

Introduction to the LLVM compiler framework

Welcome & Course Outline

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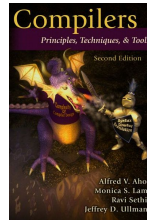
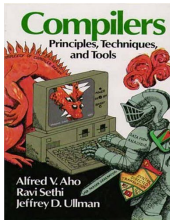


About the dragon

- ▶ The **LLVM logo** [1] is a stylized wyvern (a kind of dragon).
Dragons have connotations of power, speed and intelligence, and can also be sleek, elegant, and modular (err, maybe not).

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Dragons have connotations of power, speed and intelligence, and can also be sleek, elegant, and modular (err, maybe not).
- ▶ There is a famous **compiler book** dating back to the 1970s with cover art featuring a knight fighting a dragon. [2]
After all, compilers are also **scary**...



About LLVM

The idea behind LLVM is that compilers should **NOT** be scary!

Instead, they should be **easy** to extend and hack at your leisure.

In this course we will see how to have fun with compilers, instead of being scared of them.

About me

Daniele Cattaneo

- ▶ `daniele.cattaneo@polimi.it`
- ▶ PhD candidate @ Politecnico di Milano (Italy)
- ▶ Obsessed with compilers for a long time...
- ▶ ...now working on research projects with LLVM!
- ▶ (yes I have strange tastes, I know)

About you

In order to fully understand the content of this course, you should have:

- ▶ knowledge of what a compiler is
- ▶ proficiency in the most common data structures
- ▶ proficiency in Object-Oriented Programming
- ▶ at least some experience with C++

That's it!

About the course

1. First part

- ▶ Compiler design
- ▶ LLVM structure overview
- ▶ LLVM-IR language

2. Second part

- ▶ LLVM Documentation
- ▶ Available middle-end passes (overview)
 - ▶ Normalization
 - ▶ Analysis
- ▶ LLVM quick start tutorial (depending on time)

Goal of the course

At the end of these lectures you will (hopefully) be able to:

- ▶ understand the LLVM compiler infrastructure
- ▶ read a .ll file (LLVM-IR)
- ▶ know where to look for documentation
- ▶ know which middle-end weapons LLVM provides you, out of the box
- ▶ know how to implement a simple analysis / transformation
- ▶ know how to test your code

Bibliography I



Apple Inc.

Llvm logo.

<http://llvm.org/Logo.html>.



Alfred V. Aho and Jeffrey D. Ullman.

Principles of Compiler Design (Addison-Wesley Series in Computer Science and Information Processing).

Addison-Wesley Longman Publishing Co., Inc., Boston, MA, USA, 1977.



Think Geek.

Relaxing with a pipe full.

<http://www.thinkgeek.com/product/ee7f/?i=14556>.

Bibliography II



Alfred V. Aho, Ravi Sethi, and Jeffrey D. Ullman.
Compilers: Principles, Techniques, and Tools.
Addison-Wesley Longman Publishing Co., Inc., Boston, MA,
USA, 1986.



Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman.
Compilers: Principles, Techniques, and Tools (2Nd Edition).
Addison-Wesley Longman Publishing Co., Inc., Boston, MA,
USA, 2006.