

GISC 2025

Global ICT Standards Conference 2025

정보기술(ISO/IEC JTC 1) 주요 표준화 동향

International Standardization Trends of IoT and Digital Twin

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Chair-elect JTC 1/SC 41

ICT Standards and Intellectual Property:
AI for All

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- 01** Introduction to IoT & Digital Twin
- 02** Introduction to ISO/IEC JTC 1/SC 41
- 03** Foundational Standards of JTC 1/SC 41
- 04** Vertical Standards of JTC 1/SC 41
- 05** Conclusion

Abstract

The Internet of Things (IoT) is a system concept that incorporate many IT and, for some applications, OT technologies.

IoT systems are network intensive, and data driven.

The processing of this data, through advanced analytics and Digital Twin technologies, provide value and enable a 'smarter' world.

This presentation will outline ISO/IEC JTC 1/SC 41 standardization status and strategy on IoT and Digital Twin.

01. Introduction to IoT & Digital Twin

ISO/IEC Definition of IoT (ISO/IEC 20924)

3.2.8

Internet of Things

IoT

infrastructure of interconnected entities, people, systems and information resources together with services which processes and reacts to information from the physical and virtual world

IoT is not a technology !

IoT - Horizontal technology with a wide-range of applications



01. Introduction to IoT & Digital Twin

What value does IoT bring ?

Among many things:

The ability for an entity (human or machine) to make a decision using 'real-time' and historical data (patterns,..) and act on it.

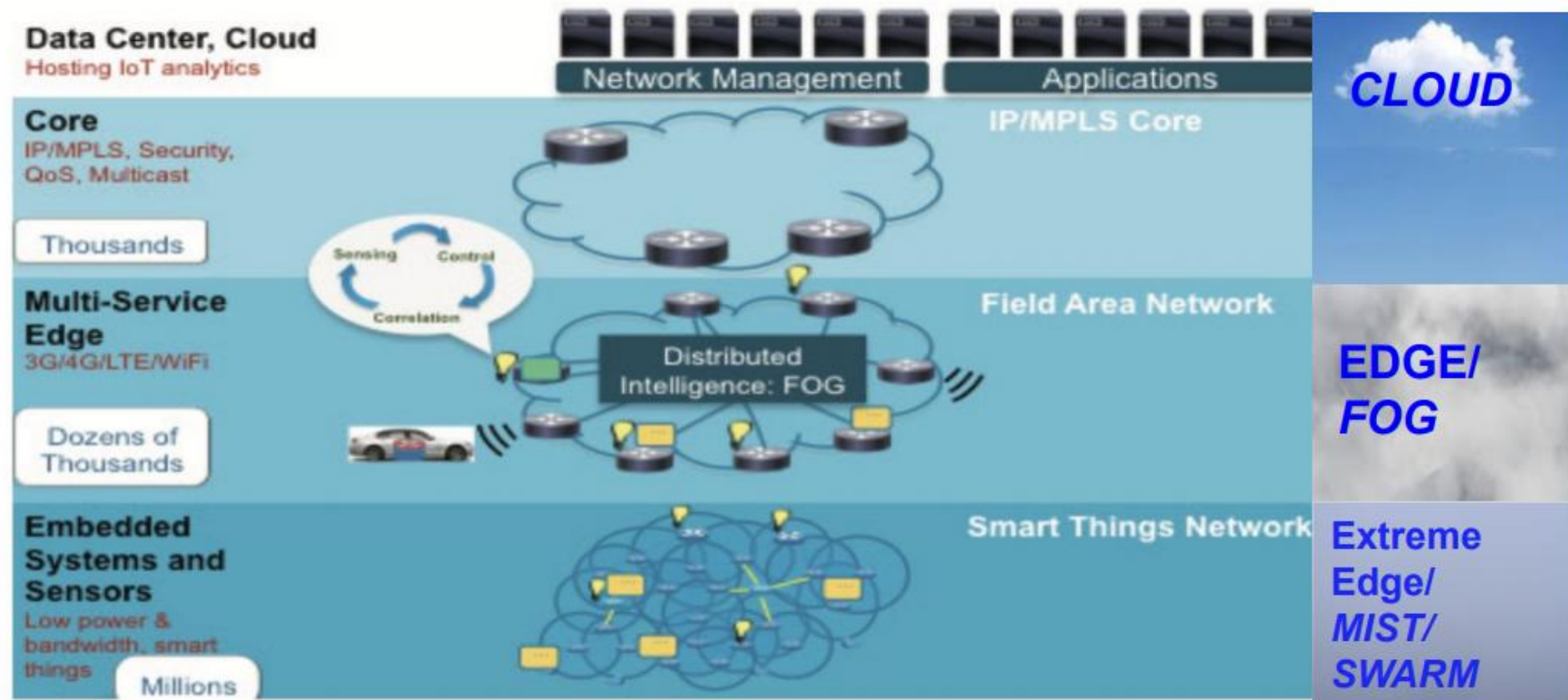
Role of IoT = Smart Everything Everywhere



01. Introduction to IoT & Digital Twin

IoT - A Distributed, **Network centric System** or System of Systems (**SoS**)

Modified from: Fog Computing and Its Role in the Internet of Things, Flavio Bonomi, Rodolfo Milito, Jiang Zhu, Sateesh Addepalli, Cisco Systems Inc.



01. Introduction to IoT & Digital Twin

IoT – Data Intensive system

- IoT systems consist of interconnected devices and sensors that continuously **collect, transmit, and sometimes analyze data**. This naturally makes them highly data-driven
- IoT is a Data-Intensive System
 - Massive Data Generation often in real-time
 - High Frequency & Volume of data transmission
 - Variety of Data handling : structured (e.g. temperature readings) and unstructured data (e.g. video streams)
 - Need for Real-Time Processing
 - Storage and Analytics Demands : often in cloud or edge

01. Introduction to IoT & Digital Twin

ISO/IEC Definition of Digital Twin (ISO/IEC 20924)

3.3.4

digital twin

DTw

digital representation of a target entity with data connections that enable convergence between the physical and digital states at an appropriate rate of synchronization

Note 1 to entry: Digital twin has some or all of the capabilities of connection, integration, analysis, simulation, visualization, optimization, collaboration, etc.

Note 2 to entry: Digital twin can provide an integrated view throughout the life cycle of the target entity.

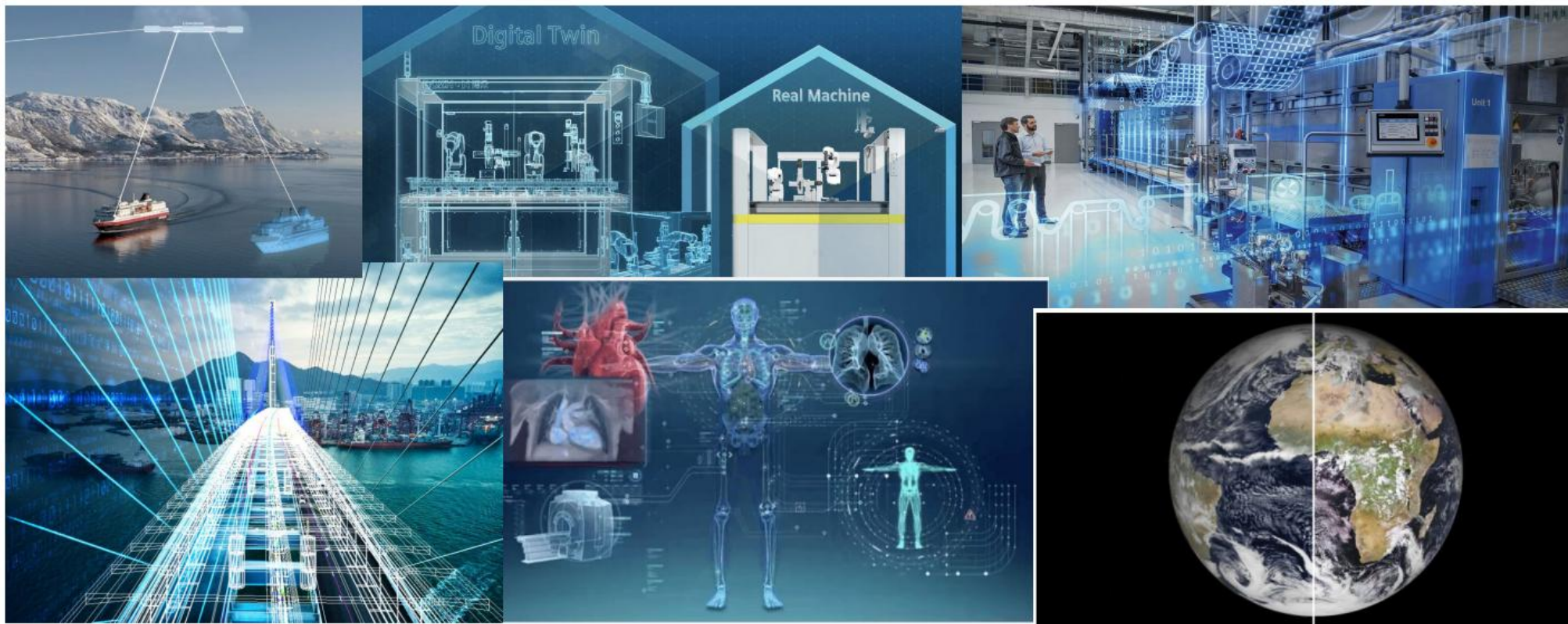
01. Introduction to IoT & Digital Twin

About DTw

- According to Gartner and Deloitte, a digital twin as a **digital representation of a real-world entity or system**, it is an evolving digital profile of the historical and current behavior of a physical object or process.
- The implementation of a digital twin is an encapsulated **software object or model** that mirrors a unique physical object, process, organization, person or other abstraction. The digital twin is thus based on massive, cumulative, real-time, real-world data measurements across an array of dimensions.
- Data from **multiple digital twins** can be aggregated for a composite view across a number of real-world entities, such as a ship, a bridge, a building, a factory, a supply-chain or a city.
- **Mirroring** is done through **synchronization** using data streams. The data streams are generated by sensors, but also transactions and other sources (virtual sensors).

01. Introduction to IoT & Digital Twin

Horizontality of DTw



01. Introduction to IoT & Digital Twin

Double 'horizontality'

Therefore, JTC 1/SC41 can be considered as being double 'horizontal' by regard to:

- technologies used in IoT and DTw systems
- application domains or sectors

01. Introduction to IoT & Digital Twin

'Technologies' found in IoT and DTw systems

- IoT architectures (JTC 1/SC 41)
- Operational Technologies (IEC/TC 65)
- Digital Twin (JTC 1/SC 41)
- Sensors, actuators, tags (IEC/TC 44, 47, 49, 65, 72, 86/SC 86C, 124; JTC 1/SC 3; ISO/TC 211; ..)
- Wearables (IEC/TC 124)
- Networks... (JTC 1/SC 6, IEC/TC 65, ITU-T,..)
- Cloud computing (JTC 1/SC 38)
- Big Data (JTC 1/SC 42)
- AI (JTC 1/SC42)
- Cybersecurity (JTC 1/SC 27)
- Security and privacy technologies (JTC 1/SC 44 & JTC 1/SC 27)
- Software and Systems Engineering (JTC 1/SC7)
-

02. Introduction to ISO/IEC JTC 1/SC 41

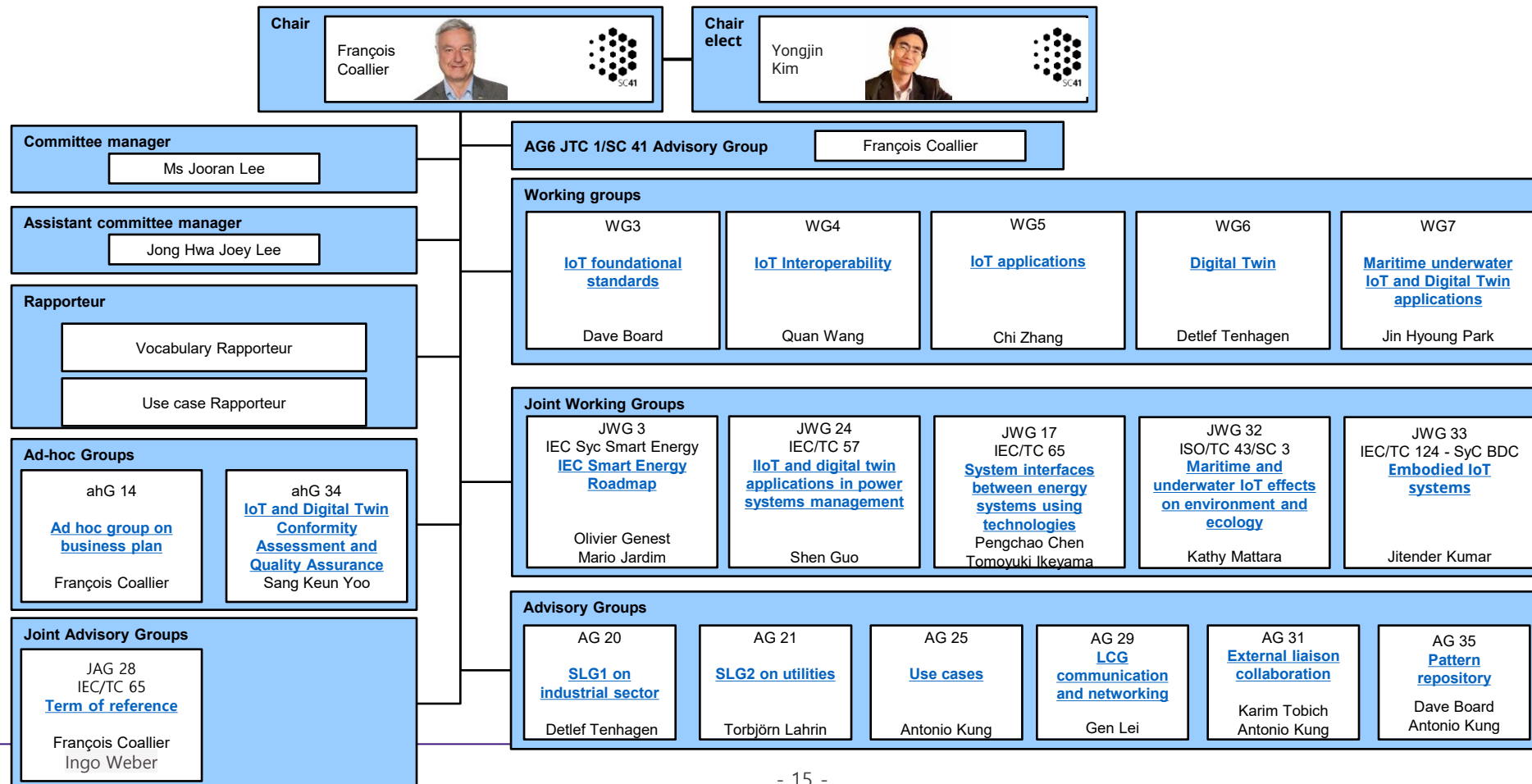
ISO/IEC JTC 1/SC 41 IoT and Digital Twin

- **History** (<https://jtc1info.org/sd-2-history/jtc1-subcommittees/sc-41/>)
 - 2009: Creation of JTC 1/WG 7: Sensor networks
 - 2014: Creation of JTC 1/WG 10: IoT
 - 2016: Creation of SC41: IoT and related technologies : Merging of WG 7 and WG 10
 - 2020: Adding Digital Twins in the scope
- **Scope** (https://www.iec.ch/dyn/www/f?p=103:7:16160045003496:::FSP_ORG_ID,FSP_LANG_ID:20486,25)
 - Standardization in the area of Internet of Things and Digital Twin, including their related technologies.
 - . Serve as the focus and proponent for JTC 1's standardization programme on the Internet of Things and Digital Twin, including their related technologies.
 - . Provide guidance to JTC 1, IEC, ISO and other entities developing Internet of Things and Digital Twin related applications.



02. Introduction to ISO/IEC JTC 1/SC 41

ISO/IEC JTC 1/SC 41 Structure



ISO/IEC JTC 1/SC 41 Published Standards (52)

Interoperability	21823-1 IoT interoperability - framework 2020IoTData	21823-2 IoT transport interoperability 2020IoTData	21823-3 IoT semantic interoperability 2021IoTData	21823-4 IoT syntactic interoperability 2022IoTData	30181 Functional architecture for resource ID interop 2024IoTArch	30184 Autonomous IoT object identification in connected home 2024IoTArch	Underwater acoustic networks
Digital twin	20924 Ed3 IoT and digital twin – Vocabulary 2024IoTDTw				Sensor networks		30140-1 UWASN – Overview and requirements 2018UWAN
	30186 – Digital twin maturity model and assessment guidance 2025DTw				30173 Digital twin concepts and terminology 2023DTwArch		30140-2 UWASN – Reference architecture 2017UWAN
Industrial IoT	30162 Compatibility requirements within industrial IoT systems 2022IoTInd				TR 30166 Industrial IoT 2020IoTInd		30140-3 UWASN – Entities and interfaces 2018UWAN
	TS 30168 Generic trust anchor API for industrial IoT devices 2024IoTInd						30140-4 UWASN – Interoperability 2018UWAN
Core IoT	30169 IoT applications for electronic label systems (ELS) 2022IoT		30179 IoT system for ecological environment monitoring 2023IoT		Use cases		30142 UWASN – Network mgt system overview & reqs 2020UWAN
	30174 Socialized IoT system resembling human social dynamics 2021IoT		TR 30189-1 IoT-based cultural heritage mgt – Framework 2025IoT		TR 22417 IoT use cases 2017IoT		30142-2 UWASN – Network management system u-MIB 2020UWAN
Edge	30164 IoT edge computing 2020IoTEdge		TR 30163 Platform req for chattel asset monitoring 2021IoT		30172 Digital twin use cases 2023DTw		30143 UWASN – Application profiles 2020UWAN
	30165 2021 Real-time IoT 2021IoTArch				TR 30194 Best practices for use case projects 2024Gen		30167 Underwater communication technologies for IoT 2021UWAN
Arch	Architecture				TR 30176 Integration of IoT & DLT-blockchain: use cases 2021IoT		30171-1 B-UWAN - Overview and requirements 2022UWAN
	Data related						
Edge	Edge						
	Industry domain						
IoT	IoT						
Gen	General						
	System engineering						
DTw	Digital twin						
	Sensor network						
SN	Sensor network						
	Underwater acoustic network						
UWAN	Underwater acoustic network						

SC41

SC41 Published Standards

ISO/IEC JTC 1/SC 41 Projects (36)

Concepts and architecture			Interoperability			Applications		
30187 Evaluation indicator for IoT systems WG5 IoT Assur	30188 Digital twin Reference Architecture WG6 DTw Arch		21823-5 Behavioral and policy interoperability WG4 IoT Data	TR 30138 Fidelity metric of digital twin system WG6 DTw Data		3200-1 Multi-modal underwater wireless com. tech – reqs WG5 IoT UW	TR 30123 Guidance on IoT application to home healthcare WG5 IoT Health	30175 IoT apps using context aware collaboration service WG5 IoT Oth
			30178 Data format, value and coding for interoperability WG4 IoT Data	30198 Edge computing gateway interoperability framework WG4 IoT Edge		30180 Status of self-quarantine through IoT data interfaces WG5 IoT Oth	30197 IoT for stress management, good health and well-being WG5 IoT Health	30199 Smart onshore aquaculture - General and technical reqs WG5 IoT Aqua
20924 Ed4 IoT and digital twin vocabulary WG3 IoT DTw	30141 Ed3 IoT reference architecture WG3 IoT Arch	30147 ED2 Integration of IoT trustworthiness in ISO/IEC/IEEE 15288 WG3 IoT Eng	21823-1 Ed2 IoT interoperability framework WG4 IoT Data			TR 30189-2 IoT-based cultural heritage mgt – Use case WG5 IoT CH	30202 General requirements for seized asset management WG5 IoT Oth	
30151 Digital Twin extraction & transaction of data products WG6 DTw Data	30152 IoT & DTw guidance on connection to data spaces WG6 DTw Data							
PWI 19 (30153) Digital twin guidelines for digital entity modelling WG6 DTw Data	PWI 21 (40141) Guidance on IoT reference architecture WG3 DTw IoT	PWI 22 Architecture considerations IoT – Edge – Cloud WG3 IoT Edge	PWI 25 Guidelines on testing of IoT devices WG4 IoT Assur	PWI 27 Functional blocks in data platform for control & monitoring WG4 IoT Data		PNW 517 General reqs of information publishing system based on IoT WG5 IoT Oth	PNW 518 IoT systems using wireless power technology WG5 IoT Oth	PWI TR 12 TR Env. effect of underwater acoustic signalling WG7 IoT UW
PWI 33 (40188) Guidance on digital twin reference architecture WG6 DTw IoT			PWI 28 Framework for massive data interop of Real-Time IoT system WG4 IoT Data	PWI 32 General requirements of information exchange WG6 DTw Data		PWI 26 IoT applications for construction WG5 IoT Cons	PWI 29 Reqs for underground structure corrosion monitoring WG5 IoT Pipe	PWI 30 Req for liquid pipeline leakage monitoring WG5 IoT Pipe
						PWI 31 Underwater network management system interworking WG5 IoT UW	PWI 34 Integrated Network System for Ship IoT WG5 IoT Mar	



SC41 Projects

Project status

National level
Expert level
Study level

Tags

Arch	Architecture	Ind	Industry domain	Aqua	Aquaculture	Mar	Maritime
Data	Data	IoT	IoT	Cons	Construction	Other	Other
Edge	Edge	DTw	Digital twin	CH	Cultural heritage	Pipe	Pipelines
SE	System eng.	ASSUR	Assurance	Health	Health	UW	Underwater

Other committees

TC65	IEC TC 65 Industrial-process measurement, control and automation
TC57	IEC TC 57 Power systems management and associated information exchange

TR 63353 IIoT apps in power dist systems mg - arch & funct regs

TC57	IIoT	Power
------	------	-------

TR 63655-1 IoT Apps for long-distance oil and gas pipeline

TC65	IoT	Gas
------	-----	-----

TR 63657-2 IoT apps for natural gas distribution system

TC65	IoT	Gas
------	-----	-----

IoT projects in other committees

Project status

National level
Expert level
Study level

Tags

Ind	Industry domain
IoT	IoT
Gas	Gas distribution
Power	Power dist

02. Introduction to ISO/IEC JTC 1/SC 41

ISO/IEC JTC 1/SC 41 Membership

- **P-members (voting) (Total: 32)**

Australia , Austria, Belarus, Belgium, Canada,
China, Denmark, Finland, France, Germany, India,
Ireland, Israel, Iran, Italy, Japan, Korea, Luxembourg, Malaysia, Mexico,
Netherlands, Norway, Portugal, Russia, Saudi Arabia, Singapore, Spain,
Sweden, Switzerland, UAE, UK, US (Total: 32)

- **O-members (observing) (Total: 10)**

Argentina, Iceland, Indonesia, Hungary, Kenya,
Pakistan, Philippines, Poland, Romania, Slovakia

02. Introduction to ISO/IEC JTC 1/SC 41

ISO/IEC JTC 1/SC 41 Liaisons

Liaison Type	No. of Liaisons
Internal Liaisons within ISO	21
Internal Liaisons within IEC	16
Internal Liaisons within ISO/IEC JTC 1	19
External Category A	10
External Category C	8

02. Introduction to ISO/IEC JTC 1/SC 41

Strategic Approaches for SC 41 Standardization

- **Concentrate on foundational standards: vocabularies, reference architectures, interoperability, trustworthiness etc.**
- **Systematically collect use cases across all application domains to elicit and document standardization requirements**
- **Have an 'incubator' to kick-start domains or sectors applications to cover 'dead-angles or to form a JWG**

03. Foundational Standards of JTC 1/SC 41

Vocabulary

ISO/IEC 20924

ISO/IEC 20924:2024

Internet of Things (IoT) and digital twin - Vocabulary

ISO/IEC 20924:2024 provides a definition of Internet of Things and digital twin along with a set of terms and definitions. This document is a terminology foundation for the Internet of Things and digital twin. This third edition cancels and replaces the second edition published in 2021.

03. Foundational Standards of JTC 1/SC 41

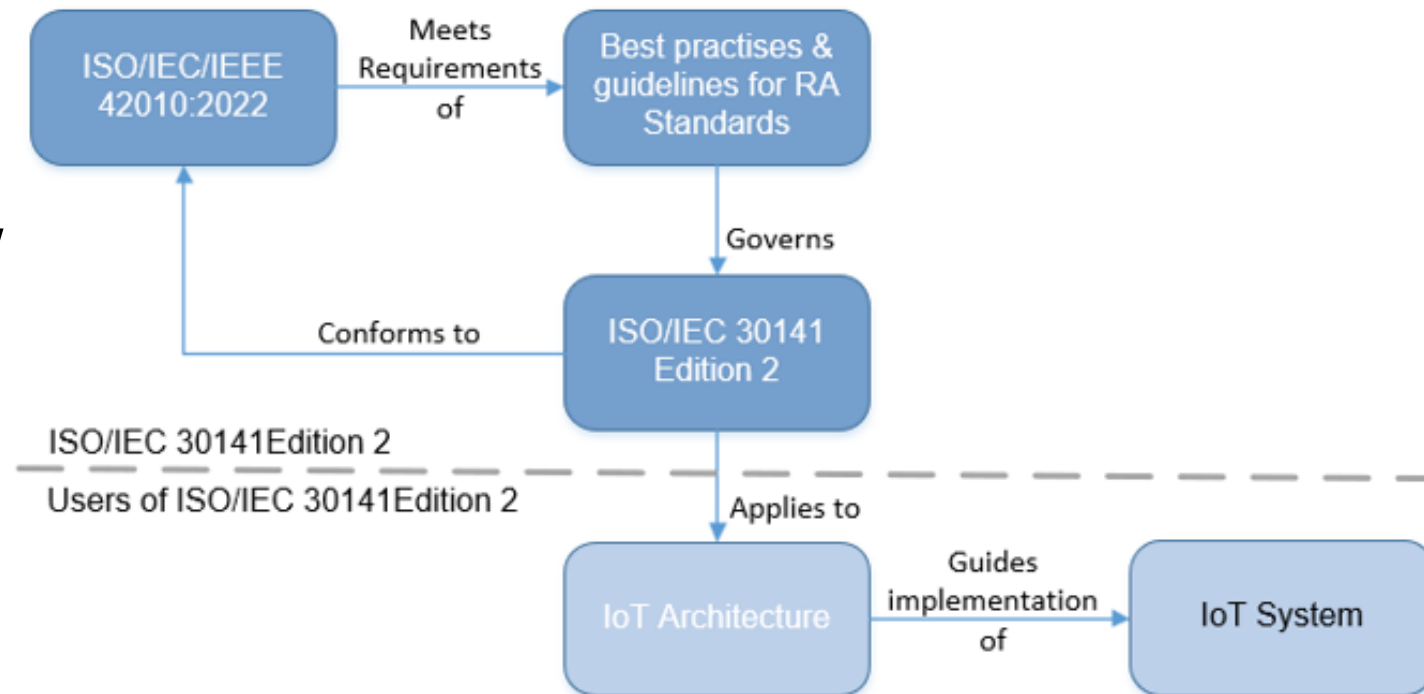
IoT Reference Architecture (I)



03. Foundational Standards of JTC 1/SC 41

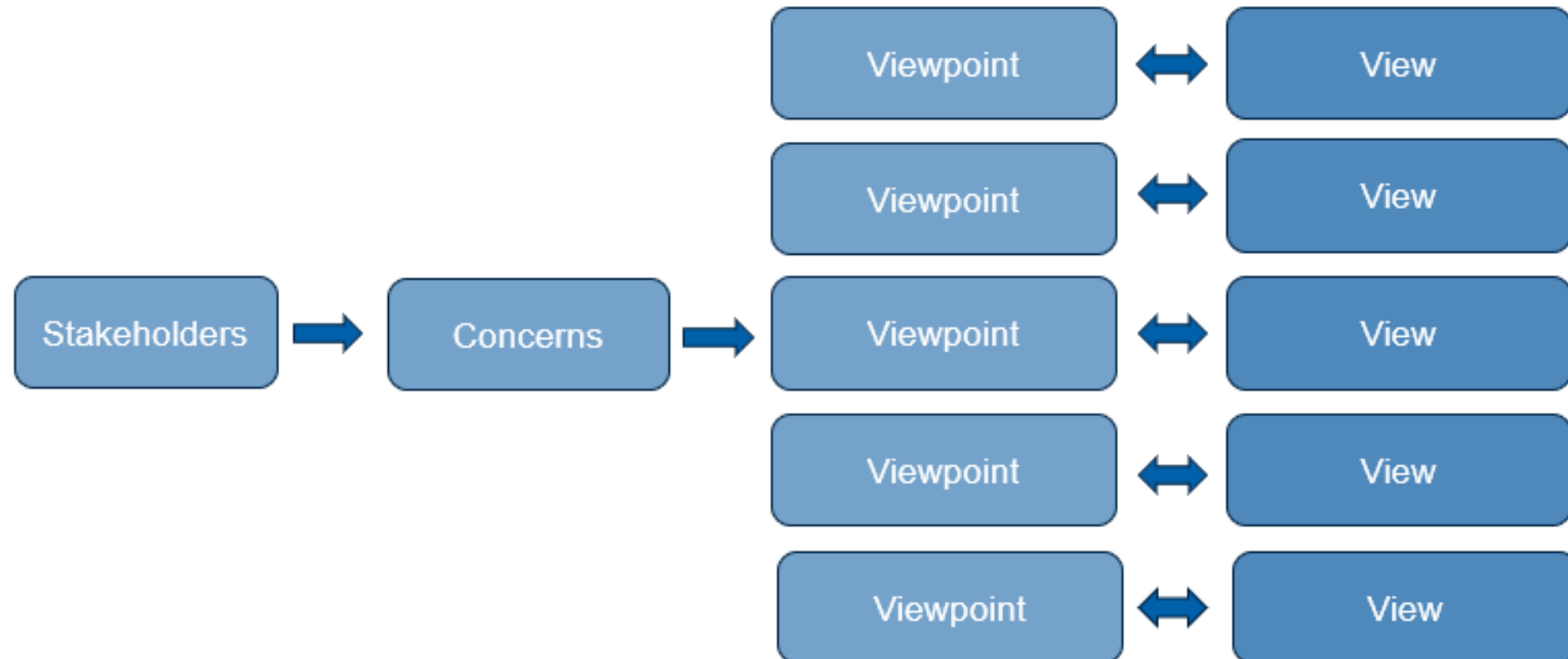
IoT Reference Architecture (II)

- IoT RA serves as a **conceptual blueprint** for designing, developing, and governing IoT systems.
- IoT RA provides a common language, structure, and best practices to ensure interoperability, scalability, security, and business alignment in complex IoT ecosystems.



03. Foundational Standards of JTC 1/SC 41

Methodology for creating IoT RA



03. Foundational Standards of JTC 1/SC 41

IoT RA Viewpoints and Views – ISO/IEC 30141

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03. Foundational Standards of JTC 1/SC 41

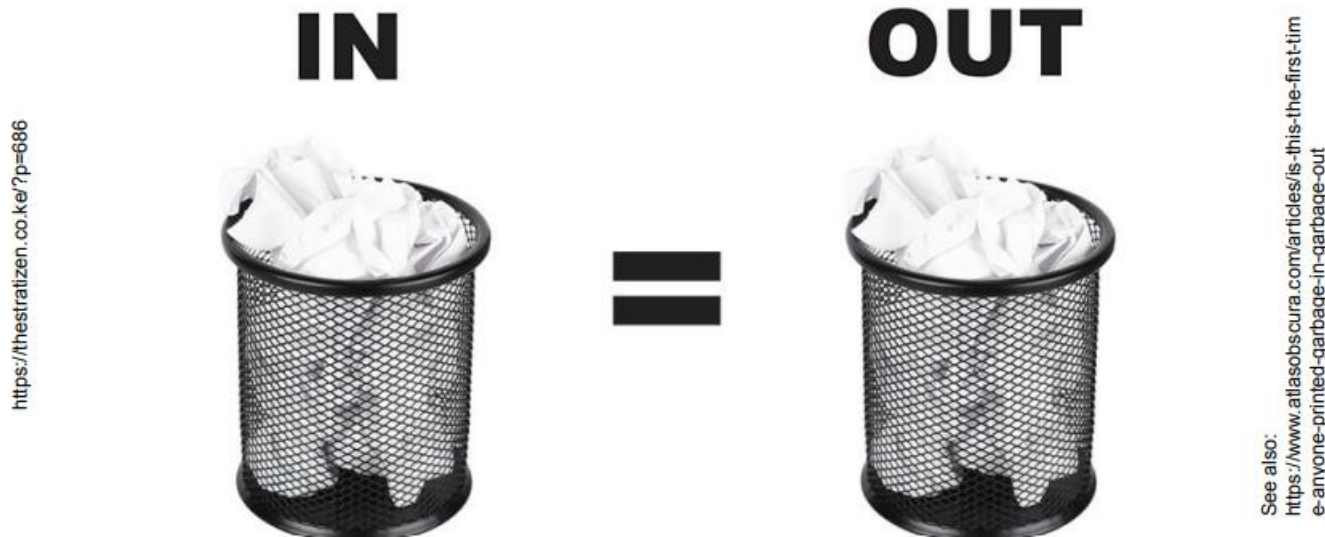
IoT RA **Patterns** – ISO/IEC 30141 release 3

- Reusable solution to a common problem
- Well working solution for a common problem
- Use knowledge gained from past experience

03. Foundational Standards of JTC 1/SC 41

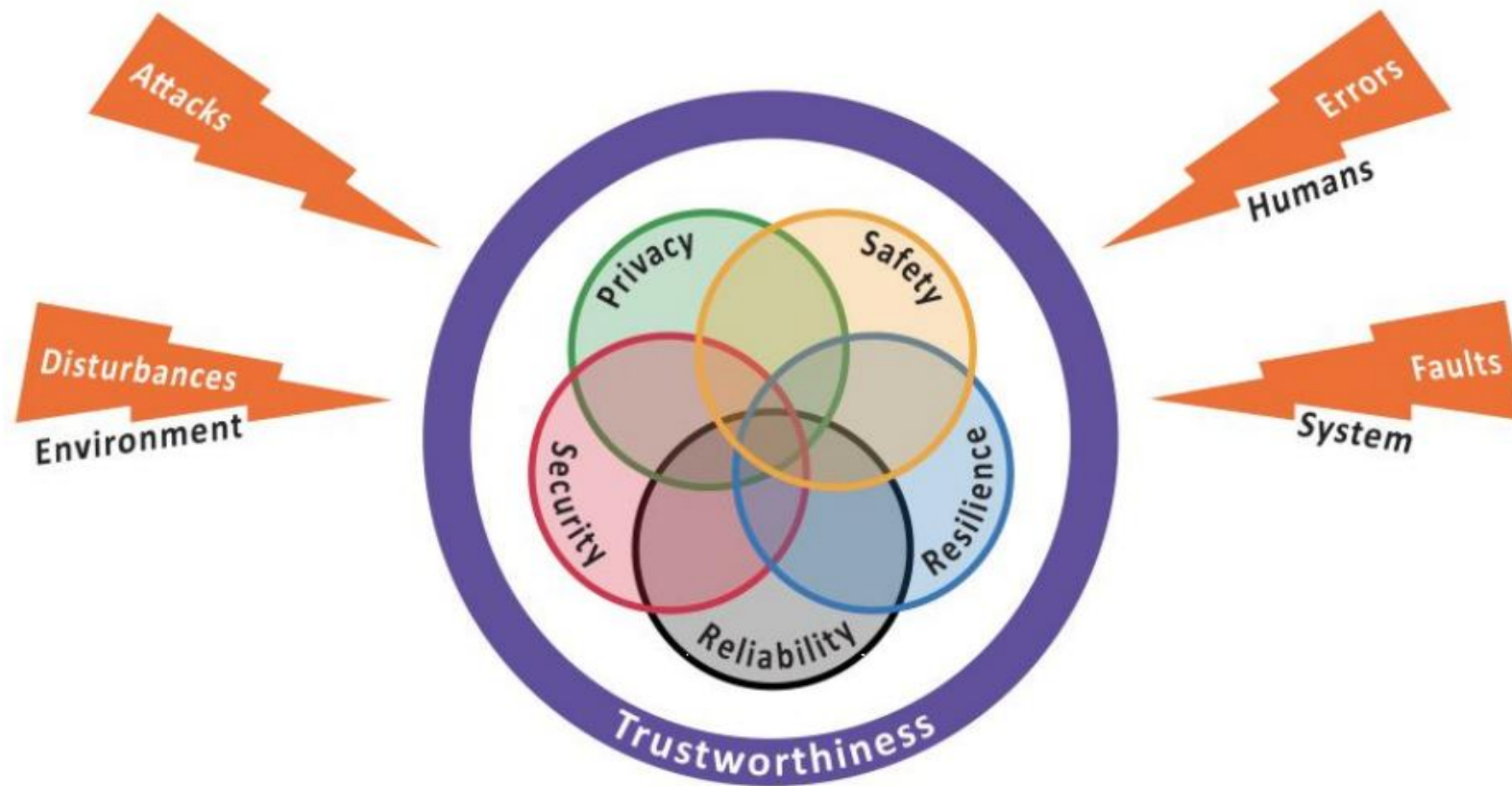
IoT Trustworthiness (I)

GIGO = Garbage In Garbage Out



03. Foundational Standards of JTC 1/SC 41

IoT Trustworthiness (II)



https://www.iiconsortium.org/pdf/Trustworthiness_Framework_Foundations.pdf

03. Foundational Standards of JTC 1/SC 41

IoT Trustworthiness (III)

ISO/IEC Technical Specification 30149

ISO/IEC TS 30149:2024

Internet of Things (IoT) - Trustworthiness principles

ISO/IEC TS 30149:2024 provides principles for IoT trustworthiness based on ISO/IEC 30141 - IoT Reference Architecture.

ISO/IEC 30147

ISO/IEC 30147:2021

Internet of Things (IoT) - Integration of IoT trustworthiness activities in ISO/IEC/IEEE 15288 system engineering processes

ISO/IEC 30147:2021(E) provides system life cycle processes to implement and maintain trustworthiness in an IoT system or service by applying and supplementing ISO/IEC/IEEE 15288:2015. The system life cycle processes

03. Foundational Standards of JTC 1/SC 41

Overview of IT Trustworthiness projects

Trustworthiness related projects, April 2025 (Green = published, Orange >= CD, Light Red = CD, Red = PWI, NP)

TS 5723:2022 Trustworthiness vocabulary		30147:2021 Trustworthiness in lifecycle process	TR 27563:2023 Security and privacy in AI use cases	TR 6114:2023 Security throughout the product life cycle		TR 5469:2024 Functional safety and AI systems	TS 8200:2024 Controllability of automated AI systems	23894:2023 Guidance on risk management			250xx Quality requirements and evaluation
		TS 30149:2024 IoT Trustworthiness principles				TS 12791:2024 Treatment of bias	TR 24027:2021 Bias in AI systems and AI aided decision	TR 24028:2020 Overview of trustworthiness in AI			
						TR 24029- 1,2:2021-2023 Assessment of robustness of NN	TR 24368:2022 Overview of ethical and societal concerns	TS 25058:2024 Guidance for quality eval of AI systems			
						25059:2023 Quality model for AI systems					
31303 Trustworthiness - Overview and concepts		30187 Evaluation indicators for IoT systems	5181 Data Provenance	27090 Addressing security threats to AI systems	27091 AI Privacy protection	6254 Explainability of ML models and AI systems (TS)	12792 Transparency taxonomy of AI systems	22443 Societal concerns & ethics (TS)			9837 System resilience concepts
						25029 AI-enhanced nudging	42105 Guidance for human oversight (TR)	42106 Benchmarking of AI system quality (TR)			42042 Reference Architecture
					27115 Cybersecurity eval of complex systems (TS)	24029-3 Robustness NN – statistical methods (TR)	25029 AI-enhanced nudging	25059 Ed2 Quality model for AI systems	11034 Trustworthiness of cloud services	AI Trustworthiness framework	
						25568 Addressing risks in gen AI systems (TS)	25570 Reliability assessment of AI systems (TS)	25571 Documenting ethical issues in AI (TS)			
31310 Trustworthiness - ontology (NP)	20822 City knowledge trustworthiness evaluation (NP)		PWI Attack potential in deep learning technology	7709 Sec & privacy for multi-sourced data processing	PWI Enhancing common criteria for AI evaluation	PWI Resilience assessment of AI systems	24029-5 NN robustness & other AI algorithms (PWI)	25058 Guidance for quality eval of AI (NP)			
JTC 1/WG 13 Trustworthiness	JTC 1/WG 11 Smart cities	JTC 1/SC 41 IoT and digital twin	25240 Evaluation of AI- based technology	27116 Customised and multi purpose evaluation (PWI)	JTC 1/SC 27 Cybersecurity and privacy	25566 Concepts domain eng; (NP TS)	42117 Trustworthiness Fact Labels for AI systems (PWI)	JTC 1/SC 42 Artificial Intelligence	JTC 1/SC 38 Cloud computing	CEN-CLC JTC 21 AI	JTC 1/SC 7 System engineering

03. Foundational Standards of JTC 1/SC 41

IoT Interoperability

- ISO/IEC 21823-1 Internet of things (IoT) – Interoperability for IoT systems - Part 1: Framework
- ISO/IEC 21823-2 Internet of things (IoT) – Interoperability for IoT systems - Part 2: Transport interoperability
- ISO/IEC 21823-3 Internet of things (IoT) – Interoperability for IoT systems - Part 3: Semantic interoperability
- ISO/IEC 21823-4 Internet of things (IoT) – Interoperability for IoT systems - Part 4: Syntactic interoperability
- ISO/IEC 21823-5 Internet of things (IoT) – Interoperability for IoT systems – Part 5: Behavioural and policy interoperability



03. Foundational Standards of JTC 1/SC 41

Data Space

governance framework and supporting services to build trustworthiness and enable data sharing through an agreed set of policies, semantic models, protocols and processes
[SOURCE ISO/IEC 20151:2026, 3.1]

- A Data Space is a federated, interoperable **framework** that allows multiple stakeholders to **share, exchange, and use data in a trustworthy, secure, and sovereign way** - while maintaining control over their own data.
- Key Characteristics
 - Interoperability: Common standards and semantics ensure data exchange
 - Trust & Governance: Rules, identity, and access are clearly managed
 - Decentralization: No central data storage; distributed architecture
 - Purpose-Bound Use: Data shared only for clearly defined purposes
 - Data Sovereignty: Participants retain full control over their data

03. Foundational Standards of JTC 1/SC 41

Data Space (Survey by SC 41)

ISO/IEC JTC 1/SC 41/AG 31 External liaison collaboration
Example of landscape work: categorizing standards.



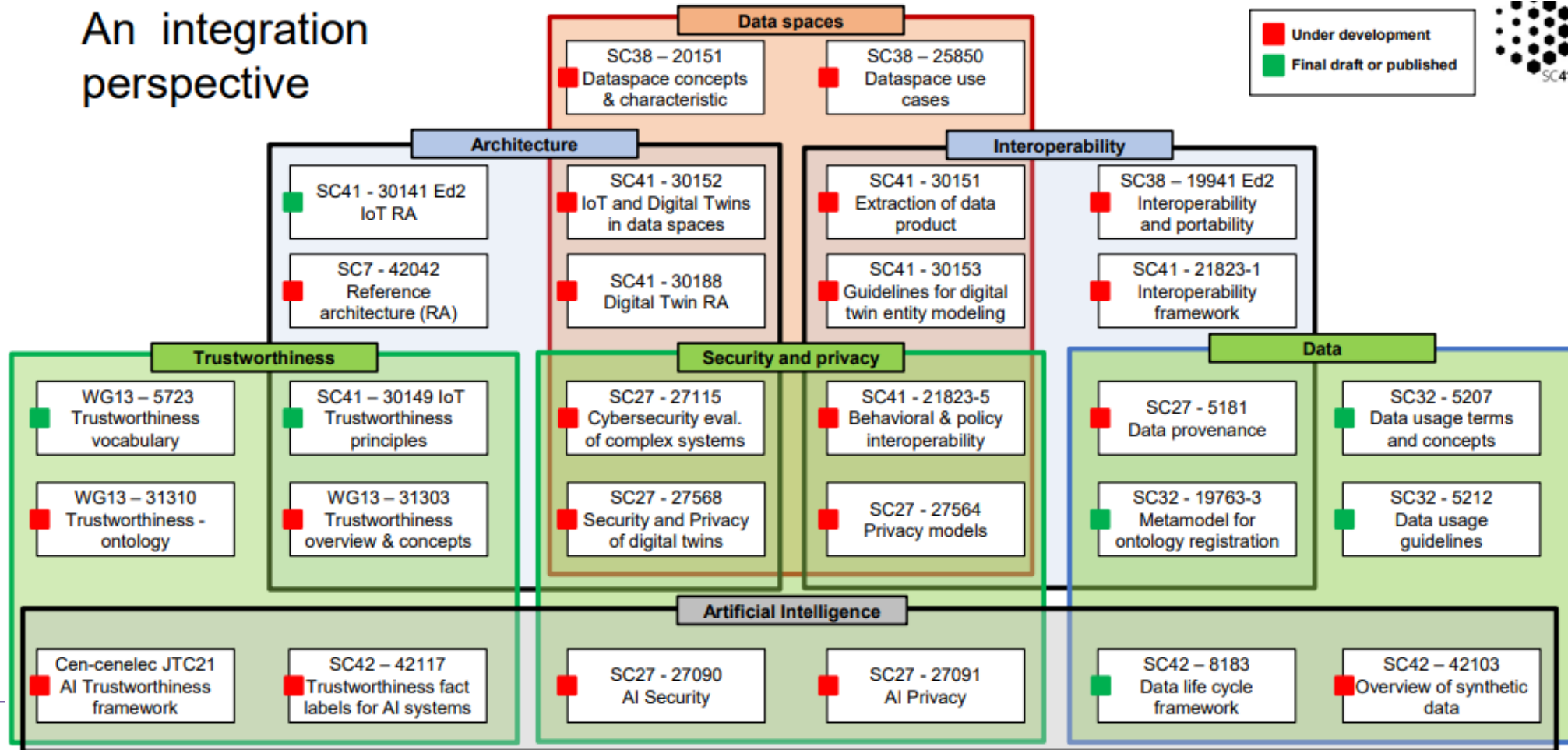
1	Introduction.....
1.1	Copyright.....
1.2	Purpose of report.....
1.3	Standards to enable AI, IoT and digital twin in data spaces
1.4	Colour codes
2	Data usage.....
2.1	ISO/IEC 5207:2024 Data usage — Terminology and use cases (SC32).....
2.2	ISO/IEC 5212:2024 Data usage — Guidance for data usage (SC32).....
3	Data sharing – Meta data
3.1	ISO/IEC 19583-1:2019 Concepts and usage of metadata – Part 1: metadata concepts (SC32).....
3.2	ISO/IEC 11179-1:2023 Metadata registries (MDR) – Part 1 framework (SC32).....
3.3	ISO/IEC 11179-3:2023 Metadata registries (MDR) – Part 3: Metamodel for registry common facilities
3.4	ISO/IEC 11179-33:2023 Metadata registries (MDR) - Part 33: Metamodel for data set registration (SC32).....
3.5	ISO/IEC 19763-1:2023 Metamodel framework for interoperability (MFI) – Part 1 Framework (SC32).....
3.6	ISO/IEC 19763-3:2020 Metamodel framework for interoperability (MFI) - Part 3: Metamodel for ontology registration (SC32).....
3.7	ISO/IEC 19763-10:2023 Metamodel framework for interoperability (MFI) - Part 10: Core model and basic mapping (SC32).....
3.8	ISO/IEC 19763-12:2015 Metamodel framework for interoperability (MFI) - Part 12: Metamodel for information model registration (SC32).....
4	Data sharing – Expressing usage.....
4.1	ISO/IEC 19944-1:2020 Cloud computing - Data flow, data categories and data use – part 1: fundamentals (SC38)
4.2	ISO/IEC 19944-2:2022 Cloud computing - Data flow, data categories and data use – part 2: guidance on application and extensibility (SC38).....
5	Data sharing - Representation.....
5.1	ISO/IEC 9789:1994 Guidelines for the organization and representation of data elements for data interchange — Coding methods and principles (SC32).....
5.2	ISO/IEC 11404 General-Purpose Datatypes (GPD) (SC32).....
5.3	ISO/IEC 14957:2010 Representation of data element values — Notation of the format (SC32).....
5.4	ISO/IEC 30178 IoT and digital twin - Data format, value and coding (SC41)
6	Data sharing – Governance

Data and data spaces standards
ISO/IEC JTC 1/SC 41/AG 31 Report
June 2024
AG31 Convenors: Antonio Kung, Karim Tobich

03. Foundational Standards of JTC 1/SC 41

Data Space – Related Committees and Standards

An integration perspective



03. Foundational Standards of JTC 1/SC 41

Digital Twin

- Develop a strong **set of Digital Twin foundational standards**

ISO/IEC 20924 Ed3 IoT and digital twin vocabulary

ISO/IEC 30173 Digital twin concepts and terminology

ISO/IEC 30186 Digital twin maturity model and assessment guidance

ISO/IEC 30188 Digital twin Reference Architecture

ISO/IEC TR 30138 Fidelity metric of digital twin system

ISO/IEC 30151 Digital Twin extraction & transaction of data products

ISO/IEC 30152 IoT & DTw guidance on connection to data spaces

ISO/IEC 30153 Digitaltwin guidelines for digital entity modelling

ISO/IEC 40188 Guidance on digital twin reference architecture

04. Vertical Standards of JTC 1/SC 41

IT/OT Convergence

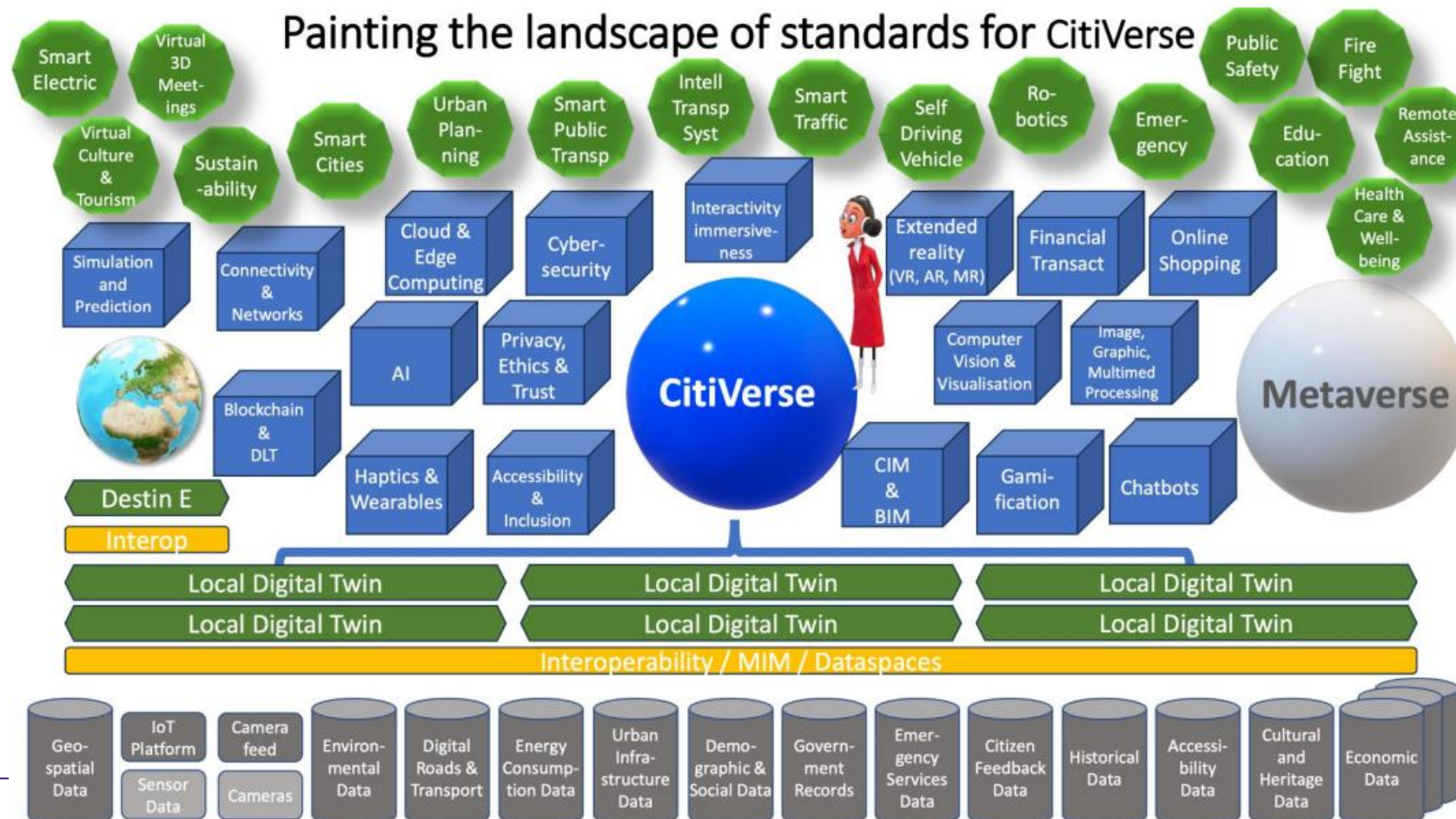
- IT/OT convergence is the integration of information technology (IT) systems used for data-centric computing with operational technology (OT) systems used to monitor events, processes and devices and make adjustments in enterprise and industrial operations.



- **Smart Manufacturing**, Smart Factory, Industrial Automation ...

04. Vertical Standards of JTC 1/SC 41

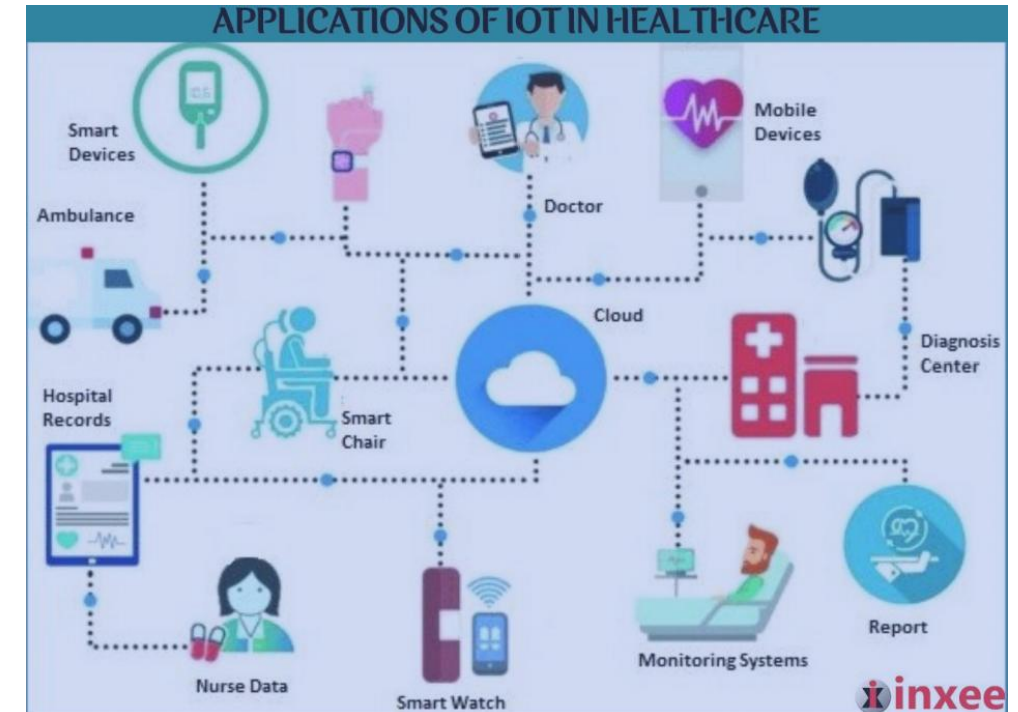
DTw for Smart City : CitiVerse



04. Vertical Standards of JTC 1/SC 41

Bio-Digital Convergence

- Smart Health Care, Smart Hospital ..



04. Vertical Standards of JTC 1/SC 41

Others

- **Environment Monitoring & Climate Change**

ISO/IEC 30179:2023

Edition 1.0 (2023-01-26)

Internet of Things (IoT) - Overview and general requirements of IoT system for ecological environment monitoring

- **Pandemic**

ISO/IEC TS 30180:2025

Edition 1.0 (2025-08-21)

Internet of Things (IoT) - Functional requirements to determine the status of self-quarantine through IoT data interfaces

- **Foods**

ISO/IEC 30199 ED1

Internet of Things (IoT) - Smart onshore

aquaculture - General and technical requirements

- **Smart Health Care (for Elderly)**

ISO/IEC TR 30123 ED1

Internet of Things (IoT) - Guidance on IoT application to home healthcare

- ..

04. Vertical Standards of JTC 1/SC 41

Underwater IoT – amazing potential applications !!

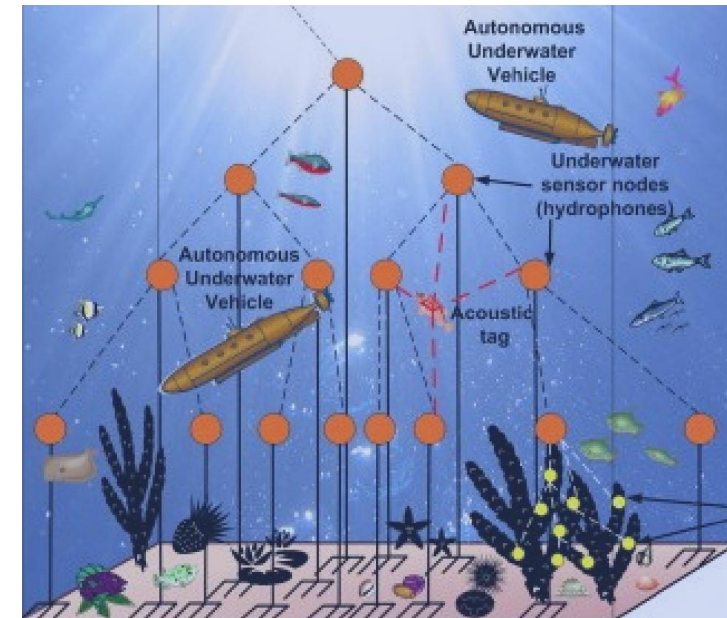
- ISO/IEC 30140 : Underwater acoustic sensor network (UWASN)

Part 1: Overview and requirements

Part 2: Reference architecture

Part 3: Entities and interfaces

Part 4: Interoperability

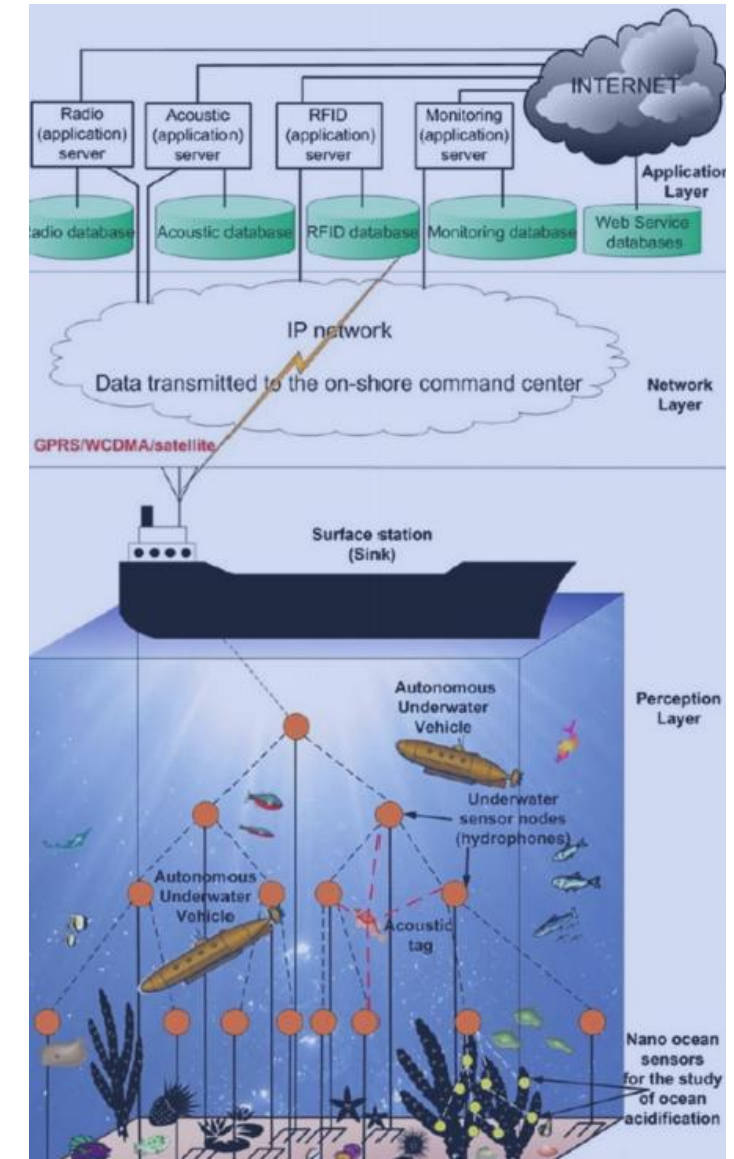


- Presently developing a technical report (TR): **"Environmental and Ecological Effects, Risks, and Considerations of Underwater Acoustic Signaling."**

04. Vertical Standards of JTC 1/SC 41

Maritime IoT

- Ships IoT and Smart vessels
- Smart Ports and logistics hubs
- Cargo tracking
- Container management
- Offshore energy and fisheries operations



05. Conclusion

Technological Improvements

- **Sensors & Actuators Technologie**
 - Biosensors, Quantum sensors, Virtual sensors
 - Piezoelectrics, artificial muscles ..
- **Internet of X Things**
 - Internet of Intelligent Things (AloT)
 - Internet of Robotics Things
 - Internet of Multimedia Things
- **Communication and Networking Technologies**
 - Underwater
 - In body
- **Computing Technologies**
 - Distributed computing : the edge and the extreme edge
 - Neuromorphic computing
 - Swarm Computing

05. Conclusion

Challenges

- **Data Space**
 - Data Interoperability
 - Connection of (IoT & DTw) systems to Dataspaces
- **Trustworthiness**
 - Conformity Assessment and Quality Assurance
 - MSS
- **DTw for Metaverse**
 - Integration of Digital Twins With Extended Realty (XR)
 - DTaaS and Cloud-based Solutions
 - Growth into New Markets and Domains

05. Conclusion

Future SC 41 Plenary Meetings

- 2025: November 24 ~ 28, Berlin Germany
- 2026: May 11 ~ 15, Paris, France
- 2026: November 30 ~ December 4, Kanazawa, Japan

05. Conclusion

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- 감사합니다 -

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ICT Standards and Intellectual Property:
AI for All