WEEE Open: electronics, sustainability and open source

2020

Politecnico di Torino

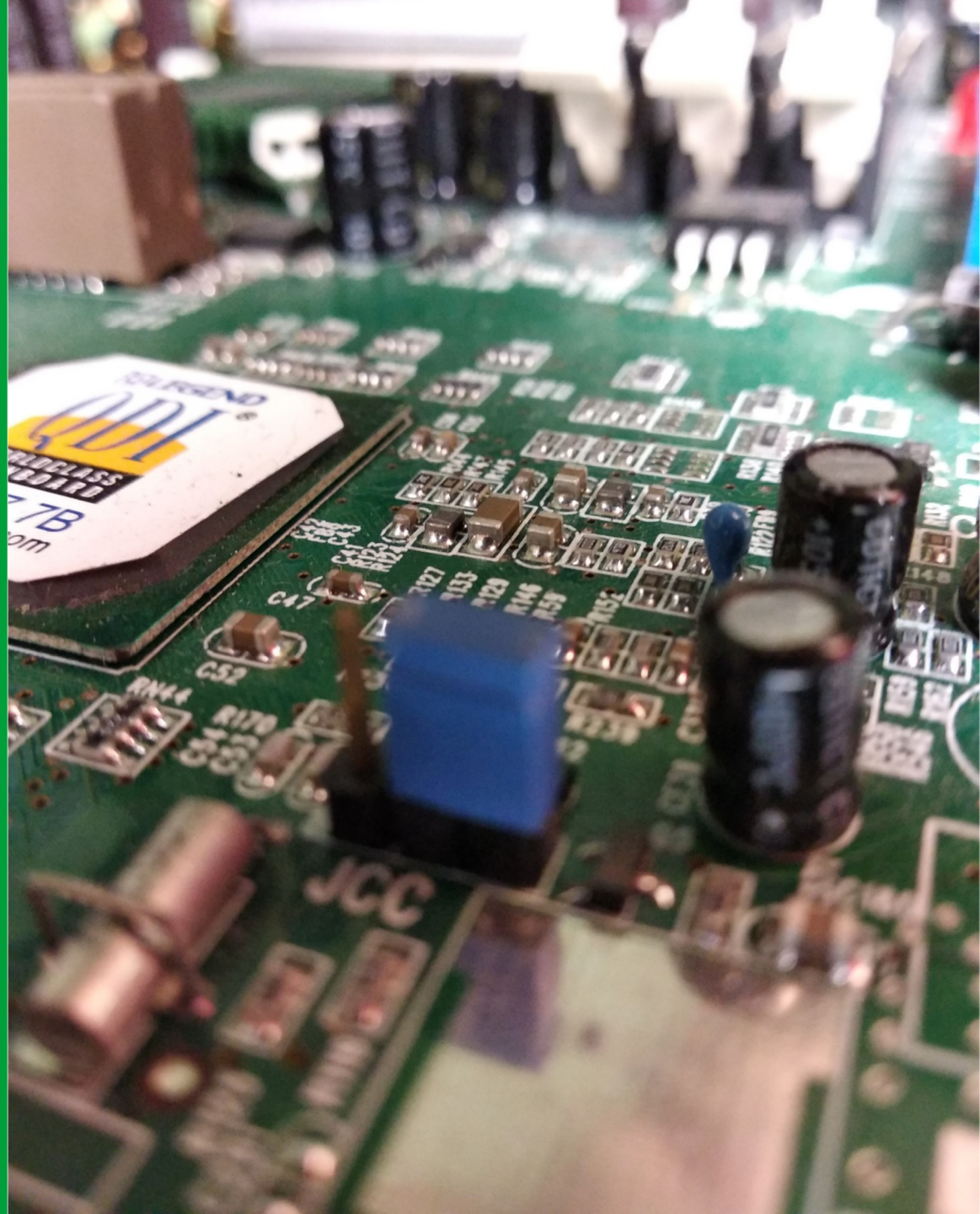
Objectives

- Reduce the amount of electronic waste thrown away despite still being usable
- Promote learing «hands-on» and peer to peer education
- Share our work through open source licensing
- Donate repaired computers and other devices to no-profit organizations, schools, public institutions and so on

Our final goal is to bring the quantity of electronic waste produced by Politecnico as close as possible to 0 tons per year

The e-waste problem

Most of electronic waste (80% globally[1], 65% in Italy[2]) produced in the world isn't correctly disposed: it ends up in illegal landfills in the poorest areas of the Planet.
To reduce the quantity of waste, reuse is a possible solution



[1] Source: Baldé, Cornelis P., et al.The global e-waste monitor 2017:Quantities, flows and resources. United Nations University, InternationalTelecommunication Union, and International Solid Waste Association, 2017.
[2] Source: Presa Diretta, 6-2-2017

What we have done until now

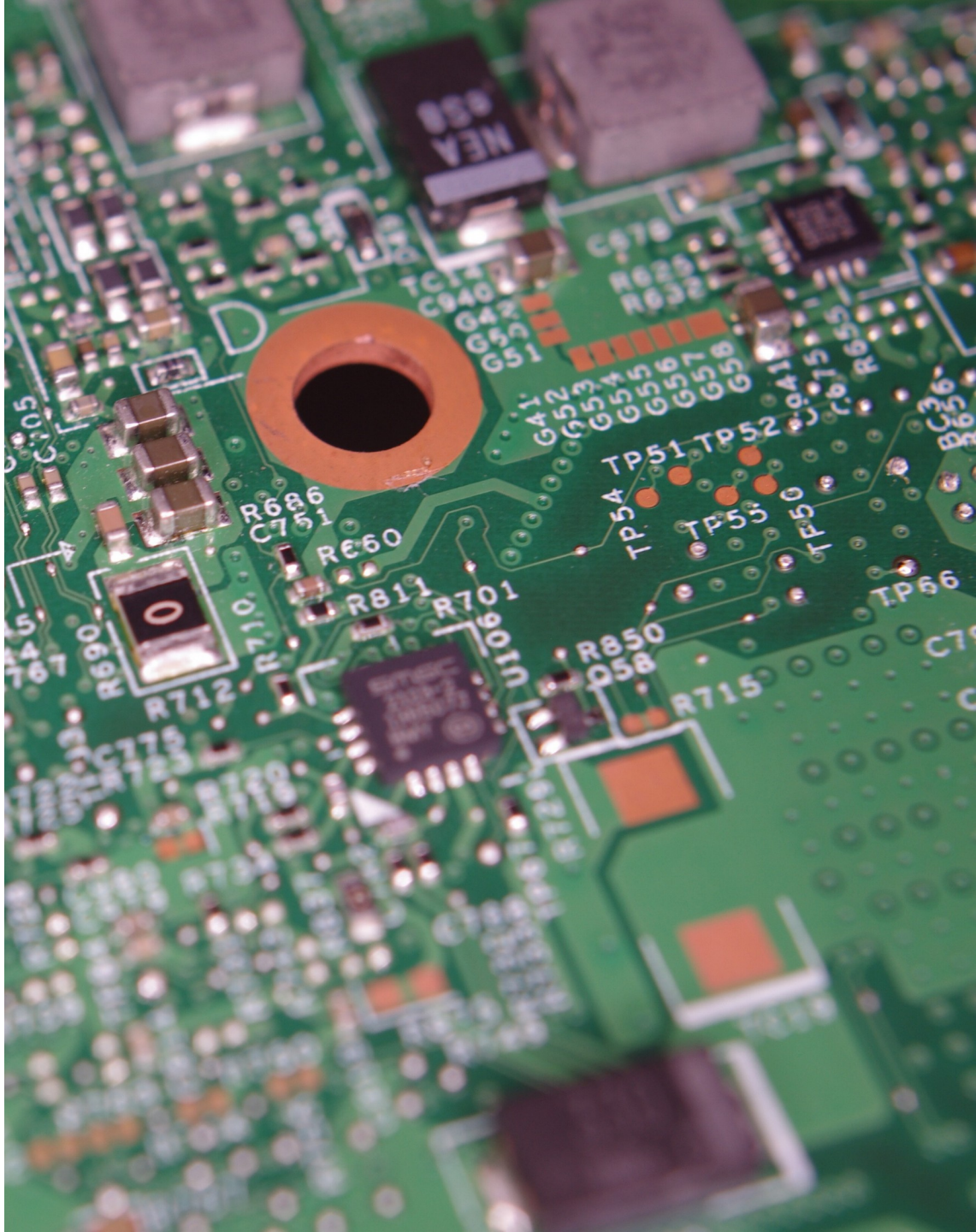
- 4 years of activity
- 28 members
- 1 chaotic lab with lots of cool tools and stuff
- 100 computers repaired
- 160 hard drives erased
- 40000 lines of code in active projects (excluding comments)

We repair potential WEEE (**Waste of Electric and Electronic Equipment**) and give it a new life.

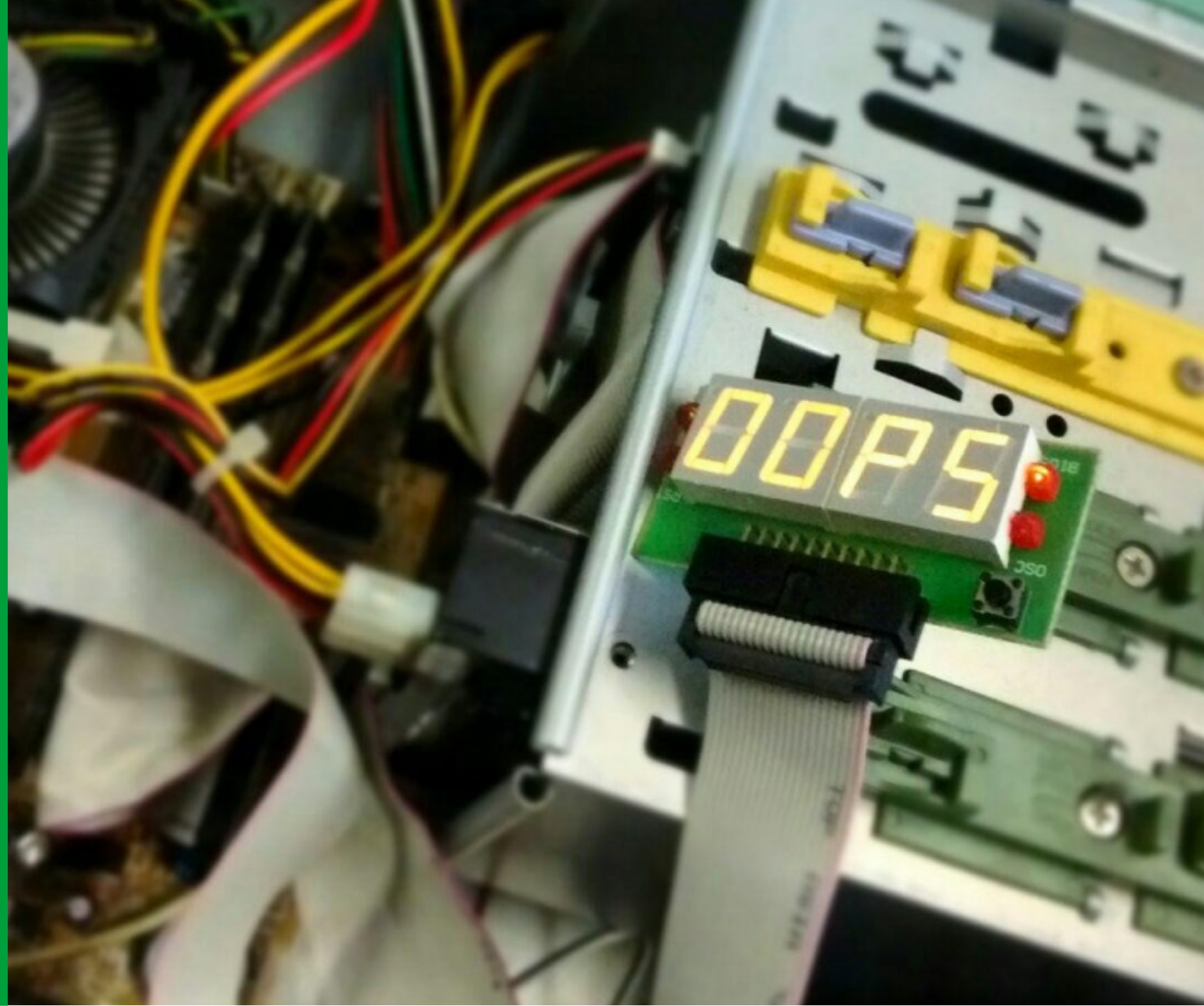
We embrace the **open source philosophy**, using free software and releasing our own digital material to the community

Three core areas:

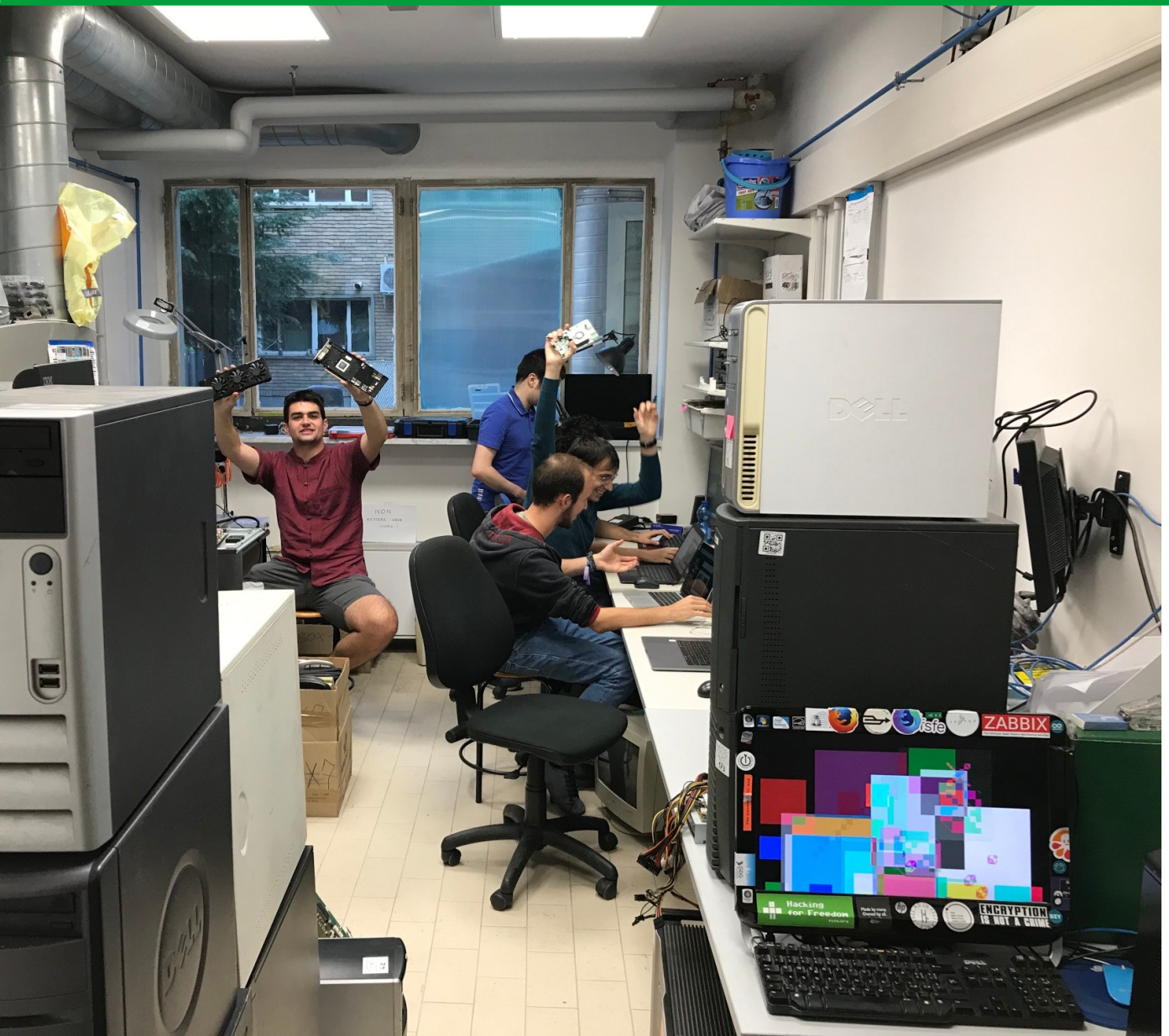
- Hardware Repair and Refurbish
- Software Development
- Electronic Design



Hardware Repair and Refurbish



Hardware Repair and Refurbish

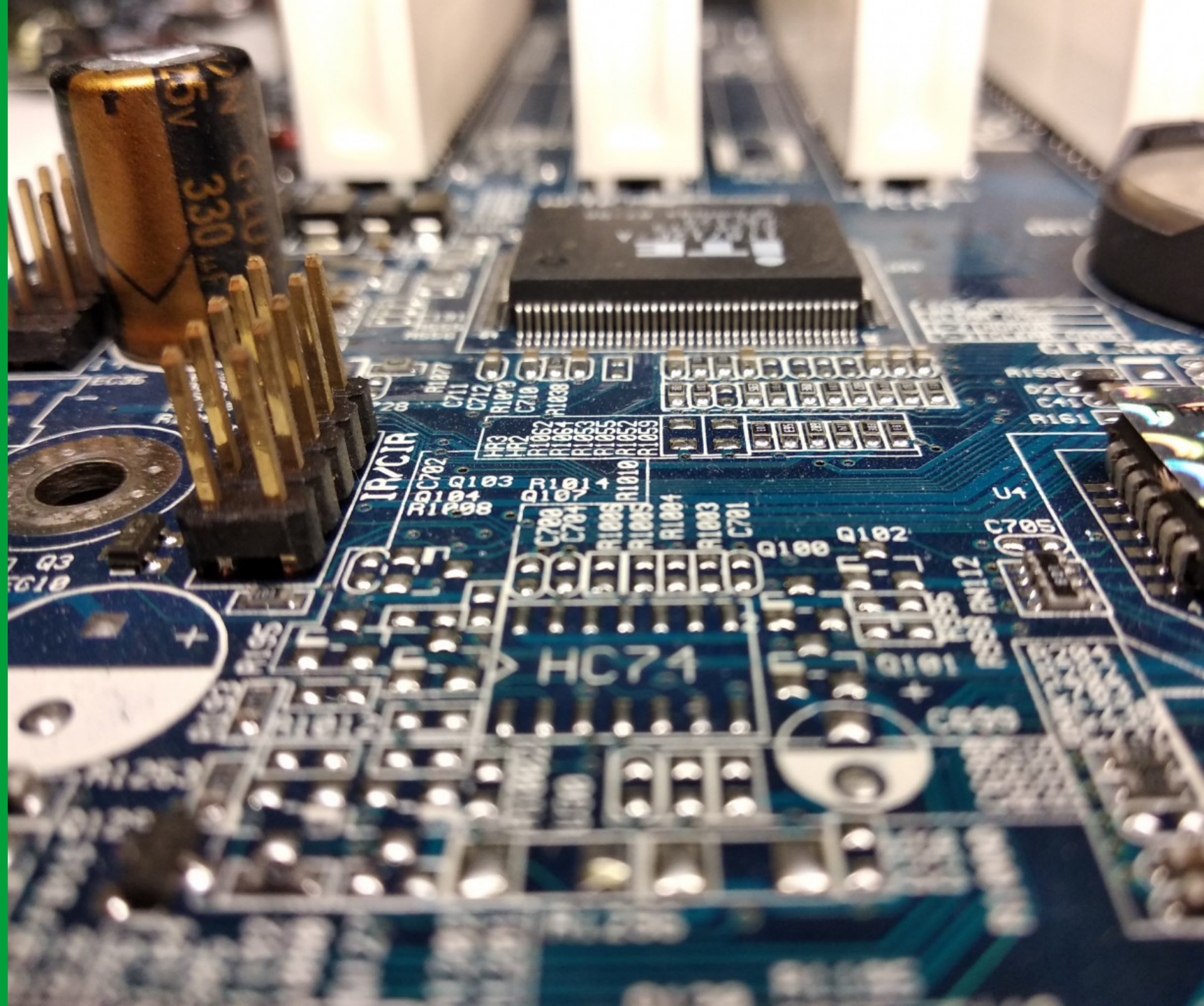


Main Activities:

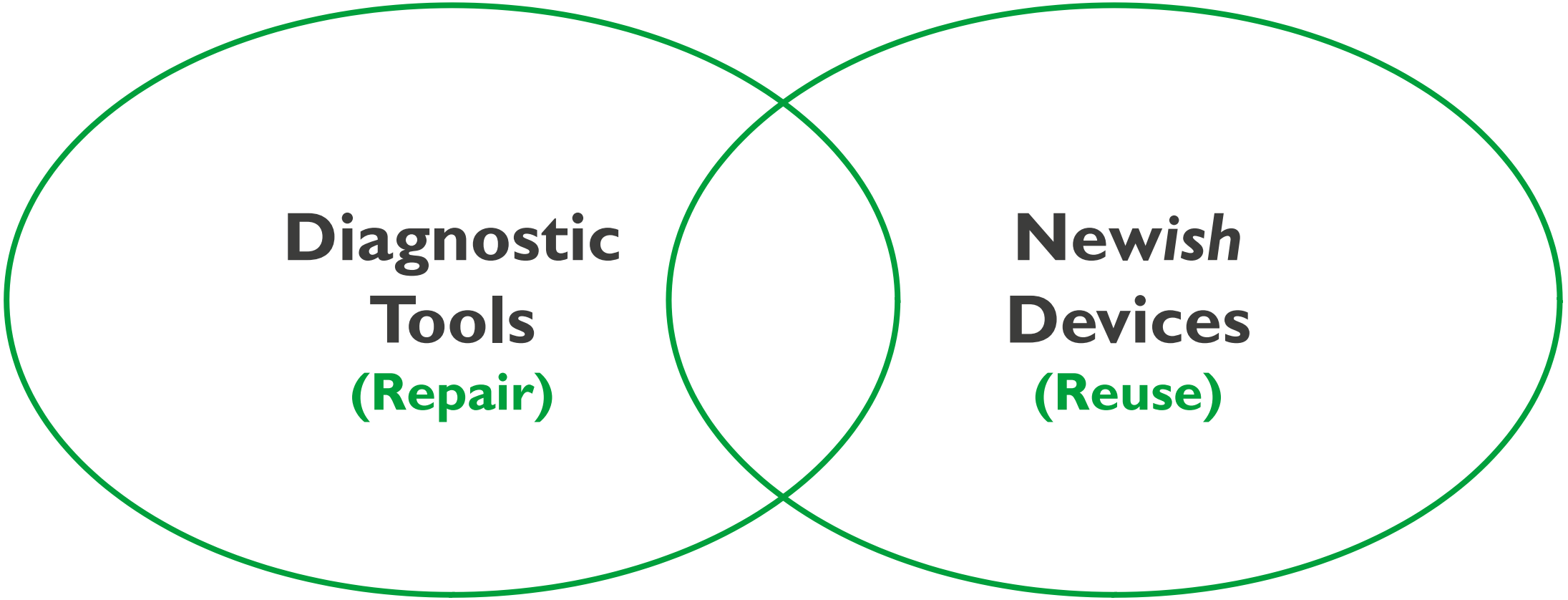
- Recover hardware from Politecnico departments
- Internal inventory procedures
- Diagnostic phase
- Separation of components
- Repairs
- Assembly of "new" machines
- Donation procedure

Over the years we've donated 57 computers complete with peripherals

Electronic Design

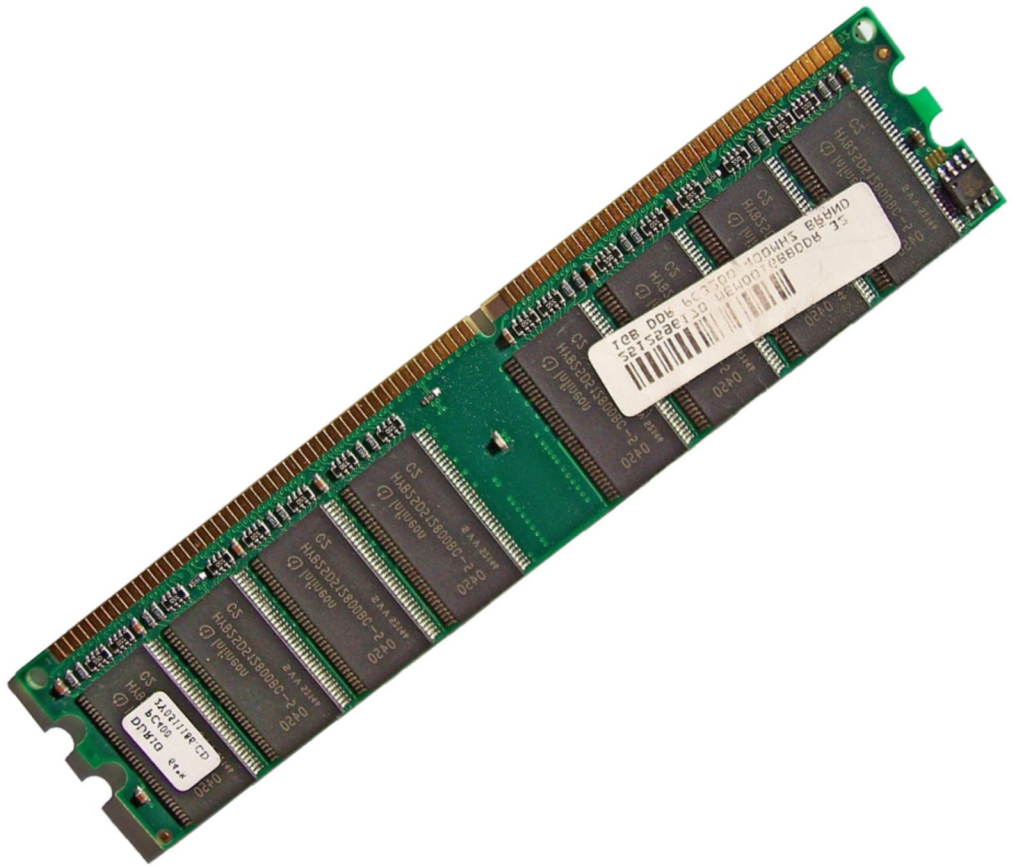


Thematic Areas



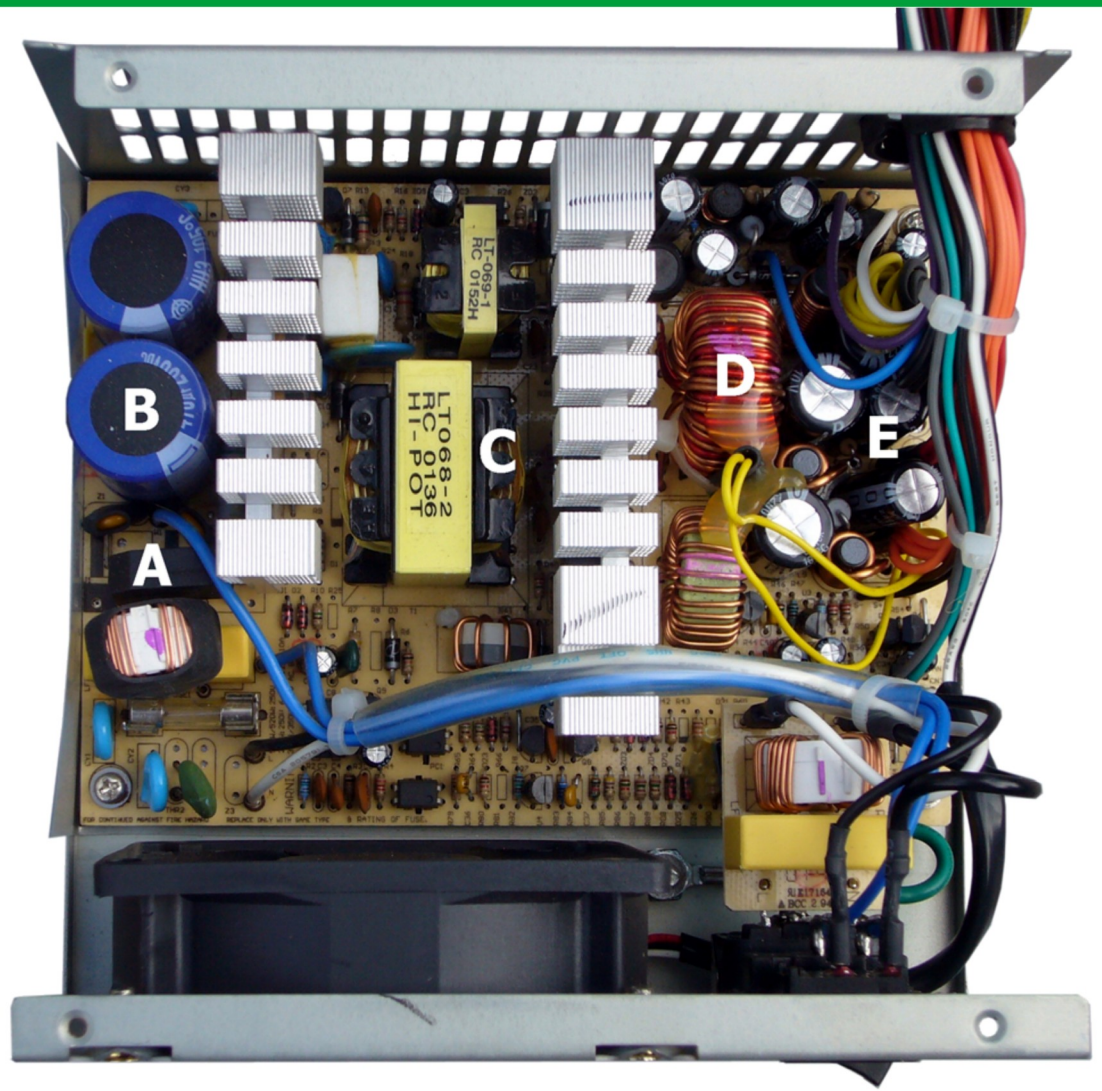
Diagnostic Tools – A.R.A.N.C.I.N.A.

- Hardware tool for quick DIMM testing
- R/W test, lifetime analysis, characterization, etc.
- Implemented with FPGA, microcontroller or hybrid platform
- Early stage of development
  - We need people!

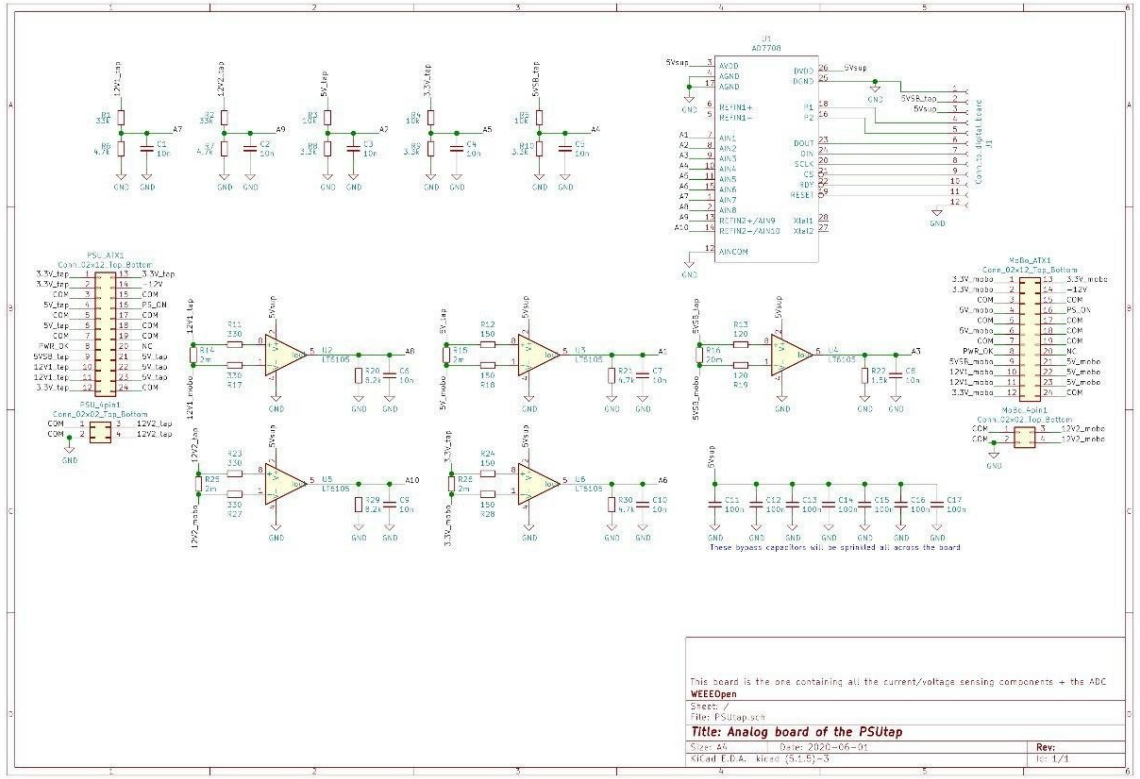


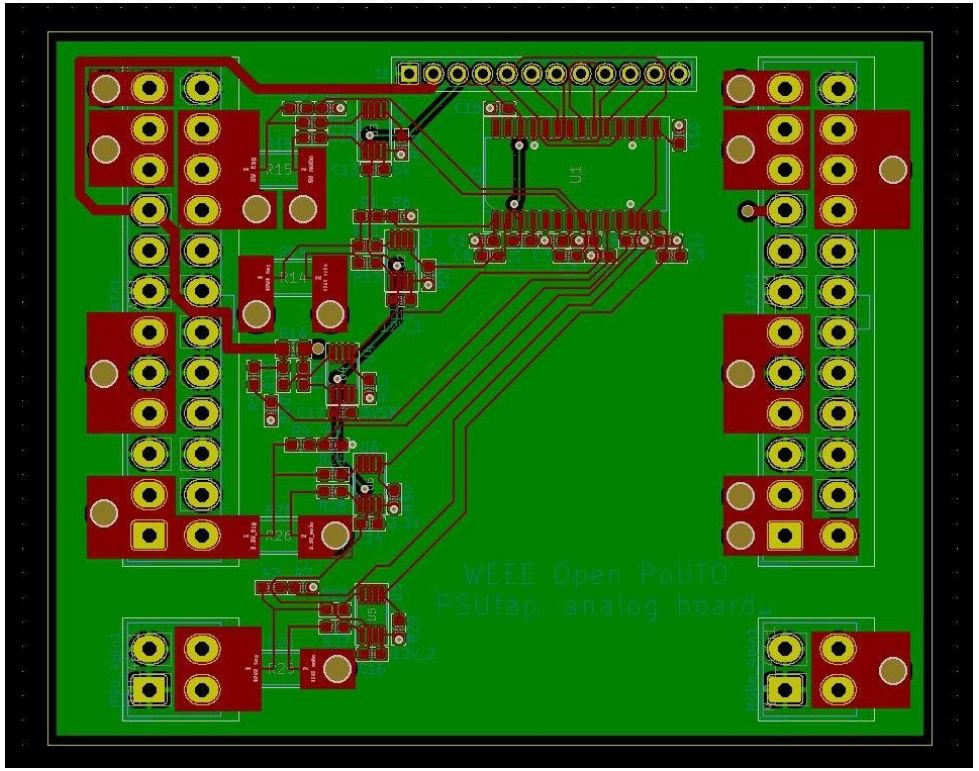
Diagnostic Tools – PSUTap

- Tool to monitor Power Supply Units lines voltage and current
- Detect failures and out-of-specs lines
- (Ideally) quantify noise, ripple, transient behavior
- Steady development pace
  - Still far from the final goal



Diagnostic Tools – PSUTap (2)

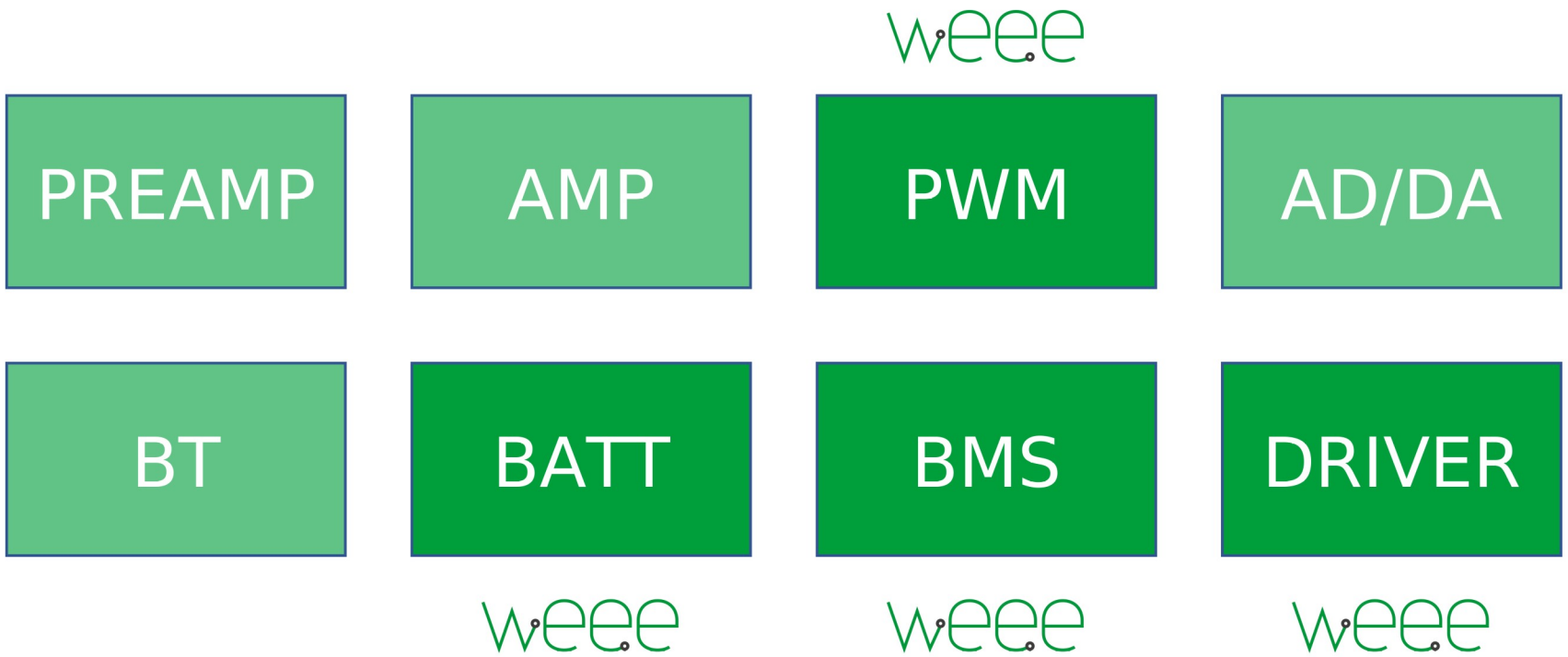




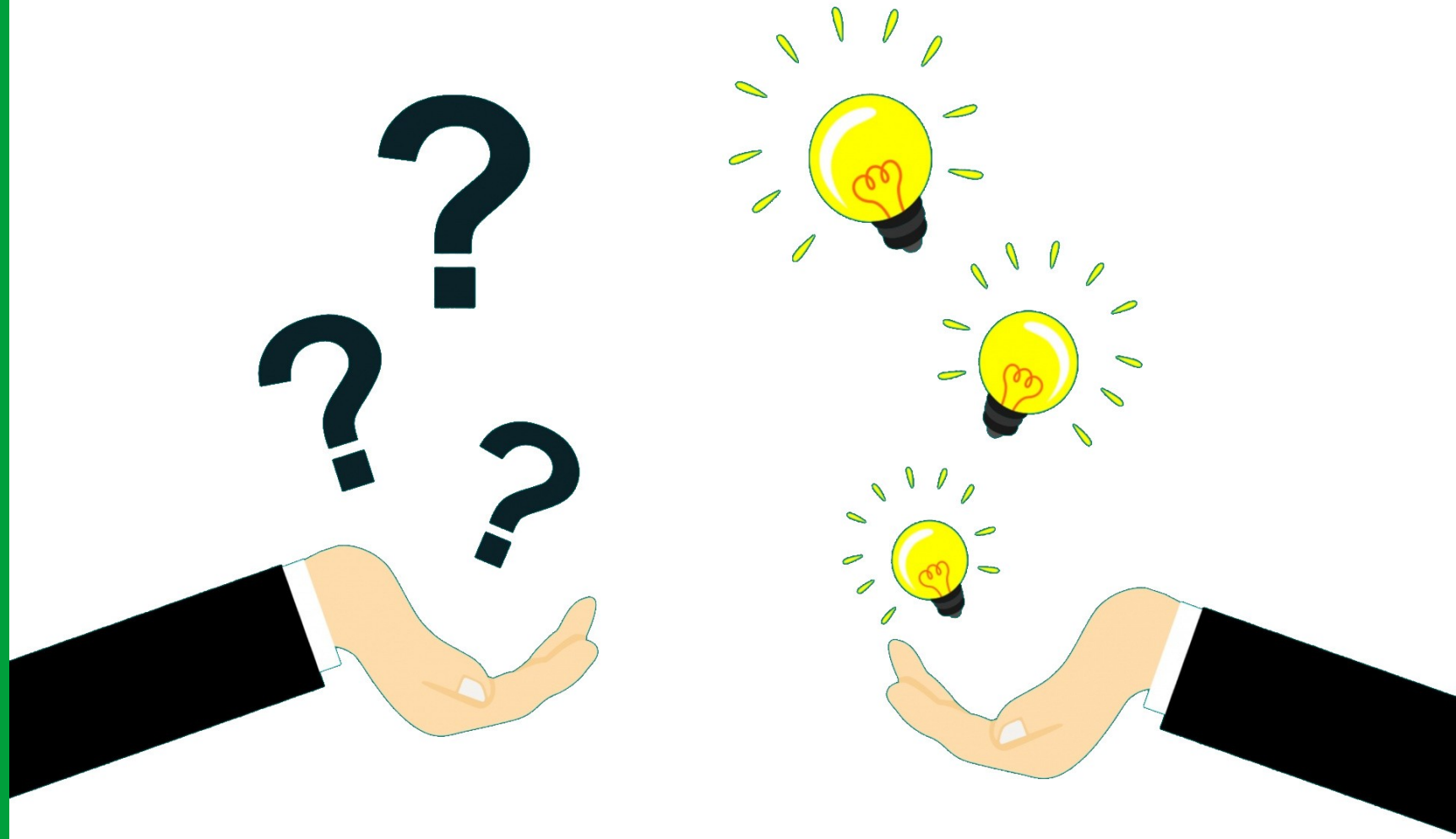
New*ish* Devices – WEEEAmp

- Portable Bluetooth Audio Speaker
- Partially built from recovered components
- Designed from scratch
- Steady development pace
  - Still far from the final goal

New*ish* Devices – WEEEAmp (2)



What's Next?



Software Development

```
            dimms[i].ram_type = ""

        if line.startswith("Maximum module speed"):
            freq = line.split(" ")[-3:-1]
            dimms[i].frequency = int(freq[0])
            if "KHz" in freq[1] or "kHz" in freq[1]:
                dimms[i].human_readable_frequency = freq[0] + " KHz"
                dimms[i].frequency *= 1000
            elif "MHz" in freq[1]:
                dimms[i].human_readable_frequency = freq[0] + " MHz"
                dimms[i].frequency *= 1000 * 1000
            elif "GHz" in freq[1]:
                dimms[i].human_readable_frequency = freq[0] + " GHz"
                dimms[i].frequency *= 1000 * 1000 * 1000
            if dimms[i].frequency == 666000000:
                dimms[i].frequency = 667000000

        if line.startswith("Size"):
            cap = line.split(" ")[-2:]
            dimms[i].capacity = int(cap[0])
            if "KB" in cap[1] or "kB" in cap[1]:
                dimms[i].human_readable_capacity = cap[0] + " KB"
                dimms[i].capacity *= 1024
            elif "MB" in cap[1]:
                dimms[i].human_readable_capacity = cap[0] + " MB"
                dimms[i].capacity *= 1024 * 1024
```

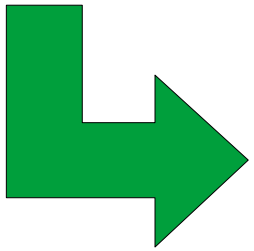
Goals

Make life easier for team members

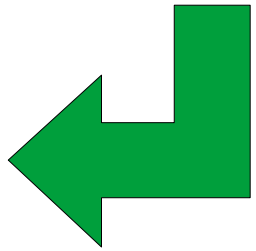
- Automate Linux install and configuration
- One account to rule them all (SSO)
- Automate everything, even paperwork

Gather and analyze data

- Who is in lab?
- Dump “secret” CPU registers

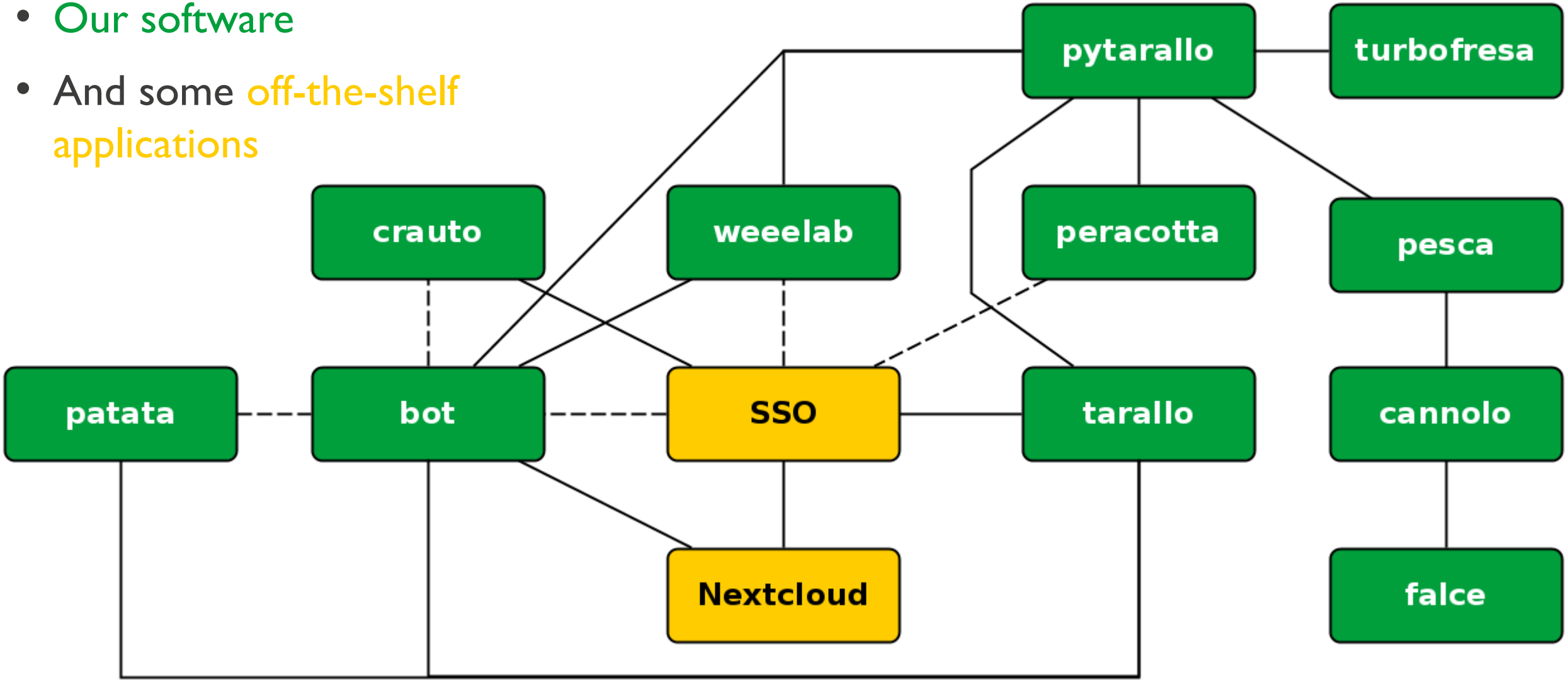


- Parts and computers inventory
- Who is in lab? Who is going later?

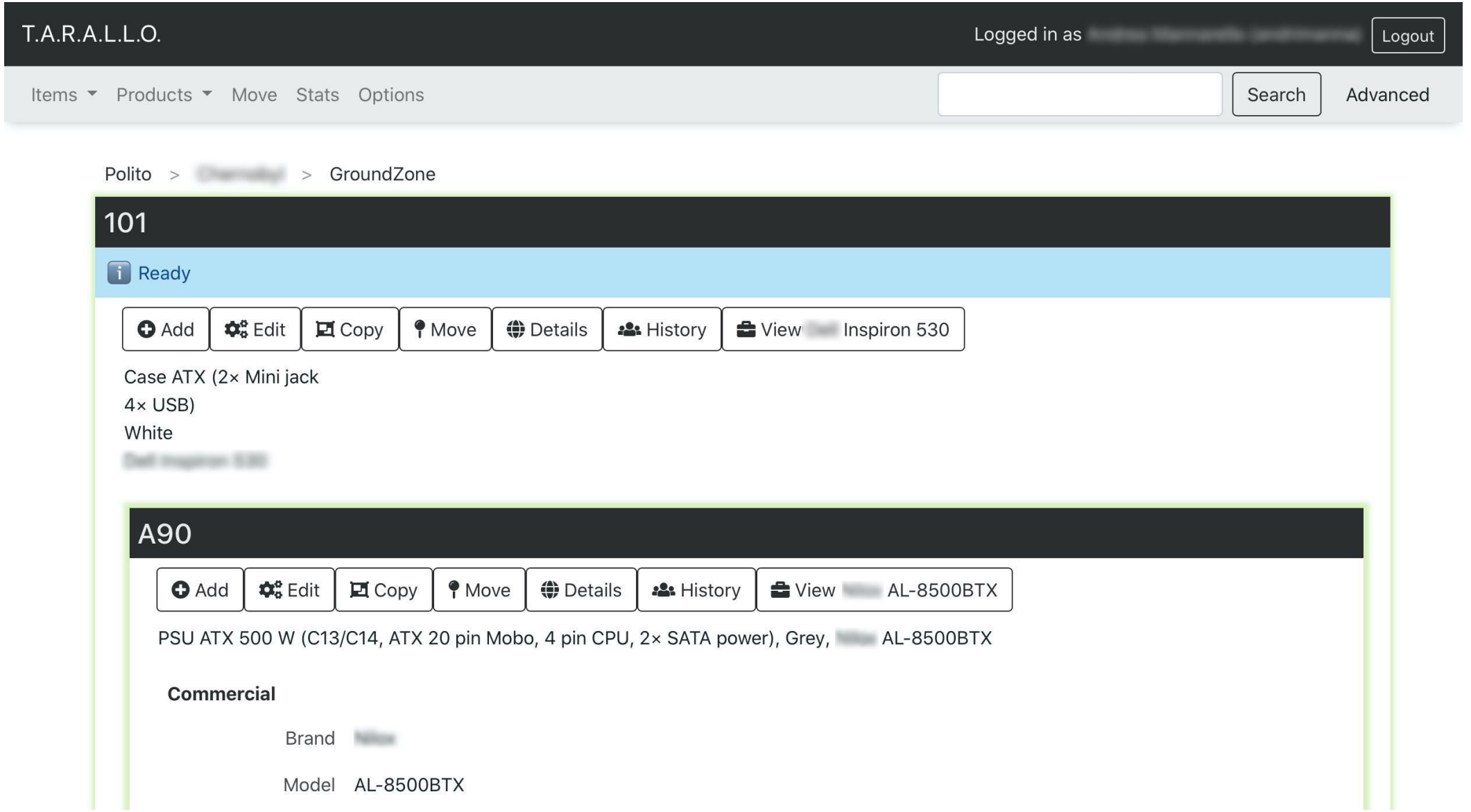


Lots and lots of software

- Our software
- And some off-the-shelf applications



“Big” data


T.A.R.A.L.L.O.
Logged in as
Logout
Items
Products
Move
Stats
Options
Search
Advanced
Polito > > GroundZone
101
Ready
Add
Edit
Copy
Move
Details
History
View Inspiron 530
Case ATX (2× Mini jack
4× USB)
White
A90
Add
Edit
Copy
Move
Details
History
View AL-8500BTX
PSU ATX 500 W (C13/C14, ATX 20 pin Mobo, 4 pin CPU, 2× SATA power), Grey, AL-8500BTX
Commercial
Brand
Model
AL-8500BTX

“Big” data

Tarallo

- Granular inventory (computer component level)
- Ports, slots, sockets, memory size, ...
- Location, works yes/no, next steps, ...
- Useful statistics (for us and for “management”)

Peracotta

- Gather data from command output (BIOS tables, data detected by kernel and drivers, ...)
- Automate inserting data as much as possible
- Command line tool, GUI is work in progress

Linux install automation

- Turbofresa: *automated* secure erase of hard drives
- Pesca: *automated* post-install configuration
- Falce: *automated* ISO customization and creation
- Cannolo: *automated* golden image creation and installation
  - Will supersede/integrate Pesca and Falce

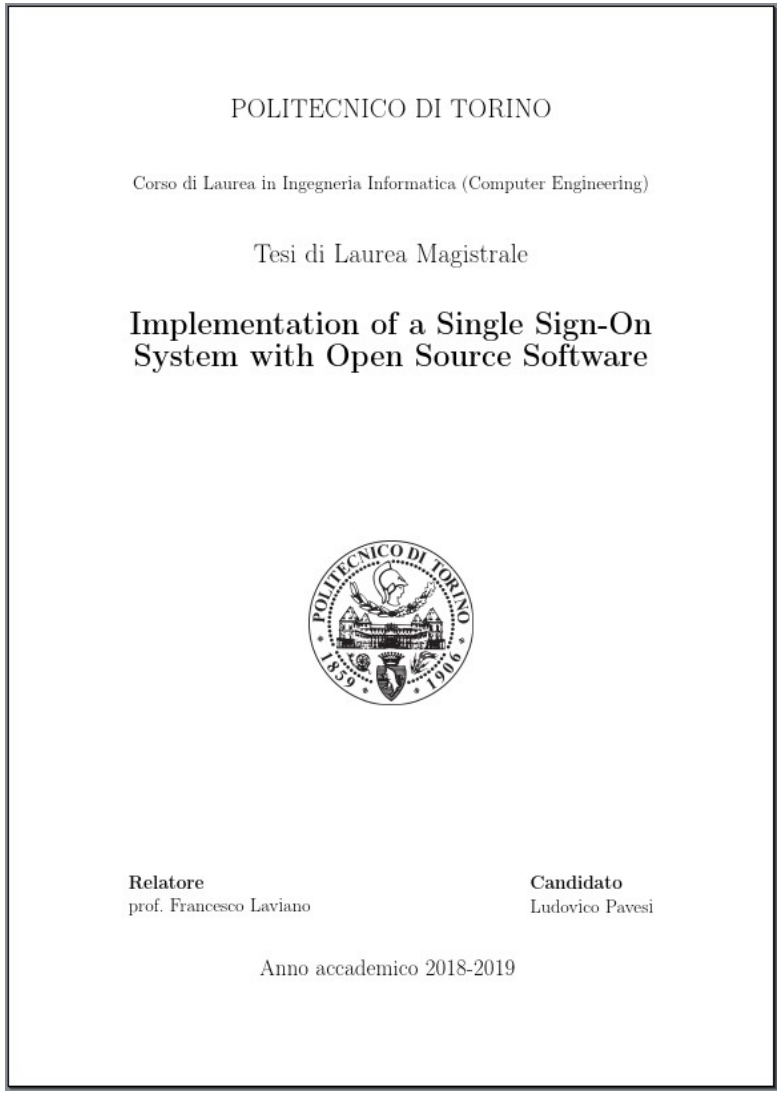
- Secure erase in progress →

Human interaction

- Telegram bot
  - Who is in lab
  - Who is going to lab
  - Query Tarallo for information
  - A lot of IF statements - almost an AI :P
- WEEEHire: the software where you're going to apply
- Crauto: User account management linked to SSO
- Patata: info screen and TODO list

SSO

- One account, access to everything
- Was a big project
  - So big it became my thesis



POLITECNICO DI TORINO

Corso di Laurea in Ingegneria Informatica (Computer Engineering)

Tesi di Laurea Magistrale

Implementation of a Single Sign-On System with Open Source Software

Relatore
prof. Francesco Laviano

Candidato
Ludovico Pavesi

Anno accademico 2018-2019

Thank you for the attention

Q&A