KuVS Newsletter

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Editor Message

This newsletter is providing you with all information that you need to know about the KuVS community from the last half a year.

At the end of the newsletter, you again find some riddles from Rolf Windenberg based on his mathematically oriented reform of English orthography.

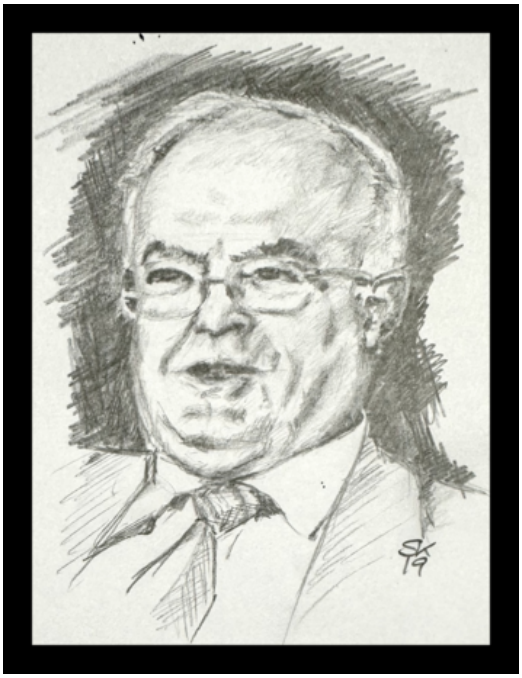
More information and recent editions of our newsletter are available on https://www.kuvs.de/newsletter/.

We hope you enjoy reading this edition of the KuVS newsletter. We wish you happy holidays and a happy new year.

Oliver Hohlfeld
Universität Kassel

KuVS Newsletter

Prof. Dr. Dr. h.c. Otto Spaniol (11.4.1945 - 10.12.2023)



(c) COMSYS, RWTH Aachen University

Prof. Dr. Dr. h.c. Otto Spaniol, co-founder and honorary chairman of KuVS, passed away on December 10

Otto Spaniol was full professor at RWTH Aachen University and headed the Chair of Communication and Distributed Systems from 1984 to 2010. Prior to that, he held professorships at the universities of Bonn and Frankfurt. He played a significant role in the DFG, the Gesellschaft für Informatik, and the Wissenschaftsrat, and guided the establishment of graduate schools in computer science over many years and decades. He was a co-founder and honorary chairman of KuVS and significantly shaped its direction. In recognition of both his scientific achievements and his honorary engagement his was named a GI-Fellow in 2008.

The KuVS community looses a long-time researcher that substantially shaped the communication and distributed systems field.

For further information:
obituary by the Chair of Communication and Distributed Systems: https://www.comsys.rwth-aachen.de/team/otto-spaniol/obituary

Book of Condulence: https://blog.rwth-aachen.de/trauerbuch-otto-spaniol/2023/12/12/book-of-condelence/

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Movement of persons

- **Prof. Dr. Vaibhav Bajpai** accepted an offer for the new HPI professorship for data-intensive Internet computing
- **Prof. Dr.-Ing. Kalman Graffi** accepted a full professorship on Networks, Communication Systems and Cyber Security at TH Bingen
- **Prof. Dr. Michael Seufert** accepted a full professorship on Networked Embedded Systems and Communication Systems at Universität Augsburg
- **Prof. Dr. Lin Wang** accepted a full professorship for Computer Networks at Universität Paderborn
- After more than 2.5 years, **Dr. Abdorasoul Ghasemi** (Associate Professor) has ended his research activities as an AvH (Alexander von Humboldt Stiftung) scholarship holder at the Chair of Computer Networks and Communications, Prof. Hermann de Meer (University of Passau) on 31.12.2023. He will move to the Lakeside Labs in Klagenfurth on the 1st of January 2024.

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Awards

Konrad Zuse Medal 2023 **Prof. Anja Feldmann** (Max Planck Institute for Informatics) received the Konrad Zuse Medal 2023. The Konrad Zuse Medal for Services to Computer Science is the highest award of the Gesellschaft für Informatik (German Computer Science Society), given every two years to one or sometimes two leading German computer scientists.

IEEE Koji Kobayashi Computers and Communications Award 2023 **Prof. Anja Feldmann** was bestowed with this award "For contributions to the field of networking and Internet technologies, specifically to traffic engineering, network measurements, and Internet protocols." The IEEE Koji Kobayashi Computers and Communications Award is a Technical Field Award of the IEEE established in 1986. This award has been presented annually since 1988 for outstanding contributions to the integration of computers and communications.

Peter Compes-Price 10.02.2023 **Ali Alshawish PhD**, Chair of Computer Networks and Communications at Universität Passau: "Risk-based Security management in Critical Infrastructure Organizations"

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Project News

LOEWE-Zentrum emergenCITY geht in die zweite Phase

Das LOEWE-Zentrum emergenCITY wird weiter vom Land Hessen gefördert und erhält für das Jahr 2024 insgesamt rund fünf Millionen Euro Projektmittel. Das haben die Gremien des LOEWE-Forschungsförderprogramms des Landes entschieden. Der interdisziplinäre Forschungsverbund unter Federführung der TU Darmstadt und Beteiligung der Universitäten Marburg und Kassel erkundet seit 2020, wie Städte besser durch Krisen und Katastrophen kommen und sich auf der Basis von Informations- und Kommunikationstechnologie schnell wieder stabilisieren können.

Die Forschenden am LOEWE-Zentrum "emergenCITY" erarbeiten Lösungen, die in Krisenfällen einen Notbetrieb sicherstellen und schnelle Hilfe und die Rückkehr zur Normalität ermöglichen sollen. Bild: Gerd Keim

"Nachdem es in Deutschland über Jahrzehnte keine großen, existenziellen Krisen gab, haben wir in den vergangenen Jahren mit Pandemie, Kriegsgefahr, drohender Probleme in der Energieversorgung oder auch Hacker-Angriffen auf Kommunen erlebt, wie verwundbar unsere Infrastrukturen sind", erklärt Wissenschaftsministerin Angela Dorn. "Mit emergenCITY haben die TU Darmstadt, die Universität Kassel und die Philipps-Universität Marburg ein Forschungszentrum ins Leben gerufen, das bundesweit eine profilierte Vorreiterrolle innehat."

Weitere Informationen: www.emergencity.de

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EU project “META BUILD”: Using digital twins to electrify university buildings

A team headed by computer scientist Professor Herrmann de Meer will be participating in the EU Horizon project “META BUILD”: Using buildings on the University of Passau campus, computer scientists will be testing ways to reduce the carbon emissions of academic institutions.

Further information: https://www.fim.uni-passau.de/en/computer-networks/research/projects/details?tx_converis_pi1[project]=3353

FFG Project cells4.energy

The team of Professor Herrmann de Meer participates in the “Regionale Energiezellen als Multi-Energy-Reallabore für eine schnelle Systemtransition - cells4.energy” project, funded by the Österreichischen Forschungsförderungsgesellschaft mbH (FFG).

BMWK Project EnerSat – satellite networks for reliable monitoring of critical infrastructures

The BMWK Project “Enersat” of University of Passau, Zentrum für Telematik (ZfT), Institut für Energie- und Hochspannungstechnik (IEHT) researches on reliable satellite network architectures to support normal and emergency operation of sustainable energy systems.

Further information: https://www.fim.uni-passau.de/en/computer-networks/research/projects/details?tx_converis_pi1%5Bproject%5D=3261

DFG project ResiServD – resilient infrastructure for the energy revolution

Renewable energies are central to the energy revolution, but the power supply network needs to be adapted to suit the altered conditions. A research team from the universities of Passau and Kassel, already in the second funding phase, are investigating how failures in the new energy infrastructure can be averted.

Further information: https://www.fim.uni-passau.de/en/computer-networks/research/projects/details?tx_converis_pi1%5Bproject%5D=2413

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DFG project – calculating flexibility in energy systems

For stable and safe operation, the electricity system requires flexibility, particularly in these times of renewable energies. A team from the universities in Passau and Freiburg are developing mathematical calculation methods to help them model that flexibility.

Further information: https://www.fim.uni-passau.de/en/computer-networks/research/projects/details?tx_converis_pi1%5Bproject%5D=2414

KuVS Newsletter

Finished PhD Theses

Frank Loh

University of Würzburg (advisor Tobias Hoßfeld)

Title: Monitoring the Quality of Streaming and Internet of Things Applications

Abstract:

The ongoing and evolving usage of networks presents two critical challenges for current and future networks that require attention: (1) the task of effectively managing the vast and continually increasing data traffic and (2) the need to address the substantial number of end devices resulting from the rapid adoption of the Internet of Things. Besides these challenges, there is a mandatory need for energy consumption reduction, a more efficient resource usage, and streamlined processes without losing service quality. We comprehensively address these efforts, tackling the monitoring and quality assessment of streaming applications, a leading contributor to the total Internet traffic, as well as conducting an exhaustive analysis of the network performance within a Long Range Wide Area Network (LoRaWAN), one of the rapidly emerging LPWAN solutions.

An observable trend in literature leans towards more complex and resource-intensive solutions. Therefore, our goal is to predict key Quality of Experience (QoE) degradation factors for video streaming solely using uplink data in a lightweight and resource-efficient manner. Based on our large-scale dataset opened to the research community, our findings indicate an effort reduction of about 86% if only uplink-data need to be monitored. The reduction potentially allows us to monitor 100 to 1,000 times more streaming flows in parallel using the same hardware in comparison to full packet trace monitoring. With this insight, and to predict key QoE degradation factors accurately, using uplink data exclusively, we leverage the inherent characteristics of video data transmission to create a simplified predictive model to identify impairments during video streaming. This real-time applicable approach can be implemented with or without expert knowledge, yielding comparable or even better prediction outcomes when compared to complex state-of-the-art Machine Learning techniques from literature. We demonstrate that our approach can be valuable to predict severe QoE degradation factors, eliminating the need for complicated and resource-intensive solutions.

Furthermore, we introduce a novel and innovative gateway placement strategy for the LPWAN LoRaWAN. In this context, we examine diverse network configurations and compare the performance of our approach to existing state-of-the-art techniques. Our results showcase that our placement strategy reduces the required number of gateways by up to 30%, while enhancing collision probability in comparison to current solutions. The approach remains versatile across various network deployments, end-device transmission patterns, and different emulated deployments for cities around the globe. Furthermore, it remains resilient against an expected load increase in future networks. In addition, and to improve the reliability of data transmissions in a LoRaWAN, we present a fully time-scheduled channel access approach designed to eliminate

message collisions within the network. Through theoretical analysis, we establish the maximum feasible number of devices that can transmit using our method, while complying with network regulations. A comprehensive simulation study validates our approach's effectiveness in collision reduction and its performance in the presence of concurrent interfering traffic. Finally, we explore distinct channel access strategies in terms of energy consumption and energy efficiency. Our study introduces a versatile model to characterize the energy consumption of LoRaWAN sensors transmitting data via diverse channel access approaches. Based on this insight, we devise a novel and general energy efficiency metric for comparative assessment of channel access methods, enabling determination of the most energy-efficient data transmission approach in a LoRaWAN. This universally applicable energy efficiency metric holds potential value for network operators, academia, and industry, extending its utility beyond the design of a LoRaWAN to areas such as data centers and large-scale application deployments.

KuVS Newsletter

Keno Christian Garlichs

TU Braunschweig (advisor Lars Wolf)

Title: Efficient Message Dissemination in Cooperative Vehicular Networks

Abstract:

Cooperative networking of vehicles with each other and their environment (V2X) is transitioning from research to everyday life. Currently, Cooperative Awareness is already being introduced to evermore commercially available vehicles, and Collective Perception is in the final phase of standardisation, soon ready as the next step of Cooperative-Intelligent Transportation Systems. Afterwards, Manoeuvre Coordination will be a key functionality for Connected Automated Vehicles. The according messages will be transmitted wirelessly next to other existing and future messages in a reserved frequency band with a limited capacity. With increasing Market Penetration Ratios (MPRs), it will be challenging to satisfy the ever-increasing resource demand with the limited spectrum capacity. In this thesis, the influence of the MPR as well as other parameters on channel load and application performance, are analysed. Then, different approaches are proposed to efficiently disseminate the respective messages, e.g., by controlling the message generation of a service, combining multiple messages or prioritising between different messages generated by the same station. Finally, a user study shows that V2X information is not only usable for automated driving systems but can also help human drivers to avoid accidents and therefore makes traffic safer.

KuVS Newsletter

Negar Emami

Universität Bern (advisor Torsten Braun)

Title: Deep Learning Techniques for Mobility Prediction and Management in Mobile Networks

Abstract:

Trajectory prediction is an important research topic in modern mobile networks (e.g., 5G and beyond 5G) to enhance the network quality of service by accurately predicting the future locations of mobile users, such as pedestrians and vehicles, based on their past mobility patterns. A trajectory is defined as the sequence of locations the user visits over time. The primary objective of this thesis is to improve the modeling of mobility data and establish personalized, scalable, collective-intelligent, distributed, and strategic trajectory prediction techniques that can effectively adapt to the dynamics of urban environments in order to facilitate the optimal delivery of mobility-aware network services. Our proposed approaches aim to increase the accuracy of trajectory prediction while minimizing communication and computational costs leading to more efficient mobile networks. The thesis begins by introducing a personalized trajectory prediction technique using deep learning and reinforcement learning. It adapts the neural network architecture to capture the distinct characteristics of mobile users' data. Furthermore, it introduces advanced anticipatory handover management and dynamic service migration techniques that optimize network management using our high-performance trajectory predictor. This approach ensures seamless connectivity and proactively migrates network services, enhancing the quality of service in dense wireless networks. The second contribution of the thesis introduces cluster-level prediction to extend the reinforcement learning-based trajectory prediction, addressing scalability challenges in large-scale networks. Cluster-level trajectory prediction leverages users' similarities within clusters to train only a few representatives. This enables efficient transfer learning of pre-trained mobility models and reduces computational overhead enhancing the network scalability. The third contribution proposes a collaborative social-aware multi-agent trajectory prediction technique that accounts for the interactions between multiple intra-cluster agents in a dynamic urban environment, increasing the prediction accuracy but decreasing the algorithm complexity and computational resource usage. The fourth contribution proposes a federated learning-driven multi-agent trajectory prediction technique that leverages the collaborative power of multiple local data sources in a decentralized manner to enhance user privacy and improve the accuracy of trajectory prediction while jointly minimizing computational and communication costs. The fifth contribution proposes a game theoretic non-cooperative multi-agent prediction technique that considers the strategic behaviors among competitive inter-cluster mobile users. The proposed approaches are evaluated on small-scale and large-scale location-based mobility datasets, where locations could be GPS coordinates or cellular base station IDs. Our experiments demonstrate that our proposed approaches outperform state-of-the-art trajectory prediction methods making significant contributions to the field of mobile networks.

KuVS Newsletter

Hugo Leonardo Melo dos Santos

Universität Bern (advisor Torsten Braun)

Title: Multimedia Service Orchestration in Multi-tier Edge Computing Environments

Abstract:

High Definition Video on Demand (VoD) and immersive multimedia services, such as Virtual Reality (VR) and Augmented Reality (AR), have been attracting thousands of new users every day for digital spaces. Static and mobile users usually watch multimedia services during entertainment, retailing, gaming, training, traveling, advertising, and commuting activities. However, multimedia services have stringent requirements in terms of Quality of Service (QoS) and Quality of Experience (QoE) support for static and/or mobile users in heterogeneous cloud-based ecosystems. Thus, new efficient approaches for orchestrating networking and computing resources and distributing multimedia flows in multi-tier mobile edge computing environments are required. The orchestration schemes must be developed to choose suitable edge nodes to execute multimedia-based services while improving the usage of networking and computing resources and providing QoE/QoS support for static and/or mobile users. This thesis contributes to efficiently meeting VoD, VR, and AR services needs in multi-tier edge computing environments. The first contribution is a service orchestrator to define an appropriate edge node to stream VoD, considering QoE, QoS, and monetary costs. The second contribution is a mobile-aware orchestrator that cooperates with edge nodes on the ground space and selects and places flying edge nodes to improve multimedia flow distribution with QoS support in congestion or failure periods. The third contribution is a mobility-aware Service Function Chaining (SFC) orchestrator for static and mobile scenarios. The proposed scheme aims to map, instantiate, and re-instantiate Service Function (SF) into multiple edge nodes considering networking and computing parameters. The proposed solutions were widely compared to related works on different scenarios. The results show that the proposed approaches outperform the state-of-the-art schemes.

KuVS Newsletter

Diego Oliveira Rodrigues

Universität Bern (advisor Torsten Braun)

Title: Mobility-aware Software-Defined Service-Centric Networking for Service Provisioning in Urban Environments.

Abstract:

Disruptive applications for mobile devices, such as the Internet of Things, Connected and Autonomous Vehicles, Immersive Media, and others, have requirements that the current Cloud Computing paradigm cannot meet. These unmet requirements bring the necessity to deploy geographically distributed computing architectures, such as Fog and Mobile Edge Computing. However, bringing computing close to users has its costs. One example of cost is the complexity introduced by the management of the mobility of the devices at the edge. This mobility may lead to issues, such as interruption of the communication with service instances hosted at the edge or an increase in communication latency during mobility events, e.g., handover. These issues, caused by the lack of mobility-aware service management solutions, result in degradation in service provisioning. The present thesis proposes a series of protocols and algorithms to handle user and service mobility at the edge of the network. User mobility is characterized when user change access points of wireless networks, while service mobility happens when services have to be provisioned from different hosts. It assembles them in a solution for mobility-aware service orchestration based on Information-Centric Networking (ICN) and runs on top of Software-Defined Networking (SDN). This solution addresses three issues related to handling user mobility at the edge: (i) proactive support for user mobility events, (ii) service instance addressing management, and (iii) distributed application state data management. For (i), we propose a proactive SDN-based handover scheme. For (ii), we propose an ICN addressing strategy to remove the necessity of updating addresses after service mobility events. For (iii), we propose a graph-based framework for state data placement in the network nodes that accounts for user mobility and latency requirements. The protocols and algorithms proposed in this thesis were compared with different approaches from the literature through simulation. Our results show that the proposed solution can reduce service interruption and latency in the presence of user and service mobility events while maintaining reasonable overhead costs regarding control messages sent in the network by the SDN controller.

KuVS Newsletter

Jakob Schärer

Universität Bern (advisor Torsten Braun)

Title: A Distributed Audit Trail for the Internet of Things

Abstract:

Sharing Internet of Things (IoT) data over open-data platforms and digital data marketplaces can reduce infrastructure investments, improve sustainability by reducing the required resources, and foster innovation. However, due to the inability to audit the authenticity, integrity, and quality of IoT data, third-party data consumers cannot assess the trustworthiness of received data. Therefore, it is challenging to use IoT data obtained from third parties for quality-relevant applications. To overcome this limitation, the IoT data must be auditable. Distributed Ledger Technology (DLT) is a promising approach for building auditable systems. However, the existing solutions do not integrate authenticity, integrity, data quality, and location into an all-encompassing auditable model and only focus on specific parts of auditability. This thesis aims to provide a distributed audit trail that makes the IoT auditable and enables sharing of IoT data between multiple organizations for quality relevant applications. Therefore, we designed and evaluated the Veritaa framework. The Veritaa framework comprises the Graph of Trust (GoT) as distributed audit trail and a DLT to immutably store the transactions that build the GoT. The contributions of this thesis are summarized as follows. First, we designed and evaluated the GoT a DLT-based Distributed Public Key Infrastructure (DPKI) with a signature store. Second, we designed a Distributed Calibration Certificate Infrastructure (DCCI) based on the GoT, which makes quality-relevant maintenance information of IoT devices auditable. Third, we designed an Auditable Positioning System (APS) to make positions in the IoT auditable. Finally, we designed a Location Verification System (LVS) to verify location claims and prevent physical layer attacks against the APS. All these components are integrated into the GoT and build the distributed audit trail. We implemented a real-world testbed to evaluate the proposed distributed audit trail. This testbed comprises several custom-built IoT devices connectable over Long Range Wide Area Network (LoRaWAN) or Long-Term Evolution Category M1 (LTE Cat M1), and a Bluetooth Low Energy (BLE)-based Angle of Arrival (AoA) positioning system. All these low-power devices can manage their identity and secure their data on the distributed audit trail using the IoT client of the Veritaa framework. The experiments suggest that a distributed audit trail is feasible and secure, and the low-power IoT devices are capable of performing the required cryptographic functions. Furthermore, the energy overhead introduced by making the IoT auditable is limited and reasonable for quality-relevant applications

KuVS Newsletter

Manoj R. Rege

TU Berlin (advisor Adam Wolisz)

Title: Lowering Barriers to Mobile Cloud Computing (MCC) Application Testing and Evaluation

Abstract:

The last decade has ushered in a new era of Mobile Cloud Computing (MCC) applications. The MCC application's behavior is primarily impacted by its operational conditions, also known as context. Thus, testing & evaluating an MCC application under the impact of various contexts is essential. Such an approach to testing & evaluating MCC applications is called context-aware testing & evaluation. The MCC application context can be categorized into four main types - hardware, software, communication network, and sensor. The context is characterized by heterogeneous interdependent factors, also called modalities, which may change over time. These modalities include the hardware capabilities and the Operating System (OS) software of the mobile device. Other modalities include the mobile devices sensor like camera, location, accelerometer, and magnetometer. Furthermore, modalities also consist of the different mobile network types like Wi-Fi, 4G/LTE, and 5G, and their Quality of Service (QoS) metrics, namely, access time latency, bandwidth, and packet loss. Context-aware testing & evaluation is a big challenge for MCC application developers for various reasons: (1) They typically lack sufficient understanding of the context and the interdependencies of the modalities in which the application runs, (2) There are no readily available tools to generate systematic context comprised of interdependent modalities, (3) Developers lack domain knowledge to build context generation tools, and (4) they have time and cost constraints. Therefore, systematic context-aware testing is rarely pursued in practice. This work considers a hybrid option to context-aware testing of MCC applications across four different types of context. In particular, we use off-the-shelf emulators for mobile devices, model and emulate the mobile network, and use a real cloud backend. Our work lowers the barriers to context-aware MCC application testing & evaluation through a framework that facilitates and simplifies context specification and generation. Bridging the gaps in the realistic communication network and sensor context generation is the first pillar of this framework. And improving the ease of generation by specifying the context as a code forms its second pillar. In the communication network context, we address the problem of realistic synthetic trace generation for various scenarios. We solve it by proposing a measurement- driven methodology based on transfer learning with Long Short Term Memory (LSTM) neural nets. The methodology requires a relatively short sample of the targeted con- text to adapt the presented base model to new contexts and simplify synthetic trace generation. We show the application of this approach on realistic Wi-Fi and LTE cloud access time models adapted for diverse target contexts with a trace size of 6000 samples measured over a few tens of minutes. We implement the methodology as a part of ContexPerf framework to generate synthetic access time traces. Finally, we integrate a network emulator in the framework to support emulation using synthetically generated access time traces. For the sensor context, we propose the ContextMonkey framework that supports realistic

trace-driven sensor context generation by leveraging traces in an interdependent manner from heterogeneous sources: remote trace databases, models, and trace files. It lessens the burden on the developers by automating the collection of interdependent traces, converting them to a common format, and feeding them to the mobile device emulator in an orchestrated manner. The framework architecture supports multiple data sources and mobile device emulators, is extensible to be integrated with new context modalities, and is seamless such that no application code changes are necessary to execute the application under the effect of context. Further, we also address the problem of context modeling and specification for context-aware testing & evaluation. We use the Model Driven Engineering (MDE) approach that enables MCC application developers to model a context and then transform that model into specification code. A Directed Acyclic Graph (DAG) based context model is proposed where nodes represent context category type & its modalities and interdependencies between them are defined using directed edges. The APIs are provided to transform the model to code, which can then be integrated with the MCC application test code. Using examples, we demonstrate how a context is modeled and transformed into its specification code. Our expressivity evaluation shows that one can successfully generate common MCC application contexts using the DAG-based model. Further, with low to moderate programming effort - 89 and 188 Lines of Code (LoC) in our examples, an application developer can specify context as a code; this demonstrates the model's and the specification API's simplicity in context generation. Finally, we present four case studies demonstrating our solution framework's simplicity and potential to ease context-aware testing & evaluation. Our sensor context case studies highlight the impact of the context-aware testing setup and traces used in simulation on the test results and their accuracy. On the other hand, the network context case studies demonstrate the superiority of synthetic access time traces in providing a better quantile assessment of the QoE metrics compared to the simple normal distribution-based access time models.

KuVS Newsletter

Taylan Şahin

TU Berlin (advisor Adam Wolisz)

Title: Resource Allocation for Vehicle-to-Vehicle Communications under Intermittent Cellular Coverage

Abstract:

Vehicle-to-vehicle (V2V) communication is a key technology to enable safer, more efficient, and more comfortable road traffic. The stringent reliability and latency requirements of V2V messages necessitate efficient radio resource management given the scarce spectrum and the dynamic vehicular environment. Under cellular network coverage, the resource allocation can be centrally coordinated by a base station (BS), which can efficiently ensure collision-free transmissions. When out of coverage, vehicles resort to distributed mechanisms, which yet suffer from degraded communication quality due to the vehicles' limited local view. In this thesis, we propose a novel approach for V2V communications in expected, delimited out-of-coverage areas (DOCAs), whereby a centralized scheduler pre-assigns resources to the vehicles via the BSs surrounding the area, before vehicles enter it. We first explore the feasibility of this approach by exploiting the road and data traffic information available in coverage to reserve and provision the resources. While the required number of resources does not grow prohibitively with increased reliability targets, the rate of successful V2V transmissions gets highly impacted by various factors such as vehicle mobility, thus necessitating efficient means to cope with uncertainties in DOCAs. As a predictive method for resource allocation, we propose a vehicular reinforcement learning scheduler, VRLS, which is applicable to DOCAs that vary in vehicle density, mobility, wireless channel characteristics, and resource configurations. VRLS can significantly increase resource utilization efficiency by requiring fewer resources than state-of-the-art distributed scheduling solutions to support the same reliability targets. Nevertheless, considering that the performance of learning-based solutions may degrade upon parameter distributions much beyond their training environment, we propose a hybrid scheme that combines the centralized RL-based and the distributed sensing-based scheduling approaches. We show the performance benefits of such a solution under heavily congested road traffic due to an accident, as compared to either of the centralized or the distributed solutions. Finally, we shift our focus to those areas under network coverage where vehicles suffer from rather short and unpredictable coverage interruptions to the BSs. We consider an extension of our RL-based approach for this problem. The proposed solution performs better than the state-of-the-art baseline in the cases of coverage losses, especially under high traffic load and lower frequency of scheduling updates, otherwise delivering similar performance.

KuVS Newsletter

Alexander Jahl

Universität Kassel (advisor Kurt Geihs)

Title: Situative teams in cooperative autonomous systems

Abstract:

Distributed systems have been established in many areas of IT and will play an even more significant role in the future. Such systems are no longer limited to specific fields of application but interconnect many different domains. They encompass, e. g. Cloud Computing, Internet of Things, service robotics, and autonomous vehicles. The integrated sub-systems communicate in order to exchange information and, if necessary, perform tasks together. Moreover, the number of interconnected sub-systems is constantly growing. That makes it challenging to administrate them without a certain degree of autonomy. Furthermore, these systems should also be able to handle new tasks without previously specified adaptations. The demand for solutions that consider these circumstances is therefore growing at the same rate.

It leads to the question of what such a system could look like. The novel approach presented in this thesis focuses on distributed systems composed of idle executing units in the initial state, i. e. they do not necessarily execute a task or pursue a goal. Instead, tasks assign themselves to units under certain conditions at runtime. Therefore, tasks themselves specify these conditions. Furthermore, tasks can decide independently about their assignment to executing units. Thus the task assignment takes place depending on the currently provided properties and capabilities of individual units and by considering the needs of the tasks. As a result, single tasks are not necessarily tailored to specific units. In addition, dependencies between tasks lead to automatic team formations. They dissolve after all tasks have been completed.

The provided solution approach defines several models. Therefore, the approach adopts a unique perspective on the organisational structure. The first model specifies relationships and dependencies of properties, abilities, and behaviours. The second model describes the assignment of tasks to suitable executing units. Finally, the third model considers the reusability of behaviours to become more independent of predefined definitions and enable existing executing units to fulfil previously unknown novel tasks. Furthermore, it opens the possibility of evaluating the quality of the execution and, if necessary, suggesting more appropriate alternatives for behavioural implementations, which requires adequate learning mechanisms.

KuVS Newsletter

Johannes Zerwas

TU Munich (advisor Wolfgang Kellerer)

Title: Design and Evaluation of Demand- and Topology Reconfiguration-aware Networks

Abstract:

The digitalization of our society has led to the adoption of novel data-centric applications and use cases that rely on communication networks. In turn, networks and their operators face new challenges with respect to traffic growth, diversity of communication patterns, and temporal variability of communication demand. Besides the softwarization of the networks through control and data plane programmability, the programmability and reconfiguration of the topology have emerged as one promising approach to render network operation more efficient. Optical technologies allow reconfiguring the topology, i.e., changing the connectivity between networking devices at run-time. However, this results in new problems and challenges for network management. For instance, every reconfiguration interrupts connectivity, which in turn puts stress on the network's control and data plane.

This thesis investigates topological reconfiguration-awareness in demand-aware networks on a macroscopic level by exploring the characteristics of topological reconfigurability in communication networks along three dimensions: reconfiguration delay, networking layers involved in reconfigurations, and reconfiguration classes.

The reconfiguration delay, i.e., the length of the interruption due to reconfiguration, directly impacts the network operation efficiency. It can vary widely depending on the equipment used. In addition to the optical switching devices, also the link endpoints contribute to this delay. In order to investigate this first characteristic and provide a better understanding of how commercially off-the-shelf (COTS) networking devices behave under reconfigurations, this thesis presents procedures to measure the end-to-end reconfiguration delay on the control and data plane. It also analyzes the results of a measurement campaign of COTS networking devices and derives statistical models of the reconfiguration delay. The results show, a strongly varying behavior across the devices. Finally, the thesis introduces a flexible emulation framework that aids the evaluation of different reconfigurable topologies using only COTS equipment. The second dimension is motivated by the fact that topological reconfigurations unavoidably lead to reconfigurations on higher networking layers, e.g., the IP routing. The question arises if and how these reconfigurations can be jointly optimized with the topological reconfigurations. This thesis assesses the benefits of such joint optimization and reconfiguration of multi-layer networks. It provides a multi-layer modeling and corresponding mixed integer program for a cooperative environment between an Internet Service Provider (ISP) and content providers (CPs). In contrast to previous work, the proposed joint optimization spans the IP topology, IP routing, and the demand layer. The evaluation on production data from a large ISP demonstrates its benefits across a range of reconfiguration frequencies, achieving 15% reduction in deployed capacity on average.

As far as the reconfiguration classes are concerned, there are two classes: demand-aware (DA)

and demand-oblivious (DO). Utilizing their potential requires agility of the routing algorithms and control planes. This is particularly the case for datacenter network (DCN) environments with frequent reconfigurations. As the timely propagation of an up-to-date view of the network is challenging, many designs fall back on separating the traffic on the dynamic (adaptive) topology part from that on the static part, creating a situation of segregated routing. This thesis proposes a novel, high-throughput reconfigurable datacenter network (RDCN) design, coined Duo, which builds on the properties of de Bruijn graphs. These graphs allow greedy routing along the shortest paths using local information. The property translates to the dynamic case facilitating the design of an efficient control plane. Duo can be implemented using longest prefix matching and provides out-of-the-box support for TCP and other transport protocols. The evaluation results demonstrate Duo's superiority over state-of-the-art solutions, and a proof-of-concept implementation shows its feasibility. The two reconfiguration classes have shown their benefits for different traffic patterns. Choosing the best-suited reconfiguration class is particularly challenging, as the traffic may be a mix of several patterns. This thesis proposes two systems that integrate both reconfiguration classes into a single topology and, thereby, introduces macroscopic awareness for the third characteristic of topological reconfigurations. The proposed systems Cerberus and Trio contain three subtopologies that are beneficial for different traffic patterns. The sub-topologies are sized to match the shares of the traffic classes in the overall traffic mix. Cerberus and Trio utilize flow sizes or application-level information to assign traffic to the best-suited sub-topology. In addition, using label-based source routing and link endpoint-based management of the sub-topologies' recon- figuration classes, Trio also features the ability to adapt the sizes of the sub-topologies. This enables Trio to continue matching the traffic even if the traffic mix changes – a new dimension of demand-awareness. The results show that both concepts outperform state-of-the-art solutions and illustrate the benefits of matching the reconfiguration classes in the topology to the traffic mix in terms of increased throughput and lower flow completion times.

KuVS Newsletter

Sai Kireet Patri

TU Munich (advisor Wolfgang Kellerer)

Title: Planning and Control of Disaggregated Quantum-Safe Optical Transport Networks

Abstract:

Optical communication networks have become an essential element of long-distance and high-speed communication since their widespread deployment in the last two decades. The migration towards cloud data centers has increased the need for high-speed, high-capacity interconnection between critical sites. Moreover, as fifth-generation (5G) networks are being rapidly deployed across the globe and sixth-generation (6G) network requirements are currently being defined, network operators and service providers need to profitably deploy high-capacity optical networking devices. However, traditional optical networks based on a fixed-grid spectrum do not scale proportionally to such growth in demand and require expensive upgrades in terms of optical components and transmission bands. This dissertation introduces and evaluates heuristics and combinatorial optimization algorithms to plan optical networks capable of carrying high-capacity internet traffic over large geographical distances. Network studies conducted across different networks provide pivotal insight into the benefits and drawbacks of various upgrade decisions available to a long-haul network operator. Apart from studying the effects of different flexible optical terminals, the study of optical band transmission upgrades is also conducted for multiple reference optical networks. These studies show a clear advantage of using a combination of multiple optical transmission bands, along with flexible bandwidth variable transceivers, for meeting the traffic demands over the entire planning period. With the increased deployment of software-tunable optical components, the risk of device failure also increases. To mitigate this risk, a monitoring and fault localization mechanism is explored in this dissertation. The concept of network monitoring and device flexibility can be extended to include device disaggregation, where different optical device vendors adhere to open-source models, thereby driving down network deployment costs. Such deployments need to be emulated for network-wide effects, and cross-device functionality can be ironed out. In this dissertation, the control plane and orchestration of an open-source disaggregated optical device are deployed as a simulation, and several operations are tested. To guarantee their users' protection against data theft and espionage, network operators are exploring the deployment of quantum-safe approaches in their flexible optical networks. The devices needed for such a network should also be planned, and the keys generated by such quantum-safe techniques need to be managed and controlled using existing network management principles. In this dissertation, we first plan the device placement for such a quantum-safe network and then delve into key management methodologies to enable end-to-end security against quantum computer attacks.

KuVS Newsletter

Patrick Krämer

TU Munich (advisor Wolfgang Kellerer)

Title: Design, Implementation, and Evaluation of Data-driven Algorithms for Networking

Abstract:

(Communication) Service Providers (SPs) face increasing demand in data rate and high diversity in service requirements. To meet increasing demand and diverse services, SPs look towards a cloud-native approach to networking. Cloud-Native Communication Networks promise to meet increasing demand and satisfy diverse service requirements cost-efficiently by implementing Network Functions (NFs) as containerized microservices, enabling cloud-style automation and orchestration patterns for communication networks. The resulting Cloud-Native Communication Networks increase the network infrastructure's utilization and thus lower the cost of operation. Further, a cloud-native approach to networking shortens innovation cycles and speeds up service development, enabling distinguishing service quality and exploration of new business models.

To realize the benefits of Cloud-Native Communication Networks, specialized resource management, and packet processing algorithms are required. Specialized resource management and packet processing algorithms allow Cloud-Native Communication Networks to operate efficiently and achieve distinguishing service quality. Thus, the development of resource management and packet processing algorithms must keep pace with the shorter innovation cycles and faster service development. However, developing customized algorithms is challenging due to the large number of Containerized Network Functions (CNFs) resulting from the microservice-based implementation of NFs, and the need to incorporate use-case-specific properties into the algorithm design to make the algorithms efficient. Developing such algorithms takes time, effort, and expertise, potentially reducing the efficiency of Cloud-Native Communication Networks.

To match the development of algorithms to the complexity and agility of Cloud- Native Communication Networks, academia and industry look towards Machine Learning (ML) and Artificial Intelligence (AI). ML and AI can accelerate the algorithm design through the automatic extraction of patterns in data, allowing SPs to automate the specialization of resource management and packet processing algorithms to their specific use cases in an automated manner. Successfully designing, implementing, deploying, and maintaining ML-enabled communication networks is thus an important aspect for the operation of Cloud-Native Communication Networks.

This thesis presents approaches to automate the algorithm design for three prototypical networking use cases. As a first use-case, this thesis presents a microservice-based, ML-enabled traffic classification system deployable at the network edge that identifies the website a user accesses. As a second use case, this thesis shows an ML-enabled TE system that automates the design of a distributed TE mechanism for a given TE policy. As a third use case, this thesis presents an ML-enabled CNF platform that optimizes the co-location of CNFs on CPU cores, resulting in improved resource utilization. This thesis shows the feasibility of each ap-

plication scenario through prototypical implementations and testbed evaluations. Finally, this thesis summarizes the gained experience from over 30 ML projects in networking into a process model providing guidelines to develop ML-enabled systems in the context of communication networks successfully.

KuVS Newsletter

Dominik Danner

Universität Passau (advisor Hermann de Meer)

Title: Towards Quality of Service and Fairness in Smart Grid Applications

Abstract:

Due to the increasing amount of distributed renewable energy generation and the emerging high demand at consumer connection points, e. g., electric vehicles, the power distribution grid will reach its capacity limit at peak load times if it is not expensively enhanced. Alternatively, smart flexibility management that controls user assets can help to better utilize the existing power grid infrastructure for example by sharing available grid capacity among connected electric vehicles or by disaggregating flexibility requests to hybrid photovoltaic battery energy storage systems in households. Besides maintaining an acceptable state of the power distribution grid, these smart grid applications also need to ensure a certain quality of service and provide fairness between the individual participants, both of which are not extensively discussed in the literature. This thesis investigates two smart grid applications, namely electric vehicle charging-as-a-service and flexibility-provision-as-a-service from distributed energy storage systems in private households.

The electric vehicle charging service allocation is modelled with distributed queuing-based allocation mechanisms which are compared to new probabilistic algorithms. Both integrate user constraints (arrival time, departure time, and energy required) to manage the quality of service and fairness. In the queuing- based allocation mechanisms, electric vehicle charging requests are packetized into logical charging current packets, representing the smallest controllable size of the charging process. These packets are queued at hierarchically distributed schedulers, which allocate the available charging capacity using the time and frequency division multiplexing technique known from the networking domain. This allows multiple electric vehicles to be charged simultaneously with variable charging currents. To achieve high quality of service and fairness among electric vehicle charging processes, dynamic weights are introduced into a weighted fair queuing scheduler that considers electric vehicle departure time and required energy for prioritization. The distributed probabilistic algorithms are inspired by medium access protocols from computer networking, such as binary exponential backoff, and control the quality of service and fairness by adjusting sampling windows and waiting periods based on user requirements.

The second smart grid application under investigation aims to provide flexibility provision-as-a-service that disaggregates power flexibility requests to distributed battery energy storage systems in private households. Commonly, the main purpose of stationary energy storage is to store energy from a local photovoltaic system for later use, e. g., for overnight charging of an electric vehicle. This is optimized locally by a home energy management system, which also allows the scheduling of external flexibility requests defined by the deviation from the optimal power profile at the grid connection point, for example, to perform peak shaving at the transformer. This thesis discusses a linear heuristic and a meta heuristic to disaggregate a flexibility request to the single participating energy management systems that are grouped into a flexibility pool. Thereby, the linear heuristic iteratively assigns portions of the power flexibility

to the most appropriate energy management system for one time slot after another, minimizing the total flexibility cost or maximizing the probability of flexibility delivery. In addition, a multi-objective genetic algorithm is proposed that also takes into account power grid aspects, quality of service, and fairness among participating households. The genetic operators are tailored to the flexibility disaggregation search space, taking into account flexibility and energy management system constraints, and enable power-optimized buffering of fitness values.

Both smart grid applications are validated on a realistic power distribution grid with real driving patterns and energy profiles for photovoltaic generation and household consumption. The results of all proposed algorithms are analyzed with respect to a set of newly defined metrics on quality of service, fairness, efficiency, and utilization of the power distribution grid. One of the main findings is that none of the tested algorithms outperforms the others in all quality of service metrics, however, integration of user expectations improves the service quality compared to simpler approaches. Furthermore, smart grid control that incorporates users and their flexibility allows the integration of high-load applications such as electric vehicle charging and flexibility aggregation from distributed energy storage systems into the existing electricity distribution infrastructure. However, there is a trade-off between power grid aspects, e. g., grid losses and voltage values, and the quality of service provided. Whenever active user interaction is required, means of controlling the quality of service of users' smart grid applications are necessary to ensure user satisfaction with the services provided.

KuVS Newsletter

KuVS Calls and Announcements

In this section you find an overview on calls for papers and participation in the german-speaking area.

5th KuVS Expert Talk on Localization
https://www.kuvs.de/
6 & 7 June 2024 @CoSA Center of Excellence
Technische Hochschule Lübeck

5th KuVS Expert Talk on Localization

General Chair

Horst Hellbrück TH Lübeck

Technical Program Committee

Marco Cimdins	TH Lübeck
Marco Gunia	TU Dresden
Hossein Shoushtari	HCU

Organization

Marco Cimdins TH Lübeck

Important Dates

Abstract Submission:	12.04.2024
Notification of Acceptance:	03.05.2024

We announce the 5th Expert Talk on Localization of GI/ITG specialist group Communication and Distributed Systems. The objective of this Expert Talk is intense discussions among researchers from academia and industry in this challenging area.

Scope: Localization is a major technology in the field of medical, industrial, and logistics applications. The Expert Talk offers researchers a platform to discuss recent results of their work and share opinions with each other. They are invited to discuss current issues and upcoming challenges. The Expert Talk on Localization features a demo session. The demo session is dedicated to the presentation of practical results, e.g., localization systems, sensors, applications, and other contributions.

We invite contributions (abstracts, demos) of topics on localization, positioning, and related concepts.

Topics included (but are not limited to)

- Novel ideas and concepts about localization, positioning, and navigation
- Applications (e.g., IoT, industry 4.0, autonomous vehicles, sensor networks robotics, logistics, medical, safety, smartphones)
- Sensors for ranging or positioning (UWB, IMU, RFID, RSS, Phase-based, optical,…)
- Robustness, reliability, scalability, networking, data communication, localization infrastructure
- Mapping or SLAM
- Context, privacy

We plan a demo, and a technical exhibition session as well as panel discussions. Please contact us if you are interested in presenting a demonstrator, in addition to submitting an abstract.

Abstract submission:

Authors are requested to submit abstracts limited up to three pages in a two-column IEEE conference format. Abstracts must present original research. Late-breaking advances and work-in-progress reports from ongoing research are appreciated. We also encourage you to submit failed ideas as it might spawn interesting discussions. Please submit your abstract via EasyChair by 12.04.2024.

Presentation:

Authors of accepted submissions are expected to present their work during the event.

Feel free to send your questions to cosa-papers@th-luebeck.de.

TECHNISCHE HOCHSCHULE LÜBECK

CoSA Center of Excellence

Gesellschaft für Informatik

KuVS Newsletter

Einladung zur KuVS Summer School “Internet of Bio-Nano Things” vom 18. bis 20. Juni 2024 in Hohwacht (Ostsee)

Nach längerer Pause findet im Jahr 2024 erstmals wieder eine KuVS Summer School für Nachwuchswissenschenschaftlerinnen und -wissenschaftler statt. Thema wird das “Internet of Bio-Nano-Things” (IoBNT). Das IoBNT stellt eine bahnbrechende Schnittstelle zwischen Biotechnologie, Nanotechnologie und Informations- und Kommunikationstechnologien dar. In dieser aufstrebenden Disziplin werden biologische und nanoskalige Komponenten so entwickelt, dass sie mit dem Internet kommunizieren können, wodurch unglaubliche Möglichkeiten in Bereichen wie Medizin, Umweltschutz und industrielle Prozesse entstehen. Durch die Nutzung biologischer Prozesse auf molekularer Ebene können IoBNT-Systeme beispielsweise in der Medizin zur zielgerichteten Arzneimittelabgabe oder zur Überwachung von Gesundheitszuständen eingesetzt werden. Gleichzeitig ermöglichen sie in der Umweltüberwachung eine präzise Erfassung und Analyse von Daten auf mikroskopischer Ebene. Diese innovative Verschmelzung von Bio- und Nanotechnologie mit dem Internet eröffnet somit ein weites Spektrum an Anwendungen, die sowohl die Effizienz bestehender Prozesse verbessern als auch vollkommen neue Lösungsansätze in Wissenschaft und Technik bieten.

Die dreitägige IoBNT Summer School bietet inspirierende Vorträge von führenden Expertinnen und Experten, praktische Übungen mit Simulatoren und interaktive Diskussionsrunden, die den Teilnehmerinnen und Teilnehmern ein tiefes Verständnis für die Integration biologischer und nanotechnologischer Elemente in das Internet ermöglichen werden. Über drei Tage hinweg werden die neuesten Entwicklungen, Anwendungen und Herausforderungen dieses span-

nenden interdisziplinären Feldes erkundet und dabei sowohl theoretische Grundlagen als auch praktische Anwendungsbeispiele umfassend beleuchtet.

Die Summer School findet vom 18. bis 20. Juni 2024 im Ferienort Hohwacht an der Ostsee im Hotel Hohe Wacht statt. Nach der Vorabendanreise am 17. Juni erstreckt sich das attraktive wissenschaftliche Programm über die folgenden drei Tage, wobei am Mittwochnachmittag ein Social Event vorgesehen ist. Auch für die Nutzung des unmittelbar angrenzenden Strandes wird ausreichend Zeit sein ;-) Das Programm endet Donnerstag nach dem Mittagessen. Die Tagungsgpauschale inklusive Teilnahme an allen Sitzungen, dem Social Event, drei Übernachtungen im Hotel Hohe Wacht, Vollpension sowie Kaffeepausen und Getränken wird sich voraussichtlich auf ca. 850 Euro belaufen. Weitere Informationen sind auf https://kuvs-summerschool-2024.com/ verfügbar. Die Summer School wird von der Fachgruppe Kommunikation und verteilte Systeme der Gesellschaft für Informatik, der Deutschen Forschungsgemeinschaft, dem Lehrstuhl für Kommunikationsnetze der TU München und dem Institut für Telematik der Universität zu Lübeck unterstützt.

Es stehen insgesamt 25 Plätze zur Verfügung. Erfahrungsgemäß sind diese schnell vergeben, so dass wir um frühzeitige Anmeldung auf https://kuvs-summerschool-2024.com/ bitten. Die Vergabe der Plätze erfolgt entsprechend der Reihenfolge der Anmeldungen; kostenfreie Abmeldung ist bis zum 30. April 2024 möglich. Gehen mehr Anmeldungen ein als Plätze verfügbar sind, wird eine Warteliste eingerichtet. Weitere Informationen bekommen Sie auch von Prof. Dr. Stefan Fischer, stefan.fischer@uni-luebeck.de.

Dezember 2023

Stefan Fischer und Wolfgang Kellerer

KuVS Newsletter

Open Positions

The **University of Passau** owes its strong visibility and good repute to excellent research, innovative teaching and its tight-knit international academic networks. Some 11,000 students and more than 1,300 staff study and work on our University campus, which is located a stone's throw from the historical Old Town of Passau and combines state-of-the-art technical infrastructure with award-winning architecture. Internationally successful high-tech companies and a vibrant start-up scene, coupled with a rich culture and Lower Bavarian traditions, give Passau and the surrounding area a special appeal that makes it a great place to live and work.

The **Chair of Computer Networks and Computer Communications** (Professor Hermann de Meer) at the Faculty of Computer Science and Mathematics is seeking a

Graduate Research Assistant / Graduate Research Associate (m/f/d) in full-time

or post-doctoral researcher (m/f/d) in part-time position

to start at the next possible date. The position is initially limited to one year with the option of renewal.

Duties and responsibilities

- Collaborate on the research project "Powering the METAmorphosis of BUILDings towards a future decarbonised and sustainable energy system – META-BUILD" funded by the European Commission or on other projects in various research fields related to networks, e.g. software defined networks, network function virtualisation, virtual network embedding
- Take on tasks in teaching, research and self-administration

Person specification

- Must have an excellent (university) master's degree in computer science or a related field
- Excellent knowledge of computer networks and computer communications
- Good knowledge of energy informatics is an advantage
- Proficiency in German and English (both spoken and written)
- We are looking for a team player with mental agility, who is open-minded and able to work independently and responsibly, even under pressure

What we offer you

- The opportunity to pursue a doctoral degree
- Collaboration with employees of respected business enterprises and renowned scientists
- If expedient: participation in project meetings and conferences
- Remuneration in accordance with pay grade E13 of the German public-sector collective agreement TV-L; the salary step depends on the candidate's qualifications and experience
- A rewarding, diverse and challenging academic position on a modern, verdant campus located on the banks of the river Inn, a few minutes' walk from the historic Old Town of Passau
- A great work climate in a family-friendly environment

The University of Passau actively promotes equal opportunities for all genders as well as diversity in the workforce; therefore, applications are welcome from all candidates who fulfil the requisite qualifications, without regard to gender, cultural or social background, religion, world view, disability or sexual identity.

As the University of Passau wishes to raise the proportion of women in research and teaching, female academics are expressly encouraged to apply.

Registered disabled persons are given preference over non-disabled applicants who do not otherwise have statutory preferential status if their overall personal aptitudes, skills and qualifications are equal.

If you have any further questions about this position, please contact Professor Hermann de Meer by e-mail: sekhdm@uni-passau.de.

To apply, please send your full application with all supporting documents (including your curriculum vitae and school, training and work certificates) as **a single** pdf file to sekhdm@uni-passau.de by no later than **14 February 2024**. E-mailed applications are kept on file for six months after the conclusion of the appointment procedure, whereupon they are deleted from our systems.

Please visit www.uni-passau.de/en/university/current-vacancies for our data privacy statement.

Only the German version of this vacancy announcement is legally binding.

Die **Universität Passau** genießt durch exzellente Forschung, innovative Lehre und ein dichtes internationales Netzwerk hohe Sichtbarkeit und Ansehen. Rund 11.000 Studierende aus 100 Nationen und über 1.300 Beschäftigte lernen und arbeiten nahe der Altstadt auf einem Campus, der modernste technische Infrastruktur mit einer preisgekrönten städtebaulichen Anlage vereint. International erfolgreiche Hightech-Firmen und eine lebhafte Gründerszene, gepaart mit reicher Kultur und niederbayerischer Tradition, verleihen Stadt und Region Strahlkraft und tragen zur hervorragenden Arbeits- und Lebensqualität bei.

An der Fakultät für Informatik und Mathematik der Universität Passau ist am **Lehrstuhl für Informatik mit Schwerpunkt Rechnernetze und Rechnerkommunikation** (Herr Professor Dr.-Ing. Hermann de Meer) zum nächstmöglichen Zeitpunkt eine Stelle einer/eines

Wissenschaftlichen Mitarbeiterin / Wissenschaftlichen Mitarbeiters (m/w/d)

in Vollzeit zunächst auf ein Jahr befristet mit der Möglichkeit der Verlängerung zu besetzen.

Ihre Aufgaben

- Mitwirkung am Forschungsprojekt „Regionale Energiezellen als Multi-Energy-Reallabore für eine schnelle Systemtransition - cells4.energy", das von der Österreichischen Forschungsförderungsgesellschaft mbH (FFG) gefördert wird, oder an anderen Projekten in verschiedenen Forschungsgebieten im Bereich Netzwerke, z. B. software defined networks, network function virtualisation, virtual network embedding
- Beteiligung an den Aufgaben der Arbeitsgruppe in Lehre, Forschung und Selbstadministration

Ihr Profil

- Sehr guter Master-Abschluss (Universität) in Informatik oder einem vergleichbaren Fachgebiet
- Sehr gute Kenntnisse in den Bereichen Rechnernetzwerke und Rechnerkommunikation
- Gute Kenntnisse im Bereich Energieinformatik sind von Vorteil
- Sichere Beherrschung der deutschen und englischen Sprache in Wort und Schrift
- Teamfähigkeit, Offenheit, Flexibilität sowie die Fähigkeit zu selbständigem und eigenverantwortlichem Arbeiten; Belastbarkeit

Wir bieten Ihnen

- Möglichkeit zur Promotion,
- Zusammenarbeit mit Beschäftigten angesehener Unternehmen und renommierten Personen aus der Wissenschaft,
- gegebenenfalls Teilnahme an Projekttreffen und Konferenzen,
- Eingruppierung und Stufenzuordnung in Entgeltgruppe 13 TV-L, je nach Qualifikation und Berufserfahrung,
- eine interessante, abwechslungsreiche und herausfordernde Tätigkeit auf einem modernen, idyllisch am Inn gelegenen Universitätscampus,
- ein angenehmes Arbeitsklima in familienfreundlicher Umgebung.

Die Universität Passau hat sich zum Ziel gesetzt, ihren Frauenanteil zu erhöhen, und fordert Frauen nachdrücklich zur Bewerbung auf. Teilzeitbeschäftigung ist möglich, sofern sich mehrere entsprechend qualifizierte Teilzeitkräfte bewerben und diese sich passend ergänzen.

Für Rückfragen steht Ihnen Herr Professor Dr.-Ing. de Meer (E-Mail: sekhdm@uni-passau.de) zur Verfügung.

Die Stelle ist für die Besetzung mit schwerbehinderten Menschen geeignet. Diese haben bei der Einstellung Vorrang vor gesetzlich nicht bevorrechtigten Personen bei im Wesentlichen gleicher Eignung, Befähigung und fachlicher Leistung.

Ihre Bewerbung richten Sie bitte per E-Mail mit aussagekräftigen Unterlagen (insbesondere Schul- und Ausbildungszeugnisse, Arbeitszeugnisse) nur im PDF-Format als ***eine*** Datei bis zum **14.02.2024** an sekhdm@uni-passau.de. Diese löschen wir sechs Monate nach Abschluss des Bewerbungsverfahrens.

Im Übrigen verweisen wir auf unsere Datenschutzhinweise, die auf folgender Seite abrufbar sind: http://www.uni-passau.de/universitaet/stellenangebote/

How 2 Shor10 English Texts

Riddles Based on a "Mathematically Oriented Reform" of English Orthography

Rolf Windenberg (alias: Nigel Fred Brown)

The Rules:

1. Usage of mathematical symbols and of numbers
2. Capital letters are pronounced as in the alphabet

Examples:

(Trafalgar)^2 [meaning: Trafalgar Square]

$\sqrt{\mathbf{66}}$ [meaning: Route 66]

Y R U so Z 2dA ? [meaning: why are you so sad today ?]

The Riddles *(Solutions, see on next page)***:**

- *Beginners:* **I h8 U**
- *Playing with Capital Letters:* **2 DYd**
- *Advanced Persons:*
  4 U, ∅ sEms 2 B impossible
- *Experts:*
  (+y + s+ra) of10 tNd 2 dispute heavily
- *Geniuses:*
  I C th@ U R | lE | (l+own)

Fig. 1: Illustration to assist the reader in solving the fourth riddle (source: [1])

[1] Windenberg, R., Hasselfang, R.W.: How 2 Shor10 English Texts. Shaker Media Verlag, Düren, ISBN 978-3-95631-590-9, 2017

Solutions of the riddles (by Rolf Windenberg):

- I hate you [because: *I*-h-*eight*-*U*]
- to divide [because: *two*-*D*-*Y*-d]
- for you, nothing seems to be impossible [because: *four*-*U, nothing*-*s*-*E*-ms-*two*-*B*-impossible]
- Andy and Sandra often tend to dispute heavily [because: (*and*-y-*and*-s-*and*-ra)-of-*ten*-t-*N*-d-*two*-dispute-heavily]
- I see, that you are absolutely lonesome [because: *I*-*C*-th-*@*-*U*-*R*-*absolute*-l-*E*-l-*own*-*sum*]

KuVS Newsletter

Next Newsletter - Deadline May 15th

Next newsletter : 06/2024

Deadline for submissions and contributions : 15th May 2024

We ask you for submissions in English. Topics can be from the following time frame: December 2023 - May 2024.

- Fachgruppe KuVS
  - Geschäftsberichte der GI – KuVS – Fachgruppe
  - ...
- News from the working groups
  - Dissertations
  - Awards
  - News form persons
  - Open positions
  - ...
- New projects (DFG, BMBF, KMU, etc.)
  - Initiatives
  - Larger projects
  - ...
- Calls and news from events, conferences, etc.
  - Reports (Conferences, workshops, Fachgespräche, Dagstuhl, doctoral summer/winter schools, ...)
  - Call for papers and participation
    (conferences (supported by or hosted in Germany/Austria/Switzerland), Fachgespräche, Summer Schools, ...)
  - ...
- Announcements and important dates

The preferred submission format is text, e.g., using markdown language. Call for papers can also be submitted as PDFs.