Momentum Worldwide (IPG): Quantum Computing Keeps a Tour on Track

Planning a tour is already hard work. But simultaneously planning four parallel tours that must each efficiently traverse vast swathes of the United States—with strict guidelines informing the design of each route—takes that challenge to another level.

Momentum Worldwide, a division of IPG, is no stranger to thorny logistical problems. Every year, this marketing agency successfully plans and activates over 18,000 in-person "brand experience" events. But when confronted with the prospect of coordinating four tours encompassing 80 events at 40 stores separated by hundreds of miles, they opted to partner with D-Wave to see how the company's quantum computing capabilities might streamline the planning process.
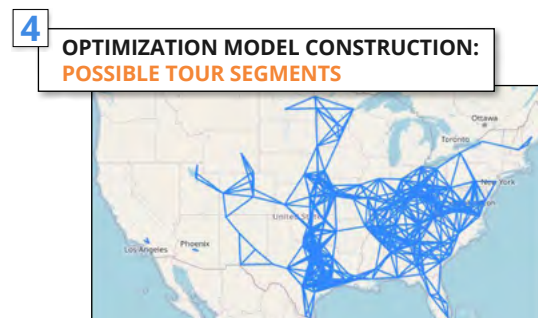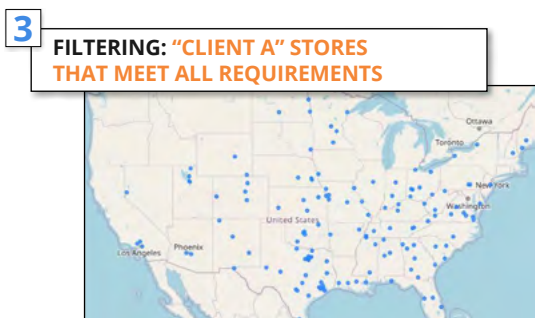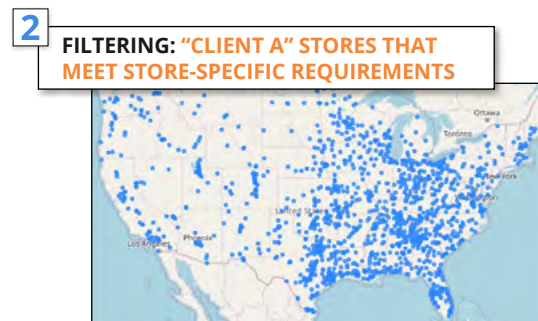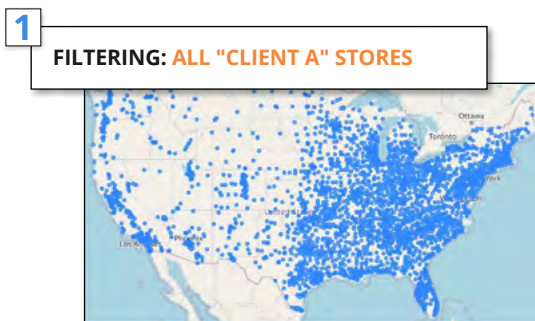
For this project, Momentum needed to coordinate separate tours that each make stops at ten of the client's largest stores in four different regions of the US. There were many constraints and considerations including: a certain store square footage, having a large parking lot, not being a leased building, and that there were no movie theaters within close driving distance. There were numerous other constraints as well, including concerns about the broader impact of the tour route. **"Part of the calculus in planning these tours is our consideration for our ecological impact,"** explained Momentum's Global CTO, Jason Snyder. **"We also want to make sure that we have the best quality of life for our tourists and for our team."** This means limiting the overall mileage of each route, while managing the amount of driving that the team needs to do during any given week of the tour.

Quantum computing and marketing companies don't normally work hand in hand, but Snyder says that Momentum and D-Wave teams collaborated effectively to tackle the tour-planning challenge. **"D-Wave worked to ensure that we had a tremendously positive experience in helping to translate the business challenges into these mathematical models,"** said Snyder. They framed the project as a version of the "traveling salesperson" problem, a well-known mathematical puzzle in which the goal is to find the shortest round-trip route by which a salesperson can hit every target on a map without repeat visits.

1 FILTERING: **ALL "CLIENT A" STORES**

2 FILTERING: **"CLIENT A" STORES THAT MEET STORE-SPECIFIC REQUIREMENTS**

3 FILTERING: **"CLIENT A" STORES THAT MEET ALL REQUIREMENTS**

4 OPTIMIZATION MODEL CONSTRUCTION: **POSSIBLE TOUR SEGMENTS**

In this case, the number of potential solutions was staggering, with 1,838[44] theoretically possible itineraries based on 4,567 store locations. Developing an acceptable solution would normally take months of effort by Momentum's event-planning team, but the D-Wave Leap™ quantum cloud service made short work of this task, delivering 1,600 possible solutions—including 100 fully-optimized routes—in less than an hour. Critically, the optimized itineraries delivered by D-Wave's solution were able to account for all of the rigorous constraints specified by Momentum's client, including some that would be particularly difficult to wrangle with conventional computational approaches. For example, travel days needed to alternate between short (25–125 miles) and long (100–250 miles) distances, introducing additional challenges into the optimization process.

Based on this success, Snyder is enthusiastic about the opportunities to further develop this prototype into a product for routine use in future event-planning efforts, and is also keen to see how quantum computing might improve other aspects of Momentum's business. **"We're going to continue to work with D-Wave to understand how quantum computing might improve other aspects of our business,"** he said.
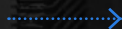
SOLUTION: OPTIMIZED TOURS
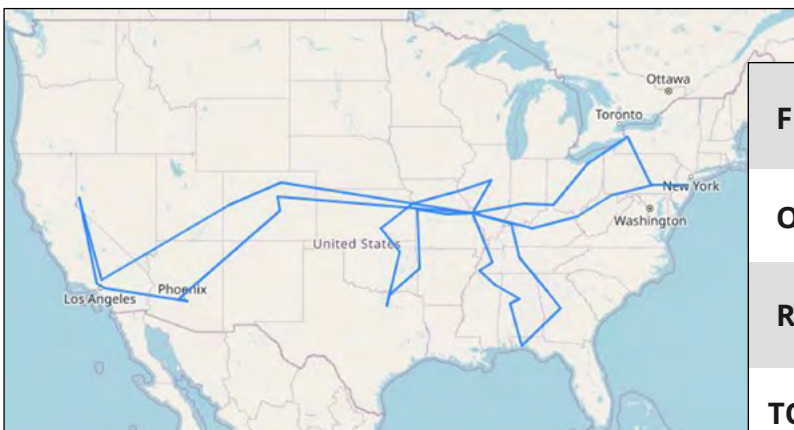
FEASIBLE SOLUTIONS	1600
OPTIMIZED SOLUTIONS	100
RUN TIME (ALL STEPS)	50 MIN
TOTAL DISTANCE FOR SOLUTION	9,423 MILES

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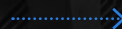
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