A Graphical Tool for Design Portable Automation Software

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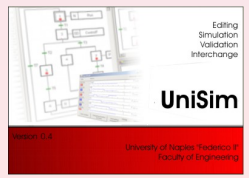
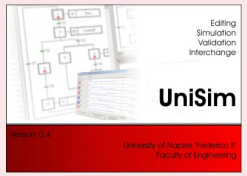
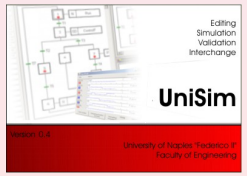


Outline



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
- Students should learn how to:
  - design automation systems (methodology)
  - develop automation software (practice)

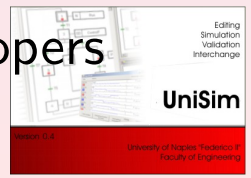


Automation projects and IEC 61131-3 standard

Automation project

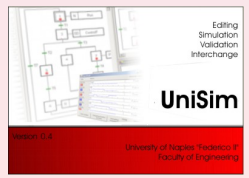
An automation project includes all the information about the control system configuration, the data and the code

- 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 66131 - Part 3 specifies:
  - how an automation project should be structured
  - the programming languages that can be used by the developers



Teach IEC 61131-3 standard

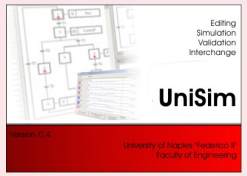
- Although IEC 61131-3 has been introduced in 1993, only few manufacturer produce devices which fully complies with the standard
- Students who have learned IEC 61131-3, should be introduced to the platform available in the laboratory



UniSim

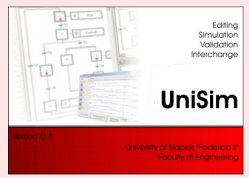
UniSim is an educational tool developed at University of Naples

- 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
- UniSim can be used to *fast prototype* the automation systems using a desktop equipped with low-cost I/O boards

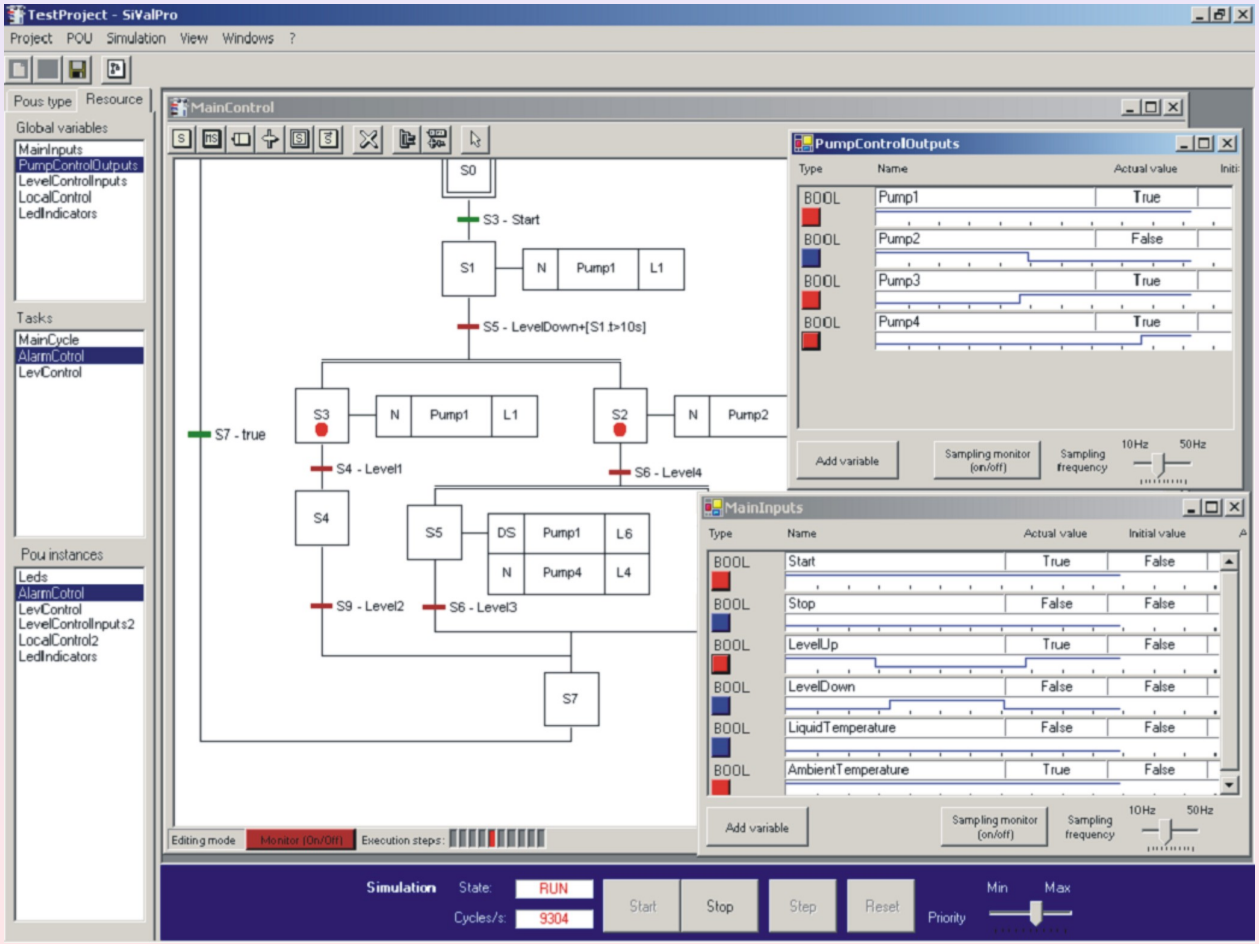


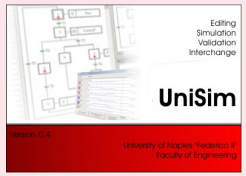
. . .moreover. . .

- 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
  $\longrightarrow$ portability

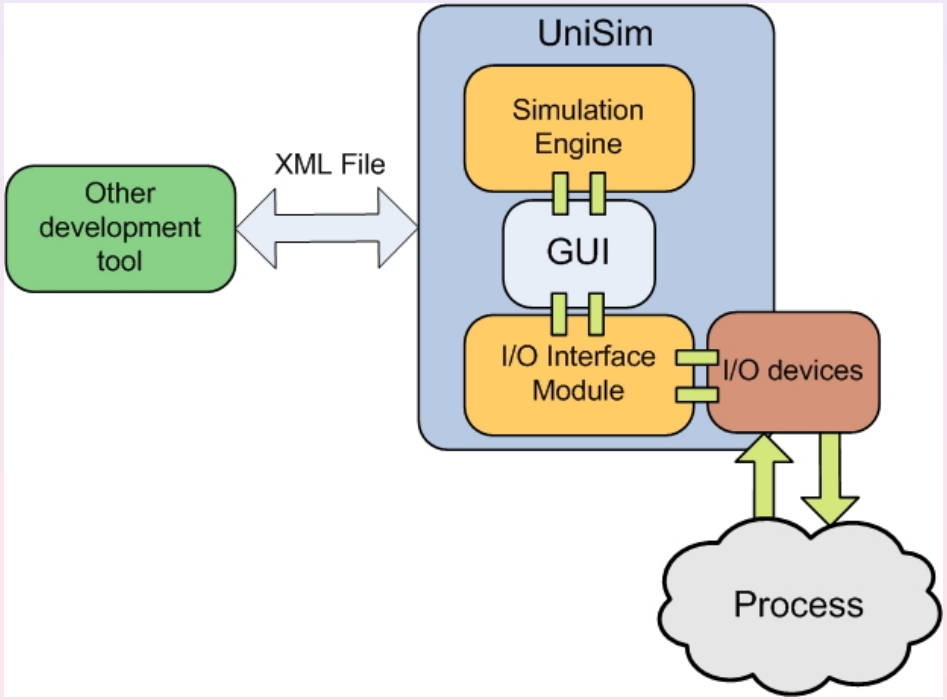


UniSim - Snapshots



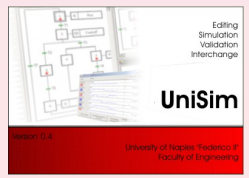


UniSim - Software architecture

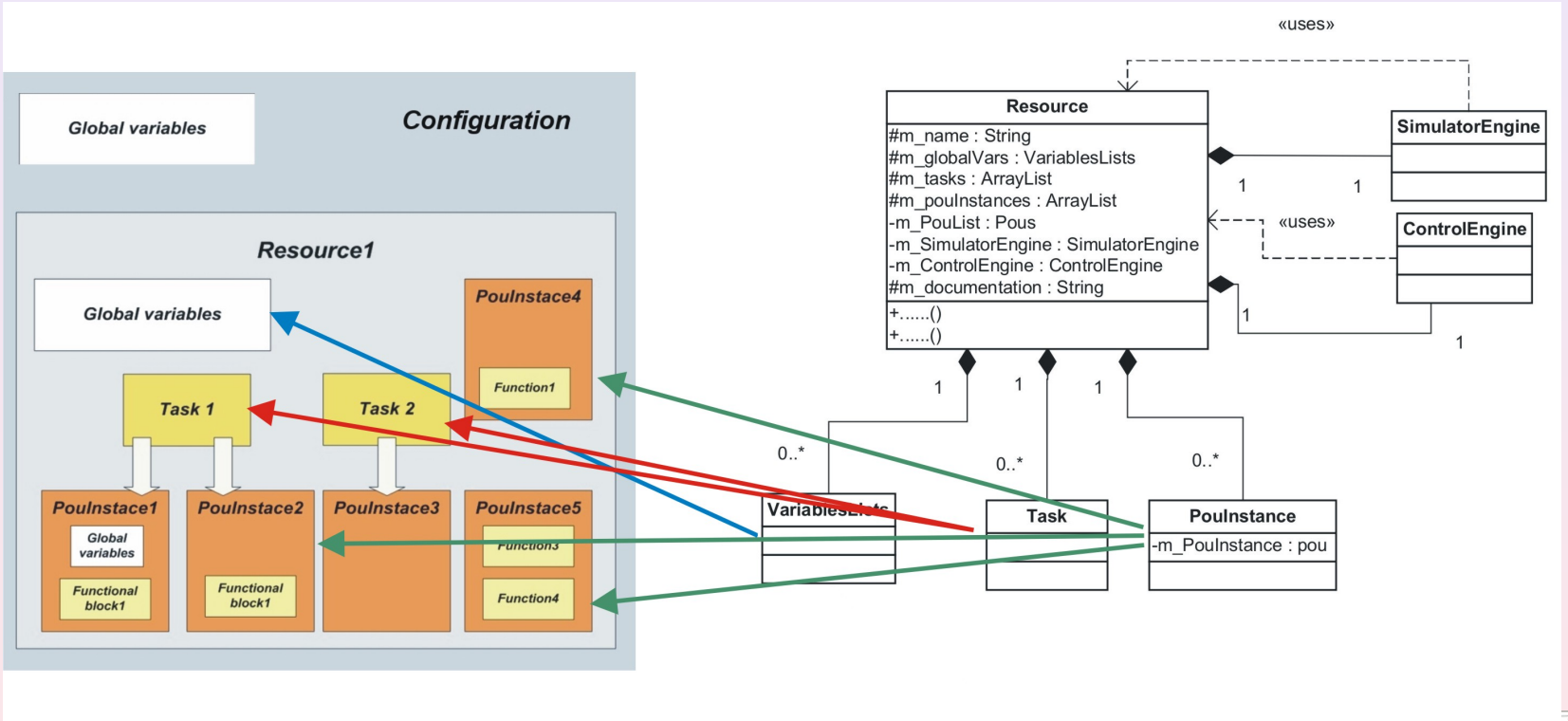


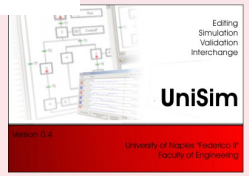
UniSim

- It has been designed by using an object-oriented approach
- It has been developed on the **.Net** platform



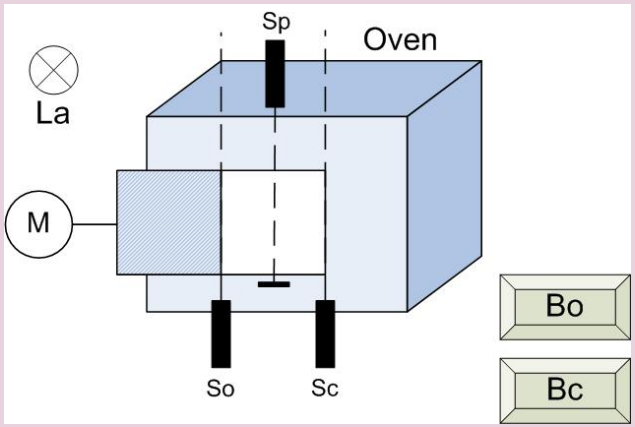
Objects hierarchy





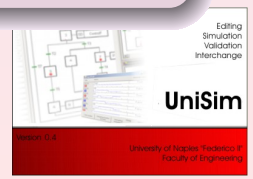
Toy example

Oven

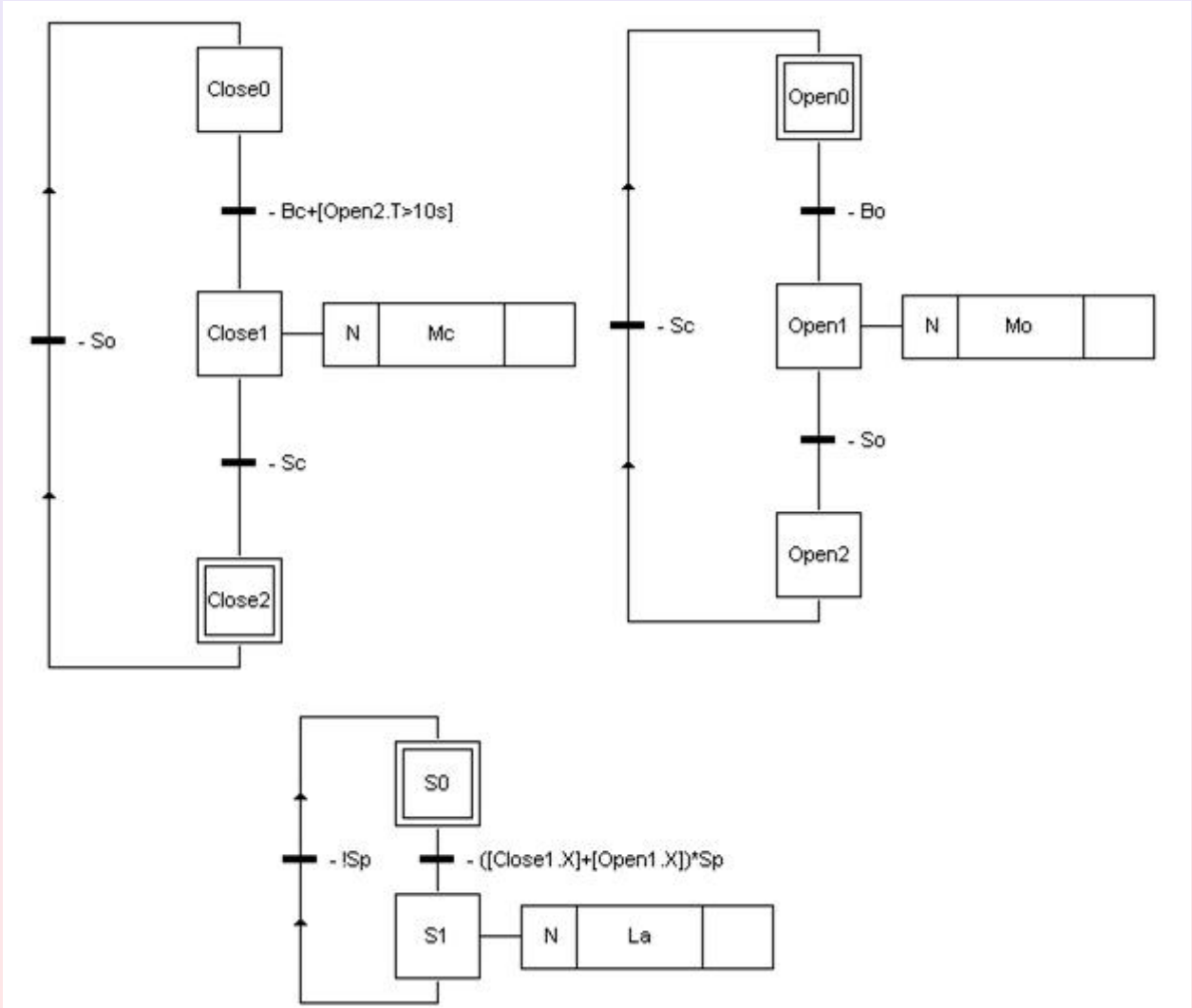


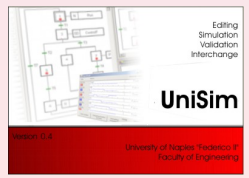
Requirements

- The door must be opened when the button *Bo* is pushed
- The door must be closed when the button *Bc* is pushed, or if it stays open for more than 10s
- If an object is detected by *Sp* while the door is moving, lamp *La* must be turned on

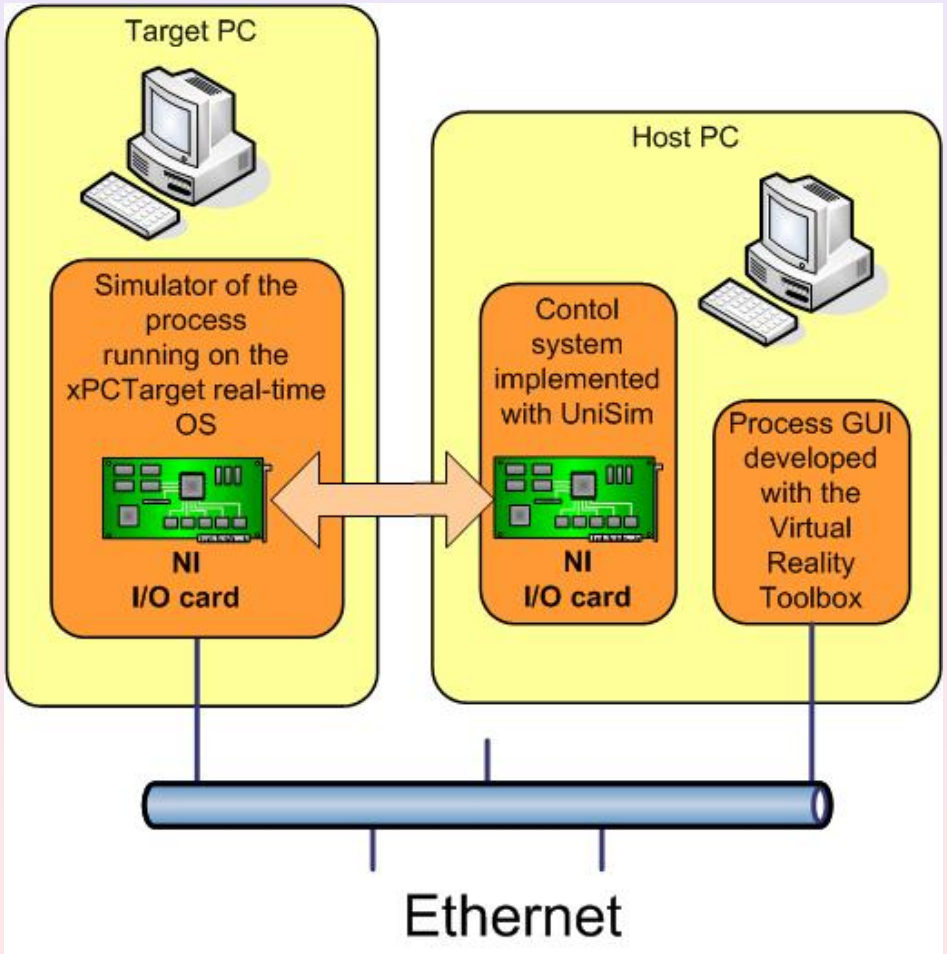


Control algorithm

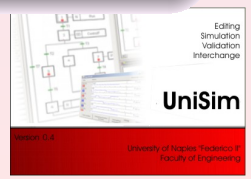




Lab setup



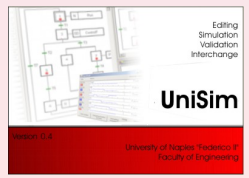
- The **Host** runs the control algorithm with UniSim and a graphical user interface for the process
- The **Target** runs the *xPC Target real-time OS*, which executes the process simulator



Conclusions

UniSim

- It allows to teach IEC 61131-3 standard without tieing to any commercial platform
- It can be used to easily set up a lab for an industrial automation class using only *off-the-shelf* devices
- It uses *XML Formats for IEC 61131-3* guaranteeing software portability



Conclusions

But

- 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

By the way

UniSim is distributed with a *GPL* license
http://wpage.unina.it/detommas/unisim