



Università degli studi di Udine
Dipartimento Politecnico di Ingegneria e Architettura

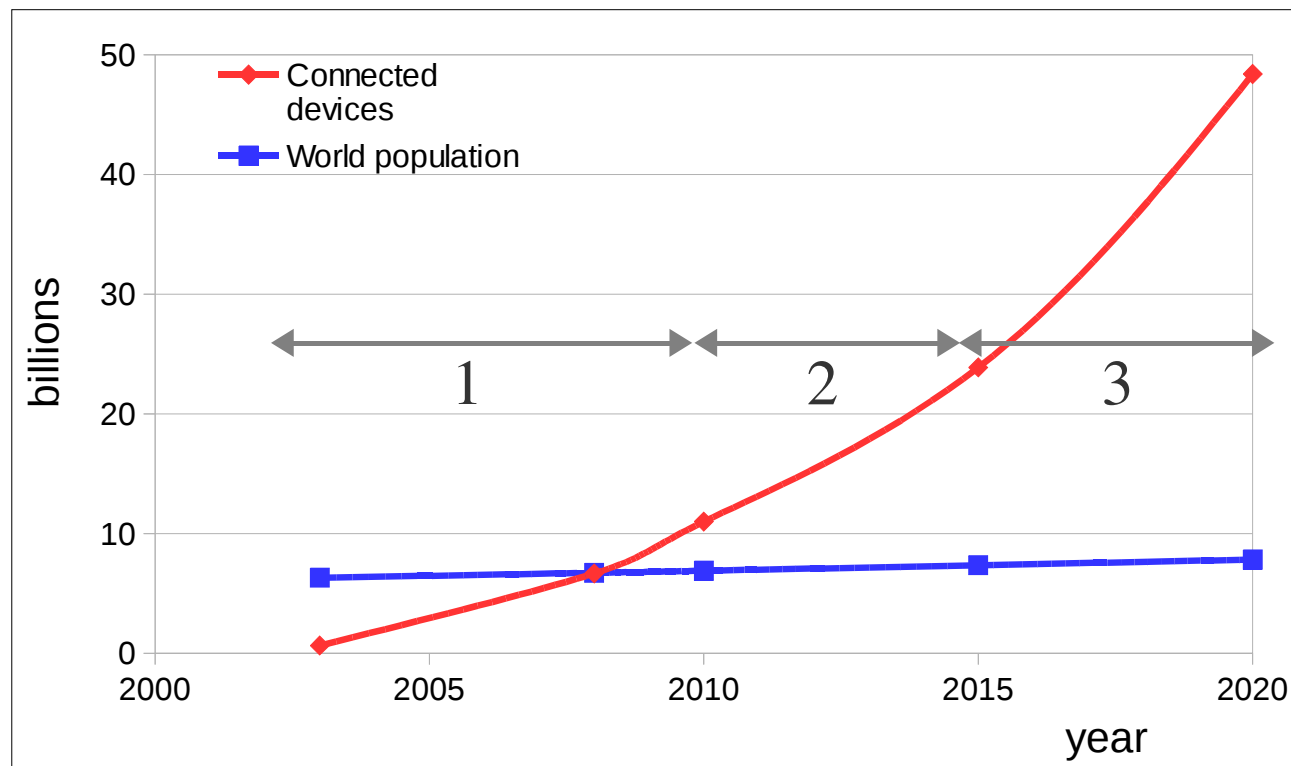
Challenges and Opportunities of Smart Environments

*Home Automation, Smart Cities
and IoT*

8 aprile 2016

Trends

- Evolution (*and projection*) of connected devices
 1. Computers, Phones
 2. Computers, Phones, Tablets
 3. Computers, Phones, Tablets, Sensors
 - World of Interconnected Things
 - Machine to Machine (M2M) Iteration





Internet of Things

- **Network of Smart Devices connected through Internet**
 - *Sensor networks, control systems, automation, ...*
- **Pervasive and Ubiquitous Network**
 - *Environment Management*
 - Monitoring
 - Control
 - *Data Gathering*
 - *Data Analysis*



Internet of Things - Requirements

- **Communication**
 - *Huge Network Scalability*
- **Embedded and Distributed Intelligence**
 - Fog Computing (vs Cloud Computing)
 - *Microprocessor, Microcontroller, Custom HW*
- **Data Collection**
- **Network Resource Preservation**
- **Fast Reaction Times**
 - *Closed Loop Functioning*



Internet of Things - Applications

- **Media**
- **Environmental monitoring**
 - *Environmental protection*
 - Air and water quality
 - Atmospheric and soil conditions
 - Movements of wildlife and their habitats
 - Early-warning systems (earthquake, tsunami, ...)
 - *Infrastructure management*
 - Bridges, railway tracks



Internet of Things - Applications

- **Manufacturing Support**
 - *Reliability*
 - measurements, predictive maintenance, statistical evaluation
 - *Process control, supply chain networks, ...*
 - *Health and safety management*
- **Energy management**
 - *Smart Grid*



Internet of Things - Applications

- **Medical and healthcare systems**
 - *Remote health monitoring*
 - Pacemakers, heart monitors, automatic drugs supply, ...
 - *Emergency notification systems*
- **Building and home automation**
 - *Climate control, lighting control, media control*
 - *Security*
 - *Support for the elderly and disabled*



Internet of Things - Applications

- **Smart cities**
 - *Transportation*
 - Inter- and intra-vehicular communication
 - Smart traffic control, smart parking
 - Logistic and fleet management
 - Vehicle control
 - Autonomous cruise control
 - Autonomous vehicles
 - *Local departments information systems*
 - *Schools and libraries services*
 - *Hospitals coordination*



Internet of Things - Challenges

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- **Energy management**
- **Security**
 - *Privacy threats*
 - Information leaks
 - Data protection
 - Cryptography $\Rightarrow$ protection of crypto keys
 - *Social control and political manipulation*
 - *Malicious device manipulation*
 - Life threats
 - *Anonymity threats*



Internet of Things - Challenges

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- **Reliability**
 - Transient connections
 - Varying bandwidths
- **Interoperability**
 - SW/HW interfaces
 - Communication protocols
- **SW environment**
 - OS, OS-less platforms
- **HW/SW development tools**



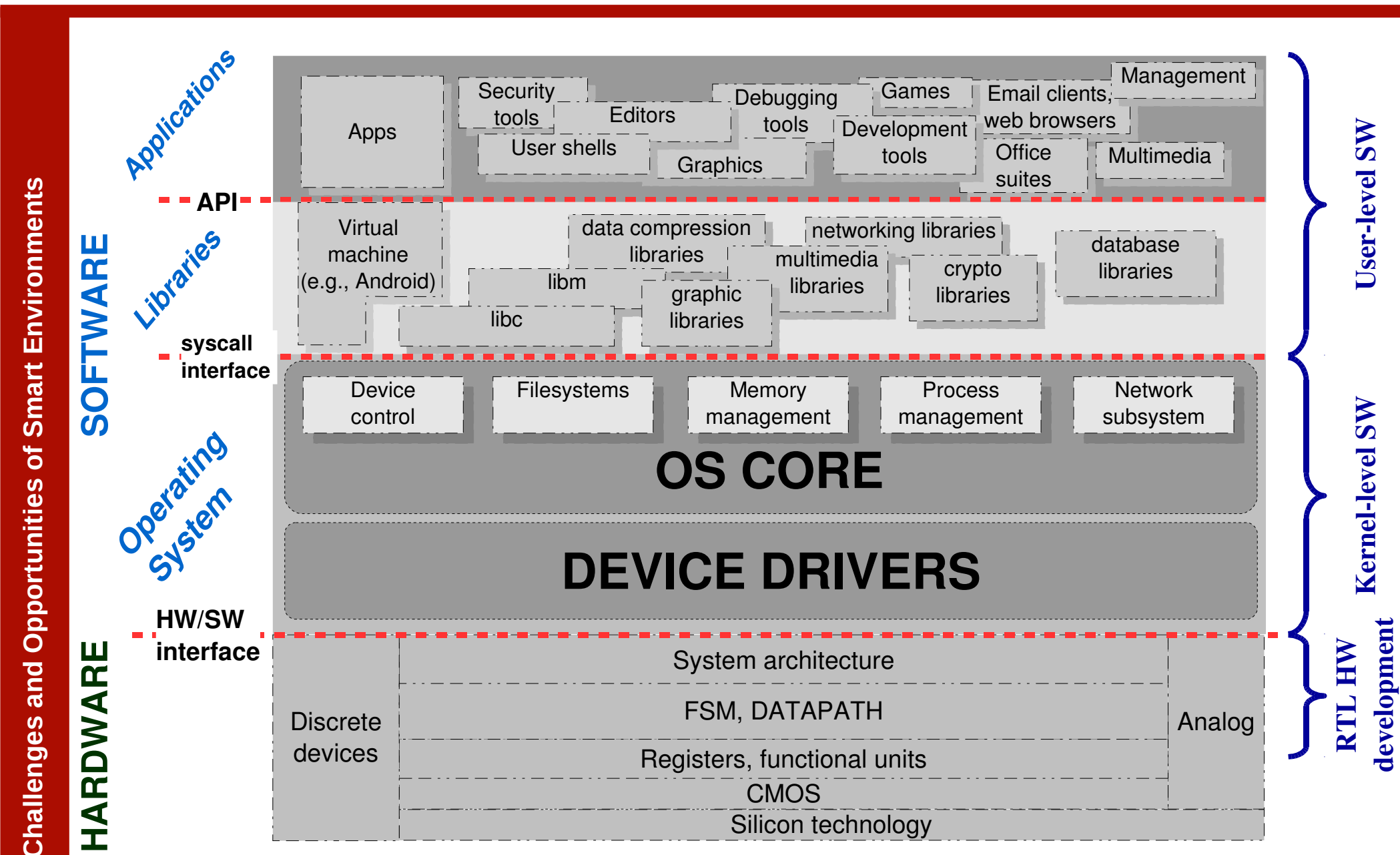
Internet of Things - Opportunities

- **Humongous Market**
 - *Estimation: 50 billion of IoT objects by 2020*
- **Ubiquitous Connectivity and Computing**
- **Improved Quality of Life**
 - *Human augmentation*
- **Reduced Public Expenditure for Health Care**
 - *Handling population aging*



DPIA Activities

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DPIA Activities

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- **User-level SW**
 - *Mobile apps*
 - *Desktop applications*
 - *Embedded systems applications*
 - *Networked SW infrastructures*
- **Kernel-level SW**
 - *OS customization*
 - *Device drivers development*
 - *Low power SW strategies*
- **RTL HW development**
 - *Custom HW devices*
 - *Low power architectures*