

Dynamic configuration in immutable infrastructure using Spinnaker and EC2

V 1.0



Dynamic configuration in immutable infrastructure using Spinnaker and EC2

Paweł Królikowski, Money SRE

March 13, 2019

Uber

Agenda

01 On {self}

02 On dynamic configuration

03 On our landscape

04 On the change

05 On results

06 Questions

On {self}

Overview

Build/compile time configuration are the settings you bundle in your application artifact.

Runtime configuration is the ability to change your application's behaviour when you start it.

Dynamic configuration is the ability to modify and extend a system *while it is running*.

Uber
Eng

!=

Uber
Eng

Uber != Uber

- Small team
- No prior experience with clouds
- Inherited, no full control



<https://web.archive.org/web/20081208150839/http://www.globalnerdy.com/2008/09/30/old-man-yells-at-cloud/>

On dynamic configuration

Runtime configuration

Google runtime configuration

All Images Videos News Shopping More Settings Tools

About 62,900,000 results (0.40 seconds)

Runtime configuration — envoy 1.10.0-dev-32bdce documentation

https://www.envoyproxy.io/docs/envoy/latest/intro/arch_overview/runtime

Envoy supports "runtime" configuration (also known as "feature flags" and "decider"). Configuration settings can be altered that will affect operation without ...

People also search for

envoy proxy configuration management
envoy proxy log level
envoy tcp routing
envoy proxy scripting
envoy init
envoy tracer

Runtime Configurations - Help - Eclipse Platform

<https://help.eclipse.org/mars/topic/org.eclipse.stardust.../runtime-configurations.html>

Runtime configurations are separated from simulation configurations, because you may want to use the same simulation configuration for different runtime ...

People also search for

runtime configuration definition
twilight eclipse run time

Cloud Runtime Configuration API | Cloud Deployment Manager ...

<https://cloud.google.com/deployment-manager/runtime-configurator/reference/rest/>

Oct 17, 2018 - The Runtime Configurator allows you to dynamically configure and ... Lists variables within given a configuration, matching any provided filters.

Runtime Configurator Fundamentals | Cloud Deployment Manager ...

<https://cloud.google.com/deployment-manager/runtime-configurator/>

Oct 30, 2017 - During startup, you can configure your nodes to report their status to the Runtime Configurator, and then have another application query the ...

Runtime Configuration - Codemesh

codemesh.com/products/unction/doc/runtime_config.html

This is what runtime configuration is all about. In addition to setting JVM options, there are

Cloud Deployment Manager > Documentation

Runtime Configurator Fundamentals

☆☆☆☆

SEND FEEDBACK

★ Beta

This is a Beta release of Runtime Configurator. This feature is not covered by any SLA or deprecation policy and may be subject to backward-incompatible changes.

Set Kubelet parameters via a config file

FEATURE STATE: Kubernetes v1.13 beta

A subset of the Kubelet's configuration parameters may be set via an on-disk config file, as a substitute for command-line flags. This functionality is considered beta in v1.10.

aws / amazon-ecs-agent

Watch

197

Star

<> Code

Issues 86

Pull requests 7

Projects 0

Insights

Need Host environment variable resolution to pass some information to a container #3

Open

owaaa opened this issue on

Jan 6, 2015

102 comments

Dynamic configuration

Google dynamic configuration

All Images Videos Shopping News More Settings Tools

About 341,000,000 results (0,43 seconds)

Dynamic Configuration for Distributed Systems - ACM Digital Library

<https://dl.acm.org/citation.cfm?id=4111>

by J Kramer · 1985 · Cited by 459 · Related articles

Dynamic system configuration is the ability to modify and extend a system while it is running. The facility is a requirement in large distributed systems where it ...

Abstract · Authors · Cited By

Dynamic Configuration Management in Microservice Architecture With ...

<https://dzone.com/articles/dynamic-configuration-management-in-microservice-a>

Feb 5, 2018 · Improve your microservices dynamic configuration management with Spring Cloud and learn how to reconfigure your application live without ...

People also search for

microservices centralized configuration
microservice orchestration tools
service registry open source

vaadin microservices
distributed configuration management
using etcd for service discovery

PDF Dynamic Configuration for Distributed Systems - Spiral

<https://spiral.imperial.ac.uk/.../Dynamic%20Configuration%20for%20Distributed.pdf>

by J KRAMER · Cited by 459 · Related articles

Dynamic Configuration for Distributed Systems. JEFF KRAMER AND JEFF MAGEE. Abstract- Dynamic system configuration is the ability to modify and extend a ...

Dynamic configuration — envoy 1.10.0-dev-9644cd documentation

https://www.envoyproxy.io/docs/envoy/latest/intro/arch.../dynamic_configuration

Simple deployments are possible with a fully static configuration. More complicated deployments can incrementally add more complex dynamic configuration, ...

Dynamic Configuration for Distributed Systems - IEEE Journals ...

<https://ieeexplore.ieee.org/document/1702024>

by J Kramer · 1985 · Cited by 459 · Related articles

Abstract: Dynamic system configuration is the ability to modify and extend a system while it is running. The facility is a requirement in large distributed systems ...

Google dynamic configuration -host

All Images Videos Shopping News More Settings Tools

gas dynamic

dynamic trap

dynamic balancing

wave dynamic

light scattering

dynamic light

time warping

saturn

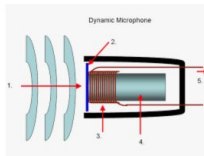
dynamic test

gif

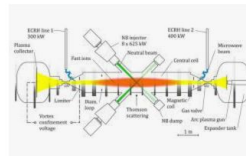
value

png

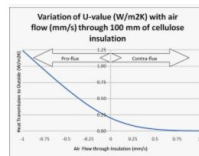
1



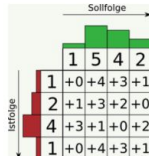
File:Micro-dynamic.PNG - Wikimedia Commons



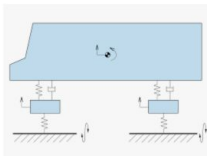
File:Gas Dynamic Trap - Diagnostics.png ...



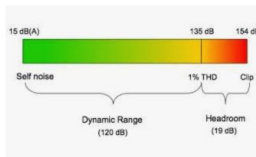
File:Dynamic Insulation U-value.png ...



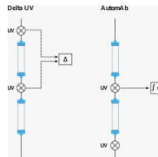
File:Animation Dynamic Time ...



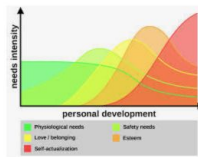
File:Half car dynamic model.svg ...



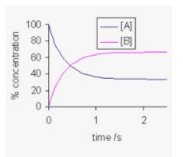
File:Dynamic Range.jpg - Wikimedia Commons



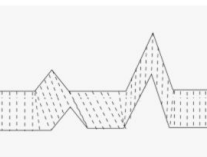
File:Dynamic process control me...



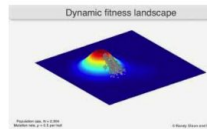
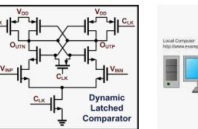
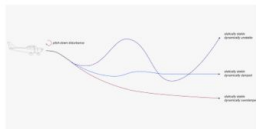
Dynamic hierarchy of needs - Maslow.svg ...



Dynamic equilibrium.png - Wikimed...



File:Dynamic time warping.png ...



https://en.wikipedia.org/wiki/Dynamic_Host_Configuration_Protocol

Dynamic configuration requirements

- Code compatibility
- Performance
- Persistence across deploys
- Persistence across reschedules
- Speed of delivery
- Reliability of delivery
- Gradual/canary deployments
- Zone deployments
- History/auditability
- Atomicity
- Rollbacks
- Atomic rollbacks
- Permissions / ACL
- Reviews
- Differential change log
- Staging



Dynamic configuration requirements

- Scalability
 - Reliability
 - Master failures
 - Masterless rollbacks
 - How much do you **really** trust it?
 - Lockdown
-
- Abuse/data size
 - Schema
 - Experiments
 - Namespaces
 - Old values cleanup
 - UI



Uber
Eng

!=

Uber
Eng

Dynamic configuration requirements



<https://media2.giphy.com/media/23BST5FQOc8k8>



<https://giphy.com/gifs/reactionseditor-3o7btT1T9qpQZWWhNIK>

On our landscape

Landscape

- Codecommit => Jenkins => Spinnaker => EC2
- 2 regions
- Dev/staging/production environments
- Immutable images
 - 20 minutes to build + deploy
- Configuration baked into the source code
- Rate limiter broke :(



[codecommit](https://codecommit.amazonaws.com/)



https://jenkins.io



<https://www.spinnaker.io/>



[AWS EC2](https://aws.amazon.com/ec2/)

Landscape - options

- Try to push for full Dynamic Configuration, as described in earlier
 - Pluses: ✓
 - Minuses: 🤖
- Rebuilding the images as we do now
 - Pluses: no changes 😊
 - Minuses: 20 minutes deploy 😞
- Restarting the processes
 - Pluses: 2 minutes to deploy, no application changes 🤖
 - Minuses: delivery, load balancers, warm-up time, gradual rollout 🤖
- Hot reloading
 - Pluses: instant-ish deploy 🤖
 - Minuses: delivery, code changes, need to build a history/audit system 🤖
- ???

Landscape - already dynamic

- Images automatically pull the correct region on startup
 - All kinds of things get configured
- Images get the “environment” set via User Data
- Images sometimes compete for a resource
 - “Acquiring a lock”

On the change

Goals

- Be faster than 20 minutes :)
- Change only in emergency
- Changes are not permanent
- Preserve clear history/auditability
- MVP



Implementation

- Manually triggered in Spinnaker
- Spinnaker sets EC2 tags
- Instances pull the tags on startup to disk
- Application picks the target tag from disk, sets environmental variables
- Done

Implementation - Spinnaker #1

The screenshot displays the Spinnaker web interface. On the left, a sidebar contains a search bar and a list of pipelines under the heading 'PIPELINES'. A red arrow labeled '2' points to the 'Reorder Pipelines' button. The main area shows a list of pipeline runs. A modal dialog titled 'Confirm Execution' is open in the center, showing the selected pipeline 'forwarderwebserverdev'. The dialog includes a confirmation message, a list of parameters to fill (AMI, JenkinsBuildInfo, RuntimeEnvVars), and a 'Run' button. A red arrow labeled '1' points to the 'Start Manual Execution' button in the top right of the pipeline list.

Confirm Execution

Pipeline: **forwarderwebserverdev**

This will start a new run of **forwarderwebserverdev**.

This pipeline is parameterized. Please enter values for the parameters below.

AMI

JenkinsBuildInfo

RuntimeEnvVars

Notifications ☐ Notify me when the pipeline completes

PIPELINES

- ☐ forwarderwebserverdev

STATUS

- ☐ Running
- ☐ Terminal
- ☐ Succeeded
- ☐ Not Started
- ☐ Canceled
- ☐ Stopped



MANUAL START

anonymous
a day ago
AMI: "ami-006af48b272685e13"
DynamicConfig: ""
JenkinsBuildInfo: "#361"
Status: **SUCCEEDED**
Duration: 04:35

MANUAL START

anonymous
2 days ago
AMI: "ami-07d2347ed9d1483be"
DynamicConfig: ""
JenkinsBuildInfo: "#360"
Status: **SUCCEEDED**
Duration: 04:15

Implementation - Spinnaker #2

 **forwarderwebserverdev** 

PIPELINESCLUSTERTASKS

LOAD BALANCERSSECURITY GROUPSCONFIG

SEARCH ⓘ

PIPELINES

☐ forwarderwebserverdev

Reorder Pipelines

STATUS

☐ Running

☐ Terminal

☐ Succeeded

☐ Not Started

☐ Canceled

☐ Stopped

Pipelines

+

-

Group by Pipeline

Show 10 executions per pipeline

☐ stage durations

SPINNAKER-RW-US-EAST-1

forwarderwebserverdev 1

Configure

Start Manual Execution

MANUAL START

[anonymous]

a few seconds ago

AMI: "ami-08276dd5a9edd2e85"

JenkinsBuildInfo: "#372"

RuntimeEnvVars: "RATE_LIMITER_ON=false;LOG_EVENTS=DEBUG"

>Details

Status: RUNNING

Duration: 00:12

MANUAL START

anonymous

4 hours ago

AMI: "ami-08276dd5a9edd2e85"

DynamicConfig: ""

JenkinsBuildInfo: "#372"

>Details

Status: SUCCEEDED

Duration: 04:45

Implementation - Spinnaker #3

forwarderwebserverdev PIPELINES CLUSTERS TASKS LOAD BALANCERS SECURITY GROUPS CONFIG

Clusters Edit multiple Show ☒ Instances ☐ with details Create Server Group

SPINNAKER-RW-US-EAST-1 forwarderwebserverdev 4 ▲ : 100%

US-EAST-1

V892 4 ▲ : 100%

Instance Actions

Type c4.large

Server Group forwarderwebserverdev-dev-v892

VPC vault-workers.dev.us-east-1 (vpc-9cd7fafa)

Subnet svc_pool-dev

Image ID ami-08276dd5a9edd2e85

STATUS

Load Balancer ▲ fwder-web-elb-dev

DNS

SECURITY GROUPS

TAGS

AMI ami-08276dd5a9edd2e85

aws:autoscaling:groupName forwarderwebserverdev-dev-v892

JenkinsBuildInfo #372

Name tokenizer-forward-http-service-dev

RuntimeEnvVars RATE_LIMITER_ON=false;LOG_EVENTS=DEBUG

Implementation - Bash #1

- Does one thing: reads the tags, writes them on disk
- /proc like
- Available as a gist at <http://t.uber.com/ec2-config-gist>

```
usage() {
{
    echo "Reload configuration of this EC2 instance."
    echo
    echo "The script reads tags set on this EC2 instance and saves them in"
    echo "${tag_location} to be used by other resources."
    echo
    echo "Usage: ${0##*/}"
    echo
    echo "The script currently takes no arguments."
} >&2
}

function main() {
    if [ $# -ne 0 ]; then
        usage
        exit 1
    fi
    refresh_tags_from_ec2 "$@"
}

if [ "$0" == "${BASH_SOURCE[0]}" ]; then
    main "$@"
fi
```

Implementation - Bash #2

- Reads one tag
- Validates it
- Sets it as environmental variables
- Available in the same gist: <http://t.uber.com/ec2-config-gist>

```
set -euo pipefail

declare allowed_pattern="^[A-Za-z0-9_-]+=[A-Za-z0-9_-]+$"

export_vars() {
    IFS=';' read -ra vars

    [ -z "${vars:-}" ] && return 0

    for var in "${vars[@]}"; do
        if [[ ! "$var" =~ $allowed_pattern ]]; then
            echo "ERROR: Line contains disallowed chars: \"$var\", does not match: \"$allowed_pattern\" " >&2
            return 1
        fi
        export "${var?}"
    done
}
```

On results

Pluses

- Emergency change takes 2 minutes
- Spinnaker takes care of history
- Spinnaker takes care of rollbacks/ELBs
- Not much code
- Most of the code is generic
 - Paves the way to potential hot-reloading
 - Operators can use the console to easily view & reconfigure the tags
 - Can use conditional keys in IAM to limit access to read/write specific tags

Gotchas

- Not persisted between deploys
- 256 chars limit
- Generic field, so typos are possible
- No reviews
- Bash injection

Questions

Questions

Questions from {self}

- Why not User Data?
 - Single blob
 - tooling has to be compatible
 - fiddly when modifying a subset
 - Base64 encoded: awkward to modify in Spinnaker
 - Have to stop the instance
 - Cannot set permissions per config-key.
- Why not git?
 - Solves a lot of the problems (history, reviews, atomicity, etc)
 - Overkill for now, might come in v2
 - Would still probably use tags to pass in commit sha into the image 🤖

Questions from !{self}

- Questions?
- Questions later? => pawel@uber.com

Uber

Proprietary and confidential © 2019 Uber Technologies, Inc. All rights reserved. No part of this document may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval systems, without permission in writing from Uber. This document is intended only for the use of the individual or entity to whom it is addressed and contains information that is privileged, confidential or otherwise exempt from disclosure under applicable law. All recipients of this document are notified that the information contained herein includes proprietary and confidential information of Uber, and recipient may not make use of, disseminate, or in any way disclose this document or any of the enclosed information to any person other than employees of addressee to the extent necessary for consultations with authorized personnel of Uber.