



# NetApp HCI for DevOps

## HCI

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# NetApp HCI for DevOps

## Building an End-to-End CI/CD Pipeline

This series of blogs and videos will explore how *NetApp HCI* satisfies the requirements of the **DevOps Continuous Integration (CI)** and **Continuous Delivery (CD)** pipeline.

[Learn more](#) about NetApp HCI.

## What is DevOps?

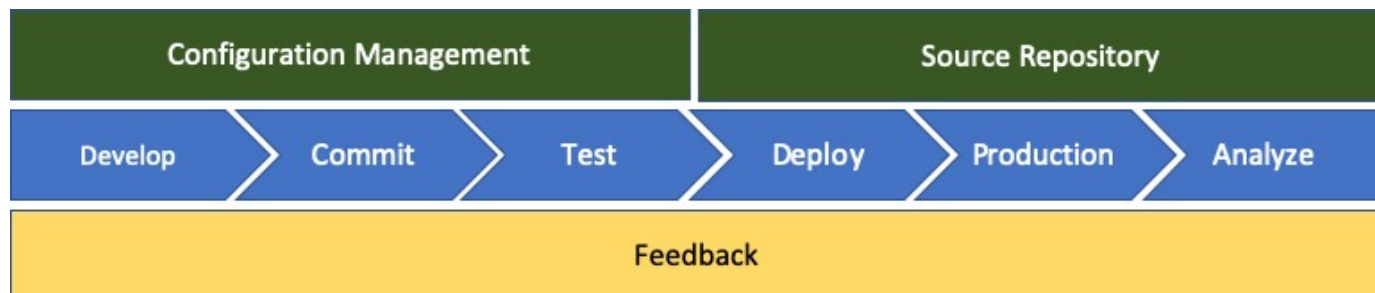
**DevOps** is a set of software development practices that combine software development (*Dev*) and information-technology operations (*Ops*) to shorten the systems-development life cycle while delivering features, fixes, and updates frequently in close alignment with business objectives.

As DevOps is intended to be a cross-functional mode of working, those that practice the methodology use different sets of tools—referred to as "toolchains"—rather than a single one.

## What is a CI/CD Pipeline?

**Continuous Integration (CI)** and **Continuous Delivery (CD)** embody a culture, set of operating principles, and collection of practices that enable application development teams to deliver code changes more frequently and reliably. The implementation is also known as the *CI/CD pipeline* and is one of the best practices for DevOps teams to implement.

## Addressing the CI/CD Pipeline with NetApp HCI



**Figure 1:** DevOps CI/CD Pipeline - Use the navigation panel (at the right) to learn more about each of the components of the CI/CD pipeline.

## Configuration Management

Configuration management refers to the process of setting up the virtual infrastructure for a DevOps CI/CD pipeline. Automation of the infrastructure configuration is a key tenant in DevOps where automation tools such as Ansible and Puppet are widely used to perform the required automation steps.

## Automate configuration on your Virtual Infrastructure:

- Deploy Kubernetes on NetApp HCI with NKS: [Blog](#)

The screenshot shows the NetApp Kubernetes Service (NKS) configuration interface. At the top, there is a progress bar with three steps: 'Choose a provider' (completed), 'Configure your provider' (completed), and 'Configure your cluster' (active). The main content area is titled 'NetApp | HCI'. On the left, under 'Recommendation', it lists: 1 Master (Size: m, Disk: 50 GB), 2 Workers (Size: m, Disk: 50GB), lab-rtp, and Default SPC SSH Keypair. Below this is a 'Key-Value Store' section with the etcd logo. On the right, the 'Cluster Name' is 'hctest' (7 / 255 characters). The 'Orchestration' section shows 'kubernetes' 1.14.3 with checkboxes for 'Install Dashboard' and 'Enable RBAC'. The 'Pod Network' is '10.2.0.0 /16' and the 'Service Network' is '10.3.0.0 /24'. The 'Distribution' section shows 'debian' 'Stable'. At the bottom, a 'PROCESSING...' button is visible.

## Source Repository

A source repository is where the “code” is stored throughout the CI/CD pipeline. Developers “check-out” code to make changes, test the changes and “check-in” the code to be built and deployed. Examples of source repositories that will be referenced in the DevOps video/blog series include jFrog and Bitbucket.

### Choose and setup a Source Repository:

- Configuring Jenkins with a new pipeline to run jobs in Kubernetes: [Blog](#)

The screenshot shows the Jenkins configuration interface for a Pipeline job. The browser address bar indicates the URL is <https://jenkins.netmnf15bs.nks.cloud/job/Demo/configure>. The configuration page has four tabs: General, Build Triggers, Advanced Project Options, and Pipeline. The Pipeline tab is selected, showing the following settings:

- Definition:** Pipeline script from SCM
- SCM:** None
- Script Path:** Jenkinsfile
- Lightweight checkout:** ☒

At the bottom of the configuration section, there are **Save** and **Apply** buttons. A **Pipeline Syntax** link is also visible.

## Develop

In order to develop code in a CI/CD pipeline, a code and binary management system must be defined. The management system defines the practices for developing and introducing code into the pipeline. Tools such as Artifactory help in managing this process for DevOps.



Behind the scenes of Artifactory and HCI:

## Commit

Once code is developed and tested, it must be built before it can be deployed. The commit phase of the CI/CD pipeline addresses how the code is committed into the code management system and built so that it can be deployed.

**Setup your CI pipeline and Run your first builds:**

- Configuring Jenkins with a new pipeline to run jobs in Kubernetes: [Blog](#)

The screenshot shows the Jenkins configuration interface for a job named 'Demo'. The browser address bar indicates the URL is <https://jenkins.netmnf15bs.nks.cloud/job/Demo/configure>. The configuration page has four tabs: 'General', 'Build Triggers', 'Advanced Project Options', and 'Pipeline'. The 'Pipeline' tab is selected and active. Under the 'General' tab, there are checkboxes for 'Preserve stashes from completed builds', 'This project is parameterized', and 'Throttle builds'. The 'Build Triggers' section includes checkboxes for 'Build after other projects are built', 'Build periodically', 'Poll SCM', 'Disable this project', 'Quiet period', and 'Trigger builds remotely (e.g., from scripts)'. The 'Advanced Project Options' section is currently empty, with an 'Advanced...' button visible. The 'Pipeline' section contains a 'Definition' dropdown set to 'Pipeline script from SCM', an 'SCM' dropdown set to 'None', a 'Script Path' text field containing 'Jenkinsfile', and a 'Lightweight checkout' checkbox that is checked. A 'Pipeline Syntax' link is located below the 'Lightweight checkout' checkbox. At the bottom of the configuration page, there are 'Save' and 'Apply' buttons.

## Test

Testing is a critical component in any development process. In a CI/CD pipeline, testing is performed at the development phase as well as part of the “acceptance” of code prior to deployment.

## Deploy

Deployment of code occurs once the code has been developed, tested and built. Once built and verified, code can be deployed into a production or pre-production environment.

### Deploy blue/green environments with Kubernetes:

- Deploy an application on a NetApp HCI cluster using curated NKS Helm charts: [Blog](#)

The screenshot shows the NetApp HCI Kubernetes Dashboard. The top navigation bar includes the 'hctest' cluster name, 'Kubernetes v1.14.3 - RBAC Enabled', and a 'FEDERATE' button. The left sidebar contains navigation links: 'Kubernetes Dashboard', 'MacBook', 'kubeconfig', 'Quick Start Guide', 'Event Log', and 'Report an Issue'. A 'Preview' section is also present.

**Master Nodes (1)**

Hostname	Node Size	Private IP	Public IP
netr66lpc-master-1	m (50GB)	10.61.185.81	--

**Worker Node Pools (1)**

Hostname	Node Size	Nodes
Default Worker Pool	m (50GB)	2

**Deployments (23)**

Name	Namespace	Labels	Pods	Age
nginx-ingress-controller	ingress-nginx	app.kubernetes.io/...	1 / 1	9 days
istio-ingressgateway	istio-system	app: istio-ingressg...	1 / 1	3 days
jenkins	jenkins	app.kubernetes.io/...	0 / 1	a few seconds
coredns	kube-system	k8s-app: kube-dns	2 / 2	9 days
tiller-deploy	kube-system	app: helm, name: tiller	1 / 1	9 days

- Deploy a custom application on a NetApp HCI cluster using a custom helm chart: [Blog](#)

The screenshot shows the 'NetApp Kubernetes Service Solutions' page. It features a grid of 'Trusted Charts' categorized by function:

- Service Mesh:** Istio
- Registry:** JFrog ARTIFACTORY
- Security:** JFrog XRAY
- Cloud Volumes:** NetApp Cloud Volumes for AWS (Automated by Trident)
- Monitoring:** Prometheus
- Logging:** Elasticsearch, fluentd, Kibana
- HAProxy:** HAPROXY COMMUNITY EDITION
- Autoscaler:** autoscaler

## Production

Once code is deployed into the production environment, it can be utilized to meet a customer use case. This topic will touch on how the DevOps CI/CD pipeline introduces code into production to solve a

business need.

**Data Protection, and DR to any place: on premise, off premise and the Cloud:**



## Analyze

Throughout the lifecycle of a CI/CD pipeline, analysis and metrics surrounding the code provide an effective means of evaluating the performance and effectiveness in meeting a business need. This section will touch on metrics and analytics using tools such as ServiceNow (as a self-service portal) and Cloud Insights.

**Metrics are king:**



**ServiceNow for a self-service Portal:**



**Using Cloud Insights:**



## Feedback

Feedback is a fundamental tenant of a successful CI/CD pipeline. At every point in the pipeline, feedback is given to ensure that the code is meeting the expectations. There are a variety of feedback options including, but not limited to, email, reports, blogs, source management notifications and execution logs.

**Communicate status to your developers:**





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