BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

SECOND SEMESTER 2021-2022

SESAP ZG629T PROJECT WORK

Project Work Outline

BITS ID No. 2020HS70018 **Name of Student:** Shraddha Gulati

E-mail ID of the student: 2020HS70018@wilp.bits-pilani.ac.in

Name of Supervisor: Dharmesh Rana

Designation of Supervisor: Software Architect

Qualification and Experience: BE, Computer Science and 17.2 SAP years

E- mail ID of Supervisor: dharmesh.rana@sap.com

Title of Project Work: High-Performance Data Exchange in Microservices

Name of Examiner: Sujith Pratap

Designation of Internal Examiner: Lead Customer Officer @ Customer Office (SAP API Management)

Qualification and Experience: MS, Computer Science and 16.7 SAP years

E- mail ID of Internal Examiner: s.prathap@sap.com

Supervisor's rating of the Technical Quality of this Project Work Outline

EXCELLENT / GOOD / FAIR/ POOR (Please specify):   _____

Supervisor's suggestions and remarks about the outline:

(Signature of Student)   (Signature of Supervisor)

Date: 08.02.2024   Date: 08.02.2024

1. Broad Area of Work

Minimize the latency in high-performance data interchange system in microservice architecture.

2. Background

Initially, the standard architecture of a service was a HTTP/1.1 REST communication of a monolithic architecture, we understand that there is one service, and that service needs to communicate to a data source (OLAP, REDIS, Database). All the calls made, goes to the monolithic service, and gets executed.

Later, looking at the latency, monolithic architecture was overpowered by the microservice architecture where we divided the service based on the modules, features and various other parameters. In a true microservice architecture, we see that each microservice communicates to individual data source.

Later, we observed that there are redundancy issues of the code present at various microservices executing the similar logic. To avoid these redundancy issues, we introduced a common service where the common code/features can be bundled, and redundancy can be minimized among other microservices.

But, when the common service was introduced, we understand that the different microservices can have different way of communicating to various databases. For example, Service A connects with SQL database while Service B connects with OLAP system. Now, for a common service C, it is difficult to connect with the various database and maintain the database call protocols. This architecture might be applicable where there are less microservices. If we have a higher number of microservices, it becomes difficult to maintain different data source adapters.

To reduce the above complexity, we can do microservice to microservice call via REST, so that the original logic will lie in its microservice and reuse the same logic by doing a REST call. But, in high performance system; the microservices do not scale properly and this call can take a lot of time.

Hence, we need to revisit the current architecture and look at the parameters that can be improved in reducing the latency of the data transmission among microservices.

3. Objectives

The objectives of my research are as follows:

- Minimize the latency in high-performance data interchange system in microservice architecture.
    - o Analyze how much is the latency when we call a service in microservice architecture due to data transmission technologies (JSON, XML, YAML).
    - o Exploration of new data transmission technologies to minimize the latency in the microservices execution (BSON, MessagePack, Protocol buffers, etc.)
    - o Exploration of HTTP/2 Protocol for microservice execution instead of HTTP/1.1
    - o Concluding the transmission technologies based on the scenarios analyzed.

4. Scope of Work

The purpose of the application is to bring out the improvements that can act as a booster to the performance of the data transmission among the microservices and analyze the weak points of the current transmission exchange formats used as a standard in todays' market.

Over the next 16 weeks, my project will revolve around exploring data exchange formats and addressing associated latencies. Starting with outlining the project and seeking feedback from Supervisors, I'll finalize the project scope. The exploration phase will involve a detailed analysis of JSON, XML, and YAML, focusing on understanding latencies and their impact on the existing architecture.

Moving forward, I'll research techniques to minimize latencies, comparing them across transmission formats and creating a Proof of Concept (PoC) to showcase effective latency reduction. The evaluation and documentation phase will include comprehensive study documentation and a detailed Plan of Work (PoW). I'll analyze the performance differences between HTTP/2 and HTTP/1.1, providing a report on findings.

Concluding the project, I'll merge PoCs, offer an overview of the overall performance comparison, and draw conclusions from analyzed scenarios. The final phase involves preparing product documentation and a research paper, incorporating feedback from Supervisors and Examiners for the ultimate submission of the Product Documentation & Research Paper.

4. Detailed Plan of Work (for 16 weeks)

S. No.	Tasks or Subtask to be done	Start Date - End Date	Planned Duration in Weeks	Specific Deliverable in terms of project
1.	Outline of the project and review from the Supervisors and Internal Examiners	Feb 5th – Feb 8th	0.7	Finalized Outline of the project
2.	Exploration on data exchange formats	Feb 8th – Feb 10th	0.3	Understanding about the transmission formats
3.	Explore and understand the latencies that data exchange format JSON brings in.	Feb 12th – Feb 17th	1	Understanding about the latencies JSON holds currently

4.	Explore and understand the latencies that that data exchange formats XML and YAML brings in.	Feb 19th – Feb 24th	1	Understanding about the latencies XML, YAML holds currently
5.	Explore and analyze how the latencies can affect the current architecture.	Feb 26th – Mar 2nd	1	Understanding how these latencies are becoming a bottleneck.
6.	Work on exploring techniques to minimize the latency.	Mar 4th- Mar 9th	1	Understanding on reducing the latencies
7.	Work on comparing the techniques with the transmission formats	Mar 11th – Mar 16th	1	Comparison of all the findings.
8.	Examine and evaluate the techniques with the help of a small PoC	Mar 18th – Mar 23rd	2	PoC on the comparison where all the latencies are well reflected and how to minimize those.
9.	Document and Submit the PoW of the study done.	Apr 1st – Apr 6th	1	PoW and Documentation of the study done.
10.	Understand how HTTP/2 can boost the performance than HTTP/1.1	Apr 8th – Apr 13th	1	Understanding about HTTP/2 and HTTP/1.1
11.	Demonstrate and analyze the HTTP/2 with a small comparison PoC.	Apr 15th – Apr 20th	1	PoC on analyzing the speed of HTTP/2 over HTTP/1.1
12.	Bring all the PoC together to compare the overall performance of the data exchange happen with the newer methods.	Apr 22nd – Apr 27th	1	Merge of both the PoCs and comparison on better methods.
13.	Concluding the PoC done and, the scenarios analyzed.	Apr 29th – May 4th	1	Document the PoCs and conclusion of the better performance methods
16.	Start of the preparation of the product documentation and research paper	May 6th – May 11th	1	Product Documentation & Research Paper
17.	Working on the research paper	May 13th – May 18th	1	Product Documentation & Research Paper
18.	Working on the feedback from supervisor and examiner	May 20th – May 27th	1	Product Documentation & Research Paper
19.	Project Report Submission	May 27th		Product Documentation & Research Paper

5. Literature References

[1] https://groups.google.com/g/google-web-toolkit/c/d7IM9Q4lIoE

[2] https://en.wikipedia.org/wiki/Comparison_of_data-serialization_formats

6. Particulars of the Supervisor and Examiner

	Supervisor	Additional Examiner
Name	Dharmesh Rana	Sujith Pratap
Qualification	BE, Computer Science	MS, Computer Science
Designation	Software Architect	Lead Customer Officer @ Customer Office (SAP API Management)
Employing Organization and Location	SAP Labs, Bangalore	SAP Labs, Bangalore
Phone No.(with STD Code)	+919886258820	+919986733432
Email Address	dharmesh.rana@sap.com	s.prathap@sap.com

7. Remarks of the Supervisor

Signature of Student	Signature of Supervisor	Signature of Additional Examiner
Name: Shraddha Gulati	**Name**: Dharmesh Rana	**Name**: Sujith Pratap

Approval Email from Supervisor:
Approval Email from Additional Examiner:

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI
WORK INTEGRATED LEARNING PROGRAMMES (WILP) DIVISION
SECOND SEMESTER OF ACADEMIC YEAR 2021-2022

SESAP ZG629T: PROJECT WORK OUTLINE

STUDENT ID No.	2020HS70018
NAME OF THE STUDENT	Shraddha Gulati
STUDENT'S EMAIL ADDRESS	2020HS70018@wilp.bits-pilani.ac.in
STUDENT'S EMPLOYING ORGANIZATION & LOCATION	SAP Labs, Bangalore
SUPERVISOR'S NAME	Dharmesh Rana
SUPERVISOR'S EMPLOYING ORGANIZATION & LOCATION	SAP Labs, Bangalore
SUPERVISOR'S EMAIL ADDRESS	dharmesh.rana@sap.com
ADDITIONAL EXAMINAER'S NAME	Sujith Pratap
ADDITIONAL EXAMINER'S EMPLOYING ORGANIZATION & LOCATION	SAP Labs, Bangalore
ADDITIONAL EXAMINER'S EMAIL ADDRESS	s.prathap@sap.com
DISSERTATION / PROJECT / PROJECT WORK TITLE	RESEARCH / Minimize the latency in high-performance data interchange system in microservice architecture.

Please prepare the outline as a separate document with the following sections along with the above identification information.
1. Cover Page with Student ID No., Name, Course Number, Course Title and Dissertation / Project / Project Work Title, Broad Academic Area of Work.
2. Background (Relevance of the Project to the current work environment in the employing organization)
3. Objectives
4. Scope of Work (To be done by the student independently)
5. Plan of Work (Work to be done during the semester)
6. Literature References
7. Particulars of the Supervisor and Additional Examiner
8. Remarks of the Supervisor