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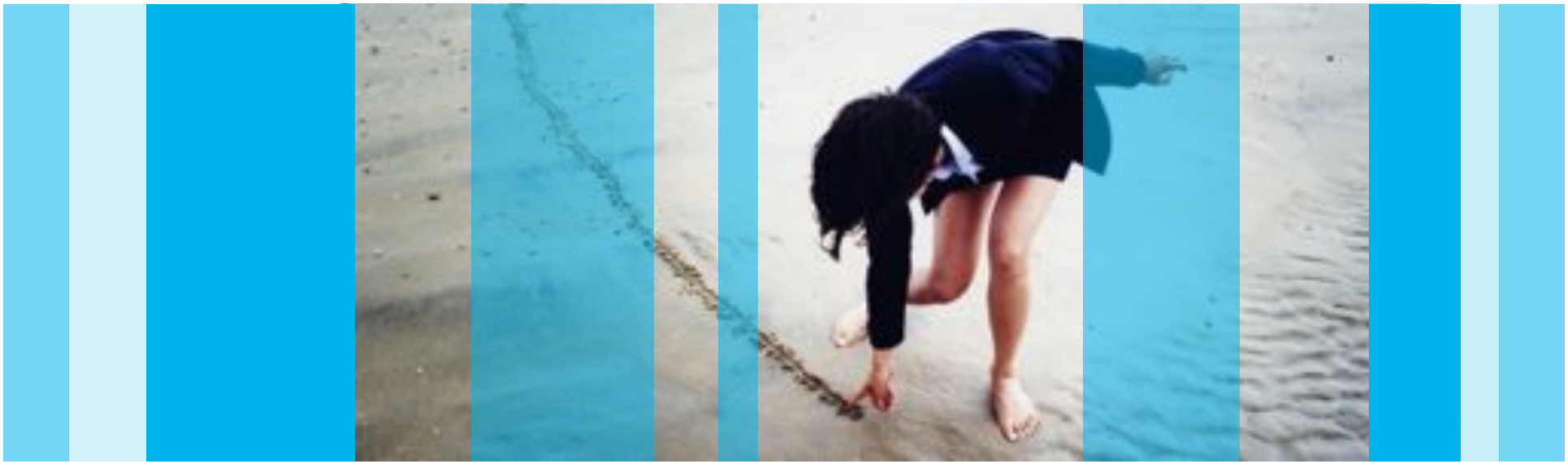

MRA Cluster Green Software

Kansen voor West G4P4

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Knowledge Network Green Software #KNGS

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This presentation

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Greenness and Software

- Does software consume energy?
- Green aspects of software – a taxonomy
- Challenges

Initiatives

- Sustainable Application Scan
- Software Energy Footprint Lab
- MRA Cluster Green Software

For You

- Student project proposal

Software is key to Green IT

Hardware consumes energy

why?

Because software tells it to.

Wirth's Law

a.k.a. the great Moore's Law compensator

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"Software is getting slower more rapidly than hardware becomes faster."

Niklaus Wirth, "A Plea for Lean Software", Computer 28, 1995

Hardware became more powerful, but does your word processor run faster?

Do you need results of a search query while you are still typing it?

Comparison of Microsoft Windows minimum hardware requirements (for x86 versions).

Windows version	Processor	Memory	Hard disk
Windows 95[4]	25 MHz	4 MB	~50 MB
Windows 98[5]	66 MHz	16 MB	~200 MB
Windows 2000[6]	133 MHz	32 MB	650 MB
Windows XP[7] (2001)	233 MHz	64 MB	1.5 GB
Windows Vista[8] (2007)	800 MHz	512 MB	15 GB
Windows 7[9] (2009)	1 GHz	1 GB	16 GB

Software Development
1964 – resource aware

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Software development
Now – resource agnostic

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Power Loss Chain

Extended version ...

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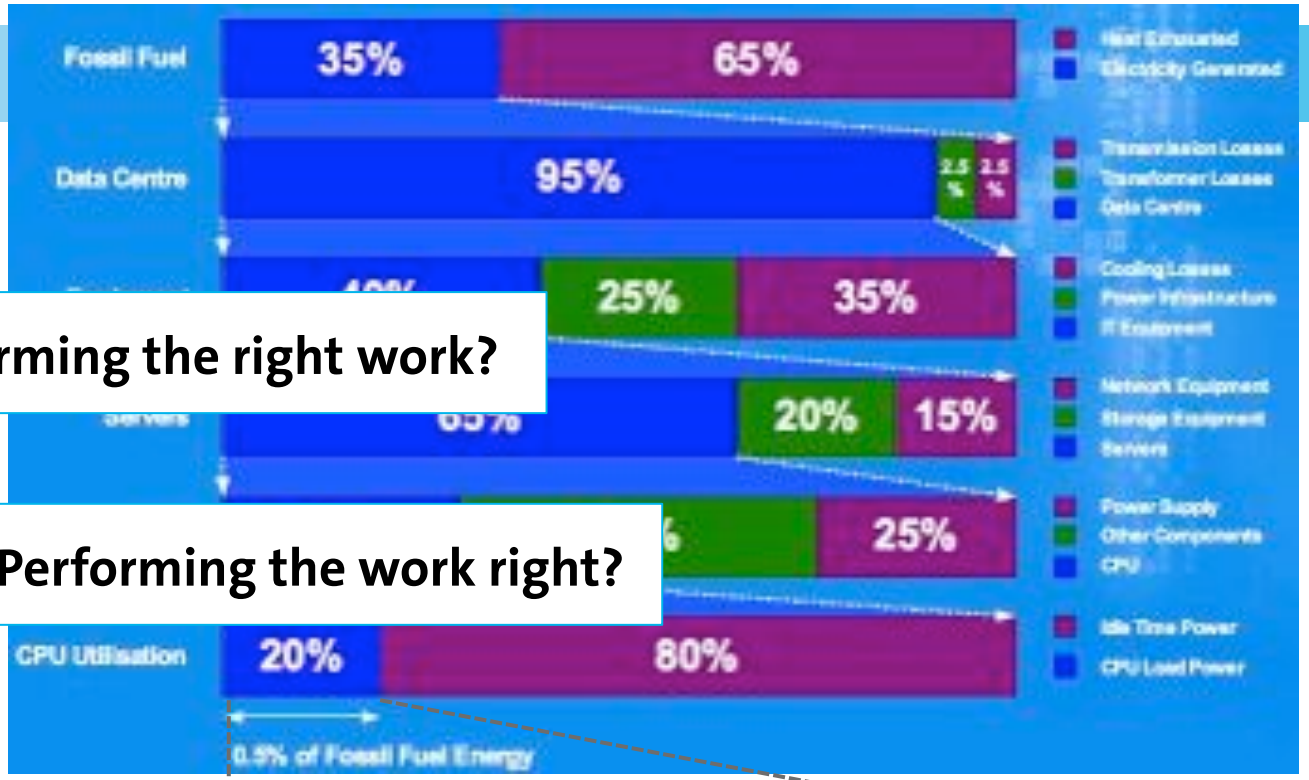
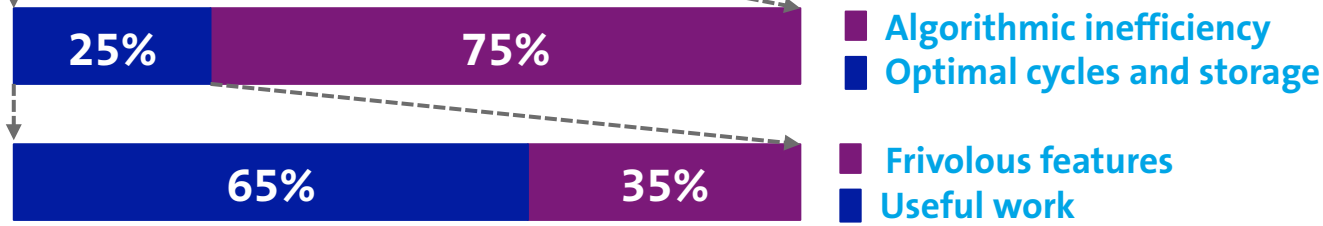


Performing the right work?

Performing the work right?

Image source:
British Computer Society
Data Centre Specialist Group



Percentages are indicative only

Taxonomy

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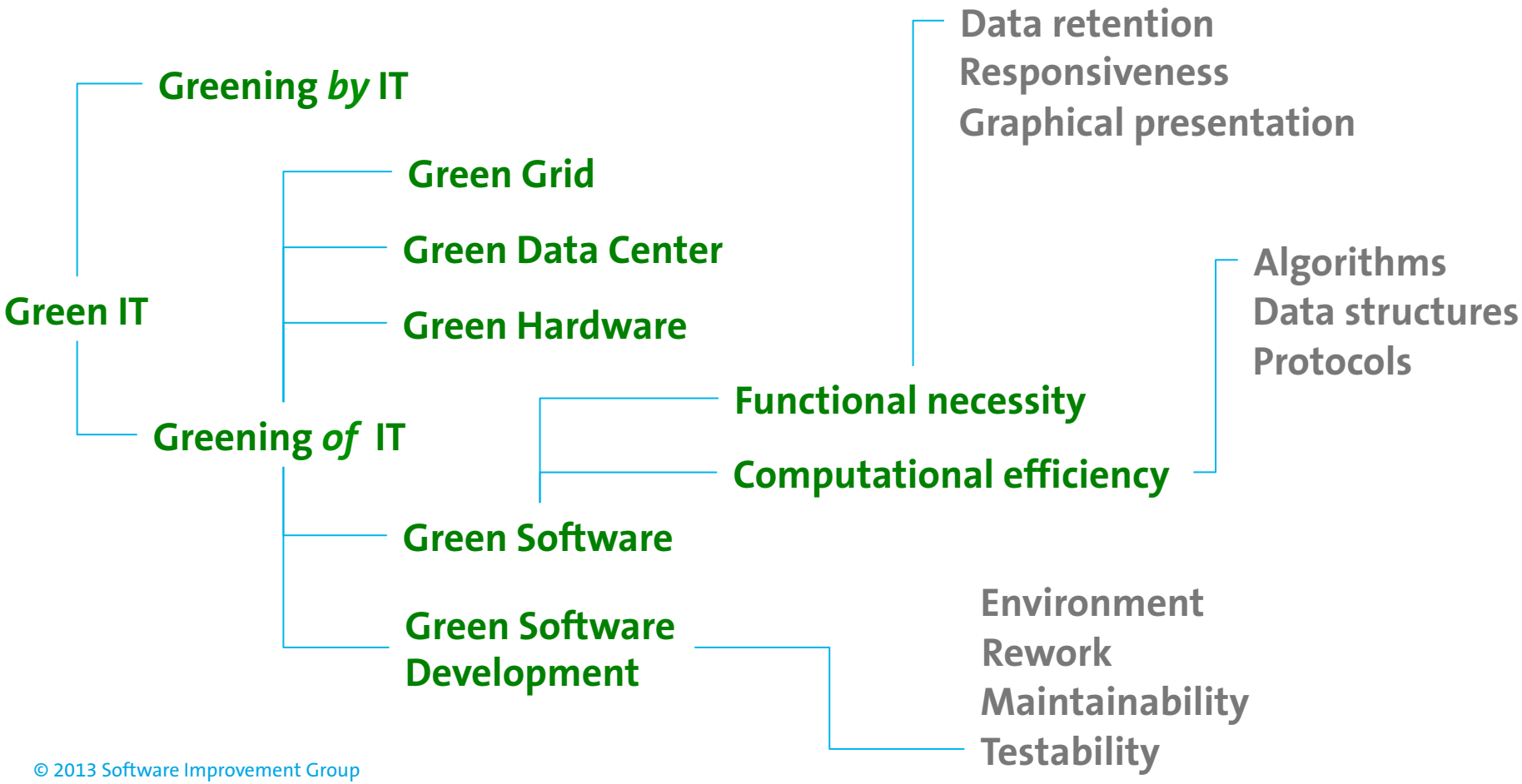

Research challenges

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Maturity of software production processes

- Need for awareness, commitment, communication, organisation
- Additional control variable in an already complex process

“You can’t control what you can’t measure”
Tom DeMarco

Attribution of energy consumption to applications

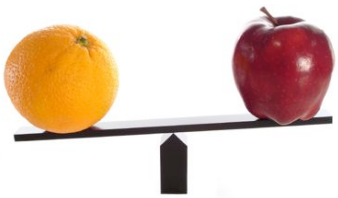
- Hardware consumes energy to run applications
- Multiple applications run on multiple machines in parallel and/or interleaved

==> Attribution is hard and necessarily imprecise

Comparability between applications

- Energy consumption must be seen in relation to delivered functionality
- Comparability only between functionally equivalent applications

==> Common standard is hard to define



Some initiatives

Sustainable Application Scan

Software Energy Footprint Lab

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Sustainable Application Scan

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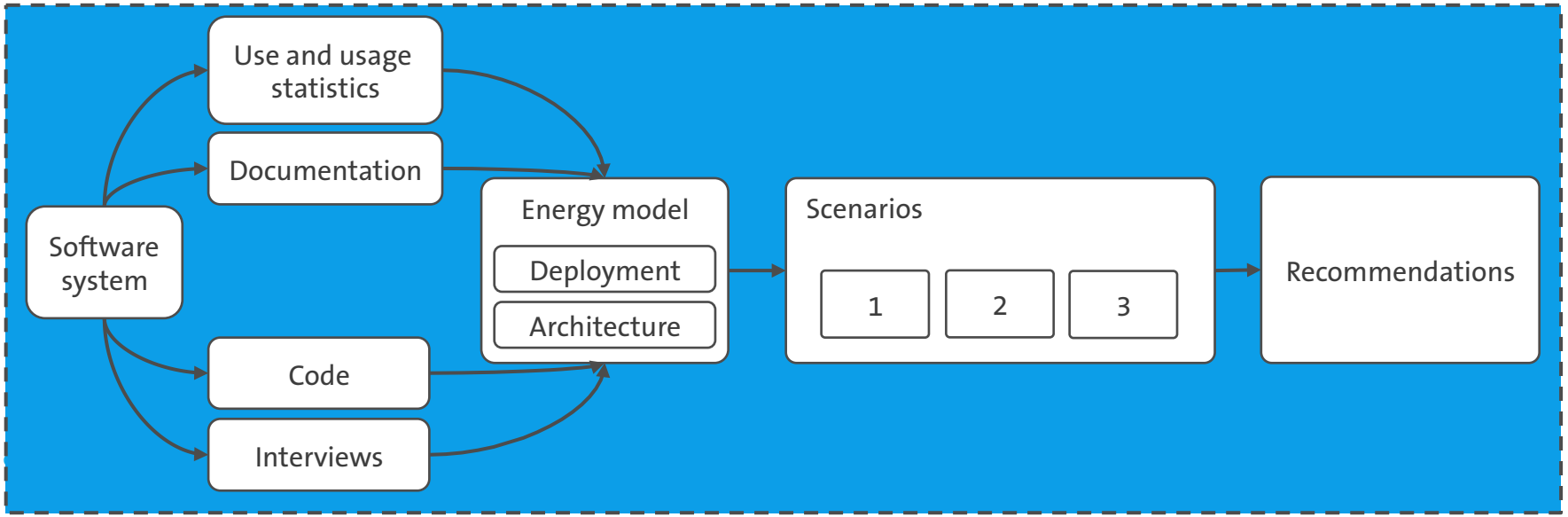
Method developed by SIG

- Identify opportunities for energy savings by review of architecture, coding, deployment

- Find Savings 30 – 80 %



Case: mobile service

Total savings potential: 45%

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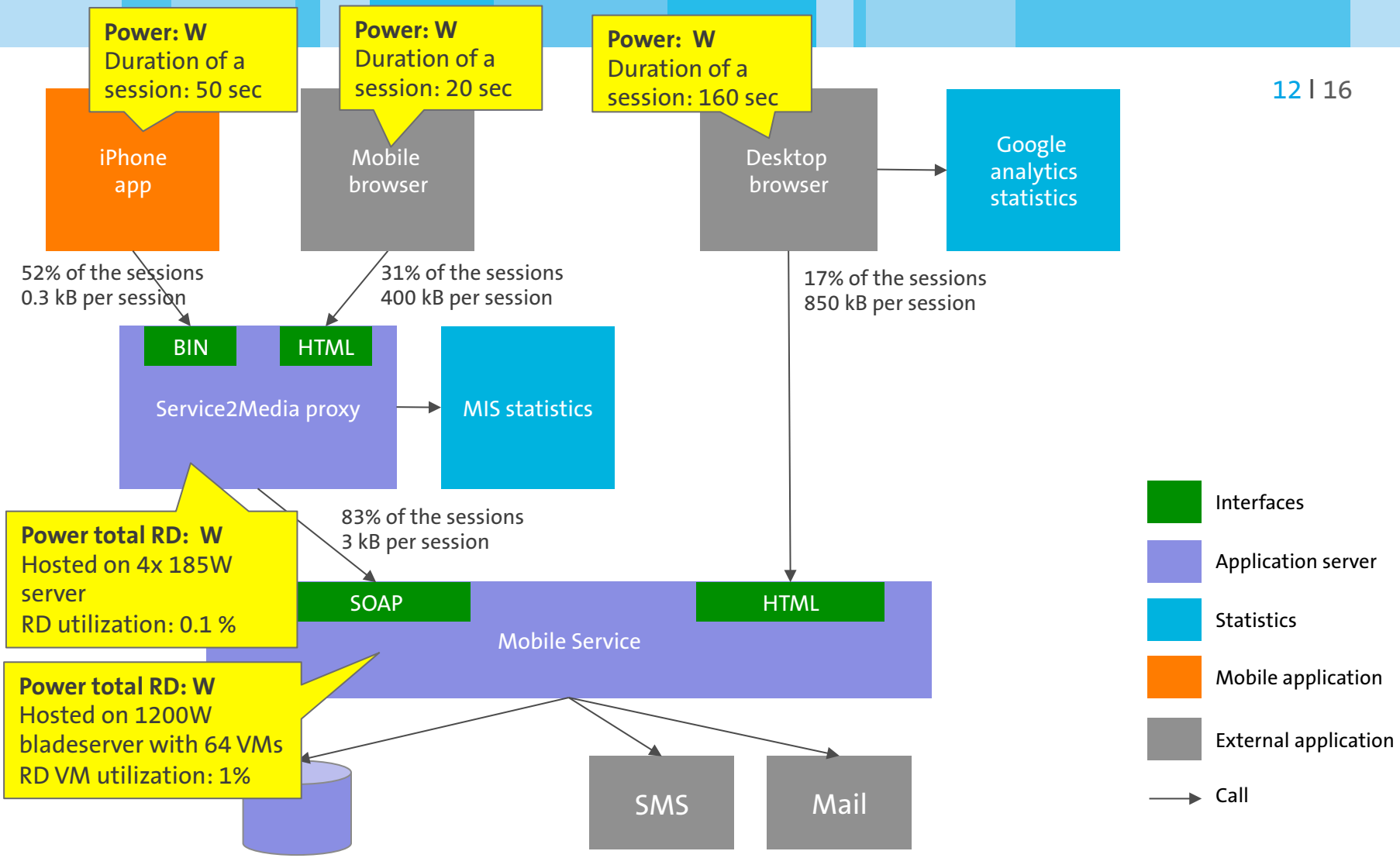

Software Energy Footprint Lab

Questions

- How do different database management systems compare in terms of energy footprint?
- How do different programming languages compare?
- How do different browsers, word processors compare?
- How do different data formats and communication protocols compare?
- How accurate are software energy profiling tools?

...

Lab created by Hogeschool van Amsterdam (CleanTech)

- Controlled measurement of energy profiles of application software
- First students sponsored by SIG
- Hardware donations by e.g. Schuberg Philis

Wat is the *MRA Cluster Green Software*?

Regional technical-scientific cluster

- MRA = Metropole Region Amsterdam

Research geared at industry

- From experiment tot practical validation

Kansen voor West G4P4

Europese Unie
Europees Fonds voor Regionale Ontwikkeling
Hier wordt geïnvesteerd in uw toekomst!

Hogeschool van Amsterdam

SURF SARA

Universiteit van Amsterdam

EQUINIX

Greenit amsterdam region

VU VRIJE UNIVERSITEIT AMSTERDAM

SCHUBERG PHILIS

Wat does to *MRA Cluster Green Software do*?

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Targets

- Clustering of knowledge and top research
- Breakthrough innovation and sustainability

Activities

- Joint development and validation of tools and models
- R&D projects, PhD, masterstudents
- Define a strategy

Impact

- Possible Spin-off's,
- Elicit investments
- Dissemination of knowledge

Eco Label

Energy Footprints

SEFLab

DC Toolkit

Design strategies

Measurement Model
ISO 25010

Student project: PAPI and energy information.

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PAPI is the Performance Application Programming Interface, a standard API for accessing hardware performance counters on modern microprocessors. Recently the PAPI library can provide information on energy consumption of systems.

We are interested in determining how the system behavior can be extracted from the PAPI counters without having to explicitly read power consumption with external measurement units.

We will focus on typical applications running on the LISA cluster at SURFSARA. The student should collect data from PAPI on the energy consumption in the nodes, later comparing the results with the instrumented LISA node being built at the HvA.

This projects is carried out at the UvA under the supervision of dr. P. Grosso http://staff.science.uva.nl/~grosso/) in close collaboration with SURFSARA and HvA.