From a cluster to the Cloud

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Tomcat
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Agenda

Who I am
A cluster:
   Session replication and application.
The cloud:
   Looking at the different cloud providers
   KUBEPing and DNSPing
   Modify the tomcat cluster
      Allow a dynamic list of nodes
         Only TCP. (8888 port exported via deployment.yml)
   Operator and S2I
   Demos
What next? Questions / Suggestions

28/10/19
Who am I?

Jean-Frederic Clere

- Red Hat
- Years writing JAVA code and server software
- Tomcat committer since 2001
- Doing OpenSource since 1999
- Cyclist/Runner etc
- Lived 15 years in Spain (Barcelona)
- Now in Neuchâtel (CH)
Session replication in a cluster

HTTP/1.1
No transaction
No persistent connection

Web App:
Using cookies to carry session ID
Store information in the session:
  Shopping cart etc.

Multi nodes and dynamic
Route request to right node
Replicate information

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A cluster

- Load balancer
- HTTPD
- mod_proxy
- Tomcat node
- Tomcat node
- Tomcat node
How to replicate sessions

In cluster:

<distributable/> in web.xml

<Cluster className="org.apache.catalina.ha.tcp.SimpleTcpCluster"/>

Port upd 45564

Ports tcp range 4000:4100
Kubernetes is an open-source system for automating deployment, scaling, and management of containerized applications. https://kubernetes.io/
Most of the major cloud providers rely on Kubernetes as a container management solution.
Cloud providers

We worked on adding support for Kubernetes so that our solution would be available on all of these providers.
Because the deployment can be time consuming and slightly different for each of the cloud providers (in terms of permission management). We’re currently working on automating the process preparing an operator.

**AWS:**
- awscli /IAM console / docker / kops / kubectl

**Azure:**
- azure-cli /Azure console / docker / kubectl

**Google:**
- google-cloud-sdk / google cloud console / docker / kubectl

**IBM:**
- OpenShift / kubectl or oc (origin-clients)
OPENSHIFT

A Red Hat project / product
See OpenShift
https://www.openshift.com/
Can use AWS (public cloud) or Private on premise.
A layer on top of kubernetes to make developers life more easy.
Tomcat in OpenShift/Kubernetes
Developing Tomcat App in OpenShift/Kubernetes

When a developer creates a new application OpenShift start a new pod

Master
Node
Node
Node

AWS / CloudForms / OpenStack (IaaS) / RHEV (Virt) / Bare Metal

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Getting started

minishift:
   Allows a demo on a single box.
   Easy to setup
   Small demo

Online:
   We have prepared wiki to help you to start:
      https://github.com/web-servers/tomcat-in-the-cloud/wiki
   We have a katacoda tutorial:
      https://katacoda.com/jfclere/courses/tomcat-in-the-cloud

Bare metal / VM:
   Use ansible to install (for openshift)
   2 nodes + master + infra minimal
   Tomcat webapp with sessions
      Rest Counter demo.

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From a cluster to the Cloud

**Diagram:**
- Load balancer
- Tomcat node
- RHEL Broker
- RHEL Node
- RHEL Node

**Text:**
- Load balancer
- Tomcat node
- RHEL
- Broker
- Node
- Node
- Node

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Problems for a cluster to cloud...

Many ways to solve:
- Embed tomcat with SpringBoot
- Create a docker image
- Extend an existing docker image
- Fabric8 / S2I

Tomcat session replication:
- No multicast in the cloud.
- Need a “ping” to find the other nodes (KubePing/DNSPing)
- KubePing needs “view nodes” permission to the system account of the project.
- DNSping uses DNS service in Kubernetes.
Solutions: KUBEPing

Tomcat cluster built-in solution
Peer discovery through multicast heartbeat messages
Does not work in a cloud environment

Multicast

Session Data
Session Data
Session Data

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solution
Peer discovery through Kubernetes Downward API
Works in all Kubernetes clouds

Kubernetes API

Session Data
Session Data
Session Data
Kubernetes API

Tools for managing a Kubernetes cluster

Accessible from the pods within the cluster

GET /api/v1/namespaces/tomcat-in-the-cloud/pods

- Return a JSON representation of all the pods in the cluster
- Requires permissions
Architecture KUBEPing case

DynamicMembershipService

RefreshThread
- Call memberProvider.getMembers()
- Filter out already known Member
- Inform listeners of new/dead members

MemberProvider
- init(Properties)
- getMembers(): List<Member>

KubernetesMemberProvider
- init():
  - Get URL, cert, ... from environment variables
  - Set startTime
- getMembers():
  - Call api to get pods
  - Filter active pods
  - Compute aliveTime
Solutions: DNSPing

Tomcat cluster built-in solution
Peer discovery through multicast heartbeat messages
*Does not work in a cloud environment*

Multicast

Peer discovery through DNS lookup
*Works in all kubernetes clouds*

InetAddress.getAllByName(namespace)
DNS lookup

nslookup name-space
Accessible from the pods within the cluster

InetAddress.getAllByName()
Demos contents:

We use Katacoda for the demos.

**Where is the code:**

In Tomcat `tomcat-maven` for the Docker Image

In Tomcat for the DNS/KUBEPing cluster code

In github for the [https://github.com/web-servers/tomcat-s2i](https://github.com/web-servers/tomcat-s2i)

In github for the [https://github.com/web-servers/tomcat-operator](https://github.com/web-servers/tomcat-operator)

More documentation / tests are welcome
Katacoda demo using KUBEPing

https://katacoda.com/jfclere/courses/tomcat-in-the-cloud

And the sources:


Requires permission to read pods configuration (use it in private cloud)

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Katacoda demo using DNSSPig

https://katacoda.com/jfclere/scenarios/dnsping-tomcat

And the sources:

https://github.com/jfclere/intro-katacoda/tree/master/DNSSPing-tomcat

Runs everywhere, but requires a service for DNS discovering.

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What is a Kubernetes operator

- **kubernetes definition**
  Basically it automates the services, routes and build (S2I) process.

What do we have now

- We have one written in GO (**prototype**)
- S2I (source to image) just tooling (**PR # 188**) vetoed but doesn’t need to be in Tomcat.
Katacoda demo using operator

Operator demo in Katacoda

And the sources:

https://github.com/jfclere/intro-katacoda/tree/master/war-katacoda

Every thing is created by the operator: pods, services etc.
Where we are

Main sites:

https://github.com/web-servers/tomcat-in-the-cloud
https://github.com/jfclere/tomcatPI
https://docs.openshift.com
https://github.com/apache/tomcat
tomcat : res/tomcat-maven
DNSMembershipProvider / KubernetesMembershipProvider
Tomcat operator and S2I PR#188
THANK YOU

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