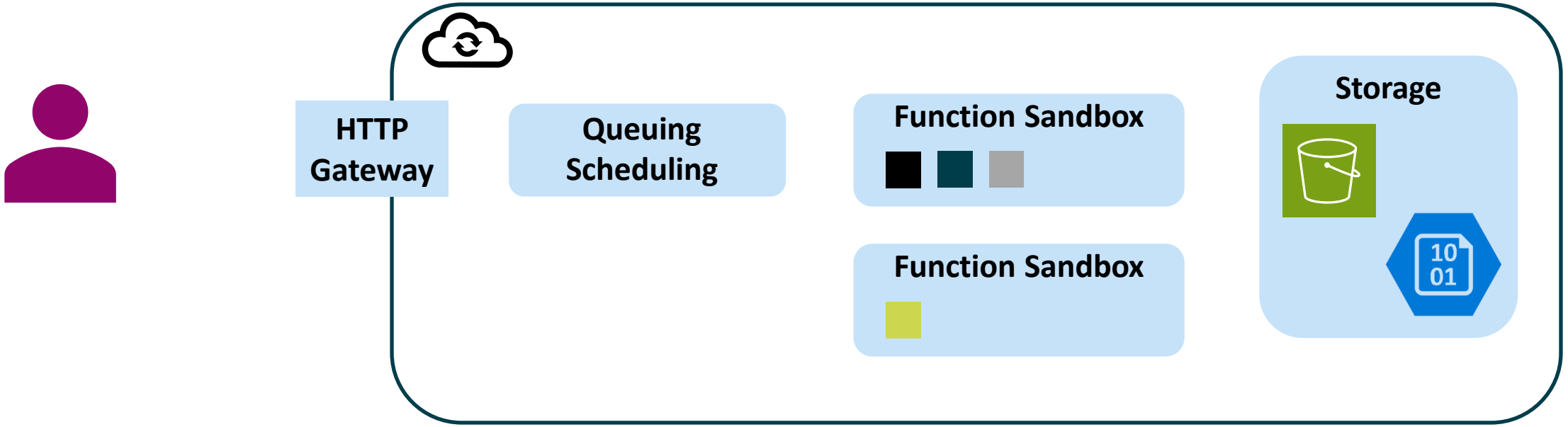
MARCIN COPIK, ALEXANDRU CALOTOIU, GYORGY RETHY, ROMAN BÖHRINGER, RODRIGO BRUNO, TORSTEN HOEFLER

SOCC ACM Symposium on Cloud Computing

Process-as-a-Service: Unifying Elastic and Stateful Clouds with Serverless Processes

LaTeX Microservice in Serverless



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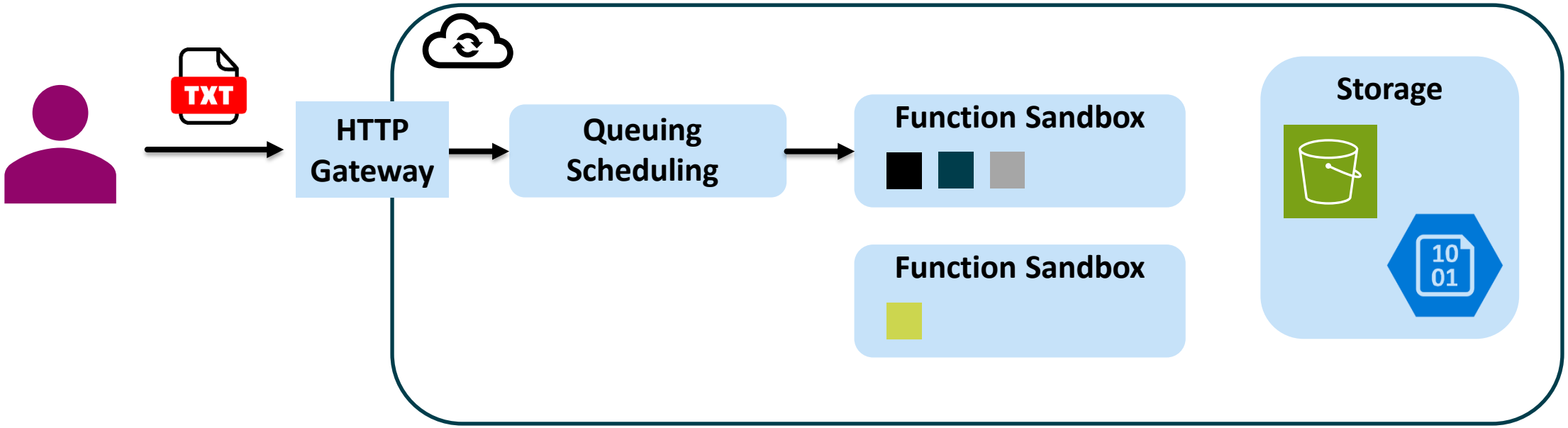

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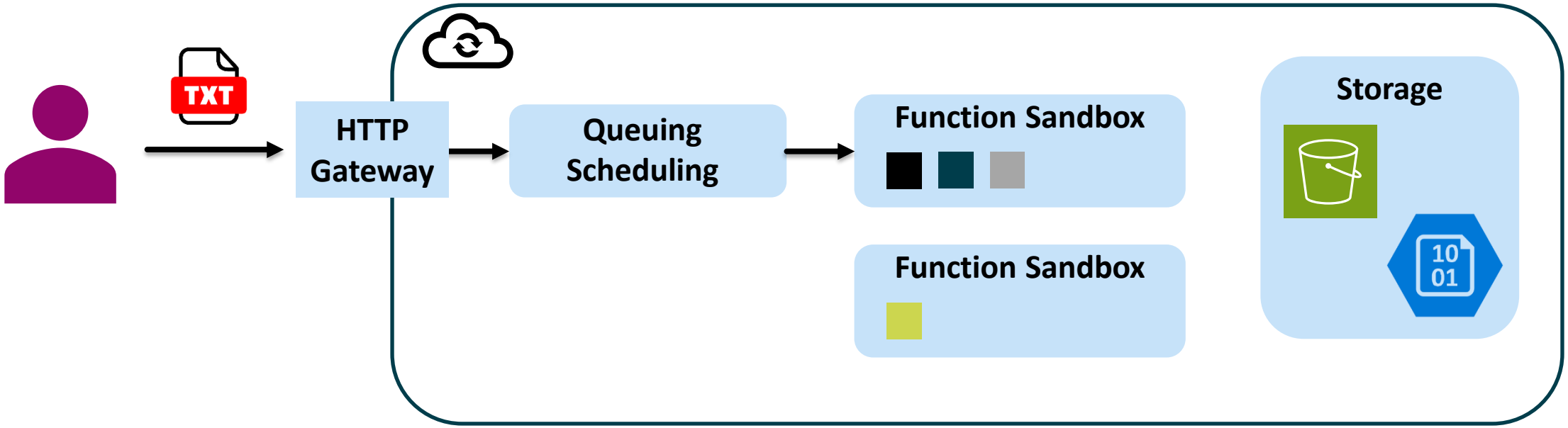

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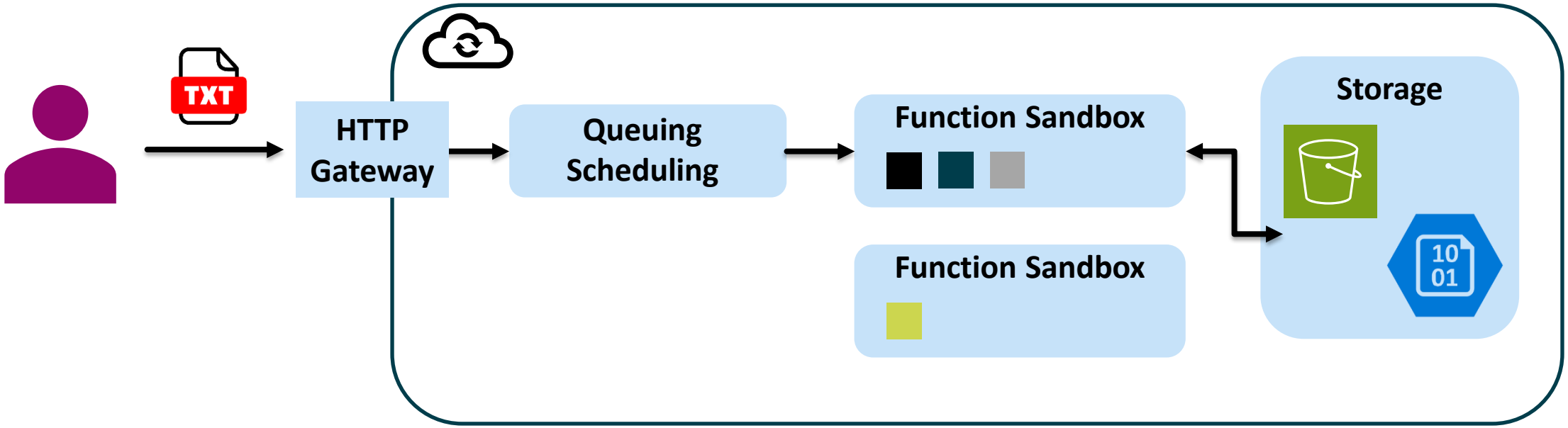

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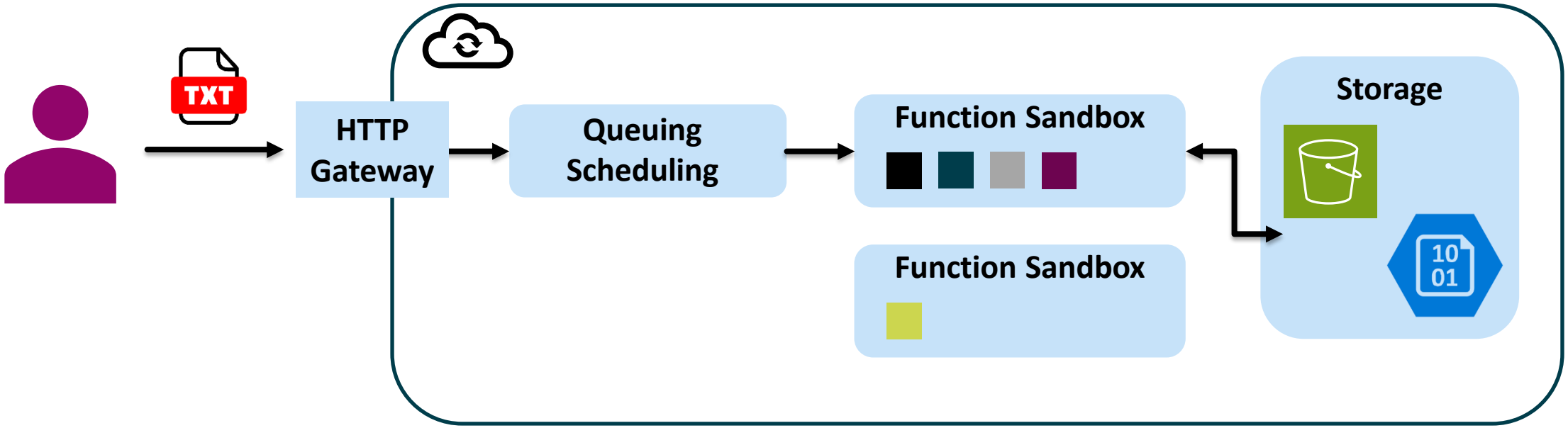
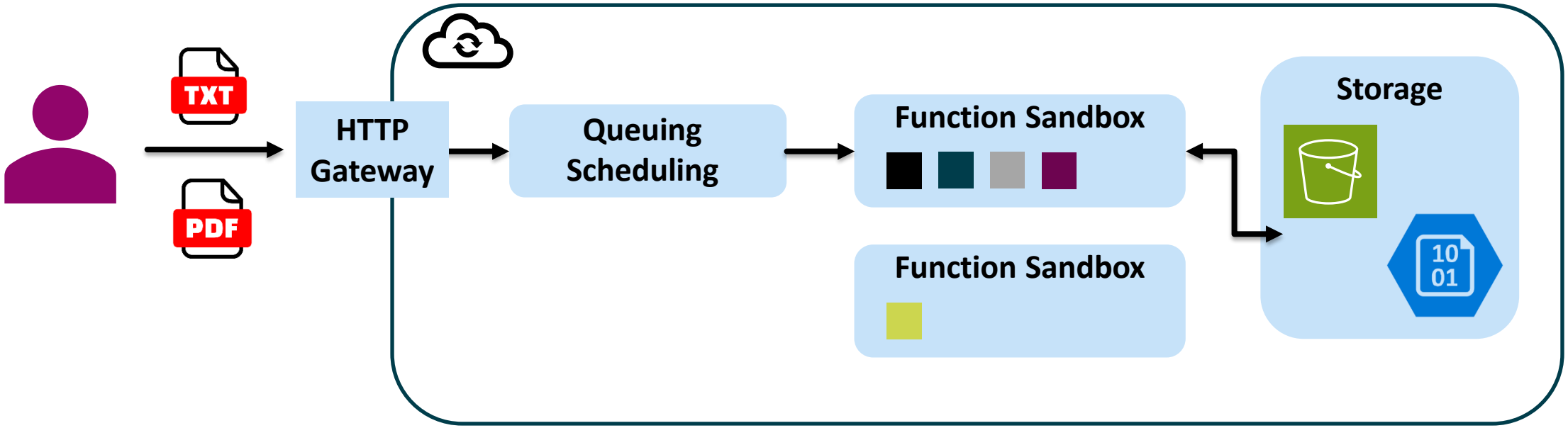


Serverless Service

- Cached function state is not reliable

LaTeX Microservice in Serverless



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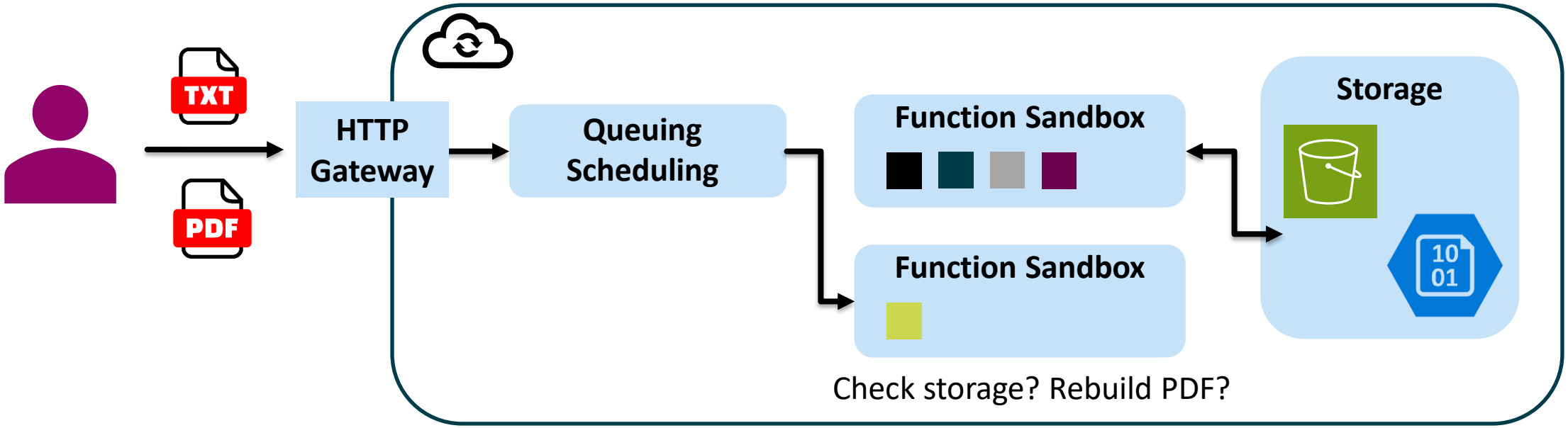

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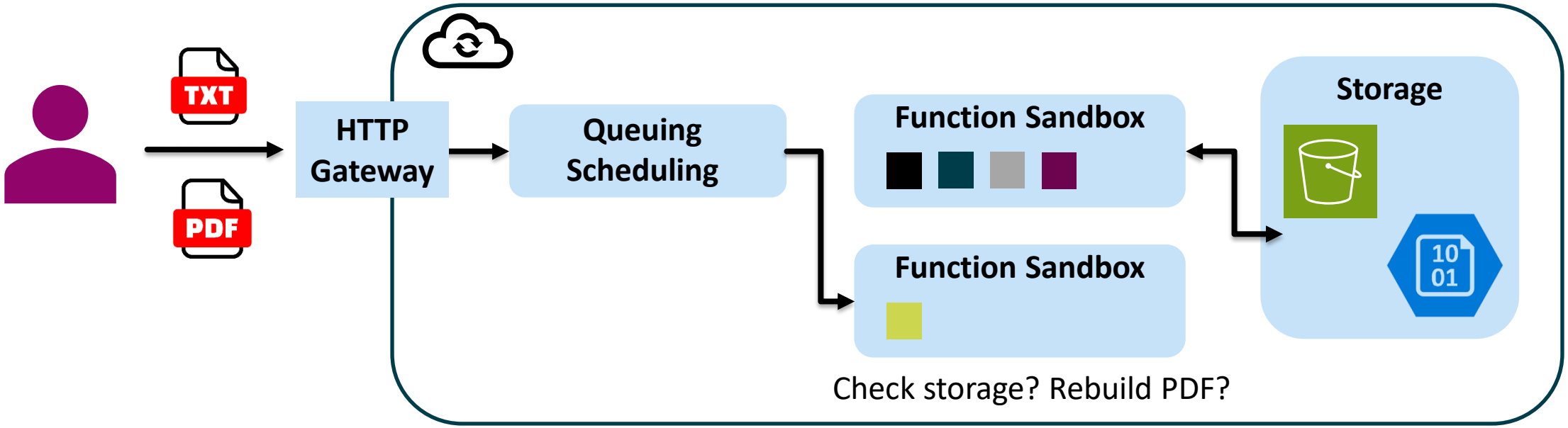
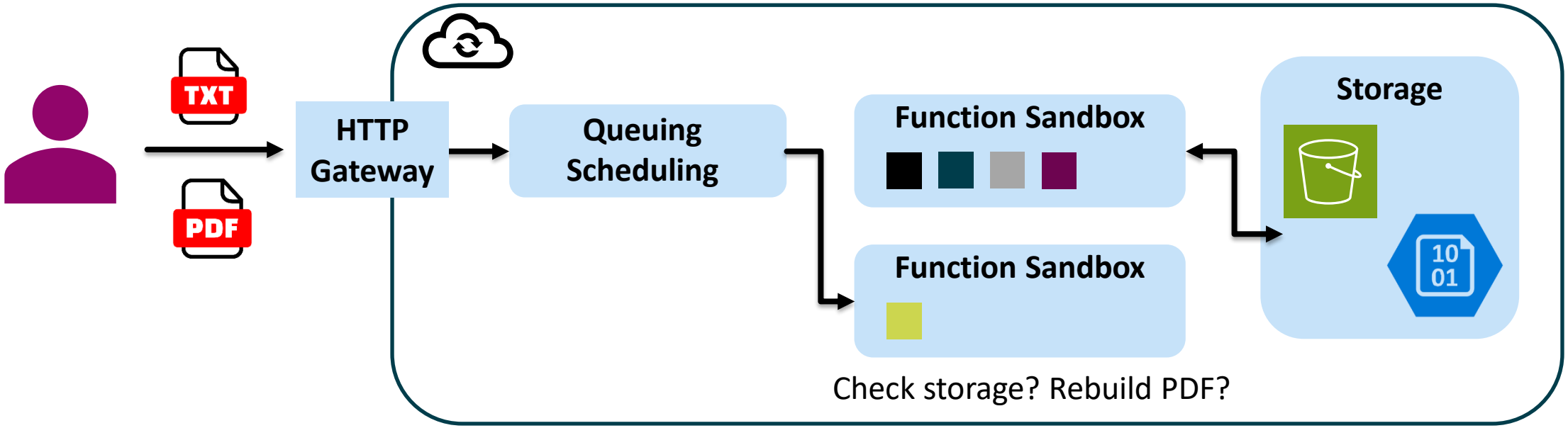


Serverless Service

- ✗ Cached function state is not reliable
- ✗ Request context has no influence on scheduling

LaTeX Microservice in Serverless



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Standard Microservice

- ✓ Extensive caching
- ✓ Load balancing with sticky sessions

LaTeX Microservice in Serverless

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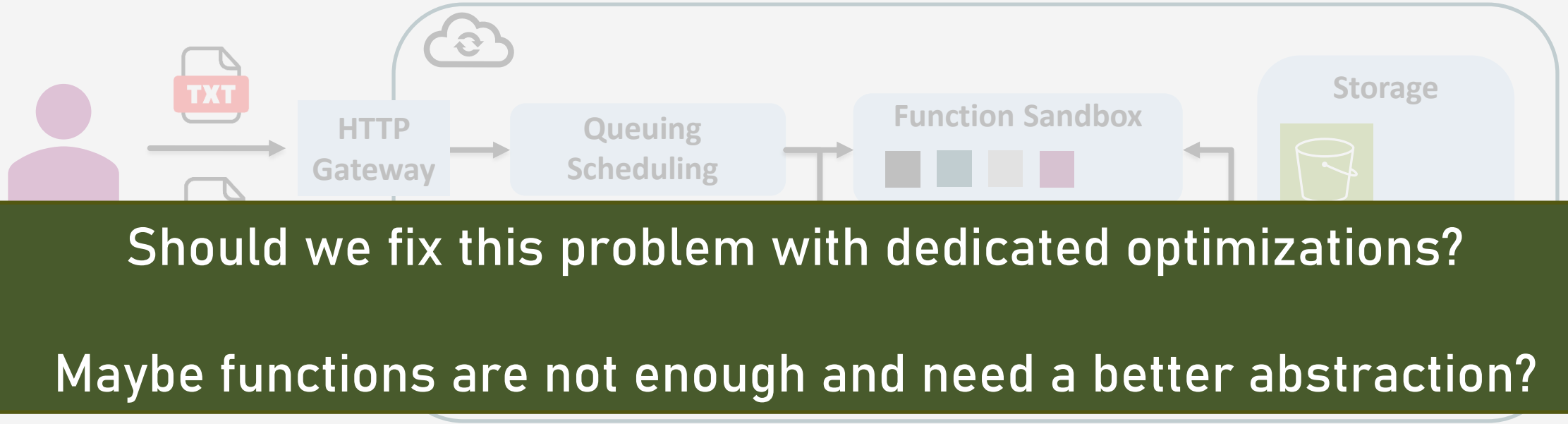


Should we fix this problem with dedicated optimizations?

Maybe functions are not enough and need a better abstraction?

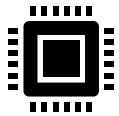
Serverless Service

- ✗ Cached function state is not reliable
- ✗ Request context has no influence on scheduling

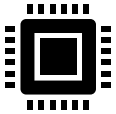
Standard Microservice

- ✓ Extensive caching
- ✓ Load balancing with sticky sessions

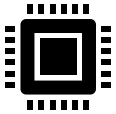
Cloud Models



Cloud Models

	IaaS	CaaS
	Persistent	Persistent
	Provisioned	Provisioned
	Persistent, local	Persistent, local
	Months	Hours, days
	Manual, minutes	Semi-automatic, minutes & seconds

Cloud Models

	IaaS	CaaS	FaaS
	Persistent	Persistent	Ephemeral
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Cloud Models

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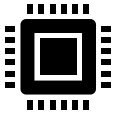	Persistent	Persistent	Ephemeral
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Cloud Models

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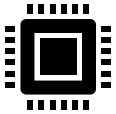	Persistent	Persistent	Ephemeral
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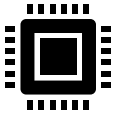
Cloud Process

	IaaS	CaaS	FaaS
	Persistent	Persistent	Ephemeral
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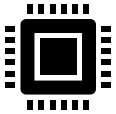
Cloud Process

	IaaS	CaaS	PraaS	FaaS
	Persistent	Persistent		Ephemeral
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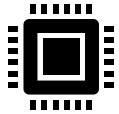
Cloud Process

Durable state of a container

	IaaS	CaaS	PraaS	FaaS
	Persistent	Persistent		Ephemeral
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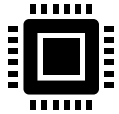
Cloud Process

Durable state of a container and **ephemeral compute** of serverless.

	IaaS	CaaS	PraaS	FaaS
	Persistent	Persistent	Ephemeral	Ephemeral
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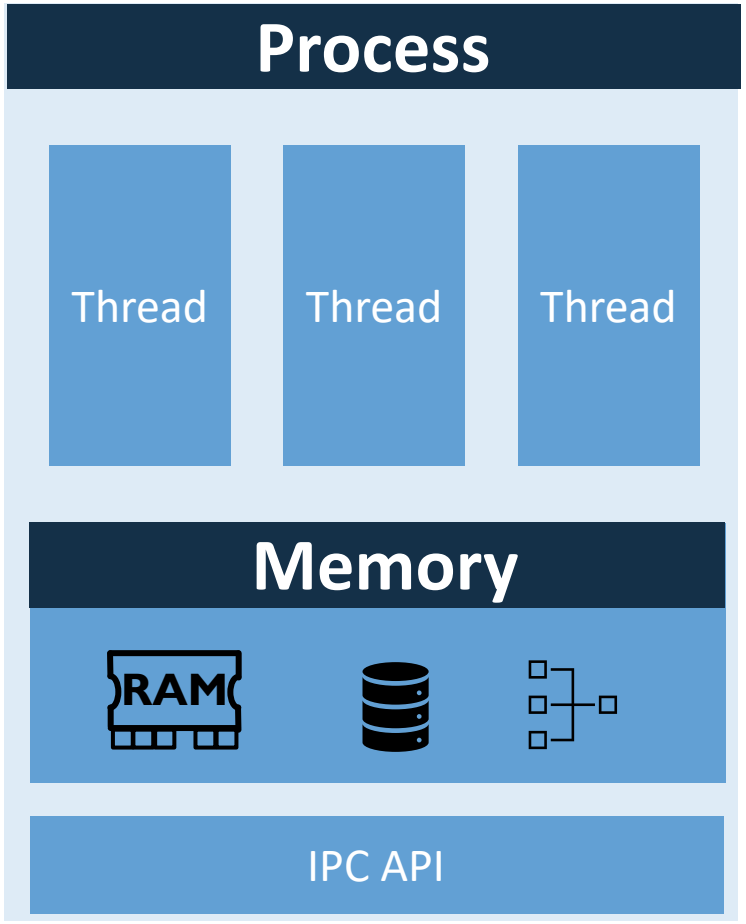
Cloud Process Model



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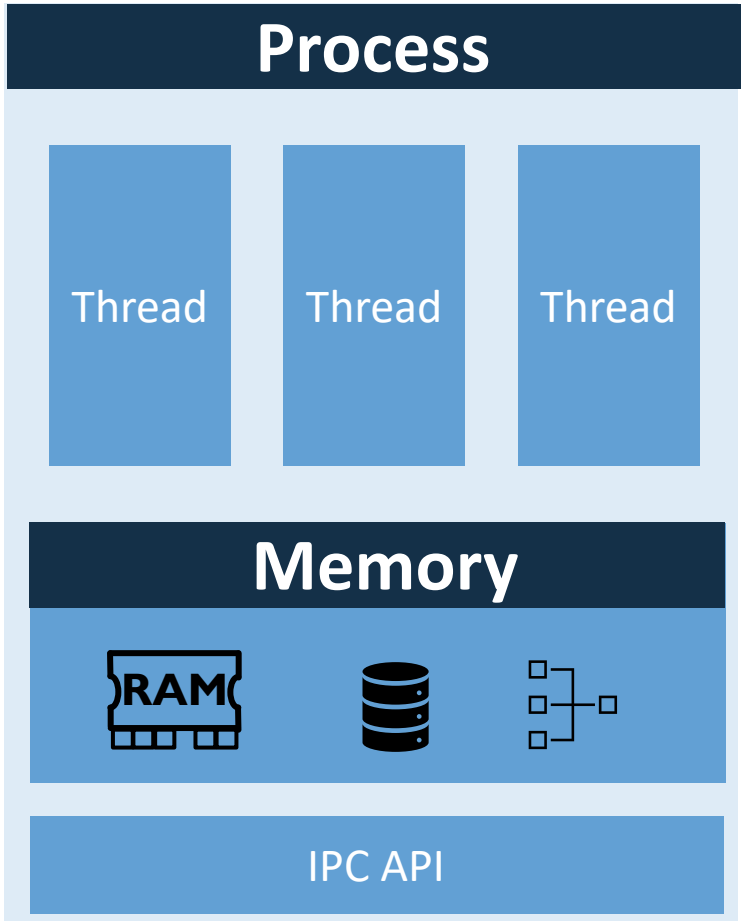

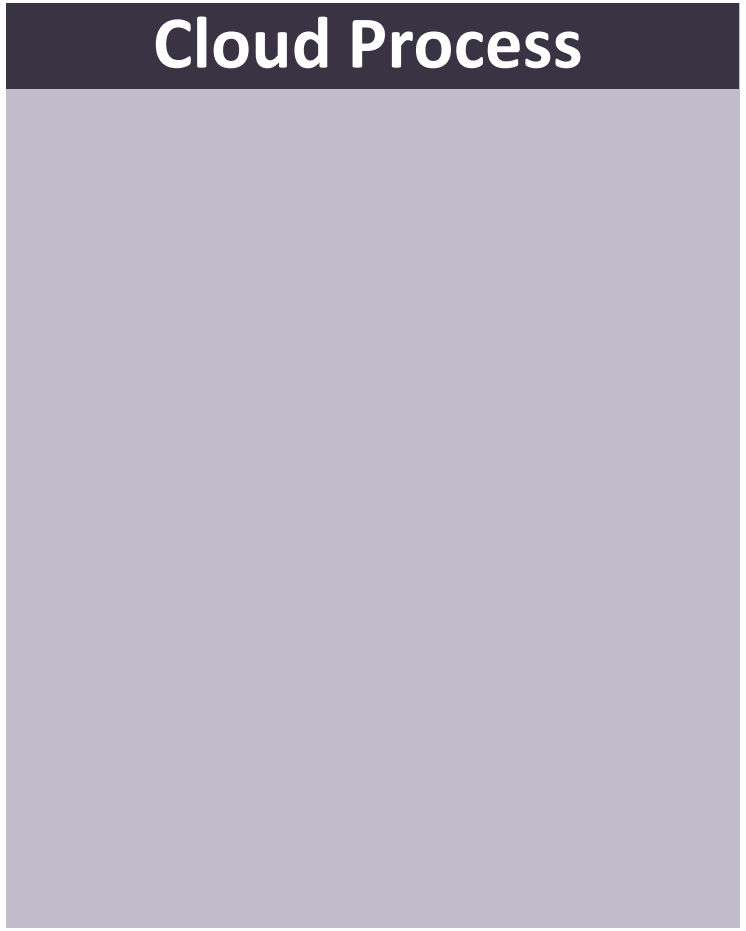

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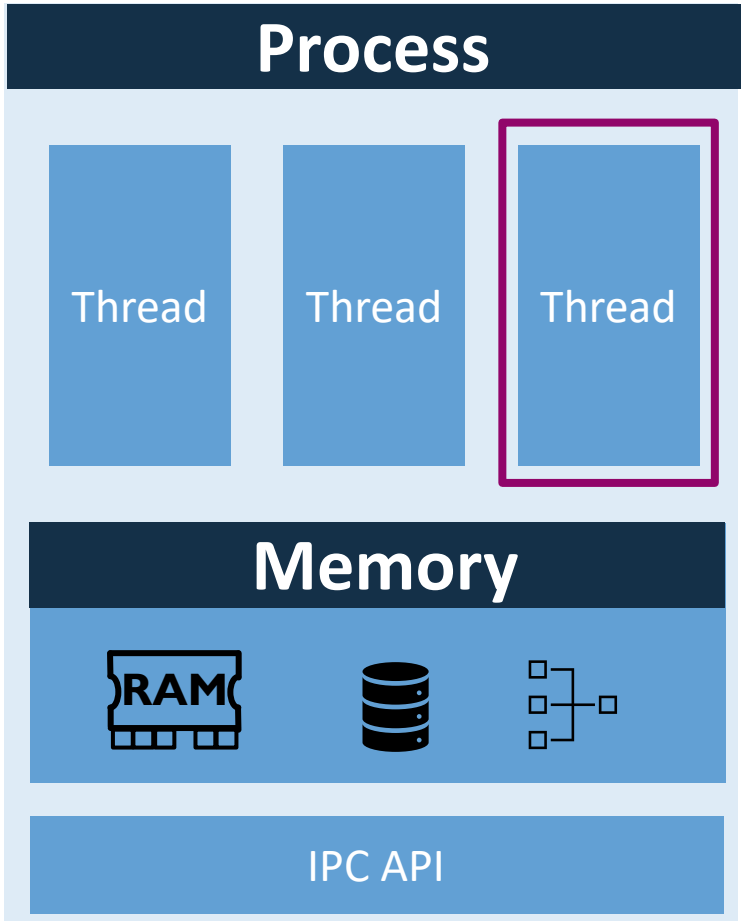
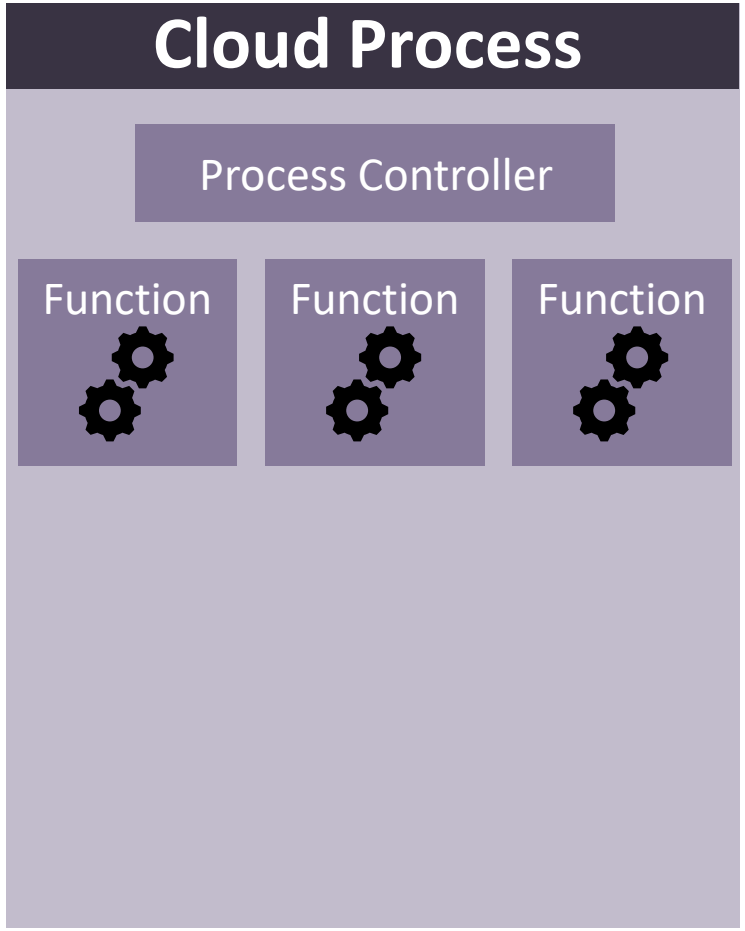
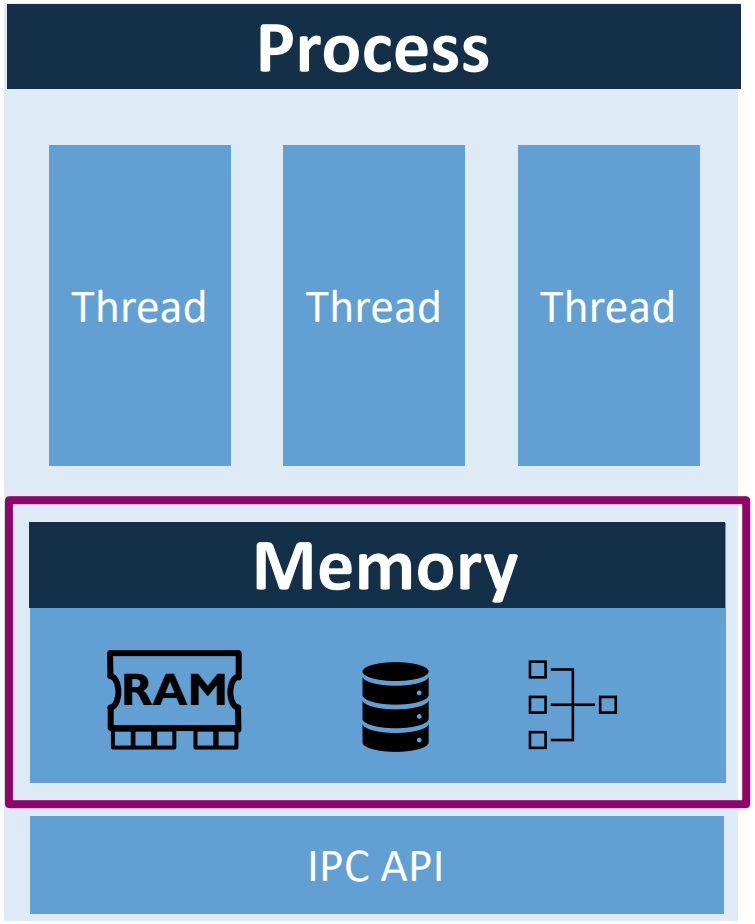
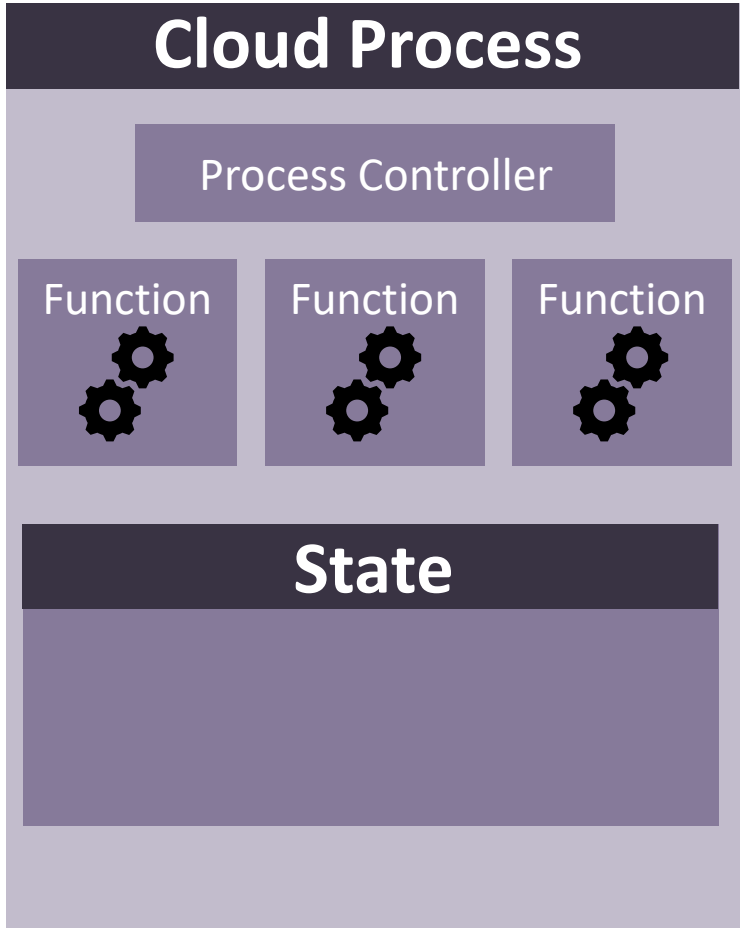




Functions represent computational threads within process.

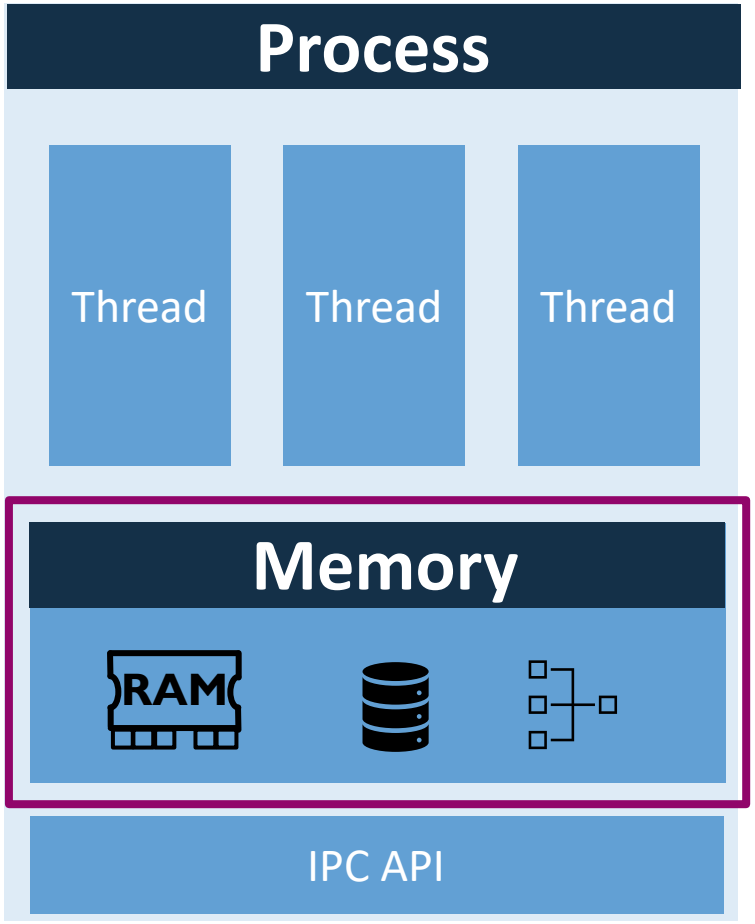
Cloud Process Model

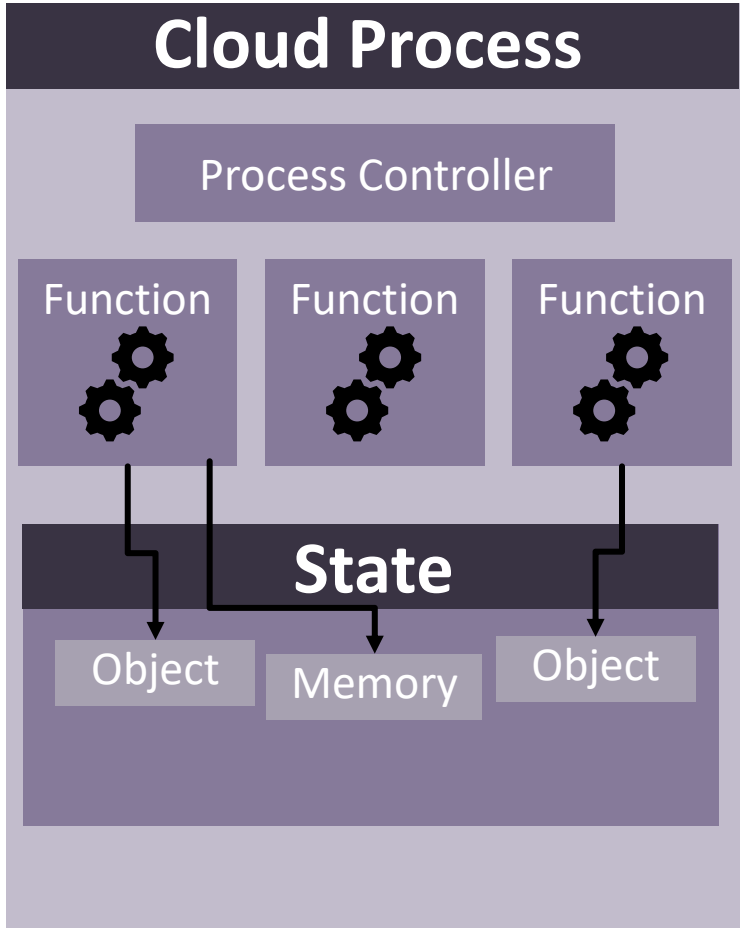




State is represented as a collection of generic objects

Cloud Process Model





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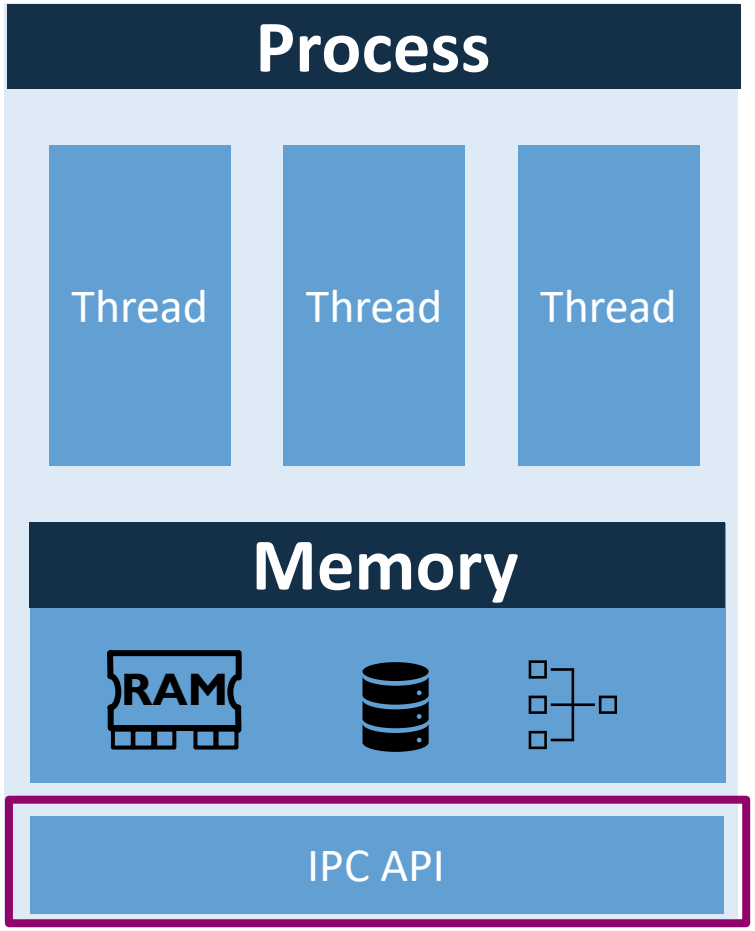
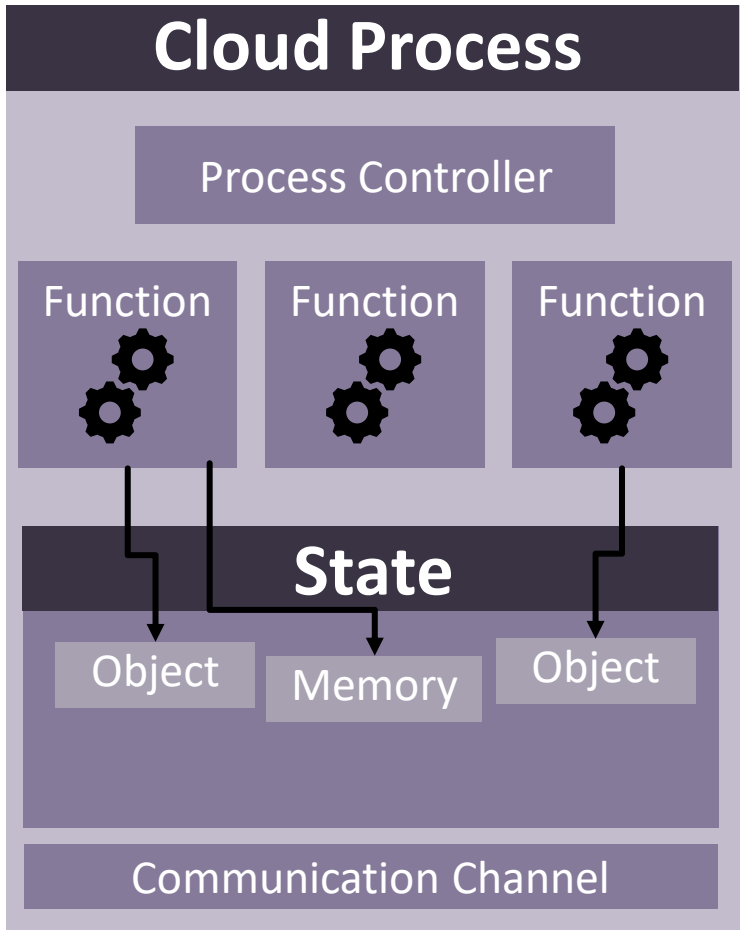
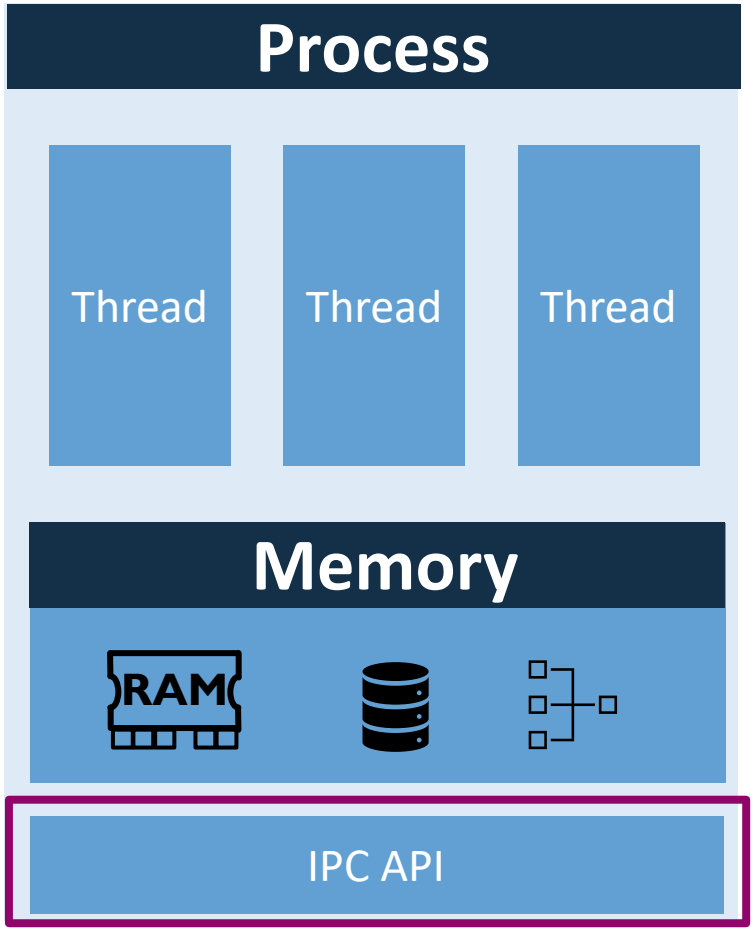
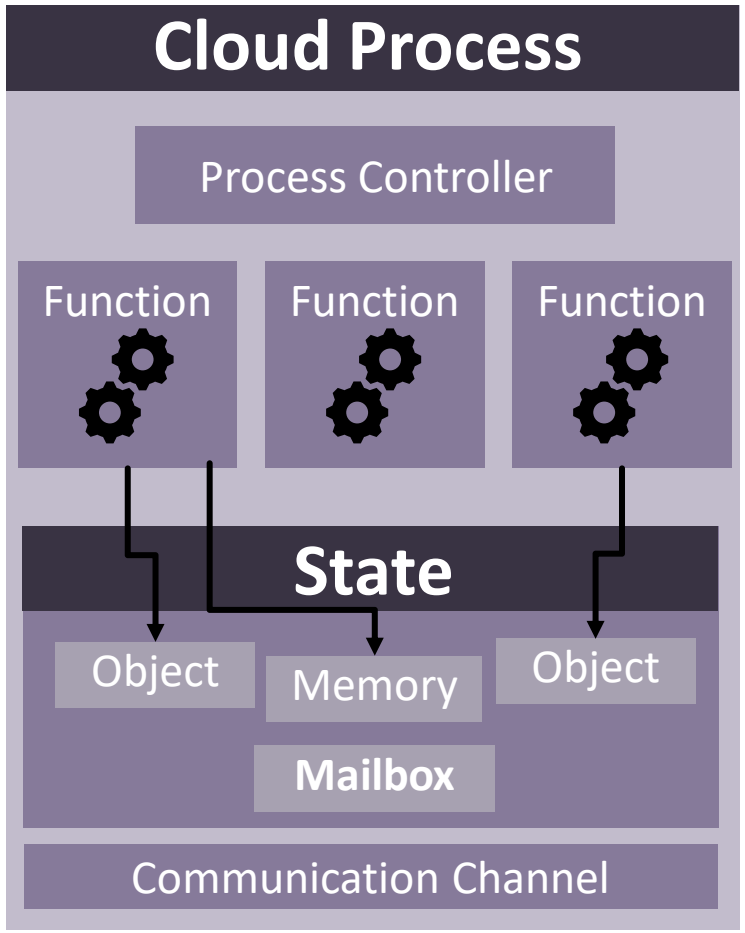




Channels are an abstraction for actual data movement.

Cloud Process Model





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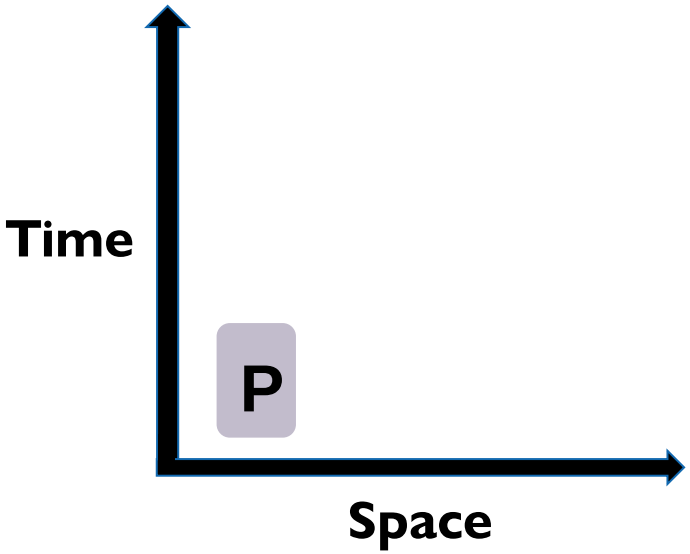
Inter-Process Communication



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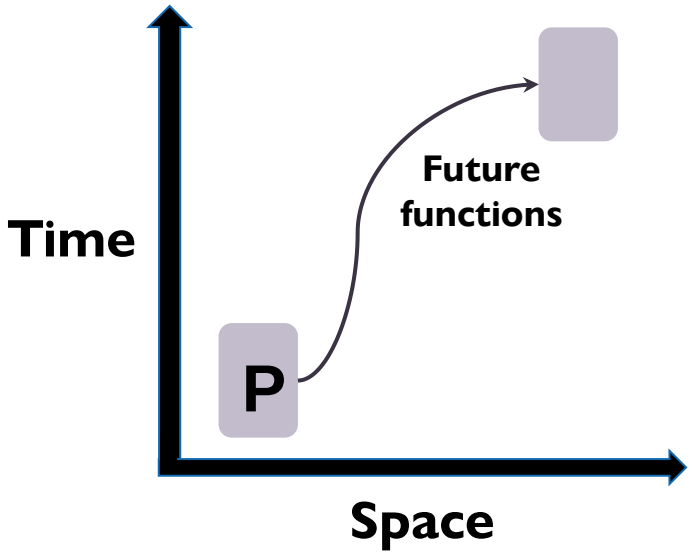

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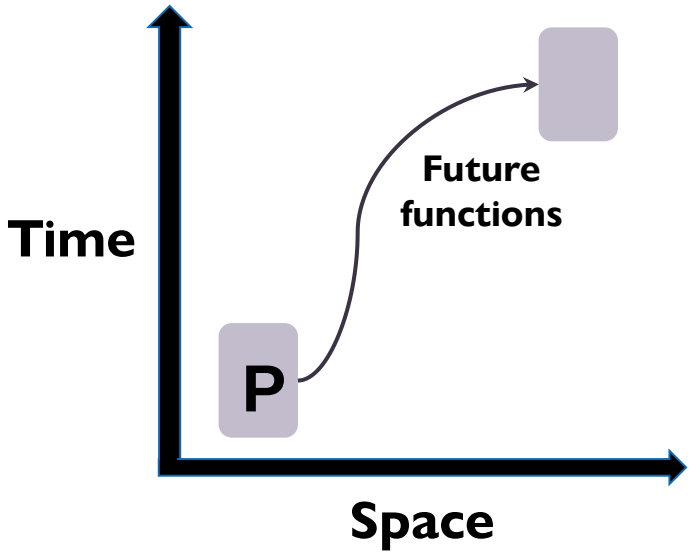
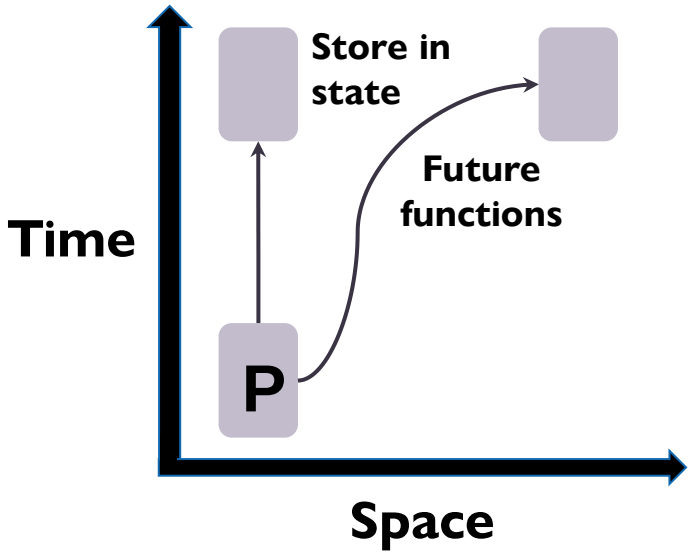



```
invoke(pid_destination, function, data)
```

Inter-Process Communication

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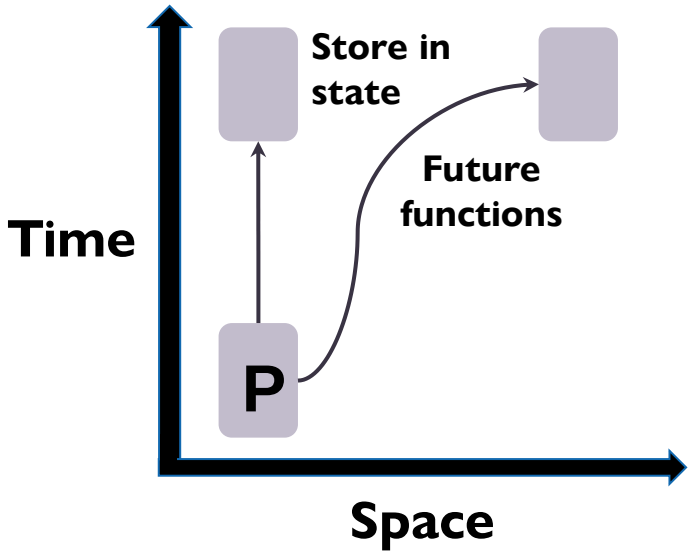


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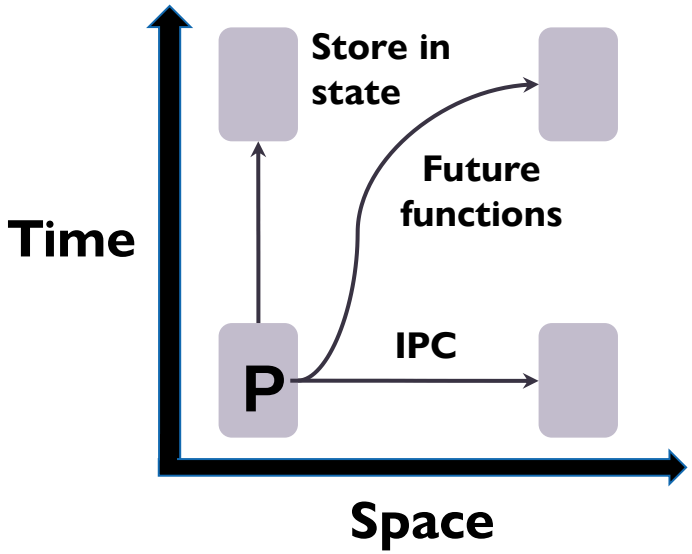
invoke(pid_destination, function, data)

state(key, data)
data = state(key)
```

Inter-Process Communication

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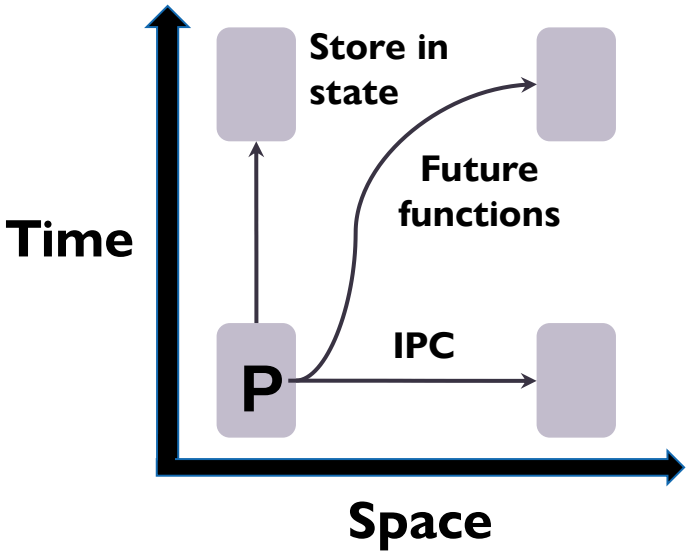
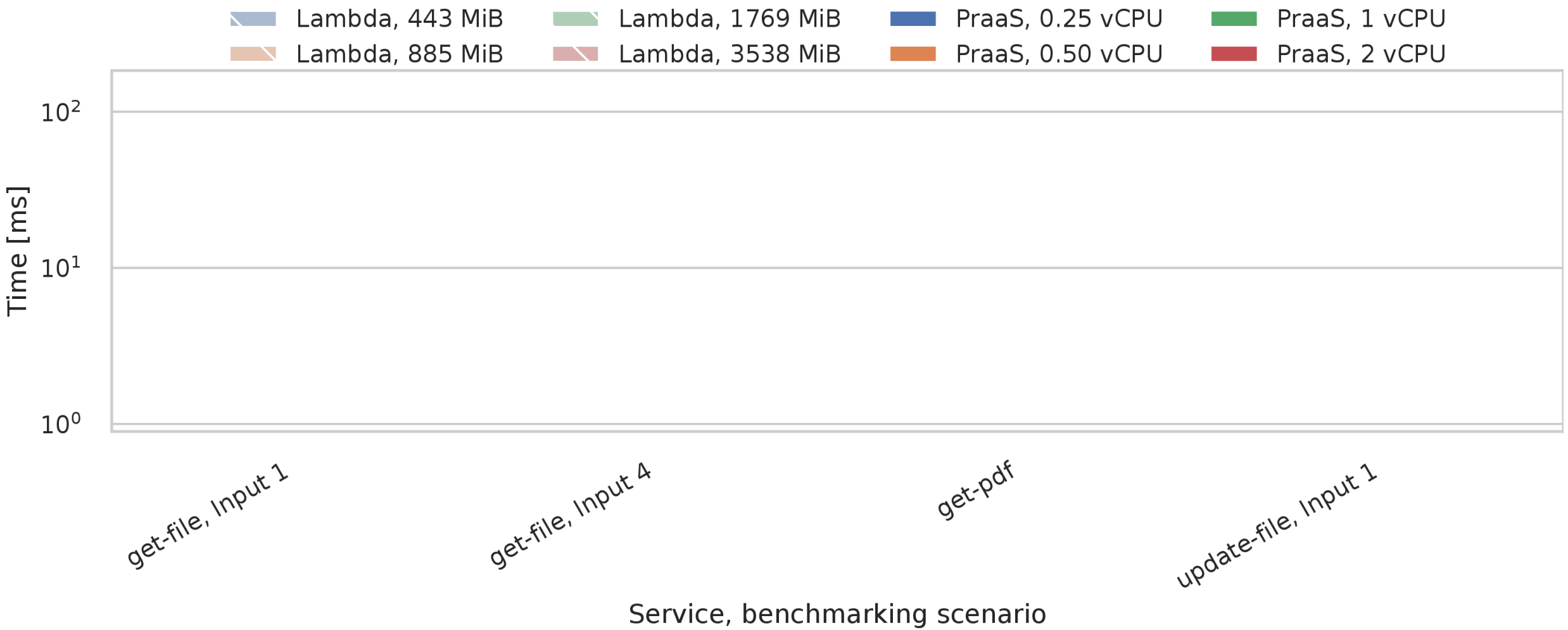



```
invoke(pid_destination, function, data)

state(key, data)
data = state(key)

send(pid_destination, key, data)
data = recv(pid_source, key)
```

Benchmark: LaTeX Microservice



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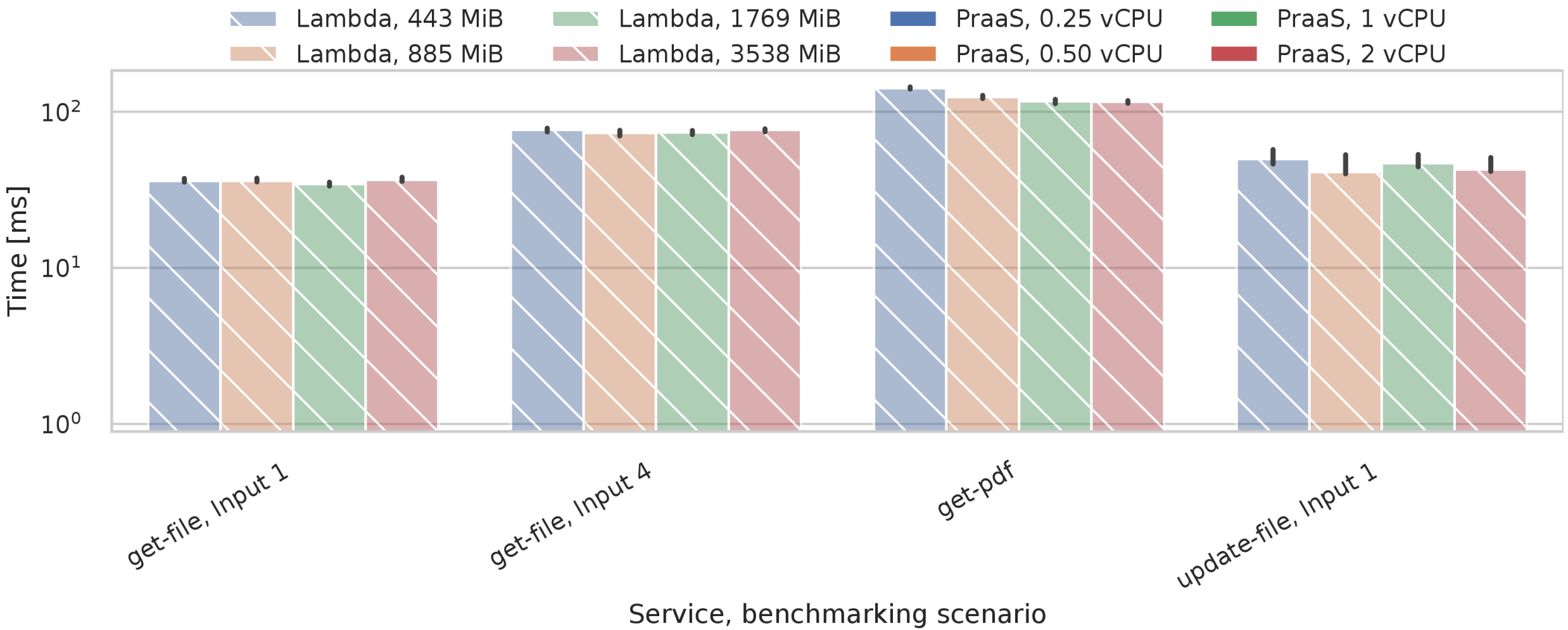

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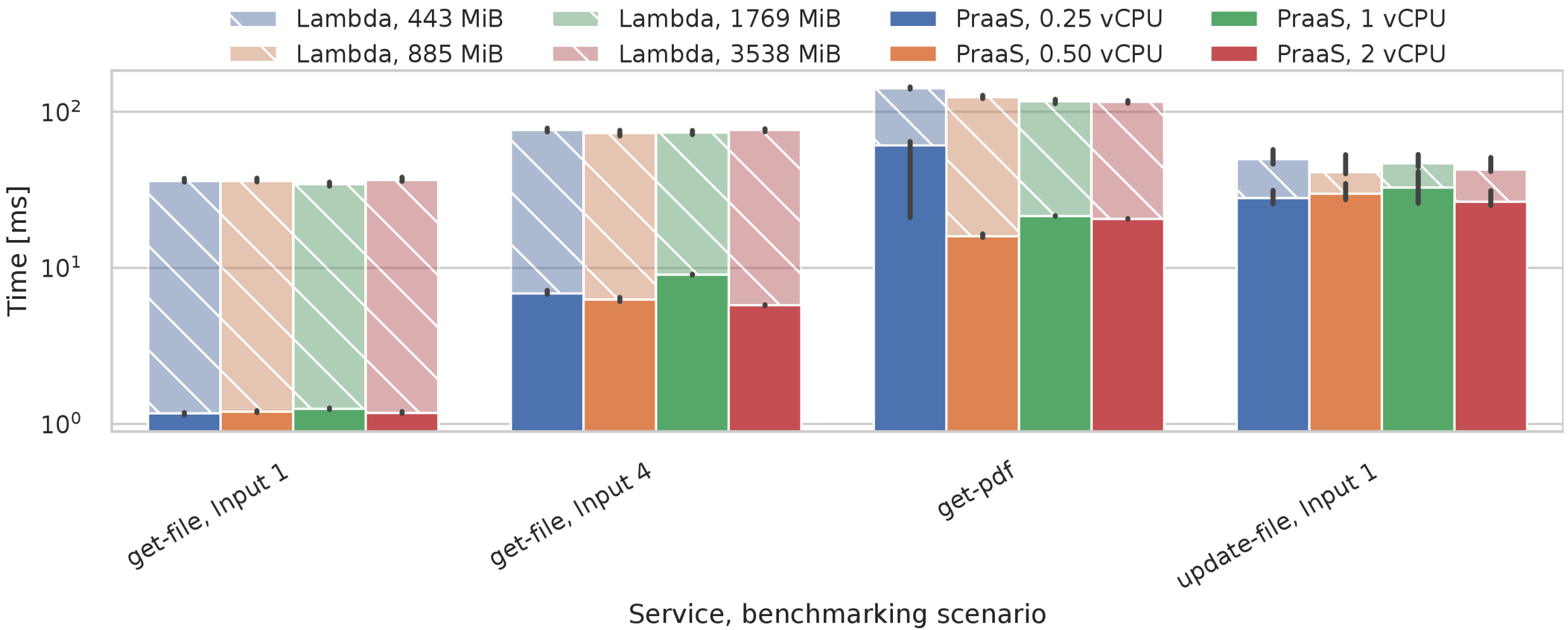

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ETH Zurich

Gyorgy Rethy
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