## Introduction -Computer Organization-

#### Lionel Morel

Computer Science and Information Technologies - INSA Lyon

Fall-Winter 2023-24

## Lecturer - Lionel Morel<sup>1</sup> (lionel.morel@insa-lyon.fr)

- 93-96: High School in La Mure (38) Term. S-Maths + "Sport-Étude-Ski préparation au monitorat"
- 96-98: DEUG Maths-Info UJF-Grenoble
- 98:00: Licence + Maitrise d'Informatique UJF-Grenoble
- 01: DEA Informatique (now M2R) Grenoble 2001
  + Intern at Stirling Uni, Scotland
- 05: PhD in CS at INPGrenoble Programming of Critical Reactive Systems
- 05-06: Post-doc in Turku, Finland
- 06-07: Post-doc in Rennes, France
- Since 2007: Associate Professor at INSA Lyon
- ▶ 17-20: Researcher at CEA-Grenoble
- 20-..: Back at INSA Lyon

<sup>1</sup>lionel.morel.ouvaton.org/

### Lecturer - Lionel Morel

- Since 2020: Research on OS and Programming Languages for frugality, see next slide
- Teaching at the IF department: Computer Architecture, Operating Systems, Compiler Construction
- But this is a pay-job ...
  - I'm a musician too
  - I am working to become "Accompagnateur en Moyenne Montagne"

### **Current Research and Teaching Interests**

I know you heard, but we've set ourselves into serious trouble: Human-Induced Climate Change, 6th Extinction, etc.



### **Current Research and Teaching Interests**

Some (observed) solutions:

- "Don't Look Up", aka "Business as Usual"
- Abandon Ship (eg Grothendiek, students at Agro-Paris-Tech, and many others)
- Tech will save us (and the world) "Techno-béatitude" (Musk, Electric Car, GDP/CO2 decoupling believers, etc)
- What if we stopped building Technology for itself and be more adult -"Techno-critique" - "Techno-réalisme"

### Current Research (and Teaching) Interests

- Apply this idea to our field: operating systems, programming languages (and compilers a little bit)
- 1 What would mean frugality for computing systems: a hw+sw combination that would not last 3 years (average) but 10? 50? 100?
- 2 We are used to propose technology that go and impact society (and is actually imposed on it, through law, commercials, influences, etc). What about asking the society what it really needs ? What are "good" usages? What do reall people need?

Phenix Citi<sup>2</sup>

<sup>&</sup>lt;sup>2</sup>https://phenix.citi-lab.fr/

## My take-away message

#### Let's prepare for a rough ride

- Tech will NOT save us: it might be a part of the solution, but the main task is organizing society to accomodate for change and change the direction
- Let's build something new, not relying (specially) on tech
- Let's build something together (individualism is part of the problem)
- Let's enjoy this!

### Context: Architecture - Operating System - Networks

#### 3IF - Semester 1

- ► AC Architecture des Circuits / Digital Circuits (Guillaume Beslon)
- ► AO Architecture des Ordinateurs / Computer Organization (Lionel Morel)
- PRC Programmation C / C Programming (Frédéric Prost)

### 3IF - Semester 2

- **SYS** Systèmes d'Exploitation / Operating Systems (*Guillaume Salagnac*)
- RE2 Bases Techniques pour les réseaux / Networks 1 (Frédérique Biennier)

### 4IF - Semester 1

SERE Programmation Réseaux / Distributed Programming (Frédéric Prost)

### 4IF - Semester 2

- SERE Sécurité Réseau / Network Security (Lionel Brunie)
- **COMP** PLD Compilateur / Compiler Design (*Florent de Dinechin*)

## AC, AO, SYS: Objectives

- SYS: "Basic understanding of the fundamental concepts and issues in the topic of operating systems"
- AC: "Gain theoretical and practical understanding of the principles and mechanisms that govern digital circuits, from basic logic gates up to a simple microprocessor."
- AO: "Understand:
  - the design and working principles of a modern computer (processor, memory hierarchy, peripherals)
  - the lower levels of the software stack: assembly language, application binary interfance, interruptions, input/output drivers, compiler

## AC - Content (reminder)

- Boolean logic
- Combinatorial Circuits
- Registers and Memories
- Finite-State Machines
- Sequential Circuits
- Algorithmic State Machines ...
- And their implementation with registers and gates

### AO - Content of the lectures

- Von Neuman Machine, Processor from the (low-level) programming perspective, assembly language
- Von Neuman Cycle, Execution perspective, Link between assembly language and processor's internals
- Input/Output, Interruptions, Memory-Mapped IO
- Function Calls, calling sequence, call/ret, parameter passing, recursion, return values

### AO - Content of the Labs

- Assembler programming "on paper", simple algorithms (if-then-else, loops)
- Assembler programming on machine, assembly/disassembly, instruction encoding
- Memory-mapped IO
- Function calls (register-based parameter passing)
- Function calls (stack-based parameter passing)

## AO - Content of the Labs

#### $\mu\text{-}\mathsf{Machine}$ implem on Digital



# Assembly programming on msp430



### Practical matters - Agenda

Week	Lecture	Lab	MCQ
47	#1: Von Neumann		
	(ASM programming)		
48	#2: Von Neumann	Lab 1 (2hrs): ASM programming	
	(internals)		
49	#3: Inputs/Outputs		
50	#4: Inputs/Outputs	Lab 2 (4hrs): CPU design	
51	#5: Function Calls	Lab 4 (2hrs): CPU design	MCQ1
52	Christmas break		
1	Christmas break		
2	#6: Function Calls	Lab 4 (4hrs): ASM programming	
3			MCQ2
4		Lab 5 (4hrs): Interrupts	
5		Exam	

## **Practical matters**

### **Evaluation**

Final grade calculated from:

- 2 moodle quizzes:
  - week 51 (20% of the final grade)
  - week 3 (20% of the final grade)
- ▶ 1 final exam (60% of the final grade):
  - 1h30
  - Date: week 5, Tuesday January 30th, 10:00-12:00

### Q/A sessions

Every Monday from 1 to 2 PM Room 501.208.

### IF/AO: People — first.last@insa-lyon.fr







#### Guillaume Beslon Florent de Dinechin Lucas Chaloyard



Jonathan Rouzaud-Cornabas





Guillaume Salagnac Lionel Morel

### Readings



### All you need is ...

#### ... on moodle ...

INSA NUMBER

Accueil Tableau de bord Mes cours Aide - Accès rapides -



Informatique / Informatique / Informatique / IF-3

#### **3IF - Architectures des ordinateurs**

Cours Paramètres Participants Notes Rapports Plus -

#### ✓ Organisation

#### Course Info

- Code: IF-3-AO
- ECTS: 2.0
- · Lectures Hours: 9hrs (6\*1.5hrs)
- · Lab Hours: 16hrs (2\*2hrs + 3\*4hrs)
- · Personal Work: 25hrs
- Language: spoken French, lecture slides in English, labworks in French.
- ECTS description: FR/EN

#### Planning



#### Personnel

Lecturer: Lionel Morel

Instructors: Guillaume Beslon, Lucas Chaloyard, Florent de Dinechin, Jonathan Rouzaud-Cornabas, Guillaume Salagnac,

#### http://moodle2.insa-lyon.fr/course/view.php?id=1438