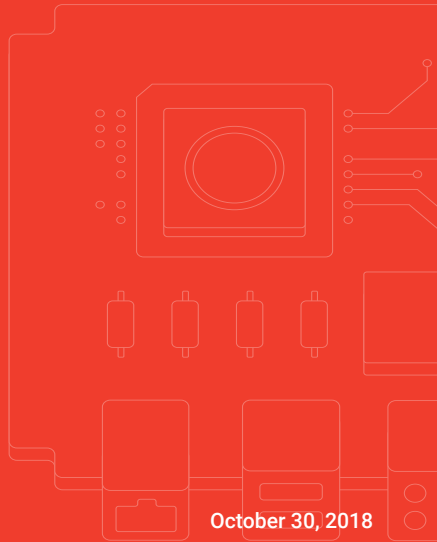# Programming languages: Choices for OpenWrt
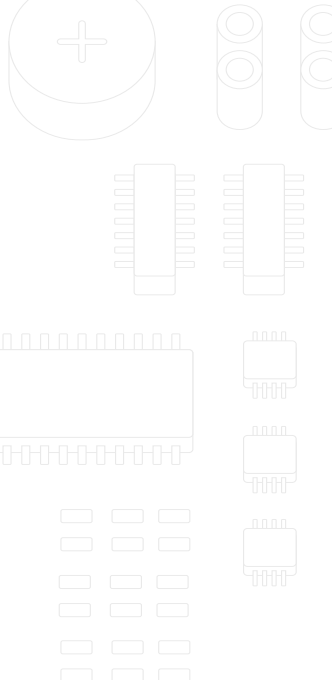
Mislav Novaković
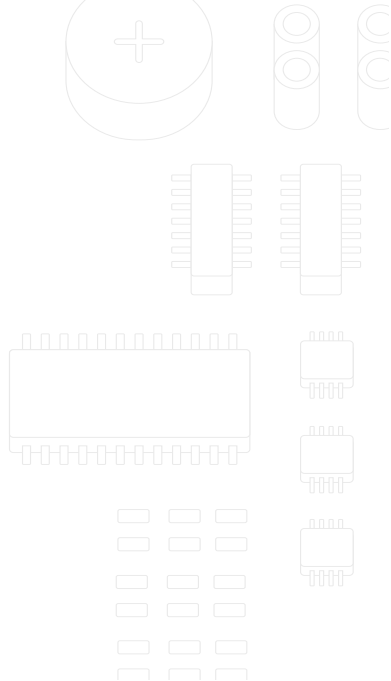
sartura

October 30, 2018

Motivation

- What is the best language for prototyping in OpenWrt?
- Finding the optimal solution between:
  - Constraints of embedded devices
  - Speed of development
- Where to start?
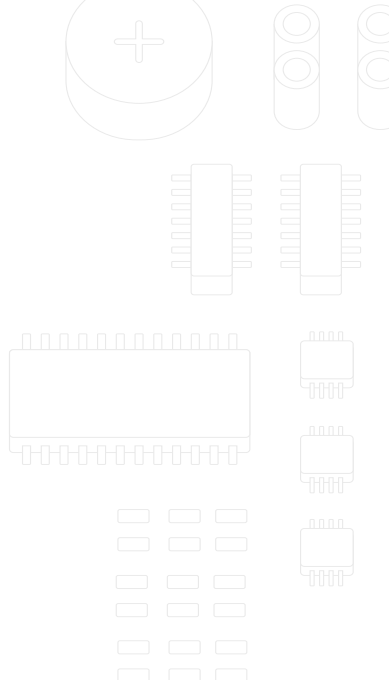- Code samples used from Rosetta

Build setup

- OpenWrt feed:
  - github.com/sartura/languages_feed
- Dockerfile:
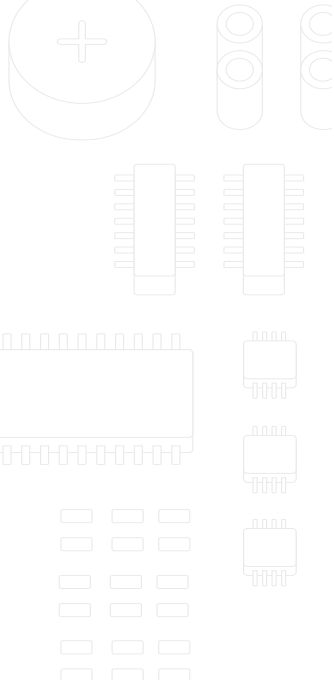 - github.com/sartura/languages_feed_dockerfile

C/C++

- Imperative (OO), low-level language
- Integrated with OpenWrt and Linux kernel
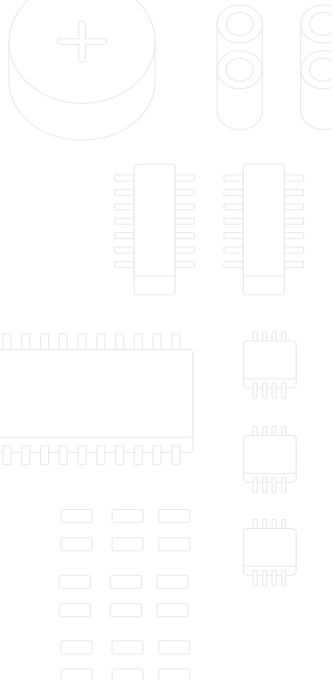- C++ support
- Cross-platform support

SWIG

- High-level wrapper for C/C++ (www.swig.org)

- Python, Lua, Go, Perl, PHP and Ruby

- Better results with C++
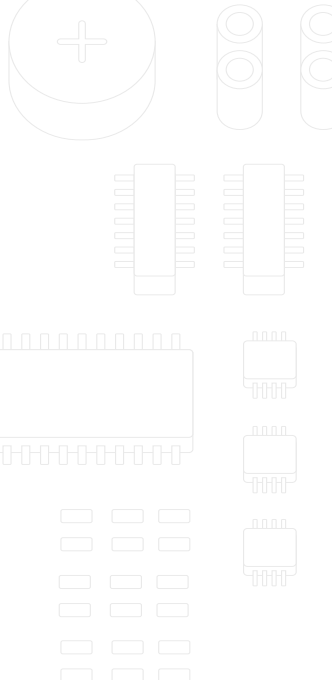
- Sysrepo OpenWrt package

Python

- Imperative, procedural, OO language
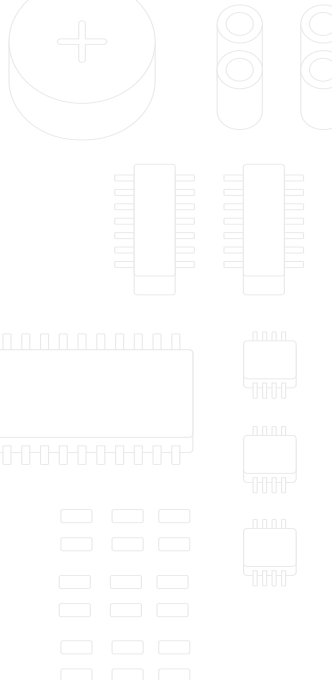- Python 2 & 3
- 250+ packages
- Good C integration

Lua

- Lightweight embedded language
- Lua 5.1
- 40+ packages
- UCI and LuCI
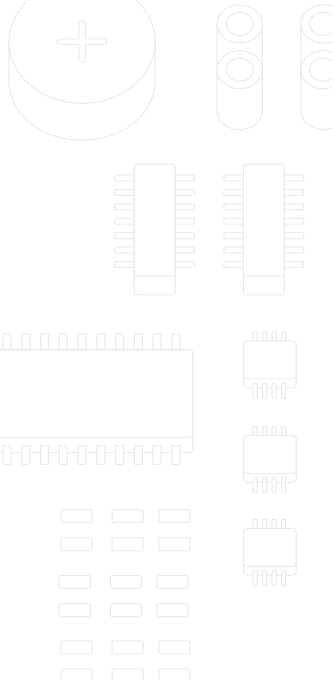- Good C integration

GoLang

- Compiled, statically typed language (C-like)
- Go 1.10.3
- 5+ packages
- MIPS not fully supported
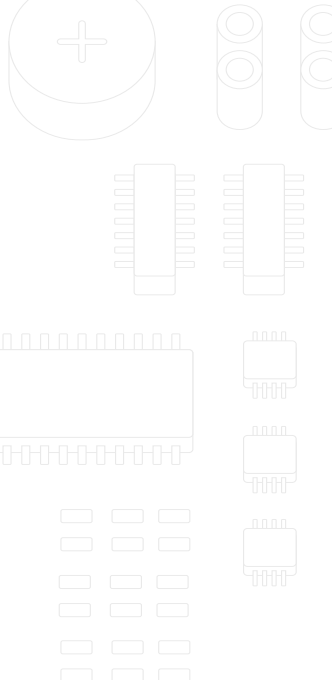- Large binary size

Rust

- System, imperative, procedural language
- Cross-compiled
- MIPS not fully supported
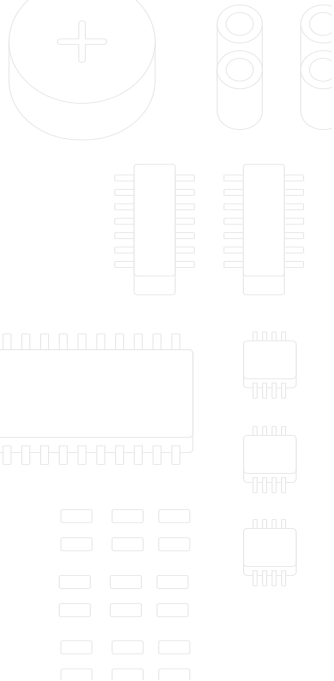- Good default binary size

Nim

- Imperative, compiled language
- Cross-compiled
- Compiles to C/C++, Objective-C or JavaScript
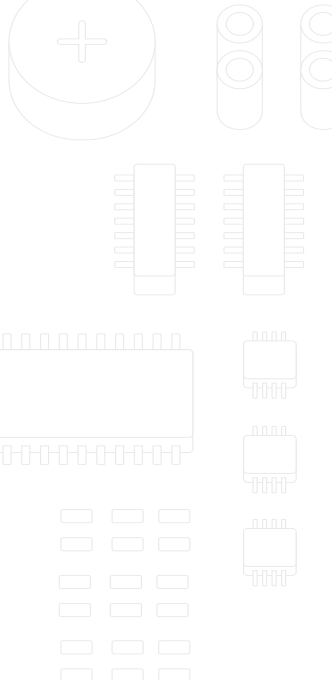- Good default binary size

Node.js

- JavaScript run time environment
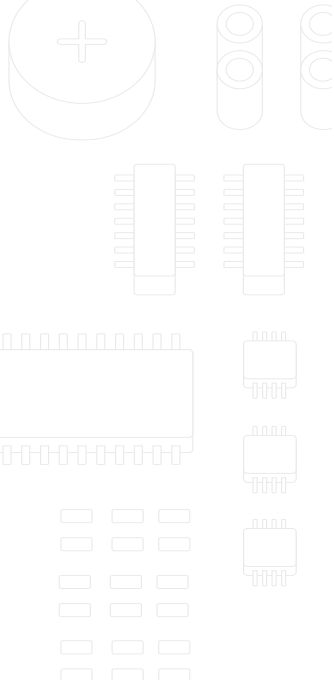- Node.js 8.11.3
- 10+ packages

Perl

- Interpreted, dynamic language
- Perl 5
- 200+ packages

PHP

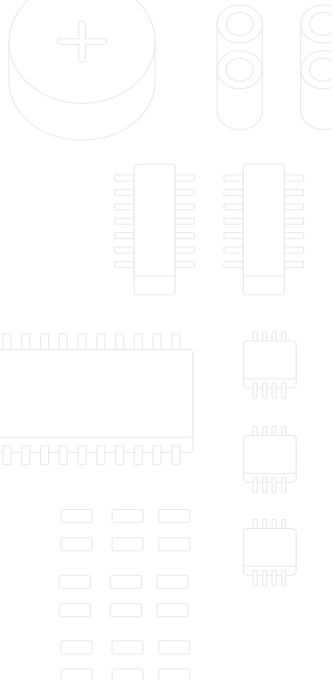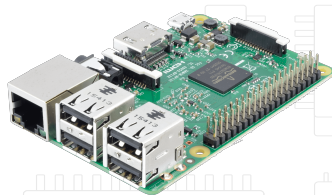- Server-side scripting language
- PHP 7
- 50+ packages

Ruby

- Dynamic, interpreted, OO language
- Ruby 2.5
- 50+ packages

Used boards

- Raspberry Pi 3
- ClearFog Base
- ARM + musl (cross-compiling)
- Built & tested on beginning of October 2018

Binary sizes

Language	Binary size
C	4.2 Kb
C++	4.2 Kb
Nim	64.1 Kb
Rust	484.3 Kb
Go	3432.5 Kb

Library sizes

- Size of additional libraries used for scripting languages (rough measurements)

Language	Library size
Python	17152 Kb
Node.js	12476 Kb
Ruby	4808 Kb
PHP	3380 Kb
Perl	2824 Kb
Lua	364 Kb

Performance

```
$ httperf —port=80XX --server IP --num-conns=10000
```

Language	Result
Perl	1326.6 req/s
C++	1320.8 req/s
C	1299.1 req/s
Nim	1052.1 req/s

PHP	765.8 req/s
Go	763.0 req/s
Rust	586.5 req/s
Node.js	472.2 req/s
Lua	455.5 req/s
Ruby	132.3 req/s
Python	102.4 req/s

Programming languages: Choices for OpenWrt

mislav.novakovic@sartura.hr · info@sartura.hr · www.sartura.hr