



POLYGLOT DEVELOPMENT USING GRAALVM - MEMEGEN

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WHAT IS GRAALVM?

GraalVM is a modified Java HotSpot VM which uses the Graal JIT compiler and supports the Truffle based interpreters.

It provides an environment for running code written in different languages within one application.

Advantages:

- Performance
- Polyglot
- Interoperability
- Embeddability
- Tooling (debuggers, profilers etc.)

Supported Languages:

- Java
- JavaScript (Node.js)
- Ruby
- Python (partially)
- R (partially)

WHAT IS TRUFFLE?

- Truffle is a framework for implementing languages as simple interpreters. Together with the **Graal compiler**, Truffle interpreters are automatically just-in-time compiled and programs running on top of them can reach performance of normal Java.
- Common AST structure enables interoperability. The framework executes AST nodes regardless of which language they come from

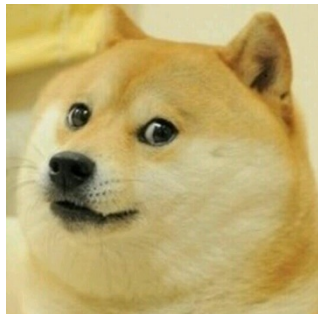
TASK OVERVIEW

Purpose: create a MemeGen web-application:

- Using frameworks and libraries
- Applying different mechanisms (databases, image processing)
- Using Node.js platform

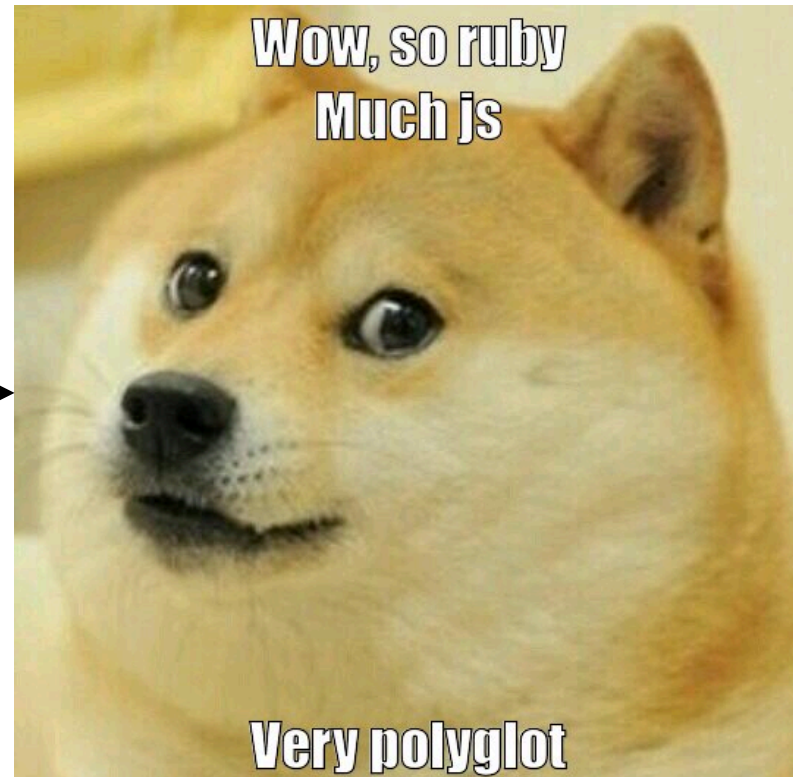
WHAT IS MEMEGEN?

“Wow, so ruby\nMuch js”

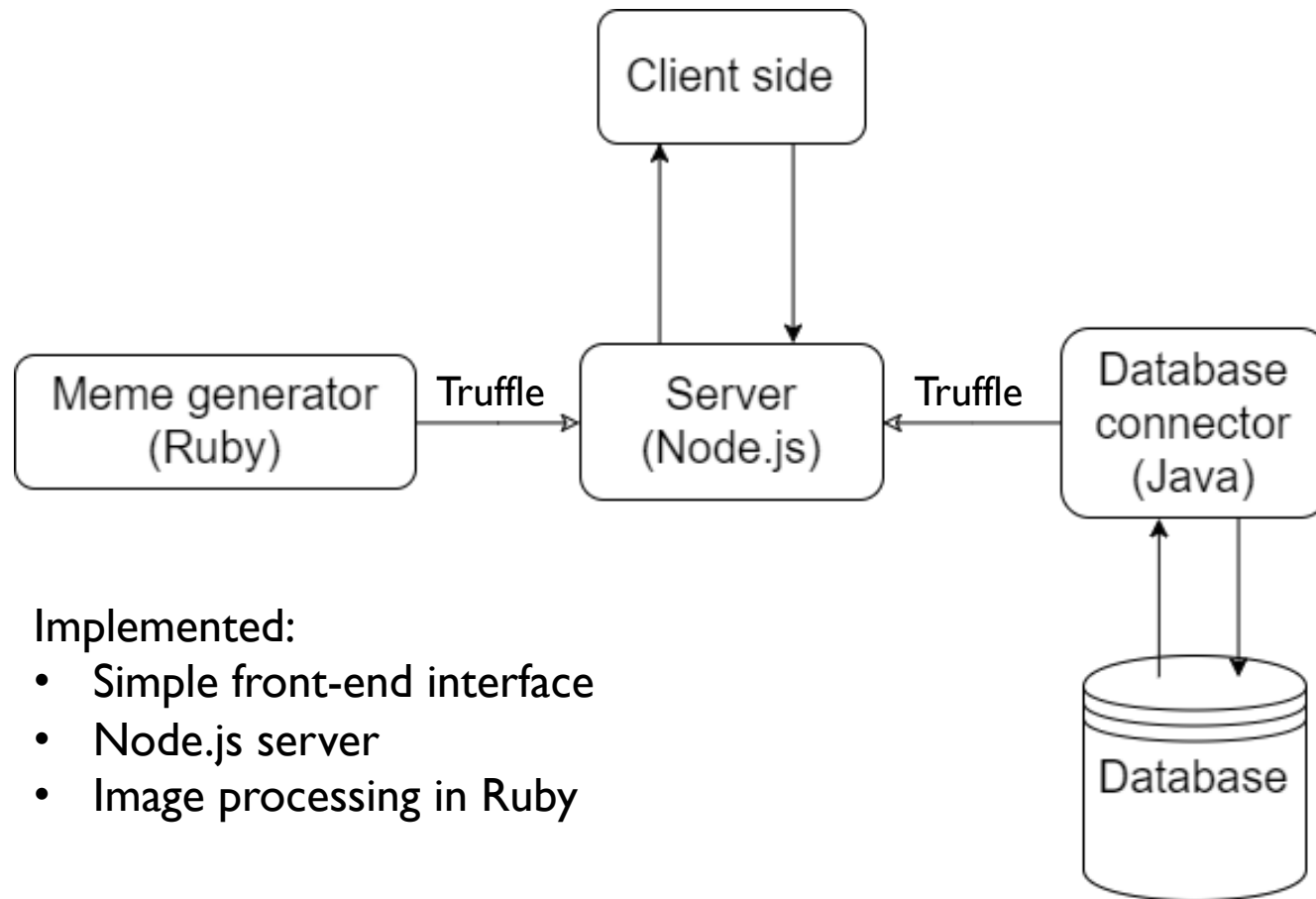


MemeGen

“Very polyglot”



APPLICATION STRUCTURE



Implemented:

- Simple front-end interface
- Node.js server
- Image processing in Ruby

FRAMEWORKS AND LIBRARIES

Server:

- Express
- Multer
- Body-parser

Image processing script:

- Mini-Magick (uses C-extensions!)

Java database manager:

- Java SQL Connector

ACCESSING RUBY CODE FROM JAVASCRIPT

Ruby code implementing meme generation and export:

```
def generateMeme(filename, top_caption, bot_caption)
end

Truffle::Interop.export_method(:generateMeme)
```

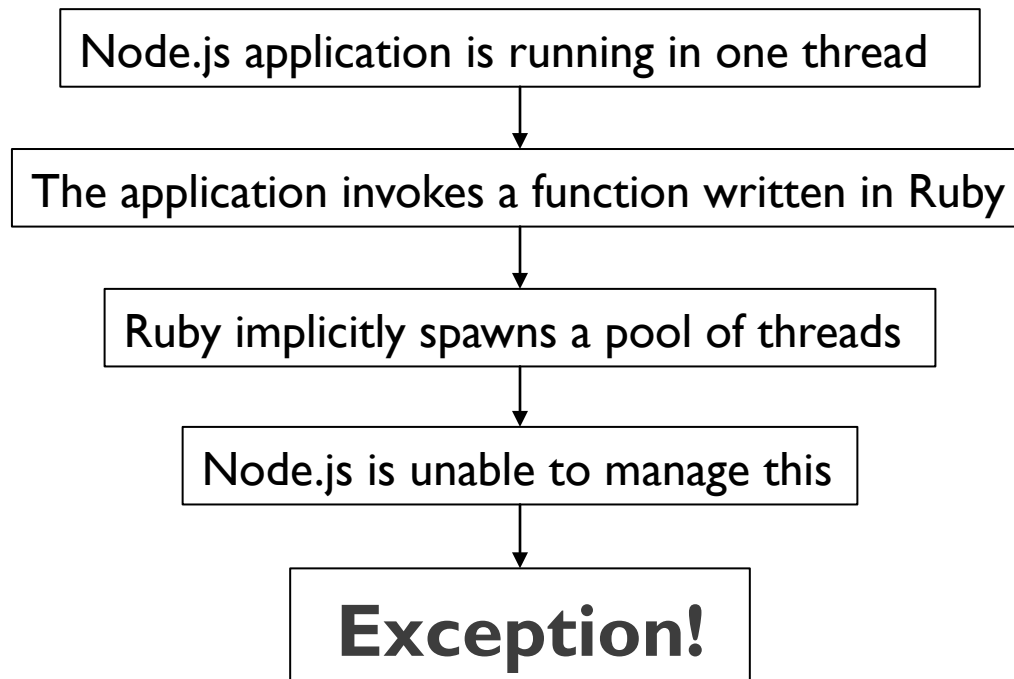
JavaScript code implementing the import of Ruby function:

```
fs.readFile('process_image.rb', 'utf8', function(err, contents) {
  var rubyMemeGen = contents;
  Interop.eval("application/x-ruby", rubyMemeGen);
  makeMeme = Interop.import("generateMeme");
  console.log("Ruby code is loaded!");
});
```

Further this function is available by the name “**makeMeme**”

REVEALED ERRORS

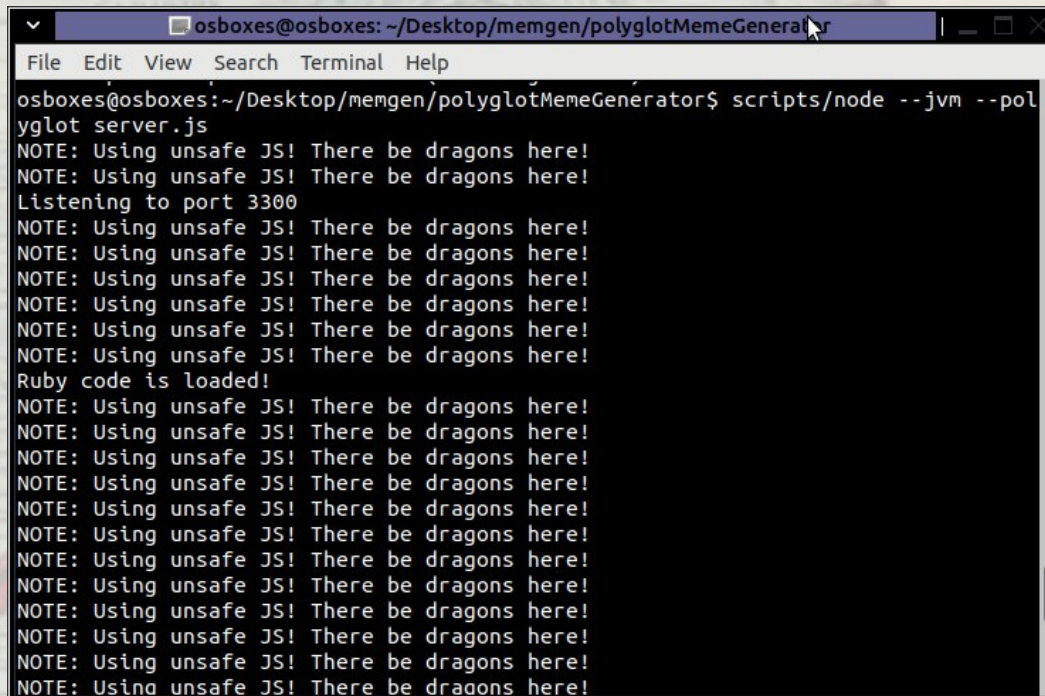
I. Multithreaded behavior of the Ruby script caused **PolyglotIllegalStateException**.



REVEALED ERRORS

How it was fixed:

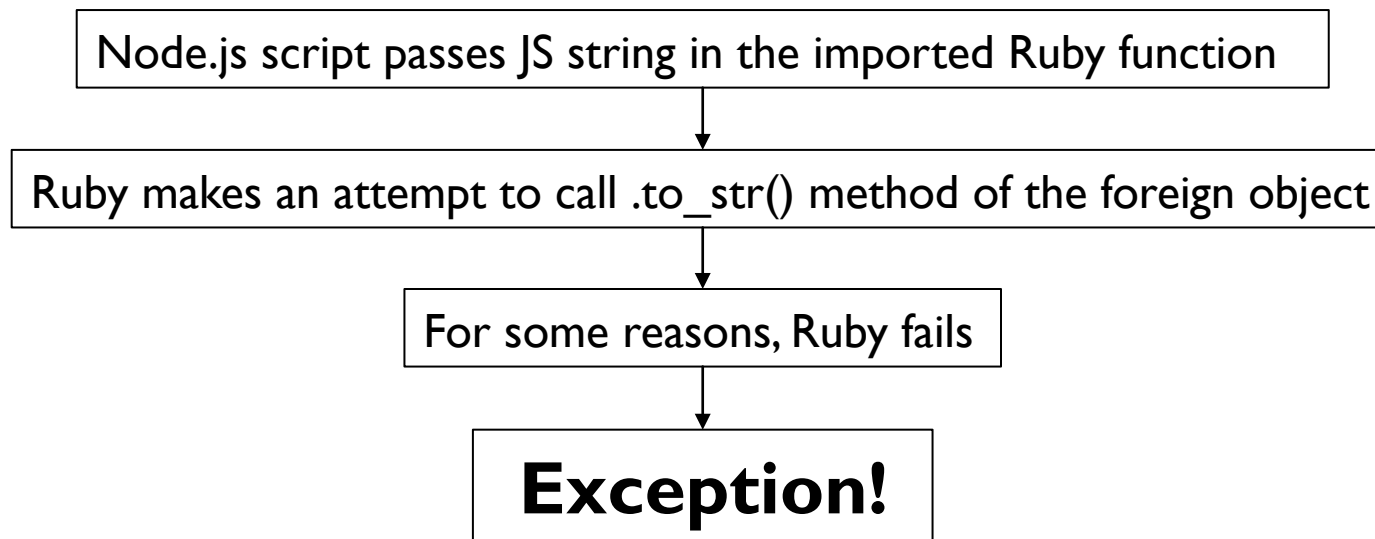
The work was proceeded with a new version of the GraalVM compiler with deactivated thread protection. It was substituted with the warning:



```
osboxes@osboxes: ~/Desktop/memgen/polyglotMemeGenerator
File Edit View Search Terminal Help
osboxes@osboxes:~/Desktop/memgen/polyglotMemeGenerator$ scripts/node --jvm --polyglot server.js
NOTE: Using unsafe JS! There be dragons here!
NOTE: Using unsafe JS! There be dragons here!
Listening to port 3300
NOTE: Using unsafe JS! There be dragons here!
NOTE: Using unsafe JS! There be dragons here!
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```

REVEALED ERRORS

2. **CoercionError** while invoking the Ruby function from JavaScript passing the string parameter.



REVEALED ERRORS

How it was fixed:

TruffleRuby team ensured that foreign objects which are foreign strings can be converted to Ruby strings.

FUTURE WORK

- Java database manager
- Front-end revision

WHAT WAS CONSIDERED

- GraalVM allows developers to run their applications written in Java, JavaScript, Ruby, Python and R languages on JVM.
- GraalVM performs highly effective optimization and provides good performance for also for interpreted languages.
- MemeGen web-application is aimed to create use-cases for this technology.
- During development some bugs and errors were revealed.
- The application will be developed further (Java database connectors will be introduced).