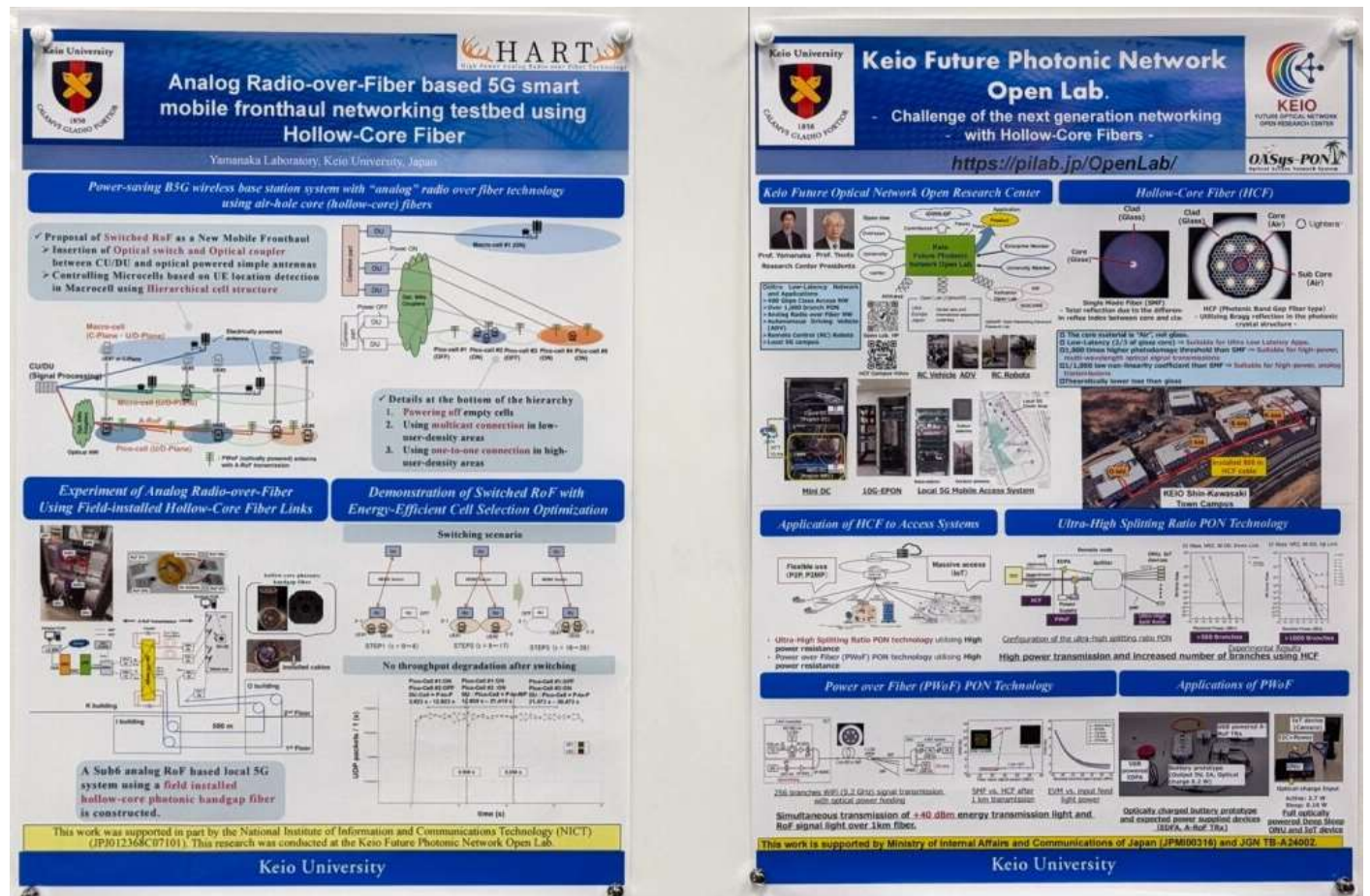


Keio Future Photonic Network Open Lab.

Keio University has established the Future Photonic Open Research Center to pursue optical technology research through open innovation. Hollowcore fiber has been deployed across Keio's campuses, enabling collaborative researchers to utilize it together. Hollowcore fiber not only transmits data at speeds 1/3 times faster than conventional fiber and carries 1,000 times more energy, but also exhibits low nonlinearity and supports Analog Radio over fiber (RoF.) In the booth, we will show new ONU (User access box) which has power over fiber interface without AC power supply. And also RoF demonstration will show by video. This makes it a major breakthrough for 6G.



Poster and Demonstration (GJWS7-PD2)

Scaling Optical Testbed Data Space for Data Sharing Across Vendor and Organizational Boundaries

Angela Mitrovska^{1, 2}; Yusuke Hirota³; Vignesh Karunakaran⁴; Sugang Xu³; Taiga Suzuki³; Aydin Jafari¹; Nikhil Dsilva⁴; Behnam Shariati¹; Yuki Yoshida³; Achim Autenrieth⁴; Pooyan Safari¹; Johannes Fischer¹; Ronald Freund^{1, 2}; Yoshinari Awaji³;

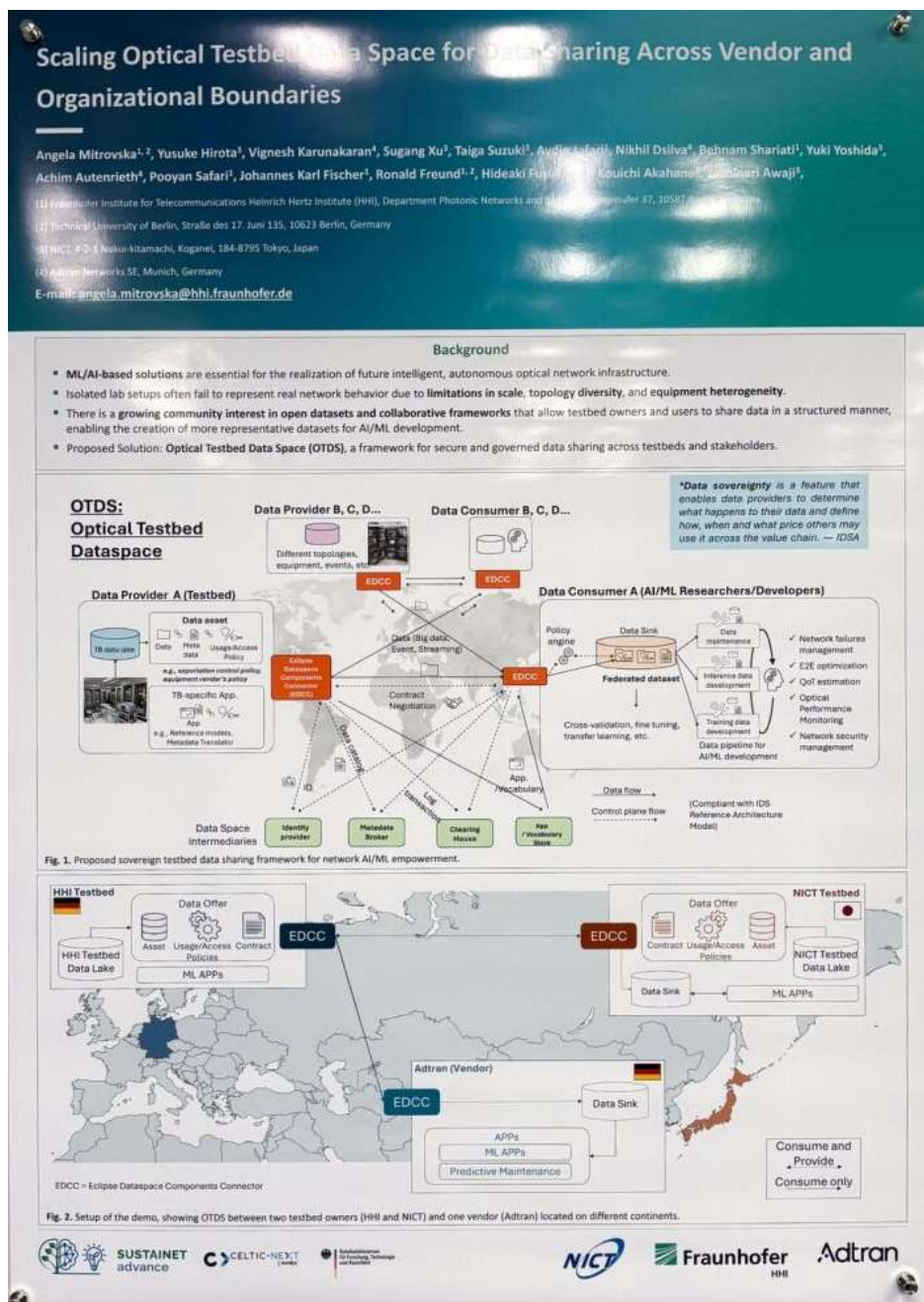
1. Fraunhofer-Institut für Nachrichtentechnik Heinrich-Hertz-Institut HHI, Berlin, BE, Germany.

2. Technische Universität Berlin, Berlin, BE, Germany.

3. National Inst of Information & Comm Tech, TOKYO, Koganei, Japan.

4. Adtran Networks SE, Martinsried, BY, Germany.


We demonstrate a data-sharing platform enabling on-demand sovereign data exchange across optical testbeds and system vendors to support ML development and predictive maintenance, through advanced vendor-, anonymization- and purpose-based governance controls.



Resilient Relay-Assisted mmWave Communication for Mobile Robots with ML-Based RSSI Prediction

Nguyen Nam Khanh, Nann Win Moe Thet, Kenichi Takizawa, and Haris GACANIN (RWTH Aachen University), Firooz Bashashi Saghezchi (RWTH Aachen University)

Millimeter-wave (mmWave) communication is particularly vulnerable to blockage, posing a significant challenge to maintaining reliable connectivity in mobile robotic systems under severe channel environments. This work presents a resilient relay-assisted mmWave communication framework that leverages machine learning (ML)-based received signal strength indicator (RSSI) prediction with environment awareness at the robot to enable proactive link adaptation. As the robot moves, future RSSI values are predicted to anticipate channel degradation and non-line-of-sight (NLoS) conditions. When the RSSI of the current connection is predicted to be weak, communication switches to an amplify-and-forward (AF) relay with independent transmit and receive beamformers to mitigate self-interference; otherwise, direct transmission is maintained. The proposed approach eliminates the need for instantaneous channel state information, enabling low-complexity and fast adaptation in dynamic environments.



Leveraging Machine Learning and Full Duplex Relay for Resilient Robot Communication

Nann Win Moe THET, Khanh Nam NGUYEN, and Kenichi TAKIZAWA Firooz Bashashi SAGHEZCHI, and Haris GACANIN

Sustainable ICT Systems Laboratory, Resilient ICT Research Center
National Institute of Information and Communications Technology (NICT), Japan Chair of Distributed Signal Processing
RWTH Aachen University, Germany

Mission

Provide high-quality wireless communication for robot control by **optimizing the use of communication resources** and **detecting the radio environment**, even in severe radio environments.

ABSTRACTS

- **Challenge:** mmWave links in mobile robotic systems are highly vulnerable to blockage and NLoS conditions.
- **Objective:** Demonstrate a resilient mmWave communication setup under severe blockage.
- **Approach:** Implement a **relay-assisted mmWave network** between a base station and a remote device when the direct path is blocked.
- **Relay Design:** Use an **amplify-and-forward (AF) relay** with independent transmit and receive beamformers to mitigate self-interference.
- **Outcome:** The relay restores connectivity and improves link robustness in blocked mmWave scenarios without requiring instantaneous CSI.

SYSTEM MODEL

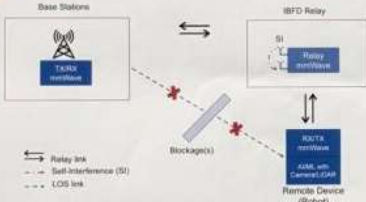


Fig. 1: Proposed robot communication system with mmWave links for robust connectivity in dynamic, obstructed environments.

EXPERIMENTAL SETUP

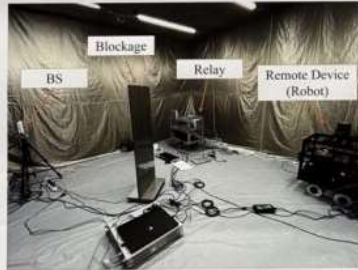
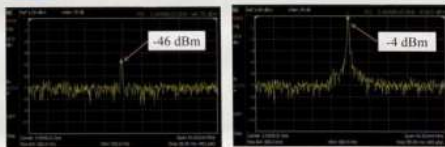


Fig. 2: Experimental demo setup for 28GHz mmWave relay-assisted communication system

EVALUATION




(a) Without Relay (BS <=> Robot) (b) With Relay (Relay <=> Robot)

Fig. 4: Received signal power spectrum at the remote device (Robot)

Conclusion

- Relay-assisted mmWave communication restores links under blockage.
- AF relay with independent beamforming improves NLoS robustness without CSI.
- **Future work:** integrate RSSI prediction for proactive link adaptation and further enhance resilience in dynamic environments.

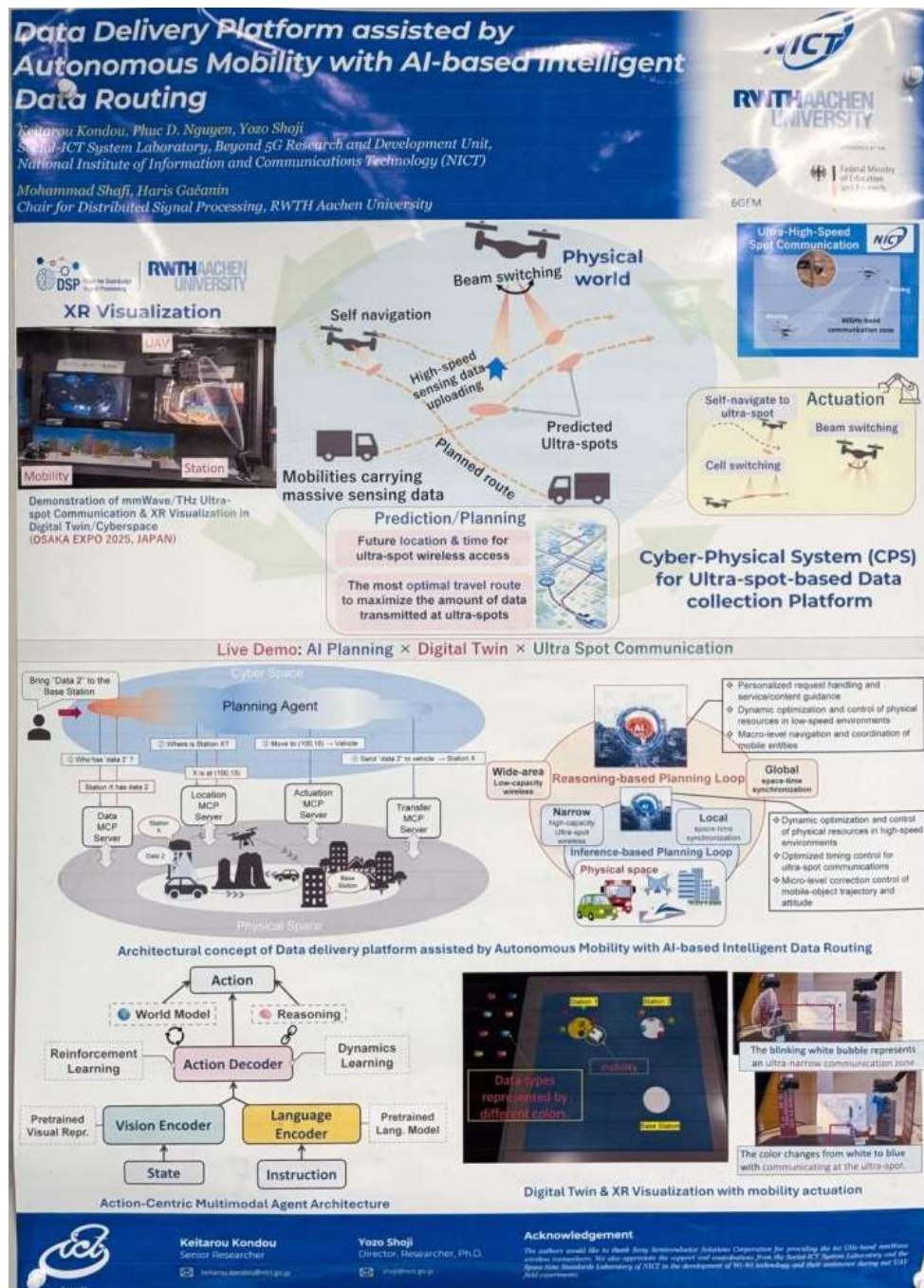


Contact:
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Data Delivery Platform assisted by Autonomous Mobility with AI-based Intelligent Data Routing

Keitarou Kondou (NICT), Phuc D. Nguyen(NICT), Mohammad Shafi, Haris Gačanin (RWTH Aachen University), Yozo Shoji (NICT)

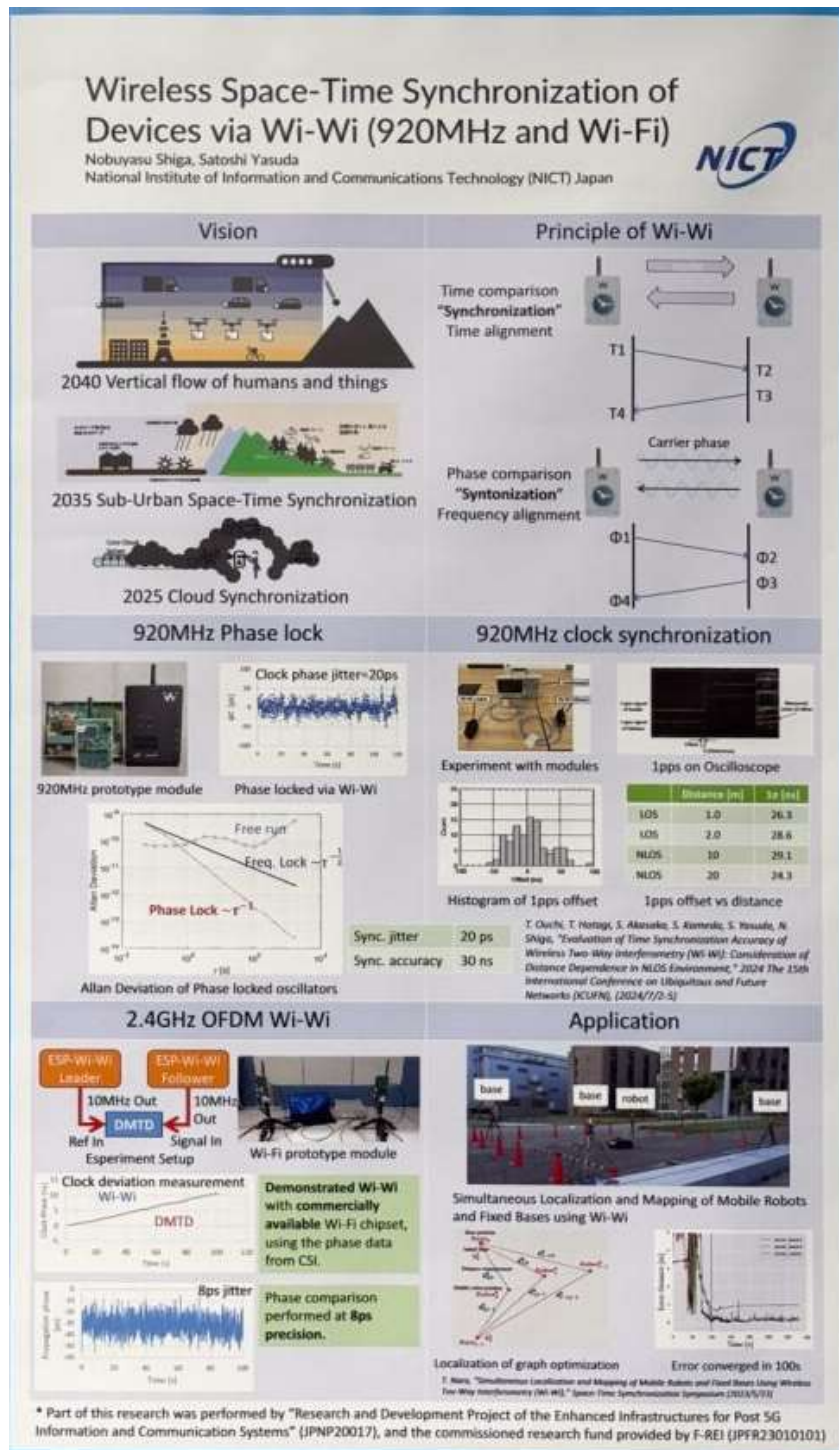
This work explores an architecture for mobility control that optimizes ultra-spot communications using an AI-driven approach. We are studying a concept in which an AI agent performs long-horizon, reasoning-based planning to orchestrate mobility and actions, enabling ultra-spot (localized, high-capacity) communication as a service. XR visualization is employed to present communication status at each ultra-spot. Building on this, we propose a two-layer architecture: (1) a service-level planning loop for global, long-horizon optimization, and (2) an inference-based planning loop for fast, local control using lightweight on-device models (e.g., Vision–Language–Action-style) to achieve real-time alignment and adaptive actuation. This layered approach aims to balance strategic reasoning with responsive control, paving the way for future CPS and digital twin implementations in Beyond 5G/6G environments.



Demonstration of Wi-Wi–Based Position Estimation Using Distributed Wireless Time Synchronization

Nobuyasu Shiga, Satoshi Yasuda

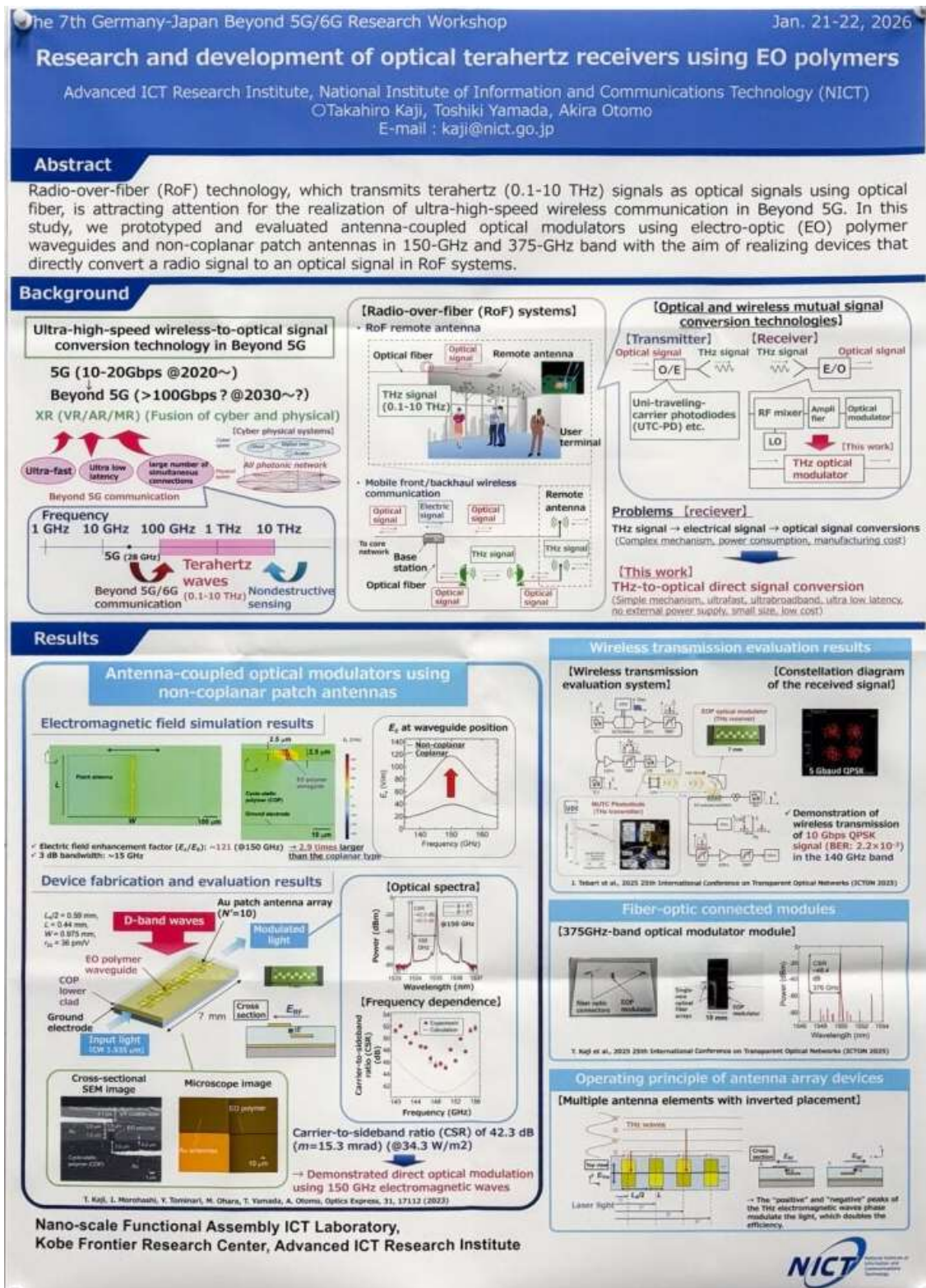
Accurate sensing of position estimation and motion is a fundamental requirement for future Beyond 5G/6G cyber-physical systems, including smart factories, distributed robotics, and resilient positioning infrastructure. In this demonstration, we present a real-time position measurement system based on Wi-Wi (Wireless Two-Way Interferometry), a wireless time-synchronization technology that enables sub-nanosecond relative clock alignment between distributed nodes. By exploiting carrier-phase information synchronized through Wi-Wi, small spatial displacements and dynamic motion can be detected without reliance on GNSS or centralized timing references. The demo showcases experimental results of position variation tracking under controlled motion, highlighting robustness against multipath and clock drift.



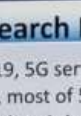
Research and development of optical terahertz receivers using EO polymers

Takahiro Kaji, Toshiki Yamada, Akira Otomo

Radio-over-fiber (RoF) technology, which transmits terahertz (0.1-10 THz) signals as optical signals using optical fiber, is attracting attention for the realization of ultra-high-speed wireless communication in Beyond 5G. In this study, we prototyped and evaluated antenna-coupled optical modulators using electro-optic (EO) polymer waveguides and non-coplanar patch antennas in 150-GHz and 375-GHz band with the aim of realizing devices that directly convert a radio signal to an optical signal in RoF systems.



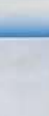
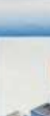
Millimeter-wave (mmWave) communication enables high data rates but suffers from limited coverage and blockage. Network-Controlled Repeaters (NCRs), standardized in 3GPP Release 18, offer a cost-effective solution using analog beamforming. This paper presents a software-controlled beamforming method for NCRs based on Taylor amplitude distribution to obtain extremely low sidelobe level. A 32-element phased array with phase-control ICs was implemented, and the radiation patterns were measured in an anechoic chamber at 28.0 GHz. The results confirm effective beam manipulation and sidelobe reduction, demonstrating the feasibility of software-defined NCR control.



Software-Controlled Analog Beamforming for Network-Controlled Repeater

Jin Nakazato^{*1}, Go Itami^{*2}, Yuki Tanaka^{*2}, Naoya Okubo^{*2}, Yuki Sasaki^{*1}, Arokia Nathan^{*3}

*1: Tokyo University of Science, *2: Visban Corporation, *3: Cambridge University

Research Background

- Since 2019, 5G service has been started worldwide.
- However, most of 5G vendors use Sub-6 (e.g., 3.4 GHz, 4.0 GHz).
- mmWave bands have signal propagation challenges. (e.g., path loss, atmospheric absorption, and blockage effects)

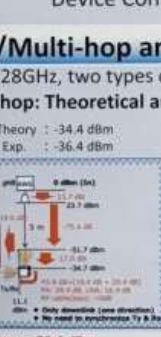
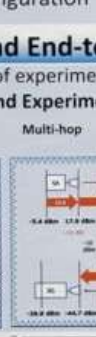
Repeater and Intelligent Surface have potential to extend mmWave coverage

- Repeater has two kinds of types (AF and DF); NCR has AF structure.
- Intelligent surface has also two kinds of types (RIS/IRS and Metasurface)

This paper focuses on NCR because its structure is easy to extend coverage

Repeater	Processing	Noise	Latency	Cost
AF	Amplify	×	Low	Low
DF	Decode	○	High	High

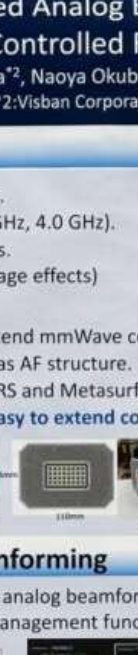
Prototype


DOI: 10.1109/ICC.2021.9518867, "Study on NR network-controlled repeaters," Oct. 2021

Software-controlled Analog Beamforming


- Development of a software-controllable mmWave analog beamformer device prototype.
- Software architecture and implementation with management functions for deploying multiple NCRs.



Total Gain = 81.8dB
 Device Configuration



[Antenna Pattern]



Single/Multi-hop and End-to-End Evaluation


Center Freq.: 28GHz, two types of experiment (continuous wave (CW), end-to-end (gNB, COTS UE))

Single/Multi-hop: Theoretical and Experimental values agree


Single-hop	Theory	Exp.	Multi-hop	Theory	Exp.
	-34.4 dBm	-36.4 dBm		-34.4 dBm	-36.4 dBm


3 NCRs can improve throughput compared to one gNB

End-to-End Evaluation: BW: 100MHz, MCS 27, TDD (50:50)




Cable Loss: 11.8 dB

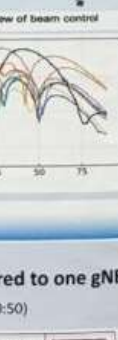




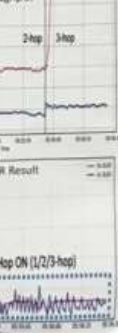
(a) UDP Throughput



(b) MCS Result



(c) BLER Result



Detected power: -36.4 dBm