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News@ComSoc Bangalore

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Communication Society Chapter Bangalore . ComSoc-Bangalore India Newsletter (ComSoc-NL)

About IEEE ComSoc Chapter Bangalore Newsletter

The IEEE ComSoc Chapter Bangalore Newsletter includes news useful to its members, non-members and highlights most important technology development. It also highlights important concluded and upcoming events. Links for few important topics from current issue of *IEEE Communication Magazine are also embedded.*

Editor Message

Dear readers,

We are delighted to present the 7th edition of ComSoc newsletter, Bangalore Chapter, June 2020 issue. At the outset we would like to thank the chair and Ex-Com for giving us the opportunity in bringing the seventh issue of the newsletter.

The newsletter highlights the activities and achievements which happened in the first half of the year 2020. We have included some high-quality technical articles of current trends like 5G and some nontechnical article in communication community and higher education information relevant to national and international institutes.

In the first article we discuss the NSA Deployment configuration in 5G and the associated challenges which need to be solved from an implementation perspective. The second article is a part of the 5G Tutorial series and touches on the aspect of Edge Computing. The motivation for Edge Computing and how it works with other components of the Cellular network are worth understanding for everyone. The conceptualization of MEC (Multi-Access Edge Computing) and the value it provides to different use cases and businesses is also well explained. Another student article on the same topic touches additionally on aspects of both Edge and Cloud Computing. The third article tries to demystify different types of bandwidth definition which exist in the 3GPP 5G Standard and declutters these by giving examples correlating these terms with the standard. Continuing the 5G bucket we also feature a student article on the Cellular Vehicle-to-Everything Technology (C-V2X) aspects. The manner in which connected cars will operate in future and interact with other networks is deliberated upon in this article. In addition to 5G, we also have an article on Medical microwave radiometer which is based on PhD work carried out at IIT-Madras. The details of the system and prototype measurements taken are discussed in this article.

In this newsletter, we also present consolidated reports from activities in Student Branch Chapters related to IEEE ComSoc and future planned technical activities and views, findings, and advancements. We will be happy to receive more articles from various streams in the field of communication, technical research, and social awareness to publish in the next issues.

IEEE ComSoc Bangalore Chapter Newsletter Team:
Anindya Saha, Shobha KR & Navin Kumar

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CHAIRMAN MESSAGE

In the last newsletter, I welcomed you all to this decade with hope and ambition. Since then, Covid-19 has definitely disrupted our planned activities, but not our indomitable spirit.

I am very pleased to see that the IEEE Bangalore chapter and our Communications society have been quite vibrant. We appreciate a good number of you contributing to technical forums, in-depth workshops, student contests, and other initiatives. We are fully leveraging the online collaboration, virtual forums, and video conferencing to sustain our continuous learning and knowledge dissemination.

A series of six webinars on different "Technologies underlying 5G" happened in a week. We delved into intricacies of "Role of AI/ML in 5G Networks" through a half-day virtual workshop. Another half-a-dozen webinar covered "Quantum Communication", "Computer Vision in Autonomous Car" and many other emerging topics.

We were privileged to have IEEE 5G World Forum hosted in Bangalore in Sept 2020, but due to the present situation, we had to convert that to an online program. This year's summer school has been called off, but we have re-applied on theme '5G and IoT' for June 2021. This year, we will continue our advanced workshops and deep-tech sessions in 5G, SDN/NFV, Blockchain, Intelligent Transportation Systems, and other cutting-edge technologies.

Though we could conduct only two face-to-face meetings of Execom, we have conducted four more in virtual mode. Our society has good representation from Industry and Academia. We are finding avenues to leverage this mix judiciously in all our activities. Our student branches are organizing interesting sessions. We also concluded the Masters/Ph.D. thesis contest (GraTe-7) along with Kerala and Hyderabad sections.

. My sincere thanks to all of you for your time and effort. I am looking forward to your continued participation to make Y2020 a distinct year!

Dr. Aloknath De,
Chair, IEEE Bangalore ComSoc Chapter
CTO -Samsung R&D India, Bengaluru.

5G New Radio NSA Overview from Implementation perspective

BV Sreeramulu, Founder, 5G Research
iSignal Research Labs. Bangalore

The increasing demand for the data rates and various industry vertical requirements has challenged both academia and industry to re-think beyond LTE enabled key technologies like flexible bandwidth, OFDMA, MIMO, and beamforming. The primary use cases include Gaming applications like Augmented Reality, Virtual Reality, Tactile Internet, Smart Grid, IoT, mass connectivity per square kilometer, and ultra-reliable connections with ultra-low latency applications such as industrial automation, military applications to name a few. These challenging use cases have inspired a new paradigm shift in the design and adoption of entirely new solutions in the wireless system leading to innovations for 5G technology. The New Radio (5G NR) technology is more flexible, scalable, and adaptable, keeping end-users, OEMs, operators in mind, to build the cellular wireless systems to be both backward and forward compatible. However, for the initial deployment, 3GPP designed to take advantage of existing LTE infrastructure to avoid deployment cost by upgrading the software at the 4G and addition of the 5G Sub-6GHz and mmWave carrier. (EUTRA-NR Dual Connectivity) EN-DC is the fastest and cost-effective solution for achieving the 5G use case scenarios like eMBB targeting at the order of 4Gbps to 6Gbps Cell peak throughput.

In the EN-DC, C-Plane signaling happens through EPC and various U-plane options given by the standards for the vendors to choose the data split in designing the RAN according to QoS requirements. After several years of efforts by researchers, practitioners, and professionals from the industry, 3GPP adopted advanced technologies such as Massive MIMO, mmWave, various beamforming techniques as the solution for achieving the desired KPIs of diversified applications, by adapting CP-OFDMA from the LTE for both uplink and downlink considerations. Scheduling, higher layer, and lower layer data processing stand the primary challenging aspects in enabling the NR because of the stringent requirements, especially from link reliability, throughput, and latency aspects at the order of 1ms. Resource Allocation in terms of time and frequency making use of flexible numerology at mini-slot duration, pose challenges in the design of MAC Scheduler at the gNB for achieving critical KPIs such as mass connectivity, link reliability, extremely low latency.

Wireless Channel Modeling is the primary challenge in the multipath fading environment where we experience interferences issues. There is an increase in computational complexity in implementing signal processing techniques such as precoding at the transmitter and combining at the receiver. These make the design of the hardware complex because of the large number of the antennas, RF chains, and phase shifters required to achieve the desired transmission scheme for acceptable throughput and link reliability. Besides, there is a challenge in addressing significant targets such as peak spectral efficiency [bps/Hz/cell], mitigating interference between the users in cell coverage and achieving the desired SINR, and BER for employed modulation and coding schemes in the propagation environment. There is an increased likelihood of encountering decoding failures in interference scenarios and more HARQ retransmissions observed mainly at the cell edges leading to more C-plane overhead and lots of load on the PDDCH channel with higher aggregation levels.

CALL FOR CONTRIBUTION TO COMSOC NEWS

Please get in touch with us if you wish to write and to be included in this newsletter (in the area of Communication Technology). The article should be from 300-1000 words in docx or doc file and separate image files must be provided in jpeg or tiff file format. You can submit to: (shobha_shankar@msrit.edu or navinkumar@ieee.org)

IF YOU WISH TO ADVERTISE

The newsletter is circulated to more than 10,000 members from academia and industry. It has wide reach and slowly getting popularity. Please contact us to advertise in the newsletter. Increase your visibility with us.

Anindya Saha (anindya@saankhyalabs.com)

Navin Kumar (navinkumar@ieee.org)

Dear Reader, we plan to dedicate this page for 5G Tutorial Series. Starting from the basic, I would like to continue discussing about 5G Cellular System and Technologies in sequence (starting from Part 1, Part 2, etc). The tutorial will be in continuation from the previous issue. I hope, we will go in parallel with ongoing 5G research and development. It is believed that the reader will gain better understanding of 5G Cellular System if they follow the tutorial. In the last part VI, we discussed the advantages and issues in the SDN and NFV architecture. In this issue, our focus is on Edge Computing and Multi-Access Edge Computing.

Navin Kumar, PhD, Associate Professor, Amrita School of Engineering Bangalore

5G Technology and Cellular System Tutorial Series: Part VII – Edge Computing

Sheeba Kumari M, PhD Scholar
Navin Kumar, PhD

In this part of the series, our focus is on one of the very important technologies, that is edge computing and Multi-access edge computing (MEC). Edge computing is computing that is done at or near the source of the data, instead of relying on the cloud at one of a dozen data centres to do all the work. It does not mean the cloud will disappear. It means the cloud is coming to you. Edge computing optimizes Internet devices and web applications by bringing computing closer to the source of the data. This minimizes the need for long distance communications between client and server, which reduces latency and bandwidth usage. In simpler terms, edge computing means running fewer processes in the cloud and moving those processes to local places, such as on a user's computer, an IoT device, or an edge server. Bringing computation to the network's edge minimizes the amount of long-distance communication that has to happen between a client and server. The edge of the network is geographically close to the device, unlike origin servers and cloud servers, which can be very far from the devices they communicate with.

Consider a building secured with dozens of high-definition IoT video cameras. These are 'dumb' cameras that simply output a raw video signal and continuously stream that signal to a cloud server. On the cloud server, the video output from all the cameras is put through a motion-detection application to ensure that only clips featuring activity are saved to the server's database. This means there is a constant and significant strain on the building's Internet infrastructure, as significant bandwidth gets consumed by the high volume of video footage being transferred. Additionally, there is a heavy load on the cloud server that has to process the video footage from all the cameras simultaneously.

Now imagine that the motion sensor computation is moved to the network edge. What if each camera used its own internal computer to run the motion-detecting application and then sent footage to the cloud server as needed? This would result in a significant reduction in bandwidth use because much of the camera footage will never have to travel to the cloud server. Additionally, the cloud server would now only be responsible for storing the important footage, meaning that the server could communicate with a higher number of cameras without getting overloaded. This is what edge computing looks like.

Some of the key benefits of edge computing are:

- Decreased latency
- Decrease in bandwidth use and associated cost
- Decrease in server resources and associated cost
- Added functionality

One drawback of edge computing is that it can *increase attack vectors*. With the addition of more 'smart' devices into the mix, such as edge servers and IoT devices that have robust built-in computers, there are new opportunities for malicious actors to compromise these devices.

Another drawback with edge computing is that it *requires more local hardware*. For example, while an IoT camera needs a built-in computer to send its raw video data to a web server, it would require a much more sophisticated computer with more processing power in order to run its own motion-detection algorithms. But the dropping costs of hardware make it cheaper to build smarter devices.

Architecture for the edge computing is known as multi-access edge computing (MEC). MEC offers application developers and content providers cloud-computing capabilities and an IT service environment at the edge of the network. This environment is characterized by ultra-low latency and high bandwidth as well as real-time access to radio network information that can be leveraged by applications.

MEC provides a new ecosystem and value chain. Operators can open their Radio Access Network (RAN) edge to authorized third parties, allowing them to deploy innovative applications and services. This arrangement enables flexible and rapid deployment for various markets including mobile subscribers, enterprises, and vertical segments.

Multi-access edge computing will enable new vertical business segments and services for consumers and enterprise customers. Some of the use cases include:

- video analytics
- location services
- Internet-of-Things (IoT)
- augmented reality
- optimized local content distribution and
- data caching

We will continue to discuss further details of MEC architecture in the next issue.

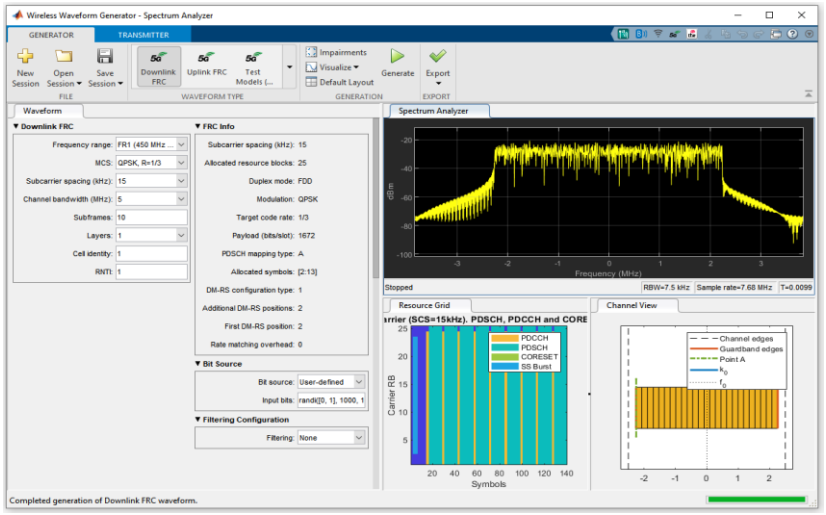
5G TOOLBOX

MATHWORKS

Simulate, Analyze, and Test 5G Communications Systems

5G Toolbox™ provides standard-compliant functions and reference examples for the modelling, simulation, and verification of 5G New Radio (NR) communications systems. The toolbox supports link-level simulation, golden reference verification, conformance testing, and test waveform generation.

With the toolbox you can configure, simulate, measure, and analyze end-to-end 5G NR communications links. You can modify or customize the toolbox functions and use them as reference models for implementing 5G systems and devices



Key Features

- Standard-compliant models for 3GPP 5G NR Release 15
- Link-level simulation with reference examples, including 5G NR PDSCH and PUSCH throughput simulation
- Generate NR-TM, and uplink and downlink FRC waveforms using the Wireless Waveform Generator app
- TR 38.901 propagation channel models, including tapped delay line (TDL) and clustered delay line (CDL)
- Support for DM-RS, PT-RS, SRS Signals and PRACH Physical Channels
- Signal processing functions, including channel coding (LDPC and polar codes), channel estimation, synchronization, and equalization
- Deep learning data synthesis for 5G channel estimation

Explore 5G wireless Technology development:

5G BANDWIDTH DEFINITION CONUNDRUM

Kiran C Marathe, Founder, dtri.in

Starting 4G and in 5G, 3GPP standard document has introduced multiple types of bandwidth (BW) definitions.

Up to 3G, GSM and CDMA technologies have fixed 'channel bandwidth (CH_{BW})' which is assigned to various users by the network operator. Example: For GSM850 band, fixed channel (or user) bandwidth is 200kHz.

When the technology upgraded to 4G, 3GPP specification provided network with flexibility of choosing from multiple CH_{BW} options – 1.4MHz, 3MHz, 5MHz, 10MHz, 15MHz and 20MHz. With 5G options extended up to 100MHz. This is understandable since the focus of 4G was higher data rate compared to previous generations of cellular technologies and this implied a higher bandwidth requirement. 4G also introduced OFDM in the specification and additional types of bandwidth. In addition to CH_{BW} the specifications also introduced bandwidth in terms of resource blocks (RB). From 3GPP TS 38.101-1 Rel-15.5 as per Tables 5.3.2-1 and 5.3.5-1, a user equipment (UE) operating in 5G-New

Table 5.3.2-1: Maximum transmission bandwidth configuration N_{RB}

SCS (kHz)	5MHz	10MHz	15MHz	20 MHz	25 MHz	30 MHz	40 MHz	50MHz	60 MHz	80 MHz	90 MHz	100 MHz
	N_{RB}	N_{RB}	N_{RB}	N_{RB}	N_{RB}	N_{RB}	N_{RB}	N_{RB}	N_{RB}	N_{RB}	N_{RB}	N_{RB}
15	25	52	79	106	133	160	216	270	N/A	N/A	N/A	N/A
30	11	24	38	51	65	78	106	133	162	217	245	273
60	N/A	11	18	24	31	38	51	65	79	107	121	135

Table 5.3.5-1 Channel bandwidths for each NR band

NR Band	NR band / SCS / UE Channel bandwidth											
	SCS kHz	5 MHz	10[1,2] MHz	15[2] MHz	20[2] MHz	25[2] MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
n1	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60		Yes	Yes	Yes								
n2	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60		Yes	Yes	Yes								
n3	15	Yes	Yes	Yes	Yes	Yes	Yes						
	30		Yes	Yes	Yes	Yes	Yes						
	60		Yes	Yes	Yes	Yes	Yes						
n5	15	Yes	Yes	Yes	Yes								
	30		Yes	Yes	Yes								
	60												

Radio (NR) band n5 with channel bandwidth of 10MHz can accommodate up to 52 RBs (N_{RB}). Introduction of RB in bandwidth definition originated from OFDM concept where an OFDM waveform is composed of multiple sub-carriers and 1 RB is a group of 12 such sub-carriers. One RB is considered as the lowest unit of frequency resource that can be allocated to a user in OFDM systems and one sub-carrier can be considered as the lowest unit of measurement which can be scaled up to arrive at channel bandwidth. But the question is how to connect N_{RB} with CH_{BW}? Since RBs are formed of sub-carriers there is a need to know the bandwidth of each such sub-carrier. This sub-carrier bandwidth is defined as 'sub-carrier spacing (SCS)' in the 3GPP specifications. Going back to RBs in the example, since each RB represents 12 sub-carriers, multiply N_{RB} with SCS. 3GPP specification provides multiple SCS options. For this example, 15kHz is chosen. Continuing the calculation, the bandwidth in MHz is 52*12*15kHz = 9.36MHz.

This bandwidth is termed as 'transmission bandwidth configuration', which is the maximum possible bandwidth for fitting in the information for assigned CH_{BW}, SCS and N_{RB} configuration. Refer to Fig-1. Note the use of word 'maximum' here. In addition to having multiple channel bandwidth options (1.4MHz to 100MHz) flexibility is provided in number of RBs used for transmission. It is not mandatory for a user (or device) to utilize the entire transmission bandwidth configuration (in this case 52RBs) and less RBs than specified maximum is permitted based on application. These RBs are called 'active RBs' since during transmission even though all allocated RBs can be used (52 in this example) but in reality, only few RBs are active or carry useful information. Remaining RBs are empty or can be re-purposed. This group of active RBs is defined as 'transmission bandwidth'. Note that the unit is 'RB' and not 'Hz' typically used while specifying bandwidth. Using less RBs than maximum is a common case in most 4G and 5G communication system applications. Many low BW applications using narrow-band Internet of Things (NB-IoT) technology require just 1RB out of those 52 RBs.

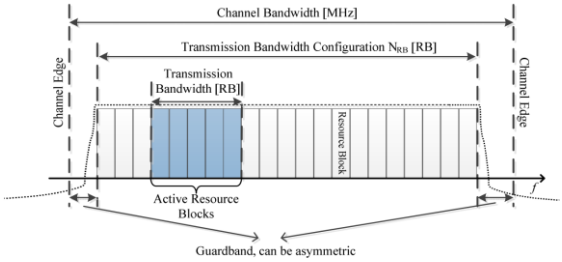


Fig-1: Pictorial representation of bandwidth
Source: 3GPP TS 38.101-1 Rel-15, Figure 5.3.1-1

Now getting back to the calculations, 9.36MHz is less than 10MHz, the CH_{BW} that was chosen for this example. Referring to Fig-1, the remaining part is 'guard band'. 3GPP also defines guard band values in Table 5.3.3-1.

Table 5.3.3-1: Minimum guardband for each UE channel bandwidth and SCS (kHz)

SCS (kHz)	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
15	242.5	312.5	382.5	452.5	522.5	592.5	552.5	692.5	N/A	N/A	N/A	N/A
30	505	665	645	805	785	945	905	1045	825	925	885	845
60	N/A	1010	990	1330	1310	1290	1610	1570	1530	1450	1410	1370

For this example of CH_{BW}=10MHz, N_{RB}=52, SCS=15kHz, the guard band is 312.5kHz. Adding this to 9.36MHz results in 9.6725MHz. But still short of 10MHz. Remember that guard band is on either side of the transmission bandwidth. So, add another 312.5kHz which gives value as 9.985MHz. This value still does not add up to 10MHz. This is because real world systems are not brick-wall filter systems so adhering to exact transmission bandwidth configuration is not possible. 3GPP specifies 'minimum' guard band which means the designer has additional 15kHz (for this example) to design a practical filter skirt. This additional BW accounts for design tolerances such that the channel transmission waveform has sufficient guard band to ensure the spill over to neighboring channel is within permissible limits. Finally, adding15kHz will result in CH_{BW} of 10MHz.

RECENT IMPORTANT EVENTS

A very successful half day VIRTUAL workshop was Organized on 31st May 2020, on Leveraging AI in 5G and Wireless Networks. The workshop was attended by over 70 participants.

HOW TO WRITE QUALITY TECHNICAL JOURNAL PAPER

Dr Navin delivered a couple of half day events, organized by IILM, Greater Noida; KGIT group of Institution, Chennai, and with IEEE HQ publication wing. Over 6000 attendees took part in 3-different events in April and May 2020.

On 14th Jan, one-day workshop on research methodology was organized by UVCE and conducted jointly by section and Antenna and MTT Chapter.

ComSoc arranged a back to back webinar on **5G and Beyond** from 1-6 June 2020 from 7:30-8:30pm. Over 600 participants registered and on an average 110 registrants participated on daily basis.

IEEE COMSOC STUDENT COMPETITION

***Communications Technology Changing the World* Student Competition**

The winning student (or student team) can earn up to US$2,000. The team leader or the individual of the First prize **will be invited to receive the prize at IEEE GLOBECOM 2020, Taipei, Taiwan, with expenses paid.**

https://www.comsoc.org/membership/ieee-comsoc-student-competition

IEEE COMSOC BEST READINGS

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https://www.comsoc.org/publications/ctn/be-or-not-be-there-person-what-future-technical-conference

MEDICAL MICROWAVE RADIOMETER– AN ALTERNATIVE IMAGING MODALITY

M.R. Vidyalakshmi PhD
Saankhya Labs Pvt. Ltd.

Microwave radiometer is a low noise, high sensitivity receiver commonly used for weather monitoring, radio astronomy, and oceanography. Recently medical applications of microwave radiometer have caught attention as a low-cost, passive, non-invasive, and non-ionizing diagnostic modality.

Medical microwave radiometers are mainly used for tissue/cavity temperature monitoring and the early diagnosis of inflammatory diseases like tumours [1]. Conventional scanning techniques like MRI/ultrasound imaging are active imaging modalities which require injecting contrast agents or exposure to ionizing radiation. This prevents them from being used for frequent check-ups or regular screening. Conventional temperature monitoring based on Infrared (IR) thermography is only capable of measuring subcutaneous skin temperature whereas the microwave radiometer can measure tissue temperature several centimetres deep from the surface due to the lower operating frequency (1- 4 GHz) and higher penetration depth.

The microwave radiometer consists of a high gain near field antenna followed by an RF front-end chain with a processing unit as shown in Fig. 1.

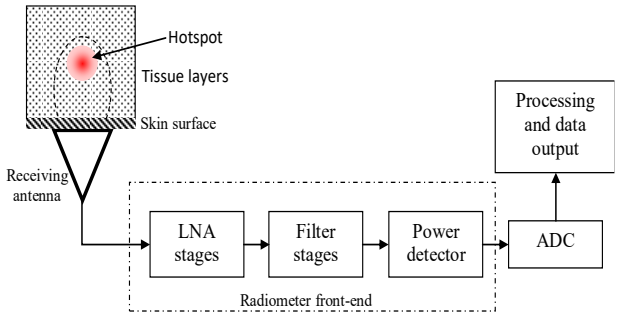


Fig. 1. Block diagram of a medical microwave radiometer

The principle behind the radiometer operation is the black body radiation – all objects above 0 K give out thermal emissions that span all over the EM spectrum. The human body also emits thermal radiation as the core body temperature is maintained at 37°C and the skin temperature is a gradient with respect to the environment. Any lesion or inflammation would be at an elevated temperature due to high metabolic activity than the healthy tissues. The change in the tissue temperature is captured by the radiometer through an antenna and processed using a low noise high gain receiver.

Medical microwave radiometry is a boon early for diagnosis and deep tissue temperature monitoring, especially for neonatal and paediatrics care. Some of the clinical applications of microwave radiometer demonstrated with clinical trials include the screening of breast cancer, brain temperature monitoring during hypothermia treatment for neonatal infants to name a few [2]. It is also possible to monitor the core body temperature in the non-contact mode for COVID-19 scanning. Apart from this, microwave radiometer has been in use in veterinary clinics, for knee temperature monitoring of horses and animals serving for the military.

The major reasons for the technique being not in vogue -

- Sensitivity requirements closer to thermal noise floor (in the order of -161 dBm/Hz at 37 °C)
- Ambient EMI problem – the signal strength of mobile phone and other wireless communication devices operating over 0.8 - 4 GHz.

. Thus, it is important to assess the EM compatibility of the device under the ambient clinical environment along with its functionality.

A medical microwave radiometer with 0.225 °C temperature resolution and 45 mm sensing depth were developed at IIT Madras using custom-designed components [3] for temperature monitoring of knee-joints. The radiometer prototype is shown in Fig. 2. The radiometer complies with the CISPR 22 standard for class B devices and capable of measurement in the ambient clinical environment.

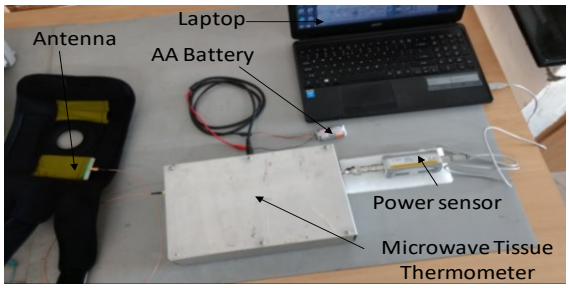


Fig. 2. Microwave radiometer (tissue thermometer) developed at IIT Madras.

Currently, clinical trials and animal studies using microwave radiometer for diagnosis of various ailments related to thermal anomalies are underway. Research is progressing to increase the temperature sensing depth and the temperature resolution of the device. Efforts are also taken for miniaturization of the instrument. Statistical modelling of the input signal (thermal noise) generated by different types of inflammations is also explored.

In all, the future of microwave radiometer as a medical imaging modality looks promising – offering a low cost, screening mechanism for various inflammatory diseases, and temperature monitoring at primary health care centres.

References

[1] N.K. Nikolova, "Microwave imaging for breast cancer," IEEE Microw. Mag., vol. 12, pp.78-94, 2011.

[2] I. Goryanin et al., "Passive microwave radiometry in biomedical studies," Drug discovery today, 2020. DOI: https://doi.org/10.1016/j.drudis.2020.01.016.

[3] V.M. Ravi and K. Arunachalam, "Design, Development and Pre-clinical Evaluation of Microwave Radiometer for Deep Tissue Thermometry," PhD Thesis, Dept. of Engineering Design, IIT Madras, May 2019.

PH.D. POSITIONS IN 6G PHY DEVELOPMENT AT RWTH AACHEN UNIVERSITY

There are two full-time vacancies for excellent Ph.D. candidates with Prof. Haris Gačanin of the Institute for Communication Technologies and Embedded Systems (www.ice.rwth-aachen.de) at RWTH Aachen University in Aachen, Germany.

These positions are part of the development of novel physical-layer radio technologies for 6G communication systems. The topics include the development of novel physical-layer for low-latency applications, full-duplex radio, flexible device-to-device radio networking, channel estimation and equalization, radio resource management and optimization, radar/sensing-communications (more details at https://www.dsp.rwth-aachen.de).

Tasks:

Contribute to R&D projects through the development of simulators and prototypes

Participate in collaboration projects with our academic and industry partners

Support event organization and assist in teaching, e.g. lecture exercises, labs, and seminars

Qualifications:

Applicants must hold a Master of Science in electrical engineering or computer science equivalent and compliant to RWTH Aachen requirements for a Ph.D.

PHD POSITIONS ARE OPEN @ IIT-CNR, PISA, ITALY, on the following topics

#1: Human-centric Artificial Intelligence (H2020 Humane-AI-Net & SoBigData++)

#2: Analysis of large-scale Online Social Networks (H2020 Humane-AI-Net & SoBigData++)

#3: Serverless computing in the device-to-cloud continuum (H2020 MARVEL)

** Hosting Universities:

IIT-CNR is part of several PhD programs including

- the PhD program in Data Science (https://datasciencephd.eu/)
  hosted by the Scuola Normale Superiore (https://www.sns.it/en)
- the PhD programs in Computer Engineering (https://phd.dii.unipi.it/en/)
  and Computer Science (https://dottorato.di.unipi.it/),
  hosted by the University of Pisa
- the PhD program in Smart Computing, jointly organised by the Universities of Florence, Pisa, Siena, CNR, FBK
  https://smartcomputing.unifi.it/

Selected applicants shall apply to the official call of the specific PhD

PHDS AND POSTDOCS IN SATELLITE AND WIRELESS COMMUNICATION SYSTEMS

The University of Luxembourg is seeking to hire highly qualified PhDs and Postdocs at the Interdisciplinary Centre for Security, Reliability and Trust (SnT), in particular for the SIGCOM research group, headed by Prof. Symeon Chatzinotas and Prof. Björn Ottersten, which focuses on signal processing for satellite/wireless communications/networking and radar applications.

Application Process

For a complete list of open positions and in order to apply, please visit the following link : http://bit.ly/2Cb2PGl

In the above context, SnT-SIGCOM is looking for highly qualified applicants in the following positions:

§ 12 Post-Doc positions in:

- Real-Time Signal Processing
- Signal Processing and Communications (3 positions)
- Satellite Communications Systems (2 positions)
- Wireless Communications & Networking (2 positions)
- Ultra-Reliable and Low-Latency Communications for 5G and Beyond Wireless Networks
- UAV-Assisted Communications for 5G and Beyond Wireless Networks
- Algorithmic Aspects of Network Slicing over Next Generation Satellite Systems
- SDN and NFV as Key Enablers for SatCom Integration into 5G Ecosystem

§ 8 PhD positions in:

- Resource Slicing for UAV Communications and Control in 5G and Beyond Wireless Networks
- Wireless Communications Technologies for 5G/6G Networks (2 positions)
- Demand-based optimization of Multi-beam Satellite Communications Systems using Active Antennas
- Hybrid Satellite-Terrestrial Connectivity Solutions for Emerging IoT/MTC Systems
- Dynamic Spectrum Management for Emerging Integrated SatCom and 5G Networks
- Flow management for resilient backhauling in 5G and beyond integrated satellite-terrestrial networks Modelling, optimization, and reconfiguration of hybrid MEO/GEO satellite networks for integrated service delivery

STUDENT BRANCH CHAPTERS CORNER

INDIAN INSTITUTE OF SCIENCE, BANGALORE

The ComSoc Student Branch Chapter was formed in 13th January 2011. The branch has 18 ComSoc members

Faculty advisor: Prof. T. Srinivas

Student Chair: Chandana S Deshpande

AMRITA SCHOOL OF ENGINEERING, BANGALORE CAMPUS

The ComSoc Student Branch Chapter was formed in April 2016. The student branch has largest number of student members over 120 and perhaps the largest Student ComSoc Members. They conduct lot many activities and are highly active.

Faculty advisor: Sagar Basavaraju

Student Chair:

RAMAIAH INSTITUTE OF TECHNOLOGY, BANGALORE

The ComSoc Student Branch Chapter was formed in 9th Dec 2019. The branch has 30 ComSoc members

Faculty advisor: Dr . Shobha K R

Student Chair: Shreshtha Mehrotra

RVCE , BANGALORE

The ComSoc Student Branch Chapter was formed in July 2016

Faculty advisor: Shushrutha K S

Student Chair: Kashish Malhotra

ST JOSEPH ENGINEERING COLLEGE, MANGALURU

The ComSoc Student Branch Chapter was formed in 28 April 2018

Faculty advisor: Dr Rohan Pinto

Student Chair: Valona Mandonca.

CMRIT , BANGALORE

The ComSoc Student Branch Chapter was started in late 2012 but was inactive for a short period. It was restarted on 30 April 2019

Faculty advisor: Mahesh Kumar Jha

Student Chair: Rashmi T

NEW CHAPTERS BY COMSOC

The Student Branch Chapter formation of the Communications Society of IEEE RITB is December 9, 2019. The elections for the office bearers were conducted on 29 January 2020. The number of members when the chapter was started was 10 in December 2019, which has grown to be 30 as of now. ComSoc student chapter was inaugurated in Ramaiah Institute of Technology, Bangalore, on 6th January 2020. The lighting of the lamp was done by Dr. Navin Kumar, Dr. Neelesh. B. Mehta, Dr. Sethu Selvi, Dr. B K Sujatha, and Dr. Shobha K R. The inauguration was done as part of a one-week workshop on **"5G Communication Networks and its Future Perspective".** Dr. Navin Kumar from ComSoc gave a talk on the activities carried out by ComSoc and the benefits of becoming a ComSoc member. He also delivered a keynote address on 5G. Dr. Neelesh. B. Mehta discussed enabling rate adaptation and scheduling in 4G/5G cellular systems with reduced feedback.

MALNAD COLLEGE OF ENGG, HASSAN

The ComSoc Student Branch Chapter was formed in Oct 2019

Faculty advisor: Triveni.C.L

Student Chair: Chalana S.

STUDENT ARTICLE

5G ENABLED CELLULAR VEHICULAR-TO-EVERYTHING TECHNOLOGY(C-V2X)

Kandala Anupama Satya Sai Lakshmi
Secretary, IEEE ComSoc Student Branch
Amrita School of Engineering, Bengaluru

This is the new era of transportation where vehicles are connected to other vehicles, infrastructures, pedestrian, and data centres. Human reliance of vehicles is slowly reducing, and vehicles are being more connected by the day. Vehicles are communicating with other vehicles and infrastructure via V2X communication, which is also known as Vehicle to Everything communication (fig.1). The V2X communication includes V2V (Vehicle to Vehicle Communication), V2P (Vehicle to Pedestrian Communication), V2N (Vehicle to Network Communication), V2I (Vehicle to Infrastructure Communication).

This technology ensures more efficient driving experience leading to highly intelligent, highly secured, increasingly autonomous and hybrid vehicular systems in future. A few of V2X broad set of use cases like "Forward collision warning", "Curve Speed Driving", "Platooning", "Vulnerable Road User alerts", "Discover Parking and Charging", "Traffic signal priority", makes the travel more predictable, productive, safer and greener.

Evolution of V2X communication

The earlier V2X communication had adapted 802.11p standard (Wi-Fi based technology) running in the unlicensed 5.9 GHz band. It is also used in Distance Short

Range Communication (DSRC) which extends up to a range of 225m. Besides, it also works in high speed mobility conditions. However, a few disadvantages like a packet loss at high densities, limited support for network communications has been observed. As it does not use cellular connectivity, it uses ad-hoc networks widely to make connections to roadside uses.

To resolve the disadvantages faced by 802.11p V2X, we use C-V2X communication, which is also known as Cellular-Vehicular to everything communication .It is also known as LTE V2X according to the 3GPP Release 14.C-V2X provides an integrated solution for vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), and vehicle-to-network (V2N) using cellular networks.

C-V2X has two transmission modes: The first mode is over the PC5 interface running on the unlicensed 5.9GHz band which is used for direct V2V communications. It is designed to deliver safety messages such as immediate potential hazard warnings for short-range which extends

Fig 1. V2X communication , Image Source: Ficossa

up to 450 m in V2V, V2I, and V2P situations. This mode uses LTE Direct D2D design.

The second mode is over the Uu Interface on the licensed band cellular network which is usually V2N communication in cases like infotainment and to deliver safety messages and warnings for longer-range traffic conditions and potential hazards. This mode use LTE Broadcast to broadcast messages from V2X server to vehicles and beyond. Vehicles unicast the messages to the server as shown in fig.2

5G- V2X Communication

The advanced and next generation cellular network 5G has many advantages over LTE. This in turn shows some significant advancements in the V2X technology.5G supports more spectrum bands and types as well as licensed and unlicensed, shared band allocations. The 5G air interface is highly capable to adapt to target use cases and spectrum. The 5G radio interface is referred to as 5G New Radio (NR). It supports an array of advanced features such as scalable Orthogonal Frequency Division Multiplexing (OFDM), massive Multiple-Input Multiple-Output (MIMO).

These features together deliver V2X services by providing longer range, lower latency, enhanced reliability, higher spectral efficiency, very high throughput, and high precise positioning. Incorporating 5G technology in V2X Communication, will support a large number of V2X use cases with higher data rate, low power consumption, massive Machine-to-Machine communications (mMTC) with Ultra Reliable Low Latency Communications (URLLC). 5G enables vehicles to connect in a new way like multi-hop to extend the coverage area. 5G -V2X is failure tolerant because of the involved multiple connected links. It can also achieve Line of sight (LoS) and non-LoS ranges. The advanced features like vehicles connecting to the cloud allows to store a huge data in the cloud from the sensors embedded in the vehicles and roadside units (RSU's).

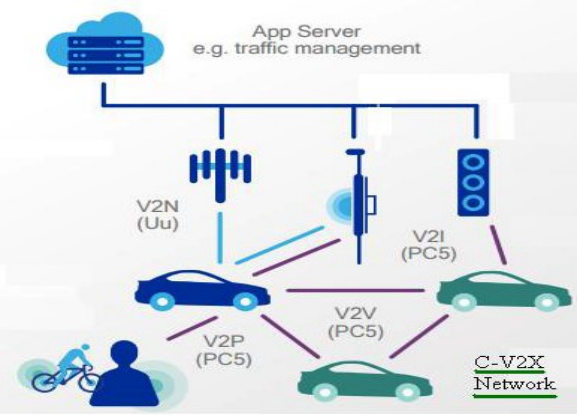


Fig2: LTE-V2X communication, Image Source: Qualcomm

Some advanced use cases with 5G are as follows (also refer fig.3)

1. Advanced Driving with trajectory sharing
2. High density Platooning of Vehicles
3. Autonomous Vehicles
4. Remote Driving for Autonomous Vehicle
5. Real time HD mapping for Automated Driving
6. High Precision Positioning of Vehicles

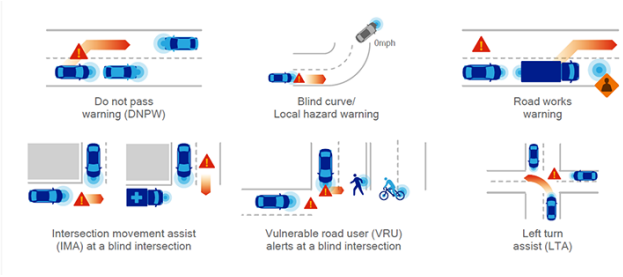


Fig 3. Related use-cases of v2v communication
Image Source: Qualcomm

Emerging technologies in electronics, sensing and computing like AI, computer vision is likely going to be in reality in the following years. Autonomous vehicles with advanced features can be designed by integrating these technologies withV2X.As we talk about the self -driven and autonomous vehicle technologies, 5G is surely going to bring new revolutions in the era of V2X communications.

EDGE & CLOUD COMPUTING

Neehar Chandavarkar
Secretary, IEEE Communications Society,
Ramaiah Institute of Technology

Cloud computing is defined as the on-demand availability of computer system resources, especially data storage and computing power without direct active management by the user. Without cloud, the data storage, especially for companies having thousands of employees becomes awfully expensive. Thus, companies opt to outsource the services from cloud service providers. Some of the leading cloud computing services are Amazon Web Services, OneDrive by Microsoft, and Google Drive. The user's data is handled in the data centres of these cloud service providers. However, the cloud that is centrally deployed on a global scale needs to process an enormous amount of data. In addition, as the physical distance between the cloud and the user increases, transmission latency increases, in turn increasing the response time. On top of that, the processing speed in this environment is largely dependent on the performance of the user's device. Hence, the tech giants felt the need to upgrade cloud computing and leverage 5G wireless technology and AI to enable faster response and simplified maintenance in computing. This is where edge computing comes into picture. It is also be viewed as extension of cloud computing.

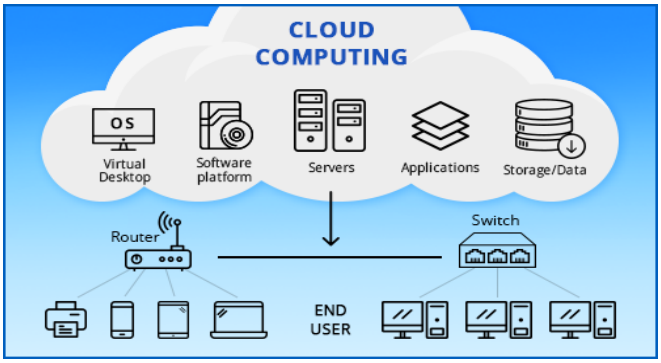


Fig 1: Cloud Computing, Image Courtesy: thinkitsolutions

According to a Cabinet office survey, when PC users were asked what they were doing on their PCs, 95% responded that they were using the internet. When asked for what, responses included watching videos, research and downloading data. Also, in recent years, web browsers have been operating on more and more devices. From set-top boxes and stick PCs, to digital signage displays; and the world continues to add more devices in the pool. Yet, the usability and the display speed of a web browser is heavily dependent on the performance of devices. And if it is not up to the task, the weight can be stressful. So, to reduce that stress, edge computing platform acts as an efficient tool. A web browser in this environment will off-load a part of the workload to an edge server.

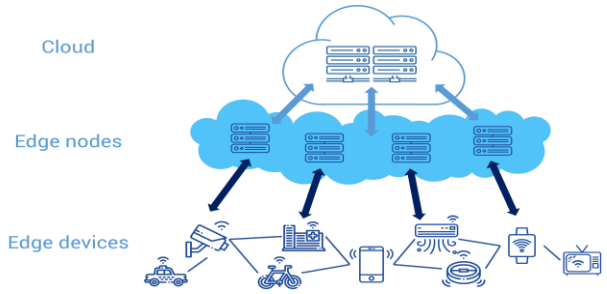


Fig 2: Edge Computing, Image Courtesy: Alibaba cloud

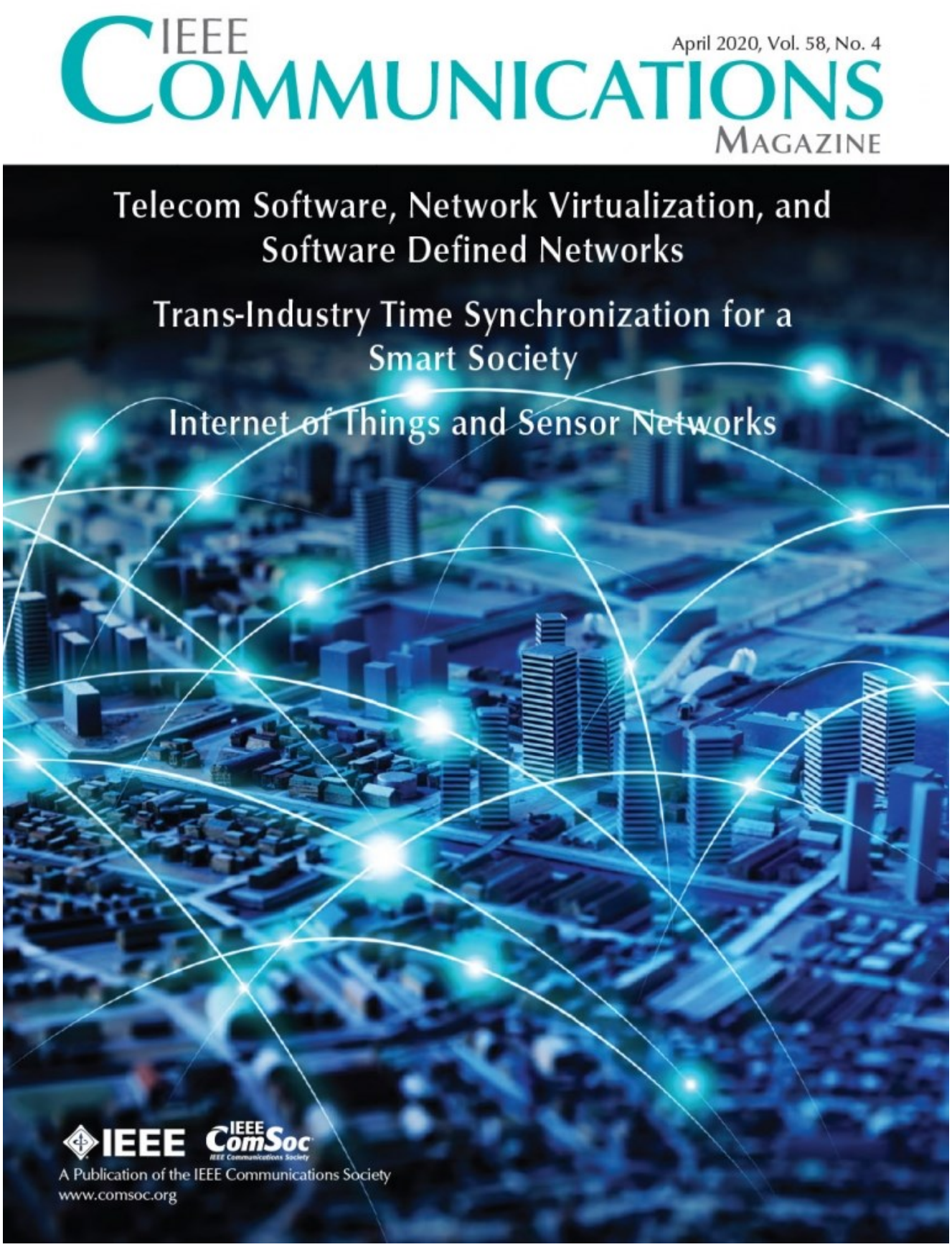
After comparing the web browsers in the standard platform with the web browsers in the edge environment, it was found that websites with complex processing like JavaScripts and websites with a lot of images in particular loaded much faster on the edge platform than in the standard cloud environment. Also, since most of the processing is performed on the edge server rather than the device itself, the performance of the device mostly becomes irrelevant allowing support for a wide range of devices.

FUTURE SCOPE

Looking at the present scenario where the existing IOT systems perform all their computations in the cloud using data centres, the question many ask is when can edge computing be a part of our day to day lives. According to experts, the true potential of the edge computing will become apparent when 5G networks go mainstream because all that is required is a strong internet connection and not big memory storage computers. Experts also believe that by the year 2025, over 75% of the data handling will be done on the edge servers. Several companies have already begun testing and have started using edge computing. For example, NVIDIA, one of the biggest players of design and manufacture of graphics and AI acceleration have announced EGX, an edge computing platform. Edge computing is overall a major update of cloud computing in terms of speed and data handing

IMPORTANT UPCOMING EVENTS

EVENT NAME	DATE AND MONTH	VENUE
HALF DAY VIRTUAL WORKSHOP ON – **THE ERA OF PROGRAMMABLE NETWORK**	27 JUN 2020	VENUE – VIRTUAL
IEEE CONF **CONECCT 2020 (COMMUNICATION TRACK)**	2-4 JUL 2020	VIRTUAL
T-TIME CHARCHA	25 JUL 2020	VIRTUAL (HALF DAY)
RESEARCH METHODOLOGY WORKSHOP	22 AUG 2020	VIRTUAL (ONE DAY)
IEEE 5G WORLD FORUM	10-12 SEP 2020	
3GPP NR WORKSHOP	26 SEP 2020	VIRTUAL (HALF DAY)
3RD ITS WORKSHOP	07 NOV 2020	WIPRO/VIRTUAL
IEEE 5TH 5GFWT 2020 WORKSHOP (IN ASSOCIATION WITH ANTS 2020)	16-19 DEC 2020	VIRTUAL/IIIT DELHI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