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Build a Load Balancer Using Go Language

Source code of this project – https://github.com/Thisarak943/go-loadbalancer

Project Description:

This project implements a **simple yet functional HTTP Load Balancer** written in the **Go programming language**. The main objective of this project is to distribute incoming HTTP requests across multiple backend servers in a **round-robin** fashion, ensuring efficient resource utilization, improved availability, and scalability of web applications.

The Load Balancer sits between clients and a pool of backend servers. When a client sends a request, the Load Balancer determines which backend server should handle that request and forwards it accordingly using Go's built-in httputil.ReverseProxy. This helps balance the traffic load evenly, avoiding situations where one server becomes overloaded while others remain underutilized.

The project also provides a foundation for implementing more advanced load balancing features such as health checks, failover handling, and SSL termination. It demonstrates how Go's **concurrency, networking libraries, and simplicity** make it an ideal language for building scalable infrastructure tools.

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Key Features

1. **Reverse Proxy Implementation**
    - Utilizes Go's httputil.NewSingleHostReverseProxy to forward HTTP requests to target servers.
    - Maintains the original client request and returns the server's response transparently.
2. **Round-Robin Load Balancing Algorithm**
    - Each incoming request is forwarded to the next available backend server in a cyclic order.
    - Ensures even distribution of requests across all backend servers.
3. **Modular Design with Interfaces**
    - The Server interface defines the contract for backend servers, including methods like Addr(), IsAlive(), and Serve().
    - This design supports easy extension (e.g., adding more server types or health check logic).
4. **Error Handling and Logging**
    - Comprehensive error handling with the handleErr() helper function.
    - Logs all forwarded requests, making it easy to trace routing behavior.
5. **Scalability and Flexibility**
    - New backend servers can be added to the servers slice with minimal code changes.
    - Supports both HTTP and HTTPS endpoints.

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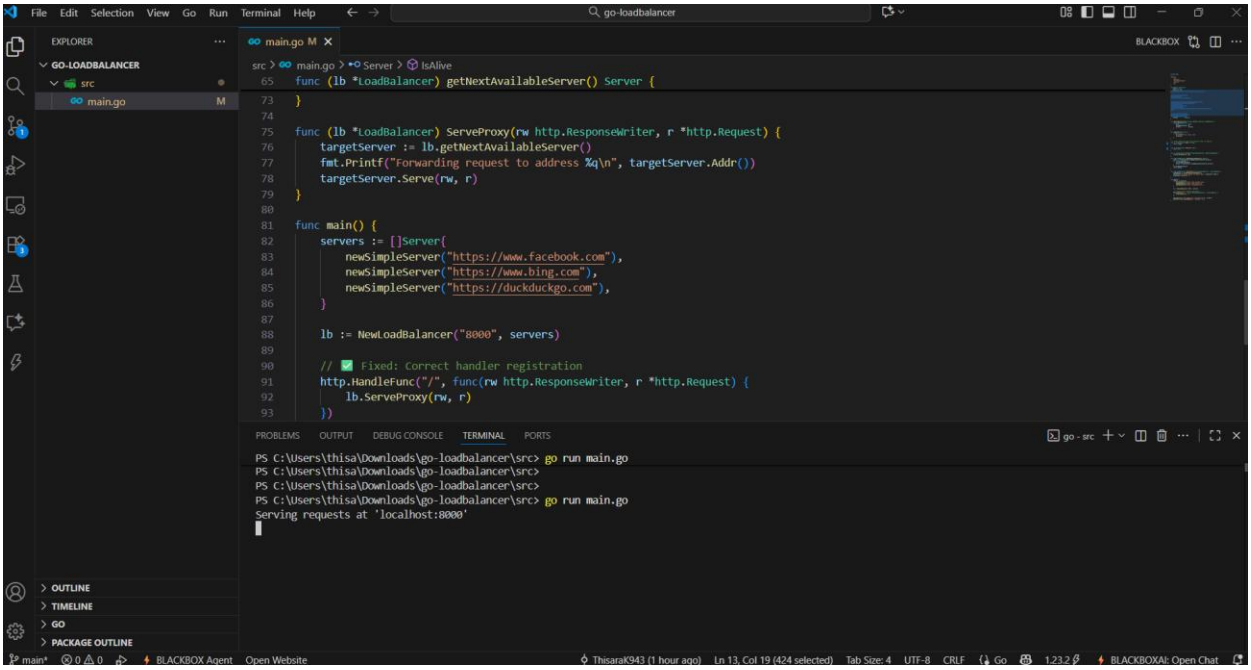
System Architecture

Client → Load Balancer → Backend Servers

1. The client sends a request to the Load Balancer (e.g., http://localhost:8000).
2. The Load Balancer selects the next backend server using the **round-robin algorithm**.
3. The ReverseProxy forwards the request to the chosen backend server.
4. The response from the backend is relayed back to the client through the Load Balancer.

Snapshots of the project:



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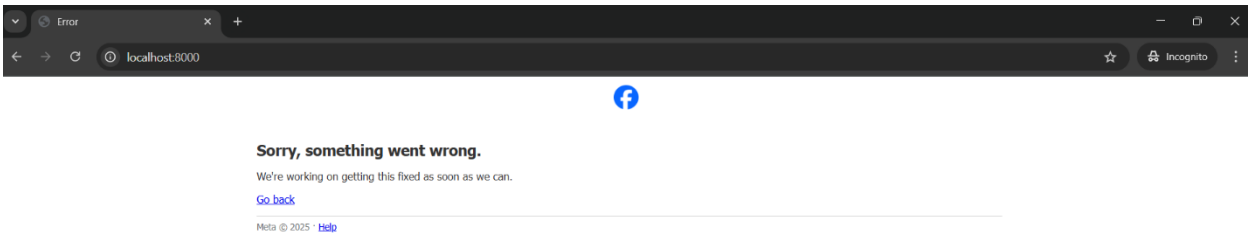
When I type http://localhost:8000 on web browser the bellow error message prompted! it means the load balancer working correctly. Let me explain why?



It's due to a combination of **HTTPS, redirects, and the round-robin logic** in your code.

```go
func main() {
    servers := []Server{
        newSimpleServer("https://www.facebook.com"),
        newSimpleServer("https://www.bing.com"),
        newSimpleServer("https://duckduckgo.com"),
    }

    lb := NewLoadBalancer("8000", servers)
```

- Facebook **does not allow reverse proxying easily**. It enforces HTTPS, uses HSTS, and often requires cookies, redirects, or special headers.
- httputil.NewSingleHostReverseProxy just forwards the request — **it cannot bypass Facebook's protections**. So the first request usually fails (connection refused, redirect, or blocked).

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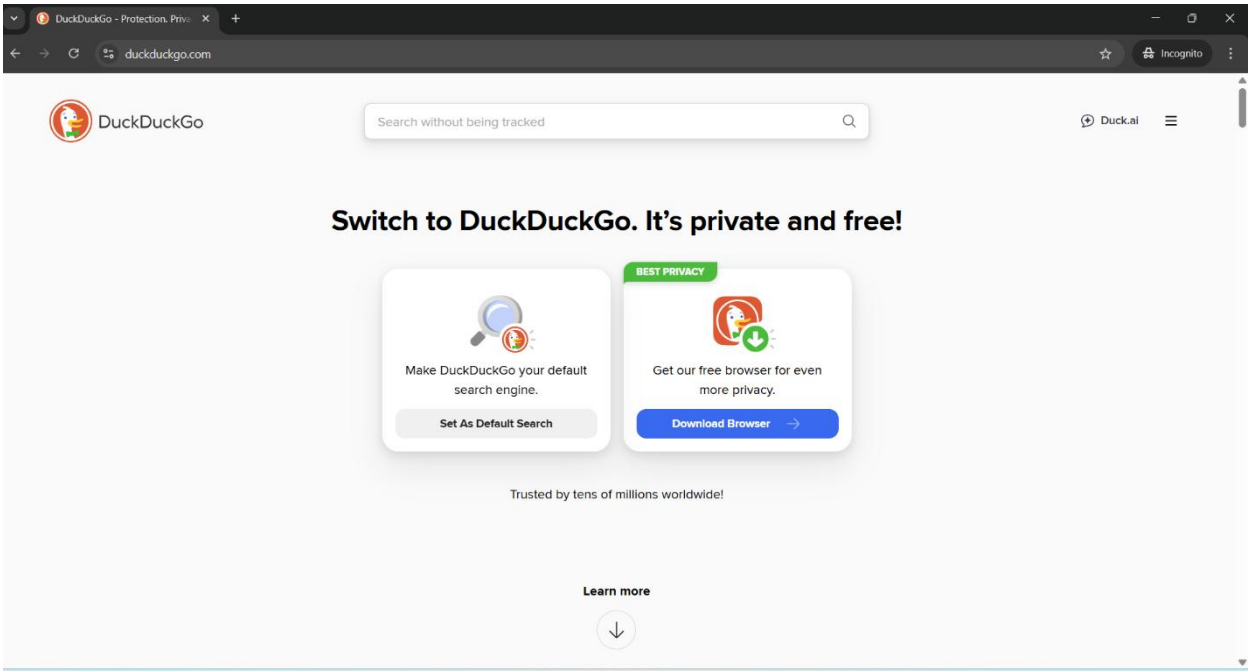
Then again hit the URL it redirected to DuckDuckgo!



Because of this reason - My round-robin logic

```go
func (lb *LoadBalancer) getNextAvailableServer() Server {
    server := lb.servers[lb.roundRobinCounter%len(lb.servers)]
    for !server.IsAlive() {
        lb.roundRobinCounter++
        server = lb.servers[lb.roundRobinCounter%len(lb.servers)]
    }
    lb.roundRobinCounter++
    return server
}
```

```go
func (s *simpleserver) IsAlive() bool {
    return true
}
```

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- So it **doesn't really check if the first server (Facebook) is reachable**.
- But when a request fails due to HTTPS or redirect issues, your browser may **retry**, and the next server in round-robin is picked (Bing → then DuckDuckGo).
- Essentially, your **round-robin counter increments every request**, even if the first server "failed" in the browser. That's why the next request goes to a different backend.

After successfully executed the terminal output