Program for Swe-CTW 2014

June 3 at 13.20 – June 5 at 12.40
AROS Congress Center Västerås
http://www.acc.se/

Monday, June 2
9.00-17.00 SNCNW, http://www.sncnw.se/2014/

Tuesday, June 3
9.00-12.00 SNCNW, http://www.sncnw.se/2014/
11:00–13:20 Registration
13:20–13:30 Welcome
13:30–15:00 Tutorial on Sparse Systems, Part 1
15:00–15:30 Coffee
15:30–17:00 Tutorial on Sparse Systems, Part 2

Wednesday, June 4
09:00–10:30 Invited talks: Best IEEE VT/COM/IT Sweden Conference Papers, Part 1
10:30–11:30 Poster Session 1 & coffee
11:30–12:30 Invited talks: Best IEEE VT/COM/IT Sweden Conference Papers, Part 2
12:30–14:00 Lunch
14:00–15:00 Invited talks: Best IEEE VT/COM/IT Sweden Journal Papers, Part 1
15:00–16:00 Poster Session 2 & coffee
16:00–17:00 Invited talks: Best IEEE VT/COM/IT Sweden Journal Papers, Part 2
19:00–21:00 Workshop Dinner & announcement of the Best Conference and Journal papers, Restaurant Strike, Torggatan 1, Västerås, http://strike.nu

Thursday, June 5
09:00–10:30 Tutorial on Wireless Sensor Networks, Part 1
10:30–11:00 Coffee
11:00–12:30 Tutorial on Wireless Sensor Networks, Part 2
12:30–12:40 Closing
Tutorial on Sparse Systems

Saikat Chatterjee

KTH Royal Institute of Technology

Tuesday, June 3: 13:30–15:00 Tutorial on Sparse Systems, Part 1
Tuesday, June 3: 15:30–17:00 Tutorial on Sparse Systems, Part 2

Tutorial abstract: The tutorial objective is to provide an understanding of recent research trend in Sparse Systems mainly sparse representations and processing. Linear algebra has played a pivotal role in many engineering solutions where solving a set of linear equations is of paramount importance. The theory and results associated with classic linear algebra is definite and timeless. Surprisingly, within this well-understood arena, there is an elementary problem that has to do with sparse solutions of under-determined linear systems, which only recently has been explored in depth. The tutorial will revolve around such an under-determined linear system setup and we will see surprising answers, leading to many practical engineering developments, including Compressive Sensing.

Tutorial format: Three hours in total with one break of 15 minutes. The first session is for mathematical understanding, and the second session is for relevant applications.

Bio of the speaker: Saikat Chatterjee is a researcher jointly with the Communication Theory Lab and the Signal Processing Lab, KTH-Royal Institute of Technology, Sweden. He was also with the Sound and Image Processing Lab at the same institution as a post-doctoral fellow for one year. Before moving to Sweden, he received Ph.D. degree in 2009 from Indian Institute of Science, India. He was a coauthor of the paper that won the best student paper award at ICASSP 2010. His current research interests are sparse systems, source coding, statistical signal processing, machine learning, speech and audio processing, wireless communications and computational biology.

Invited talks: Best IEEE VT/COM/IT Sweden Conference Papers, Part 1

Wednesday, June 4: 09:00–10:30


9.30-10.00 Piergiuseppe Di Marco, Carlo Fischione, Fortunato Santucci, Karl Henrik Johansson, "Effects of Rayleigh-lognormal fading on IEEE 802.15.4 networks," IEEE International Conference on Communications (ICC), Budapest, Hungary, June 2013.

10.00-10.30 Maksym A. Girnyk, Mikko Vehkapera, Lars K. Rasmussen, "Large-system analysis of the K-hop AF MIMO relay channel with arbitrary inputs," IEEE International Symposium on Information Theory (ISIT), Istanbul, Turkey, July 2013.
1. **Reciprocity calibration methods for Massive MIMO based on antenna coupling**
João Vieira, Fredrik Rusek and Fredrik Tufvesson, Lund University

Abstract:
In this paper we consider time-division-duplex (TDD) reciprocity calibration of a massive MIMO system. The calibration of a massive MIMO system can be done entirely at the base station (BS) side through antenna coupling by sounding the BS antennas one-by-one while receiving with the other BS antennas. With an M antenna BS, this generates $M(M-1)$ signals that can be used for calibration purposes. In this paper we study several methods, including maximum-likelihood (ML) and minimum mean square error (MMSE) based approaches, differing in the number of received signals that are being used. We compare the performance of the estimators, and we conclude that near-ML performance can be reached with much less complex methods.

Charles Kabiri, Blekinge Institute of Technology; Hans-Jürgen Zepernick, Blekinge Institute of Technology; and Hung Tran, National Institute of Education Management, Information Technology Department, Vietnam

Abstract:
In this paper, we analyze the power consumption of wireless sensor nodes with min(N,T) policy and M/G/1 queue in the presence of Nakagami-m fading. In particular, this system setting is applied to a wireless sensor node operating in a cognitive radio system as secondary user in the presence of a primary user. As such, not only the queue policy influences the power consumption but also the interference power constraint imposed on the wireless sensor node by the primary user. Thus, a queued sleep/wake-up strategy is analyzed in order to mitigate the average power consumption of a sensor node using min(N,T) policy in the context of an M/G/1 queue and a spectrum sharing environment in the presence of signal fading. Numerical examples are presented to illustrate the impact of queuing parameters and fading channel on the power consumption of a wireless sensor node.

3. **Adaptive Modulation and Coding with Queue Awareness in Cognitive Incremental Decode-and-Forward Relay Networks**
Thi My Chinh Chu and Hans-Jürgen Zepernick, Blekinge Institute of Technology

Abstract:
This paper studies the performance of adaptive modulation and coding in a cognitive incremental decode-and-forward relaying network where a secondary source can directly communicate with a secondary destination or via an intermediate relay. To maximize transmission efficiency, a policy which flexibly switches between the relaying and direct transmission is proposed. In particular, the transmission, which gives higher average transmission efficiency, will be selected for the communication. Specifically, the direct transmission will be chosen if its instantaneous signal-to-noise ratio (SNR) is higher than one half of that of the relaying transmission. In this case, the appropriate modulation and coding scheme (MCS) of the direct transmission is selected only based on its instantaneous SNR. In the relaying transmission, since the MCS of the transmissions from the source to the relay and from the relay to the destination are implemented independently to each other, buffering of packets at the relay is necessary. To avoid buffer
overflow at the relay, the MCS for the relaying transmission is selected by considering both the queue state and the respective instantaneous SNR. Finally, a finite-state Markov chain is modeled to analyze key performance indicators such as outage probability and average transmission efficiency of the cognitive relay network.

4. **Reducing Consecutive Errors in Industrial Wireless Networks Using Relaying and Packet Aggregation**

   Svetlana Girs, Elisabeth Uhlemann, Mats Björkman, Mälardalen University

   **Abstract:**
   Reliable and timely packet delivery in industrial systems is of great importance. Wireless networks can bring significant reductions in cost and complexity when used to replace wires in existing systems. Moreover, wireless networks provide more flexibility and higher availability. However, higher packet error rates, resulting from signals travelling through wireless channels subject to shadowing and fading, should be taken into account. To decrease the number of lost or corrupted packets, spatial diversity techniques, e.g. relaying, have proven successful. Even further gains can be reached by allowing the relay node to aggregate several different source packets into one, as relayers are often sparse in industrial networks. However, not only the average packet error rate per source is crucial in industrial systems, but also the number of consecutive errors encountered at the destination from each of the source nodes individually. The number of consecutive errors from each source is of particular importance, since many industrial applications can tolerate a certain number of consecutive errors (if the equipment is turned into a safe state), but have to be switched off if further errors are encountered. Thus, the relaying schemes proposed in this work are aiming to reduce not only the average packet error rates, but also the consecutive number of packet errors from a particular source. We allow the relay node to keep track of source packets in error at the destination, and, in the next allocated relaying time slot, to prioritize the packet from the source with the highest number of accumulated packet errors. The results show that the proposed schemes noticeably reduce the number of consecutive errors and thereby the number of times a particular machine has to be turned off. However, it can also be seen that many times the relay node cannot help, as it does not hold a correct copy of the source packets needed at the destination, and consequently future work should include development of schemes increasing the number of source packets correctly received at the relay node.

5. **Reducing the Complexity of LDPC Decoding Algorithms: An Optimization-Oriented Approach**

   Muris Sarajlić, Liang Liu and Ove Edfors, Lund University

   **Abstract:**
   The paper presents a structured optimization framework for reducing the computational complexity of LDPC decoders. Subject to specified performance constraints and adaptive to environment conditions, the proposed framework leverages the adjustable performance/complexity tradeoffs of the decoder to deliver satisfying performance with minimum computational complexity. The performance and complexity are traded by adjusting the parameters of the “forced convergence” technique that stops the updating of individual soft bits after their magnitude crosses a certain threshold. Two performance constraint scenarios are studied: the “good-enough” performance and “as-good-as-possible performance”. The effectiveness of the proposed method has been verified by simulating a set of LDPC codes used in IEEE 802.11 and IEEE 802.16 standards. Computational complexity reductions of up to 35% have been observed.
6. **Kalman Predictions for Multipoint OFDM Downlink Channels**

Rikke Apelfröjd, Uppsala University

Abstract:

Coordinated Multipoint (CoMP) transmission provides high theoretic gains in spectral efficiency with coherent Joint Transmission (JT) to multiple users. However, this requires accurate Channel State Information at the Transmitter (CSIT). Unfortunately, coherent JT CoMP often is accompanied by long system delays, due to e.g. data sharing over backhaul links. Therefore, the CSIT will be outdated. This report provides a detailed description on how to increase the accuracy of the CSIT by utilizing Kalman filters to predict Orthogonal Frequency Division Multiplexing (OFDM) downlink channels. The small scale fading of these channels are modeled by Auto Regressive (AR) models of finite order. The report includes descriptions on how to estimate these models based on past knowledge of the channel as well as analytical result on the predictability of such models. Different technical design aspects for deploying the Kalman filters in communication, such as pilot patterns, AR model estimations and the location of Kalman filters that predict downlink Frequency Division Duplex (FDD) channels, are also discussed.

The aim of the report is to in detail describe the prediction procedure used in previous work. Some of the results from this previous work are here presented and extended to provide a complete overview. All simulation results are based on measured channels.

The report also includes a description on how to model block-fading channels with a specified channel accuracy that would have been obtained with Kalman predictions. This model can then be used for system simulations.

7. **Spatial Coupling of Turbo-Like Codes**

Saeedeh Moloudi and Michael Lentmaier, Lund University; and Alexandre Graell i Amat, Chalmers University of Technology

Abstract:

We investigate the impact of spatial coupling on the thresholds of turbo-like codes. On one hand, we apply the concept of spatial coupling to serially and parallel concatenated (PCCs and SCCs) codes. On the other hand we consider braided convolutional codes (BCCs), which are inherently a class of spatially coupled turbo-like codes (SC-TCs) that have a structure similar to product codes or generalized LDPC codes. For all these cases of SC-TCs, we derive exact density evolution (DE) equations for binary erasure channel. We observe that by spatial coupling the belief propagation (BP) threshold is improved compared to the uncoupled ensembles and approaches the maximum a posteriori threshold for a proper coupling memory.

8. **Security Issues with Wireless TTEthernet**

Elena Lisova and Elisabeth Uhlemann, Mälardalen University; Johan Åkerberg, ABB Corporate Research; and Mats Björkman, Mälardalen University

Abstract:

TTEthernet is a communication platform for real-time systems with mixed criticalities that includes both fault-tolerant and real-time mechanisms. Initially it was developed as a wired system, but as more and more diverse application requirements emerge, there is a strong market need to make it mixed wireless and wired. Obviously, this will enable a wider spectrum of applications and even possible enhancements of already existing applications. One of the prime issues that naturally needs to be addressed when allowing wireless access is security. Wireless links can more easily be intercepted and influenced as they open up communication also with intruders and eavesdroppers. The overall research target is the development of a security framework targeting wireless real-time networks that are suitable to complement wired
TT-Ethernet networks, as well as targeting combined wireless and wired networks. The main challenge from a security perspective is that the implemented security mechanisms should not be allowed to impact on the real-time capabilities. The first step to achieve this goal is to define assets, adversary goals and possible adversary abilities. This allows restricting the problem space. The next step is to look for existing protocols and mechanisms to decide whether and how these can be used to solve the main research question. One suitable protocol candidate is IPSec, which represents a set of different protocols and techniques able to provide services such as packet source authentication and packet integrity as well as packet data confidentiality. However, it also has some evident weaknesses where the most prominent ones are lack of real-time support and a point-to-point architecture. Therefore, to use IPSec in a Wireless TT-Ethernet framework the protocol needs to be adapted and combined with other techniques such that networks with real-time constraints and different addressing schemes can be supported.

9. **Using Concurrent Multipath Transfer to Improve the SCTP Startup Behavior for PSTN Signaling Traffic**

Karl-Johan Grinnemo and Anna Brunstrom, Karlstad University; Jun Cheng, Ericsson AB

Abstract:
Although latency in the Internet has gained much attention in the research community, the latency issues of mobile control signaling have received less attention, and this all the while many telecom operators are experiencing a several-hundred percent increase in signaling traffic over only a couple of years. We believe one way to address both the latency and increased signaling load of mobile networks, is to exploit concurrent transfer of signaling traffic over several paths a.k.a. concurrent multipath transfer. Our work has studied whether or not SCTP extended with concurrent multipath transfer (CMT-SCTP) could provide a faster startup behavior than standard SCTP. The outcome of our work complements previous studies on CMT-SCTP, and extends it to PSTN signaling traffic. Particularly, our work suggests that CMT-SCTP could give a faster startup behavior over paths with similar bandwidths and round-trip times, but that its behavior is sensitive to differences in round-trip time between the paths. Moreover, our work suggests that provided CMT-SCTP is configured with large enough send and receive buffers, it could provide a faster startup behavior than standard SCTP over a multipath association, in spite of some of the paths having a packet-loss rate of several percent.

10. **User-centric Pre-selection and Scheduling for Coordinated Multipoint Systems**

Annika Klockar, Karlstad University; Mikael Sternad, Uppsala University; Anna Brunstrom Karlstad University, and Rikke Apelfröjd, Uppsala University

Abstract:
The data traffic volumes are constantly increasing in cellular networks. Furthermore, a larger part of the traffic is generated by applications that require high data rates. Techniques including Coordinated Multipoint transmission (CoMP) can increase the data rates, but at the cost of a high overhead. The overhead is reduced if only a subset of the users are served with CoMP. In this paper, we propose a user selection approach, including pre-selection of CoMP users and scheduling, that takes user requirements into account, and uses the fact that some users have high requirements and others have lower. Users that require a higher data rate to reach an acceptable level of service satisfaction are selected to use coherent joint processing CoMP in some of their downlink transmission bandwidth. Simulation results show that the number of satisfied users and fairness are improved with the proposed user selection as compared to user selection that does not consider individual user requirements.
11. **The SensibleThings platform – Enabling Distributed Global Services on the Internet-of-Things**

Stefan Forsström, Victor Kardeby, Ulf Jennehag, Patrik Österberg and Mikael Gidlund, Mid Sweden University

Abstract:

Most research into the Internet-of-Things (IoT) area have so far focused on quite narrow and specific scenarios, such as communication within short range wireless sensor networks or attaching low cost sensors to different real-world objects. The vision is however to create a global Internet-of-Things with at least 50 billion ubiquitously connected devices in the future. The proliferation of next generation IoT applications is however held back by the current underlying architectures which does not support dissemination of sensor and actuator information on a global scale. The current commercial interests also work against the proliferation of a global Internet-of-Things with open sharing of sensor and actuator information, because of the utilization of centralized or cloud based walled garden solutions. To this end, we have created the SensibleThings platform that simplifies the exchange of sensor information between ubiquitously connected devices, to let developers focus on creating new and interesting IoT applications. Hence, with this platform anyone can share sensors and actuators with the whole world, securely, selectively, and with low latency. In detail, the platform is based on peer-to-peer networking techniques to exchange data in an optimized manner and it is free to use under the LGPLv3 open source license, which allows commercialization of external applications built on top of the platform. This poster describes the technical solutions that are implemented in the platform, as well as a series of demonstrator applications which verify the wide range of possibilities enabled by the platform. Finally, we present future work and how it will be used in our future research endeavors, spin off companies, and other commercial interests.

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**Invited talks: Best IEEE VT/COM/IT Sweden Conference Papers, Part 2**

**Wednesday, June 4: 11:30–12:30**

11.30-12.00  Wei Yang, Giuseppe Durisi, Tobias Koch, and Yury Polyanskiy,"**Quasi-static SIMO fading channels at finite blocklength,**" IEEE International Symposium on Information Theory (ISIT), Istanbul, Turkey, July 2013.

Invited talks: Best IEEE VT/COM/IT Sweden Journal Papers, Part 1

Wednesday, June 4: 14:00–15:00


Poster Session 2

Wednesday, June 4: 15:00–16:00

1. Does ETSI beaconing frequency control provide a cooperative awareness?
   Nikita Lyamin, Alexey Vinel and Magnus Jonsson, Halmstad University
   Abstract:
   Platooning is an emergent vehicular application aiming at increasing road safety, efficiency and driving comfort. The cooperation between the vehicles in a platoon is achieved by the frequent exchange of periodic broadcast Cooperative Awareness Messages (CAMs) also known as beacons. CAM triggering conditions are drafted in ETSI EN 302 637-2 European Standard and based on the dynamics of an originating vehicle. These conditions are checked repeatedly with a certain sampling rate. We have discovered that the improper choice of the sampling rate value may increase collisions between CAMs and, therefore, diminish the efficiency of beaconing in a platoon. This effect is studied via a platooning simulator, which incorporates the ETSI CAM triggering rules, the IEEE 802.11p medium access control protocol and a car-following mobility model. The recommendations on the mitigation of the studied phenomenon, which might be important for further ETSI standardization, are provided.

2. Large-System Analysis of MIMO Wire-Tap Channels with Randomly Located Eavesdroppers
   Maksym Girnyk and Lars K. Rasmussen, KTH Royal Institute of Technology
   Abstract:
   Wireless security has become a subject of growing interest in wireless communications due to the broadcast nature of wireless channels. In the present paper, we consider a multi-antenna wire-tap channel with randomly distributed eavesdroppers. In the fast fading environment, the overall performance of such channel is characterized by the ergodic secrecy capacity, which, in general, cannot be characterized explicitly. Nevertheless, based on the assumption that the numbers of antennas at legitimate terminals and the number of eavesdroppers grow large without bound, we derive a deterministic approximation for the achievable ergodic secrecy rate. The obtained large-system approximation matches well with the actual simulated secrecy rates, revealing some interesting behavior of the secrecy rates in the given scenario.
3. **On the operation of Massive MIMO with and without transmitter CSI**  
Marcus Karlsson and Erik G. Larsson, Linköping University  
Abstract:  
The paper considers the issue of activating inactive terminals by control signaling in the downlink in a massive MIMO system. The issues with short coherence time, in particular when the number of antennas is greater than the number of allowed pilot symbols, and no transmitter CSI are dealt with by repeating a pilot matrix of smaller dimensions over the antennas. We show that this repetition does not affect the spectral efficiency significantly, while making it possible to estimate the channel in a standard way using MMSE. Using the MMSE estimate, we derive an achievable rate for the downlink with spatial repetition. The paper also sheds some light the uplink-downlink power balance in massive MIMO.

4. **On the Impact of Non-Linear Power Amplifiers in Massive MIMO**  
Christopher Mollén, Erik G. Larsson, Thomas Eriksson, Linköping University  
Abstract:  
Conventional downlink signals in massive MIMO suffer from high PAR, which requires the power amplifiers of the base station to be backed off to avoid signal distortion, which lowers power efficiency. To improve efficiency, there are precoding schemes that produce signals with low PAR. These precoding schemes however require higher transmit power than conventional linear precoding to achieve the same rate performance. To compare different precoding schemes, their power consumptions have been estimated through simulations, in which in-band distortion, out-of-band radiation and amplifier efficiency effects are taken into consideration. It is found that, when only in-band distortion and the data rate requirement determine the back-off, the in-band distortion is negligible and the power amplifiers can be operated at peak efficiency. When out-of-band radiation is taken into consideration, high-PAR signals from conventional precoding can no longer be amplified close to saturation and low-PAR precoding sees a power gain from the higher power amplifier efficiency. It turns out that low-PAR and conventional, high-PAR, precoding schemes result in approximately the same power consumption.

5. **Achievable Rates of ZF Receivers in Massive MIMO with Phase Noise Impairments**  
Antonios Pitarokoilis, Linköping University; Saif Khan Mohammed, IIT Delhi, India; Erik G. Larsson, Linköping University  
Abstract:  
The effect of oscillator phase noise on the sum-rate performance of large multi-user multiple-input multiple-output (MU-MIMO) systems is studied. A Rayleigh fading MU-MIMO uplink channel is considered, where channel state information (CSI) is acquired via training. The base station (BS), which is equipped with an excess of antenna elements, SM, uses the channel estimate to perform zero-forcing (ZF) detection. A lower bound on the sum-rate performance is derived. It is shown that the proposed receiver structure exhibits an $O(\sqrt{M})$ array power gain. Additionally, the proposed receiver is compared with earlier studies that employ maximum ratio combining and it is shown that it can provide significant sum-rate performance gains at the medium and high signal-to-noise-ratio (SNR) regime. Further, the expression of the achievable sum rate provides new insights on the effect of various parameters on the overall system performance.

6. **MIMO Capacity under Power Amplifiers Consumed Power and Per-Antenna Radiated Power Constraints**  
Hei Victor Cheng, Daniel Persson, Erik G. Larsson, Linköping University  
Abstract:  
We investigate the capacity of the multiple-input-multiple-output channel taking into account the consumed power in the power amplifiers. The mutual information is optimized with a
limitation of total consumed power and per-antenna radiated power for a fixed channel with full channel state information at both the transmitter and receiver. The capacity is thus obtained by optimizing the input distribution to maximize the mutual information. Since the optimization problem is non-convex, direct computation of the capacity suffers from high computational complexity. Hence upper and lower bounds on the capacity are given as benchmarks for different ad-hoc schemes. An efficient suboptimal algorithm is also presented. Numerical results show that the suboptimal algorithm performs close to the capacity.

7. **Optimal Energy Minimization in Load-Coupled Wireless Networks**
   Chin Keong Ho, Institute for Infocomm Research, Singapore; Di Yuan and Lei Lei, Linköping University; and Sumei Sun, Institute for Infocomm Research, Singapore
   Abstract:
   We consider the problem of sum transmission energy minimization in a cellular network where base stations interfere with one another. Each base station has to serve a target amount of data to its set of users, by varying its power and load, where the latter refers to the average level of channel resource usage in the cell. We employ the signal-to-interference-and-noise-ratio (SINR) load-coupled model that takes into account the load of each cell. We show analytically that operating at full load is optimal to minimize sum energy. Moreover, we provide an iterative power adjustment algorithm for all base stations to achieve full load. Numerical results are obtained that corroborate the analysis and illustrate the advantage of our solution compared to the conventional solution where uniform power is used for all base stations.

8. **Polynomial Complexity Minimum-Time Scheduling in a Class of Wireless Networks**
   Qing He, Vangelis Angelakis, Anthony Ephremides and Di Yuan, Linköping University
   Abstract:
   We consider a wireless network with a set of transmitter-receiver pairs, or links, that share a common channel, and address the problem of emptying finite traffic volume from the transmitters in minimum time. This, so called, minimum-time scheduling problem has been proved to be NP-hard in general. In this paper, we study a class of minimum-time scheduling problems in which the link rates have a particular structure consistent with the assumed environment and topology. We show that global optimality can be reached in polynomial time and derive optimality conditions. Then we consider a more general case in which we apply the same approach and thus obtain approximation as well as lower and upper bounds to the optimal solution. Simulation results confirm and validate our approach.

9. **Requirement Definition and Performance Analysis of Platooning Applications**
   Annette Böhm, Elisabeth Uhlemann and Magnus Jonsson, Halmstad University
   Abstract:
   Recent advances in cooperative driving hold the potential to significantly improve safety, comfort and efficiency on our roads. An application of particular interest is platooning of vehicles, where reduced inter-vehicle gaps lead to considerable reductions in fuel consumption. This, however, puts high requirements on timeliness and reliability of the underlying exchange of control data. Considering the harsh radio environment as well as the random channel access method used by the IEEE 802.11p standard for short-range inter-vehicle communication, these requirements are very difficult to meet. The relatively static topology of a platoon and the role of the first vehicle as a designated leader of the platoon, however, allow the use of centralized communication protocols that would not be possible in decentralized Vehicular Ad-Hoc Network (VANET) applications. To assess the performance of different communication solutions in terms of timing and reliability from a platooning application perspective, the usual performance metrics like delay and throughput do not suffice. Instead, two main objectives for safe and efficient implementation of platooning on our roads have to be considered. Each platoon vehicle is required to hold
sufficiently fresh control information to maintain its inter-vehicle distance. At the same time, event-driven messages triggered by e.g., unexpected hazards have to be spread throughout the entire platoon within a certain maximum delay. Performance of time-triggered control messages is generally improved by providing timely channel access, increased reliability, increased update rate and reduced jitter. In contrast, the communications requirements of event-driven messages are typically quite different from those of the time-triggered messages, as jitter is of no interest, but instead a low dissemination delay. To this end, we propose to consider two performance metrics jointly, Status UTD (Up-to-Date) and Event DD (Dissemination Delay). Status UTD is defined as the worst-case inter-arrival time between status updates a vehicle received from a specific neighbor, while the Event DD of a platoon is the delay from event detection until the entire platoon received a warning about that particular event.

10. Analysis and Optimization of Random Sensing Order in Cognitive Radio Networks
Hossein Shokri-Ghadikolaei and Carlo Fischione, KTH, Royal Institute of Technology

Abstract:
Developing an efficient spectrum access policy enables cognitive radios to dramatically increase spectrum utilization while ensuring predetermined quality of service levels for the primary users. In this paper, modeling, performance analysis, and optimization of a distributed secondary network with random sensing order policy are studied. Specifically, the secondary users create a random order of the available channels upon primary users return, and then find optimal transmission and handoff opportunities in a distributed manner. By a Markov chain analysis, the average throughputs of the secondary users and average interference level among the secondary and primary users are investigated. A maximization of the secondary network performance in terms of throughput while keeping under control the average interference is proposed. It is shown that despite of traditional view, non-zero false alarm in the channel sensing can increase channel utilization, especially in a dense secondary network where the contention is too high. Then, two simple and practical adaptive algorithms are established to optimize the network. The second algorithm follows the variations of the wireless channels in non-stationary conditions and outperforms even static brute force optimization, while demanding few computations. The convergence of the distributed algorithms are theoretically investigated based on the analytical performance indicators established by the Markov chain analysis. Finally, numerical results validate the analytical derivations and demonstrate the efficiency of the proposed schemes. It is concluded that fully distributed sensing order algorithms can achieve substantial performance improvements in cognitive radio networks without the need of centralized management or message passing among the users.

Invited talks: Best IEEE VT/COM/IT Sweden
Journal Papers, Part 2

Wednesday, June 4: 16:00–17:00


Workshop Dinner
Wednesday, June 4: 19:00–21:00

Announcement of the best IEEE VT/COM/IT Sweden Conference/Journal Paper

Restaurant Strike
Torggatan 1, Västerås
http://strike.nu

Tutorial on Wireless Sensor Networks
Carlo Fischione
KTH Royal Institute of Technology
Thursday, June 5: 09:00–10:30 Tutorial on Wireless Sensor Networks, Part 1
Thursday, June 5: 11:00–12:30 Tutorial on Wireless Sensor Networks, Part 2

Tutorial abstract: Wireless Sensor Networks (WSNs) are networks of small, autonomous nodes equipped with wireless transmission and sensing capabilities for a huge variety of applications, such as energy efficient buildings, healthcare, transportation systems, industrial automation, and smart grids. WSNs have the potential of dwarfing the revolution that the Internet has brought to the world of computing, entertainment, work, and human interaction by the creation of the Internet of Things. They are the fundamental building block of the Internet of Things, by which several billion devices will be communicating over the Internet.

The focus of the tutorial is on theoretical aspects of distributed algorithms, optimization, and on their application to WSNs. The basic networking, signal processing, control and optimization topics for sensor networks will be given. The prominent WSNs protocols, such as IEEE 802.15.4 and RPL, will be reviewed along with a system-level design approach for protocols supporting control applications over WSNs. Iterative methods for distributed computation and network optimization will be discussed. The lecture also includes recently developed optimization based methods for privacy preserving computations over sensor networks.

Bio of the speaker: Dr. Carlo Fischione (http://www.ee.kth.se/~carlofi/) is a tenured Associate Professor at KTH Royal Institute of Technology, Electrical Engineering and ACCESS Linnaeus Center, Automatic Control Lab, Stockholm, Sweden. He received the Ph.D. degree in Electrical and Information Engineering in May 2005 from University of L’Aquila, Italy, and the Dr.Eng. degree in Electronic Engineering (Laurea, Summa cum Laude, 5/5 years) in April 2001 from the same University. He held research positions at University of California at Berkeley, Berkeley, CA (2004-2005, Visiting Scholar, and 2007-2008, Research Associate) and Royal Institute of Technology, Stockholm, Sweden (2005-2007, Research Associate). His research interests include optimization and parallel computation with
applications to wireless sensor networks, networked control systems, and wireless networks. He has co-authored over 100 publications, including book, book chapters, international journals and conferences, and an international patent. He received a number of awards, including the best paper award from the IEEE Transactions on Industrial Informatics of 2007, the best paper awards at the IEEE International Conference on Mobile Ad-hoc and Sensor System 05 and 09 (IEEE MASS 2005 and IEEE MASS 2009), the Best Business Idea award from VentureCup East Sweden, 2010, the “Ferdinando Filauro” award from University of L’Aquila, Italy, 2003, the “Higher Education” award from Abruzzo Region Government, Italy, 2004, the Junior Research award from Swedish Research Council, 2007, the Silver Ear of Wheat award in history from the Municipality of Tornimparte, Italy, 2012, and the Best Business Idea Award of STING Stockholm Innovation and Growth of 2014. He has chaired or served as a technical member of program committees of several international conferences and is serving as referee for technical journals. Meanwhile, he also has offered his advice as a consultant to numerous technology companies such as Berkeley Wireless Sensor Network Lab, Ericsson Research, Synopsys, and United Technology Research Center. He is co-founder and CTO of the sensor networks start-up company Aukoti. He is Member of IEEE (the Institute of Electrical and Electronic Engineers), and Ordinary Member of DASP (the academy of history Deputazione Abruzzese di Storia Patria).