

# Mobile Service Management Platform in Support of Pervasive Healthcare Applications

(A potential contribution to health@home)

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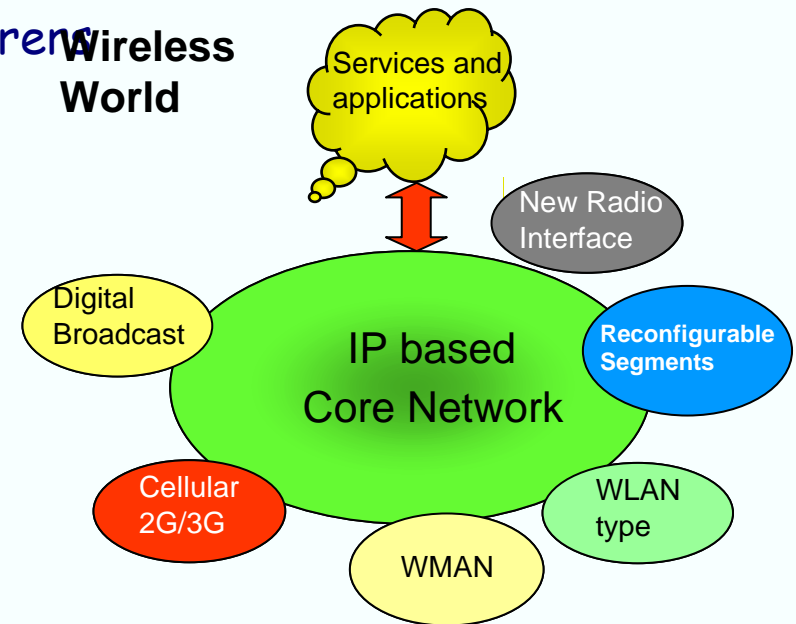
- ❖ **Advances in the telecom world: the B3G era**
- ❖ **Advances in the medical world: healthcare of the 21<sup>st</sup> century**
- ❖ **How can wireless communications support and facilitate electronic healthcare applications?**
  - Requirements
  - Key objectives and challenges of a potential project proposal
- ❖ **A mobile service management platform in support of healthcare Applications**
  - Overview
  - Potential contribution
- ❖ **Summary and Conclusions**

## ❖ Enormous advances in telecommunications

- Research and development projects
- Work performed in international fora
- Creative competition among manufacturers

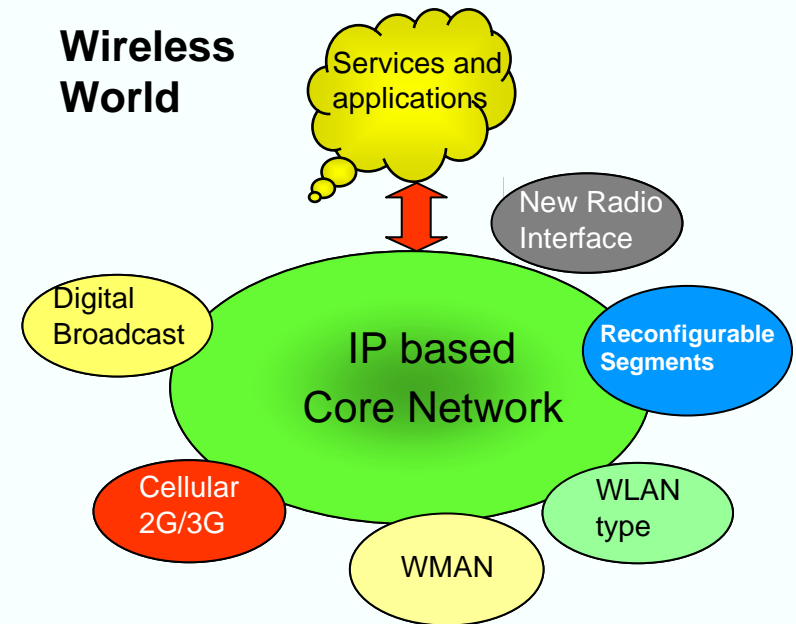
## ❖ As a result?

- **The B3G era**
  - Coexistence of versatile Radio Access Technologies (RATs)
- **Innumerable innovations**
  - Powerful infrastructures
    - Increasingly high data rates
  - Intelligent management platforms



# Advances in the telecommunications landscape

- **B3G features**
  - Flexible Spectrum Management
  - Reconfigurability
  - Cognitive Wireless Networks
- **Versatile novel applications assure the success and usefulness of innovations**
- **Medical sciences and healthcare are areas addressed.**
  - Where do they stand nowadays?



- ❖ **Increasing expectations from medical sciences**
  - Identification of novel answers to numerous medical problems
    - A priori diagnosis (**proactive behavior**)
    - Prevention
    - Treatment of numerous, previously incurable, diseases.
- ❖ **Demographic problems and patient expectations have put the provision of healthcare applications in the forefront of medical sciences**
  - Advancement of electronic healthcare products and applications
    - Access to quality healthcare, regardless of their personal condition and geographical location
    - Selection of the appropriate health resource from anywhere at any time (**mobility**).
      - **Important in emergency healthcare situations**
    - Facilitation of medical approaches
      - Patient management technologies in telemedicine, remote diagnostics
- ❖ **How can the above be supported?**

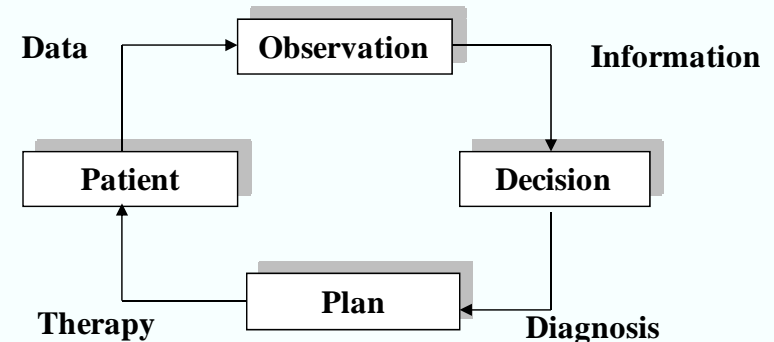
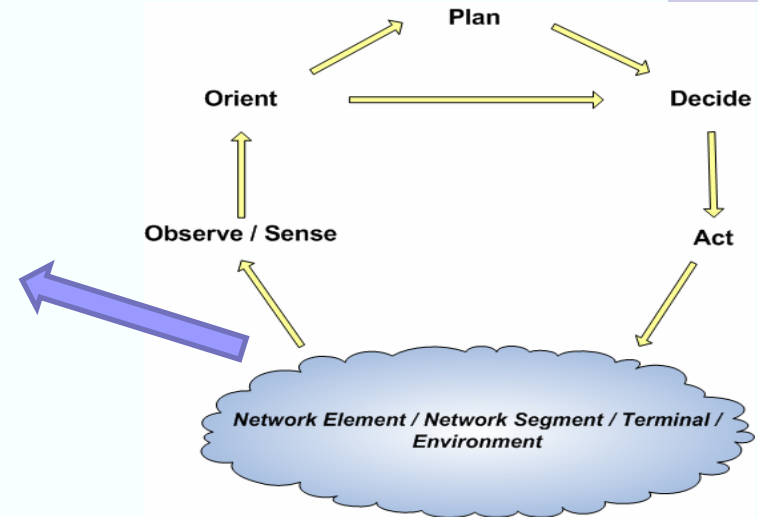
- ❖ Need for interdisciplinary research and development strategies
- ❖ ICT has a role to play
  - Utilization of the findings of telecommunications and electronics.
  - Birth of beyond the 3rd generation (B3G) communication systems
    - Ubiquitous provision of applications at **increasingly high bit rates**

- Advent of cognitive networks
  - A **cognitive system** is a system which retains information from previous interactions with the environment, gradually transforms this information to knowledge (experience) and plans its future behavior based there upon.
  - Application to B3G wireless networks
    - Exploitation of reconfigurable platforms
    - Utilization of intelligent management functionality
- Are there any similarities between the telecom world and the medical world that could be taken into account and facilitate their cooperation?

# Analogies: Cognitive wireless networks and healthcare services / applications

## ❖ Cognitive Wireless Networks

- Cognition cycle
  - Observation, planning, action
- Step 1: network observes (senses) changes in the environment
- Step 2: network, through an orientation and planning process, decides on proper adaptation manner
- Step 3: adaptation is performed (leading to optimization)



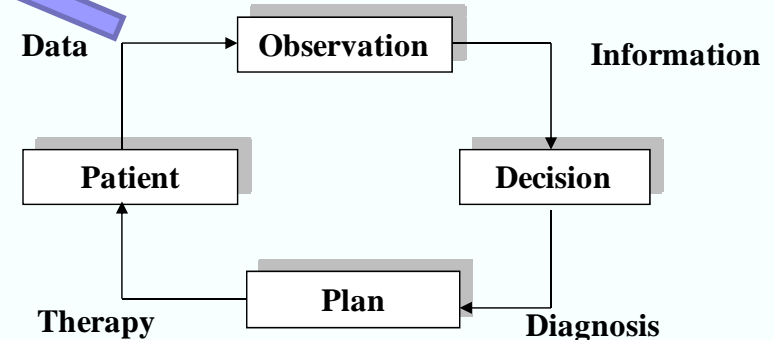
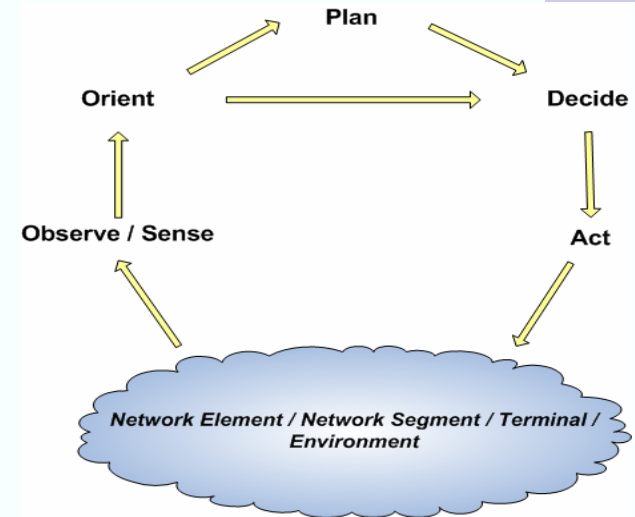


# Analogies: Cognitive wireless networks and healthcare services / applications

## ❖ Healthcare

- Diagnostic-treatment cycle
  - Observation, diagnosis, treatment
- Step 1: patient informs doctor
- Step 2: doctor collects data
- Step 3: doctor decides on treatment

❖ In both cases, past knowledge and experience is of critical importance



# Key objective and challenges of a potential proposal



## ❖ Key objective

- **Design, development and validation of a distributed, mobile service management platform for providing improved pervasive healthcare conditions @home and on the move, through the exploitation and integration of a number of key technologies and solutions.**

## ❖ Anticipated challenges

- Develop a user-centric service management platform to ease users' lives
- Support numerous electronic healthcare services and applications
  - Possibility to incorporate/support novel ones
    - Remote diagnostics
    - Patient management technologies in telemedicine
- Make the platform interoperable
- Manage and conceal complexity
- Offer high quality of service (QoS) levels to demanding applications
  - Relevance to emergency/critical healthcare situations
  - Enable fast and effective decision-making

- ❖ **Abstraction of the complexity (virtualization)**
  - Important for facilitating the exploitation of the infrastructure from the higher (middleware/application) layers (infrastructure unobtrusive and invisible to the user)
  
- ❖ **Device management**
  - Important so as to provide the means to effectively, transparently and securely direct versatile devices @home and on the move, in order to offer innovative universal healthcare services and applications.

## ❖ Cognition

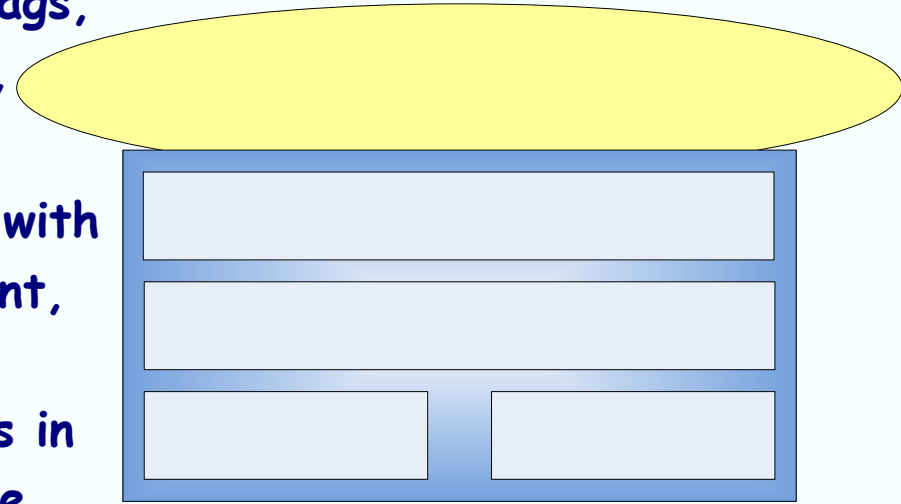
- Devices should adapt to external requisitions (selection of networks) while @home and on the move
- Devices should learn from their experience, in order to offer their help faster and more efficiently, according to user needs and environment conditions.

## ❖ Facilitation of development and deployment of healthcare services/applications, as well as coordinated operation.

- Mechanisms that enable the exploitation of the context-aware services and of the intelligent-environment network infrastructure by healthcare applications
- Service coordination (orchestration) should also be supported.

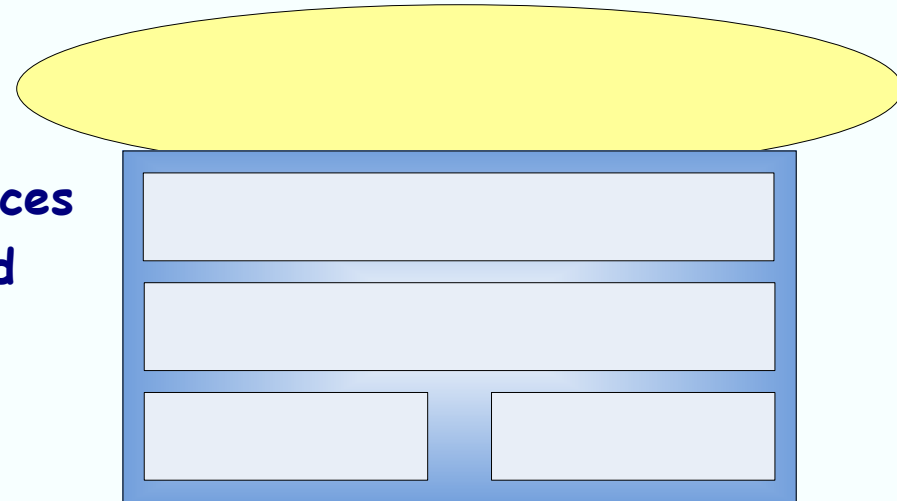
# Overview of Platform: features

- ❖ Provision of innovative, pervasive healthcare services for the ageing and disabled society
- ❖ Management of heterogeneous ambient networking and computing devices (e-tags, RFIDs, sensors, actuators, appliances, computing elements)
- ❖ Provision to senior persons and people with disabilities with an “always on” assistant, capable of receiving and processing information so as to support individuals in their daily activities @home and on the move.



# Overview of Platform: features

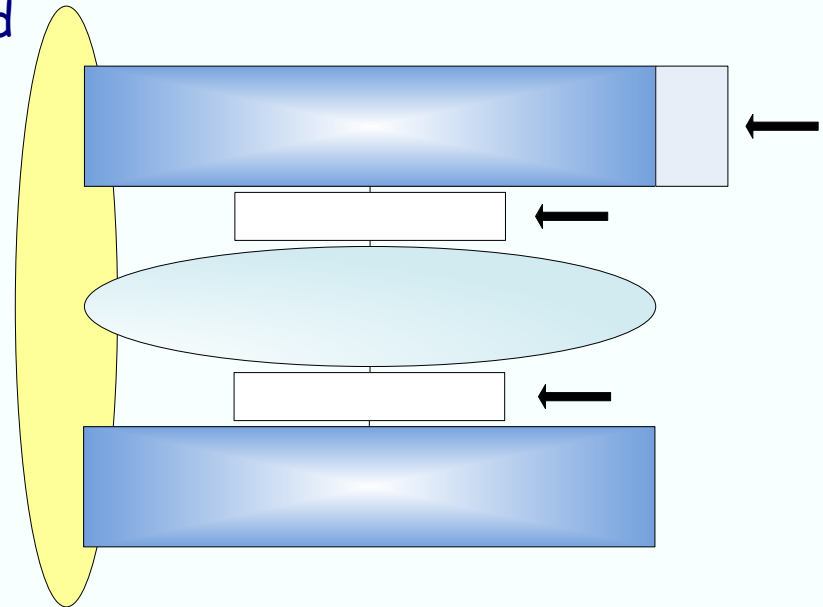
- ❖ Interaction with users through advanced and sophisticated (audio-visual and voice) interfaces and mobile devices.
- ❖ Open service-oriented framework for manufactures, operators and service providers with mechanisms and interfaces that facilitate their communication and interaction



# Key solutions and potential contribution

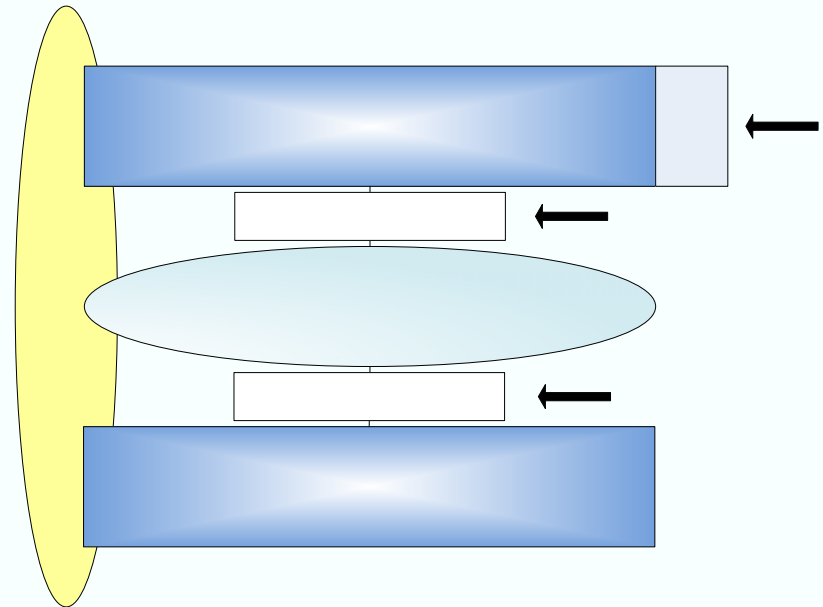
## ❖ Key solution approach

- The platform will employ self-management mechanisms and incorporate elements capable of independently reaching decisions and making selections
  - This will be achieved by “developing” knowledge and experience through machine learning techniques, which lead to cognition.
- Service oriented architecture (SOA)
- Web Services
- Universal Plug and Play (UPnP)
  - set of computer network protocols developed by the UPnP Forum
- Open Services Gateway initiative (OSGi) Alliance
  - A service framework that can be remotely managed.



## ❖ Potential contribution

- Service management platform, development and validation
- Design, development and validation of platform's management and control mechanisms
- Mechanisms for cognition
- Abstraction - user interfaces





# Summary and Conclusions



## ❖ Enormous advances in the telecom world

- Novel applications
  - Electronic healthcare
    - Innovations in the medical world
  - Support is needed from the IT world (wireless communication systems)

## ❖ Potential proposal objective

- Design, development and validation of a distributed, mobile service management platform for providing improved pervasive healthcare conditions @home and on the move, through the exploitation and integration of a number of key technologies and solutions.
- Platform's benefits:
  - 1. support of innumerable healthcare applications
  - 2. concealment of complexity
  - 3. support of increasingly high bit rates
  - 4. interoperability
- Key solutions
- Potential Contribution

## ❖ Future plans

- Way forward? (establish consortium - start discussions)

# General information



❖ Thank you!!!

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❖ Recent related publications

- *G. Dimitrakopoulos, K. Tsagkaris, V. Stavroulaki, A. Katidiotis, N. Koutsouris, P. Demestichas, V. Merat, S. Walter, "A Management Framework for Ambient Systems Operating in Wireless B3G Environments", ACM/Springer Mobile Networks and Applications journal, to appear.*
- *G. Dimitrakopoulos, P. Demestichas, F. Malamateniou, "Cognitive Network Infrastructures and Virtualization Platforms in Support of Healthcare Applications", In Proc. of First International Conference on Electronic Healthcare in the 21st Century (eHealth2008), London, UK, 8-9 September 2008.*
- *G. Dimitrakopoulos, P. Demestichas, K. Tsagkaris, A. Saatsakis, K. Moessner, M. Muck, D. Bourse, "Emerging Management Concepts for Introducing Cognition in the Wireless B3G World", Springer Wireless Personal Communications journal, to appear.*
- *K. Tsagkaris, G. Dimitrakopoulos, P. Demestichas, A. Saatsakis, "Distributed Radio Access Technology Selection for Adaptive Networks in High-Speed, B3G Infrastructures", International Journal of Communication Systems, October 2007.*