NEC Innovation Day

02

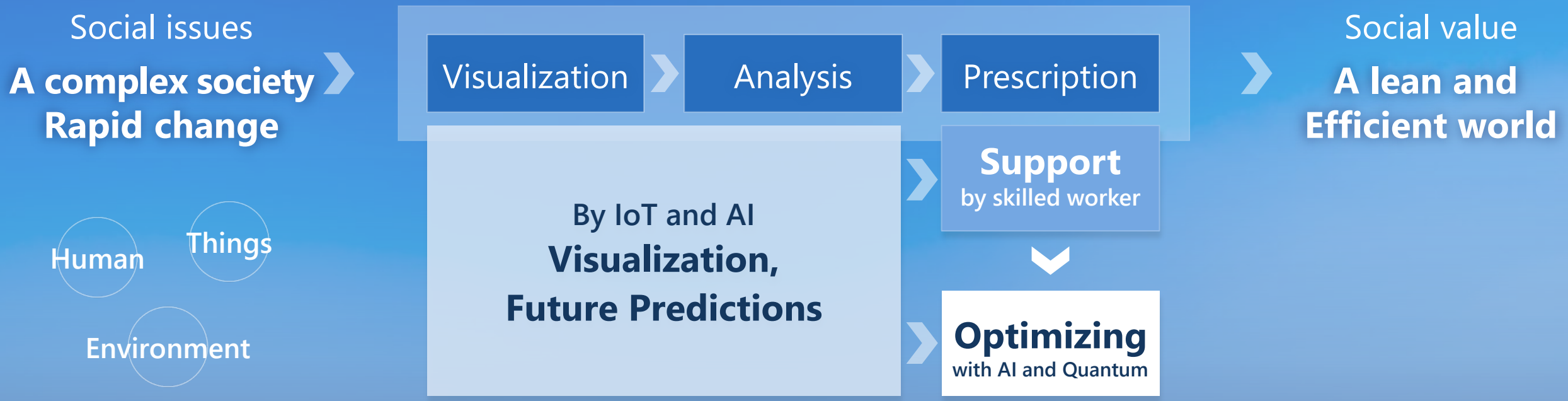
Optimization

Optimizing Technology to Create New Social Value

Optimal Connection of Analysis Results from the Cyber World to the Real World

Optimization

At present, skilled workers take optimal actions and make decisions based on the results of predictive analysis by AI.
It will be increasingly important to utilize AI and quantum technology in addressing social issues effectively as society has become more complex, uncertain and dynamically changing.



NEC's Approach to Optimization Technologies

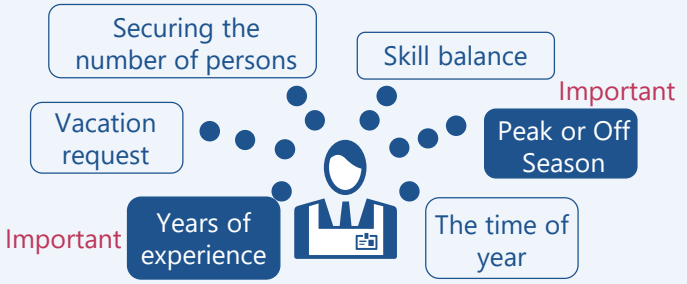
Optimization

Intention Learning

[Challenge] Digitization of ultra-complex field operations

Learn the intelligence and intention of judgment from various decision making case models that you want to reproduce.

"Intent," a tacit knowledge, is quantified. Reproduces the decision-making of a skilled worker.

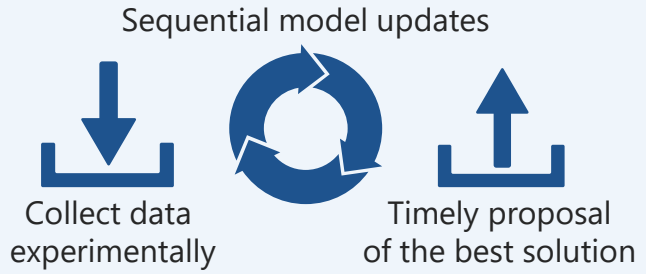


Online Optimization

[Challenge] Flexible response to an ever-changing environment

Leading to the best decisions to adapt to a changing environment

The system incrementally updates measures, based on a series of small experiments and observations, therefore flexibly responds to changes in the environment



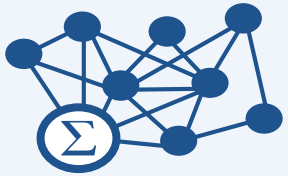
Quantum Computing

[Challenge] Solving Large-Scale "Combinatorial Optimization Problems" Efficiently

Quickly suggest the best solution from a huge number of combinations

- Efficiently searches valid solutions that meet restrictions only, by original algorithm using vector computer.
- Global sales launch of D-Wave's quantum computing cloud service.

Search for solutions that meet restrictions in a short period of time



Started providing support services for the introduction of optimization technologies

(press release on November 26, 2021)

Optimization can be applied to decision making in various areas

Manufacturing and Logistics

Production planning, Manufacturing planning, Worker shifts, Materials Informatics, Delivery planning, Cargo loading

Government agency

Tax collection plan,
Police patrol route plan,
Personnel changes in local governments

Stores/Retail

Product assortment, Shelving/layout, Product recommendations, Dynamic pricing, Employee shift

Media

Commercial Scheduling Planning,
Ad Delivery,
Personalization of distribution articles

Traffic

On-demand bus and railway schedule correction
Dynamic pricing,
Automatic operation

Healthcare/Medical

Recommendations for meal planning and menu,
Drug creation, Personalizing fitness plans,
Route planning for home health care, Nurse shifts

Finance

Personnel allocation and personnel transfer
Product recommendations,
Financial investment portfolio

Other

Maintenance optimization,
Satellite scheduling,
Personalizing travel plans

NEC's Optimization Strength: Top-Class Human Resources

Riki Eto

NEC
AI Analytics Division
(Data Science Research Laboratories)
Expert

In March 2012 He received Master of Engineering, Department of Aeronautics and Astronautics, the University of Tokyo and joined NEC in April 2012.
Currently in charge of the principle research and business application of machine learning, data mining and system identification, and received the 29th Advanced Technology Award (Fuji Sankai Business Award) in 2015.
Drive NEC's optimization business.

Tsuyoshi Yamamoto

NEC
System platform Research Laboratories
Research ChiefResearch Fellow

In 2004 he was selected as one of MIT's "100 Young Engineers of the World".
At present, NEC's Quantum annealing Research Leader.
It was adopted by the development project manager of the HW elemental technology aiming at realization of the error-tolerant general-purpose quantum computer in the moon shot program led by the Cabinet Office in 2020, and it leads the research.

Shinji Ito

NEC
Data Science Research Laboratories
Senior Principal Researcher

He joined NEC in 2015 and received Ph.D. in Graduate School of Information Science and Technology, the University of Tokyo in 2020.
Has been working on theoretical research of on-line optimization and bandit optimization. He has published numerous papers in the most difficult international conferences in the field of machine learning, such as NeurIPS, ICML, and AISTATS. In Japan, he takes a leading position in AI and mathematical optimization research in Japan.

Hiroshi Chishima

NEC
Technology Value Creation Division
Quantum Computing Promotion Office
Senior Expert

From 2016 to 2018, he was seconded to the Council for Science, Technology and Innovation, Cabinet Office, Government of Japan, as Director for Policy Planning and Investigation. He was involved in the promotion of quantum computing technology. Returned to NEC in 2018. Worked on exploring applications for quantum annealing machines. He is promoting the commercialization of platforms and solutions for annealing methods.

NEC's Quantum Computing Services

Optimization

NEC provides total support of cloud services, from provision, to education and application support necessary for the introduction, and is promoting practical application of Quantum Computing technology.

NEC Vector Annealing (VA) Service

Launched in November 2021

By using a vector computer, provides cloud services for high-performance simulated annealing machines

Features of annealing machines

- Ultra-high speed processing by vector computer and originally developed algorithm suitable for annealing process More than 300 times better than conventional simulated annealing systems.
- Supports large scale combinatorial optimization problems equivalent to 100,000 qubits.
- Enables easy development of applications linked to big data/AI software

※1 Use of commercialized SX-Aurora TSUBASA as a supercomputer
※2 Examination of 2 NEC. Compared with the conventional algorithm (simulated annealing) performed by Xeon processor in the 100 urban traveling salesman problem.

Leap™ Quantum Cloud Service

Launched in December 2021

Leap Quantum Cloud Service of D-Wave provided by NEC enabled support in Japanese language

Quantum Computing Applying Service

Launched in June 2020

Total support for customers' business issues, including technical verification using NEC vector annealing machines and D-Wave's Leap Quantum Cloud Service

- Extract Business Issues
- Examine Optimization Method
- Formulate and Desk-check
- Put it into Field-Application Test

Quantum Computing Education Service

Launched in November 2021

Supporting human resources development of quantum computing to accelerate customers' use of DX and AI

Basic

Programs to learn what quantum computing is and what kind of problems can be solved in a short period of time

Skills Practice

Service for acquiring programming skills for problem solving by quantum annealing


Orchestrating a brighter world
NEC