

## Summary of work in H2020 CloudButton - Red Hat

### Abstract

Red Hat contributed to several aspects of the CloudButton serverless computing stack. The Infinispan server code has been significantly modified to allow native compilation. Native compilation allows an Infinispan server to use half of the memory on startup compared to its JVM counterpart, as well as starting up in less than half-a-second compared to over 4 seconds, which is essential for fast scaling in cloud-based environments. The server was also enhanced to allow drop-in extensions, and IMT's Crucial DSO was ported to this extension model. Additionally a new scaling algorithm, named Anchored Keys, was developed to significantly reduce the impact of state transfer when a new node is added to an Infinispan cluster. The Infinispan Kubernetes operator was developed that allows for simplified provisioning, management and monitoring of an Infinispan cluster with as little user intervention as possible. The operator handles all aspects related to configuration, security, persistence and scaling. A Python Hot Rod client, for communicating with an Infinispan server, was developed and integrated within the Lithops framework.

### Staff members that participated in the project

Tristan Tarrant (Senior Principal Software Engineer)  
Gustavo Fernandes (Principal Software Engineer)  
Galder Zamarreno (Principal Software Engineer)  
Will Burns (Principal Software Engineer)  
Ryan Emerson (Principal Software Engineer)  
Vittorio Rigamonti (Senior Software Engineer)  
Pavel Drobek (Senior Software Quality Engineer)  
Diego Lovison (Senior Quality Engineer)  
Emmanuel Bernard (Distinguished Engineer)

**List of publications (with links, everything must be open access). Staff participating in each publication. Total number of publications by partner.**

N/A

**List of github repositories (with links). Staff contributing to each repository. Total number of repositories.**

*total: 5*

Infinispan: In-Memory Distributed Data Store

[Link](#)

Infinispan Quarkus: Natively compiled

[Link](#)

Infinispan Container Images

[Link](#)

Infinispan Kubernetes Operator

[Link](#)

Infinispan Python Client

[Link](#)

**List of dissemination activities. Staff contributing to each dissemination activity. Total number of dissemination activities.**

*total: 7*

Infinispan Anchored Keys:

<https://infinispan.org/blog/2020/07/22/anchored-keys>

Infinispan Native image:

<https://infinispan.org/blog/2020/06/16/native-server-announce>

Infinispan Operator:

<https://infinispan.org/blog/2020/02/24/infinispan-operator-1>

Infinispan Operator v2.2:

<https://infinispan.org/blog/2021/10/27/infinispan-operator-2-2-final>

Create and manage Red Hat Data Grid services in the hybrid cloud:

<https://developers.redhat.com/articles/2021/06/08/create-and-manage-red-hat-data-grid-service-s-hybrid-cloud#>

Lithops Hot Rod storage backend

<https://infinispan.org/blog/2021/12/01/lithops>

Crucial DSO Server

<https://infinispan.org/blog/2022/04/07/crucial-dso>

**List of exploitation activities. Staff contributing to each exploitation activity. Total number of exploitation activities.**

The improvements made to the Infinispan Kubernetes Operator, including service provisioning, autoscaling and metrics have made RHDG much more attractive to customers in terms of manageability and monitoring, the reduced memory footprint and startup time allow for improved performance and higher density deployments, especially in the context of Red Hat's Serverless

product, where RHDG will be deployed to offer high-performance in-memory storage alongside other, more traditional persistent storage.

The process for features introduced in an upstream project to be delivered as part of a product at Red Hat follows the typical pattern of going through a variable period in which such features are validated by early adopters, called “community bake-time”.

We can already claim that Infinispan’s participation in the project has been a booster for RHDG’s usefulness to Red Hat customers. All of the customers running RHDG on OpenShift are already taking advantage of the improvements to the operator, which has greatly simplified the management story. The additional improvements to memory management and deployment density has dramatically reduced the resource allocation for some of the most demanding customers who were running hundreds of nodes in production.

**List of collaborations or integrations with other partners. Staff contributing to each collaboration activity. Total number of collaboration activities.**

Red Hat integrated IMT’s Crucial as an extension to the official Infinispan server, thus leveraging the advantages of all the improvements in manageability and monitoring implemented as part of the CloudButton project.

Red Hat has contributed a native Hot Rod client connector for the Lithops project using a brand new Python client.