Systematic analysis of mobile banking application security vulnerabilities across different operating systems

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1 Introduction

The proliferation of mobile banking applications has fundamentally transformed financial services delivery, with over 65

This research addresses critical gaps in current mobile banking security literature by conducting a systematic cross-platform vulnerability analysis that accounts for the complex interplay between operating system characteristics and application security implementations. Our investigation moves beyond conventional vulnerability categorization to examine how platform fragmentation influences vulnerability manifestation, detection complexity, and remediation effectiveness. The study employs a novel multi-method assessment framework that integrates static application security testing, dynamic behavioral analysis, and platform-specific security feature evaluation.

We formulate three primary research questions: How do vulnerability distributions differ systematically across major mobile operating systems? What platform-specific architectural factors contribute to differential vulnerability manifestation? To what extent do current security assessment methodologies adequately account for platform heterogeneity in mobile banking contexts? These questions guide our investigation into the complex security landscape of modern mobile banking ecosystems.

2 Methodology

Our research methodology employs a multi-phase assessment framework designed to capture the complex interactions between platform architecture

and application security. The study analyzed 150 mobile banking applications across iOS, Android, and emerging platforms, selected through stratified random sampling to ensure representative coverage of different banking institution sizes, geographic regions, and application maturity levels.

The assessment framework integrates three complementary analytical approaches: static code analysis using enhanced pattern recognition algorithms capable of identifying platform-specific code vulnerabilities; dynamic runtime monitoring employing custom instrumentation to track security-relevant behaviors during actual application usage; and comparative platform architecture analysis examining how operating system security models influence vulnerability manifestation. Each application underwent comprehensive security testing across multiple usage scenarios, including authentication, financial transactions, data storage, and inter-app communication.

We developed novel assessment instrumentation specifically designed for cross-platform vulnerability comparison. This included custom security testing harnesses that could execute identical test cases across different platforms while accounting for platform-specific security controls. The instrumentation captured detailed vulnerability metrics including exploit complexity, potential impact severity, detection difficulty, and platform-specific manifestation patterns. Statistical analysis employed multivariate regression models to identify significant relationships between platform characteristics and vulnerability distributions.

Data collection occurred over a six-month period, with applications tested across multiple operating system versions to account for platform evolution effects. Security testing followed responsible disclosure protocols, with all identified vulnerabilities reported to respective application developers through established security channels. The methodology incorporated rigorous validation procedures, including independent expert review of vulnerability classifications and cross-verification of findings through multiple assessment techniques.

3 Results

Our systematic analysis revealed significant differences in vulnerability distributions across mobile operating systems, with platform architecture emerging as a primary determinant of security posture. Android applications exhibited substantially higher rates of cryptographic implementation flaws (42

The research identified previously undocumented vulnerability patterns that manifest differently across platforms. Platform-specific API misuse constituted a significant vulnerability category, with Android applications more frequently misusing inter-process communication mechanisms while iOS applications exhibited higher rates of keychain service misconfiguration. These patterns reflect fundamental differences in platform security models and developer accessibility to low-level system components.

Cross-platform analysis revealed that vulnerability detection effectiveness varies significantly across assessment methodologies. Static analysis tools demonstrated higher precision for iOS applications due to the platform's standardized development environment, while dynamic analysis proved more effective for Android applications where runtime behavior varies substantially across device configurations. This finding has important implications for security testing strategy selection in heterogeneous mobile environments.

Statistical analysis identified strong correlations between specific platform features and vulnerability categories. Applications targeting newer Android permission models showed 28

Our findings challenge conventional assumptions about mobile platform security superiority, revealing instead a complex landscape where each platform exhibits distinct security strengths and weaknesses. The research provides empirical evidence that effective mobile banking security requires platform-aware assessment approaches that account for these differential vulnerability patterns.

4 Conclusion

This research makes several significant contributions to mobile banking security knowledge. First, we demonstrate empirically that vulnerability distributions differ systematically across mobile operating systems, with platform architecture serving as a primary determinant of security posture. Second, we introduce a novel vulnerability classification taxonomy that accounts for platform-specific manifestation patterns, providing a more nuanced framework for cross-platform security assessment. Third, we develop and validate a comprehensive methodology for cross-platform vulnerability analysis that can adapt to evolving mobile ecosystem architectures.

The findings have important practical implications for multiple stakeholders. Banking institutions should adopt platform-specific security testing

strategies that account for differential vulnerability patterns, rather than applying uniform assessment approaches across platforms. Application developers require enhanced guidance on platform-specific secure coding practices, particularly regarding cryptographic implementation and data storage security. Platform vendors can leverage these insights to strengthen security architectures in areas where applications demonstrate consistent vulnerability patterns.

This research also identifies several promising directions for future work. Longitudinal studies tracking vulnerability evolution across platform generations could provide insights into the effectiveness of platform security enhancements. Investigation of emerging platforms and their security implications represents another critical research avenue. Additionally, developing automated tools that incorporate platform-aware vulnerability detection represents an important practical application of this research.

The systematic approach developed in this study provides a foundation for more effective mobile banking security assessment in an increasingly fragmented digital ecosystem. By accounting for platform heterogeneity and its security implications, stakeholders can develop more targeted and effective security strategies that address the unique challenges of cross-platform mobile banking environments.

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