Software Development Intern Endeavours

Internship Report

Submitted for the partial fulfilment of the degree of

Bachelor of Technology

In

Engineering Mathematics & Computing

Submitted By

Isha Mathe

0901MC201030

UNDER THE SUPERVISION AND GUIDANCE OF

Dr. Atul Kumar Ray

Professor

Department of Engineering Mathematics and Computing

माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA

Deemed to be University

NAAC ACCREDITED WITH A++ GRADE

January-June 2024

DECLARATION BY THE CANDIDATE

I hereby declare that the work entitled **"Network Automation For 6Wind, Juniper & Huawei Routers"** is my work, conducted under the supervision of **Dr. Atul Kumar Ray, Assistant Professor,** during the session Jan-May 2024. The report submitted by me is a record of bonafide work carried out by me.

I further declare that the work reported in this report has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Isha Mathe
0901MC201030
B.Tech. VIII Sem

Date: 15-05-2024
Place: Gwalior

This is to certify that the above statement made by the candidates is correct to the best of my knowledge and belief.

Guided By:

Dr. Atul Kumar Ray
Assistant Professor
Department of Engineering Mathematics and Computing
MITS, Gwalior

Departmental Project Coordinator

Dr. D. K. Jain
Professor
Department of Engineering
Mathematics & Computing
MITS, Gwalior

Approved by HoD

Dr. Vikas P. Shinde
Professor & Head
Department of Engineering
Mathematics & Computing
MITS, Gwalior

PLAGIARISM CHECK CERTIFICATE

This is to certify that I, a student of B.Tech. in **Mathematics & Computing** have checked my complete report entitled "**Network Automation For 6Wind, Juniper & Huawei Routers**" for similarity/**plagiarism using the "Turnitin"** software available in the institute.

This is to certify that the similarity in my report is found to be …12%... which is within the specified limit (20%).

The full plagiarism report along with the summary is enclosed.

Isha Mathe

0901MC201030

Checked & Approved By:

Dr. J. K. Muthele
Associate Professor
Department of Engineering Mathematics and Computing
MITS, Gwalior

EXECUTIVE SUMMARY

This executive summary encapsulates the enriching experience and contributions made during my internship at Matrecomm, a dynamic startup specializing in network solutions. The internship spanned a period of October 2023 to April 2024, during my tenure, I received compensation of 18k per month while actively contributing to the company's innovative endeavors, enhancing network functionalities and contributing to Matrecomm's innovative initiatives.

The summary begins with a declaration affirming the authenticity and originality of the work presented in the report, followed by a plagiarism check certificate to ensure the integrity of the content. It further provides a concise overview of the internship report's structure and key components, including the executive summary, acknowledgment section, certificate of internship, content layout, and chapters detailing the internship journey.

During my internship, I assumed the role of a Software Development Intern, engaging in both frontend and backend tasks to support Matrecomm's mission of revolutionizing network infrastructures. On the frontend, I was involved in editing and deleting data using RPC [1] calls, optimizing data management processes, and enhancing user experience. The technologies utilized included MongoDB [2], REST [3] api and the MERN [4] stack, ensuring robust and efficient frontend operations.

On the backend, I collaborated with routers like 6Wind [5], Juniper [6], and Huawei [7], developing functions to receive parameters and execute tasks seamlessly. Leveraging the POCO [8] library and Matrecomm's proprietary CWorld [9] library, I facilitated efficient router configurations and network management solutions.

Key responsibilities and achievements during the internship included:

- Conducting research on cloud networking trends and technologies, contributing valuable insights to project strategies.
- Designing and implementing software modules to facilitate migration of networks to the cloud, enhancing scalability and performance.
- Collaborating with cross-functional teams to troubleshoot network issues and ensure reliable network connectivity for clients.
- Participating in brainstorming sessions and contributing innovative ideas for product enhancements and technological innovations.

The learning outcomes from the internship encompassed technical skills in network programming, cloud computing, software development methodologies, and agile practices. Challenges encountered were addressed through perseverance and collaboration, enhancing problem-solving abilities and adaptability to new technologies.

The executive summary concludes with expressions of gratitude in the acknowledgment section to all individuals and entities who supported and guided throughout the internship journey. The certificate of internship validates the successful completion of the internship program, highlighting the duration, role, and responsibilities undertaken.

In conclusion, the internship at Matrecomm was a rewarding and insightful experience, providing opportunities to contribute to innovative network solutions, enhance skills, and gain practical knowledge in network management and software development within a dynamic startup environment.

ACKNOWLEDGEMENT

The full semester internship has proved to be pivotal to my career. I am thankful to my institute, **Madhav Institute of Technology and Science** to allow me to continue my disciplinary/interdisciplinary internship as a curriculum requirement, under the provisions of the Flexible Curriculum Scheme, approved by the Academic Council of the institute. I extend my gratitude to the Director of the institute, **Dr. R. K. Pandit** and Dean Academics, **Dr. Manjaree Pandit** for this.

I would sincerely like to thank my department, **Department of Engineering Mathematics and Computing**, for allowing me to explore this Internship. I humbly thank **Dr. Vikas P Shinde**, Professor and Head, Engineering Mathematics and Computing, for his continued support during the course of this engagement, which eased the process and formalities involved.

I am sincerely thankful to my faculty mentors. I am grateful to the guidance of **Dr. Atul Kumar Ray**, Assistant Professor, Engineering Mathematics and Computing for his continued support and guidance throughout the internship. I am also very thankful to the faculty and staff of the department. I extend my deepest appreciation to my family and Siddharth for their unwavering support, encouragement, and understanding throughout this journey.

Isha

Isha Mathe

0901MC201030

CERTIFICATE OF INTERNSHIP

MatreComm Technologies Private Limited

42-46, 1st Main Rd,
3rd Phase, JP Nagar,
Bengaluru, Karnataka 560078

Date: 8th May 2024

To Whomsoever it may concern

This is to hereby certify that **Isha Mathe** has worked as Software intern from 1st Oct 2023 to 8th May 2024.She has completed all the tasks assigned and her performance during the period was **excellent**.

Srinivas Gudipudi

CEO
MatreComm Technologies Pvt Ltd

CONTENT

Table of Contents

ACRONYMS

Acronym	Full Form
QoS	Quality of Service
NAT	Network Address Translation
VLAN	Virtual Local Area Network
VPN	Virtual Private Network
IKE	Internet Key Exchange
OSPF	Open Shortest Path First
BGP	Border Gateway Protocol
JSON	JavaScript Object Notation
HTML	Hypertext Markup Language
CSS	Cascading Style Sheets
CLI	Command Line Interface
GUI	Graphical User Interface
RPC	Remote Procedure Call
WAN	Wide Area Network
MPLS	Multiprotocol Label Switching
IPv6	Internet Protocol version 6
IPv4	Internet Protocol version 4
SSL	Secure Sockets Layer
IPsec	Internet Protocol Security

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1: INTRODUCTION

Matrecomm is a dynamic and innovative technology company at the forefront of revolutionizing network solutions and digital transformation in the telecom industry. Founded with a vision to bridge the gap between traditional networking infrastructures and modern cloud-based solutions, Matrecomm has established itself as a key player in enabling businesses to navigate the complexities of digital evolution with ease and efficiency. At the heart of Matrecomm's mission is a deep commitment to leveraging cutting-edge technologies and strategic insights to empower telecom providers and enterprises in optimizing their network operations, enhancing service delivery, and embracing the opportunities presented by the digital era.

Figure 1 - MatreComm

Core Services and Offerings

Matrecomm's core services and offerings encompass a wide spectrum of solutions tailored to meet the diverse needs of its clients:

- **CraftWorld Automation Tools**: Matrecomm's flagship automation software, CraftWorld, streamlines network service management for telecom providers, offering robust functionalities to automate tasks, optimize workflows, and enhance operational efficiency.

- **Consulting Expertise**: Matrecomm's team of seasoned consultants provides strategic guidance and advisory services to businesses embarking on digital transformation journeys. From developing comprehensive transformation strategies to implementing best practices, Matrecomm's consulting expertise is pivotal in driving organizational success.
- **Software Development Solutions**: With a focus on innovation and agility, Matrecomm develops customized software solutions that address specific challenges and opportunities within the telecom industry. From network optimization tools to customer experience management platforms, Matrecomm's software development capabilities are geared towards driving tangible business outcomes.

Technological Expertise

Matrecomm's technological prowess is evident in its proficiency across a range of cutting-edge technologies and frameworks:

- **Network Automation**: Leveraging automation technologies, Matrecomm empowers organizations to automate routine network tasks, reduce manual intervention, and accelerate time-to-market for new services. By implementing automated processes, Matrecomm enables seamless configuration management, network provisioning, and performance optimization, thereby enhancing operational efficiency and agility for its clients.

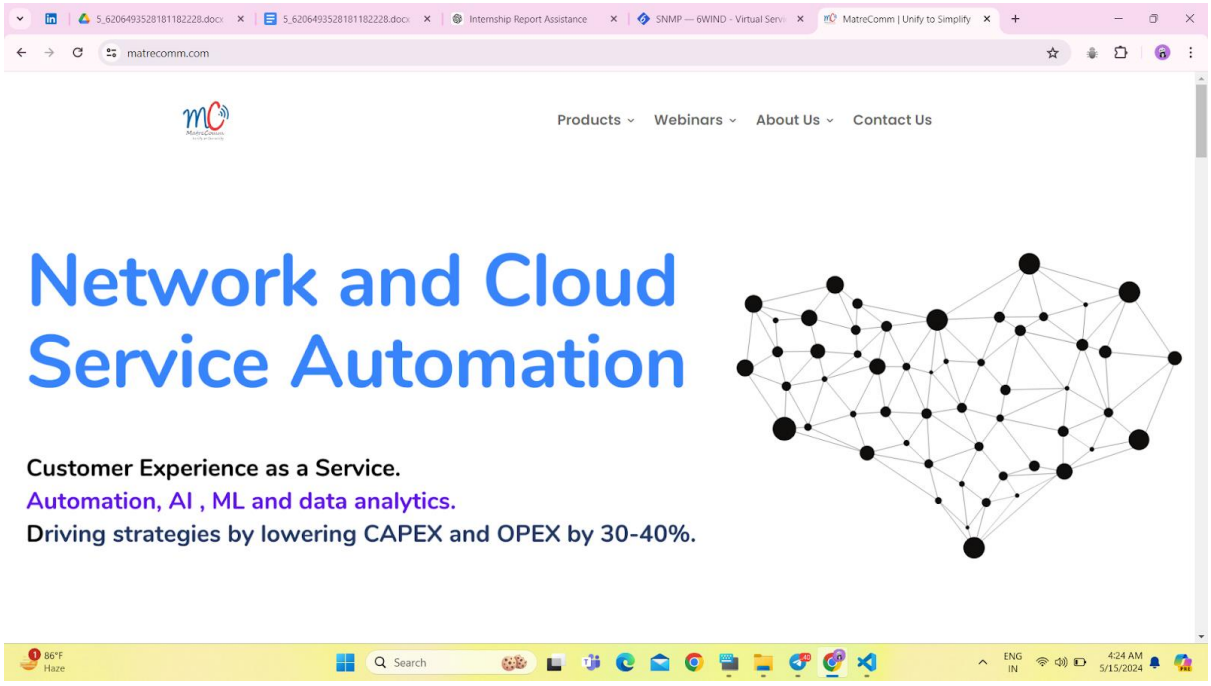


Figure 2 – MatreComm Snapshot

Clientele and Partnerships

Over the years, Matrecomm has built strong partnerships and collaborations with leading telecom providers, enterprises, and technology partners globally. Its diverse clientele spans across industries, showcasing its ability to cater to a wide range of business needs and requirements. Notable clients include prominent Internet Service Providers (ISPs) like Airtel and Vodafone, as well as telecom companies such as Infynix and HFCL. These partnerships reflect Matrecomm's commitment to delivering innovative network automation solutions and digital enablement to industry leaders, further solidifying its position as a trusted partner in the telecom industry.

Through continuous innovation and strategic partnerships, Matrecomm continues to set new benchmarks in the realm of network automation, paving the way for enhanced scalability, reliability, and performance for its clients.

CHAPTER 2: LITERATURE SURVEY

Matrecomm revolutionizes network and router management by offering a cloud-based solution that consolidates all tasks into a single, accessible interface. This eliminates the need for multiple tools and allows administrators to manage their network infrastructure from anywhere. The cloud technology provides flexibility, scalability, and liberation from physical limitations. Matrecomm's platform simplifies tasks that once required hours of manual work, enhancing security and resilience through robust encryption and redundant infrastructure. Additionally, it employs automation and AI to continuously optimize network performance, ensuring efficiency and preparing organizations for future challenges. Overall, Matrecomm provides unprecedented convenience, security, and efficiency in network management.

Below is the detailed description of the key terms and technologies used in the report. These terms are integral to understanding the technological framework and methodologies applied during the internship at Matrecomm:

1. **RPC**: Remote Procedure Call (RPC) allows a program to request a service from a program located on another computer in a network, facilitating communication between different systems.
2. **MongoDB**: A NoSQL database known for its high performance, scalability, and flexibility, allowing for the storage and retrieval of large volumes of unstructured data.
3. **REST API**: Representational State Transfer (REST) API is an architectural style for designing networked applications, using HTTP requests to access and manipulate data.
4. **MERN Stack**: A full-stack development framework consisting of MongoDB, Express.js, React.js, and Node.js, used for building robust web applications.
5. **6Wind**: A networking software company that provides high-performance network solutions, including routers, for improved data traffic management.
6. **Juniper**: A provider of networking hardware and software, including routers and switches, known for its reliable and scalable solutions for enterprises and service providers.
7. **Huawei**: A global technology company offering a range of networking equipment, including routers and switches, with a focus on innovative and efficient network solutions.
8. **POCO**: The C++ Portable Components (POCO) library is a collection of C++ class libraries that simplify the development of network-centric and cross-platform applications.
9. **CWorld**: Matrecomm's proprietary library used for backend development, providing specialized functions and tools for managing network devices and automating network tasks.

CHAPTER 3: 6WIND ROUTER

6WIND is a technology company specializing in high-performance networking solutions. They offer innovative software solutions and services aimed at optimizing network performance, scalability, and agility, particularly in data center and cloud environments. 6WIND's products are known for their ability to accelerate packet processing, improve network efficiency, and support advanced networking functionalities.

Figure 3 - 6Wind

6WIND routers are part of the company's portfolio of networking solutions. These routers are designed to provide advanced networking capabilities, including high-speed packet processing, flexible routing configurations, and support for virtualized network functions. They are tailored to meet the evolving demands of modern networks, offering scalability, reliability, and performance optimization features.

The decision to use NETCONF CLI for automation was likely driven by its advantages in network configuration and management. NETCONF (Network Configuration Protocol) is a standardized protocol used for configuring network devices and managing network operations. It provides a programmatic interface for automating configuration tasks, monitoring network devices, and performing management operations.

By utilizing NETCONF CLI, automation tasks can be streamlined and executed efficiently. The CLI (Command-Line Interface) aspect of NETCONF allows administrators to interact with network devices using a command-line interface, enabling them to automate repetitive tasks, deploy configurations across multiple devices, and maintain consistency in network configurations. This approach enhances network agility, reduces manual errors, and improves overall operational efficiency in managing network infrastructure.

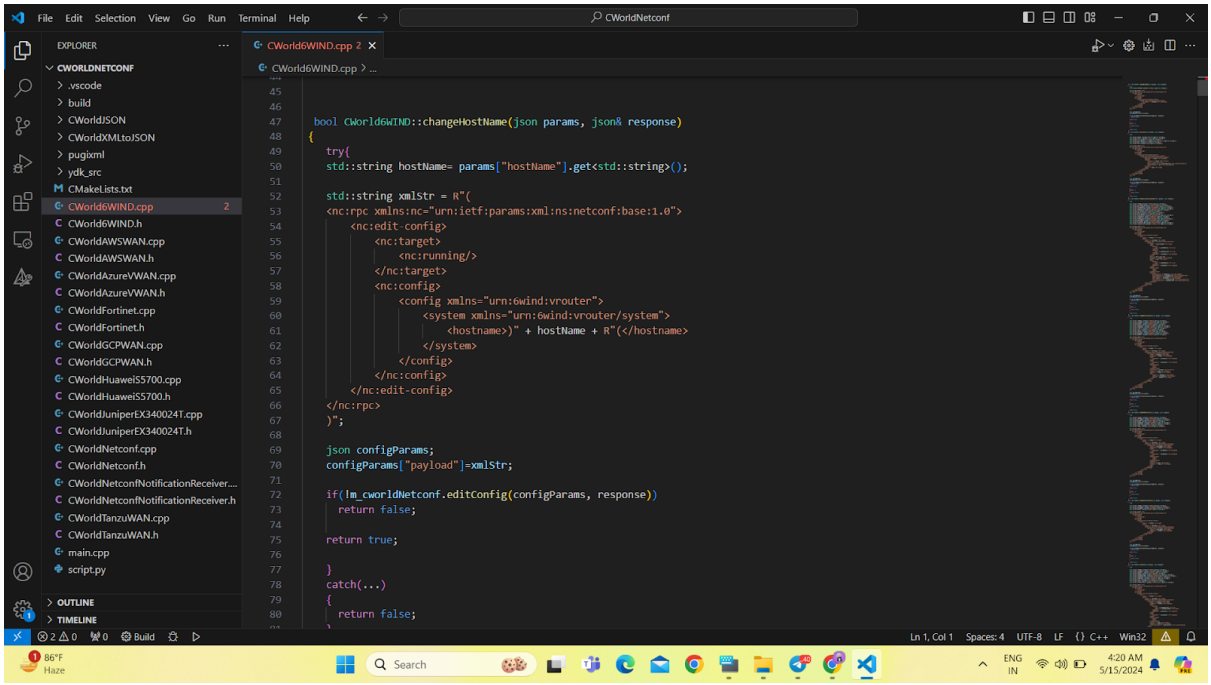


Figure 4 - 6Wind Function Code

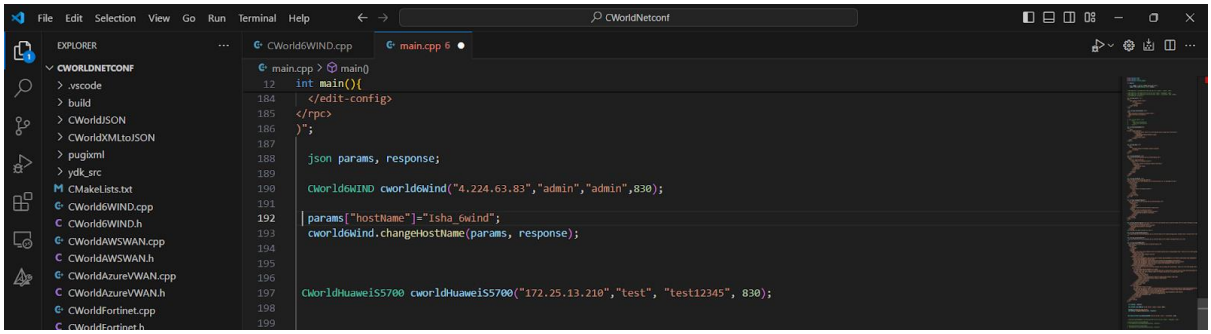


Figure 5 - 6Wind Function Testing Code

Before implementing the functions described below, thorough testing and validation were conducted in development environments. The configuration changes were initially tested in simulated environments to detect and resolve any potential errors or inconsistencies. This rigorous testing process ensured that the backend infrastructure was ready and optimized for seamless connectivity with the frontend components. Only after thorough testing and error resolution, the backend systems were deemed ready to connect with the frontend interfaces for operational deployment.

Category	Functions	Description
Network Configuration	changeHostName, setLicense, setPhysicalInterfaceL3Vrf, setTunnel, setVlanInterface	Manage hostname, licensing, physical interfaces, tunnels, and VLANs
QoS Configuration	createQoSPolicy1UsingSelectors, createQoSCreatePolicer, setQoSShaper, createQoSClass	Create QoS policies, policers, shapers, and class configurations
NAT Configuration	setCGNATStaticSNAT44, setCGNATDynamicSNAT64, setSourceNAT, setNATDestinationRule	Configure NAT rules and mappings
Security and VPN	createGroupForFirewall, setVPNvpnhq, setIKEIKEPolicyTemplate, enableISIS, setOSPF, setBGP	Setup firewall, VPN, IKE policies, ISIS, OSPF, and BGP configurations
Routing and Protocols	createRouteMap, createStaticRoute, setPolicyBasedRouting, enableISIS, setOSPF, setBGP	Create routing maps, static routes, routing policies, and protocols

Table 1:6Wind List of Important Functions

This table provides a quick overview of the main functions in each category without delving into detailed descriptions. It should help readers grasp the scope of your work in network configuration, QoS, NAT, security, VPN, and routing protocols.

CHAPTER 4: JUNIPER ROUTER

Juniper Networks is a leading provider of networking solutions, known for its high-performance routers that cater to a wide range of networking requirements. Juniper routers are designed to deliver reliability, scalability, and security, making them a popular choice for enterprises, service providers, and data centers.

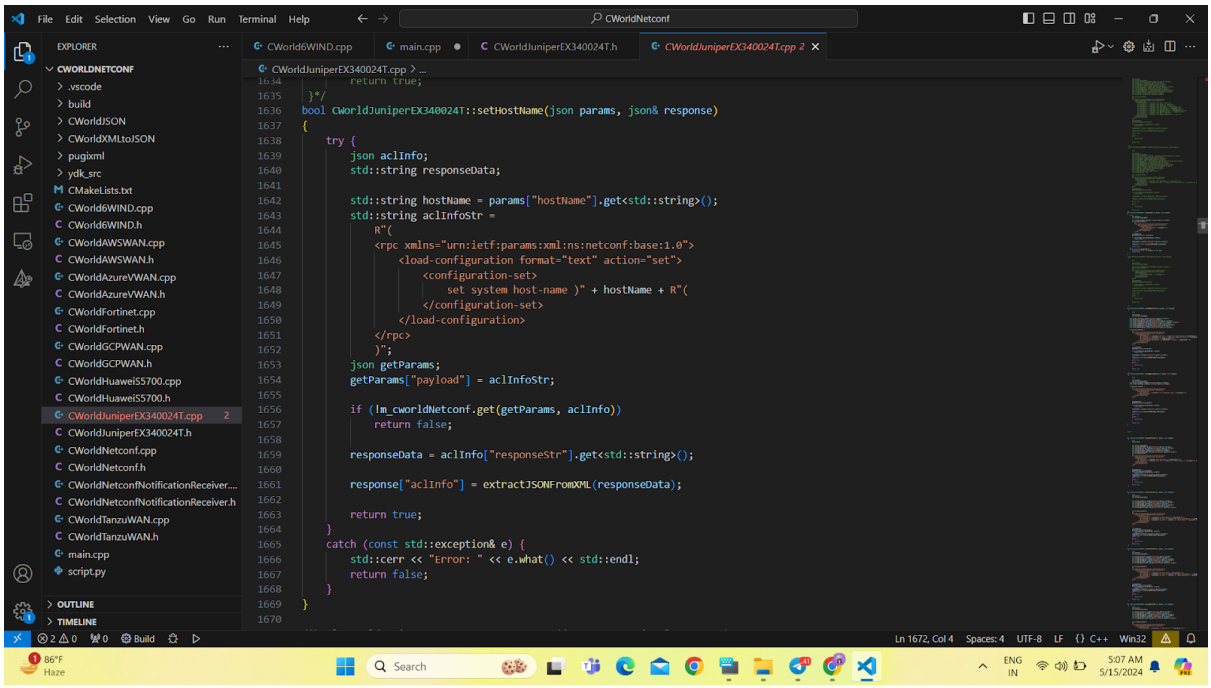
Figure 6 - Juniper

I found working with Juniper's CLI commands quite challenging. You have to first unlock the configuration to make changes, then carefully edit the settings, lock them back to prevent accidental modifications, and finally commit the changes to make them permanent. This process requires precision and attention to detail because any mistake can lead to configuration errors or unintended network disruptions. Additionally, Juniper's resources, while powerful, are not always readily available, which adds another layer of complexity to the task.

Configuration Management

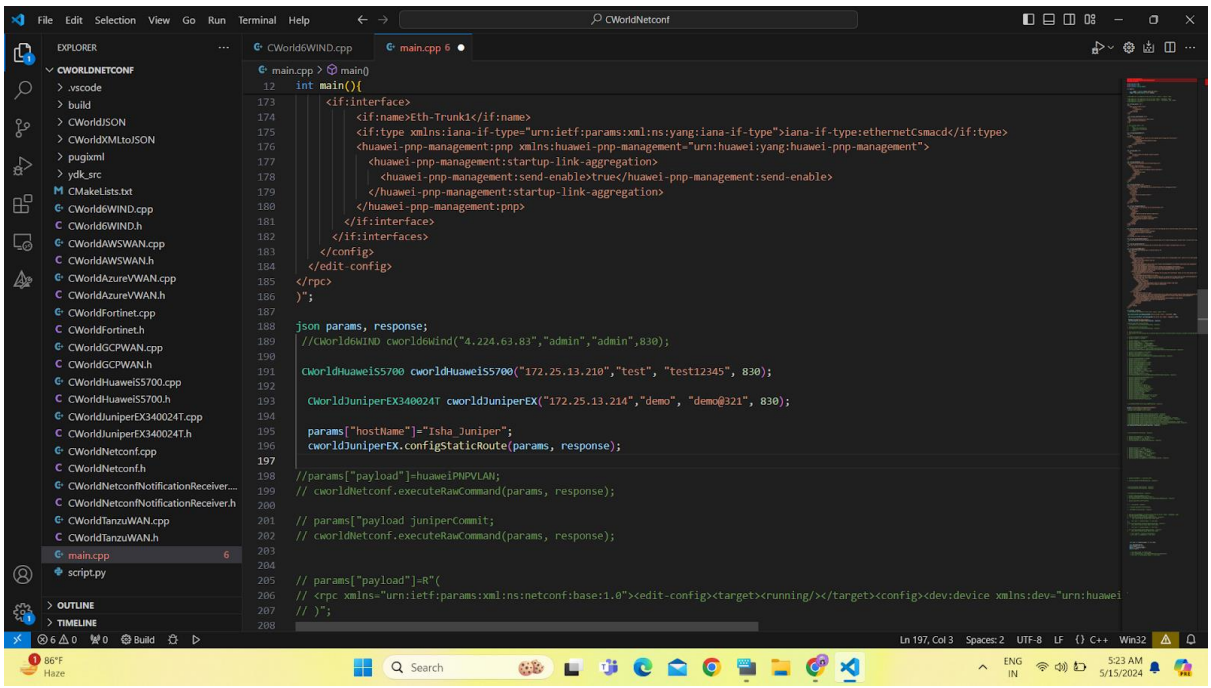
Function	Description
lock(json params, json& response);	Locks the configuration for editing.
commit(json params, json& response);	Commits the changes made to the configuration.
unlock(json params, json& response);	Unlocks the configuration for further editing.

Table 2 :Juniper Configuration Management



```cpp
bool CWorldJuniperEX340024T::setHostName(json params, json& response)
{
    try {
        json aclInfo;
        std::string responseData;

        std::string hostName = params["hostName"].get<std::string>();
        std::string aclInfoStr =
            R"(
            <rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
                <load-configuration format="text" action="set">
                    <configuration-set>
                        set system host-name )" + hostName + R"(
                    </configuration-set>
                </load-configuration>
            </rpc>
            )";
        json getParams;
        getParams["payload"] = aclInfoStr;

        if (!m_cworldNetconf.get(getParams, aclInfo))
            return false;

        responseData = aclInfo["responseStr"].get<std::string>();

        response["aclInfo"] = extractJSONFromXML(responseData);

        return true;
    }
    catch (const std::exception& e) {
        std::cerr << "Error: " << e.what() << std::endl;
        return false;
    }
}
```

Figure 7:Juniper Function Code



```cpp
int main(){
<if:interface>
    <if:name>Eth-Trunk1</if:name>
    <if:type xmlns:iana-if-type="urn:ietf:params:xml:ns:yang:iana-if-type">iana-if-type:ethernetCsmacd</if:type>
    <huawei-pnp-management:pnp xmlns:huawei-pnp-management="urn:huawei:yang:huawei-pnp-management">
      <huawei-pnp-management:startup-link-aggregation>
        <huawei-pnp-management:send-enable>true</huawei-pnp-management:send-enable>
      </huawei-pnp-management:startup-link-aggregation>
    </huawei-pnp-management:pnp>
  </if:interface>
 </if:interfaces>
</config>
</edit-config>
</rpc>
)";

json params, response;
//CWorld6WIND cworld6Wind("4.224.63.83","admin","admin",830);

CWorldHuaweiS5700 cworldHuaweiS5700("172.25.13.210","test", "test12345", 830);

 CWorldJuniperEX340024T cworldJuniperEX("172.25.13.214","demo", "demo@321", 830);

 params["hostName"]="Isha_Juniper";
 cworldJuniperEX.configStaticRoute(params, response);

//params["payload"]=huaweiPNPVLAN;
// cworldNetconf.executeRawCommand(params, response);

// params["payload juniperCommit;
// cworldNetconf.executeRawCommand(params, response);


// params["payload"]=R"(
// <rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"><edit-config><target><running/></target><config><dev:device xmlns:dev="urn:huawei
// )";
```

Figure 8:Juniper Testing Code

Configuration Management	Network Interface Configuration	Security and Authentication	Routing and Protocol Configuration
lock, commit, unlock	Physical Interface, Hostname	CHAP Secret, Server-Initiated Negotiation, Loopback Clear Timer	BGP Configuration, OSPF Settings
configGRE, configVLAN	Firewall Settings, VXLAN Setup	BGP Peering, BGP Policy Options	OSPF Configuration, Route Maps
configSTVI, configCGNAT	VLAN Interface, Bridge Settings	BGP Authentication, BGP Peers	BFD in OSPF, Route-Based VPNs
configStaticRoute, configNAT	Loopback Setup, Static Routes	IKE Policies, IPsec Settings	IPv4 Over IPv4 Tunneling, DHCPv4
configOSPFv3, configVPNGateway	IPv6 Configuration, DHCP Server	SNMP, LLDP Configurations	VRRP, IP Networking Settings

Table 3 - Juniper Function Description

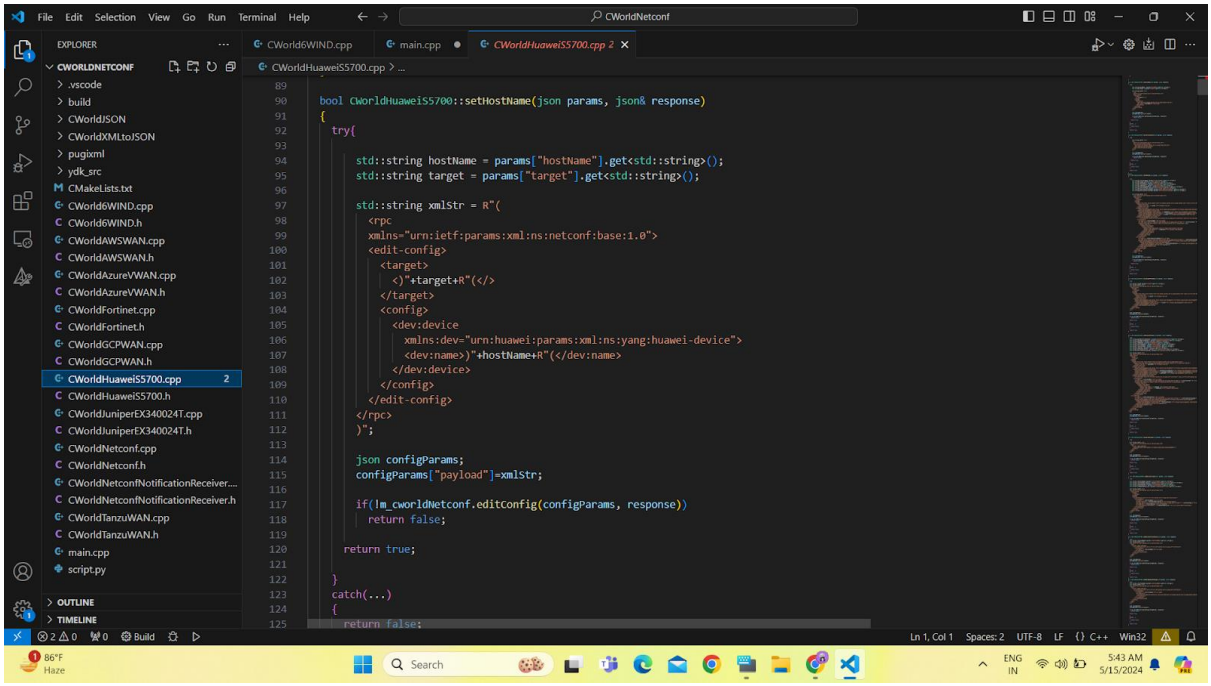
This table provides a quick overview of the main functions in each category without delving into detailed descriptions.

CHAPTER 5: HUAWEI ROUTER

Huawei routers are renowned for their robust performance and advanced configuration capabilities. With Huawei routers, network administrators can access a wide range of features, including efficient routing protocols, secure VPN configurations, Quality of Service (QoS) management, and sophisticated network address translation (NAT) options. What sets Huawei routers apart is their intuitive user interface and comprehensive documentation, making configuration tasks streamlined and accessible even for complex network setups. The reliability and versatility of Huawei routers make them a preferred choice for businesses and organizations seeking high-performance networking solutions.

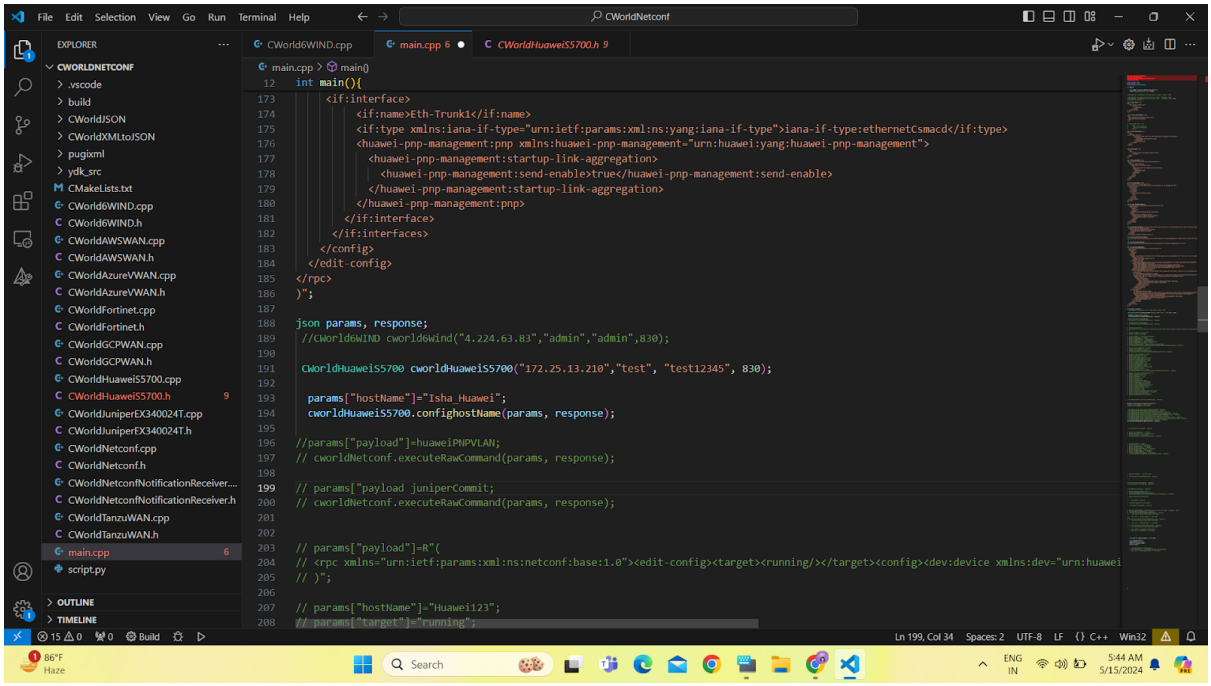
Figure 9 - Huawei

In the enterprise sector, Huawei's routers are designed to meet the demanding requirements of medium to large businesses. They offer advanced features such as high-speed connectivity, multiple WAN interfaces, Quality of Service (QoS) controls, Virtual Private Network (VPN) support, and integrated security mechanisms. These routers ensure secure and efficient network operations, essential for business continuity and productivity.



```
bool CWorldHuaweiS5700::setHostName(json params, json& response)
{
  try{

      std::string hostName = params["hostName"].get<std::string>();
      std::string target = params["target"].get<std::string>();

      std::string xmlStr = R"(
        <rpc
        xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
        <edit-config>
          <target>
            <)"+target+R"(</>
          </target>
          <config>
            <dev:device
              xmlns:dev="urn:huawei:params:xml:ns:yang:huawei-device">
              <dev:name>)"+hostName+R"(</dev:name>
            </dev:device>
          </config>
        </edit-config>
      </rpc>
      )";

      json configParams;
      configParams["payload"]=xmlStr;

      if(!m_cworldNetconf.editConfig(configParams, response))
        return false;

    return true;

  }
  catch(...)
  {
    return false;
```

Figure 10 - Huawei Function Code



```
int main(){
    <if:interface>
        <if:name>Eth-Trunk1</if:name>
        <if:type xmlns:iana-if-type="urn:ietf:params:xml:ns:yang:iana-if-type">iana-if-type:ethernetCsmacd</if:type>
        <huawei-pnp-management:pnp xmlns:huawei-pnp-management="urn:huawei:yang:huawei-pnp-management">
          <huawei-pnp-management:startup-link-aggregation>
            <huawei-pnp-management:send-enable>true</huawei-pnp-management:send-enable>
          </huawei-pnp-management:startup-link-aggregation>
        </huawei-pnp-management:pnp>
      </if:interface>
    </if:interfaces>
  </config>
 </edit-config>
</rpc>
)";

json params, response;
 //CWorld6WIND cworld6Wind("4.224.63.83","admin","admin",830);

CWorldHuaweiS5700 cworldHuaweiS5700("172.25.13.210","test", "test12345", 830);

 params["hostName"]="Isha_Huawei";
 cworldHuaweiS5700.confighostName(params, response);

//params["payload"]=huaweiPNPVLAN;
// cworldNetconf.executeRawCommand(params, response);

// params["payload juniperCommit;
// cworldNetconf.executeRawCommand(params, response);


// params["payload"]=R"(
// <rpc xmlns="urn:ietf:params:xml:ns:netconf:base:1.0"><edit-config><target><running/></target><config><dev:device xmlns:dev="urn:huawei
// )";

// params["hostName"]="Huawei123";
// params["target"]="running";
```

Figure 11 - Huawei Testing Code

CONFIGURING PNP VLAN

Function	Description
setPnPVLAN	Configures PnP VLAN.
setDeletePnPVLAN	Deletes PnP VLAN.

Table 4 - Configuring PNP VLan

PORT MANAGEMENT

Function	Description
setBasicAttribute	Sets basic attributes.
setQueryInterfaceStatus	Queries interface status.
setEnablePortIsolation	Enables port isolation.
setEnableIPSGOnInterface	Enables IPSG on interface.
setConfiguringInternalLoopbackDetectionOnInterface	Configures internal loopback detection.

Table 5 - Port Management

MTU MANAGEMENT

Function	Description
setConfiguringMTUForIPv4Traffic	Configures MTU for IPv4 traffic.
setConfiguringMTUForIPv6Traffic	Configures MTU for IPv6 traffic.

Table 6 - Port Management

MAC ADDRESS MANAGEMENT

Function	Description
setQueryingMACAddressTable	Queries MAC address table.
setConfiguringStaticMACAddressEntry	Configures static MAC address entry.
setDeleteConfiguringStaticMACAddressEntry	Deletes static MAC address entry.

Table 7 - MAC Address Management

In data center environments, Huawei's routers are tailored for high-performance computing, low-latency networking, virtualization support, and cloud integration. These routers play a crucial role in creating agile and scalable data center networks, essential for modern cloud-based applications and services.

Key features across Huawei routers include high-speed interfaces, wireless capabilities, advanced routing protocols, robust security measures, Quality of Service controls, and centralized management interfaces. These features ensure that Huawei routers meet the diverse networking needs of users across different sectors, backed by comprehensive support and maintenance services.

CHAPTER 6: CRAFT UNIFY

During my internship at Matrecomm, I had the opportunity to work extensively with their flagship platform, Craft Unify. Craft Unify stands out as their main platform, meticulously designed to cater to diverse human needs within the networking domain. What makes Craft Unify truly exceptional is its ability to seamlessly integrate cutting-edge technologies and adapt to the unique requirements of different users. As part of my responsibilities, I was deeply involved in enhancing the platform's functionality, particularly in areas related to data management.

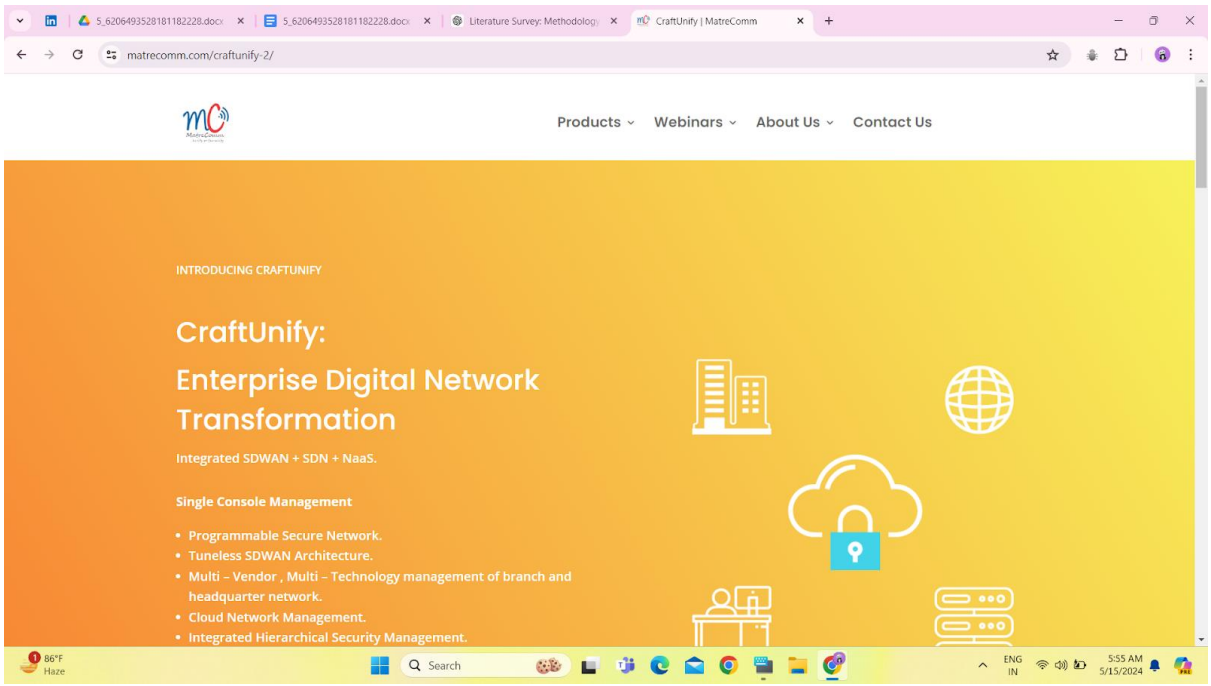


Figure 12 - Craft Unify Website

The edit and delete functionalities involved creating user-friendly interfaces in the frontend, allowing users to interact with and modify data elements such as network configurations, policies, and device settings. Leveraging technologies like React and other frontend frameworks, I designed intuitive interfaces that enabled users to edit existing data entries or delete redundant ones with ease.

To ensure smooth communication between the frontend and backend systems, I integrated Remote Procedure Call (RPC) mechanisms into the implementation. RPC calls were utilized to transmit user actions and data modifications initiated in the frontend to the backend servers. This architecture facilitated real-time data synchronization and seamless execution of edit and delete operations across the Craft Unify platform.

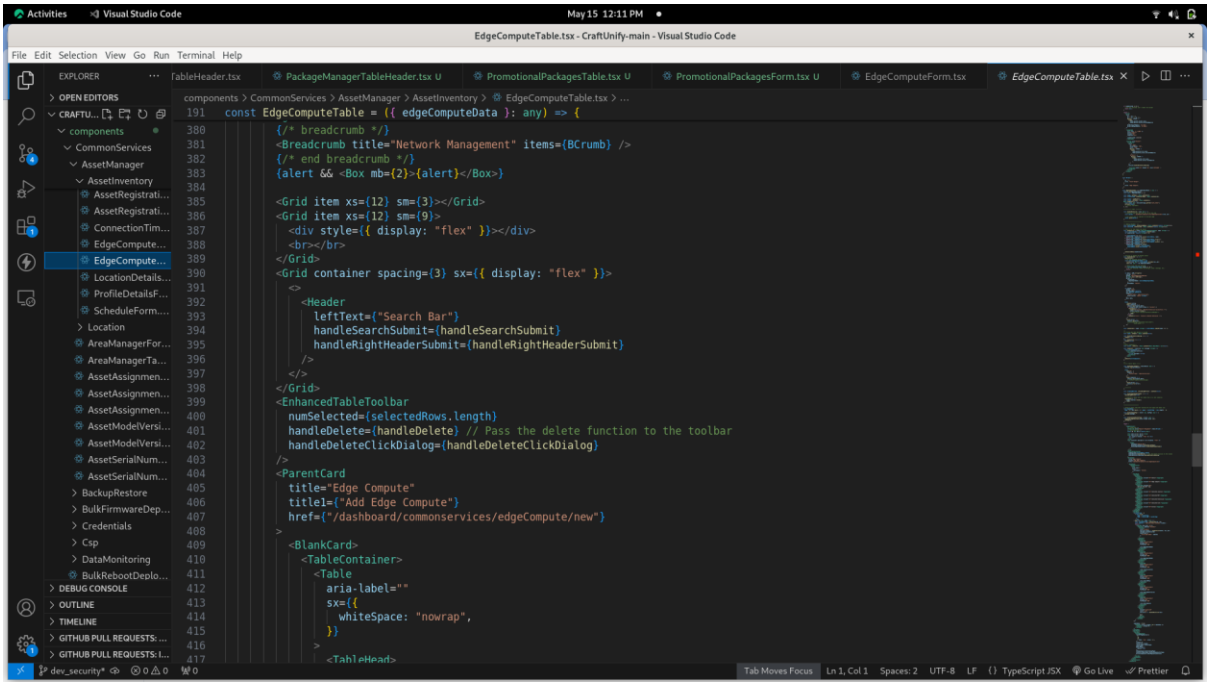


Figure 13 - Craft Unify Code Glimpse

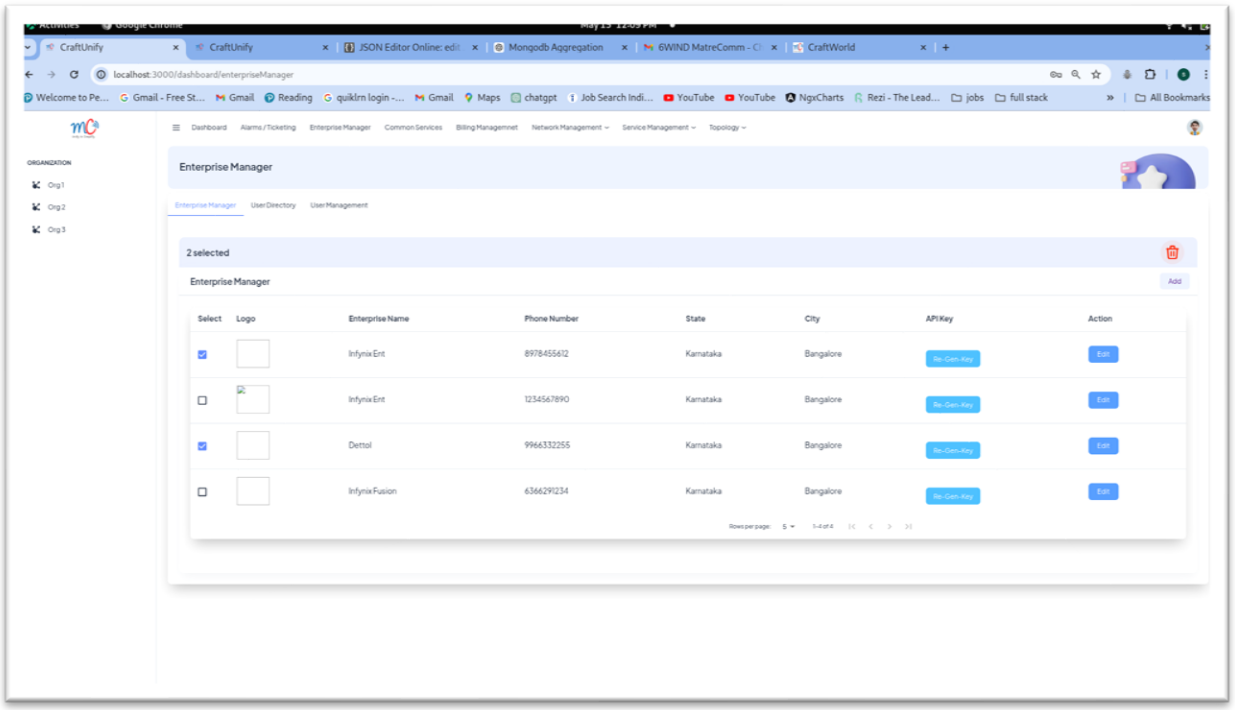


Figure 14 - Craft Unify Code Output

CHAPTER 7: CONCLUSION

During my internship at Matrecomm, I embarked on a journey of continuous learning and skill development, gaining invaluable insights and hands-on experience in various aspects of software development and network management. I honed my proficiency in frontend development, exposed to technologies like React and frontend frameworks to create intuitive user interfaces and enhance user experiences.

On the backend side, I delved into the intricacies of network automation and backend development, working with technologies such as the POCO library and MatreComm's proprietary CWorld library. This exposure allowed me to grasp the complexities of backend systems, including data handling, API integration, and server-side operations.

Moreover, my internship experience provided me with valuable insights into network management platforms and their real-world applications, particularly in the context of network automation, cloud integration, and network security. I learned how to tailor software solutions to meet specific business needs, customize functionalities, and optimize performance for enhanced user satisfaction.

Overall, my internship journey at Matrecomm was a transformative learning experience, equipping me with a diverse skill set encompassing frontend and backend development, network automation, API integration, and user-centric design principles. These learnings have not only enhanced my technical capabilities but also instilled in me a deep appreciation for the dynamic and evolving field of software engineering and network management.

REFERENCES

Below is the detailed description of the key terms and technologies used in the report, with references for further reading:

1. Stoyenko, A. D. (1994). Supra-RPC: Subprogram parameters in remote procedure calls. Software: Practice and Experience, 24(1), 27-49.

2. Banker, K., Garrett, D., Bakkum, P., & Verch, S. (2016). MongoDB in action: covers MongoDB version 3.0. Simon and Schuster.

3. Masse, M. (2011). REST API design rulebook: designing consistent RESTful web service interfaces. "O'Reilly Media, Inc."

4. Subramanian, V. (2019). Pro Mern Stack: Full Stack Web App Development with Mongo, Express, React and Node. Apress.

5. Horvath, T., Berry, S., Hollis, B., Singer, B., & Chang, C. L. (2002, June). Boundary layer transition on slender cones in conventional and low disturbance Mach 6 wind tunnels. In 32nd AIAA fluid dynamics conference and exhibit (p. 2743).

6. Miller, R. F., Svejcar, T. J., & Rose, J. A. (2000). Impacts of western juniper on plant community composition and structure. Rangeland Ecology & Management/Journal of Range Management Archives, 53(6), 574-585.

7. Kaska, K., Beckvard, H., & Minárik, T. (2019). Huawei, 5G and China as a security threat. NATO Cooperative Cyber Defence Center for Excellence (CCDCOE), 28, 1-26.

8. Kadusic, E., Zivic, N., Hadzajlic, N., & Ruland, C. (2022, August). The transitional phase of Boost. Asio and POCO C++ networking libraries towards IPv6 and IoT

networking security. In 2022 IEEE International Conference on Smart Internet of Things (SmartIoT) (pp. 80-85). IEEE.

9. Szűgyi, Z., Sinkovics, Á., Pataki, N., & Porkoláb, Z. (2009). C++ metastring library and its applications. In International Summer School on Generative and Transformational Techniques in Software Engineering (pp. 461-480). Berlin, Heidelberg: Springer Berlin Heidelberg.

These references provide additional context and detailed information about the technologies and methodologies employed during the internship, highlighting the innovative approach taken by Matrecomm in network management and optimization.

TURNITIN PLAGIARISM REPORT

Similarity Report

PAPER NAME

report.docx-14-29 (1).pdf

WORD COUNT	CHARACTER COUNT
2033 Words	**13134 Characters**
PAGE COUNT	FILE SIZE
16 Pages	**3.8MB**
SUBMISSION DATE	REPORT DATE
May 17, 2024 12:50 PM GMT+5:30	**May 17, 2024 12:50 PM GMT+5:30**

- **12% Overall Similarity**

The combined total of all matches, including overlapping sources, for each database.

- 6% Internet database
- 3% Publications database
- Crossref database
- Crossref Posted Content database
- 11% Submitted Works database

- **Excluded from Similarity Report**

- Bibliographic material

ANNEXURE-1

LEARNING OUTCOMES

During my internship at Matrecomm, I had the opportunity to immerse myself in a dynamic and innovative environment, where I gained valuable hands-on experience. Receiving a monthly stipend of 18k, I was able to fully focus on developing my skills and contributing to various projects. My time at Matrecomm provided me with the following key learnings and experiences:

1. **Diverse Skill Set:** Acquired skills in frontend, backend (POCO,Netconf CWorld), and network automation with routers (6Wind, Juniper, Huawei).

2. **Technical Proficiency:** Developed expertise in web development, API integration, database management, and network automation.

3. **Industry Relevance:** Gained practical experience in telecom technology, digital transformation strategies, and software solutions for businesses.

4. **Problem-Solving:** Enhanced problem-solving abilities through complex project tasks and handling network configurations.

5. **Competitive Advantage:** Positioned for roles in Full-Stack Development, Backend Engineering, Network Management, and tech consulting.

6. **Career Growth:** Prepared for challenges in dynamic tech environments, offering scalability and adaptability in career progression.

7. **Professional Network:** Expanded network with industry professionals, mentors, and peers for future collaboration and opportunities.

ANNEXURE-2

DAILY DIARY

Month	Duration Start date – End date (DD/MM/YY) - (DD/MM/YY)	Progress of Internship/ Project
Month - 1	01/01/24-31/01/24	Worked for developing Functions of 6WIND
Month - 2	01/02/24-29/02/24	Worked for developing Functions of Juniper
Month - 3	01/03/24-31/03/24	Worked for Edits and Delete for Craft Unify
Month - 4	01/04/24-30/04/24	Worked for developing Functions of Huawie

ANNEXURE-3A

MPR-1

FORMAT

MONTHLY REPORT OF PROGRESS (MRP) FROM INDUSTRY MENTOR

Name of student	Isha Mathe		Department	Mathematics and Computing	
Industry/Organization	MatrixComm Technologies Pvt Ltd		Date/Duration	DD/MM/YR -DD/MM/YR 01/01/24-31/01/24	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work					✓
Learning capacity/Knowledge upgradation					✓
Performance/Quality of work					✓
Behaviour/Discipline/Team work					✓
Sincerity/Hard work					✓
Comment on nature of work done/Area/Topic	Software Development Worked on backend and frontend for CraftUnify in Network As A Service Domain. ✓				
OVERALL GRADE (Any one)	~~POOR/AVERAGE/GOOD/VERY GOOD~~/EXCELLENT				
Name of Industry Mentor	GUDIPUDI SRINIVAS				
Signature of Industry Mentor	G. Srinivas				

Receiving Date	17/05/24	Name of Faculty Mentor	DR. ATUL KUMAR RAY	Sign	17/05/24

MATRIXCOMM TECHNOLOGIES PRIVATE LIMITED BANGALORE

ANNEXURE-3B

MPR-2

FORMAT

MONTHLY REPORT OF PROGRESS (MRP) FROM INDUSTRY MENTOR

Name of student	ISHA MATHE		Department	MATHEMATICS AND COMPUTING
Industry/Organization	MATRECOMM TECHNOLOGIES		Date/Duration	DD/MM/YR -DD/MM/YR 01/02/24 - 29/02/24
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work					✓
Learning capacity/Knowledge upgradation					✓
Performance/Quality of work					✓
Behaviour/Discipline/Team work					✓
Sincerity/Hard work					✓
Comment on nature of work done/Area/Topic	Worked with routers and networking devices for automating configurations. ✓				
OVERALL GRADE (Any one)	~~POOR/AVERAGE/GOOD/VERY GOOD~~/EXCELLENT				
Name of Industry Mentor	GUDIPUDI SRINIVAS				
Signature of Industry Mentor	G.S.i.V				

Receiving Date	17/05/24	Name of Faculty Mentor	DR ATUL KUMAR RAY	Sign	17/05/24

MATRECOMM TECHNOLOGIES PRIVATE LIMITED * BANGALORE

ANNEXURE-3C

MPR-3

FORMAT

MONTHLY REPORT OF PROGRESS (MRP) FROM INDUSTRY MENTOR

Name of student	Isha Mathe		Department	Mathematics and Computing	
Industry/Organization	MatrecComm Technologies		Date/Duration	DD/MM/YR -DD/MM/YR 01/03/24 - 31/03/24	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work					✓
Learning capacity/Knowledge upgradation					✓
Performance/Quality of work					✓
Behaviour/Discipline/Team work					✓
Sincerity/Hard work					✓
Comment on nature of work done/Area/Topic	Worked with the Cryptography as for deletion and editing of the data present through UI ✓				
OVERALL GRADE (Any one)	~~POOR/AVERAGE/GOOD/VERY GOOD~~/EXCELLENT				
Name of Industry Mentor	GUDIPUDI SRINIVAS				
Signature of Industry Mentor	G.S.N				

Receiving Date	17/05/24	Name of Faculty Mentor	Dr. ATUL KUMAR RAY	Sign	Atul 17/05/24

MATRECOMM TECHNOLOGIES PRIVATE LIMITED BANGALORE

ANNEXURE-3D

MPR-4

FORMAT

MONTHLY REPORT OF PROGRESS (MRP) FROM INDUSTRY MENTOR

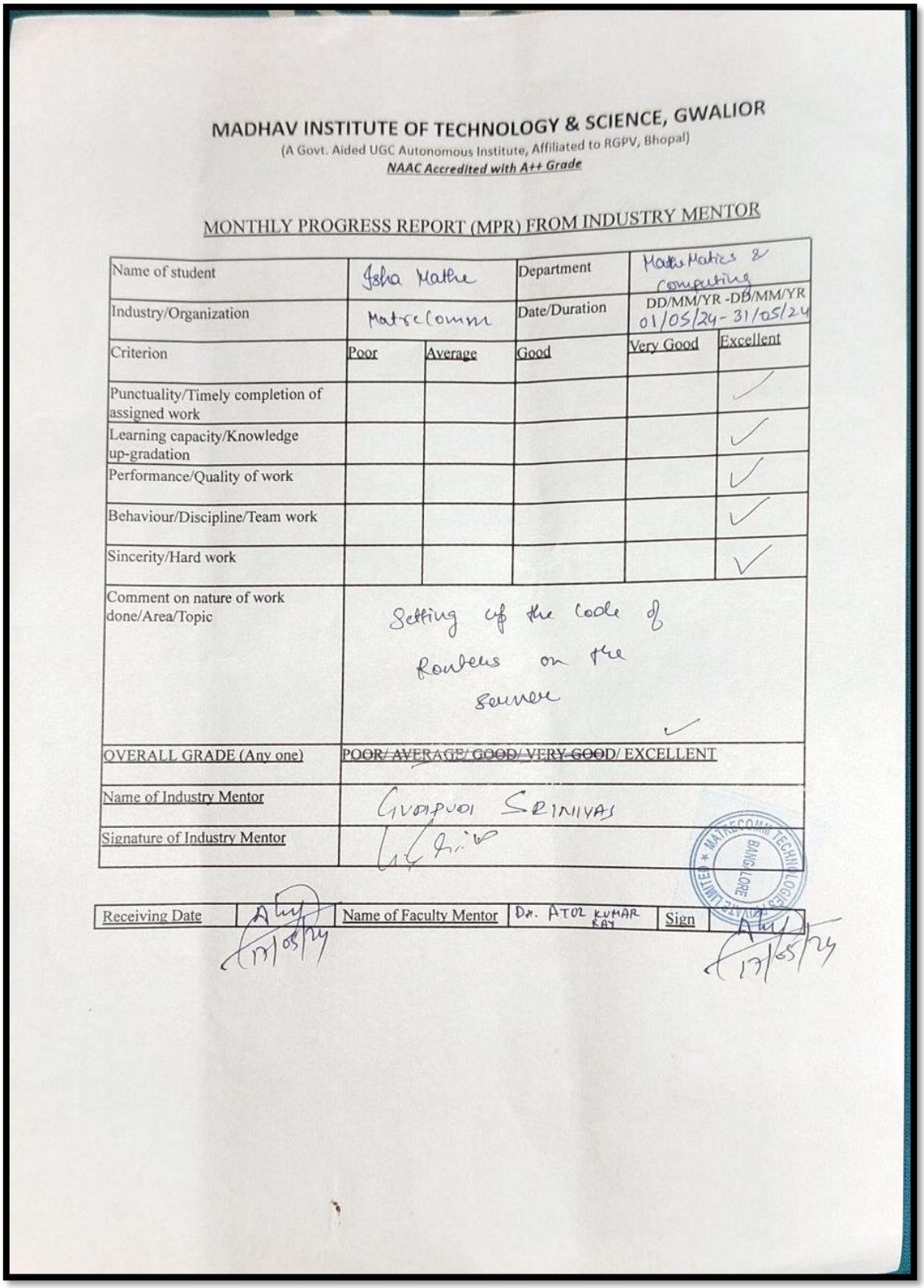
Name of student	Isha Mathe		Department		
Industry/Organization	Matrecomm Technologies		Date/Duration	DD/MM/YR -DD/MM/YR 01/04/24 30/04/24	
Criterion	**Poor**	**Average**	**Good**	**Very Good**	**Excellent**
Punctuality/Timely completion of assigned work					✓
Learning capacity/Knowledge upgradation					✓
Performance/Quality of work					✓
Behaviour/Discipline/Team work					✓
Sincerity/Hard work					✓
Comment on nature of work done/Area/Topic	Worked for configuration of devices like JUNIPER, GWIND and HUAWEI. ✓				
OVERALL GRADE (Any one)	~~POOR/AVERAGE/GOOD/VERY GOOD~~/EXCELLENT				
Name of Industry Mentor	GUDIPUDI SRINIVAS				
Signature of Industry Mentor	G. Srinivas				

Receiving Date	17/05/24	Name of Faculty Mentor	Dr. ATUL KUMAR RAY	Sign	

MATRECOMM TECHNOLOGIES PRIVATE LIMITED * BANGALORE

ANNEXURE-3E

MPR-5



MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

NAAC Accredited with A++ Grade

MONTHLY PROGRESS REPORT (MPR) FROM INDUSTRY MENTOR

Name of student	Isha Mathe		Department	Mathematics & Computing	
Industry/Organization	Matrcomm		Date/Duration	DD/MM/YR -DD/MM/YR 01/05/24 - 31/05/24	
Criterion	Poor	Average	Good	Very Good	Excellent
Punctuality/Timely completion of assigned work					✓
Learning capacity/Knowledge up-gradation					✓
Performance/Quality of work					✓
Behaviour/Discipline/Team work					✓
Sincerity/Hard work					✓
Comment on nature of work done/Area/Topic	Setting up the code of Routers on the server ✓				
OVERALL GRADE (Any one)	~~POOR/ AVERAGE/ GOOD/ VERY GOOD~~/ EXCELLENT				
Name of Industry Mentor	Gudipudi Srinivas				
Signature of Industry Mentor					

Receiving Date	17/05/24	Name of Faculty Mentor	Dr. Atul Kumar Ray	Sign	17/5/24

ANNEXURE-4

OFFER LETTER MATRECOMM

MatreComm Technologies Private Limited

42-46, 1st Main Rd, 3rd Phase,
JP Nagar, Bengaluru,
Karnataka 560078

Isha Mathe **29th Sep 2023**

MITS, Gwalior

Dear Isha Mathe,

Congratulations! We are pleased to extend the offer of internship to you on the following terms and conditions.

1. **Position:** You will be appointed as Software Development Intern to be based in Bangalore. You shall perform such duties as may from time to time be assigned to you and shall comply with all reasonable directions by the Management.
2. **Commencement Date:** You will be required to join on 3rd October, 2023 which shall be official commencement date of your internship.
3. **Internship Payment:** You will be paid a monthly amount of Rs 18000/- (Eighteen Thousand only).
4. **Duration: 6** months from the date of joining. We reserve the right to extend your internship/training period for further period/s or convert to regular employment based on your performance.
5. **Working Hours:** 9.00 am – 6.00 pm, Monday to Friday

   Based on project requirements, sometimes work maybe required to be done on **weekends**.
6. **Notice of Termination:** This appointment may be terminated by either party giving to the other party by notice in writing or by paying remuneration in lieu thereof of 7 days. We reserve the right to terminate your service at any time without notice should you be guilty of misdemeanor, misconduct, negligence or any breach of the terms and conditions of this agreement.
7. **Intellectual Property of other Employers:** We have extended this offer to you based upon your general knowledge, background, experience and skills and abilities and not because of your knowledge of your current employer's or any previous employer's trade secrets or other company specific information. As a condition of employment with us, you agree not to disclose or use confidential or proprietary information or any trade secrets of any of your current or prior employers. In this regard, you should be extremely careful not to bring any documents or other materials in any tangible form belonging to or acquired from any current or prior employers.
8. **Non-disclosure, confidentiality and Intellectual Property agreement:** As on the date of acceptance of this offer you will execute the attached Non-disclosure, confidentiality and Intellectual Property agreement and abide by all the terms and conditions agreed.
9. **Other terms:** During the period of your employment, you will be governed by the prevailing guidelines of the Company, which are issued and or amended with cause, from time to time. This offer is subject to verification of your education, work experience and salary history. You will be terminated forthwith for any false information provided without any compensation.

We are pleased to have you join us as Software Development Intern and are looking forward to a challenging and rewarding association. This offer is valid for a period of 7 working days. This offer is null and void if this offer letter along with the **Non-disclosure, confidentiality and Intellectual Property agreement** is not signed and returned to us by the end of 7 working days from today.

Yours sincerely,

For **MatreComm Technologies Private Limited**

Authorized Signatory

I accept the above mentioned terms and conditions of employment.

Signature:

Date:

Name

ANNEXURE-5

OFFER LETTER HASHEDIN BY DELOITTE

Hashedin
by Deloitte

Hashedin Technologies Private Limited
#36/5, Somasundarapalya, 27th Main Road, Sector 2,
HSR Layout, Bengaluru – 560102, India
Tel: +91 80 6755 3331
www.hashedin.com

Apr 25, 2024

Ms. Isha Mathe
Khachcha ram ki gali, Dhaniram master ka bada, Lohamandi, Gird P.O,
Gwalior, 474003
India

Dear Isha Mathe:

We are pleased to inform you that your application for the Training program has been accepted.

Your training with **HashedIn Technologies Private Limited** (the "Employer" or "Company") will be located in **Bengaluru**. The Training program is for a tentative duration of **15 weeks** starting from **May 27, 2024**.

During this period, you will be paid a monthly stipend of **Rs./₹ 25,000/-**.

You will maintain confidentiality of the information you would have access to - both during and after the completion of the training.

Upon your reporting, you will be informed of your guide and program scope.

For HashedIn Technologies Private Limited
Best regards,

DocuSigned by:
By: Himanshu Varshney
568DCCCCE6B4E5...
Signature

Authorized Signatory

Isha