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“Telecommunications, Informatics, Energy and Management” (TIEM) is a conference organized by the University of Telecommunications and Posts, Sofia Bulgaria. The goal of the TIEM 2021 conference is to provide an international forum for researchers, academics, people in industry, and students to address recent research results and to present and discuss their ideas, theories, technologies, systems, tools, applications, work in progress and experiences on all theoretical and practical issues arising in telecommunications, electronics, signal processing and applications, information technologies, energy and management.

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- Management, Economics, Leadership and Entrepreneurship;
- Telecommunications & Information Technology;
- Information, Networking, Security Technologies.

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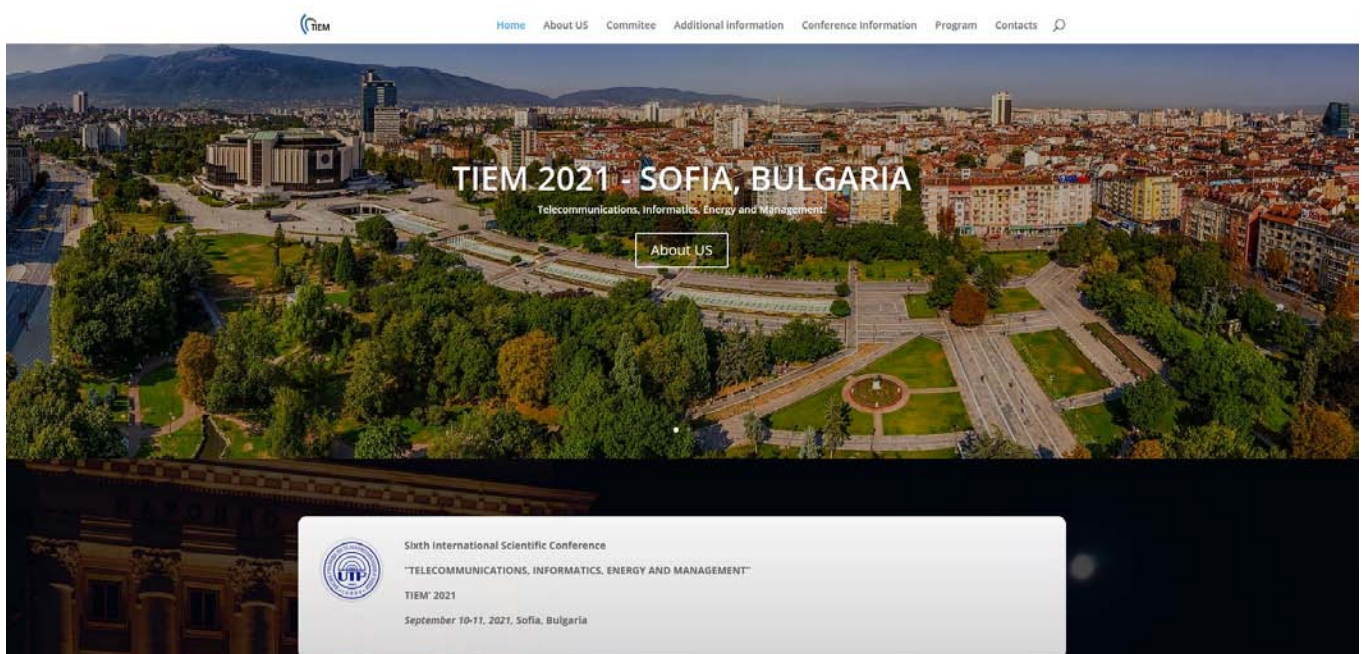
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OPENING SESSION – 10.09. – 10:00 AM



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Rector

**Rector of the University
of Telecommunications and Post,
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Wellcome speech

KEYNOTE SPEECH 1 – 10.09. – 10:10 AM



Luca Lepore
Business Development Manager

CISCO SYSTEMS:
Educational programs

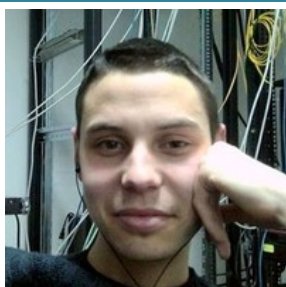
KEYNOTE SPEECH 2 – 10.09. – 10:25 AM



Yang Cao
Sales Director EU & MENA

HILLSTONE NETWORKS
**Trends and innovations in modern
cybersecurity technologies**

KEYNOTE SPEECH 3 – 10.09. – 10:40 AM



Martin Rakov
Sales Engineer in COMPUTER 2000
Bulgaria

**Cybersecurity and Cyber Threats
in 2021**

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Section 1.

MANAGEMENT, ECONOMIC, LEADERSHIP AND ENTREPRENEURSHIP

An Emotions as a Personal Meaning of Information

Liubov Ilieva¹

Abstract – In this work, we develop a cognitive approach modelling the genesis and manifestation of the emotional processes based on the pragmatic meaning of signals. We analyse the emotional reactions that activate perception, the process of thinking and acting in a complex structure and form the specific significance of information and appropriate behaviour. Three stages of signal processing are distinguished in our research; We pay special attention to problems of the identifying of the features of one object, the connection between the object and the word as well to the semantic analysis of this connection. The research is carried out taking into account the current level of the scientific understanding and modelling of the information processes in its pragmatic context and achievements of the theory of artificial intelligence and neural networks.

Keywords – motivation, demands, emotional reaction.

I. INTRODUCTION

In this article, we investigate emotional aspect of receiving and working out of information. All areas of human cognition and behaviour have emotional back up. Emotional processes accompany perception and activate it, as well as they accompany the processes of thinking. All our actions have emotional back up. Emotional processes underlie the manifestation of a person's attitude to the situation in all spheres of his life. All basic human needs and the possibility to satisfy them in the current given situation are also associated with the emotional sphere, which determines the choice of behaviour appropriate for the situation.

Emotions are connected with informational phenomenon, so they could be investigated in the frames of cognitive psychology [1], Lazarus stressed that the quality and intensity of emotions are controlled through cognitive processes. It is necessary to indicate that the cognitive activity connected with the emotional context may be conscious or unconscious [2] but in both cases we could describe it through pragmatic modelling and work out of the informational flows, by creating the personal data sense. According to Arnold [3], object intuitive valuation is cognitive determinate for emotions and both emotion and action follow this intuitive valuation. Lazarus [4] thinks that the emotion appears as a result of cognitive action in the end of this activity. In the cognitive scheme, the receiving of message results in the emotion appearance. First perception takes place, and then the first evaluation of the information takes place and then research activity. The research activity forms personal meaning of information, based on the value of responding to it, this is how a secondary assessment is formed, which leads to a tendency to action and to an emotional reaction.

According to Ortony et al. [5] emotional experiences are caused only at the stage of semantic awareness of information.

As Schachter [6] shows that not only received information but the one's experience are the source of an emotion. Except the result of the information evaluation emotion could be shortcuts to process information and influence behaviour [7].

One can see that cognitive approach connects the manifestation of emotions with the formation of the personal significance of the signal of that is happening at different stages of its processing. It is very important to fulfil the model of emotional manifestation that will describe all the successive stages of identifying of the pragmatic meaning of the information and emotional significance of the signal connected with it. In such a model it is necessary to take into account not only all the stages of identifying the pragmatic meaning of information, but also the interaction between the stages. So in the complex system approach we could describe emotional phenomena as reactions forming the pragmatic meaning of the message.

The our days level of understanding and modelling information processes in pragmatic context determines the perspective of such an approach [8-10]. See also the development of the theory of artificial intelligence and neural networks [11], that have advanced the understanding of the process of recognition in the context we are analysing – giving the sense to incoming data. Taking into account the limited scope of the current work we propose here a systematic model of emotion in its most general form, and we will consider it in more detail in subsequent studies.

II. RESULTS

According to the modern researches of human perception, we observe three principal stages of working out of the information connected with emotions. One could find other stages of the reduction of information in order to simplify its analysis. If we represent the signal that is coming into an eye as a picture, it means that during this process of incoming of signal we are dealing with the reduction of the data forming information of the contrast changing, these data do not have emotional manifestation. This three stages system of the signal working out is depicted in the block diagram of Fig. 1. Signal signs are first identified, then – objects associated

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with them and at the end of this process – words appear. Some authors connect these three stages of the signals working out with three functional brain centers: bodily instinctive center, emotional and intellectual [12] – or instinctive, biological, social. Two sets of arrows are shown in the figure. Arrows marked with continuous line indicate the forward transmission of information-bearing signals through the system. The arrows marked with pointing line signify the presence of feedback in the system.

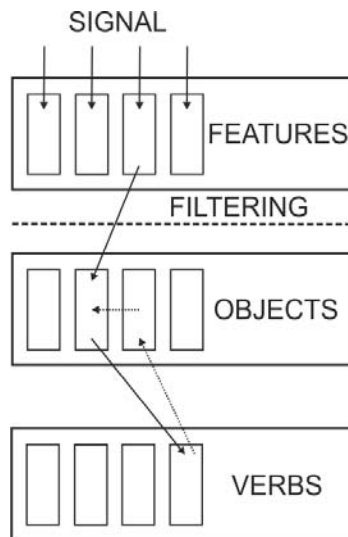


Fig. 1. Block diagram representation of three-stage system of information-processing.

In addition to signals in these parts information related to the emotional manifestation in each of the parts is transmitted. These parts are not shown in this figure. In the Fig. 1. each element is an example of the simplest implementation of the same type of sub-elements at the same level, each level reveals one characteristic of the signal, it could be one sign, one image, one word, but essentially characteristics of signal have very complicated structure.

Feature extraction

At the first stage, the signal features are analyzed and the significance of the signal towards these features is determined. Only significant and new signals are transmitted for further proceeding, the other signals are blocked. At this stage, the conscious does not take part in the filtration, because the filtration is quick and rough. As a result of this work instinctive reaction to the receiving signal could appear before. Such a reaction is the most ancient, it became more complex in the process of developing of living creatures, this is why human still have this type of reaction. At the stage of feature extraction, the signs are caught up and it is specified how important is the signal associated with the feature. In his synergetic model of quality information H. Haken has shown how the feature associated with the signal received the pragmatic sense [8,9]. Set of parameters defines one feature.

This set builds relief surface. There is something like valleys in this surface. The valleys define attractor position. When one signal comes, the system moves into one of the valleys. The importance of the signal is depending on the importance of the valley. In this model, we analyze emotion as a personal meaning of information and we suppose that this meaning is connected with the evaluation of pleasant – unpleasant, useful – bad, dangerous – or not dangerous, do we wish something or we prefer to get rid of it. This is why every valley has mark by value that determines its place. The model recognizes feature and emotional value connected with the signal. Both the feature and emotional value are pre-formed. It is possible due to the feedback from (of) the following stages of working out or genetically. In the theory of neural networks this model is realized as Hopfield network and represents autoassociative memory. In this model the set of parameter values defining this feature are represented by the synaptic weights. The set of features and their emotionality are evolutionarily related to the motives of human behavior. It is rather possible that some signals with very small amplitude of emotion, described in literature as emotional tone of senses, are considered as unemotional. Such signals are not transmitted for further working out. For signals leading to very large amplitudes of emotion the response is formed in the form of a previously fixed reaction. Emotional responses from this stage are accumulated in buffer as an average emotional signal for a sufficiently long period. This signal forms emotional ton. Emotional response is the signal in which the strength of the emotional tone is adjusted according to the magnitude of the emotional background.

Emotional response plays the role of a motivating factor for more detailed signal processing and reaction to the signal at the next stages of message processing. After being recognized emotional response and emotional tone become the part of human memory. They reach the level of consciousness indirectly – through experience as a feeling. We do not recognize the object associated with the signal at the considered signal processing level, this happens at the next stage of giving subjective meaning to the signal.

Object extraction

In principle, we could define an object in the same way as at the previous level of signal processing, by adjusting the synaptic balance so that the network detects the desired object. However, researches show that identifying the personal meaning of an object, forming of the emotional condition defined by the signal significance, need another type of proceeding. The signal has pragmatic character if the object, associated with the signal can realize targeted actions. To understand if the signal is pragmatic we evaluate the possible behavior to which leads the receiving of the signal. Different strategies, different sequences of actions set different routes of the system movements along the surface. When we choose the set we could reach the point with the biggest possible emotional response. Additional parameters define the

possibility to replay behavior in virtual time. These type of additional parameters are named control parameter, operating with them the subject can scroll imaginary films, in which action and emotion are connected in one. Their senses order, kept as memory defines the concrete memory, the concrete dynamic process associated with the object of message. So, at this stage of signal proceeding we could define an object identified by three factors: valley, to which our behavior has led, the rout as a purposeful process and emotional tension associated with them. These three factors form frame [13]. There could be some different nuances in the way of defying of each parameter, for example we can define emotional response the same way as at the stage of feature extraction – by increasing the values of the emotional state. We always have to keep in mind the fact of memory and imagination. There is one another way to form emotional reaction. This way is associated with the subject possibility to define his behavior. In this case, the message receiver is in the position of “player”. Therefore, we could define the result of his behavior can be evaluated in terms of mathematical theory of games as “guaranteed payoff”. And we can evaluate pragmatic value of the received signal proportional to how much receiving a signal increases the payoff [10,14,15]. Emotional response will be proportional the changing of guaranteed payoff, that represents the measure of the evaluation of the message for the receiver. Virtual dynamics in the formation of the path to achieving the goal determines the possibility of existence of the emotional part. We meet realization of such an approach in the models of neuron networks as reinforcement learning[18].

The connection between manifestation of emotions and the actions of the signal receiver gives the possibility to differentiate emotions more in detail than at the stage of feature extraction. If at the stage of feature extraction emotion is perceived by the degrees of pleasant – unpleasant, now we add the factors of power and activity [16,17]. In this three factors semantic space we define as areas such principle emotions as joy, sadness, anger, disgust, contempt, fear, shame and some other. Emotions defined this way form motivation.

Experience shows that the result can be improved if we look at the situation not only from the point of view of the map, defined by the object of perception, but from the point of view of much larger map, that is more structured. It is very hard to find such a map after identifying a specific object associated with a message. Evolution has found a way to simplify the formation of such maps – more precisely by forming identifiers of the attractor conditions (in case of objects) and defining the relation between identifiers themselves. The words play the role of identifiers while establishing a relationship between a frame associated with an object and a “word” in language as a general concept of the class to which the object belongs.

Cognitive semantics stage

The word revealed as an object during the process of perception is identified as a sub-frame in the semantic space and a part network of nodes and relations. This word is an

element of the frame-systems that is formed as collections of related frames. Relations between frames define the possibility of the sematic proceeding of signals that are coming from the stage of the object extraction. At this stage we have a whole new “world”, defined by the relations between word, intellectual and social constructs that are not directly connected with the level of the perception of objects. The “top levels” of a frame can reveal new targets, new strategies improving the value of signals and define new specific pragmatic sense associated with semantic space. That defines the emotional response associated with cultural construct and the behavior of the subject in the communicative sphere and the rules in this sphere – for example the aesthetic emotions. Intellectual demands influence the pragmatic value of the signal at this stage. Top levels of a frame influences object extraction stage based on feedback, associating with the neuron network modules that define memory about an object. At the base of the network obtained this way we can to play one more time the actions at the larger map and to define emotional response of the signal in more details. Emotional response resulted from common actions of object extraction and semantics stage based on feedback influences the emotional genesis of the feature extraction stage. Such an emotional response can change an amplitude of emotion (very slowly), emotional background and amplitudes of thresholds that define to skip the signal for further processing or to block. The exchange of the emotional reactions between the stages regulates the focus and content of cognitive processes.

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Challenges and Trends Arising from COVID-19 in the Management of Companies in the Telecommunications Sector

Gergana Dimcheva¹ and Ivaylo Stoyanov²

Abstract – In recent years, the topic of digitalization of business is gaining more and more popularity, including among organizations in the telecommunications sector. The main reasons for this are the opportunities that are provided – solutions for more efficient customer service, faster and easier access to information, simplification of some business models, the creation of tools to improve the competitiveness of the organization, etc. These capabilities proved their importance and during the global COVID-19 pandemic.

The purpose of the publication is to study and analyze the main challenges and trends in the management of companies in the telecommunications sector in the conditions of COVID – 19.

Keywords – telecommunications, COVID – 19, digitalisation, challenges and trends.

I. MAIN CHALLENGES FOR BUSINESS ORGANIZATIONS IN BULGARIA IN THE CONDITIONS OF A PANDEMIC

The beginning of 2020 was marked by the appearance of the coronavirus COVID – 19, which severely affected the world economy. The restrictive measures that were imposed led to a sharp contraction in economic activity. These measures had an impact, both in the short and long term, on the main macroeconomic indicators such as Gross Domestic Product (GDP), employment, unemployment, and on indicators at the organizational level – financial result, number of staff, labor policy, strategic tools used, etc.

The pandemic affected all sectors of the economy, all areas in Bulgaria. It has accelerated some processes within organizations, in order for them to continue to exist and develop. One of these processes is the digital transformation that has completely changed business and society.

The dynamic development of technology requires changes in business organizations not only in technology but also in organizational management, which requires new ways and mechanisms for doing business [1]. In a pandemic, organizations have moved from a physical to a digital work environment. This has led to a change in work processes, communication between employees, increased use of digital tools and more [7].

A survey of 250 Bulgarian companies from 13 sectors, of which the largest share is occupied by Telecom / IT / Media (31%), identified the main challenges of the Corona Pandemic,

which the leaders of these organizations have to deal with [2]. Out of a total of 10 challenges, the first five, which occupy the largest share, are indicated in the following figure (Fig. 1).

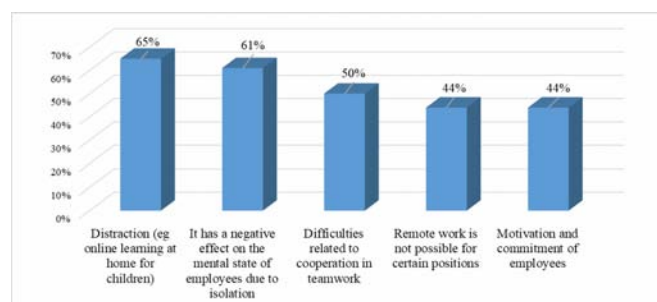


Fig. 1. Main challenges for the leaders of Bulgarian companies when working remotely (%).

Source: LS-S 2021 „How does your organization cope with the challenges of the Corona Pandemic?“, www.lss.bg

Along with the challenges that the leaders of Bulgarian companies have to deal with, the benefits for employees and organizations when working remotely should not be missed (Fig. 2).

The dynamic changes imposed by the covid pandemic also require a change in the work policy of each company, including those in the telecommunications sector (Fig. 3).

Most of the Bulgarian companies are successfully coping with the extraordinary conditions.

This is also confirmed by the survey, which shows that 63% of companies cope with the challenges of Covid-19 better than originally expected, and 79% have improved the company's overall productivity when working remotely [2]. If we have to focus specifically on telecommunications companies, they are certainly part of the above results. What distinguishes them from those in other industries is that it depends on them how business will be conducted in other sectors of the economy.

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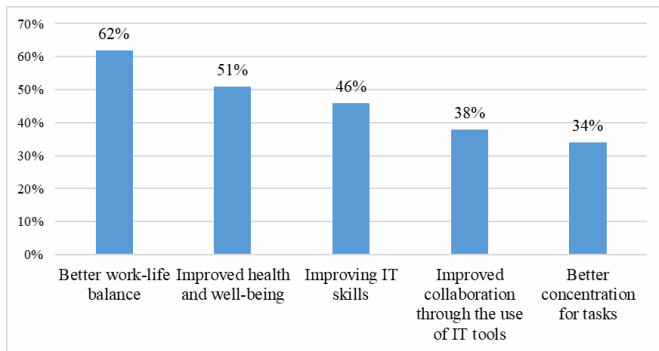


Fig. 2. Benefits for employees and organizations when working remotely (%)¹

Source: LS-S 2021 “How does your organization cope with the challenges of the Corona Pandemic?”, www.lss.bg

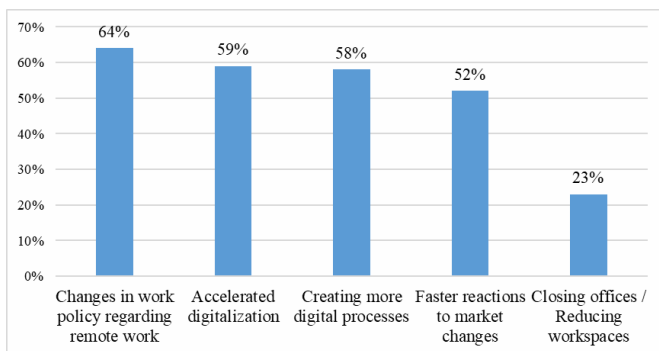


Fig. 3. Changes in work policy, accelerated digitalisation and the creation of more digital processes ... focal points in adaptation to the “new normal” (%)²

Source: LS-S 2021 „How does your organization cope with the challenges of the Corona Pandemic?”, www.lss.bg

II. ROLE OF TELECOMMUNICATION OPERATORS IN THE DEVELOPMENT OF THE ECONOMY IN THE CONDITIONS OF A PANDEMIC

The dynamic changes that occur in the activities of organizations are dictated on the one hand by rapid technological development, and on the other by the coronavirus pandemic.

The rapid transition from normal to “new normal” is due to telecommunications, which are becoming one of the main industries of the economy. The introduction of digital technologies in the activities of organizations from all spheres of activity, especially in a pandemic, emphasizes the critical importance of the telecommunications sector.

Given social isolation and the transfer of entire businesses and education to a remote virtual environment, telecommunications networks have become more important than ever. Digital infrastructure and services have literally saved much of the

economy in the current state of emergency. [3]

Most of the organizations had to create new business models in a short time, to invest in new technologies, to create new channels for market access. All this is happening thanks to the services provided by telecommunications operators, which makes them the subject of high expectations from different stakeholder groups (Fig. 4).

The rapid development of technology leads to new and higher expectations of consumers for personalized products and services. At the same time, the opportunities and renewal of technologies, processes, products in enterprises are developing at a slower pace [4].

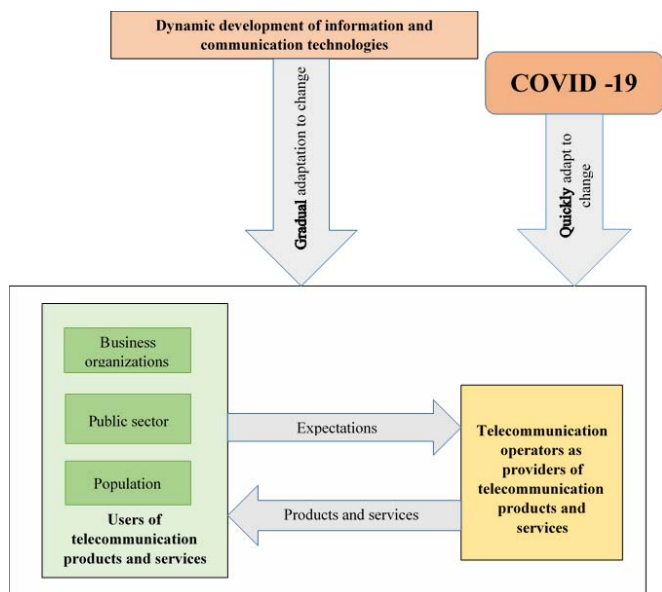


Fig. 4. Place of telecommunication operators in society³

The pandemic over the past year and a half has highlighted the importance of telecom operators. It is safe to say that they are the backbone of the economy that makes it work.

This trend is clearly evident in the following figures (Figs. 5, 6, 7 and 8), which show the increased consumption of Internet and cloud services in Bulgaria, as one of the main telecommunications services.

It is important to note that with the increased demand for Internet services, which is noticeable especially after the onset of the global pandemic, there is a decline in those who have never used the Internet. This fact is understandable, caused by the fact that people have to adapt to new working conditions, education, communication.

According to Telenor CEO Jason King, a survey shows that “People put telecommunications services in the top 3 most important goods and services – along with food and medicine and hygiene products, and only a small number are willing to consider reducing the cost of telecommunications if the situation worsens.” [5]

¹ The indicated factors in the made research are a total of 8, the first 5 are indicated in the figure.

² The factors mentioned in the study are a total of 10, the first 5 are shown in the figure.

³ Author's development

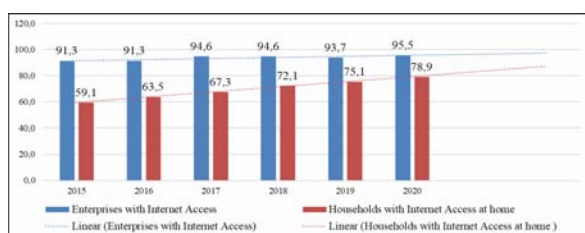


Fig. 5. Enterprises and Households with Internet Access (%)
(According to NSI data)

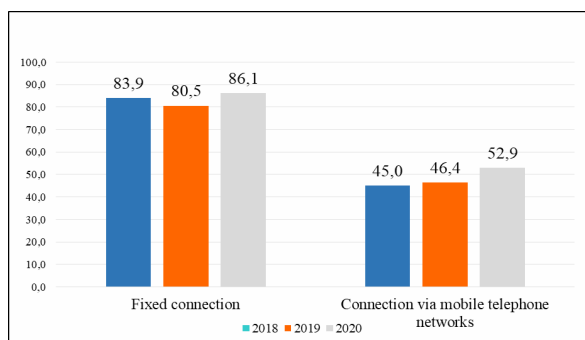


Fig. 6. Enterprises with Internet access by type of connection (%)
(According to NSI data)

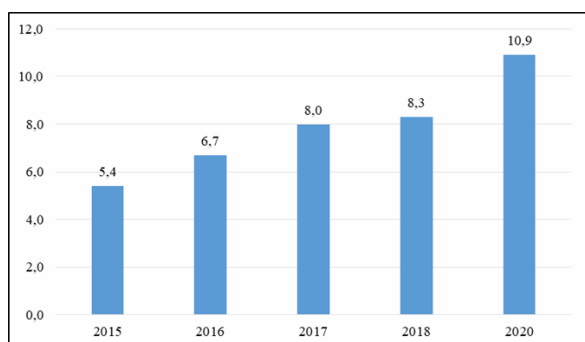


Fig. 7. Enterprises using paid cloud computing services (%)
(According to NSI data)

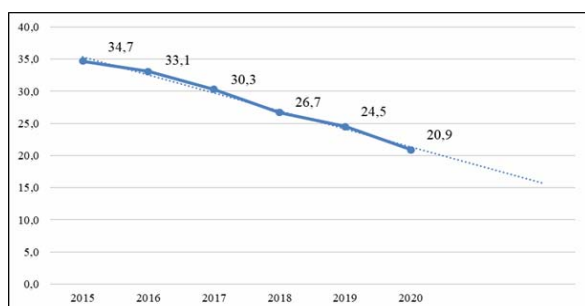


Fig. 8. Individuals who have never used the Internet (%)
(According to NSI data)

This requires telecommunications companies to pay attention to the reliability of networks, maintenance of telecommunications infrastructure, which in turn will meet the growing volumes of traffic. Under these conditions, operators must be prepared to offer additional products and services to their customers.

III. MAIN CHALLENGES FOR TELECOMMUNICATIONS OPERATORS IN THE PANDEMIC CONDITION

The importance of telecommunications companies stood out precisely in the context of a coronavirus pandemic, which poses major challenges to telecoms, namely:

- Increasing investment in telecommunications infrastructure to strengthen networks, provide greater security and reliability, deal with traffic, efficient use of equipment;
- Providing access to services to hard-to-reach places in the country, which in turn requires additional investment;
- The digital transformation leads to professional transformation related to the increasing use of digital technologies, increasing the requirements for employees to improve digital skills, increasing the opportunities for adaptation to the changing work environment, conducting trainings in this direction;
- Increasing productivity by changing the main business processes – transition to hybrid or fully digital models;
- Changing the working policy of telecommunications companies in relation to both working remotely and communicating with customers.

IV. CONCLUSION

Undoubtedly, the pandemic will leave an imprint on the development of the world economy, of course, to varying degrees on individual countries and economic sectors.

And, while some sectors have failed to take advantage of digitalisation to operate and have suffered significant losses, including financial losses, job losses and even entire organizations and businesses, for others it has led to successful transition to the digital space, implementation of fully digital work processes, preservation of jobs, reporting of sales growth, etc.

The global pandemic did not have a negative impact on the development of telecommunications companies, on the contrary, not only did it lead to an increase in the consumption of many services, but also required a rapid reorientation of telecoms to flexible organizational structures, change in strategic goals, change in management, change in the whole corporate environment, constant renewal of the portfolio of products and services.

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Internet provision, technology transfer and customer satisfaction in Bulgaria (part 1)

Dimitar Kolev¹ and Elizar Stanev²

Abstract – Internet provision is among the most significant services for telecom operators and small enterprises in Republic of Bulgaria. Nearly 80% of the countries’ households have broadband internet connection, according to NSI data. Following the rapid increase of customer demand internet providers have offered higher speed and sustainable connections. This gave the Bulgarian internet a very good evaluation and led it to one of the top spots of connection speed globally. On the other hand, the technological development led to the establishment of similar quality of mobile data networks, 4G and 5G respectively. Bulgarian telecom operators have also been going along this developmental trend, providing 4G and striving to introduce 5G for their customers.

This article delves into the challenges faced by the telecommunication operators and small enterprises in Bulgaria in supplying the aforementioned services, the fast-changing environment, the strife for retaining market share and customers. Within this study we measure user satisfaction with the current services provided, expected connection speed, primary usage purpose and the demand for new technologies such as fiber-optical broadband and 5G. On that basis, some key conclusions about internet provision and its role for the telecommunication sector in Bulgaria are drawn.

Keywords – Telecommunications sector, Internet provision, Internet suppliers.

I. INTRODUCTION

The turbulent development of internet services and the rise of internet coverage among the population of Bulgaria has resulted in increasing customer expectations regarding said services. Meanwhile, companies providing these types of services are looking for various ways to secure their market shares and attract new customers through expanding their service portfolio by offering better technology – e.g. fiber broadband connection, 5 GHz wi-fi routers and 5G mobile data.

The fixed internet-provision market in Bulgaria is segmented, with 3 large telecoms possessing around 60% of the number of user accounts, while the rest is held by more than 650 smaller companies. Concerning mobile data, the market tends to approach a classical oligopoly structure, with only 5 (big) companies providing the service. The market, as a whole, has generated 1 196 mln. BGN in revenue for 2020. CRC data shows there are 2 113 103 retail users for the fixed service and 6 580 566 retail users, subscribed to mobile data plans [1], clearly revealing the prevalence of mobile subscriptions. This discrepancy does not constitute that mobile data is preferred over fixed services in terms of quantity. Most mobile SIM card payment plans include some form of internet access by default, which, considering that the mobile phone is generally an individual good (also, a large swath of people may own more than a single SIM card) – comparisons between the two types of connection may not be entirely suitable. Unlike mobile, fixed services are usually attributed to entire households (presenting

themselves as more of a “club good”, instead of an individual one). Further proof of that point is the fact that, although the CRC reports on around 2 mln. individual user accounts, NSI data clearly states that 59.4% of Bulgarian households have fixed access to the internet at home [2]. Furthermore, the data states that the majority of households that report on using mobile data [6] are also subscribed to a fixed service at home, effectively using both.

Based on the relatively high internet service consumption in Bulgaria, research regarding the quality, quantity, technology and customer needs and satisfaction is justified. The main goal of this paper is to evaluate current internet usage and customer satisfaction with the services offered in Bulgaria, coupled with measuring customer expectations and demand for technological advancement.

II. MARKET OVERVIEW AND SURVEY METHODOLOGY

For the needs of this paper we classify the service delivery in two main groups – fixed and mobile. Fixed services can be further differentiated into two main categories – broadband cable and fibre optics. The CRC offers a classification of the main fixed networks and methods used to deliver the service. The most widespread in Bulgaria are as follows: LAN (Local Area Network), FTTH (Fibre to the Home), FTTB (Fibre to the Building), FTTC/N (Fibre to the Curb/Node), CaTV (Cable Television). For the purposes of this paper we have aggregated them into the following main categories – broadband cable (includes LAN and CaTV) and fibre optic (FTTH, FTTB, FTTC/N).

In terms of access and coverage, Eurostat data shows that the percentage of households with internet access comes at a 90% average for the 27 member states of the European Union for 2019. Although Bulgaria boasts a significant

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coverage (at 75%), the country still lags behind the European average. The trend of encompassing a larger percentage of the population has remained steady, with that number growing by 18 percentage points from 2014 to 2019 [3].

The Bulgarian internet provision market, as already mentioned, is concentrated in the hands of a few large telecoms. They have a pivotal role in both fixed and mobile internet supply. The main providers and their respective market shares are presented in table 1.

TABLE 1
INTERNET SUPPLIERS' MARKET SHARES,
REVENUE PERCENTAGE 2020 (SOURCE: CRC,
ANNUAL REPOT 2020, [1])

Company	Fixed service market share	Mobile service market share
Vivacom	21.6%	34.7%
A1 Bulgaria	15.8%	35.6%
Telenor	n/a	29.6%
Bulsatcom	9.1%	0.02%
Others	53.5%	0.08%

The data suggests that Vivacom are positioned with the largest market share in both service types, followed by A1 Bulgaria. However, one of the main telecoms – Telenor does not provide fixed internet access, as per the definition we imposed earlier, but are still one of the prominent companies on the mobile data market.

Barring the one exclusion, the main telecoms operate on both markets. This state of the market has led to the narrowing down of the options that respondents of the survey can select, pertaining to their internet provider.

The process of technological modernization regarding the switch from traditional broadband cable to fibre optic internet transmission is approaching its final stages in Bulgaria. CRC data shows that close to 65% of users in 2020 already have some form of fibre optic connection delivering their fixed internet (Fig.1). Going back to 2013, there has been a trend of fibre optic cable substituting broadband LAN connection, with companies rapidly switching from one to the other.

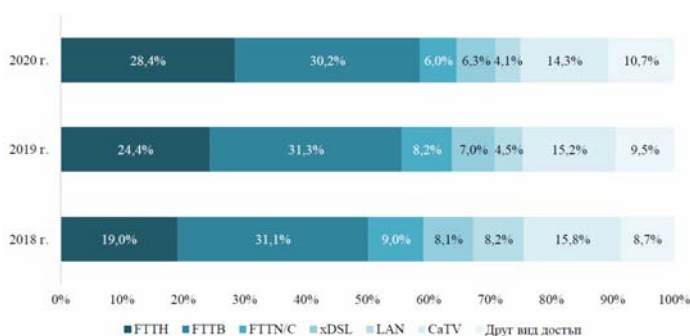


Figure 1. Fixed internet user structure 2018-2020
(source: CRC, Annual report 2020, [1])

In remote districts with lack of decent coverage people prefer using other forms to gain internet access. Based on the fact that the main type of fixed coverage in Bulgaria is now fibre optic, it can be concluded that users show a distinct preference for better connection speed and reliability. This leads to the inclusion of specific questions in the survey regarding speed requirements for normal, daily use of the service.

This trend is also evident in the realm of mobile data, with telecoms already pushing towards the switch from 4G to 5G networks in order to remain competitive. In order to not over-encumber the survey, the questions are focused on the main type of connection that consumers use in their everyday tasks and on the further evaluation of the quality of said service and its features.

On the topic of mobile data, the survey also includes questions regarding the willingness of users to pay relatively higher fees in order to facilitate the switch between 4G and 5G. In accordance with negative information, circulating in social media, regarding safety issues with 5G (human and animal health concerns), we posed a question that measures whether respondents have concerns about its introduction.

The final survey segment introduces questions focused on measuring the level of public Wi-Fi access in key locations across the places where respondents live. In order to measure the demand for public Wi-Fi access, respondents were also asked to point out where they would like to have such connectivity provided by public institutions (libraries, public transport, etc.).

The survey contains multiple choice questions (both single- or multiple-select answers) and Likert scales.

RESULTS AND DISCUSSION

The survey was performed throughout a month period and managed to engage 168 respondents, with 52% being male and 48% female. The main channels through which the questionnaire was delivered were social networks and e-mail. The age ranges in the inquiry are distributed as follows: under 18, 19-30, 31-40, 41-50 and above 50, with most respondents turning out between 31-40, posing 53.6% of all people surveyed, followed by the age range between 19-30 (29%). The majority of respondents fall into the most active groups that typically use internet services, shop online and engage with online content the most.

Most people who engaged with the inquiry process have a higher education diploma (84%), while 15.5% have completed high school¹. Keeping this distribution in mind, as most respondents report having a university degree, they can be considered a reliable focus group for making qualitative statements regarding the service.

The distribution of users according to their provider shows that 32.5% are customers of A1, 17.5% – of Vivacom, Telenor customers make up 7.2% and Bulsatcom – 4.2%. All

¹ A few respondents do not report their age/sex/education level

the rest are clients of smaller, local operators.

As stated, respondents were first asked to point out the type of internet connection they use most on a daily basis. The results are presented in Fig.2 below.

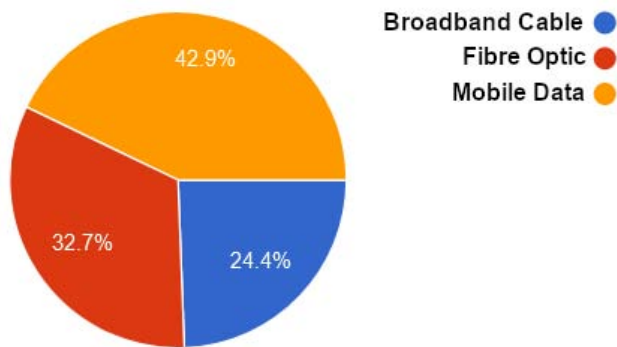


Figure 2. Most used type of internet connection

Our study suggests that within the focus group mobile internet use prevails as the most commonly used type of connection (by 42.9% of respondents). In terms of the fixed internet service – respondents report in groups that are relatively close in numbers between fibre and broadband cable. As such, there should be sufficient data on consumer preferences on all types of internet provision to make the qualitative customer evaluation representative of the service as a whole.

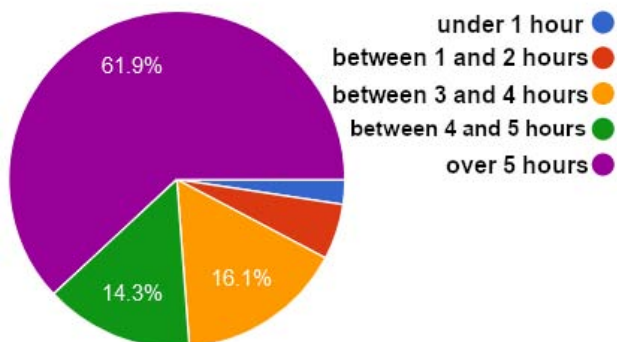


Figure 3 Average daily internet use

According to the inquiry results, 62% of consumers report using internet over 5 hours daily, on average. The second and third largest segments of the people surveyed evaluate their usage within the categories “3 to 4” and “4 to 5” hours daily. This leads to the conclusion that the internet plays a major role in everyday life for Bulgarian customers. This trend is no exception – it is also supported by international studies that place the average daily use of internet at around 7 hours at the last quarter of 2020 (global average [4]). Compared to one of the most popular pastimes in Bulgaria – watching TV

– the daily average use of the internet (both recreationally and in terms of working) is significantly higher (in a previous study we found that the average weekly use of TV services in Bulgaria varied between 6-8 hours [5]).

The next key element in the survey aimed to determine the main purpose of internet use in Bulgaria. The results are presented in Fig.4.

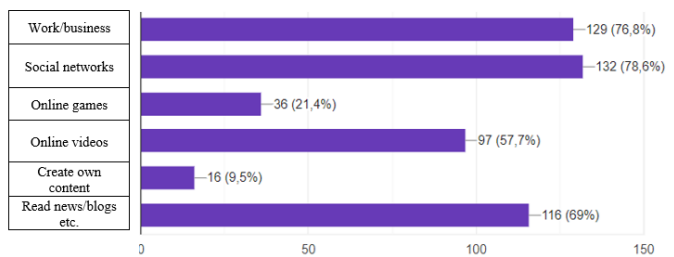


Figure 4 Main purposes for being online

It is important to note there was the option to select more than one answer. Therefore, the two most preferred objectives share similar levels of around 78% support – work/business and social networks. Not far behind is the option of consuming various non-streaming media (news, blogs and so on), with 69% of respondents pointing out that their information necessities are satisfied through internet use. The high work/business result could be attributed to the lasting COVID-19 pandemic, which caused a large number of people to switch their normal business and work routine to home office. The least preferred options were creating personal content and playing video games online, although the democratization of online content generation has led to global tendencies of increasing amounts of user generated content. 9.5% of survey respondents report using their internet connection to create and upload their own content which is a relatively high amount considering the sample size.

Some aspects of internet use intrinsically require higher connection speed. As a logical follow up we posed the question – “what connection speed is sufficient for your main internet activity?”. Results are shown in Table 2.

TABLE 2
CONNECTION SPEED REQUIREMENTS EVALUATION FOR
PERFORMING THE CHOSEN ONLINE ACTIVITIES

Required speed	Responses
Up to 50 Mbps	6.6%
51 to 100 Mbps	34.1%
101 to 150 Mbps	15.6%
151 to 200 Mbps	12.6%
Above 200 Mbps	9.6%
Not sure	21.6%

The basic assumption that users, in general, would be well-informed regarding the topic of connection speed, is partially not sustained, as proven by close to 22% of people surveyed being unsure about the speed required to perform the tasks selected in the previous question. Barring subjects that answered with “not sure”, the majority of respondents have determined that connection speed between 51-100 Mbps is enough for them to be satisfied with their particular activities. Considering which the most selected activities are, it becomes apparent why these particular speed ranges are preferred, since social networks, work and consuming media has a relatively low to mid-level requirements on connection speeds, as opposed to online gaming, creating content and streaming videos.

II. CONCLUSION

In conclusion, broadband Internet provision in Bulgaria is marked by significant changes towards the technological transfer towards fibre optic networks, while telecoms improve upon their own mobile networks by switching to 5G. This process is mainly driven by the increase in customer expectations and the strife of companies to enlarge their market share. Bulgarian consumers reported Internet speed sufficient for daily activities to be mainly between 50 and 200 Mbps. Keeping in mind that speeds over 100 Mbps require fibre optic networks (at least to the building), the most reported connection speed categories are a prerogative of the high-end of broadband cable and low-end of fibre optic. This constitutes that customer expectations are pushing towards the substitution of the older with the newer technology. Furthermore, the main activities outlined by participants in the survey do not require high speed Internet connection overall, but taking into consideration that most users also report over 5 hours of daily Internet use and

usually multitask between different activities, it could be assumed that higher speed is in demand.

The relatively high daily use of Internet signifies that this service is among the most important ones for Bulgarian customers. From the standpoint of Internet suppliers, considering the low cost of switching providers for customers, it becomes of utmost importance that companies strive for the increase of the service’s quality.

ACKNOWLEDGEMENT

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Facilitator Work Challenges in Virtual Project Meetings

Gergana Dimcheva¹ and Ivaylo Stoyanov²

Abstract – This paper discusses the main facilitator work challenges in virtual project meetings. In order to meet the requirements for holding these meetings, a plan is needed that helps the facilitator to structure the main options in his work – before, during the meeting and after its conclusion.

Keywords – Project management, virtual project meetings, facilitator work.

I. INTRODUCTION¹²

Regardless of the form of the project meetings (conventional or virtual), each of them requires the intervention of an “facilitator” to plan, organize and coordinate their effective implementation. The work of the “facilitator” is complex and responsible, because figuratively speaking, this is the person directing the project meetings in the direction desired by the management, ie. to the implementation of project goals and objectives. He has a supporting but essential role in the project meetings, mainly facilitating the quality of work and that of the project manager and the team’s initiatives when it comes to purely organizational activities. The job of the “facilitator” is not to determine who should do what, nor to take a stand on the issues under discussion, this is a priority of the project management (mainly the manager), but to monitor whether and how the meetings are held, creating the conditions for this to happen without any problems. In other words, the “facilitator” should have the qualities and competencies to facilitate project meetings, and his role covers two functions – to prepare them for implementation (plan, organize and coordinate) and to influence people’s behavior actively and constructively. participate in discussions and decision making (stimulates team potential) by directly communicating and discussing the results with the project manager.

The basic work of the “facilitator” is reduced to a routine structural scheme in the various formats of project meetings, with the difference that their implementation has specifics in conventional (physical) and virtual (digital) environment. The general scheme of work covers three fundamental aspects – opportunities for operational activities (rights and obligations) of the “facilitator”, an approach to conducting a project meeting and developing a constructive plan. All three

aspects are an integral part of the work of the “facilitator” and determine the direction in which he can plan, organize and coordinate project meetings.

The opportunities for operational activity (independence) of the “facilitator” are standard for each project, which, however, does not exclude the possibility of variations in the different stages of the project meetings, ie. more active or more limited participation in the sessions. This, of course, is very difficult to plan and practice shows that in these cases the situation is relied on, ie. the situational factors in the project meetings are decisive for the intervention of the “facilitator”. Otherwise, the traditional procedures are clearly spelled out – no interference in the operational work and decisions of the project manager and the team, only competent and adequate planning, organization and coordination of project meetings. However, the approach to holding project meetings is strictly individual and depends on the vision, competencies and experience of the “facilitator”, at least because he is responsible for the nature of the project meetings. In this sense, the intervention of the project manager is not that it is not possible, but it is not desirable (or at least to have a coordination function), because it can create difficulties compared to the preliminary scenarios of the “facilitator”. Part of this approach, but with more specificity of the views of the “facilitator” for conducting project meetings is the development of a detailed plan. The latter details all activities and events for holding project meetings – before, during and after their completion. This is the main difference in the work of the “facilitator” in conducting conventional and virtual project meetings, as this publication emphasizes the specifics of the latter.

II. THE BASIC IDEAS

In general, virtual project meetings are more difficult to plan, organize and coordinate than conventional ones, not only because of the technical requirements that arise for their holding, but also because of people’s behavior, which cannot be revealed in depth. Here, however, a distinction must be made between the degree of convenience and efficiency between the parties involved. First, the virtual project meetings are convenient for the management and the project

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participants, because it is not necessary to commit to travel time (if they do, such as consultants or other experts from the company by territorial divisions), to provide transport, to search halls, hotels, equipment, to incur catering costs, etc. [12][13]. Second, in some projects and project activities (such as engineering projects, high-tech projects, etc.), the goals and tasks are so complex that it is not right or appropriate to hold the meetings virtually. It follows that, unlike conventional project meetings, those in an online environment have advantages if the project activities allow them to take place, but this in no way applies to the work of the “facilitator”.

On the contrary, his task of planning, organizing and coordinating the activity becomes even more difficult because, in addition to the commitments for the project meeting, he must monitor the technical aspects so that the appropriate software applications can be selected (or at least approved).), there should be no interruption, loss of time, distraction, etc., combined with the reactions and actions of the people you have to observe, which is not the same in the online environment.

As already established, this requires the “facilitator” to draw up a detailed plan outlining the ways and mechanisms for conducting the virtual project meetings as far as his professional commitments are concerned. This plan takes into account the various challenges in the work before, during the meeting and after its conclusion. The most important aspects in this direction are the following:

- *Challenges in the work of the “facilitator” before the virtual project meetings*

Before proceeding to the actual part of the virtual project meetings, the “facilitator” is obliged to envisage some activities that facilitate this process, such as [2,3,5,6,9,10,11,12]:

→ *Selection of a suitable software application.* One of the first points that comes into the field of view of the “facilitator” is related to the communication channels for the project meeting. On the one hand, the suitability of the software application to be used is taken into account, ie. whether it will meet the requirements of the specific meeting and the preferences of the project manager and the team. In the field of information and communication technologies, various software applications are used to conduct real sessions for sharing audio and video connection (Zoom, Microsoft Teams, WebEx, Go To Meeting, etc.) with functionality and way of working [10].

It is the responsibility of the “facilitator” to establish whether the software application and the methods to be used are approved for work on the project and to what extent all participants are familiar with their functionality and features in the operating mode. This is extremely important because project meetings often consist of many people or a team of specialists who come from other divisions of the company, some participate only on certain issues, others have a sporadic role, as experts or when the team meets for the first time. road. This requires the “facilitator” to establish that

each member of the team is fully familiar with the software application to be used [9]. At first glance, this is not a big problem, because the people participating in the project meeting will probably orient themselves in the situation and will adapt to the specifics of the application, if they have previously used something else (on a project or in a work environment). The problem is that while looking for visual landmarks or technical solutions, their minds will focus more on the software application, out of fear of not being exposed or unable to react at the right time, which will distract them from the work in the meeting, ie. is. they may miss important information while thinking about the functionality of the application [9]. Therefore, the “facilitator” must specify in advance the software application with which the meeting will be held and whether the participants are familiar with its functionality. Otherwise, actions are taken for training and explanation of the technical parameters and way of using the software application.

Another problem that may arise is whether to use only one software application or several are needed, and of course what is the project budget for their provision. Some of these applications have a free version or limited features, which may not be enough for the goals, priorities and complexity of project meetings. Thus, the work of the “facilitator” is to determine what and how many software tools are needed to conduct the meetings, how the information will be provided, who will be responsible for possible technical problems during the meeting, how the information will be stored, etc. [2] As there are no visual guidelines for the participants’ behavior during the meeting, the “facilitator” needs to provide monitoring devices, people to see each other and he to get a visual and audio connection for their actions [1]. It is not to be underestimated during the virtual meeting that each of the participants should provide a suitable background on which to see and sound effect, so as to avoid the inconvenience of side noises or visual landmarks that should not be displayed (for example, walking around small children around the technical device or their interest in it). Testing of systems and devices before the meeting is mandatory to make sure that the “facilitator” works flawlessly and people are familiar with their functionality [2,3,11].

→ *Duration of the project meeting.* Unlike conventional project meetings, where the presence of many people in one place and the interaction between them create fatigue, psychological stress, physical exertion, etc., in virtual meetings, some of these obstacles are ignored. In this sense, the time for holding virtual project meetings can be longer than conventional ones, the question for the “facilitator” is how long they should be. The situation is delicate, because keeping the participants’ attention in front of the monitors more than necessary can have the opposite effect – lack of attention, boredom, boredom, etc. [8] This is normal because the lack of physical contact that keeps participants awake does not exist, which relaxes people and makes them inert to initiatives that have long occupied their attention. Therefore, the “facilitator” should provide standard time for the

meetings, and when the issues or problems are too complex, to provide breaks and their organization [2,8,12].

→ *Document management.* In conventional project meetings, all speeches, opinions, recommendations, questions during discussions, submitted documents, reports, schedules, etc. are documented and stored in the company's office or in designated areas. In virtual project meetings, the “facilitator” should provide for the person who will administer the online document flow, which must be different from the technical assistant who will record the information and monitor the correctness of the technical parameters of the system. The person who is engaged in the administration of the document flow must be part of the project team, be aware of the reporting documentation, keep notes, know the documents and categorize them by priorities and project areas. When the documents are many, the “facilitator” sends them in advance to the participants to get acquainted with their content, and in case of large files and data sets an access link can be created or through a personal password the participants can enter a specific repository specially designed for the project directory meeting [2,9].

→ *Technical support of the system.* The task of the “facilitator” is to provide technical support to the system for virtual project meetings and system administrators to be responsible for this activity. In case of problems with the webcams or the video connection, opportunities for fast communication are provided with appropriate tools (group chat, telephone conversations, e-mail, etc.) [9,10]. In case of any disturbances in the equipment and devices, the system administrators are obliged to react quickly and efficiently to restore the connection, except in cases when the problem is beyond their competence. Sometimes it happens that the “facilitator” have a connection problem and are unable to establish visual or audio contact with the participants, so they apply a backup option – they authorize a person to replace them so as not to waste people's time and patience waiting.

→ *Overcoming the language barrier and cultural differences.* In meetings of multinational teams, this can be a big problem if the “facilitator” does not take the necessary measures in time. First, you need to agree with the project management and the participants in the meeting, the language that will be used, so that everyone prepares the materials and presentations in accordance with this requirement (usually English is widely used). Second, it must be aware of the nationality of the participants, send this information to the other members and give them attention on how to communicate with each other [4].

→ *Agenda and plan for the meeting.* The agenda of the virtual project meeting is sent by the “facilitator” to all participants who have previously announced their presence. It contains more general information and sets out the main actions and decisions that will be taken and taken at the meeting. When agenda items are complex and require more information, the “facilitator” fixes links with an access link.

• *Challenges in the work of the “facilitator” during the virtual project meetings*

During the virtual project meetings, the “facilitator” performs various activities, the most important of which are [2,3,5,6,8, 9,10,11,12]:

→ *Start the meeting on time.* Since the project manager is busy with various activities on the materials that he will present at the virtual meeting, as well as the arrangement of their visualization in the system (except for the previously sent ones), some have to monitor the quorum, ie. the inclusion of the participants and the start of the meeting at the appointed time. This is part of the duties of the “facilitator”, who registers and gives people the right to participate in the virtual meeting, which must be done quickly and efficiently. Any delay, even at the beginning of the meeting, whether the reasons are technical, lack of quorum or others, will affect people's behavior and their perception of the organization of work. While joining or staying online in the system, waiting for the others, participants often fill their time with side activities, a prerequisite to enter the meeting distracted or with reduced concentration. A bigger problem arises when the participants are from a multinational team, and the time difference affects their physiology and psychology.

→ *Monitoring the presence of the participants.* During the virtual meeting, the “facilitator” monitors the presence and work of the participants, is informed when they leave the system and identifies the reasons outside the regulated breaks. He must regularly monitor the quorum of the meeting and at a certain period of time make name checks, ensuring the activity of people in work activities [11,12]:

→ *Focus on pressing priorities.* One of the important tasks of the “facilitator” is to help the project manager to keep people's attention on the key aspects of the project meeting agenda. While the project manager concentrates on the tasks and documentation he has to present, the “facilitator” monitors the actions and behavior of the people, deterring them when they do something different from what was planned in the meeting. Phone conversations that are not on the topic of the meeting, writing e-mails, half-sentences or signs, chatting, talking to the family or interlocutor during the discussions are not allowed, and the task of the “facilitator” is to make sure that it doesn't happen.

→ *Sharing personal information about the participants.* Project meetings have not only an emotional charge when they take place, but they change the roles and commitments of people, according to the nature and complexity of the goals, sub-goals and tasks in the project. In virtual project meetings, it is quite difficult for participants to stare at the monitor, guess and recognize the people present, especially if they are new to the team. The role of the “facilitator” is to acquaint the participants in advance with the biography of the new candidate, his functions in the project and the commitments in the meeting [10,12]:

→ *Providing feedback.* Unlike conventional project meetings, where people can express an opinion through

verbal cues or body language so that they can be noticed and heard, in virtual meetings this is quite difficult and the “facilitator” constantly monitors people’s behavior. The first condition for this is to have a picture of all participants in the meeting, visualized on a separate monitor (often several monitors). The second condition is to observe what is the interest and activity of the people during the meeting, whether they want to take the floor, whether they are active or passive, ie. maintain or lose interest in the meeting and how to get involved so as to make a personal contribution. The toolkit of the “facilitator” is reduced to verbal communication, inviting, encouraging or taking the floor of the participants in the meeting or through signals in the system (chat, emoticons, symbols, etc.) affects their emotional state and behavior.

→ *Mediation and overcoming conflict points.* It is not uncommon for disputes and conflict situations to arise during meetings that the project manager is unable to control or has difficulty with. The person who has to take care of this is the “facilitator”. In conventional project meetings, when people are surrounded by colleagues and support staff, they usually feel uncomfortable or have a limit of dysfunctional behavior [12]. In virtual project meetings, people feel alone, without the physical presence of colleagues around them, which can provoke aggression and trigger conflicts.

The job of the “facilitator” is to resolve them, which is relatively easy in an online environment. If the participant does not follow the advice of the “facilitator” to limit the conflict, with the help of a system administrator he can exclude it from the system or mute it, if the respective application has this option. He has to talk to the problem participant on the phone and when he has calmed down and is willing to work, he can return him to the working mode of the meeting.

→ *Achieving consensus on neuralgic points.* Each project meeting, including the virtual one, has specific dimensions (goals, tasks, priorities) that must be procedurally followed and implemented. In the course of the project there are various changes in the way of working and the views of the participants on the project activities, which are discussed at the virtual project meetings. The duties and intentions of the “facilitator” are limited to seeking consensus among the participants on contentious issues or reducing differences to an acceptable level. This is mandatory because the clear regulation of the processes and activities for the project implementation is a guarantee for synchronization of efforts and resources for optimal project results.

→ *Closing the meeting with specific decisions and conclusions.* As a result of the work of the “facilitator” on the convergence of the position of the parties, he announces to those present in the system the decisions taken, deadlines for implementation and expected results. Each meeting requires final conclusions to be drawn about its benefits and the effect that has been achieved. It is the responsibility of the “facilitator” to ensure that the decisions and conclusions are clear, specific and understandable to all, that there is no

ambiguity and, most importantly, that they are implemented in the implementation of the project. Last but not least, the practice shows that the positive emotions, the good mood and the successful end of the virtual project meeting are a prerequisite for creativity and motivation for future initiatives [1,2].

- *Challenges in the work of the “facilitator” after the end of the virtual project meetings*

After the end of the virtual project meetings, the work of the “facilitator” continues with the following activities [2,3,5,6,9,10,11,12]:

→ *Identifying future initiatives.* After the virtual meeting, in an informal setting (up to half an hour), the “facilitator” discusses with the project manager and the participants what has not been done to include it in the plan for a future project meeting. In practice, this is the collection of basic information during the meeting for follow-up initiatives that remain unresolved and cannot be postponed.

→ *Sending the decisions and conclusions from the meeting to the participants in formal, official documentation.* Each of the participants in the virtual project meeting must receive information from the “facilitator” about the final decisions of the meeting, given in official documents. The possibilities are to be sent directly by e-mail or by courier to each participant or all to have controlled access to an electronic platform from where to receive all the necessary information.

→ *Feedback from the participants in the meeting for problems or difficulties with the technology used.* When the virtual project meeting is over and the participants have real monitoring of the software application/s devices and systems, the “facilitator” collects up-to-date information on possible problems or technical difficulties to be eliminated.

→ *Regular sending of information to the participants about upcoming events or deadlines for fulfillment of commitments.* The “facilitator” has the issue of sending up-to-date information to the participants about upcoming project events or virtual project meetings, as well as reminder emails about the deadlines within which data must be received or activities approved by decisions must be performed of the meetings held.

III. CONCLUSION

The work of the “facilitator” in virtual project meetings is accompanied by many challenges that affect the outcome of their conduct. The experienced “facilitator” must deal with environmental conditions that directly or indirectly affect the technical infrastructure or the human factor in the meetings.

Unlike the technique and technology that can be provided or predicted how it will be used, human behavior is difficult to predict. In fact, the problems in conducting virtual project meetings arise not so much from the available machinery and equipment, but from the perception of the human factor for the digital work environment and the consequences of this activity.

Information and communication technologies are constantly evolving, which is a prerequisite for improving the technical infrastructure in virtual project meetings. Perhaps the main issue that is subject to future research is the social element in the behavior of people in a virtual environment. How to replace that sense of social belonging that is typical of people's emotions, their desire to communicate and communicate? That is why the challenges in the work of the “facilitator” in the virtual project meetings will constantly increase.

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Internet Provision, Technology Transfer and Customer Satisfaction in Bulgaria (Part 2)

Dimitar Kolev¹ and Elizar Stanev²

Abstract – This article is a logical continuation to a previous study about the challenges faced by the telecommunication operators and local suppliers of internet services in Bulgaria. It focuses on the internet service quality evaluation, the readiness and desire of Bulgarian customers for technologically superior networks (both mobile and broadband). We also explore the availability and need for free public wi-fi connection in key public spaces.

Keywords – Telecommunications sector, Internet provision, Internet suppliers.

I. INTRODUCTION

In part 1 of this study [1], we discussed the basics of internet services in Bulgaria – main suppliers, technological structure, daily average consumption, main user activities and required speed. As a logical continuation within the current study, we add further details for the evaluation of the service features, the readiness of users to pay for the switch to higher quality connections such as fibre optic and 5G mobile data. Moreover, we explore the availability of public connections with free access and peoples’ opinion about the practice and desired locations.

As such, the following goals are pursued:

- analyze the evaluation of the importance of various service features for Bulgarian customers in order to determine what providers should be focusing on;
- determine the justification for the technological transition towards fibre optic and 5G (for broadband and mobile, respectively) from the standpoint of Bulgarian customers;
- discussing the need for and priorities of free access public hotspots in Bulgaria.

Given the fact that this is an addition to part 1 of the same-named research article, the methodology is omitted and the article progresses directly to discussion of the survey results.

II. RESULTS AND DISCUSSION

The evaluation of the internet service is done through 5-degree Likert scales. The first question pertains to the evaluation of the current service used and the second one outlines the importance of different service features. The first quality evaluation uses the following criteria: connection speed, price/quality ratio, customer support, connection

stability and combined services (with TV, mobile data and so on). The second Likert scale includes criteria concerning the importance of various service aspects – namely speed, reliability, customer support, loyalty bonuses, combined services, price, mobility of the service, areal coverage, new technology integration.

The main goal was to determine the respondents’ attitudes towards the Internet service they currently use and after that to point out the most important features for them, which would be useful for the suppliers as key features to focus on when supplying said services.

TABLE 1
CURRENTLY USED SERVICE FEATURE QUALITY EVALUATION (PERCENTAGES³)

Evaluation >	Very low	Low	Undetermined	Good	Very good
Feature					
Connection speed	3.5	8.3	3.5	50.3	33.1
Price/quality	4.1	10.7	4.7	54.4	24.3
Customer support	3.5	10.1	11.8	44.4	26.6
Stability	4.1	13	4.7	53.3	23.7
Combined services	5.9	5.9	21.3	38.5	25.4

In general, Bulgarian customers give a “good” and “very good” feedback when it comes to their Internet service quality. This applies to 4 out of 5 of the presented criteria (excluding “combined services”). In terms of connection speed, 50% of respondents report having a satisfying connection speed, with 33% evaluating their speed at excellent levels. When it comes to the subjective view of the price/quality ratio, as perceived by customers, close to 55% of respondents are relatively satisfied with their current service, but also 14.8% report perceiving this ratio as below

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³ A small segment of respondents skipped answering the question, which causes the results to not add up to 100%

par. When it comes to the “customer support” category, 70% of people provide positive feedback. A similar picture is painted when participants are questioned about how they’d rate the reliability of their connection. A large percentage of the examined population (21.3%) reports being undetermined when evaluating the quality of combined services, which is explainable, as not all customers subscribe to combined services. Besides that, most respondents report a positive outlook on the quality of their combined services.

TABLE 2
SERVICE ASPECTS EVALUATION (PERCENTAGE)

Importance > Factor v	Unimp ortant	Slightly important	Undeter mined	Important	Very important
Connection speed	0	3	3	27	67
Reliability	2	1	2	16	78
Customer support	1	2	7	31	59
Loyalty bonuses	4	12	15	36	33
Combined services (e.g. TV)	8	13	14	36	29
Price	2	2	5	38	53
Service mobility	3	7	15	37	39
Service coverage	0	4	11	27	57
New technology integration	2	11	20	29	38

The data suggests that “connection speed” and “reliability” are the two main aspects that users consider of utmost importance, with 67% and 78% respectively. Three other fall in very close by – “customer support” 59%, “service coverage” 57% and “price” 53%. It is important to note that reliability is considered very highly, even more so than the price of the service. This could be due to the vast consumption of the service with more than 5 hours per day for the average customer in Bulgaria. Moreover, the specifics of the COVID crisis have forced many office workers to do it from home which makes reliability a top priority.

Some of the answers offered are inevitably interconnected – for example, reliability is closely related to customer service, as failures in the provision of the service are managed through the customer service procedure, explaining why these two are highly rated together. Another closely-related pair is “service coverage” and “service mobility”, with the main difference being that service coverage mainly applies to mobile data access availability, while service mobility represents the ability to use the same internet service at different geographical locations. As evident, service coverage is considered more important than mobility.

A part of the results seems counterintuitive – higher connection speeds do require new technology integration, but a relatively high percentage of respondents are undecided when it comes to the importance of that factor. Other, relatively less significant features of Internet provision, as pointed out by participants, are “loyalty bonuses” and “combined services”, but in absolute terms the majority expresses their overall importance.

In unison with the requirements for higher speed and reliability, we asked respondents would they be willing to pay higher fees for fibre optic and 5G mobile, respectively. When it comes to upgrading from broadband cable to fibre optic, we have omitted participants who have already undergone the switch. Out of the remaining respondents (80% of all), 39% are willing to pay more for the upgrade, 35% are satisfied with the current state of their service and would not make the transition, and 26% are undetermined.

When asked regarding the transition to 5G from 4G mobile networks, respondents were asked to provide additional opinions concerning whether they consider the 5G network to be more beneficial than its predecessor. Due to recent health scares within the Bulgarian media environment, we also posed a question regarding the safety of the new technology.

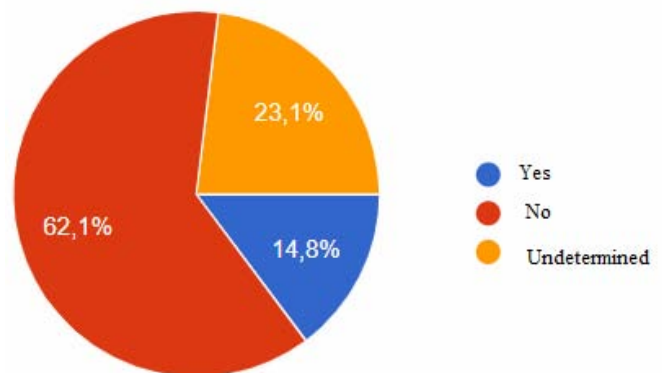


Figure 5. Willingness to pay higher fees for 5G

Contrary to the importance of connection speed for Bulgarian consumers, the current mobile data users participating in the survey are generally not willing to pay more in order to facilitate the transition to 5G networks – 62.1%, while merely 15% are ok with it.

When asked whether 5G would be more beneficial than 4G to them as customers, approximately half of people surveyed were negative, while 26% reported being unsure whether that would be the fact. The data regarding the transition corresponds with the previous question, as attitudes in the surveyed population seem mostly reserved. It could be concluded that the main obstacle before transitioning to 5G seems to be centered around the worries over an eventual increase in costs for the consumer.

Health concerns have played a major role in the obstruction of the implementation of the newer type of mobile network across the world [3][4]. These concerns are further exasperated by the ongoing pandemic, as people are made more aware of and become more sensitive to social health issues. To elaborate on the attitudes of Bulgarian consumers, we posed a question whether participants consider 5G to be safe for human and environmental wellbeing.

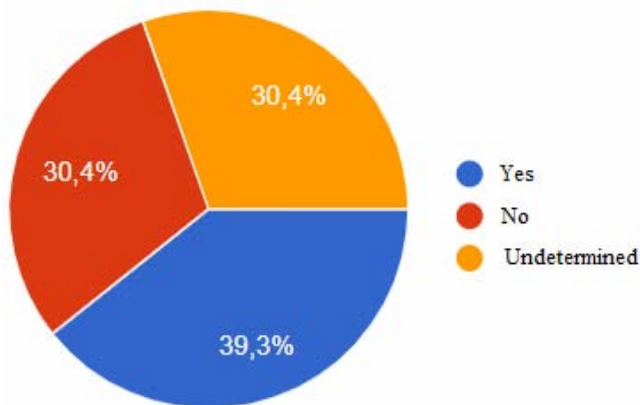


Figure 6. Do you consider 5G safe for human and environmental wellbeing

As evident from the data, less respondents are concerned about health or wellbeing issues related to 5G implementation, as 39% of them are positive about it. The lesser percentage of concern leads to the conclusion that a perceived increase in service costs is a more overall worrying factor for customers as opposed to health issues, which may be the driving force for respondents being generally reserved towards the implementation. Still, a not-so-small segment of people surveyed do subscribe to the ideas that 5G might prove dangerous to human and environmental wellbeing.

The next set of questions directed participants towards the development of public Internet access networks. On a global scale, major cities in developed countries are moving towards the idea of “Smart cities”, which can be defined as: “A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operations and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects” [1]. Internet access infrastructure is an integral part of such an establishment. In Bulgaria the process of transitioning towards smart cities is in its early stages. One of the relatively easy to attain accomplishments of urban organization for the increase in population wellbeing is the provision of public Internet access. In this manner of thought, we created a set of questions to address the need and expectations of respondents to have Internet connectivity in

different key locations across their intermediate living area. The underlying assumption is that such access should be provided by local governmental institutions (municipalities).

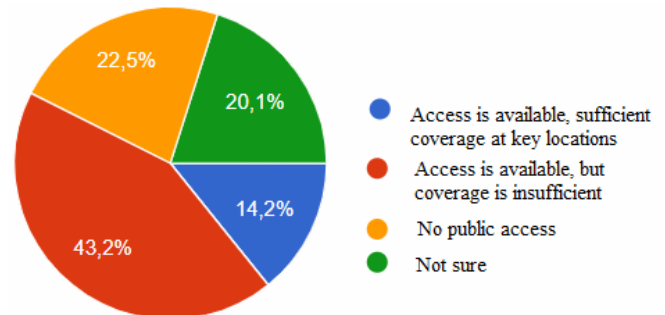


Figure 7. Public Wi-Fi internet access availability and coverage

The feedback received points out that the majority of respondents acknowledge the existence of public access hotspots, but find their coverage of key locations insufficient (as defined by the questionnaire, key locations can be tourist spots, public transportation, public buildings, public parks, etc.). 14.2% of people surveyed report sufficient coverage and access availability, while 22.5% lack public Internet access altogether. These findings indicate that local government bodies can improve public Internet infrastructure to encompass more popular locations. To support that claim, within a separate question, 81.1% of respondents have pointed out that there is a need for such connectivity provided by local authorities.

In order to specify locations that Bulgarian users mostly desire to be connected at through public access, we asked participants to outline them. The results are presented in Fig.4.

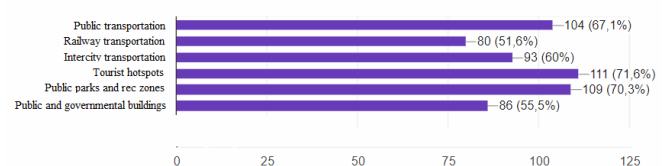


Figure 8 Desired key locations to have free public Wi-Fi Internet access (respondents can select more than one option)

Respondents were spread out close to even across the offered options, reacting positively to most of them. As a trend it could be concluded that the majority of participants outline the need for public access across many aspects of their daily lives – from all forms of public transportation to tourist hotspots, public parks and governmental buildings. Since none of the options stand out, the local governmental bodies need to address the overall development of public access infrastructure as a whole.

III. CONCLUSION

In conclusion, Bulgarian Internet users are generally satisfied with the quality level of the services they are receiving. The most important aspects that consumers focus on, and thus – companies should try to emphasize – are connection speed and reliability, coupled with customer support. In terms of mobile data, Bulgarian users are reluctant to pay additional fees to facilitate the technological transition towards 5G networks, as they do not consider it to be more beneficial than current options. In addition, a third of participants expressed concerns over human and environmental health issues. Relatively more respondents were willing to incur an increase in cost for the transition from broadband cable to fibre optic, provided that the supplier would offer it.

Regarding public Internet access, the majority of respondents consider its availability inconsistent and/or insufficient, but at the same time almost unanimously desire its presence at key city locations. This should be a clear indicator for government institutions for moving forward with developing additional infrastructure to facilitate said needs. Maintaining such projects long-term can prove to be a stepping stone towards the integration of Bulgarian urban areas into smart cities.

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The Covid Crisis and Society

Plamen Iliev, PhD¹

Abstract: More than a year Covid crisis cause us confront new and possibly large financial and economic crisis of 2020. Due to infection of coronavirus, which no one can predict its duration, when it will be completed and at what price.

In an attempt to limit the effects of the new economic crisis on countries and businesses in general, it is necessary to put some order and avoid chaos in order to find and implement a comprehensive, new or already tested model of governance. It is probably good for everyone to wait for EU assistance in the fight against the infection and the economic consequences of this, but these are temporary and limited measures, so it is necessary to look for opportunities to reduce costs, prevent rising unemployment, increase the efficiency of labor and investment, and a real attempt to get out of the emerging crisis by introducing a new and modern system or management concept that monitors the financial performance of individual economies, the company, to plan, analyze and coordinate.

Every management at all levels must pay attention to this. It is necessary to take into account the public moods and the control of the society, the connection between the rulers and the ruled should not be broken because the society is usually a victim, but it is always a corrective of any wrong decision or management. In fact, this shows the real picture of public relations and public control in our country in the last year, expressed in public discontent, a series of elections /public control /, showing in the end a difficult situation – we want change but we are not ready and not we know how to make them.

Key words: crisis, economy, society, public control, pandemic

I. COVID, CRISIS AND CONSEQUENCES¹

The clash with a possible crisis of the economy, society and the social sphere may be on every issue of their development. According to A. Grove, “the crisis is a state in which existing means of achieving the goals become inadequate, resulting in unpredictable situations and problems.” The outcome is “its eradication as an extreme form or its successful overcoming.” Another feature of the crisis may be its time limit or limited decision-making time in times of crisis. Indeed, the crisis cannot last indefinitely and has its limits, and the earlier the leadership begins to fight it, so much more chances of “salvation”. /Iliev – 2015/.

In other words, the crisis is a time-limited phenomenon which, from the current situation and the actions of management, can be characterised by suddenness of occurrence or be predicted and prevented as consequences for an enterprise – to take it to a new stage of development or lead to liquidation. The crisis is most often seen as an acute shortage of cash caused by problems in supply, supply, an increase in unemployment, a dysfunctional economy, etc. At the same time, this shortage of cash resources is one of the main causes of the crisis, and as a sign of imminent bankruptcy at the micro level, an enterprise is considered to be unable to meet creditors’ demands as monetary obligations. So managing the movement of cash or financial flows is a key tool of anti-crisis control and requires maximum attention.

The current crisis of the early 2020s caused total panic, such as:

– “First of all, the threat of COVID-19 seemed harmless from distant China, then from Italy, and in the end everyone

realized that the threat was ubiquitous;

– The COVID-19 pandemic literally melts social and economic life around the world, which is unprecedented in human history.

Perhaps some would compare the current social and economic situation to the other scary and large-scale event in human history – The Second World War, but the current situation is very different – for it, world leaders had no information, no plan and no solutions. The world’s rulers were completely surprised and shocked, although in their scientific institutes, agencies, security services and military ministries all kinds of crisis situations were played out, but not like with COVID-19. /Popov – 2020/

While the virus was only going on in China, for everyone else, including world leaders, this was seen as a regional problem, or like the Ebola virus in Africa, there were even statements in our country that this thing could not get to our country.

Globally, the leaders reacted by:

“First of all, shocked and confused by what is happening, they have quarantined social contacts. Once they realized it was going to kill the economy, and probably more people, they started announcing bailouts;

“The next thing we know, social isolation is going to kill the national and global economies, and the consequences could be even more severe for people’s health and lives,” he said. That is why, at the end of March, proposals for economic measures were introduced in order to preserve employment and to rebuild economies after the restrictions on social contacts were lifted.

This leads to investors naturally waiting to pay the lowest price for the assets they normally trade with – but not before they are convinced that once they have bought them, they will be able to quickly sell them for some profit.

The behaviour of people with savings is similar – they also

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stand in a waiting position to make sure that the assets they want to buy, such as land, house, car or luxury goods, have reached their lowest price.

No different is the behaviour of people without savings who spend only on vital goods because they are not sure about their income in times of crisis and whether it will not get worse in the near future (Popov – 2020)

This particular behavior and uncertainty among investors and people is the reason why a huge part of the money available stops moving in the economy, which creates the feeling that all the money is lost or gone.

When money does not move, it reduces consumption, which in turn negatively affects production, trade, services, employment and income.

The COVID-19 pandemic is in its insem, all the world's economies have virtually stopped, and people are in shock at how long this will last and what their life prospects will be after the pandemic end of the crisis. Despite generous business benefits in strong economies, unemployment is growing at a record pace, and consumption, which is driving the economy, has been reduced to life-sufficient products and services.

No one can guess what people's behaviour will be after the pandemic and how consumption of all types of goods and services will recover, which is at the heart of the recovery in employment and economic growth.

The world will need years to recover from the coronavirus pandemic, he warned on March 23, 2020. Organisation for Economic Cooperation and Development. **José Ángel Gurria**, Secretary-General of the OECD, said the economic shock was already greater than the financial crisis. He commented that to believe that countries would emerge quickly was “wishful thinking”. The OECD calls on governments to abide by spending rules to ensure rapid testing and treatment of the virus and that countries will cope but suffer from the economic downturn “for years to come.”

It is expected from the economic uncertainty created by the virus that economies are already experiencing more shock than during the terrorist attacks of 11 September 2001 or the financial crisis in 2008.”And the reason is that we do not know how much we will need to deal with unemployment because we do not know how many people will remain unemployed.

The spring economic forecast for 2020 from 06.05.20 the European Commission is for a deep and uneven recession followed by an uncertain recovery. The EU economy will see a recession of historic magnitude – despite swift and comprehensive policy measures. **Bulgaria foresees a 7.2% drop in real GDP, an 18% reduction in investment and 7% unemployment.**

By comparison, in its april 14 spring forecast, the IMF expects a contraction of 4% and the World Bank by 3.7%. According to Finance Minister Vladislav Goranov, the worst scenario for the Bulgarian economy is to shrink by 3% and on the basis of it the budget update was made.

The global economy will shrink this year at a rate not seen since the Second world war, **it said in a report on June 8,**

2020 of The World Bank. The reason – the Covid-19 pandemic, which limited incomes and sent millions of people from emerging and developing countries into poverty. Global gross domestic product (GDP) is likely to shrink by 5.2 percent in 2020, the Washington-based institution said in its economic outlook report.

This, according to the WB, will be the fourth deepest recession in the last 150 years. Such meltdowns history remembers only in 1914, 1930-32 and 1945-46, world bank experts say. Per capita production will shrink in over 90% of countries around the world – an unprecedented situation since 1870. The economy will recover in 2021, growing by 4.2%, the report said. “This is the first recession since 1870, triggered solely by a pandemic, and it continues to manifest itself,” World Bank Vice President for Fair Growth, Finance and Institutions Jayla Pazarbasoglu told reporters by phone, as quoted by Bloomberg. “Given this uncertainty, further downgrading of the outlook is highly likely,” she adds. [/https://www.bloomberg.com/europe/](https://www.bloomberg.com/europe/)

The World Bank present two alternative scenarios. In one, in which the Covid-19 pandemic lasts longer than expected, requiring an extension of traffic restrictions, the global economy will shrink by almost 8% this year. – If control measures can be largely eliminated in the near future, the contraction will be 4 %, but twice as deep as that recorded during the global financial crisis of 2009 “The global recession will be deeper if the pandemic is brought under control takes longer than expected or if financial stress causes cascading unfulfilled requests”, says the World Bank.

For his part, in connection with the emerging severe crisis, the famous Steve Hanke warns Forbes that Bulgaria must keep the bgn and the currency board, and it will be fatal for it to give up on them. It must stop following all orders and demands from Brussels, because it is not good for the people, commenting on the meracs to get Bulgaria into the “waiting room of the euro zone”.

Hanke is known as the father of the currency board in Bulgaria and is firm about keeping the board and BGN as a currency in the country. According to him, the board allows Bulgaria to issue its own currency, which is solid and is traded at a fixed rate with the euro, is fully secured and convertible at the moment. This means that the lev is an arbitrary clone of the euro and that our country is part of the euro area, albeit informally. That's why we don't have to officially enter it.

It is extremely important that at the moment, because of the board, the government cannot borrow from the Monetary Council (BNB). Thus, bulgarian politicians are imposed fiscal discipline and can not take money from the reserve of the state. They take out loans from outside banks, and the reserve stays. Otherwise, he'd have been eaten a long time ago. Why would the euro be adopted when the lev is stable and tied to it?

Why would anyone want to fix something that's healthy and hasn't broken down to throw itself into the unknown? No thinking person, especially a politician, would try to do so if

there was no personal benefit from it, Hanke argues.

However, according interview with Mr. **Dombrovskis** from May, 2020 to “Horizont” radio, Bulgaria can join the ERM II currency mechanism, better known as the “waiting room of the eurozone” in July. This will happen if the country fulfills the last condition. Bulgaria can make the bid for the single currency together with the other candidate for that – Croatia This refers to the low assessment of the ECB from last year. Therefore, the financial institution recommended increasing the capital of two banks – “Investbank” and “First Investment Bank”. <https://bnr.bg/>

For this reason, the shareholders of „Investbank” have already increased their capital by BGN 22 million, approving the proposal for distribution of the profit for 2019 in the amount of BGN 2 million. that it has filled its capital with over 50 million euros.

From its side in the issue of the appeal „**First Investment Bank**” announced that it will buy up to 25 million new shares in the Bulgarian fund, which is not the case.

In this regard, on June 11, 2020, the State buys a share from First Investment Bank in order to fulfill the last condition for our entry into the ERM II currency mechanism, namely strengthening the capital of all banks in our country. Until now, only Fibank did not meet the requirements. The information that the state acquires shares in the bank was confirmed by the Ministry of Economy to the Bulgarian National Radio.

The ministry clarifies that the only motive for the state intervention is the deadline for July to meet all the requirements of the European Central Bank for the accession of our country to the so-called. waiting room for the eurozone.<https://bnr.bg/>

In the same month, Bulgaria sent a letter of assessment to the ECB. In the same way, the BBC will participate in April /2020 for cyap line in the size of 2 billion euro with Central bank”This is another element that provides security for the financial system,” according to **V. Dombrovskis** on this topic.

Meanwhile, Frankfurt and Brussels have issued regular reports on the countries’ progress towards the eurozone. Both the European Central Bank and the European Commission emphasize that Bulgaria is already outside the criterion of price stability set out in the Maastricht Treaty. The opinions of the bank and the commission are also key to the political decision for our country, which must be taken by the eurozone countries and Denmark – the only country that is currently part of the currency mechanism, but with a preserved national currency.

The ECB adds that the legal framework in our country is also not fully responsible for the introduction of the euro. <https://www.debatibg/>

The contraction of the Bulgarian economy is expected to be more than 5% in 2020, dictated by the restrictive measures to control the coronavirus, the European Bank for Reconstruction and Development forecasts in a report from 13.05.20. Other EU countries in Southeast Europe will also

be hit hard. A key channel for the collapse will be tourism, which is at the heart of the Cypriot and Greek economies, but is also important for Bulgaria, the EBRD report said. According to calculations in it, tourism in Bulgaria represents about 10% of the gross domestic product (GDP).

Nevertheless, the country’s entry into ERM-2 as planned took place together with Croatia on 10 July 2020, although further delays were not ruled out, „according to an EBRD report. <http://www.ebrd.com/>

In view of the impending, unexpected and unknown economic and financial crisis caused by COVID 19, it is good to recall the **Marshall Plan (officially the European Recovery Program)** of 1948, as an initiative of the United States, whose idea is to support states from Western Europe in order to recover faster politically, economically and culturally after the Second World War, with the United States allocating 17 billion dollars (equivalent to about 198 billion against the dollar exchange rate by 2018) to be distributed among individual European countries.

In response, on 27.05.2020, the European Commission presented details of its “modern Marshall Plan” for recovery from the coronary crisis, called the “next generation EU” and worth a total of 750 billion euros. In the explanatory memorandum to its proposal, the Commission states that it will ensure a sustainable, equitable, inclusive and equitable recovery for all Member States.

The new instrument will be “embedded” in the next long-term budget of the European Union (2021-2027), which will reach an unprecedented 1.85 trillion. euros.

The coronavirus shook Europe and the world, testing the health and social systems of the individual countries in the Bloc. Societies and economies, as well as the way of living and working together, were put to the test. To protect people’s lives and livelihoods, to repair the single market, and to build a lasting and prosperous recovery, the European Commission is proposing to use the full potential of the EU budget.

“The recovery plan addresses the huge challenge we face, not only by supporting recovery, but also by investing in our future.

The European Green Deal and digitalisation will stimulate jobs and growth, the sustainability of our societies and the health of our environment. This is the moment of Europe, commented the President of the European Commission Ursula von der Leyen. The “next generation EU” will raise money by temporarily raising the own resources ceiling to 2% of the EU’s gross domestic product (GDP), and the Commission will use its high credit rating to borrow 750 billion euros from the financial markets. This money will be channeled through various programs and will be disbursed over a long period of time through future EU budgets – not before 2028 and not after 2058.

The money from the „next generation EU” will be invested in three pillars.

1. Support for Member States with investment and reform – A new 560 billion euro recovery and sustainability instrument will offer financial support for investment and reform, including in relation to green and digital transitions and

the resilience of national economies, linking them to priorities of the EU. This tool will be built into the European Semester.

2. A „flying start” for the EU economy by stimulating private investment.

A new solvency support tool will mobilize private resources to urgently support viable European companies in the most affected sectors, regions and countries. It can be operational from 2020 and will have a budget of € 31 billion, aimed at unlocking € 300 billion in support for companies from all economic sectors and preparing them for a cleaner, digital and sustainable future.

3. Dealing with the lessons of the crisis. A new EU4Health program to strengthen health security and prepare for future health crises with a budget of € 9.4 billion.

Strengthen the RescEU by € 2 billion, the Union's Civil Protection Mechanism, which will be expanded to be able to prepare for and respond to future crises.

EUR 94.4 billion for Horizon Europe, which will be strengthened to fund vital research on health, sustainability and green and digital transitions. https://ec.europa.eu/info/index_en/

For its part, Bulgaria will be able to count on 15 billion euros from the funds provided in the EU reconstruction fund, presented by the President of the European Commission Ursula von der Leyen. However, in order to gain access to this money, our country must first contribute 3.3 billion euros (nearly 8% of the country's GDP). In other words, our country has a chance to receive a net 11.7 billion euros under the "Next Generation EU" plan in the form of loans and grants. / <https://www.economic.bg/>

Of course, here at the place to mention the new third programming period 2021 – 2027, from which it is clear that under the various EU programmes for the period a further 29 billion are envisaged. and the IMF's decision of 08.08.2021 to approve a new total allocation of SDRs of EUR 650 billion. US dollars – the largest allocation in the history of the IMF – to meet long-term global reserve needs during the worst crisis since the Great Depression, for which Ms Kr. Georgieva, and which is due to be approved by the end of the month.

She likens this action to putting a vaccine in the hands of the world. The allocation of SDRs will increase the liquidity and reserves of all Member States, build confidence and promote the resilience and stability of the global economy. In 2009, the allocation of SDRs contributed significantly to the recovery from the global financial crisis and the benefits of this new allocation will be similar. The allocation of SDRs will help each IMF member country – especially vulnerable countries – and increase their ability to respond to the crisis following COVID-19.

II. SOCIETY AND CONTROL

From the beginning of its existence, human society has realized the necessary need for control. At this stage, public relations are related to the attitude of the group of people to the behavior of individual members, as well as to the

acquisition and protection of their property. The social nature of the production processes also determines the content of the object of control. Both owners and contractors and managers are involved in these processes, with all parties perceiving the need for control. For its part, however, ownership dictates the behavior of the subject of control. Therefore, the size of the owned property determines not only the right to control, but also its forms and organization. (Dinev-Control and regulation in social management-2015)

But above all, control must be seen as control and regulation in social management, where in reality are located and constitute both the subjects and the objects of control in the form of various operating and operating systems.

Apart from being a function of management, control must be considered as a public attitude, which leads to the establishment of socially accepted norms and rules of conduct, to the impact on the behavior of individuals.

The society, going through certain stages of its development, creates different structures and organization of government. Thus, the managerial functions in dynamics express the possibilities of the individual structures to manage and be managed

Depending on the affiliation of the control function, we have state and public;

- **state control** – is carried out by institutions specially created for this purpose by law and derives from the right of the state to protect its interests. It is primarily external to the controlled objects and can include tax control, customs control, control of the National Audit Office and others.

- **public control** of less pronounced, recently more and more imposed and established, as a manifestation of a critical attitude to the behavior of the state, its institutions, officials, etc. In addition, it is assumed that public control also applies to the observance of generally accepted rules and norms of conduct by individuals. Rallies, strikes, referendums, elections, the institution of a national ombudsman, etc. can be referred to as a manifestation of public control today, embodying the democratization of society, civil rights and criticism, as a critical attitude of society.

Public control is a manifestation of the participation of citizens in governance and the enhanced role of the public. Public control can be considered in a broad and narrow sense.

In a broad sense, public control covers all forms and types of control exercised by non-state forms and organizations, ie the control of the general public of the population of public bodies and organizations and of citizens.

Public control in the narrow sense is exercised by public bodies or organizations, structures of public initiative and other forms of democracy, including the manifestations of public opinion and the mass media. The control exercised by the trade unions, by political parties, formal and informal structures of the public amateur activity is public control, because it protects the control influences of different groups of the society on the activity of the administration.

Particularly active form of public control are critical

publications and materials in the media print, radio, television, internet. Media control claims to be the fourth power in the management of society, but here the so-called fake news, as it appears more and more often.

The functions of public control are the directions of the control impact on the relations in the sphere of administration. Public control has and expresses all the general tasks of control in general, but its public nature affects the specifics and intensity of its manifestations. / Donev K. 2010 /

The specifics of public control puts it in a special place in the system of control over the administration. The main task of public control is to assist in the positive management process – to create an environment that does not allow or prevent the occurrence of negative phenomena and their causes. Public control fully serves both parties in the process of functioning of the administration – the governing bodies and the objects of management – the citizens and the public.

The prevention of public control is closely related to its educational and motivational nature. The educational impact of public control has a significant social effect, which acquires social and political significance for the behavior of bodies and officials. With his wide opportunities for direct contact with people, he convincingly contributes to the formation of new patterns of behavior, education in discipline and order.

The preventive function of public control is related to its publicity. The knowledge of successfully conducted inspections, detected violations, imposed penalties help to increase the authority of public control. Citizens and the public are convinced of the effectiveness and comprehensiveness of public control, while at the same time activating the power of public influence against violations and violators.

In the program “In development” on Bloomberg TV Bulgaria, Prof. Z. Zahariev, President of the National Association “One Belt, One Road”, points out that the dialogue between citizens and government through the transmission of political forces, such as their country, must be restored. to restore the regulatory functions on the economic processes and to fulfill its constitutional obligations – to regulate not in a certain interest, but in the interest of the society as a whole.

According to him, public control through the media will allow to counteract the sad reality of civilization, but it is likely that corrupt practices will not disappear because they are problems of people’s psychology. / M. Semov-1997/

The chance for Bulgarians to become a society is called “coronavirus”. The coronavirus crisis can be a litmus for a person’s natural need to be part of a community that protects and supports him. This is exactly what is happening in Bulgaria, al argues in his article. Child. /<https://www.dv.com/>

The crisis that unleashed the new coronavirus was unbreakable. Even in Bulgaria, it prompts people to unexpected mobilizations When a common threat appears, it is consolidation that is the most natural, impulsive and

spontaneous reaction. In his theory of the functions of social conflict, sociologist Luis Kozer says that conflict is a form of socialization. It serves to create and maintain group identities. The special situation in the current situation: conflict is fought not between different groups in society, but between people and disease.

It is logical and inherent for people in recent days to strive for active participation in the community. Especially when faced with the deadly threat that invades everywhere with the invisible, deadly viruses. This is a chance and an opportunity to reach consensus and connectivity going far beyond the demonstrations of gratitude to the medics – which they undoubtedly deserve. We still don’t know how scary the current crisis will hit the economy. But despite or precisely because of the coming severe recession and economic crisis, fragmented and fragmented societies can heal thanks to a until recently unexpected injection of solidarity. /<https://www.dv.com/>

In this regard, today its society lacks information, transparency, publicity, and results on the costs of the EPF, costs related to the crisis – clothing, medicines, precautions, hospitals, there is mistrust about the spread and infection with the Corona virus.

Distrust arises in the institutions and their representatives for their relations with representatives of the Underground, the placement of political, judicial and financial umbrellas over iconic figures of the gray economy. There is a strong distrust of the state institutions with control functions, such as the NRA / the case with the expired personal data of about 5 million people from 2019 /, the Registry Agency / the case of the hacker attack from 2018 /, RA / for a number of cases related to smuggling of drugs and goods – the case from April / 2020 in Studentski grad /, the Financial Supervision Commission and the Gambling Commission / the case with taxes and fees from the State Lottery /, the BNB / banking supervision / and many others that fade over time and no culprits have been identified and punished. The same applies to the judiciary, which is still monitored by the EC, despite claims by the government.

This, as well as many other problems today, provoked the reaction of the society from the last ten days in almost the whole country. These public protests may have needed a small spark sparked by quarrels between institutions on both sides of Dondukov Blvd. in Sofia.

These civil society protests lately / not only in our country, but also in the USA, France, etc./ are a very vivid manifestation of public control over institutions and government everywhere. And although the protests in bulgaria from last year were „yachted” by certain political parties, led to some changes in the political building in bulgaria, as a prerequisite for changing the political model and the status quo of recent years.

According to Ivan Hinovski in one of his analyzes from 2016. The crisis in Bulgarian society is unexpectedly deep and we are not aware of it, gradually getting used to the absurdities of chalga society – gone aesthetics and lack of need for intellect, manifested shamelessness, primary

passions of primitives everywhere, who scandalize us with paraded luxury, eroticism and wealth. And this, strange as it may seem, is tolerated by the media.

No one analyzes the depth of this moral and spiritual crisis, but it is growing and only foreigners visiting Bulgaria periodically find alarming trends: irreversible ethnic changes in society and progressive melting of the productive part of the nation, degradation of trust in statehood and politicians, progressive progress, asociality of the Bulgarian and resentment towards the neighbor, inefficient administration of justice and education, our abandoned church, the sent media, no respect for laws and rules and the most eroding consciousness of the Bulgarian – the shocking social asymmetry. / I. Hinovski 2016 /

Moral degradation in society is catalyzed by the spreading uncontrollable vulgarity in almost all our media. Responsible and regulatory authorities have failed to understand that this is one of the serious reasons for the progressive degradation of society's morale, for the growing aggression on the roads and in schools, for its growing "theft" at all levels. The media have become helpful to someone, mostly criminal chroniclers and distributors of erotica and yellow news, as the leading news in the main news programs of almost all televisions, with few exceptions, are full of catastrophic and negative information. This creates a depressed mood that works against the power of the nation and erodes the psyche of the individual and so he instinctively lives in a zone of aggression and violence.

In addition, there is a clear and ubiquitous lack of responsibility in society related to the failures of politicians with dire consequences for the nation, failed economic initiatives worth billions, criminal traffic violations swept under the rug of corruption and a dormant society. And it, irresponsibility is related to the lack of spirituality and understanding of the interconnectedness of both the success and the failure of society. / I. Hinovski 2016 /

Collective political and personal impunity create a sense of futility to do anything today, resulting in nihilism and lawlessness, but politicians do not take serious measures that enslave lobbying interests and the root cause of ongoing elections.

The last few months of public life in our country overlap 100% with the "prophetic" words of Mr. Hinovski from five years ago, but now with his participation as an MP from "There is such a people"!

In this direction in an interview given by Al. Karakachanov, on April 15, 2019, he claims that over 95% of all problems in Bulgaria are not rooted in the Constitution at all, but are solved by sub-constitutional norms and their implementation. We have not bad laws, but then they are not enforced. This is the big problem of Bulgaria for more than 30 years.

He emphasizes that society still lacks enough political culture and cannot control its politicians. Society does not know what it wants in many cases because it wants "something better", but what exactly – it does not know and cannot ask it from politicians who do what they want.

According to him, everyone is to blame for what is happening in Bulgaria, but to a different degree. Those who are

at the top are the most guilty, and those who are at the bottom, if they think they are not guilty, are wrong, and it is the fault of his generation that today's students complete their secondary education semi-literate. They are informed, but the bad thing is that they are informed about things that are not essential. The state of education is a serious problem of the state.

III. INSTEAD OF A CONCLUSION

From what has been said so far, it is clear that in the coming years we will have unpleasant things to deal with. First of all, the constant "new waves" of all strains of the Kovid infection must be overcome, and further decline in GDP, unemployment, reduced purchasing power, bankruptcies of companies, aggravated social environment, etc., for which overcoming and recovery, in the most – the best case we will need at least 3-4 years. That is why we need a sharp reduction in costs for everyone, adequate solutions at all levels, etc., because staying at home and wearing masks will seem like a fairy tale from childhood, compared to what awaits us in the coming years and what we must overcome. In addition, we must be aware that the lack of public control **will increase the cases of corruption, bribery, weak and unprepared politicians and government, as shown by the „native sweet picture” from 04.04 2021 here!**

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The New Provisions in the Bulgarian Legislation in Connection with the Implementation of the Connecting Europe Facility (CEF 2) – Digital and the Providing of Opportunities for the Construction of 5G-based Innovative Small Wireless Networks (Small Cells)

Kiril Iliev PhD¹

Abstract – with the adoption in 2018 of the Regulation defining the new Connecting Europe Facility CEF 2 – Digital, was created solid financial and regulatory instrument for the development of the digital sector in the EU. With this Mechanism, EU is aiming to provide fast and secure, based on 5G-technology internet network and to provide a basis for intelligent, sustainable economic growth. The purpose of the article is to analyze the aims of the CEF 2 Digital mechanism and the impact that it will have on Bulgarian legislation, as well as to outline key recommendations for amending and supplementing it.

Keywords – Connecting Europe Facility, CEF 2-Digital, 5G-based wireless networks, legislative changes to the Law on Electronic Communications.

I. INTRODUCTION

Only three years ago, the European Commission adopted a special regulation establishing a new common document called the Connecting Europe Facility (CEF 2), which is expected to lay the foundations for regulating network deployment for the period from 2021 to 2027 for Europe’s digital connectivity from end to end. Upgrading over the first Mechanism – Connecting Europe Facility (CEF 1) [1], which has been in operation since January 2014, the new financial instrument is expected to provide the necessary support for building a strategic infrastructure for technological connectivity between all member states of the Union, under the direct guidance of the European Commission. The total budget that the Union will allocate for the creation of technological and telecommunication interconnections between the countries and regions is 3 billion EUR – direct financial support, and the total budget of the program covering all three departments: transport, energy and digitalization amounts to 33.7 billion EUR [2]. Of course, in order for the mechanism to achieve its objectives, it is also necessary for the national legislations in the member states to be sufficiently prepared to accept the challenges of the environment and to adapt to its new regulations in order to help speed up and implement them according the aims of the

program. Our country is no exception. Although our legislation in the electronic communications sector is considered to be one of the most rational and effective at the same time within the EU, it is often either at a more advanced stage than the legislation of other Member States, which causes a conflict, caused by the unequal legislative development of European countries, or businesses investing in technology do not have sufficient financial capacity to build and maintain new networks due to the limited small internal market and consumer capabilities of users.

Through the new program, the EC makes an ambitious request, based on the experience gained so far under the CEF 1 Mechanism in the CEF 2 Mechanism, to overcome all the difficulties identified so far and to proceed to the desired unification of regulatory documents in each Member State. The changes will be made in the all three-sector policies subject of the program – transport, digital technologies and energy, which requires the implementation of a common European document and targeted funding. That is why it is urgent for each Member State to comply with the objectives of the Mechanism and the framework set out in it, and to implement the changes in its internal legislation, that determine the rapid development of cross-border relations between countries. The agenda is inherently extremely ambitious, but only in this way it will be possible to promote the transition to greater economic, social and territorial cohesion between regions and to achieve smart, sustainable and inclusive growth for the whole EU, and the union to maintain its leading role in the sectors of intervention.

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Guided by all this, through this article, it will be shown what should be the scope of the changes, what will be the new provisions in our national legislation and how, most smoothly and adequately to implement the commitments that Bulgaria should make to apply the Mechanism for Connecting Europe (CEF 2) Digital, and of course, how to speed up the construction of the so-called “Small cells” – 5G-based innovative wireless networks, which are one of the pillars for achieving the objectives of the Mechanism.

II. PRESENTATION OF THE STUDY

The fact is that the Connecting Europe Facility for the period 2021-2027 (CEF 2) – Digital is facing the difficult task to urgently achieve several important strategic goals, the main one of which is to implement regional integration, and to overcome the differences between countries in some of the most important sectors for the EU, such as transport, telecommunications and energy, and to fund opportunities for national key projects in areas with a direct impact on the Union’s economy. Like any strategic document, what determines the success of its successful implementation is, to know the problems in the sector and also to know how to overcome them, and also to point the financial instruments to this overcoming. With this in mind, the EC has allocated a record budget for the sector of 3 billion EUR, which will be used for direct support. Additional funding has been provided from the budgets of the connected programs as InvestEU [3] and the European Regional Development Fund [4]. A significant part of the finances of which programs will be directed to the construction of new networks with a large capacity for data transmission between the regions and increase the transmission capacity and quality of the existing networks.

At present, just a few months before the mechanism itself becomes operational, a strategic draft regulation for CEF 2 has been adopted and detailed political agreement has been reached. All of significant differences between the European Parliament and the Council of the EU on its individual issues also have been clarified, and the specific areas of direct intervention were pointed. Some of them are, as follows:

First of all, to build the necessary new infrastructure facilities for the use of networks with very large data transmission capacity, including 5G systems [5]. The main purpose of these systems is to implement the so-called. Gigabit connectivity via “very large capacity networks” [6] between the regions where the socio-economic drivers of the Member States are located, and to achieve and build fast technological and digital connectivity in real-time data exchange. It is more than clear to the European legislator that Europe must not lag behind in any way in the global digital transformation processes that have been going on for more than two decades now. From that depends also how quickly and adequately the EU will approach digitalisation processes which is the base of its future competitiveness, and depends the preservation of its leading market and economic

positions. What the European Commission can do, is to point investments in future infrastructure, which will not only increase connectivity in the regions, but also will help them to develop equally, so that underdeveloped technological areas do not slowdown the developed ones. Of course, connectivity will initially be built in the areas that are still the drivers of Europe’s economy, but the development of the network must gradually cover even the most remote ones. Unfortunately, the business logic of private service providers is to focus investment and introduce new technologies in areas where they will get a faster return, because they have more consumers and therefore higher income levels. EC is aware that if business is expected, to build networks in areas where there is no return, this may not happen or it will take unnecessarily long time. That is why, the EU must bear the brunt of this risk and invest in areas, where businesses have no interest in building networks, because it knows that digitalisation is today the most effective way to bridge regional disparities. By ensuring opportunities for participation in the digital single market is the right way to provide opportunities for development of regions, and the way to introduce of many new and innovative services. That why due to new technologies will be transformed not only the economy in the outermost regions of the EU, but also will help the other sectors such as health, education, ecology and all sectors in which digitalisation can be applied to be improved. Who else, but the development of technology and the greater connectivity they create will lead to the desired socio-economic growth?

Secondly, the construction of high-quality free local wireless connectivity in the settlements. As already mentioned above, the creation of wireless distribution infrastructure (Wi-Fi and 5G small cells) in areas at risk of lagging behind in 5G coverage is a key priority for the Commission. EC need to provide local communities with very high quality internet access for free, and for this purpose, it will be necessary to create multiple single access points via 5G-based innovative small wireless networks (small cells) in a simplified administrative mode. As such, it will not necessarily be aimed only at small and remote settlements, but also at places where ordinary consumers need access to fast and cheap internet, such as medical centers, public administration buildings, transport centers or business parks and parks in urban environment. Of course, the foundations of these processes were laid in the previous Mechanism through the Wifi4EU program [7], which has shown its effectiveness and based on the experience from which the next phase for providing wireless connectivity will be built.

Thirdly, the investment and creation of 5G systems with complete and continuous coverage, covering the most important transport roads, which will gradually be extended to all transport routes to full technological and digital coverage of the trans-European transport corridors. How can 5G systems support transport and how will data exchange improve the transport sector, the connectivity of regions and the transport of people and goods and related service

provision? The future of the transport sector is the entry of more and more smart vehicles to „correspond” with each other. This smart transport interaction will lead firstly to a reduction in the number of accidents; secondly will lead to more significant traffic regulation, reduction in the number of congestion, and from there to the reduction of carbon dioxide emissions released into the atmosphere, of course to the overall optimization of traffic on EU roads. Until then a necessary infrastructure must be built along the main arteries of the continent, and it will cover all cross-border transport corridors (for road, rail or inland European water transport). Currently, the 5G network is the one that allows fast and reliable data exchange and is expected to expand its scope and become a major factor in achieving fully automated mobility, which will help the implementation of the connected program CEF 2 – Transport [8], and the implementation of the policy for achieving Connected and Automated Mobility and the implementation of the policy for achieving Connected and Automated Mobility (CAM) [9] in Europe. In this way, the strategic goal will be achieved not only for the deployment of 5G infrastructure on the main transport routes in Europe by 2025, but also the competitiveness in the transport sector will be fully promoted, the introduction of innovative digital transport systems and technologies will be achieved, to manage the sector and other strategic digital projects will be implemented through the construction of 5G networks along the lines of CEF 2.

Fourthly, a complete modernization and expansion of the capacity of the main existing networks through which connectivity is still established both between the Member States of the Union and with third countries outside the Union. Due to the need dictated by the expected increase in data exchange, the EC is clearly aware of the need to increase the transmission capacity of existing infrastructure. The more secure the digital infrastructure and the higher the data exchange capacity, the more competitive the Union's economy as a whole will be. An important element for the implementation of modernization and increasing the capacity of networks and facilities for technological connectivity is the establishment in 2018 of the joint venture – EuroHPC [10] which allows all EU member states to invest in building supercomputers that can perform multibillion operations per second and perform high-performance computing to improve cooperation in both innovation and science, as well as industry and technology. One of the eight supercomputers will be put into operation soon in Sofia [11] which will ensure not only the competitiveness of our economy, but also the economy of entire Eastern Europe and the Balkans, and thus ensure both technological and digital progress of the region based on new technologies.

And, of course, in fifth place is the creation of a new, more comprehensive and developed digital connectivity infrastructure to help ensure the exchange of large databases for even the outermost regions of the European Union. Investing in new technologies and building networks to

increase connectivity between regions in the EU is extremely conducive to exploring opportunities for convergence of the three most important sectors of the Union economy – transport, energy and digital, which is the main goal of the Mechanism to connect Europe from end to end. The synergy between the three sectors based on digitalisation will lead to increased efficiency and effectiveness in each of them and the benefits for the Union economy will be unlimited. Through the synergy of the three industries and the construction of common operational digital platforms directly related to transport or energy infrastructures, will lead to the optimization of resources and processes related to the implementation of efficient use of fuels, energy storage, and also to increasing the use of renewable energy sources, which will lead to a significant improvement of socio-economic, climatic and environmental conditions in the union.

However, how ready are national governments to respond to the need for new regulations and how quickly and adequately can they change the existing regulatory framework to help achieve the aims of the EC and the CEF 2 – Digital Mechanism? To achieve the needed levels, decisive measures are needed so that Bulgarian national legislation can now, more than ever, quickly adapt all necessary European regulatory and administrative laws and accelerate legislative reforms in the technology sector. The analysis of the main normative acts, which create the legal framework for building and facilitating the construction of internal networks and cross-border connectivity in the telecommunications sector, shows that there is still much to be desired. Although the norms that exist now in the sector meet the needs of reality and meet the basic needs of the sector, they may not be good enough in the future to be able to achieve all that is set in the Mechanism, and may cause a slowdown in growth, from which the EU is worried. That is why it is more than necessary for the legislation to be predictive and so argued that the new relations that arise in the sector to be fully regulated and covered by law with maximum accuracy and in the most detailed details possible. Thus, through the instruments of law, security and stability in relations will be guaranteed for both business and the state and of course the consumers.

We will analyze several basic laws that need to be adapted and that are directly related to the creation of the legal conditions for the realization of the objectives set in the Mechanism.

We will start with the Law on Electronic Communications (LEC) [12]. It regulates all public relations related to the implementation of electronic communications by transmitting, transmitting, transmitting or receiving signs, signals, written text, images, sound or messages of any kind, whether by wire, radio, optical or by another electromagnetic medium. The law also regulates the relations arising in connection with the access to and joint use of electronic communications networks, facilities and the related infrastructure, etc. According to the changes in the LEC from March 2021 and more precisely with the creation of a new

art. 70a [13] The law regulates for the first time the term „Short-range wireless access point”. The legislator defines that these points will be used for providing wireless access to short-range electronic communications, which can use the radio frequency spectrum freely in registration or licensing mode, and will be part of an electronic communications network which to allow maximum free wireless access of all users to electronic communications networks and services. It is clear to the European legislator that the rapid deployment and construction of access points will not go smoothly from a regulatory point of view and involves a lot of investment. It is the Law on Electronic Communications that is expected to create such rules as to encourage the service providers-operators to increase their data transmission capacity according to the market demand, because with the entry of 5G networks an increase in the number and variety of devices which use 5G technologies is expected, and not only mobile devices, but also autonomous vehicles, new generation measuring equipment and devices using IoT [14]. To this aim, operators will have to build a network of small 5G cells with high radiated power and redesign their existing networks so that new equipment can be deployed quickly and easily in compliance with all regulations. Also, in view of the fact that the introduction of 5G networks is expected to use new frequency bands in different bands, the law should create the so-called frequency adaptation and synchronization, which means the emergence of new relationships in the process of consumption and regulation of telecommunications services. That is why the LEC will have to create such a legal framework to provide assurance to operators that, when they invest in many and new access and distribution points, with which to maintain the new radio purities for the needs of 5G, their investments will be guaranteed and even partially covered with the idea do not slow down technologically, compared to third countries and the other world economies.

The second law that needs to be revised is the Law on Electronic Communications Networks and Physical Infrastructure (LECNPI) [15]. This law regulates all relations connected to the purely physical location of the cells, use, maintenance and development of electronic communications networks on the territory of the Republic of Bulgaria, providing access to and use of existing physical infrastructure by entities operating in the market for provision of telecommunications services, including and access to infrastructure serving other types of networks. The law also regulates the relations between the service providers for the joint planning and use of the physical infrastructure, as well as their basic rights and obligations as network operators. Also regulates the relations between the companies and real estate owners, holders of limited property rights, persons who manage or use real estate, and tenants related to the provision of access to real estate, in order to ensure conditions for the provision of electronic communications services. The law applies to electronic communications networks and physical infrastructure, whether public or

private, municipal or state property, but it cannot, by its nature, regulate or create obligations that fall within the competence of the LEC, and especially those imposed in connection with with access to and joint use of electronic communications networks, facilities and related infrastructure within the meaning of the Law on Electronic Communications. It is the need to create many new points and cells with wick to provide maximum traffic. The provision of new frequency bands will lead to the need for rapid construction and commissioning of new facilities, mainly on the existing physical infrastructure. The main direction, in which the reforms in LECNPI should move, are related to easing the deadlines related to the procedures for the deployment of electronic communications networks, coordination with state and municipal authorities, obtaining data on the existing infrastructure network and the fast communications with the other newtwork operators for jointventures and information exchange for the location of facilities of other operators and suppliers. Especially for the last problem, it can be said that, there is practically no data for the location of the already existing physical infrastructure, its type and the way of use. The lack of an underground network cadastre and a clear delineation of the easement zones of other network operators in most settlements in the country, creates the most serious obstacles in the planning and design of networks. An important aspect for overcoming this problem is the creation of the Unified Public Register of Spatial Planning, which is expected to be operational by the end of 2021 – a very optimistic period. Another problem that needs to be addressed, which faces operators who need to have multiple short-range wireless access points, is the regulation of property management by municipal and state authorities that manage physical infrastructure. These facilities include elements of the street environment, such as lighting poles, street signs, traffic lights, billboards located in urban and rural areas, bus and tram stops and metro stations, and in general any environment that is technically suitable to be located on it. points or which can be used for the deployment of a new generation electronic communications network. As a step in the right direction can be considered the change from March 2021 in LECNPI through which state bodies and local governments were identified as network operators, which will significantly support the processes of deployment of electronic communications networks. Another difficulty that needs to be overcome through legal reforms is the optimization of deadlines for correspondence and obtaining agreement between the network operators themselves, which provide access or share physical infrastructure in order to deploy and use new 5G networks. The LECNPI must also specify the amount of one-off compensation due, which must take into account the amount of costs incurred, as well as specify the deadlines for granting the rights to deploy and use electronic communications networks, the rights of passage and the rights of special use, rights without a tender or competition (they are now established for a period of 10

years) and etc. The contract periods also can be used as an incentive instrument and must be linked to the payback periods. This approach is not actually unknown to matter and is equated with the approach to the so-called price constraint with imposition of price thresholds, and with the approach of cost orientation in pricing.

The third law related to the deployment of networks and the creation of the necessary physical infrastructure is the Law on Spatial Planning (LSP) [16], which regulates the public relations related to the spatial planning, investment design and construction, and determines the various restrictions that may arise on the property in connection with the development goals of general interest. LSP defines and regulates all activities related to investment, coordination and approval of investment projects, issuance of construction permits and commissioning of physical infrastructure for deployment of electronic communications networks, and the construction of transceiver stations necessary for the implementation of electronic communications. The changes in the law should be aimed at optimizing the deadlines for coordination and announcement, and optimizing the phases through which a project goes. Already in 2018, the first steps in this direction were taken, and according to the then adopted Art. 64 item 6 [17] all transceiver stations were categorized as elements of the technical infrastructure and their regime of construction and installation was greatly eased, the regime related to the deployment of cable electronic communications networks in buildings in co-ownership or condominium mode and the deployment of facilities to the regulatory line of the property, and the regime for issuing a building permit for construction of physical infrastructure in the construction of elements for deployment of electronic communications network from the regulatory line of the property in which it is built, to the entry point for access to a privately owned building individual low-rise housing was canceled. With the subsequent changes from 2021 and more precisely in Art. 56 para. 14[18] and Art 151 para. 1 item 18 [19] from LSP new reliefs related to the deployment of short-range wireless access points were also regulated, as the regime related to the placement and approval of schemes and preparation of individual design documentation was also abolished, and accordingly the requirement to issue a building permit as soon as these points meet the requirements set out in the Regulation, which defines the characteristics of short-range wireless access points Regulation (EU) 2020/1070 [20]. This is how the most serious problems facing the deployment of the 5G network can be overcome, and progress in facilitation must be made in the deployment of transmission sites through underground infrastructure and the construction of mobile stations – something that must be seriously addressed. Actually, this is one of the main requirements adopted back in 2014 with the adoption of Regulation (EU) № 283/2014 of the European Parliament and of the Council of 11 March 2014 on guidelines for trans-European networks in the field of telecommunications infrastructure [21].

Another law that needs to be changed quickly and adequately according to the new requirements and as far as the rights of users are concerned is the Law on Consumer Protection (LCP) [22]. It regulates the protection of consumers (called users in the LEC), the powers of state bodies and the activities of consumer associations with regard to providing protection against risks from the acquisition and use of goods and services that may endanger the life, health or property of individuals. and legal entities, including the protection of their economic interests in the acquisition of goods and services where they are subject to unfair commercial practices and methods of sale, unfair contract terms and the provision of guarantees for goods, and regulates the right to compensation for damages from defective goods and offering poor quality services and so on. Here, what can be considered is to ensure the minimum quality of the services offered, with a view to ensuring that, when deploying networks, operators are able to provide coverage that meets the basic needs of users, and where this is not ensured, to be prevented, the providers to be forced to establish new networks or other guarantees and compensatory instruments in support of consumers – users of electronic communications services.

Changes must also be made in the Law on Electronic Government (LEG) [23]. This law regulates the public relations between the administrative bodies, related to the work with electronic documents and the provision of administrative services electronically, as well as the exchange of electronic documents between the administrative bodies. As it also applies to public service organizations, and again concerns the exchange of electronic documents and the operation of communication and information systems, which are also relevant to the collection and provision of information by public authorities directly involved in the exchange of data necessary for adequate and rational interaction between countries, it is necessary to impose through it commitments of state bodies to use certain categories of electronic protocols and to ensure better connectivity in the provision of new and additional services, as well as to ensure that in increased demand and offering services, users' rights will be protected to the maximum, and that a fast, secure and efficient service can be provided to users.

And of course, last but not least, the Law on Health (LH) [24] and by-laws, which should also be optimized as regards the deployment of antennas and base stations and the control of their impact on human health. As has been said many times, the Connecting Europe Facility 2021-2027 (CEF 2) was set up to encourage investment and facilitate procedures in national legislation to build many new so-called small 5G cells to connect to create 5G-based wireless networks, which we can currently treat as partially unexplored in terms of the impact on human health and nature. Since the introduction of 5G technology, many debates have taken place in the public space, based on the impact of networks on the greatest human value – health. According to the current legislation,

all facilities, regardless of their scope and size, after being placed or put into operation, go through a procedure for coordination and obtaining a permit for use from the Regional Health Inspectorates, which perform measurements of electromagnetic radiation inspection on each individual object before it is put in exploitation and use. The approved standards of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) [25], acting as an organization – an official body for cooperation in this direction of the World Health Organization (WHO) [26] should also be reviewed. The fears that, due to the fact that 5G cells will be numerous, located at relatively short distances from each other, and that they will generate huge traffic and will emit the so-called non-ionizing radiation in a larger volume than the current one, can not be neglected. At the moment our country, with the introduced standards, has actually maintained the power of the radiation almost in the lower limits. According to research on existing networks, it is known that radiation is spread in a cone and does not radiate in the whole space and it is maximally safe if the transmitters are placed at a certain angle from the surface – between 65 degrees horizontally and 7 degrees vertically, with the strongest impact of organisms in the 40-60th meter of the wave. That mean that it is unacceptable the antenna to be point to residential or other buildings, kindergartens, schools or hospitals. At the moment, it is still not clear what the consequences will be and whether there will be any consequences from the radiation of 5G cells, for which studies and analyzes have yet to be made, and on the basis of which, it will be made the most effective and rational regulatory framework so the people to feel safe and secure.

III. CONCLUSION

In conclusion of the article we can summarize that with the adoption in June 2018 by the EC of the Regulation defining the new Connecting Europe Facility, and more precisely with the adoption of the special program CEF 2 – Digital, was created a solid financial and regulatory tool for development of the digital sector throughout the Union, and only by building a solid infrastructure to ensure the connection, integration and bridging of regional disparities will be possible to overcome the imbalance in digital development between the various regions. However, all the objectives of the Mechanism may remain desirable or cannot be achieved in their entirety if the Member States concerned do not undertake adequate and timely changes in their internal and national legislation to meet the challenges their society, in connection with the introduction of new digital technologies, will face. Neither the individual countries, nor the individual regions in them, nor the European Union and its regions can afford to lag behind in their development, and their economies not to be enough competitive and technologically prepared for digitalisation. Changes in our national legislation must also be comprehensive and the entire regulatory framework must be subordinated to the idea, that

with new technologies the lives and well-being of citizens will be improved and society will develop, because digital connectivity is not only the decisive factor in overcoming of economic, social and territorial division in Europe, but it is also the factor that will lead to growth and development.

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E-Commerce in the Telecommunications Sector

Gabriela Terezova¹

Abstract – The dynamic development of technologies and in particular ICT, both in Bulgaria and globally, contributes to the increased penetration of e-commerce in many markets. Nowadays, combining technology and trade is no longer a new method of selling, but a necessity for both traders and end customers.

Keywords – E-commerce, Telecommunications, Electronic communications services, ICT.

I. INTRODUCTION

In modern society, the term „e-commerce” is extremely widely used, both in business circles and as part of the daily lives of end users of goods and services.

Many sources provide different definitions and reasoning regarding the nature of or e-commerce, but in general the following should be defined as the main subdivisions of e-business, which on each side can be defined as “virtual dimension “ on modern traditional business.

As a key component for the existence of e-business and in particular e-commerce in the Internet environment, the influence and development in recent years of information and communication technologies (ICT) should be noted. Without their „intervention”, it would not be possible to carry out e-commerce, the digital transformation of a number of businesses, and last but not least, to create conditions for end-users to shop directly from their office, from home or while traveling. Thanks to these technologies, the „seller-buyer” contact is accelerated and at the same time facilitated, as it is realized through end devices such as: personal computers, laptops, tablets, smartphones and more. As the listed devices have access to the global network (Internet), this creates unlimited opportunities for shopping and supply for both customers and merchants. Some of the existing limitations in traditional business, such as the difference in the geographical location of the merchant and the end user, can be ignored as an obstacle, as it can be overcome thanks to the modern possibilities of e-commerce.

In this regard, the accelerated pace of development in most market sectors (such as telecommunications, transport, hospitality, banking) requires more and more companies, organizations, small businesses and others to adapt the e-commerce model to their activity. On the one hand, this is provoked by the penetration of the Internet on a global level and the active development of ICT and on the other hand by end users, for whom modern shopping tools are mostly convenient, save time and money and offer a much wider choice of goods and services.

II. E-COMMERCE IN THE TELECOMMUNICATIONS SECTOR

The Internet and in particular access to it are one of the most commonly used indicators, which are used to prepare a number of analyzes and statistics of various nature, which provide information such as business about how many people have access to the Internet, for what most often used (shopping, banking, training, etc.), what is the level of digital skills of Internet users, etc.

According to Eurostat data for the last 10 years, internet use in Bulgaria has increased by 45%, as shown in Chart 1 „Individuals internet use in Bulgaria”.

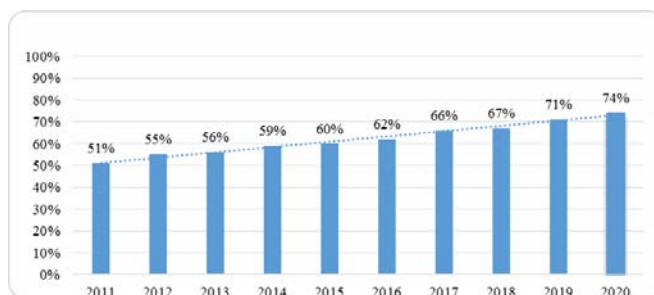


Fig. 1. Individuals internet use in Bulgaria [1]
(According to Eurostat)

There is an increase in other indicators such as „the total number of subscribers to Internet retail services (fixed and mobile Internet access) is 8.630 million and again marked an increase of 1.7% compared to the end of the previous year growth in 2019 compared to 2018). The total volume of the ECS market in Bulgaria, which amounts to BGN 2.861 billion, at the end of 2020 also for the third consecutive year continues its upward trend compared to data for previous periods (reported growth of 6.7% compared to 2019)”.[2]

All these upward trends indicate that more and more users need to have access to the Internet and / or other ECSs.

Last but not least, the role of the 2020 pandemic caused by the spread of Covid-19 should be taken into account. Given this fact, it can be concluded that this was the engine that mainly contributed to the growth of Internet traffic, as at certain times in the existence of business, education, work and interpersonal communication were influenced by the

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pandemic. Social isolation has made the use of the Internet a daily occurrence for thousands of people around the world. In turn, this has prompted many people to acquire so-called ‘digital skills’ or to improve their existing ones, as they are the backbone of the digital society. „They enable people to use digital services and engage in basic activities online, especially when mobility is restricted. The COVID-19 crisis has shown that adequate digital skills empowering citizens to access information and services are crucial for the whole population.” [3]

In particular, all these circumstances have given such a strong impetus to the development of e-commerce in most market sectors.

The implementation of e-commerce, regardless of the sector, hides the same risks, advantages and disadvantages. Its implementation optimizes operating costs, such as those for salaries and commissions, rent, etc., but increases investment costs, such as those for new software products (mobile applications, web-based sales platforms) of goods and services, etc.), costs related to the improvement of internal systems for customer relationship management, etc.

To a large extent, the telecommunications sector is influenced by the same factors in the implementation of e-commerce.

The constant connection between the development of ICT and the sector is positioned by the enterprises providing electronic communications services (ECS), as the main conductor of the possibility for e-commerce by other trade organizations.

The nature of the telecommunications business suggests that the main subject of sale are electronic communications services, such as Internet access (fixed and mobile), access to mobile and fixed telephony, television services and others. In order to use these services, it is necessary for companies to provide or sell terminal devices such as smartphones, routers, tablets, TV sets, etc. Due to the wide range of goods (terminals) and services offered, their positioning in an online environment such as a web platform or mobile application provides greater opportunities for operators to fully deploy their sales potential.

„A prerequisite for a successful online presence is the presence of an attractive, modern and mobile website. For this purpose, the web pages need to be easily accessible and readable on mobile devices, which requires a leader in the design of the interface and structure of the sites to be their independence from the various screen resolutions and the requirement for convenient navigation by touch”. [4]

The presence of these conditions makes the contact between the operator and the end user in the Internet environment requires the creation of customer profiles by registering on the specific site or mobile application of the operator.

This conditionality is the most significant difference between the sale of goods and services, namely the sale of the service is not anonymous. Regardless of whether the user will use subscription services that require the conclusion of a

fixed-term contract or those for which it is not necessary to conclude one, he must be identified in advance by voluntarily providing his personal data. This necessity is legally regulated and is necessary to prevent abuse of different types that can be realized through the use of ECS. Despite the sanctions provided for in the sectoral legislation and the relevant regulatory framework of the sector, the risk of fraud by consumers with unclear identities is becoming one of the main problems faced by enterprises providing ECS in the implementation of e-commerce.

The positive aspect of being clear about „who uses the service” allows operators to take full advantage of the electronic capabilities of e-sales platforms by offering highly personalized content that „emerges as an essential feature” of “e-commerce”. [5]

As an example can be considered customers who use ECS in roaming, ie. outside the territorial boundaries of its operator. Thanks to the conditions of geographical neutrality created by e-commerce, consumers traveling abroad can purchase services (additional minutes, or mobile traffic data, etc.) directly from the mobile application provided by the operator. The operator can also notify the user in real time that his included traffic data is exhausted and an additional charge is forthcoming. Accordingly, based on his daily consumption, the operator can offer a package with a sufficient amount of mobile data. This way of buying and selling facilitates both parties – the operator realizes a sale, which under other conditions could not take place and demonstrates concern for the customer by offering him relevant content, and on the other hand the customer receives the necessary service at the right time without effort.

This can be considered as one of the main advantages of conducting e-commerce in the telecommunications sector, namely to purchase services that cannot be excluded in fixed-term contractual relations between operators and customers that can be paid and used at the moment.

Despite the facilitated process of selling services offered by e-commerce, according to NSI data, at the end of the last quarter of 2020, the orders of goods and services on the Internet related to the purchase of a subscription for Internet, television or mobile telephone service (including subscription renewal) represent 8.7% of all e-orders placed in Bulgaria”. [6]

From the above data it is currently not possible to unambiguously determine whether the percentage of sales of ECS via the Internet is satisfactory, as the purchase of some of these types of services is more specific and has a longer-term nature associated with their long-term use. It is also the operators in Bulgaria who provide the opportunity to purchase ECS electronically, offer the option, use the information about the sales made mainly for internal purposes and it is specific in terms of the specifics of the services offered and customer behavior.

Another factor that influences the number of online orders placed by ECS is the fact that currently a significant number of people still prefer the so-called „live contact” with the

seller and the physical access to the goods and products offered in a store. According to NSI data, 31.4% of the surveyed consumers say that they prefer to shop on the spot in a store (Fig. 2. Reasons why Bulgarian users do not shop online for 2019).

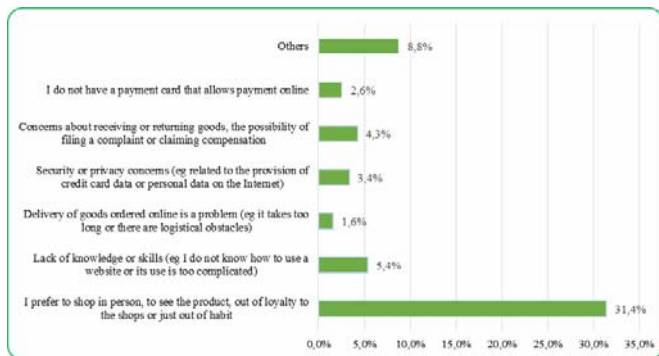


Fig. 2. Reasons why Bulgarian users do not shop online for 2019 [7] (According to NSI data)

The promotion of e-commerce as a means of purchasing ECS among the subscribers of the operators is a complex task that requires serious planning, preparation of customer models of behavior, offering more and more favorable price conditions and last but not least maintaining a high quality of services.

In order to achieve the listed goals, it is necessary for the operators to use a unified approach or the so-called “omni-channel” approach. „An omnichannel approach means there’s integration between distribution, promotion and communication channels on the back end“.[8]

„An omni-channel approach allows companies to provide their customers with relevant information and to better engage with them across multiple channels and touchpoints“.[9] „For example, a customer service representative interacting with a customer in a store can immediately reference the customer’s previous purchases and preferences as easily as a customer service representative on the phone or a customer service webchat representative. Or the customer can use a desktop computer to check inventory by store on the company’s website, buy the item later with a smartphone or tablet, and pick it up at a chosen location. An omnichannel approach improves customer service by providing multiple communication options. The back-end integration of channels also allows for more flexibility, as the customer can switch between channels throughout an interaction“.[10]

This approach guarantees a good and quality customer experience for consumers, which in turn is an extremely important indicator of customer satisfaction, which must be monitored by operators.

Building such an approach is time consuming and requires large investments on the part of operators, but would also generate efficient customer service, more access to services and information and last but not least maintain the image of

the organization.

By receiving unified information from all customer service channels (contact center, chat, email, physical store, pavilion, web site, mobile application, etc.), users build trust in the operator and become loyal customers. In this way, operators build a stable customer base and can monitor the behavior of their customers in the long run, such as what they buy most often, for what period, what is their consumption and more.

Accordingly, this in turn helps to offer the so-called „personalized content”, ie. advertisements, services and products that the consumer really needs. This content is based primarily on analyzes of customer behavior and aims to be relevant to customer needs.

In this aspect, striving to implement an “omni-channel” strategy, the enterprises providing ECSs are becoming more and more competitive, as they are constantly improving both the services offered and the channels and access to them through which they are available for sale (contact center, email, shop, web site, mobile application, etc.). The continuous improvement of sales processes and the receipt of regular feedback from users (eg through surveys), guarantees greater customer satisfaction from the used ECSs.

In this regard, the deployment of e-sales, through websites or mobile applications of operators, is key to the implementation of the „omni-channel” strategy, as the e-commerce platform is the channel that provides the most opportunities to track additional convenience for end users is the freedom to choose and manage their orders when and how it is convenient for them.

We can conclude that the implementation of e-commerce by companies providing ECS, hides more challenges related to the changing environment, technological impact and more of as many restrictions.

III. CONCLUSION

Combining technology and trade is no longer a new and modern method of selling, but a necessity for both traders and end customers.

Taking into account the current development of technologies and in particular ICT, both in Bulgaria and globally, it can be concluded that thanks to them, e-commerce has become an alternative method of trading in general.

On the Bulgarian telecommunications market, electronic sales are carried out by the three major telecommunications companies (Bulgarian Telecommunications Company EAD, Telenor Bulgaria EAD and A1 Bulgaria EAD), providing ECS. In addition to realizing the methods of standard sales, they also develop their own platforms and mobile applications for e-commerce, offering a rich and diverse range of ECSs need for communication (personal, official, public), the need for distance work, distance learning, etc.

The impact and opportunities of e-commerce in the sector should not be underestimated by any market participant, such as opening up great opportunities for advertising and communication with customers and partners, increasing sales

revenue, maintaining the image of the organization and building lasting and loyal customer relationships.

Choosing the right „approach, including the simultaneous use of several channels, achieves greater efficiency of trade, increases consumer confidence and loyalty not to a particular point of sale (a particular store or site), but to the brand. It is imperative that businesses focus their efforts in the future on successfully combining the benefits of the classic physical store with those of popular e-commerce platforms, focusing primarily on the still underutilized opportunities offered by mobile devices”.[11]

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Cryptolaw – Future for Cryptocurrencies. The New Vision of the European Commission for the Regulation of Cryptocurrencies

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Abstract – In September 2020, the EC presented and proposed the adoption of a new Regulation of the EP and of the Council on Markets in Crypto-assets, and amending of Directive (EU) 2019/1937. The adoption of this regulation will create the regulatory framework for the foundation of a instrument which to regulate trade relations and the conduct of financial transactions with cryptocurrencies. The purpose of this article is to give a critical and descriptive analysis of these new relations, and to center the role of the law in this new digital era.

Keywords – Proposal for a regulation of EP and of the Council on Markets in Crypto-assets, and amending Directive (EU) 2019/1937, cryptolaw, cryptocurrency, blockchain, virtual currency, token, stablecoin.

I. INTRODUCTION

Only cryptolaw can protect cryptocurrencies!

A decade ago, terms like cryptocurrency, blockchain, virtual currency, token, stablecoin, etc. were not filled with content, and only a few people on this planet had an idea of what they were and what potential lay in the world market for everything which will bear or contain the name – crypto. In addition to that the not only ordinary people, commercial enterprises and associations, but also the national and supranational state administrations, including those that are official EU bodies, underestimated the importance of cryptocurrencies in the future, and were caught unprepared for the challenges of the environment and also were caught in the impossible condition to cannot exercise any control and to not enforce applicable regulations for influencing emerging relationships in the parallel virtual world. This was not just a problem of the European Union and European law – global law and institutions were also challenged because the global virtual world is now more comprehensive than the real one.

Now that the world is facing a crypto-revolution that is expected in the foreseeable future to overturn both markets and societies as a whole, and lead by the pure practical need for stability and security of relations in crypto markets it need to be created a law regulation system unknown by now from the world and without any legal precedent in the relation.

Legal researchers faces a really huge challenge, the overcoming of which depends on the answer to the question, how can with legal instruments cover something that cannot be precisely defined legally; is not issued on the basis of

legal techniques and logic; exists only in the virtual world, it has no material equivalent; and is not tied to anything that can give it stability and give enough security to everyone involved in cryptocurrency relationships. How this legal puzzle can be solved? The European Commission and the European Parliament are trying to find the answer.

There are currently several thousand cryptocurrencies with different values, profitability and liquidity¹. According to the most common understanding cryptocurrencies are a mathematical and algorithmic formula obtained on the basis of complex calculations that become part of a blockchain chain, build it and exist in it based on the consent of other participants in this chain. All cryptocurrencies in the blockchain form and compose a cryptographic string, which in itself is unique as content code and has its own irreparable and unrepeatable uniqueness, and this uniqueness gives it the opportunity to have qualities close to the monetary ones, the most important of which is that it can be exchanged and identified, has value and can be used as a direct means of payment. Payment through it, can be made by sending the given code from one digital wallet to another and after the transfer the participants can confirm the transfer, and the cryptotransaction is considered completed. Therefore, it is already accepted in practice that the crypto assets perform all the functions of money – they can be determined by value, have an exchanged equivalent and are quickly liquid.

However, the most serious problem is the state recognition of cryptocurrencies through the instruments of law and the legal system. This problem is caused by the lack of clearly defined rules for the exchange and investment in cryptocurrencies and applies to the entire world economic space. There is virtually no country on a global scale that can be said to have any basic legal readiness to meet the challenges of the phenomenon called crypto, but it is more than clear to any observer that the application of regulatory and control measures is more out of necessity, and the lack of any work in this direction can harm the economies of

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countries in the future. Guided by this, the highest legislative body of the European Union – the European Parliament has undertaken the ambitious task of creating a single Community legislation called “Regulation of the European Parliament and of the Council on cryptocurrency markets and amending Directive (EU) 2019 / 1937”. The document was presented in September 2020 and through it the EU requested to create the much-needed regulatory framework for the whole of the Union, containing specific rules for the issuance, trade and investment in cryptocurrencies and, of course, the provision of activities and services through them.

That is why, guided by the understanding that without legal regulation cryptocurrencies can remain outside the established legal order of our society, and lead by that, that their indisputable effectiveness is proven by each passing day, legislators around the world must focus their efforts on creating a fair legal basis to regulate all relations arising in the markets of cryptocurrencies. This is also the biggest risk for the business environment, because if a self-determining environment as cryptoenvironment, acting on its own algorithmic and economic rules and laws, is improperly regulated and its natural order is viluated, traders and investors in cryptocurrencies will not receive an adequate legal protection and the consequences for the global market will be disastrous. An important point that should be taken into consideration in their analysis, is that since the EU itself did not have the necessary readiness to create a common harmonized regulatory framework, the individual Member States will also lagged behind in the rule-making process and the environment will be left entirely to self-regulation and the EU economic will be slowed down. This will also led to deficits in the supply of services provided through cryptocurrencies, delays in investment and diversion to crypto markets where fair market practices have already been established to ensure a better investment climate. This delay can now be made up, because the need to create and implement a clear and predictable regulatory environment is real, and the creation of an effective legal framework will lead to predictability in the behavior of market participants and will minimize the risks that could arise for participants in it. However, the ambitious goal set by the EU will not be achieved without the joint efforts of individual Member States and the unification of their national legislation in the field as fast as its possible.

Guided by all these problems and challenges to the environment, the EU through Directive 2019/1937, begins the gradual introduction of clear and transparent rules to regulate all activities related to cryptocurrencies and cryptocurrency markets from the very process of issuing them, through the activity, the organization and the management of cryptocurrency service providers, to establish rules to protect users of those services, and to limit attempts to prevent market abuse of cryptocurrencies.

According to the proposal for the amending of the Directive, there are three main subcategories of cryptocurrencies that will be eligible for use within the EU.

In the first place, cryptocurrencies that serve only to access of product or service, which can be accepted as means of payment only by the issuer of the token or in other words specific tokens – cryptocurrencies used for non-financial purposes to access a specific product and service provided by the issuer. Secondly, cryptocurrencies secured by real assets or the so-called “Tokens secured by assets”, which will be of the greatest research interest in the matter, because they are those cryptocurrencies that will be directly involved in trade, and which, in order to have a stable value, must be secured with assets and treated as “stablecoins”². They will also be most interesting, and because they must be the kind of cryptocurrency that will shape market stability and prevent speculation through other cryptocurrencies, by connecting them to legal tender such as various currencies or commodities and other types of real assets. Another important value of the crypto asset is its ability to be used as an asset to preserve the achieved value – something that will also be developed in future. And of course the third subcategory of cryptocurrencies are cryptocurrencies, whose main purpose is to serve as a mean of payment and in which the stabilization of value is carried out by linking only to a certain fiat currency³. The function of these cryptocurrencies is very similar to that of electronic money within the meaning of Article 2 (2) of Directive 2009/110 / EC of the European Parliament and of the Council⁴ according to which “electronic money” means a monetary value held in electronic form, including a magnetic form, constituting a claim on the issuer, issued on receipt of funds for the purpose of making payment transactions within the meaning of Article 4 (5) of Directive 2007/64 / EC and is accepted by a natural or legal person other than the issuer of electronic money. Like electronic money, these cryptocurrencies are an electronic substitute for coins and banknotes and are used to make payments. These cryptocurrencies are defined as „electronic money tokens”, but they will not be the subject of this study.

In addition to defining the three main types of cryptocurrencies, another important and main objective of the European legislator is to create the basis for regulating all types of relationships that may arise related to the issuance of asset-backed tokens and electronic money tokens. From obtaining a license to do so, through the regulation of exchange relations which to empower the national competent authorities, the European Banking Authority (EBA)⁵ and the European Securities and Markets Authority (ESMA)⁶ and through the provision of a normative possibility for the application of supervisory measures and through the search for administrative liability in case of violations and the application of corecive measures, and through supervision and imposition of sanctions, all this procedures need to be precisely implemented. In summary, in its main parts, proposal for the amending of the Directive 2019/1937 covers all procedures related to obtaining a permit – license, through which all persons wishing to issue cryptocurrencies can legally offer cryptocurrencies, organize their public offering and obtain

“White Paper on Cryptocurrencies”⁷ which should be an inseparable document in the public offering of cryptocurrencies⁸. It also determines the form of the legal entity through which this activity should be carried out and under what conditions issuers can obtain a license; the content of the application for a license; the procedure for evaluating the application and all rights and competencies of control authorities around the licensing regime. The Directive will also regulate the possibilities for time limitation of the supply of cryptocurrencies, how to make changes in the circumstances in the initial “white paper” on cryptocurrencies, as well as when their license may be revoked, or how the acquirers of cryptocurrencies may be refused.

An important part will be focused on the specific regulation of the obligations and responsibilities of issuers of cryptocurrencies, as well as the respective responsibility of issuers regarding the content of the “white paper” on cryptocurrencies, and the possible occurrence of conflicts of interest in which issuers may fall. The consideration of complaints, the procedures for informing in case of a change in the management bodies of the legal entities – issuers, as well as the reflection of the change of the rules for their actual management, change in the capital amounts, provision of reserve assets to be maintained of the value of the tokens, and the rules for investing the reserve assets for the purpose of additional profitability and so on important issues are determined in the Directive. The document also contains regulations for special relationships that may arise, such as those related to the procedures for the acquisition of legal entities – licenses, determining the value of the acquisition, the procedures related to determining which tokens are significant and what it depends on their significance⁹, as well as who and under what conditions may request a token to be declared significant, the creation and maintenance of capital policies for managing the liquidity of tokens and their interoperability with other assets or requiring all funds received from the issuer in exchange for tokens for electronic money, to be invested in assets denominated in the currency to which the value of the electronic money token is linked, etc. Other important points in the new Directive are related to the existence of risks of the occurrence of market misuse of cryptocurrencies, misuse of inside information leaks, market manipulation and supervision of registered cryptocurrency trading platforms, the activities of custodian and credit institutions that may offer services for trading in asset-backed tokens, as well as the competences of the ECB and the European System of Central Banks and the application of regulatory standards to them. The specific competencies of the European Banking Authority (EBA) in respect of issuers of significant tokens secured by assets and issuers of significant tokens for electronic money, including the provision of a legally recognized privilege, a request for information, the granting of specific powers of investigation, on-the-spot checks, exchange of information, as well as the initiation of proceedings before the Court of Justice of the European Union regarding EBA decisions.

Although, the new amended Directive is inherently an extremely key and comprehensive document. The complexity of the matter and the intensity of the processes that take place in the economic and cyberspace, show certain weaknesses in it, which need to be analyzed. We are not talking for the regular difficulties that every strategic document is facing in the process of its implementation, we are talking for systemic weaknesses that need to be addressed from the outset in order to make the Directive workable and enforceable. First of all, the EU faces the question that the Directive itself regulates mainly the relations that take place on an already existing self-organized market and the introduction of a licensing regime will lead to a natural negative reaction and this is somehow underestimated by the EP, because nowhere the legislator does not envisage the existence of compensatory or transitional instruments for a smoother transition from the self-organized and self-controlled market to one organized and controlled by administrative state bodies. It is also not set how the relations connected to the natural persons-holders of cryptocurrencies worth more than the set minimum ones in the directive, should be formed, and what should be the incentive for the persons not to fragment their financial portfolios into smaller ones and to operate with them, and receive income as individuals instead of as legal entities, and what should be their interest to go through the licensing procedure. Another point that is not reflected at European level is related to the specifics of the liability of legal entities in individual Member States. Guarantees of different amounts must be taken into account precisely and also it need to have more precised procedure of that how the activity will be exercised, and how the amount of investments in assets and their monetary equivalent of the investment in cryptocurrencies can be guaranteed. Important element to be taken into consideration is also, how the values of the many different types of cryptocurrencies that currently exist will be managed and how can they will be most easily covered by the common system of stable currencies, lead by that, that in essence, they are also hybrid assets, which means that their value can not be tied only to their face value, but must be consistent with their current or future value¹⁰. Here the legal thought should be focused on how through legal instruments the so-called “Stable currencies” with a cryptocurrency and to guarantee not only its face value but also its real value. How stable are stable currencies and can it be assumed that cryptocurrencies are in some respects more stable than currencies that have prevailed globally and which by their nature are also not materially secured in any form other than through government guarantees and assets. And given that cryptocurrencies are used primarily as a means of payment rather than for investment purposes, and ultimately typing a stable currency to cryptocurrencies can prove to be a “double-edged sword” and lead to market tensions, including the depreciation of both the crypto asset and the associated stable currency¹¹. Another important issue is if no one wants to use national or European trading platforms, how and under

what conditions global ones can be used, on which unsecured cryptocurrencies can still be traded. As it is a virtual electronic exchange unit – token, it will be extremely difficult to exchange and trade only on one platform and the opportunity will always be search and sought through different platforms, to achieve better conditions for the trade or sale of cryptocurrencies. Excessive regulatory interference can lead to a reduction in the volume of traded assets through EU-licensed platforms and a slowdown in the economy. The establishment of new supervisory authorities and their territorial competence need to be clarified by the Directive, as well as there should be more specifics on how the trade relations with third countries need to be formed according to the trade of cryptocurrencies. The national control authorities will have their autonomy, but in no case should it be allowed to be excessive. Another important point of the new amended Directive is the provision of the possibility for one of the issuers to be able to buy the crypto assets that he holds at “face” value when presenting a claim by a holder, provided that they are tied to a fiat currency. Whether or not they should buy cryptocurrencies and at what value currently depends solely on the issuers, as additional security would be formed if all issuers were obliged to hold cryptocurrency holders at any time to claim and receive a certain market value for their cryptocurrencies. Another controversial point around the application of the new Directive is the obligation for all cryptocurrency trading platforms, portfolio providers and other participants in cryptocurrency trading to have physical offices in an EU Member State. This can currently be considered as a restrictive condition, the easing of which should also be considered. Indeed, in this way it can be ensured in some form that the licensing company meets EU standards for carrying out this type of activity, but in the practice imposed by identical cases it is seen that the effect on the economy is minimal and there are risks of impeding free competition, because in the cryptocurrency market the scale is global and supranational, and when it is, corporate migration leads to an economic slowdown in the country of origin¹².

It may also be desirable to point out that the Directive itself does not contain specific actions to be taken to avoid and prevent market abuse. The approach to market self-regulation that has been adopted is correct, but the lack of concrete measures and effective supervision of the risks to the financial stability of the EU and the euro area as a whole is worrying. The most common abuses are related to lack of awareness and lack of secure information flows, which in turn leads to an increased risk of unwanted distortions and phenomena such as fraud, artificial depreciation of assets and pushing to unreasonable commercial risks. All these risks can be foreseen and covered by the regulation, and the competencies of the control bodies in this direction are expanded. A critical analysis can also be made of the part of the Directive that deals with the supply of cryptocurrencies on secondary markets where the risk of abuse is many times higher and the presence of speculative practices is

commonplace. Although the Directive places the secondary market within the new regulatory limits, none of the risks is specifically taken into account and no mechanism is provided for the legislator to express its explicit will to increase control over this market. The lack of specifics related to the so-called “Diggers”¹³ of cryptocurrencies is also a huge problem. It is mentioned that they will be subject to regulatory control under the Directive on the taking up, pursuit and prudential supervision of the activities of electronic money institutions¹⁴. This part of the document is inherently obsolete as a document and must be revised and supplemented in accordance with the new requirements of the market. At the end, the Directive as a whole does not have enough specificity on how to react in the event of money laundering through cryptocurrencies and terrorist financing¹⁵ as well as the adoption of a new package of measures by the European Commission related to the cessation of practices that could lead to money laundering and the implementation of the EU Security Union Strategy^{16,17}.

In conclusion of this article and in view of the facts and analyzes of the newly adopted Directive and assessing the weaknesses of such a strategic document, observing the rule that any legal act of this nature must have predictive functionality in order to be able to provide regulates relations that do not exist at the time of its creation, we can reasonably conclude that the EU and the common regulatory framework it has introduced to ensure relations in the cryptocurrency market has only partially achieved its goal, and has created if not perfect, it is at least a lasting legal basis for the security of the cryptocurrency market. Thus, the introduced licensing regimes will not only ensure the unification of the activities of the companies operating in these markets, but will also provide quick and easy investor access to the national markets of the Member States, and will achieve the necessary levels of legal certainty for market participants of cryptocurrencies, loyal market relations between the entities will be guaranteed, the necessary financial stability will be achieved and a basis will be formed for unleashing the full potential that digital financial services have in the future. Another thing that may be desired is the correct application of the experimental pilot system proposed by the EC for the organization of market infrastructures, and so through simulated transactions and relationships will be tested financial practices in cryptocurrency trading under the new rules of the Directive and implementing the pilot regime on Distributed Ledger Technology (DLT)¹⁸ market infrastructures, and through experience gained as both traders and regulators will acquire the necessary routine in how to minimize market risks and maintain market stability and security. Only a clear single harmonized legal basis will reduce the risks that cryptocurrencies pose as a stable means of payment associated with an established and existing “fiat” currency or other tangible asset. Thus, by providing the necessary levels of consumer protection, ensuring fair market

relations and practices between entities and conducting a secure monetary policy in just a few years, the cryptocurrency market will reveal its potential for development and growth, with minimal levels of risks and threats to “bona fide” participants in this market.

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Sectoion 2.

INFORMATION, NETWORKING § SECURITY TECHNOLOGIES

Deep Learning Neural Network for Classification of Fire-Affected Areas with Satellite Data

Irina Topalova¹

Abstract – The purpose of this study is to utilize satellite images, aiming to make a classification of burned by wildfire areas on the Earth surface. For newly emerging fires in the same or other areas, the Normalized Burn Ratio graphs of the same length is classified with the trained neural network in order to match the result to a predicate database for appropriate recovery activities. An adaptive approach is applied with application of a Multi-Layered Perceptron neural network, which was trained with different Normalized Burn Ratio graphs. Images with free access of burned areas obtained by satellite „Sentinel 2“ are used for the research. On the base of the obtained database and classification results, it becomes possible to classify burn areas with percentage variation/ differences in consequences due to the adaptive capabilities of neural networks. Feature research work is also proposed.

Keywords – satellite data, fire-affected areas, neural networks, classification.

I. INTRODUCTION¹

In recent years, wildfires have been on the rise for various reasons. Due to the severe damage and the irreversible consequences for years, it is essential that they be classified and based on the result a database be created with both appropriate remedial measures and prescriptions for proper actions in extinguishing similar fires.

Thanks to the free access to satellite images and related databases provided by the European Space Agency (ESA), as well as the large number of freely available software tools for processing these images, it is possible to implement a number of ideas to effectively limit the harmful effects of various natural disasters. In this research for newly emerging fires in the same or other areas, the Normalized Burn Ratio graphs of the same length is classified with the trained neural network in order to match the result to a predicate database for appropriate recovery activities. An adaptive approach is applied with application of a Multi-Layered Perceptron neural network, which was trained with different Normalized Burn Ratio graphs. Images with free access of burned areas obtained by satellite „Sentinel 2“ are used for the research. On the base of the obtained database and classification results, it becomes possible to classify burn areas with percentage variation/ differences in consequences due to the adaptive capabilities of neural networks. Feature research work is also proposed.

PROPOSED METHOD

The proposed method for classification of scorched earth surfaces is based on the training of a neural network of the Multi-layer Perceptron (MLP) type with graphs of variation of the Normalized Burn Ratio coefficient (NBR). This factor is a measure of the degree of damage caused by a wildfire.

The NBR is defined to highlight areas that have burned and to index the severity of the damages. The formula (1) for the NBR uses near-infrared band 4 and the short-wave infrared band 7 [1], where Band 4 is in the Near-Infrared area with wavelenth between 0.76 – 0.90 μm for 30 meters resolution and Band 7 is in the Mid-Infrared area with wavelenth between 2.08 – 2.35 μm for 30 meters resolution.

$$\text{NBR} = (B4 - B7) / (B4 + B7) \quad (1)$$

For healthy areas B4 is high and B7 is low i.e. high values of NBR; For burned areas: B4 is low and B7 is high i.e. low/negative values of NBR. Fig. 1 shows the variations of NBR for a burned area.



Fig.1 NBR for a burned area

Many NBR graphs of the obtained by satellite Sentinel 2 images, for five burned areas in August 2021 were used as input data to a MLP neural network. The MLP was trained to classify the graphs in five different categories according to their different NBRs. In the test phase, different NBR test exemplars with standard deviation and not included in the train set, were used to generalize the classification.

The obtained recognition accuracy in the test stage is given in a table for the five investigated burned areas.

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EXPERIMENTS

For the purposes of this study, images from five different regions with fire damage, which took place in August of the current year 2021, were used. The images, their processing and the extraction of the NBR graphics were obtained by means of software tool Earth Observation Browser [2]. Fig.2 to Fig.6 show different burned areas in the Balkans and Cyprus for August 2021 as follows: AREA-1-62,87 km², AREA-2-8,62 km² and AREA-3-3,23 km² in North Macedonia, as well AREA-4-65,57 km² in Cyprus and AREA-5-2,36 km² in Bulgaria. The low values of NBR represent a high level of damages.



Fig. 2. Burn area AREA-1-62,87 km² in North Macedonia with corresponding NBR for August 2021

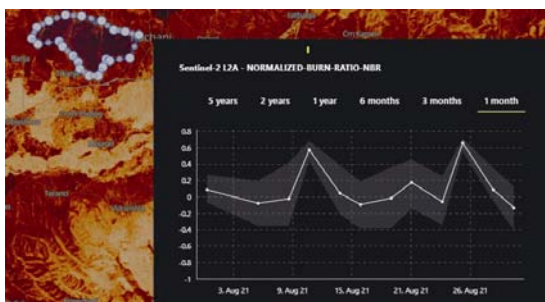


Fig. 3. Burn area AREA-2-8,62 km² in North Macedonia with corresponding NBR for August 2021

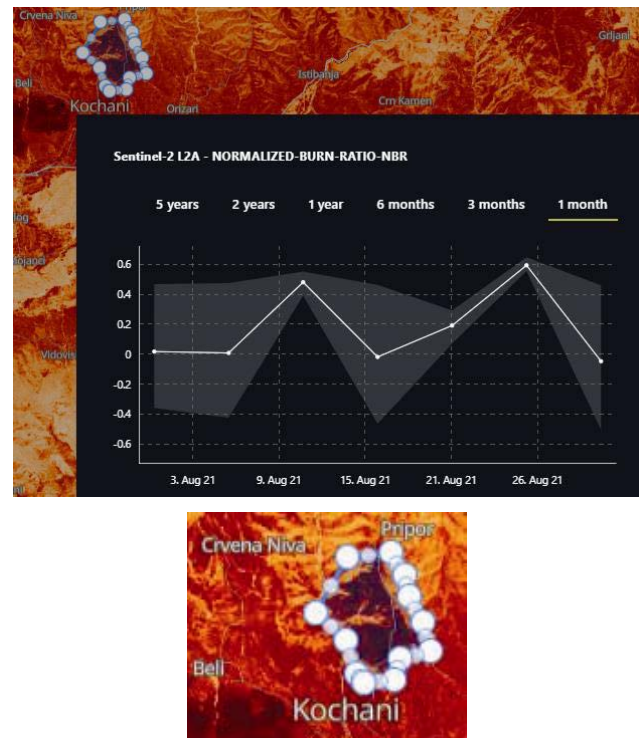


Fig. 4. Burn area AREA-3-3,23 km² in North Macedonia with corresponding NBR for August 2021

Exported in *Earth Observation* tool are the mean-values of NBRs for the defined 5 Areas in time period 01.08 – 31.08. 2021, which is a period of active fires in these regions. They are represented in Fig 7. The chosen MLP topology is trained with these values, where 13 measured points constitute the input training set for each area. The proposed MLP structure is shown in Fig. 8. It has one hidden layer and 5 output neurons, corresponding to 5 categories for the 5 recognized areas. In the Browser, when selecting Custom settings, the developer is given the opportunity to choose a combination of frequency bands. In our case, Red, SWIR and BLUE channels are chosen.

In the test stage different test samples of NBRs representing NBR graphs of the defined five areas are extracted having standard deviation of 10-20%. They are shown in Fig. 9 for areas 1 and 2, in Fig. 10 for areas 3 and 4 and in Fig. 11 for areas 4 and 5.

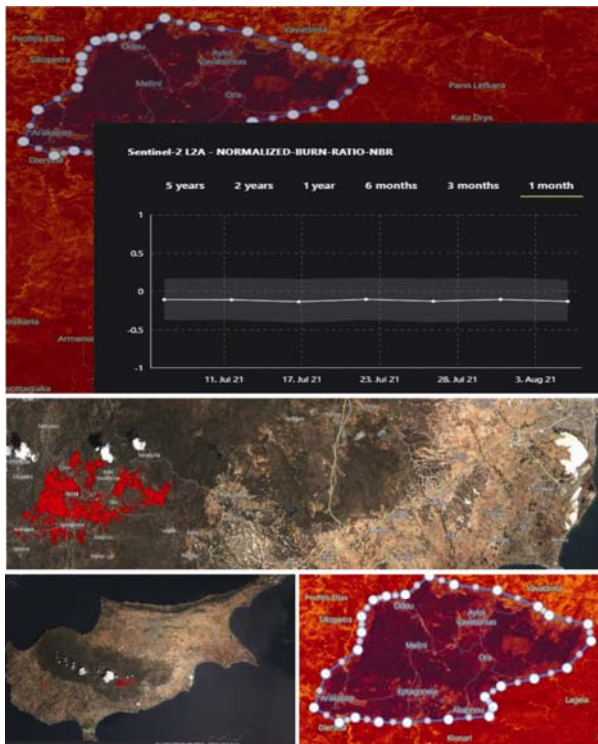


Fig. 5. Burn area AREA-4-65,57 km² in Cyprus with corresponding NBR for August 2021

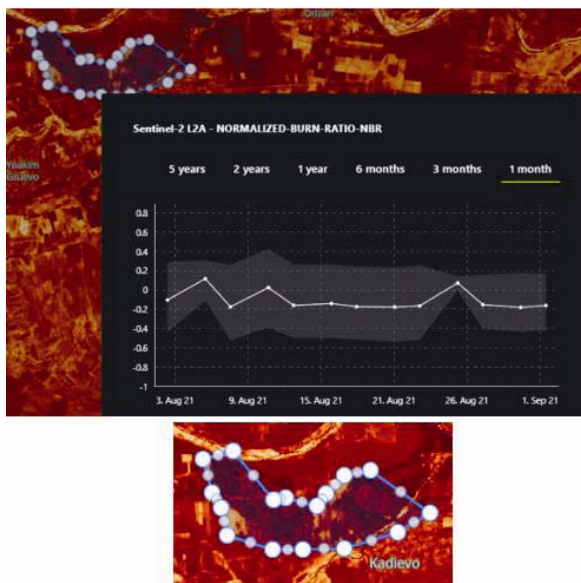


Fig. 6. Burn area AREA-5-2,36 km² in Bulgaria with corresponding NBR for August 2021

The proposed MLP structure is trained with a Mean Square Error (MSE) of $\varepsilon = 0.1$. The input train samples feed the input MLP in a random sequence [4]. The defined MSE was reached after 2356 Epochs in the train stage. Each area is represented with five test NBR Graphs of the corresponding burned area.

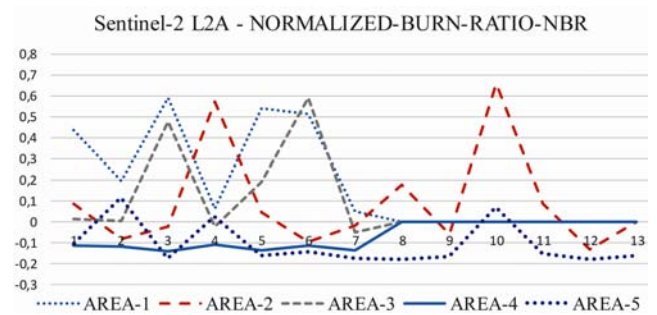


Fig. 7. Mean values of NBR graphs for the defined 5 areas in the time period 01.08 – 31.08. 2021.

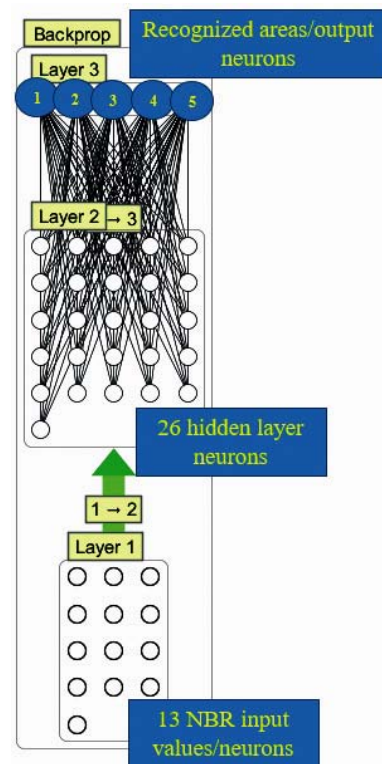


Fig. 8. Trained MLP topology with 13 input neurons, 26 hidden layer and 4 output neurons with Software SIMBRAIN [3]

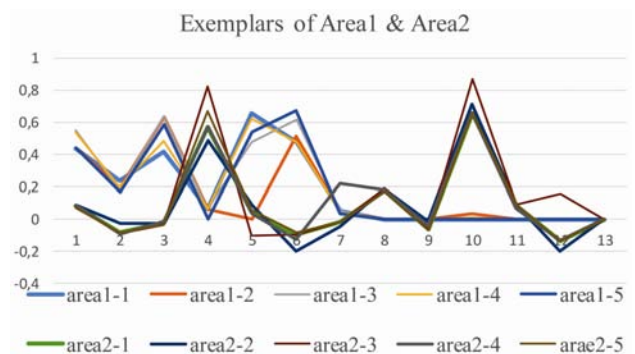


Fig. 9. Test samples of NBRs for areas 1 and 2

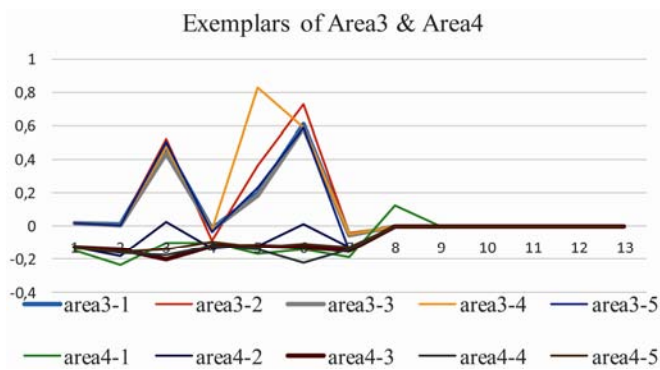


Fig. 10. Test samples of NBRs for areas 3 and 4

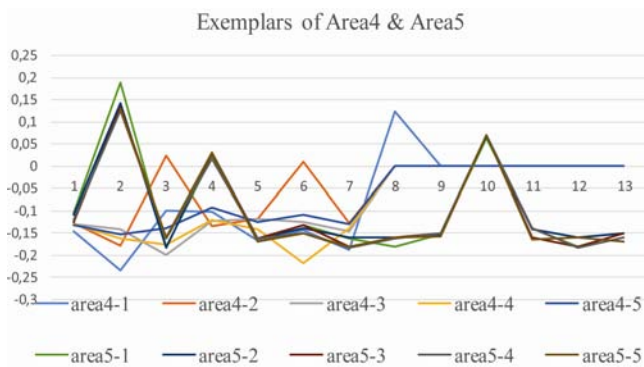


Fig. 11. Test samples of NBRs for areas 4 and 5

IV. RESULTS

In the recognition stage all test images are given to the MLP input layer. The obtained classification accuracy is shown in Table 1.

The results show a relatively good separation of the parametric input space and are an appropriate prerequisite for further investigations with many other sets of different train and test exemplars. It is a necessary step for method generalization.

TABLE I.

RESULTS OF THE TEST AREA CLASSIFICATION

Recognition accuracy for all areas				
Area 1	Area 2	Area 3	Area 4	Area 5
83%	67%	100%	83%	67%

V. CONCLUSION

On the basis of classified burned areas it will be possible to create a database with the relevant measures, techniques and methods of counteraction, already applied in their extinguishing, [5]

For newly emerging fires in the same or other areas, NBR graphs of the same length should be classified with the trained neural network in order to match the result to a predicate database for appropriate recovery activities, [6]

It will be possible to classify burn areas with percentage variation / differences in consequences due to the adaptive capabilities of neural networks.

ACKNOWLEDGEMENT

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The Impact of COVID-19 on Cybercrime Trends

Svetlin Lazarov¹

Abstract – The COVID-19 pandemic crisis has demonstrated the unfortunate impact potential of such crises on our daily lives as well as how extremely vulnerable society is in all respects. During the social distancing, we all have relied more than ever on computer systems, mobile devices and the Internet to work, communicate, shop, share and receive information and continue our normal life in the new realities. This report examines the ways hacker groups have taken advantage of the impact of social distancing and modified various cyberattacks.

Keywords – cybercrime, hackers, COVID-19.

I. INTRODUCTION¹

COVID-19 shows how cybercrime – at its core – remains largely the same but criminals change the narrative. They adapt the specifics of their approach to fit the societal context as a means to enhance their rate of success. No doubt, during the outbreak of COVID-19 cybercrime became more popular than before. The latter can be easily illustrated by the conclusions of the FBI’s 2020 annual Internet Crime Report. According to the said report, the FBI’s Internet Crime Complaint Center received in 2020 information from 791,790 complaints of suspected internet crime – which makes an increase of more than 300,000 complaints from 2019 – and reported losses exceeding \$4.2 billion [1]. It can be assumed that most countries have been affected by such unprecedented rate increase of cybercrime.

Figure 1 shows the increase of internet crime complaints in 2020 [1][2].

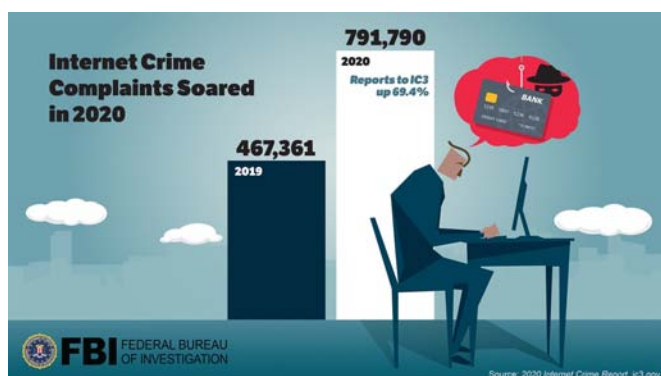


Fig. 1. FBI – internet crime complaint in 2020

The success of cybercriminals is due to their ability to exploit the new vulnerabilities of society to their own advantage. Cybercrime adapted itself to changes that the

global epidemiological situation has led in our daily activities and social environment. Physical lockdowns became the norm; home-office has become the “new normal”; many commercial sites and organizations (retails, restaurants, shops etc.) closed; many businesses reorganized their activities to the online environment; most schools switched from face-to-face classes to distance learning, etc. As a consequence, technologies and Internet have become even more important in both our professional and personal lives. All these factors created a precondition for malicious actors to modify several internet attacks and frauds according to the situation [3]. Figure 2 shows INTERPOL statistics for distribution of the key COVID-19 inflicted cyber threats based on member countries feedback [4].



Fig. 2. Statistics for distribution of the key COVID-19 inflicted cyber threats.

II. INTERNET ATTACKS

A. Scam websites related to public health

The first example of such modified internet frauds is the deceptive sale of personal protective equipment and disinfectants so much needed in the fight against the Corona Virus. The shortage of the market for personal protective equipment has created tension in society which has thrived to look for them on the Internet. Websites claiming to be large

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European companies for production of personal protective equipment which can be easily delivered to any point in the world appeared all over the Internet space.

Normally there is a banner on the title page of such websites that says: A fight for Corona Virus. Face Masks N95, Surgical Masks, Medical Masks, 3M Masks. All stocks are available ready to be shipped. Figure 3 shows a homepage of a scam website.



Fig. 3. Homepage of a scam website

The only condition for delivery of the needed personal protective equipment is the partial or whole prepayment of the invoice by bank transfer [Fig. 4]. Normally the bank transfer and the receipt of the transferred sum require some time. Since there was delay in transport at state borders, which in some places in Europe were temporarily closed, the organizers of that fraud were safely enabled to receive and dispose of the transferred sum before it could be discovered that there will be no shipment. Figure 4 shows payment terms and conditions on a scam website.

Payment Terms & Conditions

All payments for goods must be made via international wire transfer directly to one of our bank accounts which we have within the EU regions of Poland, Portugal, Belgium, Germany, Hungary, Turkey. Client's consignment are shipped after the payment confirmation in one of our bank accounts given in our signed Invoice, and kindly contact us through phone/email after you have make a payment for confirmation.

Our payment terms is strictly T/T payment.

Clients are expected to email us with the scan proof of the payment by your bank, so we can released your order immediately to shipped. Clients are responsible for all bank transfer fees. We do ship clients order once payment is received.

There will be no shipment booking confirmation for your order/consignment until agreed payment deposit are received in our account.

Fig. 4. Payment Terms & Conditions on Scam website

In the report of INTERPOL “GLOBAL LANDSCAPE ON COVID-19 CYBERTHREAT” there was reported an increase of domains registered with the key words ‘COVID’ or ‘corona’. According to Palo Alto Networks many of these registered domains may have been developed with malicious

intent. As an illustration of this criminal tendency, in the end of March there were discovered 2022 malicious and 40261 high-risk newly registered domains. Hackers are creating fake websites related to COVID-19 to entice victims into opening malicious attachments or clicking phishing links, resulting in debit or credit card details impersonation or illegal access to personal accounts. Also, Trend Micro reported that almost one million spam messages have linked to the COVID-19 pandemic crisis since January 2020 [3].

B. Spam campaign called “I am a hacker”

Another example of a newly invented cyber fraud is the spam campaign called “I am a hacker” which was received by most Bulgarian Internet users.

It aims to mislead users that their operating system is compromised and that the information available on it will be disseminated on the Internet if a certain amount is not paid in virtual currency within some timeframe of receiving the email. The message itself does not carry malicious code, but the effect of what was written in it managed to raise a lot of questions in those who read it about their own cybersecurity. Figure 5 shows an original text of the “I’m a hacker” spam message.

Hello!

I am a hacker who has access to your operating system. This means that I have full access to your account. I've been watching you for a few months now. The fact is that you have been infected with malware through an adult site that you have visited. If you are not familiar with this, I will explain. A Trojan horse gives me full access and control over a computer or other device. This means I can see everything on your screen, turn on the camera and microphone, but you don't know about it. I also have access to all your contacts and all your correspondence. I made a video that shows how satisfied you are in the left half of the screen, and in the right half you see the video you watched. With one click I can send this video to all your emails and contacts on social networks. I can also post access to all your emails and messages you use. If you want to prevent this, transfer the amount of (BGN 1,100) to my bitcoin address (if you do not know how to do this, write to Google: Buy bitcoin). My bitcoin addresses (BTC wallets) are: After receiving the payment, I will delete the video and you will never hear me again. I give you 72 hours to pay. I have a notification when this letter is read and the timer will work when you see this letter. There is no point in filing a complaint somewhere, as this email cannot be tracked as my bitcoin address. I don't make mistakes. If I find that you've shared this message with someone else, the video will be distributed immediately. At your disposal!

Fig. 5. Text of the “I’m a hacker” spam message

C. Business email compromise scams

Since the beginning of the outbreak, hackers have incorporated COVID-19 into a variety of fraud schemes, including business email compromise (BEC) scams which serve as a third example of this report. This is actually one of the most financially damaging online crimes.

How hackers carry out BEC Scams: in the first step of a BEC scam, the hackers searches for a target using publicly

information on Internet. They identify a potential victim company online, and then get a deep and accurate understanding of it on social media and other publicly available information. From there, they find the names of company executives, particularly, the CEO and CFO. But they may also pay attention to other employees in finance or accounting department, and may scour social media accounts, website posts, or public pictures.

Once the hackers decide which company to attack, they attack the company's email environment through a variety of methods. Their mission is to obtain the username and password of the initial victim. Hackers often use phishing email sent supposedly from “System Administrator”. The email begins with a header title “Your mailbox is almost full”. It notifies recipients that their mailbox has reached its maximum size and as a consequence, they are unable to receive any emails and send emails. A link is provided for them to increase mailbox size.

Figure 6 shows an original phishing message.

Dear user@example.com.bg,
Your mailbox is almost full.
465MB Current Size
500MB Maximum Size
You are hereby advised to increase your mailbox quota size automatically by clicking on [HERE](#) and re-login to automatically increase your mailbox quota size.
IMPORTANT NOTE: You won't be able to send and receive mail messages at 480MB.
Thanks.

Fig. 6. Text of the phishing message

As a next step hackers will modify the domain in the email address of a partner by a single character – for instance, by substituting “d” with “b” or “l” with “i”. These spoofed domains are referred to as cousin domains.

These modifications by a single character may be extremely difficult to detect at a glance and are usually indistinguishable for the unsuspecting user. Example modify domain in email address: „user[[@](#)]mdo.bg“ changed with „user[[@](#)]mbo.bg“.

In this way, hackers listen to the entire correspondence between a victim company and its partners. When hackers have full control over the email communication they find money mule to open a bank account.

Figure 7 shows how hackers are listening to correspondence between two companies.

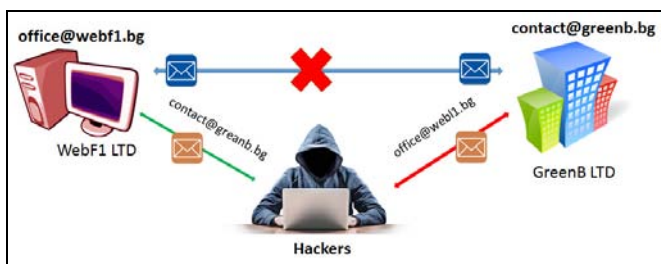


Fig. 7. Listening to correspondence

Now hackers can send an email with an invoice on behalf of the partner. They change the partner's IBAN with the IBAN of the money mule. For greater credibility they add in their email a text for bank account changes due to audit or COVID-19 measures. The victim company transfers the money to the money mule bank account. Afterwards, money is withdrawn from the mule's bank account and transferred to the hackers by various methods.

Figure 8 shows the cycle of hackers attack by changing bank data in an invoice and the successive money transfer to the hackers.

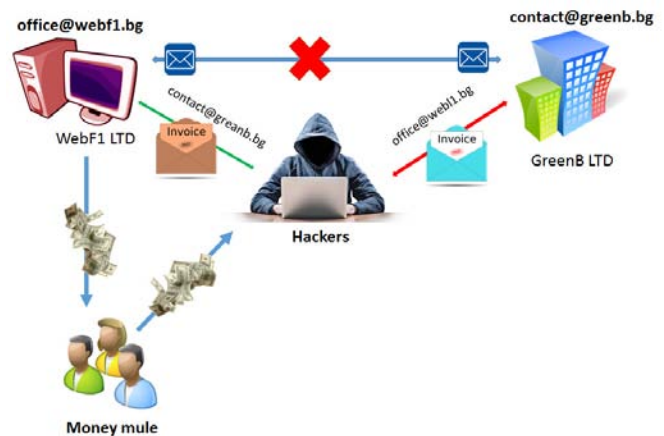


Fig. 8. Modifications in an invoice and bank transfer to hackers

The success rate of that cybercrime is well illustrated by the report of the FBI's Internet Crime Complaint Center according to which in 2020 the said center received 19,369 Business Email Compromise (BEC) complaints with adjusted losses of over \$1.8 billion [1].

III. CONCLUSION

It may be concluded from the above said that regardless of the global pandemic situation, Internet users will continue to be the target of hacker attacks. The financial losses from these attacks are growing every year. This is a clear indication that cybersecurity needs to be constantly updated in every aspect, [6].

It is necessary to constantly pay attention to the main factors that have a negative effect on security in the online environment. These are the increased dependence on digital content and services of economic entities and public administration, the low level of knowledge and awareness regarding safety in cyberspace and the lack of experts in the field.

According to statistics issued from Atlas VPN, monetary losses due to cybercrime increase related to the COVID-19 crisis will continue to surge by around 40% annually. Thus, in 2025 hackers could profit around \$27.855 billion [5].

This concerning forecast suggests that cybercrime will continue to develop at an accelerated pace and that the related damages will increase. This is further proof that

comprehensive measures are needed to reduce future damages from cybercrime. Users of computer systems and mobile devices must now have the knowledge of a system administrator.

Figure 9 shows estimated cybercrime monetary damage 2020-2025 as per data from Atlas VPN.

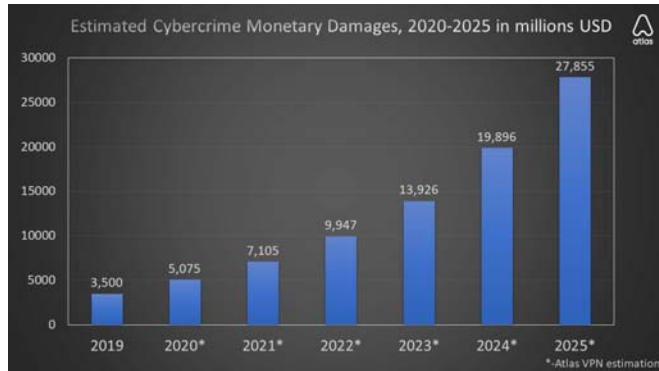


Fig. 9. Atlas VPN – estimated cybercrime monetary damage 2020-2025

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Evaluation of Test Algorithms Using Different Programming Languages

Mihail Chalashkanov¹

Abstract – In this paper are collected different test algorithms for programming languages. Collecting test cases would help in future researches for evaluating potential similar scenarios in testing so they can be recognized, isolated and with execution in one step performance in automation testing should be increasing with run time reducing of recognized scenarios.

Keywords – Tests optimisation algorithm evaluation, 2021.

I. INTRODUCTION

Testing is one of the main and most important phases in the creation process of software products. They test the individual components and their integration in a unified system. The tests are for undetected errors, business logic of the software and for security. The results of the last phase are the test protocols and cases. Software testing is research that is done in order to give information to all interested parties on the quality of the product or the service. It guarantees and ensures the quality of the software (Software Quality Assurance). The role of Quality Assurance (QA) is to reduce the risk of problems for end users. Testing is divided into two main types – systemic and functional.

II. COLLECTING TEST CASES IN DIFFERENT LANGUAGES

The main principles of creation in the process of software development are [1]:

The tests must be able to follow the requirements of consumers.

Test planning should start before testing, after following the system requirements specifications and after the access project is ready.

In order for an action to be created, it must be carried out by independent testing group.

Testing should start “small” and progress to testing “In the big one.” The first tests are aligned with the system components. The latest tests are for the whole system or for the integration in others systems, if any. There are two main approaches to testing software systems: functional and structural.

Functional testing (Black-box) is also called testing the principle of the black box [2] [3]. It is related to the external quality assessment of code by users. The tests are performed through the graphic system interface (Graphical User Interface – GUI). An analysis of the output results depending on the input data set. Object of study are the functional requirements for the system.

The structural testing (White-box) examines the software of the system based on the knowledge of the program code and its architecture. It is realized through: Testing to “cover” the code based on structural analysis (Code coverage measurement) – is realized through specialized tools. The quality assessments of the system are made on the basis of the structure and logic. Code Review. This type of testing is known as a “white-box” testing – structural testing in which the structuring of system code. It relates to the procedural details of the application, p internal logical structures.

The main levels of testing are [1]:

Component Testing (Unit) – Component testing is synonymous with Unit testing or modular testing. This is the first stage of testing that is done when we have it ready operating functional unit. As this unit can be a method function, procedure or class. In over 90% of cases, this testing is done by software developers. In general, these are quick tests, which show what the state of the system itself is.

Integration Testing – This is testing that is done when the individual components are integrated, in order to verify that they interact according to the specification after their integration. Interfaces and communication between systems are also subject to this testing.

System Testing – System testing is the main way to check if the system is responding of the specifications set by the customers. During system testing test cases are executed. It is described in the test scenarios the sequence of actions to verify the functional or technical requirement for the system. They consist of the identification part and a sequence of implementation steps.

Acceptance Testing It is often done by the customers themselves. The idea is to be checked by a client in terms of whether the system works as intended specifications. An important factor here is the performance of the testing itself in an environment as close as possible to the real one. Quality testing can be manual and automated. In the QA Manual, the tests are performed run only by humans without the use of scripts. In this case knowledge of programming languages and code writing is not required, but only recommended. Specialized are used bug and bug recording platforms or so-called Bug Tracking Systems (Jira, Bugzilla,

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Redmine, Mantis and others).

Automated testing is the implementation of our testing plan (the parts of the application we want to test, the order in which to tested, and the expected answers) via a script instead of manual testing. Python is offers a set of tools and libraries to help us create automated tests for our application [4][5]. Testing of Multiple components are known as integration testing. An integration test verifies that the components in the application are working with each other.

It is possible to write both integration tests and modular ones tests in Python directly in REPL (the interactive Python interpreter). For example, to write a component (unit) test for the built-in function `sum()`, we need to check the output of `sum()` against some output via `assert`.

```
>>> assert sum([1, 2, 3]) == 6, "Should be 6"
```

In this case, it will not output anything because the values are correct (the statement is true). If the result of `sum()` is incorrect, it will fail with `AssertionError` and the message “Should be 6”. As we test again statement with wrong values, we will see `AssertionError`

```
>>> assert sum([1, 1, 1]) == 6, "Should be 6"
```

Traceback (most recent call last):

File “<stdin>”, line 1, in <module>

AssertionError: Should be 6

Instead of testing in REPL, it is better to put the code in a new Python a file called for example `test_sum.py` and run it again:

```
def test_sum():
    assert sum([1, 2, 3]) == 6, "Should be 6"
if __name__ == "__main__":
    test_sum()
print("Tests passed")
```

We have written a test case, statement and entry point (command line) and we can do this in the command line:

```
$ python test_sum.py
```

Tests passed

We tested with a list. Now we will test with tuple. We create a new file, called `test_sum_2.py` with the following code:

```
def test_sum():
    assert sum([1, 2, 3]) == 6, "Should be 6"
def test_sum_tuple():
    assert sum((1, 2, 2)) == 6, "Should be 6"
if __name__ == "__main__":
    test_sum()
    test_sum_tuple()
print("Tests passed")
```

Writing tests this way is good for simple checking, but for more serious testing are used so-called test runners. The test runner is special application designed for conducting tests, checking the output and provide troubleshooting and diagnostic tools tests and applications.

There are many test runners for Python. In the standard library of Python has a built-in `unittest`. The principles of `unittest` are easily transferable to another framework. The three most popular test runners are `unit test`, `nose` or `nose2` and `pytest`.

There are tools for automatic testing, when we make changes and send them (commit) to a repository to control source code like `Git`. Automated testing tools are common known as `CI / CD` instruments, which means “Continuous integration / Continuous implementation”. They can run tests, yes compile and publish any applications.

`Travis CI` is one of the many services available for `CI` (continuous integration). `Travis CI` works with Python and can the tests we created to we automate their execution in the cloud. It is available for use in `GitHub` and `GitLab`. We verify with our `GitHub` or `GitLab` and create a `travis.yml` file with the following content:

During manual `JAVA` testing, a tester prepares the test cases from the detailed design document and tries to cover every scenario and code snippet possible.

```
@Test
//unit test case that will check whether the method returns
//the anticipated output or not public void
testMultiplication() {
    int result = app.multiply(10, 5);
    assertEquals(result,40);
}public void testDivision() {
    int result1 = app.divide(10, 5);
    assertEquals(result1,40);
}public void testAddition() {
    int result2 = app.add(10, 5);
    assertEquals(result2,40);
}public void testSubtraction() {
    int result3 = app.subtract(10, 5);
    assertEquals(result3,40);
}
```

The real difficulty in testing `C` code is breaking the dependencies on external modules so is needed isolate code in units. This can be especially problematic when you are trying to get tests around legacy code. In this case I often find myself using the linker to use stubs functions in tests.

This is what people are referring to when they talk about “seams”. In this example only option really is to use the pre-processor or the linker to mock dependencies.

```
#include “myimplementationfile.c”
#include <gtest/gtest.h>
// Mock out external dependency on mylogger.o
void Logger_log(...) {}
TEST(FactorialTest, Zero) {
    EXPECT_EQ(1, Factorial(0));
}
```

```
}  
Unity – Highly recommended framework for unit testing C  
code.  
#include <unity.h>  
void test_true_should_be_true(void)  
{  
    TEST_ASSERT_TRUE(true); }  
int main(void) {  
    UNITY_BEGIN();  
    RUN_TEST(test_true_should_be_true);  
    return UNITY_END(); }
```

III. CONCLUSION

In this paper Software development is a complex mental action, so we must always be careful not to recklessly write new code. This will create a high-quality product that has clean, easy to maintain, poorly connected and reusable software products that will not be difficult for any developer who has tried to understand them. After all, the most

important advantage of the tested code is not the testing itself, but the ability to understand, maintain and continue it extremely easily. With recognized scenarios we can eliminate the repeating execution and eliminate then wherever it is possible.

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Evaluation of E-Government Concept in Terms of Information Security

Egnar Özdikililer¹ and Osman Sümer²

Abstract – It has been an obligation in this era to benefit more from information and communication technologies in the matter of information sharing or transmission among government, citizens and all institutions efficiently and timely. Under these circumstances, a series of parallel and coherent information networks and interactive government services which can transact upon these networks have emerged.

In this respect, e-Government is a settlement in which relation between citizens and government is provided by an electronic networking environment. In this matter of services, it is essential to record whole e-Government application oriented information and to give access to these. However, the most important problem encountered in e-Government system is information security. The main aim of the information security is preventing unauthorized accesses which can interfere the data and ensuring users' browsing around in forementioned platform. But some citizens do not believe that sharing information in electronic networking environment is safe. Citizens need to trust e-Government applications. In this regard; it is necessary to discuss e-Government, which has a technical infrastructure alongside supplying social contributions, in the aspect of “information security”

In this work, the correlation between “digital transformation” and “security” is going to be determined theoretically after a literature review preparing the intellectual and hypothetical substructure about “e-Government”. Moreover, e-Government applications which emerged with technological advancement and progression are going to be discussed critically through the example of “information security”.

Keywords – Information, Digital Transformation, Information Management, e-Government, Information Security

I. INTRODUCTION

Information has become more essential for humanity in our era. Advancements in information technologies provide the opportunity to access information easily, share and study on it. Nowadays the most important capital stock of institutions and organizations is information. It is an obligation for these, so, called institutions and organizations to access current information at right time, place and form as soon as possible for accommodating themselves to competitive conditions and making right and sound decisions on boarding level. (Smith and Kallaus, 1997:2). Therewithal humanity is in a process of transformation beyond a great change compared to past with rapid advancement of information and communication technologies.

Therefore, electronic networking environment, based transformation process is a digitalization period of change starting with e-Government by easing life thanks to affecting all kinds of public services from collecting taxes to substructure systems or from economics to politics which were unimagined before the internet. (Waller and Weerakkody, 2016: 5-7, 9). As is seen, it provides the chance of accessing to information with ease, sharing and studying on it.

II. INFORMATION MANAGEMENT

Technological advance increased the interest to information management via two main sources: (Mårtensson, 2000:208) Rapid growth of internet-like information sources and acceleration of technological change. Providing an ultimate benefit from possessed information sources and/or potential by the way of enabling adaption to changing conditions and raising abilities is possible with a good information management. (Kim, 2000: 1-2). Generally, information management is a process of managing all sorts of information consistently to develop new opportunities, determine and use existing and acquired information and meet the present and developing needs. From this point of view, the objectives of information management a lines as follows; (Jarrar, 2002: 322-323) first one is to contribute to increase competitive capacity, second one is to activate decision making and to prevent time wasting and the last one is to increase responsibility towards service industries.

On the other hand, there are other different noteworthy aspects of information management. Namely: (Kalseth and Cummings, 2002:167) first one is a more beneficial and successful corporate storage approach, second one is dealing with information related to strategy, execution and policies oriented activities settled at every level of institution and the third one is the strategy of storing the information in the appropriate format for both continuation of advancement, providing and distributing the convenient information at convenient time to convenient people with corporately open and secret intellectual values.

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III. E-GOVERNMENT

Rapid advancements in information and communication technologies created a rapid transformation in the bureaucratic structure of the government. This made us encounter with a concept of “Electronic Government” or briefly “e-Government” by which execution of transactions can be handled more rapidly, easily and with a lower cost (OECD, 2003:29). Henceforth, it seems that information technologies have permeated almost all government operations and there has come an “e” letter before all services.

Also e-Government can be considered as the face of proactive government striving to adapt digital era. Numerous changing potential of information and computing technologies and so called technologies’ administratively, politically and socially complex applications is called as e-Government. (Montagna, 2005: 204-205). In other words, there are phenomenons and notions directing social life behind the extent of these applications. Globalizing world changes the ways of individuals’ and organizations’ ways of communication, cooperation and competition. Trade relations getting beyond the national limits and information and communication technologies flatten the world and shape new and complex interaction systems. Basically interconnected markets and information revolution created by individuals who are connected to each other through databases and information and communication technologies force government sector to review its present strategies, management and operations to meet citizens’ demands. (Wirtz and Daiser, 2015: 35, 88). E-Government is a structure emerged as result of aforementioned phenomenons and processes.

Recognizedly e-Government concept, as it is known as digital government, is explained by different definitions in literature. In actual fact e-Government definitions include one or several of four elements generally respondent to questions of “how”, “who”, “for whom” and “what”. (Anttiroiko, 2008: xlii):

- Technological means: The initial and principal element of e-Government definitions are the information and communication technologies accenting the necessity of technological aspect of e-Government and pointing the “e” initial of e-Government.

- Application fields: Definitions including this element emphasize applications and functional fields which include administrative functions, financial management, rendering services (e-Education, e-Health, e-Voting, e-Passport etc.), producing policies, political leadership, public governance and democratic practices.

- Government’s objectives and active role: The second element appearing in e-Government definitions includes general objectives such as transformation and reforms of government sector depending on assimilation and utilization of information and communication technologies by government or more specific objectives such as effectiveness

of government, increasing service qualities and subjects’ participation.

- Citizens, customers, shareholders: Most of the definitions in modern arguments emphasize shareholders of e-Government applications especially citizens and business world.

This element is closely associated with public governance and it reflects the relational approach to e-Government.

On the other hand, e-Government services show up in a variety of daily fields of utilization. It is possible to classify these utilization fields as three main titles: daily life, remote management and political participation. (Aichholzer, Schmutzer and Hochgerner, 1998: 3).

TABLE I
UTILIZATION FIELDS OF E-GOVERNMENT SERVICE

	Information Supply Services	Communication Services	Online Transaction Services
Daily Life	– business life – housing – health – culture – education – information about transportation, environment etc.	– consulting about daily life issues – business or housing announcements – electronic mail communication	– ticket reservations – registrations to various programs
Remote Management	– public services’ guide – administrative processes and guidance – public records and databases	– communication with public officials through e-mail	– filling up forms in electronic environment
Political Participation	– legislative regulations – discussions about assembly records – position papers – documents of resolution process	– political programmes – communication with politicians through e-mail	– referendum – selections – polls

Source: Aichholzer, G., Schmutzer, R. and Hochgerner, J. (1998). *Bringing public administration closer to the citizens. Background Paper to the Conference of the Information Society Forum of the European Commission WG 5: “Public Administration”*. Vienna. 12-13 November 1998. pp.4.

Information supply services in Chart 1 states a one sided information supply services by public institutions and organizations. Communication services contains services which enables both one-sided communication and two-sided

communications with public institutions as well. As for online services; it explains the share of same thing by institutions, organizations and people from different places at the same time and the same way by the help of electronic systems whereas these all participants and processes should have been at the same place and same time to utilize these transactions under normal circumstances without electronic systems. (Aichholzer, Schmutzer and Hochgerner, 1998: 3-5). By this means, two-dimensional integration of various service types and different utilization fields is possible.

Frankly, despite of the covered distance on providing e-Government services; not all segments of society's being informed enough about electronic government service, inefficiency of citizens about the ability of using information and communication technologies (Liu, Chen and Zhou, 2006), inadequacy of technical and humane substructure for providing services (Moon, 2002; Zhang, Cresswell and Thompson, 2005; Sang, 2008), citizens' distrust against network services (Cullen and Houghton, 2000) and not all segments being financially able to benefit from aforesaid services (Bélanger and Carter, 2006; Kuk, 2002) etc. issues continue to be relevant in conducted researches.

Trust Perception of e-Government

Citizens' manner is essential for e-Government services to succeed. However, in an environment where subjects can't access the technology, distrust electronic services, don't adopt public services to be presented online and have a fear of misusing information technologies it is impossible to benefit from the potential of e-Government. So, despite the benefits of e-Government applications there are obstacles derived from users or usage (Baker and Panagopoulos, 2003:101). These obstacles are security of online information and privacy which is concerned by society. (Panagopoulos, 2003: 120). Users' initial concerns were technologies' performance and application of those technologies at the beginning of internet's implementation but then these concerns growingly inclined towards security. (Shah, Peikari and Yasin, 2014:48). Collecting information about citizens bring privacy issues into question.

Further data's being stored way easily and rapidly and collecting of this data probably without informing users and allowing these things to happen thanks to the online technology raises concerns about privacy. (Bélanger and Hiller, 2006: 54). Briefly collecting data without the approval of users from online and offline databases is the most critical problem.

One of the most encountered problems of e-Government portals is security problem. Critical data are stored in mentioned systems. There are multiple methods to attack to those data. Thus there are security weaknesses happening frequently in system. It can be simply said that: all the information related to citizens have to be kept private by government for a variety of reasons. By this way, privacy becomes valid for all e-Government applications. (Mittal et al, 2004: 719). Users information should be kept in a secure base and users should be assured of privacy policies are underway.

e-Government in Turkey is the use of digital technology to improve service efficiency and effectiveness in Turkey. Available services can be done via the internet without physically going to an office. Services are offered from government agencies, municipality services, universities and individual companies (mostly communication companies). On 14 February 2018, family trees through the 1800s were opened to all citizens. Unexpectedly high demand overwhelmed the system, which shut down for upgrades. A week later, the service re-opened, allowing users to queue for service. This service also surprised some users who have Armenian roots, due to controversial relations between the two countries.

Services include:

Social security documents /Forensic clearance /Address documents

Tax debts / Traffic bills /Mobile telephone number checks / Deeds / Student documents / Family tree [26]

Available in	Turkish (with limited English support)
Owner	Digital Transformation Office of the Presidency of Turkey, Turksat
URL	turkiye.gov.tr
Commercial	No
Users	55 million (December 2020)
Launched	20 April 2008

Fig. 1. https://en.wikipedia.org/wiki/E-Government_in_Turkey Last accessed: 09.09.2021 [26]

IV. INFORMATION SECURITY

Information security is a topic on the world agenda. In general terms information security can be defined as; “A total of transactions and technologies utilized in order to prevent information worth data from unauthorized access, disclosure, alteration or abuse and protect this data from damage and loss.” (UNCTAD, 2005:187)

V. CONCLUSION

In today's relentless terms of competition; information systems, in which government's or institution's basic strategic information is produced, processed, stored, transmitted and transacted, it should be foreseen that this information could be a potential target of interest, economical advantage and competitive force for people, institutions or even governments. In this respect, it is clear that information systems' security is going to be one of the most essential fields of study in this century eventually because of its holistic extent covering all the efforts for the protection of present strategically essential or valuable information.

In terms of security, notable security fields and data's qualification should be determined and most suitable

hardware and software based system security should be ensured by taking most relevant precautions in all ongoing e-Government applications.

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Characteristics of modern techniques for performance estimation of distributed storage

Stefan Vlaev¹ and Strahil Sokolov²

Abstract – In this paper we will present the “Characteristics of modern techniques for performance estimation of distributed storage”. The data center of today requires robust infrastructure with predictable performance. Having an accurate understanding of the performance of a storage system is identified as one of the most complex things in the work in the modern data center. During the lifespan of a system which is working for a long period of time requires either highly sophisticated monitoring solution or the creation of a mathematical model tailored to the use case. Often during the work of a storage solution, it is treated as a black box which during its time is checked only when there is a problem with it. In this paper we will focus on what is important when a system should be included in the monitoring and the possible criteria which can be used for performance estimation.

Keywords – Storage, Performance, Characteristics 2021.

I. INTRODUCTION

The storage systems on the market today are having a lifespan of four to six years. Usually, they are offered by vendors like “DELL/EMC”, “IBM”, “NetApp” and other companies. Such products often use proprietary hardware, operating system and file system. That makes them not an ideal solution for a distributed system which need to achieves not only good performance and reliability but also should provide longevity on how the data is stored. There are a lot of features which the distributed storage systems are offering making them crucial in the work of the modern cloud data center. The file systems which are in use today were based on the use cases created by the users in last ten years. During this period, we have seen the move from traditional infrastructure to one hosted in the cloud. Additionally, the way people use and create data changes almost every day. The amount of computing data, increases the importance of data storage is emerging. A paper created by IDC and Seagate predicted that the size of the data stored was only be a few ZB in 2010 and it will increase to 175 ZB by 2025[1]. Some of the largest researchers in the world like CERN can produce up to 125 petabytes in just one year based on the experiments created by them in that time. Such environment requires storage solutions which need to have predictable performance, stability and capacity. In scientific research there are cases in which the data cannot be recreated. In modern IT there are a lot of ways to preserve and store such big data volumes. Also, we have the situation where a scientist can work on particular research for a long period.

Many companies have invested in developing different

hardware and software for more than 20 years. One the technologies that came from this is RAID. It has been used for storing large amounts of data because of the performance and reliability it is offering. However, RAID requires specific hardware components and proprietary software. Both of them can be either expensive or hard to work with. Having technology which is not open is making data recovery in case of emergency either expensive or impossible. Another issue with RAID as technology is that it is not easy to expand the. Adding capacity to existing array is in some cases can be hard or impossible. Such infrastructure is hard to scale making it suitable for small workloads. When a drive fails in a RAID it can lead to performance impact on the system. During extensive writing operations this may lead to data corruption.

In the past years different technologies were developed to overcome the problems with capacity growth and performance degradation.

Having a clear understanding how data is stored and what will be the performance in a distributed system in the next couple of years is a significant challenge in front of the companies and the researchers working in that field.

II. APPROACH

A. Modern systems and metrics

Modern storage systems are designed with the idea to be scaled horizontally. This approach usually means that to the systems we can add more disks or server nodes. This will increase both IO and capacity of the system linearly. Having linear increase of the performance can help in the prediction of the performance. In the storage systems used in the past the easiest way to increase the speed was to add additional disk drives. With the newer distributed storage solutions, we can add not only disk drives but we can add RAM, CPU and server nodes. All of this can be used to increase the overall performance of the system. Another part of the design of the system in this case is to provide both no single point of

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failure and automatic load balancing by placing data as evenly as possible. Distributing the workload between the different nodes of a cluster is crucial.

The above shows how important is choosing the right components of the storage stack for a distributed system from the start. It can be the OS installed on the nodes, file system, the layout of it and how the system is configured. The core components of a distributed storage system are: file system, block layer and the hardware used.

The right file system is having an impact on the performance, scalability and reliability. File systems like ZFS, GlusterFS and CephFS are created with the idea that they will be used in cluster environment. During the past couple of years, we have moved from monolith storage systems which are offering features at additional costs to distributed storage solutions with file systems which are having most these features embedded in them.

The generic block layer is a kernel component that is used to handle the requests for all block devices in the systems. Because of these the kernel may easily perform the following actions: put data in buffers, implement, manage volumes and exploit features on the hardware.

Choosing the right hardware is important in order to utilize the advanced features of the file system. The ZFS file system have features like compression, deduplication and even utilize different ways to accelerate data transfers like the use of cache for read and write operations. Other file systems can provide not only the features mentioned above but in addition they can perform volume management.

Based on the already introduced storage stack components we need to develop list of metrics which we need to monitor and use to predict the performance of either single component, node or the whole storage system. The core storage metrics are:

- IOPS
- Read/Write operations
- Throughput
- Latency

Each of them is important for predicting the performance of the system. During the work of a cloud infrastructure, it serves customers 24x7. In such case it is important for the support to predict the performance of the system. In order to do that a system should be monitored for a period of time of at least six months. The proper understanding of the workloads on the system and how they can affect it can provide information which will be used to predict the overall performance. Each load is different and it can affect the system in a different way. Having a clear information can help to either change the system or fix future issues. One the most common workloads are the write operations. They affect not only the drives on which data is written but also the RAM, cache memory, CPU and network operations. Workloads in which we need to read huge amounts of data can affect the RAM and the HDD in the system. The above-mentioned examples are showing that creating full picture of

the impact of the different components requires proper historic information and understanding of the different components which are working together.

In order to create a proper monitoring for the system and predict the performance we should have at minimum:

- Application metrics
- File system metrics
- OS metrics
- Hardware metrics

Each of this metrics can help to understand how the workload is affecting the system. Depending on the results we can adjust different settings or change the used hardware. Certain workloads can be CPU bound and require more power than processor cores, other can be RAM dependent. Usually, metadata operations can require a higher CPU load than Read or Writes. Caching is usually associated with the need of high amount of RAM memory in order to provide fast access to the storage. Lack of clear understanding what are the workloads and how the applications work can lead to performance issues. Removing possible bottlenecks is crucial if we want to be able to predict the performance of the system.

B. Performance variation

The performance of the system can be affected in various ways. The change of even a single system setting can be the reason for a drop or increase of the overall performance of the cluster. Example in this case can be the increase of the cache size on a ZFS system. When the size of the read cache increases, we can see grow in the overall system performance.

Usually during the lifespan of a distributed system, we can see different OS patches which can also affect how the system behaves. When such OS fixes are applied it is a best practice to monitor the overall behavior for at least 72 hours. Usually, a software-based system can have a life span more than a traditional storage. Systems which are based on proprietary hardware are in production until the warranty period or commercial support is no longer available. When such point is reached either the capacity or the performance cannot sustain the changed workloads. A software-based storage solution can have a much longer lifespan since it can evolve with the operating system used.

During the work of a distributed storage solution, the vendors of the different hardware components can provide firmwares which either fix bugs or provide performance improvements. The problem in such situation is that until this firmware is applied, we are not sure how this will affect the other hardware components. A bug fix for the network card can have effect on other hardware components. Again, like in the OS fixes the overall performance should be monitored after the changes were applied. Each of these changes should be carefully documented including installed and running version.

The used hardware and the age of it can lead to performance impact on the whole cluster in a software

defined storage system. When the hardware components reach certain age, they can either start failing which can lead to rebuild processes or they may not cover anymore the minimal requirements of the used OS software. We can have system components which require more CPU power that it was initially required when the deployment was completed.

When the initial decision is made for the build of storage system a lot of different hardware components are required. At this initial phase there is the possibility that some of the requested hardware can come in different revisions. One of the main problems is that some hardware vendors can change components without new revision of the hardware. Common example in such cases is the SSD's. Even when a single component is changed like the controller chip it can affect the overall drive performance. In a storage cluster we have the situation where we can have performance impact on all drives. The problem in this case is that the vendor of the drives may not provide information about what chips are used or even what firmware is on the drives. Because of this all drives in the system should be checked either before the system is deployed or during its work.

Before a storage system is in production, we can have either performance estimation based on the components used or we should try to perform simulations on at least a single node with hardware similar to the one that we will use.

The performance variation can change depending on the time when the measurements are performed. When a complex infrastructure is deployed it is of great importance to deploy a monitoring solution that will be able to gather data which can be checked for even a six months period. When we analyze the data collected, we should focus on the following topics:

- Properly selected workloads
- Key metrics depending on the application
- File systems metrics
- Hardware metrics

All of the mentioned topics can be used to create either a diagram on how the performance changes or algorithm which can be used for future estimations.

As mentioned in the previous paragraphs these are important topics for the understanding what is happening with the system itself.

The file system is important for the overall performance. In order to understand what is happening with it we can focus on the following couple of points. In the example we will use the XFS file system. The mentioned points to monitor are also seen in other file systems:

- Block size
- Inode size
- Journal mode
- Allocation group
- Nodatacow
- Nodatasum
- Atime options
- IO/ scheduler

Block size is the group of contiguous sectors and is the basic unit of space allocation in a file system. Failing to set a proper value can reduce file system performance by orders of magnitude.

Inode size is one of the most basic on-disk structures of a file system. Its job is to store the metadata of a given file, such as its size, permissions, and the location of its data blocks. The inode is involved in every I/O operation and plays a critical role for performance, especially for workloads which involve heavy metadata operations.

Journal mode is a write-ahead logging implemented by the file systems for recovery purposes in case of power losses and crashes. At the moment journaling is important for recovery purposes in various file systems. Example in this case is the EXT4 file system in Linux.

Allocation groups are specific term used for filesystems like XFS which partitions its space into regions called Allocation groups. Each allocation group has its own data structures for managing free space inodes within its boundaries.

Nodatacow is a BTRFS mount-time option that the CoW feature on or off for data blocks. When data CoW is enabled, BTRFS creates a new version of an extent or a page at a newly allocated space. CoW feature is available in other file systems like ZFS.

Atime option refers to mount options that control the inode access time.

I/O scheduler manages the submission of block operations to storage devices. The choice of I/O scheduler can have a significant impact on the I/O stack performance.

The mentioned above are just example of what needs to be monitored in a filesystem to understand its behavior under certain workloads. The list is not full since it heavily depends on the filesystem in use and the operating system.

C. Benchmarking

In order to proper, understand the performance of a distributed storage we need to evaluate its performance in certain cases. Using [2] single benchmark is not always a good solution. There are many factors, which are related to the type of test it is used to measure the proper performance of a system.

- Storage type: SAN, NAS, Flash, RAID, DAS
- File system type
- Operating system
- Workload
- Synchronous activities
- Asynchronous activities
- Caches

All of the mentioned above are factors which should be carefully taken under consideration when a distributed storage system is evaluated.

D. Distributed storage

In distributed storage systems, any node has CPU, RAM, SSD and HDD drives. At any time, all of these resources in

the server are available so all nodes behave as one single group. Since the whole group acts as a single entity, it is crucial that all nodes perform and behave the same way. When a node performance is lower than the others are it can have effect on the whole systems.

Software defined systems can have a longer life span than the ones which are developed and produced from vendors like “DELL/EMC”, “NetApp” and “IBM”. It is important that the lifespan of the system is as long as possible. Migrations take time and face the risk of data loss.

Understanding how the system works and how the different components interact with each other is crucial for predicting the overall performance of the system. Since one system will work for a long period its performance will start to change depending on many factors, which were mentioned inside the article.

The overall longevity of distributed storage system heavily depends on the file system, which is used. The proper file system can provide not only additional features but also guarantee that it can be used for longer periods. Example of this is the ZFS file system. It was developed under “Sun Microsystems” and after the company was acquired by “Oracle”, its development was continued under the OpenZFS project. In the current age of IT infrastructure, we have an environment, which is changing every day. In some cases, we need to store the research data for years. Example for such data that needs to be saved for years are satellite images which need to be stored for longer periods in order to be analyzed. Satellite images are discussed in [4].

III. CONCLUSION

The goal of this paper is to give an insight how complex is the performance estimation of a distributed storage system [3]. There are no direct measurement ways to check, monitor and predict what will be the performance of a system when it is deployed and how it will change during all of the years when the system is in use. In order to identify the current

performance and have the possibility to predict the future one we need to identify the workloads on the system, monitor it and have clear documentation what happen on the system based on all of the changes that will be performed on it. After we have all of the needed information and we perform monitoring we can deduce what will be the possible performance of the system based.

The insights that were provided in the paper will be used as a groundwork for future testing on different file systems, which will be used in the distributed storage system deployed in the University of “Telecommunication and posts”. The system that we plan to develop and implement will be used to provide different testing methodologies and benchmarks, which will be used for future papers.

ACKNOWLEDGEMENT

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Implementation of a gRPC API Service Application in a Cloud-Based Orchestration Platform

Orhan Idiriz¹

Abstract – In this paper the instructions for preparing manuscripts for the Proceedings of Sixth International Scientific Conference “TELECOMMUNICATIONS, INFORMATICS, ENERGY AND MANAGEMENT” TIEM 2021 organized by the University of Telecommunications and Post – Sofia are given. The recommended text processor is Microsoft Word.

Keywords – gRPC, API, microservice, cloud, orchestration, Kubernetes, protobuf.

I. INTRODUCTION

In the last few years, microservices are achieving more popularity these days. Actually, microservices architecture offers tangible benefits including an increase in scalability, flexibility, agility, and other significant advantages. Many leading and proven companies such as Facebook, Google, Amazon, and other tech leaders have successfully switched from a monolithic architecture to microservices.

In comparison, monolithic architecture is an established and well-known model for creating a software application. On the other hand, its trend is going down because building a monolithic application brings a number of challenges associated with handling a huge codebase, adopting new technology, scaling, deployment, implementing new changes and improvements.

Most software development companies are realizing the benefits of building a microservices-based architecture. There are many advantages: from lower costs to better performance to less downtime to the ability to scale, microservices provide mainly benefits compared with monolithic designs. Switching from a monolith to a microservices approach and breaking down into multiple microservices, one major issue will appear – how effectively and securely implement the communication between these services?

II. CONNECTION CHANNELS BETWEEN MICROSERVICES

Important pre-requirement for the development of an application or software based on microservices is their effective communication between components. This task can demand serious planning.

When speaking of monolithic architecture development, where the complex softer runs as a single process, each module communicates with each other via internal inter-process communication calls. These modules are either

closely linked to each other in case-specific objects are created via code, or loosely coupled connections can be established if references to abstractions are used, using dependency insertion.

It is well known for a microservices-based application as a system run on different processes, services, on several servers or hosts. Basically, each service instance works as a separate process, services need to work through the use of a process communication protocol. The nature of each service determines the protocols that may be used: HTTP, AMQP, or a binary TCP protocol.

Exchanging data between the client and the various microservices can be done via different types of communications, each designated to a different scenario. Basically, there are two categories for the classification of these communication systems:

- On the type of protocol: synchronous or asynchronous.
- On the number of receivers: one or many.

Synchronous protocol: It is characterized for being a system that leverages isolating for each microservice as much as possible since sub-processes are being locked. HTTP/HTTPS is a typical example of an asynchronous microservice communication protocol, where the client can message its operation when it receives a response from the server.

Asynchronous protocol: the sub-processes are not locked and protocols that are compatible with many operating systems and cloud environments are preferred. An example would be the AMQP protocol, where the client's or message sender's code usually does not wait for a reply. But it usually sends a message to a Kafka queue for example or any other messaging queue tool.

The next classification for the criterion of microservice communication protocols is the number of receivers, differentiating between one or many receivers.

Single receiver. Each request must be processed by a receiver or service. An example of this type of communication is the Command pattern.

Many receivers. Typical example of this type is the event-driven microservices architecture, which is founded on a messaging agent or event bus interface that broadcasts the

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data updates to various microservices via events. Commonly speaking, this interface is implemented with a service bus or similar device, such as Google PUBSUB using topics and subscriptions.

When speaking of microservice architecture we can't miss mentioning different API styles, Cloud and orchestration technologies.

III. API STYLES

The most used and popular communication technology between microservices is API (Application Programming Interface) which helps in communication and data exchange between two software systems. It is the channel which connects two software systems communicate with one another. Here is the description of some of the well-known and most used API styles:

RESTful API Style: REST is invented to be able to optimally use an HTTP-based infrastructure and because of the popularity of the web, HTTP-based infrastructures, such as servers, caches, and proxies, are widely available. The web, which is leveraged with HTTP, brings some proof for an architecture that has longevity and scales extremely well. The main idea of REST is to transfer the ideas that worked well for the web and apply them to web-based services [4].

- Pros:

- Loosely coupled client and server
- Discoverability
- Can be cache effectively
- Support Multiple formats well

- Cons:

- Multiple REST structures
- Large payloads
- Fetching problems

GraphQL API Style: GraphQL has been created by Facebook, the philosophy, and framework is at the core of its popular API. Tech companies increased their count which tested with GraphQL and acquired it as one of their base stones for API design.

- Pros

- Typed schema
- Very well fits graph-like data
- No versioning
- Informative error messages
- Flexible permissions

- Cons

- Demands for high HW capacity.
- Caching unfriendly
- Require serious previous development experience

RPC Style: RPC is an architectural style mainly used in distributed systems. It was invented around the 1980s. Nowadays the most used RPC styles are JSON-RPC and XML-RPC. SOAP seems to be designed to follow an RPC architectural style.

- Pros:

- direct and simple interaction
- Easy to extend with new functions
- High performance

- Cons:

- Tight coupling to the underlying system.
- Low discoverability
- Function count complexity

SOAP: SOAP is a kind of derivative from the RPC style and exposes procedures as central concepts. It became standard in API development initiated by the W3C and it seems to be the most widely used protocol for web services. SOAP style architectures are very popular in banking, however, typically only for company internal use or for services called by trusted partners.

- Pros:

- Language and platform agnostic
- Compatible with a variety of transport protocols
- Self error handling mechanisms
- Security-wise proven extensions

- Cons:

- Do not support other formats – XML only
- Heavyweight
- Requires specialized knowledge
- Cumbersome message updating

gRPC: gRPC is a modernized RPC implementation. In its main concepts it is based on language-neutral and platform-neutral specifications, and SDKs for many languages and platforms, that is why it can be used widely, for communication across various platforms and languages. gRPC is the fastest and efficient due to the usage of Protocol Buffers (protobufs) to serialize the service and data message into binary streams as well as the HTTP/2 standard is optimized for binary transfers, and bidirectional streaming to solve the issue with long polling and blocking HTTP calls.

- Pros

- Proven high level of performance and safety
- Bi-directional streaming
- Excellent Load Balancing
- Smart message compression
- Self-generated client code
- Increased optimization
- Connection pool

- Cons

- There is no browser support due to which it cannot be used for external services.

- Can't be tested with well-known API testing tools as postman or curl.

- Status codes need to be defined during development which might bring conflicts.

IV. CLOUD AND ORCHESTRATION TECHNOLOGIES

Cloud Orchestration is the process of automating the tasks needed to manage connections and operations of workloads

on private and public clouds. Cloud orchestration technologies integrate automated tasks and processes into a workflow to perform specific business functions.

Speaking of cloud orchestration technology, we can't really miss mentioning and describing Kubernetes which proved itself and became the king of standard in container orchestration and cloud platform for development and hosting of applications and microservices.

Kubernetes is an open-source container orchestration platform that organizes and brings to the next level many of the manual processes regarding deploying, managing, and scaling containerized software products.

Kubernetes clusters can be deployed across on-premise, public, private, or hybrid clouds. That is why Kubernetes is the best platform for hosting cloud-designed applications that require fast scaling, for example, real-time data streaming.

Kubernetes owes its design and development to engineers of Google. Google was one of the early pioneers who has invested in Linux container technology and has announced that most of the critical infrastructure at Google runs in containers.

Using Kubernetes in your environment, especially if you are optimizing app dev for the cloud is a great advantage, it gives you the platform to schedule and run containers on clusters utilizing physical or virtual machines (VMs) as nodes.

More broadly, it helps you fully implement and rely on a container-based infrastructure in production environments. And Kubernetes grants idempotent automation and operation of tasks, it can be done many of the same deployment over and over.

Software engineers can also create cloud-native apps with Kubernetes as a runtime platform by using Kubernetes rules. These are the tools a Kubernetes developer needs to build container-based applications and services.

With Kubernetes you can:

- Orchestrate containers across many hosts.
- Improve hardware capacity usage to the maximum and balance resources needed to run enterprise applications.
- Manage and automate application deployments.
- Manage storage for running stateful apps.
- Scale containerized applications and their resources with no downtime.
- Declarative syntax of Kubernetes infrastructure configuration files guarantees the deployed applications are going to be deployed the same way each time.
- Auto-placement, auto-restart, auto replication, and autoscaling makes Kubernetes infrastructure self-health-check and self-heal.

V. KUBERNETES ARCHITECTURE

The following diagram (Fig. 1) shows Kubernetes cluster architecture. The Kubernetes cluster is made up of the following basic elements:

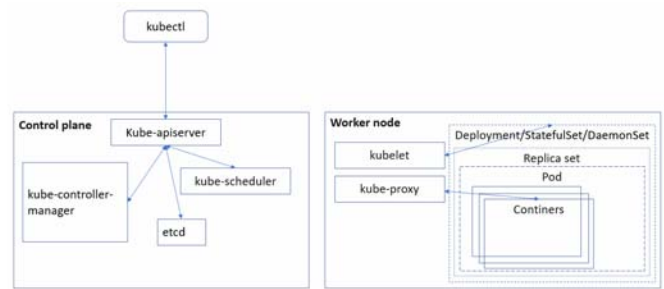


Fig. 1. Kubernetes architecture

API server: Also known as kube-apiserver

The API server is a component of the Kubernetes control plane that exposes the Kubernetes API. The API server is the front end for the Kubernetes control plane

Cluster: A set of worker machines, called nodes, that run containerized applications. Every cluster has at least one worker node.

Container: A lightweight and portable executable image that contains software and all of its dependencies.

Control Plane: The container orchestration layer that exposes the API and interfaces to define, deploy, and manage the lifecycle of containers

Controller: In Kubernetes, controllers are control loops that watch the state of your cluster, then make or request changes where needed. Each controller tries to move the current cluster state closer to the desired state.

DaemonSet: Ensures a copy of a Pod is running across a set of nodes in a cluster.

Deployment: An API object that manages a replicated application, typically by running Pods with no local state.

Kubectl: A command-line tool for communicating with a Kubernetes API server.

Kubelet: An agent that runs on each node in the cluster. It makes sure that containers are running in a Pod.

kube-controller-manager: Control plane component that runs controller processes.

kube-proxy: kube-proxy is a network proxy that runs on each node in your cluster, implementing part of the Kubernetes Service concept.

kube-scheduler: Control plane component that watches for newly created Pods with no assigned node and selects a node for them to run on.

Node: A node is a worker machine in Kubernetes.

Pod: The smallest and simplest Kubernetes object. A Pod represents a set of running containers on your cluster.

ReplicaSet: A ReplicaSet (aims to) maintain a set of replica Pods running at any given time.

Service: An abstract way to expose an application running on a set of Pods as a network service

StatefulSet: Manages the deployment and scaling of a set of Pods and provides guarantees about the ordering and uniqueness of these Pods.

Static Pod: A pod managed directly by the kubelet daemon on a specific node.

VI. gRPC

gRPC is an open-source Remote Procedure Call framework that is used for high-speed and effective communication between micro-services. It is an excellent way to connect services coded in different languages with modular support for balancing the load, tracing, health checking, and authentication. In general, gRPC uses protocol buffers for serializing structured data. Basically, gRPC is considered an optimized alternative to the REST protocol for microservice architecture. The ‘g’ in gRPC can be linked with Google, which initially developed the technology [5].

gRPC is circling around the idea of setting a service, specifying the methods that can be called remotely with their parameters and return types. On the server-side, the server implements this interface and runs a gRPC server to handle client calls. On the client side, the client has a stub that provides the same methods as the server.

gRPC clients and servers part of the application run and talk to each other in a variety of environments: servers inside the cloud, desktop computers – and allow to be coded in any of gRPC’s supported languages. Each gRPC API client and server can be easily created in different well know programming languages. Server in Java with clients in Go, Python, or C++ (Fig. 2). Besides that, the support of the latest Google APIs will provide gRPC versions of their interfaces, allowing the software engineers to easily build Google functionality into the software applications.

Basically, gRPC uses protocol buffers as the interface definition language for serialization and communication instead of JSON/XML. Protocol buffers can describe the structure of data and the code can be generated from that description for generating or parsing a stream of bytes that represents the structured data. This is the reason gRPC is preferred for web applications that are written in different programming languages. The binary data format allows the communication to be lighter. gRPC can also be used with other data formats, but the preferred one is the protocol buffers.

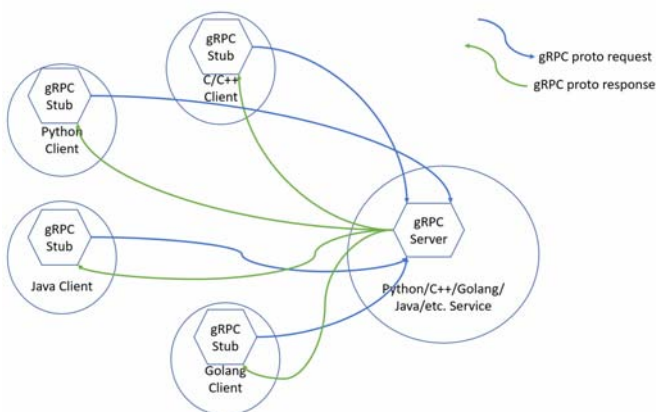


Fig. 2. gRPC client-server

Also, gRPC is built on top of HTTP/2, which supports

bidirectional communication along with the traditional request/response. gRPC allows a loose coupling between server and client. In practice, the client opens a long-lived connection with the gRPC server and a new HTTP/2 stream will be opened for each RPC call.

The first step when working with protocol buffers (Listing. 1) is to define the structure for the data you want to serialize in a proto file: this is an ordinary text file with a .proto extension. Protocol buffer data is structured as messages, where each message is a small logical record of information containing a series of name-value pairs called fields.

```
syntax = "proto3";
package hellogrpc;
// The greeter service definition.
service HelloGPRC {
  // Sends a greeting
  rpc CreateHelloGrpc( InputMessage ) returns ( HelloGrpcMessage
);
}
// The request message containing the user's name.
message InputMessage {
  string inputmessage = 1;
}
// The response message containing the greetings
message HelloGrpcMessage {
  int32 id = 1;
  string message = 2;
}
```

Listing. 1. Protocol buffer file example

Next gRPC code need to be generated which will be used by client-server application.

From the directory where the proto buffer file resides next command need to be run, Listing 2:

This command can be executed in all major platforms which support python interpreter installation: Windows, Linux, MacOS, etc.

```
$python -m grpc_tools.protoc \
-I. \
--python_out=. \
--grpc_python_out=. \
hellogrpc.proto
```

Listing. 2. Protoc command example

This regenerates hellogrpc_pb2.py which contains our generated request and response classes and hellogrpc_pb2_grpc.py which contains our generated client and server classes.

```
from concurrent import futures
import logging
```

```
import grpc
import hellogrpc_pb2
import hellogrpc_pb2_grpc
```

```
from grpc_reflection.v1alpha import reflection
```

```

count=0
class Greeter(hellogrpc_pb2_grpc.HelloGPRCServicer):
    def CreateHelloGrpc(self, request, context):
        global count
        count+=1
        return hellogrpc_pb2.HelloGrpcMessage(id=count,
message='%s!' % request.inputmessage)

def serve():
    server = grpc.server(futures.ThreadPoolExecutor(max_workers=10))
    hellogrpc_pb2_grpc.add_HelloGPRCServicer_to_server(Greeter(),
server)
    # the reflection service will be aware of „Greeter” and
    „ServerReflection” services.
    SERVICE_NAMES = (
        hellogrpc_pb2.DESCRIPTOR.services_by_name['HelloGPRC'].full_name,
        reflection.SERVICE_NAME,
    )
    reflection.enable_server_reflection(SERVICE_NAMES, server)
    server.add_insecure_port('[::]:50051')
    server.start()
    server.wait_for_termination()

if __name__ == '__main__':
    logging.basicConfig()
    serve()

```

Listing. 3. gRPC API server – server.py

In Listing. 3. is shown server part of gRPC API service. This code is developed by software engineer who uses already generated client and server classes, methods, data structures and stubs.

And Listing. 4. Is show developed by software engineer code for client process which uses already generated client stub class definitions.

```

from __future__ import print_function
import logging

import grpc
import hellogrpc_pb2
import hellogrpc_pb2_grpc

def run():
    with grpc.insecure_channel('localhost:50051') as channel:
        stub = hellogrpc_pb2_grpc.GreeterStub(channel)
        response=
stub.CreateHelloGrpc(hellogrpc_pb2.InputMessage(name='you'))
        print(„Greeter client received: „ + response.message)

if __name__ == '__main__':
    logging.basicConfig()
    run()

```

Listing. 4. gRPC API client – client.py

And the last step for this stage is to run the server and client part of the application and test the functionality. In this case bot processes are going to be started at the same machine. That is why client will connect to localhost:50051 URL. In case server process need to be implemented and executed in remote location no matter if this is going to be physical machine, virtual machine, container or server-less platform on premises or in the cloud. Next example in Listing.5 shows running and testing gRPC client and server API processes.

```

#Run the server
$ python server.py

```

```

#And from another terminal or command window, run:
$python client.py

```

Listing. 5. gRPC API running and testing

For the sake of simplicity and keeping the focus on the task encryption and authentication haven't been included in the demo. That can be easily achieved by using one of the out of the tools which provides service communication meshes. One very widely used and popular tool is Envoy proxy. In the next section there will be short introduction for integrating Envoy proxy side-car container to gRPC API service

VII. ENVOY PROXY

Envoy is a standalone process that can run alongside every application server. All of the Envoy proxies are within a transparent communication mesh where the software applications send and receive messages to and from localhost. Without a direct connection to the physical or virtual network. The delegation approach to Envoy architecture has noticeable benefits compared with the traditional library approach to service-to-service communication.

Envoy works with most of the well known application languages. One Envoy deployment infrastructure can form a mesh between Java, C++, Go, PHP, Python, etc. Now days it is a standard for micro service-oriented architectures to use various application frameworks and languages. Envoy fills the gap with transparent bridging.

In a large service-oriented architecture usually deploying library upgrades can be incredibly painful. Envoy can be deployed and upgraded quickly across an entire infrastructure with no impact on communication and availability.

L3/L4 filter architecture: At its core, Envoy is an L3/L4 network proxy. A pluggable filter chain mechanism allows filters to be written to perform different TCP/UDP proxy tasks and inserted into the main server.

HTTP L7 filter architecture: HTTP is such a critical component of modern application architectures that Envoy supports an additional HTTP L7 filter layer.

First class HTTP/2 support: When operating in HTTP

mode, Envoy supports both HTTP/1.1 and HTTP/2. Envoy can operate as a transparent HTTP/1.1 to HTTP/2 proxy in both directions. This means that any combination of HTTP/1.1 and HTTP/2 clients and target servers can be bridged. The recommended service to service configuration uses HTTP/2 between all Envoyos to create a mesh of persistent connections that requests, and responses can be multiplexed over.

HTTP L7 routing: When operating in HTTP mode, Envoy supports a routing subsystem that is capable of routing and redirecting requests based on path, authority, content type, runtime values, etc. This functionality is most useful when using Envoy as a front/edge proxy but is also leveraged when building a service to service mesh.

gRPC support: gRPC is an RPC framework from Google that uses HTTP/2 or above as the underlying multiplexed transport. Envoy supports all of the HTTP/2 features required to be used as the routing and load balancing substrate for gRPC requests and responses. The two systems are very complementary.

```
admin:
  access_log_path: /tmp/admin_access.log
  address:
    socket_address: { address: 0.0.0.0, port_value: 9901 }
static_resources: listeners:
  - name: listener_0
    address:
      socket_address: { address: 0.0.0.0, port_value: 8080 }
    filter_chains:
      - filters:
          - name: envoy.filters.network.http_connection_manager
            typed_config:
              "@type":
                type.googleapis.com/envoy.extensions.filters.network.http_connection_manager.v3.HttpConnectionManager
              codec_type: auto
              stat_prefix: ingress_http
              route_config:
                name: local_route
                virtual_hosts:
                  - name: local_service
                    domains: ["*"]
                    routes:
                      - match: { prefix: "/" }
                        route:
                          cluster: echo_service
                          timeout: 0s
                          max_stream_duration:
                            grpc_timeout_header_max: 0s
              cors:
                allow_origin_string_match:
                  - prefix: "*"
                allow_methods: GET, PUT, DELETE, POST, OPTIONS
                allow_headers: keep-alive,user-agent,cache-control,content-type,content-transfer-encoding,custom-header-1,x-accept-content-transfer-encoding,x-accept-response-streaming,x-user-agent,x-grpc-web,grpc-timeout
                max_age: "1728000"
                expose_headers: custom-header-1,grpc-status,grpc-
```

```
message
  http_filters:
    - name: envoy.filters.http.grpc_web
    - name: envoy.filters.http.cors
    - name: envoy.filters.http.router
  clusters:
    - name: echo_service
      connect_timeout: 0.25s
      type: logical_dns
      http2_protocol_options: {}
      lb_policy: round_robin
      load_assignment:
        cluster_name: cluster_0
      endpoints:
        - lb_endpoints:
            - endpoint:
                address:
                  socket_address:
                    address: 127.0.0.1
                    port_value: 50051
```

Listing. 6. Envoy-proxy.yaml example

Health checking: The recommended way of building an Envoy mesh is to treat service discovery as an eventually consistent process. Envoy includes a health checking subsystem which can optionally perform active health checking of upstream service clusters. Envoy then uses the union of service discovery and health checking information to determine healthy load balancing targets. Envoy also supports passive health checking via an outlier detection subsystem.

Advanced load balancing: Load balancing among different components in a distributed system is a complex problem. Because Envoy is a self-contained proxy instead of a library, it is able to implement advanced load balancing techniques in a single place and have them be accessible to any application.

The overall configuration of Envoy proxy is done by single YAML file. That file's path then is specified as an argument to the binary file of envoy proxy. Below in Listing. 6. is example with YAML configuration file for Envoy proxy which will help wrap the gRPC demo service application and improve its security and monitoring.

Starting of Envoy proxy is shown with following example Listing. 7.

```
$ envoy -log-level error -c Envoy-proxy.yaml
```

Listing. 7. Running envoy proxy

VIII. ASSEMBLY ALL OF THE PARTS

Now is the time to assemble all the parts of the puzzle. Run time environment is going to be used Kubernetes cluster which might be located on private or public cloud. Before that container images need to be built and published to container artifact repository as Nexus, Dist, JFrog, etc. or some public cloud service as GitHub and Docker hub.

In the following Listing. 8. are shown Dockerfile for

creating container image to the gRPC API Service.

```
FROM ubuntu:bionic
RUN apt-get update
RUN apt-get install python3 python3-pip -y
COPY ./requirements.txt /requirements.txt
RUN pip3 install -r /requirements.txt
RUN mkdir /app
EXPOSE 50051
COPY *.py /app
ENTRYPOINT ["/usr/bin/python3","/app/server.py"]
```

Listing. 8. gRPC API Service Dockerfile

```
$ docker build . -t grpc_server
$ docker tag grpc_server orhi1/grpc_hello:v1
$ docker push orhi1/grpc_hello:v1
```

Listing. 9. Commands for building and publishing container image

```
FROM envoyproxy/envoy-alpine:v1.19-latest
COPY envoy4.yaml /etc/envoy/envoy.yaml
ENTRYPOINT ["envoy", "--log-level error", "-c /etc/envoy/envoy.yaml"]
```

Listing. 10. Custom Envoy proxy – Dockerfile

```
$ docker build . -f Dockerfile -t envoy --no-cache
$ docker tag envoy orhi1/grpc_proxy:v1
$ docker push orhi1/grpc_proxy:v1
```

Listing. 11. Commands for building and publishing container image

The commands to build container image out of Listing. 8. ‘s Dockerfile and then to publish this image to the Docker Hub are shown in Listing. 9.

And for building container image with Envoy proxy configuration file and publishing to Docker Hub details are shown in Listing. 10 and Listing. 11

At this stage where container images are built and uploaded to artifact repository next and final stage is ready to be deployed. For the purpose pre-configured Kubernetes container orchestration platform is going to be used. gRPC API Service container and Envoy proxy container images are going to be packed and deployed within a Kubernetes pod. The communication with the micro service is going to be happened by exposing the downlink port of Envoy proxy via Kubernetes service. And uplink communication is done with the pod internal network with gRPC service. In the Fig. 3 the diagram shows overall architecture.

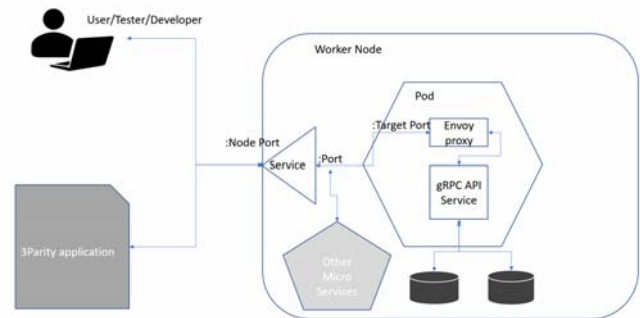


Fig. 3. Architecture of a gRPC API Service implementation

In the next Listing 12. it is shown Kubernetes deployment .yaml file. It helps deploying and activating the pod with two container images. The primary one with gRPC API Service and the ‘side-car’ one with proxy communication role.

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: grpc-hello
  labels:
    app: grpc-hello
spec:
  replicas: 1
  selector:
    matchLabels:
      app: grpc-hello
  template:
    metadata:
      labels:
        app: grpc-hello
    spec:
      containers:
        - name: grpc-server
          image: orhi1/grpc_hello:v1
        - name: grpc-proxy
          image: orhi1/grpc_proxy:v1
      ports:
        - containerPort: 8080

kind: Service
apiVersion: v1
metadata:
  name: grpc-hello-service
spec:
  type: NodePort
  selector:
    app: grpc-hello
  ports:
    - nodePort: 30008
      port: 8080
      targetPort: 8080
```

Listing. 12. grpc-hello-deployment.yaml – Kubernetes Deployment and Service management definition file

```
$ kubectl apply -f grpc-hello-deployment.yaml
```

Listing. 13. Commands for building and publishing container image

And Listing. 13. shows the command to deploy this deployment definition file. And implemented the overall application architecture.

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Remote Sensing for Our Planet Using Sentinel 3

Mariyana Dimitrova¹ and Egnar Ozdikililer²

Abstract – Nowadays, the rate of global population growth leads to irreversible consequences in a negative aspect for the planet Earth, such as global warming, pollution of air, soils and waters, endangered biological species, etc. In developed countries, the phenomenon of fast-growing cities is observed due to the well-developed infrastructure, the need for labour, a higher standard of living, also known as Urban Heat Island (UHI).

The benefits of Remote Sensing (RS) through satellite imagery provides extraordinary accurate data received by the instruments which Earth Observation satellites uses. Combination of techniques as satellite image processing with Geographical Information Systems (GIS) deliver an exact information retrieval. Extracted data could be linked with different kind of analysis for different challenging topics like urban heat phenomena, air pollution, marine observation, emergency management etc. A prediction models with Machine Learning (ML) could be created with the received data.

Keywords – Remote Sensing, Earth Observation, Copernicus, Sentinel 3, Land Surface Temperature (LST), Satellite Image, Classification, Machine Learning

I. INTRODUCTION

Nowadays, the rate of global population growth leads to irreversible consequences in a negative aspect for the planet Earth, such as global warming, pollution of air, soils and waters, endangered biological species, etc. In developed countries, the phenomenon of fast-growing cities is observed due to the well-developed infrastructure, the need for labour, a higher standard of living and higher wages for the members of the households living in them. In other words, this phenomenon is also known as Urban Heat Island UHI [1].

The benefits of Remote Sensing (RS) through satellite images provides extraordinary accurate data received by the instruments which Earth Observation (EO) satellites uses. Using techniques of satellite image processing with combination of geographical information systems (GIS) deliver exact information which could be linked with socio-economic data to provide exact analysis of different kind of challenging topics like urban heat phenomena, air pollution, marine observation, emergency management, urban planning etc.

The goal of this research is to observe urban heat phenomena of fast-growing city Sofia, Bulgaria. For analysis are used satellite imagery retrieved from satellite Sentinel-3 mission developed by European Space Agency (ESA) as a part of Copernicus Programme. [2]

II. PURPOSED METHOD

Urban Heat Island is phenomena of fast-growing cities it can be explained with increasing in air temperature during the summer season. UHI occurs when in the cities natural land cover is replaced with different kind of concentrations of pavement, buildings, and other surfaces that absorb and retain heat. During the summer the consumption of energy is increasing due to air conditioning usage. Phenomena represents radiative temperature difference between urban and non-urban areas. Negative effects and local impacts of the observed area from UHI effect (Fig. 1) can be monitored during the night hours measured with satellite thermal remote sensing sensors like Sea and Land Surface Radiometer (SLSTR) [3] which is a dual scan temperature radiometer in the low Earth orbit – (800 – 830 km altitude) [4].

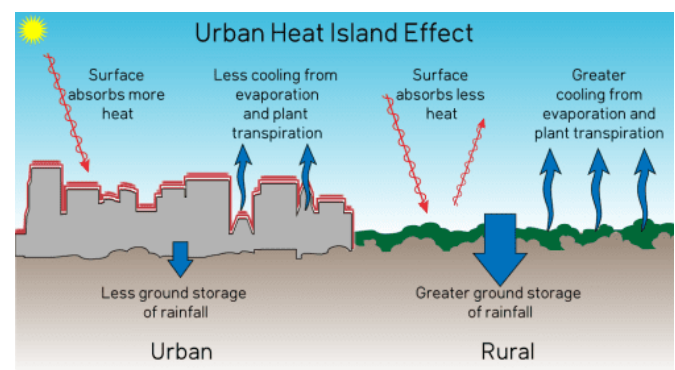


Fig. 1. Urban Heat Island Effect

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multi-instrument mission developed by European Space Agency (ESA) as a part of Copernicus Programme [5].

Research for the timeframe between 2016-2020 deliver exact information about urban and non-urban heat areas of Sofia.

For the practical part of the research are used only freeware platforms and software's developed by European Space Agency as a part for Copernicus Programme funded by European Commission [6], the software QGIS is used to link and verify the satellite data with GIS [7]. On the workflow diagram (fig.2) is represented the algorithm of satellite image processing, data validation and verification, retrieved analysis are saved for future work.

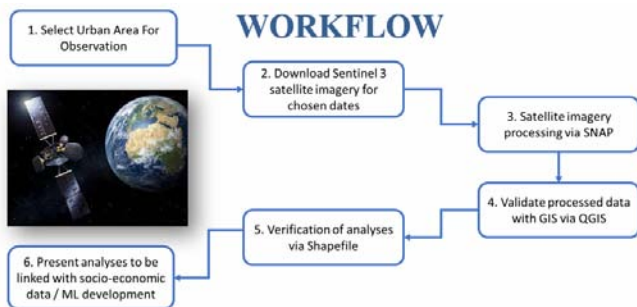


Fig. 2. Workflow Diagram

1. Satellite data is downloaded from Open Access Hub [8]. Once the platform is accessed a study area should be marked (selected) with polygon as it shown on (fig.3). To filter the results from the search of satellite images are selected exact dates, satellite mission, product type and instrument.

Select Urban Area For Observation

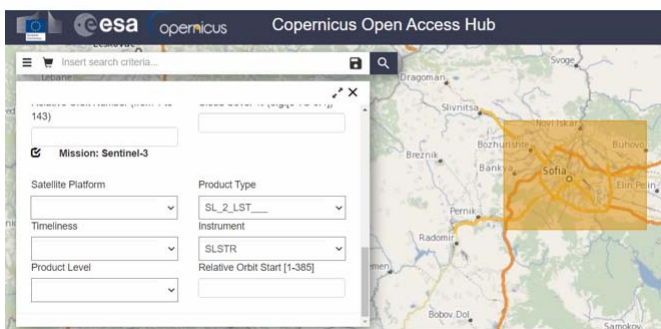


Fig. 3. Urban Area Region for Observation

The results from the search are shown only satellite imagery from mission Sentinel-3, using instrument SLSTR with 9 channels in the visible thermal and short-wave infrared spectrum, scanning with 1 km resolution. Selected product type in this case is Land Surface Temperature, i.e., SL_2_LST [9]. This product type provides measurement file with LST values and associated parameters with 1 km measurement grid. The measurement dataset include:

- Normalised Difference Vegetation Index (NDVI)
- Glob Cover surface classification code (noted biome)
- Fractional vegetation cover
- Total column water vapour.

2. For the experiment are downloaded following images from Open Access Hub platform:

- [S3A_SL_2_LST_20160802T185313_20160802T203412_20160802T144957_6059_007_113_LR1_R_NT_003],
- [S3A_SL_2_LST_20160802T084717_20160802T102817_20160802T144927_6059_007_107_LR1_R_NT_003],
- [S3A_SL_2_LST_20200804T082824_20200804T083124_20200805T141335_0180_061_178_2160_LN2_O_NT_004],
- [S3A_SL_2_LST_20200804T082824_20200804T083124_20200805T141335_0180_061_178_2160_LN2_O_NT_004].

On (fig. 4) Is presented detailed view of satellite imagery from 2nd of Aug 2016 at 18:53:13 i.e., night picture which will be used for the research. For data comparison and validation is downloaded one more image from the same date during the morning hours (08:47:17). The same operations are performed for the 2020 period.

Download Sentinel 3 images

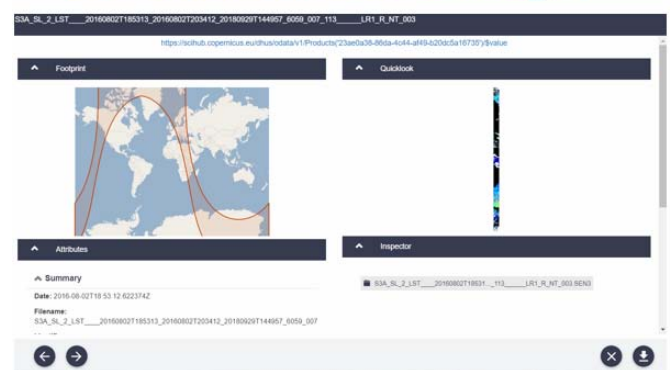


Fig. 4. Detailed view of satellite imagery from 2016

3. Once Sentinel 3 data is downloaded it should be unzipped in the chosen directory. For the satellite image calculations and processing is used free software Sentinel Application Platform (SNAP) developed by ESA [10].

4. Once the satellite imagery processing with SNAP is completed it is saved in GeoTiff for future work. Pixel values are compared with QGIS to validate processed satellite data. An additional colored classification layer has been added to verify satellite data through geographical information systems.

5. Geospatial data of observed area affected from urban heat phenomena is verified with shape file created for comparison between different satellite imagery and negative effect of UHI during the day and the night for 2016 and 2020.

6. These results are also a kind for developing variety machine learning models in order to observe and predict important topics, like how to handle with the negative effect caused by UHI.

III. EXPERIMENTS

3.1. For the purposes of the experimental part of this research are used the automatic functionalities of SNAP software. After image extraction from zipped file, data is ready to be read by SNAP as it shown on (fig. 5). An image with scan of full orbit is visualised in the black white gamma, the direction of satellite imagery depends from ascending or descending date of the acquisition scanning plans.

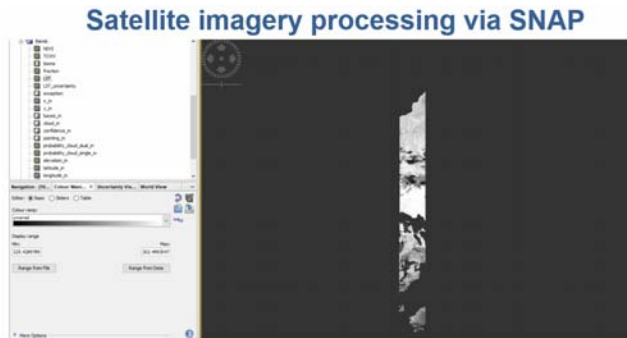


Fig. 5. Satellite Image Processing via ESA SNAP:
S3A_SL_2_LST____20160802T185313_20160802T203412_2018
0929T144957_6059_007_113____LR1_R_NT_003

Two types of subsets are made in order to extract data only for the study area of the research. First subset is for spatial subset it marks the observed area and reduce the image size. For the second subset are used only the necessary bands (NDVI, Biome, Fraction, LST, geographical coordinates and information). LST band is used to provide the result of the subset calculations of the observed region (fig. 6).



Fig. 6. Result from the subset satellite image:
S3A_SL_2_LST____20160802T185313_20160802T203412_2018
0929T144957_6059_007_113____LR1_R_NT_003

Images are reprojected to UTM map projection in order to prepare the data for the next visualisations and analysis. The result of UTM reference system reprojection is visualised on (fig. 7) it shows that the image fits in UTM matches grid.

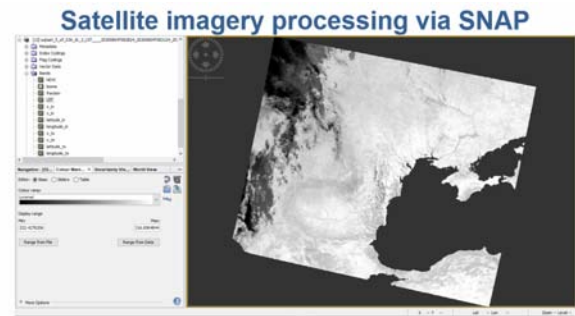


Fig. 7. UTM reprojection (TUM/WGS 84)
[S3A_SL_2_LST____20200804T082824_20200804T083124_2020
0805T141335_0180_061_178_2160_LN2_O_NT_004]

For the final subset exact geographical coordinates are given to retrieve the data only from the urban and non-urban areas around the observed region. Good point to consider is that pixels size measuring is 1 square km. The main band used for the image processing is LST because it contains the measurements for the land surface temperatures. Color rendering is performed using Color Manipulation tool. Five color ramp is chosen to visualise the temperatures measured in Kelvins. Minimum values for the color display range are set to 290.5 Kelvins (K), for the max values are set 325 Kelvins (K). (fig. 8). Urban and non-urban areas are identified along with reading the color bar, each pixel carries information about min and max values measured by the sensor. It makes it

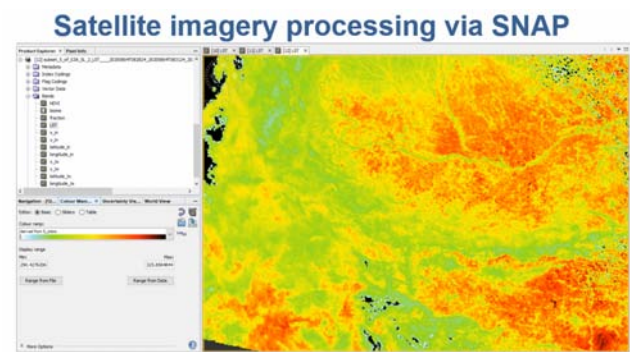


Fig. 8. LST Band – colour representation in Kelvins

To calcify the urban and surrounding areas a Land Cover Band feature of SNAP is used. An additional land cover layer CCILandCover-2015 is added to the bands for further analysis of urban and non-urban areas. The system of automated classification with CCILandCover-2015 is designed as a hierarchical classification using UTM map projection and is globally consistent. On (fig. 9) is presented global legend of CCI-2015 layer with different classes.[11]

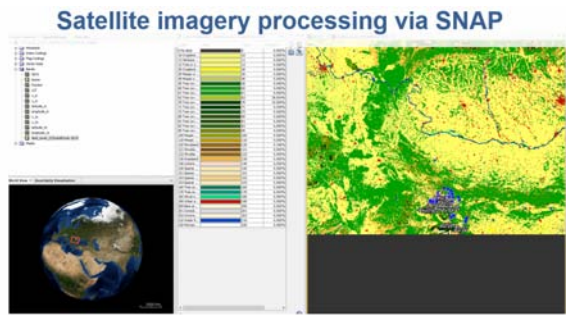


Fig. 9. Land Cover Layer Classification Classes

For the data comparison and validation next step from the image processing algorithm is to visualise CCI land cover band and synchronise it with the processed satellite image. It provides geographical synchronisation which allows to identify urban and non-urban areas by pixels (fig. 10).

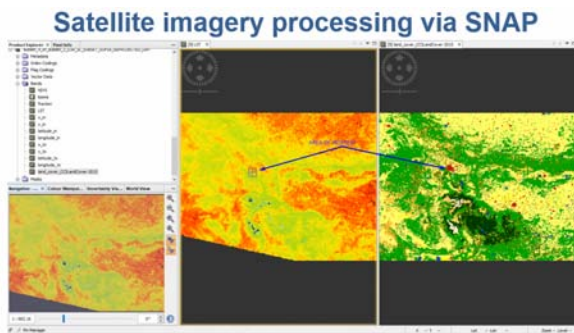


Fig. 10. Validation of Observed Area with Land Cover Band

To identify the pixels which do not belong to the urban class and to see how the effect of urban heat phenomena affects the urban and surrounding area an xml file with pins is created. Pins are placed over the pixels which belongs to different classes around the urban area. To have precise measurements for the next steps of the experiment is necessary to create an xml file which contains more than 15 pins with different classes. A presentation of loaded xml file with the pin's location validates two different areas i.e., urban and surrounding areas for the satellite imagery are from date 4th of Aug 2020 retrieved morning and evening hours. (fig. 11).

With automatic analytics statistics tool is calculated the value which represents the temperature of surroundings. Xml file is used as region of interest mask to derive the average value of those pixels. In this case the average value of selected pixels is 306.29121725899836 K (fig. 12). This calculation represents the background temperature of the environment.

Final step from the analysis in SNAP is to deliver information about Urban Heat Island effect. A subtract from the night acquisition with the temperature of the surrounding area is made with double expression using Band Maths Expression Editor. UHI effect is calculated as from the LST

band of the observed area are subtracted the average values represents the background temperature of the environment (fig. 13). A new band is created.

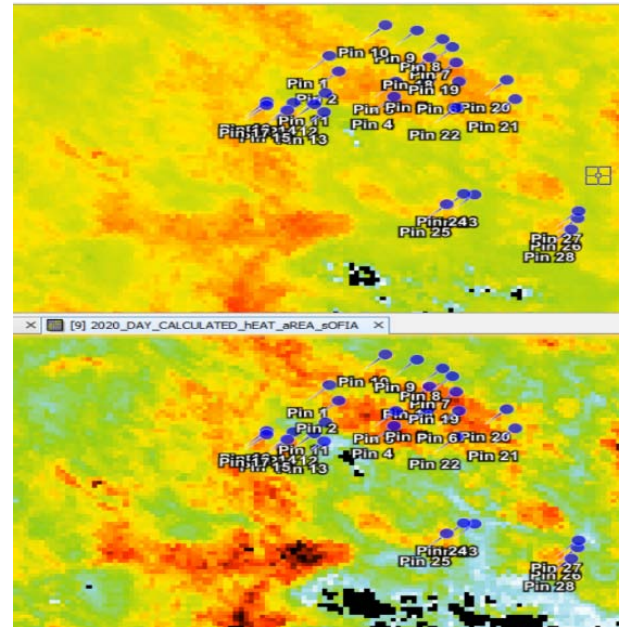


Fig. 11. Validation of Urban and Non-urban Areas with pins

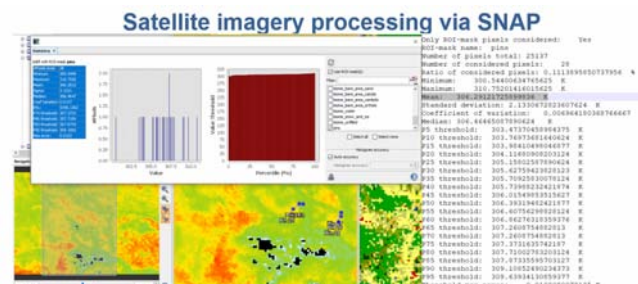


Fig. 12. Average Value calculated with Statistics tool

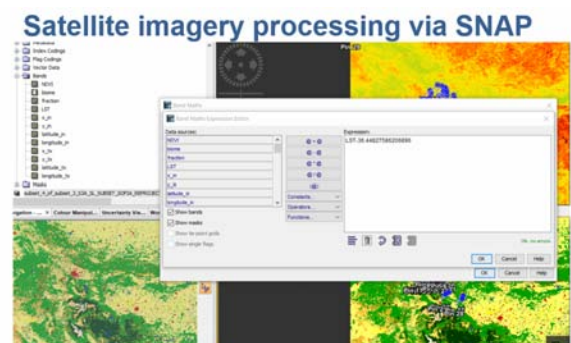


Fig. 13. Heat Phenomena Calculation: LST – Average value

The results from UHI surface are visualised using the color manipulation tool reference min and max values are set through scale from 0 to 7 data is retrieved by range (fig. 14). They

clearly show the difference of the temperature measured by the sensors and main value as referenced pixels. Thus, processed satellite images are ready for post processing analyses.



Fig. 14. Urban Heat Phenomena results

Urban heat calculations are received by the Land Surface Temperature (LST) band of satellite mission Sentinel 3. Day and night satellite imagery with combination of different kind of image processing methods like: subset, reprojection, land cover layer classification, statistics and band math techniques using Science Toolbox Exploitation Platform (SNAP) software finishes the first part of analysis. The same methodology is performed for all four satellite images. Results from remote sensing processing are exported in GeoTiff format to verify the analyses.

3.2. For the data validation of satellite image processing is used software QGIS. QGIS is a geographical information system software which allows to verify and to make changes over different kind spatial analyses. For the purposes of the experiment a base map layer – Open Street Map is used, the location of observed area of exported satellite image in GeoTiff format is validated (fig. 15).

Validate processed data with GIS via QGIS

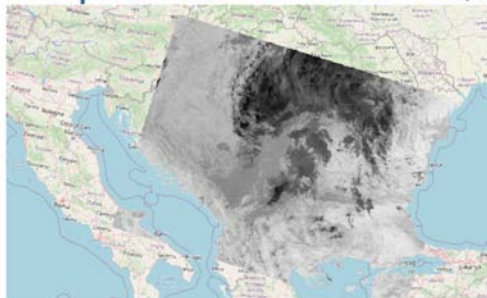


Fig. 15. Processed in GeoTiff format satellite imagery

An additional layer with five color range pallet is created to verify the calculations of UHI effect. The scale of values is set from 0 to 7 as visualisation of calculations in SNAP. Red areas are the max values of UHI effect, blue values shows that the area is not affected. The color layer is processed to the transparent gamma to allow visibility of the borders and affected regions contained in the next layer.

Validate processed data with GIS via QGIS

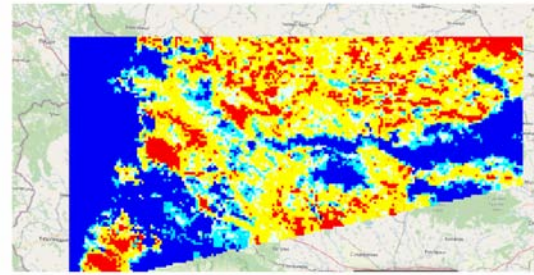


Fig. 16. Color Layer Creation with 5 values 1-7 (5colors)

Further analyses of urban heat phenomena are made using shape file of Capital Sofia which contains borders of neighbourhoods of the city. The purpose of the shape file is to highlight the affected urban and non-urban areas and to provide better visibility of problematic regions. The residential areas of the city of Sofia and the surrounding living regions are depicted in red. (fig. 17).

Verification of analyses via Shapefile

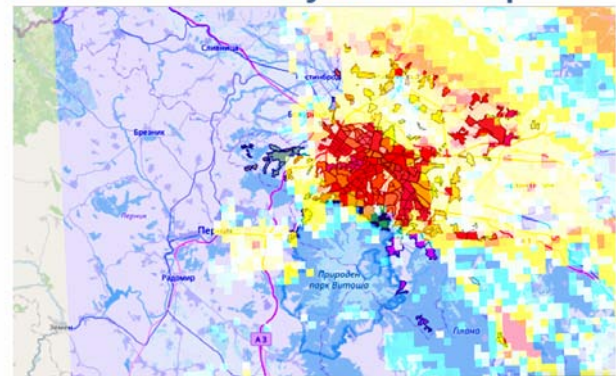


Fig. 17. Verification of Urban Heat Analyses

For satellite data validation the shape file is hidden in order to present the satellite imagery urban heat island calculations over the city area. The results shows that urban areas are colorised in a red color gamma which means that UHI effect is concentrated over the city areas. (fig. 18).

Present analyses to be linked with socio-economic data / ML development

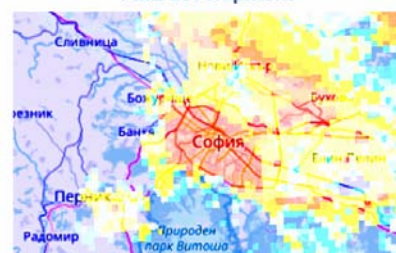


Fig. 18. Analyzed data is ready to be linked with socio-economic data M/L development

Analyses are prepared to be linked with different kind of socio-economic data which could help for further important decisions like urban planning, affected areas by population in different city regions, air quality etc. Satellite data is ready for machine learning models creation and further development. Used software's for this research are only freeware (fig. 19).



Fig. 19. Used software's

IV. RESULTS

The results from the research are helpful to find a solution and to think over different kind of challenges topics which depends well developed cities around the world. The significant results from the research are:

1. Evolution of fast-growing cities and UHI effect
2. Satellite image processing using with Sentinel 3, SLSTR instrument, LST band.
3. Validation of extracted data using GIS software
4. Data readiness for future work with socio-economic data or ML development

V. CONCLUSION

The report highlighted the importance of Remote Sensing and GIS which provide exact data for important analysis in challenge topics nowadays which humanity is facing. A machine learning models could be developed in order to

predict future urban affected areas.

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 - [11] <https://scihub.copernicus.eu/dhus/#/home>
 - [12] <https://sentinels.copernicus.eu/web/sentinel/technical-guides/sentinel-3-slstr/level-2/land-surface-temperature-lst>
 - [13] <https://step.esa.int/main/toolboxes/snap/>
- https://maps.elie.ucl.ac.be/CCI/viewer/download/ESACCI-LC-Ph2-PUGv2_2.0.pdf

World forest changes and deforestation with GIS

Lyubena Nacheva-Grigorova¹

Abstract – Deforestation is the conversion of forested areas to non-forest land use such as arable land, urban use, logged area or wasteland. This study aimed to visualize deforestation worldwide and on the different continents for the period 1990-2015. The main purpose is to visualize text data for better results and analysis and use the data for further machine learning prediction. Visualization of spatial data is based on using modern programming languages and their specific libraries. This visualization could use for better analysis and detect factors influencing forest degradation of the world or for the concrete area. Target method is to trace deforestation in Europe, Africa, North America, South America, Asia and worldwide through Python programming language. For the visualization of the data was used an interactive choropleth map. The main purpose of this paper is to show how GIS instruments and Python programming language could help in world forest management and contribute for better analysis and observation of forest loss. From a protected area management perspective, the maps of forest change patterns can help protected area managers to identify places, where conservation and forest management efforts should be focused. At a larger scale, the observation of forest change patterns can aid long-term sustainable forest management.

Keywords – Deforestation, Python Programming Language, Geographic Information Systems, Spatial Database, Forest Management

I. INTRODUCTION

Trees are essential for life on Earth. Nearly a third of our planet's land is covered by trees. At local, regional, and global scales, forests play pivotal roles in enabling life to flourish on our planet.

Deforestation is the conversion of forested areas to non-forest land use such as arable land, urban use, logged area or wasteland. According to Food and Agriculture Organization of the United Nations, deforestation is the conversion of forest to another land use or the long-term reduction of tree canopy cover below the 10% threshold. Deforestation can result from deliberate removal of forest cover for agriculture or urban development. The combined effect of grazing and fires can be a major cause of deforestation in dry areas. Deforestation implies the long-term (>10 years) or permanent loss of forest cover. [1]

Spatial Databases are very useful for different use cases in our world [2].

Over the decade since 2010, the net loss in forests globally was 4.7 million hectares per year.¹ However, deforestation rates were much significantly higher. The UN FAO estimates that 10 million hectares of forest were cut down each year.

This study aimed to visualize deforestation worldwide and on the different continents for the period 1990-2015. The main purpose is to visualize text data for better results and analysis and use the data for further machine learning prediction. Visualization of spatial data is based on using modern programming languages and their specific libraries. This visualization could use for better analysis and detect factors influencing forest degradation of the world or for the concrete area.

II. EXPERIMENTS

Forest management is the process of planning and implementing practices for the stewardship and use of forests to meet specific environmental, economic, social and cultural objectives. It deals with the administrative, economic, legal, social, technical and scientific aspects of managing natural and planted forests. It may involve varying degrees of deliberate human interventions, ranging from actions aimed at safeguarding and maintaining forest ecosystems and their functions, to those favouring specific socially or economically valuable species for the improved production of forest goods and services.

The main purpose of this paper is to show how GIS instruments and Python programming language could help in world forest management and contribute for better analysis and observation of forest loss worldwide and over concrete area. Through interactive maps it is possible to monitor forest changes over selected area for the observed period of time.

PURPOSED METHOD

GIS maps are one of the clearest and most accurate ways to share geographic data, and provide much more information and analysis than typical paper maps. For local communities, it can be an invaluable tool to stake out traditional boundaries and resolve land conflicts with government and developers.

The target method is to trace deforestation in Europe, Africa, North America, South America, Asia and worldwide through Python programming language. The period used for data analysis is: 1990-2015.

The software package used to analyze the data was Google Colaboratory. The programming language was Python with his libraries: Panda and Plotly. Pandas is fast, powerful, flexible and easy to use open source data analysis and

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manipulation tool, built on top of the Python Programming Language. Plotly's Python graphic library makes interactive, graphs and supports over 40 unique chart types covering a wide range of statistical, financial, geographic, scientific, and three-dimensional use-cases. Plotly.py is free and open source.

The datasets are from www.kaggle.com website. This website is a reliable source for different kinds of data. The dataset contents 475 rows and 4 columns with data.

WORKFLOW

The workflow of this study was: finding and downloading the dataset. The next step was the setup the google colab environment. After that was the creating of Python function for the maps. With this function was created the World Map, North America Map, South America Map, Asia Map, Europe and Africa Maps.

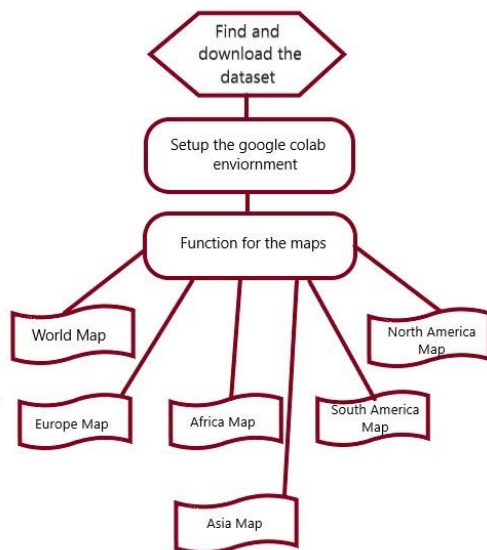


Fig. 1

The experimental work started with downloading the dataset and loading it in Google Colab environment. The dataset was checked and used in the further Python function.



Fig. 2. Loading the dataset

For the creation of spatial maps was created Python function that is shown on Fig. 3:

```

def plot_net_conv(scope,title):
    fig = px.choropleth(
        annualChangeForestArea,
        locations = "Code",
        color = "Net forest conversion",
        hover_name = "Entity",
        scope=scope,
        color_continuous_scale='RdYlGn',
        animation_frame = "Year")

    fig.update_layout(title_text=title,
        font_family="Rockwell",
        title_font_size=20,
        coloraxis_colorbar=dict(
            title='Net Forest Conversion'))

    fig.show()

```

Fig. 3. Function to plot Net Forest Conversion over geospatial map

For the visualization of the data was used a choropleth map.

Choropleth maps are popular thematic maps used to represent statistical data through various shading patterns or symbols on predetermined geographic areas. They are good at utilizing data to easily represent variability of the desired measurement, across a region. Choropleth maps typically deal with data that can be represented numerically. The data must be standardized, and cannot be raw. The dataset that was used is ready and structured.

On fig. 4 is shown worldwide deforestation for the observed period: 1990-2015.

In the next spatial maps is observed the net change in forest cover across the world – visually depicting whether or not the countries able to reforestation faster than they are losing the trees. Net forest loss is not the same as deforestation – it measures deforestation plus any gains in forest over a given period.

Net forest change – The net change in forest cover measures any gains in forest cover – either through natural forest expansion or afforestation through tree-planting – minus deforestation.

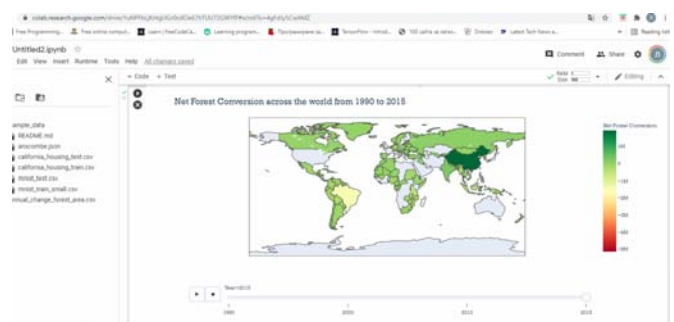


Fig. 4. Net Forest Conversion worldwide

On fig. 5 is shown net forest conversion in Asia for the observed period of time.

For Asia is typical medium to high population density, low to rapid population growth, low to high climate impacts and low to large growth in planted forest area.

In Asia we should focus on: increasing productivity from existing resources, adaptation to extreme climate impacts and adaptation to drought and health risks.



Fig. 5. Net Forest Conversion in Asia

On fig. 6 is shown net forest conversion in Africa for the observed period of time.

For Africa is specific: low to medium population density, medium to high population growth, medium to high loss of natural forests, low to high increase in planted forest area, low to medium climate impacts and low to high health impacts.

It is important to focus on expanding planted forest area, adaptation to drought and health risks and forest health management.

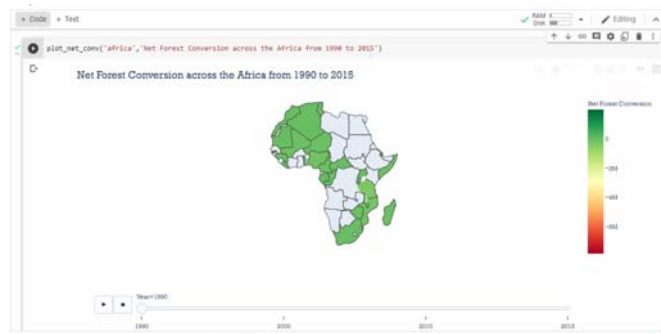


Fig. 6. Net Forest Conversion in Africa

On fig. 7 is shown net forest conversion in Europe for the observed period of time.

For Europe is typically: medium density, but stable population, stable natural forest, low planted forest expansion, medium climate impacts and high disease impacts.

It is good to focus on: climate adaptation and forest health management to maintain status.



Fig. 7. Net Forest Conversion in Europe

On fig. 8 is shown net forest conversion in North America for the observed period of time.

For North America is typically: low population density, low population growth, stable natural forest, high increase of planted forests, medium climate impacts and high health impacts.

It is good to focus on health management and adaptation to extreme climate impacts.



Fig. 8. Net Forest Conversion in North America

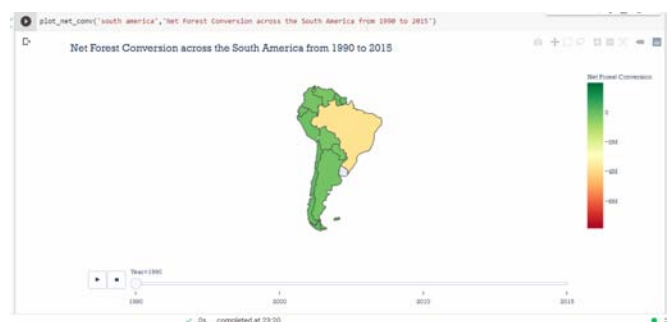


Fig. 9. Net Forest Conversion in South America

On fig. 9 is shown net forest conversion in South America for the observed period of time.

South America characterized by the low population density, medium population growth, medium loss of natural forest, high increase in planted forest area, low climate and health impacts.

It is really important to focus on: increasing planted forest area and adaptation to extreme climate impacts.

III. RESULTS

The following results extend the knowledge of using spatial databases and possibilities of Python programming language.

This method represents a visual presentation of forests loss worldwide and for every continent interactively for the examined period of time. The benefits are:

1. Good visualization and easy to understand analysis of deforestation in global or for concrete region.
2. Animated spatial visualization for the world forest loss from 1990 until 2015.
3. Good analysis of forest loss and the impact on our Planet.
4. It is possible to use the data for further predictive models with machine learning to predict and detect areas with high risk of forest loss.

IV. CONCLUSION

The consequences of the loss of trees and other vegetation could cause climate change, soil erosion, flooding, increased greenhouse gases in the atmosphere, air pollution, and biodiversity losses. Deforestation affects ecosystems. Additionally, the forest adds to local humidity through transpiration (the process by which plants release water through their leaves), and thus adds to local rainfall.

The identification of the areas vulnerable to forest changes is fundamental and important implications for biodiversity conservation in the different world regions.

From a protected area management perspective, the maps of forest change patterns can help protected area managers to identify places, where conservation and forest management efforts should be focused. At a larger scale, the observation of forest change patterns can aid long-term sustainable forest management.

GIS instruments are useful for world environmental impact analysis, urban planning, transportation planning, agriculture applications, disaster management and mitigation, emergency management...

Forests are a dynamic resource, affected by many coexisting ecological processes and direct management interventions.

Forest planning and analysis of forest loss are one of the most important aspects of environmental use cases. Forests are resources but also big part of ecologic and environmental management for our Planet. For the forests management machine learning and GIS instruments are of great benefit.

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