

CYPHER – AN INDEPENDENT LINUX-BASED OPERATING SYSTEM

Project Reference No.: 49S_BE_0246

College : East West Institute of Technology, Bengaluru
Branch : Department of Information Science and Engineering
Guide : Prof. Ashwini R
Student(s) : Mr. Venkateshwaran S
Mr. Sanjay G K
Mr. Yashwanth Rao H
Mr. Manoj S

Keywords:

Operating System, OS, Independent Linux-based OS, Minimalistic, Init System, Service Manager, Dependency management, Shell Interpreter, Job control, Graphical User Interface, Desktop Environment, Dual-boot mode (Persistent and Ephemeral mode), Time travelling file-system (tenet command), ISO file.

Introduction:

Cypher is an independent Linux-based Operating system which takes leverage of open-source components to innovate a completely novel computing environment. It introduces its own init system built using C language, a shell interpreter built using Python, and a user-friendly graphical environment, designed for speed, security and extensibility. Its objective extends beyond traditional Operating systems by enabling unique features like temporal control, dual boot mode and cyberpunk themed desktop environment. It emphasizes scalability, reliability, and minimalism.

Objectives:

1. Implementing 'Tenet', a temporal utility to make the system travel backwards in time. Users can visit past filesystem states and make it their future, if desired.
2. Enable Dual boot modes: Persistent and Ephemeral. Persistent mode is the standard mode which saves everything to hard disk. Ephemeral mode is a stateless mode, which doesn't save any writes to the hard disk, it entirely takes place in RAM (temporary memory).
3. Implementing 'Trinity', the Init system and Service manager of Cypher. This is the first process that is run by the kernel.
4. Dependency aware service management and resource management.
5. Building Rayshell, a simple shell interpreter to implement command execution with a custom syntax.
6. Designing and implementing a custom cyberpunk themed graphical environment with default apps like Filemanager, Terminal, Settings and environment.

Methodology:

The methodology of the project is:

1. **Requirement Analysis** – Cypher is a secure, high-performance OS with a custom userland, init system, cyberpunk GUI, dual modes, and temporal state control, fully compatible with Linux binaries.
2. **System Design** – Cypher uses a modular architecture separating kernel, init, shell, and GUI, with tight kernel, init integration and a lightweight userland for efficiency.
3. **System configuration and Integration** – Cypher integrates its init, shell, and GUI into a unified system, with kernel modules enabling temporal operations, dual booting, and secure sandboxing.
4. **Implementation** – Cypher's core modules—Trinity (init), Rayshell, Tenet, and GUI—are built on the Linux kernel, with C used for low-level components and Python/PyQt for the user interface.
5. **Testing** – Performed unit, integration, system, and user testing for correctness and stability and performance.
6. **Optimization** – Cypher optimized for fast-boot, low-latency, security and minimal resource usage.
7. **Deployment** – Cypher was packaged as an x86 ISO file with steps to setup and verification.

Result and Conclusion:

Cypher is a modular Linux-based OS with a custom init system, shell, Tenet temporal utility, and a cyberpunk GUI, designed for performance and security. It supports dual boot modes (persistent and ephemeral) and delivers stable performance, low resource usage, and functional temporal rollback, showcasing a novel approach to secure and innovative operating systems.

References:

1. [1] G. Beekmans, Linux From Scratch, LFS Community, 2023.
2. [2] The Linux Documentation Project (TLDP), Linux Guides and HOWTOs, Community Publication, 2022.
3. [3] OSDev.org, Operating System Development Wiki and Forum, Open-Source Community Resource, 2023.
4. [4] GNU Project, Bash Manual: The GNU Bourne Again Shell, Free Software Foundation, 2023.
5. [5] X. Sun, Y. Cai, R. Jiang, and J. Qin, "Design and Implementation of a 64-bit Multi-Process Microkernel OS," Journal of Software Engineering and Applications, vol. 15, no. 2, pp. 112–125, 2022.
6. [6] A. Kumar, M. Iyyappan, S. Priyan, S. K. Jha, and H. Gaikwad, "ASH OS: A Comprehensive Linux-Based OS with Optimized User Interface," International Journal of Computer Applications, vol. 182, no. 10, pp. 45–52, 2023.
7. [7] Riverbank Computing Ltd., PyQt5 Documentation, Version 5.15, 2023.
8. [8] The Linux Kernel Organization, The Linux Kernel Archives, Available: <https://www.kernel.org>, Accessed: Oct. 2025.

Future Scope:

The future scope of this project includes:

1. A fully functional operating system built on the Linux kernel with its own init system, shell, and cyberpunk-themed GUI, ensuring autonomy from existing Linux distributions.
2. Stable implementation of Persistent and Ephemeral boot modes, along with the Tenet utility for controlled temporal navigation, rollback, and state control.
3. A robust Ephemeral Mode enabling ethical hacking, malware testing, and cybersecurity research in a secure, disposable runtime environment.
4. Optimized boot sequences, lightweight GUI rendering, and dependency aware service management ensuring low-latency performance and high system stability.
5. Operational reversible filesystem and fine-grained time control allowing users to explore system introspection and causal state tracing.
6. A sleek cyberpunk-themed interface combining neon visuals with intuitive design for enhanced clarity and immersion. It prioritizes functionality and responsiveness, ensuring a futuristic yet practical user experience with all essential applications.
7. Cypher offers a secure, modular environment for research and cybersecurity, enabling safe testing and experimentation through its ephemeral and sandboxed design.