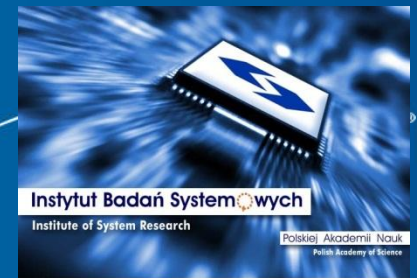


# What is to do and can be done in the question of complex informatization of municipal water supply systems

Jan Studzinski – Polish Academy of Science

2012-10-31



# Agenda

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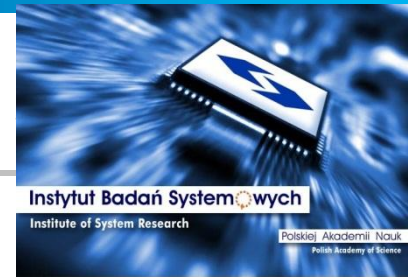
- About Systems Research Institute of Polish Academy of Sciences
- Goals of the waterworks
- What the complex informatization can cause ?
- State of the Art
- Problems and advantages
- Results and the impacts on the cities
- For Whom the all activities ?
- European partners involved
- List of detailed actions that have to and can be done



## Research areas

**Research activity of the Institute concentrates around basic and applied research as well as education of scientific staff in the disciplines mentioned below:**

- Systems analysis,
- Operational research,
- Financial mathematics,
- Optimization,
- Statistical quality control,
- Decision support systems,
- Artificial intelligence,
- Control theory,
- Theory of systems,
- Fuzzy sets and systems,
- Mathematical programming.



## Resources and capacities

- The Institute has the right to confer doctoral (PhD) and doctor of science (DSc) degrees in automatic control and robotics, and in computer science.
- Is continuously ranked in the highest scientific quality category (A) by the respective Polish authorities.
- The Institute employs 128 persons, including 16 full professors, 16 associate professors and 29 researchers with Ph.D. degree.



## International cooperation

- Systems Research Institute is well positioned within the international community of the research institutions dealing with similar scientific subject matters.
- Main partners of the Institute in international cooperation are: Ghent University (Belgium), Centre of Biomedical Engineering of the Bulgarian Academy of Sciences (Bulgaria), Chinese Academy of Sciences (People's Republic of China), Institute of Information Theory and Automation of the Czech Academy of Sciences (Czech Republic), Abo Akademi (Finland), University of Nancy (France), Budapest University of Technology and Economics (Hungary), University of Siena, ENEA, and University of Genova (Italy), Electronics and Telecommunications Research Institute, Taejon (Korea), Telenor Satellite Services, Oslo (Norway), Institute of Systems Studies of the Russian Academy of Sciences, Moscow, and St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences (Russia), University of Natal (Republic of South Africa), Artificial Intelligence Research Institute Barcelona (Spain), University of Edinburgh, and University of Bristol (United Kingdom), as well as DePaul University, Chicago (USA).



## ***The Centre for Computer Science Applications in Environmental Engineering***

### **Head: Associate Professor Jan Studzinski, D.Sc.**

- The Centre for Computer Science Applications in Environmental Engineering conducts research and development, project, implementation, training and advising activity in the use of modern methods, techniques and computer technology in the field of environmental engineering and protection.

### **Topics investigated by the Centre are as follows:**

- Development and application of environmental monitoring systems;
- Development and application of decision support system for optimization and control of urban water sewage systems;
- Development and implementation of management systems for water supply enterprises;
- Development and application of modeling and planning methods for water resource, water supply, drainage and sewage systems;
- Development and application of methods of modeling and simulation of atmospheric processes;
- Application of mathematical models in solving environmental engineering and protection issues.

## Goals of the waterworks

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- Modern water and waste water company has a number of goals. The main aspects of activity are:
  - Serving to the local community
  - Taking care about natural environment, water resources etc.
- Such companies can use integrated technical and computer aided tools to meet these requirements.

## What the complex informatization can cause ?

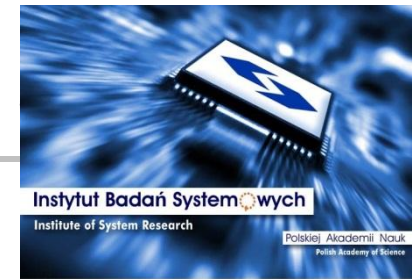


- A complex informatization can improve the complex management of municipal drink water supply and distribution systems.
- A complex informatization can support the complex management, planning and operational control of communal water networks.
- A complex informatization can cause a **computer aided and fully automated management of communal waterworks.**

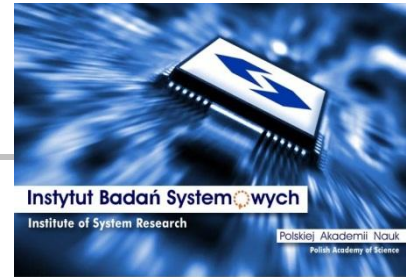




- Such the complex approach to informatization of the waterworks is **not known and used in Poland** and also abroad only partial works on this field are already done.
- The **innovative feature** of such the approach is the simultaneous solutions of problems concerning the soft and hard management of communal water supply systems.
- The **soft management** means here the solution of the tasks like financial planning of the water net expansion or revitalization or the human capital development.
- The **hard management** means the solution of the tasks like modelling, optimization and control of water nets.



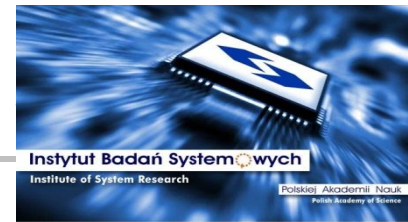
- The complex informatization of the waterworks needs the solution of the technical, economical and organizational problems coming from such the different scientific fields as **numerical mathematics, applied informatics, control theory, management and environmental engineering.**
- Its advantage and complexity consists in **integration of knowledge** of several and very different scientific and research profiles.



- The importance of the complex informatization of waterworks from the point of view of scientific innovations consists in possibility of creation of a high added value **IT product**.
- It could **improve the environmental management** regarding the better and more economical exploitation of drink water resources and saving the energy spent on waterworks operation.



- The IT product under consideration could be looked at as an **environmentally very friendly product** that would optimize and make more easy the complicated processes of the production and distribution of the drink water for the cities.
- With this IT product the **innovation capacities of the waterworks** and especially of these ones of small and medium sizes could be **essentially increased**.



### The results in general:

- The complex informatization of waterworks can help to solve better than these days the problems concerning the **production and distribution of drink water** and the **improvement of water quality**.
- The introduction of complex informatization in waterworks could lead to the **better management and utilization of available water resources** and to **energy saving water net operation**.
- **Pro-ecological results** – mainly saving water resources.



### The results in details:

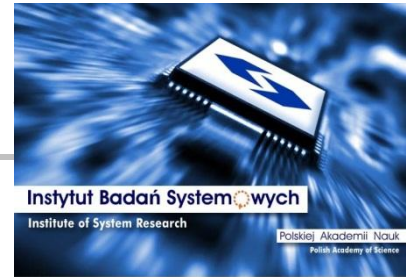
- improvement of the **drink water quality** supplied for the city
- increase of the **quality of servises** executed for local communities
- reduction of the **water losses** in the water networks
- reduction of the **money costs** while operating the water nets
- **energy** saving control of the water nets

## Results and the impacts on the cities 3



- improvement of the **water net monitoring** enabling to find the most sensitive points of the network.
- improvement of the management of **drink water resources** regarding the surface and underground water
- improvement of the **life standard** of the city communities through the improvement of the water quality for the water net users.

## Results and the impacts on the cities 4



- This diversity of problems that need currently to be solved makes the approach very complicated and also very **interesting from the scientific and practical points of view.**
- This would have an essential and positive impact on the environment regarding the **reduction of water losses and of air pollution.**
- This would also influence positively the **standard of life of human communities in the cities** in which the system will be implemented.



## For Whom the all activities ? 1

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- The **direct target groups** of the activities considered are the communal waterworks and their staffs.
- Another **direct target groups** are the employees of many different institutions and organizations private or state-running dealing with the problems of environmental engineering and environment protection.
- Also municipal governments as typical owner of water companies.

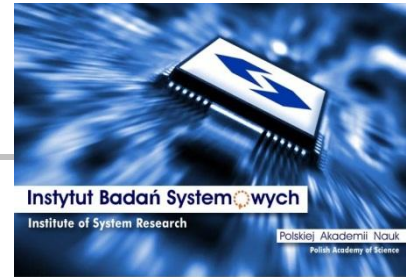
## For Whom the all activities? 2



- The **indirect target groups** of the activities are the scientists and research units working on the fields of **environmental engineering, applied informatics, control theory, numerical mathematics and communication technologies.**
- They can get the new knowledge and solutions in form of **algorithms and programs** concerning the problems they are dealing with.

## European partners involved 1

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## European partners involved 3

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## European partners involved 4

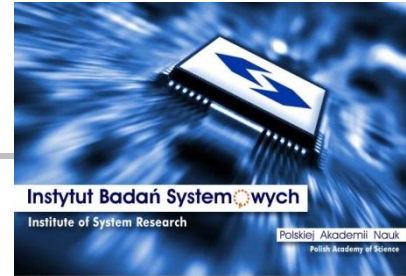
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- **University of Zurich** (Uni Zurich)
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## European partners involved 5

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- Domaniewska 52, 02-672 Warszawa, Poland
- [www.intergraph.com/global/pl/](http://www.intergraph.com/global/pl/)
- Mr. Robert Widz, Chairman of the Management
- **Contact person: Mr. Robert Brylka**
- Mobile +(48) 668 448 826
- [robert.brylka@intergraph.com](mailto:robert.brylka@intergraph.com)

## European partners involved 6

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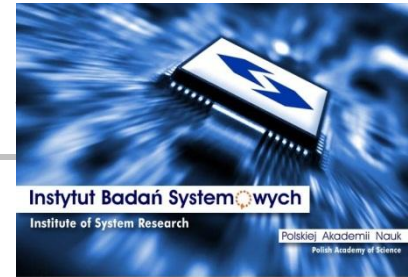


- **SCHULZ-INFOPROD Sp. z o.o.**
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- Tel. +(48 61) 865 0784, Fax +48 61 865 07 86
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- Mobile +(48) 501 463 013
- [leszek.janecki@schulz-infoprod.pl](mailto:leszek.janecki@schulz-infoprod.pl)



## European partners involved 7

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- **Ingenieur Büro - Dr. Straubel** (IB Dr. Straubel)
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## European partners involved 8

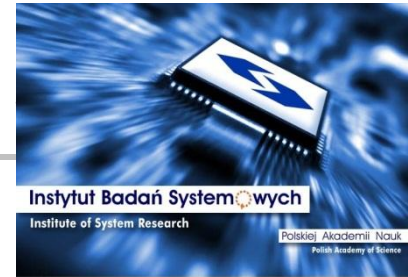
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- **Waterworks Rzeszow** (Rzeszow)
- Miejskie Przedsiębiorstwo Wodociągów i Kanalizacji Sp. z o.o.
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- [sekretariat@mpwik.rzeszow.pl](mailto:sekretariat@mpwik.rzeszow.pl)
- <http://www.mpwik.rzeszow.pl/>

## European partners involved 9

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## European partners involved 10

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- **Waterworks Krnov** (Krnov)
- Czech Republic



### The detailed actions are:

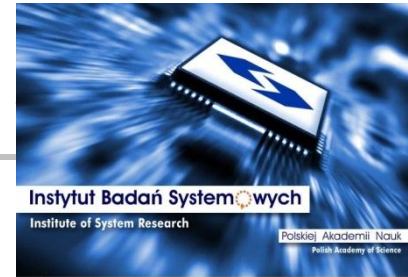
- **planning the *monitoring (SCADA) systems*** for the water networks
- **development of *GIS systems*** for the waterworks
- **development of *hydraulic models*** for the water networks
- **calibration of the hydraulic models** using the GIS and SCADA systems

## List of detailed actions that have to & can be done 2 (5)



- **development of algorithms and programs** for solving the problems concerning the water net management like:
  - **planning** the water net **revitalization**
  - **forecasting** the possible **damages** in the water net and its hydraulic load,
  - **calculation** of the **water age** in the water net,
  - **calculation** of distribution of **Chlorine** in the water net,
  - **planning** the **water price** for the waterworks.

## List of detailed actions that have to be done 3 (7)



- **development of algorithms and programs for:**
  - *optimization* of
  - *operational control* of
  - *planning* the
  - *reliability forecast* for
  - *discovering and localization* of *water leaks* in water nets with the use of the GIS and SCADA systems and the water net hydraulic model
- **integration of all programs** into united IT product

# Thank you for your attention

2012-10-31

