CRONOS

Cutting-edge Research and Development on Information & Communication Sciences

Japan Science and Technology Agency

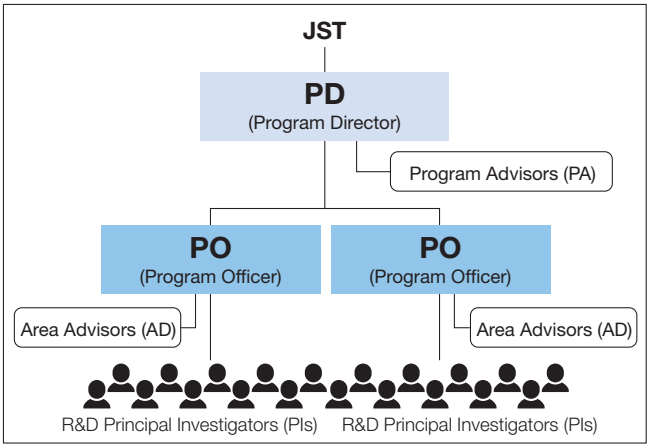
Strategic Basic Research Programs 2024»25

R&D program aims at advancement of Japan's information and communication technology through Grand Challenges

Overview

This program aims to contribute to an advancement of Japan's information and communication sciences through developing innovative technologies in the field and fostering researchers with unique ideas and conceptual skills. It sets challenging goals ("Grand Challenges") with the ultimate objective of bringing about paradigm shifts in information and communication sciences in promoting research. With the Grand Challenges and a flexible scheme that enables integration of basic and applied research, we promote research that leads to a transformation of society, and target to achieve proofs of concept (POC).

Management system



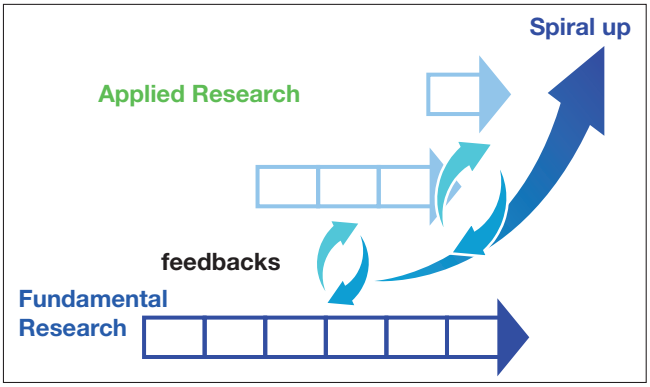
■ Program Director (PD)

SHINOHARA Hiromichi
Executive Adviser
NIPPON TELEGRAPH AND TELEPHONE CORPORATION (NTT)

■ Program Advisors (PA)

TOKUDA Hideyuki	President, NICT
HAGIMOTO Kazuo	Principal Researcher, NICT
MORIKAWA Hiroyuki	Professor, Graduate School of Engineering, The University of Tokyo
YASUURA Hiroto	Vice Director-General, NII

R&D scheme



R&D period (overall)	Total R&D budgets (overall)
5.5 years (within 6th years)	Approx. 220-300 million yen

[Fundamental Research]

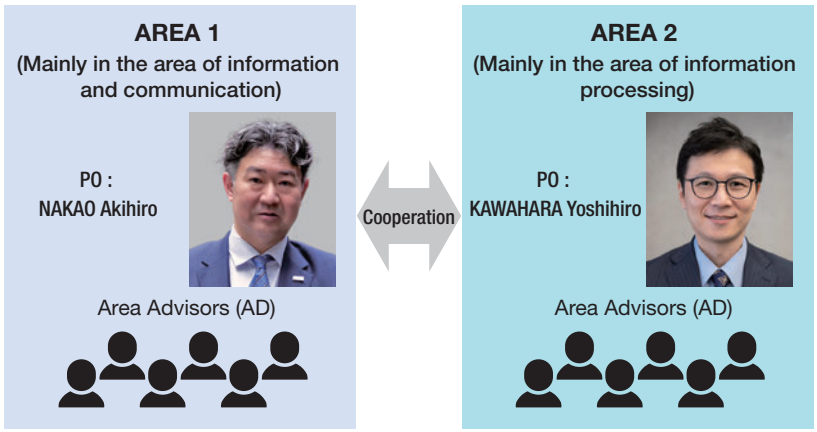
· In fundamental research, we will promote the creation of results that will create top-level technological breakthroughs internationally for the Grand Challenge and foster advanced research personnel.

[Applied Research]

· The selected R&D principal investigator (PI) will offer a distinct plan for a POC to the PO. If the plan is approved, further funding will be allocated, and the plan will be put into action.

· Through software development based on basic theory, theoretical verification using actual data, and demonstration testing in testbeds, the project aims to produce results that, at the end of the research, can be used as a bridge to Ministry of Internal Affairs and Communications (MIC)/NICT projects, promote the creation of university-launched ventures, and lead to research by companies and other entities.

Area

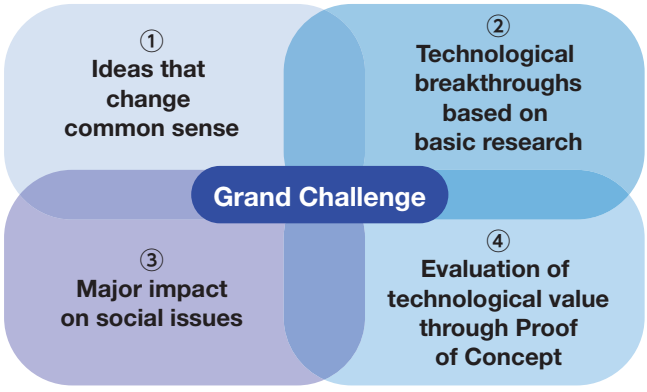


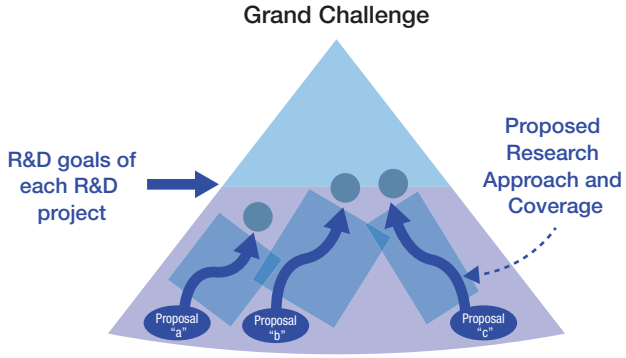
This program covers a wide range of technical areas in information and communication sciences. Issues that cannot be resolved by technological innovation based on conventional common sense or by innovation in specific technical areas are emerging as technological needs, becoming more diverse and complicated. Through efforts to achieve the Grand Challenges, this program aims to promote collaboration and integration between different technical areas, including personnel exchanges. As shown in the left figure, two areas have been defined, one focusing on the information and communication area and the other on the information processing area, and the POs manage each area in cooperation with each other.

Grand Challenge

■ Concept of Grand Challenge

The Grand Challenges include a wide range of technical area. Through efforts to achieve the Grand Challenges, the program aims to create innovative information and communication technologies in various research approaches and to foster advanced research personnel.

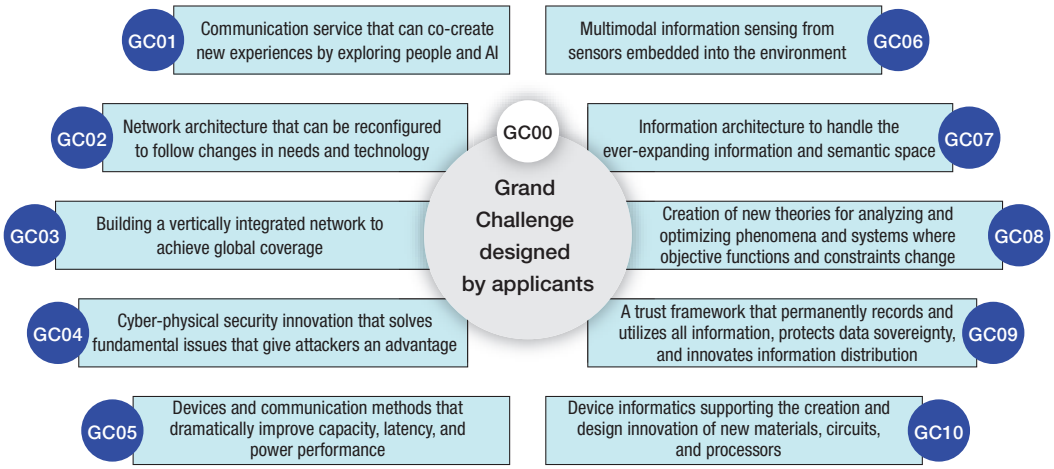




The goals of the Grand Challenges are big pictures that are expected to be realized in the future society. The applicant should specifically describe in the research and development proposal what range, what, and how far, and what approach to promote within the research and development period for the goals indicated by the Grand Challenge.

■ Grand Challenges for the 2024 Application Period

The applicant selects the Grand Challenge to challenge on and submit R&D proposals to contribute to it. Alternatively, if the applicant wishes to challenge on something other than the Grand Challenges designed by JST, it is also possible for the applicant to design the Grand Challenge itself.



Area 1 (Mainly in the area of information and communication)

Program Officer (PO)

NAKAO Akihiro
Professor,
Graduate School of Engineering,
The University of Tokyo

Goals of the Area

In this Area, we aim to establish innovative research and development that contributes specifically to the evolution and advancement of information and communication. By integrating information communication and information science, we strive to realize “the next-generation cyber infrastructure” that forms the foundation of society.

We consider not only focusing on the academic evolution but also constantly being aware of contribution to the creation of future society is the key. Our goal is to promote research and development that includes fostering of human resources in the information and communication field: we anticipate them to contribute to a sustainable development of information and communication technology that serves as an essential infrastructure in the society.

Area Advisors (AD)

SUGIYAMA Masashi	Director, Center for Advanced Intelligence Project, RIKEN/ Professor, Graduate School of Frontier Sciences, The University of Tokyo
TODE Hideki	Professor, Graduate School of Informatics, Osaka Metropolitan University
TOYOSHIMA Morio	Director General, Wireless Networks Research Center, NICT
HARADA Hiroshi	Professor, Graduate School of Informatics, Kyoto University
FUJISHIMA Minoru	Professor, Graduate School of Advanced Science and Engineering, Hiroshima University
MORI Tatsuya	Professor, Faculty of Science and Engineering, Waseda University
YAMANAKA Naoaki	Project Professor, Shin-Kawasaki (K2) Town Campus, Keio University
WAKIKAWA Ryuji	Vice President·Head, Research Institute of Advanced Technology, SoftBank Corp.

Projects Selected for 2024

Development of Ultimate Wireless Systems Beyond Classical Design

ISHIBASHI Koji
Professor, Advanced Wireless Communication research Center,
University of Electro-Communications

Our project aims to break the boundaries of classical wireless system design, which relies on simplifications such as statistical channel modeling and interference approximation, by leveraging emerging technologies like machine learning, quantum computing, and Bayesian inference. It seeks to resolve issues related to reliability, latency, and throughput, while addressing spectrum scarcity through fully optimized virtual cells composed of distributed antennas, tailored to user demands.

Body-linked Interaction Platform

KATSURA Seiichiro
Professor, Faculty of Science and Technology, Keio University

In this research, we will develop a fundamental technology that uses functional electrical stimulation as an interface to attain an interaction called "Body Link" that connects bodies, and create new forms of communication and services through information and communications. In addition to the conventional multimedia data, the "Body Link" will enable new experiences that can be shared by connecting the body with others in remote locations.

An Internet-scale Turing Machine and its Applications

KOIZUMI Yuki
Associate Professor, Graduate School of Information Science and Technology, Osaka University

The Internet, originally designed as a communication system, has evolved into a hybrid system that accommodates both communication and computing. However, this process hinders further architectural evolutions. This project aims to realize both evolvable networking and computing by realizing an Internet-scale computing platform that leverages in-network computing technologies.

Research and development of low-latency broadband space backbone

SHINADA Satoshi
Research Manager, Network Research Institute, National Institute of Information and Commuinications Technology

To realize a low-latency inter-satellite optical network in low earth orbit, spatial optical transmission and switching technologies for LEO satellites will be developed. And a novel optical networking thechnology that provides seamless end-to-end connections with adaptively controlling TN and NTN domains will be developped. Furthermore, an optical communication system integrated with these technologies will be demonstrated in an optical testbed that emulates long-distance inter-satellite optical links.

Pursuing the Ultimate Performance of Vacuum Photo-Transistors and Establishing a basis for Ultra-High-Capacity Seamless Optical-Wireless Networks

TAKIGAWA Ryo
Associate Professor, Information Science & Electrical Engineering, Kyushu University

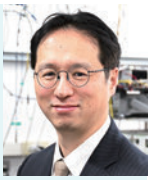
This research aims to reduce the capacitance of the electron transport layer in semiconductors by developing vacuum phototransistors, addressing the performance limits of optoelectric conversion devices. This technology will enable phased array functionality crucial for wireless communications and establish a framework for the seamless connection of ultra-high-capacity data from optical to wireless, contributing to the development of future talent.

Frequency/phase-synchronized quantum network

TAKEOKA Masahiro
Professor, Faculty of Science and Technology, Keio University

Frequency/phase-synchronized quantum network will enable new paradigm of quantum communicaiton and B5G/6G, including ultrastable clock distribution and wide area quantum networks. This project aims its realization by employing new optical/quantum tehcnologies, such as hollow core fibers, otpical frequency combs, and novel quantum optical sources.

Direct connection of THz wireless I/O with optical signal processors using microcombs



TANABE Takasumi
Professor, Faculty of Science and Technology, Keio University

Research on photonic AI accelerators is attracting attention for their high energy efficiency and speed. However, electrical interfaces remain a bottleneck. This study aims to develop a technology that directly converts optical signals into 300 GHz terahertz wireless signals, enabling next-generation systems to seamlessly integrate optical signal processors and high-speed terahertz transmitters.

Democratizing skill communication technologies based on mechanisms of brain and body

FURUYA Shinichi
Research Director, Tokyo Research, Sony Computer Science Laboratories Inc.

Our project aims to enable people to teach and learn skills from each other, even when they're far apart, through making synergy between physical science, informatics, and neuroscience. To this aim, we perform the three bodies of research: (1) using commodity sensors to estimate skills, (2) developing technologies that enhance skill acquisition, and (3) improving teaching quality by embodying learners' skills multimodally.

Ultra-high-speed In-Network Computing Platform

MARUYAMA Mitsuru
Professor, Faculty of Informatics, Kanagawa Institute of Technology

A novel processing method for ultra-high-speed stream data is proposed, achieving stability and immediacy through autonomous coordination and in-network computing, where network and computing resources are tightly integrated. This approach provides a Tbps-class network for ultra-high-definition metaverse and robotics. Additionally, application experiments will validate this architecture, promoting standardization for social implementation.

Area 2 (Mainly in the area of information processing)

Program Officer (PO)

KAWAHARA Yoshihiro
Professor,
Graduate School of Engineering,
The University of Tokyo

Goals of the Area

In this Area, we aim to promote research and development in which mutually influential relationship between technology and applications paves the way for a new era of information and communication. Creating new services, through technological innovations in information and communication, that play a role as a driving force for the next-generation information and communication infrastructure is the key to accomplish this objective.
We set goals that resonate with diverse stakeholders and encourage collaborative efforts, and we propel research and development whose outcomes become platform or foundational technologies that leads to the establishment of communities and the creation of multiple applications.

Area Advisors (AD)

AMANO Hideharu	Project Researcher, Systems Design Lab, Graduate School of Engineering, The University of Tokyo
OKABE Yasuo	Professor, Academic Center for Computing and Media Studies, Kyoto University
ONIZUKA Makoto	Professor, Graduate School of Information Science and Technology, Osaka University
SAWADA Hiroshi	Senior Distinguished Researcher, Communication Science Laboratories, NTT Corporation
TAKEDA Akiko	Professor, Graduate School of Information Science and Technology, The University of Tokyo
TSUBOUCHI Kota	Senior Chief Researcher, LY Research, LY Corporation
MAEKAWA Takuya	Professor, Institute for Advanced Co-Creation Studies / Graduate School of Information Science and Technology, Osaka University
YOKOTA Rio	Professor, Institute of Integrated Research, Supercomputing Research Center, Institute of Science Tokyo

Projects Selected for 2024

Innovative Wireless Communication Systems through Wireless-Optical Fusion

IIZUKA Tetsuya
Associate Professor, Systems Design Lab, Graduate School of Engineering, The University of Tokyo

We propose a wideband wireless receiver architecture that utilizes optical circuits for information processing, targeting 6G/7G communication standards. By leveraging a new AI inference engine called an optical neural network, we aim to create a new architecture that performs decoding in the optical analog domain. This will be achieved through interdisciplinary collaboration among experts in integrated circuits, optical circuits, and optical devices.

Developing Algorithmic Methods for Fair Assignment and Agreement in Autonomous Decentralized Environments

IZUMI Taisuke
Associate Professor, Graduate School of Information Science and Technology, Osaka University

A wide variety of future applications and services in cybserspace are inherently autonomous and decentralized, and it is one of the central requirements to manage them with guaranteeing safety and fairness of users. We particularly aim to developing algorithms for fair assignment and agreement in autonomous decentralized environments. The goal of the project is to establish the theoretical foundations of fair assignment and agreement which can address the divergent behavior of autonomous decentralized systems like as user selfishness and network dynamics.

Body-verse: Creation of an Interaction Platform between Humans and Internal Organs

INAMI Masahiko
Professor, Research Center for Advanced Science and Technology, The University of Tokyo

Building on the close interaction between the brain and the gut, we aim to expand the field of information science and interaction. By collaborating with leading researchers in the areas of internal organs, oral and interoceptive sensations, organoids, and biosensors, as well as experts in informatics, we develop the information platform 'Body-verse,' which facilitates interaction with the internal world centered on the internal organs.

Evolving Literal Communication

UCHIDA Seiichi
Professor, Graduate School and Faculty of Information Science and Electrical Engineering, Kyushu University

Text-based communication relies on characters, and these characters have the potential to be further transformed, leading to new forms of communication. In our research project, we aim to explore various topics related to the innovation of characters along four key axes: "enriching character representation," "securing characters," "personalizing characters," and "liberating characters."

Ultra-Brain Neuromorphic by Material-Device-System Co-Research

KIMURA Mutsumi
Professor, Information and Communication Engineering, Ryukoku University

Ultra-brain neuromorphic systems will be developed by material-device-system co-research, especially, transformers by memriscapacitor and spiking principle. Enormous power consumption for big data analysis and data communication in Society 5.0 will be reduced to 1/100. Japanese superior materials and production technologies will solve the disadvantages of integration, systems, and applications and realize the last great turnaround in electronics.

Inclusive Robotic Foundation Model with Unstandardized Data

KOBAYASHI Taisuke
Assistant Professor, Principles of Informatics Research Division, National Institute of Infomatics

This research aims to develop an “inclusive robot foundation model” that can effectively utilize unstandardized data. Specifically, we will develop and train a new model that freely selects the teaching method of various tasks from humans to robots with rich individuality, accepts as input the various modalities along with verbal instructions, and outputs different optimal motion commands through processing that explicitly reflects its various body structures.

Creation of an AI Interaction Platform for the Coexistence of Humans, Animals, and AI

TANAKA Toshihisa
Professor, Institute of Engineering, Tokyo University of Agriculture and Technology

This research project focuses on recent evidence suggesting that coexistence with animals contributes to human health. It aims to create a novel "communication service that can expand human and AI capabilities and co-create new experiences" where humans, animals, and AI can grow together in a trinity. By developing AI capable of monitoring and nurturing companion animals and livestock, the project seeks to establish a social infrastructure that enriches human life.

Evolutionary communication infrastructure connecting diverse mobile devices and humans

TSUKADA Manabu
Associate Professor, Graduate School of Information Science and Technology, The University of Tokyo

This research aims to create a seamless communication platform between humans and Embodied AI in future transportation systems. It enables interoperability between vendor-defined messages without relying on traditional ITS standards. Using foundational models, it will demonstrate communication among various devices. By sharing the results as open-source, the project seeks to lead the community and enhance safety and efficiency in future transportation systems.

Scaling-Friendly Tiny Fully-Integrated IoT Enabling Dynamically Environmental-Adaptive Time-Space Augmentation

NIITSU Kiichi
Professor, Graduate School of Informatics, Kyoto University

Tiny IoT with dynamically envioronmental-adaptive time-space augumentation is developed by exploiting CMOS process scaling. Specifically, scaling-friendly fully-integrated smaller-than-1mm-square IoT chip is designed and prototyped. Exploration of developed tiny IoT applicaiton will be performed.

Contacts & Website

Japan Science and Technology Agency (JST)
Department of R&D for Future Creation

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