Smart **W**earable and **A**utonomous **N**egative pressure device for wound monitoring and therapy

SWAN-iCare

Marco Romanelli
Fabio Di Franscesco

MNBS 2014 – Innovation & User involvement session

21-22 Oct 2014
Toulouse, France

Consortium

EXUS S.A.

Commissariat à l'Energie Atomique et aux Energies Alternatives

Centre Suisse d'Electronique et de Microtechnique SA

University of Pisa

CHU Grenoble

Euroresearch

Heamopharm Biofluids

European Wound Management Association Secretariat

Institute of Communications and Computer Systems

Smith & Nephew

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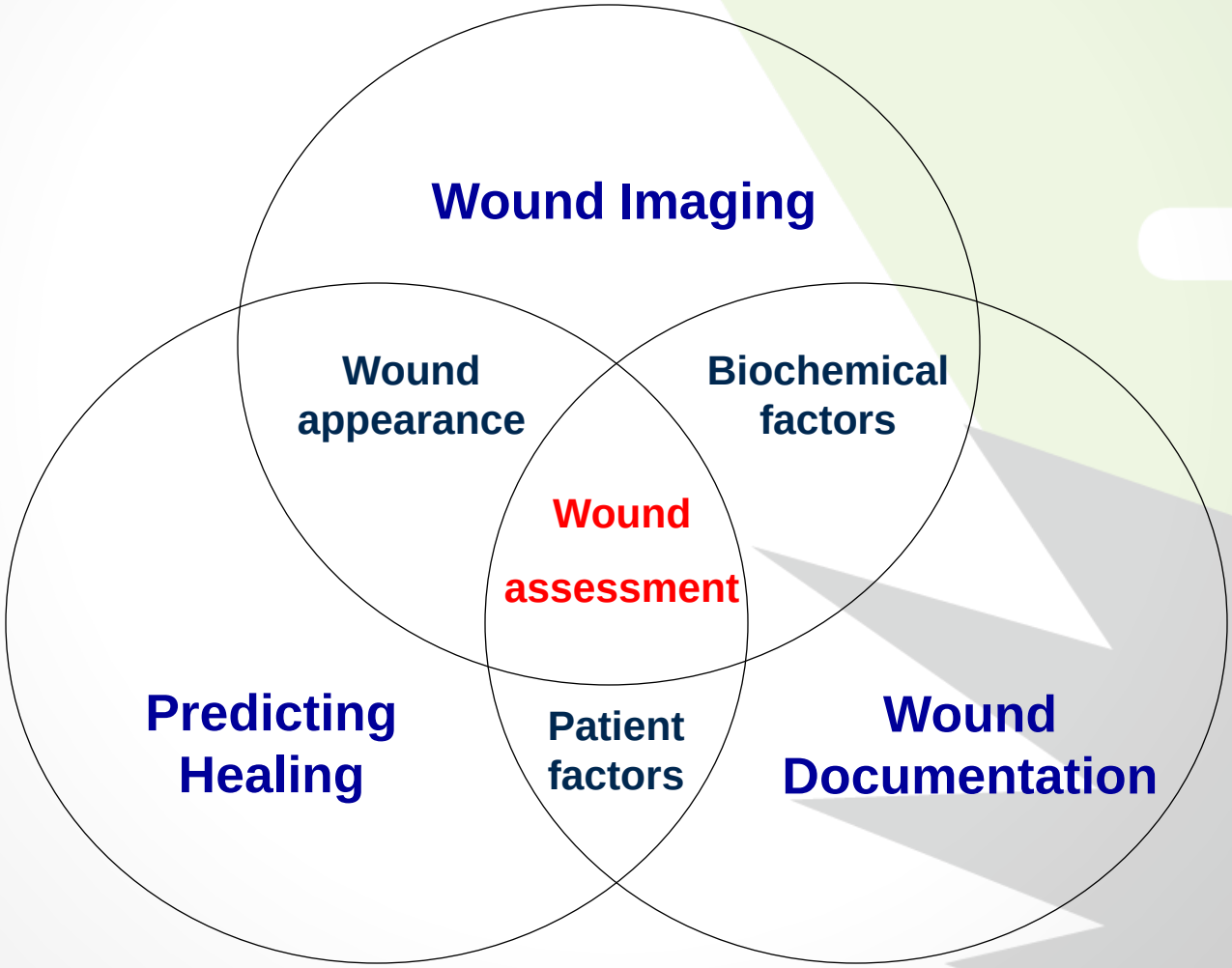
Assessing wound healing



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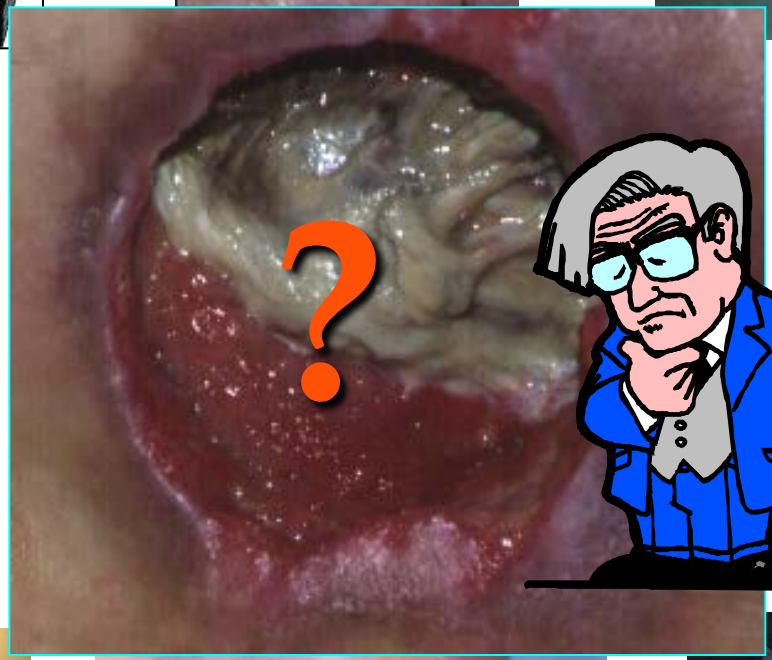

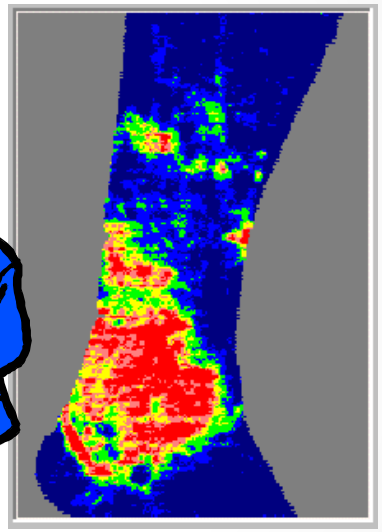

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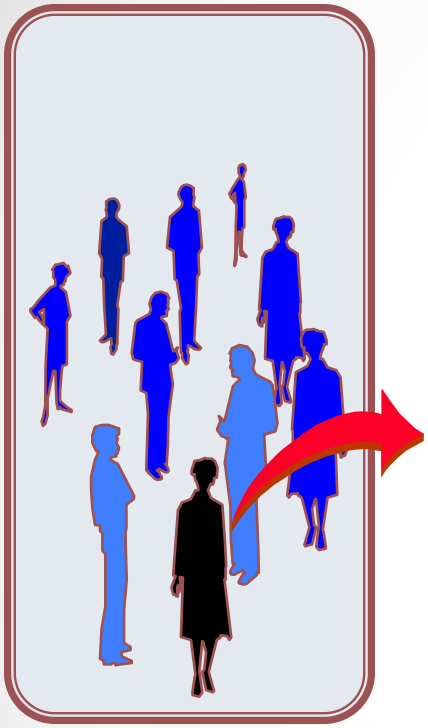
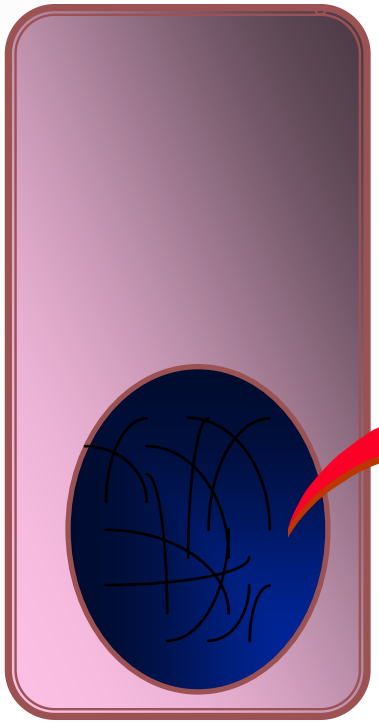
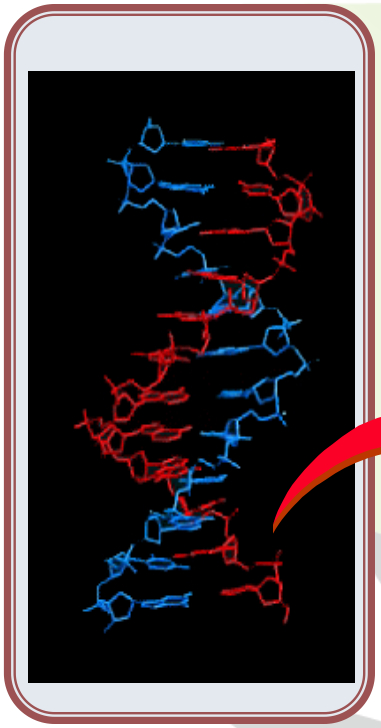
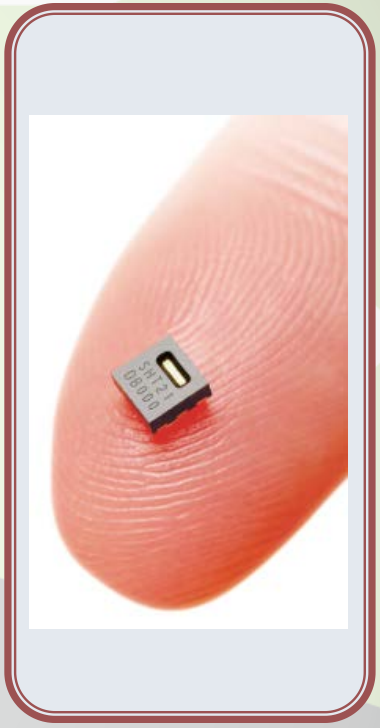








HUMAN CELL GENE SENSORS

SWAN iCare

Purpose of wound assessment

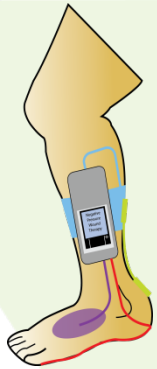
- **Initial definition/diagnosis**
- **Clinical decision support**
- **Monitoring for infection**
- **Monitoring the effect of treatment**
- **Prediction of outcome**
- **Re-imbursement**

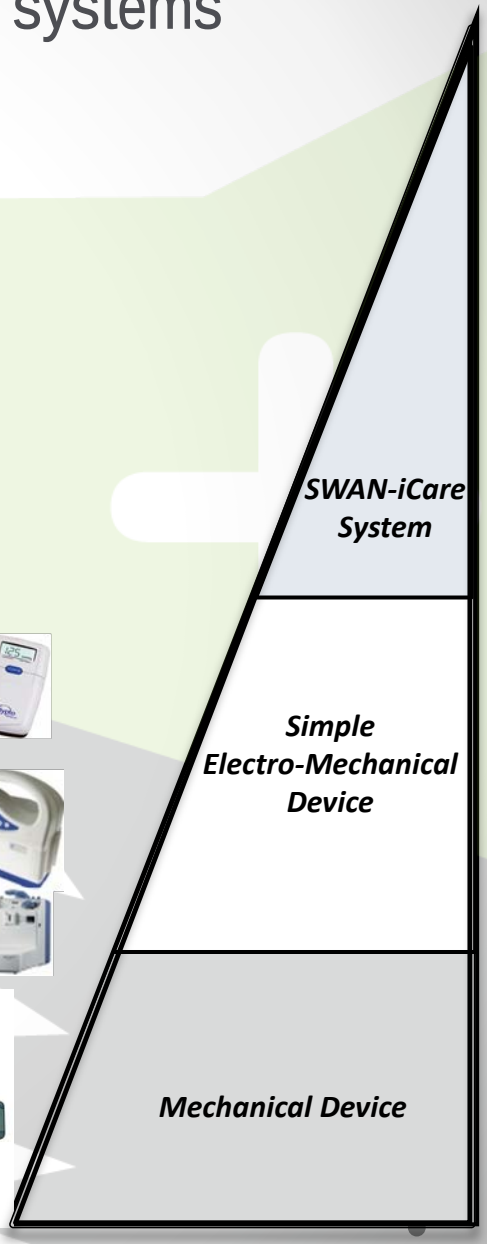
Unique value
SWAN-iCare compared against other NPWT systems

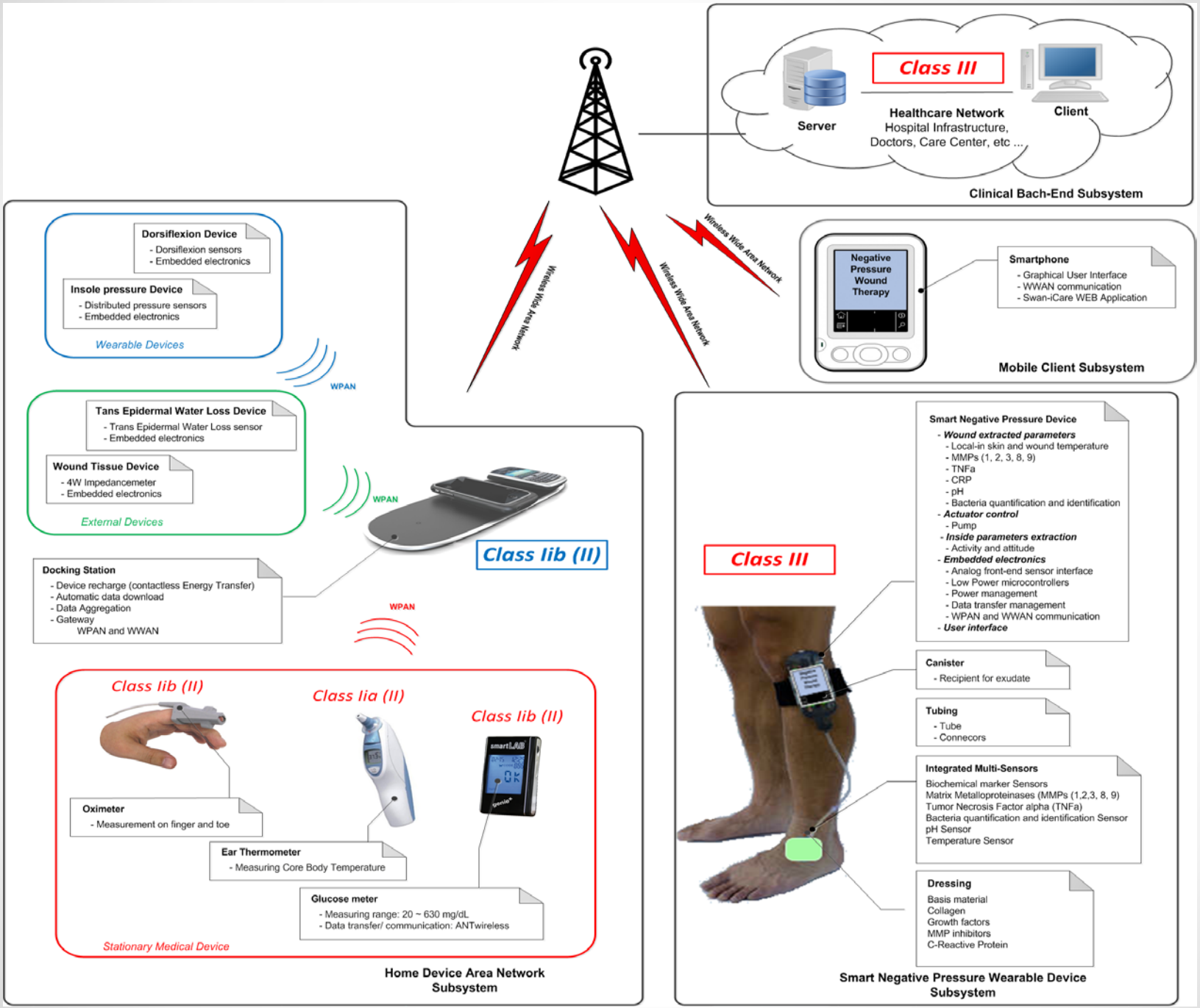
Advanced electro-mechanical devices with :
Real-time wound environment monitoring with wound parameters database.
Remote communication allowing real-time clinical support.

Simple electro-mechanical devices with limited or no exudate / wound environment monitoring, other than basic vacuum control.

Basic mechanical device with no wound sensing or electronic control.

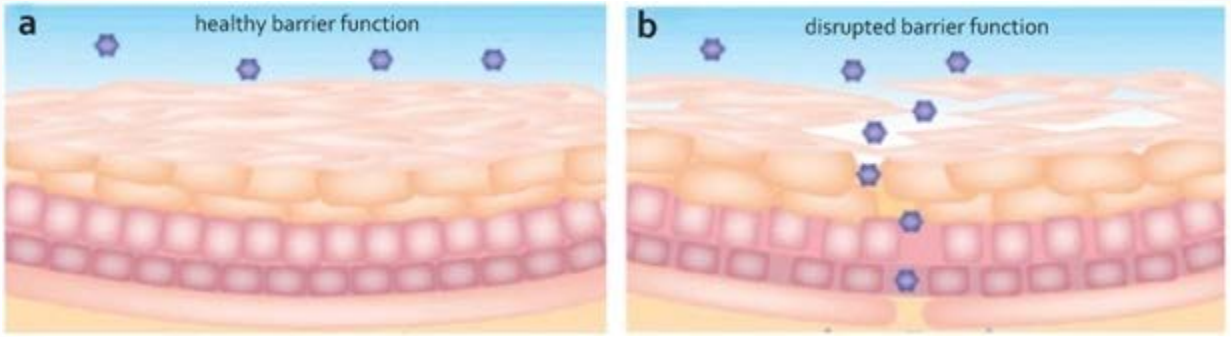




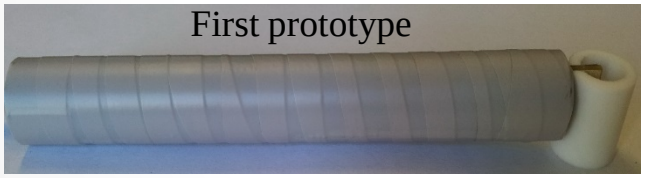

Class III
Server
Healthcare Network
Hospital Infrastructure,
Doctors, Care Center, etc ...
Client
Clinical Bach-End Subsystem
Wireless Wide Area Network
Wireless Wide Area Network
Wireless Wide Area Network
Negative Pressure Wound Therapy
Smartphone
- Graphical User Interface
- WWAN communication
- Swan-iCare WEB Application
Mobile Client Subsystem
Dorsiflexion Device
- Dorsiflexion sensors
- Embedded electronics
Insole pressure Device
- Distributed pressure sensors
- Embedded electronics
Wearable Devices
WPAN
Tans Epidermal Water Loss Device
- Trans Epidermal Water Loss sensor
- Embedded electronics
Wound Tissue Device
- 4W Impedancemeter
- Embedded electronics
External Devices
WPAN
Class IIb (II)
Docking Station
- Device recharge (contactless Energy Transfer)
- Automatic data download
- Data Aggregation
- Gateway
WPAN and WWAN
WPAN
Class IIb (II)
Class IIa (II)
Class IIb (II)
Oximeter
- Measurement on finger and toe
Ear Thermometer
- Measuring Core Body Temperature
Glucose meter
- Measuring range: 20 ~ 630 mg/dL
- Data transfer/ communication: ANTwireless
Stationary Medical Device
Home Device Area Network Subsystem
Class III
Smart Negative Pressure Device
- Wound extracted parameters
- Local-in skin and wound temperature
- MMPs (1, 2, 3, 8, 9)
- TNFa
- CRP
- pH
- Bacteria quantification and identification
- Actuator control
- Pump
- Inside parameters extraction
- Activity and attitude
- Embedded electronics
- Analog front-end sensor interface
- Low Power microcontrollers
- Power management
- Data transfer management
- WPAN and WWAN communication
- User interface
Canister
- Recipient for exudate
Tubing
- Tube
- Connecors
Integrated Multi-Sensors
Biochemical marker Sensors
Matrix Metalloproteinases (MMPs (1,2,3, 8, 9)
Tumor Necrosis Factor alpha (TNFa)
Bacteria quantification and identification Sensor
pH Sensor
Temperature Sensor
Dressing
Basis material
Collagen
Growth factors
MMP inhibitors
C-Reactive Protein
Smart Negative Pressure Wearable Device Subsystem

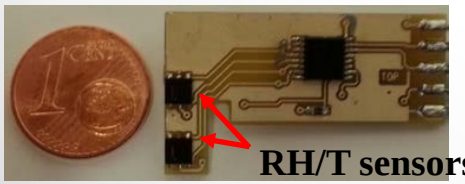
Transepidermal water loss sensor

Damaged skin looses the barrier function →TEWL increases

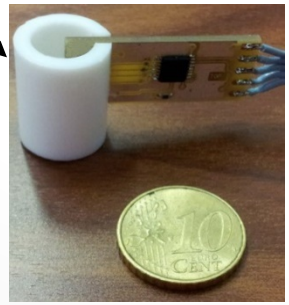


$$TEWL \propto \frac{\Delta RH}{\Delta x}$$, RH = relative humidity, x = distance from the skin.

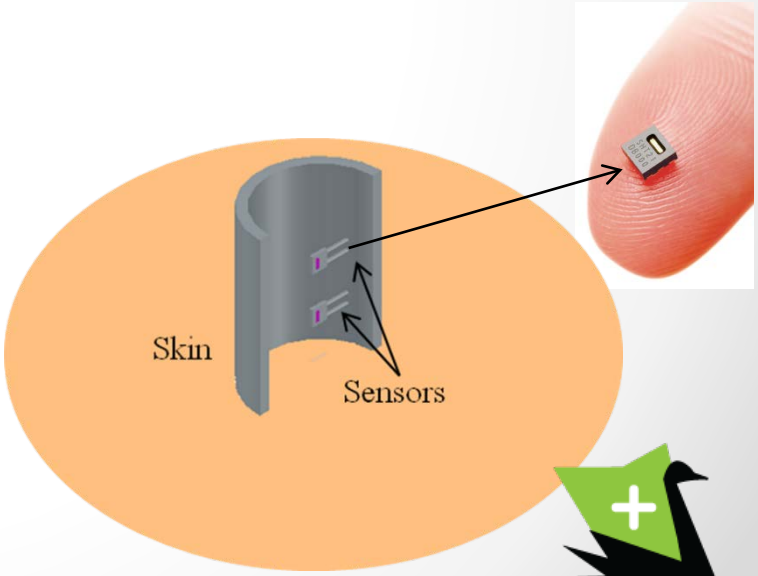




TEWL sensor - Front End
(32 mm x 19 mm)



(Teflon capsule 2 cm x 1 cm)



Simplified scheme

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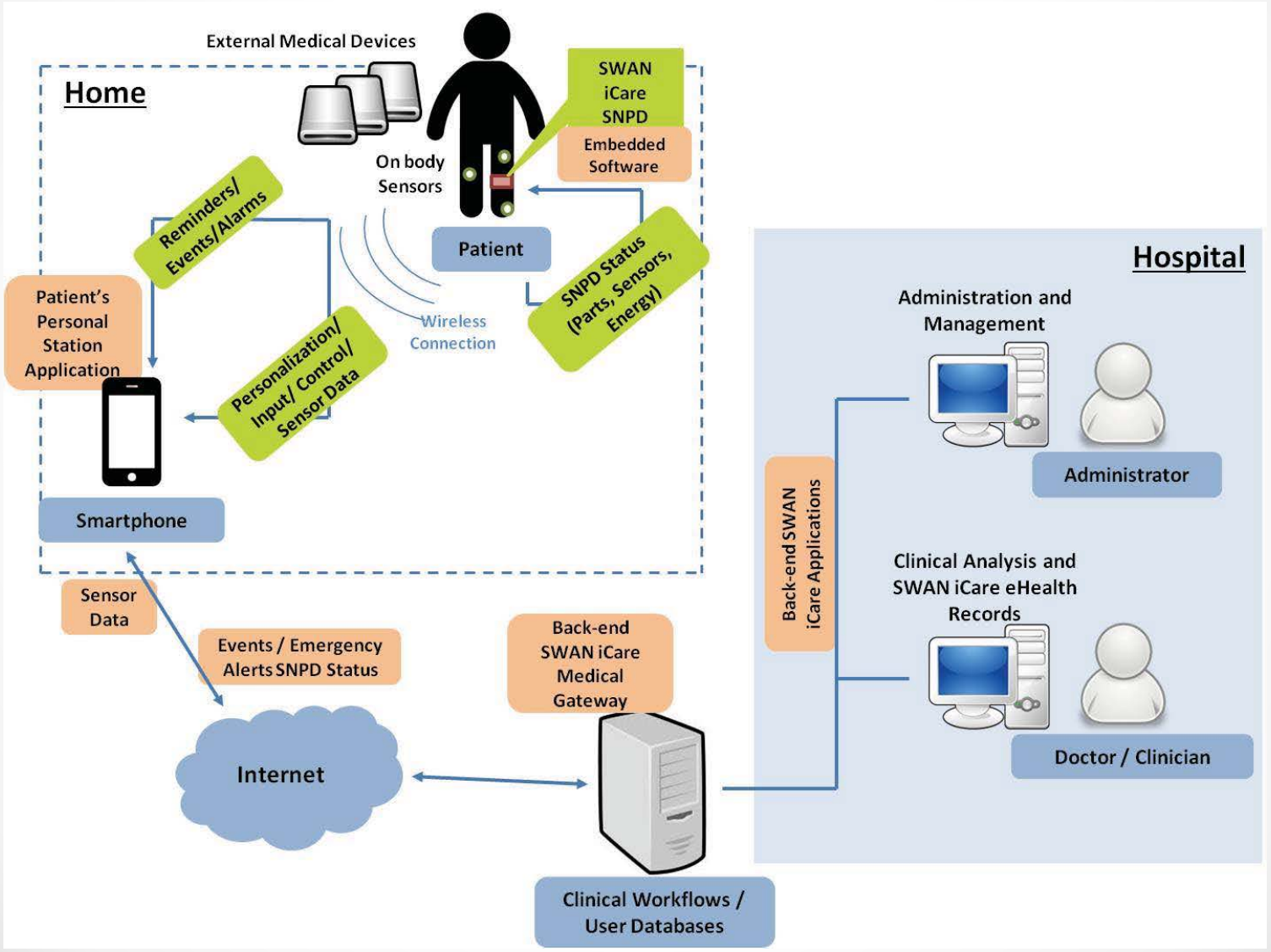
SWAN-iCare workflow

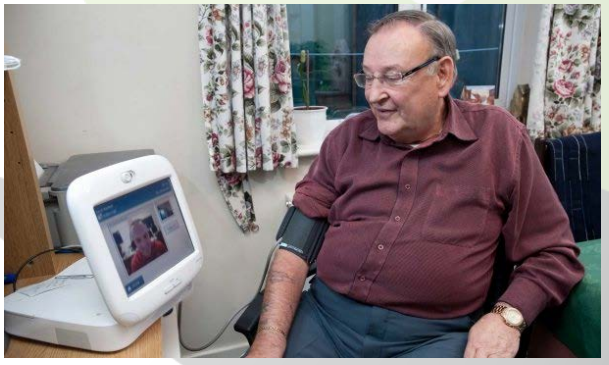


Expected Impact: the patient

Benefits for the patient

- Continuous home monitoring of a number of wound parameters
- Personalised therapy initiated by the physician remotely and adapted to the daily measurements
- Faster wound healing due to the early identification and therapy of potential problems

- Wound deterioration can be identified early and acted upon, therefore leading to reduced morbidity and amputation rates
- Reduced disturbance to patients life and possible need for hospitalisation
- Better quality of life with better mobility, more comfort ,less stress



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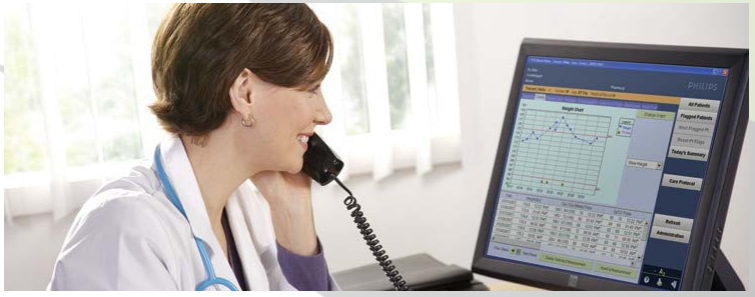
Expected Impact: Society and Healthcare

Benefits for society and healthcare

- Reduced healthcare costs as a result of reduced need for hospitalisation
- Reduced burden for the patients relatives due to faster wound healing and remote monitoring
- Reduced social costs and improved productivity as the patient returns to work earlier

- Increased access to best practice wound care for patients living in remote geographical locations
- Reduced daily nursing visits allows for more new patients' to be added to the case load



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Expected Impact: Medical science

Benefits for the medical science

- Advancement of wound care best practice, supply of the most effective wound care protocols available
- Continuous objective measurement contributing to evaluation of wound progress, and treatment effectiveness
- A better understanding of wound healing due to creation of a DATA base of continuous wound parameter measurements
- Potential for new wound healing research

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Innovation process and Road to exploitation

- **SWAN-iCare plans direct exploitation to the wound management market, organised by S&N (partner with direct access to the market)**

- **Road to exploitation is coherent with the target users: the SWAN-iCare road builds upon existing service delivery models of S&N**

Distance to the market

- **SWAN-iCare has completed 26 months out of a total of 48 months. After the end of the project, it is expected that the time needed to bring SWAN-iCare to the market is between 18 and 36 months**
- **The business plan of the project has identified the following steps that will be followed after the end of the project**
  - Regulatory approval (CE marking, etc.)
  - Purchases of supplies, materials, inward shipping
  - Manufacturing, quality assurance, packaging and dispatch
  - Warehouse, distribution and returns/recycling routes
  - Marketing activities
  - Integration with existing IT systems (telemonitoring modules of the system)
  - User training

Summary

Improved wound assessment

↓

Better prediction of healing rates

↓

Improved documentation

↓

Improved decision-making

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Improved patient outcomes

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