

Key Success Factors for Future IoT Systems

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Lucerne University of
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i|Home|Lab

**HOCHSCHULE
LUZERN**

Technik & Architektur
FH Zentralschweiz



LIVING IN THE FUTURE. TODAY.

Source: iStock



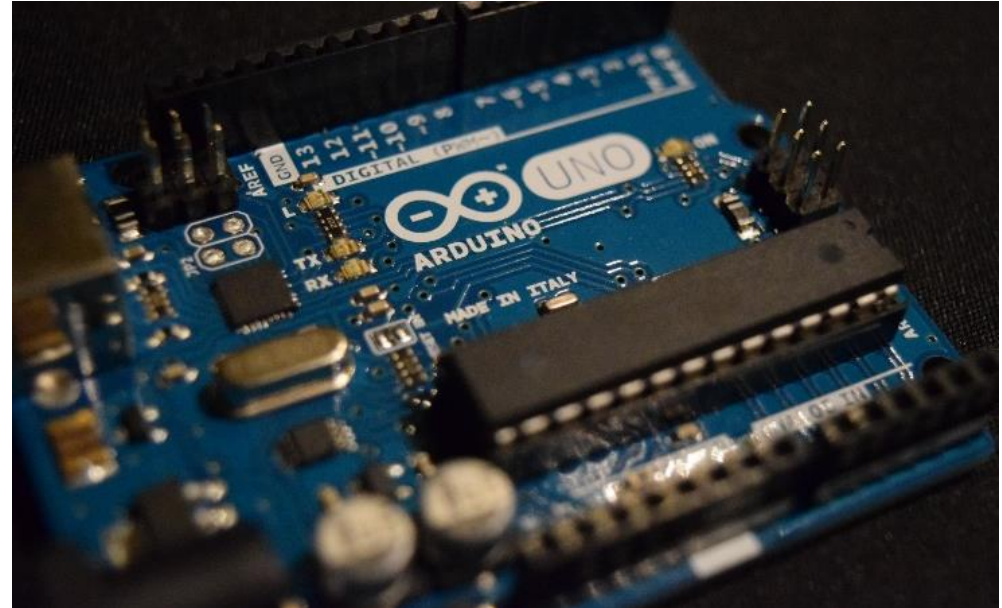
- Mobile & Autonomous systems
- Wearables & Health
- Social Media
- Smart Environments
 - Home, Building
 - City
 - Industry 4.0

Drivers for Future IoT Systems

Megatrends: Sustainability, Demographics, Lifestyle & Digitization Drive Change

Technological Development

- Ubiquitous Connectivity
- Software & Cloud Computing
- Machine Learning
 - Speech & Image Recognition
 - Learning & Generalization
- Energy harvesting & longer battery life
- New Sensors
- Privacy & Security
- Device Lifecycle



Source: Daan Lenearts | pixabay.com

**The future of
IoT will be
driven by the
applications we
choose & this
will create new
engineering
challenges**



Source: iStock

Swiss Think Tank and Research Centre for Building Intelligence

Smart Energy Management

- Load Management and integration of Renewables
- Decentral Energy measurements, Smart Metering & Load Recognition

Active Assisted Living

- Enabling elderly people a longer, active & independent lifestyle
- IoT applications for higher Quality of Life

Safe Building Intelligence

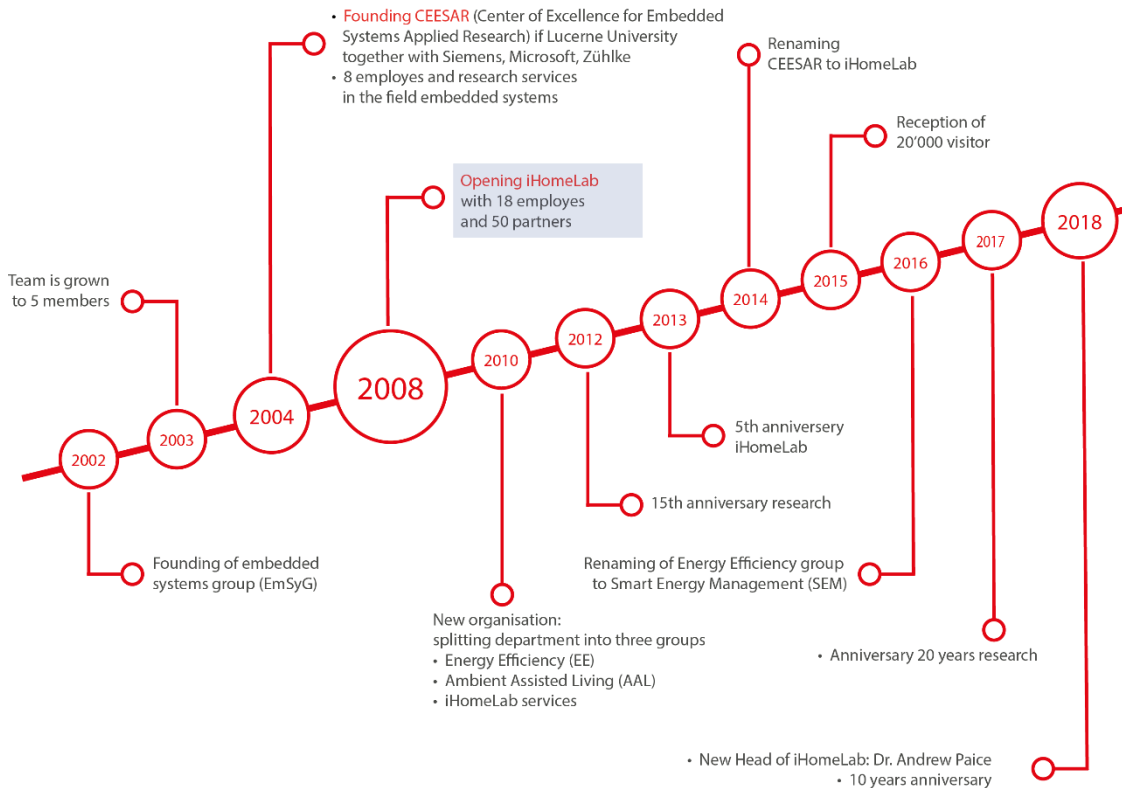
- Private, individualized support by intelligent buildings
- Digitalisation, Privacy & Data Security

Visitor Center

- 250 Events / 2500 – 3500 Visitors per year
- Up to 25 Visitors per visit (15-60 min.)



17 years of Application Oriented Research in IoT



Collaboration Modes

Innosuisse (KTI) Projects

- Industry Collaboration

EU Consortia

- Industry & Academia

Research Contracts

- Industry Partners
- BfE, EdF

Student Projects, Theses

- Industry, Investigation

iHomeLab Partners

- Partnership

iWalkActive: Personal Mobility for the elderly

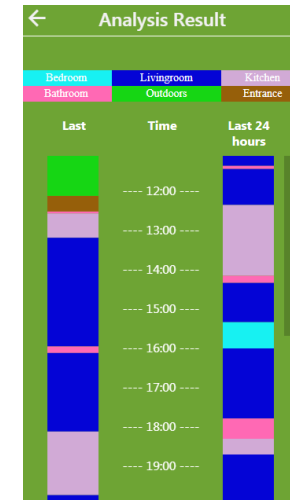
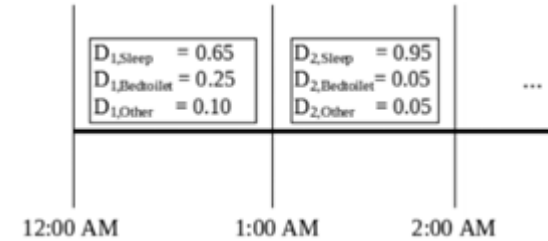
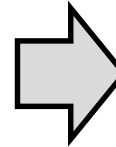
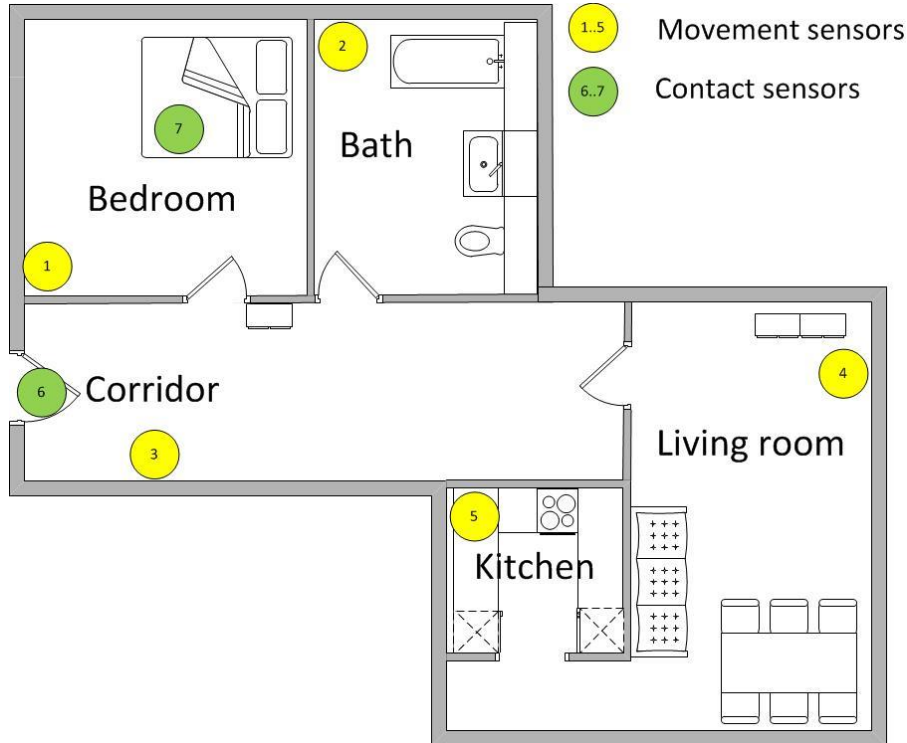
**iWALK
ACTIVE**
IWALKACTIVE.COM



Relaxed Care: Connecting People



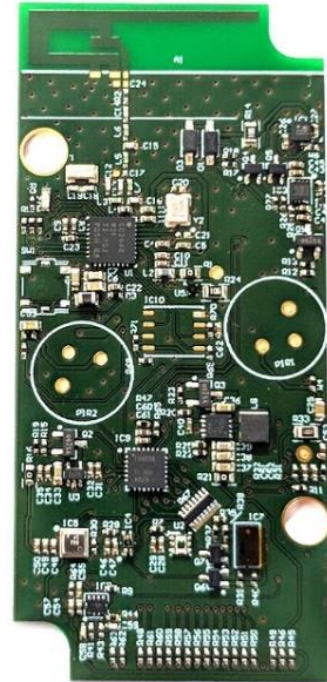
Activity Based Profiles – Dementia Detection



Research Tool: iHomeLab Multi-Sensor

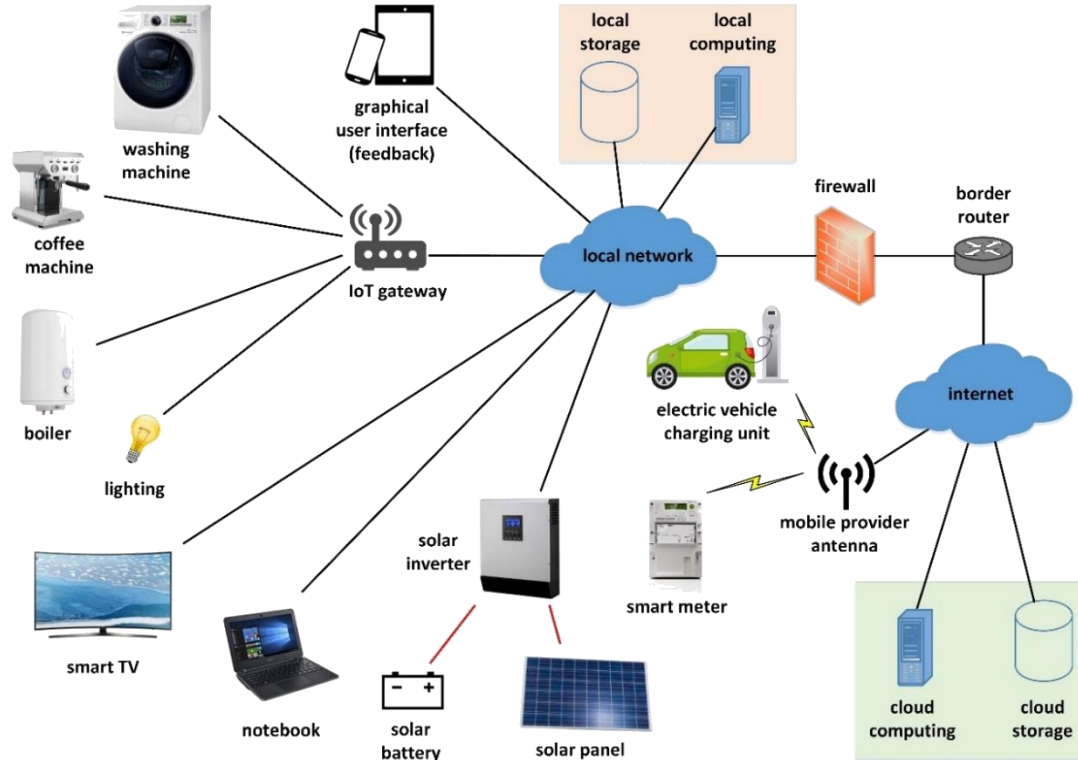
Sensor Fusion & input for Machine Learning Algorithms

- Low-Power universal sensor system
 - PIR-Sensor
 - Humidity
 - Temperature
 - Luminosity
 - Air Pressure
 - VOC (Volatile Organic Components)
 - Acceleration / Vibration
 - Door Contact Sensor
 - Magnetometer
 - Sound Pressure
 - Distance Sensor



Energy Aware IoT Study

Energy Savings through Distributed Intelligence

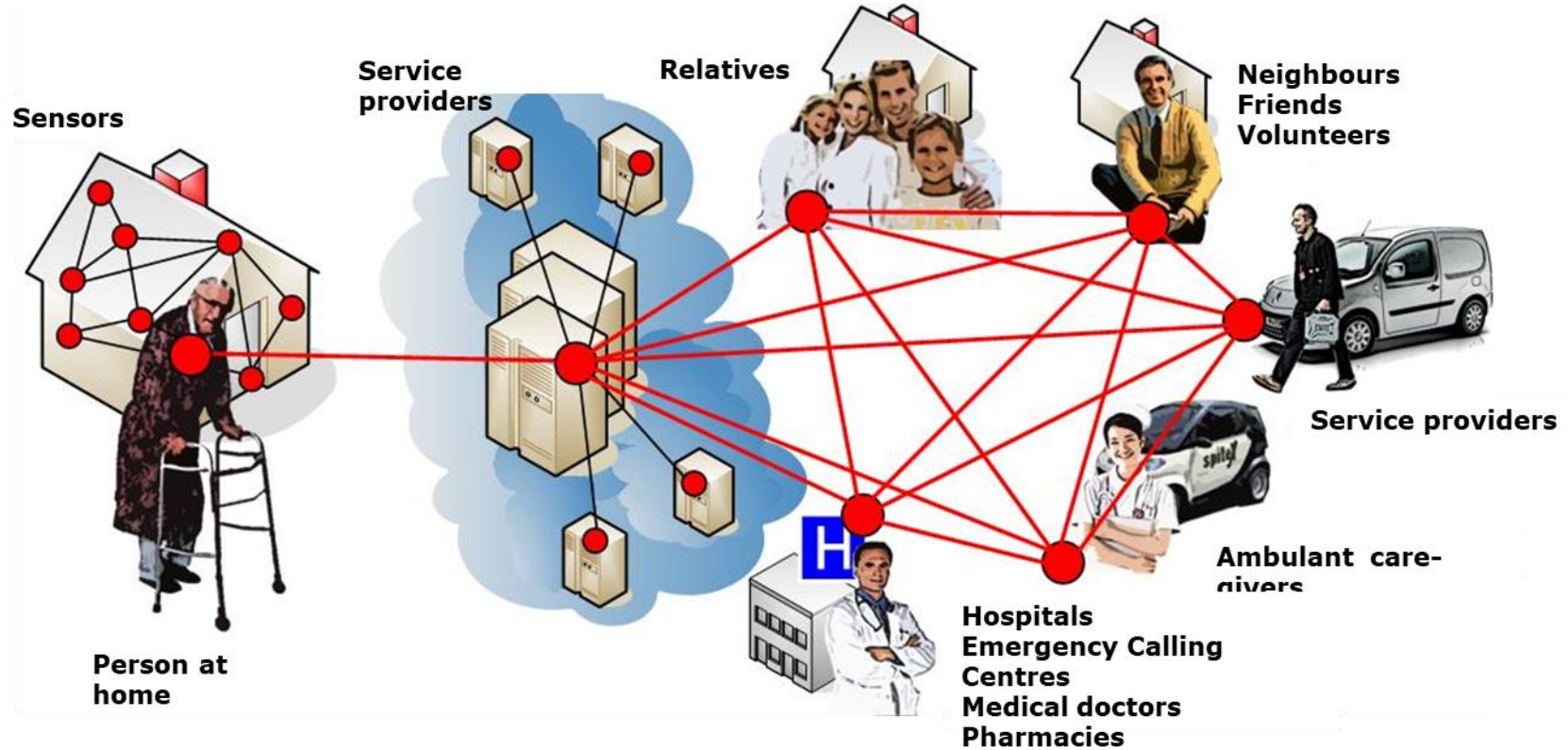


Energy awareness:

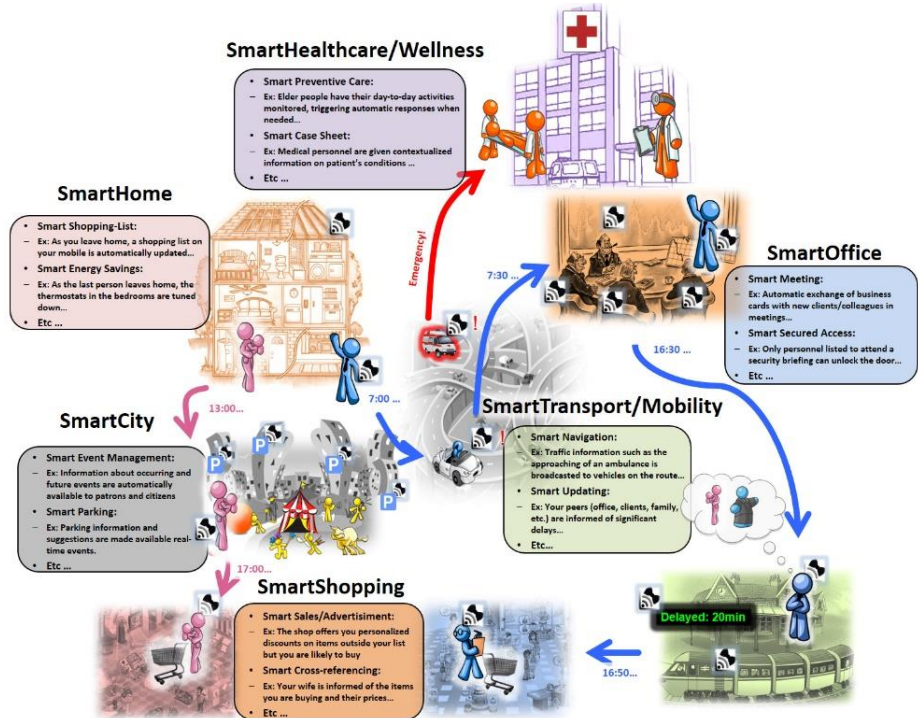
- Current energy use
- Forecasted energy use
- Flexibility
- Control inputs

Enables coordinated energy savings at large scale

IoT Ecosystems: Creating Caring Communities



EU Project BUTLER – Location, Context, Security



Successful design of IoT Systems

Key is mastering complexity and ensuring acceptance by users



Source: iStock

- Context
- Communication – M2M, H2M
- User acceptance
 - Design
 - Trust
 - Quality of Service
- Design Parameters
 - Connectivity
 - Localization
 - Energy supply
 - Intelligence
 - Interaction

iHomeLab IoT Development Process

Open development environment, Results validated in the field

Source: Bonneval Sebastien unsplash.com



- Design Thinking
 - Early user involvement
 - What's the real need?
 - Value Proposition Engineering
- Agile SW Development
- Field Trials

iHomeLab IoT Development Process

Open development environment, Results validated in the field



- Design Thinking
 - Early user involvement
 - What's the real need?
 - Value Proposition Engineering
- Agile SW Development
 - MVP* to prove prototypes
 - Sharing information supports innovation & efficiency
- Field Trials

* Minimum Viable Product

iHomeLab IoT Development Process

Open development environment, Results validated in the field



Source: Donald Giannatti unsplash.com

- Design Thinking
 - Early user involvement
 - What's the real need?
 - Value Proposition Engineering
- Agile SW Development
 - MVP to prove prototypes
 - Sharing information supports innovation & efficiency
- Field Trials
 - Validation in the real environment
 - Handover to users and project partner

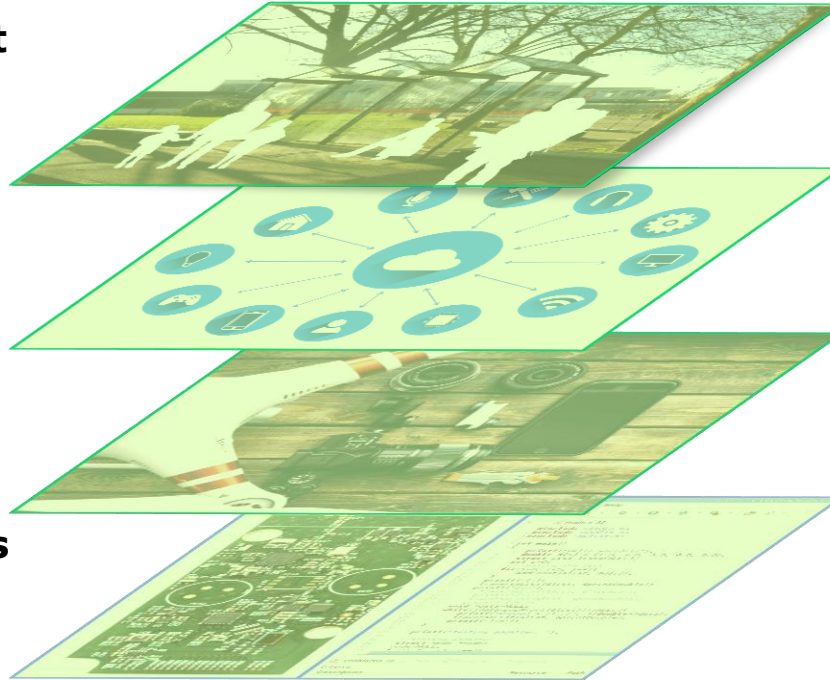
IoT Applications are Context-Embedded

Application Context

IoT EcoSystem

IoT Device Design

Device Components



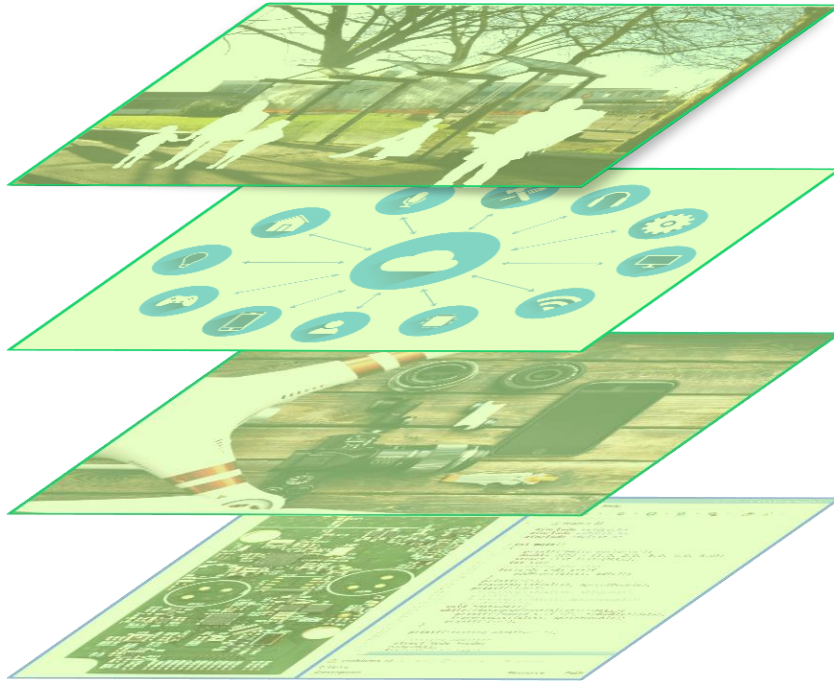
Functionality
QoS / RAM

Network Management
Security
Intelligence Architecture

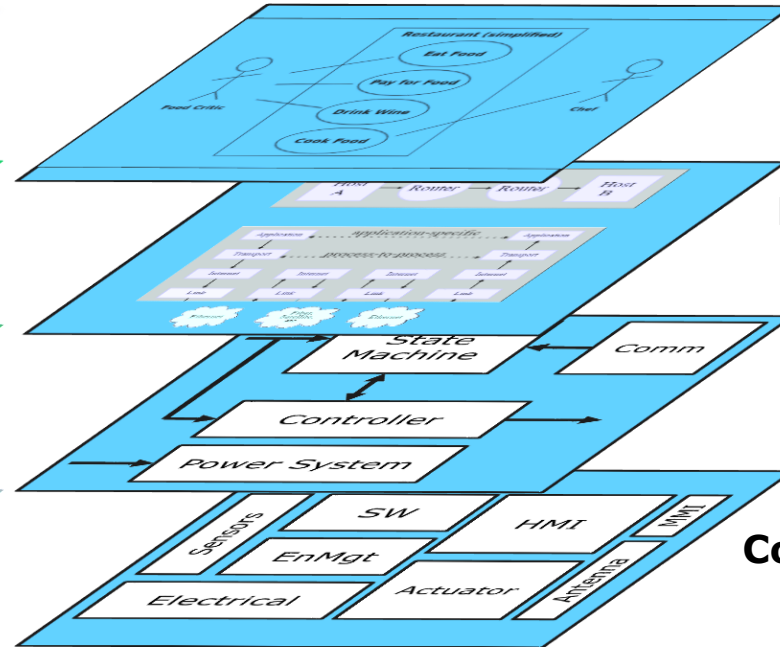
Sensing, Processing
Configuration, Diagnostics

RAM, Failure Modes
Connectivity,
Energy & processing
Costs

Digital Twins provide structure



Reality



Digital Twins

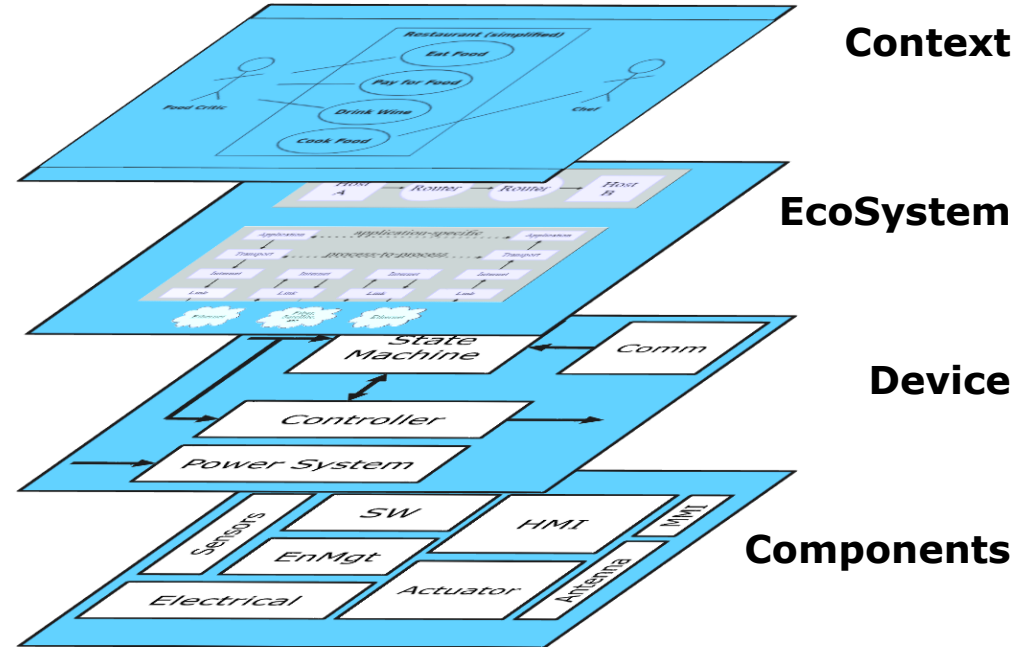
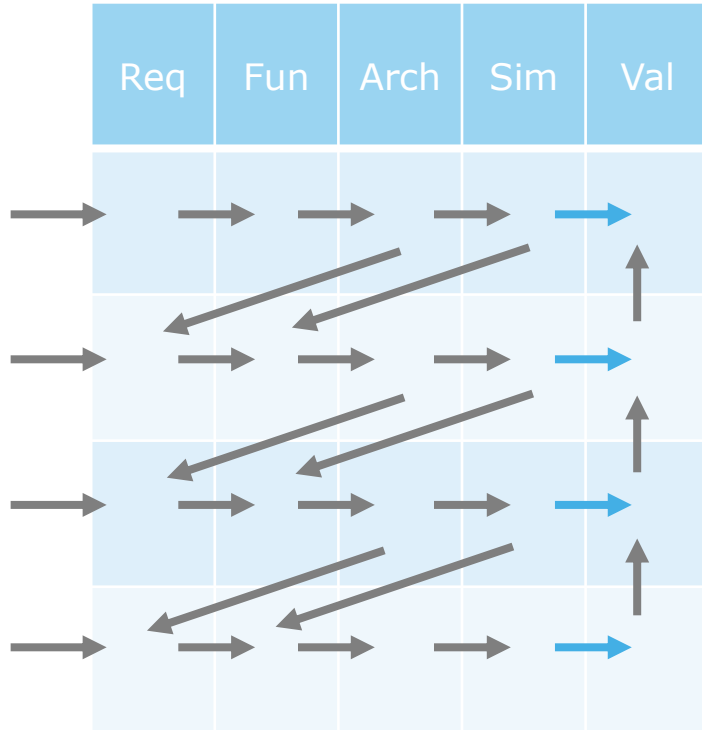
Context

EcoSystem

Device

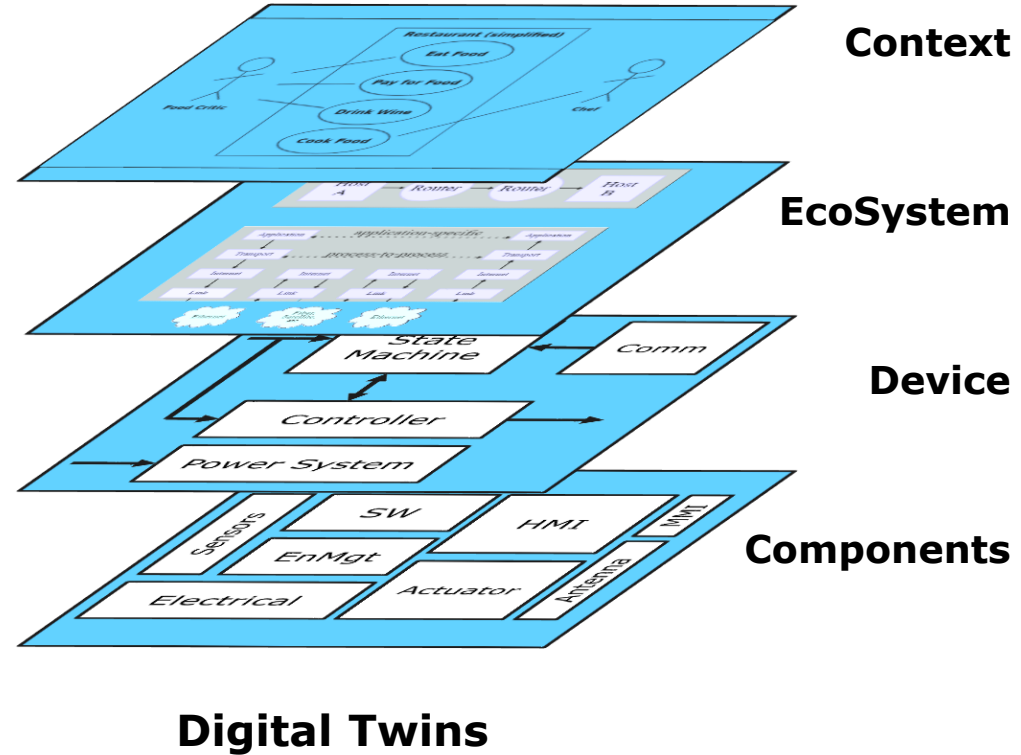
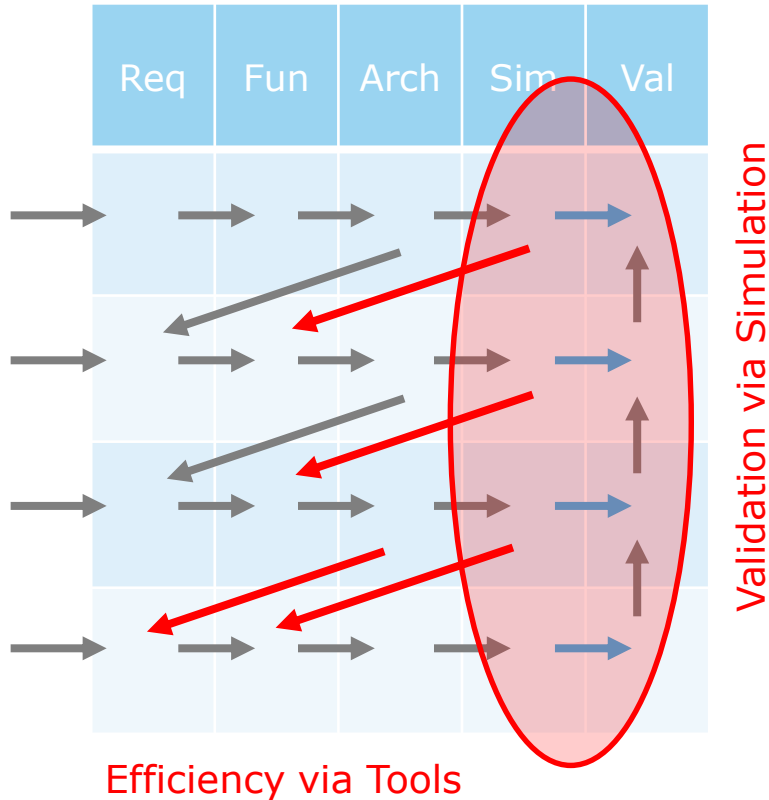
Components

Model Based Systems Engineering structures the IoT Design Process



Digital Twins

Tools & Simulation based Validation increases efficiency and agility



The future of IoT will be driven by the applications we choose & this will create new engineering challenges



Digital Twins provide a Framework to master this complexity

The alternative is a world of IoT Hackers....

iHomeLab – Living in the future, today

Lucerne University of
Applied Sciences and Arts
i Home Lab HOCHSCHULE
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