



PROJECT RESULTS

# Software evolution

## The route to system enhancement

*In recent decades, much attention has been paid to software-engineering methods and technology; as a result it is now feasible to build systems that are bigger than ever before. However the laws of software evolution dictate that the quality of these systems will decrease with time, thus putting the large investments required for building them at risk. This risk can be mitigated by applying software re-engineering methods and techniques. Within the SERIOUS project, these software-evolution related issues are addressed as they were and still are relatively unexplored territories in software engineering.*

The European software industry is confronted with several trends that impact their software systems. These include increasing market pressure to come up with new products and features faster, and to create product lines with more product differentiation. There is also an increasing need to integrate existing functionality into combined systems, and to interconnect products so they can share information. As technology has evolved, it is feasible to build these systems which are larger and more complex than ever.

A different software development approach is required to meet the increasing pace of developing software assets and their increased complexity. Changing software that has been adapted and modified several times needs different

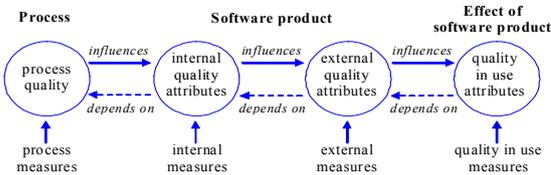
software-engineering skills from developers than required when developing software from scratch.

**Controlling development costs**  
Increased complexity and size impacts software development costs. For many companies, this increase in costs is only realistic if the lifetime of their systems can be prolonged. However, this model is no longer valid if the rate at which these systems change increases and therefore the costs required to implement these changes increases as well.

A more effective way of dealing with system evolution is therefore required and the need for a move towards an evolutionary software-development process becomes obvious. Evolutionary development explicitly takes into account optimisation of the benefits and costs during the whole life cycle, including the phases after delivery of the first product. It gives companies strategic means to evolve software, guaranteeing an increasing quality of the product during its whole lifetime.

**Maintaining quality**  
An important aspect of software evolution is maintaining the overall quality of software during the development process. It is well known that evolving systems tend to decrease in quality. Currently, most organisations focus on the development of new features without taking the consequences of these changes explicitly into account.

However, to be profitable in the long term quality aspects, such as maintainability and extendibility, must be clearly addressed in all phases to ensure an optimal life cycle. Focusing on only adding a single feature to the system may introduce unexpected problems



Software quality

## SERIOUS (ITEA 04032)

### Partners

- Alcatel-Lucent
- Bertin Technologies
- European Software Institute
- Ibermatica
- Nokia Research Center
- Philips Applied Technologies
- Philips Healthcare
- Softteam
- Surlog
- Tampere University of Technology
- University Antwerp
- University of Helsinki
- University Polytechnic Madrid
- University Zürich

### Countries involved

- Belgium
- Finland
- France
- The Netherlands
- Spain
- Switzerland

### Start of the project

1 September 2005

### End of the project

31 August 2008



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in other, even untouched, areas of the software. To overcome this situation, anticipatory development activities are needed at an earlier stage.

### Tools evaluated

SERIOUS has applied academic techniques, tools and models related to software evolution. These tools have been applied in a series of industrial case studies to evaluate their usefulness. The results of these studies have been gathered in a handbook on refactoring which is now publicly available.

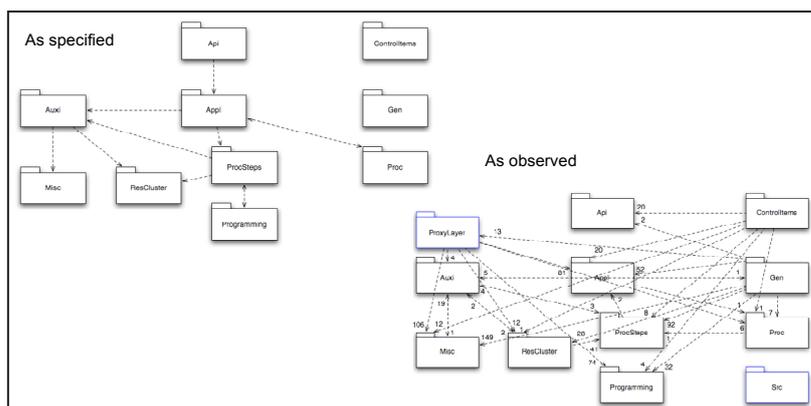
Furthermore, processes and methods that improve the software development models in industry have been gathered and applied at industrial partners that deal with evolutionary development. This collection of best practices has also been gathered in a process-patterns handbook which is now publicly available as well.

Finally, the quality aspects of software have been studied, and the results of that study have been embedded in tools which now allow partners to monitor the internal quality aspects of their systems in real time.

### Complex systems

The partners involved in SERIOUS operate in different markets:

- Nokia builds mobile phones based on platforms such as S40 and S60. These complex platforms change over time, and their development is helped by the results of the project;
- Philips Healthcare builds expensive medical-imaging equipment. The methods and processes developed within SERIOUS have helped Philips to save on development costs; and
- Networking equipment is being built within Alcatel-Lucent. SERIOUS has helped Alcatel-Lucent to adapt existing systems so that the memory use is reduced, effectively extending the lifetime of those systems.



Software design in practice

### Major project outcomes

#### Dissemination

- Six journal papers
- 24 conference papers
- 16 workshop papers
- Handbooks on refactoring and process-patterns publicly available

#### Exploitation

- Methods that previously only existed in books are now available as tools
- Case studies showed the value of academic ideas in practice
- Industrial partners have reported significant savings in the development process
- All industrial partners report an increased awareness on the issues of software evolution
- New courses on software evolution available at academic partners

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ITEA was established in 1999 as a EUREKA strategic cluster programme. We support coordinated national funding submissions, providing the link between those who provide finance, technology and software engineering. We issue annual Calls for Projects, evaluate projects, and help bring research partners together. We are a prominent player in European software development with some 10,000 person-years of R&D invested in the programme so far.

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