Introduction - Part 2

COMP 520: Compiler Design (4 credits)

Professor Laurie Hendren

hendren@cs.mcgill.ca

TRF 10:30-11:30, MC 103

RECAP and Some Ideas from the Readings!

Please note that these topics are discussed using the blackboard, and you may want to take notes on this discussion.

- Why study compilers?
- Who has a compiler with them today?
- General-Purpose vs. Domain-Specific Languages
- Interpreters vs. compilers
- Compilers that generate assembly code or machine code (pure, augmented, virtual machine)
- Ahead-of-time versus JIT compilers

The top 10 list of reasons why we use C for compilers:

10) it's tradition;

9) it's (truly) portable;

8) it's efficient;

7) it has many different uses;

6) ANSI C will never change;

5) you must learn C at some point;

4) it teaches discipline (the hard way);

3) methodology is language independent;

2) we have `flex` and `bison`; and

1) you can say that you have implemented a large project in C.

The top 10 list of reasons why we use Java for compilers:

10) you already know Java from previous courses;

9) run-time errors like null-pointer exceptions are easy to locate;

8) it is relatively strongly typed, so many errors are caught at compile time;

7) you can use the large Java library (hash maps, sets, lists, . . .);

6) Java bytecode is portable and can be executed without recompilation;

5) you don't mind slow compilers;

4) it allows you to use object-orientation;

3) methodology is language independent;

2) we have `sablecc`, developed at McGill; and

1) you can say that you have implemented a large project in Java.

Bootstrapping as illustrated in text, ”Crafting a Compiler”

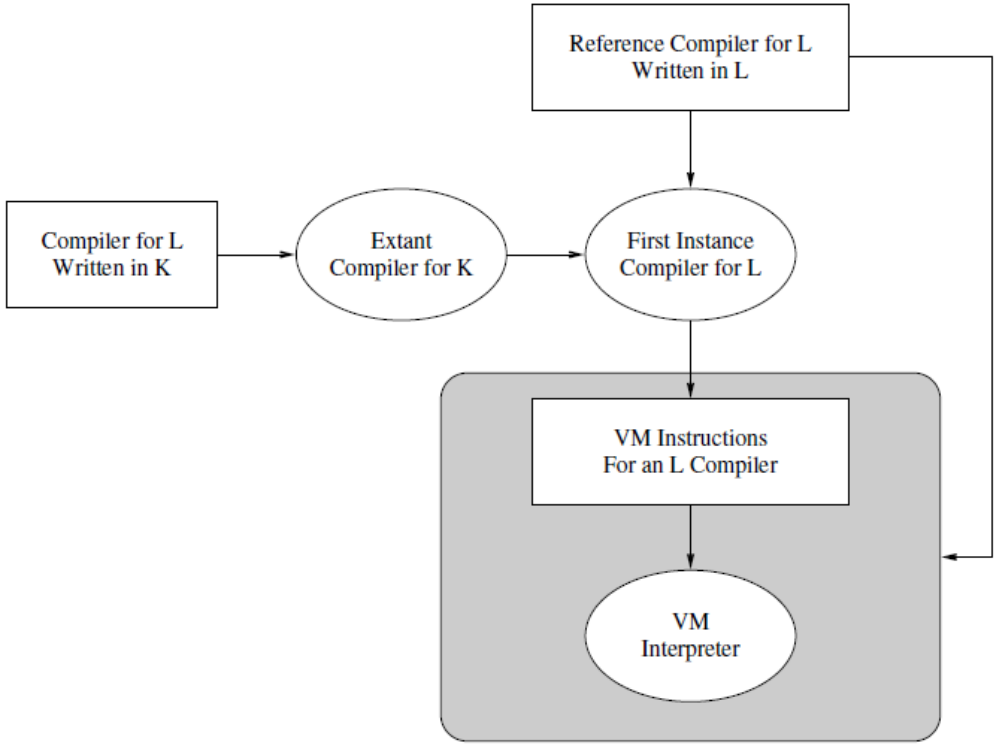
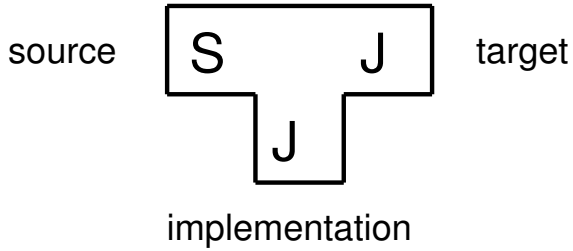


Figure 1.2: Bootstrapping a compiler that generates VM instructions. The shaded portion is a portable compiler for L that can run on any architecture supporting the VM.

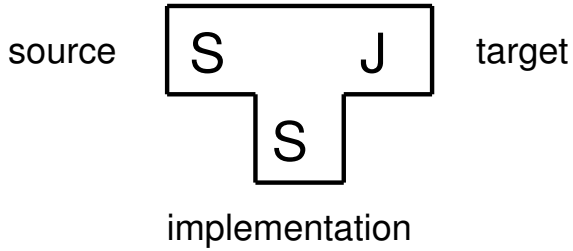
How to bootstrap a compiler (SCALA example):

- we are given a source language (L in the reading), say SCALA; and
- a target language (M in the reading), say Java.

We need the following:



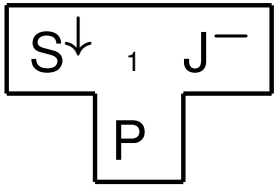
Of course, actually we like SCALA much better than Java and would therefore rather implement SCALA in itself:



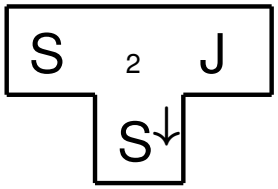
Define the following:

- $S^{\downarrow}$ is a simple subset of SCALA;
- J^{-} is inefficient Java code, and
- P is our favourite programming language, here “Pizza”.

We can easily implement:

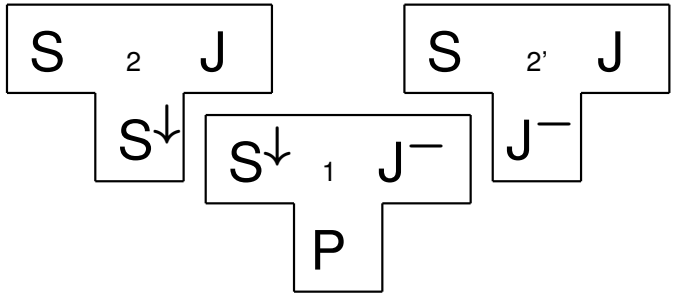


and in parallel, using $S^{\downarrow}$, we can implement:



using basically our favourite language.

Combining the two compilers, we get:



which is an inefficient SCALA compiler (based on generated Java code) generating efficient Java code.

A final combination gives us what we want, an efficient SCALA compiler, written in SCALA, running on the Java platform.