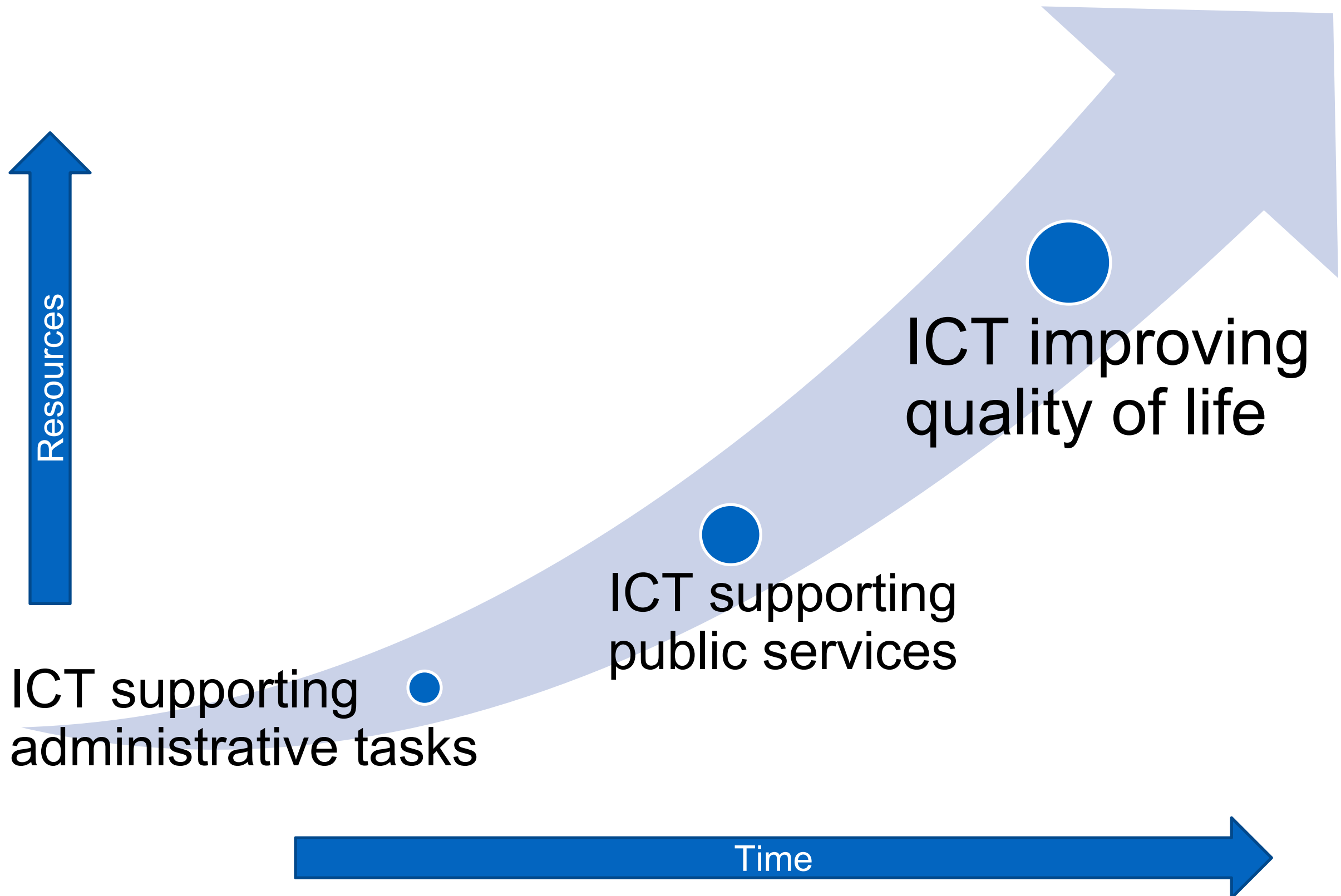


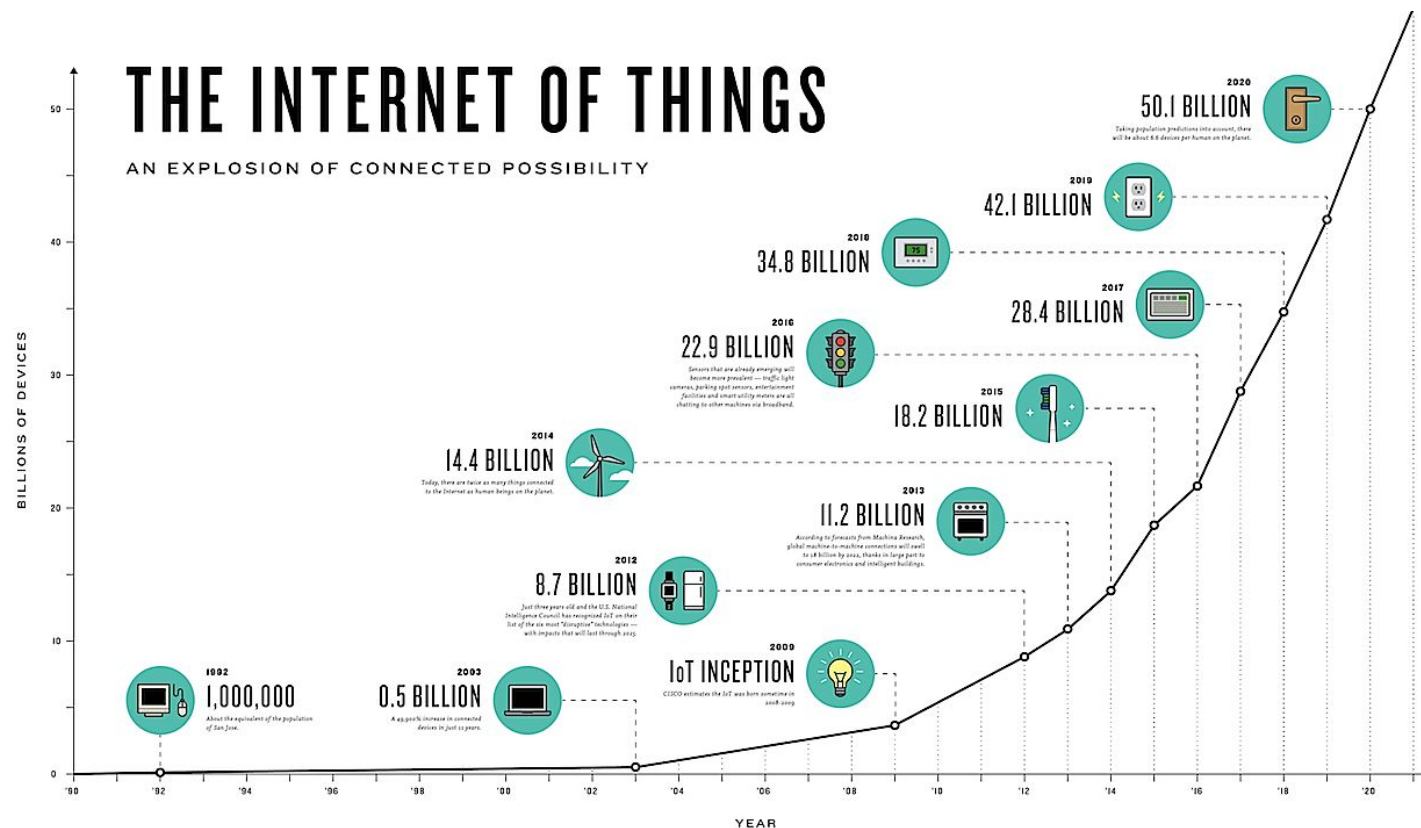
Tooling support to widen support for adopting good practices in green IT

Power management

ICT applications drive public policy



Demand for ICT continues to increase



NETWORKWORLD
FROM IDG



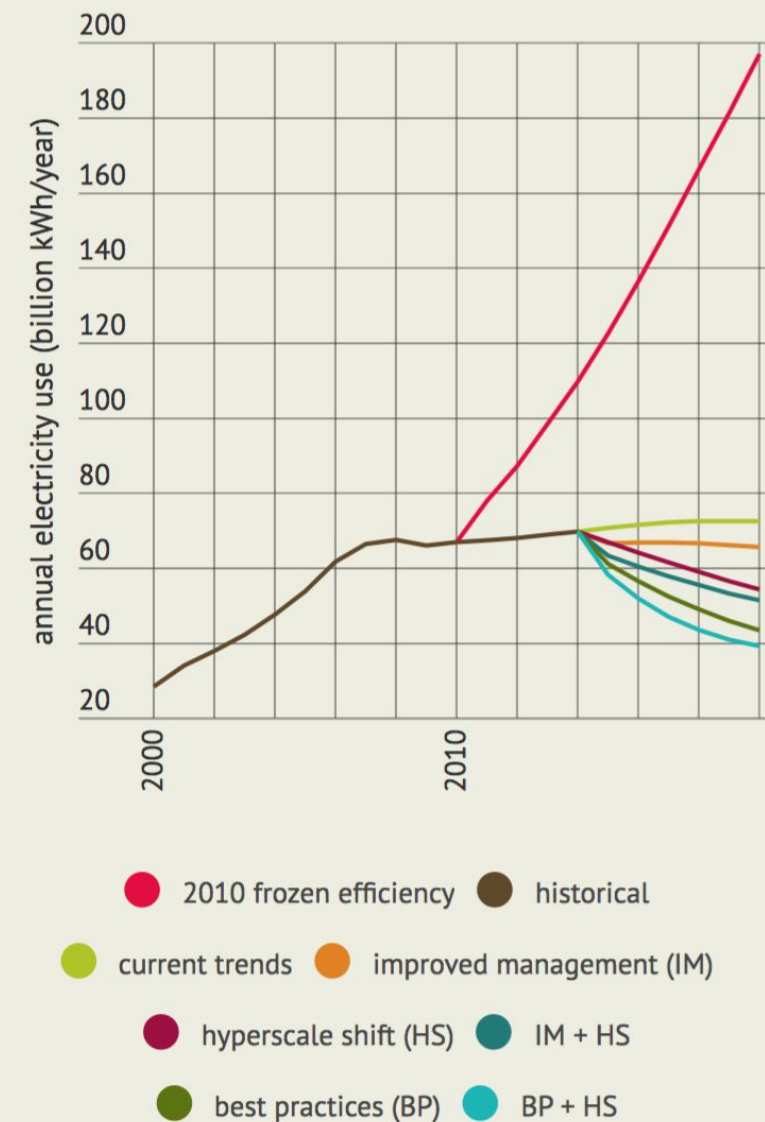
CLOUD CHRONICLES

By [Brandon Butler](#) | [Follow](#)

About |

Cloud Chronicles is
Written by Brandon Butler
the cloud computing

Berkeley Lab researchers made historical estimates for 2000-2014 and seven projection scenarios through 2020 for electricity use from servers, storage, network equipment, and infrastructure in all U.S. data centers.

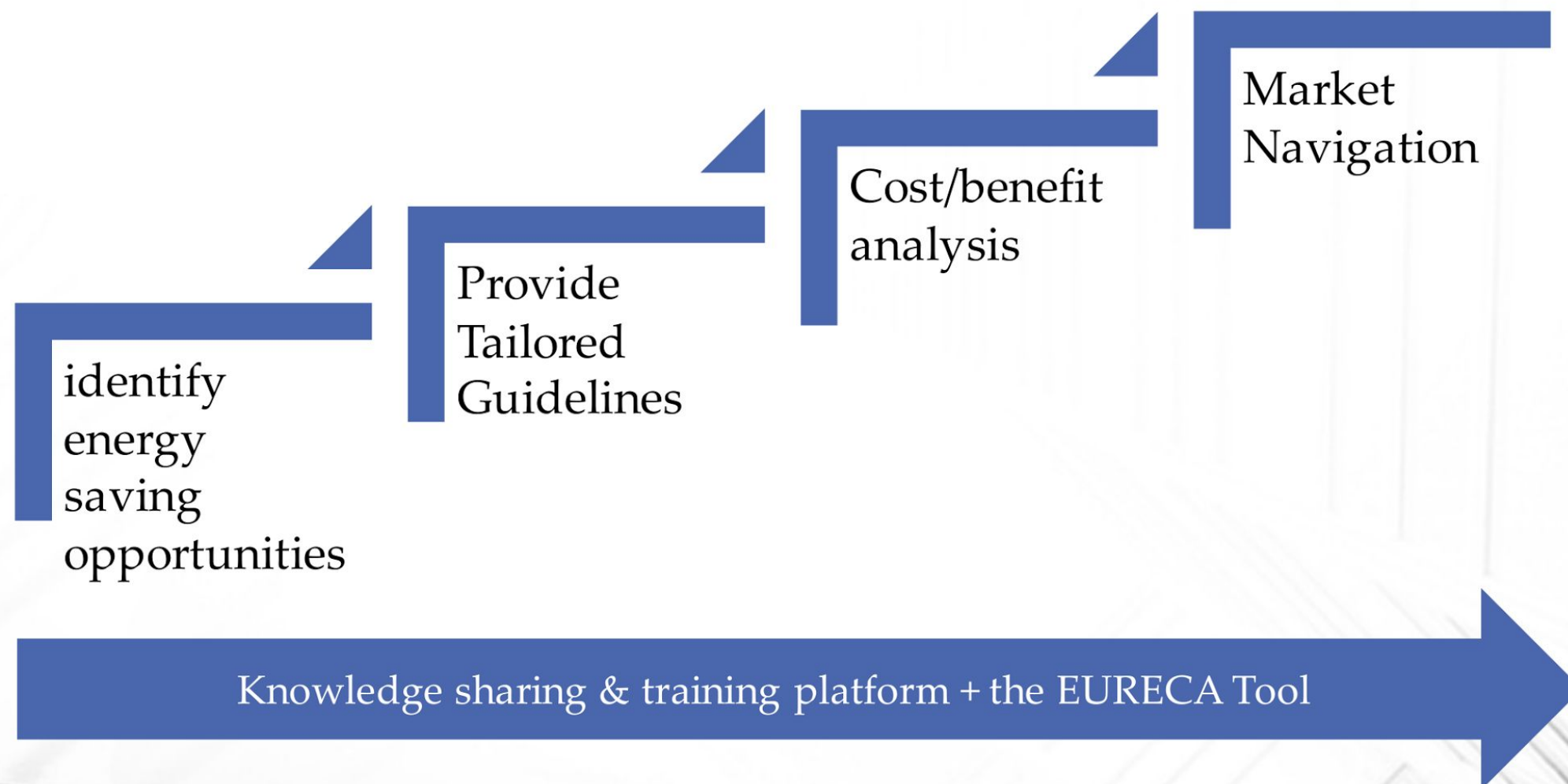


Gartner: Cloud will be the “default option” for software deployment by 2020

Increased complexity asks for tooling support for procurement



EURECA!

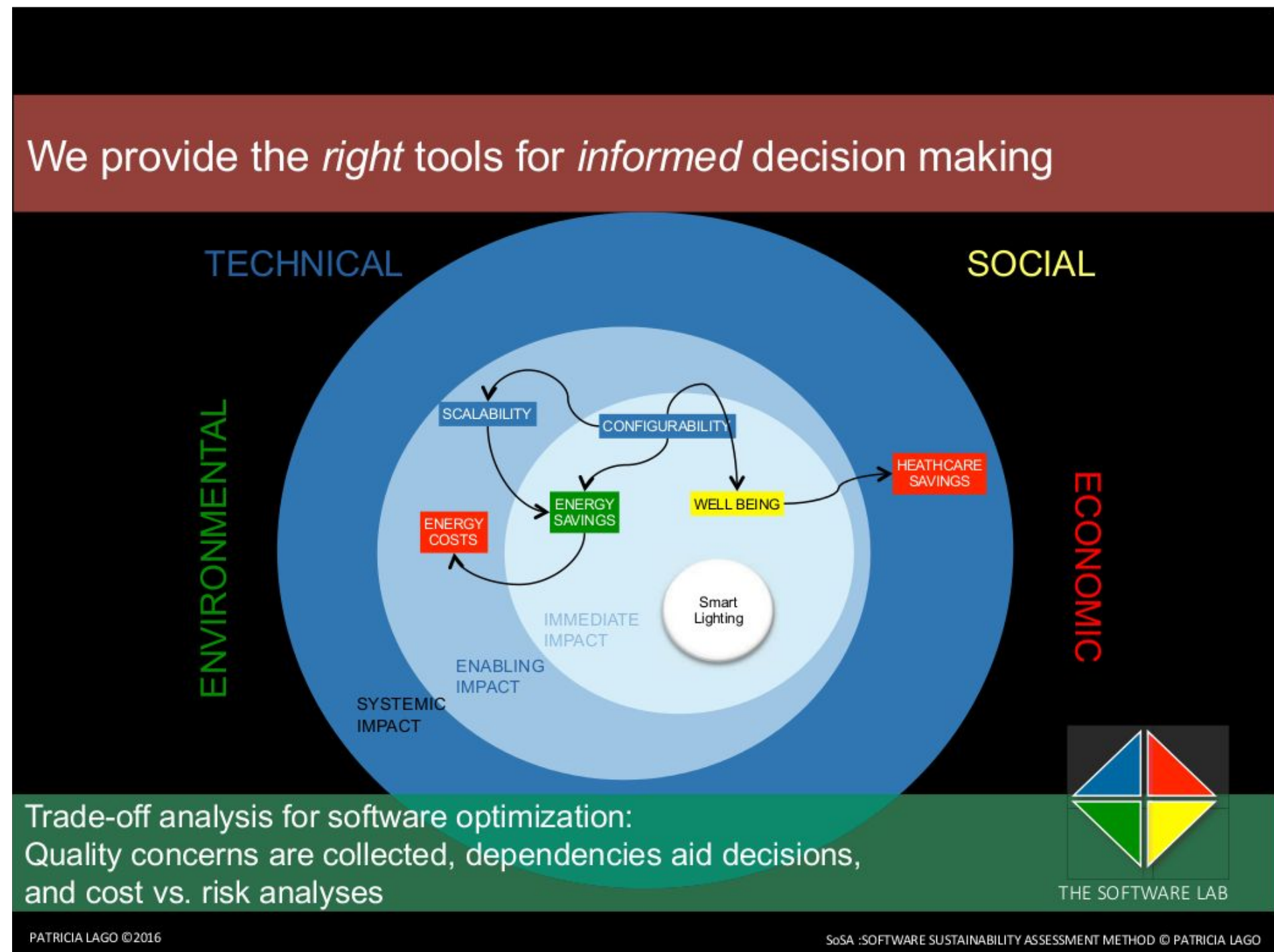


Public sector support to innovative datacenters: <http://www.eureca-project.eu>



Informed management through trade-off analyses

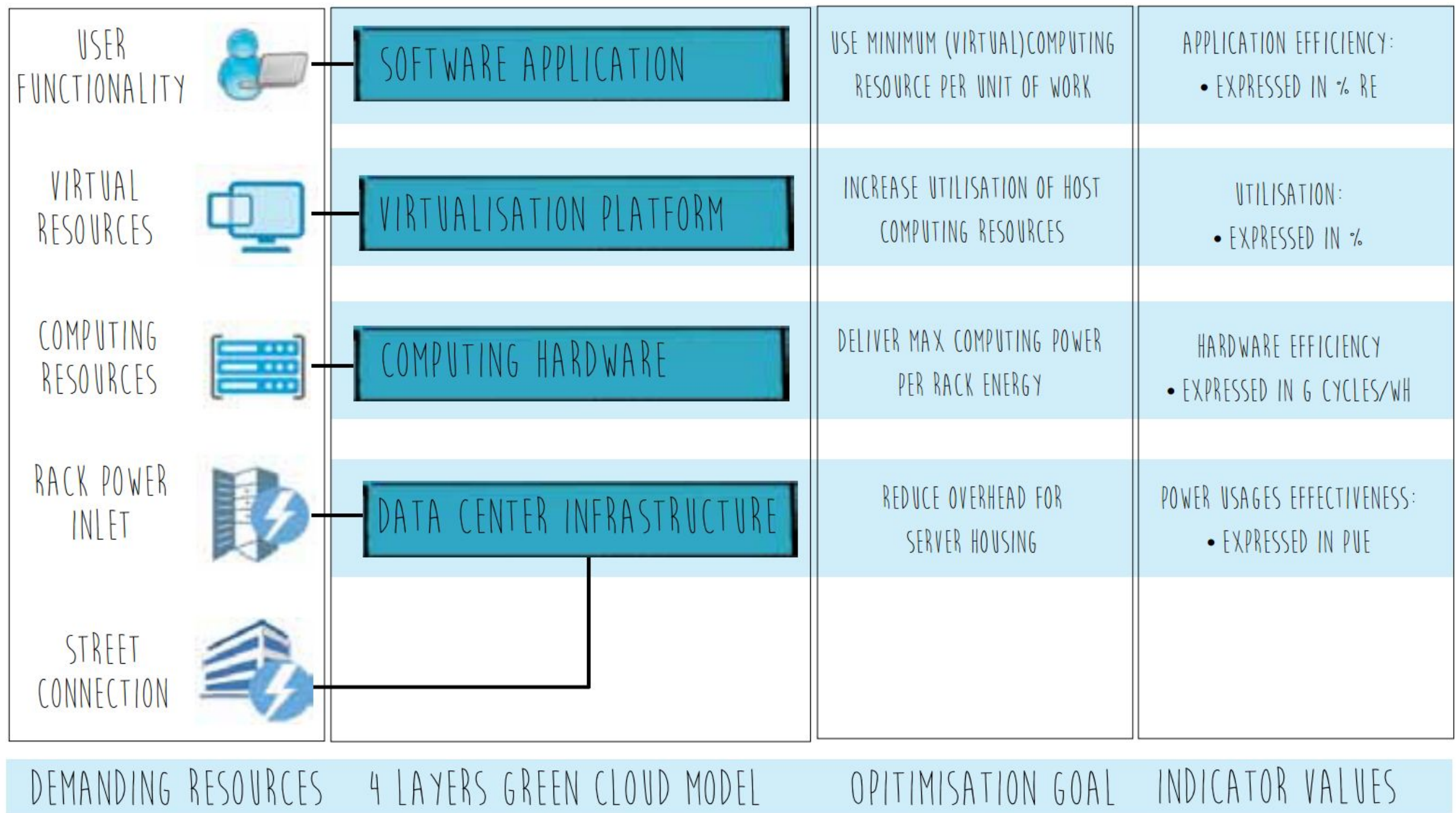
- Identify meaningful metrics
- Measure and monitor
- Energy consumption vs system quality



SOSA: Software Sustainability Assessment Methodology, © Patricia Lago

Source: Software and Services Research Group, VU Amsterdam,
<http://www.s2group.cs.vu.nl/green-lab/>

Analysis on various levels



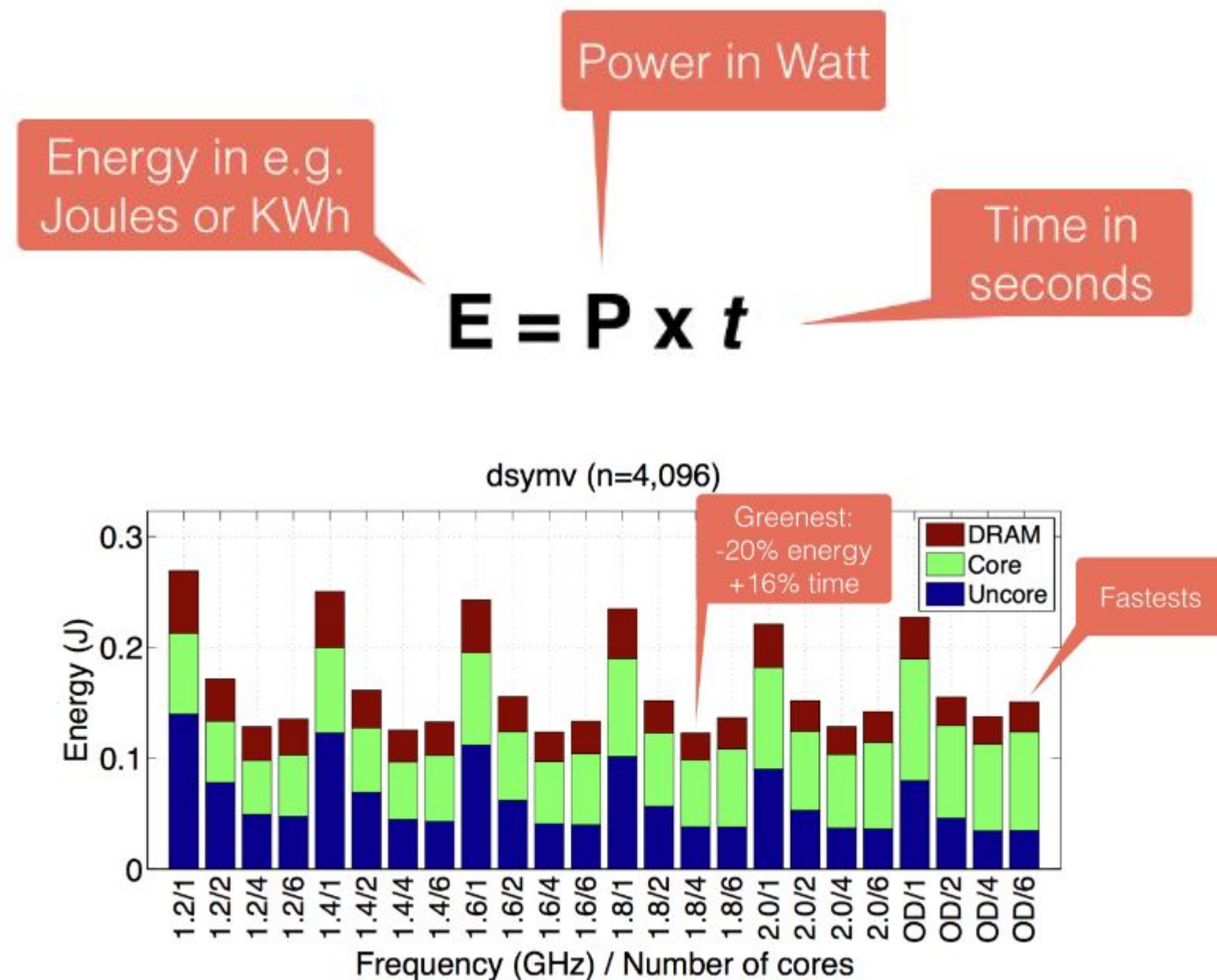
Greening the Cloud project - final publication

<http://www.greeningthecloud.nl/wp-content/uploads/2015/01/GreeningTheCloudWEBLR.pdf>

Managing cores for energy performance increase

Case study: high performance computing; speed for efficiency

- High Performance Computing (HPC)
Super fast, complex calculations
Many processing cores
- E.g., calculate weather models
- Costly, so focus on optimization
Energy cost vs 'core time'
- Measurements taken in lab setting
To complement models
- Optimization has effect
Fastest is not always most energy efficient



SURFsara, HPC research "Superefficient computing", Cedric Nugteren,

<http://www.greeningthecloud.nl/publicaties/case-studie-surfsara-superefficiente-computing/>

Distributing functionality can be more efficient

Case study: Business Application in the Cloud

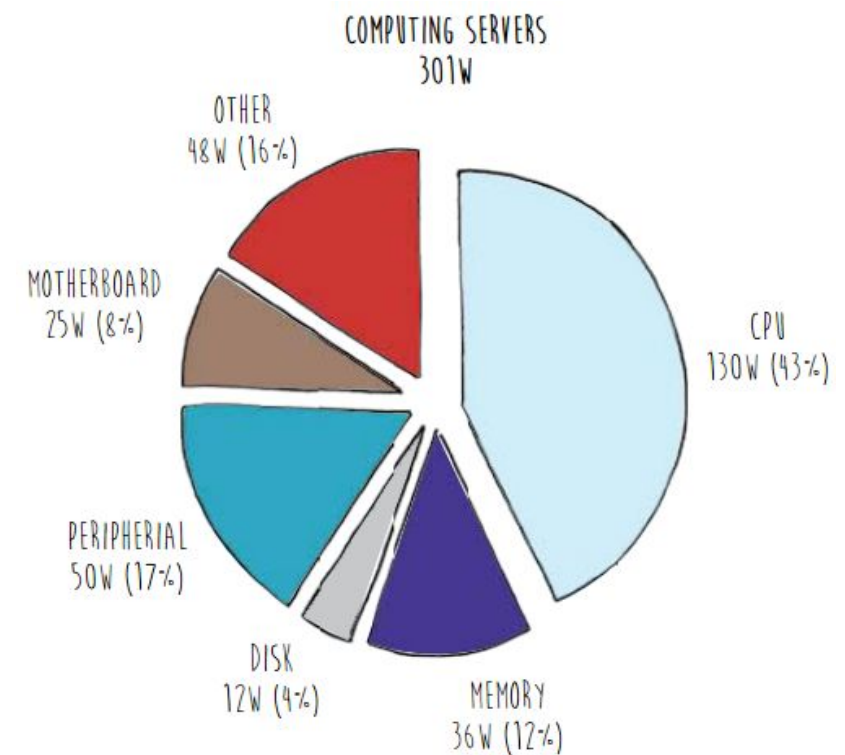
- OpenWave
 - Used by public administrations
 - Manage permits for construction works
 - “3 Tiers”:
 - Database: store data
 - Application: logic and functionality
 - Presentation: show to user
 - Run on 1 virtual system, or distribute?
- Distributed over 3 virtual machines
 - Significant performance improvement
 - Unchanged energy consumption
 - Higher CPU usage

Lesson? Distribute functionality

Manage virtual machines with the right platform

Case study: virtualization platforms, Xen vs KVM

- Virtualization helps reduce idle servers
- Hypervisors manage virtual machines running on physical machines
- Two open source examples tested by UvA and Schuberg Philis:
Xen and KVM
- Differences between 10% and 60%
- Measurements differ from models

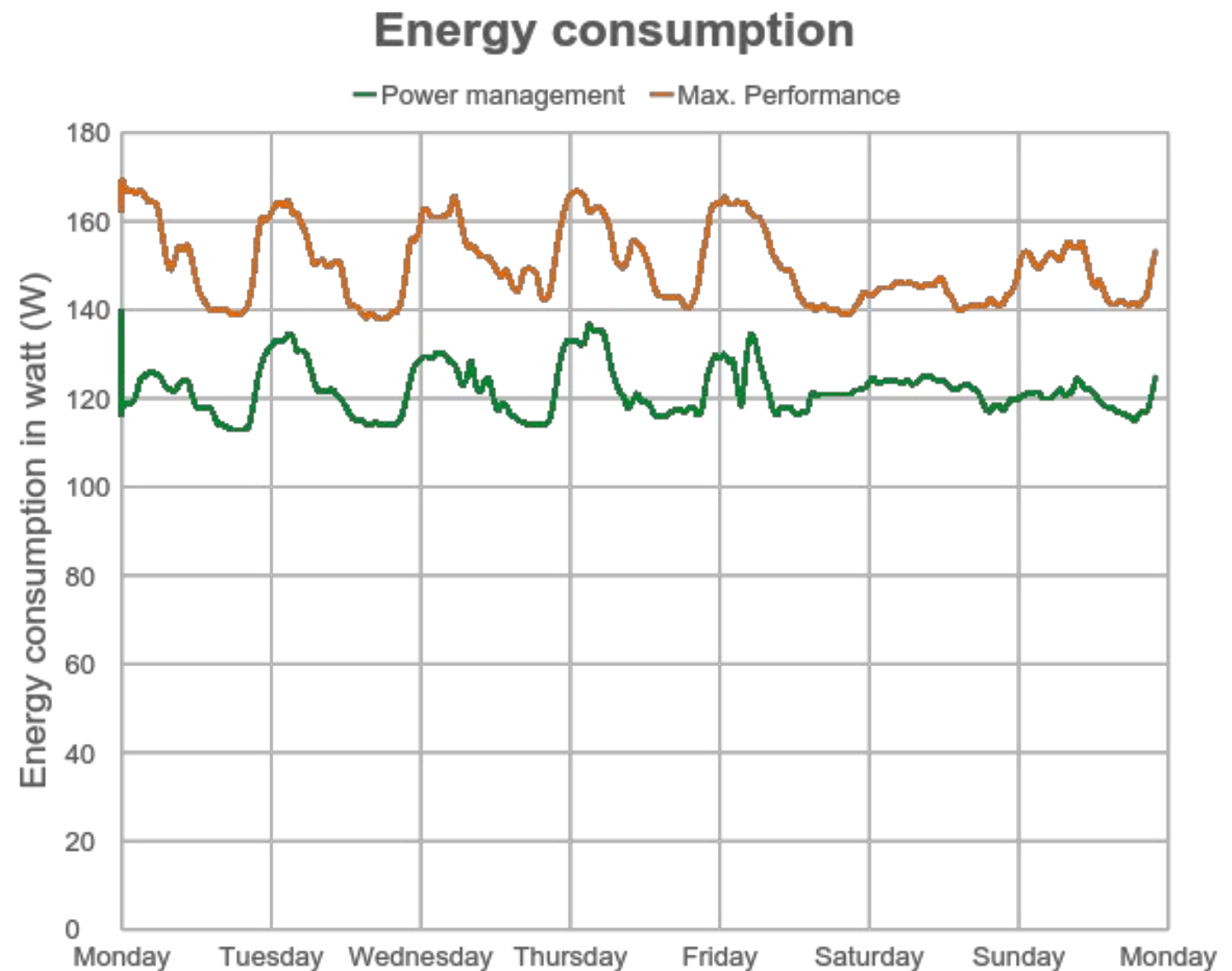


| Test | Winner |
|----------------------|--------|
| Few VM's | KVM |
| CPU stress test | KVM |
| HDD stress test | Equal |
| Memory stress test | Xen |
| Combined stress test | Xen |

Enable power management at hardware level

Case study: Power Management saves up to 20% of energy

- SURFdrive, 17.000 users
- File storage application for NL higher education, similar to Dropbox
- 16 servers
- Tested on web, database and storage servers
- Applicable to many types of servers
- More efficient use of resources
- No noticeable performance loss



Take-aways

- Enable power management at hardware level whenever possible
- When optimizing, explicitly assess energy efficiency impact
 - Hardware measurements needed to complement models
- Your application's unique profile does matter

Acquire tooling support to implement your best practice

- GreenLAB, VU Amsterdam,
<http://www.s2group.cs.vu.nl/green-lab/>
- EURECA, www.eureca-project.eu
- ICTfootprint.eu

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