# Design Document

## Data

## Deployed TeaStore on a Kubernetes cluster

## Instrument TeaStore with Prometheus for metrics collection.

## Identify relevant metrics for predictive scaling: CPU usage, memory consumption, response times, request throughput, under provisioned resources, over provisioned resources.

## Use load testing tool JMeter to simulate various user behaviours on the TeaStore, generating a diverse set of operational data under different conditions.

## Collect and store metrics with Prometheus during the load tests, gathering time-series data served as the initial dataset.

## Export the collected data from Prometheus using its HTTP API

## Pre-process the dataset to prepare for machine learning modelling. This included handling missing values, normalizing numerical features, and encoding categorical features.

## Analyse the dataset and selected features through feature selection techniques to determine which metrics most accurately predicted the need for scaling actions.

## A diagram of a cluster Description automatically generatedArchitecture

## Evaluation

The success of the project will be judged by evaluating the energy consumption of both the standard Kubernetes horizontal auto-scaler and my predictive auto-scaler.

Kepler is a tool created to monitor power consumption in a Kubernetes cluster and, once the model is fully trained, will be plugged into both auto-scalers to discover which consumed the most power.

Jmeter from Apache

## Plan

### Semester 2

* Week 1-2
  + Complete system design
  + Set up Kubernetes and start to integrate TeaStore
* Week 2-4
  + Have current draft of Chapter 1 reviewed
  + Record data set and split it between Training, Test and Validation
  + Use ML theory to isolate the most influential metrics
  + Begin to build ML model
  + Have chapter 1 mostly finalised
* Week 4-6
  + Begin drafting Chapter 2
  + Further model iteration
  + Testing the model with workload to test compatibility and produce first set of real results.
  + Final tweaks and optimisations to the model
* Week 6-8
  + Get Chapter 2 reviewed
  + Complete the machine learning model.
  + Integrate the machine learning model into the auto-scaler and collect final usage data.
  + Cross reference new usage data with benchmark data to produce final performance and consumption results.
  + Begin Chapter 3
* Over Easter
  + Complete Chapter 3
  + Start and Complete Chapter 4
* Week 9-10
  + Add the finishing touches to the report.
  + Submit the report and all supporting documents and repositories.