IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

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The ILSD TAF

Fabien Dagnat

ILSD – Presentation – 2025-2026

Context

- Software and services compose the core of the digital society
- Previously, you should have learned that software should be delivered fast, in large quantity and respect quality and security requirements
- Many software are distributed

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$\Rightarrow$ They must collaborate while being geographically dispersed

- Examples?

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- Examples?
  - Bank
  - Online games
  - Social networks, cloud platforms, ...

Objectives of the TAF

- *Ingénierie Logicielle des Systèmes Distribués*
- Software Engineering for Distributed Systems

Aims at making you

- Understand the challenges of software and data distribution
- Know the fundamentals and limitations
- Practice and apply tools

$\Rightarrow$ To become engineers capable of dealing with these complex problems

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- Data (states) must be exchanged
- Decisions must be made collectively
- ...

ILSD and you

Let's start with a small survey (thank you to use your real name):

1. Connect to `https://app.wooclap.com/ILSD`
2. You can participate

Which jobs?

- Research and development
- Architect
- In all domains
  - Industry
  - Medicine
  - Physic
  - Bank and finance
  - Trade
  - Gaming

Some past internships

- Data Science Engineer for Systems Engineering (Ariane Group)
- Full Stack Developer (KBRW)
- GIS micro-service Engineer (Buildrz)
- Goland developer (Orange)
- Blockchain developer (Automata)
- Developer (Société Générale)
- Assistant Project Manager (Ubisoft)
- Software Design and Development Engineer (Naval Group)
- Software engineer (Amazon France Logistique SAS)

Practical information

- Mainly room B1-006
- Moodle: ILSD
- Forum on moodle
- mailing list: `taf-ilsd-etudiants@imt-atlantique.fr`
- `fabien.dagnat@imt-atlantique.fr`, Office D3-120A
- 2 student representatives, volunteers?

Back-to-school week

	MONDAY 8 September	TUESDAY 9 September	WEDNESDAY 10 September	THURSDAY 11 September	FRIDAY 12 September
8h		Introduction to git	TP Linux	Maths	
9h					
10h		Conference Arnaud Wetzel (KBRW)	TP Linux	Maths	Codecamp
11h	TAF Presentation				
12h		Conference Arnaud Wetzel (KBRW)	Functional Programming	Functional Programming	Codecamp
13h					
14h	Codecamp	Codecamp	Codecamp		Codecamp
15h					
16h	Codecamp	Codecamp	Codecamp		Codecamp
17h					
18h	D UEs Presentation				

Progress

Engineering – Processes and methods

- From the problem to a solution
- Understand the problem
- Propose several solutions (reuse, build)
- Compare and justify a choice

Software – Product

- Program
- Structure, architect
- Communicate
- Test
- Validate

Systems – Uses

- Perform a function
- In a complex context
  - Faults
  - Varying Resources
  - Various Users
  - Malicious intent
- Formation starts with simple cases (basic algorithms)
  then we add complexity (centralized software), then we add concurrency...

⇒ Distribution is a new step in complexity

Distributed

- Distribution of a system leads to new kind of complexity
  - Non-locality, communication time, distributed data, replicated data...
  - Faults!
- There is no global time, no global state...

$\Rightarrow$ A result of impossibility, we must choice between

- System consistency
- Its resistance to partitioning
- Data availability

Where are distributed software?

Everywhere!

- Some examples: the cloud, online services, video conferences, online games, chat, e-commerce, booking systems...
- Even for centralized software, its deployment and updates are distributed
- We use interconnected machines whose programs work together

Progress

What's the point?

- Performance gains
  - sharing resources
  - sharing computations
- Scaling up
- The system using the software is distributed (*e.g.* a car or a plane)
- Better availability
- Better reliability

Which difficulties?

- Heterogeneity
- No global clock
- No global state just partial views
- Faults: machine, communication channel
- Security: malicious intent (*e.g.* denial of service, man-in-the-middle)
- Coordinate: reconcile
- Decide: consensus
- Various scale: from Personal Area Network to internet
- ...

Progress

Schedule

TU	Slot	Day	Period	Content
ANSYD	A	tuesday or thursday	sept – dec	fondementals & applications
FIAB	B	tuesday or thursday	sept – dec	reliability
CALC	C	tuesday or thursday	sept – dec	performance
?	D	friday	sept – dec	?
CAD	E	3 weeks	jan	design & management
?	F	tuesday	feb – mar	?
?	G	thursday	feb – mar	?
?	H	friday	feb – mar	?
Internship				

Prerequisites

- Programming
- Software design (git, test)
- Some notions of network [PRIP]
- Some notions of concurrency

We expect

- Commitment
- Personal work
- Absenteeism School policy: courses are mandatory
- Toward a professional attitude...

About using probabilistic assistants (*AI tools)

- Reminder of school policy
  - by default, the use of such tools is prohibited, unless explicitly stated otherwise
- In most educational situations, the use of such tools is not relevant
  - the goal is generally to learn how to do something
  - the journey is more important than the result
  - effective use of these tools to significantly improve productivity requires a good understanding of the field and a critical eye
  - when such a tool is permitted, it is important to be able to explain/justify the result
- Using tools to translate/synthesize natural language is totally accepted
- When unsure, please ask your teachers about their policy on this matter

Progress

Project

- 11/9 à partir de 13h30 : foire aux projets
- 18/9 : choix sur moodle
- 30/9 : affectations des sujets aux groupes d'élèves
- 2/10 : première séance de travail du groupe
- 20/11 et/ou 27/11 : revues de projet
- 19/1 et/ou 23/1 : soutenances du semestre d'automne
- Mars : Forum et rendus finaux

En fin d'après midi présentation en amphi du déroulé du projet PROCOM par Alexandre Reiffers-Masson

Progress

ANSYD

- Objectives
  - Modeling of a distributed system
  - Classical problems (diffusion, consensus, causality)
  - Distributed graph algorithms
- Content
  - Go language
  - Time, clock and synchronization
  - Gossip, membership and failure detection
  - Consensus
  - Broadcast and causal broadcast
  - Reputation systems
  - Totally and partially asynchronous iteraive algorithms
  - Stockastic approximation schemes with delays

FIAB

- Objectives
  - discover distributed programming and reliability
  - to be able to write distributed programs using the Elixir language
  - become operational by adopting professional practices
- Approach
  - work on a *realistic* e-commerce system
  - supervision by professionals (KBRW)
  - integration of reliability progressively
- Content
  - Time and clock, distributed transaction
  - Fault, fault tolerance, replication et consistency of data

CALC

- Objectives
  - communication- and computation-oriented distribution
  - discoveries of frameworks and tools
  - become operational by adopting professional practices
- Content
  - Sockets, RPC, RMI, Corba
  - MPI
  - RabbitMQ
  - map/reduce, cloud

CAD

- Objectives
  - synthesis project (reliability, performance, security)
- Content
  - Work in progress

Progress

D slot

- Choice this week
- Presentation at the end of the day

TU	Slot	Day	Period	Content
C++ IBDS PRIP WSWD ... ~~ISI~~	D	friday	sept – dec	Soft. Eng. and prog. *big data* basics of network semantic web ...

Spring

- Parcours FGH under construction shared with DCL TAF
- This year (mixing only if required)
  1. Services
     - **SCSCH** – Distributed systems for human centered services
     - **WEBAPP** – Web application engineering
     - **MOBAPP** – Application development for mobile devices
  2. Virtual Reality and Interactive Systems
     - **RVRA** – Virtual reality, augmented reality
     - **ECOTI** – Issues and design of immersive technologies
     - **RMA** – Advanced mixed reality
  3. Software development
     - **LALOG** – Languages & logics
     - **OSAP** – Service architecture and system programming
     - **BOT** – Robotic system programming

Back to the survey

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