Clojure & AWS Lambda: Serverless in the Realm of the Wild Paren

Who?

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iOS + Clojure + Creating an App Business

What?

This is a talk about AWS Lambda: Its business case and its technical use.

Lambda is a 64-bit Linux compute environment that runs JVM, Node or Python code.

Designed to be used as "functions"

— Which really are microservices*
— Especially on the JVM

Can run in 1-2ms increments and Amazon will bill you for nothing but those 1-2ms

Can be Called From:

IoT buttons, Amazon Echo, Web Requests, Things being added to various databases, notifications, queues filling up, the command line, code on client machines, other Lambda functions, etc

Why?

Your Pain Points:

- Slow code because you don't have enough computers to run it quickly
- Dying servers
- Capacity increasing is manual/hard/slow
- Code that costs thousands per month to "run", when mostly idle

More Pain Points:

- Sleep you don't get because you're on call if the servers go down
- Angry clients you lose because the servers went down
- Crunch time at work to rearchitect for scale

An End To These Pains?

Some of them

- Not enough computers: Solved
- Servers failing: Solved (kinda)
- Too Long to Add Capacity: Solvable
- Cheap to run per month: (kinda, but at what price)

Some of them

- Sleep due to pager duty, etc: Solved (mostly)
- Angry clients due to failing servers: Solved
- Crunch time at work due to rearchitecting: Solved

What about cost?

- $$$?
- Cold hard cash?

Kinda?

- You're building for scale from the get-go when you're choosing this different, constrained architecture.
- Slower work at first to save on scaling later.
- Possible loss for any organization continually staffed by software developers and system administrators (at first).

But in some cases...

- "Continually staffed" is the kicker though.
- Like many "autoscaling" PaaSs, it's a superior tool for companies without an immediate support structure.
- Mobile gets fewer "second chances" when it fails to scale.

Alternatives that also solve some of these pains

- Older PaaS (there are tons, but Google App Engine and Heroku are two examples)
- Scaling Clouds (even AWS products like ElasticBeanStalk)
- Backend as a Service (Cloudkit, Firebase, Parse)

Advantages over those:

- Less ability to fail in a way that looks bad.
- Dedicated to autoscaling architecture.
- Less vulnerable to a BaaS going out of business (Parse).
- Simpler client software when logic in the cloud (compared to Baas).
- Designed for connection to everything without coding it yourself.

How?

Some Architectures

(user) <-> (software client) <-> (lambda) <-> (dynamodb)

(user) <-> (software client) <-> (api gateway) <-> (lambda) <-> (dynamodb)

Some More Architectures

(user) <-> (IoT Button) --> (simple queue service) <-> (lambda) <-> (dynamodb) <-> (analytics user)

(user) <-> (software client) <-> (api gateway) <-> (lambda) <-> (relational database)

Still More Architectures

(user) <-> (software client) --> (s3 bucket) --> (lambda) --> (another s3 bucket)

(user) --> (software client) --> (simple queue service) --> (lambda) --> (simple notification service) --> (software client) --> (another person)

The One We're Doing Tonight

(user) --- (software client) --- (api gateway) --- (lambda) --- (dynamodb)

So let's write a system using this architecture

Melvin: signs up for an event

Sees himself and others that have signed up for the event

Meets people at the event, doing the activity

Skipping IAM setup

- Identity Access Management
- Running the commands in this presentation will require a overprivledged user
- Delegate most of these privledges to your CI tool and constrain the dev roles
- http://docs.aws.amazon.com/lambda/latest/dg/intro-permission-model.html

Our story so far

(person:Melvin) --- (software client) --- (api gateway) --- (lambda) --- (dynamodb)

Software Client

Let's do a simple JSON API with curl

(user:Melvin) --- (software client:command line client script) --- (api gateway) --- (lambda) --- (dynamodb)

Let's talk about the pain points now.

Wow, Amazon API Gateway hurts. It's hard to configure sensibly, doesn't propogate HTTP errors well, and is just super raw in many places.

What is it in theory?

- You use a web GUI or swagger specification file to specify a bunch of endpoints, including what http methods work on it
- You deploy it
- You assign other AWS services to handle the requests coming in, and return appropriate status codes

What is it in practice?

- You use a very hard to use, somewhat mis-documented GUI that is light on examples.
- Oriented towards JSON-style APIs, not HTTP param-type APIs.
- Opaque when it fails.
- The ring adapter requires a wierd pile of JS to paste in there.

What are the good parts?

- HTTPS by default.
- Able to use custom authorizers or Cognito (Amazon's user authentication system).
- Reasonable to tie into CloudFront.
- Can dispatch to EC2 servers, Lambda, or a mix.
- Generates "okay" iOS/Android/JS API.

Tricks:

- Configure them in the order specified in jpb/ring-aws-lambda-adapter's readme
- Look at the names in the upper right while selecting a method on a resource
- Copy that large block of JS, because they say to.
- You can't export YAML until you deploy, chose YAML for swagger + api
- Edit the YAML and use lein aws-api-gateway update

The Story So Far

(user:Melvin) --- (software client:Cljs client project) --- (api gateway:arctic-fun-times-api) --- (lambda) --- (dynamodb)

Lambda

LAMBDA (finally)

Can be a JVM, Node or Python (2.7) "function"

Think of the "function" as the entry point into a microservice...I'll get back to why it's not a function.

Do not use:

gen-class example from amazon/pojo example

Probably do not use:

Lambada (the extra 'a' is not a typo)

Instead: ring adapter lambda (less hard way)

https://github.com/jpb/ring-aws-lambda-adapter

Why Ring Adapter Lambda:

- You can write what works locally as a web app…and on AWS as a Lambda function.
- Main is entirely for running locally.
- In theory, I guess you could deploy the app to EC2/ EBS if you want…or Lambda.

Amazon puts your code on ice and shuts down the handlers if it ever isn't called enough

Which isn't a huge problem for node or python...but for JVM langs this is death.

Not just slow?

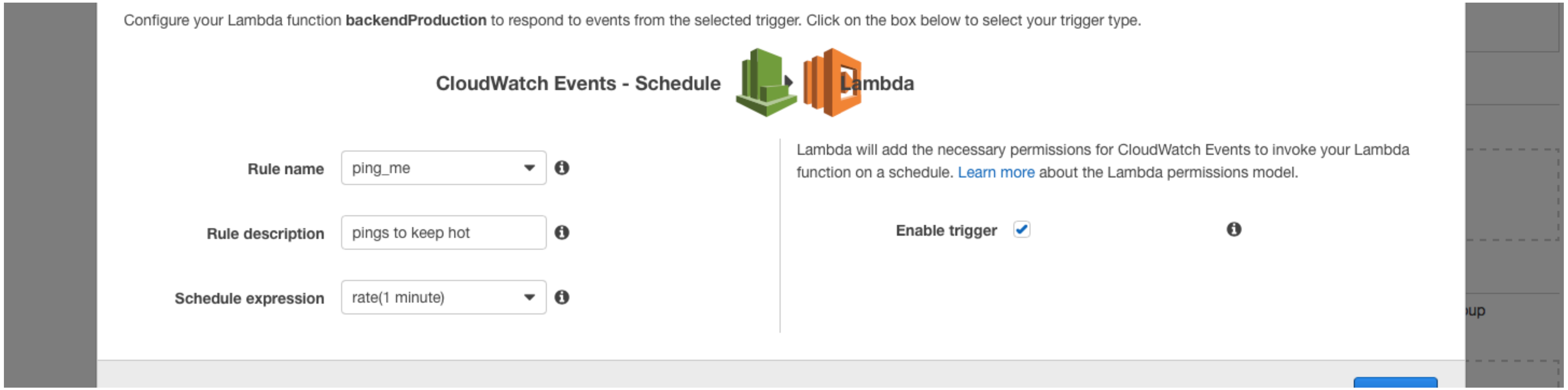
No, death. The API Gateway has a hard timeout of 10 seconds. If you don't return in 10 seconds, it errors out.

That's actually too slow to start up some Clojure servers on Lambda

Oi. So what's the remedy?

The Fix:

- After deploy, invoke the function once
- Have your "function" called once a minute (eats 1/3 of your "free" calls)



Configure your Lambda function **backendProduction** to respond to events from the selected trigger. Click on the box below to select your trigger type.

Rule name	ping_me
Rule description	pings to keep hot
Schedule expression	rate(1 minute)

Lambda will add the necessary permissions for CloudWatch Events to invoke your Lambda function on a schedule. Learn more about the Lambda permissions model.

Enable trigger ✓

The Story So Far

(user:Melvin) --- (software client:command line client script) --- (api gateway:arctic-fun-times-api) --- (lambda:backendProduction) --- (dynamodb)

DynamoDB

DynamoDB

— Lambda sometimes drowns traditional relational DBs with connection attempts.

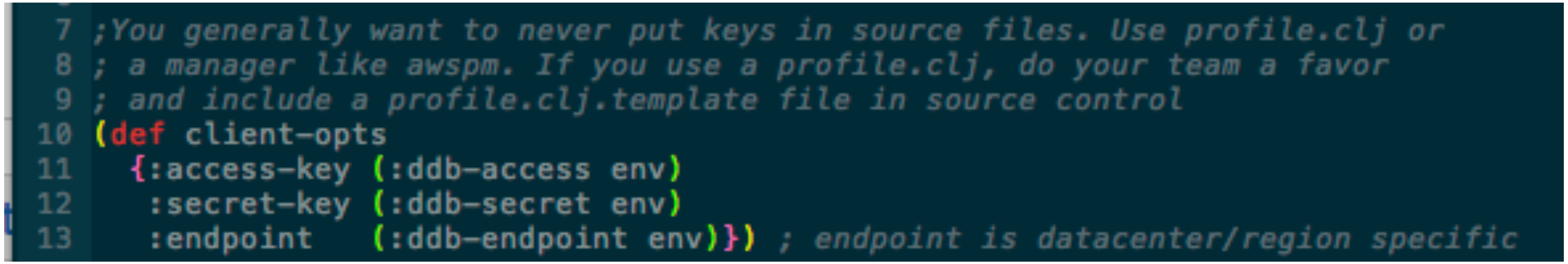
— DynamoDB is not necessary, nor always desired, but it works for many projects.

— Limited cross table queries, weird primary keys, among other oddities.

The Process:x

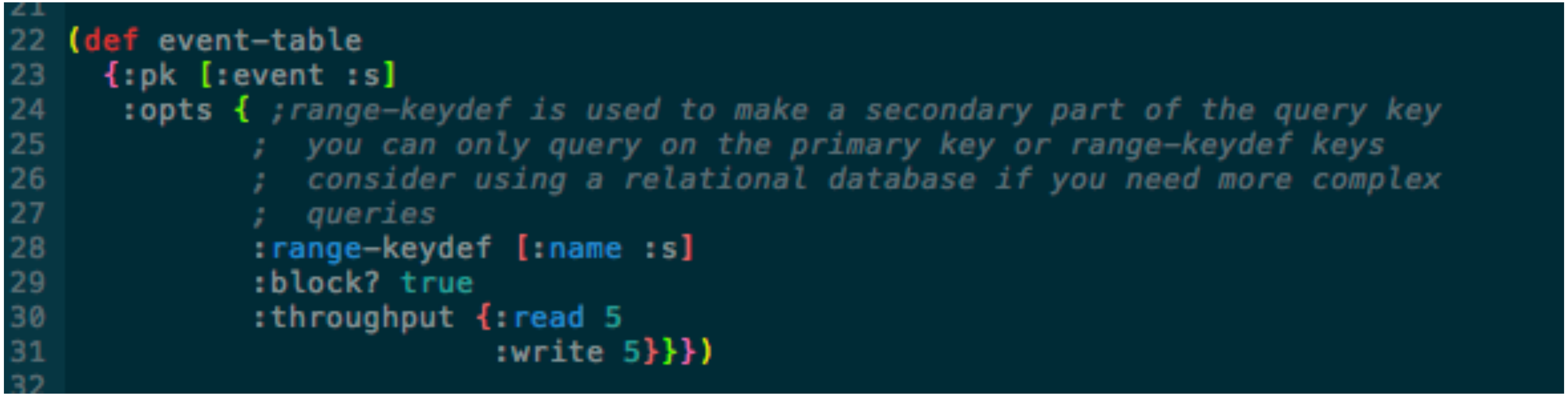
Create a table, specifying how many concurrent readers and writers we want (to pay for), as well as the weird primary key (plus any secondary "keys" we need to query on).

Client Opts: Where the DB is + login keys



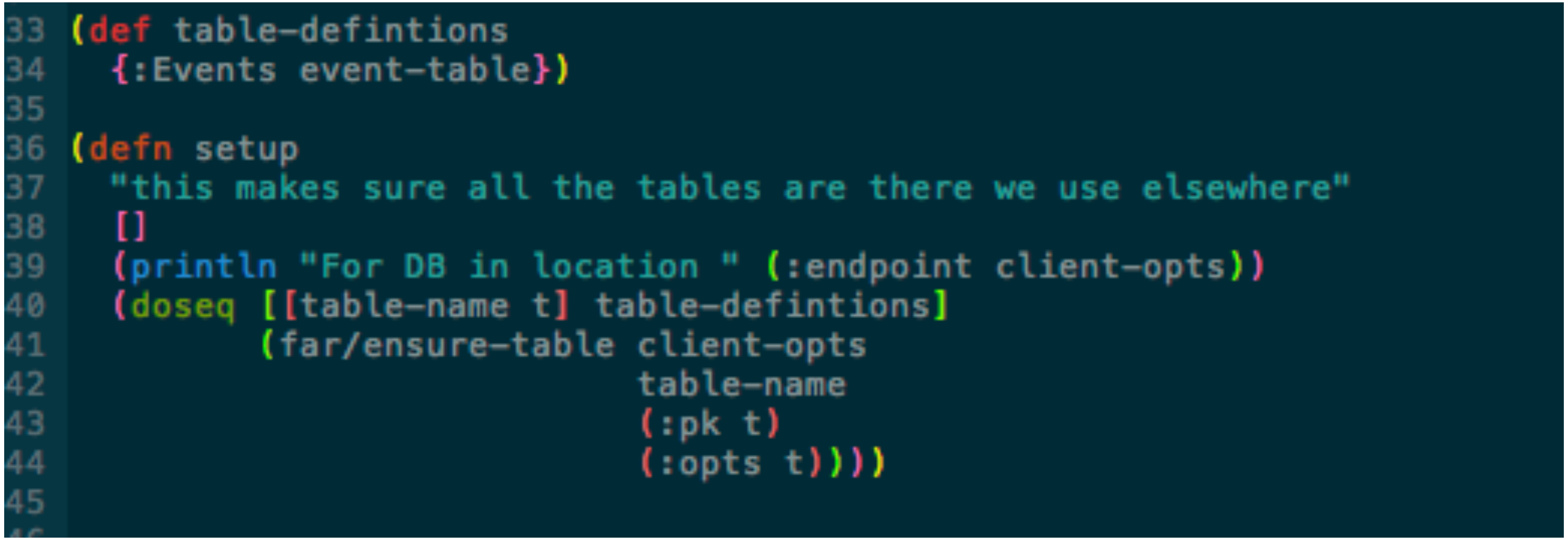
```clojure
;You generally want to never put keys in source files. Use profile.clj or
; a manager like awspm. If you use a profile.clj, do your team a favor
; and include a profile.clj.template file in source control
(def client-opts
  {:access-key (:ddb-access env)
   :secret-key (:ddb-secret env)
   :endpoint   (:ddb-endpoint env)}) ; endpoint is datacenter/region specific
```

DynamoDB Table Creation Minutia



```
(def event-table
  {:pk [:event :s]
   :opts { ;range-keydef is used to make a secondary part of the query key
          ;  you can only query on the primary key or range-keydef keys
          ;  consider using a relational database if you need more complex
          ;  queries
          :range-keydef [:name :s]
          :block? true
          :throughput {:read 5
                       :write 5}}})
```

Ensure the table is there on every execution to pick up changes



```
(def table-defintions
  {:Events event-table})

(defn setup
  "this makes sure all the tables are there we use elsewhere"
  []
  (println "For DB in location " (:endpoint client-opts))
  (doseq [[table-name t] table-defintions]
        (far/ensure-table client-opts
                          table-name
                          (:pk t)
                          (:opts t))))
```

The Story: Fin

(user:Melvin) --- (software client:command line client script) --- (api gateway:arctic-fun-times-api) --- (lambda:backendProduction) --- (dynamodb:Events)

Neglected Topics

- IAM
- Testing
- Production/Staging Separation
- Local DynamoDB
- CloudWatch
- User Management
- JSON Client App

Demo

Code: https://github.com/langford/clj-aws-lambda-example

Thanks!

References: See the code for all the libraries, clojars/ github for lambada

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