Project Achievements

ASUA

Project ID: C2013/2-2

Start Date: 1 January 2015

Closure date: 31 December 2017

Partners:

Beia Consult International, Romania

Experis Manpowergroup S.L.U., Spain

Geodata Ziviltechnikergeselleschaft mbH, Austria

Karel Elektronik San. ve Tic. A.S., Turkey

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Advanced Sensing for Urban Automation

ASUA aimed to develop and enhance the essential Information and Communication technologies, to support the applications of modern urban automation in various countries across Europe: Austria, Romania, Turkey, Spain and Belgium. ASUA enables improvements in the areas of urban automation including building automation, resource management and energy metering.

Main focus

ASUA solves the network infrastructure complexity dilemma, by designing and applying new self-configurable communication mechanisms for fully connected future cities. The solutions are developed for server, sensor and network protocol levels. The diversity and variety of these solutions brings the need for interoperability. ASUA designed an "Urban Automation Reference Platform" that is one of the key outcomes of the project besides 4 prototype applications based on this platform. All the technical solutions on server side or client side need to be compliant with each other and with the "Urban Automation Reference Platform" which provides the schemas, contracts and rules to enable interoperability. Furthermore, ASUA achieved energy savings in urban sensing devices and gateways developed during project, by enabling sensing devices with severe resource constrictions and limited wireless range. An important contribution of ASUA project is that it facilitates the addition of new types of sensing devices to existing urban automation systems, by designing flexible interfaces and adaptive gateway mechanisms. Introducing novel types of cloud enabled services based on an autonomic data-processing system, ASUA optimizes the management of raw data from asset devices and intelligently incorporates the information retrieved from them.

Approach

ASUA project addresses the challenge of enhancing our everyday lives and make European cities better, safer and more energy efficient places for everyone, through advanced ICT-technologies and a modern urban automation approach.

The technical research and development efforts of ASUA can be divided into three key elements:

- Constrained devices
  Techniques for coping with extremely resource constrained embedded devices even in challenging environments.

- Communication networks
  Adaptive communication mechanisms and flexible interfaces for secure and reliable message dissemination

- Information management
  Cloud-based technologies for distributed storage, autonomic decision making and multidisciplinary information management.

ASUA project is built on several prototypes focusing on concrete application scenarios and based on the same reference platform, aimed to validate the technological outcomes of the project and demonstrate their usefulness and real-world applicability in the context of modern urban automation in Europe.
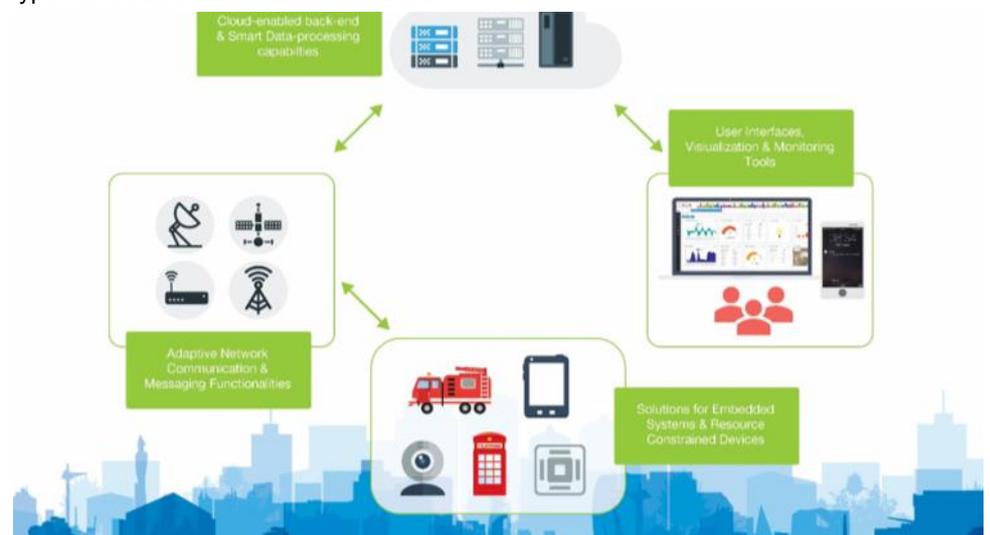
Achieved results

Setting up fundamental architecture of an ASUA Urban Automation Reference Platform was the first technical achievement in ASUA. Abstraction of sensor, network and server layers and standards based communication between layers were the goals of the design.

To increase energy efficiency, a deep sleep/auto wake up functionality is designed, and implemented on gateways and sensors. By using a power circuit, the sensors are fully disconnected from the power source during sleep period. Also, to avoid the high-volume data transfer, a method for model based data compression and reconstruction is developed and implemented.

For reliable sensor to gateway communication in challenging environments, BLE mesh network is developed. This network is based on both non-connectable broadcast advertisement and connection based data transfer. And long-range communication technologies (e.g. LoRa) are implemented to determine performance. Also, a simulation software implemented for ad hoc network creation and protocol efficiency measurement.

Remotely configurable gateways are another import outcome of ASUA. A flexible network communication manager is designed and implemented to monitor gateways, process their key parameters and reconfigure them according to a dynamic set of rules. It is based on SNMP protocol. Also, a novel robust communication technique with cloud support developed: Hybrid cloud supported dynamic node addressing and parameter setting.

For server side, standards compliant, scalable ASUA IoT Server is developed.

Cloud technology is one of the key features. It is continuous monitored by adding probes with PRTG and Veeam ONE tools. Resources can be adaptively configured to get a fault tolerant and high available system. Huge observation data are stored on Apache Cassandra, which is a horizontally scalable NoSQL database. Dynamic rule engine, which is remotely configurable, is designed and implemented to generate alarms, notifications, take reconfiguration actions or trigger actuators by evaluating observation data, gateway key parameters or other relevant information sources. ASUA architecture can be seen below.

Impact

The business impact of the project mainly focuses on new products and ICT solutions, developed for the benefit of different urban business domains in modern cities in Europe. In this context, three different city trials were conducted.

Architecture

- ♦ A management and monitoring system has been developed for Kayseri municipality in Turkey. In this study, Netcad and Karel worked together. Air quality of the city was collected by Karel and sent to the ASUA platform. These data are visualized by various methods (Charts, Maps and Reports etc.) Rules are defined by system administrator to react when "something important" occurs. For example, when the air quality exceeds a certain threshold, the relevant person is notified. Actuator devices also can be triggered thanks to wide range of standard protocol support.

- ♦ A tunnel monitoring system project is installed at Semmering Basistunnel in Austria.

- ♦ Wireless mesh (BLE/Wi-Fi) test labs are developed in KU Leuven University in Belgium.

Totally 10 new products have been developed and 4 products have been improved based on the project results. Partners of the project expect significant return of investment up to 5x.

One of the most important characteristics of ASUA is standards compliancy. Implemented standards contains but not limited to OGC SOS, MQTT, Open API Specification, GML, OGC WMS, OGC WFS, DSR, AODV, ZigBee, SNMP, IP67, BLE, Wi-Fi, FHIR. In this way, highly interoperable solution is provided to both existing and new systems.
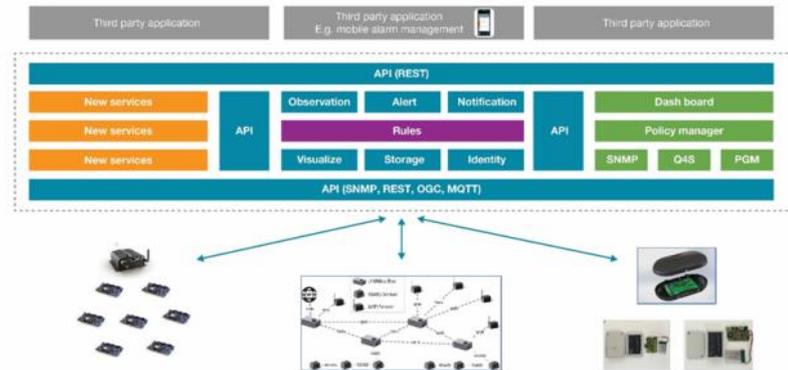
About Celtic–Plus

Celtic-Plus is an industry-driven European research initiative to define, perform and finance through public and private funding common research projects in the area of telecommunications, new media, future Internet, and applications & services focusing on a new „Smart Connected World" paradigm. Celtic-Plus is a EUREKA ICT cluster and belongs to the intergovernmental EUREKA network. Celtic-Plus is open to any type of company covering the Celtic-Plus research areas, large industry as well as small companies

or universities and research organisations. Even companies outside the EUREKA countries may get some possibilities to join a Celtic-Plus project under certain conditions.

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