Intelligent chips - Personal health advisers in pervasive information space

pHealth Seminar The Transition from Cards to Portable Devices and Sensor Networks for Wireless Personalized Health Services, Friday 26 June 08:30 - 10:30, Hotel Bristol

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pHealth in more than just personalised health services inside present (regulated) health care system. pHealth paradigm means:

- Personal health management using smart chips, sensors and PPDS with or without health professionals' advice
- Health and wellness management in pervasive environment
- Using smart chips as autonomous decision makers

**Smart chips are heart of Personal Portable Health Devices (PPD).**

All knowledge and intelligence can be imbedded,
or
PPD can be a part of larger system or health network

How smart a chip can be?
- It can measure vital signs etc.
- It has wireless communication capacity
- It is context-aware (e.g. location and social context)
- It notifies, informs and gives recommendation
- It is a personal educator
- It is an expert who gives advice or an opinion to
- It can even make diagnoses, give intelligent alarms and second opinions

Chips can be
- traditional silicon chips,
- polymeric computers
- biochips
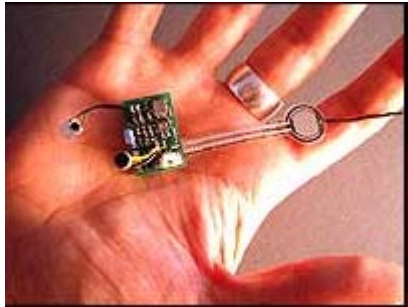
A smart chip with sensor

Wireless chip

Zarlink Semiconductor

Chips can be very small (just like intelligent dust)

Commercial stand alone PPHDs with smart chips

A wellness wrist band

Bodybugg features:
Motion (3D accelerometer)
Steps: measuring the distinct patterns created by running or walking.
Galvanic skin response: This measurement helps the device understand how active you are.
Skin temperature:
Heat flux: heat that's flowing from your body into the environment

Chip as a part of dedicated network

Health Link Chip Implant, applications of VeriChip Patient Identification System

VeriMed™
PATIENT IDENTIFICATION

Step 1. Verimed tag is implanted in patient's upper arm

Step 2. Medical provider reads unique ID from Verichip

Step 3. ID number is used to reference patient's secure records

Future pHealth with smart chips

Home monitoring

PWR

RFID-drug Sensor

Personal Smart PC

Care services

Implanted smart sensors

Smart Pill

ECG
Blood pressure
Hearing
Glucose
Position
DNA-protein
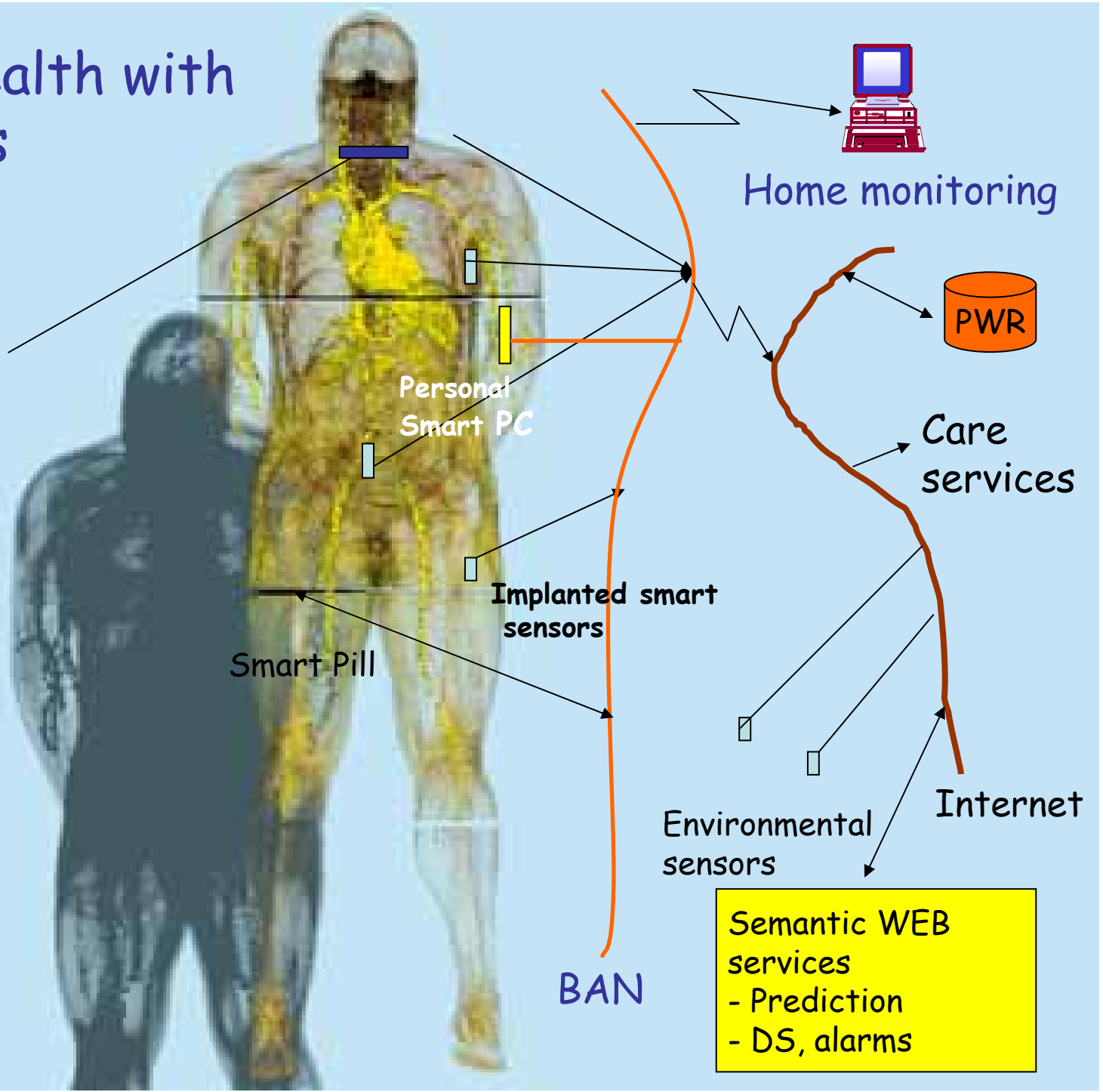
Environmental sensors

Internet

BAN

Semantic WEB services
- Prediction
- DS, alarms

Future pervasive Information Space

Any kind of personal information

Sensor networks
Motes

Implanted chips

Monitoring networks

Smart PPHD

Large number of users, contexts and purposes

Surveillance systems

Available 24h/7d from any place

Data banks

BAN

Social Web

Pervasive eHealth paradigm

- Detection of diseases and changes in functionality
- Pro-active prevention
- Personal health and wellness prediction
- Early absence, personal profiling, profiling of groups under risk, personal level lifestyle control
- Self management of chronic diseases

Pervasive eHealth require much wider information than what is collected and available today.

Pre-emptive healthcare services require also knowledge of individual's normal functions in order to provide early detection

PPHDs and smart chips have a big role in pHealth

Driving forces for smart chips, PPHDs and pHealth

- Universities and research groups
- Commercial wellness device makers
-The paradigm of proactive prevention and prediction
- Early adaptors (persons using own money)

Present barriers
-There is now real business model
- Public health care is not ready
- Lack of standards
- Ethical, safety, security and privacy protection problems
  (e.g. surveillance, secondary use of contexts data,
   erroneous profiling, wrong alarms, linking of data)

Present security and privacy protection solutions are not sufficient for trusted use of PPHDs, and for the trusted use of information collected via smart chips and sensors

- In pervasive environment there are large number of users and purposes for this information (e.g. surveillance, insurance institutes, employers, police)

- The content of collected and communicated information goes far away from the content of present regulated EHRs

- MAC, DAC, RBAC and even present policy based access control methods are not sufficient for controlling the dynamic use sensitive information in context-aware environment

Conclusion
- Paradigm shift from paternalistic healthcare to pHealth
   is in progress
- Portable personal advisers are already on the market
- pHealth can substitute increasing part of the face-to-face
   services

Challenges
 - We need better understanding about impacts of the use
    of context and lifestyle information
- Ethical and privacy dimensions of continuous monitoring,
   surveillance and control should be analyzed.
- Common principles and rules who can use information
   produced by smart chips and PPHD's, when this information
   can be used, in which contexts and for what purposes
   are required (incl. ethics and regulations)

- Evidence how information collected via PPHDs can be used at personal level for health prediction and prevention

- PPHDs and health software will be classified as MDs

- Widely accepted data models and communication standards are needed

- Responsibilities in the case where PPDs are making autonomic decisions should be defined