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Technology trends for connected health

Microelectronics in medical and healthcare applications

Medical equipment fully dependent on advanced semiconductor technologies and components

Diagnostic equipment	Medical Imaging	Therapy equipment
		

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Example of electronics inside medical equipment: portable ultrasound ecography device

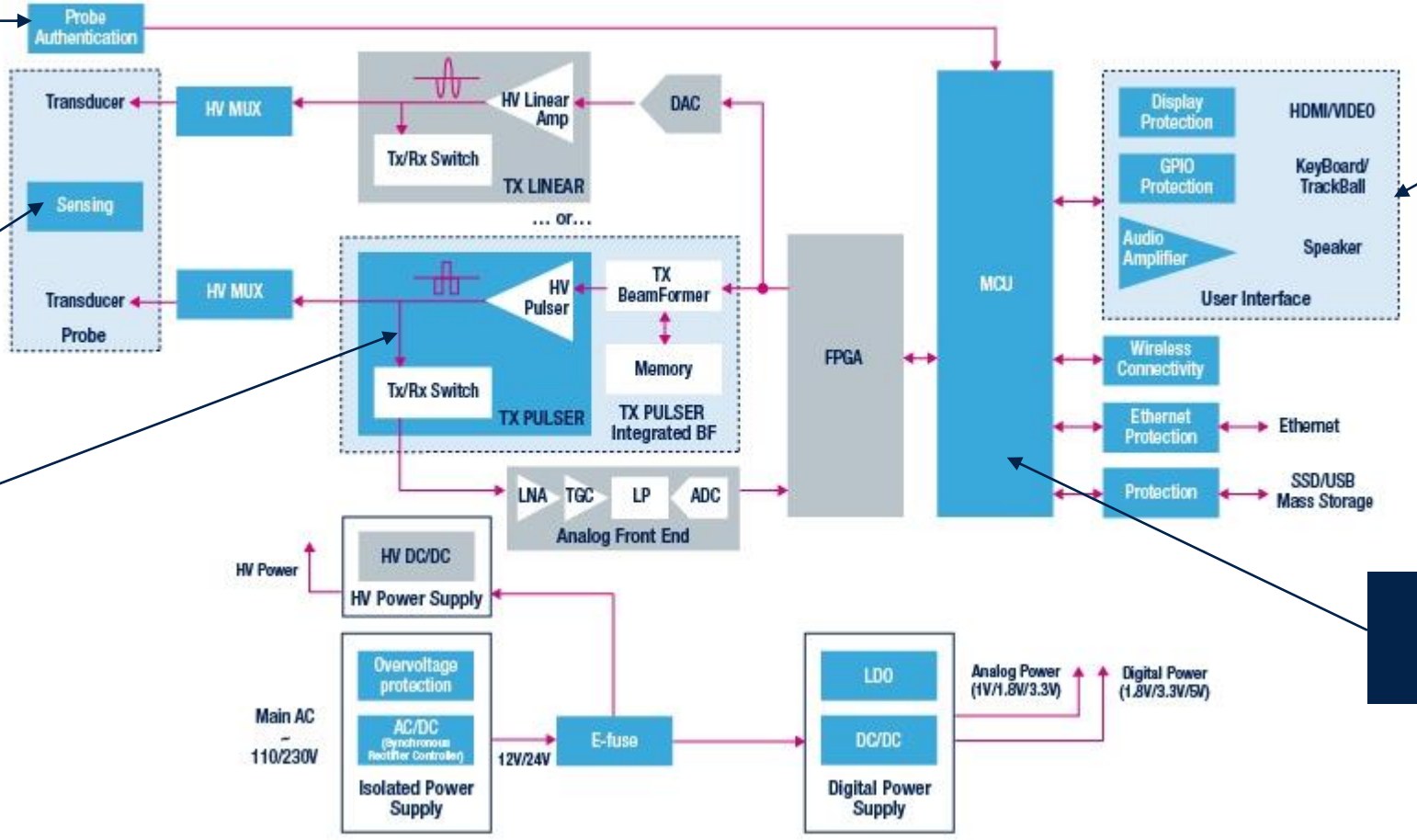
Hardware Security Feature

Remove artifacts

High Voltage Complex Operations

Commands & display

Process complex data



Low-power operation

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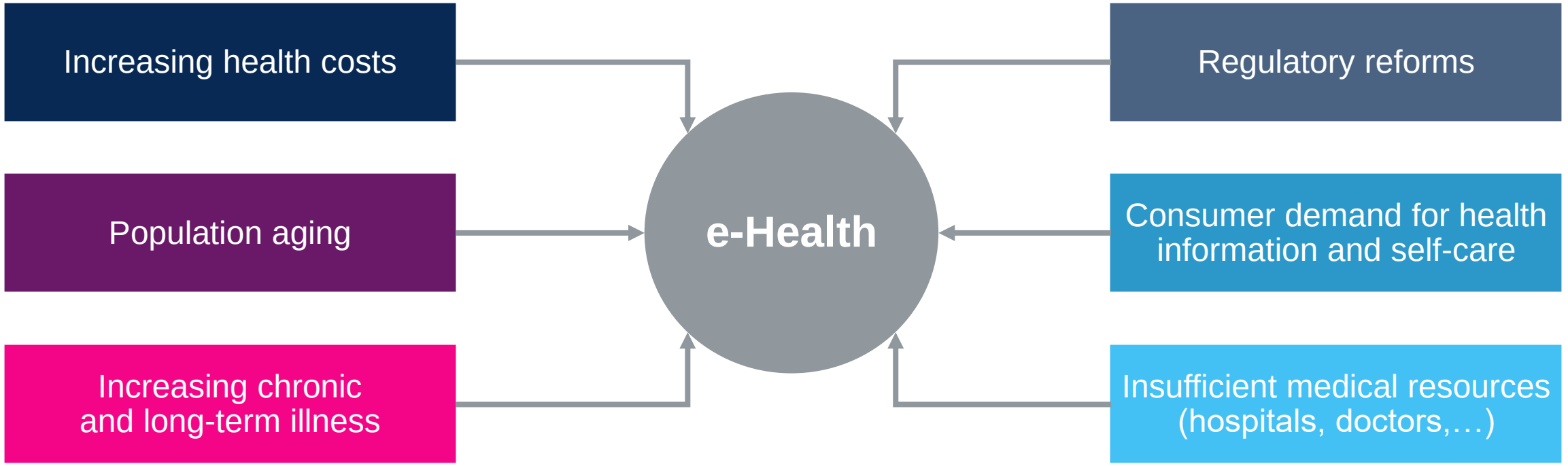
Main drivers for connected e-health

Technology can help achieve more efficiency and cost reduction



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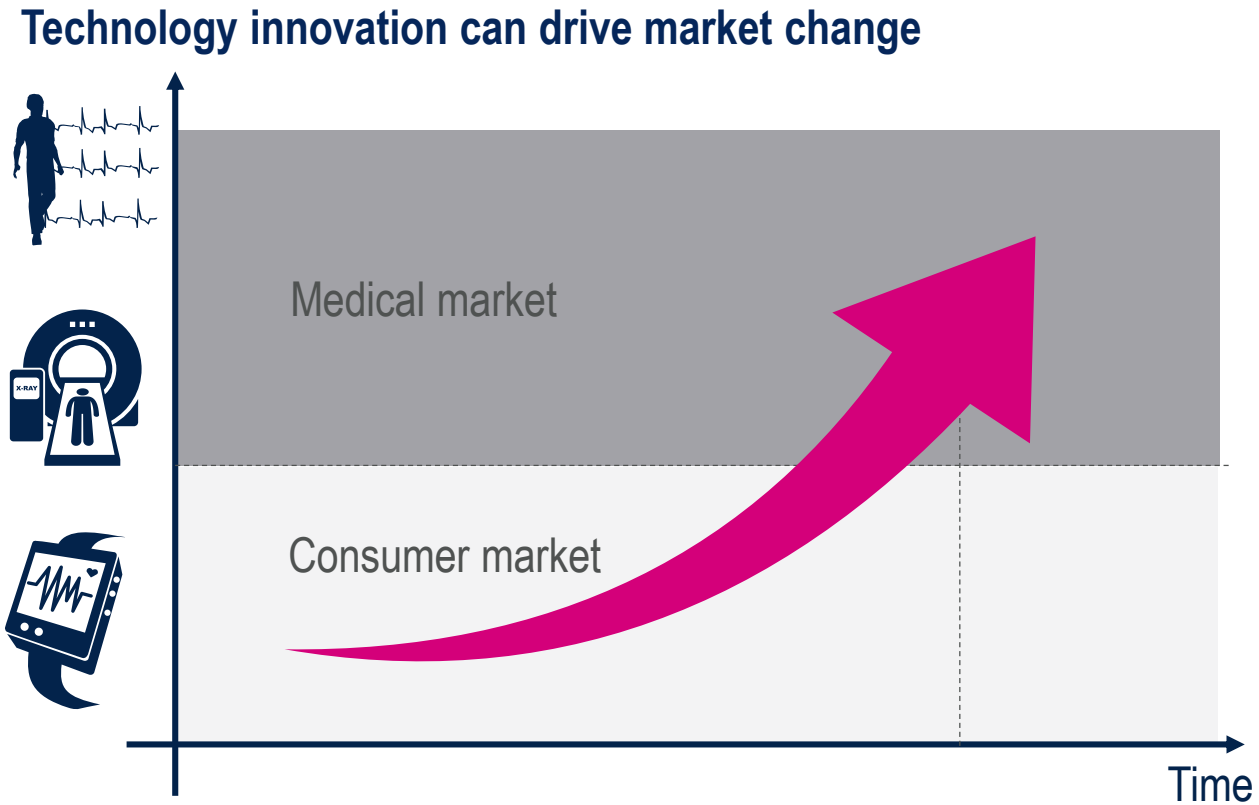
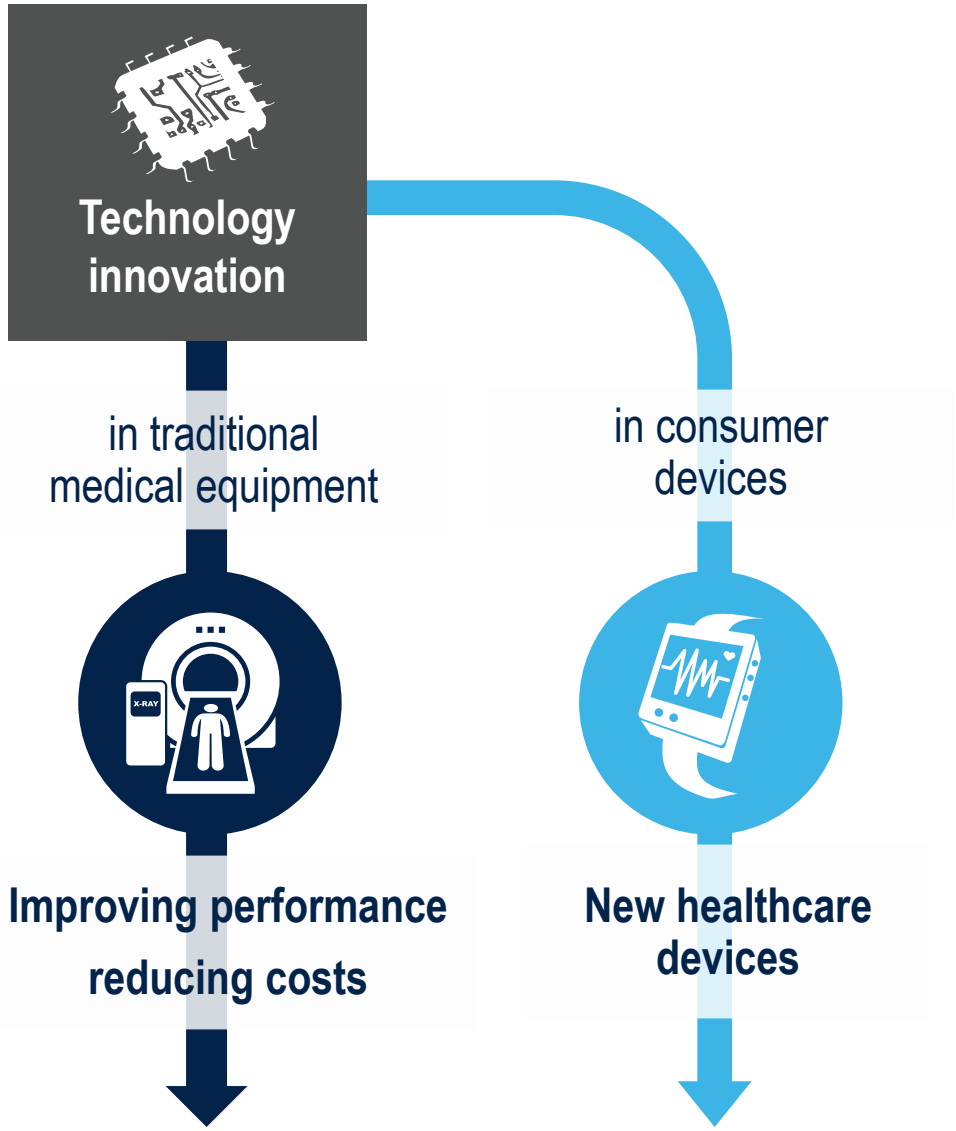
Technology innovation: multiple benefits in medical healthcare applications





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Microelectronics: an enabler for medical & healthcare

Remote monitoring
creating new services for eHealth

Compact Devices for diagnostic measurement
Lowering cost barriers

Increased processing power & A.I.
Providing new Diagnostic support tools

Privacy & integrity of patient data
for transmission and storage of medical records

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Challenges for technology

What doctors say(*)

30%	Personal connected health devices may help to make diagnostics decisions and help improve patient health
42%	moderately agree to include patient generated data in the EMR(+)
40%	agree that remote monitoring of chronic conditions can reduce unnecessary visits
60%	are concerned about how patient data is **handled and secured**

(*) Source: pchalliance.org, Ipsos, May 2017

(+) EMR = Electronic Medical Records

Their expectations from Technology

- Develop technology for **new diagnostic tools** and **Improve precision** of existing devices
- Make diagnostic tools **more pervasive**
- Use of **Artificial Intelligence** as a support for decision making
- **Improve security** at every stage
- Promote **EMR standardization** to encourage use of electronic data

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ST offer in healthcare

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ST product offering for healthcare

ST is a trusted provider of high-quality technical solutions enabling the development of breakthrough medical systems

Acquiring data
- Sensors for Imaging
- MEMS & measurement ICs
- Electronic interfacing

Processing data
- Powerful microcontrollers
- Artificial Intelligence at the edge
- Specially developed devices

Security
- Secure element for medial data integrity
- M2M-SIM for authentication and confidentiality
- Enabling Blockchain transactions

Connectivity
- Short-range low-power BLE, NFC
- Long range IoT (Sigfox, LoRa)
- Cellular Broadband, narrowband

Targeting a broad range of applications
- Medical Imaging
- Focused Ultrasound
- Energy Harvesting and Neurostimulators
- Non-Destructive testing
- Electrocardiography (ECG)
- Photoplethysmography (PPG)
- Galvanic Skin Resistance (GSR)
- Bio Impedance functionalities
- Oxygen saturation
- Respiratory Rate
- Skin Temperature

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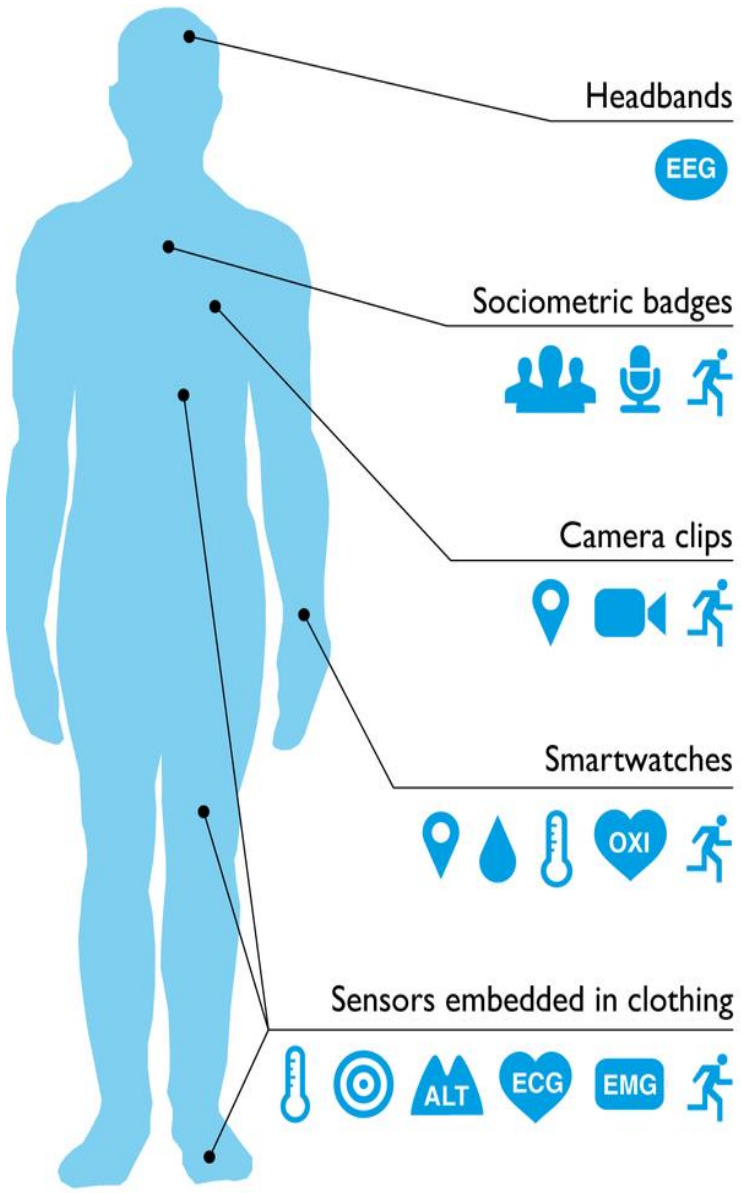
MEMS = Micro-Electro-Mechanical Systems fabricated at Silicon level

Sensor solutions for healthcare applications



Accelerometer
Altimeter
Digital camera
Electrocardiogram
Electromyograph
Electroencephalogram
Electrodermograph
Location GPS
Microphone
Oximeter
Bluetooth proximity
Pressure
Thermometer

Benefits of MEMS-based sensor solutions:

- Accuracy of Sensors
- Low power
- Non-Invasive Technique
- Machine learning core allowing data pattern recognition

Products

- Medical grade accelerometer
- Temperature sensors
- Ultrasound microphone
- Reference system solution embedding motion sensors, pressure sensors and microphone

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Imaging for health care: Spectrometer, ranging, light sensing & 3D scan imager

Time-of-Flight

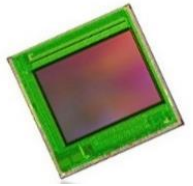
Measure true distance/depth
Independent of reflectance

Spectrometer

Spectrometer, Ambient Light Sensors, Light flicker detector

Unique Imager

High perf. In IR & visible, High Dynamic Range, flicker free.



Applications

- Proximity and ranging
- 3D depth sensing
- Fine gesture
- Heart rate monitor (HRM), PPG, SpO2…
- Body vital sensing
- Barcode scan
- Medical imagery

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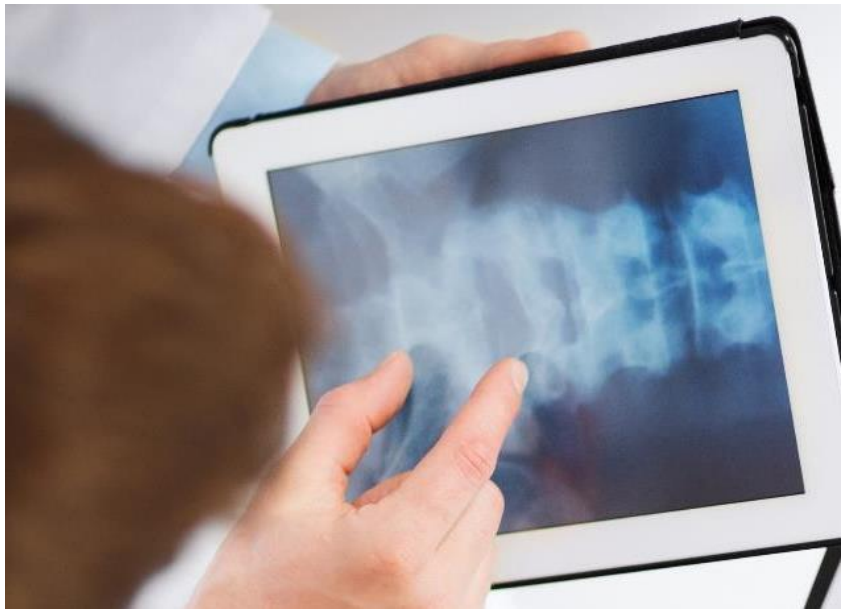
X-Ray and endoscopy

Endoscopy

- Advanced imaging technology enabling small pixel pitch
- Scalable supply chain for low volume

X-Ray



- Optimized technologies for X-Ray
- Radiation hardening expertise
- Stitching for extra-large dies
- Scalable supply chain for low volume

Ultrasound

- Ultrasonic transmitters, receivers
- Ultrasound piezoelectric actuators
- >15 year experience
- Close cooperation with top level players
- 30 patents granted on Ultrasound imaging

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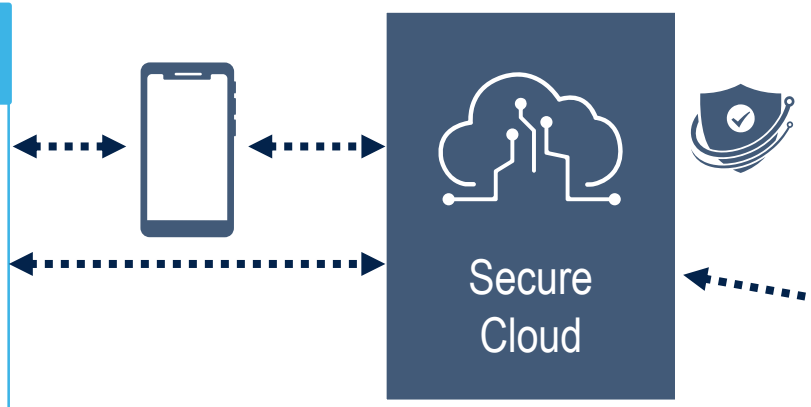
Providing end-to-end information security

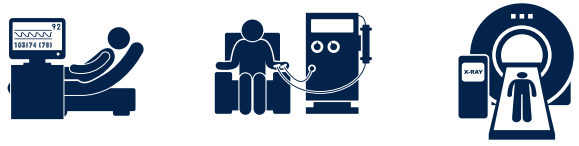
At home

- Identification of devices using **Unique ID in silicon**
- SW integrity of devices via a **Secure Boot** process
- Integrity of Patient Data with **Digital Signature**
- Confidentiality via **Encryption**
- Generation of **Blockchain transactions**



- Secure network access
- Verification of **allowed devices**
- Identification of people
- Preserving **data integrity**

At the hospital



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ST in European projects on medical

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SERENE-IoT

A european project led by ST, started June 2017 – 3.5 year program

Addresses the needs of patients remotely followed by professional caregivers by developing advanced smart e-health IoT devices and architecture in Europe

Outcome: Development of 3 medical devices addressing 3 medical domains:

Domain 1: Remote Healthcare
moving care services from hospital to home

First Low-power Medical IoT Module validated with 2 class IIx medical devices

Domain 2 : Early detection
of Methicillin-resistant bacteria

First Low-power Mobile Detector for MRSA i.e. antibiotic resistant bacteria

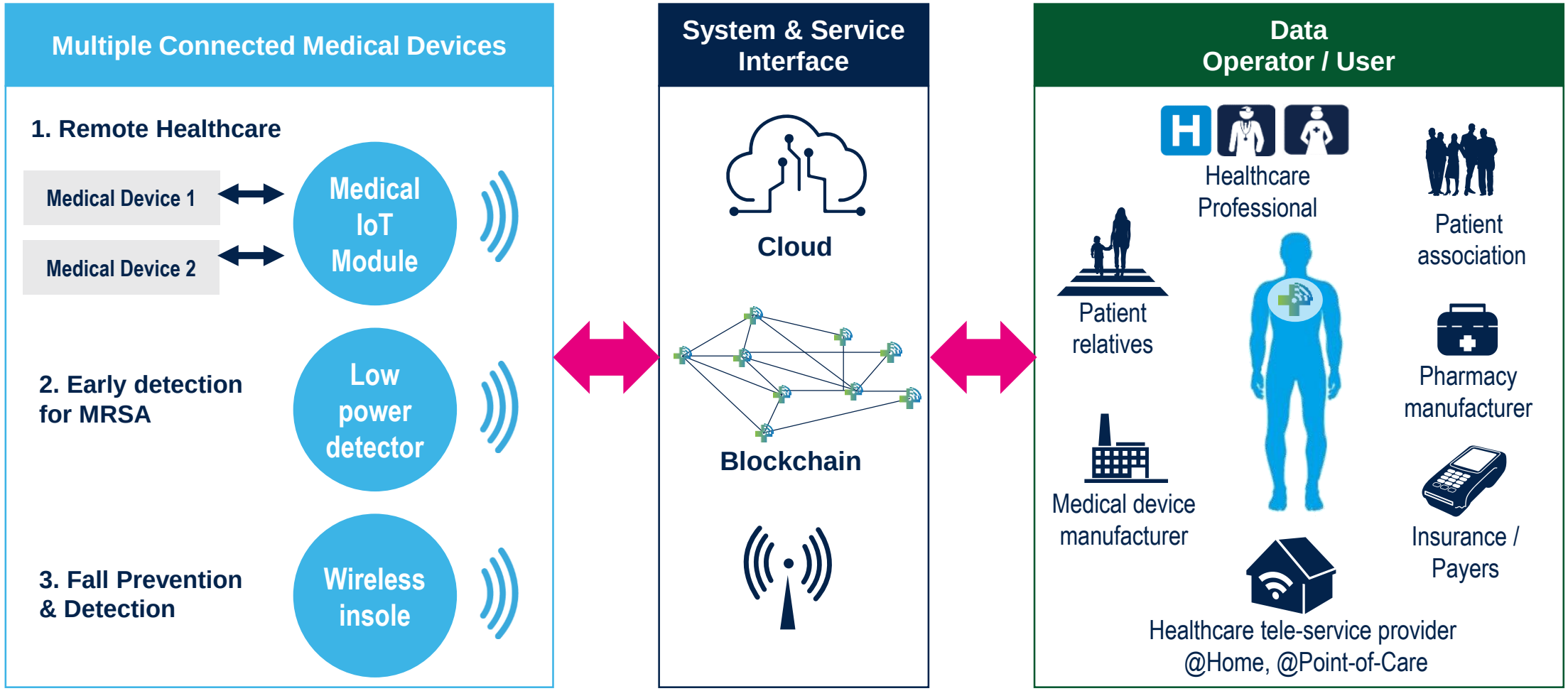
Domain 3: Fall Prevention/Detection

Fully wireless insole for Fall Detection + Risk Monitor

- Evaluated clinical prototypes
- Multi-centric clinical investigation plans
- IoT system evaluation

Penta

SERENE-IoT Use Cases: application scenario within a clinical framework



ACTIVAGE project

A european large-scale pilot on smart living environments, started Jan 2017, 4 years program

Objective: To build the first European IoT ecosystem to enable the deployment and operation of Active & Healthy Ageing IoT based solutions and services

Supporting and extending the independent living of older adults in their living environments

Responding to the real needs of caregivers, service providers and public authorities

Reusing and scaling up IoT platforms, technologies and standards, and integrating new interfaces needed to provide interoperability across these heterogeneous platforms

- 4 years project
- 9 Deployment Sites
- Seven European countries
- 50 partners

Examples of end devices powered by ST

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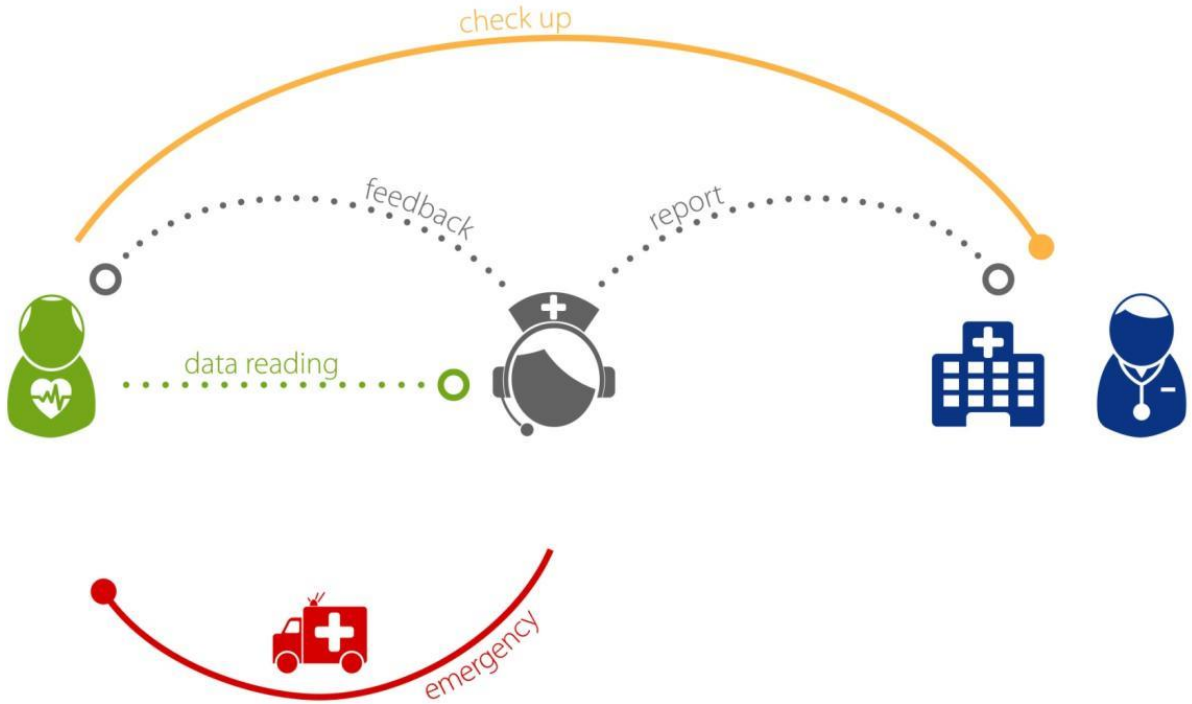
Body Gateway

- The Body Gateway recorder is a wearable, battery operated device, intended for use as a part of a multi-parameter analysis system
- It acquires, stores and periodically transmits to a device connected to a medical service (Heart rate detection, Physical activity estimation, Breathing rate measurement, Body position)

Applications

- Chronic cardiac disease monitoring
- Elderly people home monitoring
- Event monitoring
- Single lead holter



Intuity® JECT by EVEON

- An all-in-one platform offering fully automated preparation and delivery devices
  - Prepares the treatment by blending the drug and solvent with an accurate dosage
  - Guarantees the homogeneity, without manipulation or contact with the products
  - Injection, data transmission and tracking
- As the process is automated and easy to use, the injection can be operated by the patient themselves at home
- Powered by ST components
  - Ultra-low-power microcontrollers that control and process the drug preparation following parameters identified by the medial staff
  - Motor control to drive the blending
  - Bluetooth low energy module to send the data

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Takeaways

- Innovation in **sensor and processing** technologies
  - Improving equipment performance and functions
  - Lowering cost barriers
- **Low-power electronics** and innovation in consumer market
  - An opportunity for e-Health to grow
- **Artificial Intelligence** at the edge is a valid remote diagnostics support tool
- **Security devices** allow secure data collection, transmission and storage, preserving integrity and confidentiality of patient Medical Records

Thank you

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