Quantum Computing Use Cases

Sea route optimization

ExxonMobil · IBM



New Energy and Industrial Technology Development Organization (NEDO)

ExxonMobil・IBM: Sea route optimization [2020/03]

Concept

Industry	Transportation
Means	Movement of goods _ Shipping
Method	combinatorial optimization
Category	Gate*

Background

- In 2021, more than 500 LNG carriers were used to transport critical fuel supplies by sea
  - ✓ It makes thousands of voyages a year to ports where LNG is deployed to power critical infrastructure.
- **Finding the optimal shipping route can be a complex optimization problem** and the location of each vessel **needs to be considered on each day of the year, along with the LNG requirements of each delivery location** in order to transport LNG efficiently
- Currently, **this kind of problem is difficult to compute on a classical computer.**
  - ✓ Even a simple problem involving dozens of ships can lead to **2 ^1 million combinations** of possible decisions

Problem setting as a quantum computer

- The route optimization problem to transport LGN efficiently is addressed.

Issues and motivation to be solved

- **Quantum technology is expected to be used to find the optimal route for maritime transport, because it requires solving a problem with a large number of combinations, which is difficult with classical computers.**
- ExxonMobil and IBM **used quantum technologies to model offshore inventory routing, analyze the strengths and trade-offs of various vehicle and inventory routing strategies, and attempt to build a practical operational foundation.**

IBM"ExxonMobil strives to solve complex energy challenges" (https://www.ibm.com/case-studies/exxonmobil)
*Gate（gate-based）: A computing approach in which operations are applied sequentially to qubits to perform calculations. Similar in concept to logic circuits in classical computers, it can address a wide range of problems.

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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