



## ELLIIT Nyhetsblad 7 – February 2014

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Målet med ELLIITs nyhetsblad är att sprida information om händelser och nyheter från ELLIIT. Nyhetsbladet är skrivet på en blandning av svenska och engelska.

### Nyheter

#### Mid-term evaluation

The 5-year evaluation of ELLIIT will take place during 2014. The procedure will be as follows: a written self-evaluation must be submitted by May 15. Then a group of international experts will study the self-evaluations, the previous annual reports, along with various bibliometric data. During the first week of December, there will then be a hearing by a panel of evaluators. Decisions are expected during Fall 2015. Although the decision about the future of ELLIIT will arrive when the current phase is formally terminated, the funding will continue at the 2014-level during 2015 at least until the decision is available. The 5-year evaluation is extremely important and depending on the outcome, the ELLIIT funding can be made permanent.

#### ELLIIT Workshop 2014 in Norrköping

The fifth ELLIIT workshop will be organized by Linköping University, 23-24 October, with Timo Ropinski as program chair. The workshop will be held at Campus Norrköping.

#### LCCC Focus Period and Workshop on Cloud Control

From April 22 to May 23, 2014, LCCC (the Lund Linnaeus Center for Control of Complex Engineering Systems) will be hosting a focus period on Cloud Control. The aim of this focus period is to address the challenges regarding the management and control of large-scale cloud infrastructures by bringing together the computer science community doing cloud management with the control community dealing with large-scale computing systems. The main purpose of the LCCC workshop and focus period is to bring experts from academia and industry together and promote exchange of ideas and establishment of interdisciplinary collaborations.

The focus period will include a workshop with approximately 25 distinguished speakers, to be held at the Old Bishop's Palace, Lund, from May 7 to May 9, 2014. Currently the speaker list includes speakers from HP Labs, VMware, IBM Research, Microsoft Research, Alcatel-Lucent, Netflix, Google and from several universities



## Mid-Term Evaluation of Linnaeus Centers

The Linnaeus centers CADICS at LiU and LCCC at LU are currently going through their mid-term evaluations. During the last week of January both centers were subject to hearings by a panel of international experts. The outcome of the evaluation will be available by summer 2014.

## Modelica Conference in Lund

The 10<sup>th</sup> International Modelica conference will be held in Lund, March 10-12, with several from ELLIIT among the organizers. The Modelica Conference is the main event for users, library developers, tool vendors and language designers to share their knowledge and learn about the latest scientific and industrial progress related to Modelica and to the Functional Mockup Interface. The program will cover modeling of complex physical and cyber-physical systems, as well as tools, for a wide range of research and industrial applications. In addition to traditional paper presentations and poster sessions, the conference features several Modelica tutorials for beginners and advanced users, as well as vendor presentations, and an exhibition. The last Modelica conference in 2012 was visited by 350 participants from all over the world, and a similar number is expected this time. More information is available at <https://modelica.org/events/modelica2014>

## Kick-off in the new EU project on Massive MIMO

This really exciting project focuses on one of the most vibrant areas of wireless communications today - massive MIMO. ELLIIT will contribute in several areas, stretching from the underlying theory implementation and optimization of digital signal processing to characterization of the propagation channels. Lund and Linköping universities are pioneers in the area, and in the project we expect to increase both power and spectral efficiency of wireless communications by one or more orders of magnitude, as compared to the systems used today. In addition to LU and LiU the project partners are: Ericsson from Sweden, IMEC and KU Leuven from Belgium, Telefonica from Spain and Infineon and Technikon from Austria.

## New Results in FFT computations

Mario Garrido (LiU/ISY) leads several projects on optimization of various signal processing algorithms on FPGAs, ASICs and GPUs, with special emphasis on the fast Fourier transform (FFT). Nowadays, the FFT is processed at rates of tens of Gsamples/s on FPGAs, and real-time continuous-flow 2D and 3D FFTs are now possible at rates higher than 100 Msamples/s. On GPUs, the fastest algorithms so far have been achieved, resulting in the Best Paper Award for the paper: "New Radix-2 and Radix-2<sup>2</sup> Constant Geometry Fast Fourier Transform Algorithms for GPUs".

## FP7 SOrBet Project Launched

SOrBet (<http://www.fp7-sorbet.eu/>), a four-year, 1.5M€ FP7 Marie Curie project had its kick-off meeting in January 2014. SOrBet mobilizes a joint academic-industry task force aiming for highly distributed, self-organizing, self-managing, wirelessly communicating Smart-Objects enabling the



robust management of energy efficient Intelligent Buildings. Drawing lessons from the Internet of Things (IoT) will work towards realizing the concept of “reliability” in intelligent buildings and address key issues as system design and installation, need for human intervention to configure new devices proprietary technologies, and limited consideration for wireless communication security, are only a few of the issues of current systems. As a result the embedded “smartness” of the deployed objects is not actually utilized.

The consortium comprises three partners: LiU/ITN/Mobile Telecommunications, FORTH, and CONVERGE ICT Solutions. LiU/ITN is the project coordinator.

### Some Publications:

- M.Cirkic and E.G. Larsson, “SUMIS:Near-optimal soft-in soft-out MIMO detection with low and fixed complexity,” IEEE Transactions on Signal Processing. To appear.
- D. Persson, T. Eriksson and E. G. Larsson, “Amplifier-aware multiple-input single-output capacity,” IEEE Transactions on Communications. To appear.
- T. V. K. Chaitanya and E. G. Larsson, “Adaptive power allocation for HARQ with Chase combining in correlated Rayleigh fading channels,” IEEE Wireless Communications Letters. To appear.
- K. Huang and E. G. Larsson, “Simultaneous information and power transfer for broadband wireless systems,” IEEE Transactions on Signal Processing, vol. 61, pp. 5972–5986, Dec. 2013.
- H. Q. Ngo, H. A. Suraweera, M. Matthaiou and E. G. Larsson, “Multipair massive MIMO full-duplex relaying with MRC/MRT processing,” in Proc. of IEEE International Conference on Communications (ICC), June 2014. To appear.
- Amir Aminifar, Petru Eles, Zebo Peng, Anton Cervin, “Stability-Aware Analysis and Design of Embedded Control Systems”, International Conference on Embedded Software (EMSOFT 2013), Montreal, Canada, September 29 - October 4, 2013.
- Amir Aminifar, Enrico Bini, Petru Eles and Zebo Peng, “Designing Bandwidth-Efficient Stabilizing Control Servers”, IEEE Real-Time Systems Symposium (RTSS) 2013, Vancouver, Canada, December 2013.
- Amir Aminifar, Enrico Bini, Petru Eles, Zebo Peng, “Bandwidth-Efficient Controller--Server Co-Design with Stability Guarantees”, Design, Automation & Test in Europe (DATE 2014), Dresden, Germany, March 24-28, 2014.
- Michael Zimmer, David Broman, Chris Shaver, and Edward A. Lee. FlexPRET: A Processor Platform for Mixed-Criticality Systems. Proceedings of the 20th IEEE Real-Time and Embedded Technology and Application Symposium (RTAS), Berlin, Germany, April 15-17, 2014.
- Yooseong Kim, David Broman, Jian Cai, and Aviral Shrivastava: WCET-Aware Dynamic Code Management on Scratchpads for Software-Managed Multicores. Proceedings of the 20th IEEE Real-Time and Embedded Technology and Application Symposium (RTAS), Berlin, Germany, April 15-17, 2014.
- Eugene Yip, Matthew Kuo, Partha S Roop, and David Broman: Relaxing the Synchronous Approach for Mixed-Criticality Systems. Proceedings of the 20th IEEE Real-Time and



Embedded Technology and Application Symposium (RTAS), Berlin, Germany, April 15-17, 2014.

- H. Li, Z. Miers, B. K. Lau, "Design of Orthogonal MIMO Handset antennas based on characteristic mode manipulation at frequency bands below 1 GHz", IEEE Transactions on Antennas and Propagation. To appear.
- Enrico Bini, The Quadratic Utilization Upper Bound for Arbitrary Deadline Real-Time Tasks, IEEE Transactions on Computers, To appear. Matlab/Octave code publicly available.
- Enrico Bini and Giuseppe Buttazzo: The Optimal Sampling Pattern for Linear Control Systems IEEE Transactions on Automatic Control 59(1), pp. 79-90, January 2014. Matlab/Octave code publicly available
- Giorgio C. Buttazzo, Enrico Bini, Darren Buttle, Rate-Adaptive Tasks: Model, Analysis, and Design Issues, Design, Automation and Test in Europe (DATE 2014), March 2014.
- Artem Burmyakov, Enrico Bini, Eduardo Tovar, Compositional Multiprocessor Scheduling: the GMPR interface, Real-Time Systems. To appear.
- D. Sun, A. Kleiner, and B. Nebel. Behavior-based Multi-Robot Collision Avoidance. In Proc. of the IEEE Int. Conf. on Robotics & Automation (ICRA). Hong Kong, China, 2014. Accepted for publication.
- Erik G. Larsson, Ove Edfors, Fredrik Tufvesson, Thomas L. Marzetta: Massive MIMO for Next Generation Wireless Systems, IEEE Communications Magazine, Vol. 52, no. 2, February 2014
- Mario Garrido, F. Qureshi and O. Gustafsson, "Low-Complexity Multiplierless Constant Rotators Based on Combined Coefficient Selection and Shift-and-Add Implementation (CCSSI)", IEEE Transactions on Circuits and Systems I: Regular Papers. Accepted for publication
- Mario Garrido and J. Grajal, "Continuous-flow variable-length memoryless linear regression architecture", Electronics Letters, Vol. 49, Issue 24, Pages 1567-1569, Nov 2013.
- A. H. Ghapanchi, C. Wohlin and A. Aurum, "Resources Contributing to Gaining Competitive Advantage for Open Source Software Projects: An Application of Resource-Based Theory", International Journal of Project Management, Vol. 32, No. 1, pp. 139-152, 2014.
- S. Barney, V. Mohankumar, P. Chatzipetrou, A. Aurum, C. Wohlin and L. Angelis, "Software Quality Across Borders: Three Case Studies on Company Internal Alignment", Journal of Information and Software Technology, Vol. 56, No. 1 pp. 20-38, 2014.
- D. Smite, C. Wohlin, Z. Galvina and R. Prikladnicki, "An Empirically Based Terminology and Taxonomy for Global Software Engineering", Empirical Software Engineering: An International Journal, Vol. 19, No. 1, pp. 105-153, 2014.
- Khurum M., Petersen K., Gorschek T., "Extending Value Stream Mapping through Waste Definition beyond Customer Perspective", Journal of Software: Evolution and Process, accepted.
- Petersen K., Gencel C., Asghari N., Betz S., "An Elicitation Instrument for Operationalising GQM+Strategies (GQM+S-EI)", Empirical Software Engineering, accepted.
- Munir H., Moayyed M., Petersen K., "Considering Rigor and Relevance when Evaluating Test Driven Development: A Systematic Review", Information and Software Technology, accepted.



- Shah S. M. A., Alvi U. S., Gencel C., Petersen K., "Comparing a Hybrid Testing Process with Scripted and Exploratory Testing: A Pre-Experimental Study with Practitioners", Proceedings of the 15th International Conference on Agile Software Development (XP 2014), Rome, Italy, 2014.
- Mäntylä M., Petersen K., Lehtinen T. O., Casper L., "Time Pressure - A Controlled Experiment of Test-case Development and Requirements Review", Proceedings of the 36th International Conference on Software Engineering (ICSE 2014), accepted.
- S. Fricker, I. Nurdiani, J. Börstler: Towards Understanding How to Build Strategic Flexibility of an IT Organization, Proceedings of the 13th IASTED International Conference on Software Engineering, Innsbruck, Austria, Feb 2014.
- R. Jabangwe, J. Börstler, D. Smithe, C. Wohlin, "Empirical Evidence on the Link Between Object-Oriented Measures and External Quality Attributes: A Systematic Literature Review", Journal of Empirical Software Engineering, to appear.
- E. Kocaguneli, T. Menzies, E. Mendes, "Transfer Learning in Effort Estimation, Journal of Empirical Software Engineering, accepted for publication.
- M. Surligas, V. Angelakis, et al. Intelligent Building Management Systems Based on Cognitive M2M Communications, European Conference on Wireless Sensor Networks, Feb. 2014.
- E. Tragos, V. Angelakis, et al. Enabling Reliable and Secure IoT-based Smart City Applications, PerCom 2014, Percity workshop, Mar. 2014.
- H. Pöhls, V. Angelakis, et al. RERUM: Building a Reliable IoT upon Privacy- and Security-enabled Smart Objects, IEEE WCNC 2014 - Workshop on IoT Communications and Technologies, Mar. 2014.
- N. Lyamin, A. Vinel, M. Jonsson, J. Loo, Real-time detection of Denial-of-Service attacks in IEEE 802.11p vehicular networks, IEEE Communications Letters, 18(1), 2014.
- C. Campolo, A. Molinaro, A. Vinel, Y. Zhang, Modeling Event-Driven Safety Messages Delivery in IEEE 802.11p/WAVE Vehicular Networks, IEEE Communications Letters, 17(12), 2013.
- Cristian Klein, Martina Maggio, Karl-Erik Årzén, Francisco Hernández-Rodríguez: Brownout: Building More Robust Cloud Applications, In 36th International Conference on Software Engineering (ICSE), Hyderabad, India, May 2014. Accepted for publication.
- Antonio Filieri, Henry Hoffmann, Martina Maggio: Automated Design of Self-Adaptive Software with Control-Theoretical Formal Guarantees, In 36th International Conference on Software Engineering (ICSE), Hyderabad, India, May 2014. Accepted for publication.
- Giacomo Como, Enrico Lovisari, Ketan Savla: Throughput optimal distributed routing in dynamical flow networks, In 52nd IEEE Conference on Decision and Control, Florence, Italy, December 2013.
- Giacomo Como, Ketan Savla, Daron Acemoglu, Munther A. Dahleh, Emilio Frazzoli: Robust distributed routing in dynamical networks -- Part I: Locally responsive policies and weak resilience, IEEE Transactions on Automatic Control, 58:2, pp. 317–332, December 2013.
- Giacomo Como, Ketan Savla, Daron Acemoglu, Munther A. Dahleh, Emilio Frazzoli: Robust distributed routing in dynamical networks -- Part II: strong resilience, equilibrium selection and cascaded failures, IEEE Transactions on Automatic Control, 58:2, pp. 333–348, December 2013.



- Tiago Etienne, Daniel Jönsson, Timo Ropinski, Carlos Scheidegger, João Comba, L. Gustavo Nonato, Robert M. Kirby, Anders Ynnerman, Cláudio T. Silva: Verifying Volume Rendering Using Discretization Error Analysis, IEEE Transactions on Visualization and Computer Graphics (TVCG), Volume 20, Number 1, page 140--154, 2014.

## Keynotes and Invited Talks:

- E. Mendes (BTH): Keynote speaker at the 9th International Conference on Software Engineering and Applications (ICSOFT-EA), to be held in Vienna.

## Awards and Appointments:

- Lars Nielsen, professor i fordonssystem på LiU tilldelades årets Frisingerstipendium på 250 000 kronor från Volvo för sitt arbete inom fordonssystemforskning och hybridteknik, se <http://www.liu.se/forskning/forskningsnyheter/1.541390?l=sv>
- Hui Li and Buon Kiong Lau (LU/EIT) co-authored a paper that has been chosen from among 140 entries as one of the four winners of the CST University Publication Award 2013: Hui Li, Buon Kiong Lau, Zhinong Ying, and Sailing He, "Decoupling of Multiple Antennas in Terminals With Chassis Excitation Using Polarization Diversity, Angle Diversity and Current Control" IEEE Transactions on Antennas and Propagation, vol. 60, no. 12, pp. 5947-5957, December 2012.

The paper introduces a new method to design two antennas on a mobile handset that can be placed very close to each other without interfering with each other. This allows the antenna system to provide high data rates in an efficient manner. The promising design approach has also been filed as a patent application through Sony Mobile Communications AB.

- Best paper award: T. Abbas, A. Thiel, T. Zemen, C. F. Mecklenbräuker and F. Tufvesson, "Validation of a Non-Line-of-Sight Path-Loss Model for V2V Communications at Street Intersections" International Conference on ITS Telecommunications, Tampere, Finland.
- Best Paper Award for the paper: S. Ambuluri, M. Garrido, G. Caffarena, J. Ogniewski and I. Ragnemalm, "New Radix-2 and Radix-2<sup>2</sup> Constant Geometry Fast Fourier Transform Algorithms For GPUs", IADIS Computer Graphics, Visualization, Computer Vision and Image Processing (CGVCVIP) Conference, Prague (Czech Republic), July 2013, pp. 59-66.
- E. Mendes (BTH): Best paper award at the Software Quality Days International Conference.

## Program chairs and Editorships:



- Prof. Erik G. Larsson (LiU/ISY) was appointed chair of the steering committee for the IEEE Wireless Communications Letters (term: 2014-2015).
- Prof. Erik G. Larsson (LiU/ISY) was elected Vice Chair of the IEEE Signal Processing Society SPCOM Technical Committee for 2014.
- Buon Kiong Lau (LU/EIT) co-edited with Marta Martinez Vazquez the IEEE Antennas and Wireless Propagation Special Cluster on "Terminal Antenna Systems for 4G and Beyond". The Special Cluster, consisting of 14 papers, is a joint initiative EU COST Actions IC1004 and IC1102 (VISTA) to showcase latest research activities in the area both within the two Actions and worldwide! See the Guest Editorial here: <http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6717189>
- Timo Ropinski (ITN) co-chairs the EG Visual Computing for Biology and Medicine 2014 (EG VCBM) which will be held in Vienna. EG VCBM addresses state-of-the-art visual computing research with a strong focus on applications in biology and medicine. EG VCBM is unique, as it provides a highly interdisciplinary forum for experts from computer graphics, visualization, computer vision, visual analytics, human computer interfaces and end users from biology and medicine jointly working on next generation visual computing solutions for healthcare and the biotechnology sector. More information on this health related event can be found at [www.vcbm.org](http://www.vcbm.org).

## Dissertations:

- 2014-01-27: Johannes Lindblom at LiU/ISY/Communication systems successfully defended his Ph.D. thesis The MISO Interference Channel as a Model for Non-Orthogonal Spectrum Sharing.
- 2014-01-17: Reza Moosavi, , at LiU/ISY/Communication systems successfully defended his Ph.D. thesis Improving the Efficiency of Control Signaling in Wireless Multiple Access Systems. (Reza is currently with Ericsson Research.)
- 2014-02-24: Taimoor Abba at LU/EIT will defend his PhD thesis "Measurement Based Channel Characterization and Modeling for Vehicle-to-Vehicle Communications"

Vehicular communication is one of the areas that are studied in ELLIIT, and an area where many industrial partners are active. Recently the National Transportation Safety Board (NTSB) in the US announced that they will require vehicle-to-vehicle communication systems to be installed in new cars. It is not clear whether the same requirements will come in Europe, but with the US decision it seems more likely. In the thesis, the foundations of vehicular communication are analyzed based on real-world channel measurements.



- 2013-12-17: PhD defense by Emil Nilsson (HH) “Applying Microwave Technology in Short Range Radio Communication and Sensing Systems”

Microwave technology continues to reach new areas and applications. Microwave based sensors creates the possibility to sense objects in remote and hostile environments, while miniaturization makes the merge of radios, sensors, and computing into new small devices possible. Bridging the communication of the last 10 meters from numerous physical devices to a global network must be done wireless. Short range radio communication technology represents the most realistic untethered technology at hand. Advanced digital control and processing electronics enable realization of sophisticated functionality and sophisticated communication protocols, also in low cost small size radio nodes. The high level of integration today common for digital electronics is increasingly utilized in analog electronics. The need for small low power transceivers in many new applications is motivated by limited physical space and maintenance cost. The energy source for the device (usually a battery) sets the life time, the cost, and in some cases the physical dimension of the nal product. Low power electronics enables the use of more agile energy sources and longer lifetime with smaller batteries and energy harvesting techniques. In the thesis a low power transceiver hardware and MAC protocol is proposed and investigated. A theory estimating noise in an envelope detector subject to a blocking signal is developed and used as a knowledge base for implementation of aWake-up radio. The smallWake-up radio consumes 2.3W and is designed in 130 nm CMOS using no other external components than the carrier substrate its mounted on. A survey of recently published low-power receivers is compared with estimation of lowest power consumption with optimized receiver topologies. Finally, the design of a low output-power radar interferometric sensor for industrial applications is presented together with measurements and simulations.

## Personalförändringar

### **Emil Björnson new ELLIIT-assistant professor at LiU/ISY/communication systems.**

Dr. Björnson received his Ph.D. degree in Telecommunications from the Department of Signal Processing at KTH Royal Institute of Technology, Stockholm, Sweden, in 2011. Dr. Björnson was one of the first recipients of the International Postdoc Grant from the Swedish Research Council. This grant funded a joint postdoctoral position from Sept. 2012 to July 2014 at the Alcatel-Lucent Chair on Flexible Radio, Supélec, Paris, France, and the Department of Signal Processing at KTH Royal Institute of Technology, Stockholm, Sweden. From 2014, Dr. Björnson is an Assistant Professor in the tenure-track at the Division of Communication Systems at Linköping University, Linköping, Sweden.





## **Johan Wernehag new assistant professor in Electronics at LU/EIT**

Dr. Wernehag received his PhD in Circuit Design from Lund University in 2008. Since then he has been working at Nokia and Ericsson Research. His research interests are in the area of RF and mm-wave for wireless communication.

## **Two new senior lecturers in software engineering to BTH**

BTH has recruited two new senior lectures in software engineering. Kai Petersen has previously been a postdoc at BTH and will now join as a permanent staff member. Krzysztof Wnuk has been recruited from Lund University, where he held a postdoc position.

## **New ELLIIT postdoc at LiU/ITN**

Martin Falk has started as an ELLIIT PostDoc at LiU/ITN. He received his PhD in interactive visualization and computer graphics from the University of Stuttgart, Germany, in 2013. During his time at the Visualization Research Center at the University of Stuttgart his research focused on the visualization and mesoscopic simulation of cells in the context of systems biology. He joined the Scientific Visualization Group at Linköping University as a postdoctoral researcher October 2013. Since the beginning of 2014, Martin is member of the ELLIIT program. His future research focuses on the visualization of large spatio-temporal data sets with respect to data management and the development of novel visualization approaches. Promising potential applications for multiscale data are climate research, hydrology, space, or proteins within a particular cell. These data sets have in common that the differences in both time and space make the task of visualization very challenging and, thus, require new techniques.

## **Claudio Altafini new professor in control at LiU/ISY**

Claudio Altafini has been appointed full professor in automatic control at LiU/ISY. Prof. Altafini received his PhD in "Optimization and Systems Theory" from Dept. of Mathematics, Royal Institute of Technology (KTH), Stockholm, Sweden in 2001. After that he has been with the SISSA International School for Advanced Studies in Trieste, Italy. His research interests are in the field of modeling and control of nonlinear systems and of their application in different domains such as robotics, quantum mechanics, biological and socio-technological systems, including systems biology and modeling and control of complex networks.

## **Vangelis Angelakis (LiU/ITN) appointed associate senior lecturer**

Vangelis Angelakis (LiU/ITN) has been appointed associate senior lecturer ("biträdande lektor"). He has been a Postdoctoral researcher at LiU/ITN since 2009.

## **Forskningsfinansiering**

- Prof. Erik G. Larsson has received a VR (Swedish Research Council) Distinguished Young Researcher grant.



- SENSE - Supporting decision-making under uncertainty for value estimation of software-intensive products and services

Knowledge Foundation (KK-HÖG), 2014-2016, 11MSEK. PI: Prof. Emilia Mendes (BTH).

Three-year research project with focus on the building of tangible models and an open source tool for value-based decision making under uncertainty within the context of software product/project management and development. This is the first time in the value-based software engineering research area that such concrete solution is proposed. The project will thus make a marked research contribution in this area. Those models will cater for the specific needs of our industry partners and support them (and their customer companies) in making a paradigm shift to value based decision making.

- Master in Networked Software-Intensive Systems.

Knowledge Foundation (KKS-Avans), 2014-2015, 2.4MSEK. PI: Prof. Jürgen Börstler (BTH).

Two year project to develop a new advanced educational program in the area of networked software-intensive system. Focus of the program is the intersection of systems, software, (software-based) networks and quality of experience. In collaboration with 6 companies.

- EUREKA CAMILIS Project funded. Within this project, advanced navigation strategies for laparoscopic liver surgeries are investigated. The project started in January 2014, and the research work is conducted by a consortium formed by academic partners from the University of Bern, Karolinska Hospital, and Linköping University, together with Cascination AG and Sectra AB as industrial partners. The research conducted at Linköping University is coordinated by Timo Ropinski (ITN), and focuses on advanced visualization strategies as well as medical data fusion.

- ACDC - Autonomous Cooperative Driving: Communications issues

Knowledge Foundation (KK-HÖG), 2014-2016, 6.7 MSEK. PI: Prof. Magnus Jonsson (HH).

Three-year research project with focus on inter-vehicle communication for cooperative autonomous driving application. Communication methods and protocols targeting at increased reliability and real-time support are in focus. The project is in collaboration with Kapsch TrafficCom, Qamcom Research and Technology, Scania, Volvo Cars, and Volvo GTT.



- ESCHER - Embedded Streaming Computations on Heterogeneous Energy-efficient architectures

Knowledge Foundation (KK-HÖG) 2014-2016, 8 MSEK, PI: Prof. Tomas Nordström (HH)  
Industrial partners: SAAB EDS, Xcube, ImaComp, Adarate

The ESCHER project will address the design and implementation of Embedded Streaming Computations on Heterogeneous Energy-efficient architectures. The design and implementation of such systems needs a coordinated effort to co-develop both the hardware architectures and the application development environment.

With regard to hardware, the focus will be on how parallel heterogeneous architectures should be organized, designed, and evaluated, as well as how they should interface with the application development tools and frameworks. The software aspect will focus on how to develop real-time streaming applications at a high level of abstraction, develop a single application source that can target a multitude of heterogeneous architectures, utilize domain knowledge to better target a diverse set of architectures, and support an efficient design process taking into account resource efficiency and real-time aspects.