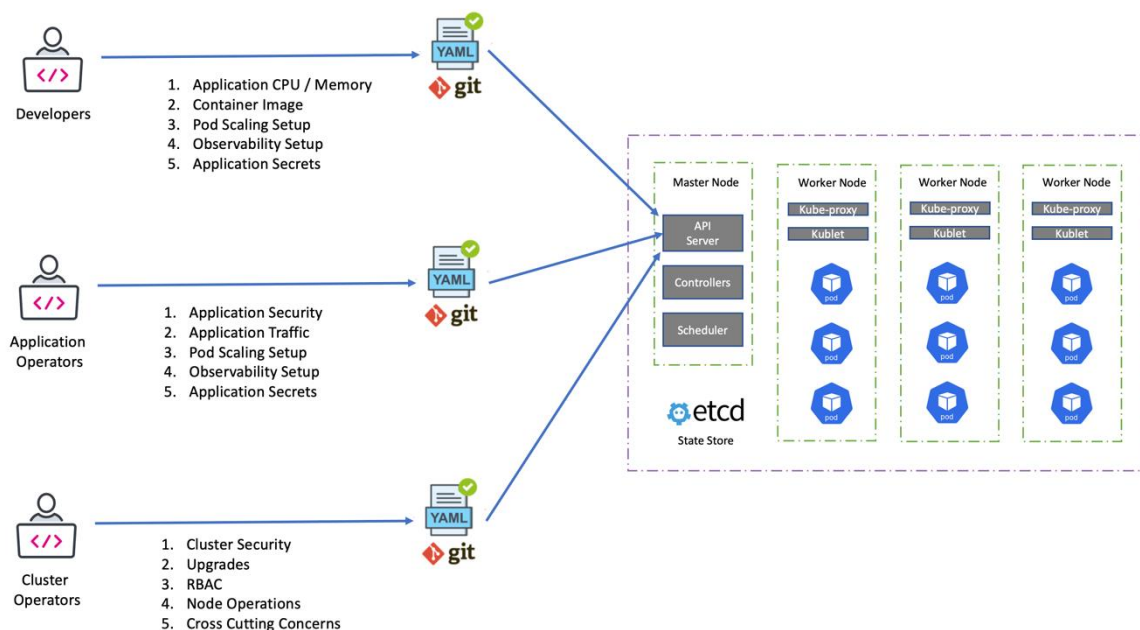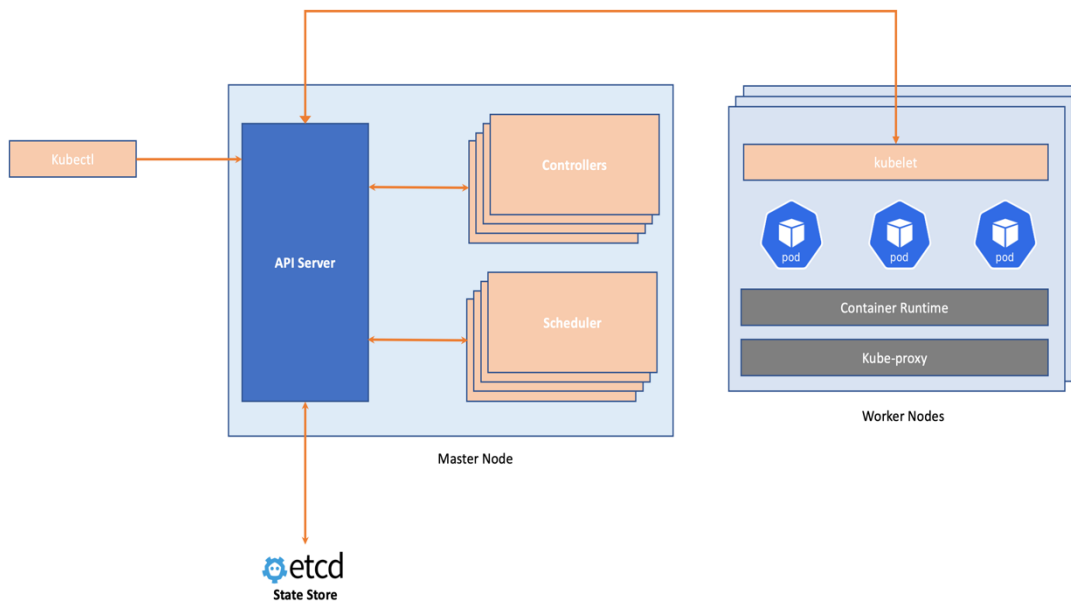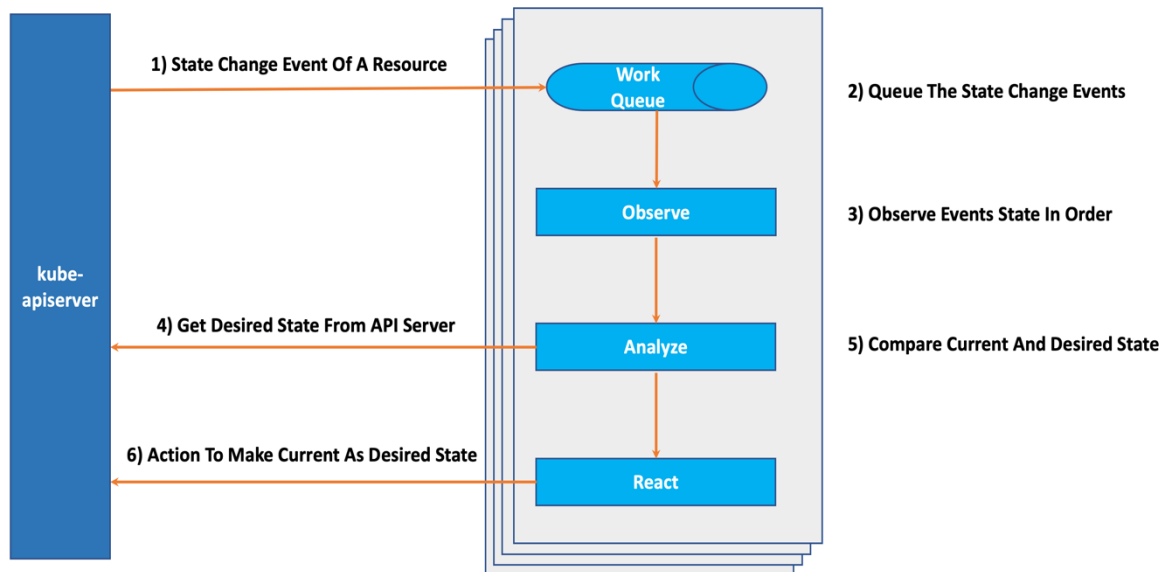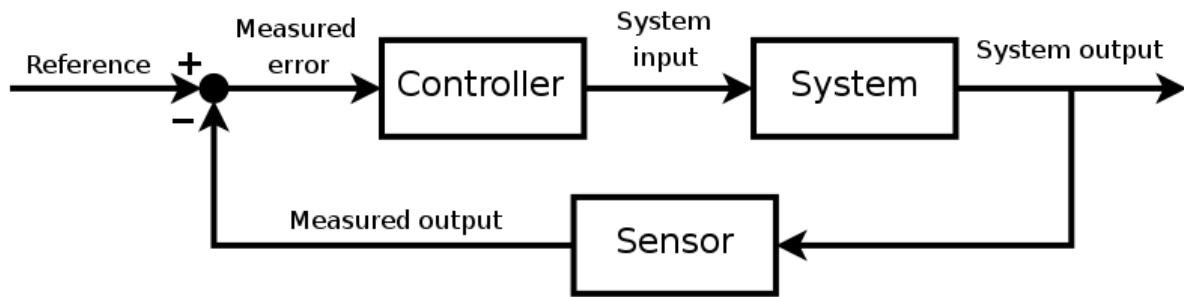# Chapter 1: Introducing the New Operating Model
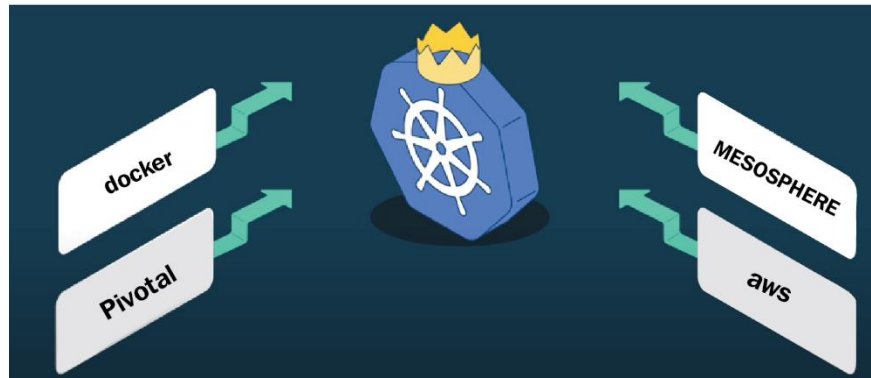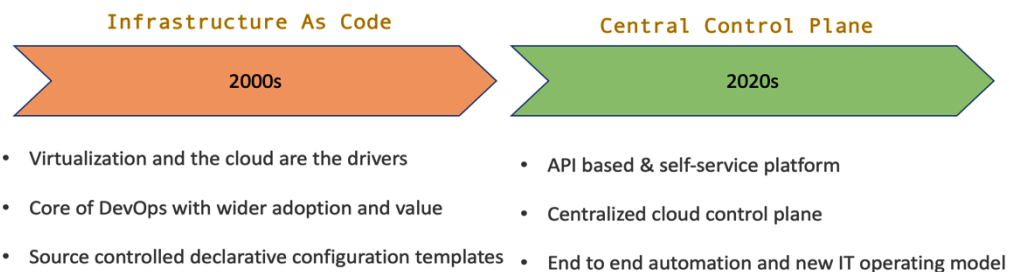


```
arunramakani@Aruns-MacBook-Pro ~ % kubectl api-resources --api-group=apps
NAME                    SHORTNAMES      APIVERSION      NAMESPACED      KIND
controllerrevisions                     apps/v1         true            ControllerRevision
daemonsets              ds              apps/v1         true            DaemonSet
deployments             deploy          apps/v1         true            Deployment
replicasets             rs              apps/v1         true            ReplicaSet
statefulsets            sts             apps/v1         true            StatefulSet
arunramakani@Aruns-MacBook-Pro ~ % kubectl api-resources --api-group=networking.k8s.io
NAME                    SHORTNAMES      APIVERSION              NAMESPACED      KIND
ingressclasses                          networking.k8s.io/v1    false           IngressClass
ingresses               ing             networking.k8s.io/v1    true            Ingress
networkpolicies         netpol          networking.k8s.io/v1    true            NetworkPolicy
```

Reference + Measured error → Controller → System input → System → System output

Measured output ← Sensor

kube-apiserver

1) State Change Event Of A Resource

Work Queue

2) Queue The State Change Events

Observe

3) Observe Events State In Order

4) Get Desired State From API Server

Analyze

5) Compare Current And Desired State

6) Action To Make Current As Desired State

React

Kubectl

API Server

Controllers

Scheduler

Master Node

kubelet

pod pod pod

Container Runtime

Kube-proxy

Worker Nodes

etcd

State Store

Chapter 2: Examining the State of Infrastructure Automation

Scripting

1990s

- Hardware purchase cycle was a barrier
- Low return on value and less adoption
- Imperative scripting driven by developers

Infrastructure As Code

2000s

- Virtualization and the cloud are the drivers
- Core of DevOps with wider adoption and value
- Source controlled declarative configuration templates

Product Teams

Platform Teams

Infrastructure Provisioning

APIs

Cross-Cutting Concerns

Policies

Control Plane

AWS

Google Cloud

Azure

Infrastructure As Code

2000s

- Virtualization and the cloud are the drivers
- Core of DevOps with wider adoption and value
- Source controlled declarative configuration templates

Central Control Plane

2020s

- API based & self-service platform
- Centralized cloud control plane
- End to end automation and new IT operating model

Kubectl

Extended
Crossplane APIs

API Server

Corssplane Custom
Controllers

K8S Cluster

etcd State Store

Google Cloud

Azure

aws

Amazon RDS AWS Lambda Amazon EC2 Amazon Cloudwatch

elastisearch Kong
neo4j CloudBees

Launched
2018
Crossplane

CNCF Donation
2020
CLOUD NATIVE
SANDBOX

CNCF Incubating
2021
Incubator
Project

• • •

Towards
Graduation

Chapter 3: Automating Infrastructure with Crossplane

Product Team

Platform Team

Consume XR claim APIs

Build new XR APIs

| XR and Claim APIs | Crossplane Platform APIs + MR, Provider Configuration APIs |

Azure Provider

GCP Provider

AWS Provider

XRD

Composite

Claim

Custom Controllers

CRD

MR - RDS

Policies + Infrastructure recipies

aws

Google Cloud

Azure

Platform & Product Team

K8S API Server

| XR and Claim APIs | Crossplane Platform APIs + MR, Provider Configuration APIs |

Azure Provider

GCP Provider

AWS Provider

XRD

Composite

Claim

Custom Controllers

CRD

MR - RDS

Policies + Infrastructure recipies

Crossplane Core

K8S Cluster

aws

Google Cloud

Azure

```
arunramakani@Aruns-MacBook-Pro ~ % kubectl version
Client Version: version.Info{Major:"1", Minor:"21", GitVersion:"v1.21.2", GitCommit:"092fbfbf53427de67cac1e9fa54aaa09a28371d7", GitTreeState:"clean"
, BuildDate:"2021-06-16T12:59:11Z", GoVersion:"go1.16.5", Compiler:"gc", Platform:"darwin/amd64"}
Server Version: version.Info{Major:"1", Minor:"21", GitVersion:"v1.21.1", GitCommit:"5e58841cce77d4bc13713ad2b91fa0d961e69192", GitTreeState:"clean"
, BuildDate:"2021-05-21T23:01:33Z", GoVersion:"go1.16.4", Compiler:"gc", Platform:"linux/amd64"}
arunramakani@Aruns-MacBook-Pro ~ % kubectl get nodes
NAME                STATUS   ROLES                  AGE    VERSION
kind-control-plane  Ready    control-plane,master   84d    v1.21.1
arunramakani@Aruns-MacBook-Pro ~ % kubectl cluster-info
Kubernetes control plane is running at https://127.0.0.1:55598
CoreDNS is running at https://127.0.0.1:55598/api/v1/namespaces/kube-system/services/kube-dns:dns/proxy

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.
arunramakani@Aruns-MacBook-Pro ~ %
```

```
arunramakani@Aruns-MacBook-Pro ~ % kubectl create namespace crossplane-system
namespace/crossplane-system created
arunramakani@Aruns-MacBook-Pro ~ % helm repo add crossplane-stable https://charts.crossplane.io/stable
"crossplane-stable" has been added to your repositories
arunramakani@Aruns-MacBook-Pro ~ % helm repo update
Hang tight while we grab the latest from your chart repositories...
...Successfully got an update from the "crossplane-stable" chart repository
Update Complete. *Happy Helming!*
arunramakani@Aruns-MacBook-Pro ~ % helm install crossplane --namespace crossplane-system crossplane-stable/crossplane
NAME: crossplane
LAST DEPLOYED: Sat Oct 30 22:36:59 2021
NAMESPACE: crossplane-system
STATUS: deployed
REVISION: 1
TEST SUITE: None
NOTES:
Release: crossplane

Chart Name: crossplane
Chart Description: Crossplane is an open source Kubernetes add-on that enables platform teams to assemble infrastructure from multiple vendors, and
expose higher level self-service APIs for application teams to consume.
Chart Version: 1.5.0
Chart Application Version: 1.5.0

Kube Version: v1.21.1
```

```
arunramakani@Aruns-MacBook-Pro ~ % kubectl get all -n crossplane-system
NAME                                         READY   STATUS    RESTARTS   AGE
pod/crossplane-6584bb9489-jbgd2              1/1     Running   0          14m
pod/crossplane-rbac-manager-856c9bb5df-6m5ss 1/1     Running   0          14m

NAME                                     READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/crossplane               1/1     1            1           14m
deployment.apps/crossplane-rbac-manager  1/1     1            1           14m

NAME                                              DESIRED   CURRENT   READY   AGE
replicaset.apps/crossplane-6584bb9489             1         1         1       14m
replicaset.apps/crossplane-rbac-manager-856c9bb5df 1        1         1       14m
arunramakani@Aruns-MacBook-Pro ~ % helm delete crossplane --namespace crossplane-system
release "crossplane" uninstalled
arunramakani@Aruns-MacBook-Pro ~ %
```
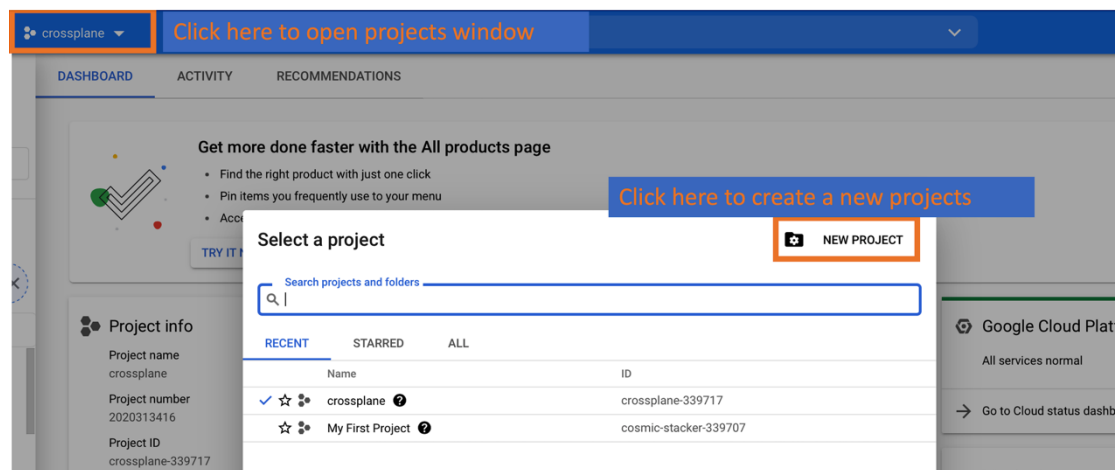


```
arunramakani@Aruns-MacBook-Pro ~ % gcloud services enable container.googleapis.com
Operation "operations/acf.p2-955276575103-dbeff1e8-c0a3-434c-b42a-1005a8dd8c43" finished successfully.
arunramakani@Aruns-MacBook-Pro ~ % gcloud services enable sqladmin.googleapis.com
Operation "operations/acf.p2-955276575103-a1c04a94-6e38-44e3-b6a4-559f95e9612b" finished successfully.
arunramakani@Aruns-MacBook-Pro ~ % gcloud services enable compute.googleapis.com
arunramakani@Aruns-MacBook-Pro ~ % gcloud services enable servicenetworking.googleapis.com
Operation "operations/acf.p2-955276575103-d30d32f0-0e45-4d10-afec-4d41b1f50b7a" finished successfully.
arunramakani@Aruns-MacBook-Pro ~ %
```

```
arunramakani@Aruns-MacBook-Pro Downloads % kubectl get all -n crossplane-system
NAME                                                READY  STATUS    RESTARTS   AGE
pod/crossplane-6584bb9489-vf7ln                     1/1    Running   1          15h
pod/crossplane-rbac-manager-856c9bb5df-kwtt9        1/1    Running   0          15h
pod/provider-gcp-3d69b3bf2649-578c98cf5f-w4565      1/1    Running   0          3m5s

NAME                                       READY  UP-TO-DATE  AVAILABLE  AGE
deployment.apps/crossplane                 1/1    1           1          15h
deployment.apps/crossplane-rbac-manager    1/1    1           1          15h
deployment.apps/provider-gcp-3d69b3bf2649  1/1    1           1          3m5s

NAME                                                   DESIRED  CURRENT  READY  AGE
replicaset.apps/crossplane-6584bb9489                  1        1        1      15h
replicaset.apps/crossplane-rbac-manager-856c9bb5df     1        1        1      15h
replicaset.apps/provider-gcp-3d69b3bf2649-578c98cf5f   1        1        1      3m5s
```

```
arunramakani@Aruns-MacBook-Pro Downloads % kubectl apply -f providerconfig.yaml
providerconfig.gcp.crossplane.io/gcp-credentials-project-1 created
arunramakani@Aruns-MacBook-Pro Downloads %
arunramakani@Aruns-MacBook-Pro Downloads %
arunramakani@Aruns-MacBook-Pro Downloads % kubectl get providerconfig
NAME                       PROJECT-ID          AGE
gcp-credentials-project-1  crossplane-330620   5m43s
```
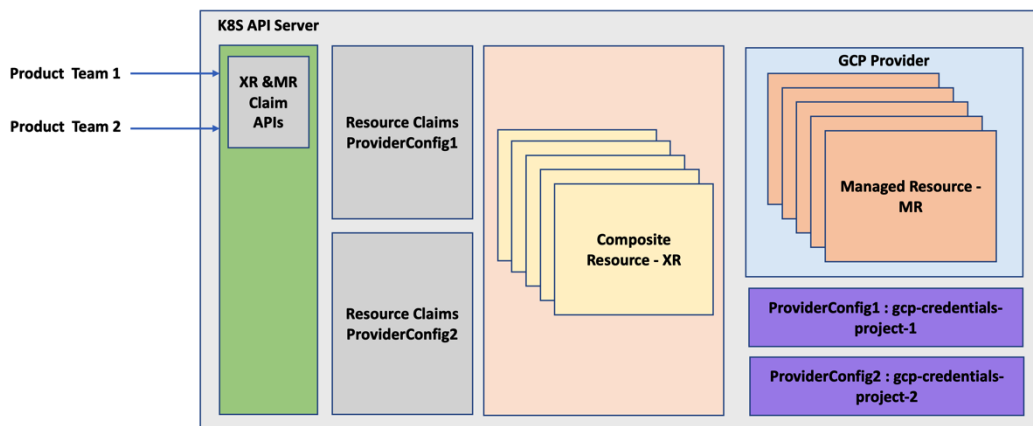


```
arunramakani@Aruns-MacBook-Pro Downloads % kubectl get CloudSQLInstance db-gcp
NAME     READY  SYNCED  STATE           VERSION       AGE
db-gcp   False  True    PENDING_CREATE  POSTGRES_9_6  83s
arunramakani@Aruns-MacBook-Pro Downloads % kubectl get CloudSQLInstance db-gcp
NAME     READY  SYNCED  STATE      VERSION       AGE
db-gcp   True   True    RUNNABLE   POSTGRES_9_6  15m
arunramakani@Aruns-MacBook-Pro Downloads % kubectl get secret db-conn -n crossplane-system
NAME      TYPE                               DATA  AGE
db-conn   connection.crossplane.io/v1alpha1  12    22m
```

```
arunramakani@Aruns-MacBook-Pro Downloads % kubectl get CloudSQLInstance db-gcp
NAME       READY     SYNCED    STATE            VERSION          AGE
db-gcp     False     False     MAINTENANCE      POSTGRES_9_6     40m
arunramakani@Aruns-MacBook-Pro Downloads % kubectl get CloudSQLInstance db-gcp
NAME       READY     SYNCED    STATE            VERSION          AGE
db-gcp     True      False     RUNNABLE         POSTGRES_9_6     41m
arunramakani@Aruns-MacBook-Pro Downloads % kubectl get CloudSQLInstance db-gcp
NAME       READY     SYNCED    STATE            VERSION          AGE
db-gcp     False     False     MAINTENANCE      POSTGRES_9_6     44m
arunramakani@Aruns-MacBook-Pro Downloads % kubectl get CloudSQLInstance db-gcp
NAME       READY     SYNCED    STATE            VERSION          AGE
db-gcp     True      False     RUNNABLE         POSTGRES_9_6     45m
arunramakani@Aruns-MacBook-Pro Downloads % kubectl get CloudSQLInstance db-gcp
NAME       READY     SYNCED    STATE            VERSION          AGE
db-gcp     True      False     RUNNABLE         POSTGRES_9_6     46m
```
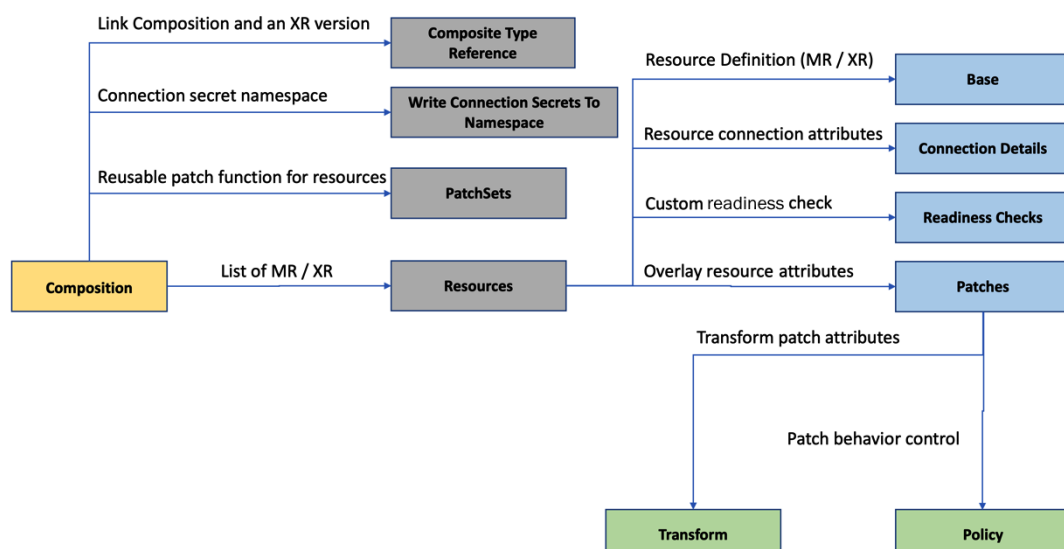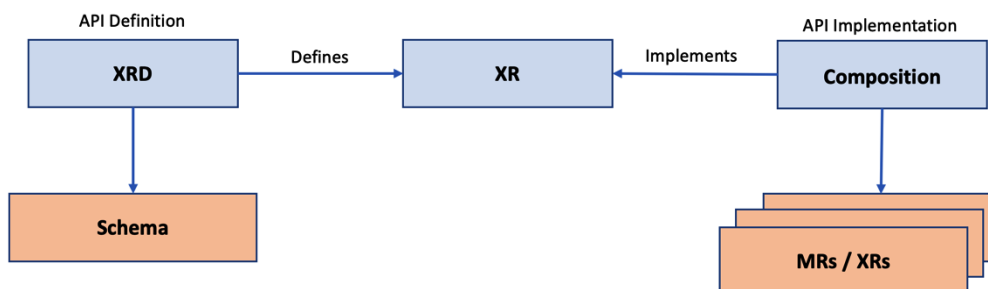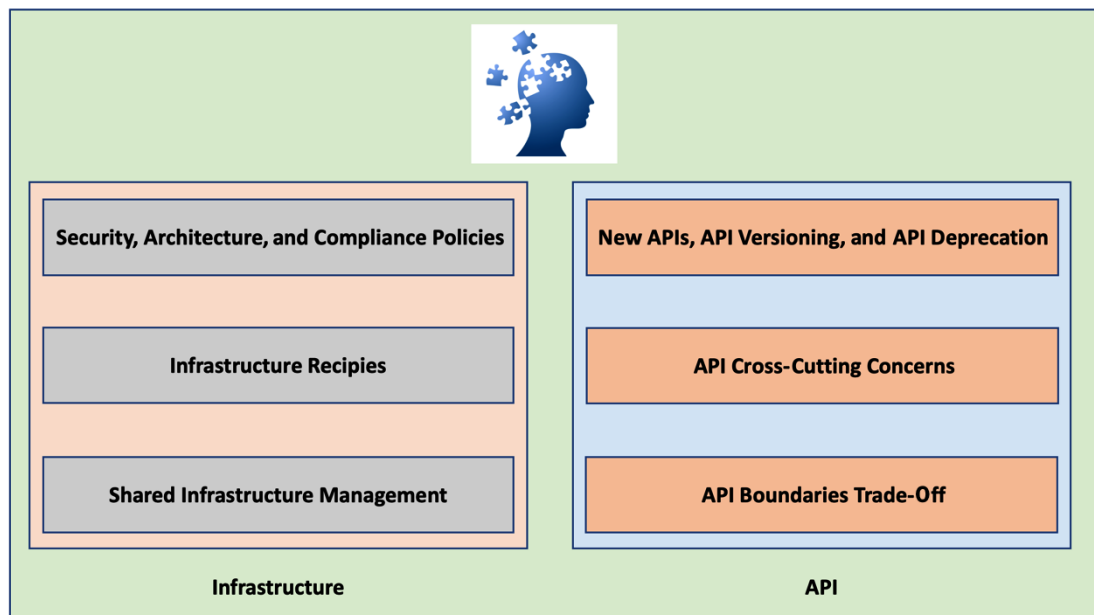
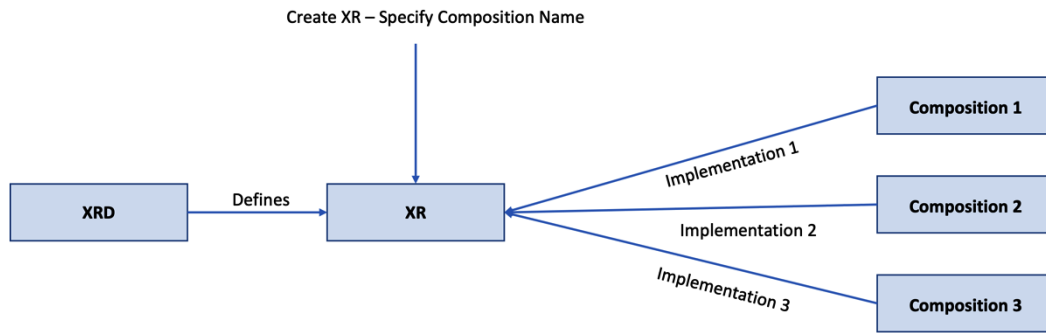```
arunramakani@Aruns-MacBook-Pro Downloads % kubectl get CloudSQLInstance db-gcp
NAME   READY   SYNCED   STATE   VERSION   AGE
db-gcp   True   True   RUNNABLE   POSTGRES_9_6   51m
arunramakani@Aruns-MacBook-Pro Downloads % kubectl delete CloudSQLInstance db-gcp
cloudsqlinstance.database.gcp.crossplane.io "db-gcp" deleted
```
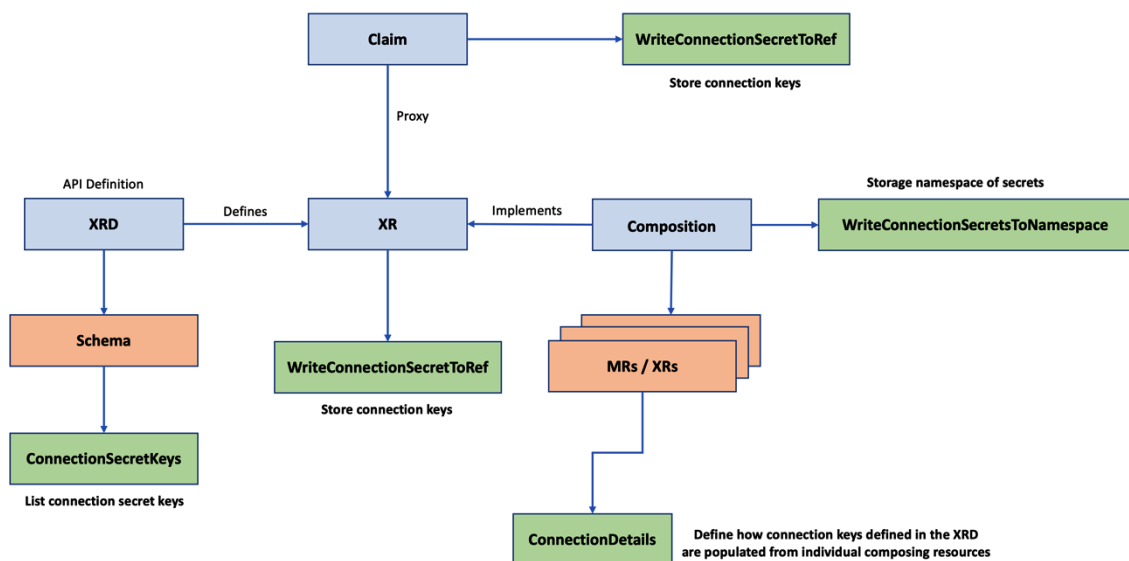
# Chapter 4: Composing Infrastructure with Crossplane



**Infrastructure**

- Security, Architecture, and Compliance Policies
- Infrastructure Recipies
- Shared Infrastructure Management

**API**

- New APIs, API Versioning, and API Deprecation
- API Cross-Cutting Concerns
- API Boundaries Trade-Off



API Definition

**XRD** — Defines → **XR** ← Implements — **Composition**

API Implementation

XRD → **Schema**

Composition → **MRs / XRs**



Link Composition and an XR version → **Composite Type Reference**

Connection secret namespace → **Write Connection Secrets To Namespace**

Reusable patch function for resources → **PatchSets**

**Composition** — List of MR / XR → **Resources**

Resource Definition (MR / XR) → **Base**

Resource connection attributes → **Connection Details**

Custom readiness check → **Readiness Checks**

Overlay resource attributes → **Patches**

Transform patch attributes

Patch behavior control

**Transform**   **Policy**

Create XR – Specify Composition Name

XRD —Defines→ XR

Implementation 1 → Composition 1

Implementation 2 → Composition 2

Implementation 3 → Composition 3

Namespace Scope (Product Team Use)

Claim

Proxy

Cluser Scope (Platform Team Use)

API Definition
XRD —Defines→ XR ←Implements— Composition    API Implementation

Schema

MRs / XRs

Claim —→ WriteConnectionSecretToRef

Store connection keys

Proxy

API Definition
XRD —Defines→ XR —Implements→ Composition —→ WriteConnectionSecretsToNamespace

Storage namespace of secrets

Schema

WriteConnectionSecretToRef

Store connection keys

MRs / XRs

ConnectionSecretKeys

List connection secret keys

ConnectionDetails    Define how connection keys defined in the XRD
are populated from individual composing resources

```
arunramakani@Aruns-MacBook-Pro gcpdb % kubectl get Network
NAME                            READY    SYNCED
alpha-beta-vpc-crossplane-ref   True     True
```

```
arunramakani@Aruns-MacBook-Pro gcpdb % kubectl apply -f xrd.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xgcpdbs.alpha-beta.imarunrk.com created
arunramakani@Aruns-MacBook-Pro gcpdb % kubectl get xrd
NAME                            ESTABLISHED   OFFERED   AGE
xgcpdbs.alpha-beta.imarunrk.com True          True      4s
```

```
arunramakani@Aruns-MacBook-Pro gcpdb % kubectl get composition
NAME        AGE
mysql       7s
postgres    41m
```

```
arunramakani@Aruns-MacBook-Pro gcpdb % kubectl get cloudsqlinstance
NAME                    READY    SYNCED    STATE       VERSION        AGE
mysql-db-lfqqw-tc4rh    True     True      RUNNABLE    MYSQL_5_7      5m47s
postgres-db-cvtnt-trcjg True     True      RUNNABLE    POSTGRES_9_6   95m
arunramakani@Aruns-MacBook-Pro gcpdb % kubectl get gcpdb -n alpha
NAME          READY    CONNECTION-SECRET    AGE
mysql-db      True     db-conn2             5m50s
postgres-db   True     db-conn              95m
```
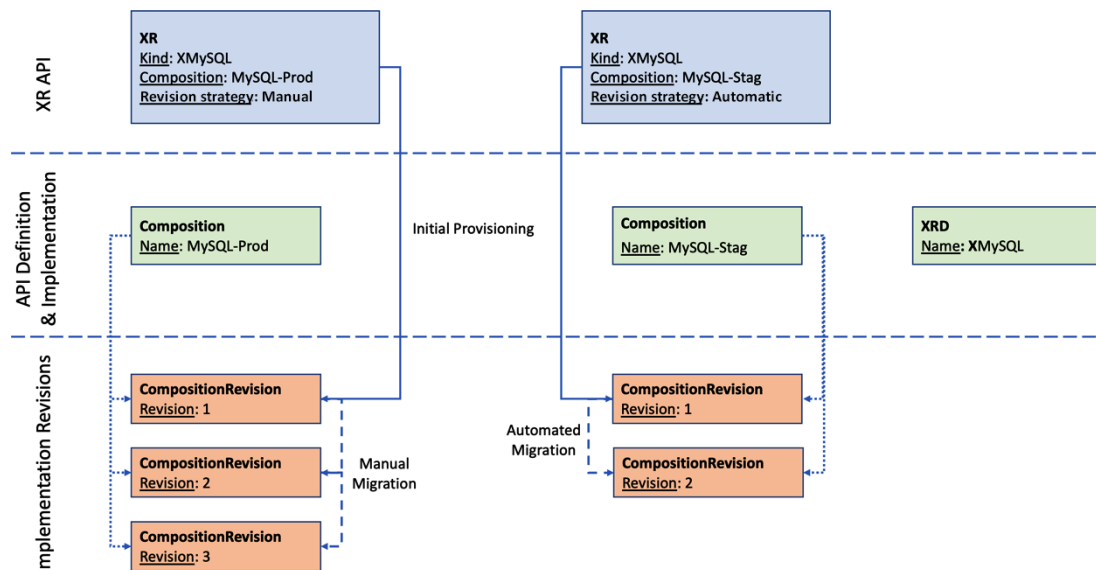
```
Status:
  Conditions:
    Last Transition Time:  2021-12-05T23:48:01Z
    Reason:                Available
    Status:                True
    Type:                  Ready
  Connection Details:
    Last Published Time:   2021-12-05T23:48:01Z
  Zone:                    us-central1-f
```

Chapter 5: Exploring Infrastructure Platform Patterns


```
arunramakani@Aruns-MacBook-Pro Composition Revision % kubectl apply -f xrd.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xmysqls.composition-revision.imarunrk.com created
arunramakani@Aruns-MacBook-Pro Composition Revision % kubectl apply -f Composition\ V1.yaml
composition.apiextensions.crossplane.io/gcp-mysql created
arunramakani@Aruns-MacBook-Pro Composition Revision % kubectl get compositionrevision -l crossplane.io/composition-name=gcp-mysql
NAME              REVISION   CURRENT   AGE
gcp-mysql-tl2p6   1          True      119s
```

```
arunramakani@Aruns-MacBook-Pro Composition Revision % kubectl get mysql -n alpha
NAME              READY     CONNECTION-SECRET     AGE
mysql-db          False                           80s
mysql-db-manual   False                           69s
arunramakani@Aruns-MacBook-Pro Composition Revision % kubectl get mysql -n alpha
NAME              READY     CONNECTION-SECRET     AGE
mysql-db          True                            9m7s
mysql-db-manual   True                            8m56s
```


	Instance ID	Type	Public IP address	Private IP address	Instance connection na	Actions
☐	✅ mysql-db-9hrgx-qqrp4	MySQL 5.7	35.239.107.138		crossplane-330620:u	⋮
☐	✅ mysql-db-manual-cg2wt-s749d	MySQL 5.7	34.134.182.137		crossplane-330620:u	⋮

crossplane-330620:us-ce

```
arunramakani@Aruns-MacBook-Pro Composition Revision % kubectl apply -f Composition\ V2.yaml
composition.apiextensions.crossplane.io/gcp-mysql configured
arunramakani@Aruns-MacBook-Pro Composition Revision % kubectl get compositionrevision -l crossplane.io/composition-name=gcp-mysql
NAME              REVISION   CURRENT   AGE
gcp-mysql-ktxb8   2          True      30s
gcp-mysql-tl2p6   1          False     80m
```

```
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f xrd\ v1.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xmysqls.xrd-non-breaking.imarunrk.com created
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f Composition\ V1.yaml
composition.apiextensions.crossplane.io/gcp-mysql created
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f Claim\ v1.yaml
mysql.xrd-non-breaking.imarunrk.com/mysql-db-v1 created
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl get composition
NAME        AGE
gcp-mysql   67s
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl get compositionrevision
NAME             REVISION    CURRENT    AGE
gcp-mysql-wphhg  1           True       88s
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl get xrd
NAME                                ESTABLISHED    OFFERED    AGE
xmysqls.xrd-non-breaking.imarunrk.com    True           True       2m
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl get mysql -n alpha
NAME         READY    CONNECTION-SECRET    AGE
mysql-db-v1  True                          5m25s
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f xrd\ v2.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xmysqls.xrd-non-breaking.imarunrk.com configured
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f Composition\ V2.yaml
composition.apiextensions.crossplane.io/gcp-mysql configured
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl get composition
NAME        AGE
gcp-mysql   6m58s
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl get compositionrevision
NAME             REVISION    CURRENT    AGE
gcp-mysql-6kmtv  2           True       13s
gcp-mysql-wphhg  1           False      7m6s
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f Claim\ v2.yaml
mysql.xrd-non-breaking.imarunrk.com/mysql-db-v2 created
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl get mysql -n alpha
NAME         READY    CONNECTION-SECRET    AGE
mysql-db-v1  True                          13m
mysql-db-v2  True                          6m28s
```
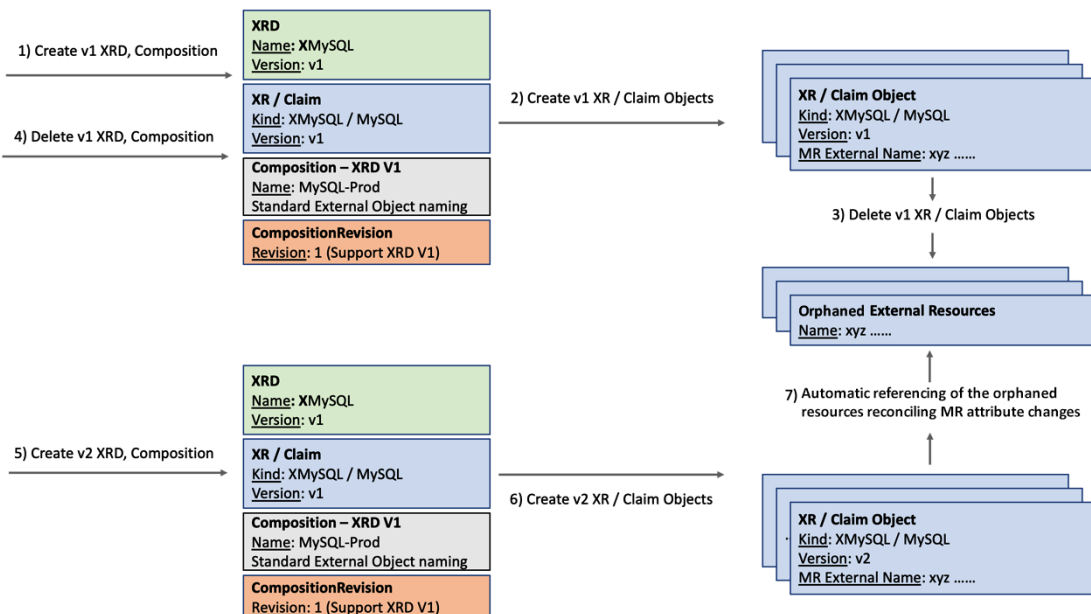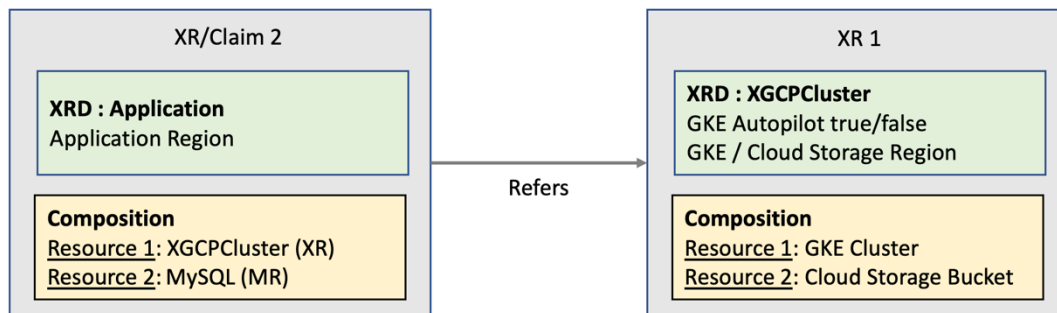
```
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f xrd\ v1.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xmysqls.xrd-breaking.imarunrk.com created
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f Composition\ V1.yaml
composition.apiextensions.crossplane.io/gcp-mysql created
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f Claim.yaml
mysql.xrd-breaking.imarunrk.com/my-db created
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl get mysql -n alpha
NAME     READY    CONNECTION-SECRET     AGE
my-db    False                          44s
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl get mysql -n alpha
NAME     READY    CONNECTION-SECRET     AGE
my-db    True                           5m6s
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl delete mysql -n alpha
error: resource(s) were provided, but no name was specified
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl delete mysql my-db -n alpha
mysql.xrd-breaking.imarunrk.com "my-db" deleted
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl delete -f Composition\ V1.yaml
composition.apiextensions.crossplane.io "gcp-mysql" deleted
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl delete -f xrd\ v1.yaml
compositeresourcedefinition.apiextensions.crossplane.io "xmysqls.xrd-breaking.imarunrk.com" deleted
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f xrd\ v2.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xmysqls.xrd-breaking.imarunrk.com created
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f Composition\ V2.yaml
composition.apiextensions.crossplane.io/gcp-mysql created
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl apply -f Claim\ migrate.yaml
mysql.xrd-breaking.imarunrk.com/my-db created
arunramakani@Aruns-MacBook-Pro XRD Contract Change - Breaking % kubectl get mysql -n alpha
NAME     READY    CONNECTION-SECRET     AGE
my-db    True                           37s
```

XR/Claim 2		XR 1
XRD : Application Application Region	Refers →	**XRD : XGCPCluster** GKE Autopilot true/false GKE / Cloud Storage Region
Composition Resource 1: XGCPCluster (XR) Resource 2: MySQL (MR)		**Composition** Resource 1: GKE Cluster Resource 2: Cloud Storage Bucket

```
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl apply -f xrd\ k8s.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xgcpclusters.nested-xr.imarunrk.com created
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl apply -f xrd\ Application.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xapplications.nested-xr.imarunrk.com created
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl apply -f Composition\ k8s.yaml
composition.apiextensions.crossplane.io/gcp-kubernetes created
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl apply -f Composition\ Application.yaml
composition.apiextensions.crossplane.io/gcp-application created
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl get xrd
NAME                                    ESTABLISHED   OFFERED   AGE
xapplications.nested-xr.imarunrk.com    True          True      3m10s
xgcpclusters.nested-xr.imarunrk.com     True                    3m14s
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl get composition
NAME              AGE
gcp-application   33s
gcp-kubernetes    39s
```

```
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl apply -f Claim\ Application.yaml
application.nested-xr.imarunrk.com/my-application created
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl get application -n alpha
NAME             READY   CONNECTION-SECRET    AGE
my-application   False                        29s
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl get application -n alpha
NAME             READY   CONNECTION-SECRET    AGE
my-application   True                         28m
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl get Xapplication
NAME                 READY    COMPOSITION        AGE
my-application-tsjd9   True    gcp-application   28m
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl get CloudSQLInstance
NAME                        READY   SYNCED   STATE      VERSION     AGE
my-application-tsjd9-rgbst   True    True     RUNNABLE   MYSQL_5_7   28m
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl get XGCPCluster
NAME                        READY    COMPOSITION       AGE
my-application-tsjd9-ptv66   True    gcp-kubernetes    29m
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl get Cluster
NAME                        READY   SYNCED   STATE      ENDPOINT        LOCATION     AGE
my-application-tsjd9-js2h6   True    True     RUNNING    35.188.188.55   us-central1   29m
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR % kubectl get Bucket
NAME                        READY   SYNCED   STORAGE_CLASS   LOCATION   AGE
my-application-tsjd9-zwrw4   True    True     STANDARD        US         29m
arunramakani@Aruns-MacBook-Pro Nested Multi-Resource XR %
```

```
Resource Ref:
   API Version:   nested-xr.imarunrk.com/v1
   Kind:          XApplication
   Name:          my-application-tsjd9
```

```
Resource Refs:
   API Version:   nested-xr.imarunrk.com/v1
   Kind:          XGCPCluster
   Name:          my-application-tsjd9-ptv66
   API Version:   database.gcp.crossplane.io/v1beta1
   Kind:          CloudSQLInstance
   Name:          my-application-tsjd9-rgbst
tatus:
```
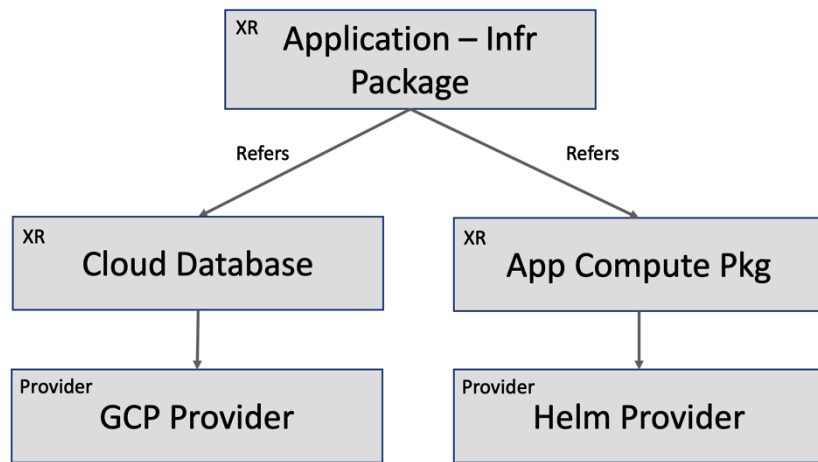
```
Spec:
  Deletion Policy:  Delete
  For Provider:
    Database Version:  MYSQL_5_7
    Region:            us-central1-b
    Settings:
      Tier:  db-g1-small
      User Labels:
        Crossplane - Kind:           cloudsqlinstance_database_gcp_crossplane_io
        Crossplane - Name:           my-application-cjgxj-zw7d9
        Crossplane - Providerconfig: gcp-credentials-project-1
  Provider Config Ref:
    Name:  gcp-credentials-project-1
Status:
  At Provider:
  Conditions:
    Last Transition Time:  2022-01-15T04:55:58Z
    Message:               create failed: cannot create new CloudSQL instance: googleapi: Error 400: Invalid request: Invalid value for r
egion: us-central1-b., invalid
    Reason:                ReconcileError
    Status:                False
    Type:                  Synced
Events:
  Type     Reason                        Age                    From                                                      Message
  ----     ------                        ---                    ----                                                      -------
  Warning  CannotInitializeManagedResource  2m52s                managed/cloudsqlinstance.database.gcp.crossplane.io  cannot update Clo
udSQLInstance custom resource: Operation cannot be fulfilled on cloudsqlinstances.database.gcp.crossplane.io "my-application-cjgxj-zw7d9"
: the object has been modified; please apply your changes to the latest version and try again
  Warning  CannotCreateExternalResource     106s (x24 over 2m52s)  managed/cloudsqlinstance.database.gcp.crossplane.io  cannot create new
 CloudSQL instance: googleapi: Error 400: Invalid request: Invalid value for region: us-central1-b., invalid
```

```
arunramakani@Aruns-MacBook-Pro XRD Versions % kubectl apply -f xrd\ invalid\ version\ test.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xbuckets.version-test.imarunrk.com created
arunramakani@Aruns-MacBook-Pro XRD Versions % kubectl get xrd
NAME                                 ESTABLISHED   OFFERED   AGE
xbuckets.version-test.imarunrk.com                           7s
```

```
┌─────────────────────────────┐
│ XR   Application – Infr      │
│      Package                 │
└─────────────────────────────┘
        │ Refers          │ Refers
        ▼                 ▼
┌──────────────────┐  ┌──────────────────┐
│ XR               │  │ XR               │
│ Cloud Database   │  │ App Compute Pkg  │
└──────────────────┘  └──────────────────┘
        │                 │
        ▼                 ▼
┌──────────────────┐  ┌──────────────────┐
│ Provider         │  │ Provider         │
│ GCP Provider     │  │ Helm Provider    │
└──────────────────┘  └──────────────────┘
```

Chapter 6: More Crossplane Patterns

Set user details

You can add multiple users at once with the same access type and permissions. Learn more

User name*   `crossplane-control-plane`

    ⊕ **Add another user**

Select AWS access type

Select how these users will primarily access AWS. If you choose only programmatic access, it does NOT prevent users from accessing the console using an assumed role. Access keys and autogenerated passwords are provided in the last step. Learn more

Select AWS credential type*   ☑ **Access key - Programmatic access**

Enables an **access key ID** and **secret access key** for the AWS API, CLI, SDK, and

Add user

(1) (2) (3) (4) (5)

▾ Set permissions

Add user to group	Copy permissions from existing user	Attach existing policies directly

Add user to an existing group or create a new one. Using groups is a best-practice way to manage user's permissions by job functions. Learn more

Add user to group

[Create group] [⟳ Refresh]

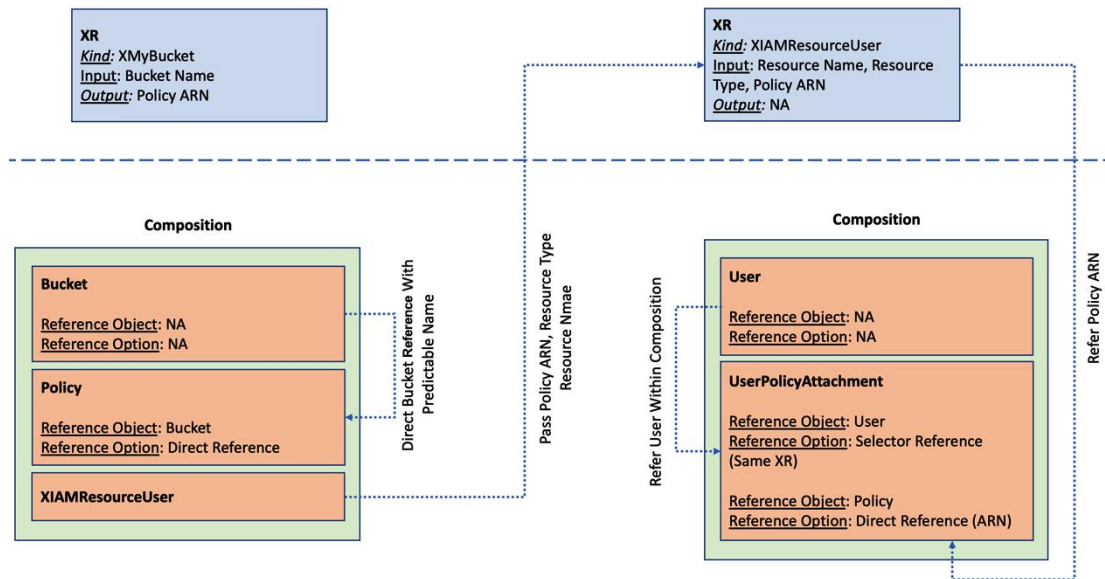🔍 Search   Showing 1 result

	Group ▾	Attached policies
☑	crossplane-control-plane	AdministratorAccess

	User	Access key ID	Secret access key
▸ ✅	crossplane-control-plane	▮▮▮▮▮▮▮▮ 🗐	********* Show

```
arunramakani@Aruns-MacBook-Pro aws-setup % aws configure --profile default
AWS Access Key ID [****************HL7W]:
AWS Secret Access Key [****************w9HY]:
Default region name [us-west-2]:
Default output format [json]:
```

```
arunramakani@Aruns-MacBook-Pro aws-setup % AWS_PROFILE=default
arunramakani@Aruns-MacBook-Pro aws-setup % echo -e "[$AWS_PROFILE]\naws_access_key_id = $(aws configure get aws_access_key_id --profile $
AWS_PROFILE)\naws_secret_access_key = $(aws configure get aws_secret_access_key --profile $AWS_PROFILE)" > aws-credentials.conf
arunramakani@Aruns-MacBook-Pro aws-setup % kubectl create secret generic aws-credentials -n crossplane-system --from-file=creds=./aws-cre
dentials.conf
secret/aws-credentials created
```

```
arunramakani@Aruns-MacBook-Pro aws-setup % kubectl apply -f rds.yaml
rdsinstance.database.aws.crossplane.io/rdspostgresql created
arunramakani@Aruns-MacBook-Pro aws-setup % kubectl get RDSInstance
NAME            READY    SYNCED    STATE       ENGINE     VERSION    AGE
rdspostgresql   True     True      available   postgres   12.8       6m6s
```

XR
Kind: XMyBucket
Input: Bucket Name
Output: Policy ARN

XR
Kind: XIAMResourceUser
Input: Resource Name, Resource Type, Policy ARN
Output: NA

Composition

Bucket

Reference Object: NA
Reference Option: NA

Policy

Reference Object: Bucket
Reference Option: Direct Reference

XIAMResourceUser

Direct Bucket Reference With Predictable Name

Pass Policy ARN, Resource Type Resource Nmae

Refer User Within Composition

Composition

User

Reference Object: NA
Reference Option: NA

UserPolicyAttachment

Reference Object: User
Reference Option: Selector Reference (Same XR)

Reference Object: Policy
Reference Option: Direct Reference (ARN)

Refer Policy ARN

Buckets (1) Info

Buckets are containers for data stored in S3. Learn more ⬚

Create bucket

Copy ARN   Empty   Delete

Find buckets by name

	Name	AWS Region ▲	Access ▽	Creation date ▽
○	test-reference-bucket-arun	Asia Pacific (Mumbai) ap-south-1	Objects can be public	February 9, 2022, 16:45:11 (UTC+04:00)

```
arunramakani@Aruns-MacBook-Pro same-nested-xr-reference % kubectl apply -f xrd-bucket.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xmybuckets.reference.imarunrk.com created
arunramakani@Aruns-MacBook-Pro same-nested-xr-reference % kubectl apply -f xrd-IAM.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xiamresourceusers.reference.imarunrk.com created
arunramakani@Aruns-MacBook-Pro same-nested-xr-reference % kubectl apply -f composition-bucket.yaml
composition.apiextensions.crossplane.io/my-bucket created
arunramakani@Aruns-MacBook-Pro same-nested-xr-reference % kubectl apply -f composition-IAM.yaml
composition.apiextensions.crossplane.io/resource-iam created
arunramakani@Aruns-MacBook-Pro same-nested-xr-reference % kubectl get xrd
NAME                                          ESTABLISHED    OFFERED    AGE
xiamresourceusers.reference.imarunrk.com      True                      27s
xmybuckets.reference.imarunrk.com             True           True       34s
arunramakani@Aruns-MacBook-Pro same-nested-xr-reference % kubectl get composition
NAME            AGE
my-bucket       25s
resource-iam    17s
arunramakani@Aruns-MacBook-Pro same-nested-xr-reference % kubectl apply -f claim-bucket.yaml
mybucket.reference.imarunrk.com/my-bucket created
arunramakani@Aruns-MacBook-Pro same-nested-xr-reference % kubectl get MyBucket -n alpha
NAME            READY    CONNECTION-SECRET    AGE
my-bucket       True                          6m19s
```

Summary

Delete user

User ARN	
Path	/
Creation time	2022-02-09 16:45 UTC+0400

Permissions | Groups | Tags | Security credentials | Access Advisor

▼ Permissions policies (1 policy applied)

Add permissions   ⊕ Add inline policy

Policy name ▼	Policy type ▼
Attached directly	
▼ policy-bucket-test-reference-bucket-arun	Managed policy ✕

Policy summary | {} JSON | Edit policy   Simulate policy

```
1  {
2      "Version": "2012-10-17",
3      "Statement": [
4          {
5              "Effect": "Allow",
6              "Action": [
7                  "s3:*"
8              ],
9              "Resource": [
10                 "arn:aws:s3:::test-reference-bucket-arun",
11                 "arn:aws:s3:::test-reference-bucket-arun/*"
12             ]
13         }
14     ]
15  }
```

```
Events:
  Type      Reason            Age      From                                                    Message
  ----      ------            ----     ----                                                    -------
  Warning   ComposeResources  14s      defined/compositeresourcedefinition.apiextensions.crossplane.io  cannot render composed r
esource from resource template at index 2: cannot use dry-run create to name composed resource: XIAMResourceUser.reference.imarunrk.com "
my-bucket-2fm8z-5tv24" is invalid: spec.parameters.policyARN: Required value
```
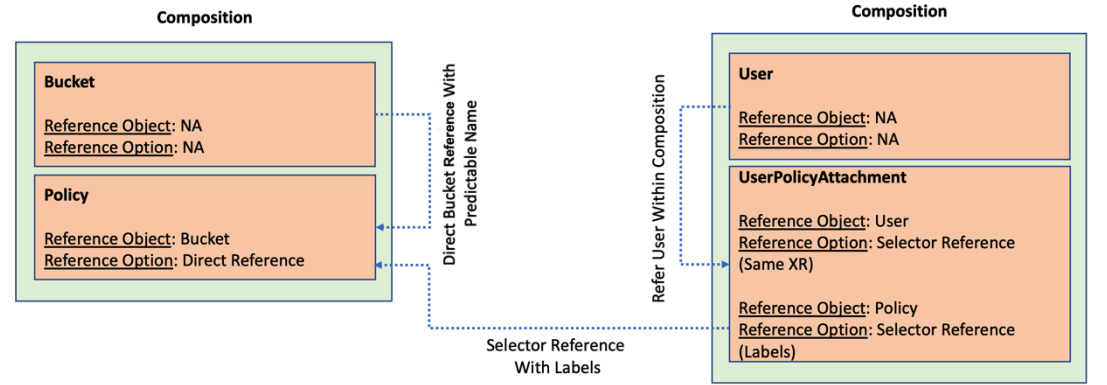
XR
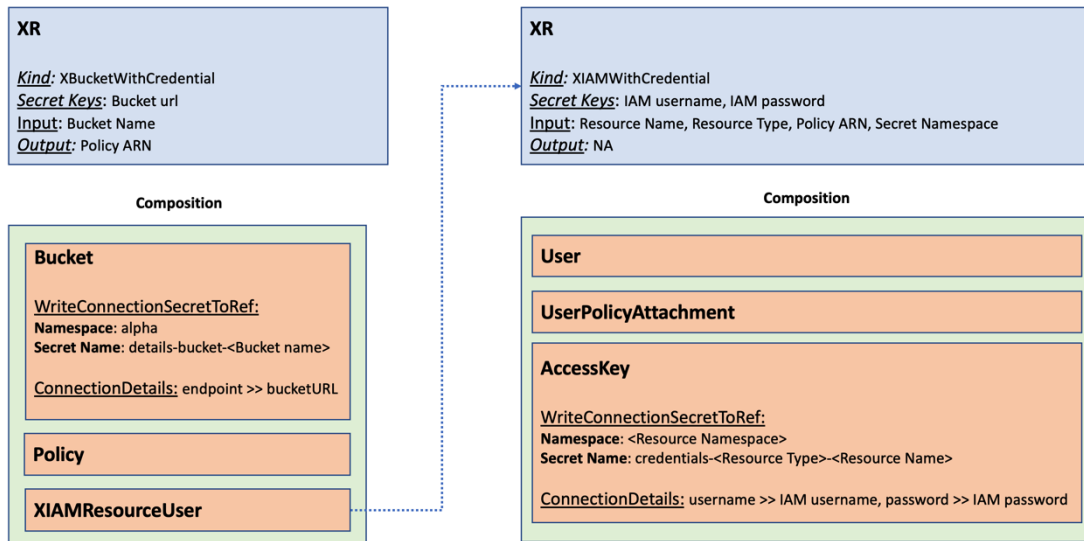*Kind:* XMyBucket
Input: Bucket Name
Output: Policy ARN

XR
Kind: XIAMResourceUser
Input: Resource Name, Resource Type, Policy ARN
Output: NA

Composition

Bucket

Reference Object: NA
Reference Option: NA

Policy

Reference Object: Bucket
Reference Option: Direct Reference

Direct Bucket Reference With Predictable Name

Selector Reference With Labels

Refer User Within Composition

Composition

User

Reference Object: NA
Reference Option: NA

UserPolicyAttachment

Reference Object: User
Reference Option: Selector Reference (Same XR)

Reference Object: Policy
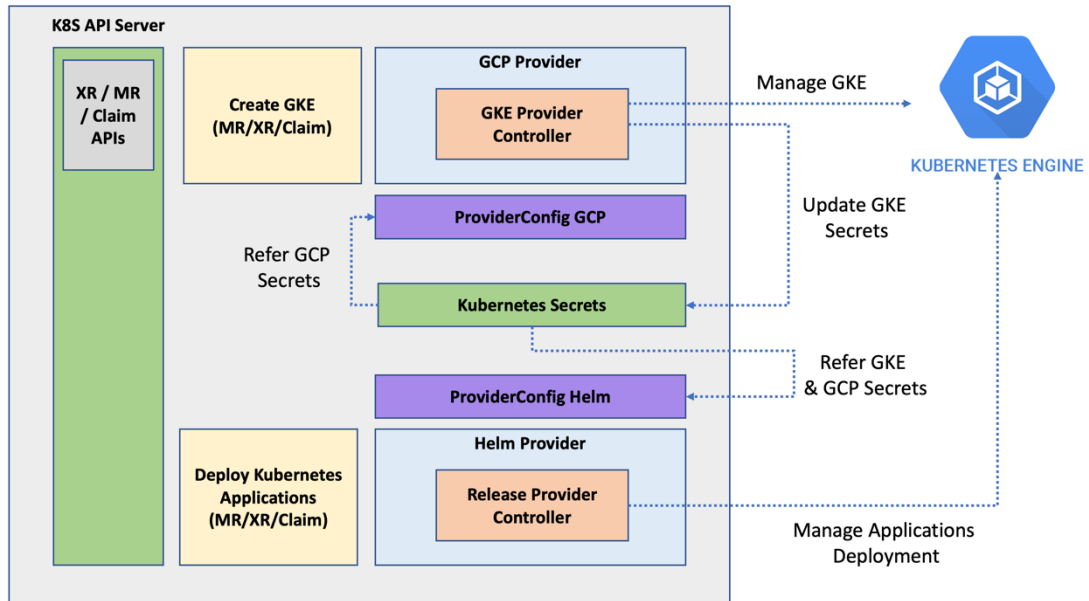Reference Option: Selector Reference (Labels)

```
arunramakani@Aruns-MacBook-Pro different-xr-reference % kubectl apply -f xrd-bucket.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xmybuckets.differentxr.reference.imarunrk.com created
arunramakani@Aruns-MacBook-Pro different-xr-reference % kubectl apply -f xrd-IAM.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xiamresourceusers.differentxr.reference.imarunrk.com created
arunramakani@Aruns-MacBook-Pro different-xr-reference % kubectl apply -f composition-bucket.yaml
composition.apiextensions.crossplane.io/my-bucket created
arunramakani@Aruns-MacBook-Pro different-xr-reference % kubectl apply -f composition-IAM.yaml
composition.apiextensions.crossplane.io/resource-iam created
arunramakani@Aruns-MacBook-Pro different-xr-reference % kubectl apply -f claim-bucket.yaml
mybucket.differentxr.reference.imarunrk.com/my-bucket created
arunramakani@Aruns-MacBook-Pro different-xr-reference % kubectl apply -f claim-iam.yaml
iamresourceuser.differentxr.reference.imarunrk.com/iam-user created
arunramakani@Aruns-MacBook-Pro different-xr-reference % kubectl get mybucket -n alpha
NAME        READY    CONNECTION-SECRET    AGE
my-bucket   True                          11m
arunramakani@Aruns-MacBook-Pro different-xr-reference % kubectl get IAMResourceUser -n alpha
NAME        READY    CONNECTION-SECRET    AGE
iam-user    True                          11m
```

XR

Kind: XBucketWithCredential
Secret Keys: Bucket url
Input: Bucket Name
Output: Policy ARN

XR

Kind: XIAMWithCredential
Secret Keys: IAM username, IAM password
Input: Resource Name, Resource Type, Policy ARN, Secret Namespace
Output: NA

Composition

Bucket

WriteConnectionSecretToRef:
Namespace: alpha
Secret Name: details-bucket-<Bucket name>

ConnectionDetails: endpoint >> bucketURL

Policy

XIAMResourceUser

Composition

User

UserPolicyAttachment

AccessKey

WriteConnectionSecretToRef:
Namespace: <Resource Namespace>
Secret Name: credentials-<Resource Type>-<Resource Name>

ConnectionDetails: username >> IAM username, password >> IAM password

```
arunramakani@Aruns-MacBook-Pro secret-propagation % kubectl apply -f xrd-bucket.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xbucketwithcredentials.reference.imarunrk.com created
arunramakani@Aruns-MacBook-Pro secret-propagation % kubectl apply -f xrd-IAM.yaml
compositeresourcedefinition.apiextensions.crossplane.io/xiamwithcredentials.reference.imarunrk.com created
arunramakani@Aruns-MacBook-Pro secret-propagation % kubectl apply -f composition-bucket.yaml
composition.apiextensions.crossplane.io/bucket-with-credentials created
arunramakani@Aruns-MacBook-Pro secret-propagation % kubectl apply -f composition-IAM.yaml
composition.apiextensions.crossplane.io/resource-iam-credentials created
arunramakani@Aruns-MacBook-Pro secret-propagation % kubectl apply -f claim-bucket.yaml
bucketwithcredential.reference.imarunrk.com/iam-bucket created
```

Secret: credentials-bucket-test-reference-bucket-arun

Created	26s ago (2022-02-10T18:19:48+04:00)
Name	credentials-bucket-test-reference-bucket-arun
Namespace	alpha
Controlled By	AccessKey iam-access-bucket-test-reference-bucket-arun
Type	connection.crossplane.io/v1alpha1

Data

password

username

Secret: details-bucket-test-reference-bucket-arun

Created	62s ago (2022-02-10T18:19:41+04:00)
Name	details-bucket-test-reference-bucket-arun
Namespace	alpha
Controlled By	Bucket test-reference-bucket-arun
Type	connection.crossplane.io/v1alpha1

Data

endpoint

region

```
arunramakani@Aruns-MacBook-Pro helm-provider % kubectl apply -f GKE.yaml
cluster.container.gcp.crossplane.io/gke-for-helm-deployment created
arunramakani@Aruns-MacBook-Pro helm-provider % kubectl get cluster
NAME                      READY    SYNCED   STATE     ENDPOINT        LOCATION     AGE
gke-for-helm-deployment   True     True     RUNNING   35.223.47.160   us-central1  4m52s
arunramakani@Aruns-MacBook-Pro helm-provider % kubectl apply -f Helm-Provider.yaml
provider.pkg.crossplane.io/provider-helm created
arunramakani@Aruns-MacBook-Pro helm-provider % kubectl apply -f Provider-Config.yaml
providerconfig.helm.crossplane.io/helm-provider created
```
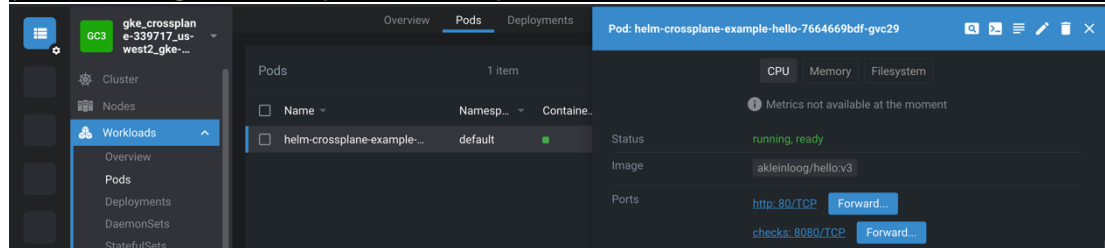


```
arunramakani@Aruns-MacBook-Pro helm-provider % kubectl apply -f Helm-test-deploy-upgrade.yaml
release.helm.crossplane.io/helm-crossplane-example configured
arunramakani@Aruns-MacBook-Pro helm-provider % kubectl get release
NAME                      CHART   VERSION    SYNCED   READY   STATE      REVISION   DESCRIPTION        AGE
helm-crossplane-example   hello   0.4.0-rc2  True     True    deployed   2          Upgrade complete   44m
```

Split Vs Merge Tradeoff
- Testability
- Things that change together
- Things with different frequencies of change
- Recipes reused across teams
- Security, Compliance & Architecture policies & governance
- Team ownership of resources & the organization's structure
- Ease of understanding, debug, maintenance & evolve
- Ease with which the product teams consume the API
- Shared resources

Chapter 7: Extending and Scaling Crossplane

```
arunramakani@Aruns-MacBook-Pro Desktop % curl -sL https://raw.githubusercontent.com/crossplane/crossplane/master/install.sh | sh
kubectl plugin downloaded successfully! Run the following commands to finish installing it:

sudo mv kubectl-crossplane /usr/local/bin
kubectl crossplane --help

Visit https://crossplane.io to get started. 🚀
Have a nice day! 👋

arunramakani@Aruns-MacBook-Pro Desktop % sudo mv kubectl-crossplane /usr/local/bin
Password:
Sorry, try again.
Password:
arunramakani@Aruns-MacBook-Pro Desktop % kubectl crossplane --help
```
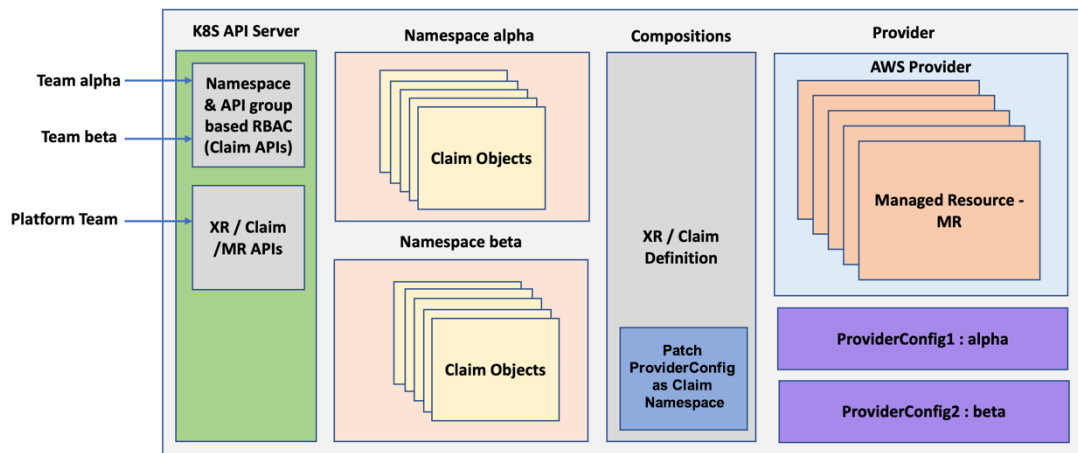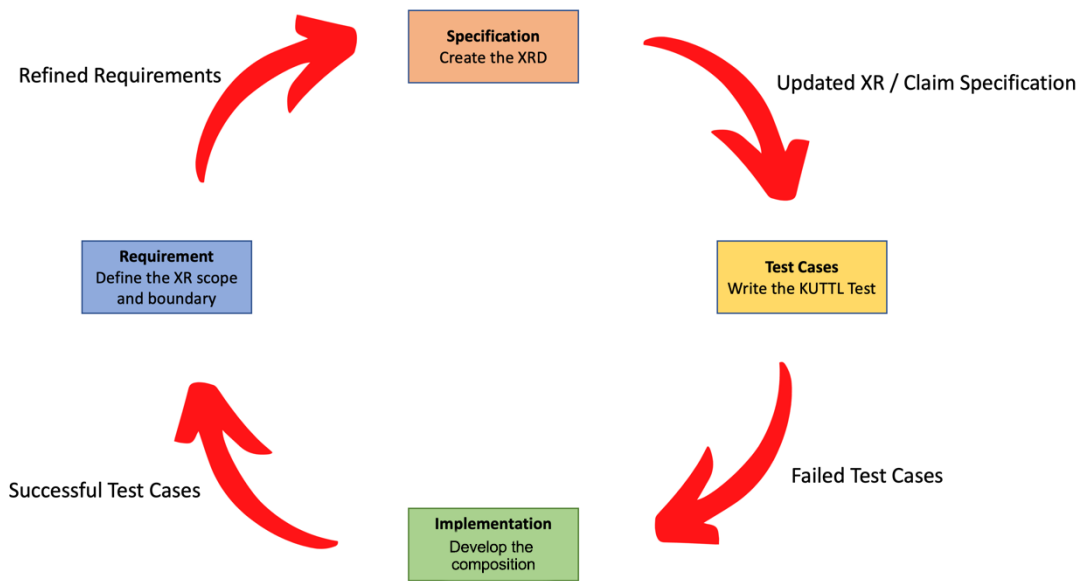
```
arunramakani@Aruns-MacBook-Pro configuration % kubectl crossplane build configuration
arunramakani@Aruns-MacBook-Pro configuration % ls
Bucket                      IAM                         aws-bucket-5e1a787cce74.xpkg    crossplane.yaml
arunramakani@Aruns-MacBook-Pro configuration % kubectl crossplane push configuration arunramakani/aws-bucket:v1.0.0
```
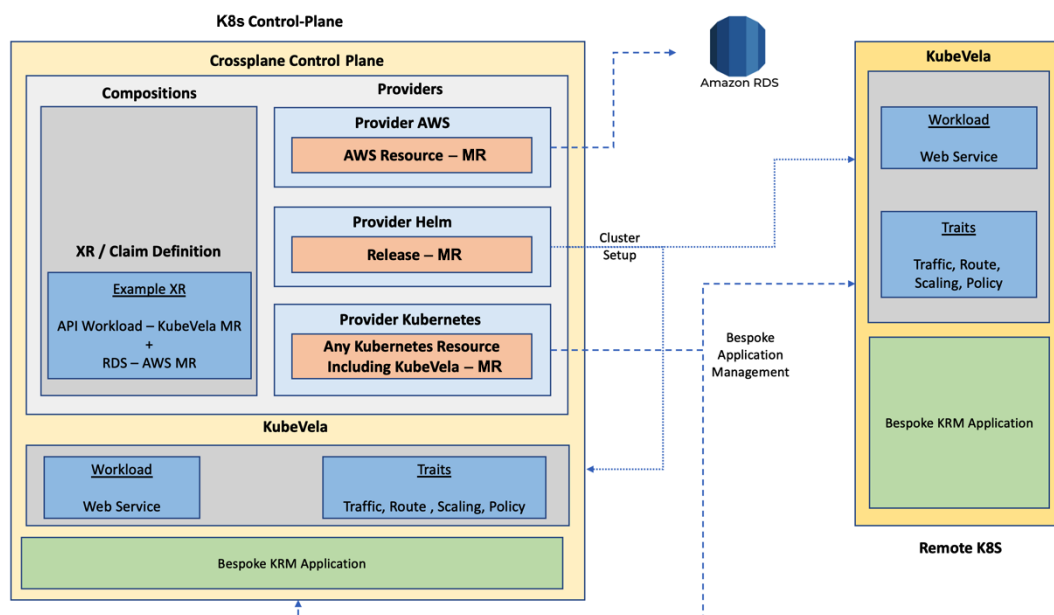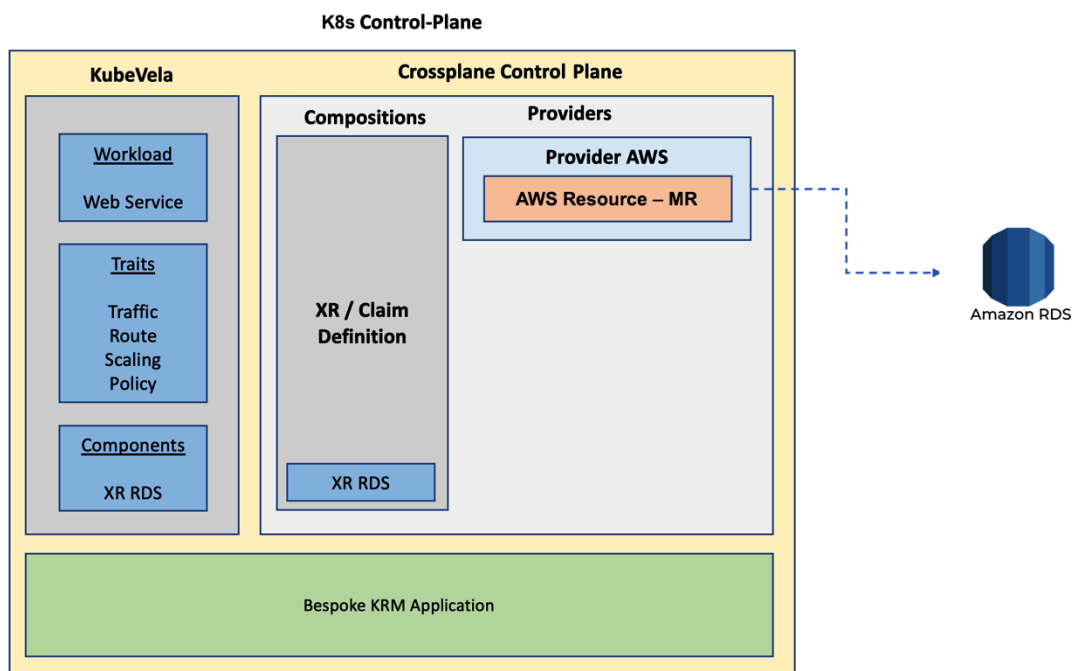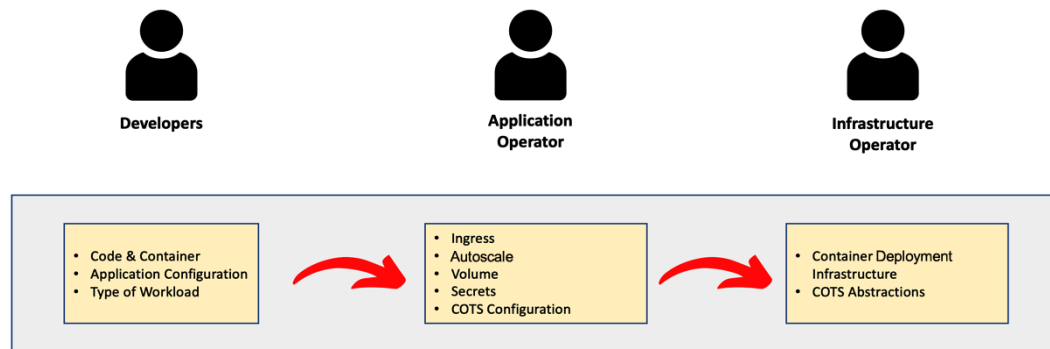
```
arunramakani@Aruns-MacBook-Pro configuration % kubectl crossplane install configuration arunramakani/aws-bucket:v1.0.0 aws-bucket
configuration.pkg.crossplane.io/aws-bucket created
arunramakani@Aruns-MacBook-Pro configuration % kubectl get configuration
NAME         INSTALLED   HEALTHY   PACKAGE                          AGE
aws-bucket   True        True      arunramakani/aws-bucket:v1.0.0   3m1s
arunramakani@Aruns-MacBook-Pro configuration % kubectl get configurationrevision
NAME                       HEALTHY   REVISION   IMAGE                            STATE    DEP-FOUND   DEP-INSTALLED   AGE
aws-bucket-5e1a787cce74    True      1          arunramakani/aws-bucket:v1.0.0   Active   1           1               3m6s
```

```
arunramakani@Aruns-MacBook-Pro configuration % kubectl crossplane install configuration arunramakani/aws-bucket:v1.0.0 aws-bucket
configuration.pkg.crossplane.io/aws-bucket created
arunramakani@Aruns-MacBook-Pro configuration % kubectl get configuration
NAME         INSTALLED   HEALTHY   PACKAGE                          AGE
aws-bucket   True        True      arunramakani/aws-bucket:v1.0.0   6s
arunramakani@Aruns-MacBook-Pro configuration % kubectl get configurationrevision
NAME                       HEALTHY   REVISION   IMAGE                            STATE      DEP-FOUND   DEP-INSTALLED   AGE
aws-bucket-5e1a787cce74    True      1          arunramakani/aws-bucket:v1.0.0   Active     1           1               116s
arunramakani@Aruns-MacBook-Pro configuration % kubectl crossplane update configuration aws-bucket v1.1.0
configuration.pkg.crossplane.io/aws-bucket updated
arunramakani@Aruns-MacBook-Pro configuration % kubectl get configuration
NAME         INSTALLED   HEALTHY   PACKAGE                          AGE
aws-bucket   True        True      arunramakani/aws-bucket:v1.1.0   2m34s
arunramakani@Aruns-MacBook-Pro configuration % kubectl get configurationrevision
NAME                       HEALTHY   REVISION   IMAGE                            STATE      DEP-FOUND   DEP-INSTALLED   AGE
aws-bucket-5e1a787cce74    True      1          arunramakani/aws-bucket:v1.0.0   Inactive   1                           2m39s
aws-bucket-9cf65cbc813d    True      2          arunramakani/aws-bucket:v1.1.0   Active     1           1               15s
arunramakani@Aruns-MacBook-Pro configuration % kubectl get compositionrevision
NAME                             REVISION   CURRENT   AGE
bucket-with-credentials-gn8xw    1          False     3m25s
bucket-with-credentials-pthgr    2          True      60s
resource-iam-credentials-stqf7   1          True      3m25s
```

```
--- FAIL: kuttl (50.66s)
    --- FAIL: kuttl/harness (0.00s)
        --- PASS: kuttl/harness/bucket-success (16.55s)
        --- FAIL: kuttl/harness/bucket-failure (32.14s)
FAIL
```

Chapter 8: Knowing the Trade-Offs

Developers

Application Operator

Infrastructure Operator

- Code & Container
- Application Configuration
- Type of Workload

- Ingress
- Autoscale
- Volume
- Secrets
- COTS Configuration

- Container Deployment Infrastructure
- COTS Abstractions

K8s Control-Plane

KubeVela

Crossplane Control Plane

Compositions

Providers

Workload

Web Service

Traits

Traffic
Route
Scaling
Policy

Components

XR RDS

Provider AWS

AWS Resource – MR

XR / Claim Definition

XR RDS

Amazon RDS

Bespoke KRM Application

K8s Control-Plane

Crossplane Control Plane

Compositions

Providers

XR / Claim Definition

Example XR

API Workload – KubeVela MR
+
RDS – AWS MR

Provider AWS

AWS Resource – MR

Provider Helm

Release – MR

Provider Kubernetes

Any Kubernetes Resource Including KubeVela – MR

Amazon RDS

Cluster Setup

Bespoke Application Management

KubeVela

Workload

Web Service

Traits

Traffic, Route, Scaling, Policy

Bespoke KRM Application

Remote K8S

KubeVela

Workload

Web Service

Traits

Traffic, Route , Scaling, Policy

Bespoke KRM Application

Chapter 9: Using Helm, Kustomize, and KubeVela

```
arunramakani@Aruns-MacBook-Pro helm % helm create hello-world
Creating hello-world
arunramakani@Aruns-MacBook-Pro helm % tree
.
└── hello-world
    ├── Chart.yaml
    ├── charts
    ├── templates
    │   ├── NOTES.txt
    │   ├── _helpers.tpl
    │   ├── deployment.yaml
    │   ├── hpa.yaml
    │   ├── ingress.yaml
    │   ├── service.yaml
    │   ├── serviceaccount.yaml
    │   └── tests
    │       └── test-connection.yaml
    └── values.yaml

4 directories, 10 files
```

```
arunramakani@Aruns-MacBook-Pro hello-world % helm install hello-world .
I0327 20:18:28.137448   22049 request.go:665] Waited for 1.197986273s due to client-side throttling, not priority and fairness, request: GET:https:/
/34.66.94.177/apis/acmpca.aws.crossplane.io/v1beta1?timeout=32s
W0327 20:18:35.785402   22049 warnings.go:70] Autopilot set default resource requests for Deployment default/hello-world, as resource requests were
not specified. See http://g.co/gke/autopilot-defaults.
NAME: hello-world
LAST DEPLOYED: Sun Mar 27 20:18:32 2022
NAMESPACE: default
STATUS: deployed
REVISION: 1
NOTES:
1. Get the application URL by running these commands:
  export POD_NAME=$(kubectl get pods --namespace default -l "app.kubernetes.io/name=hello-world,app.kubernetes.io/instance=hello-world" -o jsonpath=
"{.items[0].metadata.name}")
  export CONTAINER_PORT=$(kubectl get pod --namespace default $POD_NAME -o jsonpath="{.spec.containers[0].ports[0].containerPort}")
  echo "Visit http://127.0.0.1:8080 to use your application"
  kubectl --namespace default port-forward $POD_NAME 8080:$CONTAINER_PORT
```
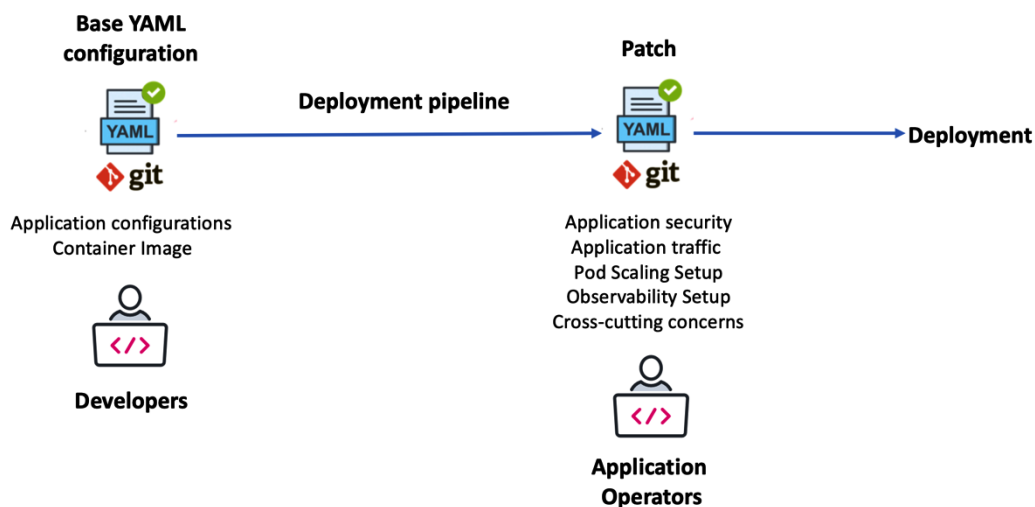
```
arunramakani@Aruns-MacBook-Pro patchesStrategicMerge % kubectl kustomize .
apiVersion: apps/v1
kind: Deployment
metadata:
  labels:
    app: busybox
    team-name: alpha
  name: busybox-deployment
  namespace: test
spec:
```

! application.yaml U ×

Chapter-9 > Hand-on-examples > KubeVela > ! application.yaml

```
1    apiVersion: core.oam.dev/v1beta1
2    kind: Application
3    metadata:
4      name: my-first-app
5    spec:
6      components:
7        - name: helloworld
8          type: webservice
9          properties:
10           image: oamdev/helloworld-python:v1
11           env:
12             - name: "TARGET"
13               value: "KubeVela"
14           port: 8080
15         traits:
16           - type: ingress
17             properties:
18               domain: localhost
19               http:
20                 /: 8080
21     policies:
22       - name: keep-legacy-resource
23         type: garbage-collect
24         properties:
25           keepLegacyResource: true
26     workflow:
27       steps:
28         - name: simple-workflow
29           type: apply-application
```

We defined the **Component** of type **webservice** (an abstraction over Kubernetes Deployment).

This is the **Trait** behavior that defines how to expose the above **Component** through ingress

Any outdated version of the **Application** will be retained as history till we manually delete it.
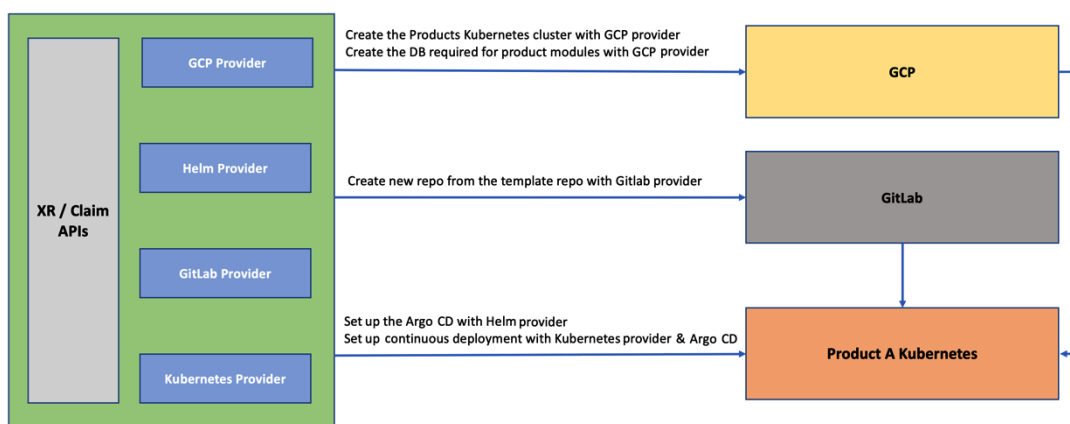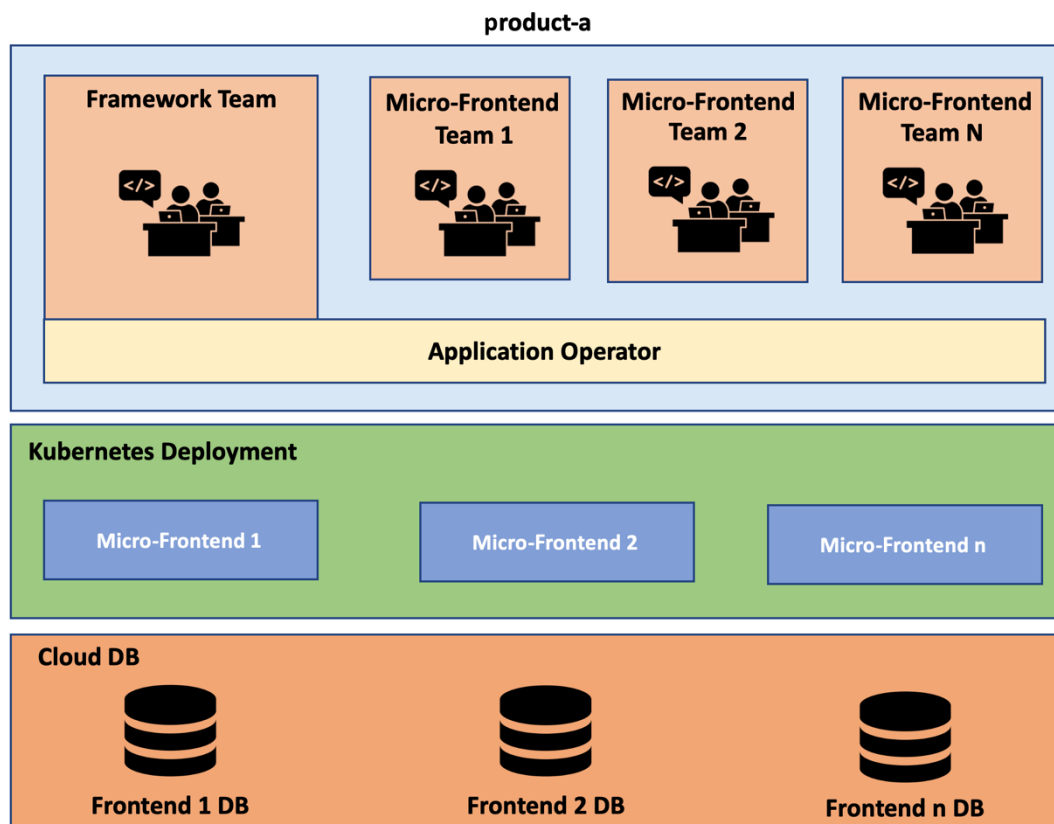
This is a simple **workflow** that applies the Traits and Policies as it is.

```
arunramakani@Aruns-MacBook-Pro KubeVela % kubectl get application
NAME          COMPONENT    TYPE        PHASE     HEALTHY   STATUS      AGE
my-first-app  helloworld   webservice  running   true      Ready:1/1   46m
```

Chapter 10: Onboarding Applications with Crossplane

product-a


```
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl apply -f Step-1-ProviderSetup/Platform-OPS/GCP
provider.pkg.crossplane.io/provider-gcp created
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl apply -f Step-1-ProviderSetup/Platform-OPS/GCP/product-a
providerconfig.gcp.crossplane.io/product-a created
namespace/product-a created
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl apply -f Step-1-ProviderSetup/Platform-OPS/Helm
provider.pkg.crossplane.io/provider-helm created
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl apply -f Step-1-ProviderSetup/Platform-OPS/Gitlab
provider.pkg.crossplane.io/provider-gitlab created
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl apply -f Step-1-ProviderSetup/Platform-OPS/Gitlab/product-a
providerconfig.gitlab.crossplane.io/product-a created
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl apply -f Step-1-ProviderSetup/Platform-OPS/k8s
provider.pkg.crossplane.io/provider-kubernetes created
```

```
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl apply -f Step-2-CreateProductTeamsKubernetesCluster/Platform-OPS
composition.apiextensions.crossplane.io/xcluster-dev created
compositeresourcedefinition.apiextensions.crossplane.io/xgcpclusters.learn.unified.devops created
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl get xrd
NAME                                    ESTABLISHED   OFFERED   AGE
xgcpclusters.learn.unified.devops       True          True      23s
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl get composition
NAME          AGE
xcluster-dev  39s
```

```
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl apply -f Step-2-CreateProductTeamsKubernetesCluster/Application-OPS
gcpcluster.learn.unified.devops/product-a-cluster created
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl get GCPCluster -n product-a
NAME                READY   CONNECTION-SECRET   AGE
product-a-cluster   True                        6m3s
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl get release
NAME                            CHART      VERSION   SYNCED   READY   STATE      REVISION   DESCRIPTION        AGE
product-a-cluster-helm-argocd   argo-cd    2.3.3     True     True    deployed   1          Install complete   10m
```



```
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl apply -f Step-3-GitProjectOnboarding/Platform-OPS
compositeresourcedefinition.apiextensions.crossplane.io/xgitprojects.learn.unified.devops created
composition.apiextensions.crossplane.io/gitprojects-composition created
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl get xrd
NAME                                    ESTABLISHED   OFFERED   AGE
xgcpclusters.learn.unified.devops       True          True      18m
xgitprojects.learn.unified.devops       True          True      12s
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl get composition
NAME                      AGE
gitprojects-composition   22s
xcluster-dev              18m
```

```
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl apply -f Step-4-WebApplication/Platform-OPS/Application
composition.apiextensions.crossplane.io/web-application-dev created
compositeresourcedefinition.apiextensions.crossplane.io/xwebapplications.learn.unified.devops created
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl apply -f Step-4-WebApplication/Platform-OPS/DB
composition.apiextensions.crossplane.io/mysql created
compositeresourcedefinition.apiextensions.crossplane.io/xgcpdbs.learn.unified.devops created
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl get xrd
NAME                              ESTABLISHED    OFFERED    AGE
xgcpclusters.learn.unified.devops     True          True      35m
xgcpdbs.learn.unified.devops          True                    10s
xgitprojects.learn.unified.devops     True          True      16m
xwebapplications.learn.unified.devops True          True      21s
arunramakani@Aruns-MacBook-Pro Hands-on-example % kubectl get composition
NAME                      AGE
gitprojects-composition   16m
mysql                     21s
web-application-dev       32s
xcluster-dev              35m
```

Overview	Pods	Deployments	DaemonSets	StatefulSets	ReplicaSets	Jobs	CronJobs

Pods		1 item		Namespace: product-a ▼		Search Pods... 🔍

☐ Name ▾	Na... ▾	Con... ▾	Rest... ▾	Con... ▾	Node ▾	Q... ▾	A ▾	S... ▾	⋮
☐ micro-frontend-o...	product...	🟢	0	ReplicaSe	gke-prod	BestE...	38s	Run...	⋮

☰ Filter	Enter property name or value								❓	▥

☐	Instance ID ❓ ↑	Type	Public IP address	Private IP address	Instance connection name	High availability	Location	Storage used	Actions
☐	✅ micro-frontend-one	MySQL 5.7	35.222.11.176		crossplane-339717:u... ▾	ADD	us-central1-f	▭▭▭▭ 0 B of 40 GB	⋮

Chapter 11: Driving the Platform Adoption

POC	Alpha	Beta	General Availability	Deprecate	Remove
Expriment with one of the product team	Adoption by a few teams	Adoption by a few more teams	Organization wide usage	Requesting teams to stop using the API	Remove the API from support

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Expriment with one of the product team	Adoption by a few teams	Adoption by a few more teams	Organization wide usage	Requesting teams to stop using the API	Remove the API from support

Collaborative working model with rapid innovation (POC, Alpha, Beta)

Self-service working model with stability and reliability (Beta & General Availability)

Facilitating working model with rapid innovation (Deprecate and Remove)

Organization X

Product-1			Product-2			Product-n		
Scrum Team 1	Scrum Team 2	Scrum Team n	Scrum Team 1	Scrum Team 2	Scrum Team n	Scrum Team 1	Scrum Team 2	Scrum Team n
Application Operator			Application Operator			Application Operator		

Platform Community Ecosystem

Platform Team – Infrastructure Developer/Operator