May 2025

Report on the 5th IOFDS meeting in Chennai

Introduction

The 5th meeting of the International Open Forum on Data Society (IOFDS) was held on April 7–8, 2025, as part of Data Spaces Week 2025, hosted at Anna University, Chennai, India. The forum brought together a diverse group of stakeholders from government, industry, academia, and international standardization bodies, engaging in discussions on frameworks, implementations, and governance models for building interoperable and trustworthy data ecosystems.

Across the two days, the meeting welcomed approximately 100 participants per day, combining in-person and online attendance. A total of 38 presentations were delivered, including keynotes, status reports, and application-focused sessions, covering a broad spectrum of perspectives — from strategic policy insights to real-world technical deployments.

The meeting reaffirmed IOFDS's role as a collaborative platform for fostering shared understanding, standards alignment, and cross-border cooperation. It further strengthened the commitment to sovereign, decentralized, and scalable data spaces as enablers of inclusive digital transformation.

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1 Day1 Monday, April 7

1.1 Attendees

Day 1 Participants: 96 (in person: 75, including students; online: 21)

1.2 Summary of day 1

The first day focused on international strategies and frameworks for data spaces, with contributions from government, industry, and academia.

Governmental Keynotes (3 presentations)

- Themes: National strategies for data ecosystems, architecture models, and policy.
- Speakers from Germany, Japan (METI, Digital Agency) introduced initiatives such as Manufacturing-X, Ouranos Ecosystem RAM, and industrial data sharing governance.

Industry and Academic Keynotes (6 presentations)

- Themes: AI integration, global IMX collaboration, national ecosystems, and Gaia-X.
- Covered how AI and data spaces are interdependent, and explored models like Catena-X, Austrian and Korean manufacturing ecosystems, and Japan's digital frontier policy.

Panel Discussion

- Theme: Strategic outlook on interoperability, trust, and governance.
- Included perspectives from Europe, Japan, and India, stressing the need for harmonized standards and trust mechanisms.

Status Report – EU Focus (6 presentations)

- Themes: Technical protocols, value creation, and cross-sector implementation.
- Topics included the Dataspace Protocol (DSP), operational updates from Catena-X, and standardization via CEN-CENELEC, IDSA, and IEEE.
- Also featured U.S. perspectives via CESMII, promoting public-private collaboration and interoperable digital infrastructure.

1.3 Call for the meeting to order

Hiroshi Mano opened the meeting and welcomed both in-person and remote participants. He reminded participants that the meeting contents (statements, presentation materials, and minutes) would be disclosed to the participant mailing list, except under exceptional circumstances where limited disclosure is agreed upon by participants.

Motion 1: Election of Meeting Officers

Proposed Officers:

Chair: Hiroshi Mano

Vice Chair: Christoph Mertens

Secretary: Isamu Yamada (remote)

Moved: Christoph Mertens

Seconded: Isamu Yamada

Decision: Approved by unanimous consent

Motion 2: Approval of Meeting Agenda

Motion to approve the agenda as follows:

https://docs.google.com/spreadsheets/d/1zXCxe34K6lzTolTg7UYHb_tfBh6Ra_BhTwxOfMPK6uw/edit?gid=0#gid=0

Moved: Dr. Gopal

Seconded: Hiroshi Mano

Decision: Approved by unanimous consent

Background of IOFDS

Hiroshi Mano explained about the IOFDS (International Open Forum on Data Society) as follows:

- Feb 2023 (Brussels): 1st roundtable and agreement to meet every six months
- Apr 2023 (Takasaki, Japan): Proposal submitted at the G7 Digital Technology Ministerial Meeting
- Jul 2023 (Berlin): Name changed to "International Open Forum on Data Society"
- Feb 2024 (Paris): Website and logo approved; task force formation initiated
- Oct 2024 (Tokyo): First "Data Space Week"; approval of membership framework, logo policy, website operation, and reporting procedures

Remarks on the Purpose and Vision of IOFDS

- Data collaboration is essential as no entity possesses all the data it needs.
- Data spaces should be trust-based, decentralized, and sovereignty-preserving ecosystems.
- IOFDS is not about specific technology but about establishing a collaborative and interoperable framework.
- He noted the relevance of recent discussions at Hannover Messe and encouraged international cross-domain cooperation.

Acknowledgment

Hiroshi Mano expressed appreciation to Dr. Gopal and the local organizing team for hosting the event in Chennai.

1.4 Inaugural session

Gopal TV, Chair of the Organizing Committee, opened the inaugural session of the 5th IOFDS meeting at DSW2025. Gopal TV said that approximately 35 participants were present in the auditorium, with an additional 15 attending online. He reflected on his experience attending Data Spaces Week 2024 in Tokyo, Japan, and emphasized how the field has evolved—moving beyond being overwhelmed by data volume to now focusing on making data work effectively for individuals, teams,

organizations, states, and nations. He highlighted the central importance of interoperability among data spaces and expressed appreciation for ongoing collaboration with the Data Society Alliance and the IEEE P3800 Working Group, which is scheduled for discussion on Day 4 of the event.

Gopal TV welcomed participants to Anna University and introduced the historical significance of the CG Tagore Auditorium. He described data spaces as decentralized ecosystems, not just technical modules, and noted that data management today requires contextualization, abstraction, and governance. He iterated the significance of the five-day conference schedule, highlighting the focus of each day: international interoperability of open data spaces (Days 1–2), research directions (Day 3), IEEE standardization on the Data Trading System (Day 4), and the Open Data Forum (Day 5). He concluded his remarks by affirming the scalability, trustworthiness, and practical relevance of data spaces across all levels of governance and society.

The Registrar of Anna University gave a formal introduction of the chief guest, Dr. C. Rangarajan. He highlighted Dr. Rangarajan's distinguished service in public policy and economics, including his roles as Governor of the Reserve Bank of India, Chairman of the Economic Advisory Council to the Prime Minister, Governor of Andhra Pradesh, and member of the Rajya Sabha. His academic and institutional contributions were also recognized, including his professorships and numerous national honors.

Hiroshi Mano presented a bouquet and shawl to honor Dr. Rangarajan and offered brief remarks. He thanked the Indian organizing team and expressed hope that the meeting would contribute to new collaborative steps through presentations and exchanges between Europe, Japan, and India.

Inder Gopal, joining remotely from the United States, shared a brief address. He described active data space initiatives in India, such as the India Urban Data Exchange (IUDX) deployed across 54 cities, the Agricultural Data Exchange in Telangana, a national geospatial data infrastructure, and a health data platform developed by ICMR (Indian Council of Medical Research) in Chennai. He acknowledged challenges including poor data quality, reluctance to share data, and uncertainties around the DPDP Act (Digital Personal Data Protection Act). Nonetheless, he emphasized the need to overcome these barriers and welcomed the opportunity for continued dialogue throughout the week.

Dr. C. Rangarajan delivered the keynote address, titled "Data, Information, and Knowledge." He began by stating that although he was not a specialist in data spaces, he had dealt with data extensively in policymaking. He outlined the evolution of statistics from enumeration to inference, stressing that inference is meaningless without data integrity. He said a sound data system is essential for evidence-based policy.

He discussed the increasing role of Big Data and its implications for analytical models and governance. While statistical sampling remains vital—especially for "constructed" data such as consumption expenditure—he acknowledged that large datasets offer new insights through correlation, even when causality is not immediately evident. He noted that data science enables a shift from deductive to inductive reasoning, allowing theory to emerge from observation.

Dr. Rangarajan also addressed the importance of data credibility, timeliness, and adequacy. He cited foundational thinkers like Lord Kelvin and Prof. C.R. Rao, and emphasized that statistical authorities must be empowered to release reliable data without political interference. He advocated for data as a public good, with appropriate privacy safeguards, and concluded by stating that we are now an information society—data comes first, then information, and finally knowledge.

He expressed his appreciation for the conference's agenda and wished participants a productive and insightful event.

1.5 Governmental keynotes

1.5.1 Ernst Stoeckl-Pukall, BMWK Germany

Ernst Stoeckl-Pukall, Director for Digitisation and Industrie 4.0 at Germany's Federal Ministry for Economic Affairs and Climate Action, delivered a keynote on the German initiative **Manufacturing-X**, emphasizing the need for federated, decentralized, and cross-sectoral data ecosystems to support global manufacturing(see d1-1Gov-01-00-Ernst Stoeckl-Pukall_India Data Week - 7th April 25.pdf).

He noted that future competitiveness depends on data sharing across companies and borders and outlined **three key goals**: enhancing resilience in supply chains, enabling sustainability through CO_2 tracking and circular economy, and fostering innovation via new data-driven business models.

As a model, he presented Catena-X, a large-scale automotive data initiative funded by the German government. It demonstrated the importance of interoperability, user sovereignty, and modular digital twins for value chain optimization. The lessons learned are now being extended through projects like Factory-X, Aerospace-X, and Semiconductor-X, forming the core of Manufacturing-X.

Stoeckl-Pukall emphasized that Manufacturing-X is pre-competitive and open, relying heavily on **open-source components** (e.g. via Eclipse Foundation) and coordinated development. He highlighted the need for shared technical infrastructure, harmonized standards, and end-to-end processes across domains.

International collaboration is key. The **International Manufacturing-X Council**, launched in 2023 and now comprising 12 member states, seeks to align governance and technical frameworks globally. He invited India to participate in this effort.

Finally, he linked data ecosystems with Europe's push for a cloud-edge continuum, noting €7.8 billion in joint investments across 120 projects. He concluded that trust, openness, and data sovereignty are essential for participation, and central to Germany's digital strategy.

1.5.2 Michitaka TSUDA, METI Japan

Michitaka TSUDA, Deputy Director at Japan's Ministry of Economy, Trade and Industry (METI) and Chief Architect of the Ouranos Ecosystem, delivered a keynote focused on the newly published **Ouranos Ecosystem Dataspaces Reference Architecture Model (ODS-RAM)**. He positioned it as Japan's technical framework to support interoperable and service-driven data spaces across industries (see d1-1Gov-02-01-Michitaka TSUDA_【METI】250407_IOFDS_DSW2025_set.pdf).

Tsuda began by tracing the historical evolution from hardware-centric industries to software-defined and data-centric ecosystems. He emphasized that data is now the defining factor of value creation, particularly in the age of AI, and that competitiveness depends on enterprise-level data utilization—not just internet-scale data.

The **ODS-RAM** addresses 13 structural issues related to data interoperability—such as discovery, access, integrity, and sovereignty—by defining **four functional layers** (**Data, Transaction, Identity, Semantics**) and **four cross-cutting perspectives** (**Service, Governance, Security, Trust**). He introduced the concept of a hybrid service ecosystem, combining federated and distributed service models to support diverse actors, including SMEs and large corporations.

He further emphasized alignment with global efforts by referencing logical **interoperability with IDSA's IDS-RAM** and showcased successful demonstrations such as the green traceability project for battery CO_2 data (in collaboration with Catena-X), and digital air mobility systems in Japan, already using data spaces for autonomous flight path coordination.

Technical components such as data space connectors and semantic modules are being released as open-source software, and ongoing development includes OSS SDKs, protocol specifications, and guidebooks. Tsuda closed by expressing hope for deeper international cooperation and encouraged participants to engage with the Ouranos initiative through available channels.

1.5.3 Kaito YAMAGUCHI, Digital Agency Japan

Kaito Yamaguchi, from Japan's Digital Agency (Chief of the Data Strategy Division), presented the government's initiatives to promote industrial data sharing and build a robust data ecosystem. He began by explaining the role of the Digital Agency, established in 2021 to lead Japan's digital transformation, and emphasized the importance of data as a key production factor for enhancing industrial competitiveness (see d1-1Gov-03-00-Kaito YAMAGUCHI2_0250407_Kaito Yamaguchi_Digital Agency.pdf).

Yamaguchi introduced the concept of industrial data sharing as a community activity where specific data is shared among actors with a shared purpose. He shared examples of current government-led use cases, such as digitalizing quality certification documents for construction steel, battery carbon footprint data (**ABtC**), plastic material lifecycle data (**PLA-NETJ**), and agricultural-environmental data (**WAGRI**).

To scale such initiatives, he outlined three core strategies. First, modularization of system functions and components is essential to prevent redundant, customized development and to allow flexibility across diverse data-sharing communities. The **Digital Agency and IPA** will support architecture design, provide reusable modules, guide implementation, and enforce governance in government-led projects.

Second, Yamaguchi addressed the importance of trust mechanisms in data sharing. He identified three types of risks: verifying the authenticity of organizations, ensuring data integrity, and validating system security. The agency is developing a framework to classify trust functions, evaluate existing trust

services, and recommend combinations appropriate to each use case. He highlighted the **gBizID** as an example of a government-issued, unified authentication system for legal entities.

Third, he introduced the draft Data Governance Guideline, aimed at promoting behavioral change among business executives. This guideline calls for data governance to be treated as a core management issue and addresses topics such as cross-border data processes, data security, organizational maturity, and the responsible use of AI.

Yamaguchi concluded by affirming the Digital Agency's commitment to leading Japan's digital transition and fostering data ecosystems driven by both public and private actors.

1.6 Panel Discussion: Summarizing Strategic Outlook

The panel discussion featured five speakers: **Gopal TV** (moderator), **Hiroshi Mano**, **Christoph Mertens**, **Ulrich Ahle**, and **Dominik Rohrmus**. Each offered perspectives on the strategic future of data ecosystems, trust, and interoperability.

Gopal TV opened by reflecting on the historical and philosophical shift from deterministic systems toward more flexible, global, and knowledge-sharing ecosystems. He emphasized India's cultural foundation in "sharing knowledge," and positioned data spaces as the framework that allows a structured, yet decentralized approach to managing data across sectors and borders.

Hiroshi Mano underscored the difference between "system" and "ecosystem," emphasizing that ecosystems include not only technologies but also trust and human cooperation. He noted that traditional OEM-based models no longer suffice in decentralized supply chains. Establishing trust among previously unknown parties is central to enabling functional ecosystems, with trust being the "driving force" behind data exchange.

Dominik Rohrmus expanded on the practical architecture of ecosystems, particularly in the industrial domain. He praised initiatives like Catena-X and Ouranos for building open, non-proprietary platforms with trust anchors (such as operating companies) that validate identities without centralizing data flows. He stressed the unique challenges in scaling trust, dealing with industrial legacy systems, and preparing the workforce to manage data ecosystems. He concluded that a decentralized, secure infrastructure is key to enabling meaningful applications of AI and federated learning.

Christoph Mertens warned against misusing the term "data space" for vendor-locked cloud platforms that lack openness and interoperability. He stressed the need for international standards, analogous to those underpinning the Internet, to ensure global interoperability. He advocated for a clearer taxonomy and common protocols for trust, identity, and governance - especially through the International Data Spaces Association's work in navigating this complexity.

Ulrich Ahle focused on the manufacturing sector's growing reliance on data. He recalled India's past "Make in India" slogan and observed that "there is no manufacturing without data." Referring again to Catena-X and IDSA's role, he reinforced the importance of global standards and modularization—echoing Kaito Yamaguchi's earlier presentation. Ahle also highlighted the critical need

for cross-domain interoperability (e.g., smart city, mobility, and energy data spaces) and argued that failing to ensure this would risk fragmentation even at the local level.

Gopal TV concluded the panel by summarizing the shared focus on trust, transparency, and interoperability, noting that integrating computer architecture, networking protocols, and databases into a seamless global framework is the challenge ahead. He thanked all speakers and ended the session with a reminder to maintain the schedule for the hybrid conference.

1.7 Industry and Academic keynotes

1.7.1 Noboru Koshizuka, University of Tokyo

Noboru Koshizuka, Professor at the University of Tokyo and IDSA Japan Hub Coordinator, delivered a keynote titled "AI for Dataspaces, Dataspaces for AI," exploring how evolving AI technologies—especially LLMs and agents—can be integrated with data space architectures (see d1-2InA-01-00-Noboru Koshizuka_20250407.IOFDS.pdf).

Koshizuka identified three key limitations of current LLM-based systems: (1) factual inaccuracy, especially in niche domains; (2) weak support for real-time data inference; and (3) lack of dynamic interactions (i.e., read-only behaviors). He presented **Retrieval-Augmented Generation (RAG)** and **AI agent** frameworks as emerging solutions, emphasizing their potential when combined with distributed databases and existing systems via API or browser automation.

He argued that AI systems increasingly require tight integration with legacy information systems and distributed data infrastructures, which leads naturally to parallels with data space architectures. Koshizuka demonstrated that technologies like federated connectors and protocols such as DATA-EX or MCP (Model Context Protocol) align conceptually and technically with the connector-based approach in data spaces.

His team at the University of Tokyo has developed and tested an architecture called **F-RAG** (Federated RAG), which combines LLMs with distributed vector databases over data spaces using standard connectors. Their research shows F-RAG achieves comparable inference precision to conventional RAG while enabling richer data interaction. Use cases include CO_2 emissions traceability (integrating with Catena-X) and real-time mobility queries using natural language.

Koshizuka concluded with three strategic priorities for the future:

1 Development of new dataspace protocols tailored to AI/LLM use,
2 Establishment of usage control models for AI—including trust and access policies for machine learning,
3 Improvement of data quality for machine readability, essential for autonomous AI agents.

He closed by proposing a shift from "data sharing" to "**AI sharing**," coining the idea of an "**AI Space**"—a next evolution where AI itself becomes a primary stakeholder within the dataspace ecosystem.

1.7.2 Thomas Hahn, IMX and Siemens

Thomas Hahn, Chairman of the **International Manufacturing-X (IM-X)** Council and Siemens Fellow, delivered a keynote on International Manufacturing-X (IM-X), positioning it as a strategic global initiative to enable interoperable industrial data ecosystems. He connected the IM-X vision to both sustainability and digital innovation and later reflected on the implications of Noboru Koshizuka's AI-oriented remarks (see d1-2InA-02-00-Thomas Hahn_250407_IMX.pdf).

Hahn began by emphasizing that **data transparency** across global supply chains is critical, particularly for CO_2 footprint tracking and sustainable battery production. Using **battery passport** initiatives from Catena-X as a live example, he highlighted that over 90% of CO_2 emissions are embedded upstream or downstream—necessitating broad, multi-party data integration.

He presented IM-X as a **federated, decentralized, and collaborative data infrastructure** for smart manufacturing that adheres to FAIR data principles. IM-X seeks to advance resilience, sustainability, and competitiveness, through the development of standards, cross-industry use cases, shared services, and common technological base layers. The initiative also aims to support new digital business models, regulatory compliance, and innovation through shared data.

Hahn described IM-X's **multi-regional engagement,** including collaboration with initiatives in Japan, Korea, India, the U.S., and the EU. He emphasized the need to harmonize differing infrastructures and regulatory environments, particularly in areas like carbon accounting, traceability, and circular economy.

Key use cases presented included **Factory-X,** with examples such as condition monitoring, modular production, carbon footprint management, and autonomous manufacturing services. He noted that success requires horizontal and vertical interoperability across domains and industries.

Hahn concluded by aligning IM-X with ongoing AI trends, echoing Koshizuka's call for federated AI and highlighting that data ecosystems are foundational not only for data sharing, but also for **enabling industrial AI**. He reinforced that **global cooperation,** shared standards, and trust-based architecture are vital to scale meaningful impact in manufacturing.

1.7.3 Dominik Rohrmus, LNI4.0 and IMX

Dominik Rohrmus, CTO of LNI 4.0 and representative of the International Manufacturing-X (IM-X) Council, presented an overview of **global IMX projects**, emphasizing international collaboration, use case sharing, and digital product regulation as the cornerstones of data-driven manufacturing (see d1-2InA-03-01-Dominik Rohrmu_250407_Overview on global IMX projects.pdf,).

Rohrmus began by outlining the structure and mission of the **International Manufacturing-X Council**, which includes representatives from Europe, the U.S., Canada, Japan, Korea, and aims to include India. Its goal is to orchestrate cooperation across standards, infrastructure, and business needs in support of **interoperable and sovereign data ecosystems.**

He introduced the "**Use Case Hub**" concept—a centralized database of industrial use cases, such as carbon footprint tracking, demand and capacity management, and digital product passports (DPPs). He stressed that although many similar initiatives exist globally, **fragmentation and heterogeneity**

hinder replication and scalability. The hub aims to offer **a trusted single point of knowledge** to improve visibility and collaboration.

Rohrmus provided an in-depth explanation of Catena-X, a flagship data space in the automotive industry. He explained how it adds business value through applications such as certificate management, predictive maintenance, traceability, and ESG compliance—ultimately enabling new business models and regulatory compliance. He emphasized the need for simple onboarding mechanisms and toolkits to support **SMEs,** and called for workforce upskilling to operate within data ecosystems.

He also detailed the upcoming **EU Digital Product Passport regulation,** beginning with automotive batteries in 2027. DPPs act as a "**digital CV (Curriculum Vitae)**" for products, containing both static (e.g., materials) and dynamic (e.g., CO_2 emissions) data. He demonstrated how DPPs and data spaces interact to support use cases like **traceability, circular economy, and cross-domain regulation**.

To close, Rohrmus invited India to join ongoing IMX showcase efforts, including a **joint international white paper** on DPPs titled "Towards a New Data Economy", aimed at clarifying the global relationship between data spaces, regulatory projects, and business implementations. He reiterated that interoperability, standards, and data sovereignty are the keys to scaling industrial ecosystems globally.

1.7.4 Roland Sommer, PI4.0 Austria

Roland Sommer, CEO of Platform Industry 4.0 Austria, presented Austria's approach to fostering a **national manufacturing data ecosystem** with low barriers for SME participation. He emphasized the challenge that many Austrian companies remain hesitant to share data due to concerns over intellectual property, unclear benefits, and limited organizational readiness (see d1-2InA-04-00-Roland Sommer_Data Ecosystem (final).pdf).

To address this, the Austrian initiative **"Domain Manufacturing Austria"** was launched under the Gaia-X Hub Austria and led by Platform Industry 4.0 Austria. It aims to raise awareness, provide training, validate use cases, and promote adoption through concrete actions and free services. Sommer outlined four core pillars: (1) communication and awareness-building, (2) laboratory-based "market fitness" testing, (3) education and consulting, and (4) dissemination via national and EU-funded projects.

Key components include:

- **Pilot LinX**, a platform connecting three pilot factories to test data sharing.
- **AI5Production (EDIH project)**, which offers training and "test-before-invest" funding for SMEs.
- The establishment of a **Data Sharing Academy**, soft-launched in 2024, with official rollout planned for late 2025.

Sommer highlighted two Austrian-German lighthouse projects:

1. **EuProGigant,** a 4-year, €8 million initiative across Austria and Germany demonstrating real-world multi-site data sharing. Use cases included CO_2 footprint tracking, component matching, and mobile processing machines.
2. **CHAMPI4.0NS**, focusing on sovereign data use in the timber industry, with use cases around geographic wood differentiation and glue aging traceability.

He concluded by stressing the importance of **bridging industry and research** and linking Austria's national activities with broader European efforts such as Gaia-X, Manufacturing-X, Catena-X, and Data Spaces 4.0. The Austrian model emphasizes **pragmatic, industry-driven uptake** of data spaces through structured outreach, experimentation, and trust-building.

1.7.5 Ulrich Ahle, Gaia-X

Ulrich Ahle, CEO of Gaia-X European Association delivered a keynote on **the role of Gaia-X in creating global, interoperable, and trusted data spaces.** He began with a historical context, from EDI (electronic data interchange) to centralized platforms, and now to federated many-to-many **data space architectures** that demand automated onboarding, governance, and trust mechanisms (see d1-2InA-05-00-Ulrich Ahle_20250407_DSW2025_Gaia-X_compressed.pdf).

Gaia-X contributes by providing a **compliance framework and technical specifications** for achieving legal, organizational, semantic, and technical interoperability. Two key instruments support this:

1. The **Gaia-X Compliance Document** (rules and trust policies), and
2. The **Gaia-X Technical Compatibility Specs** (architecture, identity and access, data exchange protocols, and ontologies).

Ahle emphasized Gaia-X's **global expansion,** highlighting collaboration with Japan, Korea, and the U.S., as well as local Gaia-X Hubs (currently 22 worldwide). He introduced the concept of **Digital Clearing Houses (GXDCH)** as infrastructure for verifying compliance and enabling secure, federated data exchanges—already being piloted in Japan by NTT DATA.

He presented the three-layer interoperability architecture co-developed with IDSA, FIWARE, and BDVA:

- **Trust Framework Layer** (e.g., verifiable credentials),
- **Data Sharing Layer** (e.g., data space protocols), and
- **Domain Layer** (e.g., vertical-specific solutions like manufacturing or health).

He also introduced the Gaia-X Endorsement Programme for certifying data spaces as qualified or lighthouse-level and showcased existing projects such as Catena-X, EuProGigant, RegenAg-X, and Dataspace4Health.

To support capacity building, Ahle introduced the Gaia-X Academy, offering 15 multilingual courses (with more in development), and promoted upcoming events such as **GITEX Europe 2025,** the **Gaia-X Summit,** and the **Market-X Hackathon.**

He concluded by reaffirming Gaia-X's mission to **enable sovereign digital ecosystems** that support compliance, AI integration, and industry transformation through shared, trusted data infrastructure.

1.7.6 Takafumi Ochiai, Atsumi & Sakai

Takafumi Ochiai, Head of the Policy Research Institute at Atsumi & Sakai and advisor to several Japanese government councils, presented an overview of Japan's evolving AI and data governance framework, highlighting recent legal developments, regulatory strategies, and emerging incentives for cross-sectoral data use (see d1-2InA-06-00-Takafumi Ochiai_Japan's DigitalFrontierDataandAIPolicy.pdf).

He began by outlining Japan's **AI governance landscape**, emphasizing an agile, multi-stakeholder, risk-based approach. The government has adopted a principles-based framework, addressing both **technological risks** (bias, hallucinations, security) and **societal risks** (privacy, democracy, monopolization, environmental impact). Japan's approach differs from the EU's AI Act by avoiding rigid risk classification, instead focusing on coordination between public, private, and academic actors via a national **AI Strategy Headquarters.**

He then introduced the updated **AI Governance Guidelines for Business (Ver.1.1)** issued in March 2025 by MIC, which clarified responsibilities across contractual relationships, emphasized human oversight in generative AI systems, and expanded risk management procedures aligned with international standards.

Shifting to **data policy**, Ochiai noted that Japan currently lacks an integrated legal foundation like the EU's Data Governance Act or Data Act and enough sector-specific regulations (e.g., existing regulations are limited, such as banking APIs, health data reuse, electricity and so on). A major government initiative was launched in December 2024 to explore a unified legal and institutional framework for data sharing, focusing on both **individual-centered (primary use)** and **society-centered (secondary use)** models.

Key policy discussions include:

- Developing constitutional alignment between **personal rights** and **data use**.
- Reforming the **Personal Information Protection Act (PIPA)** to allow statistical use of data for AI development without explicit consent.
- Introducing **architectural design standards** for interoperable data platforms.
- Strengthening **trust services, cybersecurity,** and **public-private collaboration** frameworks.

Ochiai emphasized the need for **economic incentives** to encourage data sharing, including tax benefits, grants, and public procurement mechanisms. This is because only copying European regulations will not be enough for solve challenge on sharing data in Japan. He also introduced the idea of "spaces" for **safe data utilization**, including oversight bodies, and industry self-regulation.

Finally, he previewed proposals under debate for the 2025–2026 review of PIPA, which include:

- Exception clauses for AI/statistical use,
- Tougher sanctions for violations,

- Rules for subcontractors and biometric data handling,
- Special protections for children's data.

Ochiai concluded that Japan is now at a pivotal moment to establish a unified and future-proof legal infrastructure for data and AI, balancing innovation, individual rights, and international interoperability.

1.8 Status Report-1(EU)

1.8.1 Christoph Mertens, IDSA

Christoph Mertens, Head of Adoption at the International Data Spaces Association (IDSA), delivered a report on **the current role of IDSA in promoting global, interoperable, and sovereign data infrastructure**, particularly through the development and adoption of the **Dataspace Protocol** (see d1-3SR1-02-00-Christoph Mertens_IOFDS IDSA Status.pdf).

Mertens opened by addressing a recurring question in the data space landscape: "How can companies participate?" Highlighting that many organizations hesitate to join European-led initiatives like Catena-X due to perceived complexity or geopolitical mistrust, he drew an analogy to **telecommunication networks**, where global interoperability is achieved through invisible infrastructure and open standards.

To address these participation barriers, IDSA launched the **Telco Provider Community**, with founding members including NTT (Japan), T-Systems (Germany), and KPN (Netherlands), recently joined by China Telecom and SoftBank. This effort aims to establish **nationally trusted yet globally interoperable infrastructures**, leveraging telcos' existing networks to support sovereign data exchange. Mertens presented IDSA's **interoperability model, a four-layer stack**:

1 **Legal Layer** – common legal frameworks and trust policies,
2 **Organizational Layer** – aligned responsibilities and governance,
3 **Semantic Layer** – shared vocabularies and meaning,
4 **Technical Layer** – secure, sovereign data exchange protocols.

Central to IDSA's contribution is the **Dataspace Protocol,** envisioned as the "internet protocol" for data spaces. It supports **peer-to-peer, policy-enforced data sharing** without relying on centralized platforms and allows participants to negotiate data contracts, define usage rights, and verify compliance. The protocol is being standardized as **ISO/IEC CD 20151.**

He emphasized the importance of **testbeds** and **certification environments** to support SMEs and R&D communities. These are complemented by efforts to align with other global standardization bodies like ISO and IEEE.

To close, Mertens presented the **10 Principles of Trusted Data Sharing,** forming the IDSA Manifesto. These include commitments to openness, decentralization, infrastructure agnosticism, and verification of contractual obligations. He encouraged international collaboration to avoid future fragmentation, inviting governments and businesses to align with IDSA's architecture and join its standardization efforts.

1.8.2 Silvia Castellvi, IDSA

Silvia Castellvi, Director of Research and Standardisation at the International Data Spaces Association (IDSA), delivered a detailed presentation on the **Dataspace Protocol (DSP)** — IDSA's core technical mechanism to achieve interoperable, sovereign, and scalable data exchange across domains (see d1-3SR1-01-00-Silvia Castellvi_DSW2025_IDSA_ The role of the Dataspace Protocol.pdf).

Castellvi introduced the **DSP's role** through the lens of the EU-funded **OMEGA-X project,** which focuses on federated energy data sharing infrastructures. She described a real-world deployment in the Portuguese city of **Maia**, which implemented a Sustainable Energy Action Plan integrating distributed renewable sources, public transport, and energy storage. The complexity of real-time energy balancing and the diversity of stakeholders (grid operators, municipalities, transport providers) highlighted the need for **interoperable, trusted data infrastructure** — a role served by the Dataspace Protocol.

She explained the **three-layer architecture** supported by DSP:

- **Control Plane** – handles identity, authentication, and contract negotiation.
- **Data Plane** – facilitates sovereign, secure, and standardized data transfer.
- **Governance** – aligns with legal, organizational, semantic, and technical interoperability requirements.

Castellvi emphasized the DSP's alignment with the European Interoperability Framework, covering:

- **Legal & Organizational layers** – guided by tools like the IDSA Rulebook.
- **Semantic layer** – achieved via shared ontologies and semantic models.
- **Technical layer** – enforced through standardized machine-to-machine interfaces and connectors.

The DSP is composed of three primary protocols:

- **Catalog Protocol** (data publication and discovery),
- **Contract Negotiation Protocol** (agreement on data usage),
- **Transfer Process Protocol** (actual data delivery).

She noted the DSP's compatibility with EU's **Data Act (Article 33)** and its ongoing ISO standardization **(ISO 20151**). A **Reference Implementation and TCK** (Test Compatibility Kit) are being developed under the **Eclipse Dataspace Working Group,** with **DSP Release 1 scheduled for July 2025**, and ISO progression starting **August 2025.**

Silvia concluded by reaffirming that the Dataspace Protocol is essential for:

- Establishing standardized, interoperable data exchange across domains.
- Enabling sovereign, regulated, and trusted transactions between participants.
- Supporting global harmonization across different national and sectoral data ecosystems.

She encouraged broader international collaboration in the development and implementation of DSP to prevent fragmentation and ensure a sustainable, scalable future for data sharing.

Q&A Session:

Q1: Are you aware of the newly approved IEEE project P1988 on a 'Data Space Architecture Framework with Integrated Privacy Technology'? It references IDSA concepts.

A (Silvia Castellvi): I was not previously aware of P1988 but will look into it. Thank you for pointing it out."

Follow-up – Hiroshi Mano: Explained that P1988 is an IEEE Communication Society-led project started by a China-based proposal. He raised concerns about transparency and called on IDSA members to actively participate to avoid dominance by a small group of actors.

Q2: Voiced concern about fragmentation and proliferation of competing standards, especially for industry actors like Siemens who must maintain support over decades (e.g., 20–90 years). He called for unified global standardization efforts, highlighting the technical and operational infeasibility of managing divergent protocols in long-life industrial systems.

A (Silvia Castellvi & Hiroshi Mano): Both agreed on the need for consolidation and coordination across standardization bodies (IEEE, ISO, IDSA, etc.) and emphasized the importance of early, inclusive participation to shape standards like DSP and P1988.

1.8.3 Anja Misselbeck, Catena-X

Anja Misselbeck, Managing Director of Catena-X, presented the operational progress of their collaborative data ecosystem for the automotive industry, emphasizing its alignment with IDSA and Gaia-X principles.

Catena-X is now live, enabling **multi-tier data exchange** across OEMs and suppliers. The initiative focuses on interoperability, data sovereignty, and regulatory compliance, addressing requirements such as **carbon footprint reporting, battery passports,** and **ESG monitoring.** Rather than creating new standards, Catena-X harmonizes existing ones through expert working groups and **open-source development** (via **Eclipse Tractus-X**).

The ecosystem delivers value through certified apps and toolkits, supporting:

- **Certificate Management**: one-time standardized uploads across partners
- **Traceability:** capturing supply chain data for downstream applications
- **Product Carbon Footprint** & **Digital Product Passport:** harmonized reporting across complex value chains

Catena-X uses a **kit-based approach** with multiple commercial solutions certified under a shared **governance and trust framework**. Misselbeck also highlighted global outreach efforts in **Japan**, **China,** and **North America**, encouraging other sectors to **reuse** and **adapt the Catena-X model** to avoid duplication and accelerate cross-industry data value creation.

1.8.4 Georg Kube, SAP

Georg Kube, Vice President of Manufacturing-X at SAP, delivered a forward-looking presentation on the future governance of Manufacturing-X and the strategic coordination of various industry data space initiatives. He introduced the concept of the **Manufacturing-X Guidance Board**, a

coordination mechanism established to ensure interoperability among emerging domain-specific data space projects such as **Catena-X, Factory-X, Aerospace-X**, and **Semiconductor-X**.

Kube illustrated the risks of uncoordinated project evolution, where companies operating across multiple domains would face redundant connections to incompatible systems. As an alternative, he presented a vision of unified data ecosystems allowing "connect once" access, **consistent digital twin modeling**, and **harmonized data exchange standards** across sectors. He used the example of "Small Motors Inc." — a mid-sized firm interfacing with multiple industries — to demonstrate the need for shared infrastructure and frameworks.

To support this, the **Guidance Board** (a voluntary body comprising senior representatives from each Manufacturing-X project) **identifies and addresses potential incompatibilities** across use cases, such as traceability, product carbon footprinting, and collaborative engineering. The board's outputs include shared reference architectures, interoperability requirements, governance recommendations, and coordination with national and international councils.

Kube emphasized that while the current focus is on aligning project-level development during the "build phase," a **long-term governance framework** for the steady-state operation of Manufacturing-X ecosystems is also under development.

Q&A Session:

Q: How frequently will the asset data model be used, and why is it crucial for manufacturing?

A (Kube): The asset data model will be used continuously for exchanging production and product data. It is based on Asset Administration Shell (AAS) and essential for interoperability, traceability, and digital twin use cases.

Q: What is your expectation of the role of private sector in Asia for accelerating data spaces?

A (Kube): The private sector must see value and drive adoption. The public sector initiates and aligns efforts, but only OEMs, suppliers, and software providers can ensure long-term sustainability.

Q: How do you plan to attract more end-user (customer) companies?

A (Kube): We run customer sounding boards in the Factory-X project—monthly sessions open to industrial companies to share use cases, value propositions, and pathways to early engagement.

Comment (Ulrich Ahle): Provided an example from France where EDF is leading a user-driven data space initiative (Data4NuclearX) to accelerate nuclear plant construction by improving collaboration with 2,500 partners.

A (Kube): Agreed this is an excellent example of industry-driven value creation in data spaces.

1.8.5 John Dyck, CESMII US

John Dyck, CEO of **CESMII (Clean Energy Smart Manufacturing Innovation Institute)**, provided an insightful overview of the **U.S. perspective on data ecosystems**, smart manufacturing, and international collaboration on data space harmonization. His presentation emphasized the **U.S. strategy**

to reduce the cost and complexity of smart manufacturing through **public-private partnerships, standards-based interoperability, and practical industry pilots**.

Dyck described CESMII's mission to democratize smart manufacturing by making it accessible to companies of all sizes. Their work is structured around three pillars:

- **Technology:** Development of a **standardized, open, and interoperable platform** for smart manufacturing. Key components include **smart manufacturing profiles** (analogous to **AAS submodels**), platform interoperability via **open APIs**, and the **Industrial Information Interoperability Exchange (IIIX) API**.
- **Knowledge:** Supporting workforce training, business strategy alignment, and organizational readiness for data-driven transformation.
- **Ecosystem:** Building trust and collaboration among U.S. manufacturers, government, academia, and technology providers.

He highlighted three technical imperatives:

1. **Standardized information modeling** using object-oriented architectures (e.g., OPC UA Part 5), enabling interoperability from shop floor to supply chain.
2. **Compliant and interoperable platform architecture**, ensuring data contextualization and exposure through standardized APIs.
3. **An open API for industrial data interoperability (IIIX)** developed with global industrial stakeholders, launching in the second half of 2025.

To ground these strategies, Dyck presented a U.S. initiative to establish **Manufacturing Supply Chain Digital Data Exchange** capabilities—likened to building a "digital interstate highway"—to replace fragmented manual processes (e.g., faxes, emails) with **real-time, secure, standards-based data flows** across suppliers and manufacturers.

He further emphasized CESMII's deep collaboration with **Germany** (Platform Industrie 4.0), **Japan**, and the broader **International Manufacturing-X Council**, including recent joint demonstrations like a cross-border **Digital Product Passport** at Hannover Messe.

Q&A Session

Q: How is risk quantified in such a data ecosystem, particularly when data moves between parties?

A (John Dyck): Risk and trust management are central to CESMII's current $4.5 million pilot with major manufacturers (e.g., P&G, J&J, General Mills). They've introduced a central orchestration layer that brokers communication between distributed data exchange systems. This ensures trust can be established and revoked quickly, offering traceability and control over data flows. Playbooks are being developed to capture these trust frameworks and will contribute to the International Manufacturing-X community.

1.8.6 Rajkiran Patil, OPC Hub India

Rajkiran Patil, Site Leader at **OPC Hub India,** presented OPC UA's evolving role in enabling interoperability between OT and IT systems, and its alignment with emerging data space architectures.

(see d1-4Key-02-00-Rajkiran Patil_OPC HUB INDIA - Chennai 7April.pdf)

He explained that the OPC Foundation develops the OPC UA standard—recognized globally (e.g., IEC 62541) and nationally (e.g., China, Singapore)—which supports semantic, secure, and vendor-neutral communication from field to cloud. OPC UA breaks away from the rigid automation pyramid by enabling peer-to-peer, cross-domain interoperability.

He highlighted the **OPC UA Cloud Initiative**, supporting adoption across AI, digital twins, and data spaces, and announced a new working group focused on "**OPC UA for Data Spaces**", aiming to deliver semantic models and decentralized trust mechanisms compatible with regulatory requirements like the EU Data Act and CRA.

Through **OPC Hub India**, a multi-stakeholder core team (e.g., Siemens, VDMA, Fraunhofer) is driving local adoption, companion specification development, and academic engagement.

Q&A Summary

Q: How does OPC UA, with its self-contained structure, adapt to data spaces and trust-based governance?

A (Patil): OPC UA is expanding through a dedicated data space working group, offering decentralized semantic models while aligning with regulatory demands. OPC has always evolved with industry needs, and this is a natural next step.

1.9 Closing of day 1

At the close of Day 1, the Master of Ceremonies expressed appreciation to all speakers for their valuable contributions. Hiroshi Mano was invited to the stage to present honors to several in-person delegates, including Dominik Rohrmus, Ulrich Ahle, Christoph Mertens, and Rajkiran Patel.

Gopal Tadepalli explained that in-person participation was limited to pre-registered attendees due to hall capacity and noted plans to encourage further engagement. Hiroshi Mano added a clarification regarding a minor error in the agenda list.

The session ended with a tea break.


IOFDS
IEEE
DATA SPACES WEEK 2025
Auditorium | 7 - 11 April, 2025
College of Engineering, Guindy Campus,
Anna University, Chennai, Tamil Nadu, India
Supporting Organizations

2 Day 2 Tuesday, April 8

2.1 Attendees

Day 2 Participants: 103 (in person: 77, including students; online: 26)

2.2 Summary of day 2

The second day emphasized implementation, technical architecture, and cross-border collaboration, with a shift toward Asian perspectives and practical deployments.

Status Reports – India & Japan Focus (14 presentations)

- Themes: Use case development, capability frameworks, trust frameworks, and policy alignment.
- Included key updates on:
  - Japan's IMX testbeds and RRI studies
  - Digital Data Sharing Capability Maturity Model (India)
  - Global Trust Framework and Data Levels of Assurance
  - Updates from DSA, IEEE DTS WG, CEN-CENELEC, and ISO Smart City standards
  - Korea's evolving industrial data space efforts
  - AI and data policy implementation in Japan

Application-Focused Presentations (11 presentations)

- Themes: Trust architecture, AI contradictions, platform strategies, and practical deployments.
- Featured:
  - Blockchain-based trust systems (Oracle)
  - AWS architecture for generative AI
  - Data4Industry-X and Tractus-X (Eclipse Foundation)
  - Practical manufacturing data space deployments from TRUMPF, DMG MORI, and PwC India
  - Conceptual modeling of data spaces and agentic AI vs personalization

Award Ceremony

- Recognized key contributors with symbolic mementos, emphasizing community building.

Administrative Decisions

- Approved the next IOFDS meeting in Tokyo, October 2025.
- Elected meeting officers and approved procedural documents.

2.3 Welcome talk

Dr. Gopal Tadepalli (Anna University, Organizing Committee Chair) opened Day 2 of DSW2025 by welcoming participants and reflecting on the efficient and impactful opening day. He noted that Hiroshi Mano served as chair, with Isamu Yamada appointed secretary in absentia; an onsite substitute was appointed for Mr. Yamada.

He reviewed Day 1 highlights, including the keynote by Dr. C. Rangarajan on India's economic reforms and statistical modernization, and international contributions from speakers such as Ernst Stöckl-Pukall, Michitaka Tsuda, and Dominik Rohrmus. Key themes included interoperability, trust, and long-term sustainability of industrial data ecosystems.

Dr. Gopal stressed the need to harmonize standards rather than multiply them and emphasized data as a unifying thread across domains. He concluded by inviting Dr. Mano for any remarks before commencing the day's technical sessions.

2.4 Status Report 3(India, Japan)

2.4.1 Kazuo Nakashima, RRI

Kazuo Nakashima, representing the Robot Revolution & Industrial IoT Initiative (RRI), Japan, delivered an overview of Japan's recent contributions to international manufacturing data spaces through the **IMX (International Manufacturing-X) testbed**, as well as domestic efforts to define use cases and requirements for industrial data ecosystems (see d2-1SR3-01-00-Kazuo Nakashima_20250408 IOFDS RRI r3.pdf).

He began by outlining RRI's mission, established under Japan's "New Robot Strategy" in 2015, with over 400 members primarily from the robotics and manufacturing sectors. The organization focuses on both robotic innovation and digital manufacturing transformation.

Nakashima then presented Japan's participation in the **IMX testbed** demonstration at Hannover Messe 2025. In collaboration with stakeholders like NTT, Fujitsu, and Toshiba, a Japanese virtual supplier was created to provide battery pack data (including Product Carbon Footprint) to a German OEM via **IMX-compatible Asset Administration Shells (AAS).** Data generated in proprietary formats was transformed for interoperability and successfully integrated in real-time into the German-side dashboard—demonstrating Japan's capability for cross-border and standards-based data sharing.

In the second half of his presentation, Nakashima introduced the work of **RRI's Action Group 4**, which has been developing manufacturing data space use cases for over two years. Sixteen use cases were categorized based on:

- **Business value axis** (regulatory-driven vs. innovation-driven)
- **Data axis** (product data vs. enterprise-level operational data)

The study extracted stakeholder-specific requirements for data space intermediaries, framework developers, and participant companies—highlighting the need for trust mechanisms, rule harmonization, international certification schemes, and organizational readiness for data governance.

Nakashima concluded by stressing that manufacturing must evolve to meet the demands of circular economy, climate response, and geopolitical shifts. Data spaces, supported by interoperable standards and internal readiness, are key to this transformation. RRI will continue to collaborate with global partners to shape a future-ready, sovereign, and innovative industrial data space ecosystem.

2.4.2 Dipankar Chakrabarti, Proprietor of CtoE Consultancy Services

Dipankar Chakrabarti, Proprietor of CtoE Consultancy Services, presented a research-driven analysis on what capabilities organizations require to meaningfully participate in data spaces. Grounded in digital transformation practice and IEEE P3800 Working Group experience, he argued that infrastructure and policies alone are insufficient—corporate adoption remains limited due to capability gaps, unclear value propositions, and unfamiliarity with frameworks like IDSA (see d2-1SR3-02-00-Dipankar Chakrabarti_dataspacecapabilityv1.pdf).

To address this, he applied David Teece's "dynamic capability" framework—sensing, seizing, and reconfiguring—conducting over 100 interviews and multiple case studies to identify what internal competencies are needed. His findings highlighted that many companies lack a formal data strategy and interpret digital transformation inconsistently. Concerns over data ownership, anonymization quality, regulatory uncertainty (e.g., India's DPDP Act), and external data quality further hinder participation. Skill shortages and low awareness of governance frameworks compound the issue.

Chakrabarti identified four primary types of data managed in organizations: (1) internally generated (e.g., sensor data), (2) value chain data, (3) purchased ecosystem data, and (4) synthesized outputs. Firms were most protective of internal and value chain data, and often lacked confidence in effective anonymization and evolving privacy regulations.

To promote adoption, he proposed a five-level maturity model for data sharing, from "non-existent" to "fully integrated supply chains." Through a case study of a 150-year-old consulting firm, he demonstrated how strong leadership, governance, data literacy, and internal coordination are key enablers. From these insights, he outlined a generalized framework linking external pressures (like emerging tech and hyper-personalization) with internal capabilities needed to adapt.

He concluded by proposing a Digital Data Sharing Capability Maturity Model (DSCMM), similar to CMMI, that organizations could use to benchmark progress. He called for further empirical validation and broader international comparisons.

Q&A Session:

Q: Thanked Dipankar for the insightful presentation and asked whether his architecture diagrams were derived from global frameworks.

A(Dipankar): confirmed he synthesized his model from IDSA's reference architecture and the IEEE P3800 Data Trading System framework to make the structure more comprehensible for Indian corporate audiences.

C(Christoph): emphasized the need to avoid fragmented national standards and advocated international cooperation. Both speakers agreed on the importance of harmonization to ensure long-term interoperability and practical adoption by industry.

2.4.3 Taka Matsutsuka, Fujitsu

Taka Matsutsuka, Senior Research Director at Fujitsu Research, presented an update on the Global Trust Framework Initiative, focusing on efforts to establish a Federation of Global Trust

Anchors for data spaces. He highlighted the importance of **trust anchors in cross-border data exchange**, especially in decentralized data spaces where no single hyperscaler can provide centralized identity validation. (see d2-1SR3-03-00-Taka Matsutsuka_DSW-IOFDS-202504.pdf)

He outlined the progress of the initiative since its announcement in November 2024, including technical pilots with international partners such as **T-Systems, NTT Communications, and NTT DATA**. A demonstration showcased at Hannover Messe 2025 illustrated how Japanese firms, using the domestic trust framework (e.g., **gBizID**), successfully onboarded into a federated data space infrastructure.

Matsutsuka further introduced the concept of **Data Levels of Assurance** (Data LoA), a collaborative effort with Fraunhofer ISST. This framework aims to quantify the trustworthiness of data through verifiable assurance levels, supporting more transparent, risk-informed data usage—particularly important in AI and automated decision-making contexts. Certification bodies would audit and assign LoA scores, enabling consumers to make more informed decisions about data quality, integrity, and security.

Looking ahead, the initiative seeks to involve real users, expand internationally, and develop standardized assurance frameworks for trust interoperability between jurisdictions.

Q&A Session

Q (Implementation of Trust Anchor in Japan): Who serves as the trust anchor in the example shown for Japan?

A (Taka Matsutsuka): Currently, there is no official public trust anchor in Japan for data spaces. In the demonstration, a system was constructed based on gBizID specifications. gBizID is not yet available for broad public or private sector use, though discussions are underway about its expansion.

Q (Necessity of Trust Anchors Globally): Do ministries in Japan recognize the importance of trust anchors, as needed globally?

A (Taka Matsutsuka): Yes, discussions are active in Japan. While gBizID or other systems are being considered, the establishment of a widely usable trust anchor likely requires government leadership.

Comment (Hiroshi Mano): added context from the Japanese government's perspective. He explained that Japan provides an official personal ID (MyNumber) for individuals, issued by the government and partially accessible via APIs. However, for companies, there is no official legal identifier equivalent to Europe's eIDAS. gBizID, provided by the Japanese registration authority, plays a de facto role but lacks legal recognition as a trust service. While electronic signatures are regulated under law, trust services like eDelivery or time stamps only exist as guidelines. Private sector actors such as DSA and KEIDANREN are currently engaging with the government to strengthen this trust infrastructure.

Masaru Dobashi added important information regarding the Japanese government's stance. He referred to a presentation made by Mr. Yamaguchi from the Digital Agency, which mentioned that the use of gBizID's authentication function is being considered as part of official trust services in Japan.

This move reflects growing institutional recognition of corporate authentication needs and is expected to play a key role in ongoing trust framework discussions in 2025.

Q (Definition and Certification of Data "Trustworthiness"): When discussing trust, are we referring only to ID validation, or also to aspects like quality, security, and integrity? Who certifies those?

A (Taka Matsutsuka): Excellent question. Currently, our focus is on basic authenticity. Higher-level aspects like credibility are not yet addressed systematically. Today, such evaluations are manual and conducted by credit-check or assurance companies, but not integrated into federated or automated systems. This is a crucial area for future development.

2.4.4 T V Gopal, Anna University Chennai

Gopal Tadepalli, Professor at the College of Engineering, Guindy, delivered a philosophical and socio-technical reflection on how **tacit knowledge** shapes and defines the evolving contours of data spaces. He began by contrasting the historical roots and evolving semantics of terms such as data, information, and informatics, emphasizing that data, once understood as a "fact given," has now become an ambient, often ownerless digital artifact. (see d2-1SR3-04-00-Gopal Tadepalli_Tacit Knowledge and Contours of Data Spaces.pdf)

He explored how digital systems have been built around structured and machine-processed data but are increasingly limited when addressing human-centered meaning. Through a conceptual "5C" filter (Condensation, Calculation, Contextualization, Correction, Categorization), he showed how raw data becomes information, but emphasized that the transformation from information to knowledge—especially tacit knowledge—requires intuition, values, experience, and social interaction.

Tadepalli invoked tacit knowledge as defined by Michael Polanyi, highlighting its subconscious, experiential nature—such as riding a bicycle or cooking without a recipe—where skills cannot be fully expressed or encoded. He called attention to the role of storytelling and user experiences, especially in agile design, as mechanisms for eliciting such knowledge in organizational contexts.

In conclusion, he emphasized the importance of building learning organizations that foster community, interaction, and the ability to internalize and act upon implicit knowledge. He argued that the next wave of innovation in data spaces may well depend on how effectively we incorporate and act upon this human dimension, beyond structured datasets and explicit logic.

Q&A Session

Q (What are some impactful use cases or accelerators in India?): From a Japanese perspective, we are exploring societal and industrial themes like manufacturing and digital infrastructure. What are some of the most prominent or promising accelerators or use cases in India?

A (Gopal Tadepalli): A few high-impact areas in India include systems related to faith and language, each of which presents a wide array of use cases. In addition, themes like centralization vs. decentralization, federation, and localization serve as foundational dimensions for scalable and relevant implementations.

Q (How can initiatives be accelerated despite limited resources?) : While shared goals exist, we need funding and societal commitment to accelerate initiatives. What thematic strengths can India offer?

A (Gopal Tadepalli): One major strength lies in software—the Indian ecosystem has a high capacity for abstraction, making it a natural area of leadership for developing complex systems and frameworks.

2.4.5 Hiroshi Mano, DSA

Hiroshi Mano, Secretary General of the Data Society Alliance (DSA), provided a comprehensive status report covering policy advocacy, international standardization efforts, and the technical progress of data trading systems under the DSA. (see d2-1SR3-05-00-Hiroshi Mano_DSA_Status_Report.pdf)

He began by introducing two policy proposals that DSA, in collaboration with the **Digital Policy Forum Japan (DPFJ)** and **Digital Trust Forum (JDTF),** submitted to the Japanese government. The first advocated for a **national data governance strategy,** emphasizing the need for improvement in data quality, increased distribution speed, and expanded data volume under public leadership. The second proposal stressed the international standardization of data spaces, identifying the importance of globally recognized certification mechanisms such as those promoted by Gaia-X and the DSBA. He emphasized the principles of **consensus, due process, openness, and balance** as foundational to sustainable governance.

Mano also introduced a promotional **video** produced by DSA, explaining core **concepts of data spaces,** including roles such as **data space authority, participants, intermediators**, and components like data catalogs and connectors. The video emphasized secure and sovereign **data exchange models,** including one-to-one, one-to-many, and sequential transactions.

He then presented the DSA's concept of **data usage rights**—a framework defining divisible rights such as the right to read, store, process, and trade data. These rights are formalized via data usage rights securities, which serve as machine-readable certificates ensuring exclusivity, traceability, and identifiability in data transactions.

A detailed overview of the **data trading market ecosystem** was provided, including actors such as **data brokers, clearing houses, custodians**, and **trusted third parties (TTPs)**. Mano described the state transitions of datasets (issued, unexercised, exercised, invalid) and outlined the technical requirements for trading: public key cryptography, digital signatures, and hash verification.

A **proof-of-concept "book building" experiment** was also introduced, in which multiple organizations submitted bids for various datasets, with the highest bid received for wealth statistics and banking transaction data.

Mano concluded with two forward-looking initiatives:

- Harmonization of **Open Data x Private Data x AI,** using examples such as the **Kyoto Data Marketplace,** to support data-driven services.
- The establishment of a **data trading system** based on data usage rights securities, with a forthcoming **workshop** planned for demonstration.

Finally, as Chair of the **IEEE P3800 DTS Working Group**, Mano reiterated his commitment to integrating DSA's work with international standardization efforts, proposing collaborative work with external SDOs to extend the **Data Space Concept** under IEEE frameworks.

2.4.6 Didier Navez, Dawex

Didier Navez, Senior Vice President for Data Policy & Governance at Dawex, delivered an update on the standardization progress surrounding Trusted Data Transactions under the European CEN-CENELEC framework. The presentation focused on the work of the **CEN Workshop Agreement (CWA)** and Joint Technical Committee **(JTC) 25**, Working Group 2, dedicated to data spaces. (see d2-2SaR-03-00-Didier Navez_IOFDS April 8 2025 - Dawex - CEN-CENELEC update.pdf)

Dawex, a French technology firm supporting **data ecosystems** and **data exchange infrastructures,** has played a key role in this effort. Navez explained that the **European Commission's standardization strategy,** as reflected in the **2024 Union Work Programme,** identified the creation of a "**Trusted Data Framework**" as one of its top strategic goals—anchored in Article 33 of the EU Data Act, which sets essential requirements for interoperability in data sharing services and common European data spaces.

The standardization effort consists of two main phases:

1. **Pre-standardization via CEN Workshop (CWA)**
   - Defined key terms and concepts (Part 1, published July 2024)
   - Established trustworthiness requirements (Part 2, under public enquiry as of April 2025; publication expected June 2025)
   - Involved stakeholders from industry, government, and standardization bodies (e.g., EC, Gaia-X, IDSA, Microsoft, Airbus)
2. **Formal standardization via CEN-CENELEC JTC 25 WG2**
   - Expands on the CWA with a new focus on interoperability (Part 3)
   - Backed by a Standardization Request linked to Article 33 of the EU Data Act
   - Final drafts and **harmonized standards (hEN)** scheduled from 2025 to 2027

Navez emphasized that this work is consensus-based, involving steady progress by aligning technical, regulatory, and industrial perspectives. Once published, the **hEN standards** will serve as a legal presumption of conformity under the EU Data Act, forming the backbone of trusted and interoperable data ecosystems in Europe.

2.4.7 Jens Gayko, SCI 4.0

Jens Gayko, CEO of **Standardization Council Industrie 4.0 (SCI 4.0)**, delivered a detailed presentation on the **Digital Product Passport (DPP)**, outlining its regulatory, technical, and organizational foundations in Europe. The talk was structured around three themes: the role of SCI 4.0 in standardization, the EU's political and regulatory framework for the DPP, and its implementation through digital twins and Industry 4.0 concepts. (see 2-01-Jens Gayko_2025-04-08_DSW2025_Standardization-DPP-Gayko_V2.pdf)

He first introduced **SCI 4.0,** which coordinates standardization efforts within **Platform Industrie 4.0** and supports international collaboration at ISO, IEC, and within consortia. A recent progress report outlines developments since the publication of Germany's Industry 4.0 standardization roadmap.

Focusing on the **DPP**, Gayko described it as a key mechanism under the **Ecodesign for Sustainable Products Regulation (ESPR)**. The DPP will become mandatory in 2027, starting with selected products (e.g., **batteries, toys, construction materials**) and expanding via multi-annual work programs. It builds upon previous energy-efficiency regulations by covering **product origin, emissions, durability, and recyclability**.

To implement the DPP, the European Commission issued a **Standardization Request to CEN/CENELEC JTC 24,** with deliverables due by the end of 2025. There are also ongoing discussions about forming a joint ISO/IEC technical committee for global alignment.

Though not legally required, **data spaces** are seen as practically essential to manage the upstream complexity of supply chains. The DPP links closely with **digital twin** technology, and Gayko recommended its use to streamline compliance.

He introduced **DPP 4.0,** which combines the DPP with the **Asset Administration Shell (AAS)** per IEC 63278, enabling modular integration of both mandatory and optional data elements. This approach supports regulatory needs while enabling digital transformation across sectors.

Gayko concluded that the **DPP is both a regulatory tool and a catalyst for digital innovation and** underscored the need for **international standardization** to ensure interoperability across global supply chains.

2.4.8 Xiaomi An, Renmin University of China

Xiaomi An (Renmin University of China) provided an update on the ongoing development of the **ISO/IEC 25005 series** under **JTC 1/WG 11,** which addresses **data use in smart cities.** The standard series supports effective and responsible use of data across the urban lifecycle. (see d2-2SaR-01-02-Xiaomi An_ISO IEC 25005 Series standards on data use in smart cities 2025-03-28.pdf)

The standard is composed of **three parts:**

- **Part 1: Framework** — Defines core principles and dimensions for data use, including availability, quality, ease of use, security, and innovation. The goal is to guide citywide data use as a strategic resource.
- **Part 2: Use Case Analysis** — Synthesizes findings from 23 real-world use cases across six countries, identifying common challenges, stakeholders, data types, and good practices.
- **Part 3: Evaluation and Reporting** — Proposes indicators and methods for assessing data use throughout planning, operation, and improvement of smart city services and ICT projects.

The standard emphasizes **multi-stakeholder collaboration, interoperability,** and **alignment with international practices**. Xiaomi highlighted its relevance to **data space ecosystems,** noting that the standard supports trust, quality, and meaningful data use across diverse city applications.

Q&A Highlights:

In response to a question about the applicability of the framework to data spaces and existing IT systems, Xiaomi An confirmed that the standard is compatible with **data space architectures.** She emphasized the importance of **interoperability, data security, and data quality,** noting that data use must be treated as a strategic resource that supports trustworthy and innovative digital ecosystems.

2.4.9 Hiroshi Mano, IEEE DTS WG Chair

Hiroshi Mano (Data Society Alliance, Japan; Chair, IEEE DTS Working Group) presented a two-part update on Japan's data trading initiatives and the progress of IEEE standardization activities in this field (see d2-1SR3-06-00-Hiroshi Mano_IEEE_DTS_20250408.pdf).

Part 1: Data Usage Rights and Marketplace Trials in Japan

Mano introduced Japan's pilot implementations of a data trading system using **usage rights**, where data usage rights are issued as certificates—similar to securities—to enable trading of intangible data assets.

He highlighted the **Kyoto Data Marketplace**, where open and private data are integrated. Public data can be downloaded freely, while private data is available via paid transactions. This marketplace demonstrates a functioning data space infrastructure.

A demonstration workshop is planned before the next Data Spaces Week to further showcase the system.

Part 2: IEEE P3800 and P3800.1 Standard Development

Mano outlined the progress of the IEEE P3800 standard series:

- **IEEE 3800-2024 (published):** Defines a reference model for data trading systems, including key roles (data providers, users, operators, trusted third parties) and objects (datasets, catalogs, trading terms, benefits, trust information).
- **IEEE P3800.1 (in development):** Specifies the protocols and object frameworks needed to implement DTS based on IEEE 3800, including data structures (headers, payloads) and interaction protocols among stakeholders.

Mano underscored the need for layered architectures, open and balanced standardization processes, collaboration with global SDOs, and practical implementation through certification programs. He encouraged participation in the IEEE DTS Working Group, now nearing its 100th meeting, and emphasized the importance of global collaboration in building interoperable and trustworthy data ecosystems.

2.4.10 Seonhi Ro (LNI4.0) & Seung-Ho Hong(Hanyang University, Korea)

Dr. Seonhi Ro (LNI 4.0, Germany) and Prof. Dr. Seung-Ho Hong (Hanyang University, Korea) presented an overview of Korea's evolving industrial data strategy and international cooperation

in the development of data spaces and AI-enabled manufacturing. (see d2-3SR4-01-02-Seonhi Ro and SeungHo_Dataweek 2025 Korea Presentation 1.pdf)

They outlined Korea's national efforts beginning with foundational data infrastructure projects in the 1980s and culminating in the Korean New Deal (2020), which promotes AI, big data, and cloud technologies to build a smart, green, and safe society. Governance is distributed across multiple ministries: the Presidential Committee, **MSIT (Ministry of Science and ICT)** for ICT policy, **MSS for SME-focused smart factories,** and **MOTIE (Ministry of Trade, Industry and Energy)** for industrial innovation and AI strategy.

The presenters highlighted Korea's deepening collaboration with Germany, especially through MOUs between **MSS (Ministry of SMEs and Startups)**/ **KOSMO (Korea SMEs and Startups Agency)** and LNI 4.0, as well as between MOTIE and partners like KIAT, KICOX, and SCI 4.0. Key topics include Asset Administration Shells, Digital Product Passports, and the establishment of Gaia-X hubs. A bilateral forum in 2024 further showcased Korea's engagement in global industrial data space initiatives.

They also shared Korea's latest AI policy developments. In October 2024 and January 2025, MOTIE outlined a ten-task roadmap to advance industrial AI, including the creation of AI data spaces, an industrial data bank, and strategies to address legal and technical barriers to data sharing.

Q&A Session

Q : How responsibilities are coordinated between MOTIE and MSS, given that both ministries are involved in AI and smart manufacturing ?

A (Hong) : responded that MOTIE leads Korea's national AI-driven manufacturing strategy, while MSS focuses on enabling SMEs through targeted support and standardization. He noted that data infrastructure is recognized as a core enabler in both ministries' agendas.

Dr. Ro added that MOTIE is expected to oversee broad industry-wide implementation, while MSS ensures smaller firms can participate effectively by lowering adoption barriers. She also noted that the political landscape could shift in the future, but currently there is a clear division of roles.

2.4.11 Ramya Janarthanan, Oracle

Ramya Janarthanan, a specialist from Oracle's Center of Excellence and Innovation Center, delivered a comprehensive presentation on trust architectures for decentralized data sovereignty. Drawing on her experience with **Oracle's blockchain platform** and digital currency pilots in collaboration with central banks and financial institutions, she introduced the technical and conceptual foundations needed to enable decentralized data sharing systems. (see d2-3SR4-02-00-Ramya Janarthanan_Trust Architectures for Decentralized Data Systems.pdf)

She began by highlighting challenges of centralized systems, including **single points of failure, data misuse**, and complex **cross-border regulatory compliance.** In response, decentralization was

proposed as a solution to **redistribute trust, enhance user control, and ensure tamper-evident data sharing** via consensus-based mechanisms.

She framed the architecture using four stakeholder roles in a **data sovereignty model: controller, processor, custodian, and subject,** emphasizing the need for transparent consent mechanisms and control transfer procedures. She then traced the evolution of trust architectures—from centralized (PKI-based) models to federated (using **OAuth/SAML**) and now decentralized trust supported by technologies like blockchain, self-sovereign identity (**SSI**), and verifiable credentials (**VCs**).

Key technologies underpinning this model included:

- Distributed Ledger Technology (DLT)
- Decentralized Identifiers (DIDs)
- Verifiable Credentials (VCs)
- Smart Contracts

These are supported by design patterns such as **Byzantine Fault Tolerance, Zero Knowledge Proofs, decentralized storage (e.g., IPFS),** and layered architecture spanning infrastructure, protocol, identity, data, and application layers.

Oracle's blockchain platform, built on Hyperledger Fabric, was introduced as a ready-to-deploy solution for building decentralized applications. Ramya explained its structure, emphasizing REST API-based integration, consensus-driven validation, tamper-evident ledgering, and interoperability with other blockchains.

She then gave examples of real-world applications:

- **Healthcare:** Patient-controlled medical records
- **Finance:** Real-time international settlement
- **Supply Chain:** Transparent product tracking (e.g., IBM Food Trust)
- **Digital Identity:** Self-sovereign identity systems

A case study on CargoSmart highlighted how a decentralized solution improved documentation efficiency, compliance, and trust across multiple shipping partners using Oracle blockchain. Ramya concluded by emphasizing that **decentralized architecture offers a path toward data sovereignty** by enabling individual control, secure collaboration, and scalable trust infrastructures.

Q&A Session

Q : You outlined an architecture centered around blockchain. Are you considering other technologies besides blockchain for implementing your trust models?

A (Ramya Janarthanan): Currently, our work is focused on Oracle Blockchain Platform. However, this platform is interoperable with other blockchain networks such as Ethereum and Hyperledger Fabric, across Oracle and third-party clouds. At this stage, blockchain remains our primary technical focus.

2.4.12 Kenji Hiramoto, IPA

Kenji Hiramoto, representing the Information-technology Promotion Agency (IPA), Japan, presented an extensive overview of Japan's national efforts toward establishing a robust digital infrastructure and trustworthy AI governance. He highlighted IPA's role as a central policy implementation and coordination agency supporting multiple ministries, including the Digital Agency, Ministry of Economy, Trade and Industry (METI), and the Cabinet Office, in the advancement of data governance, AI safety, and interoperable digital ecosystems.
(see d2-3SR4-03-00 Kenji Hiramoto IPA Data related activities.pdf)

Hiramoto outlined that IPA is supporting Japan's vision of Society 5.0, promoting a shift toward a data-driven society through a combination of regulatory frameworks and executive-level training. He emphasized the Digital Governance Code 3.0, which encourages companies to incorporate data-centric strategies into their management, and announced that a data maturity model will be introduced by mid-2025 to promote data quality and effective utilization.

To support executive awareness, IPA has published several playbooks such as the CDO Manual, Data Management Playbook, and a Data Maturity Playbook, forming part of Japan's "Data Spaces Academy" initiative.

On technical infrastructure, he introduced efforts to enhance the **Government Interoperability Framework (GIF)** through the development of domain-specific data models, such as for education and disaster risk management, as well as international data mapping between Japan's GIF, the EU's SEMIC, and the US's NIEM.

IPA is also undertaking a building blocks mapping project to align components such as connectors, trust services, and usage rules across Japanese initiatives. Additionally, a Data Quality Management Guidebook was recently published (March 2025) that integrates ISO standards and offers a lifecycle-based approach with process, governance, and gateway perspectives.

Further, he addressed smart city initiatives, highlighting the release of Smart City Reference Architecture v3, which integrates standardized data models, sensor data protocols, and quality metrics to foster interoperability among Japan's over 100 municipal projects.

In the realm of AI governance, Hiramoto emphasized AI's critical role in enabling data value creation and introduced Japan's **AI Safety Institute (AISI)**. Formed under the Cabinet Office with participation from 13 ministries and 5 government-affiliated organizations, AISI serves as a national hub for AI risk evaluation, standards development, and global collaboration. He also stressed the importance of multi-language and multicultural challenges in AI safety and highlighted Japan's recent guidelines and training resources to address these.

Comments:

Dominik Rohrmus (Siemens) commended Japan's commitment to AI safety and industrial AI, expressing appreciation for the establishment of AISI as a crucial step for global collaboration.

2.4.13 Klaus Ottradovetz, Eviden

Klaus Ottradovetz, Expert in Digital Ecosystems at Eviden, delivered a virtual presentation on building globally interoperable industrial data spaces within the **International Manufacturing-X (IMX)** initiative. His talk focused on reconciling diverse standards, regulations, and architectures to enable scalable, cross-border implementations of data sharing in manufacturing.
(see d2-4APP-01-00-Klaus Ottradovetz_250408 IOFDS Industrial Dataspace Update.pdf)

Ottradovetz emphasized the challenge of aligning stakeholders—from national governments and standardization bodies to industry associations and SMEs—under a **unified data space framework.** Rather than creating new standards, **IMX aims to orchestrate and integrate existing ones**, working with organizations such as **IDSA, Gaia-X, CESMII, and IPA** to shape global interoperability.

He outlined the IMX Council's governance model, which includes country representatives acting as proxies for national industries. Supporting task forces (including one led by Nakashima-san and Ottradovetz himself) are developing **foundational documents,** including:

- **Interoperability Requirements**, covering semantic, technical, organizational, and legal dimensions;
- A **Common Conceptual Model** to align terminologies like participants, connectors, and agents across frameworks;
- A **Design Blueprint** that defines how heterogeneous systems and standards can interconnect effectively.

Ottradovetz stressed the importance of defining **federated trust models**, **SLAs**, and **software modularity** to make data spaces accessible to **SMEs** and not just large corporations. Drawing from the Hanover Messe demonstrator, which involved multiple technologies (e.g., **OPC UA, Eclipse Dataspace Connector, Dawex**), he illustrated the need to document how these coexist practically.

His conclusion reinforced that **IMX is not about replacing or overriding existing initiatives** but **connecting and enabling** them to support real-world global manufacturing use cases.

2.4.14 Morgane Commowick, Dawex

Morgane Commowick, Vice President of Product & Customer Operations at Dawex, delivered a detailed presentation on **Data4Industry-X,** highlighting how standardized, regulation-aligned architecture can empower manufacturing ecosystems to orchestrate sovereign, interoperable, and compliant data spaces across global value chains.

Commowick began by explaining that **Data4Industry-X is a trusted, secure, and modular data space solution** tailored for **manufacturing sectors** such as automotive and power generation, yet adaptable to any industrial domain. The platform enables cross-border and cross-organization data sharing while ensuring traceability, data sovereignty, and regulatory compliance.

Using a system-wide visual walkthrough, she illustrated how **value chains—comprising suppliers, manufacturers, logistics providers, and end users**—benefit from a decentralized architecture. This architecture enables machine-generated data at the shop floor to be securely transmitted, enriched with

metadata (e.g., access rights, usage rights), and governed using industry standards such as **OPC-UA**, **Asset Administration Shell (AAS)**, and **API-based connectivity**.

She emphasized the control plane functionalities of Data4Industry-X that empower participants to retain autonomy while aligning with the governance principles of the ecosystem. This includes support for **peer-to-peer data exchange, legal interoperability,** and **semantic consistency.**

Commowick then outlined how compliance with data regulations (e.g., **GDPR**, **Data Act**) is embedded in the platform, supported by integration of norms and standards from ISO, CEN/CENELEC, and W3C. She noted that reference architecture from **Gaia-X** plays a key role in operationalizing these standards and accelerating trustful implementation.

To showcase applicability, she described several cross-sector use cases demonstrated at Hannover Messe, including:

- **Carbon footprint reporting** using product-level data aggregation.
- **Asset lifecycle optimization** for machine builders.
- **Eco-design methodologies** based on ISO lifecycle analysis.
- **Real-time energy monitoring** and transparency reporting.

In conclusion, Commowick stressed that interoperability—**technical, legal,** and **semantic**—is vital to unlocking the full value of data spaces, especially when use cases span multiple ecosystems or industries. Data4Industry-X, she affirmed, is built to enable exactly that.

2.4.15 Michael Plagge, Eclipse Foundation

Michael Plagge, representative of the Eclipse Foundation and lead of the Tractus-X initiative, delivered a presentation on how open-source collaboration models underpin the development of industrial data spaces and foster long-term ecosystem sustainability. His talk emphasized how **Tractus-X**, as the reference implementation of **Catena-X**, leverages a federated and transparent governance model to ensure inclusive, trusted development of interoperable data space infrastructure. (see d2-4APP-03-00-Michael Plagge_250408 IDW Tractus-X.pdf)

Plagge began by introducing the **Eclipse Foundation,** Europe's largest open-source foundation, known for applying rigorous collaboration principles—**transparency, openness, vendor neutrality**, and **meritocracy**. These principles ensure that all contributors, regardless of organizational size or origin, can participate fairly, and decisions are made based on technical merit rather than funding or corporate affiliation.

He stressed that many discussions around data spaces mention open-source but fail to distinguish between licensing and true collaborative governance. The **Eclipse model ensures sustainable open-source developmen**t, enabling multi-stakeholder contributions without centralized control.

Focusing on **Tractus-X**, Plagge described it as one of the Foundation's largest and most active projects, now moving from R&D to industrial deployment. Organizations like **BMW, SAP,** and **Siemens** are already integrating it **into production environments**. **Tractus-X** combines essential building

blocks—including **Asset Administration Shell (AAS)** and **Eclipse Dataspace Components (EDC)**—to enable cross-company data exchange in the automotive sector and beyond.

He showcased the **"KIT" system** (Keep IT Together), a set of modular deployment packages that allow organizations to quickly set up and test Tractus-X components. Each KIT contains deployment scripts, sample data, API specifications, and setup guides, supporting rapid adoption and experimentation under a "15-minute deployment rule."

Plagge emphasized that community contributions are central to the **Tractus-X** model. The project is managed through **public GitHub repositories, open meetings,** and **community workshops**, with many activities now taking place across Germany and potentially expanding globally. He encouraged participants from India and elsewhere to test the KITs, engage with the community, and propose new components.

In conclusion, Plagge reaffirmed that **Tractus-X is open to all** and guided by the Eclipse Foundation's neutral governance. The initiative offers a practical entry point for organizations seeking to contribute to the data space ecosystem through transparent, collaborative, and interoperable open-source software.

2.4.16 Sebastian Schneider, DMG MORI

Sebastian Schneider, Lead Digital at **DMG MORI**, presented practical industrial use cases for smart factories with a focus on how **Manufacturing-X** and **data spaces** can generate **tangible customer value**. His presentation outlined how DMG MORI leverages machine connectivity, data interoperability, and predictive analytics to support more efficient, sustainable, and autonomous manufacturing operations.

(see d2-4APP-04-00-Sebastian Schneider_Industrial use cases for smart factories_India_Schneider_250404.pdf)

He began by introducing DMG MORI's global manufacturing footprint, including 16 production sites across Japan, Germany, the U.S., China, and Europe. Schneider framed the evolution from Industry 4.0—focused on single-machine data collection—to Manufacturing-X, which emphasizes **cross-organizational data exchange** between **machine builders, operators**, and **component suppliers.**

He then explored three key use cases under the Factory-X initiative:

1. **Condition Monitoring-led Services:**
   By shifting from reactive to predictive maintenance, DMG MORI aims to reduce unplanned service operations, minimize downtime, and improve spare part logistics through collaborative data exchange with factory operators and component suppliers. Real-time machine usage data enables smart service planning.
2. **Energy Consumption and Load Management:**
   Energy use analysis of machine tools revealed that coolant and chiller systems consume over half of total energy. Through optimized operation cycles and data sharing across machines, energy savings of up to 36% per machine per year were demonstrated—cutting both costs and CO_2 emissions.

3. **Autonomous Operation:**
   This use case, to be further detailed by a later speaker, supports remote operation of machines with integrated camera systems, enhancing operational flexibility and uptime.

He emphasized that despite increasing automation—with over 40% of machines now equipped with PH cell or linear pallet systems—most machines are still underutilized (running less than 1,500 spindle hours per year). Through data-driven production planning and automation, DMG MORI sees a clear path to extending spindle hours and increasing ROI.

In closing, Schneider underlined how small, targeted changes—like adjusting coolant supply logic—can yield significant gains in energy efficiency, production quality, and service optimization, especially when such insights are **shared and scaled** through data spaces.

2.4.17 Michael Kirbach, DMG MORI

Michael Kirbach, Lead Aerospace at DMG MORI, delivered a focused presentation on the importance of **digital quality traceability** in the **aerospace supply chain**, drawing on his work within the **Aerospace-X project** —a Manufacturing-X initiative. His talk highlighted the urgency of **replacing paper-based documentation with digital solutions** for better safety, traceability, and efficiency in aerospace manufacturing.

Kirbach explained that quality trace is vital for aerospace due to the extreme operational requirements and the potential consequences of failure. While the aerospace industry has long-standing quality management standards (e.g., AS9100), current information transfer is still mostly paper-based, often in scanned PDFs, limiting machine readability, data searchability, and root cause analysis.

He described the multi-tier aerospace supply chain, spanning raw material providers to engine and aircraft assembly. In this ecosystem, non-conformance management, certification, and traceability are critical yet still handled through outdated methods.

As a proposed improvement, Kirbach introduced the idea of **digital twins for parts** throughout the lifecycle—from material extraction to machining, assembly, and operation. These digital twins would collect quality-relevant data (e.g., forces during machining, inspection results) from equipment like DMG MORI's machines, which offer high-frequency data acquisition and metadata tagging. Such comprehensive, structured traceability would enable:

- Faster **anomaly detection** during operation
- Efficient **backtracking** of manufacturing data for defective components
- More effective **corrective action** to prevent future issues

Kirbach emphasized the need for global standards to enable such systems across the international aerospace supply chain. He called for collaborative development of interoperable frameworks to support **digitalized, resilient, and emission-reducing** aircraft production over the next 20–25 years.

2.4.18 Ingo Sawilla, TRUMPF

Ingo Sawilla, Lead Digital at TRUMPF, presented on value creation within smart factories, focusing on how industrial firms can unlock new services through data-driven operations, AI integration, and data governance maturity. Using TRUMPF's machine tool and factory automation portfolio as context, he emphasized that value emerges when data is transformed into actionable decisions, ultimately supporting new services such as autonomous operations and remote diagnostics. (see d2-4APP-06-00-Ingo Sawilla_20250319_Sawilla_India_Dataspaceweek_ValueCreation.pdf)

Sawilla began by distinguishing between **incremental optimization**—typical of established manufacturers—and the more difficult process of generating **new data-centric value propositions,** often led by startups. He advocated a shift in mindset: companies must begin to treat **data as a value-generating asset,** rather than just a technical by-product.

He described how **standardization and regulation** play a vital role in aligning customer expectations with supplier offerings, referencing examples like fuel quality standards and their parallels in **industrial data quality**.

A key structural challenge lies in outdated architectures, such as the **automation pyramid**, which lacks support for modern **AI-based decision-making**. He proposed evolving this model by integrating AI into the architecture of machines, services, and digital ecosystems such as Manufacturing-X. In this future vision, AI would enable machines to proactively communicate with operators, reducing the need for dashboard monitoring.

To support this transformation, Sawilla introduced a simple but powerful **data governance model** developed in the Factory-X consortium. It identifies four pillars:

- **Processes** (e.g., lifecycle checkpoints)
- **Roles and responsibilities** (e.g., data steward, data governance officer)
- **Standards**
- **Organizational policies** ensuring sovereignty and data quality

He also introduced a "**readiness spider diagram**", which helps organizations benchmark their maturity across compliance, data governance, technical infrastructure, and employee training. Companies can place milestones (e.g., percentage of AI-literate staff) to track progress and align with cross-ecosystem requirements.

The presentation concluded with a demonstration of "**Autonomous Operations as a Service**", where a TRUMPF machine in the U.S. could be remotely operated overnight from Germany, thanks to secure data flows and real-time visual feedback. This capability allows manufacturers to extend productivity without onsite staff, especially during night shifts, and paves the way for future AI-driven autonomy.

Q&A Session

Q : You mentioned data governance across IT and OT systems. What are the differences when governing IT data versus OT data?

A (Sawilla): Great question. We observe a convergence between IT and OT, particularly due to growing cybersecurity demands. While data governance traditionally focused on IT, it's now crucial for OT as well. For example, machine developers must define which sensor data is transmitted to backend systems. Changes in OT signals can directly impact IT services, so data catalogs, quality frameworks, and governance structures must span both domains.

2.4.19 Masaru Dobashi, NTT DATA/ University of Tokyo

Masaru Dobashi (NTT DATA / University of Tokyo) gave a conceptual presentation titled "Consideration about Abstract Representations and Mathematical Models of Data Spaces", proposing a formal, minimalistic model to unify and compare diverse data space architectures.(see d2-5APP-01-00-Masaru Dobashi_20250405_IOFDS_NTTDATA.pdf)

Drawing from real-world deployments (e.g., mobility data spaces in Japan, Luxembourg, and Taiwan), Dobashi emphasized the need for **a shared abstract vocabulary and mathematical structure**. His proposed model includes seven key objects—**organizations, data products, provisioning mechanisms, headers, payloads, trust mechanisms, and certifications**—to express common patterns such as data publishing, subscribing, and trust validation. He suggested that this abstraction could help bridge initiatives like **DATA-EX, Eclipse Dataspace Protocol,** and **Ouranos Ecosystem RAM**.

Though still a prototype, the model aspires to enable **formal reasoning across architectures** and facilitate **interoperability and system comparability.**

Q&A Highlights

- Hiroshi Mano asked how certifications can be reliably bound to data; Dobashi acknowledged the challenge and cited NFT-style hash binding as one potential approach.
- Gopal Tadepalli suggested revisiting formal database theories referencing like the geographical distributed data bases; Dobashi agreed, noting relevance of distributed models.
- Dipankar Chakrabarti raised the issue of secondary benefits in trading; Dobashi proposed expressing them via cascaded or multi-market flows in the model.
- Dipankar Chakrabarti commented on the potential relationship with other standardization activities, such as IEEE P3800. Dobashi agreed on the relevance of this relationship.

2.4.20 Sravya Kurada & Chittapriya Mondal, Siemens Bengaluru

Sravya Kurada and **Chittapriya Mondal,** researchers from **Siemens Bengaluru**, delivered a joint presentation on **data resiliency in multi-party collaborative ecosystems**, emphasizing its central role in ensuring trust, availability, and continuity in decentralized data sharing environments.
(see d2-5APP-02-00-Sravya Kurada & Chittapriya Mondal_DataWeek-2025-Data-Resiliency.pdf)

Sravya Kurada explained that modern data ecosystems—whether open, closed, or federated—depend on **shared data and inter-organizational collaboration**, making **data resiliency** essential. She outlined six key pillars of resiliency (protection, redundancy, integrity, security, scalability, recovery)

and mapped them to practical design strategies, including **zero-trust models, real-time sync, geo-replication**, and **automated failover.**

Chittapriya Mondal introduced Depotfinity, a cloud-based Siemens solution for managing EV fleet charging across distributed systems. The platform:

- Exchanges data with utilities, vehicles, and bus management systems,
- Implements standards like **OCPP 1.6, ISO 15118**, and **VDV 463/261**,
- Offers **granular access control, traceability,** and **rate limiting,**
- Supports **multi-tenant scalability** and **custom disaster recovery** based on SLA.

Depotfinity is available via the **Siemens Xcelerator Marketplace**, with APIs and data catalogs for developer use.

Q&A Session:

Q: You've clearly highlighted core data space concepts—trust and interoperability. Would you consider adopting community protocols like the Data Space Protocol or Data Claim Protocol?

A (Chittapriya Mondal): Yes, we are open to that and would be glad to explore such alignment with the broader data space community.

2.4.21 Raghavendra Sadanand, T-Systems India

Raghavendra Sadanand (T-Systems India, Head of Data Intelligence Practice) delivered a high-level talk titled "Data Exchange in a Divided World: Mastering Collaboration on Data Across Borders", focusing on practical deployment of data spaces across geographies and sectors.

Raghavendra Sadanand emphasized that **cross-border data exchange should be as seamless and trustworthy as a phone call,** enabled by identity verification, regulatory alignment, and data sovereignty—similar to how global telecom networks operate.

He introduced T-Systems' global activities:

- Active contributor to **data space initiatives** such as **Catena-X, Manufacturing-X,** and **Mobility Data Spaces,** in collaboration with partners like **IDSA, Gaia-X,** and **German Engineering Federation (VDMA).**
- Team includes 150+ data space experts and 200+ data scientists in India.
- Clients include **Mercedes-Benz, BMW,** and others across automotive and industrial sectors.

As a practical use case, he presented **UMATI (Universal Machine Technology Interface)**, a standard-based application developed in 2019 to **enable secure and interoperable machine data exchange.** UMATI has been used in Manufacturing-X contexts to demonstrate trusted data flows, including **Digital Product Passport** integration.

He also introduced a **low-code platform** developed by T-Systems that allows organizations—including SMEs—to connect to data spaces, manage participants, control access, and exchange data securely, without deep technical involvement.

He concluded that **data spaces must be intuitive and flexible**, enabling participants to launch use cases in a multi-cloud environment with **trust, traceability, access control, and auditability** built in.

2.4.22 Mukesh Deshpande, PwC India

Mukesh Deshpande (PwC India, Partner for Data Governance & Management) delivered a focused case study presentation titled "Operationalising Data Trust," illustrating how organizations can build user confidence and extract value from data platforms by defining measurable trust frameworks.

Drawing on a real-world example from a major Indian financial institution managing over $90 billion in assets and 400 million customers, Deshpande explained how even large-scale data integration projects can fail to gain traction if users lack **trust** in the data's accuracy, lineage, or governance.

Despite the client's investment in building a unified data platform that integrated data from 120+ systems for analytics and regulatory reporting, stakeholders hesitated to adopt the new environment. Complaints centered around undefined **KPI calculations**, uncertain **data origins**, and unclear o**wnership.**

In response, PwC helped the client develop a **Data Trust Framework** comprising the following key pillars:

- **Ownership & Accountability:** Clear data stewardship roles are critical, especially in organizations where responsibility is ambiguous.
- **Transparency & Lineage:** Stakeholders need visibility into how KPIs are derived, from source system to dashboard.
- **Data Quality & Integrity:** Incorporating techniques like gamification and real-time validation enhances user confidence.
- **Usability Dashboards & Trust Indexing:** A "Data Trust Index" was introduced, allowing users to assess the reliability of specific data products through maturity scores and dashboards.

Deshpande emphasized that **top-down leadership** is essential for effective data governance, requiring executive sponsorship at the CDO or CXO level. PwC employed both perception-based and evidence-based models to calculate the trust index and maturity levels across six dimensions—including architecture, governance, and operational quality.

By visualizing trust indicators and systematically addressing concerns, the client was able to increase usage of its data platform and realize returns on its digital investments.

Q&A Session

Q: How do you define the maturity dimensions behind the Data Trust Index?

A (Deshpande): We assess around six pillars—such as stewardship, quality, access controls, and integration architecture. Maturity levels are calibrated from Level 1 (ad hoc) to Level 5 (optimized), with reference to frameworks like DAMA and DCAM. However, industry frameworks often underemphasize governance; we address that gap through tailored consulting interventions.

2.4.23 Sauvik Banerjee, First Living Spaces

Sauvik Banerjee (First Living Spaces, CEO) delivered a provocative talk titled "Why Agentic A.I. is a Contradiction to Personalization – The Contradiction in A.I.", arguing that agentic AI frameworks challenge the core principles of personalization in AI-driven systems.

Drawing on two decades of experience across AI ventures—including **Resolve.AI** (NASDAQ-listed) and **ToThis.AI**—**Banerjee** traced the evolution of neural network models across predictive, recommendation, and personalization systems, emphasizing how **structured data** and **clean semantic context** have long been the foundation of accurate, n=1 personalization.

In contrast, **Agentic AI**—built on a vision of autonomous agents creating workflows, writing their own algorithms, and operating with minimal human intervention—prioritizes predefined outputs over individual user variation. This is especially evident in use cases such as automated manufacturing, where the desired outcome is known in advance and optimized for precision.

Banerjee contended that:

- Traditional personalization systems allow **user choice and multi-output responses**, driven by contextual accuracy.
- Agentic AI aims to **streamline output**, often reducing user flexibility.
- As a result, **recommendation engines and personalization models** are difficult to replicate through agentic frameworks without diluting the value of individualization.

He further argued that, unless agentic AI evolves to become **multi-output and choice-aware,** it will remain incompatible with the goals of personalization, especially in dynamic, user-facing domains like e-commerce or social media feeds.

The core takeaway: while agentic systems may be ideal for automation and decision finality, they **contradict the open-ended, user-driven logic** of personalization. Any convergence between the two paradigms would require reengineering agentic systems to accommodate **personalization logic** and **output diversity**—a path not yet proven.

2.4.24 Puliyadi Kubendran, AWS India

Puliyadi Kubendran Magesh Babu (AWS India, Senior Technical Customer Solutions Manager) delivered a structured presentation titled "**Data Foundations on AWS for Generative AI Applications**", explaining how AWS supports the full data pipeline—from ingestion to governance—for building domain-specific generative AI solutions. (see d2-5APP-06-00-Puliyadi Kubendran_Data Foundations on AWS for generative AI V2.pdf)

Drawing on AWS's platform capabilities, Magesh emphasized that while **LLMs** and **foundation models** get attention, **data** is the true differentiator in delivering meaningful, personalized generative AI outputs. He introduced **AWS's comprehensive stack**, including Amazon S3, Redshift, OpenSearch, Glue, and Bedrock, designed to support both **structured and unstructured data**, real-time streaming, and fine-grained access control.

The core of the talk focused on three implementation patterns for generative AI:

- **Context Engineering using Retrieval-Augmented Generation (RAG)** – leveraging engineered prompts, situational context (e.g., past interactions), and semantic context (via vector search) to enrich user queries before passing them to LLMs.
- **Fine-tuning Foundation Models** – using curated and labeled domain-specific datasets to improve model response quality.
- **Training Purpose-Built LLMs** – building bespoke models when business requirements exceed the capabilities of RAG or fine-tuning.

A chat-based insurance assistant example illustrated these principles: combining user profile data, prior interactions, and semantic retrieval from policy documents enabled the assistant to provide tailored, low-latency answers.

Magesh advised that organizations typically **start with RAG** for its ease and cost-efficiency, and graduate to fine-tuning or custom LLMs as needed. He closed by promoting **Amazon Bedrock** as a flexible platform that supports multi-model orchestration, agent frameworks, and enterprise-grade security—making AWS well-suited for scalable, responsible, generative AI deployment.

2.5 An award ceremony

An award ceremony was held to honor key contributors to the success of Data Spaces Week 2025. A specially crafted memento featuring the iconic red building of the College of Engineering, Guindy (with over 230 years of history) was presented to several in-person speakers and distinguished guests as a token of appreciation for their participation and leadership.

2.6 Decision and wrap-up

2.6.1 Next IOFDS Meeting

The participants unanimously approved the proposal to host the next IOFDS Roundtable Meeting in Tokyo in October 2025. The following host organizations were proposed and confirmed without objection

Move to approve the meeting plan for the next IOFDS as

- Date Mid-October related to CEATEC
- Venue Tokyo
- Local host Japan Team

Moved Dominik Rohrmus

Seconded Ulrich Ahle

Approved by unanimous consent

2.6.2 P&P Document and Officer Election

Motion to approve

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Moved: Dipankar Chakrabarti

Seconded: Kohtaro Asai

Approved by unanimous consent

2.6.3 Elect officers (Chair, Secretary)

Motion to confirm the meeting officer of IOFDS meeting, as

- Chair Hiroshi Mano
- Secretary Isamu Yamada

Moved: Dominik Rohrmus

Seconded: Dipankar Chakrabarti

Approved by unanimous consent

Acknowledgments and Editorial Note

Isamu Yamada of the Data Society Alliance (DSA), serving as the secretariat of the International Open Forum on Data Society (IOFDS), compiled this report based on the speaker's presentations and discussions, including participants. Each speaker has made efforts to review the content. We thank all contributors for their valuable input and cooperation.