CAADE

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- Developer

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- Create Application
- Create MicroService
- Create Project
- Debug Application
- Debug MicroService
- Deploy Application
- Deploy MicroService
- Modify Code
- Publish Application
- Publish MicroService
- Test Application
- Test MicroService

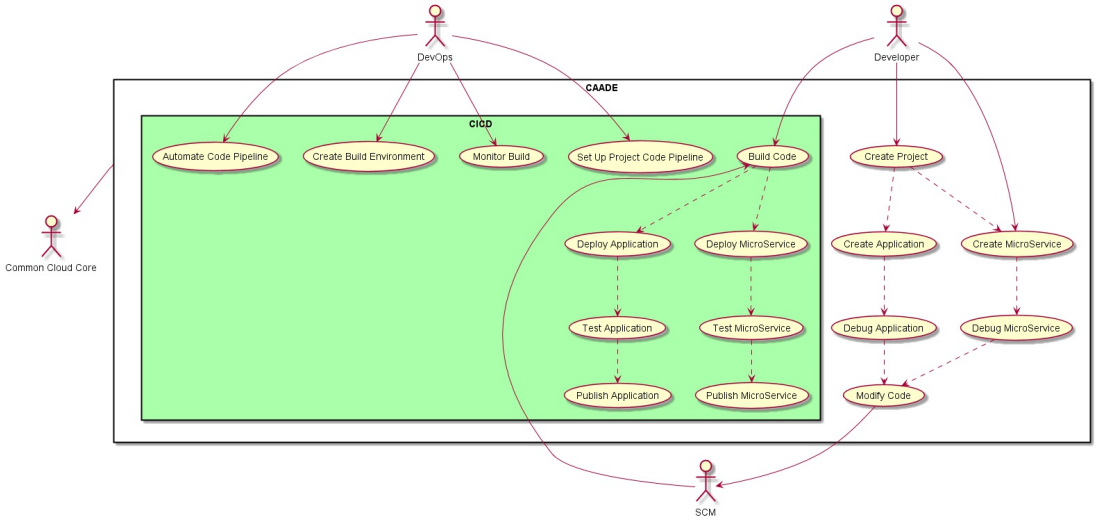
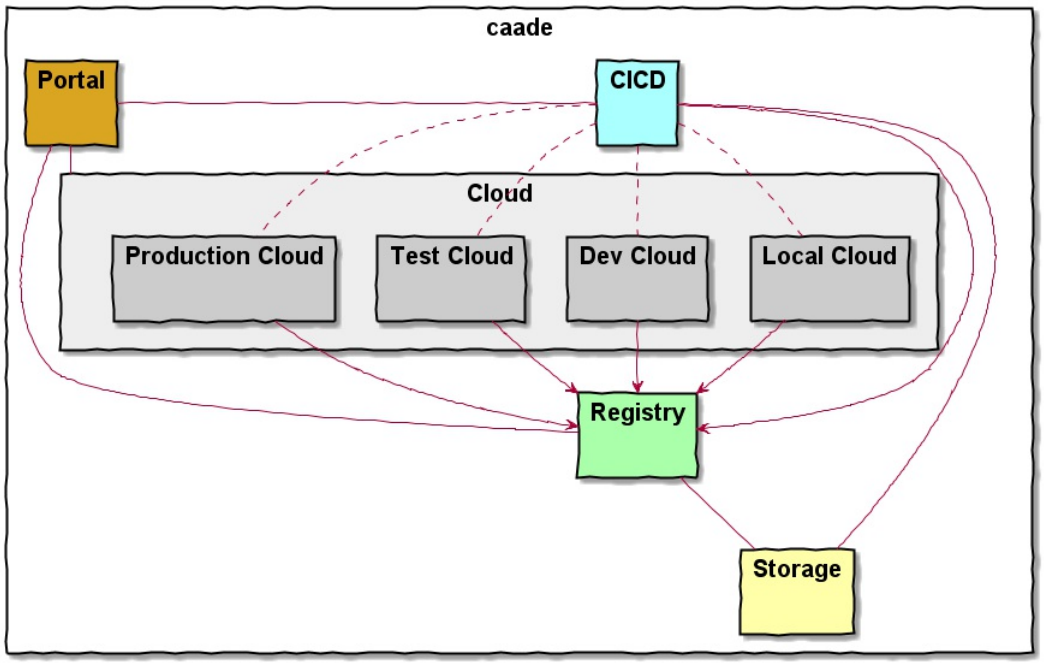


Figure: UseCases UseCases

Logical Architecture

Developers need to focus on the developement of applications. When code is modified and checked into a code repository like github. A CI/CD system will automatically build, test and deploy the application, microservice or project. Multiple environments that have been created in the Common Cloud Core will be used by CAADE and the CI/CD to promote applications across the different environments.



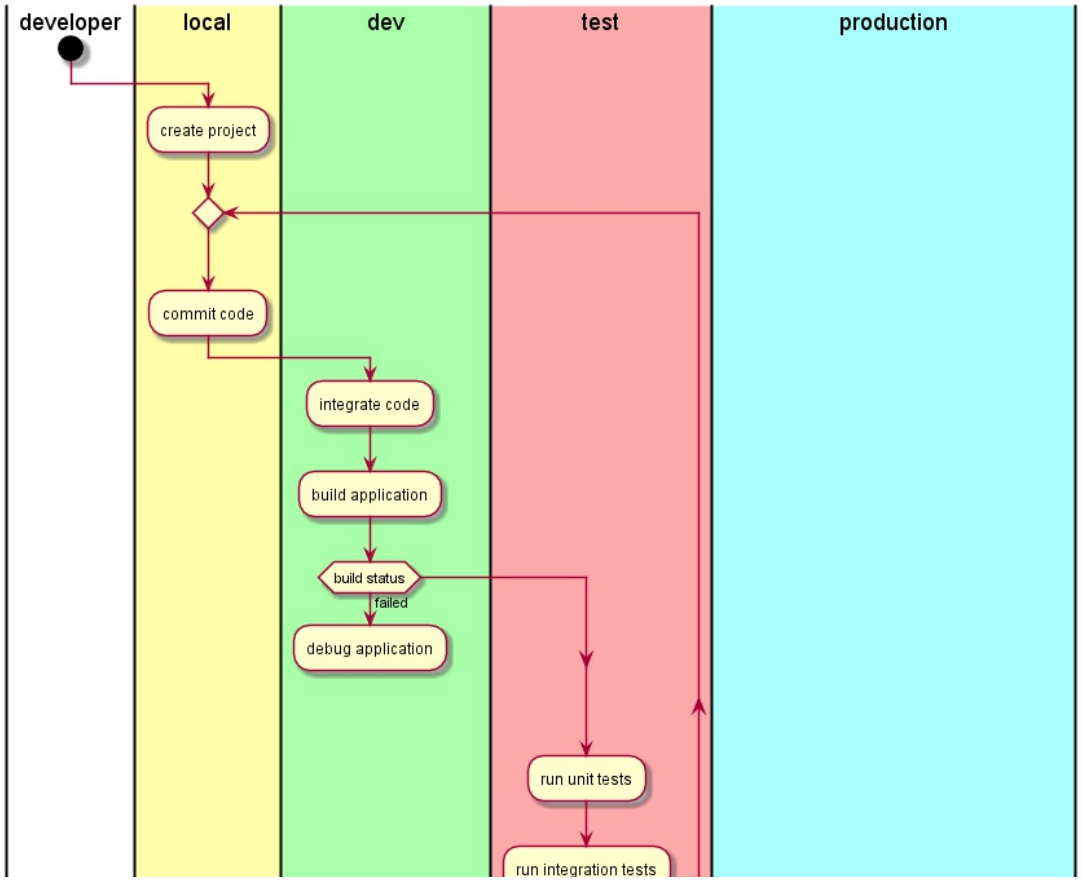
Architecture: Cloud Aware Application Development Ecosystem

Figure: docs Architecture

- Common Cloud Core - External
- CI/CD
- DevCloud
- LocalCloud
- ProductionCloud
- Registry
- SCM
- Test Cloud

Process Architecture

This diagram shows how a developer interacts with CAADE to develop, test, and deploy cloud aware applications.



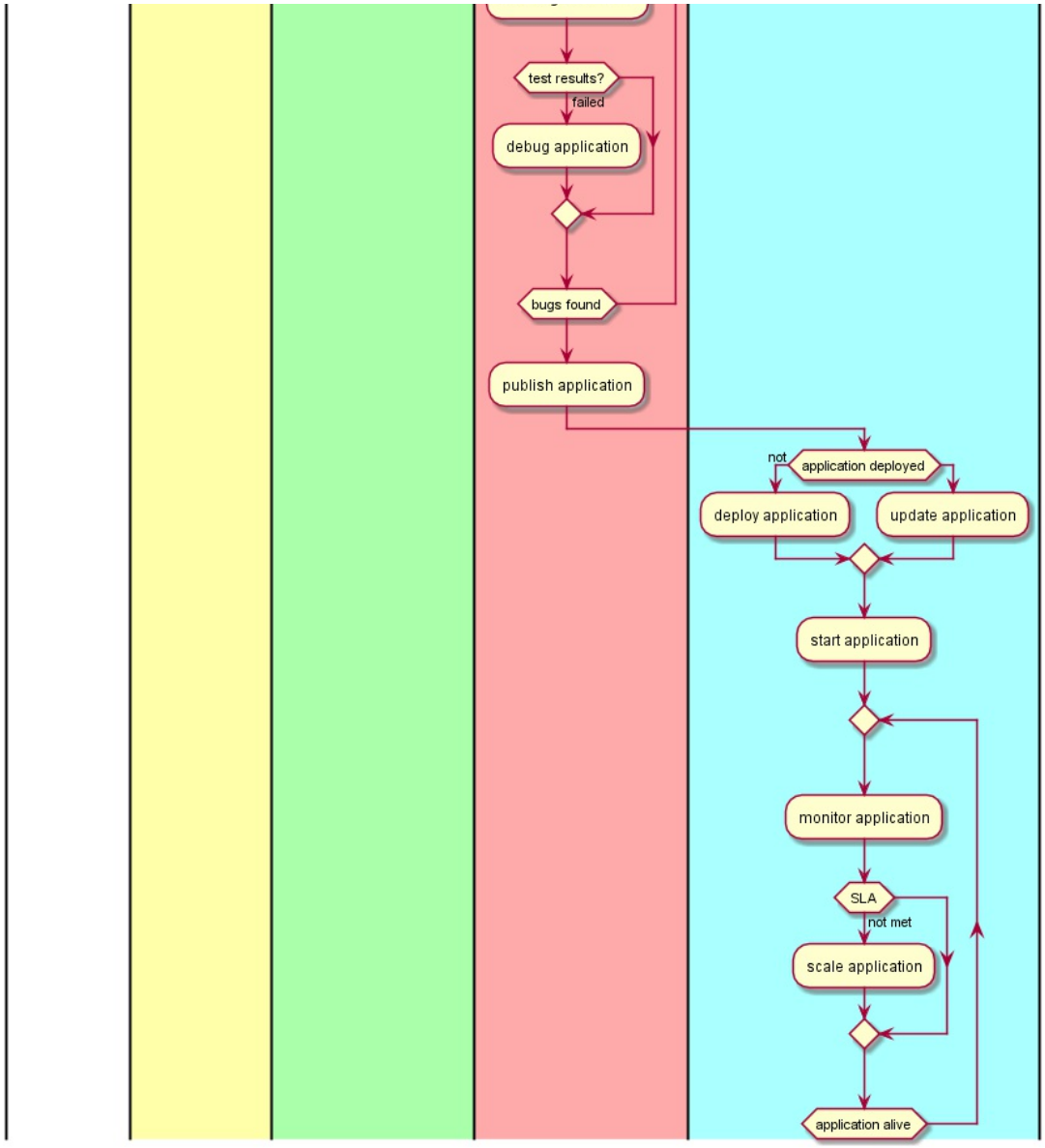


Figure: Solution Process

Deployment model

CAADE is made up a of a set of services and microservices to deliver capabilities to the Developer. The Service architect shown in the deployment model is an example of an implementation of a CAADE architecture.

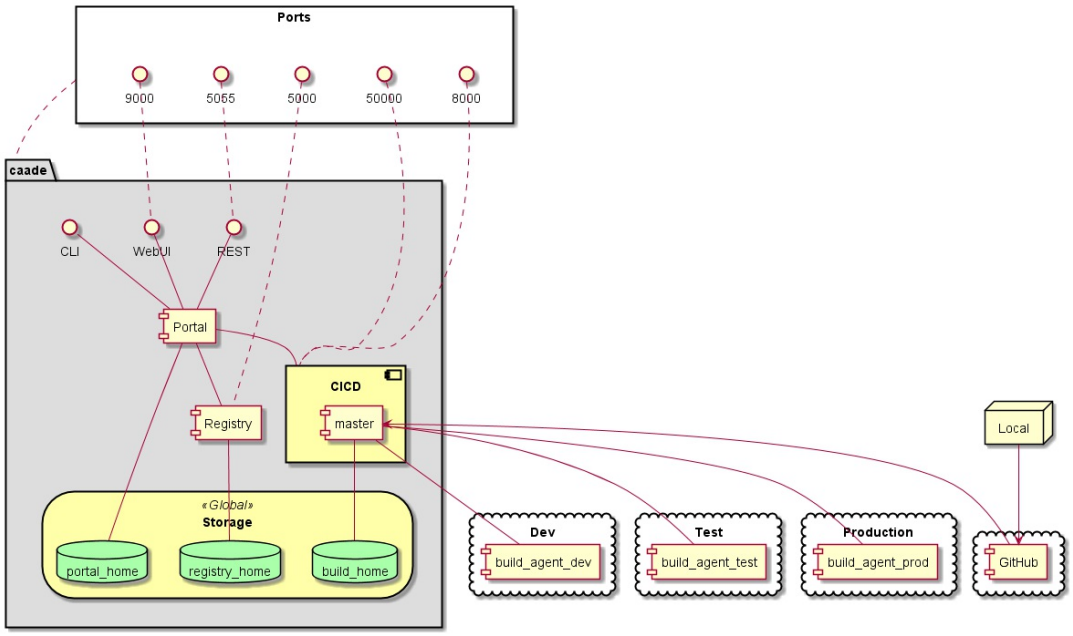


Figure: Solution Deployment

Physical Architecture

The physical architecture of CAADE is an example of a minimal hardware configuration that CAADE can be deployed.

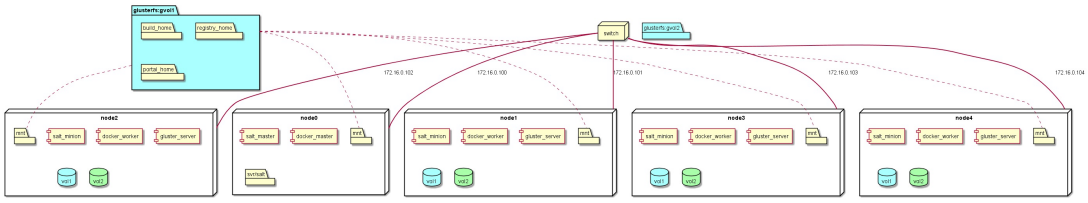


Figure: Solution Physical

Use Cases

Use Cases for caade

High level use cases for the CAADE architecture.

Use Cases

- Build Project
- Create Application
- Create MicroService
- Create Project
- Debug Application
- Debug MicroService
- Deploy Application
- Deploy MicroService
- Modify Code
- Publish Application
- Publish MicroService
- Test Application
- Test MicroService

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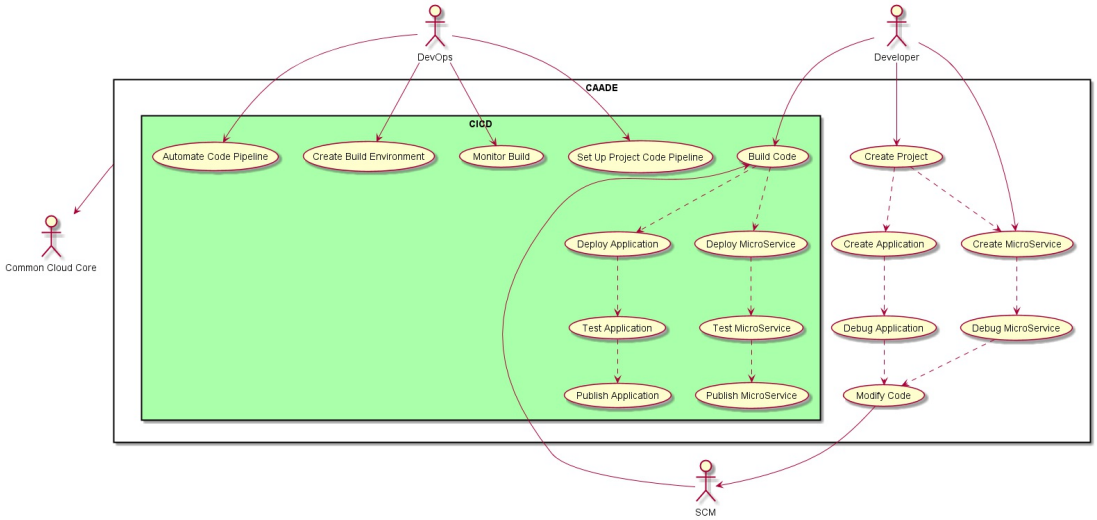

Figure: UseCases UseCases

Build Project

Build-Project

Description

Actors

- *Actors*

Activities

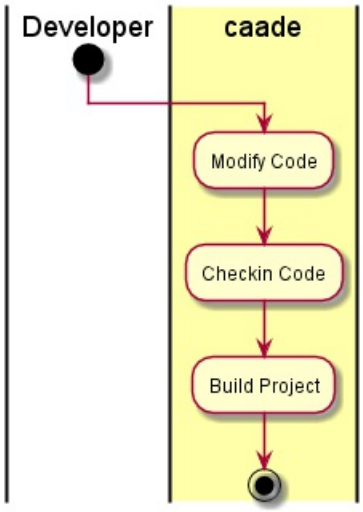

Figure: Build-Project Activities

- *Activities*

Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Define Agents

Scenario Define-Agents

Description

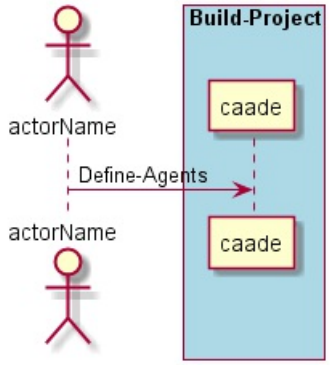

Figure: Build-Project Define-Agents

Define Pipeline

Scenario Define-Pipeline

Description

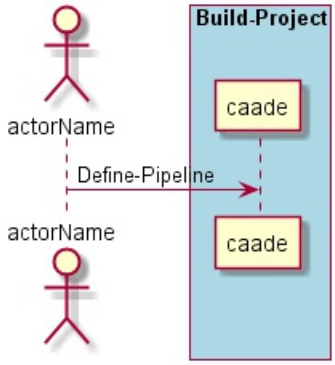

Figure: Build-Project Define-Pipeline

Define Stages

Scenario Define-Stages

Description

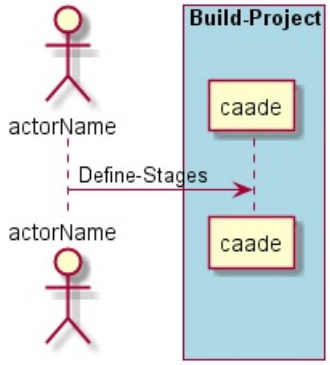

Figure: Build-Project Define-Stages

Run Build

Scenario Run-Build

Description

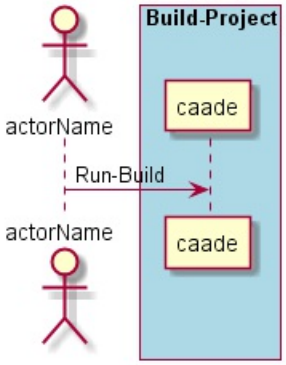

Figure: Build-Project Run-Build

Create Application

Create-Application

Description

Actors

- *Actors*

Activities

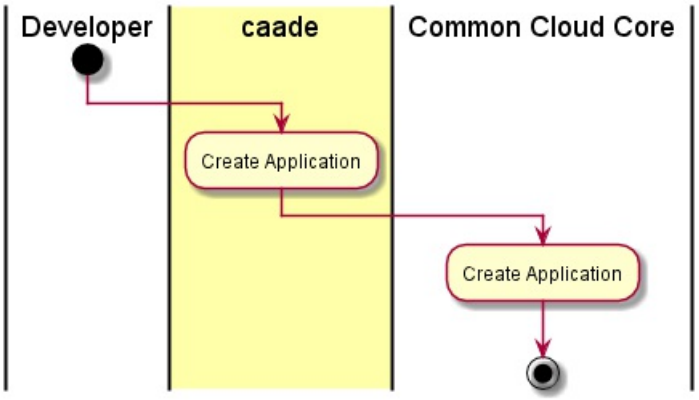

Figure: Create-Application Activities

- *Activities*

Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Create MicroService

Create-MicroService

Description

Actors

- *Actors*

Activities

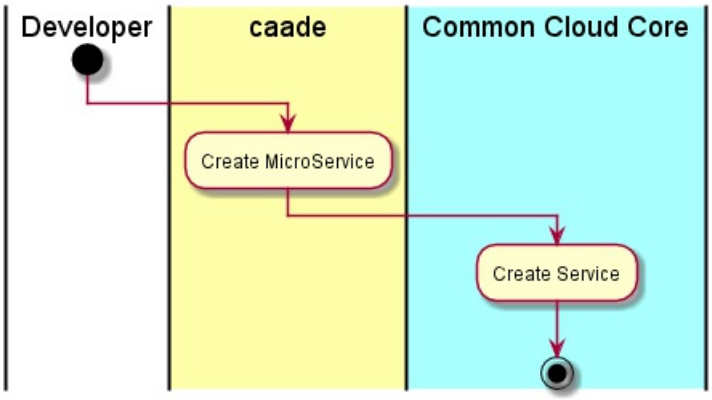

Figure: Create-MicroService Activities

- *Activities*

Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Create Project

Create-Project

Description

Actors

- *Actors*

Activities

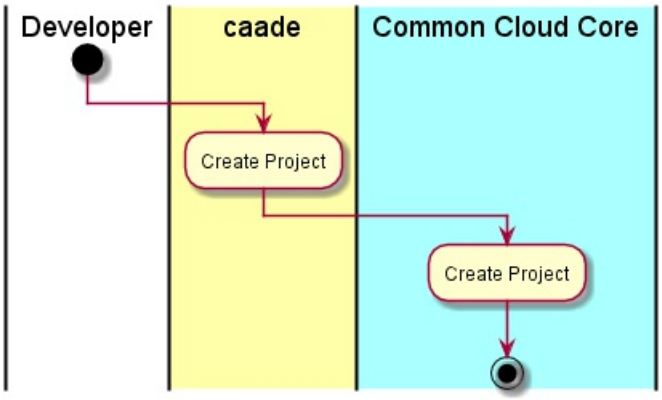

Figure: Create-Project Activities

- *Activities*

Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Debug Application

Debug-Application

Description

Actors

- *Actors*

Activities

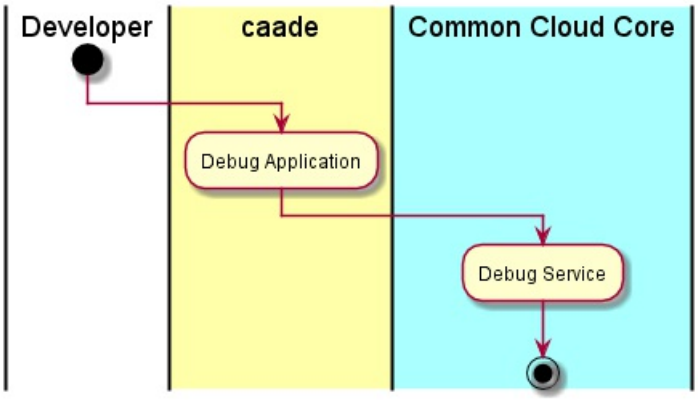

Figure: Debug-Application Activities

- *Activities*

Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Debug MicroService

Debug-MicroService

Description

Actors

- *Actors*

Activities

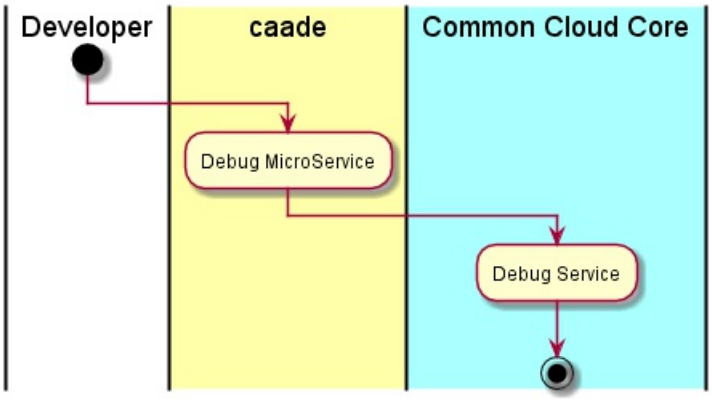

Figure: Debug-MicroService Activities

- *Activities*

Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Deploy Application

Deploy-Application

Description

Actors

- *Actors*

Activities

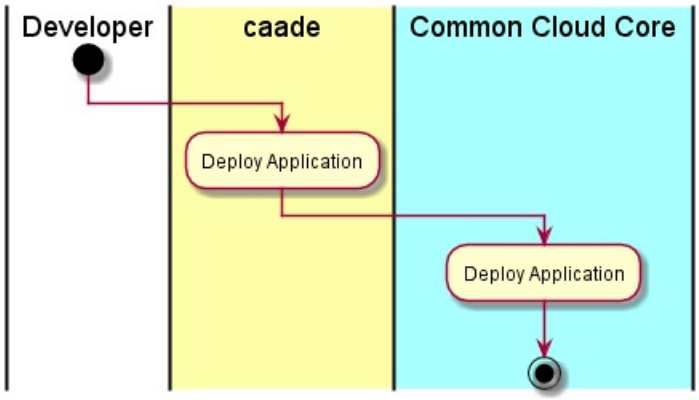

Figure: Deploy-Application Activities

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Detail Scenarios

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Systems Involved

- *Systems*

Deploy MicroService

Deploy-MicroService

Description

Actors

- *Actors*

Activities

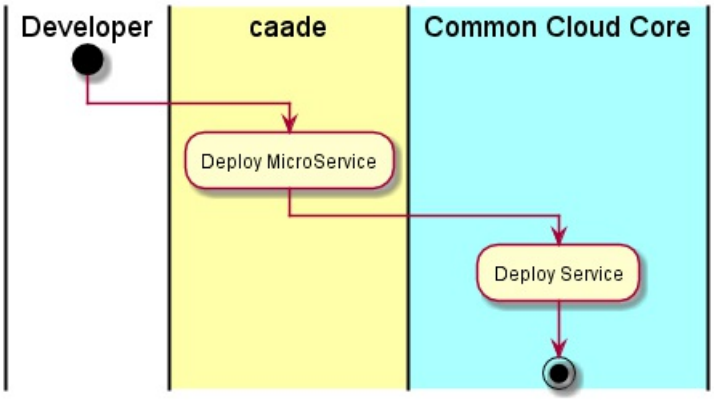

Figure: Deploy-MicroService Activities

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Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Modify Code

Modify-Code

Description

Actors

- *Actors*

Activities

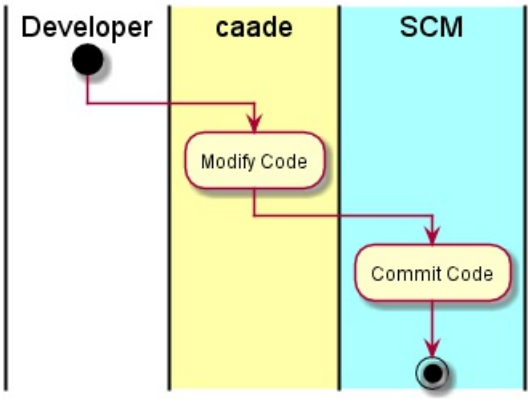

Figure: Modify-Code Activities

- *Activities*

Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Publish Application

Publish-Application

Description

Actors

- *Actors*

Activities

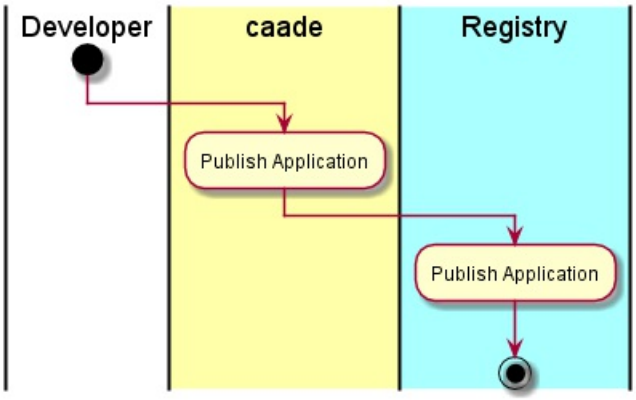

Figure: Publish-Application Activities

- *Activities*

Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Publish MicroService

Publish-MircoService

Description

Actors

- *Actors*

Activities

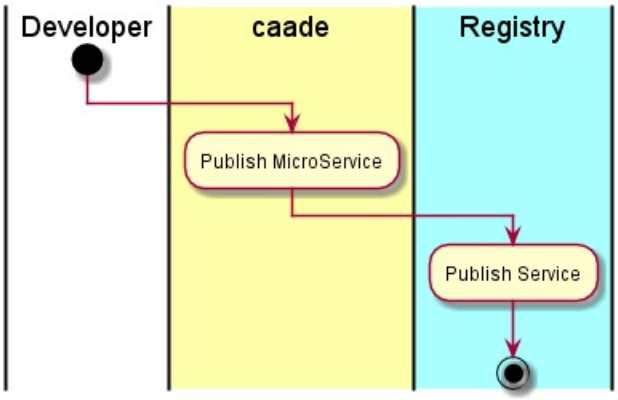

Figure: Publish-MicroService Activities

- *Activities*

Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Test Application

Test-Application

Description

Actors

- *Actors*

Activities

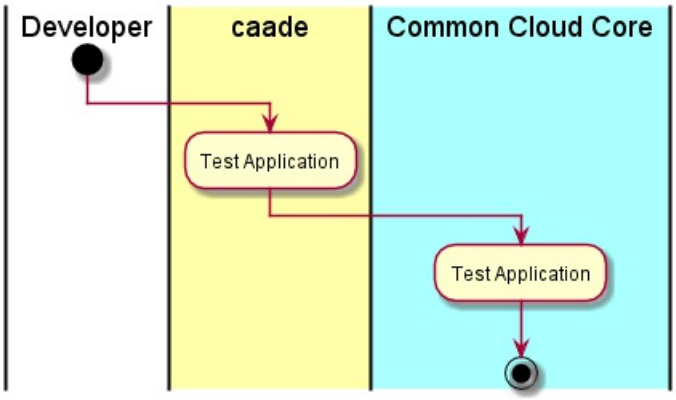

Figure: Test-Application Activities

- *Activities*

Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Test MicroService

Test-MicroService

Description

Actors

- *Actors*

Activities

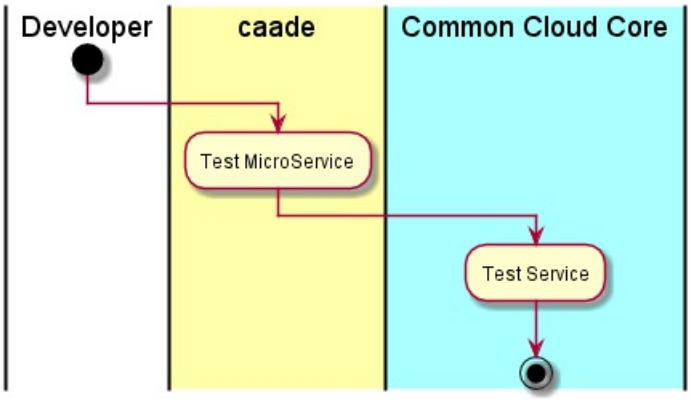

Figure: Test-MicroService Activities

- *Activities*

Detail Scenarios

- *Scenarios*

Systems Involved

- *Systems*

Actors

Actors

- Developer
- DevOps

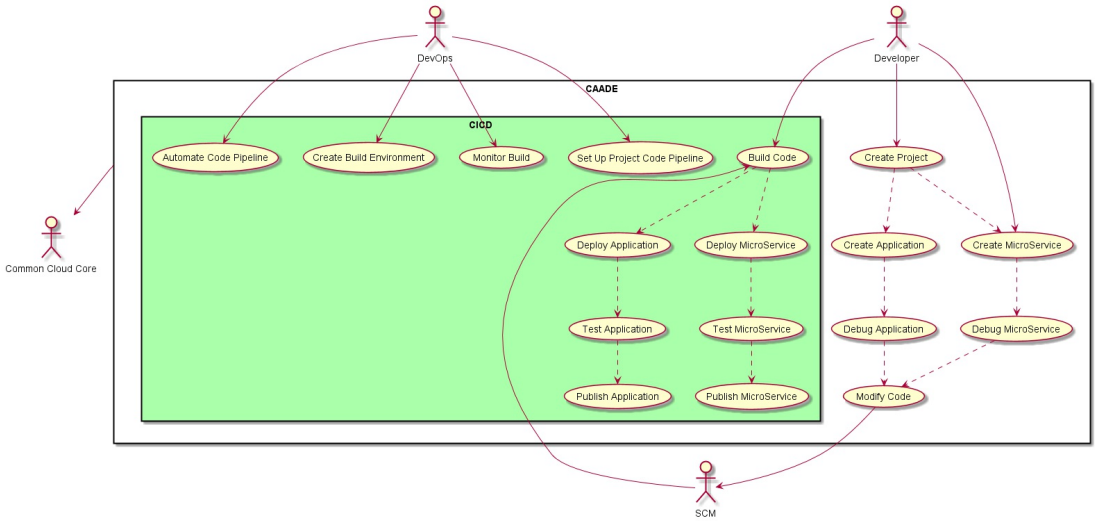

Figure: UseCases UseCases

Developer

Developer

Description

Use Cases

- *UseCases*

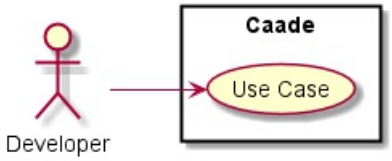

Figure: Developer UseCases

Activities

description

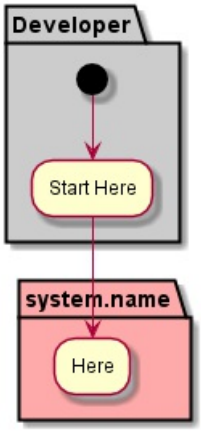

Figure: Developer Activity

Workflow

description

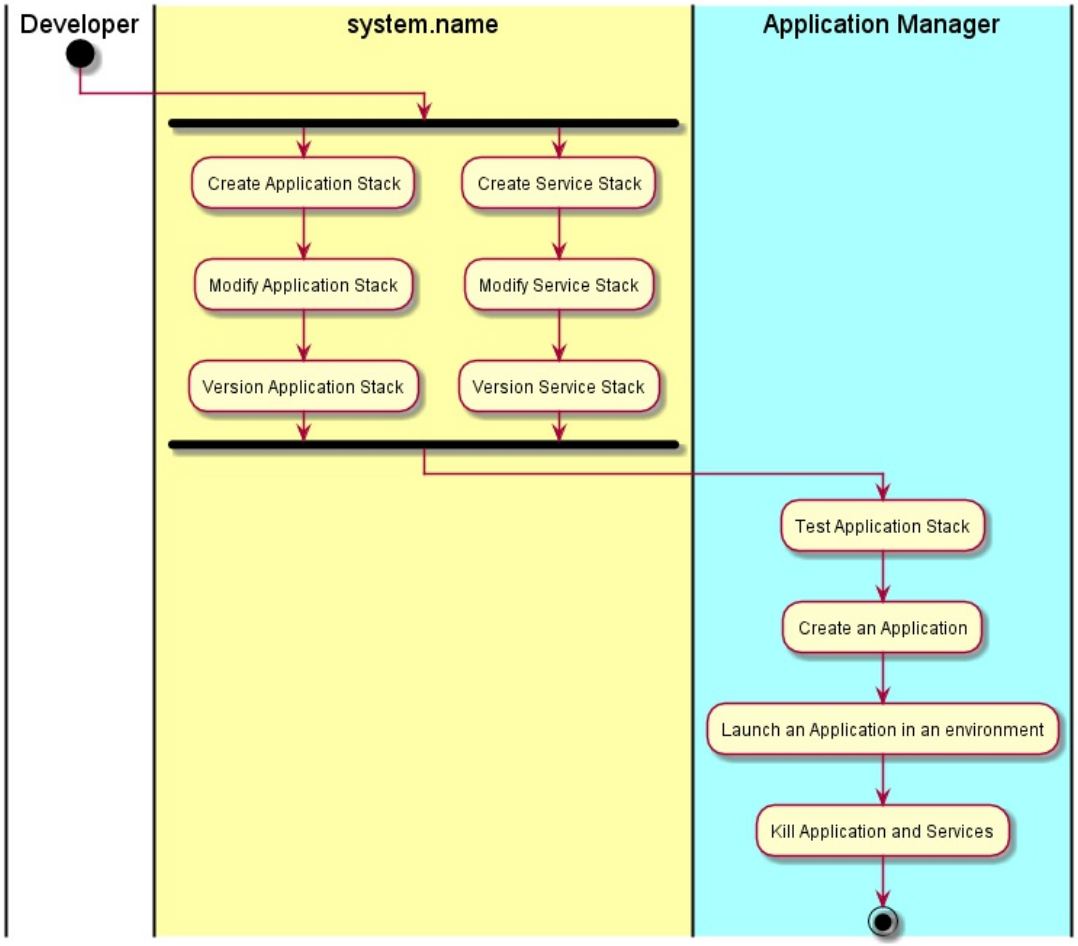

Figure: Developer Workflow

User Interface

TBD

Command Line Interface

TBD

Solution

This solution is a Docker solution of the CAADE Architecture. It utilizes Docker Swarm, Jenkins, Salt Stack and GlusterFS. It is a simple example of the concepts of the CAADE architecture running on a small scale.

Users

- Developer
- DevOps

High level Use Cases

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- Create MicroService
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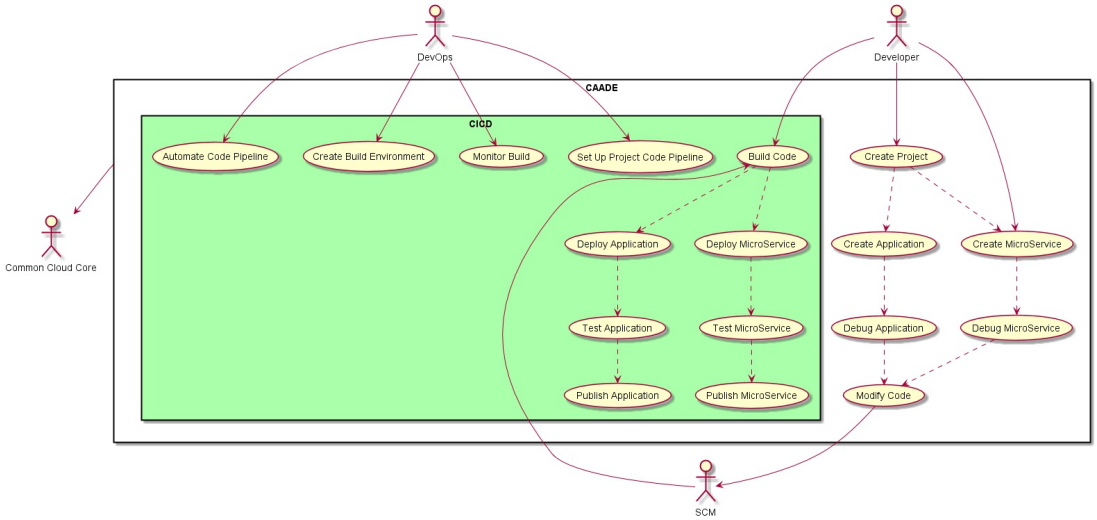

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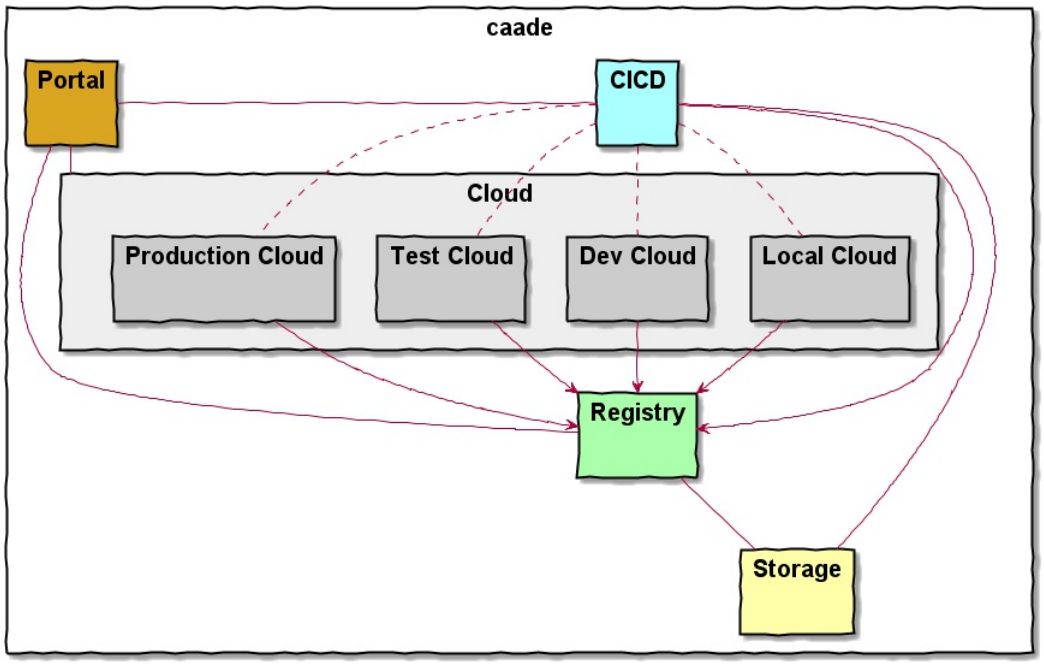

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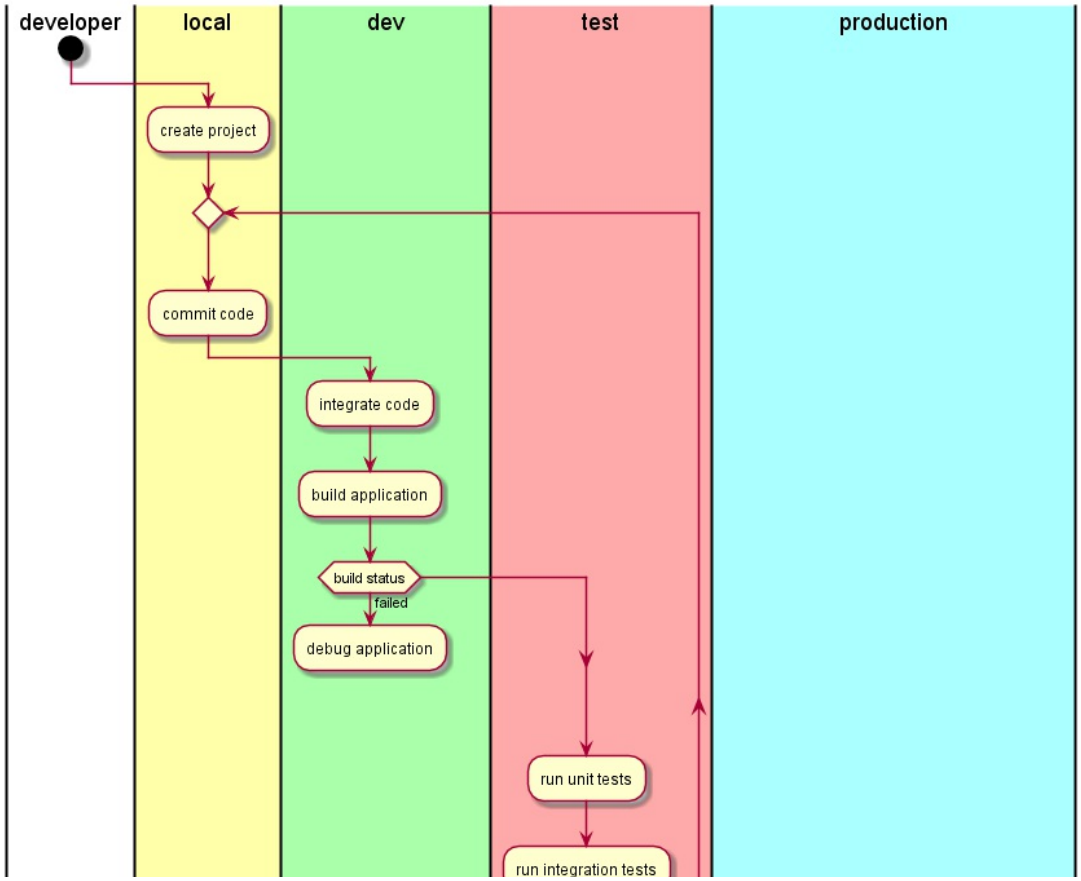

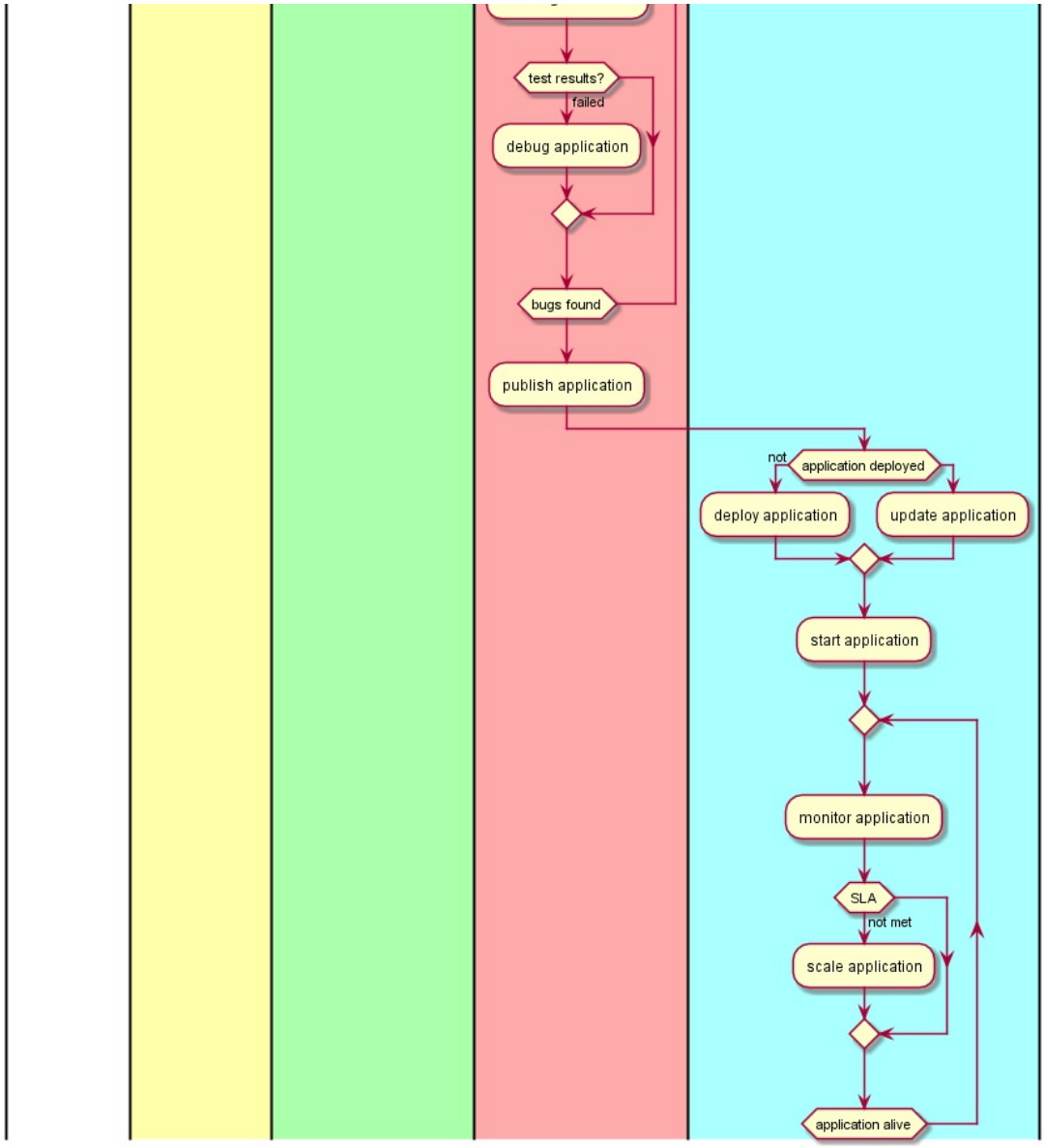

Figure: Solution Process

Deployment model

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Architecture: Cloud Aware Application Development Ecosystem

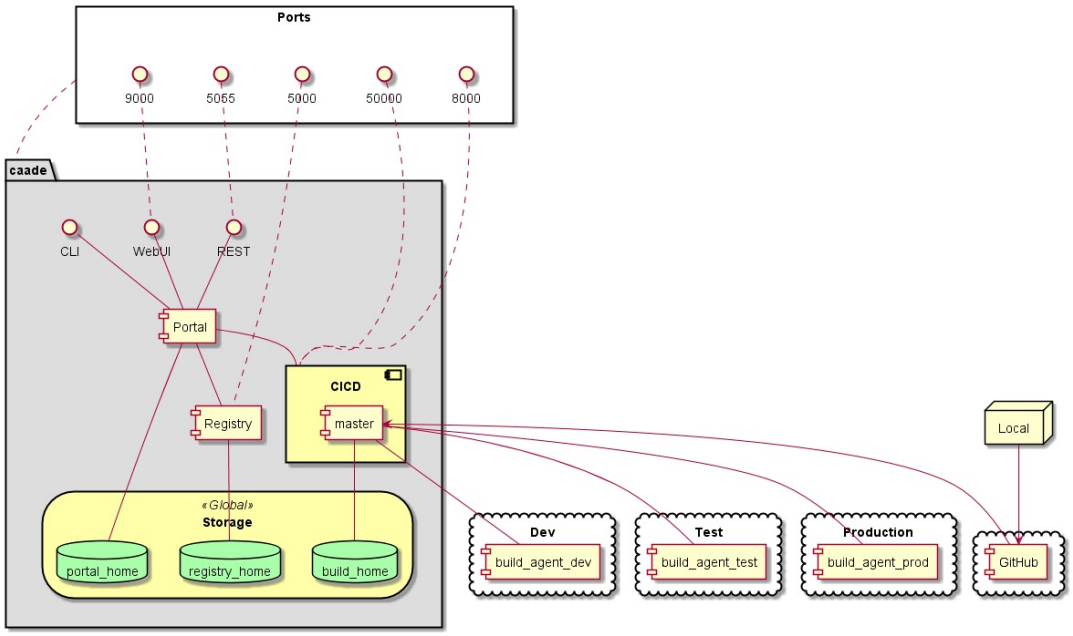

Figure: Solution Deployment

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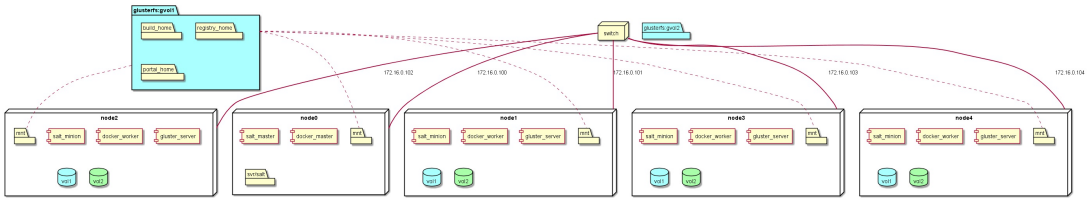


Figure: Solution Physical

Deployment_

This is a Reference Architecture for the CAADE solution using Salt, Docker, Jenkins, and Gluster

Salt Stack

Install Salt Master on Node 0

```
node0# sudo apt-get install salt-api
node0# sudo apt-get install salt-master
node0# sudo apt-get install salt-minion
```

Now that you have salt installed on node0 (master node). Go to the master configuration file /etc/salt/master and add these lines.

```
file_roots:
   base:
     - /srv/salt/

pillar_roots:
  base:
    - /srv/pillar
```

There should be several things that are in the /etc/salt/master file commented out.

Get the fingerprint of the master node

```
node0# sudo salt-key -f master.pub
```

Save this string it will be used in the configuration of the minions.

Install Salt Minion on Node[0-4]

```
node1# sudo apt-get install salt-minion
```

Now edit the /etc/salt/minion file to contain the following

```
master: node0
master_finger: "Put output of 'alt-key -f master.pub' here"
```

Get things running

On node0 start the salt master as root in the foreground

```
node0# sudo salt-master
```

or in the background

```
node0# sudo salt-master -d
```

On node[0-4] start the salt-minions

```
node1# sudo salt-minion
```

or in the background with the -d flag

```
node1# sudo salt-minion -d
```

now go back to node0 and accept the minions into the salt stack

```
node0# sudo salt-key -A
```

Now you can test and see if salt can see all of the nodes

```
node0# salt "*" test.ping
node0:
    True
node1:
    True
node2:
    True
node3:
    True
node4:
    True
```

1. Configure Salt states
2. Configure Salt Pillar
3. Download Salt Formula for CAADE

Install Gluster

Install Gluster on each of the nodes (node[0-4])

```
node0# sudo apt-get update
```

Install GlusterFS package using the following command.

```
node0# sudo apt-get install -y glusterfs-server
```

Start the glusterfs-server service on all gluster nodes.

```
node0# sudo service glusterfs-server start
```

Create Volumes for Gluster to use

This assumes that you already have drives that have been mounted.

```
sudo mkdir -p /data/gluster
sudo mount /dev/sdb1 /data/gluster
```

Add an entry to /etc/fstab for keeping the mount persistent across reboot.

```
echo "/dev/sdb1 /data/gluster ext4 defaults 0 0" | sudo tee --append /etc/fstab
```

Now attach all of the nodes to each other. Go to node0 and type the following.

```
node0# sudo gluster peer probe node1
node0# sudo gluster peer probe node2
node0# sudo gluster peer probe node3
node0# sudo gluster peer probe node4
```

Now you can add volumes to the gluster cluster

```
node0# salt "*" cmd.run "mkdir -d /data/gluster/gvol0"
node0# sudo gluster volume create gvol0 replica 2 node1:/data/gluster/gvol0 node2:/data/gluster/gvol0
node0# sudo gluster volume start gvol0
node0# sudo gluster volume info gvol0
```

Mount Gluster Volumes on all of the nodes.

Now you have created a volume and now you can access it on all of the nodes by mounting it.

```
node0# mkdir /mnt/glusterfs
node0# mount -t glusterfs node1:/gvol0 /mnt/glusterfs
```

To make the mount permanent across reboots you need to add it to the fstab

```
node0# echo "node1:/gvol0 /mnt/glusterfs glusterfs  defaults,_netdev 0 0" | echo tee --append /etc/fstab
```

Additional information can be found here

Docker Swarm

There is a great blog on how to generically set this up here.

1. Using Salt Stack install
2. Test Docker Swarm Installation

Jenkins Configuration

Install the following plugins

1. Self-Organizing Swarm Plug-in Modules

Registry Configuration

An RSA keey is needed for the local Docker Registry. This can be done with OpenSSL. The docker=compose.yaml file for the deployment of CAADE stores in volumes that are monunted into the conainter. The domain.key and domain.cert files should be accessible.

Generating the openssl certs.

So we need to generate the key and cert in a ./registry_certs directory in the same path of where you run the stack deploy command. so you will need to create a directory named registry_certs and then run the openssl command.

```
# mkdir registry_certs
# openssl req -newkey rsa:4096 -nodes -sha256 -keyout registry_certs/domain.key \
 -x509 -days 356 -out registry_certs/domain.cert
Generating a 4096 bit RSA private key
.......................++
.....................................................................................................
writing new private key to 'registry_certs/domain.key'
-----
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter '.', the field will be left blank.
-----
Country Name (2 letter code) [AU]:US
State or Province Name (full name) [Some-State]: CA
Locality Name (eg, city) []:
Organization Name (eg, company) [Internet Widgits Pty Ltd]:
Organizational Unit Name (eg, section) []:
Common Name (e.g. server FQDN or YOUR name) []: <registry server>
Email Address []:
```

Now that the keys are created and put into a directory that the docker compose file references and put into the secrets docker will now know where to find the keys and certs to launch a secure private repository. Make sure that you access the registry through the same name specified in the key generation . Ideally this would be a common name that all clients can access through exposure of the ports through the docker stack deploy. Such as the docker swarm node machine.

Putting the certs in each Client

Using the CAADE configuration we put the domain.cert in the /etc/docker/certs.d directory. Specifically we need to put the domain.cert into the /etc/docker/certs.d/<registry_address>/ca.cert. In order to do this simply we need to put the domain.cert in a mounted filesystem and using salt to update docker client. This will make it so every node in the docker swarm can access the local private repository.

```
cp -r ./registry-certs /mnt/registry/registry-certs
salt "*" cmd.run "mkdir -p /etc/docker/certs.d/node0:5000"
salt "*" cmd.run "cp /mnt/registry/registry-certs/domain.cert /etc/docker/certs.d/node0:5000/ca.crt"
salt "*" cmd.run "service docker restart"
```

Deploying the stack of services

Now that the environment is set up. You can now deploy the stack to your cluster of machines. You will need to:

1. Get the latest release from github.
2. Copy the registry_certs to the deploy directory. For the local private Registry.
3. Deploy the stack to docker.

```
# git clone http://github.com/CAADE/CAADE
# cd deploy
# cp -r <registry_certs> ./registry_certs
# docker stack deploy --compose-file production/docker-compose.yaml caade
```

Continuous Integration & Delivery

CICD

CICD is a subsystem of caade that is implemented by an existing CI/CD service that is available today. Examples of CICD systems that can be used are Jenkins, Bamboo, TravisCI, etc...

Use Cases

- Test Applicaton
- Test MicroService

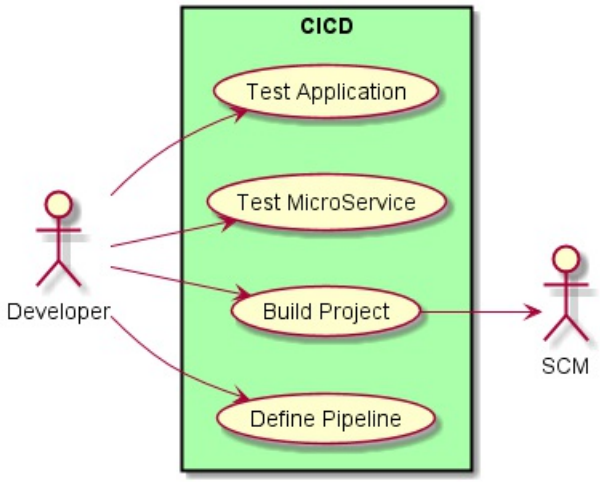


Figure: CICD UseCases

Actors

Users

- Developer

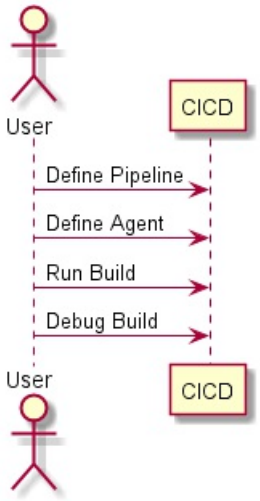


Figure: CICD UserInteraction

Uses

- CICD
- Dev Cloud
- Local Cloud
- Production Cloud
- Test Cloud

Interface

- CLI - Command Line Interface
- REST-API
- Portal - Web Portal

Logical Artifacts

- Agent - Agent running in the different clouds that perform builds for a Project
- Build - Build Stages of a pipeline for a project.
- Pipeline - Pipeline that defineds how a project is built, test, and deployed
- Project - Project that contains the application and microservices

- Stage - Stage of builds defined in the pipeline.

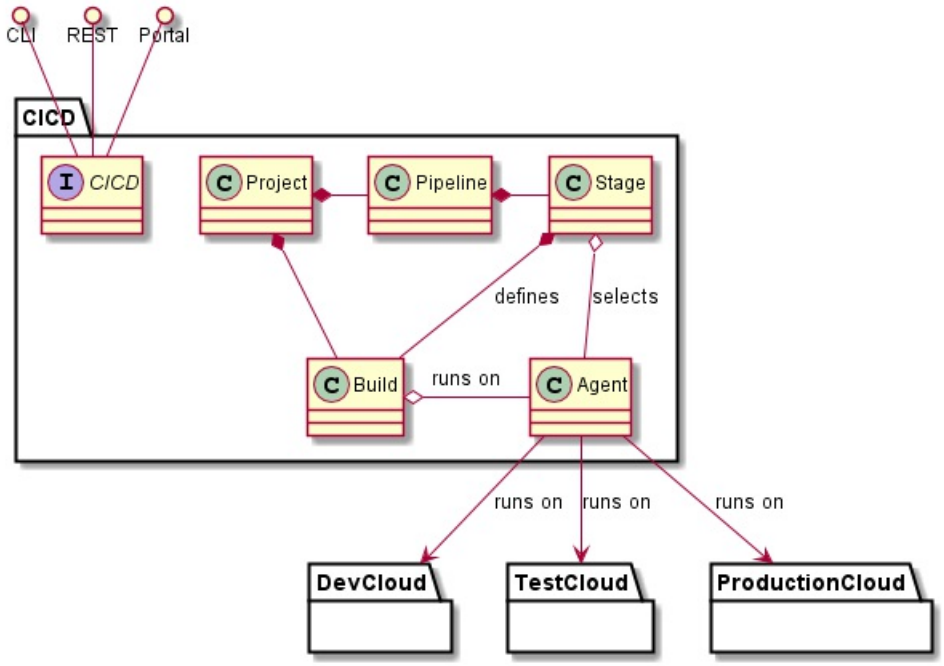


Figure: CICD Logical

Activities and Flows

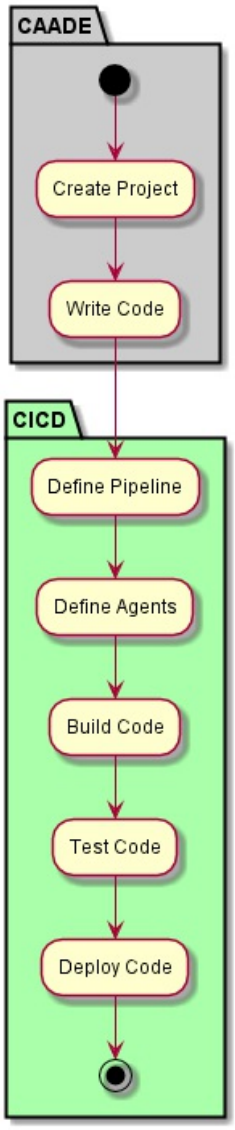


Figure: CICD Process

Deployment Architecture

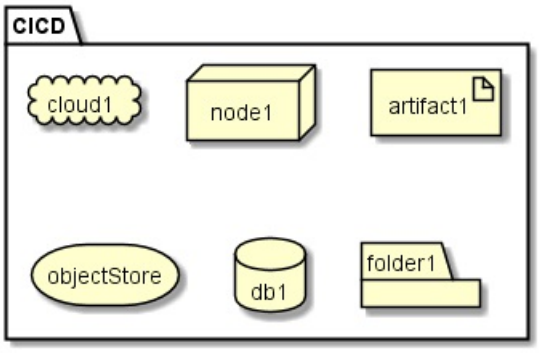


Figure: CICD Deployment

Physical Architecture

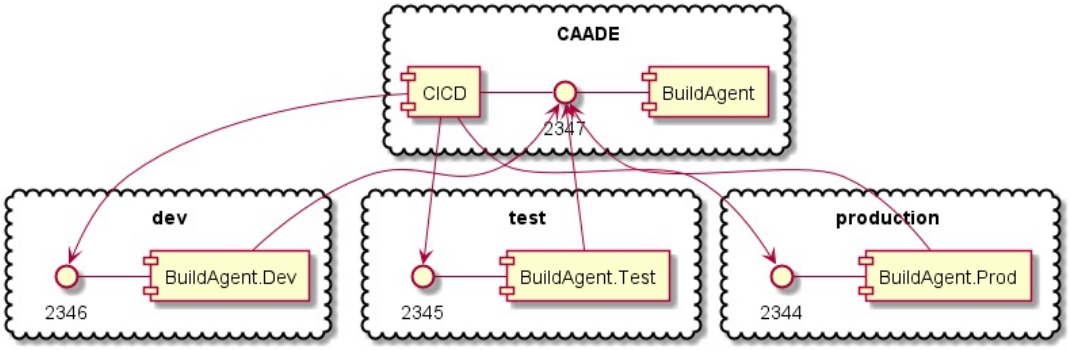


Figure: CICD Physical

Registry

Registry

Registry is a subsystem of caade ...

Use Cases

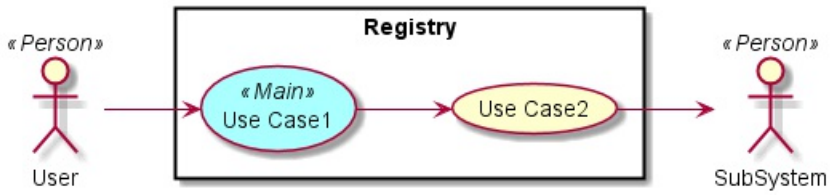
- 

Figure: Registry UseCases

Actors

Users

- User

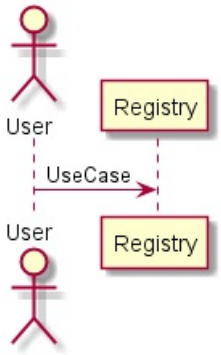


Figure: Registry UserInteraction

Uses

- SubSystem
-

Interface

- CLI - Command Line Interface
- REST-API -
- Portal - Web Portal

Logical Artifacts

*

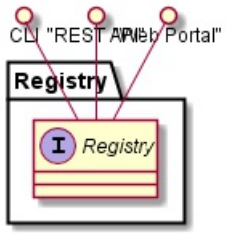


Figure: Registry Logical

Activities and Flows

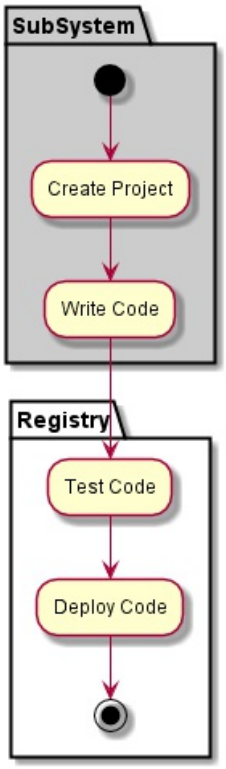


Figure: Registry Process

Deployment Architecture

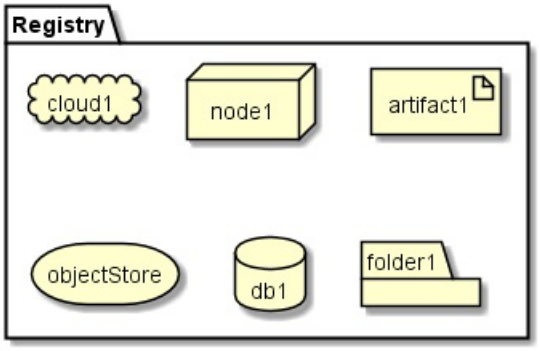


Figure: Registry Deployment

Physical Architecture

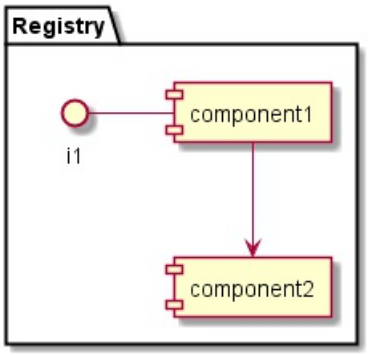


Figure: Registry Physical

Local Cloud

LocalCloud

LocalCloud is a subsystem of caade ...

Use Cases

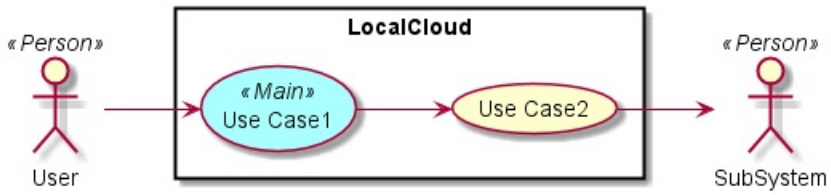


Figure: LocalCloud UseCases

Actors

Users

- User

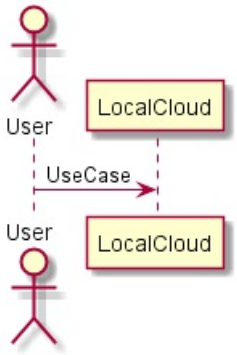


Figure: LocalCloud UserInteraction

Uses

- SubSystem

Interface

- CLI - Command Line Interface
- REST-API -
- Portal - Web Portal

Logical Artifacts

*

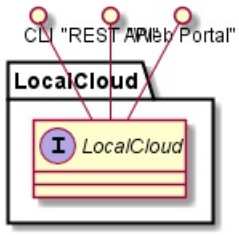


Figure: LocalCloud Logical

Activities and Flows

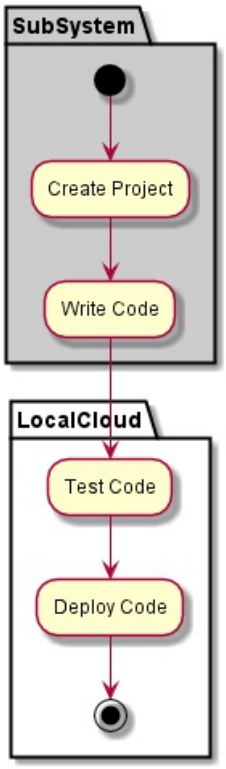


Figure: LocalCloud Process

Deployment Architecture

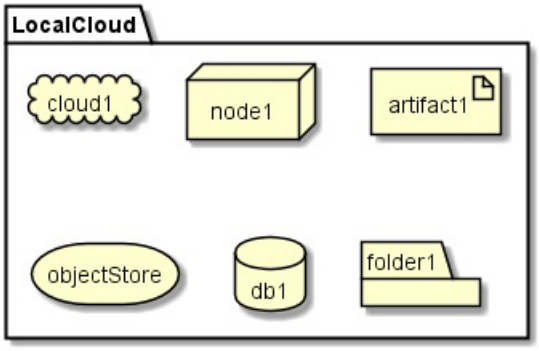


Figure: LocalCloud Deployment

Physical Architecture

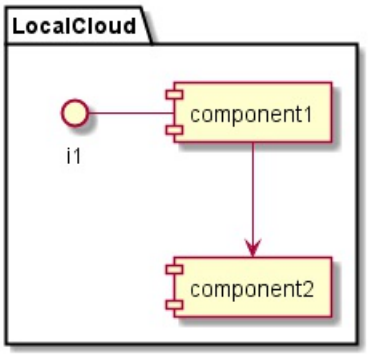


Figure: LocalCloud Physical

Dev Cloud

DevCloud

DevCloud is a subsystem of caade ...

Use Cases

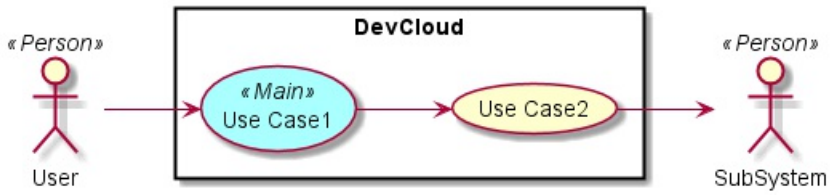


Figure: DevCloud UseCases

Actors

Users

- User

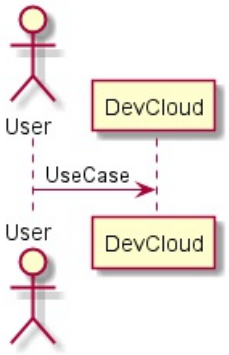


Figure: DevCloud UserInteraction

Uses

- SubSystem

Interface

- CLI - Command Line Interface
- REST-API -
- Portal - Web Portal

Logical Artifacts

*

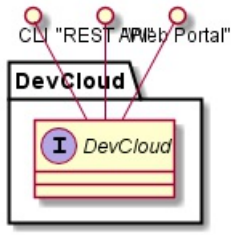


Figure: DevCloud Logical

Activities and Flows

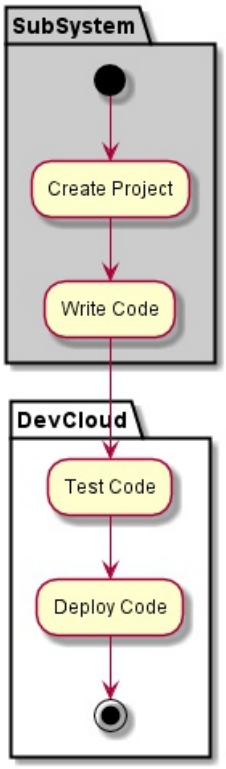


Figure: DevCloud Process

Deployment Architecture

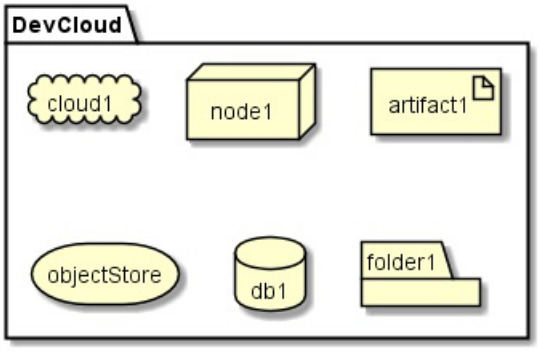


Figure: DevCloud Deployment

Physical Architecture

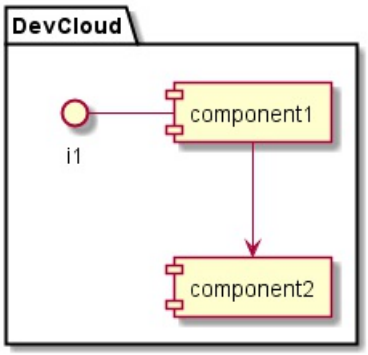


Figure: DevCloud Physical

Test Cloud

TestCloud

TestCloud is a subsystem of caade ...

Use Cases

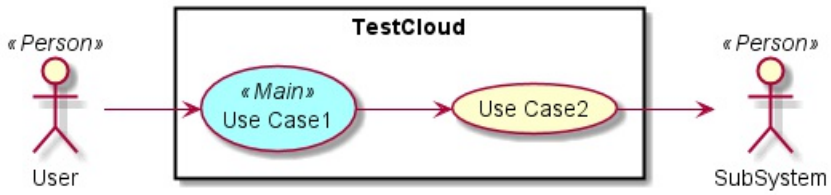


Figure: TestCloud UseCases

Actors

Users

- User

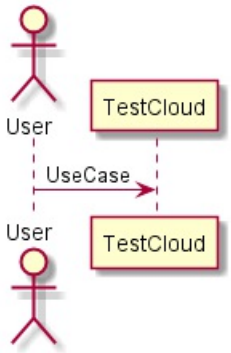


Figure: TestCloud UserInteraction

Uses

- SubSystem

Interface

- CLI - Command Line Interface
- REST-API -
- Portal - Web Portal

Logical Artifacts

*

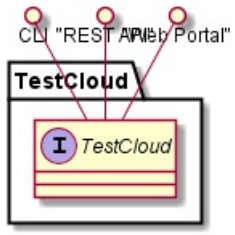


Figure: TestCloud Logical

Activities and Flows

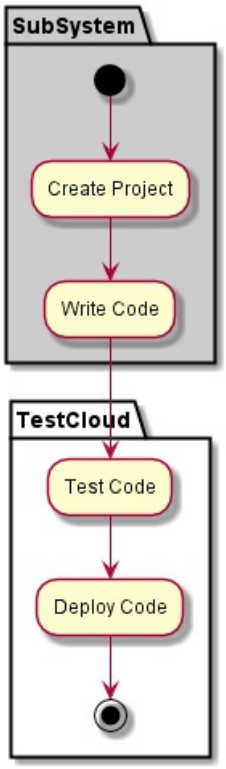


Figure: TestCloud Process

Deployment Architecture

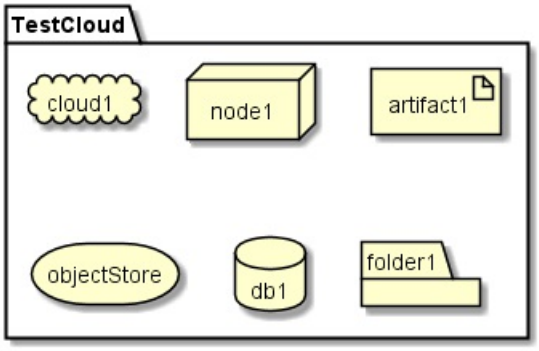


Figure: TestCloud Deployment

Physical Architecture

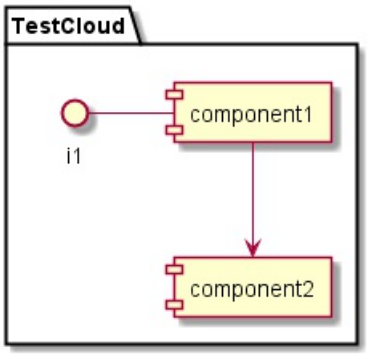


Figure: TestCloud Physical

Production Cloud

ProductionCloud

ProductionCloud is a subsystem of caade ...

Use Cases

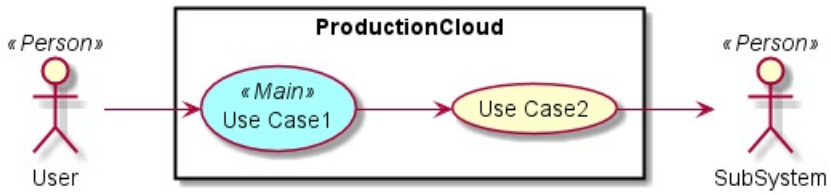


Figure: ProductionCloud UseCases

Actors

Users

- User

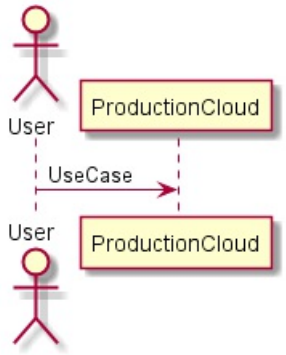


Figure: ProductionCloud UserInteraction

Uses

- SubSystem

Interface

- CLI - Command Line Interface
- REST-API -
- Portal - Web Portal

Logical Artifacts

*

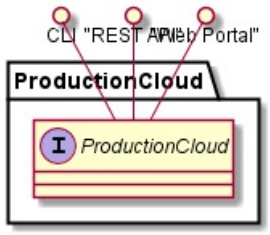


Figure: ProductionCloud Logical

Activities and Flows

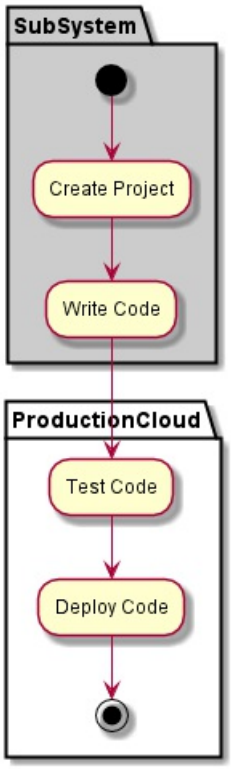


Figure: ProductionCloud Process

Deployment Architecture

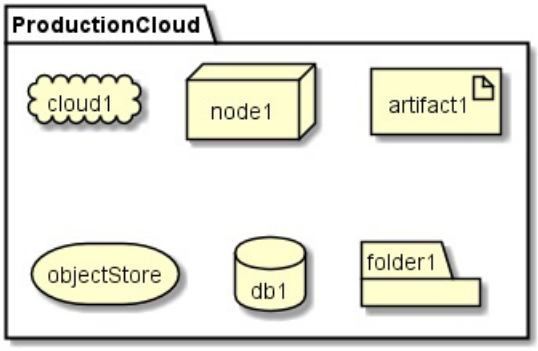


Figure: ProductionCloud Deployment

Physical Architecture

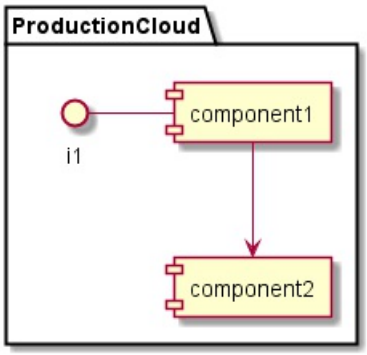


Figure: ProductionCloud Physical