Research Group for Telecommunication Networks

SIP

Peer-to-Peer

Protocols

Systems

Services

Networks

NFV

WMN

Smart Home/Grid

M2M/IoT

Frankfurt University of Applied Sciences

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick

Research Group for Telecommunication Networks

Prof. Dr. Ulrich Trick
Telekommunikationsnetze

Prof. Dr. Armin Lehmann
Programmieren in der
Informationstechnik

Dr. Patrick Wacht

M.Sc. Michael Steinheimer

approx. 10 students

M.Sc. Auberlin Paguem   **M.Sc. Besfort Shala**   **M.Sc. Olaf Reich**   **M.Eng. Gregor Frick**
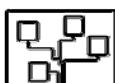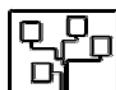
**Frankfurt University of Applied Sciences**
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick

Subjects

- **Modelling, optimization and migration of networks**

- **Session Initiation Protocol** (SIP)**, WebRTC and SIP**

- **Future communication services and Application Servers incl. testing**

- **Peer-to-Peer** (P2P) **communication with Multimedia over IP**

- **NGN-systems and architectures, Wireless Mesh Networks** (WMN)

- **Smart Home, Smart Grid and Smart Market**

- **Machine-to-Machine Communications** (M2M)**/Internet of Things** (IoT)

- **Network Functions Virtualisation** (NFV)**, Virtualisation Technologies, Cloud Computing Technologies**

- **Software Engineering in Telecommunications**

- **Network management**
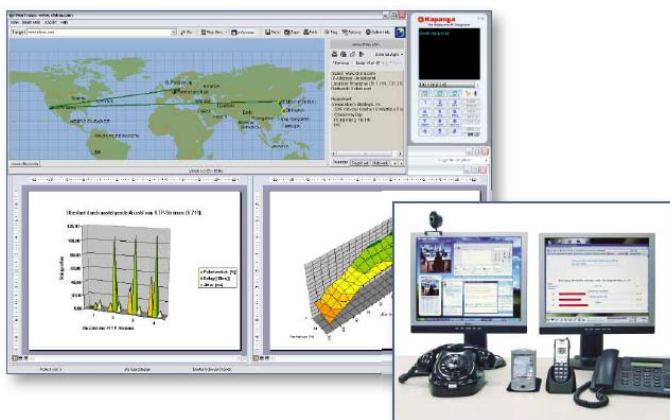
Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick

Current Research Focuses

- **NGN-systems and networks**
  - **Network elements**
  - **Network architectures**
  - **Unified Communications**
  - **IPv6**
  - **Test network**
  - **WMN, Disaster Networks**

- **Platforms and services**
  - **Smart Home/Grid/Market**
  - **M2M, IoT**
  - **P2P**
  - **Virtualisation, Clouds**
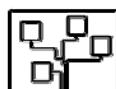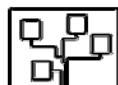
- **Services in future telecommunication networks**
  - **Requirements, ideas**
  - **Development and deployment**
  - **Value added services**
  - **Application Server, Service Delivery Platform**
  - **Services for Smart Grid, Smart Home and M2M**
  - **Testing**

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick
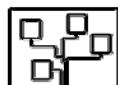
- **Future telecommunication infrastructure**; 07/2002-03/2003 (Univ. of Applied Sciences)
- **Optimization of heterogeneous, packet switched telecommunication networks**; 10/2003-04/2005 (BMBF)
- **Development of a concept for a new telecommunication network**; 01/2005-03/2005 (company project)
- **Emergency call with Voice over IP**; 05/2005-01/2006 (company project)
- **Requirements for Carrier Class VoIP networks**; 08/2005-01/2006 (company project)
- **Anti-spam and Click-to-Dial with Voice over IP**; 08/2005-02/2006 (company project)
- **Complete integration of IP networks for multi-media communication** (Next Generation Network); 09/2005-12/2005 (Univ. of Applied Sciences Frankfurt/M.)
- **High Quality Audio VoIP technology for broadcasting stations**; 10/2005-03/2006 (company project)
- **Conceptual Study for the monitoring of Quality of Service with VoIP** (Voice over IP) **in an NGN** (Next Generation Network); 03/2006-11/2006 (company project)
- **Services in NGN**; 10/2006-04/2007 (company project)
- **Services and architectures in future telecommunication networks** (DazTel); 11/2005-04/2008 (University of Applied Sciences Frankfurt/M.)

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick

- **Improvement of Quality of Service across networks with SIP-based VoIP communication** (QoSSIP); 10/2005-04/2008 (BMBF)
- **Multimedia over IP and security**; 11/2007-05/2008 (company project)
- **Provisioning and Developing of Value-added Services in NGN**; 02/2009-03/2009 (company project)
- **NGN Core technology**; 10/2008-10/2009 (company project)
- **IMS- or P2P-based provisioning and development of services for customer-specific communication processes** (TeamCom); 05/2007-05/2010 (BMBF)
- **Unified Communications System**; 04/2008-08/2010 (company project)
- **Test-controlled evolution and automated provisioning of communication services** (ComGeneration); 07/2009-09/2012 (BMBF)
- **Easy-Service Creation for Home and Energy Management** (e-SCHEMA); 10/2011-09/2014 (BMBF)

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick

Current Research and Development Projects

- **SIP-Routing Infrastructure for Audio over IP**; 04/2011-12/2016 (company project)

- **Optimised P2P service architecture for high-available M2M applications** (P2P4M2M); 04/2015-03/2019 (BMBF)

- **Network Function Virtualization and Wireless Networks**; 01/2016-12/2017

- **IoT and Disaster Networks**; 01/2017-12/2019
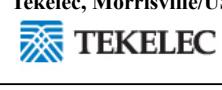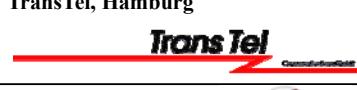
Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick

Research and development partners

AETA Audio Systems, Le Plessis Robinson/Frankreich	BT Germany, München und Frankfurt	Detecon International, Bonn
FH Köln, Institut für Nachrichtentechnik (Prof. Dr. Grebe)	FH Osnabrück, Mobilkommunikation (Prof. Dr. Tönjes)	GIP, Mainz
HEAG MediaNet, Darmstadt	JDSU, Eningen u.A.	R-KOM, Regensburg
Robert Bosch, Stuttgart	Tekelec, Morrisville/USA	TransTel, Hamburg
T-Systems, Darmstadt	Vodafone, Eschborn	Vodafone, München
ARD-Sternpunkte, Frankfurt	Centre for Security, Communications and Network Research (CSCAN) – Plymouth University	h_da HOCHSCHULE DARMSTADT UNIVERSITY OF APPLIED SCIENCES alda INSTITUT FÜR ANGEWANDTE INFORMATIK DARMSTADT
EVL Energieversorgung Limburg	NRM Netzdienste Rhein-Main	teliko

PhD topics   1
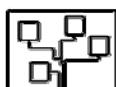
- PhD thesis, Frank Weber: **Quality of Service optimisation framework for Next Generation Networks**. Finished in September 2012
- PhD thesis, Armin Lehmann: **Service composition based on SIP peer-to-peer networks**. Finished in August 2014
- PhD thesis, Thomas Eichelmann: **Automated creation and provisioning of value-added telecommunication services**. Finished in April 2015
- PhD thesis, Patrick Wacht: **Framework for automated functional tests within value-added service environments**. Finished in August 2016

- PhD working title, Michael Steinheimer: **Autonomous decentralised application provision in M2M networks**. Transfer report approved in February 2014
- PhD working title, Auberlin Paguem Tchinda: **Optimisation of wireless disaster telecommunication network based on Network Functions Virtualisation under special consideration of energy consumption**
- PhD working title, Besfort Shala: **Security and high availability optimisation of P2P-based M2M applications and integration of testing**
- PhD working title, Olaf Reich: **Internet of Things based on Fog Computing in a disaster network on a Wireless Mesh Network basis**

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick

PhD topics   2
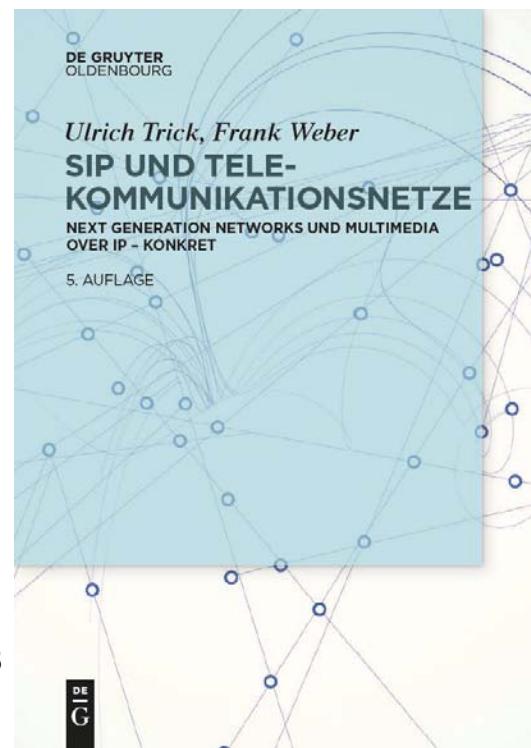
- Prof. Trick and Research Group for Telecommunication Networks in close cooperation with CSCAN and Plymouth University since 2006

- Member of competence Centre "Networks and Distributed Systems" at FRA-UAS

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick
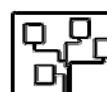
Current Publications

- **More than 75 publications in the last 13 years with the subjects**
  - **NGN**
  - **Voice/Multimedia over IP**
  - **Smart Grid/Home**
  - **Emergency call**
  - **Mobility**
  - **Peer-to-Peer communication**
  - **Services and Application Server incl. testing**
  - **M2M**
  - **Network modelling**
  - **Network migration**

- **NGN book:**
  SIP und Telekommunikationsnetze.
  5. Auflage. De Gruyter Oldenbourg, Mai 2015
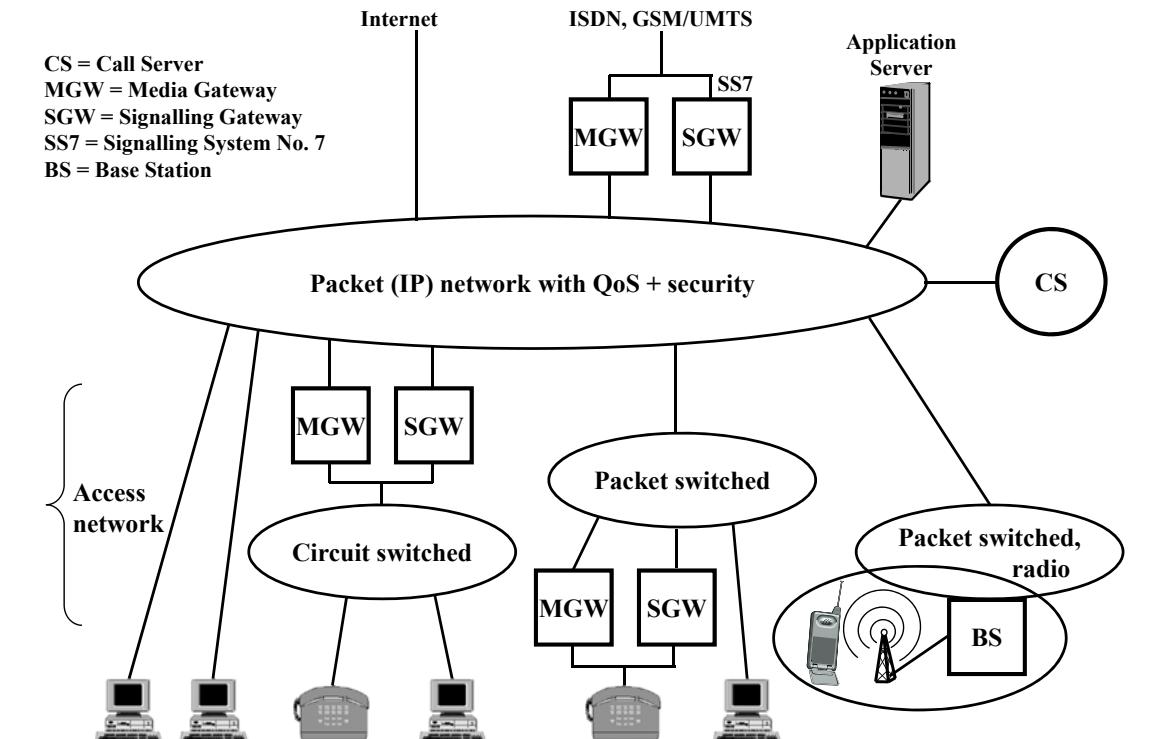
DE GRUYTER
OLDENBOURG

Ulrich Trick, Frank Weber

SIP UND TELE-KOMMUNIKATIONSNETZE

NEXT GENERATION NETWORKS UND MULTIMEDIA OVER IP – KONKRET

5. AUFLAGE

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze
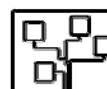
Prof. Dr.-Ing. U. Trick

Laboratory for Telecommunication Networks with NGN

Internet

ISDN, GSM/UMTS

Application Server

CS = Call Server
MGW = Media Gateway
SGW = Signalling Gateway
SS7 = Signalling System No. 7
BS = Base Station

SS7

MGW SGW

Packet (IP) network with QoS + security

CS

Access network

MGW SGW

Packet switched

Circuit switched

MGW SGW

Packet switched, radio

BS

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick

- **Multimedia over IP infrastructure with Call Servers, Gateways, Session Border Controller etc., with focus on SIP and services**

- **IP networks, WLANs, HW-IP-Router, Linux-based IP-Router, fiber optical cabling**

- **10 Gbit/s** (link aggregated up to 40 Gbit/s) **infrastructure, public IP addresses**

- **Virtualisation** (OpenStack, Hyper-V, VMware, Proxmox)**, NFC, SDN**

- **MoIP** (Multimedia over IP)**, SIP, H.323, MGCP**

- **SER** (SIP Express Router)**/Kamailio as Call Server**

- **Mobicents as SIP Application Server with JAIN SLEE framework**

- **Asterisk as Session Border Controller and Gateway**

- **Net-Net 3800** (Oracle) **and Mediant 800** (AudioCodes) **as Session Border Controller**

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick

Equipment of the NGN Laboratory @ FH Frankfurt 2

- **CMS-3000** (Radisys)**, Asterisk, SEMS** (SIP Express Media Server) **and Kurento as Media Server**

- **Server for Text to Speech and speech recognition** (e.g. Loquendo)

- **Hard-** (snom, AudioCodes) **and Soft-IP-phones**

- **Lync 2013 as Unified Communication System**

- **Protocol analysis and simulation** (e.g. Tektronix, Wireshark)

- **M-Bus, EnOcean, ZigBee, KNX, Z-Wave, digitalStrom, HomeMatic devices**

- **OSGi** (Open Services Gateway initiative)

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick
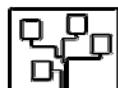
Lectures and Laboratories

- **Bachelor Elektrotechnik und Kommunikationstechnik**
  - o **Vorlesung „Grundlagen der Telekommunikation"**
  - o **Software-Projekt** (Java)
  - o **Vorlesung „Digitale Vermittlungstechnik"**
  - o **Labor zu „Digitale Vermittlungstechnik"**
  - o **Vorlesung „Kommunikationsnetze"**
  - o **Labor zu „Kommunikationsnetze"**
  - o **Studierendenprojekte**
  - o **Bachelorarbeiten**

- **Master Information Technology**
  - o **Lecture „Methods, Systems and Networks for Digital Communication"**
  - o **Lecture „Digital Switching and Routing"**
  - o **Laboratory acc. to „Digital Switching and Routing"**
  - o **Lecture „Mobile Computing"**
  - o **Project acc. to „Mobile Computing"**
  - o **Student projects**
  - o **Master theses**

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick

---
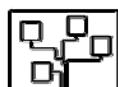
Lectures and Laboratories

- **Bachelor Wirtschaftsinformatik**
  - o **Vorlesung mit Übungen „Webbasierte Anwendungen"**

- **Bachelor Informatik**
  - o **Labor „Computer Networks"**
  - o **Vorlesung mit Übungen „Operating Sytems"**

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick

Possible areas of Cooperation

- **Research and Development for Companies**

- **Conceptual Studies**

- **Workshops**

- **Advanced training seminars**

Frankfurt University of Applied Sciences
Forschungsgruppe für
Tele-
kommunikationsnetze

Prof. Dr.-Ing. U. Trick