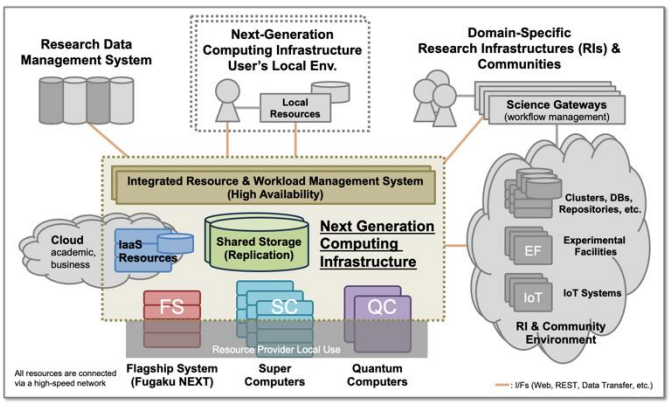
# Operation Technologies for Next-Generation HPC Infrastructure

Japan is planning to develop a successor to the supercomputer "Fugaku," *Fugaku-NEXT*, and is considering a next-generation computing infrastructure that would federate Fugaku-NEXT, major supercomputers in Japan, clouds, etc. In collaboration with the University of Tokyo, RIKEN R-CCS, and Institute of Science Tokyo, we investigate the operation technologies required by the computing infrastructure and introduce the topics of resource management and security.

## Next-Generation Computing Infrastructure

- Scientific computing infrastructures have changed their functions and structure:
  - Emergence of new technologies: Virtualization and quantum computers.
  - Change in computational patterns: Data reuse, collaboration with domain-specific research infrastructures (RIs), and AI for science.
  - Requests for solving social issues: Global warming and disaster prevention.
- We investigate a *next-generation computing infrastructure* that would coordinate and operate *Fugaku-NEXT*, *major HPC systems in Japan*, and *cloud resources*.
  - Flexible and seamless use of resources.
  - Alleviation of workload concentration and solution to data center power shortages.
  - Federation with RIs, research data mgmt. systems and community environment.
  - Optimization for carbon neutrality.
  - Digital twins.
  - Network functions to resolve the above issues.
  - Security for the integrated operation of resources across multiple data centers, etc.




- Key technologies extracted from use cases.
  - Authentication and authorization for all resources and services.
  - Resource broker and meta scheduler across all resources.
  - Resource usage abstraction.
  - Hybrid computation with HPC and quantum computers.
  - Workflow system, etc.

## HPC Security Guideline

- Due to the intensification of cyber attacks, resilience to counter intrusions and internal misconduct has become necessary, even in HPC centers.
- We have developed a draft version of the *Security Guidelines for HPC Data Centers* based on the National Institute of Standards and Technology (NIST) Cybersecurity Framework (CSF).
  - CSF functions: Identify, Protect, Detect, Respond, Recover, and Govern.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