



Universitatea "Ștefan cel Mare" Suceava  
Facultatea de Inginerie Electrică și Știința Calculatoarelor

## Transparent Interaction of SCADA Systems Developed over Different Technologies

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### OUTLINE

1. INTRODUCTION
2. MIDDLEWARE TECHNOLOGIES FOR SCADA SYSTEMS
3. PROPOSED SOLUTION
4. FUTURE WORK
5. CONCLUSIONS

## 1. INTRODUCTION (1)

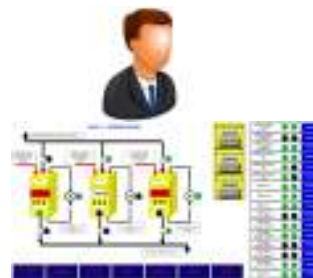
### SCADA Systems

- ▶ **SCADA** – **S**upervisory **C**ontrol and **D**ata **A**cquisition systems;
- ▶ Hardware/software systems that allow:
  - **Data acquisition** from **sensors** or **field devices** used in the monitoring and control of industrial process;
  - Transmission of commands/instructions to the **remote field devices** or **actuators**.

## 1. INTRODUCTION (2)

- ▶ The **main elements** of an **SCADA** systems are:

- **The human operator**;
- **HMI** – Human Machine Interface;
- **MTU** – Master Terminal Unit;
- **RTU** – Remote Terminal Unit.



## 1. INTRODUCTION (3)

▶ The most-used middleware technologies are

- based on **OPC** specifications (OPC DA, OPC.NET, OPC UA)



- based on **CORBA** (Common Object Request Broker Architecture) standard



- based on **DDS** (Data Distribution Service) protocol;



- based on **AMQP** (Advanced Message Queuing Protocol).



## 2. MIDDLEWARE TECHNOLOGIES FOR SCADA SYSTEMS (1)

- ▶ **OPC** specifications are developed and sustained by OPC Foundation.
- ▶ Currently, the **OPC Foundation** provides three middleware architectures, namely:
  - Classic **OPC DA** (based on **DCOM technology** from Microsoft),
  - **OPC .NET** – initially called Xi Express interface (based on **Windows Communication Foundation** from Microsoft)
  - **OPC UA –Unified Architecture** (based on **SOAP and Web services**).



## 2. MIDDLEWARE TECHNOLOGIES FOR SCADA SYSTEMS (2)

- ▶ **CORBA** (Common Object Request Broker Architecture) is a middleware standard based on the client/server paradigm to distribute data between heterogeneous applications in terms of programming language and operating system used.
- ▶ For real-time distribution, there are defined **RT-CORBA** specifications that can achieve a deterministic access to shared resources
- ▶ CORBA is still used for data distribution in LHC Experiments' Control Systems.



## 2. MIDDLEWARE TECHNOLOGIES FOR SCADA SYSTEMS (3)

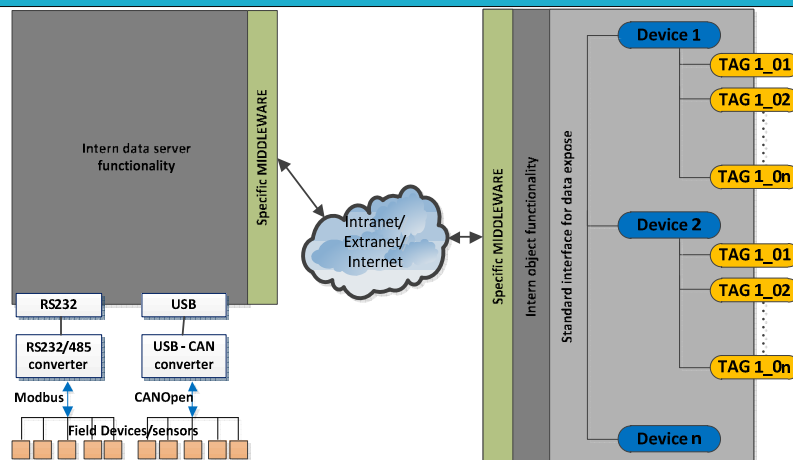
- ▶ **DDS** (Data Distribution Service for Real-Time Systems) is a middleware standard based on the publish/subscribe paradigm to distribute data between heterogeneous applications.
- ▶ An important feature of this protocol is that it has facilities for implementing **QoS (Quality of Service)** parameters in order to achieve real-time performance.
- ▶ Due to **real-time facilities**, this protocol is used in critical systems in the detriment of OPC based solutions.



### 3. PROPOSED SOLUTION (1)

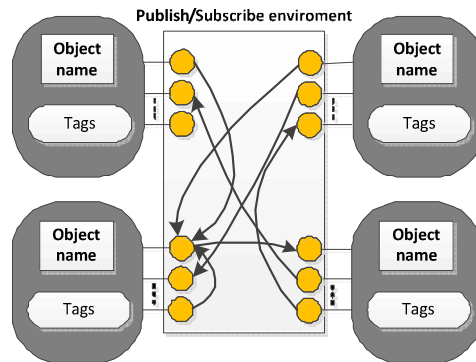
- ▶ It is proposed a framework, which will further be named **MIOF** (**M**iddleware **I**nter-**O**perability **F**ramework).
- ▶ **MIOF** is based on **middleware objects** and **connections** between these objects.
- ▶ Each object **encapsulates a specific functionality** depending on the middleware on which is based.
- ▶ Each **middleware object** has a **set of parameters** and a **set of tags** or data members (which behaves like input/output points).

### 3. PROPOSED SOLUTION (2)



- ▶ **Logical architecture of an middleware object.**

### 3. PROPOSED SOLUTION (3)

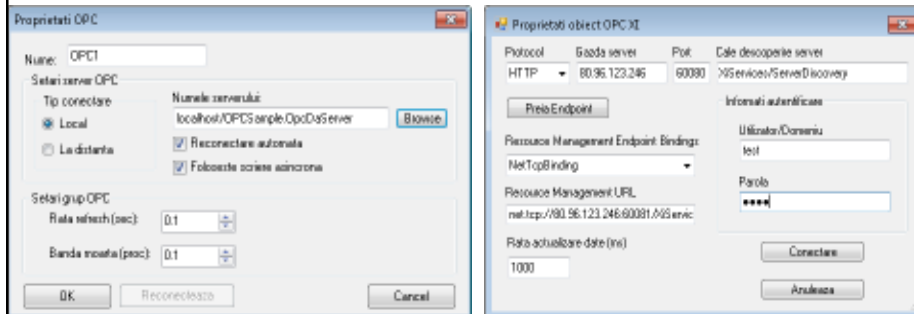


- ▶ The interconnection way of middleware objects.

### 3. PROPOSED SOLUTION (4)

- ▶ At this moment, there are implemented **middleware objects** for the:
  - OPC DA;
  - OPC .NET;
  - OPC UA;
  - TAO – an implementation of CORBA;
  - OpenDDS – implementation of the DDS standard.

### 3. PROPOSED SOLUTION (5)



- ▶ The properties of the OPC DA object.
- ▶ The properties of the OPC .NET object.

### 4. FUTURE WORK

- ▶ Can be developed objects that will take the **address space of the MIOF environment**, and they can **distribute it through a specific middleware**;
- ▶ Can be created **OPC UA, OPC. NET and OPC UA objects that work as servers**, and they expose the address space of the MIOF environment.

## 5. CONCLUSIONS

- ▶ We presented a solution for **interoperability of SCADA system** developed over **different technologies** in terms of **middleware systems**.
- ▶ The proposed solution operates on the **publish/subscribe paradigm**.
- ▶ We can easily **introduce new objects** that can retrieve data through a **specific middleware** or other methods **such as service-oriented applications**.

## ACKNOWLEDGMENT

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Thank you!



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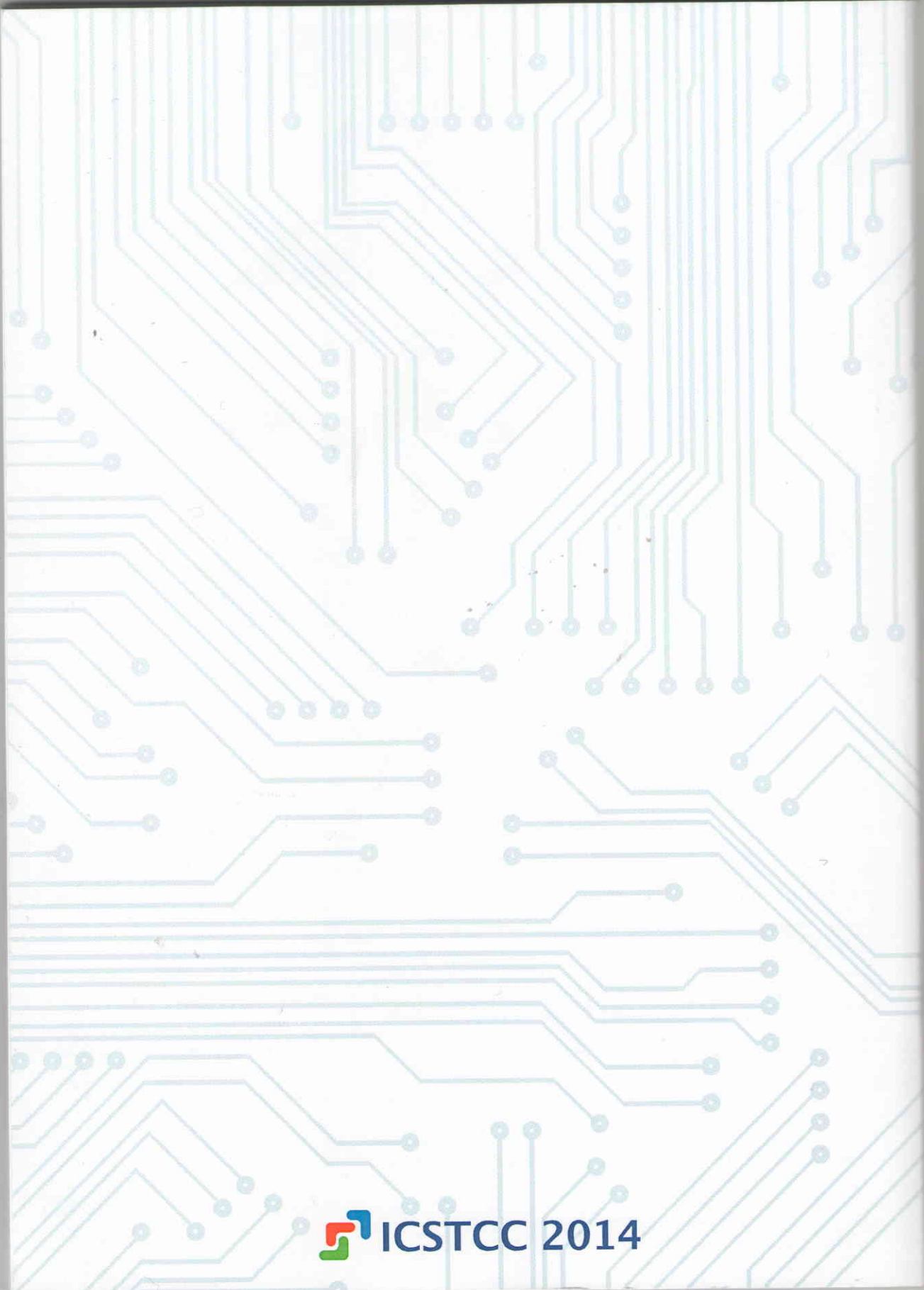
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10:50-11:10	SaC5.1
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Butincu, Cristian Nicolae	<i>Gh. Asachi</i> Tech. Univ. of Iasi
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11:10-11:30	SaC5.2
<i>Towards an Inclusive Parkinson's Screening System (I).</i>	
Geman, Oana	<i>Stefan cel Mare</i> Univ. of Suceava
11:30-11:50	SaC5.3
<i>Transparent Interaction of SCADA Systems Developed Over Different Technologies (I).</i>	
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11:50-12:10	SaC5.4
<i>Study of the Long-Term Effect of STDP in Areas of Spiking Neurons (I).</i>	
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12:10-12:30	SaC5.5
<i>An Ontology of Human Walk for Autonomous Systems (I).</i>	
Luca, Ramona	Inst. of Computer Science, Romanian Acad. Iasi Branch
Bejinariu, Silviu Ioan	Inst. of Computer Science, Romanian Acad. Iasi Branch
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12:30-12:50	SaC5.6
<i>Characterizing the Attractors of Chaotic Systems by a Direct Measurement Method (I).</i>	
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 ICSTCC 2014

# 18th International Conference on System Theory, Control and Computing

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17 - 19 October 2014, Sinaia, Romania



Mr. Ioan Ungurean  
Stefan cel Mare University of Suceava  
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720229 Suceava  
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November 3, 2014

Dear Mr. Ioan Ungurean,

On behalf of the Program Committee, it gives me great pleasure to invite you to participate in *the 18th International Conference on System Theory, Control and Computing ICSTCC 2014* which will be held at the Rina Sinaia Hotel, Sinaia, ROMANIA, during October 17 - 19, 2014.

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Accepted Paper details:

Ioan Ungurean, Nicoleta Cristina Gaitan, Vasile Gheorghita Gaitan, "Transparent Interaction of SCADA Systems Developed Over Different Technologies." Scheduled for presentation on Saturday October 18, 2014, 11:30-11:50 hrs.

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