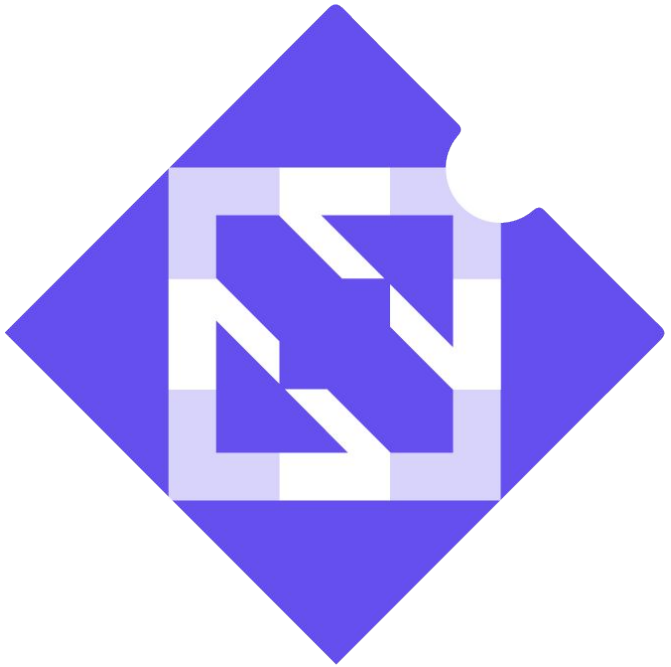

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Scratching an Itch

Running Policy in Hard To Reach Places With Wasm & OPA

Charlie Egan, Styra

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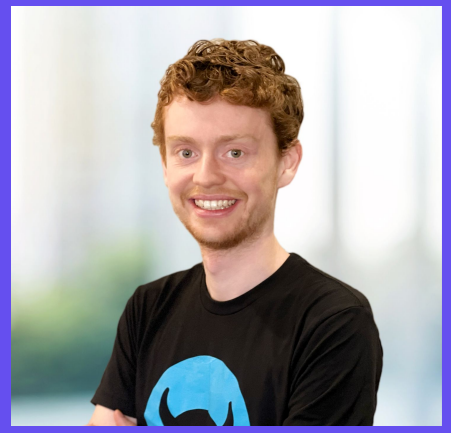
18 April 2023
Amsterdam, The Netherlands



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Styra

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I'll also be at the OPA stall in the project pavillion during KubeCon

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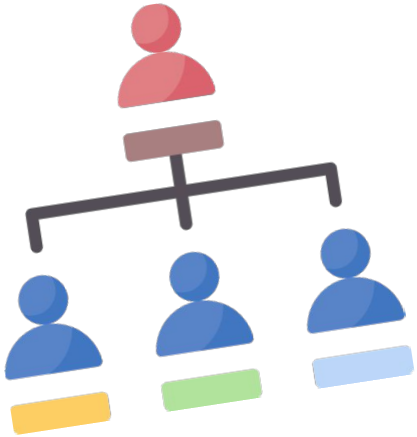
What are Policies?

(What I mean when I talk about policies)

What are Policies?



"Only admins are **allowed**"

"Users in the human resources department can **update** salary information"

images: Freepik on Flaticon.com

What are Policies?

"Customers can't book plane seats in row 13"

image: Freepik on Flaticon.com

What are Policies?

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"The product can only be sold between January 1st and the first Sunday after the full Moon that occurs on or after the spring equinox"

image: FreePik on Flaticon.com

What are Policies?

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"The product can only be sold between January 1st and the first Sunday after the full Moon that occurs on or after the spring equinox"

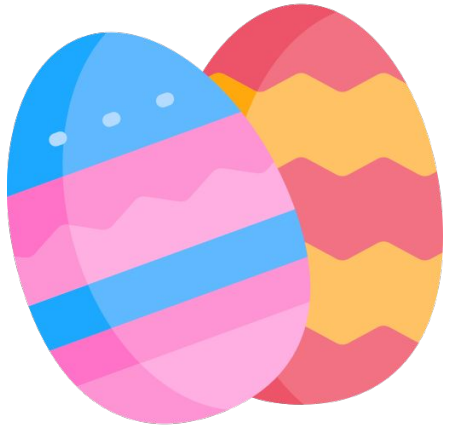

image: FreePik on Flaticon.com

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Businesses are built on policies

image: Eucalyp on Flaticon.com

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What is Policy Evaluation?

What is Policy Evaluation?

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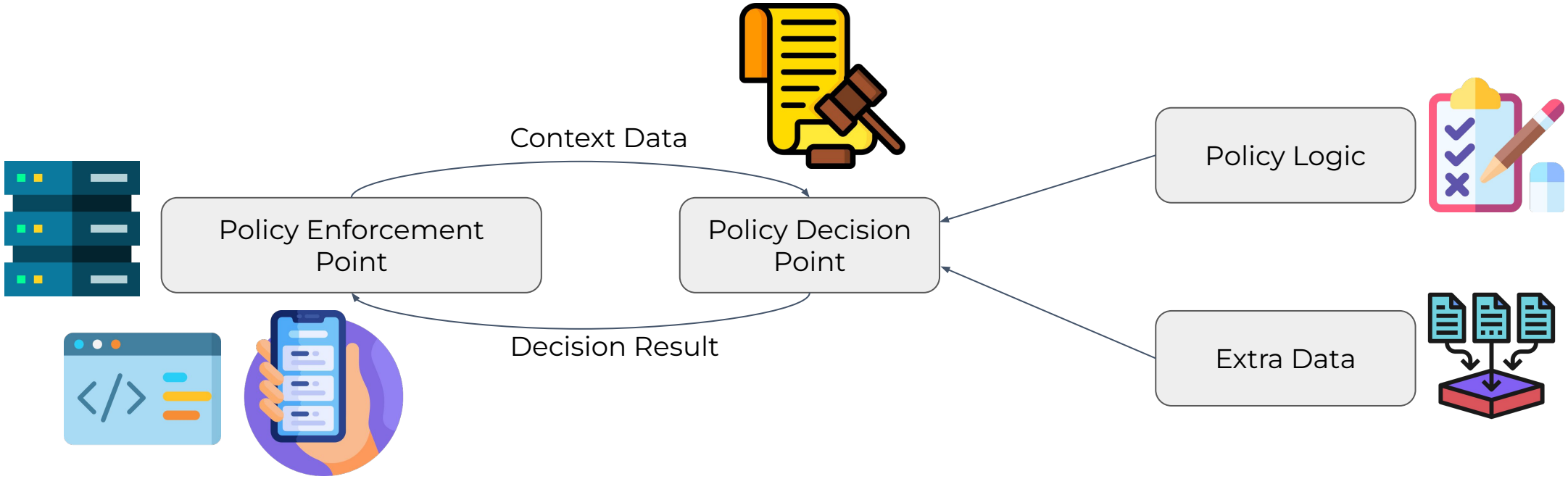
In a generic sense...



images: Freepik, Karma, Smashicons & Becris on Flaticon.com

What is Policy Evaluation?

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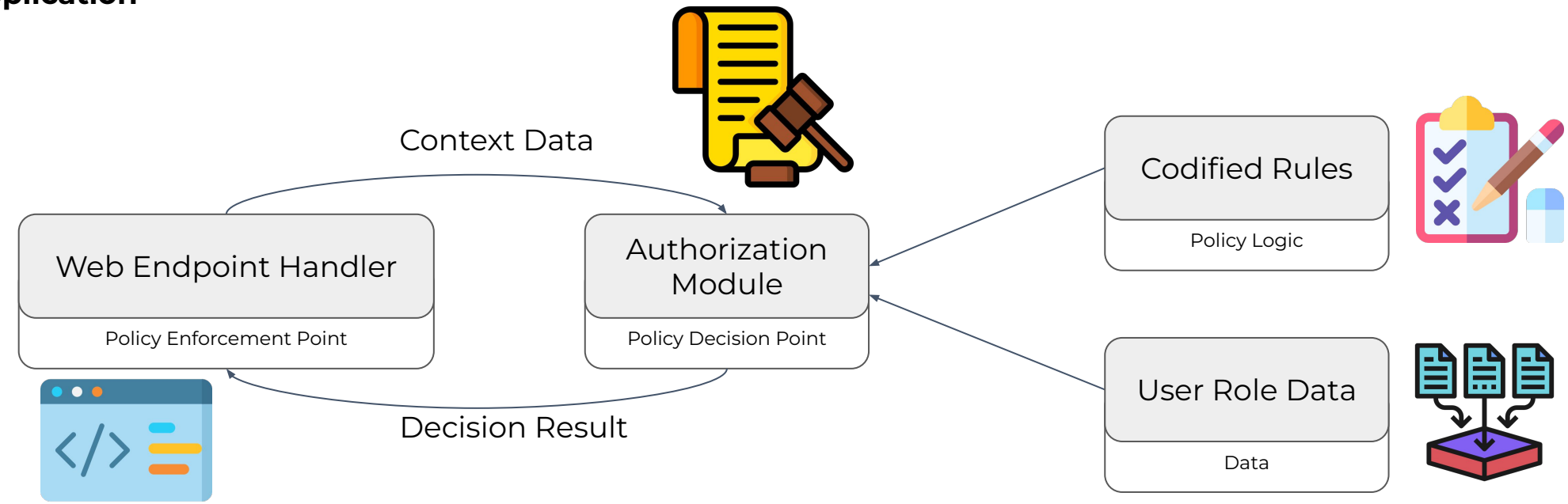
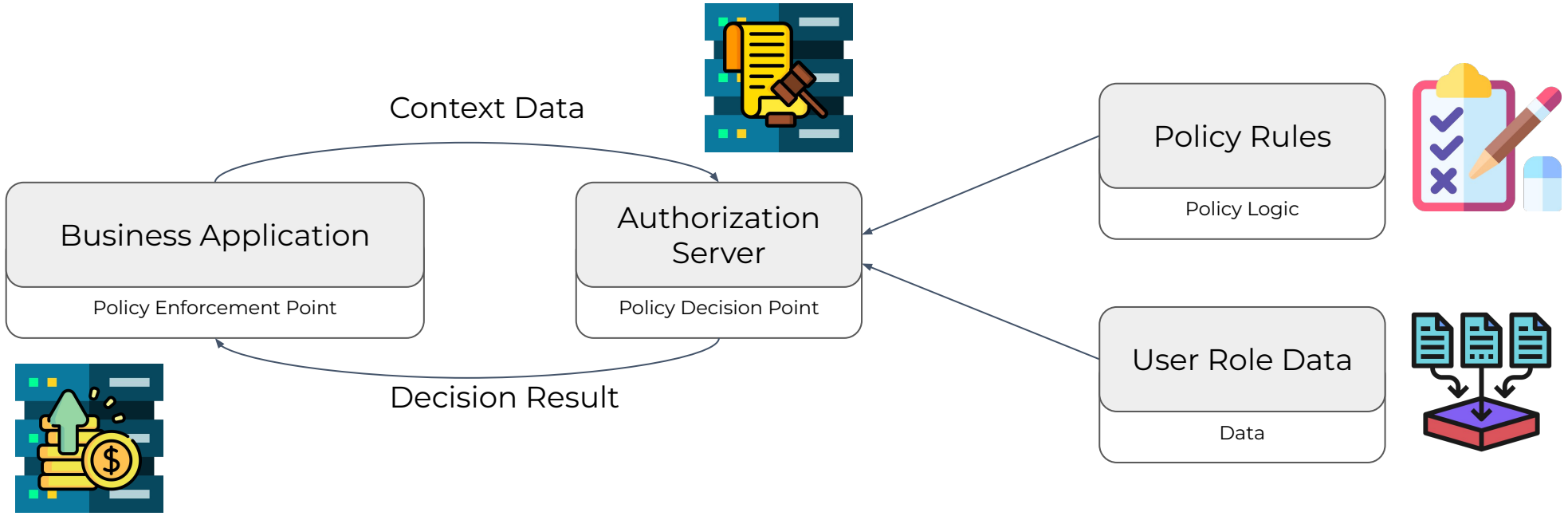
Inside a **single application**



What is Policy Evaluation?

As part of a **distributed system**



images: Freepik, Karma, Smashicons & Becris on Flaticon.com

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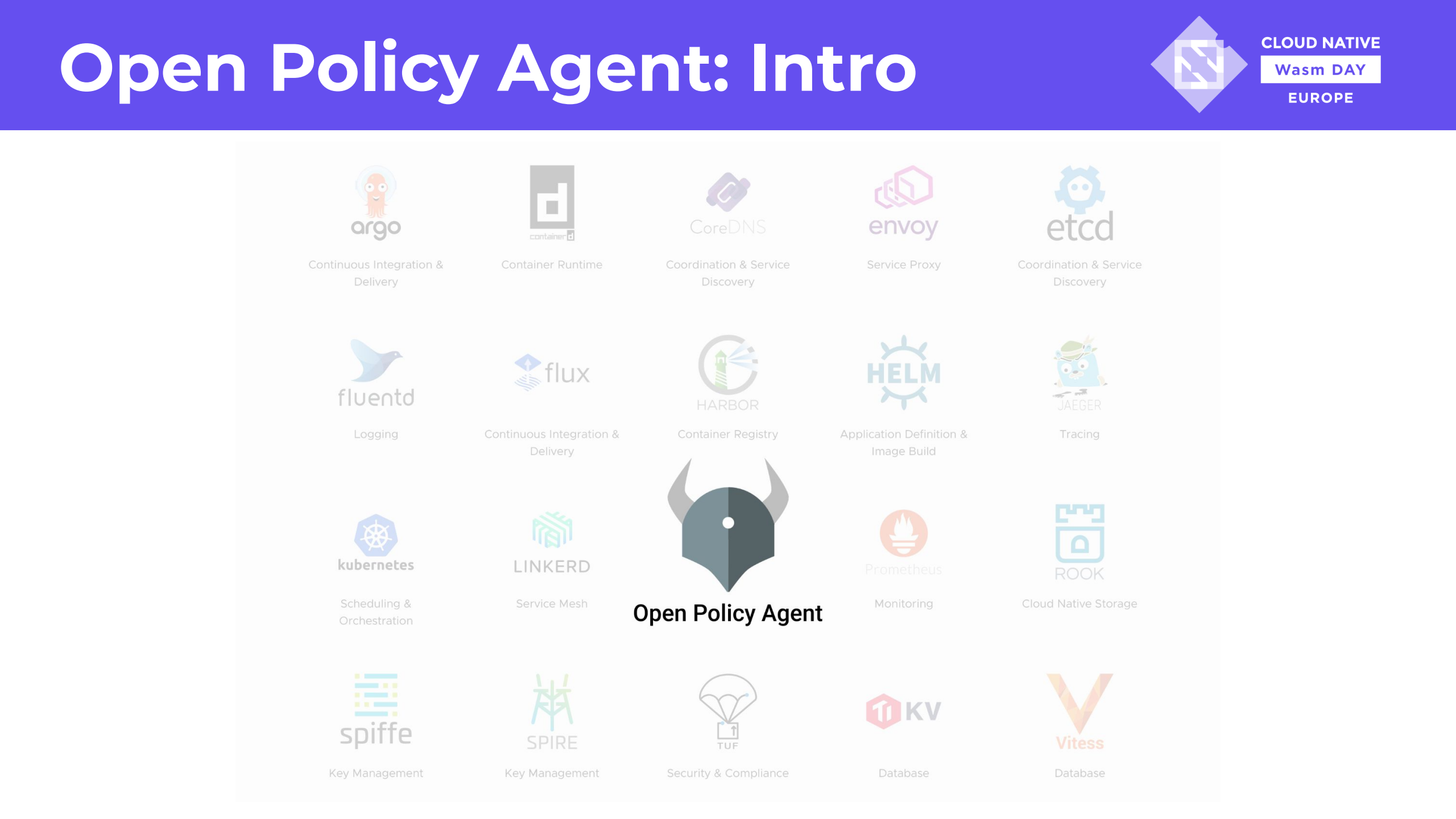
Open Policy Agent?

Open Policy Agent: Intro



Open Policy Agent: Intro

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Domain specific Policy Language (Rego)

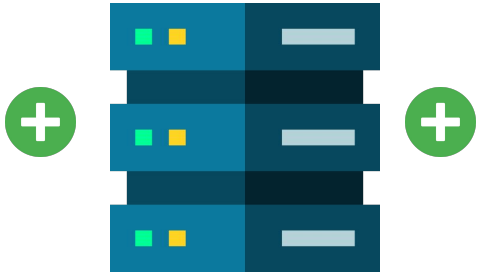
```
package authz

default allow := false

allow {
  input.role == "admin"
}

```

Policy Server



Language SDKs

Via Native SDK

Via Wasm SDKs

OPA!

Open Policy Agent: Intro

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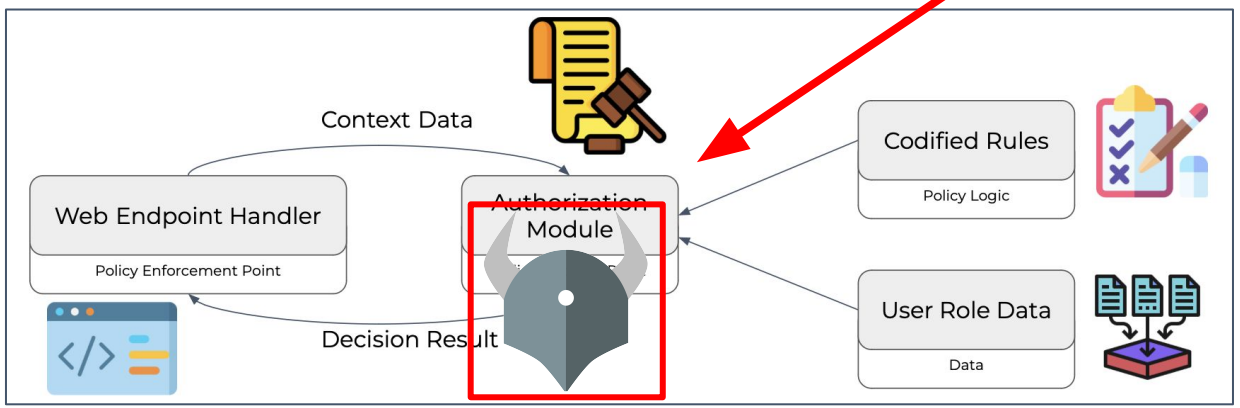
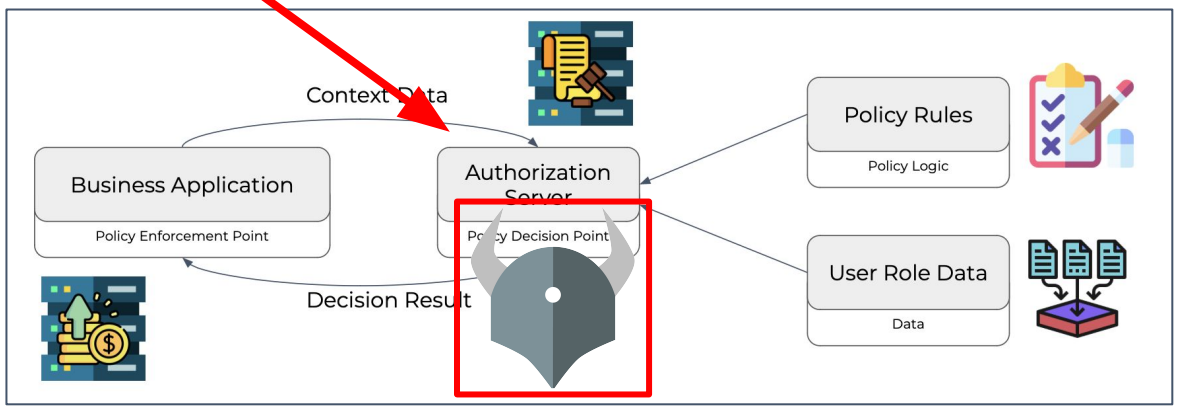
Rego

```
1  package authz
2
3  default allow := false
4
5  allow {
6    input.role == "admin"
7  }
8
```

Embedded



Distributed / Server invoked



images: Freepik, Karma, Smashicons & Becris on Flaticon.com

Open Policy Agent: Rego

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```rego
package authz

default allow := false

allow {
   input.role == "admin"
}

```

```
{
    "role": "admin"
}
```

```
{
    "role": "developer"
}
```

Open Policy Agent: Rego

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```rego
package authz

email_pattern := `^\S+@\S+\.\S+$`

deny[message] {
    not regex.match(email_pattern, input.email)
    message := sprintf("Email must match pattern %v.", [email_pattern])
}

deny[message] {
    endswith(input.email, "@example.com")
    message := "Email domain 'example.com' not permitted"
}

deny[message] {
    input.email != lower(input.email)
    message := "Email characters must be all lowercase"
}

```

```json
{
    "email": "First Last@example.com"
}
```

```
[
    "Email characters must be all lowercase",
    "Email domain 'example.com' not permitted",
    "Email must match pattern ^\\S+@\\S+\\.\\S+$."
]
```

Open Policy Agent: Rego

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```
org_chart := {
    "boss": {},
    "human_resources": {
        "managed_by": "boss",
        "access": ["salaries"],
    },
    "developers": {
        "managed_by": "boss",
        "access": ["prod", "dev"],
    },
    "interns": {
        "managed_by": "developers",
        "access": ["dev"],
    },
}
```

Open Policy Agent: Rego

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```
org_chart_graph[business_unit] := edges {
    some business_unit, _ in org_chart
    edges := {neighbor |
        some neighbor
        org_chart[neighbor].managed_by == business_unit
    }
}

org_chart_permissions[business_unit] := access {
    some business_unit, _ in org_chart
    reachable := graph.reachable(org_chart_graph, {business_unit})
    access := {item |
        some bu, _ in reachable
        some resource
        item := org_chart[bu].access[resource]
    }
}
```

```
{
    "boss": [
        "developers",
        "human_resources"
    ],
    "developers": [
        "interns"
    ],
    "human_resources": [],
    "interns": []
}
```

```
{
    "boss": [
        "dev",
        "prod",
        "salaries"
    ],
    "developers": [
        "dev",
        "prod"
    ],
    "human_resources": [
        "salaries"
    ],
    "interns": [
        "dev"
    ]
}
```

Open Policy Agent: Rego

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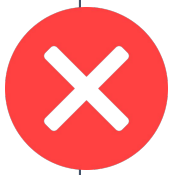
```
allow {
    input.request in org_chart_permissions[input.business_unit]
}
```

```
{
    "business_unit": "boss",
    "request": "salaries"
}
```

```
{
    "business_unit": "developers",
    "request": "prod"
}
```

```
{
    "business_unit": "interns",
    "request": "salaries"
}
```



```
{
    "business_unit": "boss",
    "request": "nukes"
}
```

Open Policy Agent: Rego

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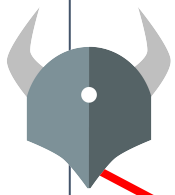
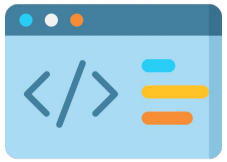
"Bringing the Rego to you"

```
1  package authz
2
3  default allow := false
4
5  allow {
6    input.role == "admin"
7  }
8
```





WA

Context Data

Web Endpoint Handler

Policy Enforcement Point

Authorization Module

Policy Decision Point

Codified Rules

Policy Logic

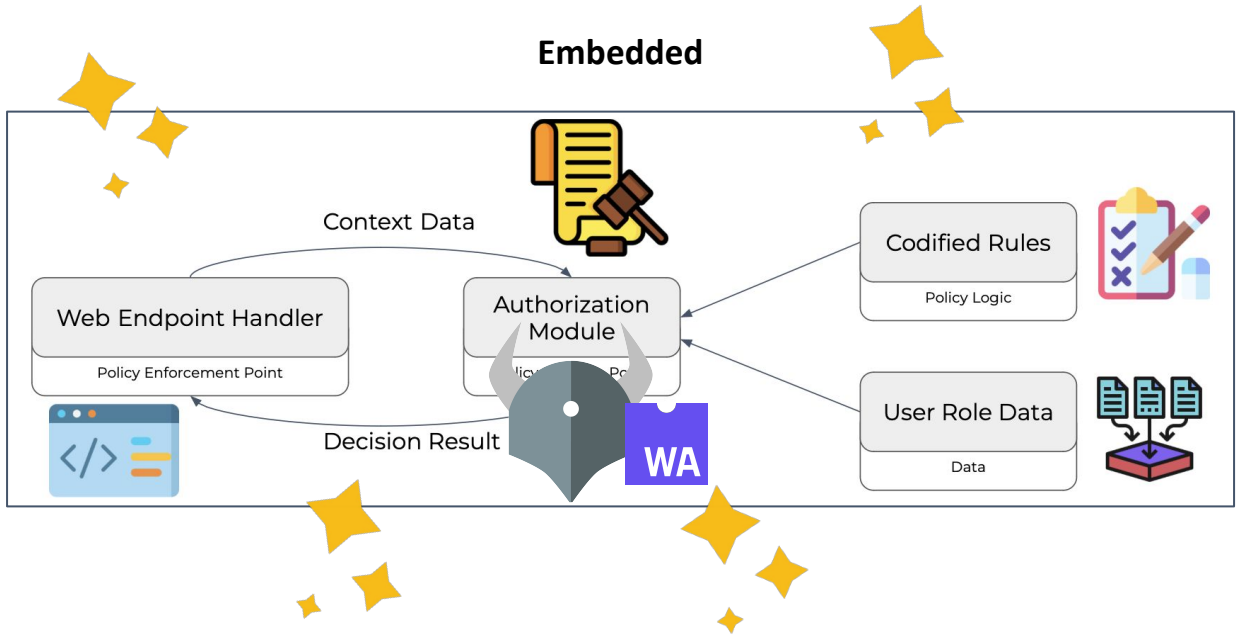
User Role Data

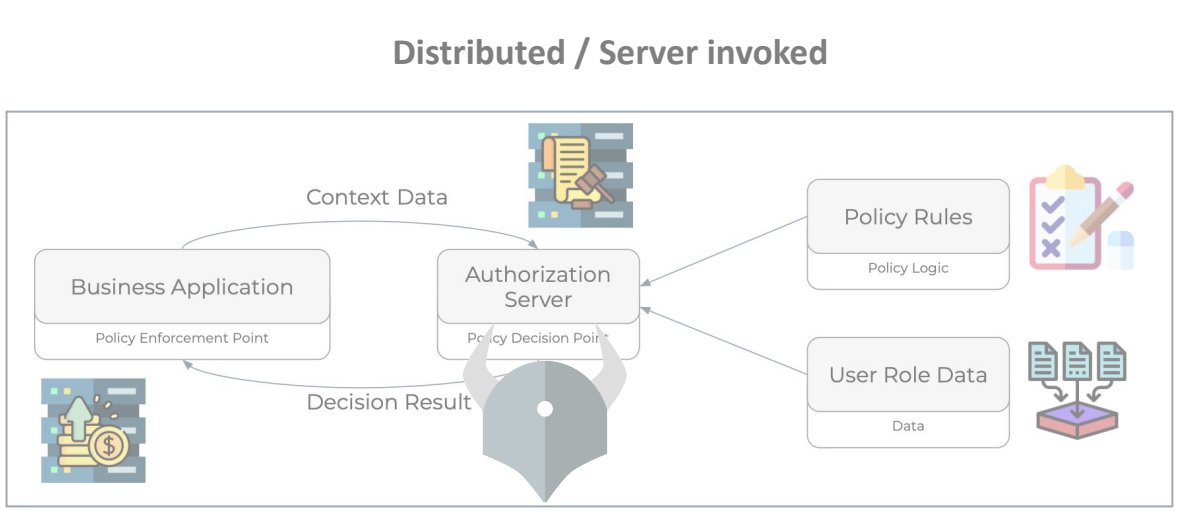
Data

Decision Result

images: Freepik, Karma, Smashicons & Becris on Flaticon.com

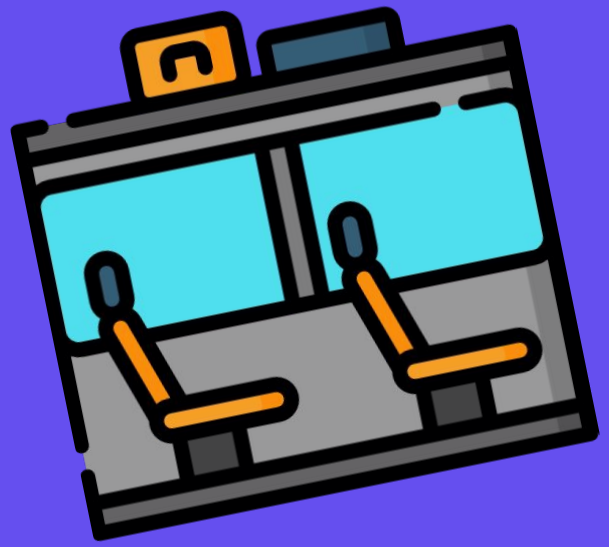
Open Policy Agent: Wasm



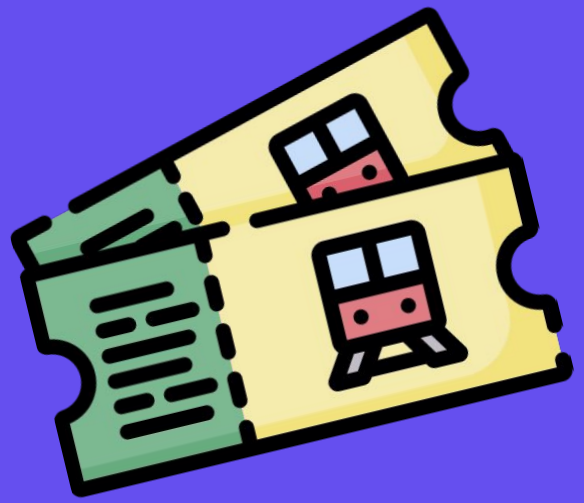


- Fast feedback to users from client side validation
- Standardised validation logic across suite of related applications
  - Web, mobile, server + other OPA deployments
  - Run OPA in more places
- Improved performance for data intensive policies

images: Aranagraphics, Freepik, Karma, Smashicons & Becris on Flaticon.com



Demo



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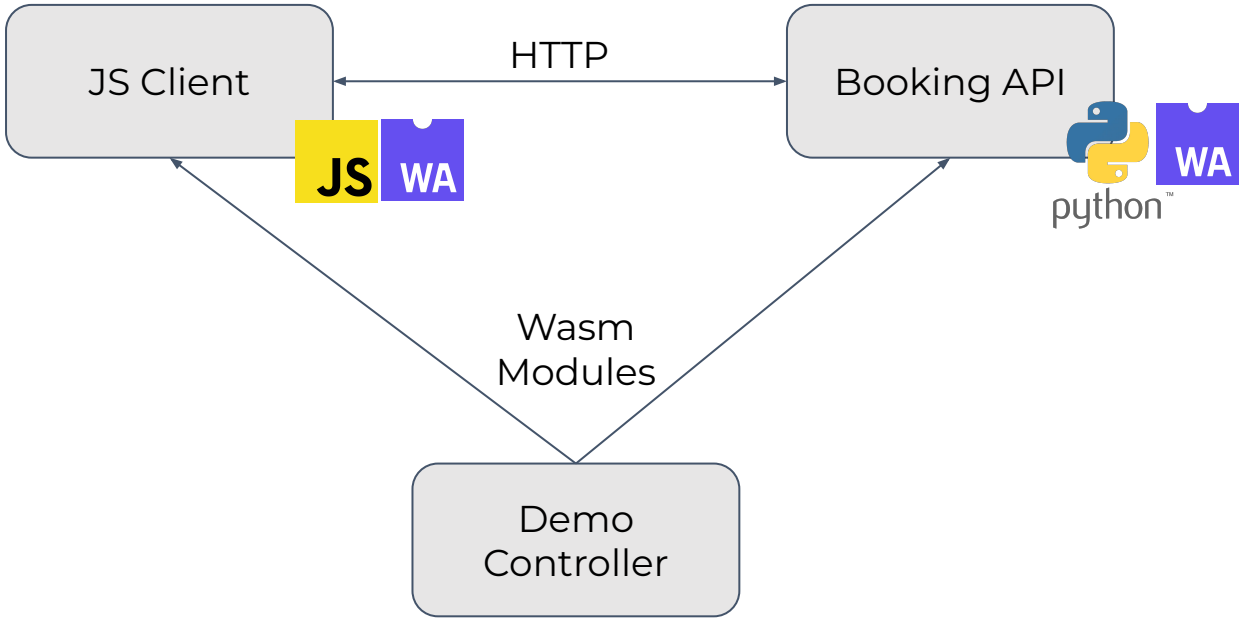
images: Eucalyp, Freepik on Flaticon.com

Demo


JS Client
HTTP
Booking API
JS
WA
python
WA
Wasm
Modules
Demo
Controller

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Wasm in OPA

Past, Present, Future

Wasm in OPA: Past

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- 2018: Proof of concept
  - In response to challenges for some users in running a sidecar server
  - & adoption seen elsewhere (Envoy & CDNs like Cloudflare and Fastly)

- Proof of concept showed good performance improvements too
  - https://blog.openpolicyagent.org/opa-v0-15-1-rego-on-webassembly-81c226c51be4

- First official SDK was developed for Node
  - Targeting the CDN use case

Wasm in OPA: Present

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- Good support for building, distributing and evaluating Wasm policy bundles
- Official and community OPA Wasm SDKs for:
  - Node JS
  - .NET Core
  - Python
  - JVM
  - Rust
- Native Wasm Support for around 50% of Rego built-in functions
  - (Remainder are SDK dependent)

Wasm in OPA: Future

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- Candidates for further development (not on roadmap - yet!)
  - Investigate options for data sharing between Wasm threads
    - https://github.com/open-policy-agent/opa/issues/3178
  - Investigate integration with envoy-wasm filters
    - https://github.com/open-policy-agent/opa/issues/3235
  - Support OPA plugins implemented as Wasm modules
    - https://github.com/open-policy-agent/opa/issues/3631
  - Implementation of additional built-in functions in Rego or Language SDKs

- (New contributors in this area would be very welcome!)

Further Reading

All the links, slides etc.
https://charlieegan3.com/talks/opa-wasm

OPA Wasm Docs
https://www.openpolicyagent.org/docs/latest/wasm/

'Awesome OPA' Wasm Items (including SDK links)
https://github.com/anderseknert/awesome-opa#webassembly-wasm

OPA PoC Blog (2019)
https://blog.openpolicyagent.org/opa-v0-15-1-rego-on-webassembly-81c226c51be4

OPA meetup this evening!
https://www.meetup.com/opa-amsterdam/events/291910668/

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