KuVS Newsletter

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Editor Message

Sehr geehrte KuVS Mitglieder,

wir möchten Sie recht herzlich zur fünften Ausgabe des KuVS Newsletters begrüßen. Nach den ersten vier Newslettern haben wir zahlreiche positive Rückmeldungen und weitere interessante Beiträge für den neuen Newsletter erhalten. In diesem Rahmen möchten wir sowohl über aktuelle Geschehnisse der Fachgruppe, als auch deren Mitglieder berichten. Hierzu zählen insbesondere Geschäftsberichte der Fachgruppe, Neuigkeiten aus den Arbeitsgruppen (Promotionen, Auszeichnungen, Stellenbewegungen, offene Stellen), Projektberichte, sowie Veranstaltungsberichte und Calls. Der Newsletter ist zur Zeit auf ein halbjährliches Erscheinen ausgerichtet. Die nächste Ausgabe erscheint im Dezember diesen Jahres.

Weitere Informationen und Newsletter finden Sie unter https://www.kuvs.de/newsletter/. Die aktuelle Ausgabe ist geprägt von Kurzvorstellungen zu Arbeiten, die mit dem KuVS-Preis ausgezeichnet wurden, einer spannenden Best Demonstration Auszeichnung, sowie abgeschlossenen Promotionen seit dem letzten Newsletter. Sie finden Berichte zu der Internationalen Konferenz NetSys 2017 an der Universität Göttingen, dem MAKI 2017 Scientific Workshop on In-Network Processing and Network-Function Virtualization as Transition Methodologies, sowie zu den Calls zu KuVS Fachgesprächen, Summer Schools und Konferenzen. Der Newsletter beinhaltet weiterhin Ausschreibungen zu offenen Stellen, Ankündigungen und kommenden Veranstaltungen. Einreichungen für den nächsten Newsletter sind herzlich erbeten.

Wir wünschen viel Spaß bei der Lektüre des vorliegenden Newsletters.

Ihre Newsletter Editoren,

Kalman Graffi
Heinrich-Heine-Universität Düsseldorf

Oliver Hohlfeld
RWTH Aachen

KuVS Newsletter

Fachgruppe KuVS

2.1 KuVS Preise

2.1.1 Bachelor Thesis Award: Cole Bailey (Martina Zitterbart, KIT)

Title: Anonymity in Ad-Hoc Social Networks

Abstract: Ad hoc soziale Netzwerke benutzen direkte Kommunikation zwischen Nutzer, um soziale Interaktionen zu ermöglichen. Geräte können ohne Internet kommunizieren und anhand kontextsensitiver Information mit anderen Geräten in der unmittelbaren Nähe interagieren. Diese Arbeit untersucht die Anonymität von ad hoc sozialen Netzwerken. Die Gefahr von Verkettbarkeits-Angriffen, die anhand der Pseudonyme verschiedener Geräte durchgeführt werden können, wird analysiert. Existierende Ansätze, die sich auf das Erzeugen und Entschlüsseln von Pseudonymen fokussieren, werden verglichen, um Maßnahmen gegen möglichen Verkettbarkeits-Angriffe zu identifizieren. Schließlich wird ein Protokoll entwickelt, das die Herstellung von direkten Verbindungen zwischen Geräten ermöglicht und die Gefahr von zusätzlichen Verkettbarkeits-Angriffen minimiert. Das entwickelte Protokoll unterstützt mehrere Discovery-Verfahren, die für unterschiedliche Applikations-Typen geeignet sind, um Mixing zwischen diversen ad hoc sozialen Netzwerken zu ermöglichen. Applikationen können mit dem entwickelten Protokoll sowohl anhand geräte- und gruppenbasierten Identitäten kommunizieren als auch einschränken, welche Geräte in der Nähe diese Indentitäten entschlüsseln können. Langfristige Unverkettbarkeit wird erhalten, indem alle aktive Pseudonyme regelmäßig gewechselt werden. Das Generieren und Entschlüsseln von Pseudonyme basiert auf einem existierenden Verfahren, welches im Rahmen des Eddystone-Projekts spezifiziert wurde. Das Wechseln von Pseudonymen findet in synchronisierten Zeitintervallen statt, wobei randomisierte Silent Periods zwischen jeden Wechsel eingefügt werden. Die Wechsel werden zu genauen Zeitpunkten synchronisiert, sodass alle Geräte ihre Pseudonyme gleichzeitig ändern. Da die Anzahl von Geräte in der Nähe, die gleichzeitig wechseln, dadurch maximiert wird, werden Verkettbarkeits-Angriffe erschwert. Randomisierte Silent Periods verhindern das Identifizieren von Geräten mit kleinen Synchronisationsabweichungen. Außerdem reduzieren sie die Erfolgsrate von Verkettbarkeits-Angriffen, die die physischen Einschränkungen eines Geräts ausnutzen, um seine Pseudonyme zu verfolgen. Wegen der Verbreitung von Bluetooth LE auf marktüblichen Geräten, wird das Protokoll für Bluetooth LE entwickelt. Das Protokoll kümmert sich zusätzlich um den Aufbau von direkten Kommunikationsverbindungen über Bluetooth LE, ohne dass die langfristige Unverkettbarkeit kompromittiert wird. Über eine direkte Kommunikationsverbindung können Geräte sich authentisieren und verschlüsselte Daten austauschen. Um verfügbare statische Information zu minimieren, werden weitere Identifikatoren, die für die Kommunikationsverbindung gebraucht werden, regelmäßig gewechselt. Bei dem Austausch von Nutzdaten wird auch ein randomisiertes Padding hinzugefügt, sodass die Länge einer Nachricht keine verkettbare Information bietet. Das Protokoll wurde als Android-Bibliothek implementiert. Mit der Bibliothek können Android-Entwicker die Funktionen des entwickelten Protokolls in ihren Applikationen integrieren. Entwickler können Ad-hoc-Kommunikation implementieren, ohne direkt mit den

BLE-Schnittstellen arbeiten zu müssen. Zusätzlich wurde eine Testapplikation entwickelt, die die Bibliothek benutzt. Mit Hilfe dieser Testapplikation wurde die Perfomanz der implementierten Bibliothek in einem Experiment evaluiert. Nach 12 Stunden hat die Applikation auf einem Testgerät nur 6% Akku verbraucht. Der Energieverbrauch wurde hauptsächlich durch Bluetooth LE verursacht. Die zusätzliche Latenz des Protokolls war insgesamt eine Größenordnung kleiner als die durchschnittliche Latenz des Verbindungsaufbaus mit Bluetooth LE. Um zu evaluieren, wie gut das entwickelte Protokoll gegen möglichen Verkettbarkeits-Angriffe schützt, wurde die angreifbare Information auf allen Schichten der vorgeschriebenen Kommunikation analysiert. Anhand der Information auf der Anwendungsschicht kann ein Nutzer nur temporär verfolgt werden. Nach jedem Pseudonymwechsel ist der Nutzer nicht mehr zu seinen vorherigen Aktivitäten gebunden. Während einer Bluetooth LE Verbindung werden modellspezifische Informationen bekanntgegeben, wie z.B. Bluetooth-Versionsnummer und unterstützte Bluetooth-Funktionen. Unter den untersuchten Geräten konnte mit einer Kombination dieser Information die Modelle der jeweiligen Geräten eindeutig identifiziert werden. Ein aktiver Angreifer muss sich jedoch regelmäßig mit allen Geräten verbinden, um diese Information auszulesen. Geräte des gleichen Modells sind mit der Information nicht unterscheidbar.

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2.1.2 Master Thesis Award: Andreas Schmidt (Thorsten Herfet, Saarland Informatics Campus)

Title: Network Traffic and Infrastructure Analysis in Software Defined Networks

Abstract: Digital communication, and in particular information exchange via the Internet, is omnipresent. This leads to increasing demands in a diverse range of services with specific requirements regarding availability and Quality of Service. Software Defined Networks (SDN) evolve as a novel paradigm to cope with these new challenges. They offer unprecedented options for measuring, as well as orchestrating networks and therefore enable dynamic, nearly instantaneous manipulations of a network's operation.

This thesis focuses to harness the monitoring and measuring mechanisms provided through SDN controllers, and supports decisions for routing, service placement and more general network optimizations. The decisions themselves can then be executed using the orchestration capabilities. In order to provide such a solution, a framework for data analysis is developed and its capabilities are demonstrated through a selected number of use cases. This results in a comprehensive, extensible software which is able to monitor and optimize Software Defined Networks.

Next steps: Wissenschaftlicher Mitarbeiter am Telecommunications Lab des Saarland Informatics Campus. http://www.nt.uni-saarland.de/en/people/staff/andreas.html

2.1.3 PhD Thesis Award: Stefanie Roos (Thorsten Strufe, TU Dresden)

Title: Analyzing and Enhancing Routing Protocols for Friend-to-Friend Overlays

Summary: The threat of surveillance by governmental and industrial parties is more eminent than ever. As communication moves into the digital domain, the advances in automatic assessment and interpretation of enormous amounts of data enable tracking of millions of people, recording and monitoring their private life with an unprecedented accurateness. The knowledge of such an all-encompassing loss of privacy affects the behavior of individuals, inducing various degrees of (self-)censorship and anxiety. Furthermore, the monopoly of a few large-scale organizations on digital communication enables global censorship and manipulation of public opinion. Thus, the current situation undermines the freedom of speech to a detrimental degree and threatens the foundations of modern society.

Anonymous and censorship-resistant communication systems are hence of utmost importance to circumvent constant surveillance. However, existing systems are highly vulnerable to infiltration and sab- otage. In particular, Sybil attacks, i.e., powerful parties inserting a large number of fake identities into the system, enable malicious parties to observe and possibly manipulate a large fraction of the communication within the system. Friend-to-friend (F2F) overlays, which restrict direct communication to parties sharing a real-world trust relationship, are a promising countermeasure to Sybil attacks, since the requirement of establishing real-world trust increases the cost of infiltration drastically. Yet, existing F2F overlays suffer from a low performance, are vulnerable to denial-of-service attacks, or fail to provide anonymity.

Our first contribution in this thesis is concerned with an in-depth analysis of the concepts underlying the design of state-of-the-art F2F overlays. In the course of this analysis, we first extend the existing evaluation methods considerably, hence providing tools for both our and future research in the area of F2F overlays and distributed systems in general. Based on the novel methodology, we prove that existing approaches are inherently unable to offer acceptable delays without either requiring exhaustive maintenance costs or enabling denial-of-service attacks and de-anonymization.

Consequentially, our second contribution lies in the design and evaluation of a novel concept for F2F overlays based on insights of the prior in-depth analysis. Our previous analysis has revealed that greedy embeddings allow highly efficient communication in arbitrary connectivity-restricted overlays by addressing participants through coordinates and adapting these coordinates to the overlay structure. However, greedy embeddings in their original form reveal the identity of the communicating parties and fail to provide the necessary resilience in the presence of dynamic and possibly malicious users. Therefore, we present a privacy-preserving communication protocol for greedy embeddings based on anonymous return addresses rather than identifying node coordinates. Furthermore, we enhance the communication's robustness and attack-resistance by using multiple parallel embeddings and alternative algorithms for message delivery. We show that our approach achieves a low communication complexity. By replacing the coordinates with anonymous addresses, we furthermore provably achieve anonymity in the

form of plausible deniability against an internal local adversary. Complementary, our simulation study on real-world data indicates that our approach is highly efficient and effectively mitigates the impact of failures as well as powerful denial-of-service attacks. Our fundamental results open new possibilities for anonymous and censorship-resistant applications.

Next steps: Senior researcher in Cryptography, Security and Privacy at University of Waterloo. https://cs.uwaterloo.ca/~sroos/

2.1.4 PhD Thesis Award: Florian Tschorsch (Björn Scheuermann, HU Berlin)

Title: Onions in the Queue: An Integral Networking Perspective on Anonymous Communication Systems

Summary: Performance is a pivot point in the design of anonymity overlays. Due to their growing popularity, they are faced with increasing load, which makes design problems imminent. The special requirements and complex architecture of anonymity overlays renders the topic a challenging but likewise inspiring object of research.

In this work, we discuss the design of low-latency anonymous communication systems in general and the Tor network as the de-facto standard in particular. We develop solutions to a number of research questions, all collectively following the aim of enhancing and securing such networks. By doing this we create a fundamental technical understanding of networking aspects in anonymity overlays and tackle the most prevalent performance issue experienced today: network congestion.

To this end, we systematically explore the design space of data transport in anonymity overlays and reveal serious performance issues. This exploration provides insights in how (not) to design a transport protocol for anonymity overlays. In order to support future design decisions, we additionally present a methodology to measure networks in a privacy-preserving manner.

The fundamental results of this thesis include the discovery of a destructive denial of service attack and the associated design flaw of performing hop-by-hop reliability and end-to-end flow control. Moreover, we emphasize the central role of fairness. In particular, we show that gross unfairness between circuits may arise and lead to poor performance. While these kind of issues are difficult to fix, we provide respective security measures and a fully distributed scheduling algorithm that implicitly achieves global fairness.

These issues clearly demonstrate the inadequacy of currently employed congestion control in anonymity overlays. In particular, we identify a feedback "gap" between incoming and outgoing connections as the primary cause of performance issues. Aware of the requirements and the problems of anonymity overlays, we develop a tailored transport protocol. It combines congestion control with a backpressure-based flow control mechanism. The resulting overlay is able to react locally and thus rapidly to varying network conditions. It yields superior performance and a resilient overlay network.

With our work, we contribute an integral perspective on networking aspects of anonymity overlays and tackle the root cause of performance issues.

Next steps: Juniorprofessor für Distributed Security Infrastructures am Einstein Center Digital Future.

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Neues aus den Arbeitsgruppen

3.1 Best Paper Awards

3.1.1 Best Demonstration Award for Probr at 41st IEEE LCN Universität Zürich

Abbildung 1: The Probr Team (from right to left): Sebastian Stephan, Joel Scheuner, Dominik Schöni, Genc Mazlami, Burkhard Stiller at the LCN 2016, and not on the picture Alessandro De Carli and Thomas Bocek

At the 41st IEEE Conference on Local Computer Networks (LCN 2016) in Dubai, United Arab Emirates[1], the probr team (cf. Figure 1) had been awarded the Best Demonstration Award for the demonstration entitled "Probr Demonstration - Visualizing Passive WiFi Data", which was complemented by the respective paper[2], prepared by a Master Project team of the Communication Systems Group CSG, University of Zürich UZH[3]. This award is based solely on audience voting, not performed by a technical jury, and has seen in a very close runner-up with three almost equally counted for votes for a total of 14 demonstrations a final win.

[1] 41st IEEE Conference on Local Computer Networks (LCN), Dubai, United Arab Emirates, November 2016, http://www.ieeelcn.org/prior/LCN41/index.html

[2] Joel Scheuner, Genc Mazlami, Dominik Schöni, Sebastian Stephan, Alessandro De Carli, Thomas Bocek, Burkhard Stiller: Probr - A Generic and Passive WiFi Tracking System; 41st IEEE Conference on Local Computer Networks (LCN), Dubai, United Arab Emirates, November 2016, pp. 495-502; http://ieeexplore.ieee.org/document/7796825/.

[3] Communication Systems Group CSG, Department of Informatics IfI, University of Zürich UZH, Switzerland, May 2017, http://www.csg.uzh.ch/.

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To study and analyze the vast amount of data generated by WiFi-enabled devices and typically broadcast, the generic passive WiFi tracking system Probr was developed. Probr manages various types of WiFi capturing devices, collects captured WiFi traces, processes collected WiFi traces, and visualizes WiFi activities via its Web interface. Probr supports several on-line analysis functions and is extensible with respect to custom storage solutions to fit further use cases. A case study conducted demonstrates the capabilities of Probr for use cases such as room utilization estimation, indoor device localization, tracking a person's presence between multiple Probr-equipped locations, and analysis of device vendor preferences.

Thus, Probr is the first system of that kind known, enabling full device administration and provided completely as Open Source, since existing work, as outlined in the paper, is either limited to dedicated use cases, specific analysis questions, or of closed source with lacking architectural or functional details.

3.2 Personenbewegungen

- Prof. Dr. Florian Tschorsch (vormals HU Berlin, AG Scheuermann) wurde zum 1. April 2017 an der TU Berlin und dem Einstein Center Digital Future zum Juniorprofessor für Distributed Security Infrastructures ernannt.

3.3 Stellenausschreibungen

Auf den folgenden Seiten finden Sie aktuelle Stellenausschreibungen.

TECHNISCHE UNIVERSITÄT DRESDEN

DRESDEN concept

The **DFG Research Training Group GRK 1907 "Role-based Software Infrastructures for continuous-context-sensitive Systems"** offers, subject to granted funds, the positions of

6 PhD Students

(subject to personal qualification employees are remunerated according to salary group E 13 TV-L)

for applicants interested in performing high-quality research on the connection between software engineering, database systems, and theoretical computer science as well as their applications in systems biology and business informatics. The open positions will start on **October 1, 2017** and finish on September 30, 2020 under the condition that the second phase of the research training group will be approved by DFG. The period of employment is governed by the Fixed Term Research Contracts Act (Wissenschaftszeitvertragsgesetz - WissZeitVG). The position will give you an excellent chance for further academic qualification (e.g. PhD).

This research program is a joint activity of Professors Lehner, Assmann, Baader, Castrillon, Baier, Sbalzarini, Schill, Strahringer, and Strufe at TU Dresden. Doctoral candidates will join an individual mentoring and qualification program that comprises specialized courses that prepare candidates optimally for their research. Also, a research seminar is offered where candidates can discuss with internationally renowned researchers in their field. Moreover, soft skills and language courses are offered.

Requirements: Applicants should have an excellent academic record, and hold an MSc (or an equivalent university degree) in computer science or related disciplines (such as mathematics or business informatics). Fluency in spoken and written English is required. Applicants with a good knowledge of software engineering or one of the application areas mentioned above are preferred. TU Dresden is committed to increase the proportion of women in research.

Applications from women are particularly welcome. The same applies to people with disabilities.

Please send enquiries to: rosi-admin@groups.tu-dresden.de or visit https://wwwdb.inf.tu-dresden.de/rosiproject for more information.

Applications consist of a CV, the names of two referees, transcripts of documents summarizing the academic performance, and a statement of interest. Application by email in pdf format is preferred, and should be submitted to **db_applications@mailbox.tu-dresden.de** (Please note: We are currently not able to receive electronically signed and encrypted data.). Alternatively, applications can be sent to **TU Dresden Fakultät Informatik Institut für Systemarchitektur, Frau Ulrike Schöbel, 01062 Dresden, Germany**. Deadline for applications is **14 July 2017** (stamped arrival date of the university central mail service applies). Please submit copies only, as your application will not be returned to you. Expenses incurred in attending interviews cannot be reimbursed.

Shortlisted candidates will be invited to Dresden in July/August 2017 to give a presentation on their Master's thesis and discuss their research interest with the participating professors. Candidates that have not yet finished their degree when they send in their application should send preliminary transcripts of their academic records as well as a letter by the thesis adviser that comments on their progress so far and on the expected date of completion of their MSc or equivalent degree.

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Projektberichte

Calls und Berichte zu Veranstaltungen

5.1 Internationale Konferenz NetSys 2017 an der Universität Göttingen

Xiaoming Fu, Volker Hilt, David Koll
Universität Göttingen, Nokia Bell Labs, Universität Göttingen

Die 20. International Conference on Networked Systems (NetSys) war vom 13. bis 16. März 2017 an der Universität Göttingen zu Gast. Die Konferenz wurde organisiert von Dieter Hogrefe (Universität Göttingen), Volker Hilt (Nokia Bell Labs), Xiaoming Fu (Universität Göttingen) und Michael Welzl, (University of Oslo) und zog mit einem hochkarätiges Programm Wissenschaftlerinnen und Wissenschaftler aus Industrie und Universitäten im Forschungsgebiet Computernetzwerke an.

Abbildung 2: Foto von Henning Schulzrinne

Die NetSys 2017 bot zum Auftakt Tutorials zu den Themen "Future Internet" und "Applied Research in Network Security", die Workshops "Software-Defined Networking and Network Function Virtualization for Flexible Network Management" (SDNFlex 2017) und "Situation Recognition by Mining Temporal Information" (SIREMTI 2017) sowie ein PhD Forum an. Das Programm der Hauptkonferenz beinhaltete Gastvorträge von Prof. Dr. Henning Schulzrinne (Columbia University, USA), Dr. Wieland Holfelder (Google, Deutschland) und Prof. Dr. Rolf Stadler (KTH Royal Institute of Technology, Schweden) und ein technisches Programm mit Themenschwerpunkten zu ICN, SDN, Management, Measurements, Wireless Networks/Smart Devices, Social/Community Networks und Security/Privacy. Eine interaktive Podiumsdiskussion lieferte neue Perspektiven zu Netzwerk-Herausforderungen für Autonomes Fahren und Vorträge zu Förderungsmöglichkeiten rundeten das Programm ab. Die Programmgestaltung sowie ein attraktives Rahmenprogramm boten viele Möglichkeiten zum direkten Austausch zwischen Konferenzteilnehmern, die intensiv genutzt wurden.

Schirmherr der Tagung war die Gesellschaft für Informatik (GI) und die Informationstechnische Gesellschaft im VDE (ITG). Technische Co-Sponsoren waren die IEEE Communications Society und die SIGCOMM-Arbeitsgruppe der Association for Computing Machinery (ACM). Weitere Informationen sind unter http://netsys17.uni-goettingen.de/ zu finden.

5.2 Report on NetSys Ph.D. Forum

Oliver Hohlfeld, Falko Dressler
RWTH Aachen University, Paderborn University

The Ph.D. Forum at the International Conference on Networked Systems (NetSys) 2017 follows the tradition and format of similar events at international conferences such as PerCom, UbiComp, or CoNEXT. The aim is threefold. First, it should provide Ph.D. students in an early phase of their career with an opportunity to to gain general feedback on meta questions about the process towards a Ph.D.. Second, the participants will be able to discuss their topics with experts get early feedback on their proposal. Third, the Ph.D. Forum is an excellent opportunity for young researchers to start a personal network with other Ph.D. students as well as with already established experts. This year, we received 17 Ph.D. Forum contributions of which 13 were accepted for presentation at the forum.

The aim of the Ph.D. forum was to discuss both 1) research topics and PhD projects at different stages (early to senior) and 2) meta aspects and experiences in course of a Ph.D. This aim was thus reflected in the Ph.D. Forum program.

The Ph.D. Forum started on Monday with two sessions dedicated to the discussion of meta aspects and sharing experience on pursuing a Ph.D. These meta aspects involved time management, teaching, and many aspects of the publication process that is central during the process of a Ph.D. How to choose suitable publication venues? What is a suitable publication strategy? Which papers should go to which conferences at which reputation? What are differences in publication cultures among different fields? When should journals be targeted, when magazines? What makes a good survey paper? What happens behind the scenes: how are Technical Program Committees (TPC) at major conferences organizes and what are the (social) influence factors that impact the acceptance / rejection of papers? How can the lessons learned from the TPC process be applied to more successful paper writing?

The second part of the program will followed on Tuesday with the presentation of all participants at the main conference. This is split into a brief introduction of the proposed topics in one-minute-madness session at Tuesday afternoon followed by a poster session, which allows the in-depth discussion of each presented Ph.D. Forum contribution. The one-minute madness session as well received by the conference attendees and provided a compact overview on the posters. Many conference attendees then lively discussed the scientific posters of the Ph.D. forum participants and provided feedback to their plans. Overall the Ph.D. forum was very well received by the Ph.D. forum participants. We often heard the concluding statement that only having a half-day dedicated to the discussion of the meta aspects was way too short and “it should have been much longer”.

5.3 Report on the 2nd NetSys SDNFlex Workshop

Oliver Hohlfeld, Thomas Zinner, David Hausheer
RWTH Aachen University, Universität Würzburg, Otto von Guericke University Magdeburg

After its successful launch at the Conference on Networked Systems (NetSys) in 2015, the workshop on Software-Defined Networking and Network Function Virtualization for Flexible Network Management (SDNFlex), was held for the second time in conjunction with NetSys, which took place in Göttingen, Germany this year.

The importance of flexible network management approaches such as SDN and NFV and the interest in the community was reflected in the number of submissions we have received. These submissions involved authors based in 10 countries. After a thorough review we finally accepted 6 out of 15 full papers for publication (acceptance rate 40%). Research topics ranged from inspiring new concepts and protocols, e.g., to control the behavior of end hosts to the operation and integration of SDN solutions into existing networks.

The technical program was complemented by an inspiring keynote on "Building Secure 5G Networks on Distributed Telco Clouds" given by Peter Schneider (Nokia Bell Labs).

The workshop attracted a large number of participants that filled the lecture room allocated to the workshop. The participants engaged in active and lively discussions with the presenters.

SDNFlex Workshop Attendees

5.4 MAKI 2017 Scientific Workshop on In-Network Processing and Network-Function Virtualization as Transition Methodologies

Paul Müller
University of Kaiserslautern / Technische Universität Darmstadt

In the scope of the collaborative research center MAKI (SFB 1053) at the Technische Universität Darmstadt, the second phase of which started in January 2017, the fourth scientific workshop took place on April 7th, see http://www.maki.tu-darmstadt.de/events_1/maki_scientific_workshop/2017_1/agenda_1.en.jsp.

Because one of the main guiding themes for MAKI in its second phase is "software defined communication systems", this year's workshop focused on "network function virtualization (NFV)" and "in-network pro- cessing (INP)" as two of the pillars of the softwarization of networks.

The basic idea of the workshop was the discussion of NFV/INP from the respective view of the speakers followed by answering the question what MAKI can learn from their particular views.

The workshop was conceived by Paul Müller (University of Kaiserslautern and Technische Universität Darmstadt). He provided an overview of MAKI's goals and backgrounds along with MAKI's main abstractions – "mechanisms" and "transitions". A transition is a novel approach to deal with adaptability in the large and scalability of future communication systems.

https://de.wikipedia.org/wiki/Transition_(Informatik) or https://en.wikipedia.org/wiki/Draft:Transition_(Computer_Science)

The introduction to the workshop was followed by a comprehensive overview of NFV and INP given by Wolfgang Kellerer from the University of Munich. He classified these topics into the scientific landscape addressing the questions of flexible networking. Moreover, he introduced a flexibility measure for software defined networks and substantiates the basic foundations of NVF and INP in concrete use cases. This helped the audience to understand the potential contribution of NFV and INP for flexible networking. The main conclusions from this talk can be summarized as follows: Softwarization of networks and especially NFV and INP provide an excellent basis for transitions between mechanisms where the (de-)chaining and the underlying dynamics must be carefully considered.

A special highlight was the talk of Peter Steenkiste from Carnegie Mellon University, USA. He is well known in the "Future Internet" research community and developed a new Internet architecture called "eXtensible Internet Architecture (XIA)" within the NSF program "Future Internet Architecture (FIA)". He argued that the current Internet only forwards packets based on the end-to-end principle with a lot of security and privacy concerns. These concerns are mainly caused by middle-boxes providing certain network functions (NF). To provide a certain functionality, the question arises which part of a packet does a network function have to read and write? In this context, the XIA architecture can help in making network functions visible and use them for smart forwarding observing security and correctness issues. Therefore, it is important for MAKI to identify network functions in the different subprojects and which network function can be seen as a mechanism in the sense of MAKI.

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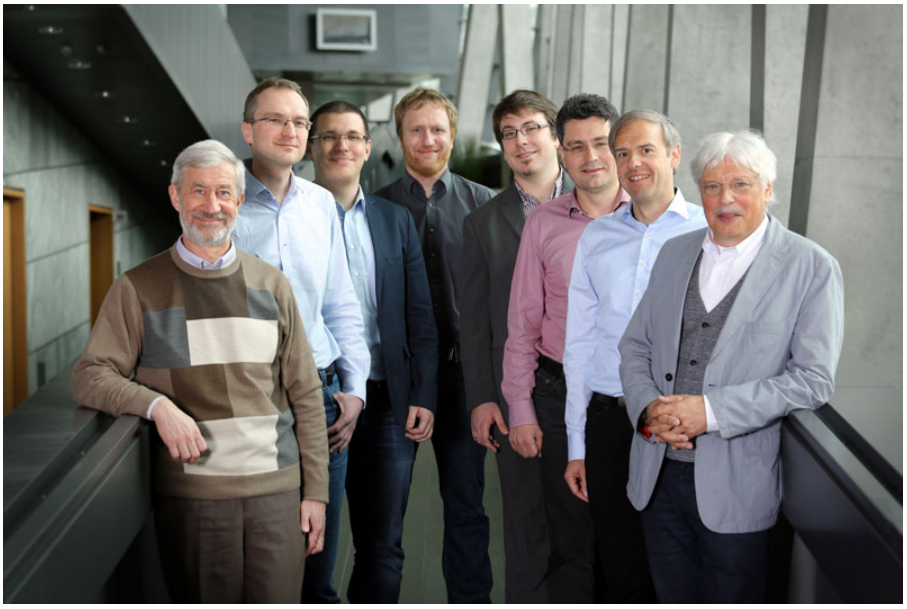

Abbildung 3: The Speakers from left to right: Peter Steenkiste, Peter Pietzuch, Michael Jarschel, Thomas Zinner, Henning Paul, Panagiotis Papadimitriou, Wolfgang Kellerer, Paul Müller (Organizer)

Henning Paul from the University of Bremen dived a bit deeper into the network stack and discussed INP for distributed estimation in mobile communications based on environmental monitoring. This fits to the MAKI approach in the sense that transitions take place not only in the upper layers of the network stack, but also in the physical layer for example between W-Lan and LTE.

After a short lunch, the workshop continued with a presentation by Panagiotis Papadimitriou from the University of Macedonia, Greece, about virtualized NF placement for INP. He also argued with the existence of middle-boxes and their migration to "network functions as a service (NF-as-a-service)" to reduce CAPEX and OPEX for enterprise networks. In his talk, Papadimitriou addressed the questions of the right NF placement, the right service chaining and management and discussed an exact method (mixed integer program) as well as heuristic methods. Moreover, he analyzed on-path and off-path network processing and introduced the MIDAS approach for middle-box discovery and selection for on-path flow processing. The potential for MAKI can be seen in the algorithms and protocols for distributed NF placement which can be adopted from the MIDAS approach and a model for signaling load estimation in cellular networks to trigger transitions.

An industrial point of view was given by Michael Jarschel from Nokia Bell Labs, Stuttgart. In his talk, he compared the IT industry and the telecommunications industry. Although they have many things in common and will likely converge eventually, they had and still have a fundamental different understanding of legacy support ("discontinue service" vs. "full support and operation for 10+ years"), reliability ("if it fails, spawn a new instance" vs. "it has to work

99.999% of the time") and workloads ("focus on swift compute/storage" vs. "Rapid I/O"). As a result, standards will play an important role for the convergence, but the evolution of the network is still going on. This means MAKI is on the right track to make the network more flexible in order to adopt to an ever-changing network world.

Benchmarking and performance evaluation of network function virtualization was addressed by Thomas Zinner from the University of Wuerzburg. He argued that performance is important to maximize the benefits of network function virtualization. Quantifying the performance benchmarking and modeling are two important topics. Moreover, he proposed to decompose the virtual network functions into functional blocks to improve scalability via finer granularity and support dynamic placement of the components. He concludes that transitions should not be seen between mechanisms only, but also hardware offloading and function placement can be discussed as state transitions.

As a last highlight, Peter Pietzuch from Imperial Collage London gave a presentation on application specific network services. While the current discussion about NF is focused on packet-based middle-boxes, he introduced application-specific functions in the network. To realize this concept, he discussed FLICK as a platform for creating application-specific functions. FLICK offers a runtime environment with a "domain specific language (DSL)" where the work can be broken into independently schedulable units (tasks) where the tasks can be chained by channels into task graphs. Based on these abstractions FLICK can offer an environment for an application oriented transition model in MAKI.

Overall the workshop was very successful for MAKI and gave us a lot food for thought. As a result of the workshop, the different work packages of MAKI will evaluate NFV and INP with respect to how these topics can influence the research for mechanisms and transitions. Based on the respective findings, MAKI will substantiate related models and evaluate them on an international testbed based on GENI, CloudLab and ToMaTo in the future.

In 2018 the MAKI scientific workshop will focus on machine learning in communication systems; Bernd Freisleben takes care of it. For more details please look at http://www.maki.tu-darmstadt.de/events_1/maki_scientific_workshop/2018/agenda_1.en.jsp.

5.5 Security and Privacy Lunch at RWTH Aachen University

Martin Henze, Jens Hiller, Roman Matzutt, Jan Henrik Ziegeldorf
RWTH Aachen University

Starting this summer semester, we offer a weekly security and privacy lunch at RWTH Aachen University: We invite students of all degrees to join us for an informal meeting during lunch break where we watch high quality conference talks (e.g., ACM SIGCOMM, USENIX NSDI) related to all things security and privacy in networked systems.

The security and privacy lunch kills two birds with one stone: We engage our students early into research, provide them with cutting edge research developments at the highest international level, and show them what makes a good (conference) presentation. At least as important, we as researchers found a way to time-efficiently keep up with the research developments at conferences that we could not attend in person.

After some initial organizational overhead, organizing the security and privacy lunch has turned out to be extremely time efficient. Essentially, we provide a seminar room, select the videos (students are encouraged to also make suggestions), and each participant brings their own lunch – at times we contribute simple finger food for everyone. After watching a talk, we usually engage in a short and informal discussion or brainstorming related to the presentation in small groups. Attendance varies between 10 to 30 participants and the feedback from students is extremely positive.

More information and our selection of videos:
https://www.comsys.rwth-aachen.de/teaching/ss-17/security-and-privacy-lunch/

5.6 Calls

Auf den folgenden Seiten finden Sie aktuelle Calls.

Web: https://www.cs.uni-potsdam.de/ars2017/

Audience Response Systeme (ARS), oftmals auch „Clicker“ genannt, werden immer häufiger an Hochschulen eingesetzt. In den letzten Jahren fand eine rege Entwicklung solcher Systeme statt, so dass es aktuell eine große Anzahl verschiedener Systeme gibt. Oft finden sich sehr ähnliche Kernfunktionen, aber z. T. auch eigene, besonders interessante Ansätze und Schwerpunkte.

Ziel des Workshops ist es, ein geeignetes Forum mit Vorträgen und anschließenden Diskussionen zu bieten. Wir möchten damit eine konstruktive Diskussion für eine bundesweit verfügbare Lösung befördern. Der Workshop richtet sich an TeilnehmerInnen aus Wissenschaft und Praxis, die ARS entwickeln, einsetzen, evaluieren oder an deren Einsatz interessiert sind. Im Sinne des thematischen Schwerpunkts des Workshops sind insbesondere diejenigen TeilnehmerInnen eingeladen, die bereits komplexe, evtl. sogar hochschulübergreifend eingesetzte Systeme entwickelt oder ARS über einen größeren Zeitraum eingesetzt haben.

Wichtige Termine

16. Juni 2017	Frist zur Einreichung von Beiträgen
18. Juli 2017	Mitteilung über Annahme/Ablehnung
26. Juli 2017	Frist für finale Fassungen der Beiträge
5. September 2017	Workshop im Rahmen der DeLFI 2017 in Chemnitz

Einreichungen

Der Workshop bietet Raum sowohl für Forschungsbeiträge als auch Erfahrungsberichte, Work-In-Progress-Paper sowie Paper über abgeschlossene Projekte. Mögliche Themen für Workshopbeiträge sind (als nicht ausschließende Aufzählung):

- Vorstellung technischer Systeme und Lösungen
- Didaktische Ansätze zum Einsatz von ARS
- Erfahrungen mit dem Einsatz von ARS
- Ansätze zu ungenutzten Potentialen von ARS
- Synergien zu anderen E-Learning Themenfeldern wie Learning Analytics und selbstgesteuertem Lernen

Beiträge können auf Deutsch oder Englisch verfasst werden (maximal 8 Seiten; Double-Blind-Review) und werden als gemeinsame Workshop-Proceedings der DeLFI sowohl über CEUR-WS als auch in der Digital Library des GI-Fachbereichs „Mensch & Computer“ veröffentlicht.

Weitere Informationen und Link zur Einreichung: https://www.cs.uni-potsdam.de/ars2017/
Ansprechpartner: Sven Strickroth (sven.strickroth@uni-potsdam.de)

Call for Papers – 16. GI/ITG KuVS Fachgespräch "Sensornetze" - FGSN 2017

Das Stichwort “Digitalisierung” ist heute allgegenwärtig. Ständig verfügbare Kommunikation hat zu einer Explosion der Möglichkeiten geführt. Im Internet der Dinge kommunizieren nun Geräte aller Art miteinander. Sie tauschen direkt und über das Internet Mess- und Regeldaten aus. Ein Zweig dieser Entwicklung sind Sensornetze, die eine Schnittstelle zur Beobachtung (Sensorik) und Beeinflussung (Aktorik) von Vorgängen ihrer Umwelt darstellen. Diese Kommunikation benötigt eigene, neuartige Strukturen. Obwohl die Anwendung drängt, sind noch nicht alle Forschungsfragen gelöst. Diese Herausforderungen spiegeln die Grenzfläche und das Zusammenwirken zwischen Messtechnik und technischer Informatik wider. Die Entwicklung dedizierter Lösungen und die Verwendung bestehender Standards stehen hierbei oft im Wettbewerb.

Es wird zur Einreichung von Beiträgen u.a. aus den folgenden Themenbereichen aufgerufen:

- Drahtlose Sensor-/Aktornetze
- Mobile Ad hoc und Mesh-Netze
- Automobilanwendungen
- Transportation, Fleet Management, Traffic Management
- Verteilte Systeme für das IoT, IoT-Protokolle und Standardisierung
- Sensordatenerfassung und Crowd Sensing
- Hausautomatisierung und Verteilte Energieanwendungen
- Synchronisation und Fehlerkompensation
- Energie- und ressourceneffiziente Sensorknoten

Beiträge

Ziel dieser Reihe von Fachgesprächen ist der informelle Gedankenaustausch für Wissenschaftler aus Forschung und Industrie sowie die Stärkung von Kooperationen in diesem multidisziplinären Forschungsbereich.

Im Rahmen des Fachgesprächs soll daher die Diskussion gegenüber der Vortragspräsentation im Vordergrund stehen. Beiträge sind in Form von Extended Abstracts einzureichen. Sie sollen 2-4 Seiten umfassen und im doppelspaltigen IEEE Transaction Format für Konferenzen in 10pt Schrift auf A4 verfasst werden. Das Fachgespräch ist offen für Beiträge, die bei anderen begutachteten Veranstaltungen publiziert wurden/werden. Die angenommenen Beiträge werden als technischer Bericht veröffentlicht.

Alle Beiträge müssen als PDF über EasyChair eingereicht werden:
https://www.easychair.org/conferences/?conf=fgsn2017

Einreichung: 15. Juni 2017
Benachrichtigung: 20. Juli 2017
Anmeldung: 03. August 2017
Fachgespräch: 07. - 08. September 2017 in Hamburg

Das diesjährige Fachgespräch Sensornetze wird an der HAW Hamburg ausgerichtet. Aktuelle Informationen zum Fachgespräch finden Sie auf der Internetseite der Veranstaltung:
http://fgsn17.inet.haw-hamburg.de/

Conference Chair
Prof. Dr. Thomas C. Schmidt
Prof. Dr.-Ing. Karl-Ragmar Riemschneider

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ITU KALEIDOSCOPE
NANJING 2017

Challenges for a data-driven society

27-29 November
Nanjing, China

Call for papers

Kaleidoscope 2017: Challenges for a data-driven society is the ninth in a series of peer-reviewed academic conferences organized by ITU to bring together a wide range of views from universities, industry and research institutions. The aim of the Kaleidoscope conferences is to identify emerging developments in information and communication technologies (ICTs) and, in particular, areas in need of international standards to aid the healthy development of the Information Society.

Theme

More data have been produced over the last two years than over the entire previous history of humanity. The volume of data that networks transport continues to soar to previously unimaginable heights. Emerging technological developments, specifically smart applications (e.g. smart cities and the smart grid) and the Internet of Things (IoT), will further fuel this trend.

This exponential growth and availability of data, along with enhanced collecting, processing and analytics capabilities, have opened up new frontiers in sustainable development. But globally accepted standards are needed to avoid the development of incompatible data silos and to establish a universal, shared and integrated data ecosystem that allows the deployment of the accumulated data in a highly secure environment, for the benefit of all.

The questions that need to be answered in this context include, among many others:

- Which technical challenges need to be overcome to encourage data portability, to share and aggregate data and to eventually enable interoperability of different data ecosystems?
- What are the legal frameworks required to build a universal, shared and integrated data ecosystem?
- What are the technological advances required to make sense of the immense volume of data available?
- What type of standards are needed for the analysis of the data and the interpretation of results?
- Are (telecommunication/ICT) standards organisations qualified to address the problems associated with data production, dissemination and storage?
- What are the synergies, if any, between the industry's view of data as a source of competitive advantage and the public sector's view of data as a public good?
- How can end-users receive equitable value in return for generating data?
- How can standards and regulation protect individual users' data across multiple organisational and geographic boundaries? How can trust be established in the provided level of protection?

Objective

Kaleidoscope 2017 calls for original academic papers that offer innovative and bold approaches relevant to technology, business and policy aspects of data management and analysis and encourage the development of applications and services building on data technologies to improve society.

Audience

Kaleidoscope 2017 targets specialists in the fields of ICT and socio-economic development, including researchers, academics, students, engineers, policymakers, regulators, innovators and futurists.

Date and venue

27-29 November 2017, Shangri-La Hotel, Nanjing, China

Submission of papers

Prospective authors from ITU Member States are invited to submit full, original papers. The submission should be within eight pages, including a summary and references, using the template available on the event website. All papers will go through a double-blind peer-review process. Submission must be made electronically; see http://itu.int/go/K-2017 for more details on online submission (EDAS). Paper proposals will be evaluated according to content, originality, clarity, relevance to the conference's theme and, in particular, **significance to future standards**.

Deadlines

Submission of full paper proposals: ***19 June 2017***

Notification of paper acceptance: ***18 September 2017***

Submission of camera-ready accepted papers: ***6 October 2017***

Publication and presentation

Accepted and presented papers will be published in the Conference Proceedings. In addition, extended versions of selected papers will be considered for publication in the *International Journal of Technology Marketing,* the *International Journal of Standardization Research,* or *the Journal of ICT Standardization*.

Awards

The Steering and Technical Programme Committees will award the authors of the three best papers. In addition, young authors of up to 30 years of age presenting accepted papers will receive Young Author Recognition certificates.

UNIVERSITÄT PASSAU

Gesellschaft für Informatik

DFG Research Training Group ENERGY STATUS DATA COLLECT • ANALYSE • UTILISE

KIT Karlsruhe Institute of Technology

Summer School on

Communication Technology and Data Analytics for Future Energy Systems

11.-15. September 2017 in Passau, Germany

Why?

The design of energy systems that can cope with the intermittency of renewable energy sources as well as with the current lack of flexibility in demand is a crucial societal concern. Recently, several new technologies – such as power-to-heat systems and electric vehicles – are emerging, making energy system design even more complex. The new discipline of Energy Informatics (EI) plays a key role in providing a scientific basis for the design of complex future energy systems.

What?

A summer school comprising talks by leading researchers in the field of Energy Informatics, practical sessions, workshops, discussions and social events.

Who?

Attendees: Researchers, Practitioners, PhD Students and Master Students.

Organisers: DFG Research Training Group „Energy Status Data“ of the Karlsruhe Institute of Technology (KIT), Gesellschaft für Informatik (GI, German Informatics Society), hosted by the University of Passau.

Where?

At the University of Passau,
in 94032 Passau, Germany.

When?

From 11.-15. September 2017.

And how...?

...do I get there?

Please visit our website www.future-energy-systems.org for further information and registration.

» www.future-energy-systems.org «

KuVS Newsletter

International Summer School on Crowdsourcing and IoT: July 31-August 04, Wuerzburg, Germany

The international summer school on "Crowdsourcing and IoT" focuses on combining objective measurement data from mobile sensors, like smart devices or IoT devices, and subjective ratings. The summer school intends to deepen knowledge in crowdsourcing in general and crowdsensing of measurement data from mobile users in particular, as well as IoT platforms and protocols. Besides the theoretical background, a core part of the summer school comprises hands-on sessions and group work on concrete research topics supervised by a tutor.

The targeted participants are Ph.D. students and early-stage researchers in the fields of Crowdsourcing, QoE, and IoT.

The summer school will take place in Wuerzburg, Germany from July 31 to August 4 2017 and include topics such as:

- Crowdsourcing in general, concepts, platforms, frameworks
- Crowdsensing, mobile and participatory sensing
- IoT architectures, platforms and OSes
- Networking protocols and paradigms for IoT
- Crowdsourced QoE
- QoE of IoT applications and services
- Machine learning and statistical analysis

The topics are addressed in lectures given by international experts from academia and industry, practical exercise, and group work. Ph.D. students will be awarded a certificate (3 ECTS) upon submission of an extended abstract, a presentation of their own research during a poster session, and participation in the program.

The application for the summer school closes June 31st or if the maximum number of participants (30) is reached.

More information is online at http://iotcrowd.org/

Abgeschlossene Promotionen

6.1 Konstantin Miller (Adam Wolisz, Technische Universität Berlin)

Title: Adaptation Algorithms for HTTP-Based Video Streaming

Abstract: Ever since the invention of the cinematography, there has been a growing demand for high-quality video content. Recently, the broad availability of high-speed wireless Internet access, complemented by the pervasiveness of mobile, computationally powerful devices with high-resolution screens, have made the video delivery over the open Internet the technology of choice for both video on demand and live streaming services. Due to the best-effort nature of the Internet, however, ensuring a high quality of experience is challenging. A state-of-the-art approach to address this challenge is adaptive streaming, designed to continuously adjust the characteristics of the streamed media to dynamically varying network conditions, leading to a smoother viewing experience with less playback interruptions and a more efficient utilization of the available network resources. Despite the ongoing efforts, however, recent studies suggest that the challenge has not yet been successfully resolved. One of the open issues is the design of efficient adaptation algorithms, that are among the primary factors determining the overall performance of a streaming service. In this thesis, I present several contributions to this area of research, that are outlined in the following. In order to cope with the wireless traffic increase expected over the next years, it will be necessary to increase the density of the deployed wireless infrastructure. In my first contribution, I focus on a simultaneous delivery of a large number of unicast video on demand streams in a dense wireless network. I jointly consider the problem of wireless transmission scheduling and video quality selection, and develop a distributed approach based on control theory. The conducted performance evaluation shows that the presented approach is able to serve an up to twice as large number of users completely without interruptions, as compared to a baseline approach. Simultaneously, it allows to reduce the number of quality transitions by up to 50Even though the majority of the video content being streamed over the Internet is video on demand, the amount of live streaming is growing rapidly. In my second contribution, I focus on a particularly challenging use case of low-delay live streaming. I develop a novel adaptation algorithm that is leveraging throughput predictions to provide a high quality of experience over wireless links, with a latency bound on the order of a few seconds. It heuristically maximizes the average video quality at an operating point defined by the live latency, amount of playback interruptions, and number of quality transitions. A comparative evaluation reveals that at the individual operating points, the developed algorithm provides an average video quality which is by up to a factor of 3 higher than the quality achieved by the baseline approach. Furthermore, it is able to reach a broader range of operating points, and can thus be more flexibly adapted to the user profile and service provider requirements. In my third contribution, I develop a universal adaptation algorithm for video on demand, that can operate over a broad range of network conditions, and that has a flexible configuration that can

be adjusted to the particular service and user requirements. It uses the playback buffer level information and the past throughput information to meet its adaptation decisions. It does not rely on a cooperation with the network nor on cross-layer information, and is therefore suitable for a standalone deployment in any network environment, and on a broad range of platforms. Moreover, it minimizes the start-up delay, which is particularly important for services, where users tend to frequently start new video sessions. I evaluate the approach against a baseline and against an omniscient client that computes optimal adaptation trajectories by solving a series of optimization problems. The evaluation reveals that the proposed algorithm allows to efficiently avoid playback interruptions, provides a smooth viewing experience by avoiding excessive video quality fluctuations, achieves a high level of network resource utilization, and provides a fair resource allocation in a multi-user environment. In particular, in the network environment used for the evaluation, the developed algorithm achieves an average video bit rate which is by up to 35% higher than that of the baseline approach, and within up to 85% of the optimum, with an up to an order of magnitude smaller total duration of interruptions. It is worth mentioning that the omniscient client developed in the course of this work can not only serve as a reliable benchmark for streaming clients but also allows to evaluate the influence of various media and network properties on the achievable streaming performance. Last but not least, based on my experience with implementing streaming client prototypes and simulation models, I develop a streaming client architecture that is modular, extendible, and platform-independent, and efficiently supports distributed operation of the individual functional blocks.

6.2 Daniel Cagara (Björn Scheuermann, HU Berlin)

Title: A Distributed Evolutionary Approach to Cooperative Vehicular Traffic Optimization

Abstract: The increasing amount of road traffic necessitates approaches that intelligently organize traffic. In this context, the study of intelligent transportation systems (ITS) has been performed for some time. The goals of such systems include, e.g., the dynamic optimization of route choices in a road network and hence the improvement of traffic conditions. There are two main methodologies how an optimization can be performed: the optimization towards a Nash equilibrium or towards a system optimum. While Nash equilibria can be easily reached, e.g., when every driver selfishly optimizes his own route, reaching the system optimum is a challenging task and requires all drivers to cooperate in an altruistic manner in favor of the system from a global perspective. In this work, we discuss the design of a decentralized ITS that is capable of approximating system optimal route choices in the network avoiding that the drivers have to pay the full price of anarchy. The focus, in this context, lies on the applicability to real life situations where a number of difficulties have to be expected, e.g., an incomplete or incorrect view of the current traffic situation, the lack of future knowledge and an imperfect or limited communication channel. In the proposed approach, cars use car-to- car communication to gradually learn about the current traffic situation. Then, each car works on a small portion of one large instance of the route choice optimization problem and propagates the results back to the other cars. The optimization is performed in real-time while the cars drive and is able to cope with sudden changes in the traffic dynamics and resource constraints in the communication channel. Results show that the proposed approach works for different types of traffic patterns and different penetration rates.

6.3 Dominik Kirchner (Kurt Geihs, Universitaet Kassel)

Title: Self-Healing in Autonomous Robot Teams

Abstract: Today, robots are used in nearly every type of automated manufacturing and assembly process. Robot installations typically apply static actuator systems in clearly structured environments. These systems show impressive abilities in speed and accuracy for repetitive manipulation tasks. Future automation applications, however, require an increasing level of flexibility, where classical systems reach their physical limits. As a reaction, robots become mobile, intelligent and cooperative. These new characteristics, however, introduce further challenges. Dependable operation, for example, is considered as a major issue. Currently achieved operation durations are often too short to meet real-world requirements. This qualifies their benefits and blocks wide-spread application.

This thesis presents RoSHA (Robot Self-Healing Architecture), a comprehensive self-healing solution to improve the dependability of autonomous mobile robot teams. Our proposed self-healing approach combines an integrative design with sophisticated self-healing abilities. The design specially addresses flexibility and ease of integration. Up to our knowledge, this design is the first that allows already existing (multi-)robot systems to integrate self-healing without extensive system changes. The self-healing functionality itself follows the Autonomic Computing paradigm and is organized after the MAPE-K structure. Our realization uses an adaptive monitoring for comprehensive and efficient system observation. An individual model-based configuration allows tailored observation for each system component in order to minimize the computational overhead. For failure detection and diagnosis, we present QBFD (Qualitative Bayesian Failure Diagnosis). QBFD provides the ability to cope with specific challenges of the robotic domain, like noisy and incomplete observations or imprecise knowledge of the systems dynamics and achieves highly reliable and efficient estimation of the failure condition. Our failure recovery mechanism is adopted from a robot behavior control language to specify architectural adaptations for coordinated multi-robot recovery. This constitutes a novel way to model cooperative recovery for multi-robot systems. All components are developed on the basis of a formal robot model. Up to our knowledge, this is the first formalization of commonly accepted dependability concepts.

Finally, we present an evaluation of our approach in a comprehensive case study. We choose the domain of cooperative driving for a challenging and realistic evaluation scenario. The case study reviews the viability of our self-healing solution in different ways, where we analyze the achievable application performance gain and the self-healing quality. A non-exhaustive cross-validation confirms a significant improvement of application performance and availability with reasonable reactivity. Therefore, we are confident that our proposed solution considerably improves dependable operation for teams of autonomous mobile robots.

KuVS Newsletter

Ankündigungen

Termine

- 15. KuVS Fachgespräch Sensornetze, 7.-8. September 2017, Hochschule für Angewandte Wissenschaften Hamburg
  https://www.kuvs.de/fachgesprache/fachgesprach-sensornetze/
- 2017 IEEE Conference on Network Function Virtualization and Software Defined Networks 6-8 November 2017 // Berlin, Germany (General Chair: Kurt Tutschku)
  http://nfvsdn2017.ieee-nfvsdn.org/
- 14. Fachgespräch "Ortsbezogene Anwendungen und Dienste" 21., 22. September 2017, Hochschule für Technik und Wirtschaft Berlin
  http://www.wireless-earth.de/fg_lbs/fg_lbs.html
- Vom 26. Juni bis 30.Juni findet die ACROSS Summer School in Bereich Latency Control for Internet of services und Cloud mit spannenden Tutorials und Hands on Labs auch zusammen mit Industrie, statt. Studenten bekommen ein ECTS Zertifikat. Mehr Infos unter https://acro2017.hotell.kau.se/
- Am 12./13.10.2017 findet das Fachgespräch Network Softwarization in Tübingen statt. Mehr Infos unter http://kn.inf.uni-tuebingen.de/KuVS-FG-NetSoft
- 12th Workshop on Challenged Networks, Co-located with ACM MobiCom 2017, October 16-20, 2017 Snowbird, Utah, USA
  http://www.acm-chants.org/

KuVS Newsletter

Nächster Newsletter

Nächster Newsletter : Dezember 2017

Einreichungsfrist für Beiträge : 1. November 2017

Wir bitten dabei um Einreichungen zu den folgenden Themengebieten:

- Fachgruppe KuVS
  - Geschäftsberichte der GI – KuVS – Fachgruppe
  - ...
- Neues aus den Arbeitsgruppen
  - Abgeschlossene Promotionen
  - Preise
  - Personenbewegungen
  - Stellenmarkt
  - ...
- Neue Projekte
  - Initiativen
  - Großprojekte
  - ...
- Calls und Berichte zu Veranstaltungen
  - Konferenzberichte (Konferenzen, Fachgespräche, Dagstuhl, ...)
  - Call for Papers and Participation (“Eigene” Konferenzen, Fachgespräche, Summerschool, ...)
  - ...
- Ankündigungen und Termine

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