

CHIONOPHILE DEMO

SUSTAINABILITY I+D PROJECT FOR CAPGEMINI

May 2022



AGENDA

1

Introduction

Explain the project goals and the sample application.

2

Main developments

Show the different software/docs artifacts developed during this project.

3

Main results

Benchmark results and practical applications.





1

INTRODUCTION



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PROJECT GOALS

- Develop a measurement tool for energy consumption.
- Develop a standard Rust based project template.
- Implement a PoC utilizing a "push to the edges" architecture.
- Compare the energy consumption of:
 - Different programming languages.
 - Monolithic architecture with Edge computing architecture.
 - Local machine with Cloud Hyperscalers.
- Provide practices for improving energy consumption across Capgemini.

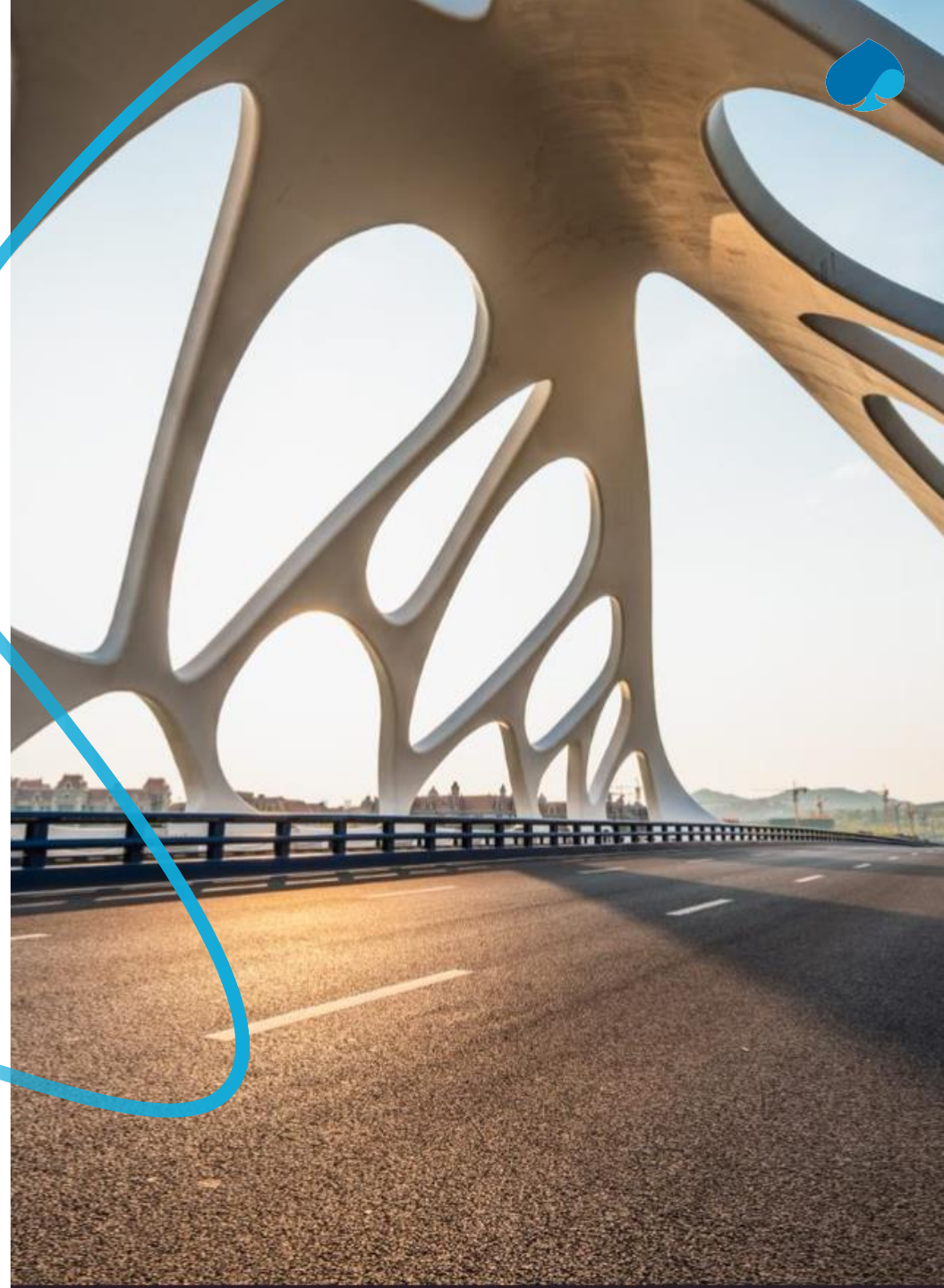


SAMPLE APPLICATION

We developed a sample application based on the “Jump The Queue” (JTQ) onboarding Capgemini project and improve it to allow for high concurrency.

We implemented the JTQ on:

- Rust (Actix 4)
- NodeJS (NestJS)
- Java (SpringBoot)
- Python (Django Rest Framework)
- C# (ASP .NET)
- Web Assembly compiled from Rust Atmo





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MAIN DEVELOPMENTS



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IMPROVED JTQ

- The app is a REST API with actions that save and retrieve objects from a PostgreSQL database.
- It has approximately 12 endpoints and it is implemented in 5 different languages.
- Improved from the original source to allow for high concurrency required by the different benchmarks.
- Github repository: <https://github.com/devonfw-forge/Chionophile>





RUST TEMPLATE

- It is recommended for projects that need high performance and/or low energy consumption.
- ACTIX 4 as the web framework.
- Based on Capgemini's Spring Boot DevonFW template.
- Uses Diesel and PostgreSQL out of the box.





EDGE COMPUTING FOR JTQ

- The application is divided in two types of servers, the edge servers and the central server.
- Edge servers work as data caches close to the client.
- This architecture highly improves read operations.
- There is no improvement in write operations, as they are redirected to the central server.





BENCHMARK

- **Benchmark B1:** 14 requests/second for 5 minutes
- **Benchmark B2:** Do as many requests as possible for 5 minutes





GENERIC BENCHMARK

Benchmark configurable through a simple config.yaml file:

- HTTP or HTTPS
- GET, POST, PUT, DELETE
- URL
- Payload and content-type
- Multiple requests flow for concurrent users.
- Success criteria based on timeout, average time per request and fail ratio





GITHUB ACTIONS (CI / CD)

This is a proof of concept made to execute the generic benchmark from a GitHub action (CI/CD), for example:

- Executing time measurements, maximum fail ratio for HTTP requests or algorithmic complexity tools and fail the action when they are worsen by a commit in the repository.
- Approximate energy consumption in AWS instances.
- Eventually, execute AI or ML tools to determine if the submitted code should be accepted for merging.





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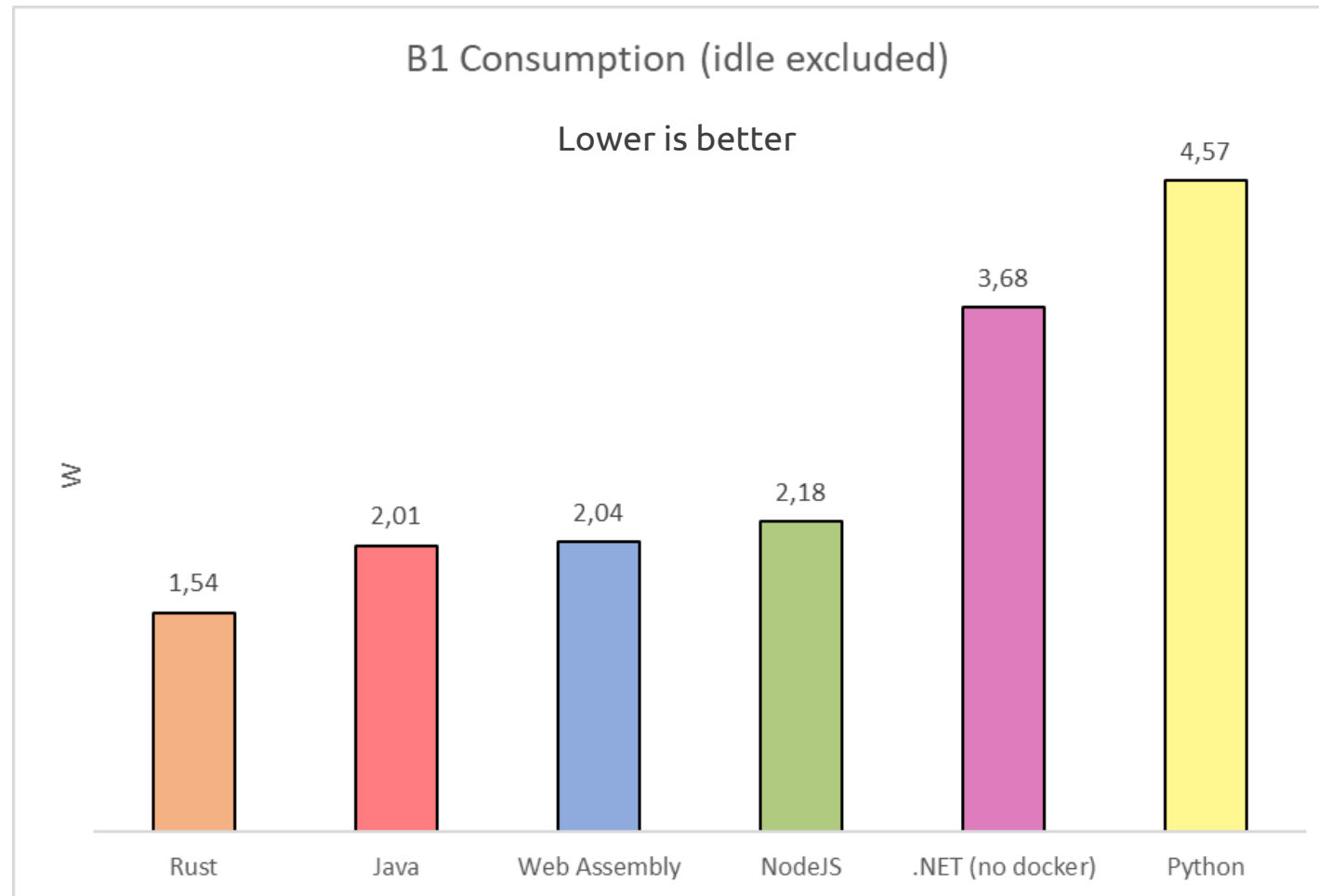
MAIN RESULTS



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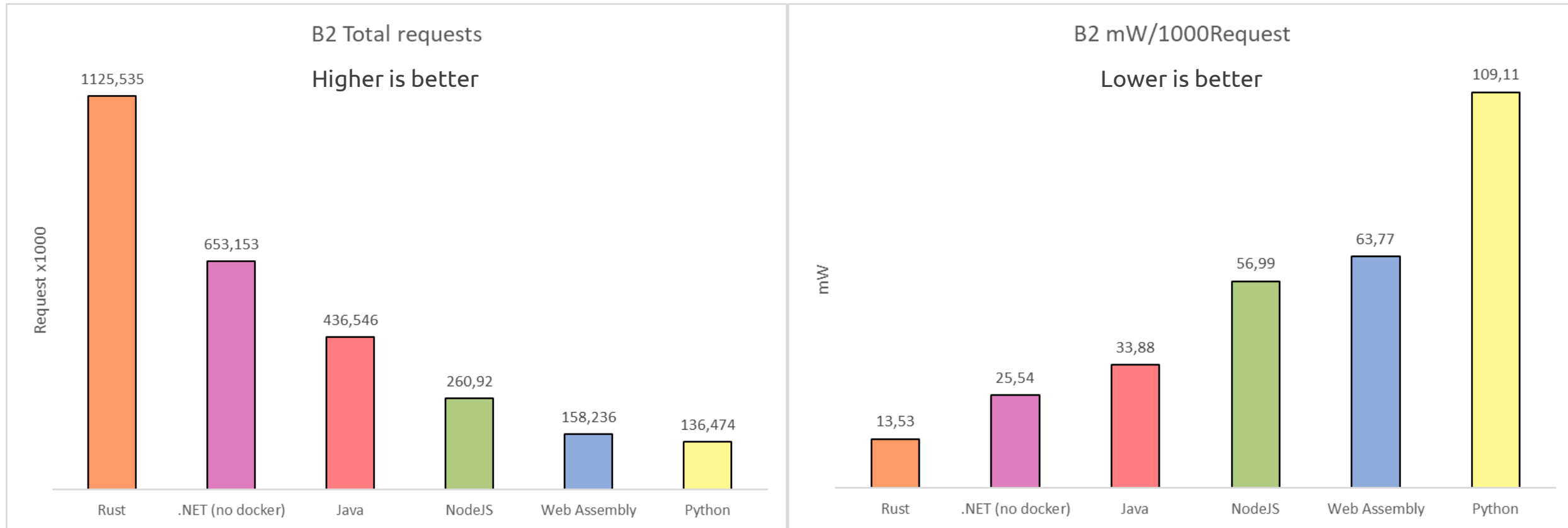


BENCHMARKS RESULTS FOR ON-PREMISES SERVER (1/2)



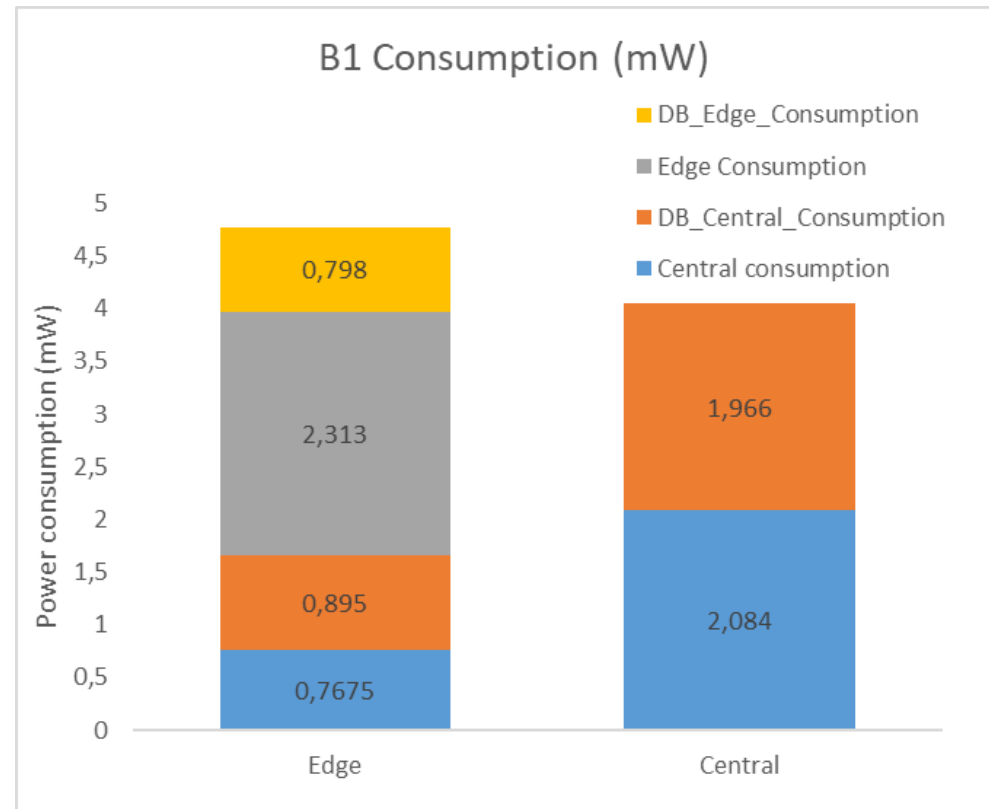


BENCHMARKS RESULTS FOR ON-PREMISES SERVER (2/2)





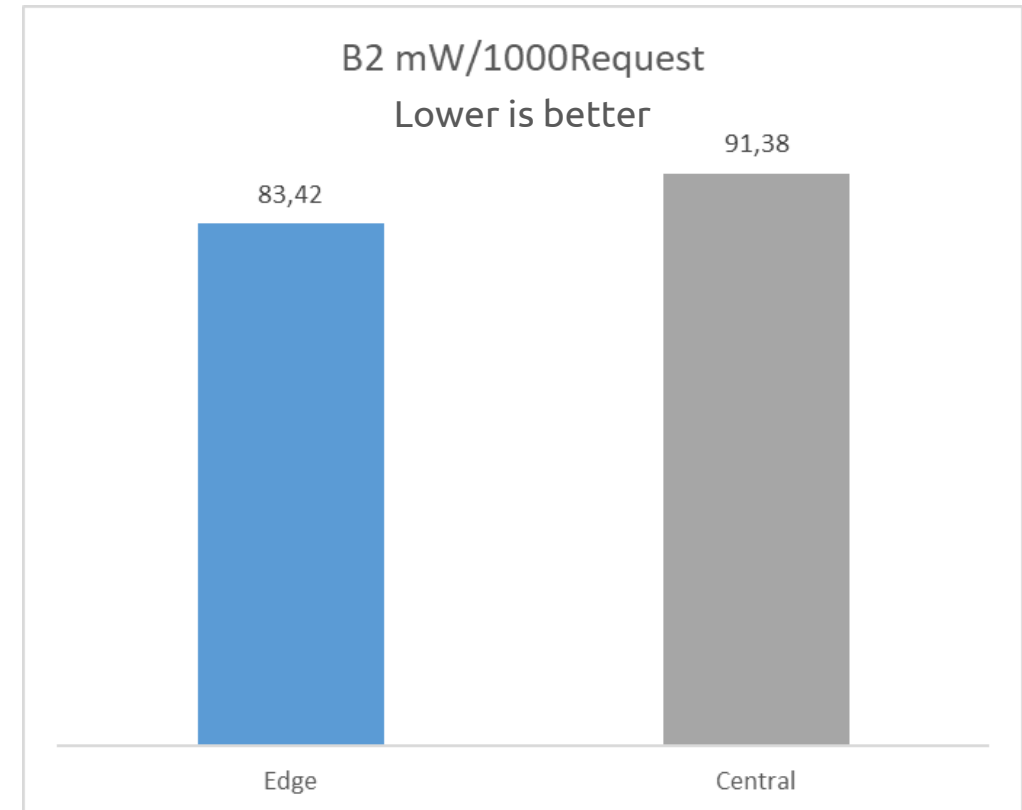
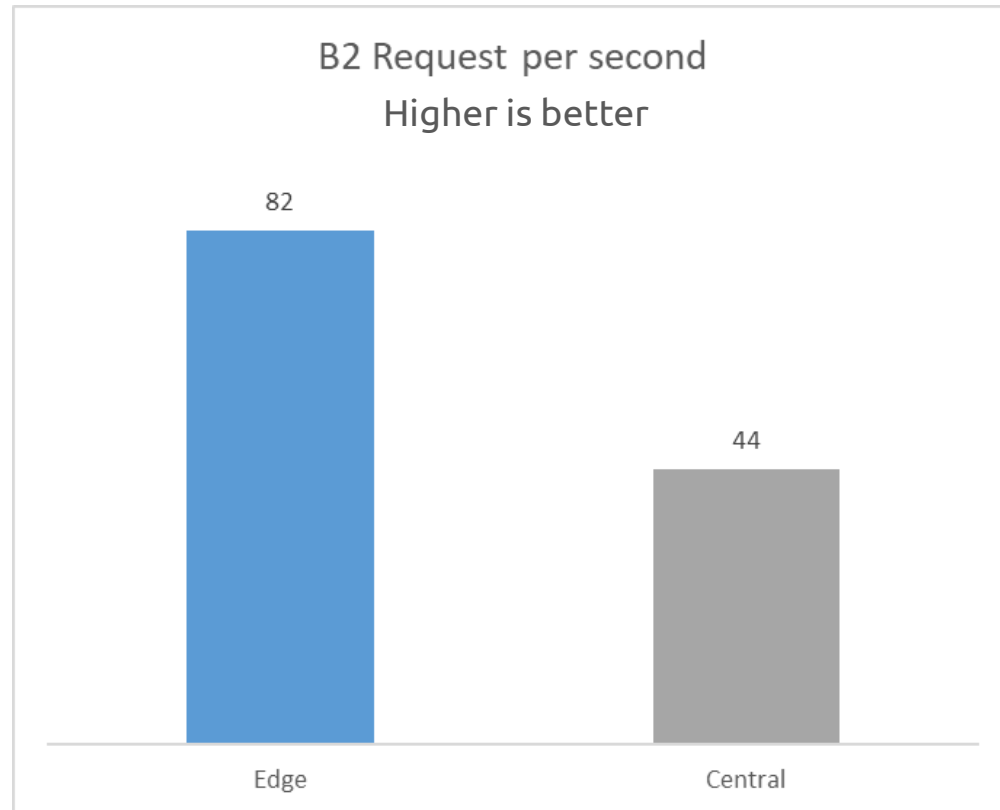
BENCHMARKS RESULTS ON EDGE ARCHITECTURE (1/2)



Lower is better

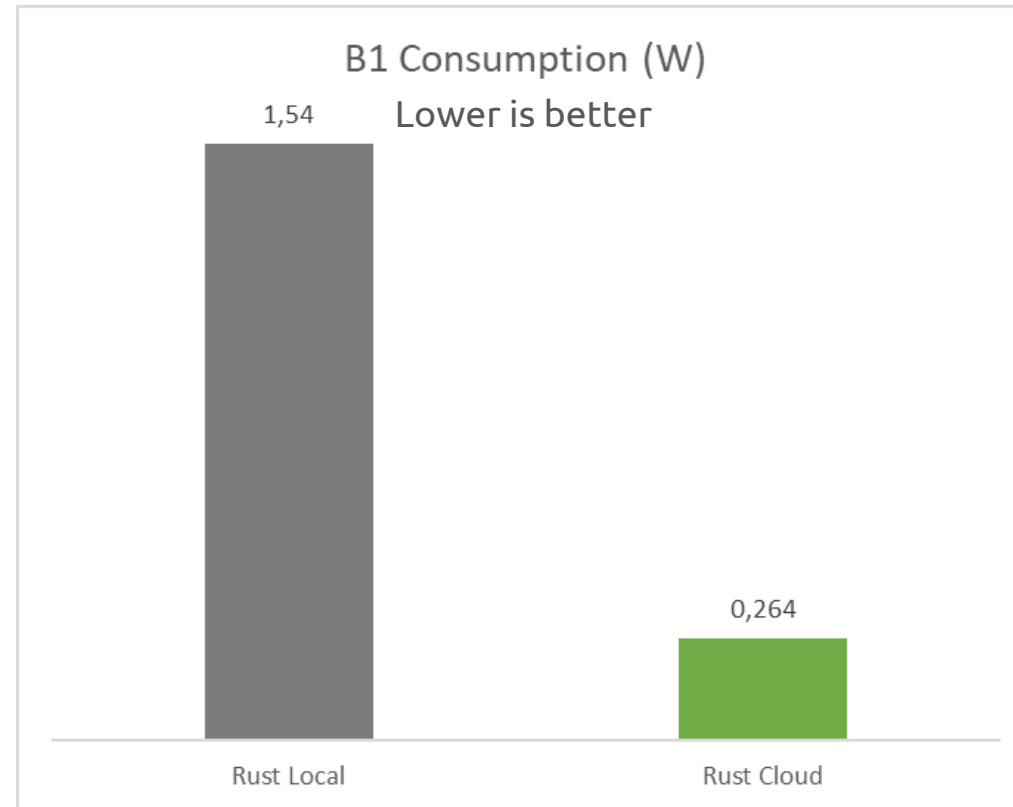


BENCHMARKS RESULTS ON EDGE ARCHITECTURE (2/2)



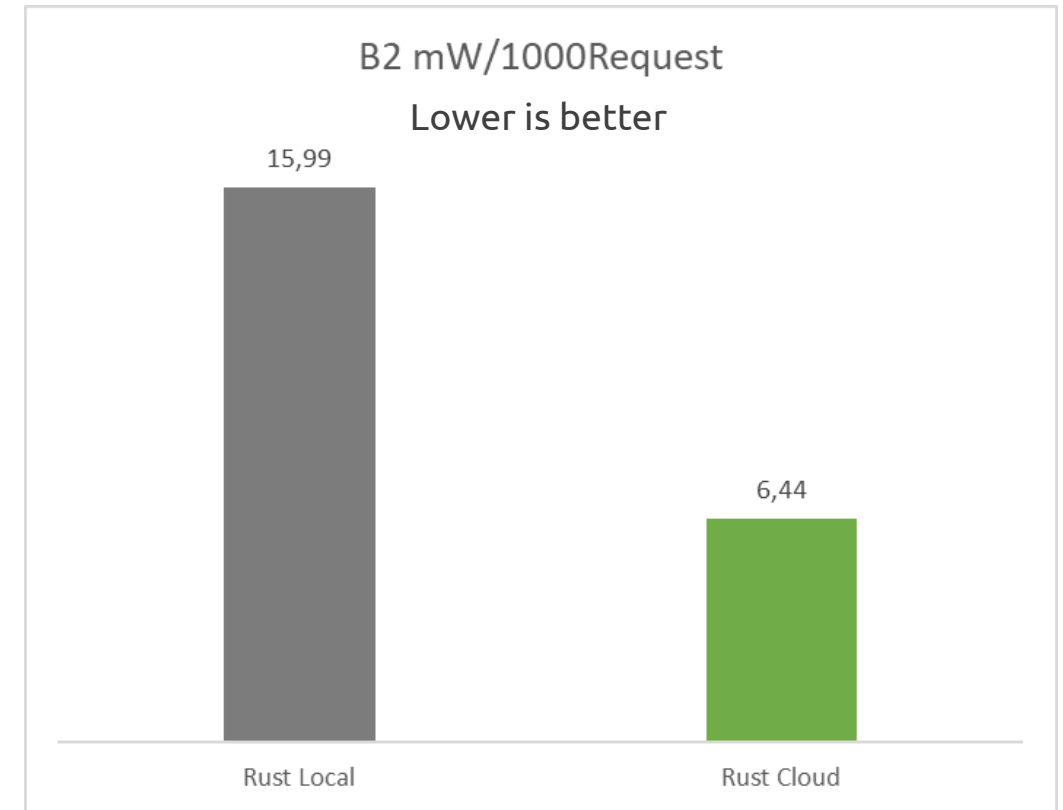
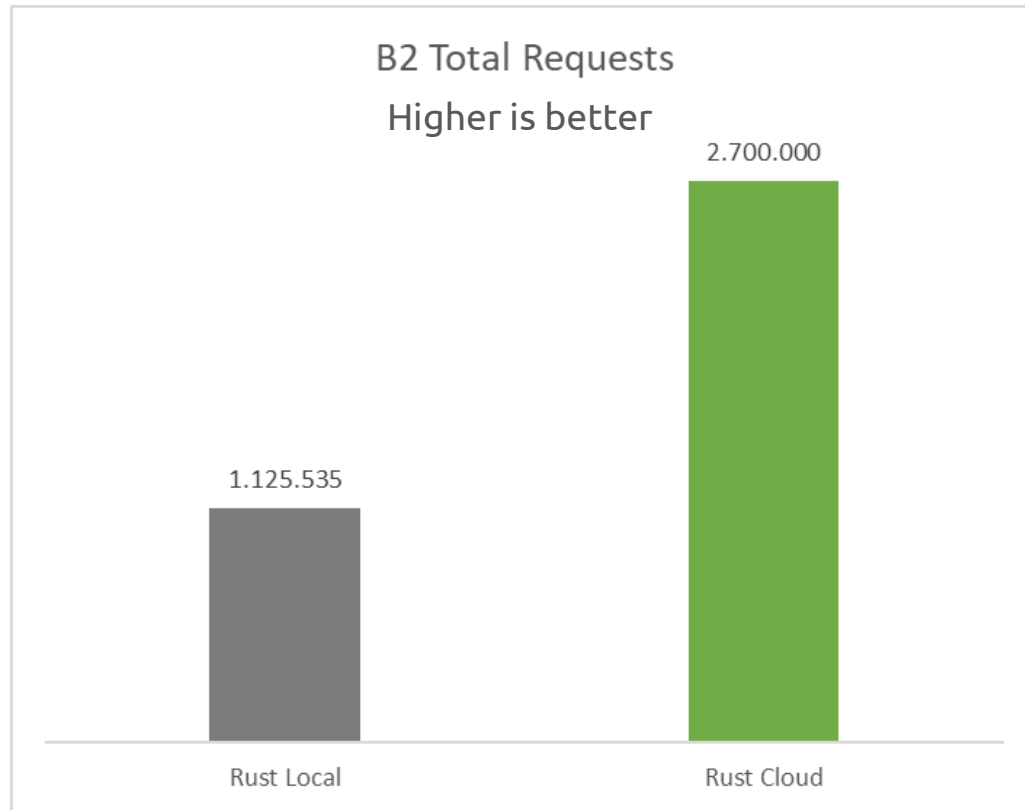


BENCHMARKS RESULTS: LOCAL VS CLOUD (1/2)





BENCHMARKS RESULTS: LOCAL VS CLOUD (2/2)





Rust is at least

47%

more efficient than any other tested language



Rust in the cloud consumes

82%

less energy for the same task than in local



CONCLUSIONS

- There are many ways to achieve sustainability.
- Rust is the most efficient tested language by a considerable margin.
- Web Assembly is still not an option to improve energy efficiency on the Back End.
- Moving to the Cloud saves a lot of energy but it cannot be measured precisely.
- An Edge architecture is at least 9% more efficient and could improve more at scale.
- Energy consumption can be monitored through CI/CD.
- Real projects at Capgemini can benefit from these approaches.

QUESTIONS?

THANKS FOR YOUR TIME



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