



X-ICS: Cross-Agency Information and Communication System for Effective Disaster Response

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Situational Awareness and Resource Allocation in the Great East Japan Earthquake

- GSDF units from across Japan were dispatched right after the disaster
- Right after the disaster, the 2nd Division, **with damage details unknown, sized search teams by population distribution**
- Taro, part of Miyako City with a small population, **was assigned one regiment**
- Based on each regiment's search progress, Taro was reinforced **with two more regiments a few days later**



Taro area, Iwate pref. Mar. 2011.

[Lesson learned]

Had information from those who know the area best — **local police and local fire departments / volunteer fire corps** — arrived sooner, units could very likely have been deployed appropriately from the start



Stronger coordination among response agencies enables rapid deployment of the right support personnel and equipment



Response to the 2024 Noto Peninsula Earthquake

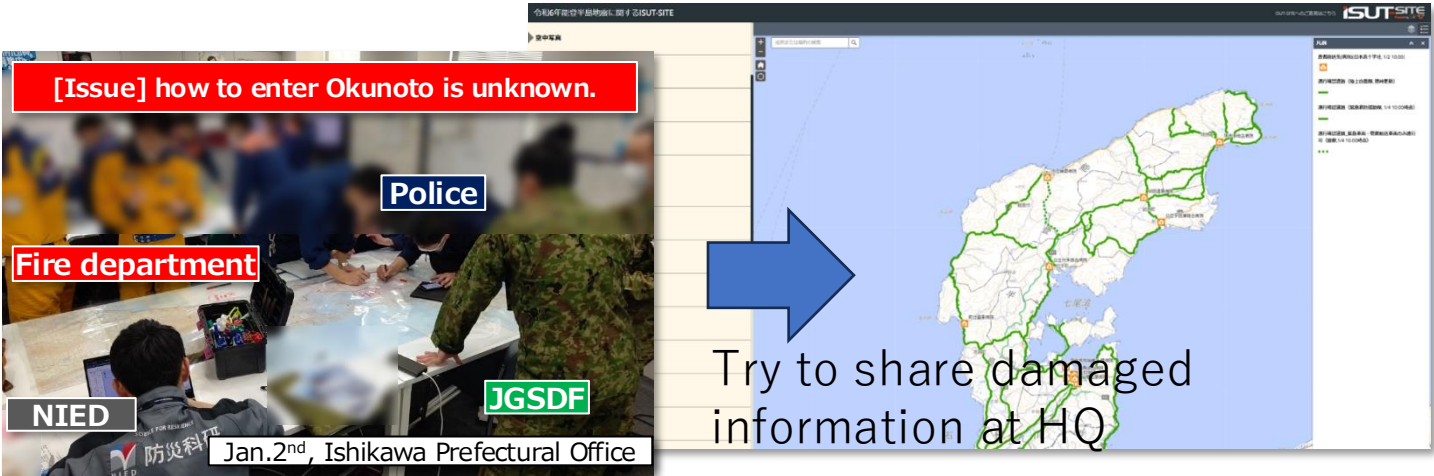


Photo: provided by NIED



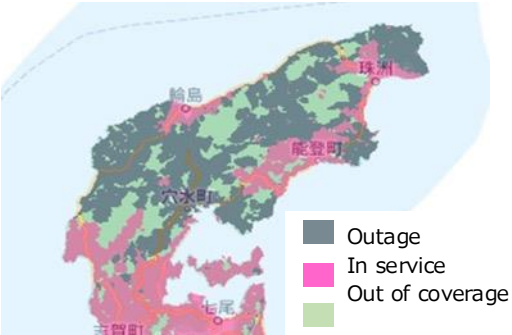
Nagoya City Fire Department (General Command and Support Unit)

Initially, the Emergency Fire Aid Unit (Aichi Pref. Battalion) was ordered to Wajima city fire site, but **could not find access route; operated at Monzen-machi (20km before Wajima city)**

Peak service outage (Jan 3–4)

NTT Docomo

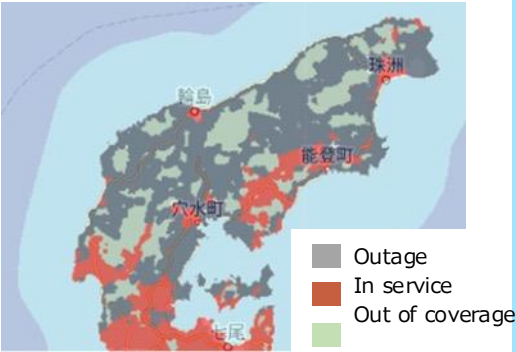
Affected municipalities: 7
Affected area: 70%



[As of Jan 4, 9:00]

KDDI (au)

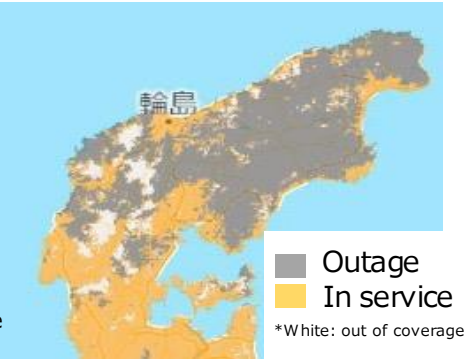
Affected municipalities: 6
Affected area: 82%



[As of Jan 3, 9:00]

SoftBank

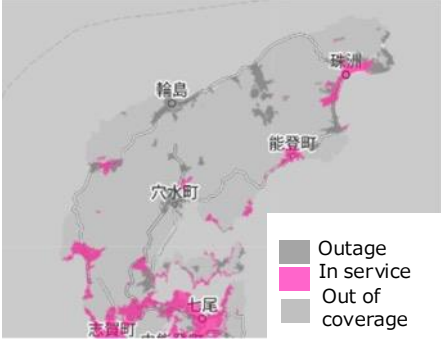
Affected municipalities: 9
Affected area: 45%



[As of Jan 3, 18:00]

Rakuten Mobile

Affected municipalities: 6
Affected area: 38% *
* Area served by own facilities



[As of Jan 3, 9:30]

Meanwhile, at the disaster site (on-site joint coordination center)...

Coordination done verbally, using maps and whiteboards

Quick and simple on the spot, but...

- Unless you are at the on-site joint coordination center, **you cannot get the information**
 - **No records are kept**, so the overall picture is hard to grasp in a national-scale disaster
- ...among other issues.



エリア	災害種別	発生場所	発生時刻	状況
C1	多重衝突	普通乗用車 3台 トラック 2台	群馬県 北はら 北里町 牛久保消防 川口消防 山梨県警	① ② ③ 2170 北はら町(北はら町) ④ ⑤
C2	"	マイクロバス1台 による交通事故 計6台		計1台
C3	"			
C4	"			

On-site joint coordination center at the FY2023 Joint Disaster Drill of nine prefectures and cities

Top: Coordination in progress
Left: Whiteboard for tracking individual incidents

SOBO-WEB: Japan's Integrated Disaster Information System

Cabinet Office, Government of Japan — geospatial information sharing for disaster response



Official name

New Comprehensive
Disaster Management
Information System
(SOBO-WEB)



Operated by

Cabinet Office,
Government of Japan,
Disaster Management
Bureau



Operation started
April 2024



Users

About 1,900 organizations,
including national
ministries/agencies,
local governments, and
designated public
institutions.



Information model

Aggregates information
based on EEI —
Essential Elements of
Information for disaster
response.

What it is



National web-based
GIS platform for
disaster information
sharing



Common operating
picture across
agencies



Built for rapid grasp
of damage and
response priorities

1. Data providers



National
ministries /
agencies



Local
governments



Designated
public
institutions



Infrastructure
operators



Field reports
(sensors, drones,
manual reports)

2. SOBO-WEB data integration EEI-based aggregation



Integrates diverse data
based on EEI (Essential
Elements of Information)
to create a unified,
trusted dataset.

3. Geospatial COP (Common Operating Picture)

- Hazard / Forecast
- Damage / Impact
- Facilities / Lifelines
- Transportation
- Population / Evacuation



4. Users



Disaster
Headquarters
(Government)



ISUT
(Information Support
Team)



Wide-area Support
Organizations



Municipalities
(Local governments)



Response Agencies
(Police, Fire, Self-Defense
Forces, etc.)

Why it matters



Faster situation
assessment



Layered map
visualization



Cross-agency
coordination



Supports evidence-
based resource
allocation



Research /
ICT perspective



Interoperability and data standardization

EEI-based model enables
consistent data exchange
across organizations.



Real-time / automatic data collection

Leverages sensors, satellites,
drones, and system feeds
for timely updates.



Resilience of access networks and field connectivity remains critical

Sustained connectivity is essential
for timely data sharing.

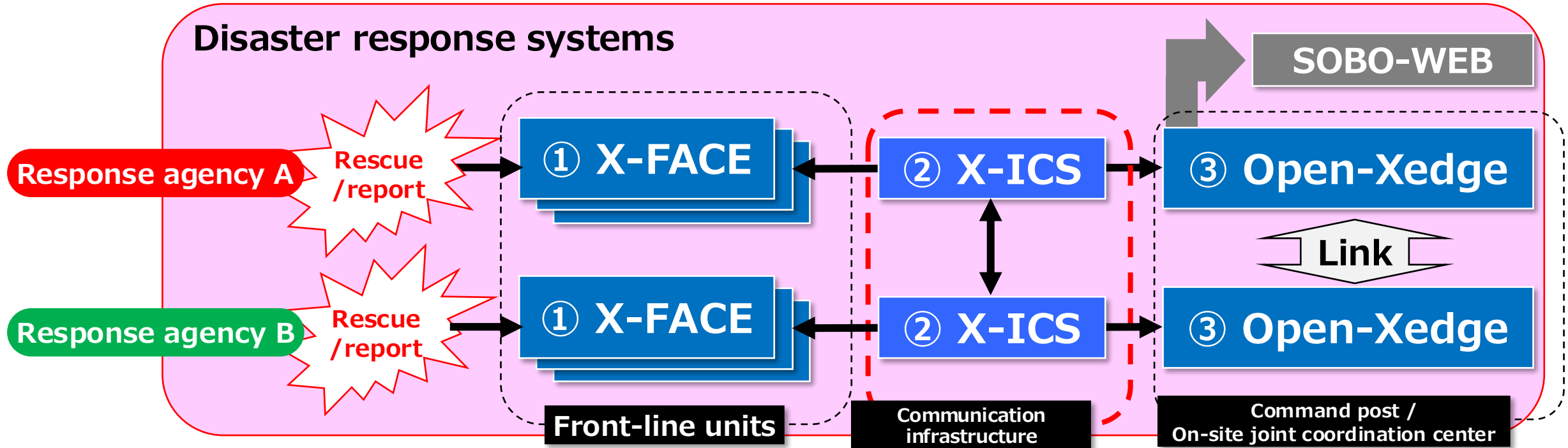


Edge/offline complement can strengthen continuity

Offline capture and edge
synchronization support
operations during disruption.

Overview of SIP3 Disaster Sub-theme C: “Cross-organizational Information Sharing and Use among Disaster Response Agencies”

Disaster response systems



① X-FACE (Cross-FACE)

- Supports front-line operations
- Hands-free input via speech recognition, head-mounted displays, etc.
- Supports field work by overlaying 3D city models

② X-ICS (Cross-ICS)

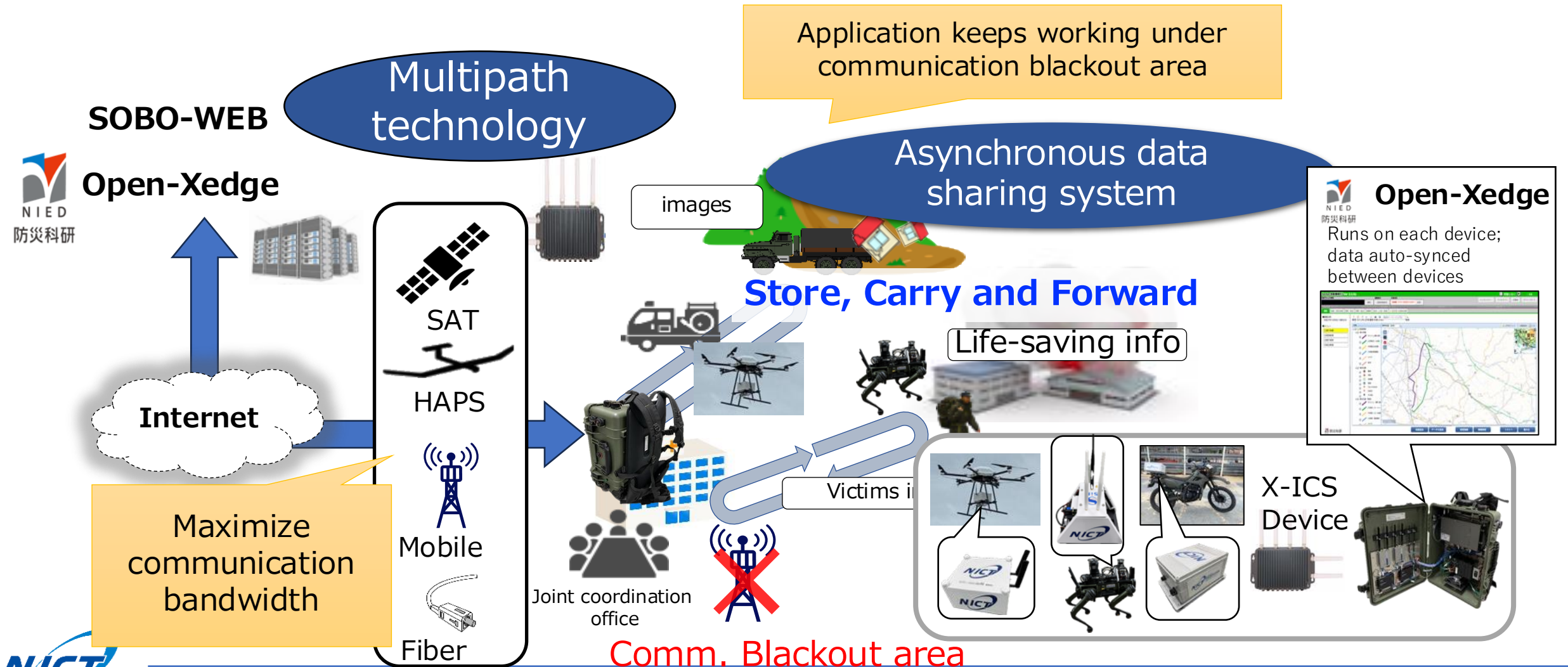
- Portable equipment for communication outages
- Uses every available link to maximize bandwidth = multipath communication
- Under a total outage, relays information by “store carry and forward”

③ Open-Xedge (Cross-Edge)

- Aggregates each agency's information / inter-agency coordination
- Linked with SOBO-WEB
- With X-ICS, integrates and operates information even under constrained communications = autonomous distributed data integration

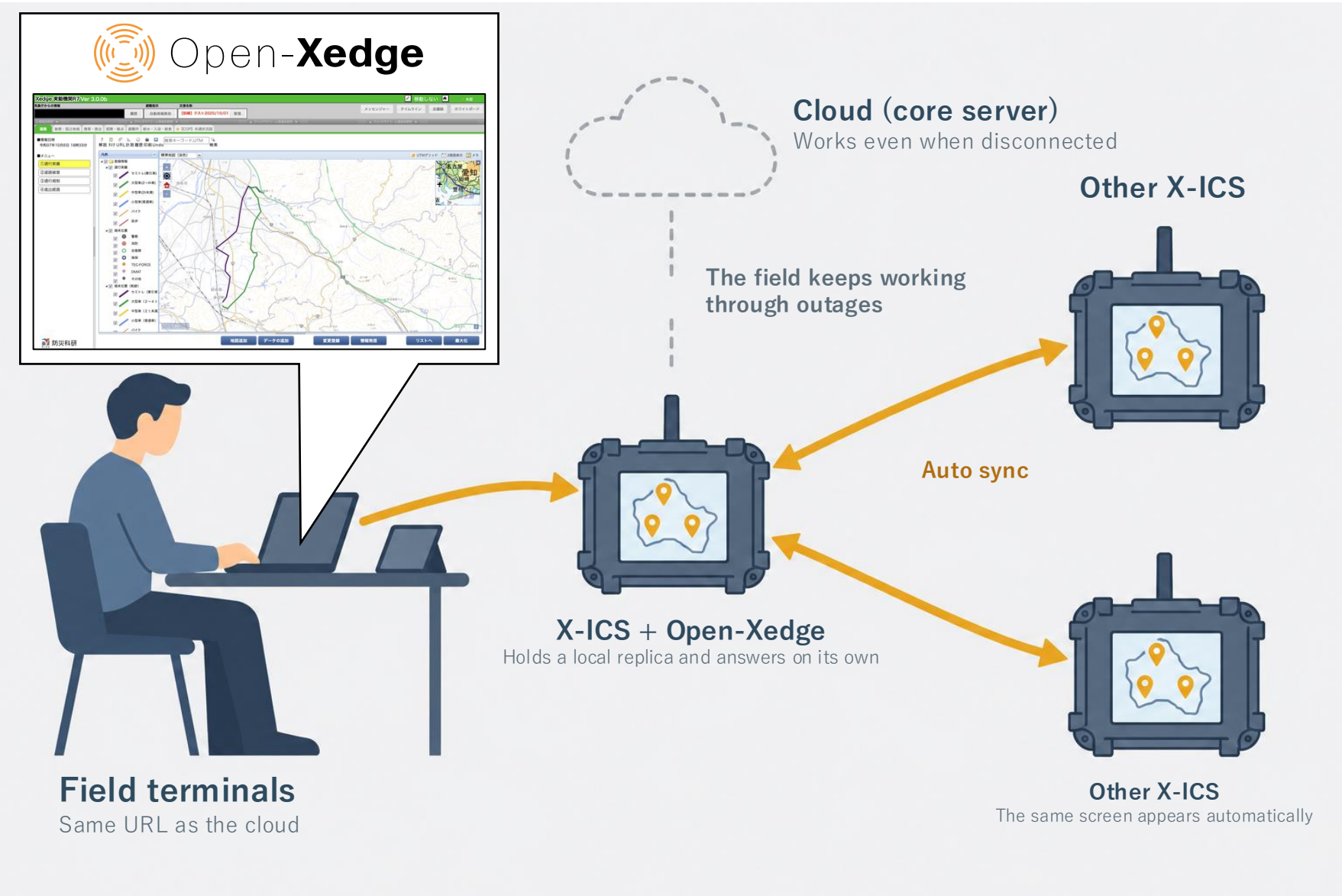
Cross-Agency Information and Communication System : **X-ICS**

System enabling info sharing among disaster response agencies, **even in areas where internet is unavailable** due to major disasters



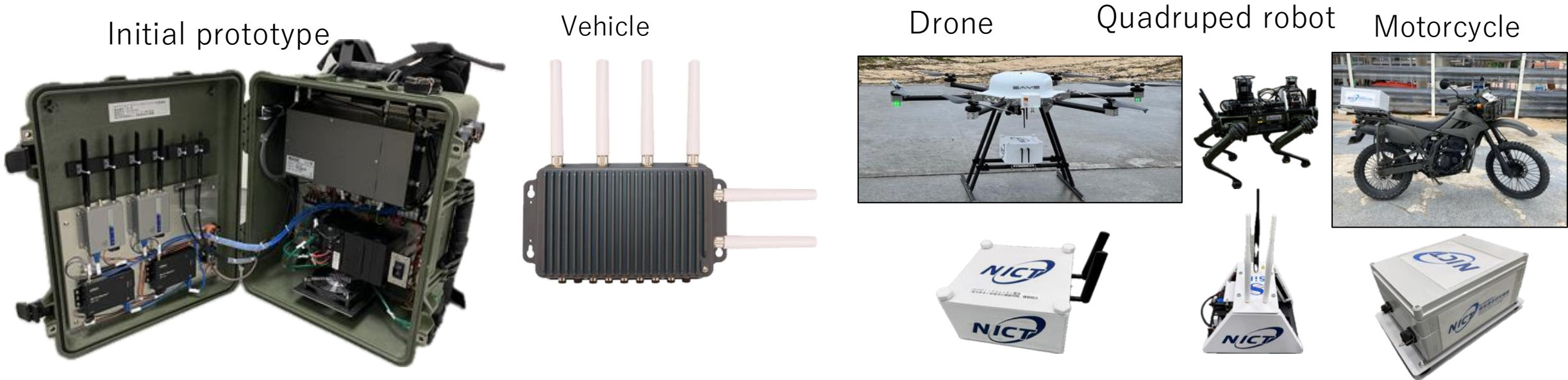
Sharing the Same Screen (COP) Between Field Sites without the Cloud

No changes to terminals or apps. The URL stays the same; only the destination switches to the local node.



- 1 Nothing changes on terminals**
Keep using the same URL as the cloud. Only name resolution points to the local node, so neither terminals nor apps need any "X-ICS settings."
- 2 Input stays on the local node**
Information entered on screen is first stored on the local node. Work on site continues even if the link is down.
- 3 Automatically passed to neighbors**
The same information automatically goes to connected neighboring nodes. No need to configure peers.
- 4 Other nodes do nothing either**
Received information appears on that node's screen as-is. Zero work on the receiving side.

X-ICS Device Types and Functions



	Initial prototype	Vehicle	Drone	Quadruped robot	Motorcycle
LTE/5G links	◎(au/docomo)	◎ (au/docomo)	○	○	○
Wi-Fi AP	○ (PoE)	○ (PoE)	○	○	○
Wi-Fi STA	○	○	○	○	○
Wi-Fi HaLow AP	○ (PoE)	○ (PoE)	○	○	○
Built-in battery runtime	30min	None (external)	6h	6h	6h
WAN ports	×3	×3	×1	×1	×1
LAN ports	×1	×2	-	-	-
CPU/RAM/Storage	Intel Core i7-10700TE 2GHz / 32GB RAM/ SSD 1TB	Intel Atom C3808 2GHz / 32GB RAM/ SSD 512GB	NXP Cortex®-A53 1.6GHz/ 3GB RAM/ SSD 128GB	NXP Cortex®-A53 1.6GHz/ 3GB RAM/ SSD 128GB	NXP Cortex®-A53 1.6GHz/ 3GB RAM/ SSD 128GB

Demonstration at a JGSDF Northeastern Army Exercise

Large-scale disaster response exercise "Michinoku ALEART2024" (hosted by JGSDF Northeastern Army, Nov 16–17, 2024, Ishinomaki, Miyagi)

- Under an outage, field information was **bucket-relayed via X-ICS** and **shared with SIP4D**
- Combining tsunami run-up forecasts computed in a cloud data center with worker locations, issued **secondary-disaster prevention alerts**



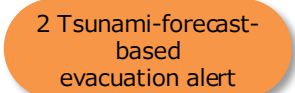
LCAC landing



X-ICS vehicle comes ashore

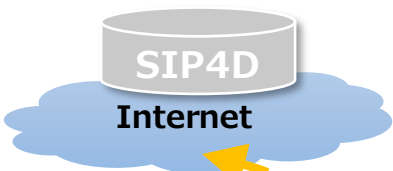


1 Disaster info sharing



2 Tsunami-forecast-based evacuation alert

HQ



Command post

Succeeded in two-way information sharing among field personnel, command-post personnel, and SIP4D under a simulated outage: sharing the latest information entered at the site, and delivering tsunami-forecast-based evacuation information to the site

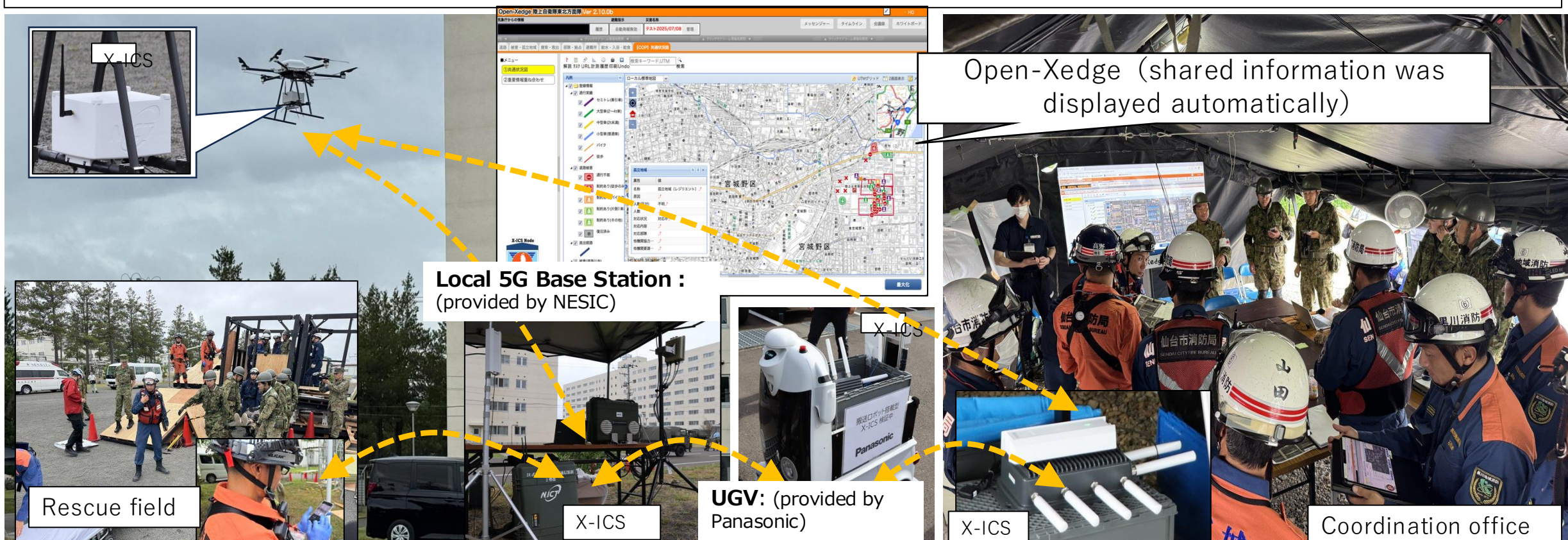


Participants: JGSDF Northeastern Army, NICT, NIED, ATR, ATR-Trek, Shibaura Institute of Technology, Tohoku University, and others

Joint Demonstration at Sendai Garrison July 14–15, 2025

Demonstration during training utilizing Local 5G and drones (UAV/UGV):

- Under communication outages, X-ICS units mounted on vehicles and drones (UAV/UGV) moved autonomously, enabling information sharing between remote field sites and the on-site coordination office.
- Local 5G base stations and X-ICS units were interconnected, enabling X-ICS-to-X-ICS communication, data synchronization, and information sharing via Local 5G.



Training Participants: JGSDF Tohoku Army, JGSDF Training and Education Research Command, Sendai City Fire Bureau, Kurokawa Community Fire Department, Sendai City Hospital, Miyagi DMAT
Supporting Organizations: SIP Sub-Project C (NIED, ATR, A.I.), NEC Networks & System Integration, Panasonic, EAMS Robotics, etc.

<https://www.youtube.com/watch?v=M56Zw0xbi-c>



通信途絶対策の技術実証実験

～ドローン搭載型X-ICSの実証実験～



Imagine a world where the flow of information is no more.
What would it mean if communications just stopped?

Our lives, even their most everyday moments,
have taken shape through a succession of endeavors and innovations.

Our passion is to keep people in comfort and security
and co-create a vibrant society, one full of curiosity.
We will always pursue a freer, more expansive future.

We are transcending boundaries, forging connections,
and liberating people from constraints.

**Beyond human intelligence,
co-create new standards for future society.**

NICT