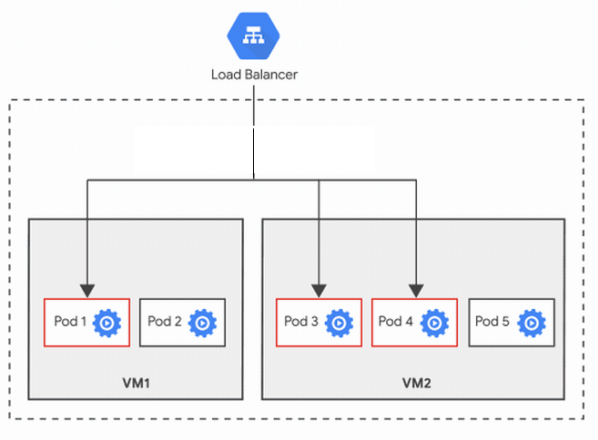
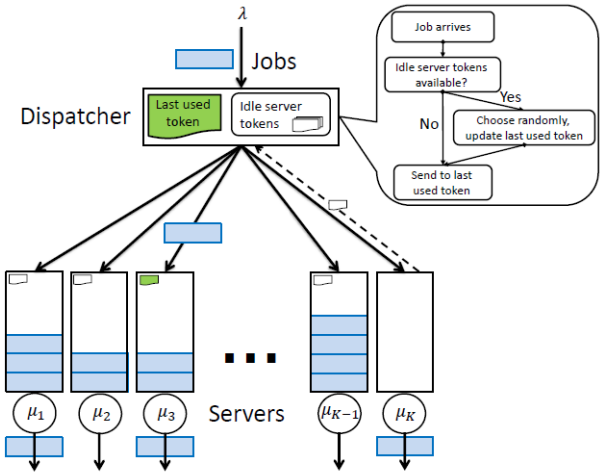
Persistent-Idle (PI) Kubernetes Load Balancing

Abstract:

Kubernetes (commonly stylized as **K8s**),is a new and fast-evolving Open source project, originally created by Google. It is a popular coin tanker orchestration system for automating deployment, scaling and management of containers. An important component of Kubernetes is its Load Balancer (LB). It provides a way to distribute load across Pods belonging to a service. When a client connects, the LB chooses a Pod, connects to it and forwards it the stream.





The current out-of-the-box LB policies available in Kubernetes are:

- Linux IPTables, using random choice (Default).
- Round robin (RR).

In previous semester project, we implemented new LB policy called: Join-Shortest-Queue-2 (JSQ-2) or Power-of-Choice. In this policy, The Kubernetes LB samples randomly 2 server's queue and dispatches the job to the server among the 2 with the shortest queue. We showed that it out-performs the RR algorithm and in some cases is close to ideal, when the servers are homogeneous. However, it is well known that in an environment with heterogeneous servers, JSQ-2 leads to poor performance and even to instability.

A new innovative policy called Persistent-Idle (PI) LB is proposed for heterogeneous environment. It is based on Join-the-Idle-Queue (JIQ) algorithm where the dispatcher knows which servers are idle. PI suggests an improvement to JIQ that will outperform in such an environment.

Goals:

1. Study Kubernetes - https://kubernetes.io/
2. Refer to the Power-of-Choice (JSQ-2) algorithm implementation in:
   https://gitlab.cs.technion.ac.il/lccn/w2018-kubernetes-load-balancing
   and raise its environment
3. Simulate heterogeneous servers environment and show that JSQ-2 is instable
4. Implement weighted JSQ-2 and verify its stability in heterogeneous servers environment
5. Learn the Persistent-Idle Load-Distribution paper in:
   https://www.researchgate.net/publication/329885375_Persistent-Idle_Load-Distribution

6. Implement the new PI algorithm in the Kubernetes LB.
7. Compare PI vs JSQ-2 vs weighted JSQ-2 performance in heterogeneous environment.

Requirements:

Introduction to Networking (Must), Internet Networking (Optional)

Programming Language:
Go

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