Proactive Serverless Function Resource Management

Sixth International Workshop on Serverless Computing (WoSC6) 2020

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Background

Freshen Design

Evaluation

Discussion

Questions

Outline

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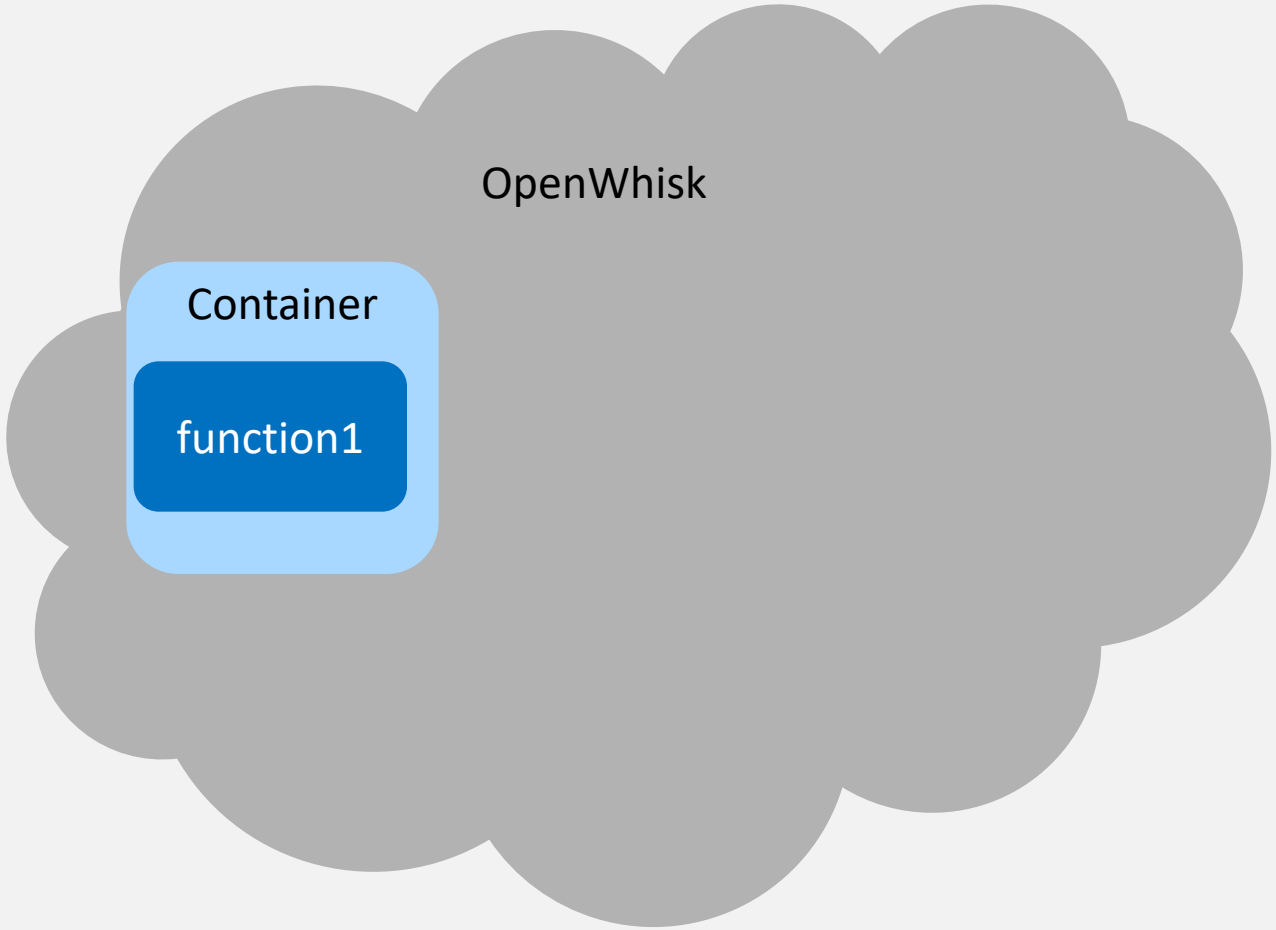
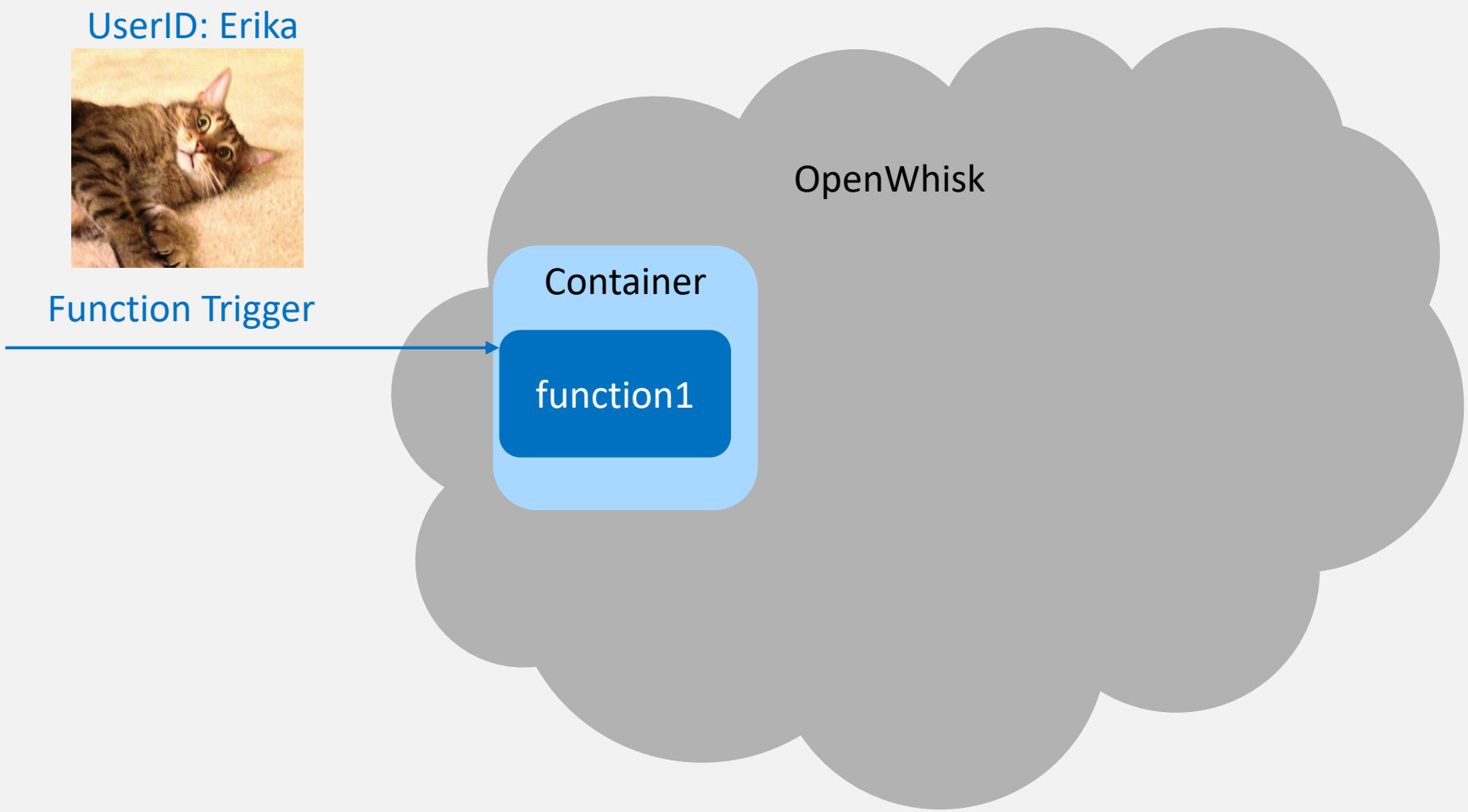
Outline



IDCat Serverless Application



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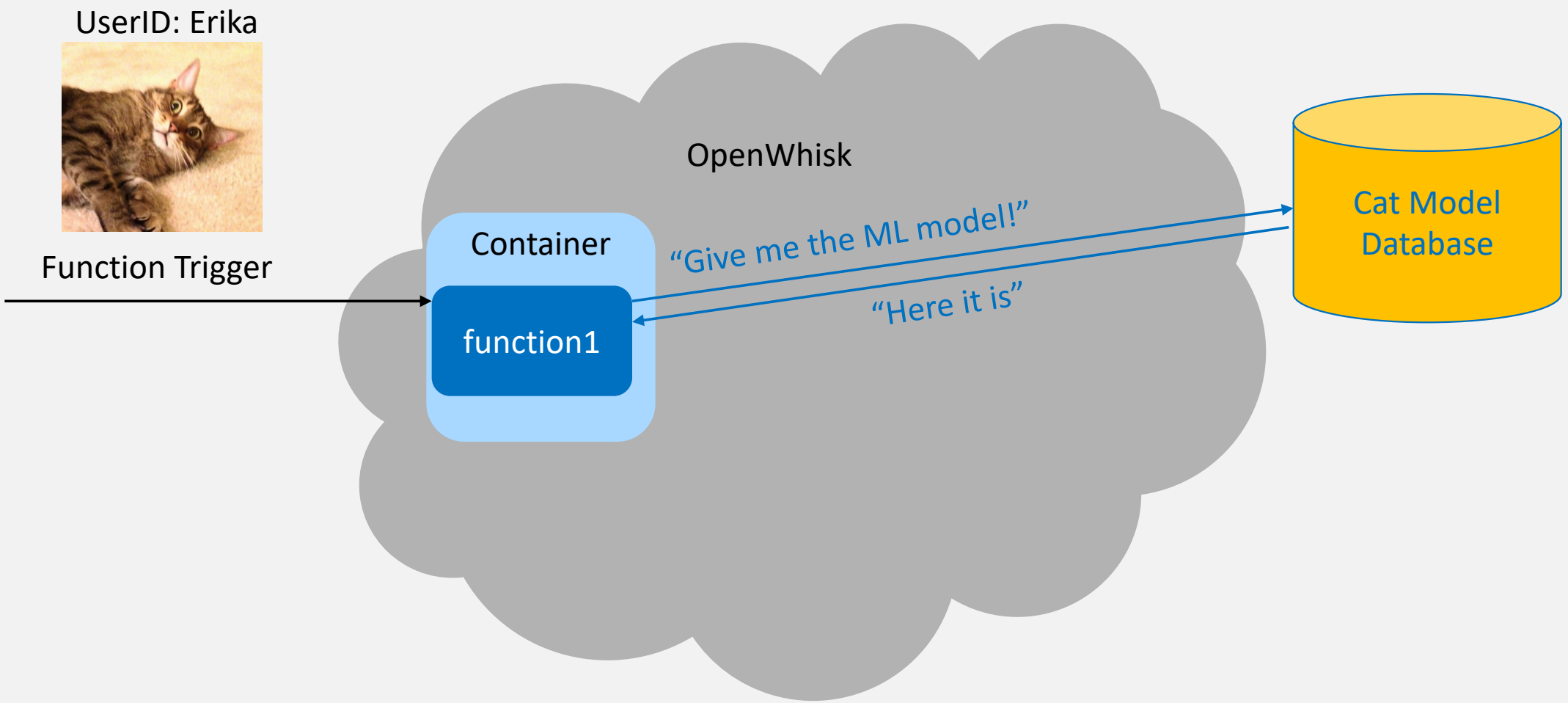

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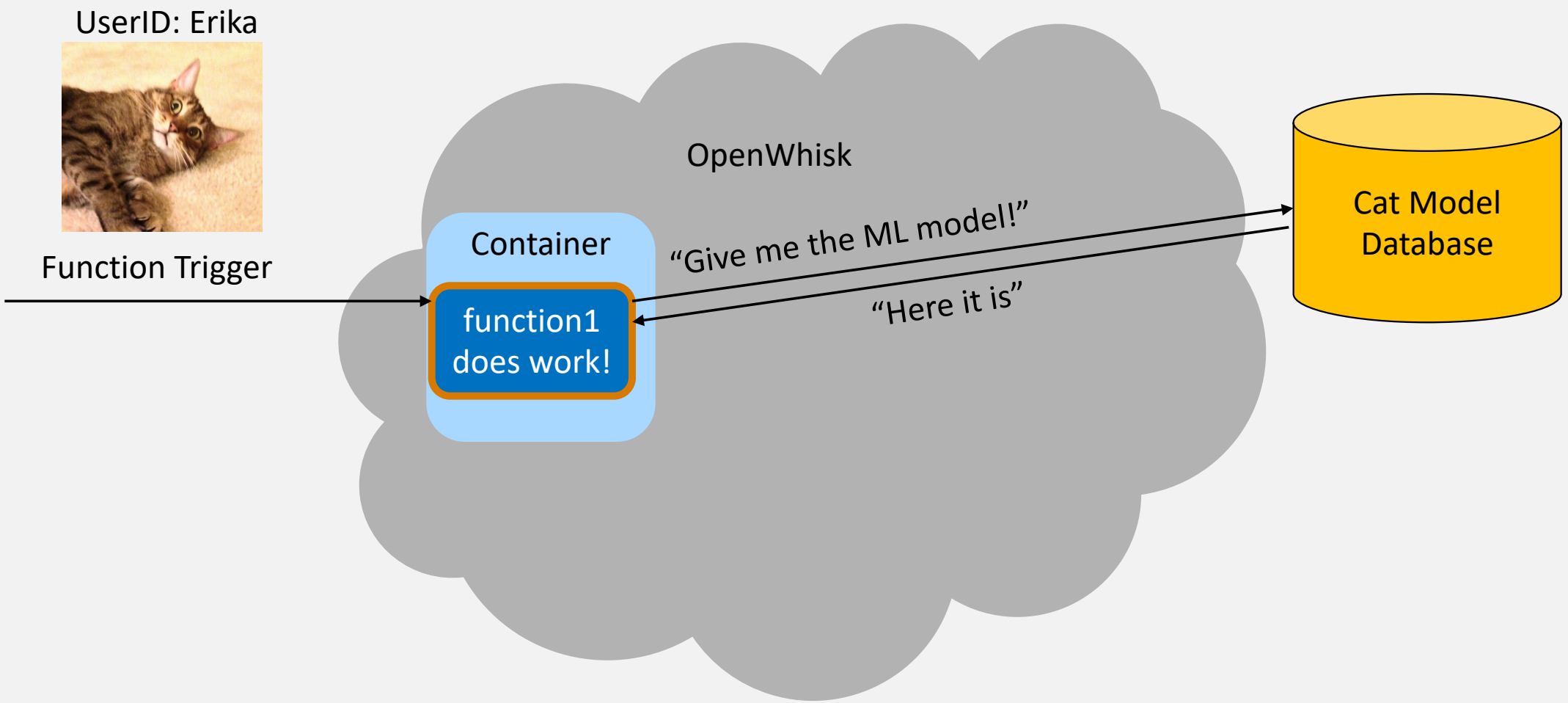

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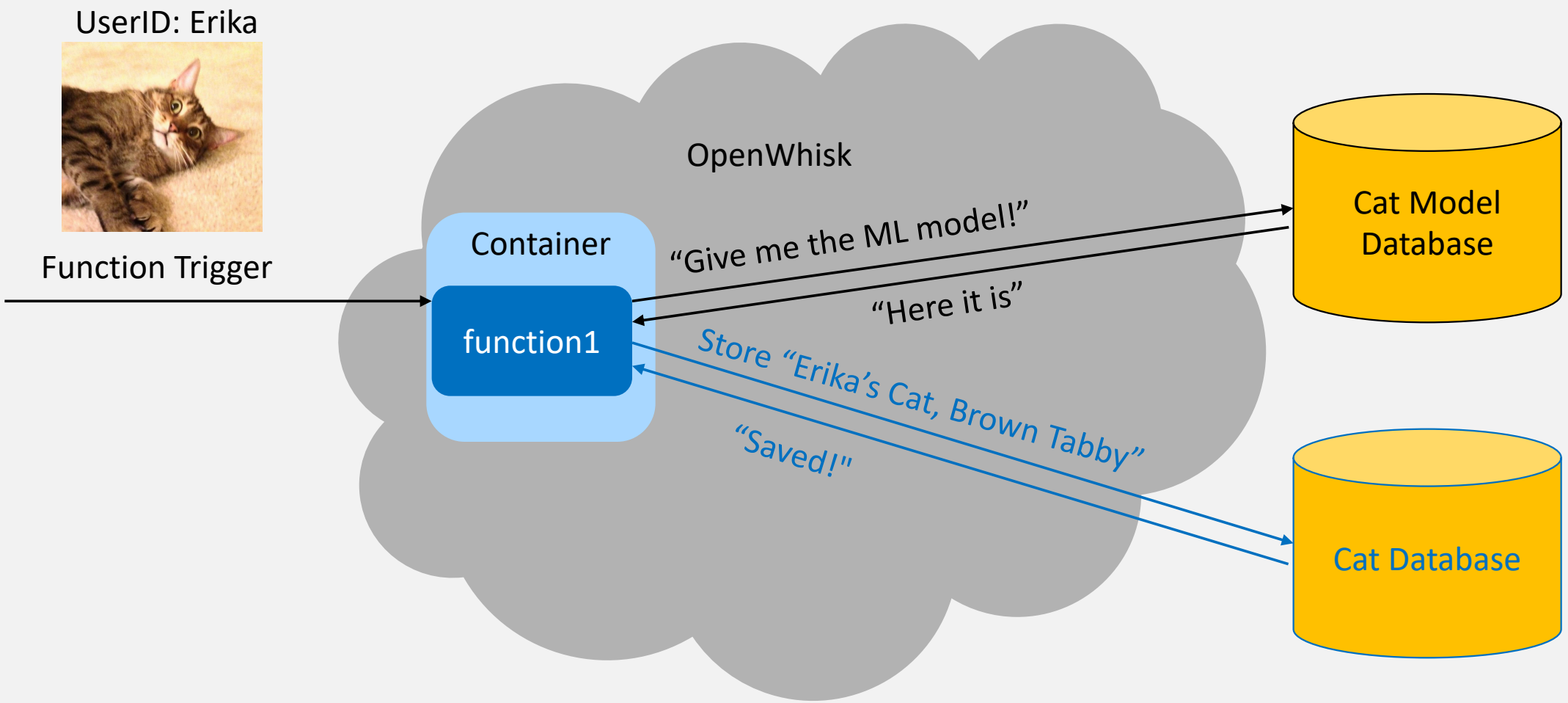

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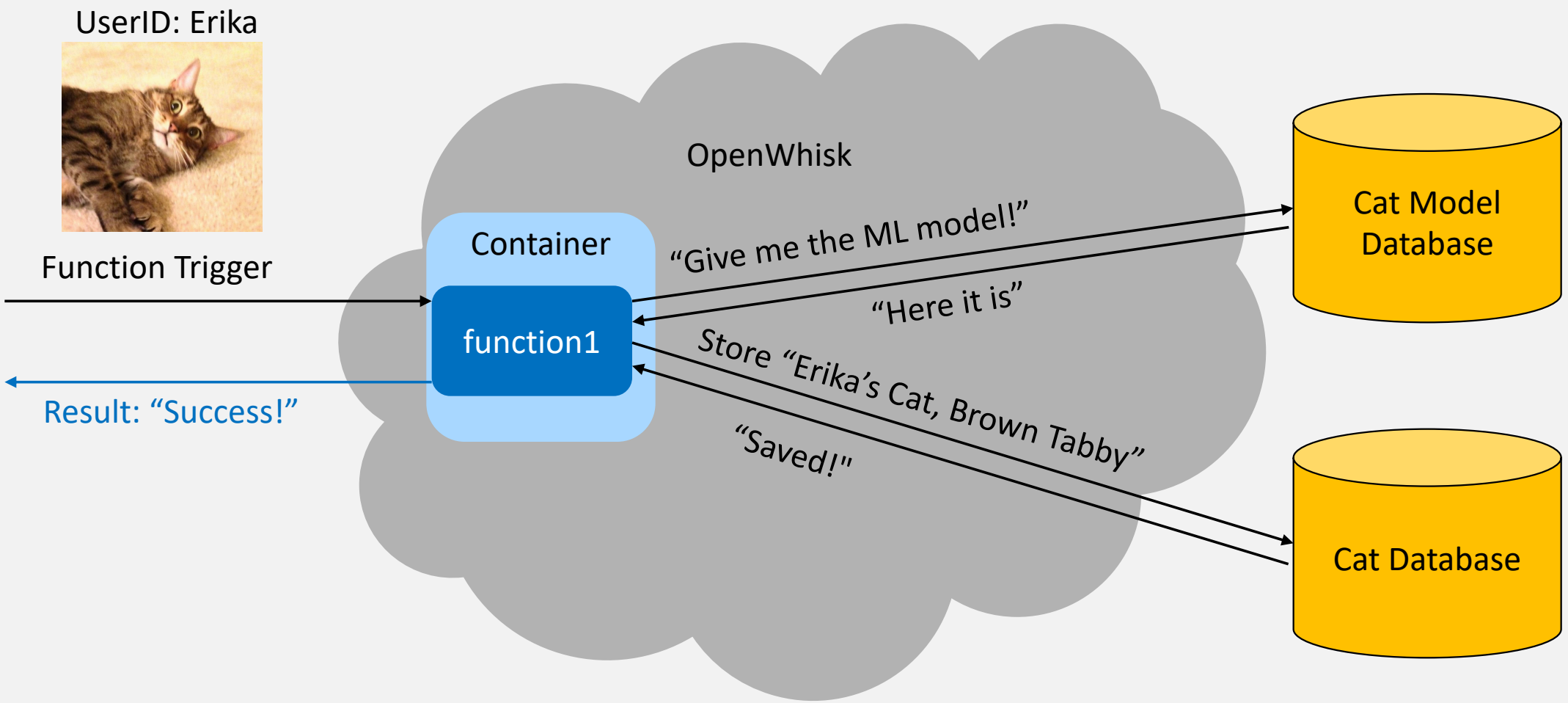

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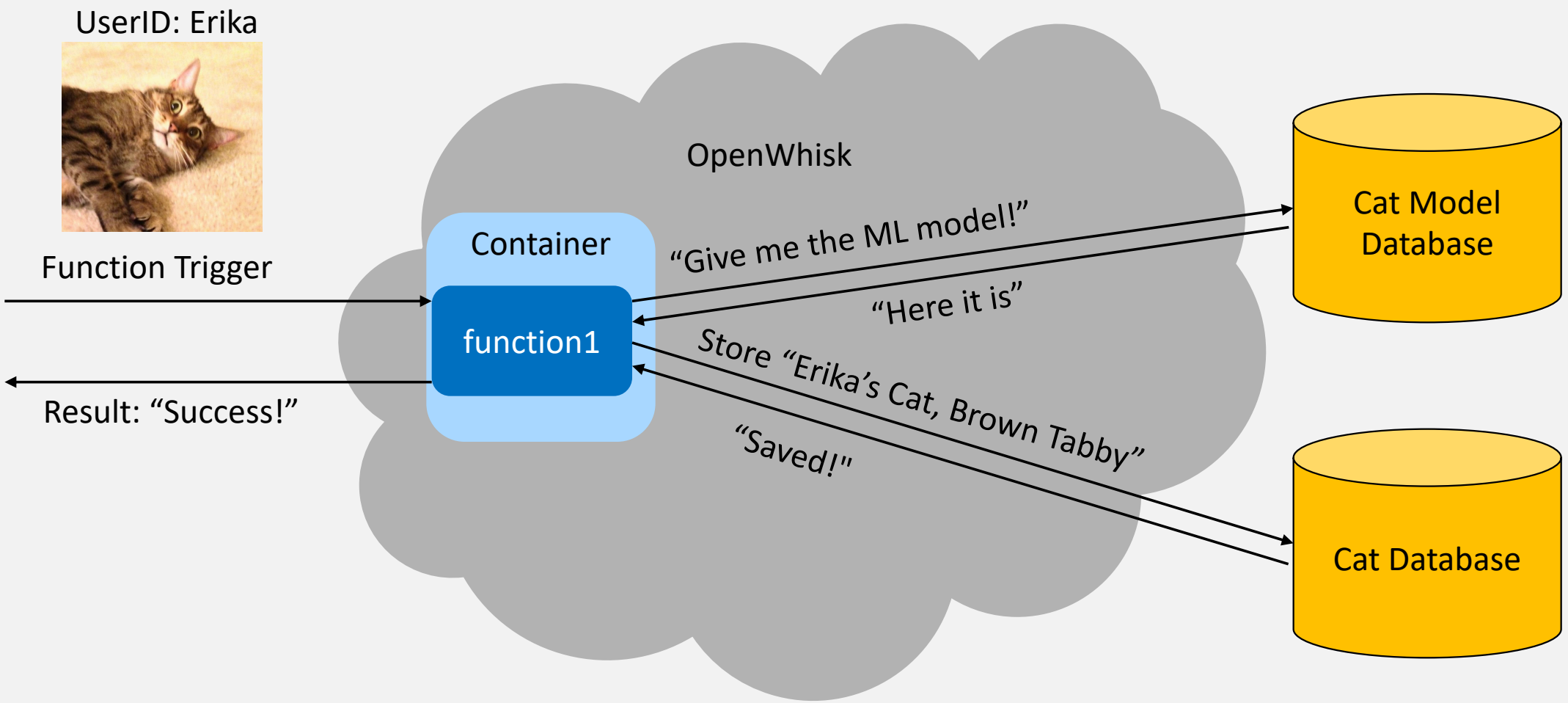
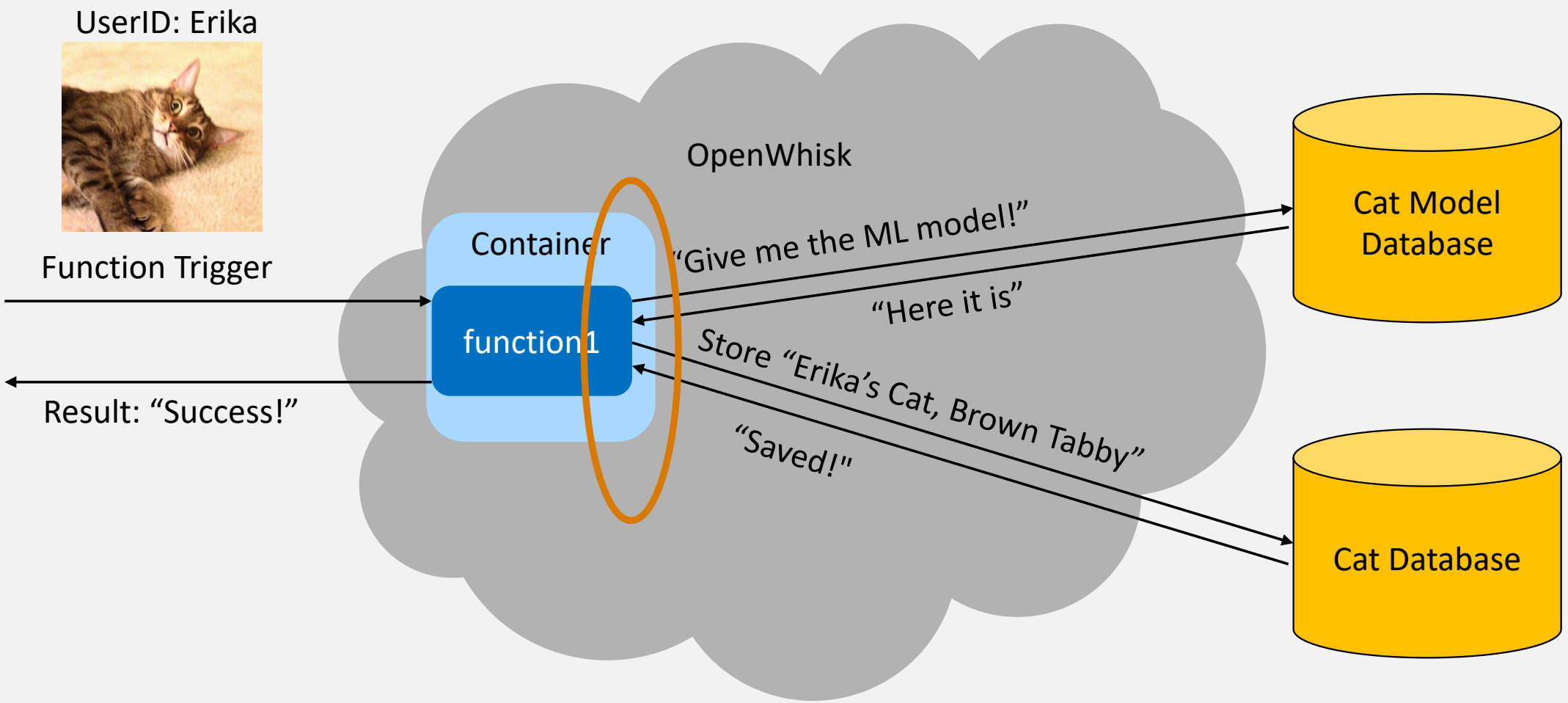


Improve Efficiency?



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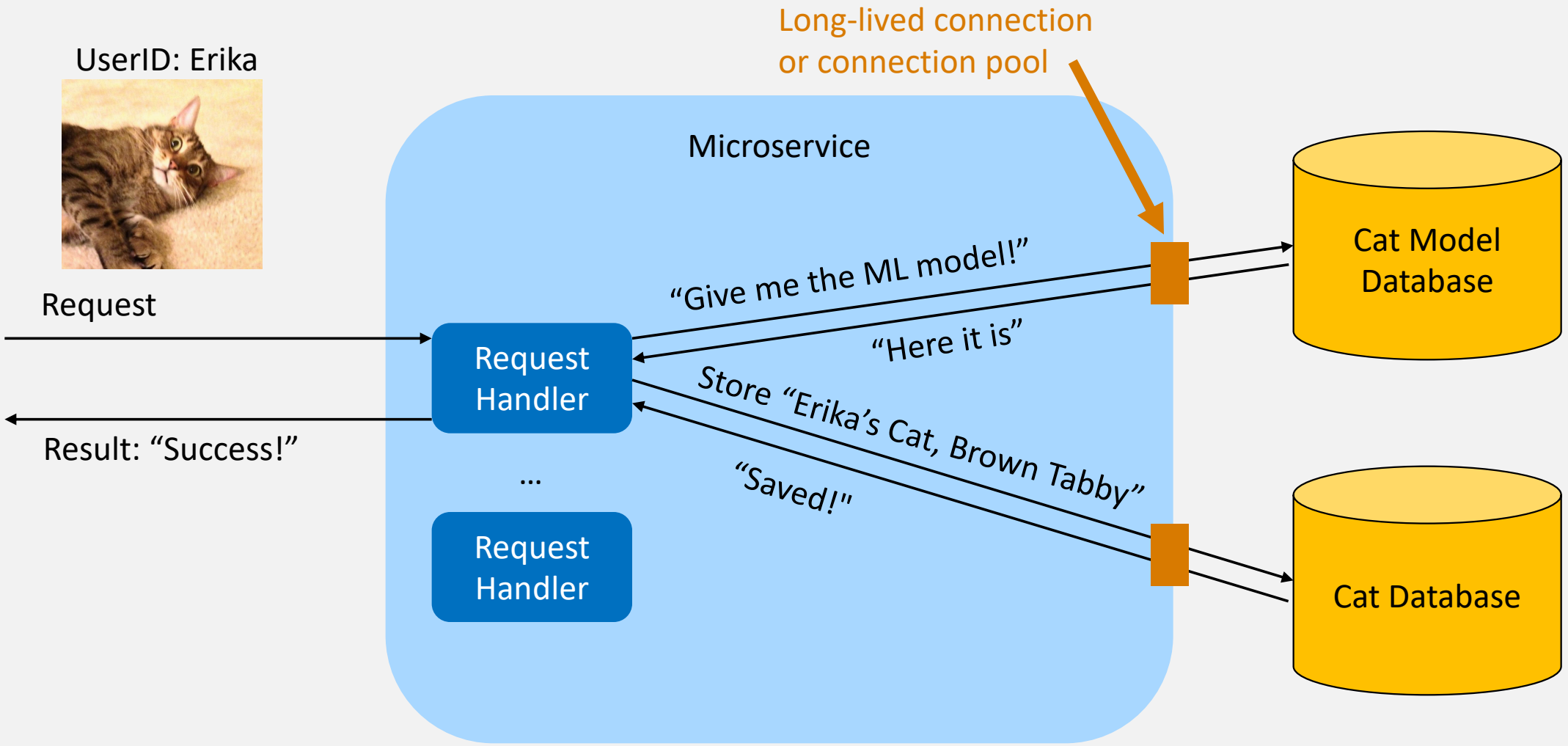
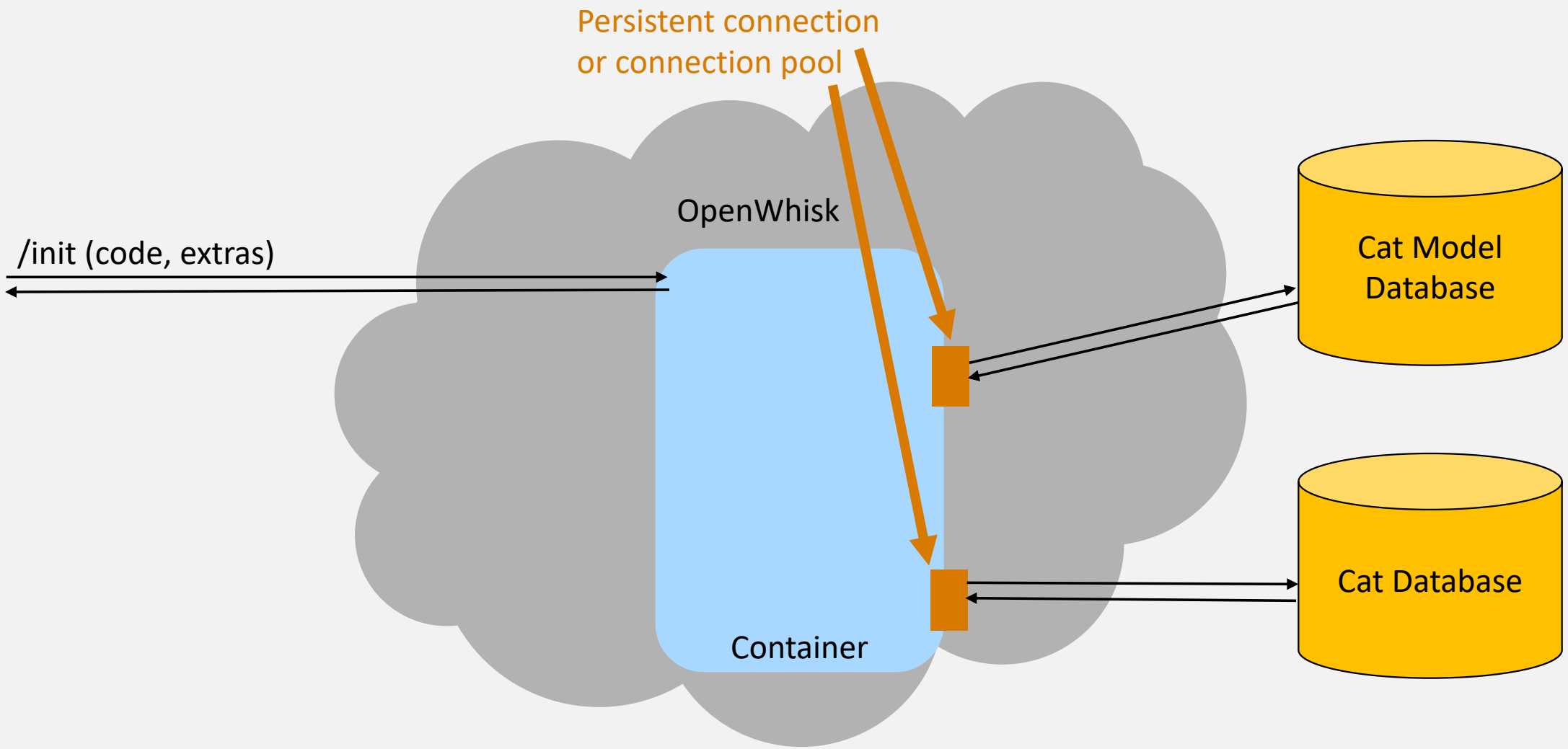
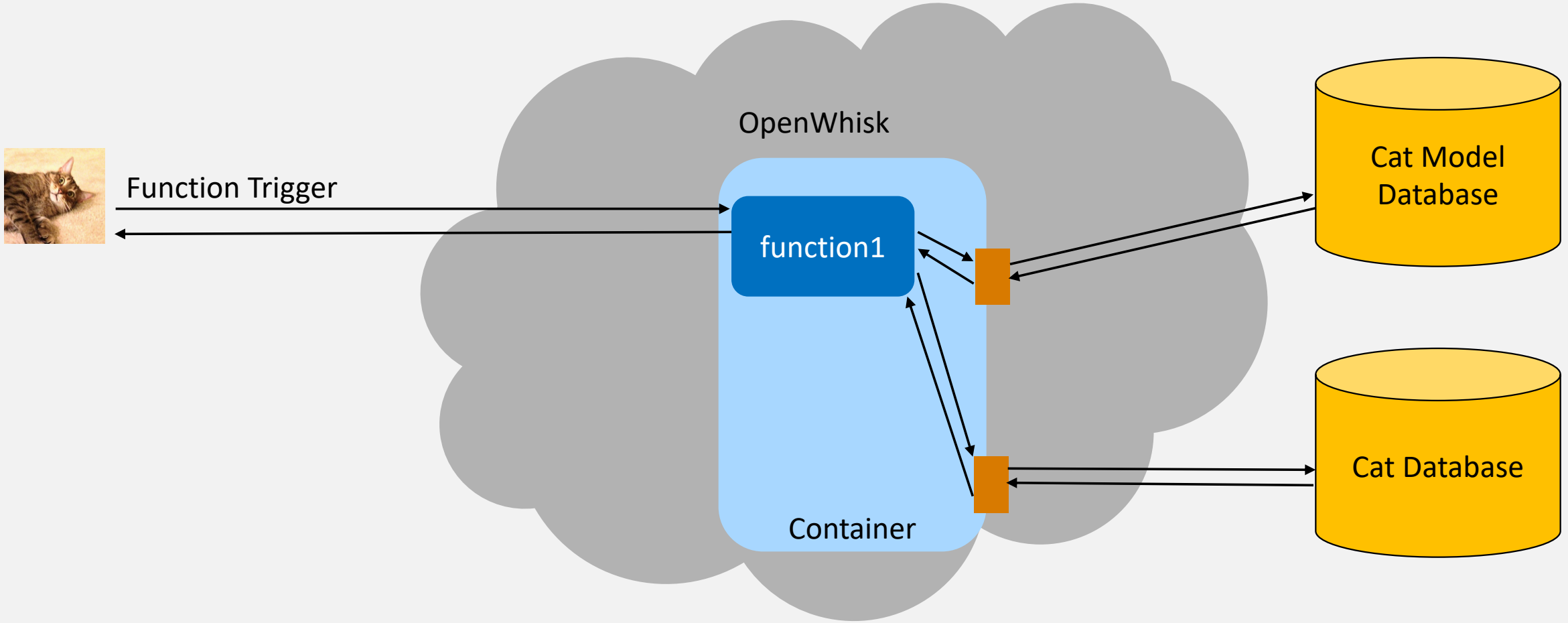


IDCat Microservice



Runtime Reuse in Serverless



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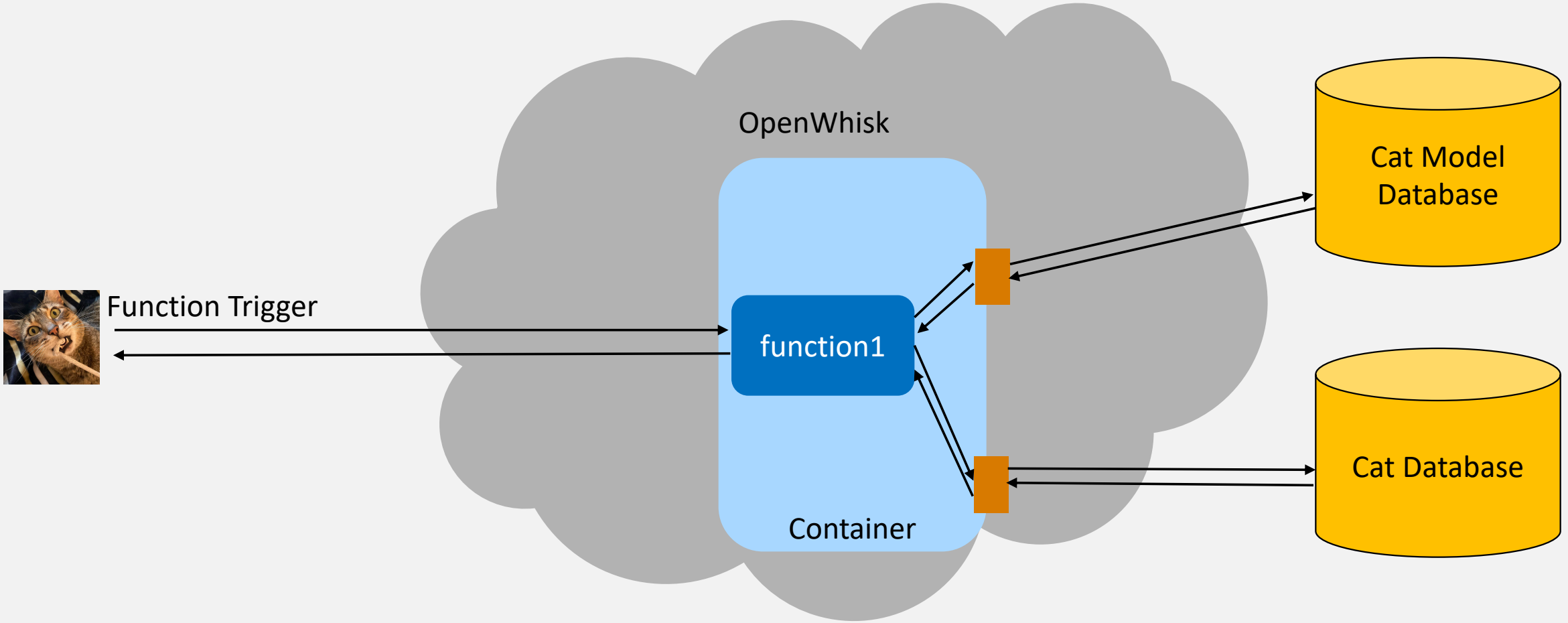

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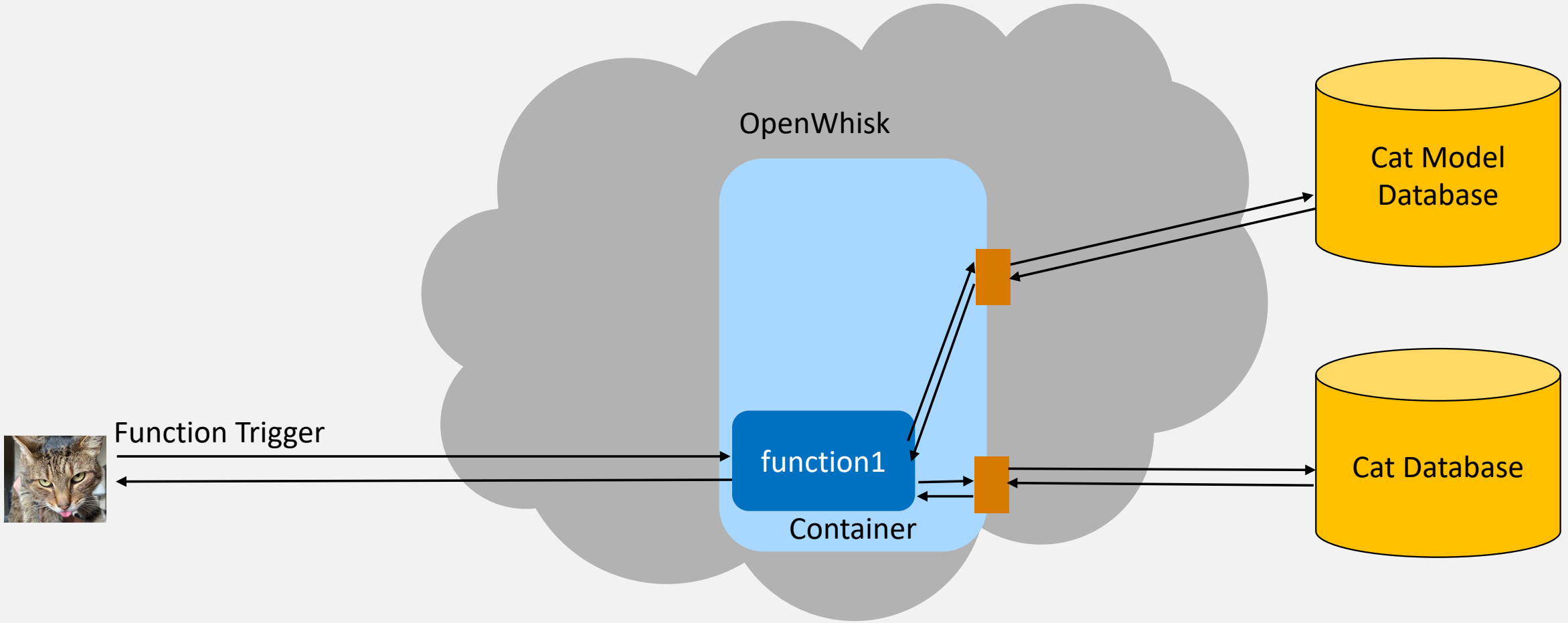

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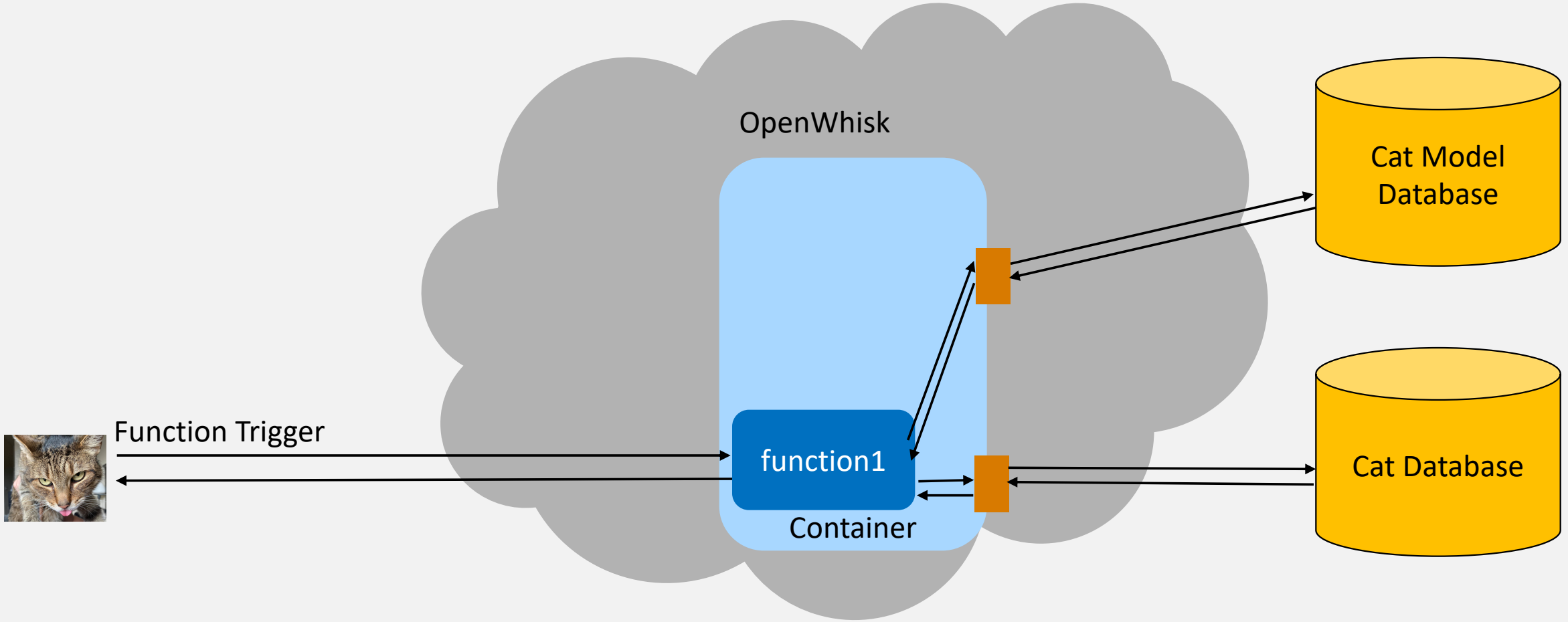


Runtime Reuse in Serverless – **Room for Improvement?**

Background

***Freshen* Design**

Evaluation

Discussion

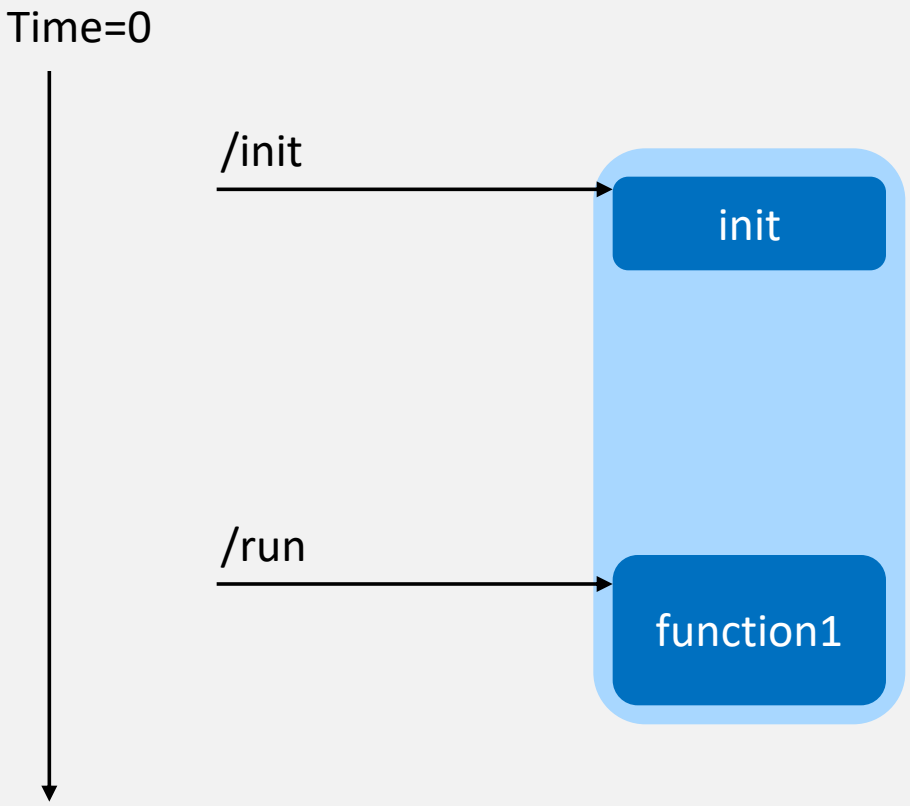
Questions

Outline

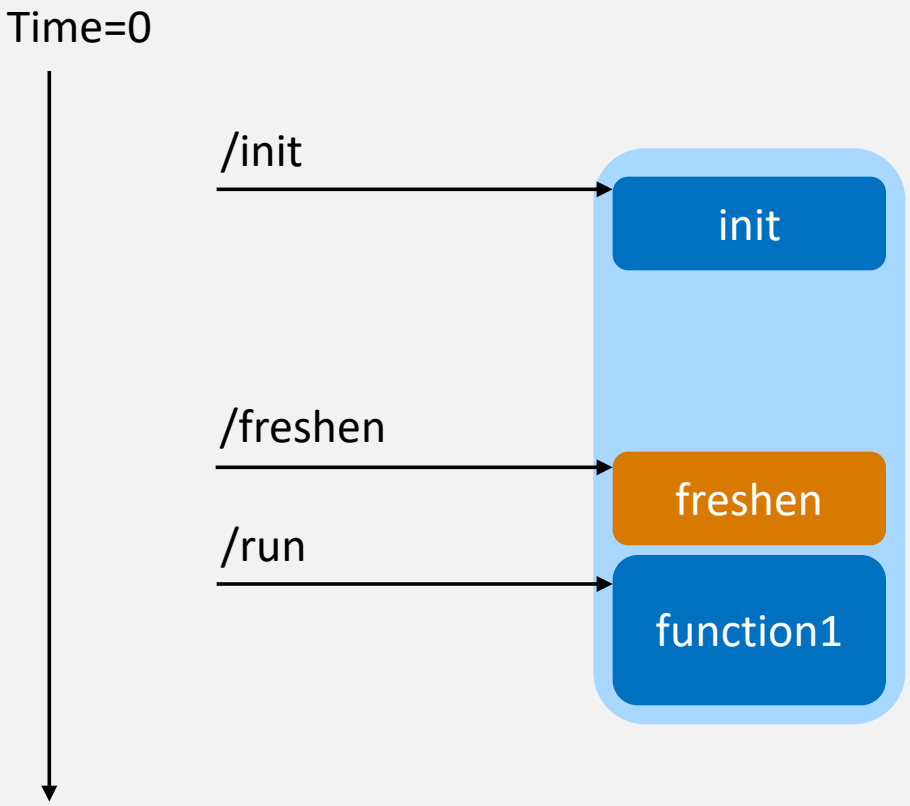
Overview

- We propose a new serverless runtime primitive, ***freshen***, as a mechanism to enable proactive serverless function resource management.

- Goals:
  - Build mechanism for dynamic resource management into serverless lifecycle
  - Reduce function latency
  - Dynamically manage state without cluttering function code



Freshen Design



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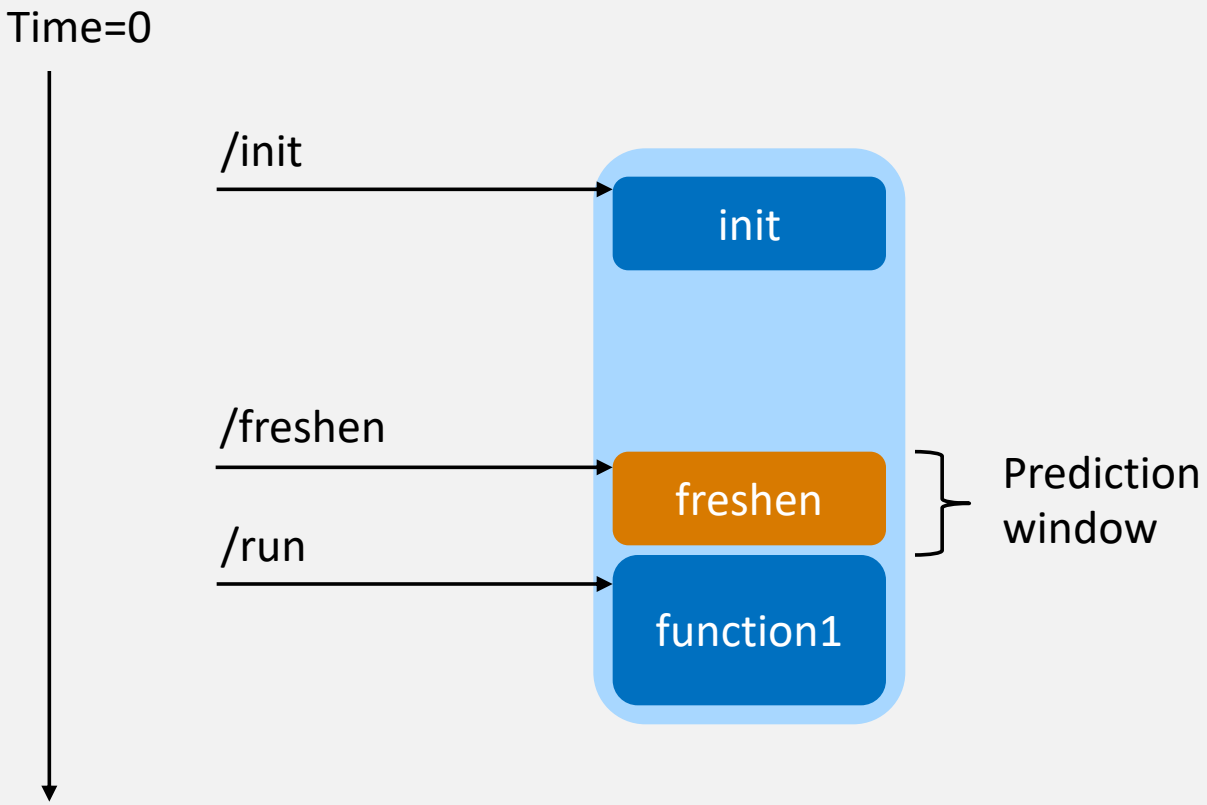

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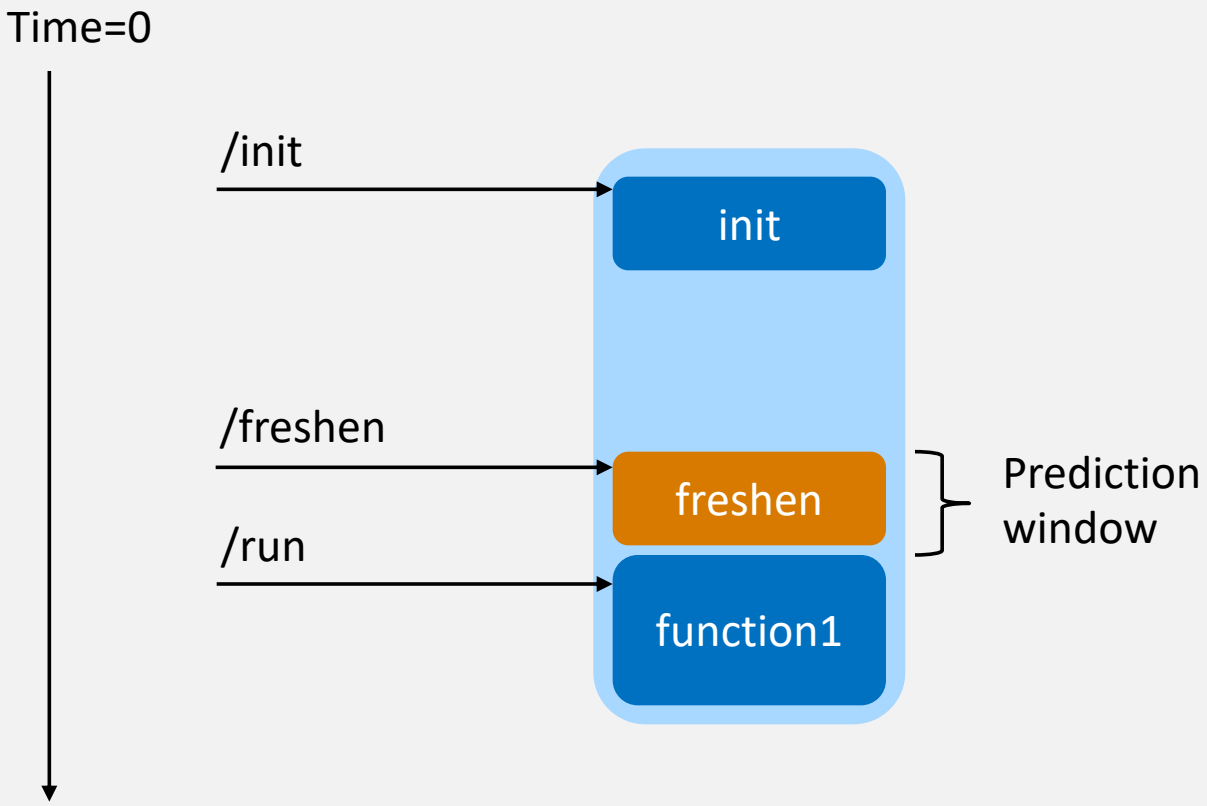
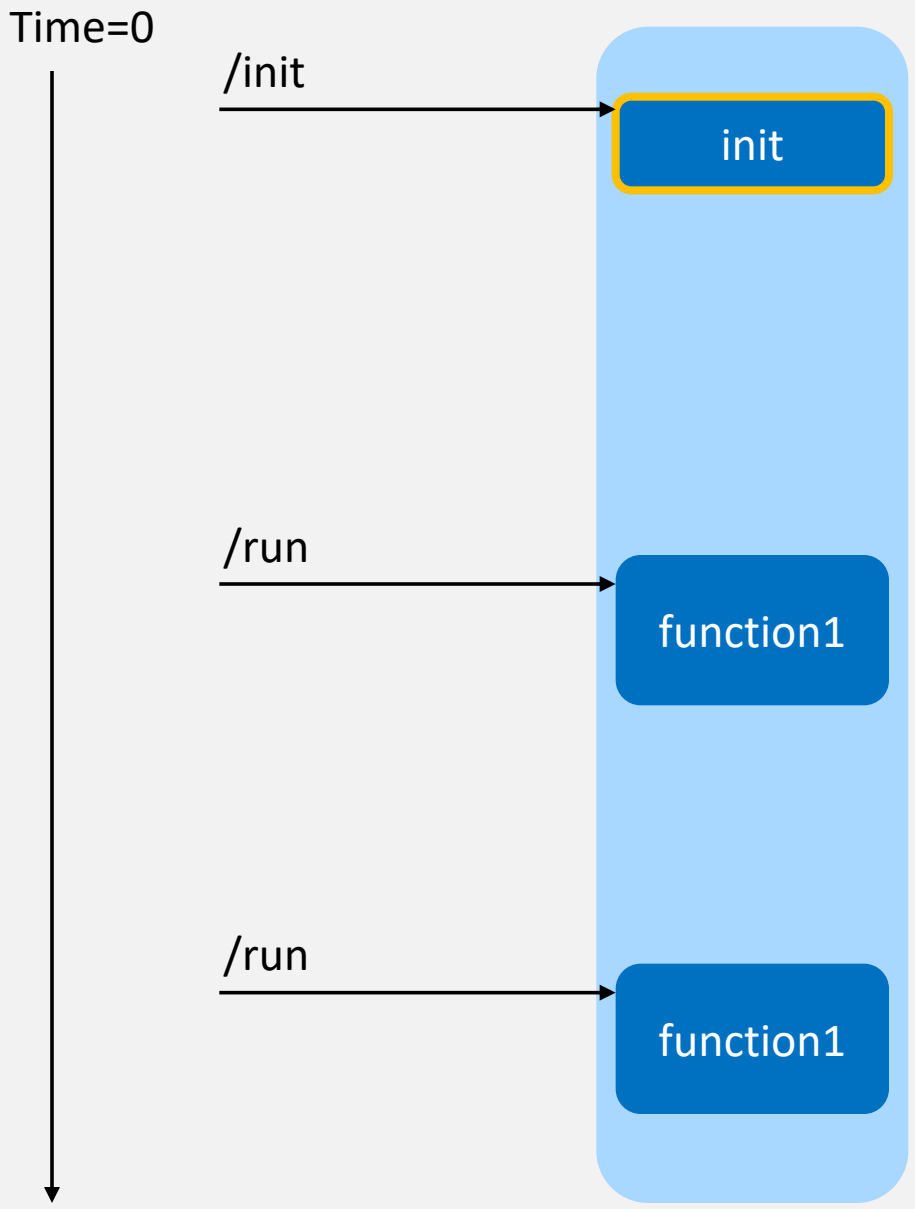


Policy Options:

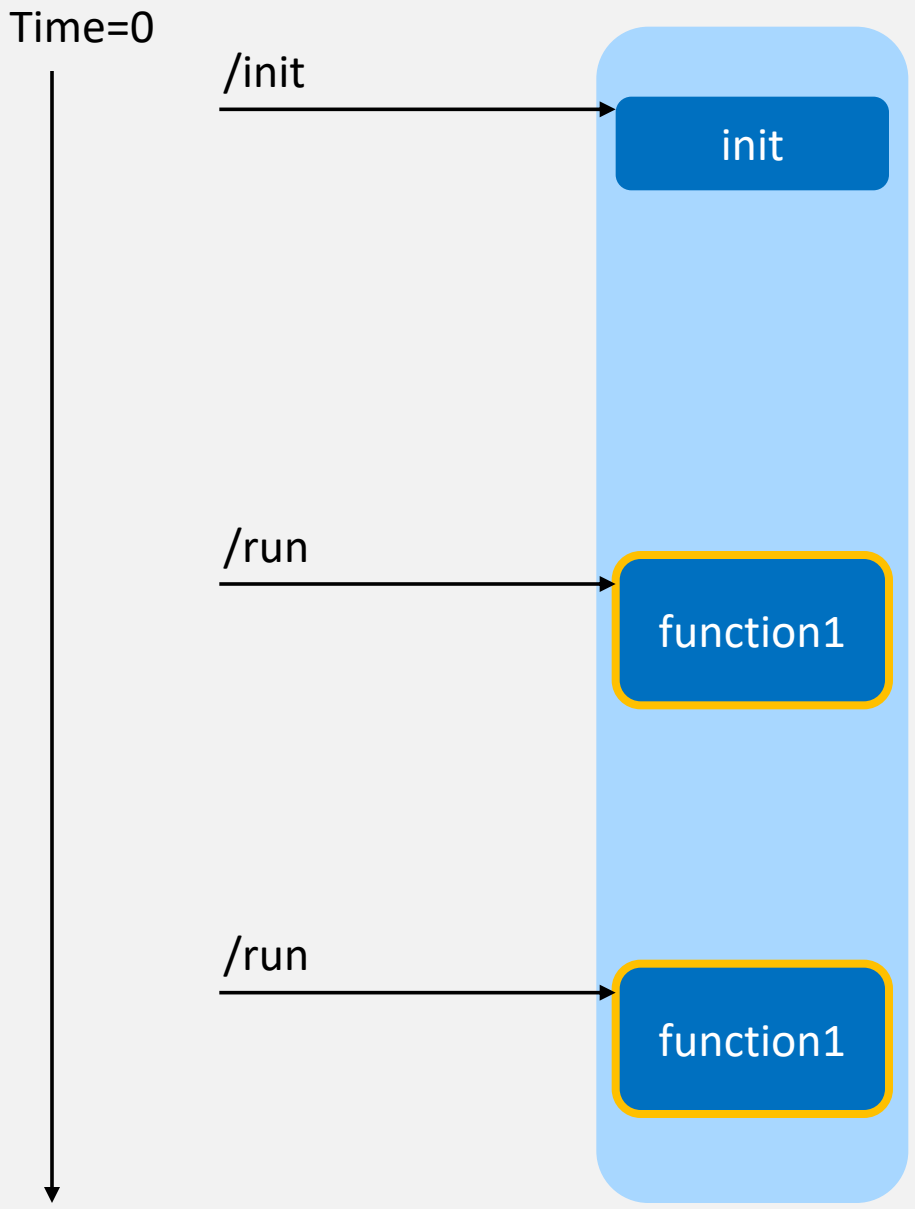
- Prediction
- Concurrency
- Forced blocking

Freshen Design



Serverless Resource Management Overview

	Reuse	Dynamic State	Proactive
Init Phase	✓	✗	✗
Function Code			
Runtime Reuse			
Freshen			



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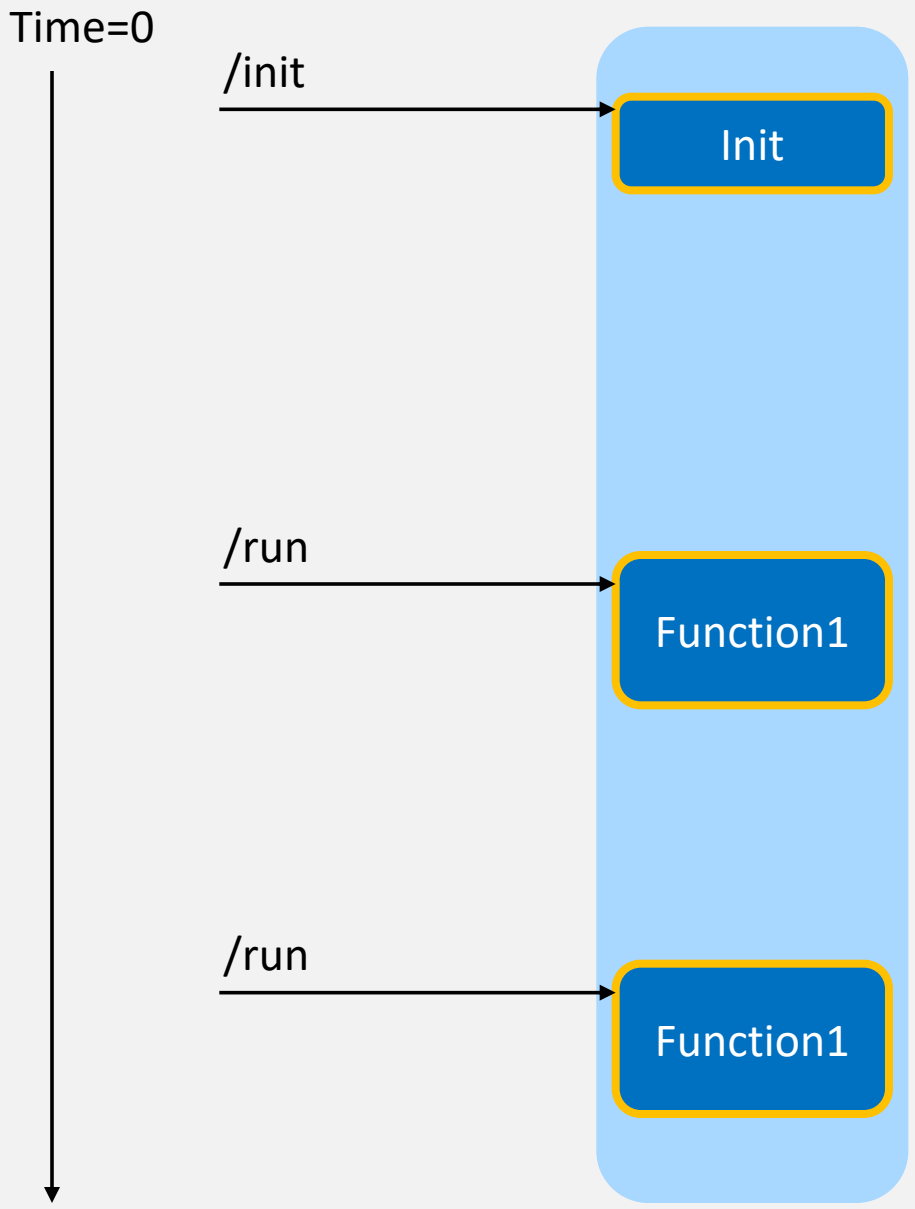

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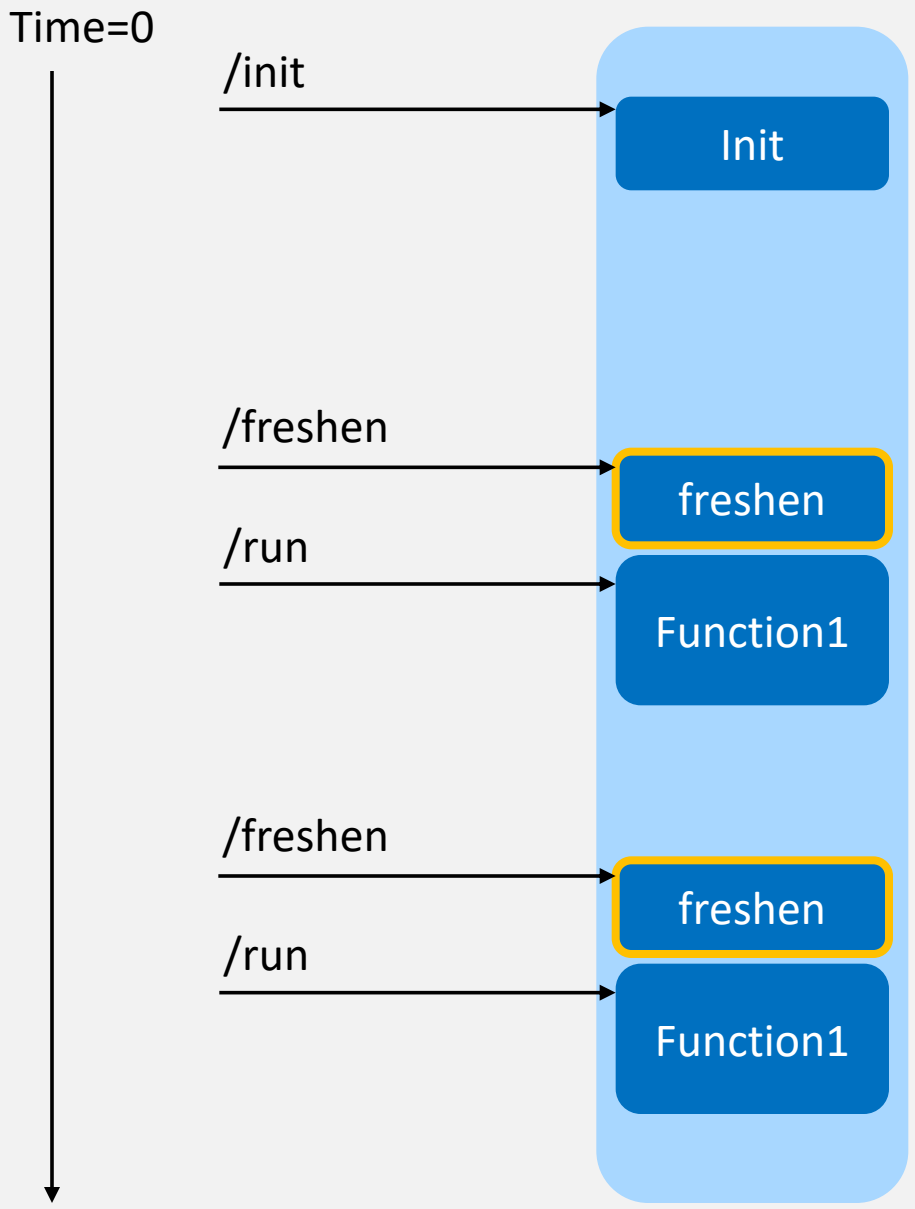

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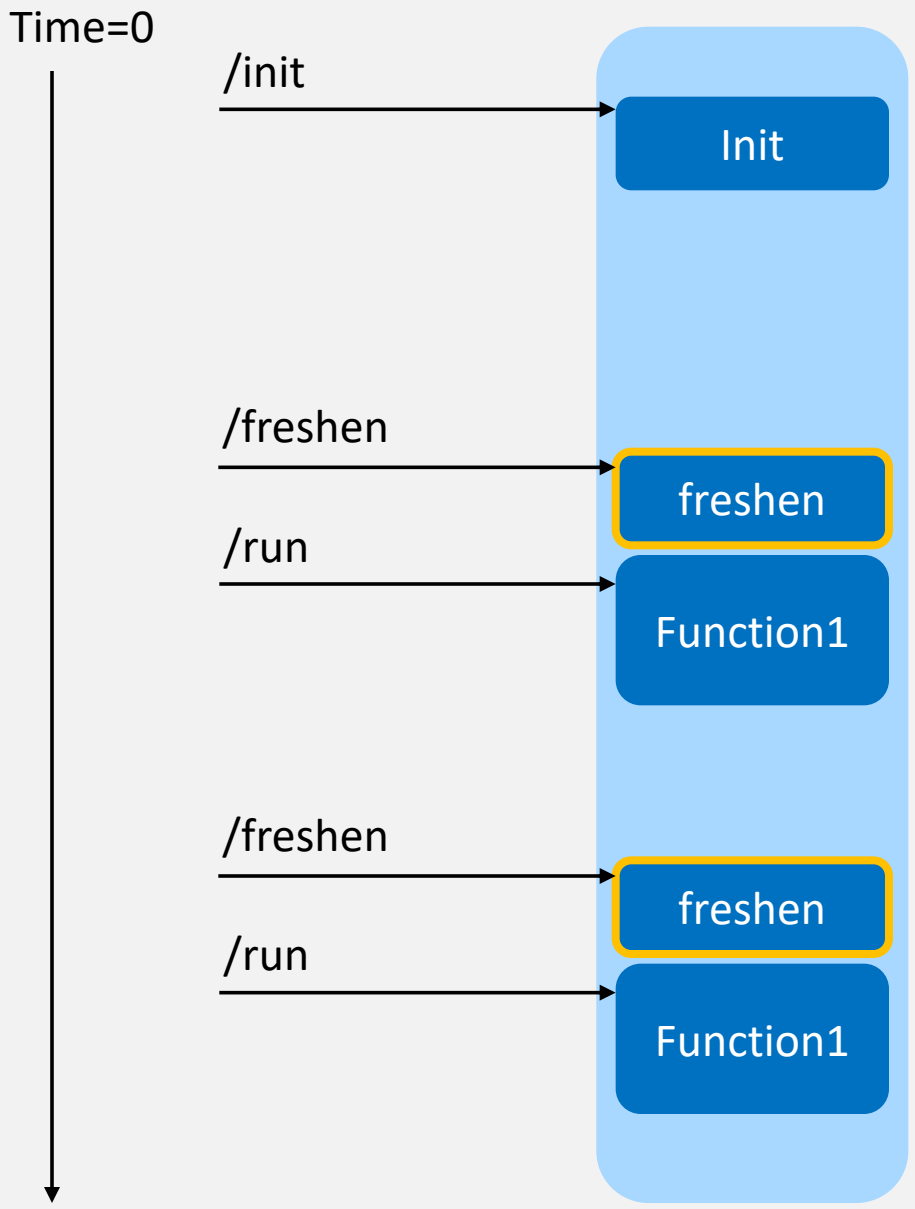

Serverless Resource Management Overview

	Reuse	Dynamic State	Proactive
Init Phase	✓	✗	✗
Function Code	✗	✓	✗
Runtime Reuse	✓	✓	✗
Freshen	✓	✓	✓

By **proactively** supporting **reuse** and **dynamic state maintenance**, freshen removes the latency cost of those tasks from function execution.

Serverless Function Prediction

Prediction useful for many reasons (scheduling, resource utilization, coldstart avoidance, etc.)

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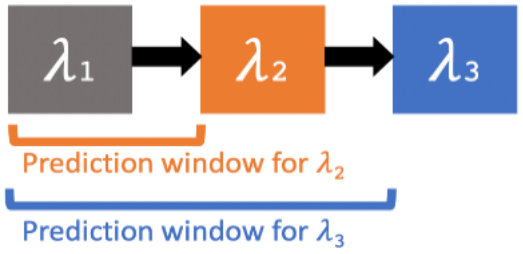
Some cases are easier to predict, e.g., chained functions



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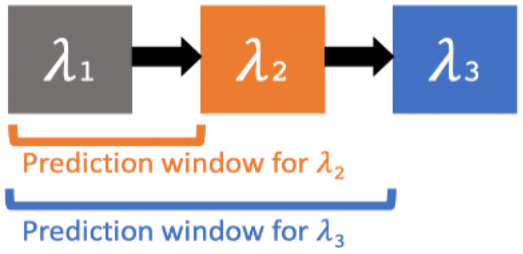
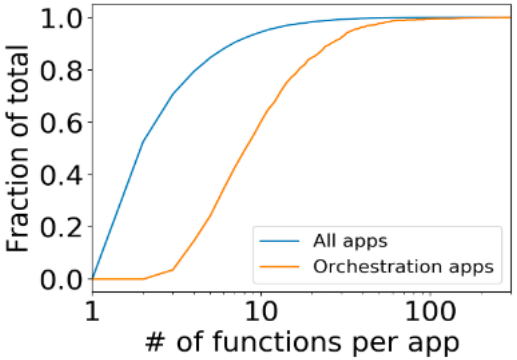


Many applications consist of multiple functions



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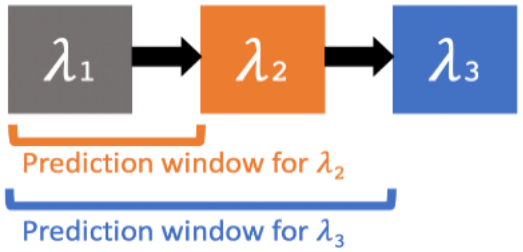

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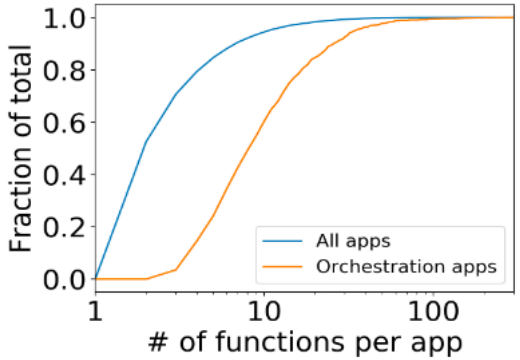
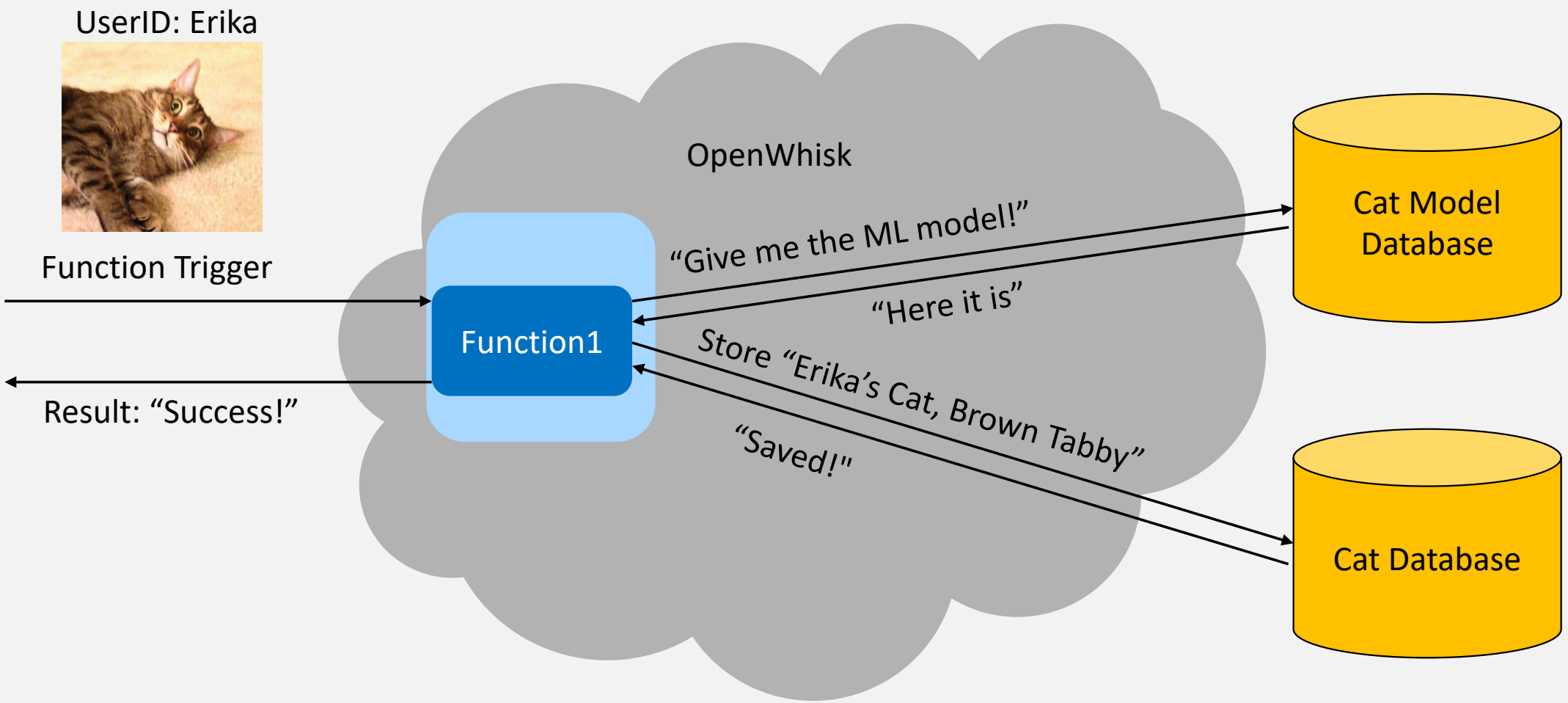


May be infrastructure overheads

Trigger Service	Delay (s)
Step Functions	0.064
Direct (Boto3)	0.060
SNS Pub/Sub	0.253
S3 bucket	1.282

What Can ***Freshen*** Do?



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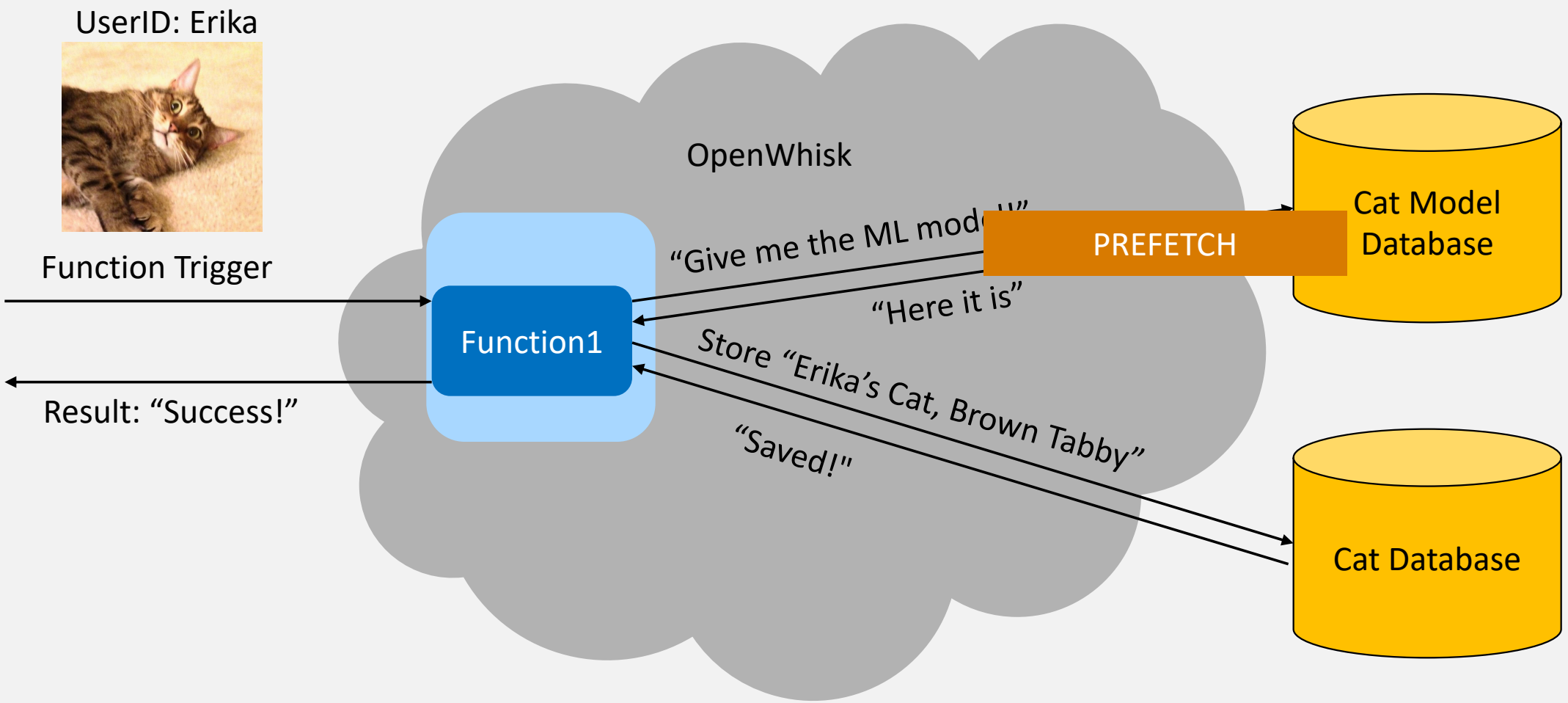

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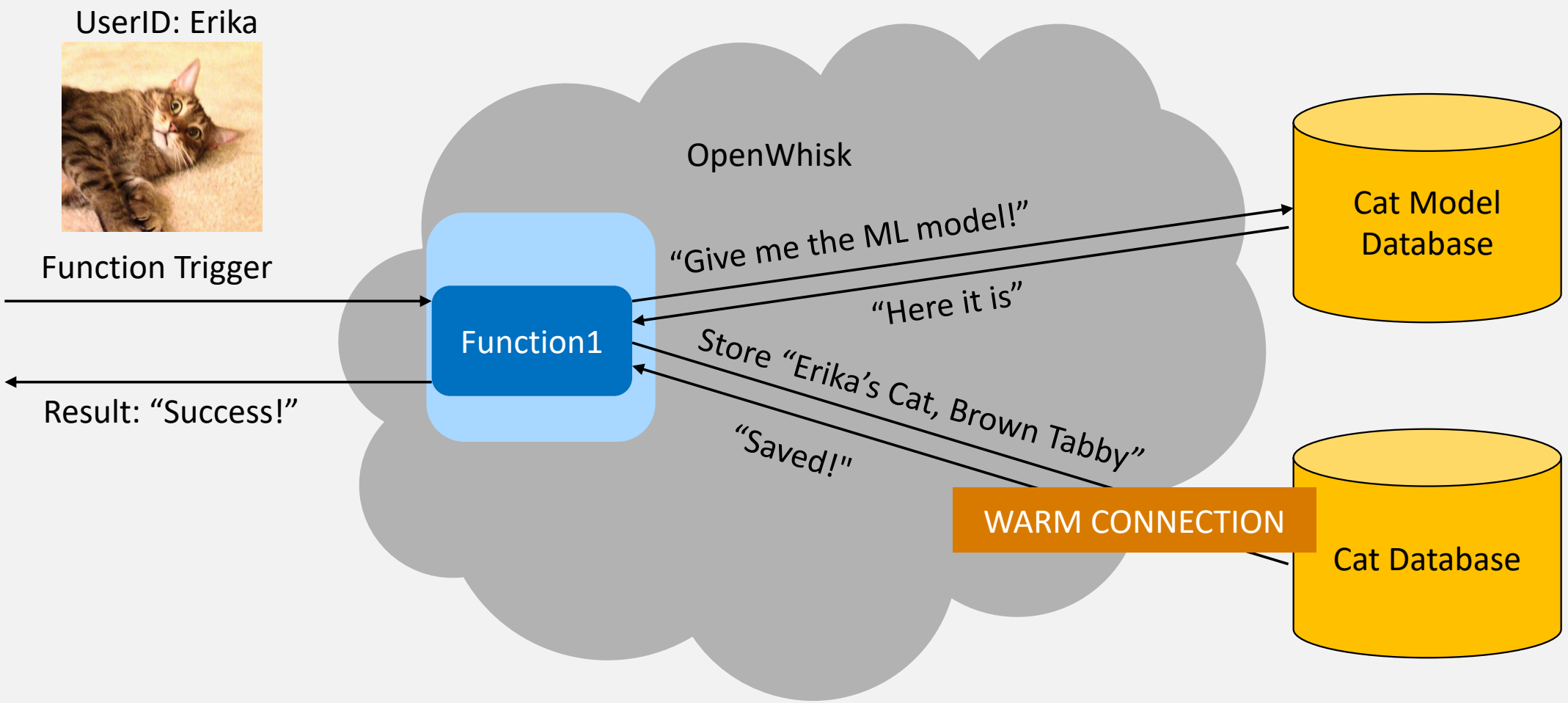

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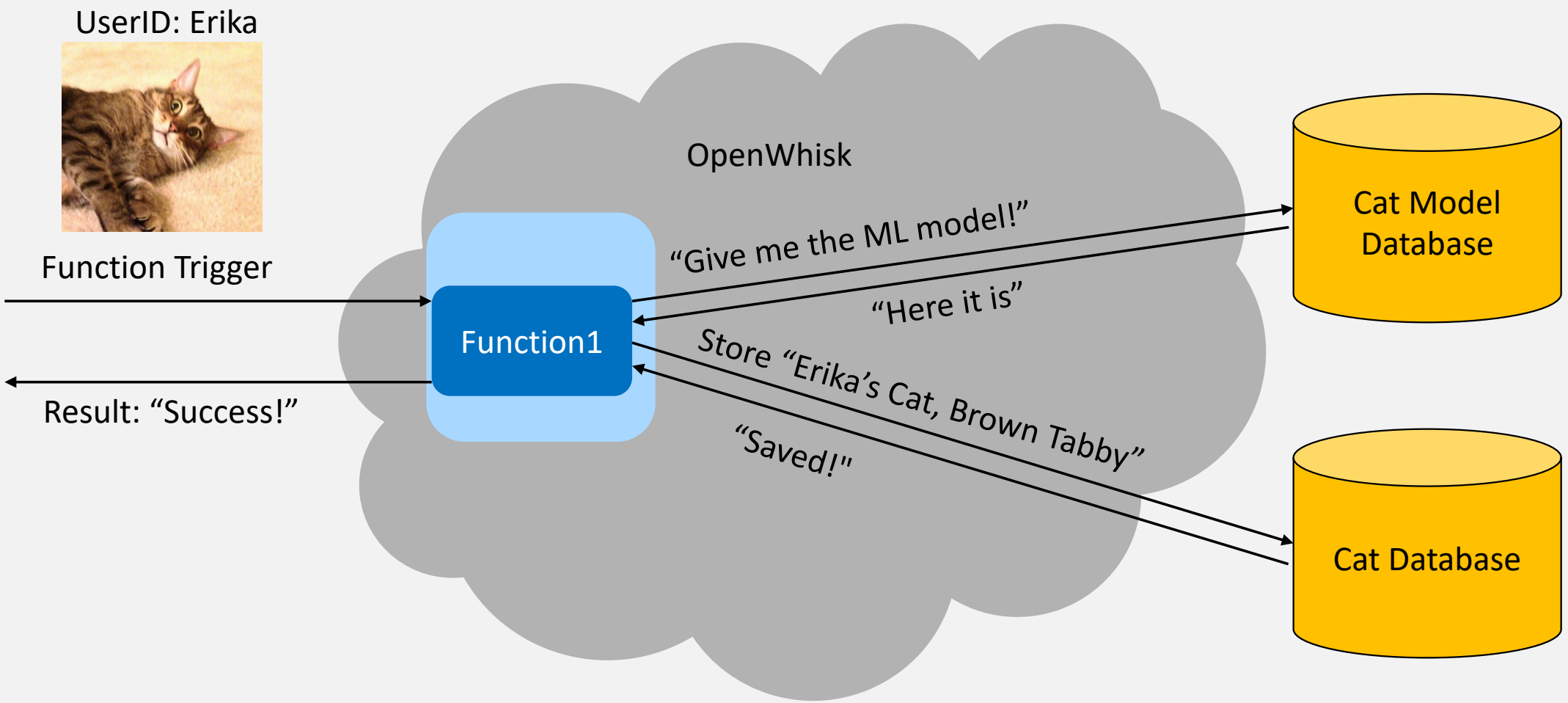

What Can ***Freshen*** Do?

MORE?

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Freshen Design

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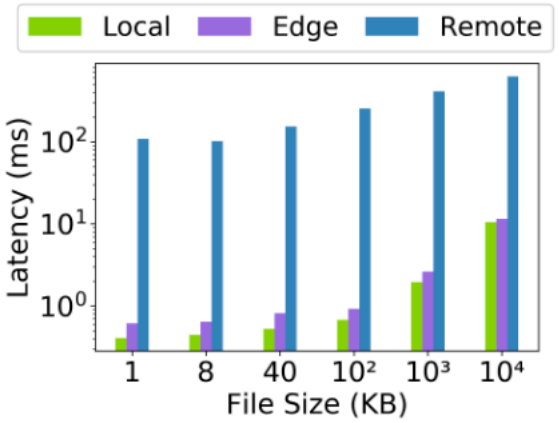
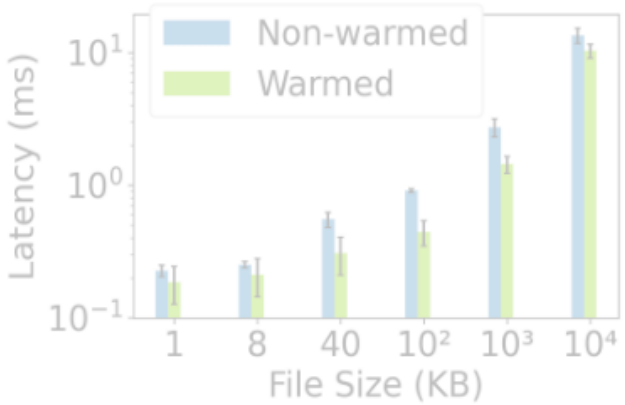
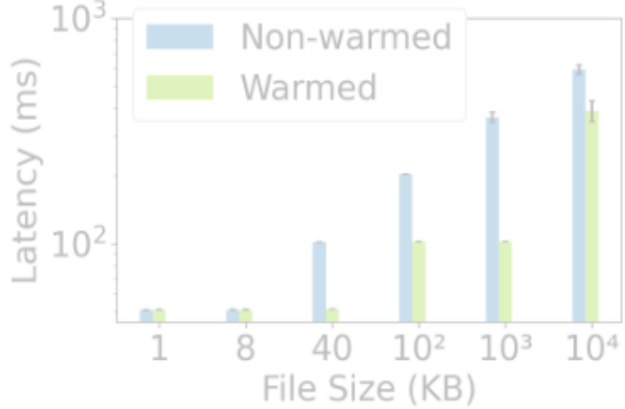
Freshen Motivation

PREFETCH



WARM CONNECTION

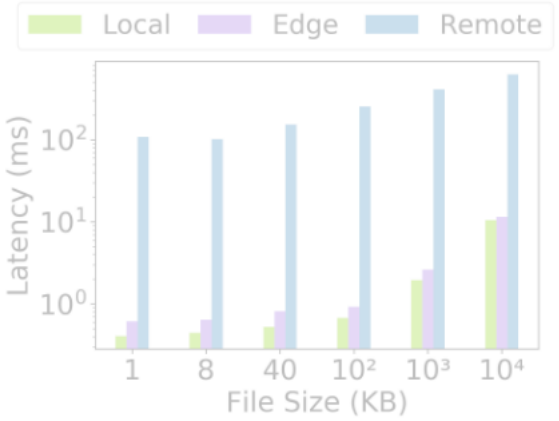




Reduces latency to access data

Freshen Motivation

PREFETCH



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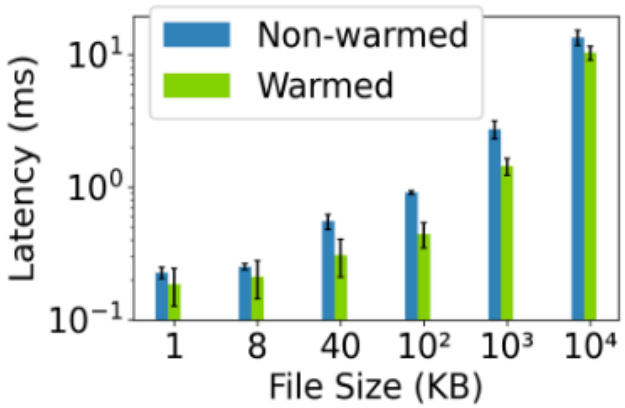

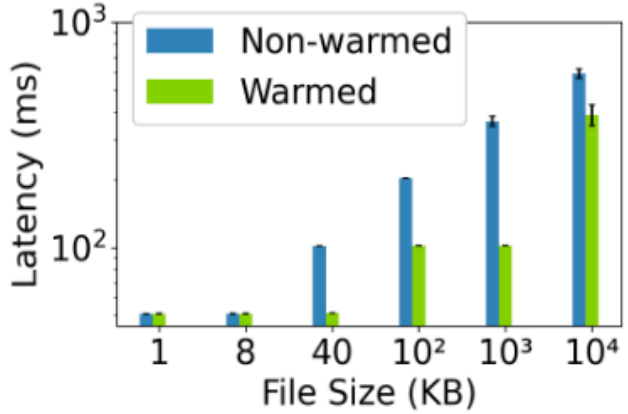

Warmed TCP connections send traffic more efficiently

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Freshen Design

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Outline

Discussion

- Connection state manipulation
- Function prediction
- Who is responsible for ***freshen***?
- Other ***freshen*** actions

How to access connection state?

Beyond TCP?

Discussion

Connection state manipulation

Function prediction

Who is responsible for ***freshen***?

Other ***freshen*** actions

Discussion

Connection state manipulation

Function prediction

Who is responsible for ***freshen***?

Other ***freshen*** actions

Developer written

Libraries

Inference

Discussion

Connection state manipulation

Function prediction

Who is responsible for ***freshen***?

Other ***freshen*** actions

Memory allocation?

Prepopulating Caches?

Things we have not yet thought of?

Background

Freshen Design

Evaluation

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Questions

- We propose a new serverless runtime primitive, ***freshen***, as a mechanism to enable proactive serverless function resource management.

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https://www.serverlesscomputing.org/wosc6/#p11