SDIA

SUSTAINABLE DIGITAL
INFRASTRUCTURE ALLIANCE

Why do we need an environmental footprint for software?

Agile Testing Days, Berlin, 23-11-2022

Sustainability = A balance of environmental, societal and economic needs.

Even more important: The sustainable development of our society & economy.

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

United Nations Brundtland Commission, 1987

What does this mean for us in the SDIA Community?

"We want to chart a path for the sustainable development of IT, Digitalization, the Digital Economy, and Digital Infrastructure and execute it."
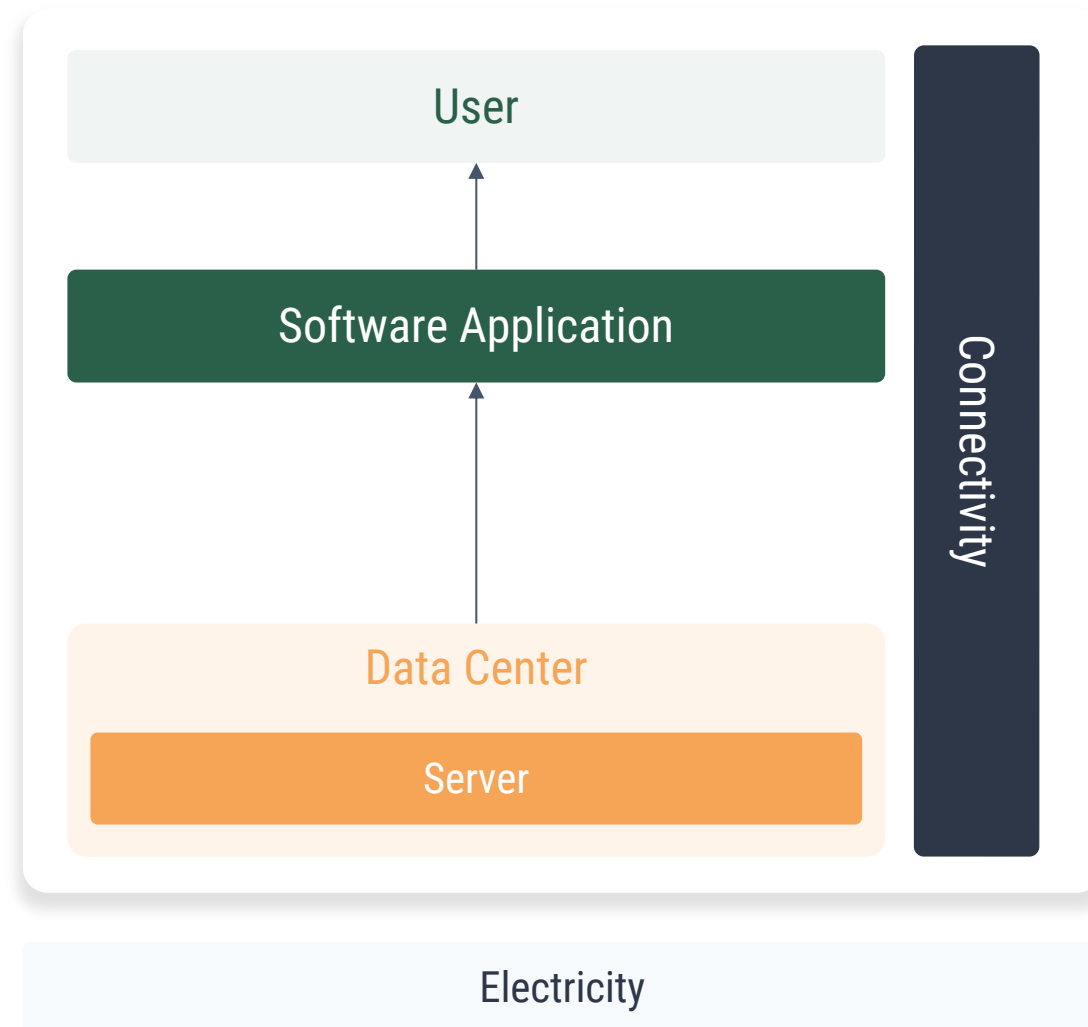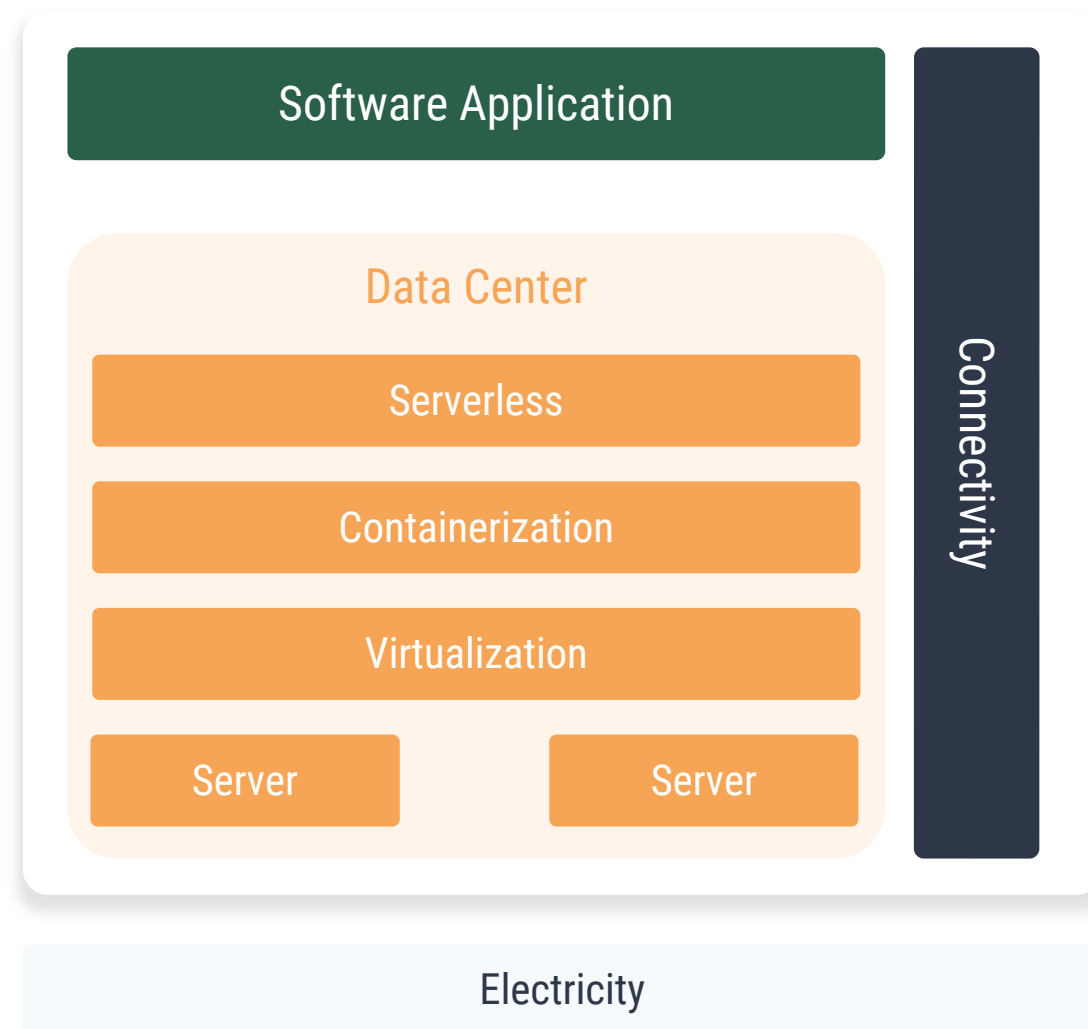
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"to measure is to know"

Lord Kelvin

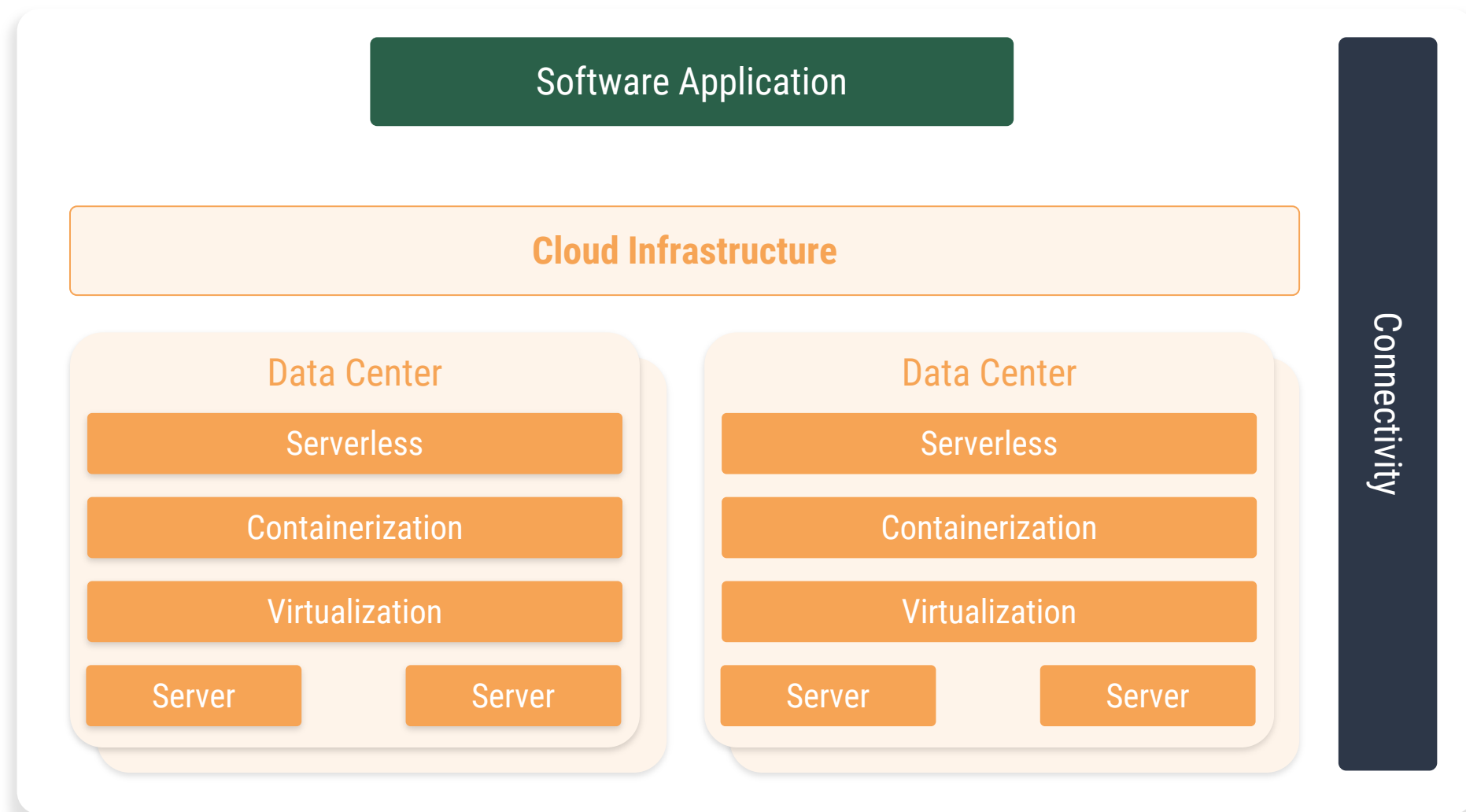# When I started my career, software applications and their infrastructure looked like this:

As my career advanced, I watched the application move further and further away from the physical infrastructure.

Each layer of abstraction made the one below invisible - the illusion of infinite resources is created.
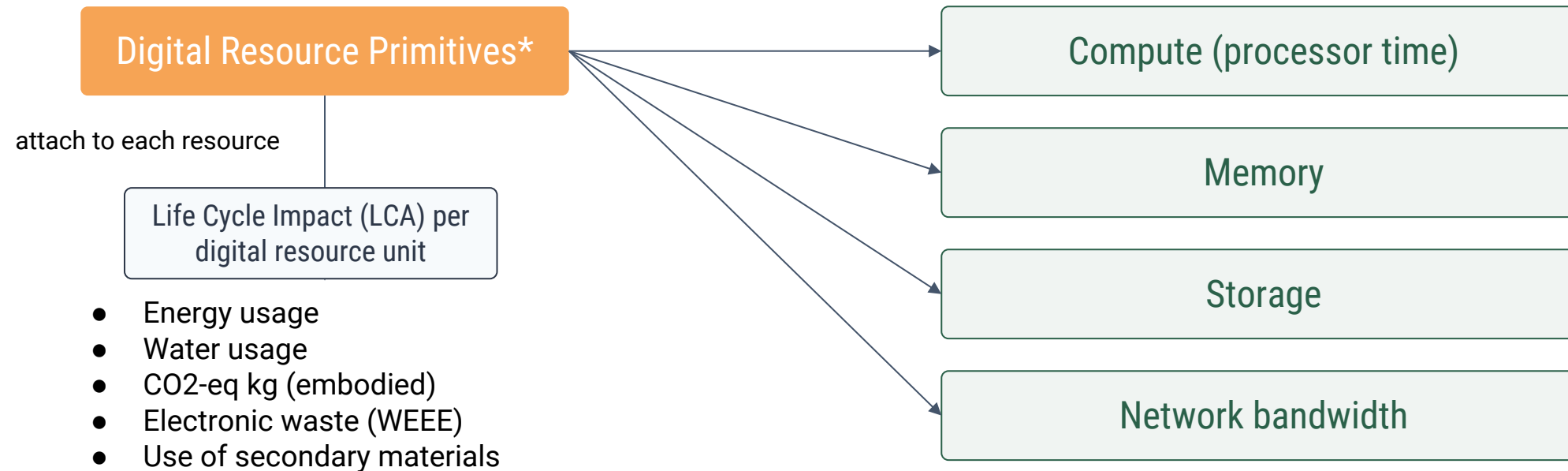
So we started to define a more simplified model & school of thought on how we can look at digital products & infrastructure:

User

uses

Software Application

allocates resources

Resource Provisioning

produces resources

Digital Infrastructure
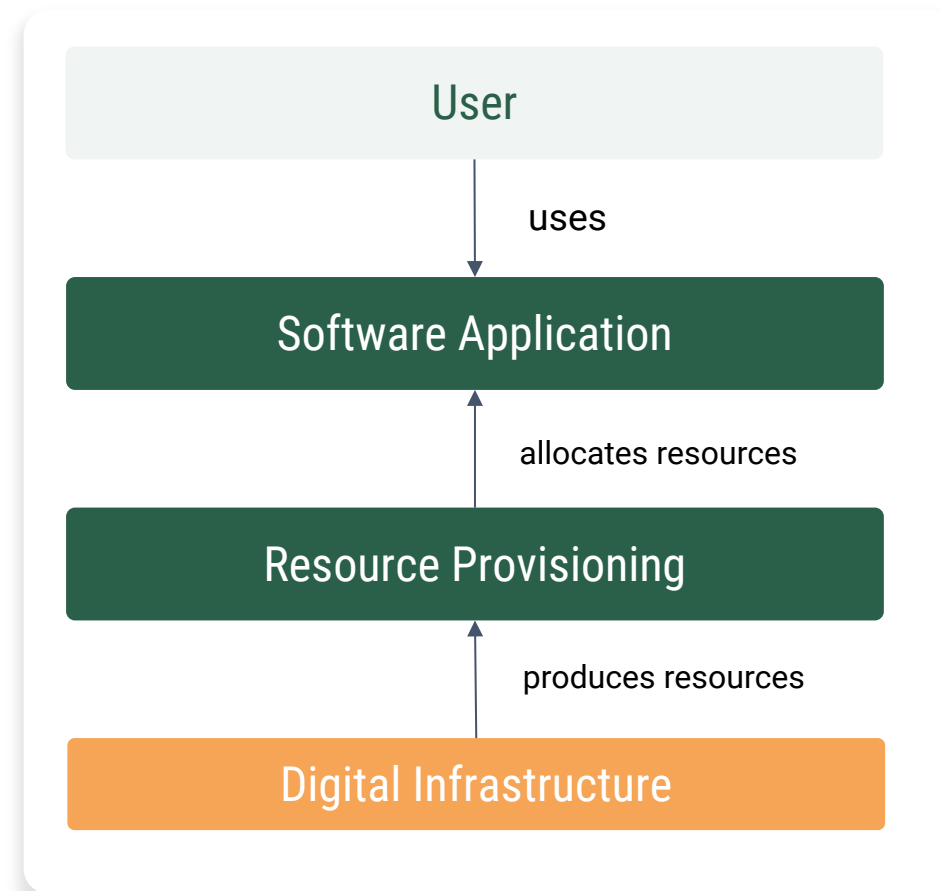
A more detailed version can be found in the paper Taxonomy for a Digital Economy
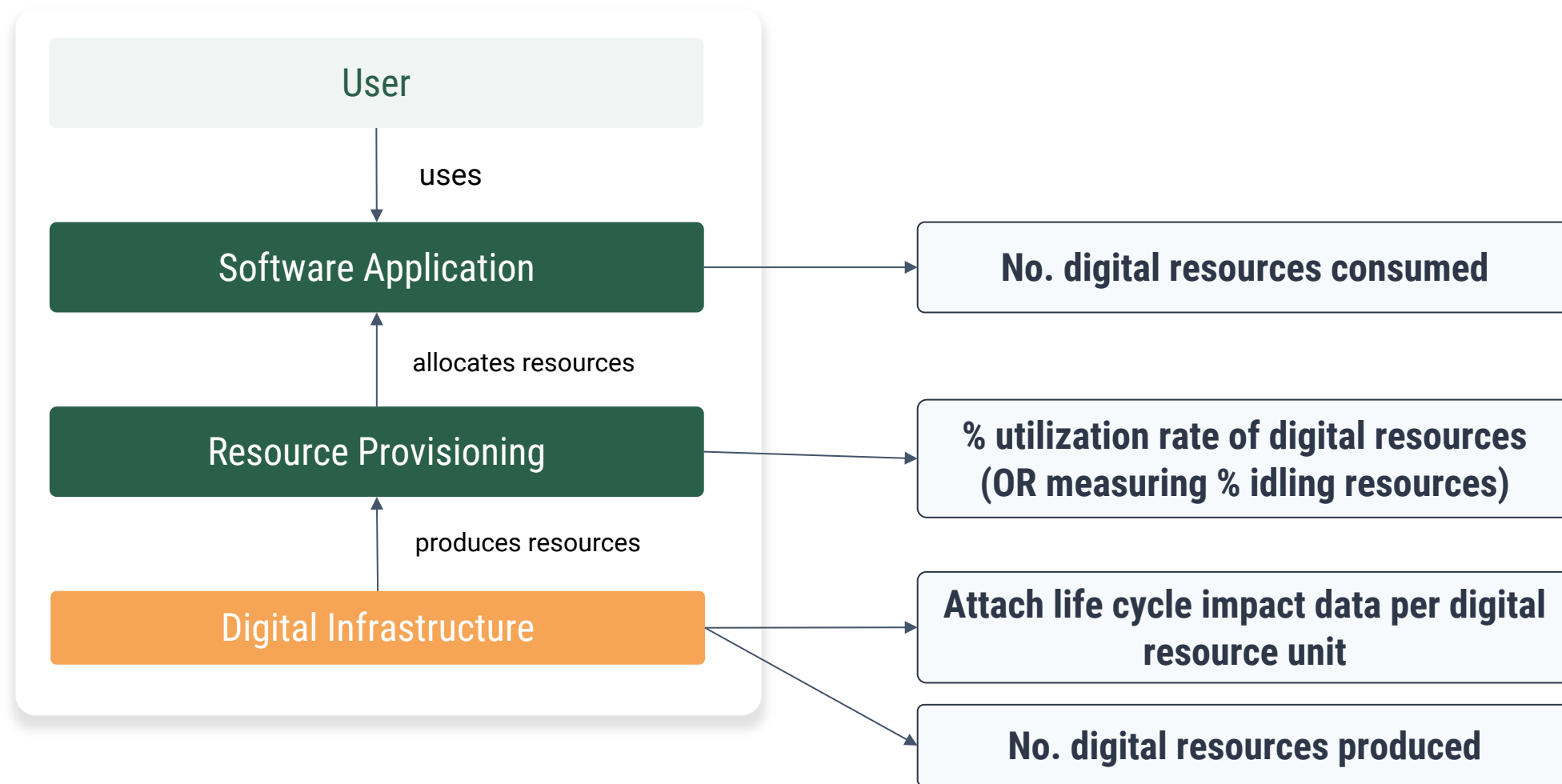*Schulze, Kumar, Oghia, 2021 published by the Commonwealth & SDIA*

With this simplified model and the introduction of the concept of a digital resource that can be produced & consumed...

Digital Resource Primitives*

attach to each resource

Life Cycle Impact (LCA) per digital resource unit

- Energy usage
- Water usage
- CO_2-eq kg (embodied)
- Electronic waste (WEEE)
- Use of secondary materials

Compute (processor time)

Memory

Storage

Network bandwidth

simplified, each resource primitive can of course have
further attributes (e.g. type of compute, storage, etc.)

* More information on the exact definition can be found at knowledge.sdialliance.org
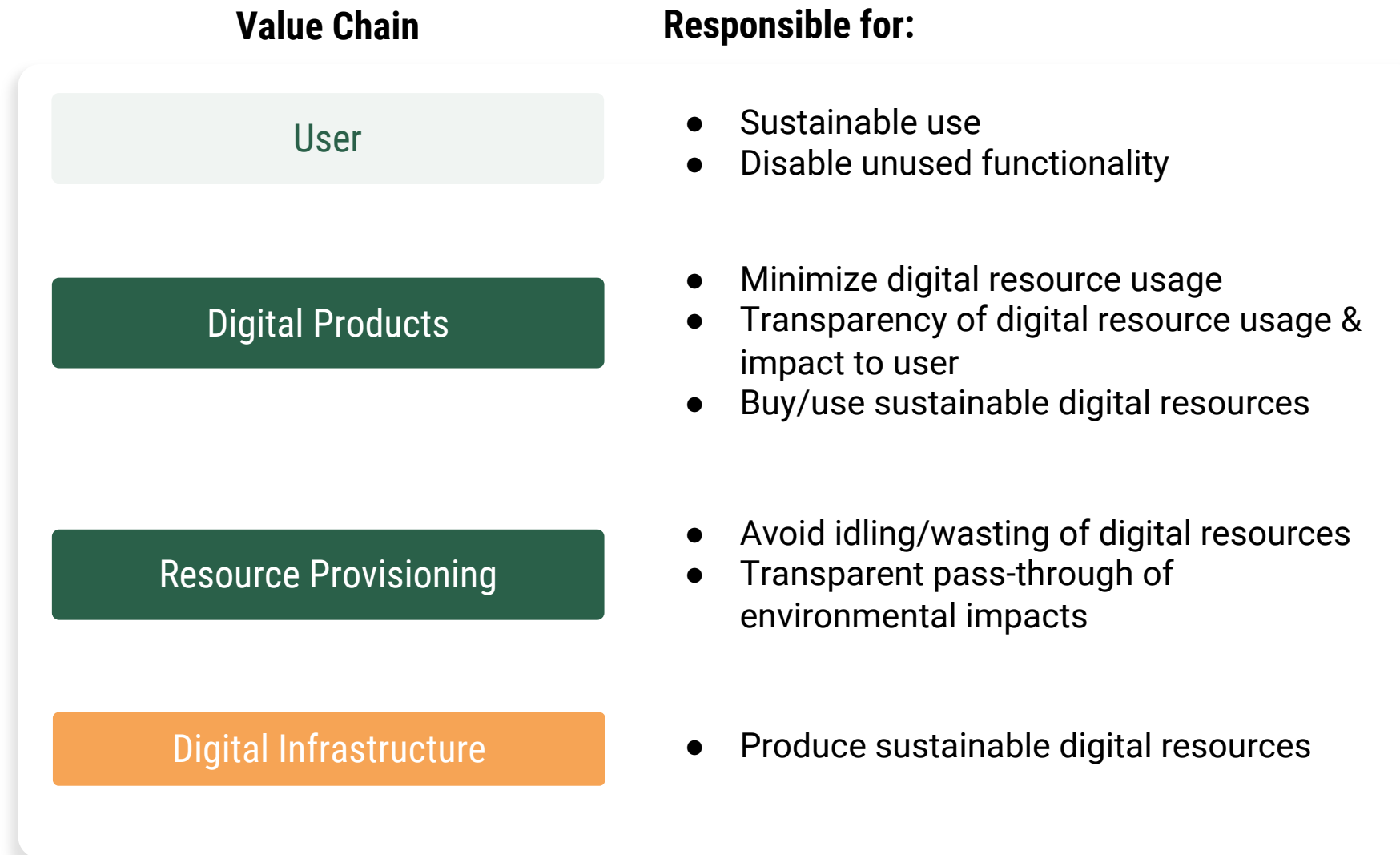
...measuring becomes a lot easier.

User

uses

Software Application → **No. digital resources consumed**

allocates resources

Resource Provisioning → **% utilization rate of digital resources (OR measuring % idling resources)**

produces resources

Digital Infrastructure → **Attach life cycle impact data per digital resource unit**

No. digital resources produced

OK, we can measure it, but how does it become sustainable?

How we do enable the sustainable development of the digital economy & digitalization?

It starts with clarifying and taking up responsibilities across the software value-creation chain.

Value Chain

Responsible for:

User	• Sustainable use • Disable unused functionality
Digital Products	• Minimize digital resource usage • Transparency of digital resource usage & impact to user • Buy/use sustainable digital resources
Resource Provisioning	• Avoid idling/wasting of digital resources • Transparent pass-through of environmental impacts
Digital Infrastructure	• Produce sustainable digital resources

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And what does it mean for software testing?

Integration tests can help determine the energy use and environmental impact of a software application in a repeatable way.

We got some funding to explore this question from the German Environmental Agency.

To narrow the scope, we focussed on the key ingredients of modern software development: open-source libraries

Black Duck Future of Open Source Survey:

"78 percent of respondents said their companies run part or all of its operations on OSS and 66 percent said their company creates software for customers built on open source."

Repository

github.com/facebook/react

Homepage

reactjs.org/

↓ Weekly Downloads

17,922,371

Test Result Trend

● Failed — ● Skipped — ● Passed

35,000
30,000
25,000
20,000
15,000
10,000
5,000
0

#155013   #155023   #155036   #155043   #155051   #155062   #155072   #1550

https://www.slideshare.net/blackducksoftware/2016-future-of-open-source-survey-results

https://dispatcher.drupalci.org/job/drupal_patches/

So we build a test laboratory based on GitLab to measure the environmental impact of integration and unit tests

https://gitlab.com/softawere-hackathon/test-davinci/-/jobs/3318581247

So we build a test laboratory based on GitLab to measure the environmental impact of integration and unit tests

https://grafana.eco-qube.eu/d/uozlBVjnz/def-test?orgId=1
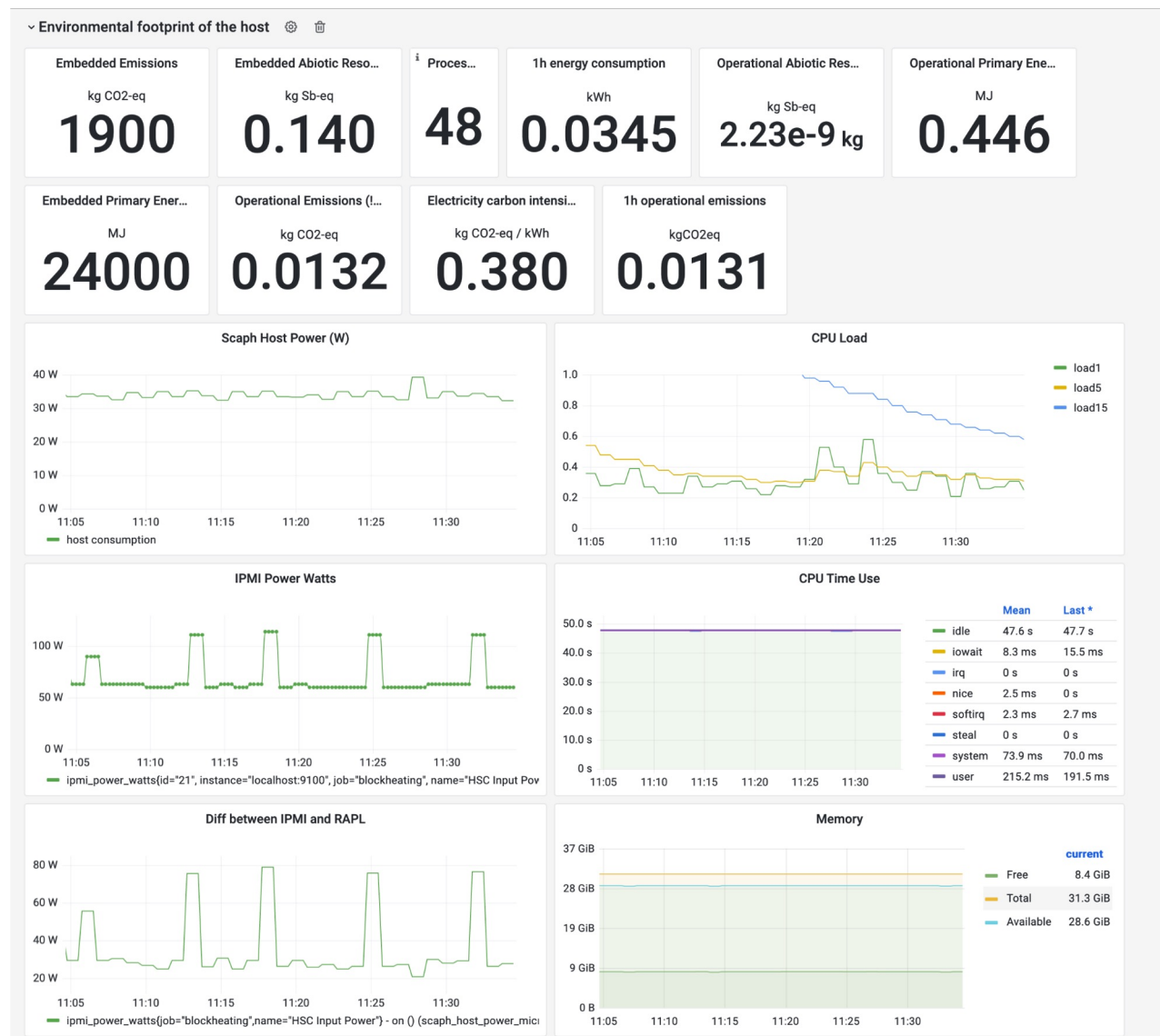
To do this we pioneered a new non-root based methodology using mathematics as well as full support for IPMI/RAPL

SDIA Formulas
Estimations

SDIA Testlab
IPMI/RAPL

Boavizta API for Embodied Impact / LCAs of the servers

ElectrictyMap API for CO2-eq of the power grid

Our tooling can be used in any test execution pipeline - our community is working on the next environments

SDIA Formulas
in Kubernetes

SDIA Measurement
on Github

~ 50 open source projects will be measured for verification

Evaluation of a label for open-source libraries

Do you want to help us shape and develop the tools & environments? Have questions & feedback?

Everyone is welcome in our community – **it's free and open to everyone.**

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Thank you!

Join the SDIA (it's free): sdia.io/join

My contact details

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