HOKKAIDO UNIVERSITY INFORMATION INITIATIVE CENTER

2025–2026

Hokkaido University Information Initiative Center

A message from the director

Masaharu Munetomo
Director, Hokkaido University
Information Initiative Center

The Hokkaido University Information Initiative Center was established in 2003 through the integration of the Large-scale Computer Center and the Center for Information and Multimedia Studies.

The Interdisciplinary Large-scale Computing System has been developed by the Center provides services to researchers nationwide. In addition to promoting interdisciplinary joint research by HPCI and JHPCN, the system has also contributed to advanced research within the University. At the end of FY2024, the system was upgraded to a new configuration with more than double the theoretical peak performance. The new system, consisting of the Grand Chariot 2 supercomputer system and the Research Cloud System, introduces GPU (Graphic Processing Unit) accelerators, enabling expansion into new application domains such as artificial intelligence (AI). Furthermore, under the Program for Forming Japan's Peak Research Universities (J-PEAKS), in which Hokkaido University has been selected as a core institution, the Center plans to introduce a large-capacity data storage system as research big-data infrastructure, serving as the foundation for achieving digital transformation (DX) in research. Through these initiatives, we will further promote research DX across the University and contribute to the enhancement of its research capabilities.

With the rapid development of generative AI in recent years, expectations are rising for the Center to play a leading role in realizing AIX (AI Transformation) beyond DX. In addition to introducing GPU accelerators for AI applications in the new system, and in recognition of the indispensable need to establish a "knowledge generation infrastructure" to foster the creation of new knowledge, the Center's budget request for FY2025—"Enhancement of the Research and Development Framework for the Development and Utilization of an Advanced Knowledge Information Infrastructure" —was adopted, leading to the establishment of the Knowledge Generation Infrastructure Research Division within the Center.

Making the fullest use of advanced AI technologies, exemplified by the recent rapid progress of generative AI, has become an urgent challenge for strengthening the University's research capabilities. It is imperative to advance cutting-edge research and development that enhances the entire lifecycle of research data, thereby contributing to the reinforcement of our research capacity. To this end, the newly established division will take the lead in realizing the knowledge generation infrastructure by designing and implementing research data and AI platforms, and by conducting the R&D necessary for their university-wide deployment and utilization. Such efforts include the development of advanced AI and machine learning technologies, including foundation models of generative AI, and their application to real-world problems; research and development related to the optimal design of the knowledge generation infrastructure system; and R&D on lifecycle management covering the generation, storage, sharing, processing, and publication of data.

Humanity has evolved in coexistence with the tools, machines, languages, and IT technologies it has created. As the coexistence and co-evolution of humanity and AI inevitably advance, the role expected of an information center within a university will become ever more significant. To support the strengthening of research capabilities both at Hokkaido University and in Japan as a whole, the Center will continue to advance research and development, system construction, service provision, and establishment of their support frameworks. We sincerely ask for the continued guidance and cooperation of all concerned, both within and outside the University.

Information Initiative Center North Building

Information Initiative Center South Building

HISTORY

1960s

Large-scale computing infrastructure

Aug. 1962 Hokkaido University Computation Center established
(for joint use by Hokkaido University, other national
universities and technical colleges in Hokkaido)
(HIPAC 103, Hitachi; NEAC2203, NEC; storage
capacity: 10 K words)

NEAC2203-G

1970s

Apr. 1970 Hokkaido University Large-scale Computer Center
established (for domestic joint use)
(FACOM230-60, Fujitsu (160 K words))
Nov. 1977 Terminal connection service involving the use
of switched lines launched
Oct. 1979 Hitachi system introduced(HITAC M-180 (6 MB))

Educational information infrastructure

Apr. 1979 Center for Information Processing Education established
(for on-campus joint use) (HITAC M-170, Hitachi)

1980s

Oct. 1981 Large-scale Computer Center's N1 network service launched
Aug. 1986 Supercomputer introduced (S-810/10, Hitachi (128 MB))

Initial practical training

1990s

Painted S3800/380 supercomputer

Oct. 1993 Internet service (e-mail, web) launched
Mar. 1996 Large-scale general-purpose computers
replaced with WS- and PC-based server-client system
Apr. 1999 Center for Information Processing Education
reorganized into Center for Information and
Multimedia Studies

Network infrastructure

Mar. 1992 Hokkaido University Information Network
System (HINES) established (FDDI)
Jan. 1995 Super information highway(ATM)
operation launched
Mar. 1999 Operation of ultra-high speed campus
network extension system launched

2000s

Foundation of the Information Initiative Center

Apr. 2003 Information Initiative Center established
Nov. 2003 Center opening ceremony held
Information Processing Research Conference 2003 held
Mar. 2005 Educational information system updated
Jan. 2006 Supercomputers updated
Mar. 2007 General-purpose computer system updated
Mar. 2009 Campus network system updated
Jun. 2009 Center inaugurated as network-type constituent of JHPCN
(for the period from Apr. 2010 to Mar. 2016)
Jul. 2009 Academic exchange agreement concluded with the Graduate School
of Education at Korea University College of Education (Republic of Korea)

Approx. 90 attendees from the
Ministry of Education, Culture,
Sports, Science and Technology,
the Hokkaido Government, the
Sapporo Municipal Government,
Hokkaido University and other
national, public and private
universities

Information Processing
Research Conference 2003

2010s

Mar. 2010 Educational information system updated
Jul. 2010 Research agreement on large-scale demonstration experiment for a next-generation green
supercomputer concluded with the National Institute of Informatics and Tokyo Institute of Technology
Oct. 2010 Center selected as a constituent of a consortium in preparatory stages toward high-performance
computing infrastructure (HPCI) development (computational resource provision)
Jul. 2011 Academic exchange agreement concluded with Hansung University College of Arts (Republic of Korea)
Nov. 2011 Large-scale computer system updated (interdisciplinary large-scale computer system
(e.g., supercomputer, cloud) introduced)
Sep. 2012 HPCI service launched
Nov. 2013 Information Initiative Center 10th anniversary ceremony held
Apr. 2014 Petabyte-class integrated data science cloud storage service launched
Mar. 2015 Campus network system updated
Oct. 2015 Education information system updated
Oct. 2015 Research divisions reorganized (from 4 to 6); Cyber Security Center established
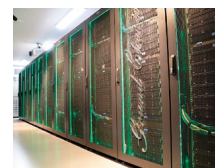Jan. 2016 Certification as a network-type Joint Usage/Research Center for Interdisciplinary Large-scale
Information Infrastructures renewed (for the period from Apr. 2016 to Mar. 2022)
Dec. 2018 Large-scale computer system (Interdisciplinary Large-scale Computing System) updated
[Hokkaido University High Performance Inter-cloud]
Dec. 2019 AI-compatible advanced computer system introduced

Information Initiative Center 10th Anniversary Ceremony

Launch Ceremony for the Interdisciplinary Large-scale
Computer System

2020s

Aug. 2020 ICT Planning and Technical Advisory Office established
Mar. 2021 Campus network system updated
Oct. 2021 Certification as a network-type Joint Usage/Research Center for Interdisciplinary Large-scale Information
Infrastructures renewed (for the period from Apr. 2022 – Mar. 2028)
Nov. 2023 Information Initiative Center 20th Anniversary Ceremony and Commemorative Lecture held
Apr. 2025 Large-scale computer system (Interdisciplinary Large-scale Computing System) updated
Jun. 2025 One new research division established (total of 7 divisions)
Nov. 2025 AI-enabled research DX Big Data infrastructure system introduced (scheduled)

Information Initiative Center 20th Anniversary Ceremony

Interdisciplinary Large-scale Computing System

Overview

The Hokkaido University Information Initiative Center has replaced its Interdisciplinary Large-scale Computing System, which consists of a supercomputer and a cloud system, with a new system centered on the FUJITSU Server PRIMERGY series. The new system began operations in April 2025 and launched official services in July. The system is utilized for research and development in computational science, computer science, data science, and AI/machine learning at Hokkaido University and other universities and research institutes across Japan. In addition, the system provides computational resources for open-type joint research under the High-Performance Computing Infrastructure (HPCI) and the Joint Usage/Research Center for Interdisciplinary Large-scale Information Infrastructures (JHPCN), supporting researchers from academia as well as industry nationwide. The system also serves as a platform for education and the development of human resources in computational science, computer science, data science, and AI/machine learning, helping advance these fields. With the introduction of this system, the Hokkaido University Information Initiative Center further enhances its contribution to society.

Supercomputer system

The supercomputer system consists of the computing system "Grand Chariot 2", which comprises two types of computing nodes—CPU nodes and GPU nodes—and a storage system. The computing nodes deliver a theoretical peak performance of 9 PFLOPS, 2.27 times that of the previous system, while the storage system provides a physical capacity of 16.95 PB in an all-flash (full SSD) configuration. In addition, two types of computing services are offered: "Shared course" and "Exclusive course", allowing users to choose the type of service according to their research needs.

System configuration

■ CPU nodes (FUJITSU Server PRIMERGY CX2550 M7)

Each node is equipped with two Intel multi-core CPUs (Xeon Gold 6548Y+, 32 cores, Emerald Rapids) and 512 GiB of memory, and the system consists of 480 nodes in total. The computing nodes are interconnected by an InfiniBand NDR network.

■ GPU nodes (FUJITSU Server PRIMERGY GX2560 M7)

Each node is equipped with two Intel multi-core CPUs (Xeon Gold 6548Y+, 32 cores, Emerald Rapids), four NVIDIA GPUs (H100), and 512 GiB of memory. The system consists of 24 nodes in total. The computing nodes are interconnected by an InfiniBand NDR network.

■ Storage system (DDN ES400NVX2)

The storage system is configured entirely with flash memory (SSD) in an all-flash architecture, providing a physical capacity of 16.95 PB. It employs a distributed file system based on Lustre (DDN EXAScaler).

Software

On the CPU and GPU nodes, Intel compilers (Fortran, C, and C++), numerical libraries (MKL), MPI libraries, and other tools are provided. Java and Python are also available. On the GPU nodes, GPU-oriented compilers and libraries such as the NVIDIA HPC SDK can be used, enabling a wide range of applications from numerical computation and simulation to AI and machine learning. Application software such as Gaussian and V-FaSTAR is available, along with numerous open-source software packages including OpenFOAM and TensorFlow. In addition, a container execution environment using Singularity is provided.

Services

On the CPU and GPU nodes, the following services are provided. In each service type, users may form a group to share the resources allocated to them.
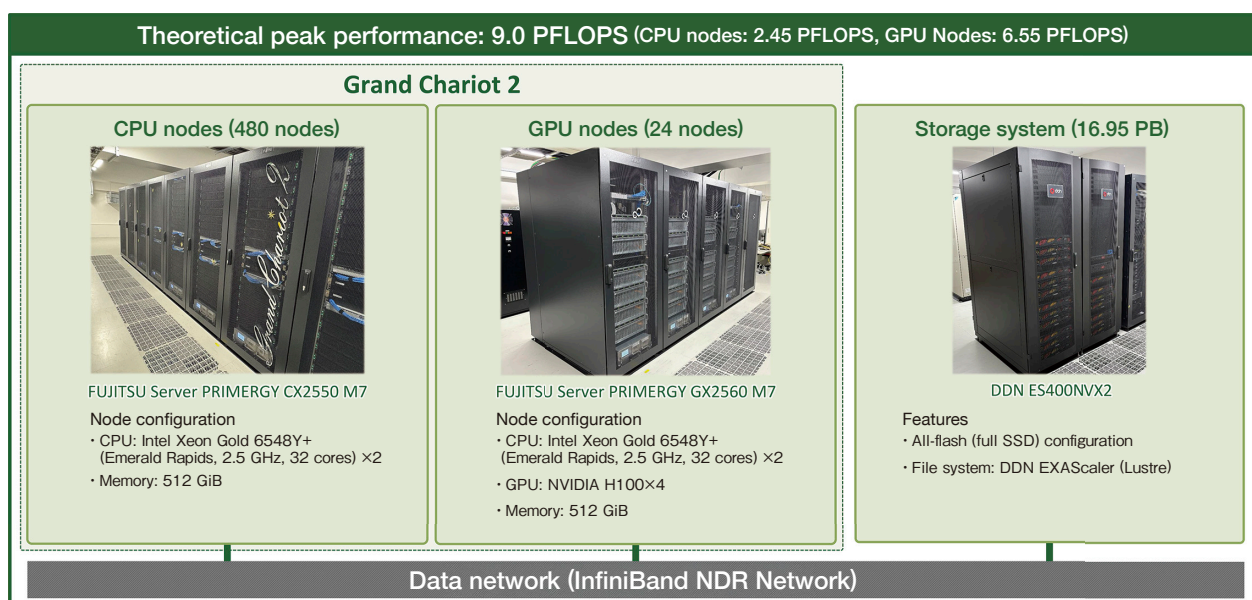
■ Shared course

In this service type, computing resources are shared among users. Users can execute their jobs by applying for operation time (tokens) and consuming them. Large-scale jobs using many computing nodes are available. Usage fee is calculated based on the product of elapsed time and the number of CPU sockets or GPU cards used.

■ Exclusive course

In this service type, users apply for CPU sockets or GPU cards, and can utilize the allocated resources throughout the year without having to wait for other users' jobs. Storage space is also provided depending on the allocated computing resources.

System configuration of the supercomputer system

Theoretical peak performance: 9.0 PFLOPS (CPU nodes: 2.45 PFLOPS, GPU Nodes: 6.55 PFLOPS)

Grand Chariot 2

CPU nodes (480 nodes)

FUJITSU Server PRIMERGY CX2550 M7

Node configuration
· CPU: Intel Xeon Gold 6548Y+
  (Emerald Rapids, 2.5 GHz, 32 cores) ×2
· Memory: 512 GiB

GPU nodes (24 nodes)

FUJITSU Server PRIMERGY GX2560 M7

Node configuration
· CPU: Intel Xeon Gold 6548Y+
  (Emerald Rapids, 2.5 GHz, 32 cores) ×2
· GPU: NVIDIA H100×4
· Memory: 512 GiB

Storage system (16.95 PB)

DDN ES400NVX2

Features
· All-flash (full SSD) configuration
· File system: DDN EXAScaler (Lustre)

**Data network (InfiniBand NDR Network)**

Research Cloud System

The Research Cloud System envisions a next-generation academic information infrastructure by combining disaggregated computing technology utilizing PCIe switches on the hardware side with OS container infrastructure technology based on Kubernetes on the software side, thereby providing an advanced cloud environment. This system represents a shift from the conventional concept of setting up servers (providing computing resources) to the provision of a research application platform, enabling more direct support for research. It flexibly and seamlessly responds to the diverse requirements of researchers both within and outside the University.

Hardware

■ Fsas Technologies PRIMERGY CDI (Composable Disaggregated Infrastructure)

This system is among the first to adopt disaggregated computing technology, in which each server, GPU, and NVMe storage device is interconnected via a high-speed fabric using PCIe switches. The servers provided to users consist of 20 units of PRIMERGY RX2530 M7 for CDI, each equipped with two Intel Xeon Gold 6538N processors and 256 GB of memory. Each server is equipped with four NVIDIA H100 GPUs and 30.72 TB of NVMe SSDs, which can be flexibly assigned through the high-speed fabric. The assigned GPUs and NVMe SSDs can be accessed as local resources from each server.

Configuration of the Research Cloud System
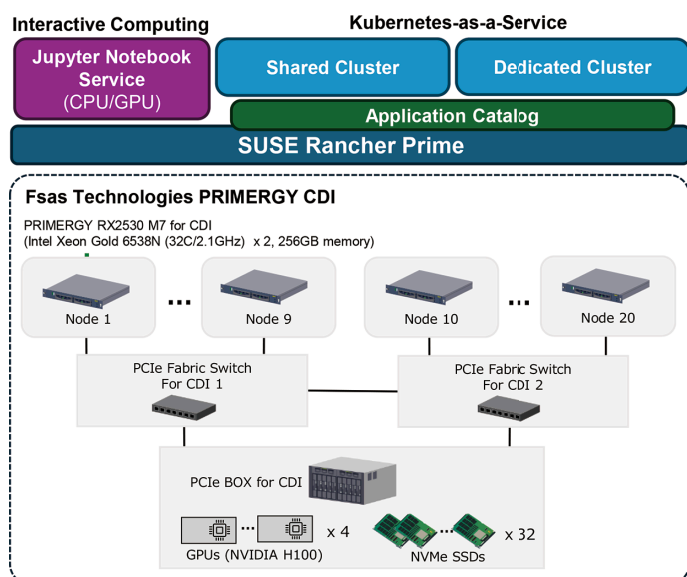
Cloud infrastructure software

■ SUSE Rancher Prime

In this system, Rancher has been adopted as the cloud infrastructure software. The platform has shifted from the former OpenStack-based virtual machine technology to a Kubernetes-based infrastructure centered on OS container technology. Containers are executed directly on bare-metal servers without passing through virtual machines. Application deployment to Kubernetes clusters can be carried out interactively and visually via the GUI from the application catalog provided by Rancher.

Services

The Research Cloud System offers the following services and functions to support research activities.

■ Jupyter Notebook service

A Jupyter Notebook service, widely used in machine learning, generative AI, and large-scale data analysis, is provided within the scope of the basic usage fee. This environment supports both CPU computation and GPU computation (MIG-partitioned GPUs), and user storage is also provided as required.

■ Kubernetes cluster service

A shared kubernetes cluster service is provided, in which all users share a single kubernetes cluster, with user separation achieved through the namespace function. In addition, an exclusive cluster service is partially provided, offering independent Kubernetes clusters separated from other users.

Others

■ Application server

The application server provides various applications (e.g., Mathematica, MATLAB, COMSOL), which can be used through a GUI-based interface.
Note: Due to license restrictions, some software is available only to researchers and students affiliated with Hokkaido University.

■ Cloud archive system (FUJITSU Storage ETERNUS LT140)

A magnetic tape archive device with a physical capacity of 17 PB has been installed at Kitami Institute of Technology, providing an environment that serves as a foundation for open science. This system also functions as a remote backup system with disaster tolerance in mind and aims to preserve research data for more than ten years, thereby supporting measures against research misconduct.

■ Cloud storage (DDN ES200NVX2)

This large-scale storage system, with a physical capacity of 1.2 PB, serves as a foundation for open science. As cloud storage, it provides a WebDAV storage service based on Nextcloud. The service can be used via the official Nextcloud client software or a web browser interface. The official client software is available for Windows PCs, Mac computers, smartphones, and tablets, and enables automatic synchronization of data between user devices and the cloud storage. Through the web interface, files can be uploaded and downloaded from any environment, and functions such as file- and folder-level sharing are also supported. Data stored in the Center's storage system through this service is automatically backed up to the magnetic tape archive device at Kitami Institute of Technology.

■ Large-format printer

A large-format color printer capable of output up to A0 size is available. Printing is supported on plain paper, glossy paper, and cloth media.

Joint Usage/Research Center

The Center serves as a joint-usage facility for the eight universities consulting the network-type Joint Usage/Research Center for Interdisciplinary Large-scale Information Infrastructures (JHPCN; a network organization established in line with the School Education Law's Enforcement Regulations).

■ Facilities of the network-type Joint Usage/Research Center

- Information Initiative Center, Hokkaido University
- Cyberscience Center, Tohoku University
- Information Technology Center, The University of Tokyo (core base)
- Center for Information Infrastructure, Institute of Science Tokyo
- Information Technology Center, Nagoya University
- Academic Center for Computing and Media Studies, Kyoto University
- D3 Center, The University of Osaka
- Research Institute for Information Technology, Kyushu University

■ Effective designation period

April 1, 2022 – March 31, 2028

■ Center mission

The network-type center's mission is to contribute to the further advancement and ongoing development of Japanese academic and research facilities through interdisciplinary joint usage/research relating to grand challenges (i.e., particularly difficult issues) using super-large-scale computers, super-high-capacity storage/network resources and other types of information infrastructure. its work covers information processing fields in general, including the global environment, energy, substanc-es/materials, genome information, web data, academic information, time-series data from sensor networks, image data and program analysis.

■ Center operation

JHPCN is operated by the Steering Committee and Joint Research Project Screening Committee under The University of Tokyo Information Technology Center, which is its core base.

■ Promotion of open-type joint research

At this center, research proposals are solicited in interdisciplinary fields utilizing large-scale information infrastructures, including large-scale numerical computation, large-scale data processing, large-scale network technology, and integrated large-scale information systems that combine these fields. In FY2025, 74 joint research projects are being conducted, 11 of which are related to this Center. In addition, since FY2016, a system has been in place under which joint research projects independently solicited by each center constituting the network-type centers, with the expectation of future development into JHPCN projects, are designated as JHPCN Exploratory Joint Research. As of June 2025, 25 such projects have been adopted.

■ Computational resources available for open-type joint research at the bases

Supercomputer systems

Grand Chariot 2
* Shared course is available

Research Cloud System

Shared kubernetes cluster
Exclusive kubernetes cluster
* L2VPN is available

Promotion of seminal joint research

To fulfill the purpose of the network-type Joint Usage/Research Center for Interdisciplinary Large-scale Information Infrastructures (JHPCN), the Information Initiative Center has conducted its own open-type joint research since FY 2009 in addition to the joint research it conducts as a JHPCN base.

The Information Initiative Center is playing a central role in the implementation of grand challenge-type research using information infrastructure and interdisciplinary joint research by dividing projects into the following research types as exploratory joint research. Twelve joint research projects are being conducted with teachers and researchers of domestic research institutions (as of July 2025).

- Research type A: Type to utilize computational resources
- Research type B: Type to support the organiza tion of research meetings

AI-enabled research DX Big Data infrastructure system

In FY2023, the Information Initiative Center was selected to participate in the "Program for Forming Japan's Peak Research Universities (J-PEAKS)" as the lead institution for a DX project.

This initiative is dedicated to the theme of building and developing sustainable food production systems based on field science to restore the global environment.

The DX project is being advanced by researchers including specially appointed faculty members of this Center with expertise in AI/ML and cloud technologies.

To promote advanced and cutting-edge research aligned with the objectives of the five-year project, the Center is developing this system, which consists of an AI-focused research platform and large-scale storage available as a repository for research data. The system will be launched in November 2025.

Through this effort, the Center will not only facilitate AI-driven research activities on campus, but also contribute to the "Collaborative Research Platform Project ," which supports interdisciplinary and applied research representing unique and distinctive strengths of the University. In this way, the Center plays a key role in forming a research hub that embodies the University's commitment to "Excellence" in education and research in science and technology, as well as "Extension," which expands education and research to society and contributes to solving global and regional challenges.

Furthermore, this storage system will be used not only as a online storage for research purposes, but also in coordination with GakuNin RDM (Research Data Management Infrastructure*), with the aim of achieving unified management of research data.

(*)A research data management service operated by the National Institute of Informatics, enabling researchers to manage and share research data and related materials.

Unified storage ×1
[AFF-C80 (physical capacity: 1.5 PB)]

Operation management servers (Hyper-V) ×2
[PRIMERGY RX2530 M7]

Active directory for operation management system ×1
[PRIMERGY RX2530 M7]

Backup storage for operation management Servers ×1
[Synology RS3621xs+]

Nextcloud servers (DB ×2 / Web ×4)
[PRIMERGY RX2530 M7]

Private AI Platform on PRIMERGY×1
[PRIMERGY RX2540 M7]

Load balancers ×2
[IPCOM EX2-3200]

FW×2
[Fortigate FG-400F]

Configuration of the AI-enabled research DX Big Data infrastructure system

Cyber Security Center

In response to the establishment of the Basic Act on Cybersecurity and social developments, the Cyber Security Center (CSC) was established in the Information Initiative Center in October 2015. The Cyber Security Research Division, established at the same time, plays the central role. CSC works in close cooperation with the ICT Security Office of the ICT Promotion Office, which is an on-campus computer security incident response team (CSIRT), for activities on cyber security in the university which used to be conducted collaboratively with the involvement of multiple organizations (e.g., the Information Security Committee, ICT Promotion Office and Information Initiative Center), and provides a wide range of services, including training and education related to cyber security.

## https://www.iic.hokudai.ac.jp/csc/

Hokkaido University

On-campus CSIRT activities

In case of a security incident on campus, CSC plays a central role in information collection, identification of the cause, analysis of the incident and development of immediate responses and recurrence prevention measures, in collaboration with the ICT Security Office of the ICT Promotion Office, which is an on-campus computer security incident response team (CSIRT).

Cyber drills

In preparation for unforeseen circumstances, CSC plans, designs and implements cyber drills, including simulated virus mail and virtual incident responses, in cooperation with the ICT Promotion Office.
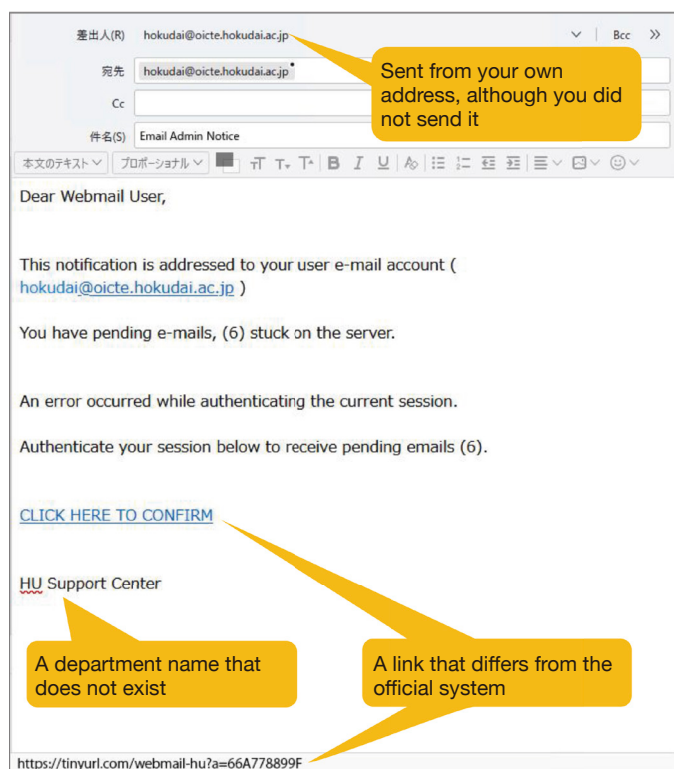
Reference: Targeted Email Attack Training, FY2024

Cooperation for inbound access control

Cooperation with the screening of applications for the lifting of inbound access control on campus.

CSC cooperates with the ICT Security Office of the ICT Promotion Office in technical screening of applications for the lifting of restrictions on Internet communication to the University from outside, in accordance with the Hokkaido University's Rules for Information Security Measures and Hokkaido University's Bylaw for Lifting of Inbound Access Control.

Contact for application: ICT Security Office
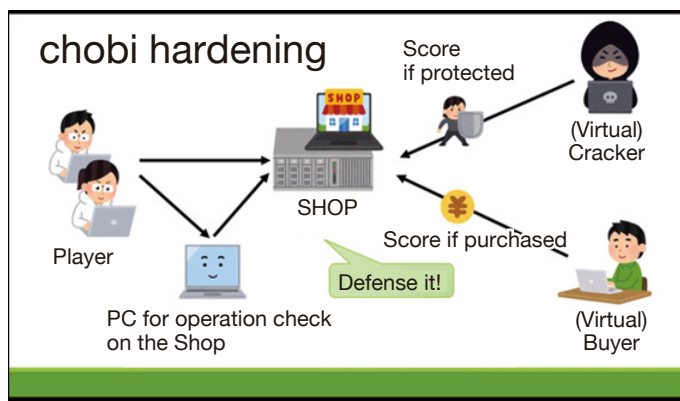exception-apply@security.hokudai.ac.jp

Enlightenment activities and joint research related to cybersecurity

CSC's enlightenment activities include presentations on cybersecurity and personal information protection for various training courses of national universities held at Hokkaido University. In addition, in cooperation with the ICT Promotion Office, CSC is making efforts to maintain and improve the level of cybersecurity within the University through information security seminars held on a university-wide scale, as well as through faculty development (FD) activities and student guidance conducted by each department.
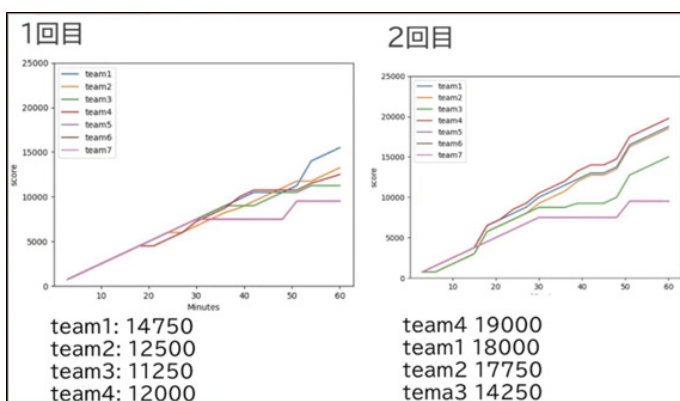
Furthermore, the Center participates in the Industry Creation Course organized by the Institute for the Promotion of Business-Regional Collaboration, thereby promoting joint research with the private sector in the field of cybersecurity.

Collaboration with related organizations

CSC participates in various events and activities for enlightenment and training in collaboration with related government ministries/agencies and other organizations related to cyber security in Hokkaido. In one example, as an organizer of events in the Security College for Youth (SC4Y) project, CSC uses facilities of the Information Initiative Center to perform "Micro Hardening", a competition-style simulation in which participants try to protect an e-commerce website from cyberattacks as an administrator, and its simplified versions "Micro Hardening Basic" and "chobi hardening" for youth in Hokkaido.


Outline of chobi hardening

team1: 14750
team2: 12500
team3: 11250
team4: 12000

team4 19000
team1 18000
team2 17750
tema3 14250

Competition result

Supercomputing Research Division

Development of space plasma applications

As applications for analyzing variations in the near-Earth space plasma environment, we have developed two first-principles kinetic applications entirely from scratch: the Particle-In-Cell (PIC) plasma particle code, which solves the equations of motion for charged particles, and the Vlasov code, which solves the time evolution of the distribution function described by the Boltzmann (Vlasov) equation. For these applications, we have introduced the latest numerical schemes, implemented process parallelization for large-scale parallel computing environments, applied thread parallelization and made performance tuning for many-core processors. These kinetic applications are applied to the analysis of various space plasma phenomena. In addition, as a new approach to large-scale phenomena that cannot realistically be solved using first-principles kinetics on present-day supercomputer systems, we are also developing a third application based on newly derived electromagnetic fluid equations.
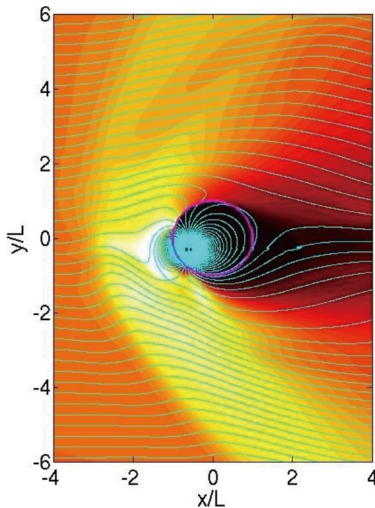

Deformation of the magnetosphere revealed by large-scale massively parallel simulations using the super-computer

High-Performance Numerical Methods for Scientific Computing

We conduct research and development on advanced numerical methods and computational techniques that fully exploit the capabilities of state-of-the-art computing environments, including supercomputers, to achieve high-performance numerical computation. These techniques serve as fundamental building blocks supporting a wide range of scientific and engineering applications such as numerical simulation, data analysis, and machine learning. Specifically, we pursue both a mathematical approach, focusing on the development and improvement of algorithms themselves, and an HPC-oriented approach, emphasizing the development and refinement of parallel processing and implementation techniques. For example, in the case of QR factorization, one of the fundamental matrix factorization methods, we have analyzed and evaluated its performance for massively parallel computation on supercomputers, providing useful insights, including guidance for selecting appropriate algorithms. In addition, we have developed a new QR factorization algorithm, building on the insights gained from the limitations of existing algorithms. The developed algorithm requires fewer communications during parallel computation and features a computational structure well-suited to leveraging the performance of modern CPU architecture. Its effectiveness, compared with existing algorithms, has been confirmed on supercomputers such as Hokkaido University's previous system, Grand Chariot. As illustrated by this example, our research focuses primarily on enhancing the performance of general-purpose numerical linear algebra methods on currently available computers. At the same time, we also study computational techniques for specific applications and develop techniques to leverage emerging next-generation hardware. Ultimately, we aim to contribute to improving the efficiency of various applications that involve numerical methods by providing high-performance numerical libraries and software frameworks based on our research results.

Comparison of the performance of different QR factorization methods on Hokkaido University's supercomputer, Grand Chariot
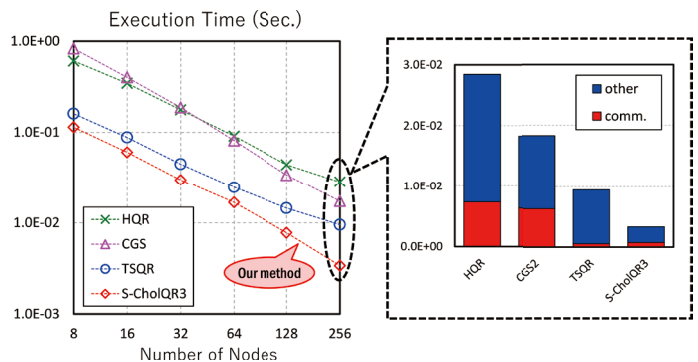
Digital Contents Research Division

Shifting the boundary between Academism and creativity

Increasing amounts of academic information can today be made public thanks to the progress of digital technology, but such content is often not consumed efficiently due to inappropriate presentation and methods of utilization. Accordingly, research is conducted to develop methods for the automatic conversion of such information into teaching materials, the promotion of autonomous study using such materials, the introduction of creative approaches to academism, and the integration of creator education with university education.

In addition, we are analyzing basic science data by means of numerical simulation using computers and conducting research as evaluation contents of basic science data using the obtained results.

Information Network Research Division

Information network visualization

Research is being conducted on visualization systems that support communication via messages tied to objects based on connections between networks and augmented reality (AR). An example of this is the AR book retrieval system, which allows books to be located by simply pointing a smartphone camera linked to a cloud-hosted database at shelves in libraries and other places. The system also allows messages to be attached to books, supporting expectations for new forms of social networking based on encounters with such publications. The division's R&D efforts include work on a system for the visualization of behavior on social network sites in virtual-reality urban spaces via the mapping of complex follow relationships on Twitter and other major social networks.


An augmented reality-type book retrieval system linking cloud and smartphone services

TwitterCity
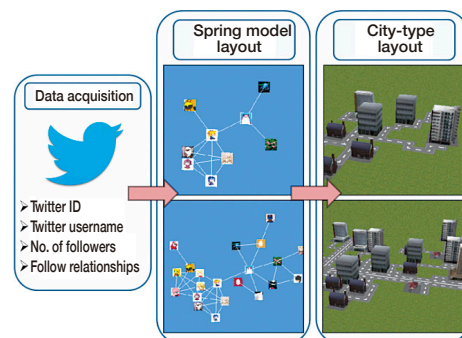
Visualization of social networks using virtual urban spaces

Augmented reality communication

As one of the applications of network-connected virtual reality/augmented reality (VR/AR), we are developing an avatar-based AR communication system that maintains spatial consistency such as eye direction. In this system, posture and position information of a terminal and feature point information around the target obtained when local participants in the group communication field recognize the AR target, which is a 3D-CG avatar of a remote participant, are shared through network linkage between terminals, and are reflected in the avatar's eye direction with spatial consistency in the avatar's behavior as seen from each terminal. This allows for natural behavior of avatars that corresponds to the respective physical placement and posture of the people participating in the field.
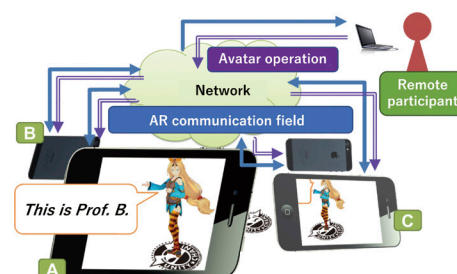
Media Education Research Division

Advancement of information education Studies on teaching methods of information ethics and copyright

In information ethics education, effective teaching methods for domestic and international students are explored using videos and manga. In copyright education, efforts are being made to teach copyright from creators' and users' standpoints. For that purpose, a learning support environment where derivative works can be created from an original licensed by the author is developed and evaluated.

Example of *manga* used to teach information ethics

Programming education

A classroom programming teaching environment for beginners (Moodle plug-in, see left diagram below) has been developed, and its practical evaluation is performed. In addition, programming robots are used to conduct practical research on programming education that combines individual learning and cooperative learning (see right figure below).

Support for education in hospital schools and R&D using information media and networks

At hospital schools, in-patient minors suffering from conditions of varying severity are provided with tailored treatment. Such children tend to be isolated both spatially and mentally. To establish an open and advanced educational environment, consistent research is conducted with a focus on informatization and educational support for hospital schools. Such efforts include research on tools that help hospitalized children interact with the outside world.

Research and practice in open education

Activities encompass research and practice in open education, including the use of OpenCourseWare. Flip teaching will be introduced and implemented in information education for all students.
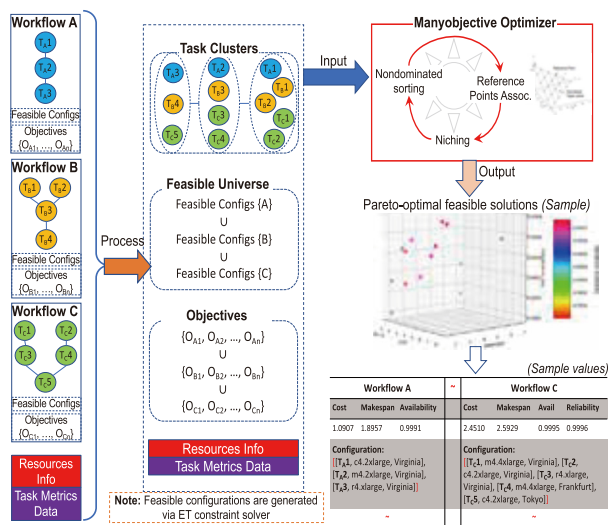
System Design Research Division

Establishment of an optimal academic inter-cloud system

In this division, R&D is promoted toward the establishment of a high-performance, intelligent inter-cloud system corresponding to today's era of big data. The aim is to create and utilize a nationwide academic inter-cloud system by connecting public cloud systems and private cloud systems run by universities and research institutes nationwide.

Under this project, which is promoted in conjunction with researchers nationwide, Hokkaido University advances the development and implementation of optimization algorithms, with a focus on research on resource allocation optimization on inter-cloud systems. Optimum resource allocation on inter-cloud systems will be realized by solving multipurpose optimization problems in consideration of performance, cost, reliability and other evaluation axes, while satisfying diverse constraints related to cloud infrastructure and applications.

The project also involves researchers in application fields, including genome sequence analysis and fluid acoustic analysis, in addition to those specializing in cloud infrastructure and middleware, so that multiple scientific and technical workflows can be optimized simultaneously.

In addition, research is conducted to integrate the HPC technology centered on conventional supercomputers with the cloud technology centered on microservices. HPC calculations that have traditionally been performed in batch scheduling are divided by element into fine-grained microservices, with the aim of achieving interdisciplinary interorganizational federation in the high-level microservice layer. Efforts are also made to make HPC calculation and the provision of cloud services coexist in the same Kubernetes cluster. Furthermore, research is conducted on the utilization of hybrid clouds for applications other than virtual machines, mainly "serverless" applications.

Optimization Process for Simultaneous Workflows
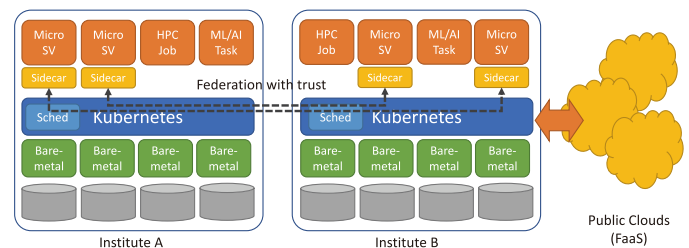


Cyber Security Research Division

The division handles a wide range of research fields related to cyber security.

Specifically, the division is conducted to contribute to the protection and prevention of cyber-attacks. Research subjects include data-driven cyber security topics utilizing advanced data science techniques to find regular and anomalous features from an enormous amount of datasets measured on the Internet, as well as cyber security topics for the emerging technologies implemented as networked and distributed systems on the Internet.

The professors use research results in both technological and practical aspects and contribute to educational activities on cyber security as members of the Cyber Security Center (CSC). In the field of cyber security education, after working as a partner school in the security field of the "Education Network for Practical Information Technologies (enPiT)" project implemented by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) from FY 2008 to FY 2020, we also participated in the Basic SecCap Consortium, which was organized after the project was completed. As a member of the Basic SecCap Consortium, we are in charge of "Basic Cyber Security Exercise," a cross-faculty course for third-year students and above in all faculties, and are continuing to provide education in cooperation and collaboration with other universities.

Symbolic data analysis for ICMP Echo Reply data
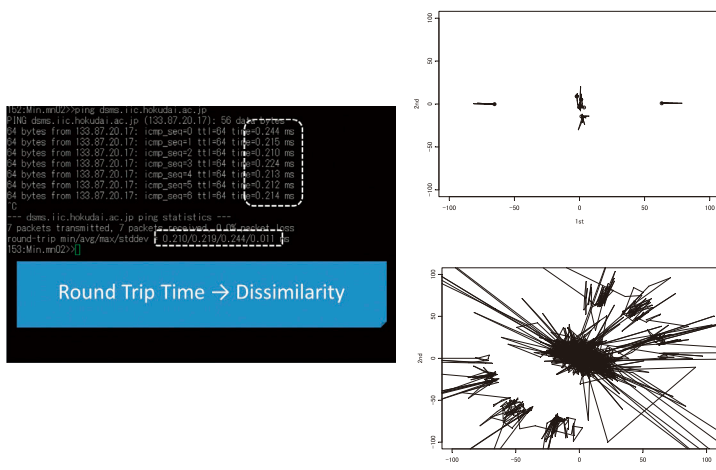
General-purpose anomaly detection mechanism for Internet backbone traffic
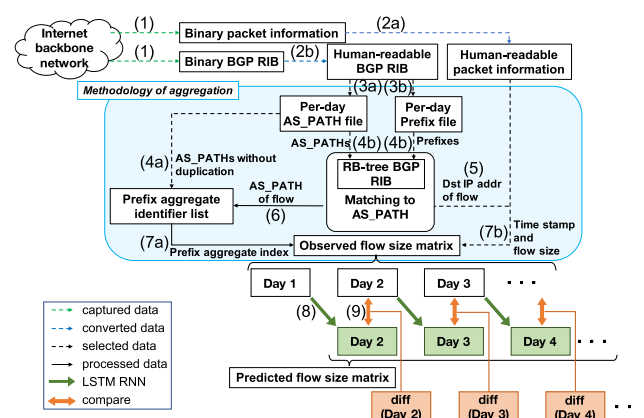
Main activities of the Information Initiative Center

In its role as a nationwide joint usage facility, the Center promotes the advancement of education/research and the implementation and support of education based on information media through R&D to facilitate informatization and information infrastructure development/operation.

Innovative high-performance computing infrastructure (HPCI)

HPCI operation was commenced in September 2012 with the establishment of an innovative computation base for joint use to meet diverse user needs. This was enabled via the high-speed network (SINET6) connection of RIKEN's next-generation supercomputer with other supercomputers at universities and research institutes nationwide.

The Center also participates as a system provider institution, offering computing resources. As of April 2025, five research projects utilizing this Center have been adopted.

■ HPCI system providers

- RIKEN Center for Computational Science
- **Information Initiative Center, Hokkaido University**
- Cyberscience Center, Tohoku University
- Center for Computational Sciences, University of Tsukuba
- Information Technology Center, The University of Tokyo
- Center for Information Infrastructure, Institute of Science Tokyo
- Information Technology Center, Nagoya University
- Academic Center for Computing and Media Studies, Kyoto University
- D3 Center, The University of Osaka
- Research Institute for Information Technology, Kyushu University
- Center for Earth Information Science and Technology, Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
- Center for Engineering and Technical Support, the Institute of Statistical Mathematics (ISM)
- National Institute of Advanced Industrial Science and Technology (AIST)

Interdisciplinary large-scale computer system training sessions/consultation meetings

Training sessions and consultation meetings on the interdisciplinary large-scale computer system are held occasionally to support users.

■ Past training sessions/consultation meetings

- Training sessions for the supercomputer system and consultation meetings on user's program
- Training sessions for the cloud system
- Training sessions and consultation meetings for application software
  ＊COMSOL Multiphysics ＊Mathematica ＊Gaussian

Supercomputer training session

Cloud Week@Hokkaido University (cloud symposium)

In November 2011, with the introduction of Hokkaido University Academic Cloud , one of the largest academic cloud platforms in Japan, the Information Initiative Center began hosting the annual Cloud Week symposium in FY2012. Each year, researchers from Japan and abroad who are engaged in cloud-related studies gather to exchange views on the current state of cloud research and to contribute to its future development. After the event, the recorded lectures are made available on the official YouTube channel of the Information Initiative Center.

Opening remarks at CloudWeek2024 @ Hokkaido University

Conferences/seminars

Conferences and seminars related to the Center are held occasionally.

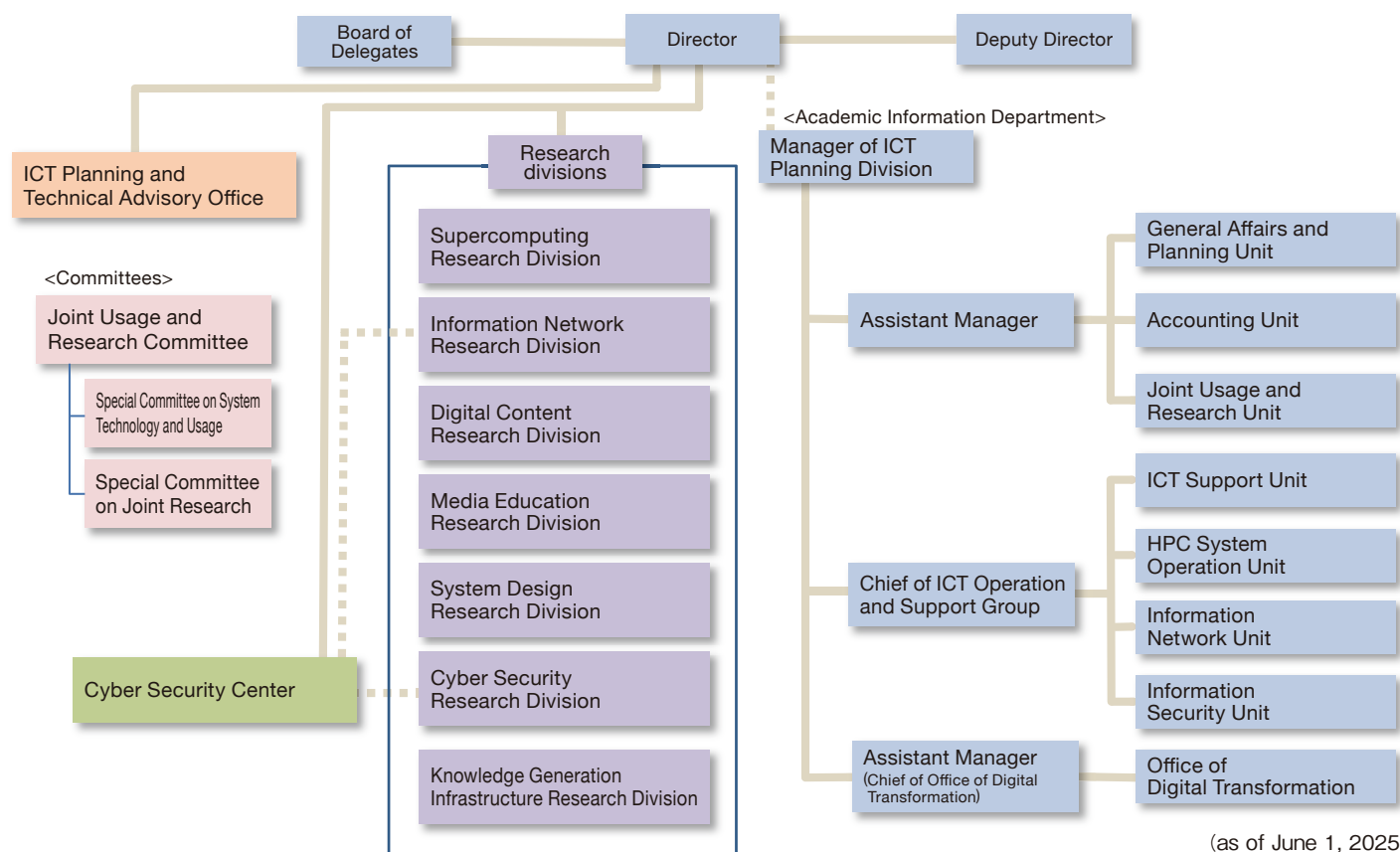Conference on Teaching of "Programming-like Thinking" to Elementary School Students

Exhibition in the Supercomputing Conference (SC)

The Center holds a booth exhibition to present its activities in the Supercomputing Conference (SC), which is an annual international conference on supercomputing in the United States.


Booth exhibition

Administrative organization of the Information Initiative Center

Board of Delegates — Director — Deputy Director

ICT Planning and Technical Advisory Office

<Committees>

Joint Usage and Research Committee
- Special Committee on System Technology and Usage
- Special Committee on Joint Research

Cyber Security Center

Research divisions
- Supercomputing Research Division
- Information Network Research Division
- Digital Content Research Division
- Media Education Research Division
- System Design Research Division
- Cyber Security Research Division
- Knowledge Generation Infrastructure Research Division

<Academic Information Department>

Manager of ICT Planning Division

Assistant Manager
- General Affairs and Planning Unit
- Accounting Unit
- Joint Usage and Research Unit

Chief of ICT Operation and Support Group
- ICT Support Unit
- HPC System Operation Unit
- Information Network Unit
- Information Security Unit

Assistant Manager (Chief of Office of Digital Transformation)
- Office of Digital Transformation

(as of June 1, 2025)

Information Initiative Center

Research Divisions	Professor	6
	Associate Professor	4
	Assistant Professor	2
	Specially Appointed Professor	1
	Specially Appointed Associate Professor	1
	Specially Appointed Assistant Professor	3
	Research Support Staff	5
Administrative Division (ICT Planning Division, Academic Information Department)	Administrative Staff	16
	Technical Staff	11
	Professional Associate	2
	Contract Staff Fixed-term Employee	1
	Specialist	1
	Administrative Assistant (full time)	6
	Administrative Assistant (part time)	4
	Technical Assistant (part time)	1
Total		64

(as of July 1, 2025)
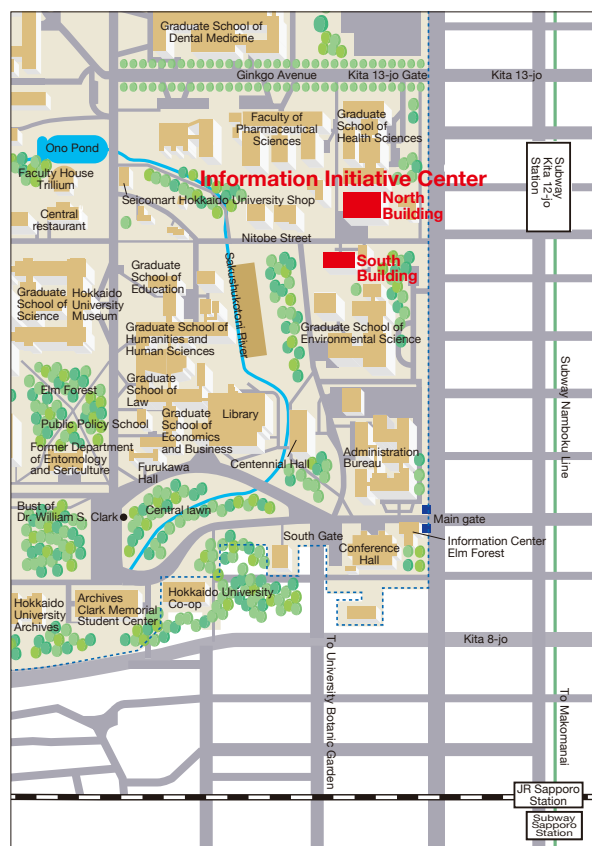
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