

5. Innovation Agenda

One of the goals of NIRICT is to contribute substantially to innovation. NIRICT research creates knowledge which can be used in the development of new ICT products, applications, and services. Innovation requires that ideas which have a commercial potential move from the laboratories into the marketplace. To strengthen the knowledge transfer within the six Strategic Research Agenda's and the NIRICT Center-of-Excellence CeDICT, the joint NIRICT Research Lab (NRL) has been founded.

Knowledge transfer from universities to industry and society

There are several ways to realize knowledge transfer:

- Graduates and research projects: The Dutch economy is becoming ever more knowledge-based; this demands a more highly-skilled workforce. The most important way in which knowledge is transferred from the 3TU's into the wider world is through the skills and experience gained by the numerous graduates and PhDs. In externally funded research projects, knowledge transfer takes place between the participating universities and the industrial project partners (often larger companies and/or high-tech SME's). In general, these - more traditional - aspects of knowledge transfer are taking place within the SRA's.
- Transfer through programmes and projects. These are broad collaborations of university groups, knowledge institutes, branch organisations and individual companies to perform pre-competitive research.
- Licensing and spin-off companies: Licensing of university intellectual property and consulting have long been the traditional methods by which universities have spread their skills and experience into the wider world beyond. In the past few years, the creation of spin-out (or start-up) companies has become an important additional mechanisms through which the knowledge and expertise developed by universities flows directly to industry. Knowledge transfer performance is not easy to measure but if the rate of ICT spin-outs is any guide, the track record of the 3TU's is impressive. NIRICT will build upon the existing successful spin-off activities of the 3TU's, which will be further professionalized within the 3TU Innovation Lab (o.a. stimulation and development of the required mentality and skills of the researchers, TOP arrangements). Coming up with nice ideas and turning them into clever technologies is not sufficient by itself. A clear understanding of how each new technology addresses a real market need is essential, and for this, new skills and dedicated ICT networks are needed. Besides, in contrary to most other disciplines, the possibilities to take out a patent (which can form the basis for a potential business case) are rather limited in the ICT (software) sector; alternative business strategies are required. Therefore, NRL will play a specific supporting role in the process of setting up ICT-knowledge based spin-off companies (although NRL will make use of the standard facilities and knowledge provided by the 3TU Innovation Lab). The cooperation between NRL and ICT-based Business Accelerators (such as Smart Systems) will speed up the expansion of favorable young ICT-based spin-off companies.

NIRICT Research Lab (NRL)

The NRL will initiate and coordinate projects where research expertise is applied to industrial and societal applications, especially for SME's. Because these SME's have a strong basis in their region, NRL will have three locations, although it will be managed as one organization (one board). Each branch will have his own expertise / specialization and a front desk to serve the own region. NRL will be managed by one director and three branch coordinators. Preferably, the NRL activities will be performed by employees of the 3TU's.

LaQuSo (Laboratory for Quality Software)

Scientific leader

Drs. Henk Schimmel (TU/e)

Smart Environment Laboratory

Scientific leader

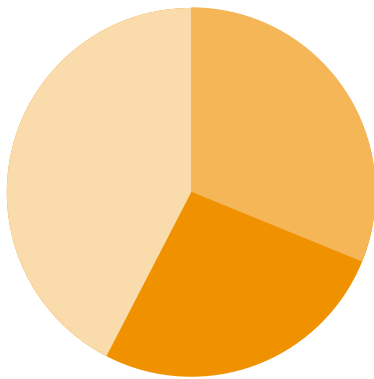
Prof.dr. Pieter Hartel (UT)

NIRICT Design Labs

Scientific leader

Prof.dr.ir Patrick Dewilde (TUD)

- Website, demo center, brokerage events: NRL will make the NIRICT research results easily accessible for potential (industrial and/or governmental) users via a website specifically addressing particular target groups. Web-based and mobile demonstrators presenting various aspects of NIRICT research (e.g. context-aware ICT services, intrusion detection, mobile eHealth services) will show potential end users the possibilities of research results. At the same time, NRL will play a coordinating role in the organization of meetings such as 3TU customer days and other brokerage events with a focus on the matchmaking between supply (knowledge institutes) and industrial demand.



FTE overview in 2005

- Structural Fundings 271,5 fte
- Basic Research Funding 220,7 fte
- Strategically Research Fundings 346,9 fte

The groups within NIRICT have a substantial involvement in innovation and industry related projects. Next to the structural university funding and basic research funding by the national science foundation, a considerable part of the funding is from strategic research programmes (BSIK, EU, industr, etc.).

LaQuSo (Laboratory for Quality Software)

No matter how carefully software is being developed, at the end only the quality of the product matters, both for the developer and the user. The central question is: does the software system provide the added value which it has promised?

LaQuSo (Laboratory for Quality Software) fully concentrates on measuring, quantifying and predicting the quality of software. This includes the intermediate results that are produced during the development process, as well as the end product, the code of the program. That is why LaQuSo wants to provide its customers a maximal insight in the reliability and predictability of software. More than 50% of software development time is spent on finding errors. LaQuSo helps to decrease this percentage. This is done by developing methods, techniques and tools to detect bugs in artifacts of the software industry. The starting point for all those activities is the problem description defined by the software industry i.e. organizations and departments that professionally develop software.

LaQuSo develops and supports two core competences.

- (Formal) methods, techniques and tools for verification (proving)
- (Empirical) methods, techniques and tools for validation

A Certificate for software

The complexity of software systems is growing. At the same time, the demand for security and dependability increases, this is certainly true for the users' side. Moreover, the legislation puts even higher demands.

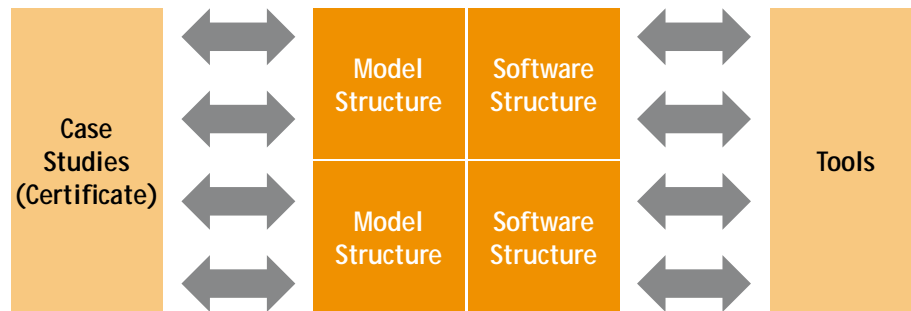
This requires an independent evaluation. LaQuSo will achieve this by introducing a quality certificate for software systems or parts of them. The basis for such certificate is a clearly formulated requirements package which can be thoroughly diagnosed by LaQuSo. As soon as LaQuSo does not detect any more errors, there is a foundation for the certificate: "LaQuSo cannot find any more bugs in this system".

LaQuSo is developing itself as "the" expertise and research centre for verification and validation of software systems. Methods and tools come from the scientific world, as well as from industrial practice. LaQuSo will bridge the gap between scientific computer science and software industry. The piles under this bridge are adding value with low thresholds; transforming scientific knowledge

into methods, techniques, and applicable tooling for industry; performing practical case studies; researching with and for the industry and transferring the obtained knowledge and developed methods, techniques and tools to the industry.

Themes and domains

LaQuSo groups its activities into six themes. These are complementary and support each another. The themes optimally fit to both of the goals: increasing the quality of software and bridging science and industry. The themes are presented in the following model:



Research is further focused on 7 domains and services. The domains represent on the one hand the development cycle of software systems i.e. Requirements, Architecture, Software code and Executing systems, and on the other special properties that need special attention, such as Security, User interaction and Performance of software systems.

Tools

The industry has developed a vast amount of tools for verification and validation of software systems. These tools form the instrumental basis for the support of the certification program. Moreover, LaQuSo develops additional tools in-house, and a repository as a mediator between the different views of the system. Due to the formation of the expertise centre these tools will be visible and applicable for industry and the scientific community. This leads to knowledge transfer, practical daily usage and development of new tools.

Methods and techniques for verification and validation form the underlying value for the diagnosis of software systems. The software industry currently does apply a limited number of methodologies. LaQuSo will define and perform new research in cooperation with the industry. Such projects are substantive and financially possible thanks to the good contacts between the industry, LaQuSo, the universities, the ministry of economic affairs and other financial sponsors.

Cooperation

The cooperation between LaQuSo and industry might have several appearances.

- Case Studies:

In case studies we identify problems, put diagnoses and offer solution directions. Apart from the case studies performed by students within the framework of a training period, we distinguish professional case studies. These lead to a formal diagnosis and possibly to a certification of the examined software system.
- Research:

Innovation takes place in the research projects which LaQuSo carries out by itself, or with partners. Several research projects concern fundamental research in the field of verification and validation. LaQuSo gives large importance to the research initiated by the industry and to the investigations that are conducted in close cooperation with industry. The industry can outsource research to LaQuSo.
- Expertise centre:

The available methods, techniques and tools for verification and validation are operational in the LaQuSo Expertise Centre. Interested parties can use the demonstration facilities of LaQuSo.
- Partner of LaQuSo:

This program contributes to the knowledge transfer by organizing lectures, conferences, publications, demonstrations etc. for industry and science.

Organization

LaQuSo, Laboratory for Quality Software, is a joint activity of 3TU. and Radboud University Nijmegen. All knowledge and capacity in the domain of verification and validation of software systems present at these universities is available via LaQuSo. To guard the focus and bridge between science and industry an Advisory Board with representatives and thought leaders of both the industry and the scientific world advises the direction and the management.

Smart Environment Laboratory (SEL)

Many promising results of research in ubiquitous computing remain in the laboratory because it is difficult to assess the value of experimenting with these technologies in a realistic settings. The costs and benefits of creating such an environment, integrating the technology, and inducing a realistic usage for the ubiquitous services are all highly uncertain factors.

Aim and Vision

In our vision, ubiquitous technologies and services simply should work; for individuals and for groups of people. People should be able to depend on the proper operation of these services, with respect to their availability, reliability, and security. Yet their operation must be intuitively and unobtrusive.

It is our ambition to realise the above vision in The Smart Environment Laboratory (SEL), where we will connect users with core technology such that individuals can appreciate state-of-the-art technology and that their perception will guide the development of technology. Thus facilitating innovative application of technology. The SEL facilitates creative use of technology under development. We will contribute to new applications and business models, contribute to the re-arrangement of the way-of-work for the consequent improvement of productivity, and to contribute to the creation of infrastructure for enhancing the quality of life of people. The use cases in SEL will demand for integration and seamless interworking of technology. Typically, a prototype implementation will suffer from imperfections, resolving these undoubtedly will yield new, expectedly exciting, technology.

Approach

To realise our ambition we are creating an infrastructure in which researchers from a wide range of disciplines work closely together. Some researchers will be working on engineering topics such as communication technology, embedded software and hardware configurations, and security and privacy issues, whereas others will work on topics from the social sciences such as user interfaces, user perception, human monitoring and coaching. A particular asset of our infrastructure is that we effectively close the gap between an individual user and a dedicated technology, which is generally a gap too big to close for individual projects. At each of the three Technical Universities, the SEL has a so-called Smart Network eXPerience lab (SmartXP). Each SmartXP lab is intimately connected to a range of specialised laboratories, through the engineers and social scientists that work in the SmartXP lab. The range of satellite laboratories include laboratories for technology integration and core technology development as well as laboratories for human machine interaction and user interface design targeting specific user groups, of which the emerging home and care labs are distinct examples. A SmartXP lab is a place where technology can be experienced in a realistic setting. It offers people a chance to participate in applications and validation tests. Concurrently, a SmartXP lab offers researchers the opportunity to observe the use of technology and its ability to interoperate with various other technologies. A SmartXP lab is the place where research meets applied technology, mutually strengthening each other.

The Smart Environment lab is self-reinforcing. It is a living lab in which scientists and engineers participate constantly in each-other's applications; they share each-other's technology and they typically will use each-other's applications in their daily life. Moreover, the smart environment lab is a market place for expertise and state-of-the art technology for the next generation of ubiquitous services.

Example

We are working on a system for virtual presence that provides the opportunity to collaborate, participate, and observe at a distance. The same system can be used to distribute applications and to observe its usage in daily life of the SmartXP researchers.

Another example is the health monitoring system. Here researchers experience the fact of being constantly monitored. The monitoring system is integrated with a coaching system that guards the well-being of the researchers. Note that the virtual presence system is a technology under development as well as a tool. We will investigate to what extent the virtual presence will change the way-of-work of our researchers.

Portfolio

The Smart Environment Lab provides easy access to a broad field of expertise; recall hierarchical structure of SmartXP labs and their satellite laboratories. Today, we accommodate a number of projects in the field of health, safety, and well-being related applications, a portfolio which we are actively extending. We believe that an important aspect of future applications will be experience sharing among individuals and amongst groups of people. We hope to welcome soon in our lab representatives from various kinds of user groups as well as representatives of a broad range of technologies. We look forward to work together with industry and research institutes on the next generation of ubiquitous services.

NIRICT Design Labs

The electronic design labs of the three universities have joined their forces in the NIRICT Design Labs, with the aim to open up their facilities for each other, to coordinate the development of new methods and techniques, and to jointly participate in EU projects.

Problem formulation

The design of modern ICT systems are characterized by the need to implement higher functionality and much better performance than was the case with traditional systems and components such as processors, radios, memories or programs. For example, in an 'ambient intelligent surrounding' it is necessary to combine the utilization of special materials, a computer processor, a radio link, several sensors and actuators and an energy supply. Research groups and engineers are more often than not specialized in one specific area, they are specialized in one type of hardware or software and one discipline. If the system asks for the combination of more functions – e.g. sensing and communication, they are often at loss of how the combination can be realized, let alone to dispose of a prototype design for the parts of the system for which they do not have adequate experience. In this way, not only valuable results of research and development get lost, but new systems are not proficiently designed and great opportunities for new systems are lost. We want to remedy this system by providing a repository of information, past designs and tools that should allow each designer to have easy access to all the knowledge and practical experience he/she needs to design systems that combine many more aspects than the own discipline can provide.

Approach

The main carrier for cooperation will be a joint "design platform" that combines design tools (programmes), libraries of components, design methodologies, testing strategies, support for design flows and design cases both in the area of hardware and software design (including embedded software). This platform will be open to the NIRICT partners and students from the three educational programmes, but it will guarantee the "intellectual property" of the individual groups on innovative and new designs. It is also the ambition of the Lab to extend its activities to outside parties, in particular companies. At the moment there are already such cooperations active, also in the EU context where an action in the same direction is taking place. The NIRICT Design Labs will serve as the Dutch participant in these larger programs and may even provide the basic framework for the platform, based on its experience in setting up such a platform for low power integrated system design.

The platform that is envisaged should support heterogeneous design strategies. Many modern designs require the combination of different technologies, e.g. the combination of a sensor with intelligent signal processing capabilities and a 'low power radio'. Large companies in general have enough qualified people to cover these different aspects but young inexperienced researchers and small companies do not always have the expertise and it is difficult to gather the necessary expertise to realize heterogeneous designs. The NIRICT groups have a large resource of strategic knowledge and it is the aim of the Design Labs to make this knowledge available such that it is easier for other partners to make innovative designs. Besides original designs and design tools,

also a great assembly of international contributions and tools will be provided, all organized in a user friendly and accessible way, using modern data repository techniques including the usage of semantic web methods, work flow and version control, search engines and research information. An international board of editors will evaluate and judge the inputs and quality indications of the various components will be given.

The platform will provide a basic design substrate for the other components of the NIRICT program, ranging from hardware to software, with special emphasis on integration and system design. In particular, the NIRICT SRA's aiming at Ambient Intelligent, Broadband Telecommunication systems and Software Engineering should profit from the existence of the platform and contribute to its content.

Current situation

The design platform is being defined and the individual partners now contribute to its contents. This effort will also be made part of the Dutch contribution to the EU design platform ERICA, part of the 'Ecosystem Design' of ENIAC Scientific Community Council (ENIAC is the European Technology Platform voor Nano Elektronica en Embedded Systems). Also companies and other interested users will be invited to contribute to and use the platform. It is our ambition to set up a system that will find wide usage in the overall international community, much as is the case for major libraries of functions such as LAPACK, Some of the same techniques shall be used to create a community of supplier and users, taking into account that also the quality of the supplies must be guaranteed, and that the whole setup must be effective.