

# A Graphical Tool for Design Portable Automation Software

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# Outline

- 1 Introduction
- 2 UniSim
- 3 Example
- 4 Conclusions



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# PLCs and industrial automation

- Control of industrial processes is today dominated by computerized systems
- Programmable Logic Controller (PLC) are widely used for industrial automation
- PLCs have been developed in the late 60's, and since then have evolved into powerful devices
- Teaching PLCs programming in industrial automation classes
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  - design automation systems (methodology)
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# Automation projects and IEC 61131-3 standard

## Automation project

An automation project includes all the information about the control system configuration, the data and the code

- Many manufacturers - many ways to define automation projects - many different programming languages
- The *IEC 61131* standard has been introduced by the *International Electrotechnical Commission*
- IEC 61131 - Part 3 specifies:
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*UniSim* is an educational tool developed at University of Naples

- UniSim can be used to design automation software which complies with IEC 61131-3
- UniSim allows to avoid the choice of a specific commercial platform when teaching PLCs programming.
- Thanks to its *simulation engine*, UniSim allows to validate *off – line* the developed software
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- UniSim can be used
  - by the teacher - in the classroom to work out examples
  - by students - when solving their homework
- UniSim interfaces with off-the-shelf I/O boards, thus it can be used during lab activities
- Labs do not need to be equipped with a large number of expensive commercial PLC platforms
- UniSim makes use of the *XML Formats for IEC 61131-3* to import/export the projects. This feature give the possibility to reuse the developed software on a commercial platform  
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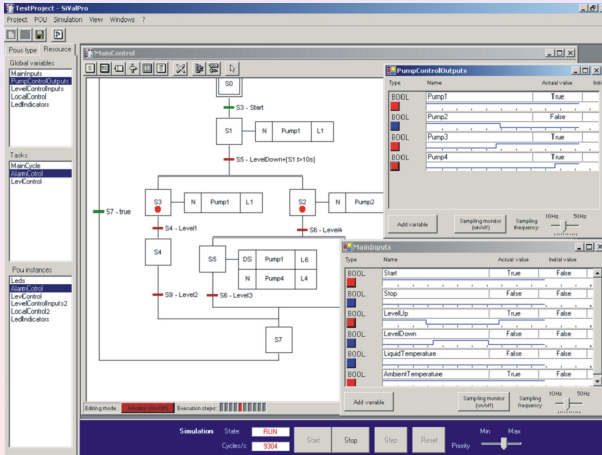


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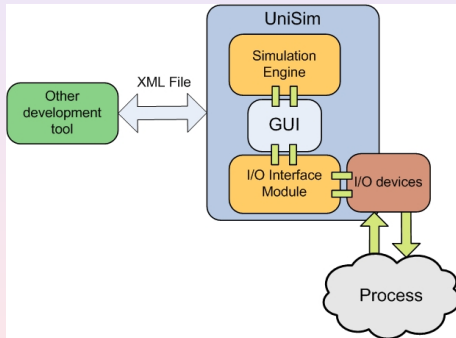
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# UniSim - Snapshots



# UniSim - Software architecture

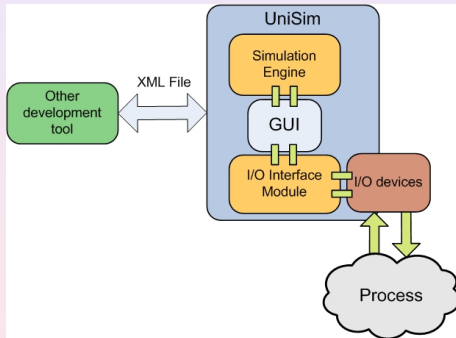


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- It has been developed on the .Net platform



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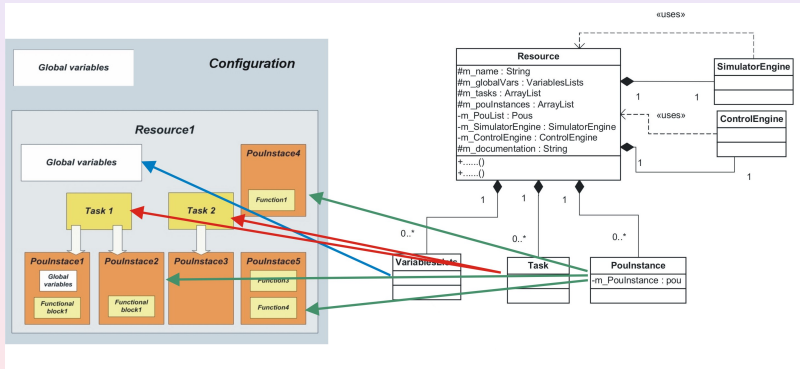


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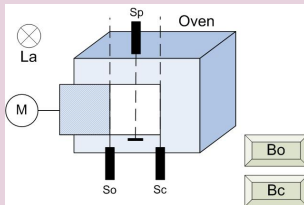
# Objects hierarchy





# Toy example

## Oven



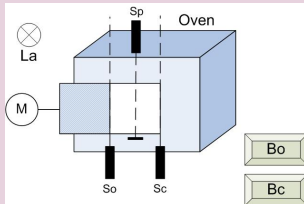
## Requirements

- The door must be opened when the button  $B_o$  is pushed
- The door must be closed when the button  $B_c$  is pushed, or if it stays open for more than 10s
- If an object is detected by  $S_p$  while the door is moving, lamp  $L_a$  must be turned on



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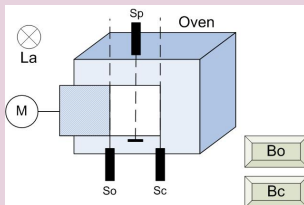
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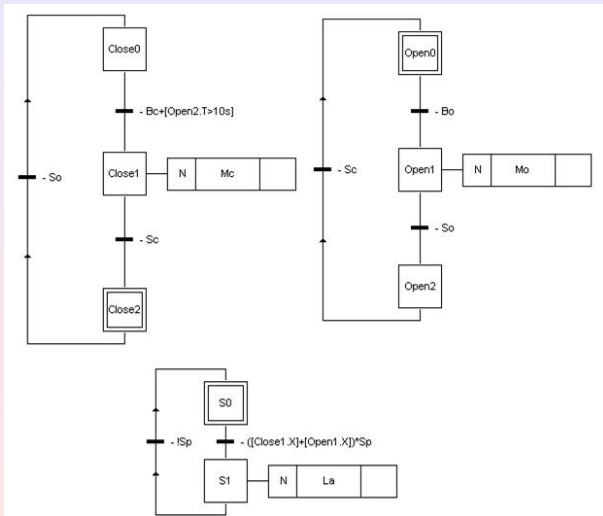


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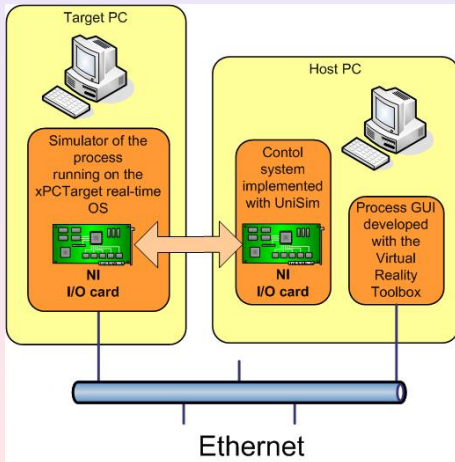
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# Control algorithm



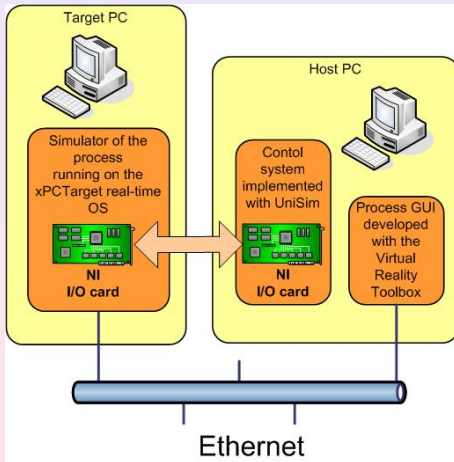
# Lab setup



- The **Host** runs the control algorithm with UniSim and a graphical user interface for the process
- The **Target** runs the *xPC Target real-time OS*, which executes the process simulator



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- It is a *work in progress* release
  - Not all the features provided by the standard have been implemented
    - Only one *resource* can be specified in each *project*
    - Only the *sequential functional chart* and the *ladder diagram* languages have been implemented yet
    - ...
  - The development of UniSim it is itself a way to teach IEC 61131-3 standard

UniSim is distributed with a *GPL* license  
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