EBOOK

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Unleash the Performance of Digital Banking Apps

CONTENT INSIDE

INTRODUCTION

In the rapidly evolving banking landscape, digital applications have become indispensable tools for both financial institutions and customers. These applications enable convenient access to a wide range of banking services, including account management, fund transfers, bill payments, and financial planning.

As the reliance on digital banking applications continues to grow, ensuring their optimal performance and reliability has become a critical priority for banks and financial institutions.

Approximately 87% of banks agree that improving customer service, client engagement and the ability to deliver new services is critical to generate new leads and new revenue streams. The Financial Services State report predicts that BaaS will have a significant impact on 85% of global financial institutions, further driving the digital transformation of banking services. The shift towards cashless transactions is gaining momentum, with the transaction volume expected to more than double by 2030. In addition, the rise of innovative financial services, such as Buy Now Pay Later (BNPL), is reshaping consumer behavior. Over 39% of Americans have already tried BNPL at least once, highlighting the evolving landscape of financial transactions and the growing demand for seamless and efficient digital banking experiences.

In 2022, a notable incident occurred within the banking industry, shedding light on the critical importance of perfect performance testing. A UK-based bank faced a significant outage that impacted its online banking and app platforms, leaving customers unable to access essential services. This incident highlights the potential repercussions that banks may face without robust performance testing measures in place.

As customers increasingly rely on digital banking services for their financial needs, ensuring uninterrupted availability and seamless functionality becomes paramount.

By implementing effective performance testing processes and adhering to best practices, organizations can ensure seamless user experiences, minimize downtime and enhance customer satisfaction. Embracing the transformative potential of digital banking and investing in robust performance testing strategies will position banks for success in an increasingly digital-driven future

BACKGROUND

Banking in specific has undergone significant changes in the last few years, driven by technological advancements, evolving customer expectations, regulatory changes and market dynamics.

The COVID-19 pandemic accelerated the adoption of digital banking applications much further as people sought to minimize physical interactions. Social distancing measures and lockdowns prompted many individuals and businesses to rely heavily on digital banking services for their financial needs.

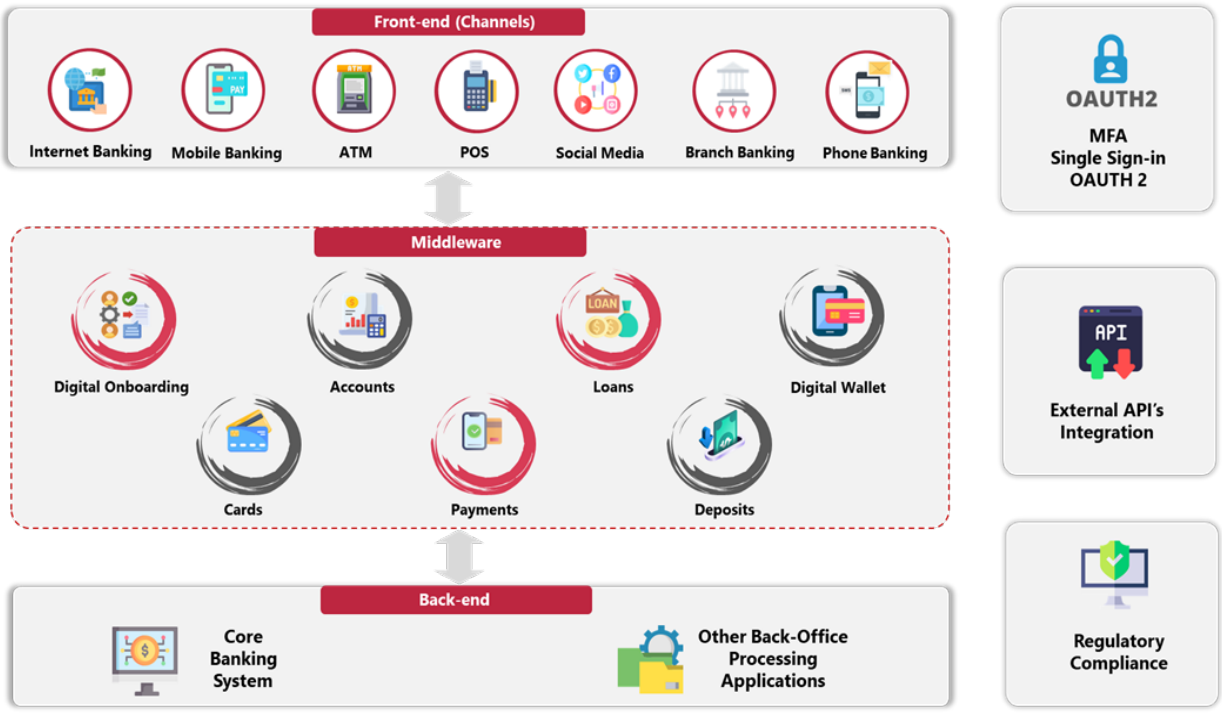
Digital banking applications provide customers with the convenience of accessing banking services at any time and from anywhere. These applications offer a broad array of secure functionalities that were previously conducted in person at physical bank branches. Customers can securely access their bank accounts through these applications to view account balances, transfer funds, pay bills, and even apply for loans.

Digital banking applications are expected to deliver exceptional performance, maintain data integrity and protect sensitive customer information. Failure to meet these expectations can result in dissatisfied customers, loss of business and damage to the bank's reputation. So, in the development of digital banking application, performance testing plays a crucial role.

By conducting performance testing, banks and financial institutions can proactively address potential performance issues before they impact end-users. The testing process involves creating realistic test scenarios, simulating heavy user loads and monitoring system behaviour. It helps identify performance bottlenecks, fine-tune application configurations, optimize resource utilization and enhance the overall performance of the digital banking application.

ARCHITECTURE OF DIGITAL BANKING APPLICATION

Digital banking application typically involves multiple components that work together to provide the desired functionality and services. While specific architectures may vary depending on the application's requirements, below is the common architecture pattern for digital banking apps.



Architecture of digital banking application

1. Presentation Layer

This layer refers to the user interface (UI) and user experience (UX) components that enable customers to interact with the banking system. It is the front-end layer responsible for displaying information, receiving user input and providing a seamless and intuitive user experience. Digital banking provides various channels for end users – Web, Mobile, ATM and POS.

Below are typical functionalities found in the presentation layer:

- Account dashboard
- Fund transfers
- Deposits
- Bill payments
- Loans
- Cards
- Investments
- Help and Support

ARCHITECTURE OF DIGITAL BANKING APPLICATION

2. Application Layer

It acts as the intermediary between the presentation layer (user interface) and the backend infrastructure. This layer contains the business logic and rules that govern the operations of the digital banking application. It handles user requests, processes transactions, and performs validations and calculations. This layer is responsible for managing user authentication, authorization, and session management.

- **Business logic -** The layer implements the specific business rules and processes of the digital banking application. It includes algorithms, workflows, and validations that govern various banking operations
- **Data processing -** The layer handles the processing and manipulation of data required for banking operations. This involves retrieving and storing customer information, performing calculations, generating reports, and updating data in the backend systems.
- **Transaction processing -** Manages the processing of financial transactions initiated by customers. It ensures the accuracy, integrity, and security of transactions, including fund transfers, bill payments, and other monetary transactions. This can involve validating transaction details, updating account balances, and generating transaction records.
- **Security and Compliance -** Includes security measures and compliance checks to protect customer data and ensure regulatory compliance. This can involve implementing encryption, access controls, fraud detection mechanisms, and adhering to industry-specific security standards and regulations.
- **Application Performance -** The application layer is responsible for ensuring optimal performance and responsiveness of the digital banking application

It includes performance optimization techniques, such as caching, query optimization, and resource management, to enhance the speed and efficiency of operations.

3. Middleware Layer

In the context of digital banking, middleware refers to the software components or services that act as intermediaries between different systems, applications, or layers within the banking infrastructure. It helps facilitate communication, data exchange, and integration between various software components in a secure and efficient manner.

Here are some examples of middleware used in digital banking -

- **API Gateways –** API gateways serve as a centralized entry point for APIs offered by diverse banking systems, offering security, authentication, and authorization mechanisms. They also handle request routing and transformation, enabling secure and seamless data sharing among various systems.
- **Message Brokers -** Message brokers enable asynchronous messaging and communication between different banking systems. They ensure reliable delivery of messages between applications, even if the sender and receiver are not available simultaneously.
- **Enterprise Service Bus (ESB) –** ESB allows integration and communication between various applications and services within the digital banking ecosystem. It provides a central hub for routing messages, transforming data formats, and orchestrating complex workflows. ESBs often support different communication protocols and data transformation standards to enable seamless interoperability between systems.

ARCHITECTURE OF DIGITAL BANKING APPLICATION

- **Identity and Access Management (IAM) –** Plays role in managing user authentication, authorization, and identity-related services. It handles user authentication, session management, single sign-on (SSO), and access control across multiple banking systems and applications. IAM middleware ensures secure access to banking services while providing a seamless user experience.
- **Data Integration -** Responsible for connecting and synchronizing data between different banking systems, databases, and applications. It enables real-time or batch data integration, transformation, and synchronization to ensure data consistency and accuracy across the banking ecosystem. Data integration middleware helps consolidate data from various sources, such as core banking systems, customer relationship management (CRM) systems, and data warehouses.

4. Backend Layer

In a digital banking application, the backend refers to the server-side components and infrastructure that handle the processing, storage, and management of data and business logic. It encompasses the underlying systems that support the application's functionalities and enable the interaction between the frontend (user interface) and the data storage systems.
Here are some key aspects of the backend in a digital banking application:

- **Integration with channels and systems -** Core banking systems integrate with various banking channels, such as mobile banking, internet banking, ATMs, and branch systems. They ensure consistent and synchronized data across multiple channels and enable seamless banking experiences.
- **Database Management** - The backend manages the storage and retrieval of customer data, account information, transaction records, and other relevant data. It typically involves working with databases, , such as relational databases, to securely store and organize the data required for banking operations.
- **Batch processing -** The backend often includes batch processing capabilities for handling tasks that require bulk data processing. This can include overnight transaction posting, interest calculation, statement generation, or other periodic processes.

5. Security Layer

Refers to the set of measures and protocols implemented to protect customer data, transactions, and the overall integrity of the banking system. It encompasses various components and practices that safeguard sensitive information and prevent unauthorized access or fraudulent activities.

Here are some key aspects of the security layer in digital banking:

- **Authentication & Authorization -** Authentication and authorization are crucial aspects of digital security. Authentication includes techniques like passwords, biometrics, OTPs, and security tokens, while authorization ensures proper access privileges based on user roles and permissions.
- **Data Encryption -** Sensitive data, such as customer information, account details, and transaction data, is safeguarded through encryption techniques like SSL or TLS. These techniques encrypt the data during transmission and storage, ensuring its protection from unauthorized access or interception.
- **Secure Communication -** Ensures safe data transmission by using protocols like HTTPS, protecting against eavesdropping and tampering.

CHALLENGES FACED BY BANKING APPLICATION IN TERMS OF PERFORMANCE

Digital banking applications face several challenges in terms of performance, which can impact the user experience and the overall success of the application.

Here are some common challenges:

1. **Response time –** Users expect application to provide faster response for their queries and transactions. Slow response time are new downtime today, can lead to customer dissatisfaction, they may switch to another application or system. Ensuring consistent fast response time even during high load and complex transactions is one of the key challenges.
2. **Scalability –** Application must be able to handle increasing user loads and transaction volumes. As the user base grows, the application should scale seamlessly to accommodate the demand. However, ensuring effective scalability while maintaining optimal performance can be challenging, especially during peak usage periods.
3. **Reliability and Availability –** Application crashes, downtime, or disruptions can severely impact customer trust and satisfaction. Ensuring high availability and minimal downtime requires robust infrastructure, efficient load balancing, and proactive monitoring.
4. **Complex internal and external integration –** Application often integrate with various internal and external systems, such as payment gateways, core banking systems, or third-party services. Ensuring smooth integration and interoperability while maintaining performance can be challenging. Issues with data synchronization, compatibility, or communication between systems can impact the overall performance of the application.

Addressing these performance challenges requires thorough performance testing, capacity planning, infrastructure optimization, and continuous monitoring. By proactively identifying and resolving performance issues, digital banking applications can deliver a seamless and responsive user experience, maintain customer satisfaction, and foster trust in the application's reliability and security.

BENEFITS OF PERFORMANCE TESTING

Performance testing for digital banking applications offers multiple benefits: improved user experience, increased customer retention, business growth, scalability planning, system reliability, cost optimization and security compliance. By investing in performance testing, banks can deliver high-performing applications that meet user expectations, drive customer satisfaction, and achieve success in the digital banking landscape.

Here are some of the key benefits of performance testing.

Enhanced user experience

Performance testing optimizes digital banking applications to provide a fast, responsive, and seamless user experience, aligning with your design requirements.

Increased customer retention

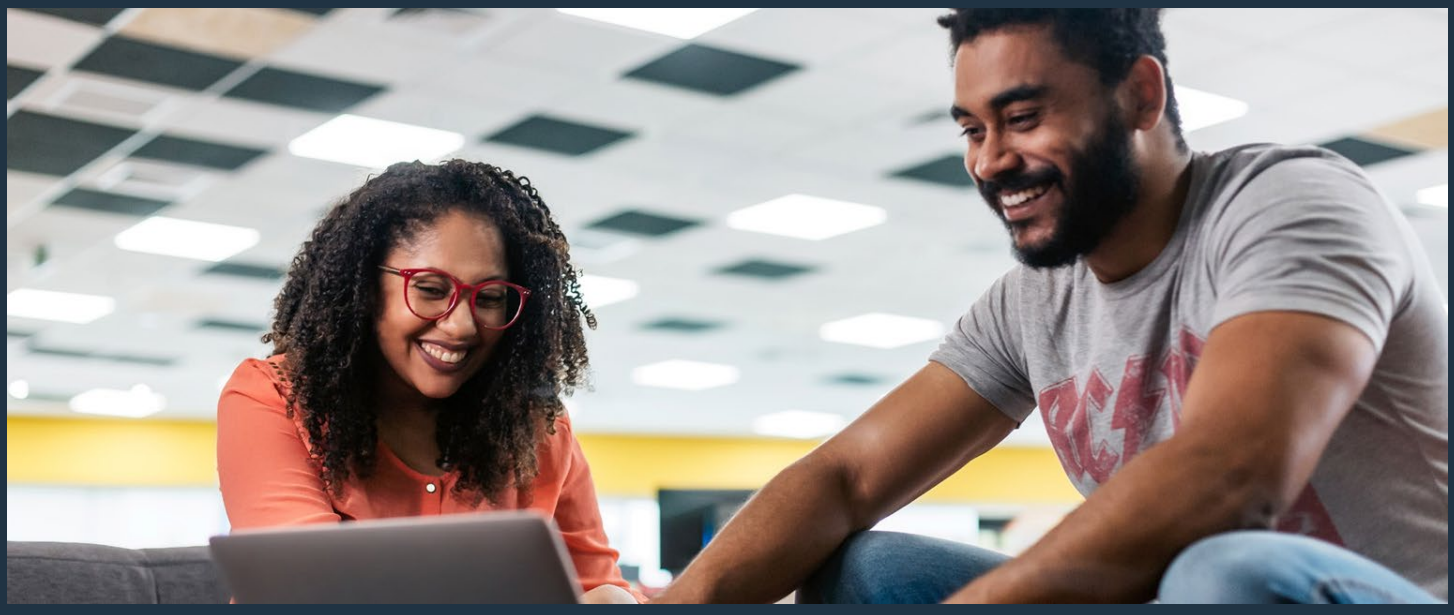
Performance testing helps enhance customer retention in digital banking applications by proactively identifying and resolving performance issues that can lead to user frustration and the search for alternatives.

Business Growth and Competitiveness

Performance testing is crucial for banks to stay competitive in the digital banking industry, as it ensures high-performing applications that attract and retain customers, leading to business growth and improved market position.

Cost Optimization

Performance testing identifies and addresses performance bottlenecks and inefficiencies, optimizing costs by preventing expensive fixes and rework in the production environment. It also optimizes resource utilization, infrastructure requirements, and capacity planning, leading to cost savings for banks while adhering to your design specifications.



PERFORMANCE TESTING PROCESS

Here's a detailed process for conducting performance testing for a digital banking application:

1. Planning & Preparation

- Understand the application architecture.
- **Define performance testing key goals and objectives –** Identify key performance metrics you want to measure, such as response time, throughput, scalability, and resource utilization. These objectives will help guide testing approach.
- **Identify scenarios -** identify critical transactions and scenarios that need to be tested. This could include tasks like logging in, checking account balances, transferring funds, and generating reports. Create realistic test scenarios that mimic real-world usage patterns.
- Identify workload profiles to simulate realistic load on the system

Following are some of the key business processes which we recommend for performance testing.

- **Account statement view -** Account statement viewing capability, including mini statements and specific date ranges.
- **Account statement download -** Easy account statement download capability.
- **Beneficiary management -** Beneficiary/payee management capability for transfers.
- **Transfer to own accounts -** Fund transfer capability between the customer's own accounts.

PERFORMANCE TESTING PROCESS

- **Transfer to same bank accounts -** Find transfer capability to other accounts within the same bank.
- **Transfer to other bank accounts -** Fund transfer capability to accounts in other local banks.
- Register & approve biller - Process for registering and approving billers for hassle-free payments.
- **Pay credit card bill -** Capability for paying credit card bills.
- **Cheque Book Request -** Initiating a request for a new cheque book by contacting the bank.
- **Utility Bill Payment -** Selecting a utility bill and making payment through the preferred payment channel.

2. Design & Develop scripts

- **Test environment –** Co-ordinate environment set-up. Set-up dedicated performance testing environment that closely resembles your production environment. This should include hardware, software, and network configurations, as well as relevant databases and servers. Ensure the environment is isolated to prevent interference from other systems.
- Set-up appropriate performance testing & monitoring tool based on requirement and budget. Choose tool that can generate desired load, simulate user behaviour and provide detailed performance metrics. Set-up monitoring tool for measuring key performance metrics and health of server.
- Develop test scripts for identified critical scenarios; Enhance the scripts to handle dynamic parameters, add think time and configure test data to mimic real user behaviour.
- Perform dry run of scripts and create a baseline.

3. Execute & Analyse

- Run performance tests using the defined test scripts and configurations.
- Monitor system health during the test capturing relevant performance metrics like response time, transaction throughput, error rates, and resource utilization.
- Analyze the collected performance metrics to identify bottlenecks, performance issues, and areas for improvement. Compare the observed performance against defined benchmarks or service-level agreements (SLAs). Look for trends, anomalies, and areas of the system that may require optimization.
- Publish performance test reports
- Based on the analysis of the test results, optimize the digital banking application to address performance issues. This could involve tuning server configurations, optimizing database queries, improving caching mechanisms, or enhancing code efficiency. After implementing the optimizations, rerun the performance tests to validate the improvements

BEST PRACTICES

Performance testing of digital baking application requires comprehensive planning and execution to ensure a seamless and reliable user experience across various channels.

Here are some of the best practices specifically tailored to performance testing of digital banking application.

1. Identifying scenarios

Identifying appropriate scenarios for performance testing is crucial to ensure digital banking application is thoroughly tested under realistic conditions. Here are some key considerations.

- Prioritise the most critical and frequently performed user actions.
- Study the usage patter and behaviour of real users in production environment, if available.
- Create scenarios that over end-to-end user journeys, for example user logging-in, followed by viewing account details, making a fund transfer, checking balance and finally logging-out.

2. Real-world

Include tests from across various channels – Web, Mobile, ATM, POS to simulate real-world load conditions. In addition, simulate anticipated peak loads during specific times (e.g salary days), this will ensure the performance test accurately reflects actual usage patterns

3. Data volumes

Use representative data sets that mimic the volume and complexity of real-world banking data. Consider a range of data sizes, such as different numbers of accounts, transaction histories, and user profiles. Performance testing with realistic data helps identify any performance issues related to data processing, retrieval, and storage.

4. Network and Connectivity factors

Digital banking applications are accessed through various networks and devices. Test the application's performance under different network conditions, including high latency, low bandwidth, or intermittent connectivity. This helps identify any performance issues related to network communication, data synchronization, or mobile device compatibility.

5. Load Generation

Generate load from distributed locations or device types to observe the behaviour. Integrate load generators from various geographically distributed locations that represent majority of customer base.

6. Client-side performance

Measure client-side performance during peak load conditions. For Internet banking application, measure page load time at UI layer, check for rendering time across various browsers. For Mobile banking application, check response time, CPU, battery and memory consumption using physical device during peak load condition.

Ensure that the performance testing process is iterative, allowing for continuous improvements based on results and feedback. It is crucial to engage the development, operations, key stakeholders from Bank and QA teams at every stage to guarantee thorough performance testing and optimization of the digital banking application.

CONCLUSION

Performance testing of digital banking applications is a critical component in ensuring the success and reliability of modern software systems. As technology advances and user expectations continue to rise, it becomes imperative for businesses, especially in the digital banking sector, to invest in comprehensive performance testing practices.

By conducting performance testing, banks can enhance the user experience, increase customer retention, drive business growth, optimize costs and ensure compliance with security requirements. Through meticulous planning, well-designed test scenarios, and thorough analysis of performance metrics, banks can identify and address performance bottlenecks, optimize resource utilization, and deliver high-performing applications that meet user expectations. The architecture of digital banking applications, along with the best practices outlined in this white paper, provides a solid foundation for effective performance testing. By adopting these practices, banks can proactively mitigate risks, enhance system reliability, and deliver seamless and efficient digital banking experiences.

It is crucial for banks to view performance testing as an ongoing process rather than a one-time activity. Continuous monitoring, analysis, and optimization are key to ensuring that digital applications perform optimally in an ever-evolving technological landscape. By embracing a proactive approach and making performance testing an integral part of their development and maintenance processes, banks can stay ahead of the competition, drive customer satisfaction, and achieve sustainable business success.

Performance testing is not just a technical necessity; it is a strategic imperative for digital banking institutions. By investing in performance testing, banks can build trust, foster customer loyalty, and create a competitive advantage in today's digital-first era.

TESTHOUSE PERFORMANCE ENGINEERING SERVICES

At Testhouse, we take pride in our extensive experience in delivering large-scale performance engineering services for our clients. With the capability to deliver tests for up to 500,000 users within just 6 to 8 weeks, we are confident in our ability to optimize the performance and stability of your digital products. Our team consists of over 30 performance testing specialists who deliver services to customers across the globe. We have a wealth of experience in a variety of performance testing tools, including Jmeter, Gatling, HP LoadRunner, Neoload and more. One of our key strengths is our ability to apply shift-left testing practices around performance, which has helped us to reduce the cost of quality by identifying defects early in the life cycle.

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Whether you have a query or an enquiry, specific or general, we are more than happy to help. .

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