



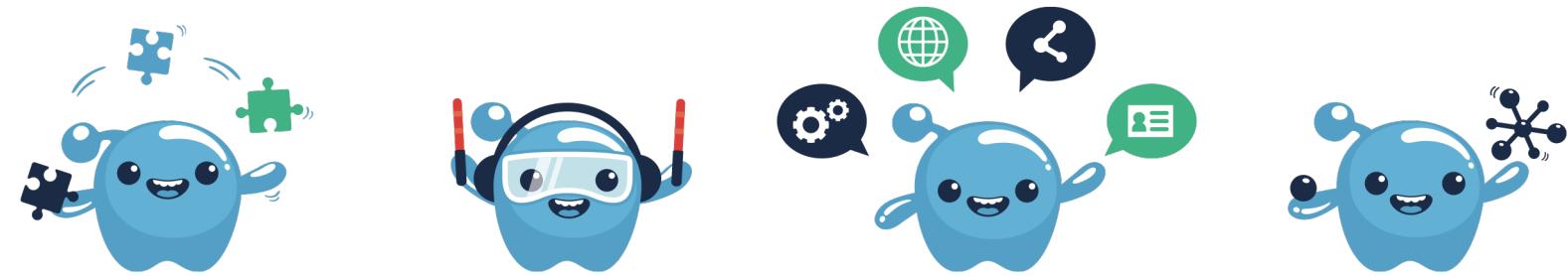
solo.io

Developing & Debugging WebAssembly Filters

Idit Levine & Yuval Kohavi



Idit Levine | Founder & CEO, Solo.io



Yuval Kohavi | Chief Architect, Solo.io

Istio Adoption with Gloo Mesh

Crawl



Upstream Istio support (24 X 7)
LTS (N - 3)
FIPS, ARM
Tech Advisory

Walk



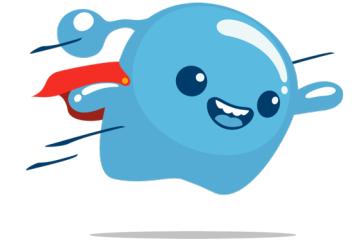
Developer portal
API Gateway
Security (EW)
Observability
Zero-trust

Run



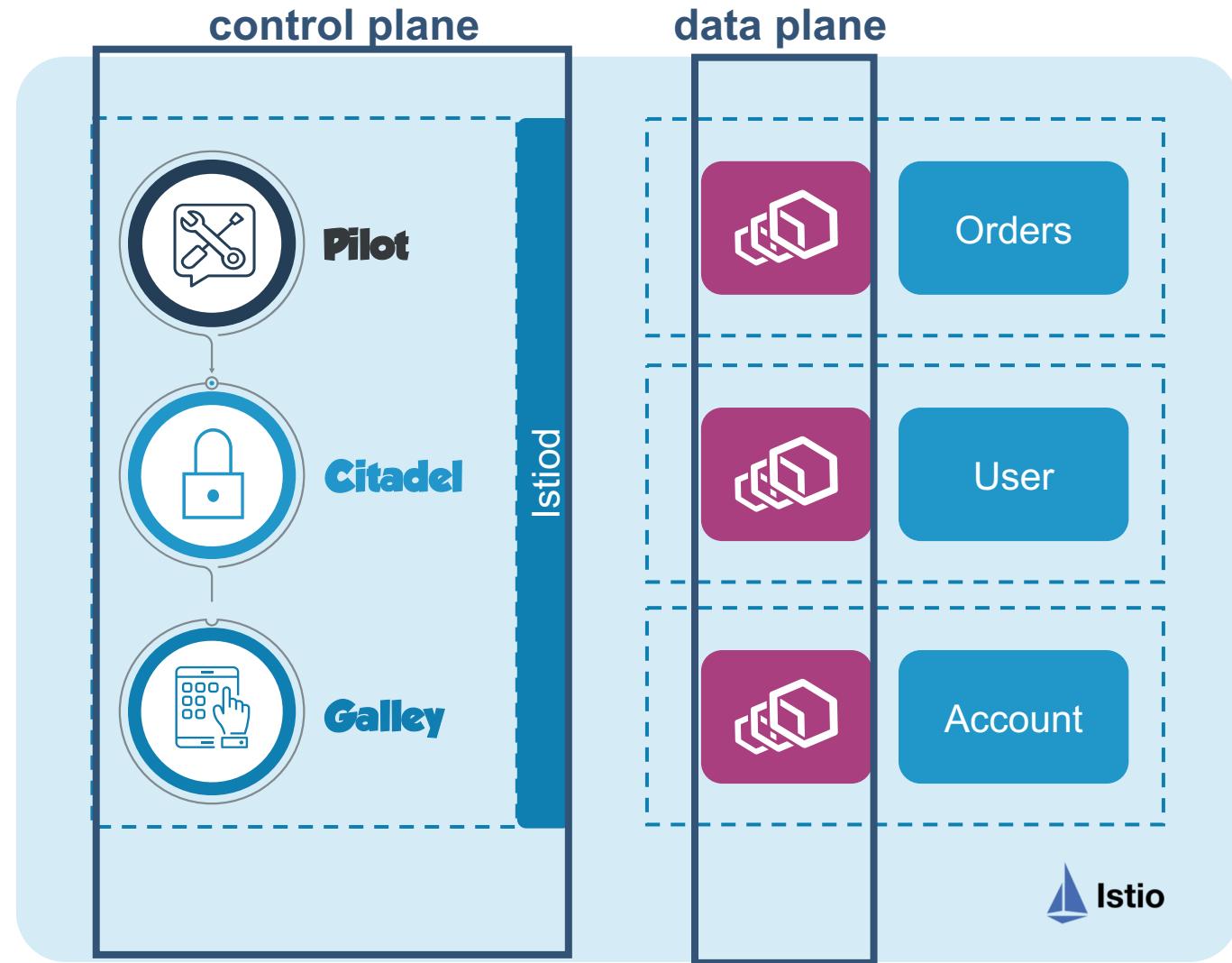
Approval Processes
Rollback
Delegation
WASM

Fly

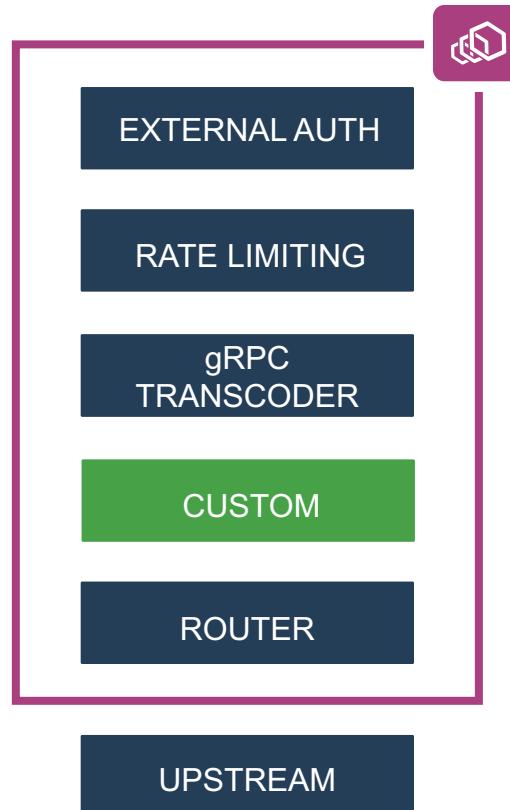


Multi Cluster
Global Service
Failover
Multi Mesh

Understanding Istio: Control and data planes



Extend Envoy Proxy with Filter



Build Custom Envoy Filter

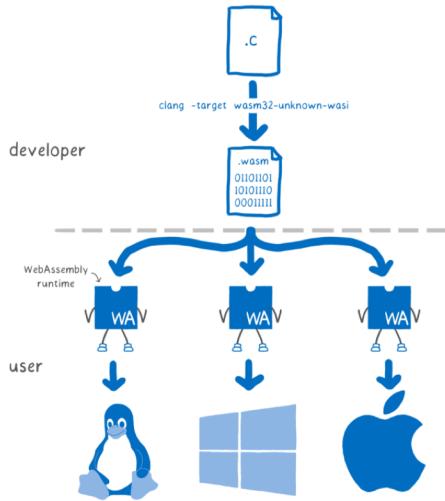
Develop: Envoy Filters are written in C++ Async

Build: need to recompile and maintain a build of Envoy

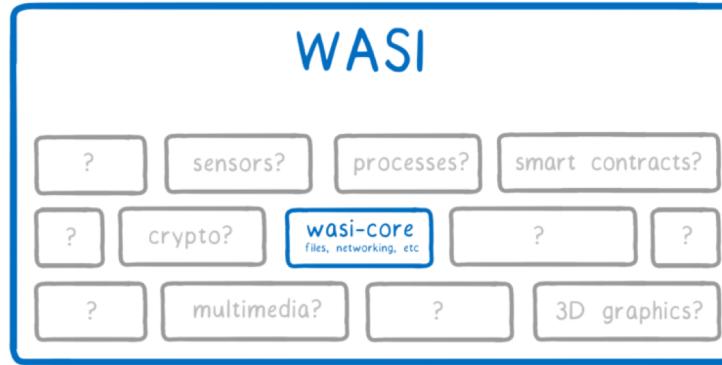


Web Assembly

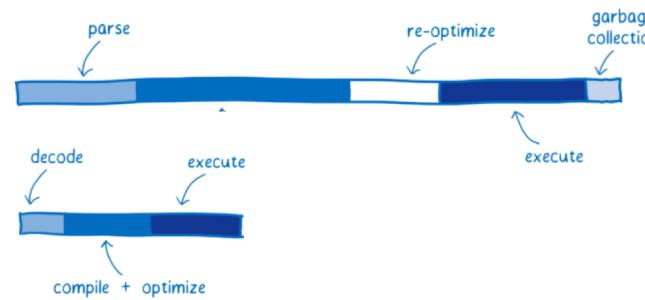
Portable



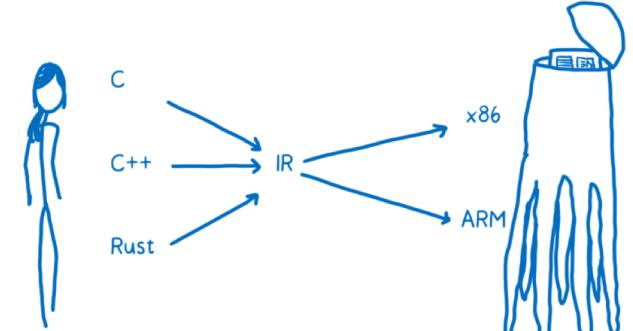
Outside the Web



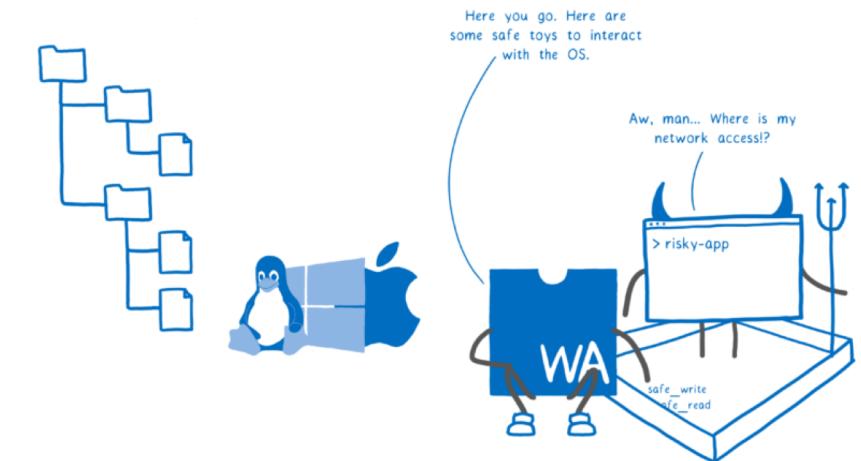
Fast



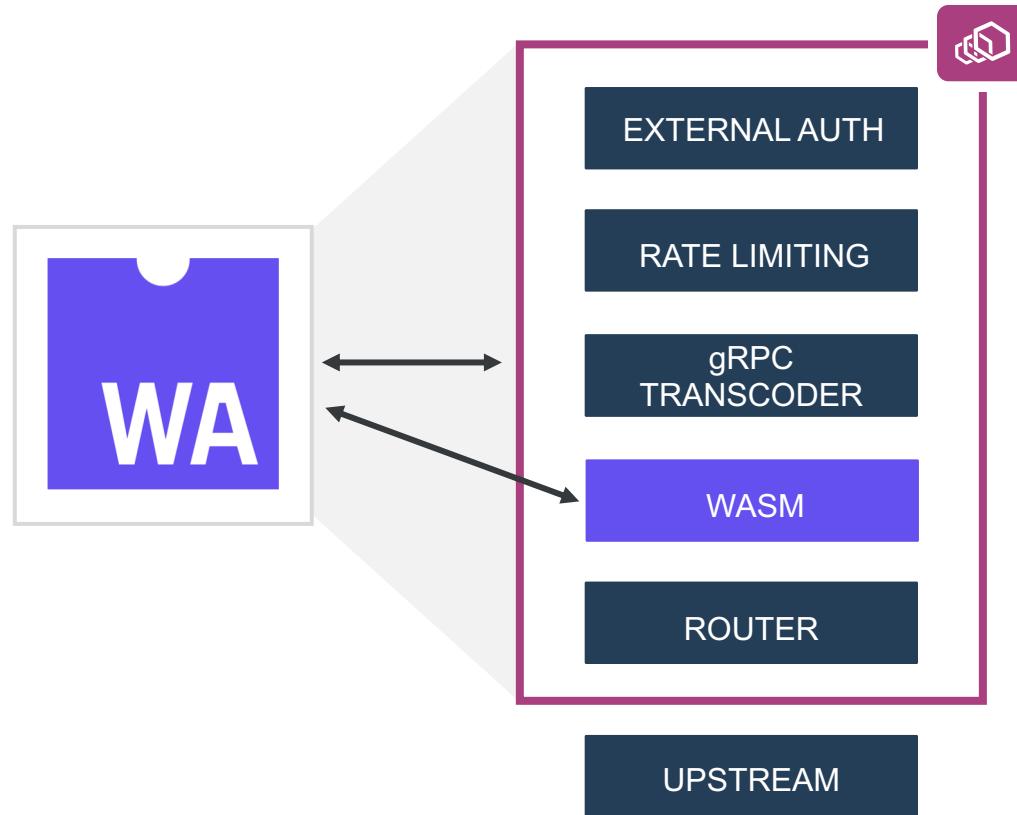
Any Language



Secure



Extend Envoy Proxy with Web Assembly (Wasm)



Why WebAssembly?

Polyglot: Envoy Filters are written in C++ and Wasm expands to any language

Secure and Reliable: Wasm runs in isolated VM, can dynamically update w/o Envoy restarts, no hard dependencies or cascading failures

Speed: Near native performance

Sustainable: Eliminates need to recompile and maintain a build of Envoy

User Experience



Solomon Hykes @solomonstre · Mar 27, 2019

If WASM+WASI existed in 2008, we wouldn't have needed to created Docker. That's how important it is. Webassembly on the server is the future of computing. A standardized system interface was the missing link. Let's hope WASI is up to the task!



Lin Clark @linclark · Mar 27, 2019

WebAssembly running outside the web has a huge future. And that future gets one giant leap closer today with...



Announcing WASI: A system interface for running WebAssembly outside the web (and inside it too)

[hacks.mozilla.org/2019/03/stand...](https://hacks.mozilla.org/2019/03/standalone-wasi/)

[Show this thread](#)

34

745

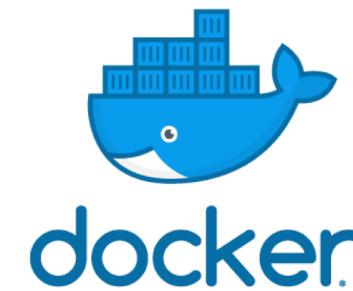
1.7K



Technology



User Experience

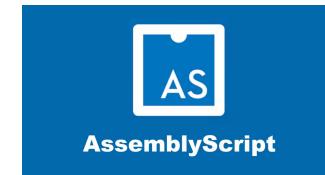


Web Assembly lifecycle



Build

ABI: Application Binary Interface



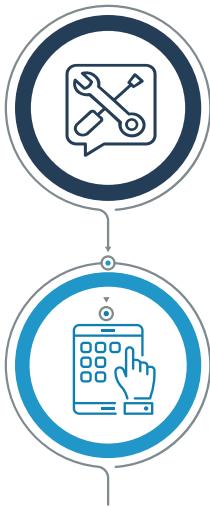
HTTP (L7) extensions

`proxy_on_http_request_headers`

- params:
 - `i32 (uint32_t) context_id`
 - `i32 (size_t) num_headers`
 - `i32 (bool) end_of_stream`
- returns:
 - `i32 (proxy_action_t) next_action`

Called when HTTP request headers are received from the client. Headers can be retrieved using `proxy_get_map` and/or `proxy_get_map_value`.

```
> meshctl wasm init addheader-filter --language rust
> meshctl wasm build rust -t
webassemblyhub.io/yuval/addheader-rust:v1 ./addheader-filter
```



Build

Store

Explore Extensions

AWS Lambda
By Solo.io
Latest Version: 0.12.0

Transform request to look like a lambda API call.

Inja Transformation
Latest Version: 0.12.0

Transform your request using Inja templates

WebApplication Firewall
By Solo.io
Latest Version: 0.12.0

This module extends envoy to support detecting and rejecting incoming malicious traffic.

Coming Soon!

Filters

Filter by name...

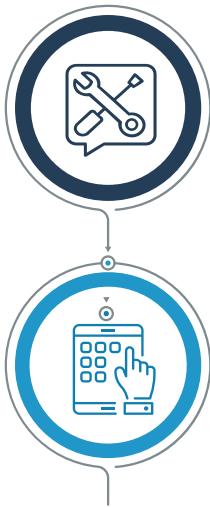
Category

Transformation Metrics Security Serverless Routing Observability

Projects

Gloo Istio Envoy

```
> meshctl wasm push webassemblyhub.io/yuval/addheader-rust:v1
```



Build
Store

WASM Artifact Image Specification

```
[
  {
    "mediaType": "application/vnd.module.wasm.config.v1+json",
    "digest": "sha256:d0a165298ae270c5644be8e9938036a3a7a5191f6be03286c40874d761c18abf",
    "size": 125,
    "annotations": {
      "org.opencontainers.image.title": "runtime-config.json"
    }
  },
  {
    "mediaType": "application/vnd.module.wasm.content.layer.v1+wasm",
    "digest": "sha256:5e82b945b59d03620fb360193753cbd08955e30a658dc51735a0fcbe2163d41c",
    "size": 1043056,
    "annotations": {
      "org.opencontainers.image.title": "filter.wasm"
    }
  }
]
```

The following is the runtime config stored as the `application/vnd.module.wasm.config.v1+json` layer:

```
{
  "type": "envoy_proxy",
  "abi_version": "v0-541b2c1155ffffb15ccde92b8324f3e38f7339ba6",
  "config": {
    "root_ids": [
      "add_header_root_id"
    ]
  }
}
```



Hollie Ratke · 5 months ago

Solo.io Borrows OCI Spec to Bundle WebAssembly Modules

Following last year's release of its [WebAssembly Hub](#), Solo.io has released a proposal for a new [WebAssembly \(WASM\) Open Container Initiative \(OCI\) image specification](#) that it says will "define how to bundle WASM modules as OCI images to make it easy to build, pull, publish, and execute."

Solo.io Proposes OCI Format Extension for WASM

September 14, 2020 · containers, kubernetes, oci, OCI specification

by Mike Vizard

Solo.io has launched an initiative to define a format to extend the Open Container Initiative (OCI) image specification to standardize how an image bundles and stores metadata when developers write code using WebAssembly (WASM).

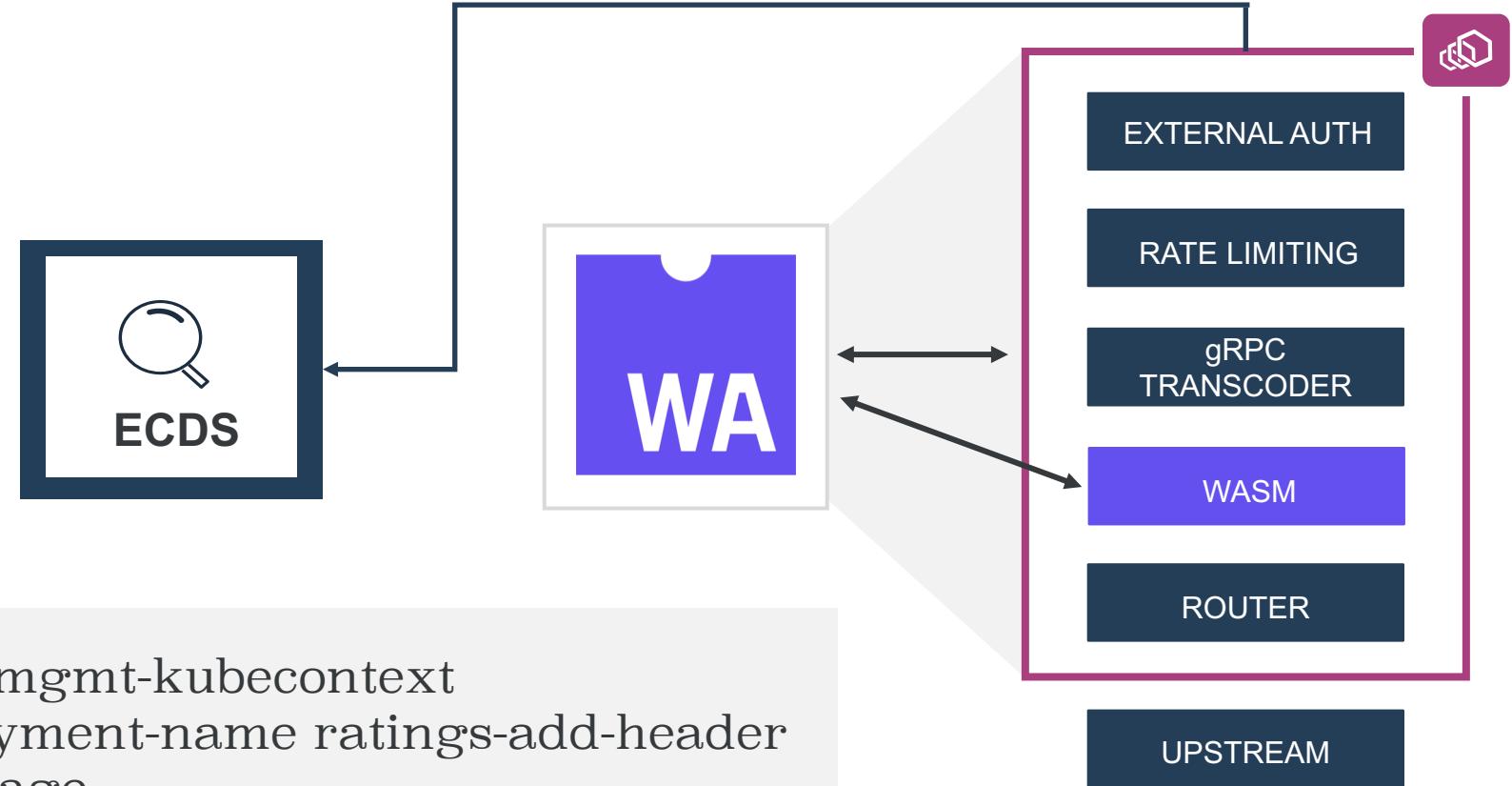
DEVELOPMENT / OPEN SOURCE / SERVICE MESH

Solo.io Borrows OCI Spec to Bundle WebAssembly Modules

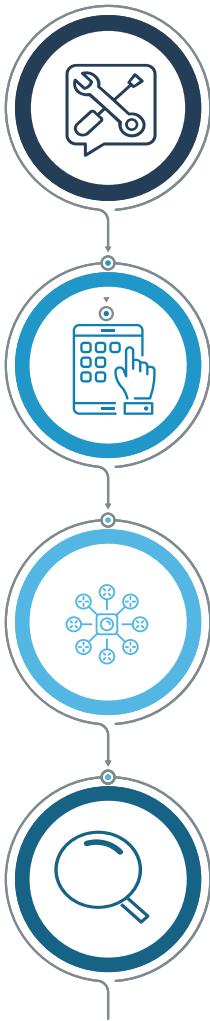
17 Sep 2020 11:02am, by [Mike Melanson](#)



Extension Config Discovery Service



```
> meshctl wasm deploy istio --mgmt-kubecontext
  kind-mgmt-cluster --deployment-name ratings-add-header
  --namespace bookinfo --image
webassemblyhub.io/yuval/addheader-rust:v1
  --cluster mgmt-cluster --labels app=ratings
```

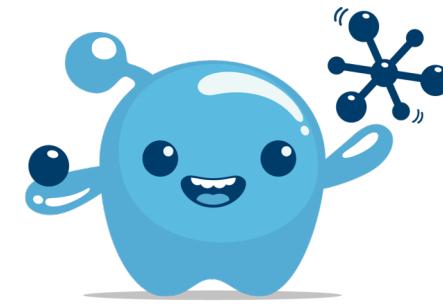


Build

Store

Deploy

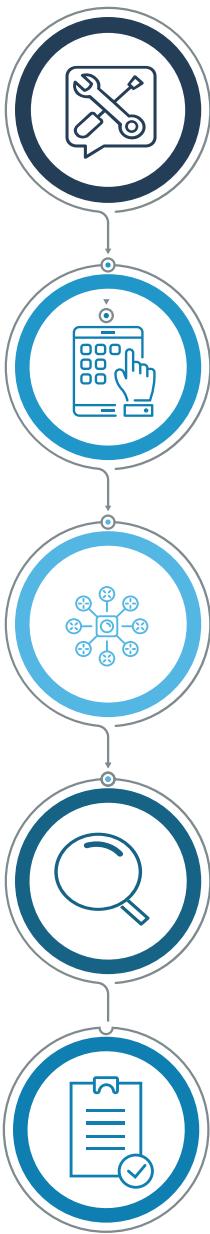
Debug



GlooMesh



```
meshctl wasm debug workloadSelector
```



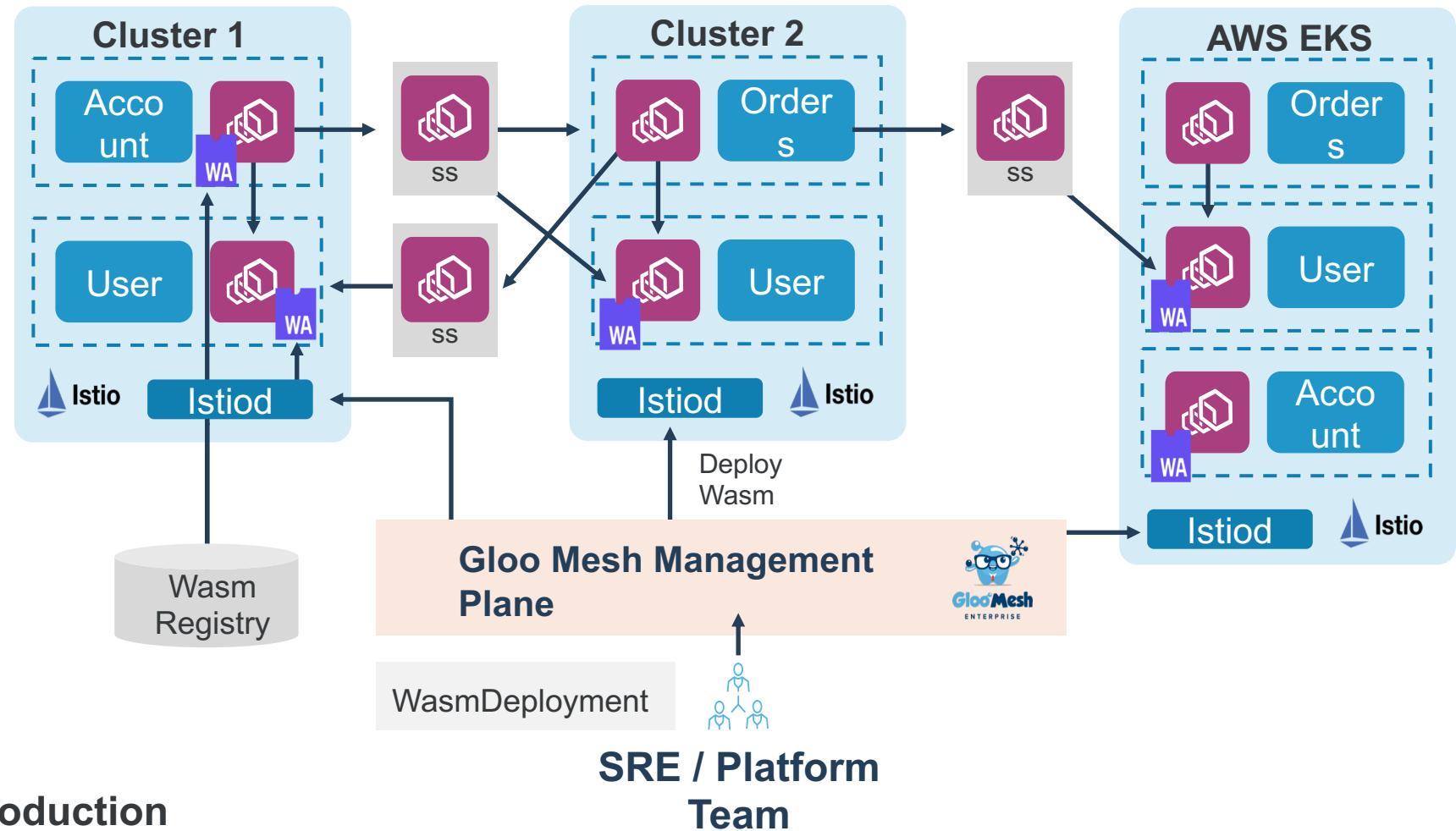
Build

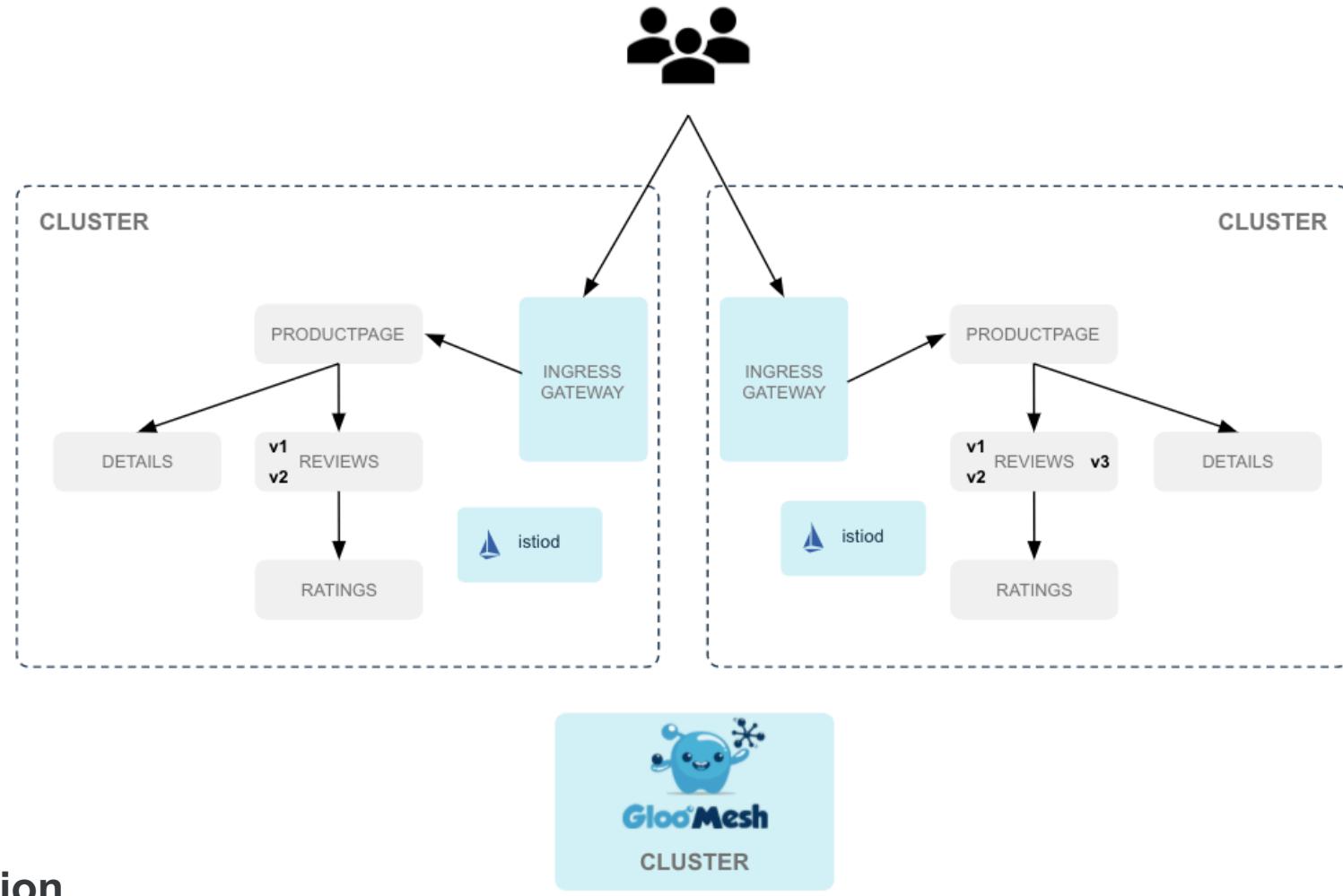
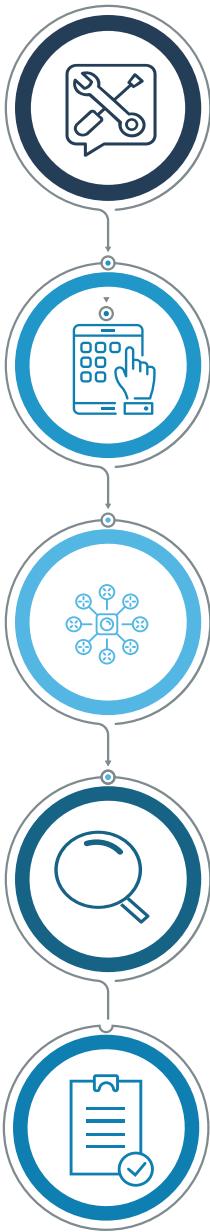
Store

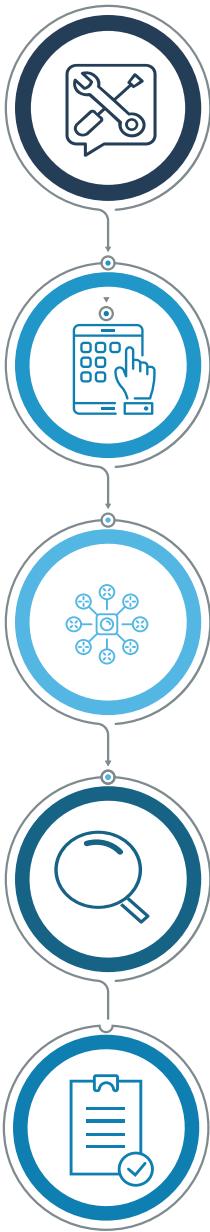
Deploy

Debug

Debug in Production







Build

Store

Deploy

Debug

Debug in Production

Debug Logs Access Logs Metrics

Gloo Mesh

Graph

Find by Name... Hide by Name... Mesh Filter

AWS-Mesh-1
Istio-Mesh-1
Linkerd-Mesh-1
Linkerd-Mesh-2
Namespace Filter
Bookinfo
default
gloo-mesh
gloo-system
istio-system

Graph Feb 4: 09:51:46am - 10:51:46am

Display Last 1 hr Every 15s Refresh

View Legend Replay

details status ●
Has Access Policy
Has Traffic Target

details status ●
Traffic Traces

HTTP request per second:

	Total	% Success	% Error
In	0.01	100.00	0.00
Out	0.00	100.00	0.00

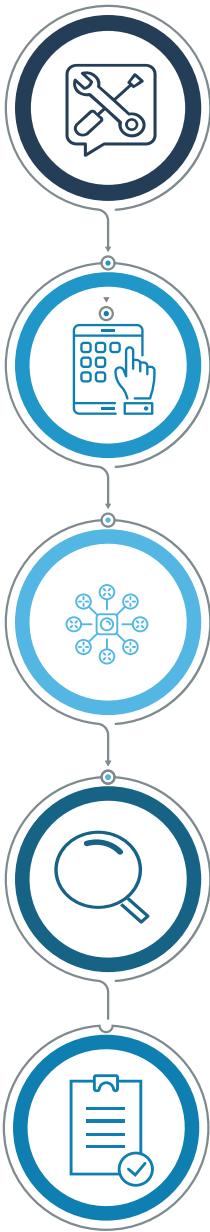
Out In

OK 3xx 4xx 5xx NR

HTTP - Request Traffic min/max RSP: 0.00/0.24, % Error 0.00/0.00

No GRPC traffic logged.

Graph Tour



Build

Store

Deploy

Debug

Debug in Production



Web Assembly Envoy Filter: User Experience



Simplified tooling to bootstrap Wasm modules in Rust, C++, TinyGo, AssemblyScript



Infrastructure to build, push, share, deploy, debug Wasm into Istio service mesh



Wasm Registry



Multi-cluster management, orchestration of Wasm lifecycle



- <https://solo.io>
- <https://solo.io/blog>
- <https://slack.solo.io>
- <https://gloo.solo.io>
- <https://envoyproxy.io>
- <https://istio.io>
- <https://webassemblyhub.io>

