NDS Labs Architecture



This page is out of date and does not reflect the current Labs Workbench architecture.

Note: Also see architecture/design notes within the source code under docs

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Concepts and Terminology

- Infrastructure: The compute and storage resources in a cloud or infrastructure service (AWS, etc) that an NDS Labs cluster runs on. The NDS
 Labs reference architecture is OpenStack.
- Site: A site is an administrative organization that provides resources to and operates one or more NDS Labs clusters.
- Cluster/NDS Labs cluster: The NDS Labs software platform that runs on the infrastructure.
- Project/Namespace: An isolated, named environment within the cluster that contains a set of services that are managed and operated
 independently of other projects. Projects typically implement the equivalent of a "website".
- · Administrator: An authenticated person that manages and operates a part of the system.

NDS Labs System - Roles and Responsibilities

- Infrastructure Administrator:
 - o Provisions infrastructure to run a NDS Labs cluster
 - On OpenStack, AWS, GCE, Rackspace, MaaS, ...
 - Deploys the NDS Labs base cluster software
 - Registers resources from infrastructure with NDS Labs cluster resource pool
 - O Provides API and credential to Cluster Administrator
- Cluster Administrator:
 - Manages and operates the NDS Labs cluster infrastructure
 - Manages Projects in the cluster
 - Provisions Projects on the cluster
 - Manages resource assignments from the cluster pool to project pools
 - Provides API and credentials per-project to Project Administrators
- Project Administrator:
 - Provisions and deploys services in a project using resources granted to the project pool by the cluster administrator.
 - Manages, monitors, and administrates services within independent projects.
- User/Project User: A client/user of the services within a project.
- Tool/Service Provider: A NDSC partner that provides a tool or service in a set of containers that include NDS Labs service descriptors to enable
 the service to be integrated in a NDS Labs cluster.

NDS Labs Architecture

NDS Labs extends the Kubernetes base system with NDS-specific services and REST API's that support NDS Labs cluster services, project services, intercluster NDS Labs services. The implementations of NDS Labs services are implemented via cluster-specific Kubernetes pods and sidekick containers that are deployed in conjunction with service pods in the cluster and in project-specific services that "extend" cluster-specific and project-specific pods with integration to services such a monitoring, volume management, etc.

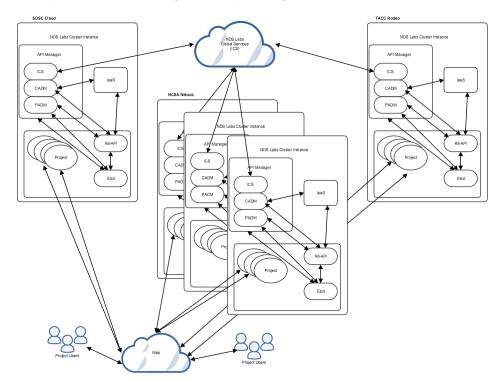
- NDS Labs Cluster Services:
 - o API Manager: Manages cluster-wide API naming and public API exposure from the cluster public IP firewall/load-balancing system.

- Catalog, Configuration, and Deployment (CCD) Service: Automatically updated catalog of NDS Labs services available for deployment in the cluster (for cluster admins), and for projects (for project admins). The service catalog manager is configured with NDS Labs-specific container repositories, and periodically pulls service descriptions from the containers.
- Cluster Admin Project Administration (CADM): Provide the cluster administrator with project provisioning including project admin credentials. Provides management of infrastructure resources to projects, including volumes and managing differentiated compute resources.
 - Cluster Administrator Monitoring (CMON) Tools/Service: Provides services for cluster administrators to monitor cluster operations, including logging, performance analysis, and resource utilization. Monitor services include ELK, Prometheus, etc. in addition to Kubernetes-provided tools like cadvisor.
- NDS Labs Project Services:
 - Project Manager Administration (PADM): Allows the project manager to deploy, monitor, and manage application services within their project.
 - Per-project Monitoring (PMON): Provides project-specific monitoring of project resources, utilization, performance, and app lication/service specific monitoring and logging.
- Inter-Cluster/Integrated-Cluster Services (ICS): Provide NDS Labs web services across multiple distributed clusters in the larger NDS Labs
 context to implement global NDS Labs services such as global resource search, distributed data access, and provide distributed application
 developers services to implement service discovery and distributed API access within their services.
 - o Distributed search: Locating named data and services in the NDS Labs global system.
 - Resource discovery: Locates attribute-specified resources in the NDS Labs global system, such as specifically sized data-storage resources, or specific compute resources such as HPC resources, or accelerator-enabled compute resources, for example.
 - o Advanaced Data Management: Allows composing cross-cluster data management applications

High Level Global Architecture

The NDS Labs system is comprised of NDS Labs cloud services that run on clusters at various sites. Clusters provide the resources to one or more PTO

jects comprised of a related set of cloud-based services targeted to a specific community or application. In a service-oriented model the site is equivalent to an laaS provider, the cluster is equivalent to a PaaS provider, and a project is equivalent to a uniquely configured and deployed platform on the PaaS system. Specific NDS Labs services are implemented within each layer that assist with convenient deployment and operation of the PaaS and platform layers. Global distributed data services such as search across all NDS Labs sites and projects will be provided in the Inter-cluster system (ICS) that will provide infrastructure building blocks for implementing wide area cross-cluster services.

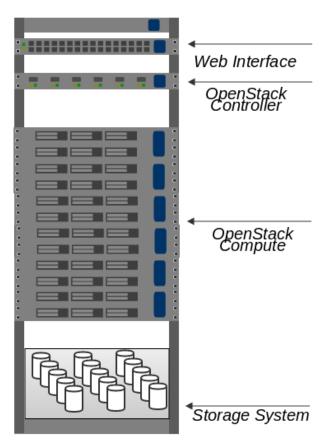


Single Cluster Architecture Diagrams

Layer 0 - Single Cluster Infrastructure

The NDS Labs reference infrastructure is OpenStack. A cluster begins with a cluster of 6 OpenStack VMs. The cluster admin can add additional compute nodes as-needed based on dynamic demand.

OpenStack Cluster Hardware

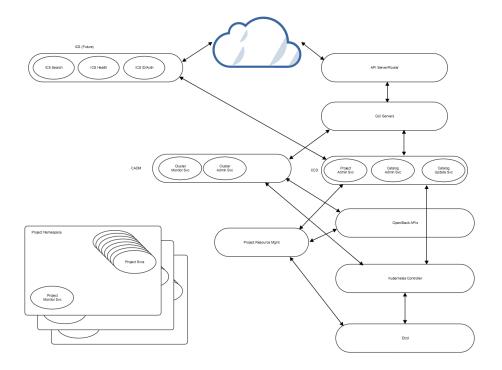


Layer 1 - Kubernetes Container and Service Orchestration Layer

The initial 6-VM system is provisioned as a CoreOS cluster with 3 serving as etcd masters (not shown for simplicity), and 3 serving as the initial Kubernetes infrastructure, with the following architecture. additional compute resources can be added to the kubernetes cluster as demand requires.

Layer 2 - Single-Cluster Detail - NDS Labs Services and APIs

The NDS Labs architecture layer services on top of kubernetes that implement the NDS Labs services to manage and monitor the cluster, provision and manage resources for projects in the cluster, and provide project managers the ability to manage software service stacks within their project. The NDS Labs services leverage the facilities of the underlying kubernetes cluster orchestration system and the etcd system for managing configuration and state information of the services.



API/Service Catalog

	APIs	UsedBy
е		

Service/Component/Role Matrix with Descriptions

Stage of Development Color Key: Completed In Development In Design Future

Service	Component Description	Planning Notes	Role/Use				
			Infrastructure Admin	Cluster Admin	Project Admin	Tool Developer	System Service
Developers Environment and Tooling (DEVENV) https://github.com/nds-org /ndslabs-developer-shell	Kubernetes Devenv Host-node network IPaddrs	NDSC5 - Planned for managed small- scale release to handful of early adopters	NA	NA	Test project deploy	Test tools	NA
https://github.com/nds-org /ndslabs-system-shell							
	Kubernetes Devenv w/ External firewall IPaddrs	Needs tests/design etcd/connfd/nginx	NA	NA	Test project with proper public interface	Develop to proper external interface	NA
	Container build support Makefiles	Needs: docs, instructions, catalog yml support, publish process integration	NA	NA	NA		NA
OpenStack Platform Interface	Production Cluster Deploy	Infrastructure provision done Needs production config: TLS, security, data persistence	Deploy Cluster Infrastructure	NA	NA	NA	NA
	Volume Interface Service	Needed for OpenStack deploy	Provide vol resources	Allocate vol resources to projects	Implicit use of auto-named vols	NA	Register /track resources
Catalog, Configure, Deploy (CCD) https://github.com/nds-org /ndslabs	Service catalog Admin Interface (CATADM) Register catalog URLs in etcd	NDSC5 demo component	NA	Admin Catalogs - register catalog URLS	NA	Publish service Needs service format	
	Update local service		NA	NA	NA	NA	Pull catalog

	catalog from configured catalogs (CATSVC)	NDSC5 demo component					maintain in etcd
	Project Deploy CLI Deploy service stacks in project	NDSC5 demo	NA	NA	Deploy named service stacks in project	NA	Uses kubernetes API
	Project Deploy GUI /Server Web deploy tool on CLI (CCDSRV)	NDSC5 demo Needs volume management CLI	NA	NA	Web configurator and deploy	Use to test newly developed tools	NA
	Project Service Monitor (PMON)	NDSC5 demo Display state of stacks in project	NA	NA	CCD gui	NA	NA
Cluster Administator/Ops (CADM)	Cluster Monitor (CMON)	NDSC5 demo component ELK, cadvisor/prometheus, etc. Graphical tools Needs configuration and testing	NA	Monitor cluster health and performanc e	NA	NA	NA
Inter-Cluster Services (ICS)	Search	Search across all NDSL clusters Needs research, requirements, plan	NA	Registration	Register data resources	relevant for developing search interfaces /tools	External interface to cluster Distributed global service
	Registration Cluster registration /federation	Needs development	NA	Global registration	Project resource registration	??	Local and global distributed service

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