EHRA Summit 2010

22-23 March 2010, Sophia Antipolis

From e-Health to m- and p-Health

Loukianos Gatzoulis

Unit "ICT for Health"

DG Information Society and Media

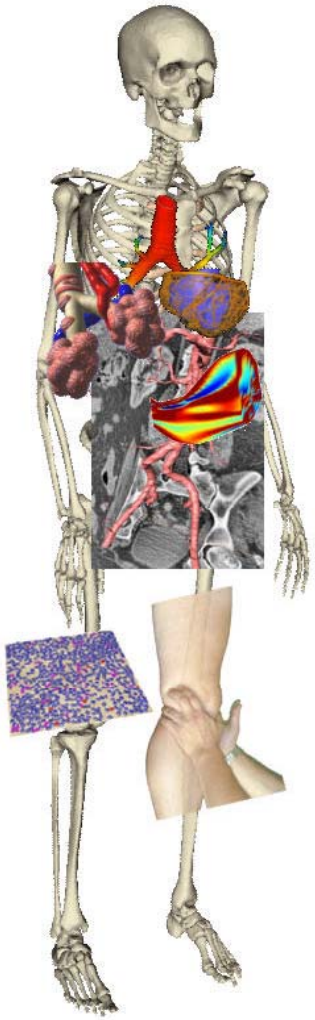
European Commission

European Commission
Information Society and Media

Who are we?
"ICT for Health" Unit, Information Society and Media DG
European Commission

- **Supported > 500 eHealth projects with > €1 Billion since 1989**
- **Current support (~ €100 Mil/year)**
- Major focus in 90's:
  - *Regional Health Information Networks, Electronic Health Records, Homecare/telemedicine*
- **Today's focus:**
  - ***a) Research:***
    - ✓ Personal health systems (wearable, portable monitoring)
    - ✓ Patient safety (Clinical information systems for safer outcomes)
    - ✓ Modelling and Simulation of diseases (Virtual Physiological Human)
  - ***b) Policy and support to deployment***
    - ✓ eHealth Action plan, Lead market initiative
    - ✓ Recommendation on Interoperability, Communication on Telemedicine
    - ✓ Large Scale Pilots, certification of Electronic Health Record Systems

DG INFSO / ICT for Health – Research areas



- ***Personalisation of Healthcare***
  - ✓ **Personal Health Systems (PHS)**

    € 135 million in 2007-2010

MYHEART

- ***Virtual Physiological Human (VPH)***
  - ✓ Predictive Medicine – Modelling/simulation of diseases

    € 140 million in 2007-2010

- ***Patient safety - avoiding medical errors***

  € 60 million in 2007-2010

Challenges for European Health Systems

- ***Pressure on healthcare systems:***
  - Citizens' expectations for high-quality care
  - Demographic changes
  - Increased prevalence of chronic diseases
  - Increased mobility of citizens and patients
  - Staff shortages, unequal territorial distribution
  - Reactive model of healthcare delivery
  - Rising healthcare costs

How to offer high-quality & affordable care?

Continuity of care enabled by eHealth

General Practitioners

Health Authorities

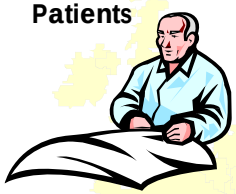
Prevention

Social Service

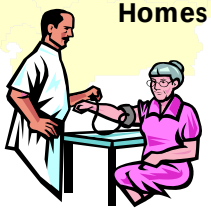
Hospitals

Healthy citizens

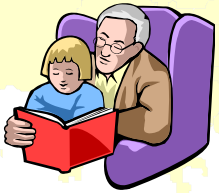
Patients



Nursing Homes



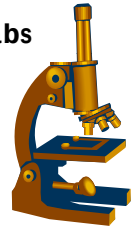
Diagnosis & Care



Frail persons

Rehabilitation

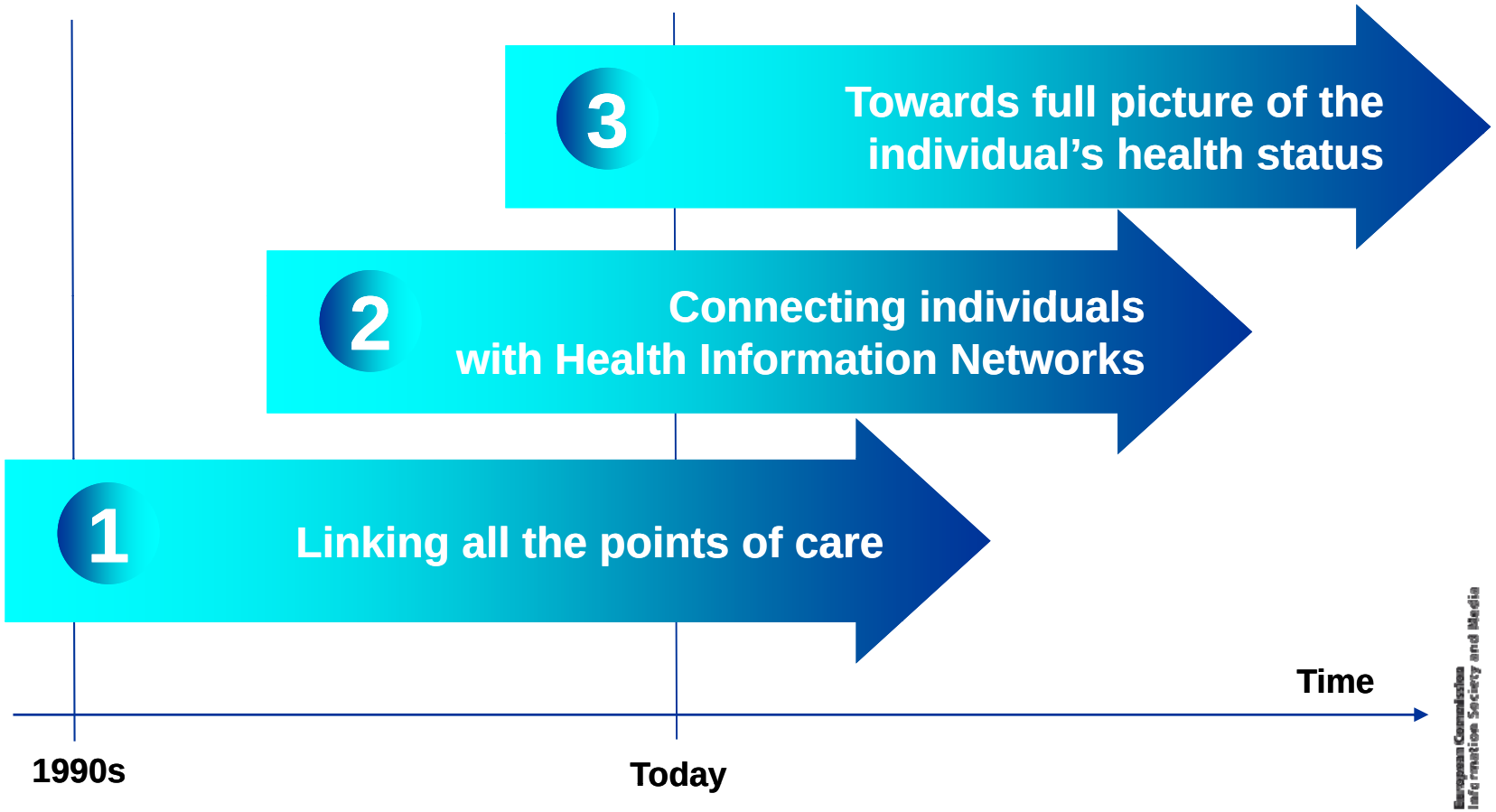
Labs



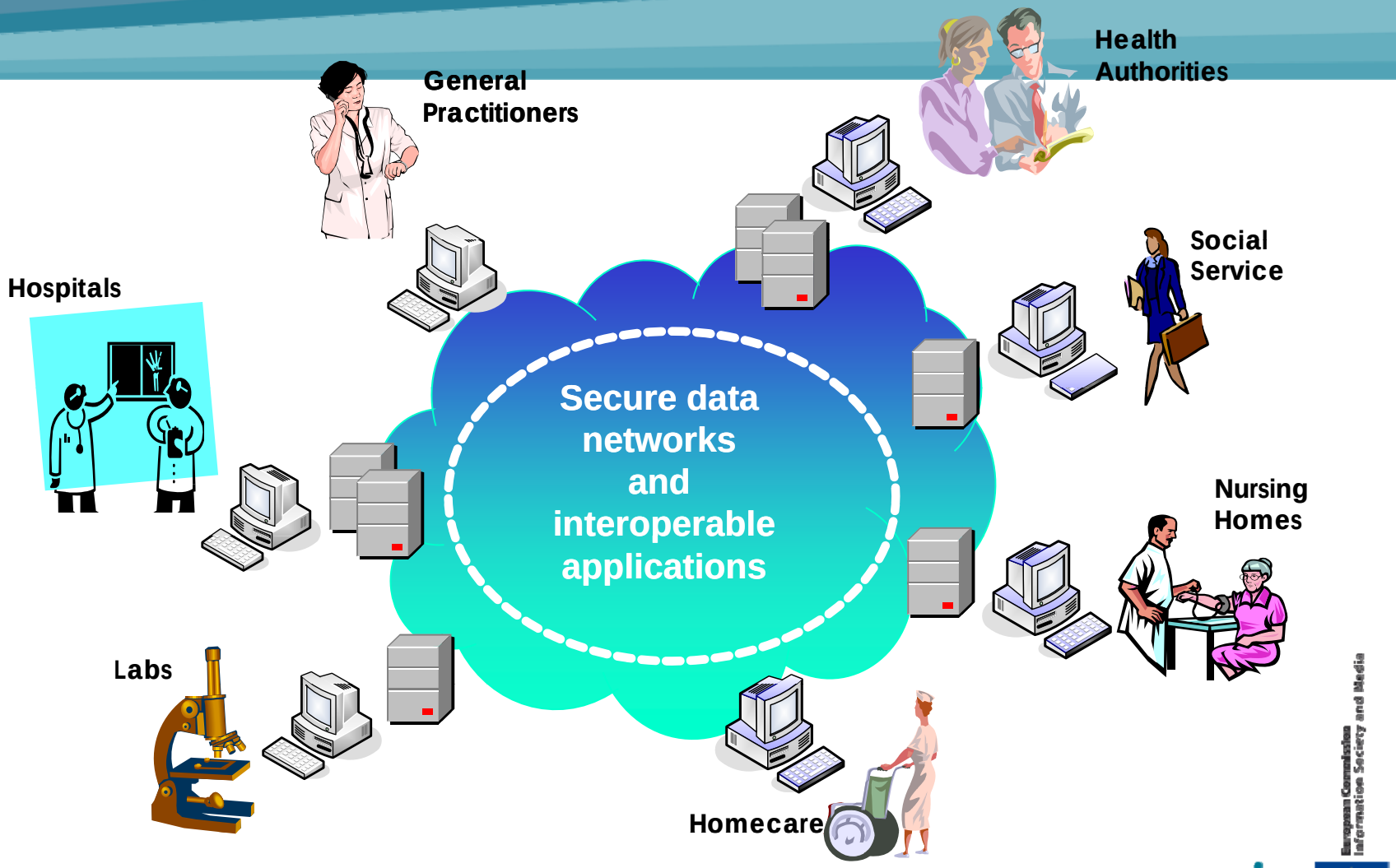
Homecare

How: By sharing information
Tools: Electronic Health Records, Regional Information Networks, Portable Systems

The EU roadmap for eHealth



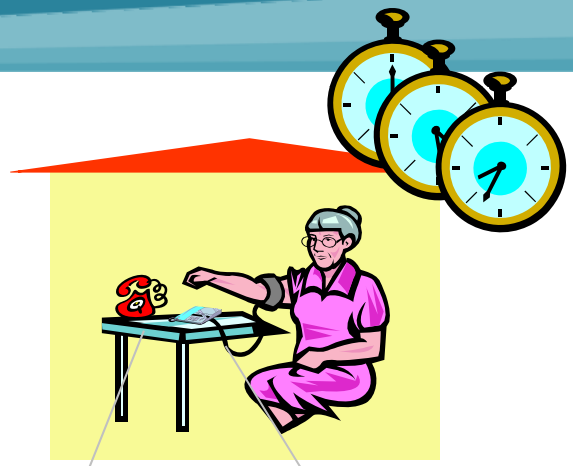
Step 1 – Linking all the points of care



Large Scale Pilot on cross-border eHealth interoperability

- ***"epSOS – Smart Open Services for European Patients"***
  - Patient Summary for EU Citizens
  - ePrescription for EU Citizens

Step 2 – Connecting individuals with Health Information Networks



Patient at home

Data acquisition

Data communication and feedback

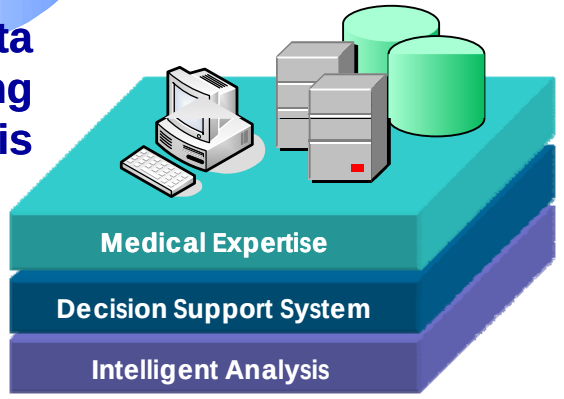
Hospital

General Practitioner

Homecare

Data processing & analysis

Devices for multi-parametric monitoring



Personal Health Systems - PHS

A new generation of disruptive eHealth tools

- Place the individual person in the centre of the healthcare delivery process
  - ✓ **Person-centric care**
- Aim for high quality, personalised care at the point of need
- Better use of the available healthcare resources

Key facilitators for:

- Ubiquitous personalised care
- Continuity of care (in time and space)
- Supporting the shift to preventive care

PHS characteristics

Realised as:

- **Wearable**, **implantable**, **portable** systems
- Integration of various components and technologies
  - e.g., sensors, implants, signal processing algorithms, user interfaces, mobile and wireless communications
- Used by the patient or healthy individual
- Coupled with telemedicine platforms to provide personalised services

Non-/minimally-invasive monitoring and management

- Remote & continuous health status monitoring and disease management
- Personalised medical advice, recommendations & treatment
- Available at anytime and location beyond hospitals

The First Approaches in PHS: “Telehealth”

Telehealth solutions for home care employing:

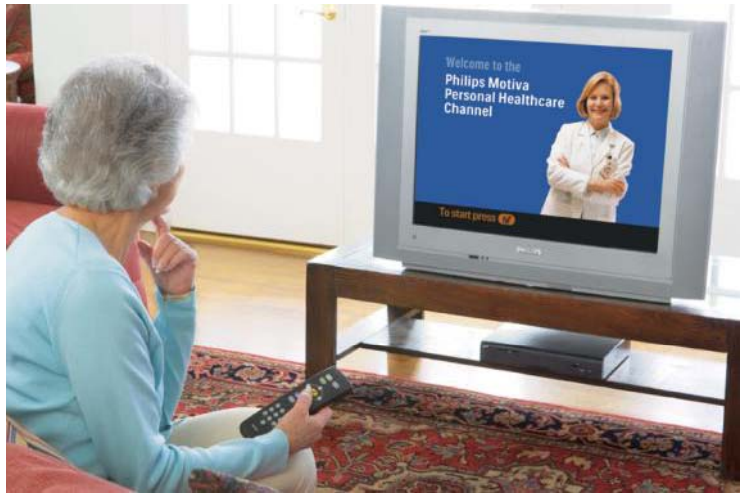
- *Sensing and monitoring equipment*
  - ECG (event) recorders, blood glucose monitors, etc…
- *Communication networks*
  - Via telephone lines
- *Services provided by call centres*
  - 24 hours a day, all year round
  - Linked with networks of health professionals
  - Medical response and guidance
- *Example: Telecardiology - Boario Home Care Project, IT*

Telehealth becomes “interactive”

Interactive TV:

- *Remote care at home*
- *Easy to use interface*
- *Patient education (through personalised videos)*
- *Feedback and motivational messages*
- *Supporting doctor-patient interaction*

- *Example: MOTIVA by PHILIPS*



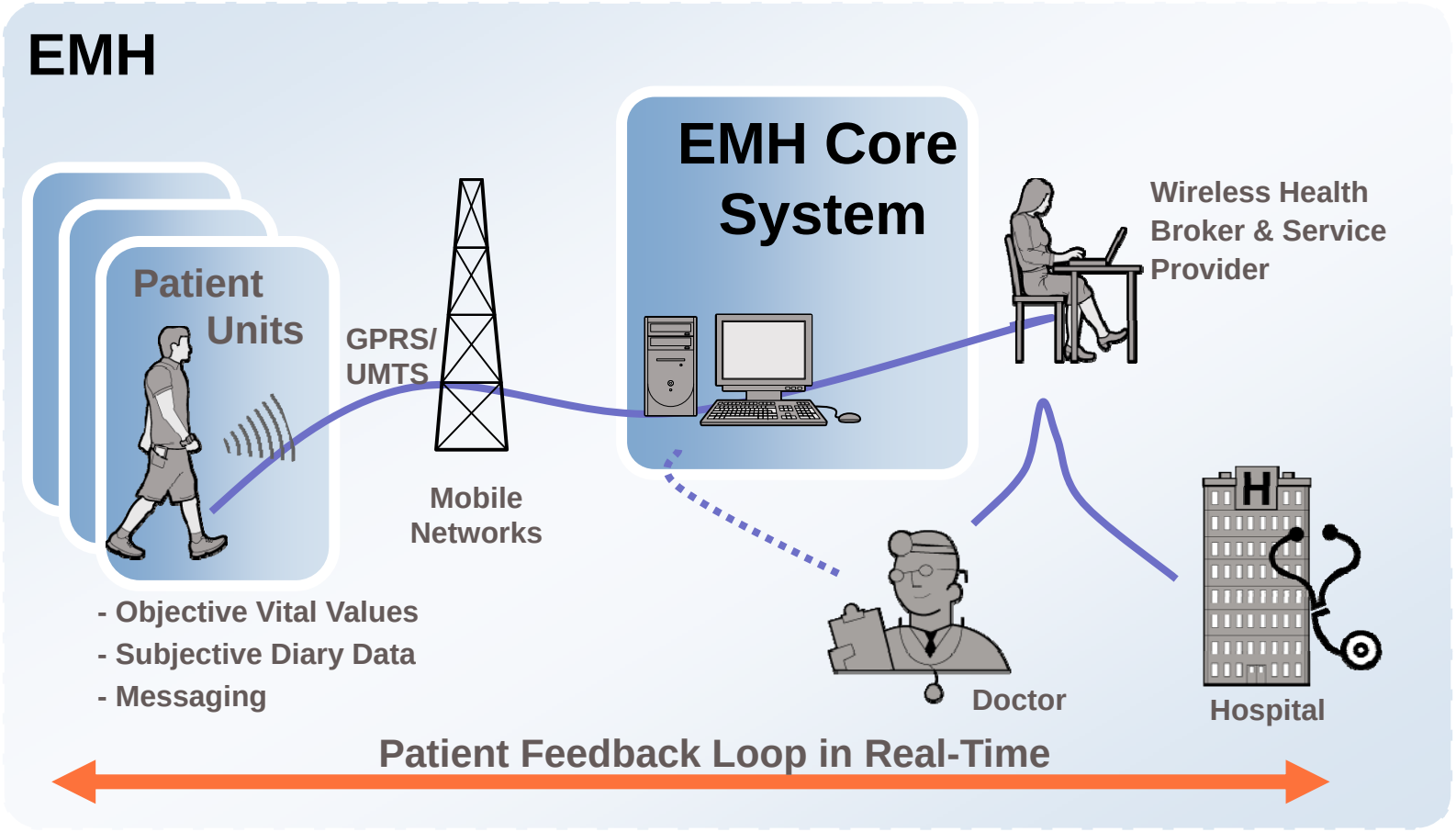
Source: Philips
http://www.medical.philips.com/main/products/telemonitoring/products/motiva/

European Commission
Information Society and Media

Introducing mobile technology: the move to “m-Health”

- *Mobile monitoring of health status*
  - Body sensors (wearable, wireless)
  - Measurement of vital signs (ECG, heart rate, blood pressure, blood glucose, …)
- *Mobile/Wireless communication networks*
  - Wirelessly from sensor network to PDA or mobile phone
  - GPRS / UMTS mobile networks to servers in medical centres
- *Services*
  - Health service providers
  - Linked with health professionals
  - Real-time feedback to patient
  - Messages, reminders

Introducing mobile technology: the move to “m-Health”



Source: Rainer Herzog, Ericsson,
presented at the Personal Health Systems conference, Brussels, 12-13 February 2007

Prototype PHS in the hands of the users

(from FP5 and FP6 research projects)

Examples for monitoring vital signs

- Wrist-worn devices
- Body Sensor Networks
- Biomedical clothes

AMON

MOBIHEALTH

MYHEART

WEALTHY

Prototype PHS in the hands of the users

(from FP5 and FP6 research projects)

The MyHeart system for closed-loop management of Heart Failure

- Patient self management: taking measurements at home, morning and night
- Detect trends in measurements prior to medical events
- Early prediction of patient "decompensation"

T-shirt

Respiration
ECG
Activity

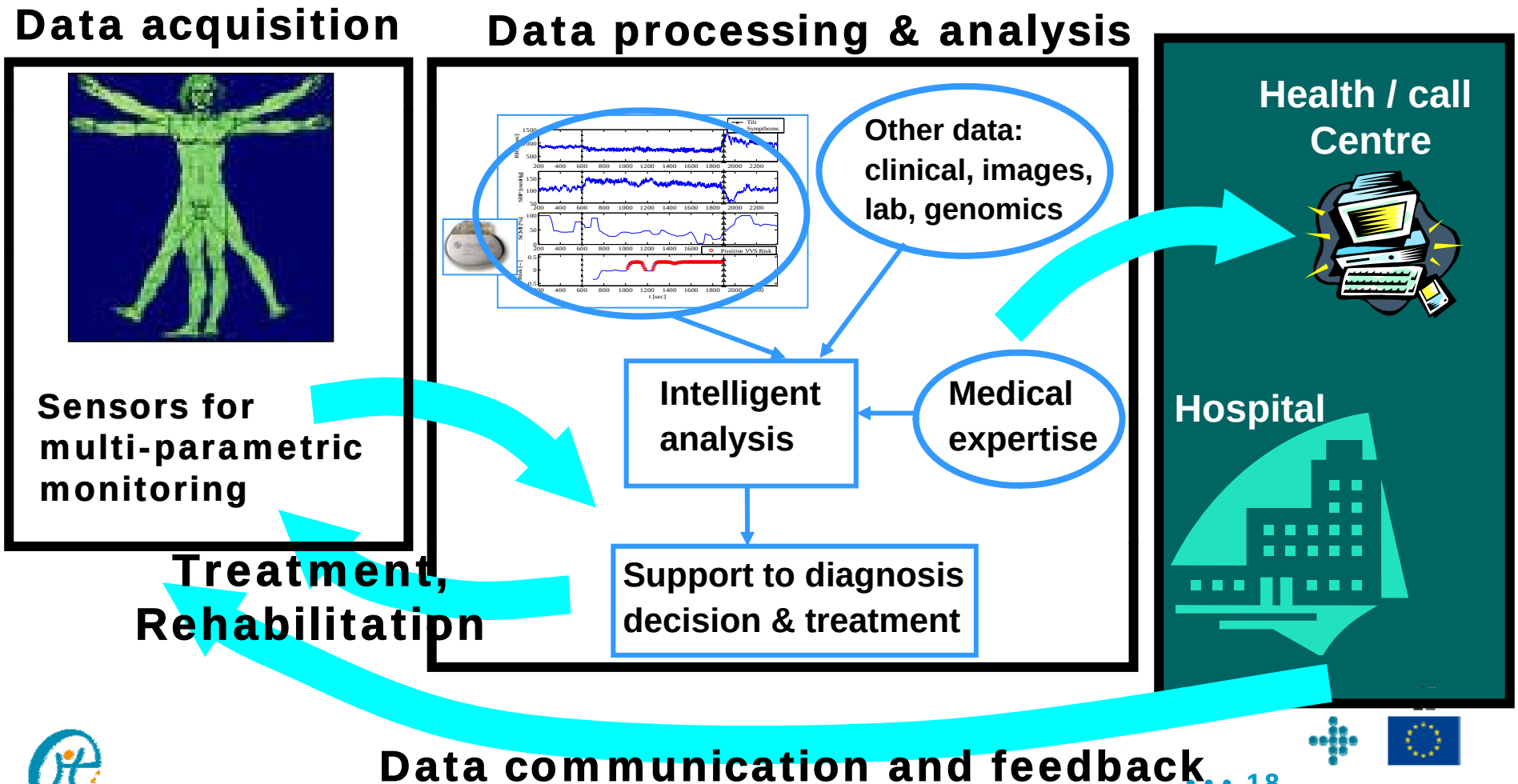
Smart Bed

ECG
Pressure
•Heart Rate
•Respiration Rate
•Activity

Reference

Weight
Blood Pressure
Implant
•ECG
•Activity

Personal Health Systems: the bigger picture

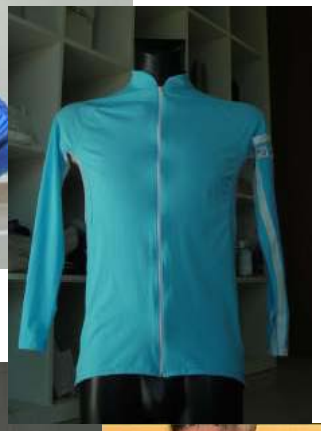


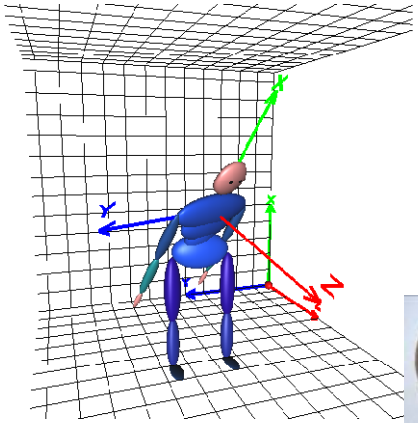
Prototype PHS in the hands of the users

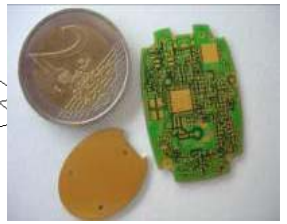
(from FP5 and FP6 research projects)

In neurological applications

- Textiles with embedded sensors to assist rehabilitation







MYHEART

PHS - research on Point-of-care systems

Portable systems for prevention/early identification of a disease

- Lab-on-Chip, microfluidics, integrated sensors
  - Integration of different functions in miniature devices (preparation, mixing, analysis, etc.)
  - Parallel measurements from small samples
  - High throughput screening
  - Identify predisposition to diseases

SmartHEALTH
Integrated Project

Considering personalised context and characteristics:

the complete move to “p-Health”

- **Enrich information**
  - *from surrounding environment, activities, emotions, genetic …*
- **Account for measurements in non-clinically controlled environments**
  - *give “context” to a value, i.e. under which conditions it was measured*
- **Adapt to specific characteristics of the individual**
  - *we are all different from each other*
  - *a blood pressure level may be high for person X but normal for person Y*
- **Consider all the above in:**
  - *reducing false alarms*
  - *medical decision making*
  - *providing services*
- **PHS research moves in this direction**
  - *… but we are not quite there yet*

Does all this work?

- Is there **evidence** that specific eHealth applications improve clinical (health) outcomes and/or are cost effective?
- Can anybody get in "**trouble**" for **NOT** deploying eHealth solution today?
- Need for a **commonly** used set of assessment & evaluation methodologies in order to **pool evidence** about eHealth
- Such **evidence** to be
  - *in large scale settings*
  - *using scientifically sound methods*

What are the benefits and evidence?

- **UK Department of Health on potential of self-care:**
  - *Reduce GP visits by 40%*
  - *Reduce outpatient visits by 17%*
  - *Reduce hospital admissions by 50%*
  - *Reduce length of hospital stay by 50%*
  - *Reduce days off work by 50%*

- **Boario telecardiology:**
  - *Estimated annual benefit cost ratio > 3.3:1 by 2012*
  - *Net benefit even from the first year*
  - *35-47% reduction in hospital admissions (in various studies)*
  - *12% reduction in outpatient visits*

What are the benefits and evidence?

- **Practical:**
  - *More than 4 billion mobile phones in user worldwide*
  - *Quick and low-cost solution for a large population*

- **Clinical:**
  - *Patient mobility, quality of life*
  - *Clinical efficacy*
  - *Evidence from TEN-HMS study on home telemonitoring of heart failure:*
    - improved survival rates by 15% over usual care
    - 26% reduction in hospital days per patient
  - *Evidence from trials on cardiovascular diseases (Source: Ericsson & HealthServices24):*
    - Admissions reduced by 60%
    - 90% of the patients claimed to feel more reassured

What are the benefits and evidence?

- **Economic:**
  - *Evidence from COPD trials (Source: Ericsson & HealthServices24):*
    - Reduced hospitalisation days
    - 38% reduction in patient costs
  - *Evidence from TEN-HMS study on home telemonitoring of heart failure:*
    - 10% overall cost savings with respect to nurse telephone support
  - *Potential of Mobile Monitoring in Germany (Source: GesundheitScout 24 GmbH & Bayerisches Rotes Kreuz):*
    - Up to €1.5 billion/year savings through early patient discharge
    - Assuming 3 days less hospital stay for 20% of patients

What are the benefits and evidence?

- **Study across nearly 1000 homecare agencies in USA***
  - *Significant benefits of telehealth applications for homecare*
  - ***>76%** of the agencies reported reductions in unplanned hospitalisations and in emergency room visits*
  - ***>71%** of the agencies reported improved patient satisfaction from telehealth services*

* **"National study on the future of technology & telehealth in home care"**

by National Association for Home Care & Hospice, Philips Home Healthcare Solutions and Fazzi Associates, Inc.

http://www3.medical.philips.com/resources/hsg/docs/en-us/custom/HomeCareStudy.asp

Achievements until now

- **Systematic support to R&D so far has helped to:**
  - *overcome many technological challenges*
  - *realise the first generations of prototype PHS*
- **Early evidence suggests significant benefits to healthcare systems and individuals**
- **Two parallel streams of activities:**
  - *Assistance towards the wide **deployment/integration** of first PHS generations in healthcare systems*
  - *Continued **research** activities towards new PHS generations: moving to **personalised** care*

CIP ICT-PSP Call 3 2009
"ICT for patient-centered health service"

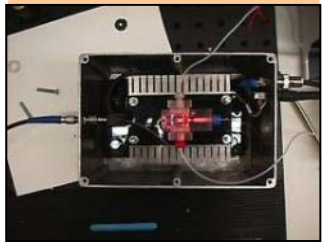
- ***Large Scale Pilot on Telemedicine:***
  - Allocated ***€7M*** within the Competitiveness and Innovation Framework Programme (CIP ICT-PSP) for the deployment of a ***large-scale pilot*** "(...) to validate in real life settings the use of existing PHS for innovative types of Telemedicine services and to prepare for their wider deployment".
  - Focus on three chronic conditions: ***diabetes, cardiovascular diseases and COPD***, a statistically significant sample size of the population to be monitored for each disease and the same methodology to be used in all testing sites.

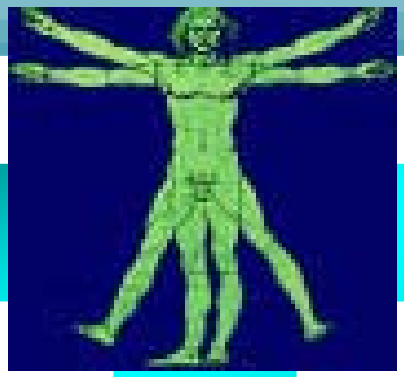
CIP ICT-PSP Call 3 2009
"ICT for patient-centered health service"

- ***Large Scale Pilot on Telemedicine:***
  - Targets ***six to eight regional healthcare authorities or local healthcare organisations*** directly responsible for the deployment of existing or planned telemedicine services.
  - Operations starting early in ***2010*** for a duration of ***three years***.
  - The initiative is expected to build up the ***largest multi-centre clinical trial*** ever deployed in Europe ***to measure the effectiveness and cost effectiveness of Telemedicine solutions***.

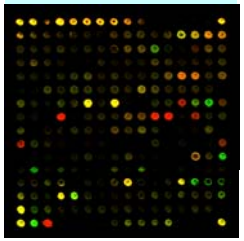
Step 3 – Towards full picture of individual's health status

Biosensors



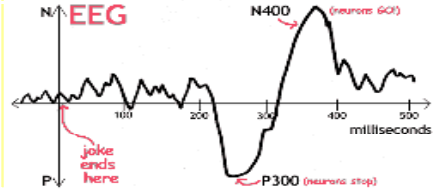


Biochips

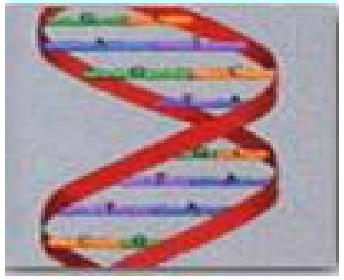


Environmental Data

Phenomic data



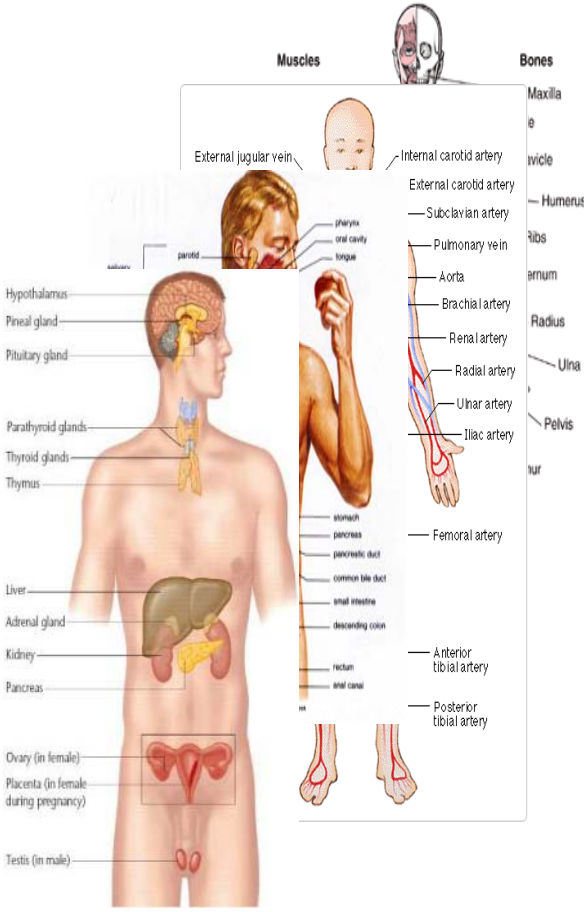
Genomic data



ICT Systems

The Virtual Physiological Human (VPH) concept

Based on the ideas of the International Physiome project



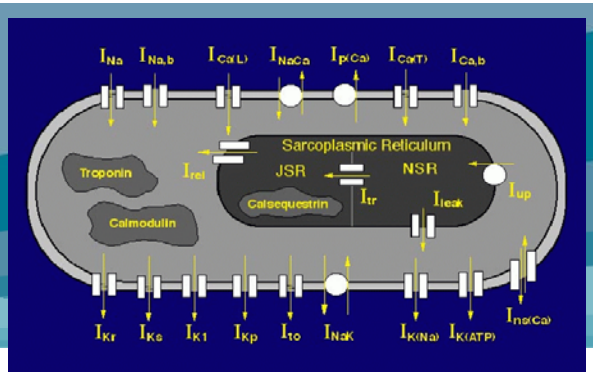
A VPH definition within ICT context:

•The Virtual Physiological Human is a methodological and technological framework that once established will enable the investigation of the human body as a single complex system.

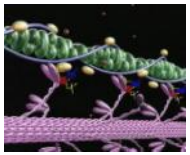
Personalised (patient-specific) healthcare solutions aiming at:

•Early diagnostics & predictive medicine

•Understanding diseases for the first time across several biological levels

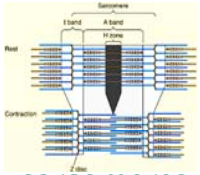


Computational Models of the Human Body



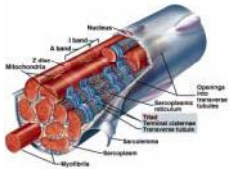
nano

ATP



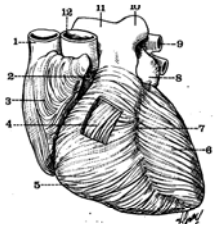
micro

sarcomeres



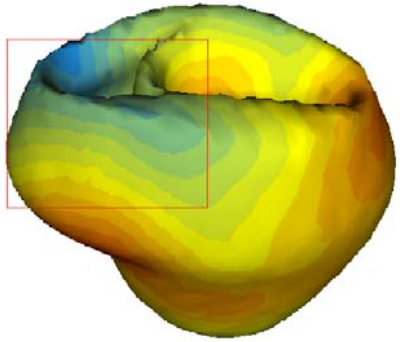
meso

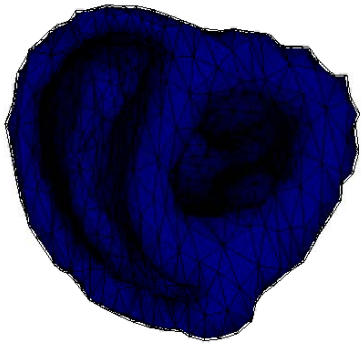
fibers



macro

organ





INRIA in silico electro-mechanical cardiac model

- ***Reproduce Anatomical and Functional properties of physiological systems at various scales***
  - ***molecules, proteins, cells, tissues, organs, systems, body, etc.***
- ***Integrate Geometry, Physics, Chemistry, Physiology…***
- ***Help understand normal or pathological evolutions :***
  - ***systems : cardio-vascular, Central Nervous, Digestive, Reproductive, etc.***

N. Ayache, INRIA

The Virtual Physiological Human (VPH)

Vision:

Personalised medicine *(e.g. drug specific to a set of patients, personalised healthcare)*

Preventive and predictive medicine *(e.g. moving from costly medical intervention after symptom and diseases to early detection of predisposition and the cause of diseases).*

Solutions:

Use of ICT for simulation of the human body *(zoom in/out from organ to cell/gene levels)*

e.g. Models of patient's cerebral un-ruptured aneurysm can be used to decide on surgery or not and to treat the cause.

e.g. models of patient's heart can be used to decide on optimal/personalised treatment or to plan the surgery.

Potential Market:

Pharmaceutical industry *(to shorten drug development, avoid animal testing, personalised drug)*

Medical industry *(devices and imaging benefit from simulation)*

Software industry *(development of models/simulators)*

Example: euHeart – Integrated Cardiac Care Using Patient-Specific Cardiovascular Modelling

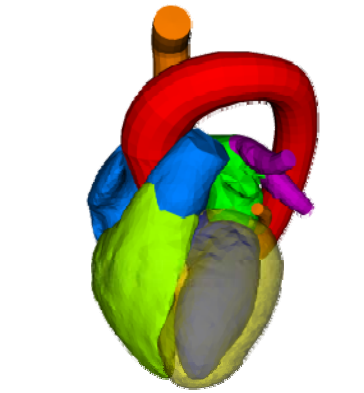
- ***euHeart*** **is about the development, personalisation and validation of computational models of the heart to improve:**
  - **Diagnosis,**
  - **Treatment planning,**
  - **Interventions and**
  - **Design of implantable devices**

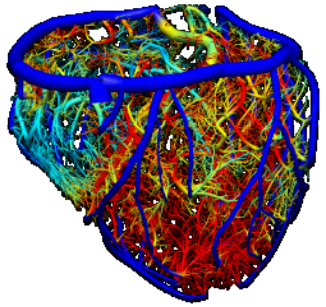
- **5 clinical focus areas:**
  - **Cardiac Resynchronization Therapy**
  - **Radiofrequency Ablation**
  - **Heart Failure**
  - **Coronary Artery Diseases**
  - **Valves and Aorta**

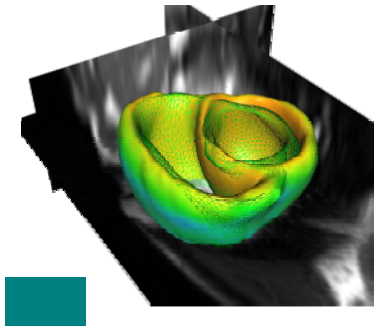
Project coord.: Philips Research
Scientific coord.: University of Oxford

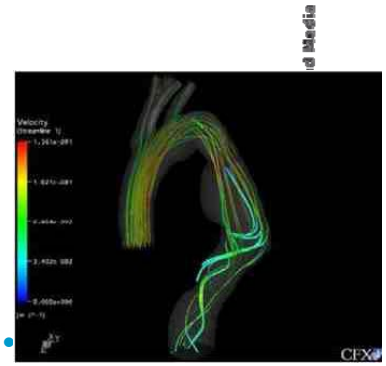
17 partners (6 companies, 6 universities, 5 clinics)

Budget ~19M€ (~14M€ EU funding)









To find more on ICT for Health activities / eHealth?

- **Policy and Research**: http://europa.eu.int/information_society/eHealth
- **Regular eHealth e-Newsletter:** http://ec.europa.eu/information_society/activities/health/newsletter/index_en.htm
- **eHealth Task Force report:** http://ec.europa.eu/information_society/activities/health/docs/lmi-report-final-2007dec.pdf

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