Unlocking the Power of Quantum:
Applications in Production with D-Wave

Driving business value today with real-world quantum-hybrid applications

At D-Wave, we don't view quantum computing as tomorrow's technology; in fact, when it comes to delivering business value for real-world optimization problems, the technology is very much here today.

Studies show that enterprises across many industries are actively exploring the potential for quantum computing to help solve complex business problems. According to a recent Hyperion Research report on quantum computing use cases, 1 in 7 respondents indicated that their organization's main quantum computing activity was either a current proof of concept program or some form of production use for one or more business processes. This highlights the significant role that production quantum applications play in shaping the future of business. Here, a "production application" means one that is actively being used by customers in a live environment, helping them to solve real use cases and deliver business value.

D-Wave has been at the forefront of the quantum journey, helping businesses on the path to production applications. Our quantum computing and quantum hybrid technology is built to solve real-world optimization problems in manufacturing and logistics, financial services, life sciences, and more. To further illustrate how quantum computing can help take businesses from idea to quantum-hybrid applications in production, let's take a closer look through the lens of D-Wave customers SavantX, Pattison Food Group, and Recruit Group.

### SAVANTX: LOGISTICS OPTIMIZATION AT THE PORT OF LA

SavantX is a team of data scientists, engineers, and visionaries with a mission to make data accessible and understandable through quantum computing, artificial intelligence, smart search, augmented intelligence, machine learning, and data visualization. They were contracted by the Port of Los Angeles, one of the busiest US ports, to be part of a large project to dramatically streamline port operations.

A significant business challenge that SavantX faced was the inefficiency across the cargo-handling process. The process involves unloading and transferring container units from the ships to the trucks that take the containers to their destinations. To unload these containers, rubber tyred gantry (RTG) cranes are used to collect and maneuver the containers off the ship and onto the trucks. However, the containers in each row are randomly stacked, which means that a truck can wait for hours before its intended cargo is given to it. Attempting to speed up the current process by adding more RTG cranes and employees, both costly and labor intensive, would still be random. As a result, the current process led to many delays and high costs in clearing containers from Pier 300.

SavantX developed a framework called the Hyper-Optimized Nodal Efficiency Engine (HONE), which leverages D-Wave's quantum annealing technology. They created a digital twin and generated rich data from more than 100,000 different cargo-handling runs across a range of different scenarios to identify opportunities and strategies for achieving more optimized handling of these containers.
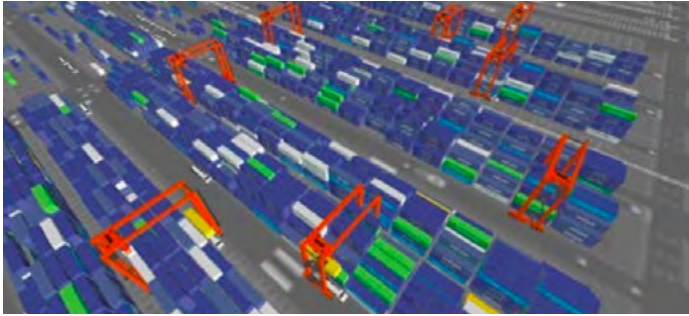
SavantX's Digital Twin simulation.

In the end, HONE dramatically streamlined port operations across a number of key performance indicators. For example, after HONE, the terminal was using nearly 40% less of its RTG crane resources for the unloading process, and each of these cranes was traveling a considerably smaller average distance per day of 6,200 meters rather than 8,900 meters. The cranes also increased their number of deliveries by more than 60%, and truck turnaround time decreased by at least 30% (the time trucks waited for their payload after arriving at the terminal).

The success of SavantX's quantum solution in optimizing the container unloading process at the Port of Los Angeles is a testament to the potential of quantum computing in the logistics industry.

PATTISON FOOD GROUP: DRIVER SCHEDULING OPTIMIZATION

Pattison Food Group (PFG), Canada's largest Western-based provider of food and health products, is using D-Wave quantum hybrid technology in production to optimize e-commerce driver scheduling. Until recently, managing the driver schedules for those orders was a manual task that took over 80 person-hours of work per week.

With the recent surge of online retail orders, scheduling deliveries can be a complicated task with a lot of room for optimization. With over 100 retail locations offering online ordering and e-commerce drivers across the provinces, PFG's logistical capabilities to fulfill this surge in orders were being tested.

Developing schedules is not simply a matter of mapping out each worker's weekly availability. The system also needs to account for factors and constraints, such as: which stores a given driver is willing and able to get to, how many drivers are needed on each shift, ensuring that time between each shift is at least 10 hours, and

other considerations. The number of variables and constraints contribute to the complexity of developing optimal schedules.

Leveraging D-Wave technology, PFG developed an auto-scheduling solution that was deployed into production in 2022 and has resulted in an 80% time savings. The new auto-scheduler can meet a threshold of 95% of the demand from the company's e-commerce shoppers and the drivers routinely receive schedules that fulfill their work expectations. PFG's quantum hybrid solution is streamlining operations and is a promising development in the retail industry.

RECRUIT GROUP: TV SCHEDULING OPTIMIZATION TO MAXIMIZE BRAND RECOGNITION

Recruit Group is a global technology company transforming the world of work by simplifying hiring, helping businesses work smarter, and creating a social impact that enables everyone to prosper together. Operating in more than 60 countries, their key subsidiaries include Indeed, Glassdoor, and its worldwide staffing business. In Japan, Recruit Group is also focused on streamlining business essentials from sourcing to marketing through its cloud-based smart solutions and matching platforms.

Recently, Recruit harnessed D-Wave's quantum hybrid technology to maximize the value from TV advertising for their customers. In marketing, TV advertising continues to be a popular tool for businesses; however, measuring a campaign's success based on the reach is challenging. This is especially true when a series of different ads are broadcast to viewers in a brief timeframe. The challenge then becomes how companies can maximize the exposure of their
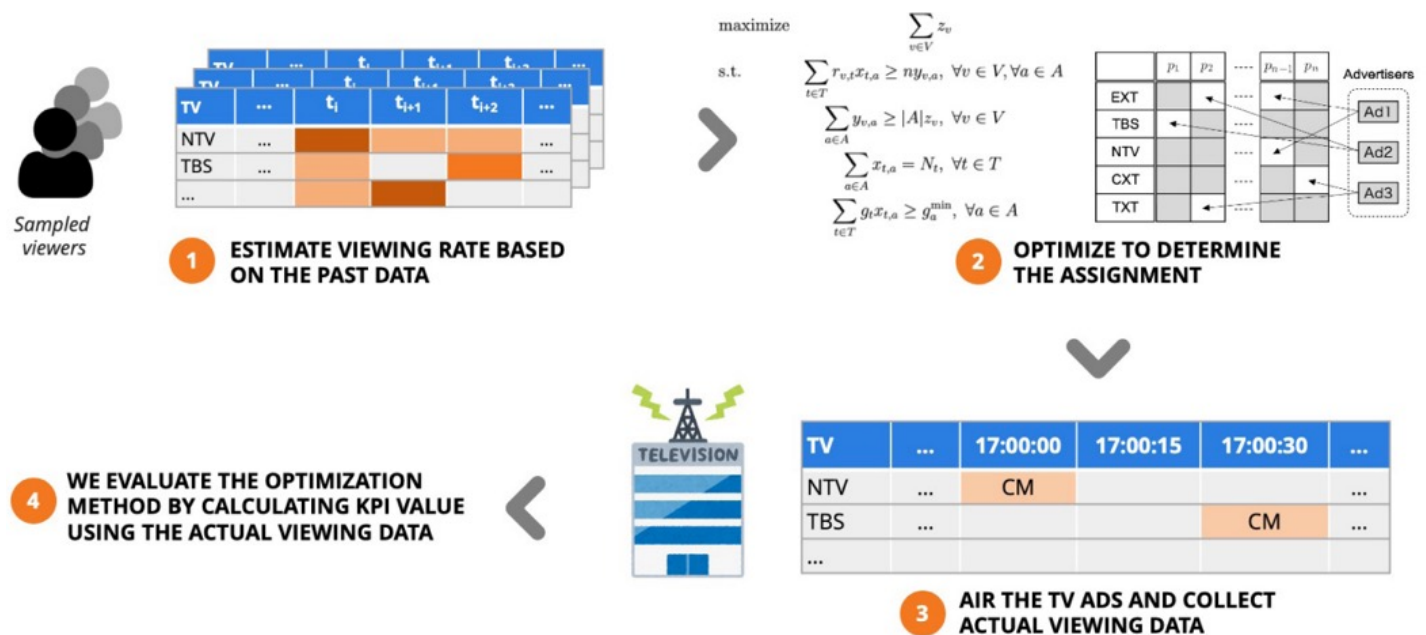
advertisements across a finite number of timeslots throughout the day.

Maximizing this metric for multiple advertisers across a finite number of timeslots in the course of a day's programming is a complex combinatorial optimization problem. These kinds of problems are well-suited to be solved by quantum hybrid technology. As a training set, the Recruit team collected historic ad-watching data from a sampling of real TV viewers, and estimated viewing rates using a machine learning algorithm. Then the quantum optimization was run to create proposed schedules for future broadcasts. Finally, Recruit employed the proposed solutions to actually book ads into specific timeslots and analyzed how these various solutions performed in the real world.

Recruit tested three different computing solutions—CBC solver and IBM CPLEX, a pair of mathematic solvers based on classical computing, and D-Wave's CQM hybrid solver. The results showed that the CQM solver consistently outperformed the two classical computing approaches and proved to be more robust with real data with more noise.

With CQM, Recruit's solution delivered reach metrics 90% better than those achieved through manual scheduling methods. Today, millions of people in Japan are watching TV commercials that are scheduled by D-Wave's hybrid solvers.

maximize $\sum_{v \in V} z_v$

s.t.

$\sum_{t \in T} r_{v,t} x_{t,a} \geq n y_{v,a}, \; \forall v \in V, \forall a \in A$

$\sum_{a \in A} y_{v,a} \geq |A| z_v, \; \forall v \in V$

$\sum_{a \in A} x_{t,a} = N_t, \; \forall t \in T$

$\sum_{t \in T} g_t x_{t,a} \geq g_a^{min}, \; \forall a \in A$

1 ESTIMATE VIEWING RATE BASED ON THE PAST DATA

2 OPTIMIZE TO DETERMINE THE ASSIGNMENT

4 WE EVALUATE THE OPTIMIZATION METHOD BY CALCULATING KPI VALUE USING THE ACTUAL VIEWING DATA

3 AIR THE TV ADS AND COLLECT ACTUAL VIEWING DATA

Quantum computing can revolutionize the way industries approach complex problems and help them stay competitive. By leveraging D-Wave's quantum hybrid computing technology, SavantX, Pattison Food Group, and Recruit Group have demonstrated that quantum computing is more than a research project. It is a revolutionary computing resource that can be used for real-world production applications that deliver business value today.
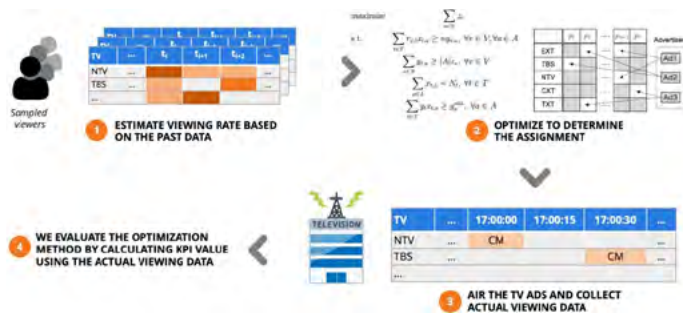
To accelerate your quantum journey today and get on the path to production, check out [D-Wave Launch](#)™.

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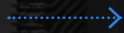
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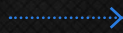## D-Wave Launch™: The on-board to quantum computing program

If you are ready to get started but not sure how, the D-Wave Launch program has been designed to help enterprises at every step of their quantum journey, from problem discovery through production implementation.
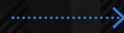
| Identify the problem best suited to quantum | Get your team trained and start the development process | Move your application into test and ready for production | Get your application up and running to deliver benefit to your business |

Sign Up Now To Get Started: www.dwavequantum.com/d-wave-launch