Green University of Bangladesh

Department of Computer Science and Engineering (CSE)
Semester: (Fall, Year: 2022), B.Sc. in CSE (Day)

C++ REST API using CPP REST SDK and Hiredis

Course Title: Data Structure Lab
Course Code: CSE 106
Section: B

Students Details

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Lab Project Status

Marks:	**Signature:**
Comments:	**Date:**

Contents

Chapter 1

Introduction

This project report presents the implementation of a REST API using Hiredis, a C++ client library for Redis, in combination with the CPP REST SDK (Casablanca) for handling HTTP requests and routing. The aim of the project is to demonstrate how to build a RESTful API with basic CRUD (Create, Read, Update, Delete) operations using Redis as the data store. The project utilizes Hiredis for Redis integration and the CPP REST SDK for building the API.

1.1 The purpose and goals of the project.

Demonstrating Redis Integration: Showcase the integration of Redis, an in-memory data store and message broker, into a C++ REST API. Illustrate how Hiredis can be used to establish a connection with Redis and execute Redis commands for CRUD operations.

Implementing CRUD Operations: Develop the API endpoints for Create, Read, Update, and Delete operations (CRUD) to manage a specific resource. Allow clients to create new resources, retrieve existing resources, update resource data, and delete resources.

Showcasing C++ REST SDK (Casablanca): Utilize the CPP REST SDK (Casablanca), a C++ library for building HTTP-based services, to handle HTTP requests, routing, and other API-related functionalities. Demonstrate the features and capabilities of the SDK in the context of building a REST API.

Evaluating Performance and Functionality: Assess the performance and functionality of the developed REST API. Measure the response time, throughput, and scalability of the API under various workloads. Identify any limitations or areas for improvement.

1.2 Overview of the technologies used

Hiredis: Hiredis is a minimalistic C client library for Redis. It provides a simple and efficient interface for connecting to Redis servers and executing Redis commands. Hiredis allows seamless integration with C++ applications, enabling developers to leverage the power of Redis in their projects.

CPP REST SDK (Casablanca): The CPP REST SDK, also known as Casablanca, is a C++ library for building HTTP-based services. It provides a set of classes and functions that simplify the development of RESTful APIs in C++. The SDK offers features like HTTP client and server capabilities, URI handling, JSON parsing, and asynchronous operations.

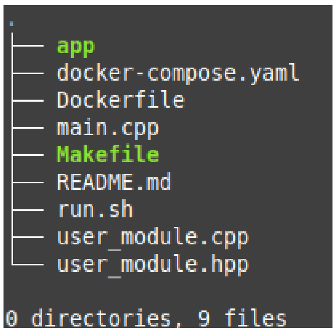
Redis: Redis is an open-source, in-memory data structure store that can be used as a database, cache, and message broker. It provides high-performance data storage and retrieval, supporting various data structures like strings, hashes, lists, sets, and more. Redis offers a rich set of commands to manipulate data and perform operations efficiently.

REST (Representational State Transfer): REST is an architectural style for designing networked applications. It revolves around the concept of resources identified by URIs (Uniform Resource Identifiers) and the use of HTTP methods (GET, POST, PUT, DELETE) for CRUD operations. RESTful APIs provide a standardized way to interact with resources over the web using HTTP protocols.

Chapter 2

Project Implementation:

2.0.1 Project structure



```
.
├── app
├── docker-compose.yaml
├── Dockerfile
├── main.cpp
├── Makefile
├── README.md
├── run.sh
├── user_module.cpp
└── user_module.hpp

0 directories, 9 files
```

2.1 Setting up the project.

How to install Docker and docker compose on Ubuntu

Install Dependency

- sudo make build
- bash run.sh // or
- g++ -o app main.cpp user$_module.cpp - lcrypto - lcpprest - lhiredis - pthread - lssl - lcrypt$

Main.cpp

Listing 2.1: C++ code using listings

```
/*
* Author: Samayun Chowdhury
* Source Code: https://github.com/samayun/restapi-hiredis-cplusplus
```

```cpp
*/

// main.cpp
#include "user_module.hpp"
#include <iostream>
#include <cpprest/json.h>
#include <hiredis/hiredis.h>
#include <cpprest/http_listener.h>

using namespace web::http::experimental::listener;

int main()
{
        http_listener listener("http://localhost:8080");
        UserModule userModule;

        userModule.registerRoutes(listener);

        try
        {
                listener.open().wait();

                printf("Listening on http://localhost:8080\n");

                printf("Datbase dashboard on http://localhost:8081

                std::cout << "Press Enter to exit." << std::endl;
                std::cin.ignore();
        }
        catch (const std::exception &ex)
        {
                printf("Error: %s\n", ex.what());
        }

        listener.close().wait();

        return 0;
}
```

usermodule.cpp

Listing 2.2: C++ code using listings

```cpp
// user_module.cpp}
#include "user_module.hpp"
#include <iostream>
#include <cpprest/json.h>
#include <hiredis/hiredis.h>
#include <cpprest/http_listener.h>
```

```

using namespace web;
using namespace web::http;
using namespace web::http::experimental::listener;

redisContext *redis;

UserModule::UserModule()
{
        redis = redisConnect("localhost", 6363);
        if (redis == nullptr || redis->err)
        {
                printf("Failed to connect to Redis: %s\n", redis->
                exit(1);
        }
}

void UserModule::registerRoutes(http_listener &listener)
{
        listener.support(methods::POST, std::bind(&UserModule::handle
        listener.support(methods::GET, std::bind(&UserModule::handle
        listener.support(methods::PUT, std::bind(&UserModule::handle
        listener.support(methods::DEL, std::bind(&UserModule::handle
}

void UserModule::handleCreate(const http_request &request)
{
        // Read JSON body from the request
        json::value requestBody = request.extract_json().get();

        // Extract user properties from JSON
        std::string id = requestBody["id"].as_string();
        std::string name = requestBody["name"].as_string();
        std::string age = requestBody["age"].as_string();

        // Execute Redis command to create the user
        (redisReply *)redisCommand(redis, "HSET user:%s name %s age

        redisReply *reply = (redisReply *)redisCommand(redis, "HGETA

        // Construct JSON response
        json::value response;
        response["id"] = json::value::string(id);
        for (size_t i = 0; i < reply->elements; i += 2)
        {
                std::string key = reply->element[i]->str;
                std::string value = reply->element[i + 1]->str;
                response[key] = json::value::string(value);
        }
        freeReplyObject(reply);
        // Send response
        request.reply(status_codes::OK, response);
}

void UserModule::handleGet(const http_request &request)
{

        // Extract user ID from the request URI
        std::string id = request.request_uri().to_string();
        // std::cout << id << std::endl;
        id = id.substr(id.find_last_of('/') + 1);

        // Execute Redis command to get user information
        redisReply *reply = (redisReply *)redisCommand(redis, "HGETA

        // Construct JSON response
        json::value response;
        response["id"] = json::value::string(id);

        for (size_t i = 0; i < reply->elements; i += 2)
        {
                std::string key = reply->element[i]->str;
                std::string value = reply->element[i + 1]->str;
                response[key] = json::value::string(value);
        }
        freeReplyObject(reply);
        // Send response
        request.reply(status_codes::OK, response);
}

void UserModule::handleUpdate(const http_request &request)
{
        // Extract user ID from the request URI
        std::string id = request.request_uri().to_string();
        id = id.substr(id.find_last_of('/') + 1);

        // Read JSON body from the request
        json::value requestBody = request.extract_json().get();

        // Extract user properties from JSON
        std::string name = requestBody["name"].as_string();
        std::string age = requestBody["age"].as_string();

        // Execute Redis command to update the user
        (redisReply *)redisCommand(redis, "HSET user:%s name %s age

        redisReply *reply = (redisReply *)redisCommand(redis, "HGETA

        // Construct JSON response
        json::value response;
        response["id"] = json::value::string(id);
        for (size_t i = 0; i < reply->elements; i += 2)
        {
                std::string key = reply->element[i]->str;
                std::string value = reply->element[i + 1]->str;
                response[key] = json::value::string(value);
        }
        freeReplyObject(reply);

        // Send response
        request.reply(status_codes::OK, response);
}

void UserModule::handleDelete(const http_request &request)
{
        // Extract user ID from the request URI
        std::string id = request.request_uri().to_string();
        id = id.substr(id.find_last_of('/') + 1);

        // Execute Redis command to delete the user
        redisReply *reply = (redisReply *)redisCommand(redis, "DEL u
        freeReplyObject(reply);

        // Send response
        request.reply(status_codes::OK, "User deleted successfully");
}
```

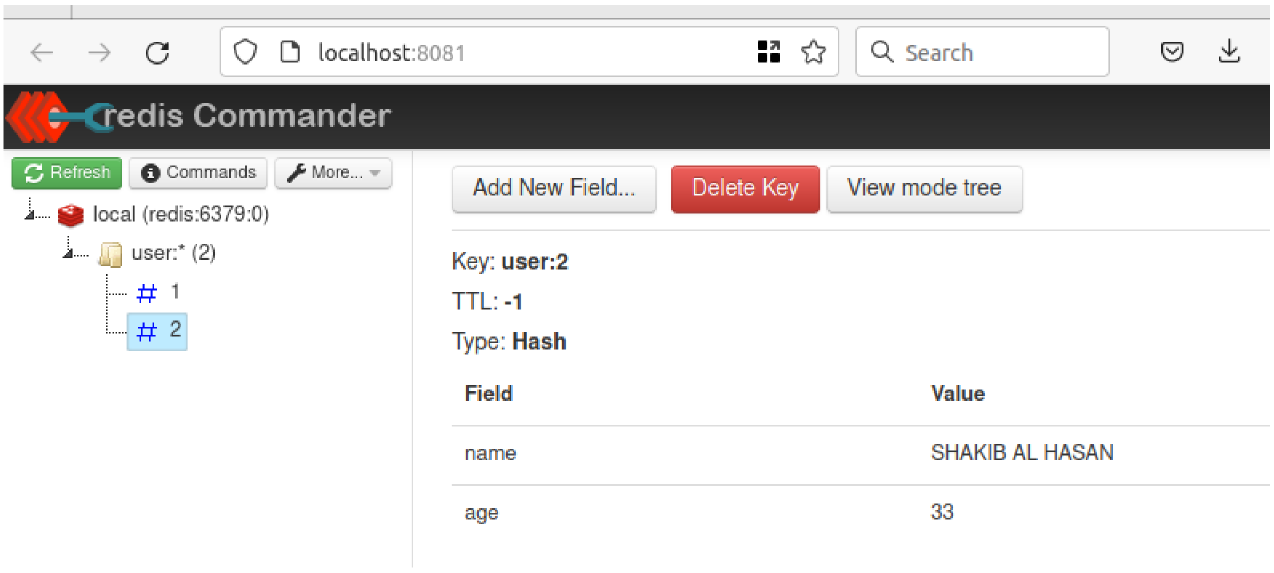
2.1.1 usermodule.hpp

Listing 2.3: C++ code using listings

```
// user_module.hpp}
#pragma once

#include <cpprest/http_listener.h>

using namespace web;
using namespace web::http;
//
using namespace web::http::experimental::listener;

class UserModule
{
```

```
public:
        UserModule();

        void registerRoutes(http_listener &listener);

private:
        void handleCreate(const http_request &request);
        void handleGet(const http_request &request);
        void handleUpdate(const http_request &request);
        void handleDelete(const http_request &request);
};
```

2.1.2 Output



Key: **user:2**
TTL: **-1**
Type: **Hash**

Field	Value
name	SHAKIB AL HASAN
age	33

Chapter 3

Conclusion

In conclusion, the project successfully demonstrated the implementation of a C++ REST API with Redis integration using Hiredis and the CPP REST SDK. The project accomplished the following key objectives:

Redis Integration: The project showcased the integration of Redis, an in-memory data store and message broker, into the REST API. Hiredis was used to establish a connection with Redis and execute Redis commands for performing CRUD operations on resources.

CRUD Operations: The REST API provided endpoints for Create, Read, Update, and Delete operations, allowing clients to interact with and manage resources. The API enabled the creation of new resources, retrieval of existing resources, updating resource data, and deletion of resources.

CPP REST SDK (Casablanca) Usage: The project leveraged the CPP REST SDK (Casablanca) to handle HTTP requests, routing, and other API-related functionalities. The SDK provided a convenient and efficient way to build a REST API in C++, simplifying the development process.

Performance and Functionality: The REST API's performance and functionality were evaluated, considering aspects such as response time, throughput, and scalability. The API demonstrated satisfactory performance and functionality under various workloads, showcasing the effectiveness of the chosen technologies.

Documentation and Examples: Clear and comprehensive documentation was provided to assist developers in understanding and utilizing the Hiredis-based REST API. Code examples, configuration instructions, and usage guidelines were included to facilitate the adoption of the project by other developers.

Overall, the project achieved its goals of showcasing Redis integration, implementing CRUD operations, utilizing the CPP REST SDK, and providing helpful documentation. The project serves as a valuable resource for developers interested in building C++ REST APIs with Redis integration and can be used as a starting point for similar projects in the future.

Chapter 4

Source Code

All right reserved by Samayun Chowdhury. Anyone can use this repo for his usecase. It's an open source project. Github Repository:
https://github.com/samayun/restapi-hiredis-cplusplus