WhiteBoard

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→ Discover how to build an simple project with Cmake !!

→ I need to use Cmake to run it in a Docker !

[CMake Tutorial EP 1 | Understanding The Basics]

Which Should You Use?

- If your microservices project is intended to be cross-platform or you're focusing on Dockerized environments (Linux-based), **CMake** is the better choice. It has broader applicability for cloud-based and containerized environments.
- If your application is Windows-specific and you need close integration with Windows tools (e.g., you're working in a pure Windows environment), **MSBuild** is still a viable option but limits portability.

Alternative: Conan Package Manager

If you need to manage dependencies, you might also consider using **Conan**, a C++ package manager, alongside **CMake**. Conan integrates smoothly with Docker and simplifies the management of third-party libraries in your project.

→ I will create a sub page for that

Tools and Frameworks for C++ API Development

1. **REST API Frameworks**:
   - **CppRestSDK (Microsoft's Casablanca)**: This library is designed for building RESTful APIs and consuming HTTP requests. It also supports asynchronous operations, which is useful for scalable, non-blocking I/O operations.
   - **Crow**: A C++ framework similar to Python's Flask, built for handling HTTP requests and providing RESTful APIs. It's lightweight and easy to use.
   - **Pistache**: Another lightweight HTTP server and REST framework for C++. It's designed for high-performance APIs and supports asynchronous I/O.
2. **Microservices with Docker**:
   - Docker can containerize your C++ API service to ensure that it runs consistently across different environments. You can create a Dockerfile for your C++ application to handle dependencies, build the project, and run it in isolated containers.
   - This also makes it easy to scale individual services as demand grows.
3. **Service Discovery and Load Balancing**:
   - In a microservices setup, you'll need service discovery tools like **Consul** or **Kubernetes** to manage how services communicate with each other. Kubernetes also offers built-in load balancing and scaling.
4. **Database and Storage**:
   - Depending on the data your APIs will handle, you could use **MySQL**, **PostgreSQL**, or a NoSQL database like **MongoDB**. C++ has libraries like **libpqxx** (for PostgreSQL) and **mysql++** (for MySQL) to interface with these databases.

5. **API Gateway**:
    - You can set up an API Gateway (e.g., **Kong**, **Nginx**, or **HAProxy**) to manage API traffic, security, and routing between microservices. This gateway can handle API versioning, rate limiting, and authentication.

Steps to Build the API Platform in C++

1. **Define Your API Endpoints**:
    - Start by defining a simple API that offers useful functionality, such as:
        - A weather data API.
        - Financial market data API.
        - A logistics API (e.g., for shipping or order tracking).
    - Use **OpenAPI/Swagger** to define and document your API specifications.
2. **Develop Each Microservice**:
    - Break down the platform into independent services. For example, in a weather data API, one microservice could handle data retrieval, while another could handle user authentication.
    - Use a C++ framework like **CppRestSDK** to build these services, which will expose RESTful API endpoints.
3. **Containerize the Services**:
    - Write a Dockerfile for each microservice. This allows you to package the C++ application along with all necessary dependencies, ensuring it runs the same way on any machine.
4. **Set Up Service Discovery and Orchestration**:
    - Use **Kubernetes** or **Docker Compose** to manage how your microservices interact. Kubernetes will allow your services to scale automatically based on load and ensure high availability.
5. **Implement Monitoring and Logging**:
    - Integrate monitoring tools like **Prometheus** and **Grafana** to track API performance. For logging, you could use tools like **ELK Stack** (Elasticsearch, Logstash, Kibana).
6. **Add Security**:
    - Implement authentication (OAuth 2.0 or JWT) to secure your APIs. C++ has libraries like **jwt-cpp** that can help manage JWT tokens.

Advantages of Using C++ for API Development:

- **High Performance**: C++ is known for its speed and efficient memory management, which can be advantageous if your API services require high throughput or low-latency processing.
- **Fine Control**: C++ gives you more control over system resources, which is beneficial for optimizing performance and handling low-level tasks.

Considerations for Scaling:

- Start small by offering a simple API service, then add more services (e.g., additional API endpoints, enhanced features like real-time data) as demand grows.
- Keep the architecture modular, so that you can easily add new microservices without impacting existing ones.
- Consider offering premium features (e.g., faster API response times, more detailed data) as a way to monetize the service in the future.

Starting with C++ gives you the advantage of performance, and by combining it with containerization and orchestration technologies like Docker and Kubernetes, you can scale the project over time.