

Green Software Development

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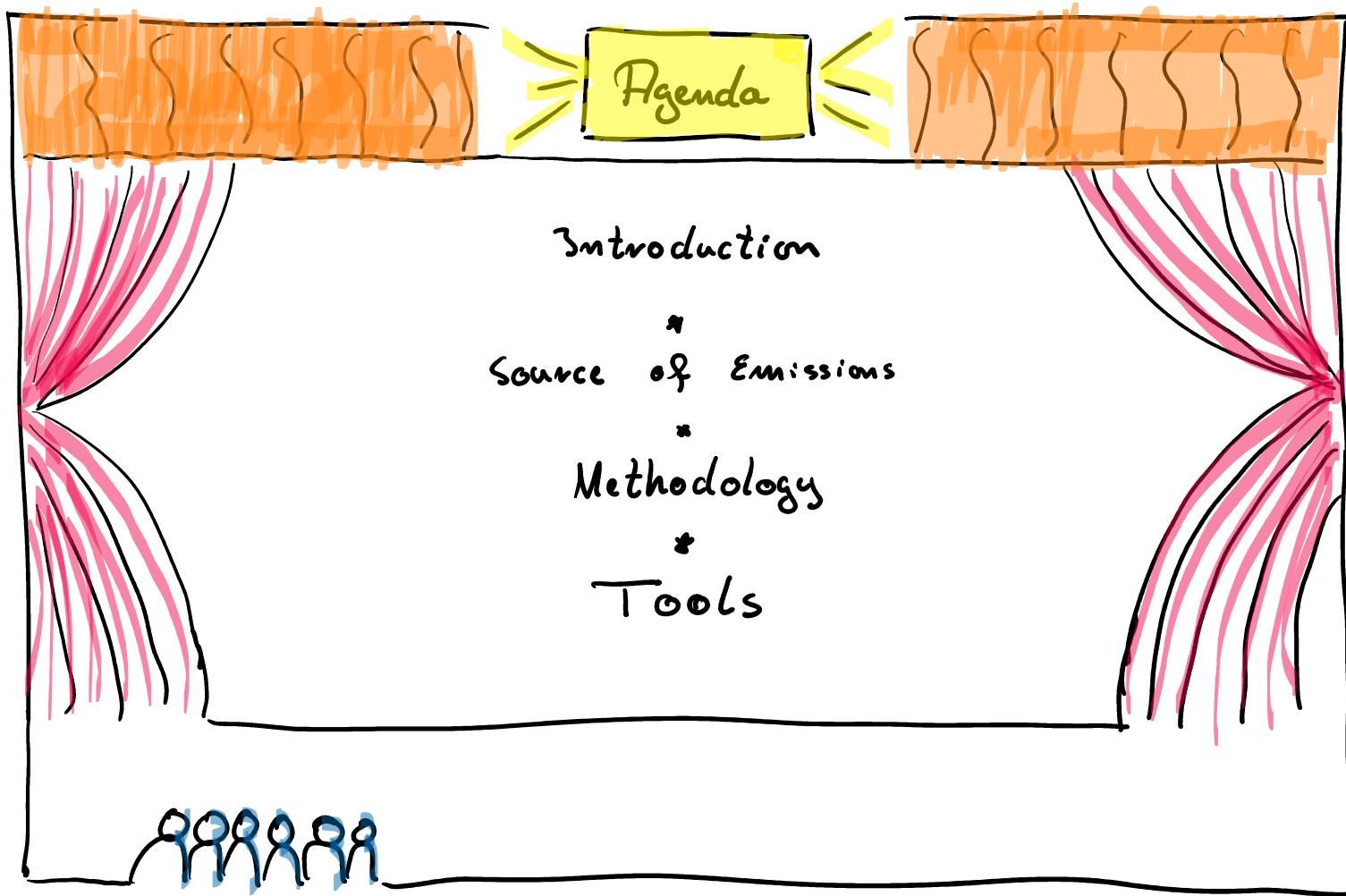
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github.com/bluehands



Share in global emissions

4%



Measuring carbon emissions

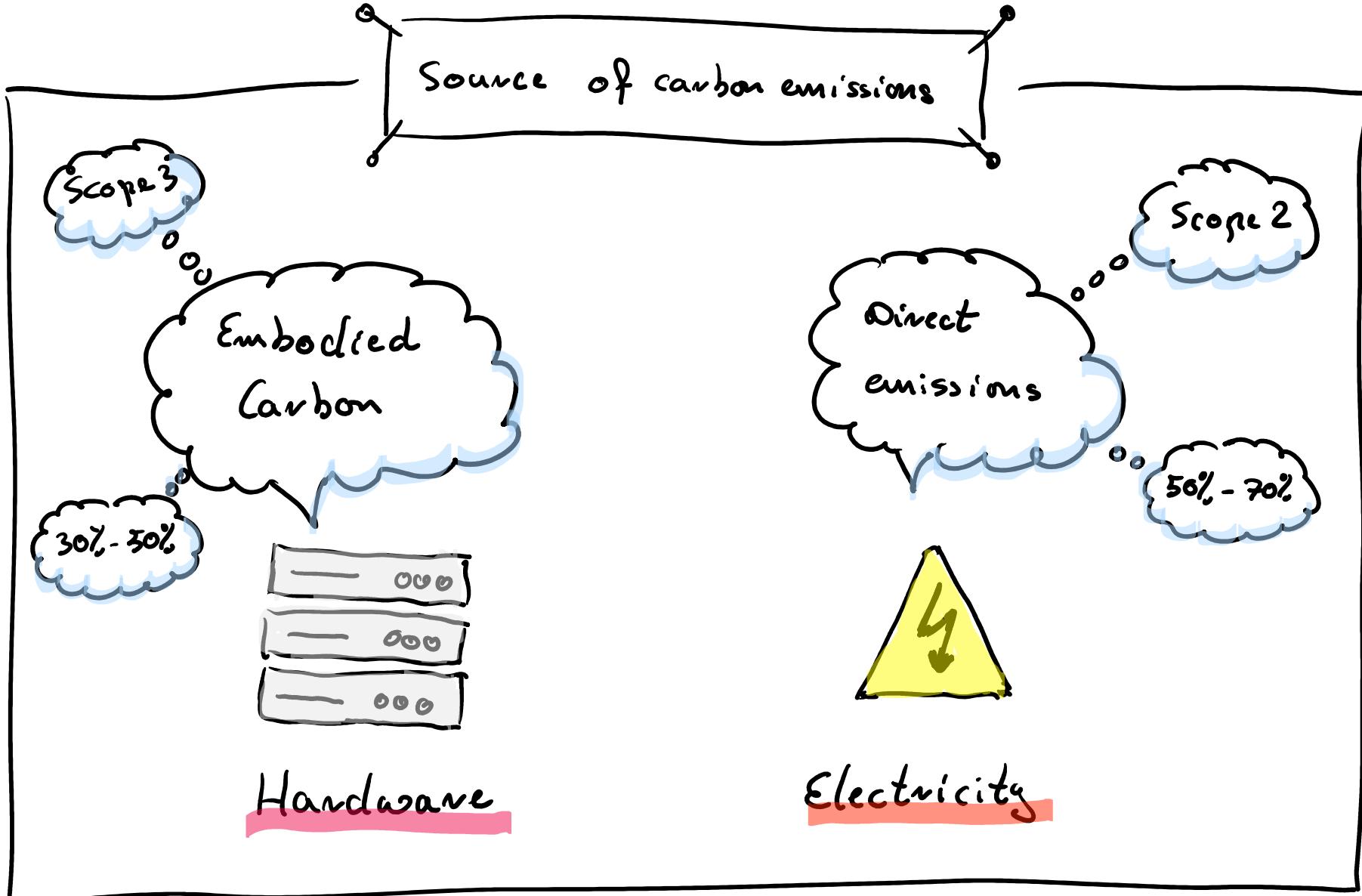


Use cases:

- Optimizing \Rightarrow Reduce Emissions
- Reporting \Rightarrow CSR &
- Monitoring \Rightarrow Control & React
- Transparency \Rightarrow Awareness



Grid Intensity, Embodied-Carbon , 3d6 - Offset
CPU - Utilization , RAM , PUE



Embodied Carbon

Hardware contains emissions from production
delivery & final disposal



■ Lifetime : How long the hardware
is in use



■ Server Utilization : How many apps are
running on the hardware

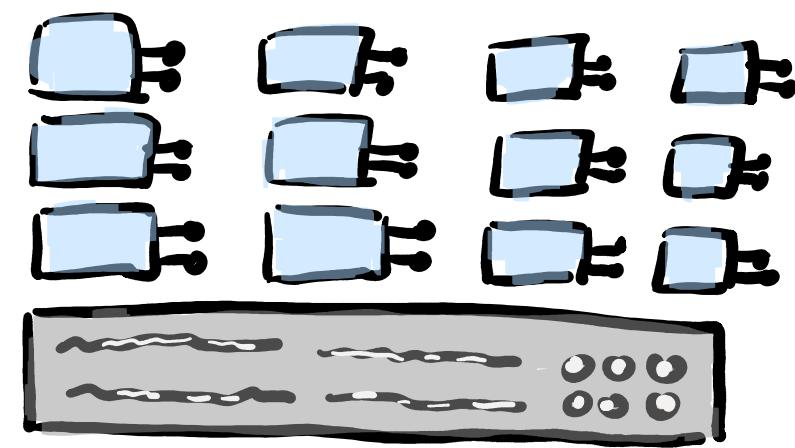
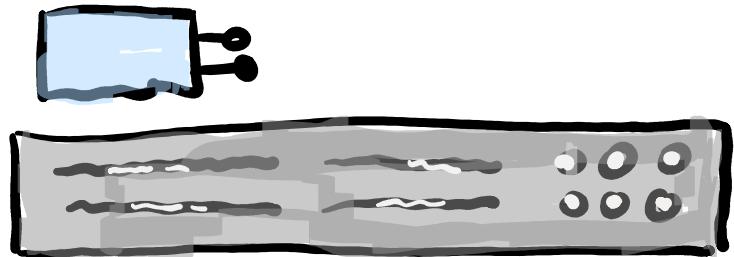
Server Utilization



Maximize Server Utilization



Minimize Embodied Carbon / Application



Split Sdle-Gap



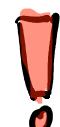
Server without load consumes Energy



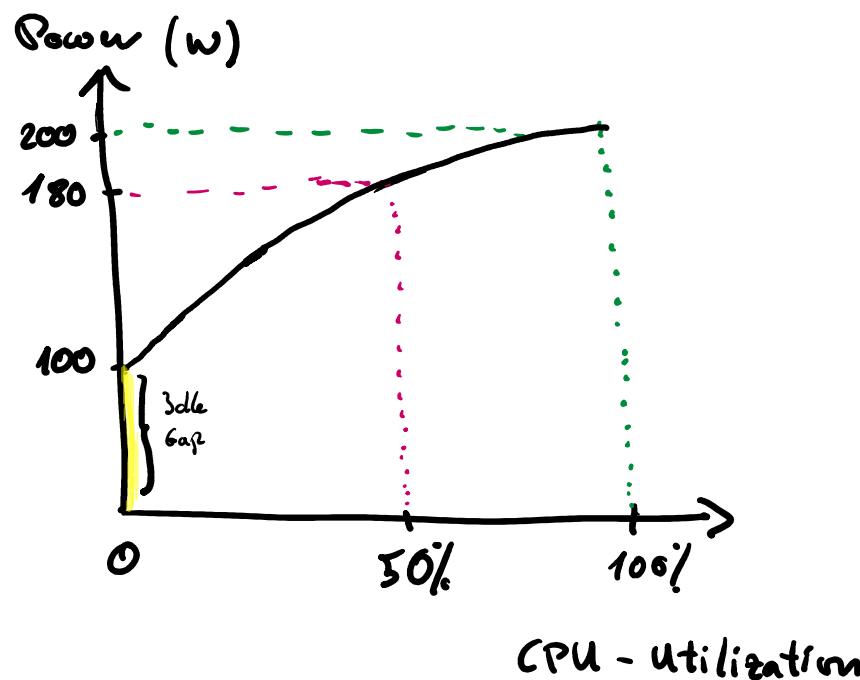
load/Energy - Ratio is not linear

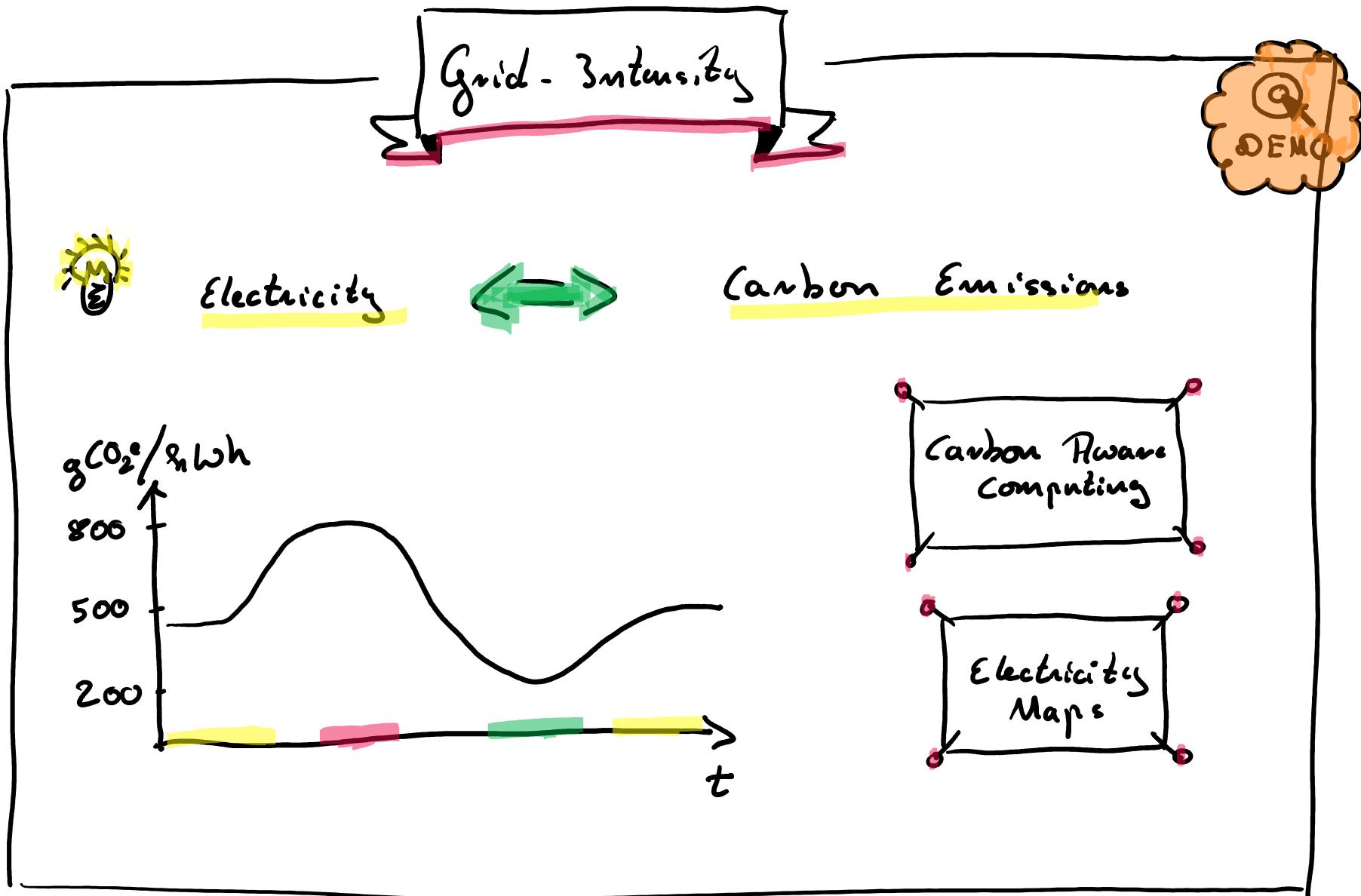


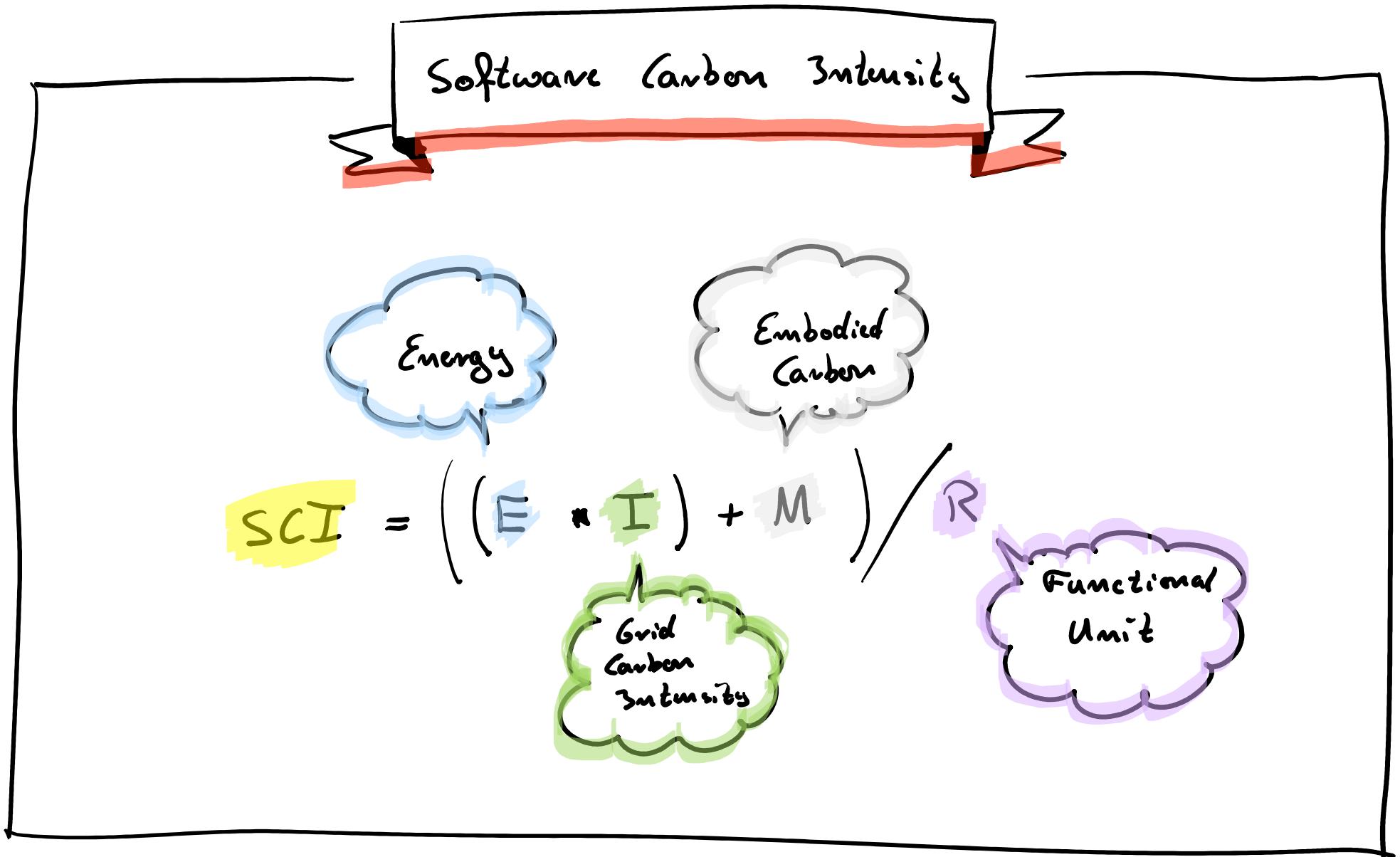
Maximize server utilization

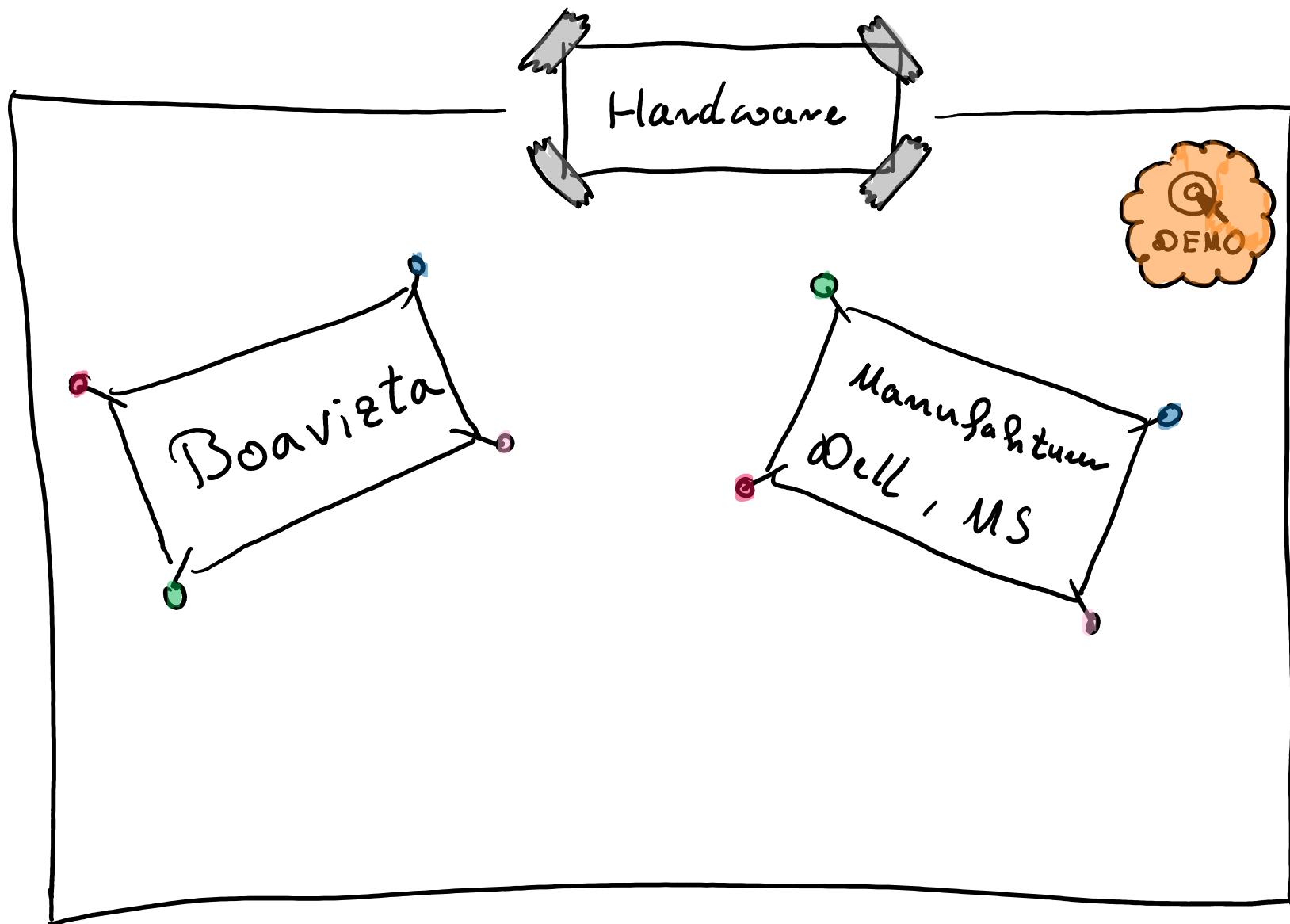


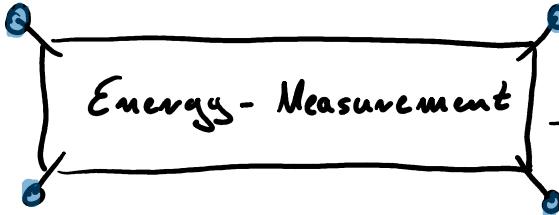
Split Sdle-Gap



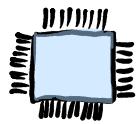








At the socket or power management



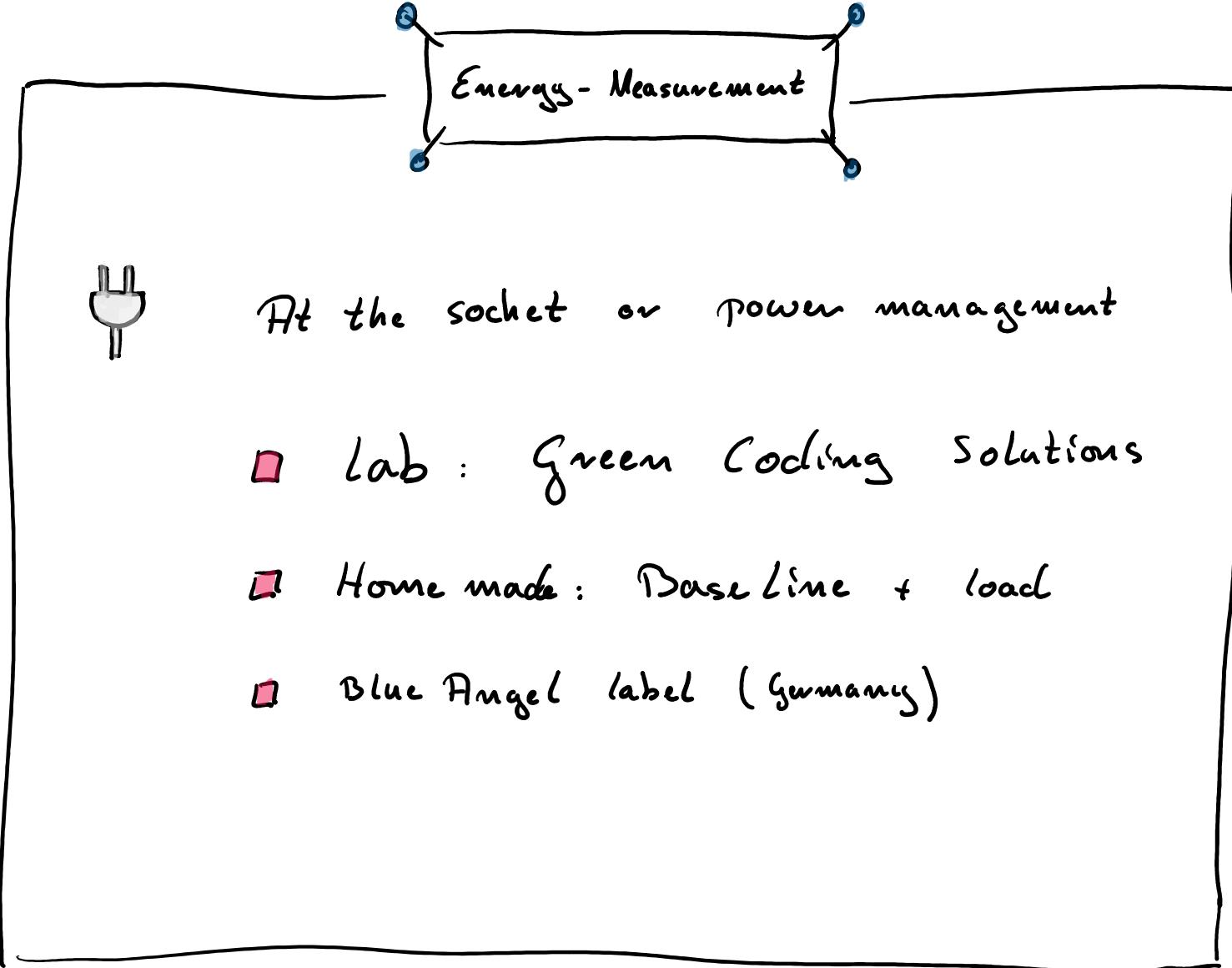
RAPL , CPU , Mainboard , Periphery

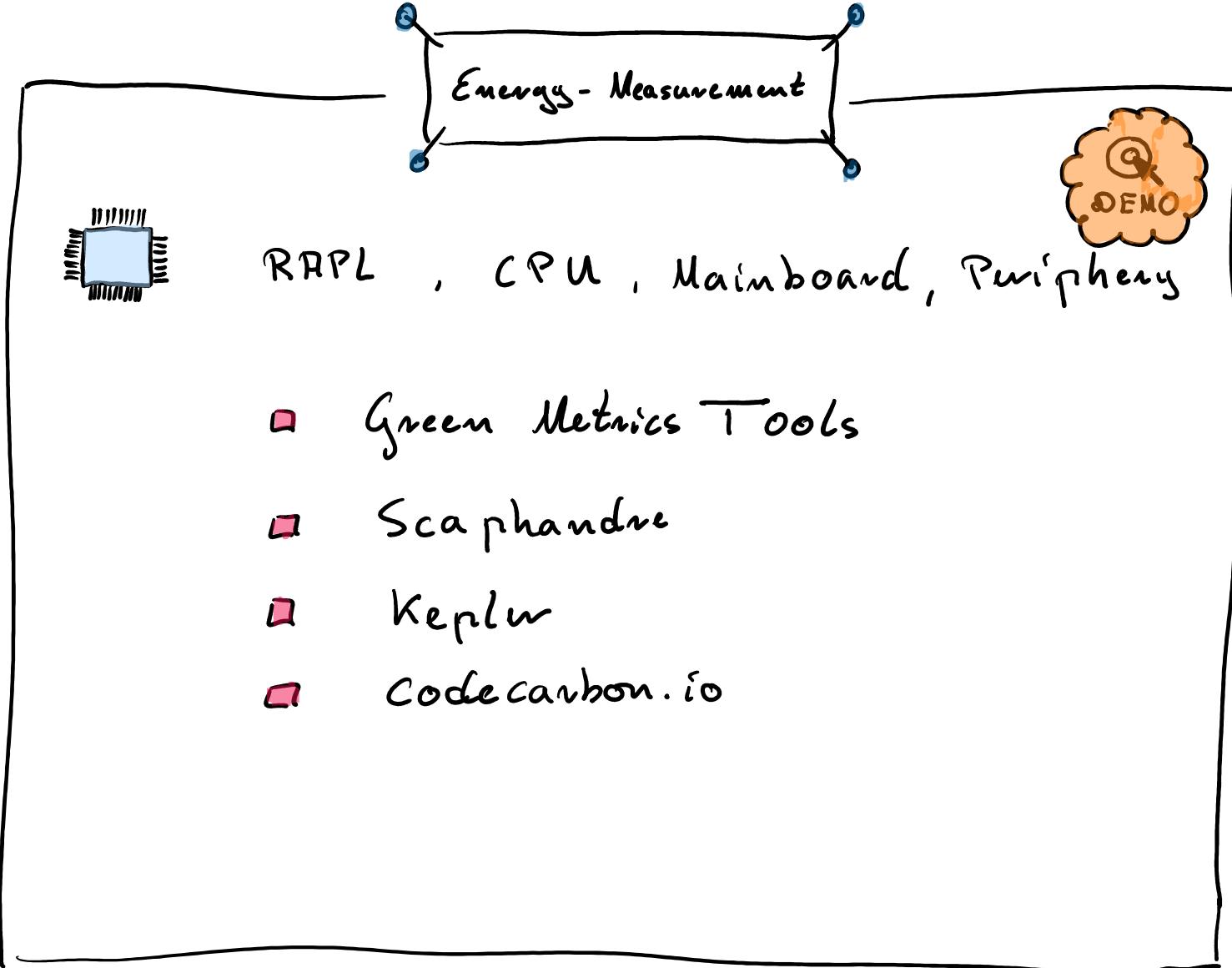


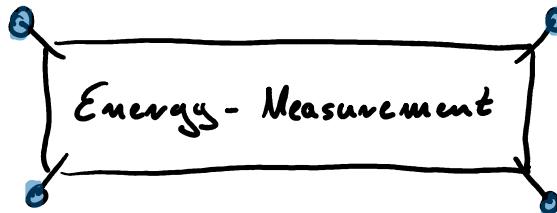
Estimation with trained models



Counting and use of emission factors



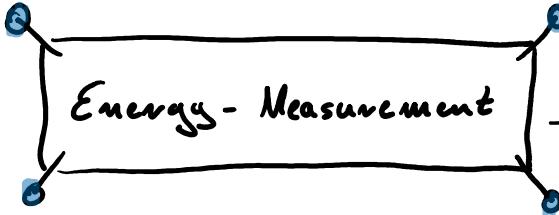




Estimation with trained models

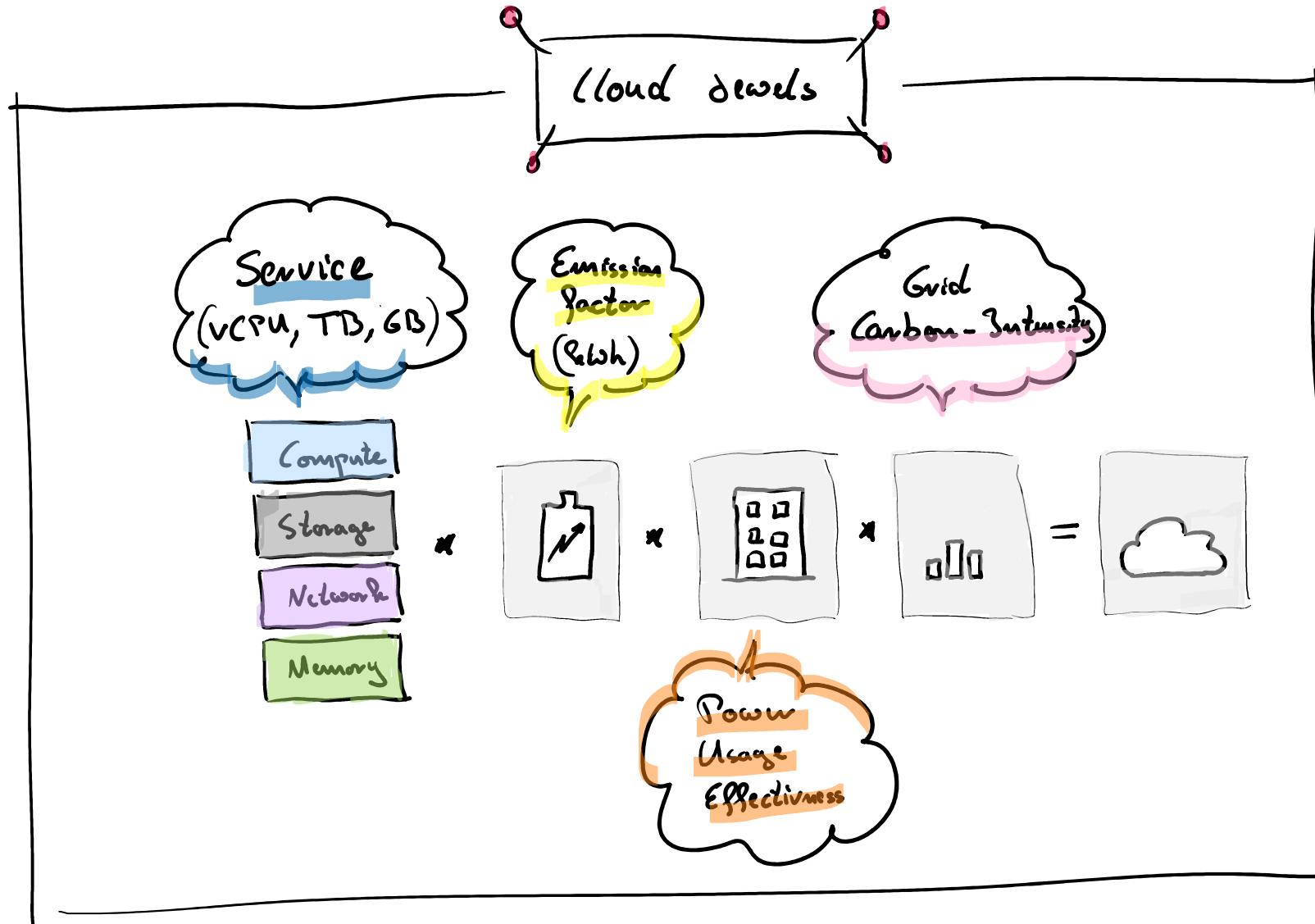


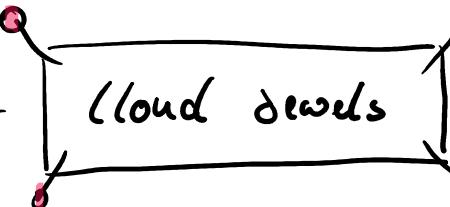
- Cloud Energy
- Scaphandre
- Kepler



Counting and use of emission factors

- Cloud Carbon Footprint
- Technologie Carbon Standard





Best Software in Town for Cloud Jewels

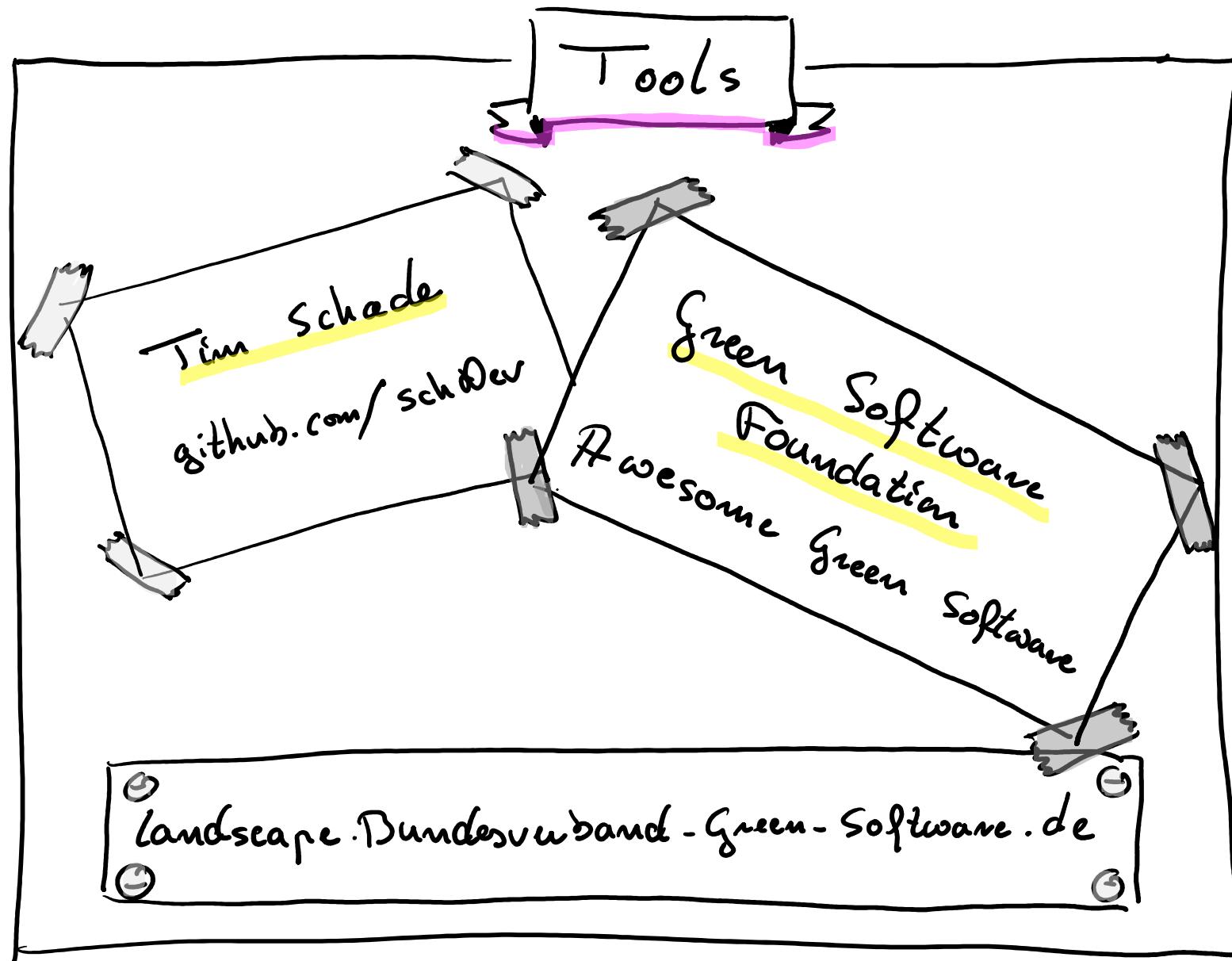
⇒ Cloud Carbon Footprint



Use Billing-API or Consumption-API
to collect the jewels



Emission Factors for the jewels





! Many Components: Backbone, devices , networks

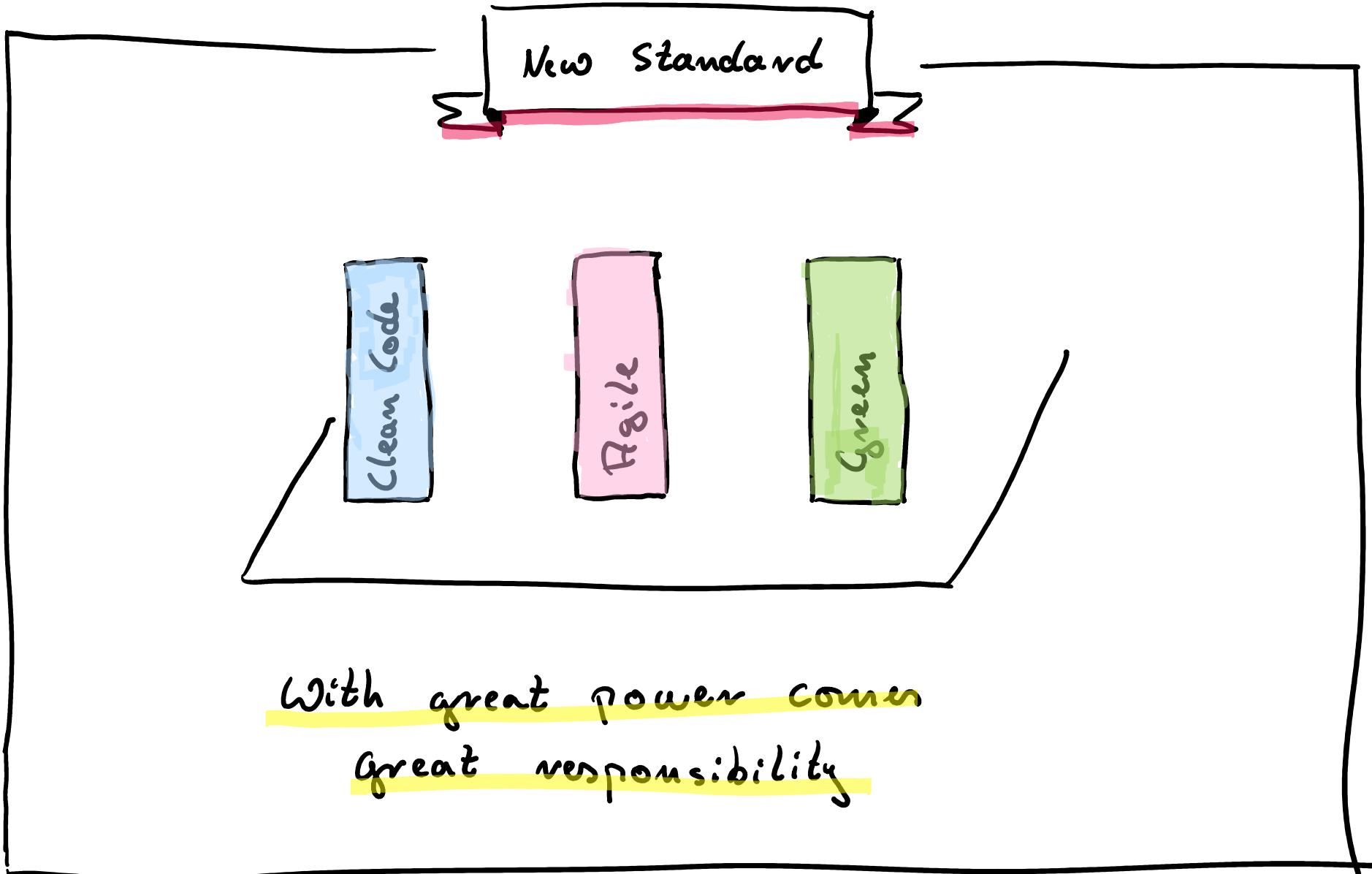
💡 Research: Mostly from Network

⇒ Extremely simplified model :

Transferred Bytes ~ Emissions

⇒ CO2.js from Green Web Foundation

⇒ Website Carbon Meter





- Green Software Foundation
- Green Web Foundation
- Electricity map.org ; Watttime.org
- Bundesverbund Green Software
- CloudCarbonFootprint.org
- Eco-Compute.io
- Climateaction.tech
- Carbon-aware-computing.com