

Comparative Study of Communication Technologies Between Microservices

- **Decision criteria for communication technology selection**
- **Performance comparison between HTTP, gRPC and WebSockets**
- **The strengths and weaknesses of the selected communication protocols**

Test Setup and Evaluation

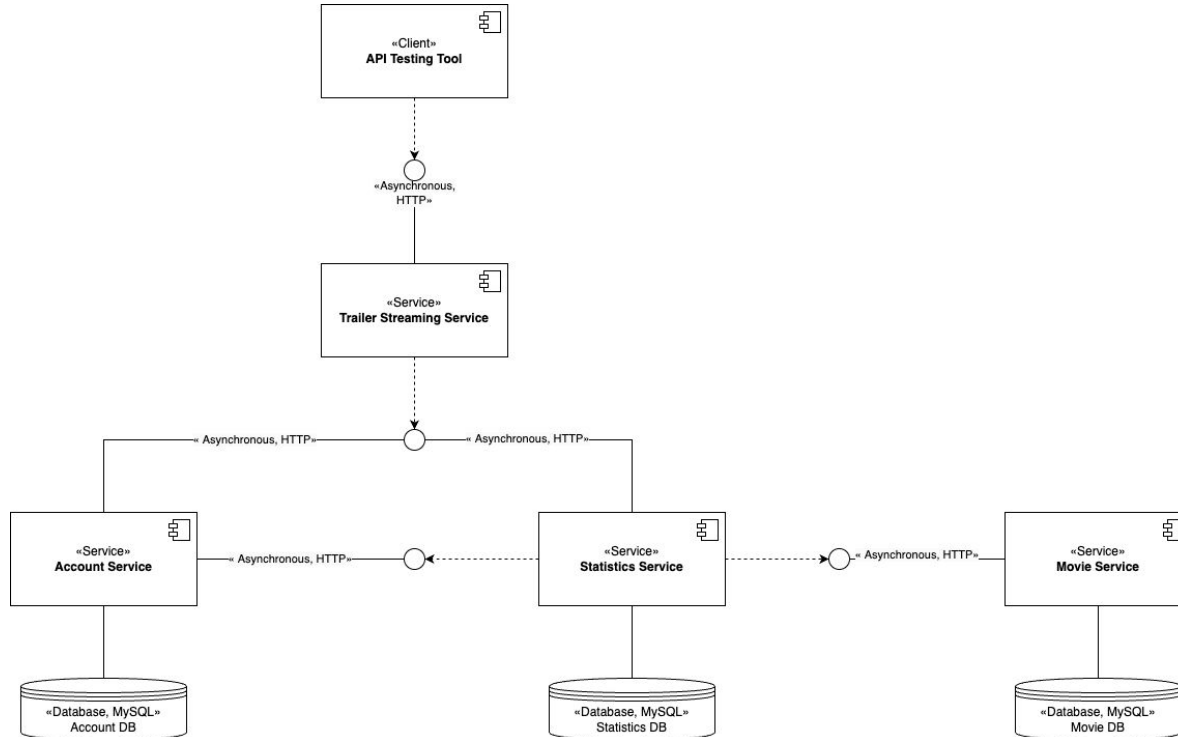
Test Setup

- **Microservices Architecture for Video Streaming**
 - **Trailer Streaming Service:** Streams movie trailers upon authorized request
 - **Movie Service:** Handles movie data management
 - **Account Service:** Manages user account registration and authentication
 - **Statistics Service:** Collects data on movies and users

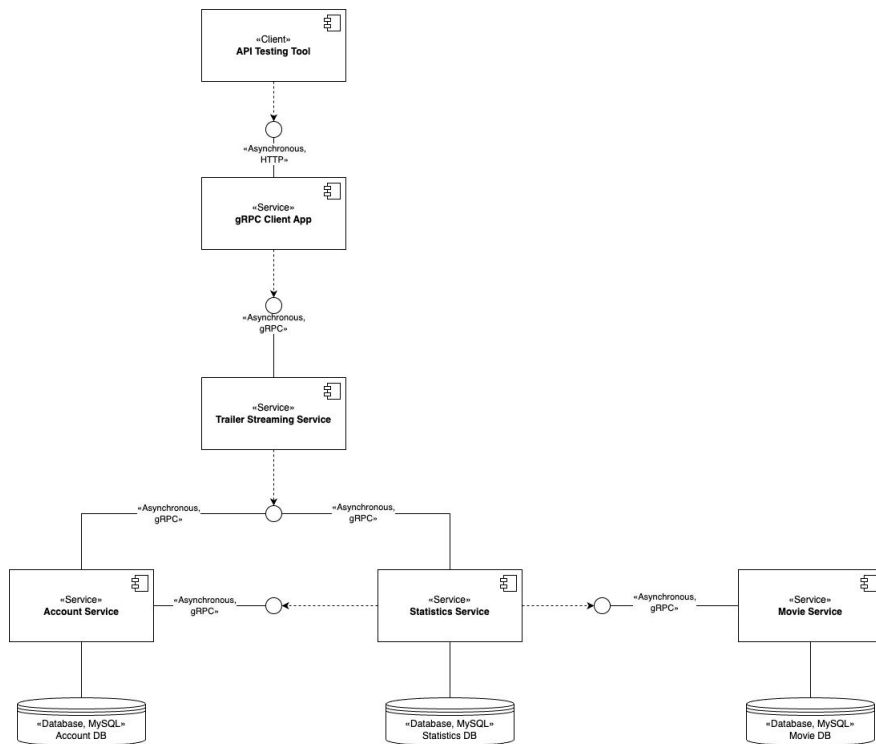
Evaluation

- Developed three versions of the application using HTTP, gRPC, and WebSockets.
- The inter-service communication is the same across all versions.
- All versions were deployed on GCP using GKE.
- Developed an application that issues the same set of 100 concurrent requests to each version.
- Collected response time and data transfer metrics for analysis.

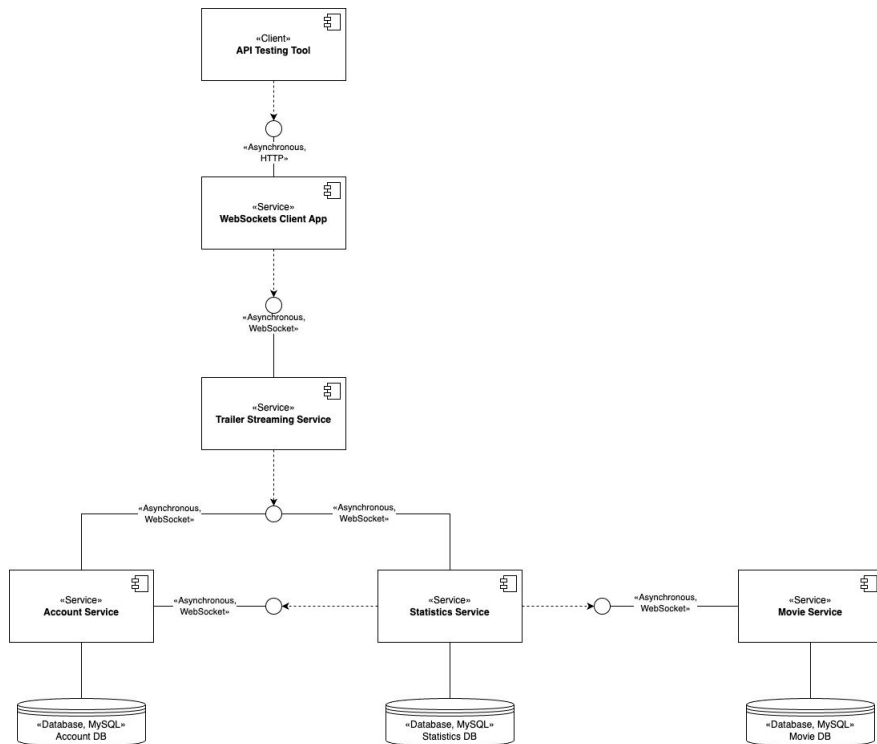
HTTP Implementation



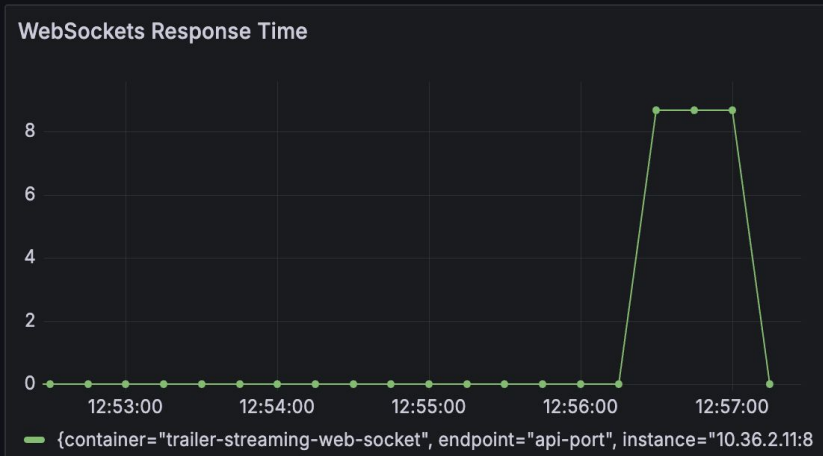
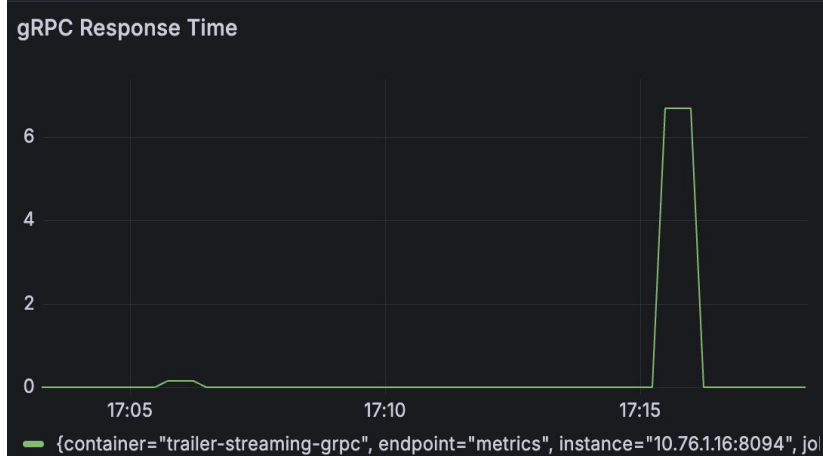
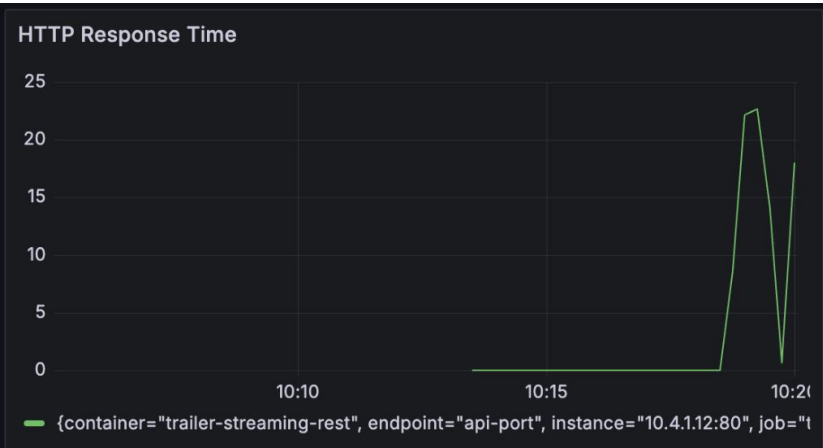
gRPC Implementation



WebSocket Implementation



Results



Performance and Characteristics

HTTP

- Performed less efficiently due to higher latency and larger payloads
- Ease of use over performance
- Suitable for traditional web services

gRPC

- Outperformed WebSockets and HTTP due to lightweight payloads and efficient serialization
- Best suited for applications requiring large data loads and high performance, real-time or streaming applications, inter-service communication
- Has steeper learning curve
- Has limited support by browsers

WebSockets

- Not well suited for inter-service communication
- Best suited for real-time applications due to persistent connections, bidirectional communication, low latency overheads
- Has complex maintenance and scalability

The Costs

Protocol	Seconds	Configuration	Testing Cost	Requests Per Day
HTTP	24	E2 cluster, 2vCPUs, 8GB RAM, 3 nodes	\$0,005	360,000
gRPC	7	E2 cluster, 2vCPUs, 6GB RAM, 3 nodes	\$0,003	1,230,000
WebSockets	9	E2 cluster, 2vCPUs, 8GB RAM, 3 nodes	\$0,003	960,000

Conclusion

- **Choose communication technology based on the specific responsibility and requirements of each microservice.**
- **Consider project needs: ease of development vs. high performance.**

Potential Choices

- **Trailer Streaming Service:** WebSockets for real-time streaming
- **Account Service:** HTTP for simplicity
- **Statistics Service & Movie Service:** GraphQL for efficient data retrieval

Future Work

- **Experiment with potentially more suitable technologies**
- **Introduce an API Gateway**
- **Adopt event-driven architecture**
- **Experiment with a hybrid cloud deployment**
- **Compare the new setup with the current best-version**