ClusterCloud

10 Dec 2017 15:39:28

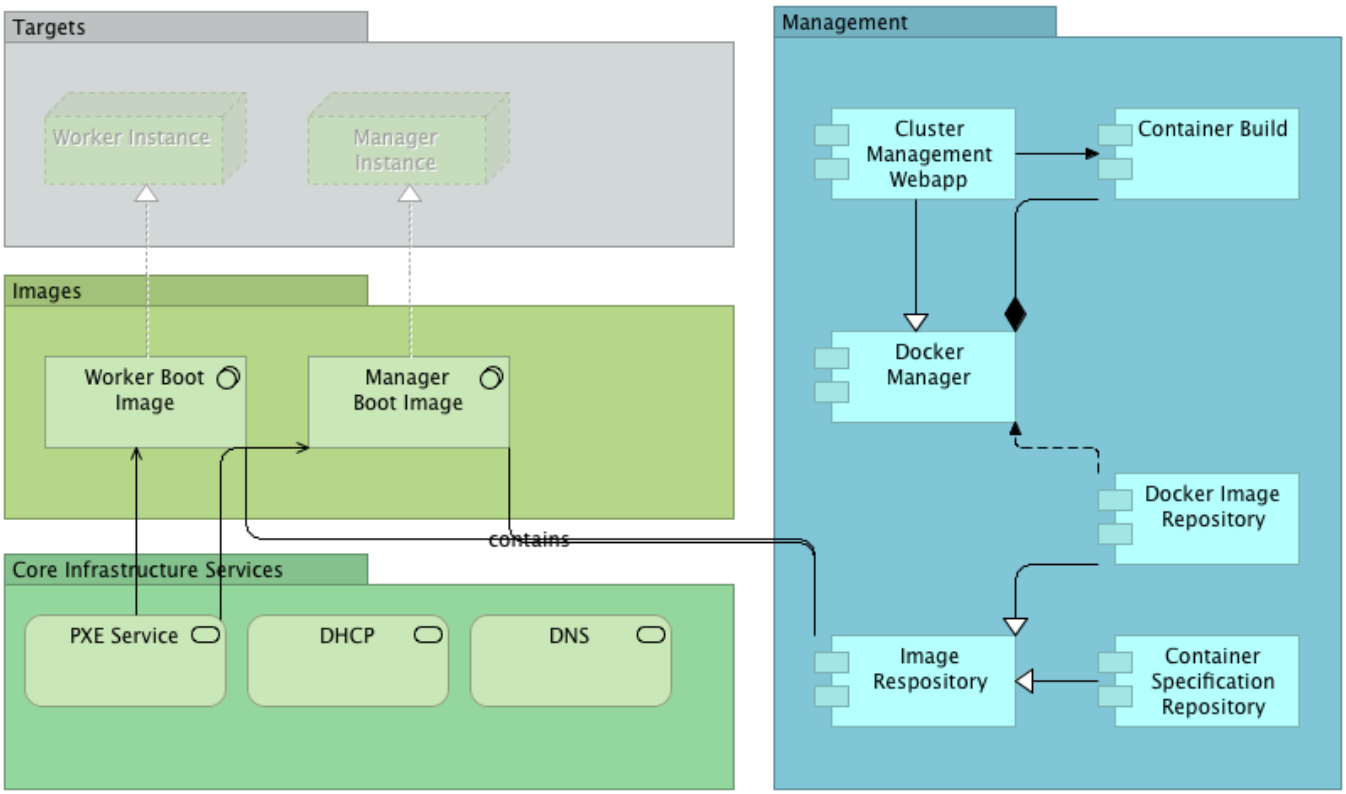
Purpose

Specification of a on-prem container cluster based on Raspberry PI 3 architecture.

Views

Block Architecture

Implementation and Deployment viewpoint



Documentation

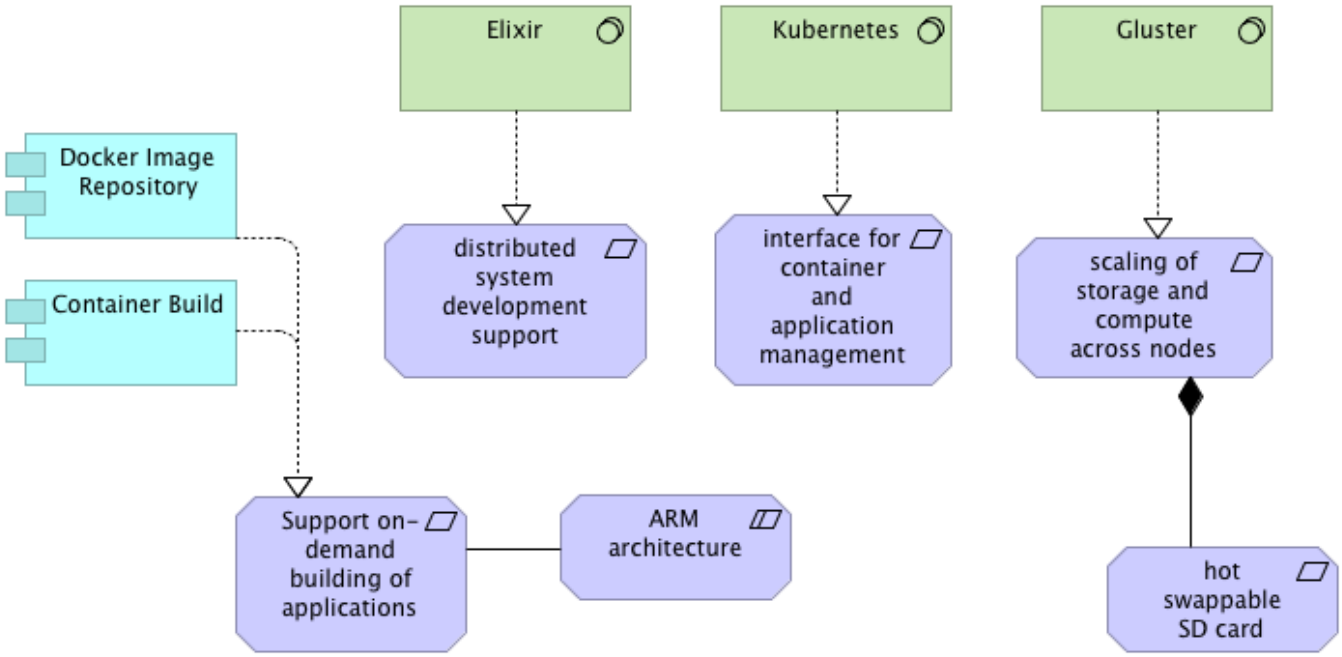
Overall architecture (Component view)

Elements

Element	Type
Cluster Management Webapp	Application Component
Container Build	Application Component
Container Specification Repository	Application Component
DHCP	Technology Service
DNS	Technology Service
Docker Image Repository	Application Component
Docker Manager	Application Component
Image Respository	Application Component
Manager Boot Image	System Software
Manager Instance	Node
PXE Service	Technology Service
Worker Boot Image	System Software
Worker Instance	Node

Constraints and Requirements

Requirements Realization viewpoint

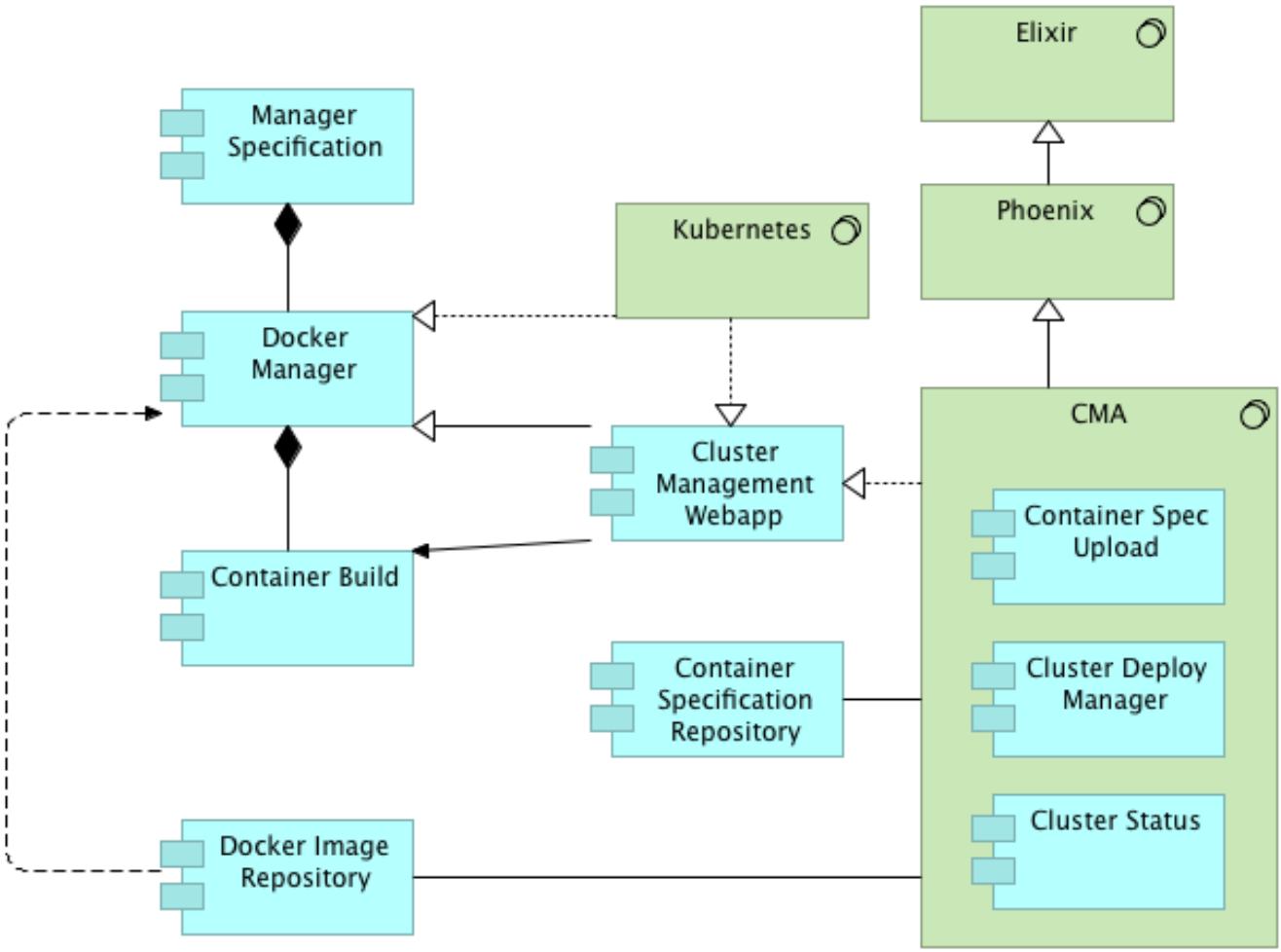


Elements

Element	Type
ARM architecture	Constraint
Container Build	Application Component
distributed system development support	Requirement
Docker Image Repository	Application Component
Elixir	System Software
Gluster	System Software
hot swappable SD card support	Requirement
interface for container and application management	Requirement
Kubernetes	System Software
scaling of storage and compute across nodes	Requirement
Support on-demand building of applications	Requirement

Container Management

Technology Usage viewpoint

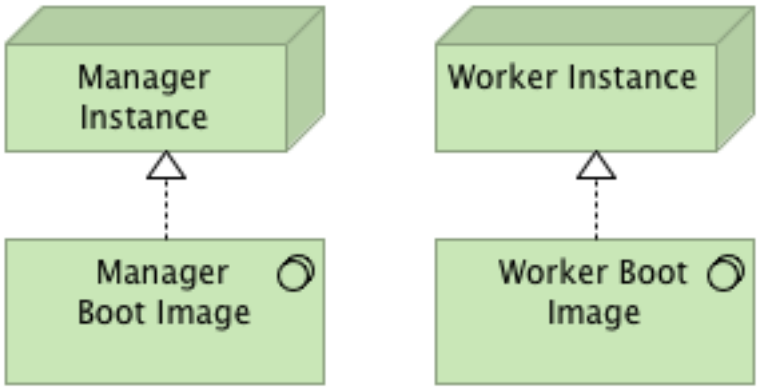


Elements

Element	Type
Cluster Deploy Manager	Application Component
Cluster Management Webapp	Application Component
Cluster Status	Application Component
CMA	System Software
Container Build	Application Component
Container Spec Upload	Application Component
Container Specification Repository	Application Component
Docker Image Repository	Application Component
Docker Manager	Application Component
Elixir	System Software
Kubernetes	System Software
Manager Specification	Application Component
Phoenix	System Software

Deployment

Technology viewpoint

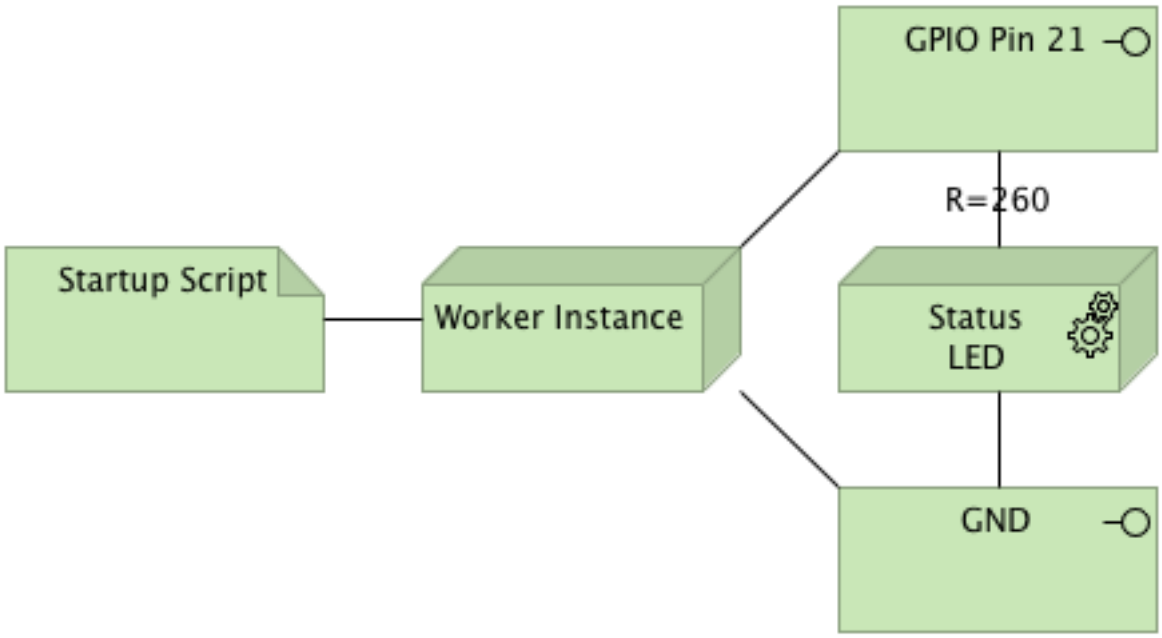


Elements

Element	Type
Manager Boot Image	System Software
Manager Instance	Node
Worker Boot Image	System Software
Worker Instance	Node

GPIO Hardware IMPL

No viewpoint



Documentation

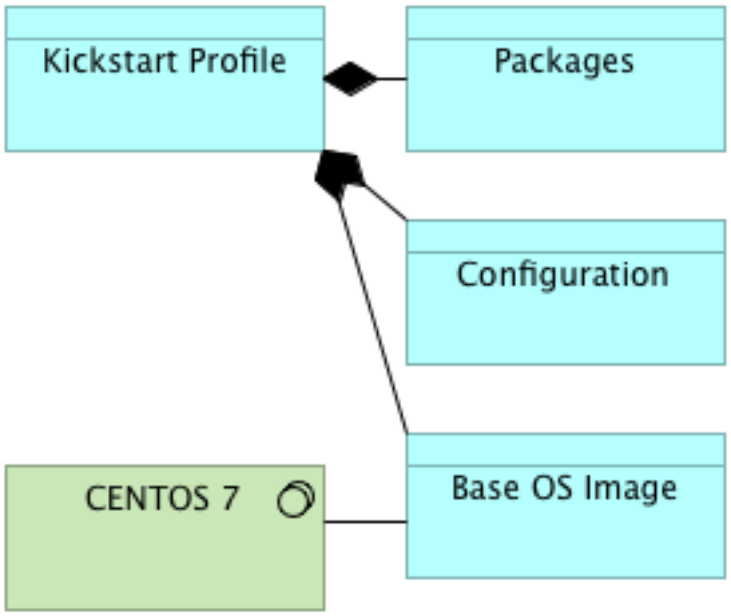
Implementation of hardware notification of node status via RPI LED

Elements

Element	Type
GND	Technology Interface
GPIO Pin 21	Technology Interface
Startup Script	Artifact
Status LED	Equipment
Worker Instance	Node

Kickstart Profile

Implementation and Migration viewpoint



Documentation

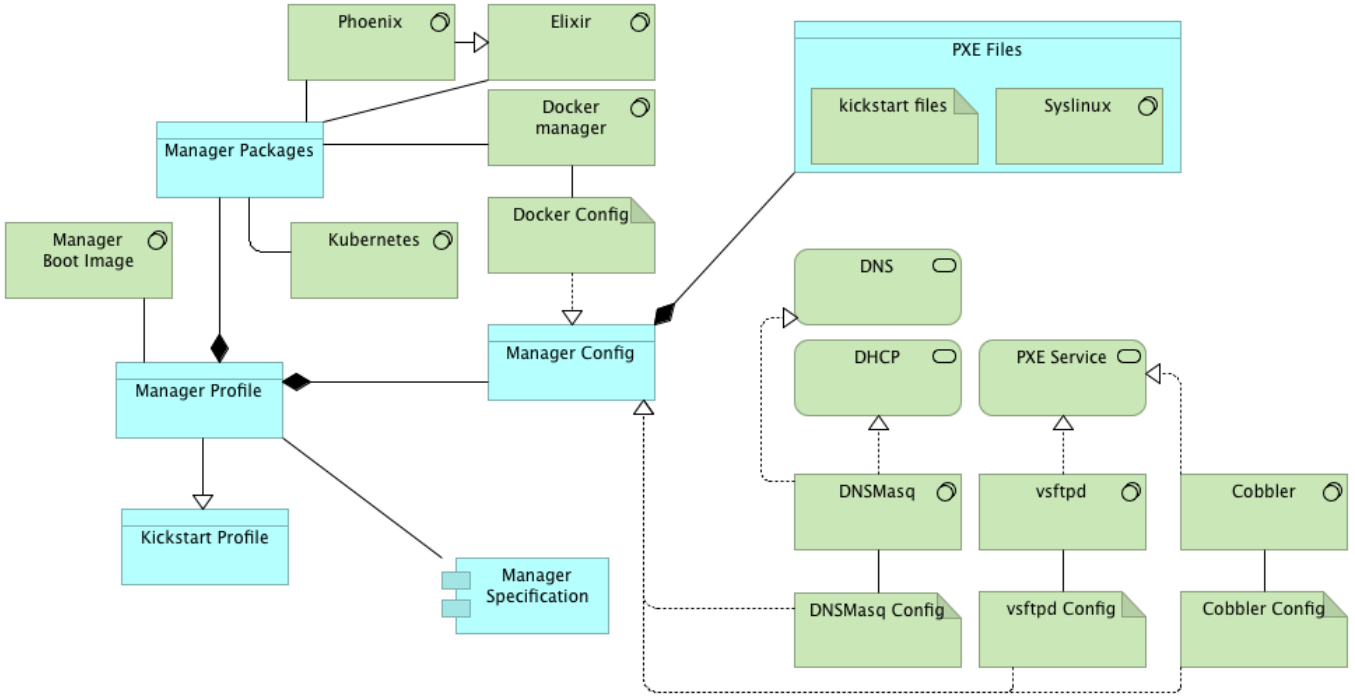
Components of a kickstart profile

Elements

Element	Type
Base OS Image	Data Object
CENTOS 7	System Software
Configuration	Data Object
Kickstart Profile	Data Object
Packages	Data Object

Manager Profile

Implementation and Migration viewpoint



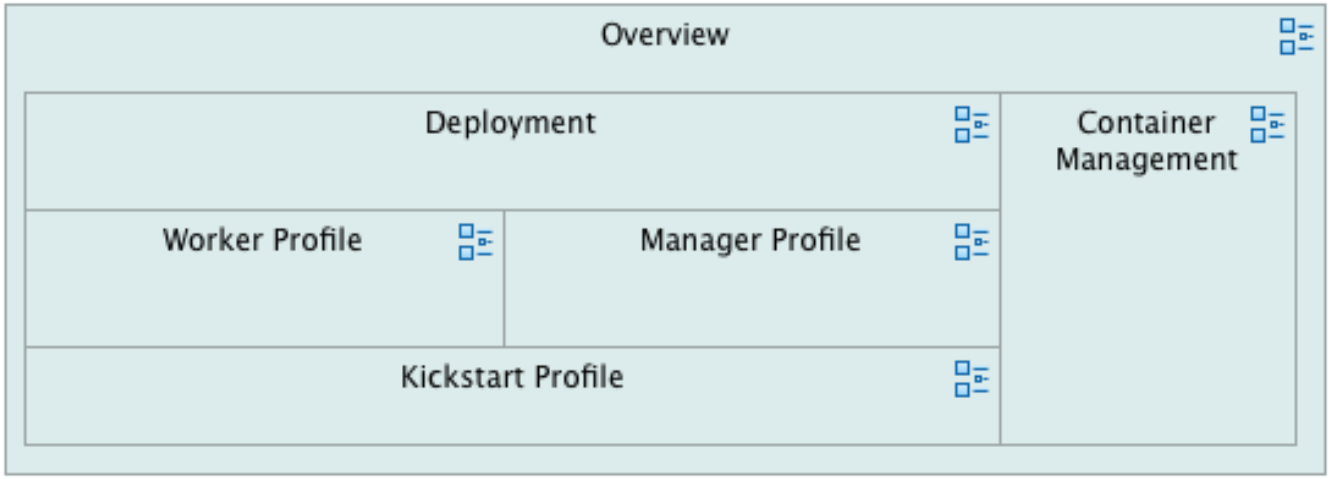
Elements

Element	Type
Cobbler	System Software
Cobbler Config	Artifact
DHCP	Technology Service
DNS	Technology Service
DNSMasq	System Software
DNSMasq Config	Artifact
Docker Config	Artifact
Docker manager	System Software
Elixir	System Software
kickstart files	Artifact
Kickstart Profile	Data Object
Kubernetes	System Software
Manager Boot Image	System Software
Manager Config	Data Object
Manager Packages	Data Object
Manager Profile	Data Object
Manager Specification	Application Component
Phoenix	System Software
PXE Files	Data Object
PXE Service	Technology Service
Syslinux	System Software
vsftpd	System Software

Element	Type
vsftpd Config	Artifact

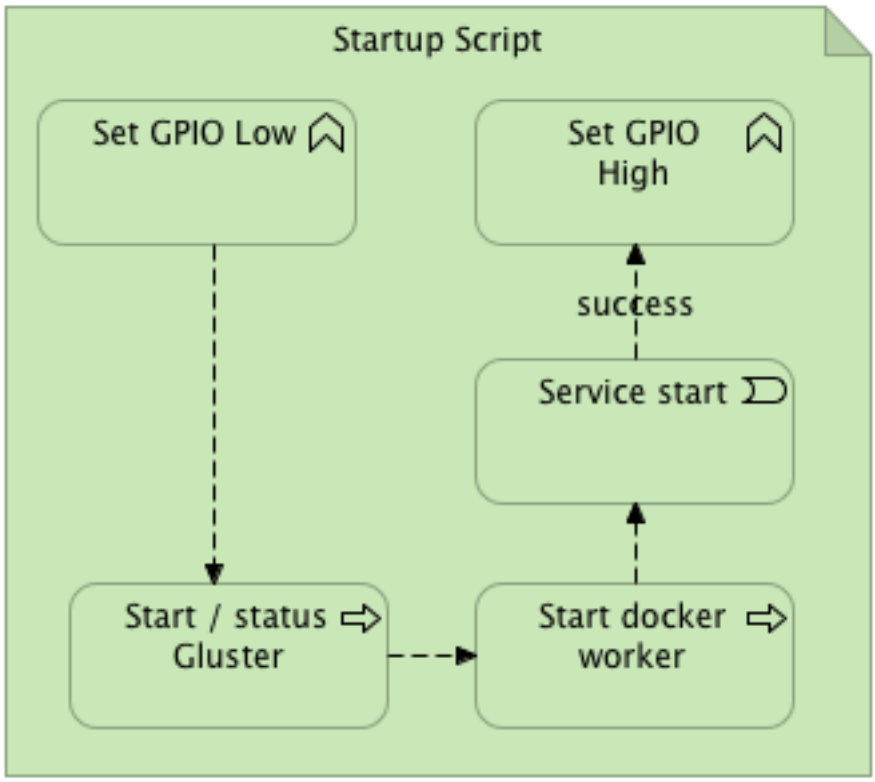
Map View

Project viewpoint



Notification Script IMPL

Technology viewpoint



Documentation

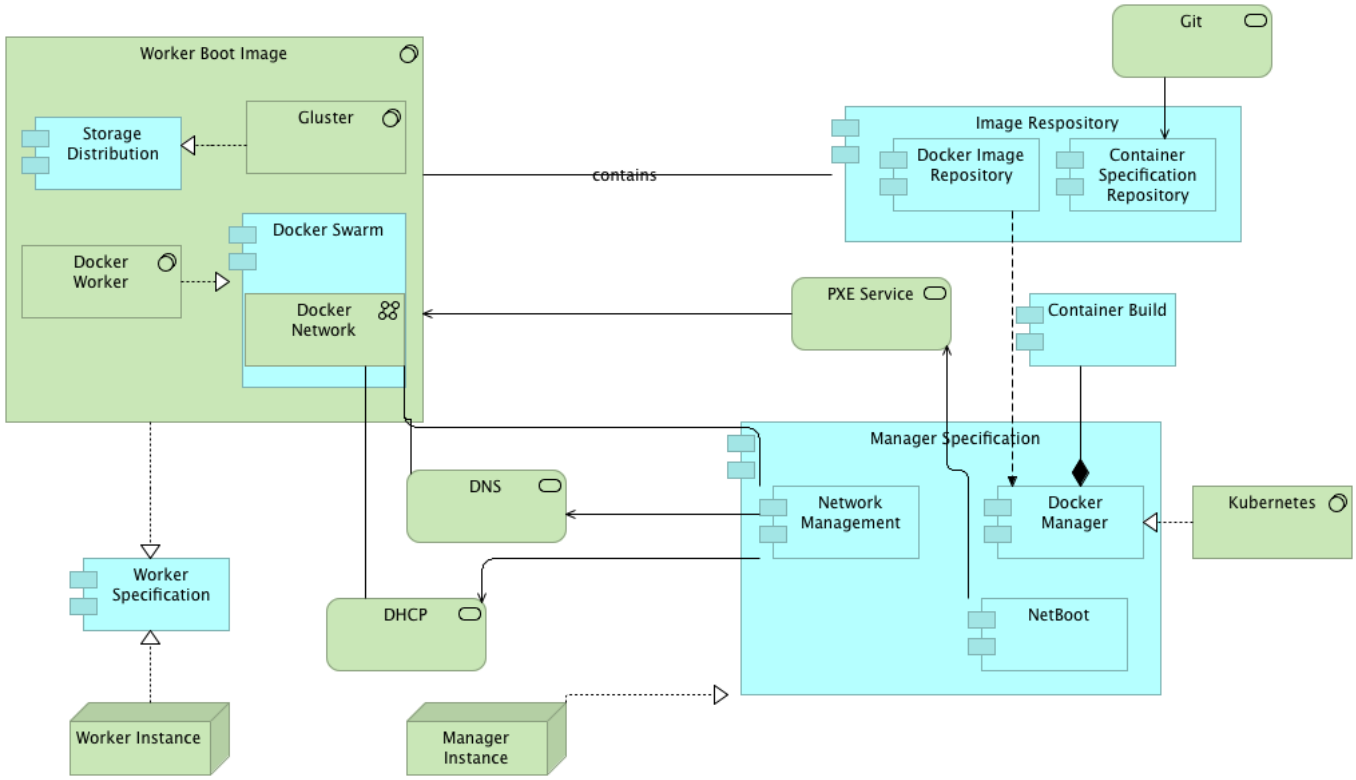
Implementation workflow for LED Status

Elements

Element	Type
Service start	Technology Event
Set GPIO High	Technology Function
Set GPIO Low	Technology Function
Start / status Gluster	Technology Process
Start docker worker	Technology Process
Startup Script	Artifact

Overview

Implementation and Migration viewpoint



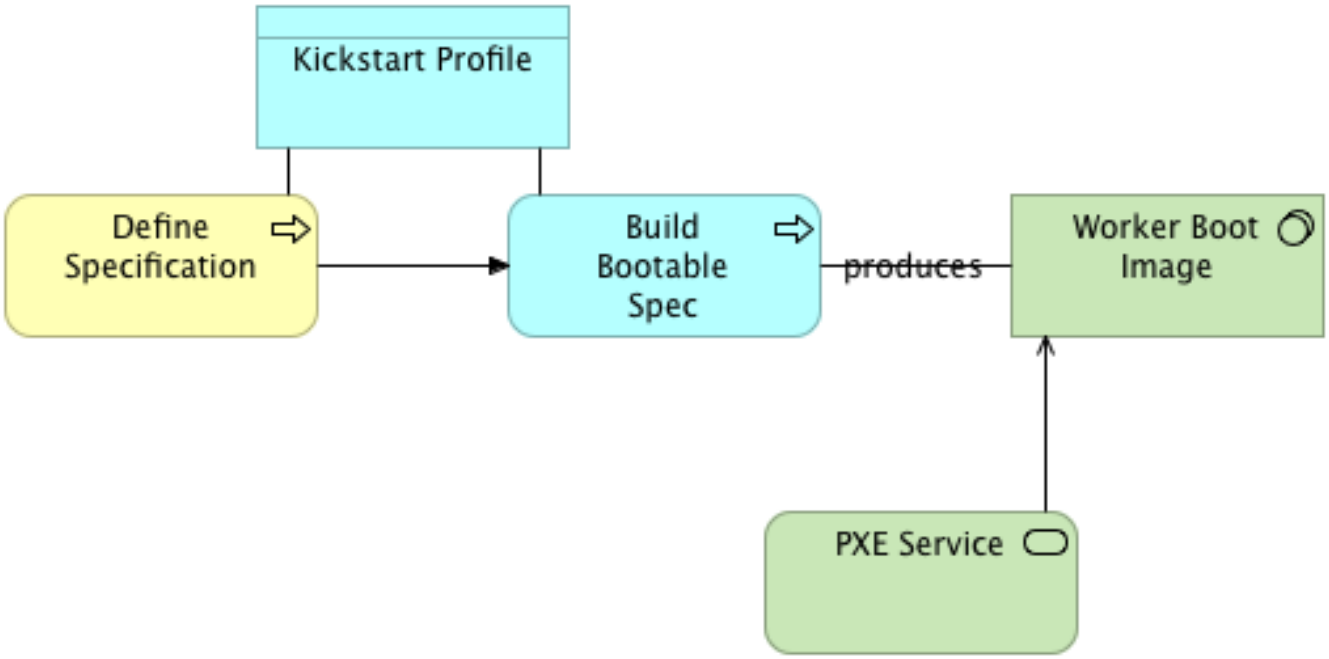
Elements

Element	Type
Container Build	Application Component
Container Specification Repository	Application Component
DHCP	Technology Service
DNS	Technology Service
Docker Image Repository	Application Component
Docker Manager	Application Component
Docker Network	Communication Network
Docker Swarm	Application Component
Docker Worker	System Software
Git	Technology Service
Gluster	System Software
Image Respository	Application Component
Kubernetes	System Software
Manager Instance	Node
Manager Specification	Application Component
NetBoot	Application Component
Network Management	Application Component
PXE Service	Technology Service
Storage Distribution	Application Component
Worker Boot Image	System Software
Worker Instance	Node

Element	Type
Worker Specification	Application Component

Process - Create PXE Image

No viewpoint



Documentation

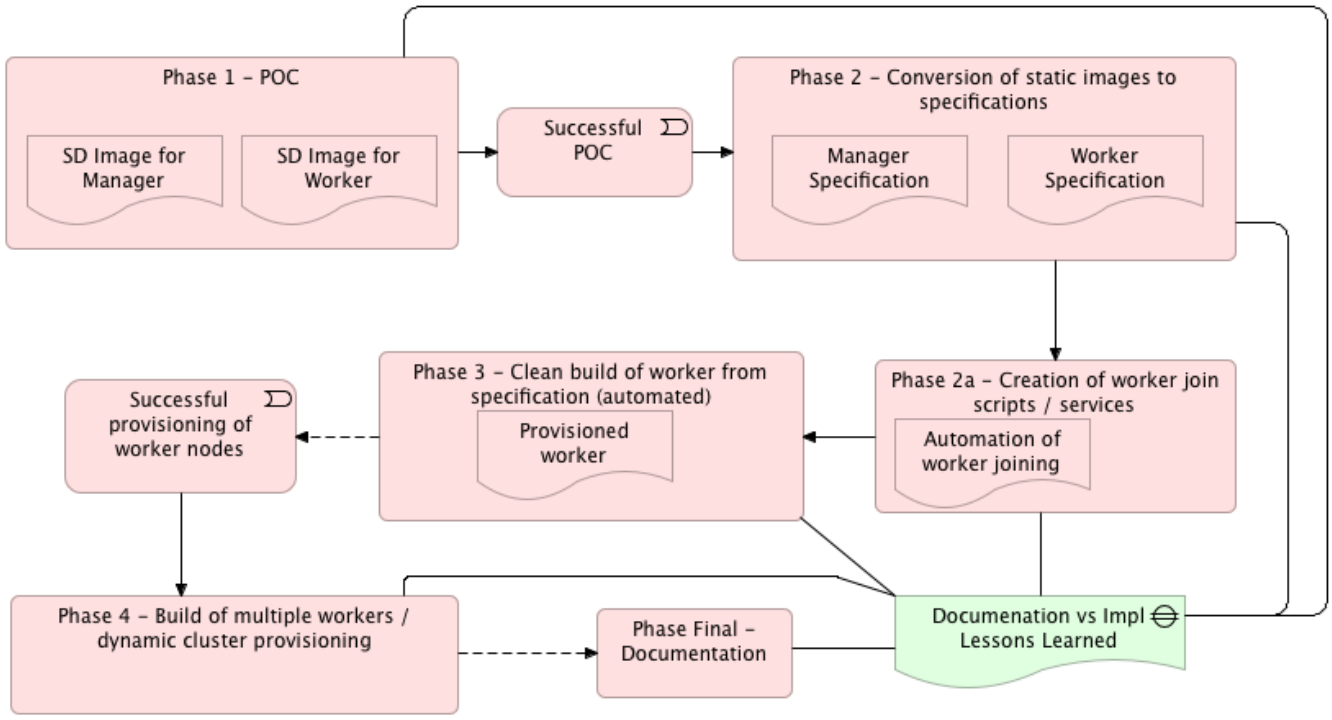
Creation of boot image

Elements

Element	Type
Build Bootable Spec	Application Process
Define Specification	Business Process
Kickstart Profile	Data Object
PXE Service	Technology Service
Worker Boot Image	System Software

Work Packages

Implementation and Migration viewpoint



Documentation

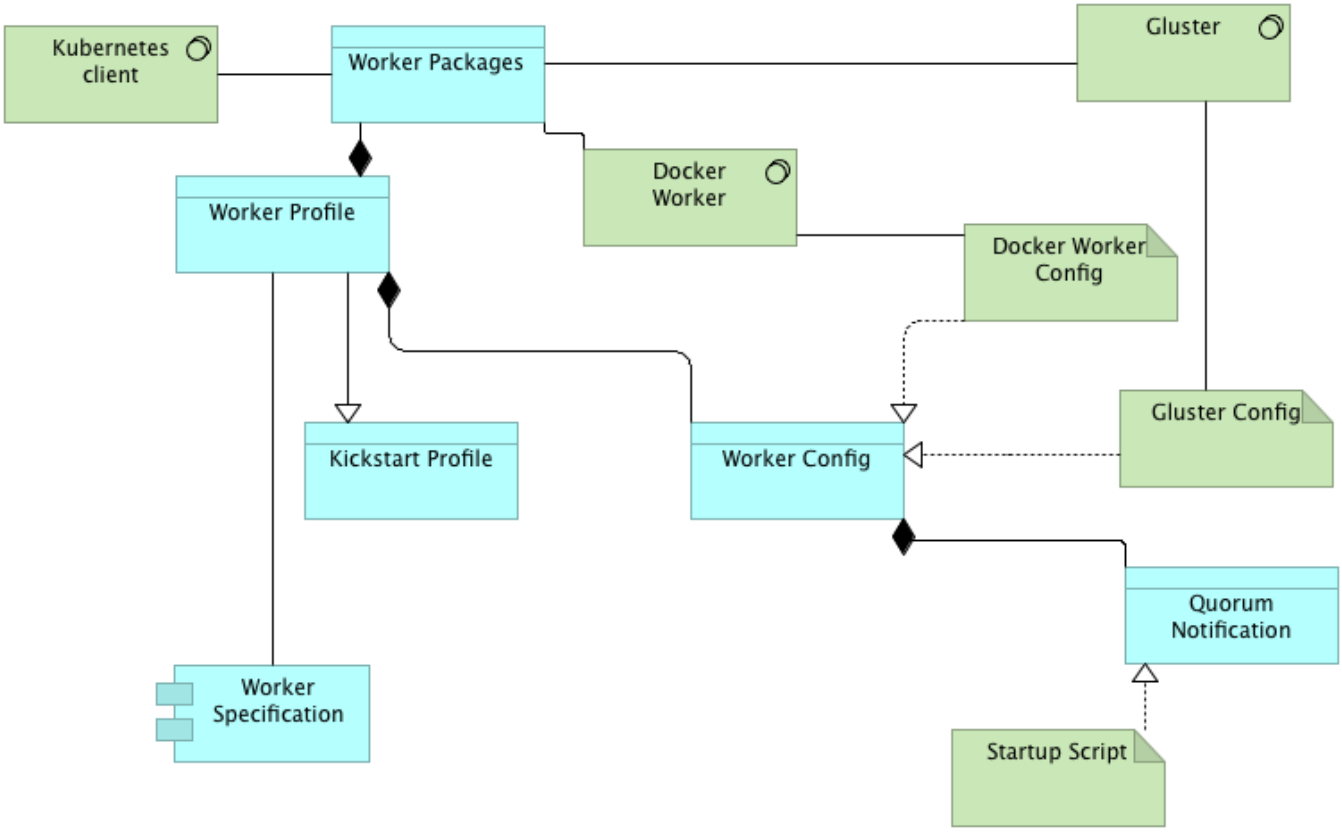
Description of major work packages and deliverables

Elements

Element	Type
Automation of worker joining	Deliverable
Documenation vs Impl Lessons Learned	Gap
Manager Specification	Deliverable
Phase 1 - POC	Work Package
Phase 2 - Conversion of static images to specifications	Work Package
Phase 2a - Creation of worker join scripts / services	Work Package
Phase 3 - Clean build of worker from specification (automated)	Work Package
Phase 4 - Build of multiple workers / dynamic cluster provisioning	Work Package
Phase Final - Documentation	Work Package
Provisioned worker	Deliverable
SD Image for Manager	Deliverable
SD Image for Worker	Deliverable
Successful POC	Implementation Event
Successful provisioning of worker nodes	Implementation Event
Worker Specification	Deliverable

Worker Profile

Implementation and Migration viewpoint



Elements

Element	Type
Docker Worker	System Software
Docker Worker Config	Artifact
Gluster	System Software
Gluster Config	Artifact
Kickstart Profile	Data Object
Kubernetes client	System Software
Quorum Notification	Data Object
Startup Script	Artifact
Worker Config	Data Object
Worker Packages	Data Object
Worker Profile	Data Object
Worker Specification	Application Component

Business Layer

Define Specification

Type	Business Process

Application Layer

Application Service

Type	Application Service

Application Component

Type	Application Component

Base OS Image

Type	Data Object

Build Bootable Spec

Type	Application Process

Cluster Deploy Manager

Type	Application Component

Cluster Management Webapp

Type	Application Component

Cluster Status

Type	Application Component

Configuration

Type	Data Object

Container Build

Type	Application Component

Container Spec Upload

Type	Application Component

Container Specification Repository

Type	Application Component

Docker Image Repository

Type	Application Component

Docker Manager

Type	Application Component

Docker Swarm

Type	Application Component

Image Respository

Type	Application Component

Kickstart Profile

Type	Data Object

Kubernetes

Type	Application Component

Manager Config

Type	Data Object

Manager Packages

Type	Data Object

Manager Profile

Type	Data Object

Manager Specification

Type	Application Component

NetBoot

Type	Application Component

Network Management

Type	Application Component

Packages

Type	Data Object

PXE Files

Type	Data Object

Quorum Notification

Type	Data Object

Storage Distribution

Type	Application Component

Worker Config

Type	Data Object

Worker Packages

Type	Data Object

Worker Profile

Type	Data Object

Worker Specification

Type	Application Component

Technology & Physical Layer

CENTOS 7

Type	System Software

CMA

Type	System Software

Cobbler

Type	System Software

Cobbler Config

Type	Artifact

DHCP

Type	Technology Service

DNS

Type	Technology Service

DNSMasq

Type	System Software

DNSMasq Config

Type	Artifact

Docker Config

Type	Artifact

Docker manager

Type	System Software

Docker Network

Type	Communication Network

Docker Worker

Type	System Software

Docker Worker Config

Type	Artifact

Elixir

Type	System Software

Git

Type	Technology Service

Gluster

Type	System Software

Gluster Config

Type	Artifact

GND

Type	Technology Interface

GPIO Pin 21

Type	Technology Interface

kickstart files

Type	Artifact

Kubernetes

Type	System Software

Kubernetes client

Type	System Software

Manager Boot Image

Type	System Software

Manager Instance

Type	Node

Phoenix

Type	System Software

PXE Service

Type	Technology Service

Service start

Type	Technology Event

Set GPIO High

Type	Technology Function

Set GPIO Low

Type	Technology Function

Start / status Gluster

Type	Technology Process

Start docker worker

Type	Technology Process

Startup Script

Type	Artifact

Status LED

Type	Equipment

Syslinux

Type	System Software

vsftpd

Type	System Software

vsftpd Config

Type	Artifact

Worker Boot Image

Type	System Software

Worker Instance

Type	Node

Motivation

ARM architecture

Type	Constraint

ARM architecture of Raspberry PI limits available docker images and packages

distributed system development support

Type	Requirement

Support the development of distributed systems, applications, and components

hot swappable SD card support

Type	Requirement

Storage system should be built such that once n+1 environment is up, storage can be incrementally increased by failing a storage physical device, replacing with a larger capacity device, and adding back into cluster.

interface for container and application management

Type	Requirement

A GUI should be provided for the management of nodes, applications, and images

scaling of storage and compute across nodes

Type	Requirement

Storage and compute can be added dynamically based on adding a new worker or manager node, higher capacity SD card, etc

Support on-demand building of applications

Type	Requirement

Implementation and Migration

Automation of worker joining

Type	Deliverable

Documenation vs Impl Lessons Learned

Type	Gap

> Gap between documentation and implementation

Manager Specification

Type	Deliverable

Phase 1 - POC

Type	Work Package

Phase 2 - Conversion of static images to specifications

Type	Work Package

Phase 2a - Creation of worker join scripts / services

Type	Work Package

Phase 3 - Clean build of worker from specification (automated)

Type	Work Package

Phase 4 - Build of multiple workers / dynamic cluster provisioning

Type	Work Package

Phase Final - Documentation

Type	Work Package

Provisioned worker

Type	Deliverable

SD Image for Manager

Type	Deliverable

SD Image for Worker

Type	Deliverable

Successful POC

Type	Implementation Event

Successful provisioning of worker nodes

Type	Implementation Event

Worker Specification

Type	Deliverable

Other

Junction

Type	Junction

Relations

Realization relation

Type	Realization relation
Source	Worker Instance
Target	Worker Specification

Realization relation

Type	Realization relation
Source	Manager Instance
Target	Manager Specification

Serving relation

Type	Serving relation
Source	NetBoot
Target	PXE Service

Realization relation

Type	Realization relation
Source	Gluster
Target	Storage Distribution

Composition relation

Type	Composition relation
Source	Worker Specification
Target	Docker Swarm

Composition relation

Type	Composition relation
Source	Worker Specification
Target	Storage Distribution

Composition relation

Type	Composition relation
Source	Manager Specification
Target	Docker Manager

Composition relation

Type	Composition relation
Source	Manager Specification
Target	Network Management

Composition relation

Type	Composition relation

Source	Manager Specification
Target	NetBoot

Serving relation

Type	Serving relation
Source	Network Management
Target	DHCP

Serving relation

Type	Serving relation
Source	Network Management
Target	DNS

Composition relation

Type	Composition relation
Source	Docker Manager
Target	Container Build

Association relation

Type	Association relation
Source	Network Management
Target	Docker Network

Realization relation

Type	Realization relation
Source	Worker Boot Image
Target	Worker Specification

Realization relation

Type	Realization relation
Source	Worker Boot Image
Target	Storage Distribution

Realization relation

Type	Realization relation
Source	Worker Boot Image
Target	Docker Swarm

Composition relation

Type	Composition relation
Source	Worker Boot Image
Target	Gluster

Serving relation

Type	Serving relation
Source	PXE Service
Target	Worker Boot Image

Specialization relation

Type	Specialization relation
Source	Docker Image Repository
Target	Image Respository

Specialization relation

Type	Specialization relation
Source	Container Specification Repository
Target	Image Respository

Serving relation

Type	Serving relation
Source	Git
Target	Container Specification Repository

Flow relation

Type	Flow relation
Source	Docker Image Repository
Target	Docker Manager

Composition relation

Type	Composition relation
Source	Worker Boot Image
Target	Docker Worker

Realization relation

Type	Realization relation
Source	Docker Worker
Target	Docker Swarm

Association relation

Type	Association relation
Source	Docker Network
Target	DNS

Association relation

Type	Association relation
Source	DHCP
Target	Docker Network

Composition relation

Type	Composition relation
Source	Kickstart Profile
Target	Packages

Composition relation

Type	Composition relation
Source	Kickstart Profile
Target	Configuration

Association relation

Type	Association relation
Source	Configuration
Target	Packages

Composition relation

Type	Composition relation
Source	Kickstart Profile
Target	Base OS Image

Association relation

Type	Association relation
Source	Packages
Target	Base OS Image

Association relation

Type	Association relation
Source	CENTOS 7
Target	Base OS Image

Association relation

Type	Association relation
Source	Kickstart Profile
Target	Build Bootable Spec

Triggering relation

Type	Triggering relation
Source	Define Specification
Target	Build Bootable Spec

Association relation

Type	Association relation
Source	Define Specification

Target	Kickstart Profile

Specialization relation

Type	Specialization relation
Source	Worker Profile
Target	Kickstart Profile

Composition relation

Type	Composition relation
Source	Worker Profile
Target	Worker Packages

Association relation

Type	Association relation
Source	Gluster
Target	Worker Packages

Association relation

Type	Association relation
Source	Docker Worker
Target	Worker Packages

Composition relation

Type	Composition relation
Source	Worker Profile
Target	Worker Config

Composition relation

Type	Composition relation
Source	Worker Config
Target	Quorum Notification

Realization relation

Type	Realization relation
Source	Startup Script
Target	Quorum Notification

Specialization relation

Type	Specialization relation
Source	Manager Profile
Target	Kickstart Profile

Composition relation

Type	Composition relation

Source	Manager Profile
Target	Manager Packages

Composition relation

Type	Composition relation
Source	Manager Profile
Target	Manager Config

Association relation

Type	Association relation
Source	Docker manager
Target	Manager Packages

Association relation

Type	Association relation
Source	vsftpd Config
Target	vsftpd

Association relation

Type	Association relation
Source	DNSMasq Config
Target	DNSMasq

Realization relation

Type	Realization relation
Source	DNSMasq Config
Target	Manager Config

Realization relation

Type	Realization relation
Source	vsftpd Config
Target	Manager Config

Realization relation

Type	Realization relation
Source	Docker Config
Target	Manager Config

Association relation

Type	Association relation
Source	Docker manager
Target	Docker Config

Composition relation

Type	Composition relation
Source	Manager Config
Target	PXE Files

Realization relation

Type	Realization relation
Source	Docker Worker Config
Target	Worker Config

Realization relation

Type	Realization relation
Source	Gluster Config
Target	Worker Config

Association relation

Type	Association relation
Source	Gluster
Target	Gluster Config

Association relation

Type	Association relation
Source	Docker Worker
Target	Docker Worker Config

Association relation

Type	Association relation
Source	Worker Profile
Target	Worker Specification

Association relation

Type	Association relation
Source	Manager Profile
Target	Manager Specification

Specialization relation

Type	Specialization relation
Source	Cluster Management Webapp
Target	Docker Manager

Triggering relation

Type	Triggering relation
Source	Cluster Management Webapp
Target	Container Build

Realization relation

Type	Realization relation
Source	CMA
Target	Cluster Management Webapp

Specialization relation

Type	Specialization relation
Source	CMA
Target	Phoenix

Specialization relation

Type	Specialization relation
Source	Phoenix
Target	Elixir

Association relation

Type	Association relation
Source	Phoenix
Target	Manager Packages

Association relation

Type	Association relation
Source	Elixir
Target	Manager Packages

Realization relation

Type	Realization relation
Source	CMA
Target	Container Spec Upload

Realization relation

Type	Realization relation
Source	CMA
Target	Cluster Deploy Manager

Realization relation

Type	Realization relation
Source	CMA
Target	Cluster Status

Association relation

Type	Association relation
Source	CMA

Target	Container Specification Repository

Association relation

Type	Association relation
Source	CMA
Target	Docker Image Repository

Realization relation

Type	Realization relation
Source	DNSMasq
Target	DNS

Realization relation

Type	Realization relation
Source	DNSMasq
Target	DHCP

Realization relation

Type	Realization relation
Source	vsftpd
Target	PXE Service

Association relation

Type	Association relation
Source	Manager Boot Image
Target	Manager Profile

Serving relation

Type	Serving relation
Source	PXE Service
Target	Manager Boot Image

Realization relation

Type	Realization relation
Source	Manager Boot Image
Target	Manager Instance

Realization relation

Type	Realization relation
Source	Worker Boot Image
Target	Worker Instance

Association relation

Type	Association relation

Source	Image Respository
Target	Manager Boot Image

Realization relation

Type	Realization relation
Source	Cobbler
Target	PXE Service

Realization relation

Type	Realization relation
Source	Cobbler Config
Target	Manager Config

Association relation

Type	Association relation
Source	Cobbler
Target	Cobbler Config

Association relation

Type	Association relation
Source	Status LED
Target	GND

Association relation

Type	Association relation
Source	GPIO Pin 21
Target	Worker Instance

Association relation

Type	Association relation
Source	GND
Target	Worker Instance

Association relation

Type	Association relation
Source	Startup Script
Target	Worker Instance

Flow relation

Type	Flow relation
Source	Start docker worker
Target	Service start

Flow relation

Type	Flow relation
Source	Set GPIO Low
Target	Start / status Gluster

Realization relation

Type	Realization relation
Source	Startup Script
Target	Service start

Realization relation

Type	Realization relation
Source	Startup Script
Target	Set GPIO High

Realization relation

Type	Realization relation
Source	Startup Script
Target	Set GPIO Low

Realization relation

Type	Realization relation
Source	Startup Script
Target	Start docker worker

Realization relation

Type	Realization relation
Source	Startup Script
Target	Start / status Gluster

Flow relation

Type	Flow relation
Source	Start / status Gluster
Target	Start docker worker

Composition relation

Type	Composition relation
Source	Manager Specification
Target	Kubernetes

Composition relation

Type	Composition relation
Source	Docker Manager
Target	Kubernetes

Realization relation

Type	Realization relation
Source	Kubernetes
Target	Docker Manager

Association relation

Type	Association relation
Source	Manager Packages
Target	Kubernetes

Association relation

Type	Association relation
Source	Kubernetes client
Target	Worker Packages

Realization relation

Type	Realization relation
Source	Kubernetes
Target	Cluster Management Webapp

Composition relation

Type	Composition relation
Source	scaling of storage and compute across nodes
Target	hot swappable SD card support

Association relation

Type	Association relation
Source	Support on-demand building of applications
Target	ARM architecture

Realization relation

Type	Realization relation
Source	Kubernetes
Target	interface for container and application management

Realization relation

Type	Realization relation
Source	Gluster
Target	scaling of storage and compute across nodes

Realization relation

Type	Realization relation
Source	Elixir

Target	distributed system development support

Realization relation

Type	Realization relation
Source	Container Build
Target	Support on-demand building of applications

Realization relation

Type	Realization relation
Source	Docker Image Repository
Target	Support on-demand building of applications

Realization relation

Type	Realization relation
Source	Phase 1 - POC
Target	SD Image for Manager

Realization relation

Type	Realization relation
Source	Phase 1 - POC
Target	SD Image for Worker

Triggering relation

Type	Triggering relation
Source	Phase 1 - POC
Target	Successful POC

Realization relation

Type	Realization relation
Source	Phase 2 - Conversion of static images to specifications
Target	Manager Specification

Realization relation

Type	Realization relation
Source	Phase 2 - Conversion of static images to specifications
Target	Worker Specification

Realization relation

Type	Realization relation
Source	Phase 3 - Clean build of worker from specification (automated)
Target	Provisioned worker

Triggering relation

Type	Triggering relation

Source	Successful POC
Target	Phase 2 - Conversion of static images to specifications

Flow relation

Type	Flow relation
Source	Phase 2 - Conversion of static images to specifications
Target	Phase 3 - Clean build of worker from specification (automated)

Realization relation

Type	Realization relation
Source	Phase 2a - Creation of worker join scripts / services
Target	Automation of worker joining

Flow relation

Type	Flow relation
Source	Phase 2 - Conversion of static images to specifications
Target	Phase 2a - Creation of worker join scripts / services

Flow relation

Type	Flow relation
Source	Phase 2a - Creation of worker join scripts / services
Target	Phase 3 - Clean build of worker from specification (automated)

Triggering relation

Type	Triggering relation
Source	Phase 3 - Clean build of worker from specification (automated)
Target	Successful provisioning of worker nodes

Triggering relation

Type	Triggering relation
Source	Successful provisioning of worker nodes
Target	Phase 4 - Build of multiple workers / dynamic cluster provisioning

Flow relation

Type	Flow relation
Source	Phase 3 - Clean build of worker from specification (automated)
Target	Successful provisioning of worker nodes

Triggering relation

Type	Triggering relation
Source	Phase 2 - Conversion of static images to specifications
Target	Phase 2a - Creation of worker join scripts / services

Triggering relation

Type	Triggering relation
Source	Phase 2a - Creation of worker join scripts / services
Target	Phase 3 - Clean build of worker from specification (automated)

Flow relation

Type	Flow relation
Source	Phase 4 - Build of multiple workers / dynamic cluster provisioning
Target	Phase Final - Documentation

Association relation

Type	Association relation
Source	Phase 2 - Conversion of static images to specifications
Target	Documenation vs Impl Lessons Learned

Association relation

Type	Association relation
Source	Phase 2a - Creation of worker join scripts / services
Target	Documenation vs Impl Lessons Learned

Association relation

Type	Association relation
Source	Phase 3 - Clean build of worker from specification (automated)
Target	Documenation vs Impl Lessons Learned

Association relation

Type	Association relation
Source	Phase 4 - Build of multiple workers / dynamic cluster provisioning
Target	Documenation vs Impl Lessons Learned

Association relation

Type	Association relation
Source	Phase Final - Documentation
Target	Documenation vs Impl Lessons Learned

Association relation

Type	Association relation
Source	Phase 1 - POC
Target	Documenation vs Impl Lessons Learned

contains

Type	Association relation
Source	Image Respository
Target	Worker Boot Image

produces

Type	Association relation
Source	Build Bootable Spec
Target	Worker Boot Image

R=260

Type	Association relation
Source	GPIO Pin 21
Target	Status LED

success

Type	Flow relation
Source	Service start
Target	Set GPIO High