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SCADA Systems Overview

Supervisory Control and Data Acquisition

Hans-Petter Halvorsen

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Introduction

Hans-Petter Halvorsen

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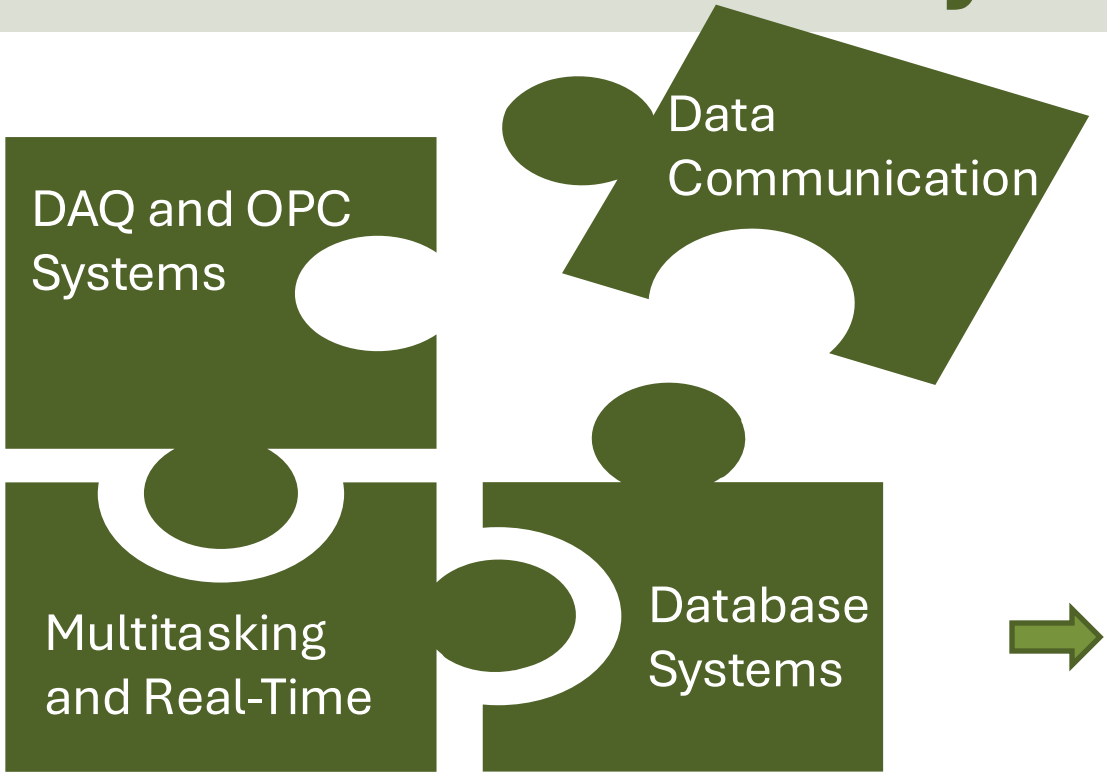
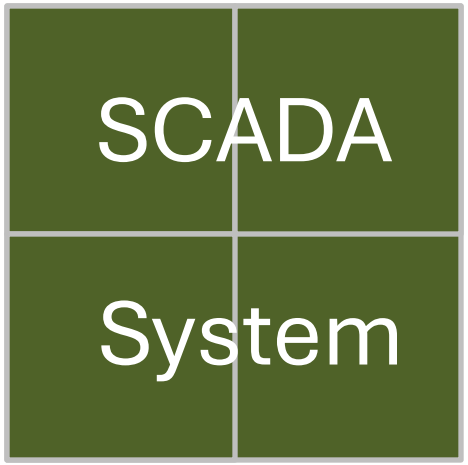
SCADA System



Data Communication, DAQ, OPC, Multitasking and Real-Time Systems and Database Systems will be the foundation/ backbone for a SCADA System.



SCADA System Example

DAQ Device
(USB-6008)

Air Heater

Process Plant

Simulator/Real Process

Control System

OPC Server

Network

Datalogging System

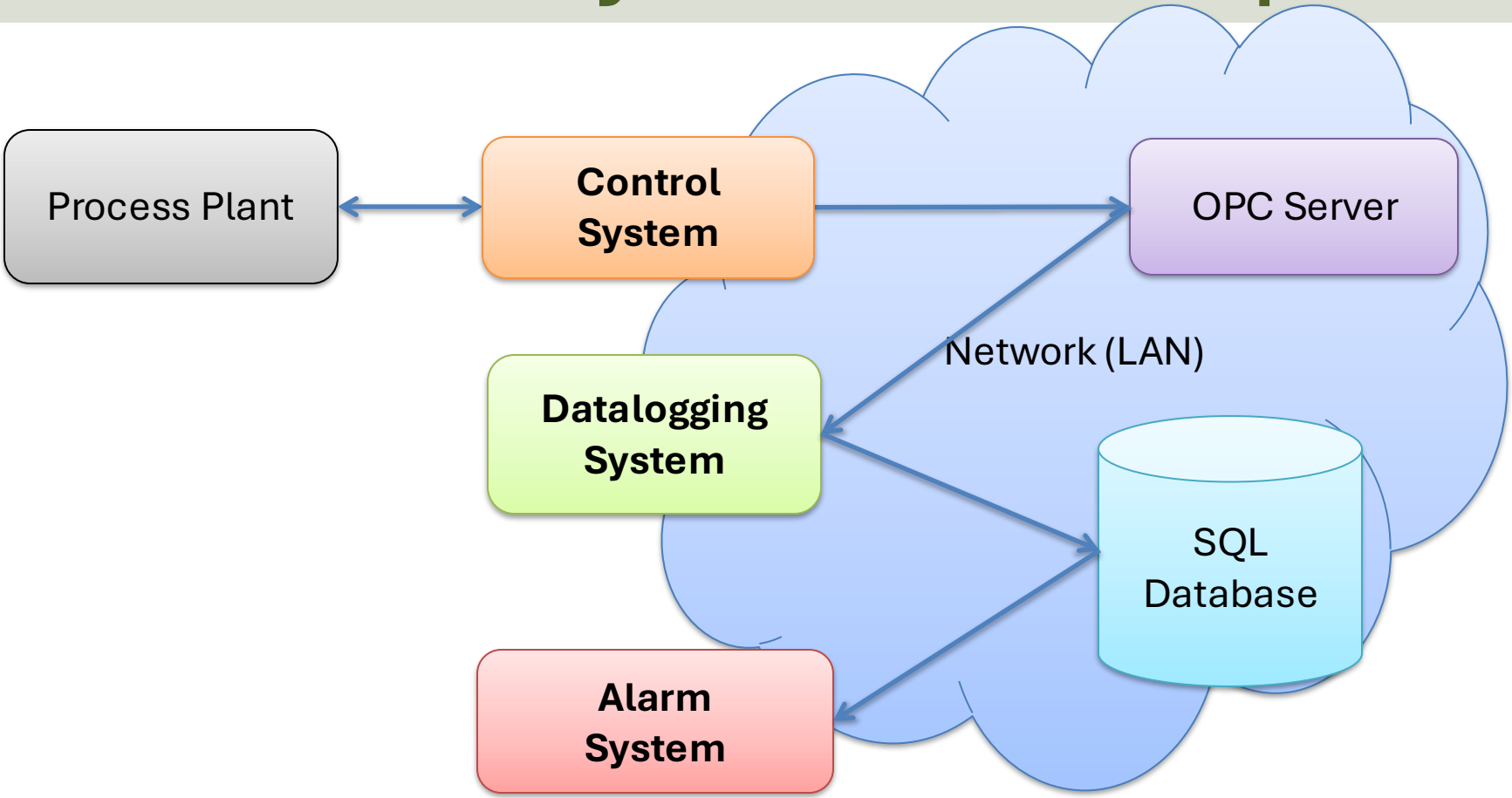
SQL Database

Microsoft SQL Server

Alarm System

Alarm Trigger

SCADA System Example



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SCADA Systems

Supervisory Control and Data Acquisition

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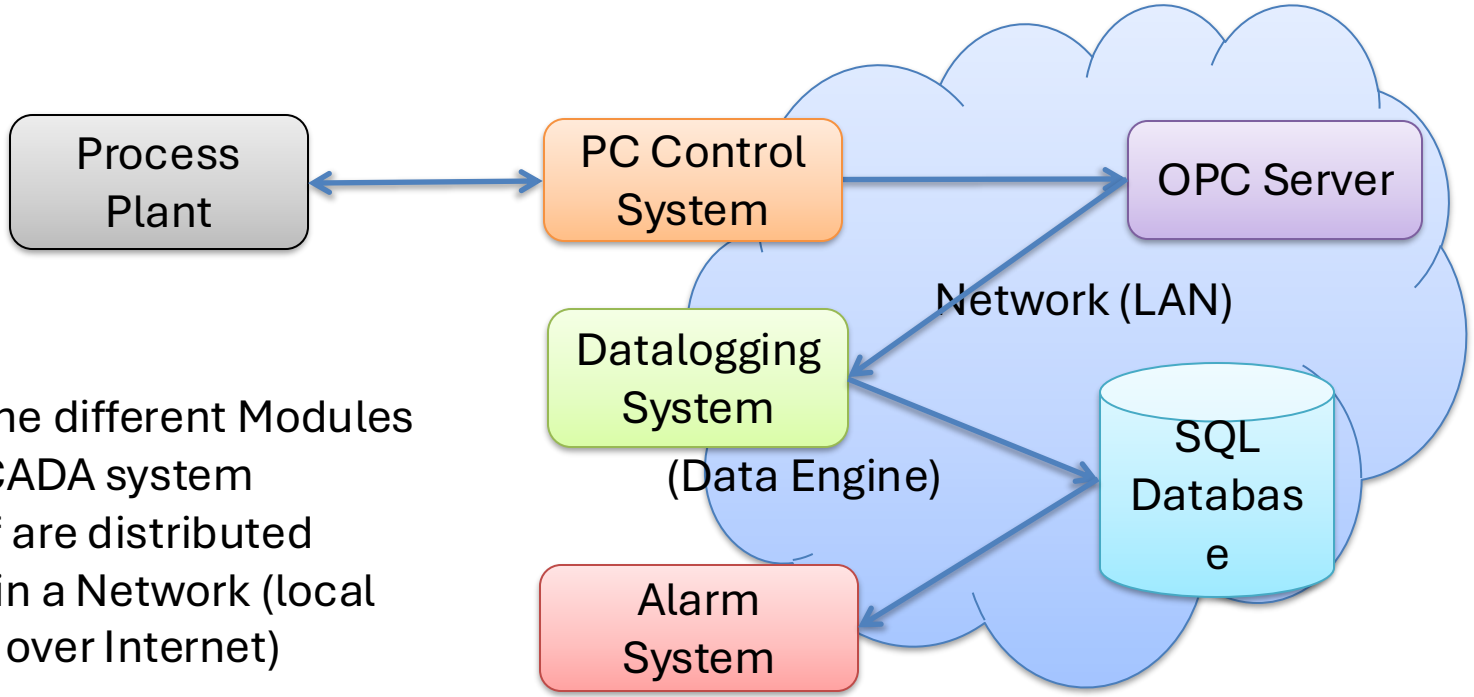
SCADA System Overview

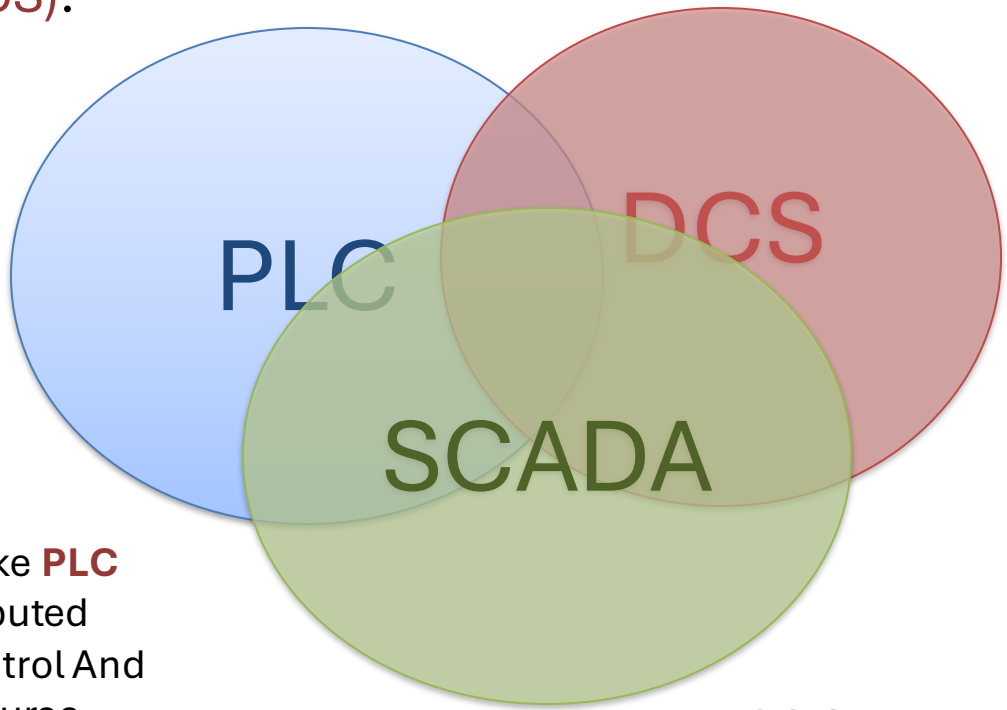
Typically, the different Modules that the SCADA system consists of are distributed physically in a Network (local network or over Internet)



SCADA Systems

SCADA (Supervisory Control And Data Acquisition) is a type of Industrial Automation and Control System (IACS).

Industrial Automation and Control Systems (IACS) are computer systems that control and monitor industrial processes.



IACS Systems

Industrial Automation and Control Systems, like **PLC** (Programmable Logic Controller), **DCS** (Distributed Control System) and **SCADA** (Supervisory Control And Data Acquisition) share many of the same features.

Industrial Control Systems

Industrial Automation and Control Systems (IACS) are computer systems that control and monitor industrial processes.

cRIO

LabVIEW

1

I/O Module

5

Programmable Automation Controller (**PAC**)

4

Industrial **PID** Controller

PC based Control System/**SCADA** System (Supervisory Control And Data Acquisition)

2 Distributed Control Systems (**DCS**)

DeltaV

PLC (Programmable Logic Controller)

3

Siemens PLC

PC-based Control System

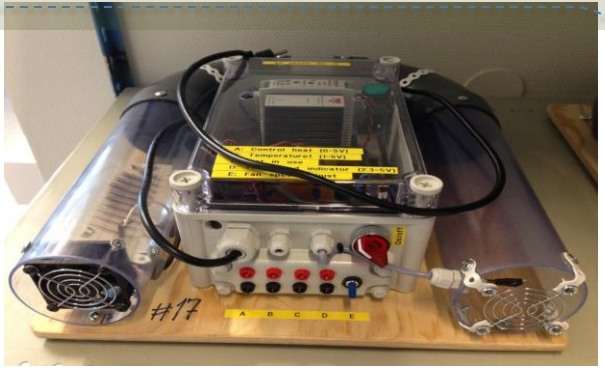
Industrial PID Controller

Embedded system with built-in PID algorithm, etc.

PID Control using PC and I/O Module

I/O Module

PC-based Control System Example



Process

0-5V/1-5V

0-5V

Analog Measurement(s) In

Analog Out Control Signal

I/O Module

USB-6008

AD Converter

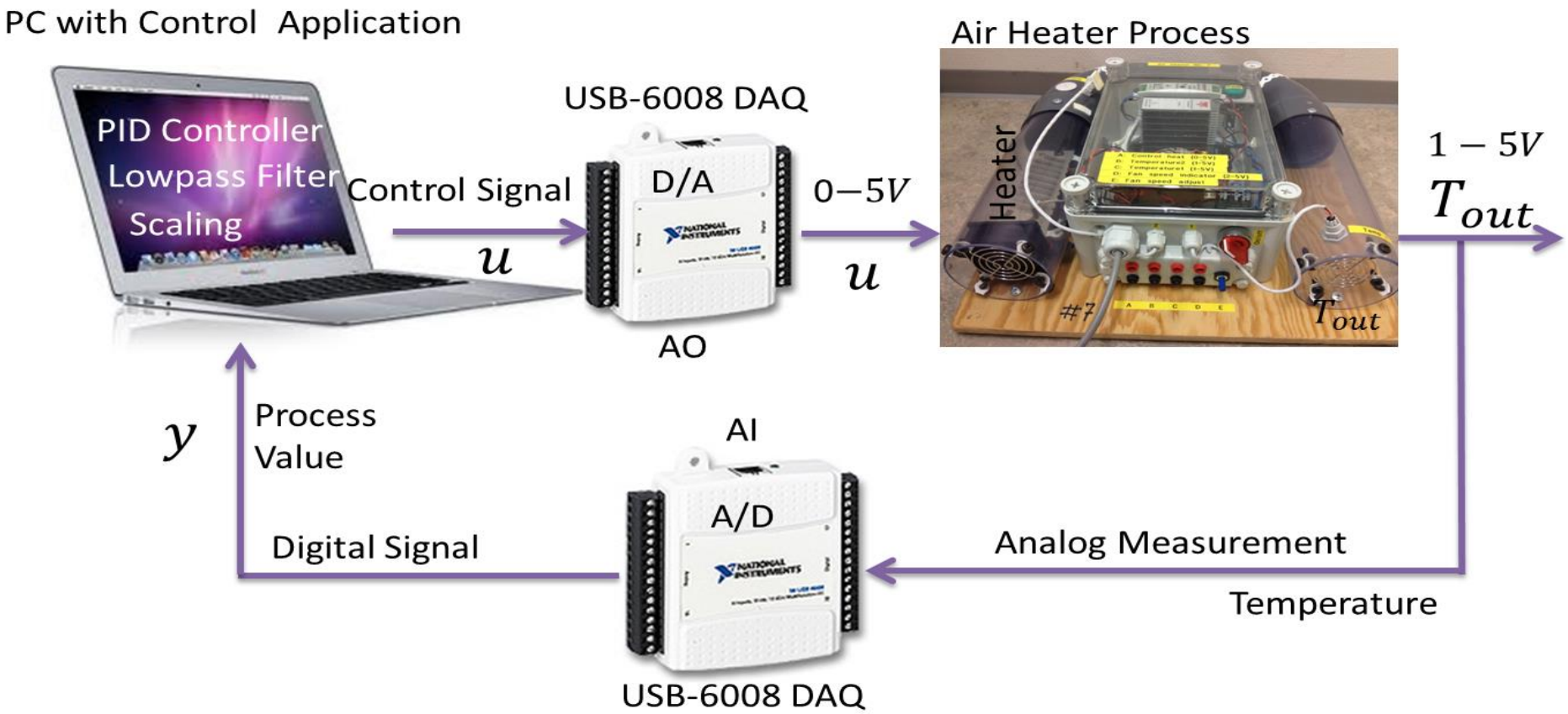
DA Converter

USB

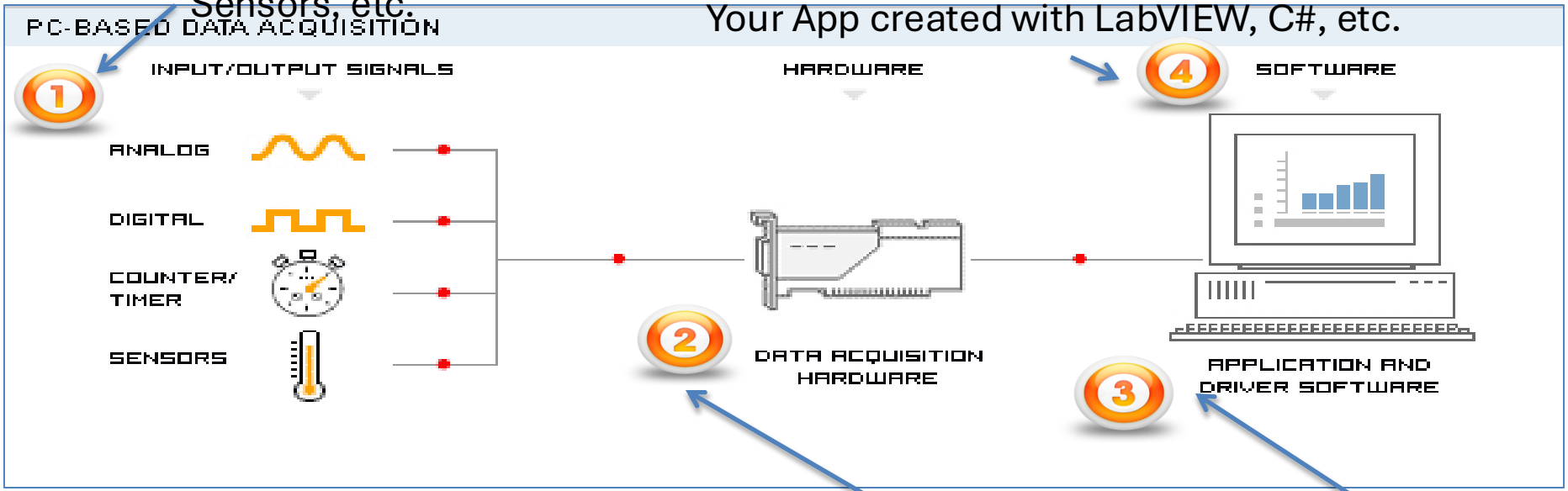
Controller (PID) and Lowpass Filter Implementation

C#

PC-based Control System



DAQ – Data Acquisition



A DAQ System consists of 4 parts:

1. Physical input/output signals
2. DAQ device/hardware
3. Driver software
4. Your software application (Application software)

NI USB 6008 DAQ Device

NI DAQmx Driver or similar

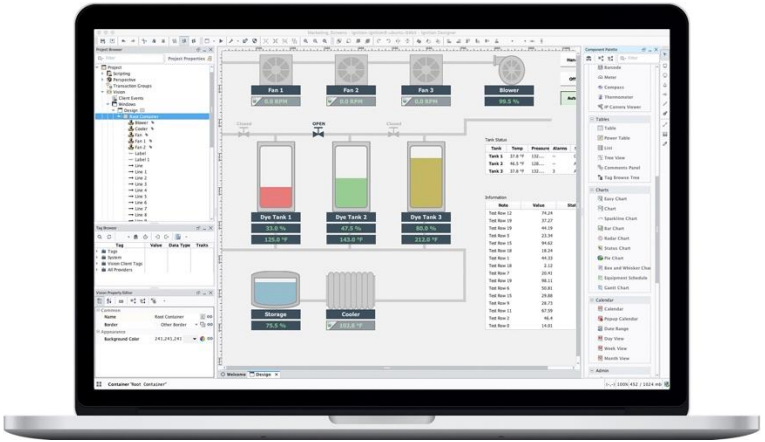
SCADA System

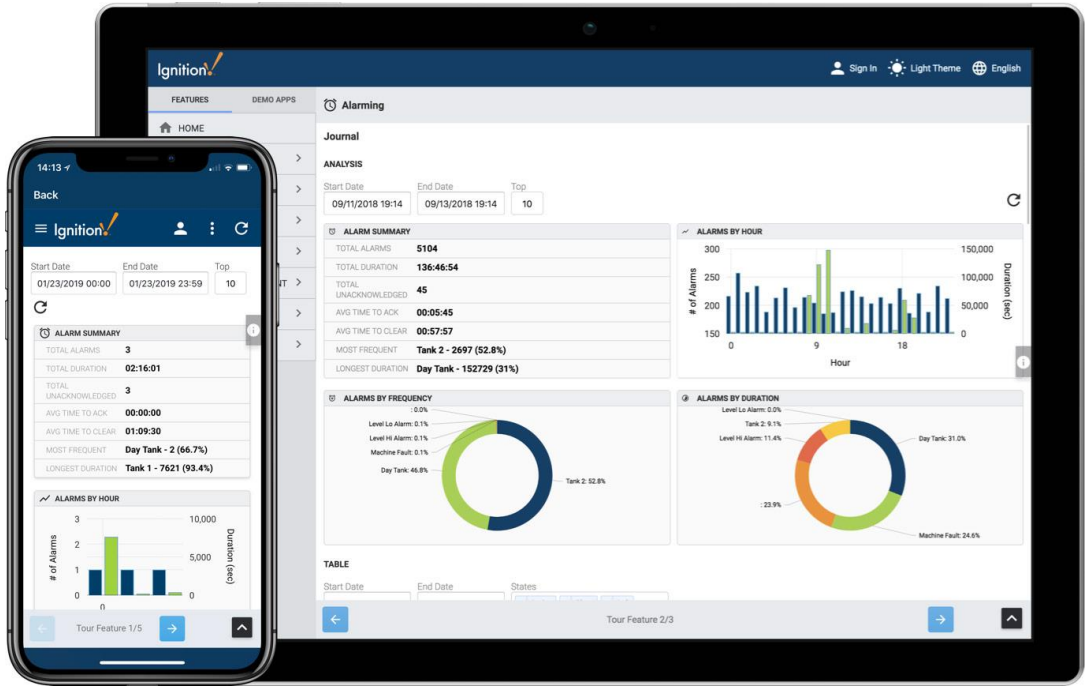
- The SCADA system typically contains different modules, such as:
  1. OPC Server
  2. A Database that stores all the necessary data
  3. **Control System**
  4. **Datalogging System**
  5. **Alarm System**
- Note! They are typically implemented as separate applications because they should be able to run on different computers in a network (distributed system).

Ignition SCADA Software

- Ignition is an example of industrial SCADA software from “Inducive Automation”.
- You can download an unlimited trial version or the Ignition Maker Edition.
- https://inductiveautomation.com
- Feel free to integrate (or get ideas) your solution with existing industrial software like OPC software, PLC software or SCADA software like Ignition.

Ignition SCADA Software





https://inductiveautomation.com

Air Heater

Hans-Petter Halvorsen

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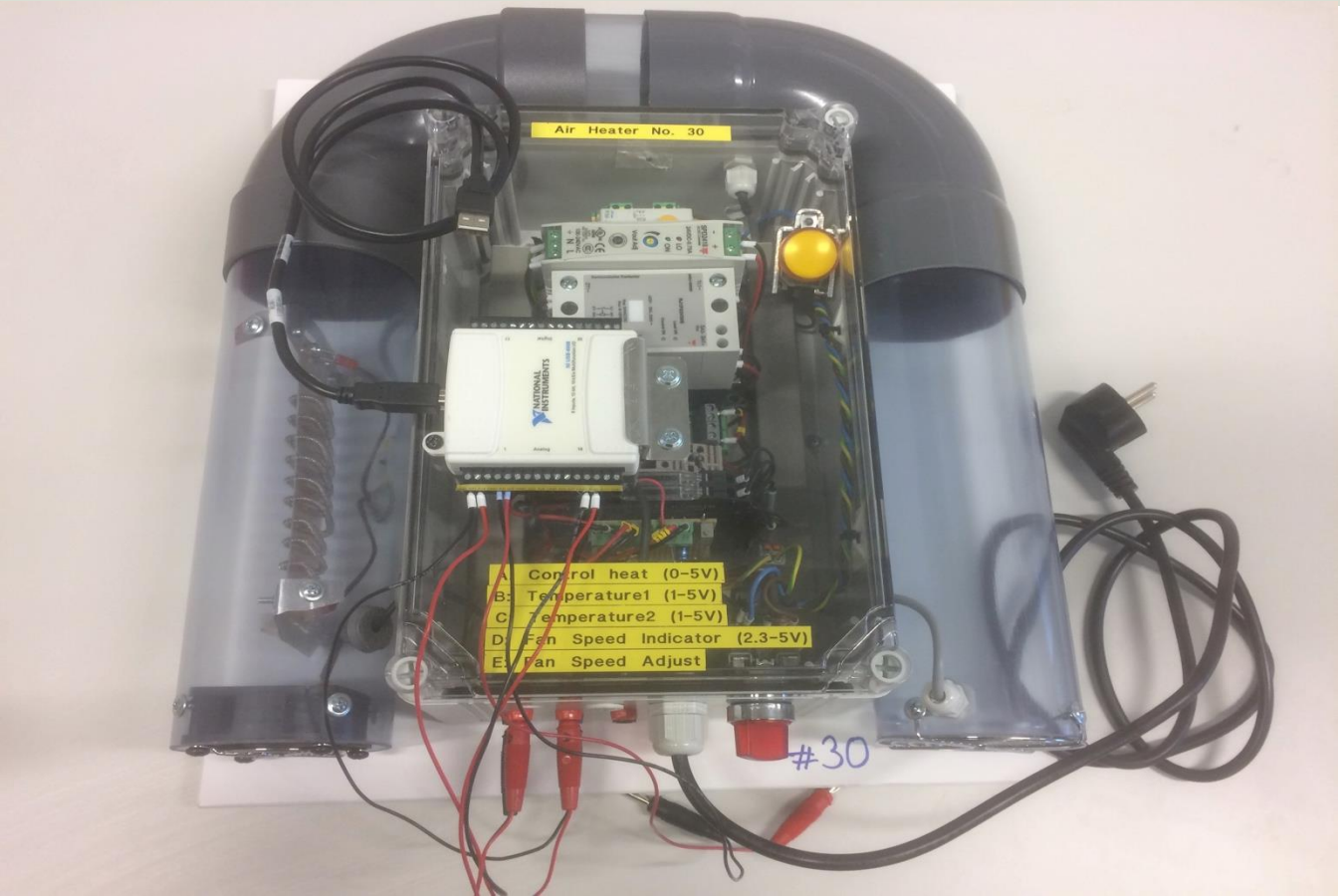
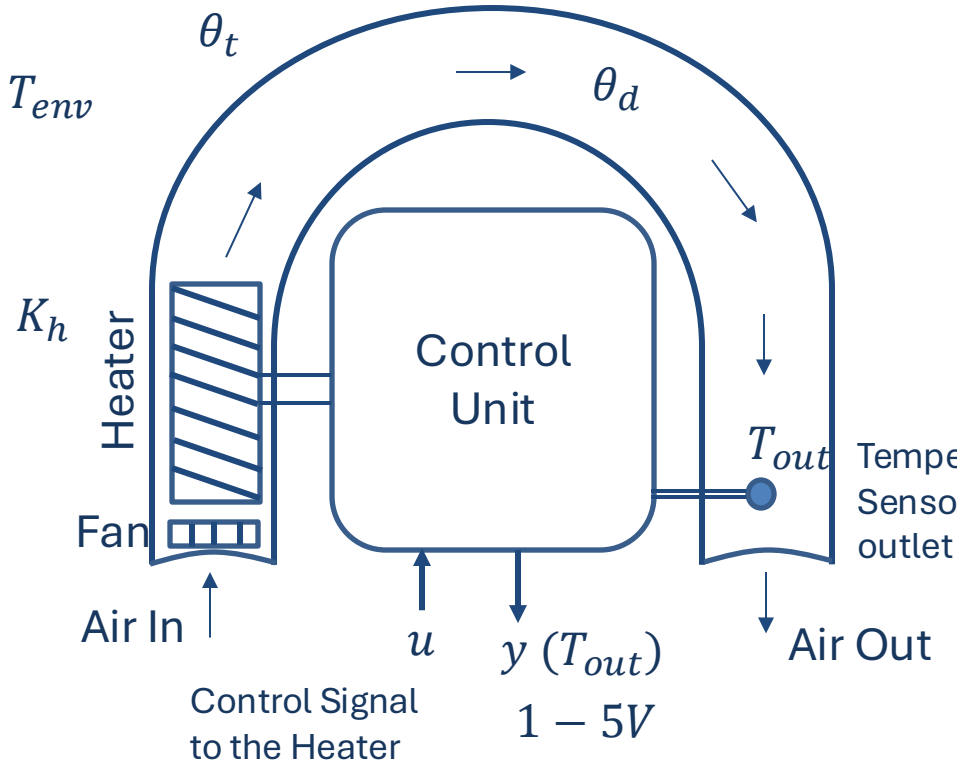
Air Heater



The Air Heater is a small-scale laboratory process suitable for learning about control systems

The purpose is to control the Temperature on the outflow of the Air Heater tube.

Air Heater



Aim:
Control the Temperature on the outlet (T_{out})

Air Heater Mathematical Model

$$\dot{T}_{out} = \frac{1}{\theta_t}\{-T_{out} + [K_h u(t-\theta_d) + T_{env}]\}$$

Where:

- T_{out} is the air temperature at the tube outlet
- $u\ [V]$ is the control signal to the heater
- $\theta_t\ [s]$ is the time-constant
- $K_h\ [deg\ C\ /\ V]$ is the heater gain
- $\theta_d\ [s]$ is the time-delay representing air transportation and sluggishness in the heater
- T_{env} is the environmental (room) temperature. It is the temperature in the outlet air of the air tube when the control signal to the heater has been set to zero for relatively long time (some minutes)

Example of Model Parameters:

Use, e.g., these values:

$$\theta_t = 22\ sec$$

$$\theta_d = 2\ sec$$

$$K_h = 3.5\ \frac{°C}{V}$$

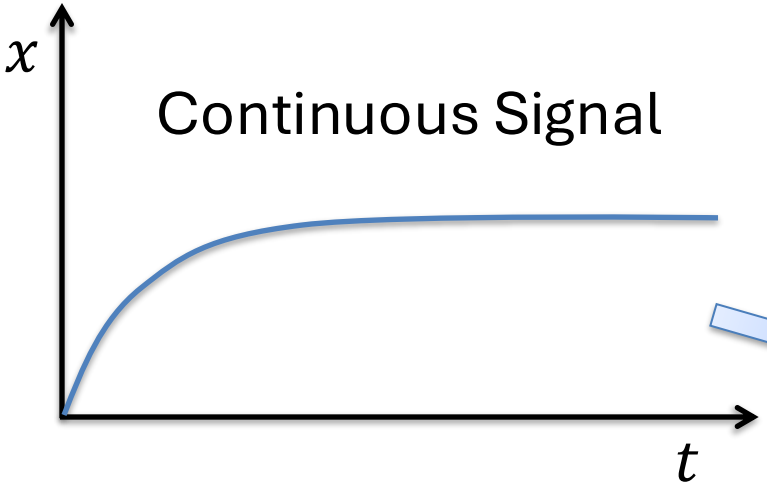
$$T_{env} = 21.5\ °C$$

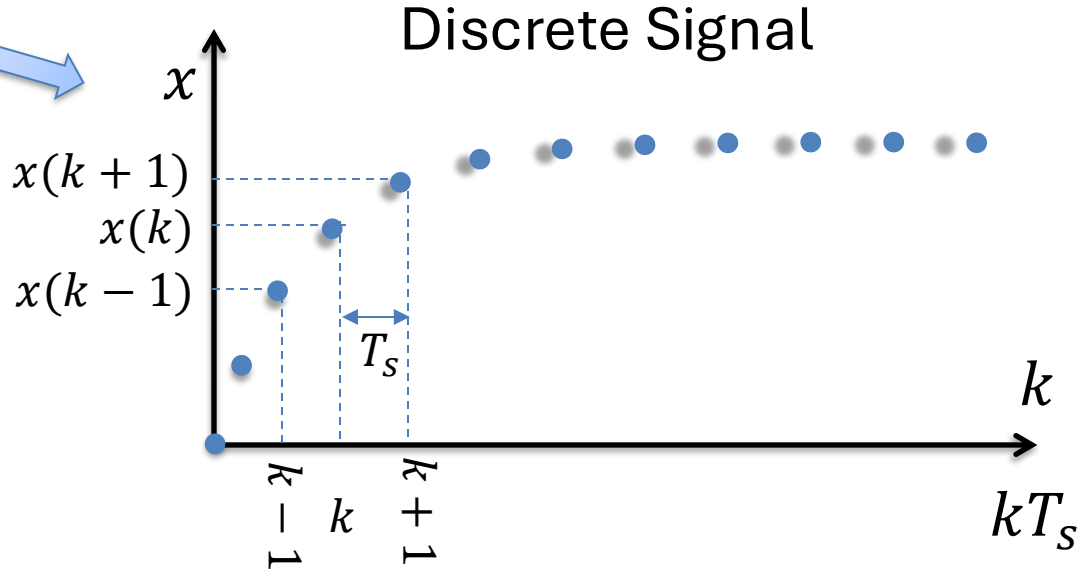
Air Heater Implementation

- The Air Heater is a standard 1.order process with time delay.
- In LabVIEW or C#, you can make a discrete version of the model and implement it. In LabVIEW you can, e.g., use a Formula Node.
- Discrete version: $T_{out}(k+1) = \ ...$
- Tip! The Time delay part of the system can be a bit “tricky“ to implement. Start by discarding/remove the Time delay part and implement ant test it.
- Then later, try to implement and include the time delay part of the system. The time delay part can typically be implemented by creating an array/FIFO queue.

Continuous vs. Discrete Systems

A computer can only deal with discrete signals





T_s - Sampling Interval

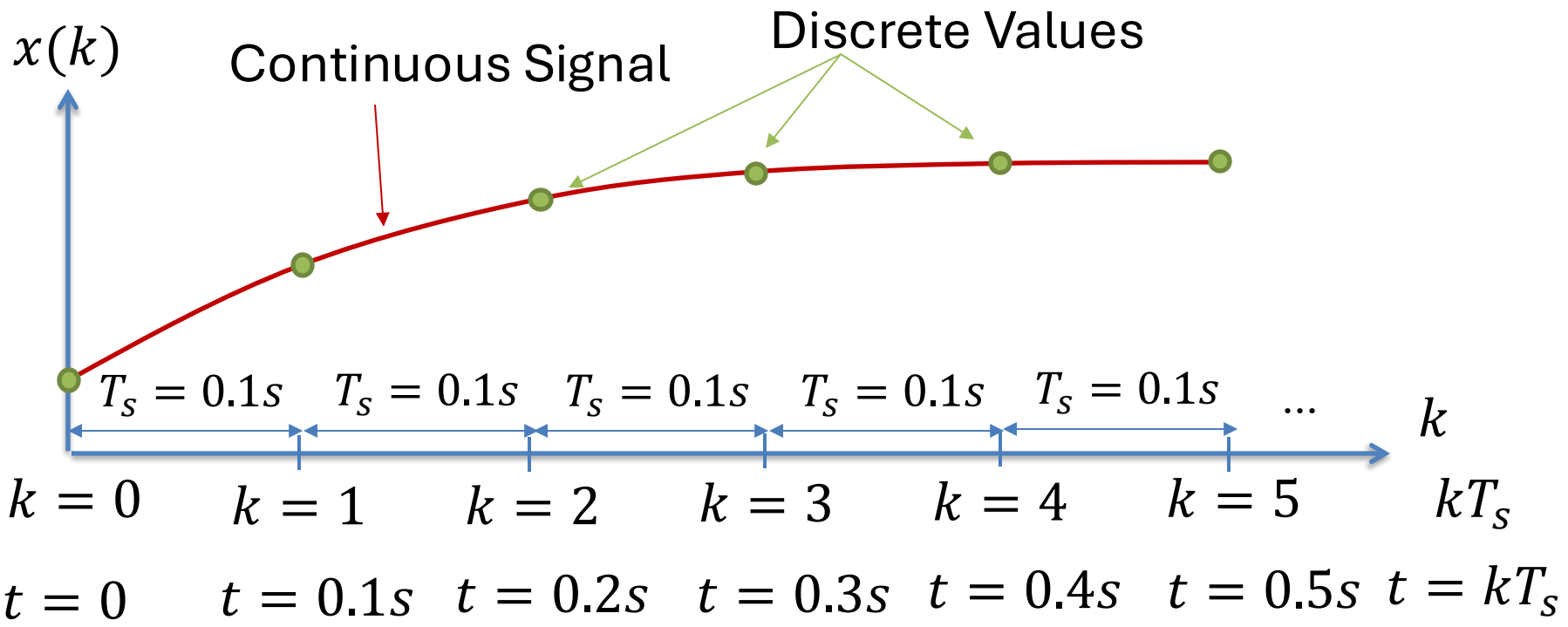
$x(k-1)$ - Previous Value

$x(k)$ - Current Value

$x(k-1)$ - Next Value

Continuous vs. Discrete Systems

In this Example we have used Sampling Interval $T_s = 0.1s$



Discretization

Continuous Model:

$$\dot{T}_{out} = \frac{1}{\theta_t}\{-T_{out} + [K_h u(t-\theta_d) + T_{env}]\}$$

We can use e.g., the Euler Approximation in order to find the discrete Model:

$$\dot{x} \approx \frac{x(k+1) - x(k)}{T_s}$$

T_s - Sampling Time

$x(k)$ - Present value

$x(k+1)$ - Next (future) value

The discrete Model will then be on the form:

$$x(k+1) = x(k) + \ \ldots$$

We can then implement the discrete model in C#

Finding Model Parameters using “Trial and Error”

You may use, e.g., the following Parameters as a starting point, but since every Air Heater is unique, you may want to adjust these parameters. The “Trial and Error Method” may be an easy way to find the Parameters for your Process.

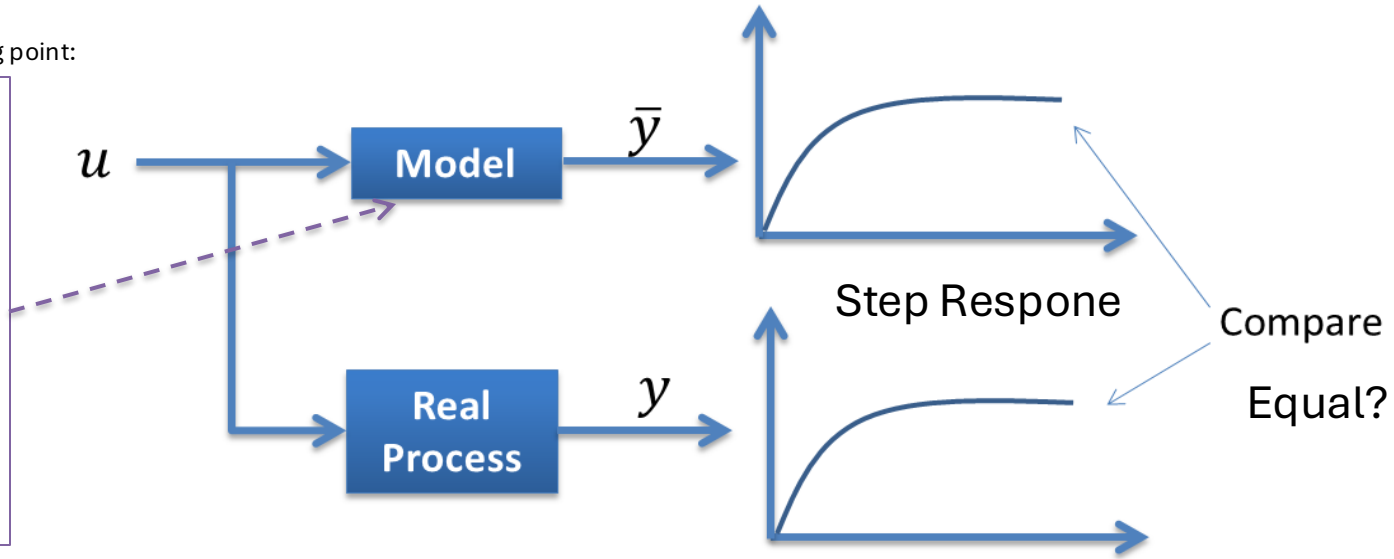
These values can be a good starting point:

$$\theta_t = 22\ sec$$

$$\theta_d = 2\ sec$$

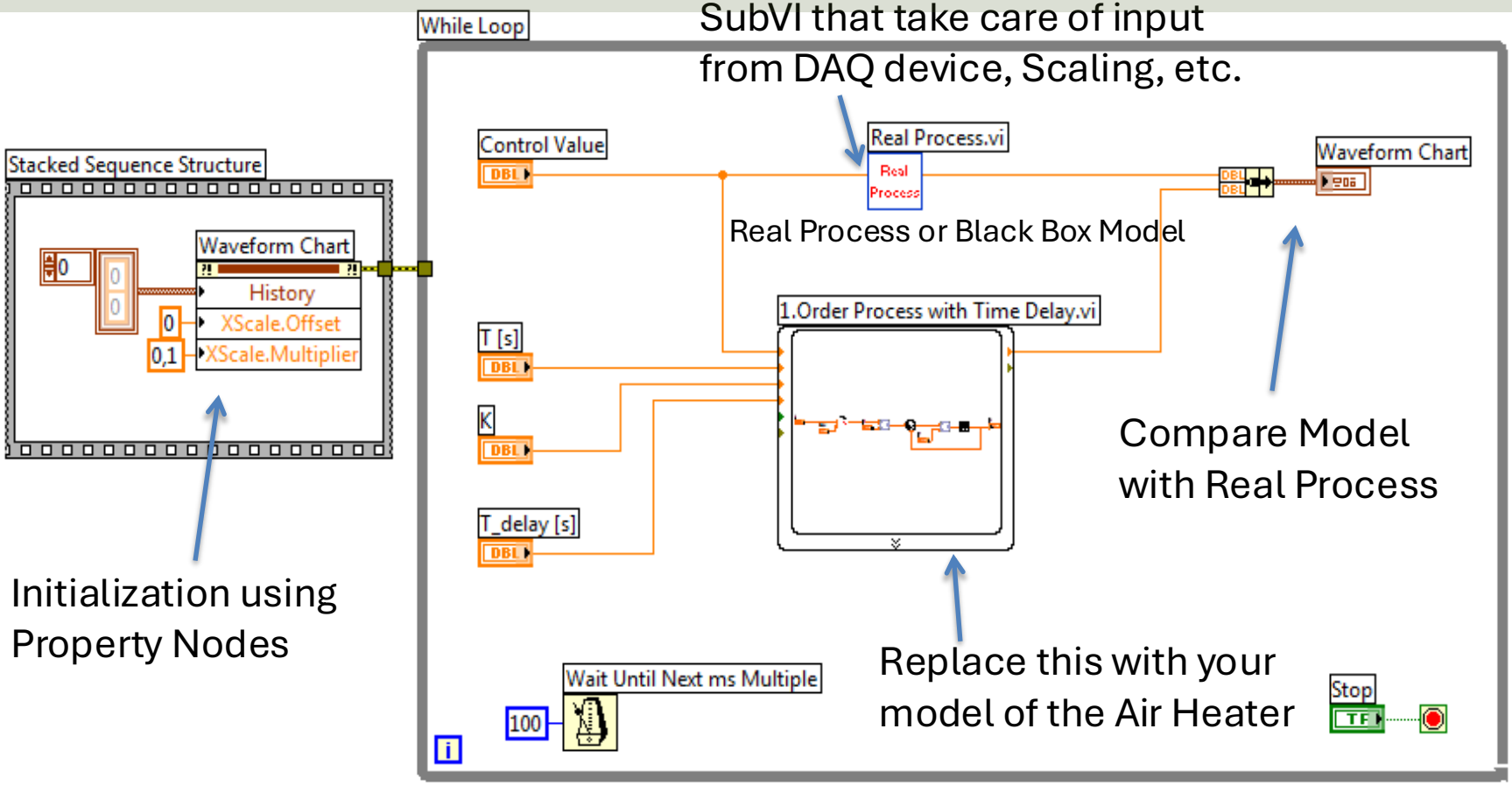
$$K_h = 3.5\ \frac{°C}{V}$$

$$T_{env} = 21.5\ °C$$



Procedure: You run the Model and the Real Process in Parallel. Adjust the Model Parameters until the output of the Model and the Real Process is “equal”.

“Trial and Error” Example in LabVIEW



Control System

Hans-Petter Halvorsen

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Control System

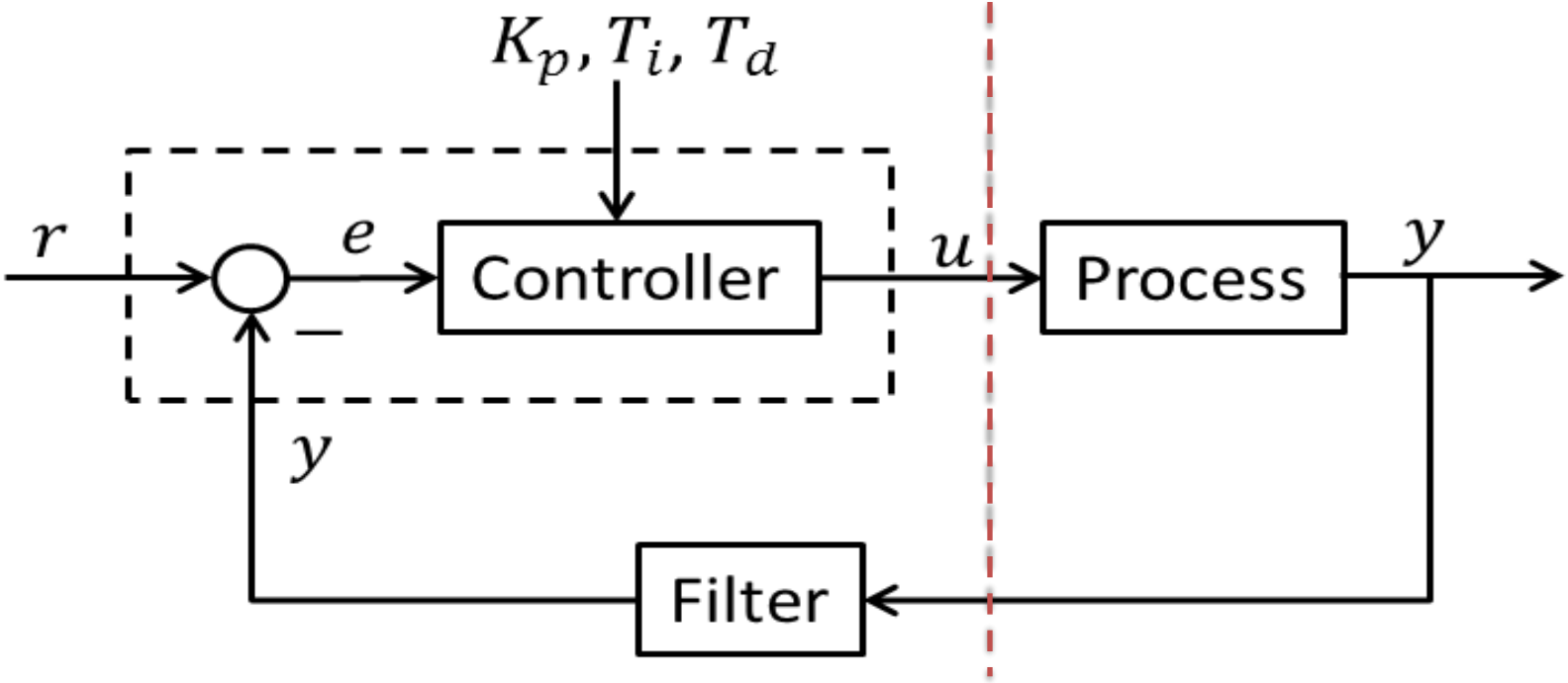
Computer

I/O Module

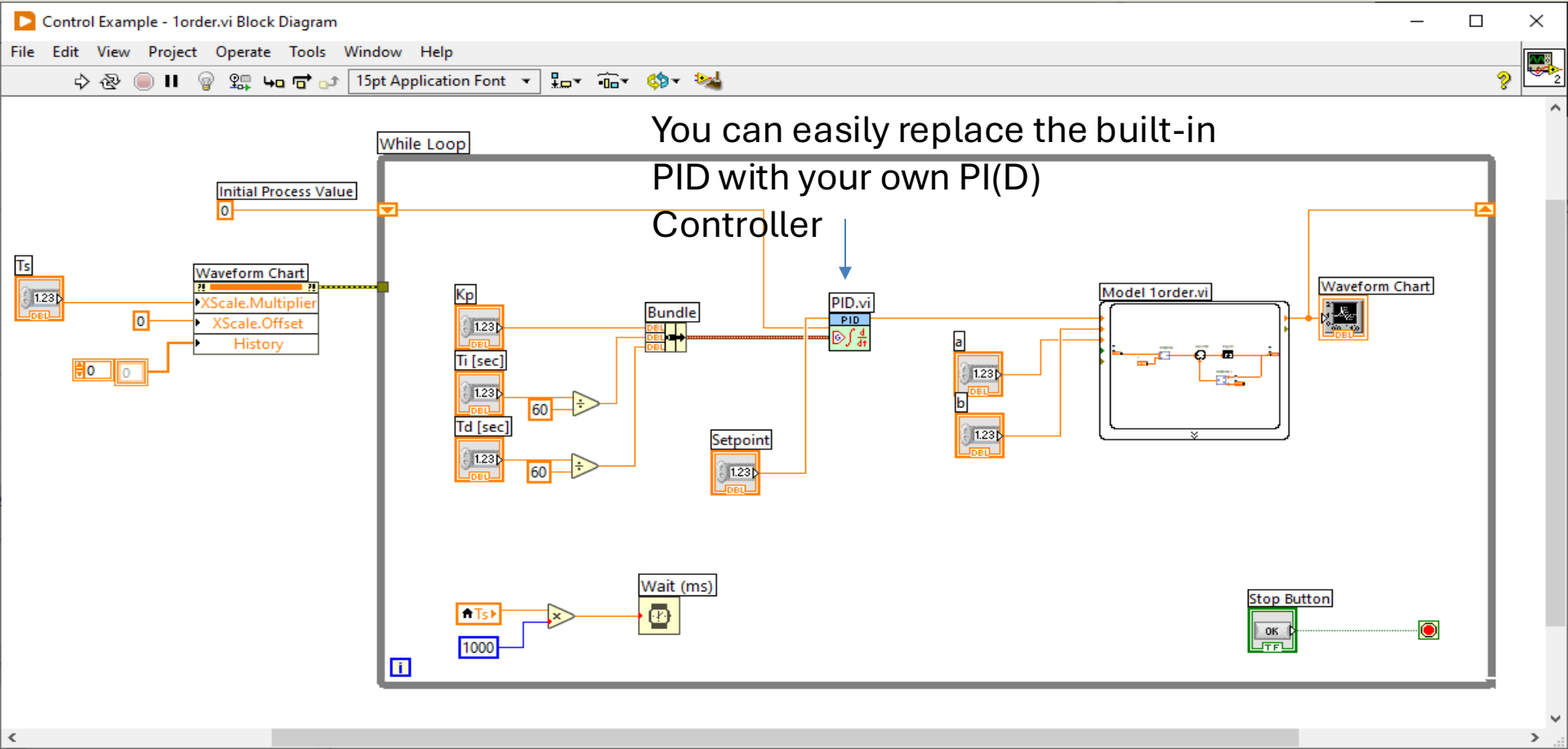
Air Heater

Control System Example

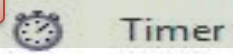
While the real process is continuous, normally the Controller and the Filter is implemented in a computer.



LabVIEW Control System



Control System in C#

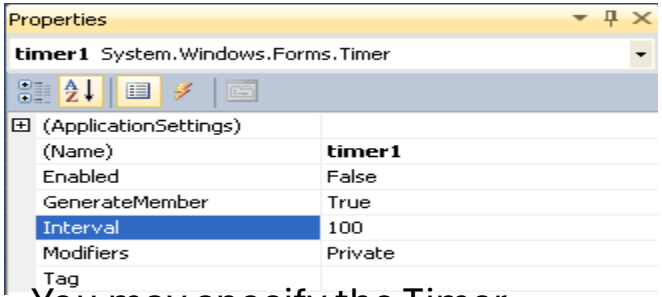
1 

Select the "Timer" component in the Toolbox

2 **Initialization:**

```
public Form1()
    {
      InitializeComponent();
      timer1.Start();
    }
```

3 **Properties:**



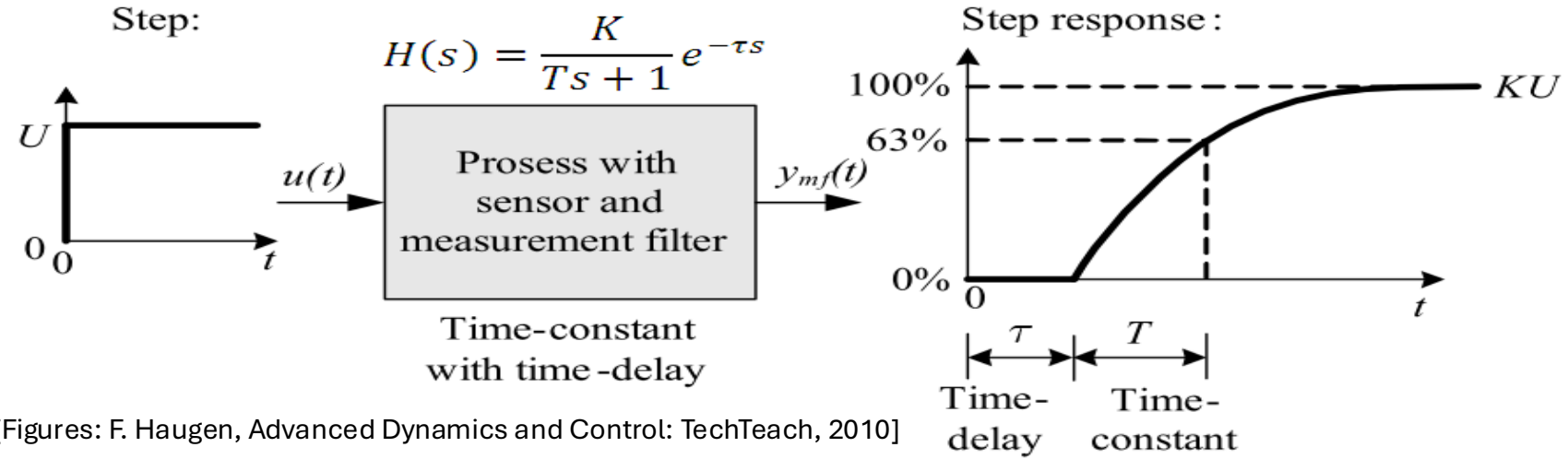
You may specify the Timer Interval in the Properties Window

4 **Timer Event:**

```
private void timer1_Tick(object sender, EventArgs e)
    {
      … //DAQ
      … //Scaling
      … //Control
      … //Plot Data
      … //Write to OPC
    }
```

In Visual Studio you may want to use a Timer instead of a While Loop in order to read values at specific intervals.

PID Tuning with Skogestad



[Figures: F. Haugen, Advanced Dynamics and Control: TechTeach, 2010]

We can set, e.g., Tc=10 sec. and c=1.5.
You may use other values if these values give a poor result.

Process type	$H_{psf}(s)$ (process)	K_p	T_i	T_d
Integrator + delay	$\frac{K}{s}e^{-\tau s}$	$\frac{1}{K(T_C+\tau)}$	$c\,(T_C+\tau)$	0
Time-constant + delay	$\frac{K}{Ts+1}e^{-\tau s}$	$\frac{T}{K(T_C+\tau)}$	$\min\,[T,\, c\,(T_C+\tau)]$	0
Integr + time-const + del.	$\frac{K}{(Ts+1)s}e^{-\tau s}$	$\frac{1}{K(T_C+\tau)}$	$c\,(T_C+\tau)$	T
Two time-const + delay	$\frac{K}{(T_1s+1)(T_2s+1)}e^{-\tau s}$	$\frac{T_1}{K(T_C+\tau)}$	$\min\,[T_1,\, c\,(T_C+\tau)]$	T_2
Double integrator + delay	$\frac{K}{s^2}e^{-\tau s}$	$\frac{1}{4K(T_C+\tau)^2}$	$4\,(T_C+\tau)$	$4\,(T_C+\tau)$

Table 1: Skogestad's formulas for PI(D) tuning.

Discrete PI(D) Controller

Hans-Petter Halvorsen

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Discrete PI Controller Example

Continuous PI Controller:

$$u(t) = u_0 + K_p e(t) + \frac{K_p}{T_i}\int_0^t e d\tau$$

$$\dot{u} = \dot{u}_0 + K_p \dot{e} + \frac{K_p}{T_i} e$$

We use the Euler Backward method:

$$\dot{x} = \frac{x_k - x_{k-1}}{T_s}$$

$$\frac{u_k - u_{k-1}}{T_s} = \frac{u_{0,k} - u_{0,k-1}}{T_s} + K_p \frac{e_k - e_{k-1}}{T_s} + \frac{K_p}{T_i} e_k$$

$$u_k = u_{k-1} + u_{0,k} - u_{0,k-1} + K_p(e_k - e_{k-1}) + \frac{K_p}{T_i} T_s e_k$$

We may set:

$$\Delta u_k = u_k - u_{k-1}$$

This gives the following discrete PI algorithm:

$$e_k = r_k - y_k$$

$$\Delta u_k = u_{0,k} - u_{0,k-1} + K_p(e_k - e_{k-1}) + \frac{K_p}{T_i} T_s e_k$$

$$u_k = u_{k-1} + \Delta u_k$$

This algorithm can be easly implemented in a Programming language

Discrete PI Controller Example

```
class PidController
{
        public double r;
        public double Kp;
        public double Ti;
        public double Ts;

        public double PiController(double y)
        {
            double e;
            double u;

            e = r - y;
            u = ...;
           return u;
        }
}
```

Note! This is just a basic Example

Data Acquisition DAQ

Hans-Petter Halvorsen

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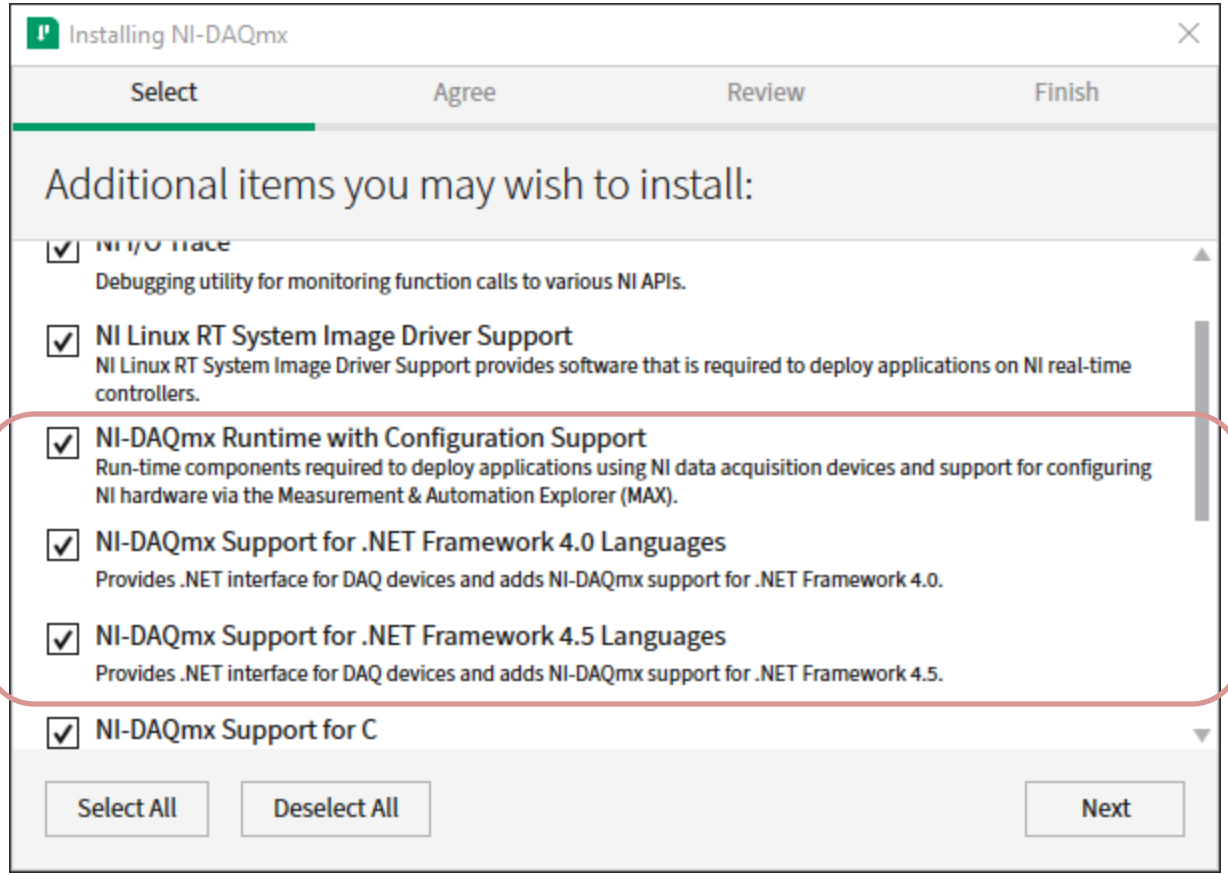
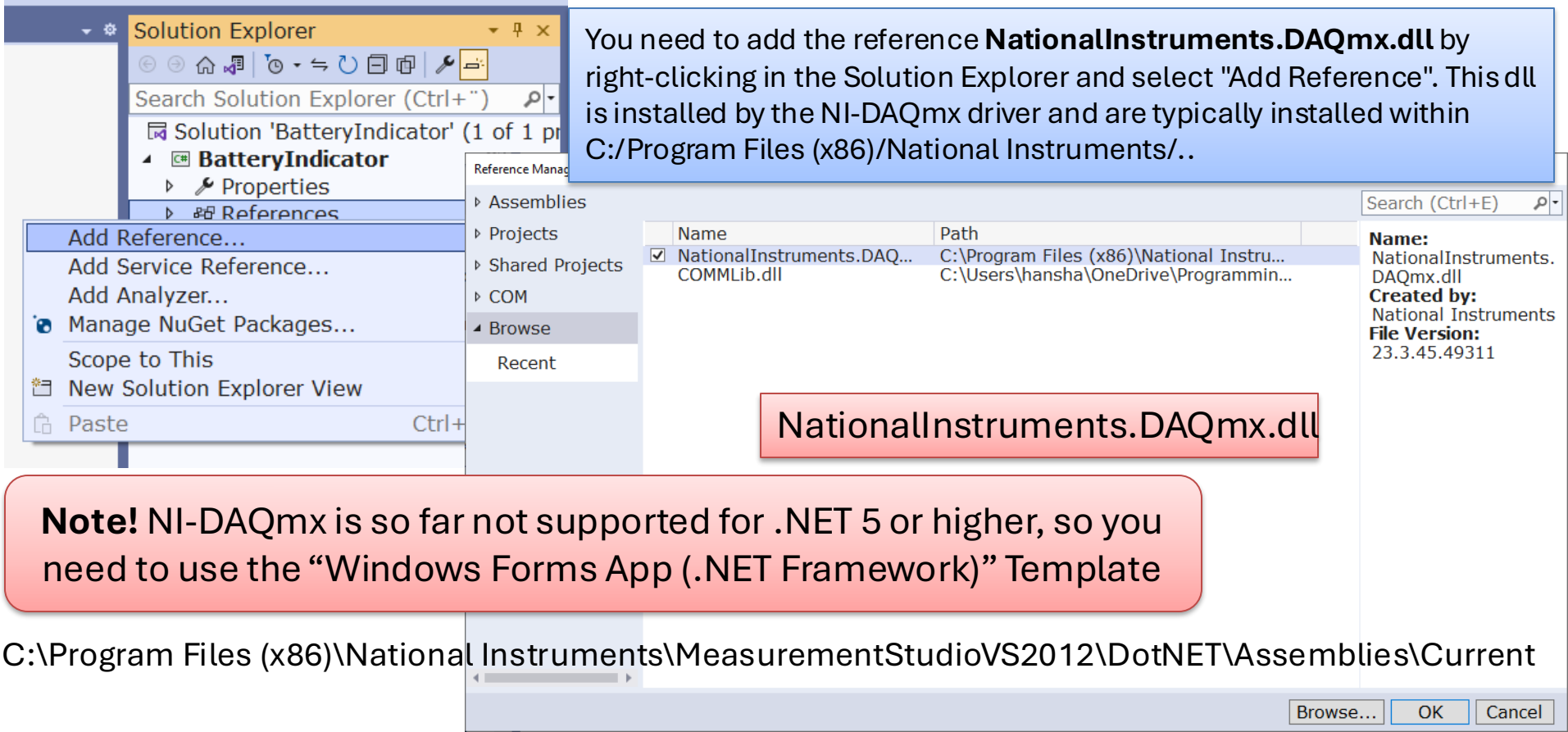
NI-DAQmx Installation



Make sure to add support for Visual Studio/.NET during installation of the NI-DAQmx software

Add DAQ Reference



You need to add the reference **NationalInstruments.DAQmx.dll** by right-clicking in the Solution Explorer and select "Add Reference". This dll is installed by the NI-DAQmx driver and are typically installed within C:/Program Files (x86)/National Instruments/..

Note! NI-DAQmx is so far not supported for .NET 5 or higher, so you need to use the “Windows Forms App (.NET Framework)” Template

C:\Program Files (x86)\National Instruments\MeasurementStudioVS2012\DotNET\Assemblies\Current

DAQ in C# with DAQmx

```
double ReadDaqData()
{
    Task analogInTask = new Task();

    AIChannel myAIChannel;

    myAIChannel = analogInTask.AIChannels.CreateVoltageChannel(
                "dev1/ai0",
                "myAIChannel",
                AITerminalConfiguration.Differential,
                0,
                5,
                AIVoltageUnits.Volts
                );

     AnalogSingleChannelReader reader = new
             AnalogSingleChannelReader(analogInTask.Stream);

     double analogDataIn = reader.ReadSingleSample();
     return analogDataIn;
}
```

Analog In Example

Note! The physical wiring on the DAQ device can either be “Differential” or “RSE”. Make sure your code and the wiring uses the same configuration.

DAQ in C# with DAQmx

Analog Out Example

```
WriteDaqData(double analogDataOut)
{
      Task analogOutTask = new Task();

      AOChannel myAOChannel;

      myAOChannel = analogOutTask.AOChannels.CreateVoltageChannel(
                  "dev1/ao0",
                  "myAOChannel",
                  0,
                  5,
                  AOVoltageUnits.Volts
                  );

      AnalogSingleChannelWriter writer = new
              AnalogSingleChannelWriter(analogOutTask.Stream);

      writer.WriteSingleSample(true, analogDataOut);
}
```

Discrete Lowpass Filter

Hans-Petter Halvorsen

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Discrete Lowpass Filter Example

Lowpass Filter Transfer function:

$$H(s) = \frac{y(s)}{u(s)} = \frac{1}{T_f s + 1}$$

Inverse Laplace the differential Equation:

$$T_f \dot{y} + y = u$$

We use the Euler Backward method:

$$\dot{x} = \frac{x_k - x_{k-1}}{T_s}$$

This gives:

$$T_f \frac{y_k - y_{k-1}}{T_s} + y_k = u_k$$

$$y_k = \frac{T_f}{T_f + T_s} y_{k-1} + \frac{T_s}{T_f + T_s} u_k$$

We define:

$$\frac{T_s}{T_f + T_s} \equiv a$$

This gives:

$$y_k = (1 - a) y_{k-1} + a u_k$$

Filter output

Noisy input signal

$$T_s \leq \frac{T_f}{5}$$

This algorithm can be easly implemented in a Programming language

Discrete Lowpass Filter Example

```
class Filter
{
        public double yk;
        public double Ts;
        public double Tf;

        public double LowPassFilter(double yFromDaq)
        {
            double a;
            double yFiltered;

            a = Ts / (Ts + Tf);
            yFiltered = (1 - a) * yk + a * yFromDaq;
            yk = yFiltered;
            return yFiltered;
        }
}
```

Note! This is just a simple Example

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Database Design

Hans-Petter Halvorsen

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Database Examples

Tag Configuration:

The TAG table(s) could e.g., have the following columns:

- TagId (int, Primary Key, Identity)
- TagName (varchar)
- ItemId (varchar) (OPC)
- ItemUrl (varchar) (OPC)
- Description (varchar)
- etc.

Alarm Configuration & Alarm Data:

Important fields in an alarm handling system could be:

- AlarmId
- Activation Time
- Acknowledge Time and Person
- Type of Alarm
- Which Tag
- Alarm Limits
- Textual Description
- etc.

Here are some examples of functionality of the SCADA system and information that typically could be stored in the Database.

Tag Data:

Create one or more tables used for logging the Tag Values into the Database. Example of information:

- Value
- Timestamp
- Status (e.g., “Active”, “Not Active”)
- Quality (e.g., “Good”, “Bad”)
- etc.

Database Examples

The alarm system will be responsible for the warnings and the alarms in a monitoring and control system. An alarm system contains different **Alarms** and **Warnings** like:

- Timeout; no input from a sensor or another computer system within a specific amount of time,
- High High (HH) or Low Low (LL) alarm; a critical alarm condition,
- High (H) or Low alarm (L)
- I/O device errors
- System device errors
- etc.

Make sure your Alarm tables and system can handle some of these kinds of alarms and warnings.

An Alarm System use different Alarm Devices, such as, e.g.,

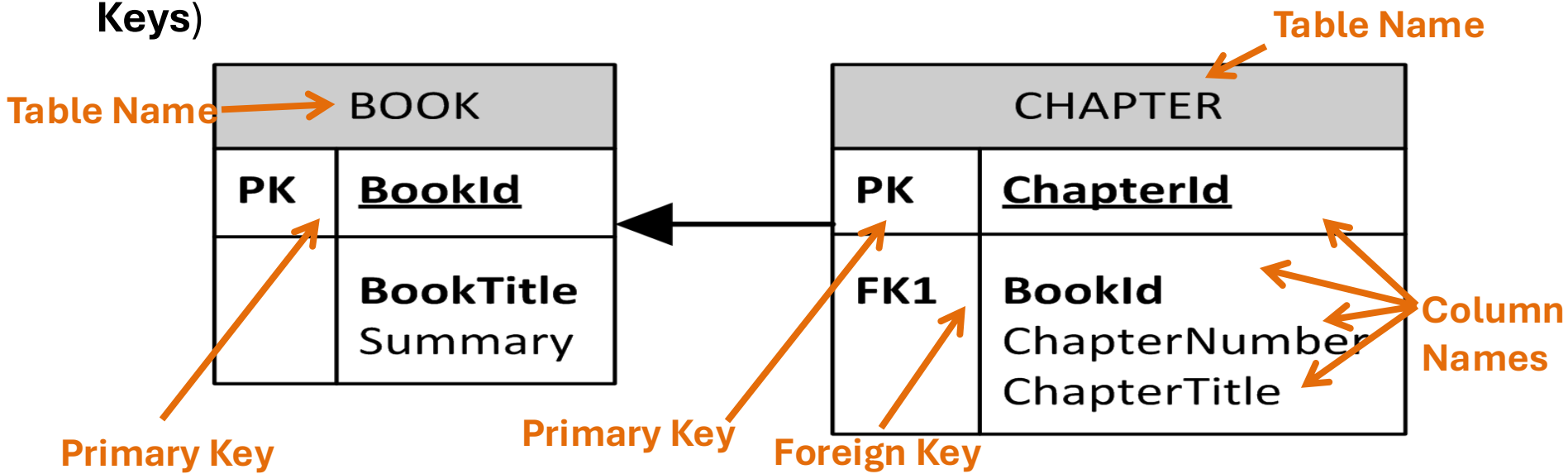
- Screen; display the alarms
- Keyboard; alarm operations
- Horn; indicate an active alarm, or security alarm
- Lamp; indicate an active alarm, or an active alarm by blinking and an acknowledge alarm by a steady light
- Printer; logging of the alarm states
- SMS
- E-mail
- Etc.

Make use of one or more of these alarm devices in your Alarm Handling and Management System.

Database Design – ERD

ER Diagram (Entity-Relationship Diagram, ERD)

- Used for Design and Modeling of Databases.
- Specify Tables and **relationship** between them (**Primary Keys** and **Foreign Keys**)



Relational Database. In a relational database all the tables have one or more relation with each other using Primary Keys (PK) and Foreign Keys (FK). Note! You can only have one PK in a table, but you may have several FK's.

Database - “Best Practice”

- **Tables**: Use upper case and singular form in table names – not plural, e.g., “STUDENT” (not “students”)
- **Columns**: Use Pascal notation, e.g., “StudentId”
- **Primary Key**:
  - If the table name is “COURSE”, name the Primary Key column “CourseId”, etc.
  - “Always” use Integer and Identity(1,1) for Primary Keys. Use UNIQUE constraint for other columns that needs to be unique, e.g. “RoomNumber”
- Specify **Required** Columns (NOT NULL) – i.e., which columns that need to have data or not
- Standardize on few/these **Data Types**: *int*, *float*, *varchar(x)*, *datetime*, *bit*
- Use English for table and column names
- Avoid abbreviations! (Use “RoomNumber” – not “RoomNo”, “RoomNr”, …)

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SQL Server

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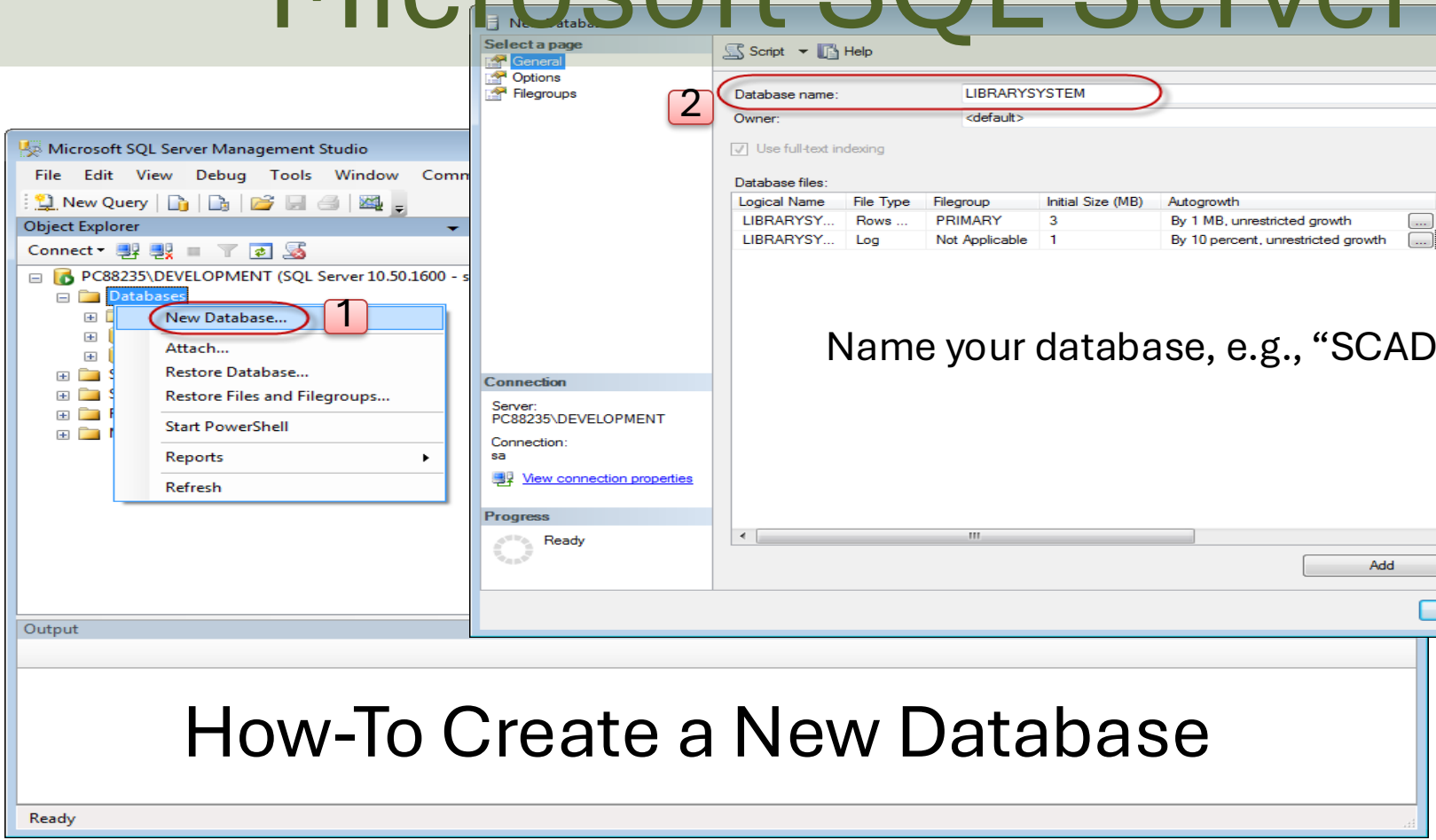
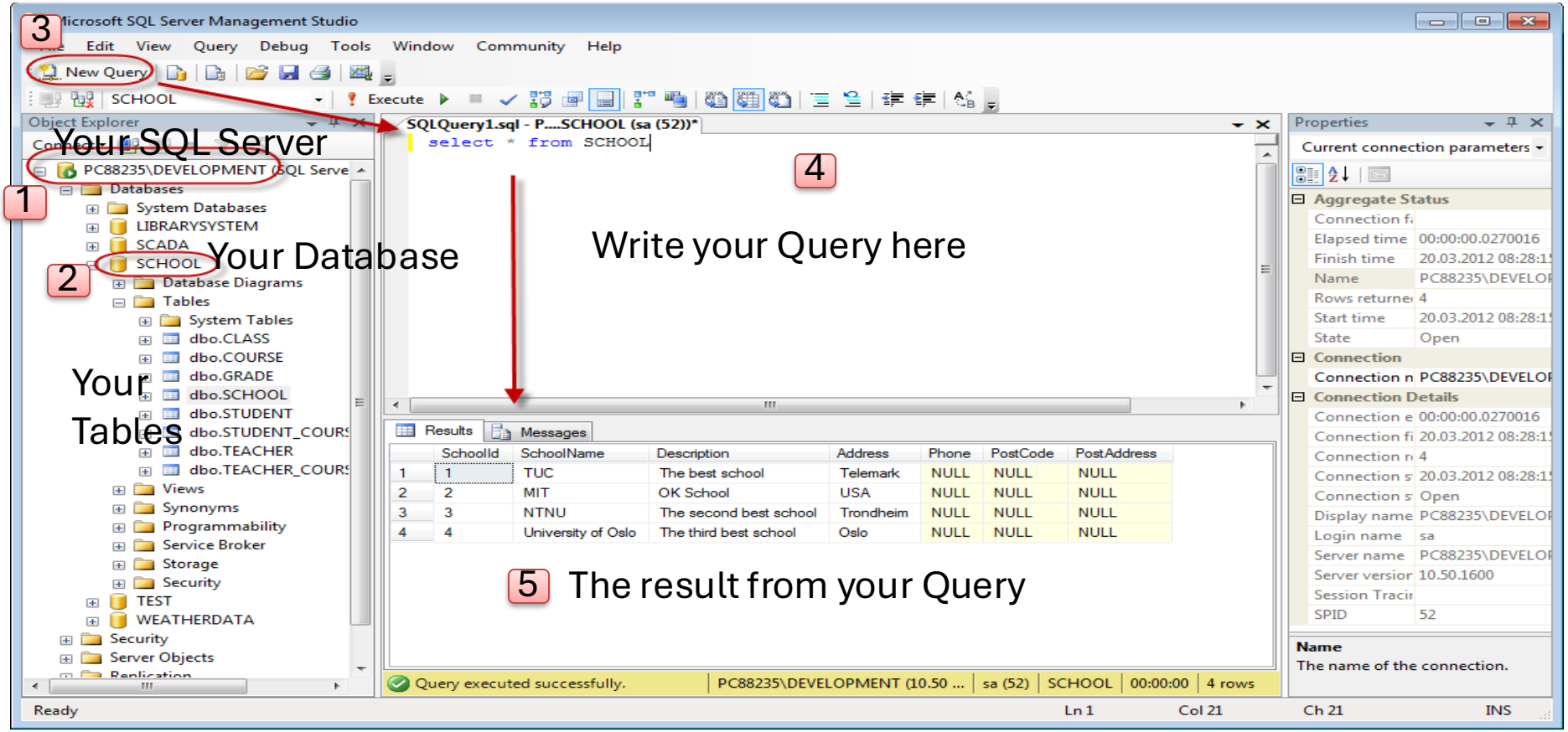
Microsoft SQL Server



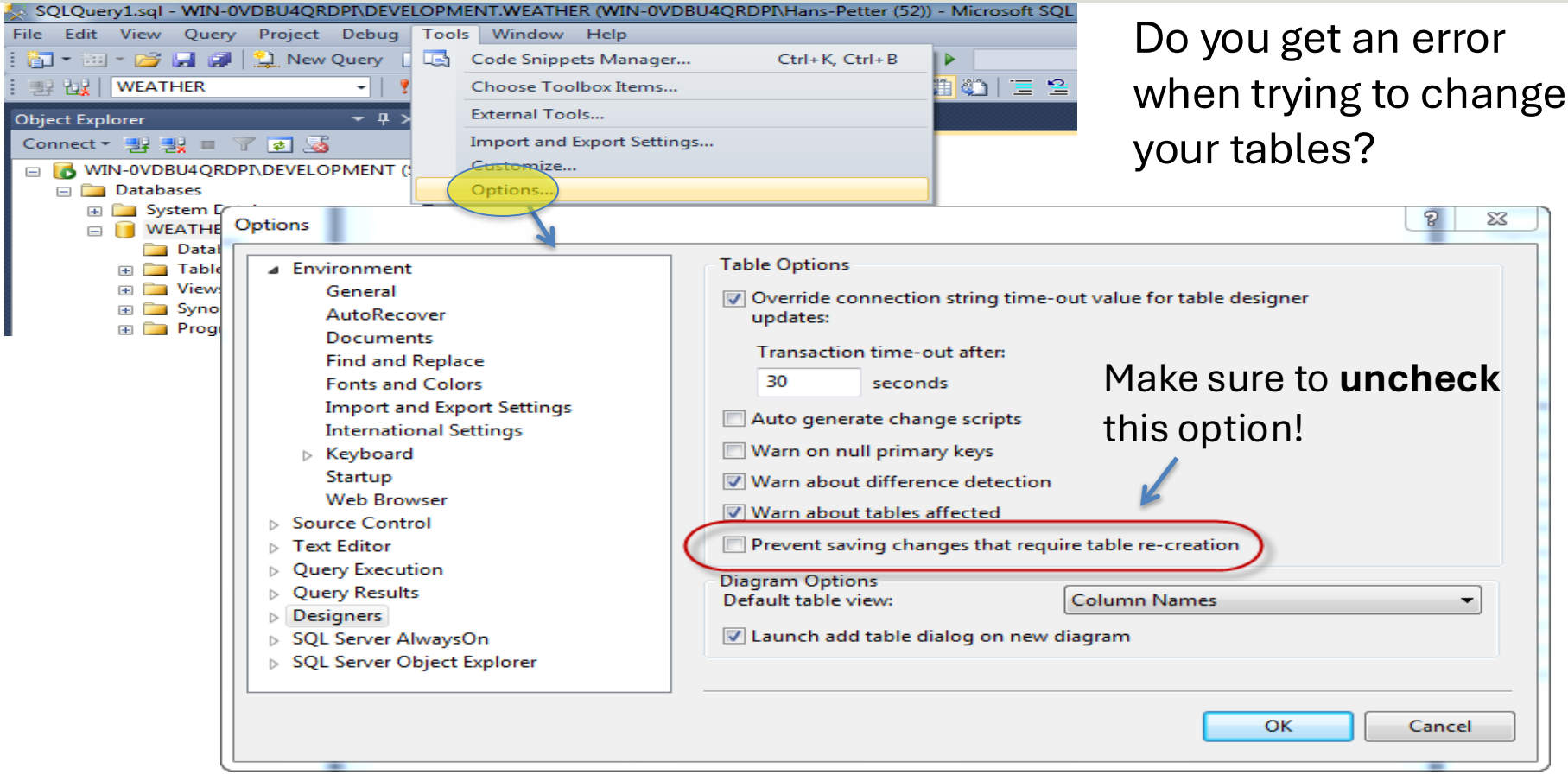
Name your database, e.g., “SCADA”

How-To Create a New Database

Microsoft SQL Server



Microsoft SQL Server



Do you get an error when trying to change your tables?

Make sure to **uncheck** this option!

OPC UA

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OPC UA in LabVIEW

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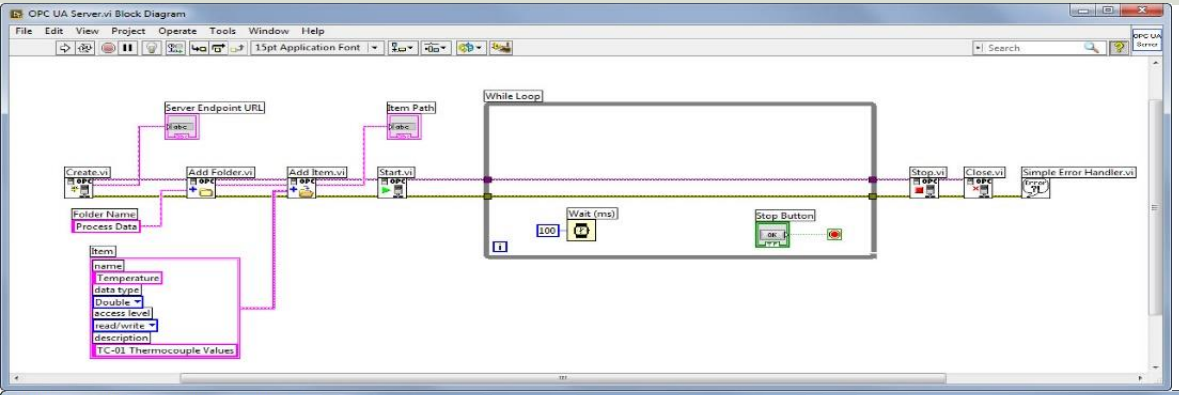
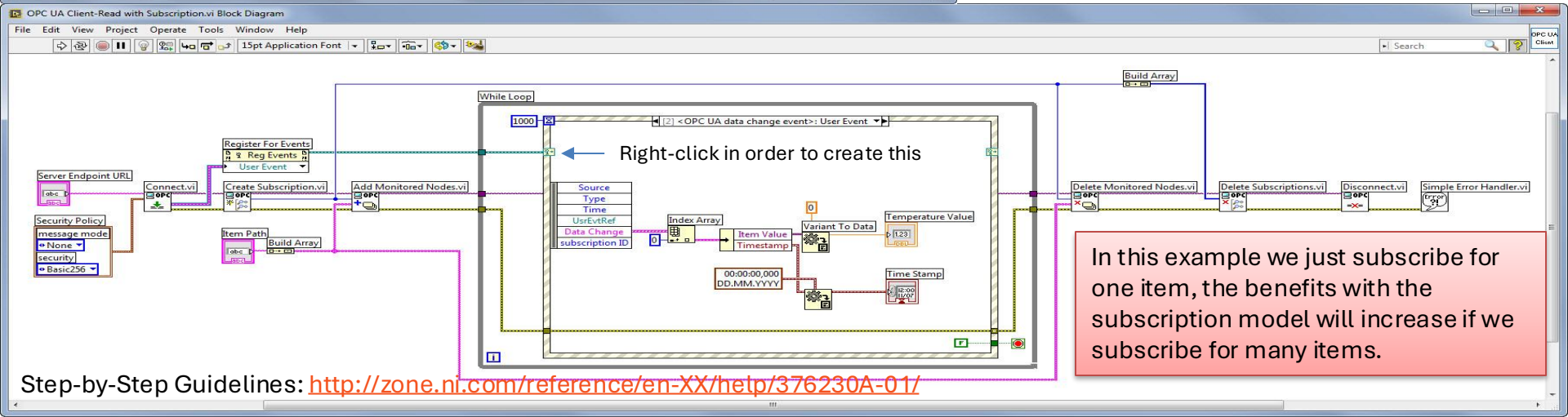
OPC UA Client with Subscription



Here you read data on the client only when the value on the server is changed.



In this example we just subscribe for one item, the benefits with the subscription model will increase if we subscribe for many items.

Step-by-Step Guidelines: http://zone.ni.com/reference/en-XX/help/376230A-01/

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OPC UA .NET SDK

& OPC UA Server Simulator

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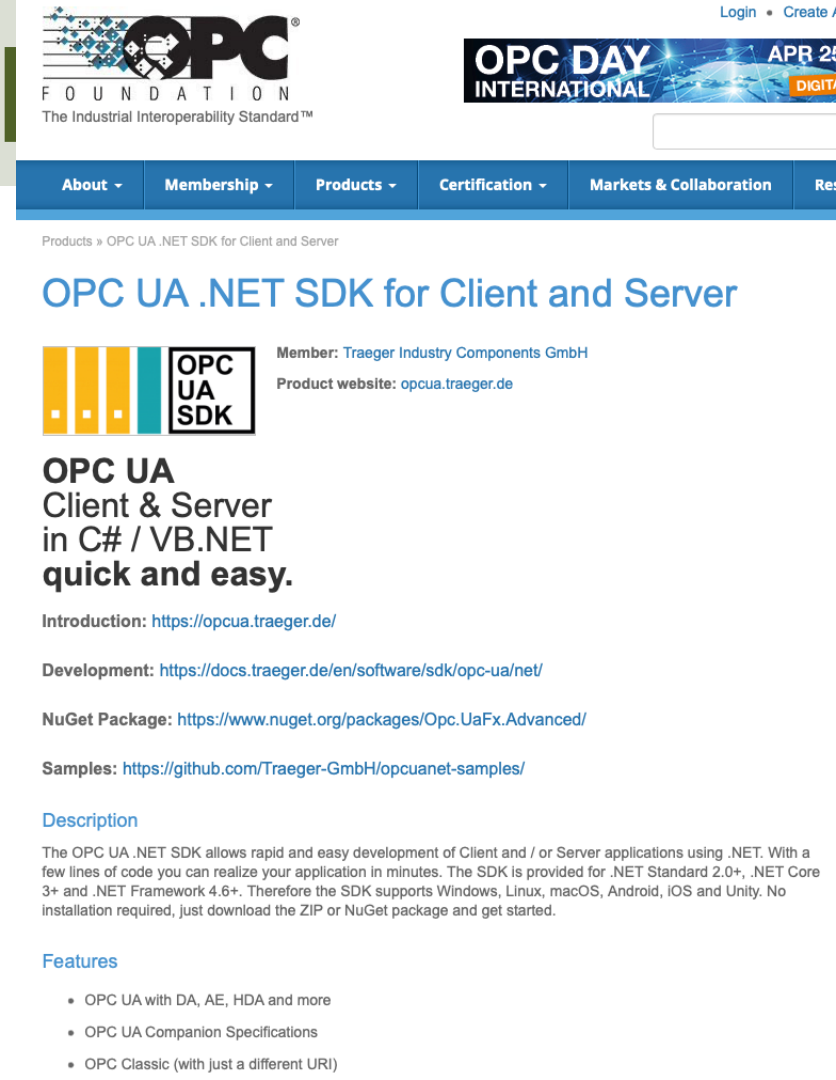
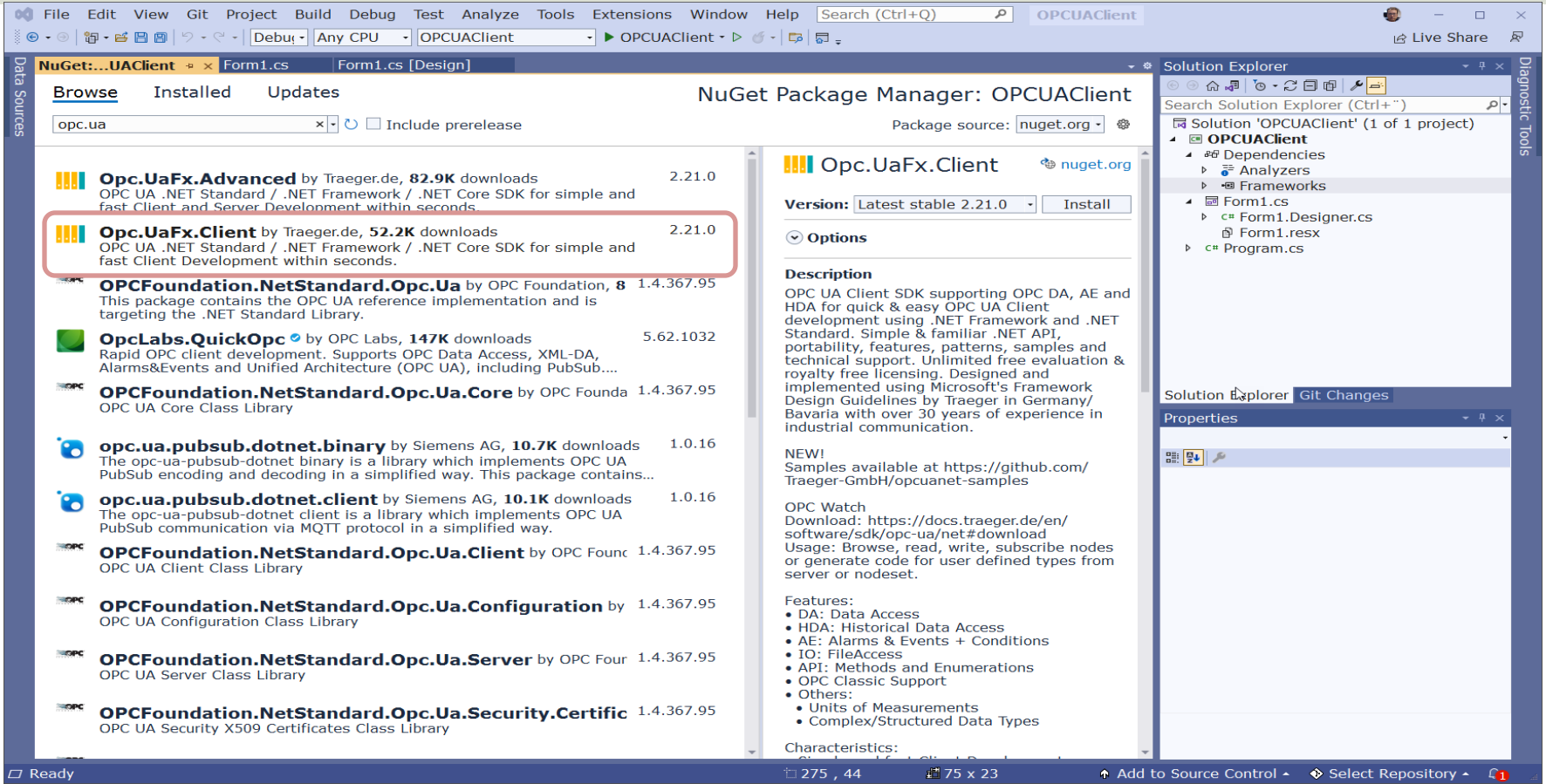
OPC UA .NET SDK

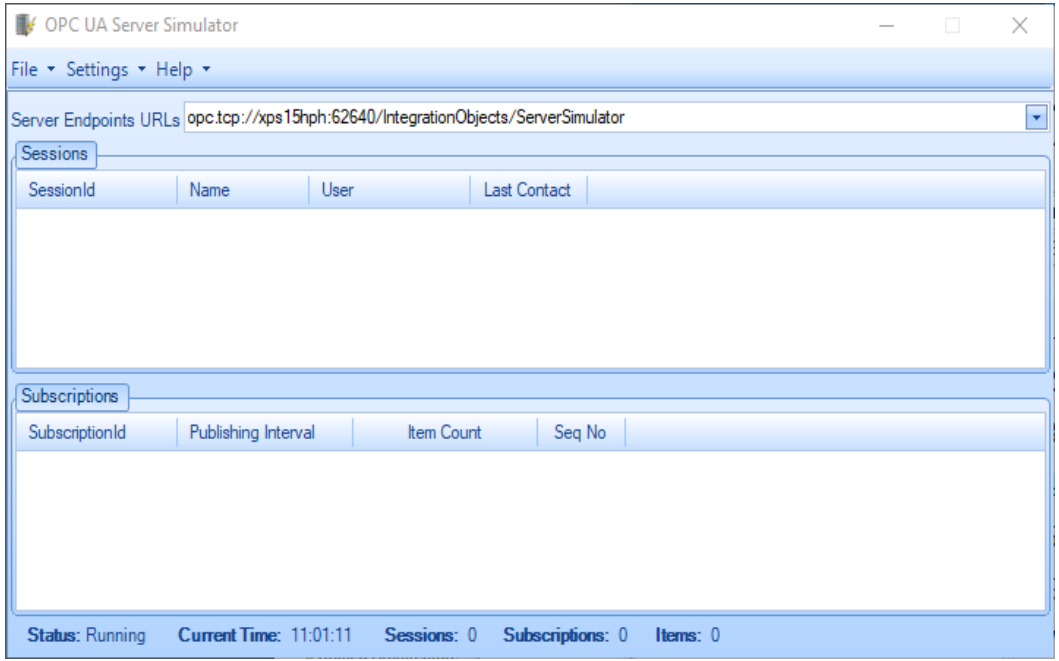
- The “OPC UA .NET SDK” comes with an evaluation license which can be used unlimited for each application run for 30 minutes
- It comes in a NuGet Package you can install and use in your Visual Studio Project
- https://opcfoundation.org/products/view/opc-ua-net-sdk-for-client-and-server



OPC UA .NET SDK Installation



OPC UA Server Simulator



- This free OPC UA Server tool supports data access and historical access information models of OPC UA.
- It provides simulated real-time and historical data.
- It is possible to configure your own tags and the data simulation via CSV files.
- OPC UA clients can monitor real-time data and explore history data from this simulator.

https://opcfoundation.org/products/view/opc-ua-server-simulator

Write Data to OPC UA Server

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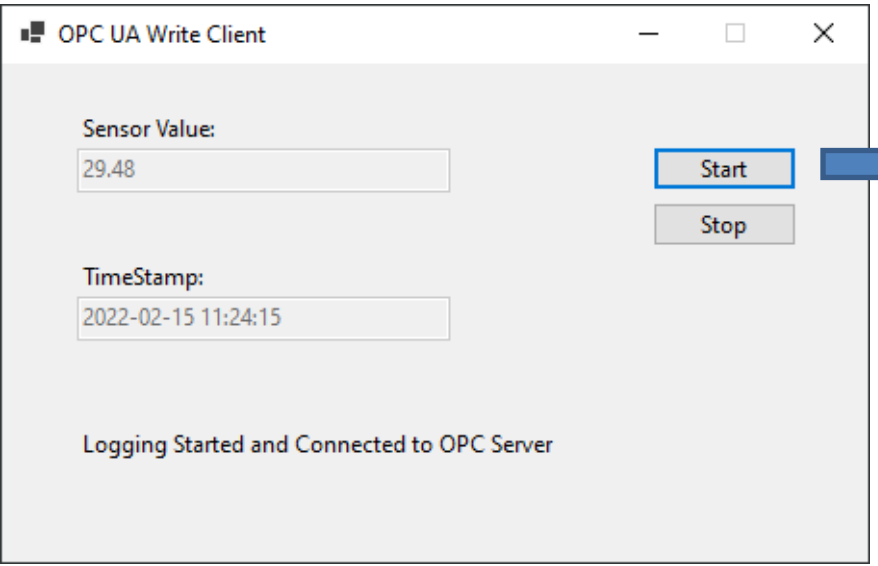
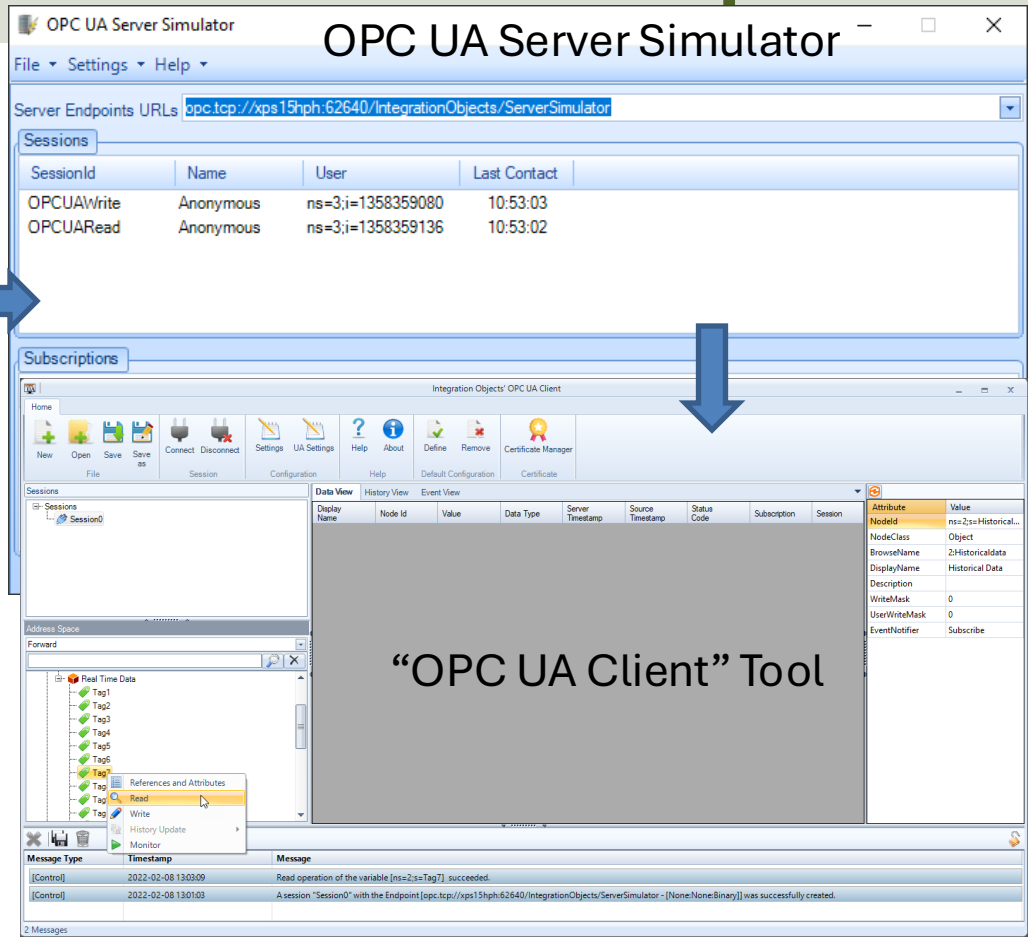
OPC UA .NET SDK Example

OPC UA Write C# App



This is just a very simple Example.
You need to implement “OPC Write” within your “Control Application”

OPC UA Server Simulator



OPC UA .NET SDK Example

```
private void btnOpcWrite_Click(object sender, EventArgs e)
{
	string opcUrl = "opc.tcp://localhost:62640/";
	var tagName = "ns=2;s=Tag7";

	var client = new OpcClient(opcUrl);
	client.Connect();

	double temperature;
	temperature = Convert.ToDouble(txtOpcDataWrite.Text);

	client.WriteNode(tagName, temperature);

	client.Disconnect();
}
```

Datalogging System

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Read Data from OPC UA Server

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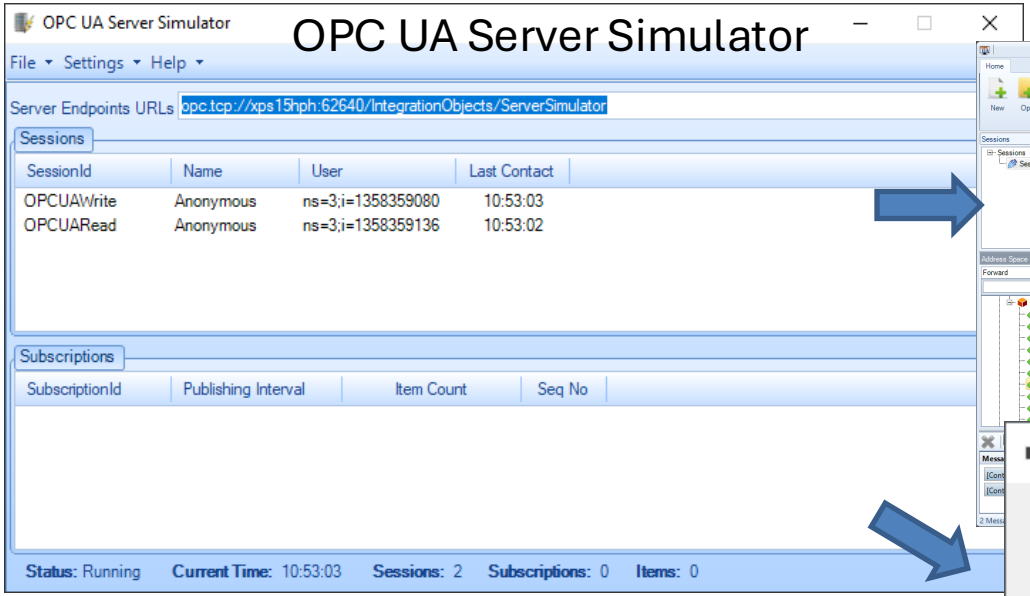
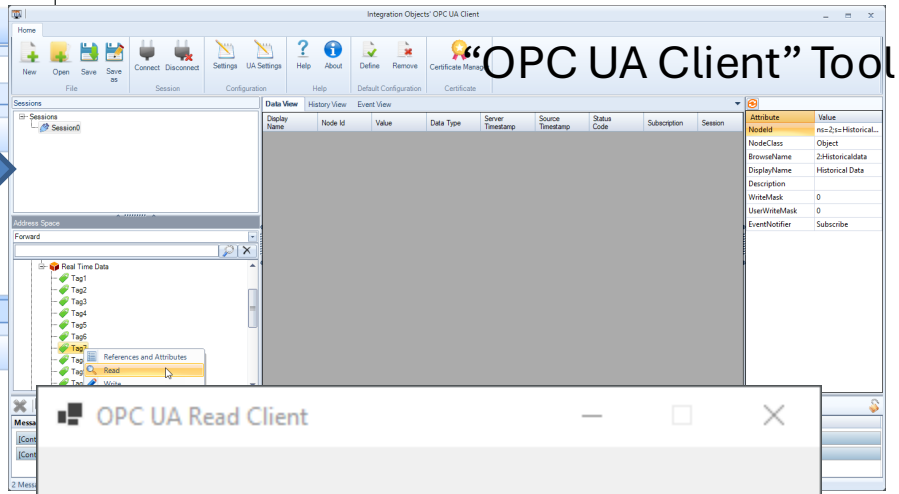
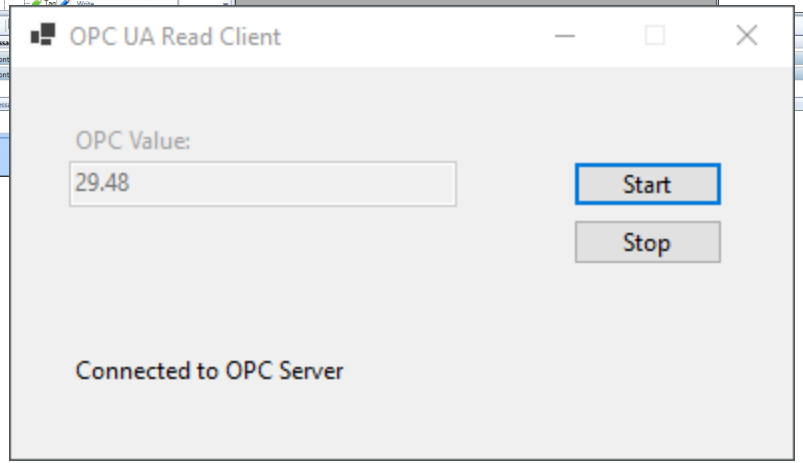
OPC UA .NET SDK Example



OPC UA Server Simulator



“OPC UA Client” Tool



OPC UA .NET SDK Example

```
private void btnOpcRead_Click(object sender, EventArgs e)
{
    string opcUrl = "opc.tcp://localhost:62640/";
    var tagName = "ns=2;s=Tag7";

    var client = new OpcClient(opcUrl);
    client.Connect();

    var temperature = client.ReadNode(tagName);
    txtOpcDataRead.Text = temperature.ToString();

    client.Disconnect();
}
```

Save Data to SQL Server

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Stored Procedure Example

```
IF EXISTS (SELECT name
           FROM  sysobjects
           WHERE  name = 'StudentGrade'
           AND           type = 'P')
          DROP PROCEDURE StudentGrade
OG

CREATE PROCEDURE StudentGrade
@Student varchar(50),
@Course varchar(10),
@Grade varchar(1)

AS

DECLARE
@StudentId int,
@CourseId int

select @StudentId=StudentId from STUDENT where StudentName =
@Student

select @CourseId=CourseId from COURSE where CourseName = @Course

insert into GRADE (StudentId, CourseId, Grade)
values (@StudentId, @CourseId, @Grade)
GO
```

A Stored Procedure is like a Method in C# - it is a piece of code with SQL commands that do a specific task – and you reuse it

This part is not necessary – but if you make any changes, you need to delete the old version before you can update it

Procedure Name

Input Arguments

Internal/Local Variables
Note! Each variable starts with @

SQL Code (the "body" of the Stored Procedure)

Using the Stored Procedure:

```
execute StudentGrade 'John Wayne', 'SCE2006', 'B'
```

Saving Data to SQL from C#

```
public void CreateBook(string connectionString, Book book)
{
            try
           {
                using (SqlConnection con = new SqlConnection(connectionString))
                {
                    SqlCommand cmd = new SqlCommand("CreateBook", con);
                      cmd.CommandType = CommandType.StoredProcedure;

                      cmd.Parameters.Add(new SqlParameter("@Title", book.Title));
                      cmd.Parameters.Add(new SqlParameter("@Isbn", book.Isbn));
                      cmd.Parameters.Add(new SqlParameter("@PublisherName", book.PublisherName));
                      cmd.Parameters.Add(new SqlParameter("@AuthorName", book.AuthorName));
                      cmd.Parameters.Add(new SqlParameter("@CategoryName", book.CategoryName));

                      con.Open();
                      cmd.ExecuteNonQuery();
                      con.Close();
                }
            }
            catch (Exception ex)
            {
                throw ex;
            }
}
```

It is recommended to create and use a **Stored Procedure**.
It is also recommended that the Connection String is stored in **App.config**

Alarm System

Alarm Generation and Alarm Monitoring

Hans-Petter Halvorsen

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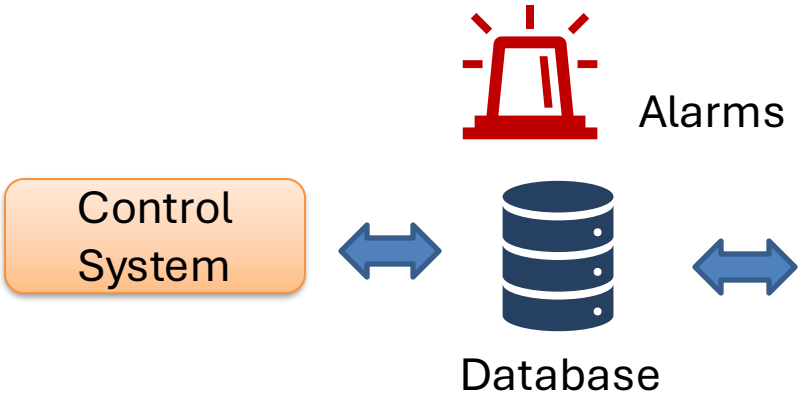
Alarm System

- The Alarm System typically checks for Alarms and saves the Alarm information in your Database.
- The operator should be able to see the Alarms and make some actions to these alarms, i.e., the operator should have the possibility to Acknowledge Alarms, Show Alarms with different Priorities, etc.
- A **Database Trigger** can be used in order to generate Alarms in the Database
- A Database **View** can be created and used to retrieve Alarm Data from the Database

Alarm System Example



Trigger that checks new Process values against Alarm Levels and generates Alarms

Alarms that need to be Acknowledged by the Operator

Simple Example:

Alarm Application

Alarm List: Operator: Nils-Olav

AlarmId	TagName	AlarmType	Priority	ActivitionTime	AckTime
5	Level	High	High	12:45	Ack
6	Temp	Low	Low	12:10	Ack
9	Pressure	High	Low	12:20	12:22
12	Level	Low	High	12:30	12:31
14	Pressure	High	Low	12:35	12:36
4	Level	HighHigh	High	12:40	12:42

Alarms that have been Acknowledged by the Operator

Trigger

A Trigger is executed when you insert, update or delete data in a Table specified in the Trigger.

```
IF EXISTS (SELECT name
           FROM   sysobjects
           WHERE  name = 'CalcAvgGrade'
           AND        type = 'TR')
        DROP TRIGGER CalgAvgGrade
GO

CREATE TRIGGER CalcAvgGrade ON GRADE
FOR UPDATE, INSERT, DELETE
AS

DECLARE
@StudentId int,
@AvgGrade float


select @StudentId = StudentId from INSERTED

select @AvgGrade = AVG(Grade)  from GRADE where StudentId = @StudentId

update STUDENT set TotalGrade = @AvgGrade where StudentId = @StudentId

GO
```

This part is not necessary – but if you make any changes, you need to delete the old version before you can update it

Name of the Trigger

Specify which Table the Trigger shall work on

Specify what kind of operations the Trigger shall act on

Internal/Local Variables

Inside the Trigger you can use ordinary SQL statements, create variables, etc.

SQL Code (The "body" of the Trigger)

Note! "INSERTED" is a temporarily table containing the latest inserted data, and it is very handy to use inside a trigger

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ASP.NET Core Web Applications

Hans-Petter Halvorsen

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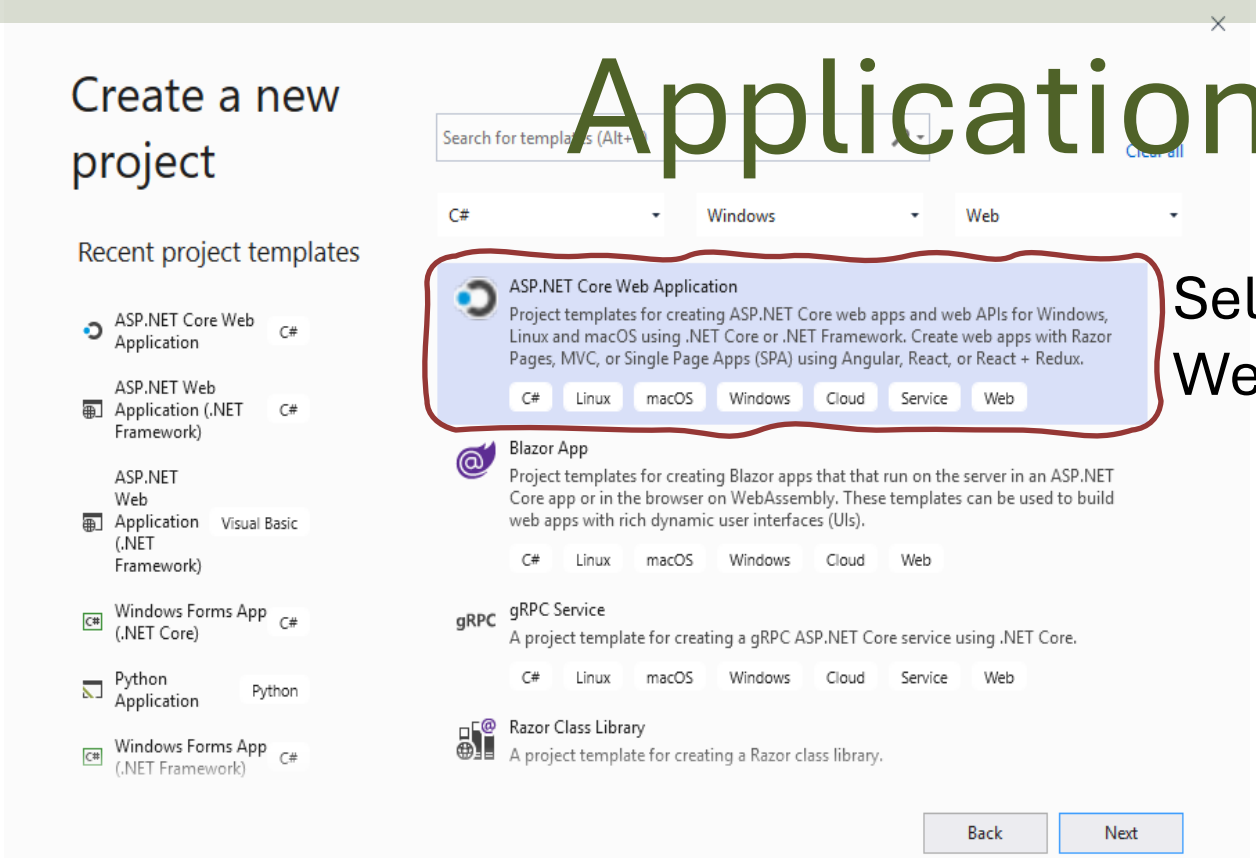
ASP.NET Core Web Applications

- ASP.NET is a Web Framework for creating Web Applications
- ASP.NET is integrated with Visual Studio and you will use the C# Programming Language
- .NET Core is cross-platform, meaning it will work on Windows, Linux and macOS.
- ASP.NET Core is Microsoft's newest baby, and it is the future of Web Programming

ASP.NET Core Web Application



Select the ASP.NET Core Web Application Project

ASP.NET Core Examples

Recommended Videos:

- ASP.NET Core – Introduction: https://youtu.be/zkOtiBcwo8s
- **ASP.NET Core - Database Communication: https://youtu.be/0Ta3dQ3rxzs**
- ASP.NET Core - Database CRUD Application: https://youtu.be/k5TCZDwTYcE

Download Examples here: https://www.halvorsen.blog/documents/programming/web/aspn

ASP.NET Core Resources

- Textbook
- Videos
- Tutorials
- Example Code

https://www.halvorsen.blog/documents/programming/web/aspnet

Cyber Security

Hans-Petter Halvorsen

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Cyber Security in IACS Systems

- CSMS – Cyber Security Management System
- IACS – Industrial Automation and Control Systems
- Security is critical in IACS systems because a potential hacker can do great damage
- In the Norwegian energy and oil and gas sector alone, more than 50 cyber security incidents are detected the last year.*

Source: Norwegian National Security Authority

Cyber Attacks

- In computers and computer networks an **attack** is any attempt to expose, alter, disable, destroy, steal or gain unauthorized access to or make unauthorized use of the system
- A **cyber attack** is any type of action that targets computer information systems, infrastructures, computer networks, or personal computer devices.
- An **attacker** is a person or process that attempts to access data, functions or other restricted areas of the system without authorization, potentially with malicious intent

https://en.wikipedia.org/wiki/Cyberattack

Cyber Security Standards

- To protect the cyber environment of a user or organization.
- This environment includes users themselves, networks, devices, all software, processes, information in storage or transit, applications, services, and systems that can be connected directly or indirectly to networks
- Reduce the risks and prevent Cyber Attacks
- IEC62443 – Cyber Security standard for IACS systems

https://en.wikipedia.org/wiki/Cyber_security_standards

Cyber Security in IACS Systems

Things to consider:

- Data & Cyber Security Issues regarding your SCADA Software
- How can you secure your Software against threats and vulnerabilities?
- What kind of precautions have you done when implementing your system?
- What can/should you/have you done do to protect your Software?

Hans-Petter Halvorsen

University of South-Eastern Norway

www.usn.no

E-mail: hans.p.halvorsen@usn.no

Web: https://www.halvorsen.blog