



## Smart System Adaptability

### PROJECT FACTS

**Partners:** Océ-Technologies B.V.  
Delft University of Technology  
Eindhoven University of Technology  
Radboud University Nijmegen  
University of Twente  
Embedded Systems Institute

**Period:** July 2007 – June 2011

**Capacity:** 20 fte/year, 8 PhDs, 4 PostDocs

### INDUSTRIAL CHALLENGE

Today's high-tech systems industry operates in a complex and highly dynamic business environment. In order to ensure a successful product range, a well chosen trade-off between market position, functionality and technological capabilities is required. In addition to this, time-to-market, cost engineering, and life-cycle management considerations can also be considered critical factors to a product's success.

As an example, consider professional color printing systems. Current systems are designed to operate in a confined and well-defined context, in which system interactions are well known and understood. Future systems will be expected to deal with a much more dynamic operating context, with continuously changing requirements for application, function and technology. In order to ensure the competitive positioning of such system in this dynamic market and to effectively deploy the required development investments, it has become of paramount importance to design-in the correct level of system 'evolvability' and 'adaptability'.

The Octopus project is a collaborative research project of the Embedded Systems Institute, where a professional high-volume color printing system from Océ Technologies is taken as an 'industry-as-laboratory' case to research new ways to design-in system evolvability and -adaptability. To illustrate this principle, consider the consistency of 'image quality of color prints'. Quality results are expected whilst using a wide variety of media formats and types (even new ones), under environmental conditions that can widely vary. This involves adaptability and consistency of both the digital processing of images and control of the printing-on-paper process.

The challenge of runtime adaptability in systems design is widespread in industry. This project aims to create new adaptability concepts and patterns that can be used across

a broad range of industrial applications. Central to these concepts is the transparent coordination of system control over different technology domains, supported by adequate, multi-disciplinary models.

### RESEARCH OBJECTIVES

The challenge of developing adaptable high-tech systems is to find a mixed set of relatively simple first-principles models and heuristic approaches that can be used to design system level control. For the industrial case of Océ Technologies this comprises the improvement of system adaptability by:

- Model-based sensory analysis and innovative actuation of the system. This should be supported by a system architecture that intrinsically facilitates adaptability;
- Model-based trade-off analyses to develop control strategies of the chain of software components that are used in the digital image processing.



### EXPECTED RESULTS

The Octopus project partners will address a number of key technology aspects for adaptability of complex embedded systems:

- Concepts, methods, and tooling for design-for-adaptability;
- Model-based system interpretation techniques to analyze, develop, and optimize adaptability strategies;
- Digital signal processing control and adaptability concepts;
- Physical layer control and adaptability concepts;
- Proof-of-concept demonstrators based on Océ printers.

### INFORMATION

For further information, please visit the website [www.esi.nl](http://www.esi.nl)