

# ENSURING CONSISTENT USER EXPERIENCE ACROSS WINDOWS, MACOS, AND LINUX SYSTEMS

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## Анотація

У роботі досліджуються методи забезпечення стабільного користувацького досвіду (UX) на десктопних операційних системах, включаючи Windows, macOS та дистрибутиви Linux. Особлива увага приділяється викликам фрагментації середовищ робочого столу в Linux (GNOME, KDE) та способам уніфікації інтерфейсів за допомогою сучасних фреймворків.

**Ключові слова:** користувацький досвід (UX), Linux, кросплатформеність, середовище робочого столу, програмна інженерія.

## Abstract

The paper explores methods for ensuring a consistent user experience (UX) across desktop operating systems, including Windows, macOS, and Linux distributions. Particular attention is paid to the challenges of desktop environment fragmentation in Linux (GNOME, KDE) and methods for unifying interfaces using modern frameworks.

**Keywords:** user experience (UX), Linux, cross-platform, desktop environment, software engineering.

## Introduction

In the modern landscape of software engineering, providing a seamless user experience (UX) across diverse operating systems has become a fundamental requirement for high-quality software products. While Windows and macOS offer relatively stable and centralized design ecosystems, the inclusion of Linux introduces significant complexity due to the fragmentation of desktop environments like GNOME and KDE Plasma. For a developer, the challenge lies not only in visual replication but in maintaining functional predictability, where users expect familiar interaction patterns regardless of whether they are working in a proprietary or open-source environment. This necessity for consistency is driven by the increasing mobility of professional users who frequently transition between different system architectures during their workflow.

Furthermore, the evolution of cross-platform development has shifted from simple code portability to deep UI/UX integration. According to recent academic perspectives, the success of a software product is often measured by its ability to reduce the user's cognitive load when switching between platforms [1]. The integration of Linux into the development lifecycle is no longer an optional task for niche applications but a strategic necessity, especially given the rise of tools like WSL2 and containerized environments. Therefore, understanding the intersection of system-specific APIs and universal design principles is crucial for building resilient, scalable, and user-friendly software that remains effective across all major desktop platforms.

## Research results

The process of achieving UX consistency requires a multi-layered engineering approach that balances abstraction with native performance. Our research indicates that the choice of UI toolkits, such as Qt or GTK, plays a decisive role in how an application adapts to different window managers and display servers like X11 or Wayland. By implementing advanced design patterns specifically tailored for multi-platform systems, developers can ensure that visual components remain stable while respecting the unique rendering logic of each OS [1]. One of the most effective methods for solving the fragmentation issue on Linux is the adoption of containerized distribution formats like Flatpak, which allow for a consistent runtime environment across various distributions [4]. This approach minimizes the "dependency hell" and ensures that the application's interface remains identical to its intended design regardless of the underlying system libraries.

Moreover, the study of language features and architectural patterns shows that abstracting platform-specific logic into separate modules allows the core application to maintain high performance without sacrificing its cross-platform integrity [3]. Practical implementation of these principles reveals that developers must also account for OS-specific navigation and input methods to avoid the "uncanny valley" effect, where an application feels out of place in its host environment. By leveraging modern frameworks that support adaptive styling, it is possible to mimic native Windows Mica effects or macOS translucency within a unified codebase, thereby fulfilling the technical requirements of modern software design [2]. Ultimately, the integration of these methodologies leads to a significant reduction in long-term maintenance costs and a substantial improvement in the overall reliability of the software across Windows, macOS, and Linux ecosystems.

## Conclusion

Achieving consistency in user experience across various operating systems is an essential component of modern software engineering. By utilizing containerized packaging and adaptive UI toolkits, developers can bridge the gap between fragmented Linux environments and centralized proprietary systems, ensuring optimal performance and user satisfaction.

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