

AWB Bootcamp

Red Hat OpenShift and IBM Cloud Paks

Luca Floris
IBM Cloud Technical Consultant



Agenda

Day 1 (General containers and OpenShift)

- Welcome and Kick off (15 mins) 9am
- Adopting Cloud technologies and container native development
- Introduction to Containers
- Deploying containers
- Container images and repositories
- Introduction to Red Hat OpenShift
- Introduction to OpenShift and Applications
- Introduction to OpenShift Storage

Recap

Agenda

Day 2 (Architecture and Installation)

- OpenShift 4.3 Architecture
- OpenShift Container Security
- OpenShift DNS
- OpenShift Storage
- OpenShift Authentication
- OpenShift Container Networking
- OpenShift 4.3 Common Cluster Architectures
- OpenShift 4.3 Installation
- OpenShift Day2

Agenda

Day 3 (Application Deployment)

- Deploying applications on OpenShift
- Scaling/Autoscaling applications
- Introduction to Helm charts
- OpenShift Security Context Constraints
- Resource Quotas

Agenda

Day 4 (Cloud Paks)

- IBM Cloud Paks
- IBM Cloud Pak Common Services
- Cloud Pak for Applications
 - IBM Accelerators for Teams
 - Application Modernization and Middleware Migration
 - Microclimate
 - Transformation Advisor
- Cloud Pak for Multicloud Management
 - Application Lifecycle Management
 - Introduction to Application resources
 - Application Monitoring
 - Governance and Risk & Compliance Management
 - Policies

Agenda

Day 5 (MCM and CAM)

- Cloud Pak for Multicloud Management Continued
 - Infrastructure Lifecycle Management
 - Infrastructure management and automation
 - CloudForms
 - Red Hat Ansible Tower
 - Cloud Automation Manager
- Cloud Automation Manager (CAM)
- Introduction to CAM
- Introduction to Terraform
- Introduction to the CAM templates format
- CAM Template Designer
- Workshop conclusion

Adopting Cloud Technologies – Journey to Cloud

Tim Burns

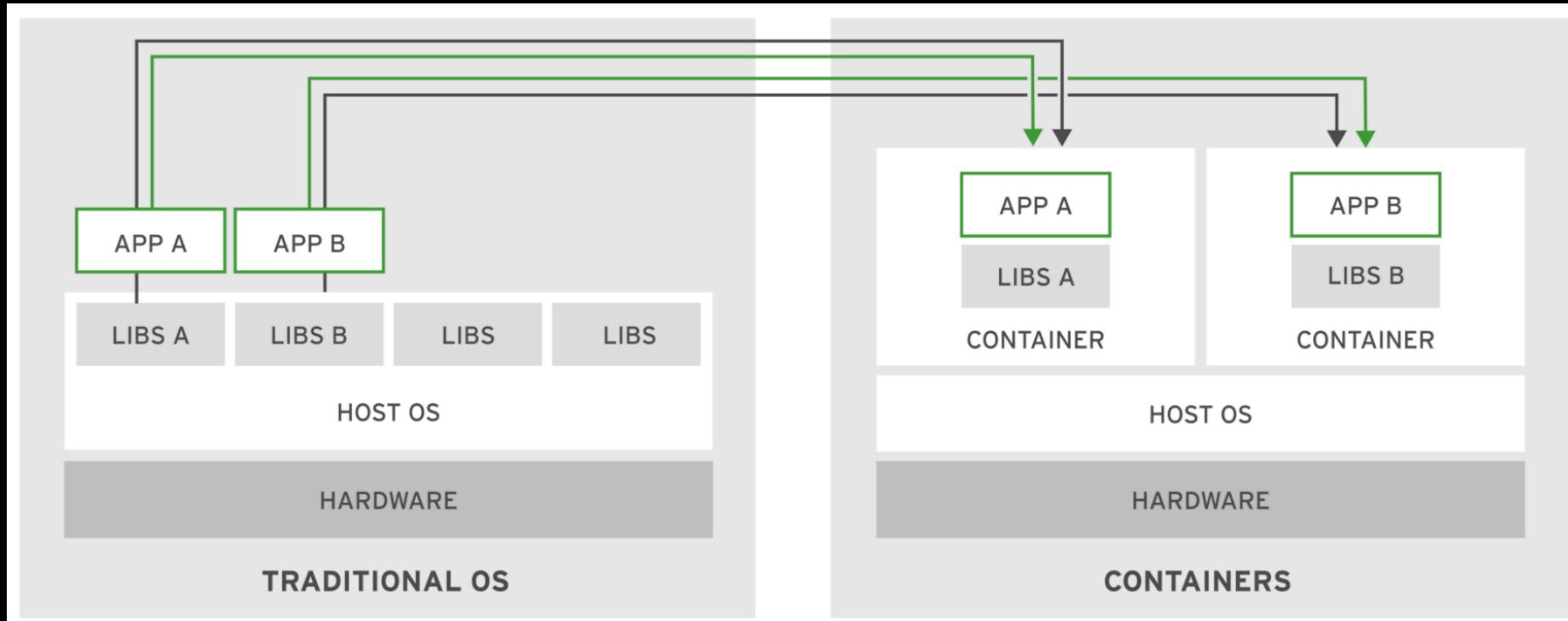
Managing Consultant & Exec Project Manager

Introduction to Containers

What is a container?

- A container is a set of one or more processes that are isolated from the rest of the system.
 - Containers provide many of the same benefits as virtual machines, such as security, storage, and network isolation.
 - Low hardware resource requirements
 - Quick to start and terminate.
 - They also isolate the libraries and the runtime resources for an application
- ✓ Efficiency, elasticity, portability and reusability!
 - ✓ Low hardware footprint
 - ✓ Environment isolation
 - ✓ Quick deployment
 - ✓ Multiple environment deployment
 - ✓ Reusability

Traditional Application vs Containers



Deploying Containers

Can be done on any machine that has a container runtime

Examples include Docker, Podman, cri-o, containerd etc

Commands are as simple as

```
$ docker run hello-world
```

Hello from Docker!

This message shows that your installation appears to be working correctly.



Container Persistence

A container can be stateless or stateful, but the [12 Factor Microservices methodology](#) recommends apps to be as stateless as possible

Stateless requires no defined container storage, whereas stateful requires a **volume**.

Volumes are mounted to the container by the container runtime and provide a means to write data to something accessible from outside the container

Where are my logs?

What if the container restarts?

I have a database, what now?

???

Container Images

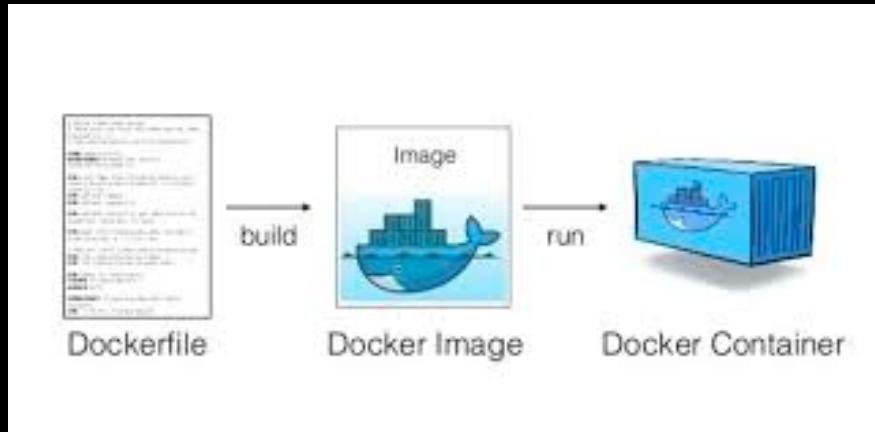
Contains all the dependencies required for the container to run

Foundation for running containers

Containers use an immutable view of the image, so multiple containers can use the same image simultaneously.

Images are created using a **Dockerfile**

Images are stored locally or in a accessible **image repository**



Running a Container Locally

Figure out WHAT and HOW you want the container to run

Does it need a name?

Does it need a volume?

Do you need to expose an application port?

With a name

```
docker run --name hello hello-world
```

Stateful

```
docker run --name hello -v  
$(pwd)/data:/data hello-world
```

Port 3000 exposed

```
docker run --name hello -p 3000:3000  
hello-world
```

Additional environment variables

```
docker run --name hello -e MYVAR1=foo  
hello-world
```

Building a Docker Image

```
FROM python:2.7-slim

# Set the working directory to /app
WORKDIR /app

# Copy the current directory contents into the container at /app
ADD . /app

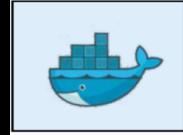
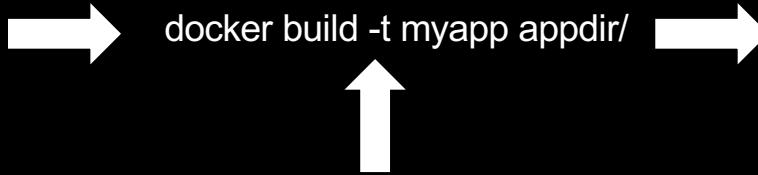
# Install any needed packages specified in requirements.txt
RUN pip install -r requirements.txt

# Make port 80 available to the world outside this container
EXPOSE 80

# Define environment variable
ENV NAME World

# Run app.py when the container launches
CMD ["python", "app.py"]
```

Dockerfile



Image

```
from flask import Flask
from redis import Redis, RedisError
import os
import socket

# Connect to Redis

app = Flask(__name__)

@app.route("/")
def hello():

    html = "<h3>Hello {name}!</h3>" \
        "<b>Hostname:</b> {hostname}<br/>"
    return html.format(name=os.getenv("NAME", "world"), hostname=socket.gethostname())
    return 'My hostname is %s'

if __name__ == "__main__":
    app.run(host='0.0.0.0', port=80)
```

Application

Demo - Using the Lab Environment

Demo – Building a Container Application

Lab – Building a Container Application

Visit <https://github.com/lfloris/openshift-bootcamp/tree/master> for lab materials

Go to Lab 1

Goals

Locally build and run a stateless container

Locally build and run a stateful container

Locally build and run a 2 tier Wordpress and MySQL container application

Locally build a custom Python Docker image

Kubernetes

What is Kubernetes?

Kubernetes is a portable, extensible, open-source platform for managing containerized workloads and services

A framework to run distributed systems resiliently

Provides container orchestration that automates many of the manual processes involved in deploying, managing, and scaling containerized applications.



kubernetes

Benefits of Kubernetes Orchestration

- Service discovery and load balancing
- Storage orchestration
- Automated rollouts and rollbacks
- Automatic bin packing
- Self-healing
- Secret and configuration management

Red Hat OpenShift

What is OpenShift?

Container host and runtime

Enterprise Kubernetes

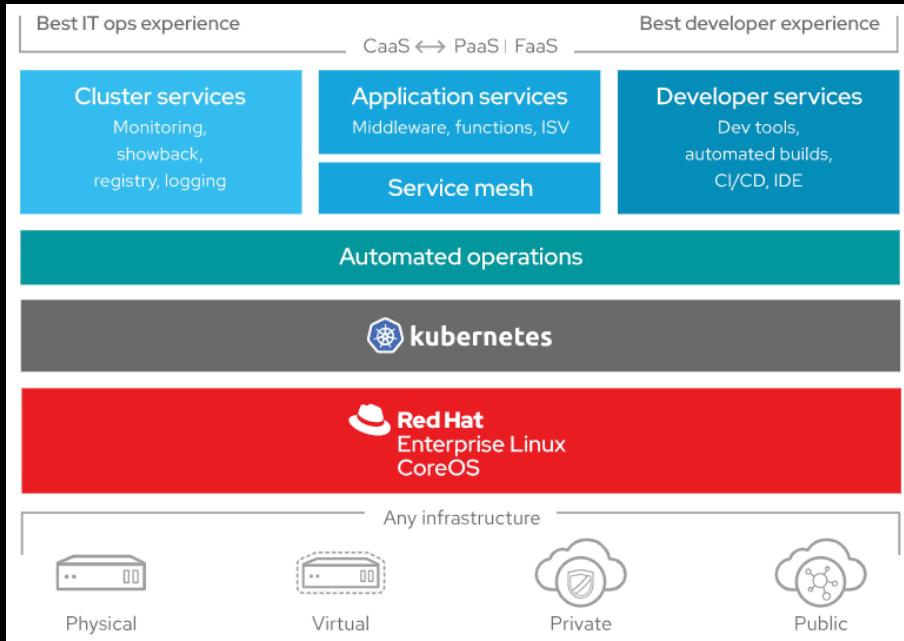
Validated integrations

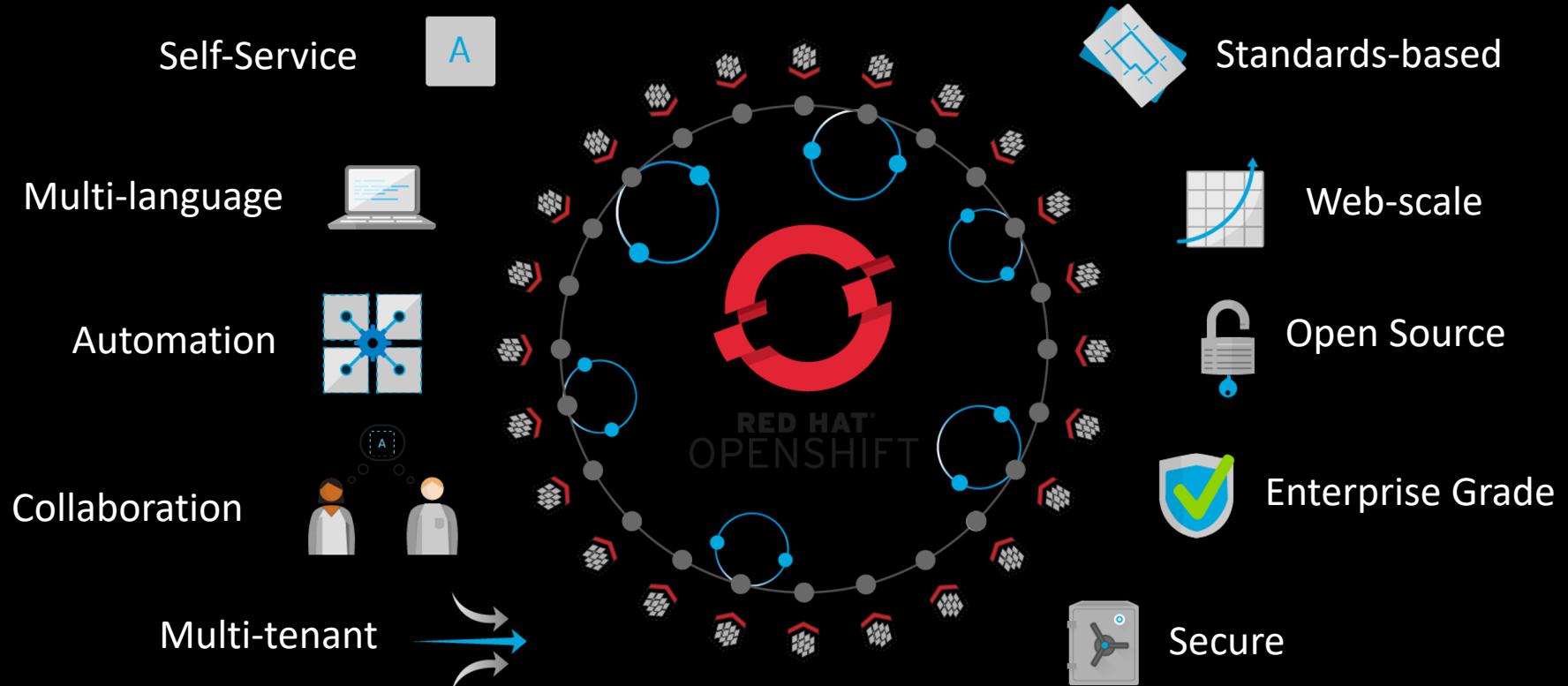
Integrated container registry

Developer workflows

Easy access to services

Improved installation based on immutable Red Hat® Enterprise Linux® CoreOS for consistency and upgradability.





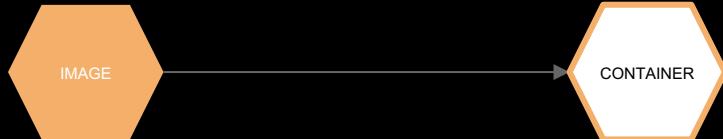
OpenShift Core Components

- Pods

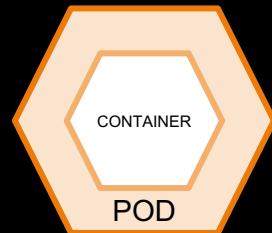
A Container is the smallest deployment unit



Containers are based on container images

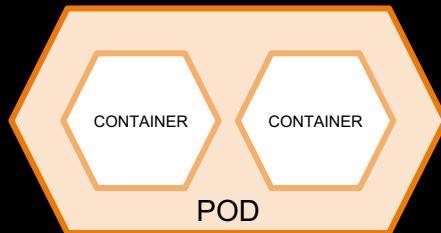


Containers are wrapped in pods that are the base units for deployment in OpenShift



BINARY

RUNTIME



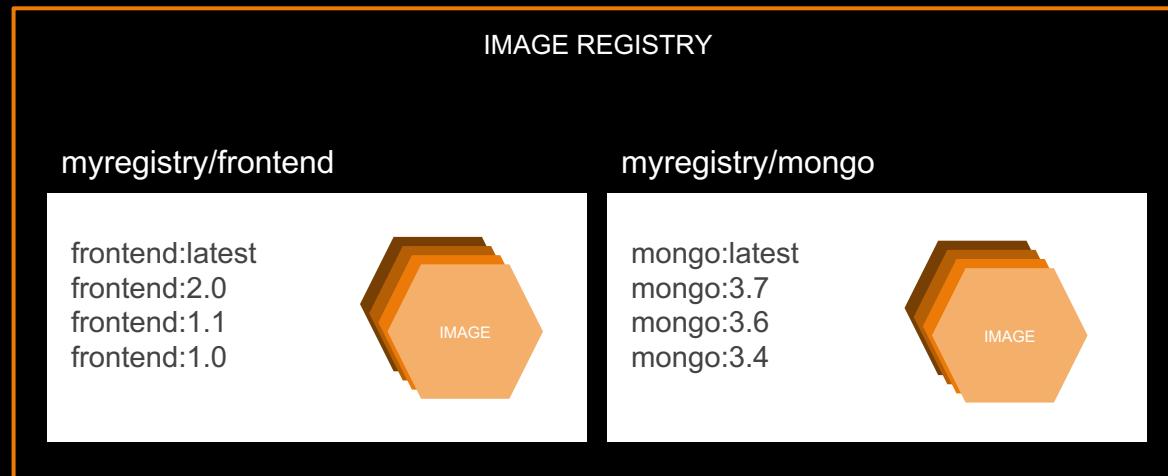
10.140.4.44

10.15.6.55

OpenShift Core Components

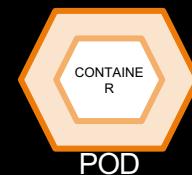
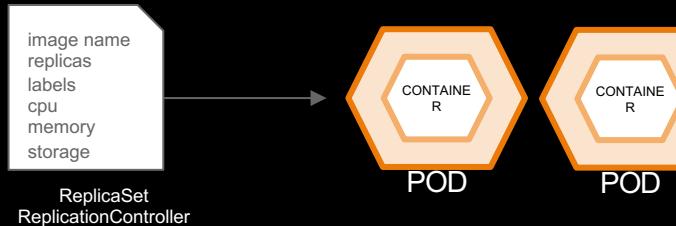
- Images

Images are stored in an Image Registry/Repository that keeps all versions of an image



OpenShift Core Components

- ReplicaSets / Deployments

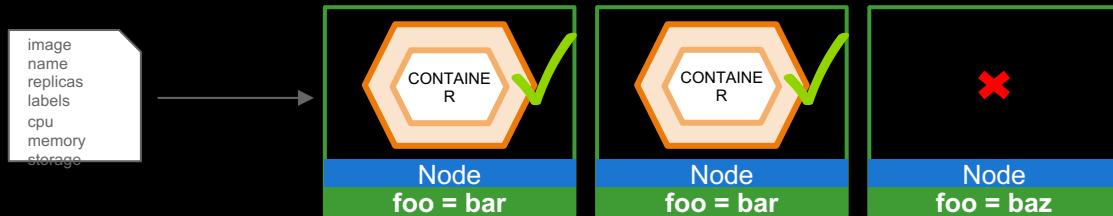


- Runs 1-N replicas of an application and automatically replaces any instances that fail or become unresponsive.
- Provide a way to define how an application runs in a Kubernetes cluster
- Control a vast array of deployment specifications

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: python-app
  labels:
    app: python
spec:
  replicas: 3
  selector:
    matchLabels:
      app: python
  template:
    metadata:
      labels:
        app: python
    spec:
      containers:
        - name: python
          image: mycluster.icp:8500/default/python-app:v1
          imagePullPolicy: IfNotPresent
          resources:
            requests:
              memory: 128Mi
              cpu: 100m
            limits:
              memory: 512Mi
              cpu: 200m
          ports:
            - containerPort: 80
```

OpenShift Core Components

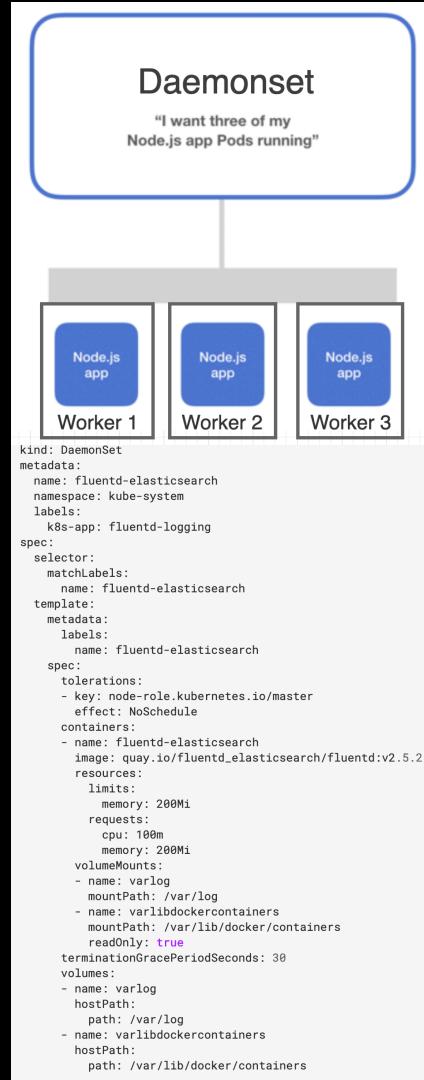
- Daemonsets



A *DaemonSet* ensures that all (or some) Nodes run a copy of a Pod. As nodes are added to the cluster, Pods are added to them.

As nodes are removed from the cluster, those Pods are garbage collected.

Deleting a DaemonSet will clean up the Pods it created.



OpenShift Core Components

- StatefulSets

Manages the deployment and scaling of a set of [Pods](#), and provides guarantees about the ordering and uniqueness of these Pods.

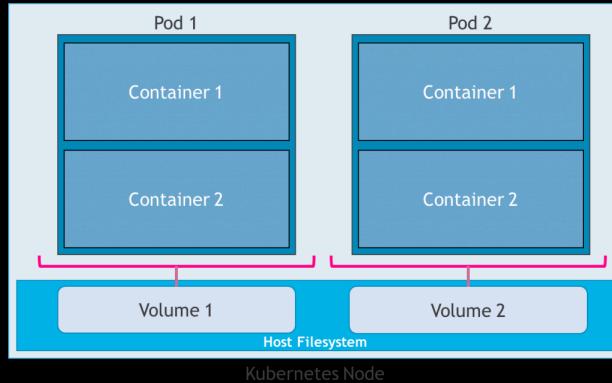
Like a [Deployment](#), a StatefulSet manages Pods that are based on an identical container spec.

Unlike a Deployment, a StatefulSet maintains a sticky identity for each of their Pods. These pods are created from the same spec, but are not interchangeable: each has a persistent identifier that it maintains across any rescheduling.

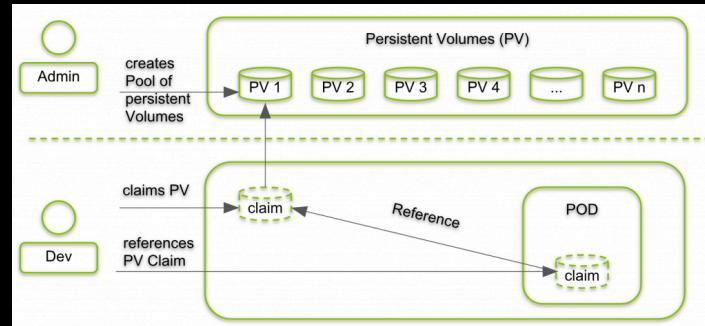
```
apiVersion: apps/v1
kind: StatefulSet
metadata:
name: web
spec:
selector:
matchLabels:
  app: nginx # has to match .spec.template.metadata.labels
serviceName: "nginx"
replicas: 3 # by default is 1
template:
metadata:
labels:
  app: nginx # has to match .spec.selector.matchLabels
spec:
terminationGracePeriodSeconds: 10
containers:
- name: nginx
  image: k8s.gcr.io/nginx-slim:0.8
  ports:
  - containerPort: 80
    name: web
  volumeMounts:
  - name: www
    mountPath: /usr/share/nginx/html
volumeClaimTemplates:
- metadata:
  name: www
spec:
accessModes: [ "ReadWriteOnce" ]
storageClassName: "my-storage-class"
resources:
requests:
  storage: 1Gi
```

OpenShift Core Components - Persistence

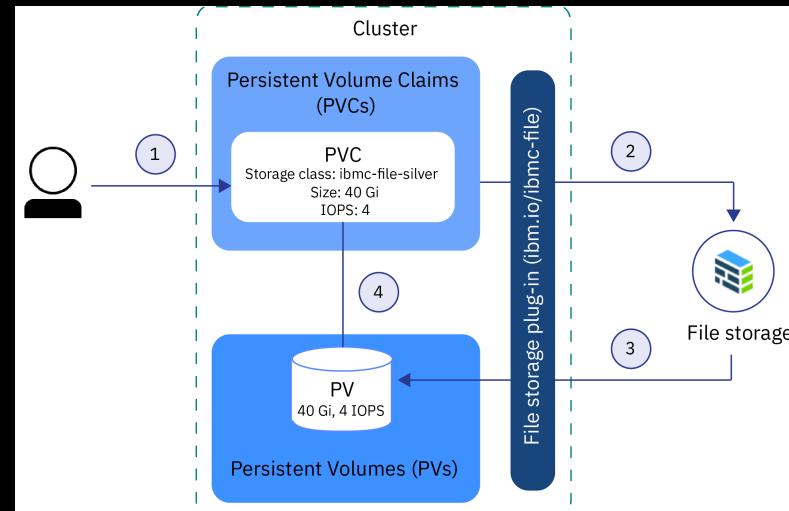
PersistentVolumes



PersistentVolumeClaims

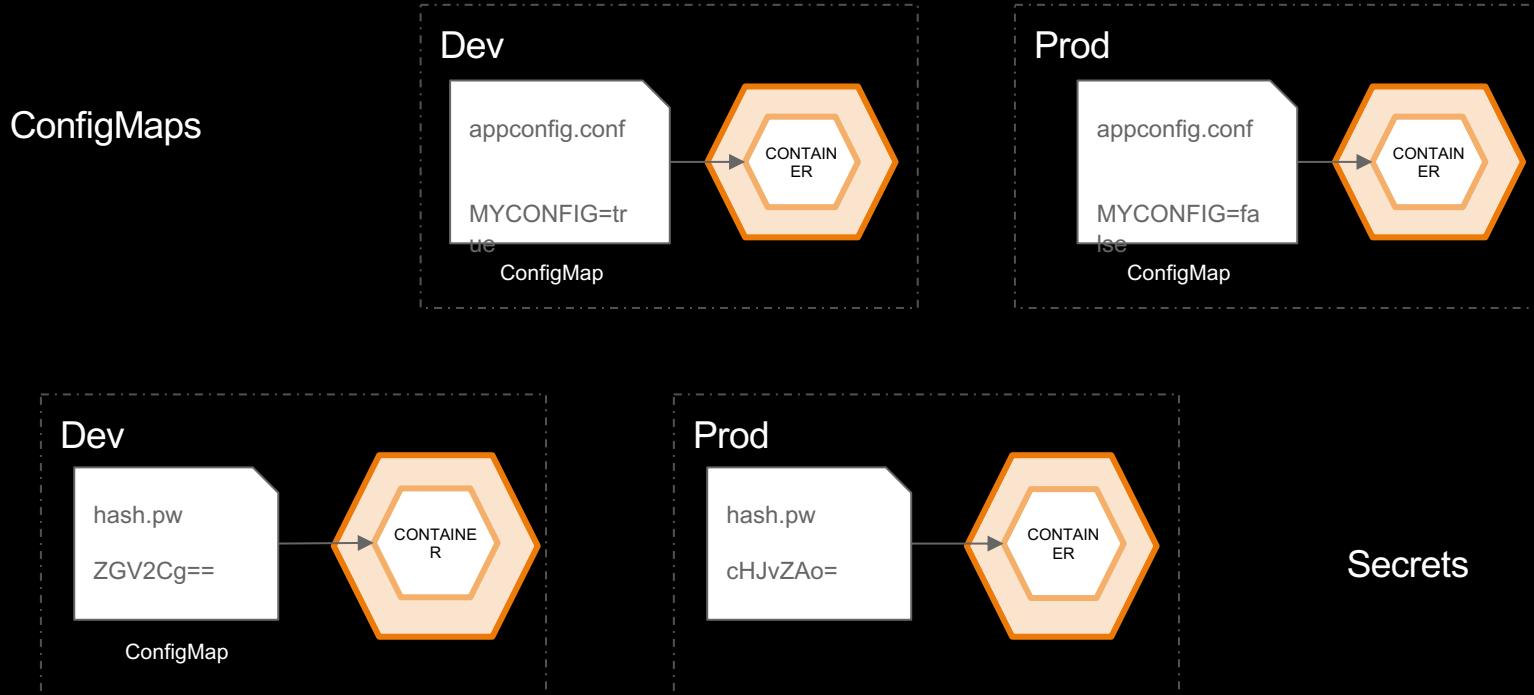


Storage Class



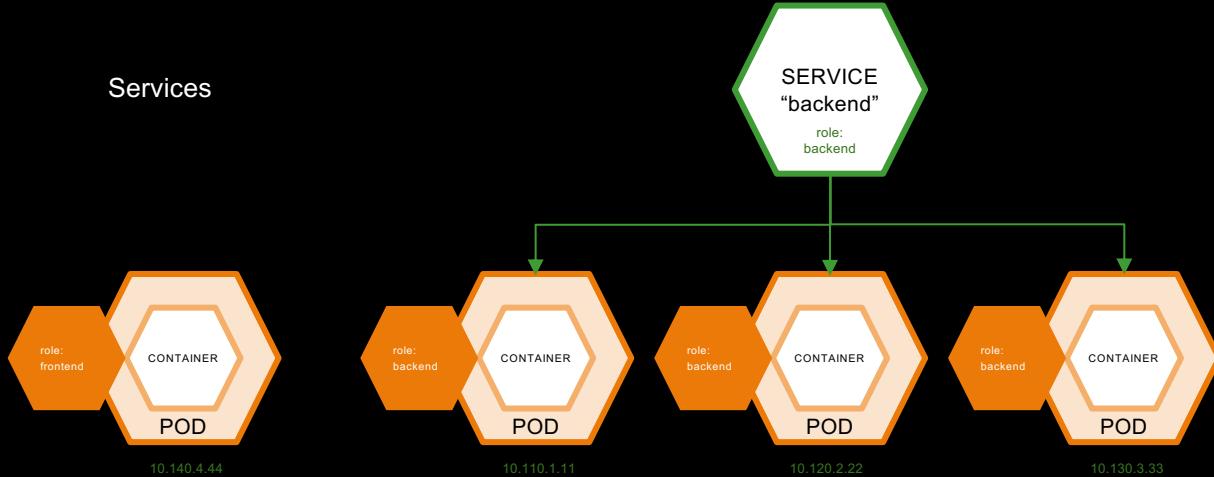
OpenShift Core Components

- ConfigMaps and Secrets

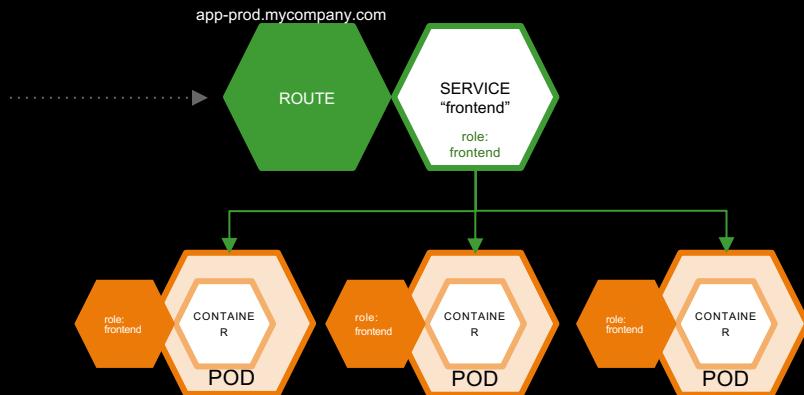
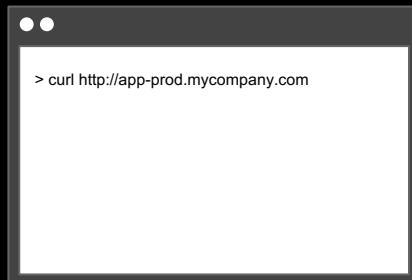


OpenShift Core Components - Services and Routes

Services



Routes



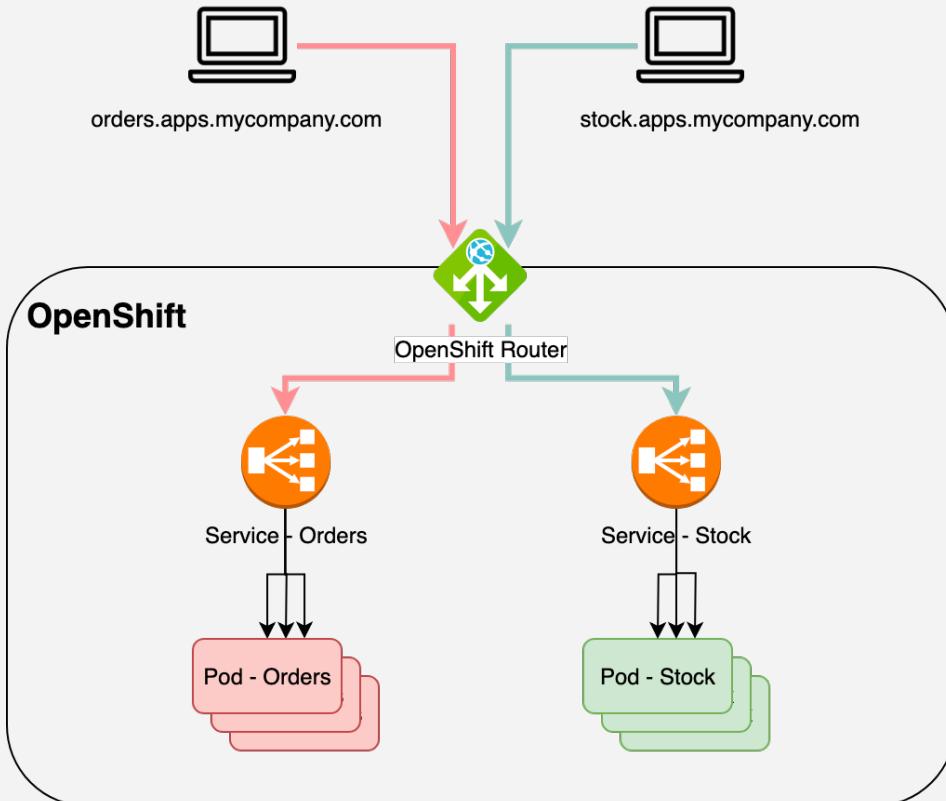
OpenShift Core Components

- Routes

Routes are a specific OpenShift technology

Provides an easy way to expose a service

All exposed routes by default use the OpenShift Router at <name>.apps.mydomain.com

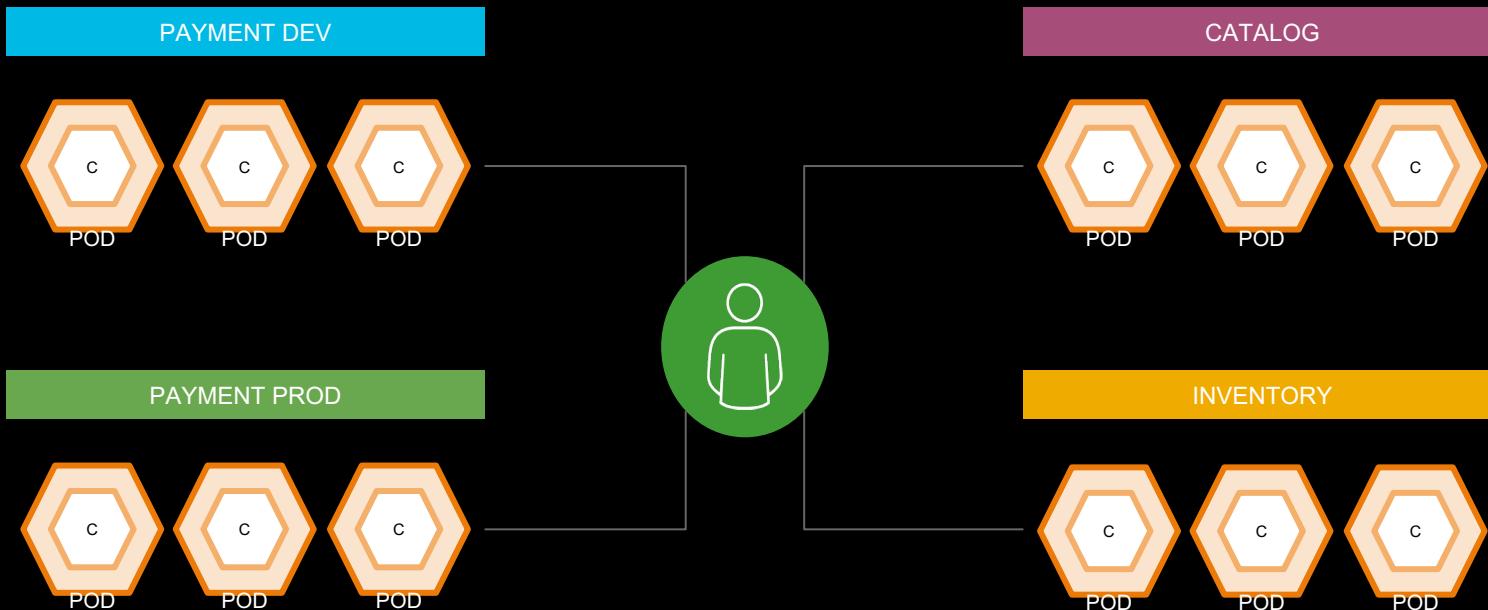


OpenShift Core Components

- Projects

Projects == Kubernetes Namespaces

Projects isolate applications and resources within the cluster



OpenShift Core Components

– Custom Resource Definitions

Custom Resource Definitions are extensions of the API Server

It defines your own object kinds and lets the API Server handle the entire lifecycle.

Typically paired with a custom controller

Specify a desired state of a collection of objects, controlled and monitored by the controller

CRD's form the basis of the operator life cycle for container native applications

OpenShift Operators

An Operator is a method of packaging, deploying and managing a Kubernetes-native application.

The Operator is a piece of software running in a Pod on the cluster, interacting with the Kubernetes API server. It introduces new object types through Custom Resource Definitions, an extension mechanism in Kubernetes. These custom objects are the primary interface for a user; consistent with the resource-based interaction model on the Kubernetes cluster.

The Operator Framework is an open source project that provides developers and cluster administrators tooling to accelerate development and deployment of an Operator.



Enables developers to build Operators based on their expertise without requiring knowledge of Kubernetes API complexities.



Oversees installation, configuration, and updates, during the lifecycle of all Operators (and their associated services) running across a Kubernetes cluster.



Usage reporting for Operators that provide specialized services. [Follow the code-to-cluster walkthrough.](#)

<https://github.com/operator-framework/getting-started>

Examples of Operators in OpenShift

- ✓ Authentication
- ✓ Cluster Autoscaler
- ✓ DNS
- ✓ Cluster Monitoring
- ✓ Network
- ✓ Operator-lifecycle-manager
- ✓ Storage
- ✓ Cluster Logging
- ✓ Console
- ✓ Image Registry

Demo – OpenShift User Interface and CLI

OpenShift Application Deployment

Deployments

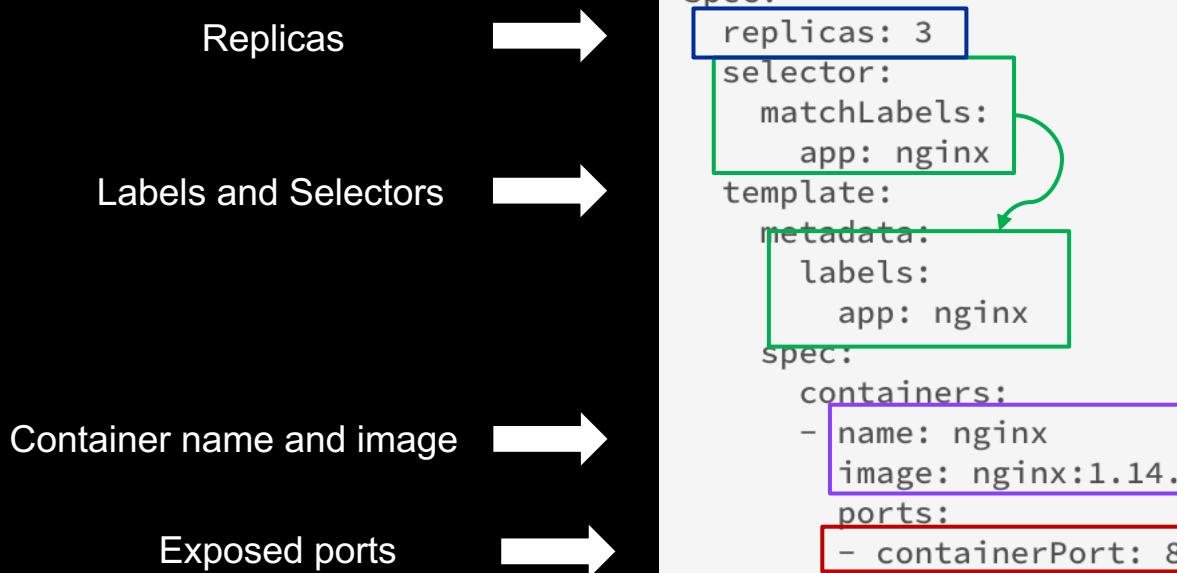
Provides declarative updates for [Pods](#) and [ReplicaSets](#).

You describe a *desired state* in a Deployment, and the Deployment [Controller](#) changes the actual state to the desired state at a controlled rate.

The most simple deployments only require you to specify the number of replicas, selectors/labels, a container name and the image.

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: nginx-deployment
  labels:
    app: nginx
spec:
  replicas: 3
  selector:
    matchLabels:
      app: nginx
  template:
    metadata:
      labels:
        app: nginx
    spec:
      containers:
        - name: nginx
          image: nginx:1.14.2
        ports:
          - containerPort: 80
```

Writing a Deployment Spec - Basics



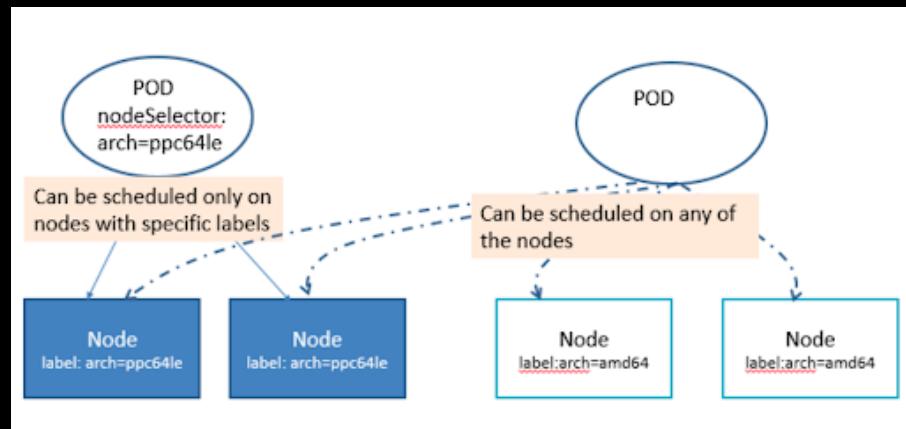
Writing a Deployment Spec - NodeSelector

A NodeSelector instructs the OpenShift scheduler that the pod runs on a specific node

Specifies a key-value pair to match to a node

Node(s) must be labelled

```
nodeSelector:  
  node-role.kubernetes.io/worker: ''
```



Writing a Deployment Spec – Readiness/Liveness

Liveness is used by kubelet to know when to **restart** a container

```
livenessProbe:  
  httpGet:  
    path: /healthz  
    port: 1936  
    scheme: HTTP
```

Readiness is used by kubelet to know when the container is **ready**

```
readinessProbe:  
  httpGet:  
    path: /healthz/ready  
    port: 1936  
    scheme: HTTP
```

Writing a Deployment Spec - Resources

Two types of resource constraints for pods

- Memory (Mi/Gi)
- CPU (m)

```
resources:
  requests:
    cpu: 100m
    memory: 256Mi
  limits:
    cpu: 500m
    memory: 2Gi
```

Writing a Deployment Spec - Volumes

Volumes are mounted to pods at a specified filesystem location, accessible to the containers in a pod

To use a volume, a Pod specifies what volumes to provide for the Pod (the `.spec.volumes` field) and where to mount those into Containers

Lots of different volume types are available

Extensive list found here

<https://kubernetes.io/docs/concepts/storage/volumes/#types-of-volumes>

```
<container-spec>
...
  volumeMounts:
    - name: default-certificate
      readOnly: true
      mountPath: /etc/pki/tls/private
    - name: metrics-certs
      readOnly: true
      mountPath: /etc/pki/tls/metrics-certs
  volumes:
    - name: default-certificate
      secret:
        secretName: router-certs-default
        defaultMode: 420
    - name: metrics-certs
      secret:
        secretName: router-metrics-certs-default
        defaultMode: 420
```

Writing a Deployment Spec – Taints and Tolerations

Node taints repel pods that do not contain the right tolerations

Pod tolerations allow the pods to be scheduled to nodes matching the node's taints

Use Cases:

Dedicated Nodes – Assign a dedicated set of nodes for a group of users

Nodes with special hardware – Useful for pods that need specialised hardware such as GPU's

```
tolerations:  
  - key: node-role.kubernetes.io/master  
    operator: Exists  
    effect: NoSchedule  
  - key: node.kubernetes.io/unreachable  
    operator: Exists  
    effect: NoExecute  
    tolerationSeconds: 120  
  - key: node.kubernetes.io/not-reachable  
    operator: Exists  
    effect: NoExecute  
    tolerationSeconds: 120
```

Creating ConfigMaps

Can be created from literal strings, files or whole directories

```
# Get the files
wget https://kubernetes.io/examples/configmap/game.properties -O configmaps/game.properties
wget https://kubernetes.io/examples/configmap/ui.properties -O configmaps/ui.properties

# Create the configmap from the files in the directory
oc create configmap game-config --from-file=configmaps/
```

```
apiVersion: v1
kind: ConfigMap
metadata:
  creationTimestamp: 2016-02-18T18:52:05Z
  name: game-config
  namespace: default
  resourceVersion: "516"
  uid: b4952dc3-d670-11e5-8cd0-68f728db1985
data:
  game.properties: |
    enemies=aliens
    lives=3
    enemies.cheat=true
    enemies.cheat.level=noGoodRotten
    secret.code.passphrase=UUDDLRLRBABAS
    secret.code.allowed=true
    secret.code.lives=30
  ui.properties: |
    color.good=purple
    color.bad=yellow
    allow.textmode=true
    how.nice.to.look=fairlyNice
```

Creating Secrets

```
oc -n default create secret generic mysecret  
--from-literal=username=admin --from-literal=password=1f2d1e2e67df
```

```
apiVersion: v1  
kind: Secret  
metadata:  
  name: mysecret  
type: Opaque  
data:  
  username: YWRtaW4=  
  password: MWYyZDFlMmU2N2Rm
```

Creating Services

Services expose application ports defined in the pod spec

```
oc expose deployment mydeploy
```

```
apiVersion: v1
kind: Service
metadata:
  name: my-service
spec:
  selector:
    app: MyApp
  ports:
    - protocol: TCP
      port: 80
      targetPort: 9376
```

Creating Routes

Routes expose services to the outside world through the OpenShift Router

```
oc expose service my-service
```

```
kind: Route
apiVersion: route.openshift.io/v1
metadata:
  name: my-route
spec:
  host: my-app.apps.ocp4.os.fyre.ibm.com
  to:
    kind: Service
    name: my-service
    weight: 100
  tls:
    termination: passthrough
    insecureEdgeTerminationPolicy: Redirect
    wildcardPolicy: None
```

Application High Availability

Applications in OpenShift are naturally highly-available!

Need to update an application?

Rolling updates

If a whole node fails?

Move the pods to another node

If a pod fails?

Restart it

Demo – Creating a simple OpenShift application

Lab – Creating an OpenShift Application

Visit <https://github.com/lfloris/openshift-bootcamp/tree/master> for lab materials

Go to Lab 2

Goals

Create and deploy a simple MariaDB application that uses ConfigMaps and Secrets

Create and deploy a simple WebSphere Liberty application that is exposed using a Route

Lab – A more complex WordPress application

Visit <https://github.com/lfloris/openshift-bootcamp/tree/master> for lab materials

Go to Lab 3

Goals

Develop a more complicated 2 tier OpenShift application with a front end and a back end

Questions or Discussions?

Welcome to the IBM Presentation Template

IBM Arial variant

About this template

This template is a living document that will be upgraded on an ongoing basis. Please check for updates prior to each use of this template to ensure you are using the latest version.

- The layouts are grouped by background color: black and light gray. Each group uses this [color palette](#).
- The sample slides demonstrate ways to apply some of the layouts in the template.
- Please be sure to remove unnecessary slides and replace all generic content with your own. (You may remove an entire section of slides by selecting the section title and clicking “delete.”)
- Contact IBM Brand to ensure you have the most recent version of the template or to get answers to questions you might have.
- Do not create your own template.

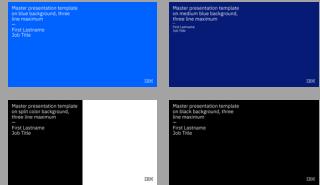
Master pages

Use master pages to ensure consistency throughout your presentation.

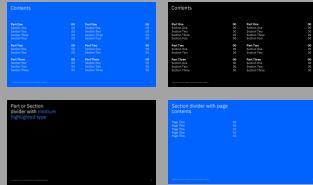
- With the variety of layout solutions, one or more layouts should work to showcase your content.
- Using this template will help avoid overly dense pages and fonts that are unreadable. This will present a more unified look across presentations.
- Master layouts are grouped by background color: black and light gray.
- Each master group includes 32 page designs for you to choose from.

Master slide types/categories

Covers



Contents/dividers



Text/image



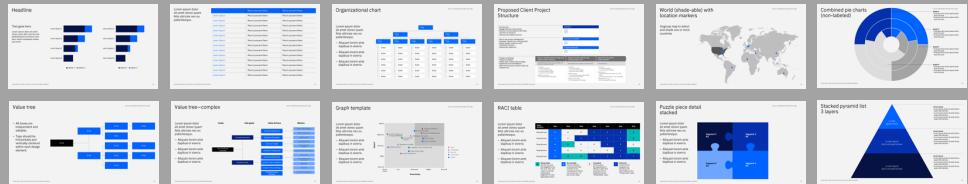
Color blocks



Case studies



Charts/tables



Background colors

You may choose from four background color options: black, blue, light gray and white.

- Black and light gray are the main background colors for on-screen presentations. Blue may be used for section dividers, large text layouts, and quotes. White should be used sparingly or in instances when you'll be printing the presentation.
- To change the background color, go to the Design tab in the toolbar and click on the “Format Background” button. From there you can edit the background color.
- Select “Apply to All” to change the background color of your entire presentation.

Guides and page grid for alignment

This template uses guides and this grid to ensure consistent placement of elements, including type, charts and imagery.

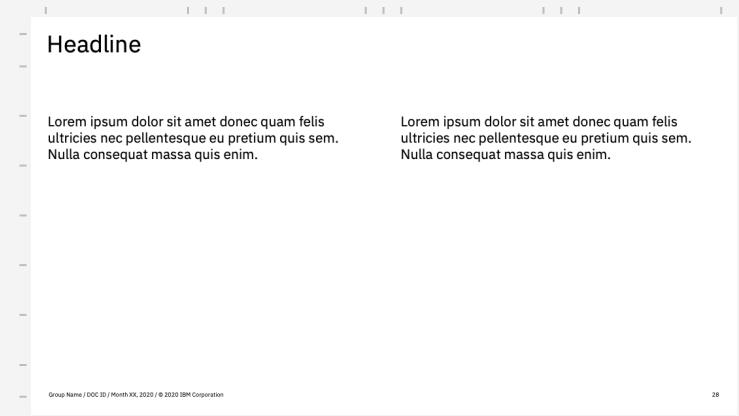
- To turn guides on and off go to the “View” tab and check “Guides.” You may also activate the context menu (right-click) from any slide, then select Guides from the Grid and Guides submenu.
- To use as a guide, copy this grid into the master slide or onto individual page layouts
- Use the magenta rule at the top of this text box as the main hangline for all content.
- Users may customize the color of this reproducible grid.

Tick marks

Light gray tick marks have been placed on the outside edge of the slide to help you quickly place items without having to turn the guides on and off. They will not print or be seen during slideshow mode.

You may change the color of tick marks by selecting them in the slide master and changing the shape outline color.

Once you are satisfied with your presentation layout, turn guides on to correctly align all of the elements with the guides.



Full color palette

The last page of this template contains the full IBM color palette for your reference.

Click here to [go to the color palette](#).

Color palette

Black R0 G0 B0 #000000	Magenta 100 R42 G10 B22 #2a0515	Magenta 90 R47 G10 B43 #57002b	Magenta 80 R118 G10 B58 #76033a	Magenta 70 R161 G50 B80 #a11950	Magenta 60 R209 G39 B101 #d12765	Magenta 50 R239 G39 B139 #e1538b	Magenta 40 R250 G17 B166 #f575a6	Magenta 30 R255 G16 B194 #ffac22	Magenta 20 R255 G207 B225 #ffccf1	Magenta 10 R255 G240 B246 #fffbf6	White R255 G255 B255 #ffffff
Purple 100 R30 G14 B51 #1e1033	Purple 90 R56 G20 B107 #38146b	Purple 80 R79 G33 B150 #4f2196	Purple 70 R110 G50 B201 #6e32c9	Purple 60 R159 G63 B252 #8a51fc	Purple 50 R199 G63 B252 #a661fa	Purple 40 R216 G110 B250 #ad66fa	Purple 30 R237 G142 B255 #b66eff	Purple 20 R230 G214 B255 #e6d6ff	Purple 10 R247 G241 B255 #f7f1ff		
Blue 100 R5 G13 B67 #051243	Blue 90 R8 G13 B128 #061280	Blue 80 R5 G48 B173 #0534a0	Blue 70 R5 G74 B218 #0554e0	Blue 60 R5 G74 B255 #0554e0	Blue 50 R64 G139 B252 #4088bc	Blue 40 R110 G166 B255 #6e6eff	Blue 30 R151 G193 B255 #97cfff	Blue 20 R201 G222 B255 #c9def1	Blue 10 R237 G244 B255 #e6d4ff		
Teal 100 R8 G26 B28 #0681a1c	Teal 90 R0 G49 B55 #003337	Teal 80 R0 G69 B72 #004548	Teal 70 R0 G97 B97 #006561	Teal 60 R0 G125 B121 #007f79	Teal 50 R0 G156 B152 #009c98	Teal 40 R0 G186 B182 #00bbbe	Teal 30 R32 G213 B210 #20dbd2	Teal 20 R146 G238 B238 #92eeee	Teal 10 R219 G251 B251 #dbfbfb		
Gray 100 R23 G23 B23 #171717	Gray 90 R40 G40 B40 #282828	Gray 80 R61 G61 B61 #3d3d3d	Gray 70 R86 G86 B86 #565656	Gray 60 R111 G111 G111 #6f6f6f	Gray 50 R140 G140 B140 #8cbc8c	Gray 40 R164 G164 B164 #a4a4a4	Gray 30 R190 G190 B190 #bebabe	Gray 20 R220 G220 B220 #dcdcdc	Gray 10 R243 G243 B243 #f3f3f3		
Cool Gray 100 R19 G23 B26 #13172a	Cool Gray 90 R36 G42 B46 #242426	Cool Gray 80 R55 G43 B66 #373442	Cool Gray 70 R80 G46 B91 #505659	Cool Gray 60 R105 G112 B119 #6f7f7f	Warm Gray 50 R143 G139 B139 #ff998b	Warm Gray 40 R167 G152 B162 #f7a2a2	Warm Gray 30 R193 G188 B187 #c1c1b9	Warm Gray 20 R224 G219 B218 #e0d9da	Warm Gray 10 R247 G243 B241 #f7f1f1		

Group Name / DOC ID / Month XX, 2020 / © 2020 IBM Corporation

70

Theme and custom colors

- All theme and custom colors are available for use in the color drop-down menu.

- The Theme Colors are the primary color set. Custom Colors include the full IBM palette for use as secondary colors, when needed.

- To apply one of these colors to your presentation do any of the following:

- Use the drop down menu and select the color of your choice.

- Copy the RGB value from the color palette and paste it into the color picker tool.

- Use the eyedropper tool.

Please note:
The color shades below Theme Colors and the colors labeled Standard Colors in PowerPoint are not approved IBM colors. They are default colors within the tool and are not customizable; they should not be used.

Standard Colors

Bulleted lists

The following bullet styles are recommended:

Text level one

– Bullet level one

• Bullet level two

– Bullet level three

» Bullet level four

- Use the **tab** key or the **Indent** button in the navigation menu/ribbon to create bulleted lists.
- Avoid using the Bullets button, which would apply default bullet styles to your text.



Editing footer information

These instructions allow you to edit all footers in your document with one change applied globally. This applies to built-in, templated pages only.

- Go to “Insert > Header and Footer...”
- In the pop-up window, type the desired information in the input labeled “Footer” and select the “Apply to All” button.
- Note that the “blank (no footer)” slide layout in each of the four master layouts has no footer information at all; this layout is for the use of complex full-bleed images that make footer information unreadable. When the full-bleed image does not diminish the legibility of the footer information, use the “blank (with footer)” slide layout instead.

Master presentation template on blue background, three line maximum

—
First Lastname
Job Title

- Do not place photos or images on cover pages.
- Please remove this information box before using this cover page.



Master presentation template on medium blue background, three line maximum

First Lastname
Job Title

- Do not place photos or images on cover pages.
- Please remove this information box before using this cover page.



Master presentation template on black background, three line maximum

First Lastname
Job Title

- Do not place photos or images on cover pages.
- Please remove this information box before using this cover page.



Master presentation template on split color background, three line maximum

First Lastname
Job Title

- Do not place photos or images on cover pages.
- Please remove this information box before using this cover page.



Contents

Part or Section
divider with medium
highlighted type

Section divider with page contents

Page Title	00

Section divider

Fact with small description acting
as headline or title of the page

84%

Fact with small description acting
as headline or title with image

1,459



Go simple
and big if
possible

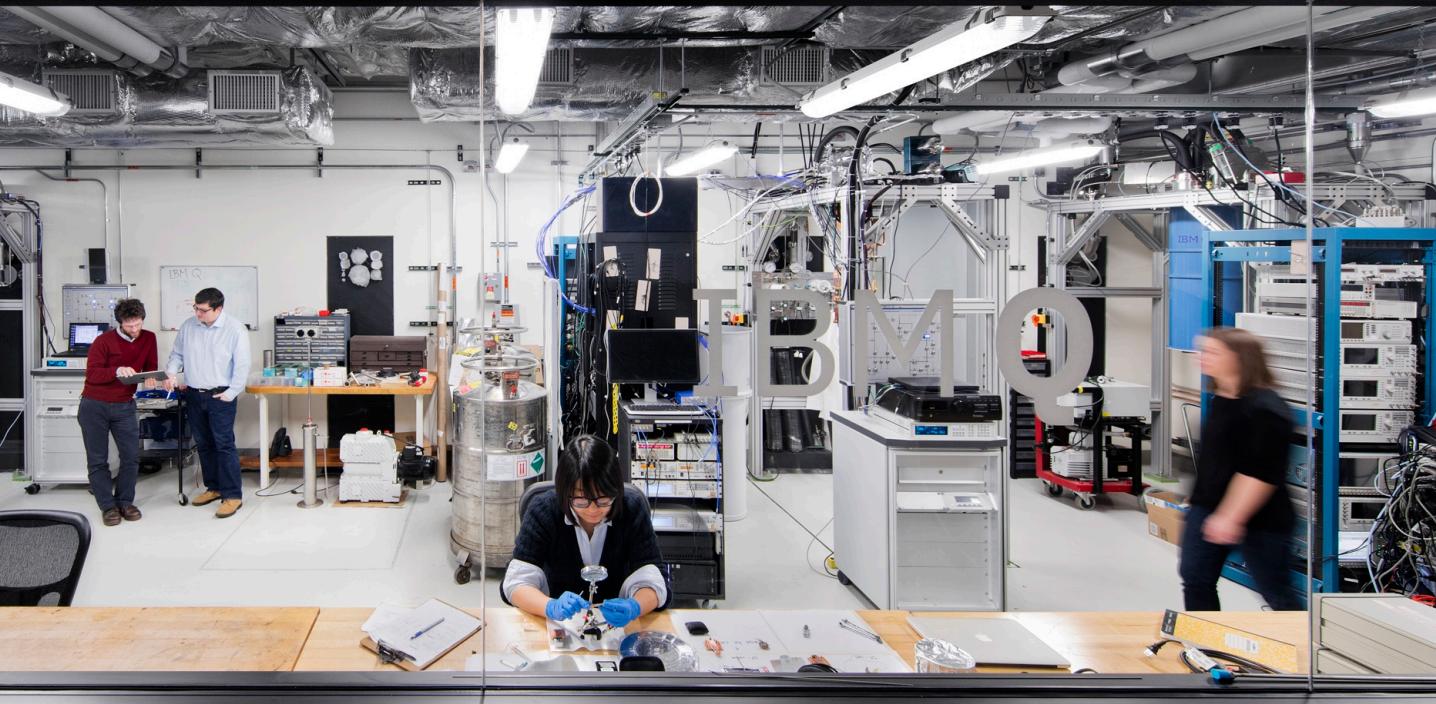
“Design is a plan for arranging elements in such a way as best to accomplish a particular purpose.”

Charles Eames

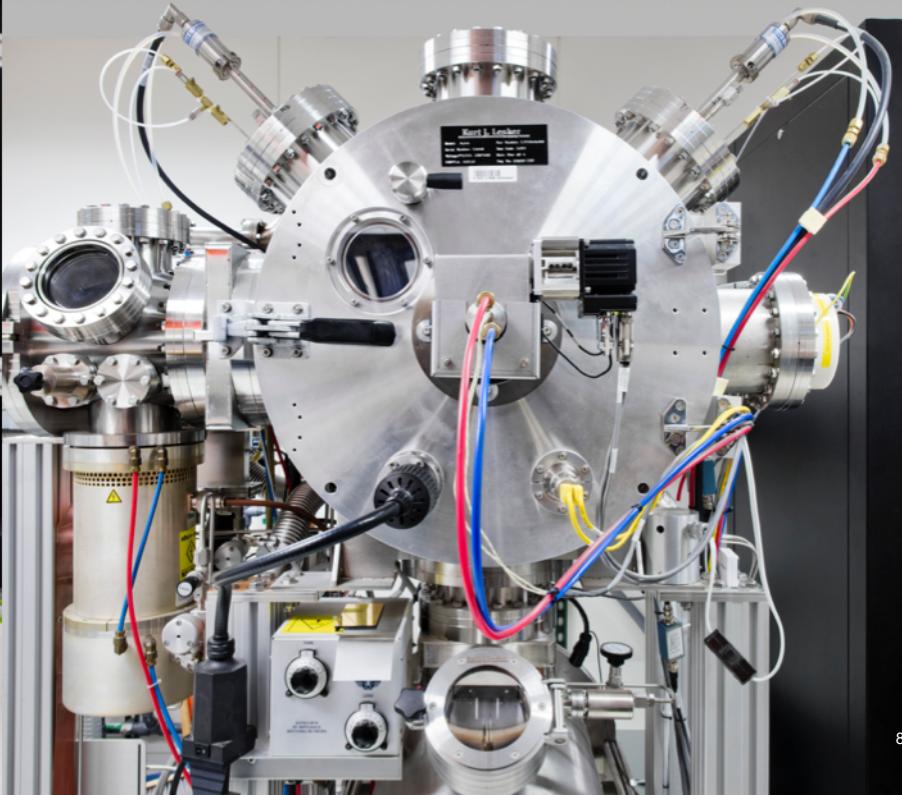
The Information Machine, 1964

IBM Q

*Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque pretium
quis sem.*



Text goes here lorem ipsum



Headline

Lorem ipsum dolor sit amet donec quam felis
ultricies nec pellentesque eu pretium quis sem.
Nulla consequat massa quis enim.

Headline

Lorem ipsum dolor sit amet donec quam felis
ultricies nec pellentesque eu pretium quis sem.
Nulla consequat massa quis enim.

Lorem ipsum dolor sit amet donec quam felis
ultricies nec pellentesque eu pretium quis sem.
Nulla consequat massa quis enim.

Headline

Text goes here

 Lorem ipsum dolor sit amet
 donec quam felis ultricies nec
 pellentesque eu pretium quis
 sem. Nulla consequat massa
 quis enim.

Headline

Lorem ipsum dolor sit amet donec quam felis
ultricies nec pellentesque eu pretium quis sem.
Nulla consequat massa quis enim.



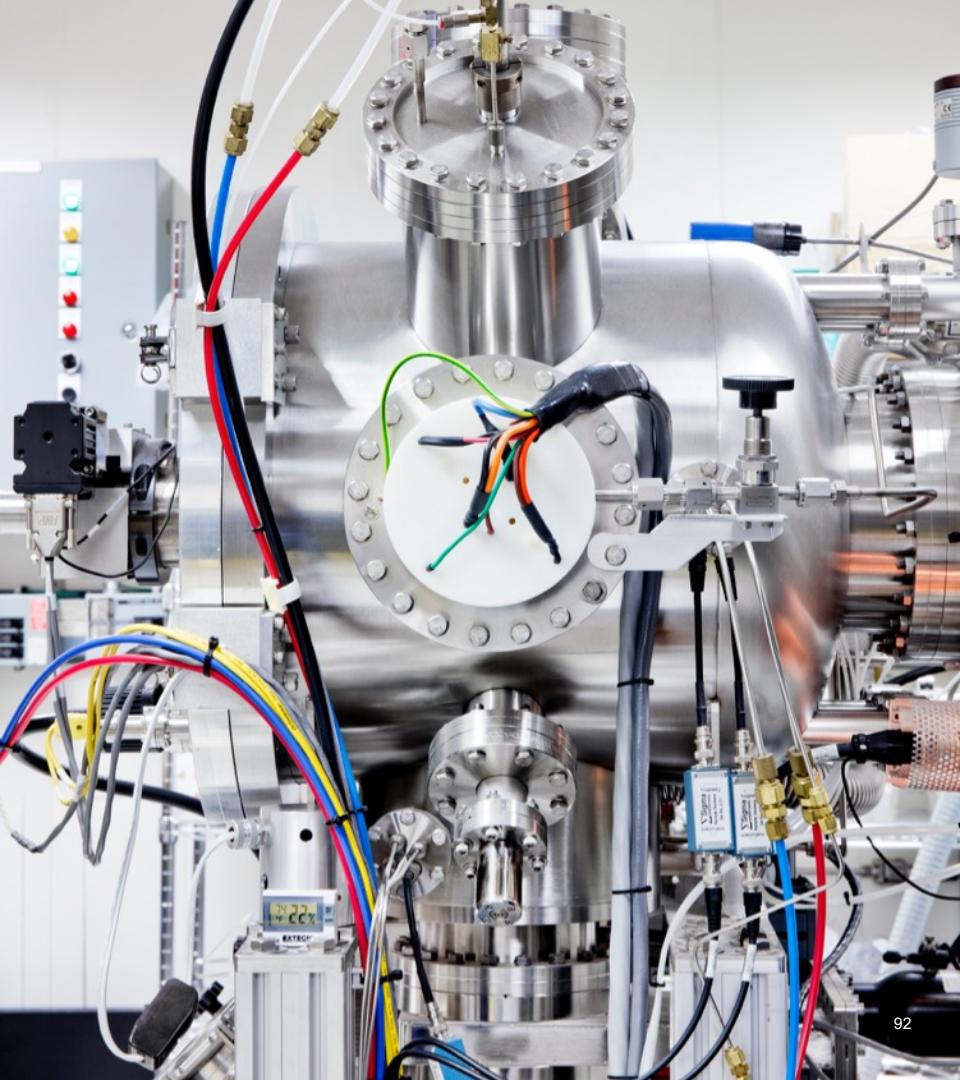
Headline

Text goes here

Lorem ipsum dolor sit amet donec quam felis ultricies nec pellentesque eu pretium quis sem. Nulla consequat massa quis enim.

Text goes here

Lorem ipsum dolor sit amet donec quam felis ultricies nec pellentesque eu pretium quis sem. Nulla consequat massa quis enim.



Headline

Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.

Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.

Headline

For a new generation of leaders—working at the intersection of strategy, creativity and technology to tackle the biggest business challenge:

Tomorrow.

Headline

Lorem ipsum dolor sit amet, Donec quam felis,
ultricies nec, pellentesque eu, pretium quis, sem.
Nulla consequat massa quis enim.

- Aliquam lorem ante dapibus in viverra quis feugiat
a tellus
- Aliquam lorem ante dapibus in viverra quis feugiat
a tellus
- Aliquam lorem ante dapibus in viverra quis feugiat
a tellus

Placeholder Text
Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.

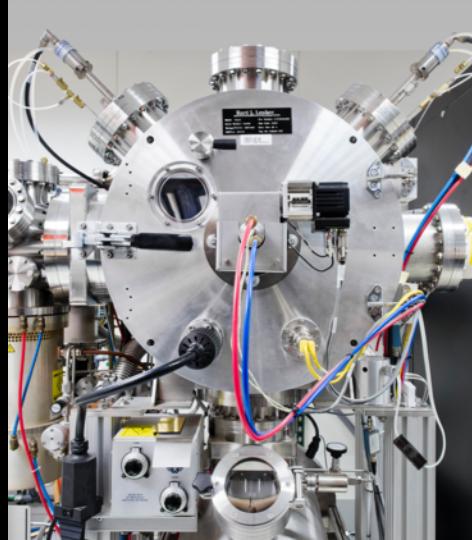
Placeholder Text
Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.

Placeholder Text
Lorem ipsum dolor sit amet donec quam felis
ultricies nec eu pellentesque pretium quis sem.
Nulla consequat massa quis enim.

Headline

Lorem ipsum dolor sit amet, Donec quam felis, ultricies nec, pellentesque eu, pretium quis, sem. Nulla consequat massa quis enim.

- Aliquam lorem ante dapibus in viverra quis feugiat a tellus
- Aliquam lorem ante dapibus in viverra quis feugiat a tellus
- Aliquam lorem ante dapibus in viverra quis feugiat a tellus



Lorem ipsum dolor sit amet donec quam felis ultricies nec eu pellentesque.



Lorem ipsum dolor sit amet donec quam felis ultricies nec eu pellentesque pretium quis sem. Nulla consequat massa quis enim.

Lorem ipsum dolor sit amet donec quam felis ultricies nec eu pellentesque.

Lorem ipsum dolor sit amet donec quam felis ultricies nec eu pellentesque.

Lorem ipsum dolor sit amet donec quam felis ultricies nec eu pellentesque pretium quis sem. Nulla consequat massa quis enim.

Lorem ipsum dolor sit amet donec quam felis ultricies nec eu pellentesque pretium quis sem. Nulla consequat massa quis enim.

Lorem ipsum dolor sit amet donec quam felis ultricies

**Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.**

**Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.**

**Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.**

**Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.**

Lorem ipsum dolor sit amet donec quam felis ultricies nec eu pellentesque.

- Aliquam lorem ante dapibus in viverra
- Aliquam lorem ante dapibus in viverra
- Aliquam lorem ante dapibus in viverra

Lorem ipsum dolor sit amet donec quam felis ultricies nec eu pellentesque.

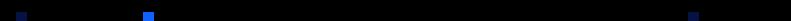
Lorem ipsum dolor sit amet donec quam felis ultricies nec eu pellentesque.

Lorem ipsum dolor sit amet donec quam felis ultricies nec eu pellentesque.

Headline

Text goes here

Lorem ipsum dolor sit amet
donec quam felis ultricies nec
pellentesque eu pretium quis
sem. Nulla consequat massa
quis enim.



**Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.**

Thank you

First Lastname

Job Title

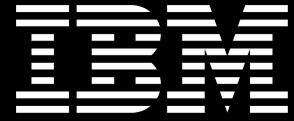
—

firstlastname@us.ibm.com

+1-555-555-5555

ibm.com

© Copyright IBM Corporation 2020. All rights reserved. The information contained in these materials is provided for informational purposes only, and is provided AS IS without warranty of any kind, express or implied. Any statement of direction represents IBM's current intent, is subject to change or withdrawal, and represent only goals and objectives. IBM, the IBM logo, and ibm.com are trademarks of IBM Corp., registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available at [Copyright and trademark information](#).



Case Study (option 1)

Text goes here lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed aliquet, arcu sed **180% tincidunt** tellus orci ullamcorper purus, eu sodales tellus berum quis magnate ntiorio.

Business problem

Fermentum core re conem id magnimus volupta tionem veniscillit abore, ipsandi tota se si autectiam quo to ommos debitio. Quiatem lani abo. Odit, nimusda esciis moluptatis est, omnis eat vendigento quunt valor apiciis suntiiscide eum.

Solution

Fermentum core re conem id magnimus volupta tionem veniscillit abore, ipsandi tota se si autectiam quo to ommos debitio. Quiatem lani abo. Odit, nimusda esciis moluptatis est, omnis eat vendigento quunt valor apiciis suntiiscide eum.



Case Study (option 2)

Text goes here lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed aliquet, arcu sed **180% tincidunt** tellus orci ullamcorper purus, eu sodales tellus berum quis magnate ntiorio.

Business problem

Fermentum core re conem id magnimus volupta tionem veniscillit abore, ipsandi tota se si autectiam quo to ommos debitio. Quiatem lani abo. Odit, nimusda esciis moluptatis est, omnis eat vendigento quunt valor apiciis suntiiscide eum.

Solution

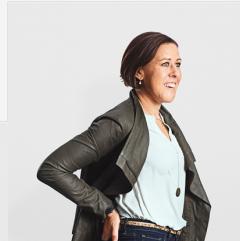
Fermentum core re conem id magnimus volupta tionem veniscillit abore, ipsandi tota se si autectiam quo to ommos debitio. Quiatem lani abo. Odit, nimusda esciis moluptatis est, omnis eat vendigento quunt valor apiciis suntiiscide eum.

“Us excepud igendamus et liquis apic totatemolori berum magnate ntiorio te omnis magnisit rem. Del mint quibus eleniet et optatem nonsecero.”

Volenda Sendent
Quiatem Lani Abo

The team

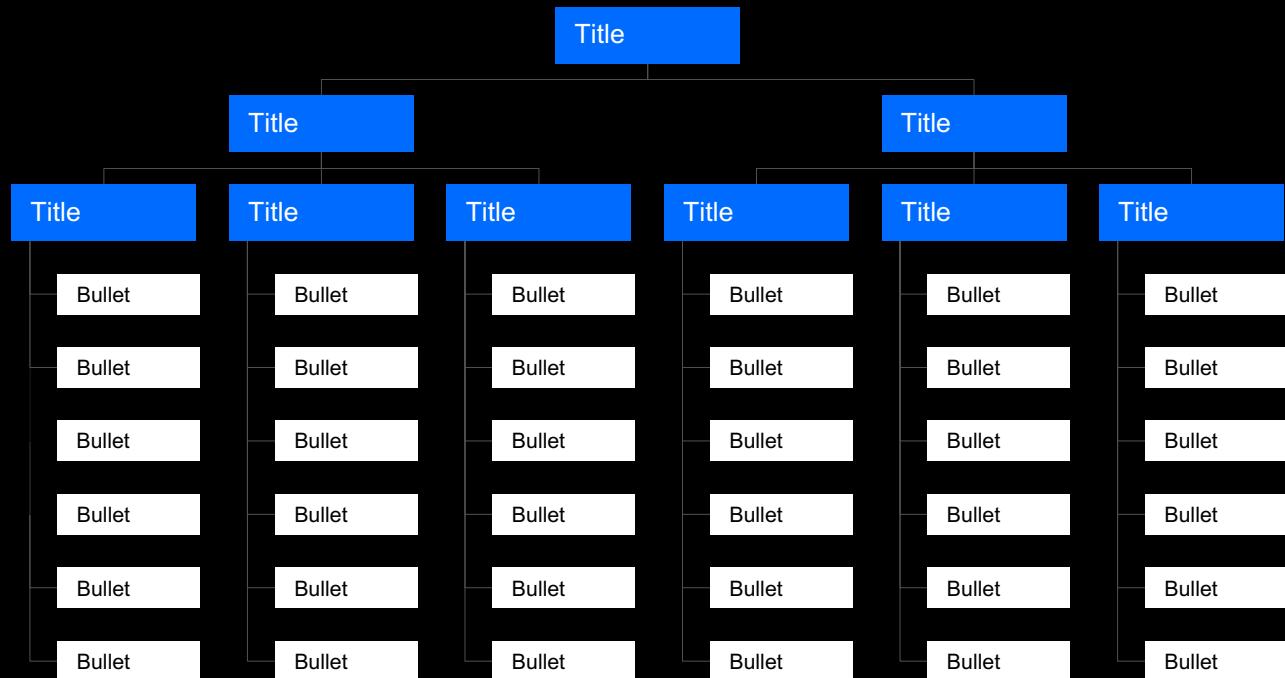
**Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.**



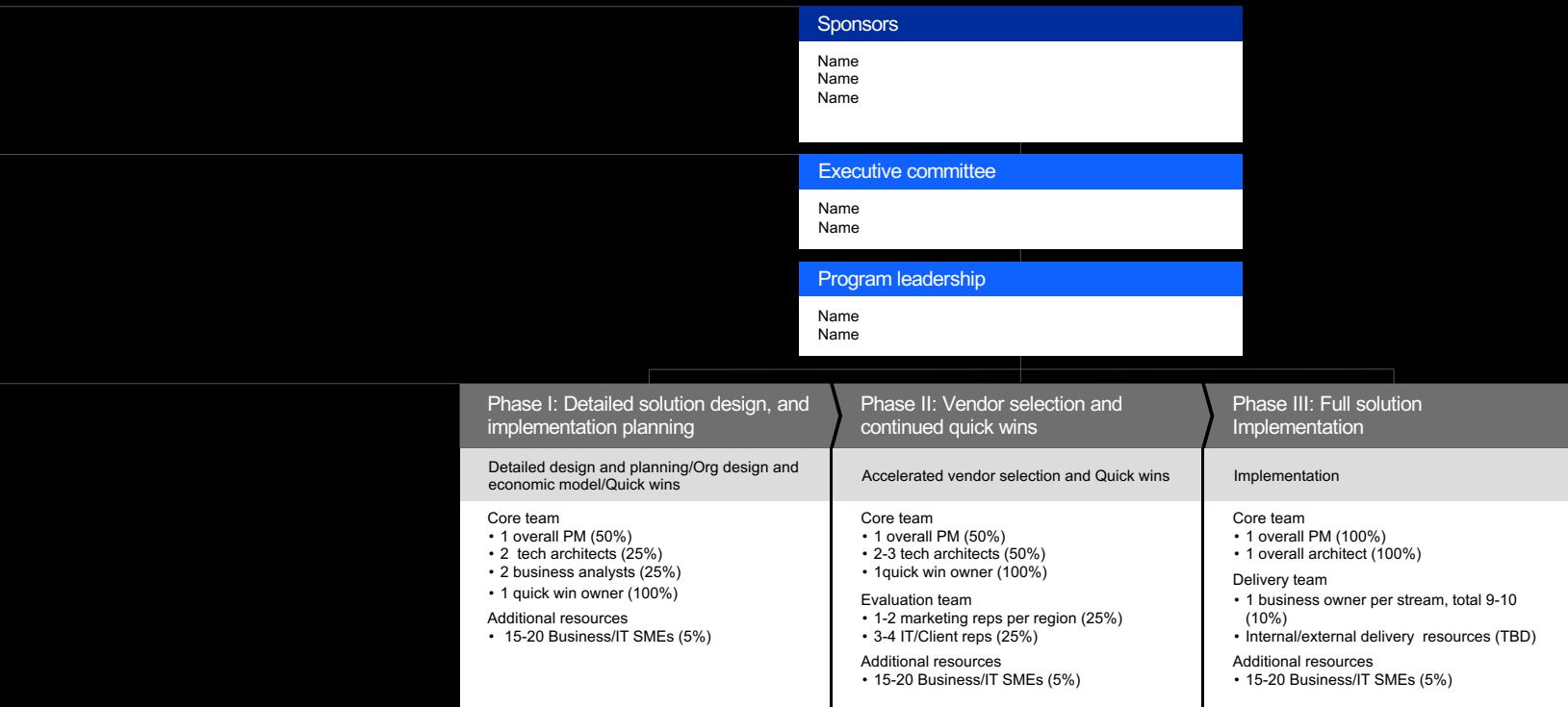
Organizational chart

Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.

- Aliquam lorem ante dapibus in viverra
- Aliquam lorem ante dapibus in viverra
- Aliquam lorem ante dapibus in viverra

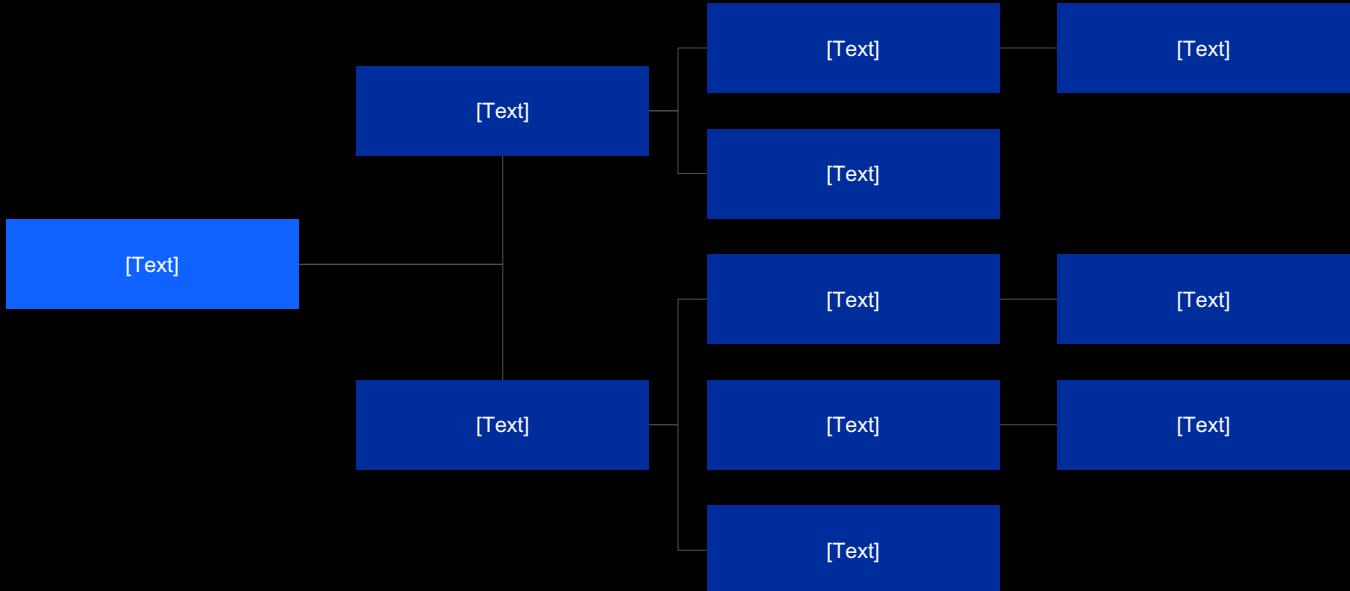


Proposed Client Project Structure



Value tree

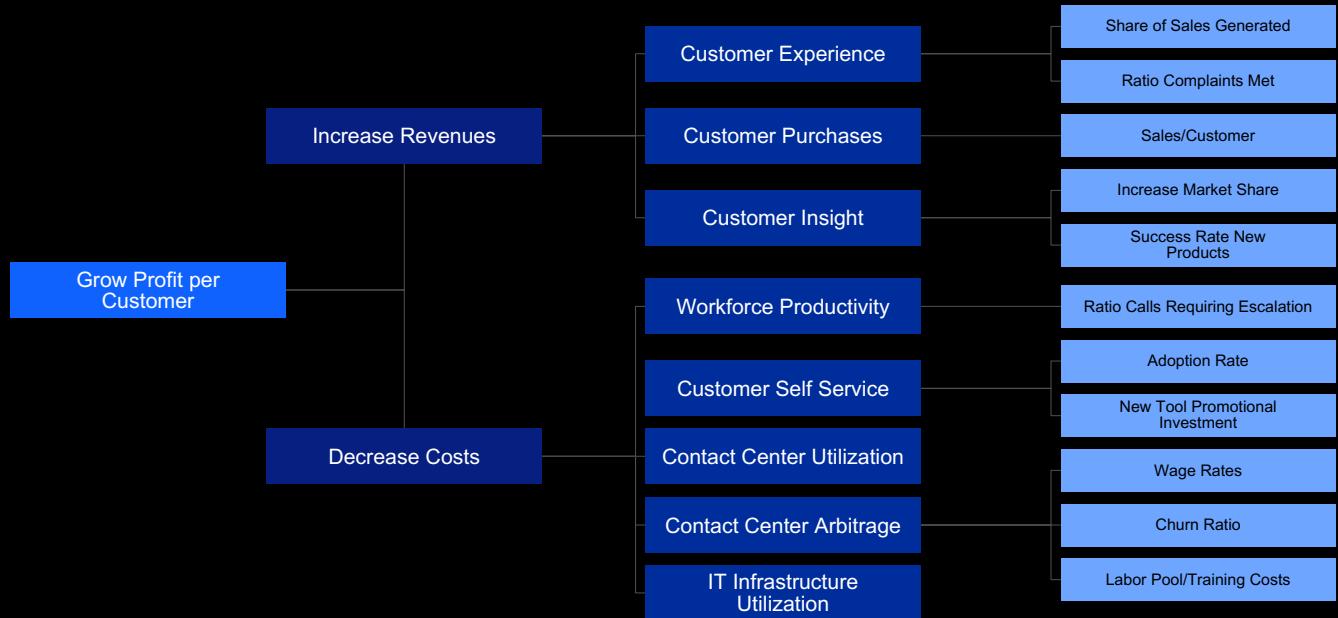
- All boxes are independent and editable.
- Type should be horizontally and vertically centered within each design element.



Value tree

Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.

- Aliquam lorem ante dapibus in viverra
- Aliquam lorem ante dapibus in viverra
- Aliquam lorem ante dapibus in viverra

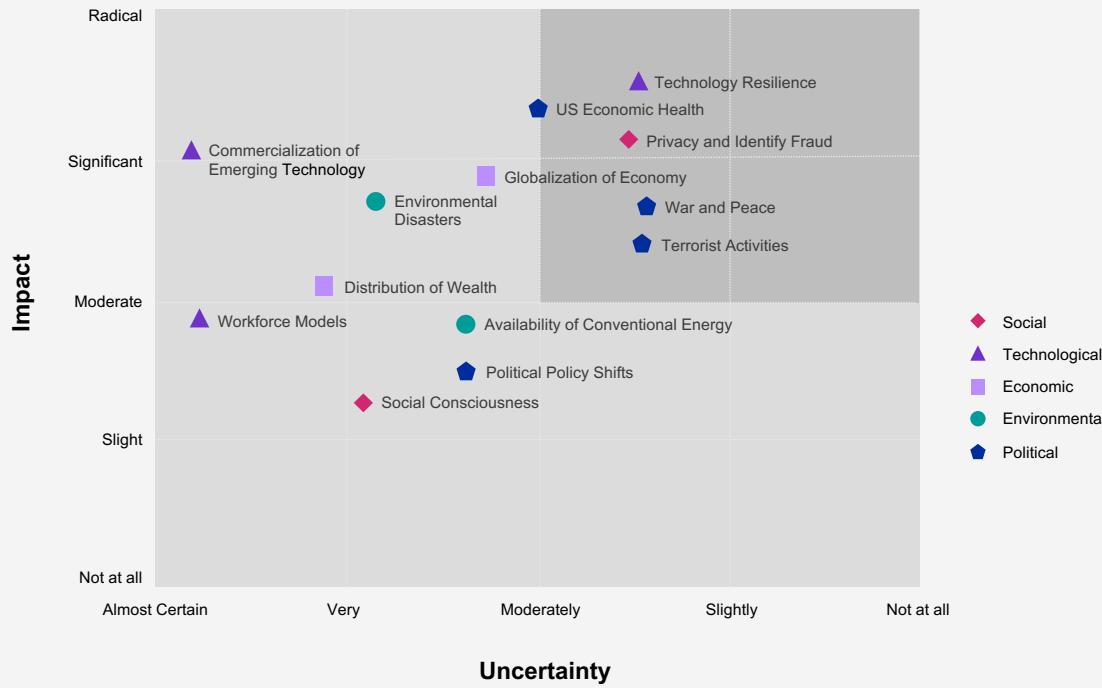


Graph template

Source: If applicable, describe source origin

**Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.**

- Aliquam lorem ante dapibus in viverra
- Aliquam lorem ante dapibus in viverra
- Aliquam lorem ante dapibus in viverra



RACI table

Step/ decision	Role						
	A			I	I	I	R
	A		I	I	I	I	R
	A	R			I	I	
	A					I	R
	A	R	R	I	I	I	I

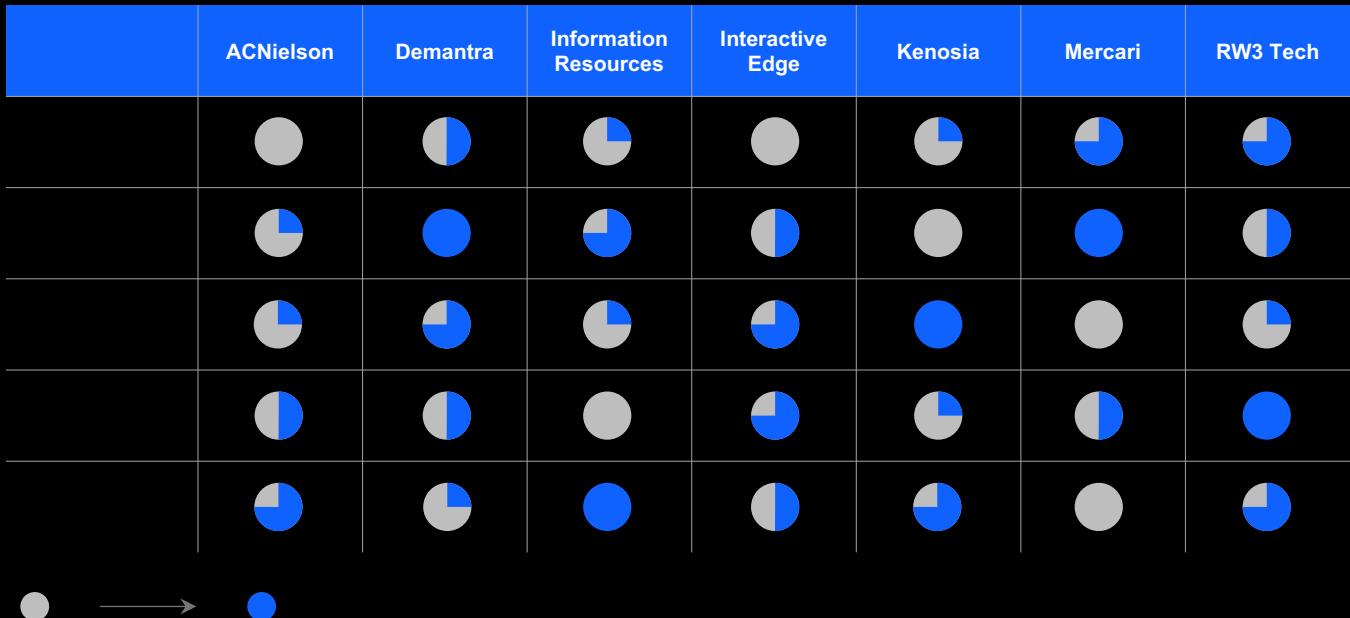
R

A

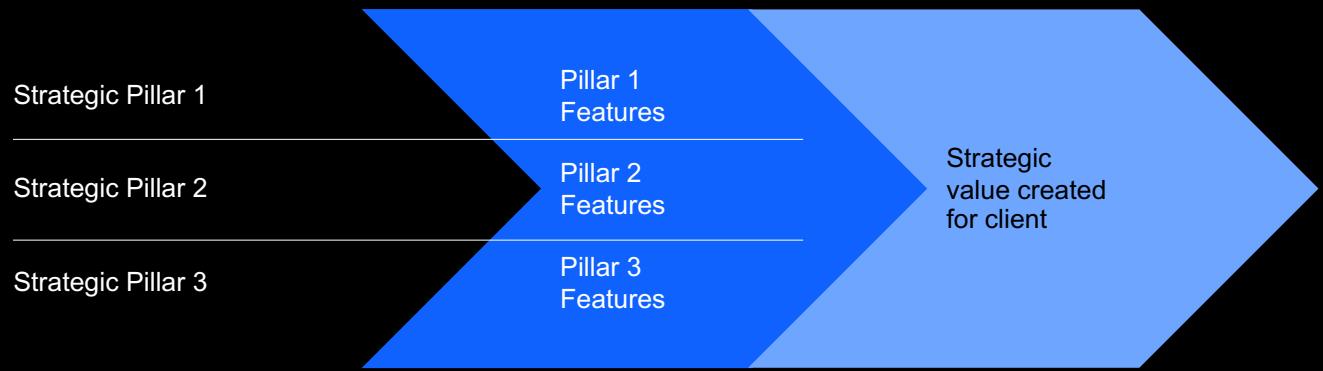
C

I

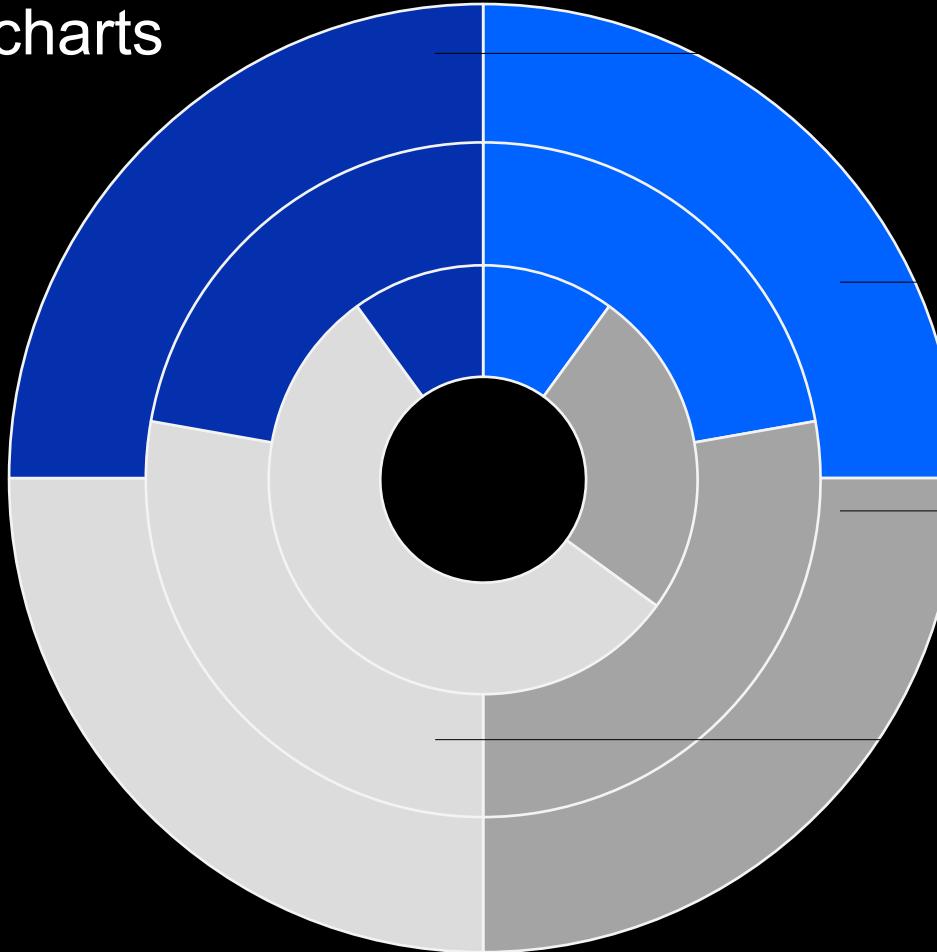
Portfolio matrix



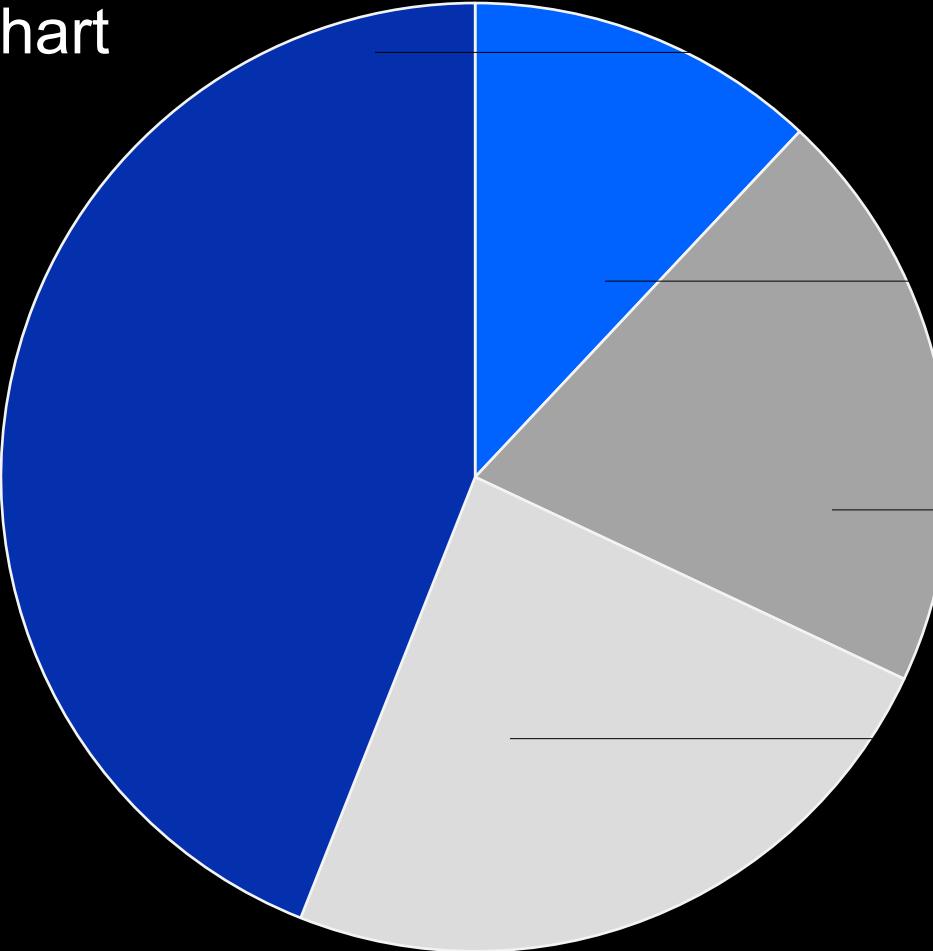
Strategy overview



Combined pie charts (non-labeled)



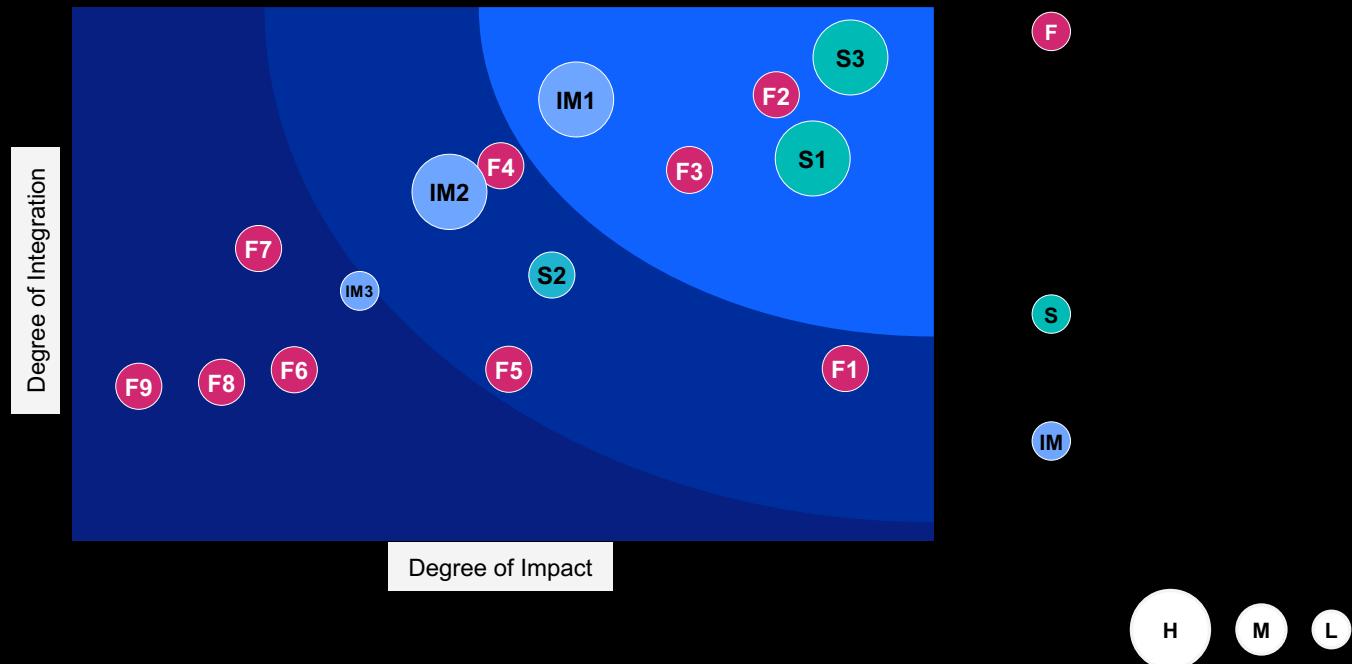
Simplified pie chart (non-labeled)



Opportunity prioritization matrix

Lore ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.

- Aliquam lorem ante dapibus in viverra
- Aliquam lorem ante dapibus in viverra
- Aliquam lorem ante dapibus in viverra



Performance health check framework

Purpose

A clearly articulated vision and mission that all staff and clients are aligned to.

Performance

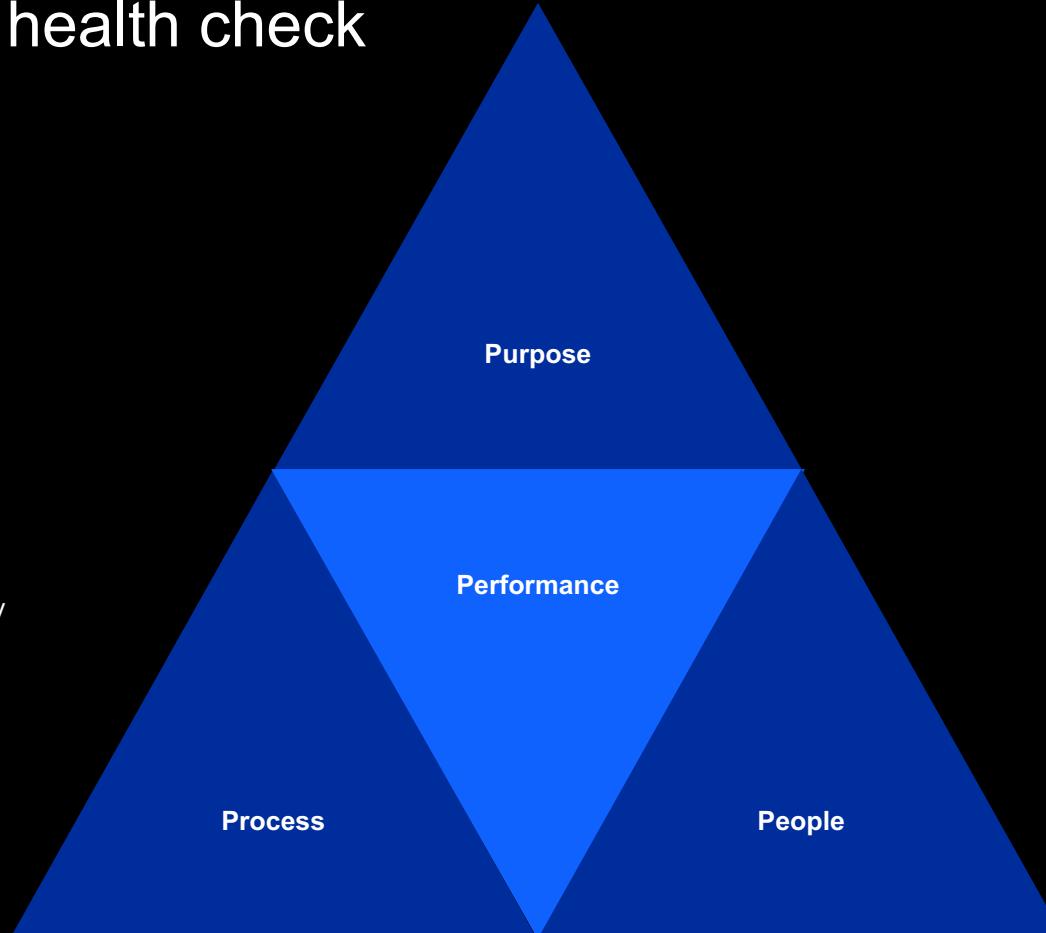
Mechanisms in place to plan and forecast workload, match capacity, and measure performance and feedback.

Process

Processes, tools and technology to support the organization's workflow.

People

An organizational structure that matches clients demands and facilitates collaboration and a culture that makes this the "best place to work."

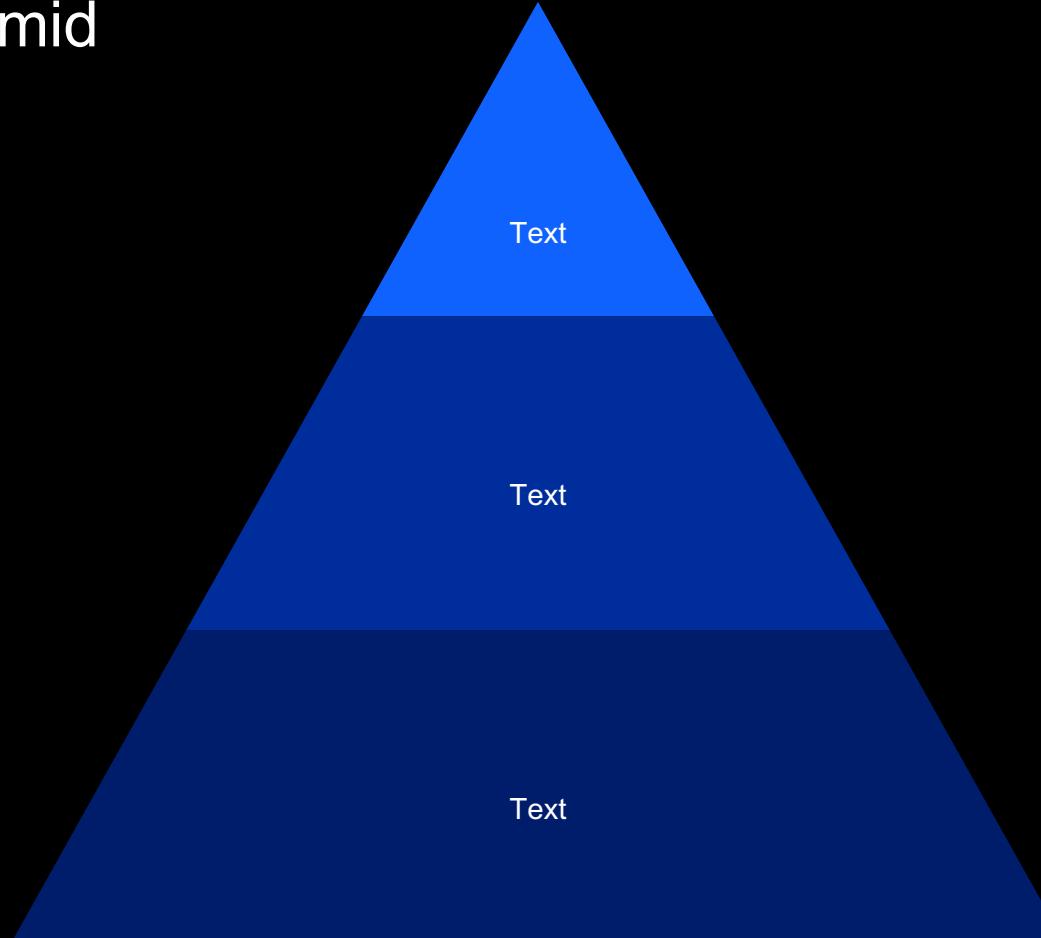


Stacked pyramid

3 layers

Lorem ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.

- Aliquam lorem ante
dapibus in viverra
- Aliquam lorem ante
dapibus in viverra
- Aliquam lorem ante
dapibus in viverra



Stacked pyramid list

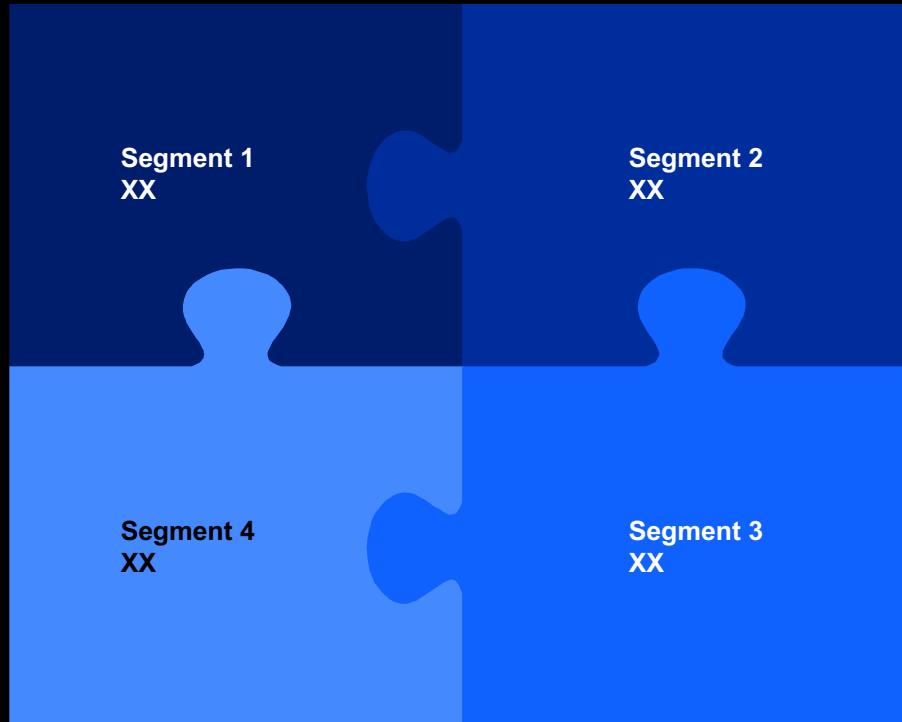
3 layers



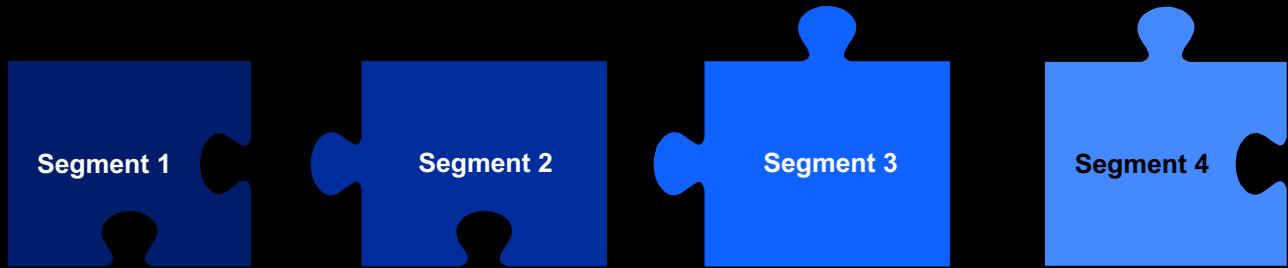
Puzzle piece detail stacked

Lore ipsum dolor
sit amet donec quam
felis ultricies nec eu
pellentesque.

- Aliquam lorem ante
dapibus in viverra
- Aliquam lorem ante
dapibus in viverra
- Aliquam lorem ante
dapibus in viverra

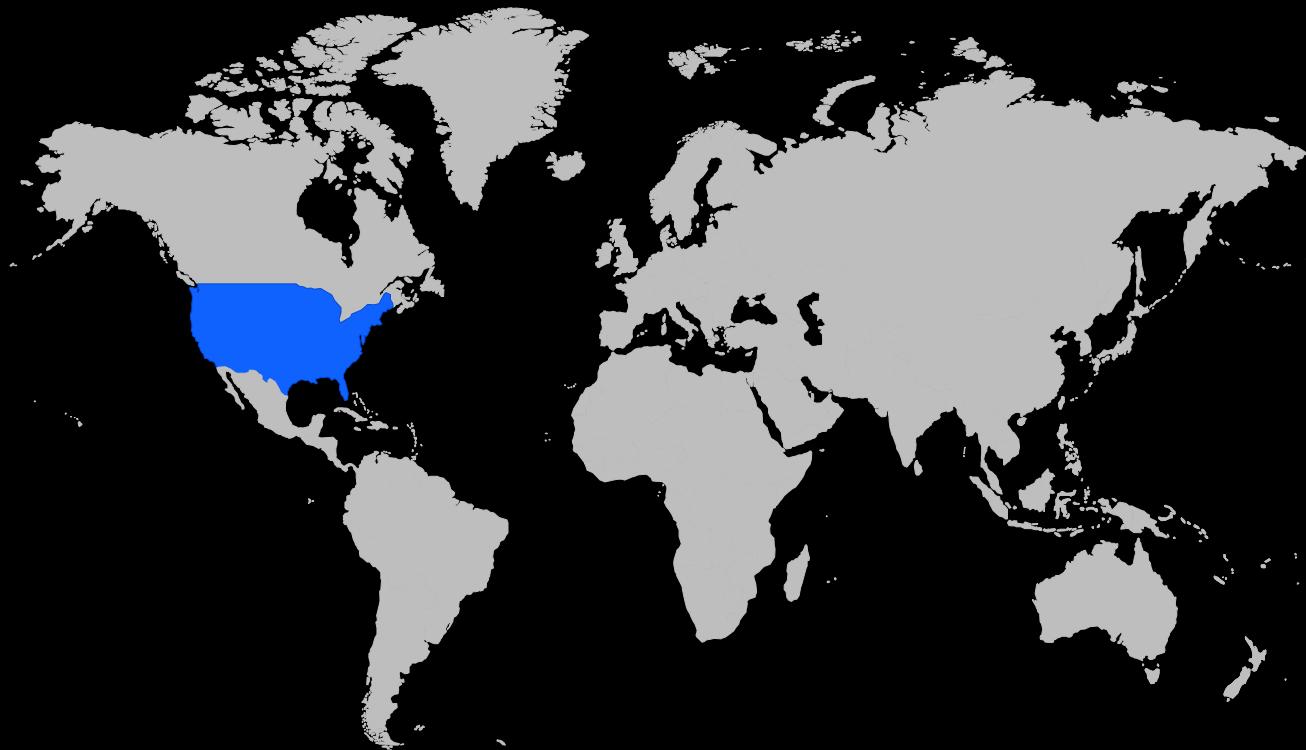


Puzzle piece detail horizontal



World (shade-able)

Ungroup map to select
and shade one or more
countries



World (shade-able) with location markers

Ungroup map to select
and shade one or more
countries

