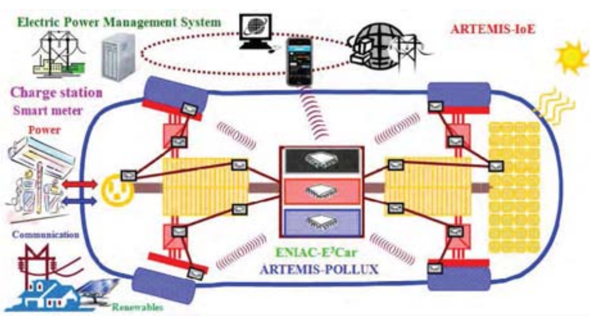
1.4 POLLUX & IoE

POLLUX (March. 2010-Feb. 2013)
IoE (May 2011- April 2014)
Interview with Ovidiu Vermesan, SINTEF

Challenge

The societal challenge addressed by the POLLUX project centred on electro-mobility, especially with respect to tackling efficient energy management and making the switch from architectures based on the combustion engine to new architectures dedicated to electric mobility with a natural fit to X-by-wire concepts for semi-automatic parking assistance for urban electric vehicles. The IoE project focused on the ecosystem for energy generation, supply, distribution and consumption, and more specifically the micro-grid ecosystem, targeting the transport and control of small amounts of energy in a similar way to data transfer within/across the internet. In this domain one of the main challenges is the bi-directional transport of energy.



Achievement

POLLUX addressed partly automated driving and parking, and demonstrated that the close-to-real feedback from the vehicle dynamics and from the road surface can be generated and transmitted to the steering wheel and braking or accelerating pedal (force feedback). The focus on the steer-by-wire system highlighted the benefits of system and functional integration as well as the need for functional safety requirements. Several demonstrators were developed for single and multi-motor compute architectures with specific microcontrollers for each demo. The beauty of this project was that hardware, software and OEM companies (FIAT and Peugeot) were involved, which enabled complete solutions to be realised.

The Project developed the EV architecture and the technology that form the basis for future development of autonomous driving/parking, communication network in the vehicle that

Duracar
HMI X-by-Wire, Force Feedback Pedal

Think
X-by-Wire, Parking Assistance

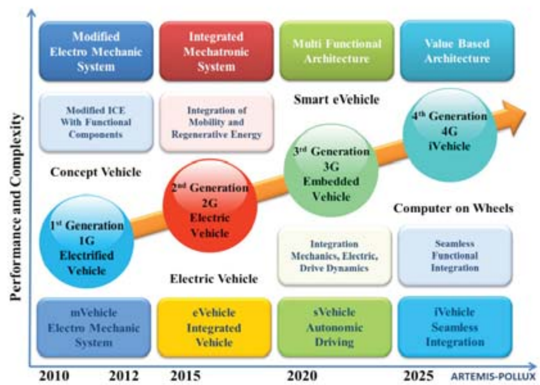
Fiat 500 HEV
Multicore processing motor controller, FlexRay Networking, Battery Management System

City Motion
Vehicle Controller, HMI, DC-DC Converter, Battery Management System, Partial CAN Networking

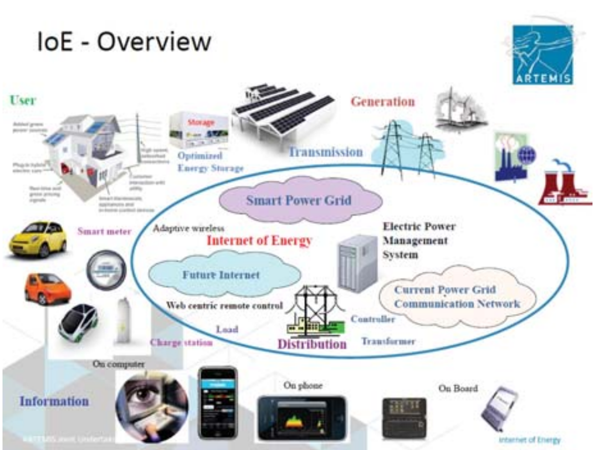
Test Bench Vehicle - PSA Peugeot Citroën
Battery Management, Multi propulsion power train, Multicore processing, PLC networking, FlexRay networking, V2I, V2G integration

allows for the future Ethernet backbone architecture and advanced human machine interfaces for performing the necessary communication services, inside and outside the vehicle (Vehicle to Vehicle – 'V2V', Vehicle to Infrastructure – 'V2I', Vehicle to Grid (V2G) and Internet Connection (V2G+I)).

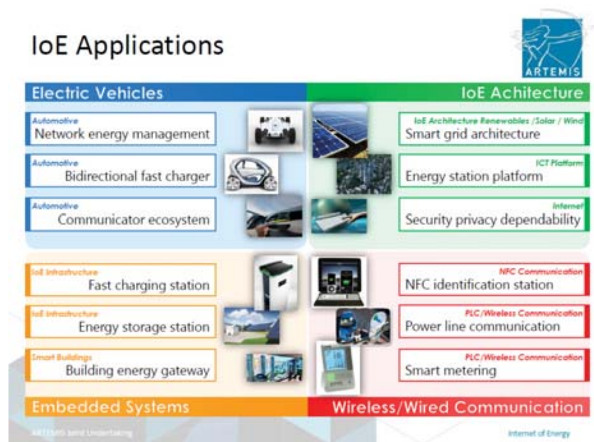
One of the main achievements of the ARTEMIS POLLUX project was to propose a roadmap for electric vehicle generations as illustrated below.



Electric vehicle generations
The **Internet of Energy** project addressed electric mobility with specific reference to the Smart Grid, which is expected to implement a new concept of energy transmission and a distribution network that is able to efficiently route the energy produced from both concentrated and distributed plants right through to the final user, or prosumer (being both producer and consumer) with a high level of security and quality of supply. In other words, a kind of 'internet' in which energy is managed similarly to data, across routers and gateways that can autonomously decide the best pathway to the destination with the best integrity levels.



In this respect the 'Internet of Energy' concept is defined as a network infrastructure based on standard and interoperable communication transceivers, gateways and protocols that allow a real time balance between local plus global generation and storage capability together with the energy demand, creating a high level of consumer awareness and involvement. The targeted applications are illustrated below.



This micro grid ecosystem addresses in fact a whole new market, whose parameters are sustainability and micro grid autonomy; in fact, the micro grid is not continuously connected to the main power grid. Energy brokers, which could be a residential building, for example, are developed to optimise power supply and demand on the micro grid.

Business Impact - Highlights
Dual core microcontrollers developed in the POLLUX project target complex and safety-critical systems in the automotive sector. These microcontrollers are used in the development of safety-critical applications since they were specifically designed to meet and have been deemed suitable for use in safety integrity level 3 (SIL3). POLLUX addressed the requirements and specifications of dual-core microcontrollers that include the standard definitions of automotive safety standard ISO26262, flanking the industrial safety standard IEC61508.

The project also developed CAN (Control Area Network) Partial Networking, a major innovation in power efficiency. The standalone CAN transceiver and system basis chip is the world's first highly integrated solution that supports CAN Partial Networking, thereby giving design engineers precision control over a vehicle's bus communication network.

The project generated the EV (Electric Vehicle) architecture and the technology that form the basis for the future development of autonomous driving/parking, as well as creating a communication network in the vehicle that allows for the future Ethernet backbone architecture and advanced human-machine interfaces to perform the necessary communication services, inside and outside the vehicle.

The technology and concepts developed by the project are used today in the development of the 3G generation of smart e-Vehicles that will be on the market in the next few years. The technology allows the penetration of electric vehicles from e-bikes and lightweight electric vehicles to electric buses.

The technology developed by the project can be scaled to different classes of electric vehicles. Lightweight EVs is one of the largest and fastest growing electric vehicle markets where light electric vehicles (e-bikes, nano, micro class electric vehicles) will proliferate in cities due to the demand for clean transportation.

Internet of Energy for Electric Mobility developed the technology that supports the ecosystem for energy generation, supply, distribution and consumption, and more specifically the micro-grid ecosystem.

The concepts and technology developed allow the transport and control of small amounts of energy, in a way that is similar to data transfer within/across the internet by solving one of the main challenges in this domain; the bi-directional transport of energy. The prosumer is the end-user of such systems.

IoE contributes to reference design and architectures by addressing architectural and functional dependability, thus ensuring secure, reliable and timely system services and the design, development and deployment of ubiquitous electronics and software systems.

Many future products and services are expected to be rolled out of the IoE project achievements, such as the development of five bi-directional, on-board chargers based on different topologies and the development and deployment of four building energy management gateways demonstrating different functionalities. The key features of integration and interoperability were demonstrated in two software platforms for the federation of information around charger stations that realised 50KW DC and 22kW 3 phase AC fast charging with PLC, GPRS and NFC communication features. In addition, two energy storage solutions (Li-Ion, Fly-Wheel) were demonstrated and a communication protocol for energy storage units proposed. Other achievements include an urban traffic simulation tool developed that can be combined with grid information and a vehicle controller touch screen display and multiple communication protocols (Wi-Fi, 3G, NFC, CAN).

The Internet of Energy concept facilitates the development of future Smart Grid deployment and the integration of Energy Bi-directional Switch, Energy Hub Energy Cloud and Energy Storage Cloud concepts. The Energy Hub combined charging stations, improved operating efficiencies and cost savings, accelerated fault finding and improved power quality as well as facilitated the integration of renewable and distributed generation sources in the city context using micro/nano grid deployments and cloud energy source distribution.

New requirements for power matching have been defined for operating micro/nano grid systems that incorporate the necessary flexibility to accommodate inherently intermittent renewable technologies, such as wind and solar.

Energy Storage Cloud allows the seamless integration of local and mobile energy storage (distributed energy banks to a standalone or part of the buildings/homes/parking/poles infrastructure, second-life battery packs, dynamically generated battery banks-fleet of vehicles connected when charging or when parking) into the Energy Cloud using the communication interface and moving towards energy as a service implementation.

The results of the project have been used to accelerate electric vehicle uptake in the Member States involved and focus on interoperability, sustainable infrastructure set-up and network planning alongside infrastructure deployment.

An example of exploitation is the case of ABB B.V. (Netherlands), manufacturer of fast charge solutions and partner of the IoE consortium that is leading the ELECTRIC project funded by the 'Trans-European Transport Networks (TEN-T). Via TEN-T the European Union contributes to the internal market aim to harmonise and better connect transport systems in Europe. The objective of the TEN-T programme is to co-fund investments in transport infrastructure in order to enhance European transport networks. The total budget of this project amounts to about 8.4 million euros. Ultimately the project targets the creation of an open access, fast charging corridor situated along major motorways connecting Sweden, Denmark, Germany and the Netherlands via a total of 155 foreseen chargers, with up to 30 in the Netherlands, 23 in Denmark, 35 in Sweden and 67 in Germany.