Languages, Compilers and Interpreters (Lab)

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Presentation

IMT SCUOLA ALTI STUDI LUCCA

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- Instructor @ UniFI for the course “Distributed Programming for IoT” (MSc. Degree in Computer Science)
- Coach of C3T team @ cyberchallenge.it (born2scan)

Research interest: PL, Language-based security, Program analysis and verification, Blockchain, IoT

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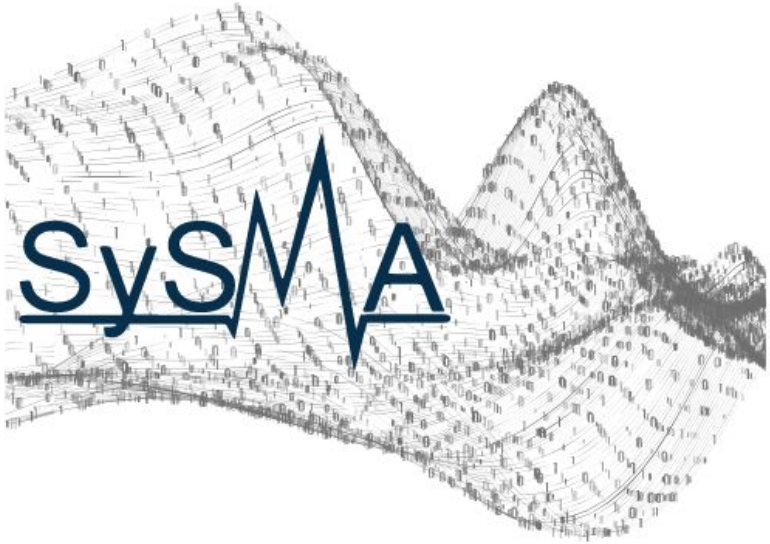
IMT SCHOOL FOR ADVANCED STUDIES LUCCA



SySMA - Systems Security Modelling and Analysis

The Systems Security Modelling and Analysis (SySMA) unit at IMT Lucca deals with the development of languages and techniques for the analysis, evaluation and verification of possibly distributed systems. The SySMA unit goal is to push the use of formal methods as methodological and automatic tools for the development of high-quality, correct software and systems that are secure, fast, usable, reusable, maintainable, and modular. We also study algorithms and systems to protect the security and integrity of computer systems, the information they store, and the people who use them. We make large usage of formal methods as enabling technology also for the security-by-design development model.

Course Logistics

Class Schedule:

- Wednesday: 14:00 - 16:00 classroom: L1

Office hours: e-mail me to set up a virtual meeting

Course page: https://github.com/lillo/compiler-course-unipi

There will be programming exercises: bring your laptop

Course Readings

Programming tutorials, papers & further material

References will be given during the classes and will posted on the course page

A note about slides

- Slides are made to be used **by the teacher** during the lectures, **not** to be studied **by students**
- Slides will be available on the page course
- Students must study the corresponding chapters of the books and the other referenced material

This Lab Will Teach You

How to implement a small compiler and interpreter

Side effects:

1. The basics of OCaml
2. How to implement parsers using parsers generators
3. How to implement semantic analyses
4. How to use the LLVM toolchain for generating and optimize code

Our main goal: the µcomp-lang compiler

A small component-based imperative language:

- Programs are made of components
- Interfaces specify what a component can do
- datatypes: only int and char variables, arrays, and references
- no structs, unions, doubles, ...
- no initializers in variable declarations
- functions can return only int, char, void, bool
- references and arrays are not interchangeable
- no dynamic allocation of memory

```
component EntryPoint provides App {
 def main() : int {
   var i : int;
   var a : int[10];

   i = 0;
   while(i < 10){
     a[i] = i + 1;
     i = i + 1;
   }

   i = 0;
   while(i < 10){
     print(a[i]);
     i = i + 1;
   }

   return 0;
 }
}
```

Our main goal: the µcomp-lang compiler

At the end of each block of lectures there will be an assignment concerning the implementation of a piece of the compiler

Program of the Course

1. Introduction to OCaml
2. Lexing and parsing using ocamllex and menhir
3. Semantic analysis implementation: type checking, scope management, control-flow analysis
4. Introduction to LLVM infrastructure and LLVM intermediate language
5. Code generation

Questions?