



### “ Communication Platform “

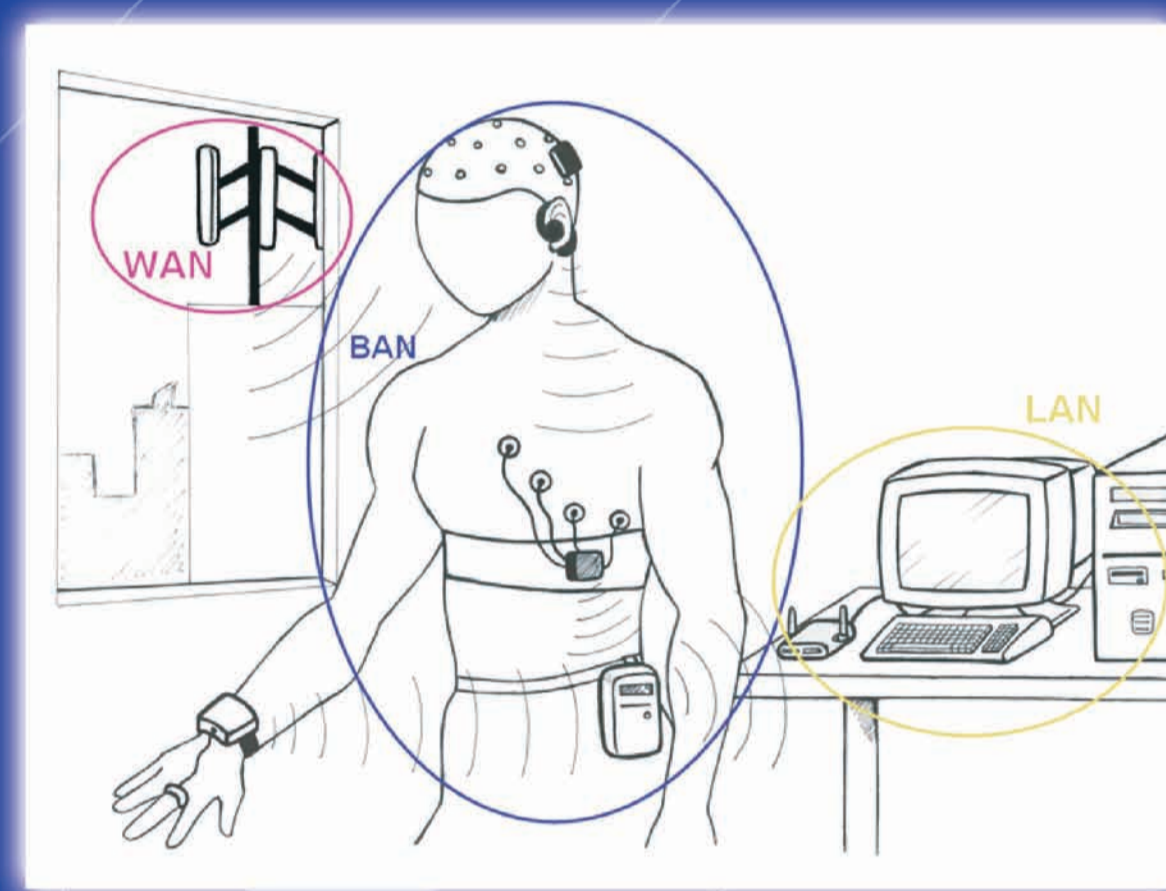
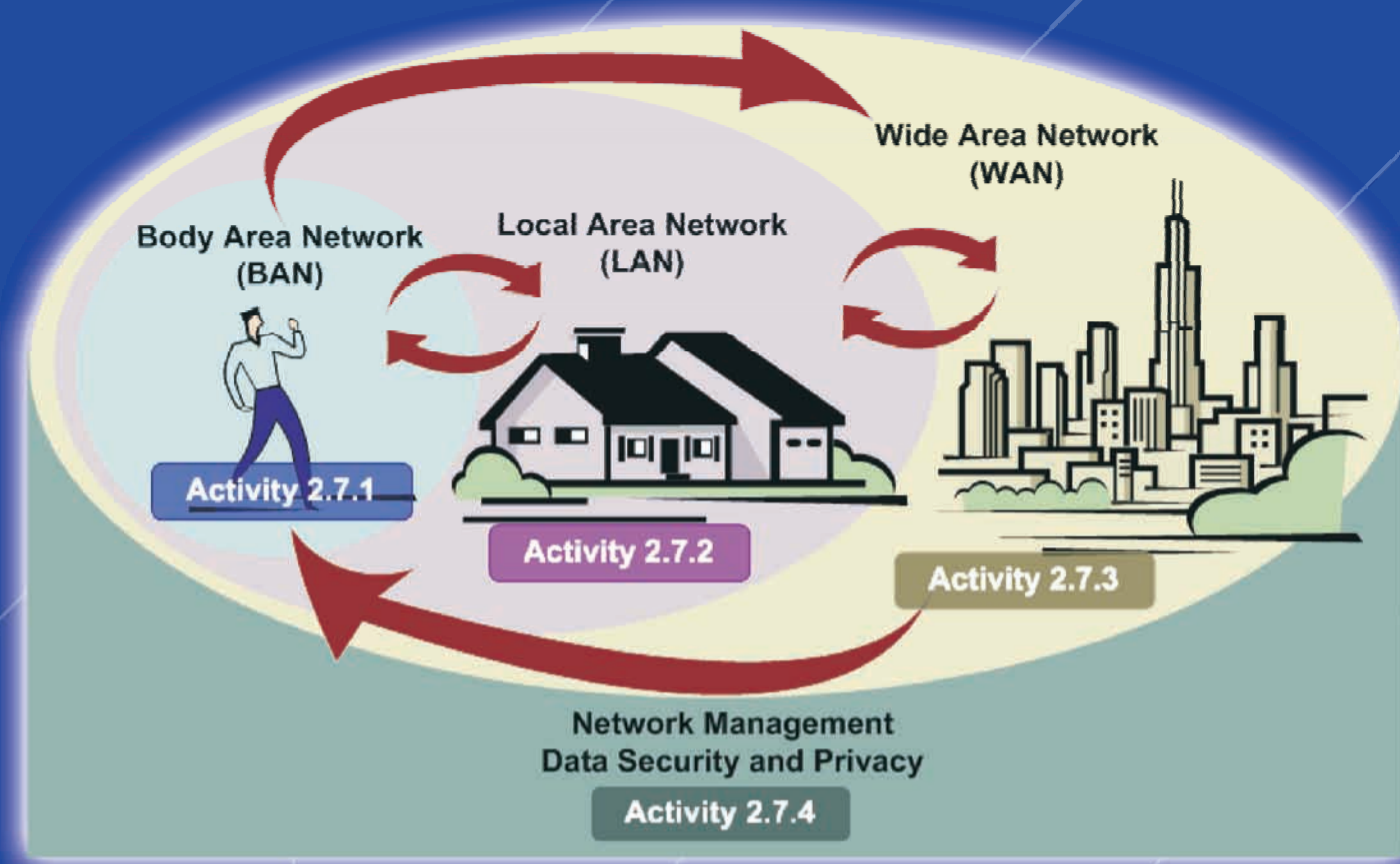
#### Introduction

In order to connect the SENSATION sensors and applications, the development of a comfortable and unobtrusive communication platform has been addressed as an important task of the SENSATION project, based on the use of wireless technologies. Certainly, in some applications that are being developed in the project, users are going to wear a variable number of sensors all over the body. These users will have to carry out common daily activities and the use of wires for transmitting the information acquired by the sensors would impede the performance of these activities in their usual manner, making the applications obtrusive and uncomfortable. Trying to avoid as much as possible the existence of wires is an essential condition to get the SENSATION applications unobtrusive and comfortable.

The communication platform has been developed in three different levels:

- The Body Area Network (BAN)
- The Local Area Network (LAN)
- The Wide Area Network (WAN)

This structure allows for the monitoring of a user in a body/personal, local or wide environment.

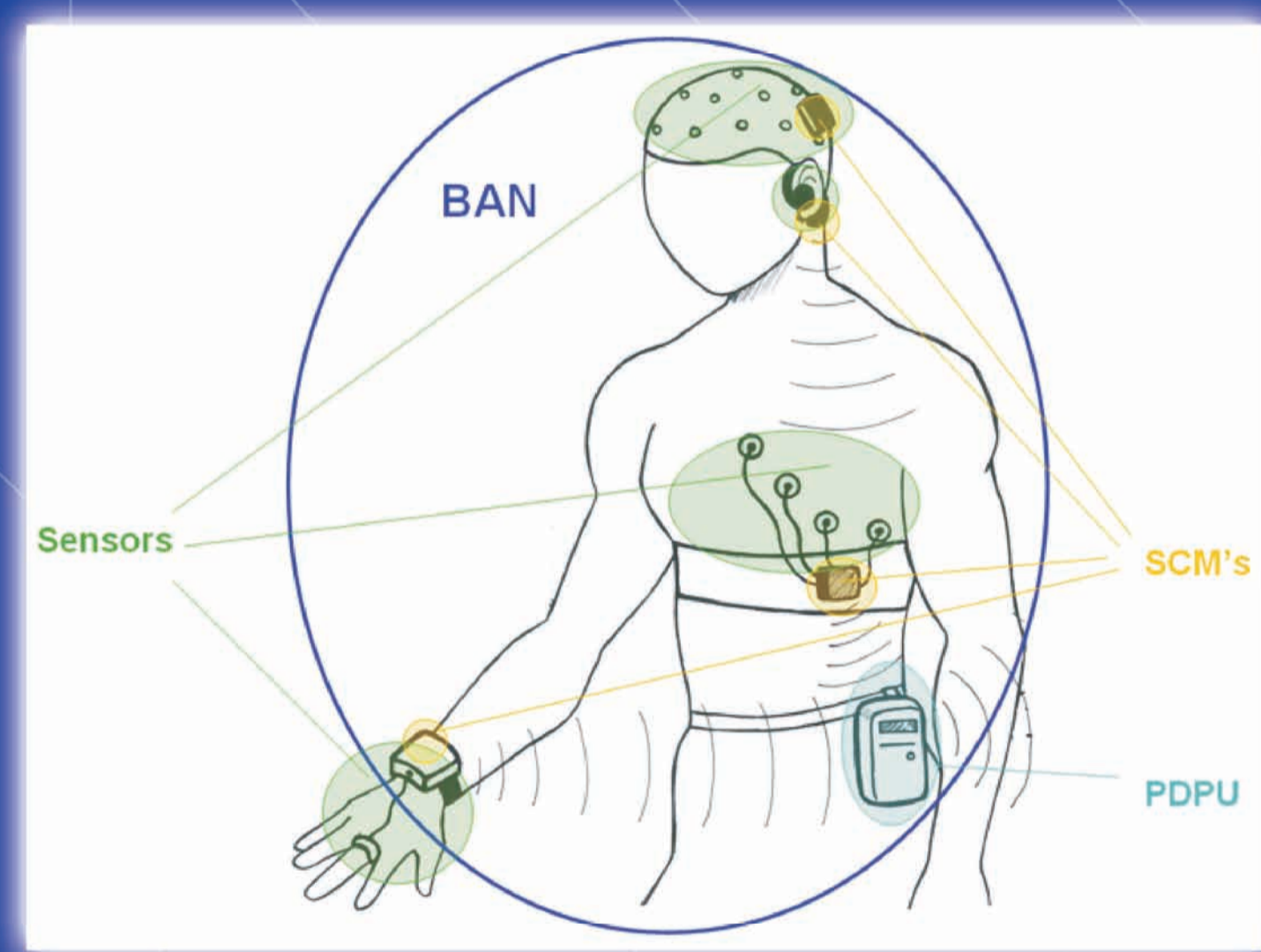


#### Communication Platform Levels

The BAN's aim is the communication between the sensors and a central device that will receive the data from them and perform data process, required user feedback and communication management.

The LAN's aim is to control different BANs in order to provide a collaborative network where a local application can take advantages of the interaction among them.

The WAN's aim is to communicate data for applications that cross the 'local' boundaries in a distributed system.

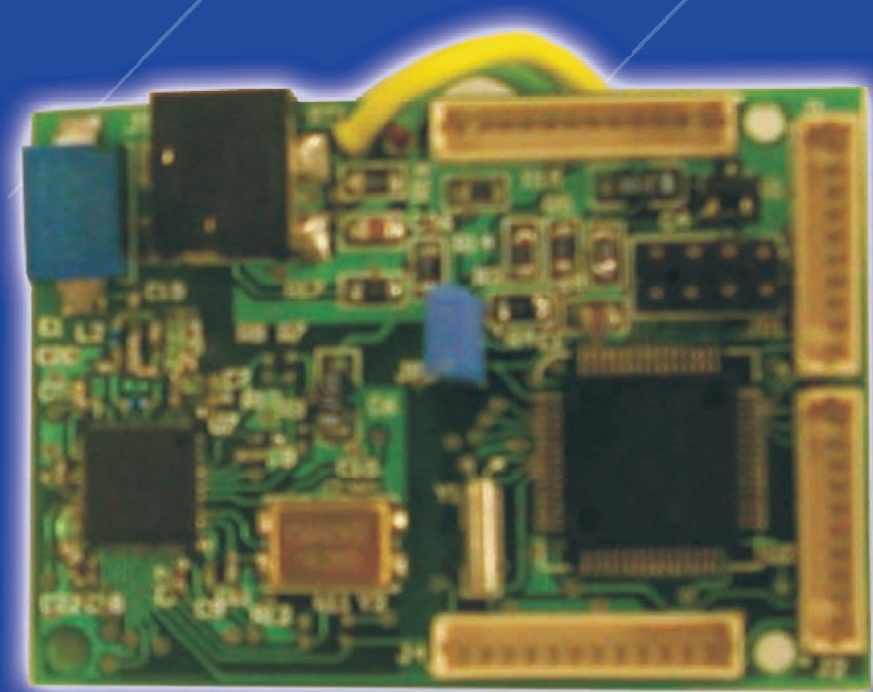


#### The Body Area Network

The BAN is composed by sensors and activators distributed on the body of the users, a small module called Sensor Communication Module or SCM attached to the sensors that allows the wireless communication of the information acquired by the sensors to the central device, called Personal Data Processing Unit or PDPU.

The SCM has the following features:

- Capability for the secure transmission of data from 4 analogue sensors or 4 digital sensors
- Communication with the BAN coordinator (PDPU) via a 2.4GHz wireless link based on IEEE 802.15.4/Zigbee protocol.
- Special mode to provide 1uA test current to check the impedance of the analogue sensors
- Li-ion rechargeable battery



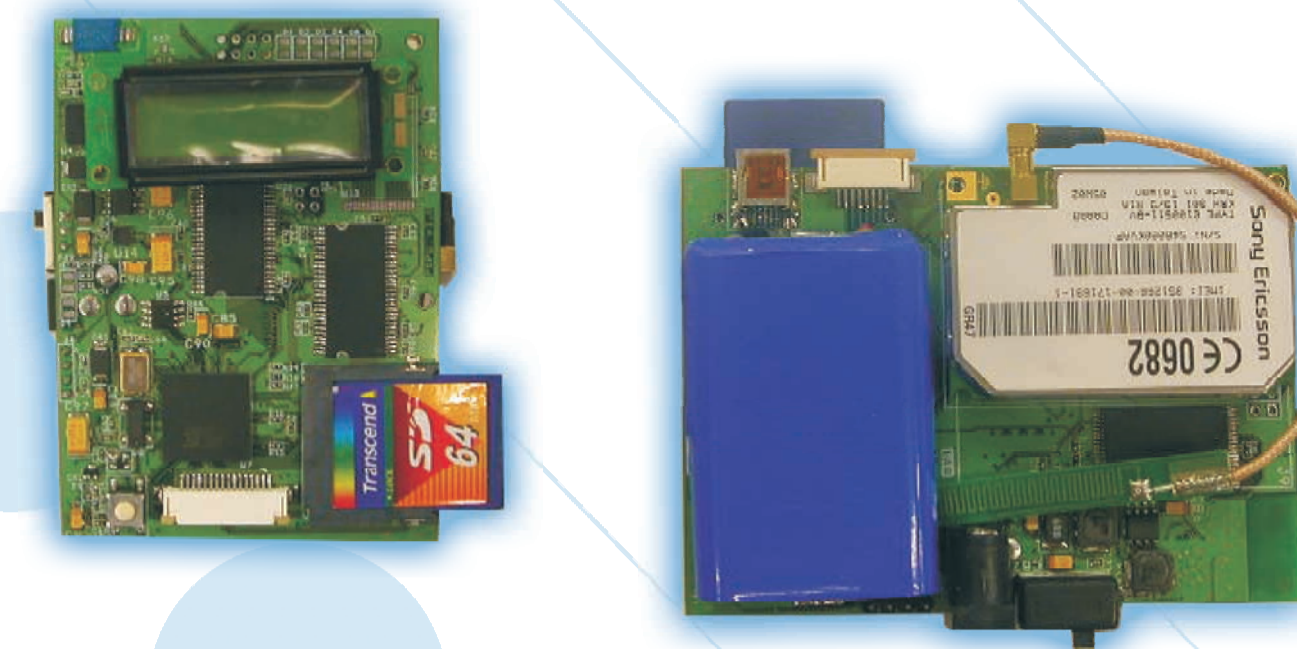
The PDPU has two basic functions:

- Coordinator of the BAN, receiving the information from the sensors through the SCMs
- Bridge between the BAN and the LAN/WAN, retransmitting the data acquired by the sensors to applications existing at the LAN or WAN levels.

In addition, the PDPU has the capacity of processing the information before resending it to the LAN or WAN levels. Therefore, the PDPU will be able to get more significant information and/or to content simple BAN applications.

Its main characteristics are:

- Secure Wireless communication with the SCMs/actuators based on IEEE 802.15.4/Zigbee.
- Secure Wireless communication with the LAN/WAN using Wi-Fi/GPRS.
- Wired communication with the LAN using USB.
- SIP capable for connection with LAN and WAN.
- LCD screen.
- Li-ion rechargeable battery .
- Flash Memory.
- SD Memory.



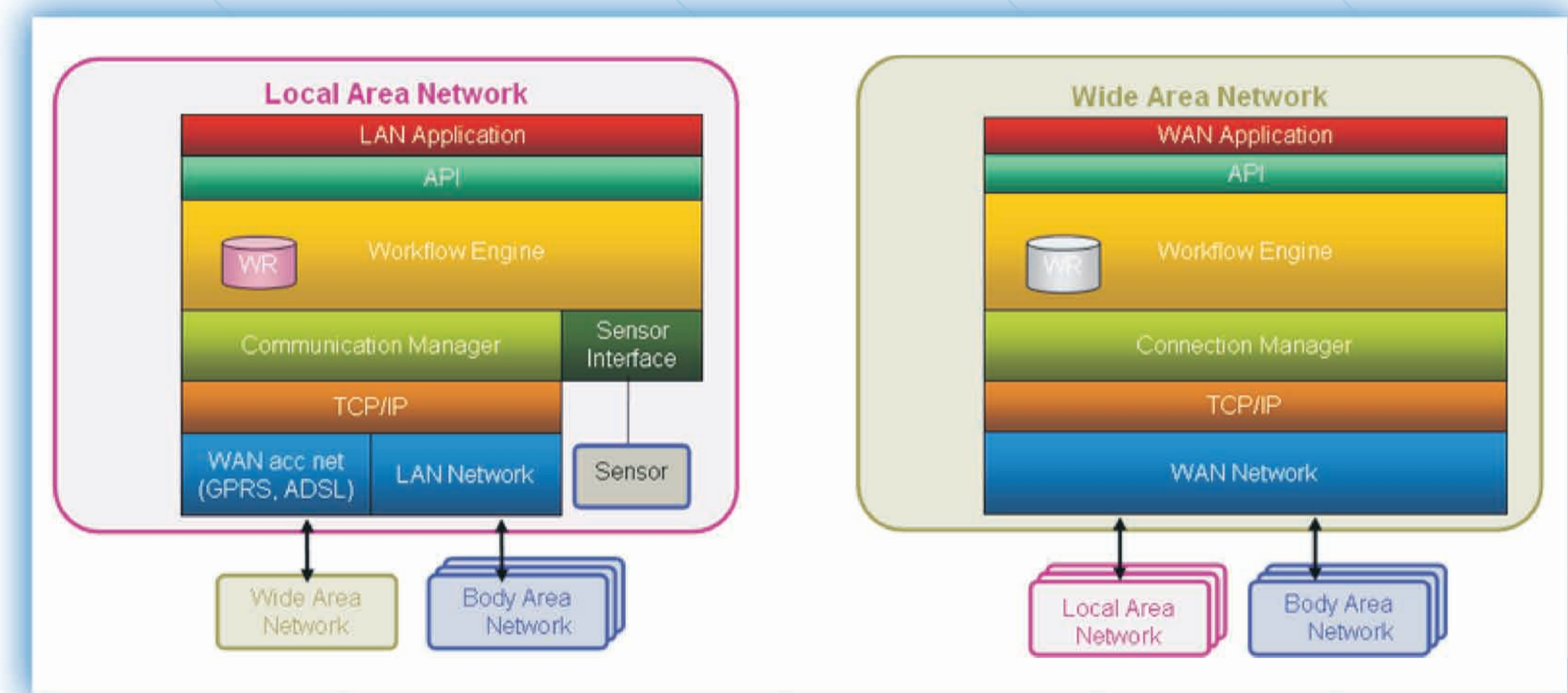
#### The Local and Wide Area Networks

The LAN and WAN levels allows applications deployed in local and wide environments the communication with sensors in a distributed way. Both have similar architecture but the internal design and implementation of the various modules that compose the levels, although similar in concept and functionalities, presents some differences in order to deal with the particular requirements of each level.

The *Workflow Engine* can be considered as the core module of the LAN and WAN architecture, since it is in charge of the orchestration of the whole system.

The main tasks that accomplishes are:

- First, To provide an interface between applications and communication platform, in order to give the applications a user friendly connection point hiding the complexity of the protocol that handles the communication with the other levels of the communication platform.
- Second, the LAN and WAN level offers mechanisms for the synchronization of the interoperation of processes running in the levels and of the data acquired by both sensors connected to BANs and LANs.
- Third, it addresses security tasks as authentication of the applications, controls user access, permissions and encryption of the anonymous information transmitted.



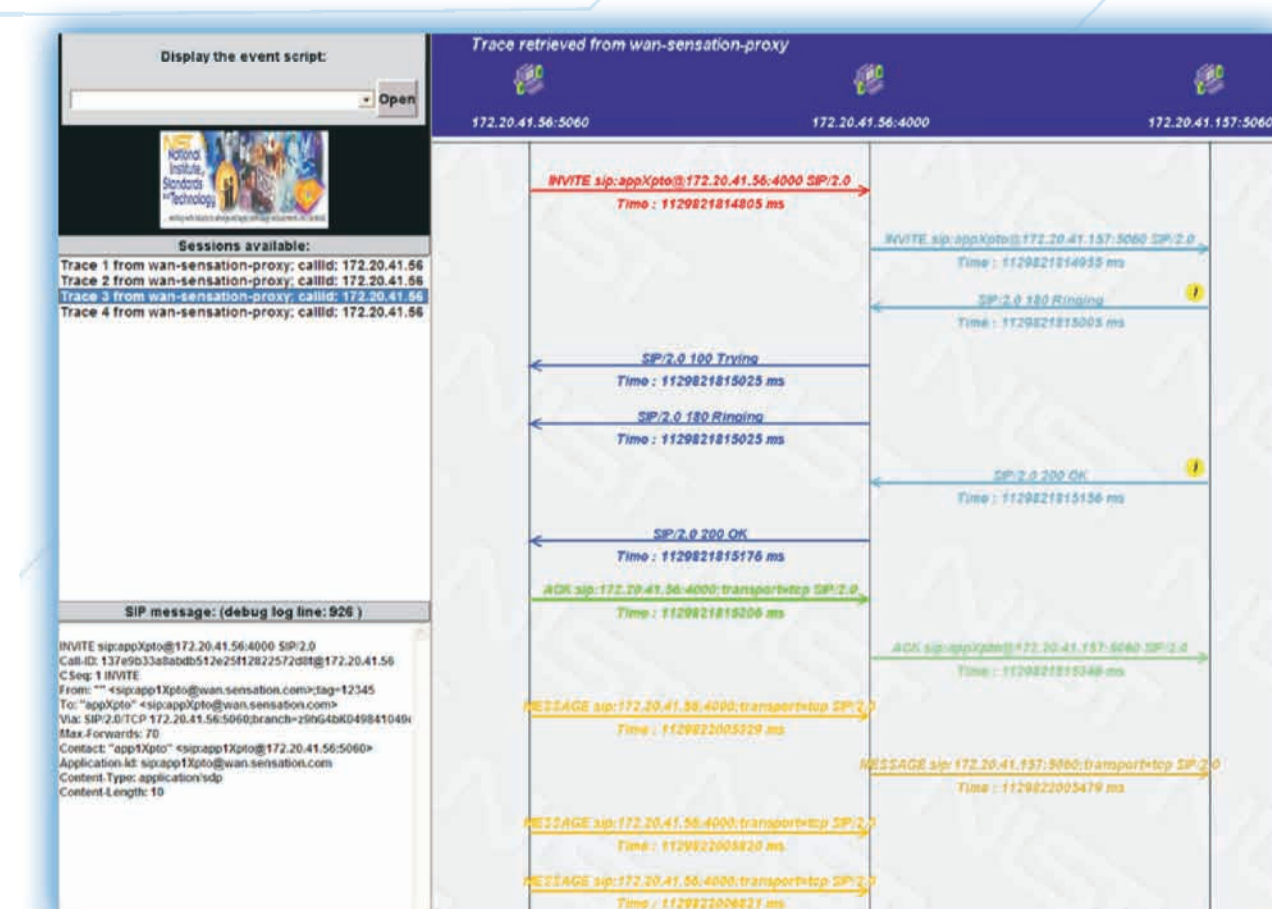
The *Communication Manager* module is in charge of establishing and controlling the communications between the different levels. The Communication manager offers to the Workflow Engine the possibility of establishing two types of applications. One for store & forward communications and other for streaming communications.

This module is based on the Session Initiation Protocol or SIP that enable the communication of two applications which reside in separate machines and which do not know of each others physical location. For this reason, it is very useful when BANs and LANs are mobile elements. SIP is independent of the protocols used by the applications to exchange data.

Other important module of the LAN and WAN is the *Application Programming Interface (API)* that provides an easy way for applications to interact with the communications platform, abstracting the pure communications issues for the application developers at the same time of providing a common interface to a wide range of applications. Through the API is possible to establish a communication, to control, to configure and to exchange information with the BAN and the information exchange between LAN and WAN.

The communication platform can be accessed by the applications in three ways: through a Command line, a Java Method or a Webservice. In the case of the applications in the WAN, it is possible to deploy all the layers of the WAN architecture or directly to access to a Workflow engine in a LAN through the use of Web Services.

One module existing the LAN level but not in the WAN level is the *Sensor Interface*. Most of the sensors are connected to the BAN, but due to the high throughput requirements of some sensors, as well as their physical characteristics, which make them unsuitable for being integrated into the BAN, the LAN provide the possibility for sensors to be directly connected to it through a adaptation software module that simulate a virtual PDPU.



#### Conclusions

The communication platform is now prepared to offer modular and flexible communication feasibilities for the development of the medical, transport and industrial applications to be developed in the project. They can take advantage of the wireless and wired protocol, signalling, security and open interfaces that the platform provides all this thought in order to make the final services unobtrusive and comfortable for the final users.