

# Involving PhD students into industry initiated software-engineering projects

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# Overview

## How?

- structured PhD program since 1994, accredited doctoral schools, milestones, requirements inherited from PhD in math/electrical eng.
- involving CS PhD students in teams to participate in R&D projects is motivating (NTSF basic research linked to industry initiated applied research)
- PhD students focus on research (e.g. semantics, DSL design, correctness, static analysis)
- context: long-running, innovative software-engineering projects in cooperation with industrial partners
- team: MSc + PhD students with faculty staff members

## Why?

- results of the projects are used in the software industry → highly motivating
- release of the prototype software product with an open-source license, and research results' publications
- participating MSc students → next generation PhD students, earlier results → better chance of successful PhD
- industrial-like project environment → grow on project management, collective and individual responsibility skills in maintaining high quality and respecting deadlines

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# Challenges of the academic-industrial cooperation

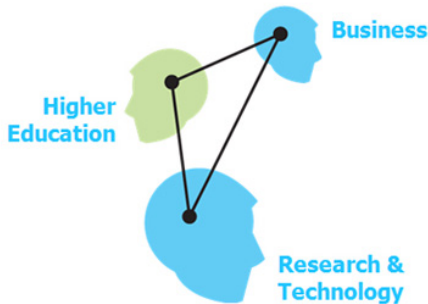
University  $\neq$  Industry

+

Student  $\neq$  Employee

⇓

University student work  
 $\neq$   
Industry employee work



# Software quality

- The quality of the code is key factor for industry (ever for prototype applications)
- Industry requires stability and conformance to the specification
- University students can\* produce „**industry quality code**”

\* Study on 20 MSc students led by 5 PhD students, C++ code: same average number of bugs/codeline, code rule violations, dangerous C++ code patterns. Code review by experienced senior programmer (PhD) is required, unit tests are essentials, automatic code rule checkers and property based testing are a great help.



# Teamwork, communication

- Typical team: 10-20 (BSc)+MSc and 3-5 PhD students → very diverse group (study years, programs, specialisations).
- Different working time-slots and working places ≈ multinational software company.
- Good teamwork is obligatory.

## Teamwork tools:

- virtual meetings, videoconferences
- tools to collect and redistribute information
- distributed project management
- open source tools: `trac`, `svn`, Jenkins

Face to face meetings are also essentials...

# Reporting and the Way of Work

- Every industrial partner has its own project methodology and tries to apply it for the university also.
- University students are working and living in a different environment than their industrial partners. They have lectures, home works, exam periods and longer vacations, etc.)

An automatic extension of industrial way of working simply does not work for students.

As an example, organizing daily scrum meetings are almost impossible as the students have disjoint timetables.

Still, most of the agile methodology can be applied for university teams: rapid prototyping, test-driven development, continuous integration worked well.

Weekly reports, however, notoriously were late or completely missed by the students.

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# EIT - ICT Labs KIC - ELTE



European Institute of  
Innovation & Technology

Eötvös Loránd University,  
as the leader of the Budapest Associate Partner Group  
is part of the European Institute of Innovation and Technology (EIT),  
Information and Communication Technologies (ICT Labs)  
Knowledge and Innovation Community (KIC)



# EIT ICT Labs Doctoral School in ICT Innovation

Doctoral School in ICT Innovation: doctors with an innovative and entrepreneurial (I&E) mind-set:

- Robust entrepreneurship education
- Highly integrated, innovative learning-by-doing curricula
- Mobility, European dimension and openness to the world
- Outreach strategy and access policy

Doctoral Training Centres (DTC's)

- focused research topic
- physically co-located
- strong involvement of industrial partners

Doctoral candidates participating in the “EIT ICT Labs Doctoral School on ICT Innovation” acquire an Innovation and Entrepreneurship (I&E) mind-set.

# Innovation and Entrepreneurship education (I&E education) in the DTC's

The Innovation and Entrepreneurship education (I&E education) is a mandatory component of the doctoral studies; standardized I&E education that complements the doctoral curriculum:

- Business Competence phase
  - Opportunity Recognition,
  - Business Modelling and Development,
  - Growth and Harvest
- Business Development Experience

*„The doctors that will come out of this school will become the commercially aware research leaders or entrepreneurs who understand current and future challenges as well as the opportunities these present to industry...”*

Our approach fits into the concept of the EIT ICT Labs KIC Doctoral Training Center (DTC) initiative, where

- PhD students gets research topics related to the state-of-the-art challenges of the industry,
- work in teams on related topics,
- get a joint academic-industrial supervision,
- should produce research results applicable in innovative products and services
- get experience and education in management, innovation and entrepreneurship skills.

In the DTC's the PhD students are working in a very close relation with their academic and industrial tutor and they participate on industry related R&D projects.

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# Results

More and more industrial related R&D projects are starting, involving more and more BSc, MSc, and PhD students.

Projects are not only beneficial for the industrial partners, but -more importantly-, students working on these projects acquires competences on collective and individual responsibility, quality coding, team working and communication.

Selected PhD students can also participate on the EIT ICT Labs Doctoral School on ICT Innovation program.

## Thank you for your attention!

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- 3 Horváth Z.: Activities of the Budapest ICT Lab AssociateNode of the European Institute of Innovation and Technology. Presentation at IPTS - IT STAR International Conference on ICT Research and Innovation Challenges in Eastern European Member States (EEMS), 11 November 2011 in Budapest, Hungary, [http://is.jrc.ec.europa.eu/pages/ISG/PREDICT/documents/Horvath\\_kic.pdf](http://is.jrc.ec.europa.eu/pages/ISG/PREDICT/documents/Horvath_kic.pdf)
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<http://eit.ictlabs.eu/action-lines/doctoral-school/>
- 5 The European Institute of Innovation and Technology homepage,  
<http://eit.europa.eu/>
- 6 The Information and Communication Technologies Labs (ICT) Knowledge and Innovation Communities (KIC) homepage,  
<http://www.eitictlabs.eu/>
- 7 The Budapest Associate Partner Group homepage,  
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