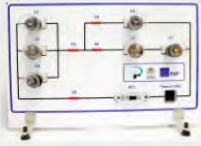


# Laboratórios

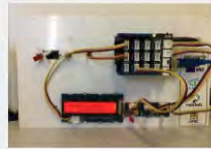
Todos | Física | Biologia | Robótica



### Painel Elétrico CA

Estudo das associações em série, paralela e mista em redes de corrente alternada.

[Acessar](#)



### Ambiente para Desenvolvimento em Arduino

Ambiente que permite verificar, carregar códigos e controlar sensores e atuadores em Arduino

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### Meios de Propagação de Calor

Estudo dos meios de propagação de calor por convecção e irradiação

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### Microscópio Remoto

Microscopia de pigmentação foliar

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### Plano Inclinado

Estudo da segunda lei de Newton do movimento e decomposição de forças em vetores

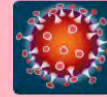
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### Disco de Newton

Estudo da composição das cores

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### COVID-19 announcement

If you are a high school, college or university that has been affected by COVID-19, you can qualify to have a **free subscription** until summer 2020.

[View more information](#)

# Labs Land

*Real laboratories, on the Internet*



Remote Labs



Try the labs



For your educational center

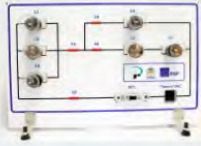
<http://relle.ufsc.br/labs>

<https://labsland.com/en>



# Laboratórios

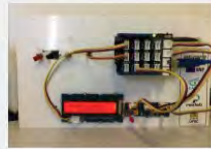
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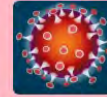
Acessar



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Remote Labs



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## Categories

All ▶

Technology

↑ All

## Education standards

NGSS ▶

## Education levels

All ▶

University & College

↑ All

Publish your lab

Suggest new lab

level: University & College × category: Technology × Search...

This laboratory is currently in beta. It might be missing features, documentation or activities.

Showing 18 out of 58.

### STM32 Nucleo (C/C++)

LabsLand ARM Community



Program a real ARM microcontroller with peripherals and low-power modes. Use an online IDE.

### STM32 Nucleo (No IDE)

LabsLand ARM Community



Program a real ARM microcontroller with peripherals and low-power modes. Upload binary file.

### Arduino robot (code)

LabsLand



Learn robotics and programming with a real robot based on a popular Arduino robotics platform

### Arduino robot (visual)

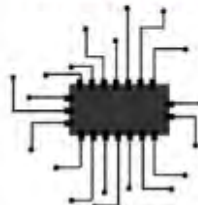
LabsLand



Learn robotics with visual programming with a real robot based on a popular Arduino robotics

### FPGA Laboratory

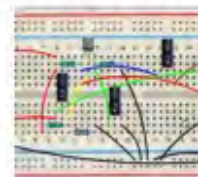
LabsLand FPGA Community



Learn Hardware design with FPGAs using any LabsLand FPGA

### Electronics - Advanced

LabsLand Electronics Community



Create and experiment with the working principles of analogi electronics.

### Arduino Board (code)

LabsLand



Program a real Arduino Uno board and use basic peripherals

### Intel DE2-115

LabsLand FPGA Community



Learn Hardware design with FPGAs using DE2-115

### Intel DE1-SoC

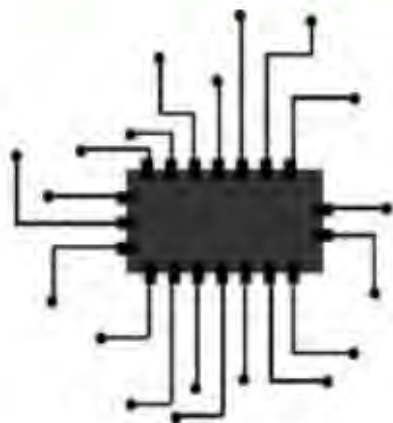
LabsLand FPGA Community



Learn Hardware design with FPGAs using DE1-SoC

Feedback



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## FPGA Laboratory

LabsLand FPGA Community

**Categories:** Technology

**Education levels:** University & College

**Type of laboratory:** Real-time laboratory

**Laboratory locations:** 4: [See locations list](#)

[Read more](#)[View contents](#)[☰ View experiments](#)[Feedback](#)

# Villar-Martínez' PhD Thesis



Title: “Improving the Reliability and Sustainability of Remote Laboratories Through New Architectures Oriented to Concurrency and Fault Detection”

- Chapter 5 – Evaluation of the WebLabPRO Architecture
  - (...) carried out in a real and uncontrolled environment provided by LabsLand. The WebLabPRO architecture was integrated into LabsLand's remote FPGA experimentation laboratories, and validation results were obtained through its use. Results were obtained using the traceability and learning analytics mechanisms provided by the LabsLand platform. This took place **over a period of more than two years**, with the participation of **hundreds of students from various countries** and of different educational levels, **who have carried out 72,377 remote experimentation sessions.**





## Intel DE1-SoC

LabsLand FPGA Community

**Categories:** Technology

**Education levels:** University & College

**Type of laboratory:** Real-time laboratory

**Laboratory locations:** 2: [See locations list](#)



## Intel DE2-115

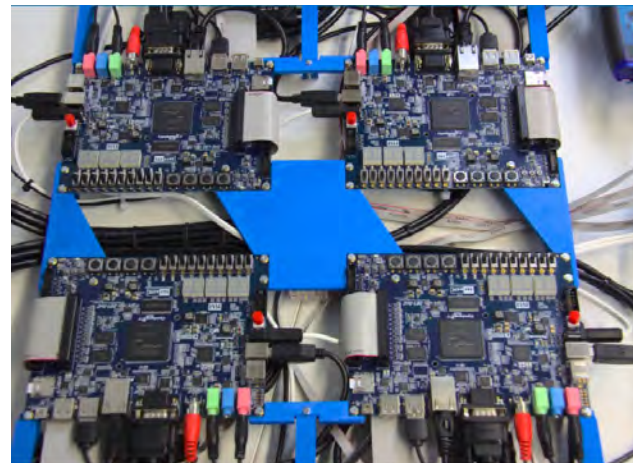
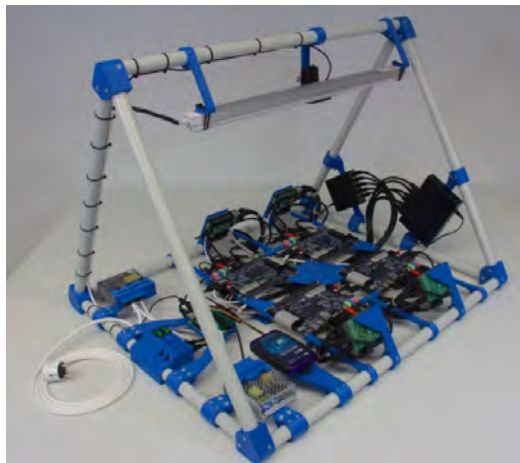
LabsLand FPGA Community

**Categories:** Technology

**Education levels:** University & College

**Type of laboratory:** Real-time laboratory

**Laboratory locations:** 2: [See locations list](#)



Several parameters related to each experimental session were recorded and stored daily, i.e.:

- Date
- Number of available experimentation instances
- Number of experimentation sessions carried out
- Number of users served
- Maximum position reached in the waiting queue
- Maximum time reached in the waiting queue, in seconds

# More about the parameters:

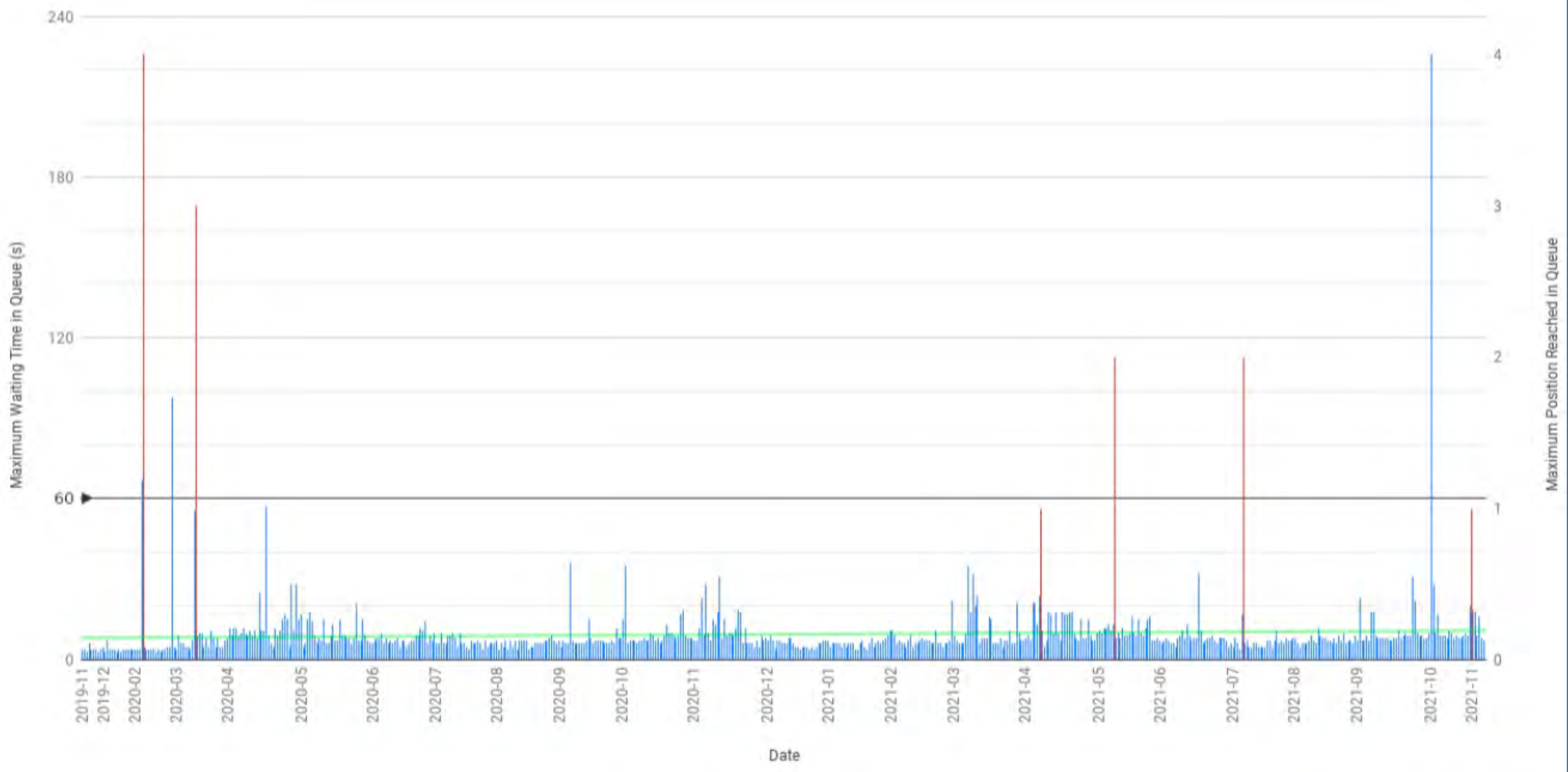
The previous parameters led to the following metrics:

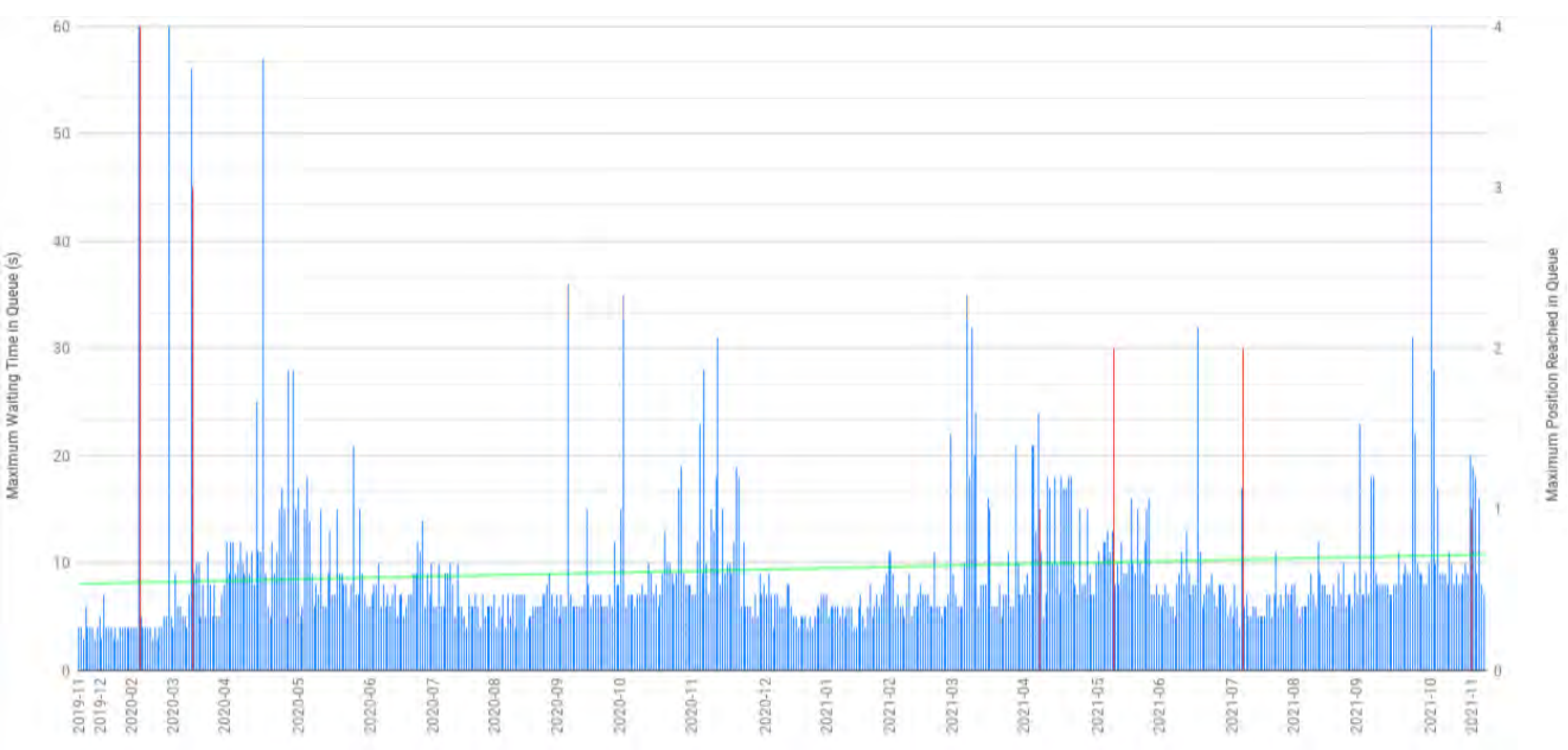
1. Number of experimentation instances available.
2. Number of days of the subperiod.
3. Number of days of the subperiod in which there was at least one use.
4. Total number of experimentation sessions carried out in the sub-period.
5. Maximum number of experimentation sessions carried out in one day.
6. Average number of experimentation sessions carried out in one day.
7. 90th percentile of the number of experimentation sessions carried out in one day.
8. Maximum number of users served in one day.
9. Average number of users served in one day.
10. 90<sup>th</sup> percentile of the number of users served in one day.
11. Maximum position reached in the queue in one day.
12. Average position reached in the queue in one day.
13. 90<sup>th</sup> percentile of the position reached in the queue in one day.
14. 99th percentile of the position reached in the queue in one day.
15. Maximum time reached in the waiting queue, in seconds, in a day.
16. Average time reached in the waiting queue, in seconds, in one day.
17. 90<sup>th</sup> percentile of the time reached in the waiting queue, in seconds, in a day.

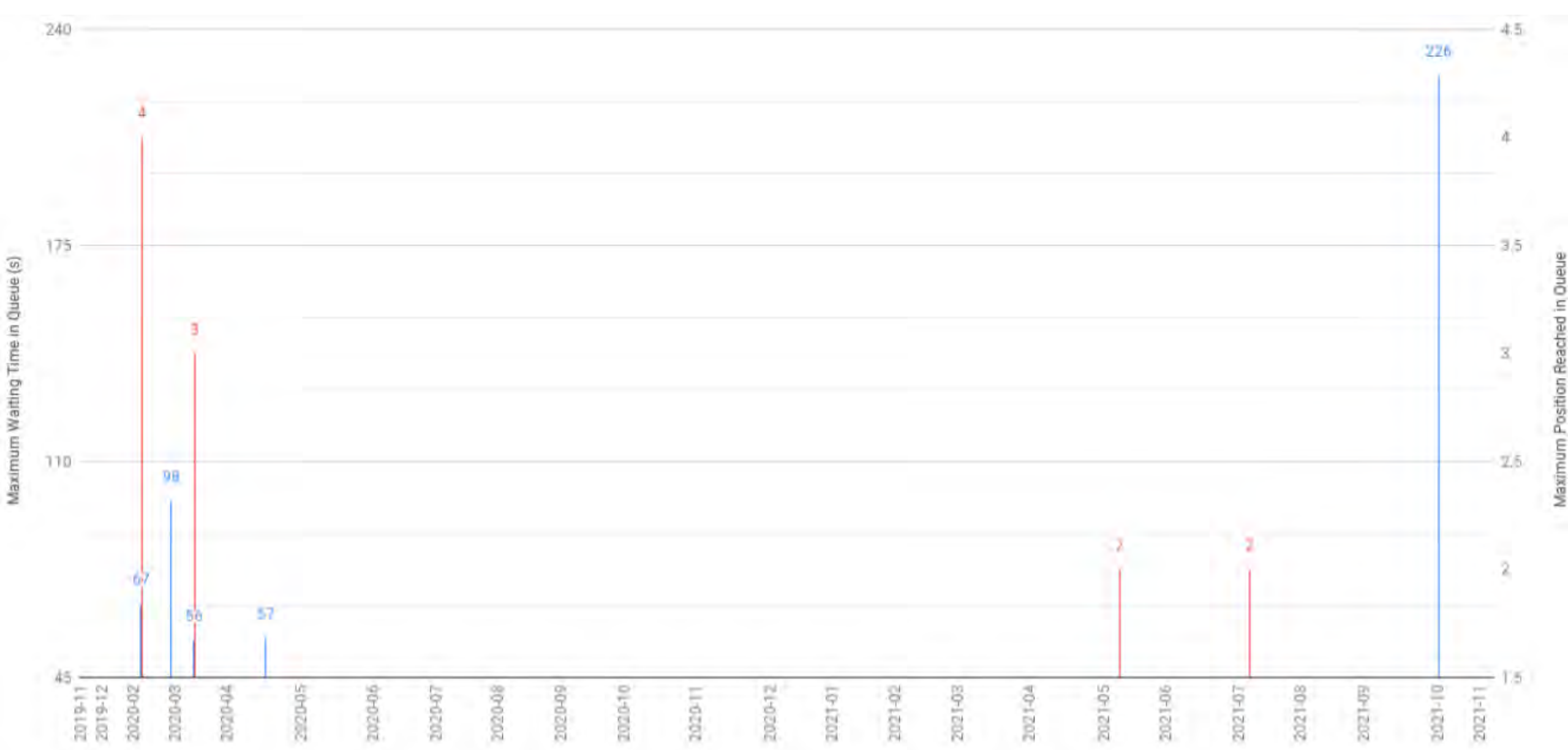
The maximum values help to identify the worst situations of the laboratory, while the mean and the 90<sup>th</sup> percentile of the data help to understand the performance of the laboratory in 90% of the occasions.

		Subperiod 1	Subperiod 2	Subperiod 3	Subperiod 4
1	<b>Number of available experimentation instances</b>	<b>10</b>	<b>18</b>	<b>34</b>	<b>62</b>
2	<b>Number of days of the subperiod</b>	361	115	205	55
3	<b>Number of days of the subperiod in which there was at least one use</b>	252	107	196	55
4	<b>Total number of experimentation sessions carried out in the subperiod</b>	22635	10033	24835	14874
5	<b>Maximum number of experimentation sessions carried out in one day</b>	807	1393	1242	1104
6	<b>Average number of experimentation sessions carried out in one day</b>	89.82	93.77	126.71	270.43
7	<b>90th percentile of number of experimentation sessions carried out in one day</b>	232.60	202.00	287.50	653.20
8	<b>Maximum number of users served in one day</b>	75	84	98	118
9	<b>Average number of users served in one day</b>	15.88	16.36	19.19	34.72
10	<b>90th percentile of number of users served in one day</b>	38.00	40.80	44.50	58.60
11	<b>Maximum position reached in the queue in one day</b>	4	0	2	1
12	<b>Average position reached in the queue in one day</b>	0.030	0.000	0.025	0.018
13	<b>90th percentile of position reached in the queue in one day</b>	0.00	0.00	0.00	0.00
14	<b>99th percentile of position reached in the queue in one day</b>	0.00	0.00	1.05	0.46
15	<b>Maximum waiting time reached in the queue, in seconds, in one day</b>	98	31	35	226
16	<b>Average waiting time reached in the queue, in seconds, in one day</b>	8.73	8.29	9.34	15.018
17	<b>90th percentile waiting time reached in the queue, in seconds, in one day</b>	12.00	13.00	16.50	19.60











# Villar-Martínez' PhD Thesis



<b>Day</b>	<b>Date</b>	<b>Available Experimentation Instances</b>	<b>Experimentation Sessions Carried Out</b>	<b>Users Served</b>	<b>Maximum Position Reached in Queue</b>	<b>Maximum Waiting Time Reached in Queue</b>
1	2020-02-13	10	168	55	4	67
2	2020-03-18	10	25	12	0	98
3	2020-03-30	10	53	30	3	56
4	2020-04-30	10	305	47	0	57
5	2021-05-24	34	363	58	2	13
6	2021-07-19	34	80	25	2	17
7	2021-10-18	62	643	105	0	226

# An open conclusion ...

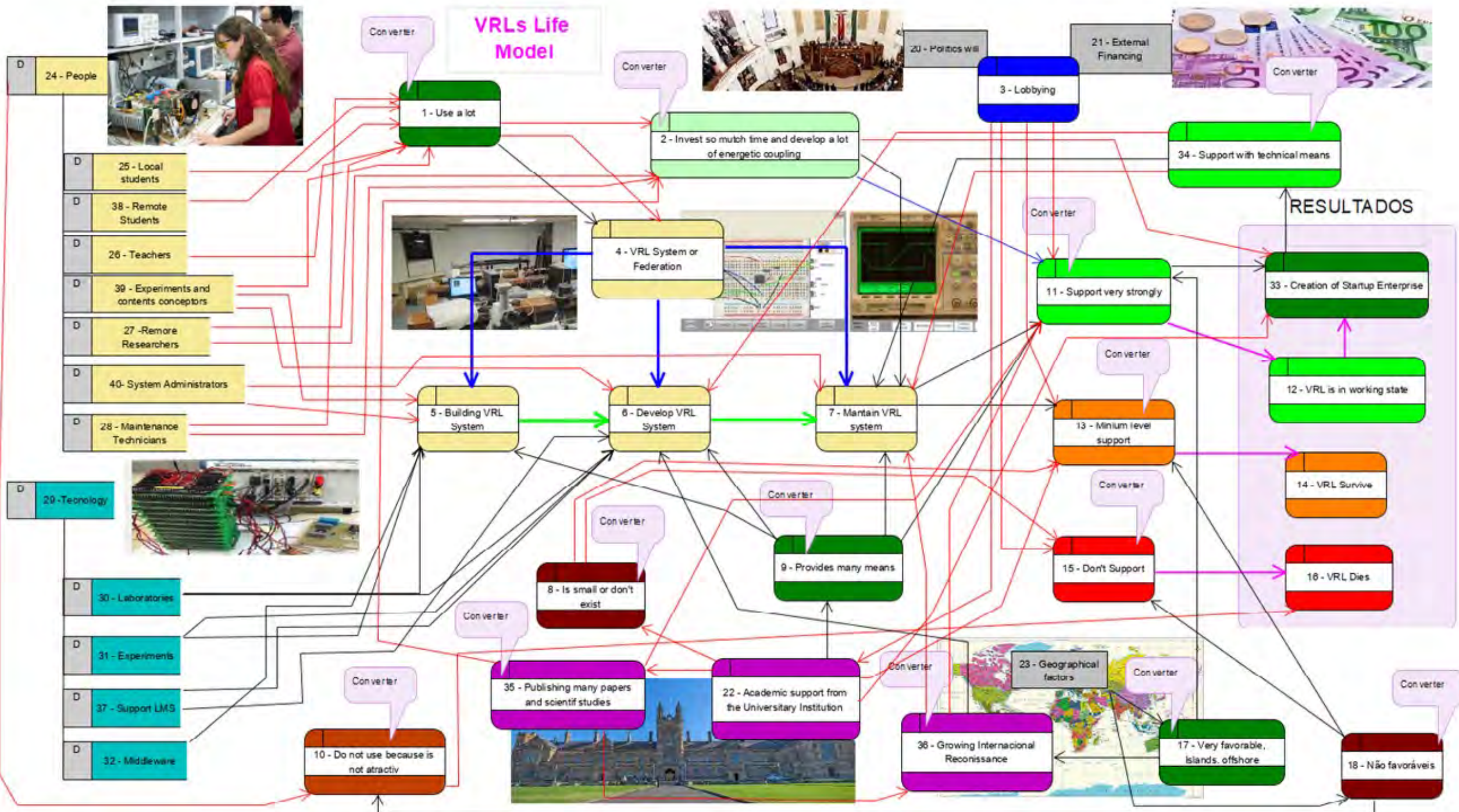
- Only by opening instructional labs to both teachers and students, by virtualizing them or making them remotely accessible, will it be possible to guarantee practical classes (in STEM education) to ALL.
- This will allow them to do more experiments, both in normal and pandemic situations.
- Only by offering a reasonable blend of hands-on, simulations and remote experiments, will it be possible to create a sustainable scenario where students acquire the right level of experimental skills.
- It is particularly important to guarantee that these non-traditional laboratories are reliable and positively contribute to education, through the adoption of proper didactical approaches.

# Finally ...



- Designing, implementing and maintaining a remote lab is not a trivial task ... it requires an whole ecosystem to guarantee both its usability and reliability.
- Raul Cordeiro's PhD thesis (NOVA University Lisbon, Portugal) proposed an evolution model for remote and virtual labs, which emphasises the importance of creating positive feedback loops, including the generation of start-up companies (e.g., similar to LabsLand) able to support existent NTL and to develop new ones.







# Remote laboratories for digital electronics: an overview

Thanks for  
your attention!  
Questions?



Gustavo R. Alves  
Polytechnic of Porto  
Portugal