World Standards Day

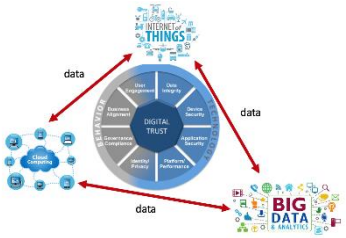
White Paper on
Data Protection and Privacy in Smart ICT

Dr. Matthias Brust

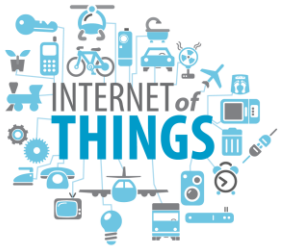
October 2018

Information and Communication Technology

- Currently, three core ICT areas are highly active in research and commercial applicability
  1. **Internet of Things**
  2. **Big Data/Artificial Intelligence**
  3. **Cloud Computing**
- These technologies are highly connected by application types and most importantly by the interchange of **data**
- For these technologies to reveal their full potential
  - **technical standardization** is paramount for success
- Technical standardization supports user adaptability by fulfilling user expectancies, i.e. providing guarantees
  - supporting economic growth
- Technical standardization is **key to implement data protection and privacy**
  - standards are chosen also from their potential to address data protection and privacy concerns
  - important for users, citizens and companies to feel safe in using new technologies

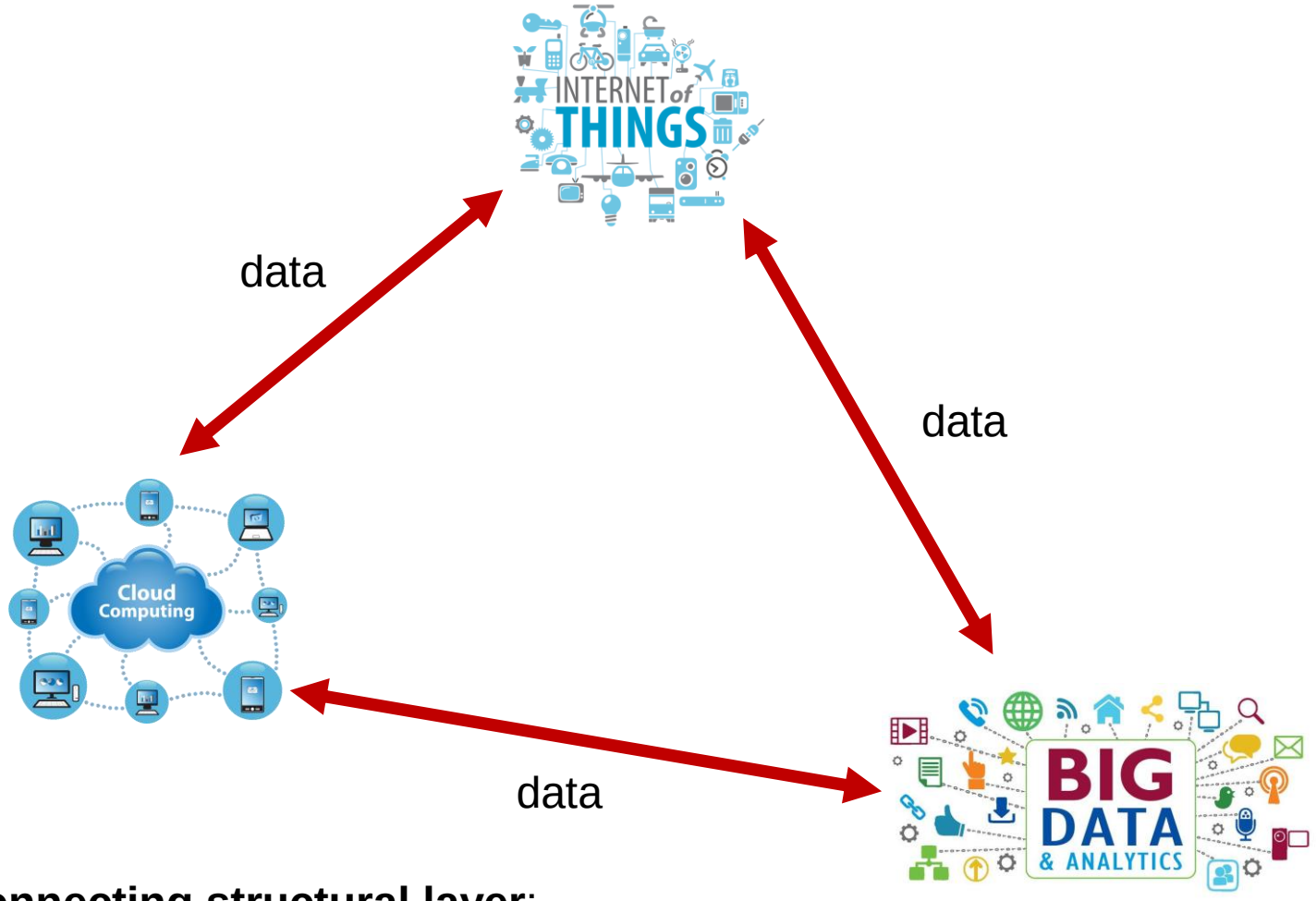


The trustful Smart ICT Ecosystem



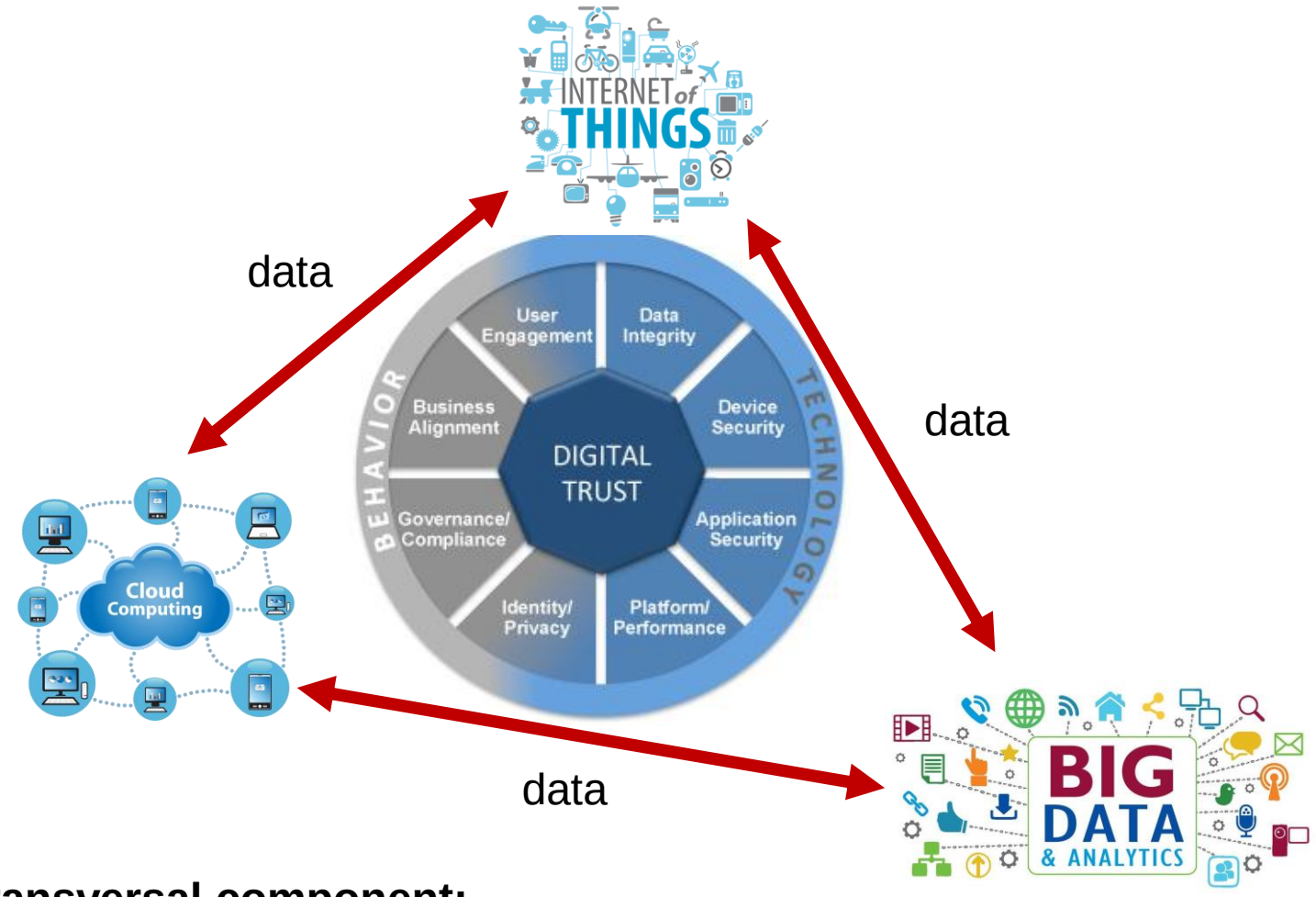
Technological pillars:
Internet of Things, Big data/AI, Cloud Computing

The trustful Smart ICT Ecosystem



Connecting structural layer:
Data

The trustful Smart ICT Ecosystem



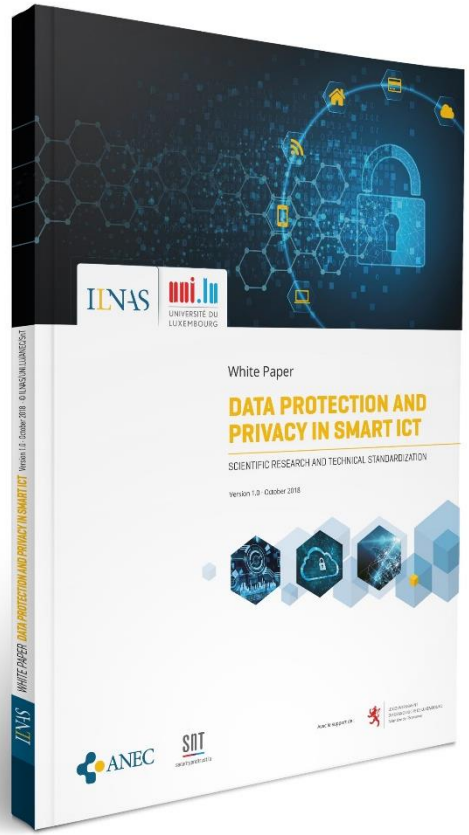
Transversal component:
Data Protection & Privacy

White Paper on
Data Protection & Privacy in Smart ICT

- For better understanding of **Data Protection and Privacy in Smart ICT Data**
  - scientific and technological challenges
  - economic potential
  - understanding related standardization needs and efforts

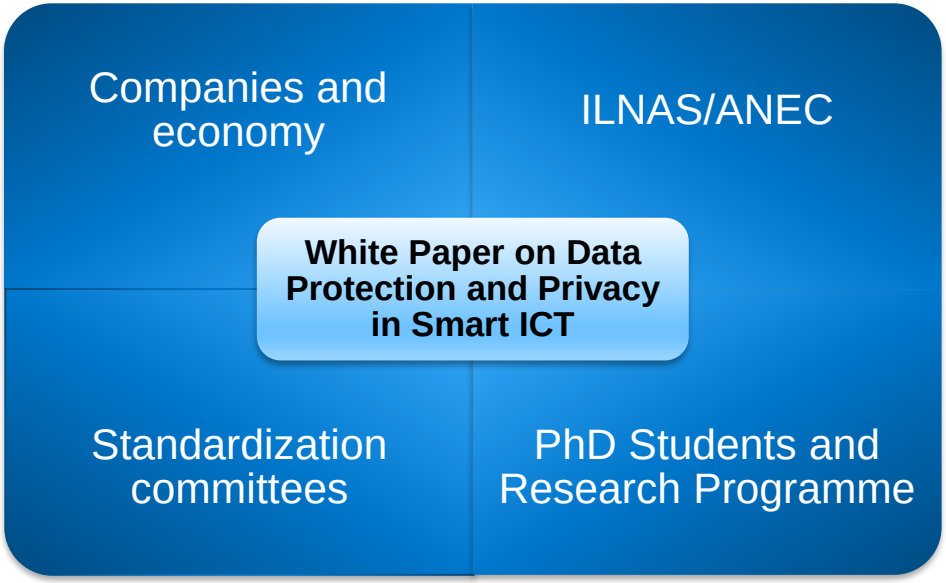
- White paper is developed as part of the **Luxembourg normative strategy**

- Objective
  - analyses the state-of-the-art from research and technical standardization perspectives
  - one of the goals of performing this analysis is to understand the **links between research and standardization**



White Paper: Highlights and Highlights

- Researchers are writing about their respective fields with understanding of technical standardization



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White Paper DPP in Smart ICT Internet of Things (IoT)

Nader SAMIR LABIB

October 2018

The Industrial Revolution

The Steam Engine

First

Electricity

Second

Third

Automation

Industry 4.0
IIoT

Fourth

Img:www.freepik.com

The 4th Industrial Revolution

Potential Benefits of Smart Manufacturing

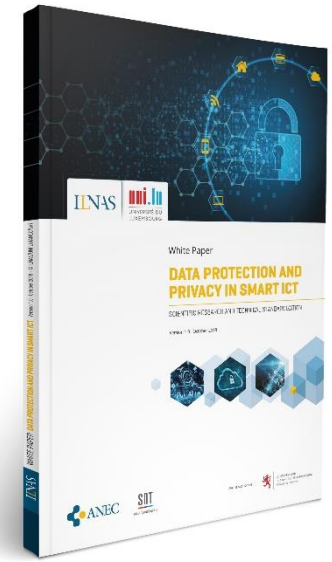
- Transformation from supply chain to digital supply network
- Asset efficiency and corrective optimization
- Improved quality
- Lower costs
- Safety and sustainability

Examples of Data Generated Estimates

- 90% of all data ever created, was created in the past 2 years
- By 2020, we will have 50 times the amount of data generated in 2011 (1.2 trillion GB)
- Airplanes generate approximately 2.5 billion TB of data each year from the engines' sensors
- Self-driving cars are expected to generate more than 2 PB of data every year
- Data generated by manufacturing industries estimated at 2 billion GB in 2010 and expected to grow exponentially in the coming years (McKinsey 2015)

The exponential growth of generated data is accelerated by IoT which is at the heart of 4th Industrial Revolution

Data Protection and Privacy



The Challenges

- Handling security-critical data
- Handling Personal Identifiable Information
- Data Protection and GDPR compliance
- Building trust in IoT systems

Objectives of the White Paper

- State of the art
- Analyse and understand links between research and standardization
  - Foster collaboration between IoT research and standardization
  - Develop more defined roadmaps for the future of research.
- Adopt IoT technical standards in research.
- Align research goals in DPP with market needs;

Internet of Things

Definition

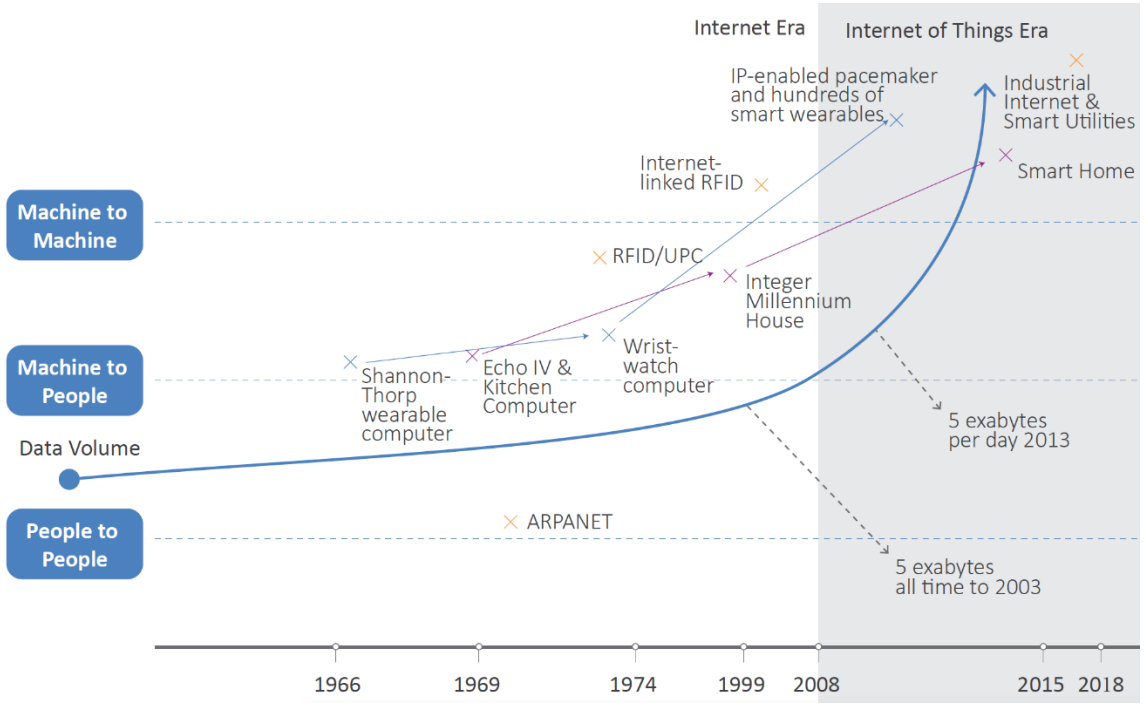
IoT refers to a network of interconnected objects that are uniquely addressable, built on standard communication protocols, and whose point of convergence is the Internet.

Developments Leading to IoT

- Invention of RFID
- Development in sensors technologies
- Development in communication technologies
- Breakthroughs in AI and Cloud Computing

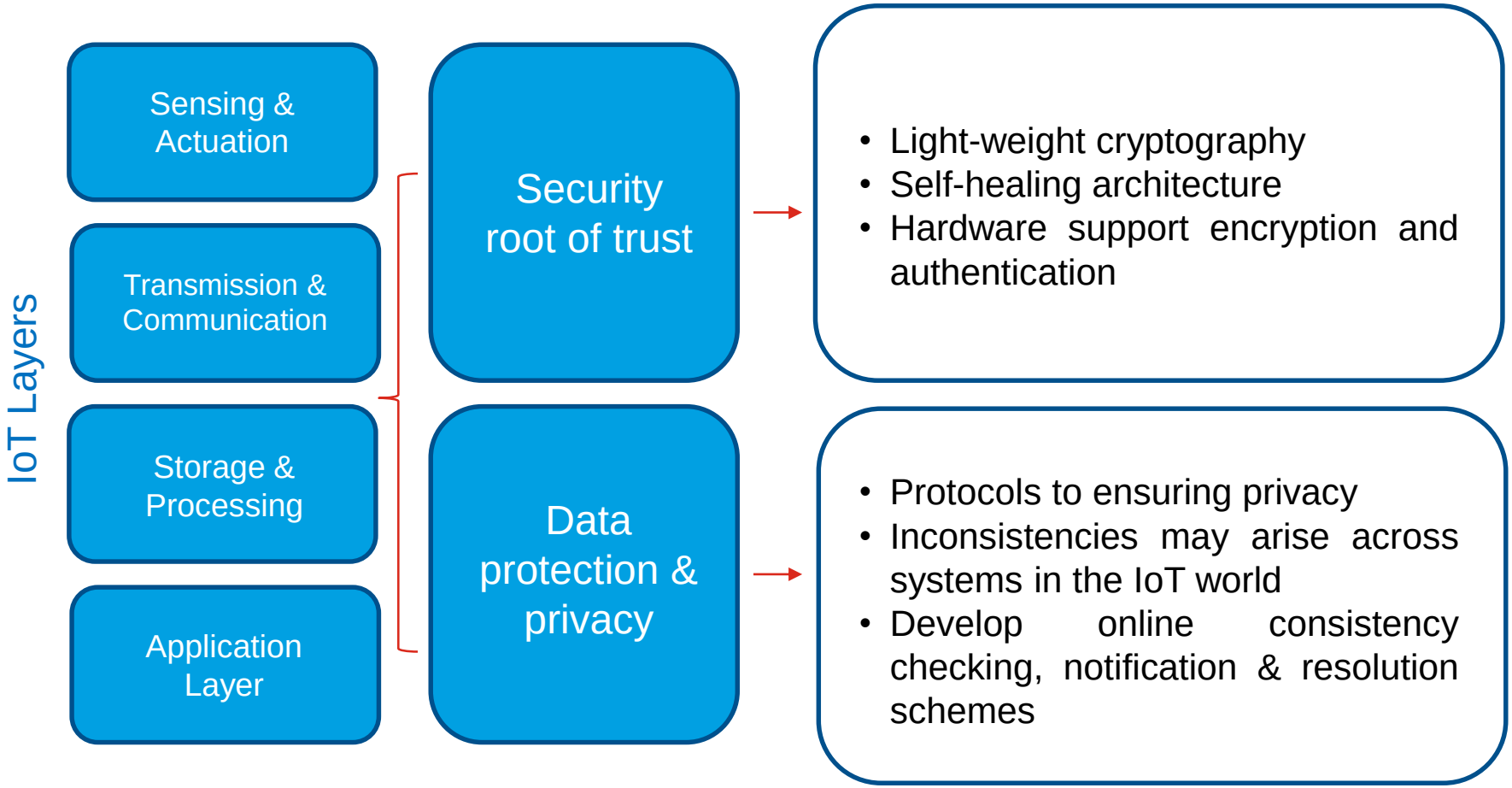
IoT Layers

- Sensing and Actuation layer
- Transmission and Communication layer
- Storage and Processing layer
- Application layer



Data volume changes with development in communication technology - Source: ITU

Scientific Developments



Technical Standardization

Overview

In the context of IoT, technical standards serve as a reference for products, services and processes, and among other benefits, ensure:

- **Transparency**
- **Coherence**
- **Effectiveness and relevance**

Relevant Committees

- ISO/IEC JTC 1/SC 41 Internet of Things and related technologies
- ISO/IEC JTC 1/SC 27 IT Security techniques
- ISO/PC 317 Consumer protection: privacy by design for consumer goods and services
- CEN/CLC JTC 13 Cybersecurity and data protection
- CEN/CLC JTC 8 Privacy management in products and services
- ETSI/TC CYBER Cybersecurity
- ITU-T SG 17 Security

Research and Standardization

Trustworthiness

•Our analysis showed that market's perception of trustworthiness depends on indices of security, privacy and data protection.

Terminology ISO/IEC 20924 *Information technology – IoT – Definition and vocabulary*

•It was evident that various research papers have different definitions for similar IoT-related terms, including the description and definition of IoT itself, highlighting the need for standardized structure and unified definitions.

Reference Architecture ISO/IEC *30141 Information technology – IoT – Reference architecture*

•Research emphasizes the need for having a reference architecture for IoT to support the security and privacy of the network. Implying that this is an active direction of the scientific community in IoT.

Interoperability ISO/IEC JTC 1/SC 41 21823 *series of standards - Interoperability*

•Our research showed that Interoperability still remains a challenge facing scientific community and SDOs.

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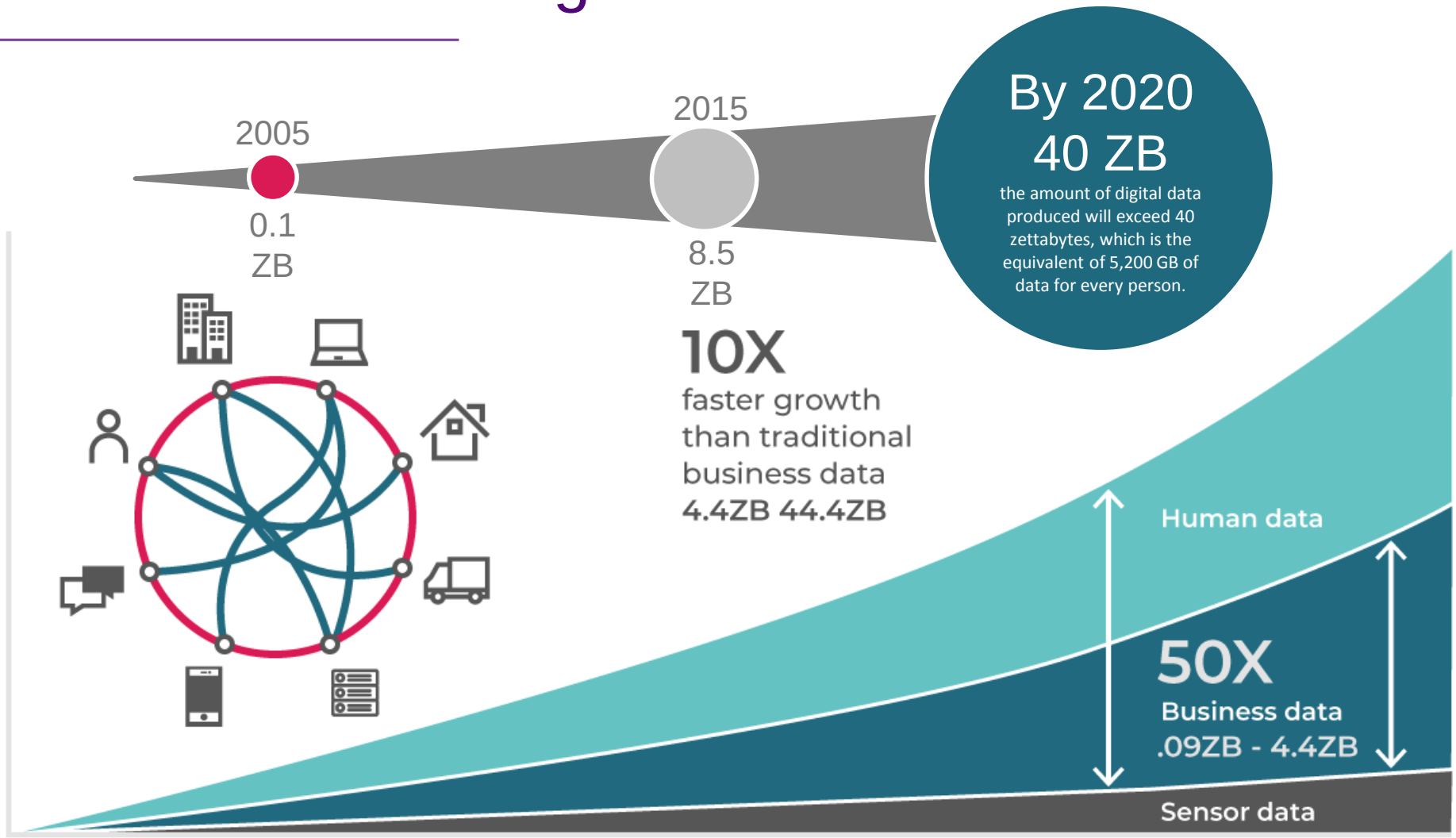
White Paper DPP in Smart ICT Big Data/AI

Saharnaz E. DILMAGHANI

October 2018

Introduction – Big Data



Source: https://insidebigdata.com/2017/02/16/the-exponential-growth-of-data

Big Data Domains

Data Protection, Privacy & Security

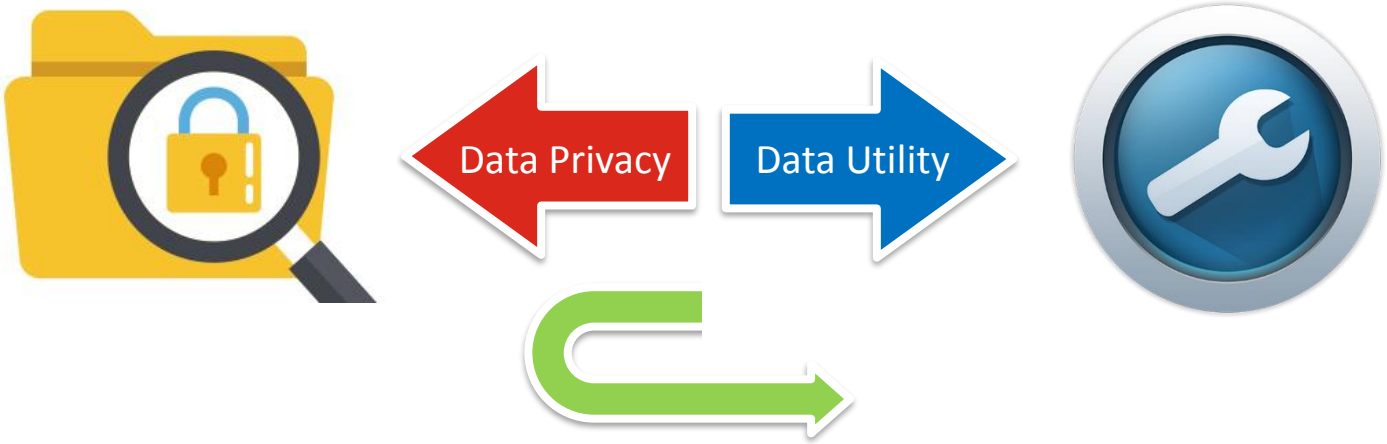
Big data analytics and AI

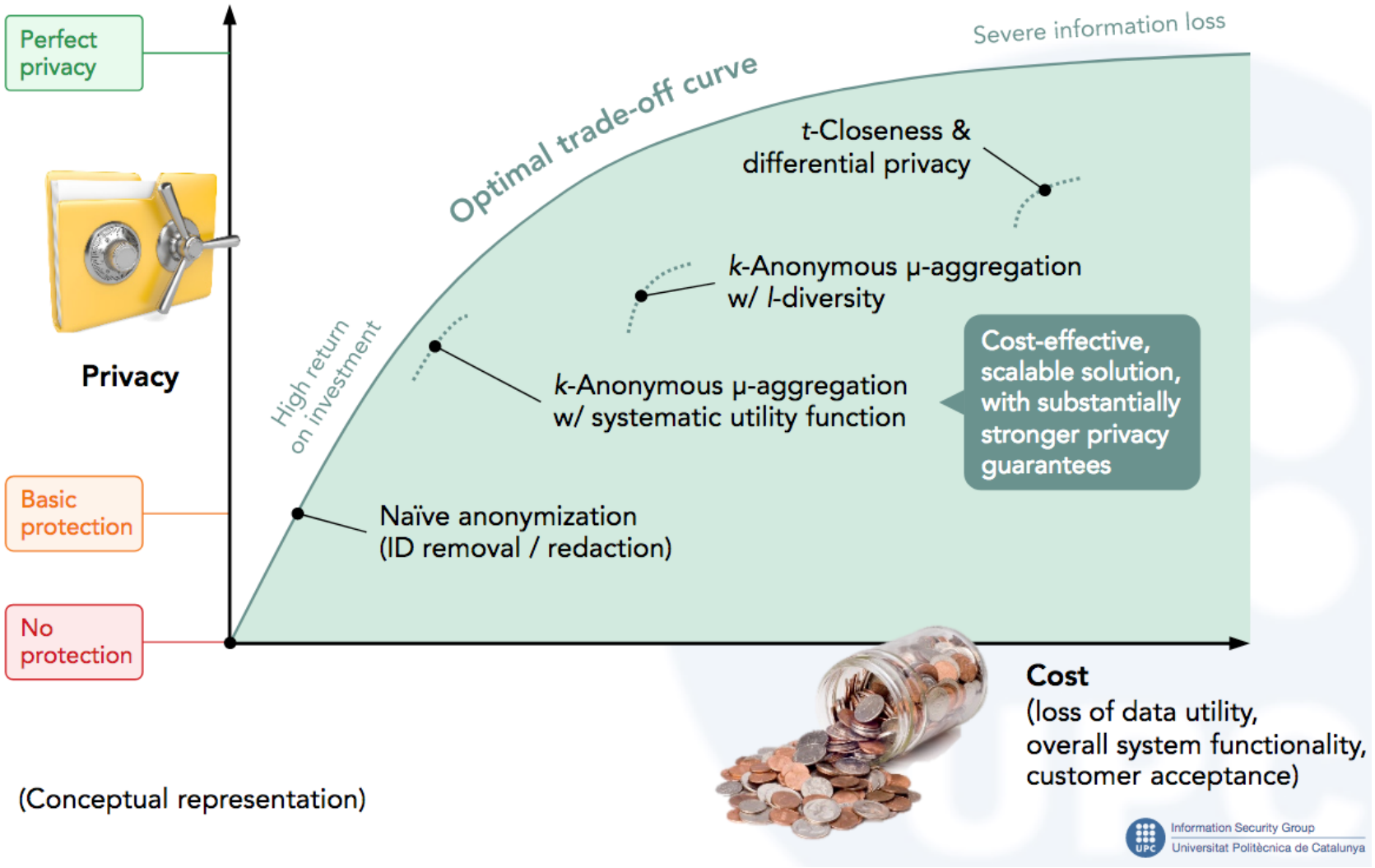
- Sharing data is not without risk!
- “Privacy isn’t about something to hide. Privacy is about something to protect.”[1]

[1] Y. Desta,“Read Edward Snowden’s moving speech[…],” Vanity Fair, Sep 2016.

Trade off between Privacy and Utility

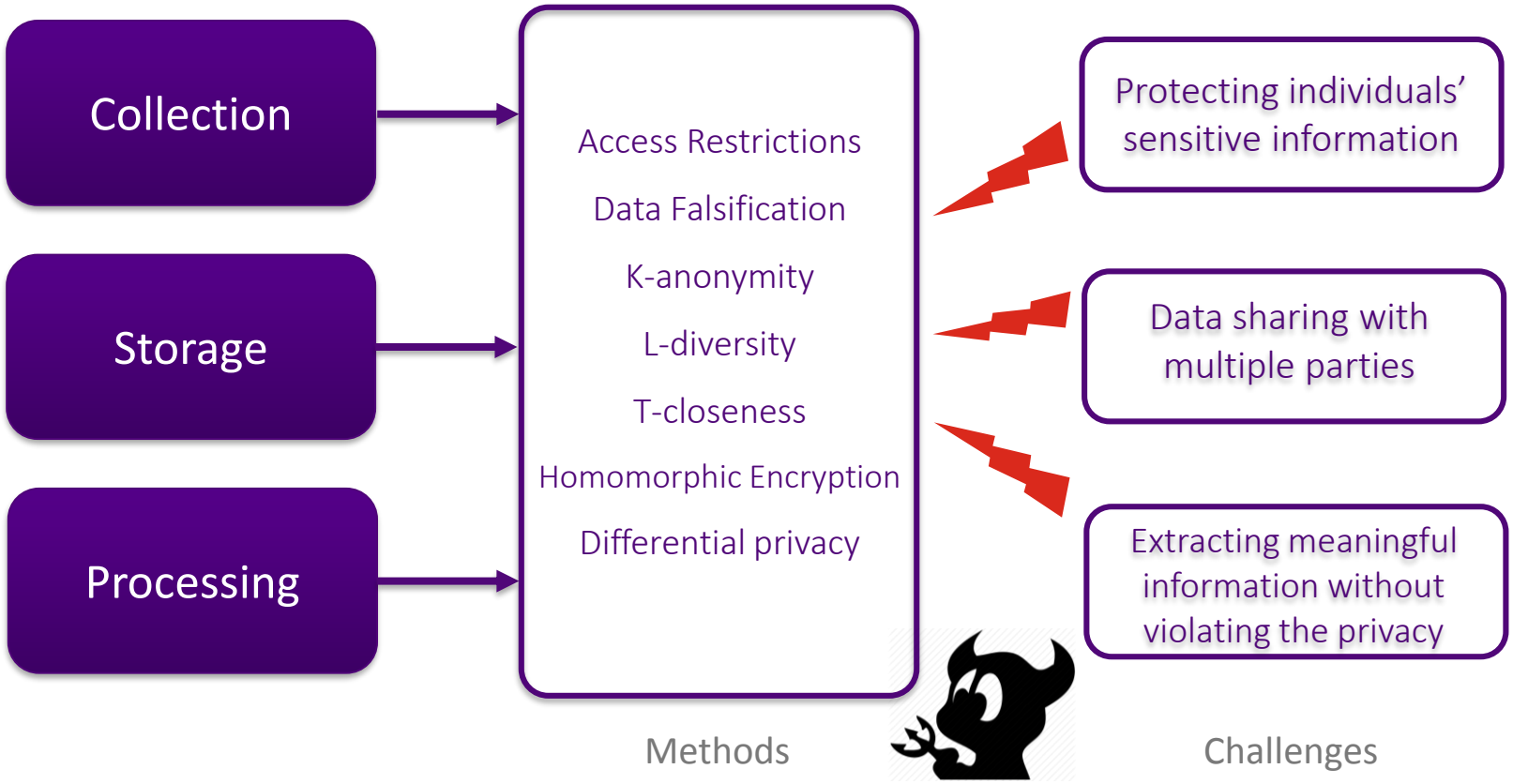
- An efficient privacy criterion should not sacrifice utility for the protection of less serious conditions
- Absolute privacy guarantees lead to an unaffordable price in utility




Perfect privacy
Basic protection
No protection
Privacy
Optimal trade-off curve
Severe information loss
High return on investment
t-Closeness & differential privacy
k-Anonymous μ-aggregation w/ l-diversity
k-Anonymous μ-aggregation w/ systematic utility function
Cost-effective, scalable solution, with substantially stronger privacy guarantees
Naïve anonymization (ID removal / redaction)
Cost
(loss of data utility, overall system functionality, customer acceptance)
(Conceptual representation)
Information Security Group
Universitat Politècnica de Catalunya

Scientific Developments

Data protection and privacy in Big data



Big Data Analytics/Artificial Intelligence Standardization

ISO/IEC JTC 1/SC 42 - Artificial Intelligence

ISO/TC 69 - Applications of statistical methods

- WG 12 Big data Analytics
  - New approved projects:
    - ISO 23347 Statistics -- Big data Analytics -- Data Science Life Cycle
    - ISO 23348 Statistics -- Big data Analytics -- Model Validation

ISO/IEC JTC 1/SC 7 - Software and systems engineering

- Family of standards referred as ISO/IEC 25000 System and Software Quality Requirements and Evaluation (SQuaRE).

Outcomes – Big Data

Links between Scientific Developments & Technical Standardization

- Technical terminology
  - Common language corresponding to Big data
  - Defining metrics for Big data analytics/AI and privacy
- Reference architecture
  - Big data chain and a basic architecture
- Big data processing
  - Differential privacy
  - Privacy by design and data protection by design
- Metrics to evaluate the threshold for the data privacy

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White Paper DPP in Smart ICT

Cloud Computing

Chao LIU

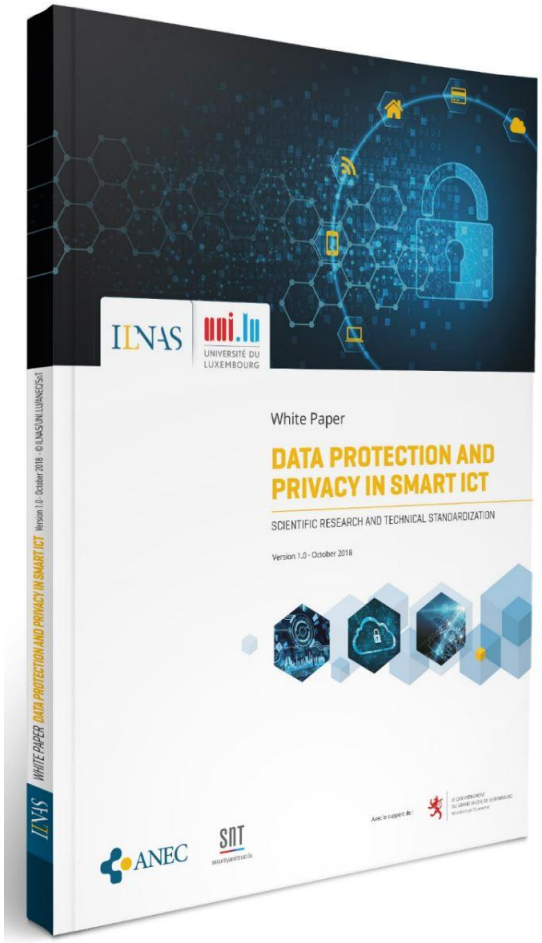
October 2018

White Paper – DPP in Smart ICT

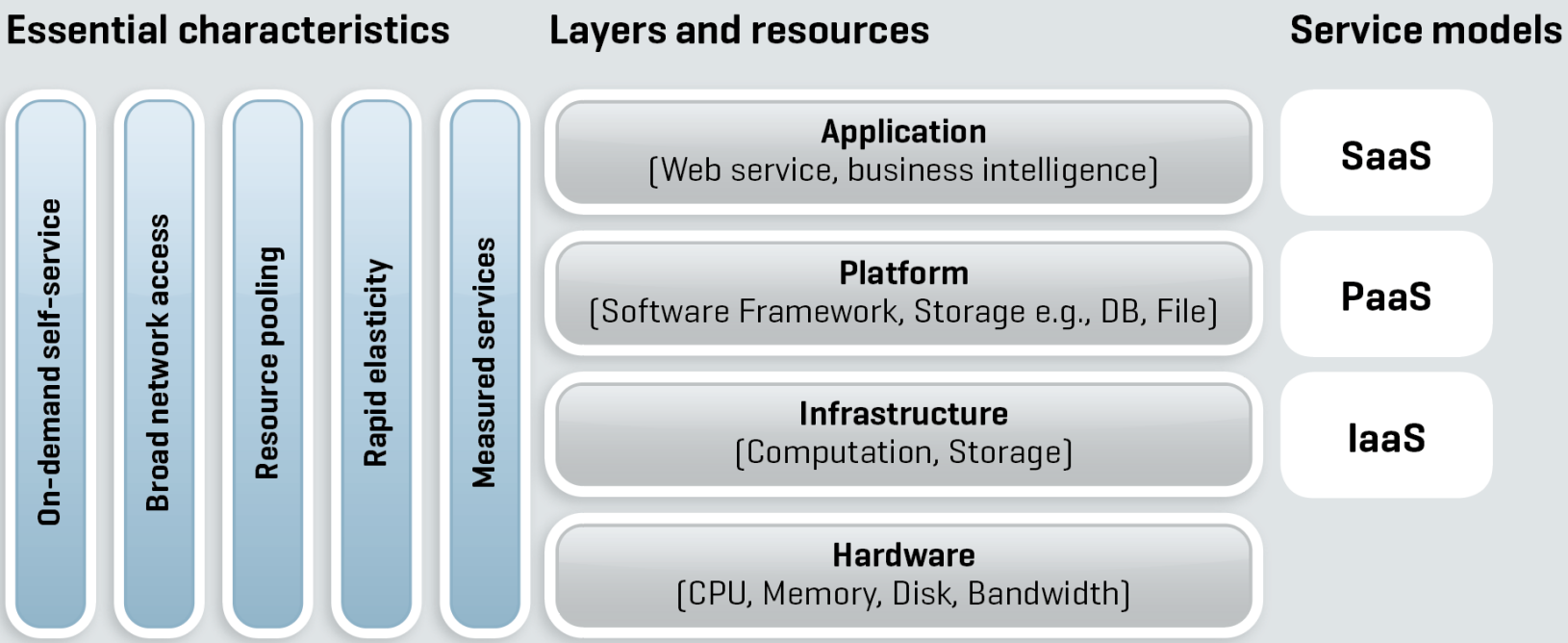
Key Objectives:

Cloud Computing Perspective

- Clarify the fundamentals of Cloud Computing
- Give an overview of data protection and privacy in Cloud Computing
- Explore the links between research and standardization (framework of trust, Interoperability & portability, Terminology)



Introduction – Cloud Computing



Scientific Developments – DPP in CC

Cloud computing aspect	Security, privacy and data protection aspect	Challenges	Potential solutions
Security and privacy controls in the Cloud	Identity management, authentication and authorization	• Exporting users' identities • Securely transferring identity attributes	• Federated identity management [45] [46] [47] • Efficient credentials management [48] • Multi-factor authentication [49] • MiLAMob: a SaaS authentication middleware [50] • A user-centric approach for platform-level authorization [51]
Security and privacy controls in the Cloud	Access control	• Provide access only to authorized users • The risks of information leakage	• RBAC (Role-based access control) [52] • An integrated solution which combines trust with cryptographic RBAC [53] • An authorization-as-a-service approach [54] • Multi domain access control policies: a comprehensive policy management framework [55] [56] • A heuristic solution to find an RBAC state [57]
	Policy management	• Auditing and proof of compliance	• A scalable distributed monitoring system [58]
Inherent properties of Cloud computing	Virtualization, secure service provisioning and composition	• In multi-tenancy an attacker having access to a virtual machine deployed on a given physical machine could compromise other VMs hosted on the same physical machine • Service providers and integrators are required to collaborate in order to provide newly composed services to customers	• The Open Services Gateway Initiative service platform [59]
Data stored and processed in the Cloud	Sensitivity of information	• Lack of users' control over Cloud resources	• Enabling users to define transparency policies over their data [60]
	Confidentiality, integrity and availability of data	• Security and privacy of data • Frequent outages reported on well-known CSPs [61]	• Using verifiable proofs of violation by external third parties [62] • Fuzzy authorization for Cloud storage [63]
	Data storage and transfer locations	• The highly distributed nature of Cloud infrastructures • Certain data protection and privacy laws also apply in specific jurisdiction	(e.g., EU's General Data Protection Regulation – GDPR [64])

Technical Standardization

Overview

- The increasing demand for **transparency, coherence, and effectiveness** in Cloud Computing domains has created a huge demand for technical standards

Relevant Committees

- ISO/IEC JTC 1/SC 38 Cloud computing and distributed platforms
- ISO/IEC JTC 1/SC 27 IT Security techniques

Links Analysis

- **Framework of trust** – Establish the trust mechanisms
  - ISO/IEC 27017 Information technology
  - ISO/IEC PDTR 23186 Information technology – Cloud computing
- **Interoperability and portability** – Providing secure interoperability in Cloud environment
  - ISO/IEC 19941 2017 Information technology – Cloud computing – Interoperability and portability
- **Terminology** – Different definitions for similar cloud-related terms
  - ISO/IEC 19086 – series Information technology Standard – Cloud computing – Service Level Agreement (SLA)
  - ISO/IEC 17788:2014 Information technology – Cloud computing – Overview and vocabulary
  - ISO/IEC 17789:2014 Information technology – Cloud computing – Reference architecture
  - ISO/IEC CD 22123 Cloud Computing – Concepts and Terminology(Under development)