Green Software

Rethinking
how to develop software
to save our planet

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Devices per person

Global average: 3.6

Middle East & Africa: 1.5
Central & Eastern Europe: 4
Western Europe: 9.4
North America: 13.4

Source: Cisco (2020), Cisco Annual Internet Report 2018-2023

https://www.cisco.com/c/en/us/solutions/executive-perspectives/annual-internet-report/index.html

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8 billion people own **30 billion devices**

6.9 billion **smartphones**
3.2 billion **smart TVs**
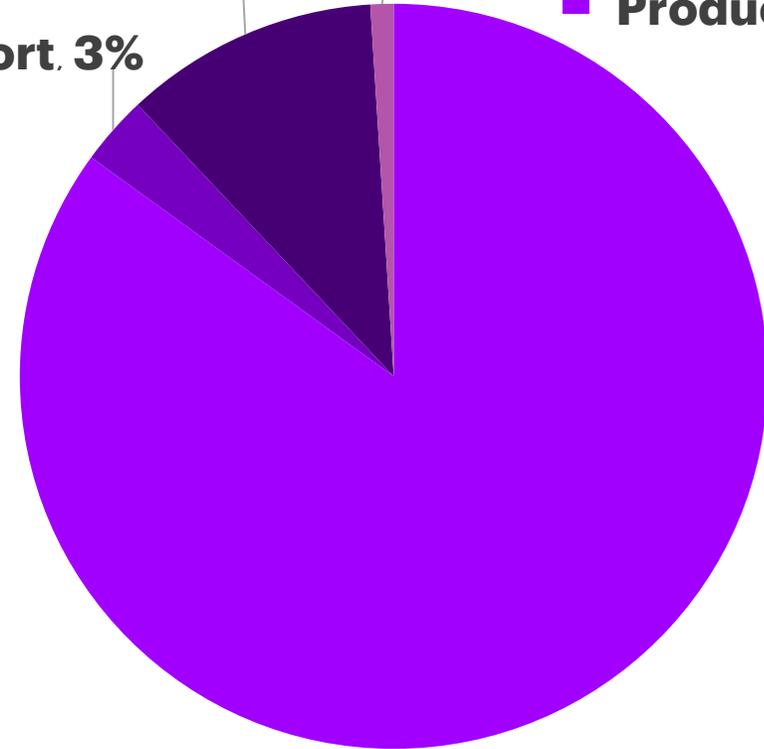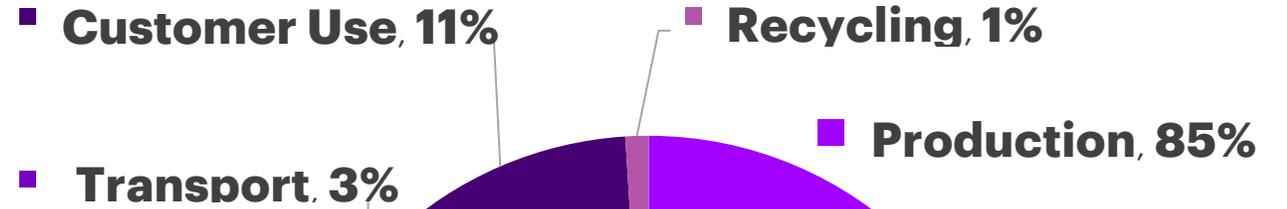1.2 billion **PCs**
840 million **tablets**

17.86 billion other devices

Source: Cisco (2020), Cisco Annual Internet Report 2018-2023

https://www.cisco.com/c/en/us/solutions/executive-perspectives/annual-internet-report/index.html
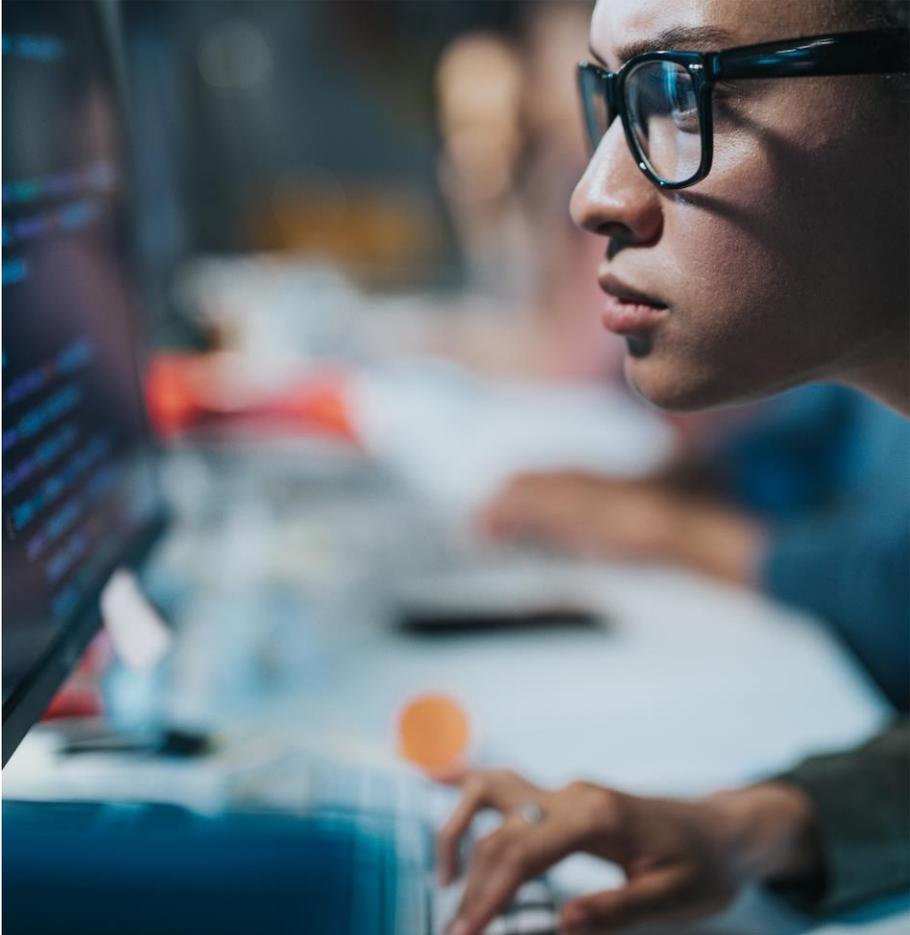
Environmental Impact of a **Smartphone**

- Customer Use, 11%
- Transport, 3%
- Recycling, 1%
- Production, 85%

Total: 95kg CO$_2$e
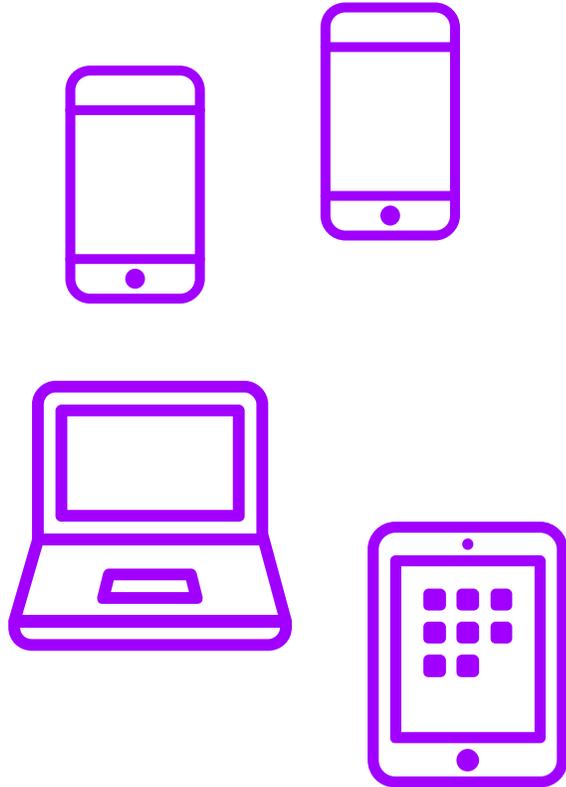
Why do we buy new devices?

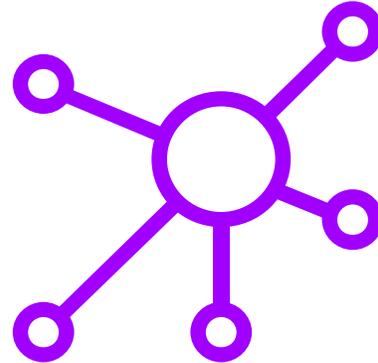# How can we **prolong** the **lifetime** of devices?

Build applications that run on older devices

- Support older OS versions

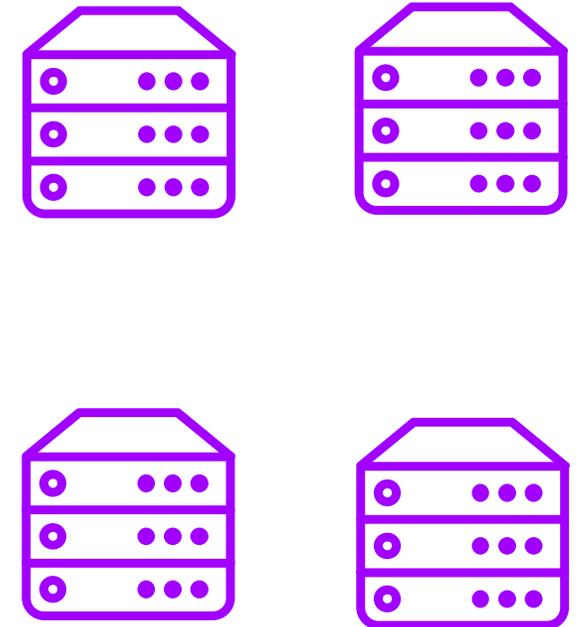- Require minimal compute & memory

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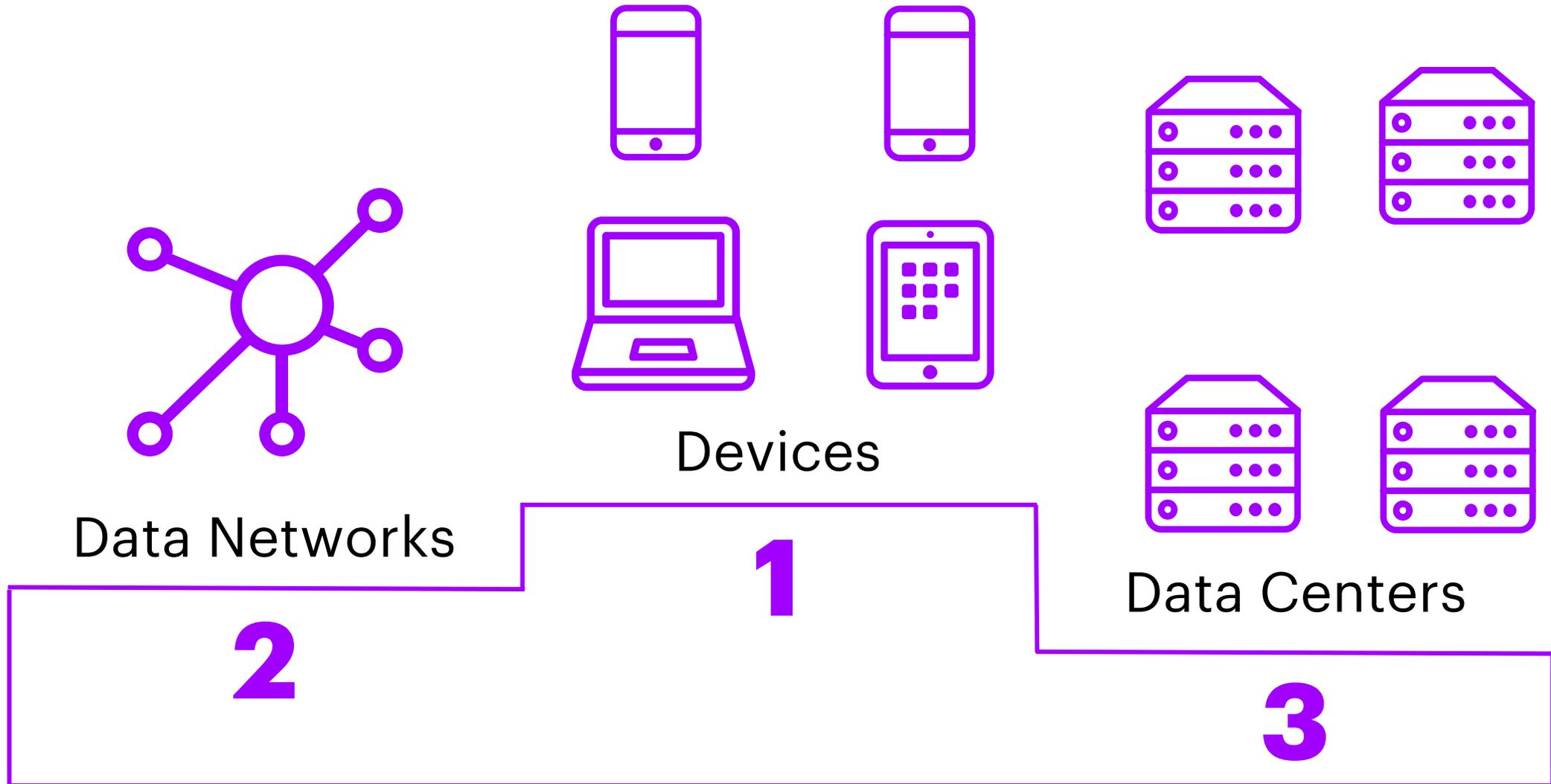# Where is the **highest** environmental impact?

Devices

Data Networks

Data Centers

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Where is the **highest** environmental impact?

Data Networks

Devices

Data Centers

2

1

3

Reduce the size of data sent over the network

How?

- Compress data

- Cache data

Trade-Offs

- CPU increase

- Storage increase

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Reduce the distance of data sent over the network
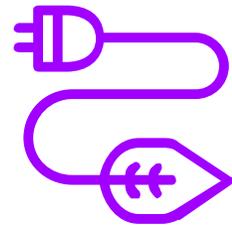
How?

- Place servers closer to end-users

- Use Content Delivery Networks

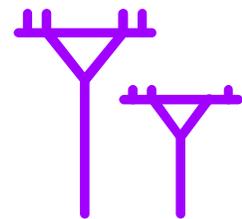- Process data at the source (edge)

Trade-Offs

- Data sovereignty

- Storage increase

- Edge servers' cost

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Challenges with Data Centers

Consume greener electricity
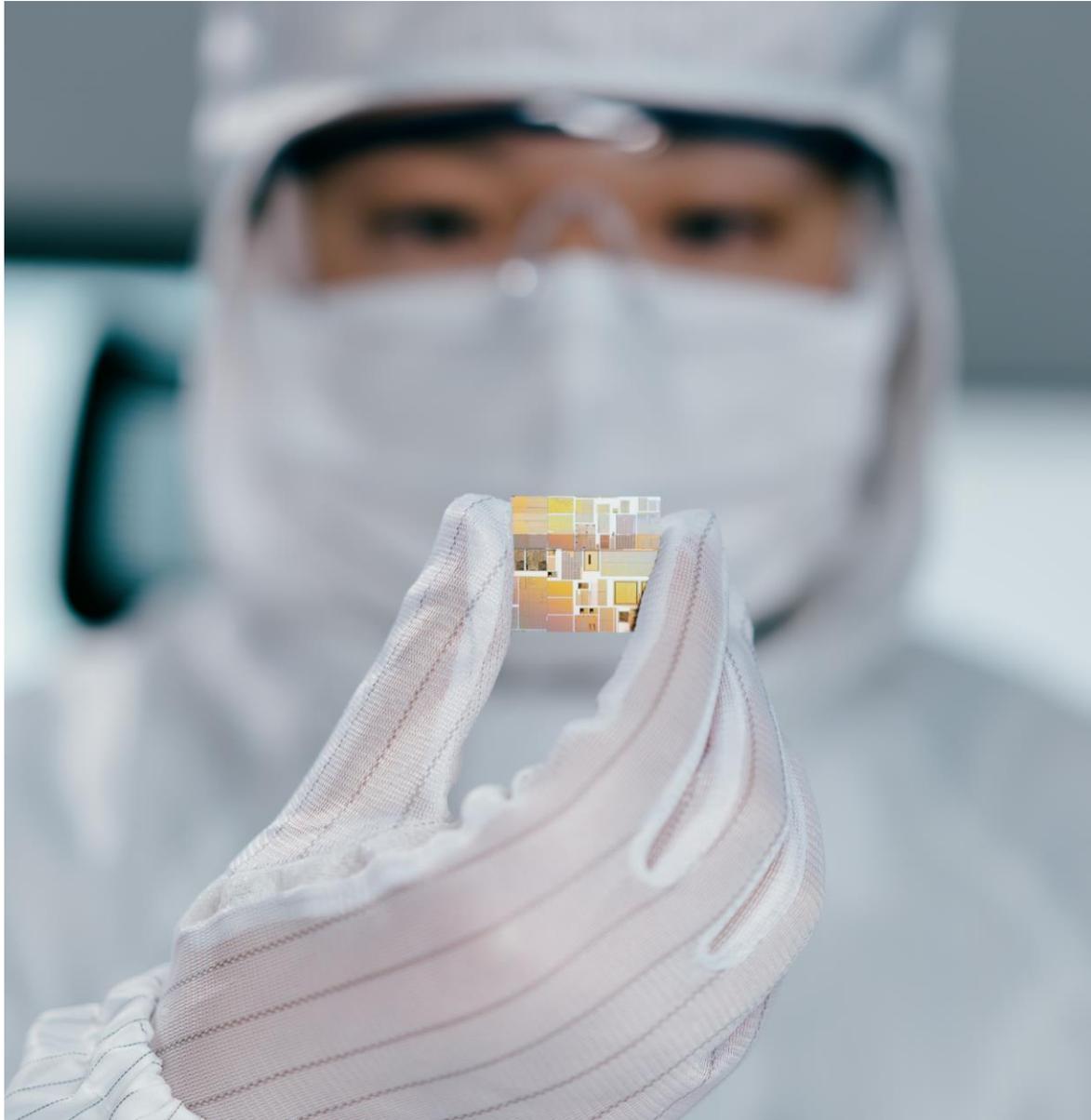by running software
when the sun shines & the wind blows

Consume less electricity
by developing software
that uses fewer resources

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Smartphones, tablets, and laptops use energy-efficient processors that prolong their battery life

Could we use the same processors for servers?

Using **ARM processors** for energy-efficiency

- [AWS Graviton](#) and [Ampere Altra](#)

- Consume ~60% less power than x86 processors

- Must port apps to ARM

- Lower operating costs

  → ROI for porting effort

Do you measure software emissions?

If you can't measure it, you can't improve it!

How to **measure** software carbon emissions?

Monitoring emissions

- [Cloud Carbon Footprint](#) (Open Source)

Pros

- Daily measurements
- Ideal for actionable insights

Cons

- Inaccurate measurements (Uses average constant values for carbon intensity & CPU utilization)

Read my blog: https://www.kolaxis.dev/measure-software-carbon-emissions-actionable-insights

Sustainability
is the newest "-ility"

Ioannis Kolaxis

Director at Accenture

- Inventor
- Speaker
- Book author: Green Software

🌐 Visit website: kolaxis.dev