

# WASP WIRELESS SENSING CONCEPT FOR NEXT GENERATION HERD CONTROL

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## WASP Introduction

The infrastructure for ambient intelligence envisaged by researchers and industry in Europe, will consist of a myriad of wireless sensors working in collaboration. The academic world is currently hard at work investigating the technology for Wireless Sensor Networks (WSN). However, industry is reluctant to use the results derived from academic research, principally because there is a mismatch between research at the application level and the sensor node and network level. The WASP project (EU KP6 project IST-034963 [www.wasp-project.org](http://www.wasp-project.org)) aims to rectify this imbalance by covering every link in the chain, from basic hardware, sensors, processors and communication, right through to the packaging and organization of the nodes, the information distribution and a selection of applications. The main emphasis in the project lies in the self organization and the services which connect the application to the sensor network. The nodes themselves also need research because there is a strong link between the flexibility required and the hardware design. The applications need to be researched, because the properties of the services required will influence the configuration of both sensor network and application for optimum efficiency and functionality. Many of the design decisions inherent to the development cannot be handled in isolation as they depend on the hardware costs involved in making a sensor and the market size for sensors of a given type. The general goal of the project is the provision of a complete system view for building large populations of collaborating objects. The provision of a European alternative to the WSNs originating in the US will have a positive impact on European research and industry. The WASP results will be well suited for adoption by SMEs. The consortium will define an active program to approach the appropriate SMEs and to familiarize them with the WASP results. A promising application field for WSN is livestock. To give individual animals in increasing herd sizes the required attention farmers are introducing individual animal monitoring systems based upon sensor technology.

## WASP Concept

The WASP concept is based on some basic principles. The WASP concept connects Wireless Sensor Networks and the Web based applications. To be able to build and support the chain from sensor (the sensor hardware) and the real world applications the technology is build up in different layers. The left side of Figure 1 shows from bottom to top the WSN layers: node, network, router, gateway and back-end with the enterprise integration component (EIC) and application platform. The application developer and the system integrator can choose in this concept where to incorporate data storage and intelligence. For example accelerometer data can be used to monitor claw health in dairy cows. If step and movement of a cow are analysed on the farm management system all data have to be transmitted. However, if the data is already analyzed on the node(sensor) then e.g only average step and movement information has to be transmitted. This makes it possible to work with trade-offs and to optimize the application for a specific situation. Figure 1 shows also that on each level several components and/or services are developed, the application builder has the possibility to choose between components. To support this a specific programming model ECA (Event-Condition-Action) has been developed within the WASP project. In the WASP project these hardware and software components and programming models are developed by the project partners: Philips Research, CEFRIEL, IMEC-NL, CSEM, TU Eindhoven, European Microsoft Innovation Center, Health Telematic Network, Fraunhofer-Gesellschaft,

Wageningen UR Livestock Research, Imperial College, ST Microelectronics, INRIA, EPFL, Centro Ricerche Fiat, TU Kaiserslautern, RWTH Aachen, SAP and University of Paderborn.

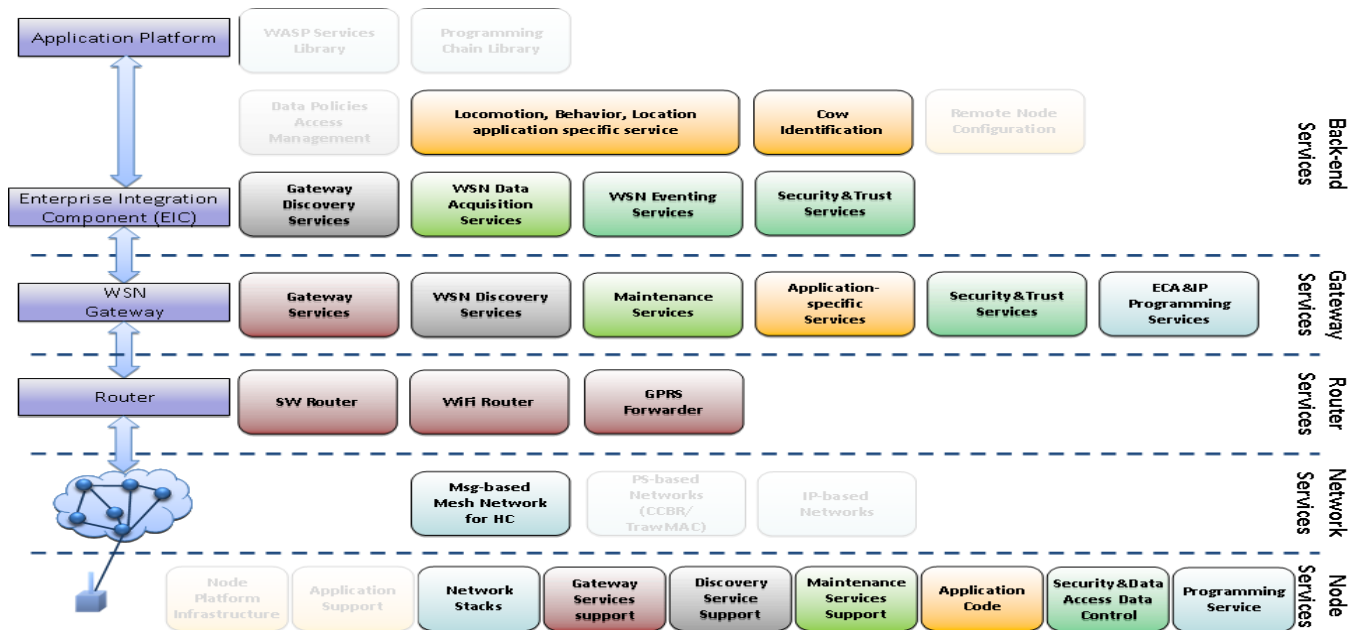


Figure 1: Schematic view of the different layers of the WSN and their components (services).

## WASP Herd Control

Within the WASP project Herd Control is, beside Elderly Care and Road Management, one of the chosen practical business cases to demonstrate the flexibility of the WASP concept. Within the broad context of Herd Control specific attention is paid to some basic measurement on cow behavior and locomotion. All locomotion and behavior aspects are based upon measurements that are performed with a 3D accelerator sensor that is integrated in the WASP sensor node. The measurement interval, duration and the frequency are adaptive to the behavior of the animal. Cow behavior is translated to different modes that are used during the testing phase. In the normal procedure the MODE 0 will not be activated. The MODE 0 is implemented because it is a nice tool for a system integrator for checking the WASP node and a farmer might want to have the possibility to start a continuous measurement for a certain cow when facing this cow.

- **MODE 0:** continuous stream of 3D values, 3x10 or 3x50 measuring values per second;
- **MODE I:** Data that the cow is laying (one value, e.g. '1');
- **MODE II:** Data that the cow is standing (one value, e.g. '2');
- **MODE III:** Data that the cow is walking (one value, e.g. '3');
- **MODE IV:** Step duration, length, swing (amplitude of the sideward movement) and amplitude (four values)

In MODE I-III there is an option of switching to raw 3D-accelerometer data with a frequency of 10 Hz and a interval length of 1 s (3x10 measuring values) and in MODE IV there is an option of switching to raw 3D-accelerometer data with a frequency of 50 Hz and a interval length of 10 s (1500 measuring values).

The WASP project uses the Herd Control case for the intensive testing. Intermediate test results will be published in 2010.