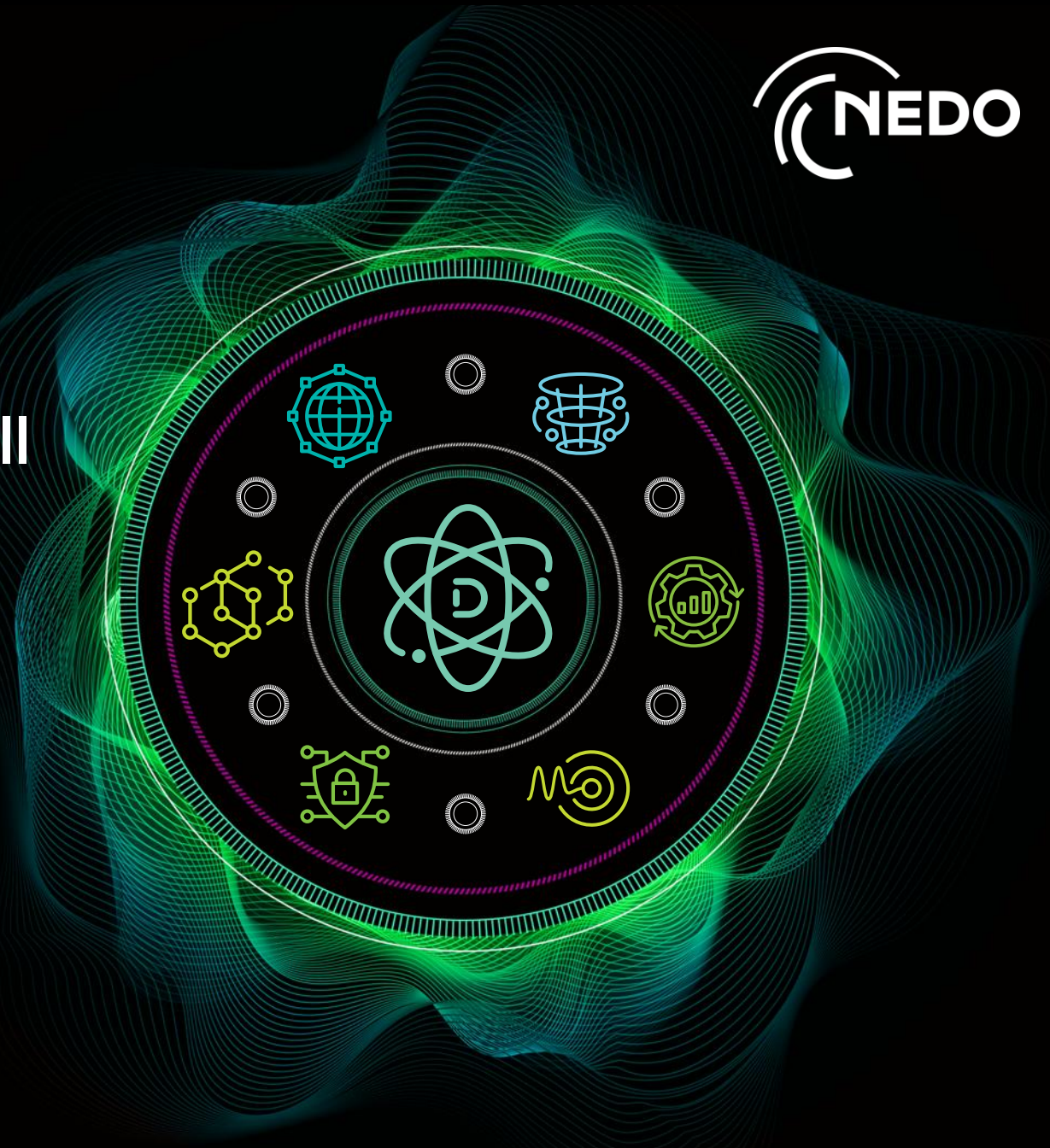
Quantum Computing Use Cases

Creating optimal work shifts at call centers

Sumitomo Mitsui FG



New Energy and Industrial Technology Development Organization (NEDO)

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Operational Use

Industry	Finance
Process	Insurance
Method	combinatorial optimization
Category	Ising*

Background

- In Japan, where the working population is decreasing year by year, call centers in various industries, such as finance, are facing an **urgent operational challenge** to continue providing high-quality services to inquirers even though the number of operators is limited.
- In order to solve operational problems, it is necessary to allocate operators appropriately in order to predict the volume of inquiries. However, in many cases, simply allocating the number of operators is not sufficient. **In practice, it is necessary to consider staffing after considering the skills of each operator, desired shifts, paid holidays, etc.**

Issues and motivation to be solved

- The person in charge of creating shifts spends an enormous amount of time and effort to create work shifts every month while considering various conditions such as the operator's skill, desired shift, and vacation schedule. However, **there is a problem that it is not possible to flexibly reflect the operator's wishes and situation because there is a limit to creating shifts by hand, and that there is a problem that there is an excess or shortage of the number of workers originally required.**
- In order to create optimal work shifts using CMOS annealing, we planned to **examine and demonstrate the practical evaluation viewpoint of CMOS annealing at several call centers of SMFG.**

Expected business benefits

- Compared to conventional work shifts created manually, **high effectiveness in optimizing personnel allocation was confirmed, such as reducing the occurrence of redundant assignments by approximately 80%.**
- Optimized staffing **can be expected to prevent increased costs due to overstaffing, delayed response due to staff shortages, and reduced service quality.**

Reference: Hitachi, Ltd. "Offers solutions to create optimal work shifts for tens or hundreds of employees" (https://www.hitachi.co.jp/New/cnews/month/2020/10/1019a.html) and Work Shift Optimization Solution (https://www.hitachi.co.jp/products/it/finance/solutions/application/common/CMOS-PersonnelShift/index.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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Operational Use

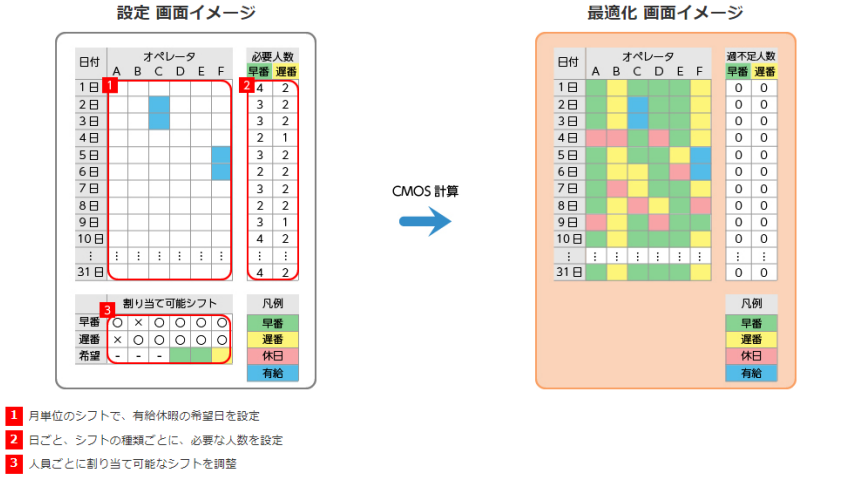
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Problem setting as a quantum computer

- In large-scale work shifts such as in call centers, **optimal personnel allocation is realized by taking into account detailed operator constraints in a complex manner** instead of uniform rotation.
  - ✓ Hourly number of people and tasks (duties)
  - ✓ leave request
  - ✓ frequency of work
  - ✓ commuting time
- The machine leverages **Hitachi CMOS annealing**

最適化イメージ

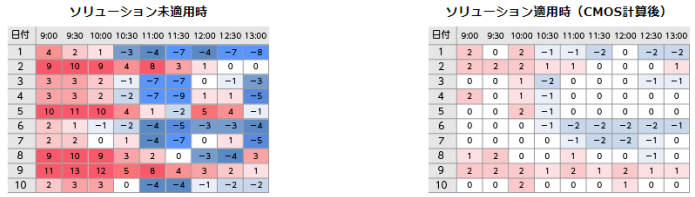
日別のシフト最適化イメージ（オペレータの状況を考慮した場合）



割り当て可能なシフトのみが割り当てられる
「遅番の翌日に早番」を禁止する設定が可能

時間別のシフト最適化イメージ

(凡例) 赤：過剰人員数、青：不足人員数
セルの色が薄いほど、割り当てた人員数が適正であることを示します。



時間ごとの人員配置を最適化

Reference: Hitachi, Ltd. "Offers solutions to create optimal work shifts for tens or hundreds of employees" (https://www.hitachi.co.jp/New/cnews/month/2020/10/1019a.html) and Work Shift Optimization Solution (https://www.hitachi.co.jp/products/it/finance/solutions/application/common/CMOS-PersonnelShift/index.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

New Energy and Industrial Technology Development Organization (NEDO)
AI and Robotics Department (e-mail: quantum_ai@ml.nedo.go.jp)

This collection of use cases was obtained as a result of the work commissioned by the New Energy and Industrial Technology Development Organization (NEDO) "Cyber-Physical Development Business of Quantum/Classical Hybrid Technology/Study of Use Case of Quantum Technology" and the “Post-5G Information and Communications System Infrastructure Reinforcement R & D Project (Quantum Industrialization)/Comprehensive Study for Promoting the Industrialization of Quantum Computers”.