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ABSTRACTS

(in order of the conference programme schedule)

Keynote. Bill O'Gorman: Progressing the EU Digital Agenda in regions: A collaborative engagement engagement between industry, government and higher education in regions — the eDIGIREGION story

- Abstract: Implementing the EU Digital Agenda in regions is not possible without the cooperative and collaborative engagement of relevant regional stakeholders in the process. This presentation brings the audience through the eDIGIREGION stakeholder engagement process and explains how to design and implement stakeholder collaborative processes in order to develop region specific Join Action Plans (JAPs). The presentation also describes how to create and develop an inter-regional JAP (iJAP). The presentation concludes with articulating five iActions currently being implemented by four diverse collaborative European regions as part of their iJAP.

Yantsislav Yanakiev: Introduction of HPC Technologies in Bulgaria: Challenges and Responses

- Abstract: The introduction of HPC in Bulgaria is marked by a contradiction. The level of technological development, type of ownership and work organization in most private companies of the local automotive and electronic industry don't require the introduction and regular use of HPC. However, due to administrative efforts to keep the pace of national economic development with trends in the global technological innovations and to fulfill directives in the EU several academic R&D centers in the country are relatively well equipped with advanced computers. In the centers there is also competent personnel trained to use the highly productive information processing hardware by applying a variety of sophisticated software programmes. The view that the competitiveness of the national economy suffers very much by this disparity is shared by all experts. How to overcome it in order to enhance the productivity and to offer high quality jobs for the well-educated young people who continue leaving the country? In the framework of the Interreg Project „High-performance Computing for Effective Innovation in the Danube Region" (InnoHPC) REGLO has collected large information on the topic and suggested several strategies for managing the critical situation.
- Keywords: HPC, InnoHPC project, Bulgaria

Doinita Ulinici: High-Performance Computing in the Republic of Moldova. Challenges and Strengths

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- Abstract: The increasing need to have access, process and visualize exceedingly large amounts of data enabled, according to RENAM, the transition of the traditional science towards e-Science. This process cannot be managed without modern computing instruments. For providing IT services to research community, the European Commission has funded the creation of specialized e-Infrastructures through a number of targeted initiatives. However, the Eastern Europe, including Moldova, are still less developed comparing to Western Europe countries in terms of existing HPC resources.
- Keywords: Computing, Moldova, Innovation, Research

Urška Fric, Nadja Damij, Borut Rončević and Zoran Levnajić: The evolutionary model – transformation from linear to complex industrial symbiosis networks

- Abstract: Although the concept of circular economy has recently found its way into research, policy- making and public debate – thus becoming a modern hype stimulated by its perceived economic and environmental benefits – the lack of well developed theoretical concepts and empirical evidence has resulted in generalizations and less-than- optimal one-size- fits-all approach. To systematize the concept, we have put together an evolutionary model of circular economy through examining the exchange of waste material, water and energy between companies and other stakeholders. In this model, development of circular economy is described as an evolution from an economy dominated by small linear networks (chains) with no feedback loops into an economy characterized by complex industrial symbiosis networks with intricate topologies and numerous feedback loops. The model is based on complex social systems theory and grounded in empirical analysis of five existing industrial symbiosis networks from different European countries, namely Finland, Denmark, Austria, Slovenia and Croatia. Employing a series of unstructured interviews and documentary analysis of waste material flows, each network has been graphically visualized by identifying local networks and adopting business process analysis tools. Using standard network analysis we are able to propose a typology of industrial symbiosis networks, including specific network characteristics for each type. At the same time, we develop both conceptualization and empirical diagnostic tools in support of future research and policy- making.
- Keywords: circular economy, industrial symbiosis, stakeholders, evolutionary model

Biljana Mileva Boshkoska, Erika Džajić Uršič and Borut Rončević: Modelling and development of industrial symbiosis networks in a regional industrial areas with DEXi

- Abstract: Resource sharing among co-located firms is referenced in the industrial ecology literature as "industrial symbiosis". Industrial symbiosis engages traditionally separate industries in a collective approach to business and environmental management involving the physical exchanges of materials, energy, water, and byproducts. In this study we create an evaluation model for already existing IS so

that we understand the regional criteria that influence on development of a regional ISN. We present a qualitative hierarchical multi-attribute decision support model for evaluation of appropriateness of industrial symbiosis networking (ISNs) based on DEX methodology. Such a model has many advantages like comprehensibility, analysis and synthesis of interactions between actors and in this case structure. We have studied a benchmark of seven IS examples, two of which are used to build a qualitative multi-criteria decision model for evaluation of the development of ISN model. The model is then used to evaluate five other IS cases. The results show that only mixtures of all three spheres, the economic, environmental and social, are rational and reliable in the context of ISNs and are needed to build a new regional ISN.

- Keywords: Industrial symbiosis, DEX, evaluation

Poster session 1. Nikolai Genov: REGLO as an Actor in the Interreg Project „High-performance Computing for Effective Innovation in the Danube Region")

- Abstract: The first task REGLO had to resolve in the local implementation of the InnoHPC Project was the collection and processing of detailed information about the current situation of HPC technologies in Bulgaria. The desktop study offered a rather controversial picture. Academic institutions are able to provide companies with high quality HPC services. However, only few companies in the automotive and electronic industry make use of the offer. A focus group discussion with stakeholders organized by REGLO in April 2017 had to clarify the basic reasons for the incompatibility and develop ideas for overcoming it. The Workshop organized in September 2017 had the task of critical discussion by experts on the diagnosis of the situation and the series of suggestion for organizational change developed by REGLO. The outcome was a more detailed picture of the strength and weaknesses of the introduction of HPC in the country. The contacts of REGLO with HCP services providers and clients continue in order to make the suggestions for reducing and potentially overcoming the disconnection between the two sides of the process better adjusted to the real needs and opportunities.
- Keywords: HPC, InnoHPC, REGLO

Keynote. Nadja Damij: Toward intellectual property rights management

- Abstract: Maximizing the value from innovation, in particular through Intellectual Property Rights (IPR), is a key element of Intellectual property rights (business process) management (IPRM). We take a "Robin Hood" approach, taking (learning) from the big companies to offer to smaller ones. The beauty of intangible assets is that through their use and knowledge sharing the bigger companies are not weakened as a consequence. The adopted interdisciplinary approach provides a conceptual framework and constructs for IPR management (IPRM), derived from practical and enriched by theoretical insights. This monograph builds upon case studies and interviews with key IP executives from major multinational

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R&D investor firms.

Jernej Agrež, Borut Rončević, Nadja Damij: Disabled friendly Stand Up Paddling board development process

- Abstract: In this paper we briefly present the development process of the disabled friendly Stand Up Paddling (SUP) board. We conducted a research that included studying existing functional solutions and running board testing sessions with disabled participants. Based on the insights we retrieved from the testing sessions, we designed a 3D e-model of the disabled friendly SUP board, followed by the production of full sized prototype. The methodology we used during the research consisted of field testing and recording the evaluation of participants` SUP experience with short questionnaire, decision tree analysis and business process modelling that we used to be able to highlight relevant dilemmas of choosing optimal SUP board characteristics during the design stage of the SUP board prototype. The overall results of this research and development case reveal us the bottom up process stages from idea to functional adjusted SUP board solution of our own design.
- Keywords: process model, decision tree, disabled friendly, prototype, SUP board

Jana Suklan: Web-based support for preparation of project application – http://www.s4p.si

- Abstract: In research, money that comes from projects is the main source of finance. Thus is important for the researchers to regular monitor important open calls and apply for grants. The analysis has shown that most project proposal are rejected because of the administrative failures. On the other hand, researchers are not only involved in their research which is complex in most of the cases, but also in the search for funds. To help them in unloading their daily work, we established a web-based application that support project applicants in the preparation of project proposals, by reducing the frequency of formal and main content errors in applications, focus on the content of applications, thus improving the efficiency and quality of project proposals and supports the preparation of project proposals, focused on project methodology and formal requirements of individual project call. Our aim is to draw attention to the available tenders and their formal constraints, reduces the time needed to analyse published calls, familiarize with the good practices of projects in EU programs and national tenders, which also provides support, supports the preparation of project proposals by reviewing appropriate project preparation methodologies, and at the same time and facilitates the preparation of a substantive part of project proposals. Key advantages of our application are advanced search for calls within the database, possible collaboration on the project, automatic control over content (through keyword evaluations) and technical structure - "automatic judge" solution, all the project

documentation available at one place that can be used as archive of good practices: overview of all past applications in one place.

- Keywords: project proposals, project calls, researchers, collaboration, web-based application

Ana Hafner, Katarina Krapež: Technology transfer process – what is in it for the researcher?

- Abstract: In July 2017, the Faculty of Information Studies (FIŠ) established the Technology and Knowledge Transfer Office (TTO) and joined the Slovenian Consortium of Public Research Organizations for Technology Transfer, coordinated by Jožef Stefan Institute. Doubtless, this is a great opportunity for FIŠ, but how does this affect individual researchers? What can an individual researcher gain by participating in the technology transfer process? Researchers need to be aware that only a publication of the research results - even though it brings esteem and benefits (such as additional research points) - is not a sufficient guarantee that the research results will be turned into tangible products and be commercialized. Generally, publicizing research results in respected journals means a transfer of copyright form researcher to the publisher, with the exception of journals with open access (and hybrid) business models. The purpose of the TTO is to push research results further: to help the researcher to envisage his/her work being successfully introduced to the market in a form of tangible products or services. TTO offices manage diverse intellectual property rights (patents, industrial designs, brands, etc.) to protect the research results and to introduce them to the business partners. This contribution will discuss successful cases and examples of good practices of the technology transfer from research institutions, with the focus on the researcher and his/her interests.
- Keywords: Technology Transfer, Innovation, Intellectual Property Rights, Licensing agreements, University Researchers

Blaž Rodič, Galia Marinova and Ognyan Chikov: Multi-criteria Decision Modelling for Filter Design Tool Selection in Online-CADCOM Platform

- Abstract: We present the development of a multi-criteria decision model for decision support in the telecommunications engineering software solution Online-CADCOM. The solution is to aid user in selecting a filter design tool based on specific selection criteria. The multi-criteria decision model will serve as the basis for the development of an expert system to be implemented in code and integrated in Online-CADCOM. The multi-criteria decision model is implemented as a Decision Matrix and combines set theory based option filtering with the MAUT method for option ranking.
- Keywords: multi-criteria decision analysis, decision matrix, filter design, telecommunications

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Keynote. Tomaž Savšek: Evolution of the automotive industry through the digitalisation

- Abstract: The speaker will present his understanding and views on topical area of digitalisation of industry and introduction of smart factories. He will start from the guidelines DigitAgenda 2016, which was prepared by the Strategic Council of Chamber of Commerce and Industry of Slovenia and from the objectives of Industry 4.0. He will present the role of digitization in the product development process and in the process of the development production process in advanced pre-development supplier in the automotive industry. He will conclude his presentation with some good practices and experiences gained in the process of business digitization and realization of smart factory concept through complete automation solutions for internal logistics.

Keynote. Pavle Boškoski: Towards digital transformation: Implementation experience

- Abstract: Digital transformation is a paradigm shift in the way how one company conducts daily operations. Implementation should result into significant increase of the company's potential. However, when performed partially or improperly, it can have disruptive negative effect. The focus of the talk is to present the lessons learned from implementation of particular steps of digital transformation at several local companies. The topics cover transformation of maintenance, quality control and business analytics segments of the production process. More importantly, the goal is to emphasize the obstacles during implementation that predominantly stem from inflexible personnel, availability of experts and integration of legacy systems. Finally, an overview of the implemented fully operational systems will be presented that were build in accordance to the principles of Industry 4.0.

Daniel Hofman, Martin Žagar and Josip Knezović: 16K Video Transcoding on Heterogeneous Many-core Architectures

- Abstract: With the rapid advance in the number of videos used on the Internet every day and the variety of end-user devices, transcoding has become the important part of the video processing. Video transcoding has been in use for several decades to transform video from one resolution to another. During this process, several approaches can be used where the original video is decoded partially or in full, resized and at the end encoded into a new resolution. In either way, partial or full decoders and encoders need to be implemented. The process of transcoding multimedia on many-core architectures demands high processing power and enough data bandwidth between processing elements. With the video resolutions going up to 4K, 8K, and even 16K, this demand transcends the limits of the current state of the art processors. To be able to transcode 16K multimedia in real time powerful novel architectures need to be used. Heterogenous architecture can enable better processing by using special hardware accelerators designed for

video processing in conjunction with standard general-purpose processing cores. Hardware accelerators provide extra processing power for lowering the transcoding time and ultimately achieving the real-time video coding and transcoding. Real-time video encoding is needed to be able to deliver real-time video to the end user and satisfy the quality-of-service prerequisite.

- Keywords: video, multimedia processing, transcoding, high-definition video, 16K, heterogeneous, many-core accelerators

Lucija Lapuh: Theoretically about value chains and factories of the future

- Abstract: Technological change influences global economy by fragmentation of production, cost access to resources (OECD, 2013) and dispersion of production. A theoretical overview of value chains and factories of the future is based on the author's postdoctoral research which tries to connect academia with industry and to have an impact on their digitalisation. The author will theoretically present the Global value chain (GVC) framework and the concept of the factory of the future. GVC framework describes the complex network relationships between firms that often span wide geographic areas. The development of information and communications technology has been an important driver in the emergence of GVCs. The central concern in GVC analysis is tracing where the value added is contributed and how its distribution can be explained (Gradin, 2016). For a new industrial revolution, which is called factory of the future, a complete automation and increased use of technology are the most important characteristics. At the end of the presentation the author will briefly present the next stage of this research - questionnaires which will be conducted with small and medium size enterprises that are high performance computing (HPC) users or providers in the automotive and electronic industry being located in Central and Southeast Europe.
- Keywords: value chains, factory of the future, small and medium size enterprises, Central and Southeast Europe

Ana Hafner, Dolores Modic: Patent databases as a source of information for social science researchers and a source of challenges for information scientists

- Abstract: Patent databases are frequently the only source of information about some inventions and can be used for evaluating and forecasting technological trends. Patent documents usually contain bibliographic data (title of invention, applicant, inventor, patent attorney, date of filing, validity of patent, technical field, abstract), description of invention, drawings, patent claims and sometimes also a state-of-the-art search report. By analyzing Slovenian inventions in a field of automotive industry we will illustrate what inventions are currently the most promising (in this field and territory). However, the Slovenian database with approximately 300 published patents per year is relatively small and thus easy manageable. When dealing with world databases with over 100 million patent

documents (especially China is facing exponential growth in number of patents in the last two decades) it has become increasingly hard for researchers (and patent examiners as well) to find what they are looking for. The last segment of the paper thus examines the biggest difficulties in prior art searching as well as in finding disruptive technologies and technology forecasting in this world of IPR big data. How to deal with multilingualism, errors that occur when images are "translated" into language by electronic scan process, different national patenting requirements and even intentional misleading from patent applicants when describing a technical solution, will be a future challenge for big data analysts. As well as how to distinguish valuable patents form majority of unworthy and invalid patents.

- Keywords: Patent databases, Big data, Slovenian database of granted patents, World patent databases, Automotive industry

Poster session 2. Nikolai Genov. REGLO as an Actor in the Interreg Project „High-performance Computing for Effective Innovation in the Danube Region")

- Abstract: See Poster session 1

Keynote. Markus Abel: Machine learning for the control of complex systems

- Abstract: Linear control strategies are simple and well-working ways to control the behaviour of simple dynamical systems. For systems with many degrees of freedom and complex behaviour such a simple approach may not work or is not applicable due to intrinsic dynamical properties of the systems. We developed an automatized way to control complex systems using machine learning methods. The main idea is to formulate the determination of the control law as an optimization problem. The optimization is found with respect to the objectives set, e.g. minimal energy, best fit, simplest law. As machine learning method we use a genetic programming based symbolic regression. A generic implementation is found at https://github.com/Ambrosys/glyph.

Kristina Ban: Multilevel complex systems approaches to computational linguistics

- Language is fundamental human characteristic. There are no other species with such complex and distinctive communication system. It enables us to express our thoughts, ideas and feelings to others, while giving us the ability to understand theirs. Language, articulated as speech, can be viewed as a sequence of words, which are composed of syllables as their fundamental building blocks. Also it can be viewed as a complex system, where syllable co-occurrence is used as a link between them. Network analysis provides methodologies that can reveal new patterns in a complex structure and can thus be applied to the study of language structures. We construct the datasets of syllabified lexicons for 10 languages

(English, German, Dutch, Latin, Spanish, French, Croatian, Slovenian, Russian and Basque) and analyze them using state-of-the-art network science methods. Our analysis reveals non-trivial patterns of similarity consistent with the language families. This analysis leads to a clustering pattern that clusters English, German and Dutch as Germanic languages, Croatian, Slovenian and Russian as Slavic, with Latin, Spanish and French as Roman languages. Another interesting find is the close structural similarity between Latin and Basque.

- Keywords: Language, Computation linguistics, Complex systems, Syllable networks

Zdravko Kunic, Robert Kopal and Biljana Mileva Boshkoska: Wind forecast correction in road traffic management decision support system

- Abstract: We present an ongoing work of development of a new algorithm for suggesting road closures due to strong winds (especially Bora on Adriatic coast). The algorithm will improve the current decision support system that is used by the road traffic managers who keep the road closures optimally balanced between traffic safety and economic losses. We use neural networks and as features we use: weighted multiple successive forecasts for the next 12-hours period, the overall shapes during respective strong wind periods, and their congruence with the latest measurements. The planned algorithm's application potential is wider than traffic control management so it can serve as as an example of using previous successive forecasts to more accurately estimate the wind power production or offering decision support in different areas that depend on other meteorological elements (e.g. temperature, air pressure, precipitation etc.)
- Keywords: Wind forecast correction, Neural networks, Traffic management

Miljenko Hajnić and Biljana Mileva Boshkoska: A decision support system for identification and access management of employees in an enterprise

- Abstract: A certain public entity with 3000 employees, 350 organizational units and yearly revenue of 2.7 billion € has business and security policies set up so that employees should periodically change their workplace. The consequence of such user migrations is the daily processing of dozens of requests for updating user accounts. Organization's human resource unit make decisions when and where a certain employee of the organization moves. Decisions are made on the basis of employee experiences, professional qualifications and completed educational programs, etc. Because of a great number of business applications that organization uses on a daily basis, user management and administration was beginning to be a rising concern and the final effect is reflected on the organization's budget. There is a need to improve the decision process of choosing and granting access permissions to an appropriate person, as well as manage them within the organization's resources in the best cost effective, secure and consistent way. Such improvement, which arises from a strong financial motivation, should lead to speeding up the primary business process, decision support system

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based on DEX methodology should reduce time for transferring employee from one working place to other (which comes in focus for certain time – dynamic of business) and new DEX multi-criteria decision model should decrease costs of administration and increase organization revenue.

- Keywords: identity management, access management, decision support system, decision expert

Albert Zorko and Zoran Levnajić: Data analysis of hearth-rate variability

- Abstract: Cardiac activity keeps our body alive and tells us a lot about ourselves, our well-being and our health. Because of our way of life, we monitor our activity more closely. It only becomes an important factor, in sports, in everyday life, and in various diseases. Cardiovascular diseases are important for our civilization, therefore we pay much attention to monitoring, observing and analyzing heart rate. This measurement is not complex and is completely non-invasive, and this analysis provides answers to many questions. In the task we will see some methodological approaches that illuminate the observed issues from a different perspective. However, we hope that with their help we may be able to better understand complex cardiac activity.
- Keywords: cardiac activity, heart rate variability, shapelet, data analysis, sample entropy, signal noise factor

Valerij Grašič and Biljana Mileva Boshkoska: An analysis of the influence of weather data for the city of Ljubljana for forecasting the number of incoming calls to a public safety system 112 using machine learning regression

- Abstract: There are many natural conditions in the world, such as floods, earthquakes that bring major accidents. The actual question is how to anticipate and predict such events in advance, which enables us to prepare in advance. In this paper, we are interested in predicting the number of incoming calls to the 112 public safety system for Slovenia. We used the weather attributes for the city of Ljubljana for the last few years. By using different machine learning regression methods we obtained different models that we compared each other. As part of our work, we are interested in finding the attributes that are most important for forecasting and determining the accuracy of individual models for forecasting. The obtained results are a good basis for further work on improving the forecasting of the number of incoming calls to the public safety system 112.
- Keywords: NFV, virtualization, OpenStack, IMS, 5G

Alen Duspara, Daniel Hofman and Mario Kovač: FRISC: Involving students in research and development of learning platform

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- Abstract: On the Faculty of Electrical Engineering and Computing in Zagreb, a simple RISC processor was designed with the intent to improve the teaching methodology of introducing computer architecture to students. Through series of lessons, the process of architectural decision making is presented to students based on specific requirements in the example of FRISC system. Afterwards, students have the laboratory exercises where they use the platform with tools which supports breakpoints, step-by-step execution, memory and register watching, simulation of the peripheral devices and system event logging. In 2013, FRISC hardware design was developed by a group of students, enabling all students to validate their designs on the real hardware. The processor was designed in VHDL and synthesized on an FPGA chip. The design could execute FRISC machine code and communicate with peripheral devices through custom developed controllers. This system was successfully used on the alternative laboratory exercises for 3 years. Each year new functionalities were added to the FRISC system opening new opportunities to easily integrate a variety of input and output device modules like Bluetooth, LCD display, matrix keyboard, relays, sensors and others. Students gave very positive feedback while working on their assignments of making and validating on real hardware basic versions of a commonly used system like a cash register, heating controller, games, calculator, home security etc. Enabling students to work on the development of such system that is used in teaching curriculum is good practice because it enables constant development of teaching quality and methodology. The results of our work show that students have much more motivation to work on their thesis when they know that results of their research will have an impact on the system that is being constantly used. Also, new generations of students find using this platform very intuitive as they can relate to the students that were building it.
- Keywords: computer architecture, learning platform, RISC processor, FPGA, VHDL

Tomaž Aljaž: Digital transformation of retailers using e-Commerce

- Abstract: In today's constrain environment where there is constant pressure to increase market share, traditional retailers are looking new ways to approach customers. In addition to traditional shopping in a store, on-line ordering of food is clearly additional benefit to them with Home delivery or pick-up at special delivery area at defined time window. The technology available make possible to place order independently of the location and time. One of the major challenges that IT companies face is how to build general solution that meets market and customer requirements for new business models combined with established processes and systems. An On-line shop & Customer experience, Cross-channel fullfilment, Analytics, Masterdata, Logistics are the main elements of the new system. In the presentation, it will be shown overview of platform, including main building blocks, a example of the technical solution and a discussion on Business processes and importance of the Masterdata data quality, especially its impact on user experience browsing through on-line shop and Home delivery / pick-up (logistic

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part). Additionally, it will be presented logistic part of customer orders done on on-line shop and how delivery to the customer using (high-speed) mobile data connection. The presentation will conclude with examples that needs to be addressed by Business processes and customer care in order to increase customer satisfaction.

- Keywords: eCommerce, Analytics, Logistic, Business processes

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