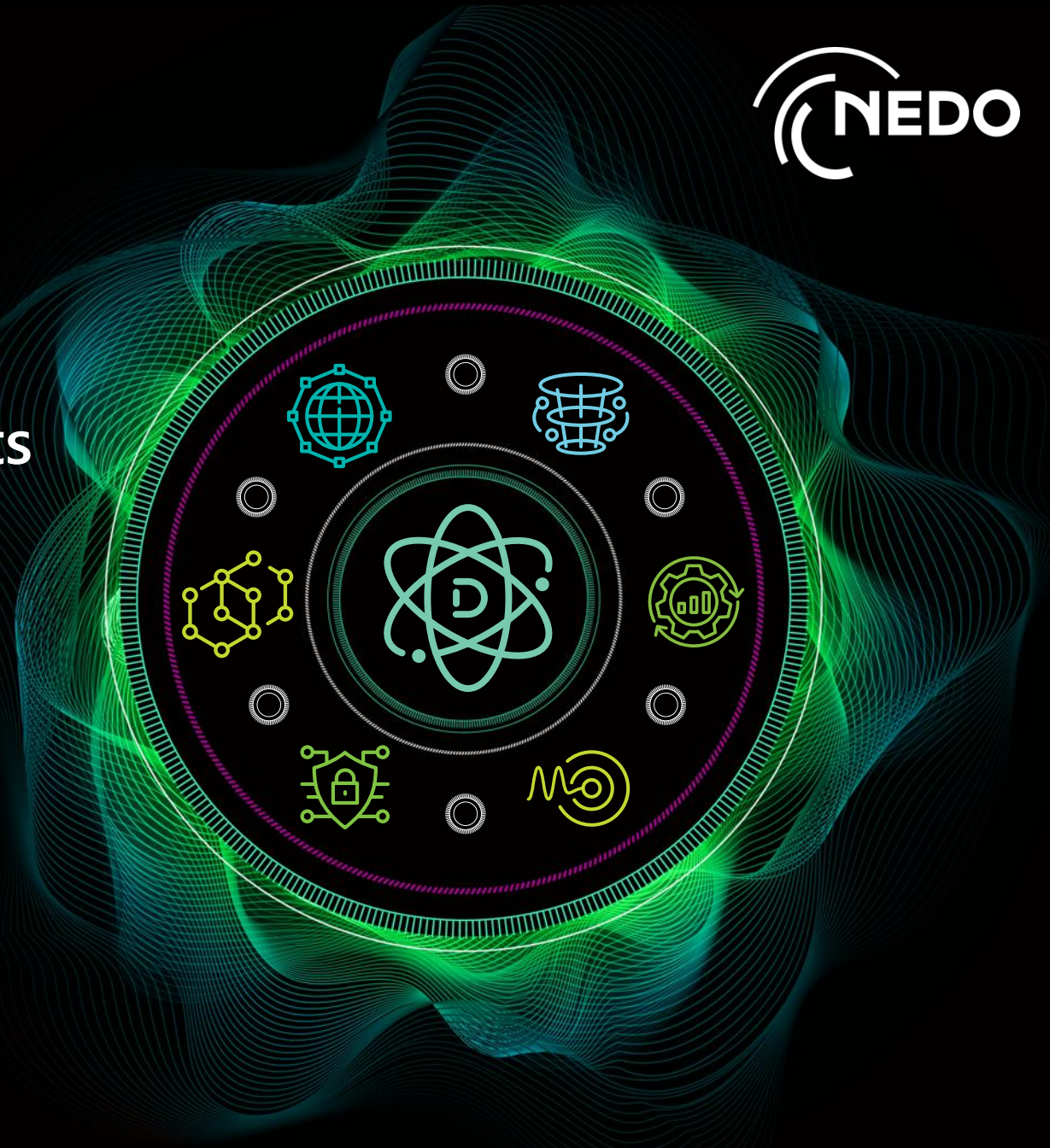
Quantum Computing Use Cases

Optimization of maintenance parts delivery plan

NEC, NEC Fielding



New Energy and Industrial Technology Development Organization (NEDO)

NEC, NEC Fielding: Optimization of maintenance parts delivery plan [2025/3] 1/2

Operational Use

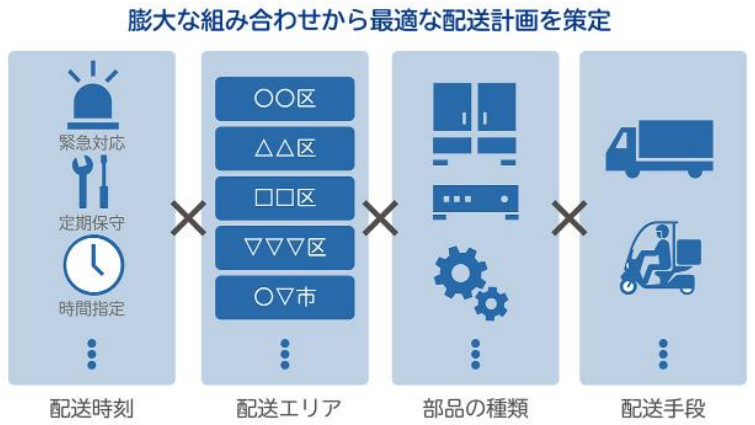
Industry	Transportation
Means	Transportation of Goods _ Land Transport
Method	combinatorial optimization
Category	Ising*

Background

- NEC Fielding's Tokyo Parts Center delivers maintenance parts to hundreds of locations in Tokyo's 23 wards 24 hours a day, 365 days a year.
- CE (Customer Engineer) who carries out maintenance and repair is moved by public transportation, and maintenance parts are sent separately by vehicle or motorcycle, assuming the operation peculiar to the urban area.
- Parking difficulties and traffic jams are common in urban areas, and it is essential to be punctual and optimize the stacking of multiple projects in accordance with the CE arrival time.
- Conventionally, a skilled person would spend two hours making a plan for the previous day using vast conditions and tacit knowledge.
- NEC Fielding built a production system using quantum-inspired technology (NEC's Vector Annealing: VA) and put it into operation in October 2022 with the aim of optimizing delivery for GX.

Issues and motivation to be solved

- We want to optimize logistics by developing high-quality plans in a short time under very large combinations and complex constraints.
- Eliminate the attribution of delivery planning that relied on expert knowledge and drastically reduce the time required to train successors



distribution plan optimization image

See: NEC: "Using Quantum-Inspired Technologies to Optimize Logistics " (https://jpn.nec.com/techrep/journal/g24/n01/240111.html)
*Ising: A computing approach, mainly associated with quantum annealers and simulators specialized for the Ising model, in which a problem is first formulated as an Ising model and then solved computationally. It is particularly well suited to problems that involve finding the optimal combination from a vast number of possibilities.

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Problem setting as a quantum computer

- Uses VA (Vector Annealing), which utilizes quantum inspired technology developed to solve large-scale combinatorial optimization problems at high speed
  - High-speed solution processing is realized by performing optimization calculations on the supercomputer SX-Aurora TSUBASA (high-speed matrix calculation and high-speed memory access) developed by NEC.

Expected business benefits

- Approximately 2 hours of work was reduced to 12 minutes, and man-hours were reduced by shortening the time required to create a delivery plan.
- Improvement of planning quality through discovery of useful route plans that were not noticed in the past at the same level as experienced personnel

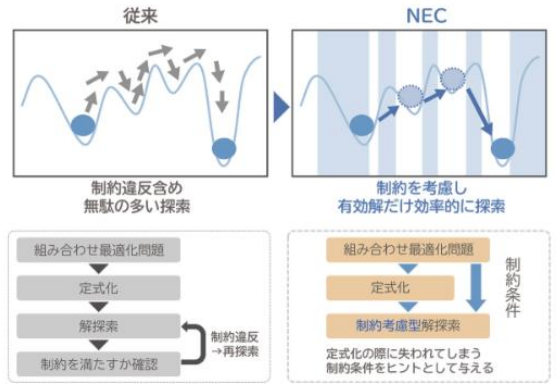


Image of Constraint-Aware Search Algorithm with VA

See: NEC: "Using Quantum-Inspired Technologies to Optimize Logistics " (https://jpn.nec.com/techrep/journal/g24/n01/240111.html)
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More use cases are available on our website. We invite you to explore them.
https://www.quantum-computing-use-cases.nedo.go.jp/english/

More Use Cases

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