users:{id} – fetch user by id
  - DELETE /delete/:id - delete user by id
- ✓ Dockerized for containerized deployment
- ✓ Will be expose on http://localhost:3000

Tier 3: Database (MongoDB)

- ✓ Stores user information and roles
- ✓ Sample schema:
- ✓ User: { userid, password (hashed), userType, isActive, id }
- ✓ Dockerized MongoDB container for containerized deployment
- ✓ Will be expose on http://localhost:27017
- ✓ Redis Caching implementation, caching expiration time is 60 seconds.
- ✓ If any Add/Delete action taken, then dashboard will load from database and cache will be refresh.

Security Implementation

1. All Docker images are officially verified on Docker hub

mongo ◎ Docker Official Image · ↓1B+ · ☆10K+

MongoDB document databases provide high availability and easy scalability.

DATABASES & STORAGE

Overview   **Tags**

Sort by   [Newest ∨]   [🔍 8.0   ✕]

redis ◎ Docker Official Image · ↓1B+ · ☆10K+

Redis is the world's fastest data platform for caching, vector search, and NoSQL databases.

DATABASES & STORAGE

Overview   Tags

Quick reference

- **Maintained by:**
  Redis LTD ↗

- **Where to get help:**
  the Docker Community Slack ↗, Server Fault ↗, Unix & Linux ↗, or Stack Overflow ↗

Supported tags and respective `Dockerfile` links

- `8.2.0` , `8.2` , `8` , `8.2.0-bookworm` , `8.2-bookworm` , `8-bookworm` , `latest` , `bookworm` ↗

2. I used small sized images specified over docker hub
3. Added a .dockerignore file in both solutions, kindly refer git repositories.

4. I have use specific image version

```
mongodb:
    image: mongo:8.0
    container_name: mongodb
    environment:
        MONGO_INITDB_ROOT_USERNAME: ${MONGO_UID}
        MONGO_INITDB_ROOT_PASSWORD: ${MONGO_PWD}
    ports:
        - "27017:27017"
    volumes:
        - mongo-data:/data/db
    networks:
        - app-network

cache-service:
    image: redis:8.2.0
    container_name: cache-service
    command: redis-server --appendonly yes --save
    ports:
        - "6379:6379"
    volumes:
        - redis-data:/data
    networks:
        - app-network
```

5. Optimized caching layers by Docker file command orders
6. Multistage build has been implemented by correct ordering on command in Docker file

```
# Step 1: Build Angular app
FROM node:20 AS builder

WORKDIR /app
COPY package.json package-lock.json ./
RUN npm install

COPY . .
RUN npx ng build --configuration=production

# Step 2: Serve with Nginx
FROM nginx:alpine

# Remove default nginx static files
RUN rm -rf /usr/share/nginx/html/*

# Copy built app to nginx web directory
COPY --from=builder /app/dist/users-app/browser /usr/share/nginx/html

# Optional: Add custom nginx config (if needed)
COPY nginx.conf /etc/nginx/conf.d/default.conf

EXPOSE 80
CMD ["nginx", "-g", "daemon off;"]
```

Application Features

- ✓ Login/Auth flow using JWT
- ✓ User CRUD from UI with REST API integration

Docker Features

- ✓ Docker Compose setup for full application configuration and run container.
- ✓ Docker common Network for service communication to each other, refer above screen shot.
- ✓ Docker Volume to persist data for database and caching too, refer above screen shot.

CI/CD Pipeline

- ✓ Git branch (advance-dev) is set for development and code push.
- ✓ PR source branch (main) is set as default branch
- ✓ CI/CD Action workflow is configured on push for main
- ✓ I have configured jobs: build-and-deploy which run ubuntu:latest
- ✓ Steps I covered is:
    1. Check out git branch
    2. Login Docker hub
    3. Build UI Application and push image with tag V{$BuildNumber}, Latest
    4. Build Api Service and push image with tag V{$BuildNumber}, Latest
- ✓ For complete details in solutions root check ci-cd.yml.txt file