



GUROBI
OPTIMIZATION

WINCOR
NIXDORF

Gurobi helps to ensure optimal cash management throughout the world



"I'm out of cash!" – we've all had it happen to us: we use up the money in our wallet faster than we expect. When that happens, we are fortunate that there is a fresh supply on virtually every corner. But how does the money actually get into the machines, and who ensures that there is enough for the likely number of withdrawals? There is far more complexity behind this process than it may appear at first glance. Complicated algorithms are used to optimally control how the machines are supplied. These algorithms are designed at Wincor Nixdorf in Germany as part of a software solution including optimization algorithms from Gurobi.

Company Background

Wincor Nixdorf has operations in more than 130 countries around the world. In particular, it is the clear market leader in its home market of Germany where its logo graces almost every automatic teller machine. Wincor Nixdorf is a major manufacturer of hardware such as ATMs, but software and services play an increasingly important role in their offering. Efforts in these areas are focused on the efficient and secure management of cash logistics and cashless payments. To this end, Wincor Nixdorf offers Cash Cycle Management™ Solutions, where the cash management processes in banks and resellers are automated, and the overall cash logistics chain is shortened.

The Model

Cash logistics presents several challenging optimization problems that must be integrated into a single optimization model. One of these is managing the amount of cash contained in both individual automatic teller machines and the cash boxes at bank branches. Among multiple business requirements, it is important that the optimization model is able to take into account individual usage forecasts for each ATM and cash box. The goal is that they neither run out of cash, negatively impacting users, nor have too much cash, which doesn't earn the bank any interest and also presents a security risk.

Another important optimization problem that must be simultaneously addressed is minimizing supply chain operating expenses. This includes the expenses associated with the transportation of cash from the central bank to the ATMs and cash boxes, as well as the expenses associated with maintaining needed cash reserves at each point in the delivery chain. Further complicating the problem are the various statutory provisions that must be met, including European Central Bank requirements such as one which stipulates only money that has been machine-checked may be recirculated in automatic teller machines. Collectively, these and other requirements make the problem much more than a simple inventory control problem.

A key tool in modeling such a complex and detailed process is a customizable, dependable solver. With this in mind, Wincor Nixdorf successfully utilizes Gurobi for a wide range of problems.

The Results

Gurobi has proven to be fast and flexible enough to solve all of the optimization problems that arise across a broad range of Wincor Nixdorf's customers, despite what are often significant differences in their cash logistics chains. Normally, only a few changes to the model, such as extra or modified constraints, are necessary to customize the software to the individual needs of the client. In addition, when questions arise, Gurobi's support has earned a reputation for always coming through, and Gurobi's flexible license management has helped make deployment easy. As a result, banks and resellers save enormous sums of money per year by efficiently managing their cash using Wincor Nixdorf's Cash Cycle Management™ solutions, powered with Gurobi.

“ Many of our optimization problems can be modeled as mixed-integer programs. Gurobi always solves these quickly and reliably. ”

— Dr. Peter Lietz, Senior Operations Research Analyst



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EXPERIENCE MEETS VISION.

Why we use Gurobi:

Gurobi is an important component of our software offering. In our case, we access Gurobi using the Java interface because we can seamlessly integrate it into our code. Gurobi is so stable and flexible that we often use Gurobi even when a more specialized approach could be used. By doing so, extra requirements can be easily integrated and we then just solve it all with Gurobi.

A dependable partner that is focused on maintaining its leadership position long-term is very important to us. We have definitely found such a partner in Gurobi.

Wincor Nixdorf

- A leading global provider of IT solutions and services, and of hardware for banks and resellers.
- Employs nearly 9000 employees and associates in 130 countries.
- Generates ~2.5 billion Euros in annual revenue.