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Design and Development of a Web-Based Customer Queue Information System on a Local Area Network Using PHP (Case Study: PT BPD Jambi Sharia Branch)

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ABSTRACT

Optimal customer service is a key factor in improving banking service quality. At PT BPD Jambi Sharia Branch, queue management is still conducted manually using paper-based queue numbers, which is inefficient and prone to errors. This study aims to design and develop a web-based customer queue information system operating on a local area network (LAN). The system was developed using the Waterfall method, including requirement analysis, system design, implementation, and testing. The technologies used are PHP and MySQL as the database. The system is designed without a login mechanism because it is intended for use in a controlled internal environment. The results show that the system improves service efficiency, simplifies queue management, and reduces errors in queue calling. Therefore, this system supports the digitalization of customer service in the banking environment. Furthermore, the system is expected to enhance operational accuracy, accelerate service time, and provide a more organized queue experience for customers at the branch and improve overall system performance.

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1. Introduction

High-quality service is one of the key factors in enhancing customer trust and satisfaction with a banking institution[1]. Amid rapid technological advancements, demands for fast, accurate, and efficient service are increasing. Customers not only expect accurate service but also convenience in the service process, including in terms of queue management[2]. Therefore, a queue system is a crucial component in supporting service quality in the banking sector.

A good queueing system can manage the service flow in a structured manner, thereby minimizing wait times and improving staff efficiency. Conversely, queue systems that are still managed manually tend to cause various problems, such as irregularities in the service order, potential errors in calling queue numbers, and a lack of transparency in information for customers[3]. These conditions can lead to a decline in customer satisfaction and a reduction in the quality of service provided.

PT BPD Jambi Syariah Branch, as a regional financial institution, plays a crucial role in serving the community. The high volume of customer visits, particularly during specific periods such as the beginning and end of the month, necessitates an effective and efficient service system. Based on the results of the observations conducted, the queue management process at this institution is still carried out manually using paper-based queue number recording. This method is considered ineffective because it has the potential to cause errors in recording and calling queue numbers, and it is unable to provide accurate information regarding queue position and estimated waiting times.

Furthermore, the manual system in use is also unable to provide structured and well-documented historical data. This makes it difficult for management to evaluate service performance, such as the number of customers served during a specific period, average service time, and operational efficiency levels. The absence of such integrated data poses a challenge for data-*driven decision-making*[4].

With the advancement of information technology, various studies have shown that the implementation of web-based information systems can serve as a solution to improve service quality, particularly in queue management [5]. Web-based systems enable automated queue management processes, provide real-time information, and can store data in a structured manner within a database [6]. Thus, this system can improve operational efficiency and reduce the error rate caused by manual processes.

Based on these identified issues, this study aims to design and develop a web-based customer queue information system that functions entirely within a local network environment. The system is built using PHP Native for backend development and MySQL as the database management system, allowing for lightweight, fast, and easily maintainable implementation. The proposed system is designed to automate queue handling processes, replacing manual paper-based methods that are often inefficient and prone to human error. Through this system, staff can manage customer queues more systematically, while customers receive clearer and more structured queue information. In addition, the system supports real-time updates within the internal network, enabling smoother coordination between service counters and queue displays. The absence of dependence on internet connectivity also ensures that the system remains operational even in situations where external network access is unstable or unavailable[7].

Furthermore, this study is expected to make a meaningful contribution to the development of simple yet effective local-based information systems, particularly in the context of service management in banking institutions. By demonstrating the feasibility of LAN-based queue systems, this research provides an alternative design model that can be adopted or adapted by other organizations facing similar infrastructure constraints. In addition, it is anticipated that this work can serve as a reference for future studies related to information technology-based queue management systems, especially those focusing on improving service efficiency, system reliability, and operational independence in environments with limited or unstable internet access.and serve as a reference for future research related to information technology-based queue management.

2. Research Method

2.1 Type and Research Approach

This study is *applied research* that produces a software artifact in the form of a web-based queue information system. The system design approach uses the *Waterfall* model of *the System Development Life Cycle* (SDLC). This model was chosen because it features a sequential design process that is well-documented, making it suitable for system design in environments where requirements are clearly defined from the outset[8]. Each phase in this model produces documentation that serves as the foundation for the subsequent phase, thereby minimizing the risk of deviating from the established specifications.

2.2 Research Location and Time

The research was conducted at the Sharia Branch of PT BPD Jambi in Jambi City. The location was selected based on the results of preliminary observations that identified specific operational issues in the existing customer queuing system. The research took place from February to April 2026, covering all stages of system design, from requirements analysis to system testing and validation.

2.3 Data Collection Techniques

Research data was obtained through three complementary data collection techniques. First, *structured observations* were conducted on the existing queue service flow to identify points of inefficiency and operational issues. Second, *semi-structured interviews* were conducted with three key informants: a teller, a customer service representative, and a branch operations manager. The interviews focused on identifying the system's functional and non-functional requirements from the users' perspective. Third, *a document review* was conducted of the customer service standard operating procedures in effect at the institution to understand the business processes that need to be accommodated within the system.

2.4 System Development Phases (Waterfall Model)

System design follows the four main phases of the *Waterfall* model as follows.

a) Requirements Analysis. This phase produces the functional and non-functional requirements specifications for the system. Functional requirements include: (1) automatic queue number generation based on service type (Teller and Customer Service), (2) queue management by staff, including calling and re-calling, (3) real-time queue display on public screens, (4) automatic recording of service times, and (5) storage of historical queue data in a relational database. Non-functional requirements include usability, system responsiveness, reliability on the local network, cross-device compatibility via *web browsers*, and system access security.
b) System Design. System modeling is performed using *the Unified Modeling Language* (UML), which includes *Use Case Diagrams* to model actor interactions with the system, and *Activity Diagrams* to represent the queue process flow. Database design uses a relational model implemented in MySQL, with a queue number table. The system architecture adopts a LAN-based *client-server* model, with a single server unit serving as the central processing and data storage hub, and multiple client units for the customer interface, staff interface, and public display media.
c) Implementation. The system was built using PHP version 8.1 as the server-side programming language, MySQL 8.0.30 as *the database management system* (DBMS), and the Apache HTTP Server as the *web server* configured within a local network environment. *The front-end* was developed using HTML5 and CSS3, with time-based intervals for the public display module.
d) Testing. System functional validation was performed using the *Black Box Testing* method, a testing technique that verifies the system's behavioral compliance based on input-output relationships without considering the internal code structure[9]. This method was chosen because it is suitable for testing the fulfillment of functional specifications from the end-user's perspective. Testing includes ten test scenarios that represent all the system's main functions[10].
2.5 Implementation Environment Specifications

The system is implemented on the following hardware and software configuration: the server uses a computer with a 10th-generation Intel Core i5 processor, 8 GB of RAM, and a 256 GB SSD running the Windows 11 operating system; the *web server* uses Apache 2.4 configured via XAMPP; the database uses MySQL 8.0.30; the programming language is PHP 8.1; and the LAN network uses a *star* topology configuration with *a* 100 Mbps *switch*. Clients access the system via *a* standard *web browser* (the latest version of Microsoft Edge) using the server's local IP address[11].

3. Result and Discussion

3.1 Overview of the Developed System

The designed customer queue information system is a web-based application operating on a local area network (LAN) with a *client-server* architecture. The system consists of three main modules that are integrated with one another: (1) a queue number retrieval module accessed by customers via a computer screen interface, (2) a queue management module used by staff to manage the call process, and (3) a public display module that presents real-time queue information to all customers in the waiting area. Inter-module interactions are managed through a local server that acts as a data processing and storage center, so that any change in queue status in one module is automatically reflected in the other modules without significant delay[12].

3.2 System Modeling

System modeling in this study is carried out using a Use Case Diagram to describe and visualize the interactions between actors and the system in a structured manner, as illustrated in Figure 1. The Use Case Diagram serves as an important tool in system analysis because it helps to clearly define the functional requirements and responsibilities of each user within the system. Through this modeling approach, the system is able to identify and organize the relationships between users and the services provided by the application.

The system identifies three main actors, each with distinct roles and responsibilities. The first actor is the customer, who interacts directly with the system to obtain a queue number and monitor queue progress. The second actor is the staff member, who is responsible for managing the queue calling process, updating service status, and ensuring that customers are served in an orderly manner. The third actor is the administrator, who has full control over the system configuration, including user management, system monitoring, and ensuring that all components function properly according to operational requirements.

This separation of actor roles is designed to ensure that each user has proportional access rights to relevant system functions. By implementing role-based access, the system minimizes the risk of unauthorized actions and improves overall system security. In addition, this structure enhances usability by providing a clear and intuitive workflow for each type of user, allowing them to focus only on the functions relevant to their responsibilities. The use of Use Case Diagram modeling also supports better system planning, easier communication between developers and stakeholders, and more efficient system implementation. Overall, this approach contributes to the development of a more organized, secure, and user-friendly queue management system. [13].

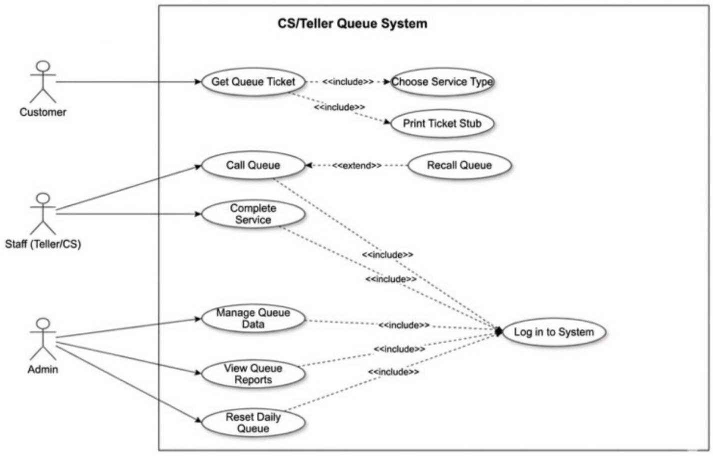

Figure 1. Use Case Diagram

The Activity Diagram (Figure 2) represents the queue process flow from a temporal perspective and the causality between activities. The process is initiated when a customer takes a queue number through the system; the system then automatically creates a new queue data entry in the database along with information on the type of service and *the timestamp* of the queue number retrieval. The issued queue number enters the active queue managed by the staff. When a staff member calls a queue, it triggers a status update in the database simultaneously with an update on the public display screen. Once the service is completed, the system updates the queue status to “completed” and records the completion time as part of the service history[14].

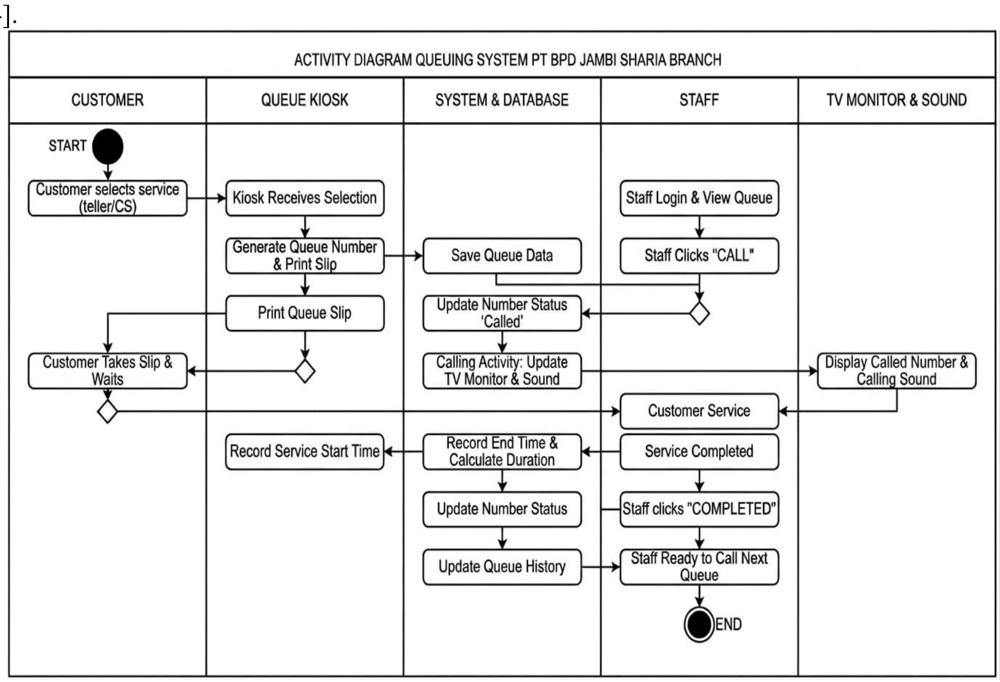

Figure 2. Activity Diagram

3.3 System Interface Implementation

The queue number retrieval interface (Figure 3) is designed based on *minimalist user interface* principles to minimize the duration of customer interaction with the system. The display presents only two service options Teller and Customer Service each represented by a large, easily identifiable button. This design deliberately eliminates non-essential interface elements to speed up the queue number retrieval process and reduce potential confusion for customers unfamiliar with technology. As a result, the queue number retrieval process, which previously required staff involvement, can now be performed independently by customers in less than five seconds[15].

Figure 3. User Interface

The issued queue number (Figure 4) displays structured information including the service type code, queue number, and retrieval *timestamp*. The numbering format used adopts a code-sequence pattern (e.g., T-001 for Teller and CS-001 for Customer Service), allowing customers to identify both the selected service type and their queue position without ambiguity. This information structure also helps staff identify which services need to be prepared before the customer reaches the counter[16].

Figure 4. Queue Number Output for Teller and Customer Service

The public display (Figure 5) presents active queue information in real-time using a time-interval-based *auto-refresh* mechanism. The information displayed includes the queue number currently being served along with the counter name, as well as the history of the last call. Automatic information updates without manual intervention by staff reduce staff cognitive load and allow them to focus entirely on the service process. The real-time transparency provided by this system also plays a role in reducing customer uncertainty while waiting—a factor proven to contribute to perceptions of service quality [17].

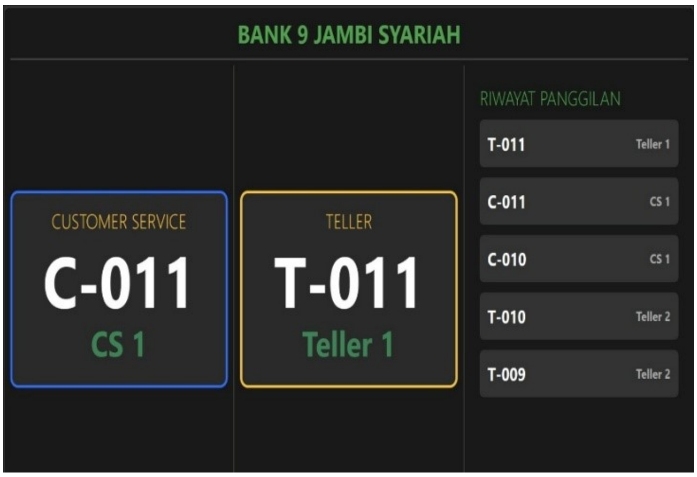

Figure 5. Real-Time Queue Display

3.4 Black Box Testing Results

Functional testing was conducted using the *Black Box Testing* method on all major system functions identified during the requirements analysis phase. Testing was carried out systematically by the research team using pre-prepared test scenarios, with each scenario defining the initial conditions, input actions, and expected output success criteria. The test results are presented in full in Table 1.

Table 1. Black Box Testing Results

No	Function Tested	Input Scenario	Expected Output	Actual Output	Status
1	Teller Queue Number Retrieval	The customer selects the 'Teller' service on the kiosk interface	The system issues a queue number in the format T-[nnn] along with a timestamp and saves a new entry in the queue table	The system issues T-001; data is stored in the database; the queue slip can be printed/displayed	✓
2	CS queue number retrieval	The customer selects the 'Customer Service' option	The system issues a queue number in the format CS-[nnn] along with a timestamp and saves a new entry in the queue table	The system issues CS-001; data is saved; numbering is separate and independent from the Teller queue	✓
3	Sequential queue numbering	Two consecutive customers select the Teller service	The system issues sequential queue numbers (T-001 and T-002) without duplication	T-001 and T-002 are issued sequentially; there is no duplication of queue numbers	✓
4	Queue call by the agent	The attendant presses the 'Call' button on the attendant interface	The system calls the next queue number, updates the status in the database, and updates the real-time display	The next queue number appears on the public display; the queue status is updated to 'Called'	✓
5	Re-calling a queue	The attendant presses the 'Recall' button for the same number	The system displays the same queue number again along with a re-call indicator without changing the queue order	The same number reappears on the display; the 'Recall' indicator is active; the queue order remains unchanged	✓
6	Service completion	The agent presses the 'Done' button after the service is provided	The system updates the queue status to 'Completed', records the completion timestamp, and moves the data to the history table	Queue status is updated; timestamp is saved; data is recorded in the service history	✓
7	Real-time display updates	Queue calls are initiated from the staff interface	The public display automatically updates active queue information without requiring manual refreshes by the user	The display updates within ≤2 seconds after a call; no user interaction required	✓
8	Simultaneous multi-client access	Two clients access the system	Both clients access and use the system	The system responds to both	✓

		simultaneously from different devices on the LAN	without data conflicts or performance issues	clients normally; no data conflicts or inconsistencies occur	
9	Reset the daily queue	The administrator executes the queue reset function	The system archives all current day queue data and resets the numbering to the beginning	Previous queue data is archived; numbering starts again from T-001 and CS-001	✓
10	Historical data persistence	Service process completed and system accessed again after restart	Historical queue data remains stored in the database and is accessible to the admin	The entire queue history and service times are maintained with complete data integrity	✓

Based on the test results presented in Table 1, all ten test scenarios produced outputs that conformed to the defined functional specifications, resulting in a test success rate of 100% (10 out of 10 valid scenarios). This achievement confirms that the developed system has met all functional requirements identified during the requirements analysis phase.

Of all the functions tested, the real-time display design mechanism (test scenario 7) has the highest operational significance because it plays a direct role in continuously providing information to customers. Test results show that the public display is capable of updating queue information within an interval of less than two seconds after a call—a level of responsiveness adequate for a banking service environment. The implementation of a time-interval-based *polling* mechanism on the client side proved effective as an alternative approach to *WebSocket* in a LAN context, given the configuration limitations required for server-based *push notification* technology.

Simultaneous multi-client access testing (Test Scenario 8) confirmed the system's capacity to serve multiple users simultaneously without any detectable performance degradation. This is crucial because, in real-world operational scenarios, the Teller module, Customer Service module, and public display module will operate simultaneously within a single LAN.

3.5 Comparative Analysis with Previous Research

Table 2. Comparison of the Developed Queuing System with Previous Research

Research	Context	Technology	Method	Connectivity	Testing
Arnando & Ubaidillah (2024)	SAMSAT Banyuasin	Web, PHP, MySQL	Waterfall	Online (Internet)	Black Box
Alissa et al. (2025)	Outpatient Clinic	Web, PHP Framework	Agile/Iterative	Online (Internet)	User Testing
Krisdy & Wang (2025)	Bank XYZ	Digital Queue System	Case Study	Online/Hybrid	Survey/Observation
This study (2026)	**BPD Jambi Sharia Branch**	**Web, PHP, MySQL (LAN)**	**Waterfall**	**Offline-ready (LAN)**	**Black Box Testing**

Source: Synthesis of literature and research (2026)

Table 2 presents a comparison between the system designed in this study and relevant previous studies. The primary distinction between this study and the research by Arnando and Ubaidillah (2024) as well as Alissa et al. (2025) lies in the system's connectivity architecture: the two previous studies developed systems that operate online and rely on an internet connection, whereas the system in this study is designed to operate in *an offline-ready mode* within a local network. This architectural difference has significant operational implications. LAN-based systems are not affected by external internet connection disruptions, have lower access latency because data traffic does not pass through public networks, and offer a higher level of data security because customer data is not exposed to public networks.

These findings align with the argument by Dudin et al. (2024), who state that infrastructure reliability is a critical factor in the quality of public service queuing systems. In the context of regional banking institutions such as PT BPD Jambi Syariah Branch, which operates in an environment with varying internet connection reliability, the LAN architecture proposed in this study offers substantial practical value.

From a technological perspective, the use of PHP and MySQL as *an open-source* technology *stack* in this study is consistent with the approach used by Arnando and Ubaidillah (2024). However, the decision not to use *a* PHP *framework* (PHP *native*) was made to maximize control over system configuration and minimize external dependencies a relevant consideration in the context of an environment with limited technical capacity.

3.6 System Usability Scale (SUS) Testing

In addition to functional testing using the Black Box Testing method, this study also evaluated the system's usability level using the System Usability Scale (SUS) method. This evaluation was conducted to measure the level of usability, effectiveness, efficiency, and the degree of acceptance by end-users of the implemented web-based customer queue information system.

The study involved 20 respondents who were direct users of the system at Bank Jambi's Sharia Branch, including customers and operational staff. The evaluation instrument consisted of 10 standard SUS statements using a 1–5 Likert scale. In accordance with standard SUS evaluation guidelines, the final score was calculated as an aggregate value ranging from 0 to 100.

3.6.1 Analysis of SUS Score Characteristics

Based on the results of processing the questionnaire distributed to 20 respondents, a total accumulated score of 1,547.5 was obtained. *The* SUS *mean score* was calculated using the following formula:

$$Rata - rata\ SUS = \frac{\Sigma\ Skor\ Akhir\ Responden}{Jumlah\ Responden} \quad (1)$$

$$(Rata - rata\ SUS) = \frac{1547{,}5}{20} = 77{,}375 \quad (2)$$

Through this calculation, the average system SUS score was found to be 77.375.

3.6.2 Interpretation of Results and System Acceptance Level

To understand the *usability* quality of the developed system, the average score of 77.375 was then analyzed based on the three standard SUS interpretation parameters: *Acceptability Ranges*, *Grade Scale*, and *Adjective Ratings*. The results of this interpretive analysis are presented in Table 3.

An in-depth analysis of the table above provides empirical confirmation regarding the quality of the operational system:

1. *Acceptability* Ranges: The score of 77.375 is well above the global *usability* standard threshold (score of 68). This indicates that the system falls into the *Acceptable* category, meaning the system is suitable and ready to be integrated into real-world banking service activities.
2. *Grade Scale*: The system received *a Grade B*. This category indicates a very low level of anomalies or interaction difficulties when users operate the application module.
3. Adjective *Ratings*: The system received a *"Good"* rating. This result provides measurable evidence that the designed *minimalist user interface* successfully reduces customer cognitive confusion, allowing the self-service queue number printing process to be completed in a short time (under 5 seconds).

These SUS test results reinforce the findings of *the Black Box Testing*, which previously recorded a 100% functional success rate. Thus, the technical aspects of the application not only operate according to the design algorithms but also successfully meet the criteria for usability, simplicity of workflow, and efficiency of interaction from a *user experience* perspective.

Changes Made:

- Removal of Raw Data: The table containing the 20 respondents' names and their individual scores has been completely removed from the manuscript.
- Restructuring Using an Analysis Table: Raw data is replaced with a Summary Table of SUS Evaluation Metrics, which directly categorizes *mean* values into the SUS classification theory (*Acceptability, Grade, Adjective*). This has become the standard practice for writing in accredited journals.

4. Conclusion

This study successfully designed and implemented a web-based customer queue information system operating on a local area network (LAN) at PT BPD Jambi Syariah Branch using PHP and MySQL with a Waterfall approach. Functional validation through *Black Box Testing* showed a 100% success rate across ten test scenarios covering all the system's main functions, confirming that the developed application fully meets the established functional specifications.

In addition to its functional success, *usability* testing using the *System Usability Scale* (SUS) method on 20 respondents yielded an average score of **77.375**. Based on the SUS interpretation standards, this score places the system in the *"Good"* (Grade B) category and falls within *the "Acceptable"* range. This demonstrates that the developed queueing system is not only technically reliable but also easy to understand, efficient, and well-received by both users and bank operational staff.

The main contribution of this research lies in the implementation of an *offline-ready*, LAN-based queue management system architecture. This approach offers high operational reliability for regional banking institutions, as service processes can continue to run optimally without relying on an external internet connection, while also ensuring better local data security. This system has proven capable of automating the queue management workflow, providing *real-time* transparent information to customers via public displays, and providing a valid historical database for evaluating bank service performance.

For future research, the following system updates are recommended:

1. Addition of an Integrated Analytics Module: Periodically present visualizations of service performance data (such as customer density trend graphs) to support management in *data-driven decision making*.
2. Implementation of Queuing Theory: Integrating mathematical waiting time estimation models, such as the M/M/1 or M/M/c models, to provide customers with more accurate estimates of waiting times.
3. Development of Local Notification Features: Utilizing local network protocols or *gateway-based* automated short message services to provide early alerts to customers when their queue number is nearing their turn to be called.
4. Network Security Enhancement: Implementing local data encryption and strengthening access rights within the system to address potential security vulnerabilities within the bank's internal network environment.

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