SYSTEM TESTING SERVICE DEVELOPMENTS USING

EOS + CTA USE CASE

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DATA ARCHIVING AT CERN

- Ad aeternum storage
- 7 tape libraries, 83 tape drives, 20k tapes
- Current use: 180 PB
- Current capacity: 0.6 EB
- Exponentially growing
DATA ARCHIVING AT CERN

EVOLUTION

• EOS + tapes...
  ▪ EOS is CERN strategic storage platform
  ▪ tape is the strategic long term archive medium
• EOS + tapes = ♥
  ▪ You just met CTA: CERN Tape Archive
CTA + EOS DEVELOPMENTS

Tightly coupled software \(\Rightarrow\) tightly coupled developments

Extensive and systematic testing is paramount to limit regressions
CASTOR INTEGRATION TEST

- Easy situation:
  - all components are within one git repository
  - Puppet deploys development instances on VMs
  - Limited external dependencies per instance: 1 database, 1 virtual tape library
CASTOR INTEGRATION TESTS

- But several issues with VM/Puppet approach:
  - deploying a developer instance from scratch takes *loooonnnng time*...
  - code changes in CASTOR often require Puppet manifest change
  - real tape hardware tests are way further down the road in separate hostgroups, environments...
    - which implies *ad hoc* developer tests...
CTA+EOS INTEGRATION TESTS

- Complex situation:
  - 2 distinct software projects
  - More external dependencies per instance: 1 database, 1 virtual tape library, 1 objectstore
CTA+EOS INTEGRATION TESTS

- How to fix everything?
  - I am lazy and impatient
    - no manual operation $\rightarrow$ CI
    - make it fast
  - Must allow similarly easy beta testing deployments for administrators/users (simple and bulletproof)
  - Must allow tests on real tape hardware.
CTA CI

Implemented in CERN Gitlab instance

- Build software: CTA RPMs available as **artifacts**
- Build and publish a **generic Docker image** in gitlab registry
  - Contains **all required versioned RPMs for instantiation** (built artifacts, EOS, XROOTD)
- Run **system tests** in custom kubernetes cluster
A COMMON REFERENCE INFRASTRUCTURE
BASIC KUBERNETES CONCEPTS

NAMESPACE 1: subnet 10.0.1.x

CONFIGURATIONS

PODs

SERVICEs

POD 1

SERVICE 1

POD 2

SERVICE 2

POD 3

NAMESPACE 2: subnet 10.0.2.x

PODs

SERVICEs

POD 1

SERVICE 1

POD 2

PV1

label: ceph

PV2

label: local

kubernetes CLUSTER
KUBERNETES RESOURCES

System tests on dedicated kubernetes clusters

- One Puppet deployed kubernetes cluster per developer on a single VM
- Kubernetes resources per cluster:
  - 1 Oracle database (+ unlimited sqlite accounts)
  - 1 Ceph objectstore (+ unlimited local objectstores)
  - 10 Virtual tape libraries: 2 tape drives, 10 tapes
INSTANTIATING A TEST

- Create k8 Namespace
- Instantiate all Services in the namespace
- Consumable resources are implemented as Persistent Volumes
  - Issue a Persistent Volume Claim with selector
  - Instantiate associated ConfigMaps in the Namespace
- Instantiate all the Pods with their associated containers to implement all the services
- Wait for all the pods to be ready
INSTANTIATING A TEST

SYSTEM TEST

setup EOS WFE
xrdcp file -> ctaeos
- is it on tape?
remove EOS disk copy retrieve from CTA
- is is back in EOS?

GITLAB

NAMESPACE

CONFIGURATIONs

PODs

SERVICEs

Object Store

Data Base

Tape Library

CTA frontend

CTA EOS

CTA CLI

tape srv

KDC

ctafrontend

ctaeos

kdc

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REAL TAPE DRIVE TESTS

- Deploy Puppet manifest on real hardware
- Add physical tape library resources in hiera
- Increase timeouts for system tests

We can deploy the same kubernetes instance on real tape hardware and run exactly the same system tests.
THE END

• Very powerful approach addresses and federates all our use cases
• Fast, flexible, isolated and self contained in software repository
• Reproducible development environment that allows regression tests

TO DO

• Write more system tests
• Evaluate possible production use 😊