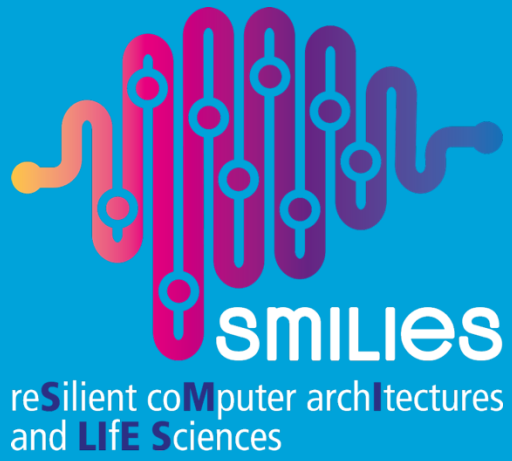

Politecnico di Torino

Department of Control and Computer Engineering

02NPSOV — OPERATING SYSTEMS FOR EMBEDDED SYSTEMS

STEFANO DI CARLO

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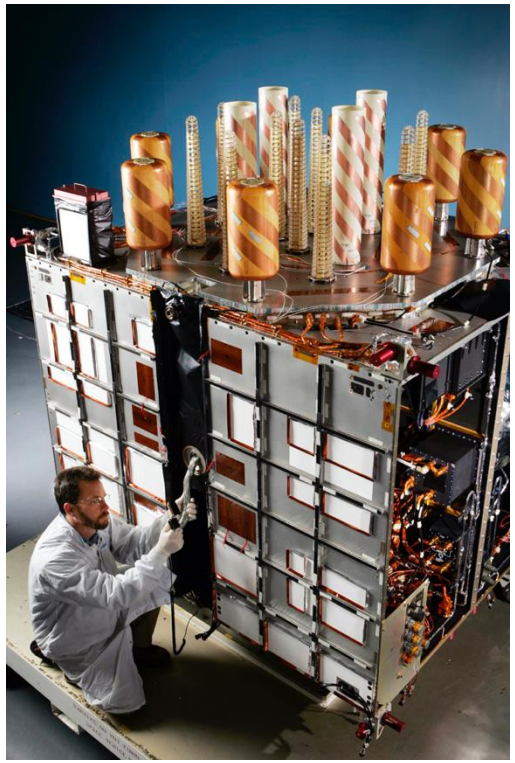
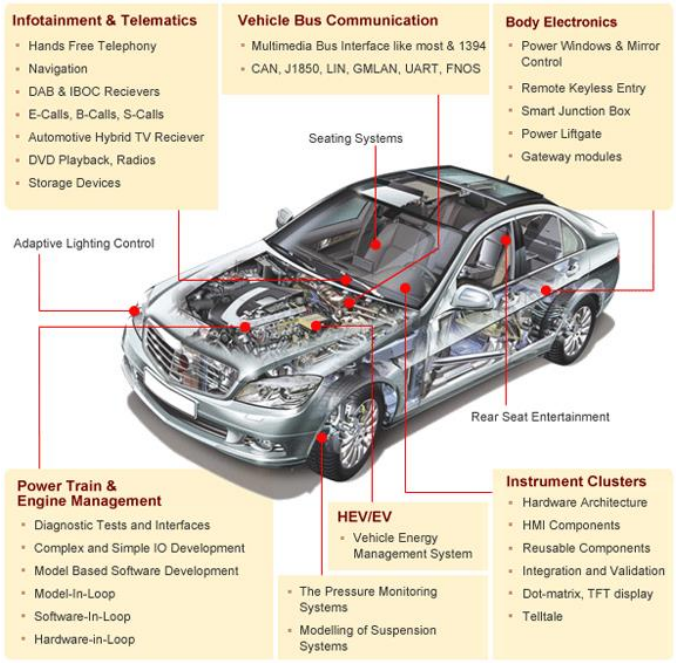
WHY SHOULD I CARE ABOUT THIS TOPIC?

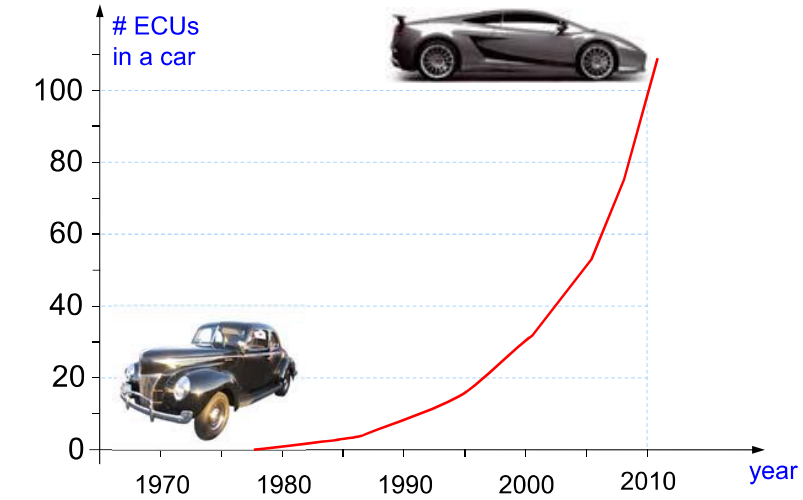
- Embedded systems are everywhere

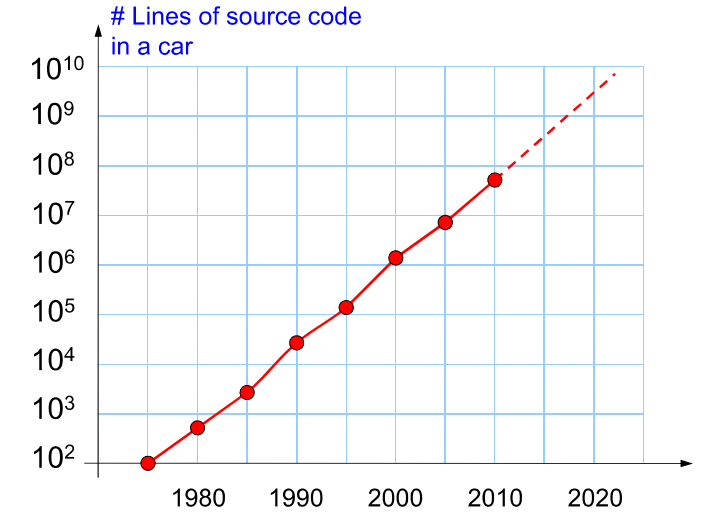




WHY SHOULD I CARE ABOUT THIS TOPIC?

- Software + hardware is everywhere
- Complexity is growing dramatically
- The old-fashion approach (1 main loop) is no longer feasible to cope with this complexity
- Operating systems are needed to raise the abstraction level and to make programmer life easier

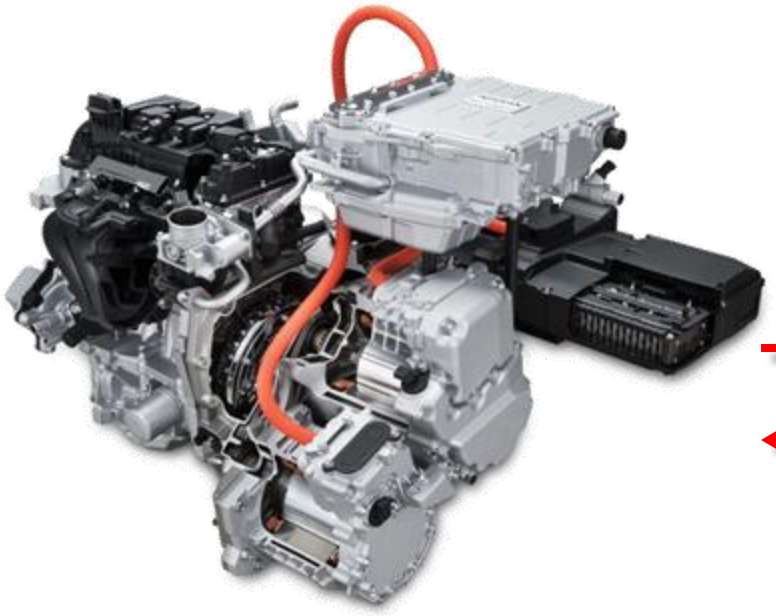




INFORMAL DEFINITION OF EMBEDDED SYSTEMS

- Embedded Systems are special-purpose computers designed for specific applications

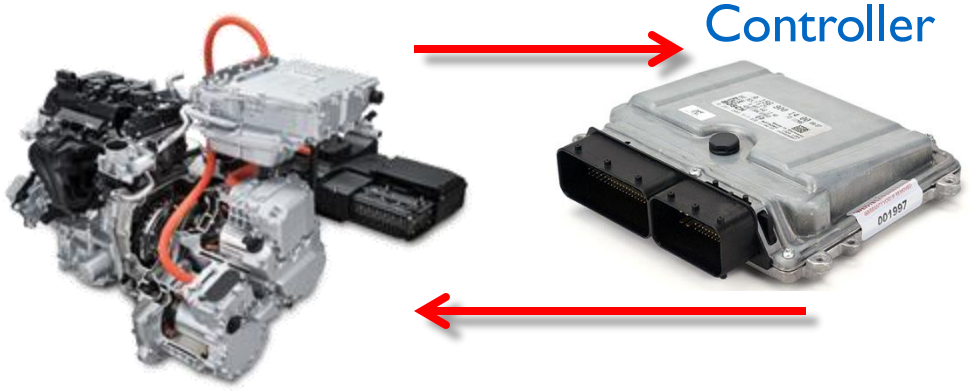
Specific application: Hybrid powertrain (HyPWT) control

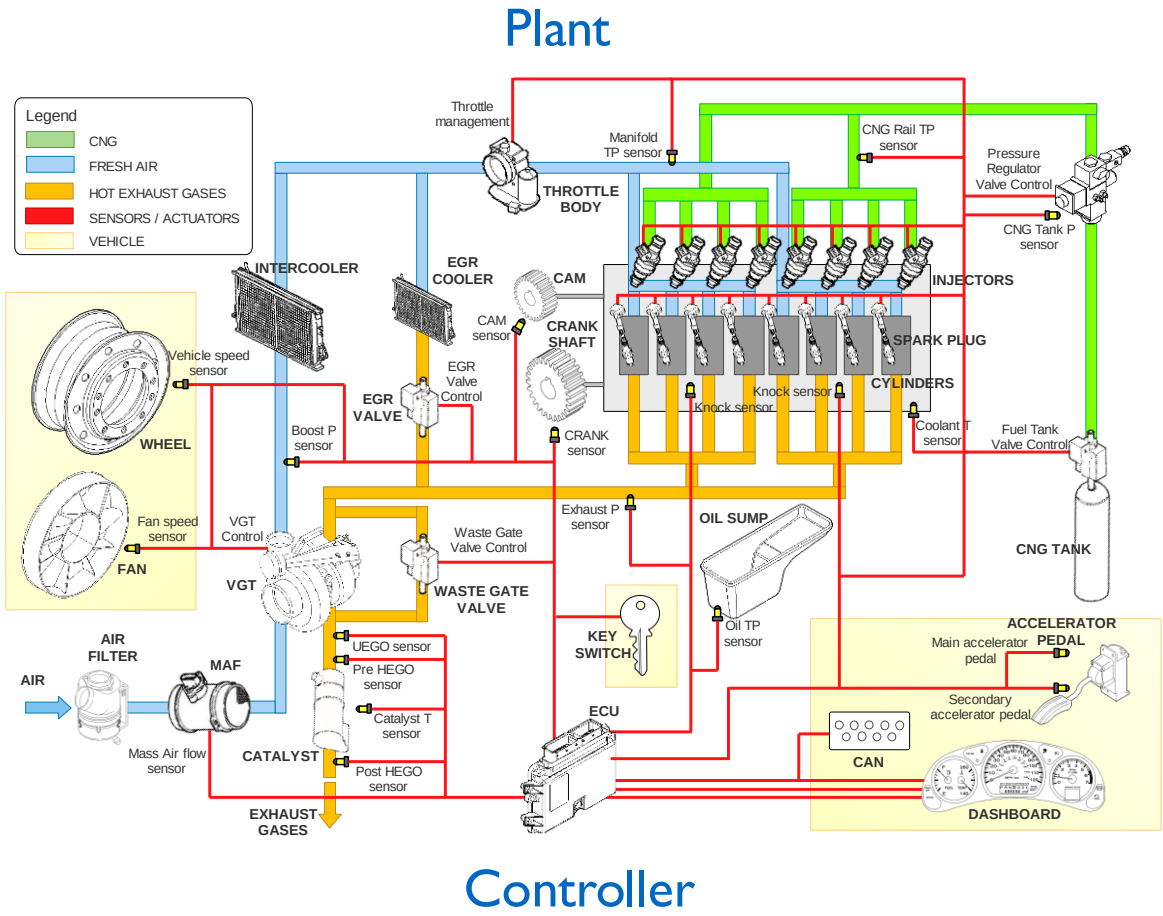


Embedded system: Electronic Control Unit (ECU) for ICE

INFORMAL DEFINITION OF EMBEDDED SYSTEMS

- An embedded system (i.e., the controller) interacts with a physical system (i.e., plant) through actuators/sensors

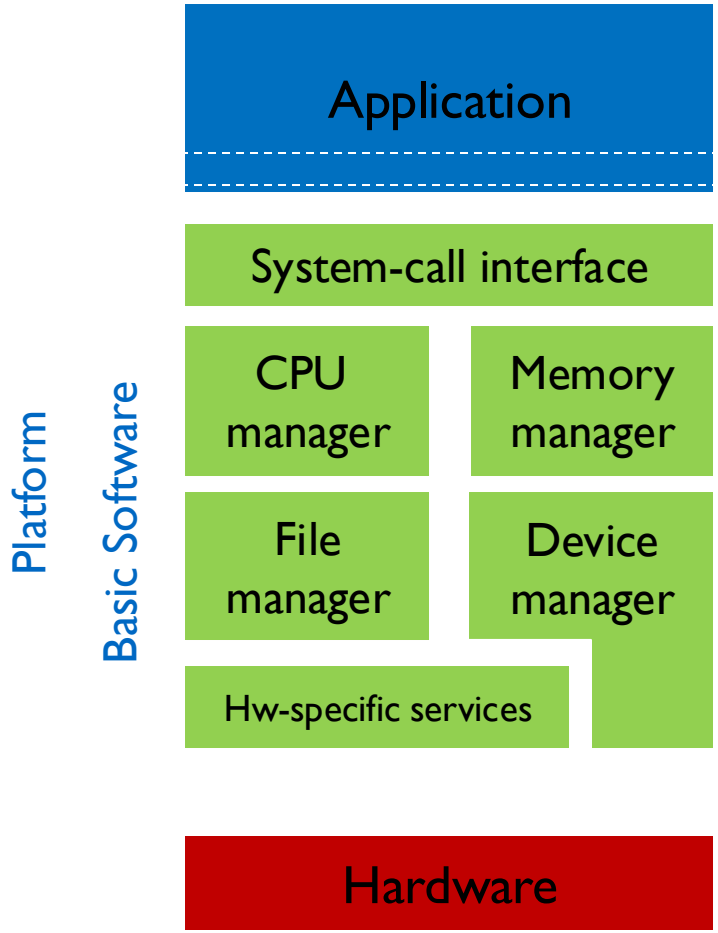




- Embedded system runs software: application sw + basic sw

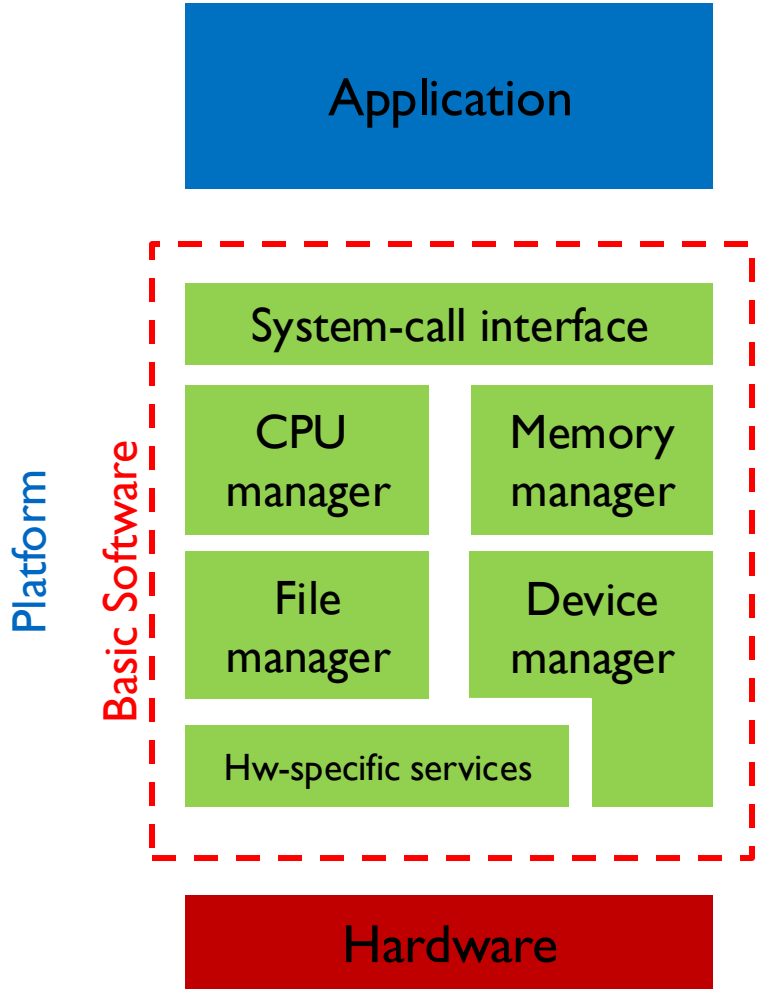
CONCEPTUAL MODEL FOR EMBEDDED SYSTEMS

- Two main components
  - Application
  - Platform
- Application
  - It is the software that implements the functionalities the embedded system is intended for (e.g., control an ICE)
- Platform
  - It is the combination of sw components (a.k.a., basic software) and hw components that provide the services needed by the application to run



FOCUS OF THIS COURSE

- The course Operating Systems for Embedded Systems focuses on the basic software:
  - CPU management with real-time scheduling
  - Memory management
  - File management
  - Device management
- Different OS for embedded systems will be analyzed
  - FreeRTOS
  - Embedded Linux



EXAM – PART I (MANDATORY)

- **Written test** that covers all the topics discussed in class.
- The test may include various types of questions, such as:
  - open questions
  - multiple-choice questions
  - exercises focusing on specific topics
  - the development of small programs.
- Each question is assigned a score, which is announced during the exam.
- **The maximum score achievable in this part is 25**
- **The minimum score to pass the exam is 18**
- The duration of the test is 90 minutes.

EXAM – PART II

- A **project** that emphasizes the application of the concepts learned in class and enhances the student's ability to independently find documentation and acquire new skills beyond the scope of the course.
- Each year, a set of topics will be assigned, but students are also encouraged to propose their own topics of interest.
- Projects that involve collaborations with other courses are particularly welcome. Once the project is completed, students are required to present it during an oral exam session, highlighting each team member's contribution to the results.
- The project aims to assess:
  - The student's proficiency in implementing and developing embedded applications.
  - The efficiency of the implementation.
  - The student's ability to work effectively in a team.
  - The student's presentation skills.
  - The individual contributions of each student to the project.
- **The maximum score achievable in this part is 10**

EXAM – PART II

- The project is a teamwork
- The evaluation must involve the entire team. Make sure you agree with your team member on when you want to deliver your project
- The project is a one-shot opportunity
- If a team member abandon the team the remaining members can still continue working on the project and for the member that abandoned the project will count as a failure (0 points)
- The project is an opportunity to increase and to evaluate your capability to build a team and to work with other people. If personal issues among team members arise try to work them out. If this is not possible, organize a meeting with the entire team and the professor

EXAM – FINAL GRADE

- The final grade is determined by summing up the grades obtained in PART 1 and PART 2 capping it to 32.
- The highest distinction, "Laude," is awarded if the total grade equals 32.
- PART 1 and PART 2 can be completed within different timeframes. However, PART 2 must be finished within one year (prior to the start of the next course edition).

PROJECT TIMELINE

- October 15th — Deadline to communicate team composition
- November 1st — Topic assignment
- Project development (free but strongly advised to develop the project during the course to take advantage of the tutoring hours)
- Project presentations: one day dedicated to project presentations at the end of each session of exams
- Projects must be completed before the beginning of the next edition of the course

- **THE PROJECT REQUIRES TO STUDY NEW TOPICS!!!!!!**

TEACHING MATERIAL

- All teaching material will be available at:
  - https://baltig.polito.it/teaching-material/CAOS
- Labs
  - Your own PC
  - Free tools and/or virtual machines provided by the teacher
- Videos and other teaching material:

After the first interactive class

SCHEDULE

- Official timetable
  - Tuesday 11.30-13.00 Room 11B
  - Friday 08:30-11.30 Room 5B
  - Monday 17.30-19.00 AcS Lab
- Remarks
  - We have the possibility of reducing the workload in class using virtual material. We will decide how to use it together after the first interactive class
  - The course schedule and log will be available at https://baltig.polito.it/

COMMUNICATIONS

Discord

https://discord.gg/6PYmMPYAC4

PoliTO

- Emails
- Push notifications