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Editor Message

Dear KuVS members,

We welcome you to the 12th edition of the KuVS newsletter, shortly before Christmas and still during an ongoing global pandemic. Given the difficult circumstances this year, the KuVS community remained vibrant, which manifests in all the input we got from our KuVS members for this newsletter.

We are happy to present an edition that features reports, call for papers, and a high number of dissertations completed within the KuVS community.

Finally, at the end of the newsletter you find riddles from Rolf Windenberg (aka Nigel Fred Brown) 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 and wish you merry Christmas and a happy new year.

Ihre Newsletter Editoren,
Oliver Hohlfeld
BTU Cottbus–Senftenberg
Mathias Fischer
Universität Hamburg

Corinna Schmitt
Universität der Bundeswehr München
Andreas Blenk
TU München





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Fachgruppe KuVS

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Fachgruppe KuVS

2.1 Movement of persons

- **Prof. Dr.-Ing. Christoph Sommer** accepted an offer from TU Dresden as W3 full professor and chair of “Prozessmodellierung für vernetzte technische Systeme” (Networked Systems Modeling); more information is available on nsm.inf.tu-dresden.de.





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News from the Working Groups

3.1 News

- The paper “Comparing Fixed and Variable Segment Durations for Adaptive Video Streaming – A Holistic Analysis” authored by Susanna Schwarzmann (TU Berlin), Nick Hainke (TU Berlin), Thomas Zinner (NTNU Norwegen), Christian Sieber (TU München), Werner Robitza and Alexander Raake (TU Illmenau) received the **The DASH Industry Forum Excellence in DASH Award**.
- IEEE ComSoc has selected the journal publication “Towards a Cost Optimal Design for a 5G Mobile Core Network based on SDN and NFV” (IEEE Transactions on Network and Service Management, vol. 14, no. 4, pp. 1061-1075, July 2017) of Arsany Basta, Andreas Blenk and Wolfgang Kellerer et al. to be published as “IEEE ComSoc Selected Publication”. The video is available on the IEEE ComSoc YouTube channel: [Video Link](#)





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3.2 Finished PhD Theses

3.2.1 Björn Gernert (TU Braunschweig)

Title: **On the Usability of Wireless Sensor Networks in Smart Farming Applications**

Abstract: Wireless communication has become a vital part of modern life. In particular, the use of mobile phones is important for many people. In recent years, mobile networks have undergone a rapid transformation from analog telephony to digital data networks, thereby opening up completely new possibilities for private and commercial use.

The crucial factor for the robustness of these networks, however, is expanding mobile radio stations to cover as many areas as possible. Given that this expansion is being conducted in Germany by private commercial enterprises, it is not yet economically feasible to implement nationwide coverage. This leads to the situation where populated areas are served first, and rural areas are served either less or not at all. The focus on inhabited areas poses some challenges for Wireless Sensor Networks (WSNs) because the expansion of mobile communications in rural or cultivated areas is usually not possible, or it is very inadequate because of cost reasons. For applications in the context of Smart Farming or Precision Farming, however, a way is needed to transmit the measured sensor data or status messages to cloud services. One method to realize this data transmission is to use Delay Tolerant Networking. This dissertation examines the use of such networks by considering two different agricultural scenarios.

In one scenario, the use of WSNs in a large agricultural area is evaluated, where a heterogeneous wireless network of four different types of sensor nodes is considered. This network includes battery-powered and solar-powered sensor nodes, agricultural machines, and mobile devices. In the second scenario, a communication network is installed in a food storage warehouse, more specifically, a potato warehouse. The high water content of the potato creates a challenging environment for wireless communication between sensor nodes. A suitable radio for wireless communication of the measured data is determined over several iterations, and a communication protocol adapted to the situation is developed. The combination of both allows reliable data transmission between the sensor nodes and toward a data sink.

Finally, a routing protocol adapted to a special type of sensor node is presented. These sensor nodes essentially consist of two very contrasting units, an energy-saving part and a high-performance part. The presented protocol, Adaptive Wake-Up Routing, can abstract both parts in such a way that for other nodes, this double function is not noticeable and appears as one node. In addition, factors such as battery charge levels, time of day, and the amount of data to be sent are considered.





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3.2.2 Mikael Gasparyan (Uni Bern)

Title: Service-Centric Networking

Abstract: The current Internet is host-based, meaning that a content consumer needs to possess the content provider's address to retrieve the given content. Information-Centric Networking (ICN) is a future Internet architecture. ICN aims to substitute the current host-centric architecture of the Internet with an information-centric one. Service-Centric Networking (SCN) is a future Internet paradigm derived from ICN. SCN extends the ICN paradigm with service support; in SCN, services are the key component of the network. One of the most prominent ICN implementations is Named Data Networking (NDN). Our contributions in this doctoral thesis are the extension of NDN with service support and the satisfaction of SCN requirements. We have extended NDN with service support and developed architectures and mechanisms to satisfy a set of SCN requirements. The contributions are divided into two parts: L-SCN architecture and Session Support for SCN.

In the first part, we have developed L-SCN (layered SCN architecture with Supernodes and Bloom Filters), the first SCN routing architecture, which makes use of a two-layer forwarding scheme composed of inter-domain and intra-domain communication. Unlike existing SCN routing architectures relying on a flat organization, our design splits the network into domains. Nodes within a domain possess significant knowledge about existing services and available resources within the domain. Supernodes provide a significant advantage in comparison to other architectures. They assure the inter-domain communication and make use of a pull and push mechanism combined with Bloom filters. It allows us to minimize the protocol overhead and optimize the sharing of information about available services and resources in the network. We have extended the L-SCN architecture with an additional forwarding support mechanism and further communication approaches. The extended architectural approach offers alternative communication strategies and improves the design in multiple dimensions, such as service accessibility and protocol overhead. We make use of an extended version of the Named Link State Routing (NLSR) protocol to disseminate service provider prefixes and resource availability information within the network. We have designed a genuine parameter support scheme that enables us to identify the parameters contained in a given service request by using hashes computed for the parameters. Our design supports short and long types of service input parameters.

We have designed a genuine parameter support scheme that enables us to identify the parameters contained in a given service request by using hashes computed for the parameters. Our design supports short and long types of service input parameters. In the second part, we have designed the first service session support scheme for SCN. We extended NDN to support services and to prototype our session support. Our design makes use of existing hierarchical naming schemes to specify sessions using unique session identifiers. Sessions are established through a two-way handshake, which allows both the service consumer and provider to exchange their generated unique session identifiers. The concatenation of the unique identifiers produced by the consumer and the provider forms the session identifier for a given session. Upon the two-way information exchange, the intermediate nodes store the session identifier, which will enable





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them to forward requests concerning a given session towards the session provider. However, the session identifier is only known by the intermediate routers along the single path over which the session was established. Therefore, we have enhanced our session support mechanism with multipath routing capabilities, which enable the session requests to be forwarded over different paths towards the service provider of a given session. We present the design and evaluation of three multipath routing techniques. The first mechanism is based upon the propagating of session identifiers within the network using Bloom filters, the second design is based upon the propagation of service provider identifiers, and the third design uses piggybacking for the propagation of service provider identifiers.





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3.2.3 Eirini Kalogeiton (Uni Bern)

Title: Information-Centric Networking in Vehicular Ad-Hoc Networks

Abstract: Vehicular Ad Hoc Networks (VANETs) are characterized by intermittent connectivity, leading to disruption in their communication. The current Internet Protocol Suite supports end-to-end communication, where nodes requesting content need to know the exact address of the node holding it. Thus, to support intermittent connectivity, new architectures have to be designed and tested. Information Centric Networking (ICN) is an approach aiming at evolving the Internet architecture from host-centric to the content-centric. An implementation of ICN is Named Data Networking (NDN). NDN's main principle is that a content object can be distributed among network nodes solely on its name. This thesis proposes efficient solutions to improve the performance of NDN applications in VANETs that address the current communication challenges caused by vehicular mobility and wireless standards.

First, we study how we can reduce the number of broadcast messages in a VANET, since broadcasting of messages leads to waste of network resources (decrease of bandwidth and throughput). In our first contribution, to deal with broadcasting every message from every node, we investigate how creating unicast paths between vehicles improves the communication and the content retrieval process. By using unique identifiers on vehicles, we create routing entries targeting destination vehicles, i.e. which vehicles should receive each message. Furthermore, we install on vehicles multiple omnidirectional antennas to enable simultaneous reception and transmission of a message. This allows us to satisfy vehicular requests compared to the standard broadcast scheme. But, since omnidirectional antennas are installed on the vehicles, a message still occupies the wireless medium in all directions. Hence, in our next contribution we install directional antennas on vehicles, to further limit the dissemination area of messages, and to not occupy the channel of other vehicles outside of the spreading area of messages.

In this thesis we also study whether using deployed infrastructure that supports intermittent connectivity and resource management assists the content retrieval process. To perform so, we use street sensors (Road Side Unit (RSU)) that act as gateways that connect vehicles in VANETs. We create two routing protocols. In the first RSUs receive and send all messages from nodes, and in the second RSUs act as a back up mechanism for nodes. Indeed, we show that with their permanent use collisions occur, leading to continuous rejection of messages. To deal with this, in our final contribution, we propose the use of Software Defined Networking (SDN). SDN offers centralized control by decoupling the network control from its forwarding functions. We use SDN to construct vehicular paths, to install rules to the forwarding tables of vehicles and to adjust the RSUs transmission power to enable their connection with the maximum number of cars, without, however, rejecting all messages.

We evaluate our algorithms using simulation tools and realistic vehicular mobility traces and we show that the solutions proposed in this thesis are efficient and assist the content retrieval of an NDN application.





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3.2.4 Mostafa Karimzadeh (Uni Bern)

Title: Prediction Models to Enhance Location Based Services in Urban Area

Abstract: Mobility trace data typically includes historical information of the user's visited locations, which presents the visited places' detailed context and corresponding time-stamps. This collected data of moving objects (e.g, pedestrians, vehicles) enables new opportunities for prediction models to capture and estimate future movement patterns of individual or group users. Predicting future behavior of moving objects can foster Location-based Services (LBSs). LBSs can be defined as services that use the location of users to bring location-specific and personalized services and information to them.

To have successful LBSs, first, we need to extract frequently visited locations of users (e.g., home, workplace, etc.) from accumulated mobility traces. This source of information provides possibilities for building models to learn and estimate the future mobility of an individual or group of moving objects in large cities. However, due to spatio-temporal dependencies of urban environments and the time-varying characteristics of user's movement patterns, it is still challenging to discover urban hotspots (frequently visited locations), and predicting moving object's future movement.

This thesis aims to define prediction algorithms to accurately estimate future behavior for moving objects in urban areas. We benefit from this information to improve LBSs. This thesis key contributions can be summarized as follows: The first contribution is to detect users' hotspots in urban areas. We utilize spatio-temporal analysis on collected geo-location points to discover moving objects' frequently visited areas in city environments. The second contribution is to estimate the future location of pedestrians in the city environment. In this way, we design a mobility prediction algorithm that benefits from both first and second-order Markov chain algorithms. Third, we investigate predictors to estimate the future trajectory of moving objects (e.g., vehicles, pedestrians) in urban areas. A trajectory is a path that a moving object takes to travel from one location to another one. To make a trajectory prediction, we proposed two novel algorithms that are based on Markov chain and neural network algorithms. Fourth, we explore algorithms to estimate traffic flow on urban trajectories. A traffic flow estimator attempts to predict the future state of urban traffic in terms of the number of users in the trajectories. We propose two algorithms that can efficiently estimate future states of urban traffic. Additionally, we introduce two system models that benefit from mobility predictor and traffic flow predictor to enhance content prefetching and safety data dissemination for users, respectively. We evaluate our proposed algorithms and system models using two real-world and large-scale datasets collected from mobile networks and VANETs.





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3.2.5 Ali Marandi (Uni Bern)

Title: Bloom Filter Based Content Discovery and Retrieval for Information-Centric Networks

Abstract: Named Data Networking (NDN) requires routing protocols that use content object names for routing clients' requests. In this thesis, we develop routing protocols for NDN based on content advertisements that we compress using Bloom filters (BF). We propose push-based Bloom Filter-based Routing (BFR) and pull-based BFR for NDN. Push-based BFR advertises all provided content object names, while pull-based BFR only advertises the requested content object names. Therefore, pull-based BFR outperforms push-based BFR in terms of the required communication and storage overhead for content advertisements. To reduce content retrieval delay, we propose to use Network Coding (NC)-based content retrieval. We use the BF-based information distributed for content discovery to select network codes. The proposed NC-based protocol uses a constraint on the equation system size and BF-based feedbacks to control codeblock size. We show that the proposed NC-based protocol achieves lower average content block retrieval delay than push-based and pull-based BFR.

Service-Centric Networking requires load balancing mechanisms to route service requests. To address this requirement, Layered-Service Centric Networking (L-SCN) proposed to divide nodes into domains where each domain of nodes is managed by a supernode. However, L-SCN lacks algorithms to select supernodes in the network topology. We present supernode selection algorithms based on the construction of Dominating Sets (DS) and Connected Dominating Sets (CDS) over the network topology. Then, we propose intra-domain and inter-domain BF-based routing protocols for routing service requests. We show that our CDS-based routing protocols require much less bandwidth overhead for routing than both DS-based routing and NDN multicast strategy. Further, we show that both DS-based and CDS-based routing protocols achieve significantly less service retrieval delay than the NDN multicast strategy.





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3.2.6 Bruno Rodrigues (University of Zurich)

Title: Blockchain Signaling System (BloSS)

Abstract: Distributed Denial-of-Service (DDoS) attacks are one of the major causes of concerns for communication service providers. When an attack is highly sophisticated and no countermeasures are available directly, sharing hardware and defense capabilities become a compelling alternative. Future network and service management can base its operations on equally distributed systems to neutralize highly distributed DDoS attacks. A cooperative defense allows for the combination of detection and mitigation capabilities, the reduction of overhead at a single point, and the blockage of malicious traffic near its source.

Cooperative defense systems face many challenges, such as deployment complexity due to high coordination overhead, reliance on trusted and stable channels for communication and the need for effective incentives to bolster cooperation among all involved parties. These challenges impairing the widespread deployment of existing cooperative defense are: (a) high complexity of operation and coordination, (b) need for trusted and secure communications, (c) lack of incentives for service providers to cooperate, and (d) determination on how operations of these systems are affected by different legislation, regions, and countries.

Driven by challenges imposed in a cooperative network defense, Blockchain Signaling System (BloSS) is presented as an effective and alternative solution for security management, especially cooperative defenses, by exploiting Blockchains (BC) and Software-Defined Networks (SDN) for sharing attack information, an exchange of incentives, and tracking of reputation in a fully distributed and automated fashion. Therefore, BloSS was prototyped and evaluated through local and global experiments, without the burden to maintain, design, and develop special registries and gossip protocols.

Evaluation results based on the local and global prototyping of BloSS highlight its effectiveness in signaling information of large-scale DDoS attacks. The world-wide scale evaluation experimenting the interaction between Autonomous Systems' (AS) victim of DDoS attacks and ASes acting as mitigators, presented an average of 97 seconds to complete all eleven possible outcomes of the BloSS protocol. The reputation assessment, based on the transparency of actions carried out on BC using Beta reputation and individual thresholds of trust for each member, showed that the defined protocol is capable of punishing malicious providers and benefiting providers by acting honestly.

The definition of contracts in BloSS stipulates the cooperative logic based on BCs and allows for the increase of trust among cooperative operators due to their transparent exchange of selected information and respective incentives on a per request basis. Overall, the main achievement and advantages reached with the design, prototypical implementation, and evaluation of BloSS include (a) the use of an existing distributed infrastructure, the BC, to flare white- or black-listed IP addresses and to distribute incentives related to the mitigation activities requested. Furthermore, it provides a proof-of-concept for (b) a cooperative, operational, and efficient





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decentralization of DDoS mitigation services, and (c) a compatibility of BloSS with existing networking infrastructures, such as Software-Defined Networking (SDN) and BC.

Open Access to Dissertation: [SciDok](#)



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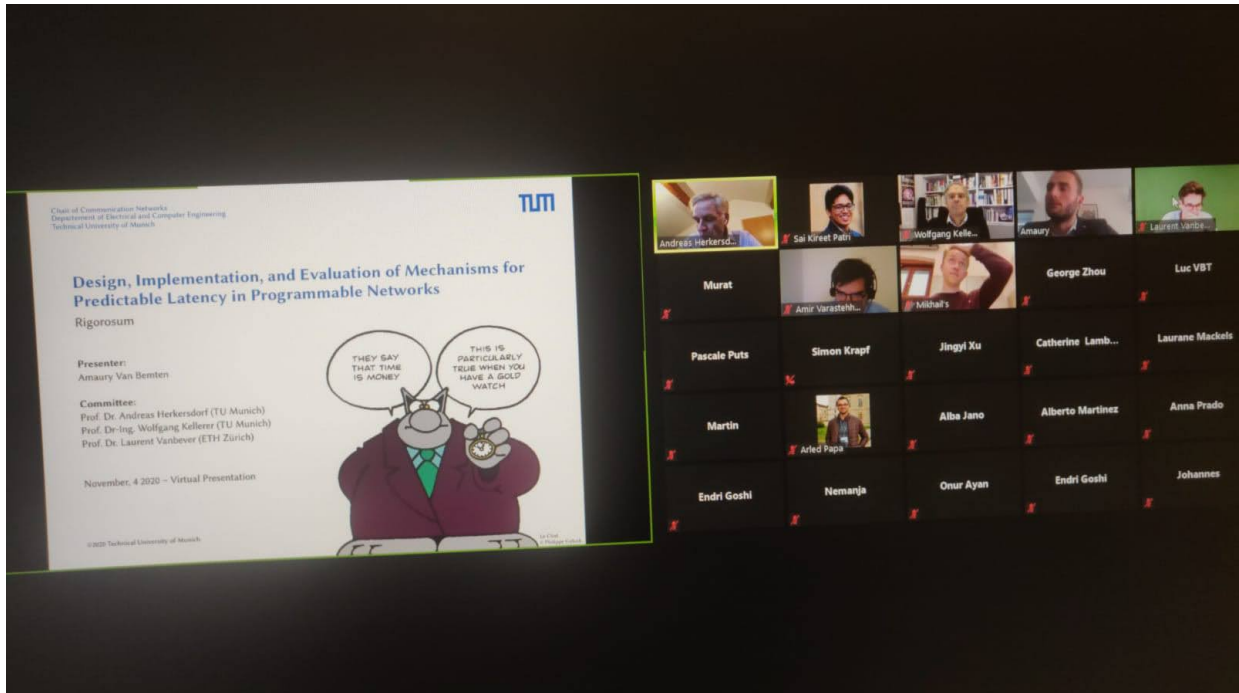
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3.2.7 Amaury van Bemten (TU Munich)

Title: Design, Implementation, and Evaluation of Mechanisms for Predictable Latency in Programmable Networks



Abstract: Communication networks form the backbone of our digital society, connecting users to data centers, data centers to each other, and sensors and actuators to automation controllers. This high connectivity enables the industry and public authorities to provide an ever growing plethora of services with systems such as the Internet of things, cyber-physical systems, smart cities, smart grids, cloud computing, and more generally, 5G networks. Ever since the deployment of the ARPANET and the first Internet node in 1969 at the University of California, Los Angeles, the Internet and communication technologies have grown and developed at an increasing pace. Originally designed for providing a simple best-effort connectivity, our modern digital society and its new applications and services now impose additional requirements for the underlying infrastructure. The quality of the service offered to users, customers, and tenants depends on the quality of service offered by the underlying communication infrastructure.

Generally, emerging applications require this underlying infrastructure to provide predictability, both from a correctness and from a performance point of view. Predictability is hard to achieve given the distributed nature of communication networks. As a result, the last decade has seen a shift from statically configured networks towards programmable networks, where the behavior of the network, and in particular of its constituting nodes, is not anymore governed by





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configuration files and an immutable logic, but rather by software that operates independently from the network hardware. Technologies such as OpenFlow and P4 enable network operators to remotely program the behavior of their network, thereby reducing costs and increasing flexibility, but most importantly allowing to cope with the heterogeneity and high variability of today's applications and communications. To which extent such technologies can provide the predictability required by modern applications is an ongoing research problem. This thesis investigates the particular problem of providing predictable latency to applications using programmable networks. Latency is a critical quality of service metric for applications, as guaranteed latency enables services to provide response time guarantees to their users, tenants, and customers. The focus of this thesis is on providing strict per-packet latency guarantees to users and applications. Providing predictability and strict determinism in distributed systems raises numerous interesting challenges and research questions.

Communication networks involve many components to transport data from one endpoint to the other. In fact, even the seemingly simple local task of forwarding a data packet from one port to the other involves many components, e.g., packet buffers, memory units, and queuing disciplines. As a result, gaining a deep understanding of all the involved components, the possible sources of delay, their causes and influential factors, is a challenging problem, especially given the fact that switching hardware has not been built with predictability in mind, but rather efficiency and statistical performance. This thesis provides measurement procedures and a predictability study of programmable forwarding devices. Results from this study are used to devise precise performance models of forwarding hardware. Such models are a required step towards the design of a network providing strict latency guarantees to its tenants. Our evaluations in several testbed setups show that the models we propose can provide worst-case end-to-end latency guarantees to applications without sacrificing network utilization.

With a setup involving a centralized controller configuring forwarding components, typical for programmable networks, a routing procedure is responsible for finding paths for communication flows. The goal of providing strict latency guarantees requires the routing procedure to consider not only the physical links where packets are forwarded but also how packets are scheduled at each link, e.g., at which priority level. At the same time, the procedure must ensure that resources are allocated wisely to flows, in order to increase the number of flows that can be simultaneously accommodated, and hence increase revenue for the network operator. This thesis provides the design and thorough evaluation of a routing procedure that defines both the physical links packets follow and the priority level at which these packets are queued at each link. Existing algorithms are investigated and new algorithms are designed to improve on the runtime, optimality, and completeness of state-of-the-art algorithms in different scenarios and problem settings.

In such an online setup where flows are embedded at runtime, the forwarding behavior of switches has to be updated without hindering the predictability of the forwarding operation performed in the data plane. Measurement campaigns in the literature have already shown that runtime updates in programmable networks can lead to unpredictable behavior. This thesis investigates the impact of these runtime reconfigurations on latency guarantees in the





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data plane. The result is the design, implementation, and evaluation of complete systems providing latency guarantees to online flow embedding requests. We design two systems, namely Loko and Chameleon, respectively focusing on small and low-capacity networks, and on data center networks. While Loko prevents unpredictability due to reconfigurations by including these operations in the latency modeling of the forwarding elements, Chameleon relies on end-host networking, and in particular source routing, to circumvent the need for reconfiguring networking devices.





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3.2.8 Mu He (TU Munich)

Title: Management of Programmable Control and Data Plane Towards Flexible Softwarized Networks

Chair of Communication Networks
Department of Electrical and Computer Engineering
Technical University of Munich

Management of Programmable Control and Data Plane Towards Flexible Softwarized Networks

Mu He

Supervisor: **Prof. Wolfgang Kellerer**
Chair of Communication Networks
Department of Electrical and Computer Engineering
Technical University of Munich

November 24th, 2020

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Uhrenturm der TUM

Abstract: Emerging networking applications and varying user demands are challenging today’s communication networks, which rely heavily on rigid networking devices and protocol stack and lack the ability to dynamically allocate networking resources on the fly. Novel networking techniques, i.e., Software-Defined Networking (SDN) and Programmable Data Plane (PDP), are proposed to provide higher flexibility in terms of dynamic network service provisioning in the era of network softwarization. In particular, SDN enables the programmability of the control plane, which can assist a fine-grained networking traffic control from a global perspective, whereas PDP enables the programmability of the data plane, which can aid the customization of packet processing functionality. Both techniques promise excellent opportunities to accommodate changing networking conditions and requirements. However, how to manage the control and data plane, especially under dynamic scenarios and with the target of flexibility, is still challenging and has not been widely studied in the literature. The goal of this thesis is to close this research gap by addressing the following four challenges.

First, to make a fair comparison between different network designs in terms of flexibility, a rigorous interpretation and a formal definition of a flexibility measure need to be derived. This thesis contributes to an interpretation by unfolding the intrinsic properties of a flexible network, i.e., support of changes in the network requirements in a timely and efficient manner. The





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network supports the changes either directly without any internal adaptation or by adapting its internal states such as the flow routes and functions' locations. If an adaptation is necessary, the time and cost factors need to be explicitly considered: the former indicates that the adaptation should accomplish under time limitation; the later indicates that the cost to realize the adaptation should also be lower than a threshold. Following the interpretation, this thesis elaborates on a presented flexibility metric and discusses the metric with a detailed survey and comprehensive use cases.

The second challenge is modeling and optimizing the placement opportunities that are offered by the flexibility of the dynamic control plane. SDN leverages the distributed control plane architecture to address the scalability and latency issues and benefits from the flexibility that enables dynamic migration of controllers and reassignment of switches. However, such architecture and flexibility introduce a new problem, i.e., where to place controller instances and assign switches to the controllers towards a specific performance metric, which is algorithmically hard. Average end-to-end flow setup time is the primary performance metric of the placement problem in this thesis, as it reveals the overhead of latency between the control and data plane during configuring flow rules along the path. The challenge here is to formulate the optimization problem based on the modeling of end-to-end flow setup time. Besides, when considering the dynamic case with multiple time-slots, changing from one placement to another placement incurs non-negligible adaptation cost, which should also be modeled in the optimization problem. Efficient algorithms are also proposed accordingly to solve the optimization problems.

The third challenge is the evaluation and optimization of the flexibility of the dynamic control plane. Different design choices, e.g., the number of controllers, have been compared considering classical performance metrics such as control latency and reliability; however, an explicit analysis and comparison in terms of flexibility are still missing in the literature. Therefore, this thesis proposes an evaluation framework that calculates the time that the control plane needs for adaptation, comprising controller migration and switch reassignment. The framework also generates a representative set of demand changes in the form of flow profiles as the input for the comparison between different design choices. Furthermore, the locations of the Data Centers (DCs) to host the controllers also have a critical impact on the highest possible flexibility that the dynamic control plane can have. In this regard, this thesis takes the flexibility analysis a step further: it presents a mathematical programming model that considers the underlying adaptation time and cost and optimally decides the static DC locations over a time horizon of planning.

The last challenge is the design of the programmable data plane towards runtime reconfiguration. Data plane programmability, especially the target-independent programming language P4, enables the customization of packet processing functionality that can be applied to various types of forwarding devices. With programmability, the functionality of each device can be reconfigured at runtime. To leverage these advantages, this thesis proposes an architecture that manages heterogeneous P4 data plane devices and explores the capability of reconfiguration without service interruption. One critical requirement of data plane reconfiguration is to ensure the consistency, i.e., the states within the data plane need to be maintained. The





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maintenance should be efficient and only target the necessary state variables. Accordingly, this thesis presents a suite of algorithms that analyze P4 programs and locate states that need to be preserved during reconfiguration. Moreover, the performance of the data plane is comprehensively measured to understand the potential overhead of reconfiguration.





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3.2.9 Raphael Durner (TU Munich, Chair of Communication Networks)

Title: Fine-grained Isolation and Filtering of Network traffic using SDN and NFV

Supervisor: Wolfgang Kellerer



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3.3 Project News

3.3.1 Sonderforschungsbereich MAKI geht in Phase 3 und wird für weitere 4 Jahre gefördert



Sonderforschungsbereich unter der Leitung der Technischen Universität Darmstadt erhält rund 15 Millionen Euro für die Erforschung eines schnelleren, hochflexiblen Internets.

Die “Zwangsdigitalisierung” während der Corona-Pandemie hat eines gezeigt: Wir brauchen digitale Infrastrukturen, die hochflexibel auf sich plötzlich ändernde Anforderungen reagieren können und dabei trotzdem stabil und leistungsfähig bleiben. Schließlich hätte niemand ahnen können, dass große Teile von Arbeit und Freizeit von einer Woche auf die andere per Videostreaming stattfinden würden.

Der Sonderforschungsbereich MAKI (Multi-Mechanismen-Adaption für das künftige Internet) an der Technischen Universität Darmstadt beschäftigt sich seit 2013 mit der Erforschung von Grundlagen für ein schnelles, flexibles und zuverlässiges Internet der nächsten Generation. Nun wird MAKI von der Deutschen Forschungsgemeinschaft (DFG) für weitere vier Jahre, von 2021 bis 2024, mit rund 15 Millionen Euro gefördert.

Nahtlose Anpassung des Netzes an den jeweiligen Nutzungskontext

Sprecher von MAKI ist Prof. Ralf Steinmetz, Leiter des Fachgebiets Multimedia Kommunikation an der TU Darmstadt. “Im Verbund mit anderen Universitäten schaffen wir die Grundlage dafür, dass das zukünftige Netz fit ist für das Internet der Dinge, neue Formen der digitalen Kommunikation und Internetdienste, die wir uns zum jetzigen Zeitpunkt nicht einmal vorstellen können”, so Ralf Steinmetz.





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Die große Herausforderung ist, dass alle Ebenen des Netzes – von der physischen Verkabelung bis zur Anwendung – nahtlos und ohne Unterbrechung zusammenarbeiten. So muss beispielsweise der Wechsel zwischen Bluetooth, WiFi und 5G gelingen, ohne dass der Datenstrom zwischenzeitlich aussetzt. Durch diese sogenannten “Transitionen” – also dem nahtlosen Umschalten von einem Mechanismus auf einen anderen – lässt sich ein Internet realisieren, das trotz steigender Datenlast stets resilient, verlässlich verfügbar, latenzarm und sehr schnell ist. Dass das keine Selbstverständlichkeit ist, zeigen heutige regelmäßige Ausfälle im mobilen Netz, wenn viele Menschen am gleichen Ort zusammenkommen, zum Beispiel bei Events wie bei großen Sportveranstaltungen. Der Nutzen der Transitionen konnte gerade in solchen Szenarien mehrfach nachgewiesen werden, beispielsweise beim Videostreaming oder bei Augmented-Reality-Spielen.

Schnellere Netze und Clouds: weltweite Grundlagenforschung trifft Industriepartner

Entscheidend ist neben der hohen Flexibilität des Netzes auf die jeweiligen Anforderungen eine extrem geringe Latenz: das heißt, eine sehr kurze Verzögerung bei der Bereitstellung von Inhalten und zwischen technischen Geräten. In der dritten Förderphase sollen Flexibilität, Resilienz und Geschwindigkeit der Kommunikationsnetze signifikant verbessert werden. Neuartige Software und Hardware kommen hier gemeinsam zum Einsatz. Es geht ebenso um die technische Umsetzung der Grundlagenkonzepte – konkret mit Industriepartnern wie NEC Laboratories Europe, der Vodafone GmbH und der Robert Bosch GmbH. Neue Hardware- und Softwarelösungen für bestehende Netze sollen vor allem drahtlose Netze und Cloud-Anwendungen deutlich beschleunigen und stabilisieren. So wird die Grundlagenforschung von MAKI auch bald im Alltag der Bürger*innen spürbar.

Die Forschung von MAKI ist selbst in einem weltweiten Netzwerk organisiert, das über die Jahre gewachsen ist: Neben Wissenschaftler*innen an der Technischen Universität Darmstadt arbeiten Wissenschaftler*innen der RWTH Aachen, Goethe-Universität Frankfurt, Universität Koblenz-Landau, Universität Mannheim, Philipps-Universität Marburg und der Universität Ulm in langfristig angelegter enger Kooperationen mit führenden Wissenschaftler*innen aus der gesamten Welt zusammen. Dieser Zusammenschluss gewährleistet flächendeckende Expertise bei der Erforschung des Internets von morgen.

Erklärvideo zur Forschung bei MAKI: www.youtube.com/watch?v=j5c9Jpg3rBk





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3.4 PhD Positions

In context of the MAKI research center, TU Darmstadt announces several openings for PhD positions:

- Department of Electrical Engineering and Information Technology (Code No. 641)
https://www.tu-darmstadt.de/universitaet/karriere_an_der_tu/stellenangebote/aktuelle_stellenangebote/stellenausschreibungen_detailansichten_1_391680.en.jsp
- Department for Computer Science (Code No. 642)
https://www.tu-darmstadt.de/universitaet/karriere_an_der_tu/stellenangebote/aktuelle_stellenangebote/stellenausschreibungen_detailansichten_1_392000.en.jsp

3.5 Faculty Positions

- Diverse Professuren an der Technischen Hochschule Ingolstadt - siehe <https://www.thi.de/karriere/wen-wir-suchen>
 - Forschungsprofessor (m/w/d) Autonome, kooperierende Systeme
 - Forschungsprofessor (m/w/d) für Innovative Mobilitätskonzepte und Geschäftsmodelle der KI
 - Forschungsprofessor (m/w/d) KI-gestützte Luftfahrttechnik und Produktentwicklung
 - Forschungsprofessor (m/w/d) Strategic Foresight and Trend Analysis
 - Forschungsprofessor (m/w/d) Technology Design and Application
 - Professor (m/w/d) Angewandte Mathematik
 - Professor (m/w/d) Biomedizinische Informatik
 - Professor (m/w/d) Digital Health Management und ein weiteres Fach der Betriebswirtschaft
 - Professor (m/w/d) Kommunikationsnetze und Cybersicherheit
 - Professor (m/w/d) Kommunikationstechnologien und ein Grundlagenfach der Elektrotechnik, Nachrichtentechnik oder Informatik
 - Professor (m/w/d) Sensorik und Mikrosystemtechnik





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4.1 Bericht CODE Jahrestagung 2020

Corinna Schmitt, RI CODE, Universität der Bundeswehr München

<https://www.unibw.de/code/events/jahrestagungen>

Die digitale CODE2020 (<https://www.unibw.de/code/jahrestagungen>) ist vorbei, mit fast 600 Teilnehmern aus ganz Europa. Am 10.11.2020 wurde die CODE2020 mit dem Thema "European Digital Sovereignty" veröffentlicht: "Road to Success?" begonnen. Ein spannender Tag mit tollen Diskussionen mit der deutschen Verteidigungsministerin Frau Kramp-Karrenbauer, der Verteidigungsministerin des Königreichs der Niederlande Frau Bijleveld-Schouten, Staatssekretärin Zimmer, Generalleutnant Vetter, Botschafter Ischinger und mehreren anderen hochrangigen Teilnehmern. Am zweiten Tag gab es 7 Workshops zu Themen wie "5G-Cybersicherheit in der EU", "Cyber-Resilienz kritischer Infrastrukturen", "Quantentechnologie" und "Cybersicherheit aus politischer Sicht" mit zum Teil über 100 Teilnehmern. Auf der Innovationskonferenz am Nachmittag wurden 12 innovative Vorschläge von einer Jury ausgewählt, die präsentiert werden sollen, und drei Gewinner ausgewählt. Und schließlich schloss der wissenschaftliche Track am dritten Tag, der den Doktoranden gewidmet war, die dreitägige Konferenz ab. Die Diskussionen drehten sich um den Fahrplan für eine europäische digitale Souveränität, die Überwindung der Fragmentierung der Kapazitäten durch den Aufbau digitaler Ökosysteme, wie wir es im CONCORDIA-Projekt tun. Besuchen Sie den YouTube-Kanal des Forschungsinstituts Cyber Defence (CODE) (<https://www.youtube.com/c/FzcodeDeubw/>), um die aufgezeichneten Präsentationen zu sehen.

Ein großes Dankeschön an alle Vortragenden, Diskussionsteilnehmer, Moderatoren, Workshop-Organisatoren, Teilnehmer und Aussteller!

Save-the-Date 20-22. Juli 2021 für CODE2021!



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Calls and Announcements

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

5.1 Overview on dates

Calls for Participation

- **Passive and Active Measurement Conference (PAM) 2021** (BTU Cottbus-Senftenberg):



March 30-31 2021

<https://www.pam2021.b-tu.de/>

- Next **Annual CODE Conference 2021** on 20.-22. July 2021: <https://www.unibw.de/code/events/jahrestagungen>
- **Capture the Flag 2020: Cube - Apocalypse** postponed to April 2021: <https://www.unibw.de/code/events/ctf>

Calls for Papers and Presentations

- 21.-24. June 2021 [IFIP Networking 2021](#), **Extended Abstract Deadline January 5th, 2021 and Full Paper Deadline January 12th, 2021**
- 13.-16. September 2021 [NetSys'21](#), **Second Deadline 31. May 2021** for extended abstracts, hot topic, demo and early work papers, PhD workshop applications



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5.2 Calls for Papers

5.2.1 IFIP Networking 2021 - Espoo, Finland June 21-24, 2021

The International Federation for Information Processing (IFIP) Networking 2021 Conference (IFIP NETWORKING 2021) will be held in Aalto University, Espoo, Finland. This is the 20th event of the series, sponsored by the IFIP Technical Committee on Communication Systems (TC6). Accepted papers will be published in the IFIP Digital Library and collected by the IEEE Xplore Digital Library. High quality papers will be recommended for fast track publications in selected journals.

The main objective of Networking 2021 is to bring together academic and industrial experts of the networking community to discuss the most recent advances in networking, to highlight key issues, identify trends, and develop a vision of the future Internet and wireless networking from the usage, design, deployment and operation standpoints.

Networking 2020 technical sessions will be structured around the following areas, although we also encourage submissions on other relevant areas:

- Network Architectures, Applications and Services
 - Network automation and management
 - Software-defined networking (SDN)
 - Artificial intelligence and networking
 - Service function chaining
 - (Multi-tenant) network slicing
 - Drone networking and unmanned technology-based services and applications
 - Protective and collaborative networking
 - Internet of Things (IoT) and crowdsensing/crowdsourcing
 - Trustworthy and multi-metric routing
 - Quantum communications
 - Fog and edge computing
 - Heterogeneous and integrated networks
 - Tbit/s optical networking
 - Overlay and P2P networks
 - Evolution of IP network architectures and protocols
 - Green networking
 - Resilient networks





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- Traffic engineering
- Quality of Service
- Emerging value-added services and applications
- Web technologies
-
- Network Modeling, Analysis, Operation, and Economics
 - Topology characterization
 - Performance measurements
 - Traffic monitoring and analysis
 - User behavior modeling
 - Quality of Experience
 - Data-driven network design
 - User profiling and tracking
 - Complex and dynamic networks
 - Analysis of participatory networks
 - Social networking
 - Socio-economic aspects of networks, pricing and billing
 - Network neutrality
 -
- Network Security, Trust and Privacy
 - Network security protocols
 - Anomaly and malware detection
 - Network forensics
 - Network security measurement
 - Authentication
 - Network attack/intrusion detection and mitigation
 - Applications of privacy-preserving computation in networks
 - Anonymization
 - Dependability
 - Situational awareness
 - Threat intelligence





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- Blockchain, ledger technologies and their network-related applications
- Wireless Networking
 - 5G access networks
 - Long-range communications
 - Mobile networks
 - Self-organizing networks
 - Wireless sensor networks
 - Visible light communications
 - Localization and positioning
 - Delay/disruption tolerant networks
 - Opportunistic networks
 - Wireless power transfer networks
 - Device-to-device communications
 - Vehicular networks and communications
 - Beyond 5G and 6G theories and technologies
 - mmWave and THz communications

The Conference Program will include plenary sessions, breakout sessions, keynote talks, a panel, a poster/demo session and a workshop day.

Important Dates

Extended abstract submissions: January 5, 2021

- **Full submission:** January 12, 2021
- **Notification of acceptance:** April 1, 2021
- **Camera-ready due:** May 7, 2021

For further details see <https://networking.ifip.org/2021/>





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Submission Guidelines The technical program committee welcomes paper submissions on all topics related to computer and communication networks. All submitted papers will be judged based on their quality and relevance through double-blind peer review, where the identities of the authors are withheld from the reviewers. As an author, you are required to preserve the anonymity of your submission, while at the same time allowing reviewers to fully grasp the context of related past work, including your own. Papers that do not conform to our double-blind submission policies will be rejected without review. Only original papers that have not been published or submitted for review elsewhere will be considered. Submitted papers should be written in English by following the IEEE conference format, with a maximum length limit of 9 printed pages, including all the figures, references, and appendices. Papers longer than 9 pages will not be reviewed. All papers must be submitted in the Portable Document Format (PDF) electronically using EDAS: <https://edas.info/N27861>. When submitting a paper, its title, all co-authors, and a concise abstract of up to 200 words should be provided to EDAS as the metadata of the paper. The metadata should be provided before the abstract registration deadline. The program committee may ask some authors to shorten their paper to a short paper of 3 pages to be presented in a poster session, instead of a plenary session.

Instruction on preparing a paper for double-blind review:

- Remove the names and affiliations of authors from the title page.
- Remove acknowledgments.
- Remove project titles or names that could be used to trace back to the authors via web search.
- Carefully name your files to anonymize author information.
- Carefully refer to related work, particularly your own. Do not omit references to provide anonymity, as this leaves the reviewer incapable of grasping the context. Instead, reference your past work in the third person, just as you would any other piece of related work by another author. For example, instead of "In prior work [1], we presented a scheme that...", sentences in the spirit of "In prior work, Clark et al. [1] presented a scheme that..." should be used. With this method, the full citation of the referred paper can still be given, such as "[1] A. Clark ..., "Analysis of...", and it is not acceptable to say "[1] Reference deleted for double-blind review."
- The submitted manuscript or its title/abstract should not be posted on a public website, such as org, or transmitted via public mailing lists.
- The submitted manuscript (PDF file) should be text-searchable. Any submission that does not meet this requirement may be returned without review.
- Many of the editing tools automatically add metadata to the generated PDF file containing information that may violate the double blind policy. Please remove any possible





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metadata that can link your manuscript to you. This includes removing names, affiliation, license numbers etc. from the Metadata as well as from the paper. Failing to meet this requirement may also lead to a rejection without review.

At least one author of each accepted paper is required to register for the conference at the full (member or non-member) rate and the paper must be presented by an author of that paper at the conference unless the TPC co-chairs grant permission for a substitute presenter before the conference. Non-refundable registration fees must be paid prior to uploading the final correctly formatted, publication-ready version of the paper. Accepted and presented papers will be published in the IFIP Digital Library and IEEEExplore Digital Library. To ensure appropriate consideration of conflicts of interest during the review process, changes to the list of authors are prohibited once a paper has been submitted for review. Should a paper be accepted, the complete list of authors, including the order of authors, must remain identical as the EDAS metadata in the final camera-ready manuscript.

GENERAL CHAIRS

- Raimo Kantola, Aalto University, Finland
- Lars Eggert, NetApp, Finland

PROGRAM CHAIRS

- Zheng Yan, Xidian University, China and Aalto University, Finland
- Gareth Tyson, Queen Mary University, UK
- Dimitrios Koutsonikolas, University at Buffalo, USA

STEERING COMMITTEE

- Robert Bestak, Czech Technical University in Prague, Czech Republic
- Andrea Passarella (Chair), IIT-CNR, Italy
- Henning Schulzrinne, Columbia University, USA
- Burkhard Stiller, University of Zurich UZH, Switzerland
- Joerg Widmer, IMDEA Networks, Spain





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5.2.2 NetSys'21 - Call for Extended Abstracts and Hot Topic Papers

The NetSys'21 has been moved from March 2021 to 13.-16. September 2021 due to COVID-19 and in the hope to hold a conference with physical presence again.

The Conference on Networked Systems (NetSys 2021) is a traditional biennial event that provides an international forum for engineers and scientists in academia, industry, and government to present and discuss recent innovations in the realm of networked systems.

NetSys21 is again a joint event organized by GI KuVS (GI, Communication and Distributed Systems) and VDE ITG (VDE, Information Technical Society). The NetSys21 technical program focusses on original contributions in the area of networking and distributed systems and also features invited presentations on hot topics in networking and distributed systems, an industry session, separate workshops, tutorials, posters, demos, an early work track, and a Ph.D. forum. Also included is the annual 1-day ITG expert symposium "Future of Networking" (Zukunft der Netze, ZdN) with invited technical presentations on advanced topics in networking. The German GI FG on Operating Systems also plans to hold its annual workshop in combination with NetSys 2021 in Lübeck.

So, NetSys 2021 solicits the **submission of extended abstracts** presenting original and novel research and ideas as well as **hot topic papers**, i.e. presentations of papers that have already been accepted or published at other conferences or journals in the field during the last two years.

The NetSys21 TPC will select extended abstract papers for presentation and inclusion in the NetSys 2021 proceedings to be published open access via the journal Electronic Communications of the EASST [ECEASST](#).

Hot topic presentations shall highlight recent and highly significant results in networked and distributed systems to be presented in a highly innovative, thought-provoking and stimulating format - containing, e.g., new research topics, directions, and methods. This includes recent papers which appeared (or are to appear) in top journals (such as TON or CCR) or top conferences (such as SIGCOMM, IMC, MobiCom, CoNEXT, INFOCOM, ICDCS) that are of high interest for the NetSys community.

Both, extended abstracts and hot topic papers, can include, but are not limited to the following topics:

- Network architectures and protocols
- Transport- and application-layer protocols
- Software-defined networking, network function virtualization, and further network softwarization
- Mobile, ad-hoc, opportunistic, vehicular, and sensor networks





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- Novel concepts for tactile and low-latency communication
- Pertinent middleware architectures, platforms, and programming support for networked systems
- Internet of Things (IoT)
- Cloud computing, mobile cloud computing, fog and edge computing
- Network security and privacy
- Information-centric networking, content distribution and retrieval, and their co-existence with classical networks
- SoA, web services, and mobile services
- Consistency, reliability, availability in networking and distributed systems
- Advancements in social networks, social computing, data-intensive computing (big data)
- Methods for design, implementation and analysis of networked systems
- Cyber-physical networked systems
- Green and energy-efficient networks / networked systems
- Artificial Intelligence and Machine Learning as well as their application in, and impacts on, networking
- Distributed ledger systems and applications
- Emerging and future networked applications and distributed systems

Important Dates

- **Extended abstract submissions**
 - **Second Deadline** - Registration & submission: Friday, May 28th, 2021
 - Notification of acceptance: Wednesday, June 30th, 2021
- **Hot topic submissions**
 - Registration & submission:** Friday, May 28th, 2021
 - Notification of acceptance:** Wednesday, June 30th, 2021





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For other dates (demo papers, PhD Forum, etc.) see netsys2021.org.

Submission Guidelines for Extended Abstracts

All abstract submissions must be original, unpublished, and not considered elsewhere for publication. Extended abstracts are limited to 4 pages including references, figures and tables (11pt font, one-column format). LaTeX and Microsoft Word templates, as well as formatting instructions, are available online [here](#).

Contributions should be submitted electronically as PDF via EasyChair (<https://easychair.org/conferences>,

The abstracts will undergo a thorough process of peer reviews by at least three members of the technical program committee.

Submission implies that at least one author will register and attend the conference to present the extended abstract via a talk or potentially via a poster.

Accepted and presented extended abstracts will be published in the conference proceedings. The authors of the best extended abstracts will be invited to submit a long version of their research to a special issue of ACM TOIT.

Submission Guidelines for Hot Topic Papers

We expect submissions of papers already published or accepted at top-tier venues. Please submit the full paper or at least the front page (at least including title, authors, abstract, and publication venue) of the published paper as well as its complete reference via this [easychair link](#).

Accepted hot topic papers have to be presented at the conference. The presentations will be 15-20 minutes per talk (at the discretion of the NetSys organizers).



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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:

$(\text{Trafalgar})^2$ [meaning: Trafalgar Square]

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

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



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

The Riddles (Solutions, cf. on next page):

- *Beginners:* **U can B so > 0**
- *Playing with Capital Letters:* **sXE**
- *Advanced Persons:*
 \forall humans should B (trEted = E)
- *Experts:*
V w8ed 4 14Hers @ the g8
- *Geniuses:* **s+y Z 2 +y: "1st of \forall U R 2 laC + moreover (not • ive) @ \forall "**

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



Solutions for riddles (by Rolf Windenberger):

- you can be so positive [because: U-can-B-so-positive]
- sXE [because: s-X-E]
- all humans should be treated equally [because: all-humans-should-B-tr-E-ted-equal-E]
- we waited for four teenagers at the gate [because: V-w-eight-ed-four-fourteen-H-ers-@-the-g-eight]
- Sandy said to Andy: "first of all, you are too lazy and moreover not productive at all" [because: s-and-Y-Z-two-and-y: "first-of-all-U-R-two-la-C-and-moreover-not-product-ive-@-all]





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Next newsletter : 06/2021

Deadline for submissions and contributions : 15th May 2021

We ask you for submissions in English. Topics can be from the following time frame: January 2021 - June 2021.

- 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.

Submissions should be done by sending emails to the editors:

<mailto:oliver.hohlfeld@b-tu.de>

<mailto:mathias.fischer@uni-hamburg.de>

<mailto:corinna.schmitt@unibw.de>

<mailto:andreas.blenk@tum.de>

