

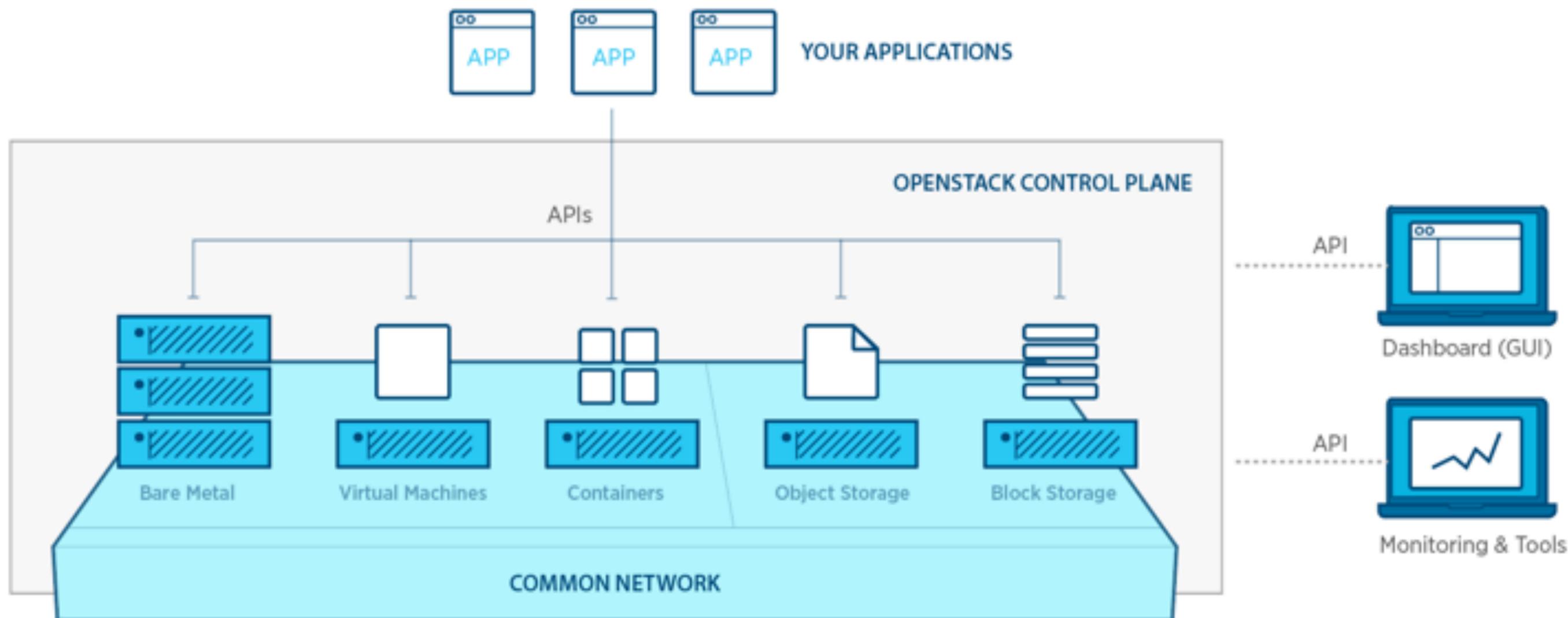


OpenStack and Container Integrations

From Bare Metal to Applications with OpenStack and open source technologies.

CHRISTIAN HOGE
SENIOR STRATEGIC PROGRAM MANAGER
OPENSTACK FOUNDATION

What is OpenStack?



The Open Source Application Stack

Bare Metal

Managing your hardware with Ironic

Infrastructure Management

Deploying OpenStack with Infrastructure Containers

Application Management

Delivering Applications on OpenStack with K8s and Docker

OpenStack Ironic

Ironic is an OpenStack project which provisions bare metal machines.

It may be used independently or as part of an OpenStack Cloud.

It integrates with the OpenStack Identity, Compute, Network, Image, and Object services.

For a fully integrated example, deployed using lightweight Loci containers and Docker Compose, please see:
<https://github.com/hogepodge/container-ironic>



IRONIC

an OpenStack Community Project

Chameleon Cloud

Chameleon is an infrastructure project implementing an experimental testbed for Computer Science led by University of Chicago, with Texas Advanced Computing Center (TACC), Renaissance Computing Institute (RENCI), and Northwestern University as partners. The Chameleon project is funded by the United States National Science Foundation (NSF). The project started in 2014 and is now in its second phase until 2020.

The current system comprises ~600 nodes split between sites at TACC in Austin and University of Chicago.

“Our decision to build Chameleon using OpenStack really paid off. From the Juno release we started with, Ironic has been steadily adding new features and gaining in maturity, to the point that most of our wish list has now been implemented. We are now in the process of integrating many of these new features in Chameleon, allowing us to make our testbed more powerful—thanks to the contributions of the OpenStack community.”

- Pierre Riteau, DevOps lead for the Chameleon projects



IRONIC

an OpenStack Community Project

CERN

As of 2016, “the CERN cloud provides computing resources for the Large Hadron Collider and other experiments. The cloud is currently around 160,000 cores in total spread across two data centres in Geneva and Budapest. Resources are managed world wide with the World Wide Computing LHC Grid which executes over 2 million jobs per day. Compute resources in the WLCG are allocated via a pledge model. Rather than direct funding from the experiments or WLCG, the sites, supported by their government agencies, commit to provide compute capacity and storage for a period of time as a pledge and these are recorded in the REBUS system. These are then made available using a variety of middleware technologies.”

<http://openstack-in-production.blogspot.co.uk/2016/04/resource-management-at-cern.html>

CERN is currently deploying Ironic into production for bare metal management of machines. With the goal of a “single pane of glass” control plane to manage all of their bare metal, virtualization, and container infrastructure.



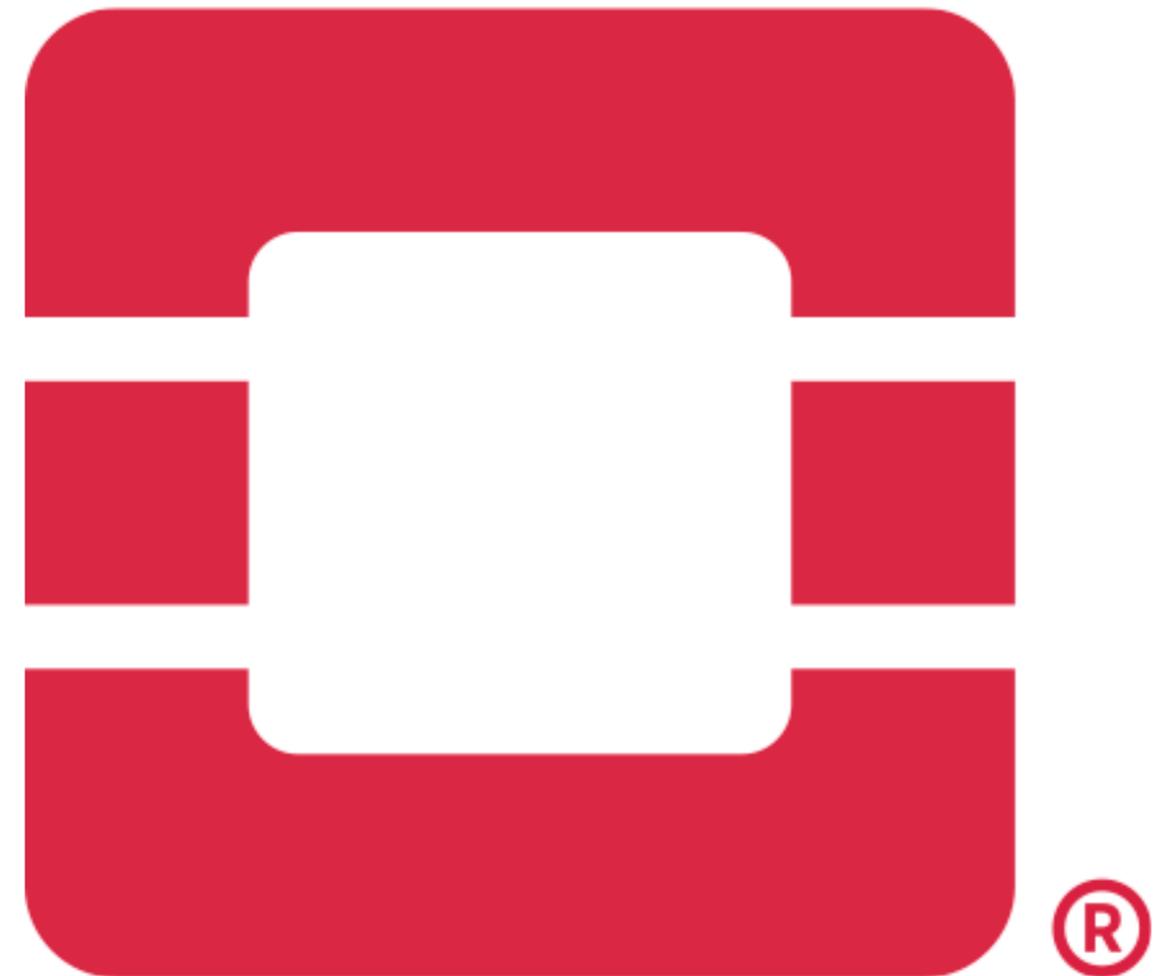
IRONIC

an OpenStack Community Project

Container Hosted OpenStack

The OpenStack community now has several projects to deploy and manage OpenStack using infrastructure containers, with projects based on:

- LXC with Ansible
- Docker with Ansible
- Kubernetes and Helm



OpenStack Ansible

OpenStack services deployed to LXC containers.

Extensive documentation and support.

Supports upgrades and node maintenance.

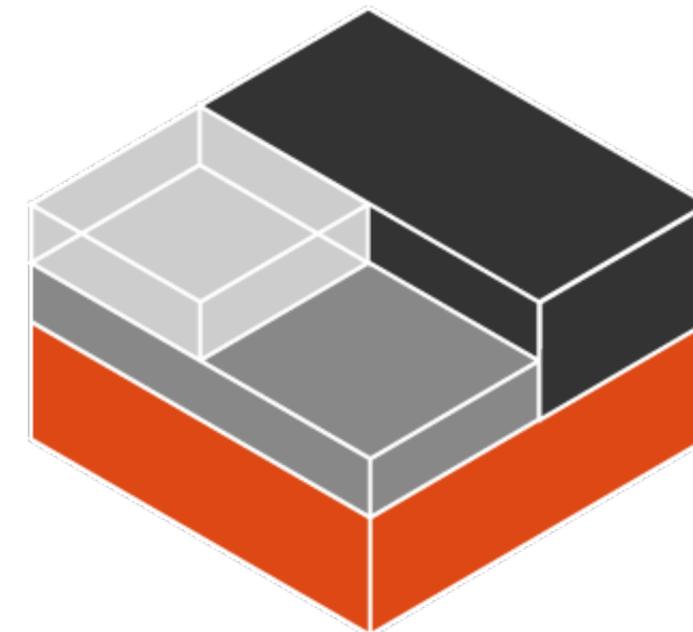
Role-based configuration.

Backs several high performance OpenStack installations, and is also used as the deployment tooling for the Certified OpenStack Administrator exam.



OPENSTACK-ANSIBLE

an OpenStack Community Project



Kolla Ansible

Kolla images, one for each OpenStack service, are available as pre-built binaries on Docker Hub.

Kolla also includes a sophisticated build system that allows for elaborate configuration of final images, built from either source or packages.

Kolla-Ansible uses the Kolla images to deploy and maintain an OpenStack installation.

Support for upgrades, cluster expansion, and node maintenance/repair/removal.



OpenStack Helm

Developed by AT&T to support their OpenStack infrastructure used for NFV and content delivery.

Is container build agnostic, and can use either Kolla or Loci containers.

OpenStack Loci containers are super-lightweight containers, one for each project. These tools assume that further configuration will happen within the deployment pipeline.

OpenStack Helm is a set of independent Helm charts for deploying and maintaining OpenStack on Kubernetes.

Leverages Kubernetes abstractions for load balancing, high availability, deployments, and upgrades.



OpenStack Hosted Containers

There are several active projects that allow you to hold container application frameworks on OpenStack, whether it be managed or installed by users.

- Zun, for hosted containers.
- Magnum for hosted Kubernetes clusters

OpenStack specific support for K8s provided by:

- Kubernetes Cloud Provider OpenStack



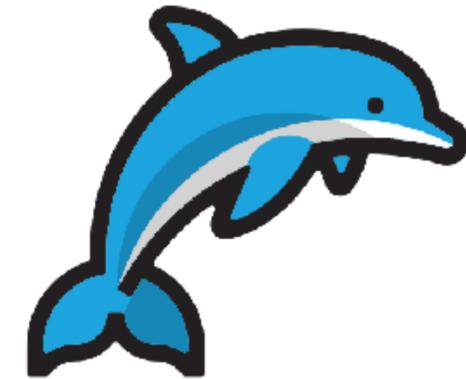
Zun

Lightweight containers as a service framework for OpenStack.

Can launch containers backed by a variety of runtimes.

Support in the works for other frameworks, including Kata Containers and Kubernetes pods.

Backed by OpenStack Kuryr for native Neutron networking support within the containers.



ZUN

an OpenStack Community Project



Magnum

Fully hosted Kubernetes (or Docker Swarm) with a simple API for starting, stopping, growing, and maintaining Kubernetes clusters.

Support for latest Kubernetes release (1.10 as of this writing).

Leverages existing OpenStack security to provide tenant isolation between untrusted clusters (work in progress for true tenant isolation through isolated machine reservations in response to Meltdown and Specter).

CERN is currently using OpenStack Magnum in production, with over 100 tenant-isolated Kubernetes clusters ranging in version from 1.7 to 1.10.



MAGNUM
an OpenStack Community Project



Kubernetes Cloud Provider OpenStack

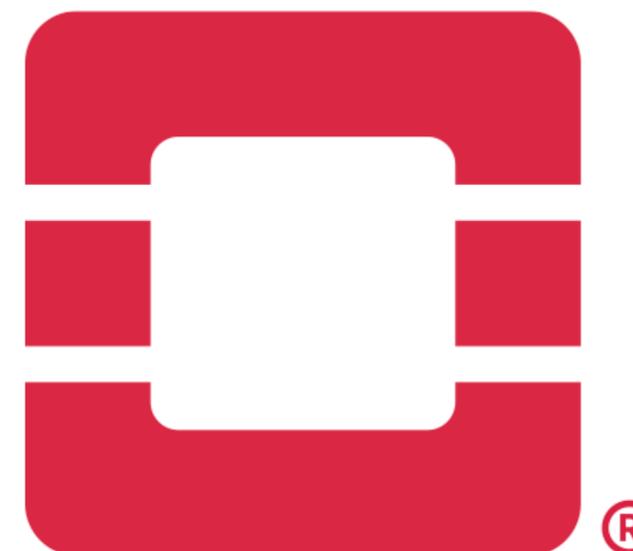
Collaboration between the OpenStack and Kubernetes community to provide a complete suite of integration drivers and plugins, along with documentation and testing.

The Cloud Controller Manager plugin provides direct support for OpenStack hosted block devices and load balancers to Kubernetes.

Support for cluster autoscaling is in the works.

In addition, independent drivers for:

- Flex and OSI Cinder block storage drivers.
- Keystone Authentication and Authorization for Kubernetes



Kata Containers

A new independent project, hosted by the OpenStack Foundation.

Open source collaboration between Intel Clear Container and Hyper.sh teams.

Fully OCI compliant container runtime engine.

Backed by lightweight virtual machines with fast launch times and ability to deliver existing Docker containers without rebuilding.

Expected 1.0 release in Q2 2018.

<https://katacontainers.io>



Installing OpenStack

➔ SIMPLE OPENSTACK IRONIC INSTALLERS

- <https://github.com/hogepodge/container-ironic>
- <https://github.com/openstack/bifrost>

➔ OPENSTACK SERVICE CONTAINERS

- <https://github.com/openstack/kolla>
- <https://github.com/openstack/loci>

➔ CONTAINER-BASED INSTALLERS

- <https://github.com/openstack/kolla-ansible>
- <https://github.com/openstack/openstack-ansible>
- <https://github.com/openstack/openstack-helm>

Running Containers on OpenStack

➔ KUBERNETES ON OPENSTACK

- <https://github.com/openstack/magnum>
- <https://github.com/kubernetes/cloud-provider-openstack>

➔ CONTAINERS ON OPENSTACK

- <https://github.com/openstack/zun>

Users and Case Studies

➔ OPENSTACK FOR SCIENCE

- Cern OpenStack in Production Blog
 - <http://openstack-in-production.blogspot.co.uk>
- Chameleon Cloud
 - <https://www.chameleoncloud.org>
- The Crossroads of Cloud and HPC Book, Version 2
 - <https://openstack.org/science>

➔ OPENSTACK AND CONTAINERS

- The Switch Cloud Blog
 - <https://cloudblog.switch.ch>
- Demo of Running Kubernetes on OpenStack
 - <https://asciinema.org/a/2dgnfMUjTSZktjzDRt25wO9Yb?speed=2>

VANCOUVER, BC

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THANKS.

Questions?



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"Any opinions, findings, conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the Networking and Information Technology Research and Development Program."

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