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Maximizing Efficiency and Reducing Costs through **ATM Route Optimization**

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Executive Summary

In the current fast-paced world, optimizing ATM routes has become a crucial strategy for banks and financial institutions to minimize cash-related expenses while maintaining continuous cash accessibility for customers. This whitepaper presents a comprehensive examination of the variables, factors, assumptions, scenarios, algorithms, and advantages of ATM route optimization, with a specific emphasis on utilizing predictive analytics to optimize ATM routes.

Introduction

With the growing use of automated teller machines (ATMs), banks and financial institutions are facing increasing challenges in managing their cash logistics while ensuring uninterrupted ATM services. One of the key challenges is to identify the optimal route for CIT (cash-in-transit) vehicles to efficiently and effectively replenish ATMs with cash while minimizing travel and inventory-related costs.

This whitepaper aims to provide a comprehensive analysis of the ATM route optimization strategy and its benefits, along with various scenarios and algorithms for achieving optimization objectives. The paper will also emphasize the factors and assumptions that must be considered to achieve successful optimization outcomes.

Objectives

This whitepaper aims to explain the significance of ATM route optimization and its benefits for financial institutions. It explores various algorithms and scenarios for optimizing routes, including predictive analytics and multi-vault scenarios. It also emphasizes the variables and factors to be considered during optimization and highlights the advantages of route optimization, such as reducing costs and enhancing customer satisfaction.

The white paper aims to address questions related to exploring ATM cash forecasting and route optimization, including techniques, case studies, and future strategies.

1. What types of data are commonly used in ATM cash forecasting and route optimization, and how are they collected and analysed?
2. What specific techniques or models can be used to forecast cash demand at ATMs, and what are their relative strengths and weaknesses?
3. How can route optimization algorithms be used to minimize the cost and time required to replenish cash at ATMs, and what are some common challenges or constraints that must be considered in this process?
4. What are some case studies or examples of successful implementations of ATM cash forecasting and route optimization using analytics, and what benefits have been observed in terms of cost savings, efficiency improvements, or customer satisfaction?
5. How can banks and other financial institutions incorporate real-time data and machine learning techniques into their ATM cash forecasting and route optimization strategies to further enhance their accuracy and effectiveness?

Factors and Assumptions

Effective optimization of ATM routes is a complex process that requires careful consideration of various factors and assumptions. Below are some of the key factors and assumptions that must be taken into account to ensure that the ATM route optimization program is successful.

Service Calendar:

It is essential to consider the service calendar for each cluster and vehicle route of the service provider while optimizing the ATM routes. This will ensure that the ATM routes are optimized based on the availability of the service provider.

SLA for Cash Loading per ATM:

Defining a Service Level Agreement (SLA) for cash loading per ATM is critical in optimizing the program. This will ensure that the ATMs are serviced within the defined time frame.

Number of Working Hours per Vendor:

The number of working hours per vendor must be taken into consideration while optimizing the ATM routes. This will ensure that the vendors are not overworked and that they have sufficient time to service the ATMs.

Fixed Costs:

Fixed costs such as vehicle maintenance, fuel costs, and driver's salary must be considered while optimizing the ATM routes. This will ensure that the routes are optimized in a cost-effective manner.

Daily Vehicle Cash Load Capacity:

It is important to consider the daily vehicle cash load capacity while optimizing the ATM routes. This will ensure that the vehicle is not overloaded, and the cash is delivered to the ATMs in a timely and efficient manner.

Number of ATMs in the Cluster per Day:

The number of ATMs in the cluster per day should be taken into account while optimizing the ATM routes. This will ensure that the ATMs are serviced based on their importance and that no ATM is left unattended.

Average Time to Replenish Cash:

Considering the average time to replenish cash in the ATMs is essential while optimizing the ATM routes. This will ensure that the ATMs are serviced within the defined time frame.

Number of Trips to the Vaults per Day/Number of Vaults:

It is important to consider the number of trips to the vaults per day/number of vaults while optimizing the ATM routes. This will ensure that the ATMs are serviced in a timely and efficient manner.

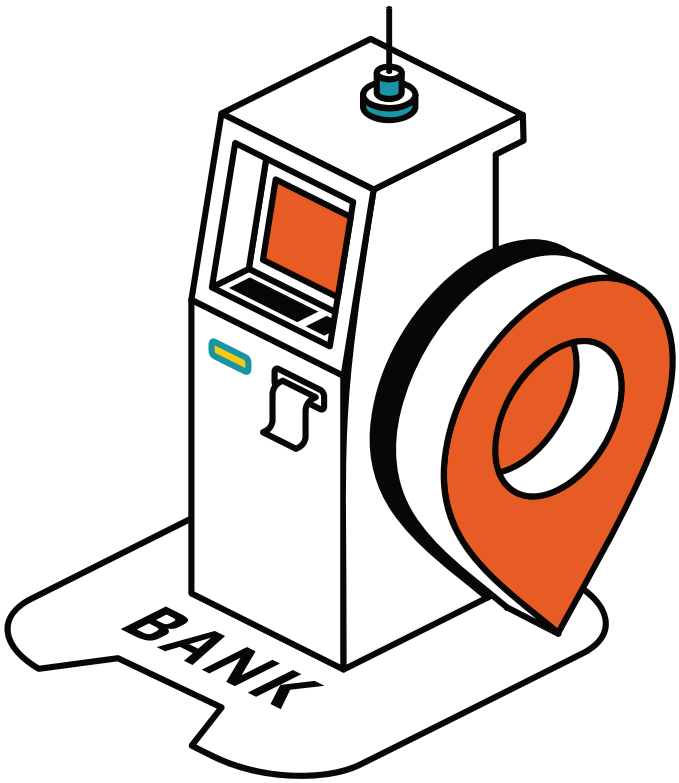
Frequency of Replenishment:

Considering the frequency of replenishment is crucial while optimizing the ATM routes. This will ensure that the ATMs are serviced based on their usage, and no ATM runs out of cash.

Optimization for High Footfall ATMs:

High footfall ATMs should be given priority while optimizing the ATM routes. This will ensure that the ATMs are serviced based on their importance, and no customer is left without cash.

These factors and assumptions play a critical role in the successful implementation of an ATM route optimization program. Considering all these factors while optimizing the ATM routes will help ensure that the program is successful and meets the objectives.



ATM Route Optimization Scenarios

The optimization of ATM routes involves determining the most efficient schedule for delivering cash to ATMs, deciding on the best route for cash transportation vehicles, and determining the amount of cash to be delivered. There are several scenarios that can be considered to optimize this process:

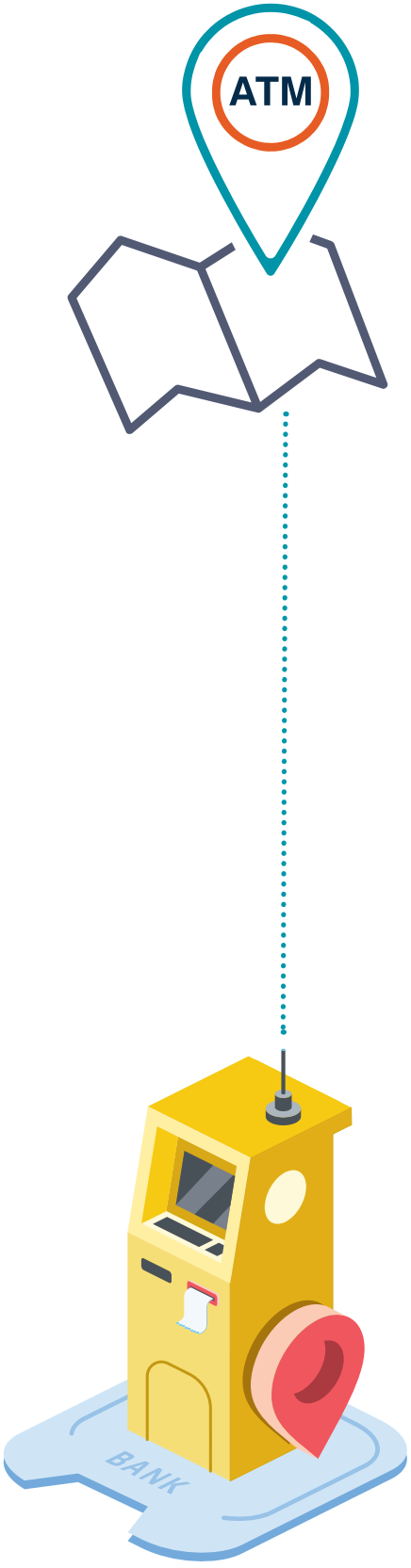
Single Vault Scenario: This scenario involves calculating the time taken to transport cash from the vault to the ATM clusters and back. An average replenishment time of 15 minutes is assumed, with the assumption that four ATMs can be replenished per hour.

Multi-Vault Scenario: In this scenario, multiple vaults are enroute to the ATM cluster where the cash transportation vehicle can load cash. Assuming the vehicle starts and returns to the same vault, this will decrease the time taken to load cash from multiple branches enroute. While there might not be a significant impact on the time taken to load the ATM within the cluster, this approach can still reduce the total time taken for the entire cash delivery process.

Multi-Vault Vs Single Vault: This scenario involves comparing the benefits of having more than one vault with the costs associated with it. More than one vault decreases the time taken to finish replenishment due to the reduction in the number of trips to the primary vault. By balancing the replenishment time and cost saved, more ATMs can be fulfilled within the cluster.

Adding Another ATM at High Footfall Location: By adding another ATM at a high footfall location, long queues outside the ATM can be reduced, and better forecasting can be done based on peak times and seasonal trends. This can help boost off-us revenue if there are limited ATMs in the locality.

It is important to carefully consider the costs and benefits of each option before making a decision.



Predictive Analytics for ATM Route Optimization

As ATM networks expand, route optimization becomes crucial for smooth and cost-effective operations. Predictive analytics provides a solution by utilizing data to create optimized schedules for ATM cash loading and maintenance.

To minimize travel and inventory-related costs while ensuring ATMs have sufficient cash, several variables, factors, and assumptions are considered in the ATM route optimization strategy. The strategy takes into account the service calendar for each cluster and the vehicle route for the service provider for the day.

Below are some of the key factors that must be considered:

- To make the most of time and resources, each vehicle is assigned a specific route for the day.
- To streamline cash supply chain and reduce expenses, all routes begin and end at the same cash vault.
- Efficiently replenishing cash with an average time of 20-30 minutes reduces the risk of running out of cash and associated costs.
- Planning routes and schedules within the allotted working hours minimizes overtime costs and maximizes efficiency.
- The fixed costs of cash handling, vehicle cost per mile, and security and driver costs are crucial in optimizing routes and determining the total cost of the cash supply chain.
- Daily vehicle cash load capacity is a key factor in effectively managing the cash supply chain and reducingcash-related expenses.
- Clustering ATMs based on the number that need service helps optimize routes and streamline the process.
- By determining the optimal number of vaults enroute, operational efficiency is maximized, and travel time and costs are reduced.
- Servicing each ATM on the cluster on the same day ensures that they are regularly checked, reducing the risk of running out of cash and associated costs.
- Timing the replenishment at the right time reduces the risk of running out of cash and associated costs.
- High footfall ATMs are factored into the optimization strategy to ensure they are serviced more frequently, reducing the risk of running out of cash and maximizing revenue.

In summary, the ATM route optimization strategy minimizes total travel cost and inventory related costs while ensuring ATMs do not run out of cash and are reloaded at regular intervals. This strategy involves considering several variables, factors, and assumptions, which are critical for efficient and cost-effective ATM network operation.

Use Case

Predictive analytics can be used to create schedules for CIT (Cash In Transit) vehicles, determining the optimal amount of cash to be delivered to each ATM in a given route and minimizing the total cost of the route.

Scheduling Options

The scheduling period can be set to daily, weekly, or monthly intervals. It is a parameter that is regularly optimized, typically for a period of six to seven days in practice.

Pattern Assignments

The following fields can be considered for pattern assignments to optimize ATM routes:

- ATM ID
- ATM cluster
- ATM type (urban, semi-urban, rural, branch-urban, branch-rural, offsite)
- Days in the scheduling period
- Commute time
- Loading time
- Distance from vault to ATM
- Cost per kilometre
- Vehicle capacity for cash holding
- Fixed cost of vehicle/driver/ATM security
- ATM withdrawal limit per day
- ATM deposit limit per day
- Remaining cash in the ATM
- Number of working hours per day
- Service time per ATM for reloading
- Number of vaults enroute
- Total distance
- Assumptions for extraneous situations such as peak traffic, road block, accident etc.

Considering these factors, pattern assignments can be made for ATM routes optimization. This approach can help service providers improve ATM uptime percentage, minimize operational costs, and reduce emergency cash reload requests. It can also assist in freeing up idle cash, reducing customer dissonance, and improving revenue generation opportunities.

Factors considered to optimise ATM routes

To optimize ATM routes, several factors can be considered, including historic ATM data such as the day of the transaction (working day, holiday, or weekends), the service calendar for each cluster, and the vehicle route for the service provider for the day. Other factors that can be taken into account include the SLA for cash loading per ATM, the number of working hours per vendor, daily vehicle cash load capacity, the number of ATMs in the cluster per day, the average time to replenish cash, the number of trips to the vaults per day/number of vaults, the frequency of replenishment, and the optimization for high footfall ATMs.
With predictive analytics for ATM route optimization, service providers can improve the uptime percentage of ATMs while reducing operating costs, minimizing emergency cash reload requests, and proactively reducing cash outage alerts. It also frees up idle cash that can be used for better revenue generation opportunities and reduces customer dissonance due to the lack of cash or availability of denomination.

Algorithm Methods

Heuristic algorithms, meta-heuristic algorithms are widely used in the optimization of ATM routes.

Heuristic Algorithms

Heuristic algorithms perform a relatively limited exploration of the search space and typically produce good quality solutions within modest computing times. These methods are based on trial and error and use a set of rules or heuristics to explore potential solutions.

Meta-heuristics Algorithms

Meta-heuristic algorithms are used to find answers to problems when there is very little knowledge about the character of the optimal solution, and brute-force search is out of the question because the solution space is too large. However, if there is a candidate solution to the problem, it can be tested and its quality assessed. In meta-heuristics, the emphasis is on performing a deep exploration of the most promising regions of the solution space.

2-Phase Algorithms

The problem is decomposed into its two natural components:
• Clustering of vertices into feasible routes
• Actual route construction - with possible feedback loops between the two stages.
Each algorithm has its own advantages and disadvantages, depending on the particular optimization problem at hand. However, when combined with relevant data inputs, they can help identify the most efficient and cost-effective route for ATM replenishment.

Benefits of ATM Route Optimization

Improved ATM uptime percentage:

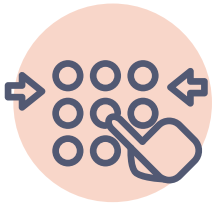
Optimizing the route and ensuring regular cash replenishment minimizes the risk of an ATM running out of cash, resulting in higher uptime percentages.

Enhanced customer experience:

Availability of cash at each ATM minimizes customer dissonance caused by lack of cash or denomination availability, leading to improved customer satisfaction and loyalty.

Reduced operating costs:

Optimizing the route reduces logistics and inventory costs, resulting in overall cost savings.



Proactive cash reloads:

Optimizing the route reduces the likelihood of emergency cash reload requests, allowing for planned and executed proactive cash reloads, which saves time and money.

Overall, ATM route optimization can help banks run their ATM networks more efficiently, enhance the customer experience, and reduce costs.

Optimized ATM cash:

Optimizing cash levels at each ATM frees up idle cash, which can be used for better revenue generation opportunities.

Conclusion

Optimizing the ATM route is a critical aspect of managing cash logistics' costs and efficiency. Service providers can reduce operational costs, improve ATM uptime percentage, and minimize emergency cash reload requests by using predictive analytics and optimization algorithms. Additionally, this helps to minimize customer dissonance resulting from a lack of cash or denominations availability and proactively reduce cash outage alerts.

The choice of algorithmic method depends on the problem complexity and data availability. Heuristic methods are suitable for problems with a limited search space, while meta-heuristics can be used for more complex problems with a large search space. 2-Phase algorithms are also useful in decomposing complex problems into smaller components.

In summary, ATM route optimization is a crucial consideration for any organization involved in cash logistics. By utilizing the power of predictive analytics and optimization algorithms, organizations can enhance operational efficiency, reduce costs, and improve customer satisfaction.

About Altimetrik

Altimetrik is a data and digital engineering services company focused on delivering business outcomes with an agile, product-oriented approach. Our digital business methodology provides a blueprint to develop, scale, and launch new products to market faster. Our team of 5,500+ practitioners with software, data, and cloud engineering skills help create a culture of innovation and agility that optimizes team performance, modernizes technology, and builds new business models. As a strategic partner and catalyst, Altimetrik quickly delivers results without disruption to the business.