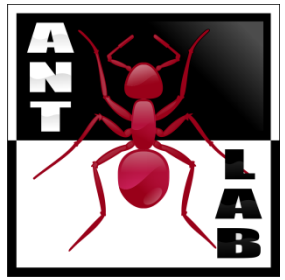

Politecnico di Milano

**A**dvanced **N**etwork **T**echnologies **Lab**oratory




# Internet of Things

## Hands on activities

- Edoardo Longo
- DEIB Building 20 - Ground Floor - ANTLab

- Email: edoardo.longo@polimi.it
- Phone: 02 2399 9614
- Beep Forum

- WebEx:

https://politecnicomilano.webex.com/meet/edoardo.longo


# Classes Objective


- Giving you an overview on the software used in the IoT community
- Stimulating your curiosity
- Providing you with basic tools to develop simple IoT applications
- Classes time is limited -> Play with these tools on your own!


# Some stats


- What is your field of study? (CS, Telecom, Auto…)
- How many programming language do you know?
- Which ones?
- Do we start at .15 or .30?

- Questions?

# Calendar

- March 24 - CoAP
- March 31 - MQTT
- April 14 - Node-RED
- May 5 - TinyOS 1
- May 12 - TinyOS 2
- May 13 - IoT pipeline

- **But check on Beep to be 100% sure**

# Hands On Activities

- Operating Networks of Embedded Devices
  - Communicate with CoAP/MQTT
  - Code with TinyOS/NesC
  - Simulate with TOSSIM and COOJA
  - Collect data with ThingSpeak
  - “Code” with NodeRed
  - Play with simulated IoT environments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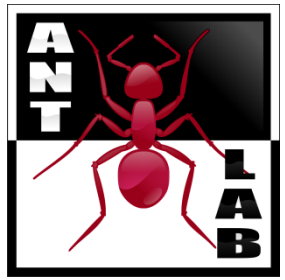


# A virtual machine for the IoT



# Motivations

- Many software are available for designing WSNs and IoT solutions
- No “standard” configuration is available
- Depending on the application, one solution may be preferable

- Even the installation of a programming environment itself is a time-consuming task



# VM contents

- TinyOS env + examples
- Thingspeak examples
- Node-RED
- Command line tools
- MQTT broker & tools
- CoAP server & tools



# IoT Virtual Machine

- A Virtual Machine is an emulation of a particular computer system
- On the class website, a Virtual Machine containing most of the needed tools is available:

https://mega.nz/file/SAVCzRYI#oMylbgmm8LLIAfwXdDINSDvrMV2TgFwYqedZ5ZG3tEY

Virtual Box:
https://www.virtualbox.org/wiki/Downloads



# How to run it

1. Download Oracle VM VirtualBox for your laptop (make sure to have at least 10 GB of free space on your HDD)
2. Download the IOT virtual machine from the class website
3. Open VirtualBox and go to File->Import Appliance and import the file iot_polimi_21.ova
4. Boot the VM:

   user: user

   password: user


# Problems


- Increase display video memory
- Set the graphic controller
- Enable/disable 3 acceleration
- Increase system base memory

- Look up on google/stack overflow
- Use Beep forum


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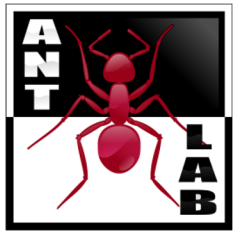
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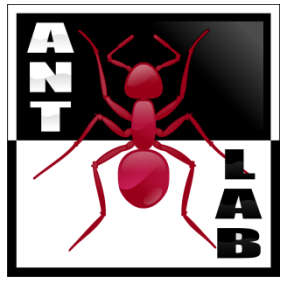


# How to pass the exam

Projects and gradings


# Grading


- **Grade Composition**
  - Written Exam: up to 25 points
  - Home projects: up to 4 points
  - Final project: up to 4 points


# Projects


- Home projects
  - Home assignment
  - Delivery approx in 3-4 days
  - Groups of max 2 students

Code developement using tools seen at Labs

- Final project
  - Home assignment
  - Delivery by September
  - Groups of max 2 students

# Calendar

- March 24 - CoAP
- March 31 - MQTT + **Home challenge #1**
- April 14 - Node-RED + **Home challenge #2**
- May 5 - TinyOS 1 + **Home challenge #3**
- May 12 - TinyOS 2 + **Home challenge #4**
- May 13 - IoT pipeline

- **But check on Beep to be 100% sure**


# Project info


- Teams are encouraged to work remotely
- Github, bitbucket, gitlab, etc. are strongly encouraged and appreciated
- Delivery consists in both code and written report


# Home Projects info


- The team can change during the semester
- If you don’t have one, use the forum to find a mate
- Grade if you’re alone is the same if you’re together

# Joint IoT/Wireless Internet projects

- For students enrolled in both courses only
- Topics/tools addressed in both courses
- Slightly larger project wrt IoT-only, but evaluated in both courses (with 1 project you gain up to 4 points both for IoT and for WI)



- Final project registration (before 28/05): https://forms.gle/UKPMdT7HdnM4eJoG7

- You don’t have to register for the home challenges