
MNBS Workshop, 15th and 16th February 2010, Neuchatel

**In vivo ULTRAsonic Transponder System
for Biomedical Applications**

ULTRAsponder

FP7 Collaborative Project, STREP

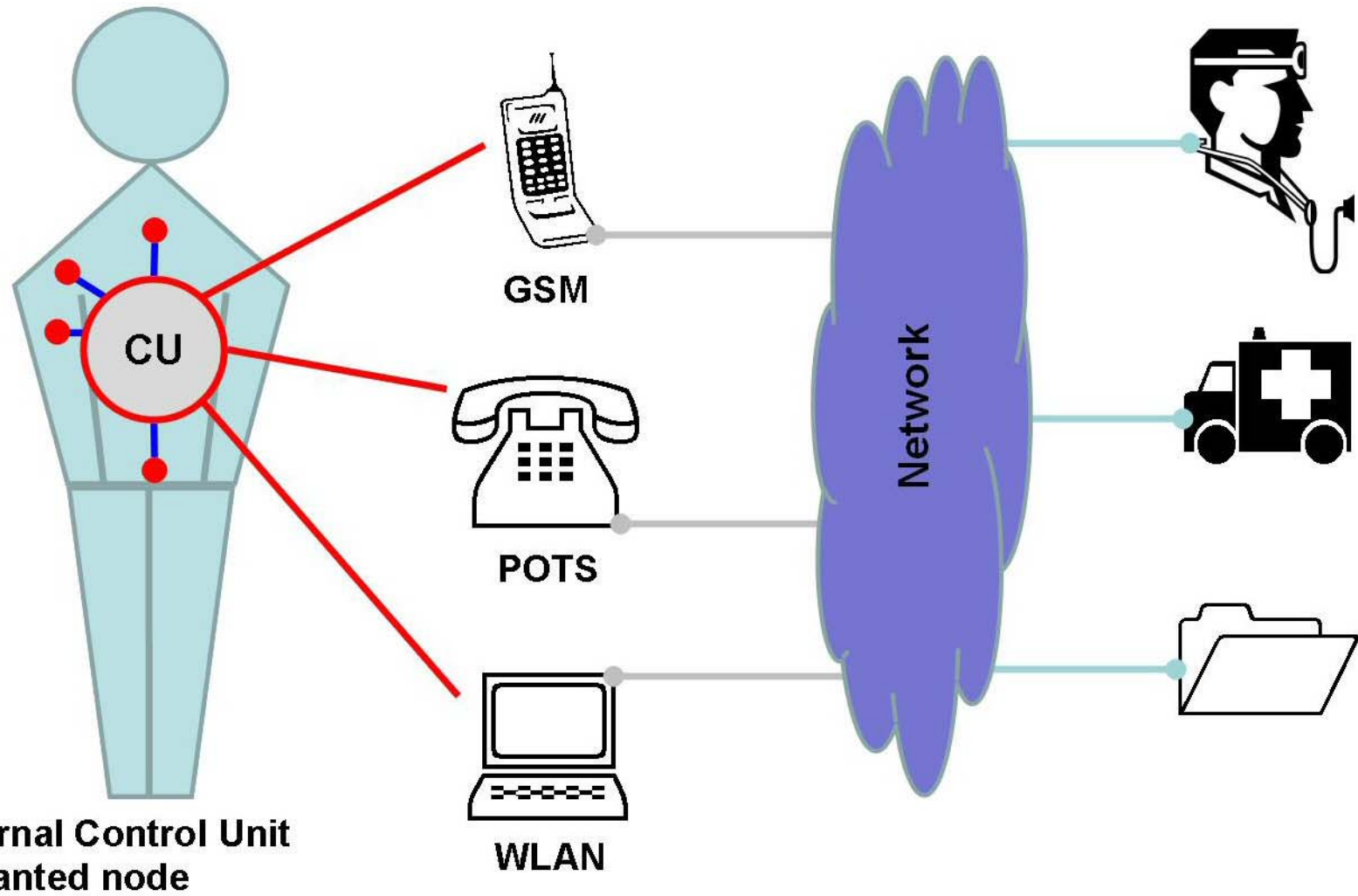
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Implantable biosensing transponder network



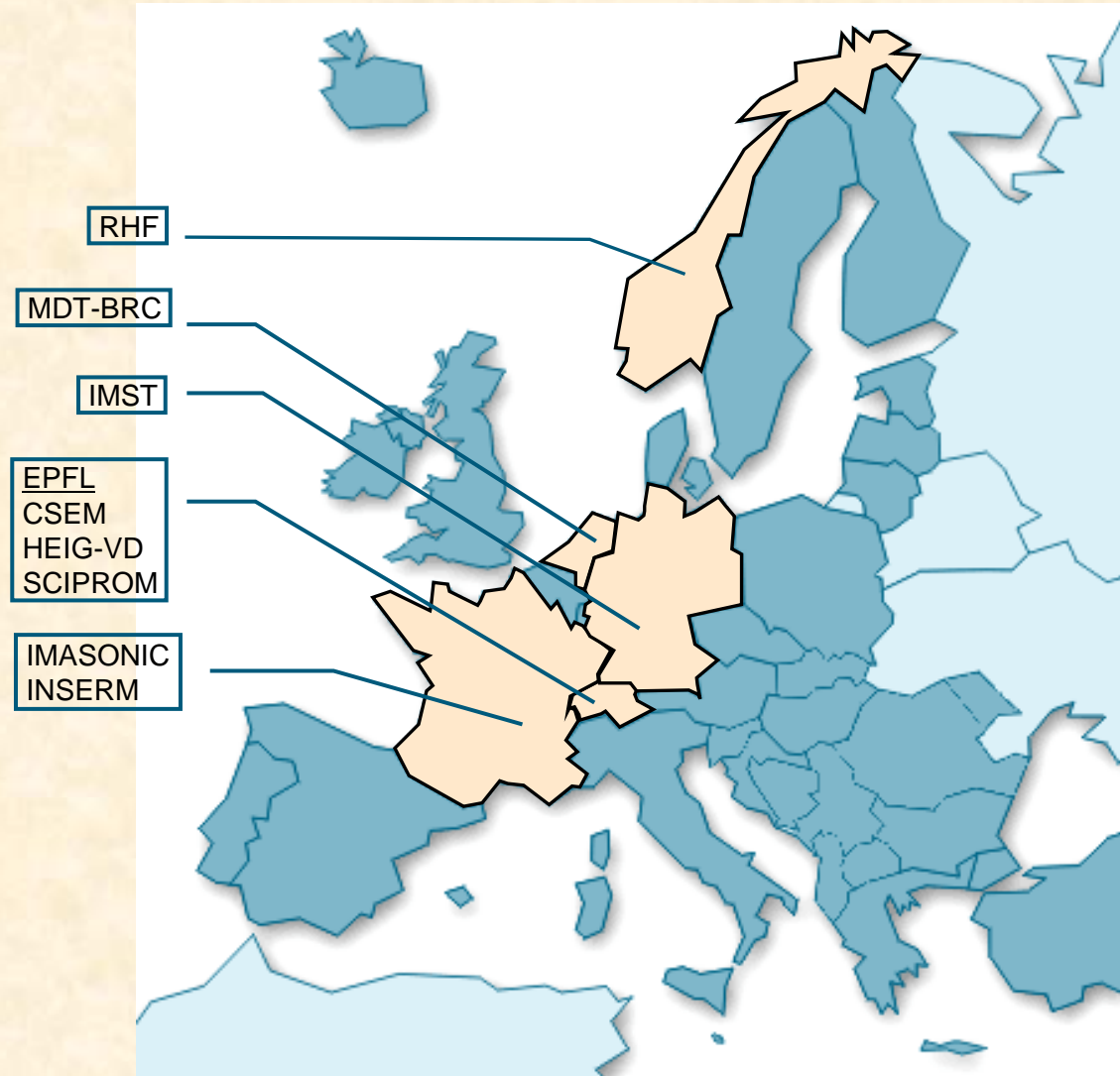
Technology challenges

- To develop a new technology for ultra-low power **sensors deeply implanted inside the body**
- To develop innovative **half-duplex wireless communication and energy transmission** techniques
- To develop key innovative features
 - **Remote powering** through ultrasonic wave
 - Half-duplex ultrasonic **wireless data transmission**
 - **Local signal processing**
- **To develop a safe and recognized technology**
 - Healthcare professionals have been using acoustic communications for decades (ultrasonography)

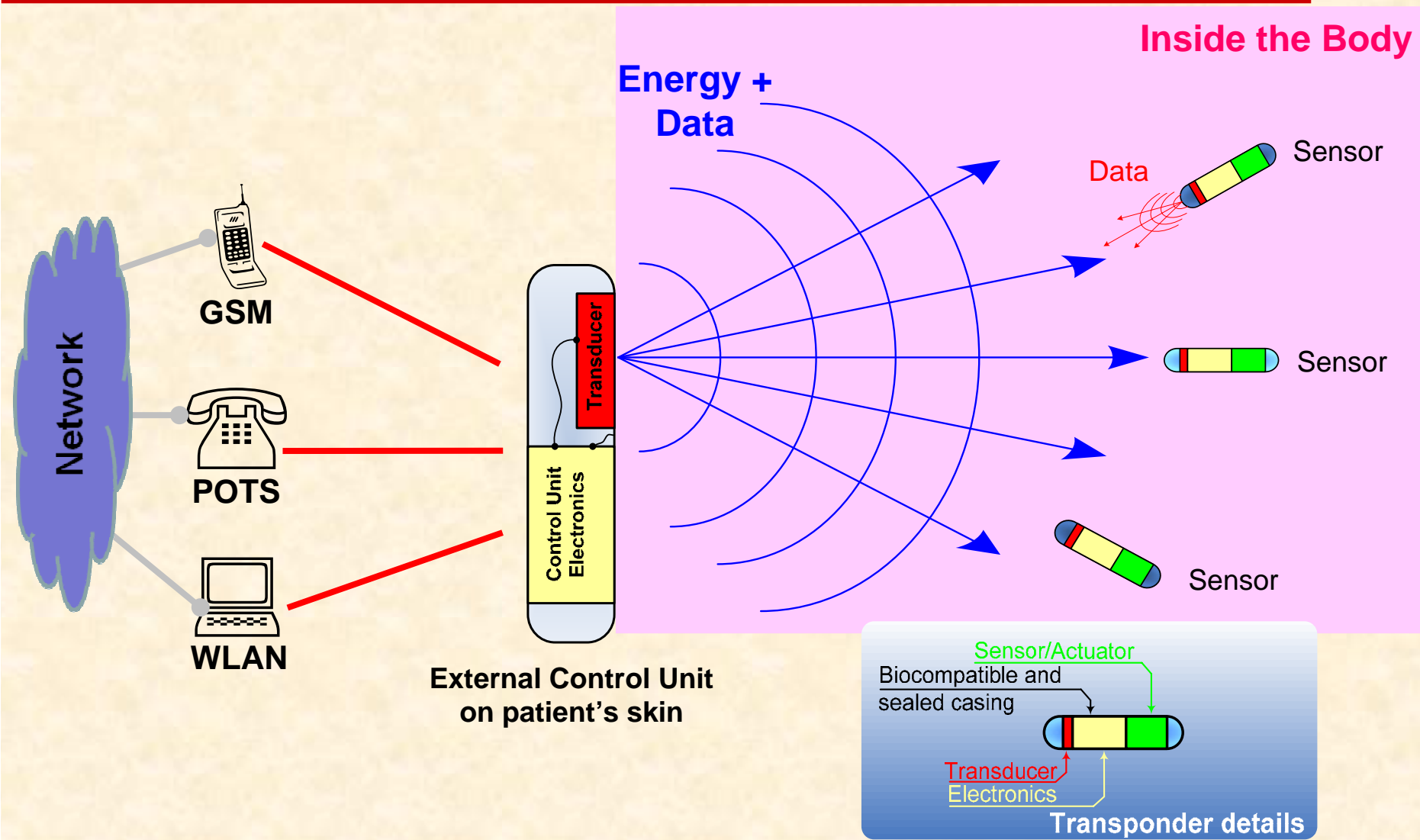
ULTRAsponder Consortium

Universities: 3
R&D Centres: 2
SMEs: 3
Industries: 1

Ultrasound propagation
Electro-acoustic transducers
Wireless communication
Remote powering
Low power A/D converters
Low power signal processing
System integration
Packaging
Clinical trials



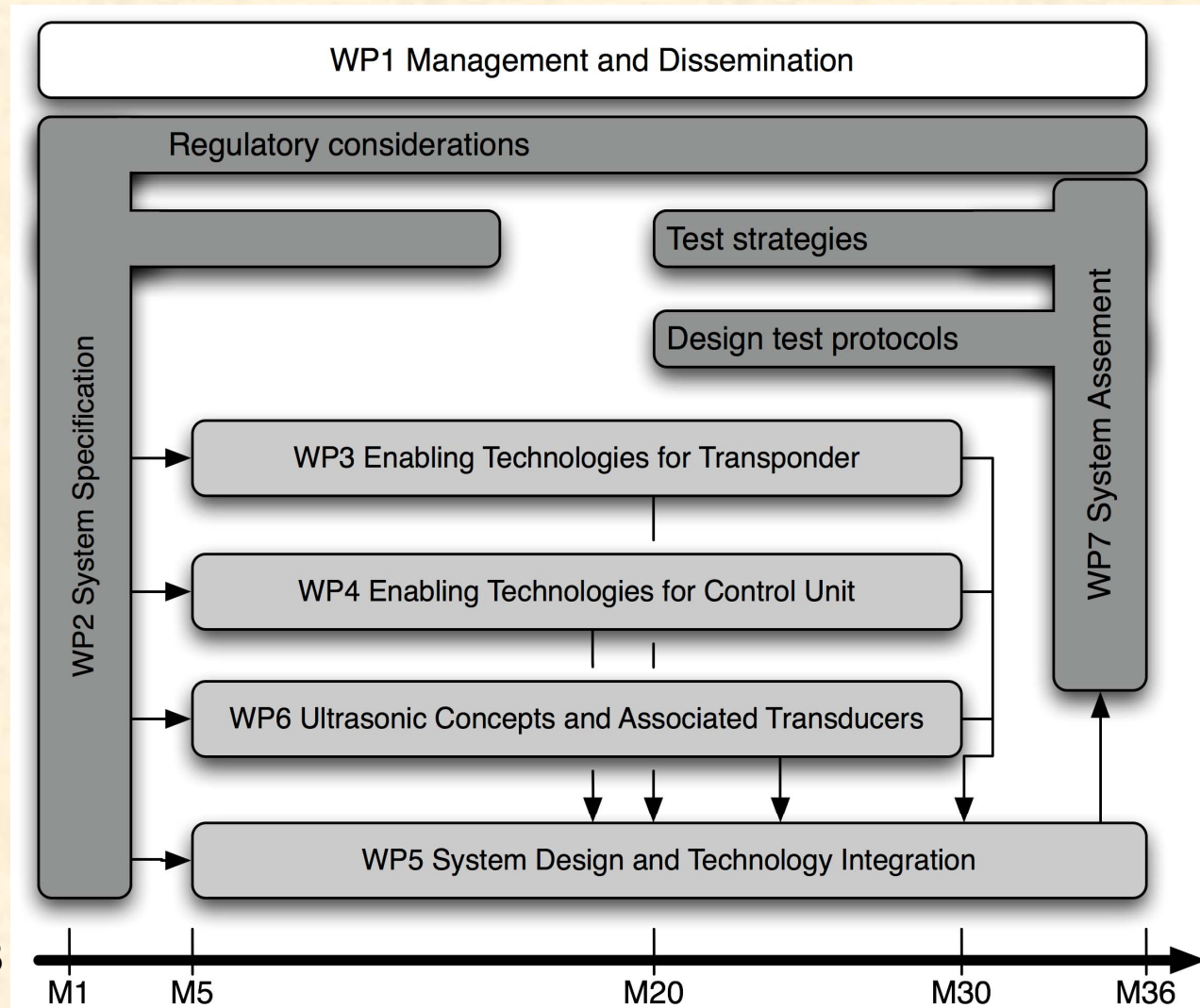
Communication between the CTRL unit and the body



Main Application: CHF

- Continuous monitoring in the diagnosis and the treatment of **cardiac congestive heart failure (CHF)**
 - To follow the day and night heart activity
 - To see how the heart reacts to **stress**, to **physical activities** and to **medications**
 - To make a **direct comparison** of the actual patient condition with a past condition

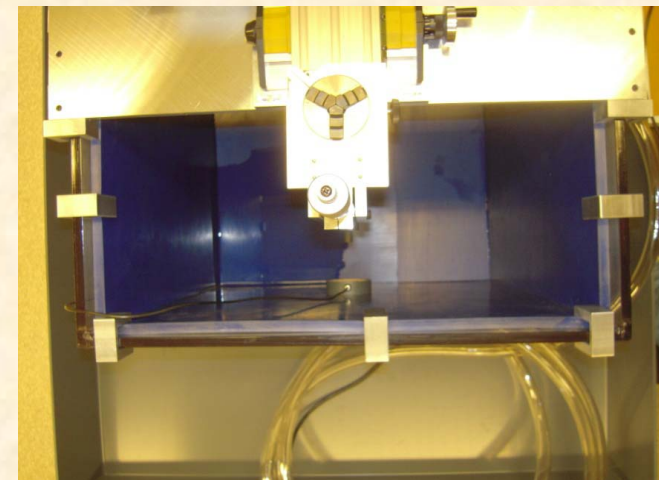
Workplan



Start: 01.09.2008

Achievements in Ultrasponder

- Determination of the main targeted application: monitoring of CHF
- Design and manufacturing of the in-vitro test bed
- Proof of concept of the wireless communication with in-vitro test bed
- Proof of concept of the recharge of the micro-battery with in-vitro test bed
- Design of the A/D CMOS converter
- Design and characterization of a CMOS low power System-on-Chip (SoC) circuit (called icycom)
 - Power management features
 - Icyflex1 32-bit processor with a mixed control and DSP architecture
 - Software and Hardware Development Kits to provide a complete platform for the use of the SoC circuit



Topics for potential cluster collaboration (1)

- **Ultrasound propagation in the body**
 - The main parameters are the density, the sound speed and the attenuation in the tissues
 - To develop model to predict the ultrasonic pressure field in the body
- **Electro-acoustic transducer**
 - CAD tool to simulate the energy transformation in the transponder
 - Design and manufacturing of the transducer
- **Half-duplex wireless communication through ultrasonic wave**
- **Remote powering through ultrasonic wave**
 - Design of the AC to DC converter
 - Recharge of the micro-battery
- **Local signal processing**
 - Low power digital signal processing and energy management
- **Low power A/D converter**
- **Small footprint, high flexibility, modular and generic**

Topics for potential cluster collaboration (2)

- **To provide an innovative medical survey conception**
 - Vital parameters are sensed in the deeply implanted transponder allowing for continuous monitoring.
 - The external control unit periodically communicates and energizes the sensor via ultrasound waves and relays data to the appropriate center.
- **To impact on the medical diagnosis and appropriate treatment**
 - Reliable and comprehensive monitoring of chronicle dysfunction brings present therapy to a personalized level.
 - Patients feel comfortable and receive a precise diagnosis and hence higher quality treatments.
- **Impact for medical industry**
 - Deeply implanted sensors will be produced and commercialized.

Contact for ULTRAsponder

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