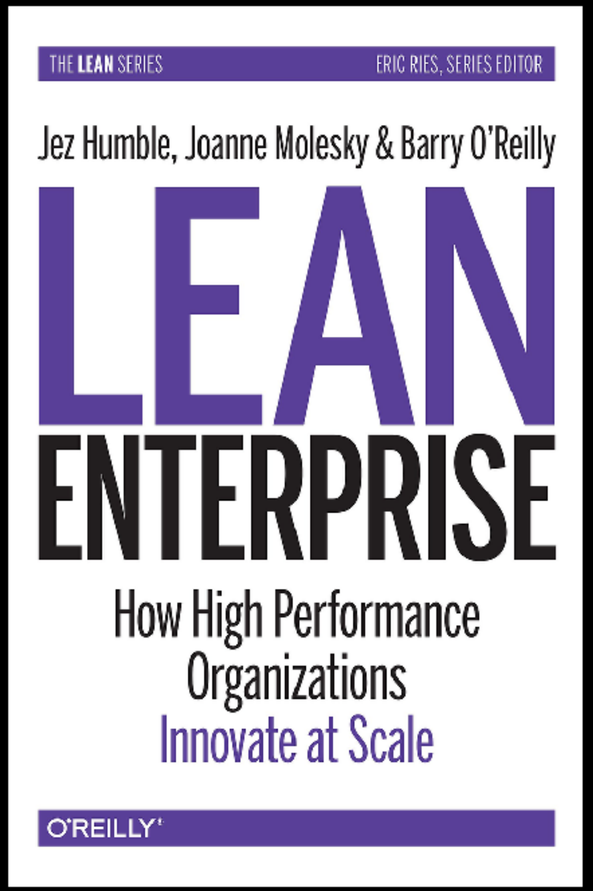


people, planet, clouds

Holly Cummins
IBM **Garage**
@holly_cummins


THE LEAN SERIES
ERIC RIES, SERIES EDITOR
Jez Humble, Joanne Molesky & Barry O'Reilly
LEAN ENTERPRISE
How High Performance Organizations Innovate at Scale
O'REILLY

Continuous integration is the practice of working in small batches and using automated tests to detect and reject changes that introduce a regression. It is, in our opinion, the most important technical practice in the agile canon, and it forms the foundation of continuous delivery, for which we require in addition that each change keeps the code on trunk releasable. However, that can be hard to adopt for teams that are not used to it.

In our experience, people tend to fall into two camps: those who can't understand how it is possible (particularly at scale) and those who can't believe people would work in any other way. We assure you that it is possible, both at small scale and large scale, whatever your domain.

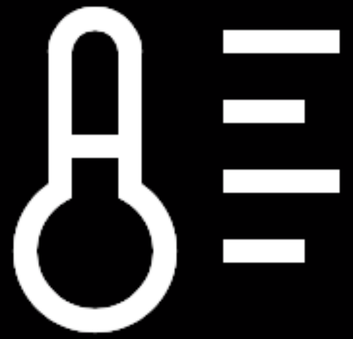
Let's first address the scale problem with two examples. First, the HP FutureSmart case study demonstrates continuous integration being effective with a distributed team of 400 people working on an embedded system. Second, we'll note that almost all of Google's 10,000+ developers distributed over 40 offices work off a single code tree. Everyone working off this tree develops and releases from trunk, and all builds are created from source. 20 to 60 code changes are submitted every minute, and 50% of the codebase changes every month.[9] Google engineers have built a powerful continuous integration system

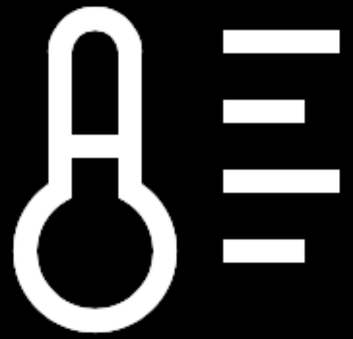
[9] http://bit.ly/1v70LcY

20 to 60 code changes are submitted every minute

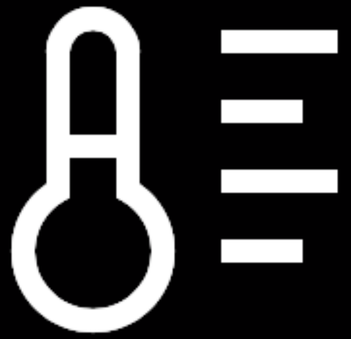
40,000 changes a day
that's a lot of builds

1 May 2019:
UK government declares a
climate emergency

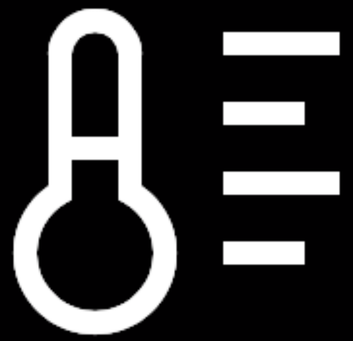




July 2019

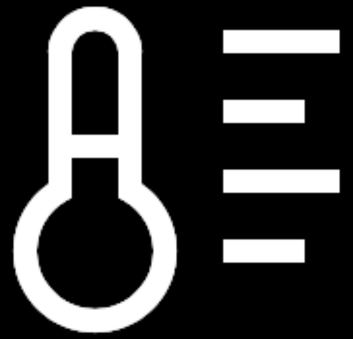


July 2019
warmest month



July 2019
warmest month

ever



July 2019
warmest month

ever

worldwide

1°

hotter
than pre-industrial

Flood by Mauro Lucchesi from the Noun Project

island nations disappearing

photo: Department of Foreign Affairs and Trade
underwater fins by Marco Livolsi from the Noun Project

30 football pitches destroyed per **minute**

Matt Zimmerman, flickr
Axe by jokokerto from the Noun Project

photo: NaveenNkadalaveni
Fire by ✦ Shmidt Sergey ✦ from the Noun Project

photo: NaveenNkadalaveni
Fire by ✦ Shmidt Sergey ✦ from the Noun Project

photo: NaveenNkadalaveni
Fire by ✦ Shmidt Sergey ✦ from the Noun Project

extinctions

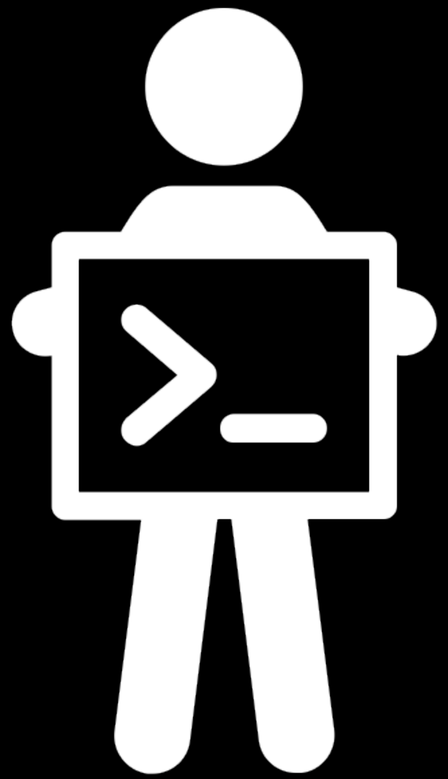
Bramble Cay melomys
first mammal to be extinct as
a result of climate change

photo: Greg Schechter
Death by Icon Island from the Noun Project
@hollycummins

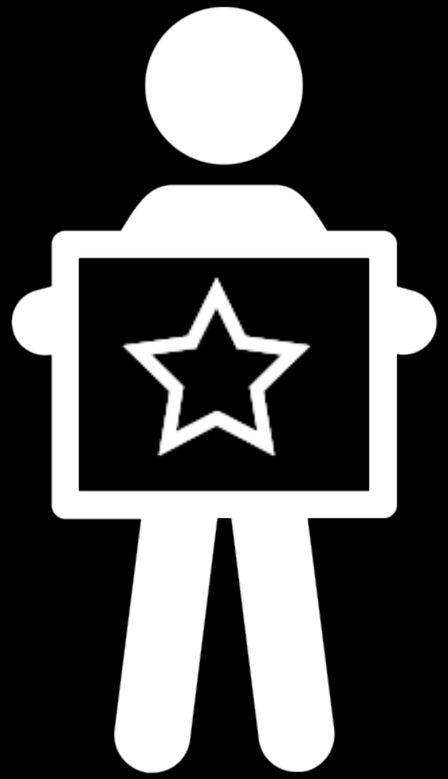
“What happens now and in these next few years will profoundly affect the next few thousand years.”

- Sir David Attenborough

where do we fit in?



developer by Adrien Coquet from the Noun Project



impact at work

developer by Adrien Coquet from the Noun Project

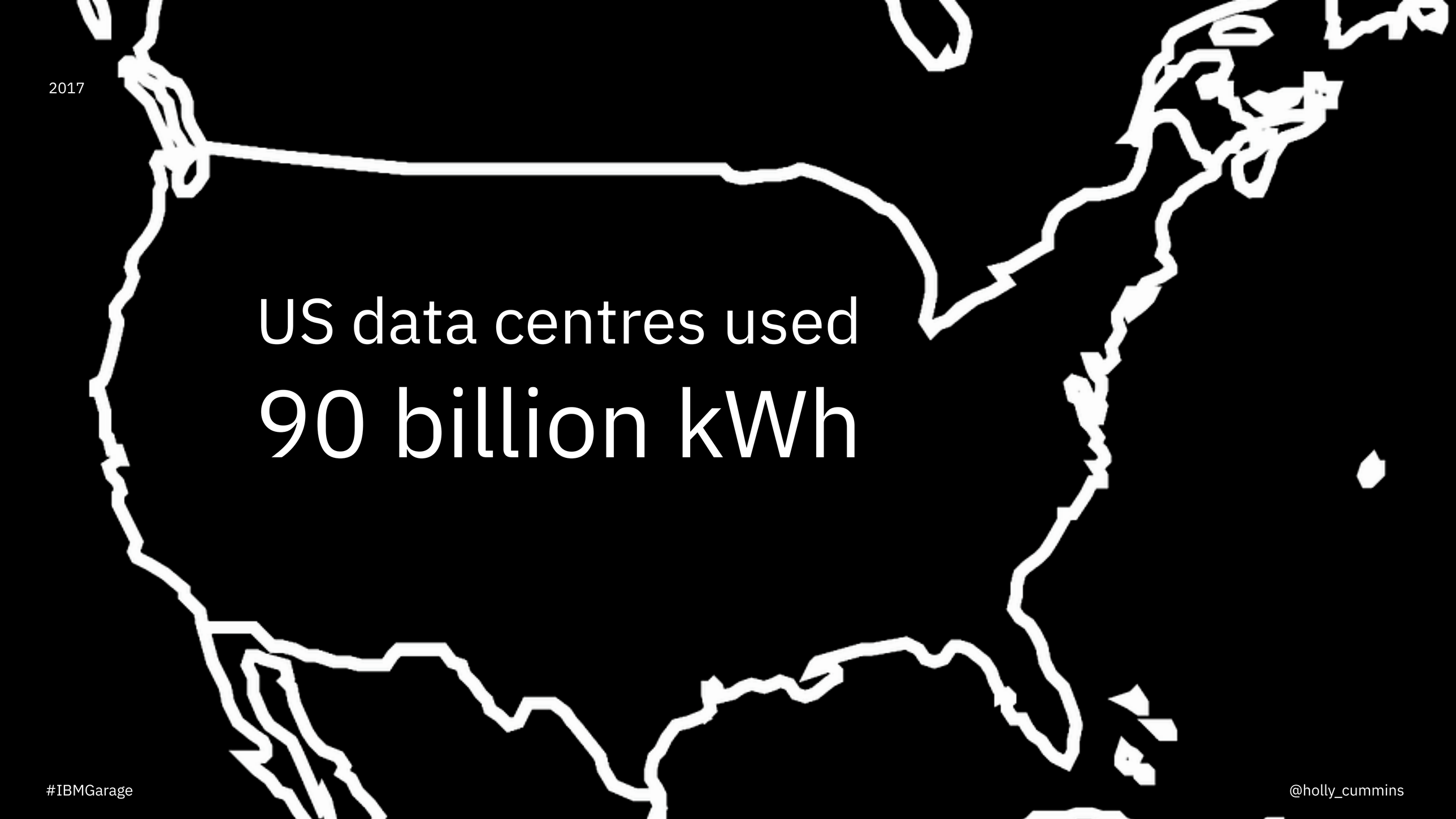
impact on the world

impact on the world
(but not that kind of impact)

Meteorite Impact by Ben Davis from the Noun Project


Grady Booch
@Grady_Booch
1.14 petaflops.
That is a lot of flops.
summit
The world's fastest supercomputers hit higher speeds than ever with Linux...
The new list of the world's fastest computers -- Supercomputing's Top 500 -- is out, and every one runs faster than a petaflop using Linux.
zdnet.com

2017

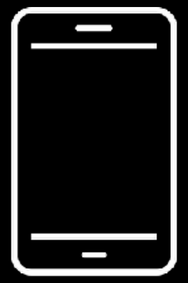


US data centres used

90 billion kWh

2017

45,000,000,000

x  x 1 year

Phone by Andrei Yushchenko from the Noun Project

416

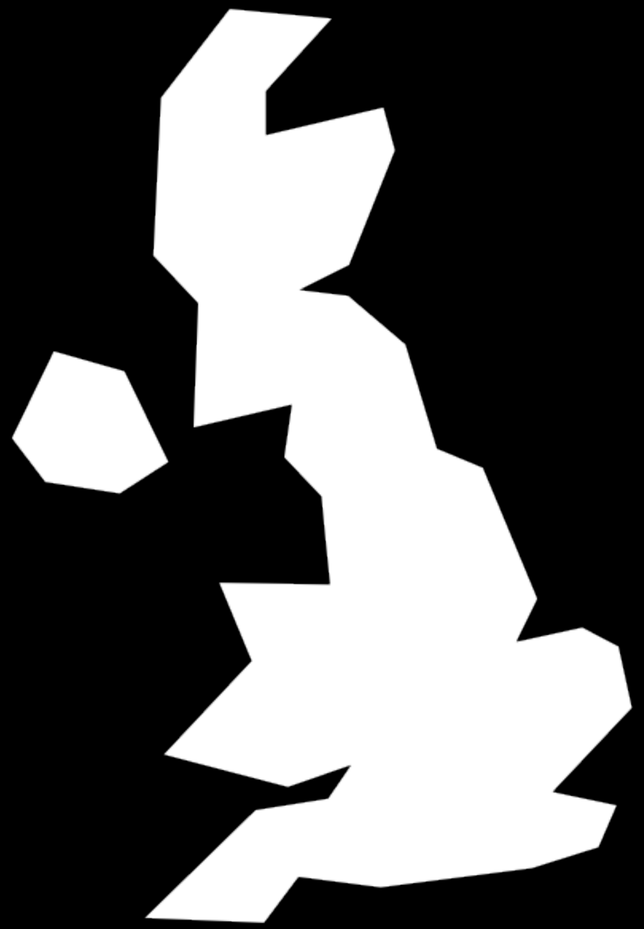
terawatts

consumed by datacenters

3%

of all electricity

is used by datacenters

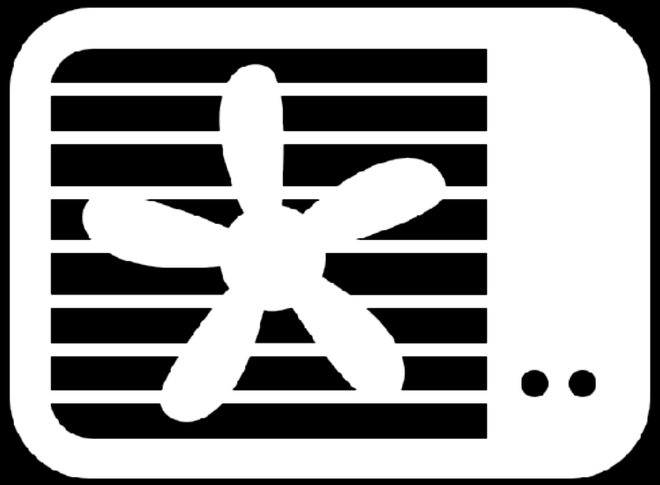


UK energy consumption

1.4 x

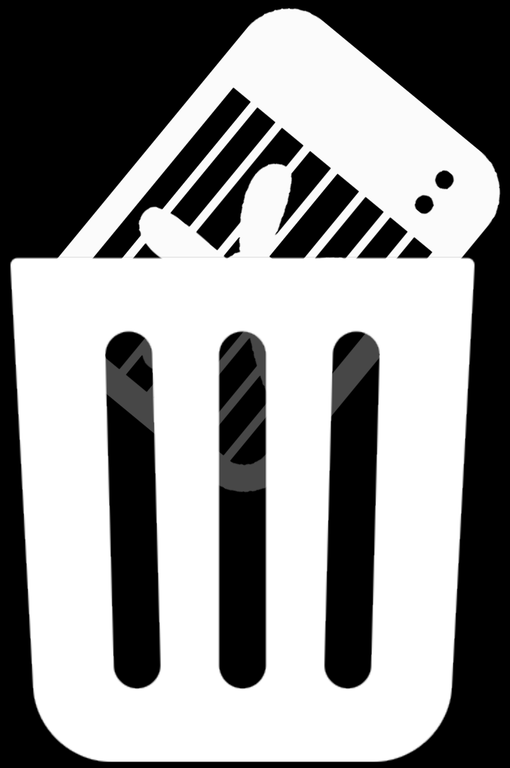
global data centre
energy consumption

UK by Richard Slade from the Noun Project



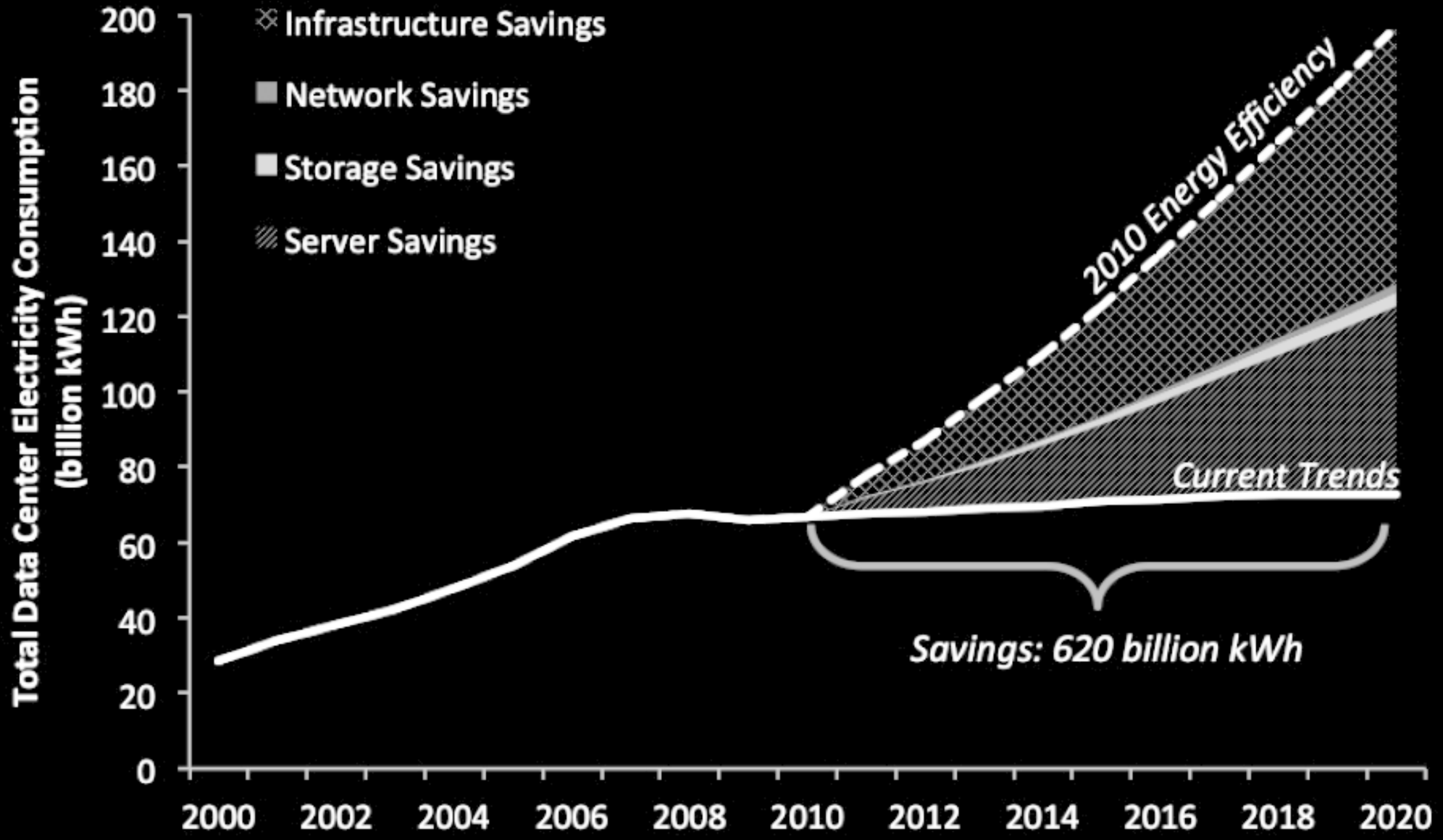
2005:
data centres so badly
organised only **40%**
of cool air reached computers

Air Conditioner by Eugene Dobrik from the Noun Project



60% of cooling energy wasted

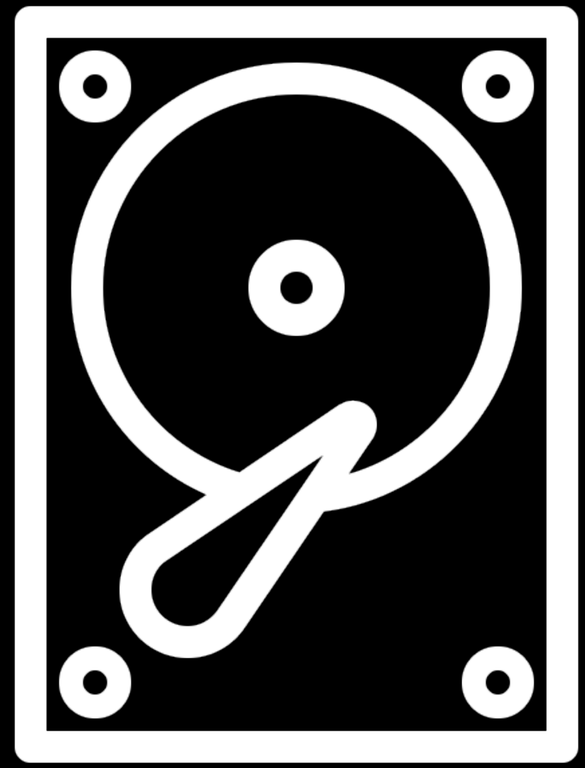
Garbage by David from the Noun Project Air Conditioner by Eugene Dobrik from the Noun Project


Infrastructure Savings
Network Savings
Storage Savings
Server Savings
Total Data Center Electricity Consumption (billion kWh)
200
180
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
2020
2010 Energy Efficiency
Current Trends
Savings: 620 billion kWh

80%

improvement in data center energy efficiency

- low-power chips
- solid state drives (instead of spinning hard drives)



disk drive by Idwar from the Noun Project

DISRUPTOR

By Patrick Nelson, Network World | OCT 18, 2017 11:13 AM PDT

About
Thought-provoking commentary on technologies that are changing the way mankind does things.

First self-powered data center opens

Aruba S.p.A. operates its zero-impact data center using 'a river of energy' hydroelectric plant, solar panels and chilling underground water.

Dinosaur by Nick Bluth from the Noun Project

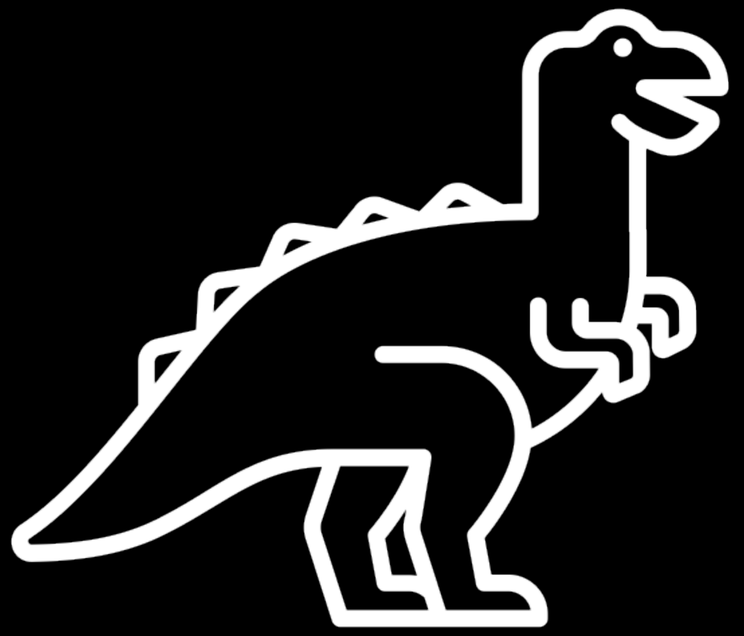
IBM z15

Dinosaur by Nick Bluth from the Noun Project

IBM zSeries

50%

power consumption of x86
(30% more performance)



FROM IDG

Home > Infrastructure

IDG CONTRIBUTOR NETWORK Want to Join?

BIG IDEAS IN BIG IRON

By Bryan Smith, Advisor, Contributor, Network World | AUG 14, 2015 8:49 AM PDT

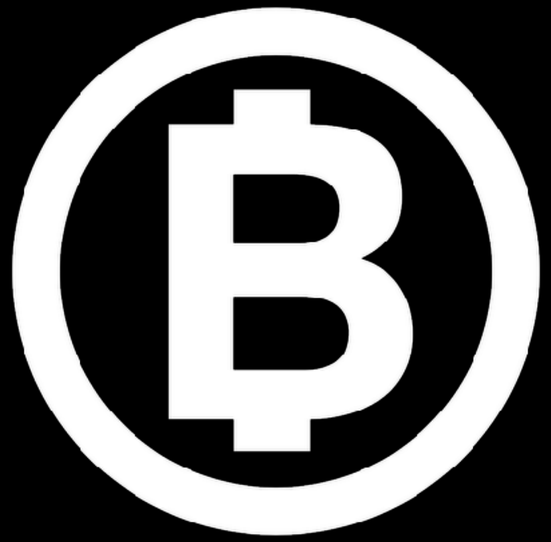
Opinions expressed by ICN authors are their own.

Are mainframes the answer to IT's energy efficiency concerns?

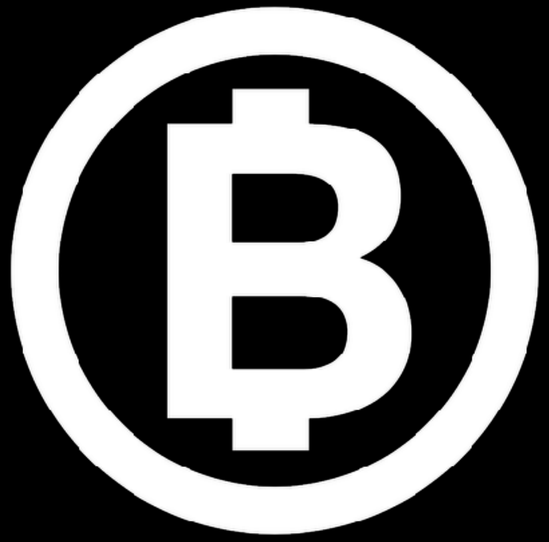
Anyone who manages the technology demands of a large business faces plenty of exciting moments on the job, but I think it's safe to say that calculating the energy costs of your company's IT systems isn't among those moments.

cloud is more energy-efficient than a small data centre

is it just data centers?



bitcoin



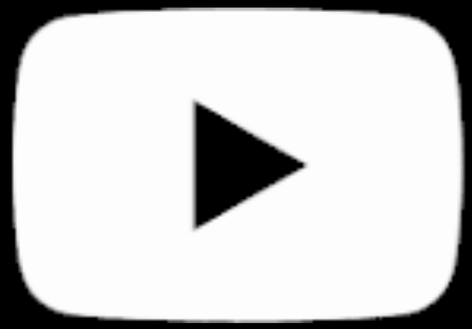
bitcoin

==

carbon footprint of

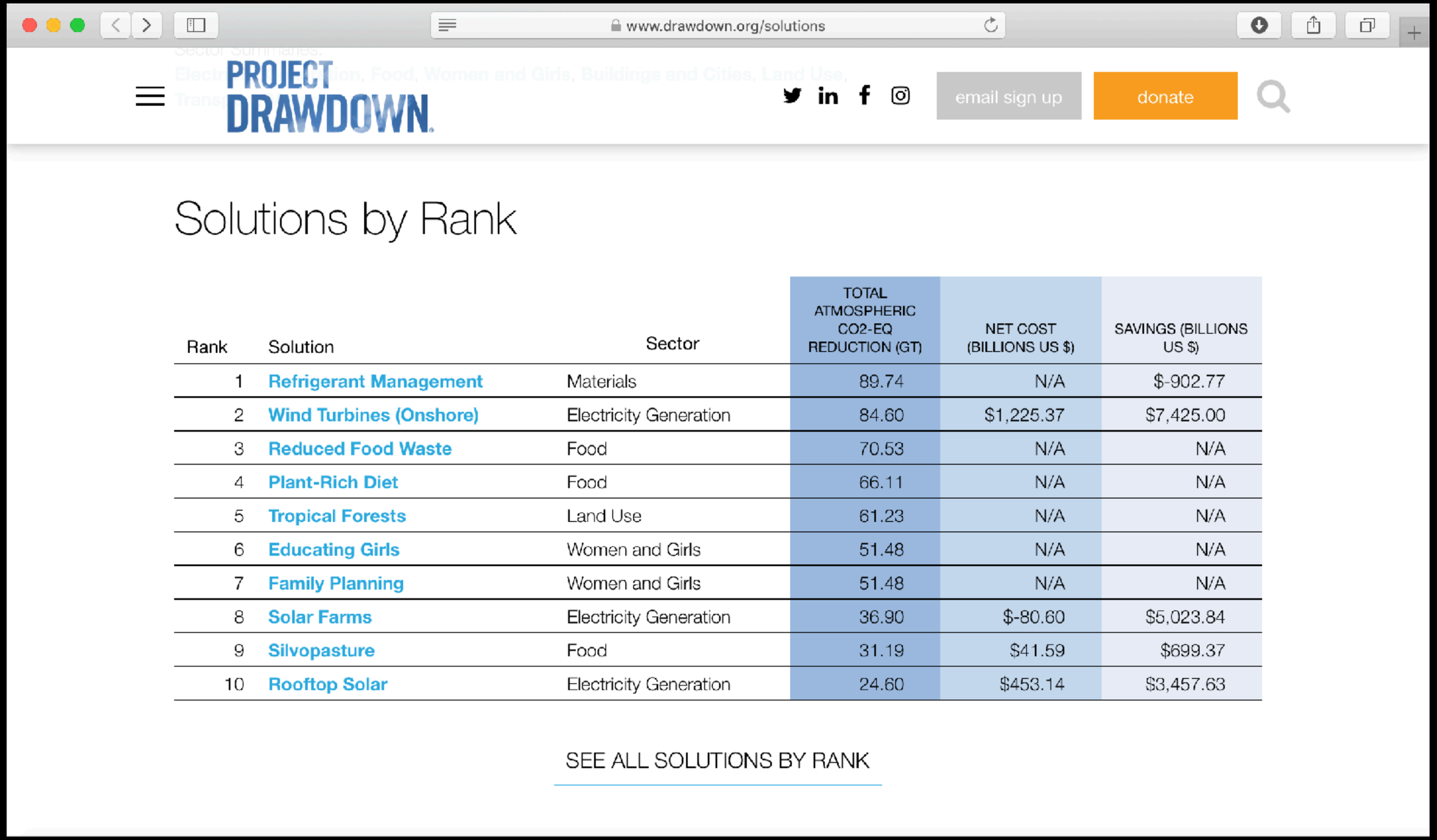
Denmark

1 bitcoin transaction ==
761,118 VISA transactions



1 bitcoin transaction ==
50,741 hours of watching Youtube

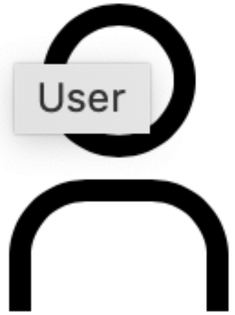
what can we do?



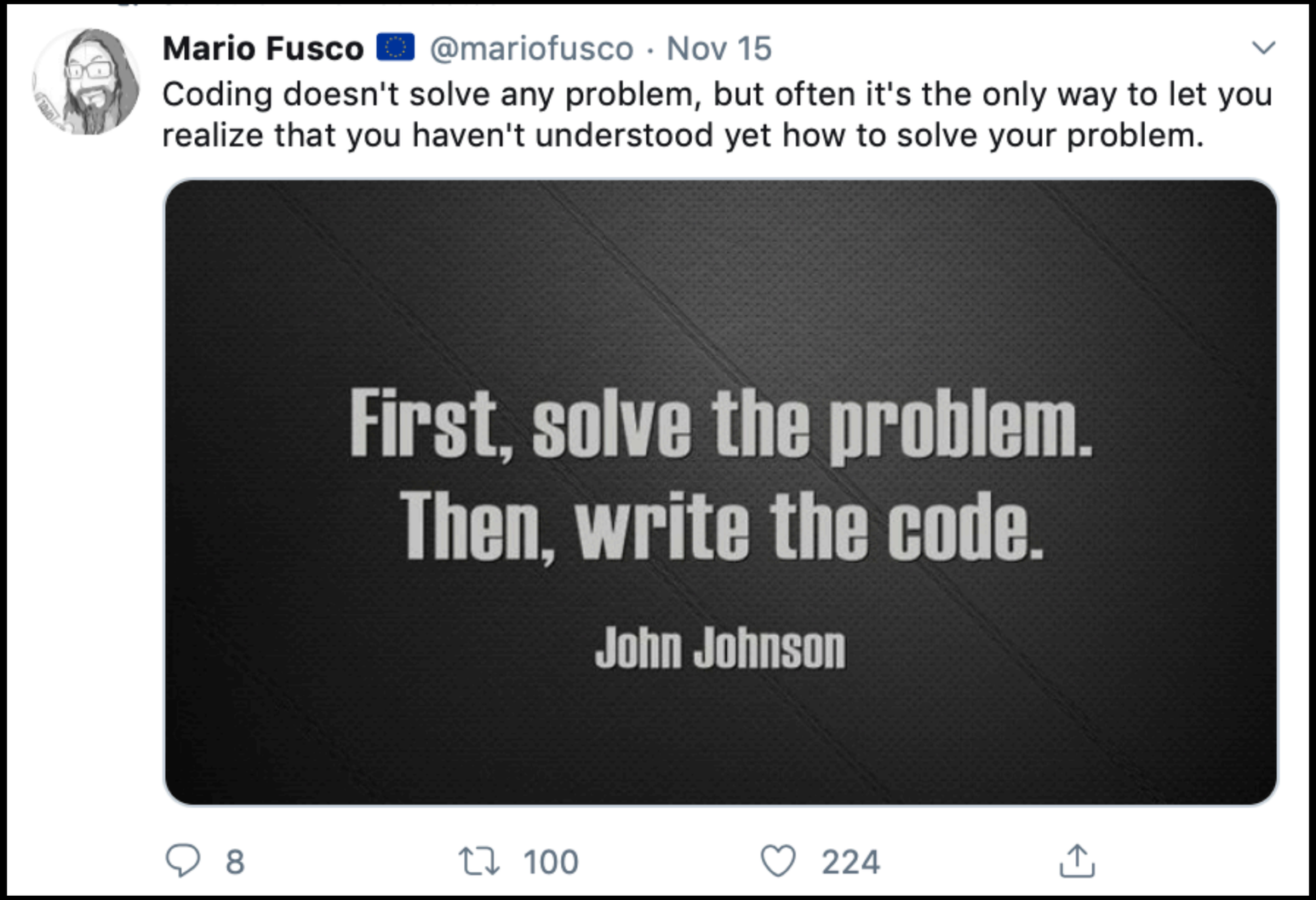
Solutions by Rank

Rank	Solution	Sector	TOTAL ATMOSPHERIC CO2-EQ REDUCTION (GT)	NET COST (BILLIONS US $)	SAVINGS (BILLIONS US $)
1	Refrigerant Management	Materials	89.74	N/A	$-902.77
2	Wind Turbines (Onshore)	Electricity Generation	84.60	$1,225.37	$7,425.00
3	Reduced Food Waste	Food	70.53	N/A	N/A
4	Plant-Rich Diet	Food	66.11	N/A	N/A
5	Tropical Forests	Land Use	61.23	N/A	N/A
6	Educating Girls	Women and Girls	51.48	N/A	N/A
7	Family Planning	Women and Girls	51.48	N/A	N/A
8	Solar Farms	Electricity Generation	36.90	$-80.60	$5,023.84
9	Silvopasture	Food	31.19	$41.59	$699.37
10	Rooftop Solar	Electricity Generation	24.60	$453.14	$3,457.63

SEE ALL SOLUTIONS BY RANK



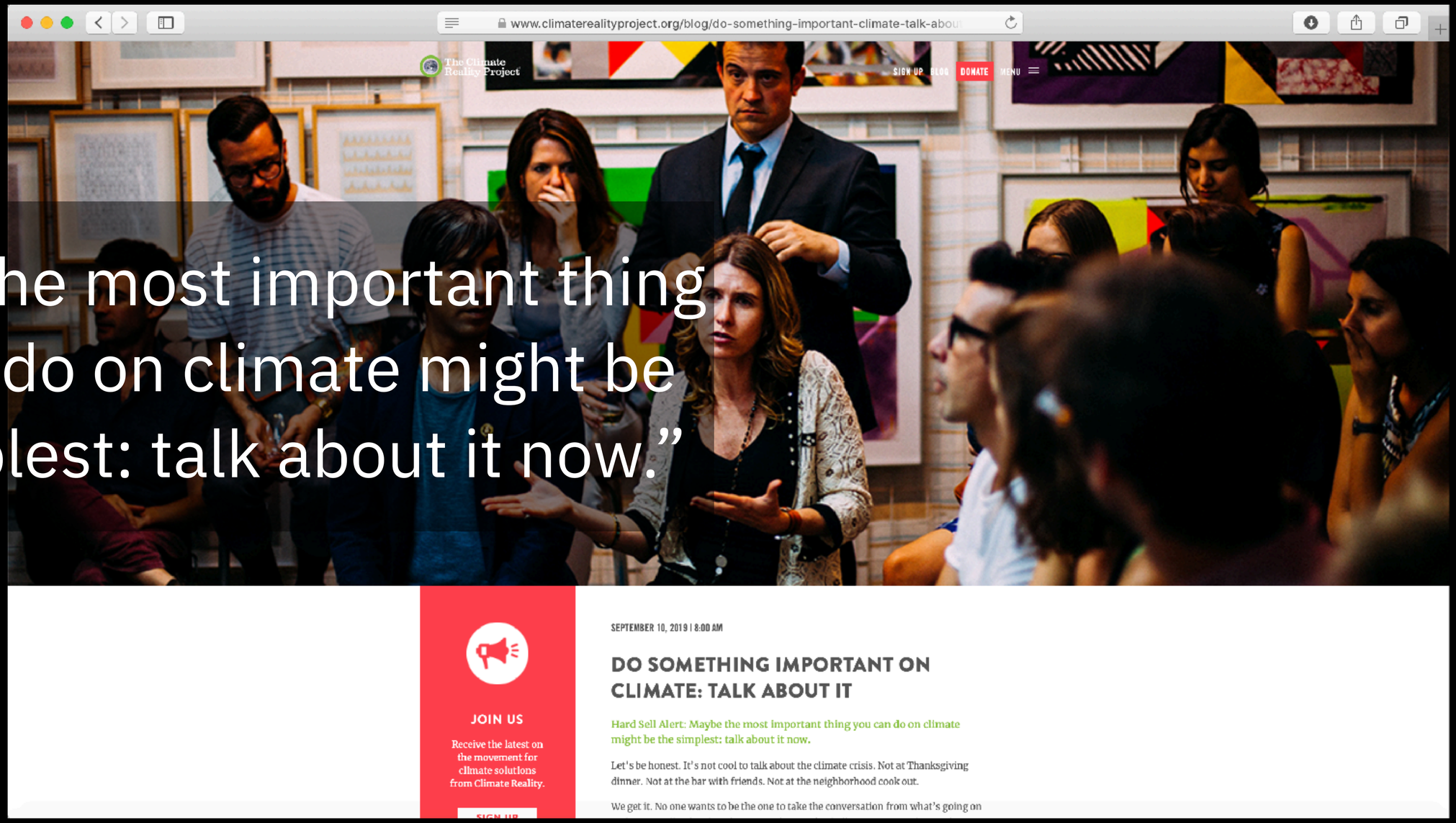
what can **we** do?

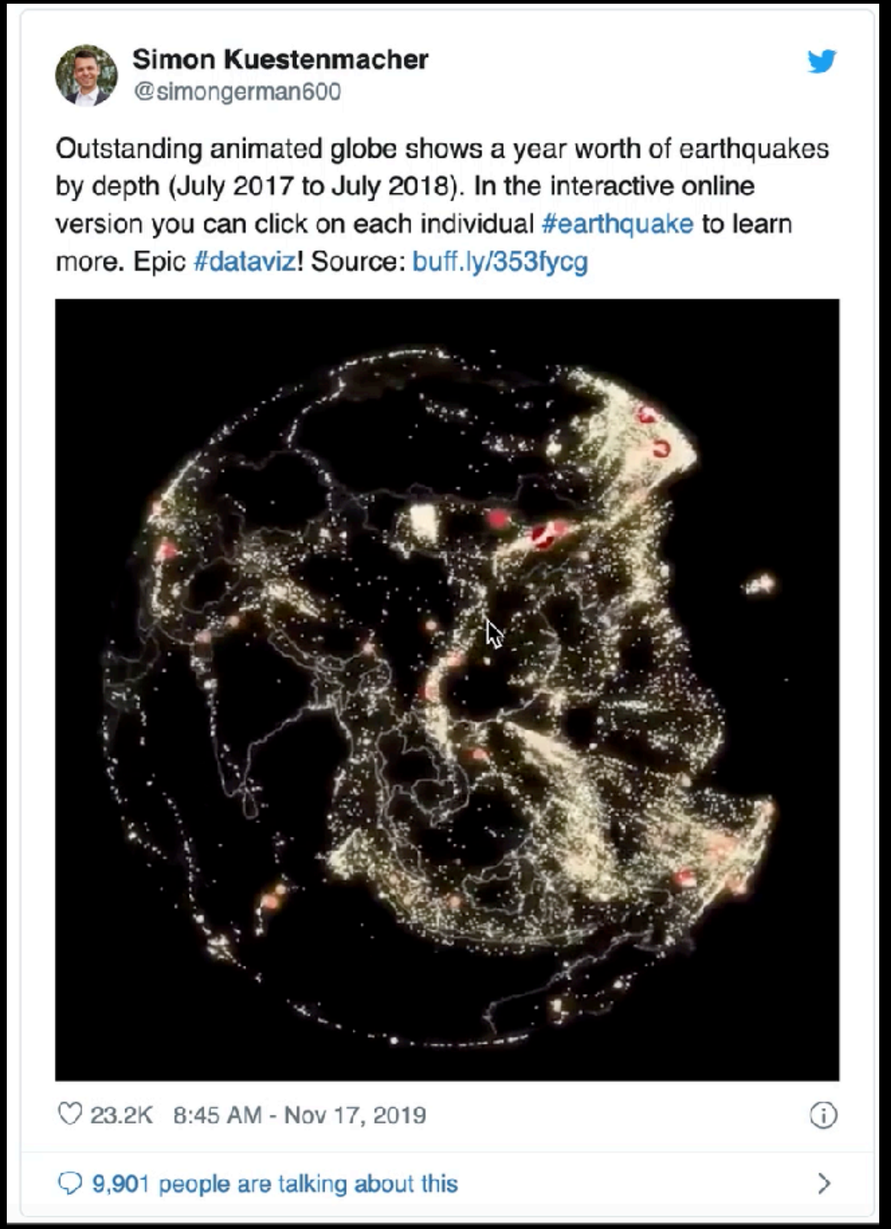

Mario Fusco @mariofusco · Nov 15
Coding doesn't solve any problem, but often it's the only way to let you realize that you haven't understood yet how to solve your problem.
First, solve the problem.
Then, write the code.
John Johnson
8
100
224

communicate


IBM Client Centre
Join the global conversation.
20th November
18:00, IBM London Client Centre
think
climate.
We can build a business, change the world and have fun.

“Maybe the most important thing you can do on climate might be the simplest: talk about it now.”

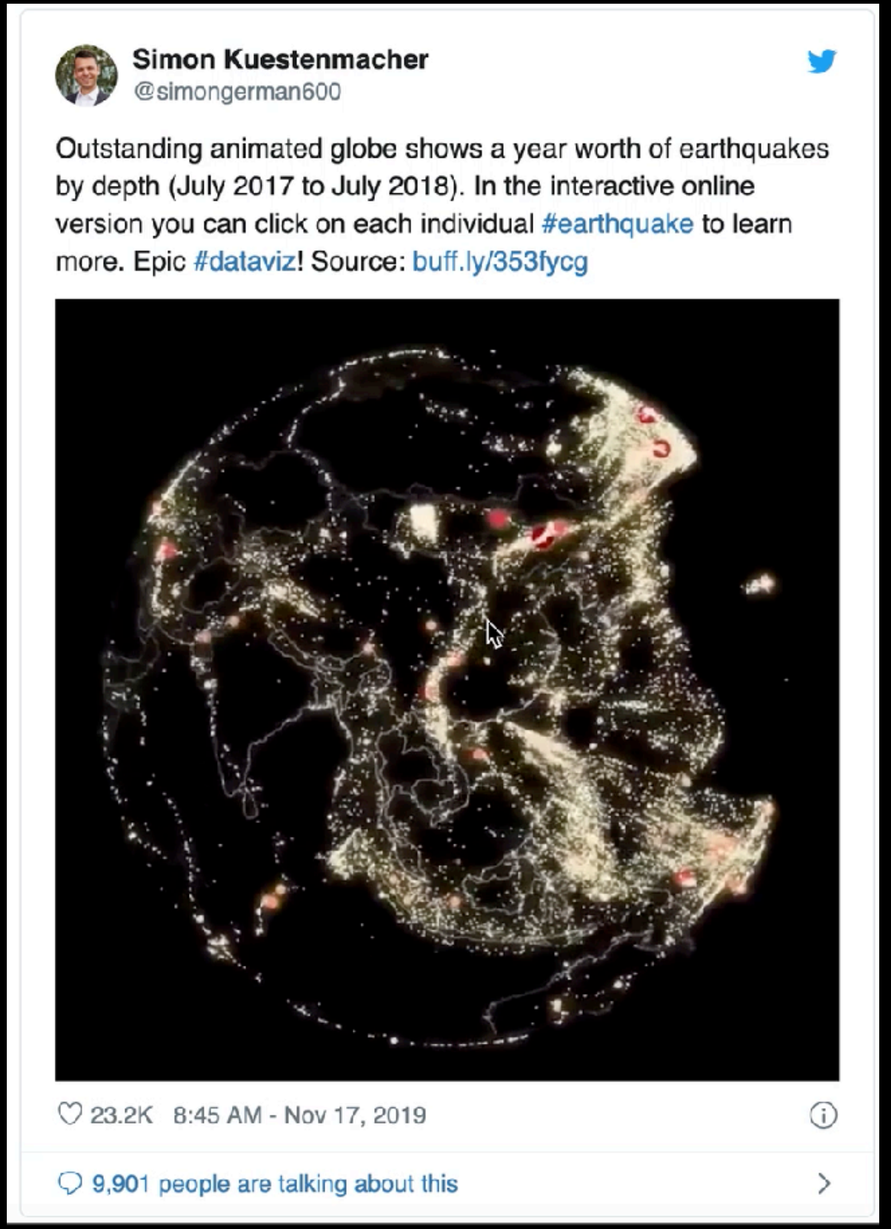




#IBMGarage

(we don't think there's much link between climate change and earthquakes - but look at the visualisation!)

@holly_cummins



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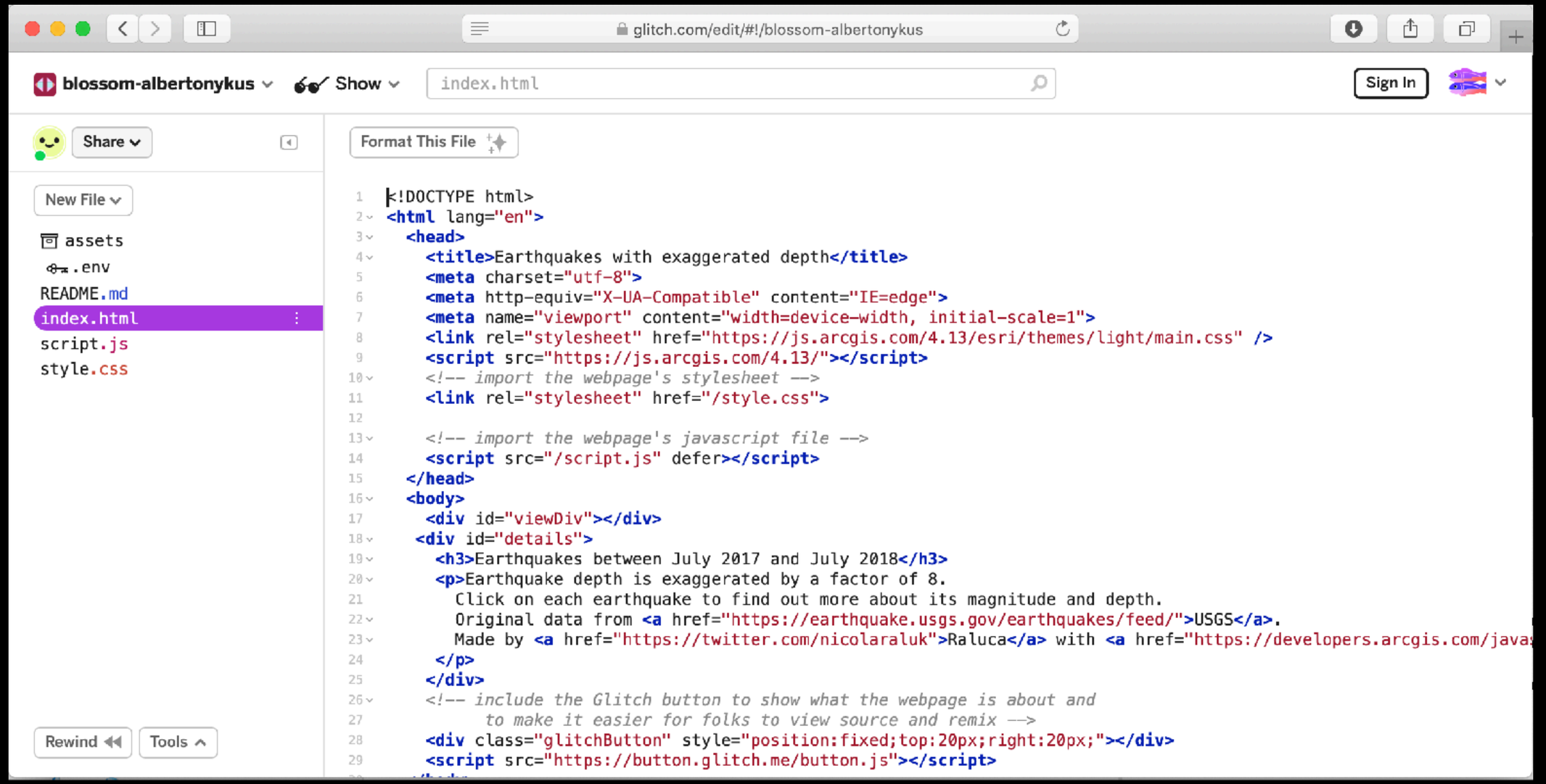

glitch.com/edit/#!/blossom-albertonykus
blossom-albertonykus
Show
index.html
Sign In
Share
Format This File
New File
assets
.env
README.md
index.html
script.js
style.css
Rewind
Tools
<!DOCTYPE html>
<html lang="en">
<head>
<title>Earthquakes with exaggerated depth</title>
<meta charset="utf-8">
<meta http-equiv="X-UA-Compatible" content="IE=edge">
<meta name="viewport" content="width=device-width, initial-scale=1">
<link rel="stylesheet" href="https://js.arcgis.com/4.13/esri/themes/light/main.css" />
<script src="https://js.arcgis.com/4.13/"></script>
<!-- import the webpage's stylesheet -->
<link rel="stylesheet" href="/style.css">
<!-- import the webpage's javascript file -->
<script src="/script.js" defer></script>
</head>
<body>

<h3>Earthquakes between July 2017 and July 2018</h3>
Earthquake depth is exaggerated by a factor of 8.
Click on each earthquake to find out more about its magnitude and depth.
Original data from USGS.
Made by Raluca with <a href="https://developers.arcgis.com/java

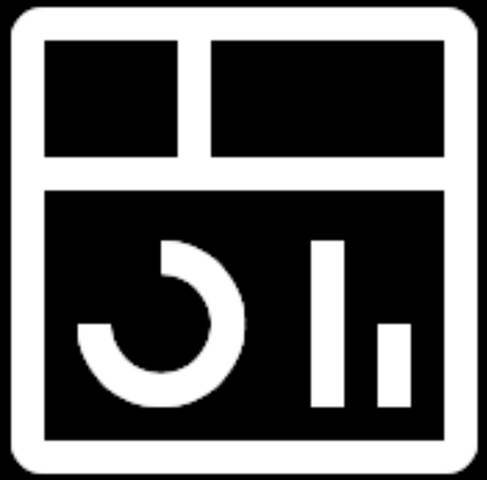
<!-- include the Glitch button to show what the webpage is about and
to make it easier for folks to view source and remix -->

<script src="https://button.glitch.me/button.js"></script>

understand

Map by SANTRI ICON from the Noun Project

models can
be improved



granularity
policy simulation
rare events

this is complex

machine learning can help

we need to innovate techniques

common client science bottlenecks:

common client science bottlenecks:
limited access to weather data

common client science bottlenecks:

limited access to weather data

insufficient computing power

common client science bottlenecks:

limited access to weather data

insufficient computing power

insufficient data storage capacity

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world community grid

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IBM.

News: News

News

News Article

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Announcing Three Winning Climate Change Projects

26 Apr 2018

Summary
After a rigorous review of dozens of applications from all over the world, we're excited to announce the research groups who will receive supercomputing power, weather data, and cloud storage from IBM to accelerate climate change science.

Topics
Special Announcements , Program News

Tags
Event or Milestone

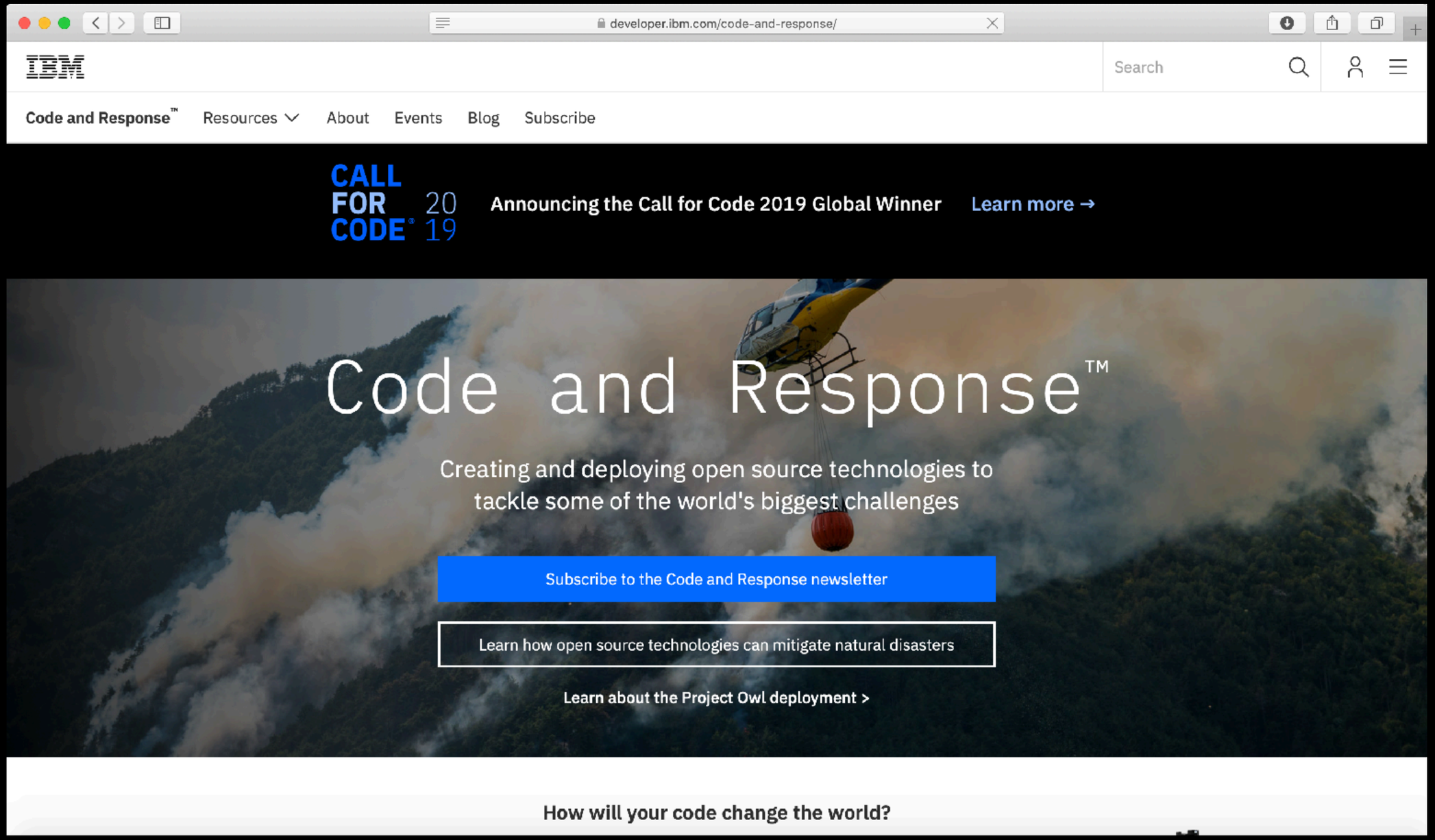
As our planet faces the mounting impacts of climate change, scientists are on the front lines of understanding complex consequences and developing solutions.

We've heard from climate change scientists that common bottlenecks they face include limited access to weather data, and insufficient computing power and data storage capacity to accurately simulate the impacts of climate change.

These are some of the reasons why IBM Corporate Citizenship recently invited

toleration

Umbrella by Rockicon from the Noun Project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Code and Response™
Creating and deploying open source technologies to tackle some of the world's biggest challenges
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Learn how open source technologies can mitigate natural disasters
Learn about the Project Owl deployment >
How will your code change the world?

developers can make
situations **better**

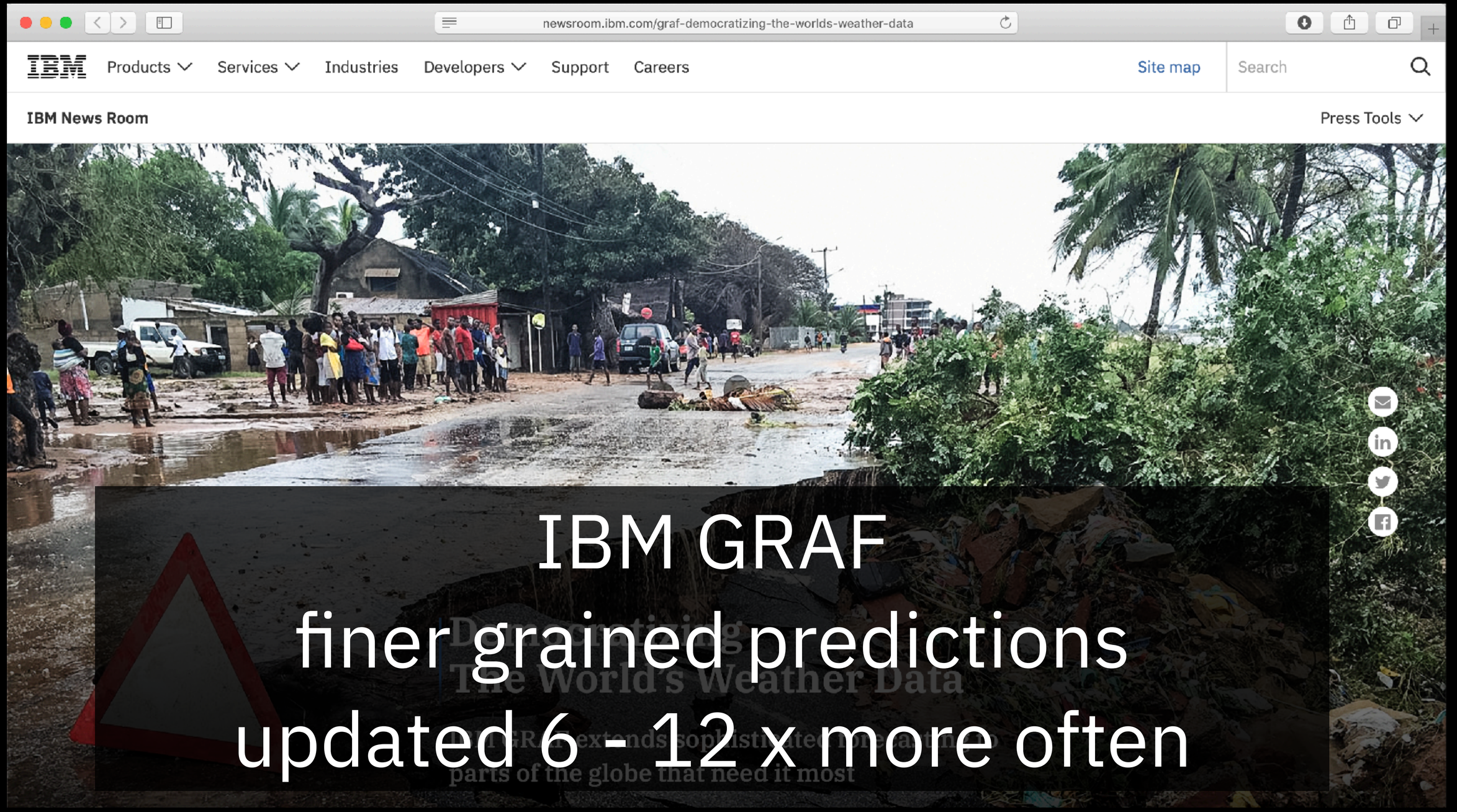
cloud democratises access to data

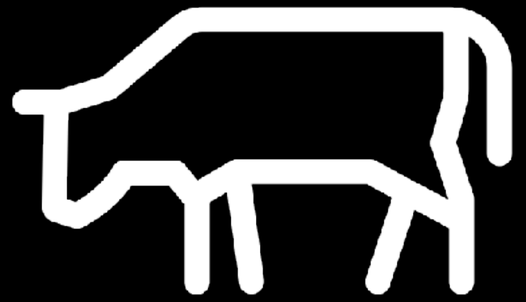
cloud democratises access to information

when infrastructure goes, the cloud goes

OWL
Call For Code 2018 winner
$200,000 IBM grant

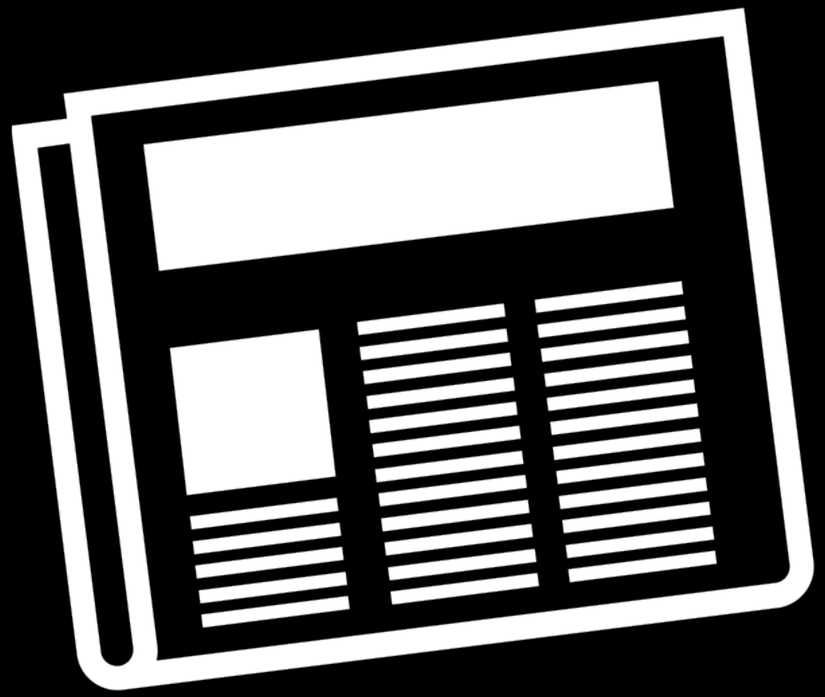

POWER9
The Weather Company
dyeus


newsroom.ibm.com/graf-democratizing-the-worlds-weather-data
IBM
Products
Services
Industries
Developers
Support
Careers
Site map
Search
IBM News Room
Press Tools
IBM GRAF
finer grained predictions
updated 6 - 12 x more often



climate change has overturned centuries-old wisdom about weather patterns

Plant by Icon Island from the Noun Project Cow by Symbolon from the Noun Project

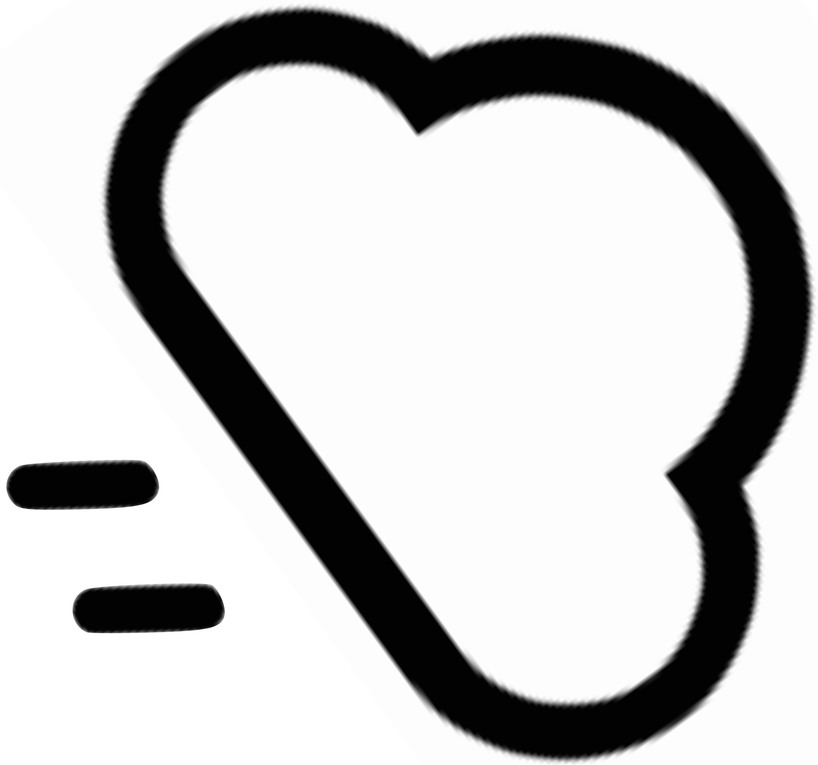


best access to forecasts: a weekly newspaper report

Newspaper by Loïc Poivet from the Noun Project

granular forecasts covering the whole world
(not just the rich parts of the world)


At Rainbow Orchards, Gladys Mwangi and her farm manager, Samuel Thiongo, say they have sometimes had entire crops ruined by rainfalls at harvest time that took them by surprise.



change

#IBMGarage

I don’t want your hope.

I don’t want you to be hopeful.

I want you to feel the fear I feel every day.

And then I want you to **act**.

I want you to act as if the house is on fire.

Because it is.

fire house by Andi Nur Abdillah from the Noun Project

“products with sustainability claims generally outperformed the growth rate of total products in their respective categories.”

efficiency

www.drawdown.org/solutions/buildings-and-cities/building-a

PROJECT DRAWDOWN

email sign up | donate

Credit: Monty Rakusen

BUILDINGS AND CITIES
BUILDING AUTOMATION

#45

RANK AND RESULTS BY 2050

4.62 GIGATONS
REDUCED CO2

$68.12 BILLION
NET IMPLEMENTATION COST

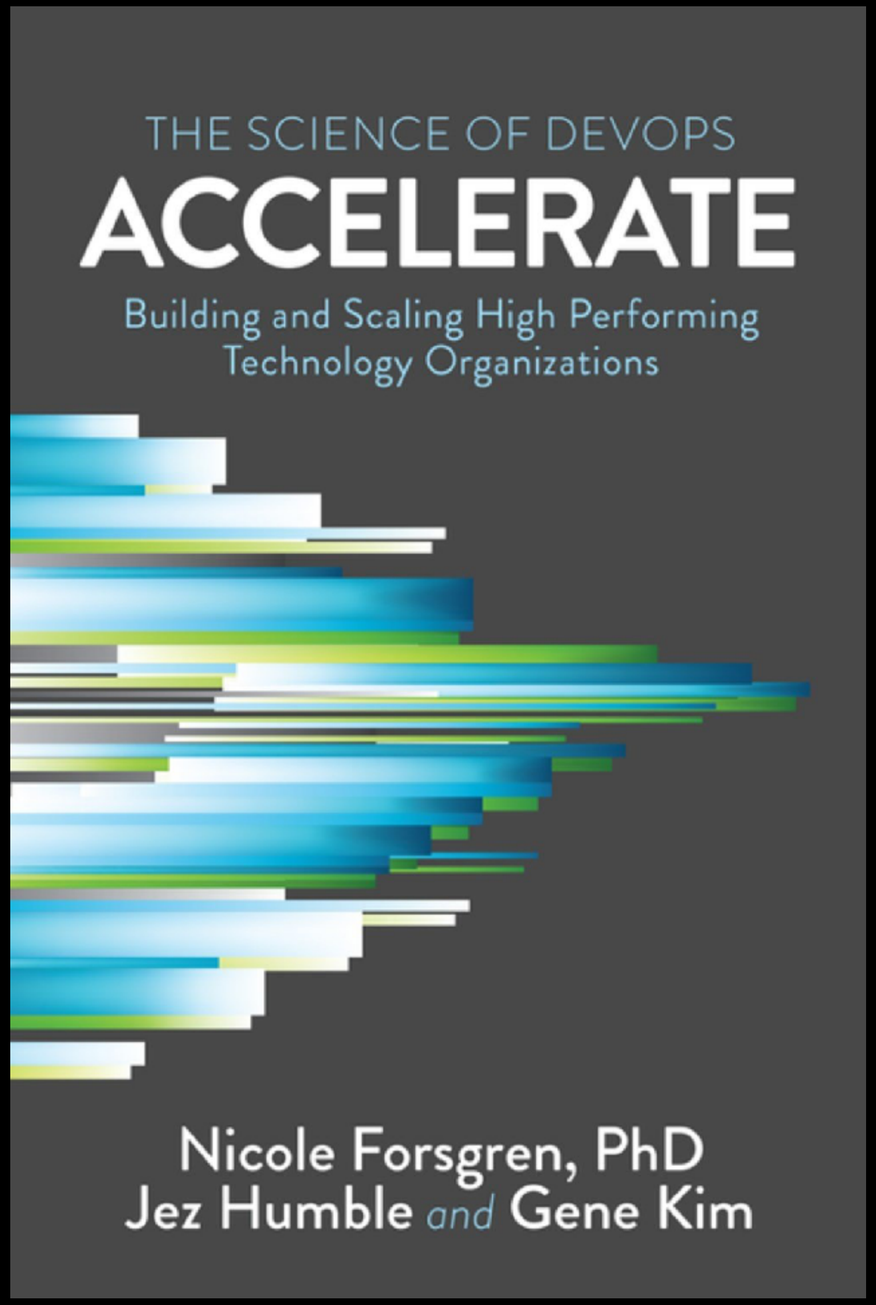
$880.55 BILLION
NET OPERATIONAL SAVINGS

Energy courses through buildings—in heating and air-conditioning systems, electrical wiring, water heating, lighting, information and communications systems, security and access systems, fire alarms, elevators, appliances, and indirectly through plumbing. Most large commercial buildings have some form of centralized, computer-based building management, used to monitor, evaluate, and control those systems. Adopting automated rather than manual building management systems can reduce energy consumption by 10 to 20 percent.

A building automation system (BAS) is a building's brain. Equipped with sensors, BAS buildings are constantly scanning and rebalancing for greatest efficiency and effectiveness. Lights switch off when no one's around, for example, and windows vent to improve air quality and temperature. New buildings can be equipped with BAS from the start; older ones can be retrofitted to incorporate it and reap its benefits.

Beyond energy savings and reduced operations and maintenance costs, BAS benefits the well-being and productivity of people inside the building. Improved thermal and lighting comfort and indoor air quality directly impact occupant satisfaction. BAS is especially useful to ensure and maintain efficiency in green buildings, so that their ratings on paper match their actual performance.

IMPACT: *BAS can result in up to 20 percent more efficient heating and cooling and 11.5 percent more efficient energy use for lighting, appliances, etc. Expanding these systems from 34 percent of commercial floor space in 2014 to 50 percent by mid-century – at an added cost of $68 billion–building owners could save $881 billion in*

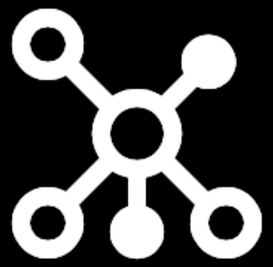


release many times a day
automate everything

do we need to stop continuous integration and deployment?

how do you build a monorepo with 9,000,000 source files?

how do you build a monorepo with 9,000,000 source files?



you get very good at dependency graphs

Buck

Search docs... DOCS ISSUES GITHUB

A high-performance build tool

GETTING STARTED GITHUB

Buck is a build system developed and used by Facebook. It encourages the creation of small, reusable modules consisting of code and resources, and supports a variety of languages on many platforms.

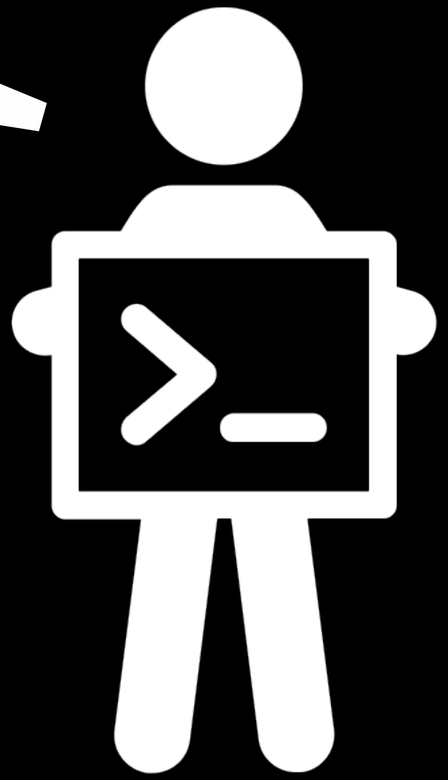
Why Buck?

Buck can help you and your team in many ways:

- **Speed up your builds.** Buck builds independent artifacts in parallel to take advantage of multiple cores on your machine. Further, it reduces incremental build times by keeping track of unchanged modules so that the minimal set of modules is rebuilt.

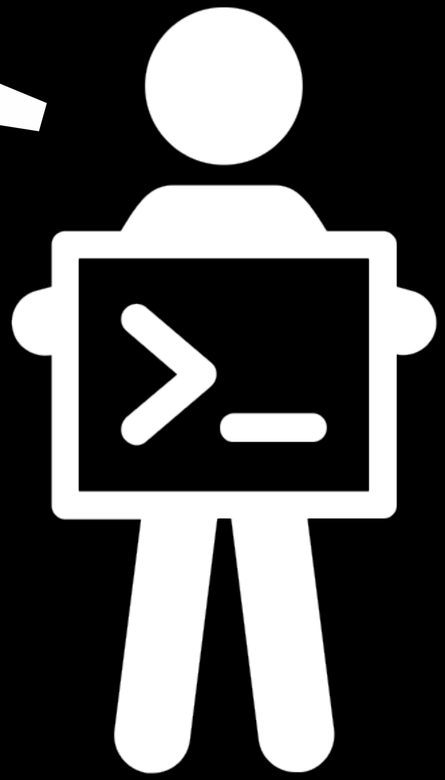
optimise for fast feedback (side effect: efficient builds)

Hey boss, I created a Kubernetes cluster.



Hey boss, I created a Kubernetes cluster.

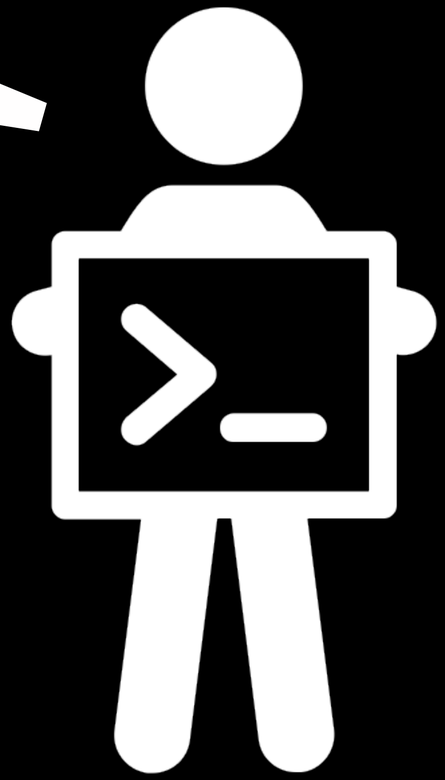
I forgot it for 2 months.



Hey boss, I created a Kubernetes cluster.

I forgot it for 2 months.

... and it’s £1000 a month.



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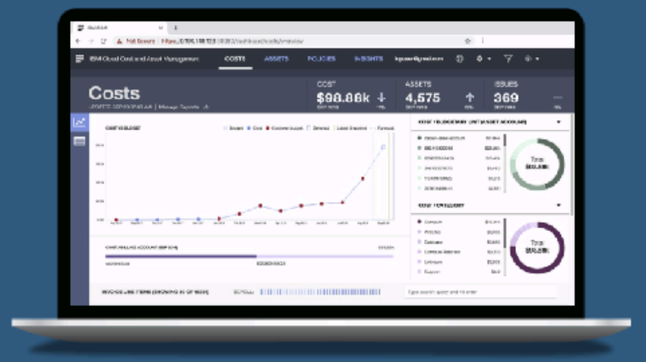
IBM Cloud Cost and Asset Management

Overview Details Pricing Contact us

IBM Cloud Cost and Asset Management

Multi-cloud management platform to optimize your costs

Contact us



How can IBM Cloud Cost and Asset Management save you money?

IBM Cloud Cost and Asset Management is a multi-cloud cost optimization solution running on IBM Cloud Private that empowers IT departments and finance teams to optimize their public and private cloud spend. The solution enables you to automatically discover your

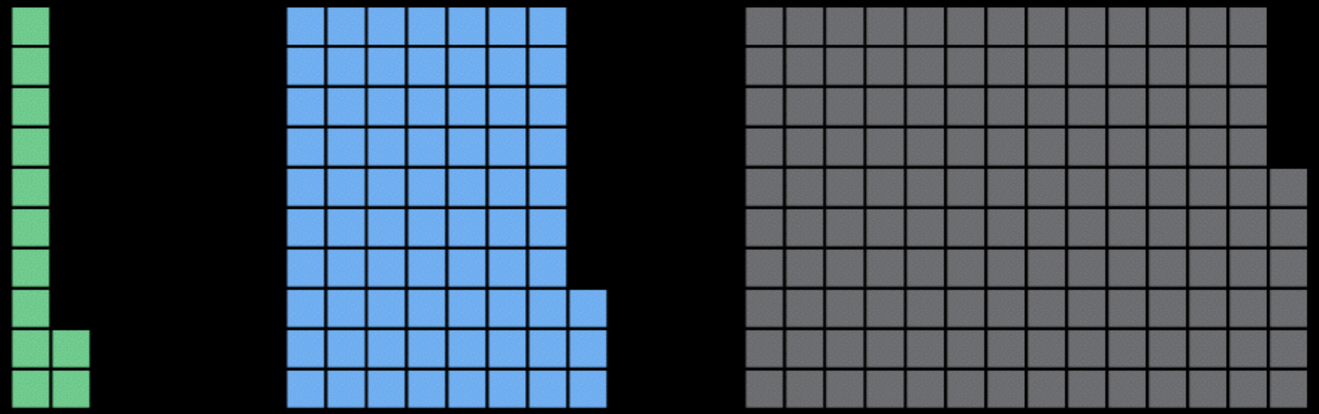
QUARKUS

supersonic subatomic Java

quarkus is **light**

Memory (RSS) in Megabytes*

REST



Quarkus + Native
(via GraalVM)
12 MB

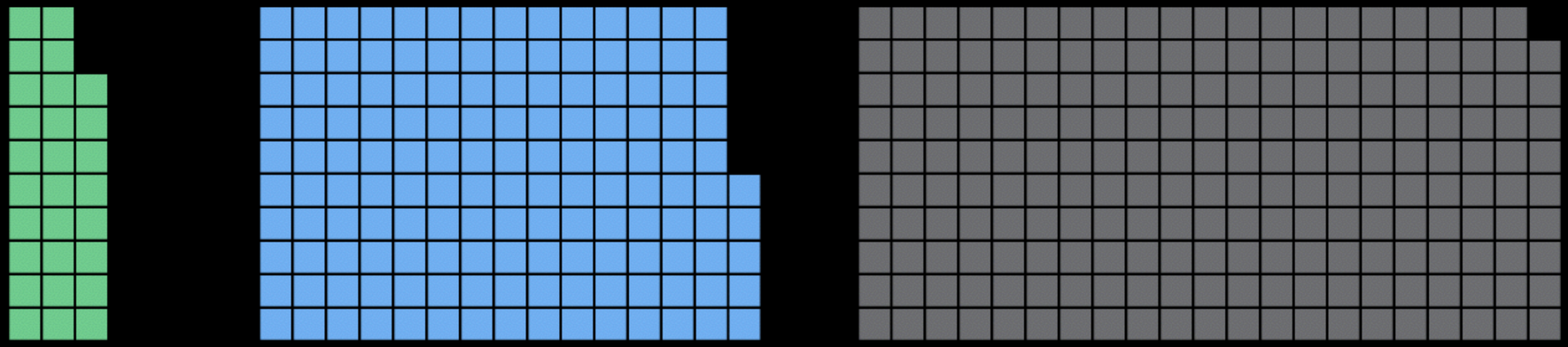
Quarkus + JVM
(via OpenJDK)
73 MB

Traditional
Cloud-Native Stack
136 MB

… still light with CRUD

*Tested on a single-core machine

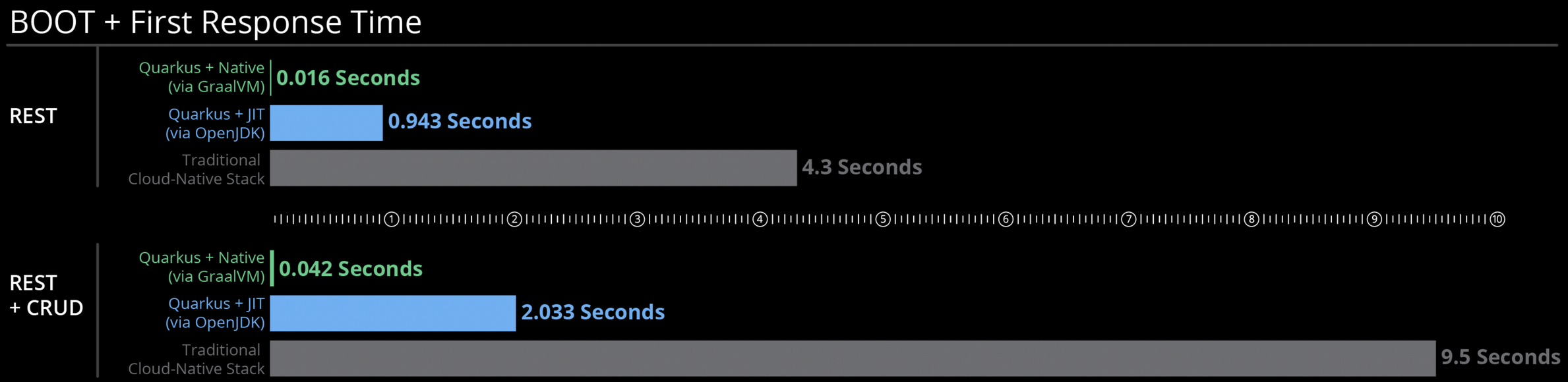
REST
+ CRUD



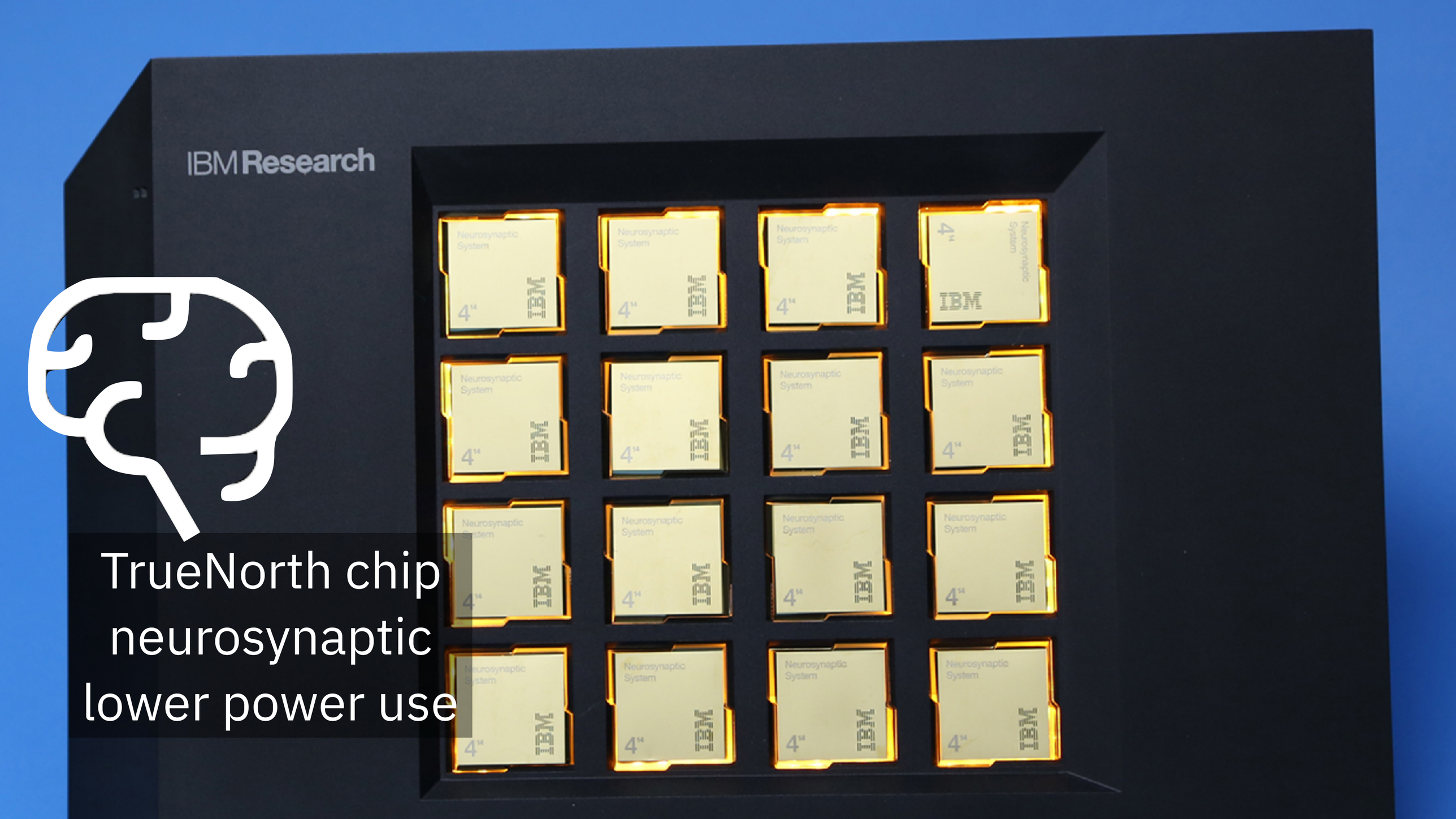
Quarkus + Native
(via GraalVM)
28 MB

Quarkus + JVM
(via OpenJDK)
145 MB

Traditional
Cloud-Native Stack
209MB



... and quarkus is **fast**


IBM Research
TrueNorth chip
neurosynaptic
lower power use


what we imagine
when we widen roads


what we get

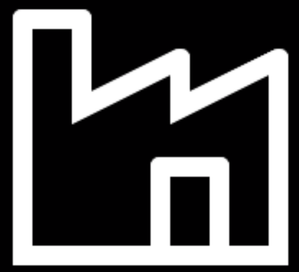
DISRUPTOR

By Patrick Nelson, Network World | OCT 18, 2017 11:13 AM PDT

About
Thought-provoking commentary on technologies that are changing the way mankind does things.

First self-powered data center opens

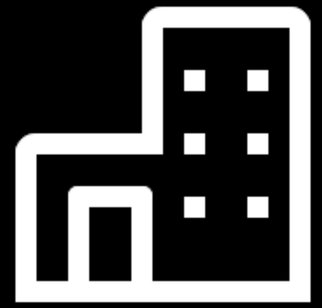
Aruba S.p.A. operates its zero-impact data center using 'a river of energy' hydroelectric plant, solar panels and chilling underground water.



8%

of CO_2 emissions
one industry:

cement



unintended consequences

is my travel sustainable?

is my travel sustainable?

is my travel sustainable?

CODING HORROR

programming and human factors

Google Custom Search

29 Jan 2009

The Sad Tragedy of Micro-Optimization Theater

I'll just come right out and say it: I love strings. As far as I'm concerned, there isn't a problem that I can't solve with a string and perhaps a regular expression or two. But maybe that's just my lack of math skills talking.

In all seriousness, though, the type of programming we do on Stack Overflow is intimately tied to strings. We're constantly building them, merging them, processing them, or dumping them out to a HTTP stream. Sometimes I even give them relaxing massages. Now, if you've worked with strings at all, you know that this is code you desperately want to avoid writing:

```
static string Shlemiel()
{
string result = "";
for (int i = 0; i < 314159; i++)
{
```

```
static string concatenator()
{
    string result = "";
    for (int i = 0; i < 314159; i++)
    {
        result += getStringData(i);
    }
    return result;
}
```

```
<div class="time">stuff</div>
<div class="gravatar32">stuff</div>
<div class="details">stuff<br/>stuff</div>
```

```
string s ="<div class="time">" + st() + st() + “</div>
<div class="gravatar32">" + st() + "</div>
<div class="details">" + st() + "<br/>" + st() + "</div>";
return s;
```

```
var sb = new StringBuilder(256);
sb.Append("<div class="time">");
sb.Append(st());
sb.Append(st());
sb.Append("</div><div class="gravatar32">");
sb.Append(st());
sb.Append(@"</div><div class="details">");
sb.Append(st());
sb.Append("<br/>");
sb.Append(st());
sb.Append("</div>");
return sb.ToString();
```

100,000 iterations

dual core 3.5 GHz Core 2 Duo

100,000 iterations

dual core 3.5 GHz Core 2 Duo

Simple Concatenation	606 ms
String.Format	665 ms
string.Concat	587 ms
string.Replace	979 ms
StringBuilder	588 ms

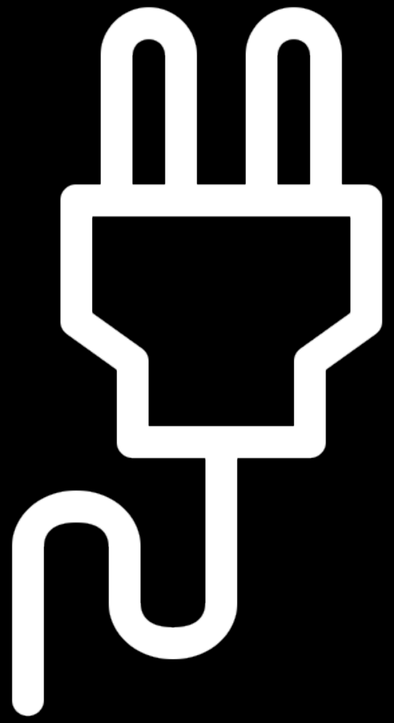
“the minute you begin worrying about tiny little optimizations, you've already gone down the wrong path”

-Jeff Atwood

every improvement is good, but ...

Theater by Symbolon from the Noun Project

knowledge helps us focus on optimisations that **matter**



a laptop uses $8 a year

(yes, you are allowed to run your unit tests)

Plug by johartcamp from the Noun Project

how can we know the eco impact?

```
waste == bad
waste == cost
 cost == bad
```

but it’s complicated


Sheffield
Shenfield


Sheffield
Shenfield


Sheffield
£47.00
Shenfield


Sheffield
£47.00
Shenfield
Berlin


Sheffield
£47.00
Shenfield
Berlin
£21.37


Sheffield
£48.80
Shenfield
Berlin
£37.57

borrowing against the future

borrowing against the future
oh ... and infrastructure

example

what is most sustainable to eat?

Plant by Icon Island from the Noun Project Meat by The Icon Tree from the Noun Project Chicken by Виталий Плут from the Noun Project Fire by ✦ Shmidt Sergey ✦ from the Noun Project

tofu

meat

#IBMGarage

Plant by Icon Island from the Noun Project Meat by The Icon Tree from the Noun Project Chicken by Виталий Плут from the Noun Project Fire by ✦ Shmidt Sergey ✦ from the Noun Project

@holly_cummins

tofu

GM soya

meat

chicken

#IBMGarage

Plant by Icon Island from the Noun Project Meat by The Icon Tree from the Noun Project Chicken by Виталий Плут from the Noun Project Fire by ✦ Shmidt Sergey ✦ from the Noun Project

@holly_cummins

tofu

GM soya

imported

meat

chicken

local

Plant by Icon Island from the Noun Project Meat by The Icon Tree from the Noun Project Chicken by Виталий Плут from the Noun Project Fire by ✦ Shmidt Sergey ✦ from the Noun Project

tofu

GM soya

imported

deforestation

meat

chicken

local

Plant by Icon Island from the Noun Project Meat by The Icon Tree from the Noun Project Chicken by Виталий Плут from the Noun Project Fire by ✦ Shmidt Sergey ✦ from the Noun Project

tofu

GM soya

imported

deforestation

meat

chicken

local

fed imported soy

Plant by Icon Island from the Noun Project Meat by The Icon Tree from the Noun Project Chicken by Виталий Плут from the Noun Project Fire by ✦ Shmidt Sergey ✦ from the Noun Project

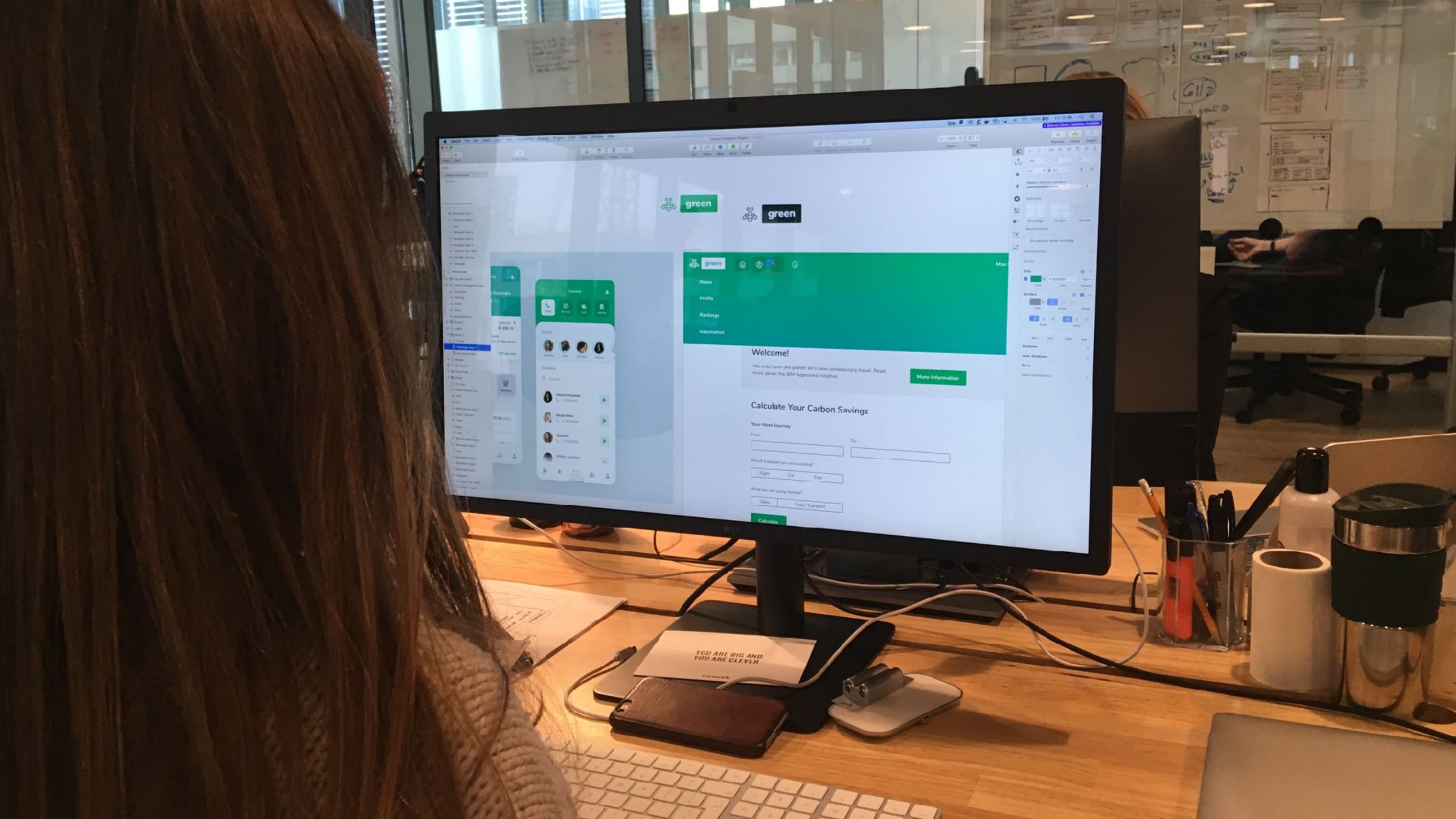
complex trade-offs

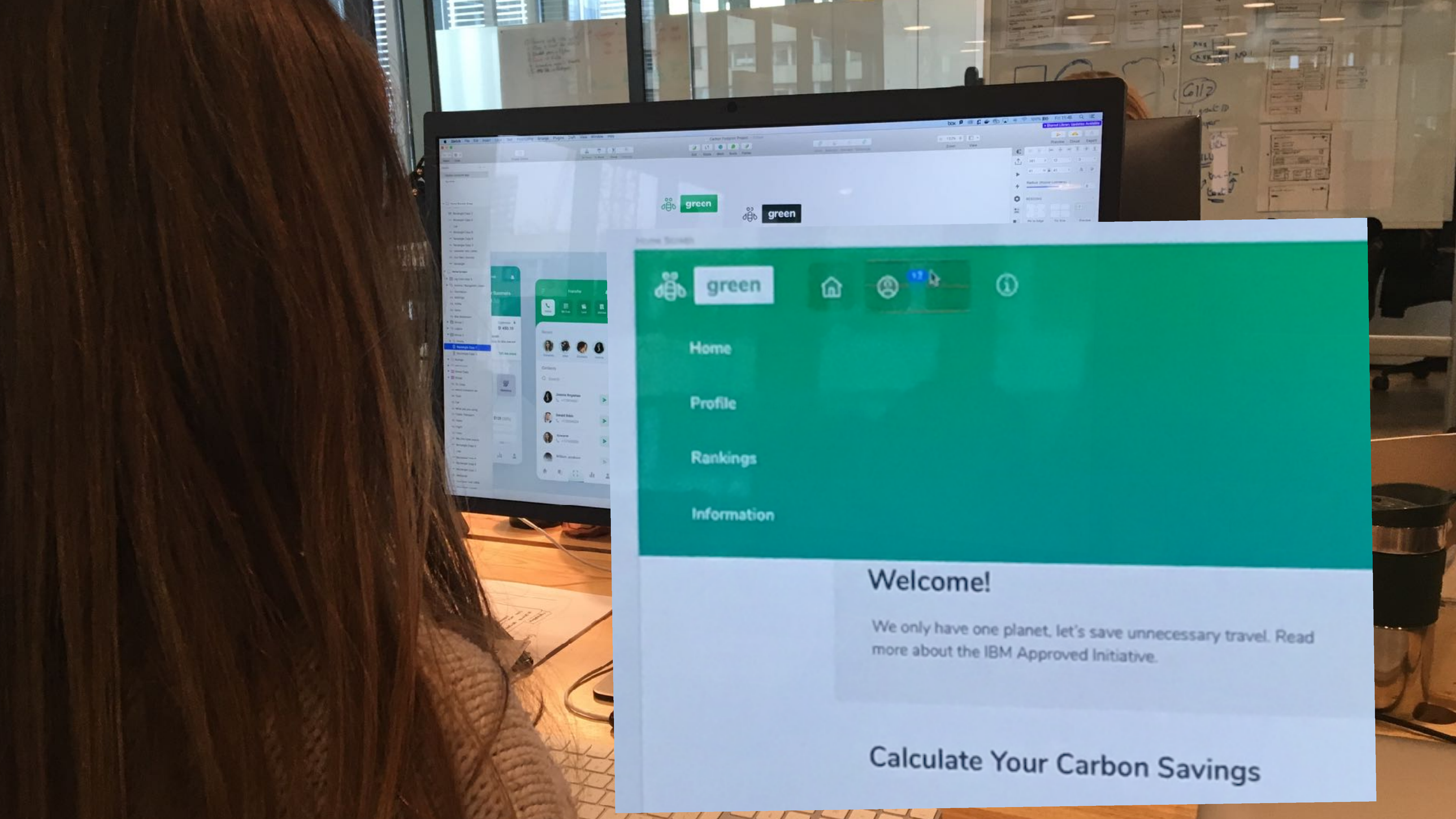
do less

reduce waste

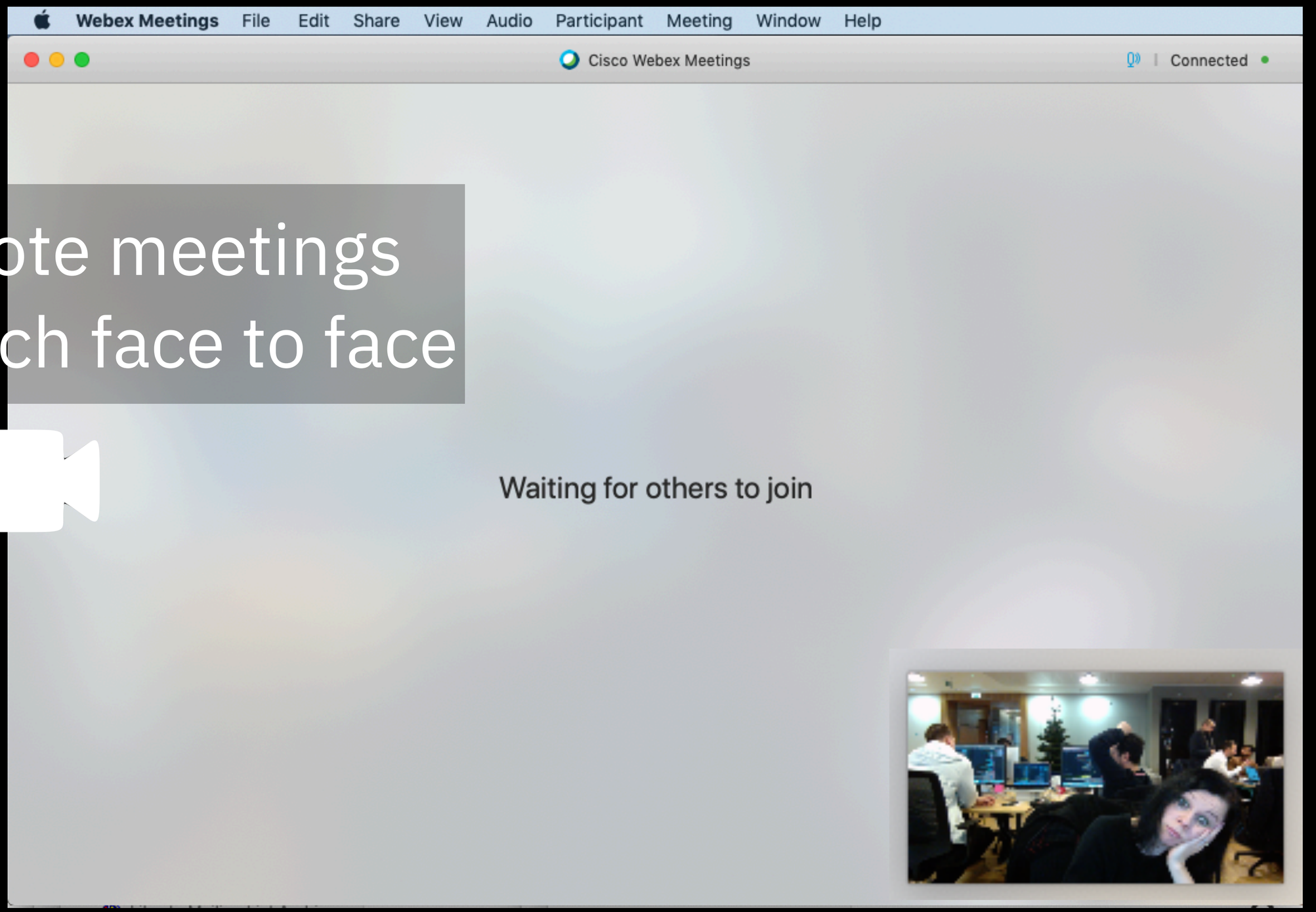
cutting back

Smile, Stress by David from the Noun Project


green
green
Home
Profile
Rankings
Information
Welcome!
More Information
Calculate Your Carbon Savings
Your Next Journey
YOU ARE BIG AND
YOU ARE CLEVER


green
green
green
Home
Profile
Rankings
Information
Welcome!
We only have one planet, let's save unnecessary travel. Read more about the IBM Approved Initiative.
Calculate Your Carbon Savings

no, remote meetings
don’t match face to face




Jeff Morris Jr.
@jmj
Eric Yuan (founder of Zoom) took 5 business trips while leading Zoom to an IPO. Crazy right.
Silicon Valley is amazed by this story. But Eric simply understood the value of dogfooding your product.
If you want to build the best video conferencing software, you avoid airplanes.
8:32 PM · Apr 22, 2019 · Twitter Web Client
163 Retweets
1.2K Likes

“The situation we’re facing isn’t how to do more with less. It’s how to do *less* with less.”

the future

“A zero-carbon world doesn’t have to be an awful one. The more we invest in it, the more the infrastructure around it changes to support it, and the easier and cheaper it gets... and the more normal it gets.”

- Liz Keogh (@lunivore)

Talk about it

Encourage your organisation to do more

Lower your footprint

Use **your** skills