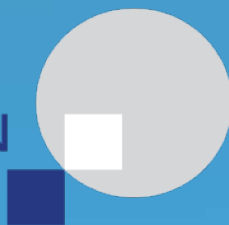


Research Trends in Control Engineering

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CERTICON
ADDED VALUE SOLUTIONS



CertiCon, a.s.

- founded in 1996
- headquarters in **Prague**, branch in **Pilsen**, office in **Sunnyvale, CA**
- **110+ employees**, turnover **5+ MEuro**
- Dun & Bradstreet rating 1A1, DUNS 36-690-9096
- **ISO 9001** certification UKAS, ANSI-RAB (BVQI)
- business focus in **consultancy, outsourcing and product development:**
 - Complex life and mission-critical systems
 - Decision support and productivity measuring systems (Business Intelligence)
 - Industrial Control and Diagnostics
 - ASIC design, verification and testing
 - Basic and applied research



CertiCon, a.s.

Searching for Innovations:

- Joint Work-site of CERTICON and **Czech Technical University** in Prague and **University of West Bohemia** in Pilsen
- Co-founding Member of national **Center for Applied Cybernetics**
- **Participating in 6 EU research projects**

Implementing Innovative Solutions:

- **Advanced Planning and Scheduling**
- **Expert Systems – Medtronic (USA) ...Therapy Advisor for pacemakers**
- **Prediction Systems**
- **Network Security**
- **Industrial Automation**



CertiCon, a.s.

Medical:

- Medtronic (USA) ...pacemakers and implantable devices, patient care systems

Automotive:

- Bosch (Germany), Teradyne (USA/GB) ...vehicle diagnostics

Air Traffic Management & Telecommunications:

- Frequentis (Austria) ..mission-critical and railway communication systems

Public Sector:

- Ministry of Finance (CZ) ...large IT systems

ASIC Design:

- Teradyne (USA/Germany), LogoMotion (Slovakia/USA)

Large information Systems:

- Perceptive Software (USA), IBM (CZ)

Industrial Automation:

- Rockwell Automation (USA), SPEL (CZ)

Daughter companies

ProTys, a.s.

- 45 employees,
- Engaged solely in industrial automation
- Cooperation with Rockwell Automation and Pavilion Technologies
- Own product: Fuzzy Designer – a tool for fuzzy control design and simulation

Cognitive Security, s.r.o. (Ltd.)

- University start-up with 2 employees
- Very efficient computer network security solution
- Own product: CognitiveOne

Main Streams of R&D in Industrial Automation

- Control Systems Architectures:

GOALS: to provide HW and SW infrastructure for real-time control,
and

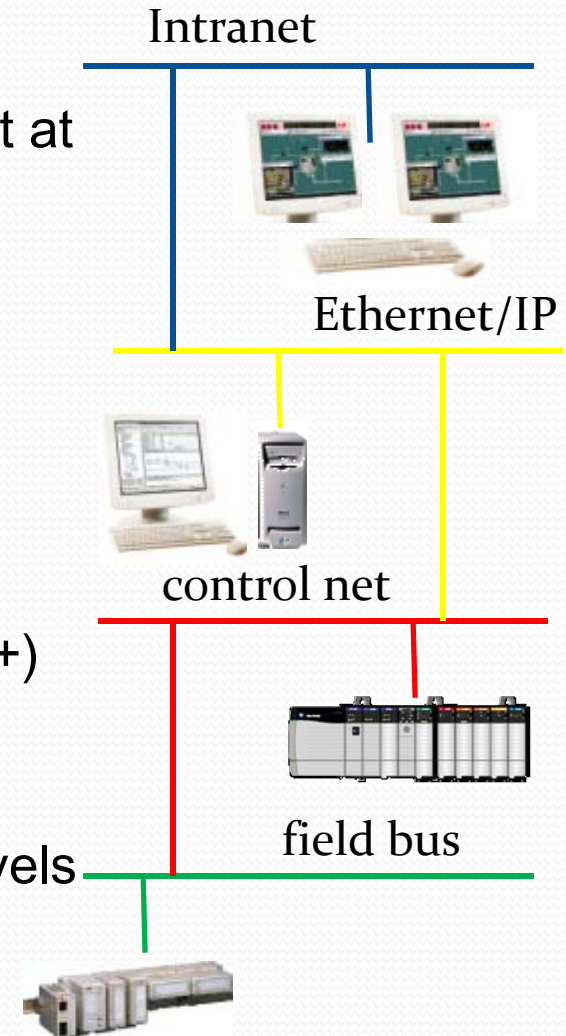
to enable appropriate data-flows from any point to any-point, even accross various control levels

- Advanced Process Control:

GOAL: to optimize the plant performance at higher level

Control System Architectures

- should allow data-flow from any point to any point at any plant level – **system integration** based on communication SW
- main development focused on
 - PLC (new processor, new capabilities etc.)
 - **data gathering (e.g. OPC servers, databases) incl. imaging (SCADA systems)**
 - local control buses (Profibus, DeviceNet, DH+)
 - control theory, **control algorithms**
- control theories successfully applied at lowest levels or locally restricted



Why Advanced Process Control?

- MAIN GOAL: to optimize the plant performance at higher level
- **economy**
 - better planning
 - optimize throughput
 - improved productivity
 - less unexpected variations
- **ecology**
 - emission
 - energy consumption
 - reducing waste

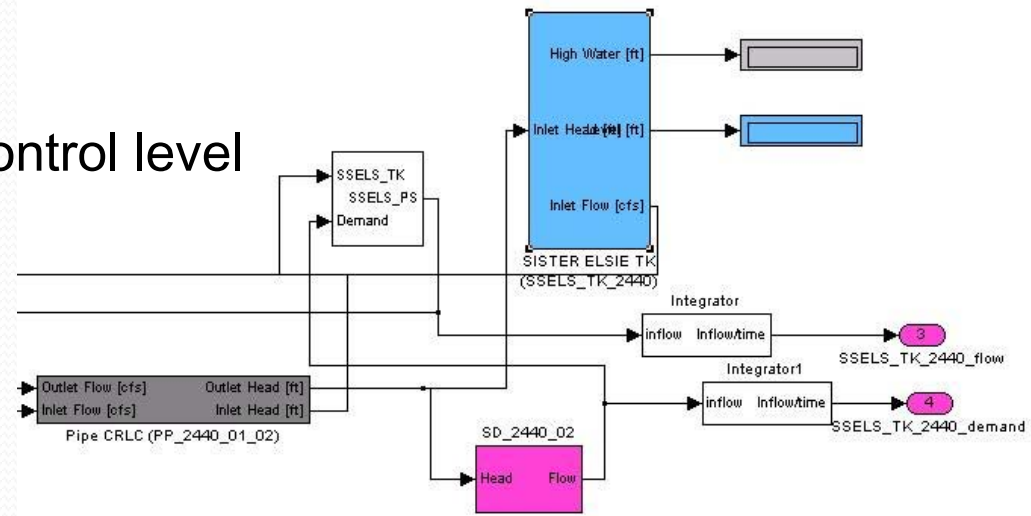
Why Models And Simulations ?

- **Advanced Process Control (APC)** requires mathematical models → simulation and simulators needed

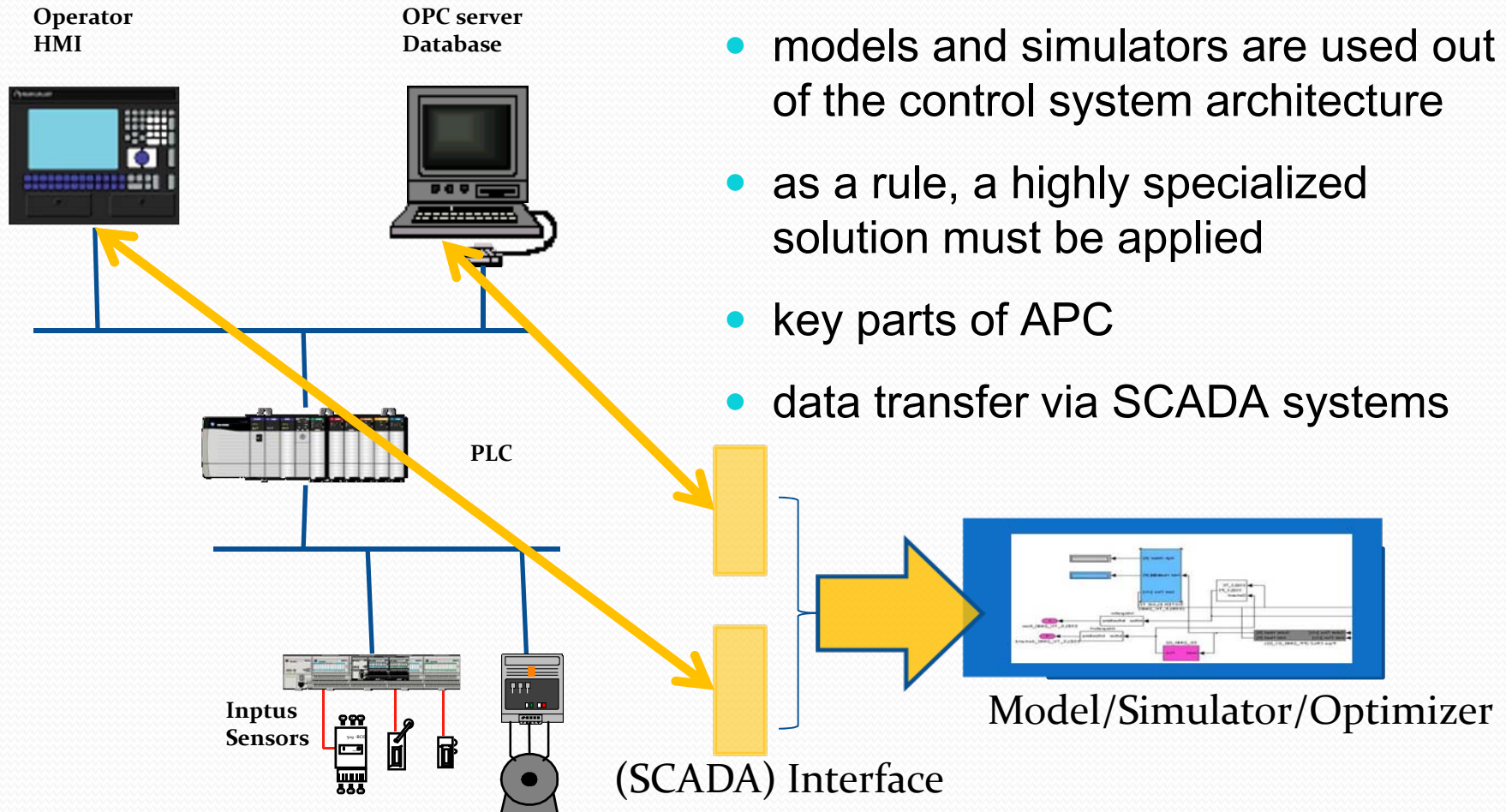
- key role of models and simulations

- plant-wide optimizer
- operator training
- decision support at any control level
- model predictive control
- system behavior

- simulators **need data**

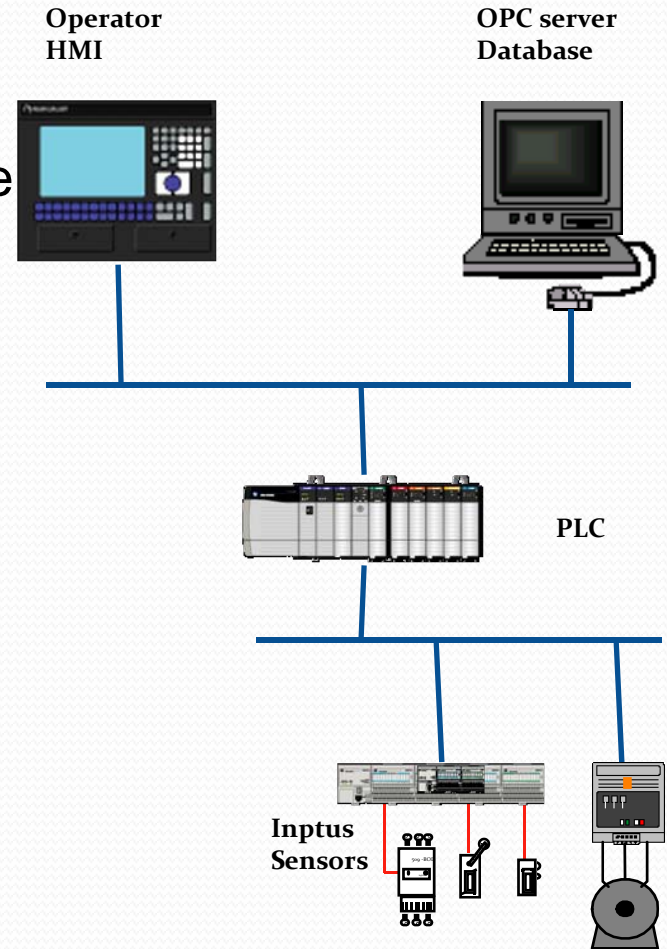


Models/Simulators in Overall System Architecture



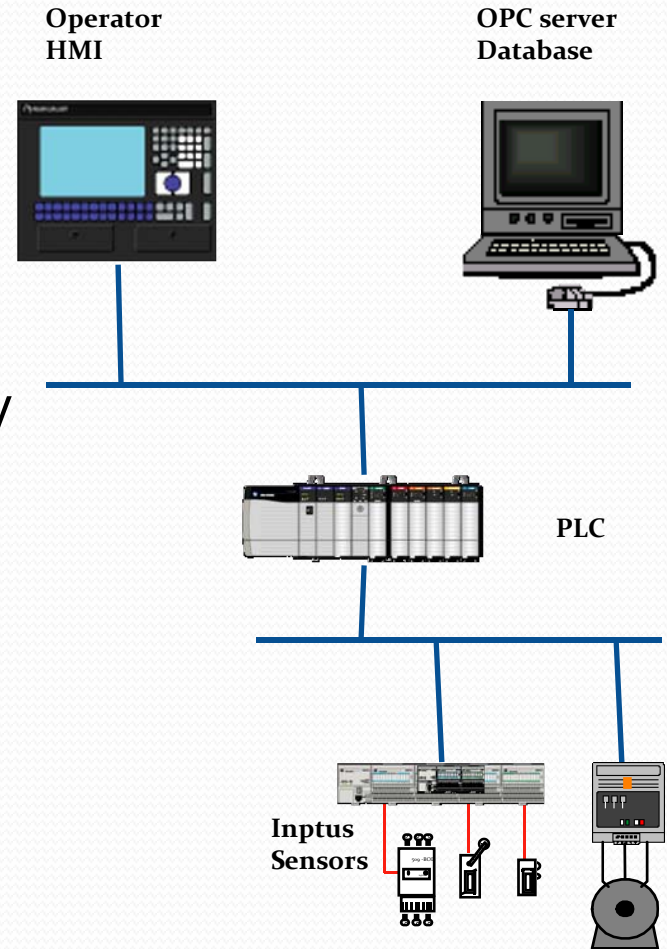
SCADA systems

- Supervisory Control And Data Acquisition substructure of Control System Architecture
- Tools for creating bridge between **Real-time Control Systems** and **Advanced Process Control (APC)**
- Involve the following components
 - sensors, infrastructure
 - HMI
 - interfaces to data servers, databases, and simulation tools



SCADA systems

- Disadvantages and problems of SCADAs:
 - some systems - low degree of modularity
 - structure differs vendor from vendor
 - low level of standardization
 - limited data handling
 - not mature for APC needs



Water Distribution System

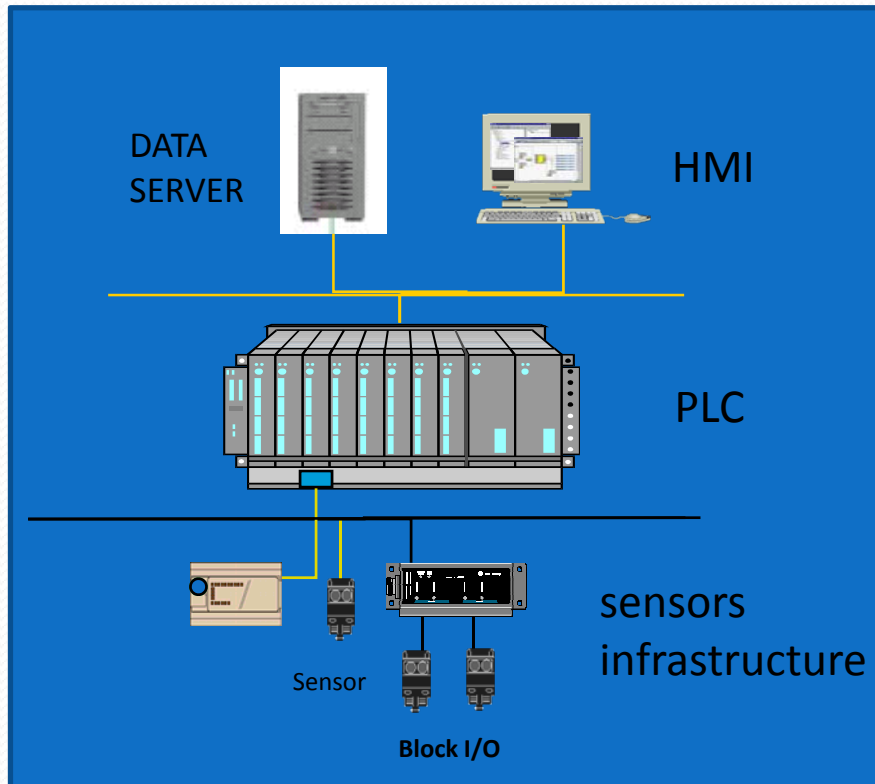
- **water distribution system** (only trunklines!)
 - water for approx. 5 mil. people
 - 20 reservoirs, 2 power stations
- **simulator**
 - approx. 1000 simulated values
 - special PC required, Matlab
 - sampling time 1 minute
- **3 simulator modes**
 - real-time simulation for estimation non-measured values, user: daily operator
 - speed-up simulations for special cases (water leakage, reservoir or line shut-downs etc.), user: operation manager
 - simulation with historical data and pre-prepared data for training of operators, user: “rookie”

**Rockwell
Automation**

SCADA system of today

**Rockwell
Automation**

- **Supervisory Control And Data Acquisition**
 - supervisory control by operator, no automation at higher level
 - simple data collection, no support for complex data handling
 - missing standards and interfaces for simulations and model utilization

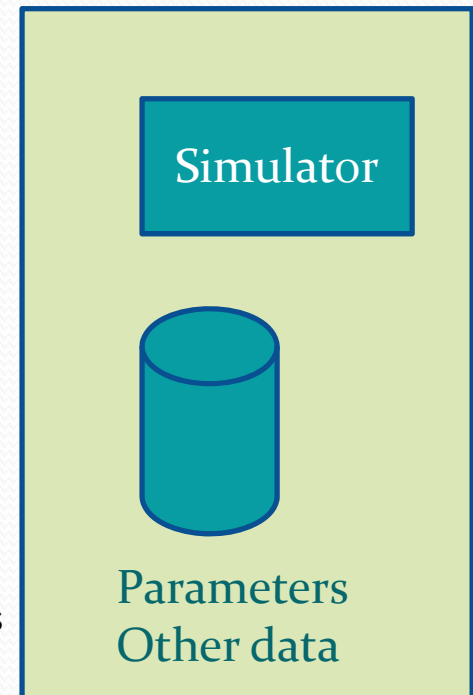


set of interface

- simulation control
- historical database
- online data etc.

unique solution depending on

- SCADA vendor
- used simulator
- system structure
- customer requirements



Research Goals & Impacts

Research goals have been set according to the needs of large industrial vendors (Rockwell Automation, Siemens, ABB):

- simulations/models/optimizers as a standard part of the overall/global control system architecture, standardized SCADA systems
standardization = savings
- simulation should be accessible from all plant levels
broader scope of availability of simulation results = higher quality of control
- plant control by daily operators as well as by top management
many-fold control = higher control robustness and efficiency

Research Goals & Impacts

- all engineering phases should be supported
 - design, development – analytical skills of a developer
 - implementation and testing – application engineer
 - full operation – user

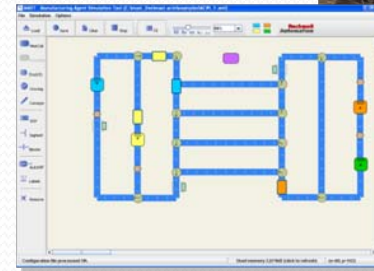
enhancements and significant speed-up of engineering activities = lower engineering costs
- Automation of decision making – fast and efficient reactions
- Open methodology for new control strategies
 - agent based technologies

higher system flexibility, reconfigurability and re-usability

Research Cooperation Experience


- **ACIN – Vienna University of Technology** – O.Struger Lab (A.Zoitl)

- Palette transfer system testbed
- Physical control of ACIN testbed by Rockwell's agent-based tool MAST
- Semantics for agents
- Conveyor belt failure tested
 - alternative routing found



- **ISIS – Vienna University of Technology** (A Min Tjoa, S.Biffli)

- Datawarehousing, datamining
- Data visualisation
- Computer security



**Vienna University of Technology
&
Kirchner Soft GmbH (logi.cals Austria)**

the very best partners to achieve the goals!

**We are looking forward to the Christian Doppler Labor joint
achievements!**

