GAIA Extended Research Infrastructure: Sensing, Connecting, and Processing the Real World

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Abstract. The GAIA Extended Research Infrastructure is located at the southeast of Spain. It targets the research of Future Internet architectures and comprises several facilities from the University of Murcia and the Spanish government. It offers a vertical infrastructure, composed of a backend with high capacity of data storage, communication, and processing, together with a frontend with an extended set of multidisciplinary testbeds, deployments, and living labs for the ubiquitous monitoring, sensing, and processing. That said, it offers a highly flexible framework for experimentation with architectures and protocols for the Future Internet. In fact, it has been used in many research projects to evaluate their outputs from the communications and telematics point of view.

Keywords: Research, Experimentation, Testbed, Living Labs, Future Internet.

1 Infrastructure Description

The GAIA Extended Research Infrastructure, as illustrated in Figure 1, is composed of several deployments, living labs, and multidisciplinary scenarios based on mobile communications, ubiquitous computing and Internet of Things (IoT). All of them are focused on the Future Internet and supported by our backend infrastructure.

The backend, as depicted in the inner sub-figure of Figure 1, is built by a computer cluster of 22 nodes with high processing capacity, connected to a storage area network (SAN) to provide high capacity/speed remote storage based on the Fiber Channel technology. The SAN is provisioned with a total capacity of 2 TiB.

In addition, the GAIA infrastructure offers many experimentation machines, interconnected by a Gigabit Ethernet (GE) network. Moreover, the experimentation infrastructure has a dedicated CWDM network to evaluate elements destined to backbone networks. Furthermore, the infrastructure also has a WiMAX network deployed throughout the university campus and connected to the main network by dedicated VLANs.

Apart from the central GAIA facilities, the research infrastructure is extended with a set of multidisciplinary deployments focused on sensor networks and monitoring platforms. They target Intelligent Transport Systems, environmental monitoring, mobile health, and buildings automation. Specifically, these deployments are:

- Building Automation: Many facilities, including a complete building from the Fuente Alamo Technology Park (FATP), are managed by over 50 multiprotocol cards developed by our research lab. These platforms are focused on energy sustainability to reach positive-net building with the deployed solar power plants.
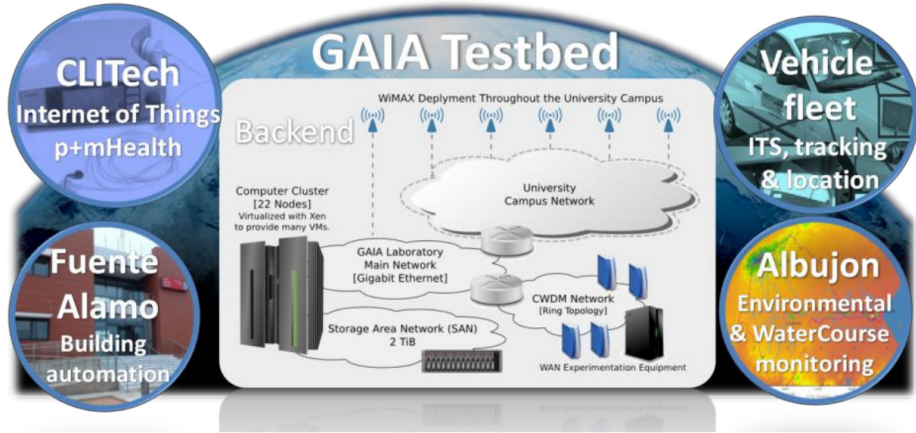
Fig. 1. GAIA extended infrastructure with the living labs and deployments

- Internet of Things (IoT): Our building at FATP also presents an IoT network with a weather station, 20 parking spots, 20 air-quality sensors located at the streetlights, 50 environmental sensors (temperature, humidity, pressure), and 50 activity sensors.
- Environmental Monitoring: We have a real-time monitoring system for the main drainage basin of the watercourse (in Albujon), covering an area of $550km^2$. These platforms are mainly focused on watercourse improvement and flood forecast.
- Clinical Technology: The clinical research lab is also located at FATP, in two dedicated rooms: an Ambient Assisted Living room with 15 personal and wearable clinical devices, and a hospital room with 5 patient monitors.
- Vehicle fleet: The vehicle fleet of the University of Murcia, composed of 48 cars destined to personnel mobility and various internal services of the university, has integrated a platform for location and tracking developed and interconnected with our research lab. For instance, this permits us to track the vehicles when experimenting with WiMAX mobility scenarios.

Finally, it is worth to mention that this infrastructure has been used for many EU projects, like SWIFT and DAIDALOS, and it is currently used for experimentation within the IoT6 project and prospectively within the OpenLab project.