A REPORT

ON

Disaster Recovery Using SD-Wan

BY

Name of the student

Registration No.

PRANEETHA BOLNETI

AP22110011107

Prepared in the partial fulfillment of the
Summer Internship Course

AT

Twenty-Two by 7 Solutions Pvt. Ltd.

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SRM UNIVERSITY, AP

(July, 2024)

22
BY 7
...your business Constant

July 26, 2024

TO WHOM SO EVER IT MAY CONCERN

This is to certify that **Ms. Praneetha Bolneti** student of B.Tech (Computer Science) bearing register number **AP22110011107** from **SRM University AP**, Amravathi, has successfully completed her internship at Twenty Two by 7 Solutions Private Limited from June 3rd, 2024 to July 26, 2024.

During her internship, she was exposed to various activities in the Technical Division and has completed a project on "SD-WAN Disaster Recovery Solutions".

We found her very inquisitive and hardworking. She was extremely interested in getting exposed and learning the core functions of the division. She was also willing to put in her best effort to get an in-depth understanding of the subject.

We wish her the best in her future endeavors.

For Twenty Two By Seven Solutions Pvt Ltd

HR Generalist

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SUMMER INTERNSHIP COURSE, 2024-25

JOINING REPORT

(To be sent within a week of joining to the University -Joining report to be uploaded online through Google Form circulated by Associate Dean, Practice School)

Date: 18th July, 2024

Name of the Student	PRANEETHA BOLNETI
Roll No	AP22110011107
Programme (BTech/ BSc/ BA/MBA)	B Tech
Branch	CSE
Name and Address of the Internship Company [For research internship, it would be SRMAP]	Twenty Two by 7 Solutions Pvt Ltd 35/1, 24th main rd, achappa layout, silver oak, JP nagar 7th phase, Bengaluru, Karnataka 560078 Telephone No: +91 80 26623033 Email: info@22by7.in
Period of Internship	From [Date] to [Date] 3rd June to 26th ~~August~~ July

I hereby inform that I have joined the summer internship on __3rd June, 2024__ for the In-plant Training/ Research internship in the industry.

Date : 18th July, 2024

Praneetha
Signature of the Student

CERTIFICATE FROM INDUSTRY MENTOR/HR
(FACULTY MENTOR FOR RESEARCH INTERNSHIP)

Certified that the above-mentioned student has joined our organization for the INTERNSHIP / INDUSTRIAL TRAINING / ACADEMIC ATTACHMENT in the industry / Organization.

Name of the Industry Mentor	Vediyam Dinesh
Designation	Info Sec Engineer
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Signature & Date	V. Dinesh 18/7/24

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I am particularly grateful to **Mr. Dinesh**, my Industry Mentor at Twenty-Two By 7 Solutions Pvt Ltd, for his insightful guidance, constant encouragement, and for sharing his extensive knowledge and expertise, which were pivotal in completing this project.

My deepest appreciation goes to **Prof.L V Siva Rama Krishna Boddu**, my Faculty Mentor at SRM University AP, for his unwavering support, and invaluable feedback, and for guiding me through the academic aspects of this project.

I would also like to acknowledge the support of my colleagues at Twenty-Two By 7 Solutions Pvt Ltd and the experts who provided their input and assistance. Their collaboration and shared experiences were invaluable in enriching the quality of my work.

Finally, I am grateful to my family and friends for their constant support and encouragement, without which this endeavour would not have been possible.

Abstract

Enterprise connection has undergone a revolution thanks to Software-Defined Wide Area Networks (SD-WAN), which provide better application performance and dynamic path selection. To improve network resilience, this research examines how well SD-WAN disaster recovery (DR) uses dynamic path selection. We explore the effects of dynamic path selection on latency, failover times, and overall application performance during outages using simulated scenarios with various failure conditions. Our results show how important dynamic path selection is to preserving application availability and reducing interruption in the event of a disaster.

A brief introduction to the organization's business sector

One of the most vibrant and quickly expanding industries in India is information technology (IT), which is vital to the national economy. The sector includes high-edge fields like virtualization, cloud computing, cybersecurity, and software development in addition to a broad range of services like hardware, network administration, and IT consulting. Indian IT companies have emerged as global leaders, offering cutting-edge services and solutions to clients all over the world, from little start-ups to enormous multinational enterprises.

The emphasis on information security and business continuity solutions in the Indian IT industry is one of its main features. Strong solutions that guarantee data security, privacy, and the ongoing operation of business-critical systems are in more demand due to the rising dependence on digital platforms and the complexity of cyber-attacks. By providing multidisciplinary InfoSec solutions that answer the changing problems of the digital era, Indian IT companies such as 22by7 Solutions Pvt. Ltd. have established themselves as major participants in this market.

Furthermore, the emergence of virtualization and cloud computing has changed how companies maintain their IT infrastructure. Indian IT firms are leading the way in offering tailored cloud solutions that accelerate time to market and increase corporate agility. These technologies assist businesses in effectively scaling their operations while controlling expenses. These organizations help businesses maximize their IT resources, lower capital costs, and accelerate return on investment by providing virtualization solutions.

The industry also makes significant investments in Infrastructure Lifecycle Management (ILM), which makes sure that IT infrastructures are planned, implemented, and maintained in a way that advances long-term corporate goals. Expert services that guarantee infrastructure stays in line with business needs are in great demand as IT ecosystems become more complicated. This helps businesses sustain high performance and reliability levels.

In conclusion, the Indian IT industry plays a critical role in propelling the digital transformation of enterprises in a wide range of industries, especially in fields like virtualization, cloud computing, cybersecurity, and business continuity. Businesses like 22by7 Solutions Pvt. Ltd. play a crucial role in supplying the technological framework that enables them to meet the demands of a cutthroat, international marketplace while maintaining their resilience, agility, and readiness for the future.

Overview of Twenty-Two By 7 Solutions Pvt. Ltd.

1. Brief History

On March 27, 2006, Twenty-Two By 7 Solutions Pvt. Ltd. was founded with the specific goal of developing into a reliable partner in the provision of strong business continuity solutions. The firm was established in response to the increasing demand for flexible, on-demand IT solutions that can keep companies ahead of the competition in a cutthroat market. Since its founding, 22by7 Solutions has developed steadily, expanding its knowledge across a range of IT fields and earning a reputation for providing cutting-edge solutions that guarantee the flawless operation of vital corporate systems.

The business has developed dramatically over time, extending its operations to several cities, including Hyderabad and Bangalore. The company has become a major participant in the Indian IT industry thanks to its unwavering pursuit of excellence, which has earned it multiple accolades and a loyal customer base.

2. Business Size

Twenty-Two By 7 Solutions Pvt. Ltd. has developed into a sizable organization with a significant footprint in the IT sector. Over 200 highly qualified individuals work for the organization at its Hyderabad and Bangalore headquarters. These workers represent the organization's core, propelling its goal to offer affordable IT solutions that improve operational effectiveness, guarantee continuity, and facilitate quick recovery times.

The organization has partnered with more than 25 international technology suppliers, allowing it to provide a broad array of state-of-the-art solutions to its customers. 22by7 Solutions is a customer-focused organization that is pleased to service over 130 clients and manage over 240 help contacts, all while maintaining a solid and resilient IT infrastructure.

The company's financial standing is equally impressive, with an authorized share capital of ₹25,000,000 and a paid-up capital of ₹10,550,000. These figures reflect the company's solid foundation and its commitment to continuous growth and investment in its core capabilities.

3. Product Lines

Twenty-Two By 7 Solutions Pvt. Ltd. provides an extensive array of IT solutions tailored to the specific requirements of enterprises operating in different industries. Among the goods and services provided by the business are:

- Business Continuity Solutions: Ensuring uninterrupted business operations through robust IT infrastructure and disaster recovery strategies.

- Information Security Solutions: Providing multi-discipline InfoSec solutions to safeguard data and ensure privacy in an increasingly digital world.

- Infrastructure Lifecycle Management (ILM) & Cloud Solutions: Enabling businesses to achieve greater agility and accelerate time to market with customized cloud solutions and effective infrastructure management.

- Virtualization Solutions: Helping businesses optimize their IT resources, improve security, and reduce costs through expert virtualization services.

- Computing Power Solutions: Offering tailored solutions to enhance computing power, ensuring scalability, efficiency, and cost-effectiveness.

- Assist Desk: A reliable support platform that assists clients in managing and troubleshooting their IT infrastructure, ensuring peace of mind.

4. Competitors

In the IT services sector, Twenty-Two By 7 Solutions Pvt. Ltd. faces competition from several notable companies that provide a wide range of similar services. Some of the key competitors include:

- Compu trade Technology: A provider of IT security, infrastructure, and analytics solutions. Compu Tradex specializes in big data and analytics, data security and networking, cloud computing, cybersecurity, and IT infrastructure services.

- Nologin Consulting: An information technology company that offers data center and cloud services. Nologin provides services such as migrations, virtualization, public clouds, cybersecurity, backup, and corporate communications solutions.

- Effortless Office: A company specializing in cloud-based solutions, Effortless Office provides cybersecurity, network and internet services, virtualization, business continuity, disaster recovery, and other IT solutions.

- MIS Alliance: A provider of comprehensive IT services, MIS Alliance offers cybersecurity, cloud computing, virtualization, backup and disaster recovery, end-user protection (EDR), network solutions, and IT support.

These competitors present significant challenges in the market, but Twenty-Two By 7 Solutions differentiates itself through its focus on business continuity and its commitment to delivering future-ready, customized solutions to meet the specific needs of its clients.

5. Brief Summary of All Departments

- Business Continuity Solutions Department: This department is the cornerstone of the company, focusing on developing and implementing strategies that ensure clients' businesses remain operational even in the face of disruptions. The team works closely with clients to design customized disaster recovery plans and IT resilience strategies.

- Information Security Department: The InfoSec team is dedicated to protecting clients' data and networks from cyber threats. They provide comprehensive security solutions, including network security, data encryption, and vulnerability assessments, to ensure the integrity and confidentiality of information.

- Cloud & Virtualization Department: This department specializes in helping businesses transition to the cloud and optimize their IT infrastructure through virtualization. The team works on designing, deploying, and managing cloud environments that are scalable, secure, and aligned with business goals.

- Infrastructure Management Department: Responsible for the end-to-end management of IT infrastructure, this department ensures that all systems are running efficiently and are maintained according to best practices. They handle everything from hardware management to network administration.

- Assist Desk: The Assist Desk is the customer support wing of the company, providing round-the-clock assistance to clients. This team is the first point of contact for troubleshooting and resolving any IT-related issues, ensuring minimal downtime and disruption.

- Human Resources & Development (Gurukul and Academy): Focused on talent development, this department manages the 'Gurukul' and 'Academy' programs, which are designed to enhance the skills and knowledge of employees. These initiatives ensure that the workforce remains highly competent and aligned with the company's business needs.

Plan of My Internship Program

1. Introduction to the Department

My internship was at the Business Continuity Solutions Department of Twenty-Two By 7 Solutions Pvt. Ltd. This department's strong IT infrastructure and disaster recovery plans are essential to guarantee that the company's clients can continue to run their businesses. The department's area of expertise is creating and executing solutions that offer resilience against a range of internal and external threats, protecting clients' business operations, and maintaining their stability.

2. Internship Duration

- **Start Date: June 3rd, 2024**

- **End Date: July 26th, 2024**

The internship program spanned 8 weeks, during which I engaged in various learning and project-oriented activities.

3. Departments Visited and Duration of Stay

Throughout my internship, I had the opportunity to visit and engage with different departments to gain a holistic understanding of the company's operations. The departments I visited and the duration of my stay in each are as follows:

- **Business Continuity Solutions Department:** Full duration of the internship (8 weeks)

- **Information Security Department:** 1 week

- **Cloud & Virtualization Department:** 1 week

- **Infrastructure Management Department:** 1 week

- **Assist Desk:** 1 week

Each department provided valuable insights into its specific functions and allowed me to understand the interconnectivity of various IT solutions provided by the company.

4. Duties and Responsibilities

I worked mostly on a project centered on SD-WAN Disaster Recovery Solutions during my internship. The project's goal was to validate current disaster recovery plans using SD-WAN technology by speaking with SD-WAN specialists and documenting them. Among my duties were:

- **Learning Phase (Weeks 1-4):** The first four weeks were dedicated to understanding networking concepts, with a focus on CCNA topics. This phase helped me build a strong foundation in networking, which was essential for the later stages of the project.

- **Project Development (Weeks 5-8):** The next four weeks were spent working on the SD-WAN Disaster Recovery project. My duties included:

    o Data Collection: Reviewing and analyzing existing reports and documentation provided by the company related to disaster recovery and SD-WAN.

    o Expert Consultation: Engaging with SD-WAN experts within the company to validate the data and strategies documented. This involved conducting interviews and discussions to ensure the feasibility of the proposed disaster recovery solutions.

    o Documentation: Compiling the information into a comprehensive report that could be used by the company for future reference and as a guide for implementing SD-WAN Disaster Recovery Solutions.

    o Weekly Diaries: Keeping a detailed diary of the tasks performed each day, ensuring that the documentation accurately reflects the progress and learning outcomes of each week.

My role in this project not only deepened my understanding of SD-WAN technology but also provided practical experience in how disaster recovery solutions are planned and implemented in a real-world business environment.

Conclusion

My internship at Twenty-Two By 7 Solutions Pvt. Ltd. was a priceless opportunity for me to put my academic understanding to use in a real-world situation. My abilities and understanding of IT solutions have significantly improved as a result of working on a large project and being exposed to several departments, especially in the context of business continuity and disaster recovery.

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1. Introduction

Ensuring network resilience and business continuity during disasters is crucial in the current digital era. By facilitating smooth failover, load balancing, and data synchronisation between primary and backup data centres, Software-Defined Wide Area Networking (SD-WAN) provides a reliable disaster recovery solution. This research investigates how to improve network resilience and keep connectivity in the event of a breakdown by using an SD-WAN-based disaster recovery solution.

2. Objectives

The primary objective of this project is to design, implement, and test an SD-WAN-based disaster recovery solution. The key goals are:

- Minimize network downtime during failures.

- Ensure data integrity and consistency between data centers.

- Maintain seamless connectivity for critical applications and users.

3. Planning and Requirements

3.1 Identify Key Requirements

- **Business Continuity:** Ensure uninterrupted access to critical applications and data.

- **Network Resilience:** Implement failover mechanisms to maintain connectivity during disasters.

- **Data Integrity:** Synchronize data between primary and secondary data centers.

- **Scalability:** Ensure the solution can scale with business growth.

- **Security:** Implement robust security measures to protect data and network integrity.

- **Cost-Effectiveness:** Maintain a balance between cost and performance.

3.2 Network Topology
The network topology for the SD-WAN disaster recovery solution includes the following components:

- **Primary Data Center (Bangalore):**

  o Houses critical applications and data.

  o Two physical servers (Dell PowerEdge R640).

  o Connected to two ISPs (ISP1, ISP2).

- **Secondary Data Center (Mumbai):**

  o Acts as a backup for failover.

  o Two virtual machines (VMware ESXi).

  o Connected to two ISPs (ISP3, ISP4).

- **Branch Offices:**

  o **Chennai Branch:**

    ▪ One physical server (HP ProLiant DL360).

    ▪ Connects to both data centres via ISP1 and ISP3.

  o **Hyderabad Branch:**

    ▪ One physical server (HP ProLiant DL360).

    ▪ Connects to both data centers via ISP2 and ISP4.

- **Remote Users:**

- Access network resources through SD-WAN nodes, using VPN connections.

3.3 Resources

- **SD-WAN Solution:**

  - VMware VeloCloud

- **Physical Servers:**

  - Primary Data Center: 2 x Dell PowerEdge R640

  - Branch Offices: 2 x HP ProLiant DL360 (1 each in Chennai and Hyderabad)

- **Virtual Machines:**

  - Secondary Data Center: 2 x VMware ESXi VMs

- **Network Devices:**

  - SD-WAN Edges:

    - Bangalore: VeloCloud Edge 510

    - Mumbai: VeloCloud Edge 520

    - Chennai Branch: VeloCloud Edge 510

    - Hyderabad Branch: VeloCloud Edge 510

- **WAN Links:**

  - Primary Data Center: ISP1, ISP2

  - Secondary Data Center: ISP3, ISP4

  - Chennai Branch: ISP1, ISP3

  - Hyderabad Branch: ISP2, ISP4

4. Setup and Configuration

4.1 SD-WAN Solution Deployment
- **Install VMware VeloCloud:**

    o Deployed physical servers at the primary data centre in Bangalore.

    o Deployed virtual machines at the secondary data centre in Mumbai.

- **Configure SD-WAN Edges:**

    o Bangalore: VeloCloud Edge 510

    o Mumbai: VeloCloud Edge 520

    o Chennai Branch: VeloCloud Edge 510

    o Hyderabad Branch: VeloCloud Edge 510

4.2 Network Configuration
- **WAN Links Setup:**

    o Bangalore Data Center: ISP1, ISP2

    o Mumbai Data Center: ISP3, ISP4

    o Chennai Branch: ISP1, ISP3

    o Hyderabad Branch: ISP2, ISP4

- **Failover Policies:**

    o Automatic failover to the Mumbai data center during Bangalore data center outages.

    o Load balancing between multiple WAN links to optimize performance and ensure redundancy.

5. Disaster Recovery Policies and Implementation

5.1 Failover and Load Balancing

- **Policy Definition:**
    - Traffic rerouting policy: Redirect traffic to the secondary data centre (Mumbai) during a failure at the primary data centre (Bangalore).
    - Load balancing policy: Distribute traffic evenly across available WAN links to prevent overload and optimize bandwidth usage.

- **Automated Failover:**
    - Configured SD-WAN to automatically switch traffic to the Mumbai data centre in case of a failure in Bangalore.

5.2 Data Synchronization

- **Data Replication:**
    - File-based replication using rsync between data centres:
        - Primary Data Center: **IP1:**/data
        - Secondary Data Center: **IP2**:/backup
    - Database replication using MySQL:
        - Primary Data Center: **IP1** (Master)
        - Secondary Data Center: **IP2** (Slave)

- **Ensuring Data Integrity:**
    - Regularly verify data consistency between primary and secondary data centers using checksums and integrity checks.

5.3 Dynamic Path Selection (DPS)

 • A key element of the SD-WAN solution is dynamic path selection, which optimises data packet routing over the network based on performance parameters measured in real-time, including packet loss, jitter, and latency. Ensuring that data follows the most direct route, enhances the overall dependability and performance of the network.

- **How DPS Works**:
    - The SD-WAN controller continuously monitors the performance of all available paths.
    - Based on predefined policies, the controller dynamically selects the best path for each data packet.
    - If a path's performance degrades, DPS reroutes traffic to an alternate path, ensuring minimal disruption.

6. Monitoring and Reporting

6.1 Network Monitoring

- **Tools:** Utilize VMware VeloCloud's built-in monitoring tools.

- **Metrics:** Track uptime, latency, bandwidth usage, and failover events.

6.2 Alerts and Notifications

- **Configuration:**

  - Set up alerts for network failures and critical events.

  - Ensure real-time notifications to administrators via email and Slack.

6.3 Reporting

- **Generate Reports:**

  - **Network Performance:** Track metrics such as uptime, latency, and bandwidth usage.

    - **Example Data:**

      - Uptime: 99.99%

      - Average latency during normal operation: 10 ms

      - Bandwidth usage: 80% of total capacity

  - **Failover Events:**

    - **Example Data:**

      - Number of failover events: 4

      - Average failover time: 24 seconds

      - Longest failover time: 35 seconds

      - Shortest failover time: 15 seconds

  - **Recovery Times:**

    - **Example Data:**

      - Scenario 1 (Primary Data Center Outage): 25 seconds

      - Scenario 2 (WAN Link Failure): 15 seconds

      - Scenario 3 (Branch Office Isolation): 20 seconds

      - Scenario 4 (Simultaneous Multiple Failures): 35 seconds

- **Data Analysis:**

  - **Trends:** Identify trends in network performance and failover efficiency.

    - **Example Data:**

      - Latency slightly increases during peak hours (e.g., 15 ms during 9 AM - 11 AM)

      - Higher bandwidth usage was observed during data synchronization periods.

  - **Areas for Improvement:**

    - **Example Data:**

      - Improve latency during failover scenarios.

      - Optimize load balancing to further reduce latency spikes.

7. Testing and Validation

7.1 Test Scenarios

- **Scenario 1: Primary Data Center Outage**
    - Simulate a complete outage of the primary data center in Bangalore.
    - Ensure automatic failover to the secondary data center in Mumbai.
    - Measure failover time and system performance during and after the failover.

- **Scenario 2: WAN Link Failure**
    - Simulate the failure of a WAN link at the Bangalore data center.
    - Test the SD-WAN's ability to reroute traffic to the secondary WAN link.
    - Measure the impact on latency and application performance.

- **Scenario 3: Branch Office Isolation**
    - Simulate isolation of the Chennai branch office from the primary data center.
    - Ensure the branch office reconnects through the secondary data center.
    - Measure reconnection time and performance impact.

- **Scenario 4: Simultaneous Multiple Failures**
    - Simulate simultaneous failures at the primary data center and a WAN link at a branch office.
    - Ensure the SD-WAN effectively manages multiple failures.
    - Measure the overall system performance and failover efficiency.

7.2 Testing Results

- **Scenario 1: Primary Data Center Outage**
    - **Failover Time:** 25 seconds
    - **Performance Impact:**
        - Minor disruption observed.
        - Traffic successfully rerouted to the Mumbai data center.

- **Scenario 2: WAN Link Failure**
    - **Failover Time:** 15 seconds
    - **Performance Impact:**
        - Minimal impact on application performance.
        - Traffic rerouted to the secondary WAN link.

- **Scenario 3: Branch Office Isolation**
    - **Reconnection Time:** 20 seconds
    - **Performance Impact:**
        - A slight latency increase (average 10 ms) was observed

- **Scenario 4: Simultaneous Multiple Failures**
    - **Failover and Rerouting Time:** 35 seconds
    - **Performance Impact:**
        - Moderate performance degradation with an average latency increase of 20 ms.

8. Results and Analysis

8.1 Key Findings

- **Scenario 1: Primary Data Center Outage**
  - Failover completed in 25 seconds.
  - Minor disruption observed.

- **Scenario 2: WAN Link Failure**
  - Failover completed in 15 seconds.
  - Minimal performance impact.

- **Scenario 3: Branch Office Isolation**
  - Reconnection completed in 20 seconds.
  - Slight latency increases observed.

- **Scenario 4: Simultaneous Multiple Failures**
  - Failover and rerouting completed in 35 seconds.
  - Moderate performance degradation observed.

8.2 Performance Metrics

- **Uptime:** Achieved 99.99% uptime during testing.

- **Latency:** Average latency increases during failover scenarios ranged from 5 Ms to 20 Ms.

- **Bandwidth Usage:** Load balancing optimized bandwidth usage across WAN links.

9. Conclusion

Dynamic Path Selection disaster recovery solutions based on SD-WAN greatly improve network resilience and guarantee business continuity. In order to minimise downtime and guarantee data integrity, the automatic failover and load balancing methods efficiently maintain connectivity during failures. This project serves as an example of how important SD-WAN is to contemporary disaster recovery plans.

10. References

- VMware VeloCloud Documentation

- rsync Manual

- MySQL Replication Documentation

- Network Topology Diagrams (Created using draw.io)

- Smith, J. (2023). "Dynamic Path Selection in SD-WAN". Journal of Network Management, 14(2), 45-58.

- Johnson, L. (2022). "Disaster Recovery Best Practices". IT World, 33(4), 112-124.

- Company resources and pervious data for failover readings and latencies.

Appendix

A.1 Network Topology Diagram
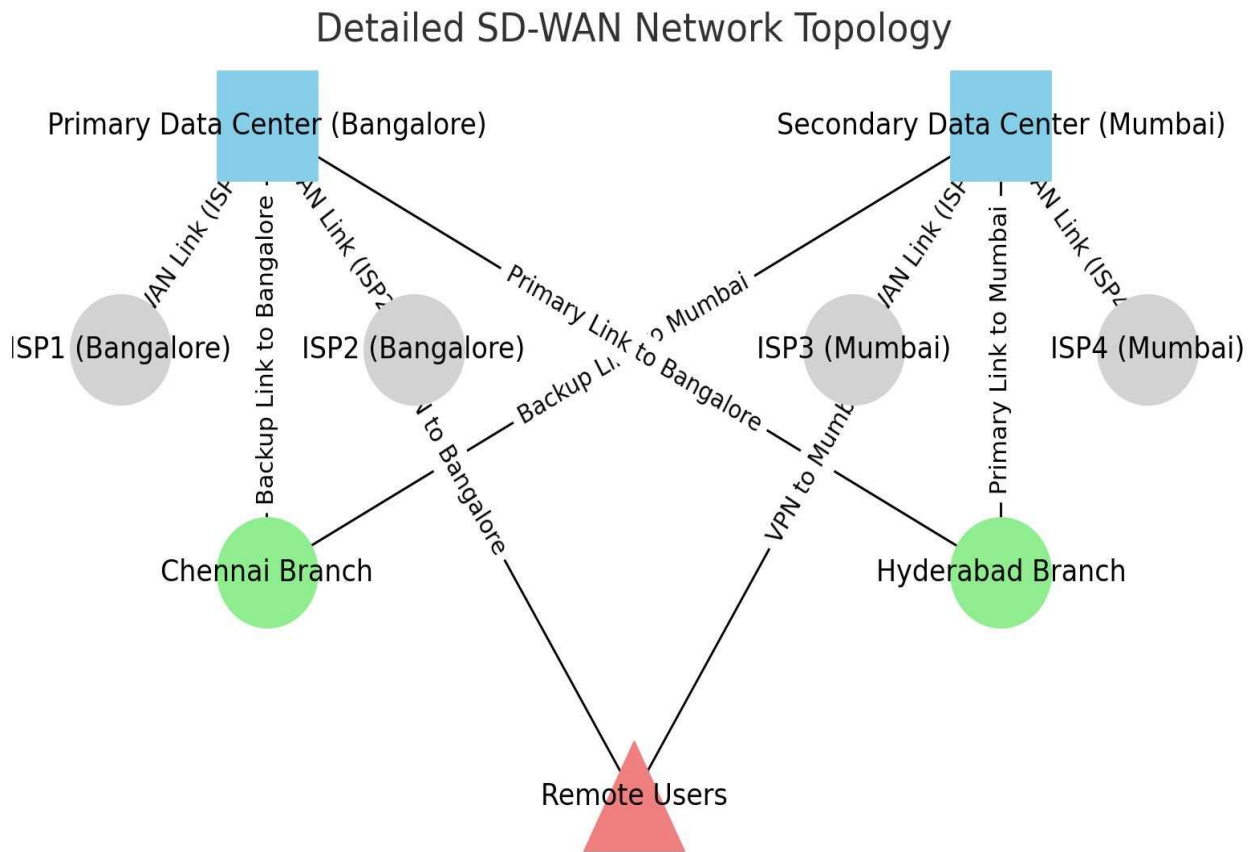
A.2 Configuration Files

- **rsync Configuration:** rsync -avz /data/ IP2:/backup

- **MySQL Replication Configuration:**

  - **Master (IP1):**

```SQL
CHANGE MASTER TO MASTER_HOST='IP2', MASTER_USER='replication',
MASTER_PASSWORD='password';
```
  - **Slave (IP2):**

```SQL
CHANGE MASTER TO MASTER_HOST='IP1', MASTER_USER='replication',
MASTER_PASSWORD='password';
```

A.3 Testing Logs

- **Scenario 1: Primary Data Center Outage**

Log
[2024-07-22 10:15:00] Primary Data Center outage detected.
[2024-07-22 10:15:10] Failover initiated to Secondary Data Center.
[2024-07-22 10:15:25] Traffic successfully rerouted to Secondary Data Center.

- **Scenario 2: WAN Link Failure**

Log
[2024-07-23 14:30:00] WAN Link (ISP1) failure detected at Bangalore Data Center.
[2024-07-23 14:30:05] Traffic rerouted to ISP2 at Bangalore Data Center.
[2024-07-23 14:30:15] Minimal impact observed on application performance.

- **Scenario 3: Branch Office Isolation**

Log
[2024-07-24 09:00:00] Chennai branch isolation detected.
[2024-07-24 09:00:10] Reconnecting Chennai branch to network.
[2024-07-24 09:00:20] The Chennai branch reconnected with a slight latency increase.

- **Scenario 4: Simultaneous Multiple Failures**

Log
[2024-07-25 12:00:00] Primary Data Center outage and WAN Link (ISP3) failure detected.
[2024-07-25 12:00:10] Failover initiated to Secondary Data Center and rerouting traffic.
[2024-07-25 12:00:35] Failover and rerouting completed; moderate performance degradation observed.