Project Proposal

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1. INTRODUCTION

In modern computing environments, data security, availability, and automation are essential requirements. Manual storage management and backup processes are inefficient, error-prone, and unreliable, especially in systems where data changes frequently. DevOps practices emphasize automation, security, monitoring, and reliability to ensure smooth system operations.

This project proposal presents **VirtuFS (Virtual File System)**, a Linux-based DevOps automation tool developed using Bash shell scripting. VirtuFS is designed to automate virtual drive management, encrypted backups, scheduled and short-term backups, access control, logging, system monitoring, and email notifications. The project aims to provide practical exposure to real-world DevOps and Linux system administration concepts in an academic environment.

2. PROBLEM STATEMENT

Many academic and small-scale systems lack proper automated storage and backup mechanisms. Common issues include:

- Absence of regular and secure backups
- Risk of data loss due to manual handling
- No encryption for sensitive data
- Lack of monitoring and alerting mechanisms
- Inefficient storage usage due to missing cleanup policies

There is a need for a lightweight, automated, and secure storage management system that demonstrates how DevOps principles can be applied using Linux tools.

3. PROPOSED SOLUTION

VirtuFS proposes a command-line-based storage automation system that treats directories as virtual drives. The system integrates multiple DevOps functionalities into a single Bash script, including drive management, encrypted backups, automated scheduling, backup rotation, access control, logging, and email notifications.

The proposed solution focuses on:

- Automation of repetitive administrative tasks
- Secure handling of backup data using encryption
- Monitoring and alerting through logs and email notifications
- Simplicity and portability using standard Linux utilities

4. OBJECTIVES OF THE PROJECT

The main objectives of this project are:

1. To design and implement a virtual file system using Linux directories.
2. To automate backup creation using secure encryption techniques.
3. To implement scheduled backups using cron jobs.
4. To support short-term, high-frequency automated backups.
5. To apply backup retention and cleanup policies.
6. To enable secure restoration of encrypted backups.
7. To manage user ownership and file permissions.
8. To maintain logs for auditing and troubleshooting.
9. To monitor system health and backup status.
10. To send email notifications for backup and cleanup events.

5. SCOPE OF THE PROJECT

The scope of the VirtuFS project includes:

- Creation, deletion, mounting, and unmounting of virtual drives
- Encrypted backup and restore functionality
- Automated backup scheduling using cron
- Short-term continuous backup execution
- Backup rotation and old file cleanup
- Email notification using SMTP
- Logging and health monitoring

The project is limited to a command-line interface and is designed for Linux-based systems.

6. METHODOLOGY

The project will be developed using the following methodology:

1. Requirement analysis and system planning
2. Designing directory structure and workflow
3. Implementing core functionalities using Bash scripting
4. Integrating OpenSSL for encryption
5. Automating tasks using cron and background execution
6. Configuring email notifications using msmtp
7. Testing backup, restore, and cleanup processes
8. Documentation and final evaluation

7. TOOLS AND TECHNOLOGIES

The following tools and technologies will be used:

- **Operating System:** Linux (Ubuntu)
- **Scripting Language:** Bash Shell
- **Encryption Tool:** OpenSSL
- **Task Scheduler:** Cron
- **Email Utility:** msmtp
- **Text Editor:** Nano / VS Code

8. EXPECTED OUTCOMES

The expected outcomes of this project include:

- A fully automated and secure storage management system
- Reliable encrypted backup and restore functionality

- Efficient storage usage through backup rotation
- Real-time email notifications for system events
- Improved understanding of DevOps and Linux administration concepts

9. SIGNIFICANCE OF THE PROJECT

This project is significant because it provides hands-on experience with real DevOps practices such as automation, security, monitoring, and system reliability. It bridges the gap between theoretical knowledge and practical implementation, making it highly valuable for academic learning and professional skill development.

10. LIMITATIONS

The limitations of the proposed system include:

- Dependence on correct SMTP configuration for email alerts
- Requires a Linux operating system
- No graphical user interface

11. FUTURE ENHANCEMENTS

Future enhancements may include:

- Integration with cloud storage services such as AWS S3
- Web-based monitoring dashboard
- Incremental and differential backup support
- Role-based access control
- System resource monitoring and alerting

12. CONCLUSION

The VirtuFS project proposal outlines a secure, automated, and efficient storage automation system based on DevOps principles. By combining encryption, automation, monitoring, and notification mechanisms, the proposed system aims to deliver a reliable and educational solution suitable for academic submission and real-world learning.