Sustainability in Software Engineering

Today and Tomorrow

Martin Lippert, Spring Tools Lead & Sustainability Ambassador @ VMware
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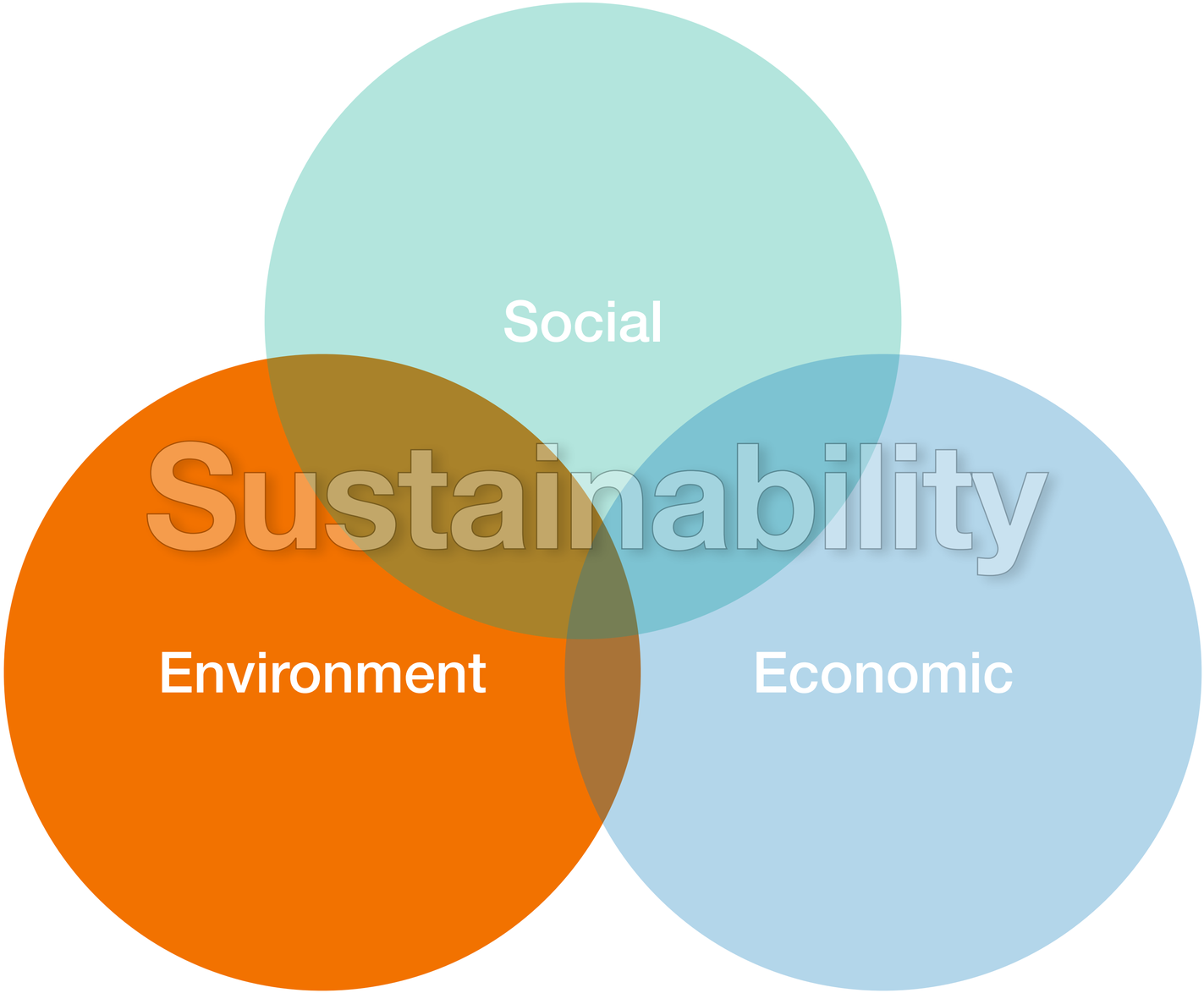
Social
Sustainability
Environment
Economic


Social
Sustainability
Environment
Economic

Climate Change is real

Greenhouse gas emissions

the main problem

Where do they come from?

Energy

What about Software?

commute to/from work

virtual meetings / zoom calls

hardware production

. . .

heating / cooling

datacenter operation (energy)

. . .

energy consumption

We need to decarbonize the entire world of software engineering

network data transfer

energy production

accommodation

conferences

business travel

food at work

. . .

. . .

Devoxx UK

Flight: 282kg
Hotel (2 nights): 51kg
Public transport: 5kg
~338kg

Driving a car for one year: 2000kg

Back to Software

Let’s talk about

Data Centers

The slogans

100%
Carbon Neutral

on 100%
Renewable Energy

On Site Production
of renewable energy

The reality

Your workloads do not run on renewable energy all the time

There is not enough renewable energy (yet)

There is not enough renewable energy (yet)

Renewable energy production varies a lot

There is not enough renewable energy (yet)

Renewable energy production varies a lot

Energy consumption increases

There is still

a long way to go

Just Wait?

No !!!

The transition is not fast enough
Energy consumption is increasing
Too many other aspects involved

What should we do

instead?

Do not run

your software

Eh, what?

Zombies
are a real problem

Related study: Jonathan Koomey & Jon Taylor: „Zombie/Comatose Server Redux“, http://anthesisgroup.com/zombie-servers-redux/

Do not run

your software - when not used

Idle machines

are a real problem

Adopt

Scale to Zero

architectures

Fast Startup
is important

Where

to run the software?

Choose the data center

wisely

Research Paper

„A Low Carbon Kubernetes Scheduler“

Aled James, Daniel Schien

When

to run the software?

Let the data center decide

when to run your batch jobs

Write better software

that uses less energy

that uses less hardware

CPU
Memory
Network

Reserved Resources

consume energy

Really think about your **container resource requirements**

In perspective

2 CPUs, 32GB: ~1930 kgCO2e / year
(Dell PowerEdge R560, 32GB, 2 CPUs, x4 300 GB HDD)

flight from FRA -> SFO: ~1883 kgCO2e
(per passenger and flight, economy, 747-8)

Don’t forget

Scaling Effects

Example:

Spring Boot
Spring Native
GraalVM

Feedback loops

are super important

Carbon Intensity
of a software will be a differentiating factor

Open Standards

to be able to compare

Green Software Foundation

https://greensoftware.foundation

Remember

We can have a huge impact

Let’s do it !!!

Thank You

for listening

Martin Lippert
@martinlippert