

# ENVISAGE



**ENVISAGE will create a development framework based on formal methods to include resources and resource management into the design phase in software engineering for the cloud. This will improve the competitiveness of SMEs and profoundly influence business ICT strategies in virtualized computing.**

## AT A GLANCE

**Project title:**

Engineering Virtualized Services.

**Project number:**

610582

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**Partners:**

Stichting Centrum voor Wiskunde en Informatica (NL), Technische Universität Darmstadt (DE), Alma Mater Studiorum-Universita di Bologna (IT), Universidad Complutense de Madrid (ES), Atbrox AS (NO), Fredhopper B.V. (NL), Engineering (IT).

**Duration:**

Oct. 2013 – Sept. 2016 (36 months)

**Total cost:** € 4.70 M

**Programme:** FP7 ICT Call 10

**Website:**

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

[twitter: @EnvisageProject](https://twitter.com/EnvisageProject)

## Context

Companies increasingly employ the cloud computing model, which offers different services for infrastructure and platform functionalities. These services make it possible to virtualize the deployment of resources and to provide an elastic amount of resources to a client's application-level services. Application-level services can, for example, acquire additional processing capacity on demand. Today, resource provisioning is regulated by a *service-level agreement* (SLA), a legal contract between the service owner and the provider of a virtualized environment. These contracts are legal texts and by their very nature not integrated in the software units.

## Challenge

To foster the industrial adoption of virtualized services, two major obstacles must be addressed: (1) the efficient analysis, dynamic composition and deployment of services with qualitative and quantitative requirements and (2) the dynamic control of resources such as storage and processing according to internal policies.

Both deployment and the SLA regulating deployment are *external* to traditional development processes: deployment parameters and SLA compliance are determined *after* designing the service logic. Virtualization allows deployment and resource provisioning to be *internalized*, so the services themselves can dynamically scale to cater for client traffic.

To realise the potential of virtualization, services should be made both scalable and cost efficient by addressing deployment decisions during the software design. But current modeling and analysis techniques do not help developers to realistically predict the resource requirements of a service during early design stages. Languages and tools for software development lack high-level support to systematically analyse performance under varying resource assumptions and to express and compare resource management policies. Variations in end-user behavior, value-added services, and dynamic service composition additionally extend the functionalities of a service but may potentially change its cost profile.

### Solution

ENVISAGE aims to overcome these obstacles to the industrial adoption of cloud computing by including SLAs into software models and resource management into the early design phases. To efficiently develop virtualized services, (1) SLAs will be part of a *design by contract methodology* for virtualized service engineering and (2) the management of virtualized resources will be explicit in the high-level service models.

ENVISAGE develops a semantic foundation for virtualization and SLAs. This foundation makes it possible to go beyond state-of-the-

art cloud technology: it permits to efficiently develop SLA-aware and scalable services, supported by highly automated analysis tools using formal methods. SLA-aware services can control their own resource management and renegotiate SLA across the heterogeneous computing landscape.

The main outcome of ENVISAGE is a practical open-source framework for model-based development of virtualized services including (1) a behavioral specification language for describing resource aware models; (2) a simulator with visualization facilities; and (3) tool support for automated resource analysis, validation of SLA, code generation, and runtime monitoring of SLA for deployed services.

### Impact

The methodology and tools developed in ENVISAGE will allow services to be delivered in a more effective, efficient, and reliable manner than today, accelerating the development cycle and lowering operational costs for innovative services that make use of cloud computing. This has the potential to significantly improve the competitiveness of SMEs, and profoundly influence business ICT strategies in all sectors. Dissemination, including an open source development model, is the strategy of the consortium to achieve this impact.

