



# Metrics for sustainable code #HerHackathon 2021

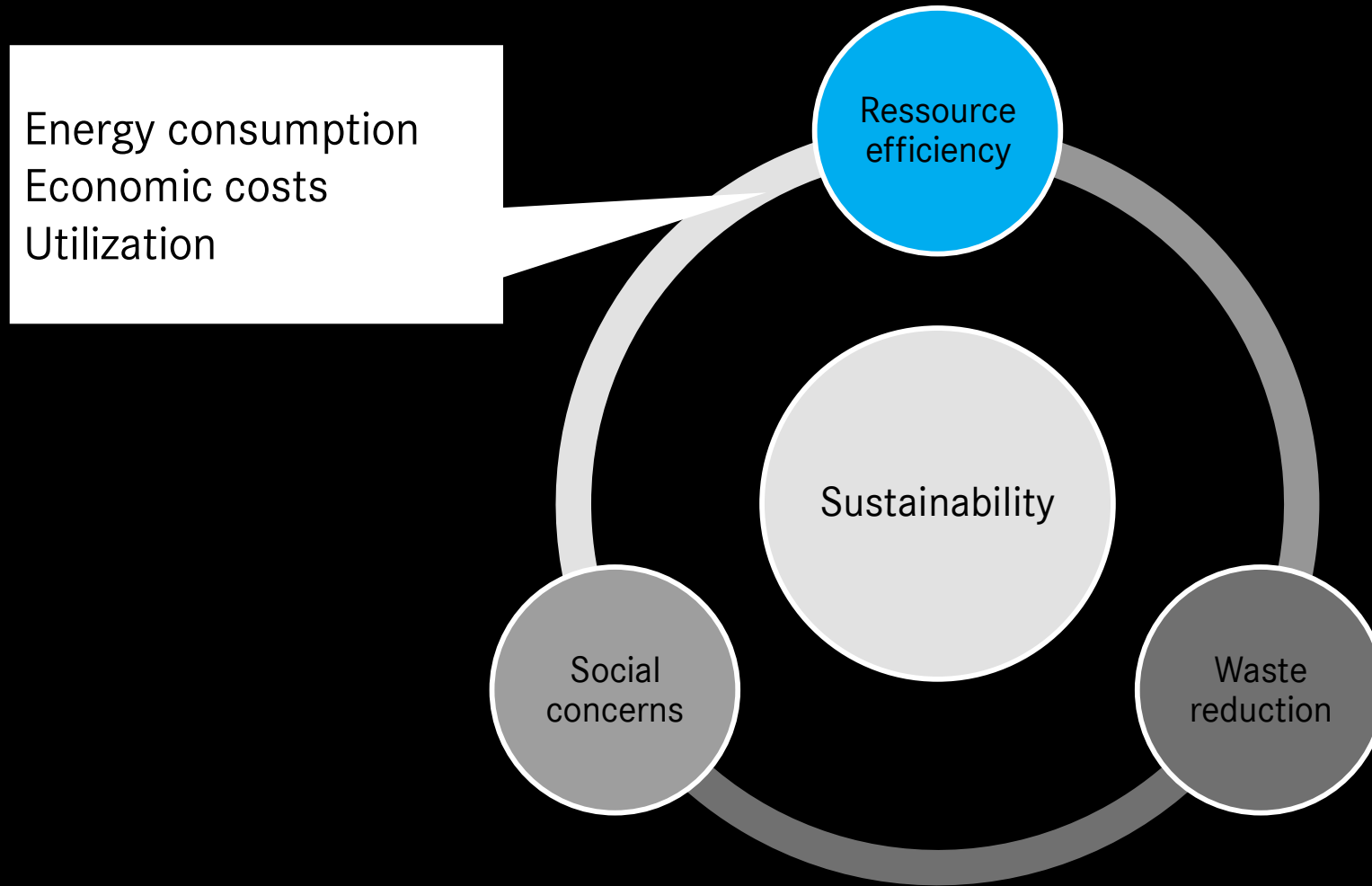
Mercedes-Benz  
The best or nothing.



# What makes Code sustainable?



# What makes Code sustainable?



# Metric 1: Ressource Efficiency - Energy Consumption

Metric Name	What is measured?	How can you apply it?
Application Energy Efficiency	Same workload across different applications	<ul style="list-style-type: none"><li>➤ Standard scenario development</li><li>➤ Automatic run</li><li>➤ ML libraries as reference</li></ul>
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	<ul style="list-style-type: none"><li>➤ Result: recommendation to run local or on cloud</li></ul>

# 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 resource-efficient code might demand more  
resources during development and maintenance,  
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'
```

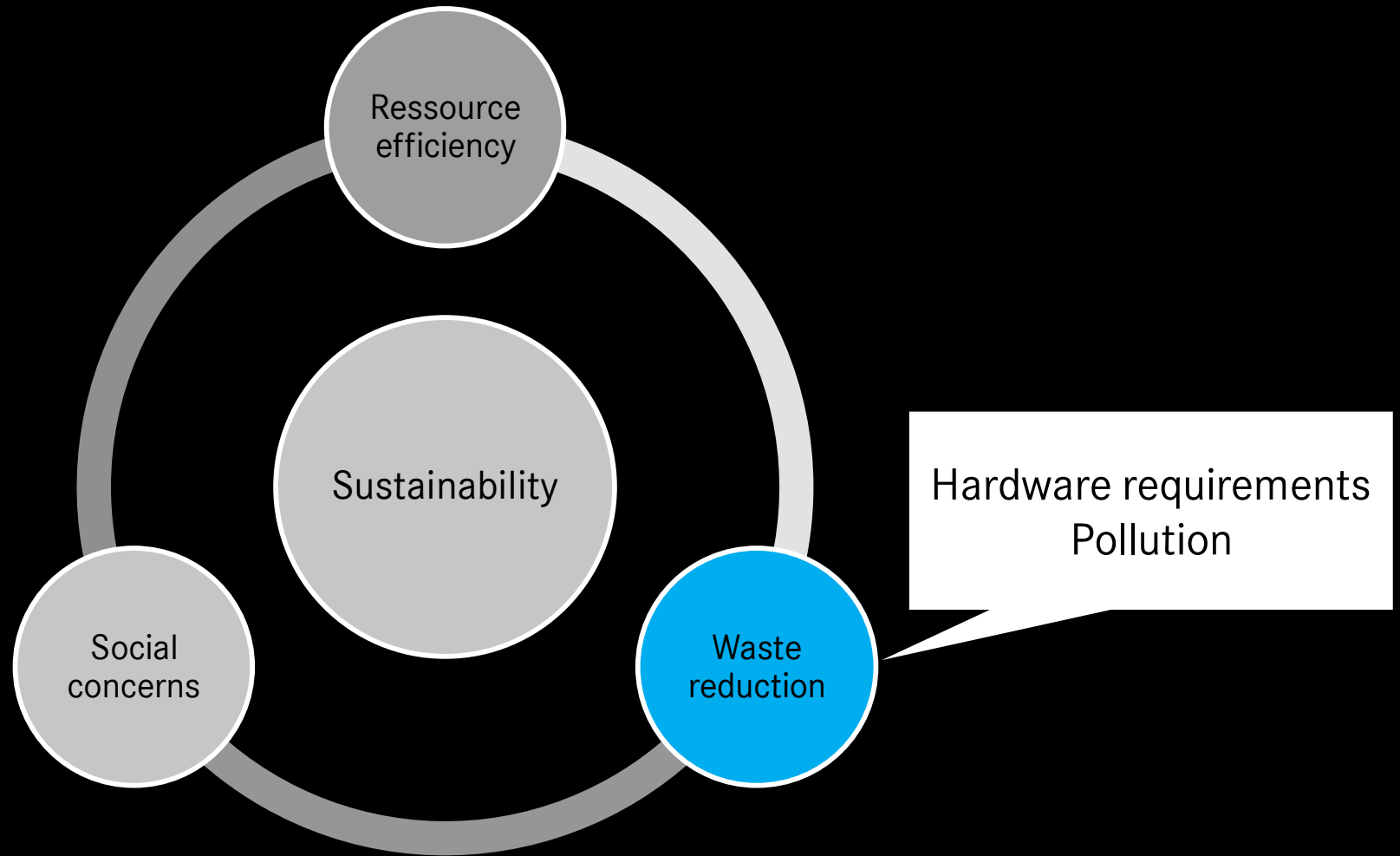
### Python:

```
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

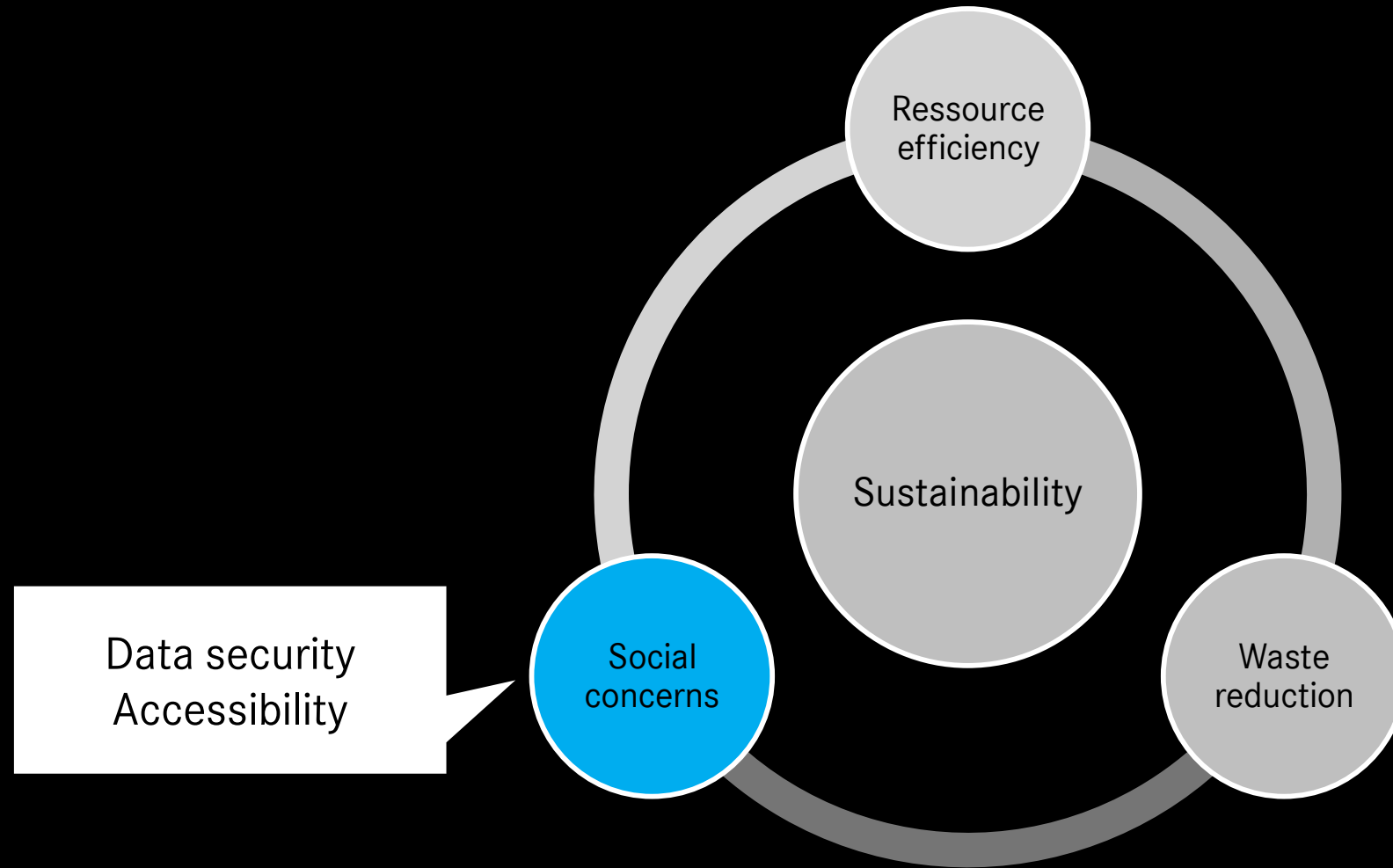
Metric Name	What is measured?	How can you apply it?
Hardware requirements	How performant must the hardware be in order to run the code?	<ul style="list-style-type: none"><li>➤ Define reference systems and rebuild conditions</li><li>➤ Test whether the code would run smoothly on a machine</li></ul>

# 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 pronounceable 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 resource usage during execution
- Compare different algorithmic approaches for a problem like sorting. Vary your input data and measure the efficiency of each algorithm.