Newsletter - *Calibrated for Creative Communications*

Vol. 16, no. 1, Spring 2018

Spring Thing

Have you experienced such a Spring Thing?

Our Spring Issue will place you into its cockpit, yet be warned: to zigzag across the Internet of Things you need the skills to understand the dynamics.

Our Cover Story, as part of a general introduction, is on the Internet of Things and Smart Cities. It sets the scene for the visions of leading professionals to lead you further into the 2018 trends, and beyond.

We hope their visions will project a speedway of change and innovations, and will raise further queries and demands regarding research and applications.

While going through, ask questions!

- What/who sets the tech-scene?
- What are the challenges, and the rewards?
- Where are the breaking points?

The Spring Issue takes a glimpse at the IT history of the Western Balkans – one of the priorities of the current EU Presidency!

Take the Journey!

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Contents

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New Member – Honorary Advisory Board

Mengqi Zhou has been with the Chinese Institute of Electronics (CIE) since the 1970s and has held the positions of Director for International Activities, Deputy Secretary General, and Vice-Chairman of the International Working Committee of CIE.

Dr. Zhou is one of the leading inaugurators of the IEEE Beijing Section in the early 1980s and IEEE China Council in 2006. As an IEEE volunteer in China, he has contributed to IEEE for many years. He has sponsored and organized many international technical events in China, such as the 16th World Computer Congress, the International Symposium on Signal Processing, the International Conference on Solid-state and IC Technology, the International Conference on ASIC and the International Conference on Microwave and Millimeter Wave Technology.

He is chief editor and translator of 5 books and a Chinese-English Learning Dictionary published in China. ■

ADVISORY BOARD

EDITORIAL POLICY

This Newsletter maintains a world-class standard in providing researched material on ICT and Information Society activities from the perspective of Central, Eastern and Southern Europe (CESE) within a global context. It facilitates the information and communication flow within the region and internationally by supporting a recognized platform and networking media and thus enhancing the visibility and activities of the IT STAR Association.

The stakeholders whose interests this newspaper is addressing are

- IT STAR member societies and members
- ICT professionals, practitioners and institutions across the broad range of activities related to ICTs in government, business, academia and the public sector in general
- International organizations

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Special arrangements for the production and circulation of the Newsletter could be negotiated.

The newsletter is circulated to leading CESE ICT societies and professionals, as well as to other societies and IT professionals internationally. Everyone interested in CESE developments and working in the ICT field is welcome to contribute with original material. Proposals for articles and material for the Newsletter should be sent two months before the publication date to info@starbus.org.

THE INTERNET OF THINGS AND ITS IMPACT ON SMART CITIES

Augusto Casaca, INESC-ID/ INOV, Portugal

1. THE INTERNET OF THINGS

The Internet of Things (IoT) is the latest development in the evolving Internet. IoT includes the interconnection of smart devices (things), which range from appliances to sensors, to the Internet. There are several forecasts for the number of smart devices to be connected to the Internet in the not distant future. Although the forecast numbers depend on the study, it is highly probable that we will have billions of devices connected after 2020 [1].

The number of applications that are based on the IoT is also large and extends into a wide range of fields. There are examples of applications in agriculture, autonomous vehicles, industry automation and smart cities, to name only a few. At present, the deployment of IoT and of its applications is progressing significantly worldwide and the technical literature supplies a widespread list of IoT realizations.

In this article we make a short introduction to the state of the art concerning the technical aspects of IoT, followed by an illustration of some relevant applications for the smart city environment.

2. THE INTERNET OF THINGS COMMUNICATION ARCHITECTURE AND PLATFORMS

The IoT has to interconnect billions of heterogeneous devices through the Internet. IoT devices are characterized by their low cost and low power and they should be interoperable. The appropriate IoT communication architecture is a layered model following principles similar to the Internet architectural principles. There are several proposals of communication layers for the IoT architecture [2]. One of the most popular has been adopted in the International Telecommunications Union (ITU-T) and consists of four layers [3]: Device layer, Network layer, Application Support layer and Application layer. They are shown in Figure 1.

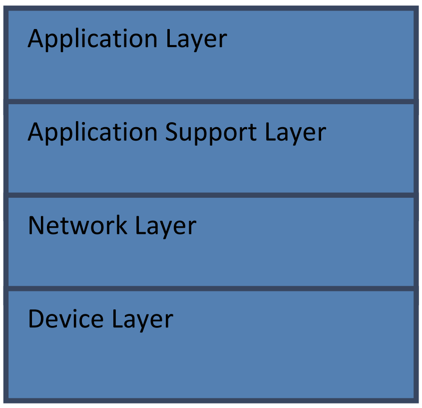

Figure 1.IoT communication model

The Device layer deals directly with the communication capabilities of the IoT devices (e.g., sensors, actuators, appliances). It basically includes the traditional physical and data link layers in the Internet model. The Network layer includes the function of interconnecting devices and gateways and also the end-to-end transport capability. It roughly corresponds to the network and transport layers in the Internet. The Application Support layer provides capabilities that are used by the applications, like database management and common data processing. Finally, the Application layer includes all the applications that interact with the IoT devices.

The communication protocols for transporting application data units in the IoT run at the network and device layers. At the network layer, the idea is to use the Transport Control Protocol (TCP) or the User Datagram Protocol (UDP) over the Internet Protocol (IP). Concerning IP, its version 6 (IPv6) is the preferred one as it provides a much larger range of addressing. However, in some cases, version 4 (IPv4) can still be used. Also, the use of IPv6 over Low-Power Wireless Personal Area Networks (6LoWPAN) is encouraged, so that compressed headers for IPv6 can be used, which is most appropriate for low power wireless networks.

At the device level, which roughly corresponds to the two lower layers of the Internet model (data link layer and physical layer), traditional protocols like Wi-Fi or cellular can be used. Also, a new version of Bluetooth for Low Power (BLE) appeared for use in the IoT. BLE uses a short-range radio with minimal power to enlarge the operation time and also has a higher range coverage and lower latency than Bluetooth. New communication protocols, specifically conceived for IoT, have also emerged recently. They are characterized by low bit rate and low power, which are features typically associated to IoT. Two of the best examples are the SigFox and the LoRaWAN protocols. Also for low bit rate and low power, we have NB-IoT, defined by the 3GPP standard body, for a cellular coverage. In the future, there is a high expectancy from the new 5G cellular network, which will start operating in a couple of years in some countries. 5G has defined Massive MTC (Machine Type Communication), which is the one for IoT, as one of its three pillar use cases (the other two are enhanced broadband connectivity and ultra-reliable low latency communications). However, Massive MTC will probably be introduced only after the enhanced broadband connectivity, which is the 5G priority service at the moment.

The hardware platforms are key elements for the computational ability of the IoT. There are several hardware platforms ready for running IoT applications, like Arduino and BeagleBone among others. Operating systems running in these hardware platforms have also to be adequate for the IoT environment and, preferably, being Real Time Operating Systems like Contiki and TinyOS. The Cloud platforms give also a strong contribution to the computational part of IoT. These platforms can receive a large amount of data from sensors and other smart objects, process that data in real time and send the results to end users. In case the delay involved in communicating with the cloud is too large, a new computing platform was introduced recently, known as Fog computing, which extends the cloud computing to the edge of the customer network. By using Fog platforms the communication delay can be substantially reduced, which is important for real time applications.

Security is another aspect that has to be addressed in IoT, namely in the communication area. The devices in IoT are constrained regarding their computational capability due to their low capacity and low cost. This means that traditional communication security solutions for the Internet need to be adapted for the IoT environment. However, solutions like IPSec at the Internet network layer, and Transport Layer Security (TLS) for TCP, or Datagram TLS (DTLS) for UDP, at the Internet transport layer are strong candidates for communication protection. At the application layer, besides encryption of data and authentication services, there are specific security solutions that are being developed for the different application environments.

3. THE INTERNET OF THINGS BASED APPLICATIONS FOR SMART CITIES

IoT will be the support for a large number of applications (also known as vertical themes). Some of those applications are key components in the roll-out of smart cities, which are ecosystems characterized by an extended deployment and use of information and communication technologies. In the context of smart cities, IoT based applications can be grouped into personal, home, mobile and utilities [4]. This classification, including examples of services, is shown in Table 1.

CLASSIFICATION	DOMAINS	SERVICES
Personal	E-health services	*Use of BAN for monitoring*
		Remote interaction with patients
Home	Smart buildings	*Comfort applications*
		Interactivity with the building
		Energy efficiency
Mobile	Intelligent transportation system	*Traffic congestion control*
		New mobility services
		Infrastructure management
Utilities	Energy and water management	*Smart energy grids*
		Smart water management

Table 1.Examples of IoT based applications for smart cities

In the group of personal applications, the most relevant one is e-health services. For e-health services, the use of Body Area Networks (BAN), based on sensors, are fundamental to allow the remote monitoring of patients by medical staff. IoT can also advance a new wave of home applications in smart buildings. This can be done, for example, through the increase of the sustainability and energy efficiency in the buildings, comfort applications for the occupants and interactivity of the occupants with the building. IoT has also the capability of supporting applications that will impact the mobility of traffic in the city. For example, solutions to better control traffic congestion, new mobility services, use and management of the infrastructure are examples of areas where the use of IoT can have a significant impact.

Concerning utilities, the most relevant applications are related to smart energy grids and smart water management. Smart energy grids originated with the introduction of Information and Communication Technologies (ICT) into the electrical energy infrastructure. In smart cities, it is of particular interest, for example, to investigate how IoT can impact the advanced metering infrastructure and the monitoring and reliability of the distribution grid, including the public lighting. On the other hand, ICT based water management solutions start appearing in the market, and due to the foreseen need of monitoring and control actions to avoid water shortages, these systems will appear more and more in the future. IoT has the potential to enable new solutions for the water management systems and to give a strong push to their deployment.

The practical use of IoT for the development of smart cities can better be illustrated by more detailed examples. We have chosen to focus into the use cases for smart grids and smart water management.

3.1 SMART ENERGY GRIDS

The IoT is an important contributor for the development of the smart energy grid (smart grid in short) and it is clear that there is a direct link between the smart grid and some objectives of a smart city. For the past few years, smart grids have been a strong research topic and some of their features have already been deployed. Among the many features characterizing a smart grid [5] there are three that have a strong impact for a smart city: renewable energy, smart meters and electric vehicles.

The contribution of renewable energy for the electricity supply is continuously increasing since the past decade, namely from photovoltaic and wind sources. However, the use of renewables as a source of energy brings challenges to the electrical grid. One of the challenges has to do with the classic paradigm of the grid that associates energy generation followed by consumption. This is no longer valid if we wish to have an efficient use of the renewables and energy storage needs to be introduced in the grid. Solutions for energy storage are still incipient, but they will increasingly appear in the coming years. The second challenge has to do with the inverted power flows (from distribution into transmission side) in the grid originated by the renewables, which typically inject energy into the distribution side of the grid. This requires new technical solutions for power quality control, over-voltage control, fault protection and reconfiguration of the grid. The implementation of these

technical solutions is based on sensing and automatic actuation in the grid, which can use the IoT protocols for the communication in the grid between sensors, actuators and intelligent units where the control algorithms are running.
Smart meters for the consumers have been, and are being, deployed in many countries by the electrical distribution operators. They allow the consumers to have their invoices based on real consumption, they facilitate the use of the demand-response paradigm and help consumers to save energy. Also the deployment of smart meters along the grid will facilitate, for example, the detection and location of faults, the monitoring of the power quality and reduction of technical losses. Also in the case of the smart meters, an IoT infrastructure will help significantly the implementation of the mentioned features.

Finally, the use of electric vehicles is, no doubt, a trend in the urban environment, but its impact into the grid is still not felt as much as the already existing impact by the use of renewables and smart meters. This is due to the fact that electric vehicles are still catching up and its impact into the grid will be only felt during the next decade. Besides their positive contribution into the environment the electric vehicles can also be used for temporary energy storage in the batteries, but the implementation of vehicle to the grid solutions are still at their infancy. The impact of electric vehicles in the grid will be similar to the impact of renewables and the use of IoT will be also significant.
All these solutions, which can be based on IoT, require not only the use of ICT, but also techniques for big data analysis, security implementation and privacy protection as previously indicated in the IoT architecture section.

3.2 SMART WATER MANAGEMENT

A better management of water resources, distribution and treatment is mandatory, as in a world with more than 7 billion people, water is a key factor for survival. The water cycle, which consists of water production, distribution, consumption and treatment of waste water, is an integral part of the urban system. IoT based systems can give a strong contribution for the optimization of the water distribution and treatment of the wastewater in the water cycle.

Concerning water distribution, better measurements in the distribution network will facilitate the analysis of network failures (e.g., leakages), water quality and consumption behaviour. Sensors and IoT based communications coupled to a central Supervisory Control and Data Acquisition (SCADA) system can originate alerts in real time, which will lead to an appropriate taking of decisions at the operation centre. Some of the decisions can even be automatically implemented through the use of actuators in the distribution system. Additionally, in the water pumping stations, preventive maintenance of the pumps can be programmed and, also, through appropriate algorithms the action of the pumps can be controlled to optimize pump electrical power consumption and corresponding costs.

On the other hand, wastewater treatment plants use processes that also consume a lot of energy. Most of this energy is consumed by wastewater filtering and pumping. Therefore, the focus should be in reducing the energy consumption in these two areas to improve the energy efficiency of the global system. In this case, IoT can be used for telemetering key points in the plant, communicating those measurements to the central SCADA.

In detail, for improving energy cost efficiency, the following actions can be done:

- Deployment of level sensors on the wet well of the pumping stations and of smart meters for telemetering in chosen points of the water network.
- Integration with inflow history information, as well as weather forecast.
- Choosing the lower energy tariffs along the day and negotiating the best tariffs with the energy supplier.
- Calculation of the energy efficiency of each water elevation pump and filtering equipment.
- Performing preventive maintenance of the pumps, based on the evolution of the energy efficiency, working hours, temperature achieved and other specific parameters.

All these actions are based on the use of smart meters, especially developed to measure energy parameters in the appropriate points of the network. Typical measurements, associated with a time stamp, are: voltage, current, power, power factor and energy.

4. CONCLUSION

The IoT and smart cities are currently two hot topics for research in the Communication Networking community. Smart cities are developed based on a widespread information and communication technology support, which includes the IoT as a subset. To illustrate the state of the art, we have considered some of the main applications in smart cities that are supported by IoT and, in particular, the smart grid and smart water management use cases.

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Technology Trends in 2018 and Beyond

Around the turn of each year, many foresight-related publications appear with forecasts on expected trends and developments in various sectors. (Information) Technology is an attractive area for such predictions and our readers have surely run across such material.

The value of our initiative is to base this on the vast experience, within the concrete area of activity, of five participating authors coming from the Region and the EU. Moreover, they have contributed to the IT STAR Newsletter in the past and are well aware of the interests of our readership.

The collated material below provides a sketch of trends and a basis with some preliminary directions for this Newsletter to follow regarding future publications in the outlined fields.

2068

Laimutis Telksnys, the Lithuanian Visionary

On 1 January *1968*, Prof. *Laimutis Telksnys was dared to forecast the future of technology 50 years later. He did it, and we published an article about that in Vol. 12, no. 2, Summer 2014 of IT STAR's Newsletter.*

In early 2018, the visionary Laimutis Telksnys was widely engaged by the Lithuanian press about future technologies after the next 50 years. He summed-up his expectations for our current NL Issue, for which we are also grateful to the LIKS President, Dr. Saulius Maskeliūnas, for making it possible.

Prof. Dr. Habilius Laimutis Telksnys was awarded Lithuania Science Premiums in 1968, 1980 and 2008, was a head of projects "Rural Area Information Technology Broadband Network RAIN" 2005-2008, "Services controlled by the Lithuanian Speech LIEPA"2013-2015, etc. Currently he heads the Lithuanian speech recognition group at "Expansion of Services controlled by Lithuanian Speech LIEPA-2" project.

The community of people and robots is flourishing: Robots, as machine assistants, actively support people - being diligent, obedient, patient, fast and precise, untiring, not striking, as the robot engineers had programmed them.

Several decades ago there was a difficult situation. The citizenry of developed countries was living longer and getting older. The number of employees had decreased. Elderly people were often alone. Immigrants, partly compensating for the shortage of labor force, have caused undesirable side effects – societal instability.

Hence, people have used robots to mitigate the situation. Some of them worked in factories for the production of various products. Other, mobile robots: self-driving vehicles carry people, cargos and goods by land, water and air; humanoids are helping elderly people. Other type of robots – the intelligent mobile robots, created twenty or thirty years ago – are actively working together with people, performing auxiliary work that requires some intellectual abilities.

The basics of this activity were backed-up almost five decades ago when systematic instruction of the young generation to live and work in environments where people interact with robots that have artificial intelligence abilities was conducted.

It is important to note that after several years, robots have appeared, with which people could have voice communication without any language barrier, because tools were created to make it possible to communicate with robots in any world language.

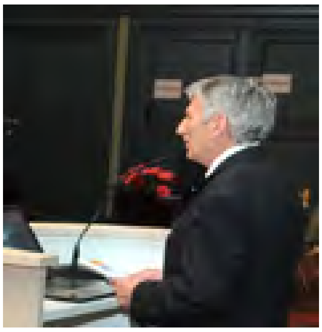
It is also important that the progress of electronics, informatics, management and control sciences has made it possible to produce nanorobots.

They have opened, for example, significant opportunities for the creation and production of new materials with the desired properties.

Nanorobots are of particular importance to healthcare – when injected into the body, e.g. into blood vessels with syringe, they travel through the body to carry-out organ prophylaxis, to "repair" disorders, to cleanse the blood vessels from accumulated unwanted substances, to fix neuronal breakdowns. ■

Quantum Computers, AI, Crypto Currencies

Niko Schlamberger

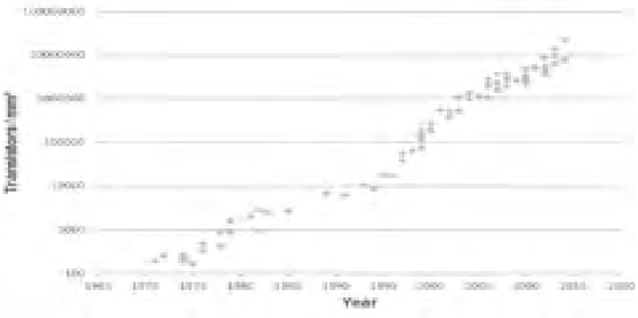


***SSI** President, Past President of **CEPIS** and former **IFIP** Vice President*

Let me start with a quote by **Mohandas Karamchand Gandhi** who said the future depends on what you do today.

It is hard to explain in a few words the tremendous possibilities that open with development but let me try to address three domains that are likely to be discrete disciplines not just in 2018 but much farther beyond:

As for technology, we have got used to ever faster, ever smaller and ever more powerful computers but hardly ever think that reduction has physical limits.



Source:https://leepavelich.wordpress.com/2014/12/20/moores-law-graphs-annoy-me/

Moore's law has been formulated in the mid 1960s maintaining that the number of transistors per unit of integrated circuit area doubles roughly every two years and it seemed at the time that a limit was too far away to think about. However, when the size of an atom is reached that is the end of the road, which seems to be already rather close today.

To keep with the trend, new approaches must be invented and one at least is already on the horizon – the **quantum computer**. There are successful developments that are encouraging but the technology is only a start of a long travel.

In software, we shall see a massive usage of **artificial intelligence**. A forecast that it will reach the level of human intelligence by 2050 is overly optimistic but it will surely simplify many aspects of life much sooner. To wit, driverless vehicles are reality as it is, the computer beat the world chess champion, has won a match with a grand master, and there is much more to come. But that are rather isolated applications compared to what a human being must have power over to be able to function as a social being. I also believe that creativity will be a privilege of man until the computer is bestowed with a mind, which is still very far away.

In business, we presently witness another development that is usually associated with **crypto currencies**, which, incidentally, are not currencies and much less money but mere tokens – the block-chain. The technique has been invented to ensure trustful transactions without a trustworthy go-between but its potential is extremely far-reaching. In abolishing the need for an intermediary such as a bank it will enable designing new business paradigms. That poses new homework upon governments. They will need to provide for rules and legislation to cope with new challenges that will appear with new models of business and the way of life at large.

So, to finish this look forward by using the wisdom of **Gandhi**, we should be very careful about what we do today if we want to have a bright tomorrow. ■

The Indian STAR Connection

IT STAR Editor *Plamen Nedkov* with *Sheila Kaul* (Feb. 1915 – June 2015), Indian stateswoman, cabinet minister and governor, **Jawaharlal Nehru's** sister-in-law and **Indira Gandhi's** maternal aunt, and daughter *Deepa Kaul*, at auntie Sheila's home in Uttar Pradesh, in March 1999. ■

Artificial Intelligence (AI) - From Hype to Successful Applications

Martin Przewloka

***Martin** is university professor and Chief Digital Officer responsible for the innovation management of msg systems AG, Munich, Germany*

The so-called "Digital Transformation" (DT) has identified a central playing field with the keyword "Artificial Intelligence" (AI). Even though AI has been known and discussed for decades, it is given right now a completely new meaning. Algorithms will dominate our lives. There is almost no technical device that misses the imprint "intelligent", or in other words: with "Smarties" one no longer directly associates sweet candies, but a telephone (smartphone), a factory (smart factory), a supply network (smart grid) and much more.

Digital Assistance Systems, as part of DT, are designed to assist users in certain actions or situations with the help of digital technologies. The prerequisite for this is a current, data-driven situation analysis optionally extended by historical and forecast data. Therefore, digital assistance systems will benefit significantly from the development of AI and Machine Learning (ML). Digital assistance systems can be fully autonomous, semi-autonomous or even advisory. Likewise, such a system can be implemented using a variety of communication channels such as, for example, text-based, voice-based, noise and / or motion-based channels and many more.

Successful digital transformations are based on three essential aspects: firstly, the application of a highly scalable technology with highly digressive marginal costs. Secondly, by the development of new use cases or business models, and thirdly, by an exponential adaptation or acceptance by the user. Research and development (R&D) undoubtedly drive the first aspect forward. Experience shows, however, that the third aspect in particular carries the most uncertainties with it, and thus success or failure in the context of useful application areas seems hardly predictable. This is all the more true for the development and market introduction of digital assistants using AI patterns. The business advantage will only be achieved if the parameter of acceptance by design is included in the solution development. The following exemplary application domain should substantiate this more detailed.

Example: "The next generation of successful Robotic Process Automation (RPA): a supporting system instead of a fully automated system"

The automation of industrial processes is one of the most central topics of DT. Triggered not least by the so-called Industry 4.0 model and discussion, digitization should enable industry to bring innovative products and services to global markets faster, more flexibly and, above all, more efficiently. Robotic Process Automation (RPA) is an advanced form of automation that uses digital technologies to deliver significant cost savings and faster turnaround times, especially in high-volume business transactions. As a rule, it is assumed that repetitive and relatively less complex or less variable processes are suitable for this evolutionary next step of automation. The addition of AI as part of the hype of this technology leads to the next generation of RPA in the form of a digital assistant, which manifests itself then, for example, in a fully autonomous factory or clerical.

On the other hand, the use of RPA is not considered enough from the point of view of continuous process improvement, permanent assistance and decision support. This requires an alternative view of process automation, especially for non or less standardized processes: RPA systems, as self-learning digital assistants, have to relieve people of inefficient work steps and sequences and to create continuously improvements to the working environment. The goal must be to expand the necessary scope for creative and complex decisions taken by humans. This form of AI-based RPA, represented by digital assistants, is working in synergy with humans instead of replacing them.

Conclusion

The foregoing application area given by way of example only represents a small part of how AI-based digital assistance systems can be created with the aid of state-of-the-art information technology, with the aim of significantly changing our private, professional and industrial environment. The real and virtual (digital) world will merge together. In concrete terms, this means that AI in the form of digital assistance systems should not be understood as a substitute for human mechanical or brain work, even though occupational and activity fields will change massively, but rather as a supportive system for humans. The technological development is so fast that we obviously cannot manage to map added value generating applications. The latter is so difficult because we put the (full) automation idea too much in the foreground and overlook the fact that completely new, cooperative working forms must form man-machine dependencies. Interdisciplinary approaches to creating sustainable digital assistance systems by using appropriate AI methodologies are therefore opportune. ■

Skills and Training Requirements useful to the DPO

Giuseppe Mastronardi

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Companies, institutions, public administrations and professional offices by May 2018 must be compliant with the new privacy regulations, as foreseen by the recent GDPR[1] (*General Data Protection Regulation - UE 2016/679*).

This regulation outlines the duties, responsibilities and structures for which the DPO (*Data Protection Officer*) must carry out activities.

This is a role, which is preferable to be carried out by a consultant, outside the organization of the holder/manager of data processing, in order to guarantee the evaluation impartiality, in the context in which it is called to operate and express an opinion. The DPO is called to play its role in full independence and to operate in the absolute absence of interest of conflict.

The DPO, to satisfy all the requirements defined by the GDPR, must be able to perform the following tasks:

1) to assist the holder and the controller of internal information;
2) to implement technical and managerial measures that guarantee and to allow to demonstrate that the treatment of data is carried out in compliance with the regulation;
3) to consider the risks related to the processing, taking into account their nature, the scope of application, the context and purposes.

According to art. 39 of the GDPR, the DPO must control the collection of information to analyze and to verify the compliance of data and to carry out information, advice and address activities towards the data controller. But the execution of these activities does not mean that the DPO is responsible for any non-compliance, as the responsibility is and remains of the data controller. The DPO therefore assumes an important role in the activities of assistance to the holder in the exercise of his specific functions. In particular, the DPO must draft the DPIA (Data Protection Impact Assessment), that is the document that certifies the verification of the impact of the data protection systems used in the structure, in order to guarantee the observance of privacy according to the GDPR, evaluating the effectiveness of precautions and countermeasures.

Most of involved institutions are insurance companies, associations, credit and finance banks, condominiums, tax, journalism, justice, business, education, work, marketing, professional orders, electoral data, public administration, public security, health and scientific research, sports, telecommunications (including internet and social media), transportation and videosurveillance. These institutions will need to adapt their internal management processes according to the DPO suggestions.

Although Art. 37 of the GDPR does not specify the professional knowledge and skills that the DPO must possess, this figure must possess adequate knowledge of legal aspects, practice of managing personal data, as well as management skills of information systems, computer security and data protection, risk management and process analysis, without ignoring the important and useful knowledge of the business sector in which the data owner's organization operates. Therefore, an adequate level of specialist knowledge, commensurate with the sensitivity, complexity and quantity of processed data, in order not to make the clients run the risk of undeserved heavy penalties.

AICA[2] already guarantees this knowledge through some of its cross-certification, such as "e4job", "Legal Informatics" and "IT Security", and the vertical ones as "Personal data protection: GDPR, Privacy and Security" and "Privacy in eHealth", whose exams, for the respective modules, can be supported in online mode at one of the many nodes of its wide network of Test Centers, about 3.000, spread throughout the national territory.

[1] http://eur-lex.europa.eu/legal-content/IT/TXT/?uri=CELEX%3A32016R0679
[2] http://www.aicanet.it/certificazioni-informatiche ■

Partner Publication

http://mondodigitale.aicanet.net/ultimo/index.xml ■

European Actions in Support of Skills

André Richier

***André** is Principal Administrator at the European Commission's DG for Internal Market, Industry, Entrepreneurship and SMEs, Unit for Key Enabling Technologies, Digital Manufacturing and Interoperability.*

Europe needs to re-skill and upskill its workforce to address the impact of globalisation, new digital technologies and the automation of routine jobs. The News Skills Agenda adopted by the European Commission in June 2016 includes ten key actions including the *Digital Skills and Jobs Coalition* and the *Blueprint for sectoral cooperation on skills.*

The Coalition has been launched in December 2016. It brings together Member States and stakeholders to tackle the lack of digital skills in Europe. Organisations can join and pledge to take action to carry out initiatives to tackle the digital skills gap. Actions to be achieved by 2020 include:

- Training young people for digital jobs, including through internships/apprenticeships and training programmes linked to local skills needs and concrete job opportunities.
- Supporting the up-skilling and retraining of the workforce for digital technologies by offering all workers the opportunity to assess and upgrade their digital skills.
- Modernising education and training to make the most of digitisation for learning, for work and for life and to provide all students and teachers with the opportunity to develop and upgrade their digital skills.
- The "*Digital Opportunity traineeship*" initiative will provide cross-border traineeships for up to 6,000 students and recent graduates between June 2018 and 2020.

Progress to date:

- Over 300 members and 80 pledges to take action;
- 17 National Coalitions;

In June 2017, a *European Conference on IT Professionalism* was organised in Brussels to discuss on the development of a European Framework for the IT profession based on the *European e-Competence Framework* which had been published by CEN as a European Standard in 2016 (EN 16234-1). The update of the standard is planned for publication in 2019. A *survey* has been launched to gather the views of stakeholders. Suggestions are highly welcome until 2 April 2018.

The Blueprint is a new strategic approach to implement demand driven sectoral skills strategies. It has been launched in 2018 and mobilises key stakeholders from industry, education and employment and use more efficiently resources funding instruments to implement new demand driven sectoral skills strategies in Europe. It will be implemented through scalable and sustainable multi-stakeholder partnerships at EU and national levels in key industrial sectors for Europe. A long-term perspective will be instilled in the partnerships from their outset. The goal is to ensure that success stories and best practices can be scaled up and stimulate an efficient use of the European Structural and Investment Funds and national/regional resources to support the roll-out at national/regional level.

Timeline:

- January 2018: start of the implementation in a first wave of pilot sectors: automotive, space, textile, tourism and maritime technology;
- 3Q2018: start of the second wave of pilot sectors in construction, steel, paper industry, additive manufacturing, green technologies and renewable energy, maritime shipping;
- A third wave is planned with new pilot implementations starting in 3Q2019.Selection of the sectors will be made in 2Q2018.

Finally, the European Commission has adopted on 17 January 2018 a new *Digital Education and Training Action Plan* to make better use of digital technology and support the development of digital competences needed for life and work in an age of rapid digital change. It was discussed at the *First European Education Summit* which took place on 25 January 2018 in Brussels. ■

A Contribution to the History of Computing and Informatics in West Balkans Countries[1]

Marijan Frković, Niko Schlamberger, Franci Pivec

Summary

The history of computing and informatics in the area, which is now known as West Balkans Countries has not been systematically and methodically considered so far. There are a few books that are more or less memoirs and therefore provide a rather narrow and specific view. The ambition of this paper is not to offer a comprehensive overview of the beginnings of deployment of computers in former Yugoslavia but rather to serve as a seminal paper for those that would like to explore the issue in depth. In particular, the paper covers deployment of first computers in Slovenia and Croatia and the influence the process has had on development of related business, profession, and science.

Introduction

The paper deals with history of computing and informatics in the countries now referred to as West Balkans. However,

1 First published in History of Computing – proceedings of the 8th IT STAR WS, 19 Sept. 2014 in Szeged, HU.

actually it is about the said history in the countries that have come to existence as successors of the federal republics of ex-Socialist Federative Republic of Yugoslavia. The denomination WBC is therefore somewhat misleading as the paper does not take into account the history of computing and informatics in Albania, which is definitely one of WBC too. Also, it is not complete as it does not deal with the respective history in Bosnia and Herzegovina, Kosovo, Montenegro, Macedonia, and Serbia. Separate contributions have appeared in IT STAR Newsletters (Vol. 6, No. 4, 2008, and Vol. 12, No. 1, 2014). The former provides the story of the first installed computer Zuse 23 in Slovenia, and the latter the story of development of the first Serbian made electronic computer CER-10. As far as we know, apart from Croatia, Slovenia and Serbia in the rest of the former Socialist Federative Republic of Yugoslavia neither computers nor peripherals were produced. Also the introduction of computers there was rather slow and conservative, which is understandable as the three mentioned republics of Yugoslavia were most economically advanced. Nevertheless we must not ignore achievements in applied computing and informatics that have come about in the period after 1975. In 1980s a notable achievement can be recorded, namely Suad Alagić from Bosnia and Herzegovina has developed at that time a most, if not even the most advanced concept of a data base management system. The reason that he has not lived to see the recognition it deserved is probably the same as that for a relatively short-lived success of Triglav/Trident computer, described further in this paper.

The history of computing in WBC can be roughly divided into three periods: before 1965s, 1965s to 1975s, and after 1975s. The division is arbitrary and reflects authors' perception and experience but can be argued. Before 1965 the deployment of computers was limited to purchase of computers and their use mostly in university. After 1965 computers have been imported also for commercial purposes, training centers have been established, and first faculties of computing and informatics have been founded. In the seventies the country has developed an ambition to produce its own computers. The start was license production of computer peripherals in Croatia and Serbia and after that also license production of computers. This effort culminated with "eigen"-production of minicomputers in Slovenia. Parallel to hardware production also a noticeable development of software can be registered, starting with general usage application software. After 1975 the achievement of Suad Alagić must not be overlooked as his database management concept was probably the world best at the time.

In former Yugoslavia there were no political barriers to import state of the art computer equipment from the West, which significantly influenced faster development of information systems and professional trainings of computer programmers. In that period, the trainings were done abroad and later in the school centers of equipment distributors in Yugoslavia.

Open market and the possibility of buying equipment in the West had a negative influence on the development of computing because users were buying computers mainly from abroad.

A. Brief History of Computing and Informatics in Croatia

Before 1965

In Croatia, the development and manufacture of computers started in 1948 when Tvornica racunskih strojeva Zagreb (TRS, eng: Computing machinery factory Zagreb) was set up, the first of its kind in Croatia. At the beginning, the factory produced mechanical computers.

From 1948 to 1973 there were not any other computer manufacturers in Croatia.

Initiator and the one who built the first digital computer in Croatia was a Croatian scientist, a doyen of computer science in Croatia and worldwide, Professor Branko Soucek, PhD. He developed and in 1959, together with the team from the Institute "Rudjer Boskovic", carried out a project called "256-channel analyzer, memory, logics and programs", which marked the beginning of computer science development in Croatia.

With regard to the achievements in technology then, Professor Soucek's computer was state-of-the-art: logic gates were based on vacuum tubes, the memory used magnetic cores, and the programs were performed at the speed of unbelievable million cycles per second, which was incredible at that time.
The whole device was placed in a closet 2m high, and the cathode tube was used as an output unit to display the data.

After the first fully functional prototype, at the beginning of 1960s, the Institute "Rudjer Boskovic", together with a group of enthusiasts who were involved in Professor Soucek's project, made a series of these computers that were used at the Institute as well as in other institutions.

Apart from practical purpose at the Institute, Professor Soucek's project aroused interest of scientific communities worldwide, so many scientists from all over the world visited the Institute to copy Professor Soucek's computer.

One of the persons to visit the Institute was Mr. Willy Higinbotham, the director of BNL (Brookheaven National Laboratory) from the US, the biggest institute for scientific research in the world, which meant that the work of Professor Soucek, i.e. the beginning of computer science in Croatia, was recognized globally.

When we look at the importance of Professor Soucek's project today, we should remember some facts related to the world trends in computer science from that period: in 1956, Japanese company Fuji developed a computer for calculation of optical systems production with 1700 vacuum tubes; in 1957, the first FORTAN compiler was developed and in 1958 the first prototypes of integrated electronic circuits were developed. In 1959, Japanese company NEC produced the first commercial computer based on transistors (opt: transistorized computer), while the first commercial mini-computers were developed at the beginning of 1960s (DEC PDP-1 in 1960 and DEC-PDP-8 in 1965).

In Croatia, the usage of computers and the development of information systems started in that period, and it was based mainly on imported equipment. Due to high price, only large organizations could afford to buy computers. Although the equipment had limited capacity, highly trained staff could develop complete applications, thus compensating for limited capacities.

From 1965 to 1975

At the beginning, TRS produced, like most of other producers worldwide, mechanical computers only.
During 1968 in Croatia, the first electronic calculator with optical display was developed. The calculator was based on 100 10-component integrated circuits produced in the factory RIZ in Croatia.

At that time, there were no LSI or VLSI-chips in the world, as well as integrated circuits of high and very high degree of integration. TRS's calculator was, by the number of components and external dimensions, one of the smallest desk calculators in the world. A couple of years passed till 1-chip calculators (desk and pocket) and calculators with printer appeared, when in 1972 the first pocket calculator and first desktop calculator with printer appeared. The first calculator in Croatia was designed in 1973, and the production was started by the company DigitronBuje.

It was the same year that TRS produced the first Croatian calculator with the printer. TRS also produced computer equipment for general purpose. At the end of 1969 TRS became a distributor of the company Nixdorf, developing a concept of distributed data processing. From the first computer independently produced in Croatia in 1974 to the end of 1988, TRS produced and installed a couple of thousand of their own computers of 700 and 900 series, equipped with mostly their own keyboards, video terminals and printers, as well as system and user software. In that period they collaborated with the company MDS and Metalka from Ljubljana in the production of 711 series computers as well as with the company IBM in the production of Series i and System 1, equipped with peripherals from Croatia, intended for use in the economy, schools, railways and others.

From 1973 to 1987 many other companies in Croatia started to produce computer equipment.

However, there was a non-market strategy of public and professional organizations that only one "large" manufacturer in Yugoslavia, and later one manufacturer in every republic, should be given a "mandate" from the state for exclusive production of computer equipment. The state ensured full protection. These companies: in Slovenia it was Iskra, in Serbia it was EI Nis, in Bosnia and Herzegovina these were Energoinvest, UNIS and Rudi Cajavec, whereas in Croatia such a company did not exist at that time.

The end of 1960s was a period when computers of 3rd generation started to be used, the computers with the real time applications, the possibilities of managing production processes, implementing communication systems, databases, multiprogramming and multiprocessing, which enabled, together with the faster processing units and larger storage of external memories, the development of integrated information systems in the economy and public administration.

With regard to equipment production, the main companies were IBM, UNIVAC, ICL, Burroughs, BULL GAMMA, Honeywell, PDP and others.

At the beginning of 1973 in Zagreb, Business community Impuls was set up in order to gather all the significant producers of telecom, electronic and computer equipment in Croatia. The founders were:
Nikola Tesla - Tvornica telekomunikacijskih uredjaja, TRS and ELKA - Tvornica elektricnih kabela, all Zagreb-based companies.

During 1974 there was an idea that the development of computer equipment production in Croatia can progress in collaboration with only one foreign partner - technologically developed and well off. Therefore, in 1976 the Government of the Republic of Croatia backed this initiative, so the Government contacted the companies ICL and SPERRY UNIVAC. In other parts of Yugoslavia the contacts were established as well, in Slovenia with the company Philips, in Serbia with the company Olivetti and Rockwell, in Bosnia and Herzegovina with NCR and Olympia. These contacts were the result of computer equipment import ban due to the lack of foreign exchange resources.

Continuing the development of computer science in Croatia, in 1966 Professor Soucek set up the first laboratory for Cybernetics, and in school year 1966/67 the first research electronic computing center: Znanstveni elektronski racunski centar - ZRCE (in 1973 it changed its name into today's: Sveucilišni racunski centar - SRCE (University computing center).

The same year a new subject was introduced: Digital computers, at the Faculty of Electrical Engineering and Faculty of Science, and in 1970 FEE introduced a new study for undergraduate students in the 3rd and 4th year of the study: Computer science, and the postgraduate study of the same name.

The books that Professor Soucek wrote at the time: Microcomputers in data processing and simulation (New York, 1973) and Microprocessors and microcomputers (New York, 1976), made a major contribution to the development of computer science in Croatia. Professor Soucek also delivered many seminars and lectures in that period around the world (New York, Boston, Paris, London, Rijeka, Opatija...). There was also a seminar on Microprocessors, a 3-day event in Croatia, which in 1978 became a scientific conference MIPRO, still being held every year.

After 1975

In this period there are a couple of companies that produced the equipment for process management in telephone exchange, CAD CAM systems and graphics workstation, personal computers and peripherals (printers, cash registers, video terminals, discs) etc.

With open market, production of hardware in Croatia developed more slowly. It is important to point out that Croatian hardware production in open market conditions, without a planned development policy, without funds and incentives could not be developed on a more significant scale.

It is encouraging that in the new circumstances the development of Croatian software accelerated, as well as network development, end-user training etc., the possibilities of buying state-of-the-art foreign hardware and software, and conducting more productive collaboration with the foreign partners increased.

There were predominantly leading manufacturers of computer equipment, such as IBM, SPERRY UNIVAC (UNISYS) and others, who continued their work by installing/building computers of great capacities, developing information systems with the support of highly trained Croatian experts, which later resulted in establishing private IT companies that positioned well in the foreign market.

B. Brief History of Computing and Informatics in Slovenia

Before 1965

First and foremost let it be said that the division of the history of computing and informatics is arbitrary and roughly follows the evolution of digital computers from electronic tubes to transistors to integrated circuits. Before 1965, the general awareness of computers, let alone of their potential to change our lives, was next to nil. Some more understanding was noticeable among technically educated persons that have seen computers as an aid to release them of burden of intellectually non-demanding but arithmetically very extensive tasks, such as calculating statics for many tens to hundreds statically undefined constructions. However, the slide rule was the main calculating aid in the technical domain while for extensive arithmetical calculations electromechanical devices were state-of-the-art. The first computer of the kind as we understand it today was Zuse 23. This period of computing[2] is in Slovenia characterized with purchase and deployment of the first digital computer in the country. From today's perspective it is hard to understand that the choice had to be made between a British Elliott 803 and a German Zuse23 computer. The US companies did not compete in this case. Eventually, in 1962 the Z23 has been introduced so year 1962 can be rightfully considered as the beginning of the computer era in Slovenia. Z 23 was used mostly in solving academic problems and research work in economics, electrical, machine, and civil engineering, and similar. It has been used in calculating the statics for the building of Ljubljanska banka. The system has been 120 times statically undefined and the engineers wanted to use the Z 23 for solving the problem. However, due to the capacity they had to reduce the 120 by 120 system to 90 by 90 by hand which took a team of three experts three months, and only after that the Z 23 has been able to take over and finish the task. The usage for business needs was at that time rather beyond perception. However, Z 23 has made a public appearance during the 1967 European Figure Skating Championship in Ljubljana for calculating the scores.

2 At that time we cannot yet speak of informatics as a discipline to go hand in hand with computing.

From 1965 to 1975

It is remarkable to notice that in this period an extremely novel and for the circumstances very brave idea was born and also came into life. One Slovenian company - Intertrade - has succeeded in providing the license to import IBM computers and peripherals and to represent IBM in the territory of then Yugoslavia. From today's perspective, we can judge this move as the major breakthrough, not in deployment of general-purpose computers of third generation, but also as a motor for acceleration of many aspects of accompanying activities. If computers were to be productive they needed to be supported in various ways. Technical support is one of obvious activities that goes with any kind of technical apparatus. Customer support needed to be developed to assist customers in transferring parts – at that time – of their business activities to computers for which customers' personnel needed to be trained in systems analysis, programming, organizing data centers, and more. In parallel to all that, also the vocabulary of computing and informatics needed to be established as at that time there were no university study programs of computing and informatics. The only university educated persons that have had some knowledge of computing essentials were electrical engineers, due to their education and understanding of technical background. Faculties of computing and informatics were established only much later.

In this period all major computer companies were present in Yugoslavia but because of specific regulation of import and export regulations they could not establish their own offices to represent them there. Instead, they were represented by national companies that have carried out business in their name and on their behalf. The companies that were represented then were UNIVAC, National CashRegister, RCA, General Electric, Control Data Corporation, Honeywell, Burroughs, Digital Equipment Corporation, Olivetti and probably some others, as well as providers of IBM-compatible peripherals such as magnetic tape devices and magnetic disk drives. Of course, we must not overlook IBM, which has at the time contributed the most to development of the computing profession and must be credited also for the start of informatics science as we understand and know it today. Probably the IBM computers of the time were – technically speaking – no better or no worse than their competition but what provided for the leading edge was the support that has been organized using IBM know-how, experience and knowledge. The result was that at least Slovenian major companies and practically all federal institutions, notably Federal Statistical Office and Public Accountancy Service, were IBM customers. The prevailing argument was support, which was organized following the IBM model. An aspect of the support was that branch offices were set up in Belgrade, Zagreb and later also in Sarajevo so that customer and systems engineers were never far away. Rather soon Intertrade established customer training center in Radovljica, some 50 kilometers from Ljubljana near Austrian border, where customers' personnel from all Yugoslavia was trained in programming, systems analysis and accompanying skills necessary to implement computers most efficiently. IBM personnel were however trained within the established IBM training scheme mostly in IBM training centers In Europe but also elsewhere. The training center has later extended its operation to become a regional IBM training center for central and east Europe.

After 1975

Besides Intertrade, we must explicitly mention one more Slovenian company, Elektrotehna, which has succeeded to qualify as a representative for DEC. The division of Elektrotehna to do with DEC computers was named Digital and was rather successful in business which resulted in establishing a new company named Delta which was still a part of Elektrotehna group[3]. The circumstances - the business success, difficulties in providing necessary convertible currency, some enthusiasts from the Ljubljana faculty of electrical engineering, possibly also the aftermath of IFIP 1971 World Congress in Ljubljana – have resulted in an idea to start own production of computers. The project was to use the original equipment manufacturer approach to build a DEC compatible computer. The approach was promising as the US government was very careful about into which countries could US companies export computers. A Yugoslavian company, coming from one of the three countries that have started the idea of the non-aligned countries, seemed a good prospect to overcome the embargo that US imposed on export of computers. Nevertheless, as the essential component of computers, the micro circuits and chips, were not produced in Yugoslavia, Delta still needed to provide those from DEC, all the more so as the computer should have been DEC compatible. Eventually they succeeded and the first Slovenian computer, Delta 340, has been assembled. The focus was on technology process support, but also applications for business processes have been developed. The company later joined another business association, Iskra Group, and changed its name to Iskra Delta. The success continued partly for the political support it enjoyed, partly for daring business decisions, partly for understanding of importance of well-organized customer and technical support, and partly for own research and development. It also organized a training center in Nova Gorica next to Italian border. Further to Delta 340 the company developed a three-processor microcomputer dubbed both Triglav[4] (for the reason of national pride) and Trident (a name to sell better in western countries). At the time of its introduction it was probably among the best computers in this class in the world. The success story of Iskra Delta which just before its end employed over 2000 people ended in the end of 1990s with the massive political and economic changes that resulted in the dissolution of Yugoslavia, and the company has been closed down. The reason was according to the memoirs of the director of Iskra Delta a clash of interests between intelligence services CIA and KGB. However, using the Occam razor for the explanation, it seems more likely that the management did not understand the reality of the world. To become a global player, massive resources are needed which just were not there.

Later, in the beginning of 1980s, also Intertrade developed an ambition to produce its own computers. Was it a result of a feeling that the company is not able to join the prestigious race or anything else is hard to tell. Also the time was different in that personal computer has already its entrance and was obviously here to stay. The fact is that the company started assembling IBM PC and made a moderate success. Together with the computer the project team under the leadership of Matjaž Čadež developed some general purpose application programs. The one that comes to mind was PCPIS, a word processor that has been a notable achievement at the time. However, even before the 1990s also this production was closed down. The global players are now represented in Slovenia as independent companies, established under Slovenian law and carrying out business just like they do elsewhere in the world.

What can we say for the end of this brief history of computing and informatics? It was good while it lasted but seems like the dreams to conquer the world with homemade computers have come to an end.

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3 The story is rather simplified as the regulatory system was much different from what it is now or what it has been in the Western world of the time.

4 Triglav, 2864 m high, is the highest peak of Slovenia and was also the highest peak of Yugoslavia.

SNAPSHOT

REGIONAL ICT ASSOCIATION IN CENTRAL, EASTERN & SOUTHERN EUROPE

Type of organization

Regional non-governmental and non-profit professional association in the ICT field.

Date and place of establishment

18 April **2001**, Portoroz, Slovenia

Membership

Countries represented (*see next page for societies*), year of accession, representatives

- Austria (2001) G. Kotsis, E. Mühlvenzl, R. Bieber
- Bulgaria (2003) K. Boyanov, I. Dimov
- Croatia (2002) M. Frkovic
- Cyprus (2009) P. Masouras
- Czech Republic (2001) O. Stepankova, J. Stuller
- Greece (2003) S. Katsikas
- Hungary (2001) B. Domolki
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- Poland (2007) M. Holynski
- Romania (2003) V. Baltac
- Serbia (2003) G. Dukic
- Slovakia (2001) I. Privara
- Slovenia (2001) N. Schlamberger

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"To be the leading regional information and communication technology organization in Central, Eastern and Southern Europe which promotes, assists and increases the activities of its members and encourages and promotes regional and international cooperation for the benefit of its constituency, the region and the international ICT community."

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IT STAR is governed according to the letter of its Charter by the Business Meeting of MS representatives:

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2016 Milan, **Italy** (October)
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2012 Bratislava, **Slovakia** (April)
2011 Portoroz, **Slovenia** (April)
2010 Zagreb, **Croatia** (November)
2009 Rome, **Italy** (November)
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2001 Portoroz, **Slovenia** (April)
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2015 –	Marek Holynski
2010 – 2015	Igor Privara
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2003 – 2006	Niko Schlamberger
2001 – 2003	Plamen Nedkov (cur. Chief Executive)

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- 10th IT STAR WS on IT Security
  http://www.starbus.org/ws10
- 9th IT STAR WS on ICT Strategies and Applications
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- 8th IT STAR WS on History of Computing
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  http://eems.starbus.org
- 5th IT STAR WS and publication on Electronic Business - http://starbus.org/ws5/ws5.htm
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- 3rd IT STAR WS and publication on National Information Society Experiences – NISE 08
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  http://www.starbus.org/ws2/ws2.htm
- 1st IT STAR WS and publication on R&D in ICT
  http://www.starbus.org/ws1/ws1.htm

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