How Arduino Is Open-sourcing Industry

Arduino Day 2015 – Fablab Côte d'Opale – Calais

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Introduction

- Arduino: cheap, easy to use, and sufficient performance for a large number of applications
- Open-source ➪ Possibility to adapt (new card, shield) for a specific application
- Development of fieldbus shields (RSxxx, CAN bus, Ethernet) and communication protocol librarys (Modbus, TCP/IP)
- Early, some thought to industrial applications (e.g., here in 2009, there in 2009, here in 2010, etc)

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- Comments in the fora:
  1. Not robust enough (10 ways to destroy an Arduino)
  2. Hardware requirement for an electrical/industrial system (12V-24V compliant, rail-mounted, etc)
  3. Integration in an industrial system (especially integration with SCADA)

  ➪ PLCs are designed for this. 40+ years of experience. Why changing?

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Two words about the open-source business model

- Provide an open tool for free (OS, software, plans to build a card)
- Sell a service to make it run (software/hardware installation, selling electronic cards, teaching how to use the material, etc)

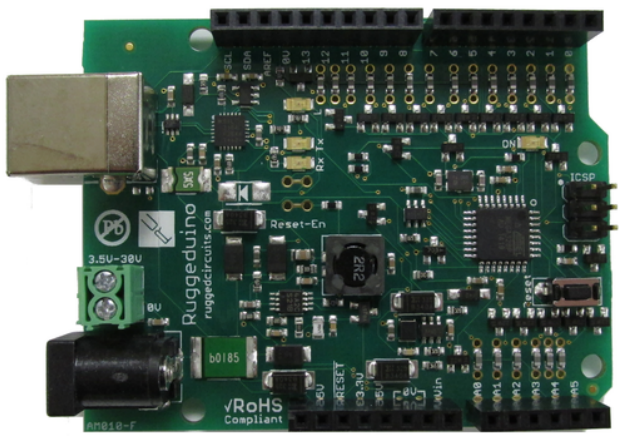
Outline of the presentation

1. Robustifying Arduino and integrating it into industrial systems
   - Rugged Arduinos
   - Arduino-based PLCs
2. Arduino and manufacturing
   - Arduino in the Computer-Integrated Manufacturing pyramid
   - SCADA softwares compatible with Arduino
3. Conclusion

Rugged Arduinos

More robust **open-source** Arduino-like cards:

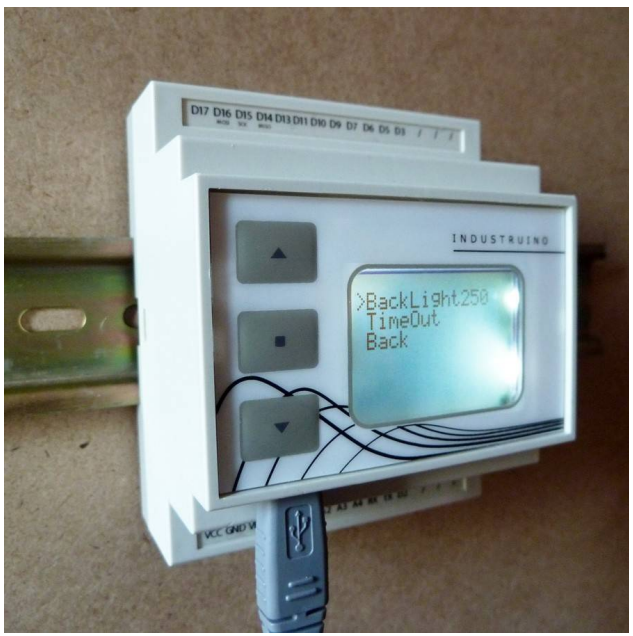
- Ruggeduino Special Edition ($54.95)
  - 16MHz, 8bit μ-C (like Arduino), 3.5–30V, I/O protected, Arduino form factor
  - Temperature range: -40°C / +50°C
  - Same IDE as Arduino
- Olimex PIC32-Pinguino (€19.95-)
  - 80 MHz, 32bit μ-C (Pinguino), 9–30V, I/O protected, Arduino form factor + specific UEXT connector
  - Temperature range: -25°C / +85°C
  - IDE (Pinguino) close to Arduino
  - Olimex builds other Duino products

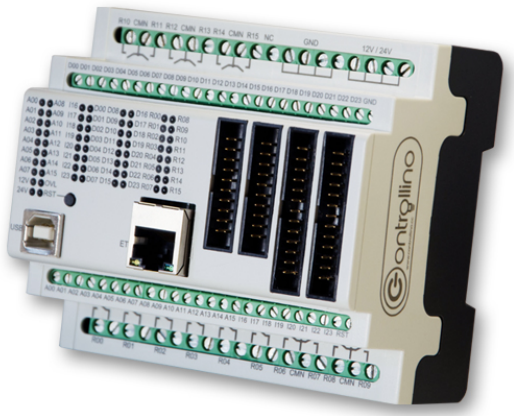


Arduino-based PLCs

Arduino-based products with easy physical integration into industrial systems (**schematics not provided!**)

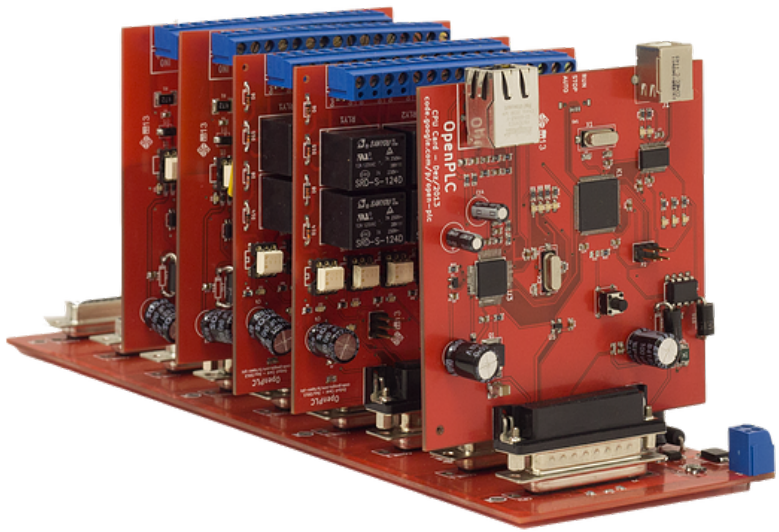
- All based on AVR μ-C (8 bits, 16MHz)
- Rugged (sold as is)
- Only software is open-source...
  - Industruino (from €52, from €110 for 12-24V compatibility)
  - Controllino (from €119)
  - Industrial shields (from €135)





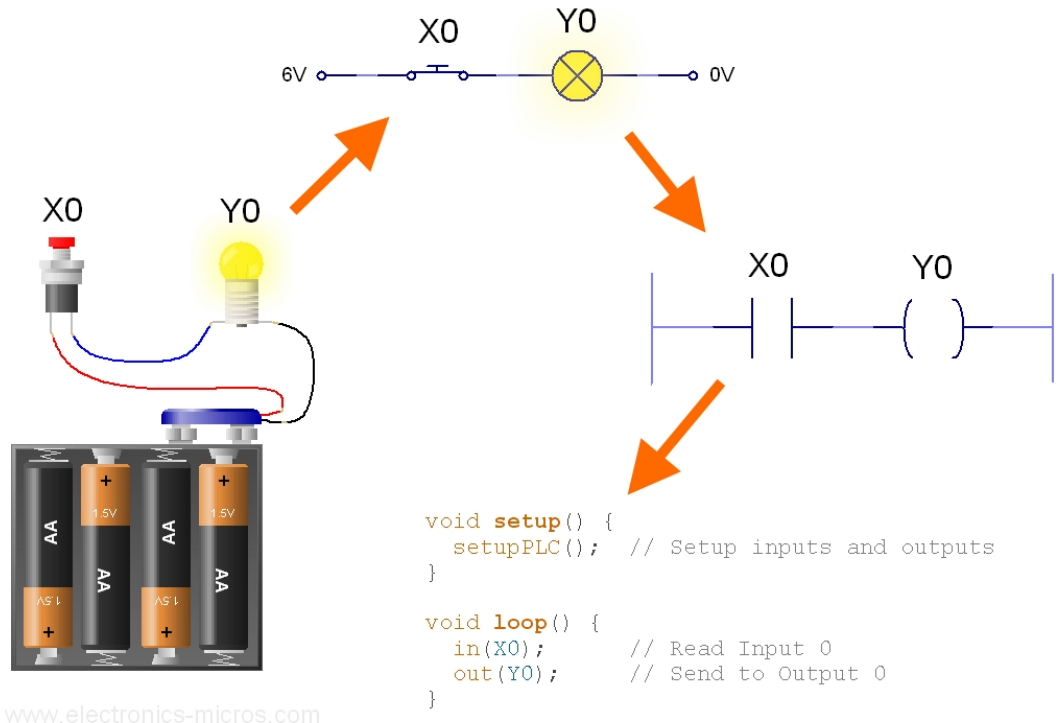
A trully open-source Arduino-based PLC

- OpenPLC: `http://www.openplcproject.com/`
- Born as a student project
- All schematics provided, possibility to build your own (not possible to buy one for now)
- Follows the concept of modular PLCs
- Not only hardware development but also software development (we're going to see it)



Programming an Arduino like a PLC

- Arduino use a language derived from C
- Various PLC programming languages
  - One inheritated from relay hardware systems: Ladder diagram



➪ Development of Ladder languages compatible with Arduino

OpenPLC – Soapbox Snap – PLClib – Ladder Logic for PIC and AVR – Waltech Ladder

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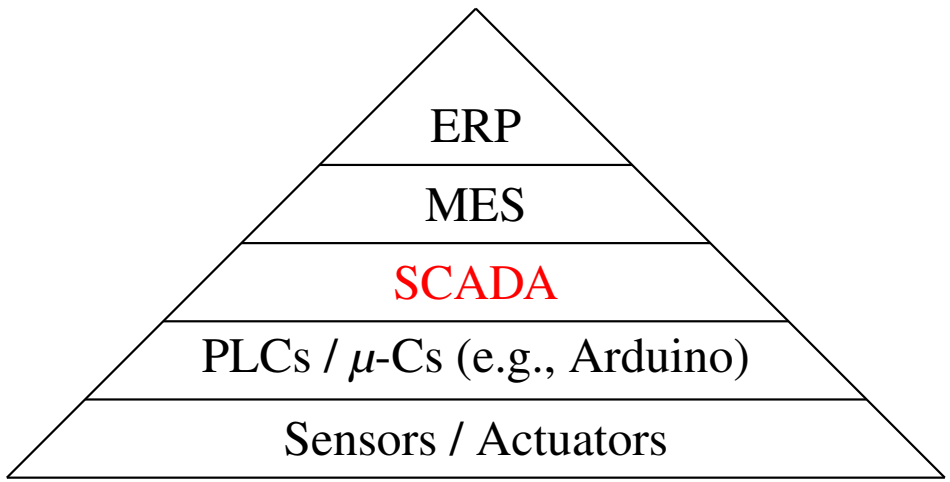
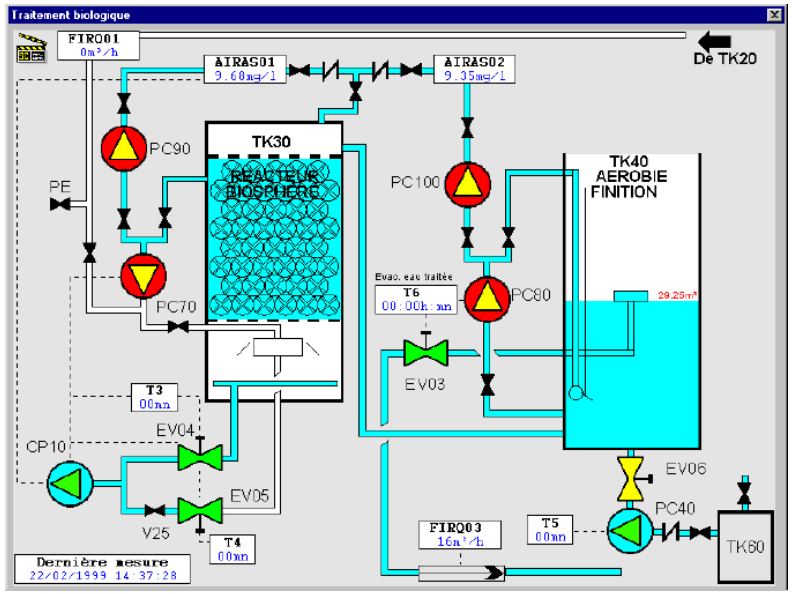
Arduino in the Computer-Integrated Manufacturing pyramid



Delayed management

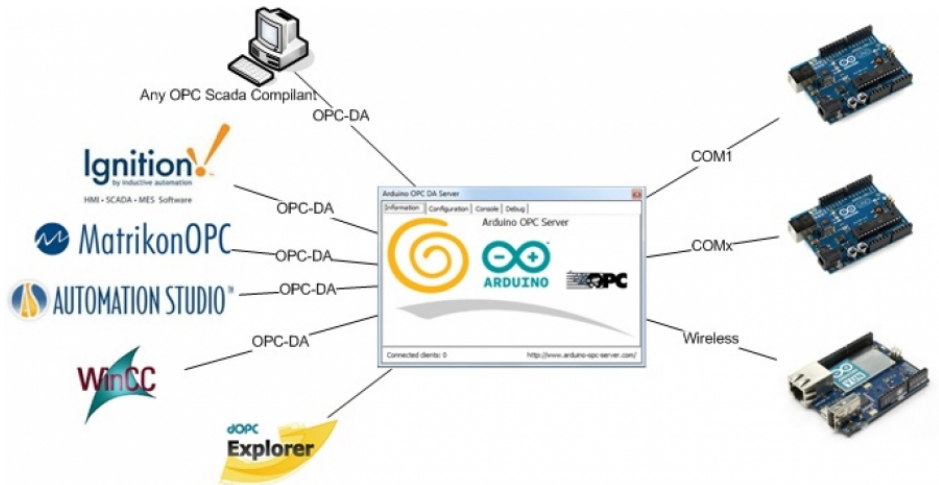
Real-time manufacturing

ERP = Enterprise Resource Planning
MES = Manufacturing Execution System
SCADA = Supervisory Control And Data Acquisition



SCADA softwares compatible with Arduino

- SCADAs can be directly linked with a PLC (one-to-one connexion) or through a server (mainly: OPC server).
- OPC server for Arduino allows the use of any SCADA software



- **Free** SCADA softwares for Arduino: ACIMUT, Visual OPC Builder
- **Open-source** SCADA softwares: Proview, ECLIPSE Scada

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- Arduino is (slowly but steadily!) open-sourcing industry
  1. Hardware
     - Open- and closed-source Arduino-based industry compliant hardware
     - Open-source PLC in development
  2. Software
     - Programming languages (Ladder)
     - Communication protocols (Modbus, TCP, OPC server)
     - SCADA (free or open-source solutions)
- Need to:
  1. Trying it
  2. Comparing it with proprietary solutions
  3. Improving it (if needed)
  4. Spreading the word

Thank you for your attention. Questions?