## GOTO Copenhagen 2022

#### #GOTOcph



# cloud chaos and microservices mayhem

Holly Cummins **Red Hat** @holly\_cummins

#### **Voxxed Athens**







@holly\_cummins



@holly\_cummins

### handwashing



@holly\_cummins

### handwashing apps



@holly\_cummins

### handwashing dpps UPS



@holly\_cummins

### handwashing dpps JUS devops



@holly\_cummins

### handwashing dpps UPS devops devsecops



@holly\_cummins

### handwashing dpps OPS devops devsecops finops







afew that are things that the things to the











### technology changes fast (duh)





## technology changes fast (duh) ... but it's taking us a while to catch up to cloud



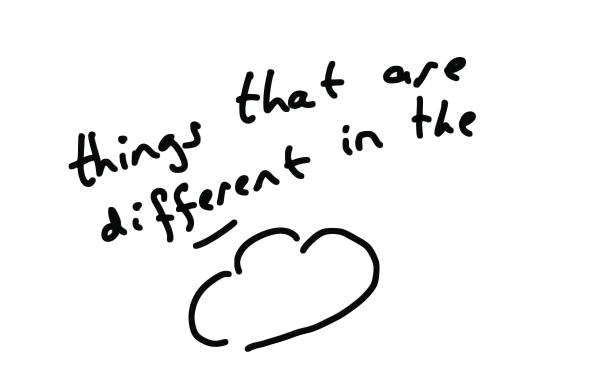




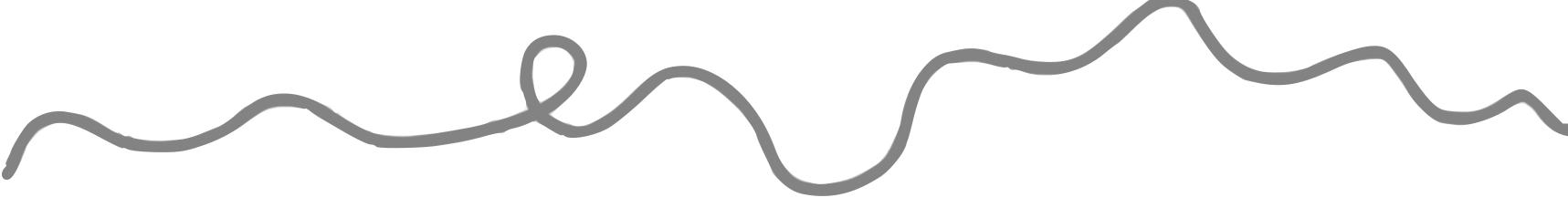
## technology changes fast (duh) ... but it's taking us a while to catch up to cloud





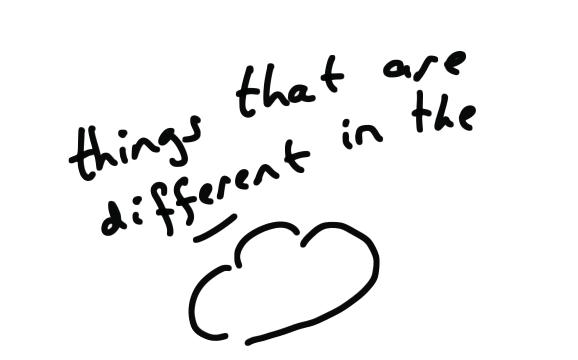


### tracing

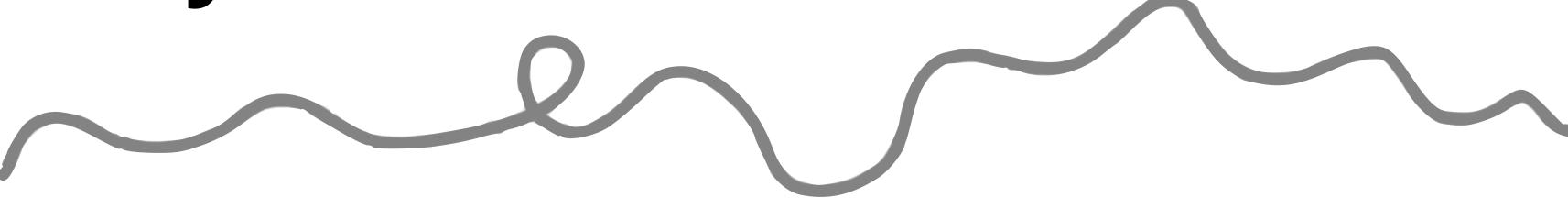


@holly\_cummins

#IBMGarage + IBM Cloud © 2020 IBM Corporation



### observability



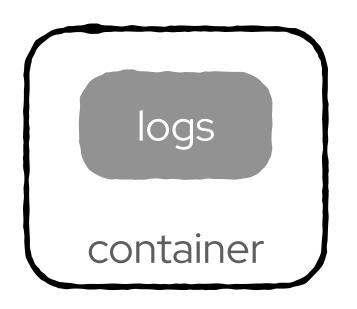
@holly\_cummins

#IBMGarage + IBM Cloud © 2020 IBM Corporation

| old way  |  |
|----------|--|
| logs     |  |
|          |  |
| hardware |  |



| old way  |  |
|----------|--|
| logs     |  |
|          |  |
| hardware |  |





| old way | y |
|---------|---|
| logs    |   |
|         |   |
| hardwar | e |

#### cloud way

logs



| old way | y |
|---------|---|
| logs    |   |
|         |   |
| hardwar | e |

#RedHat

oops



| old way | y |
|---------|---|
| logs    |   |
|         |   |
| hardwar | e |





| old | way |
|-----|-----|
|     |     |

| logs     |  |
|----------|--|
|          |  |
|          |  |
| hardware |  |

logs

@holly\_cummins





| old | way |
|-----|-----|
|     |     |

| logs     |  |
|----------|--|
|          |  |
|          |  |
| hardware |  |

logs

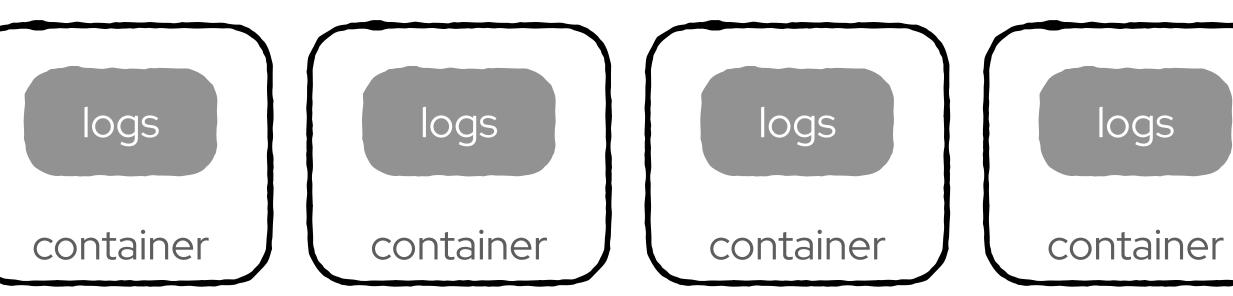
@holly\_cummins



| (                | old way  |
|------------------|----------|
| $\left[ \right]$ | logs     |
|                  |          |
|                  |          |
|                  | hardware |

logs

@holly\_cummins





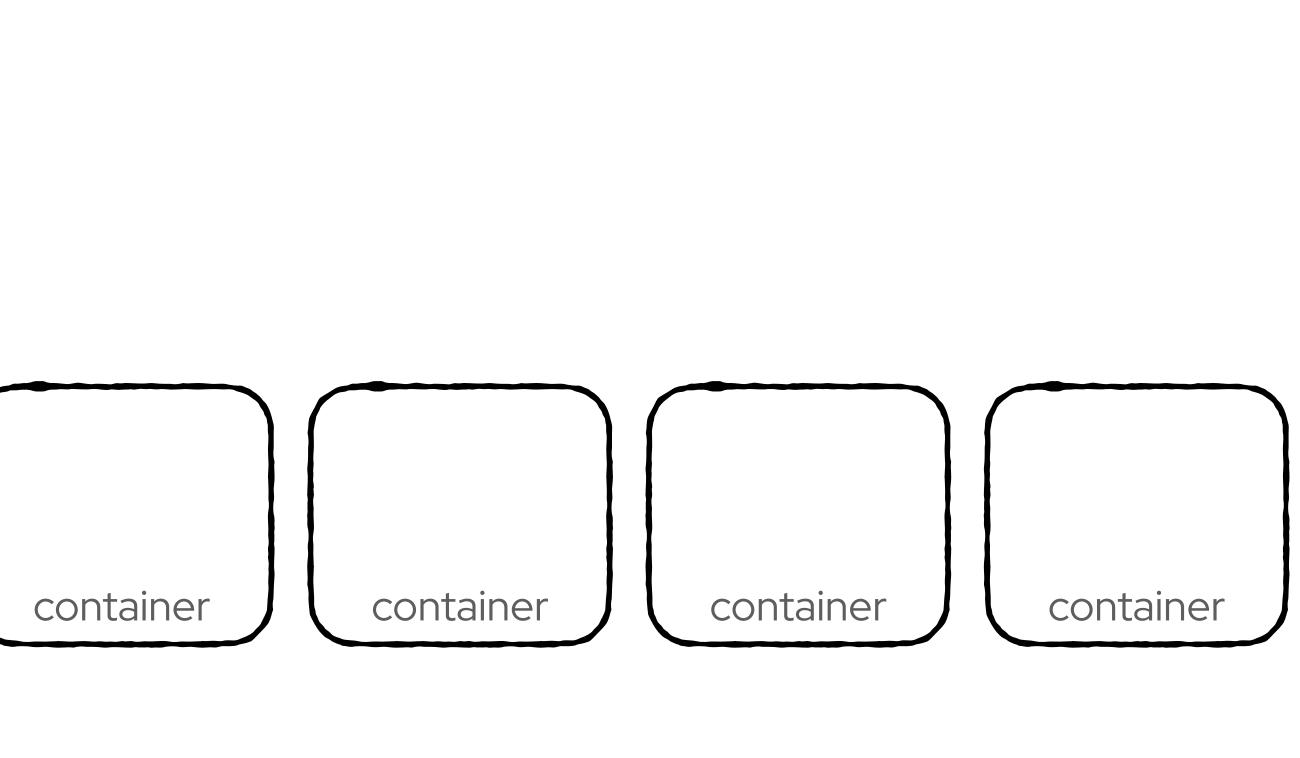


| old way  |        |
|----------|--------|
| logs     |        |
|          |        |
| hardware |        |
|          | logs s |

Ic

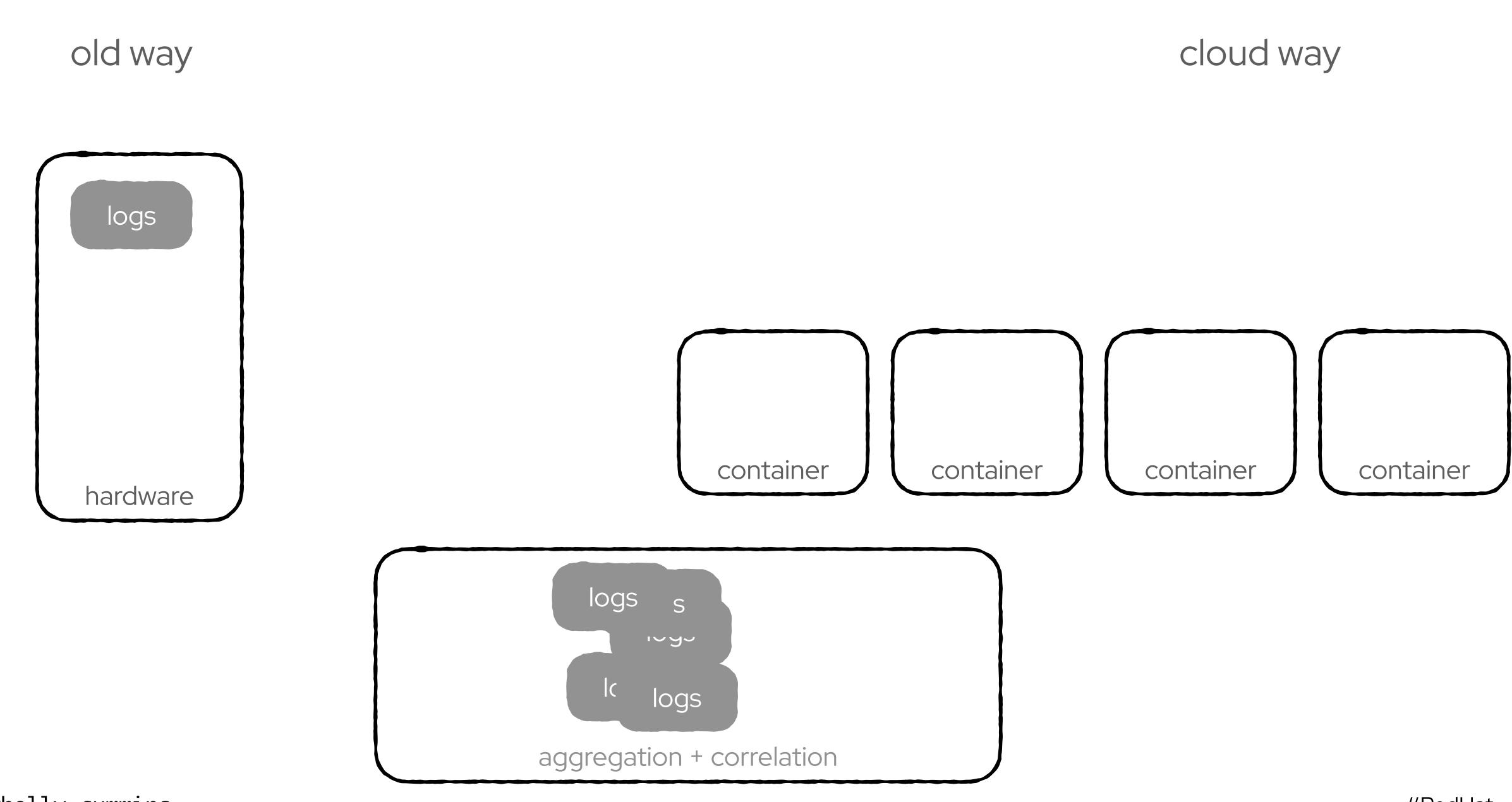
logs

@holly\_cummins

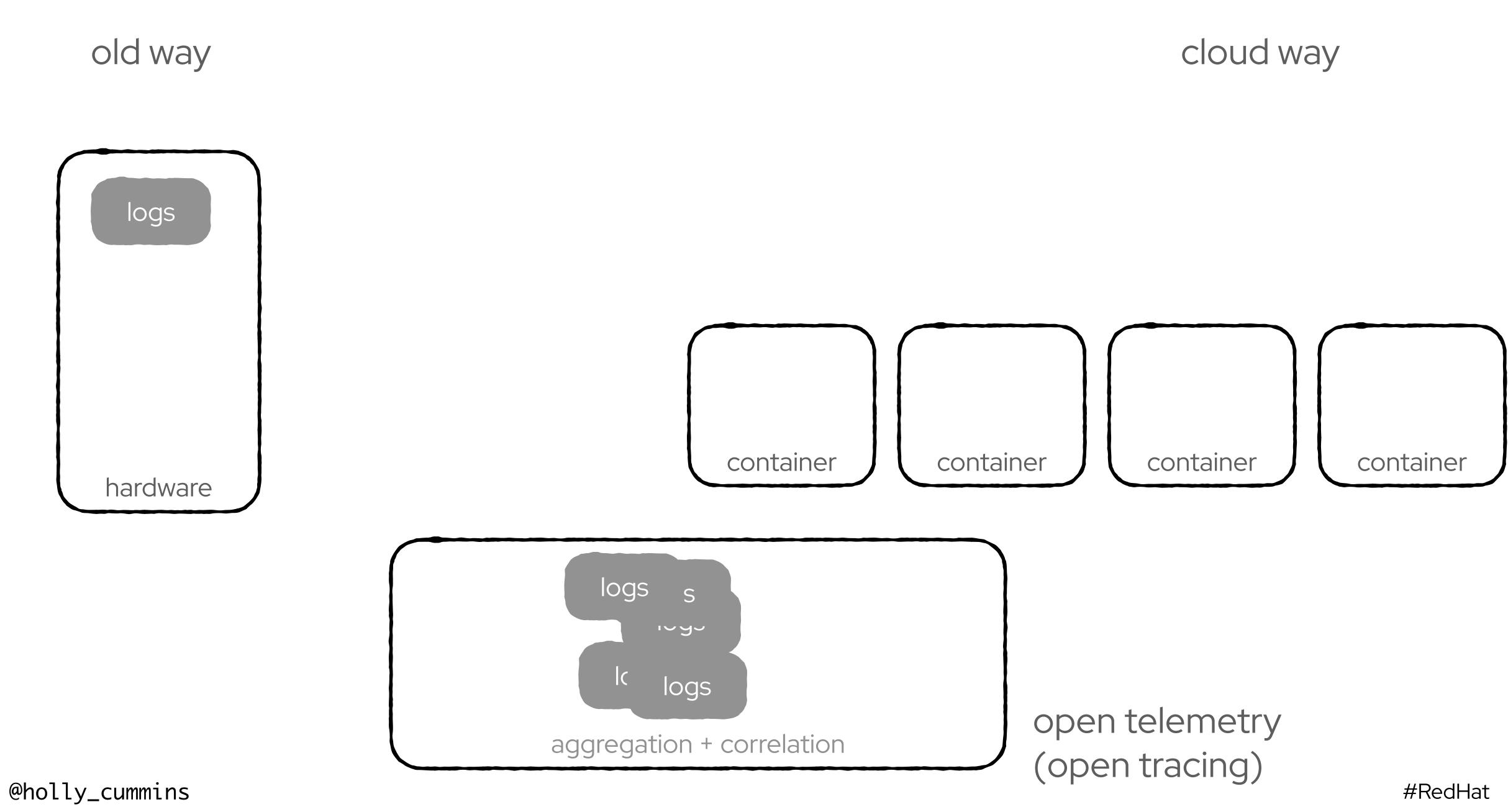


cloud way









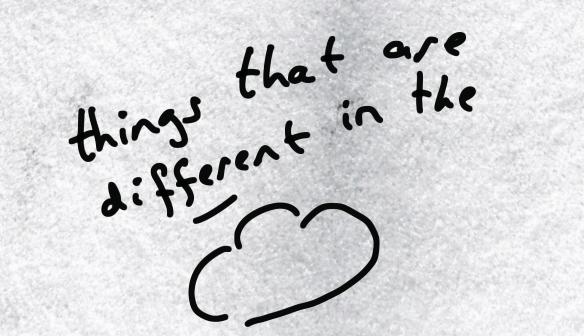


## good news: observability is 'fixed'



## good news: observability is 'fixed' bad news: not all of us are using it





### performance requirements

## memory footprint is money startup time is money



# all that dynamism we worked so hard is (now) a bad idea





D

A Kubernetes Native Java stack tailored for OpenJDK HotSpot and GraalVM, crafted from the best of breed Java libraries and standards.

#### ahead of time optimisation is (now) a good idea

QUARKUS ACKATHON WINNERS ANNOUNCED LEARN MORE

@holly\_cummins



#### **SUPERSONIC SUBATOMIC JAVA**

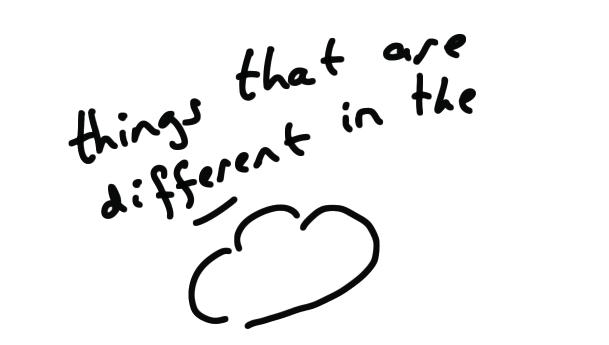
**GET STARTED WITH QUARKUS** 

Now Available QUARKUS 1.8.3

More Information



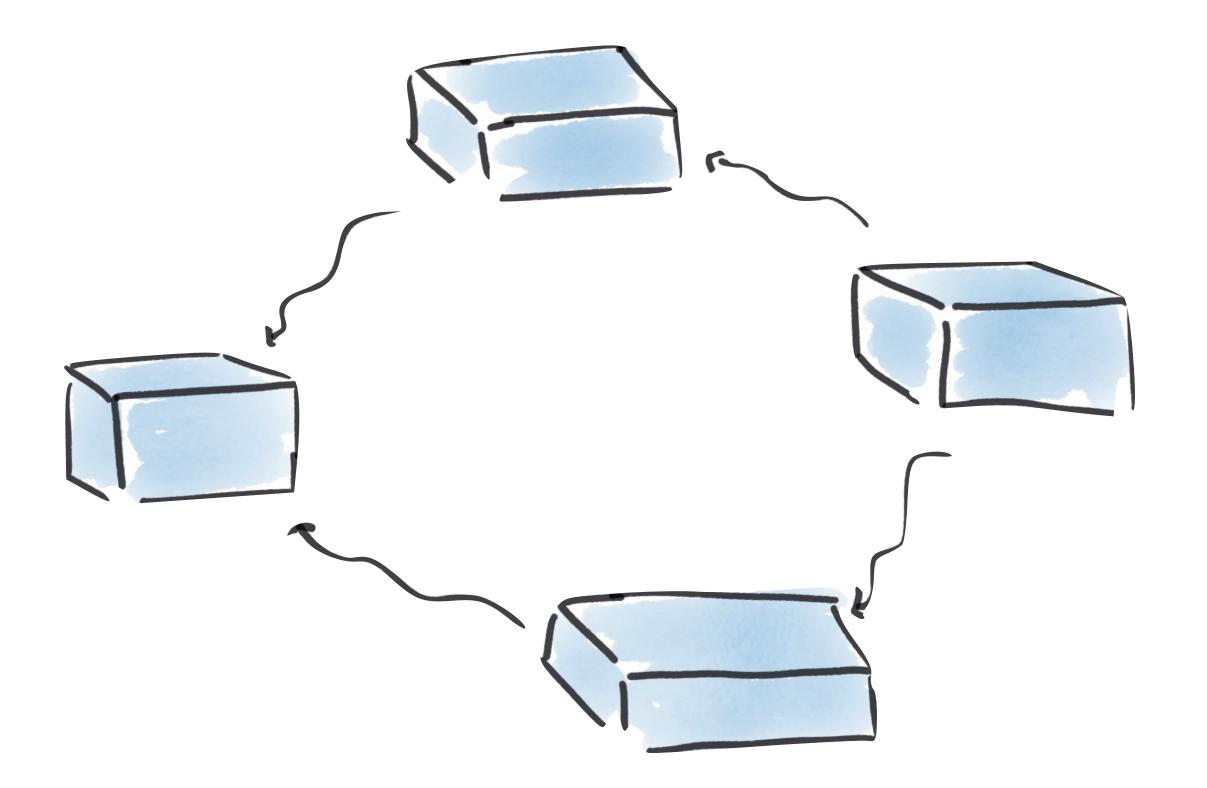




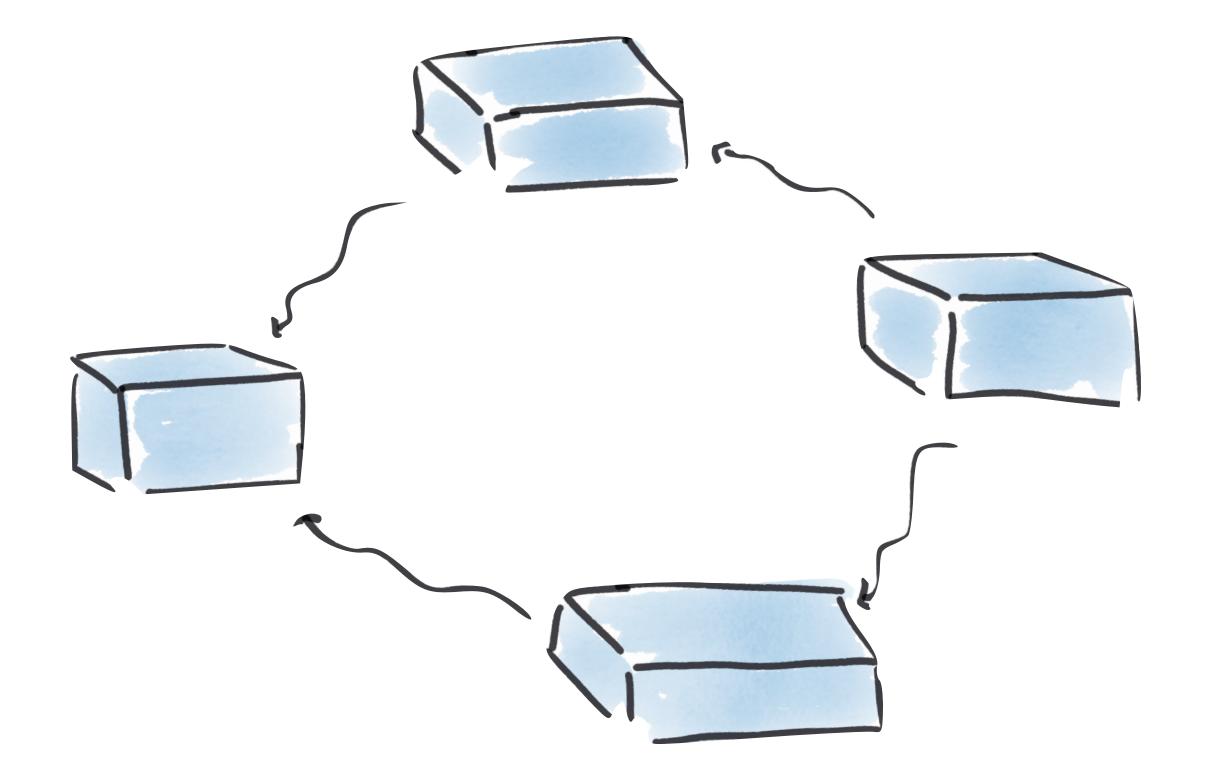
# performance optimisation

@holly\_cummins

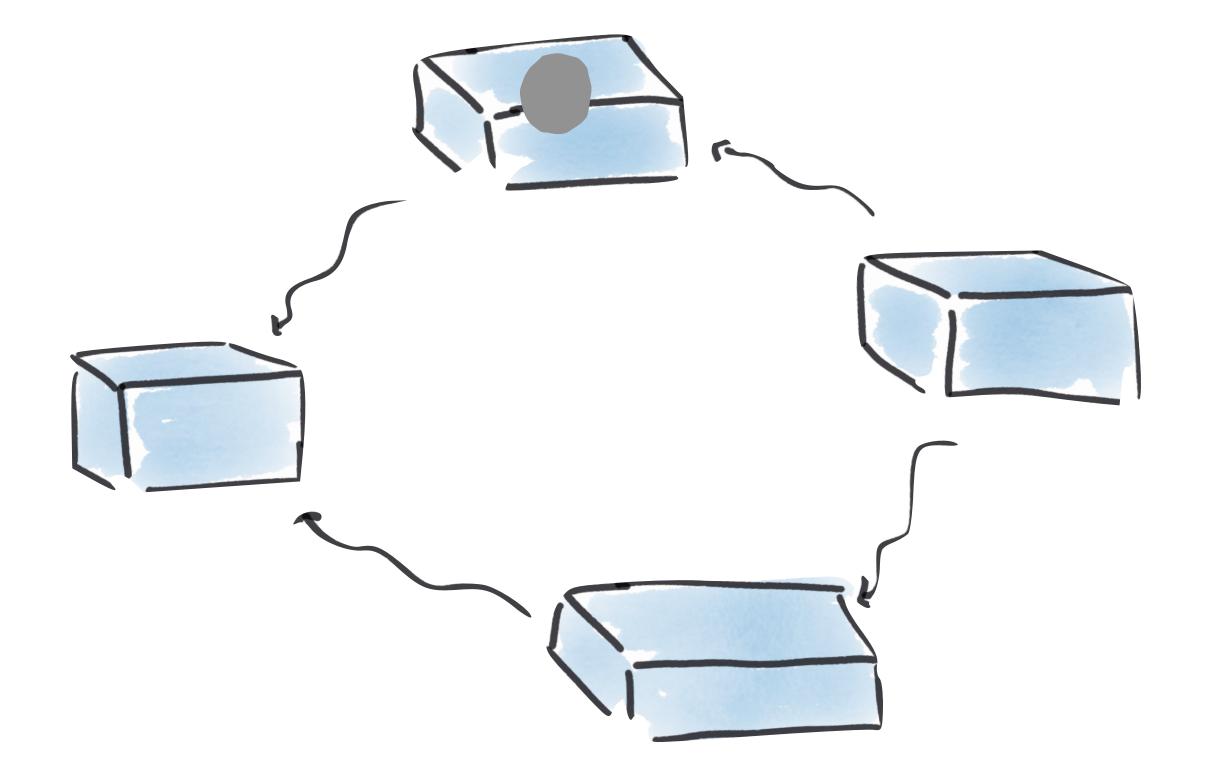
#IBMGarage + IBM Cloud © 2020 IBM Corporation



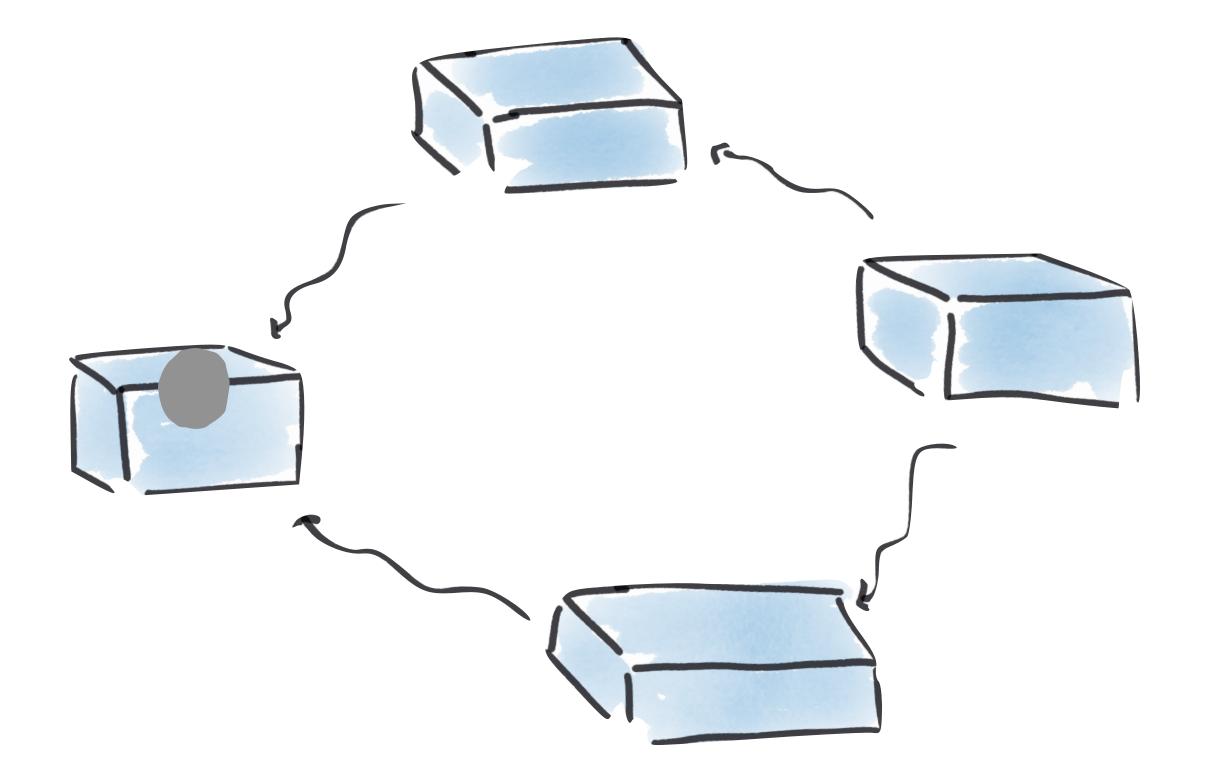




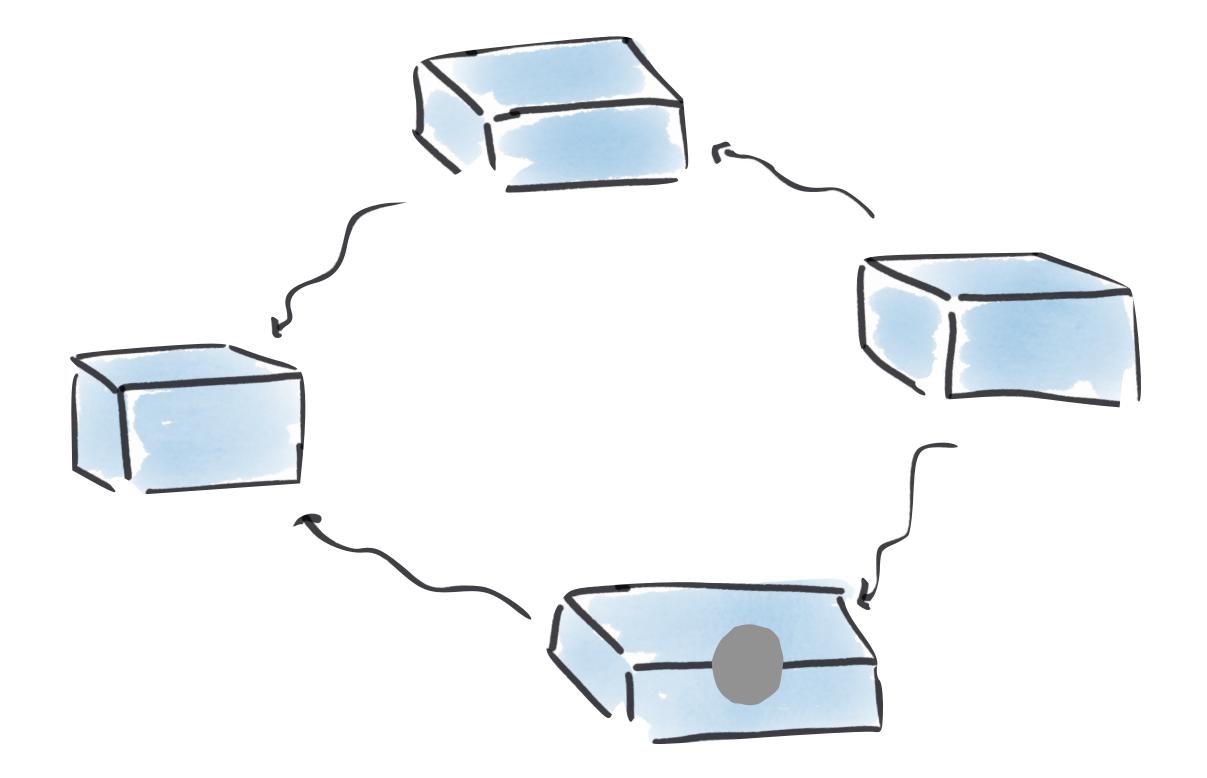






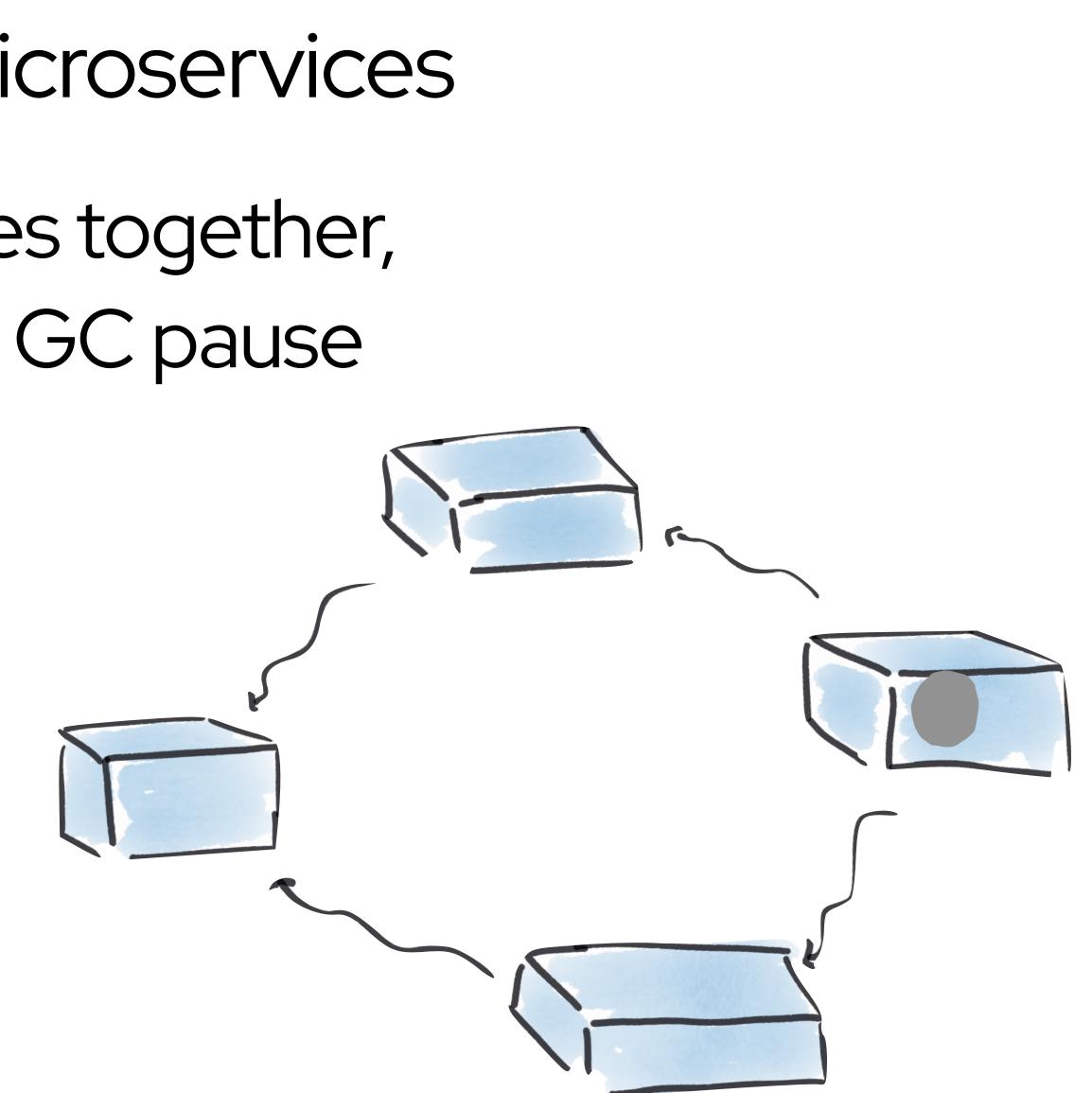








### garbage collection and microservices if you chain 100 microservices together, you are almost guaranteed a GC pause

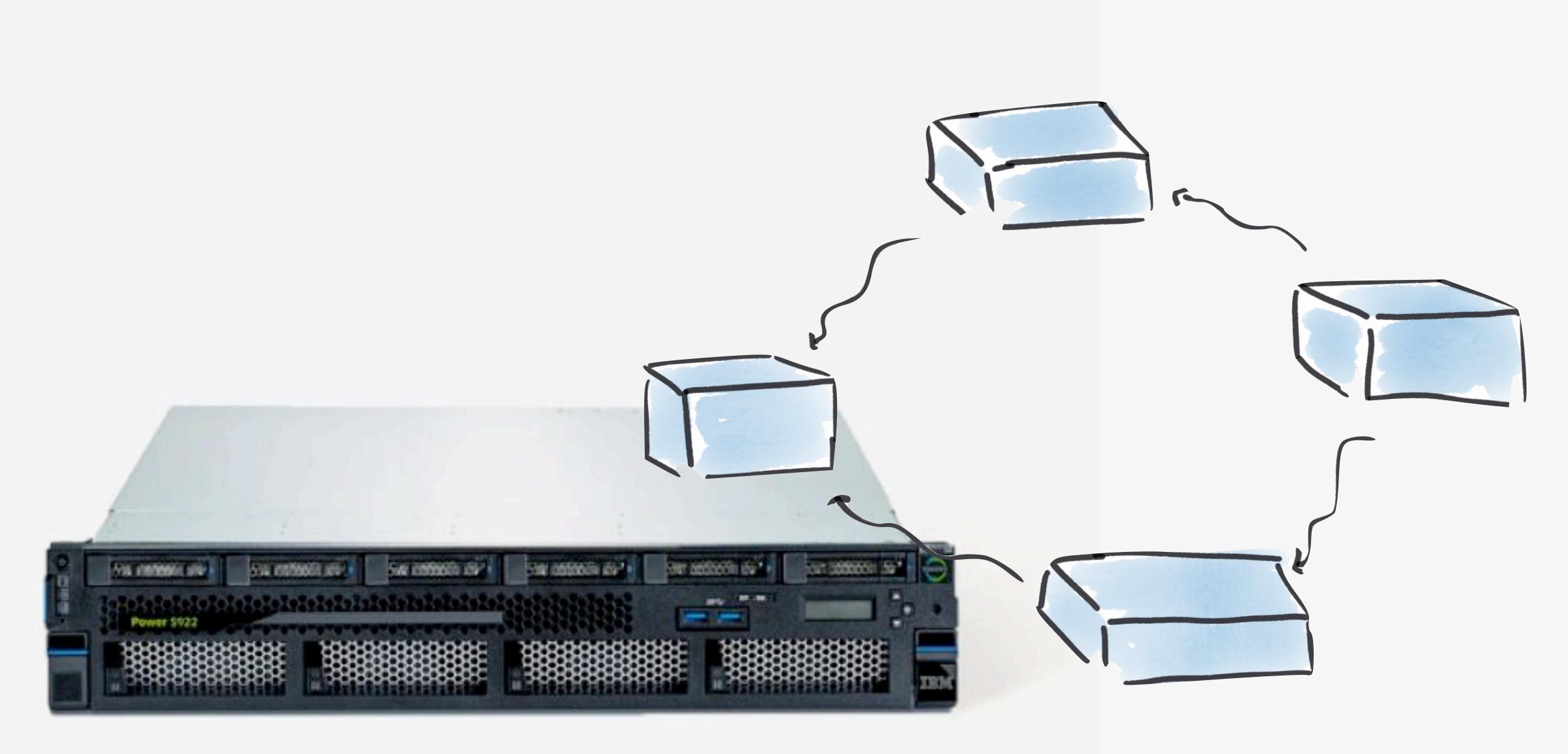




| Best practices for Java in single × +  |   |   |
|--|---|---|
| C A https://developers.redhat.com/articles/2022/04/19/best-practices-java-single-core-containers   |   | ▽ ⊻ @   |
| er Apps ৬ The Source 🛞 IT Toolbox 🄤 IT New Hire Hub 🛞 Support 🗋 Presentation Resour 🗋 Red Hat External ৬ Quarkus - Compone ৬ Community Spotligh  |   |   |
| <b>Red Hat</b><br>Developer Topics Products Developer Sandbox Build Tools Events Learn Partner   |   | Q :::: /<br>Search All Red Hat Lo                                   |
| Article  |   |   |
| Best practices for Java in single-core containers  |   |   |
| April 19, 2022 🎐 🫉 in 🖾 🗣 Containers, Java   |   |   |
|  |   |   |
| Ben Evans  |   |   |
| Ben Evans<br>Senior Principal Software Engineer  |   |   |
|  |   |   |
| Senior Principal Software Engineer   | Recent Articles   |   |
| <ul> <li>Senior Principal Software Engineer</li> <li>Table of contents:</li> <li>An increasing number of Java applications run in containers. The exact number is hard to determine, because adoption of containers depends upon the market segment and cloud maturity of each particular team or company. However, some data is available—for</li> </ul>  |   | g better security on  |
| Senior Principal Software Engineer         Image: Senior Principal Software Engineer         Image: Table of contents:         An increasing number of Java applications run in containers. The exact number is hard to determine, because adoption of containers depends upon the market segment and cloud maturity of each particular team or company. However, some data is available—for example, data from New Relic suggests that over 62% of their customers' Java workloads run in containers. Like all data points, this one  |   | g better security on  |
| <ul> <li>Senior Principal Software Engineer</li> <li>Table of contents:</li> <li>An increasing number of Java applications run in containers. The exact number is hard to determine, because adoption of containers depends upon the market segment and cloud maturity of each particular team or company. However, some data is available—for</li> </ul>  | 4 tips for achieving<br>Kubernetes  | g better security on<br>convert speech to                           |
| <ul> <li>Senior Principal Software Engineer</li> <li>Table of contents:</li> <li>An increasing number of Java applications run in containers. The exact number is hard to determine, because adoption of containers depends upon the market segment and cloud maturity of each particular team or company. However, some data is available–for example, data from New Relic suggests that over 62% of their customers' Java workloads run in containers. Like all data points, this one is an imperfect proxy for the market as a whole, but the report demonstrates that a significant subset of the Java market has already moved to container-based environments. Anecdotal data also tells us that this migration trend is far from over.</li> <li>Teams using Java need to pay special attention to some aspects of container-based deployments and adopt a couple of best practices.</li> </ul>  | 4 tips for achieving<br>Kubernetes<br>Use OpenVINO to   | convert speech to   |
| <ul> <li>Senior Principal Software Engineer</li> <li>Table of contents:</li> <li>An increasing number of Java applications run in containers. The exact number is hard to determine, because adoption of containers depends upon the market segment and cloud maturity of each particular team or company. However, some data is available—for example, data from New Relic suggests that over 62% of their customers' Java workloads run in containers. Like all data points, this one is an imperfect proxy for the market as a whole, but the report demonstrates that a significant subset of the Java market has already moved to container-based environments. Anecdotal data also tells us that this migration trend is far from over.</li> </ul>   | 4 tips for achieving<br>Kubernetes<br>Use OpenVINO to<br>text   | convert speech to<br>ty risks that keep                             |
| <ul> <li>Table of contents:</li> <li>An increasing number of Java applications run in containers. The exact number is hard to determine, because adoption of containers depends upon the market segment and cloud maturity of each particular team or company. However, some data is available–for example, data from New Relic suggests that over 62% of their customers' Java workloads run in containers. Like all data points, this one is an imperfect proxy for the market as a whole, but the report demonstrates that a significant subset of the Java market has already moved to container-based environments. Anecdotal data also tells us that this migration trend is far from over.</li> <li>Teams using Java need to pay special attention to some aspects of container-based deployments and adopt a couple of best practices. This article focuses on the choice of garbage collector (GC) and how the default choice is based on available CPUs and memory.</li> </ul> | 4 tips for achieving<br>Kubernetes<br>Use OpenVINO to<br>text<br>Kubernetes securit                       | convert speech to<br>ty risks that keep<br>hight                    |
| <ul> <li>Senior Principal Software Engineer</li> <li>Table of contents:</li> <li>An increasing number of Java applications run in containers. The exact number is hard to determine, because adoption of containers depends upon the market segment and cloud maturity of each particular team or company. However, some data is available–for example, data from New Relic suggests that over 62% of their customers' Java workloads run in containers. Like all data points, this one is an imperfect proxy for the market as a whole, but the report demonstrates that a significant subset of the Java market has already moved to container-based environments. Anecdotal data also tells us that this migration trend is far from over.</li> <li>Teams using Java need to pay special attention to some aspects of container-based deployments and adopt a couple of best practices.</li> </ul>  | 4 tips for achieving<br>Kubernetes<br>Use OpenVINO to<br>text<br>Kubernetes securit<br>developers up at n | convert speech to<br>ty risks that keep<br>hight<br>hslate physical |

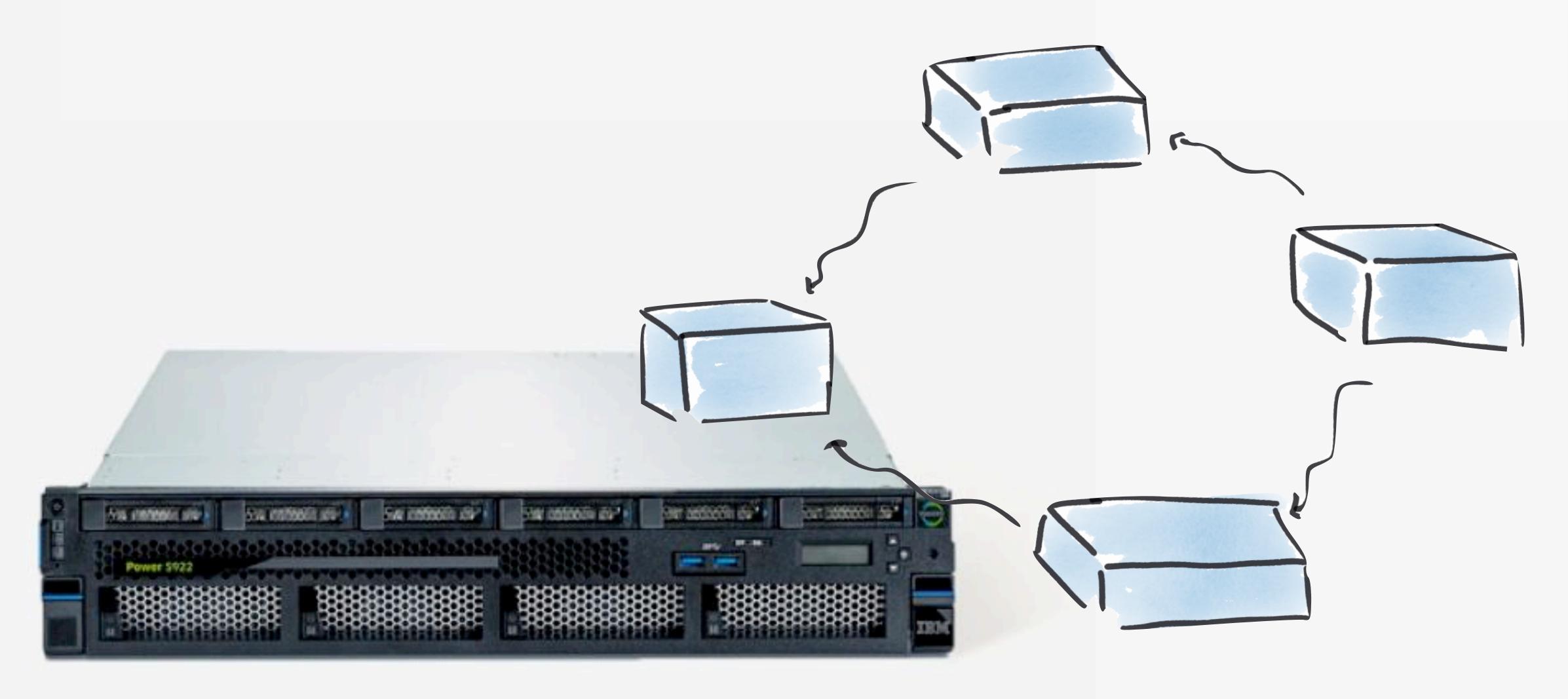






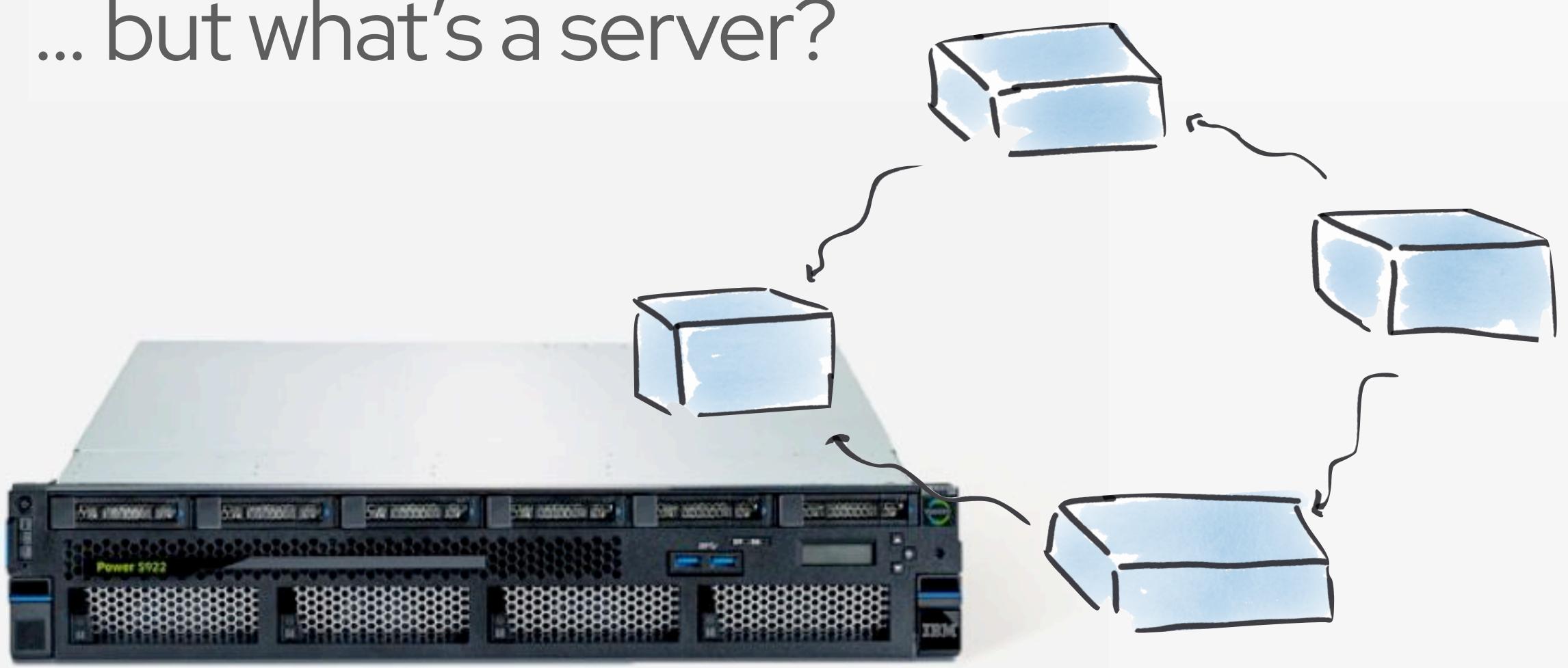


### the JVM tunes itself differently on servers





## the JVM tunes itself differently on servers ... but what's a server?





# answer(ish):





# answer(ish):

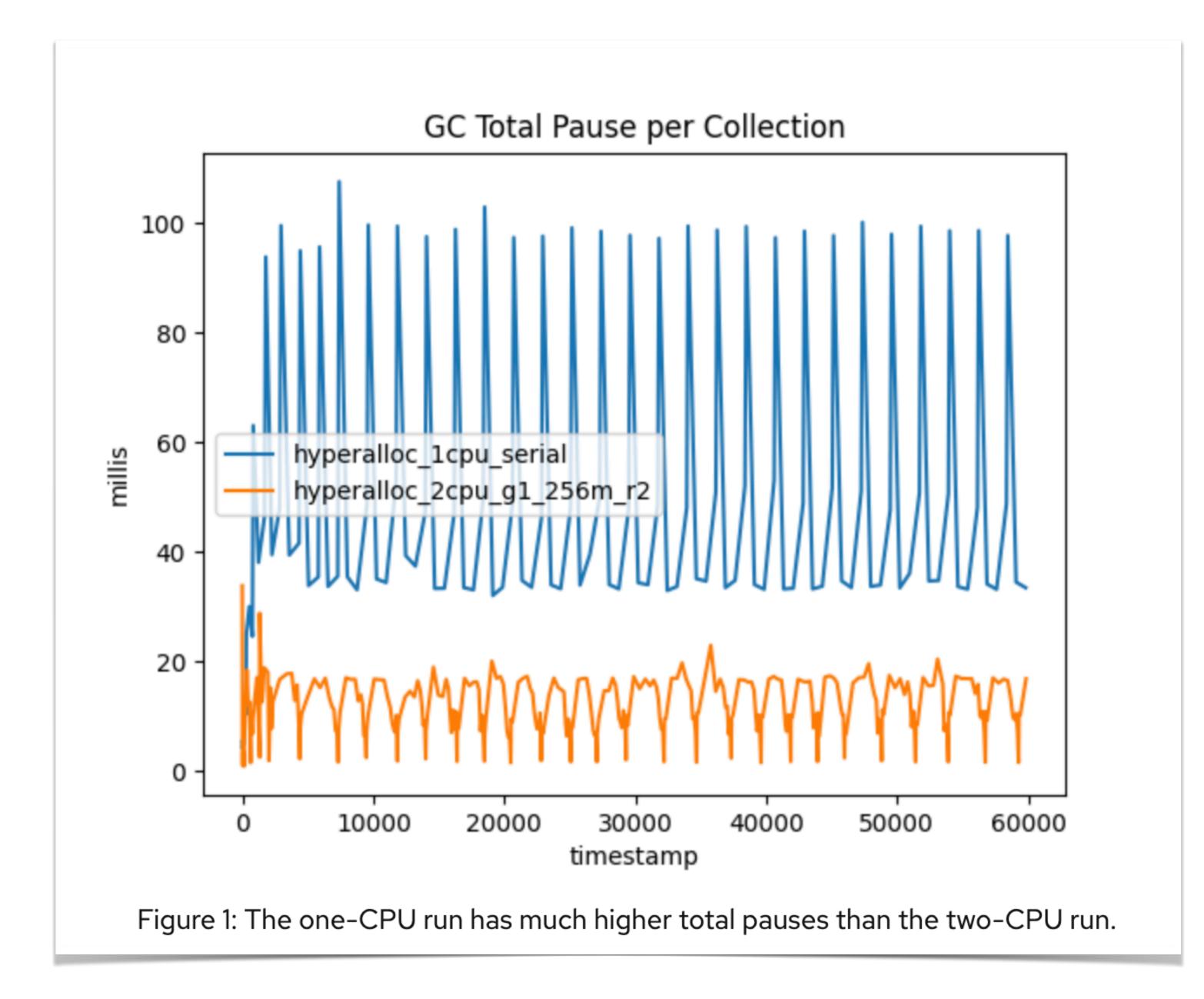
#### // This is the working definition of a server class machine: // >= 2 physical CPU's and >=2GB of memory









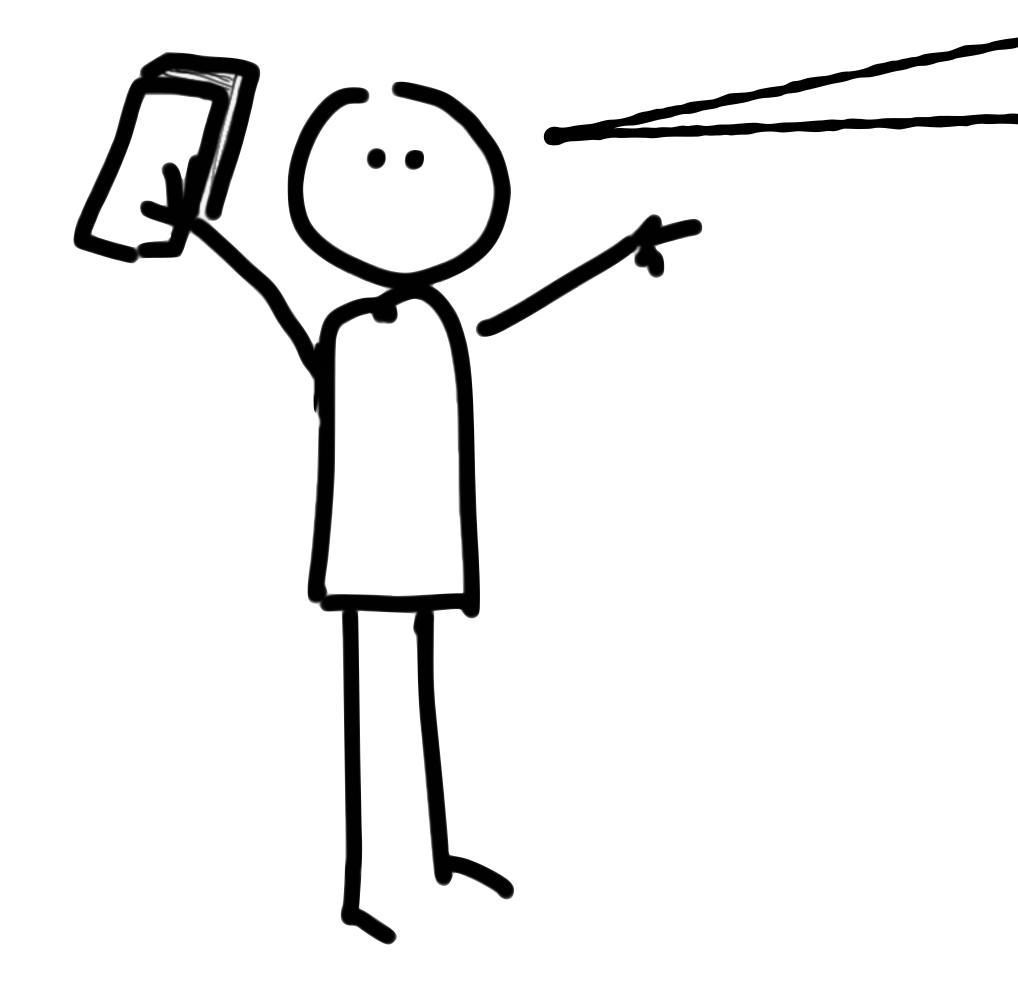




## takeaway: don't shrink your containers too much or your JVM will make bad decisions

advice accurate as of June 2022. all performance advice should be independently verified. do not try this at home without testing first. your mileage may vary.

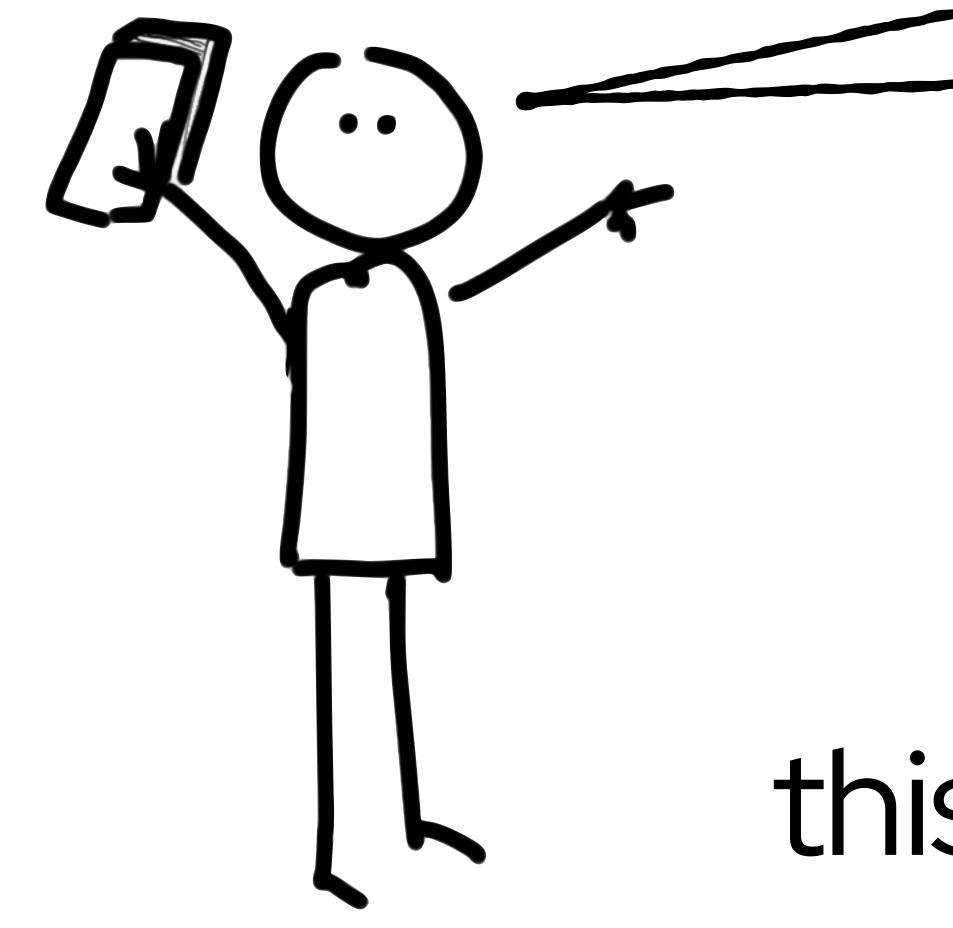




@holly\_cummins

wait, isn't that the opposite of the advice in the previous section? should my containers be big or small?



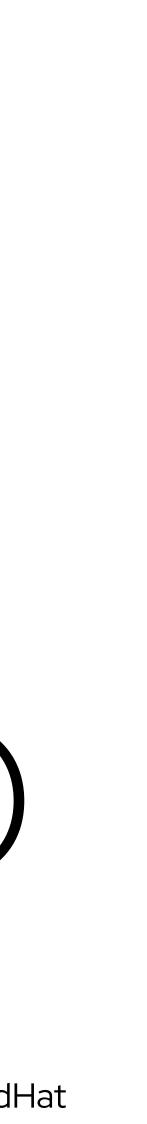


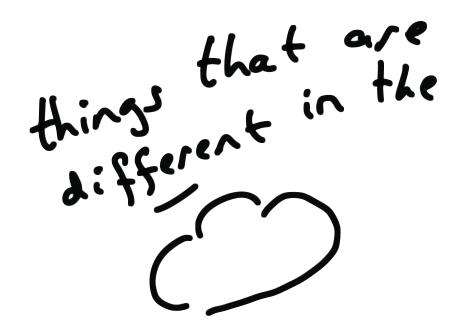
@holly\_cummins

wait, isn't that the opposite of the advice in the previous section? should my containers be big or small?

### this is the chaos part :)

#RedHat

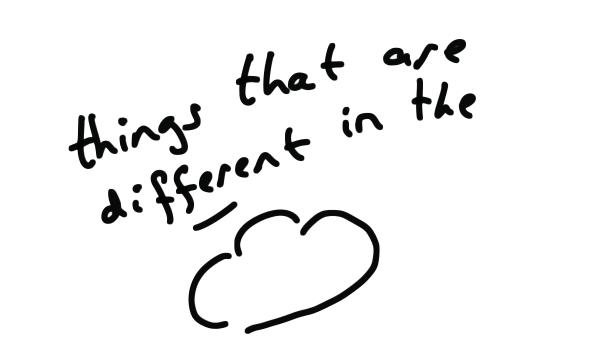




## management

@holly\_cummins

#IBMGarage + IBM Cloud © 2020 IBM Corporation



# keeping track of hardware

@holly\_cummins

#IBMGarage + IBM Cloud © 2020 IBM Corporation

# The cloud makes it **so** easy to provision hardware.



# That doesn't mean the hardware is free.



# That doesn't mean the hardware is free.



# That doesn't mean the hardware is free. Or useful.



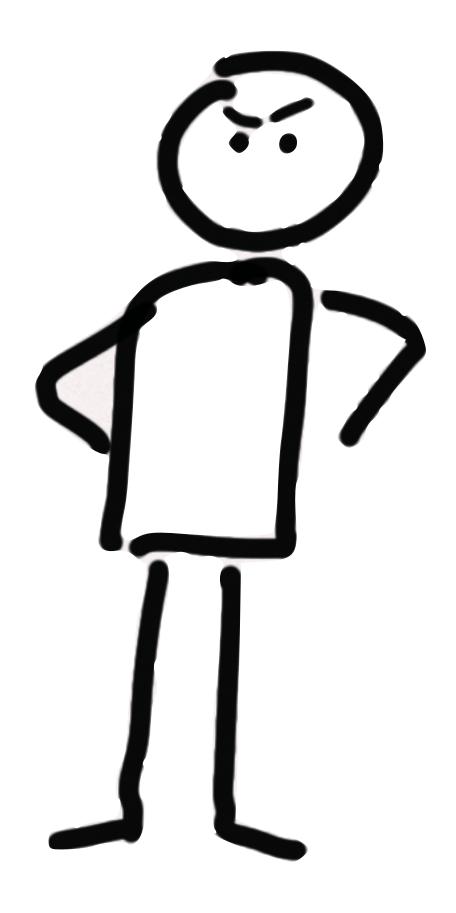
# That doesn't mean the hardware is free.

### Or useful. Or shuts itself off.



Hey boss, I created a Kubernetes cluster.

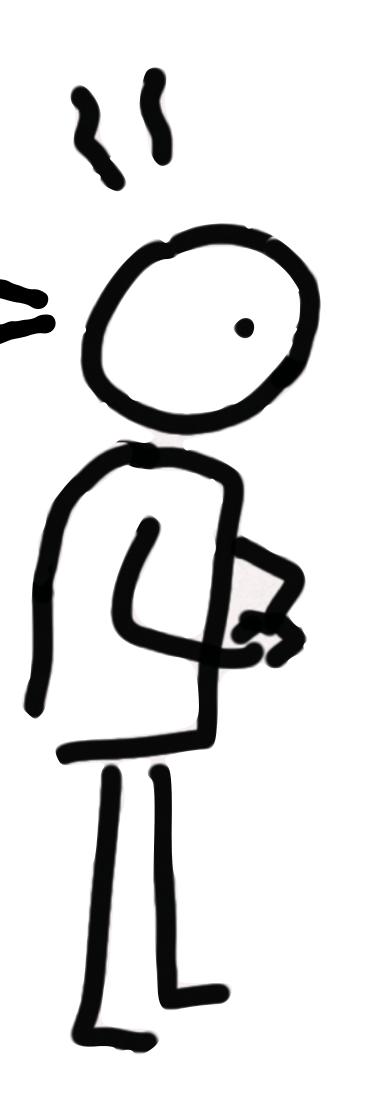


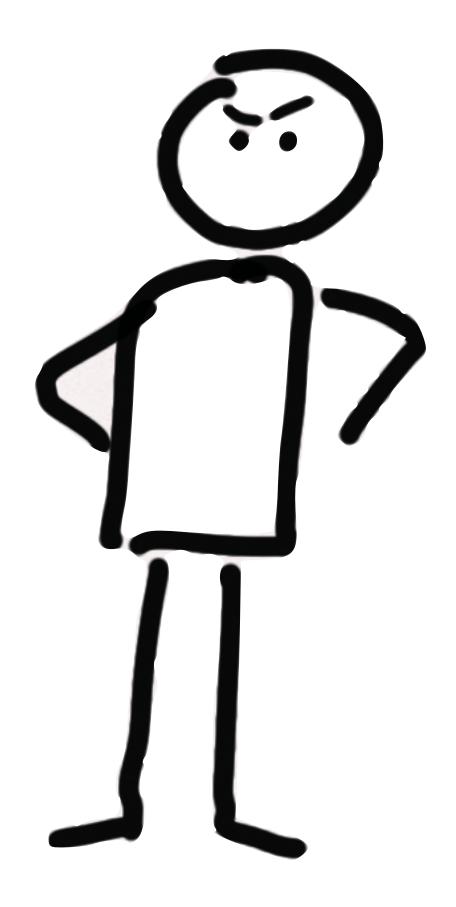




Hey boss, I created a Kubernetes cluster.

I forgot it for 2 months.





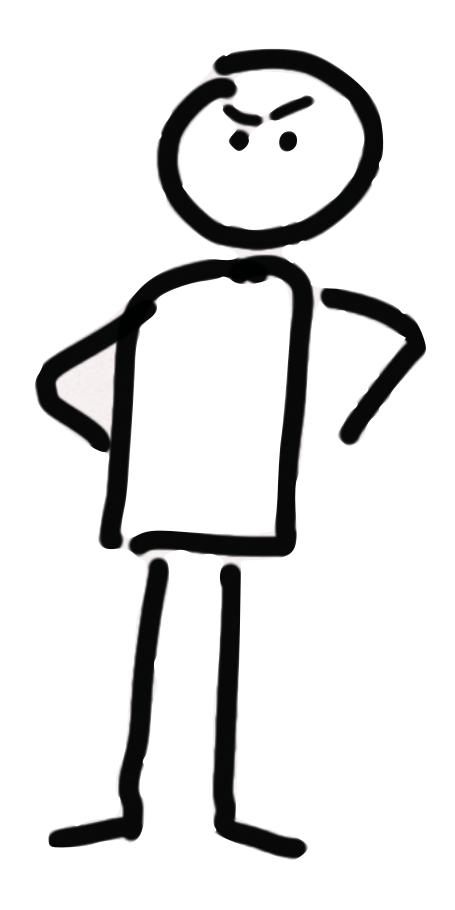


Hey boss, I created a Kubernetes cluster.

#### I forgot it for 2 months.

#### ... and it's €1000 a month.

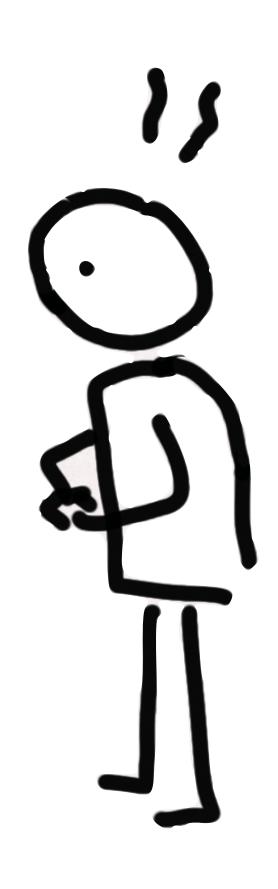




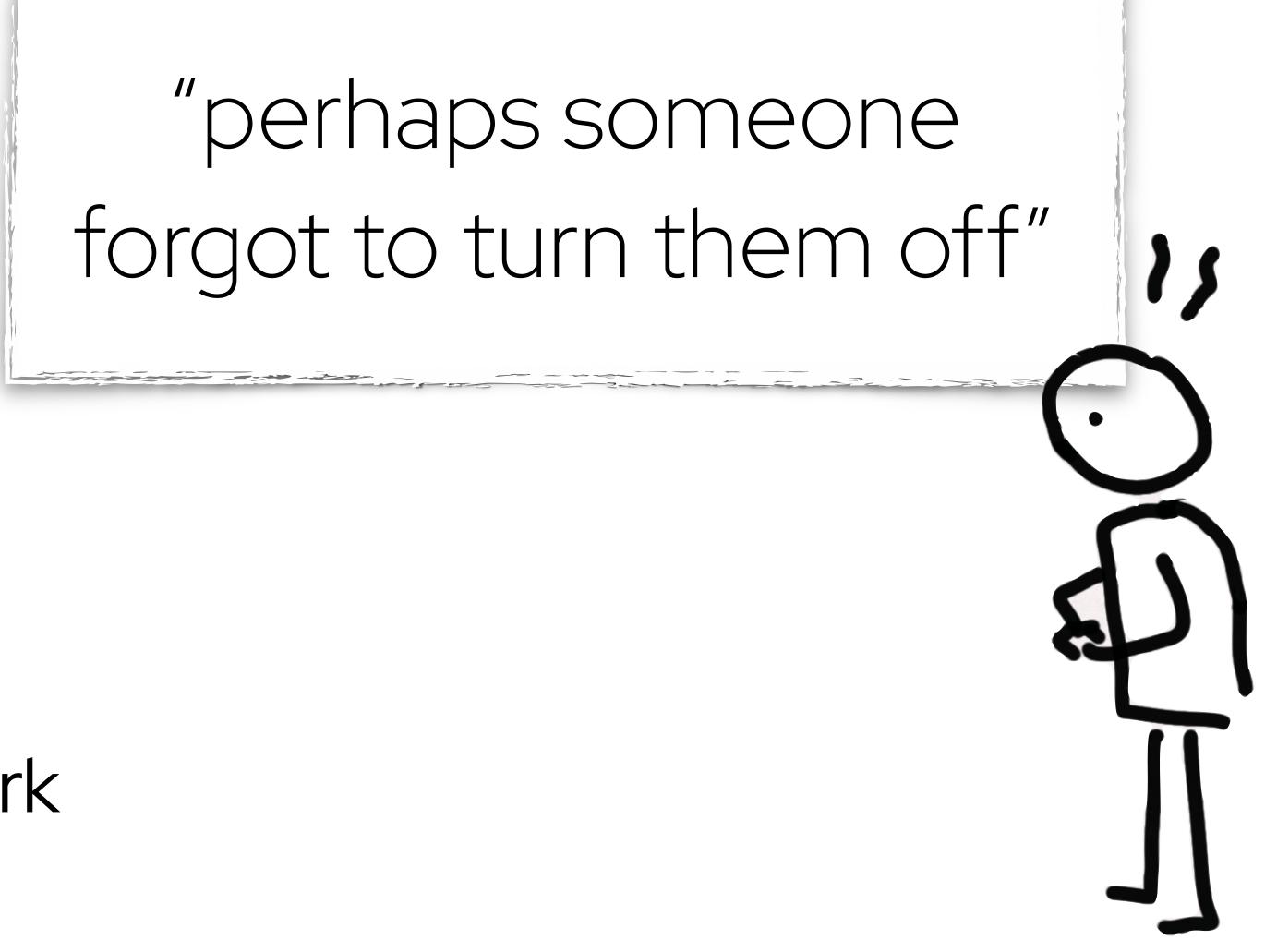




### 2017 survey 25%of 16,000 servers doing **no** useful work







#### 2017 survey

25%

### of 16,000 servers doing **no** useful work

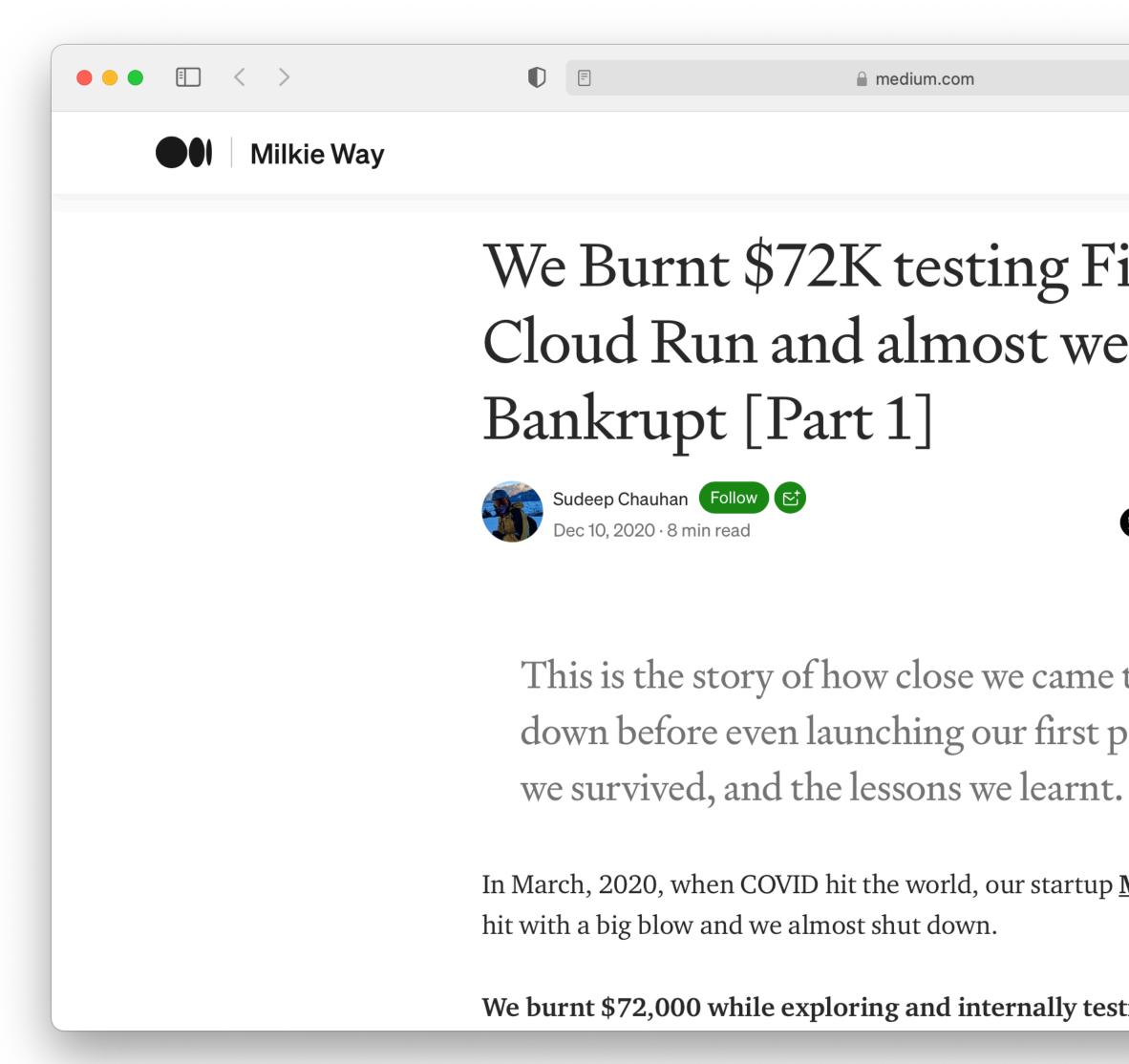


## finops figuring out who in your company forgot to turn off their cloud



# companies that went out of business for cloud cost accidents





@holly\_cummins

#RedHat

| a medium.com   | Ś       |       | ( <b>1</b> ) | Û + | - © |
|----------------|---------|-------|--------------|-----|-----|
|                |         | jî (j | Upgrade      |     |     |
| K testing Fire | ebase + |       |              |     |     |
| d almost wen   | t       |       |              |     |     |

This is the story of how close we came to shutting down before even launching our first product, how

In March, 2020, when COVID hit the world, our startup Milkie Way too was

We burnt \$72,000 while exploring and internally testing Cloud Run

#### (See Troy tomorrow at GOTO !)

|           | $\langle \rangle$      |                                       |  |  |  |
|-----------|------------------------|---------------------------------------|--|--|--|
|           | HOME WORKSHOPS         | SPEAKING MEDIA ABOU                   | JT CONTACT SPONSOR                                   |  |  |
| AU\$12K   | Sponsored by: Varonis. | Reduce your ransomware blast radius w | with the leader in data-first security. Try it free! |  |  |
| AU\$11.5K |                        |                                       |  |  |  |
| AU\$11K   |                        |                                       |  |  |  |
| AU\$10.5K |                        |                                       |  |  |  |
| AU\$10K   |                        |                                       |  |  |  |
| AU\$9.5K  |                        |                                       |  |  |  |
| AU\$9K    |                        |                                       |  |  |  |
| AU\$8.5K  |                        |                                       |  |  |  |
| AU\$8K    |                        |                                       |  |  |  |
| AU\$7.5K  |                        |                                       |  |  |  |
| AU\$7K    |                        |                                       |  |  |  |
| AU\$6.5K  |                        |                                       |  |  |  |
|           |                        |                                       |  |  |  |

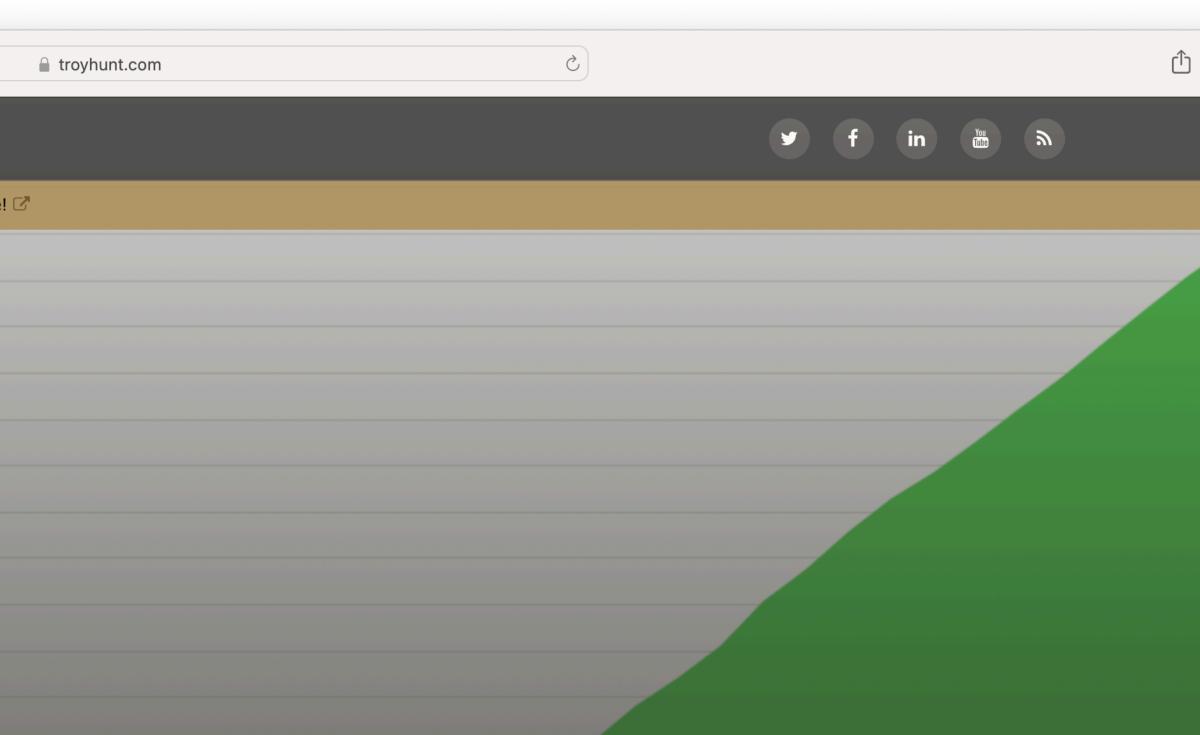
#### How I Got Pwned by My Cloud Costs



24 JANUARY 2022

I have been, and still remain, a massive proponent of "the cloud". I built <u>Have I Been Pwned</u> (HIBP) as a cloudfirst service that took advantage of modern cloud paradigms such as Azure Table Storage to massively drive down costs at crazy levels of performance I never could have achieved before. I wrote many blog posts about

@holly\_cummins



#### Troy Hunt

Hi, I'm Troy Hunt, I write this blog, run "Have I Been Pwned" and am a Microsoft Regional Director and MVP who travels the world speaking at events and training technology professionals  $\rightarrow$ 

Upcomina Ev

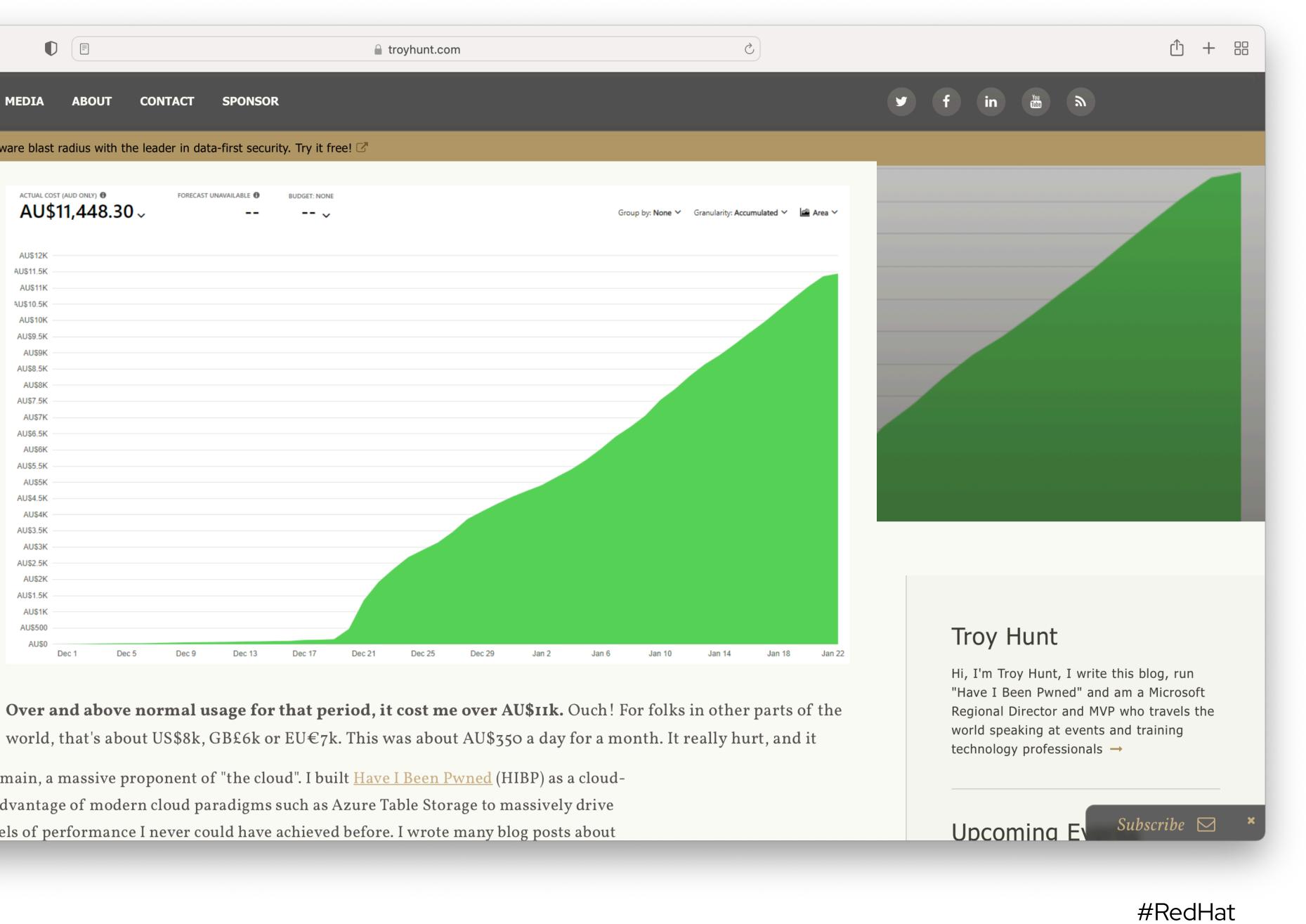
Subscribe 🖂



#### (See Troy tomorrow at GOTO !)

| ••• • <   | >        |                    |                  | D             | F                                |                 |               |                   |
|-----------|----------|--------------------|------------------|---------------|----------------------------------|-----------------|---------------|-------------------|
|           | HOME     | WORKSHOPS          | SPEAKING         | MEDIA         | ABOUT                            | CONTACT         | SPONSO        | R                 |
| AU\$12K   | Sponsore | ed by: Varonis. Re | duce your ranson | nware blast i | radius with th                   | ne leader in da | ta-first secu | rity. Try it free |
| AU\$11.5K |          |                    |                  |               |                                  |                 |               |                   |
| AU\$11K   |          |                    |                  |               | (aud only) <b>®</b><br>11,448.30 |                 | TUNAVAILABLE  | BUDGET: NONE      |
| AU\$10.5K |          |                    |                  | ΑUφ           | 11,440.50                        | <b>,</b>        |               | ~                 |
| AU\$10K   |          |                    |                  | AU\$12K —     |                                  |                 |               |                   |
| AUTIN     |          |                    |                  | AU\$11.5K     |                                  |                 |               |                   |
| AU\$9.5K  |          |                    |                  | AU\$10.5K -   |                                  |                 |               |                   |
| AU\$9K    |          |                    |                  | AU\$10K       |                                  |                 |               |                   |
| A009K     |          |                    |                  | AU\$9.5K      |                                  |                 |               |                   |
| AU\$8.5K  |          |                    |                  | AU\$8.5K -    |                                  |                 |               |                   |
| AU\$8K    |          |                    |                  | AU\$8K        |                                  |                 |               |                   |
| AUSOK     |          |                    |                  | AU\$7.5K      |                                  |                 |               |                   |
| AU\$7.5K  |          |                    |                  | AU\$6.5K      |                                  |                 |               |                   |
| A11071/   |          |                    |                  | AU\$6K —      |                                  |                 |               |                   |
| AU\$7K    |          |                    |                  | AU\$5.5K      |                                  |                 |               |                   |
| AU\$6.5K  |          |                    |                  | AU\$5K        |                                  |                 |               |                   |
|           |          |                    |                  | AU\$4K —      |                                  |                 |               |                   |
|           |          |                    |                  | AU\$3.5K -    |                                  |                 |               |                   |
|           |          |                    |                  | AU\$3K        |                                  |                 |               |                   |
|           |          |                    | * *              | AU\$2K —      |                                  |                 |               |                   |
|           |          |                    | Ho               | AU\$1.5K      |                                  |                 |               |                   |
|           |          |                    |                  | AU\$1K        |                                  |                 |               |                   |
|           |          |                    |                  | AU\$0         | Dead Dea                         |                 | Dec 42        | Dec 47            |

I have been, and still remain, a massive proponent of "the cloud". I built <u>Have I Been Pwned</u> (HIBP) as a cloudfirst service that took advantage of modern cloud paradigms such as Azure Table Storage to massively drive down costs at crazy levels of performance I never could have achieved before. I wrote many blog posts about

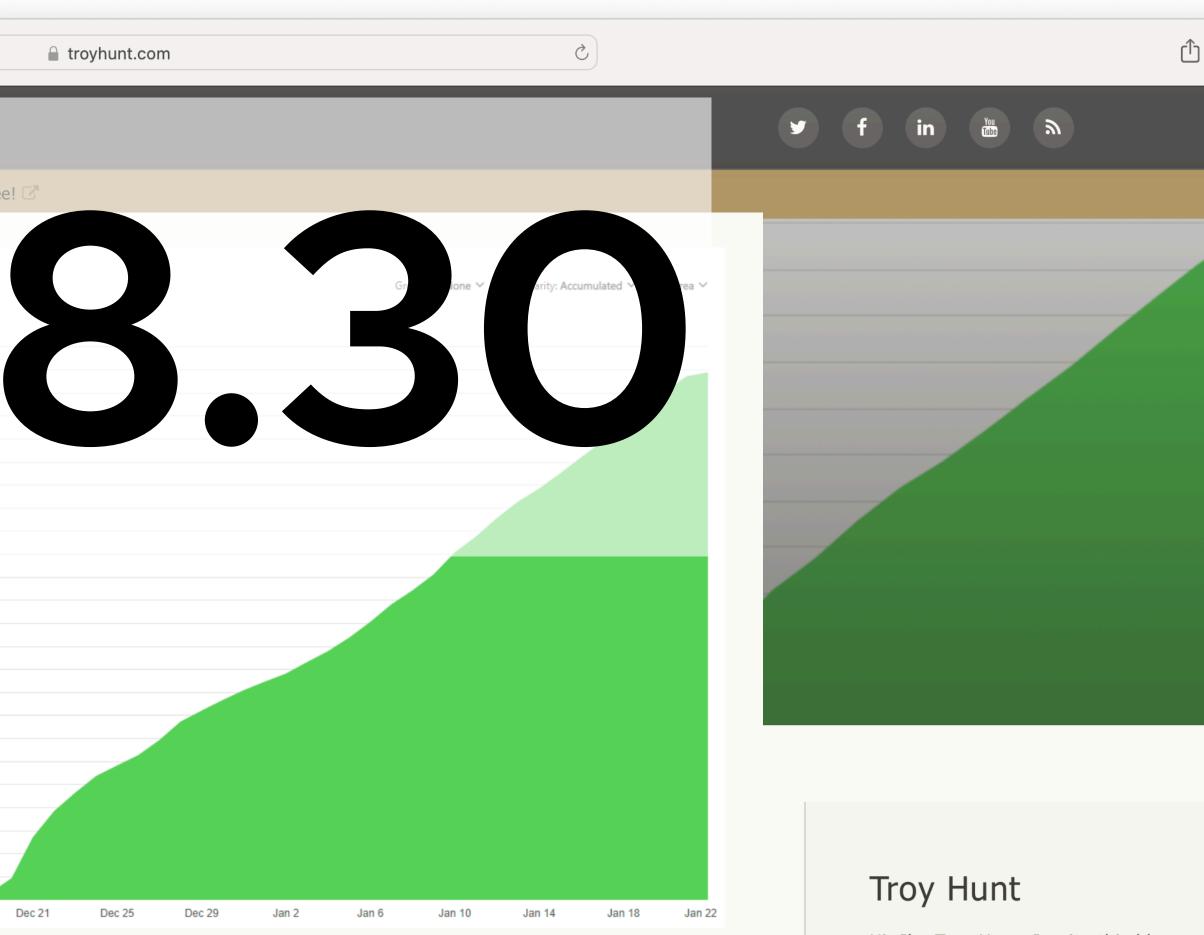


#### (See Troy tomorrow at GOTO !)

|          | < >     |                             |                  | D           | I.            |                 |                |             |
|----------|---------|-----------------------------|------------------|-------------|---------------|-----------------|----------------|-------------|
|          | HOME    | WORKSHOPS                   | SPEAKING         | MEDIA       | ABOUT         | CONTACT         | SPONSOF        | Ł           |
| AU\$12K  | Sponsor | r <b>ed by:</b> Varonis. Re | educe your ranso | nware blast | radius with t | he leader in da | ta-first secur | ity. Try it |
| U\$11.5K |         |                             |                  |             |               |                 |                |             |
| AU\$11K  |         |                             |                  | ACTUAL COST |               | FORECAS         | r UNAVAILA     | ET: NO      |
|          |         |                             |                  | AU\$        | .3            |                 |                | - 、         |
| U\$10.5K |         |                             |                  |             |               |                 |                |             |
| AU\$10K  |         |                             |                  | AUS         |               |                 |                |             |
| AU\$9.5K |         |                             |                  | AU\$11K     |               |                 |                |             |
|          |         |                             |                  | AU\$10.5K   |               |                 |                |             |
| AU\$9K   |         |                             |                  | AU\$9.5K -  |               |                 |                |             |
| AU\$8.5K |         |                             |                  | AU\$9K      |               |                 |                |             |
| AU\$8K   |         |                             |                  | AU\$8K —    |               |                 |                |             |
| AUSON    |         |                             |                  | AU\$7.5K    |               |                 |                |             |
| AU\$7.5K |         |                             |                  | AU\$6.5K    |               |                 |                |             |
| AU\$7K   |         |                             |                  | AU\$6K      |               |                 |                |             |
|          |         |                             |                  | AU\$5K -    |               |                 |                |             |
| AU\$6.5K |         |                             |                  | AU\$4.5K    |               |                 |                |             |
|          |         |                             |                  | AU\$4K      |               |                 |                |             |
|          |         |                             |                  | AU\$3K —    |               |                 |                |             |
|          |         |                             |                  | AU\$2.5K    |               |                 |                |             |
|          |         |                             | Ho               | AU\$1.5K —  |               |                 |                |             |
|          |         |                             | 110              | AU\$1K      |               |                 |                |             |
|          |         |                             |                  | AU\$0       |               |                 | Dec 13         |             |

I have been, and still remain, a massive proponent of "the cloud". I built <u>Have I Been Pwned</u> (HIBP) as a cloudfirst service that took advantage of modern cloud paradigms such as Azure Table Storage to massively drive down costs at crazy levels of performance I never could have achieved before. I wrote many blog posts about

#### @holly\_cummins



**Over and above normal usage for that period, it cost me over AU\$11k.** Ouch! For folks in other parts of the world, that's about US\$8k, GB£6k or EU€7k. This was about AU\$350 a day for a month. It really hurt, and it

Hi, I'm Troy Hunt, I write this blog, run "Have I Been Pwned" and am a Microsoft Regional Director and MVP who travels the world speaking at events and training technology professionals  $\rightarrow$ 

Upcomina Ev

Subscribe 🖂

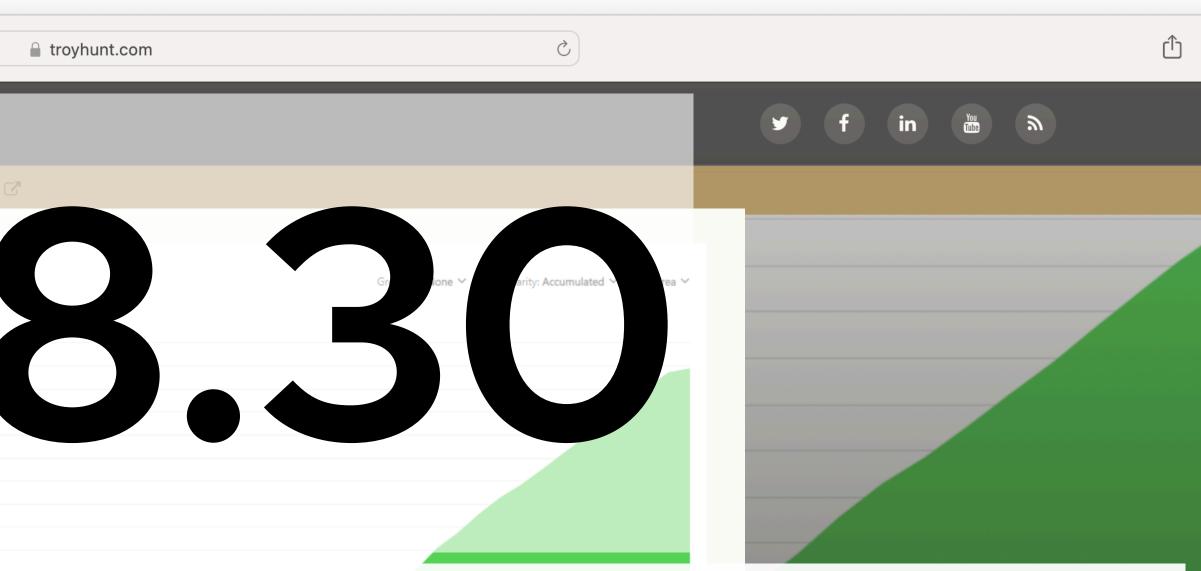


#### (See Troy tomorrow at GOTO !)

|           | < >                      |                   |                                  |   |
|-----------|--------------------------|-------------------|----------------------------------|---|
|           | HOME WORKSHOPS           | SPEAKING          | MEDIA ABOUT CON                  | TACT SPONSOR                            |
| AU\$12K   | Sponsored by: Varonis. F | Reduce your ranso | mware blast radius with the lead | er in data-first security. Try it free! |
| AU\$11.5K |                          |                   |                                  |   |
| AU\$11K   |                          |                   | ACTUAL COST (AUD OF              | FORECAST UNAVAILA                       |
| U\$10.5K  |                          |                   |                                  |   |
| AU\$10K   |                          |                   | AUS                              |   |
| AU\$9.5K  |                          |                   | AU\$11KAU\$10.5K                 |   |
| AU\$9K    |                          | _                 | AU\$10KAU\$9.5K                  |   |
| AU\$8.5K  |                          |                   | AU\$9K<br>AU\$8.5K               |   |
| AU\$8K    |                          | _                 | AU\$8K                           |   |
| AU\$7.5K  |                          |                   | AU\$7K                           |   |
| AU\$7K    |                          |                   | AU\$6K                           |   |
| J\$6.5K   |                          |                   | AU\$5K                           |   |
|           |                          |                   | AU\$4K                           | set t                                   |
|           |                          |                   | AU\$3K                           |   |
|           |                          | Ho                | AU\$2K                           | 15GE                                    |
|           |                          | 110               | AU\$1K                           | IJGE                                    |
|           |                          |                   | AU\$0<br>Dec 1 Dec 5             | Dec 9 Dec 13 Dec 17 D                   |
|           |                          |                   |                                  | 18GE                                    |
|           |                          |                   | Over and above nor               |   |
|           |                          |                   | world, that's about US           | S\$8k, GB£6k or EU€7k. T                |
|           | I have be                | een, and still r  | emain, a massive propo           | nent of "the cloud". I built            |

Have I Been Pwned (HIBP) as a cloudfirst service that took advantage of modern cloud paradigms such as Azure Table Storage to massively drive down costs at crazy levels of performance I never could have achieved before. I wrote many blog posts about

@holly\_cummins



#### d find a setting on your plan that the max cacheable file size to B and it looks like your zipfile is

B big"

This was about AU\$350 a day for a month. It really hurt, and it

travels the world speaking at events and training technology professionals →

Upcomina Ev

Subscribe 🖂

#RedHat



@holly\_cummins

#RedHat

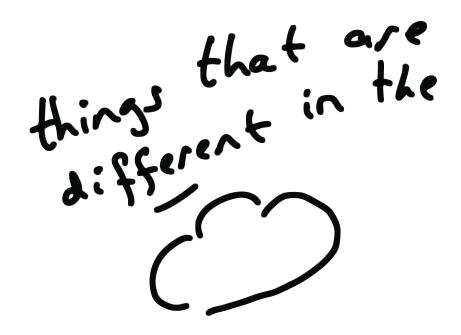




@holly\_cummins

### maybe this is the chaos part

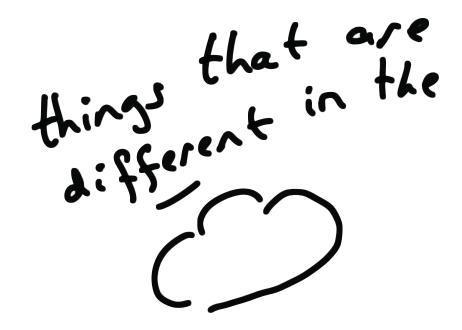




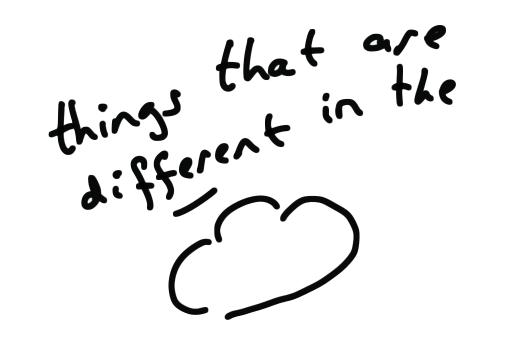
## releasing







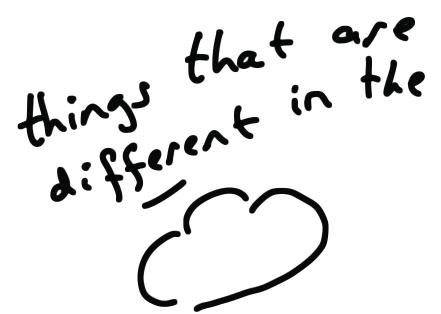
### releasing



#### microservices







#### microservices

@holly\_cummins

#### "we're moving too slowly.

@holly\_cummins

## "we're moving too slowly. we should modernise our COBOL application into microservices.

### "we're moving too slowly.

# we should modernise our COBOL application into microservices.

... but our release board only meets twice a year."

## modularity

@holly\_cummins

microservices are not the goal



# microservices are not the goal they are the means



@holly\_cummins

# wishful mimicry

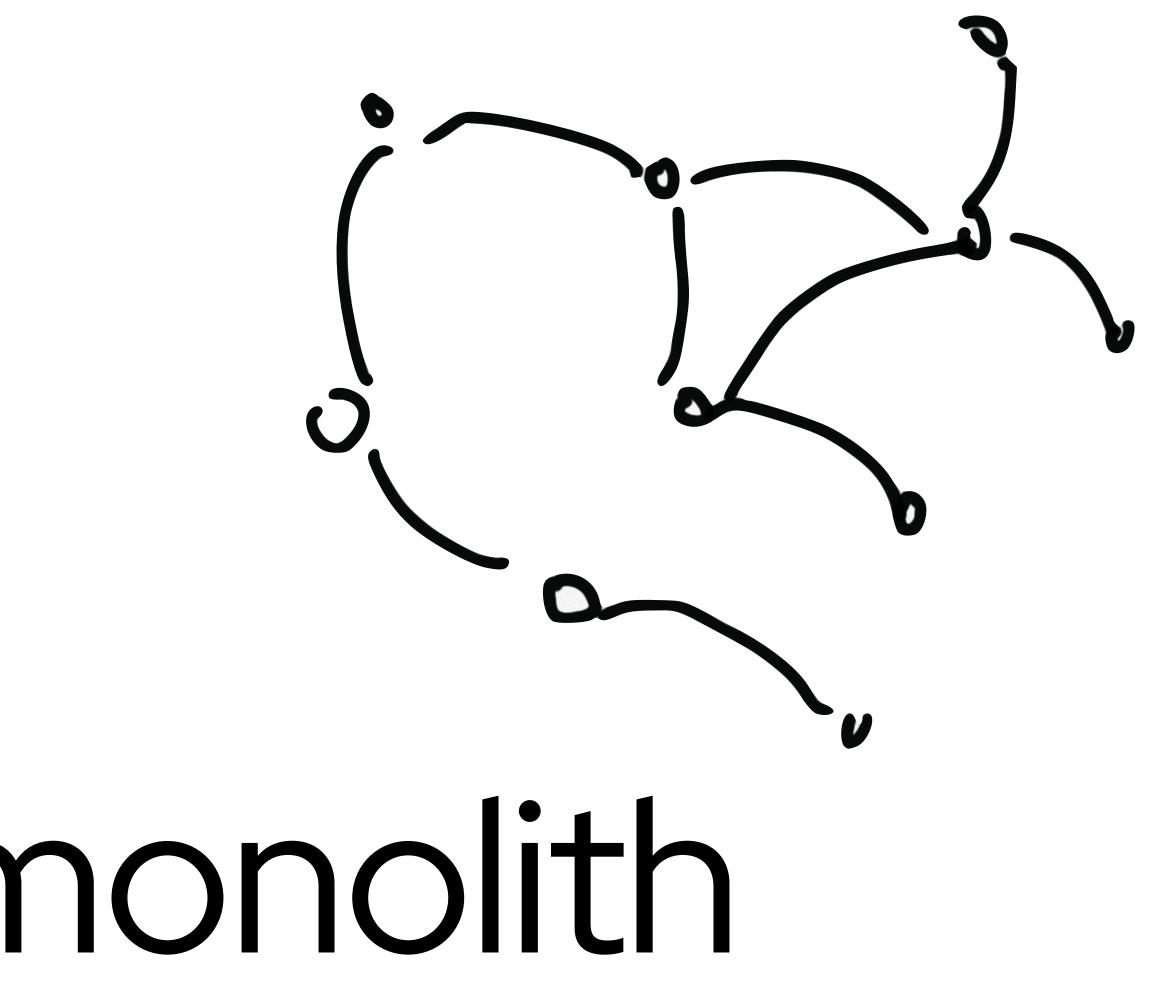
### cloud != microservices

@holly\_cummins

cloud native != microservices

### "every time we touch one microservice, all the others break."

# distributed monolith





#### distributed monolith but without compile-time checking ... or guaranteed function execution



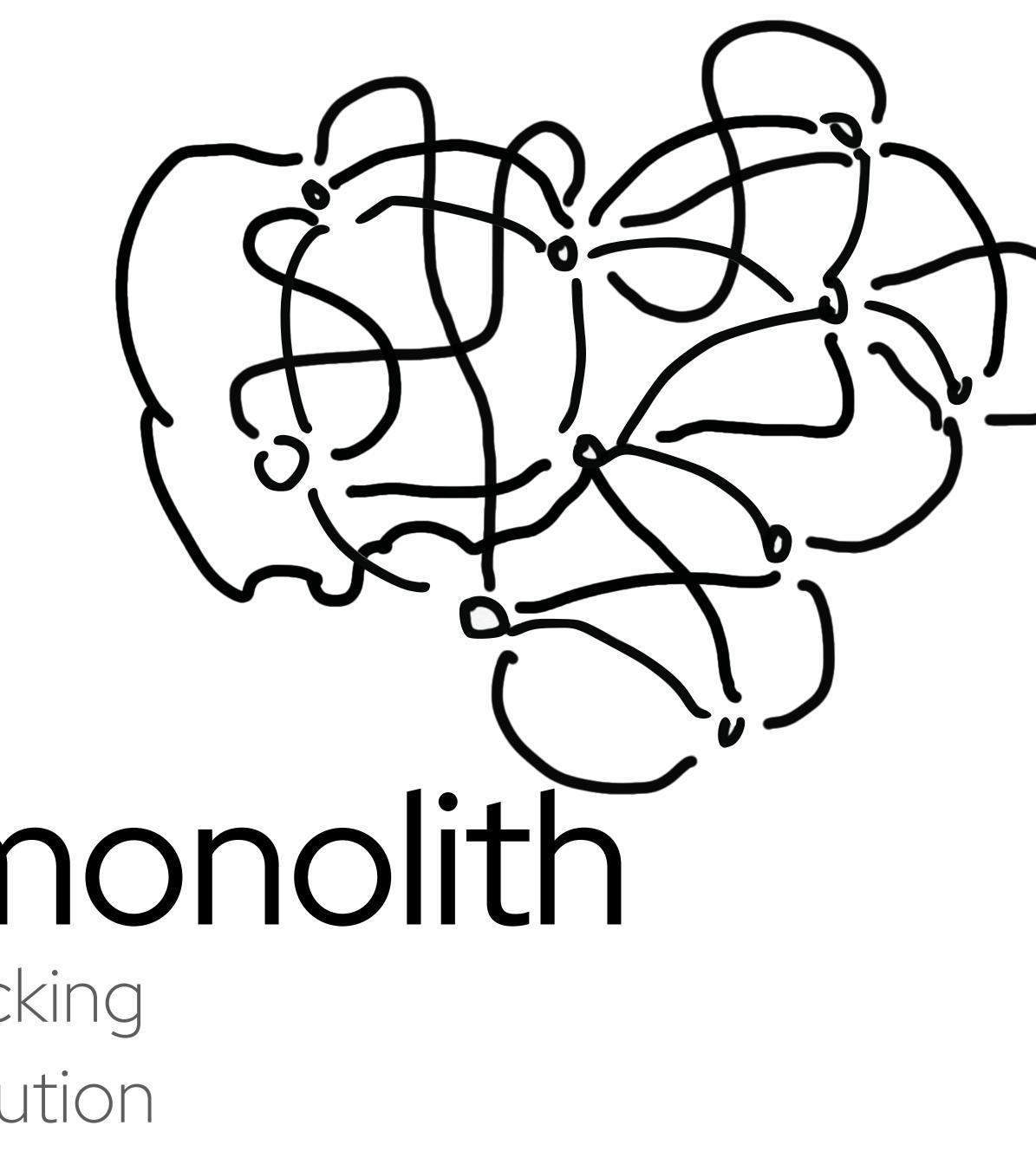


#### distributed monolith but without compile-time checking ... or guaranteed function execution





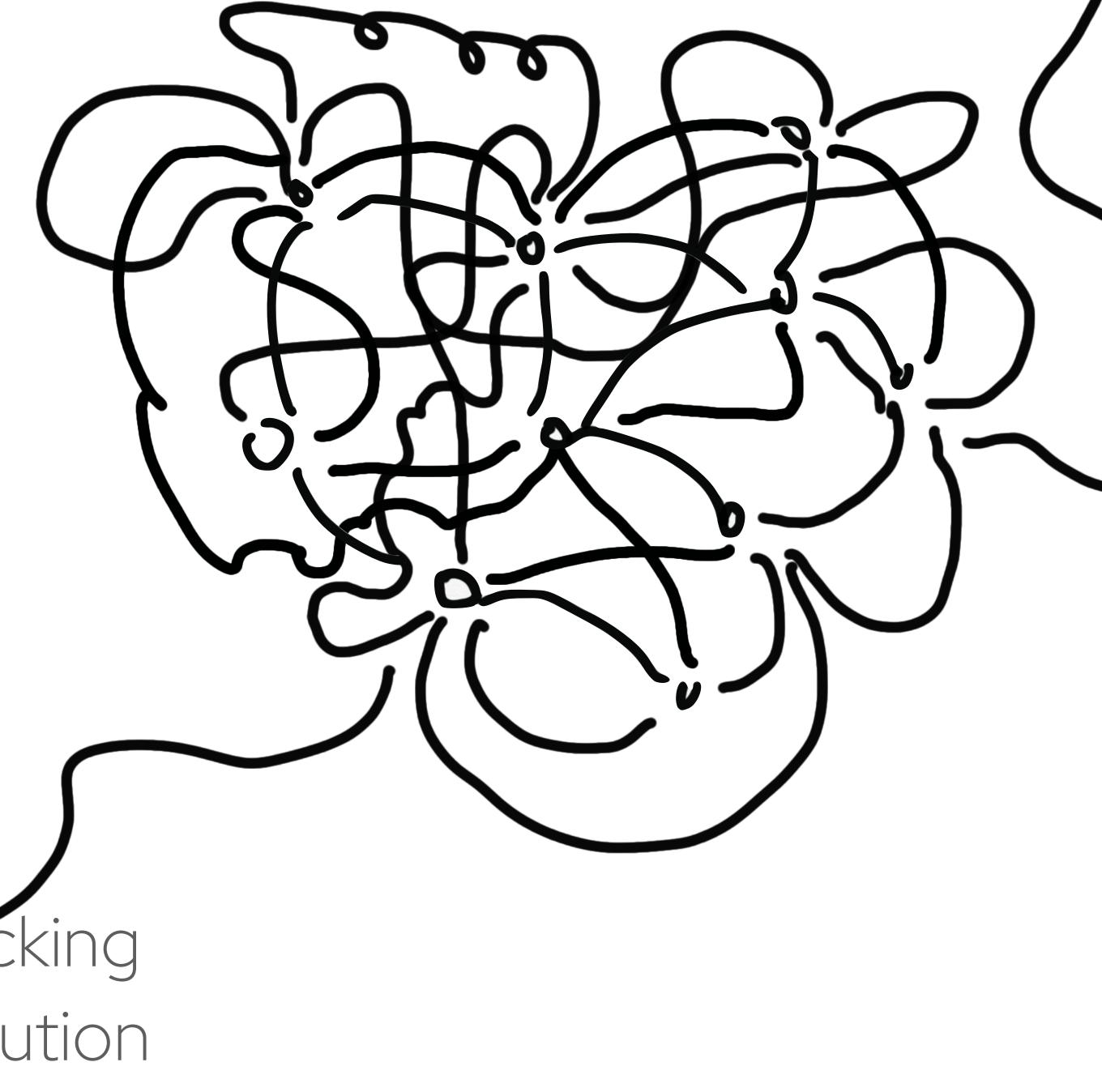
#### distributed monolith but without compile-time checking ... or guaranteed function execution







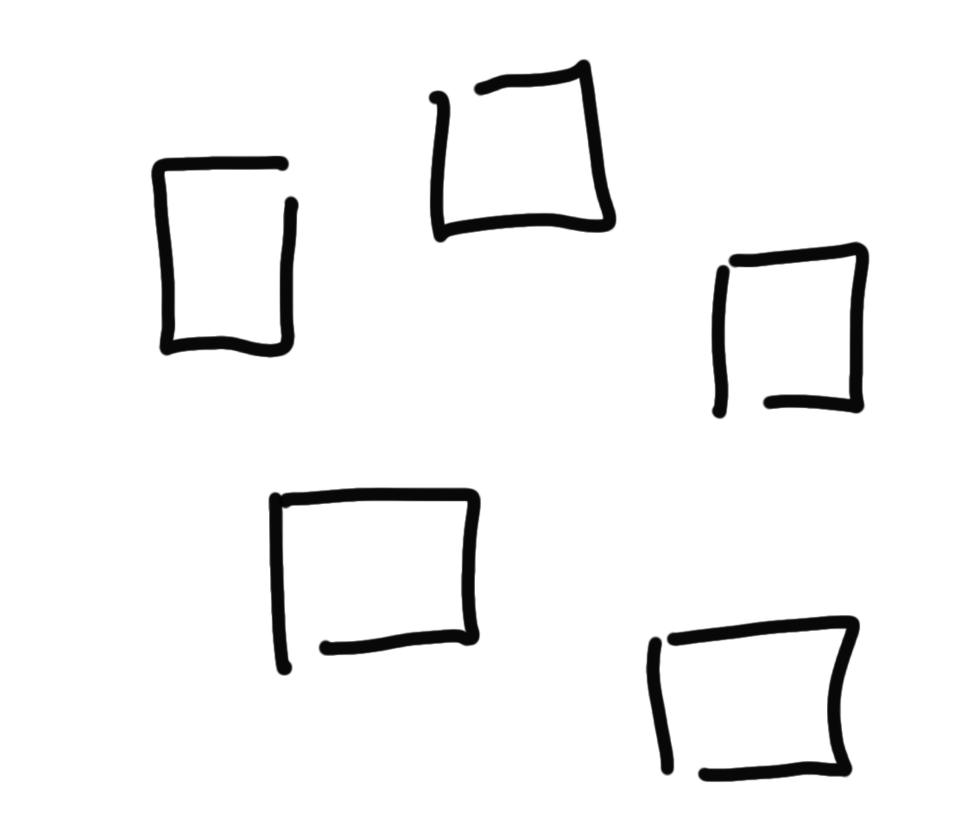
#### distributed monolith, but without compile-time checking ... or guaranteed function execution



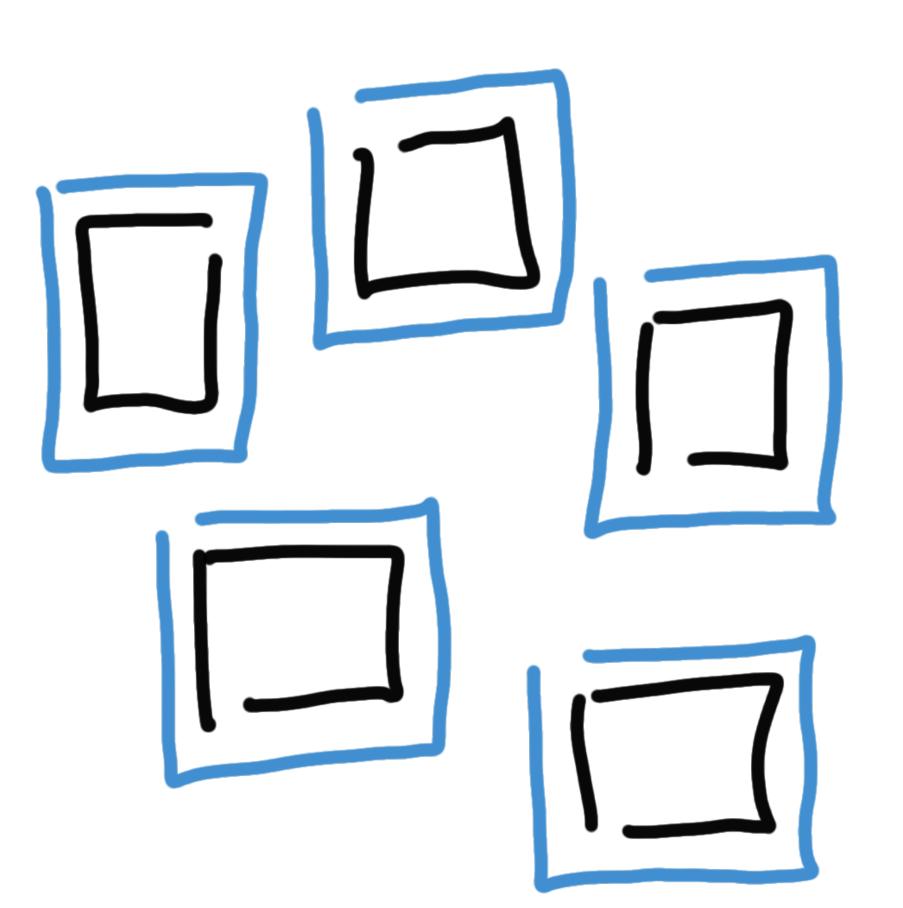
#### "each of our microservices has duplicated the same object model ... with twenty classes and seventy fields"







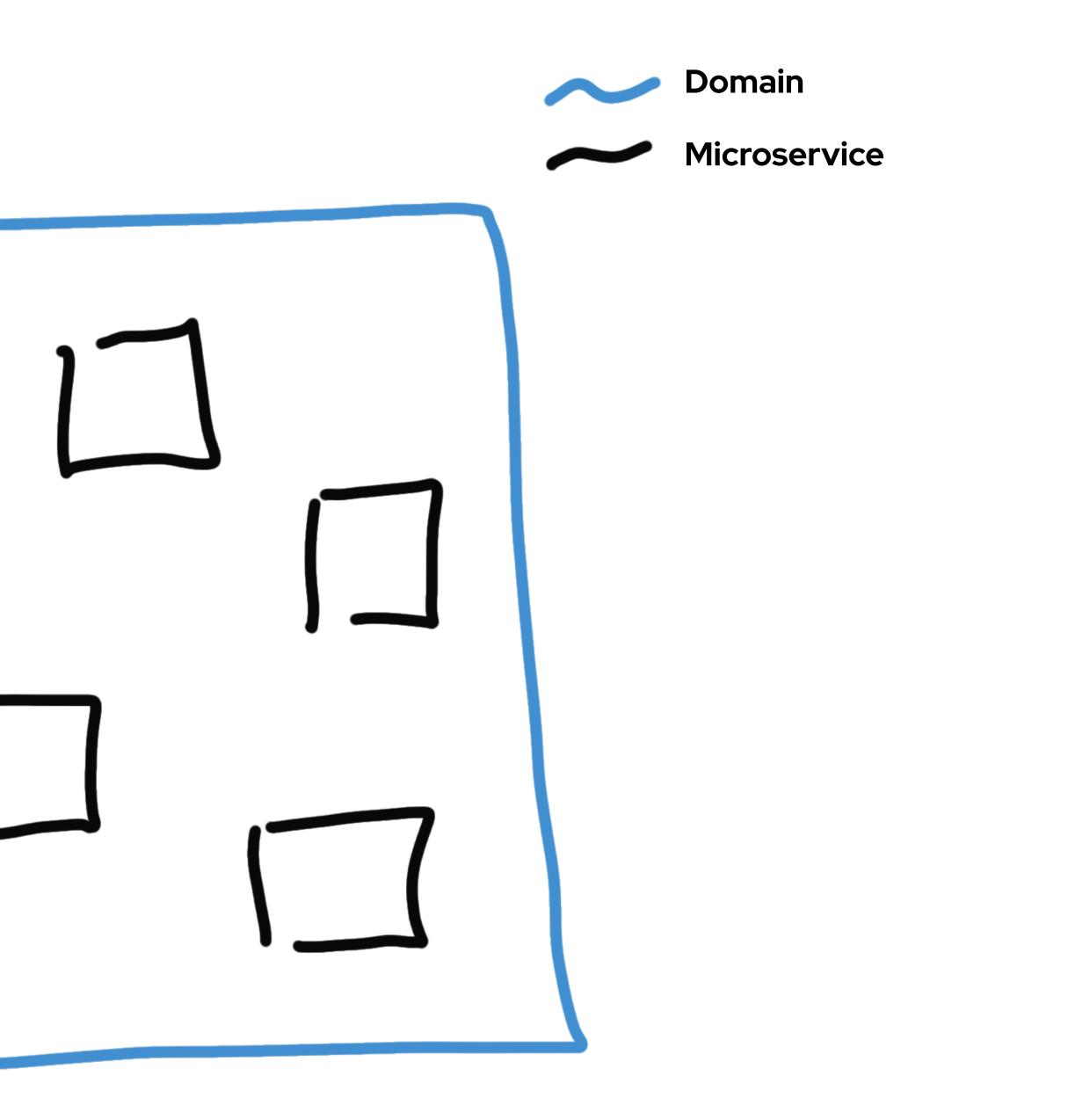








#### (this is bad)





# distributed != decoupled

#### "ohhhh, we weren't expecting your service to do **that** ... "

## "uh, what do you mean you corrected the typo in your json?"

@holly\_cummins

## If you're going to do microservices, you need to get good at automation.

# And testing.



# the test pyramid

6 Tomas

and Same

atisty which want

でのでも人に



# the test pyramid

6 Tomas

and Shares

atisty which want

#### end-to-end tests

LI THERE AND STREET AND I WERE



# the test pyramid

A Daves

#### end-to-end tests



# the test pyramid

#### end-to-end tests

#### contract tests



# the test pyramid

### (you can TDD) at every level!)

#### end-to-end tests

#### contract tests



### How to test a fire alarm?





# how not to test a fire alarm





## how not to test a fire alarm







# unit testing a fire alarm

### uh ... is that enough?





@holly\_cummins

### contract testing a fire alarm





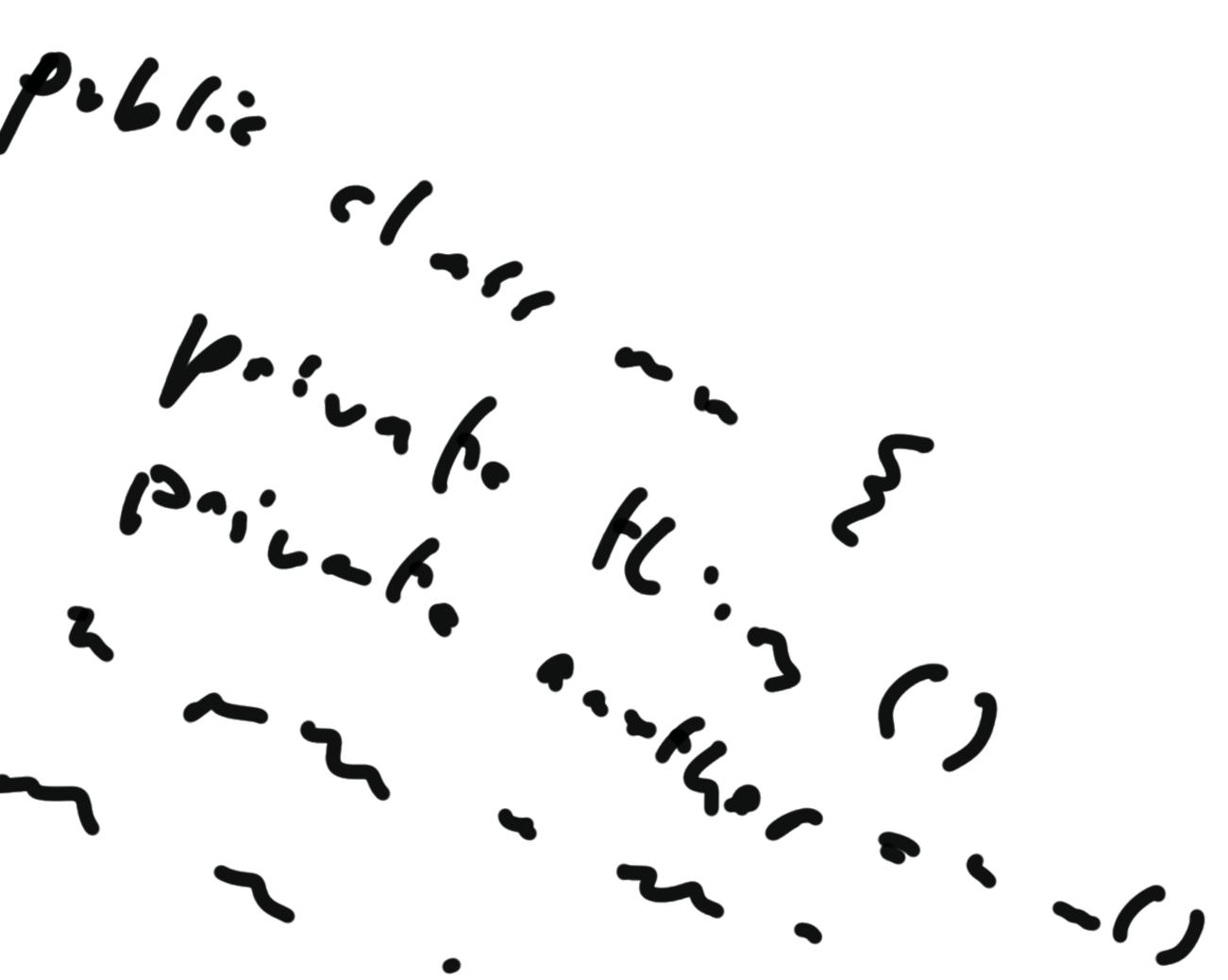
@holly\_cummins

### contract testing a fire alarm



### to the code!

@holly\_cummins



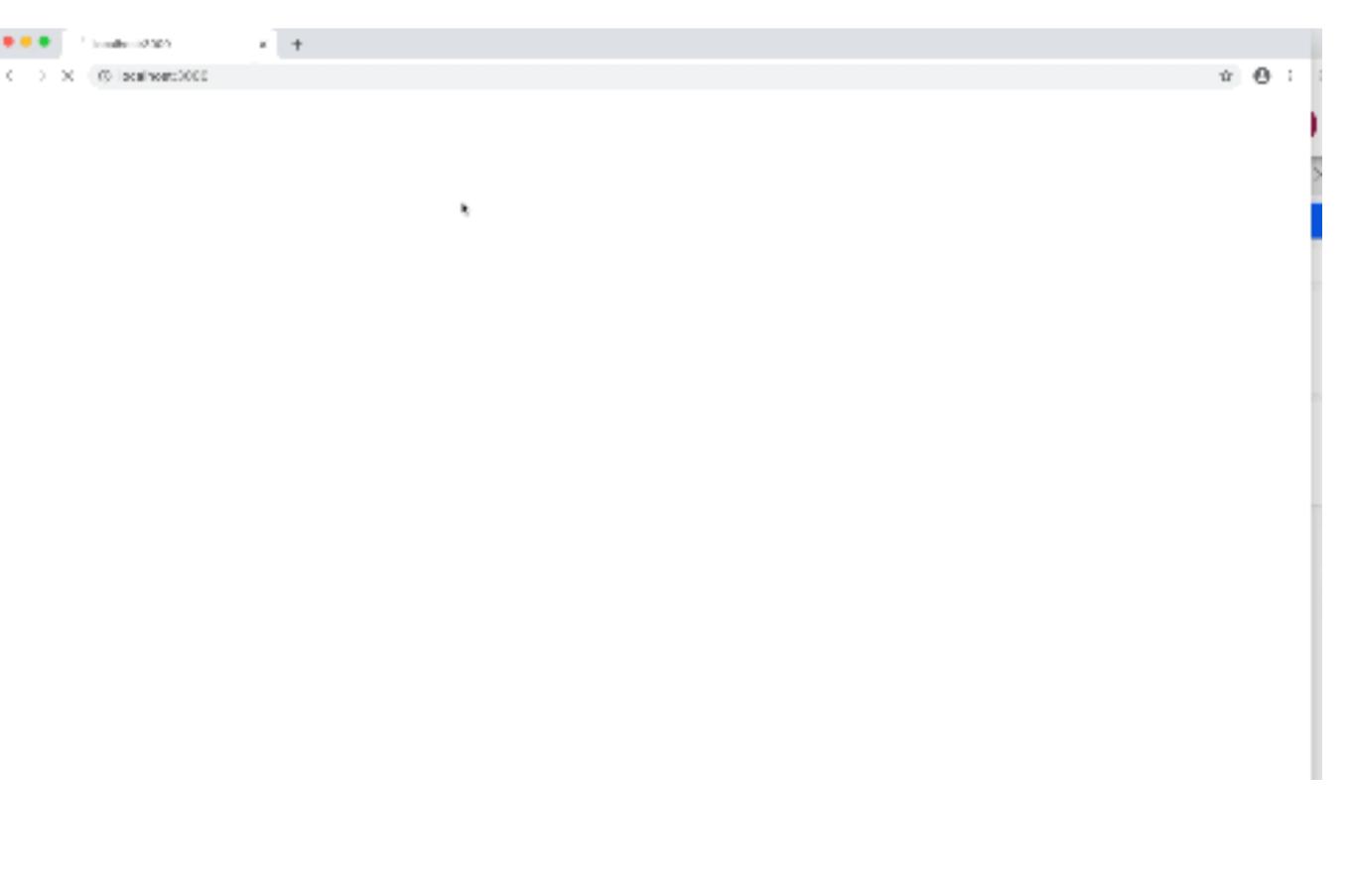
#IBMGarage + IBM Cloud © 2020 IBM Corporation







https://github.com/holly-cummins/house-of-microservices-quarkus-contract-testing-sample

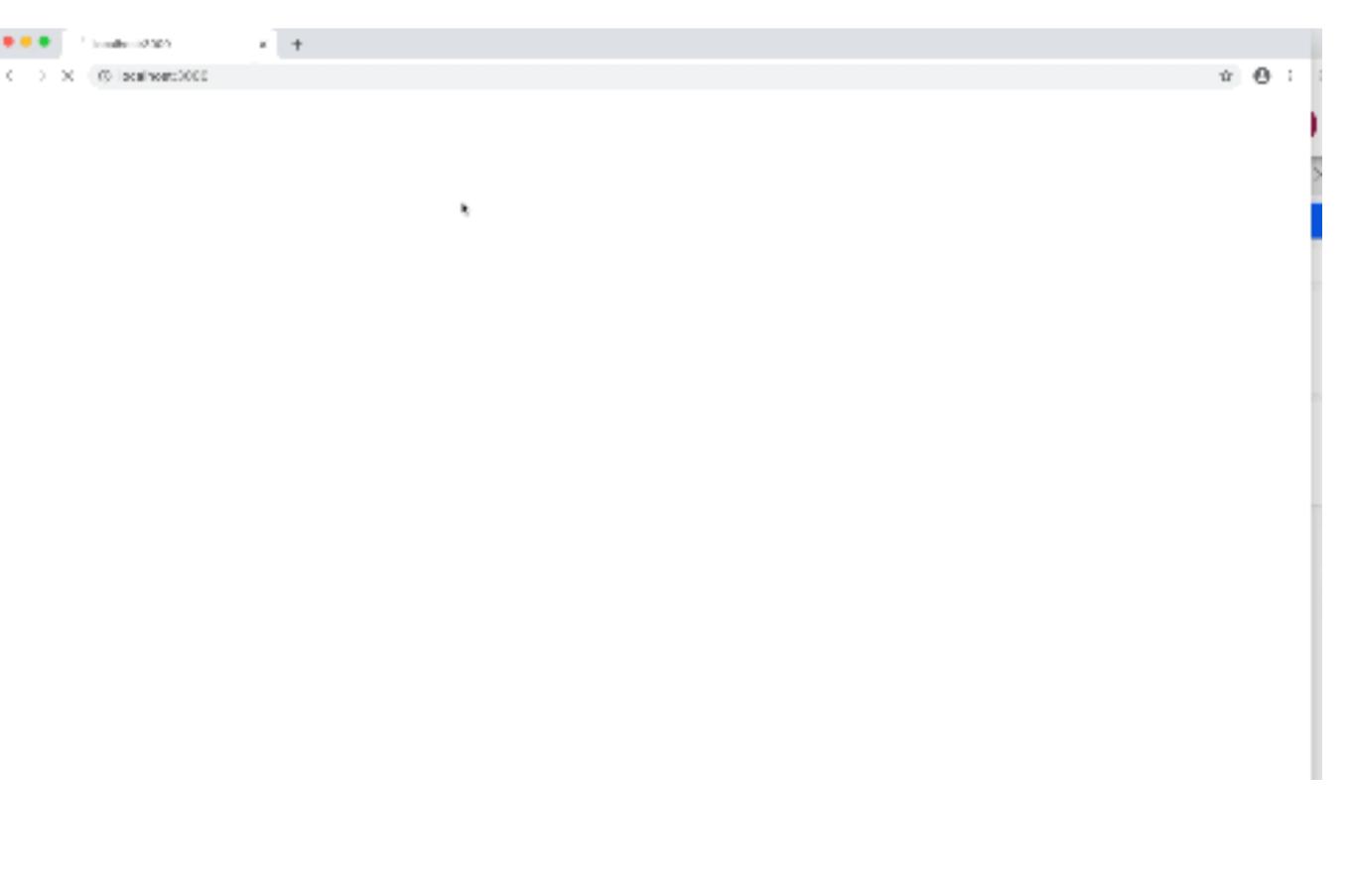








https://github.com/holly-cummins/house-of-microservices-quarkus-contract-testing-sample





#### demo recap:

- consumer-driven contract testing can save your bacon
- pact is a mock for the consumer
- pact is a functional test for the producer
- shared ison contracts aligns expectations across services

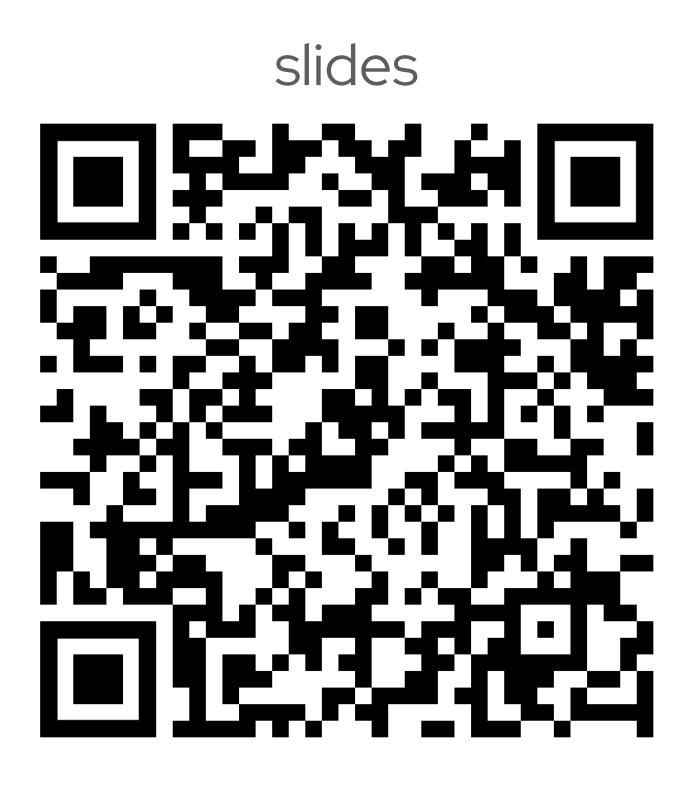


#### **SO** ...

### don't assume cloud is a solved problem don't assume microservices will solve all your problems contract testing may solve some of your problems









### thank you

# Don't forget to rate this session in the GOTO Guide app

slides





