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Towards Zero Change Incidents

Intuit's Strategy for Implementing AI-Driven Progressive Delivery

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Technology @ Intuit

Intuit is leading the way in building an AI-native development platform using cloud native open source technology. We're committed to building tools that scale and giving back to the open source community.

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97M
customers

107B
tax refunds

$2T+
invoices managed

18M
workers paid via QB payroll

88B
requests during peak season

AI-native development platform

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AI-powered App Experiences

810M

AI-driven customer interactions last year

AI-assisted development: coding, testing, debugging

8x

Developer velocity increase in past four years

AI-powered app centric runtime

65B

Machine learning predictions per day

Smart Operations using AIOps

40M+

AIOps inferences/day

We believe in open source and open collaboration

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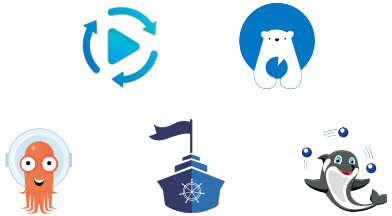
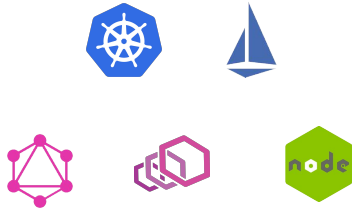
Recipient of the End User Award in 2019 & 2022



Created, open-sourced, used, and maintained by Intuit



End user of Cloud Native and mobile open source tech

bit.ly/intuit-oss

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What is Progressive Delivery?

Progressive Delivery

- Gradual release of new version
- Reduces the risk of bugs or failures
- Quick rollbacks
- e.g. Blue Green, Canary, Feature Flags
- Argo Rollouts
    - Progressive delivery for Kubernetes

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Why is there a need for AIOps based Progressive Delivery?

Change-Induced Incidents

- 1/3rd of P0/P1 incidents at Intuit were caused by changes
- Changes can be
  - New features
  - Bug fixes
  - Simple dependency updates
- Can be avoided/reduction of impact if detected & resolved early

Static Thresholding based rollbacks

- Set a hard threshold for every metric, e.g.
  - 4% error rate
  - 400 ms of latency
- If any of the metric templates fail, then rollback

Argo Rollout Example

```yaml
apiVersion: argoproj.io/v1alpha1
kind: AnalysisTemplate
metadata:
  name: success-rate
spec:
  args:
  - name: service-name
  - name: prometheus-port
    value: 9090
  metrics:
  - name: success-rate
    successCondition: result[0] >= 0.95
    provider:
      prometheus:
        address: "http://prometheus.example.com:{{args.prometheus-port}}"
        query: |
          sum(irate(
            istio_requests_total{reporter="source",destination_service=~"{{args.se
          )) /
          sum(irate(
            istio_requests_total{reporter="source",destination_service=~"{{args.se
          ))
```

Drawbacks of Static Thresholding

- Not all anomalies are Global
- Many time series metrics are seasonal
  - Daily and/or weekly
  - Contextual anomalies
- Multiple metrics collectively determine system health
  - Collective anomalies
  - Different weightage of each metric
- Every service is unique
  - Different thresholds
  - Different metrics that makes sense
  - Non operational metrics

AIOps journey at Intuit

2022

- Univariate anomaly detection on error rate

2023

- Introduced static thresholding based ensemble score

2024

- Multivariate anomaly detection

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Multivariate Anomaly Detection

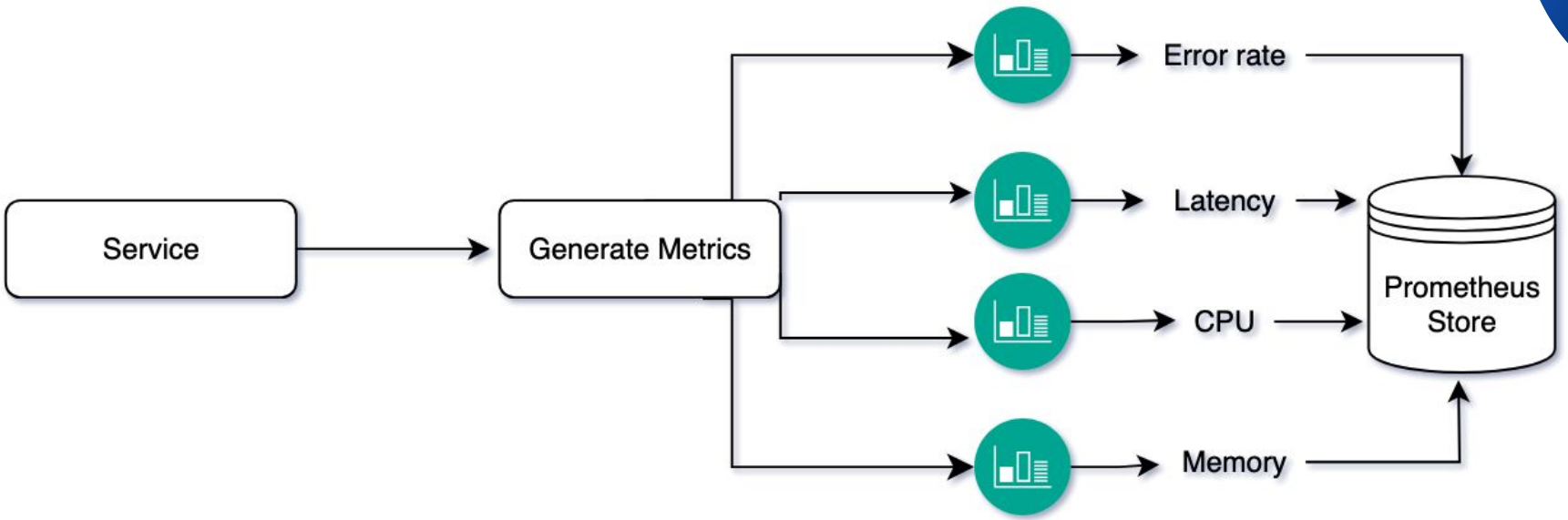
Machine Learning Requirements

- Completely unsupervised
- Able to handle multiple features
- Understand the underlying structure of the timeseries
- Fairly quick to train
- Need not more than 8 days worth of data for training
- Interpretable anomaly scores
- Auto Model Life Cycle management

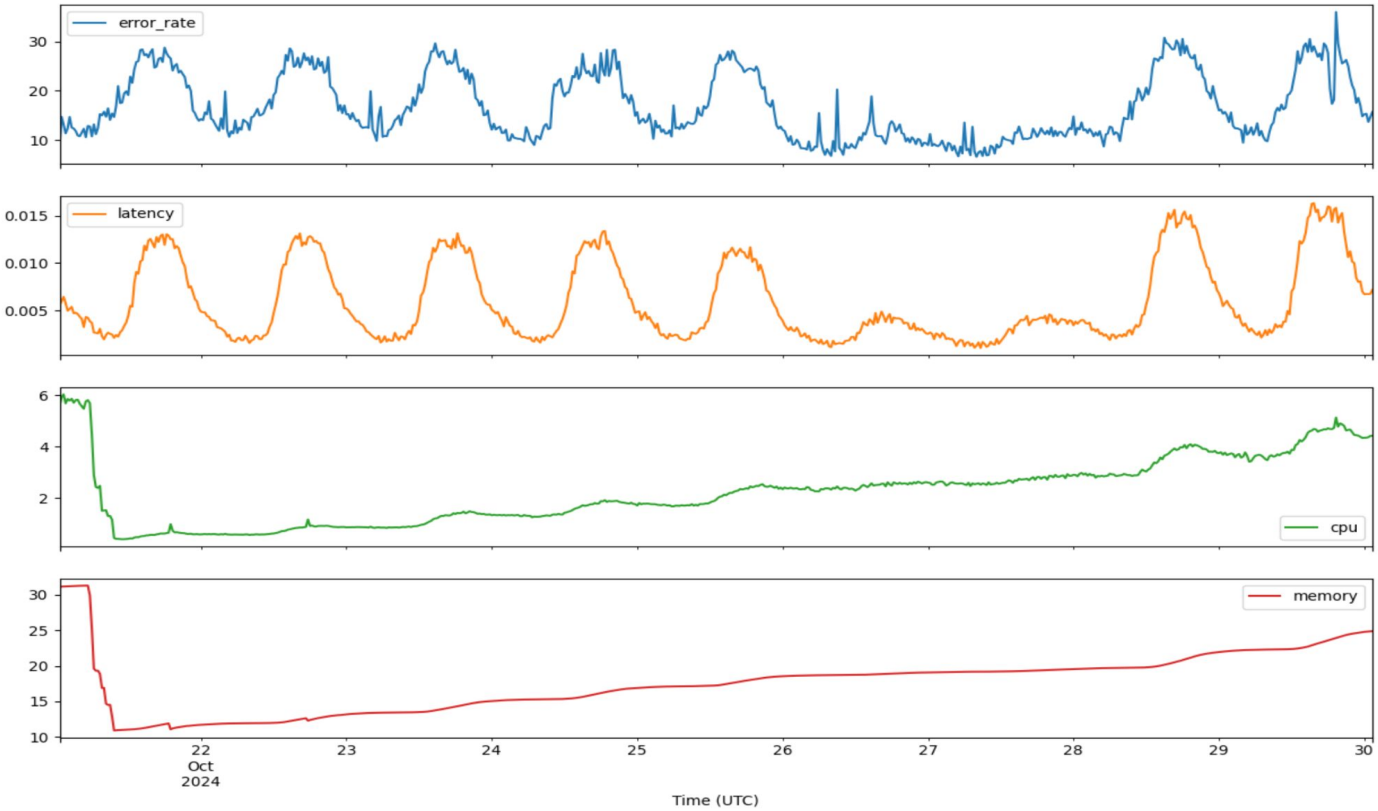
Engineering Requirements

- Stream data processing system
- Support custom sources and sinks
- Sliding window aggregation support
- Lightweight pipeline
- Easy to deploy to multiple clusters
- Right tool for progressive delivery

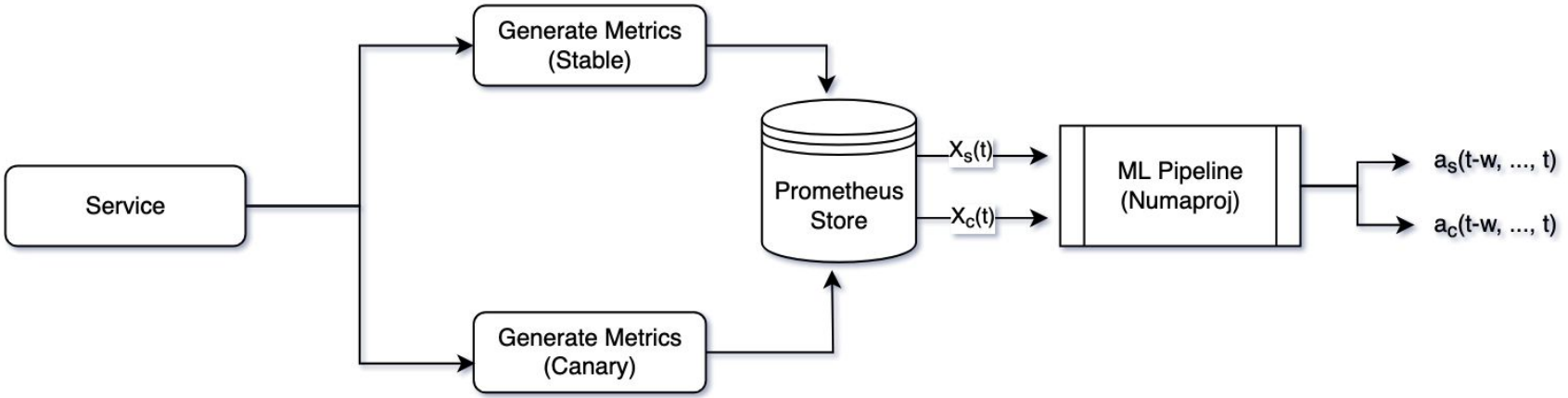
Concept


Service
Generate Metrics
Error rate
Latency
CPU
Memory
Prometheus Store

Multivariate Metrics

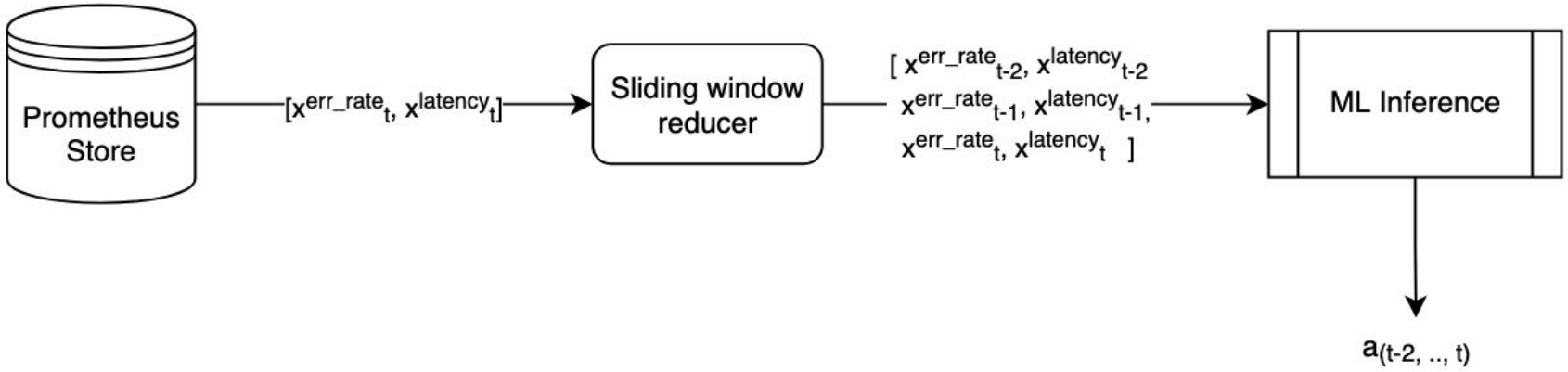


During Progressive Delivery

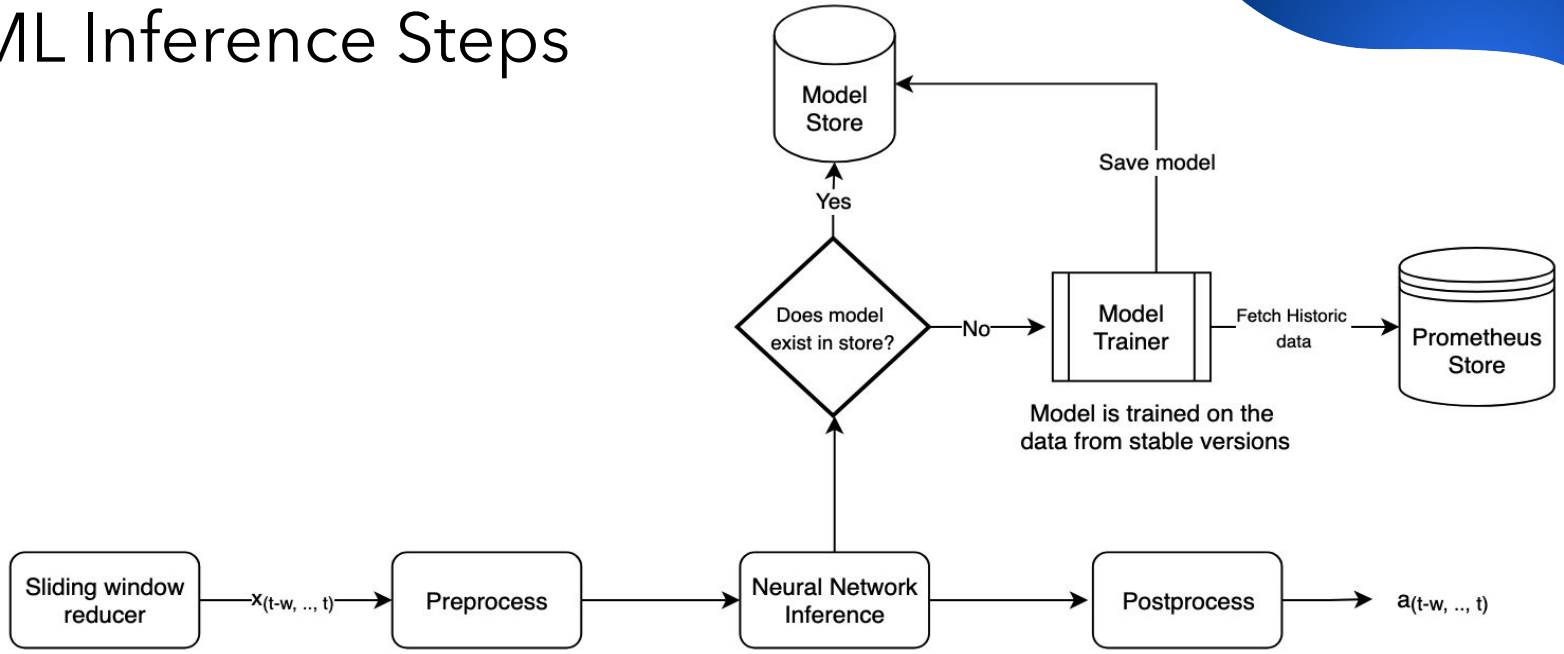


Input Data Processing

- Assume a window size of 3
- Assume 2 multivariate metrics to be processed
- Stable and Canary come in different payloads



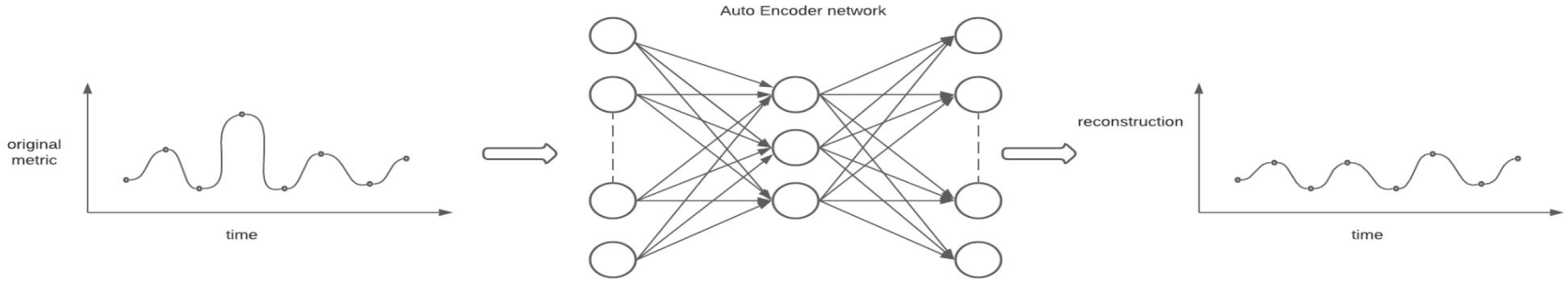
ML Inference Steps



Model Details

numalogic

- CNN, RNN based autoencoder networks
- Quick to train even without GPUs
- Robust to anomalies in the training data
- Feature/Metric weighting capability
- Interpretable anomaly scores
  - Unified
  - Per Metric



Output example

```
{
    "app": "some-service",
    "uuid": "c19d0bb770b2469eb1d8bbfe05f311a4-s",
    "role": "stable",
    "start_ts": 1729194630,
    "end_ts": 1729194690,
    "feature_scores": {
        "latency": 4.36,     // 40%
        "cpu": 1.53,         // 10%
        "error_rate": 0.0,   // 30%
        "memory": 1.23       // 20%
    },
   "unified_score": 2.14,   // weighted_average(ML_scores)
}
```

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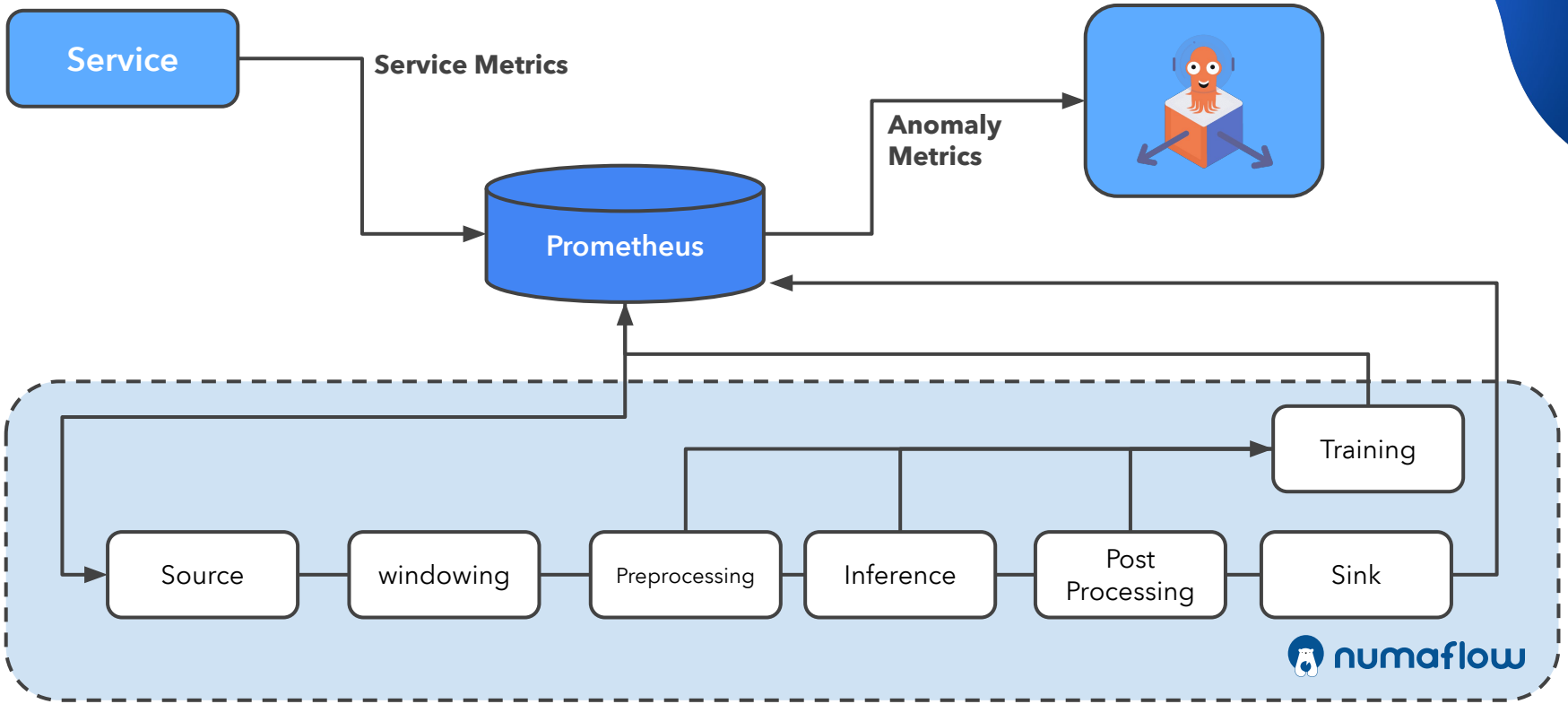
How Intuit Implemented AI-driven Progressive Delivery?

Architecture



numaflow

K8s native, **serverless platform for running scalable and reliable event processing**

K8s native event processing

K8s native lightweight event processing with fully featured stream processing semantics

Versatile and can seamlessly operate on the edge, on-prem or in the cloud

Language agnostic framework

SDKs in Java, Python, Golang, Rust.

In-built source/sink connectors. Easy to write sources, functions and sinks

Scalable and Cost efficient

Automatically scales from 0 to X, handling backpressure, while being lightweight and cost-efficient.

Capable of running on edge with a low resource footprint

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Demo

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Thank You

Numalogic Team

- Avik Basu
- Saravanan Balasubramanian
- Kushal Batra
- Nandita Koppisetty

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Check out

Numalogic

https://github.com/numaproj/numalogic