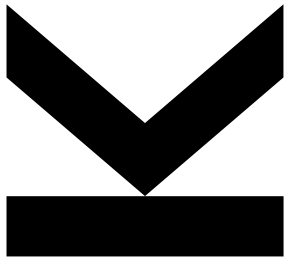
LLVM IR IN GRAALVM: MULTI-LEVEL, POLYGLOT DEBUGGING WITH SULONG



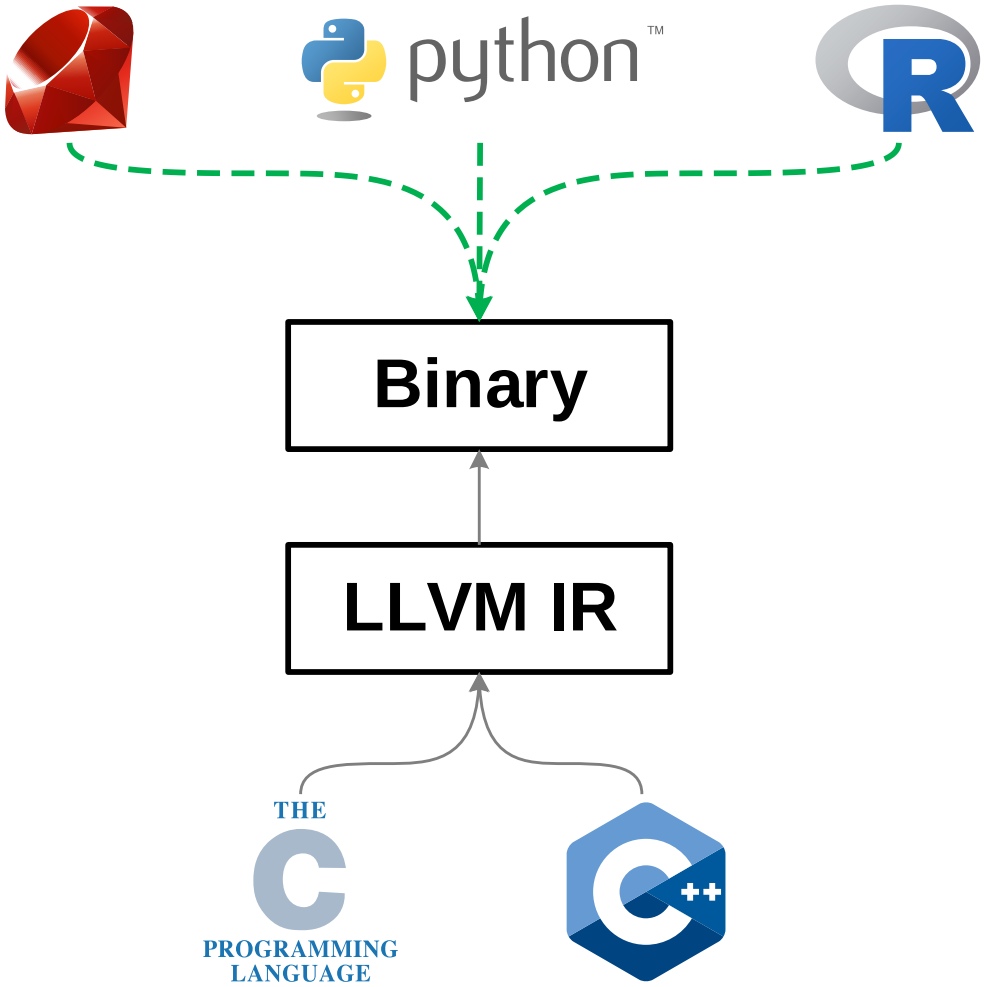
Jacob Kreindl

2019 European LLVM Developers' Meeting, April 8-9, 2019

JOHANNES KEPLER
UNIVERSITY LINZ

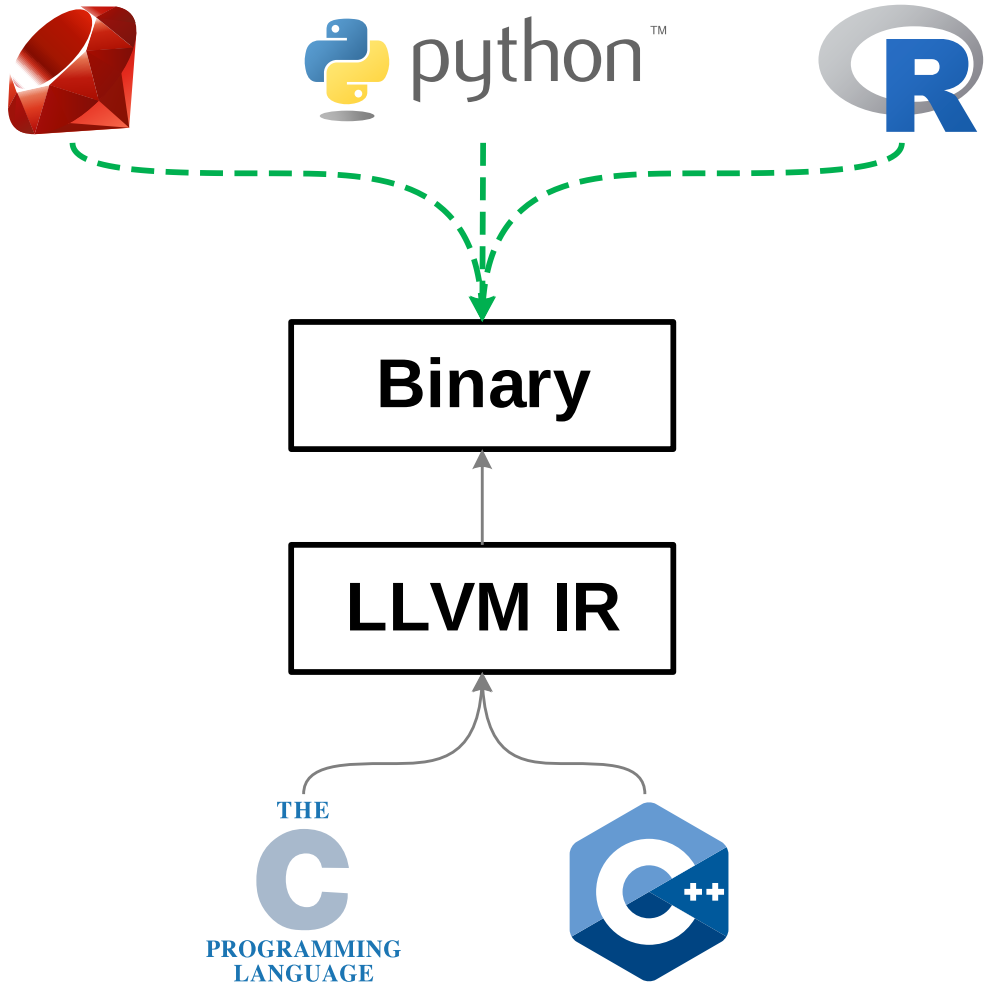
ORACLE
Labs

MOTIVATION



MOTIVATION

Debuggers for
Dynamic Languages



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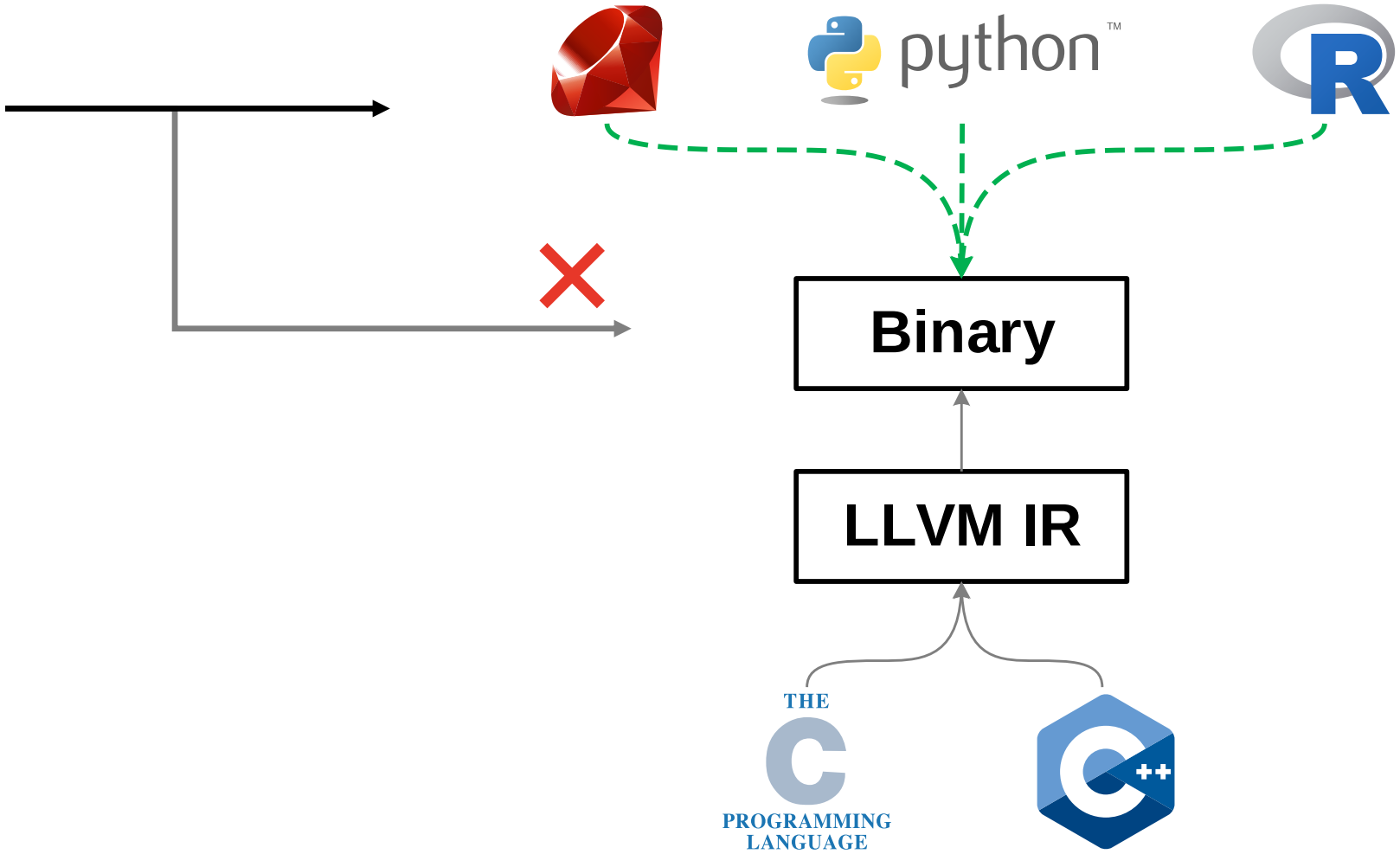

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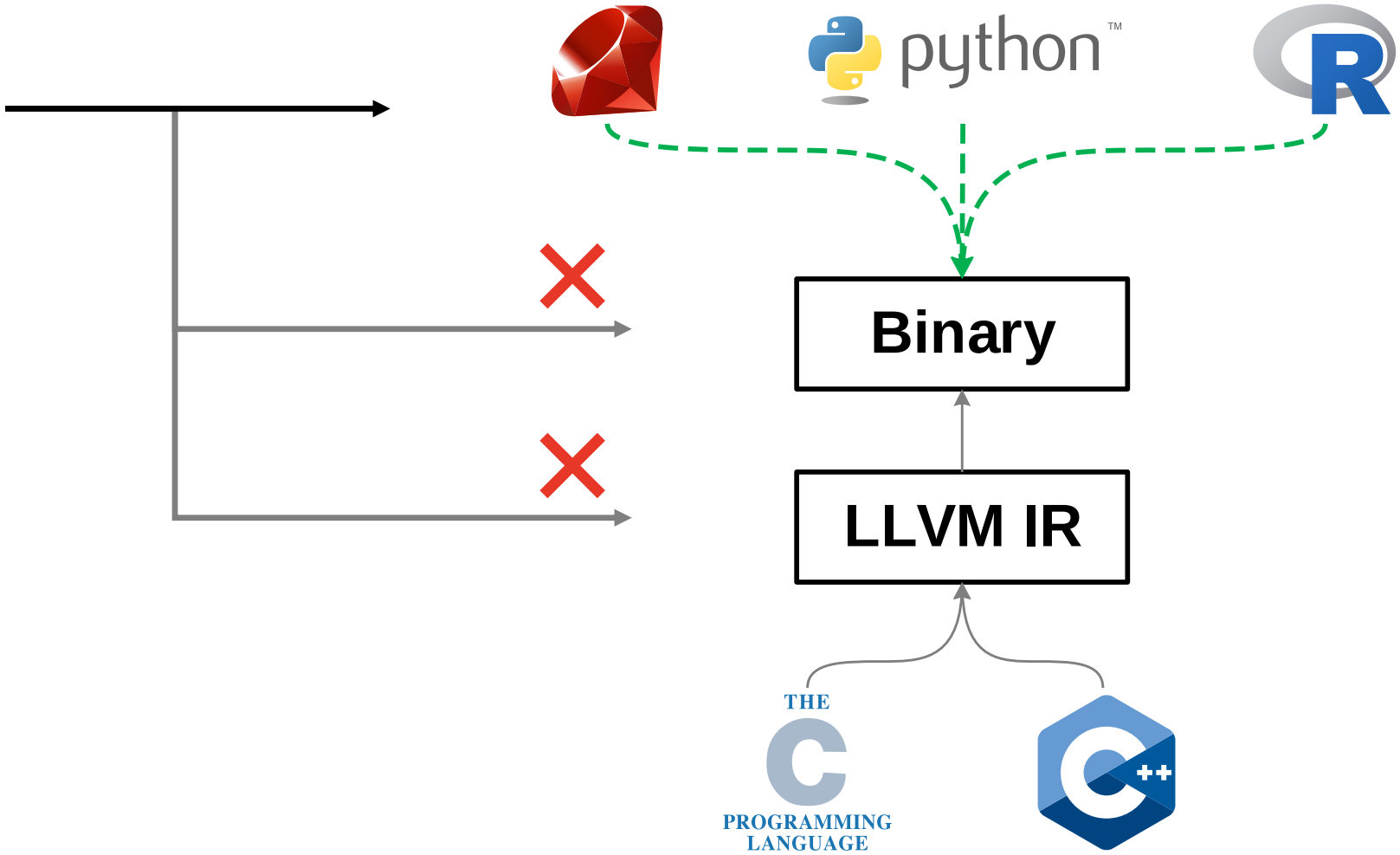

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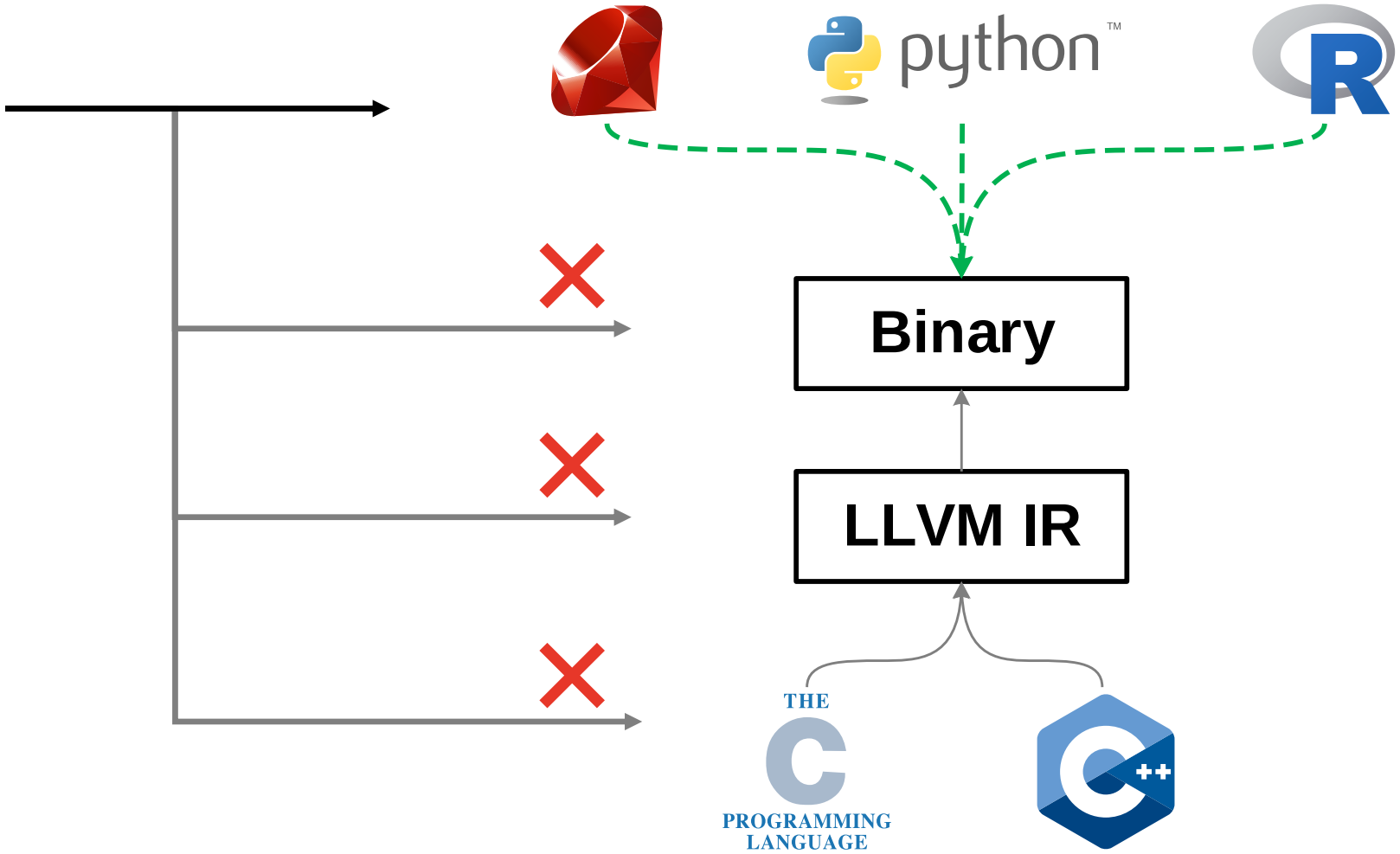

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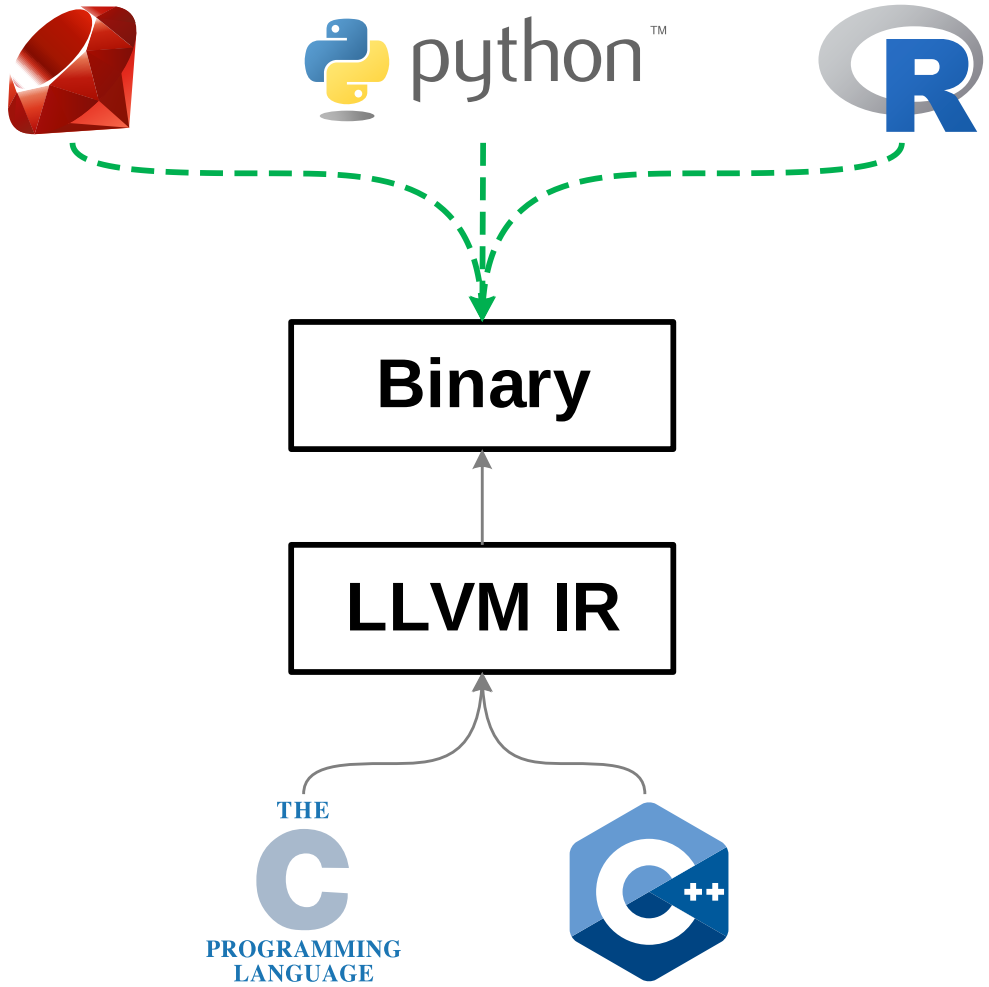

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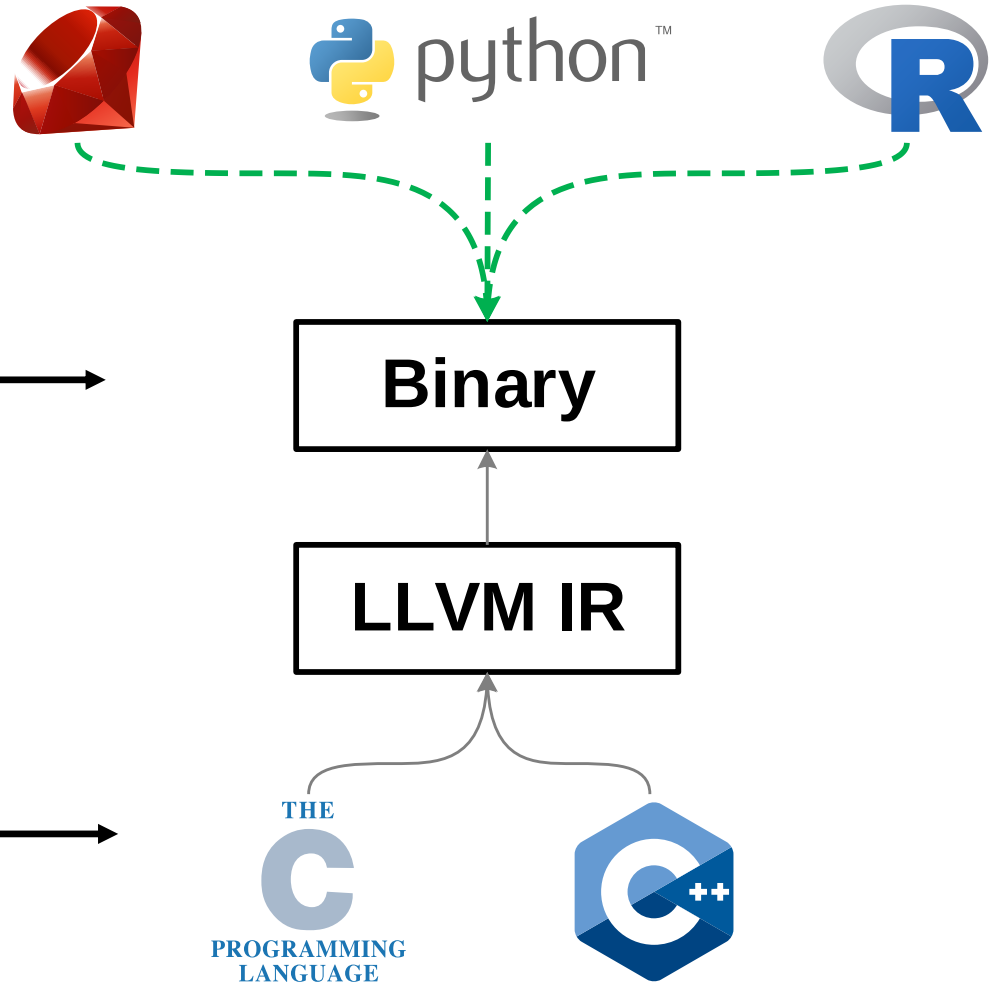
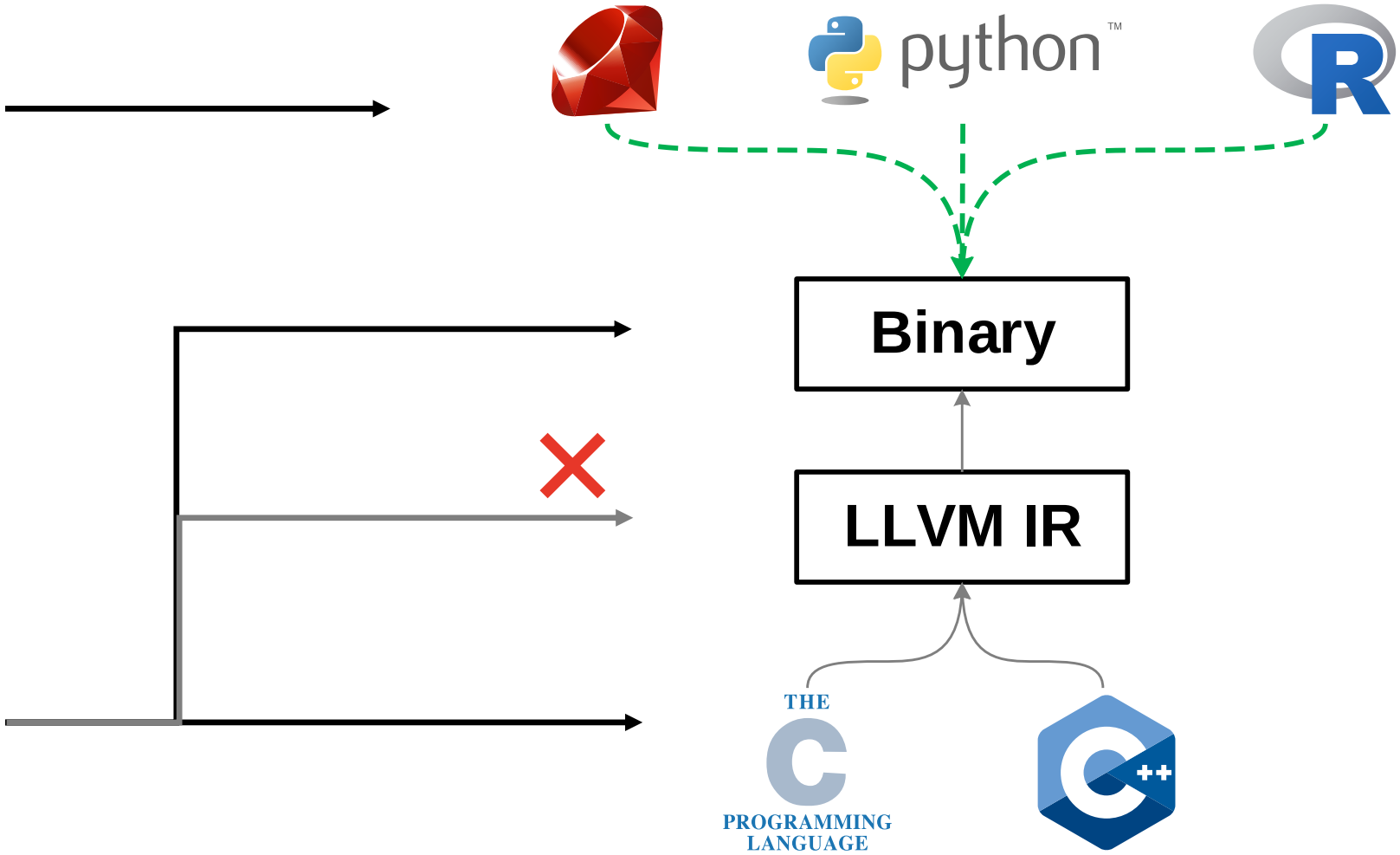


Debuggers for
Native Code

MOTIVATION

Debuggers for
Dynamic Languages



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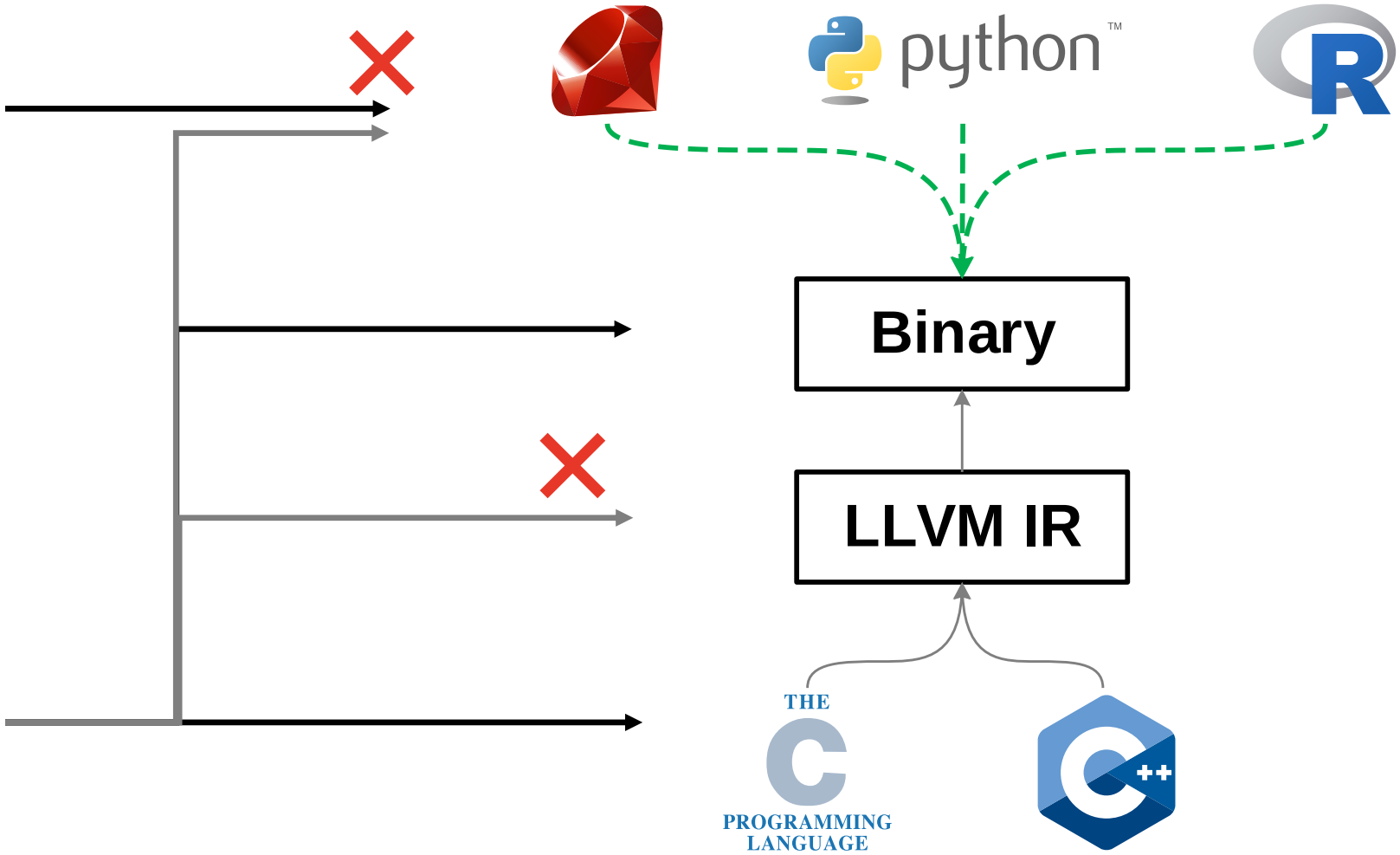

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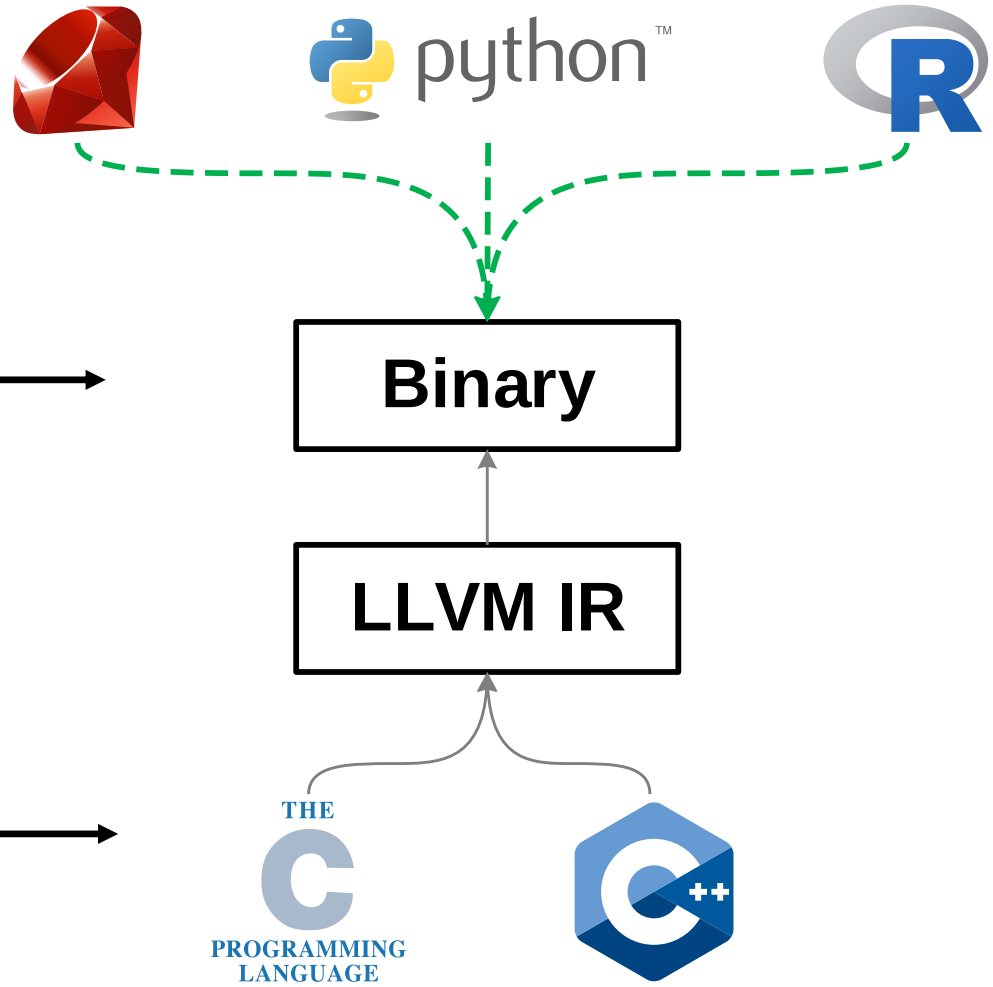
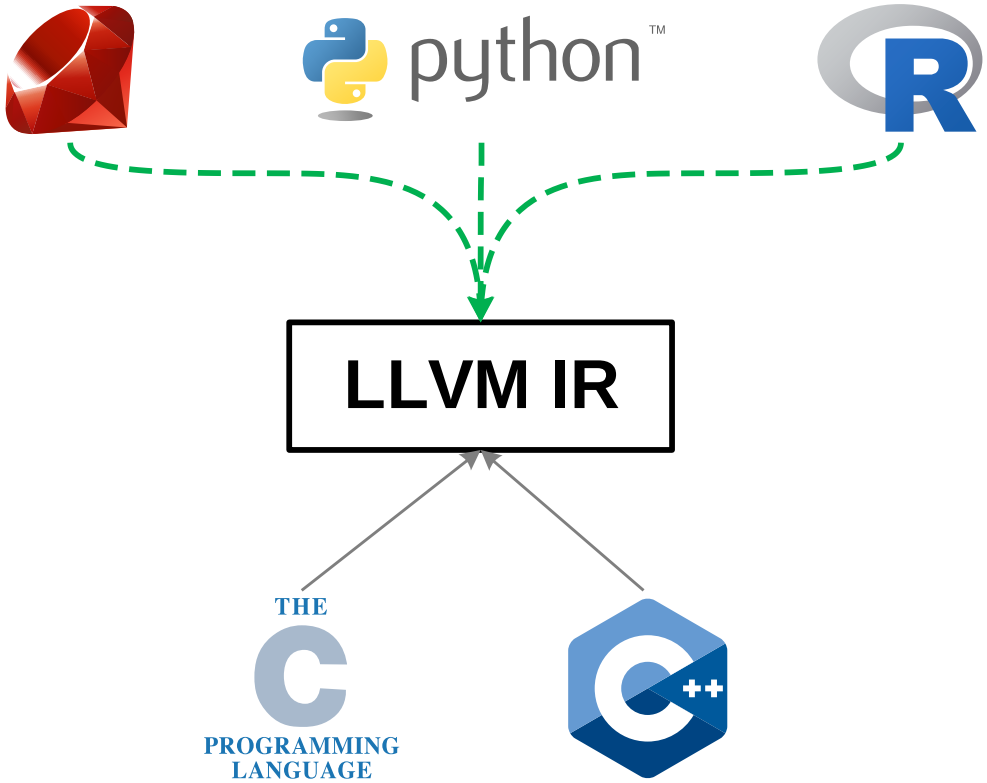


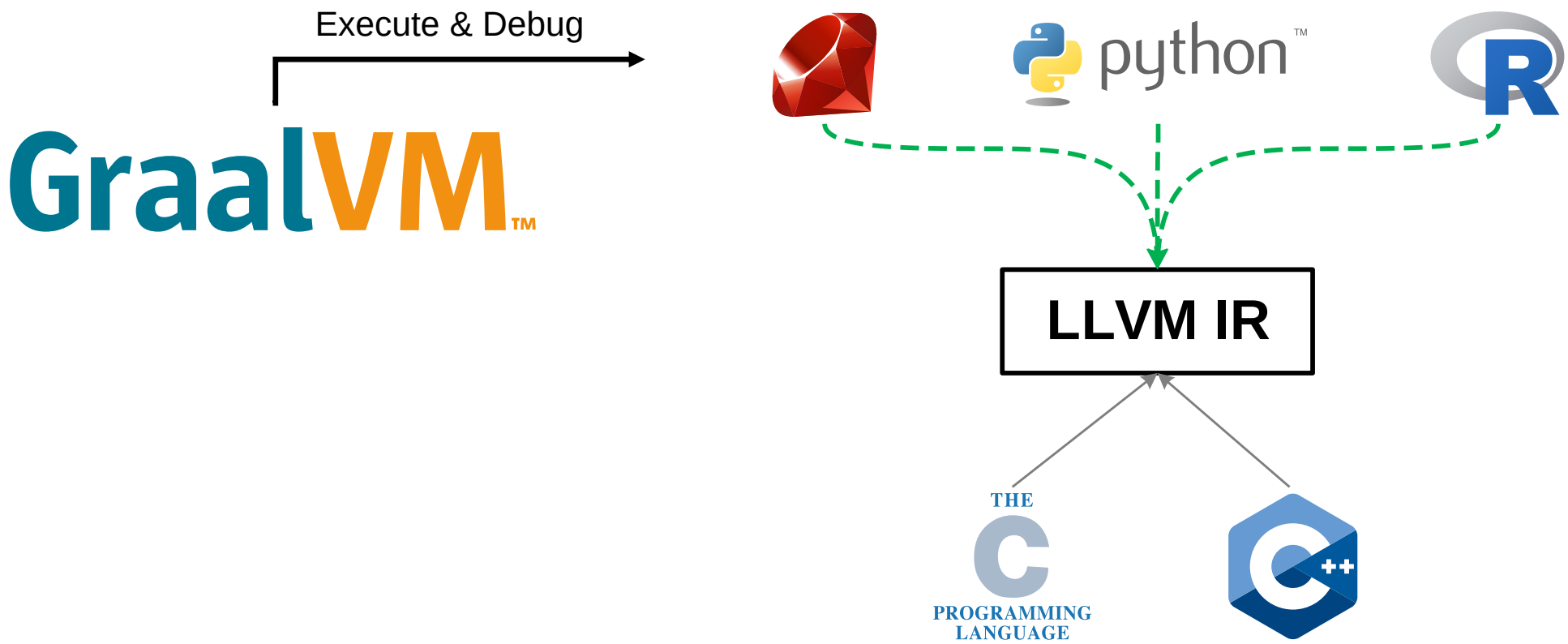
Debuggers for
Native Code

GRAALVM

GraalVM™

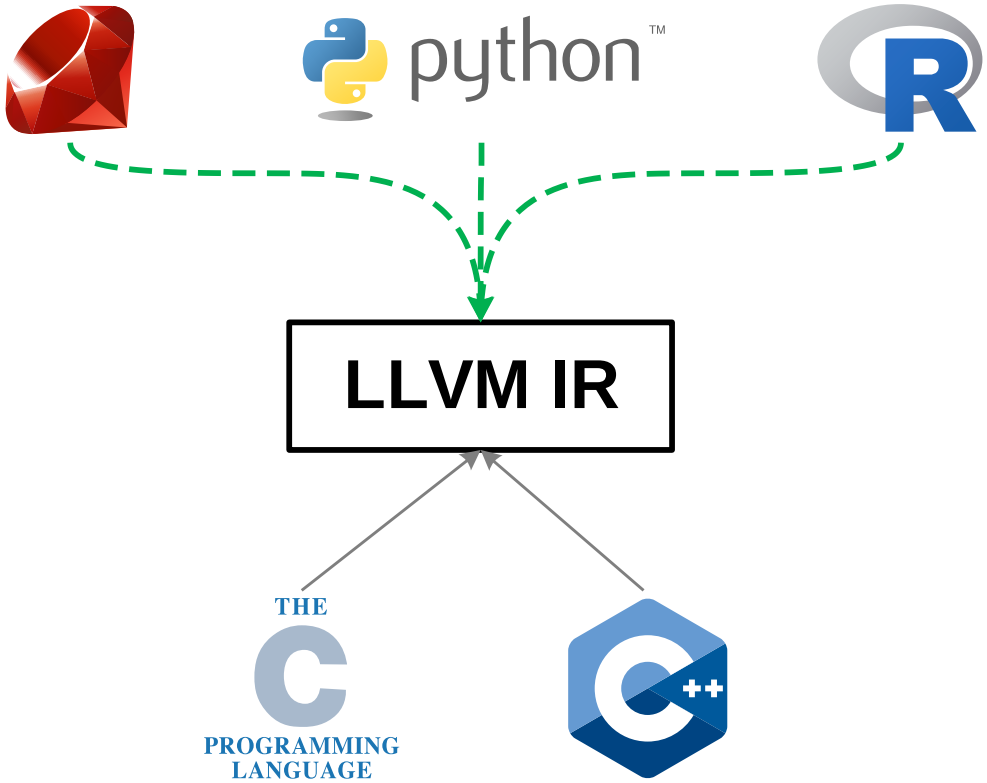


GRAALVM


Execute & Debug
GraalVM
python
R
LLVM IR
THE
C
PROGRAMMING
LANGUAGE
C++

GRAALVM


Execute & Debug
GraalVM™
Execute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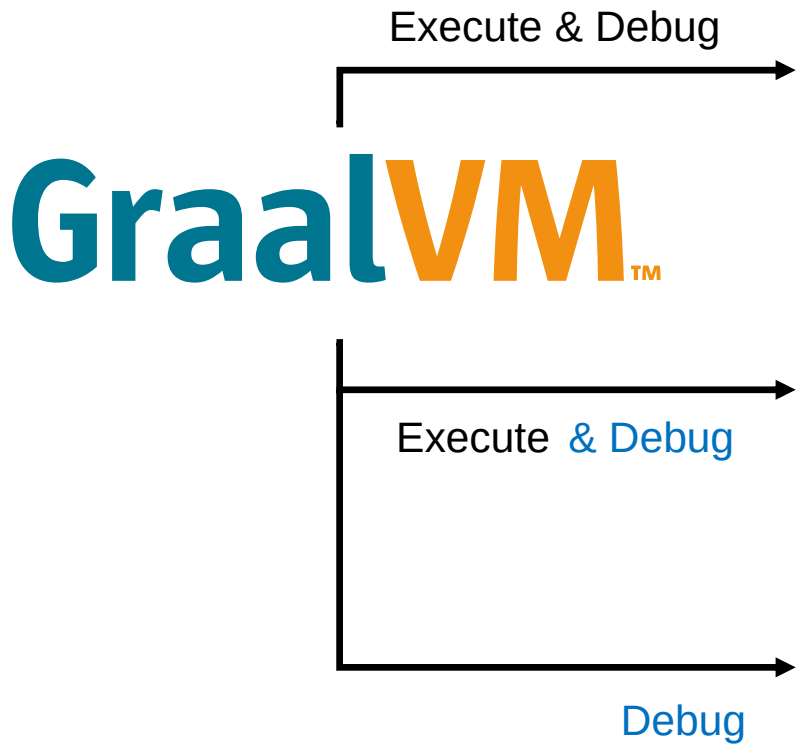
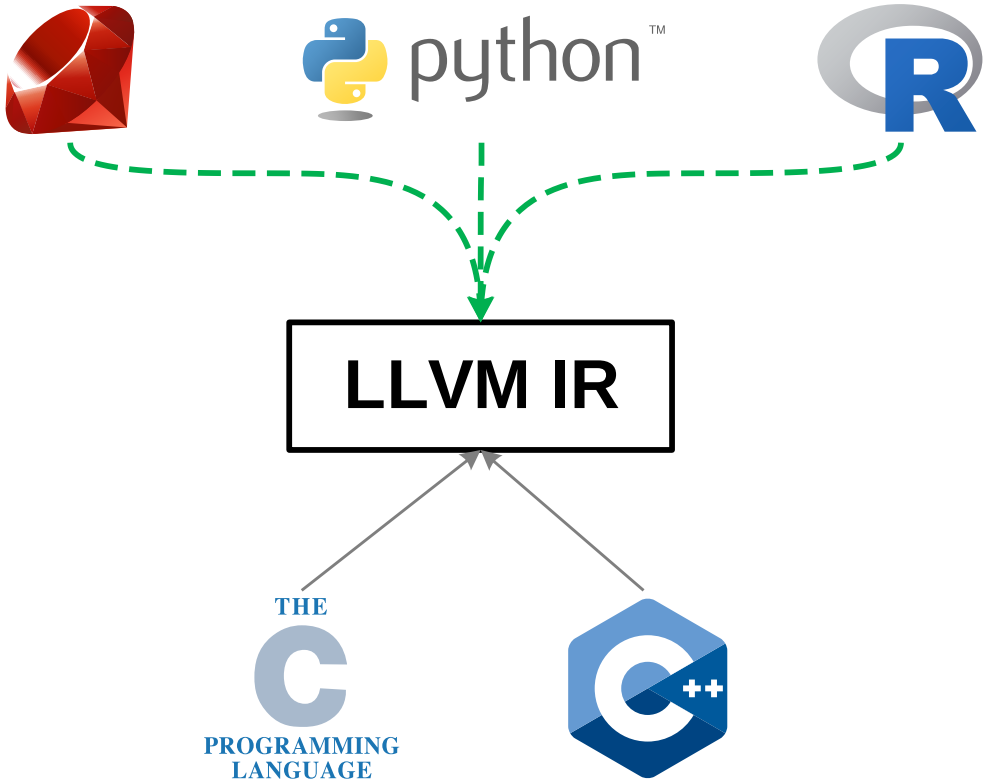

Execute & Debug
GraalVM™
Execute & Debug
Debug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GRAALVM FOR DYNAMIC LANGUAGES

GraalVM™

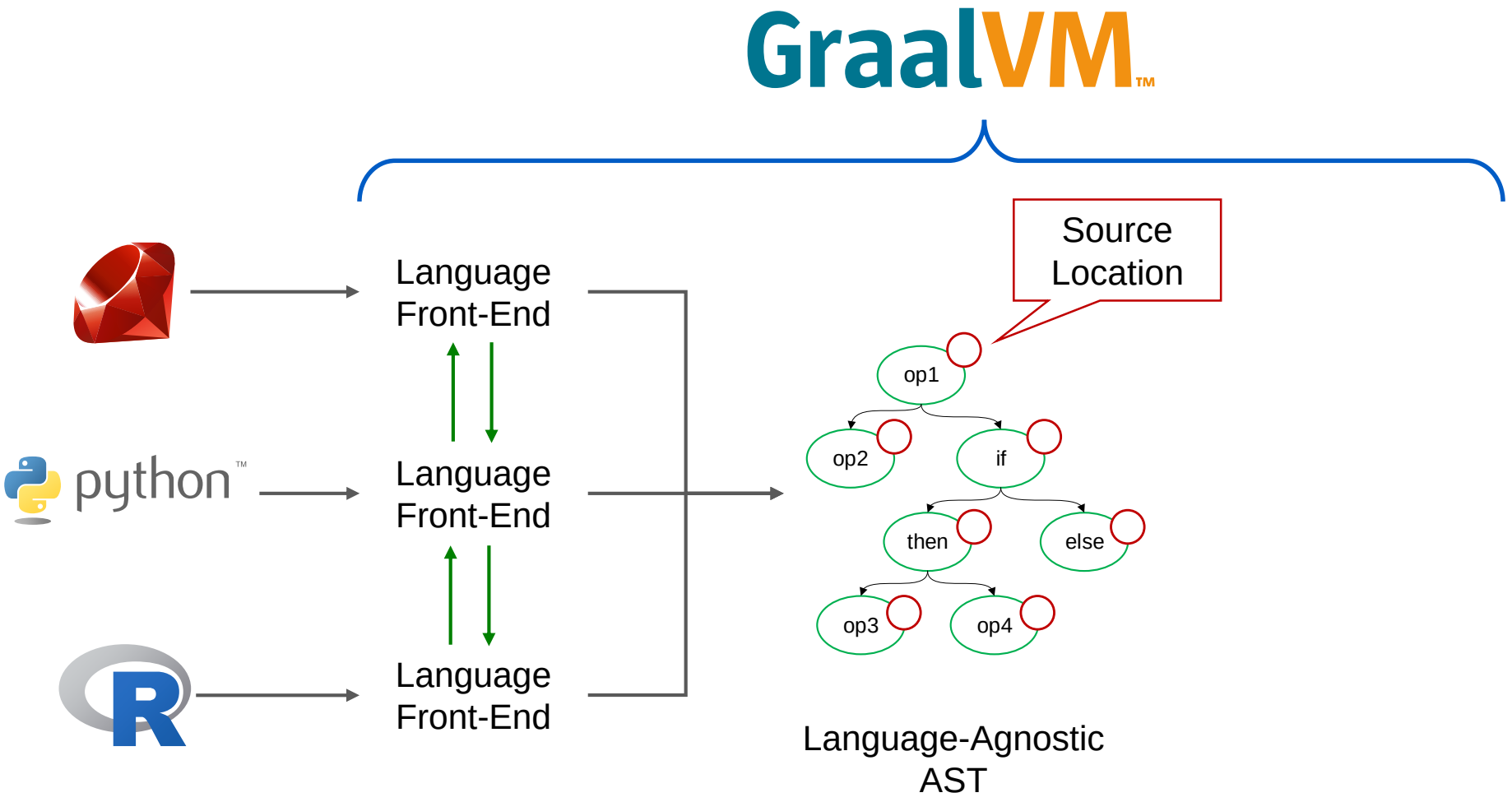
GRAALVM FOR DYNAMIC LANGUAGES

Language
Front-End

Language
Front-End

Language
Front-End

GRAALVM FOR DYNAMIC LANGUAGES



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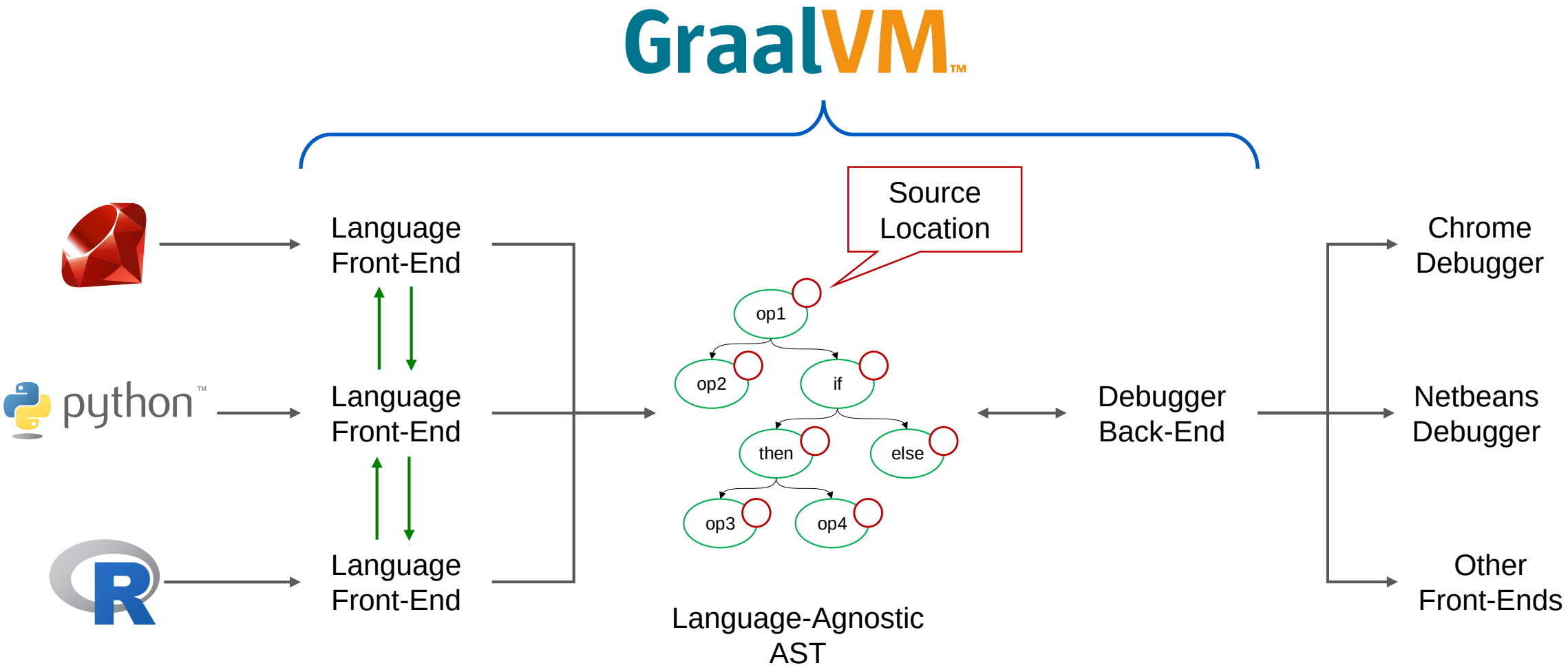
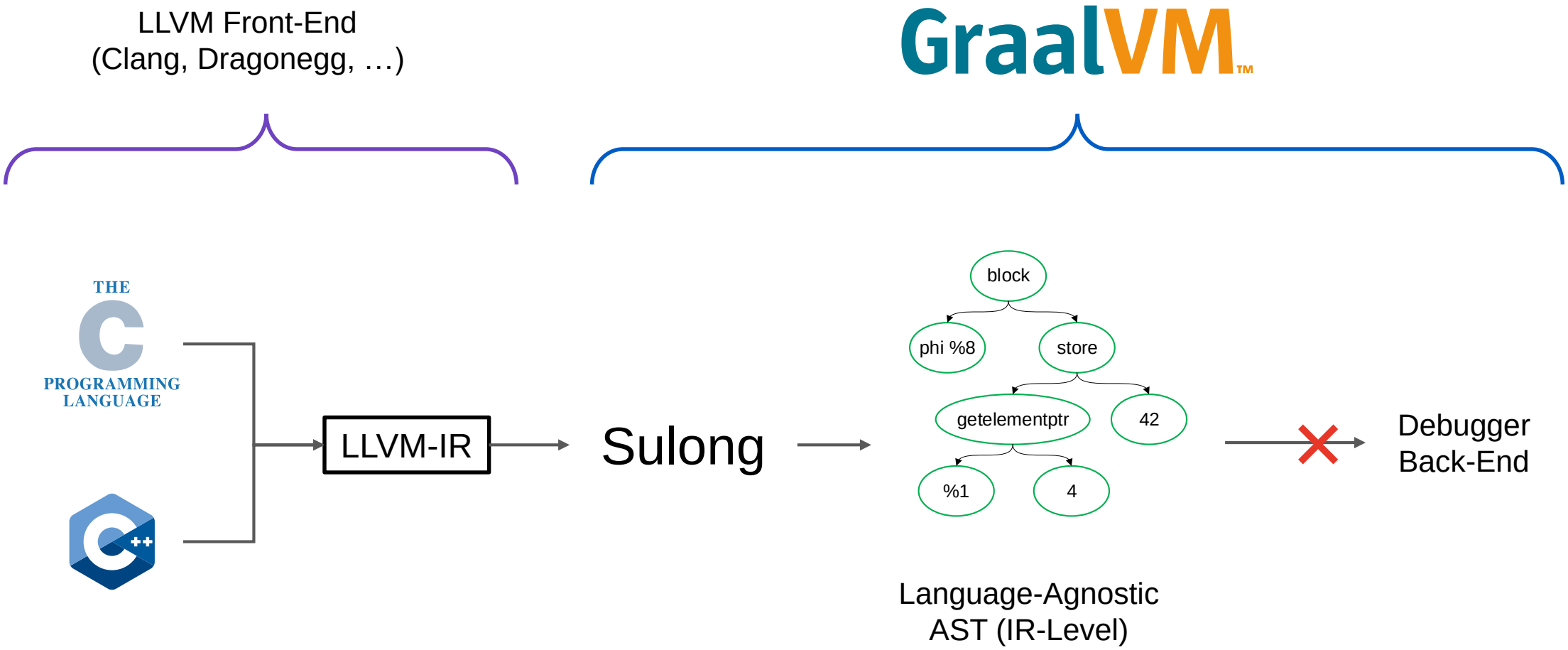
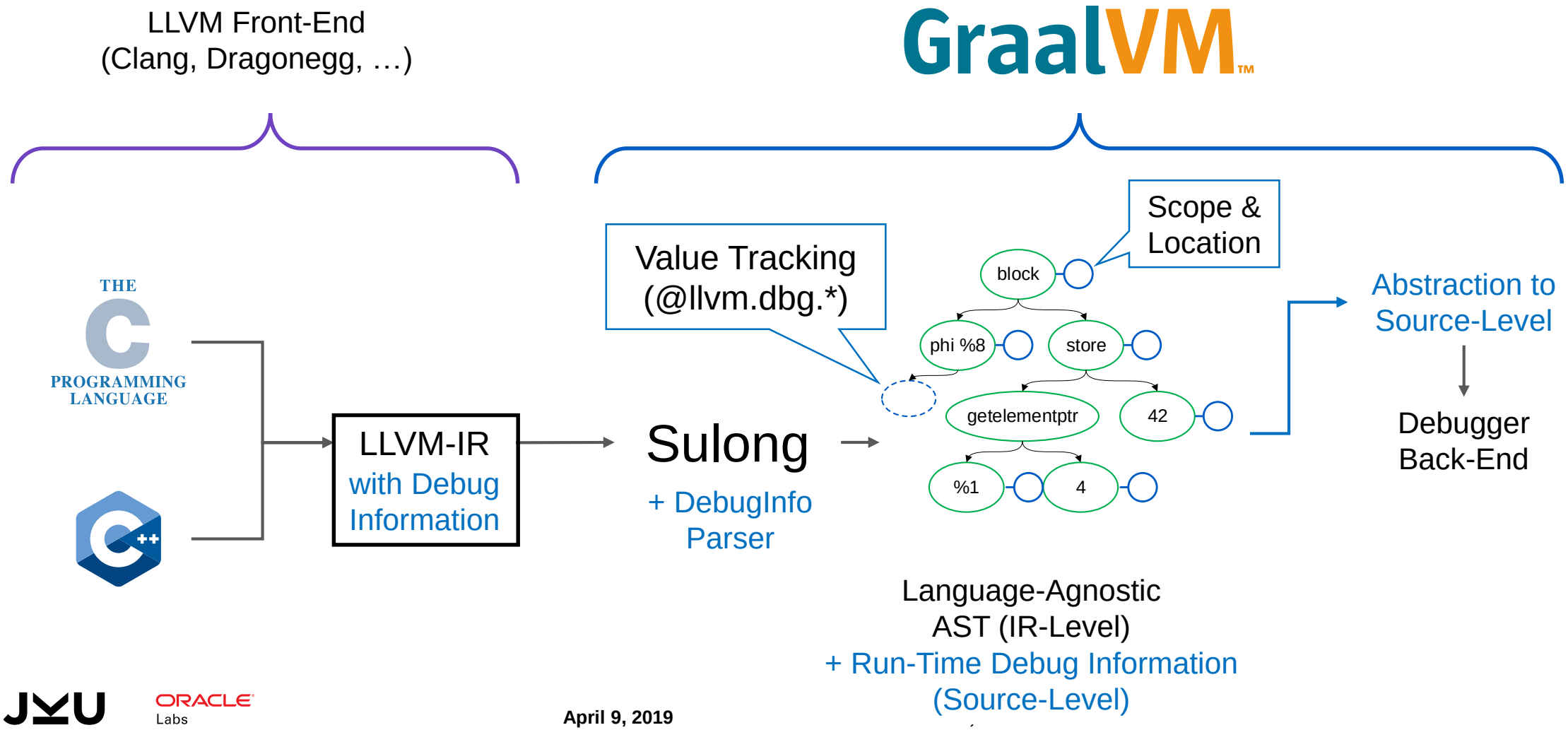


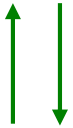
SULONG – THE LLI IN GRAALVM



SOURCE-LEVEL DEBUGGING WITH SULONG



DEBUGGING NATIVE EXTENSIONS OF DYNAMIC LANGUAGE PROGRAMS



Ruby Program
+ Native Extension

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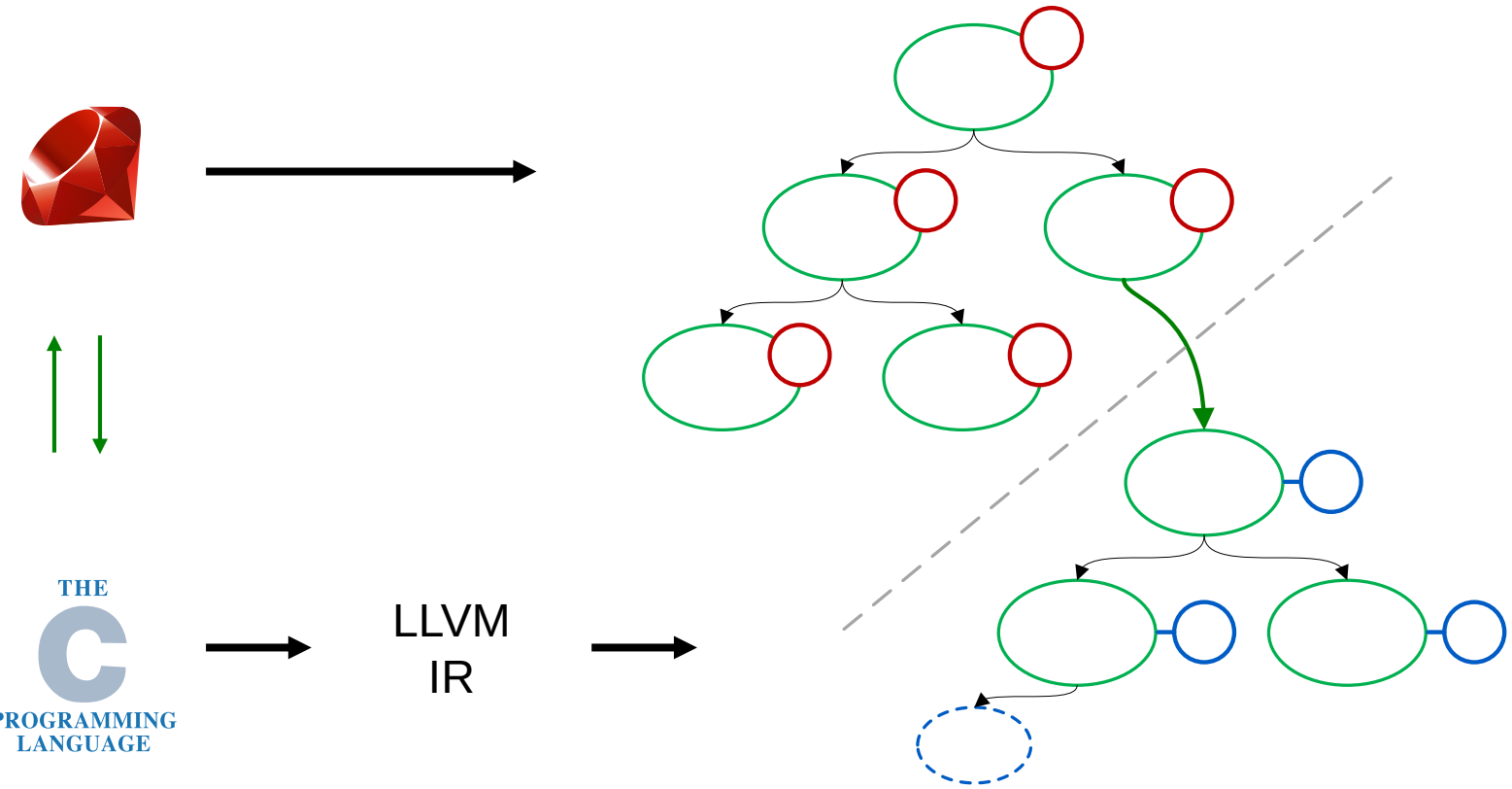

Ruby Program
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One AST
built from multiple language front-ends

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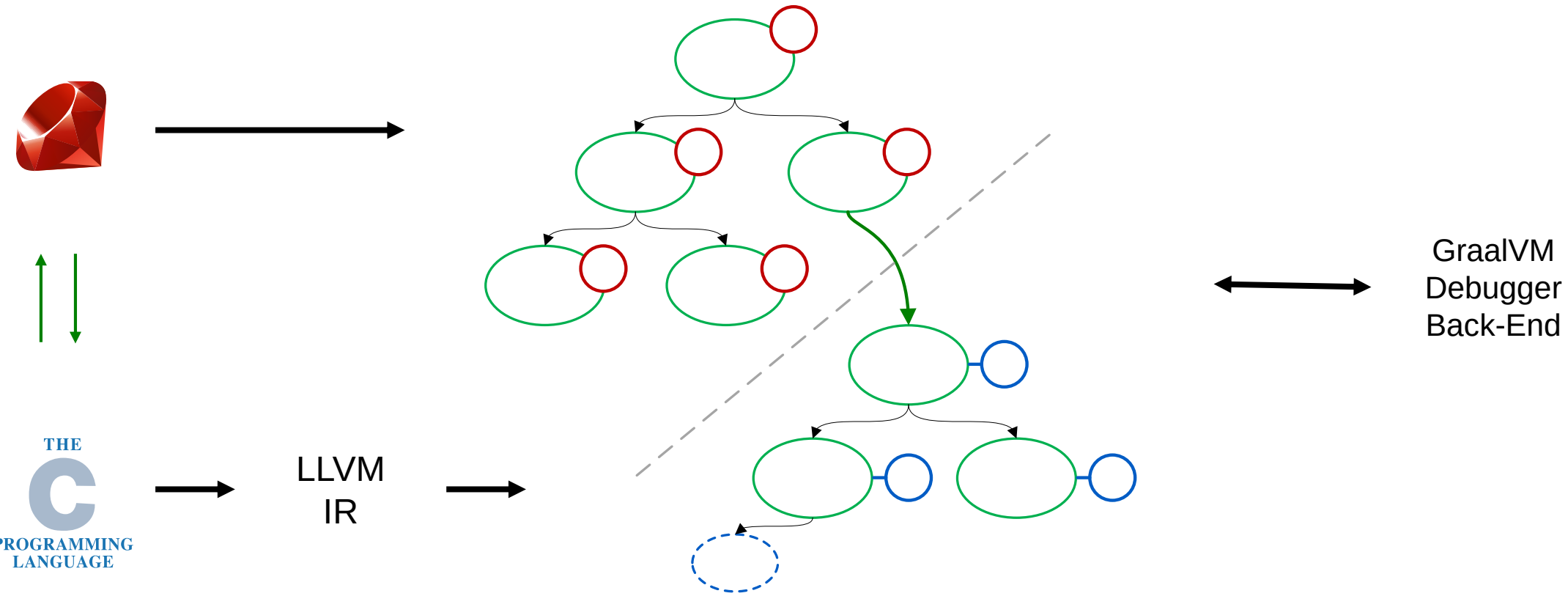

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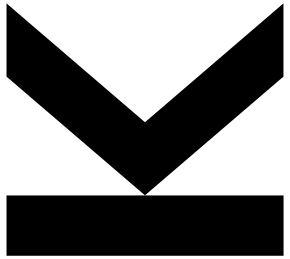
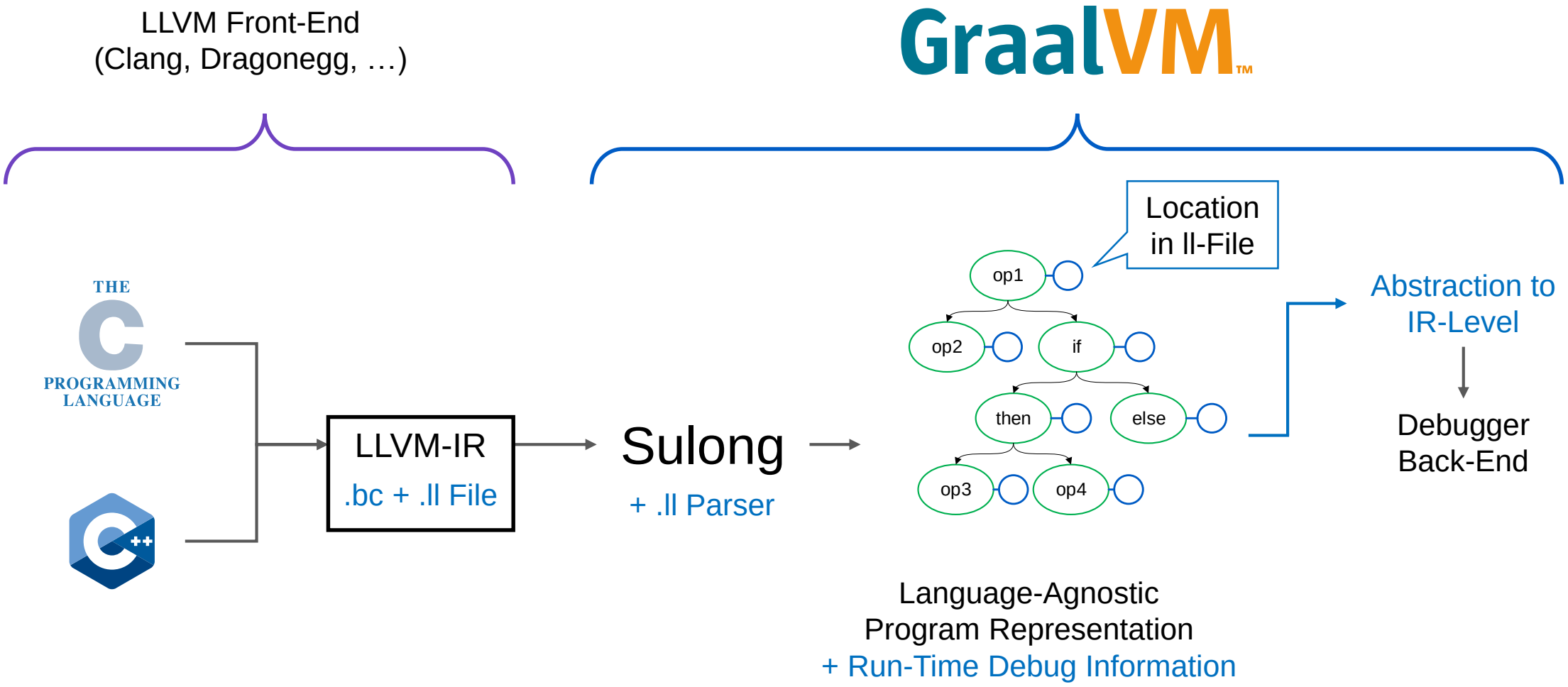
DEMO



Debugging a C-Extension for a Ruby Program with Sulong/TruffleRuby

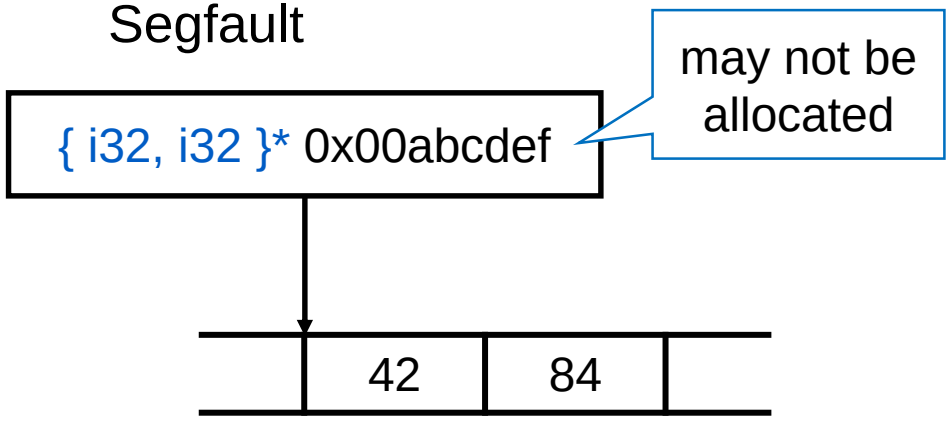
IR-LEVEL DEBUGGING WITH SULONG



MEMORY ACCESS IN SULONG

MEMORY ACCESS IN SULONG

- Native Mode
  - All allocations on the native heap
  - Using java.lang.Unsafe
  - Accessing illegal memory leads to Segfault



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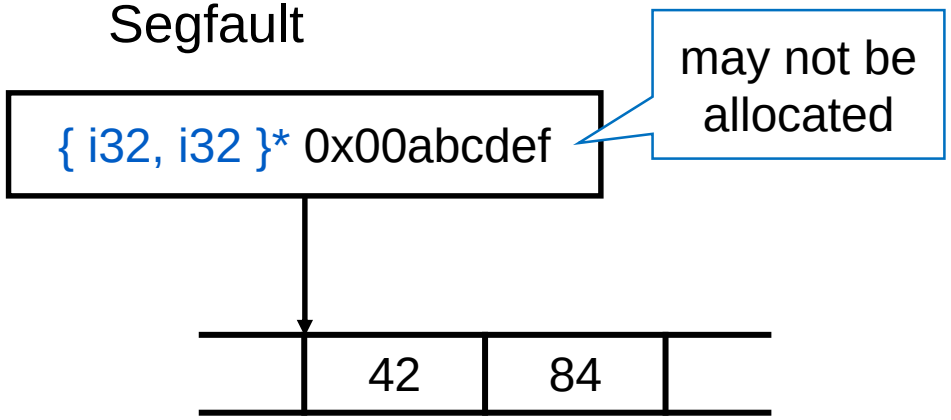
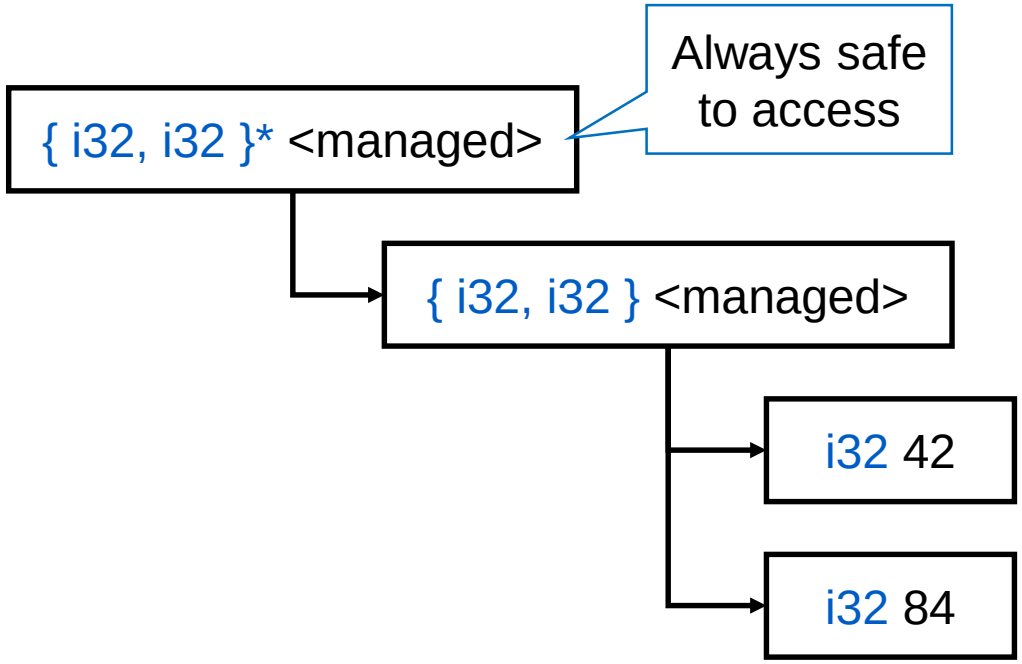


- Sandboxed Mode
  - All allocations as Java objects
  - Only in GraalVM Enterprise Edition
  - Guaranteed memory safety



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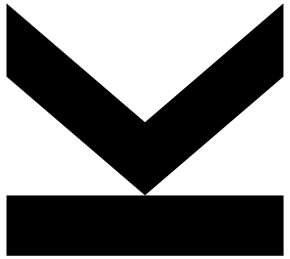


Debugging & Tracing a C-Program at IR-Level with Managed Sulong

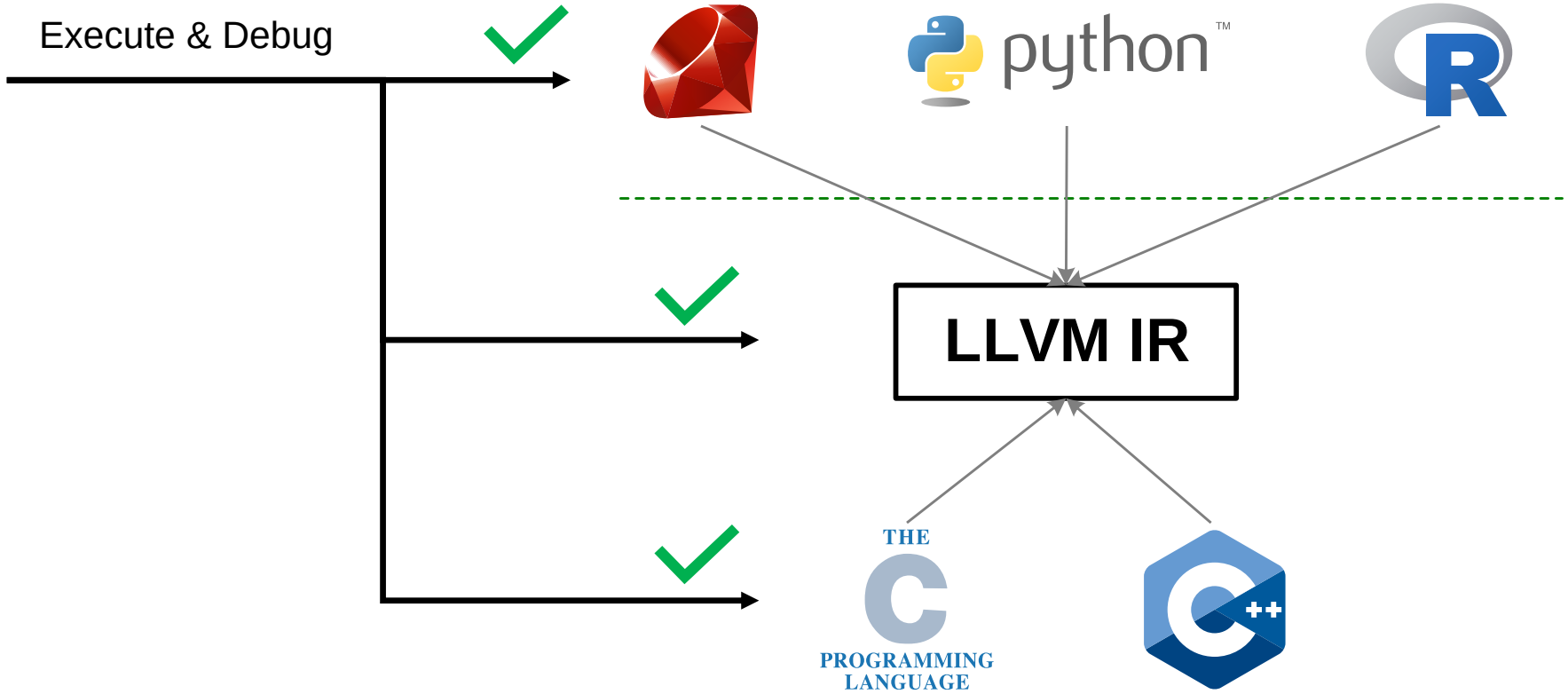
YOU CAN TRY IT YOURSELF

- Download GraalVM at https://www.graalvm.org/

- GraalVM Community Edition is Open Source: https://github.com/oracle/graal

IN CONCLUSION

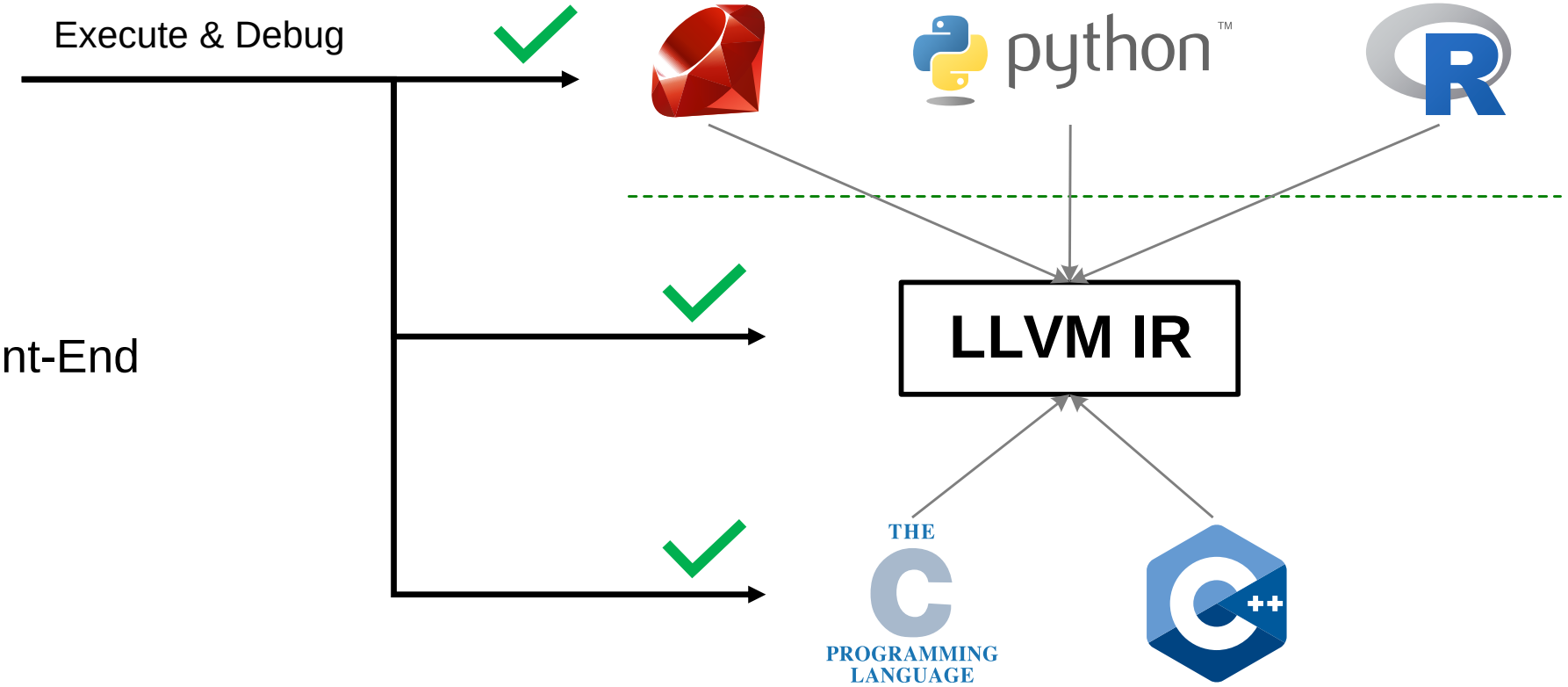
GraalVM



IN CONCLUSION

GraalVM™

- Same Debugger Front-End for all Languages



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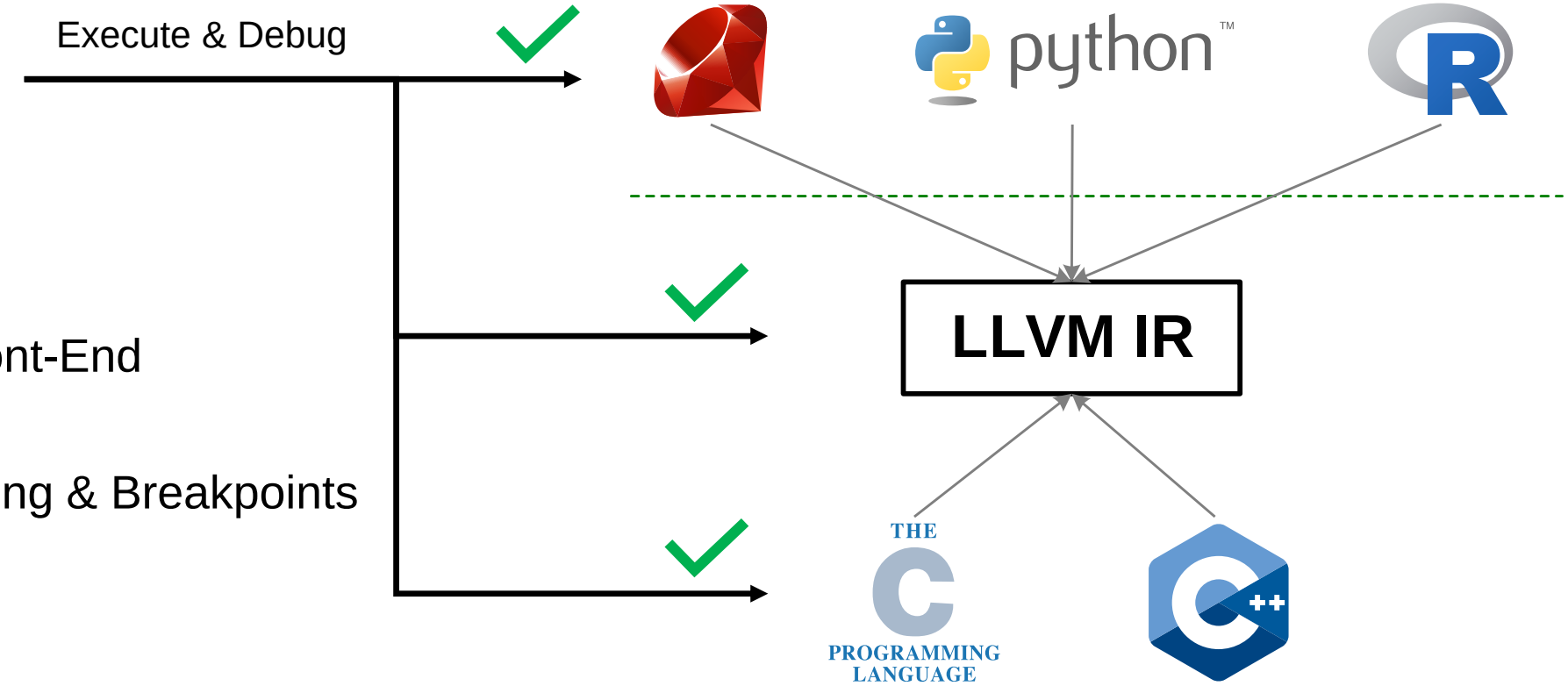
GraalVM



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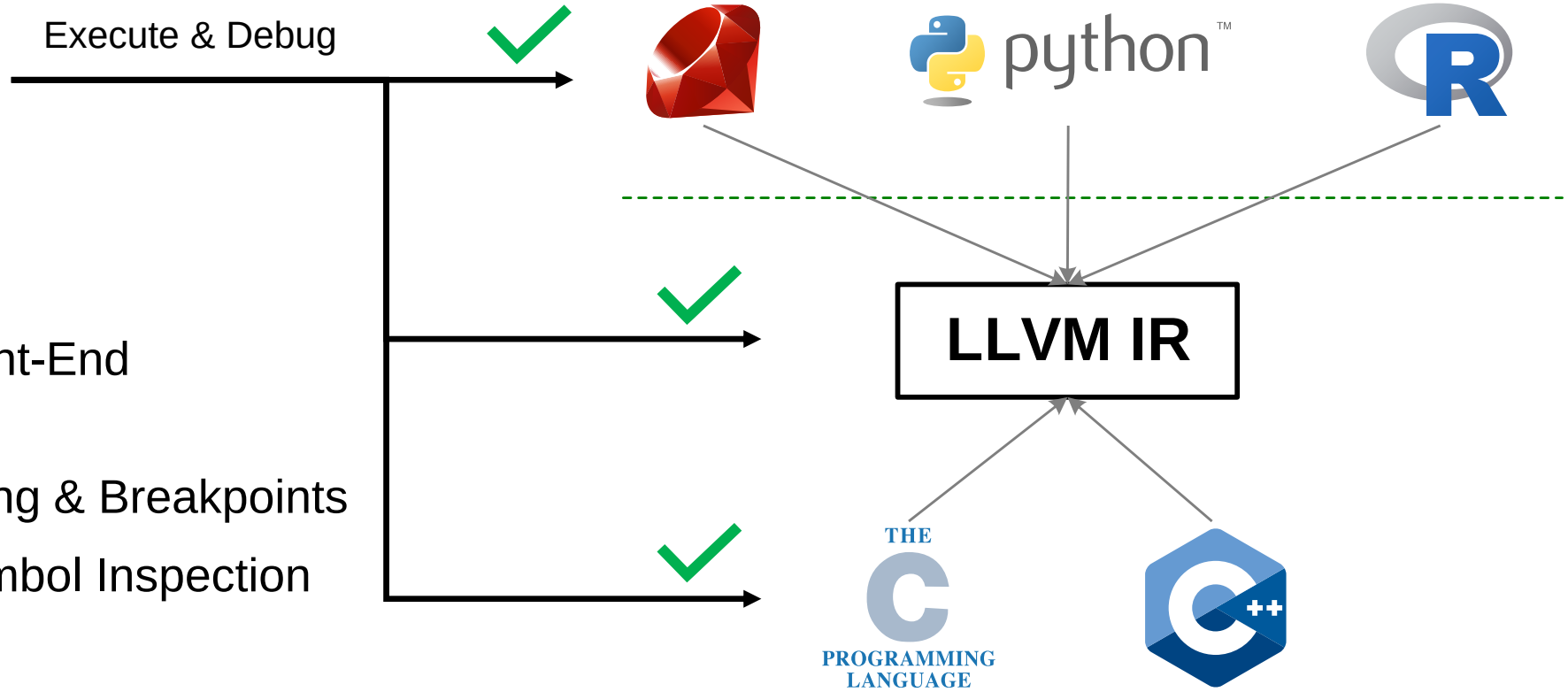

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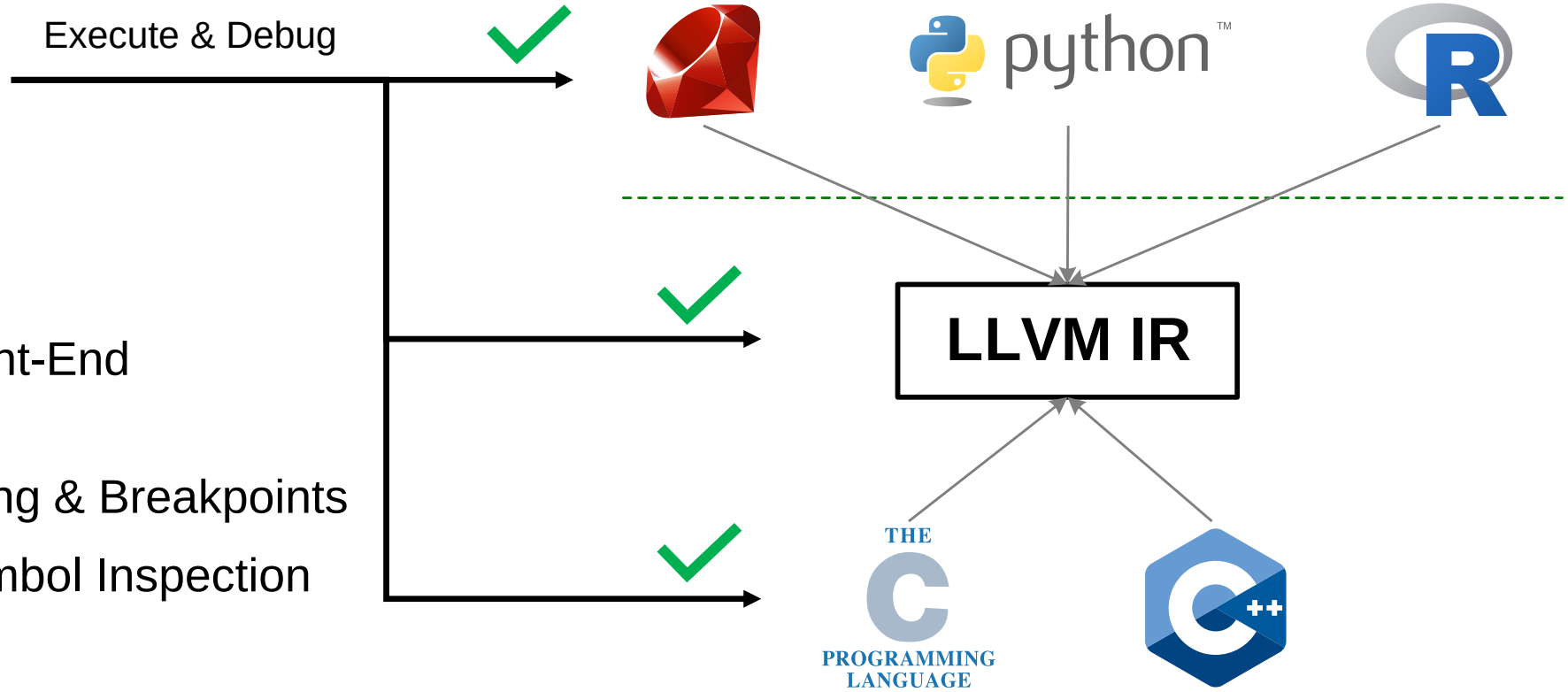

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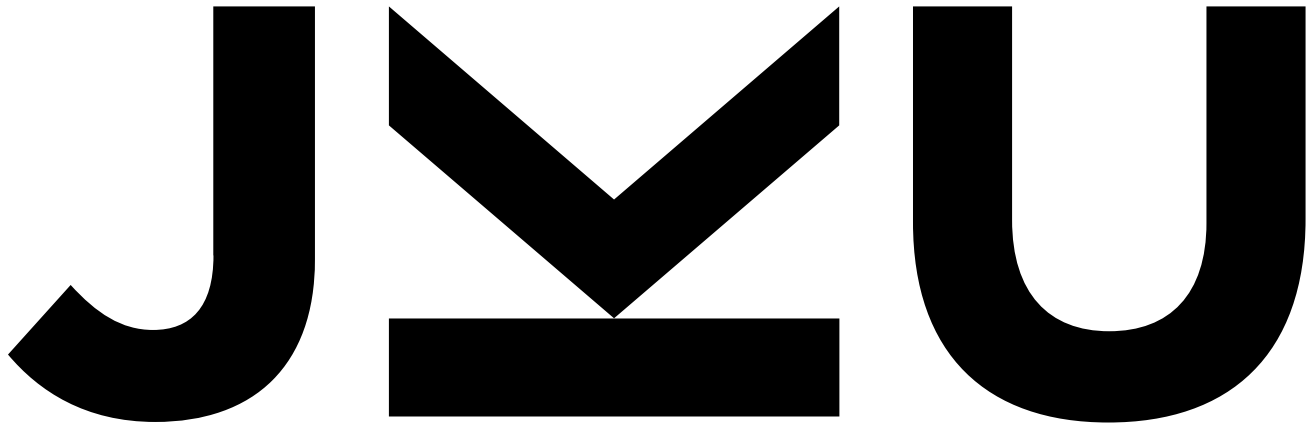
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UNIVERSITY LINZ

SYSTEM OVERVIEW