

DIGITAL SERVICES

THEMATIC EXCELLENCE PROGRAM 2019

INDUSTRY AND DIGITALISATION

APPLICATION DOMAIN SPECIFIC HIGHLY RELIABLE IT SOLUTIONS



PROJECT
FINANCED FROM
THE NRDI FUND

Reliable IT services

- **Reliable corporate solutions**
 - Cost efficiency, consistency, performance, maintainability, stb.
- **Reliable technical solutions**
 - Defence against software/server crash, service loss, viruses, malwers, data breach, etc.



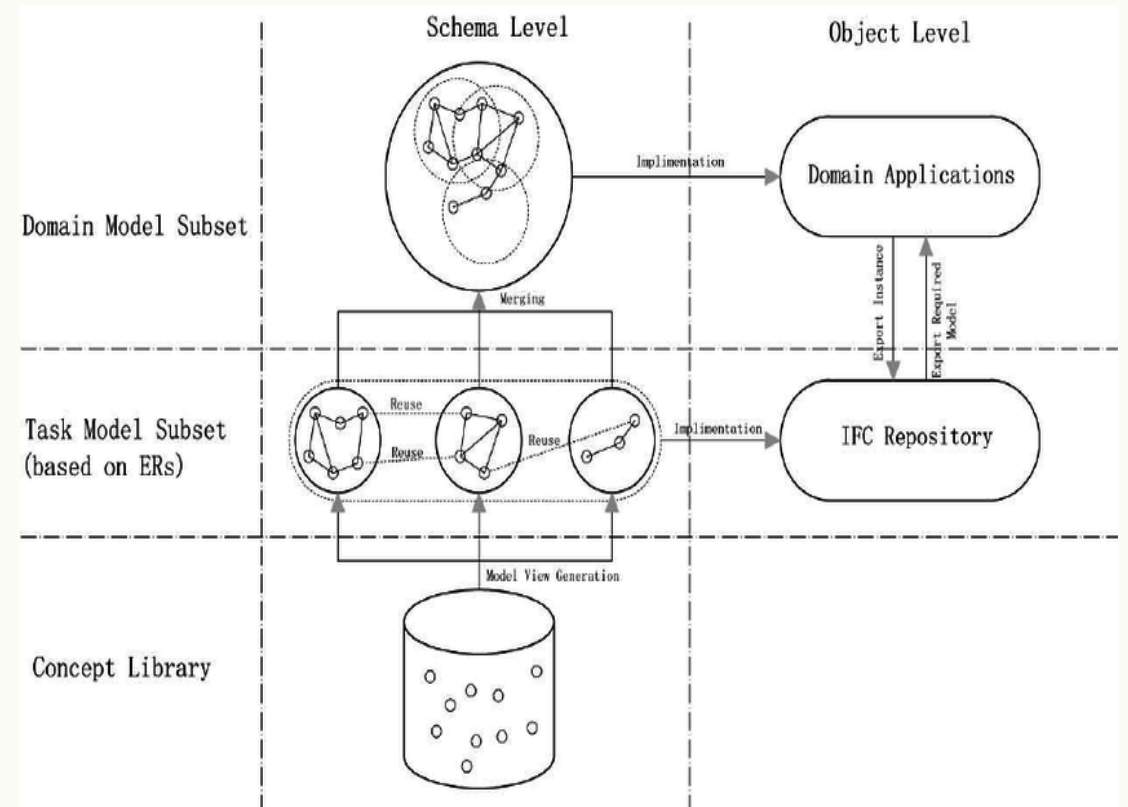
Reliable corporate solutions

- **State of the Art:** when procuring from external parties, organizations focus primarily on the functions provided by the systems and not on reliability
- **Research:** how to produce and deploy high-reliability and cost-effective application systems in a complex organizational/corporate environment.



Reliable corporate solutions

- **Model to Program (M2P)**
 - Generate programs directly from design prepared with accepted industry standards and methods
 - The aim of the research is to produce organizational processes and work processes from formal design

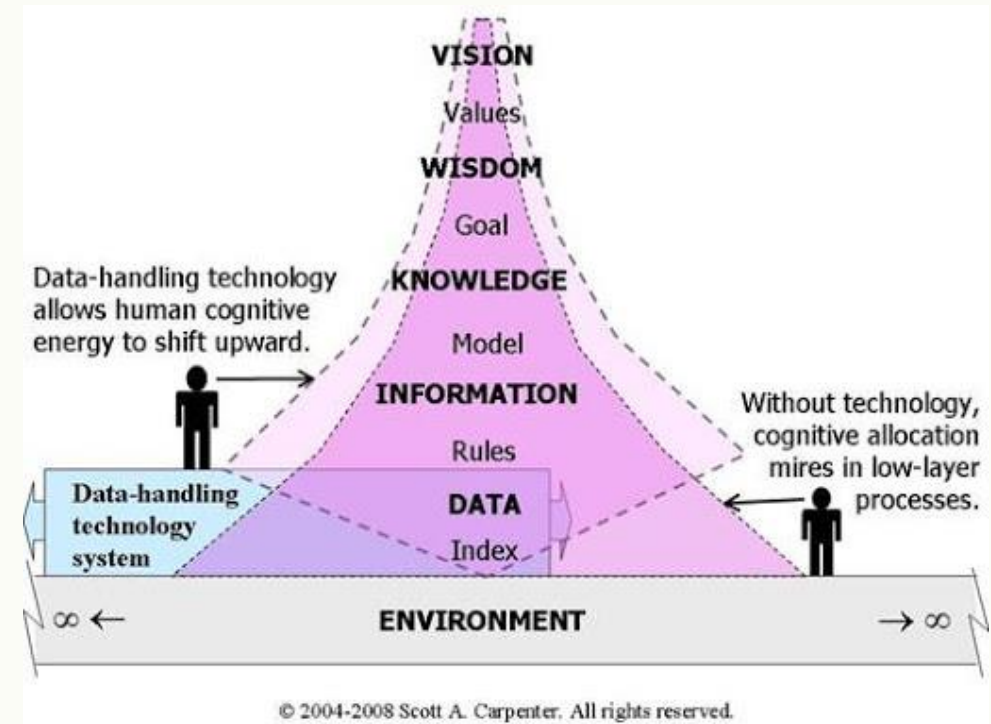


NATIONAL RESEARCH, DEVELOPMENT
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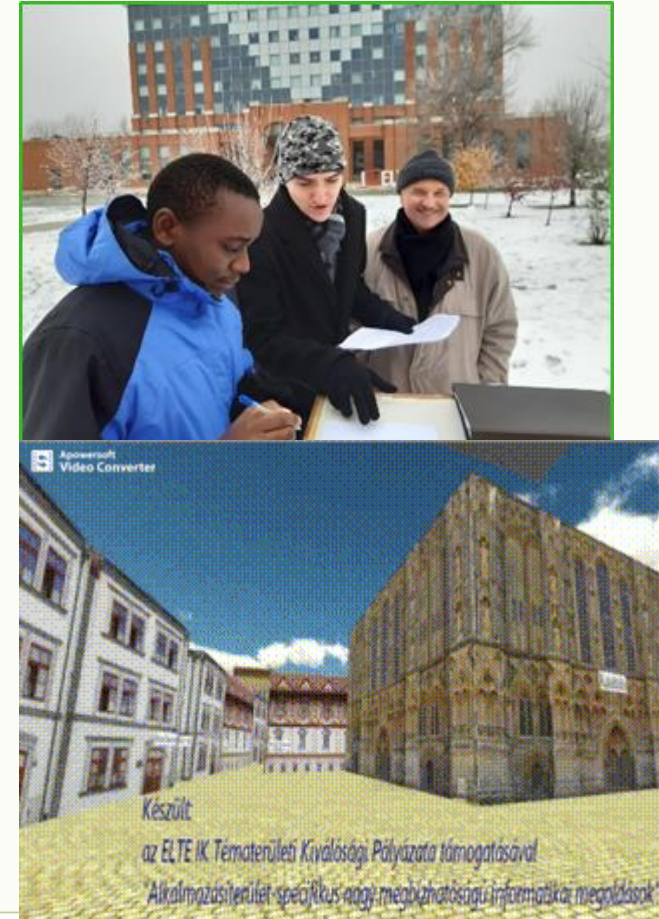
Reliable corporate solutions

- **Cognitive (socio-technological) information systems**
 - **Modeling of the human-machine relationship** in the case of modern (“intelligent”) information systems with IT tools
 - **Developing a unified negotiation framework** with approaches to cognitive sciences, information systems and organizational architectures
 - **Interpretation of the interactions** of intelligent agents through cognitive resonance



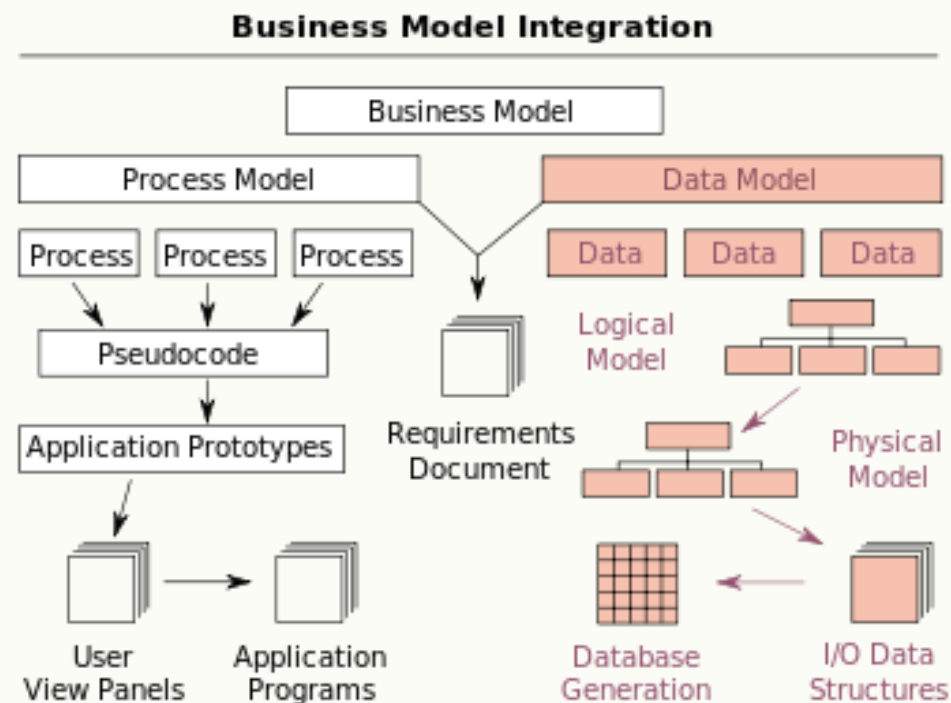
Reliable corporate solutions

- **Spatial orientation frameworks in visualization**
 - **Predict the change between** egocentric (body-centered) and allocentric (external) **orientation frameworks in navigation systems** based on user behavior (e.g. eye movement tracking)
 - **Produce a graphical interface** (a map or a static/dynamic structural model) provided by the information system from the point of view corresponding to the reference frame preferred by the user



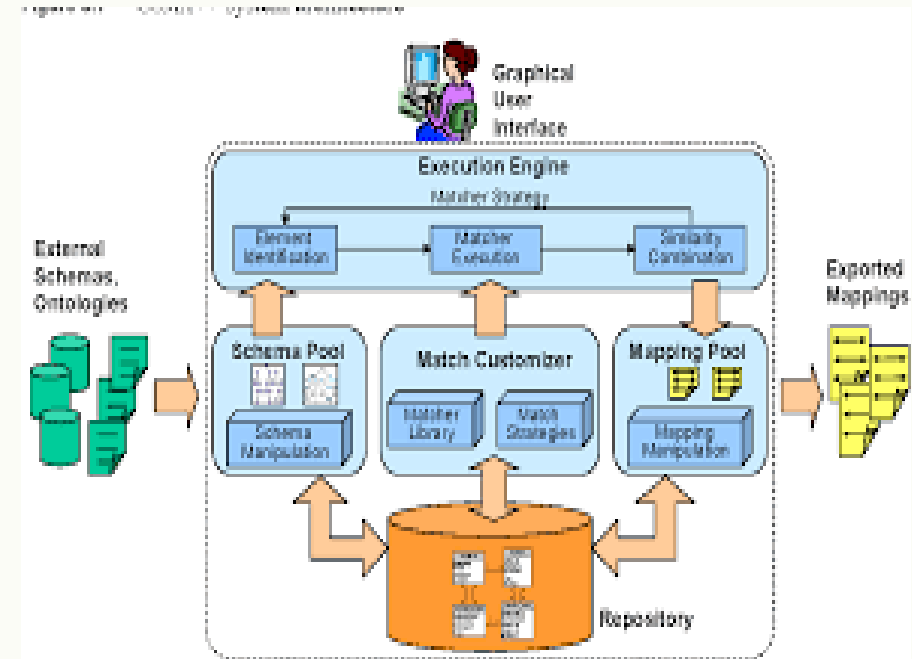
Reliable corporate solutions

- **Graph-based information system modeling**
 - This model describes the data, functional service, and event dimensions of information systems by graphs
 - Can be applied for IoT, data warehouses, data lakes, data processing



Reliable corporate solutions

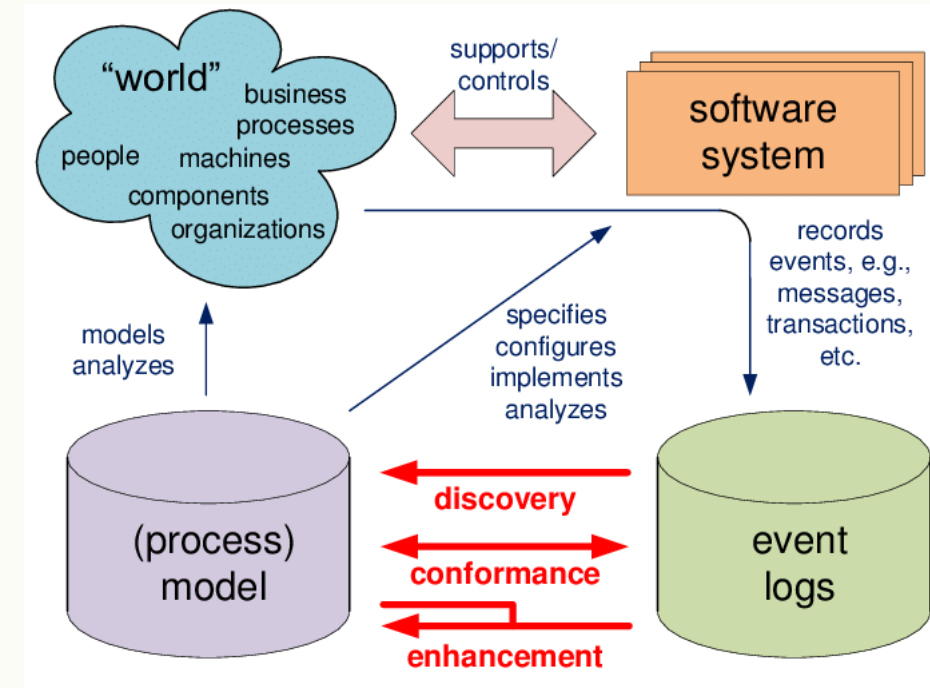
- **System and data migration**
 - Migration of legacy, data transfer, conversion of data structures
 - Integration and migration of database and data warehouse schemas of information systems
 - Investigation of computer intelligence, machine learning, search algorithms, natural language techniques, example-based searching algorithms



Reliable corporate solutions

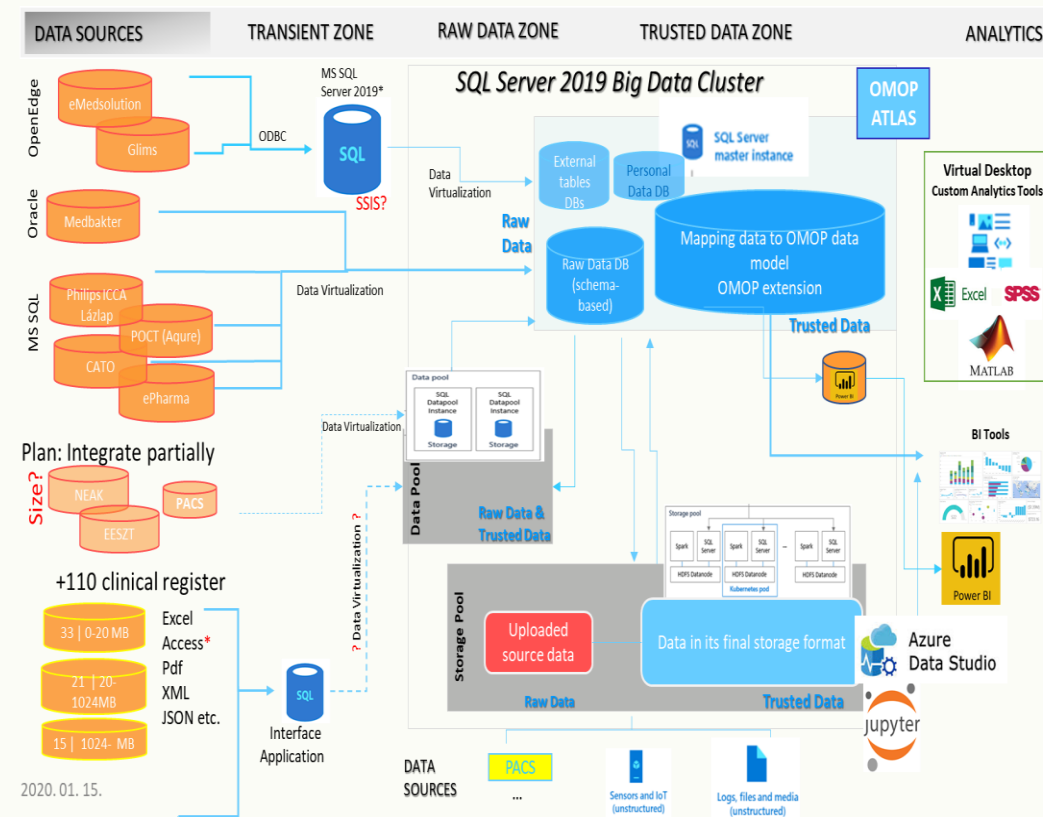
- **Process Mining**

- Analysis of corporate processes, automated work processes, and their diaries and digital footprints performed with the help of information systems using modern data science methods
- Case study-based research focuses on how process mining can be used in data analysis tasks to improve processes
 - Compliance with organizational and official regulations
 - Process organization and data management



Reliable corporate solutions: possible applications

- Framework development for **health, medical and biomedical research**
 - Experimental design for insurance companies
 - Database mapping
 - Data migration with the help natural language processing methods
- Research of data analysis, data-intensive work processes
- Investigation of the applicability of continuous improvement methods



Further plan

- **Formal modeling** of dynamically changing organizational processes and its operationalization
- **Transformation of database schemas** and ontologies of inherited, old information systems into modern data structures using modern data science approaches
- **Model building** (M2P) – cooperation with Uni Kiel
- **Examination of design issues and models of cognitive information systems**
- **Data warehouse and data lake design in Agroinformatics and Finance** - cooperation with Uni Niche Sophia Antipolis

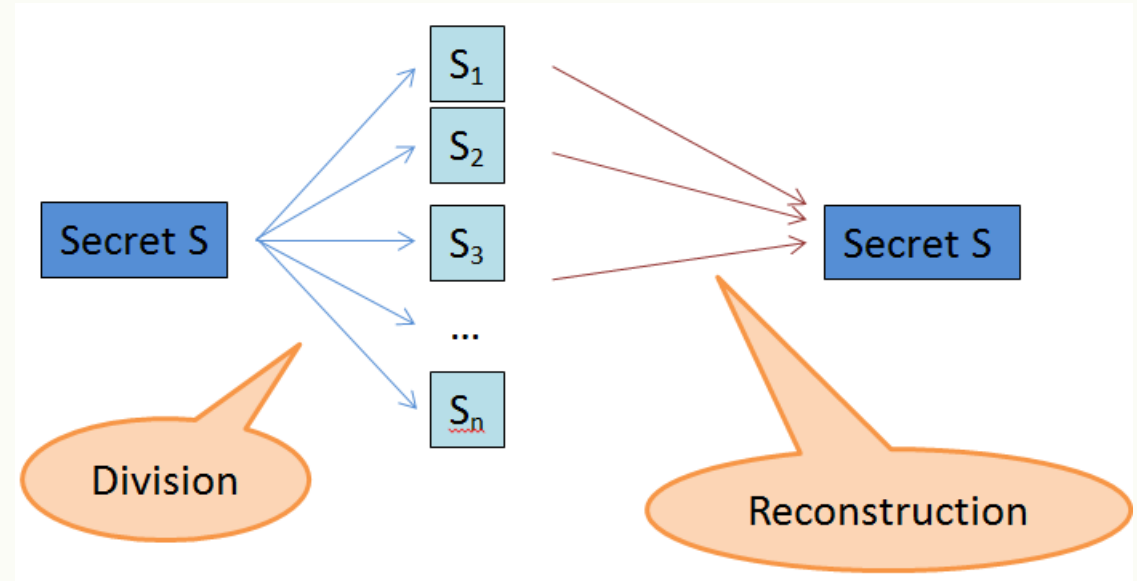
Reliable technical solutions

- **Applying mathematical models** in order to raise the reliability level
 - Developing new cryptographic protocols
- **SW testing**, quality assurance
- **Continuous vulnerability scanning**, firewalls, virtualization, log analysis



Reliable technical solutions

- **Design secure cryptographic algorithms**
 - **Security & privacy**
 - Lowering the vulnerability levels
 - Supporting GDPR, etc.
 - **Distributed zoo**
 - Communication, storage, computation



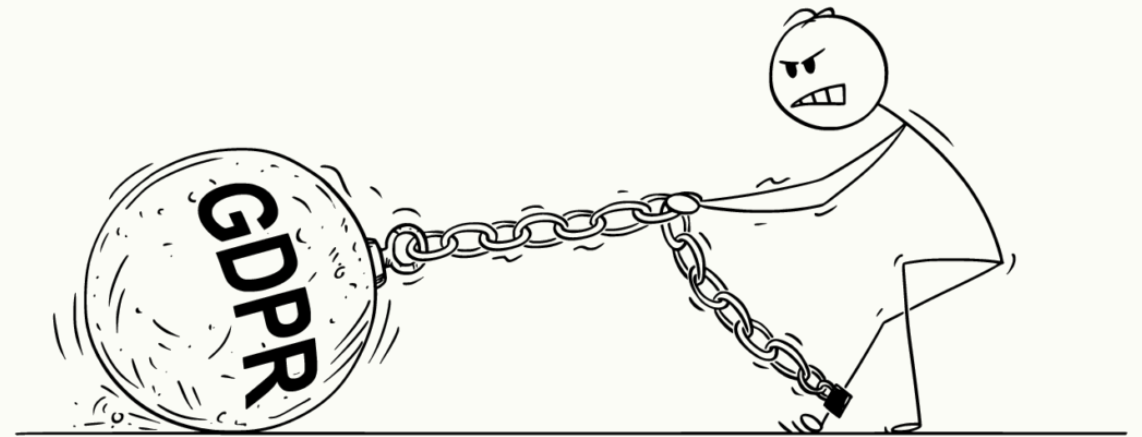
Reliable technical solutions

- **Some results/messages:**
 - Novel access control mechanisms
 - Distributed communication protocols
 - Validation by proofs + testnet
 - Efficiency by optimization



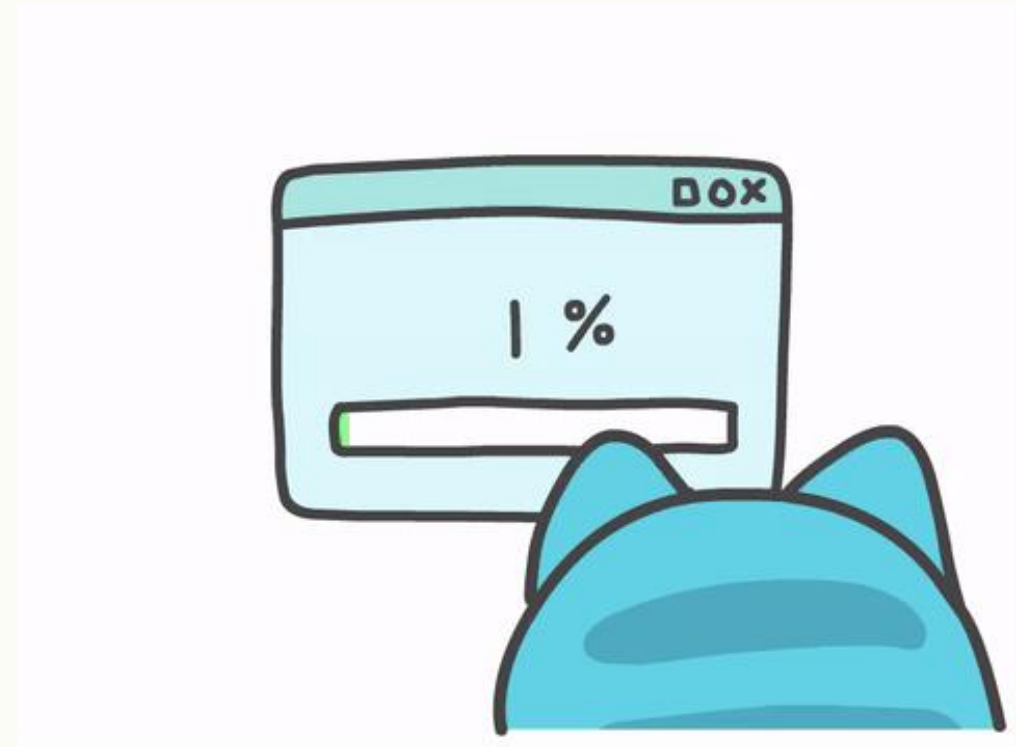
Further plan

- **Advanced access control** mechanisms
- **Secure communication** layers for IoT
- **Anonymous data sharing/processing** in medical environment



Reliable technical solutions

- SW testing
- In 2019 (worldwide)
 - More than \$430 billion was spent to SW **development**
 - More than 50% of the total cost of development is devoted to SW **testing**
 - More than \$34.5 billion went to SW **testing services**



Research: How can we perform
SW testing more effectively?

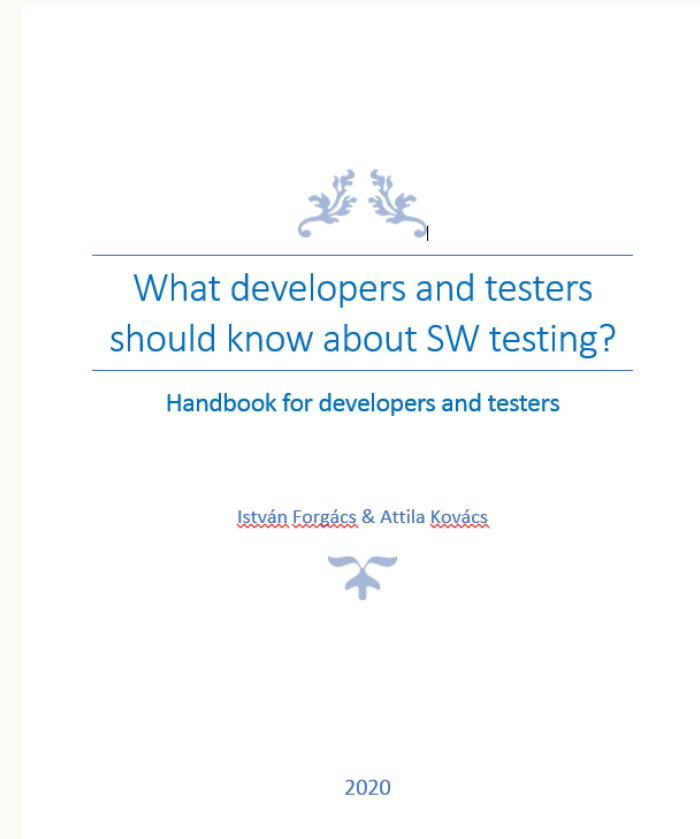
Reliable technical solutions

- Some results/messages:
 - **More care needed on requirements**
 - Never neglect **risk analysis**
 - **Defect prevention** is unavoidable
 - Develop test models separately
 - Full SDLC **cost can be optimized**



Further plan

- Introducing a **new technique** for **boundary value testing**
- Introducing a **new technique** for **extended finite state machine testing**
- Explaining the **need for refactoring**
- Etc.



Thank you for your attention



.....Questions?

Application domain specific highly reliable IT solutions

<https://tinyurl.hu/fDuY/>



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