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Naturally, getting productive

—

my journey with Grakn and Graql

#graknCOSMOS

6th Feb 2020

GRAKN COSMOS

About me

Mani Sarkar

Freelance Software, Data, ML Engineer

Java / JVM

Cloud / Infra / DevOps

Polyglot developer

AI / ML / DL / DS / NLP

LJC, Devoxx, developer communities

JCP member, F/OSS projects: @adoptopenjdk @graalvm @truffleruby

More about me

Java Champion, Oracle Groundbreaker Ambassador, Software Crafter, Blogger, Speaker

@theNeomatrix369

Introduction

About the talk

- **Productivity with Grakn:** Journey with Al, Developer turned DevOps Engineer
  - Quick introduction to GraalVM and other JVMs
  - Compare measurements from Performance perspective
  - Benefits
  - Resources on how to apply the above

GRAKN.AI

About the talk

- **Speaking Graql:** journey with Jas, a Data Scientist, NLP expert
  - **Experimental:** Translate from **English** to **Graql**
  - **Experimental:** Translate from **Graql** to **English**
- **Closing:** Summary, Lots of Resources and Q&A

GRAKN.AI

Presentation slides: live

https://bit.ly/grakn-graql-graalvm

look for the folder called presentations

https://github.com/neomatrix369/awesome-ai-ml-dl/tree/master/presentations/data/databases/graph/grakn/presentations

Thank You!

- **Grakn Cosmos 2020**, it's organisers (**Daniel Crowe**)
- Good folks at **GraknLabs** (**Haikal, Tomas, Joshua,..**)

GRAKN COSMOS

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GRAKN.AI

A Well Deserved Applause To GraknLabs

Thank You!

- Developers from the various developer communities I have been at over the years
- You for being here, sparing your time, and entrusting it with me for this session

Disclaimer

- ***YMMV***
- My **first** **GraknLabs** talk at a conference
- Might have rough edges and **inaccuracies**
- Sharing our **learnings** over the past year
- Gathered ideas from **different sources**
- **Sharing ideas and guidelines**, not a silver-bullet
- If it's not clear, **tell me**!
- I'm just a community member, no-strings-attached

Citation

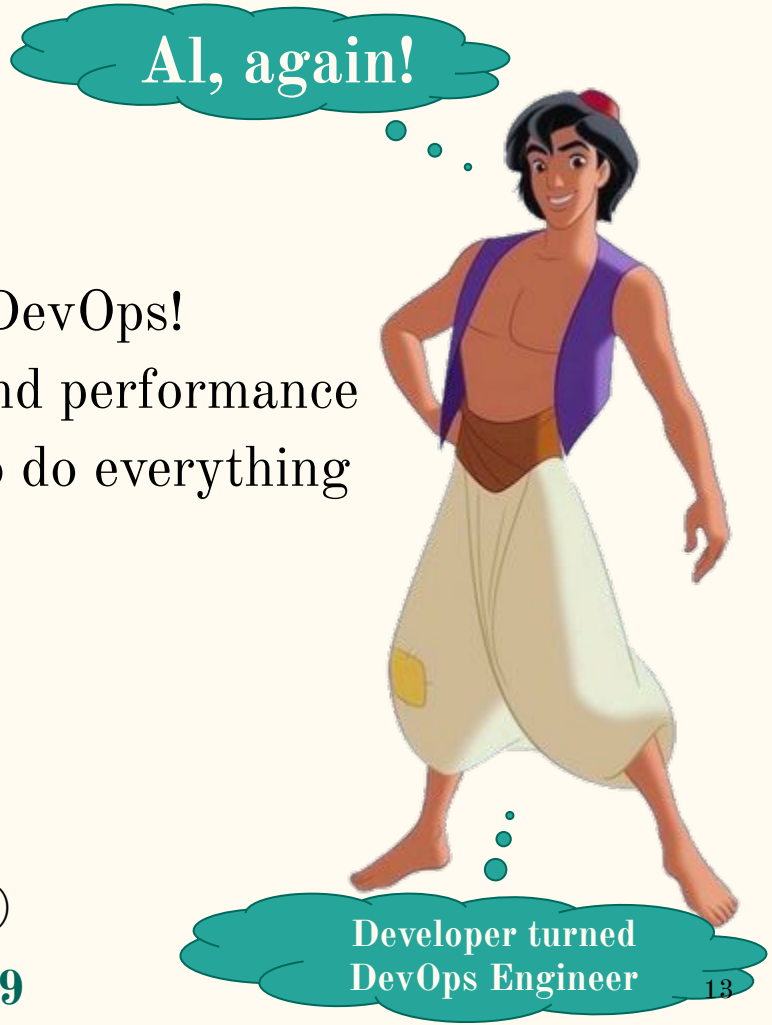
The respective authors and creators are, and remain the true owners of the images and other artifacts used in this presentation.

Thank you for your creations!

Conversation with AI

Productivity: Grakn (with AI)

- AI is setting up all things Cloud, infra, DevOps!
- He is keen on productivity, efficiency, and performance
- Also learning pragmatism over trying to do everything
- His high-level goals with Grakn are
  - Quick startup
  - High throughput
  - Low latency
  - High availability
  - Low maintenance
  - Easy knowledge transfer (to learn and to share)



Running Grakn on any JVM

JVM / JDK 101

Java 8

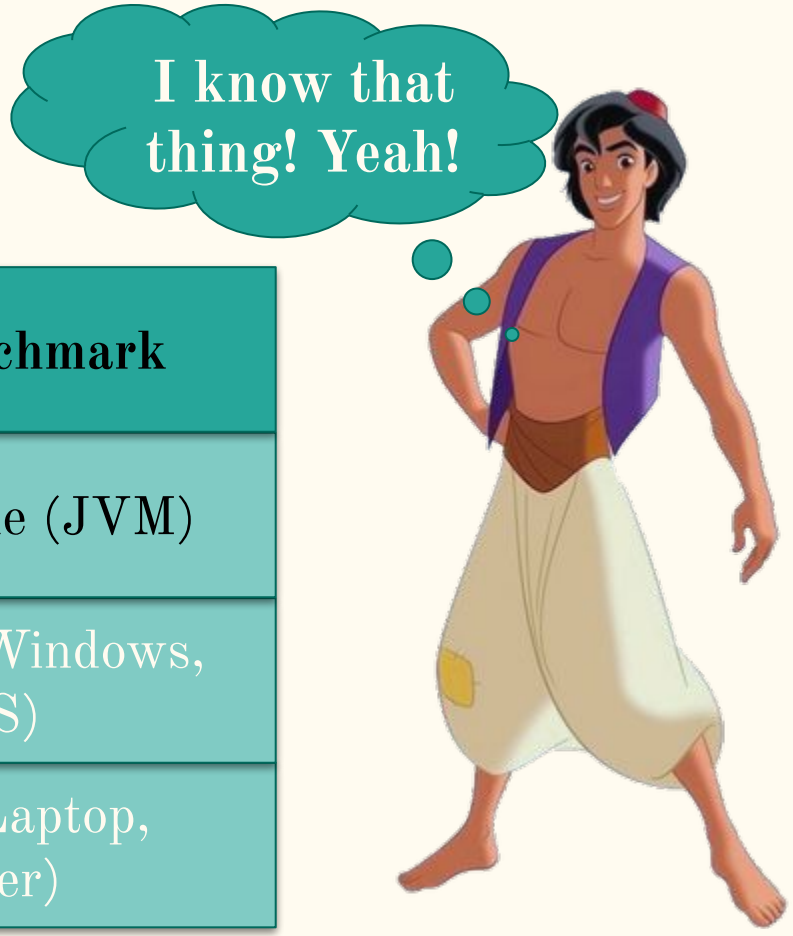
JDK from any Java vendor

Grakn, Graql, benchmark

Java Virtual Machine (JVM)

Operating System (Windows, Linux, MacOS)

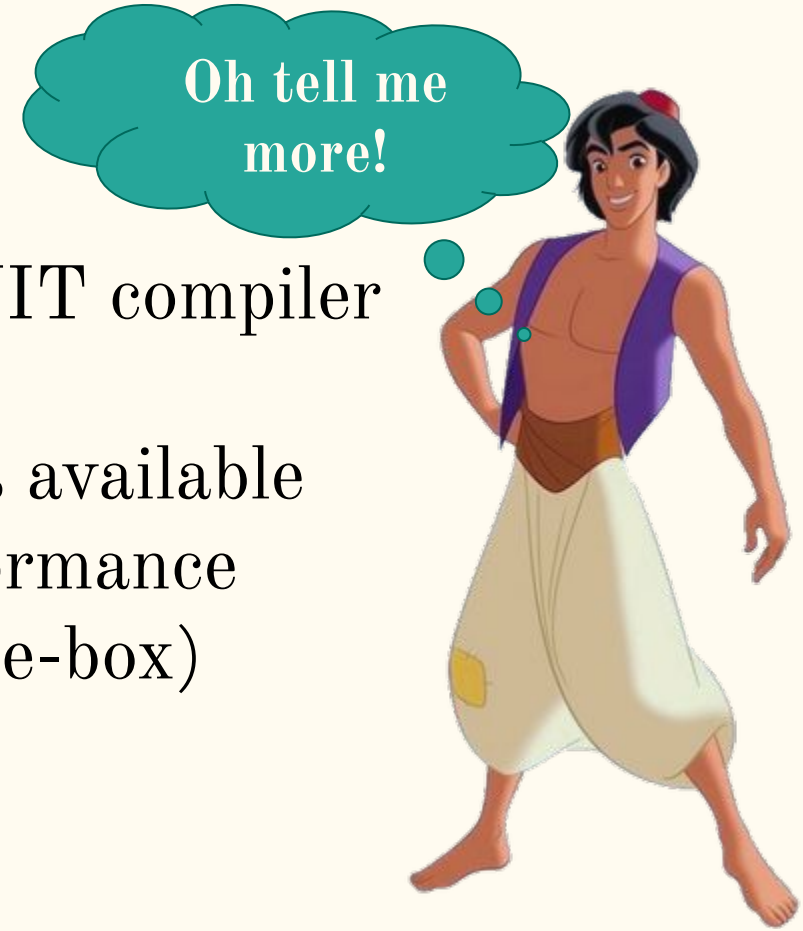
Hardware (Your Laptop, Desktop, Server)



Running Grakn

GraalVM

GraalVM 101



- Fork of a JVM with a new JIT compiler
- Built on top of **OpenJDK**
- Java 8 and Java 11 versions available
- Primary purpose: high performance
- JVM mode (works-out-of-the-box)
- native-image mode
- Polyglot VM mode

GraalVM 101

Fork of JVM with a new JIT compiler

Grakn, Graql, benchmark

GraalVM JVM

Operating System (Windows, Linux, MacOS)

Hardware (Your Laptop, Desktop, Server)

JVM mode

Grakn, Graql, benchmark (native-image)

Operating System (Windows, Linux, MacOS)

Hardware (Your Laptop, Desktop, Server)

native-image mode

Using GraalVM's native-image builder *OS-specific binaries*

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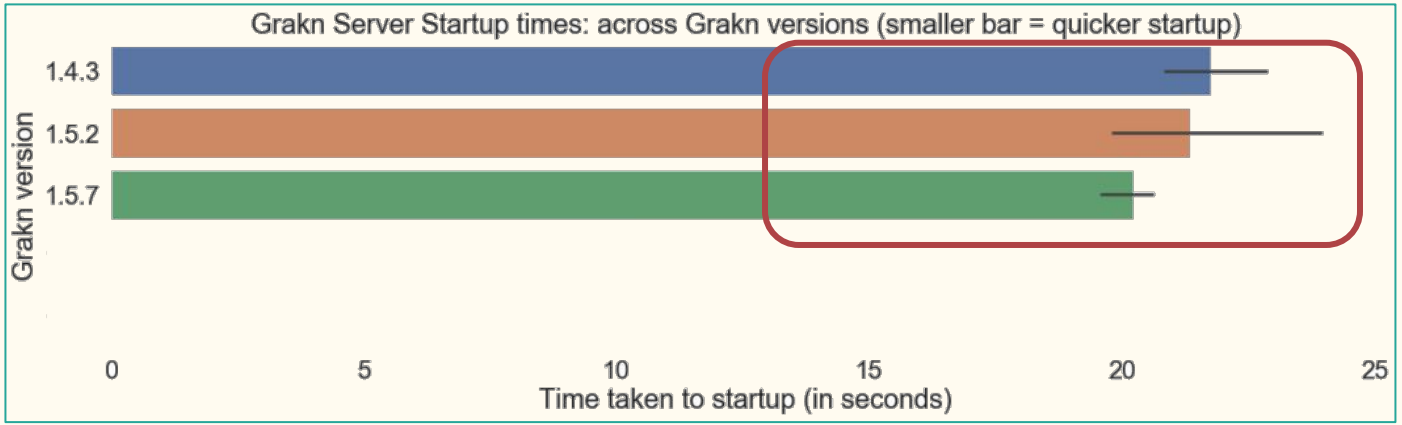
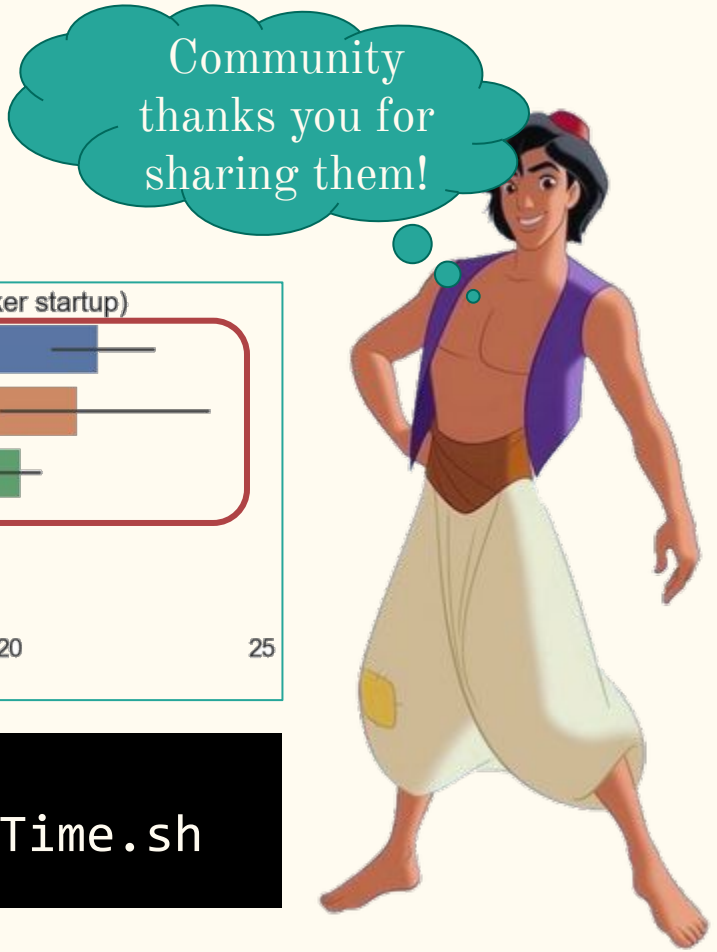
Measuring Grakn startup times

~ early to mid-2019

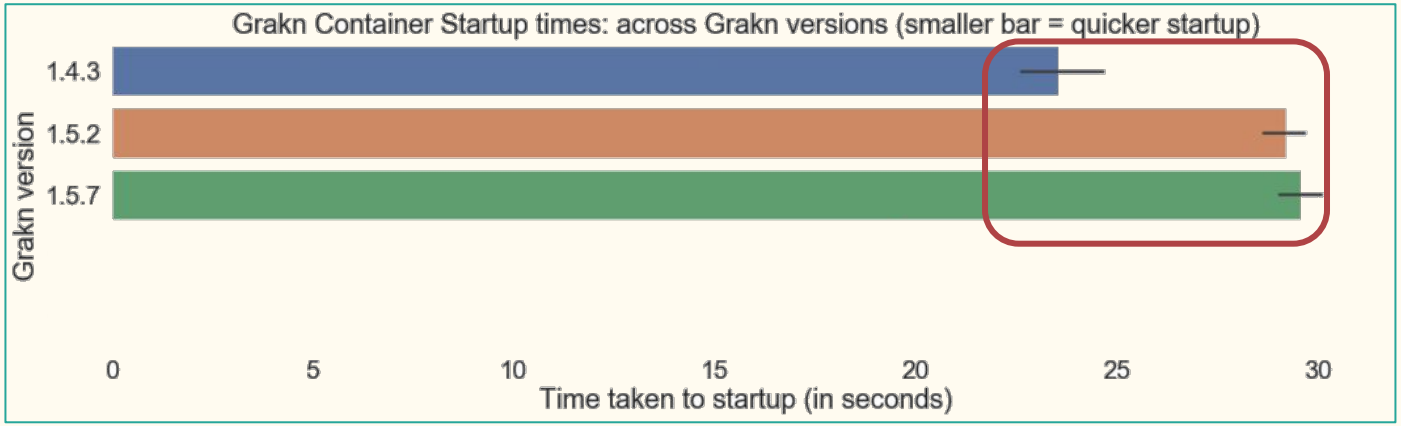
Grakn: Server startup times



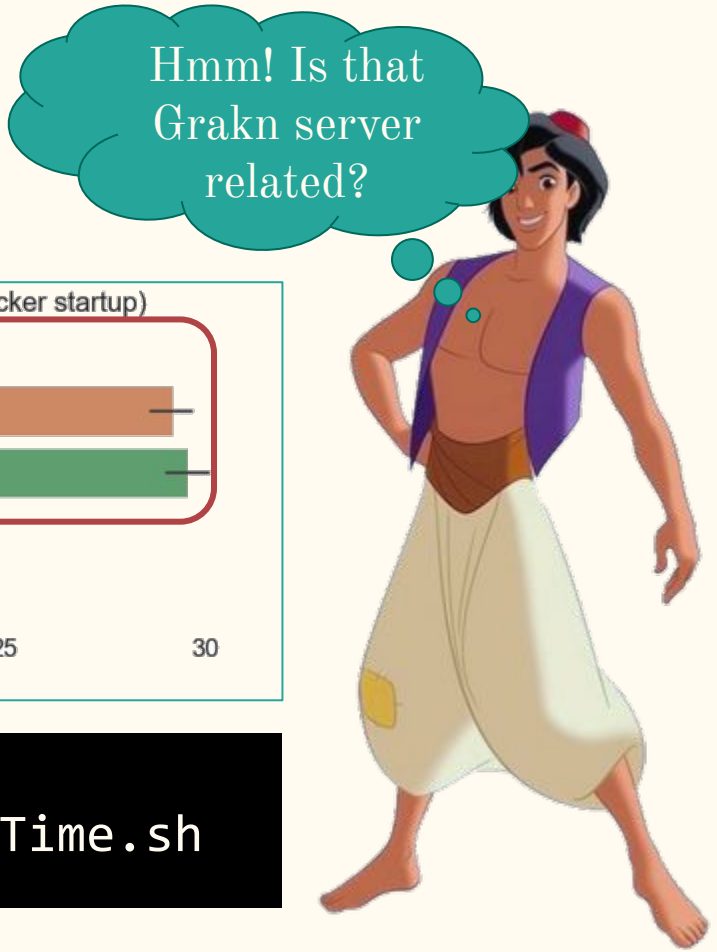

```
$ ./measureTradVersusGraalVMStartupTime.sh
```



Grakn: Container startup times

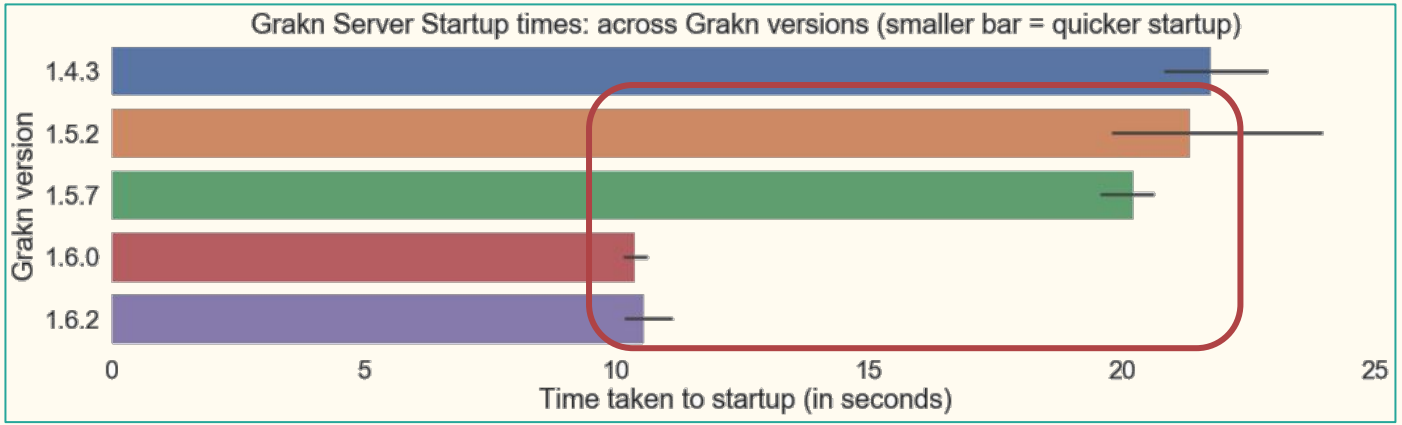



```
$ ./measureTradVersusGraalVMStartupTime.sh
```

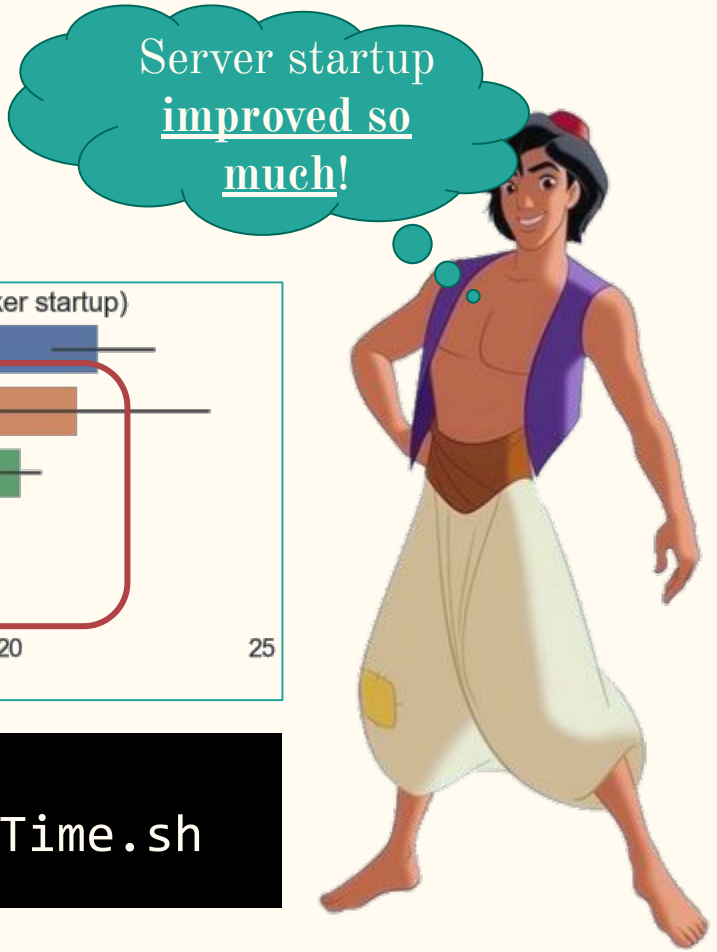


Revisited in Feb 2020

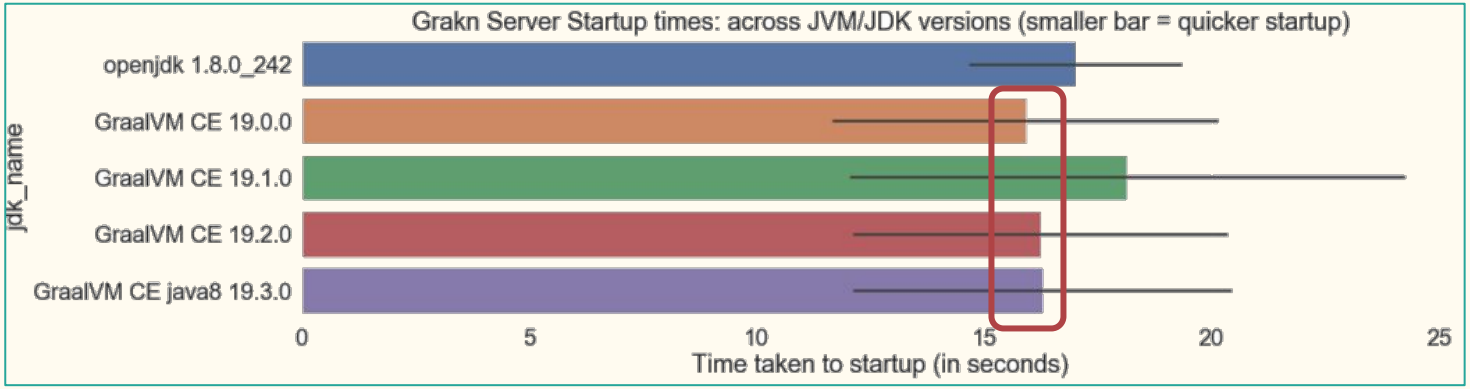
Grakn: Server startup times




```
$ ./measureTradVersusGraalVMStartupTime.sh
```

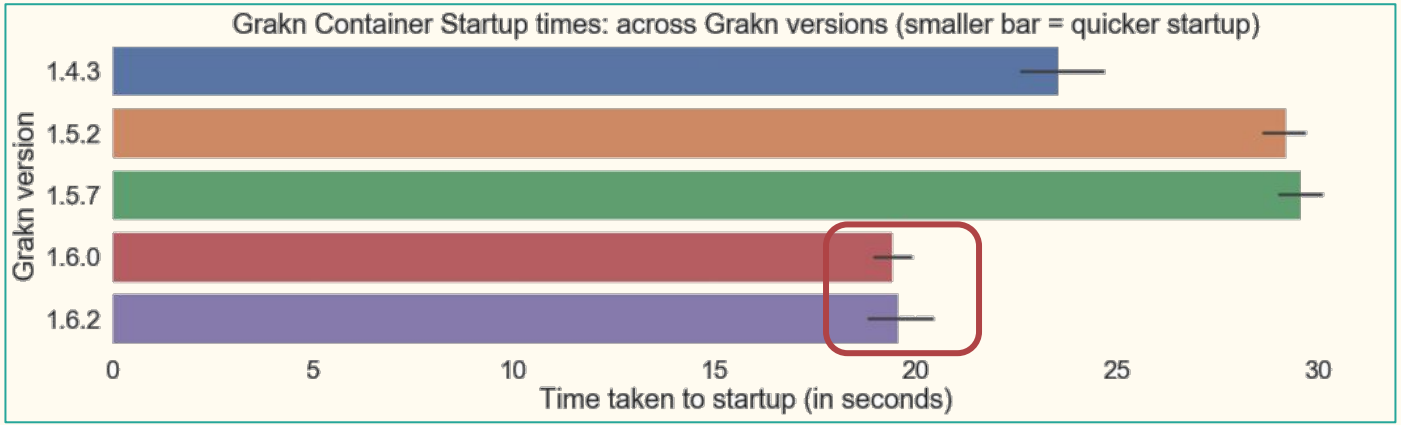


Grakn: Server startup times

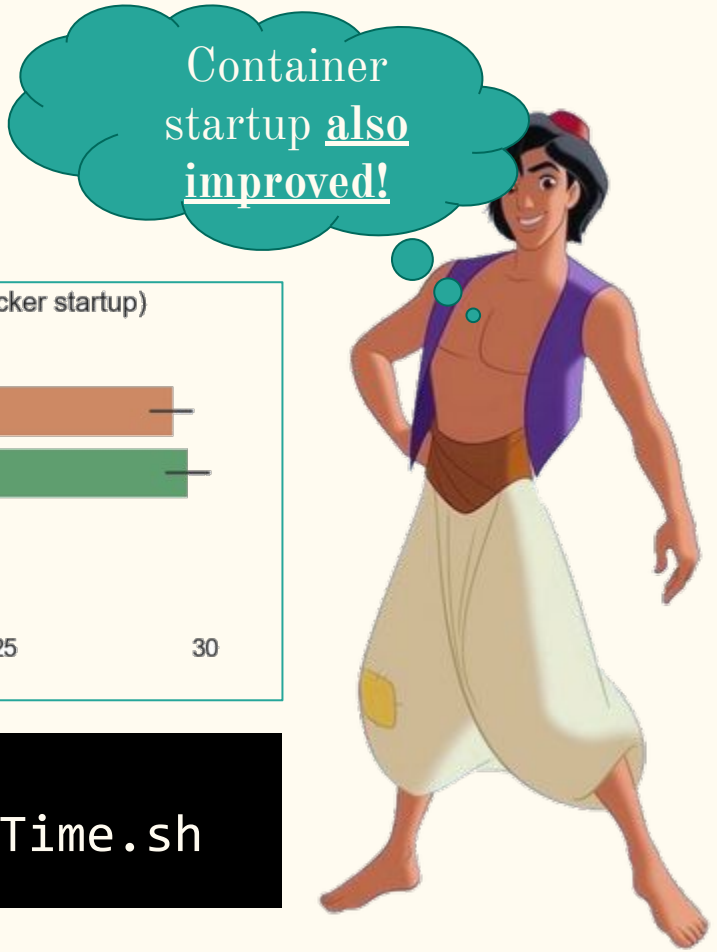



```
$ ./measureTradVersusGraalVMStartupTime.sh
```

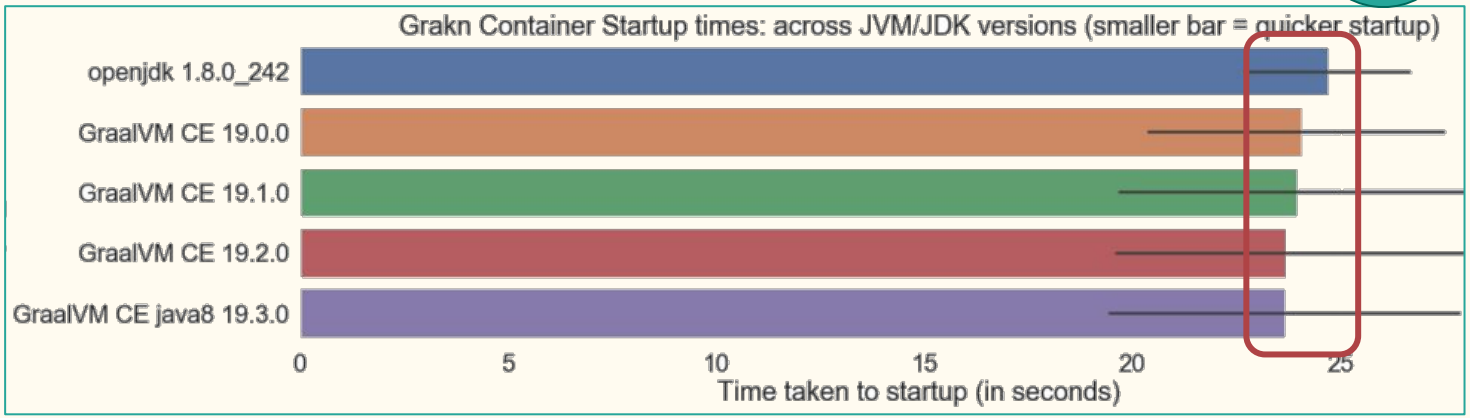
Grakn: Container startup times

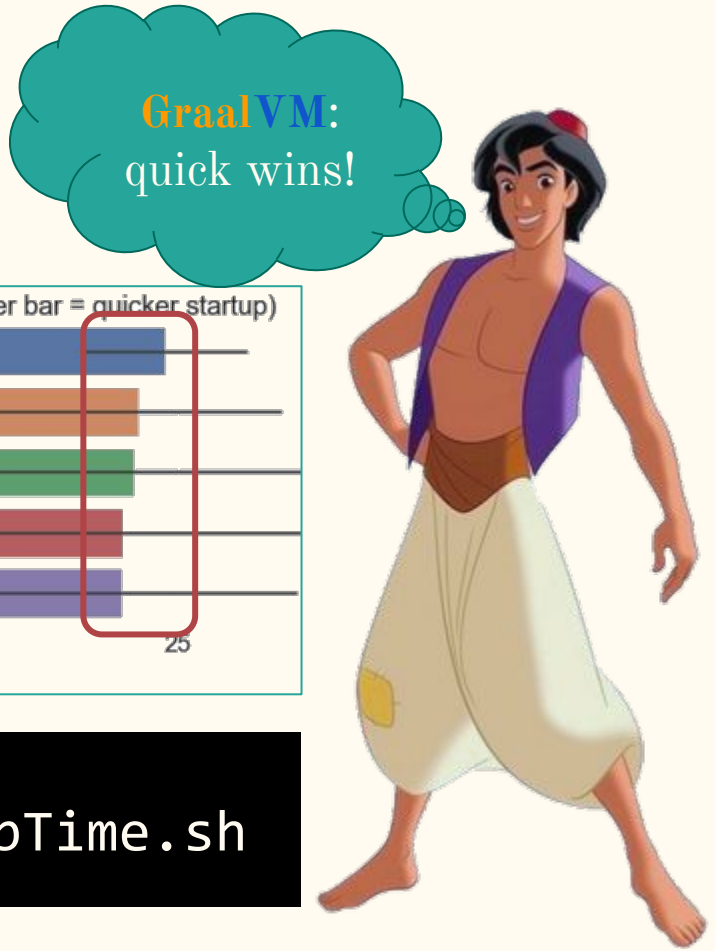



```
$ ./measureTradVersusGraalVMStartupTime.sh
```



Grakn: Container startup times

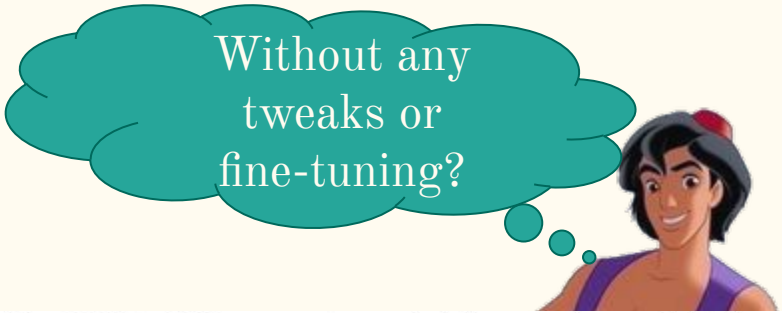


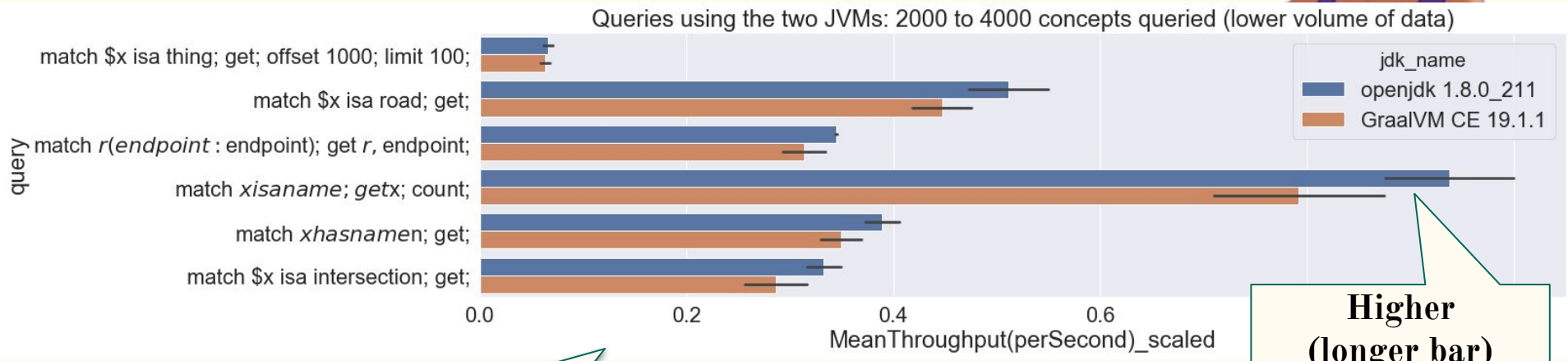



```
$ ./measureTradVersusGraalVMStartupTime.sh
```

Running benchmark on Grakn server

Benchmark results (lower volume)





Higher (longer bar) means better

OpenJDK does *better* than **GraalVM** on these queries on lower volumes of data

Grakn 1.5.7
GraalVM CE 19.1.1

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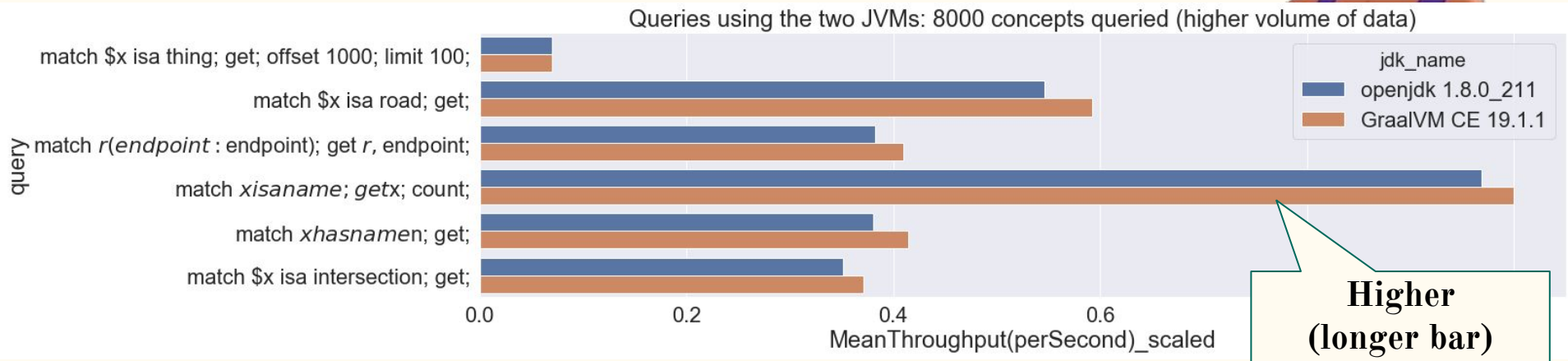
Benchmark results (higher volume)



Higher (longer bar) means better

GraalVM does *better* on these queries with higher volumes of data

Grakn 1.5.7
GraalVM CE 19.1.1

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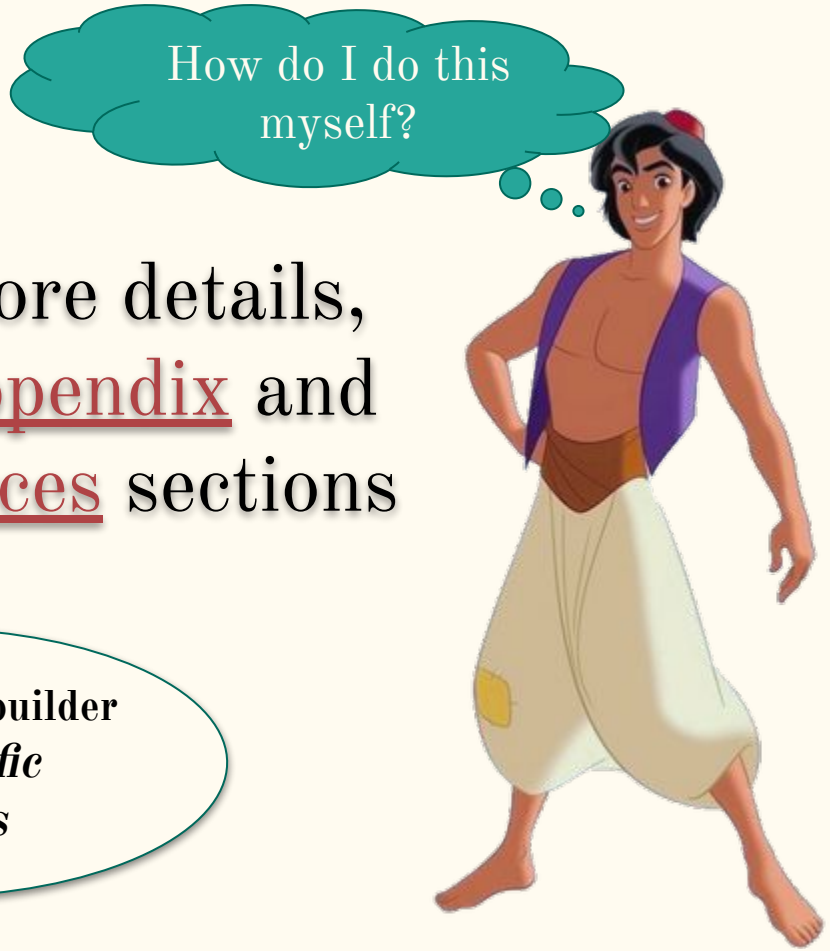
Grakn as **native-image**

GraalVM's native-image builder can convert ubjer JARs into *native binaries* (OS-specific)

native binaries have small-footprint, start quick, and have high runtime performance!

Grakn as **native-image**



No dependencies, no JVM/JDK

Grakn, Graql, benchmark (native-image)

Operating System (Windows, Linux, MacOS)

Hardware (Your Laptop, Desktop, Server)

native-image-builder
OS-specific binaries

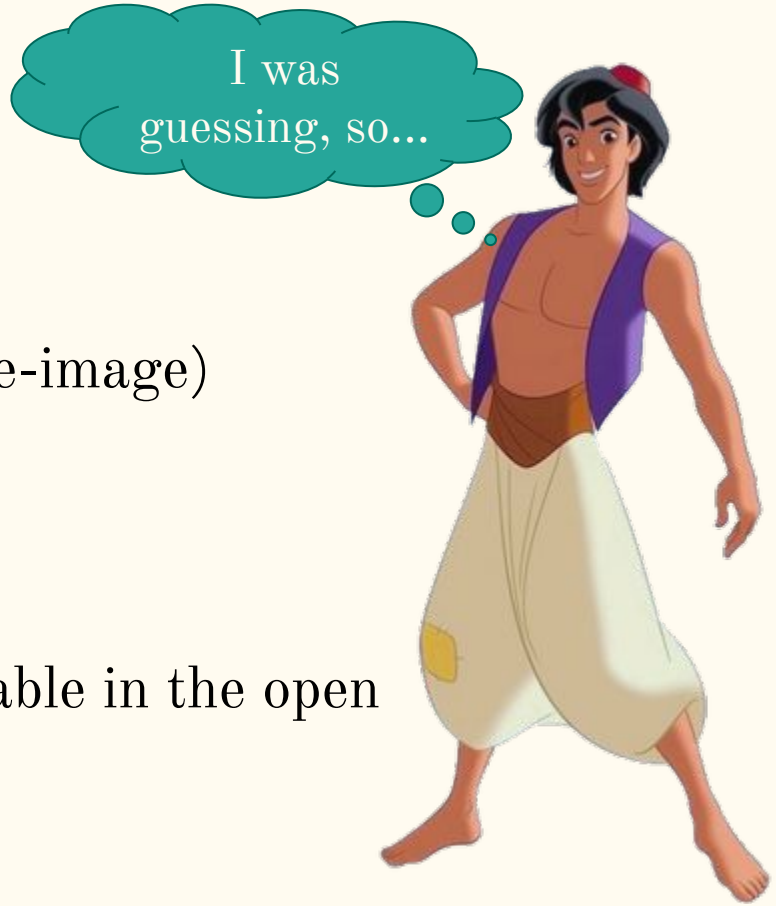
For more details, see Appendix and Resources sections

Quick recap of benefits

Benefits (JVM perspective)

- GraalVM works out-of-the-box as it is based on OpenJDK
- Primarily focussed on making the JVM performant
- In addition, allows creating OS-specific native-images
- Faster startup times
- Compact and dependency free images (native-image)
- Free Community version available
- Developed in the open (GitHub & Slack)
- Widely accepted and good community outreach

Benefits (Infra perspective)



- Fast and reliable response time
- Dependency free end-artifacts (native-image)
- Highly Portable
- Compact docker images
- Major platforms supported
- Regularly updated and updates available in the open

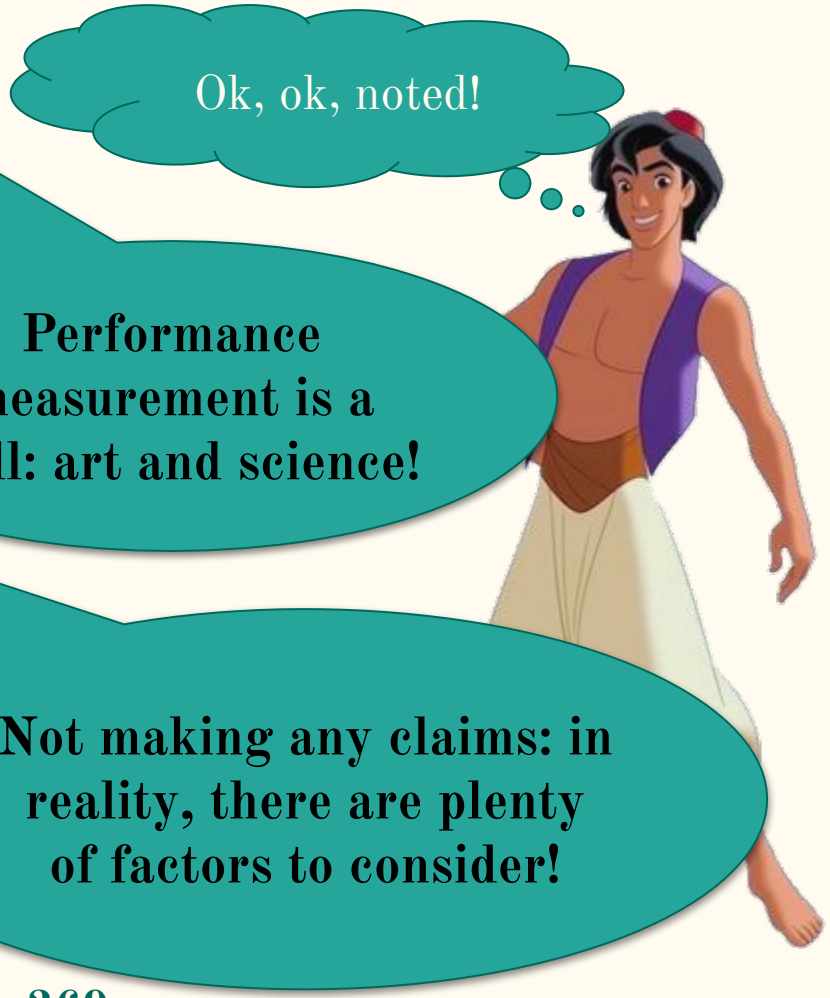
Quick disclaimer

These figures may vary in your case (i.e. environment)

Performance measurement is a skill: art and science!

Don't take them literally, make your own measurements!

Not making any claims: in reality, there are plenty of factors to consider!



An instance or clusters

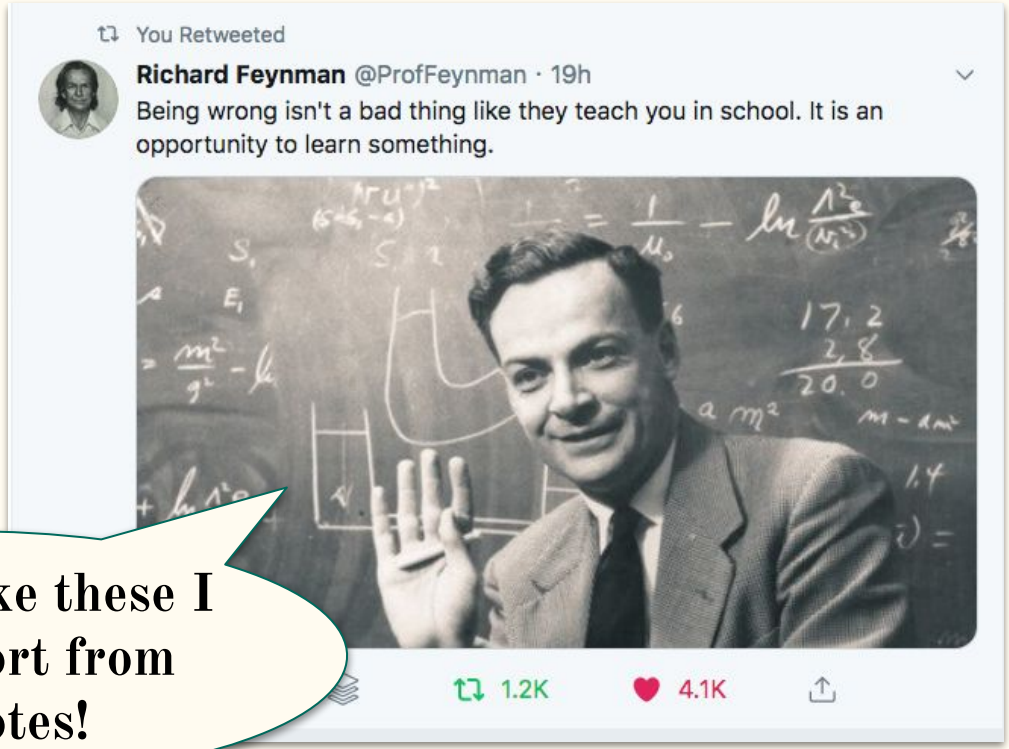
Single instance

- startup time: less in the short-run
- runtime performance
- prepare towards multi-instances
- live benchmarks

Clusters (multi instances)

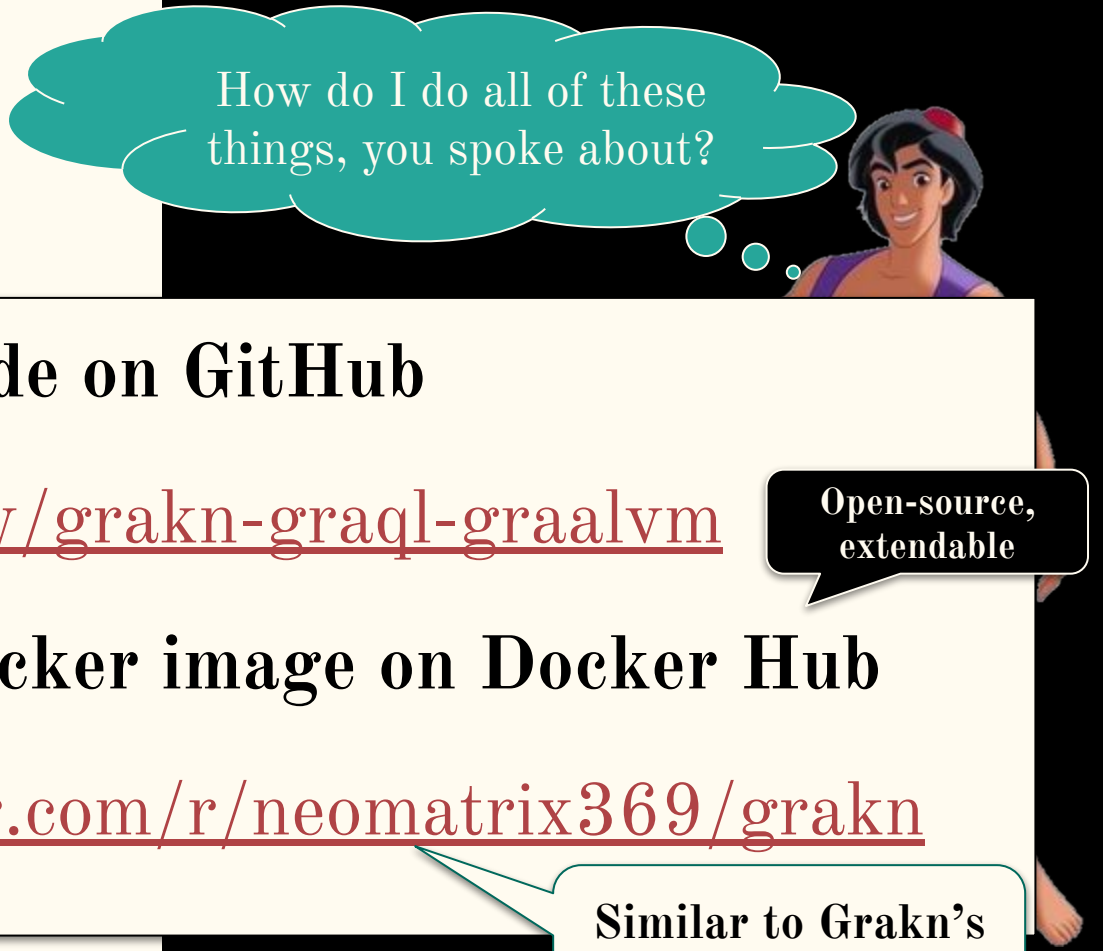
- startup time: immediate benefits short-run
- runtime performance
- scale-up and scale-out
- live benchmarks

Being wrong isn't bad...



It's times like these I take support from his quotes!

Resources



Great community support: please star, watch, fork, share the repo.

Code on GitHub

https://bit.ly/grakn-graql-graalvm

Open-source, extendable

Ready-to-use Docker image on Docker Hub

https://hub.docker.com/r/neomatrix369/grakn

Docker pulls are constantly growing, Thank You!

Similar to Grakn's docker image

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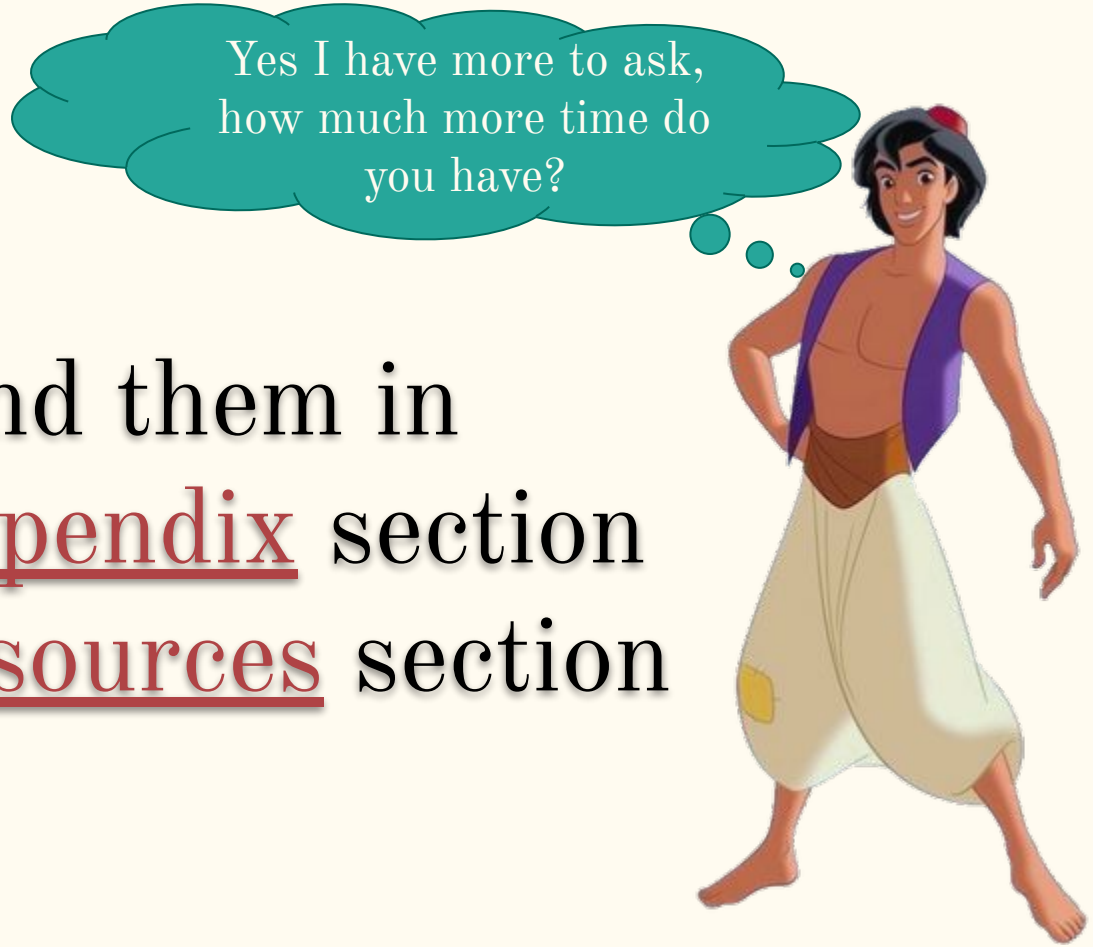
More questions…



Find them in
the Appendix section
and Resources section

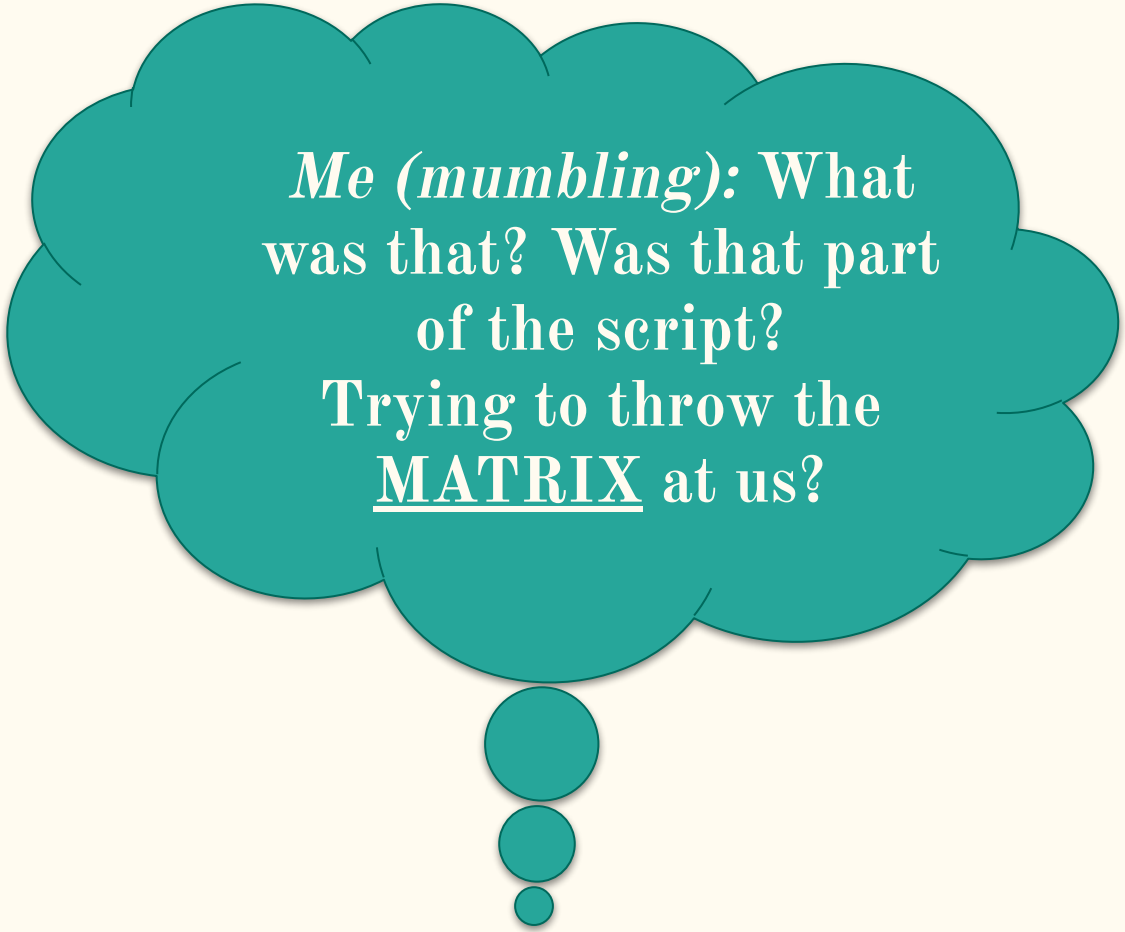
Just about to leave...

Hey, choose! Which one?

Me: Weren't you supposed to ask this right <u>at the start</u>?

Me: Umm, PASS!

Just after leaving...


Me (mumbling): What was that? Was that part of the script? Trying to throw the MATRIX at us?

Conversation with Jas

(meeting in the lobby)

Speaking Graql (with Jas)

- Jas is all about Data Science, NLP, among other things
- She is keen on ubiquitous communications all across
- Her high-level goals with **Graql** are
  - Easy to learn and understand **Graql**
  - Write **Graql** for stakeholders of all levels
    - **Graql** to **English**
  - Translate communication from stakeholders of all levels to **Graql**
    - **English** to **Graql**

English to Graql

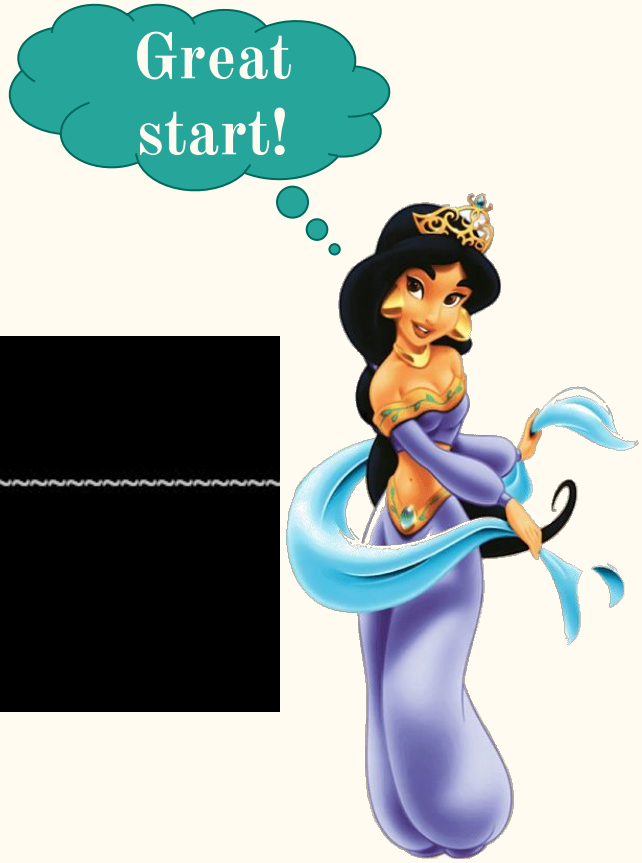
(`graql-console-client` with **`GraqlBot`**)

Speaking Graql: command-line

```
(host) $./run-python-in-docker.sh
(container) $ pip3 install -r requirements.txt
(container) $ python grakn_console_client.py
```

Run these from inside a docker container

Speaking Graql: command-line




```
GraqlBot: Enter/paste your query in English or Graql.
And may the force be with us!
Type "exit" at the prompt to leave! "clear" to clear the screen.
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: English or Graql >
```

Not like “Enter the dragon”, enter the Graql!

Speaking Graql: entering queries

```
GraqlBot: English or Graql >
Give me list of customers calling each other in London or Cambridge

GraqlBot: Not sure which one you meant! But we found others!

   0  --->  Who are the customers who 1) have all called each other and 2) have all called person with phone numbe
r +48 894 777 5173 at least once?
   Code: COMMON_CUSTOMERS_SINGLE_NUMBER  | Confidence: 50-50 chance, 54%)

   1  --->  Who are common contacts of customers with certain phone numbers
   Code: COMMON_CUSTOMERS_MULTIPLE_NUMBERS  | Confidence: 50-50 chance, 52%)

   2  --->  Who people received call from customer of certain place aged over certain age also called by someone a
ged under certain age
   Code: UNDER_20_PHONE_CALLS_LONDON?  | Confidence: 50-50 chance, 49%)

   3  --->  Get phone number of people received calls from customer aged customer potential person who made calls
to another customer aged under certain age
   Code: UNDER_20_PHONE_CALLS_LONDON?  | Confidence: 50-50 chance, 45%)

   4  --->  Who are the people aged under 20 who have received at least one phone call from a Cambridge cus
ged over 50?
   Code: OVER_50_PHONE_CALLS_CAMBRIDGE  | Confidence: 50-50 chance, 45%)

GraqlBot: Which one of these did you mean, just type the q number?
GraqlBot: one of these: [0, 1, 2, 3, 4]
```

Speaking Graql: getting results

```
GraqlBot: Which one of these did you mean, just type the q number?
GraqlBot: one of these: [0, 1, 2, 3, 4]
0
GraqlBot: Here's what the Graql query would look like if you typed it, neat isn't it?

match
    $target isa person, has phone-number "+48 894 777 5173";
    $company isa company, has name "Telecom";
    $customer-a isa person, has phone-number $phone-number-a;
    (customer: $customer-a, provider: $company) isa contract;
    (caller: $customer-a, callee: $target) isa call;
    $customer-b isa person, has phone-number $phone-number-b;
    (customer: $customer-b, provider: $company) isa contract;
    (caller: $customer-b, callee: $target) isa call;
    (caller: $customer-a, callee: $customer-b) isa call;
get $phone-number-a, $phone-number-b;


GraqlBot: Let me think, will take a moment, please be patient...
GraqlBot: The customers who have called the single number are
['+81 308 988 7153', '+261 860 539 4754', '+62 107 530 7500', '+81 308 988 7153', '+261 860 539 4754', '+62 107 53
0 7500']
GraqlBot: And it took me 4.204568386077881 seconds (real-time) to execute this query.
GraqlBot: I could things faster if you like! I'm practising for the performance Olympics
```

Could someone memorise that query?

Speaking Graql: automatic execution

Now, wait for me to choose!

```
GraqlBot: English or Graql >
Since September which customers called

GraqlBot: Yay! We found it (at least we think we did)!

  q0 ---> Since a date which customers called a person with phone number
  Code: CUSTOMERS_CALLED_SINCE  | Confidence: Pretty likely, 82%)

GraqlBot: Here's what the Graql query would look like if you typed it, neat isn't it

match
  $customer isa person, has phone-number $phone-number;
  $company isa company, has name "Telecom";
  (customer: $customer, provider: $company) isa contract;
  $target isa person, has phone-number "+86 921 547 9004";
  (caller: $customer, callee: $target) isa call, has started-at $started-at;
  $min-date == 2018-09-10T00:00:00; $started-at > $min-date;
get $phone-number;


GraqlBot: Let me think, will take a moment, please be patient...
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: These are numbers of the customers who called +86 921 547 9004 since 2018-09-10T00:00:00
['+263 498 495 0617', '+63 815 962 6097', '+81 308 988 7153', '+7 690 597 4443', '+54 398 559 0423', '+62 107 530 7500', '+370 351 224 5176', '+81 746 154 2598']
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: And it took me 3.4213337898254395 seconds (real-time) to execute this query.
```

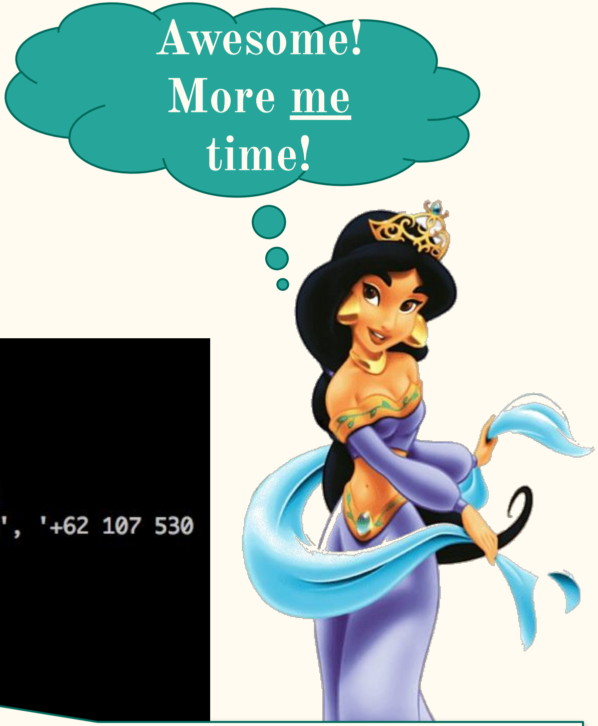
Pretty confident, hey 😉

Speaking Graql: similar query

Quite close, safe confidence ratings!

```
GraqlBot: English or Graql >
Calls related to September 10th or 14th

GraqlBot: Not sure which one you meant! But we found others!

   q0  -->  Get me the customers of company "Telecom" who called the target person with phone number +86 921 547
9004 from September 10th onwards.
   Code: CUSTOMERS_CALLED_SINCE  | Confidence: 50-50 chance, 55%)

   q1  -->  Get phone number of people received calls from customer aged customer potential person who made calls
 to another customer aged under certain age
   Code: UNDER_20_PHONE_CALLS_LONDON?  | Confidence: 50-50 chance, 49%)

   q2  -->  Get phone number of people received calls from customer aged customer potential person who made calls
 to another customer aged under certain age
   Code: OVER_50_PHONE_CALLS_CAMBRIDGE  | Confidence: 50-50 chance, 49%)

   q3  -->  Get me the phone number of people who have received calls from both customer with phone number +7 171
 898 0853 and customer with phone number +370 351 224 5176.
   Code: COMMON_CUSTOMERS_MULTIPLE_NUMBERS  | Confidence: 50-50 chance, 49%)

   q4  -->  People aged under certain age received at least one phone call from a place customer from customer ag
ed over certain age
   Code: OVER_50_PHONE_CALLS_CAMBRIDGE  | Confidence: 50-50 chance, 44%)

GraqlBot: Which one of these did you mean, just type the q number?
GraqlBot: one of these: [0, 1, 2, 3, 4]
```

Speaking Graql: results from cache




```
GraqlBot: Which one of these did you mean, just type the q number?
GraqlBot: one of these: [0, 1, 2, 3, 4]
0
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: These are numbers of the customers who called +86 921 547 9004 since 2018-09-10T00:00:00
['+263 498 495 0617', '+63 815 962 6097', '+81 308 988 7153', '+7 690 597 4443', '+54 398 559 0423', '+62 107 530 7500', '+370 351 224 5176', '+81 746 154 2598']
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: And it took me 2.86102294921875e-06 seconds (cache) to execute this query.
GraqlBot: Thats faster than Usain Bolt
GraqlBot: The above is based on your origi input: 'Calls related to Septe 10th or 14th'
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
```

0.00000286 seconds

Cached actions are usually faster (maybe less accurate)

@theNeomatrix369

Speaking Graql: manually graql-ing

```
And may the force be with us!
Type "exit" at the prompt to leave! "clear" to clear the screen.
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: English or Graql >
graql: match $customer isa person, has age < 20; $company isa company, has name "Telecom"; (customer: $customer, pr
ovider: $company) isa contract; (caller: $customer, callee: $anyone) isa call, has duration $duration; get $duratio
n; mean $duration;
GraqlBot: Wow, that's a great change, not many do that these days ;)
GraqlBot: Happy to execute it for you, if you think you have your graql-foo down
GraqlBot: Nice effort, looks like a well crafted query!

match $customer isa person, has age < 20; $company isa company, has name "Telecom"; (customer: $customer, provide
 $company) isa contract; (caller: $customer, callee: $anyone) isa call, has duration $duration; get $duration; me
 $duration;

GraqlBot: Let me think, will take a moment, please be patient (talking to Highlander Grakn Server)...
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: Here's the output to your hand-written query: 1242.7714285714285
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: And it took me 1.901900291442871 seconds (real-time) to execute this query.
GraqlBot: Even though it's been a long day, and I'm a bit lazy today!
GraqlBot: The above is based on your original input: 'graql: match $customer isa person, has age < 20; $company isa
 company, has name "Telecom"; (customer: $customer, provider: $company) isa contract; (caller: $customer, callee: $
anyone) isa call, has duration $duration; get $duration; mean $duration;'
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: English or Graql >
```

Hey! You can do that as well!

User typed in *graql* query

Me: Yeah, old school still works!

Speaking Graql: any query

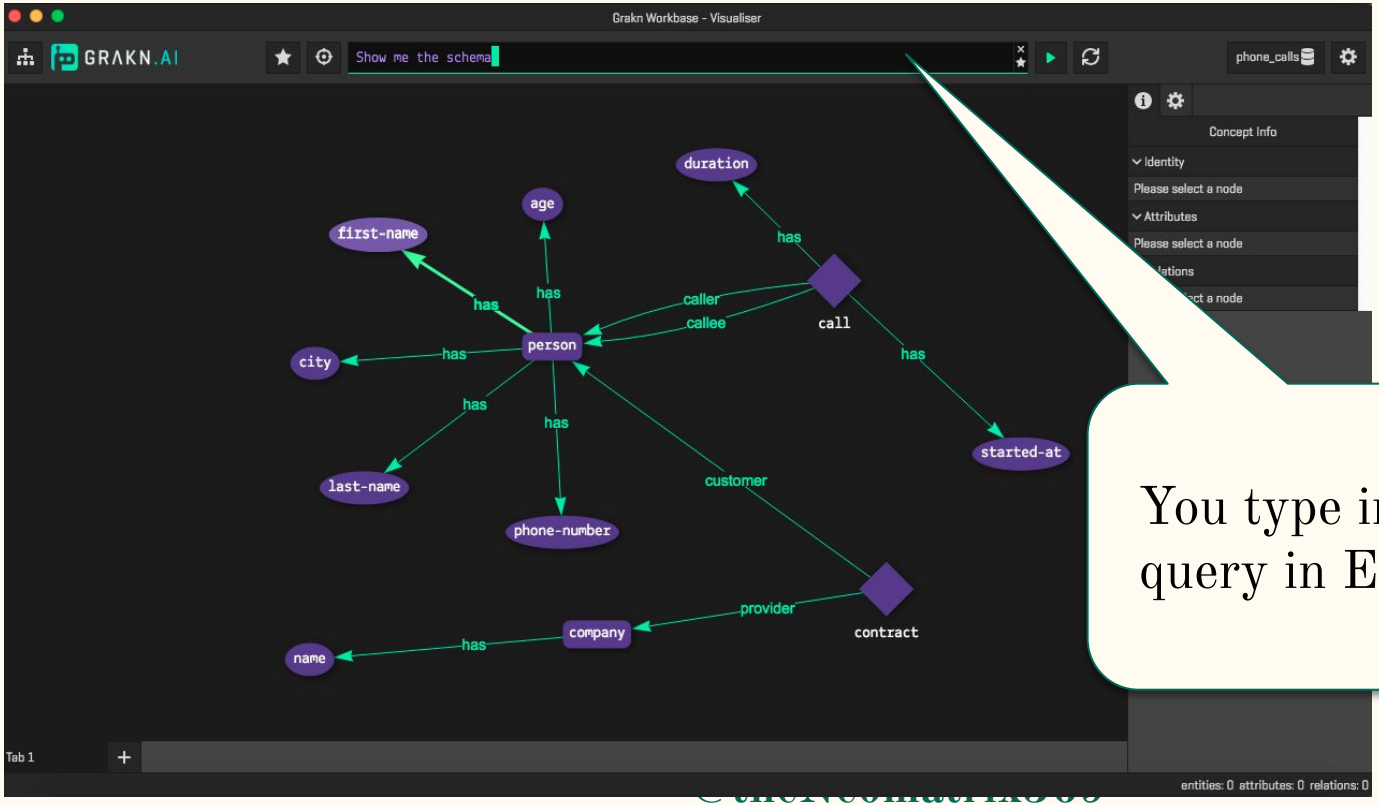
```
GraqlBot: Enter/paste your query in English or Graql, exit to leave the prompt! (Let the force be with us!)
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: English or Graql >
aSKLDjlAKSDjlAKSD

GraqlBot: Not sure what you meant by that one, not the end of the world. We can try again.
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: English or Graql >
askdjaslkdjaskldjaskldj

GraqlBot: Nice try, but we could find nothing! Do you want to try another query?
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: English or Graql >
djfhadskjfhadkjf

GraqlBot: Don't give up on me just cause I don't follow you. Keep trying till we perfect it
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: English or Graql >
v,dms.,vmads.,v

GraqlBot: Not sure what you meant by that one, not the end of the world. We can try again.
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
GraqlBot: English or Graql >
```

Hmm, let me think!

Keep trying! Everyone should get multiple chances. Who else thinks so?

Workbase

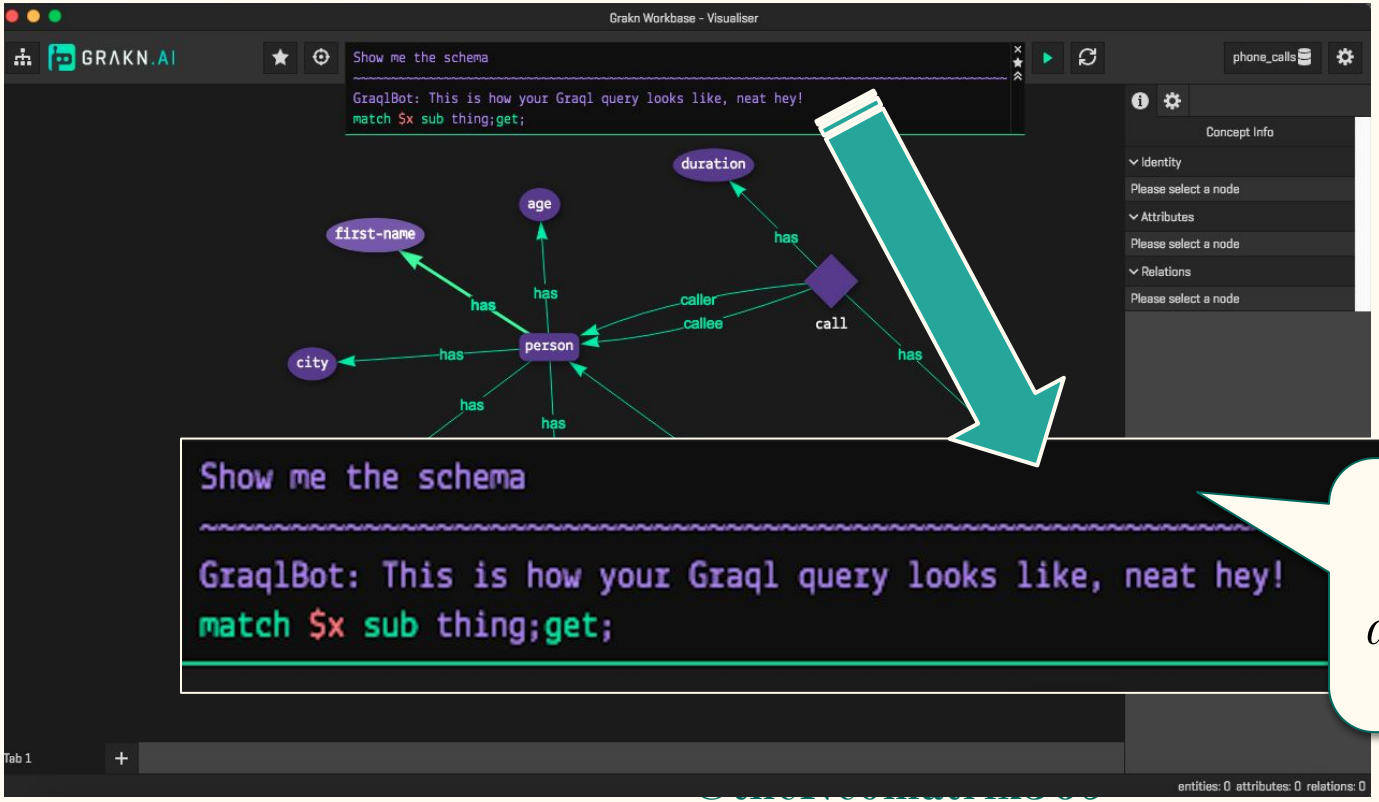
Speaking Graql: type in English



That looks easy to read

You type in your query in English

Speaking Graql: respond in English



Now! best of both worlds, hey!

You type in your query in English, *and* GraqlBot does the rest!

Graql to English

(Decomposing a graql Query)

graql query

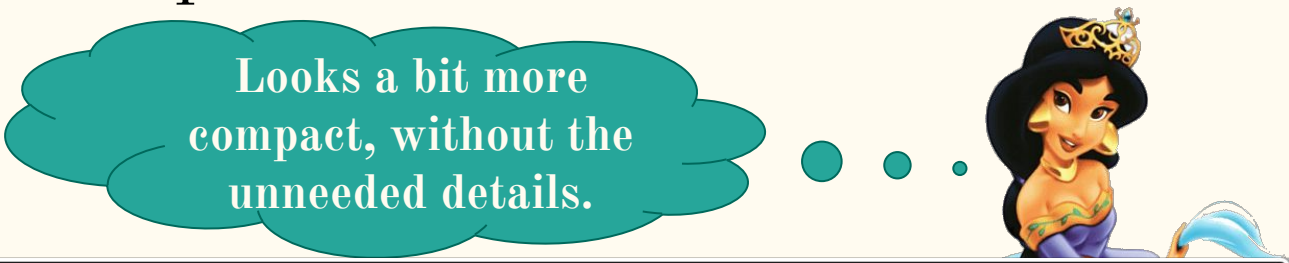

```
match
  $customer isa person, has phone-number $phone-number;
  $company isa company, has name "Telecom";
  (customer: $customer, provider: $company) isa contract;
  $target isa person, has phone-number "+86 921 547 9004";
  (caller: $customer, callee: $target) isa call, has started-at $started-at;
  $min-date == 2018-09-10T00:00:00; $started-at > $min-date;
get $phone-number;
```

In English: literal translation

I would have sort of done the same. 😄

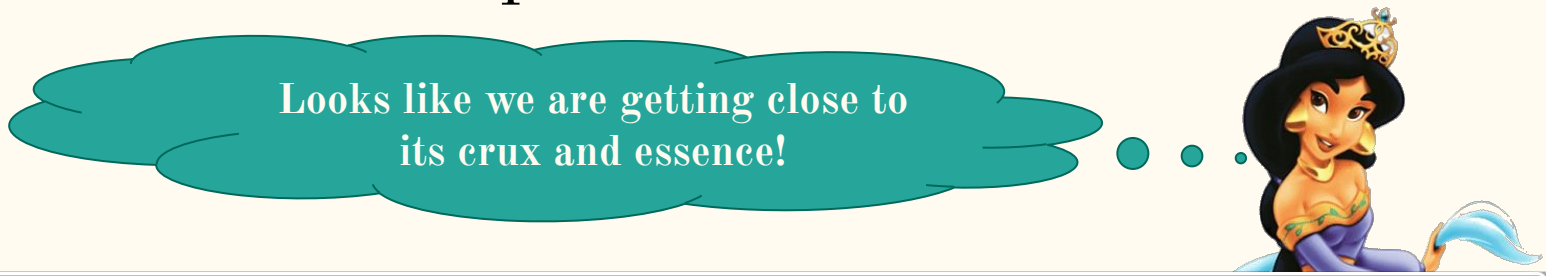
```
1 - Find customers of type person, with attribute phone number populated (valid entries)
2 - Find a company whose attribute name is Telecom
3 - Find a contract relationship between a customer and company
4 - Find a target (customer) of entity type person and with a phone number attribute of
  value "+86 921 547 9004"
5 - Find a call relationship between a customer and a target (also customer) where the
  call attribute started-at > a given minimum date of 2018-09-10T00:00:00
6 - Find the phone number of the target
```

In English: some simplifications




```
1 - Find a company by the name Telecom
2 - And customers who have a contract with this company
3 - And find the customer with the telephone number "+86 921 547 9004"
4 - Find all the calls made by this customer to others on or after the date 10-9-2018
  starting mid-night (or September 10th 2018 starting mid-night)
5 - Gather and return the phone numbers of all these people who were called
```

In English: further simplifications




```
1 - Find the customer from the company Telecom with the telephone number "+86 921 547
  9004"
2 - Get the numbers of all the calls made by this customer on or after the date 10-9-2018
  mid-night (or September 10th 2018 mid-night)
```

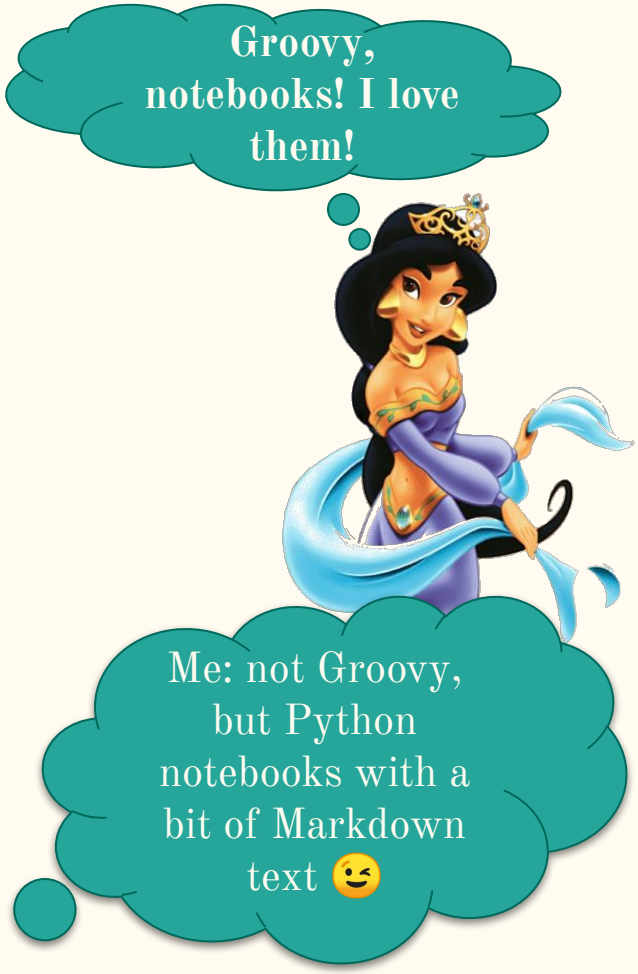
In English: amenable-to-the-eyes

Aah really, that sounds more like how our stakeholders talk to us!

```
Since September 10th, which customers called
this number +86 921 547 9004?
```

In English: text summarisation

It appears to be more about text summarisation (look for notebooks on text summarisations)



Quick recap

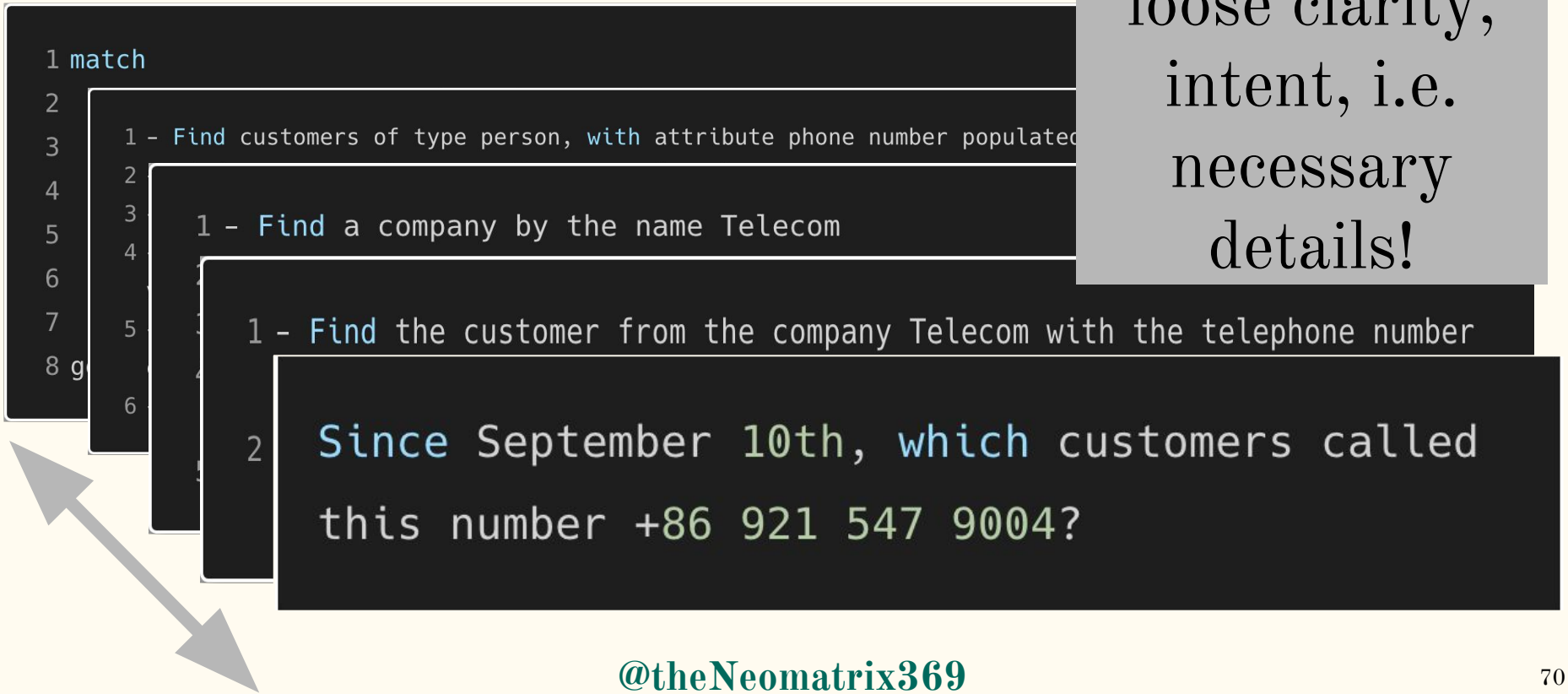
The two-way translation process

There is no “one hop” solution, it is an iterative process! Made up of layers!

The two-way translation process

Let me try to explain

Graql to English translation



We gain and loose clarity, intent, i.e. necessary details!

Towards a smooth two-way speech

English-to-Graql ⟷ Graql-to-English

From it's creators!

Graql

Alignments

Adjustments

Abstractions

Adjustments

Alignments

English

And the community

We are not far off!

And the community

From it's users!

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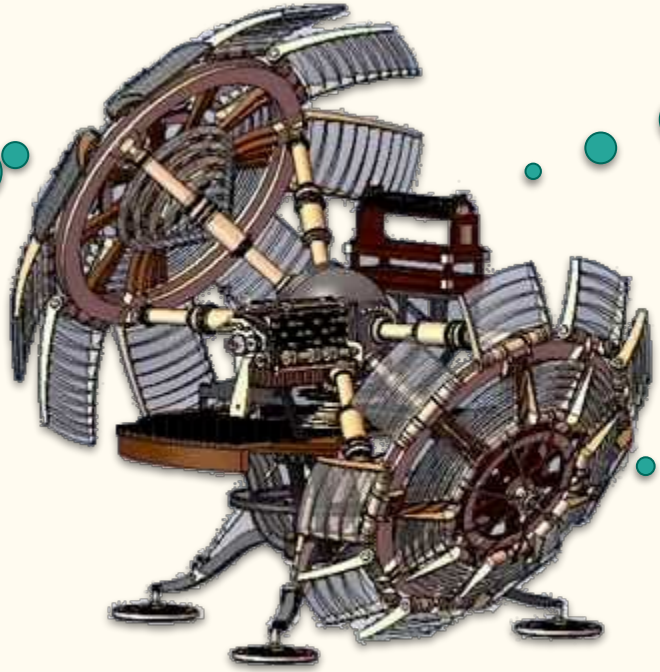
A little while later

(After finishing conversation with Jas)

Where did “Jas” find the blog?

Does Jas have a time machine?

Plan to write one but haven’t written one yet!



Is Jas from the future? #irony

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Summary

- Grakn
  - Improve the runtime performance of modern day programs running on the JVM. Solution to do that is available and easy to use! Contributions are welcome!
  - **Grakn** is versatile and easy to adapt!
- Graql
  - Beauty of **Graql** you can perform two-way translations (**E-2-G**, **G-2-E**)
  - We can use simple **pattern recognition** to deliver NLP-like solutions without doing full-fledge model building
- Al and Jas are happy users!

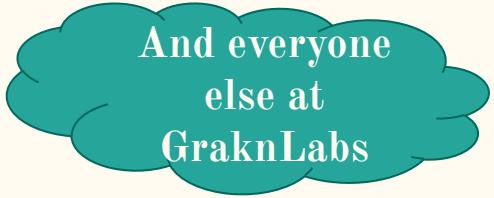
Closing notes

Community support

Resources

- These Slides: https://bit.ly/grakn-graql-graalvm
- Grakn project (referred in this presentation) [highly recommended]
- Grakn Docker Hub Image
- Awesome AI/ML/DL | Graphs | Graph Databases
- Follow GraknLab's performance initiative(s) on GitHub: [1] [2]
  - the benchmark project mentioned in this presentation | Paper on VM benchmarking
- **Graql**: English-to-Graql, Graql-to-English
  - Discussion on GitHub: [1][2][3]
  - Follow mauna.ai
- GraalVM | GitHub | Awesome Graal
- Script to build native-image of Grakn

Thank You, again!



- **Grakn Cosmos 2020**, it's organisers (**Daniel Crowe**)
- Good folks at **GraknLabs** (**Haikal**, **Tomas**, **Joshua**...)
- Developers from the various developer communities I have been at over the years
- You for being here, sparing your time, and entrusting it with me for this session

Contact and keep in touch

- twitter: @theNeomatrix369
- medium: https://medium.com/@neomatrix369
- github: https://github.com/neomatrix369/
- linkedin: https://www.linkedin.com/in/mani-sarkar/
- about me: https://neomatrix369.wordpress.com/about

Q & A

Red pill, blue ill, movie reference? Matrix?

Movie reference: Aladdin and the Magic Lamp?

Is Al from the Matrix?

Al = Aladdin?

Jas = Jasmine?

Does Jas have a time machine?

Being fictional stars: Al and Jas may not be able to answer questions!

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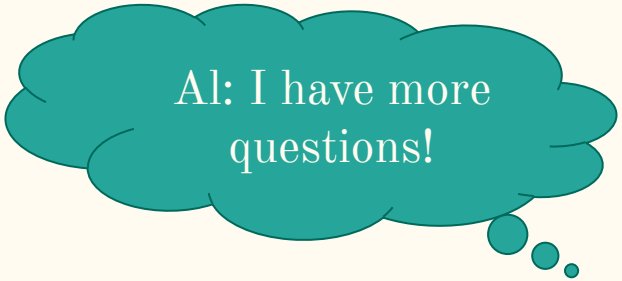
Appendix

Al: questions, discussions, ideas



It's not only about which JDK is better or the best

Benchmark and log metrics

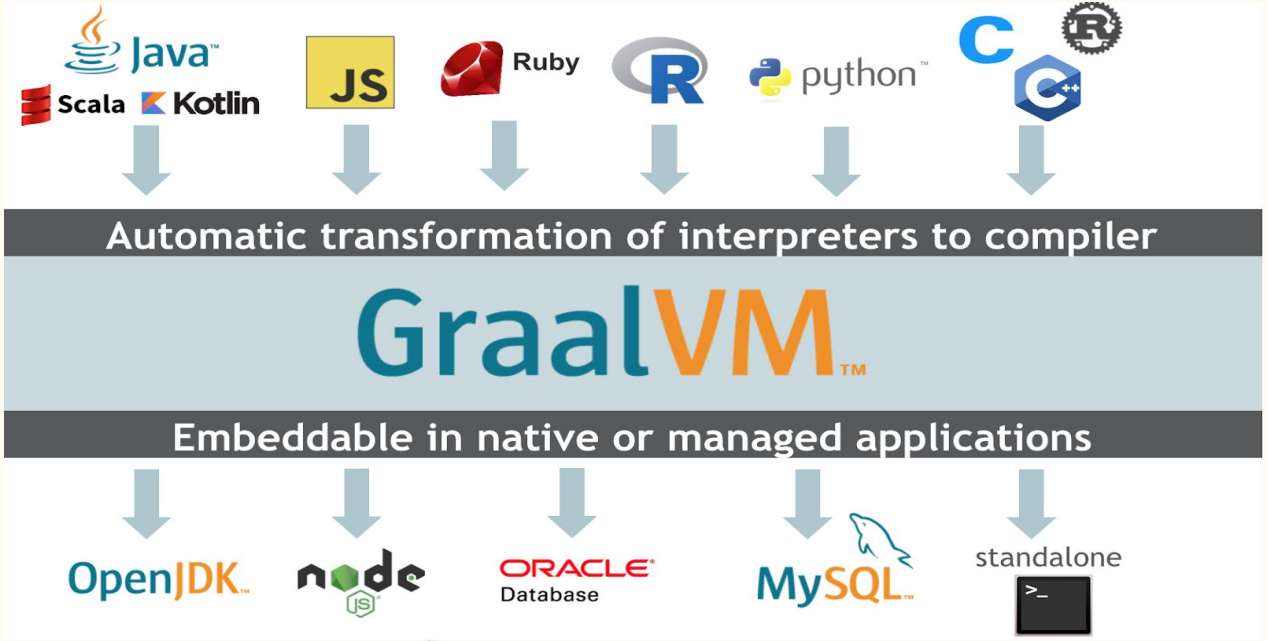
Cluster of servers behind a load balance, running different JDKs

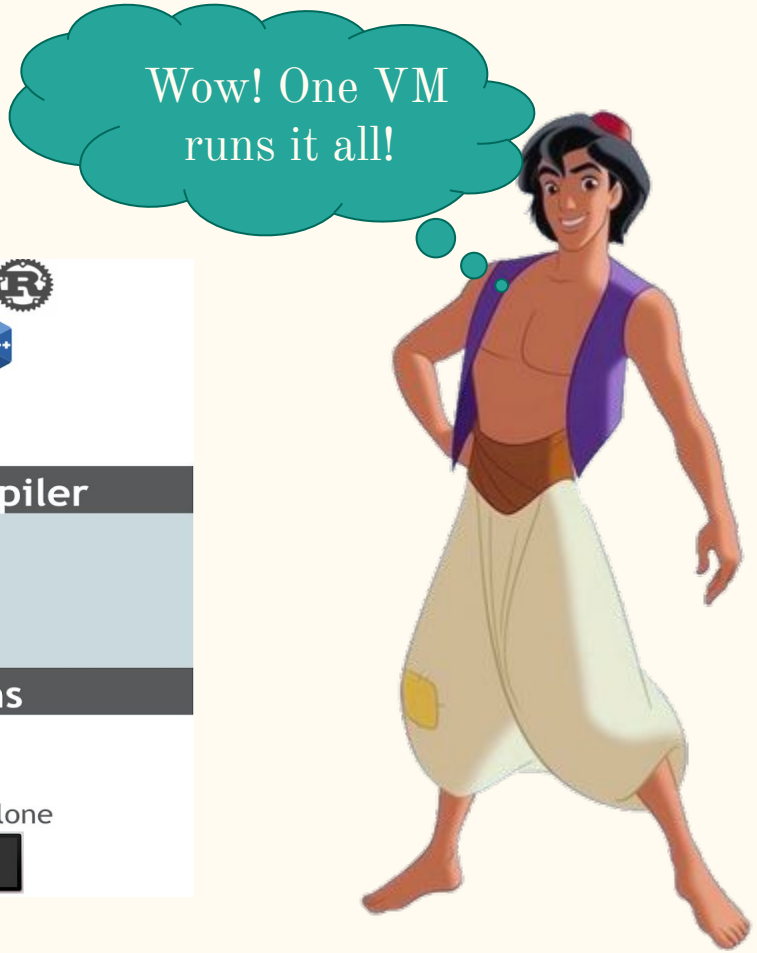
Have a setup in place to be able to run Grakn on the best of breed infra for optimum performance and throughput

Different JDKs for different end-goals

Measure startup and runtime performances between GraalVM and another JDKs

GraalVM architecture





High-level

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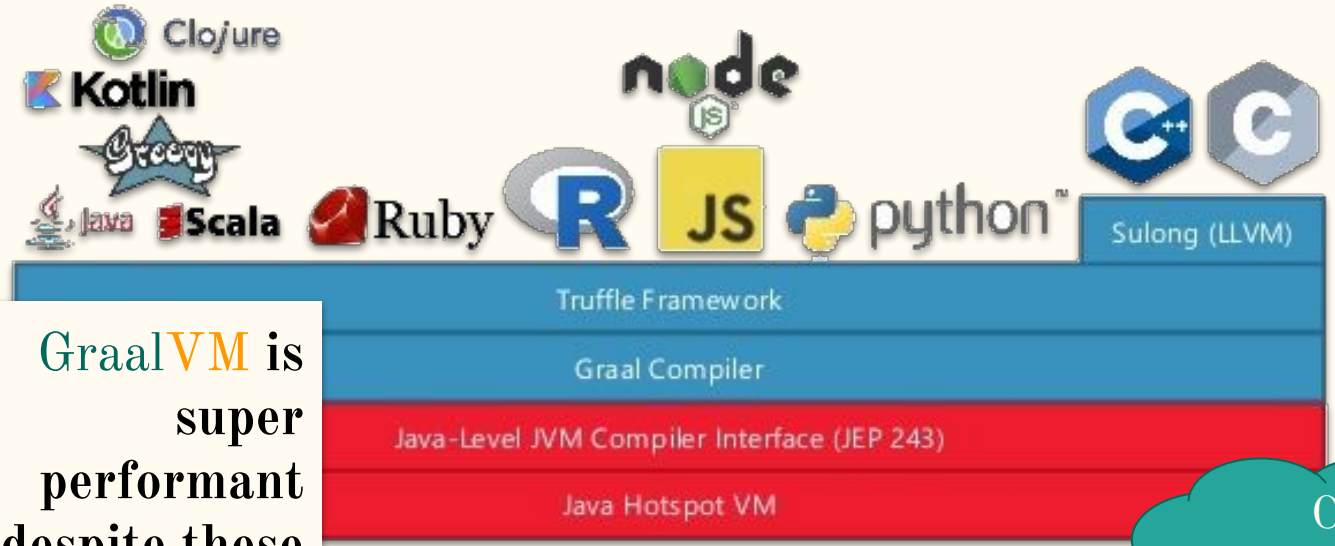
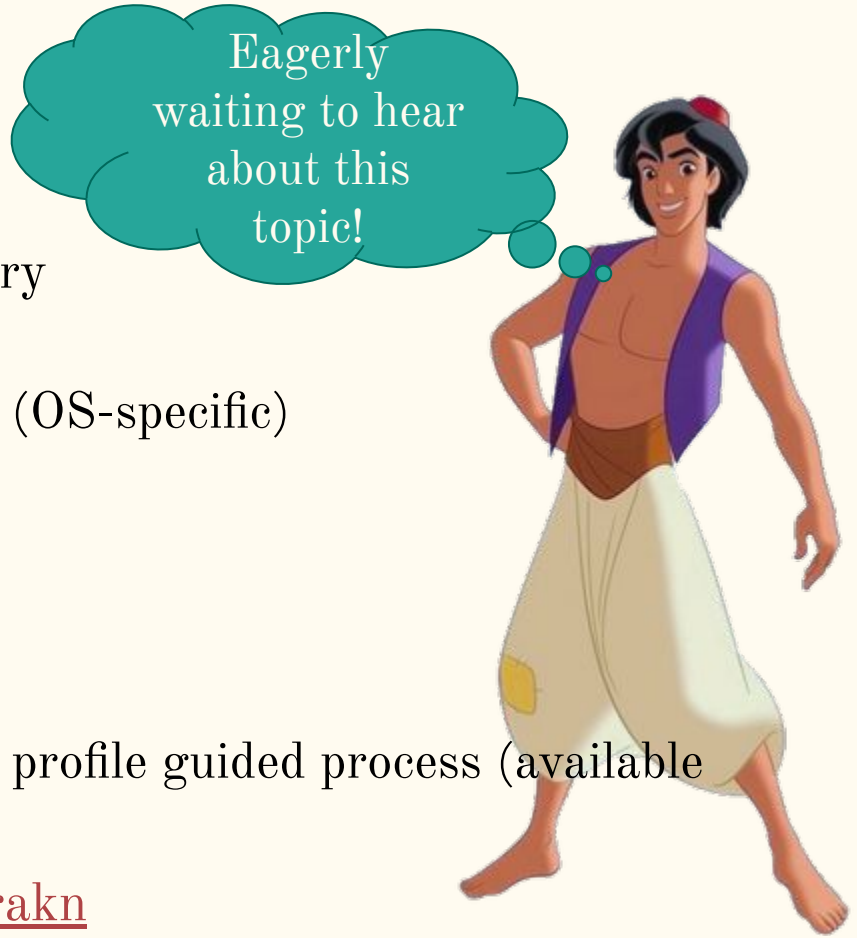
GraalVM Architecture



GraalVM is super performant despite these layers of abstractions

GraalVM native-image



- Convert uber JAR files into native-binary
- OS-specific native binaries
- Zero or very little dependencies needed (OS-specific)
- Quick startup
- Small footprint
- Ideal for docker images
- Performant at runtime
- Create highly performant images using profile guided process (available only via GraalVM EE version)
- See script to build native-image of Grakn