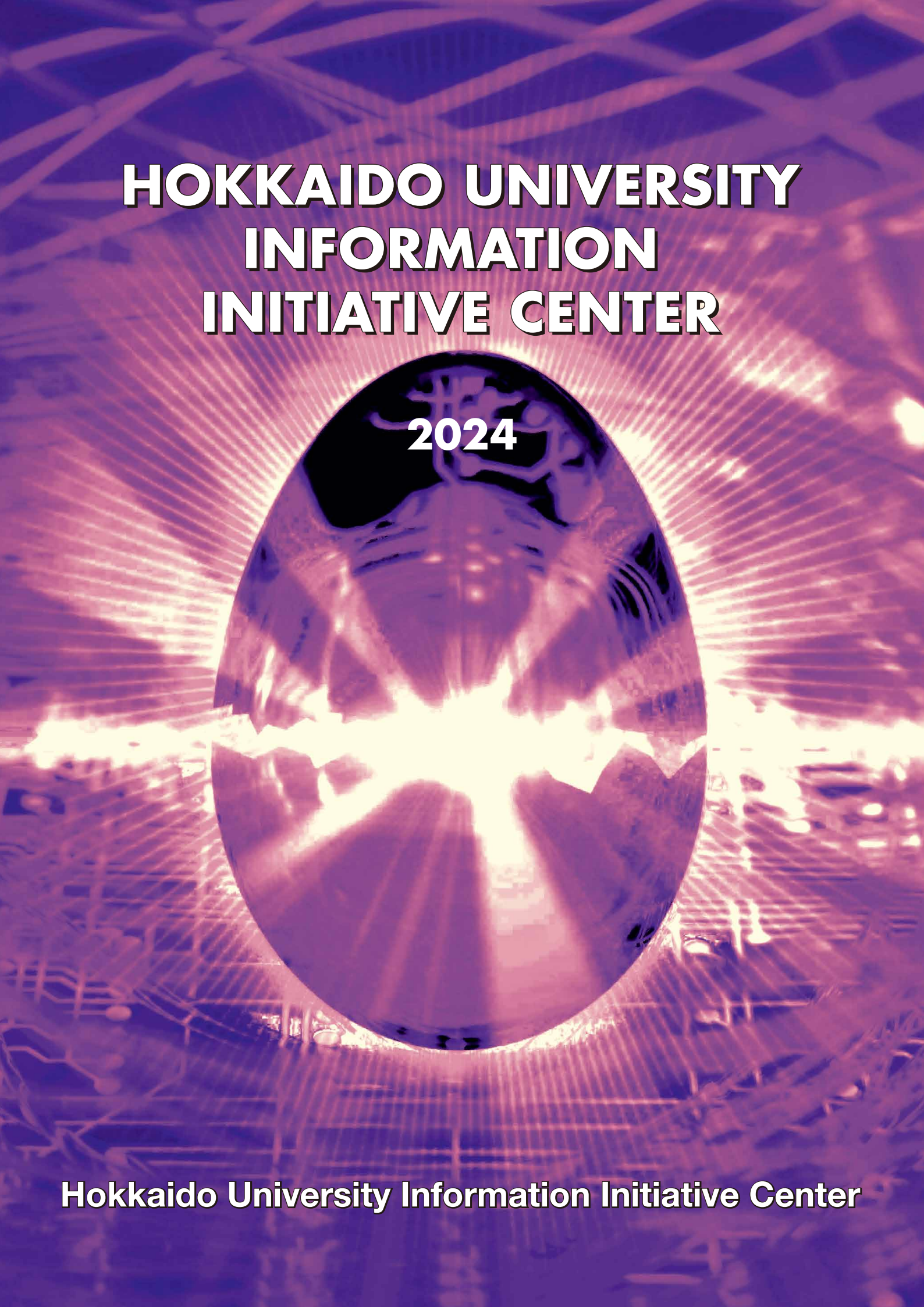
HOKKAIDO UNIVERSITY INFORMATION INITIATIVE CENTER

2024



Hokkaido University Information Initiative Center

A message from the director

Masaharu Munetomo
Director, Hokkaido University
Information Initiative Center

The mission of the Hokkaido University Information Initiative Center is to facilitate informatization at the University through R&D, as well as through maintenance and operations of the information infrastructure, thereby promoting the advancement of education and research, etc., and to implement and support education using information media. In the six divisions that constitute the Center—the Supercomputing Research Division, the Information Network Research Division, the Digital Content Research Division, the Media Education Research Division, the System Design Research Division, and the Cyber Security Research Division—R&D making the most of the characteristics of individual divisions is being promoted. In addition, the Cyber Security Center and ICT Planning and Technical Advisory Office established within the Center are promoting R&D activities aimed at realizing safer, more secure, higher-performance and more convenient information infrastructure at the University, in close collaboration with the ICT Security Office of the University.

Designated as an organization constituting the network of the Joint Usage/Research Center for Interdisciplinary Large-scale Information Infrastructures (JHPCN), the Center has been developing and operating the “interdisciplinary large-scale computer system” comprised of a supercomputer system and an inter-cloud system to support leading-edge interdisciplinary collaborative research, and has been also supporting a wide range of collaborative research in the fields of computational science, computer science, and their applications, as a system component institution that provides supercomputer computing resources to the High Performance Computing Infrastructure (HPCI) in Japan.

The National University Corporation which includes Hokkaido University has entered the Fourth Period of Mid-Term Goals and Mid-Term Plan this fiscal year. During that period, the realization of digital transformation (DX) is one of the major issues, and the expansion of the information infrastructure, which is essential for this purpose, is required. The interdisciplinary large-scale computer system of the Center has always been short of computer resources, which has been an obstacle to conducting research. Assuming the increase in demand required for the future promotion of DX, a significant performance enhancement should be achieved. Furthermore, it is especially important to promote data-driven research using artificial intelligence and other technologies, in addition to large-scale scientific and technological computations centered on computational simulations. We are planning to closely link the supercomputer system and the inter-cloud system we have built and operated with the large-capacity storage infrastructure and ultra-high-speed networks, and significantly enhance them as a system infrastructure capable of responding to new research needs during the Fourth Period of Mid-Term Goals and Mid-Term Plan. In addition, since the promotion of international collaborative research utilizing the interdisciplinary large-scale computer system is cited as one of the goals for the Fourth Period of Mid-Term Goals and Mid-Term Plan, we are also planning to promote international collaboration and joint research with researchers overseas.

Research DX is not only about digitalization but also about the transformation of the research method itself. A related task force of the University has been discussing such transformation, and we believe we should go back to the root of the issue once and for all in order to realize DX. Considering what we, researchers of the University, are studying for, how our research activities overlap with and differ from those of public institutions and private companies, how we can encourage undergraduate and graduate students to actively engage in research activities, and how we can return our results to society as a whole, in order to clarify roles of institutions of higher education, and contemplating how the Center can support all of those research activities at the University, we will discuss the improvement of the system environment, service provision and establishment of human support system in the future. We look forward to your continued guidance and cooperation both inside 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
2003 Information Processing Research Conference 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

2003 Information Processing Research Conference

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 departments 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 updated (interdisciplinary computer system [Hokkaido University High Performance Inter-cloud] introduced)
Dec. 2019 AI-compatible advanced computer system introduced

Information Initiative Center 10th anniversary ceremony

Launch ceremony for an 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 to Mar. 2028)

Interdisciplinary large-scale computer system

*This system is scheduled to be updated in April 2025.

Hokkaido University High-Performance Intercloud

The Information Initiative center replaced the interdisciplinary large-scale computer system consisting of the supercomputer and cloud systems, and launched the services of the new system at the beginning of December 2018. The overall peak performance of the new system is 4PFLOPS, which is a significant increase from that of the previous system. The Information Initiative center will realize the Hokkaido University High-performance Intercloud system, which is an advanced computer system including a nation-wide-scale distributed cloud system.

The Information Initiative center expects that the new system will be used for R&D related to computational science and computer science in Hokkaido University. The Information Initiative center will provide the computational resources of the system to open-type joint researches such as innovative high-performance computing infrastructure (HPCI) and the Joint Usage/Research Center for Interdisciplinary Large-scale Information Infrastructures (JHPCN) projects, which will support researchers in both academia and industry all over Japan. The Information Initiative center will also promote education and human resource development related to computational science and computer science by use of the system, which will contribute to various fields. With the installation of the new system, the Information Initiative center further contributes to society.

Overview of the Interdisciplinary large-scale computing system

Supercomputer system

Grand Chariot [subsystem A], 1,004 nodes
FUJITSU Server PRIMERGY
CX 400/CX2550 M4
【Node architecture】
CPU: Intel Xeon (Gold 6148/20 core) x 2
Memory: 384 GB

Polaire[subsystem B], 288 nodes
FUJITSU Server PRIMERGY
CX 600/CX1640 M1
【Node architecture】
CPU: Intel Xeon Phi (7250/68 core) x 1
Memory: 96 GB

Storage system
DDN ES14KX
16 PB

Peak performance
3.96PFLOPS

Intercloud system
(Hokkaido University Information Initiative Center)

Virtual server 500+ VM (baremetal, 16 nodes)
FUJITSU Server PRIMERGY CX400/CX2550 M4
CPU: Intel Xeon (Gold 6138/20 core) x 2
Memory: 256 GB

Baremetal servers 44 nodes
FUJITSU Server PRIMERGY CX400/CX2550 M4
CPU: Intel Xeon (Gold 6138/20-core) x 2
Memory: 256 GB

GPU servers 4 nodes
FUJITSU Server PRIMERGY RX2540 M4
CPU: Intel Xeon (Gold 6138/20-core) x 2
Memory: 256 GB
GPU: NVIDIA Tesla V100 (PCIe) x 2
Storage: 3.84TB SSD x 2 (RAID1)

SINET6

Cloud middleware
Mirantis Cloud Platform
・OpenStack Nova + KVM (virtual servers)
・OpenStack Ironic (baremetal, GPU servers)

Cloud Storage System
DDN GS7K
1 PB
Nextcloud

Cloud archive system
Kitami Institute of Technology

Backup control servers
PRIMERGY RX2530M4
x 4

Tape archive
ETERNUS
LT270 (LTO)
5PB

Intercloud system
(remote sites)

U. Tokyo	Osaka U.	Kyushu U.
Baremetal 3 nodes	Baremetal 3 nodes	Baremetal 1 node

Large-format printer

Application servers

*The content is based on the information at the time of the production of the pamphlet and is subject to change.

Supercomputer system

The supercomputer system consists of Grand Chariot (Subsystem A), Polaire (Subsystem B) and the storage system. Both subsystems have Intel CPU and Linux OS, which is close to computational environments where users usually run their programs in laboratories and so on. The computational resources of both subsystems will be provided as “shared nodes” and “fixed-rate exclusive nodes” to enable usage suited to user needs.

Hardware

■ Grand Chariot (Subsystem A, FUJITSU Server PRIMERGY CX 400/CX2550 M4)

The system consists of 1,004 nodes, and each node has two Intel multicore CPUs (Xeon Gold 6148, 20-core, Skylake) and 384 GB memory. Computation nodes are linked with each other via the Intel Omni-path network.

■ Polaire (Subsystem B, FUJITSU Server PRIMERGY CX600/CX1640 M1)

The system consists of 288 nodes, and each node has one Intel many-core CPU (Xeon Phi 7250, 68 core, KNL) and 96 GB memory. Computation nodes are linked with each other via the Intel Omni-path network.

■ Storage system (DDN ES14KX)

The storage system has a physical capacity of 16 PB in total and employs a Lustre-based parallel file system (EXAScaler).

Software

The Intel Compiler (Fortran, C, C++), numerical libraries (MKL) and MPI library are provided on Grand Chariot and Polaire. Java and Python are also available. As application software programs, Gaussian and V-FaSTAR are available (only on Grand Chariot). In addition, there are free software programs, such as OpenFOAM for computational science and Chainer for machine learning.

Services

The following services are provided on Grand Chariot and Polaire. In both service types, multiple users can form a group and share computational resources that they applied.

■ Use of shared nodes

In this service type, multiple users share same nodes and can use them by consuming tokens based on the elapsed time and the number of nodes used. Users can run large-scale jobs that need many nodes.

■ Use of fixed-rate exclusive nodes

In this service type, a user can always use nodes without waiting. Depending on the number of nodes that the user applied for, the user can also use a certain amount of the storage area.

Intercloud system

The intercloud system provides an advanced cloud environment, including a nationwide distributed cloud system extending from Hokkaido to Kyushu. There is also a magnetic tape archive device in Kitami Institute of Technology for the long-term storage of research data and provision of an environment that serves as the basis of open sciences. This cloud system places emphasis on performances, including the operation of a GPU server and other bare metal servers. Together with virtual servers that provide flexibility, the system meets the demands of various researchers within and outside of the university.

Hardware

■ FUJITSU Server PRIMERGY CX400/CX2550 M4、RX2540 M4

Each server has two Intel Xeon Gold 6138 processors, 256 GB memory and 25GbE×2 network interfaces. The GPU server has two additional units of NVIDIA Tesla V100 (PCIe). There are 64 servers at the Hokkaido University Information Initiative Center, three at the University of Tokyo, three at Osaka University and one at Kyushu University, providing overall computing performance of 166 TFLOPS or more. These bases are linked with each other via a virtual private network using the ultrahigh-speed, low-latency academic information network SINET6.

■ FUJITSU Storage ETERNUS DX500 S4

As an area for the start storage and additional storage of the cloud system, a physical HDD capacity of 500 TB in total is provided. An SSD with a total capacity of 30 TB is also used as a hybrid storage.

■ DDN GS7K

This high-capacity storage system with a physical capacity of 1PB serves as the basis of open sciences. It provides a highly functional and convenient web-based GUI of Nextcloud and client software that can be used on PCs and smartphones to realize a WebDAV storage.

■ FUJITSU Storage ETERNUS LT270 S2 (LTO)

This provides a physical archive capacity of 5 PB as a magnetic tape archive device. It functions as a disaster-resistant remote backup system, and is intended to address research misconduct and other problems and store research data for 10 or more years.

Basic software for cloud systems

■ Mirantis Cloud Platform

The current system uses OpenStack as basic software for cloud systems. In addition to the virtual server realized as a virtual machine of KVM, the bare metal servers of physical/GPU servers are managed using OpenStack Ironic, to enable unified management and operation on the same OpenStack display. The system can be used for both interactive operations between users via a web portal and automatic server operations via REST API.

Services

As the successor of the project servers of the former Interdisciplinary Large-scale Computing System, this intercloud system will provide the following services and functions for full- edged utilization for research purposes.

■ Virtual servers

Virtual machines using OpenStack Nova and KVM will be provided as virtual servers. One unit consists of a CPU core, 6 GB memory and 50 GB disc and a user can flexibly constitute a resource pool by using at least two units. After creating a resource pool, virtual servers of various sizes can be created and used within the limit of the available resource.

■ Physical/GPU servers

Bare metal servers managed using OpenStack Ironic will be provided as physical servers. It is also possible to provide up to four servers, each equipped with two units of NVIDIA Tesla V100, as GPU servers.

■ Intercloud packages

A wide-area distributed virtual private cloud environment with one physical server at each base will be provided as an intercloud package. There are two kinds of packages with 3 or 4 bases, depending on the combination of bases constituting the package.

Other

■ Application servers

Various applications (e.g., Mathematica, MATLAB, COMSOL, AVS) are available.
*Some of the programs are only available for researchers and students who belong to Hokkaido University.

■ Large-format printer

The printer can print A0-size and other large-format color prints on normal paper, glossy paper and cloth.

Joint research

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
- Cyber Science Center, Tohoku University
- Information Technology Center, University of Tokyo (core base)
- Global Scientific Information and Computing Center, Tokyo Institute of Technology
- Information Technology Center, Nagoya University
- Academic Center for Computing and Media Studies, Kyoto University
- Cybermedia Center, Osaka University
- 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, substances/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

The Joint Usage/Research Center invites research projects in the areas of super-large-scale numerical calculation system applications, super-large-scale data processing system applications, super-large capacity network technologies, as well as the area of super-large-scale information system-related research that integrates the above-mentioned areas. In FY 2022, 63 projects (ten of which are related to the base) are being conducted. In addition, a system to recognize joint research projects invited by individual centers constituting the network-type base as JHPCN seminal joint research was launched in FY 2016 in anticipation of the development of such projects into future JHPCN tasks. For FY 2022, 30 cases (three of which are related to the Information Initiative Center's base) have been adopted as of July.

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

Supercomputer systems

Grand Chariot (subsystem A)
Polaire (subsystem B)
* Use of shared nodes is available.

Inter-cloud system

Physical servers
Inter-cloud packages
Virtual servers
* 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 seminal joint research. Ten joint research projects are being conducted with teachers and researchers of domestic research institutions, of which five have been adopted as JHPCN's seminal joint research projects (as of May 2022).

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

Joint research on the AI-compatible advanced computer system

The Center introduced the AI-Compatible advanced computer system and launched its operation for Hokkaido University researchers in December 2019. The system is expected to accelerate various research through AI research using accelerators and the transfer of AI technologies to various research fields including cyber physical systems. The Center conducts the open-type joint research that uses this system, and three projects have been adopted for FY 2021 (as of April 2021), and six projects for FY 2022 (as of April 2022).

Overview of the AI-compatible advanced computer system

The system consists of eight computational nodes (FUJITSU PRIMERGY CX400 M4、CX2570 M5) and each node has two Intel CPUs (Xeon Gold 6230, 20 core), four NVIDIA GPUs (Tesla V100 SXM2, 32GB), 384GB memory and an NVMe-connected 1.6TB SSD. Computational nodes are linked with each other via the Intel Omni-Path network. It also has a storage system comprised of 21 SSDs and has a total physical capacity of 76.8TB as shared storage (DDN ES200NV). Available software includes software programs for machine learning (e.g., Tensor Flow, PyTorch, Chainer, Caffe) and a parallelizing compiler (PGI Professional Edition).

Computational nodes (eight nodes)

FUJITSU PRIMERGY
CX400M4/CX2570 M5

[Node architecture]

CPU: Intel Xeon
(Gold 6230/20 core) ×2
GPU: NVIDIA Tesla V100
(SXM2/32 GB)×4
Memory: 384 GB
Storage: 1.6TB SSD
(NVMe connection) × 1

Shared storage

DDN ES200NV (76.8 TB)

Main software programs

Tensor Flow, PyTorch, Chainer,
Caffe, PGI Professional Edition

Overview of the AI-compatible advanced computer 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.

Hokkaido University

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

On-campus CSIRT activities

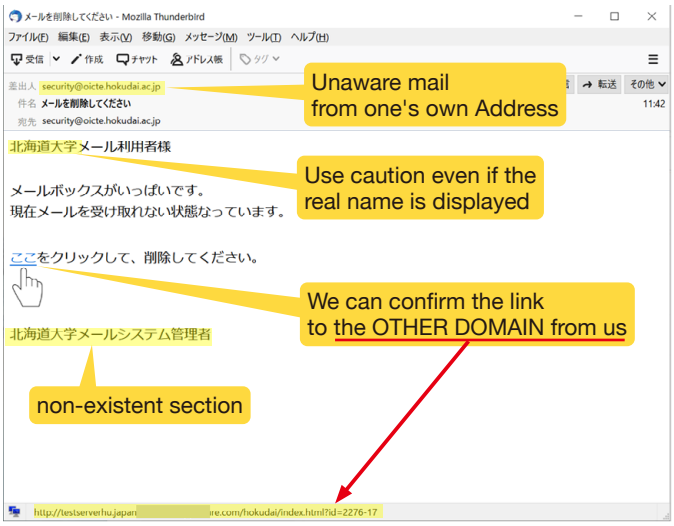
In case of a security incident on campus, CSC plays a central role in information collection, identification of the cause, analysis of the incident and development of immediate responses and recurrence prevention measures, in collaboration with the ICT Security Office of the ICT Promotion Office, which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

Enlightenment activities related to cyber security

CSC's enlightenment activities include presentations on cyber security and personal information protection for various training courses of national universities held in Hokkaido University. In addition, in cooperation with the ICT Promotion Office, CSC is making efforts to maintain and improve the level of cyber security within the University through information security seminars held on a university-wide scale, as well as through faculty development (FD) activities and guidance for students conducted by each department.

Cyber drills

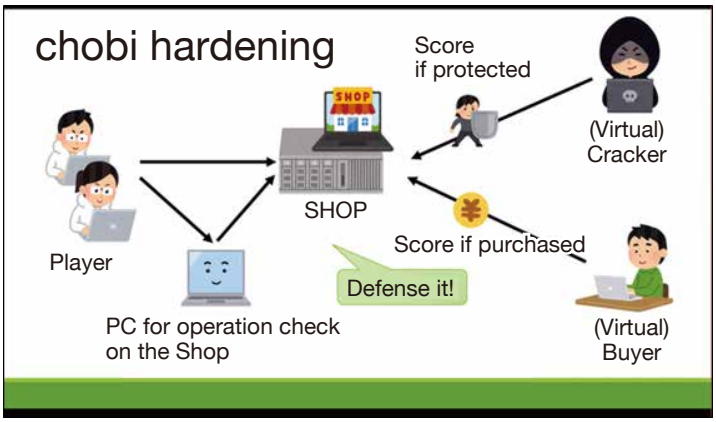
In preparation for unforeseen circumstances, CSC plans, designs and implements cyber drills, including simulated virus mail and virtual incident responses, in cooperation with the ICT Promotion Office.



Reference: 6th targeted email attack drill in FY 2019

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.



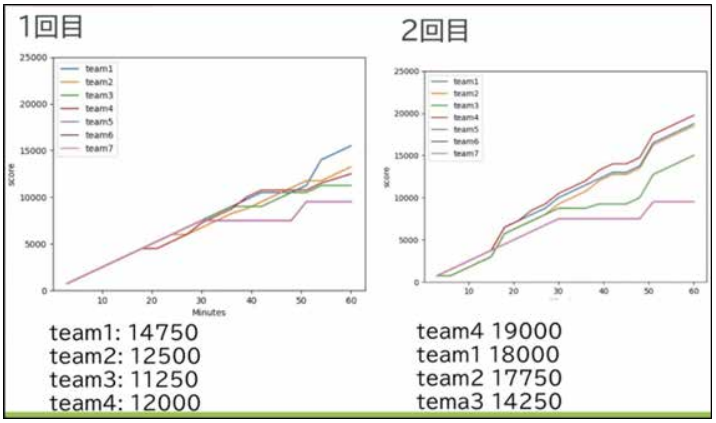
Outline of chobi hardening

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



Competition result

Diverse research and development

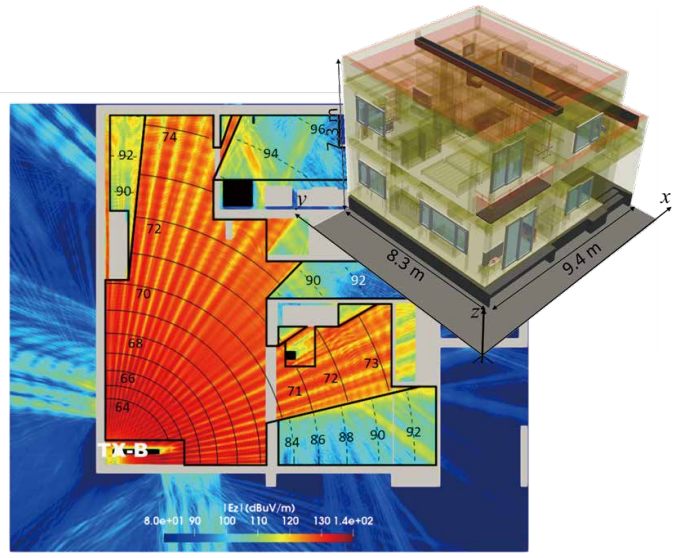
Supercomputing Research Division

Development of Jet FDTD and supports for the supercomputer users

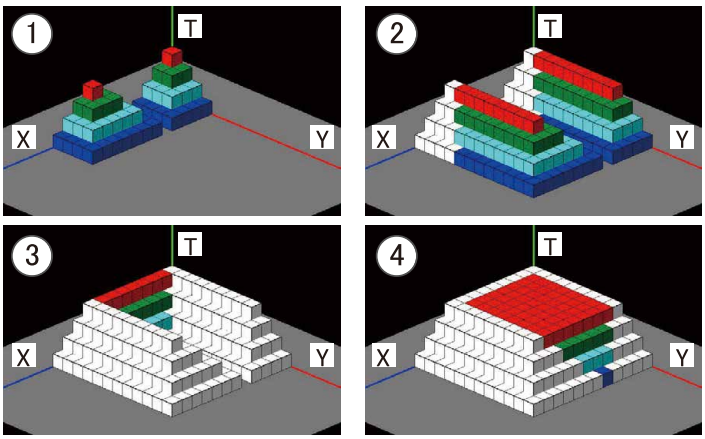
We are developing a large-scale electromagnetic field simulator for supercomputer systems referred to as Jet FDTD, whose property is a high-capacity and high-speed processing. The application software is useful to design microwave devices and to evaluate and analysis radio wave propagation in the high-frequency band above several hundred MHz to the optical region. Also Jet FDTD realizes high-precision simulations within a reasonable running time using the supercomputer systems.

The figure on the right-hand side depicts the electric field distribution in the indoor and outdoor environment which is used to predict the indoor propagation loss characteristics. An access point at a quasi-millimeter wave frequency of 28 GHz is installed at the corner of the living room in the first floor of a two-story residential house. The values in the figure indicate propagation loss (dB). The FDTD problem space with the residential house consists of about 799 billion cells when the model is discretized by a cubical cell of 1 mm long. The numerical simulation requires the main memory of 69 TB and the running time of 154 hours until transient behaviors of electromagnetic component vanish.

The Jet FDTD application software is provided to the supercomputer users in order to support their research activities. Its new functions are continuously added. Also, the organization of workshops, development of numerical models and visualization of results are conducted upon requests.



Electric field distribution (dBμV/m) and predicted propagation loss characteristics (dB) in the residential house.



Overview of time-space tiling for iterative stencil computation

High-performance computing researches for supporting simulation

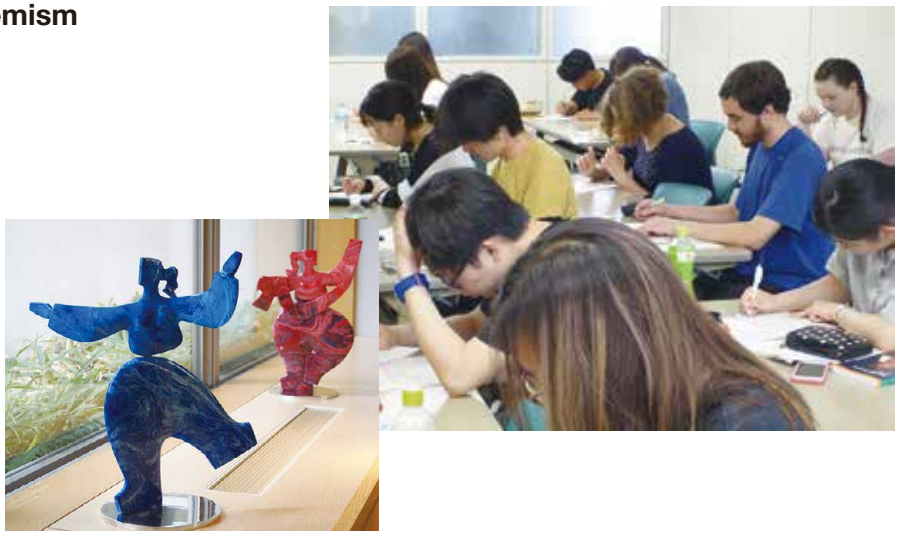
We conduct researches on high-performance computing for supporting various kinds of simulation on modern computer systems. Since recent supercomputers become larger and more complicated, in addition to mathematical approaches, HPC technologies such as parallelization techniques are vital for fully exploiting the potential of supercomputers. Focusing on important problems and their solution methods in the field of computational science, we have investigated related HPC technologies and developed software frameworks and libraries that support simulation. For example, we have investigated the time-space tiling techniques for iterative stencil computations and iterative methods for solving large-scale linear systems appearing in FEM-based simulation.

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.



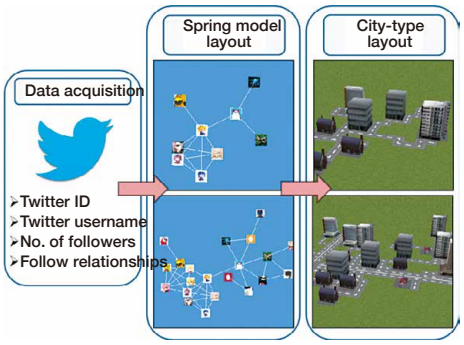
Information Network Research Division

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

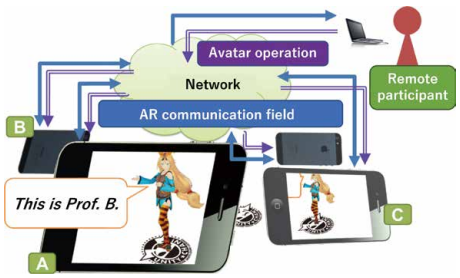
TwitterCity



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.

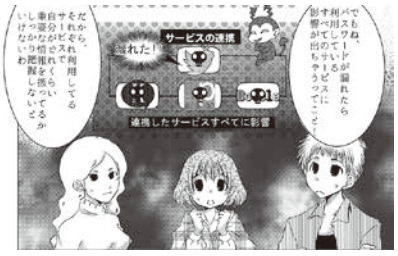


Media Education Research Division

Advancement of information education

Studies on teaching methods of information ethics and copyright

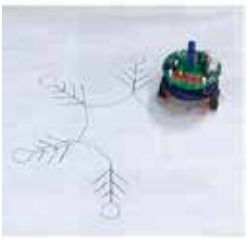
In information ethics education, effective teaching methods for domestic and international students are explored using videos and manga. In copyright education, efforts are being made to teach copyright from creators' and users' standpoints. For that purpose, a learning support environment where derivative 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

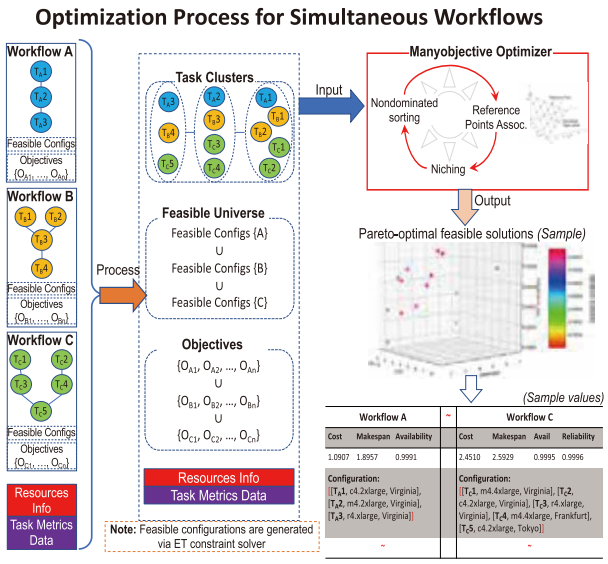
Activities encompass research and practice in open education, including the use of OpenCourseWare. Flip teaching will be introduced and implemented in information education for all students.

Diverse research and development

System Design Research Division

Establishment of an optimal academic inter-cloud system

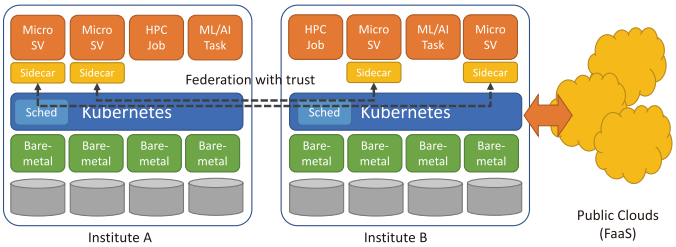
In this division, R&D is promoted toward the establishment of a high-performance, intelligent inter-cloud system corresponding to today's era of big data. The aim is to create and utilize a nationwide academic inter-cloud system by connecting public cloud systems and private cloud systems run by universities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



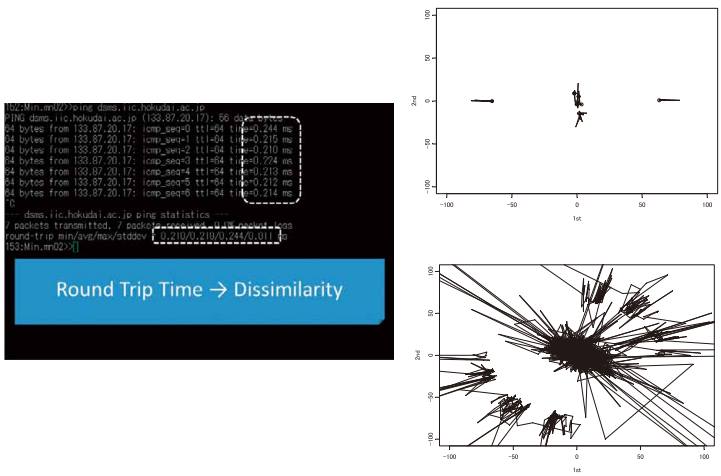
Cyber Security Research Division

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

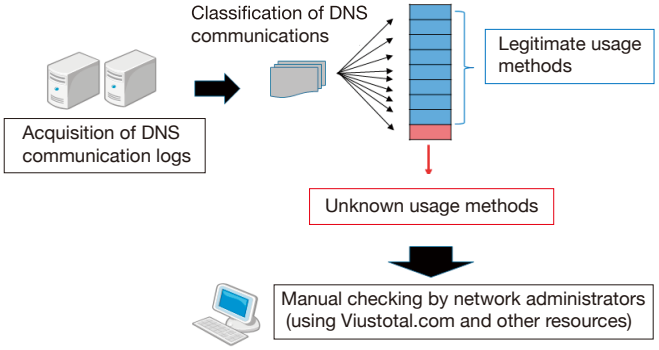
Specifically, the division is conducted to contribute to the protection and prevention of cyber-attacks. Research subjects include advanced data science techniques to find regularity and useful knowledge from an enormous amount of unauthorized access data, as well as the establishment and efficient implementation of techniques to identify suspicious devices and software programs operating in them from the traffic logs of DNS data, which is a basic technology for Internet operations.

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



Botnet communication monitoring system based on DNS traffic log analysis



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 Research Organization for Information Science & Technology (RIST) handles project selection, management of common data receipt and other utilization promotion services.

The Center plays a role in system configuration and provides related computation resources. For FY 2022, 9 research projects using the Center have been adopted as of April 2022.

Organizations providing their computational resources as the HPCI system

- RIKEN Center for Computational Science
- **Information Initiative Center, Hokkaido University**
- Cyberscience Center, Tohoku University
- Center for Computational Science, University of Tsukuba
- Information Technology Center, The University of Tokyo
- Global Scientific Information and Computing Center, Tokyo Institute of Technology
- Information Technology Center, Nagoya University
- Academic Center for Computing and Media Studies, Kyoto University
- Cybermedia Center, Osaka University
- Research Institute for Information Technology, Kyushu University
- Center for Earth Information Science and Technology, Japan Agency for Marine-Earth Science and Technology

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 conjunction with the November 2011 establishment of the Hokkaido University Academic Cloud (one of Japan's largest resources of its kind), annual symposiums for discussion on cloud research and future development among related researchers from Japan and elsewhere have been held since FY 2012. The symposiums were held online in FY 2020 and FY 2021 due to the COVID-19 pandemic. After the symposium, lecture videos are available on the official YouTube channel of the Information Initiative Center.

Speech from organizer; Held online in FY 2021 Cloud Week 2021@Hokkaido University

Conferences/seminars

Conferences and seminars related to the Center are held occasionally.

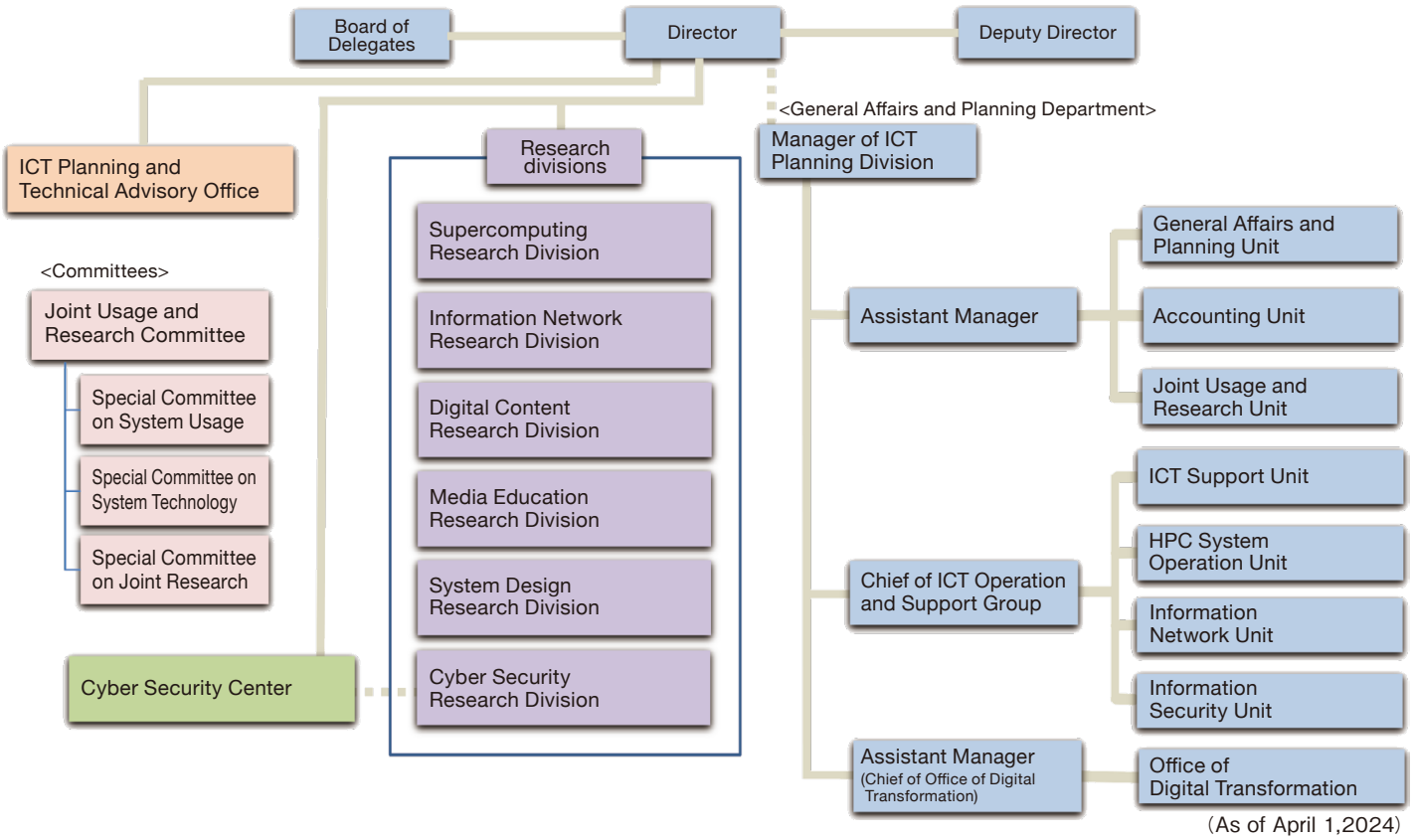
Conference on Teaching of "Programming-like Thinking" to Elementary School Students

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

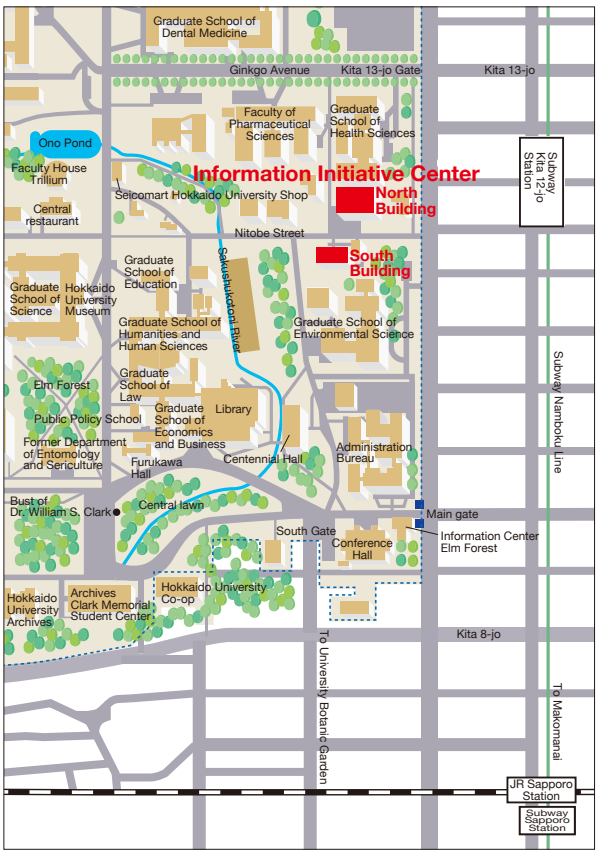
Administrative organization of the Information Initiative Center



(As of April 1,2024)

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	2
	Research Support Assistant	3
Administrative Division (ICT Planning Division of the General Affairs and Planning Department)	Administrative Staff	15
	Technical Staff	11
	Professional Associate	2
	Fixed-term Employee	1
	Specialist	1
	Administrative Assistant(full time)	6
	Administrative Assistant(part time)	4
	Technical Assistant(part time)	1
Total		60

(As of December 1,2024)



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