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**Union of Electronics, Electrical Engineering and Telecommunications (CEEC)**  
**Ministry of Transport, Information Technology and Communications**  
**The Communications Regulation Commission**  
**Technical University of Sofia**  
**Union of Scientists in Bulgaria**  
**Telecommunications Association (ASTEL)**  
**24-rd NATIONAL CONFERENCE**  
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# **TELECOM 2016**

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**NOTES ON TELECOMMUNICATIONS - 2016**

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**9.**

**THE “PRAVETS” TRADEMARK - RESURRECTION**

**Boyko Vuchev**

## 10.

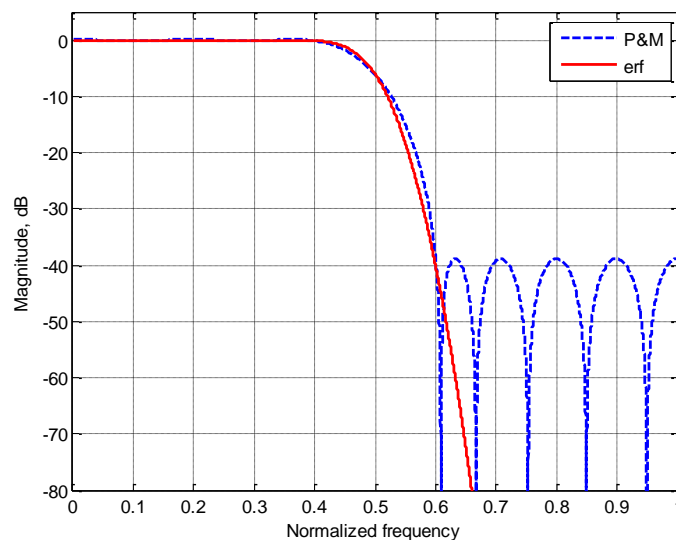
### APPLICATION OF NEW MATHEMATICAL FUNCTIONS FOR DIGITAL LINEAR-PHASE FILTERS DESIGN

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In the article we defined a new function that approximates with high precision ideal transfer function of the low-pass filter. The analytical relationships to determine the parameters of function, and their relationship with the parameters of the low-pass filter are presented. A method for linear-phase digital filters design is proposed. It has been shown experimentally that the proposed function possesses better qualities than equiripple polynomial approximation using  $L_\infty$  norm. An analysis of the results is made.

Keywords: Approximation, Error function, digital filter



Сравнение на АЧХ на новата функция с равновълнова (P&M)

## 11.

### TRAFFIC PERFORMANCE OF THE PRIORITY SERVICES OF THE IP TRAFFIC

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The paper presents an investigation of the quality of service of IP traffic flows, using different queueing discipline. The main goal is to model the possibility of using a priority scheme, which is optimal for both the priority and non-priority served traffic flows. In case of priority queues the model covers both cases: preemptive and non preemptive services. Another schema is modeled, in which the pre-emptiveness might occur with a predefined or dynamically changed probability. A software platform is created to simulate the traffic flows and the service. The results show the possibility to use such p-pre-emptive serving in case of different IP traffic flows. Packet length can be modeled with a fixed size, random value with



exponential distribution, and bimodal distribution. The model is with infinite queue length but results are given for the number of waiting packets for both traffic flows – low and high priority.

**Keywords:** Priority queue discipline, Queue length, Waiting time

## 12.

### MEASUREMENT OF THE REFERENCE SIGNAL IN 4G LTE NETWORK IN SOFIA

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Long Term Evolution (LTE) networks provide a downlink reference signal with a predetermined structure, known as the downlink pilot signal. This reference signal (RS) is transmitted from the eNodeB with a constant power and the user equipment (UE) uses RS to estimate the instant downlink channel conditions. UE measures three reference signal key parameters in LTE downlink - RSRP (Reference Signal Received Power), RSSI (Receive Strength Signal Indicator) and RSRQ (Reference Signal Received Quality). In LTE networks each UE measures RSRP and RSRQ, as these measurements are used mainly to rank different LTE candidate cells according to their signal strength and quality. The handover and reselection decisions are taken on the basis of these measurements. In this paper are presented RSRP and RSRQ measurement results in a real LTE network in Sofia.

**Keywords:** LTE network, reference signal, measurement, RSRP, RSRQ

## 13.

### DISPLACEMENT CURRENT AND AMPERE'S LAW

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The existing literature about displacement current, although it is clearly defined, there are not enough publications clarifying its nature. Usually it is assumed that the electrical current is three types: conduction current, convection current and displacement current. In the first two cases we have directed movement of electrical charges, while the third case we have time varying electric field. Most often displacement current talking in capacitors. Taking account that charge carriers (electrons and charged particles occupy the negligible space in the surrounding them space, they can be regarded only as exciters of the displacement current that current fills all space and is superposition of the currents of the individual moving charges. For this purpose, in the article analyzes the current configuration of lines in space around a moving charge. An analysis of the relationship between the excited magnetic field around the charge and the displacement current. It is shown excited magnetic flux density and excited the displacement current are linked by Ampere's law.

**Keywords:** electromagnetic field, magnetic flux density, displacement current.

## 14.

### ON THE POSSIBILITY OF IMPROVING THE CHARACTERISTICS OF PROTOCOLS FOR TELEMETRY DATA TRANSMISSION FROM UNMANNED AERIAL VEHICLE

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The present report aims to analyse modern methods and protocols for transmitting information to a remote location and to provide an overview of the used technology called telemetry. In order to achieve the objective, the main emphasis is laid on open source protocols, because they provide an opportunity for in-depth analysis and access to their internal structure. That on the other hand leads to the possibility modifying the protocol internals according to specific needs.

A comparative analysis was conducted of the most frequently used protocols for the telemetric transmission of information. Based on the obtained results, numerous advantages were identified for MavLink protocol. Some of the identified advantages are the wide field of application, cross-platform capabilities, extremely simple structure and several others.

In order to show the capabilities and advantages of the MavLink protocol, we presented a methodology for modifying the protocol source code and integrate it in specialized laboratory platform for researches. The platform consists of two single-board microcontrollers, called Arduino, one of which performs the functions of a transmitter (Unmanned Air Vehicle – UAV) and the other one – receiver (Ground Control Station – GCS). The objective is to minimize the protocol overhead as much as possible and send only telemetry information necessary for the proper operation of the system.

Developing these type of platforms is a preferred option, because the standard structure of the protocol has a lot of functionalities and options which may not be needed by a specialized system. Because of that it is necessary some of the protocol’s function blocks to be simplified or completely remove, which on the other hand will lead to increased transmission speeds, minimized overhead and overall system efficiency.

**Keywords:** Telemetry, Telemetry protocols, Arduino, single-board microcontrollers, MavLink;

## 15.

### CHALLENGES FOR PROVIDING SECURITY IN INTERNET OF THINGS

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The problem with cyber security worries many developers around the globe. After Internet of things concepts was announced many companies around the world focus their work on developing new ways to secure fast growing networks of smart devices. It is essential to find a new flexible protection which must meet the following basic requirements – adaptability to fast growing network of devices, applicability of each main layer in the IoT concept, low

computing power, low traffic over the network, and the most important thing limitless application of smart devices.



Another very important consideration that developers must focus on is the implementation of this security. Three layers can be distinguished when talking about establishing reliable protection for Internet of Things – secure the devices, secure the cloud and secure the local network. Each of these points is very important for applying good and secured environment for such a new technology. In case of a problem in one of these layers all the effort related to developing new protocols, fire walls or software products would be wasted. Many years of experience accumulated in the establishment and implementation of protection in the well-known wire and wireless technologies is a prerequisite for good development of IoT. Unfortunately, the characteristics of Internet of Things make these well-known technologies inapplicable in the form they are known.

**Keywords** – Internet of Things, security, smart home, protection;

## 16.

### **SCP-RPSC - THE KEY TECHNOLOGY IN THE NEXT GENERATION STEERABLE LINES FOR SATELLITE COMMUNICATIONS**

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A retrospective review of the author research, dealing with possible applications of SCP-RPSC technology in the next generation steerable lines for satellite communications, is given in this report. The analysis shows that there is very wide area of different SCP-RPSC applications where it is necessary: to direct a narrow beam over a sector angle and give coverage like a sector antenna; to obtain high antenna gain and thus to reduce power and amplification requirements on radios; to narrow the antenna beam width in order to reduce multipath propagation problems; to create complex and dynamically re-configurable radio networks exhibiting high spectrum efficiency; to reuse the frequencies and timeslots in different directions; to obtain secure and reliable satellite communications, resistive to the enemy active jamming, as well as to use “multiple spot beams” approach from unstable or mobile satellite communication platforms.

**Keywords:** SCP; RPSC; Steerable; Satellite; Communications.

17.

## **IMPROVING THE VOICE TRAFFIC IN WLAN NETWORK**

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This article examines the simulation model of a wireless local area network, which transmits voice and HTTP traffic. By adjusting the EDCA 802.11e parameters the voice traffic is improved compared to its default settings.

**Keywords:** IEEE 802.11e, QoS, ToS, EDCA, Voice Traffic

18.

## **MODULE FOR CONTACTLESS MEASURING OF SURFACE TEMPERATURE OF DISTRIBUTED OBJECTS IN THERMAL ZONE**

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The work is considered a module for contactless measurement of surface temperature of distributed objects in thermal zone in the room in the building. Based on his own radiation areas of the objects within the area of vision of sensors are measured their temperature. It is taken into account the impact of rear radiations, emission by the atmosphere, the distance, the type of sensors, etc. The module is part of a larger system for energy efficiency, monitoring and management of buildings. The module simultaneously measured several areas of interest, such data are transferred for further processing to search links establishment of problems, making inferences and others.

**Keywords:** infrared thermograph contact less temperature measurement

19.

## **SERVICE MODELS OF CLOUD SOFTWARE-DEFINED RADIO**

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Cloud computing and software-defined radios are promising concepts in the evolution of modern radio communication systems. Joint usage of these two technologies allows development of new architectures related to spatial distribution of the blocks of the radio and translocation of computing in the cloud. In the presented material the opportunities that integration of cloud computing and software-defined radio provides for the implementation of new models of services in modern communication networks and systems are shown. Based on the traditional model Software-Platform-Infrastructure, set in the concept of cloud computing, basic service models of cloud software defined radio are defined. Proposed

architectural models of services will allow the formation of new solutions for the development and use of cloud-based radio communication systems.

**Keywords:** software-defined radio, cloud computing, service models

20.

## **PLATFORM FOR EVALUATION AND ANALYSIS OF CONTROL PLANE PERFORMANCE IN SOFTWARE-DEFINED NETWORKS**

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SDN is a new paradigm which shifts the traditional network architecture to new one - separating and centralizing the control logic from forwarding plane functionality. Essential task in the contexts of Software-Defined Network architectures is the controller placement problem. The problem has gain a lot of attention and it is related to finding the best location of several controllers into networks considering specific network metrics. These metrics might be the latency in the network, failure tolerance of network elements (links, nodes, and controllers) or they can be the metrics related to load balancing between controllers. In most scenarios most of the criteria mutually compete, thereby solution to the problem is not unique meaning there is no single solution that would satisfy several requirements simultaneously. Therefore, finding the best controller placement in Software-Defined Networks is rather subjective process assigned to decision makers. A decision maker might be a person or computer software, whose role is to find a balance between criteria and to choose a compromise controller location.

Finding the best controller location in the control plane of Software-Defined networks is an important task that is related to the whole network performance. In order to find methods for improving network performance it is necessary to perform thorough analysis of the metric or criteria that affect the controller placement. The analysis can be performed as a survey but in order to achieve better results conducting simulation or practical researches are required. Based on results of such researches correlation between the criteria that affect network performance can be detected. Different simulation and emulation programs can be used for the implementation of such researches. In this paper the authors provide a platform capable for conducting emulations and further analysis and estimation of SDN performance.

**Keywords** Software Defined Networks (SDN), control plane, Controller placement Problem, Mininet, Internet Topology Zoo

21.

## **COMPARATIVE ANALYSIS OF TECHNOLOGIES TO CONSTRUCT VEHICLES AD-HOC NETWORKS**

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Manet and Vanet are networks, which are used for wireless communication. Mobile Ad-hoc Network (MANETs) consists of devices, which configured in independent network alone. Vehicular Ad Hoc Networks (VANET) is a subclass of Mobile ad hoc networks (Manet)

which provides a distinguished approach for Intelligent Transport System (ITS). The research of routing protocols in Vanet is important and necessary for Intelligent Transport Systems (ITS). This report discusses the advantages / disadvantages and the applications of various routing protocols for vehicular ad hoc networks. It explores the motivation behind the designed, and traces the evolution of these routing protocols. Finally, the report concludes by a tabular comparison of the various routing protocols for VANET.

Keywords: Manet, Vanet, ITS, routing protocols

## 22.

### QUALITY OF SERVICE EVALUATION IN IP NETWORKS WITH PEAKED ARRIVAL AND DEPARTURE PROCESSES

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In the paper, the peaked traffic flows in IP based network to describe by generalized arrival and departure processes with nonlinear state dependence intensities is suggested. The quality of service in modern telecommunications networks with packet switching is evaluated by the developed model of a single server delay system  $M(g)/M(g)/1/k$  (by Kendal notation) with state dependent arrival and departure processes. The investigation is based on the analytical continuation of the Poisson arrival and the Bernoulli service process and the classic  $M/M/1/k$  queue. We apply techniques based on birth and death process and state-dependent rates. The state probabilities of the system are obtained using the general solution of the birth and death processes. The influence of the peaked factors on the state probability distribution, the congestion probability and the mean system time is evaluated. It is shown that the state-dependent arrival and service rates changes significantly the characteristics of the queueing systems.

**Keywords:** single server queue, Poisson and Bernoulli process, state-dependent rates

## 23.

### BEYOND ALGEBRAIC CONNECTIVITY OF GRAPHS -EVALUATION OF TOPOLOGY, BASED ON SPECTRAL CLUSTERING

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This paper presents a method for graph topology evaluation based on the Spectral graph theory, which is based on the analysis of Eigen values and Eigen vectors of the graph matrices. When doing Spectral graph analysis, the first is to calculate the Eigen values and Eigen vectors of the Laplacian matrix of the graph, which gives the important value  $\lambda_2$  –the algebraic connectivity of a graph and the Fiedler vector. This vector has values for each node of the graph. On the base of this analysis, a variant of adding a new edge, which gives the highest gain in the algebraic connectivity, is made. Based on this work, a system for automated analysis of graphs and self-learning algorithm for graph analysis and optimization can be made.

**Keywords:** network topology, graphs, algebraic connectivity, spectral graph theory, Fiedler vector

24.

## **PAYMENT OF PENSIONS BY "BULGARIAN POSTS" PLC - MONOPOLY OR OBLIGATION ?**

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The paper studies the payment of pensions in terms of monopoly position, degree of liberalization, competition and the EU legislation in the field of services of general economic interest. The necessity of an obligation to pay pensions is justified. An analysis of the conditions and terms for provision of the services is conducted. Formulas for calculating the net costs of the postal operator are presented. The characteristics of a "pure monopoly" are compared to those of a designated provider of pensions. A conclusion as to the nature of the service and the compensation of the net costs is drawn, and an answer to the title of the report is provided.

**Keywords:** monopoly, imposed obligations, net costs compensation.

25.

## **CLOUD SERVICES- TOOLS FOR MODELING AND SIMULATION**

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In this paper the main services provided by cloud computing network are presented. The models of services and general topologies are pointed out. Various software solutions and tools for simulations in cloud computing are presented. Their advantages and disadvantages are compared. After the selecting a specific software product a real simulation in a cloud with certain parameters is made. The simulation results are presented and analyzed.

**Keywords:** Computer networks, Cloud services, Cloud system commented on are presented.

26.

## **CHALLENGES FACED BY THE AUTONOMOUS MANAGEMENT IN FUTURE INTERNET**

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Internet becomes more and more scalable infrastructure that steadies the social and economic life on the earth. This circumstance leads the need to develop new networks or to

expand the old ones in way to meet user and device requirements. Future Internet is a network architecture which aims to realize a concept like this one, networks to be more flexible and adaptive. Current publication studies the need for implementation of autonomy in future networks. There are discussed three use cases—the necessity of self-configuration of services, of self-configuration of devices and of way to locate, to inspect and to resolve faults or intrusions. The establishment of similar properties saves much time and costs while improves the quality of the provided services.

**Keywords:** Future Internet, Autonomous management, Self-management

## 27.

### **APPLICATION OF GNURADIO IN DIGITAL MODULATIONS CURRICULUM**

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Opportunities that free software (GNU) and hardware make available for training in ICT are astonishing, so many open projects supported by research teams from leading universities focus on key areas in teaching technology. The project GNURadio expand these opportunities for the use of Software Defined Radio (SDR) and makes it available virtually all modern techniques of digital signal processing, for the needs of modern digital systems for radio reception and broadcasting. The software package based GUI type drag & drop and Python scripting configuration allows the simulation and analysis of real RF signals, including decoding of digital streams and deep packet inspection sending data to other free software tools like: Wireshark, Airodump and Aircrack etc. This allows us to achieve extremely high efficiency and realism in teaching subjects related to broadcasting, coding and signal processing of radio signals. Thus, students can comprehend in details and foundation of modern standards, techniques and methods used in modern radio chip-sets as including access to a set of tools for development of new techniques for signal processing for the needs of radio communication systems.

## 28.

### **FOR THE INTEGRATIVE APPROACH OF THE TELECOMMUNICATIONS AND LOVE OF PATRIOTISM**

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The article presents one possibility for the integrative approach of the telecommunications and love of patriotism for the sustainable development.

**Keywords:** integrity, telecommunications, patriotism.



29.

## COMPARATIVE ANALYSIS OF TECHNOLOGIES FOR 3D OBJECTS REPLICATION

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3D printing turns digital 3D models into solid objects by building them up in layers. The technology was first invented in the 1980s, and since that time has been used for rapid prototyping. Already it is possible to 3D print in a wide range of materials that include thermoplastics, thermoplastic composites, pure metals, metal alloys, ceramics, resin, wax, nylon, plastic or metal laminates, standard paper and various forms of food. 3D printing encompasses a wide range of additive manufacturing technologies. Each of these builds objects in successive layers that are typically about 0.1 mm thin. The methods used vary significantly, but all start with a computer aided design (CAD) model or a digital scan. The file contains information about dimensional representation of an object. This is then processed by “slicing software” that divides the object into thin cross sections that are printed out one on top of the other. CAD file must be converted into a format that a printing machine can understand. There is Standard Tessellation Language (STL) format that is commonly used. The whole process consists of consequent printing of layer by layer hence STL file that printing machine uses should have the information for each layer. When the layer is finished, it’s moved up and the next layer is started to be worked on until printing is completed. In basic terms there are four categories of 3D printer, but the technologies are more than four. In this paper different technologies for 3D printing are analyzed and compared. Right now, 3D printing as an end-use manufacturing technology is still in its infancy. But in the coming decades, and in combination with synthetic biology and nanotechnology, it has the potential to radically transform many design, production and logistics processes.

**Keywords:** 3D printing, 3D printers, 3D technologies

30.

## DESIGN OF THE OPTICAL NETWORK STRUCTURE IN THE TRANSITION FROM 'LAN' TO 'PON' NETWORKS IN BULGARIA

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The aim of this report is to present a project in which we show how to build an environment that will allow us to study in depth FTTx (Fiber to The 'X') networks as well as in selecting the optimal solution for this environment. We consider the basic topologies of FTTx networks, namely from point to point and point to multipoint.

## 31.

### IMPLEMENTATION OF ICT IN TEACHING OF POWER SUPPLY DEVICES

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One of the main problems in education of power supply devices is the fact that apart from theoretical knowledge in mathematics, physics, electrical engineering and control systems, the students should also acquire a sufficient amount of practical experience in order to become highly qualified and competitive professionals.

The aim of this paper is to present a successful symbiosis between the products of two leading companies, manufacturers of electronics: TI and NI. The developed test bench combines hardware for data acquisition and supervisory control working in the LabVIEW environment and the recently developed innovative PMLK. In this way, working with high-tech educational power supply educational boards is accessible for a broader range of students, including also students whose education doesn't comprise a detailed study of power electronic devices. The use of LabVIEW allows for the development of virtual instruments that ease the student's work with the boards – for example if the chosen configuration could possibly damage the circuit under study, LabVIEW's virtual instrument (VI) will popup a message describing what could occur if the system executes the selected configuration and also giving the student directions on how to select the correct working configuration. Moreover, the VI's allow measurements and data acquisition without additional devices.

**Keywords:** education, DC-DC converters, power supply devices, virtual instruments

## 32.

### TELECOMMUNICATION SYSTEM FOR GREEN ECONOMY – A SURVEY

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The fast development of telecommunications arises the question of power consumption in communication systems, as well as its impact on the environment. Another important issue is the electromagnetic pollution due to the use of those systems. The article is a brief overview of the energy consumption in various types of communication systems - data centers, cloud computing, networks, systems, devices and circuits. The proposed solutions to tackle the problem vary depending on the type of communication system. Most commonly a low-power mode is used when there is absence of traffic in the entire system or parts of it. It is called economical or "sleep mode". Other good practices are developing new algorithms and protocols that improve the energy efficiency of the system.

**Keywords:** energy consumption, green communication, USRP

# Information

## for the participants and guests of Telecom 2016

Until 27 October 2016 detailed information on issues of the Conference can be obtained at the National House of Science and Technology in Sofia, 108 Rakovski St., V Floor, Room 506 or by phone: 02 987-97-67 and 0887508262.

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