

ITU Workshop on "Security for 5G and beyond"
(Geneva, Switzerland)

General aspects of future networks including trust networking

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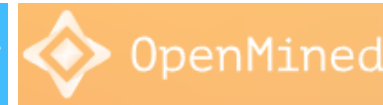
22 August 2022



Introduction

- **Data**
 - From data to actionable knowledge for creating value
- **Connected Intelligence**
 - From Cloud Native to AI Native
 - Decentralized intelligence
- **Fully automated Infrastructure**
 - AI for networks and Networks for AI

Decentralized AI Platforms



ALGORITHMIA

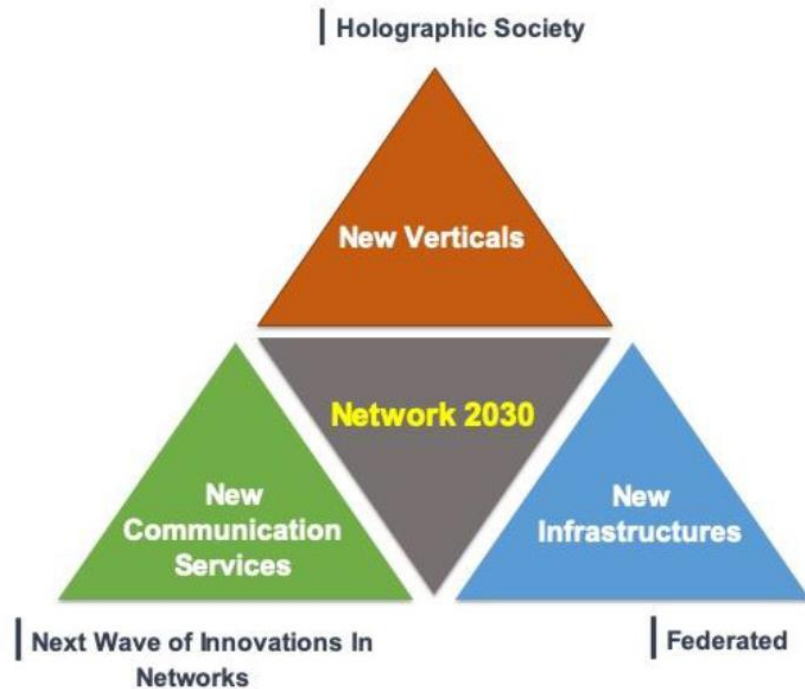


Trustworthy Networking and Services

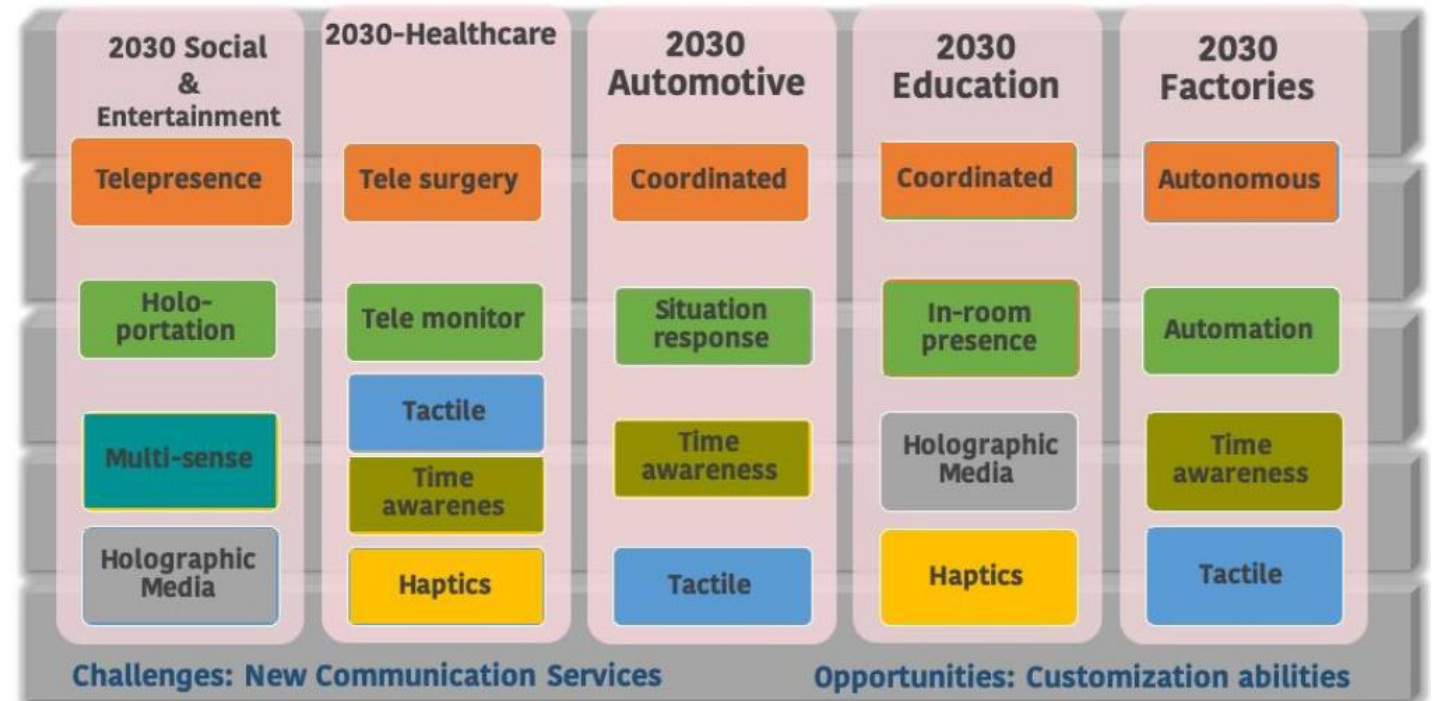


Future Networks in ITU-T (FG NET-2030)

- Network 2030 Vision



Enabling Vertical Markets with Network 2030



12 Principles for Data Driven Ecosystems

	Principles	Challenges
1	Data spaces are ecosystems of systems	Structuring and operating an ecosystem of ecosystems
2	Data usage require provisioning from connecting devices	Creation of value associated with usage control
3	Data spaces support data lifecycle	Characterizing and managing data lifecycle
4	Data interoperability enabled by a common language	Common language for semantic interoperability
5	Data usage enabled by common data models	Common data models for behavioral interoperability
6	Data curation	Organisation, description, cleaning enhancing and preserving for public use
7	Trust in data sharing	Trustworthiness and risk management
8	Governance for ethical usage of data	Governance and ethics
9	Decentralisation	Decentralisation
10	Integrated data management	Data fabric
11	Extensible data spaces	Scaling-up data spaces
12	User-centricity	Business roles and interactions

5G and Beyond

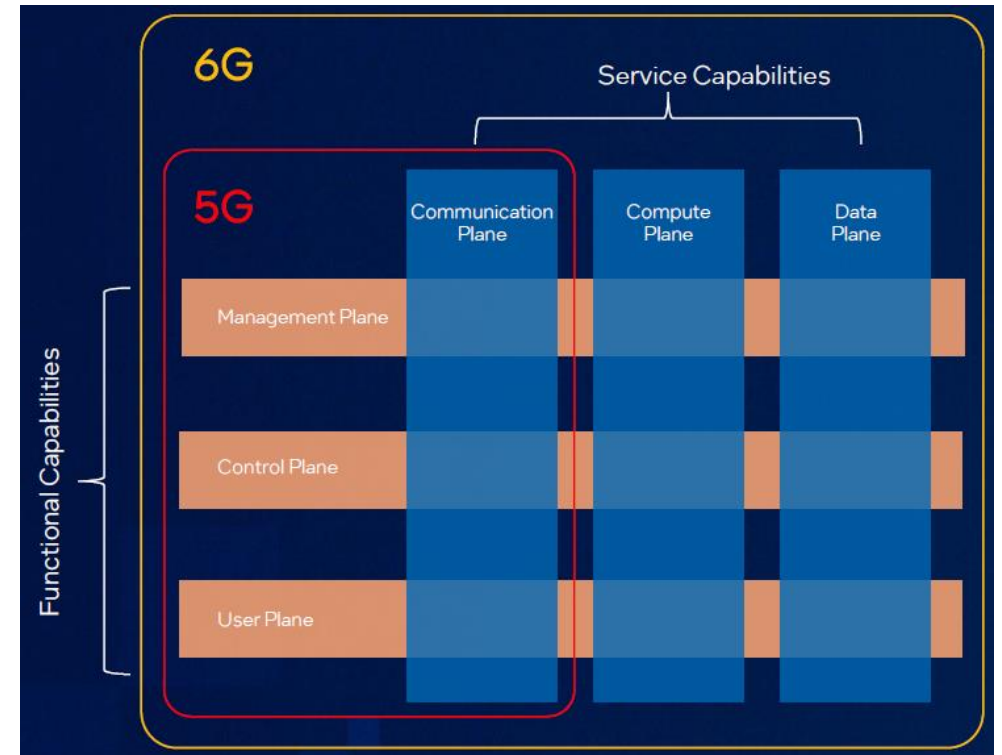
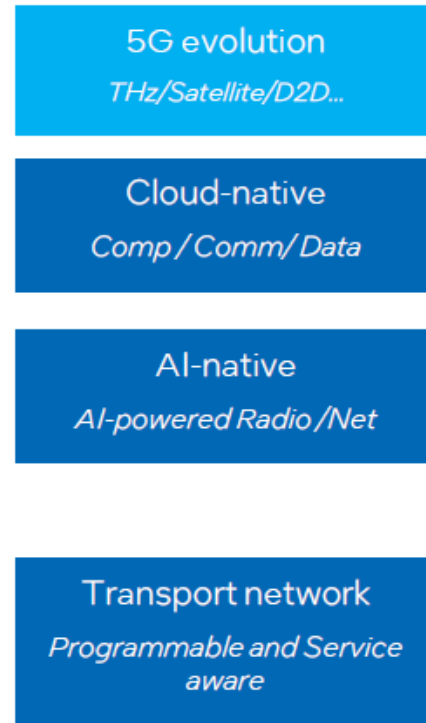
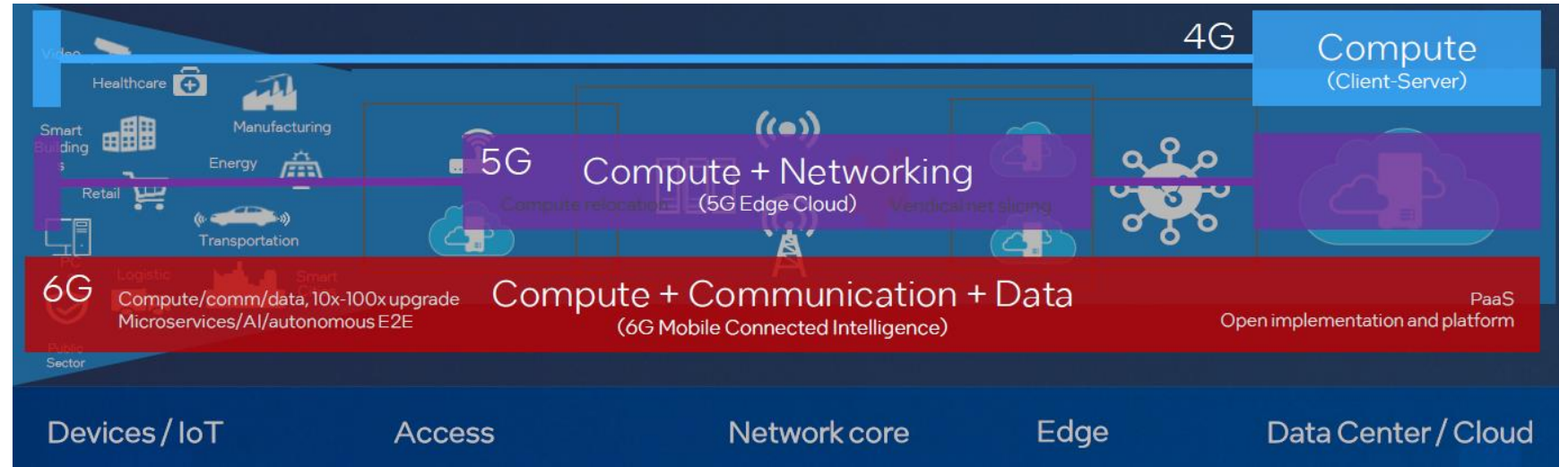
Compute +
Communication +
Data

Cloud-native
AI-native



Trust-native

Security, Privacy and Resilience



Technologies to enhance trustworthiness (ITU-R)

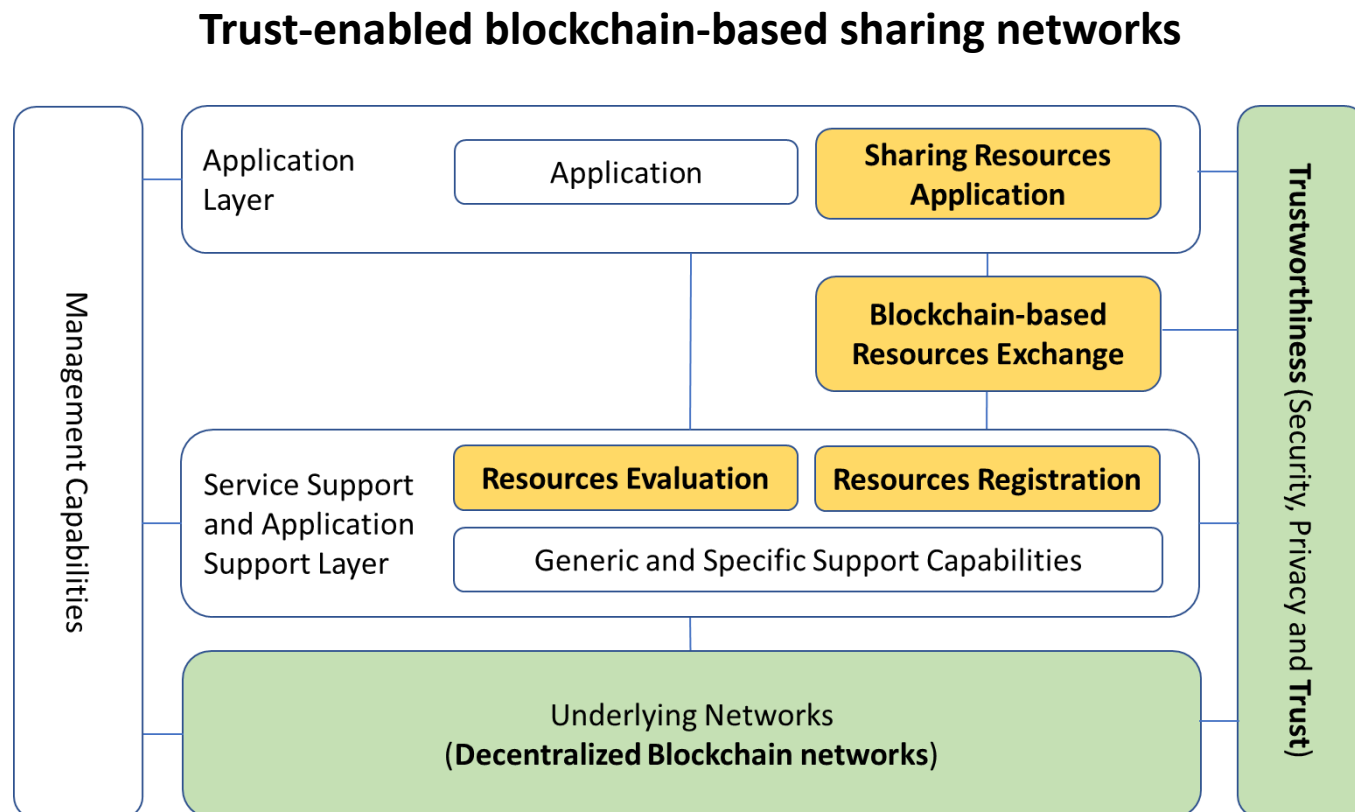
- RAN privacy
 - distributed ledger technologies, differential privacy approaches
- Quantum technology with respect to the RAN
 - a location-aware cryptographic system
- Physical-layer security technologies
 - enhance the resilience and robustness of IMT systems against active attacks at the physical layer through stealthy waveform and code design

Recent activities in ITU-T SG13

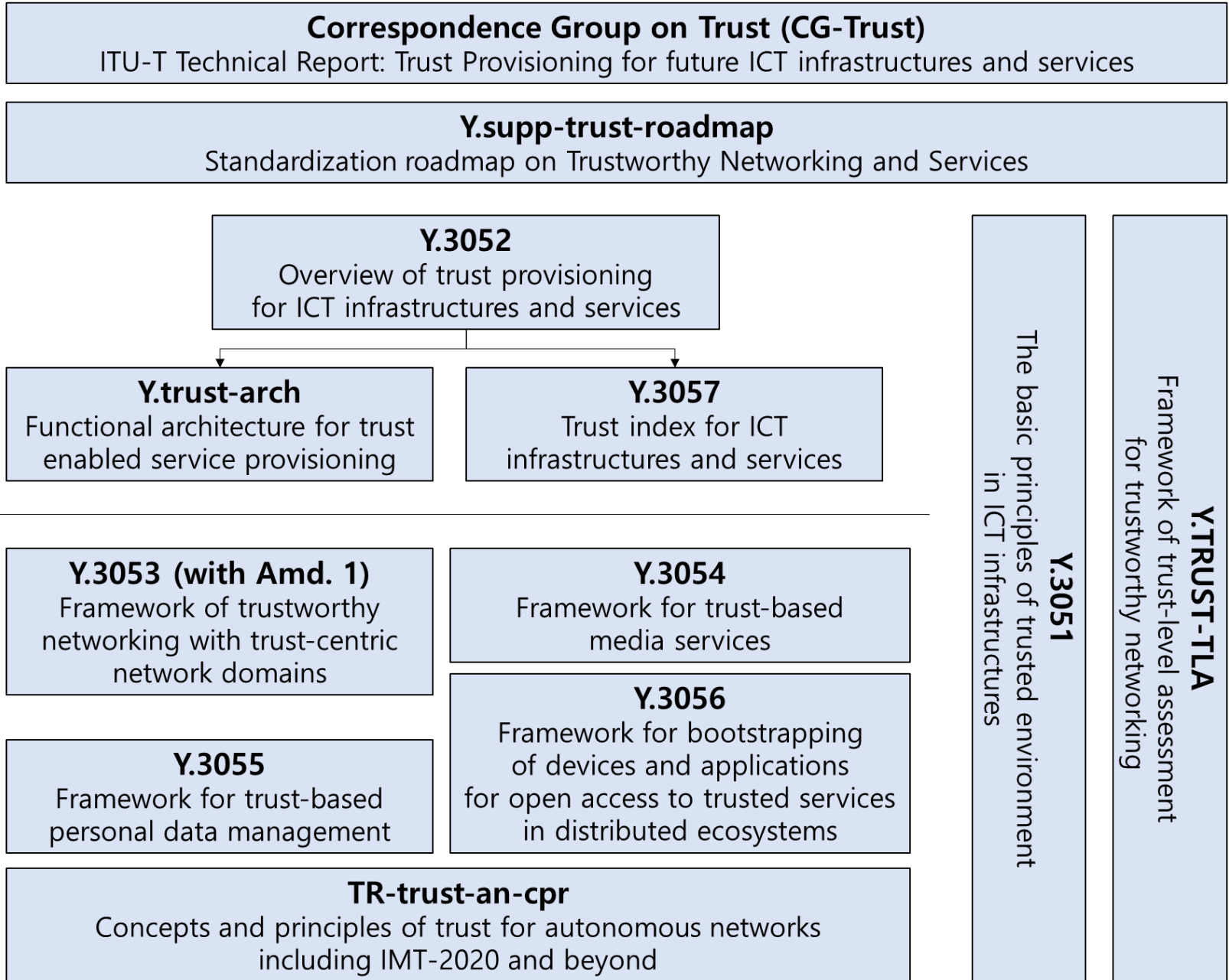
- FG-AN (Autonomous Networks)
- JCA-ML (Machine Learning)
- JCA-IMT2020 (IMT-2020 and beyond roadmap)
- CG-datasets for AI/ML in networks
- Ad-hoc group on CNC (Computing and Network Convergence) definition coordination
- Ad-hoc on "Future ICT Evolution for emerging Web Era"
- CQ - Quantum communications related studies

Networking with Blockchain/DLT in ITU-T SG13

- **Y.2086 (ex Y.DNI-fr):** Framework and Requirements of Decentralized Trustworthy Network Infrastructure
- **Y. 2342 (ex Y.NGNe-BC-reqts):** Scenarios and Capability Requirements of Blockchain in Next Generation Network Evolution
- **Y.NRS-DLT-arch:** Functional architecture of network resource sharing based on distributed ledger technology
- **Y.NRS-DLT-reqts:** Scenarios and requirements of network resource sharing based on distributed ledger technology



Standardization on Trust in ITU-T SG13



(source) Y.Supp.trust-roadmap

Trust Definition

Trust of a party **A** to a party **B** for a **given task S** is the measurable belief of **A** in that **B** accomplishes **S** dependably for a specified period **P** within a particular trust context **T** (in relation to the task **S**)

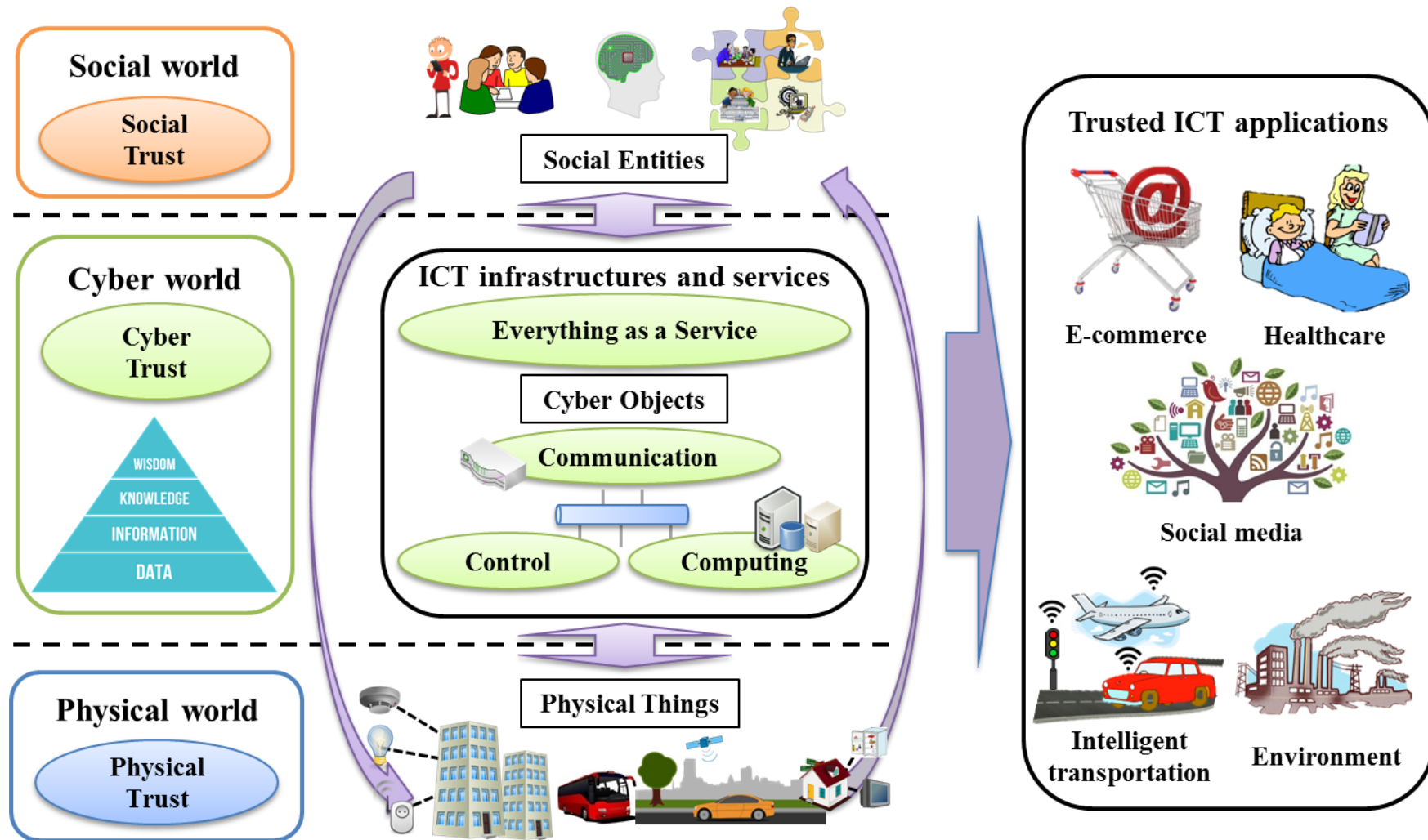
Trust is **relative** to a specific task (a service). Different trust relationships appear in different business contexts

The measurement may be **absolute** (e.g. probability) or **relative** (e.g. Level of Trust)

This period may be in the **past** (history), the **duration of the service** (from now and until end of service), **future** (a scheduled or forecasted critical time slot), or always

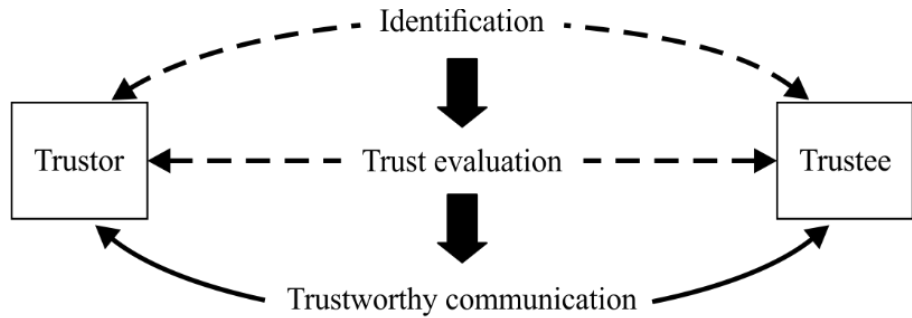
Dependability is deliberately understood broadly to include **availability, reliability, safety, confidentiality, integrity and serviceability**

Social Cyber Physical Trust



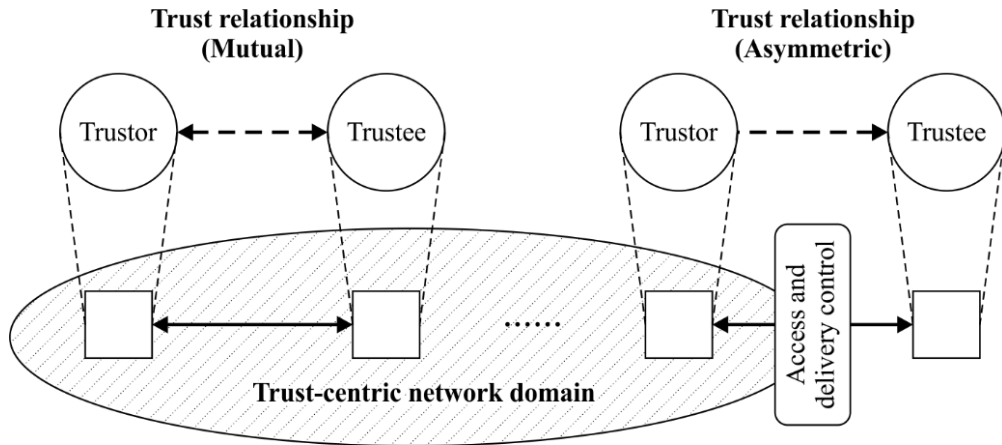
(source) ITU-T Y.3052

Trustworthy networking



□ Network element in trustworthy networking

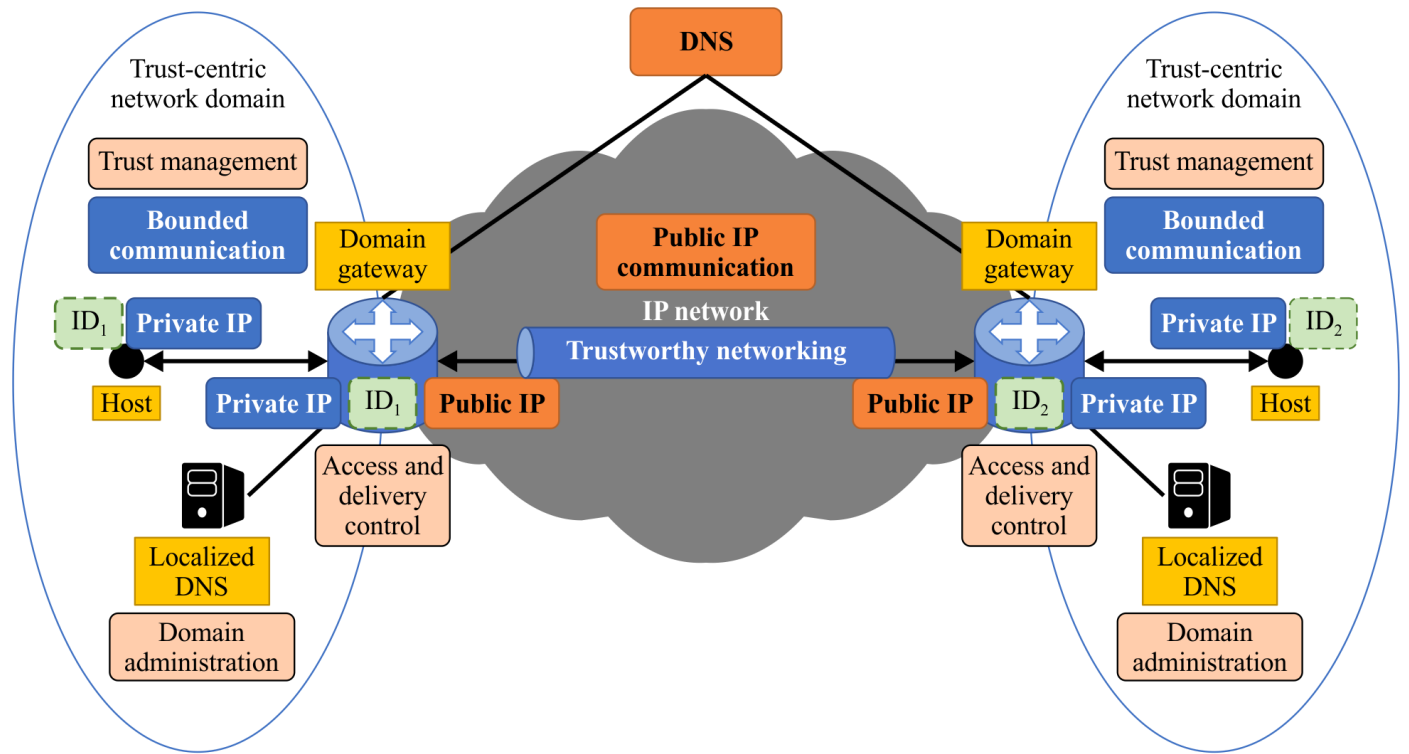
Y.3053(18)_F01



□ Network element in trustworthy networking

Y.3053(18)_F02

Conceptual architecture of trustworthy networking in IP networks



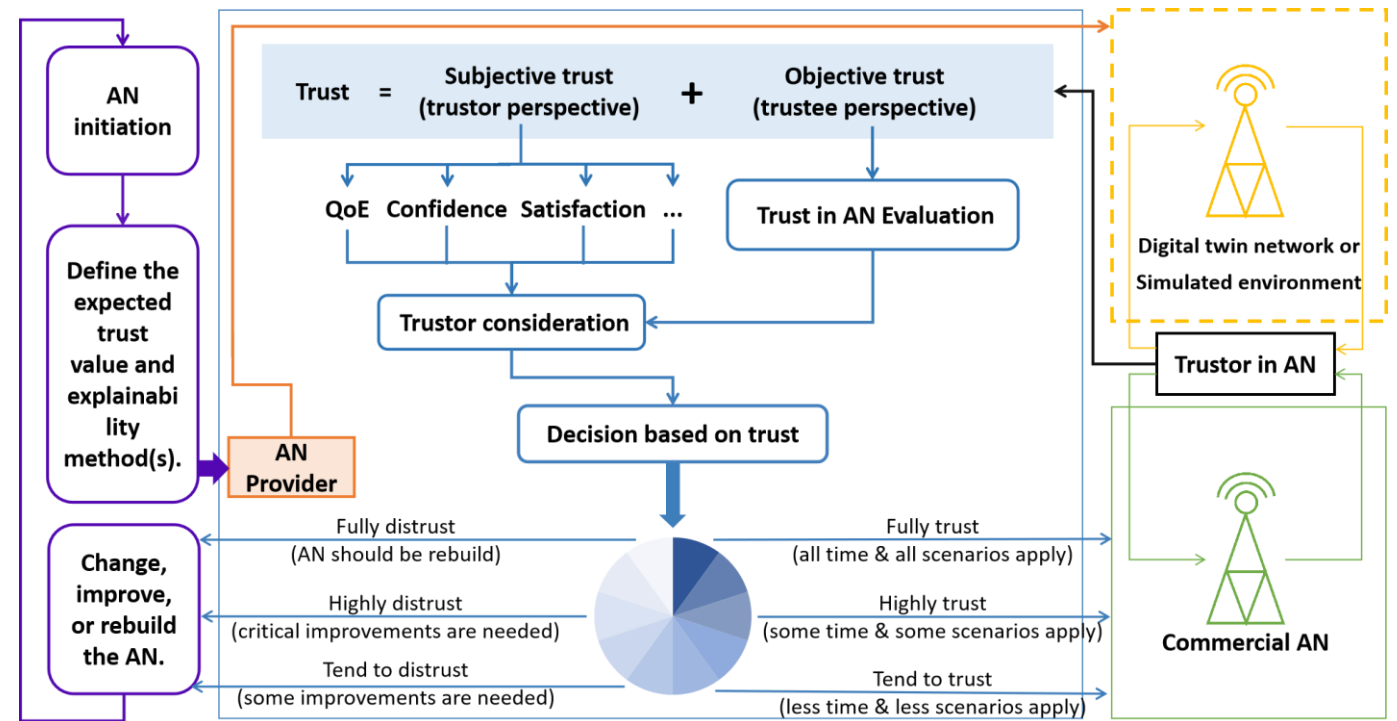
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(source) ITU-T Y.3053

Trust in Autonomous Networks

Self-configuring, self-healing, self-optimizing and self-evolving networks

- **Data-driven network architecture**
 - insights from data and decision-making based on data
 - **Trustworthy** operation
- **Quality of Trust**
 - The description or measurement of the overall trustworthiness of a network element, and the trustworthiness requirements from applications or services.
 - **QoT levels**



ITU-T FG-AN, Q16/13 work item on trust in AN

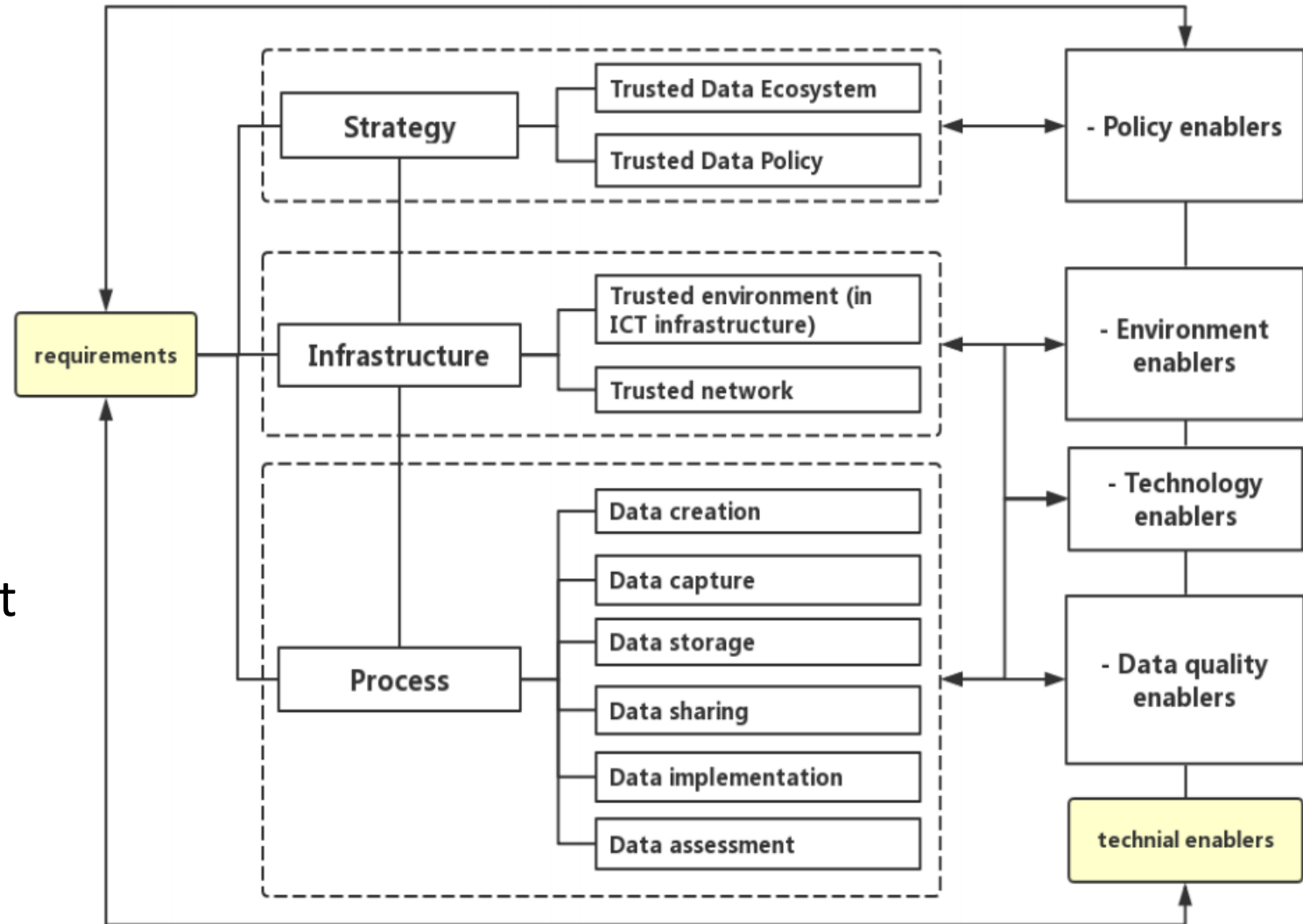
Trusted Data

Data Quality

- Accuracy
- Completeness
- Consistency
- Timelines
- Integrity
- Validity

Data Quality Measurement

Data Quality Control,
Assurance, Improvement
and Planning

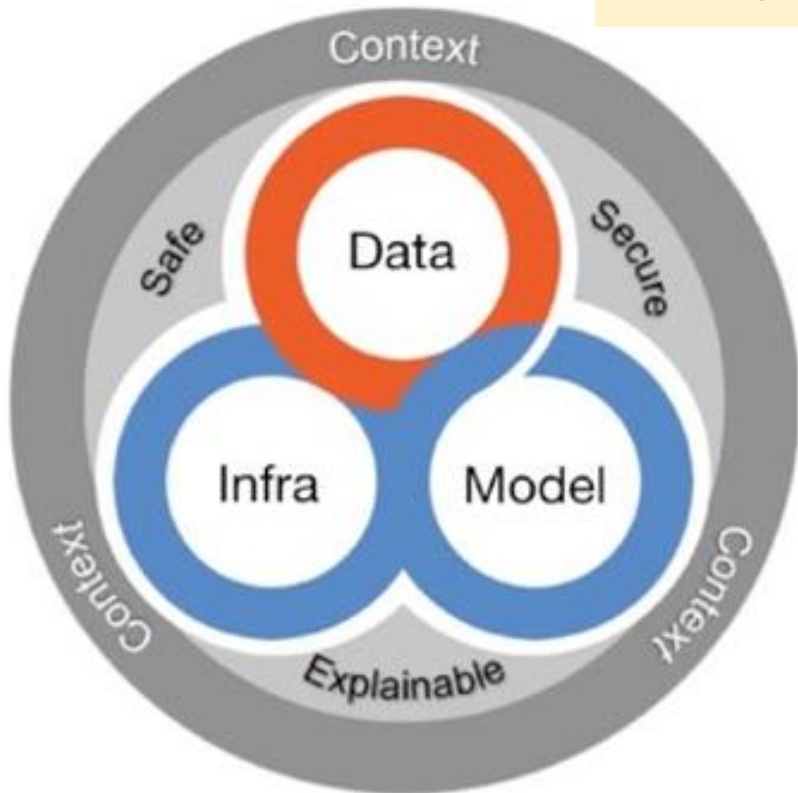


Trustworthy AI

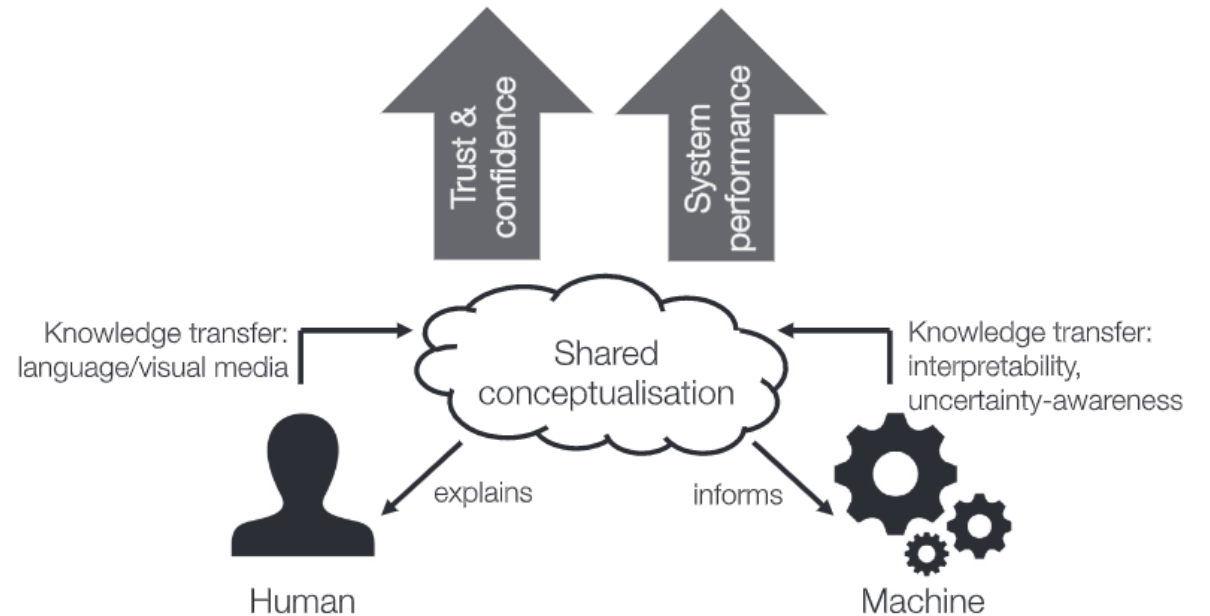
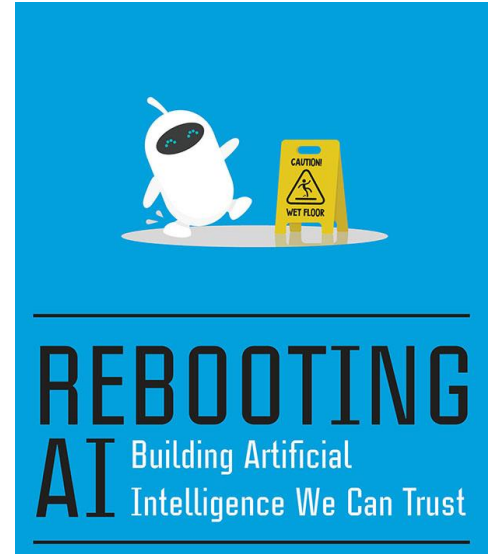
#1: Explainability: Can I explain the decision?

#2: Robustness: Is it secure and compliant?

#3: Bias: Have I been unfair?

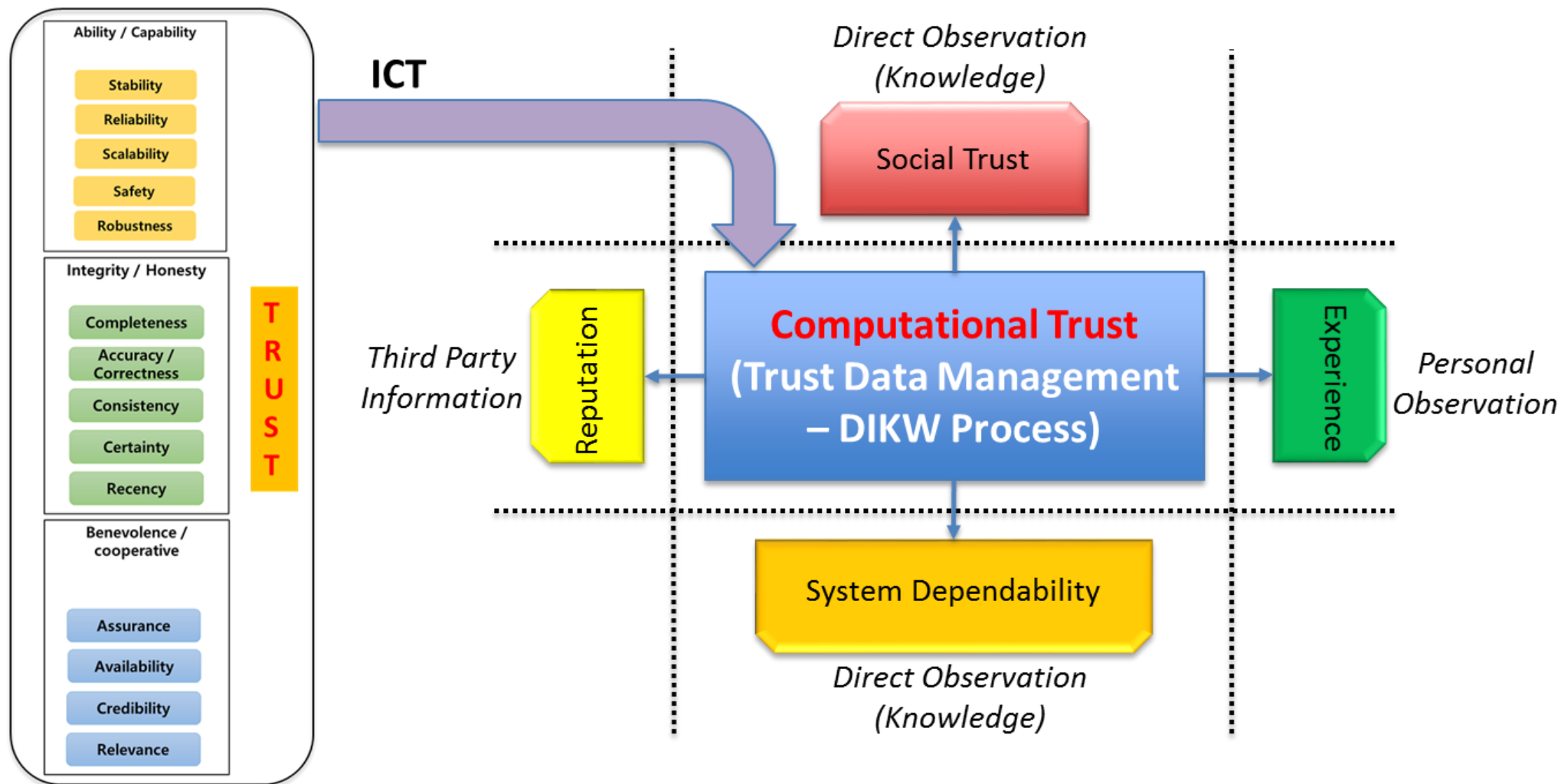


Source: <http://a3i.ai/>



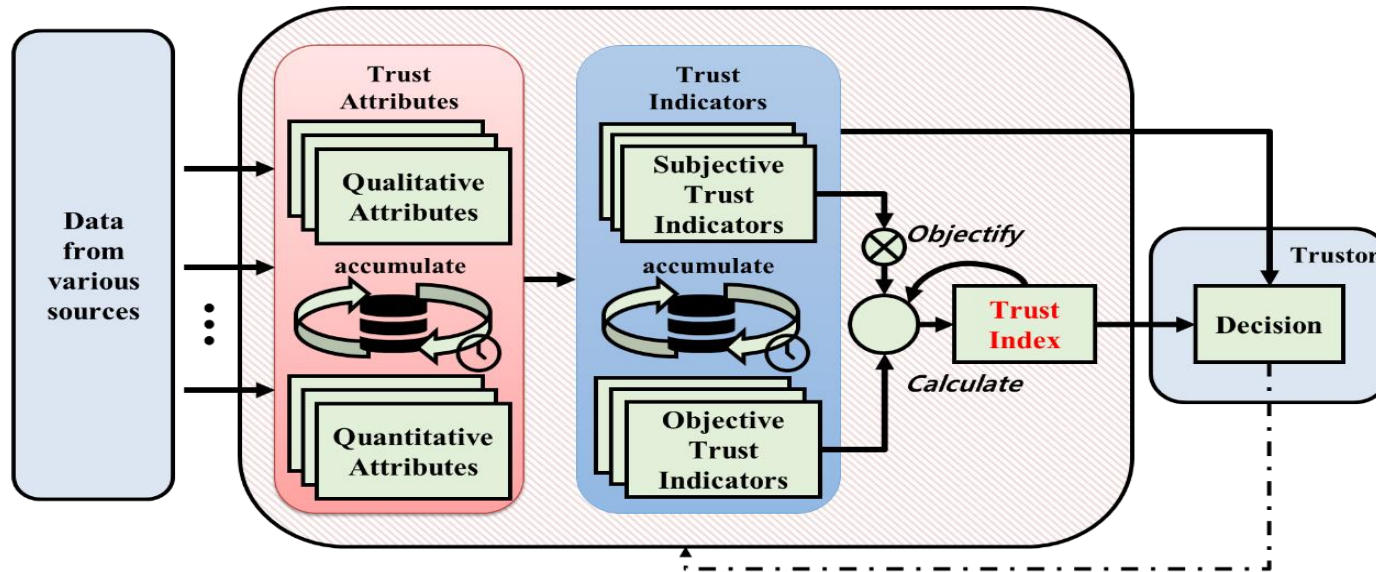
Source: "Rapid trust calibration through interpretable and uncertainty-aware AI"

Computational Trust (measurable belief)

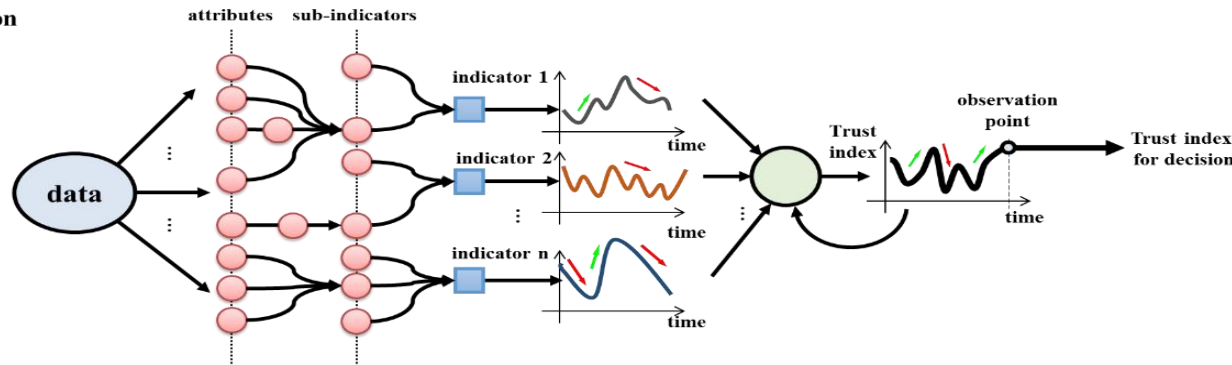


Trust index

Objectively measure and prove the competence



Operation



(source) ITU-T Y.3052, Y.3057

Challenges for trust modelling and measuring

- A new kind of **complex system**
- Trust is **situation-specific** and trust **changes over time**
- **Promote transparency** about what data is collected and how it will be processed and handled
- **A unified approach** towards trust, security and privacy co-analysis, design, implementation and verification
- **Social-cyber-physical trust relationships**

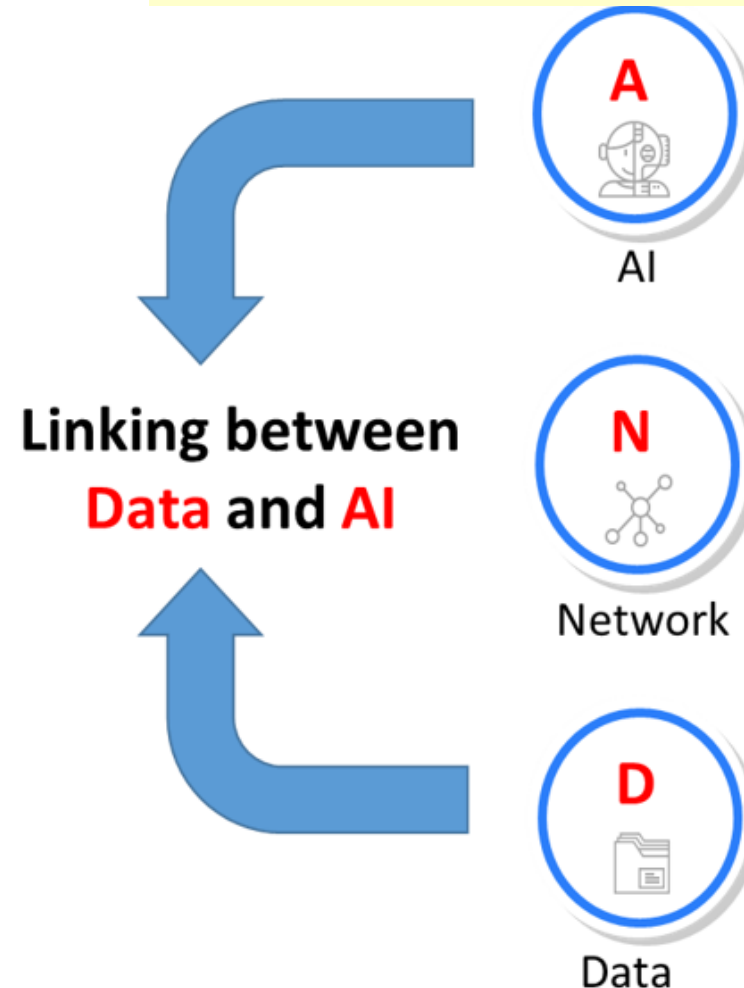
Trust by Design

- Consider trust as a key component

Concluding remark

- Data-centric approach
 - **Trustworthy Decentralized Data Ecosystems with AI**
 - **Native Cloud, AI and Trustworthiness**
- Networks in future networks
 - **Data and AI driven networks**
 - **User-centric (self-X)**
 - **Autonomous networks**
 - Zero-touch, cognitive, OT

Trustworthy Networks of humans, machines and AI



Trustworthiness in Future Networks →
Beyond Conventional Security Solutions

- **Transparency**
- **Data protection**
- **Privacy preserving**
- **Policy and regulatory issues**
- **Ethics**

