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Research results of the GreenIT Cockpit project

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Project summary

Project title: GreenIT Cockpit – Business-Oriented Management Cockpit for Energy-Efficient ICT Throughout an Organisation

Term: 01/05/2011 to 30/09/2014

Consortium: TimeKontor AG
Axel Springer AG
Technical University of Berlin
Federal Environment Agency

Project director: Thomas Leitert, TimeKontor

Website: www.greenit-cockpit.de

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Research topics

- Business process analysis and modelling
- ICT resource modelling
- Energy monitoring of ICT systems
- ICT performance measurement systems
- KPI framework and KPI evaluation table
- Development and testing of the GreenIT Cockpit

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Business process modelling

In the project, the ICT-related resources that are required to deal with specific business processes in a company were modelled in a software tool. On this basis, the ICT-related energy requirements of business processes are to be simplified and quantified.

- Modelling of three typical business processes:
 - E-publishing (Axel Springer)
 - Enforcement process (Federal Environment Agency)
 - Staff recruitment (TimeKontor)
- The business processes were modelled in BPMN 2.0.
- As software tools, the project partners Yaoqiang (open source) and Signavio are available

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Modelling of required ICT resources

In a second step, the ICT resources were specified more precisely:

- Modelling of the ICT resources was carried out using an Excel spreadsheet
- Parameterisation of the model is based on manually collected and automatically read data
- Modelling includes (up to) 39 variables per ICT resource, divided into four groups:
 - Description (product type, type and ID of the ICT resource, location, etc.)
 - Activity assignment (function of the ICT resource, usage patterns, number of process cycles per unit time, etc.)
 - Energy monitoring (power consumption per mode and over a time interval)
 - Utilisation (type of utilisation, such as CPU load, storage accesses, etc.)

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Example: Modelling of required ICT resources

The following information provides an idea of the complexity of ICT resources in an authority such as the Federal Environment Agency:

- 170 physical and virtual servers
- 1900 IP phones
- 530 printers
- 1750 computers (workstation PCs)
- 200 routers and switches
- Storage at several locations (totalling some 250 TB)

Conclusion: During operation, regular update of the resource table is required, even if the business process itself does not change. Organizational, personal, software, and hardware-related changes must be taken into account.

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Analysis of existing energy monitoring systems

Recording of ICT-specific energy requirements is complicated and usually requires complex measurements of ICT systems and their support systems, such as cooling and possibly current distribution. In the project, existing energy monitoring systems (EMS) were analysed and evaluated:

- EMS from Avocent, CA Tech., deZem, JouleX, Nimsoft, Cob-Web (proRZ), Paessler PRTG, Raritan, RiZone (Rittal), Speedikon DAMS, IBM, IT-Backbone
- Evaluation criteria include: Application area, IT connectivity options, building connectivity options, cost transparency, data quality, measuring sensor type/manufacture, data analysis of KPI/visualisation, data export
- The results of the analysis were summarised in the series ICM Project Reports of TU Berlin in Volume 02 (Energy monitoring systems of ICT systems).
- In the course of the project, JouleX and deZem were used

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Energy monitoring of ICT systems

In regard to energy monitoring, the following trends were identified:

- With ICT components, agent-based protocols such as WMI and SNMP are usually used in combination with MIB.
- The trend is toward agentless monitoring (IPMI, WMI).
- In the area of building services engineering, the trend is toward IP-based fieldbuses.
- In the area of the network environment, new opportunities are being created by the Cisco EnergyWise protocol.

With the partners, ICT-specific energy requirements were recorded in four broad categories of devices:

- Office devices (PCs, monitors, printers, etc.)
- Network between office and data centre (routers, switches, etc.)
- IT data centre (physical/virtual servers, storage, network)
- Building infrastructure (cooling, power distribution, etc.)

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GreenIT Cockpit Balance Score Card

For energy-oriented management of ICT resources, key performance indicators and efficiency indicators are an important prerequisite. A Balance Scorecard (BSC) performance indicator system was designed with the following evaluation dimensions:

- Environmental dimension (energy consumption, CO2 emissions, temperatures, etc.)
- Output dimension (electrical output, capacity, utilisation, etc.)
- Business process dimension (lead times, frequency, process output, etc.)
- Financial dimension (procurement costs, energy costs, ROI, etc.)

In a stakeholder workshop, thresholds for the assessment of indicators and for creation of sensitivity analyses were determined.

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Development of a client probe for measuring efficiency

The probe is a “bot” that carries out measurements in place of the user and determines the ongoing technical processing time “end-to-end”:

- Recorded operating sequences with test data form the basis for the cyclic measurements.
- In this project, OSX-based client probes are implemented to perform the measurements in the online editorial process at Axel Springer.
- The use of the client probe avoids direct, person-based measurements at the workplaces of the users using this process

At Axel Springer AG, the client probe is used for determining the following indicators in the GreenIT Cockpit:

- IT resource utilisation
- IT resource use
- Performance
- Intensity of use

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Patents and publications

Publications:

- 22 national and international scientific publications
- 6 volumes in the series ICM Project Reports of the TU Berlin
- 1 book “Green IT – Knowledge and best practices from case studies”