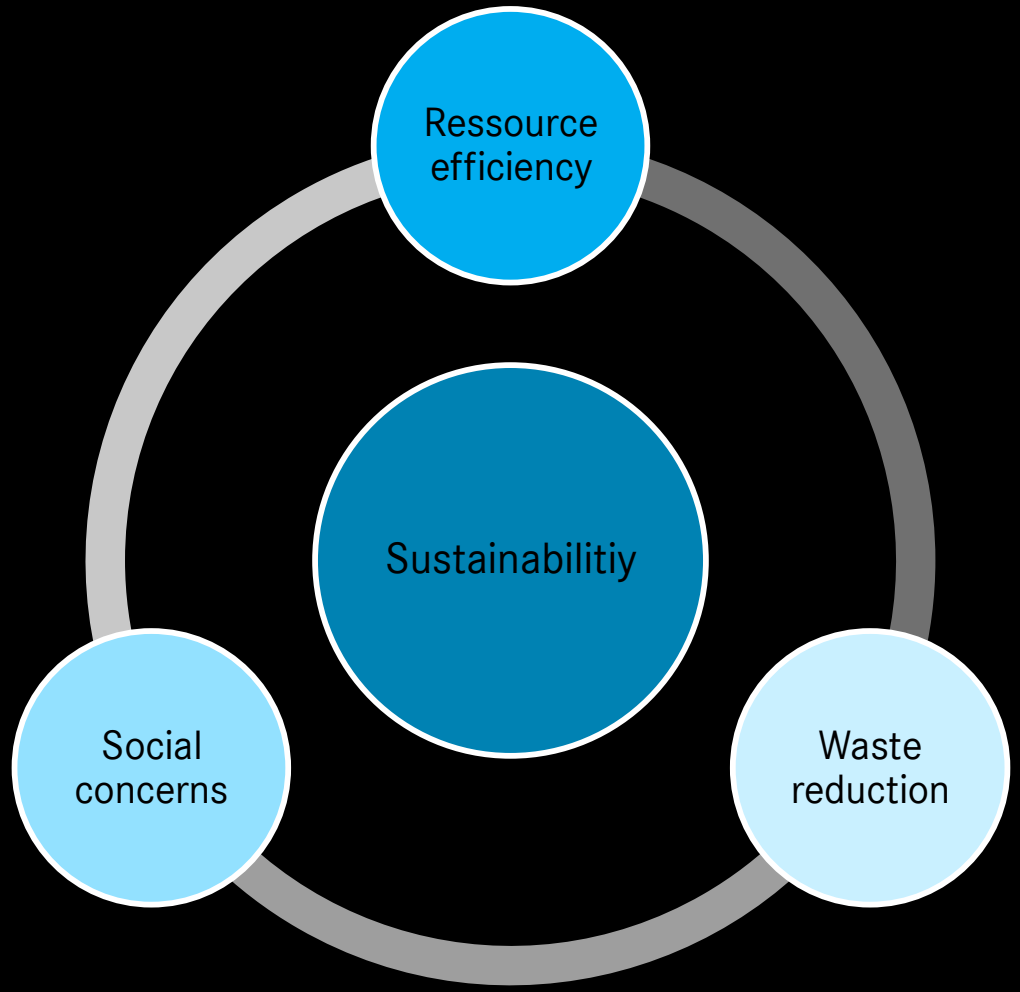
Metrics for sustainable code
#HerHackathon 2021

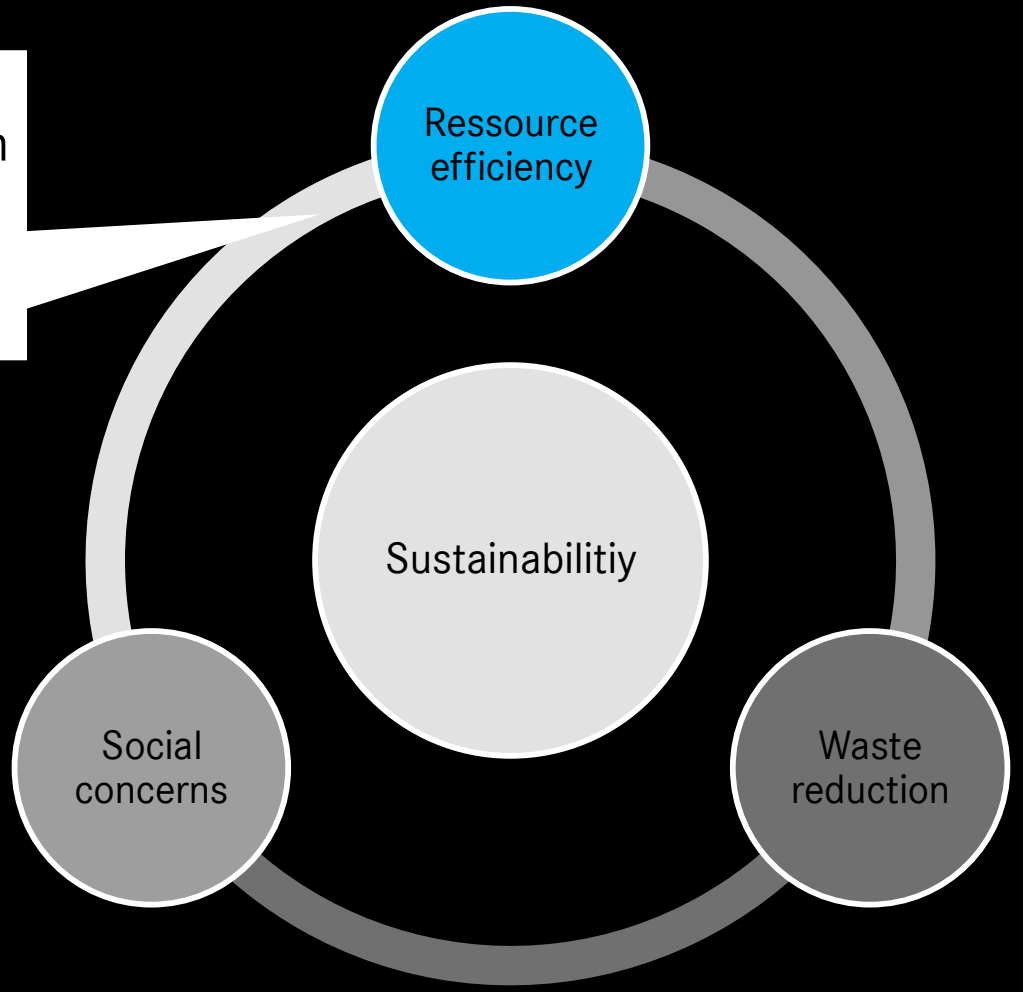
Mercedes-Benz
The best or nothing.

What makes Code sustainable?



What makes Code sustainable?

- Energy consumption
- Economic costs
- Utilization



Metric 1: Ressource Efficiency - Energy Consumption

Metric Name	What is measured?	How can you apply it?
Application Energy Efficiency	Same workload across different applications	➢ Standard scenario development ➢ Automatic run ➢ ML libraries as reference
Application Performance	Performance per energy unit	
Communication Energy Cost	Consumption due to communication, data exchange	
Computational Energy Cost	Due to CPU processing, memory access, I/O operations	➢ Result: recommendation to run local or on cloud

Metric 1: Ressource Efficiency - Energy Consumption
Methods and libraries to look into

Computational Cost – Java:

- execution of bytecode types (platform independent)
- corresponding native methods (library functions provided by JVM like `java.io.FileInputStream's read()`)
- monitor mechanism (thread handling)
- You might want to measure the platform-specific costs for each type, then multiply it by the number of calls.

Attention!
Very ressource-efficient code might demand more ressources during development and maintaince, effectively not being sustainable. Try to think of a way to present both

Metric 2: Ressource Efficiency - Utilization

CPU, Memory and storage are three of the biggest influences on overall energy consumption. Their utilization can be a good proxy for energy consumption.

Metric Name	What is measured?	How can you apply it?
Memory or Storage Usage	Percentage of RAM or storage utilization.	Profile the memory usage, either per line of code or per object type

Metric 2: Ressource Efficiency – Utilization

Methods and libraries to look into

Powershell commands:

Get-WmiObject Win32_Processor | Select LoadPercentage | Format-List

gwmi Win32_PerfFormattedData_PerfOS_Processor | select PercentProcessorTime

Get-WmiObject Win32_Processor | Measure-Object -Property LoadPercentage -Average | Select Average

cmdlet:

Get-Counter '\Memory\Available MBytes'

Get-Counter '\Processor(_Total)\% Processor Time'

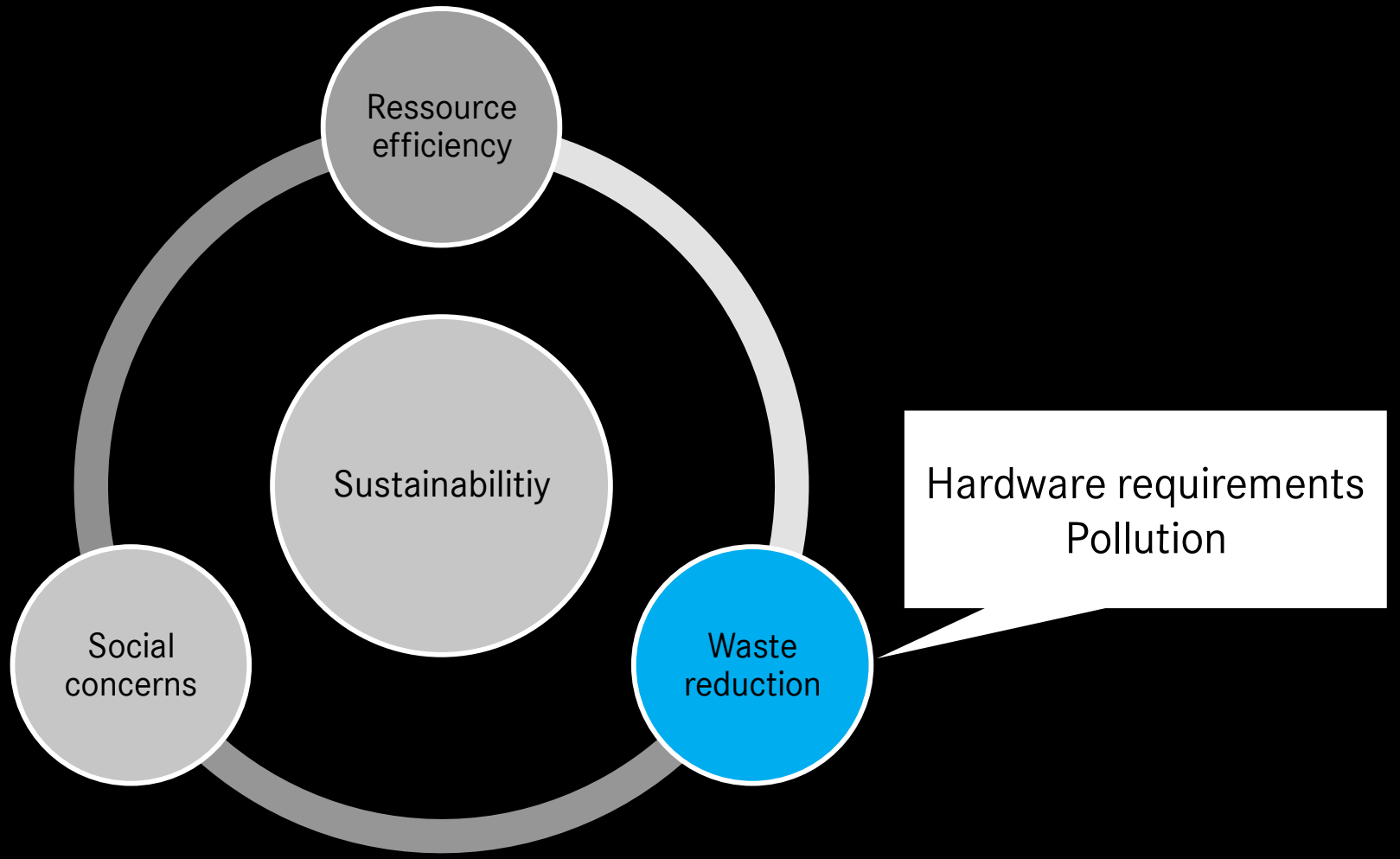
Python:

guppy3 – heapy

Java:

java.lang.management.OperatingSystemMXBean - getSystemLoadAverages

What makes Code sustainable?



Metric 3: Waste Reduction – Hardware requirements

Code with lower hardware requirements causes less hardware changes

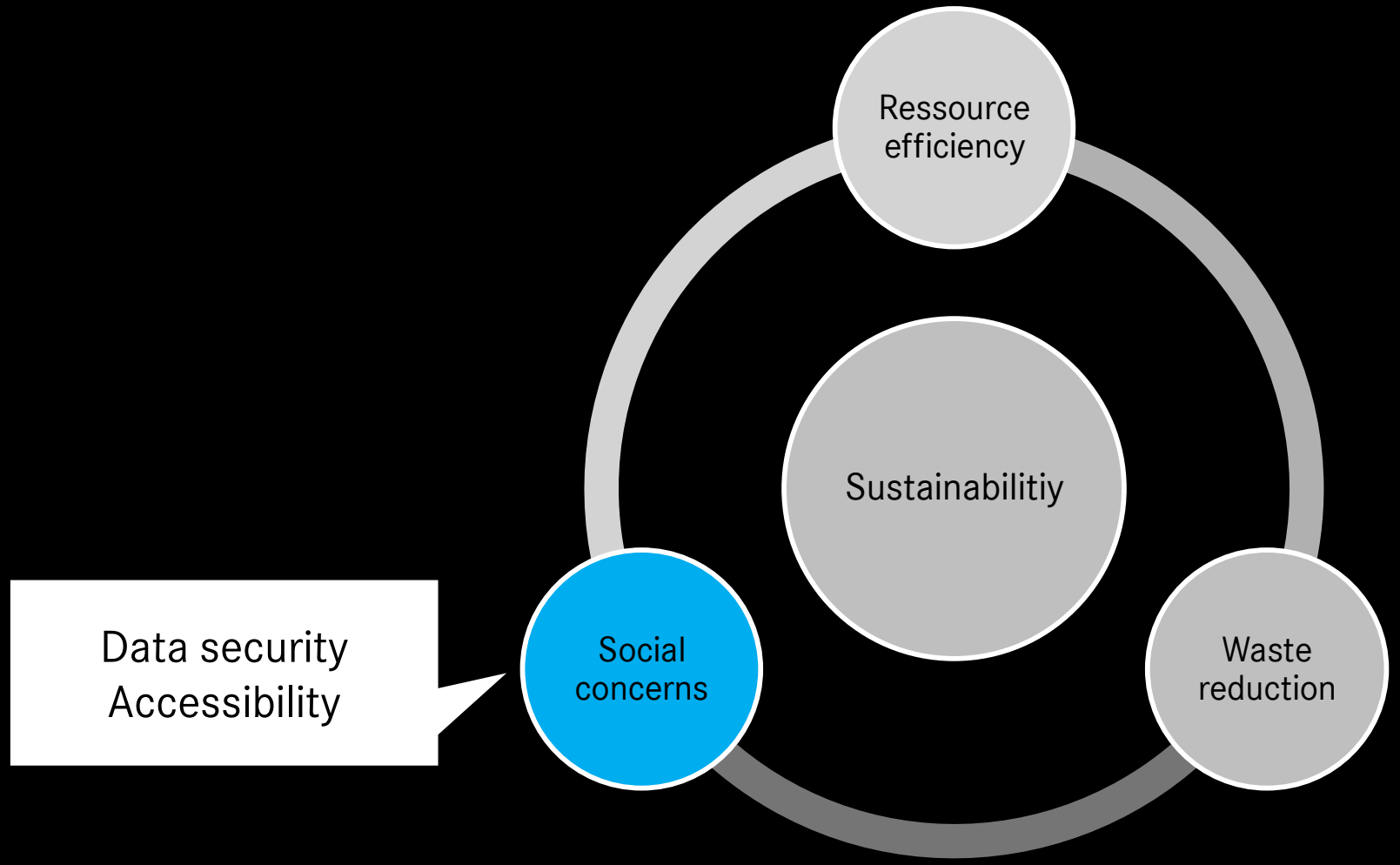
Metric Name	What is measured?	How can you apply it?
Hardware requirements	How performant must the hardware be in order to run the code?	➢ Define reference systems and rebuild conditions ➢ Test whether the code would run smoothly on a machine

Metric 3: Waste Reduction – Hardware requirements
Methods and libraries to look into

- Virtual Machines can be set up to simulate a variety of systems
- Make sure to set a high workload to find limitations

- Vagrant to automate provisioning
- Raspberry Pi Azure IoT Online Simulator

What makes Code sustainable?



Metric 4: Accessibility

Software should be inclusive both for developers and users in order to not exclude anyone who is differently abled.

Metric Name	What is measured?	How can you apply it?
Accessibility (user)	Is the resulting User Interface accessible? Many of the Web content Accessibility Guidelines are also applicable for app interfaces	Parse code and look for elements such as text alternatives and user input options
Accessibility (developer)	Is the code also maintainable by developers with a handicap?	Are variable names pronouncable and meaningful (screen readers)

Metric 4: Accessibility
Methods and libraries to look into

- WebAnywhere – Open Source tool to test Websites, might be modified for app interfaces
- Google‘s Accessibility Test Framework – Android App UI scanning

- Python: automated-accessibility-testing, axe-selenium-python, IBM‘s equal-access
- Java: Globant.Selenium.Axe, Java-a11y

Metric 5: Data Ownership

Data from everyone involved is valuable and should be well protected

Metric Name	What is measured?	How can you apply it?
Data Ownership	Is data saved in a responsible way?	Test whether any passwords are saved or transmitted unhashed, alert when a git-push includes personal data like VIN or addresses (text mining)

Metric 5: Data Ownership
Methods and libraries to look into

- Secret Scanner (for example: https://github.com/grab/secret-scanner)
- Tools relating to gdpr-conformity

Consider adding context-related scans for VINs or other personal data

If you are feeling overwhelmed...

Here are some ideas how you can approach the problem regardless of any software development:

- Compare two or more OpenSource tools, for example Databases. Write a common use case, then replicate the steps on both tools and document ressource usage during execution

- Compare different algorithmic approaches for a problem liek sorting. Vary your input data and measure the efficiency of each algorithm.