



# HEADS

**HEADS is a software engineering project targeting internet services whose logic and value emerges from a set of communicating software components distributed on a heterogeneous computing continuum going from clouds to mobile devices, sensors and/or smart objects.**

## AT A GLANCE

**Project title:**

Heterogeneous and Distributed Services for the Future Computing Continuum

**Project number:**

611337

**Project coordinator:**

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**Partners:**

Institut National de Recherche en Informatique et en Automatique (FR), Geographical Infrastructure Solutions Limited (IE), Tellu AS (NO), Software AG (DE), Athens Technology Center (GR)

**Duration:**

Oct. 2013 – Sept. 2016 (36 months)

**Total cost:** € 5.22 M

**Programme:** FP7 ICT Call 10

**Website:**

<http://www.heads-project.eu>

## Context and Motivations

The future computing continuum is composed by a highly heterogeneous interconnection of platforms and devices offering a wide diversity of capabilities. On one end of the continuum, cloud platforms provide virtually unlimited and "elastic" resources in terms of computation power, storage and bandwidth. On the other end, the already vast and rapidly increasing number of smart objects, sensors, embedded systems and mobile devices connected to the Internet provides close interaction with users and with the physical world. While offering great potential for innovative Internet-based services, the heterogeneity, diversity and massive distribution of the future computing continuum represent daunting challenges.

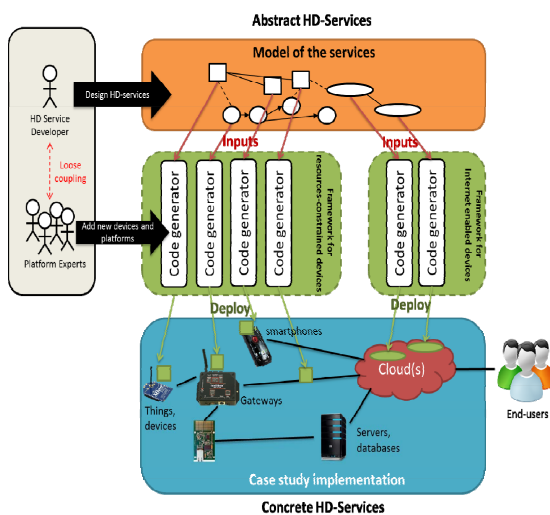
Current software engineering approaches tend to provide dedicated support for managing and exploiting only parts of the continuum. For example, current cloud computing and service-oriented software engineering practices provide efficient abstractions for virtualizing the infrastructure in order for the software engineers to concentrate on the business logic of the applications. However, these techniques merely support integration of mobile devices, sensors and actuators "as-a-service" and lack specific support for

advanced exploitation of these small devices.

Furthermore, although sensor network nodes, gateways, smart-phones, and most smart-objects are provided with APIs and development environment, there are no common practices to expose the level of flexibility, languages, APIs and customization supported by different devices and platforms. Thus, most pervasive systems tend to be proprietary silos not easily exploitable by other systems as they offer only black box provisioning of higher level services.

### Idea and Approach

The idea of the HEADS project is to leverage model-driven software engineering and generative programming techniques to provide a new integrated software engineering approach which allow advanced exploitation of the full range of diversity and specificity of the future computing continuum. The goal is to empower the software and services industry to effectively provide new innovative services that are seamlessly integrated to the physical world making them more pervasive, more robust, more reactive and closer to their users. In the following we call those services **HD-Services**.



The figure above presents an overview of the HEADS approach to the development of a HD-service. The bottom of the figure presents the infrastructure on which a HD-service is deployed and the software artefacts distributed to implement the service. The computing continuum includes cloud platforms on the right, a set of servers

in the middle and a set of devices, sensors and gateways on the left. On top of the nodes of this infrastructure, the green ellipse and squares represent the parts of the implementation of the HD-service. The HD-service implementation has to be scattered across the network of platforms and devices in order to fully exploit the capabilities of the various resources of the continuum.

### Results and Impact

The main outcome of the HEADS project will be an Integrated Development Environment (IDE) supporting a domain specific modeling language and an operational methodology for specification, validation, deployment and evolution of software-intensive services distributed across the future computing continuum. The HEADS IDE will allow modeling the behavior of a service in a homogeneous HEADS modeling language while allowing the implementation of the service to be distributed over heterogeneous networks and devices. The HEADS IDE will be developed and released as open-source and extensible by a plugin mechanism and a framework to add support for additional platforms.

HEADS will make HD-Service development affordable and accessible to a wide range of industry domains. The project especially targets SMEs which typically do not have in-house knowledge of all the target platforms they would like to exploit within the future computing continuum. It also targets sectors for which a rapid innovation and release cycle is the key. Moreover, the emergence of the future computing continuum will impact end user requirements and transform business markets, this again require companies to evolve existing products and services to fully exploit this continuum. A main impact of HEADS will be through provision of exploitable results to perform these tasks in an efficient and cost effective way.