Stream processing with R in AWS

AWR, AWR.KMS, AWR.Kinesis (R packages) used in ECS

Gergely Daroczi

@daroczig

Feb 25, 2018

About this class

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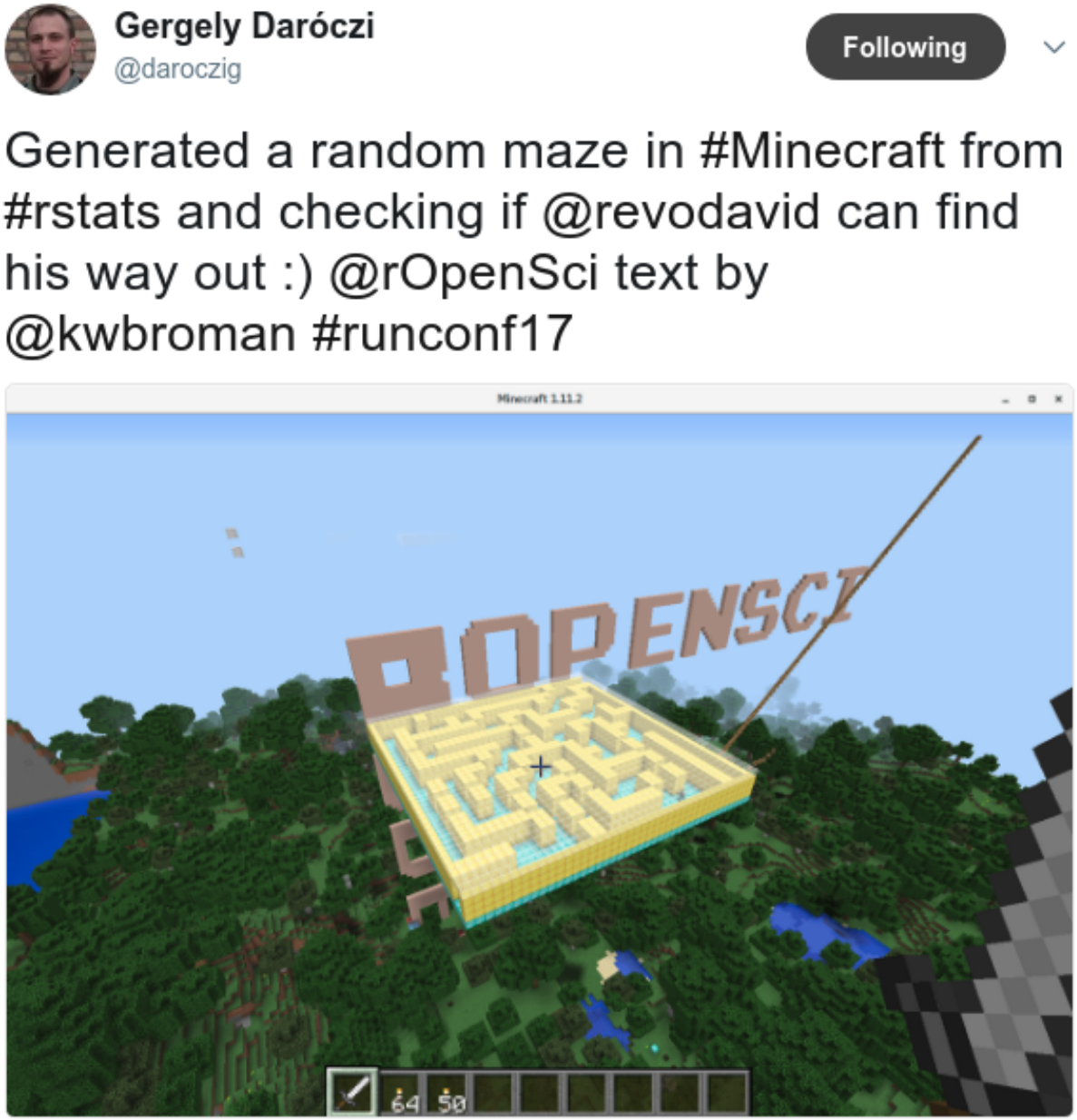


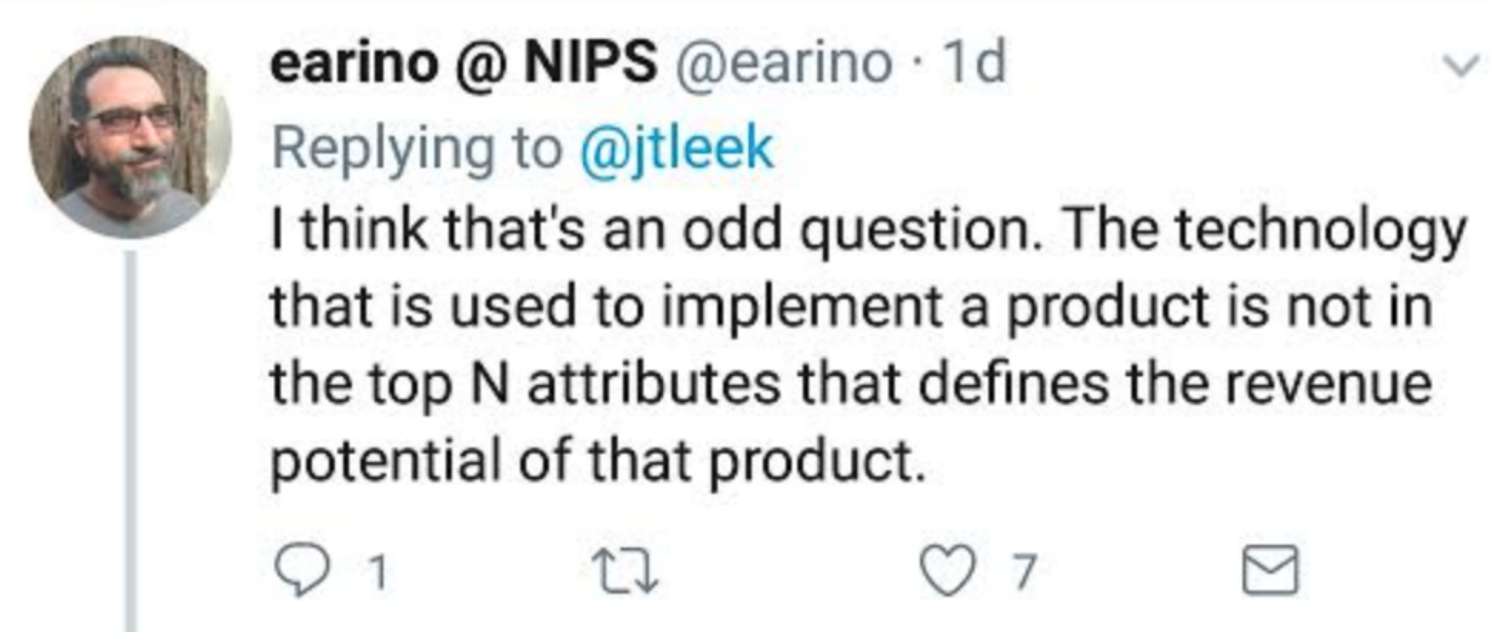
About this class

Jeff Leek
@jtleek

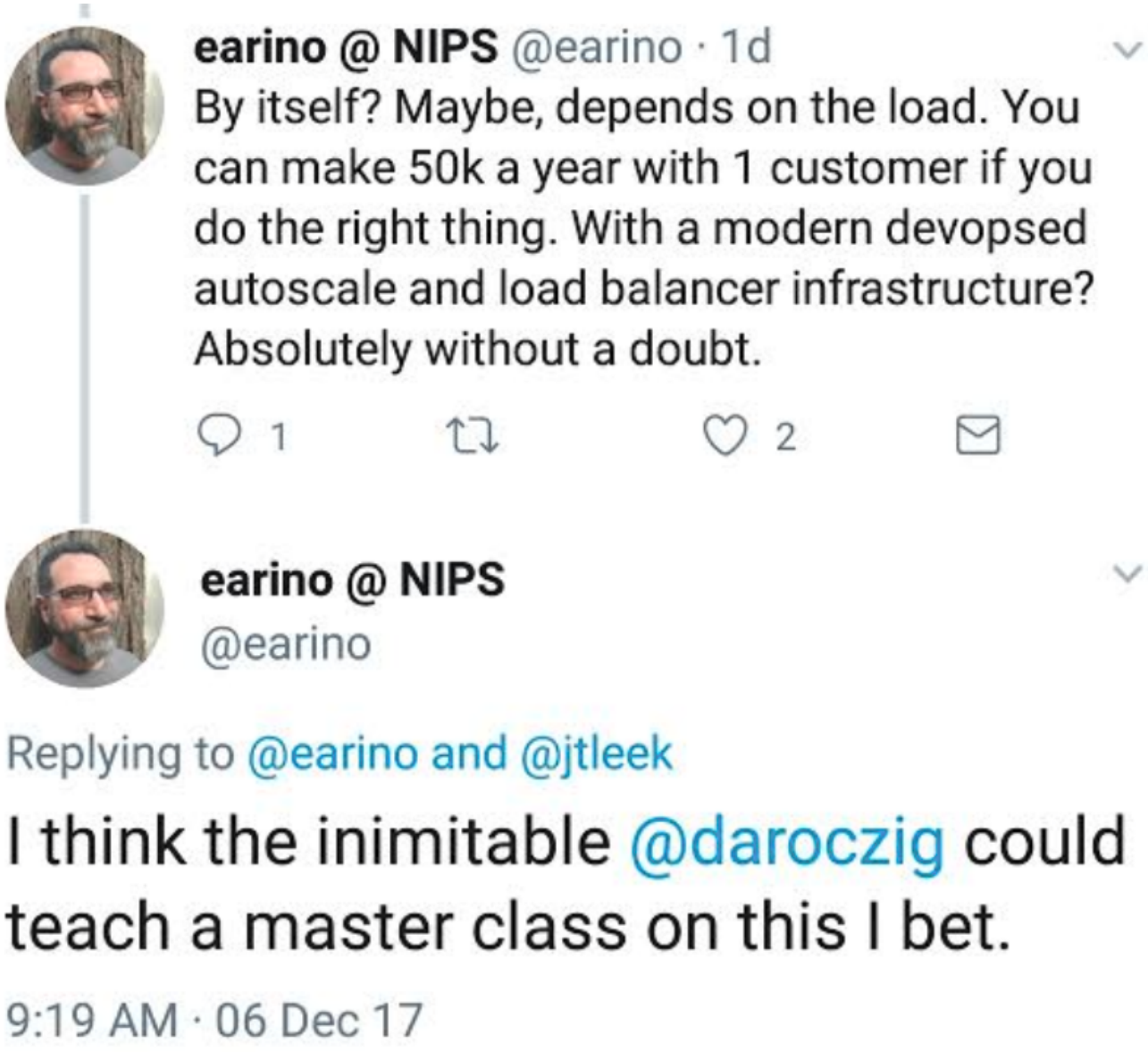
Question for the #rstats community: do you think it is possible to create a stand alone Shiny app that generates $50k+ year in revenue?

9:08 AM · 06 Dec 17

About this class



About this class



About this class

Gergely Daróczi
@daroczig

Following

Replying to @earino @jtleek

lol -- I'd be honored and love to do a class for fun on how to build such thing from scratch eg on AWS, but at the end of the day and all the fun, I think I'd just keep it pretty damn short: shinyproxy.io

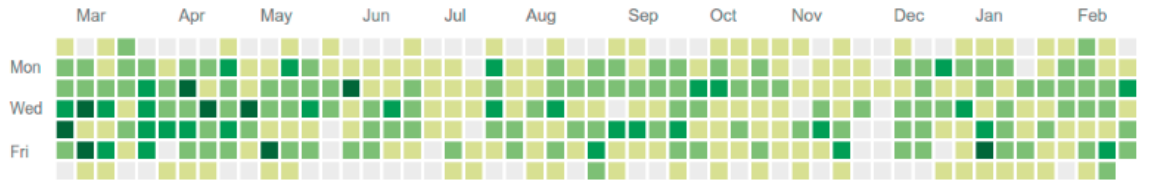
9:34 AM - 6 Dec 2017

18 Likes

About me

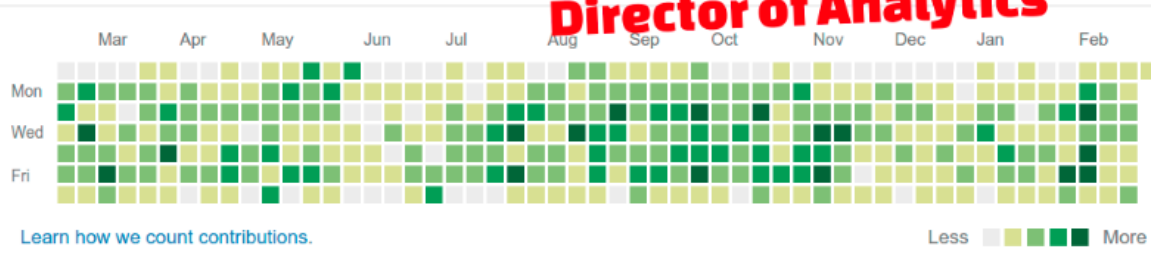
3,633 contributions in the year before last

Lead R Developer



3,470 contributions in the last year

Director of Analytics



About me

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CARD.com's View of the World

Gergely Daróczi @daroczig · Apr 11

Just received my "I ♥ R" prepaid debit card from @CARD. Will be fun to use this #rstats designed card at #user2015 :)

RETWEETS 10 FAVORITES 16

CARD.com's View of the World

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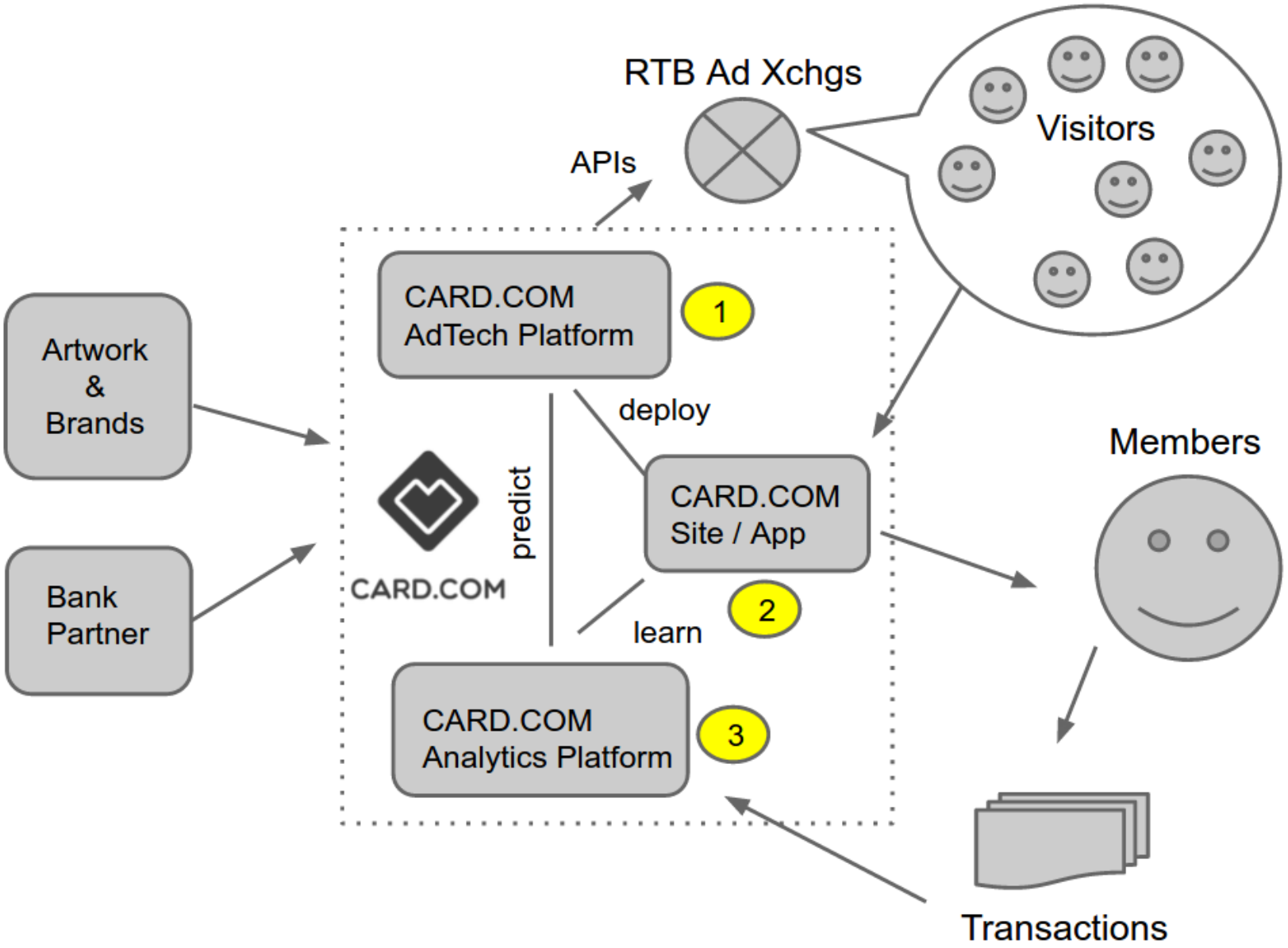
Modern Marketing at CARD.com



Further Data Partners

- card transaction processors
- card manufacturers
- CIP/KYC service providers
- online ad platforms
- remarketing networks
- licensing partners
- communication engines
- others

My View on CARD.com

Why not Hadoop instead of MySQL?

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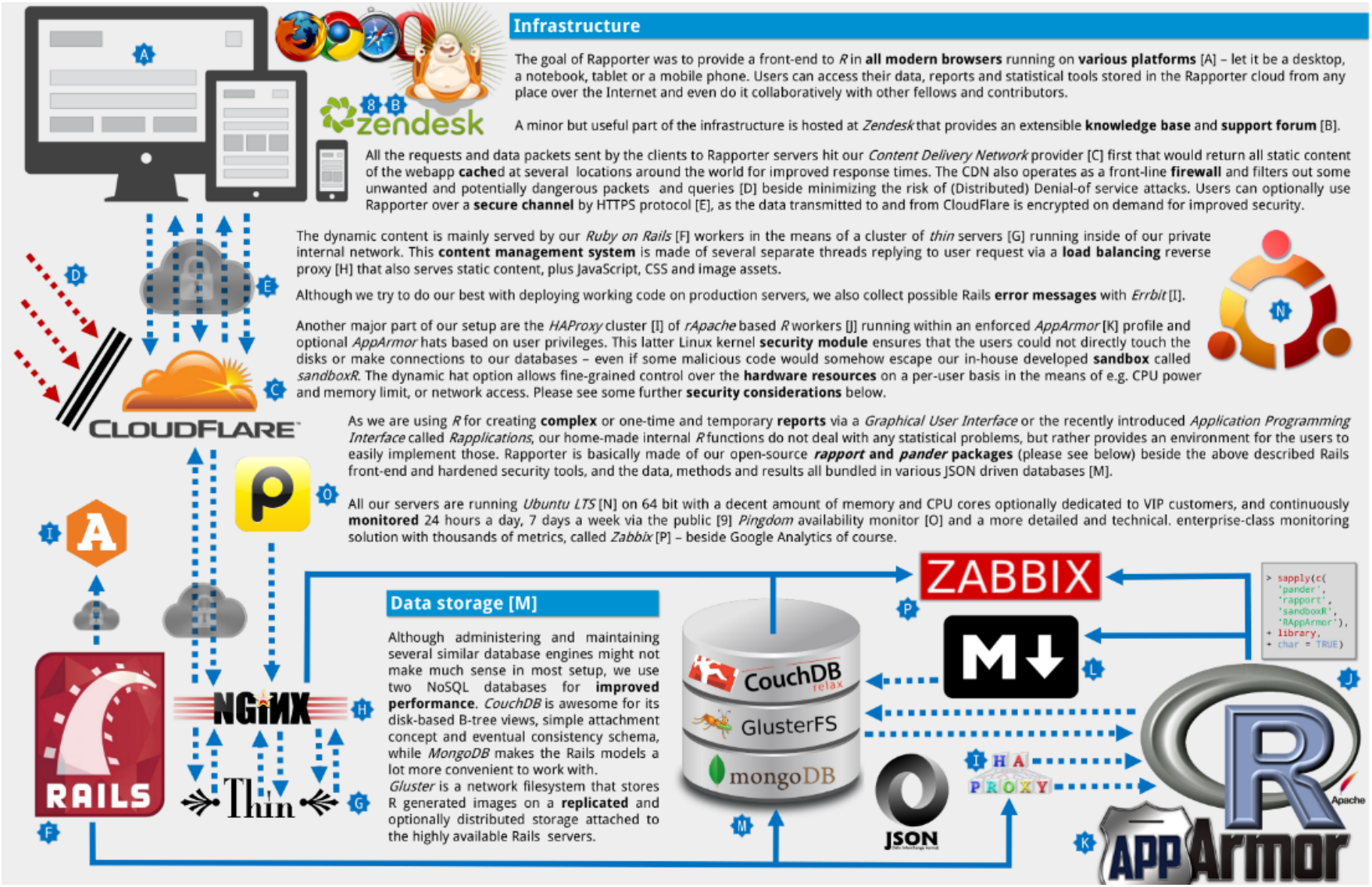
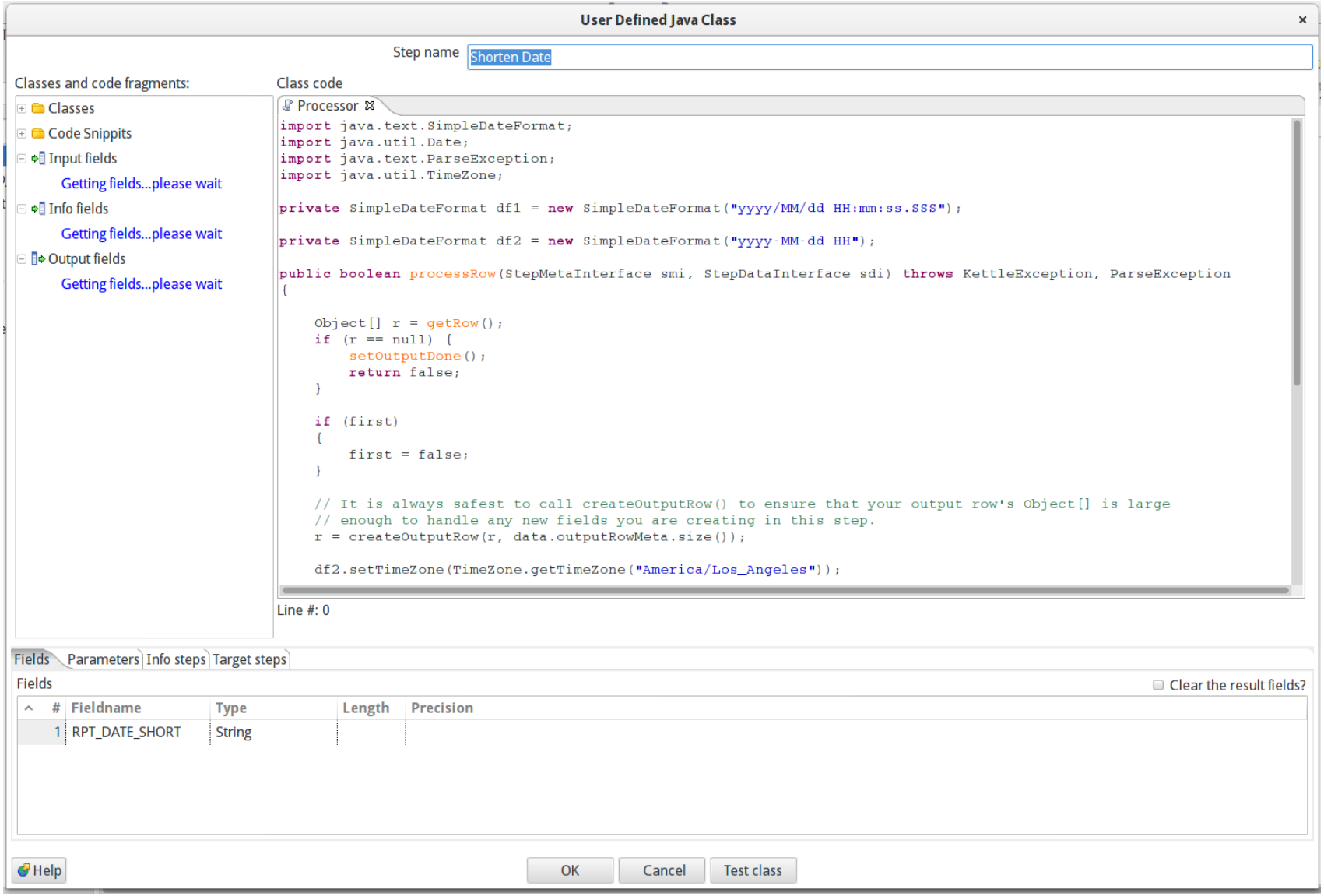


Infrastructure

Stream Processing . . . Why R?



Stream Processing . . . Why AWS?

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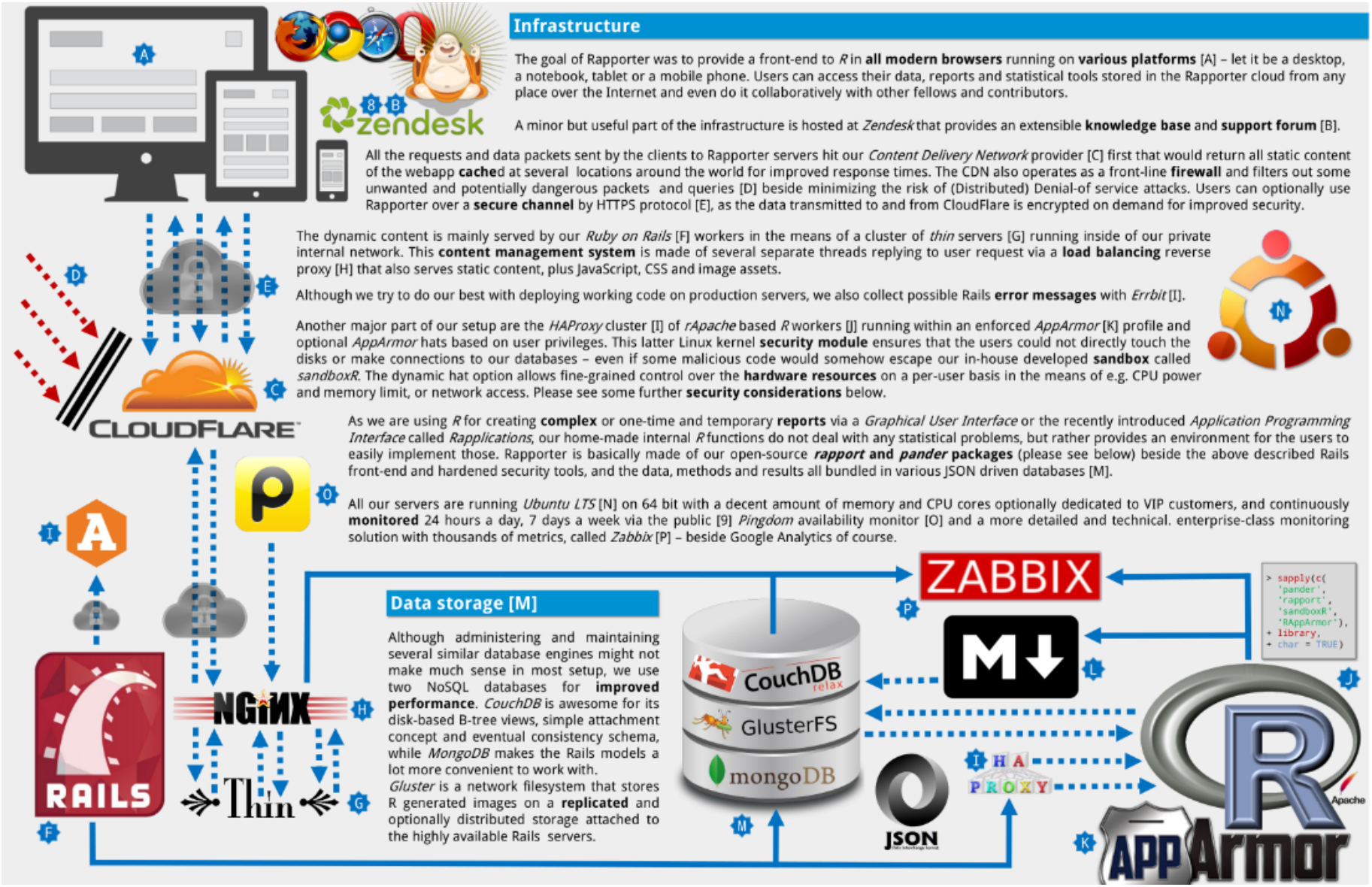
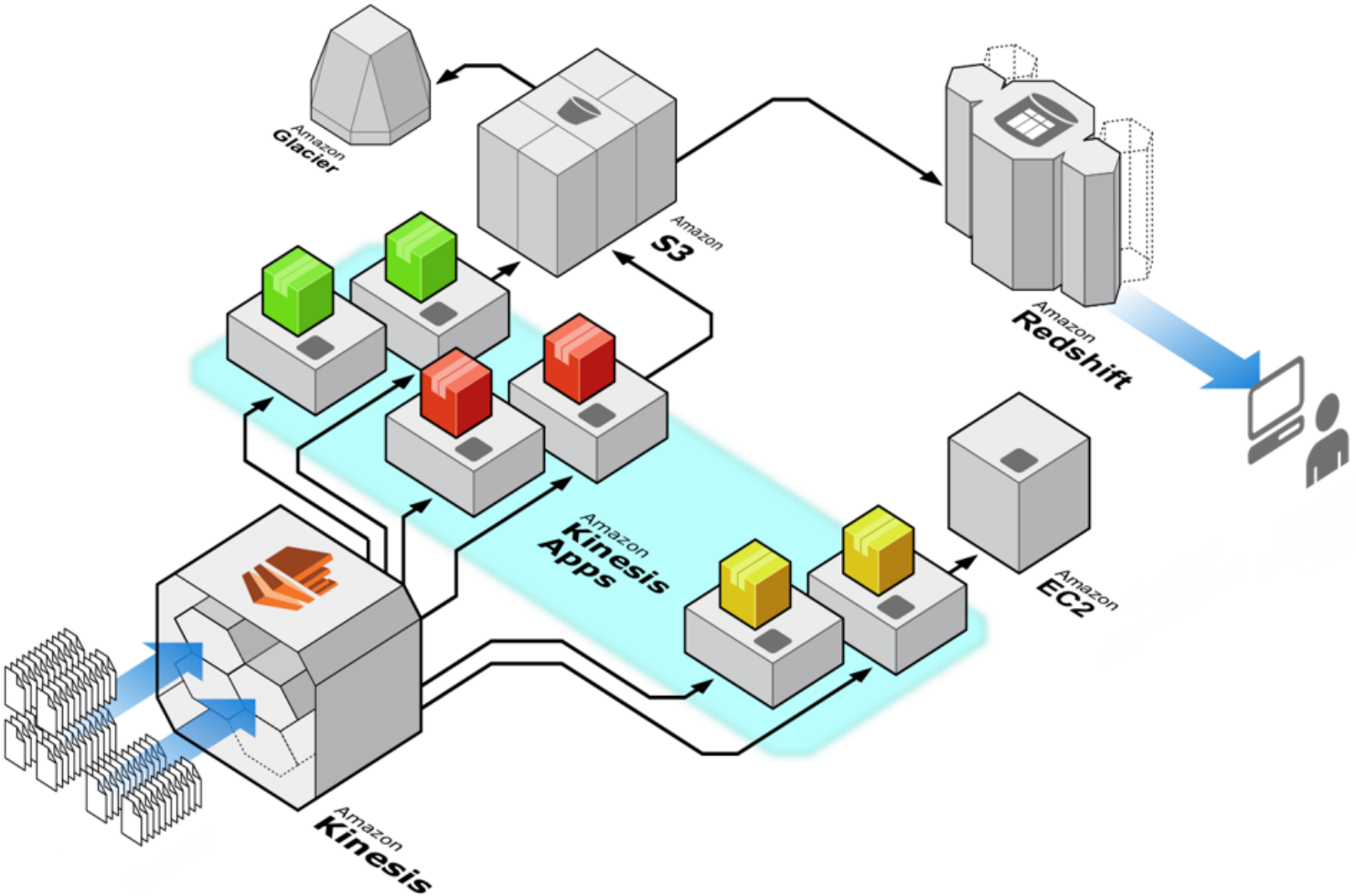
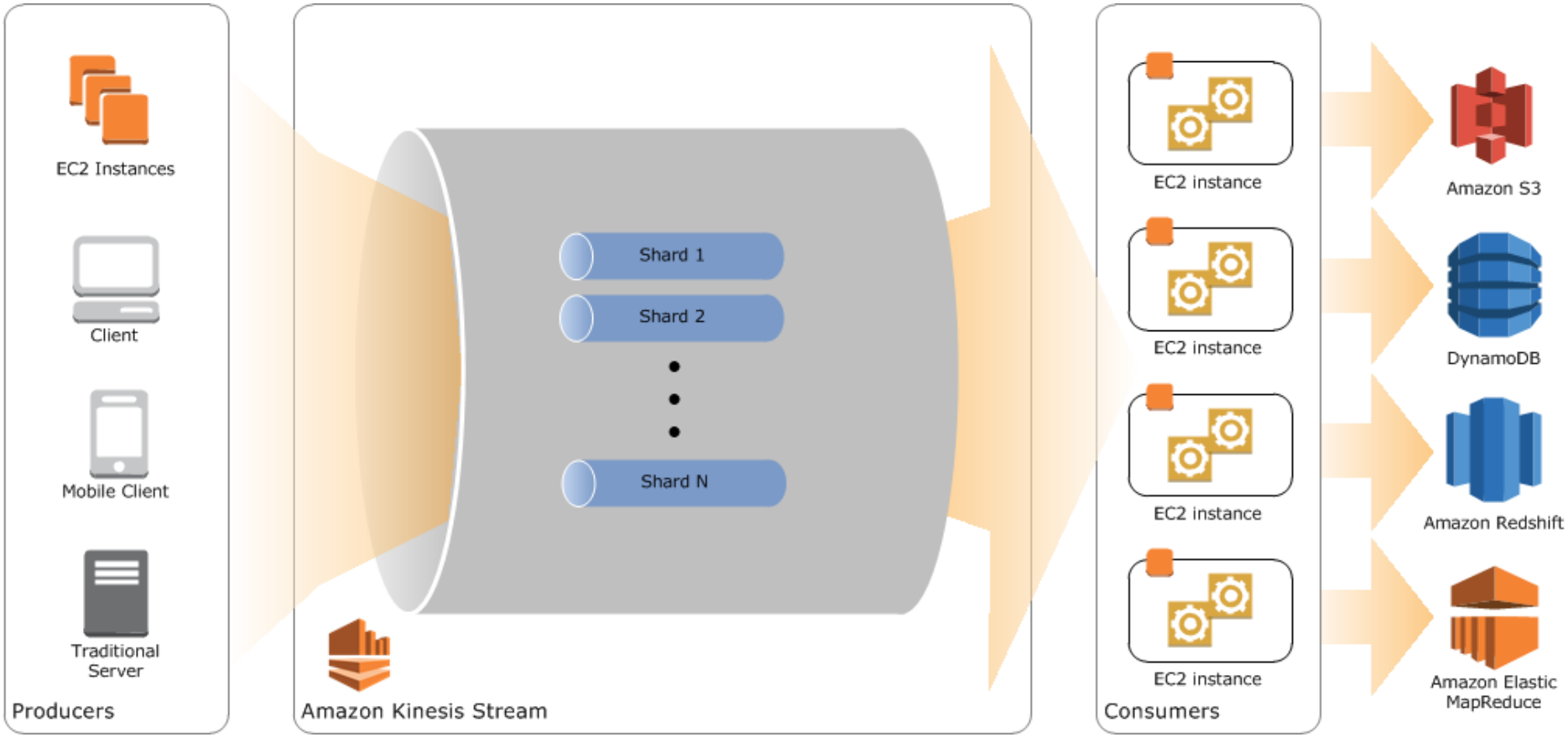


Intro to Amazon Kinesis



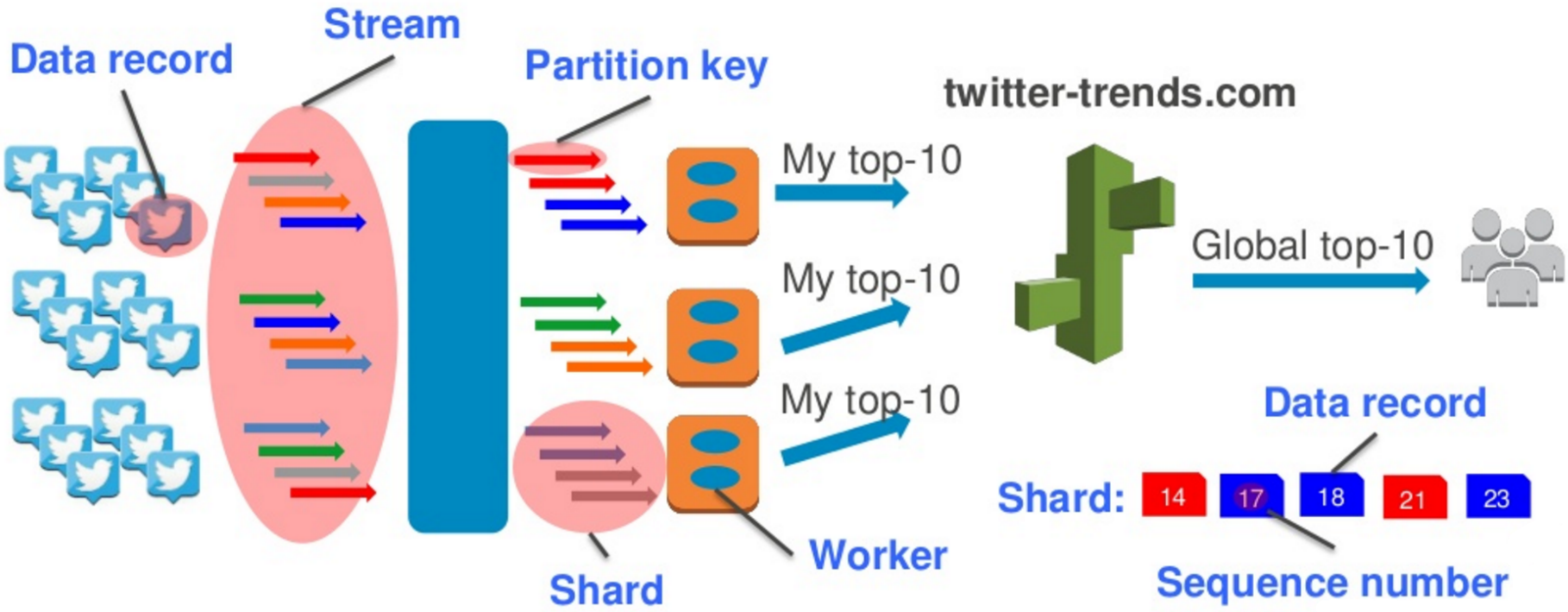
Source: Kinesis Product Details

Intro to Amazon Kinesis Streams



Source: Kinesis Developer Guide

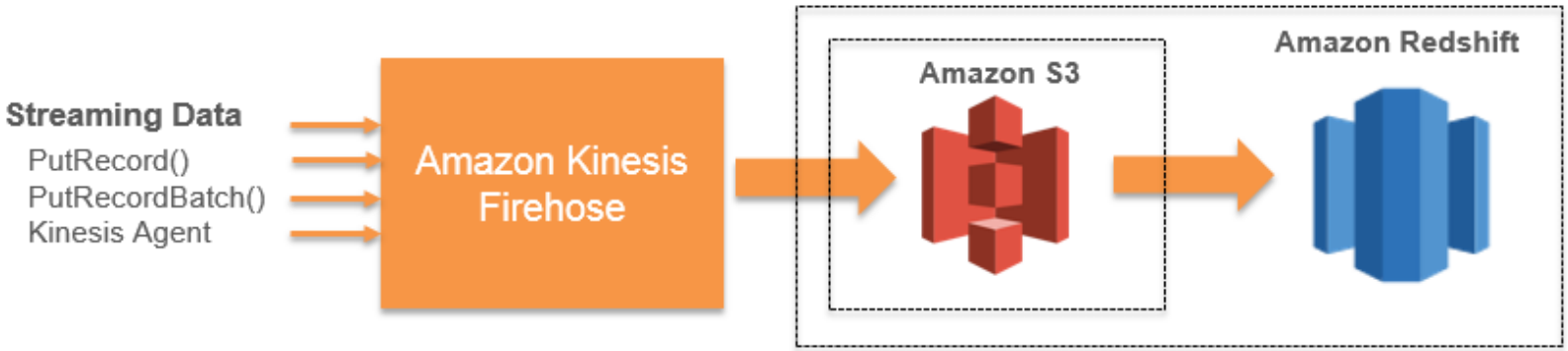
Intro to Amazon Kinesis Shards



Source: AWS re:Invent 2013

A Very Deep Learning

A Very Deep Learning



The S3 Object System

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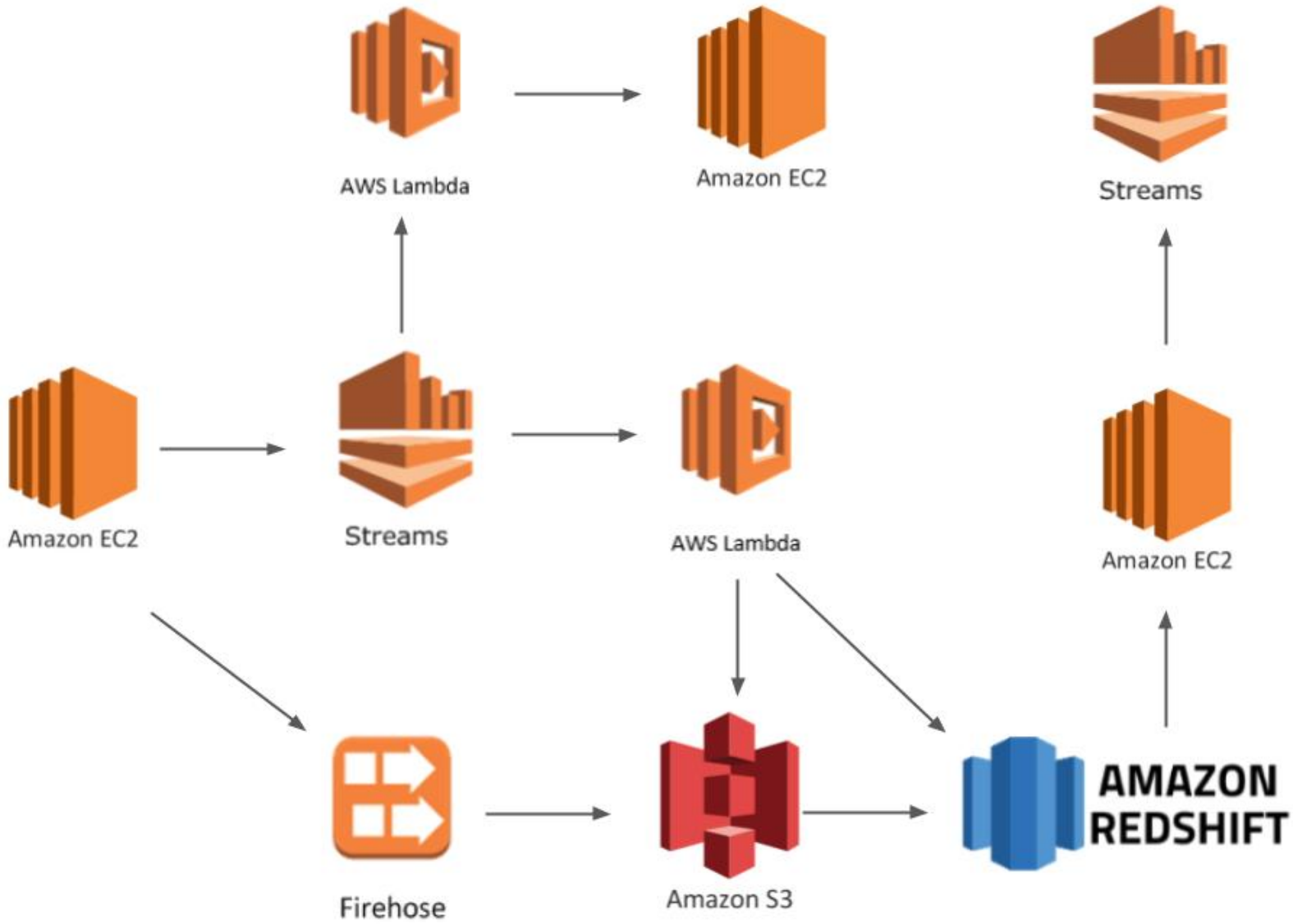
```
> x <- 3.14
> attr(x, 'class') <- 'standard'

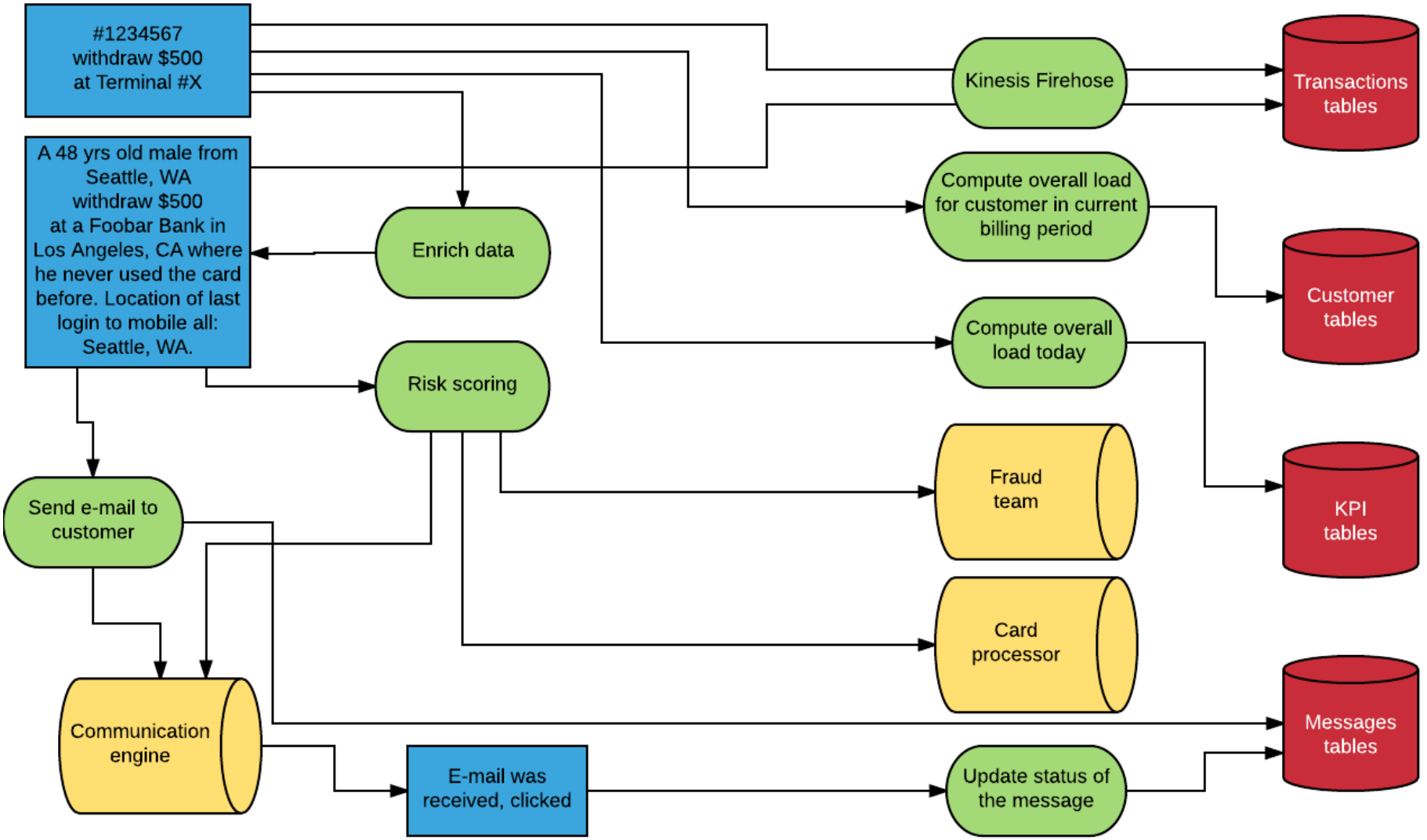
> print.standard <- function(x, ...) {
+     ## SLA
+     if (runif(1) * 100 > 99.9) {
+         Sys.sleep(20)
+     }
+     futile.logger::flog.info(x)
+ }

> while (TRUE) print(x)
INFO [2017-03-03 22:27:57] 3.14
INFO [2017-03-03 22:27:57] 3.14
INFO [2017-03-03 22:27:57] 3.14
INFO [2017-03-03 22:28:17] 3.14
INFO [2017-03-03 22:28:17] 3.14
```

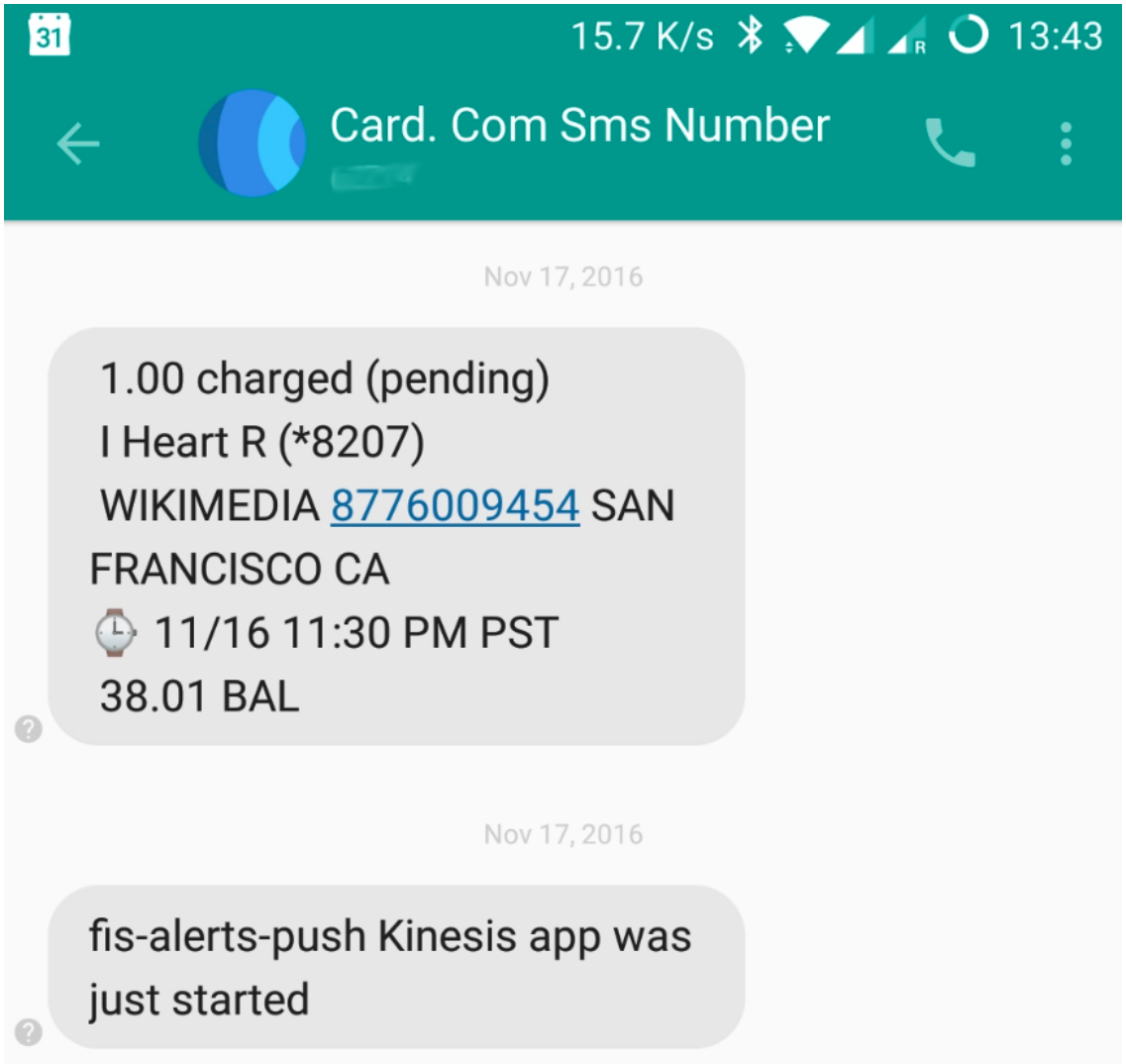
S4: Multiple Dispatch



Example use-case



Example use-case



How to Communicate with Kinesis

Writing data to the stream:

- Amazon Kinesis Streams API, SDK
- Amazon Kinesis Producer Library (KPL) from Java
- flume-kinesis
- Amazon Kinesis Agent

Reading data from the stream:

- Amazon Kinesis Streams API, SDK
- Amazon Kinesis Client Library (KCL) from Java, Node.js, .NET, Python, Ruby

Managing streams:

- Amazon Kinesis Streams API (!)

Now We Need an R Client!

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```
> library(rJava)
> .jinit(classpath = list.files('~/Projects/AWR/inst/java/', full.names = TRUE))

> kc <- .jnew('com.amazonaws.services.kinesis.AmazonKinesisClient')
> kc$setEndpoint('kinesis.us-west-2.amazonaws.com', 'kinesis', 'us-west-2')

> sir <- .jnew('com.amazonaws.services.kinesis.model.GetShardIteratorRequest')
> sir$setStreamName('test_kinesis')
> sir$setShardId(.jnew('java/lang/String', '0'))
> sir$setShardIteratorType('TRIM_HORIZON')
> iterator <- kc$getShardIterator(sir)$getShardIterator()

> grr <- .jnew('com.amazonaws.services.kinesis.model.GetRecordsRequest')
> grr$setShardIterator(iterator)
> kc$getRecords(grr)$getRecords()
[1] "Java-Object{[{SequenceNumber: 49562894160449444332153346371084313572324361665
ApproximateArrivalTimestamp: Tue Jun 14 09:40:19 CEST 2016,
Data: java.nio.HeapByteBuffer[pos=0 lim=6 cap=6],PartitionKey: 42}]}"

> sapply(kc$getRecords(grr)$getRecords(),
+        function(x)
+        rawToChar(x$getData()$array()))
[1] "foobar"
```

Managing Shards via the Java SDK

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Let's merge two shards:

```
> ms <- .jnew('com.amazonaws.services.kinesis.model.MergeShardsRequest')
> ms$setShardToMerge('shardId-000000000000')
> ms$setAdjacentShardToMerge('shardId-000000000001')
> ms$setStreamName('test_kinesis')
> kc$mergeShards(ms)
```

What do we have now?

```
> kc$describeStream(StreamName = 'test_kinesis')$getStreamDescription()$getShards()
[1] "Java-Object{[
{ShardId: shardId-000000000000,HashKeyRange: {StartingHashKey: 0,EndingHashKey: 170
SequenceNumberRange: {
StartingSequenceNumber: 49562894160427143586954815717376297430913467927668719618,
EndingSequenceNumber: 49562894160438293959554081028945856364232263390243848194}},
{ShardId: shardId-000000000001,HashKeyRange: {StartingHashKey: 170141183460469231731
SequenceNumberRange: {
StartingSequenceNumber: 49562894160449444332153346340517833149186116289174700050,
EndingSequenceNumber: 49562894160460594704752611652087392082504911751749828626}},
{ShardId: shardId-000000000002,
ParentShardId: shardId-000000000000,
AdjacentParentShardId: shardId-000000000001,
HashKeyRange: {StartingHashKey: 0,EndingHashKey: 340282366920938463463374607431768
SequenceNumberRange: {StartingSequenceNumber: 49562904991497673099704924344727019527
```

Amazon Kinesis Client Library

- An *easy-to-use* programming model for processing data

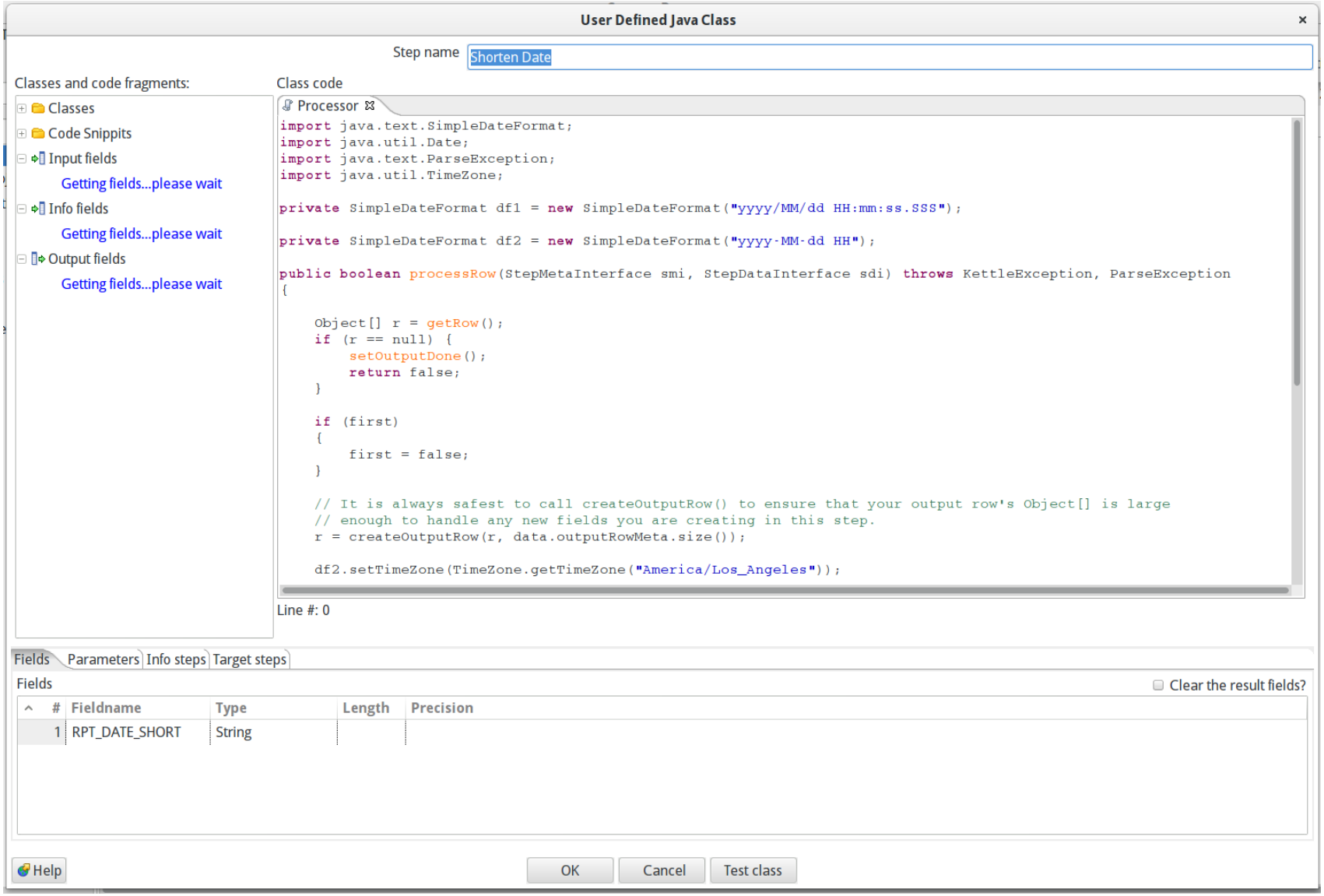
```
java -cp amazon-kinesis-client-1.7.3.jar \
  com.amazonaws.services.kinesis.multilang.MultiLangDaemon \
  app.properties
```

- *Scalable* and *fault-tolerant* processing (checkpointing via DynamoDB)
- Logging and metrics in CloudWatch
- The **MultiLangDaemon** spawns processes written in any language, communication happens via JSON messages sent over stdin/stdout
- Only a few events/methods to care about in the consumer application:
  1. initialize
  2. processRecords
  3. checkpoint
  4. shutdown

Messages from the KCL

1. **initialize**:
   - Perform initialization steps
   - Write "status" message to indicate you are done
   - Begin reading line from STDIN to receive next action
2. **processRecords**:
   - Perform processing tasks (you may write a checkpoint message at any time)
   - Write "status" message to STDOUT to indicate you are done.
   - Begin reading line from STDIN to receive next action
3. **shutdown**:
   - Perform shutdown tasks (you may write a checkpoint message at any time)
   - Write "status" message to STDOUT to indicate you are done.
   - Begin reading line from STDIN to receive next action
4. **checkpoint**:
   - Decide whether to checkpoint again based on whether there is an error or not.

Again . . . Why R?


User Defined Java Class
Step name
Shorten Date
Classes and code fragments:
Class code
Classes
Code Snippits
Input fields
Getting fields...please wait
Info fields
Getting fields...please wait
Output fields
Getting fields...please wait
Processor
import java.text.SimpleDateFormat;
import java.util.Date;
import java.text.ParseException;
import java.util.TimeZone;
private SimpleDateFormat df1 = new SimpleDateFormat("yyyy/MM/dd HH:mm:ss.SSS");
private SimpleDateFormat df2 = new SimpleDateFormat("yyyy-MM-dd HH");
public boolean processRow(StepMetaInterface smi, StepDataInterface sdi) throws KettleException, ParseException
{
Object[] r = getRow();
if (r == null) {
setOutputDone();
return false;
}
if (first)
{
first = false;
}
// It is always safest to call createOutputRow() to ensure that your output row's Object[] is large
// enough to handle any new fields you are creating in this step.
r = createOutputRow(r, data.outputRowMeta.size());
df2.setTimeZone(TimeZone.getTimeZone("America/Los_Angeles"));
Line #: 0
Fields
Parameters
Info steps
Target steps
Fields
Clear the result fields?
Fieldname Type Length Precision
1 RPT_DATE_SHORT String
Help
OK
Cancel
Test class

R Script Interacting with KCL

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```
#!/usr/bin/r -i

while (TRUE) {

    ## read and parse JSON messages
    line <- fromJSON(readLines(n = 1))

    ## nothing to do unless we receive records to process
    if (line$action == 'processRecords') {

        ## process each record
        lapply(line$records, function(r) {

            business_logic(fromJSON(rawToChar(base64_dec(r$data))))
            cat(toJSON(list(action = 'checkpoint', checkpoint = r$sequenceNumber)))

        })
    }

    ## return response in JSON
    cat(toJSON(list(action = 'status', responseFor = line$action)))

}
```

R Script Interacting with KCL

```
#!/usr/bin/r -i

while (TRUE) {

    ## read and parse JSON messages
    line <- fromJSON(readLines(n = 1))

    ## nothing to do unless we receive records to process
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        lapply(line$records, function(r) {

            business_logic(fromJSON(rawToChar(base64_dec(r$data))))
            cat(toJSON(list(action = 'checkpoint', checkpoint = r$sequenceNumber)))

        })
    }

    ## return response in JSON
    cat(toJSON(list(action = 'status', responseFor = line$action)))

}
```

Get rid of the bugs and the boilerplate

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```
> install.packages('AWR.Kinesis')
also installing the dependency ‘AWR’

trying URL 'https://cloud.r-project.org/src/contrib/AWR_1.11.89.tar.gz'
Content type 'application/x-gzip' length 3125 bytes

trying URL 'https://cloud.r-project.org/src/contrib/AWR.Kinesis_1.7.3.tar.gz'
Content type 'application/x-gzip' length 3091459 bytes (2.9 MB)

* installing *source* package ‘AWR’ ...
** testing if installed package can be loaded
trying URL 'https://gitlab.com/cardcorp/AWR/repository/archive.zip?ref=1.11.89'
downloaded 58.9 MB
* DONE (AWR)

* installing *source* package ‘AWR.Kinesis’ ...
* DONE (AWR.Kinesis)
```

Add content to the boilerplate

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Business logic coded in R (demo_app.R):

```
library(AWR.Kinesis)
kinesis_consumer(processRecords = function(records) {
    flog.info(jsonlite::toJSON(records))
})
```

Add content to the boilerplate

Business logic coded in R (demo_app.R):

```
library(AWR.Kinesis)
kinesis_consumer(processRecords = function(records) {
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})
```

Note

This is not something you should run in RStudio.

Add content to the boilerplate

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Business logic coded in R (demo_app.R):

```
library(AWR.Kinesis)
kinesis_consumer(processRecords = function(records) {
    flog.info(jsonlite::toJSON(records))
})
```

Config file for the MultiLangDaemon (demo_app.properties):

```
executableName = ./demo_app.R
streamName = demo_stream
applicationName = demo_app
```

Start the MultiLangDaemon:

```
/usr/bin/java -cp AWR/java/*:AWR.Kinesis/java/*:./ \
    com.amazonaws.services.kinesis.multilang.MultiLangDaemon \
    ./demo_app.properties
```

"Advanced" AWR.Kinesis features

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```
library(futile.logger)
library(AWR.Kinesis)

kinesis_consumer(

    initialize     = function()
        flog.info('Hello'),

    processRecords = function(records)
        flog.info(paste('Received', nrow(records), 'records from Kinesis')),

    shutdown       = function()
        flog.info('Bye'),

    updater        = list(
        list(1, function()
            flog.info('Updating some data every minute')),
        list(1/60*10, function()
            flog.info(paste(
                'This is a high frequency updater call',
                'running every 10 seconds')))),

    checkpointing = 1,
    logfile = '/logs/logger.log')
```

Let's run it locally!

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Note

In theory you could, but this is not something you should run in RStudio.

1. Create a Kinesis Stream
2. Create an IAM user with DynamoDB and Kinesis permissions
3. Write data to the Stream
4. Run the MultiLangDaemon referencing the properties file

Let's run it locally!

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Note

In theory you could, but this is not something you should run in RStudio.

1. Create a Kinesis Stream
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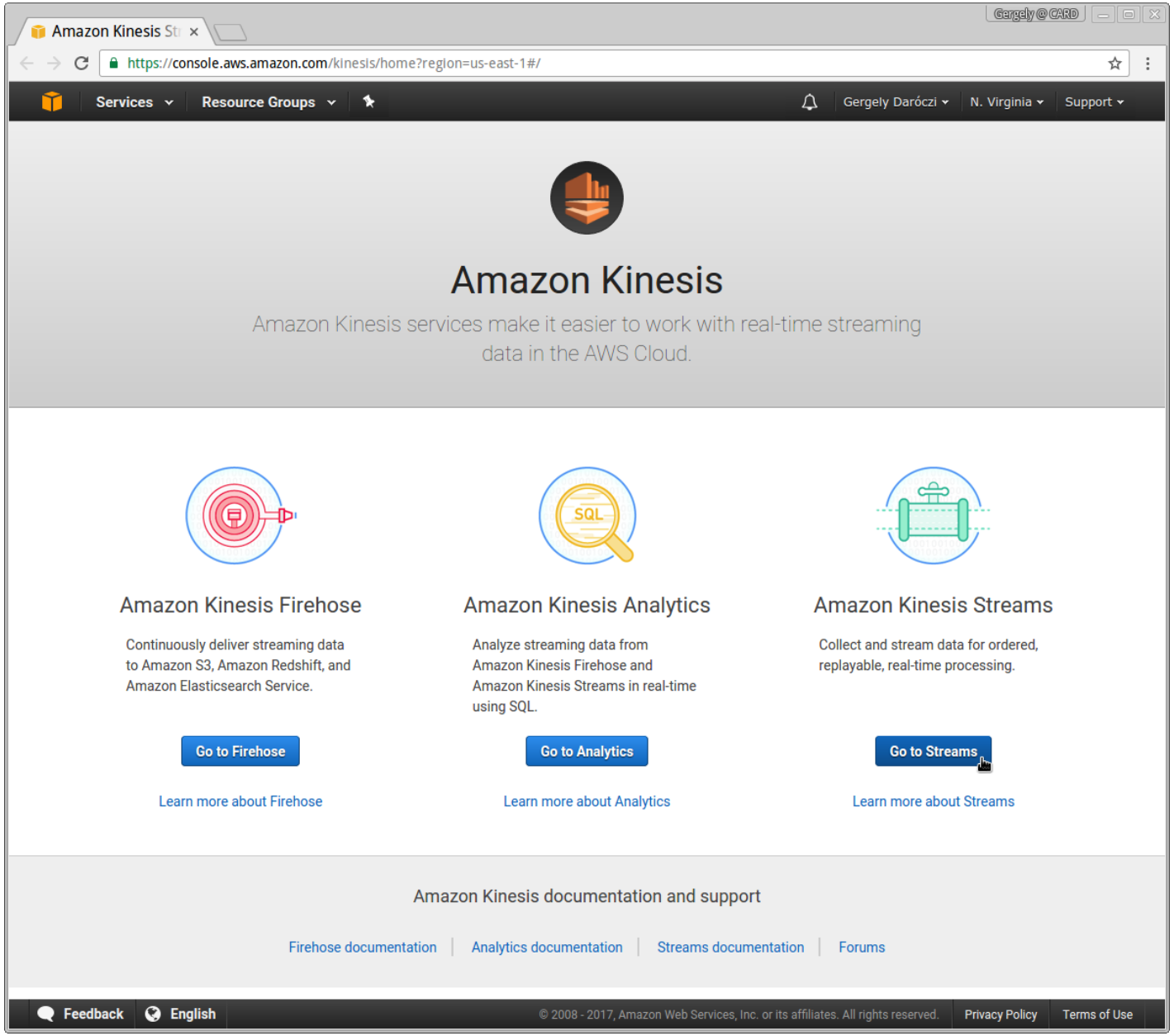
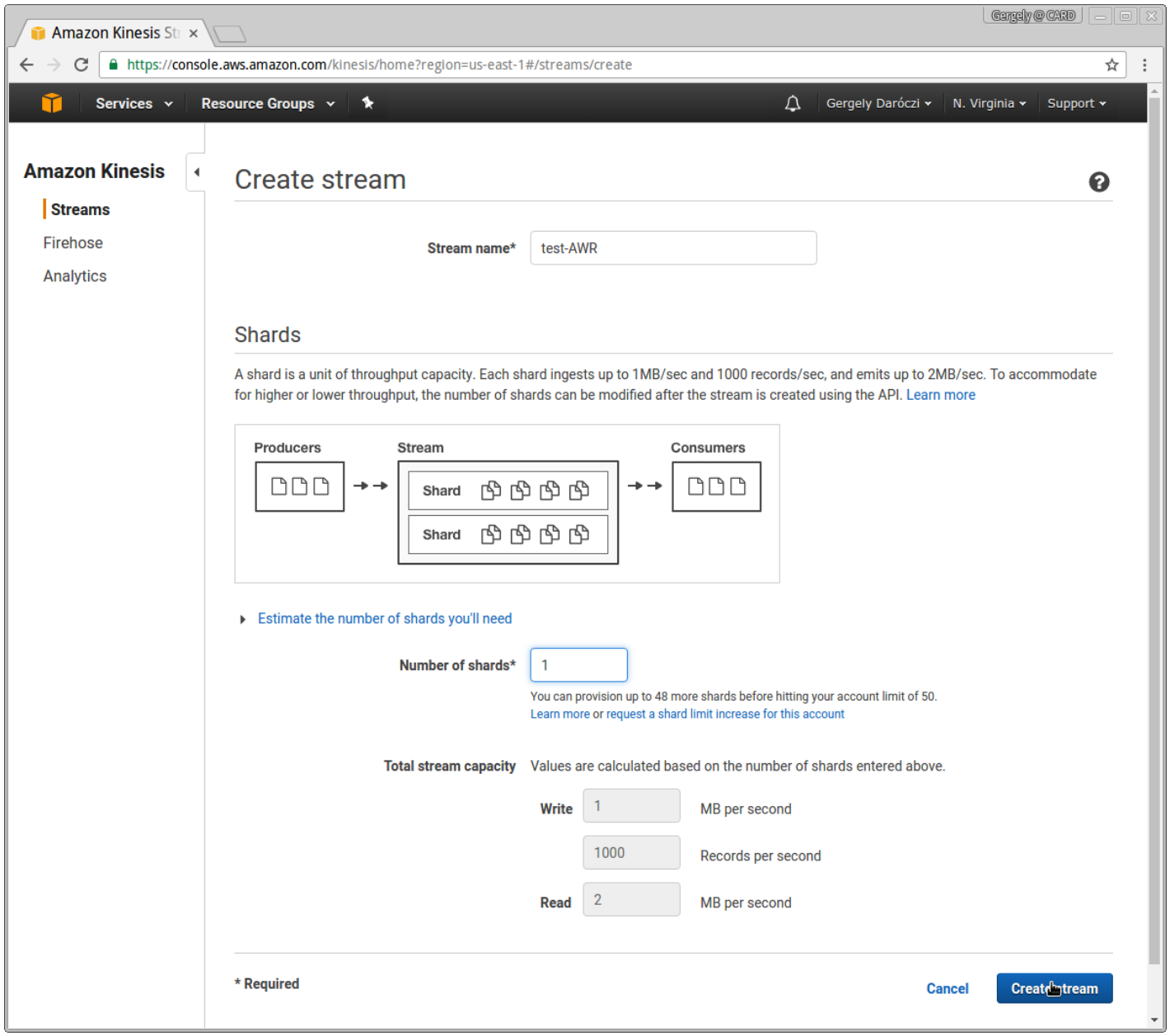
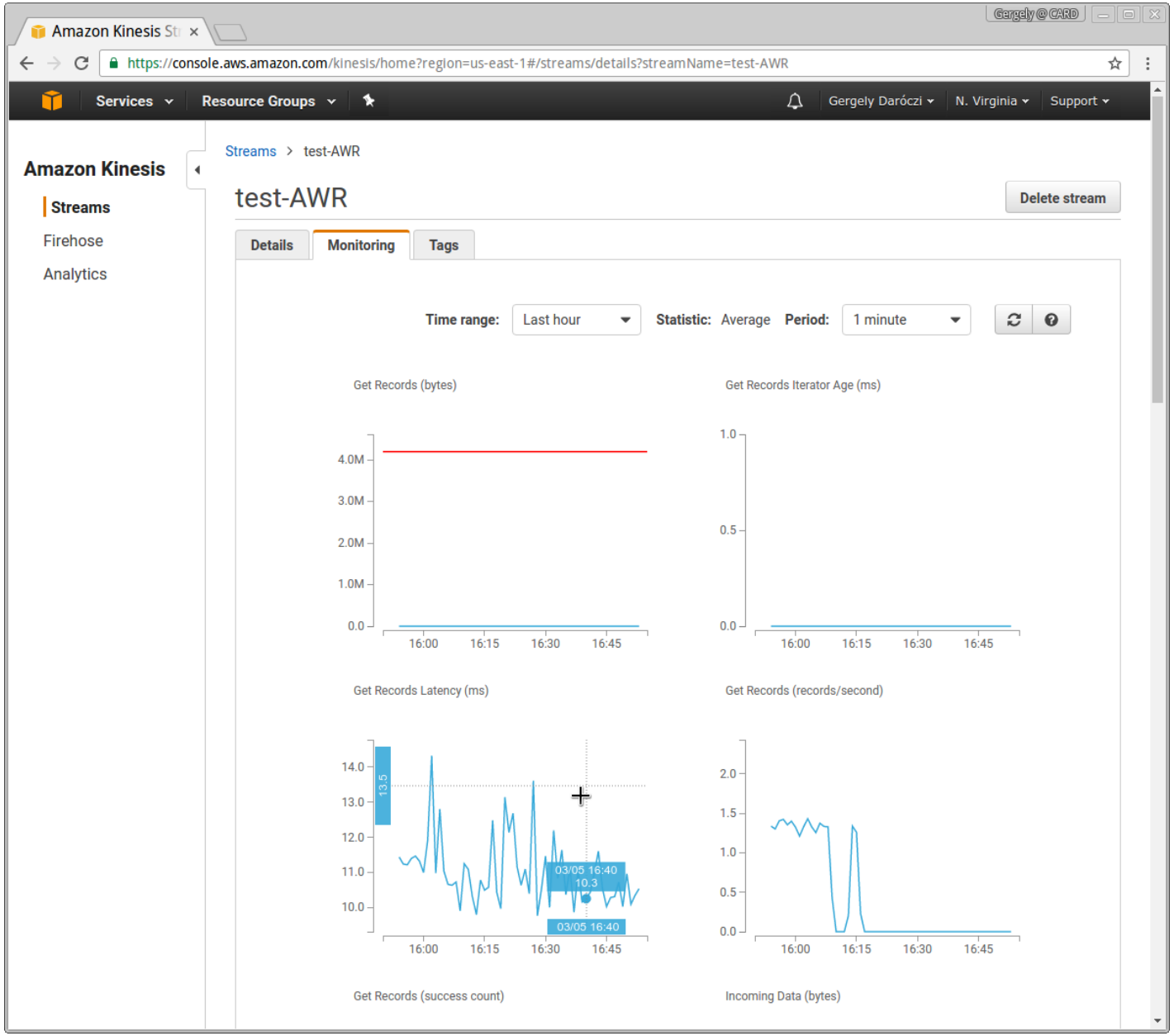
Create a Kinesis Stream



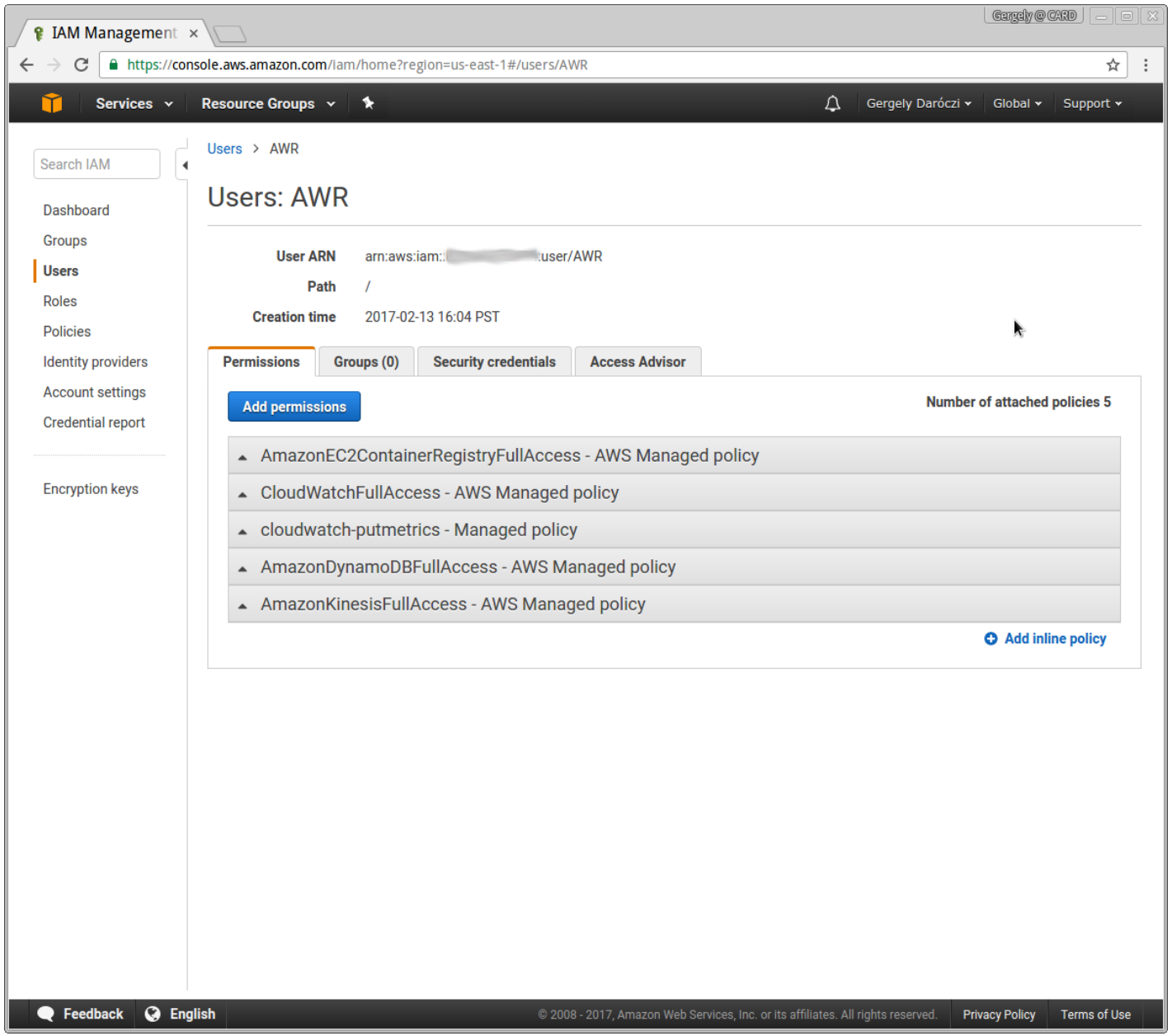
Create a Kinesis Stream



Check the Kinesis Stream



Create an IAM user



Write Data to the Stream from R

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```
library(rJava)
.jcall("java/lang/System", "S", "setProperty", "aws.profile", "personal")

library(AWR.Kinesis)
library(jsonlite)
library(futile.logger)
library(nycflights13)
while (TRUE) {

    ## pick a ~car~flight
    flight <- flights[sample(1:nrow(flights), 1), ]

    ## prr <- .jnew('com.amazonaws.services.kinesis.model.PutRecordRequest')
    ## prr$setStreamName('test1')
    ## prr$setData(J('java.nio.ByteBuffer')$wrap(.jbyte(charToRaw(toJSON(car)))))
    ## prr$setPartitionKey(rownames(car))
    ## kc$putRecord(prr)

    res <- kinesis_put_record(stream = 'test-AWR', region = 'us-east-1',
                              data = toJSON(flight), partitionKey = flight$dest)
    flog.info(paste('Pushed a new flight to Kinesis:', res$sequenceNumber))

}
```

Write Data to the Stream from R

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Minibuf-1

File Edit Options Buffers Tools Minibuf Help

```
> library(rJava)
> .jcall("java/lang/System", "S", "setProperty", "aws.profile", "personal")
> library(AWR.Kinesis); library(jsonlite); library(futile.logger); library(nycflights13)
> while (TRUE) {
+     flight <- flights[sample(1:nrow(flights), 1), ]
+     res <- kinesis_put_record('test-AWR', region = 'us-east-1', data = toJSON(flight),
+                               partitionKey = flight$dest)
+     flog.info(paste('Pushed a new flight to Kinesis:', res$sequenceNumber))
+ }
INFO [2017-03-06 21:47:16] Pushed a new flight to Kinesis: 49571082550613725758991014186133813750336290428328869938
INFO [2017-03-06 21:47:17] Pushed a new flight to Kinesis: 49571082550613725758991014186380434617537674848688406578
INFO [2017-03-06 21:47:17] Pushed a new flight to Kinesis: 49571082550613725758991014186610130523264454391882580018
INFO [2017-03-06 21:47:17] Pushed a new flight to Kinesis: 49571082550613725758991014186870049574481599664444407858
INFO [2017-03-06 21:47:18] Pushed a new flight to Kinesis: 49571082550613725758991014187125132922420286489026887730
INFO [2017-03-06 21:47:18] Pushed a new flight to Kinesis: 49571082550613725758991014187394723380194348794986364978
INFO [2017-03-06 21:47:19] Pushed a new flight to Kinesis: 49571082550613725758991014187636508544117274698647076914
INFO [2017-03-06 21:47:19] Pushed a new flight to Kinesis: 49571082550613725758991014187857741969106751837618307122
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INFO [2017-03-06 21:47:20] Pushed a new flight to Kinesis: 49571082550613725758991014188250642860481506388117291058
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INFO [2017-03-06 21:47:21] Pushed a new flight to Kinesis: 49571082550613725758991014189015892904297566724425777202
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INFO [2017-03-06 21:47:22] Pushed a new flight to Kinesis: 49571082550613725758991014189516388193618023271473610802
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INFO [2017-03-06 21:47:24] Pushed a new flight to Kinesis: 49571082550613725758991014190342084528414815135236882482
INFO [2017-03-06 21:47:24] Pushed a new flight to Kinesis: 49571082550613725758991014190545184066110072905306996786
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INFO [2017-03-06 21:47:25] Pushed a new flight to Kinesis: 49571082550613725758991014190965890251335963858104746034
INFO [2017-03-06 21:47:25] Pushed a new flight to Kinesis: 49571082550613725758991014191170198714850836257349566514
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INFO [2017-03-06 21:47:26] Pushed a new flight to Kinesis: 49571082550613725758991014191629590526304395412457390130
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INFO [2017-03-06 21:47:28] Pushed a new flight to Kinesis: 49571082550613725758991014192772025425840220119993679922
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INFO [2017-03-06 21:47:30] Pushed a new flight to Kinesis: 49571082550613725758991014193818955185626489122728181810
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INFO [2017-03-06 21:47:31] Pushed a new flight to Kinesis: 49571082550613725758991014194267466664703516546544173106
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INFO [2017-03-06 21:47:34] Pushed a new flight to Kinesis: 49571082550613725758991014195478810335957375117038714930
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INFO [2017-03-06 21:47:35] Pushed a new flight to Kinesis: 49571082550613725758991014196216255085922989823289590 26
INFO [2017-03-06 21:47:35] Pushed a new flight to Kinesis: 49571082550613725758991014196406056439601795831477305394
INFO [2017-03-06 21:47:36] Pushed a new flight to Kinesis: 49571082550613725758991014196589813164183219466032644146
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INFO [2017-03-06 21:47:39] Pushed a new flight to Kinesis: 49571082550613725758991014198145700694027247488757399602
INFO [2017-03-06 21:47:39] Pushed a new flight to Kinesis: 49571082550613725758991014198412873300162080536367464498
INFO [2017-03-06 21:47:40] Pushed a new flight to Kinesis: 49571082550613725758991014198640151354249630889931702322
INFO [2017-03-06 21:47:41] Pushed a new flight to Kinesis: 49571082550613725758991014199353417587822262171727822898
INFO [2017-03-06 21:47:41] Pushed a new flight to Kinesis: 49571082550613725758991014199624216971415939106862006322
```

* 12M U: R-kinesis-putrecord iESS [R]: run 109137 : 0 99%

M-x butterfly

This Kinesis app is being run

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```
library(futile.logger)
library(AWR.Kinesis)

kinesis_consumer(

    initialize     = function()
        flog.info('Hello'),

    processRecords = function(records)
        flog.info(paste('Received', nrow(records), 'records from Kinesis')),

    shutdown       = function()
        flog.info('Bye'),

    updater        = list(
        list(1, function()
            flog.info('Updating some data every minute')),
        list(1/60*10, function()
            flog.info(paste(
                'This is a high frequency updater call',
                'running every 10 seconds')))),

    checkpointing = 1,
    logfile = '/logs/logger.log')
```

Running the MultiLangDaemon locally

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Terminix: Default

1: daroczig@gergely-CARD: ~/Projects/card-rocker/r-kinesis-example/files

```
~/Projects/card-rocker/r-kinesis-example/files  master ?  export AWS_PROFILE=personal
~/Projects/card-rocker/r-kinesis-example/files  master ?  /usr/bin/java -cp \
"/usr/local/lib/R/site-library/AWR/java/*:/usr/local/lib/R/site-library/AWR.Kinesis/java/*:./" \
com.amazonaws.services.kinesis.multilang.MultiLangDaemon ./app.properties
Mar 05, 2017 5:32:33 PM com.amazonaws.services.kinesis.clientlibrary.config.KinesisClientLibConfigurator getConfiguration
INFO: Value of workerId is not provided in the properties. WorkerId is automatically assigned as: [redacted]
Mar 05, 2017 5:32:34 PM com.amazonaws.services.kinesis.clientlibrary.config.KinesisClientLibConfigurator withProperty
INFO: Successfully set property regionName with value us-east-1
Mar 05, 2017 5:32:34 PM com.amazonaws.services.kinesis.multilang.MultiLangDaemonConfig buildExecutorService
INFO: Using a cached thread pool.
Mar 05, 2017 5:32:34 PM com.amazonaws.services.kinesis.multilang.MultiLangDaemonConfig <init>
INFO: Running AWR-demo-app to process stream test-AWR with executable /app/app.R
Mar 05, 2017 5:32:34 PM com.amazonaws.services.kinesis.multilang.MultiLangDaemonConfig prepare
INFO: Using workerId: [redacted]
Mar 05, 2017 5:32:34 PM com.amazonaws.services.kinesis.multilang.MultiLangDaemonConfig prepare
INFO: Using credentials with access key id: [redacted]
Mar 05, 2017 5:32:34 PM com.amazonaws.services.kinesis.multilang.MultiLangDaemonConfig prepare
INFO: MultiLangDaemon is adding the following fields to the User Agent: amazon-kinesis-client-library-java-1.7.3 amazon-kinesis-multi-lang-dae
mon/1.0.1 R /app/app.R
Mar 05, 2017 5:32:34 PM com.amazonaws.services.kinesis.leases.impl.LeaseCoordinator <init>
INFO: With failover time 10000 ms and epsilon 25 ms, LeaseCoordinator will renew leases every 3308 ms, takeleases every 20050 ms, process maxi
mum of 2147483647 leases and steal 1 lease(s) at a time.
Mar 05, 2017 5:32:34 PM com.amazonaws.services.kinesis.clientlibrary.lib.worker.Worker initialize
INFO: Initialization attempt 1
Mar 05, 2017 5:32:34 PM com.amazonaws.services.kinesis.clientlibrary.lib.worker.Worker initialize
INFO: Initializing LeaseCoordinator
Mar 05, 2017 5:32:35 PM com.amazonaws.services.kinesis.clientlibrary.lib.worker.Worker initialize
INFO: Syncing Kinesis shard info
Mar 05, 2017 5:32:36 PM com.amazonaws.services.kinesis.clientlibrary.lib.worker.Worker initialize
INFO: Starting LeaseCoordinator
Mar 05, 2017 5:32:36 PM com.amazonaws.services.kinesis.leases.impl.LeaseTaker computeLeasesToTake
INFO: Worker [redacted] needed 2 leases but none were expired, so it will steal lease shardId-000000000002 from bef5
4447-3adb-444f-8dc6-67504e5c86ef
Mar 05, 2017 5:32:36 PM com.amazonaws.services.kinesis.leases.impl.LeaseTaker computeLeasesToTake
INFO: Worker [redacted] saw 3 total leases, 0 available leases, 2 workers. Target is 2 leases, I have 0 leases, I wi
ll take 1 leases
Mar 05, 2017 5:32:36 PM com.amazonaws.services.kinesis.leases.impl.LeaseTaker takeLeases
INFO: Worke[redacted] successfully took 1 leases: shardId-000000000002
Mar 05, 2017 5:32:46 PM com.amazonaws.services.kinesis.clientlibrary.lib.worker.Worker run
INFO: Initialization complete. Starting worker loop.
Mar 05, 2017 5:32:46 PM com.amazonaws.services.kinesis.clientlibrary.lib.worker.Worker infoForce
INFO: Created new shardConsumer for : ShardInfo [shardId=shardId-000000000002, concurrencyToken=[redacted], parentSh
ardIds=[shardId-000000000000], checkpoint={SequenceNumber: TRIM_HORIZON,SubsequenceNumber: 0}]
Mar 05, 2017 5:32:46 PM com.amazonaws.services.kinesis.clientlibrary.lib.worker.BlockOnParentShardTask call
INFO: No need to block on parents [shardId-000000000000] of shard shardId-000000000002
Mar 05, 2017 5:32:47 PM com.amazonaws.services.kinesis.clientlibrary.lib.worker.KinesisDataFetcher initialize
```

Running the MultiLangDaemon locally

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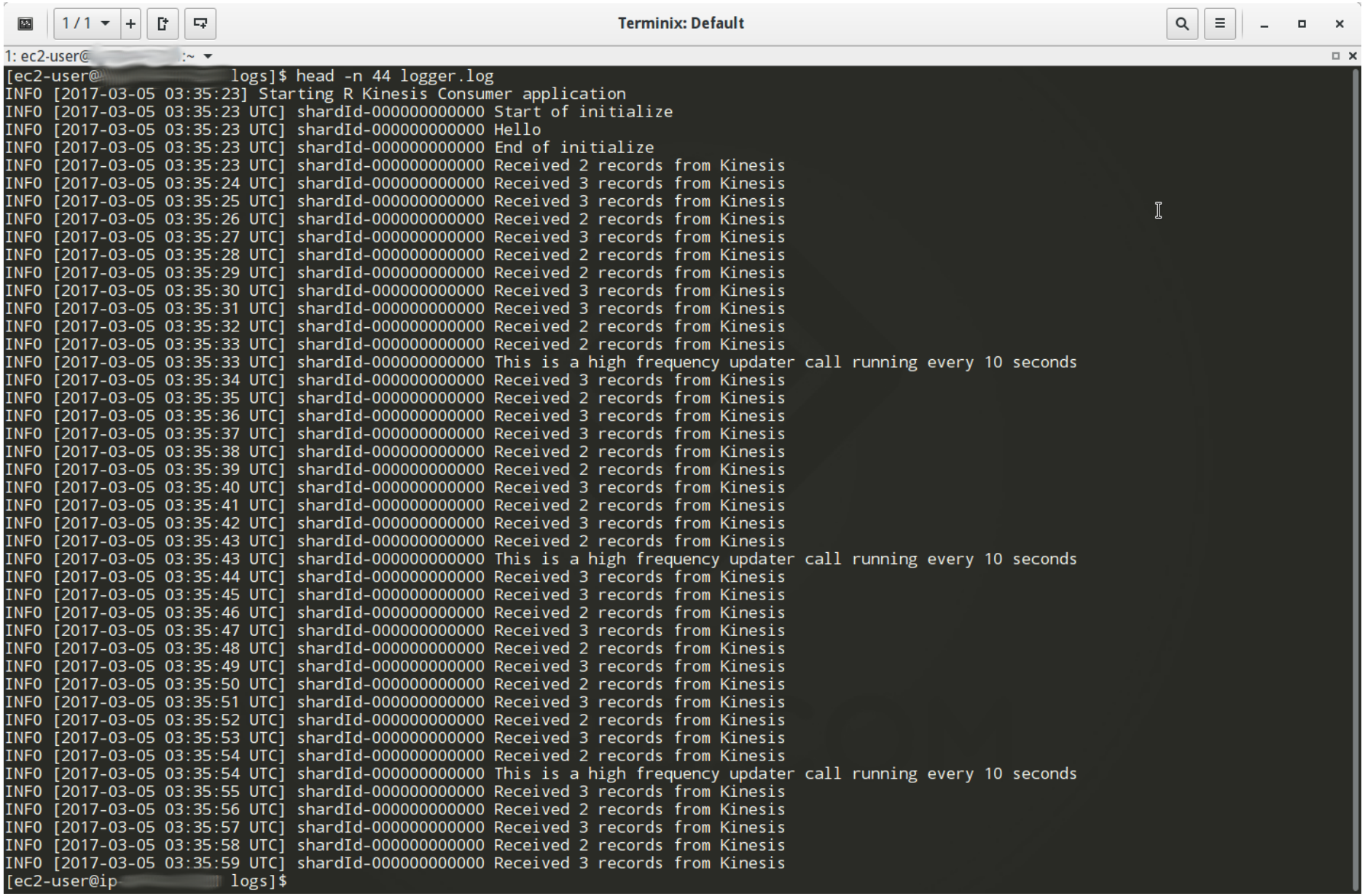

Let's run it in AWS!

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1. Dockerize your Kinesis Consumer:
   - Java
   - R
   - AWR, AWR.Kinesis packages
   - app.R
   - app.properties
   - startup command
2. Put it on Docker Hub
3. Run as a EC2 Container Service Task:
   - Create an ECS cluster
   - Create ECS Task Role
   - Create a Task definition
   - Run it (as a service)

Dockerize your Kinesis Consumer

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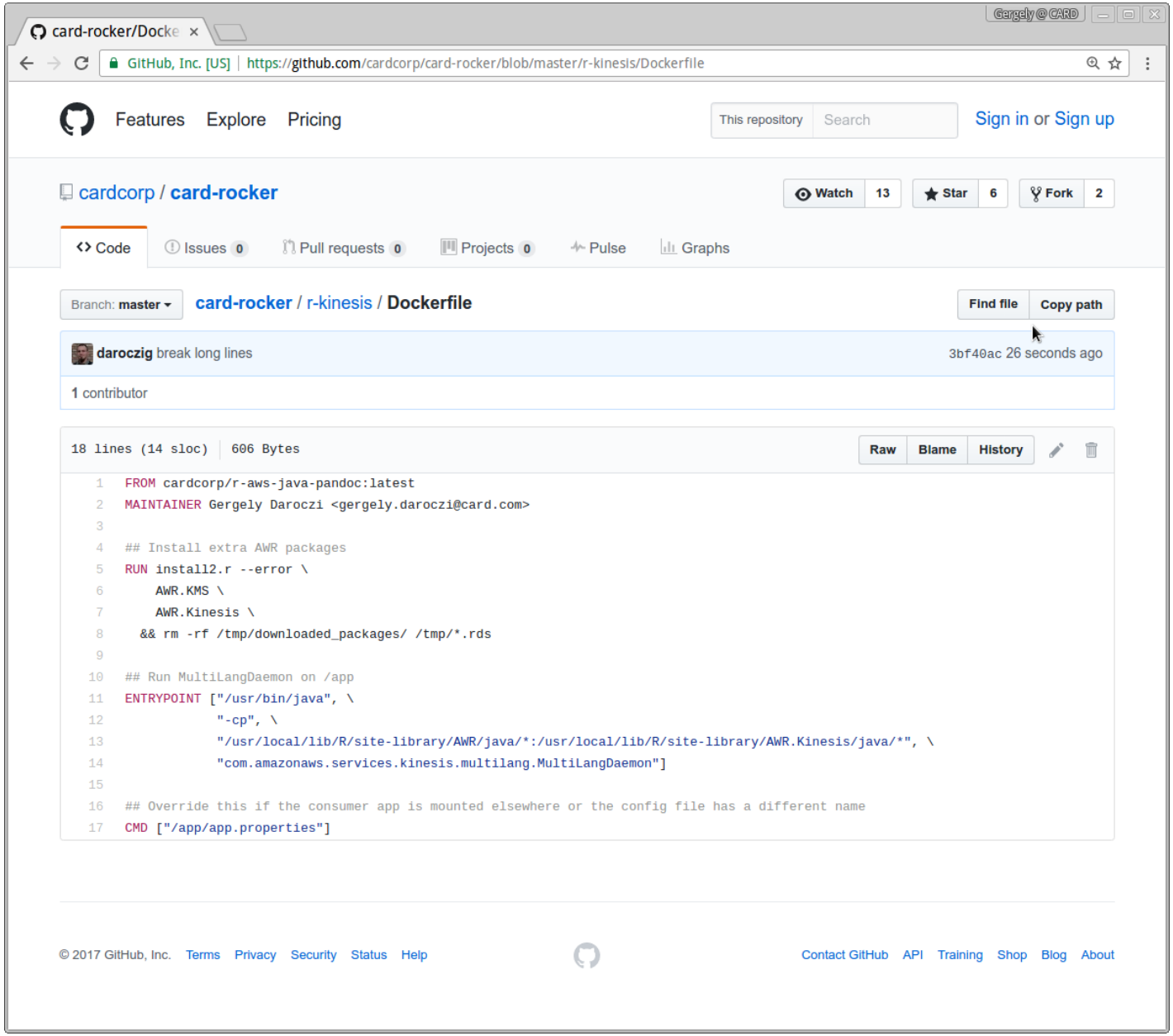
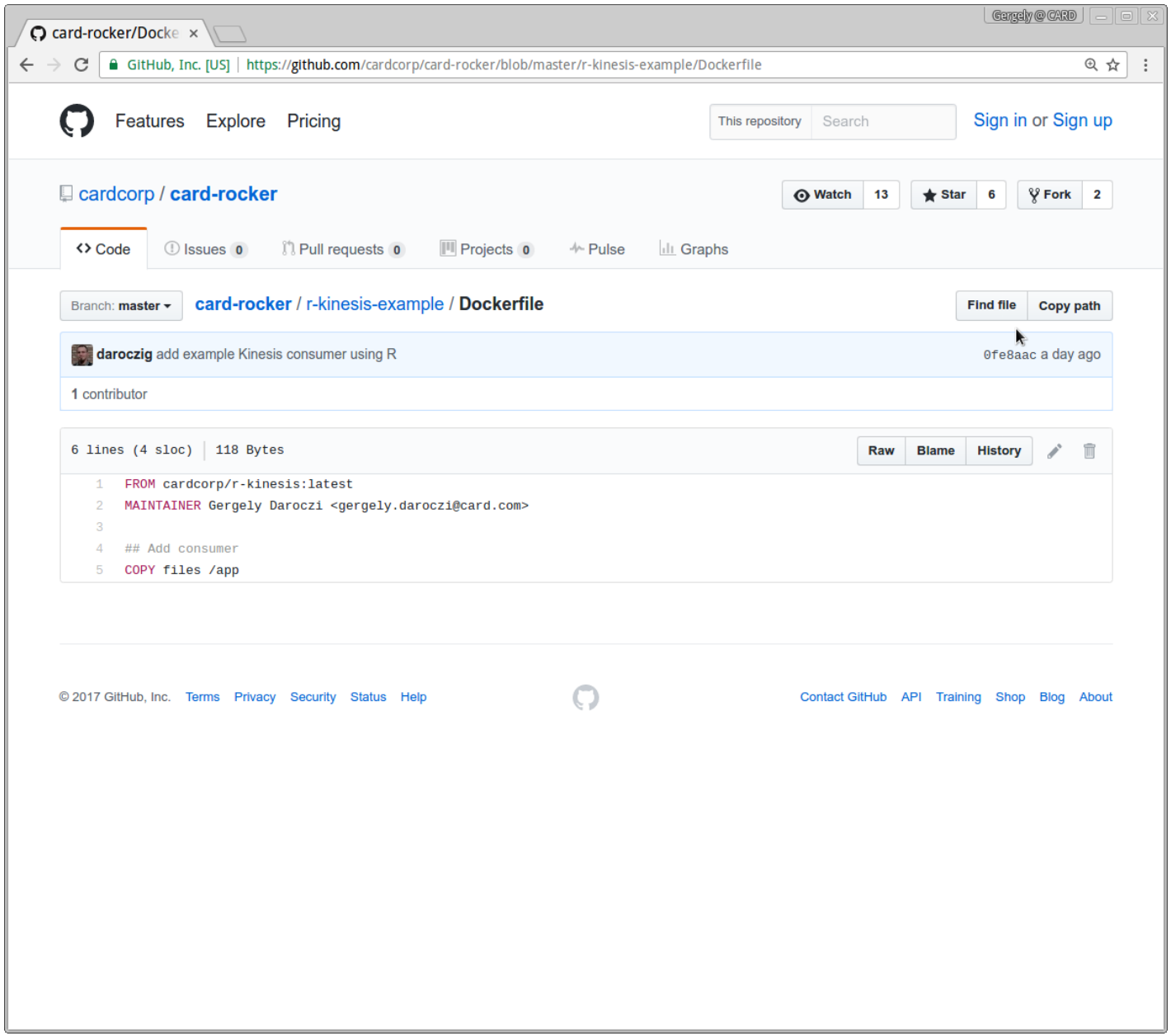


Dockerize your Kinesis Consumer



Dockerize your Kinesis Consumer

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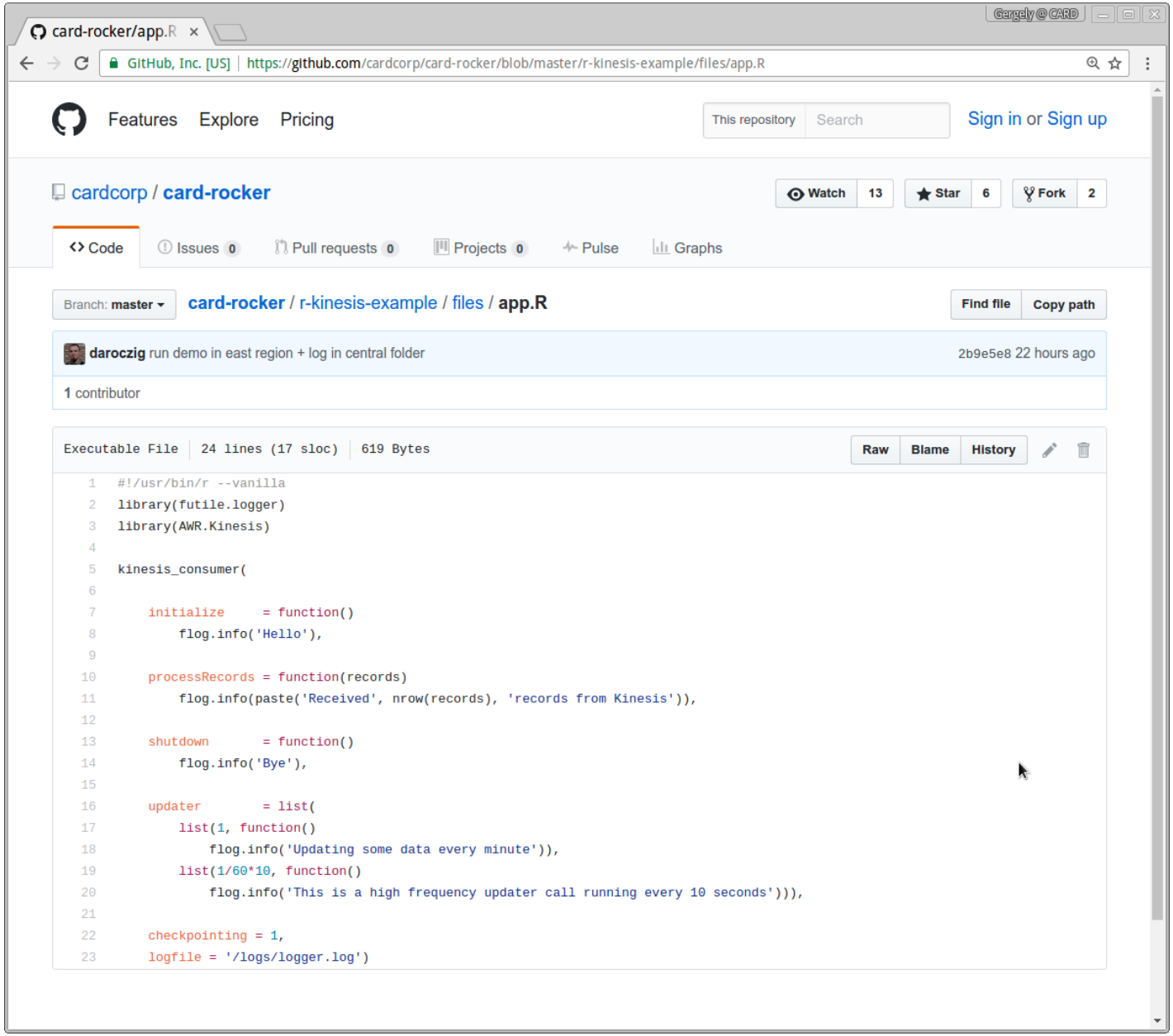

Dockerize your Kinesis Consumer

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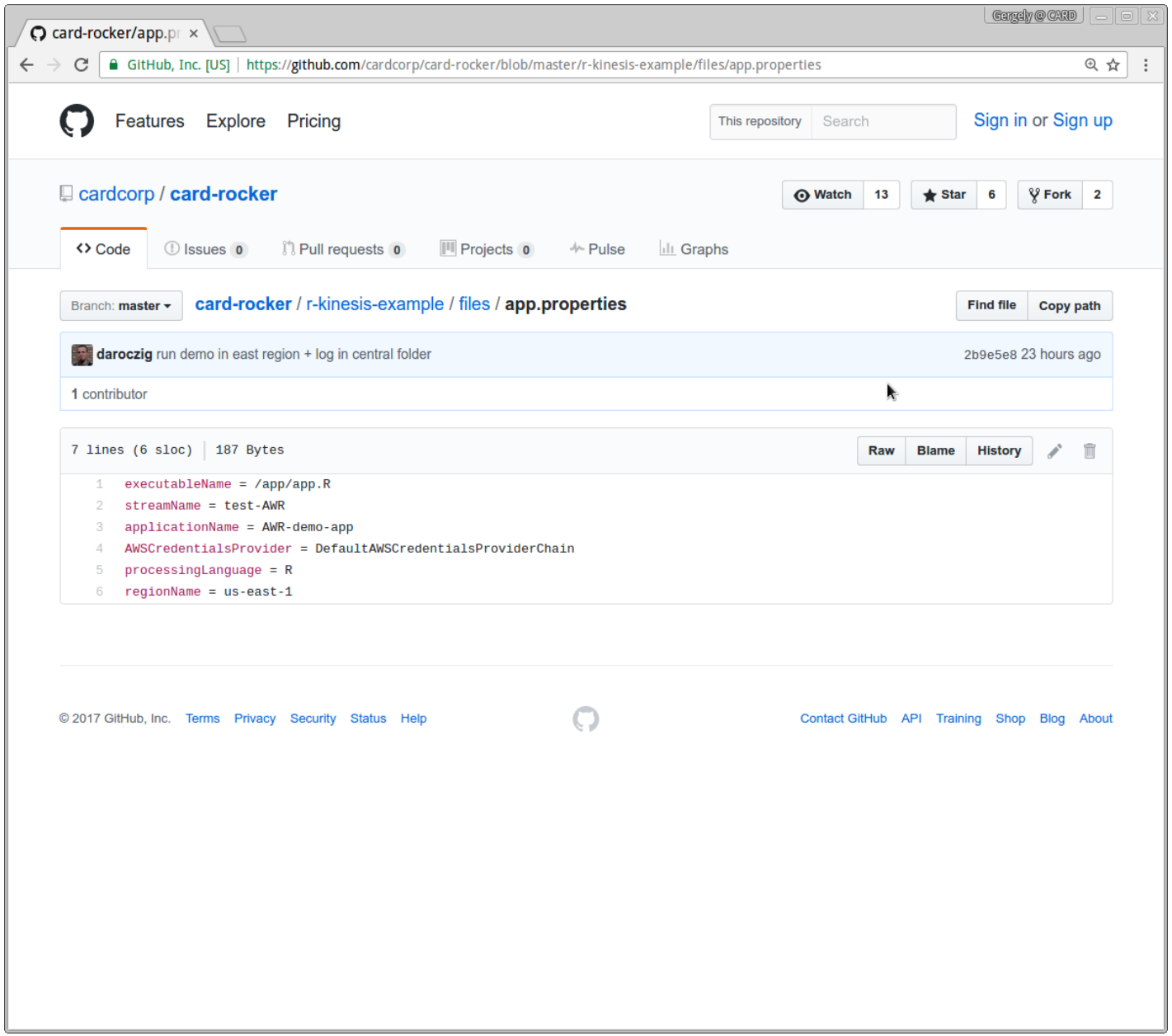
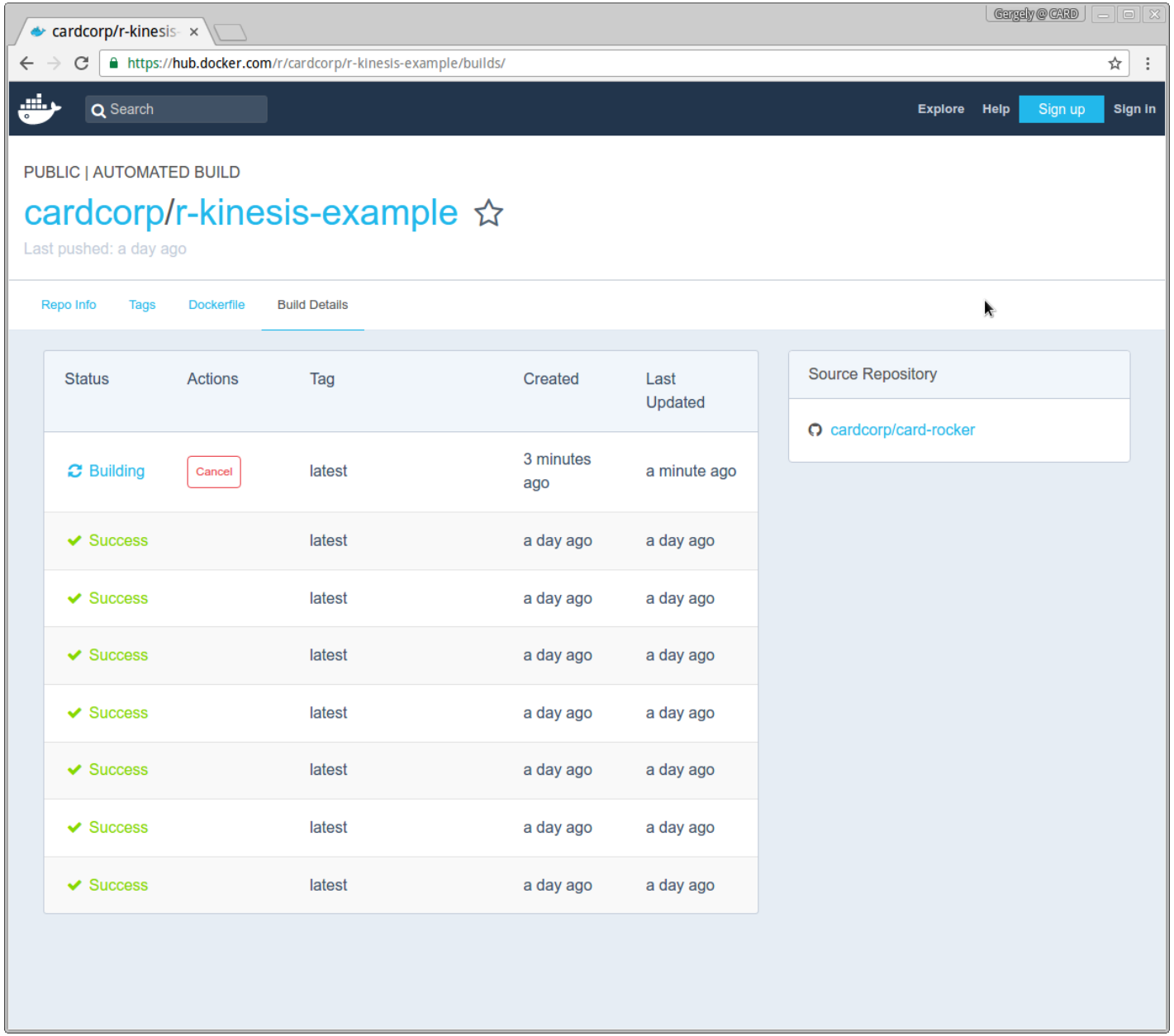
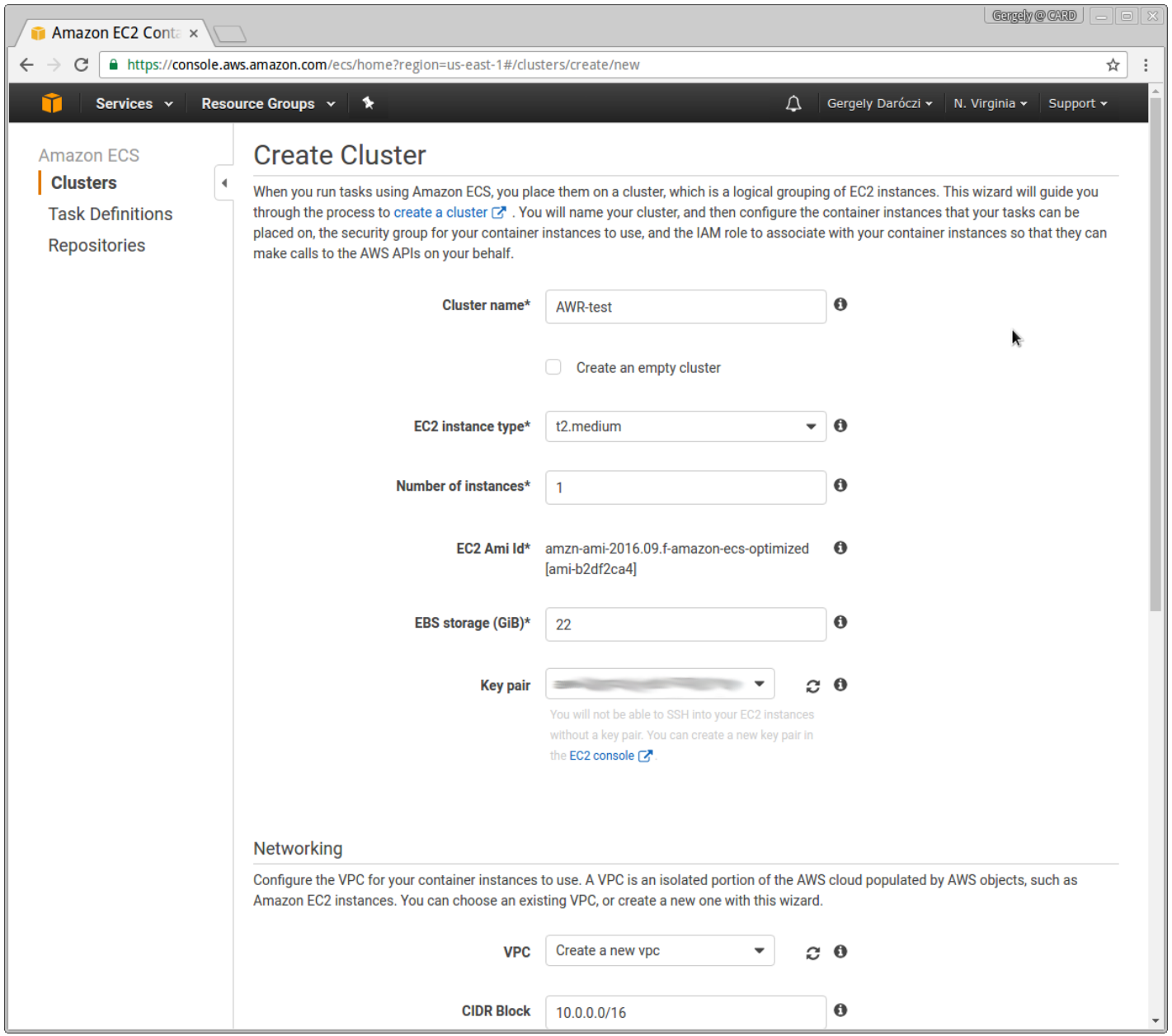


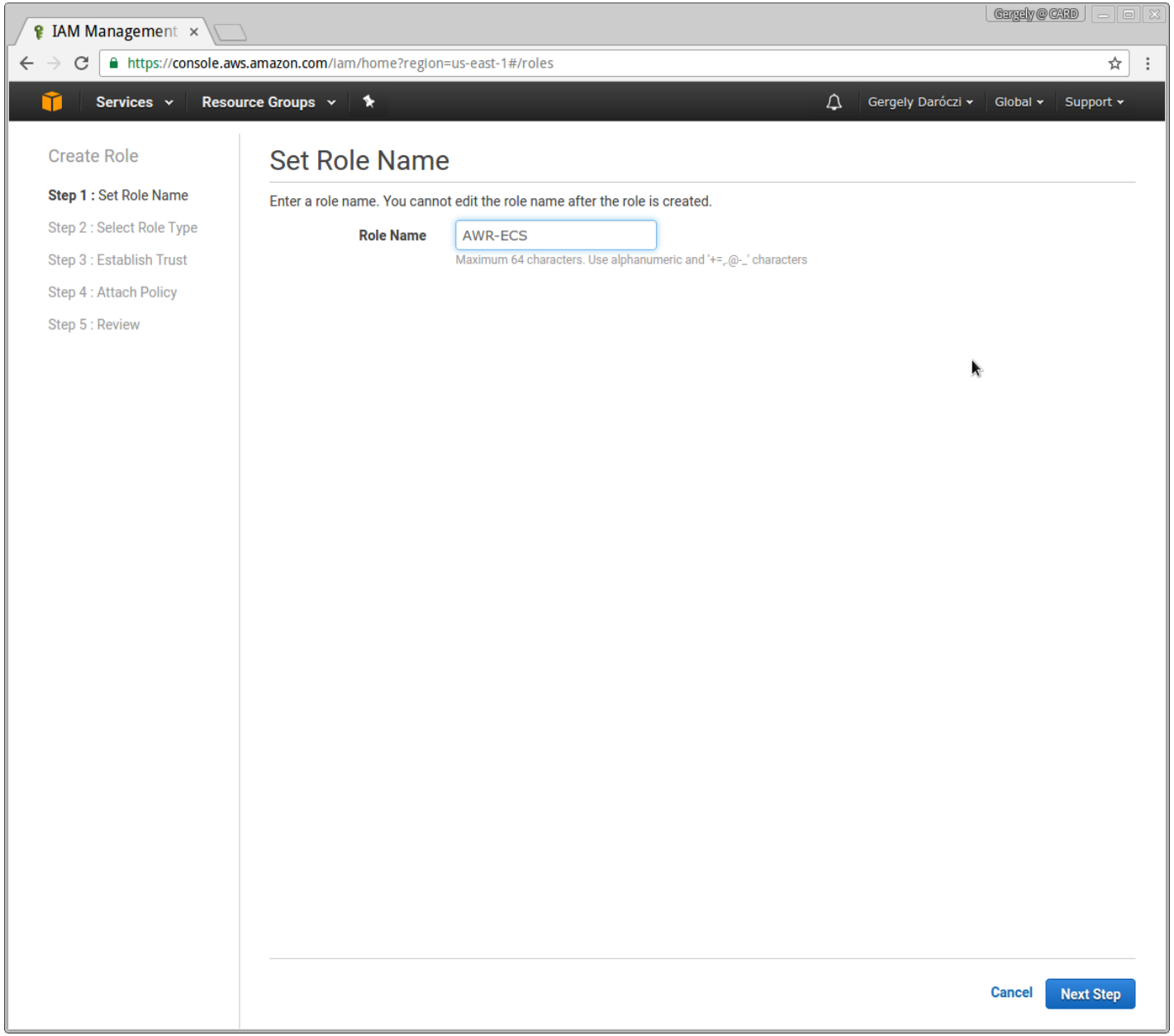
Put it on Docker Hub



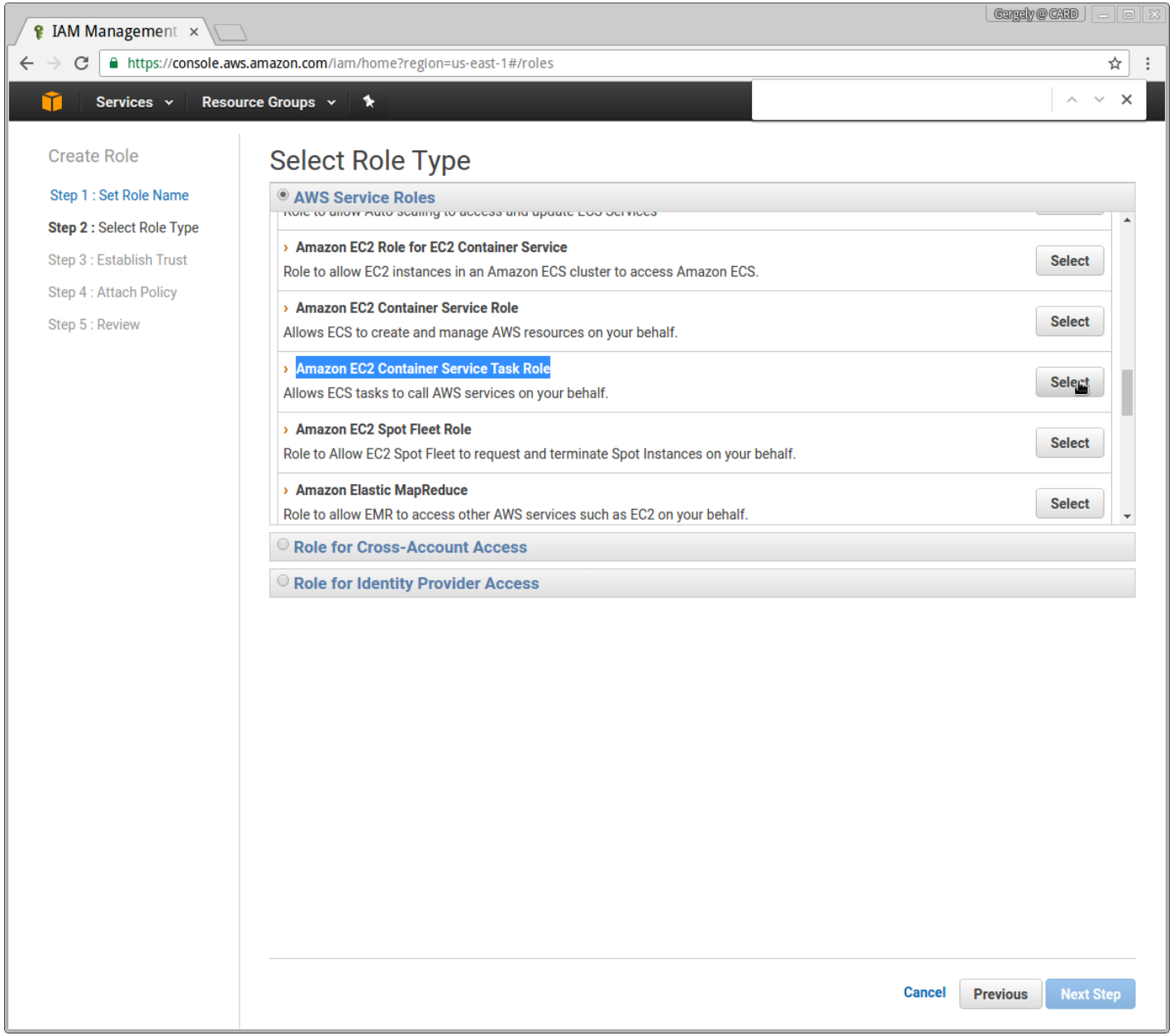
Create an ECS cluster



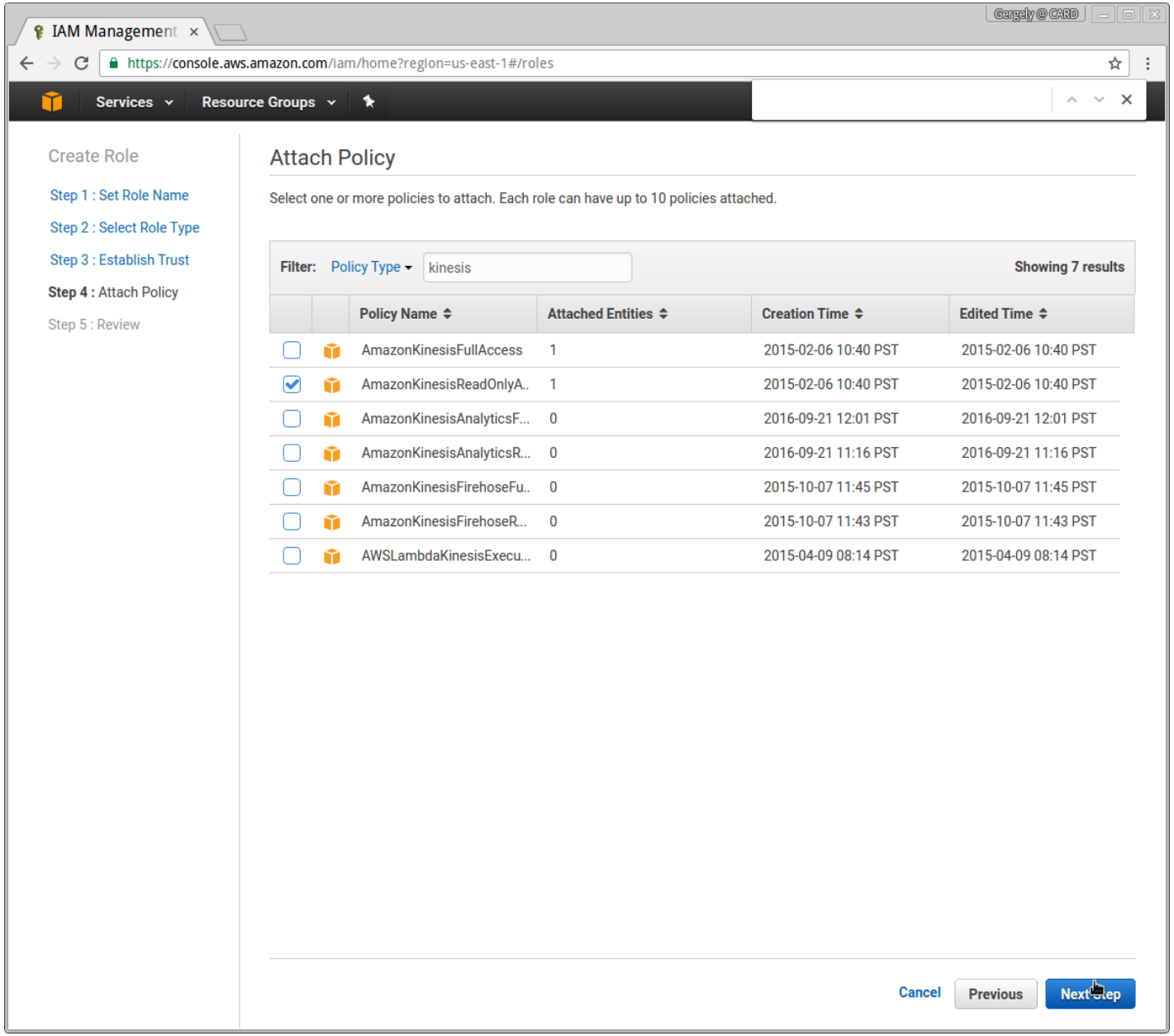
Create ECS Task Role



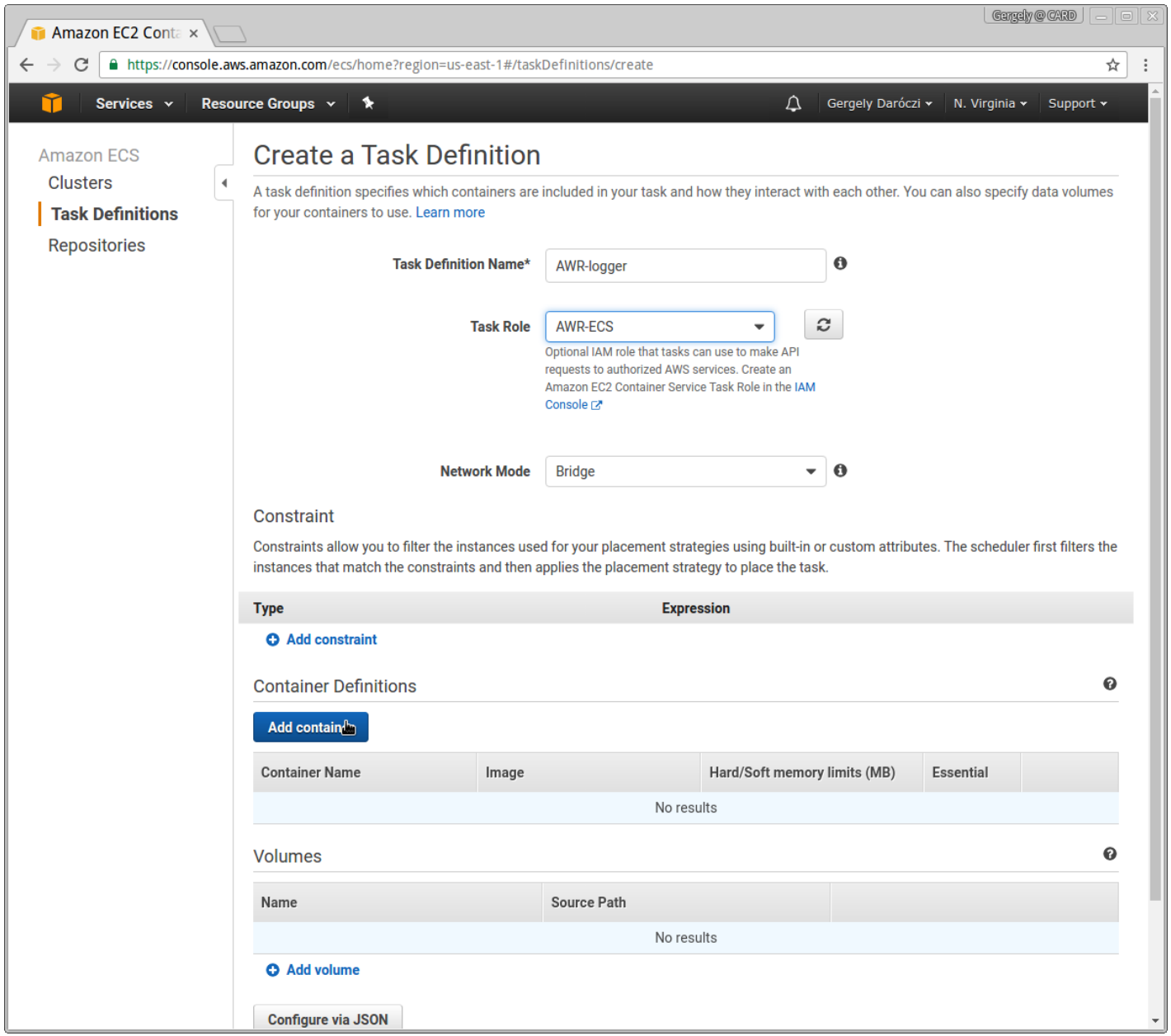
Create ECS Task Role



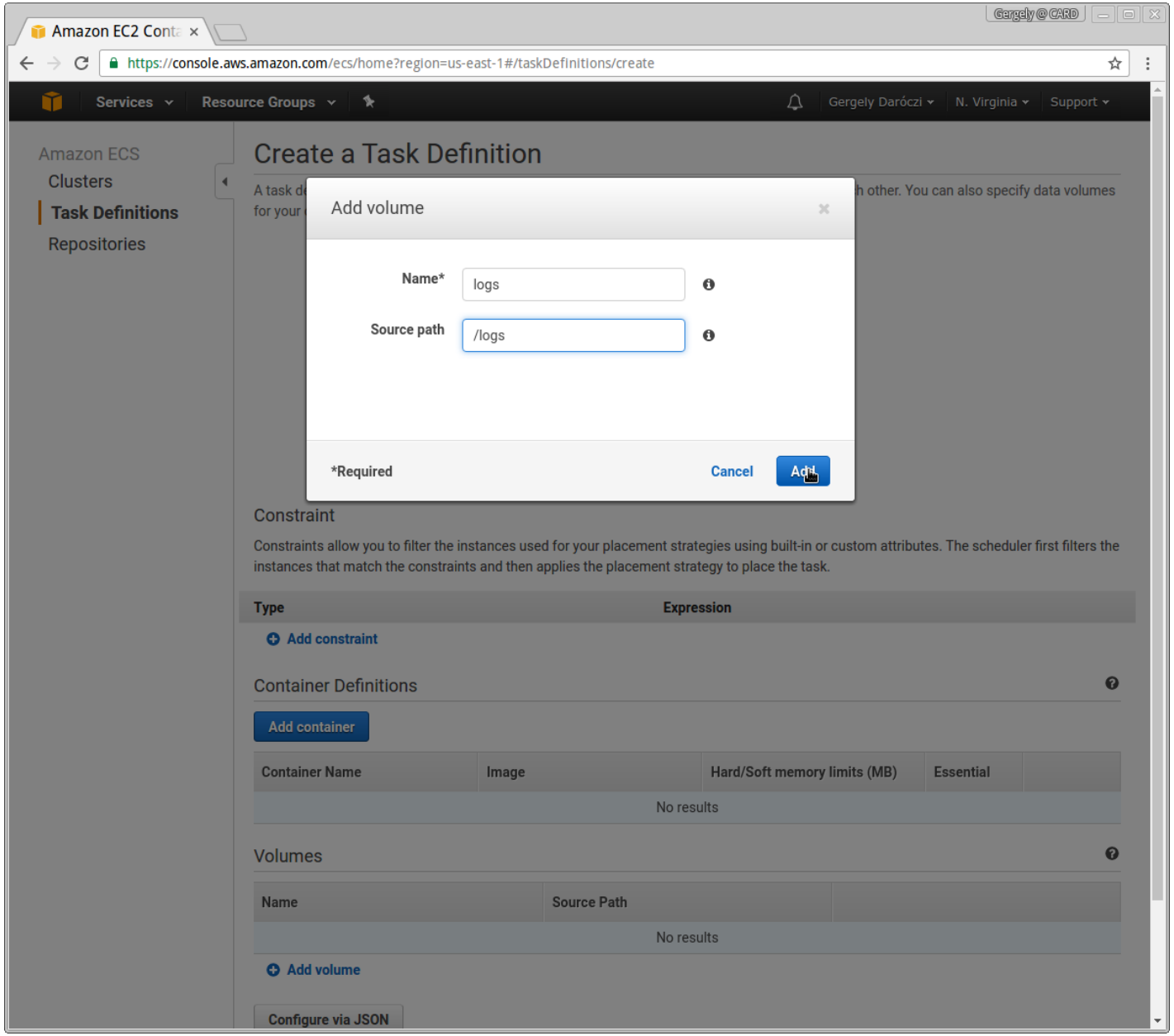
Create ECS Task Role



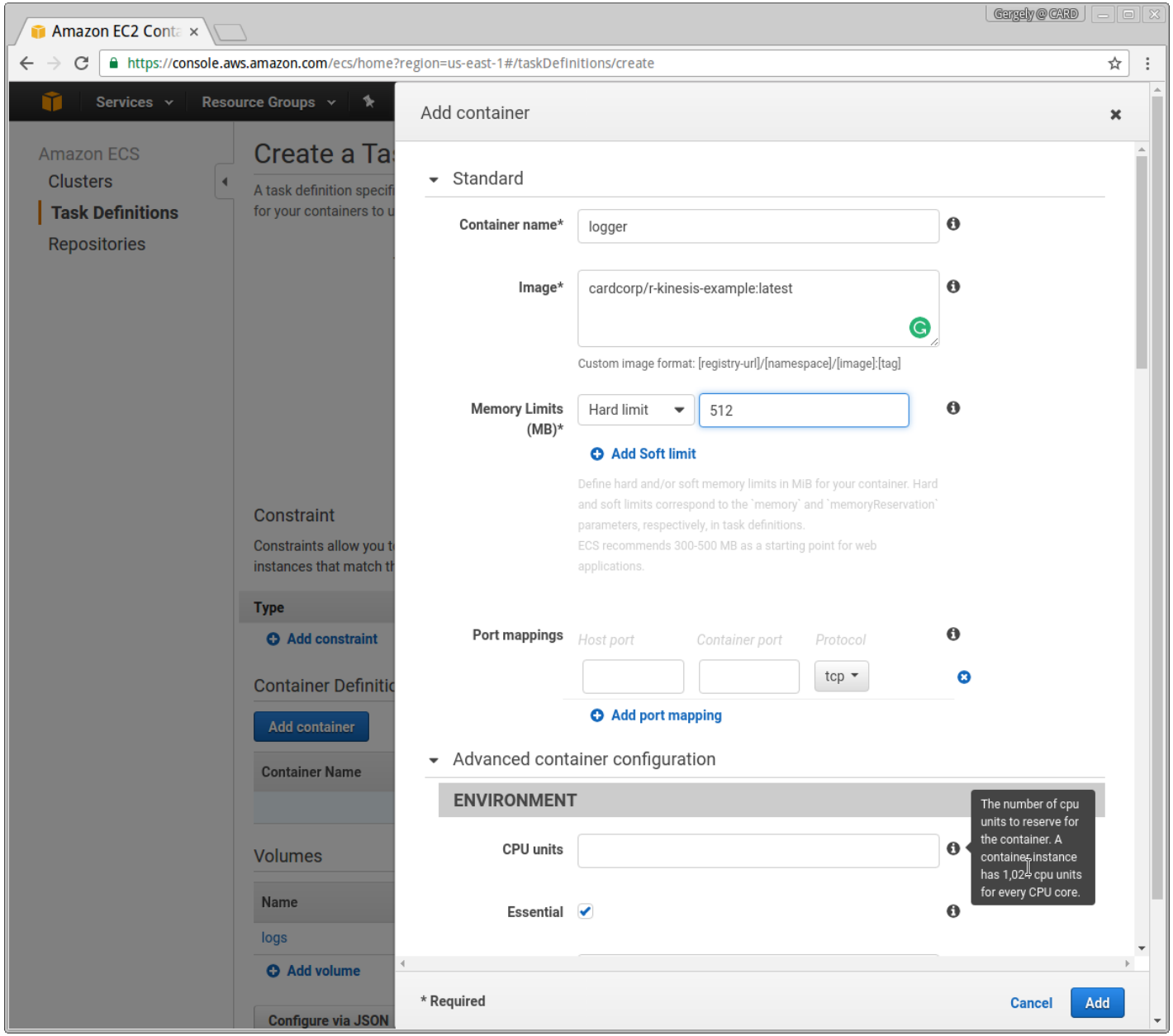
Create a Task definition



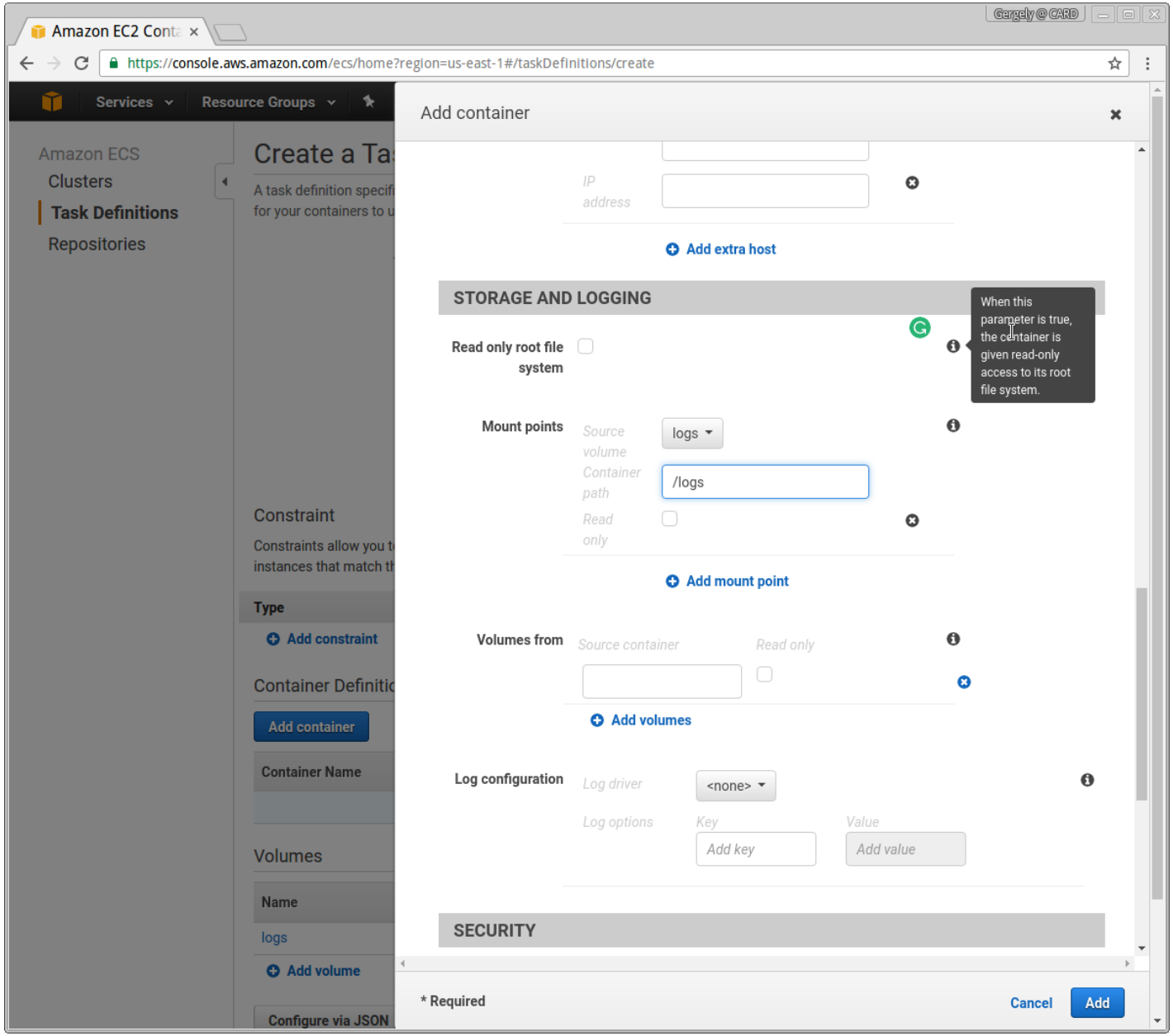
Create a Task definition



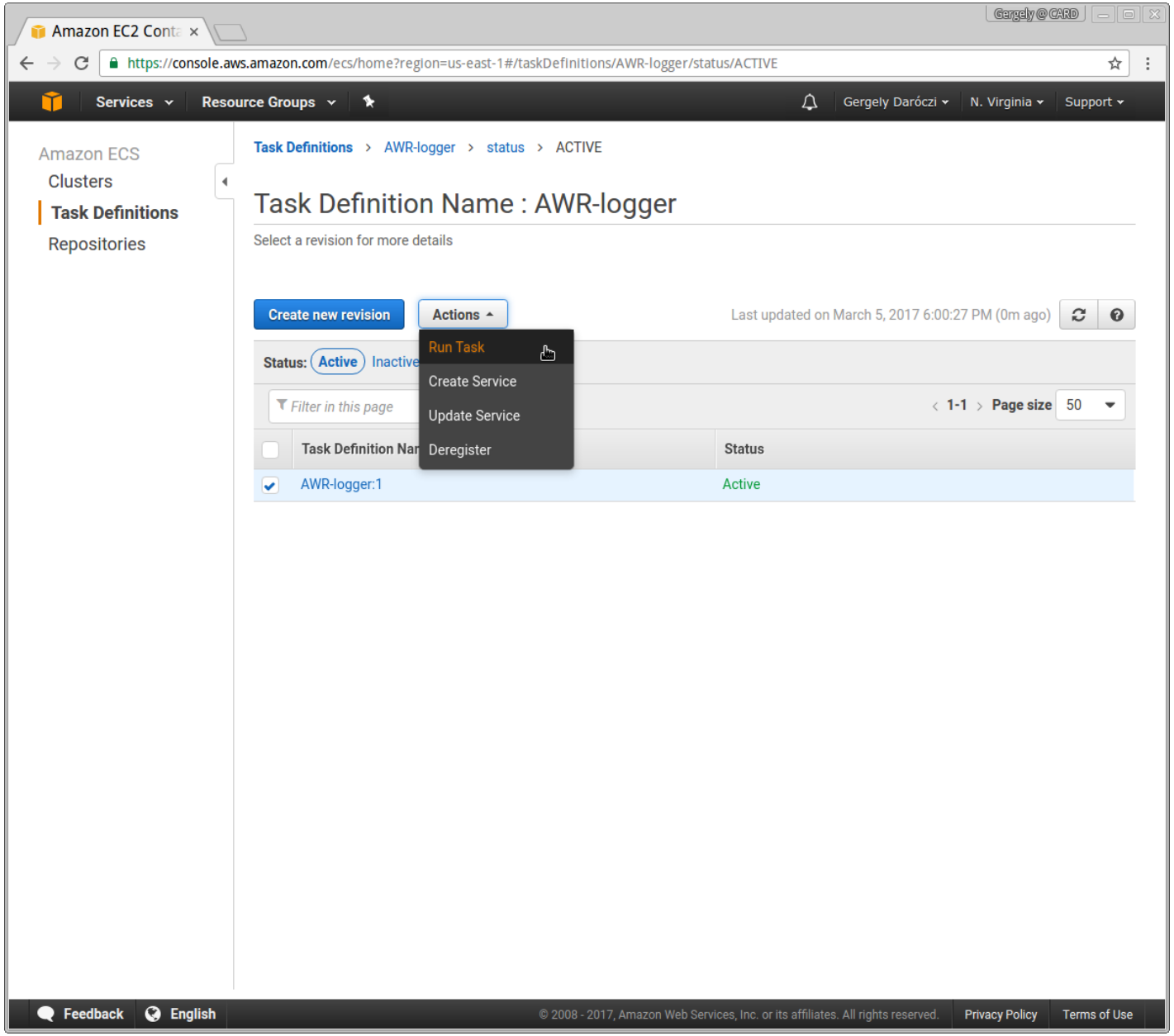
Create a Task definition



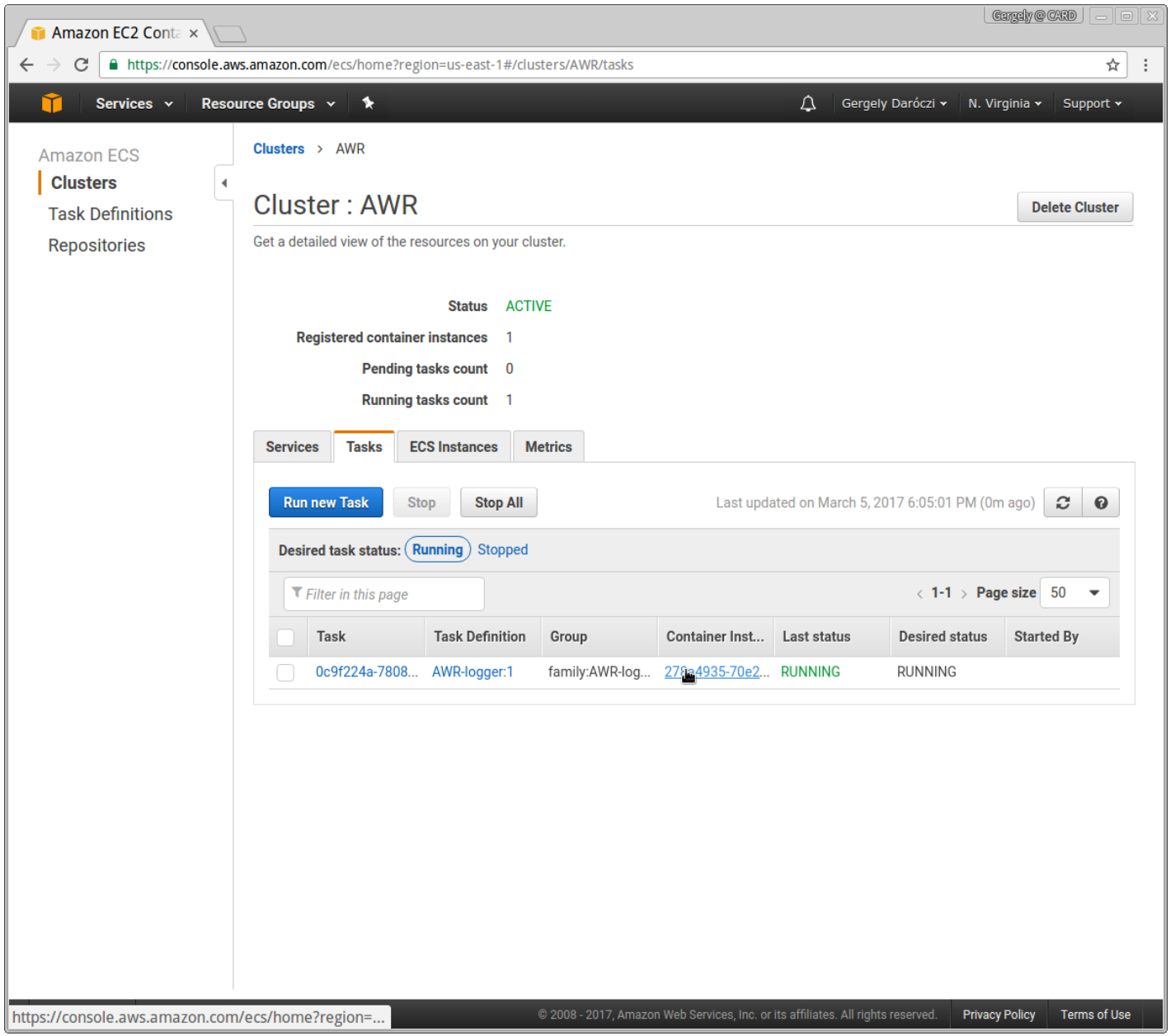
Create a Task definition



Run the ECS Task



Run the ECS Task



Run the ECS Task

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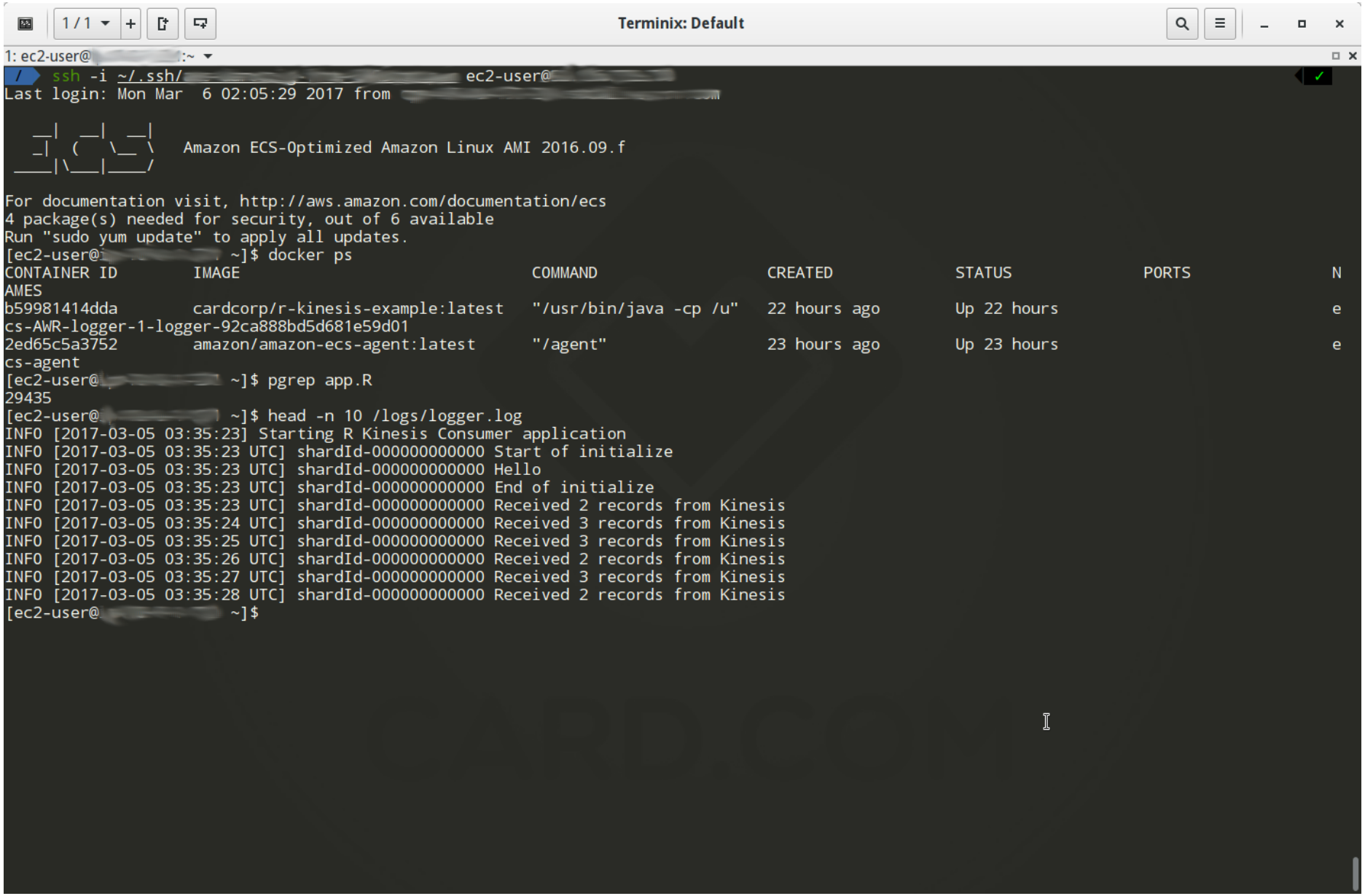

Scaling the Kinesis Consumer up

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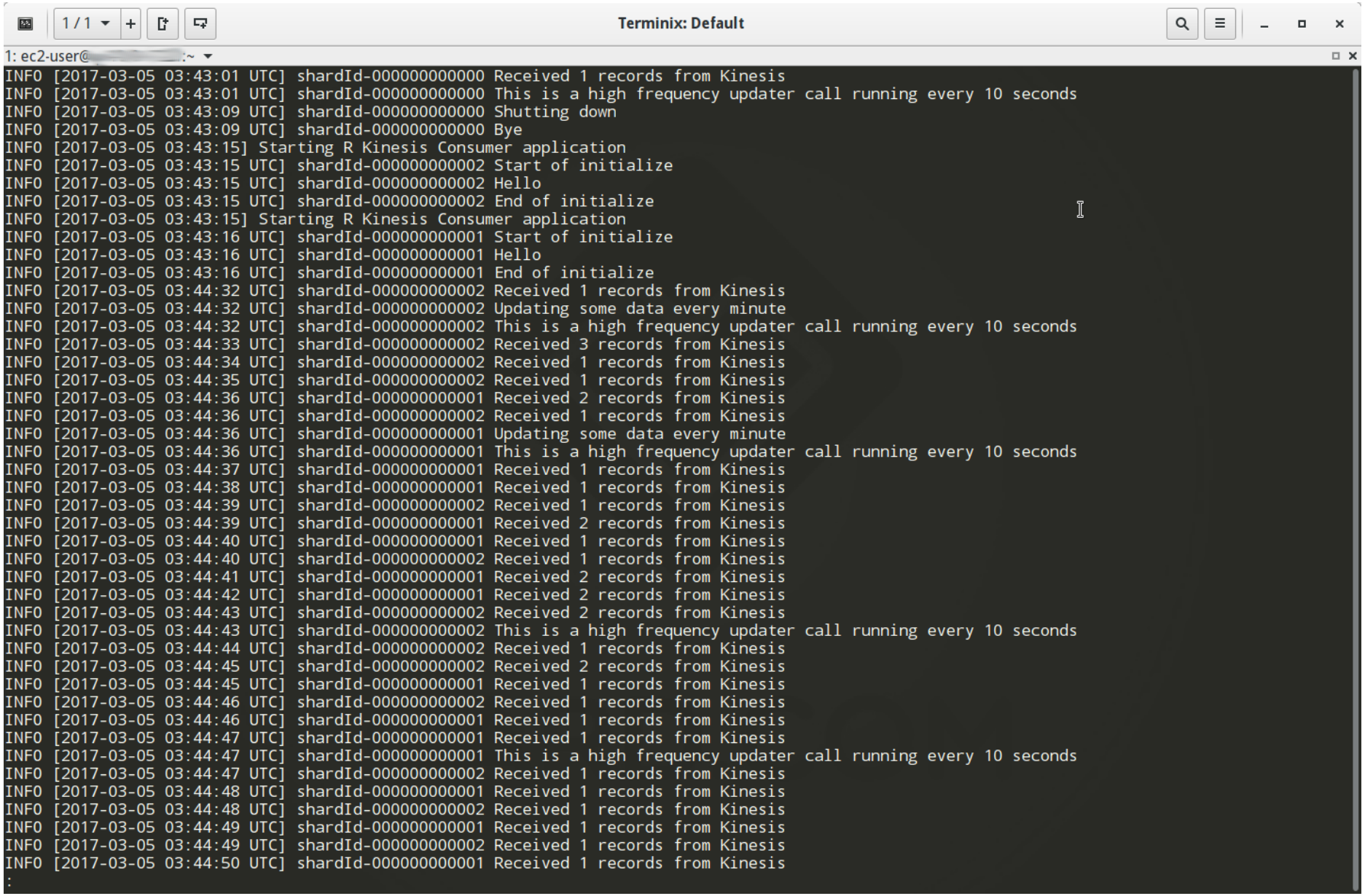


Kinesis Consumers in Production

Nice example project, but . . .

- I might want to avoid publishing my Consumer on Docker Hub
- I might want to avoid publishing my code on GitHub
- I might want to avoid commiting credentials etc to the repo

Problems:

- How to store credentials in the Docker images?
- Where to store the Docker images?

Kinesis Consumers in Production

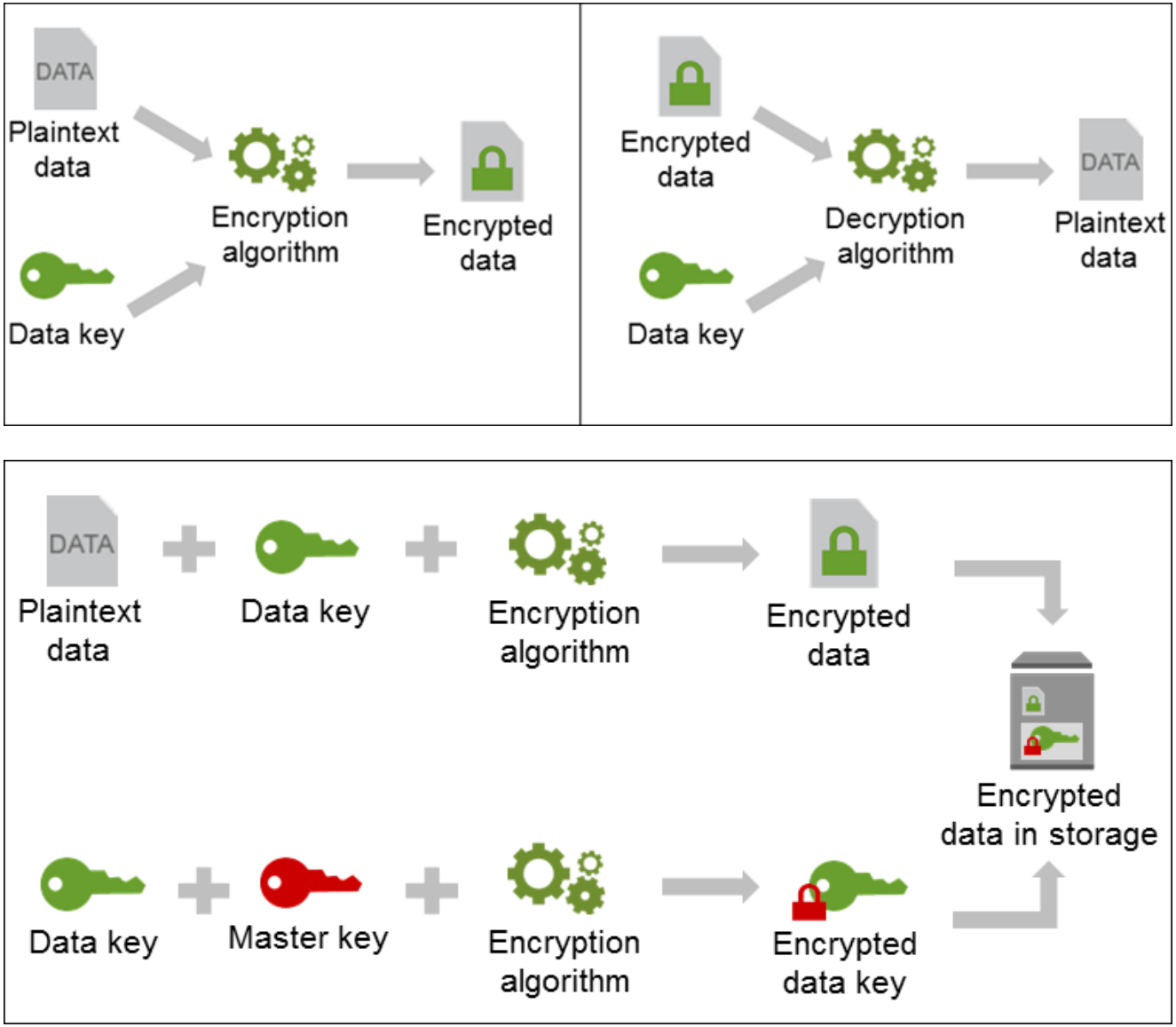
Nice example project, but . . .

- I might want to avoid publishing my Consumer on Docker Hub
- I might want to avoid publishing my code on GitHub
- I might want to avoid commiting credentials etc to the repo

Problems:

- How to store credentials in the Docker images? **KMS**
- Where to store the Docker images? **ECR**

KMS



Source: AWS Encryption SDK

Current AWR.KMS Features

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- encrypt up to 4 KB of arbitrary data:

```
> library(AWR.KMS)
> kms_encrypt('alias/mykey', 'foobar')
[1] "Base-64 encoded ciphertext"
```

- decrypt such Base-64 encoded ciphertext back to plaintext:

```
> kms_encrypt('Base-64 encoded ciphertext')
[1] "foobar"
```

- generate a data encryption key:

```
> kms_generate_data_key('alias/mykey')
$cipher
[1] "Base-64 encoded, encrypted data encryption key"
$key
[1] "alias/mykey"
$text
[1] 00 01 10 11 00 01 10 11 ...
```

Encrypting Data Larger Than 4 KB?

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```
## let's say we want to encrypt the mtcars dataset stored in JSON
library(jsonlite)
data <- toJSON(mtcars)

## generate a 256-bit data encryption key (that's supported by digest::AES)
library(AWR.KMS)
key <- kms_generate_data_key('alias/mykey', byte = 32L)

## convert the JSON to raw so that we can use that with digest::AES
raw <- charToRaw(data)
## the text length must be a multiple of 16 bytes
## https://github.com/sdoyen/r_password_crypt/blob/master/crypt.R
raw <- c(raw, as.raw(rep(0, 16 - length(raw) %% 16)))

## encrypt the raw object with the new key + digest::AES
## the resulting text and the encrypted key can be stored on disk
library(digest)
aes <- AES(key$text)
base64_enc(aes$encrypt(raw))

## decrypt the above returned ciphertext using the decrypted key
rawToChar(aes$decrypt(base64_dec(...), raw = TRUE))
```

Example "Production" Consumer App

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```
library(AWR.Kinesis); library(jsonlite); library(AWR.KMS); library(futile.logger); flog.threshold(DEBUG)

kinesis_consumer(
    initialize     = function() {
        flog.info('Decrypting Redis hostname via KMS')
        host <- kms_decrypt('AQECAHiiz4GEPFQLL9AAON5TY/lDR5euQQScpXQU9iYTn+u...')
        flog.info('Connecting to Redis')
        library(rredis); redisConnect(host = host)
        flog.info('Connected to Redis')
    },
    processRecords = function(records) {
        flog.info(paste('Received', nrow(records), 'records from Kinesis'))
        for (record in records$data) {
            flight <- fromJSON(record)$dest
            if (!is.null(flight)) {
                flog.debug(paste('Adding +1 to', flight))
                redisIncr(sprintf('flight:%s', flight))
            } else {
                flog.error('Flight destination not found')
            }
        }
    },
    updater = list(
        list(1/6, function() {
            flog.info('Checking overall counters')
            flights <- redisKeys('flight:*')
            for (flight in flights) {
                flog.debug(paste('Found', redisGet(flight), sub('^flight:', '', flight)))
            }
        })),
    logfile = '/logs/redis.log')
```

Private Docker Image

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Dockerfile:

```
FROM cardcorp/r-kinesis:latest
MAINTAINER Gergely Daroczi <gergely.daroczi@card.com>

## Install R package to interact with Redis
RUN install2.r --error rredis  && rm -rf /tmp/downloaded_packages/ /tmp/*.rds

## Add consumer
COPY files /app
```

Build and push to ECR:

```
docker build -t cardcorp/r-kinesis-secret .
`aws ecr get-login --region us-east-1`
docker tag -f cardcorp/r-kinesis-secret:latest \
            ***.dkr.ecr.us-east-1.amazonaws.com/cardcorp/r-kinesis-secret:latest
docker push ***.dkr.ecr.us-east-1.amazonaws.com/cardcorp/r-kinesis-secret:latest
```

Shiny Dashboard

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```
library(treemap);library(highcharter);library(nycflights13)
library(rredis);redisConnect(host = '***', port = '***')

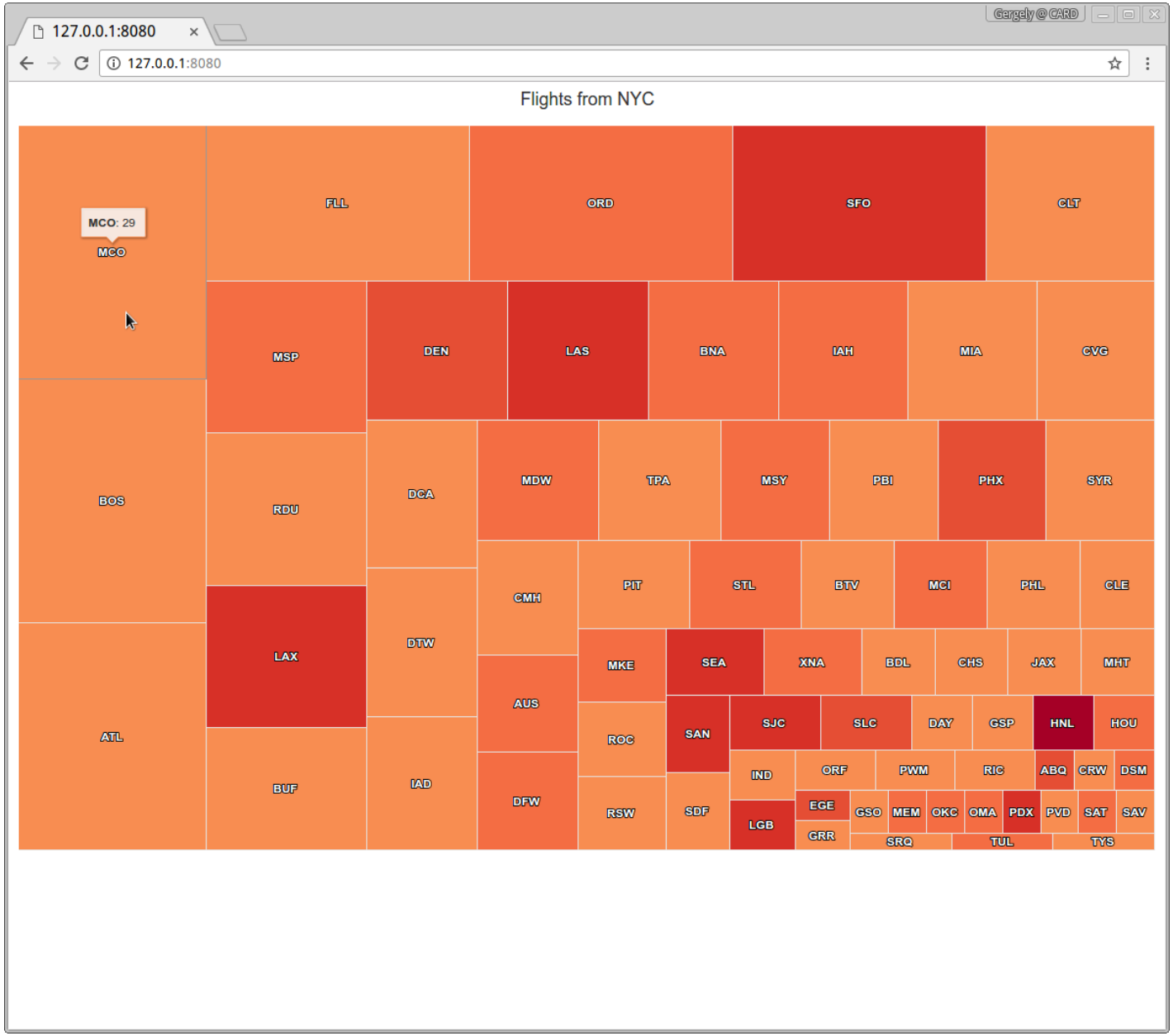
ui     <- shinyUI(highchartOutput('treemap', height = '800px'))
server <- shinyServer(function(input, output, session) {

    destinations <- reactive({
        reactiveTimer(2000)()
        flights <- redisMGet(redisKeys('flight:*'))
        flights <- data.frame(faa = sub('^flight:', '', names(flights)),
                              N   = as.numeric(flights))
        merge(flights, airports, by = 'faa')
    })

    output$treemap <- renderHighchart({
        tm <- treemap(destinations(), index = c('faa'),
                      vSize = 'N', vColor = 'tz',
                      type = 'value', draw = FALSE)
        hc_title(hctreemap(tm, animation = FALSE), text = 'Flights from NYC')
    })

})
shinyApp(ui = ui, server = server)
```

Shiny Dashboard



Technical Details

CEU CENTRAL EUROPEAN UNIVERSITY

- AWR repo:
  - 9.7 GB
  - 388 tags/versions
  - GitLab + CI + drat

```
install.packages('AWR', repos = 'https://cardcorp.gitlab.io/AWR')
```

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- Submitted to CRAN on
  - 2016-12-05

Technical Details

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```

- Submitted to CRAN on
  - 2016-12-05
  - 2017-01-09
  - 2017-01-10
  - 2017-01-11
  - 2017-01-11
  - 2017-01-13

Technical Details

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- Submitted to CRAN on
  - 2016-12-05
  - 2017-01-09
  - 2017-01-10
  - 2017-01-11
  - 2017-01-11
  - 2017-01-13
- Release cycle: 2 minor, ~125 patch versions in the past 12 months
- CI

What's Next?


```
> library(rJava)
> kc <- .jnew('com.amazonaws.services.s3.AmazonS3Client')
> kc$getS3AccountOwner()$getDisplayName()
[1] "foobar"
```


AWR
Because "S"
is so 1992.