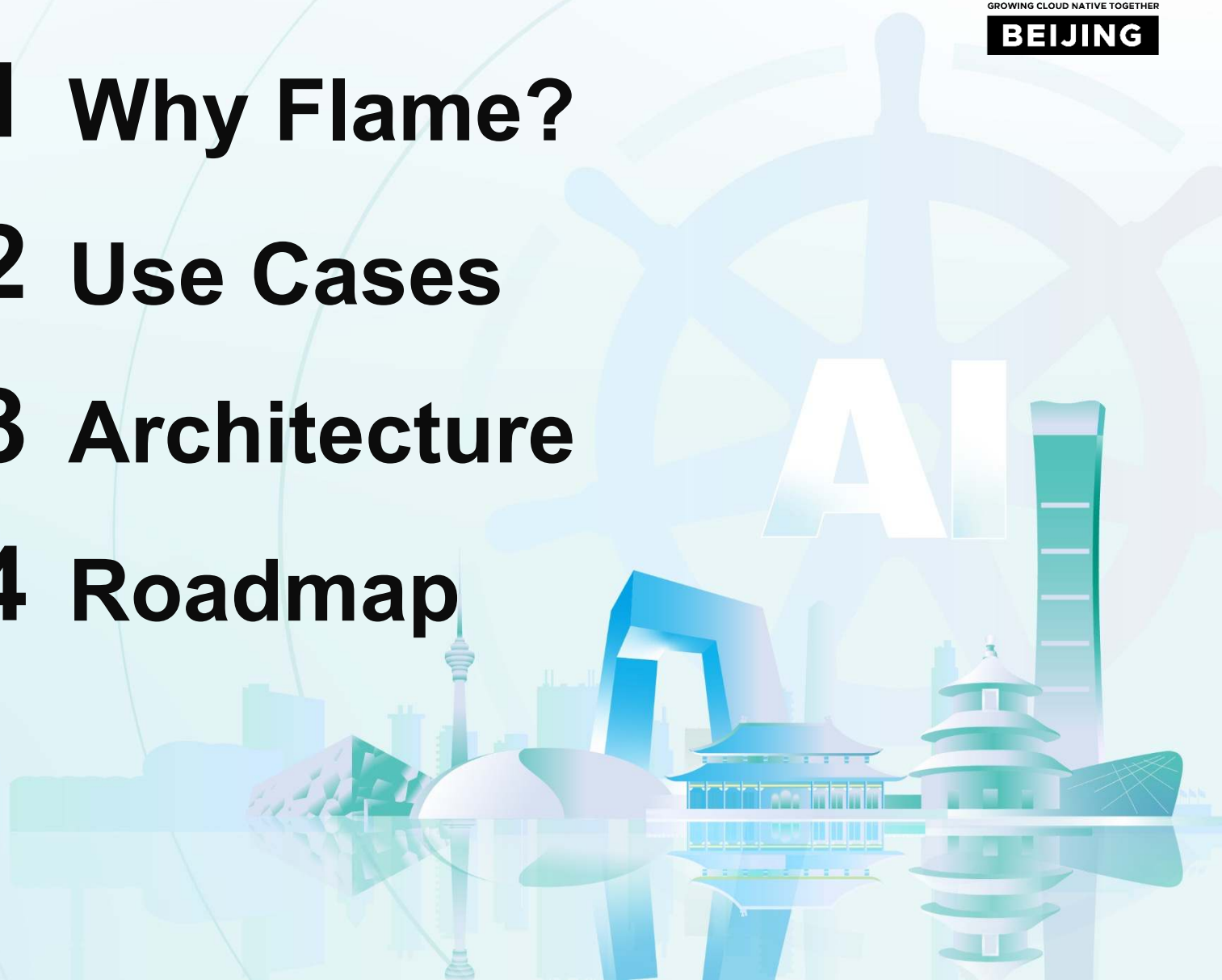
KUBERNETES COMMUNITY DAYS BEIJING 2025

Flame: A distributed system for intelligent workload

Klaus Ma (@k82cn, Nvidia)

KCD
GROWING CLOUD NATIVE TOGETHER
BEIJING

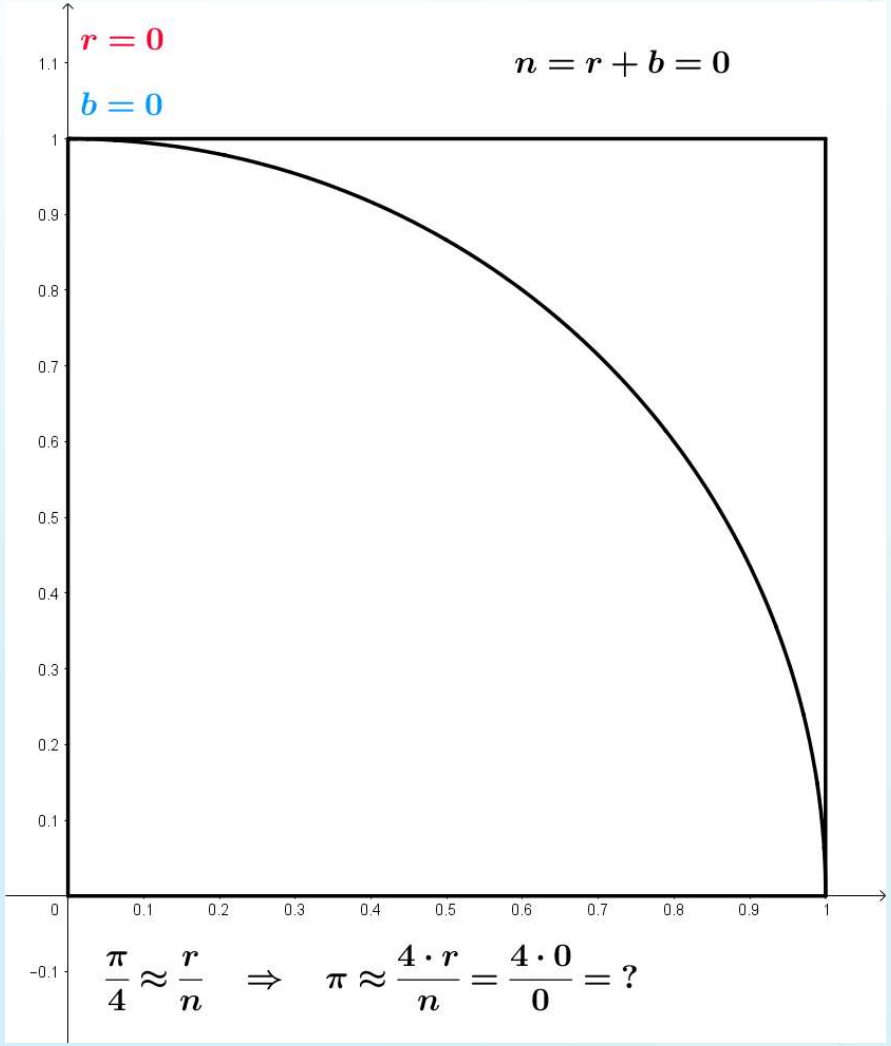
Content
目录



Why Flame?

- Currently, more and more frameworks are introduced for specific domain, e.g., BigData, AI; but the meta operations are similar, e.g., matrix, gradient, map/reduce.
- Meanwhile, no meta framework for specific distributed system use cases, e.g., Monte Carlo, Crawler, Encoder.
- Flame is a distributed engine for the frameworks in domain; the Frame focus on the meta-API, performance, throughput, scheduling and high availability.
- Exploring a new way of data sharing/exchanging

Example: Pi by Monte Carlo



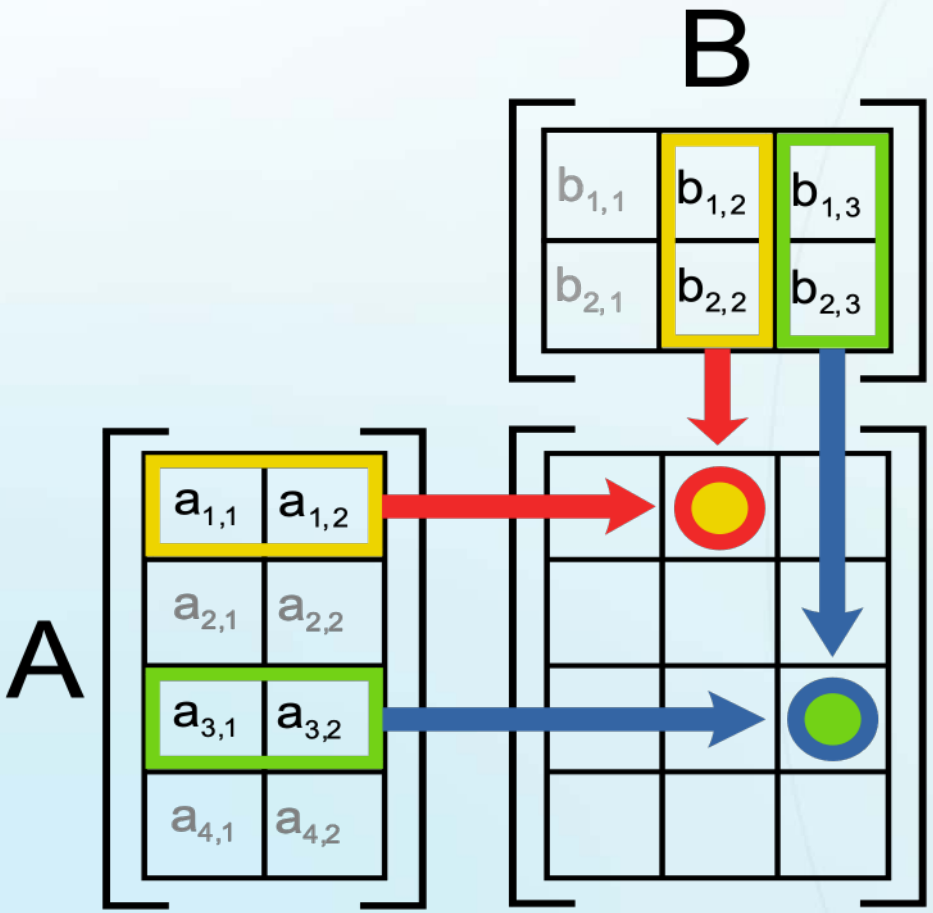
Pi Client:

1. Create a callback for each tasks
2. Create tasks based on input
3. Waiting for all tasks completion
4. Print the estimation of Pi

Pi Service:

1. Generate random points by input
2. Print how many points are in the cycle

Example: Matrix Multiplication



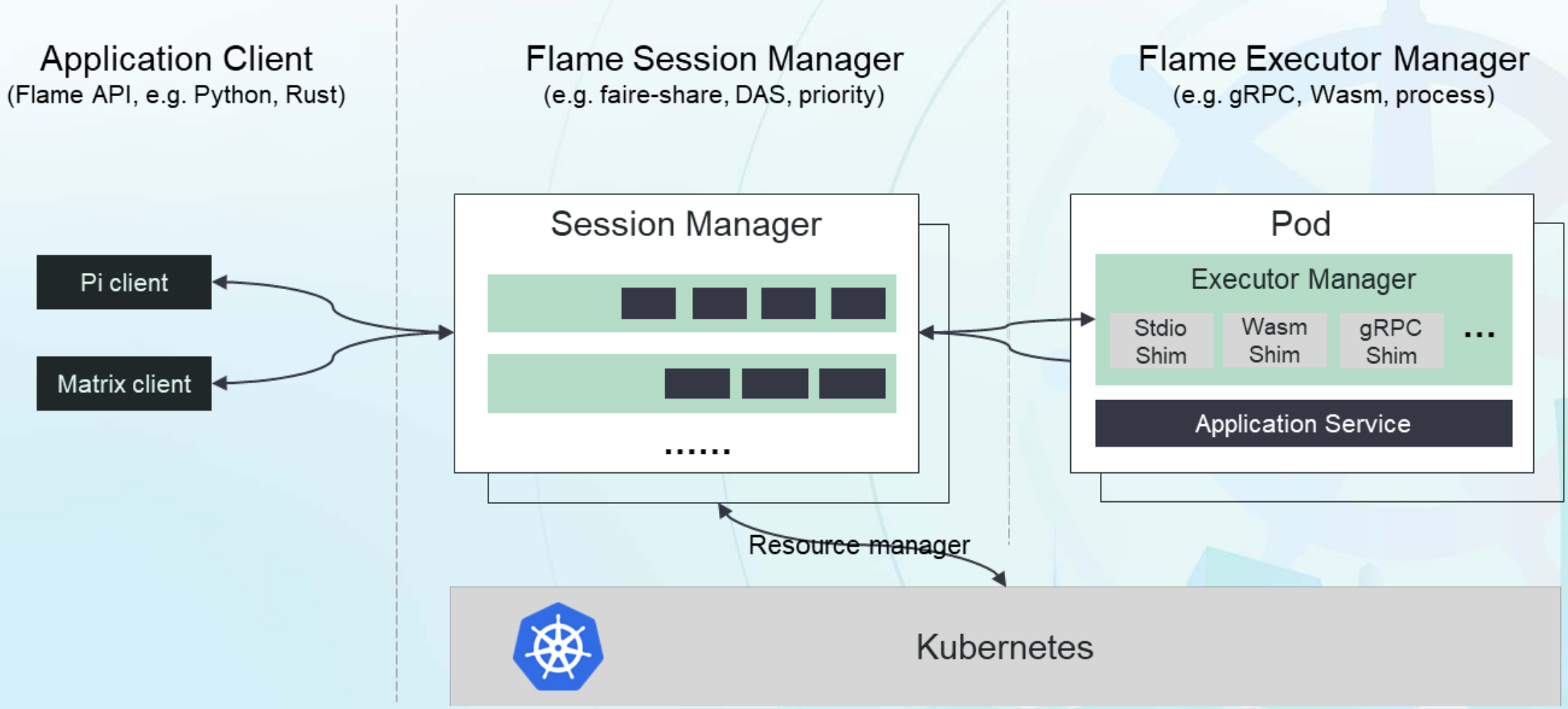
Matrix Client:

1.Create a callback for each tasks
2.Create tasks based on input
3.Waiting for all tasks completion
4.Print all items of the matrix

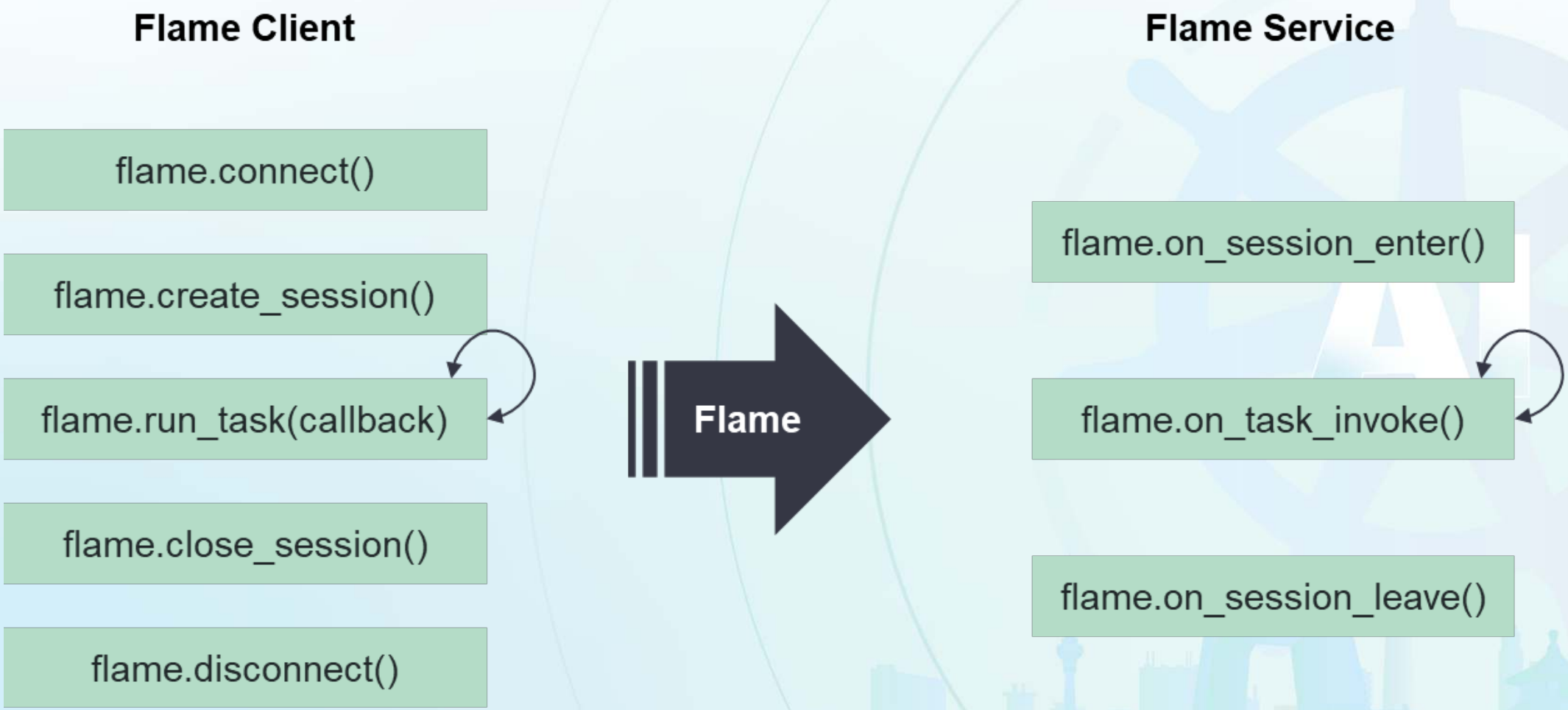
Matrix Service:

1.Calculate Cij for as the result

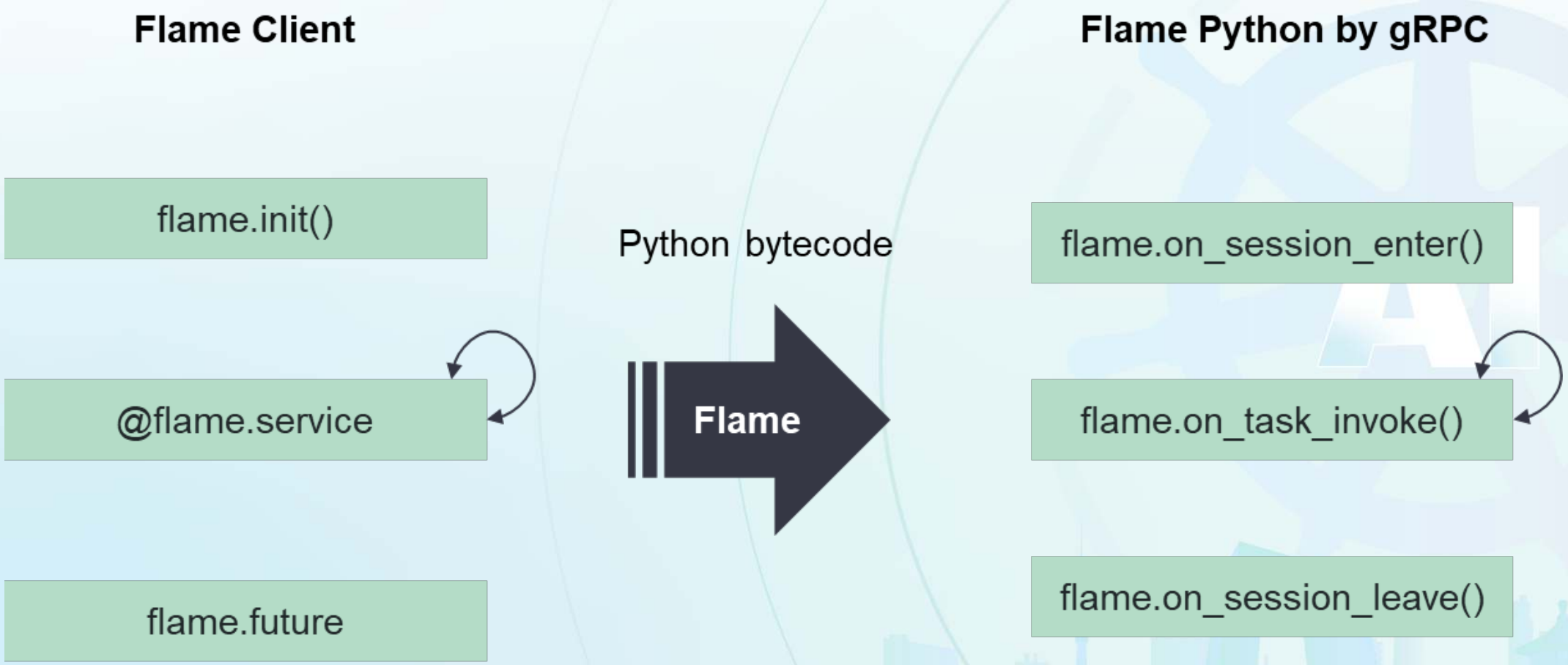
Overall Architecture



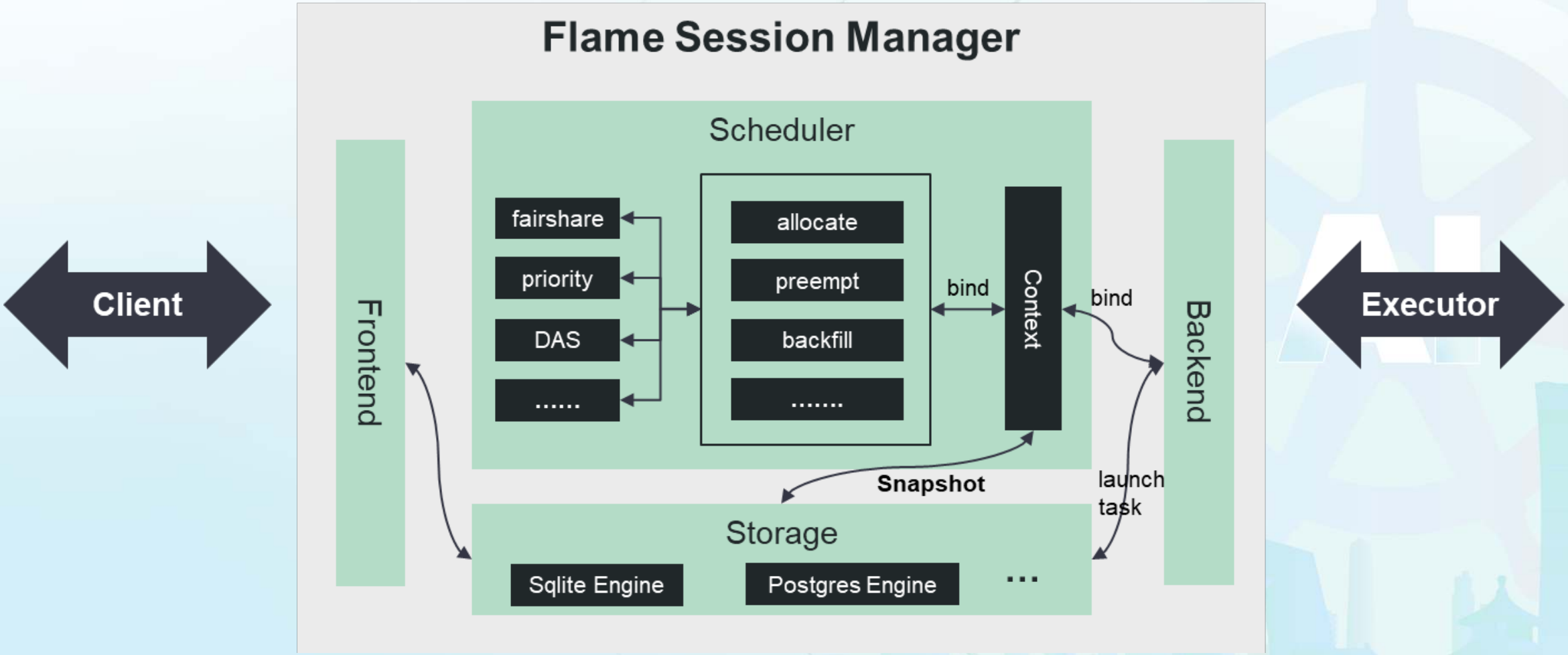
Flame SDK (core)



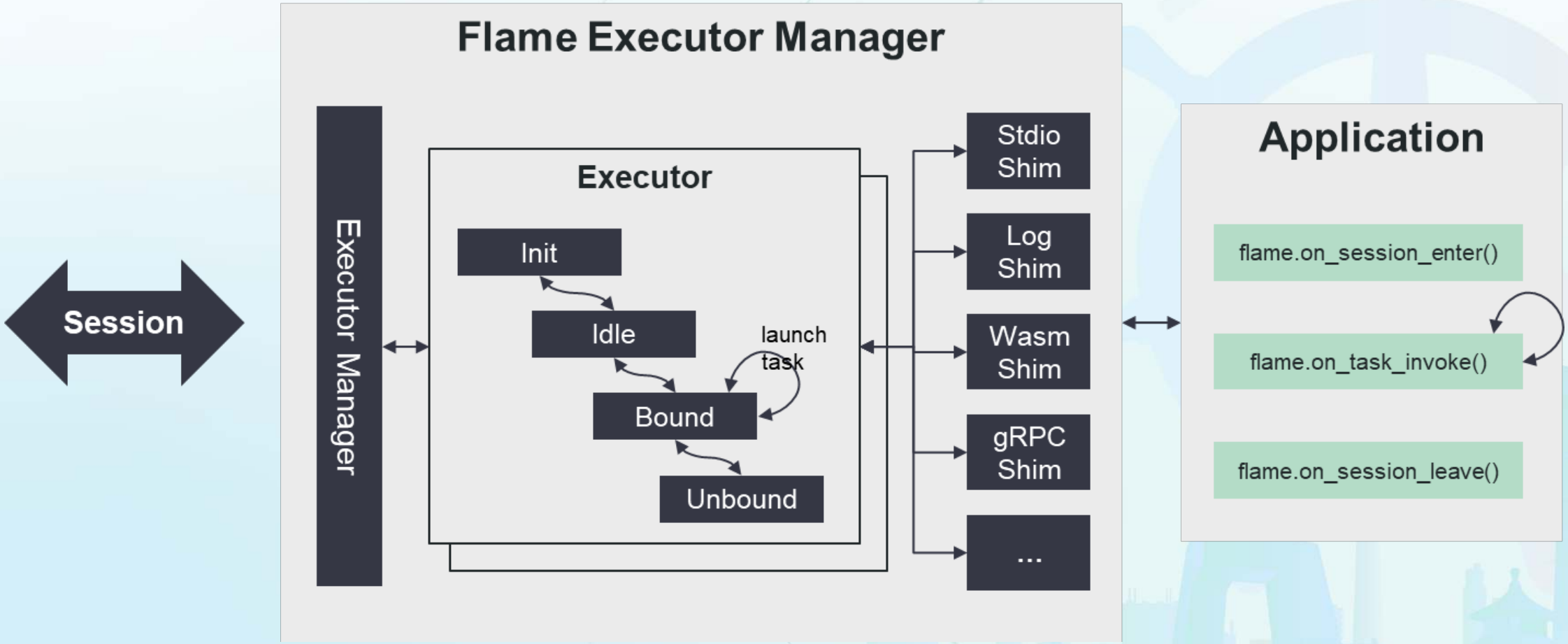
Flame Python SDK (on-going)



Session Manager



Executor Manager



Roadmap

- **gRPC shim for all language, e.g. Python, R, C++ (Done)**
- Distributed storage/cache for **data sharing/exchanging**
- PyTorch, Tensorflow examples, e.g. distributed training
- TLS/mTLS enhancement for all connection
- More scheduling policy, e.g. priority, minService/maxService, data aware scheduling
- Resource manager integration, e.g. Kubernetes
- Misc, e.g. CLI, matrics, dashboard
- flame-operator to simplify operations
- Documentation and tutorial

References

- flame-sh/flame: A distributed system for intelligent workload (github.com)
- Monte Carlo method – Wikipedia
- Matrix multiplication - Wikipedia

Thanks.