Teaching Complex Systems based on Microservices

https://uclab.xyz/complex-systems-amp-2020

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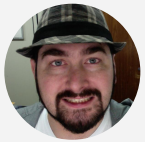


Microservices

Growing interest

in industry and academia

about the subject

Adopting

is non-trivial and has

many challenges

Learning

involves many theoretical and

technical subjects

How can universities prepare students to develop **complex systems using microservices**?

We present **our approach** for teaching the development of **complex systems based on microservices**, as applied in the course **Laboratory of Complex Computational Systems** at the University of São Paulo (USP)

Previous Experiences

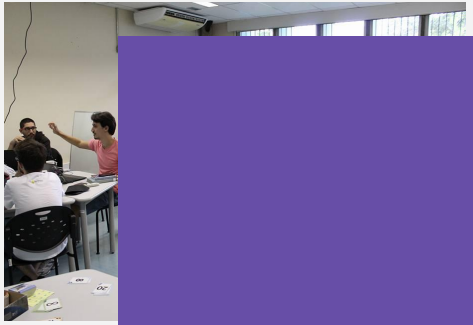
Course Structure

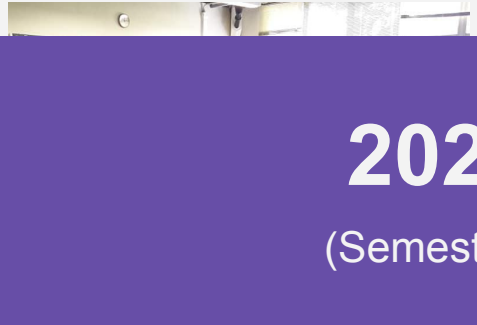
Students feedback

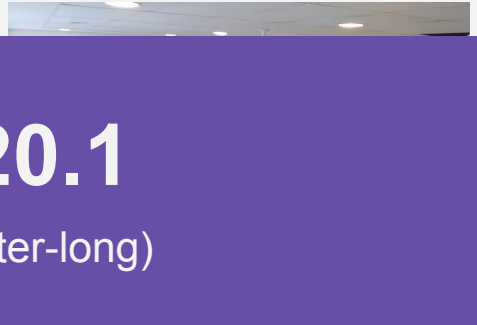
Teaching Methodology

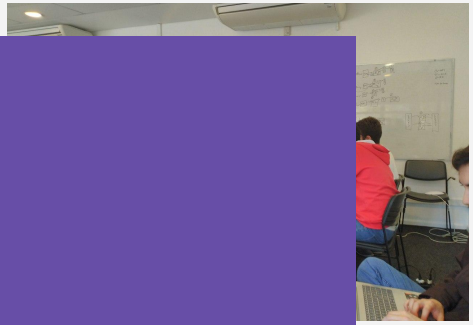
Remote Experience

Lessons Learned









2020.1

(Semester-long)

18 students

2 instructors

Remote

(due to COVID-19)

Teaching Methodology

Theoretical

Classes
about microservices,
complex systems,
and agile methods

Technological

Talks
about Web front-end
and back-end
technologies

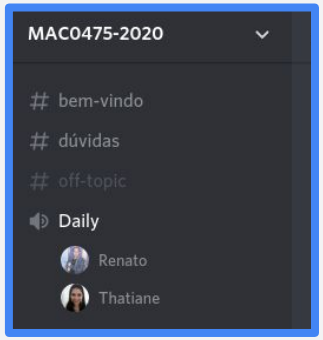
Practical

Class Project
using microservices
with multiple teams working
together

About the Course

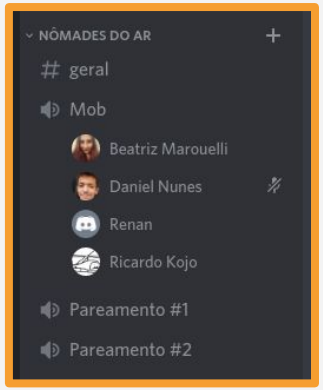
- It is divided in **blocks** whose focus **intercalate** between our three pillars (theory, technology, practice)
- Lectures are given by **researchers** and partner **industry professionals**
- The assessment mixes **different approaches**:
  - Simple tests (theoretical classes)
  - Exercise lists (technology classes)
  - Development exercises (technology blocks)
  - Attendance in class (practical classes)
  - Overtime attendance (practical classes)
- Warm-up activities to **foster team building** and **illustrate concepts learned**

Warm-up Activities



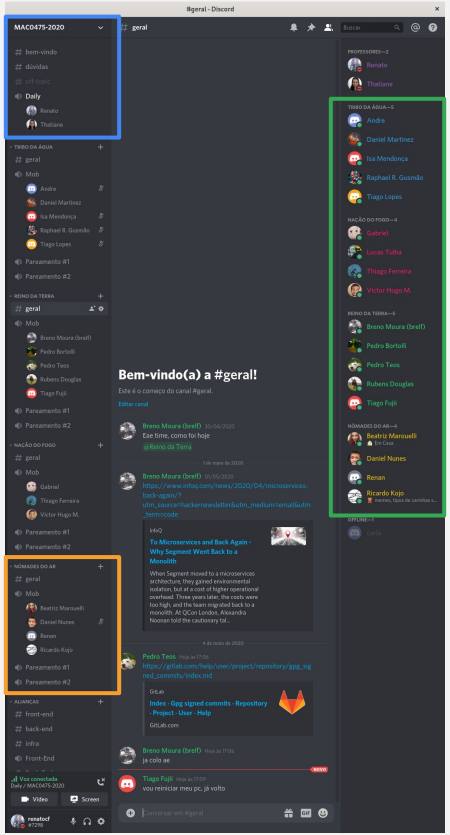
General channels

- Announcements
- Doubts
- Off-topic
- **Daily meetings**



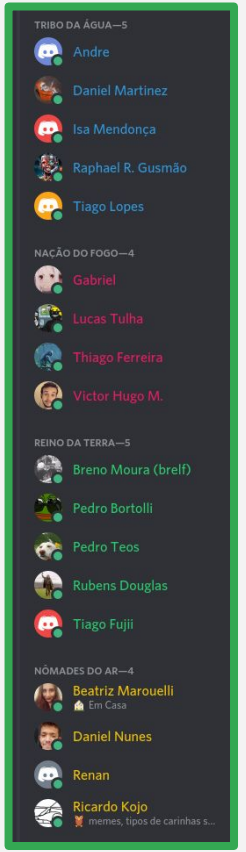
Team channels

- Discussions
- **Mob**
- **Pair** (x2)



Class organization

- **Teams** with **4-5 members** divided according to **self-declared knowledge** of the students in technologies and methodologies
- Each team builds a set of **back-end and front-end services** for the course project



Before the course

After 1st lecture block

After 1st dev sprint

After 2nd lecture block

After 2nd dev sprint

	Microservices							Web Front-End							Versioning				Methodologies											
ID	Archtect.			Patterns			Modeling				HTML			CSS			JS			VueJS			Git			GitLab			XP			Scrum			Kanban			DevOps		
1	1	3	4	1	3	3	3	4	3	4	3	4	4	4	4	1	3	3	4	4	4	4	5	4	1	3	2	4	4	4	2	3	4	1	3	2
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Heatmap with **students' self-assessed level of knowledge** in **13 of 19 skills** the course **aims to improve**

Students felt their **skills are improving**, in particular the ones related to **microservices** (architecture, patterns and modelling)

There was a **gain of knowledge** between the **2nd and 3rd surveys**, showing the importance of including a **practical project** in the course

Interview #1

Expectations

Challenges
(Theory, Technology, Practice)

Learning

Expectations

Suggestions

Background

Biggest Challenges

- **teamwork**

  since working in teams is not common in other courses they made previously

- **remote collaboration**

  since there is no single tool that worked seamlessly for all students in all environments

Knowledge gains

- **teamwork**

  since students are learning how to develop together and are enjoying the collaborative discussions from it

- **environment similar to the industry's**

  since students reported our course shows challenges they expect to deal with in a full-time job, in particular the use of microservices

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