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Build a Serverless WebAssembly App in Python using Spin

Sohan Maheshwar

Lead Developer Advocate @ Fermyon

The next wave of cloud compute will be powered by WebAssembly

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What is it?
How and when to use it?
How will this change everything?

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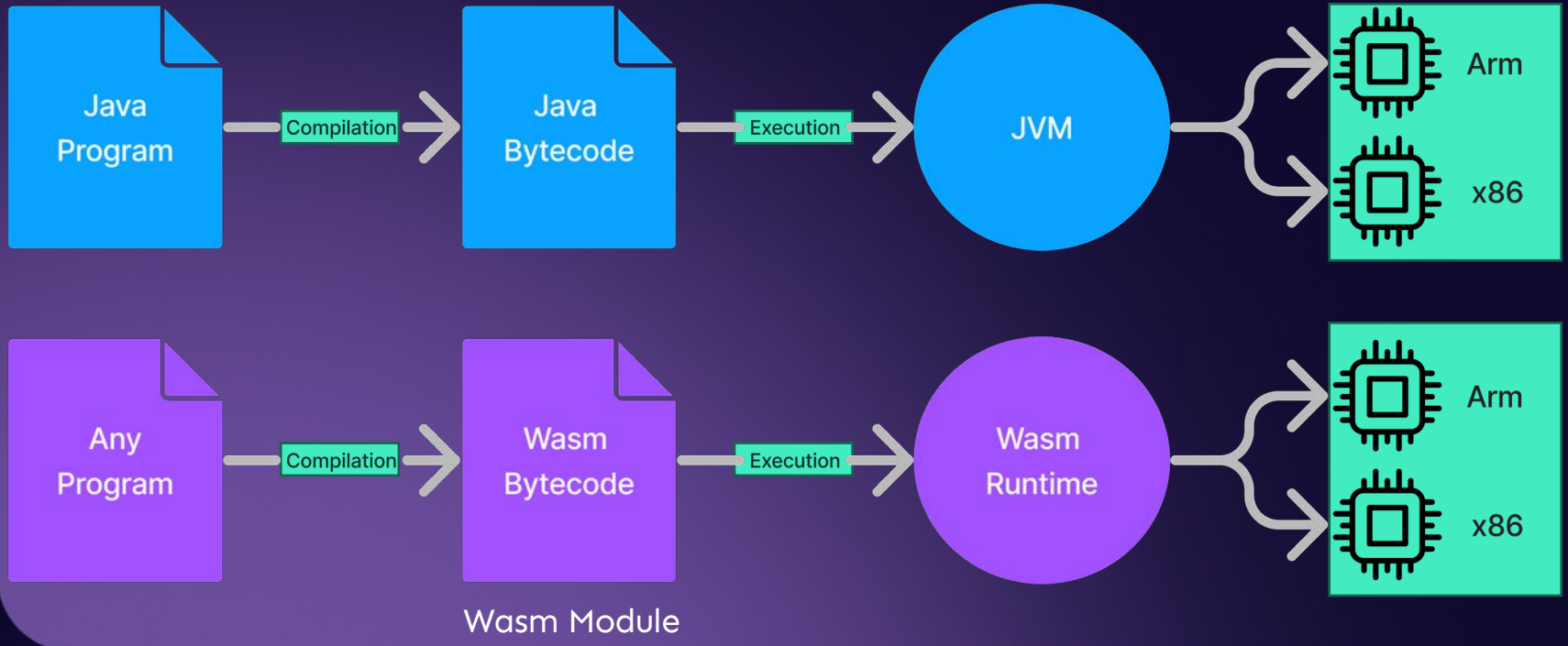
What Is WebAssembly?

The boring answer: It's just another bytecode format

A few things to know about WebAssembly

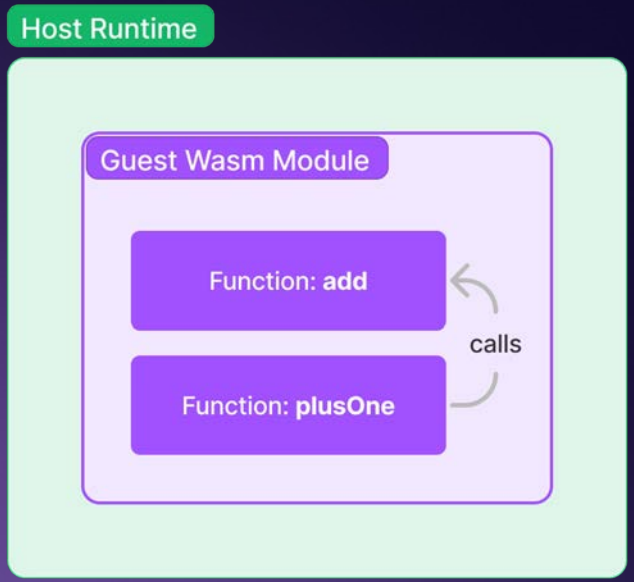
- Wasm is just another name for it
- Designed as a portable compilation target

Wasm is another bytecode format

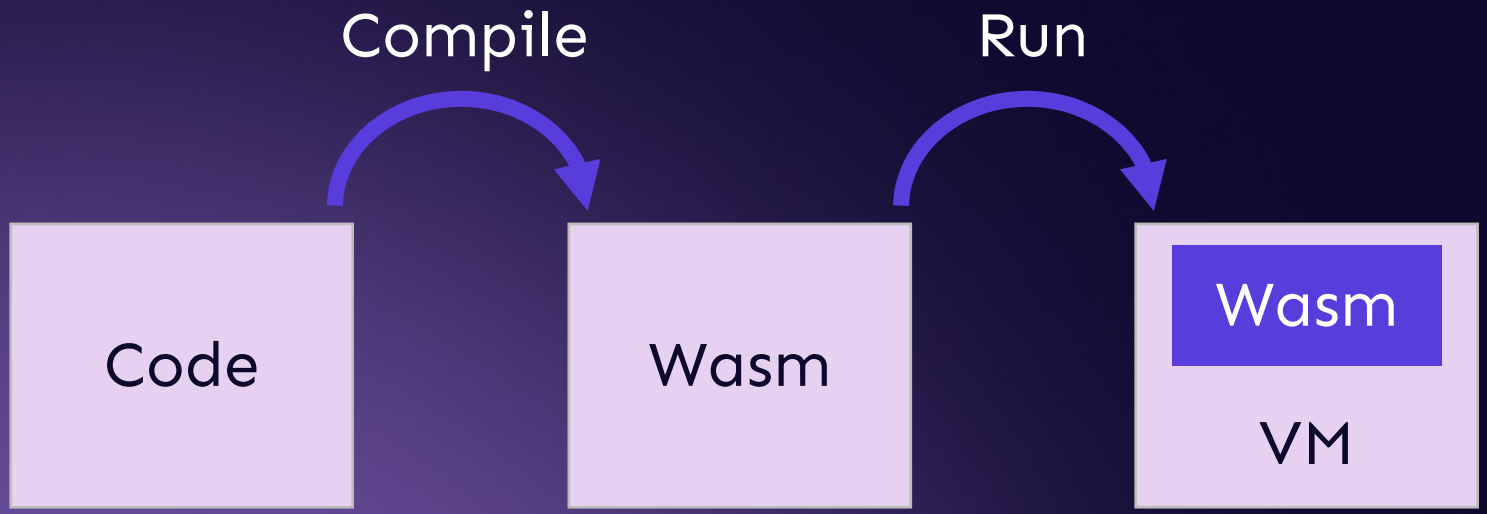


A few things to know about WebAssembly

- Wasm is just another name for it
- Designed as a portable compilation target
- Originates from the browser, now also available outside
- "compile once" and then run that code on any number of targets


Host Runtime
Guest Wasm Module
Function: add
Function: plusOne
calls

Compile and Run



WASI: A new kind of System Interface

TL;DR: it allows you to run WebAssembly outside of the browser

- Access to several operating-system-like features, including files and filesystems, clocks, and random numbers
- Independent of browsers, so it doesn't depend on Web APIs or JS
- It extends Wasm's sandboxing to include I/O.

Compilation and Language Support

WebAssembly Support in Top 20 Languages

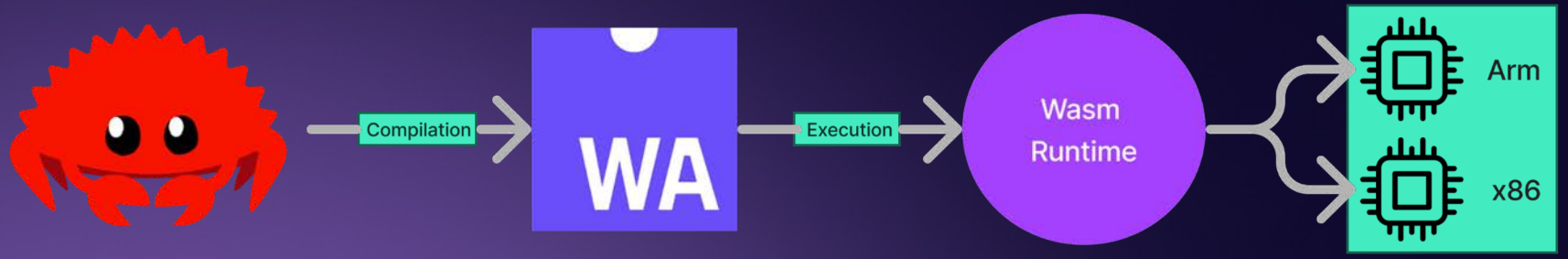
This reports on the top 20 languages from RedMonk's ranking. Some languages, like CSS, PowerShell, and "Shell", don't really have a meaningful expression in Wasm. However, we have left them here for completeness.

Language	Core	Browser	WASI	Spin SDK
JavaScript	✅	✅	⏳	✅
Python	✅	⏳	✅	✅
Java	✅	✅	✅	⏳
PHP	✅	✅	✅	❌
CSS	N/A	N/A	N/A	N/A
C# and .NET	✅	✅	✅	✅
C++	✅	✅	✅	❌
TypeScript	✅	⏳	❌	✅
Ruby	✅	✅	✅	❌

https://www.fermyon.com/wasm-languages/webassembly-language-support/

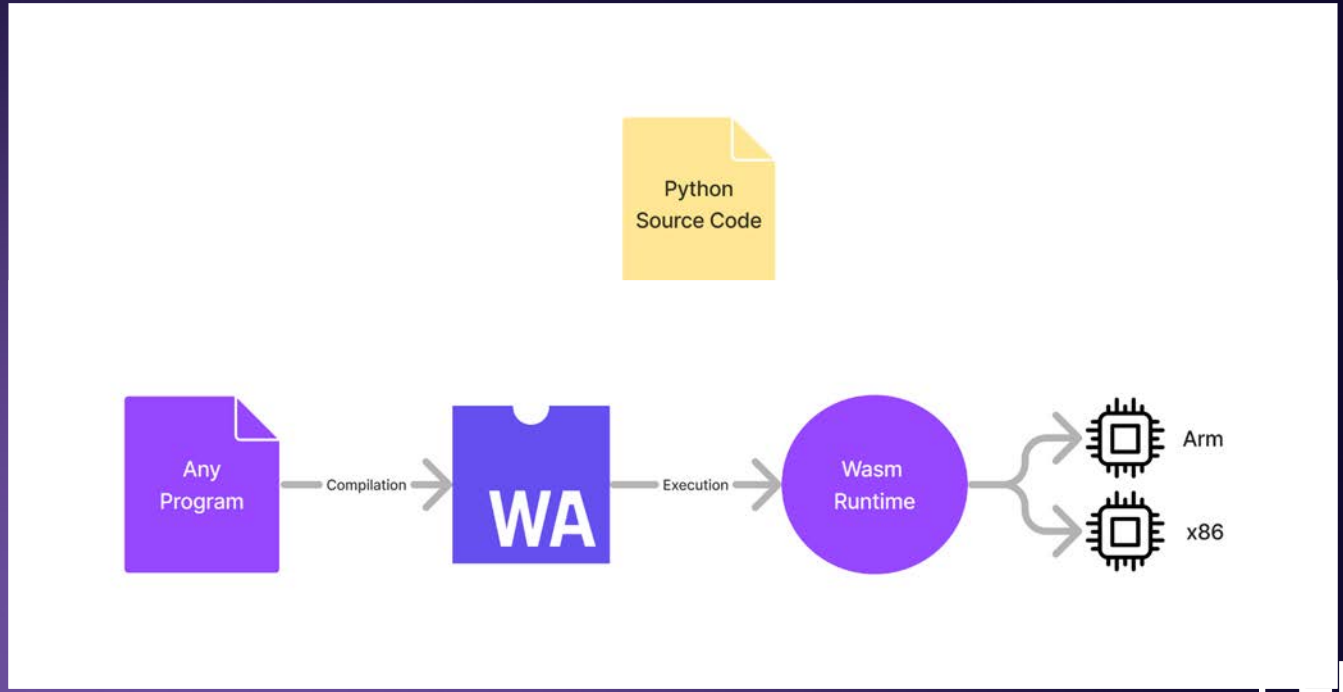
How do I compile my code to Wasm?

Rust has great Wasm support



Interpreted languages are a little more tricky

You need to compile the interpreter to Wasm



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Getting started with Wasm

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Introducing Spin

- The open-source tool for building WebAssembly serverless apps
- Create a new serverless with just a few commands.

https://developer.fermyon.com/spin

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The framework to compose serverless WebAssembly apps.

OPEN SOURCE

15+ LANGUAGES

4.6K GITHUB ★

SIMPLE CLI

github.com/fermyon/spin

SPIN

Spin is an open source project, built with open standards like WASI, Wagi and the WebAssembly Component Model.

AT A GLANCE:

Serverless AI NEW

Quickly test and run inferencing workloads with LLMs.

Key/Value Store

Easily persist data in your apps with a built-in KV store.

Powerful CLI

Easy to create, run and deploy projects - in as little as 66 seconds.

NoOps SQL Database

Add SQLite data to your app with an always-available SQLlite DB.

COMPOSING APPS:

- HTTP & Redis Triggers
- Relational Database Support
- Variables & Secrets Rotation

DEV EXPERIENCE:

- Supports almost any programming language
- Easy to debug with included helper commands

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DEMO

developer.fermyon.com/spin

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4 things making WebAssembly great

Binary Size

Rust hello-world ~2MB

AOT compiled ~300KB

Basic Spin http api
~2.3MB JIT
~1.1MB AOT

*https://00f.net/2023/01/04/webassembly-benchmark-2023/

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Startup Time

Startup times comparable with natively compiled code

Only 2.3x slower than native*

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Portability

Build once, run anywhere!

Same build (JIT) works across OS and platform arc

Security

Sandboxed execution

Capability based security model

*https://00f.net/2023/01/04/webassembly-benchmark-2023/

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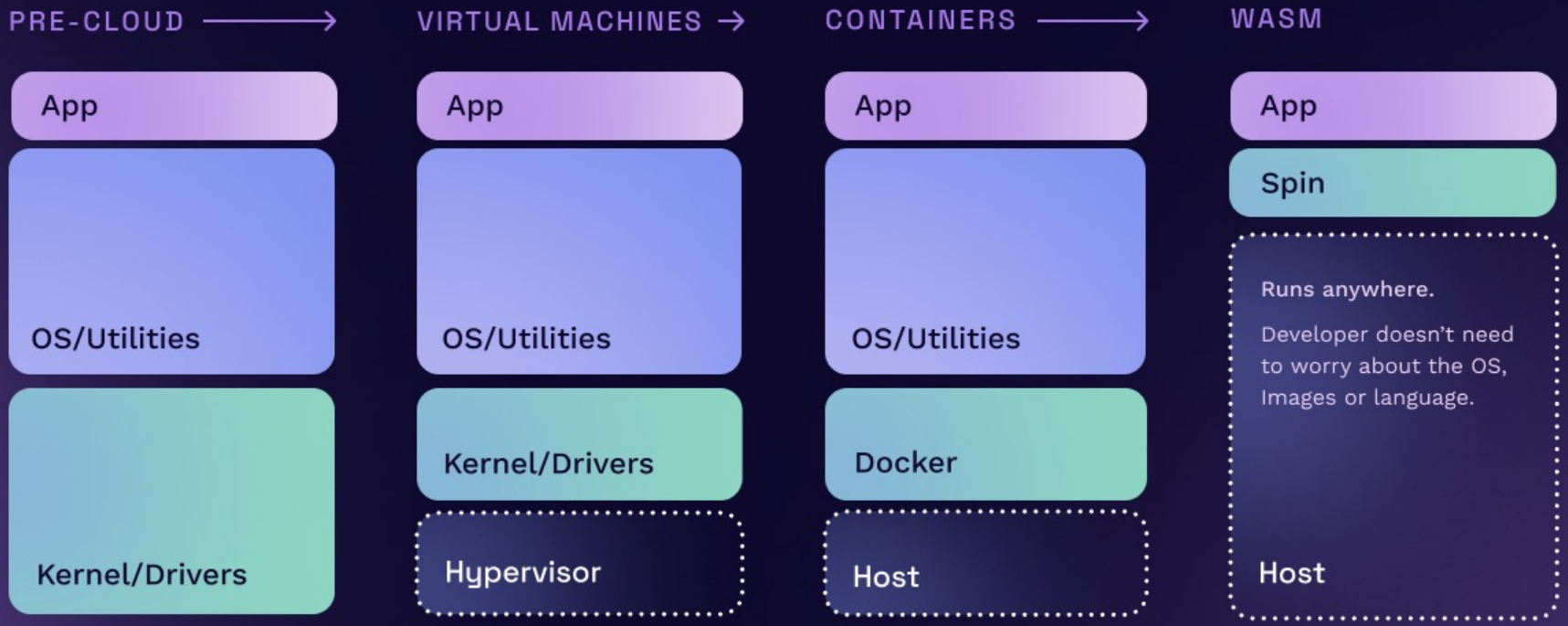
How this will change cloud computing

Gradually, then suddenly

How cloud computing has evolved:



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No more clunky containers

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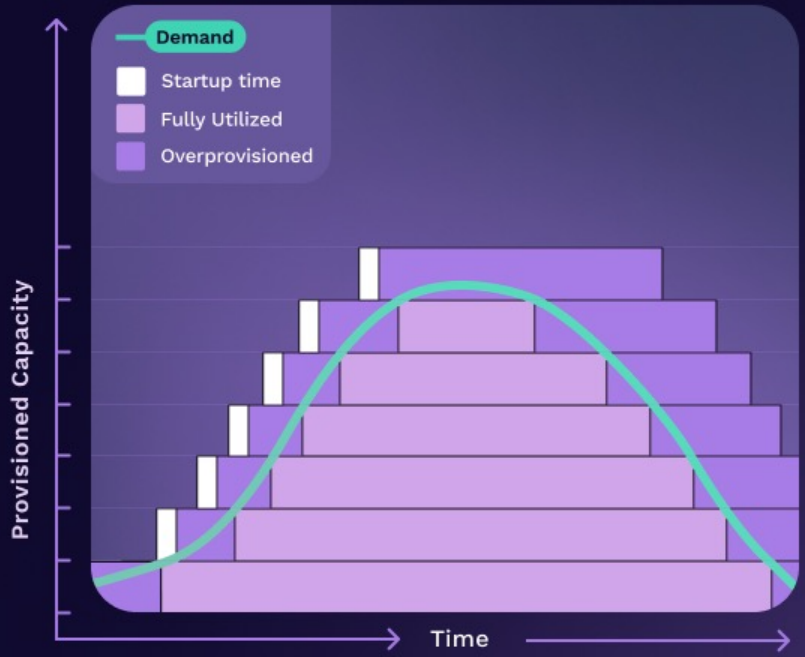
PAIN POINT

Containers are too expensive, over-consuming resources.

[A]cross 50 of the top public software companies currently utilizing cloud infrastructure, an estimated **$100B of market value is being lost** among them due to cloud impact on margins [...]

Source: https://a16z.com/the-cost-of-cloud-a-trillion-dollar-paradox/



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Fix serverless

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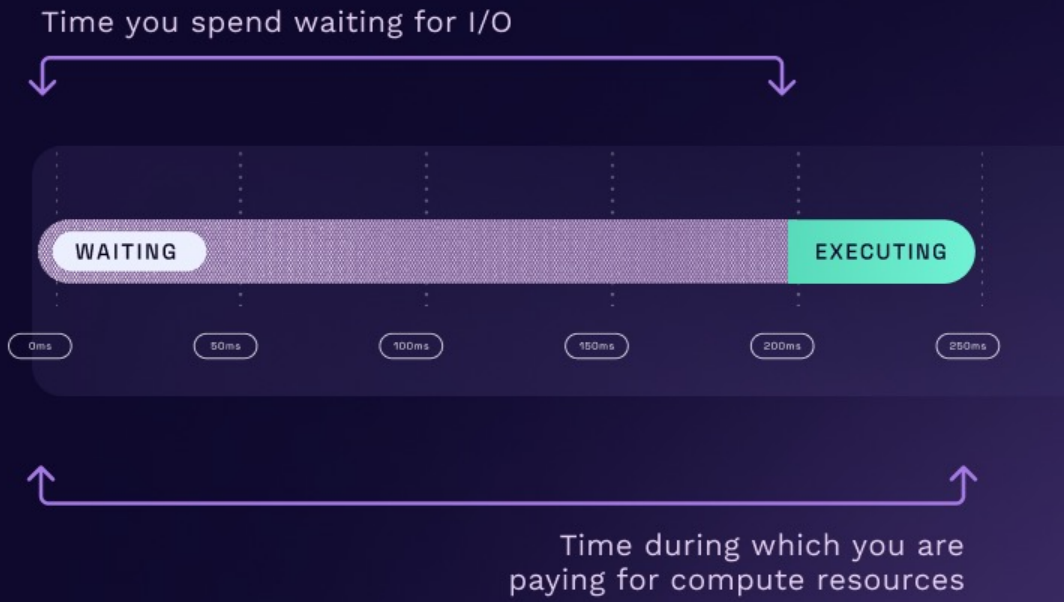
PAIN POINT

Serverless has a Cold Start problem.

Solutions like AWS Lambda frequently take 2-3 seconds to wake up and start executing. Often the startup delay is orders of magnitude longer than the execution time itself, requiring complex and expensive workarounds.



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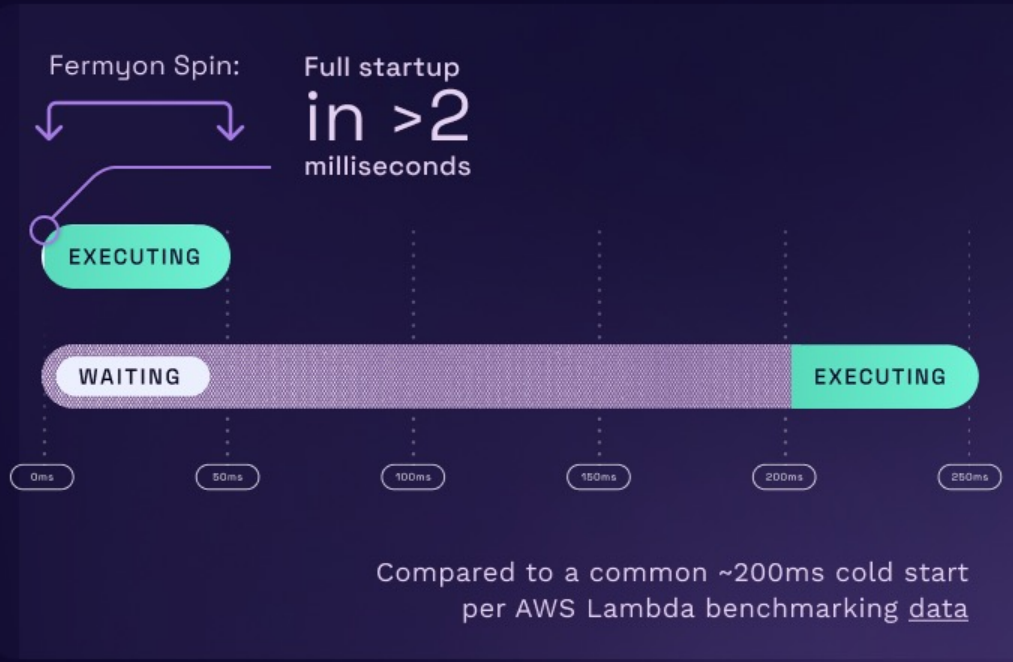
WHY FERMYON

Cold Starts become a thing of the past.

With WebAssembly's small size and fast start-up time, we're able to cold-start a module on every execution (within a millisecond in Spin), so it is not a problem to completely startup, execute and shutdown within the span of every request.



Compared to a common ~200ms cold start per AWS Lambda benchmarking data

DEMO

fermyon.com/serverless-ai

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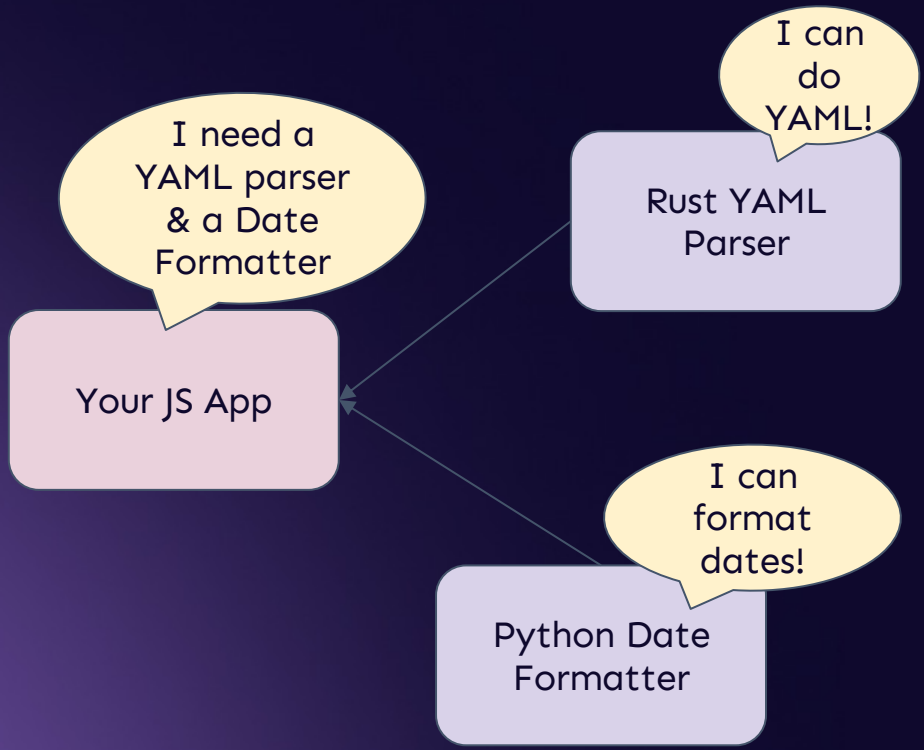
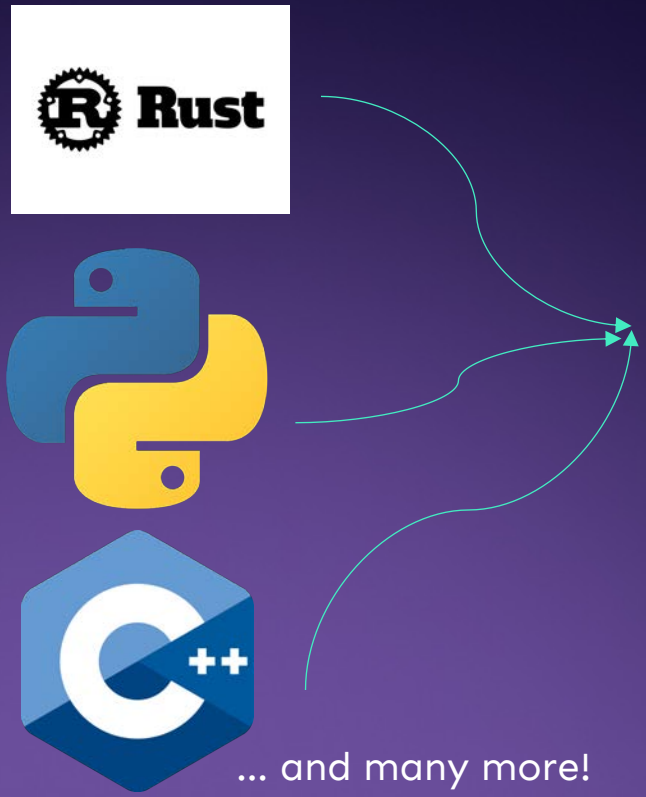
Component Model

- Write code in whatever language you want
- Use libraries from all over without even knowing what language they were written in!
- Wasm will take care of the rest.



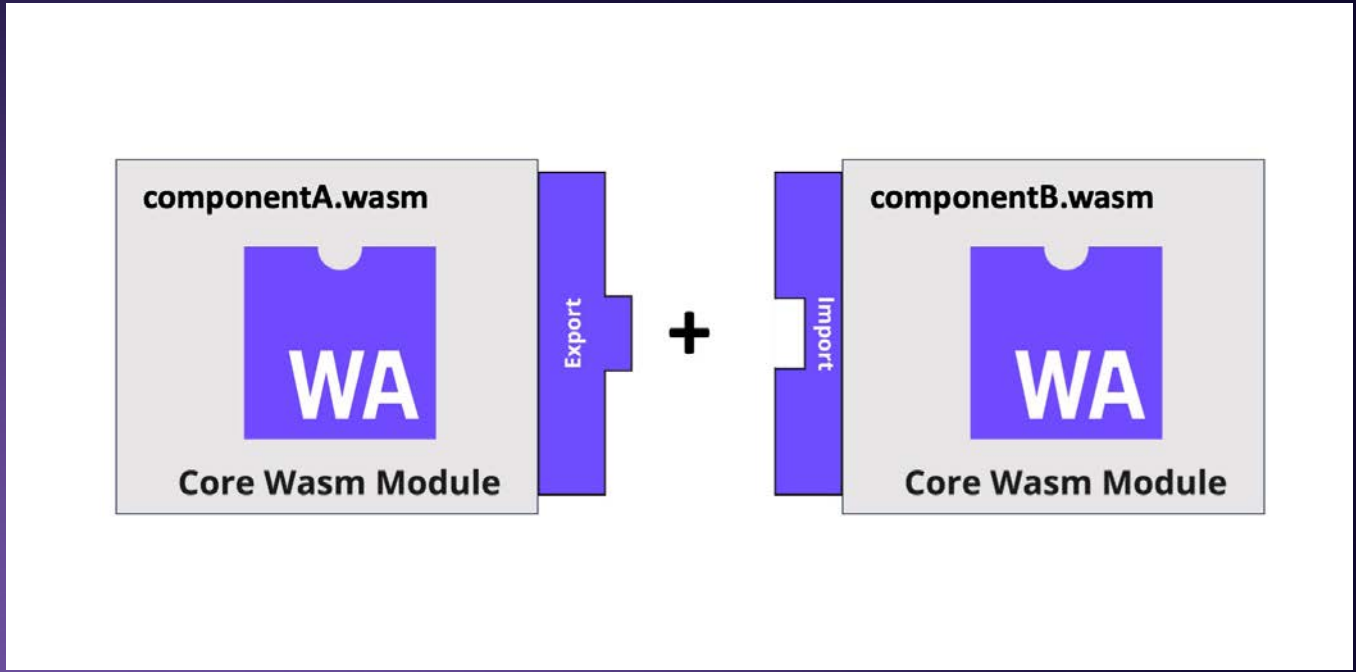
Wasm Module



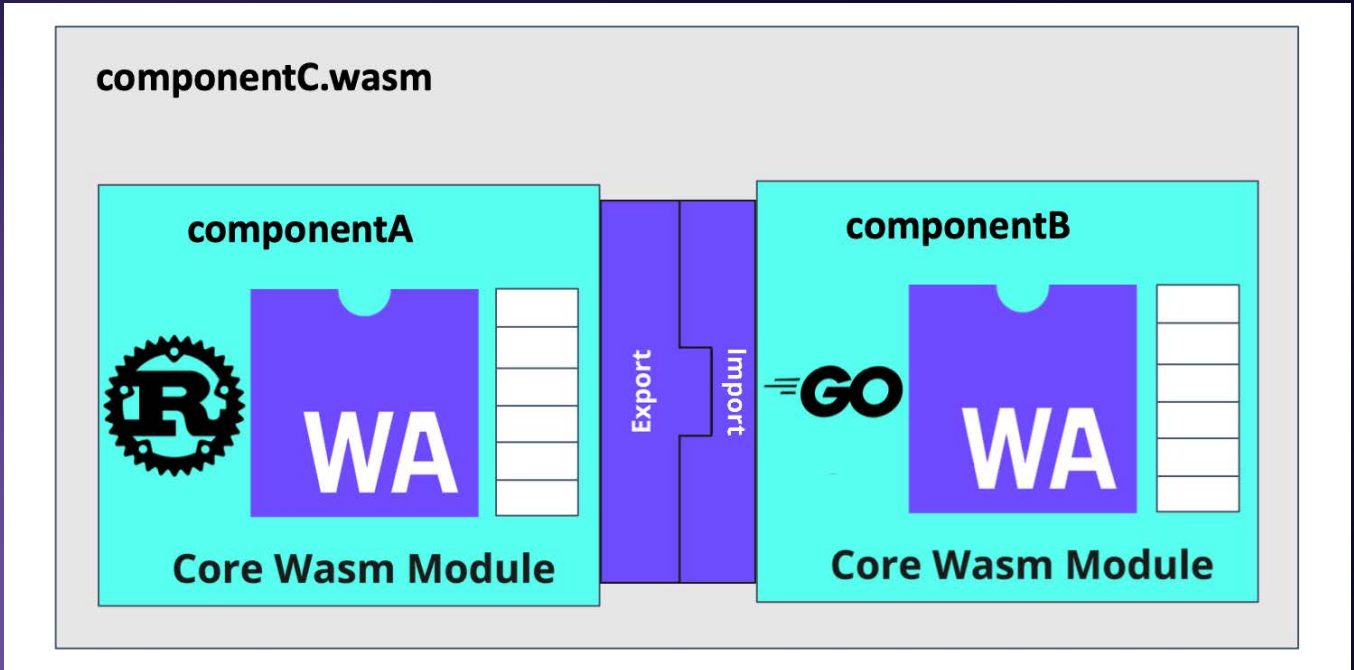
Core Wasm Module

- Portable
- Small .wasm
- Isolated
- Fast Startup
- Open Standard
- Polyglot

Composing Applications



Composing Applications



componentize-py

- Tool to convert a Python application to a WebAssembly component.
- It takes the following as input:
  - a WIT file or directory
  - the name of a WIT world defined in the above file or directory
  - the name of a Python module which targets said world
  - a list of directories in which to find the Python module and its dependencies

github.com/bytecodealliance/componentize-py

Join our Discord server!

Check out Spin!

Thank You!

linkedin.com/in/sohanmaheshwar/

developer.fermyon.com

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