

A REPORT

ON

**Project Boxy: Open Source GPU
Remote Access & Development Suite**

BY

JOEL TONY

2021A7PS2077G

AT

Coditation Systems

A Practice School – I Station of



**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE
PILANI, GOA CAMPUS**

June 2023

A REPORT
ON

**Project Boxy: Open Source GPU
Remote Access & Development Suite**

BY

JOEL TONY

2021A7PS2077G

Prepared in partial fulfilment of
the Practice School-I Course BITS F221

AT

Coditation Systems

A Practice School – I Station of



**BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE
PILANI, GOA CAMPUS**

June 2023

Abstract Sheet
BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE,
PILANI - (RAJASTHAN)

Practice School Division

Station: Coditation Systems

Centre: Pune, India

Duration: 02nd August - 21st December 2021

Date of Submission: 23rd August 2021

Title: Project Boxyy: Open Source GPU Remote Access & Development Suite

Name of student: Joel Tony

ID Number: 2021A7PS2077G

Name of Experts	Designation
Mr. Shubham Kamthania	Technical Lead
Ms. Madhuri Pulipaka	Project Manager

Name of PS Faculty	Designation
Dr. Ravi Kadlimatti	Asst. Professor, Dept. of EEE

Keywords: Open Source, GPU, Remote, Graphics, Graphics Programming, WebGPU, WebRTC

Project Areas: Graphics Programming

Abstract

This report is regarding Project Boxyy, that I am working on at Coditation Systems, Pune, as a part of my Practice School-I (BITS F221). The project involves the design and implementation of an open-source GPU remote access development suite.

Signature of Student

Signature of PS Faculty

Acknowledgements

I would like to extend my special thanks to our mentor Dr. Ravi Kadlimatti, for being a constant support throughout the duration of the project. Also, I would like to thank Coditation Systems for providing me with the opportunity of working on an interesting project. Lastly, I would like to acknowledge the role of BITS Pilani in giving me this exposure through the Practice School-I course.

Contents

Abstract Sheet	i
Acknowledgements	ii
Contents	iii
List of Figures	iv
List of Tables	v
1 Project Overview	1
1.1 Project Description	1
1.2 Motivation Behind the Project	1
2 Project Requirements	2
2.1 Functional Requirements	2
2.1.1 WebRTC	2
2.1.2 WebGPU	2
2.1.3 DevSync	2
2.1.4 Compiler Infrastructure	3
2.1.5 Collaboration and Coherence	3
2.1.6 Open Source	3
2.1.7 Cloud Infrastructure	3
2.1.8 Security	3
2.1.9 Documentation and Testing	4
2.2 Non-Functional Requirements	4
2.2.1 Performance	4
2.2.2 Usability	4
2.2.3 Reliability	4
2.2.4 Security	4
2.2.5 Scalability	5
2.2.6 Compatibility	5
3 Constraints	6
A Appendix A	7
B Appendix B	9

List of Figures

List of Tables

Chapter 1

Project Overview

1.1 Project Description

The project aims to develop an open-source sandbox environment for graphics payloads. It includes a WebRTC component for delivering graphics streams on the web, a native WebGPU component for real-time graphics rendering on the server, DevSync for real-time code editing, and a remote caching system for compiled resources.

1.2 Motivation Behind the Project

Project Boxy aims to provide affordable and accessible GPU resources to developers and researchers on resource-intensive tasks. High-end GPUs are expensive and out of reach for individuals and organizations. The project aims to address that challenge by offering a sandbox environment for developing and deploying graphics payloads.

Chapter 2

Project Requirements

2.1 Functional Requirements

2.1.1 WebRTC

- Enable real-time delivery of graphics streams on the web.
- Support secure and efficient streaming of graphics data.
- Ensure compatibility with modern web browsers and platforms.

2.1.2 WebGPU

- Develop a native component for real-time graphics rendering on the server using WebGPU.
- Support efficient and optimized graphics rendering techniques.
- Handle shader languages such as GLSL or SPIR-V.

2.1.3 DevSync

- Enable real-time code editing, compilation, and hot reloading of the graphics viewport.
- Support a seamless development experience for developers working on graphics payloads.
- Integrate development tools and frameworks that facilitate live code updates and hot module replacement.

2.1.4 Compiler Infrastructure

- Implement remote caching of compiled resources to reduce the turnaround time for graphics compilation.
- Utilize distributed caching systems or cloud-based storage solutions for storing compiled resources.
- Optimize resource management and ensure efficient compilation processes.

2.1.5 Collaboration and Coherence

- Enable collaboration among developers and researchers working on the project.
- Utilize version control systems (e.g., Git) and project management tools (e.g., GitHub, Jira) for effective collaboration.
- Foster a coherent and collaborative end-to-end developer experience.

2.1.6 Open Source

- Follow open-source development practices and guidelines.
- Enable easy contribution from the community.
- Comply with open-source licenses and requirements.

2.1.7 Cloud Infrastructure

- Enable deployment of the remote access system using cloud-based infrastructure and services.
- Manage GPU resources efficiently within the cloud environment.
- Ensure scalability, reliability, and security of the cloud infrastructure.

2.1.8 Security

- Employ authentication and authorization mechanisms to control user access.
- Ensure secure remote access to the GPU-based applications.
- Protect sensitive data and prevent unauthorized access or data breaches.

2.1.9 Documentation and Testing

- Provide clear and comprehensive documentation for developers and users.
- Utilize testing frameworks and methodologies to ensure the reliability and quality of the applications.

2.2 Non-Functional Requirements

2.2.1 Performance

- Provide real-time graphics rendering and streaming with minimal latency.
- Optimize resource utilization for efficient compilation and caching processes.
- Support a scalable infrastructure to handle multiple concurrent users.

2.2.2 Usability

- Offer an intuitive and user-friendly interface for developers and researchers.
- Provide clear instructions and documentation for setup, configuration, and usage.
- Support seamless integration with popular development environments and tools.

2.2.3 Reliability

- Ensure high availability and uptime of the remote access system.
- Implement error handling and recovery mechanisms to handle exceptions and failures.
- Regularly monitor and maintain system stability and performance.

2.2.4 Security

- Implement robust security measures to protect user data and prevent unauthorized access.
- Follow security best practices and industry standards.
- Regularly update and patch the system to address security vulnerabilities.

2.2.5 Scalability

- Support a growing user base and increasing demands for GPU resources.
- Scale the infrastructure seamlessly to handle additional users and workloads.
- Optimize resource allocation and management for scalability.

2.2.6 Compatibility

- Support major web browsers and platforms for web-based delivery of graphics streams.
- Integrate with popular development tools and frameworks for code editing and compilation.
- Ensure compatibility with various operating systems and hardware configurations.

Chapter 3

Constraints

The Boxy project requires open-source development practices and guidelines to comply with relevant open-source licenses and requirements. The project should utilize affordable infrastructure options to be cost-effective while ensuring compatibility with modern web tech and widely adopted development tools.

Appendix A

Appendix A

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.

Appendix B

Appendix B

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetur id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetur.