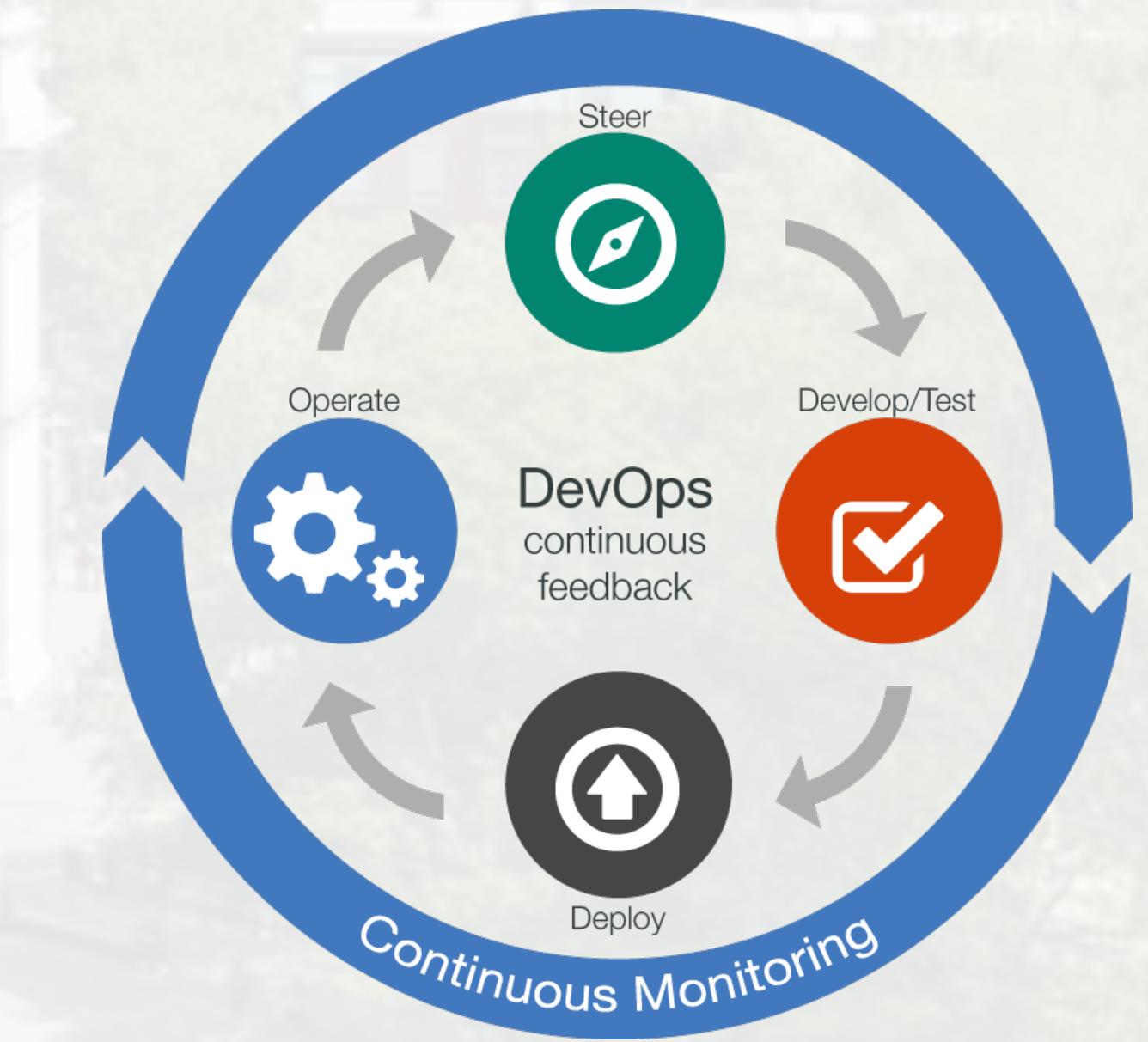


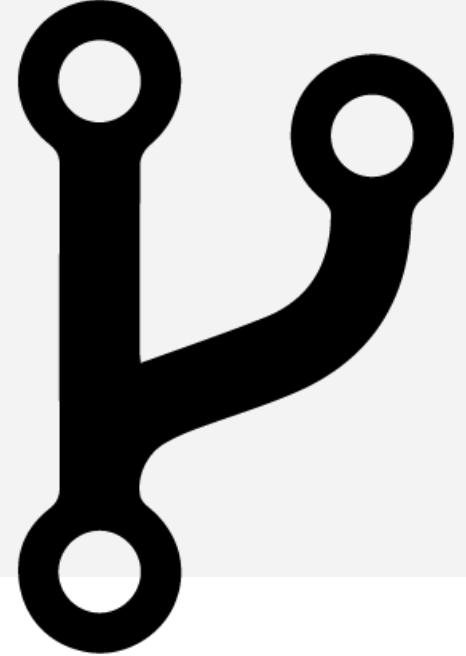
Creating A Continuous Delivery Pipeline

Fall 2020, CSCI-GA 2820, Graduate Division, Computer Science



Instructor:
John J Rofrano

Senior Technical Staff Member | DevOps Champion
IBM T.J. Watson Research Center
rofrano@cs.nyu.edu (@JohnRofrano)



Let's Get Forkin'

- The source for this lab can be FORKED from:

<https://github.com/nyu-devops/lab-bluemix-cf>



**You must fork the code so that you can push back
to your own copy and trigger the DevOps Pipeline
that we will set up**

Setup from Platform as a Service Lecture

If you did this already just skip

Fork me on GitHub

Fork Me On GitHub

The screenshot shows a GitHub repository page for 'nyu-devops/lab-bluemix-cf'. The repository has 2 commits, 1 branch, 0 releases, 1 contributor, and is licensed under Apache-2.0. It includes sections for Code, Issues (0), Pull requests (0), Projects (0), Wiki, Pulse, Graphs, and Settings. The commit history lists files like pets, static, .gitignore, LICENSE, and Procfile, all of which were initially loaded 29 seconds ago or a day ago.

This repo demonstrates how deploy a simple Python Flask RESTful service using Bluemix Cloud Foundry

Branch: master ▾ New pull request

Create new file Upload files Find file Clone or download ▾

File	Initial Load	Time
pets	Initial Load	29 seconds ago
static	Initial Load	29 seconds ago
.gitignore	Initial Load	29 seconds ago
LICENSE	Initial commit	a day ago
Procfile	Initial Load	29 seconds ago

Fork me on GitHub

Fork Me On GitHub

The screenshot shows a GitHub repository page for 'nyu-devops / lab-bluemix-cf'. A red box highlights the URL in the browser's address bar: <http://github.com/nyu-devops/lab-bluemix-cf>. A red arrow points from this URL to the text 'Go to: http://github.com/nyu-devops/lab-bluemix-cf' located below the address bar. The repository description states: 'This repo demonstrates how deploy a simple Python Flask RESTful service using Bluemix Cloud Foundry'. The repository stats show: 2 commits, 1 branch, 0 releases, 1 contributor, and Apache-2.0 license. The commit history lists the following files: pets, static, .gitignore, LICENSE, and Procfile. The latest commit was made 29 seconds ago by rofrano.

Go to: <http://github.com/nyu-devops/lab-bluemix-cf>

This repo demonstrates how deploy a simple Python Flask RESTful service using Bluemix Cloud Foundry

2 commits 1 branch 0 releases 1 contributor Apache-2.0

Branch: master ▾ New pull request Create new file Upload files Find file Clone or download ▾

File	Commit Message	Time
pets	Initial Load	29 seconds ago
static	Initial Load	29 seconds ago
.gitignore	Initial Load	29 seconds ago
LICENSE	Initial commit	a day ago
Procfile	Initial Load	29 seconds ago

Fork Me On GitHub

Fork me on GitHub

A screenshot of a GitHub repository page for 'nyu-devops / lab-bluemix-cf'. The page shows basic repository statistics: 2 commits, 1 branch, 0 releases, 1 contributor, and Apache-2.0 license. A prominent orange call-to-action button in the center says 'Fork the code to your own account'. The 'Fork' button in the top right corner is also highlighted with a red box and an arrow pointing to it from the right side of the slide.

This repo demonstrates how deploy a simple Python Flask RESTful service using Bluemix Cloud Foundry

Edit

python flask redis bluemix cloud-foundry Manage topics

2 commits 1 branch 0 releases 1 contributor Apache-2.0

Branch: master New pull request Create new file Upload files Find file Clone or download

rofrano Initial Load ... Latest commit c4622c8 29 seconds ago

pets Initial Load 29 seconds ago

static Initial Load 29 seconds ago

.gitignore Initial Load 29 seconds ago

LICENSE Initial commit a day ago

Procfile Initial Load 29 seconds ago

Your New Forked Repo

The screenshot shows a GitHub repository page for `rofrano / lab-bluemix-cf`. A red box highlights the repository name and its origin: `forked from nyu-devops/lab-bluemix-cf`. A red arrow points from this highlighted area to the text "Your repo knows that it was forked from nyu-devops" which is displayed in an orange box at the bottom of the page.

This repo demonstrates how to deploy a simple Python Flask RESTful service using Bluemix Cloud Foundry

Your repo knows that it was forked from nyu-devops

14 commits · 1 branch · 0 releases · 1 contributor

Branch: master · New pull request · Create new file · Upload files · Find file · Clone or download

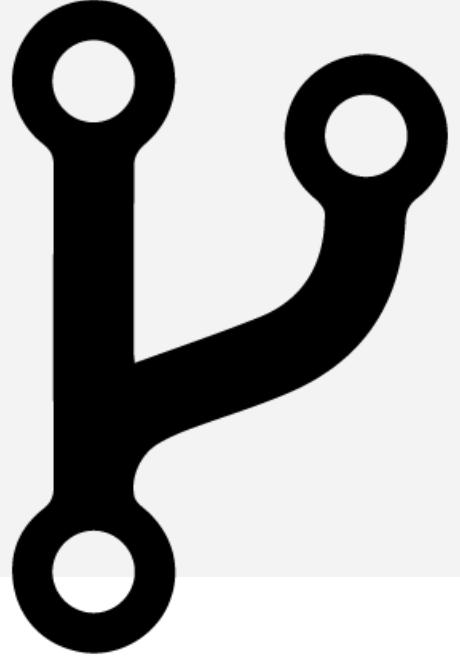
This branch is 4 commits ahead of nyu-devops:master.

John J. Rofrano synced with upstream · Latest commit 272169c 40 minutes ago

static synced with upstream · 40 minutes ago

tests fixed problems with GUI and search · a day ago

.cfignore fixed problems with GUI and search · a day ago



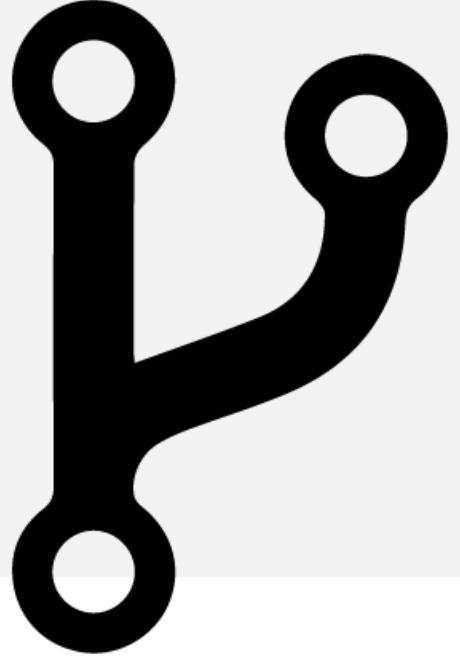
Refreshing your Fork

- If you need to update your fork from the original repo use this:

```
git remote add upstream https://github.com/nyu-devops/lab-bluemix-cf.git
git fetch upstream
git push
```

If you encounter any merge conflicts, fix them and then commit then:

```
git commit -am 'merge conflicts'
```



Refreshing your Fork

- If you need to update your fork from the original repo use this:

```
git remote add upstream https://github.com/nyu-devops/lab-bluemix-cf.git  
git fetch upstream  
git push
```

This is the URL of the upstream repo that you originally forked

If you encounter any merge conflicts, fix them and then commit then:

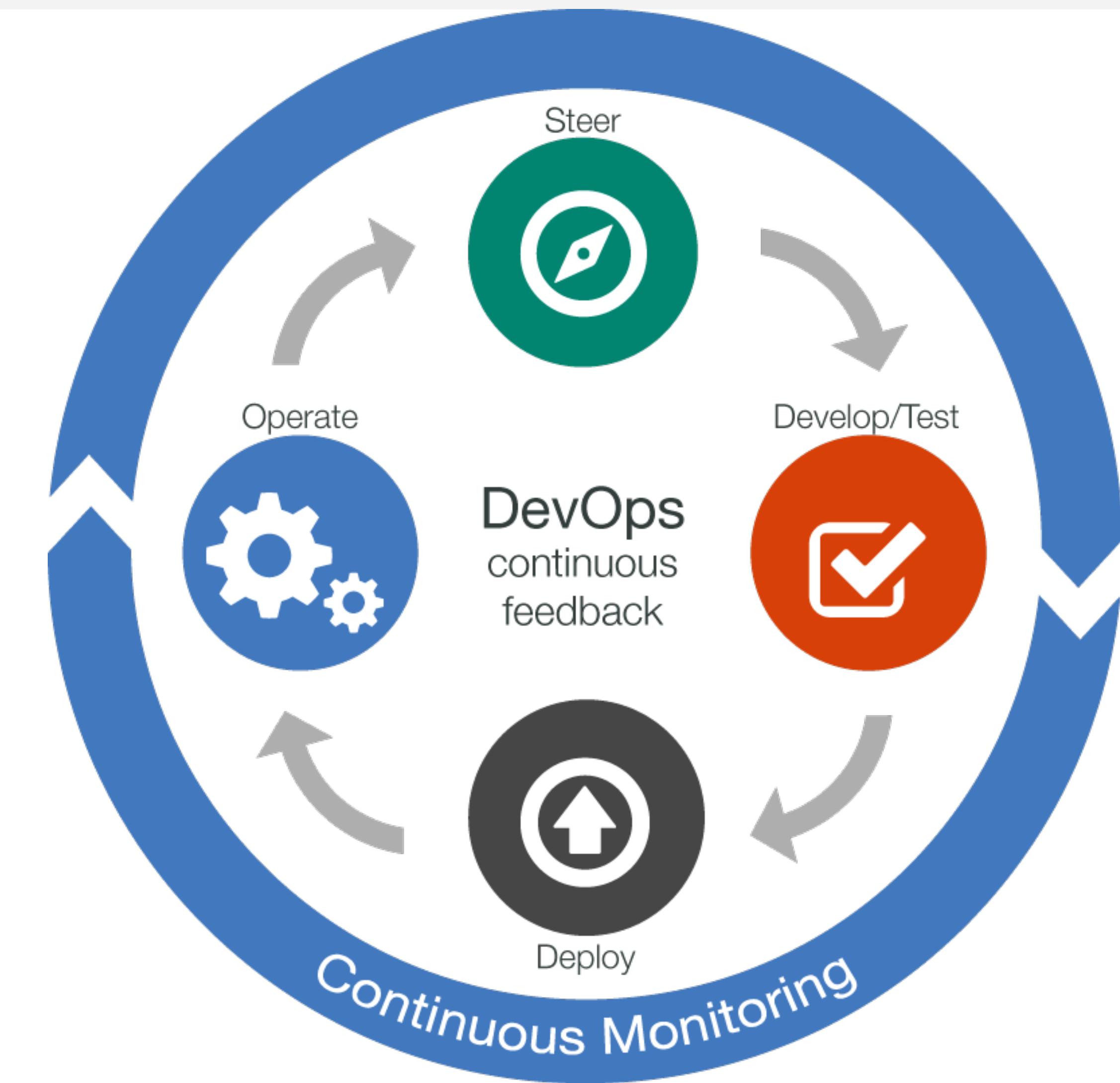
```
git commit -am 'merge conflicts'
```

What Will You Learn?

- Set up a simple DevOps Pipeline from GitHub to IBM Cloud
- Files needed to automatically deploy to Cloud Foundry
- How to link a 3rd party service to your application
- Change your app, push your code, and watch it redeploy

Core DevOps Definition

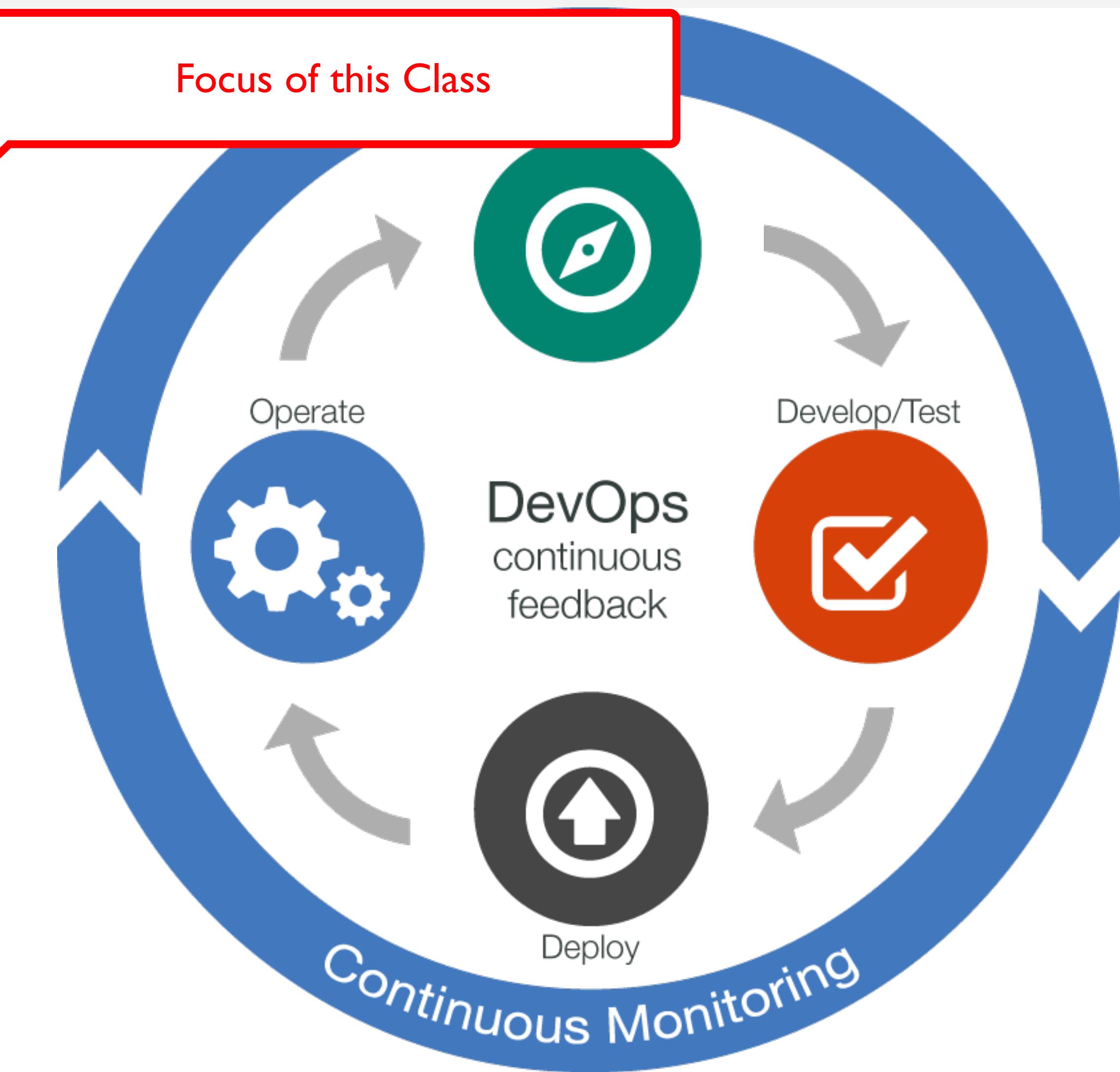
- A Cultural Movement
- Emphasizing Collaboration and Sharing
- Promoting Automation and Infrastructure as Code
 - Achieving Continuous Integration and Delivery of Changes
- Immutable Delivery
- With One set of Metrics to rule them all



Core DevOps Definition

- A Cultural Movement
- Emphasizing Collaboration and Sharing
- Promoting Automation and Infrastructure as Code
 - Achieving Continuous Integration and Delivery of Changes
- Immutable Delivery
- With One set of Metrics to rule them all

Focus of this Class

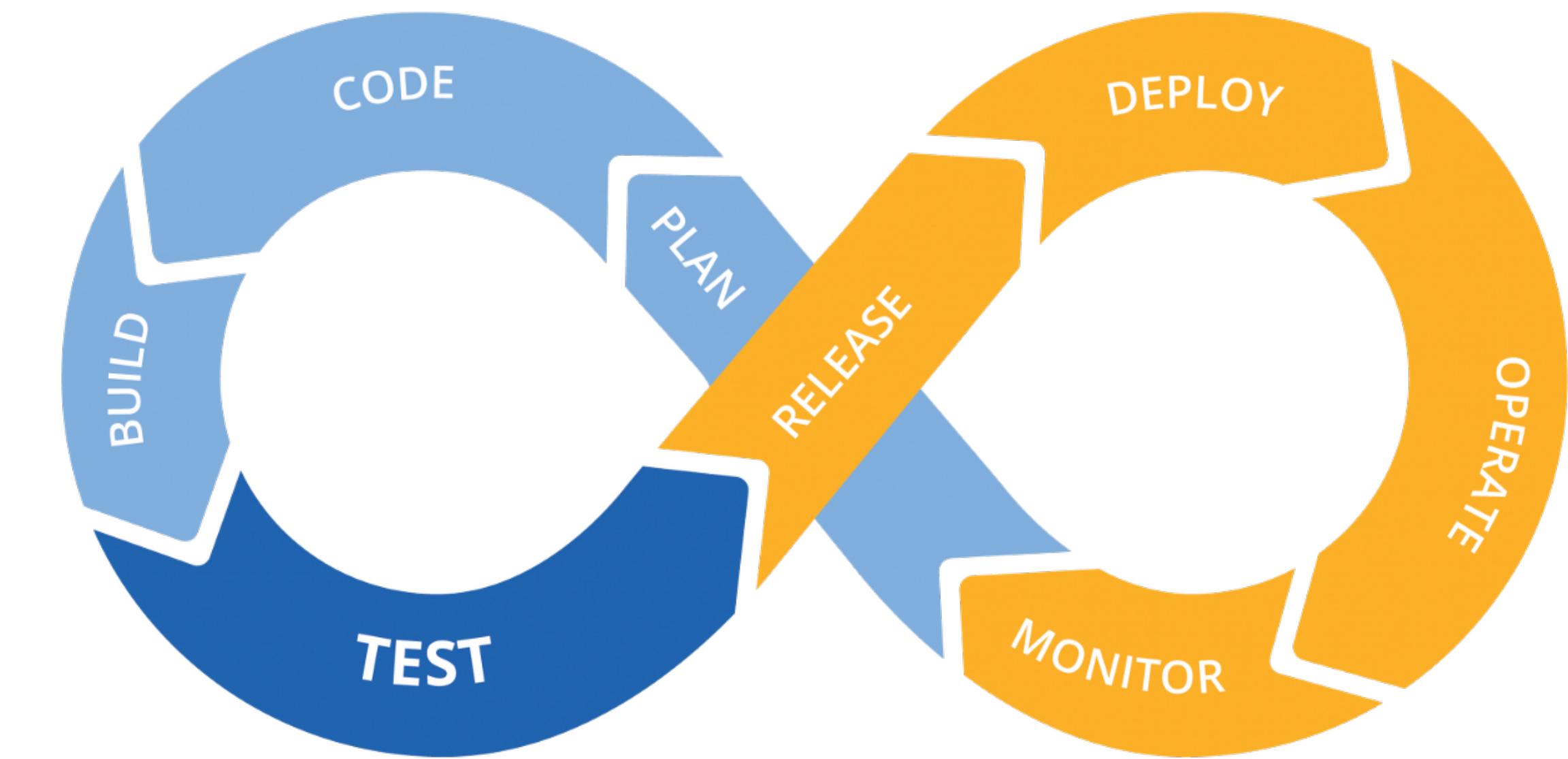


“Being able to recover quickly from failure is more important than having failures less often.”

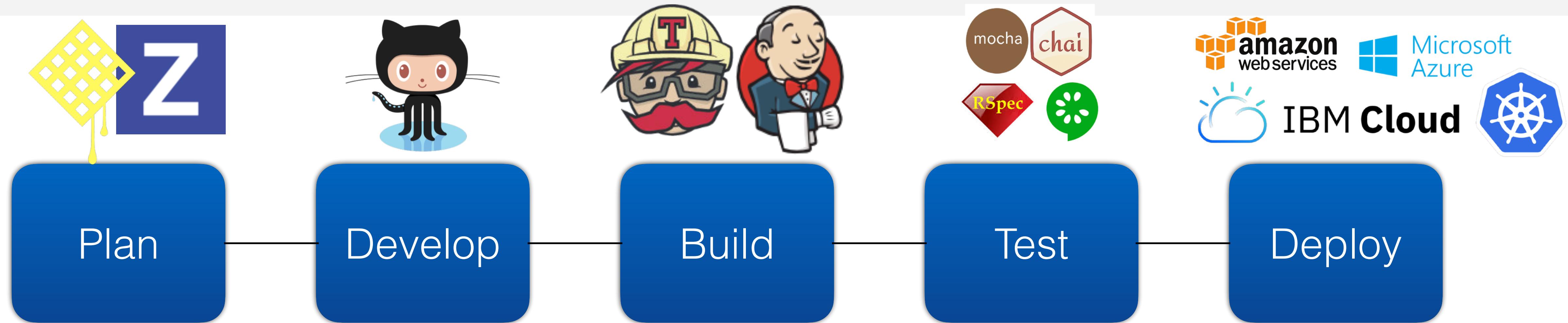
–John Allspaw, CTO at Etsy

Continuous Integration (CI) vs Continuous Delivery (CD)

- Continuous Integration
 - The process of continuously integrating every developer change into the master branch after a set of tests have passed resulting in potentially deployable code
- Continuous Delivery
 - A series of practices designed to ensure that code can be rapidly and safely deployed to production by delivering every change to a production-like environment



DevOps Pipeline



- Use tools like Waffle.io or ZenHub that promote Agile planning
- Use GitHub for Code, Issues, and Pull Requests
- Use tools like Travis CI, Jenkins, or Bluemix pipeline for Continuous Build
- Automate all testing, promote only if successful
- Deploy to dev/test/production with a repeatable automated process
 - Use canary testing to roll out

Advantages of Platform as a Service

- Minimal set-up time to get coding
 - Developers can concentrate on the application and not the infrastructure
- Large number of services to take advantage of (Database, Messaging, Analytics, Mobile, etc...)
- Very easy to scale with demand
- Delete it if it doesn't work out and pay nothing (or very little)





- There are 3 files that tell Cloud Foundry how to handle your app
 - [Procfile](#) - Tells Cloud Foundry how to start your app
 - [runtime.txt](#) - Tells Cloud Foundry exactly what environment to use
 - [manifest.yml](#) - Tells Cloud Foundry how to deploy your app



Procfile - Tells Cloud Foundry how to start your app

```
web: gunicorn --log-file=- --workers=2 --bind=0.0.0.0:$PORT service:app
```

runtime.txt - Tells Cloud Foundry exactly what environment to use

```
Python-3.7.9
```



`manifest.yml` - Tells Cloud Foundry how to deploy your app

```
# This manifest deploys a Python Flask application with a Redis database
applications:
- name: nyu-lab-bluemix
  path: .
  memory: 64M
  instances: 2
#random-route: true
  host: nyu-lab-bluemix
  domain: mybluemix.net
  disk_quota: 1024M
  buildpack: python_buildpack
  command: gunicorn --bind=0.0.0.0:$PORT service:app
services:
- Cloudant
env:
  FLASK_APP : server
  FLASK_DEBUG : false
```

Let's Set Up a DevOps Pipeline

- Now we will create a DevOps Pipeline and connect it to the GitHub repo that we Forked earlier
- We must edit the `manifest.yml` file to change the name of the app to the name that we provisioned in Bluemix
- Then push those changes back to your forked repo to kick it off



Hands-On

“live session”

Some Assembly Required

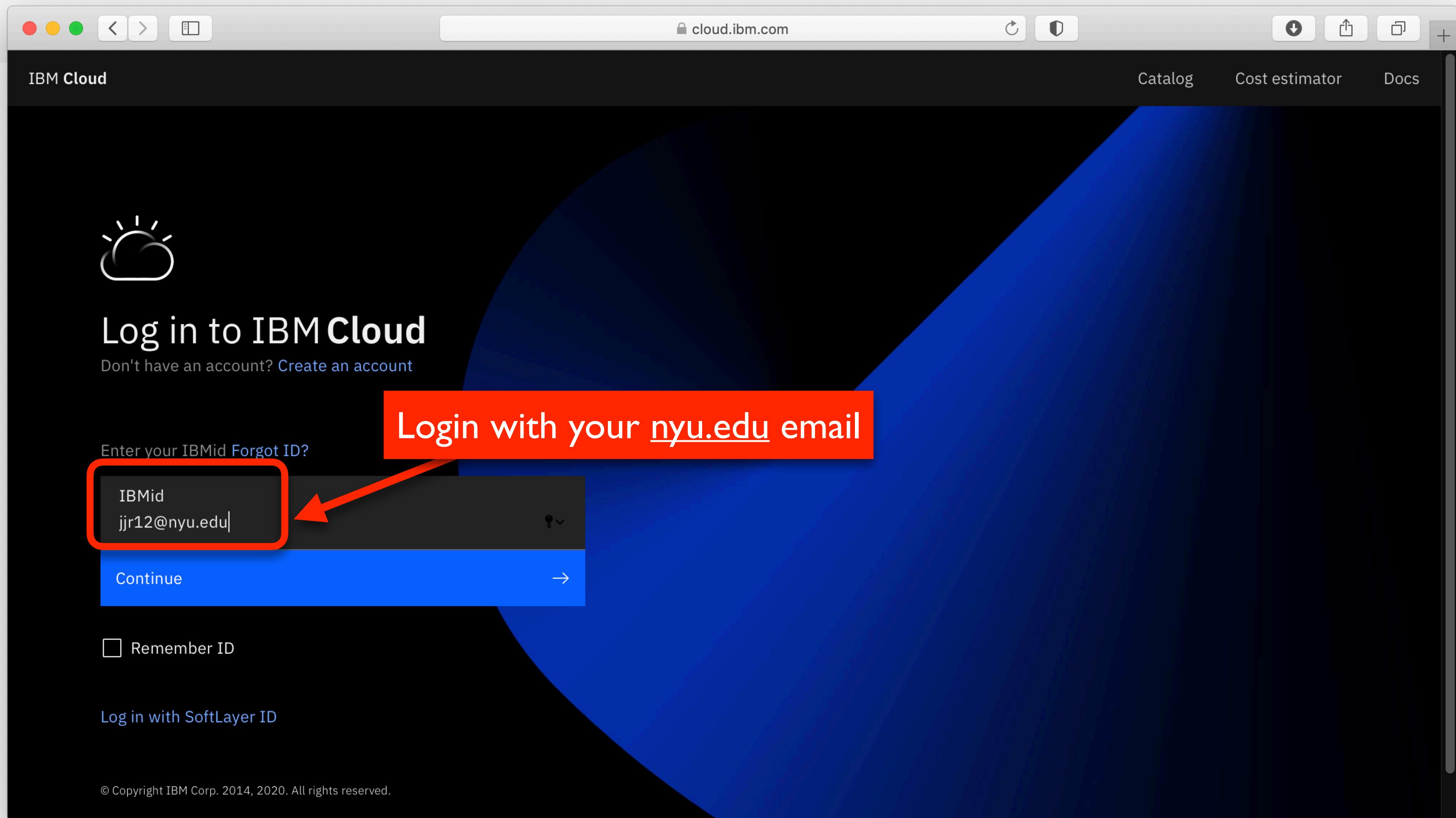
- Tools you will need to complete this lab:
 - IBM Cloud Account (cloud.ibm.com)
 - GitHub Account (github.com)
 - Git Client
 - Text Editor (e.g., Visual Studio Code)
 - Vagrant and VirtualBox



What's in This Repo?

- Pet Demo using CouchDB as a persistent store
- `Vagrantfile` with:
 - Python 3 environment
 - CouchDB database in a Docker container
 - IBM Cloud / Cloud Foundry Command Line Interface
 - Port 5000 forwarded

Go to <http://cloud.ibm.com>



IBM Cloud Services Catalog

The screenshot shows the IBM Cloud Services Catalog interface. At the top, there's a navigation bar with links for Catalog, Docs, Support, and Manage, along with a search bar and a user profile for NYU. Below the navigation bar is a dashboard section titled "Dashboard". It features several filter options: RESOURCE GROUP (All Resources), CLOUD FOUNDRY ORG (All Organizations), CLOUD FOUNDRY SPACE (All Spaces), LOCATION (All Locations), and CATEGORY (All Categories). A prominent blue button labeled "Create resource" is located on the right side of these filters. Below the filters, there's a section titled "Getting Started Tutorials" with a sub-instruction: "Select one of these step-by-step guides to get up and running in minutes." Underneath this, there are several service categories: Watson, Internet of Things, Mobile, DevOps, and Apps. Each category has associated icons and names: Push Notifications (under DevOps), Liberty for Java™ (under Apps), SDK for Node.js™ (under Apps), Runtime for Swift (under Apps), XPages (under Apps), and Go (under Apps).

IBM Cloud Services Catalog

The screenshot shows the IBM Cloud Services Catalog interface. At the top, there is a navigation bar with links for 'Catalog' (which is highlighted with a red box and has a red arrow pointing to it), 'Docs', 'Support', and 'Manage'. Below the navigation bar is a search bar and a user profile icon for 'NYU'. The main content area features a large banner with the text 'All of the IBM Cloud Services are Here' and 'Getting Started Tutorials'. It also includes a 'Create resource' button. The dashboard is organized into several sections: 'Dashboard', 'Watson', 'Internet of Things', 'Mobile', 'DevOps', 'Apps', and 'Runtime for Swift', 'SDK for Node.js™', 'XPages', 'ASP.NET Core', and 'Go'. Each section contains a brief description and a small icon.

All of the IBM Cloud Services are Here

Getting Started Tutorials

Select one of these step-by-step guides to get up and running in minutes.

Watson Internet of Things Mobile DevOps

Push Notifications

Apps

Runtime for Swift SDK for Node.js™ XPages ASP.NET Core Go

Liberty for Java™

The Catalog

A screenshot of a web browser window displaying the IBM Cloud Catalog. The URL in the address bar is `https://py-demo-jr.us-south.cf.appdomain.cloud/api/pets`. The page title is "Catalog - IBM Cloud". On the left, there is a sidebar with categories: Services (highlighted with a red box), Software, Consulting, and Category. Under Category, there is a list of service types: Compute, Containers, Networking, Storage, AI / Machine Learning, Analytics, Blockchain, Databases, and Developer Tools. The "Developer Tools" checkbox is checked. In the main content area, there is a search bar with the placeholder "Search the catalog...". Below it, a large orange callout box with the text "Quick Access to Services" points to the "Developer Tools" filter button. The filter is set to "Developer Tools" and includes a "Clear all" link. The main content shows a section titled "Developer Tools 44 items" with three service cards: "Accern-API", "Actifio GO", and "Alloy".

Services

Software

Consulting

Category

Compute

Containers

Networking

Storage

AI / Machine Learning

Analytics

Blockchain

Databases

Developer Tools

Search the catalog...

Quick Access to Services

Filters: **Developer Tools** [Clear all](#)

Developer Tools 44 items

Accern-API
Third party • Developer Tools
Get the most advanced breaking news technology for your investment strategies.
Free

Actifio GO
Third party • Storage • Developer Tools • Integration
SaaS platform for backup/DR/cloning/migration of Enterprise workloads in IBM Cloud
IAM-enabled

Alloy
Third party • Developer Tools
API for identity (KYC, AML & fraud)
Free

Developer Tools

The screenshot shows the IBM Cloud Catalog interface. On the left, a sidebar menu includes 'Catalog', 'Services' (which is selected), 'Software', and 'Consulting'. Below 'Services' is a 'Category' section with checkboxes for Compute, Containers, Networking, Storage, AI / Machine Learning, Analytics, Blockchain, and Databases. The 'Developer Tools' checkbox is checked and highlighted with a red border and a red arrow pointing to it from the bottom-left. The main content area displays a heading 'Services' with a sub-section 'Developer Tools 44 items'. It lists three services: 'Accern-API' (Third party • Developer Tools), 'Actifio GO' (Third party • Storage • Developer Tools • Integration), and 'Alloy' (Third party • Developer Tools). A large orange button at the bottom center says 'Select Developer Tools'.

Cloud Foundry - IBM Cloud

Catalog - IBM Cloud

https://py-demo-jr.us-south.cf.appdomain.cloud/api/pets

IBM Cloud

Catalog

Search the catalog...

Services

Software

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Category

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Third party • Storage • Developer Tools • Integration

SaaS platform for backup/DR/cloning/migration of Enterprise workloads in IBM Cloud

Alloy

Third party • Developer Tools

API for identity (KYC, AML & fraud)

Select Developer Tools

Continuous Delivery

The screenshot shows the IBM Cloud Catalog interface. A red box highlights the 'Continuous Delivery' service card, and a red arrow points from a text overlay 'Select Continuous Delivery' towards it. The 'Continuous Delivery' card is circled in red.

Select Continuous Delivery

Continuous Delivery Lite • IBM

Build, test and deliver using DevOps best practices.

Activity Tracker Lite • IBM

Capture, store, and visualize your IBM Cloud activities

Alert Notification IBM

Never miss critical alerts. Notify the right people immediately. Speed up response with automated escalation policies.

Auto-Scaling IBM

Automatically increase or decrease the number of application instances based on a policy you define.

Availability Monitoring Lite • IBM

Around the world, around the clock availability and performance monitoring.

DevOps Insights Lite • IBM

Elevate your DevOps to increase deployment quality, delivery control, and speed to market.

Event Management

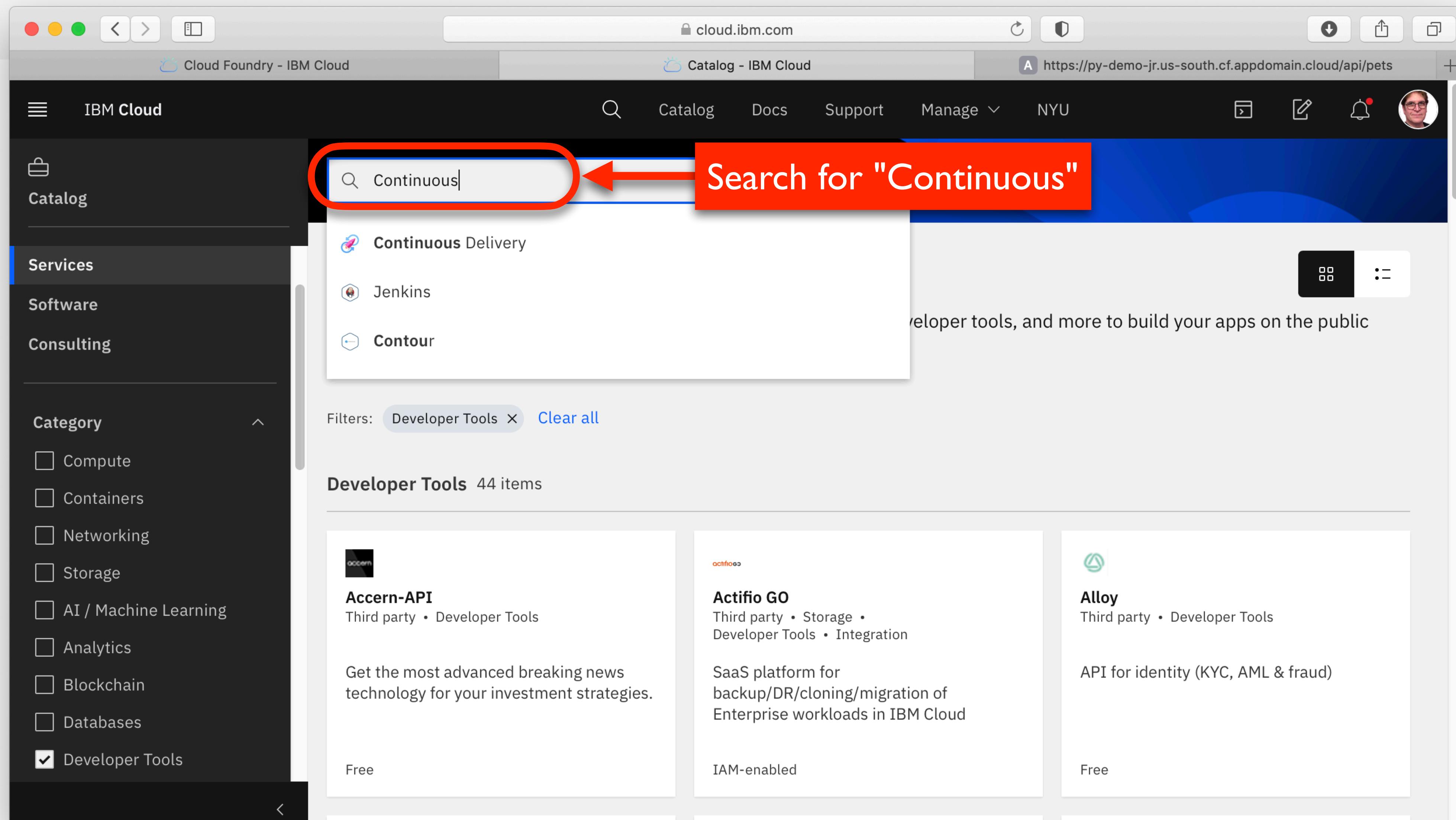
Globalization Pipeline

All Categories

- Compute
- Containers
- Networking
- Storage
- AI
- Analytics
- Databases
- Developer Tools**
- Integration
- Internet of Things
- Security and Identity
- Starter Kits
- Web and Mobile
- Web and Application

FEEDBACK

Continuous Delivery



A screenshot of the IBM Cloud Catalog interface. The search bar at the top contains the text "Continuous". A red circle highlights the search bar, and a red callout bubble to its right contains the text "Search for 'Continuous'" with an arrow pointing to the search bar. The sidebar on the left shows categories like Services, Software, Consulting, and Developer Tools, with "Developer Tools" checked. The main area displays a list of developer tools, including Accern-API, Actifio GO, and Alloy.

Cloud Foundry - IBM Cloud

Catalog - IBM Cloud

https://py-demo-jr.us-south.cf.appdomain.cloud/api/pets

IBM Cloud

Catalog Docs Support Manage NYU

Catalog

Services Software Consulting

Category

- Compute
- Containers
- Networking
- Storage
- AI / Machine Learning
- Analytics
- Blockchain
- Databases
- Developer Tools

Continuous|

Search for "Continuous"

Continuous Delivery

Jenkins

Contour

Developer Tools 44 items

Accern-API

Third party • Developer Tools

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Free

Actifio GO

Third party • Storage • Developer Tools • Integration

SaaS platform for backup/DR/cloning/migration of Enterprise workloads in IBM Cloud

IAM-enabled

Alloy

Third party • Developer Tools

API for identity (KYC, AML & fraud)

Free

Continuous Delivery

The screenshot shows the IBM Cloud Catalog interface. A search bar at the top contains the text "Continuous". Below the search bar, a list of results is displayed, with the first item, "Continuous Delivery", highlighted by a red oval and a large orange arrow pointing to it from the right. The "Continuous Delivery" entry includes a small icon of a gear and a lightning bolt. The list also includes "Jenkins" and "Contour". To the left, a sidebar shows categories like Services, Software, and Consulting, with "Developer Tools" checked. The main area below the search bar is titled "Developer Tools 44 items" and lists three services: Accern-API, Actifio GO, and Alloy.

Continuous

Continuous Delivery

Select Continuous Delivery

Catalog

Services

Software

Consulting

Category

Compute

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Storage

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Blockchain

Databases

Developer Tools

Developer Tools 44 items

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SaaS platform for backup/DR/cloning/migration of Enterprise workloads in IBM Cloud

IAM-enabled

Alloy

Third party • Developer Tools

API for identity (KYC, AML & fraud)

Free

Create Continuous Delivery

The screenshot shows a web browser window for cloud.ibm.com with the URL <https://py-demo-jr.us-south.cf.appdomain.cloud/api/pets>. The page is titled "Continuous Delivery - IBM Cloud". The top navigation bar includes links for Catalog, Docs, Support, Manage, NYU, and a user profile. The main content area displays the "Continuous Delivery" service from IBM, last updated on 10/02/2020. The service is listed as "Free" with the region set to Dallas and the plan set to Lite. The service name is "Continuous Delivery-sl" and it belongs to the "default" resource group. A dropdown menu for selecting a region shows "Dallas" as the current selection. Below this, a section for selecting a pricing plan shows the "Lite" plan, which includes "Continuous Delivery for organizations (orgs) or resource groups of up to 5 users", "5 users per organization or resource group", and "500 Delivery Pipeline jobs run per organization per month or". A large blue "Create" button is prominently displayed on the right side of the service summary.

Catalog / Services /

Continuous Delivery

Author: IBM • Date of last update: 10/02/2020 • [Docs](#)

[Create](#) [About](#)

Select a region

Select a region

Dallas

Select a pricing plan

Displayed prices do not include tax. Monthly prices shown are for country or region: [United States](#)

Plan	Features	Pricing
Lite	Continuous Delivery for organizations (orgs) or resource groups of up to 5 users 5 users per organization or resource group 500 Delivery Pipeline jobs run per organization per month or	Free

[View terms](#)

[Create](#)

Add to estimate

Create Continuous Delivery

The screenshot shows the IBM Cloud Catalog interface for creating a Continuous Delivery service. The URL in the browser is <https://py-demo-jr.us-south.cf.appdomain.cloud/api/pets>. The service details on the right indicate it's a 'Continuous Delivery' service, free, located in the Dallas region, with a Lite plan, a service name of 'Continuous Delivery-sl', and a resource group of 'default'. A large red box highlights the 'Create' button at the bottom right of the summary panel. On the left, a red box highlights the 'Dallas' option in the 'Select a region' dropdown, with a red arrow pointing to it from the text 'Select Dallas'.

Select Dallas

Select a region

Dallas

Continuous Delivery

Region: Dallas

Plan: Lite

Service name: Continuous Delivery-sl

Resource group: default

Create

Add to estimate

View terms

Create Continuous Delivery

The screenshot shows the IBM Cloud Catalog interface for creating a Continuous Delivery service. The URL in the browser is <https://py-demo-jr.us-south.cf.appdomain.cloud/api/pets>.

Region Selection: A red box highlights the "Dallas" option in the dropdown menu under "Select a region". An arrow points from the text "Select Dallas" to this highlighted option.

Action Step: A large red box with the text "Scroll Down" has a red arrow pointing downwards, indicating the user should scroll down the page to continue the process.

Service Summary: On the right, a summary panel shows the selected service details:

- Continuous Delivery** (Free)
- Region: Dallas
- Plan: Lite
- Service name: Continuous Delivery-sl
- Resource group: default

Pricing Plan: The "Lite" plan is selected, with the following details:

Plan	Features	Pricing
Lite	Continuous Delivery for organizations (orgs) or resource groups of up to 5 users 5 users per organization or resource group 500 Delivery Pipeline jobs run per organization per month or	Free

Actions: Buttons for "Create", "Add to estimate", and "View terms" are visible at the bottom right.

Create Continuous Delivery

The screenshot shows the IBM Cloud interface for creating a new service. The top navigation bar includes tabs for 'Cloud Foundry - IBM Cloud' and 'Continuous Delivery - IBM Cloud'. The main content area displays a summary of the service being created.

Summary

Continuous Delivery	Free
Region: Dallas	
Plan: Lite	
Service name: Continuous Delivery	
Resource group: default	

Configure your resource

Service name: Continuous Delivery

Select a resource group: default

Tags: env:dev, version-1

Create

Add to estimate

View terms

Lite plan services are deleted after 30 days of inactivity.

Professional **Continuous Delivery for organizations or resource groups of any size**
Charged by the number of users in your organization or resource group per month
No preset limit on the number of Delivery Pipeline jobs run per organization per month or per resource group per month
No preset limit on the amount of private Git Repos storage per organization or per resource group

\$35.00 USD/Authorized user per month

Create Continuous Delivery

The screenshot shows the IBM Cloud interface for creating a new service. The top navigation bar includes tabs for 'Cloud Foundry - IBM Cloud' and 'Continuous Delivery - IBM Cloud'. The main content area displays a 'Summary' of the service being created, showing it's a 'Continuous Delivery' service in the 'Lite' plan, located in the 'Dallas' region, with a 'Service name: Continuous Delivery' and a 'Resource group: default'. On the left, a 'Professional' plan is detailed, mentioning it covers organizations or resource groups of any size, is charged by user count, and has no preset limits on pipelines or storage. A red box highlights the 'Service name' field, which contains 'Continuous Delivery'. An arrow points from a red button labeled 'Rename it' towards this field. Below the service name, there's a 'Select a resource group' dropdown set to 'default'. Other visible fields include 'Tags' (with an example 'env:dev, version-1') and a large blue 'Create' button at the bottom.

Lite plan services are deleted after 30 days of inactivity.

Professional **Continuous Delivery for organizations or resource groups of any size**
Charged by the number of users in your organization or resource group per month
No preset limit on the number of Delivery Pipeline jobs run per organization per month or per resource group per month
No preset limit on the amount of private Git Repos storage per organization or per resource group

Rename it

Configure your resource

Service name

Continuous Delivery

Select a resource group ⓘ

default

Tags ⓘ

Examples: env:dev, version-1

Create

Add to estimate

View terms

Create Continuous Delivery

The screenshot shows the IBM Cloud interface for creating a new service. A red box highlights the 'Service name' field, which contains the text 'Continuous Delivery'. A red arrow points from the text 'Rename it' to this field. Another red box highlights the 'Select Create' button, which is blue and has a white outline. A red arrow points from the text 'Select Create' to this button. The background shows a summary of the service being created, including the plan (Continuous Delivery, Free), region (Dallas), and service name (Continuous Delivery).

Lite plan services are deleted after 30 days of inactivity.

Professional **Continuous Delivery for organizations or resource groups of any size** \$35.00 USD/Authorized user per month
Charged by the number of users in your organization or resource group per month
No preset limit on the number of Delivery Pipeline jobs run per organization per month or per resource group per month
No preset limit on the amount of private Git Repos storage per organization or per resource group

Rename it

Configure your resource

Service name: **Continuous Delivery**

Select a resource: default

Select Create

Tags: ⓘ Examples: env:dev, version-1

Create

Add to estimate

View terms

Summary

Continuous Delivery **Free**
Region: Dallas
Plan: Lite
Service name: Continuous Delivery
Resource group: default

Start with a Template

The screenshot shows the IBM Cloud Continuous Delivery dashboard. On the left sidebar, under the 'Manage' section, there is a 'Plan' item. In the main content area, the title 'Continuous Delivery' is displayed above a section titled 'Get started with Continuous Delivery'. This section features a rocket icon and three devices (laptop, monitor, tablet) displaying the IBM Bluemix DevOps interface. A red callout box with the text 'Select Start Here' points to a blue button labeled 'Start here'. Below this, another section titled 'Start from a toolchain template' is shown, featuring a network icon and a brief description of creating a toolchain for planning, developing, testing, deploying, and managing apps.

Select Start Here

Start here

Start from a toolchain template

Create a toolchain that integrates tools for planning, developing, testing, deploying, and managing your apps. You can always add or remove tools from your toolchain.

You may see one of these

The image displays two screenshots of the IBM Cloud console interface, both titled "Toolchains".

Screenshot 1 (Left): This screenshot shows the "Toolchains" page. At the top left, there's a navigation bar with "IBM Cloud", "Catalog", "Docs", "Support", and "Manage". Below the navigation bar, the title "Toolchains" is displayed. On the left, a sidebar menu has "Getting Started" and "Toolchains" listed; "Toolchains" is highlighted with a red box. In the center, there's a large circular icon with a gear-like pattern. Below it, the word "Toolchains" is written again. A message states: "Your organization doesn't contain any toolchains, or you don't have access to any toolchains in this organization. Click [Create a Toolchain](#) to get started." A blue button labeled "Create a Toolchain" is also highlighted with a red box. At the top right, there are filters for "RESOURCE GROUP" (None), "CLOUD FOUNDRY ORG" (csci-ga3033-014), and "LOCATION" (Dallas). A search bar says "Filter by resource name..." and a "Create a Toolchain" button is at the top right.

Screenshot 2 (Right): This screenshot shows a "Welcome to DevOps" page. At the top left, there's a "Getting Started" section with a "Toolchains" link. The main area features a large blue arrow pointing right. The text "Welcome to DevOps" is at the top, followed by "Continuous Delivery" with a rocket ship icon. Below that, "Get Started" is shown with the text: "DevOps transformation isn't easy. You need the right tools. Accelerate your transformation with Continuous Delivery toolchains that support development, deployment and operations tasks." A blue "Get Started" button is highlighted with a red box. To the right, there's a "Learn More" button. At the bottom right, there's another "Learn More" button. The top navigation bar is identical to the one in Screenshot 1.

Select One of These

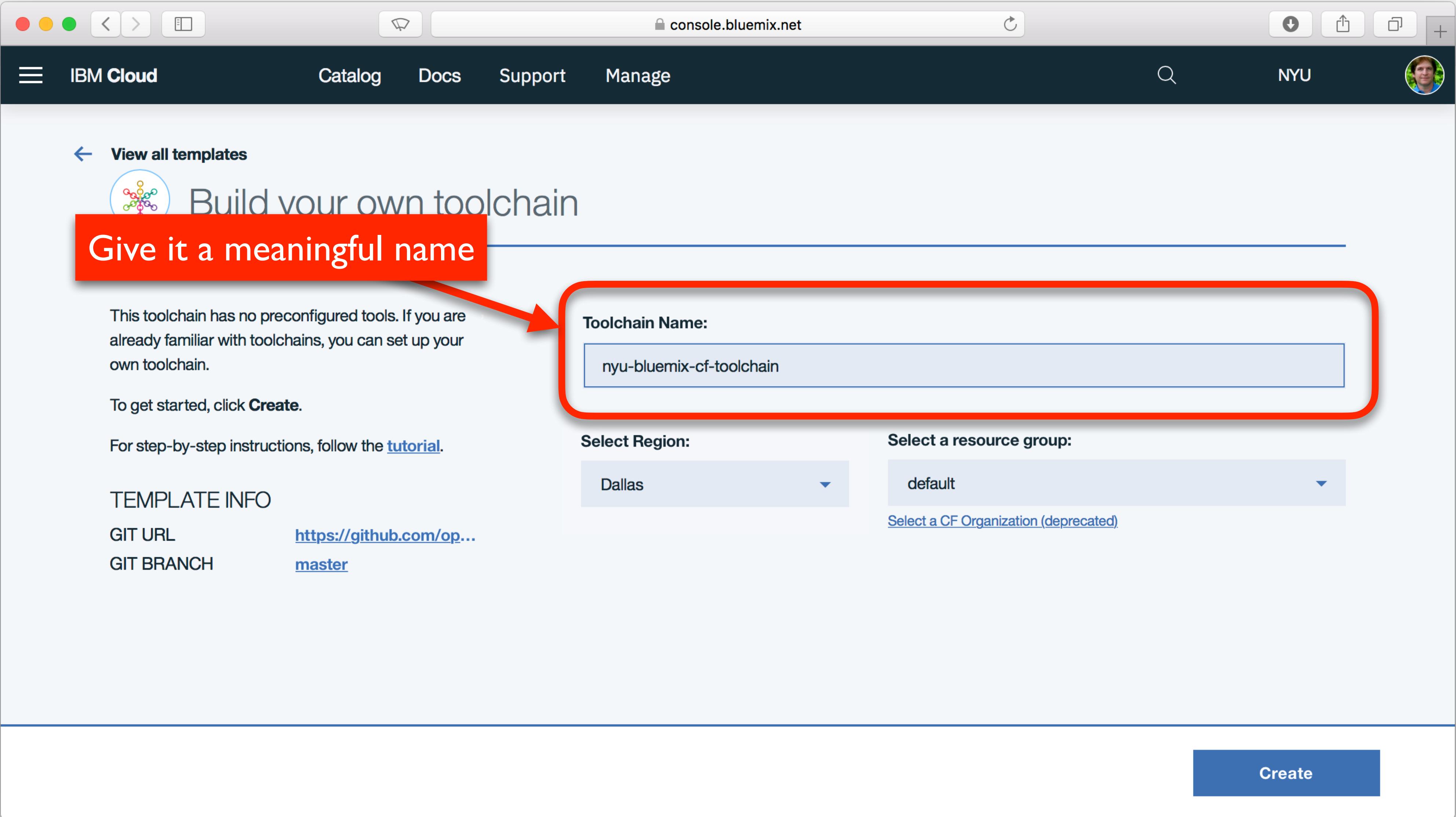
"Real" Developers Build Their Own

The screenshot shows the IBM Cloud Catalog interface on a Mac OS X desktop. The top navigation bar includes 'IBM Cloud', 'Catalog', 'Docs', 'Support', 'Manage', a search bar, and a user profile for 'NYU'. The main content area displays several service cards:

- Develop a Cloud Foundry app with DevOps Insights**: Use analytics to determine whether to deploy. Icons: lightbulb, person, Orion, circular arrow.
- Develop and test microservices on Cloud Foundry**: Continuously deliver a microservices app with repos and issue tracking hosted by IBM. Icons: lightbulb, person, Orion, pd, circular arrow, gear.
- Garage Method tutorial with Cloud Foundry**: Apply practices and tools across the DevOps lifecycle. Icons: wrench, person, New Relic, person, Orion, pd, circular arrow.
- Deployment Risk Analytics with GitHub and Jenkins**: Use analytics to determine whether to deploy. Icons: lightbulb, person, Jenkins, GitHub.
- Developer Insights and Team Dynamics with GitHub and JIRA**: Analyze GitHub source code, and GitHub or JIRA issues. Icons: lightbulb, person, GitHub, JIRA, Jenkins.

A red callout box highlights the **Select Build your own toolchain** button. A red arrow points from this button to a red-bordered box containing the **Other Templates** section, which lists the **Build your own toolchain** template. This template is described as "For advanced users, create your toolchain from scratch." Icons for this template include a colorful network graph.

Give your Toolchain a Name



console.bluemix.net

IBM Cloud Catalog Support Manage NYU

← View all templates

Build your own toolchain

Give it a meaningful name

This toolchain has no preconfigured tools. If you are already familiar with toolchains, you can set up your own toolchain.

To get started, click **Create**.

For step-by-step instructions, follow the [tutorial](#).

TEMPLATE INFO

GIT URL <https://github.com/op...>

GIT BRANCH [master](#)

Toolchain Name:
nyu-bluemix-cf-toolchain

Select Region: Dallas

Select a resource group: default

[Select a CF Organization \(deprecated\)](#)

Create

Give your Toolchain a Name

console.bluemix.net

IBM Cloud Catalog Support Manage NYU

← View all templates

Build your own toolchain

Give it a meaningful name

This toolchain has no preconfigured tools. If you are already familiar with toolchains, you can set up your own toolchain.

To get started, click **Create**.

For step-by-step instructions, follow the [tutorial](#).

TEMPLATE INFO

GIT URL <https://github.com/op>.

GIT BRANCH [master](#)

Select Dallas

Toolchain Name:
nyu-bluemix-cf-toolchain

Select Region: Dallas

Select a resource group: default

[Select a CF Organization \(deprecated\)](#)

Create

Give your Toolchain a Name

The screenshot shows the IBM Cloud interface for creating a toolchain. A red box highlights the 'Toolchain Name' field containing 'nyu-bluemix-cf-toolchain'. Another red box highlights the 'Select Region' dropdown set to 'Dallas'. A third red box highlights the 'Create' button at the bottom right. Red arrows point from the text 'Give it a meaningful name' to the 'Toolchain Name' field, from 'Select Dallas' to the 'Select Region' dropdown, and from 'Press Create' to the 'Create' button.

console.bluemix.net

IBM Cloud Catalog Support Manage NYU

View all templates

Build your own toolchain

Give it a meaningful name

This toolchain has no preconfigured tools. If you are already familiar with toolchains, you can set up your own toolchain.

To get started, click **Create**.

For step-by-step instructions, follow the [tutorial](#).

TEMPLATE INFO

GIT URL <https://github.com/op>

GIT BRANCH master

Select Dallas

Toolchain Name:

nyu-bluemix-cf-toolchain

Select Region:

Dallas

Select a resource group:

default

Select a CF Organization (deprecated)

Press Create

Create

Add the First Tool

The screenshot shows the IBM Cloud Toolchains interface. At the top, there's a navigation bar with links for Catalog, Docs, Support, Manage, and a search bar. On the right, it shows the user's name (NYU) and profile picture. The main area displays a toolchain named "nyu-bluemix-cf-toolchain". It shows the Resource Group as "default" and the Location as "US South". A prominent message box says, "Your toolchain is ready! Quick start: You can now add tool integrations. For step-by-step instructions, see the [tutorial](#) for this toolchain." Below this, there's a large button labeled "Add a Tool" with a plus sign. In the center, there's a large question mark icon inside a circle, and the text "No Tool Integrations". Below that, it says, "Click Add a Tool to add tool integrations to your toolchain." and "Not sure where to start? [Create a toolchain from a template](#) instead."

Add the First Tool

The screenshot shows the IBM Cloud Toolchains interface for a toolchain named "nyu-bluemix-cf-toolchain". The left sidebar has "Overview" selected. The main area displays the toolchain name, resource group ("default"), and location ("US South"). A success message states: "Your toolchain is ready! Quick start: You can now add tool integrations. For step-by-step instructions, see the [tutorial](#) for this toolchain." Below this is a large orange button labeled "Add a Tool" with a red arrow pointing to a blue "Add a Tool +" button. A red box highlights the "Add a Tool +" button.

Toolchains / nyu-bluemix-cf-toolchain

nyu-bluemix-cf-toolchain

Resource Group: default Location: US South

Your toolchain is ready! Quick start: You can now add tool integrations. For step-by-step instructions, see the [tutorial](#) for this toolchain.

Add a Tool

Add a Tool +

No Tool Integrations

Click Add a Tool to add tool integrations to your toolchain.

Not sure where to start? [Create a toolchain from a template](#) instead.

Add GitHub

The screenshot shows the IBM Cloud Catalog interface. At the top, there's a navigation bar with 'IBM Cloud', 'Catalog', 'Docs', 'Support', 'Manage', a search icon, and a user profile for 'NYU'. Below the navigation, a message says 'provide account information.' followed by a 'Learn More' link.

The catalog lists several services:

- Alert Notification**: Never miss critical issues. (IBM, Experimental)
- Artifactory**: Store build artifacts in your Artifactory repository. (Third-Party)
- Availability Monitoring**: Test, monitor, and improve your application as you build it. (IBM)
- Bitbucket**: Store and manage code on bitbucket.org. (Third-Party)
- Cloud Event Management**: Turn IT events into actionable incidents. (IBM, Experimental)
- Delivery Pipeline**: Automate your builds, deployments, and more. (IBM)
- DevOps Insights**: Elevate your DevOps to increase deployment quality, delivery. (IBM)
- Eclipse Orion Web IDE**: A browser-based IDE for web and cloud development. (IBM)
- Git Repos and Issue Tracking**: IBM hosted repos and issue tracking based on GitLab. (IBM)
- GitHub**: Store and manage code on GitHub.com or on your own. (Third-Party) - This service is highlighted with a red box and a red arrow from the 'Add GitHub' button.
- GitLab**: Store and manage code on GitLab.com or on your own. (Third-Party)
- Jenkins**: Build, deploy, and automate any project. (Third-Party)
- JIRA**
- Nexus**
- PagerDuty**

Authorize IBM Cloud to GitHub

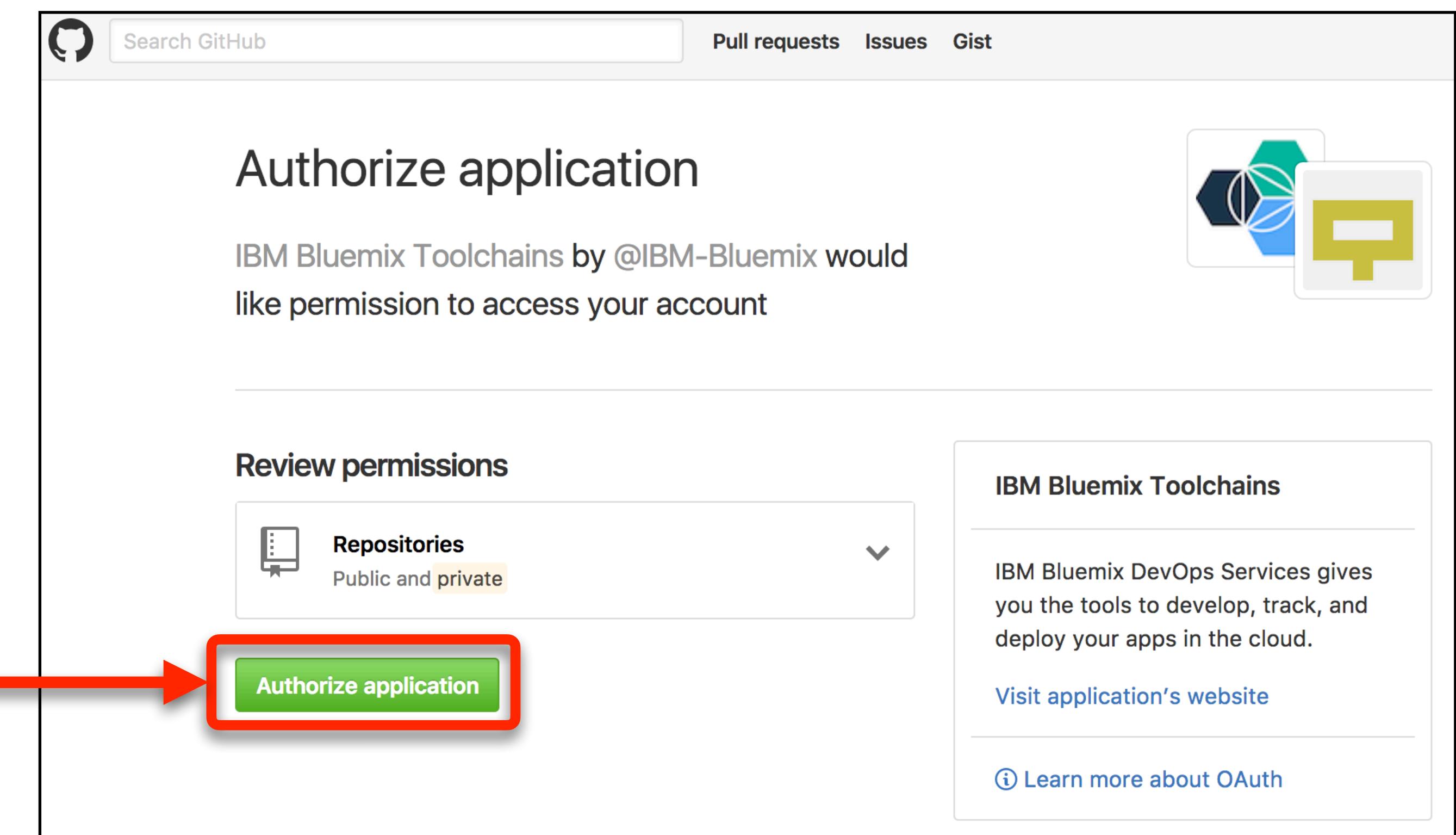
The screenshot shows the IBM Bluemix DevOps interface with a red callout box highlighting the GitHub integration step. A red arrow points from the text in the callout to the 'Authorize' button in the tool integration card.

The interface includes the following elements:

- Header: Application Details - IBM Bluemix, Create a Toolchain - IBM Bluemix, Docs, NYU | US South : nyu.edu : dev, Catalog, Support, Account.
- Tool Integrations section: GitHub icon, ORION icon, and a circular icon with arrows.
- Red callout box text: "The FIRST TIME ONLY you will need to Authorize IBM Bluemix Toolchains to access your GitHub account".
- Tool integration card for GitHub:
 - Description: Store your source code in a new or existing repository on GitHub.com and engage in social coding through wikis, issue tracking, and pull requests.
 - Info message: "You must authorize before you can configure this tool integration."
 - Authorize button (highlighted with a red border and arrow).
- Footer: Create button.

Authorize with GitHub

- One time only, you will need to authorize IBM Cloud to access your GitHub account so that it can monitor for changes and pull your code into IBM Cloud to deploy.



Point to your Repo

The screenshot shows the 'Configure the Integration' page for GitHub in the IBM Cloud interface. The top navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU. A back button labeled 'View all tool integrations' is visible. The main section is titled 'Configure the Integration' and features a GitHub icon. The configuration fields are as follows:

- GitHub Server:** GitHub (<https://github.com>)
- Repository type:** Existing
- Repository URL:** <https://github.com/rofrano/lab-bluemix-cf>
- Checkboxes:**
 - Enable GitHub Issues
 - Track deployment of code changes

At the bottom right is a blue 'Create Integration' button.

Point to your Repo

The screenshot shows the 'Configure the Integration' page for GitHub on the IBM Cloud interface. On the left, there's an orange button labeled 'Select GitHub.com' with a red arrow pointing to the 'GitHub Server' dropdown. The dropdown is set to 'GitHub (https://github.com)' and is highlighted with a red box. Below it, a message says 'Authorized as rofrano with access granted to nyu-devops, ibm-devops GitHub organization(s)'. The 'Repository type' dropdown is set to 'Existing'. The 'Repository URL' field contains the URL 'https://github.com/rofrano/lab-bluemix-cf'. At the bottom, there are two checked checkboxes: 'Enable GitHub Issues' and 'Track deployment of code changes'. A blue 'Create Integration' button is at the bottom right.

Select GitHub.com

Store your source code in a new or existing repository on GitHub.com, or on your own GitHub Enterprise server. Engage in social coding through wikis, issue tracking, and pull requests.

Third-Party

View Docs

TOOLCHAIN nyu-bluemix-cf-toolchain

GitHub Server:

GitHub (https://github.com)

Authorized as rofrano with access granted to nyu-devops, ibm-devops GitHub organization(s)

Repository type:

Existing

Repository URL:

https://github.com/rofrano/lab-bluemix-cf

Enable GitHub Issues

Track deployment of code changes

Create Integration

Point to your Repo

The screenshot shows the 'Configure the Integration' page for GitHub tool integration in the IBM Cloud console. The URL in the browser is `console.bluemix.net`. The page title is 'Configure the Integration'.

Select GitHub.com (highlighted with a red box and arrow) and **Select Existing** (highlighted with a red box and arrow) are the primary options for connecting to GitHub.

GitHub Server: GitHub (`https://github.com`)

Authorized as rofrano with access granted to nyu-devops, ibm-devops GitHub organization(s)

Repository type: Existing

Link to the repository that is specified in the Repository URL field

Repository URL: `https://github.com/rofrano/lab-bluemix-cf`

Enable GitHub Issues

Track deployment of code changes

Create Integration

Other visible elements include the IBM Cloud navigation bar with Catalog, Docs, Support, Manage, and NYU user info. A 'Third-Party' button is also present.

Point to your Repo

The screenshot shows the 'Configure the Integration' page for GitHub tool integration in the IBM Cloud console. The page title is 'Configure the Integration' with a backlink to 'View all tool integrations'. The main content area is titled 'Select GitHub.com' and describes connecting to GitHub.com or an Enterprise server. A red box highlights the 'Select Existing' button, which points to the 'Repository type' field set (GitHub Server, Repository type, and Repository URL). Another red box highlights the 'Select Your Repo' button, which points to the 'Repository URL' field. The 'Repository URL' field contains the value `https://github.com/rofrano/lab-bluemix-cf`. Below the URL field are two checked checkboxes: 'Enable GitHub Issues' and 'Track deployment of code changes'. At the bottom right is a 'Create Integration' button.

IBM Cloud Catalog Docs Support Manage NYU

← View all tool integrations Configure the Integration

Select GitHub.com

Store your source code in a new or existing repository on GitHub.com, or on your own GitHub Enterprise server. Engage in social coding, issue tracking, and pull requests.

Select Existing

Third-Party

Select Your Repo

TOOLCHAIN nyu-bluemix-cf-toolchain

GitHub Server:
GitHub (<https://github.com>)
Authorized as rofrano with access granted to nyu-devops, ibm-devops GitHub organization(s)

Repository type:
Existing
Link to the repository that is specified in the Repository URL field

Repository URL:
`https://github.com/rofrano/lab-bluemix-cf`

Enable GitHub Issues

Track deployment of code changes

Create Integration

Point to your Repo

The screenshot shows the 'Configure the Integration' page for a GitHub tool integration in the IBM Cloud console. The URL in the browser is `console.bluemix.net`. The page title is 'Configure the Integration'.

Select GitHub.com: A red box highlights the 'GitHub Server' dropdown set to 'GitHub (<https://github.com>)'. Below it, a note says 'Authorized as rofrano with access granted to nyu-devops, ibm-devops GitHub organization(s)'.

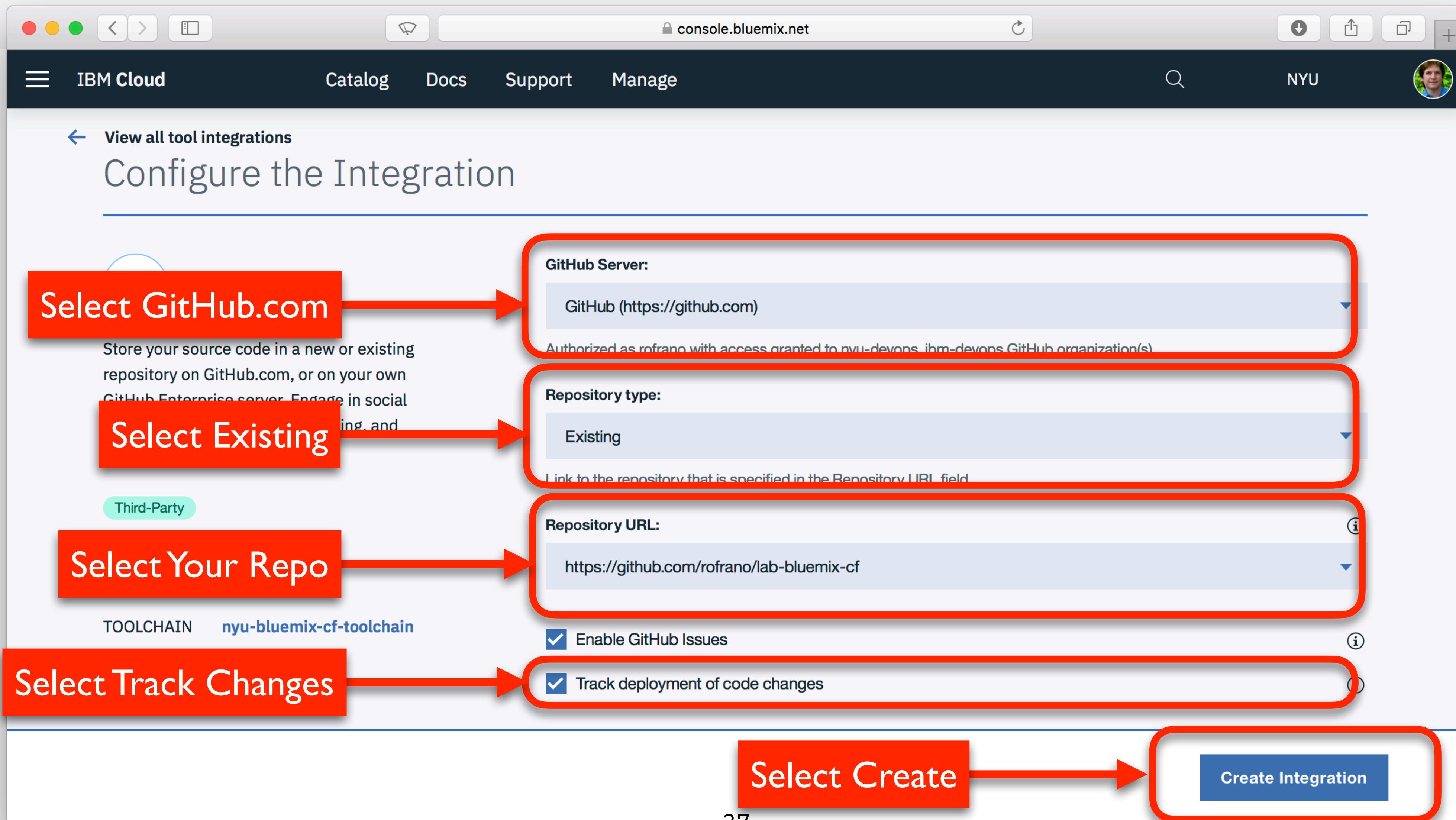
Select Existing: A red box highlights the 'Repository type' dropdown set to 'Existing'. Below it, a note says 'Link to the repository that is specified in the Repository URL field'.

Select Your Repo: A red box highlights the 'Repository URL' input field containing the value '<https://github.com/rofrano/lab-bluemix-cf>'.

Select Track Changes: A red box highlights the 'Track deployment of code changes' checkbox, which is checked.

At the bottom right is a blue 'Create Integration' button.

Point to your Repo



Add Second Tool

The screenshot shows the IBM Cloud Toolchains interface for a toolchain named "nyu-bluemix-cf-toolchain". The interface includes a navigation bar with links for Catalog, Docs, Support, Manage, and a user profile for NYU. The main content area displays the toolchain's name, resource group (default), and location (US South). A success message states: "Your toolchain is ready! Quick start: You can now add tool integrations. For step-by-step instructions, see the [tutorial](#) for this toolchain." Below this, there are two sections: "THINK" and "CODE". Under "THINK", there is an "Issues" integration with the GitHub icon, labeled "lab-bluemix-cf" and "Configured". Under "CODE", there is a "GitHub" integration with the GitHub icon, labeled "lab-bluemix-cf" and "Configured". A blue button labeled "Add a Tool" with a plus sign is located in the top right corner of the main content area.

Add Second Tool

The screenshot shows the IBM Cloud Toolchains interface for a toolchain named "nyu-bluemix-cf-toolchain". The interface includes a sidebar with "Overview", "Connections", and "Manage" sections. The main area displays two configured tools: "Issues" (lab-bluemix-cf) and "GitHub" (lab-bluemix-cf). A prominent red callout box with the text "Add another Tool" points to a blue button labeled "Add a Tool +".

Toolchains / nyu-bluemix-cf-toolchain

nyu-bluemix-cf-toolchain

Resource Group: default Location: US South

Your toolchain is ready! Quick start: You can now add tool integrations

THINK CODE

Issues lab-bluemix-cf ✓ Configured

GitHub lab-bluemix-cf ✓ Configured

Add another Tool

Add a Tool +

Delivery Pipeline

Select a tool integration to add to your toolchain. To properly connect the tool integration with the toolchain, you might need to provide account information.

[Learn More](#)

Tool Integrations

Search Filter

Tool Integration	Description	Type
Alert Notification	Never miss critical issues	IBM Experimental
Artifactory		Third-Party
Availability Monitoring	Test, monitor, and improve your application as you build it.	IBM
Bitbucket	Store and manage code on bitbucket.org.	Third-Party
Cloud Event Management	Turn IT events into actionable incidents.	IBM Experimental
Delivery Pipeline	Automate your builds, deployments, and more.	IBM
DevOps Insights	Elevate your DevOps to increase deployment quality, delivery	
Eclipse Orion Web IDE	A browser-based IDE for web and cloud development.	
Git Repos and Issue Tracking	IBM hosted repos and issue	

Select Delivery Pipeline

Give your Pipeline a Name

The screenshot shows the IBM Cloud console interface for creating a tool integration. A red box highlights the 'Give it the application name' input field, which contains the value 'nyu-bluemix-cf-pipeline'. An arrow points from the text 'Give it the application name' above the input field to the input field itself. The input field is also highlighted with a red border.

IBM Cloud

Catalog Docs Support Manage

View all tool integrations

Give it the application name

Delivery Pipeline

The Delivery Pipeline service automates continuous deployment.

Pipeline name:

nyu-bluemix-cf-pipeline

Show apps in the View app menu

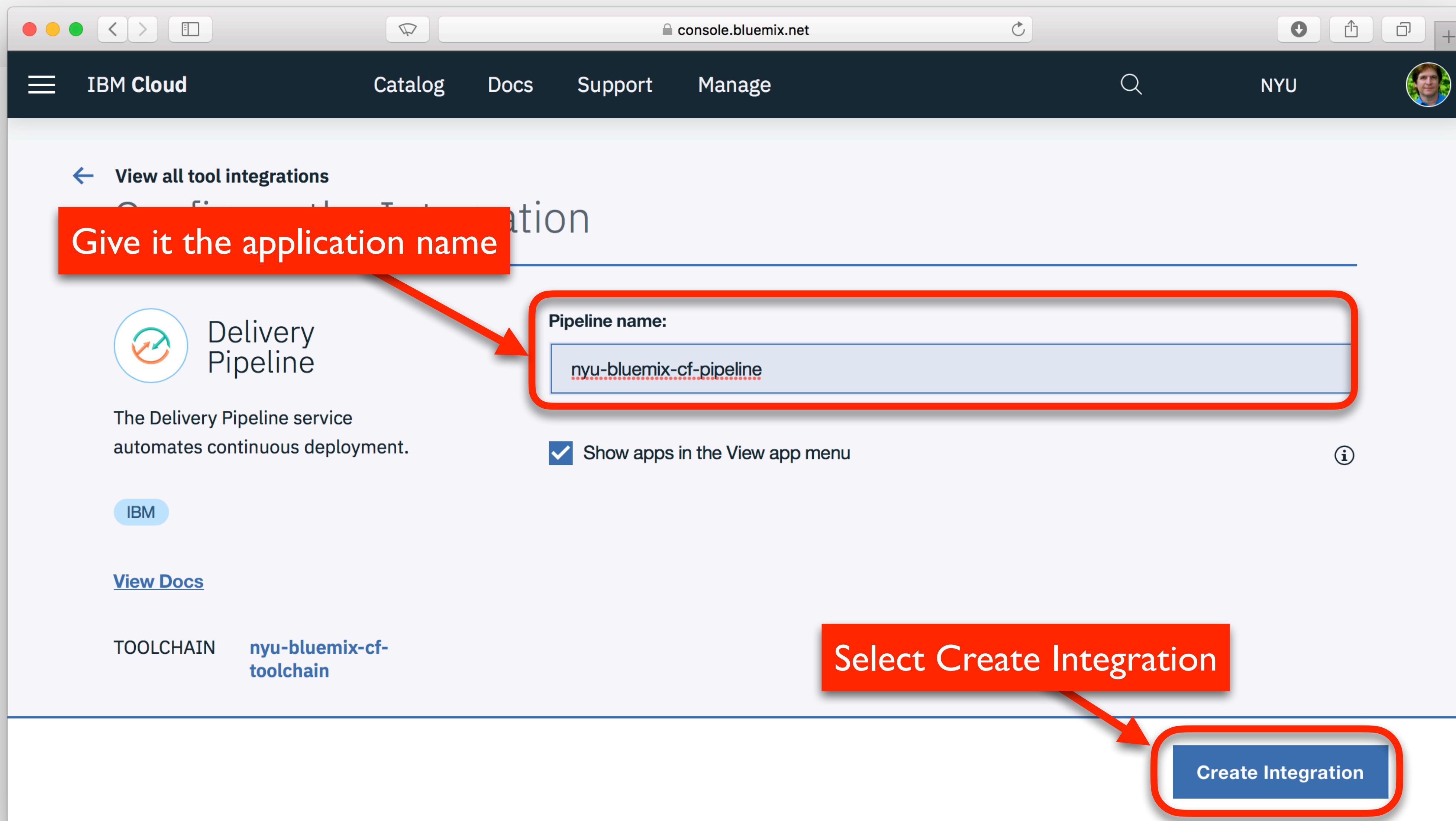
IBM

[View Docs](#)

TOOLCHAIN nyu-bluemix-cf-toolchain

Create Integration

Give your Pipeline a Name



Open the Pipeline

The screenshot shows the IBM Cloud Toolchains interface for a toolchain named "nyu-bluemix-cf-toolchain". The interface is divided into three main sections: THINK, CODE, and DELIVER.

- THINK:** Contains an "Issues" card with a GitHub icon, labeled "lab-bluemix-cf". Below it, a green bar indicates it is "Configured".
- CODE:** Contains a "GitHub" card with a GitHub icon, labeled "lab-bluemix-cf". Below it, a green bar indicates it is "Configured".
- DELIVER:** Contains a "Delivery Pipeline" card with a circular arrow icon, labeled "nyu-bluemix-cf-pipeli...". Below it, a green bar indicates it is "Configured".

A prominent message at the top states: "Your toolchain is ready! Quick start: You can now add tool integrations. For step-by-step instructions, see the [tutorial](#) for this toolchain." A "View app" button and a user profile icon are also visible.

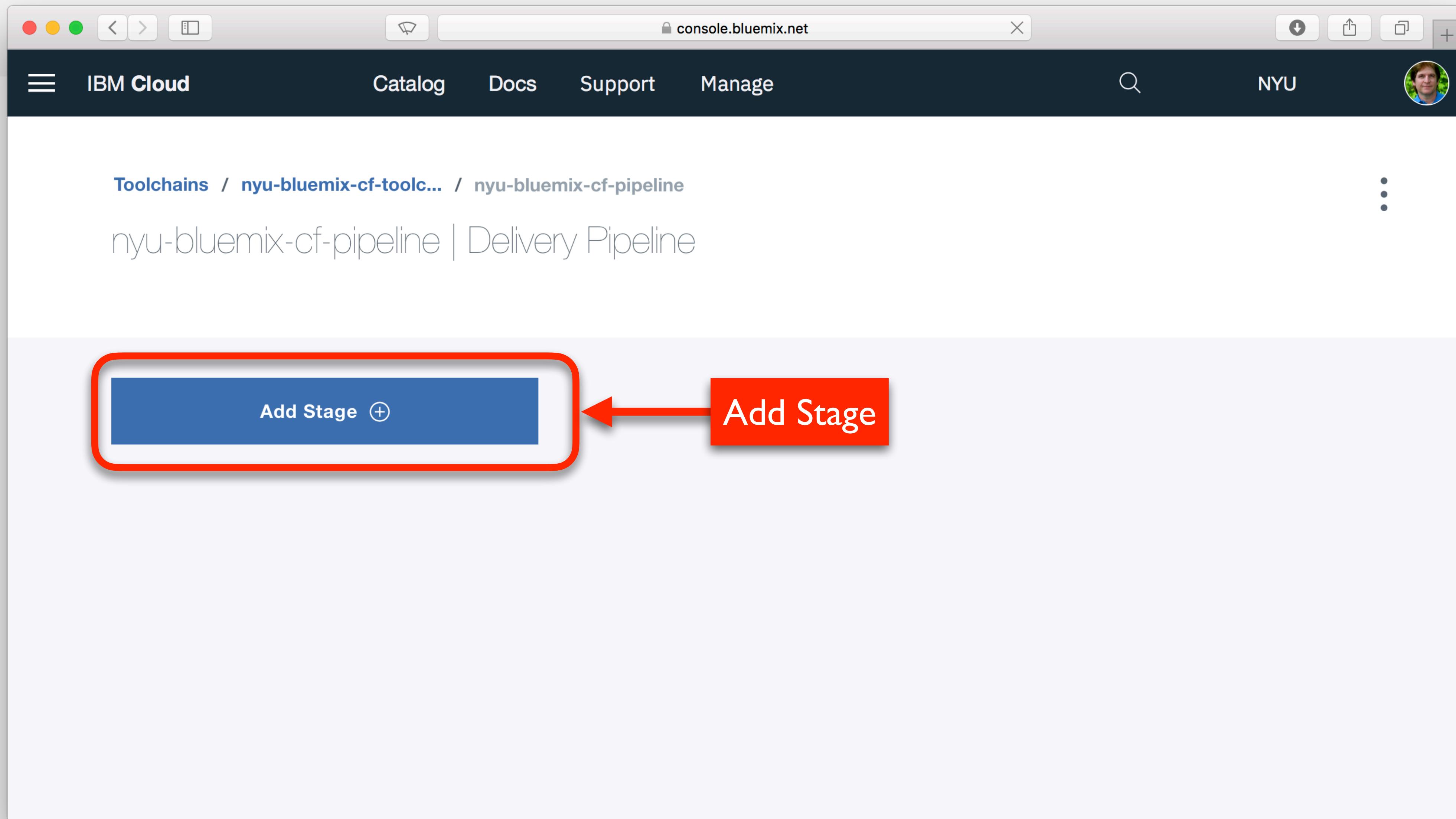
Open the Pipeline

The screenshot shows the IBM Cloud Toolchains interface for the toolchain 'nyu-bluemix-cf-toolchain'. The interface is divided into three main sections: THINK, CODE, and DELIVER.

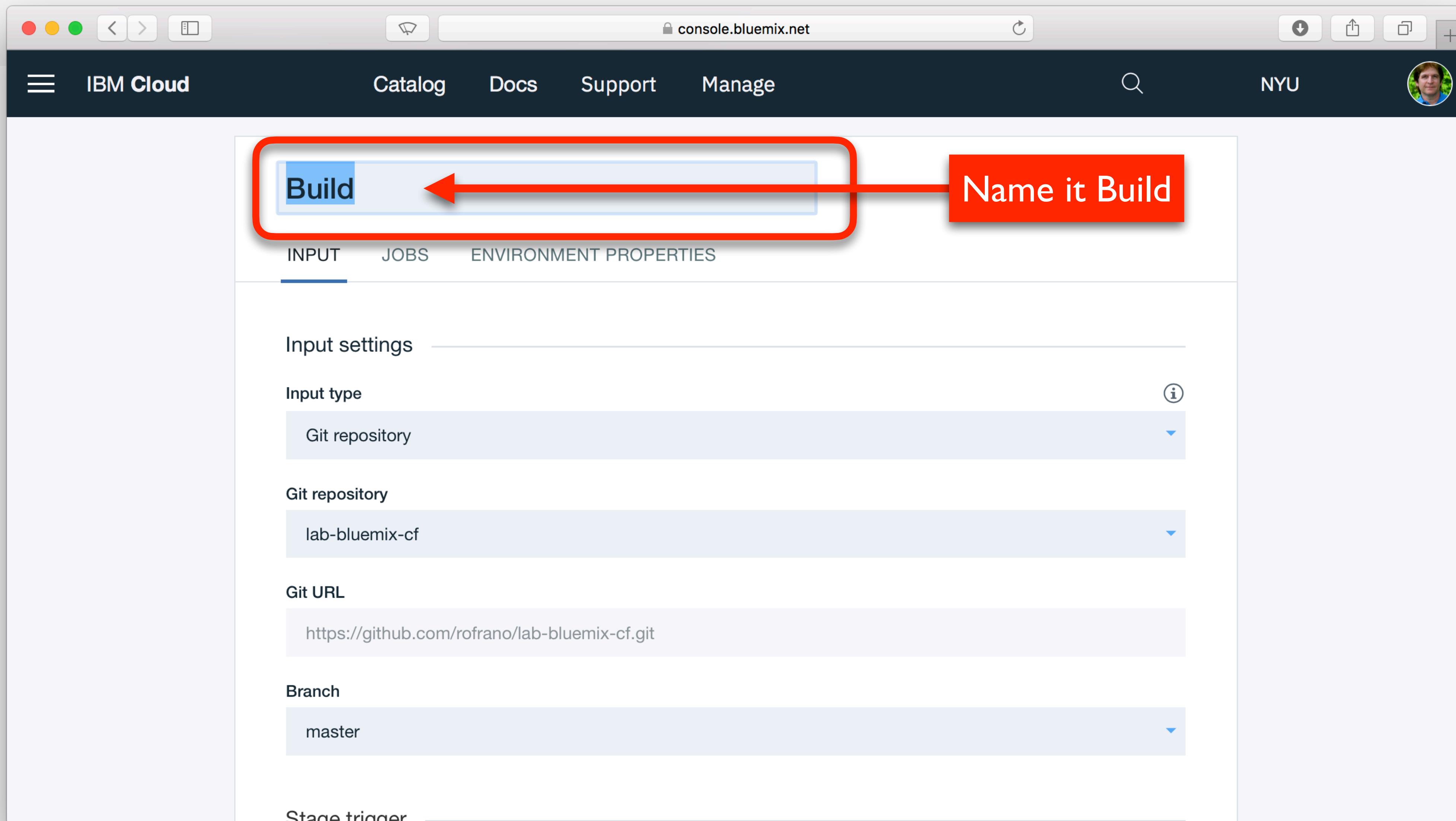
- THINK:** Contains an 'Issues' tool from GitHub, labeled 'lab-bluemix-cf'. It is marked as 'Configured'.
- CODE:** Contains a 'GitHub' tool, also labeled 'lab-bluemix-cf'. It is marked as 'Configured'.
- DELIVER:** Contains a 'Delivery Pipeline' tool, labeled 'nyu-bluemix-cf-pipeline...'. This tool is highlighted with a red box and a red arrow points to it from a callout bubble containing the text 'Select Pipeline'. It is also marked as 'Configured'.

A callout bubble with the text 'Select Pipeline' is positioned above the DELIVER section. A red arrow points from this callout to the 'Delivery Pipeline' tool in the DELIVER section. The interface includes a sidebar with 'Overview', 'Connections', and 'Manage' options, and a top navigation bar with 'IBM Cloud', 'Catalog', 'Docs', 'Support', 'Manage', and a user profile.

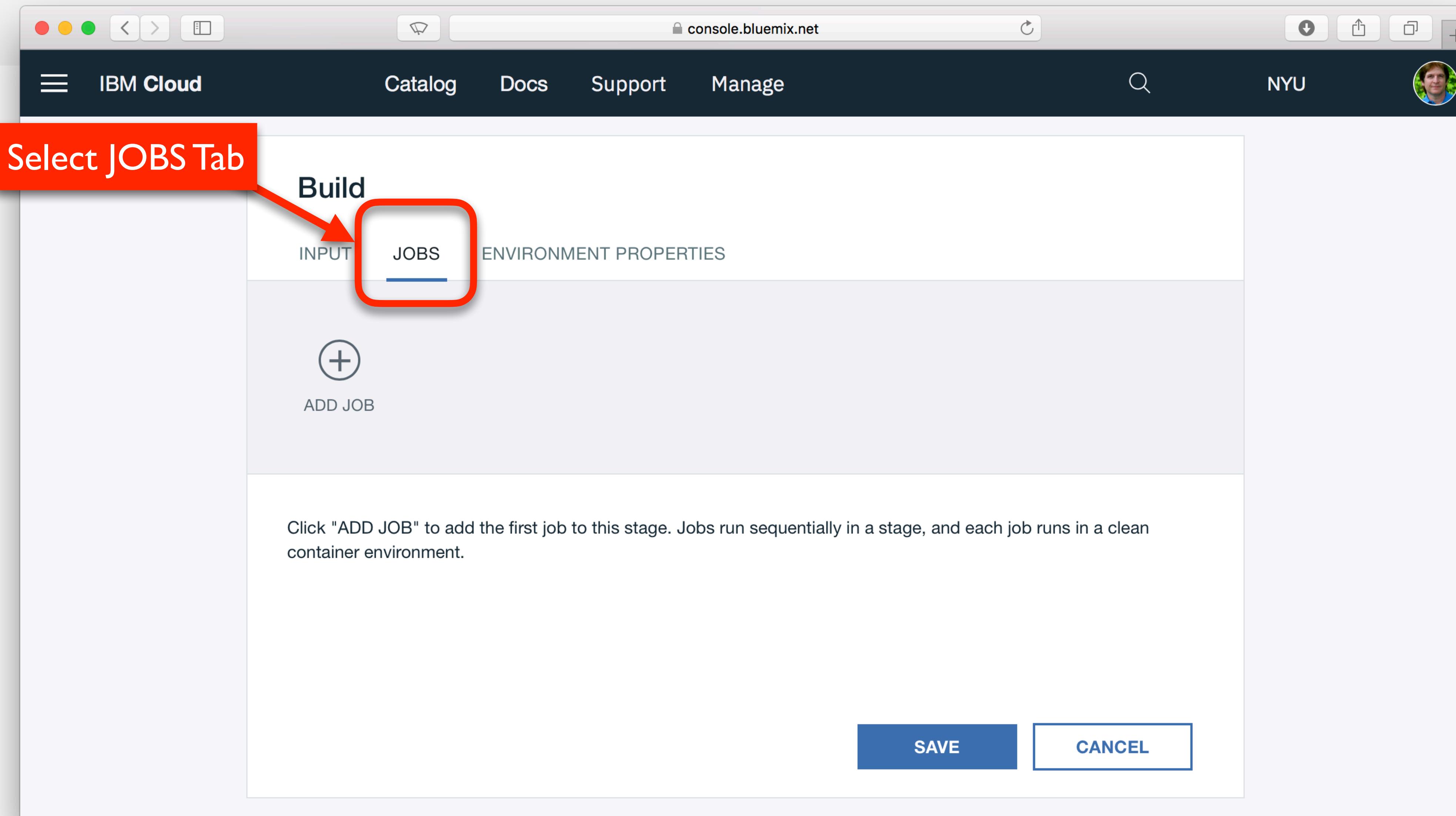
Add a Stage



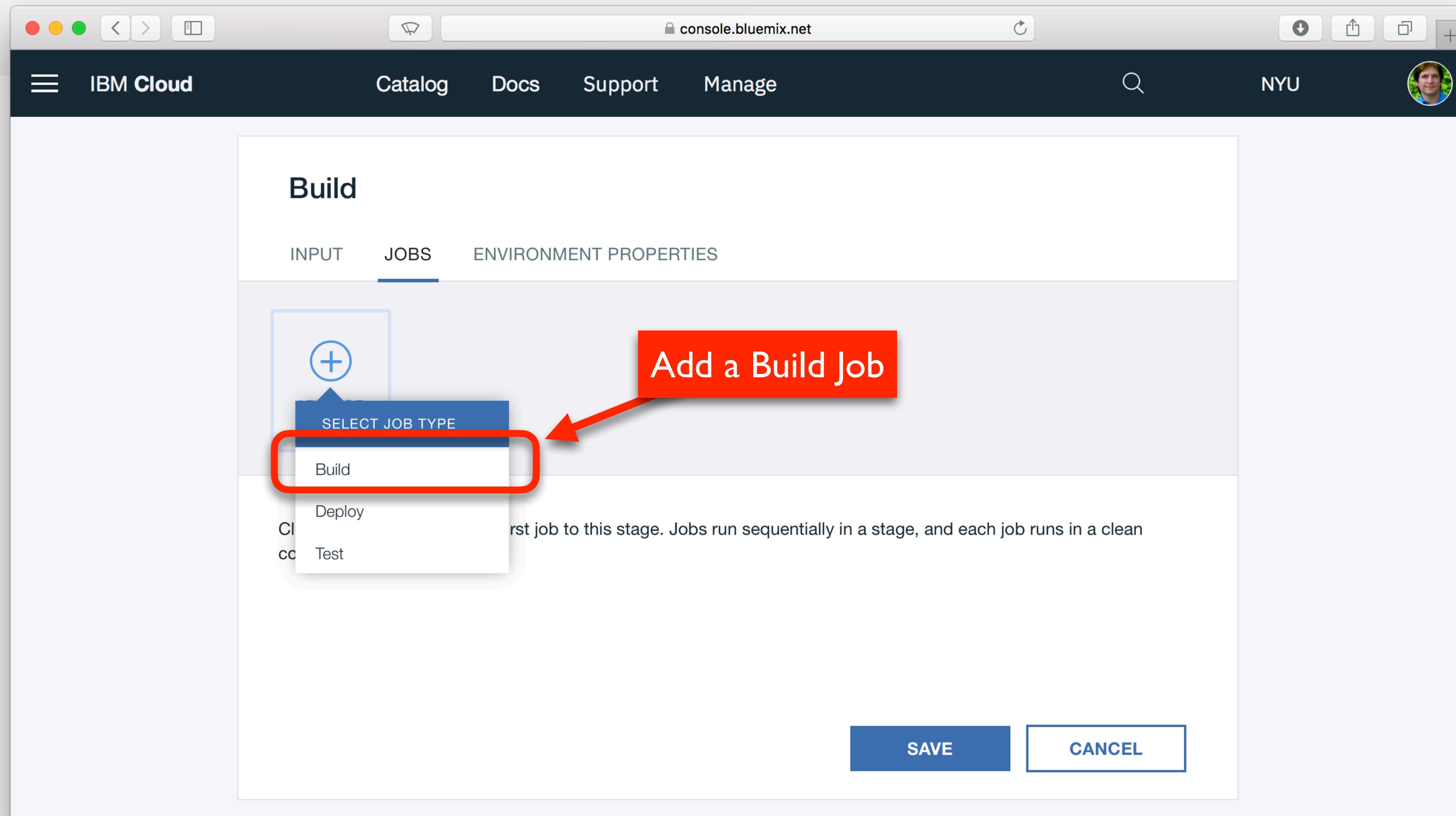
Build Stage is First



Add a Job



Build Job



A Simple Build Job

The screenshot shows the IBM Cloud Build interface. At the top, there's a navigation bar with links for Catalog, Docs, Support, and Manage. A search bar and a user profile icon for 'NYU' are also present. The main area is titled 'Build' and has tabs for INPUT, JOBS, and ENVIRONMENT PROPERTIES. The 'JOBS' tab is selected. Below it, there's a 'Build' button with a plus sign and an 'ADD JOB' link. To the right, the text 'rofrano/pipeline-base-image:python-3.7' is displayed. A red callout box with the text 'Select Simple (default)' and a red arrow points to the 'Builder type' dropdown menu, which is set to 'Simple'. The 'Simple' option is highlighted with a red rounded rectangle. Below the builder type, there's a section for 'Run conditions' with a checked checkbox for 'Stop running this stage if this job fails'.

Select Simple (default)

Build configuration

Builder type

Simple

Run conditions

Stop running this stage if this job fails

A Simple Build Job

The screenshot shows the IBM Cloud Build interface. At the top, there's a navigation bar with links for Catalog, Docs, Support, and Manage. On the right side of the bar, there's a user profile icon labeled "NYU". The main area is titled "Build" and has tabs for "JOBS" (which is selected) and "ENVIRONMENT PROPERTIES". A large orange button labeled "Add JOB" is prominently displayed. An arrow points from this button to a red-outlined "ADD JOB" button, which is located next to a "Build" icon. Below this, there's a section for a single build configuration. It includes a "Build" button, a "REMOVE" button, and a "Build configuration" section. Under "Builder type", it says "Simple". In the "Run conditions" section, there's a checked checkbox for "Stop running this stage if this job fails".

Add a Test Job

The screenshot shows the IBM Cloud CI/CD pipeline builder interface. At the top, there's a navigation bar with links for Catalog, Docs, Support, Manage, and a user profile for NYU. The main area is titled "Build" and has tabs for INPUT, JOBS, and ENVIRONMENT PROPERTIES. Under the JOBS tab, there's a "Build" step represented by a blue circle icon. To its right is a "SELECT JOB TYPE" button with a plus sign, which is currently open. A red callout box with the text "Select Test" points to the "Test" option in the dropdown menu. Below the build step, there's a section for "Build configuration" with a "Builder type" dropdown set to "Simple". At the bottom, there's a "Run conditions" section.

Add a Test Commands

The screenshot shows the IBM Cloud interface for creating CI/CD pipelines. The top navigation bar includes links for Input, Jobs (which is the active tab), Workers (with a 'New' badge), and Environment pro... . Below the tabs, there are two circular icons: 'Build' (containing a stack of blocks) and 'Test' (containing a checkmark inside a circle). A blue '+' button labeled 'ADD JOB' is positioned between them. The main content area is titled 'Test' and contains the following configuration:

- Test configuration:** A 'Remove' button is located in the top right corner.
- Tester type:** Set to 'Custom Docker Image'.
- Docker image name:** Set to 'rofrano/pipeline-base-image:python-3.7'.
- Test script:** Contains the following bash script:

```
#!/bin/bash
pip install -r requirements.txt
nosetests
```

A vertical sidebar on the right features an 'ASK A QUESTION' button.

Add a Test Commands

The screenshot shows the IBM Cloud interface for creating CI/CD pipelines. The 'Jobs' tab is active. In the 'Test' configuration section, the 'Tester type' dropdown is highlighted with a red box and a red arrow pointing to it from the 'Tester type' label. An orange callout bubble contains the text 'Select Custom Docker Image'. The 'Docker image name' field contains the value 'rofrano/pipeline-base-image:python-3.7'. The 'Test script' field contains the following content:

```
#!/bin/bash
pip install -r requirements.txt
nosetests
```

Add a Test Commands

The screenshot shows the IBM Cloud CI/CD pipeline interface. The top navigation bar includes links for Input, Jobs (which is selected), Workers (New), and Environment pro... . Below the navigation, there are two main job types: Build and Test. The Test job is currently selected, indicated by a blue circle around its icon. A large red callout box highlights the Docker image name field, which contains the text "rofrano/pipeline-base-image:python-3.7". A red arrow points from this highlighted field towards the text itself. To the right of the Docker image name field is a "Remove" button. The "Test script" section below contains the following bash script:

```
#!/bin/bash  
pip install -r requirements.txt  
nosetests
```

On the far right of the interface, there is a vertical sidebar with a "ASK A QUESTION" button.

Add a Test Commands

The screenshot shows the IBM Cloud interface for creating CI/CD pipelines. The top navigation bar includes links for Input, Jobs (which is the active tab), Workers (with a 'New' badge), and Environment pro... . Below the navigation, there are two main job types: 'Build' (represented by a stack icon) and 'Test' (represented by a checkmark icon). A blue '+' button labeled 'ADD JOB' is located between them. The 'Test' configuration is currently selected. It includes fields for 'Tester type' (set to 'Custom Docker Image'), 'Docker image name' (set to 'rofrano/pipeline-base-image:python-3.7'), and a 'Test script' block containing the following commands:

```
#!/bin/bash
pip install -r requirements.txt
nosetests
```

A red box highlights the 'Test script' block, and a red arrow points from it to a large orange callout bubble containing the text 'Add commands to run tests'.

Test Commands

- Custom Docker Image

rofrano/pipeline-base-image:python-3.7

- Test Script

```
#!/bin/bash
pip install -r requirements.txt
nosetests
```

Save Build Stage

The screenshot shows a web browser window for the IBM Cloud console at `console.bluemix.net`. The title bar includes standard OS X controls, a fan icon, and a search bar. The header features the IBM Cloud logo, navigation links for Catalog, Docs, Support, and Manage, a search icon, and a user profile for NYU.

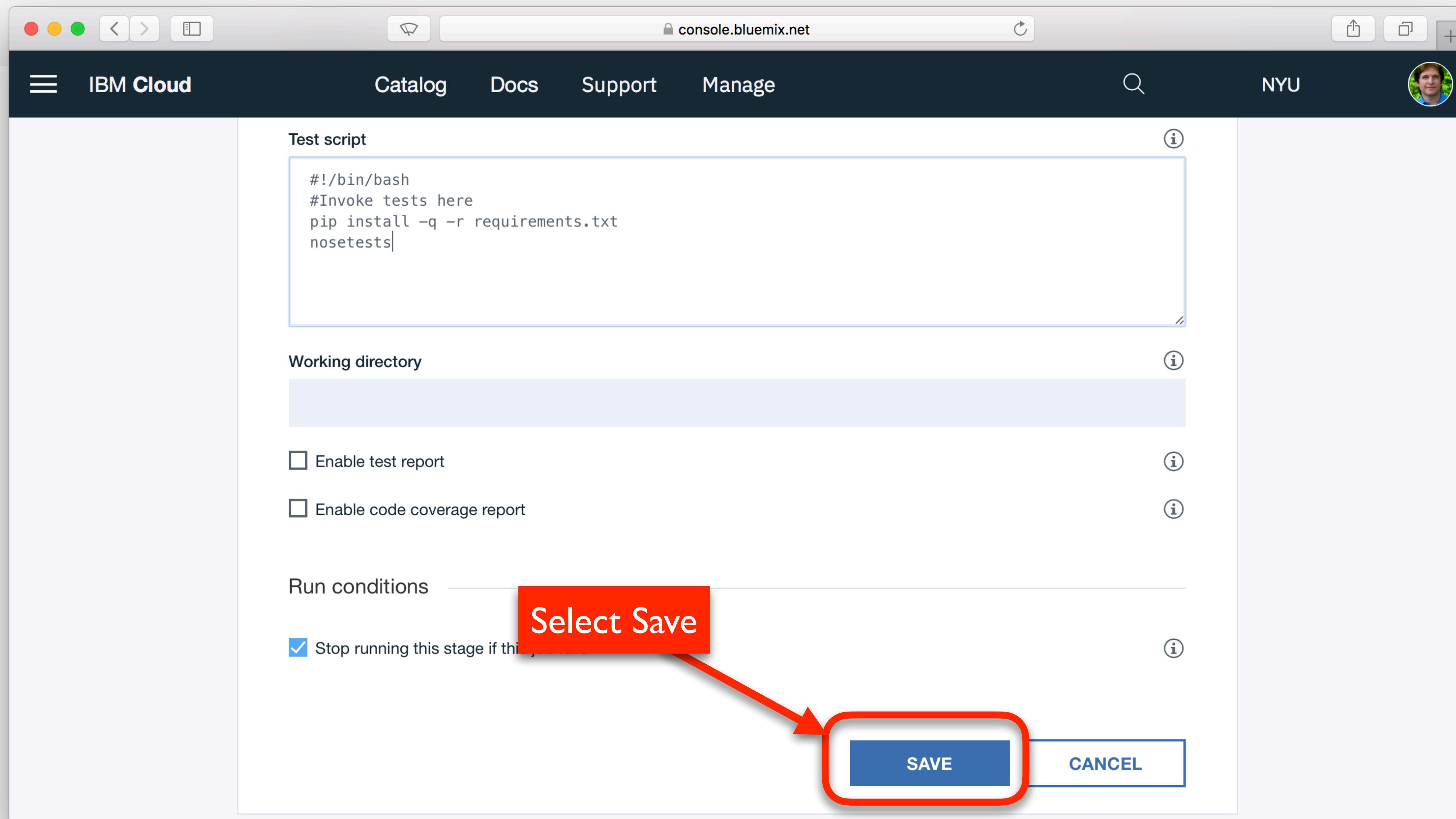
The main content area displays a configuration dialog for a build stage:

- Test script:** A code editor containing the following bash script:

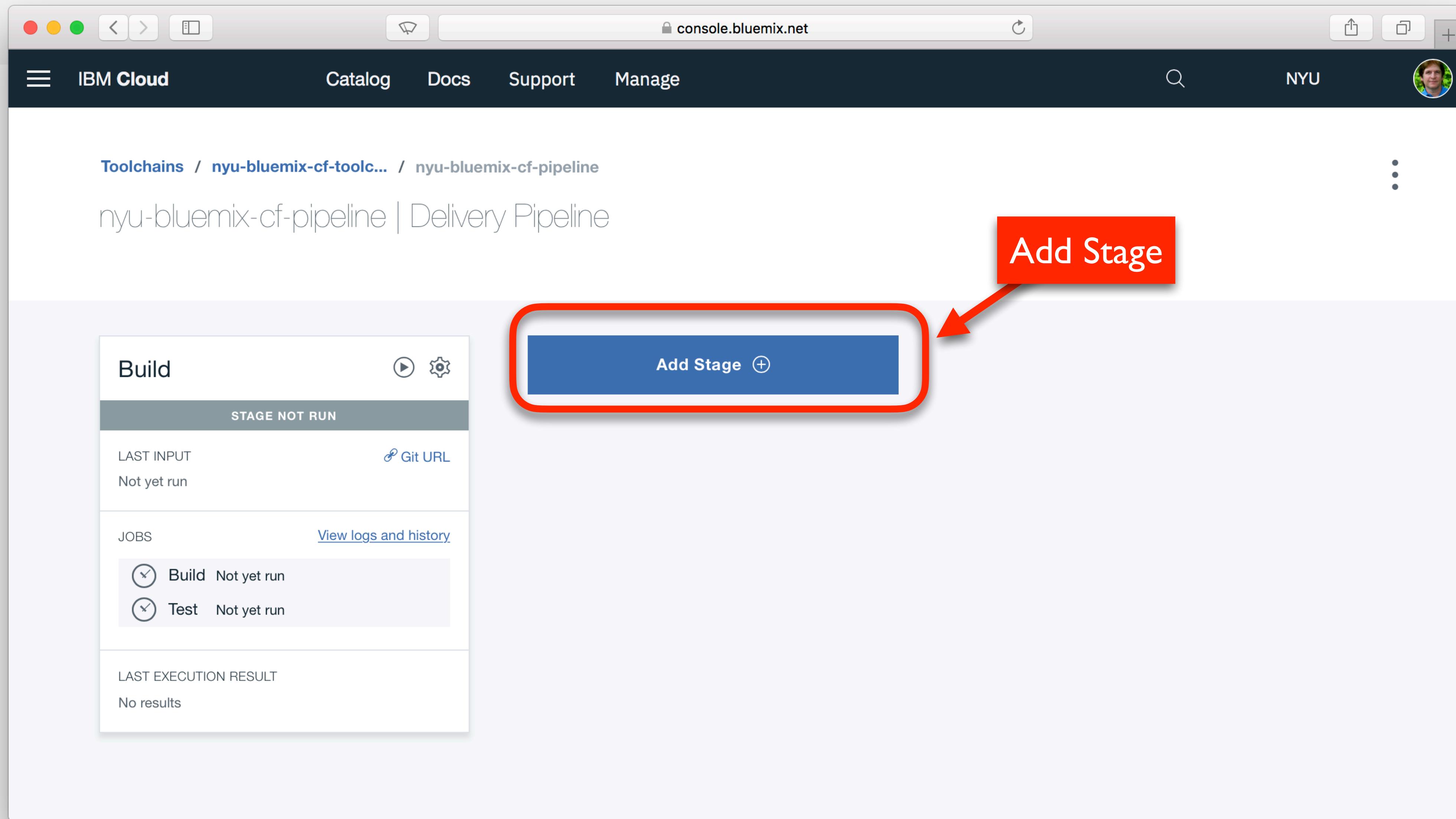
```
#!/bin/bash
#Invoke tests here
pip install -q -r requirements.txt
nosetests
```
- Working directory:** A field with a placeholder value.
- Run conditions:** A section with a checked checkbox: Stop running this stage if this job fails

At the bottom right are two buttons: a blue **SAVE** button and a white **CANCEL** button.

Save Build Stage



Add Another Stage



Add Deploy Stage

The screenshot shows the IBM Cloud Stage Configuration interface for a pipeline named "nyu-bluemix-cf-pipeline". The current view is the "Deploy" stage configuration screen.

The top navigation bar includes links for Catalog, Docs, Support, Manage, and a search bar. The user is signed in as NYU, represented by a profile picture.

The breadcrumb navigation shows the path: Toolchains / nyu-bluemix-cf-toolc... / nyu-bluemix-cf-pipel... / Stage Configuration.

The main content area is titled "Deploy". It has three tabs: INPUT (selected), JOBS, and ENVIRONMENT PROPERTIES.

The "INPUT" tab contains the following settings:

- Input type:** Build artifacts (with an information icon)
- Stage:** Build (with a dropdown arrow)
- Job:** Build (with a dropdown arrow)

Add Deploy Stage

The screenshot shows the IBM Cloud Stage Configuration interface for a pipeline named "nyu-bluemix-cf-pipeline". The "Deploy" stage is highlighted with a red box and an arrow pointing to the text "Name it Deploy Stage".

The interface includes tabs for INPUT, JOBS, and ENVIRONMENT PROPERTIES. Under INPUT settings, the input type is set to "Build artifacts". The stage is currently set to "Build". The job is also set to "Build".

Name it Deploy Stage

INPUT	JOBS	ENVIRONMENT PROPERTIES
Input settings		
Input type	(info icon)	
Build artifacts		
Stage		
Build		
Job		
Build		

Add Deploy Stage

The screenshot shows the IBM Cloud Stage Configuration interface for a pipeline named "nyu-bluemix-cf-pipeline". The URL in the browser is console.bluemix.net. The top navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU.

The main content area displays the "Stage Configuration" for the pipeline. A modal window titled "Deploy" is open, showing three tabs: INPUT, JOBS (which is highlighted with a red circle and has a red arrow pointing to it from a callout bubble), and ENVIRONMENT PROPERTIES.

Below the tabs, the "INPUT" section is visible, showing "Input settings" and "Input type" set to "Build artifacts".

The "JOBS" section contains fields for "Stage" (set to "Build") and "Job" (also set to "Build").

A large red callout bubble with the text "Select JOBS Tab" is positioned over the "JOBS" tab in the modal window.

Add a Deploy Job

The screenshot shows the IBM Cloud CI/CD Pipeline interface. The URL in the browser is `console.bluemix.net`. The navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU. The current page is `Toolchains / nyu-bluemix-cf-toolc... / nyu-bluemix-cf-pipel... / Stage Configuration`.

The main content area displays a "Deploy" configuration dialog. The "JOBS" tab is selected. A modal window titled "SELECT JOB TYPE" is open, showing options: Build, Deploy, Clean, Test, and Coverage. The "Deploy" option is highlighted with a red oval and a red arrow pointing to it from the text "Select Deploy" located below the modal.

A large red callout box with the text "Select Deploy" points to the "Deploy" button in the modal window.

Supply your API Key

The screenshot shows the IBM Cloud Deploy configuration interface. At the top, there's a navigation bar with links for Catalog, Docs, Support, Manage, and a search bar. On the right, it shows the user's name (NYU) and profile picture. The main area is titled "Deploy" and contains the following fields:

- Deploy configuration**: A "REMOVE" button is located in the top right corner.
- Deployer type**: Set to "Cloud Foundry".
- IBM Cloud region**: Set to "Dallas - https://api.ng.bluemix.net".
- API key**: A text input field with the placeholder "Provide an API key to get organizations and spaces.(Preferred)".
- Organization**: Set to "nyu.edu".
- Space**: Set to "dev".
- Application name**: This field is partially visible at the bottom.

Supply your API Key

The screenshot shows the IBM Cloud Deploy configuration interface. At the top, there's a navigation bar with links for Catalog, Docs, Support, Manage, and a search bar. On the right, it shows the user profile "NYU". The main area is titled "Deploy" and contains fields for "Deploy configuration", "Deployer type" (set to "Cloud Foundry"), "IBM Cloud region" (set to "Dallas - https://api.ng.bluemix.net"), "API key", "Organization" (set to "nyu.edu"), "Space" (set to "dev"), and "Application name". A prominent red callout box with the text "Select +Enter an existing API key" and a red arrow points to the "API key" input field, which is highlighted with a red border. The "API key" field has a placeholder "Provide an API key to get organization and space (Preferences)" and a button "+ Enter an existing API key".

Get API Key from apiKey.json

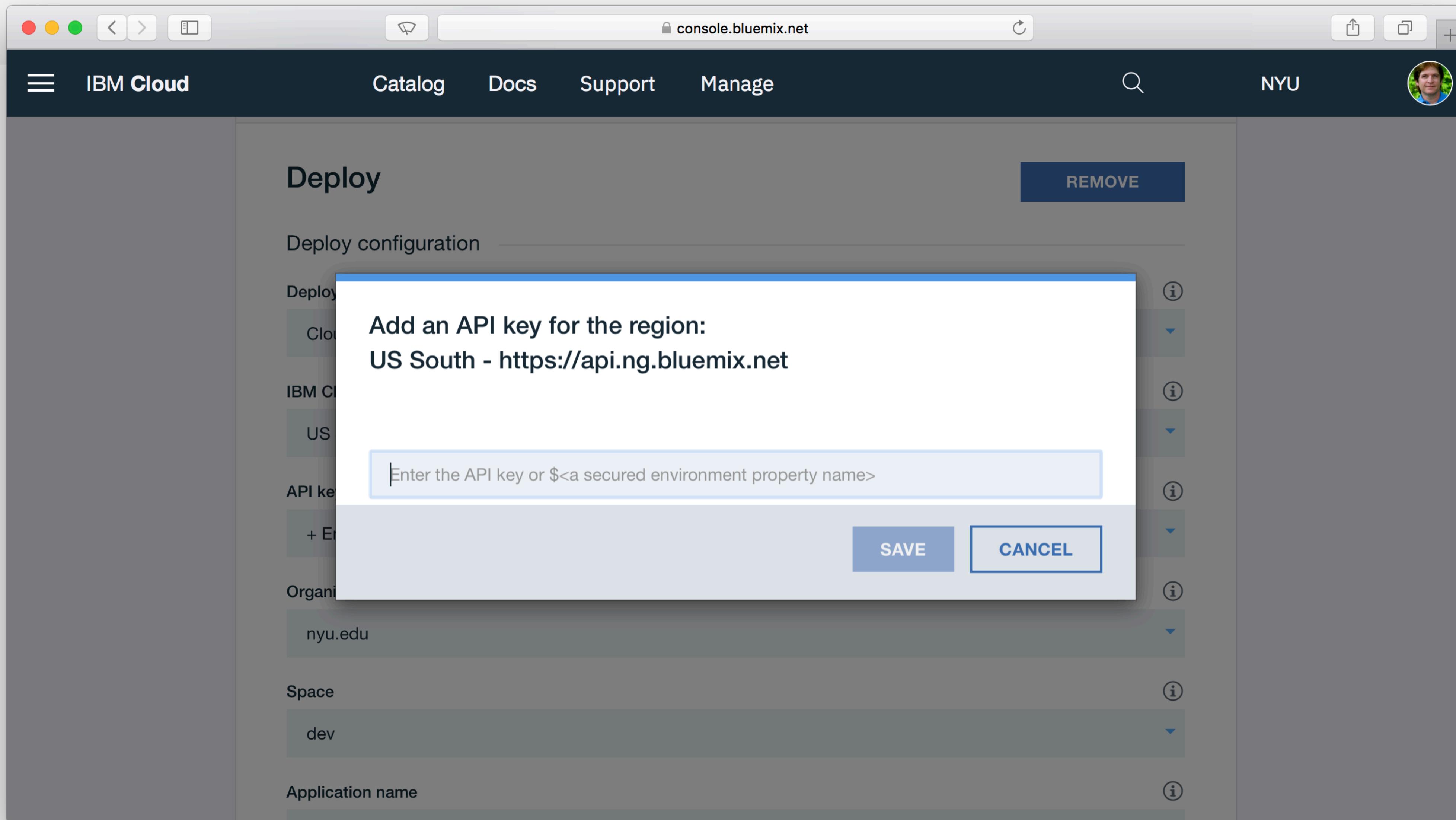
- Your API key is in: `~/.bluemix/apiKey.json`

```
{  
  "name": "development",  
  "description": "Key for NYU DevOps development",  
  "createdAt": "2017-10-11T13:44+0000",  
  "apiKey": "Vvftr56hBN3ft67UYHnjws0lrAjuy7YqjX_IO89ZZ"  
}
```

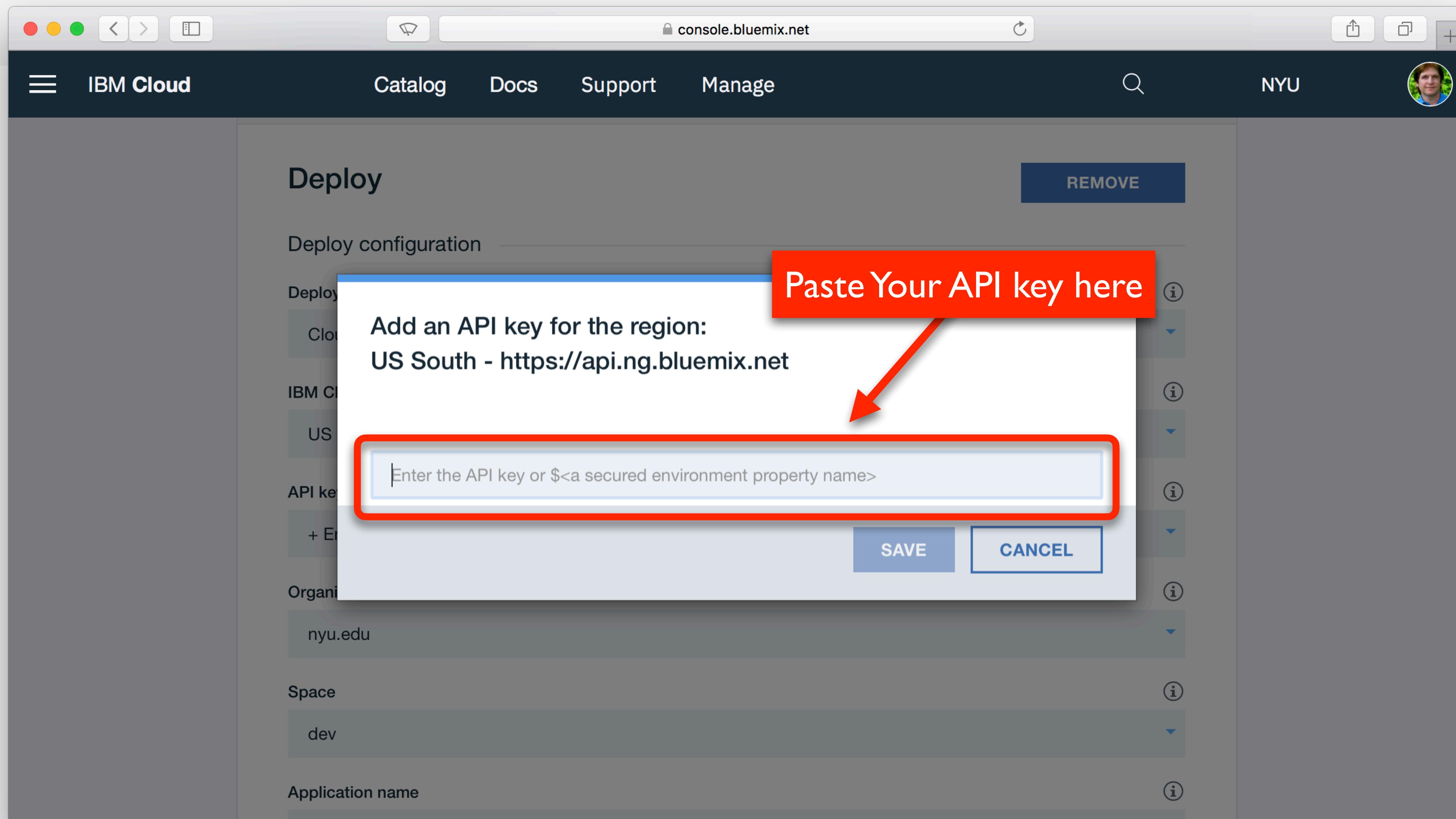


Your API Key

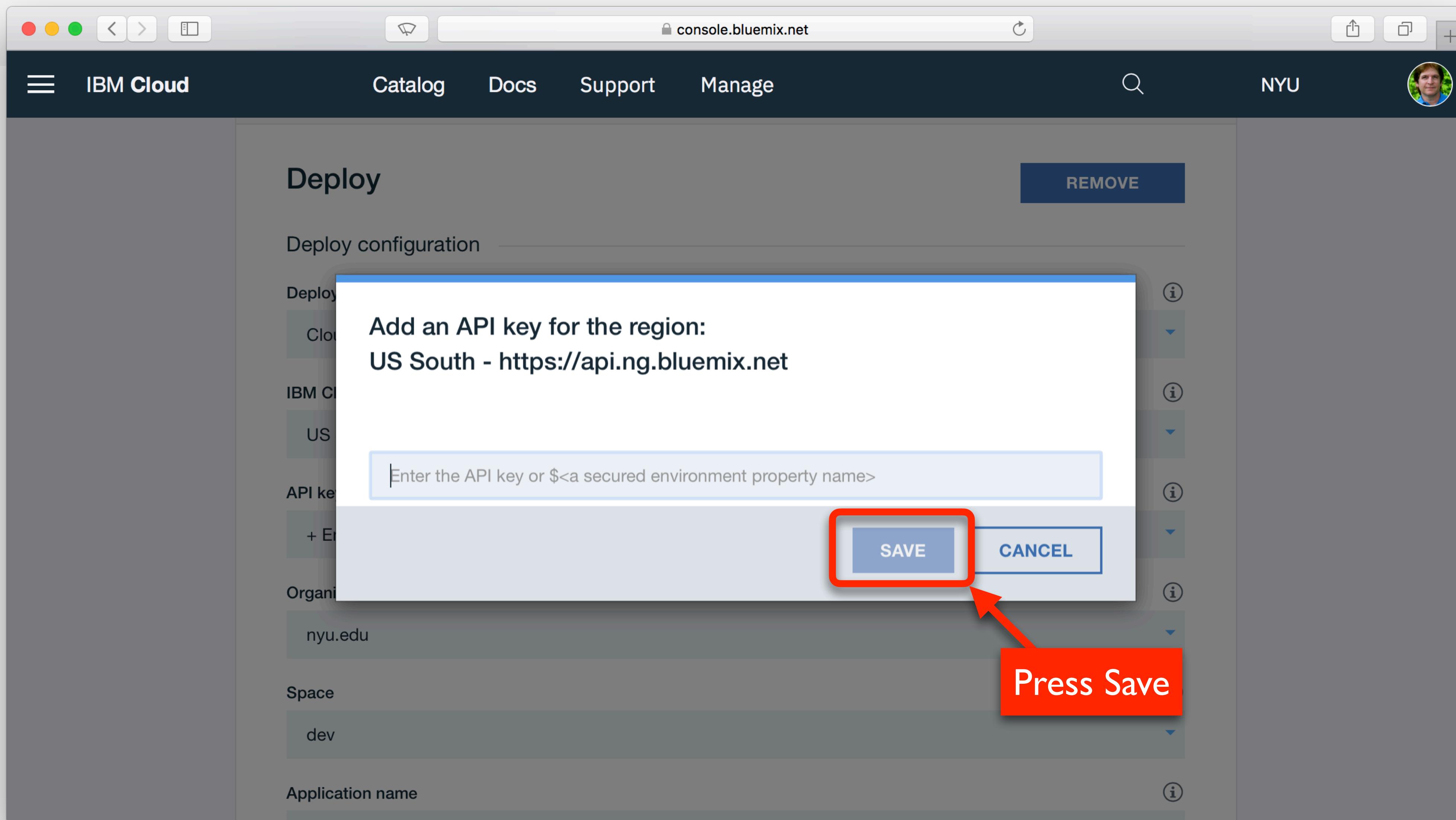
Add your Application Name



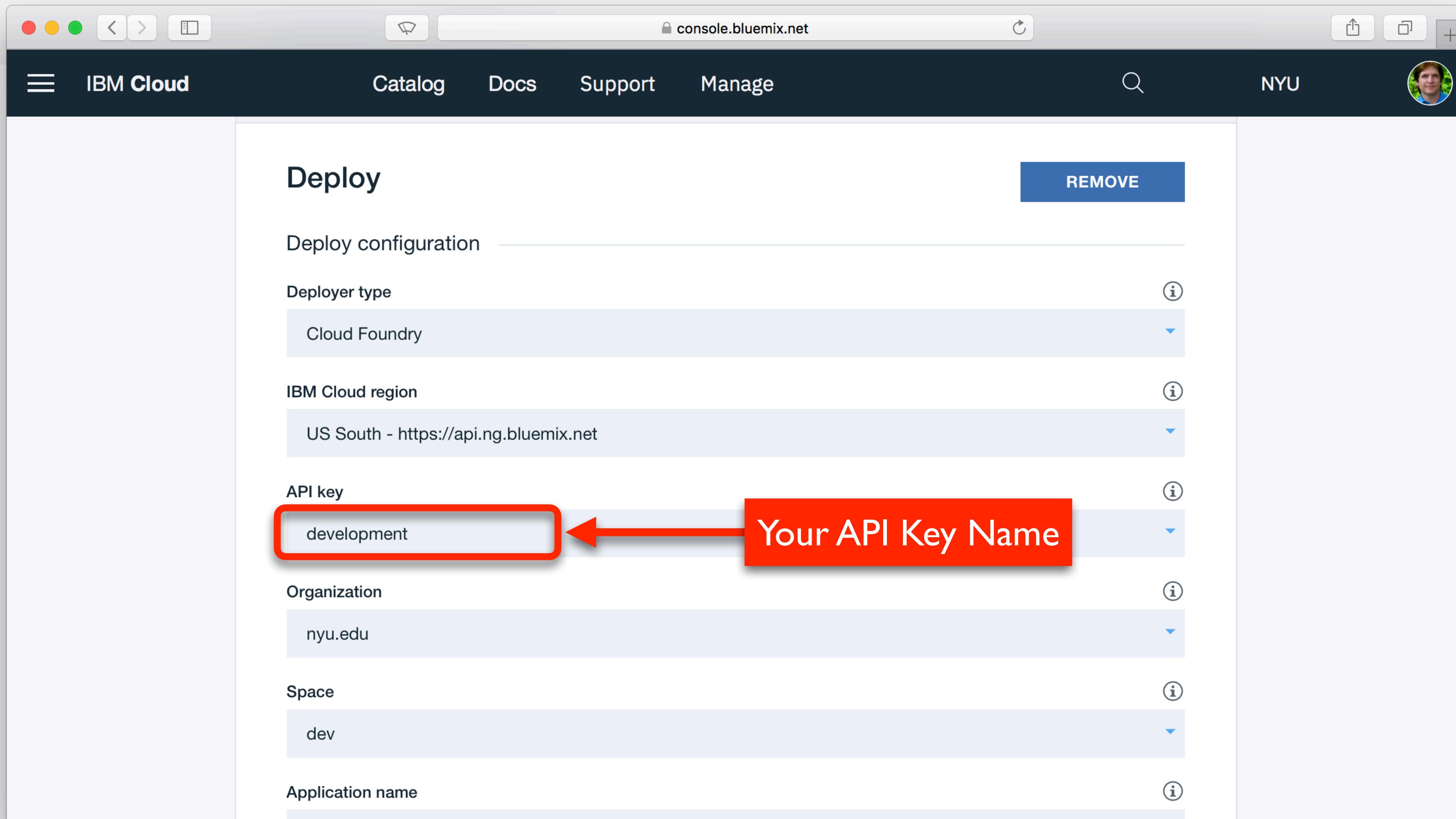
Add your Application Name



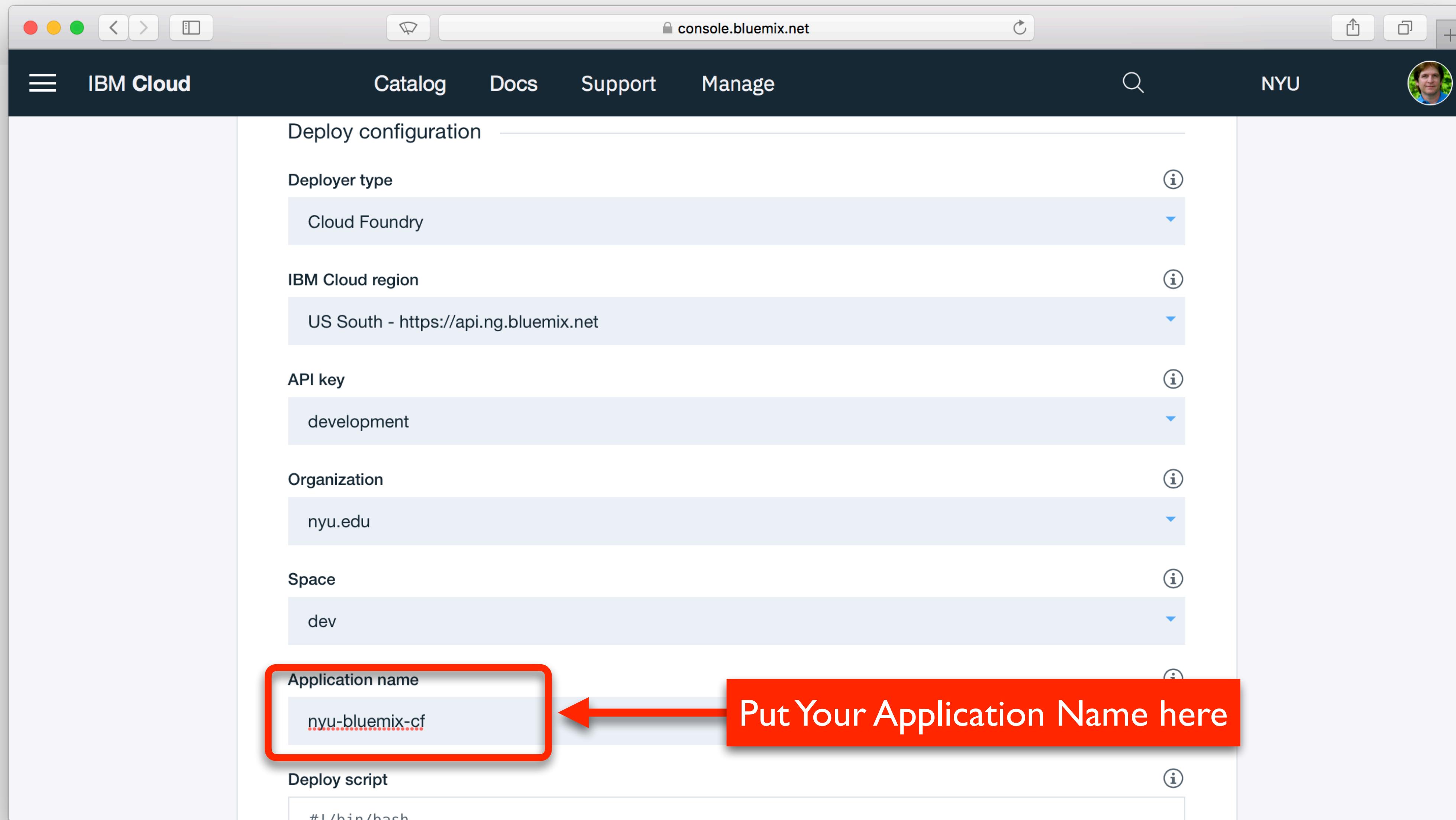
Add your Application Name



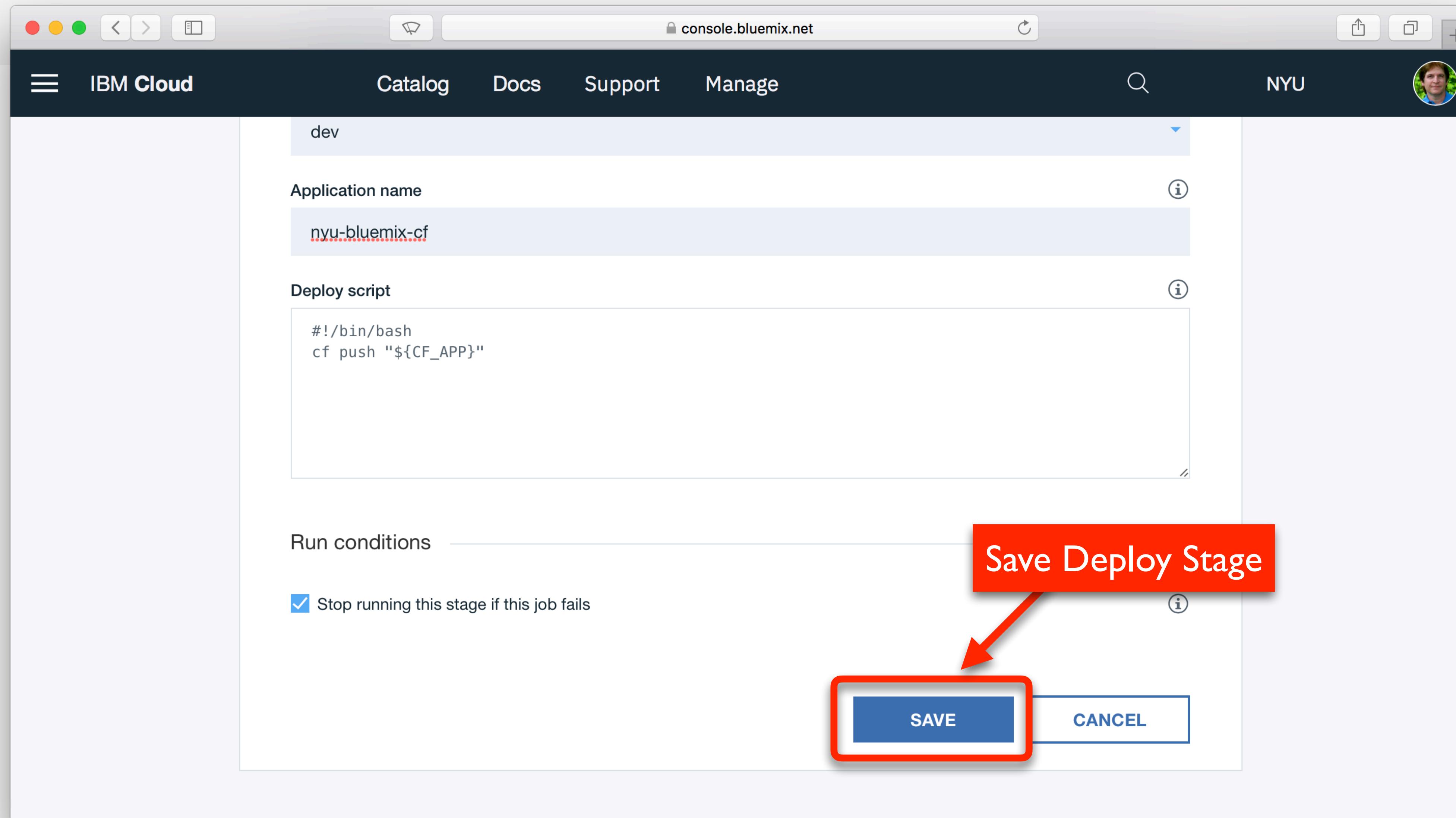
Displays the name of the API key



Add your Application Name



Save Deploy Stage



You Now Have a DevOps Pipeline

The screenshot shows the IBM Cloud Delivery Pipeline interface. At the top, the navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU. The current page path is Toolchains / nyu-bluemix-cf-toolc... / nyu-bluemix-cf-pipeline. The main content area displays a delivery pipeline with two stages: Build and Deploy.

Build Stage:
Status: STAGE NOT RUN
LAST INPUT: Not yet run
JOBS:

- Build: Not yet run
- Test: Not yet run

LAST EXECUTION RESULT: No results

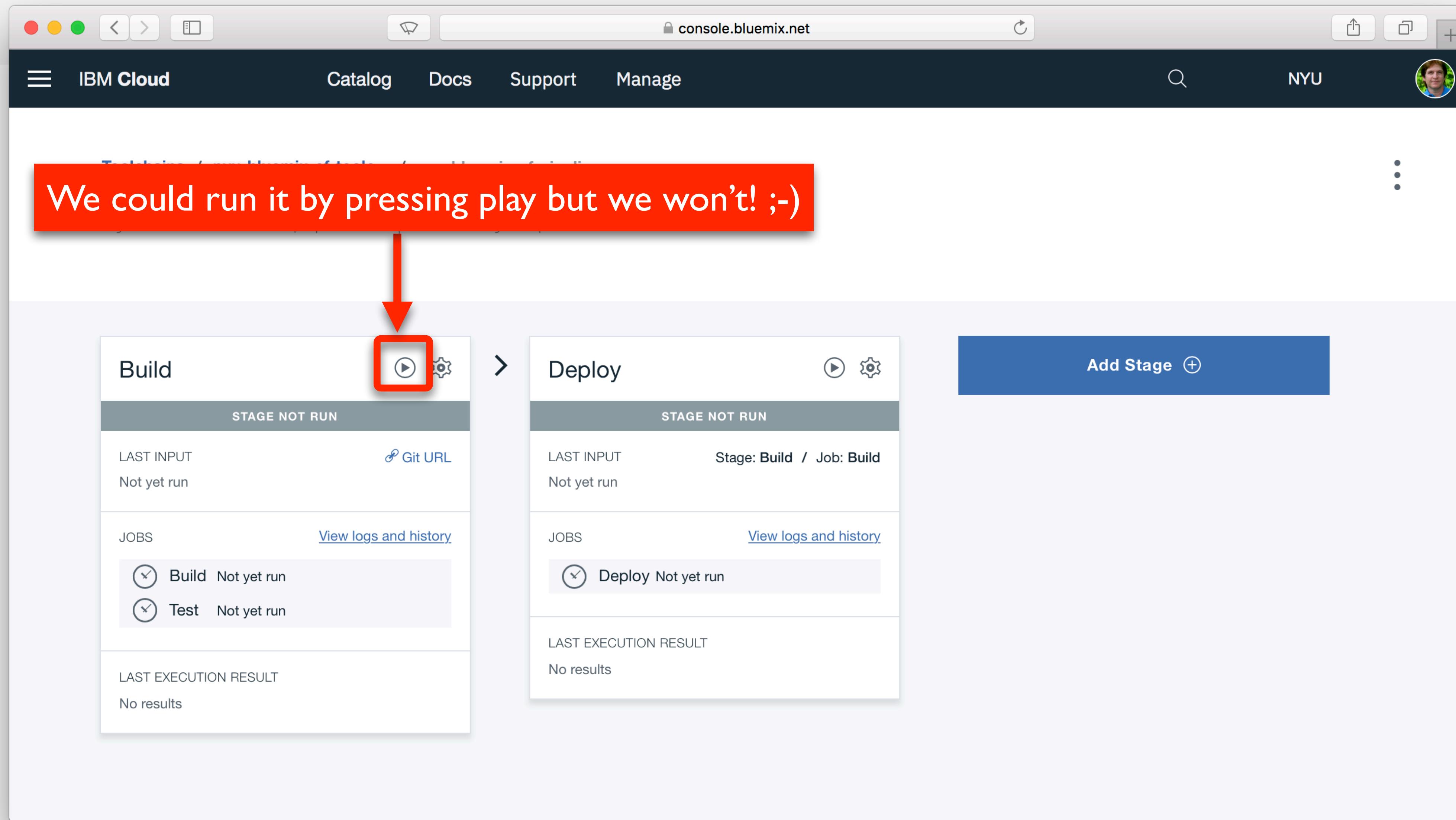
Deploy Stage:
Status: STAGE NOT RUN
LAST INPUT: Stage: Build / Job: Build
Not yet run
JOBS:

- Deploy: Not yet run

LAST EXECUTION RESULT: No results

A blue button labeled "Add Stage +" is located at the bottom right of the pipeline stages.

You Now Have a DevOps Pipeline



Binding Services like Cloudant

- Cloud Foundry will automatically bind your database to `VCAP_SERVICES` during runtime
- Unfortunately, you need to do this manually for Testing



Dashboard

The screenshot shows the IBM Cloud Dashboard interface on a Mac OS X browser window. The top navigation bar includes links for Catalog, Docs, Support, Manage, and a search bar. A user profile for 'NYU' is visible on the right.

Cloud Foundry Applications

Name	Region	CF Org	CF Space	Status
lab-flask-bdd	US South	nyu.edu	prod	● Stopped (0/2)
lab-flask-bdd-jr	US South	nyu.edu	dev	● Stopped (0/2)
nyu-lab-bluemix	US South	nyu.edu	dev	● Running (2/2)

Clusters

Name	Location	Kube version	Status
nyu-devops	US South	1.9.10_1527	● Normal

Cloud Foundry Services

Dashboard

The screenshot shows the IBM Cloud Dashboard interface at console.bluemix.net. The top navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU. A search bar and a 'Create resource' button are also present.

Cloud Foundry Applications

Name	Region	CF Org	CF Space	Status
lab-flask-bdd	US South	nyu.edu	prod	● Stopped (0/2)
lab-flask-bdd-jr	US South	nyu.edu	dev	● Stopped (0/2)
nyu-lab-bluemix				● Running (2/2)

A red box highlights the row for 'nyu-lab-bluemix', and a red arrow points from this box to a large orange button labeled 'Select your Application'.

Clusters

Name	Location	Kube version	Status
nyu-devops	US South	1.9.10_1527	● Normal

Cloud Foundry Services

Connections

The screenshot shows the IBM Cloud console interface for the 'nyu-lab-bluemix' app. The left sidebar has a 'Connections' item under the 'Overview' section. The main content area displays the app's runtime details:

Runtime	Buildpack	Instances	MB Memory per Instance	Total MB Allocation
.py	Python	2	64	128

Below this, there are sections for 'Connections (1)' (Cloudant) and 'Runtime cost'. The top right corner shows the user profile 'NYU'.

Connections

IBM Cloud

Catalog Docs Support Manage

Getting started

Overview

Connections

Runtime

Logs

API Management

Monitoring

Cloud Foundry apps / nyu-lab-bluemix .py Running Visit App URL

Org: nyu.edu Location: US South Space: dev

Routes :

Select Connections

Runtime

BUILDPACK	INSTANCES	MB MEMORY PER INSTANCE	TOTAL MB ALLOCATION
.py Python	2	64	128 7.875 GB still available

All instances are running
Health is 100%

Connections (1)

Cloudant

Runtime cost

View Credentials

The screenshot shows the IBM Cloud console interface. The top navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU. The left sidebar has sections for Getting started, Overview, Runtime, Connections (which is selected), Logs, API Management, and Monitoring. The main content area displays a Cloud Foundry app named "nyu-lab-bluemix" (type ".py", status "Running", Visit App URL). Below the app details, it shows the Org: nyu.edu, Location: US South, and Space: dev. A "Connections" table lists one item: Cloudant (Cloudant NoSQL DB). A context menu is open over the Cloudant row, listing options: View docs, View credentials, Unbind service, Rename service, and Delete Service.

CONNECTION NAME	TYPE
Cloudant	Cloudant NoSQL DB

- View docs
- View credentials
- Unbind service
- Rename service
- Delete Service

View Credentials

The screenshot shows the IBM Cloud console interface for the 'nyu-lab-bluemix' app. The left sidebar is open, showing options like Getting started, Overview, Runtime, Connections (which is selected), Logs, API Management, and Monitoring. The main area displays the app details: Org: nyu.edu, Location: US South, Space: dev, Status: Running, and a Visit App URL link. Below this, a list of services connected to the app is shown, starting with 'Cloudant'. A red box highlights the 'Cloudant' entry, and a red arrow points from this box to a context menu that appears when the 'More' button is clicked. The context menu includes options: View docs, View credentials (which is circled in red), Unbind service, Rename service, and Delete Service.

Cloud Foundry apps /

.py nyu-lab-bluemix • Running Visit App URL

Org: nyu.edu Location: US South Space: dev

Filter items Create connection +

10 Items per page | 1-1 of 1 items 1 of 1 pages < 1 >

CONNECT

Cloudant Cloudant NOSQL DB

Select View Credentials

View docs

View credentials

Unbind service

Rename service

Delete Service

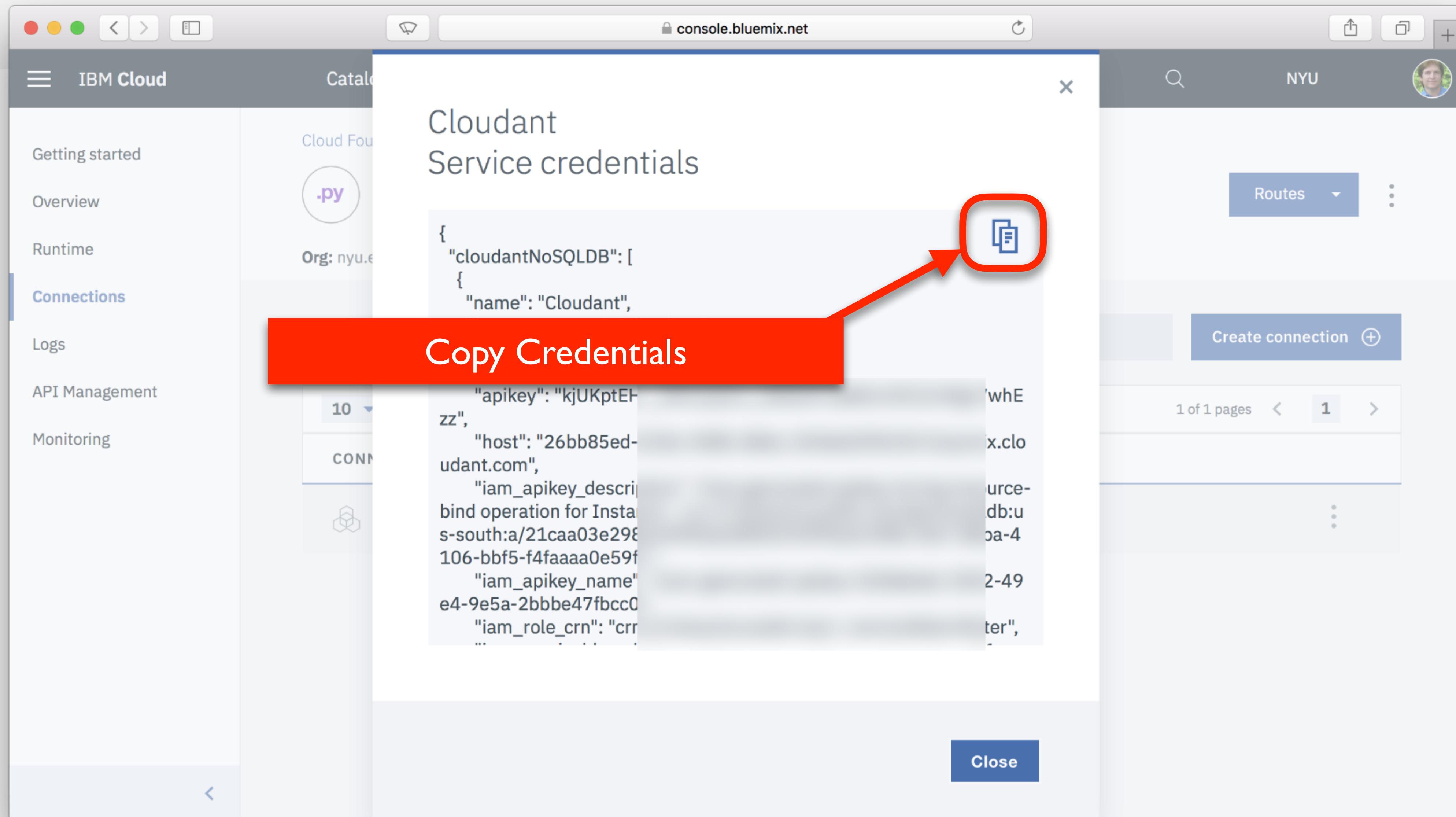
View Credentials

The screenshot shows the IBM Cloud console interface. On the left, a sidebar menu includes 'Getting started', 'Overview', 'Runtime', 'Connections' (which is selected), 'Logs', 'API Management', and 'Monitoring'. The main area displays a 'Cloudant Service credentials' dialog. The dialog title is 'Cloudant Service credentials'. Inside, there is a JSON representation of the service credentials:

```
{ "cloudantNoSQLDB": [ { "name": "Cloudant", "instance_name": "Cloudant", "binding_name": null, "credentials": { "apikey": "kjUKptEHz", "host": "26bb85ed-udant.com", "iam_apikey_description": "bind operation for Instance-south:a/21caa03e298106-bbf5-f4faaaa0e59f", "iam_apikey_name": "e4-9e5a-2bbbe47fbcc0", "iam_role_crn": "crr" } } ] }
```

At the bottom right of the dialog is a 'Close' button. In the background, the main IBM Cloud dashboard shows an 'Org: nyu.edu' section with a 'Routes' tab selected. A 'Create connection' button is visible in the top right of the dashboard.

View Credentials



Back to DevOps

The screenshot shows the IBM Bluemix console interface. On the left, there's a sidebar with various service categories: Cloud Foundry, Containers, Infrastructure, VMware, Dashboard, APIs, Apple Development (marked as New), Blockchain, DevOps, Finance, Functions, Integrate, Mobile, Security, and Watson. The main area displays a 'Cloud Foundry apps /' section. A specific application named 'nyu-lab-bluemix' is shown, indicated by a purple '.py' icon. The app status is 'Running'. Below the app name, it shows 'Org: nyu.edu', 'Location: US South', and 'Space: dev'. To the right of the app details is a 'Routes' dropdown and a three-dot menu. At the bottom, there's a table titled 'CONNECTION NAME' with one item: 'Cloudant' (TYPE: Cloudant NoSQL DB). There are also 'Filter items' and 'Create connection' buttons.

CONNECTION NAME	TYPE
Cloudant	Cloudant NoSQL DB

Back to DevOps

The screenshot shows the Bluemix console interface. On the left, a sidebar lists various services: Cloud Foundry, Containers, Infrastructure, VMware, Dashboard, APIs, Apple Development (New), Blockchain, DevOps, Finance, Functions, Integrate, Mobile, Security, and Watson. The 'DevOps' service is highlighted with a red oval and an arrow points to it from a large red box containing the text 'Select Devops'. The main area displays the 'nyu-lab-bluemix' application details, including its status as '.py' Running, Org: nyu.edu, Location: US South, and Space: dev. Below this, a table titled 'CONNECTION' lists 'Cloudant' and 'Cloudant NoSQL DB'. The top navigation bar includes Catalog, Docs, Support, Manage, a search bar, and user information for NYU.

Select Pipeline from Toolchain

The screenshot shows the IBM Cloud console interface at console.bluemix.net. The top navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU. The left sidebar has sections for Getting Started and Toolchains, with Toolchains currently selected. The main content area is titled "Toolchains" and shows 2/200 Used. It lists a single toolchain named "nyu-bluemix-cf-toolchain" with two tool integrations: GitHub and Jenkins. A "Create a Toolchain" button is located in the top right of the list area.

Name	Tool Integrations
nyu-bluemix-cf-toolchain	

Select Pipeline from Toolchain

The screenshot shows the IBM Cloud Toolchains interface on a web browser. The URL in the address bar is `console.bluemix.net`. The top navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU. On the left, a sidebar has 'Getting Started' and 'Toolchains' sections, with 'Toolchains' currently selected. The main content area is titled 'Toolchains' and shows '2/200 Used'. A table lists one toolchain named 'nyu-bluemix-cf-toolchain'. The table has columns for 'Name' and 'Tool Integrations'. A red callout box with the text 'Select Just the Pipeline' points to the 'Tool Integrations' column for the listed toolchain. A red arrow also highlights the circular icon in that column.

Name	Tool Integrations
nyu-bluemix-cf-toolchain	

Configure Build

The screenshot shows the IBM Cloud Delivery Pipeline interface for the toolchain 'nyu-bluemix-cf-toolc...'. The pipeline consists of two stages: 'Build' and 'Deploy'. The 'Build' stage is currently selected, indicated by a blue bar at the top labeled 'Configure Stage'. This stage has a status of 'STAGE NOT RUN' and a 'LAST INPUT' message stating 'Not yet run'. It contains two jobs: 'Build' (status: 'Not yet run') and 'Test' (status: 'Not yet run'). The 'Deploy' stage is shown next, also with a 'STAGE NOT RUN' status and a 'LAST INPUT' message. It contains one job: 'Deploy' (status: 'Not yet run'). A large blue button on the right says 'Add Stage +'.

Toolchains / nyu-bluemix-cf-toolc... / nyu-bluemix-cf-pipeline

nyu-bluemix-cf-pipeline | Delivery Pipeline

Build > Deploy

STAGE NOT RUN

Configure Stage

Clone Stage

Reorder Stage

INPUT

Stage: Build / Job: Build

LAST INPUT

Not yet run

JOBS

[View logs and history](#)

Build Not yet run

Test Not yet run

LAST EXECUTION RESULT

No results

Deploy >

STAGE NOT RUN

INPUT

Stage: Deploy / Job: Deploy

LAST INPUT

Not yet run

JOBS

[View logs and history](#)

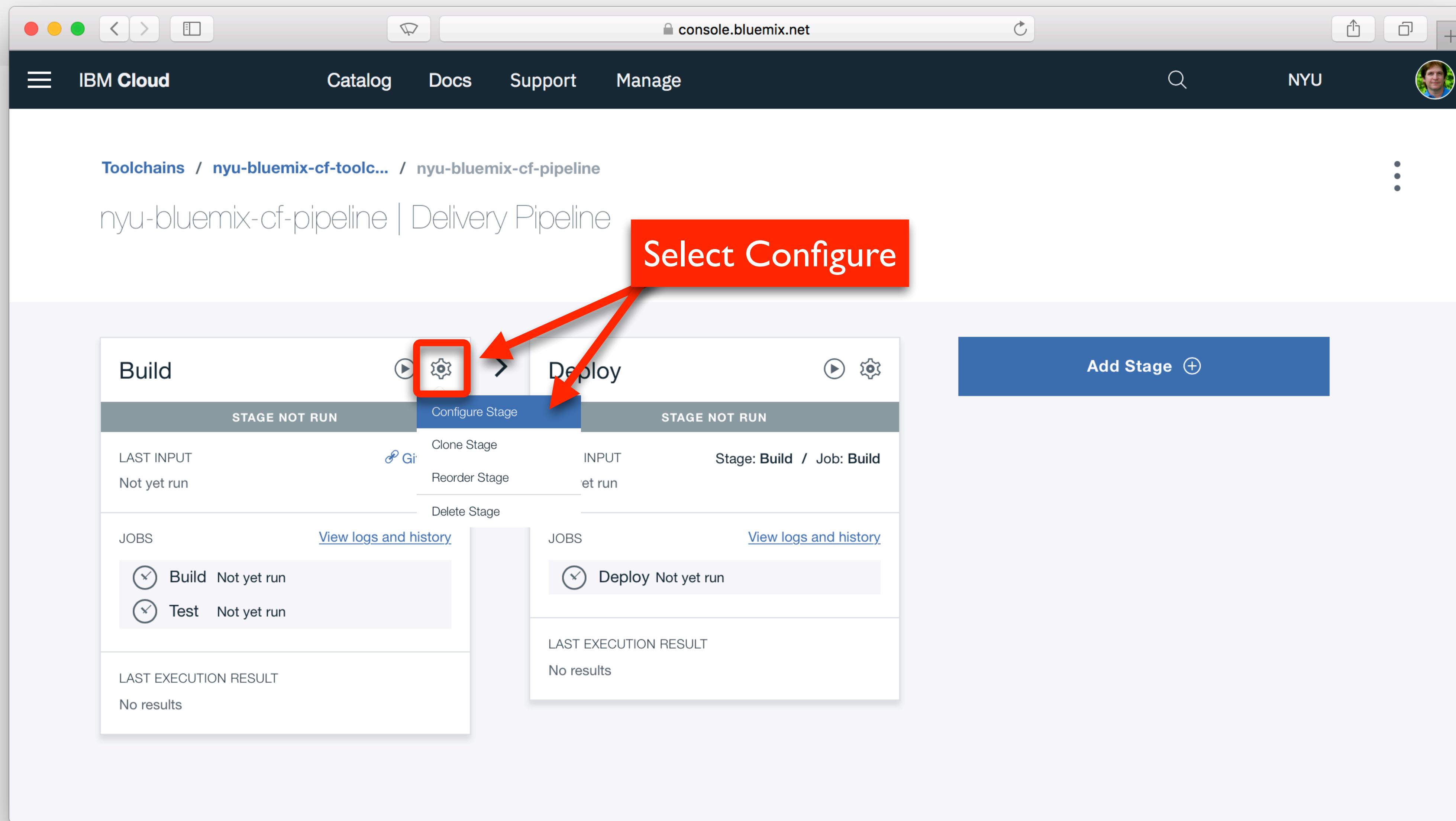
Deploy Not yet run

LAST EXECUTION RESULT

No results

Add Stage +

Configure Build



Environment Properties

The screenshot shows the IBM Cloud console interface for managing a CI/CD pipeline. The URL in the browser is `console.bluemix.net`. The top navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU.

The current page path is `Toolchains / nyu-bluemix-cf-toolc... / nyu-bluemix-cf-pipel... / Stage Configuration`. The title of the page is `nyu-bluemix-cf-pipeline | Stage Configuration`.

The main content area displays the "Build" stage configuration. It has tabs for INPUT, JOBS (which is selected), and ENVIRONMENT PROPERTIES. Under the JOBS tab, there are two items: "Build" (represented by a blue circle with a stack icon) and "Test" (represented by a white circle with a checkmark icon). A "DELETE" button is located in the top right corner of this section. Below this, there is another "Build" section with a "REMOVE" button, showing a "Build configuration" with a "Builder type" set to "Simple".

Environment Properties

The screenshot shows the IBM Cloud Toolchains interface for creating CI/CD pipelines. The URL in the browser is `console.bluemix.net`. The navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU.

The current path is `Toolchains / nyu-bluemix-cf-toolc... / nyu-bluemix-cf-pipel... / Stage Configuration`.

The main content area displays the configuration for the `nyu-bluemix-cf-pipeline`. It shows two stages: `Build` and `Build`.

- Build Stage:** Contains tabs for INPUT, JOBS (selected), and ENVIRONMENT PROPERTIES. A red box highlights the ENVIRONMENT PROPERTIES tab, and a red arrow points from the text "Select Environment Properties" to it. Below the tabs are icons for Build (blue circle with a stack of blocks) and Test (white circle with a checkmark). A button labeled "ADD JOB" with a plus sign is also present.
- Second Build Stage:** Contains a "REMOVE" button and fields for "Build configuration" (set to "Builder type: Simple") and a help icon (info icon).

Add Property

The screenshot shows the IBM Cloud interface for managing CI/CD pipelines. The URL in the browser is `console.bluemix.net`. The top navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU. The current page is under the 'Toolchains' section, specifically for the 'nyu-bluemix-cf-toolc...' toolchain, showing the 'Stage Configuration' for the 'nyu-bluemix-cf-pipeline'. The main content area displays the 'Build' stage configuration. The 'ENVIRONMENT PROPERTIES' tab is active, showing a large blue button with the text '+ ADD PROPERTY' in white. Below this button, a placeholder message reads: 'Click "ADD PROPERTY" to add properties to your stage configuration. The environment properties will be available to all jobs in the stage.' At the bottom, a note states: 'To set properties available to all jobs in the pipeline, visit the [pipeline configuration page](#)'.

Add Property

The screenshot shows a web browser window for console.bluemix.net with the IBM Cloud logo at the top. The navigation bar includes links for Catalog, Docs, Support, Manage, and a search bar. A user profile for NYU is visible on the right.

The URL in the address bar is [Toolchains / nyu-bluemix-cf-toolc... / nyu-bluemix-cf-pipel... / Stage Configuration](#). The page title is "nyu-bluemix-cf-pipeline | Stage Configuration".

A prominent red box highlights the title "Select Environment Properties".

The main content area shows a "Build" stage configuration. It has tabs for INPUT, JOBS, and ENVIRONMENT PROPERTIES, with the ENVIRONMENT PROPERTIES tab selected. A red arrow points from the "Select Environment Properties" box down to the "+ ADD PROPERTY" button, which is also highlighted with a red box.

The text below the button reads: "Click \"ADD PROPERTY\" to add properties to your stage configuration. The environment properties will be available to all jobs in the stage."

At the bottom, it says: "To set properties available to all jobs in the pipeline, visit the [pipeline configuration page](#)".

Add Property

The screenshot shows the IBM Cloud Toolchains interface for creating CI/CD pipelines. The URL in the browser is `console.bluemix.net`. The navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU.

The current path is `Toolchains / nyu-bluemix-cf-toolc... / nyu-bluemix-cf-pipel... / Stage Configuration`. The page title is `nyu-bluemix-cf-pipeline | Stage Configuration`.

The main content area is titled "Build" and shows tabs for INPUT, JOBS, and ENVIRONMENT PROPERTIES. The ENVIRONMENT PROPERTIES tab is selected, displaying a list of properties:

- + ADD PROPERTY
- Text property
- Text area property
- Secure property
- Properties file

A blue "DELETE" button is located in the top right corner of the "Build" section.

Add Property

The screenshot shows the IBM Cloud Stage Configuration interface for a pipeline named "nyu-bluemix-cf-pipeline". The current stage is "Stage Configuration". A red callout box labeled "Select Text Properties" points to the "ENVIRONMENT PROPERTIES" tab. A red arrow points from this callout to the "+ ADD PROPERTY" button, which is highlighted with a red border. A dropdown menu is open, showing options: "Text property" (which is selected and highlighted with a blue background), "Text area property", "Secure property", and "Properties file". The "Build" tab is also visible, along with the "INPUT" and "JOBS" tabs.

VCAP_SERVICES

The screenshot shows a web browser window for the IBM Cloud console at `console.bluemix.net`. The page title is "Build". The navigation bar includes links for Catalog, Docs, Support, Manage, and a user profile for NYU.

The main content area is titled "Build" and shows three tabs: INPUT, JOBS, and ENVIRONMENT PROPERTIES. The ENVIRONMENT PROPERTIES tab is selected, indicated by a blue underline. Below this tab is a button labeled "+ ADD PROPERTY".

Under the ENVIRONMENT PROPERTIES tab, there is a list of environment variables. One variable is highlighted with a blue border:

```
... VCAP_SERVICES ... "ibm_dedicated_public", "ibmcloud-alias" ] } ]}
```

Below the list, a note reads: "To set properties available to all jobs in the pipeline, visit the [pipeline configuration page](#)".

At the bottom right of the modal are two buttons: "SAVE" and "CANCEL".

VCAP_SERVICES

The screenshot shows the IBM Cloud Build interface. At the top, there's a navigation bar with links for Catalog, Docs, Support, and Manage. On the right side of the bar, there's a search icon, a user profile for NYU, and a plus sign for adding new items. Below the navigation bar, the main area has tabs for ART, JOBS, and ENVIRONMENT PROPERTIES. The ENVIRONMENT PROPERTIES tab is currently selected. A red box highlights the text "Enter VCAP_SERVICES". A red arrow points from this text to a specific environment variable entry. This entry consists of a dropdown menu showing "VCAP_SERVICES" and a text input field containing the JSON value: `":", "ibm_dedicated_public", "ibmcloud-alias"] }] }`. Below the environment properties, there's a note: "To set properties available to all jobs in the pipeline, visit the [pipeline configuration page](#)". At the bottom of the interface are "SAVE" and "CANCEL" buttons.

Enter VCAP_SERVICES

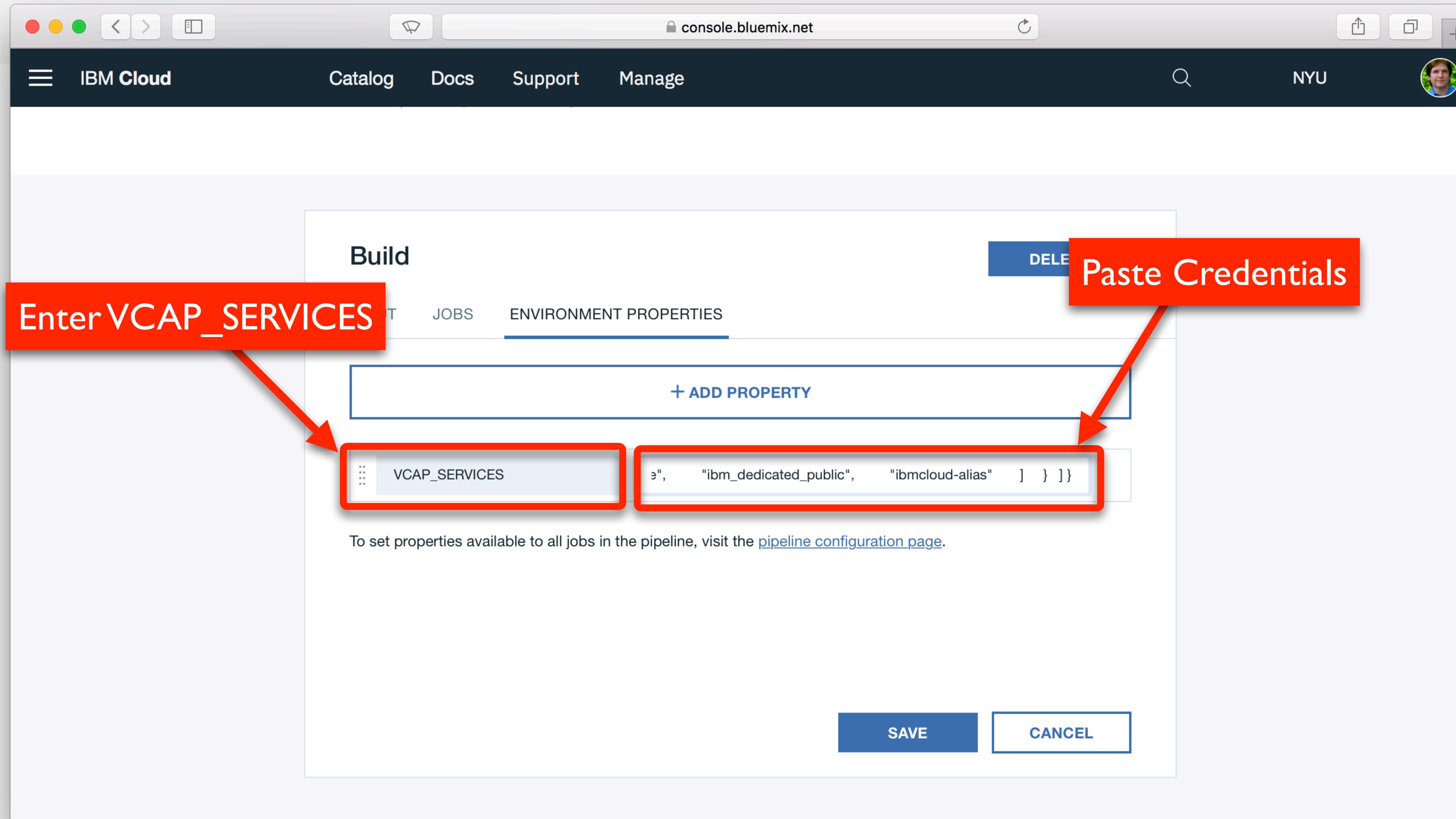
VCAP_SERVICES

`":", "ibm_dedicated_public", "ibmcloud-alias"] }] }`

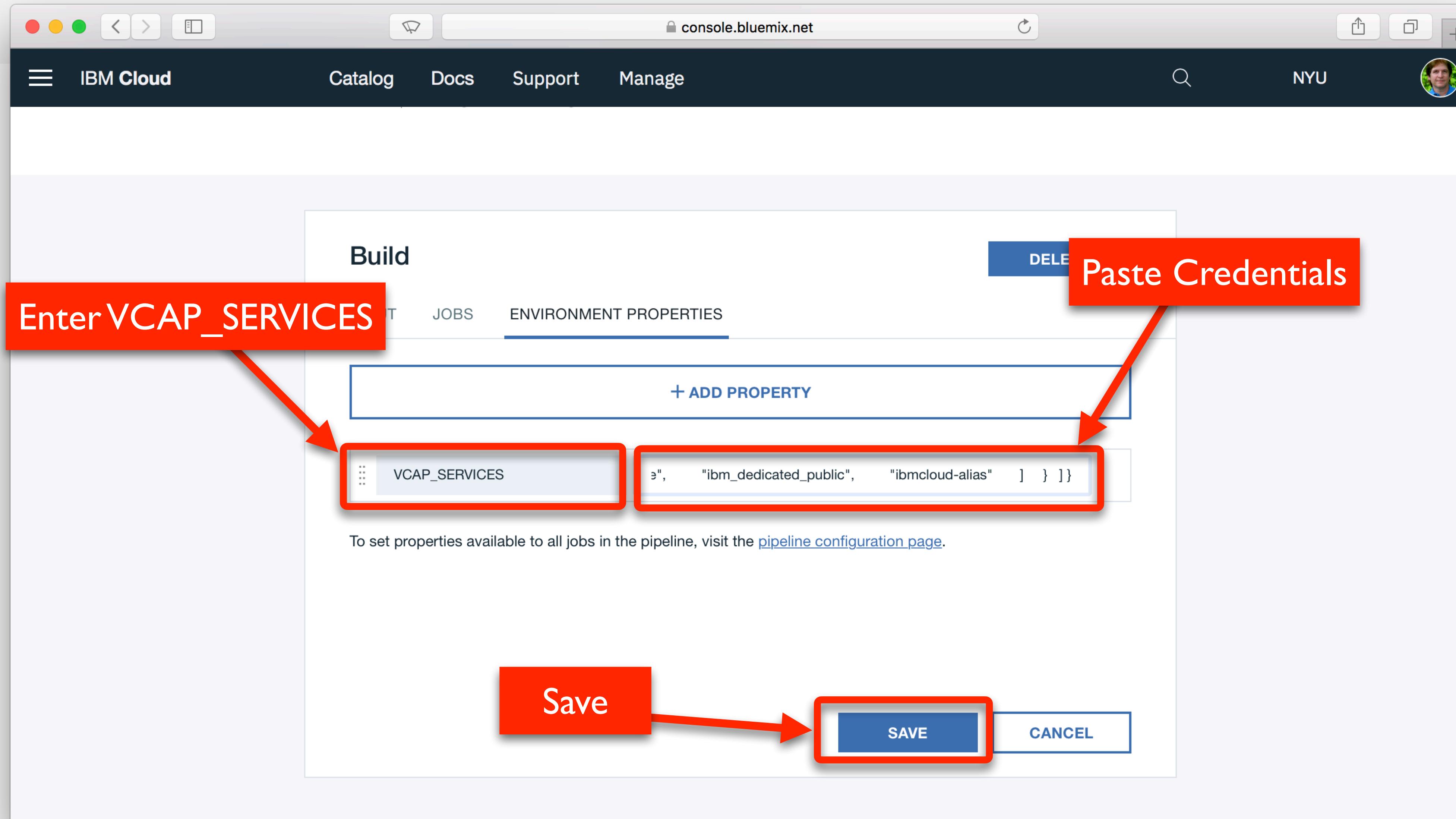
To set properties available to all jobs in the pipeline, visit the [pipeline configuration page](#).

SAVE CANCEL

VCAP_SERVICES



VCAP_SERVICES



Automated DevOps Pipeline

- Now that GitHub is configured, whenever we change the master branch, it will kick off the pipeline
- Let's edit `manifest.yml` again and push those changes back to your forked repo
- This will automatically kick off the DevOps Pipeline
- Very Cool! 😎



Edit manifest.yml

```
---
applications:
- name: nyu-lab-bluemix
  memory: 64M
  instances: 2
  host: nyu-lab-bluemix
  domain: mybluemix.net
  path: .
  disk_quota: 1024M
  buildpack: python_buildpack
  command: gunicorn --bind=0.0.0.0:$PORT service:app
  services:
    - Cloudant
```

Edit manifest.yml

```
---
```

```
applications:
- name: nyu-lab-bluemix
  memory: 64M
  instances: 2
  host: nyu-lab-bluemix
  domain: mybluemix.net
  path: .
  disk_quota: 1024M
  buildpack: python_buildpack
  command: gunicorn --bind=0.0.0.0:$PORT service:app
  services:
    - Cloudant
```

Change host to something unique
Try adding your initials
nyu-lab-bluemix-jr

Push The Changes to GitHub

```
$ git add manifest.yml  
  
$ git commit -m 'changed instance number'  
[master 2799422] changed bluemix app name  
 1 file changed, 1 insertion(+), 1 deletion(-)  
  
$ git push  
Counting objects: 3, done.  
Delta compression using up to 8 threads.  
Compressing objects: 100% (3/3), done.  
Writing objects: 100% (3/3), 332 bytes | 0 bytes/s, done.  
Total 3 (delta 2), reused 0 (delta 0)  
$
```

Build Stage is Running...

The screenshot shows the IBM Bluemix DevOps pipeline interface. At the top, the URL is `console.bluemix.net/devops/pipelines/ebdc0509-aba5-4229-`. The header includes navigation icons, a trial days counter (353 Trial Days Remaining), user information (NYU | US South : nyu.edu : dev), and links for Catalog, Support, and Manage.

The main title is "pipeline-nyu-lab-bluemix | Delivery Pipeline". Below it, there are two stages: "BUILD" and "DEPLOY".

BUILD Stage: Status is "STAGE RUNNING...". It shows the last input from "John J. Rofrano" 5m ago, which was "synced with upstream". It lists one job named "Build" which is "Running".

DEPLOY Stage: Status is "STAGE NOT RUN". It shows the last input was "Not yet run". It lists one job named "Deploy" which is "Not yet run".

A blue button on the right says "Add Stage +".

At the bottom right, there is a link "Ask us a Question".

Build Stage is Running...

The screenshot shows the Bluemix DevOps Pipelines interface. A red callout box with the text "Build Stage starts running as a result of a GitHub update to the master branch" has an arrow pointing to the "BUILD" stage card. The "BUILD" stage card is highlighted with a red border. The stage status is "STAGE RUNNING...". The "DEPLOY" stage card is shown next, with a status of "STAGE NOT RUN". A blue button labeled "Add Stage" is visible at the top right. The pipeline name "pipeline-nyu-lab-bluemix" is displayed at the top left.

Build Stage starts running as a result of a GitHub update to the master branch

pipeline-nyu-lab-bluemix | Delivery Pipeline

BUILD

STAGE RUNNING...

LAST INPUT

Last commit by John J. Rofrano 5m ago
synced with upstream

JOBS

Build Running

LAST EXECUTION RESULT

No results

DEPLOY

STAGE NOT RUN

LAST INPUT

Not yet run

Stage: BUILD / Job: Build

JOBS

View logs and history

Deploy Not yet run

LAST EXECUTION RESULT

No results

Add Stage +

Ask us a Question

Deploy Stage is Running...

The screenshot shows the IBM Bluemix DevOps pipeline interface. At the top, the URL is `console.bluemix.net/devops/pipelines/ebdc0509-aba5-4229-`. The header includes navigation icons, a trial days counter (353 Trial Days Remaining), user information (NYU | US South : nyu.edu : dev), and links for Catalog, Support, and Manage.

The main area displays the pipeline structure:

- BUILD Stage:** Status: STAGE PASSED. Last input was a commit by John J. Rofrano 5m ago, synced with upstream. It contains one job: Build, which passed now.
- DEPLOY Stage:** Status: STAGE RUNNING... Last input was Stage: BUILD / Job: Build. It contains two jobs: Build 1 (status: Up) and Deploy (status: Running).

A blue button labeled "Add Stage" with a plus sign is located on the right side of the pipeline stages.

At the bottom right, there is a link "Ask us a Question" with a speech bubble icon.

Deploy Stage is Running...

The screenshot shows the IBM Bluemix DevOps pipeline interface. On the left, the 'BUILD' stage is displayed with a green 'STAGE PASSED' bar. Below it, under 'LAST INPUT', there is a message about a recent commit by John J. Rofrano. Under 'JOBS', a single job named 'Build' is listed as 'Passed now'. At the bottom, the 'LAST EXECUTION RESULT' shows 'Build 1'. To the right, the 'DEPLOY' stage is shown with a blue 'STAGE RUNNING...' bar. It lists a job named 'Build 1' and another job named 'Deploy' which is currently 'Running'. A red arrow points from a red box containing the text 'If the Build is Successful the Deploy Stage will run' towards the 'DEPLOY' stage. A red box also highlights the 'DEPLOY' stage itself. A blue button labeled 'Add Stage +' is visible at the top right of the pipeline area.

If the Build is Successful
the Deploy Stage will run

BUILD

STAGE PASSED

LAST INPUT

Last commit by John J. Rofrano 5m ago
synced with upstream

JOBS

Build Passed now

LAST EXECUTION RESULT

Build 1

DEPLOY

STAGE RUNNING...

LAST INPUT

Stage: BUILD / Job: Build

Build 1

JOBS

Deploy Running

LAST EXECUTION RESULT

No results

Add Stage +

Deploy Complete

The screenshot shows the IBM Bluemix DevOps pipeline interface. The pipeline consists of two stages: BUILD and DEPLOY.

BUILD Stage:

- Stage Status:** STAGE PASSED
- Last Input:** Last commit by John J. Rofrano 7m ago, synced with upstream
- Jobs:** Build Passed 3m ago
- Last Execution Result:** Build 1

DEPLOY Stage:

- Stage Status:** STAGE PASSED
- Last Input:** Stage: BUILD / Job: Build
- Jobs:** Deploy Passed now
- Last Execution Result:** pipeline-nyu-lab-bluemix nyu-lab-bluemix.mybluemix.net

Additional Features:

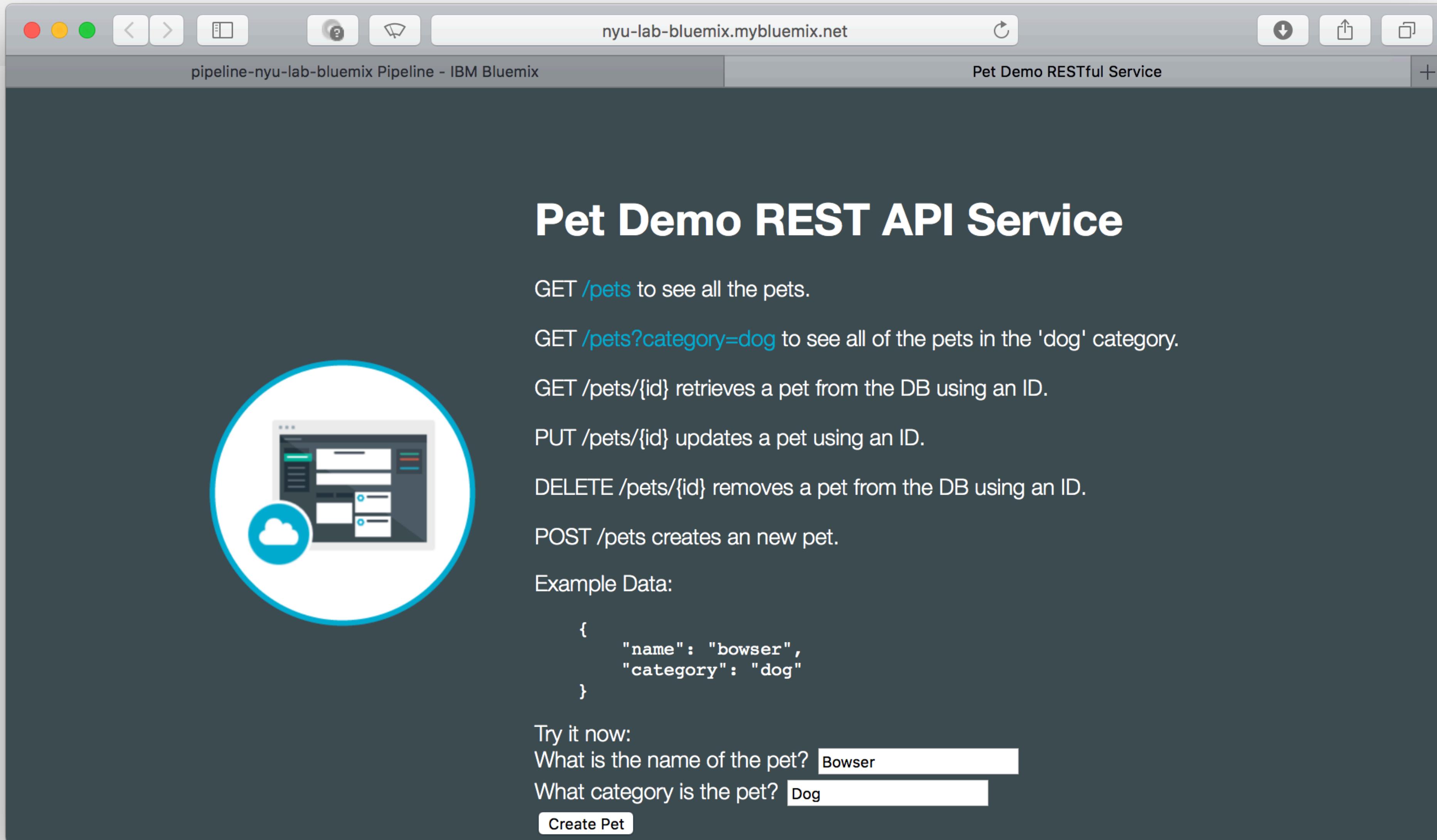
- Add Stage** button
- Ask us a Question** button

Deploy Complete

The screenshot shows the IBM Bluemix DevOps pipeline interface. On the left, the 'BUILD' stage is displayed with a green 'STAGE PASSED' bar. It shows 'LAST INPUT' from a 'Last commit by John J. Rofrano' made 7m ago, which was 'synced with upstream'. Under 'JOBS', there is a 'Build' job that passed 3m ago. At the bottom, the 'LAST EXECUTION RESULT' is 'Build 1'. On the right, the 'DEPLOY' stage is shown with a green 'STAGE PASSED' bar. It shows 'LAST INPUT' from the same commit, with 'Stage: BUILD / Job: Build' and 'Build 1'. Under 'JOBS', there is a 'Deploy' job that passed now. At the bottom, the 'LAST EXECUTION RESULT' is 'pipeline-nyu-lab-bluemix nyu-lab-bluemix.mybluemix.net'. A red box highlights this result, and a red arrow points from it to a red callout box containing the text: 'When both have completed successfully you can launch your newly deployed app'.

When both have completed successfully you can launch your newly deployed app

Application is Running



The screenshot shows a web browser window with the URL `nyu-lab-bluemix.mybluemix.net` in the address bar. The title bar includes the pipeline name `pipeline-nyu-lab-bluemix Pipeline - IBM Bluemix` and the service name `Pet Demo RESTful Service`. The main content area displays the **Pet Demo REST API Service** documentation. It features a large icon of a computer monitor with a cloud icon on the left. The documentation lists several API endpoints:

- GET `/pets` to see all the pets.
- GET `/pets?category=dog` to see all of the pets in the 'dog' category.
- GET `/pets/{id}` retrieves a pet from the DB using an ID.
- PUT `/pets/{id}` updates a pet using an ID.
- DELETE `/pets/{id}` removes a pet from the DB using an ID.
- POST `/pets` creates a new pet.

Example Data:

```
{  
    "name": "bowser",  
    "category": "dog"  
}
```

Try it now:

What is the name of the pet?

What category is the pet?

Create Pet

Summary

- You should have a good understand of what PaaS is why you would want to use it
- You just deployed your first Cloud Foundry Application
- You added a services and modified the code to use this server
- You pushed your application changes back to to IBM Cloud
- You set up a simple DevOps Pipeline to automate your builds

