


ISS Institute for Software Systems  
in Business, Environment and Administration

## Enhancing Sustainability of the Software Life Cycle via a Generic Knowledge Base

Julia Fischer, Stefan Naumann, Markus Dick



Umwelt-Campus Birkenfeld  
FACHHOCHSCHULE TRIER

Julia Fischer, Stefan Naumann, Markus Dick  
{-., s.naumann, m.dick} (at) umwelt-campus.de

Trier University of Applied Sciences, Umwelt-Campus Birkenfeld  
Campusallee, D-55768 Hoppstädten-Weiersbach, Germany

<http://www.green-software-engineering.de/>

This presentation corresponds to the following paper:  
Fischer, Julia; Naumann, Stefan; Dick, Markus: **Enhancing Sustainability of the Software Life Cycle via a Generic Knowledge Base**. In: Greve, Klaus; Cremers, Armin B.: EnviroInfo 2010. Integration of Environmental Information in Europe. Proceedings of the 24<sup>th</sup> International Conference on Informatics for Environmental Protection, Cologne/Bonn, Germany. Aachen: Shaker Verlag, 2010, pp. 716 - 725.

The project “Green Software Engineering” (GREENSOFT) is sponsored by the German Federal Ministry of Education and Research under reference 17N1209. The contents of this document are the sole responsibility of the authors and can under no circumstances be regarded as reflecting the position of the German Federal Ministry of Education and Research.



## Motivation

- IT plays a double-edged part concerning the challenges of sustainable development
- Positive
  - Improvement of processes
  - Dematerialization of physical goods
- Negative
  - Consumption of more and more energy and natural resources
- Contribution: development and usage of software itself in a resource-saving way or usage of software to save energy





## Outline

- I. Problem Description
- II. Requirements and Usage Scenarios
- III. Model Overview and Software Architecture
- IV. Exemplary Articles
- V. Summary & Outlook





## I. Problem Description





- Much information to reduce energy consumption in the area of ICT hardware
- Objectives of the knowledge base
  - To support people in optimizing their software products
  - Positive effects should be increased
  - Negative effects should be decreased
- Orientation on the software lifecycle, which is known from eco-design principles





## **II. Requirements and Usage Scenarios**



## Requirements

- Support to resolve different problems, submit request, supply users with articles
- Actor roles with different demands and expectations concerning the search results
  - Developer
  - Administrator
  - User
- The knowledge base should be generic and extensible
- Users should write their own articles, rate and edit the articles



## Usage Scenarios

- **Developer's Perspective**
  - A software developer in a company that develops software solutions in the area of logistics
  - Wants to have articles for the efficient usage of his software
  - Daily use of the article system
  - Wants to differentiate between various categories
  - Needs some functional blocks to build logistic methods







## Usage Scenarios

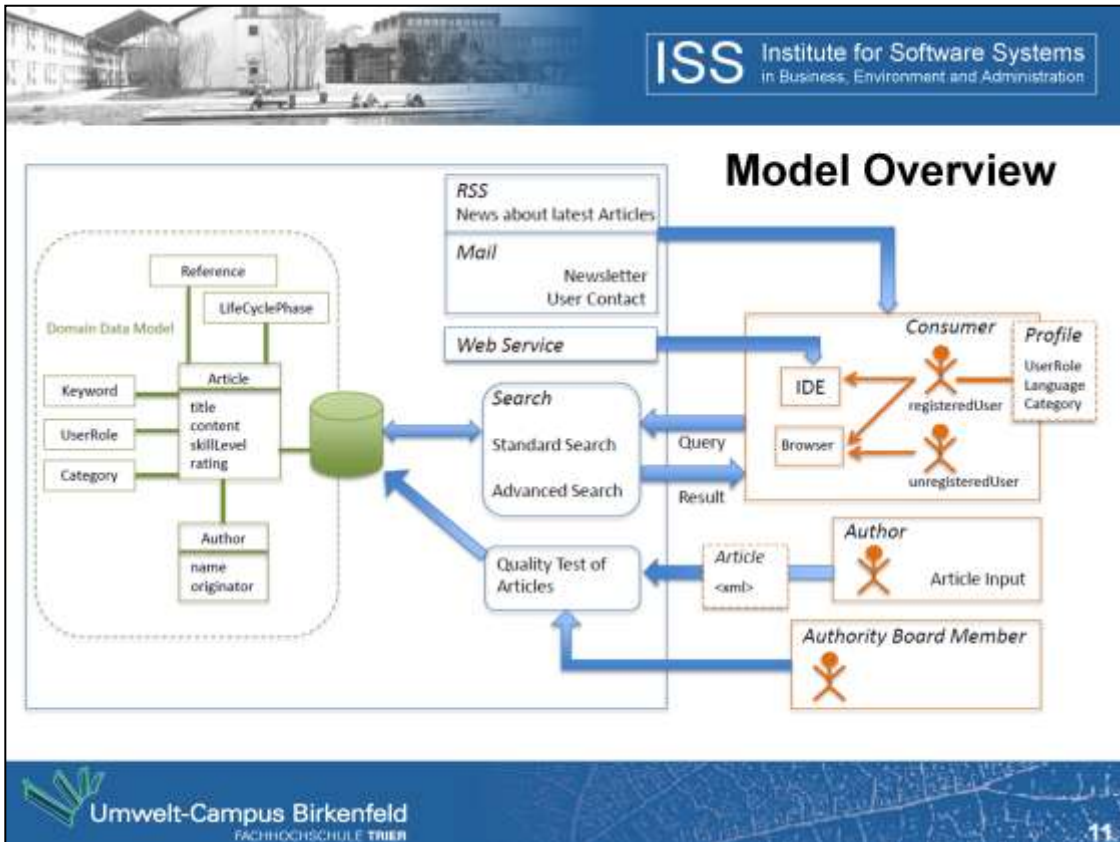
- End User's Perspective
  - She studies environmental biology at the University of Bremen
  - Usage of the Internet for researches for term papers and seminar theses
  - To get help on methods of a resource saving search in the Internet
  - Expects different categories
  - Opportunity to select different skill levels according to her expertise





### **III. Model Overview and Software Architecture**





The main components of the model are a database for managing articles, a search engine, a news service, and the different user roles.

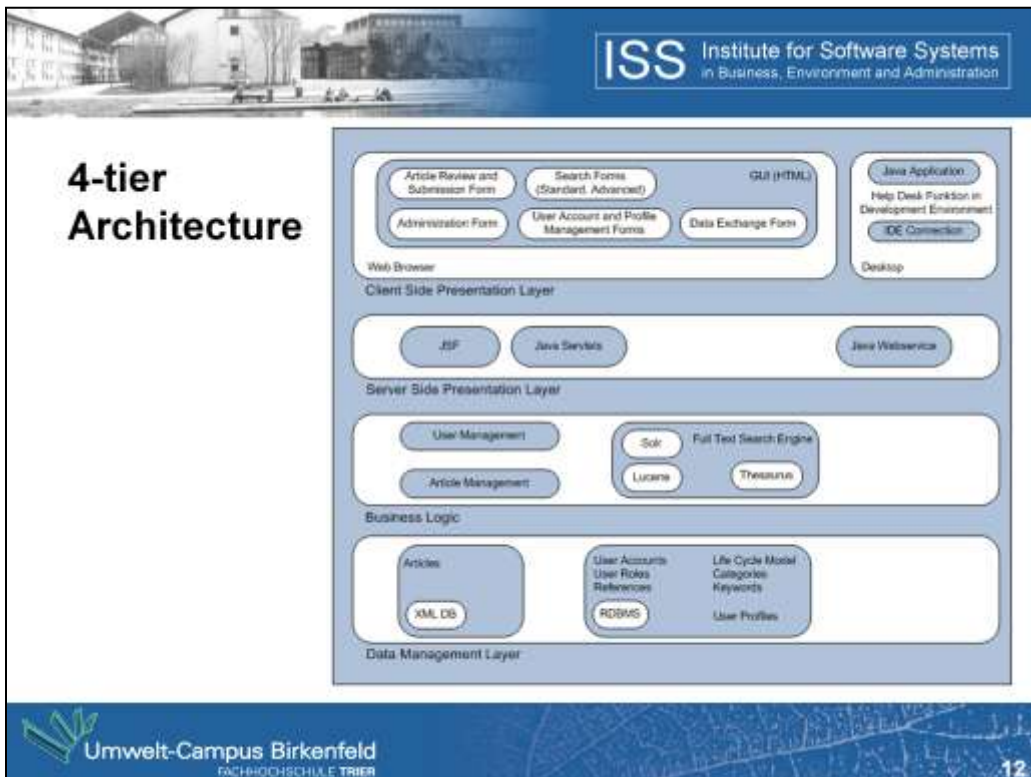
The information is structured in an independent data exchange format. In the overview of the model, one gets a first impression of the data structure by means of a domain data model

The consumers are differentiated in registered and unregistered users. Registered users have more options to interact with the system. They can search via the Internet browser or an application in an independent development environment. All users have two different possibilities for their search entry. They can use the standard search with a simple search field or the advanced search with e.g. different categories and the favorite language. The usage of the stored profiles enables registered users to use a faster and more accurate search

The profiles are necessary for users, who want to search regularly for a special problem considering the software lifecycle or dependent systems. With the profile, they save the time filling out the attributes in the advanced search. The mentioned usage scenarios have shown that the use of the article system differentiates according to the user and the expected result

Furthermore, registered users can take the role of an author. They can write own articles to fill the database. Before the article is usable for other users, it is reviewed by the authority board to guarantee high quality and correct information. Additionally, they can edit and expand articles from other users or add translations to enhance the usability of the system

The news service offers a RSS feed and a mail service. The consumer will be informed about latest entries or news considering the article system. Moreover, they can contact other users to ask questions to get more detailed information, or to solve problems when using an article.



Four-tier architecture with a client side presentation layer, a server side presentation layer, the business logic and a data management layer

**First layer:** two parts of presentation (via web browsers and plug-ins for IDE)

**Second layer:** the server side presentation layer includes JavaServer Faces to build the server-side user interfaces, Java Servlets and a Java Web service to realize the usage of the system via the IDE.

**Third layer:** full text search engine, user and article management. The full text search will be realized with parts of the open source project Lucene Java, a Java library to create and search through indices, and Solr, a search server for full text search. Both technologies will be complemented by a thesaurus to enable the search for related problems, similar spellings, and different words with the same meaning

**Fourth layer:** information in a XML database, relational database which includes among other things the profiles, accounts, user roles and the life cycle model



## **IV. Exemplary Articles**

## Optimization of CSS


Article	id	550e8400-e29b-11d4-a716-446655440000	
	publishDate	2010-04-20	
	rating	5 (very good)	
	skillLevel	1 (basic IT-knowledge expected)	
	status	published	
Title	Optimization of CSS		
Content	<p>With minimizing and optimizing CSS it is possible to reduce HTTP requests. There are tools like CSSTidy which can optimize CSS code in different ways. One mentioned technique is to use shorter definitions for colors: [color:#ff0000;] can be written as [color:#f00;]</p> <p>Another way to reduce the size of files is to delete unnecessary whitespaces, strings and blank lines. The strength of the compression depends on how readable the code has to be after the compression. If readability is not important the whole code can be tipped in one line.</p>		
UserRoles	Web Developer		
LifeCyclePhases	Development		
Categories	Source Code, Image Processing		
Authors	firstName	Ann	
	lastName	Nym	
	org	Institute for Software Systems	
	eMail	greensoft@umwelt-campus.de	
Keywords	CSS, Color, HTTP requests, Compression		
References	King, A., 2008. Website Optimization. 1st ed. Sebastopol: O'Reilly Media		

This article is especially for web developers.

## Configuration of the Web Browser

Article	id	55164301-a26e-5536-e46d-485944330017
	publishDate	2010-05-17
	editDate	2010-07-20
	rating	4 (good)
	skillLevel	3 (very good IT-knowledge expected)
	status	published
Title	Configuration of the Web Browser	
Content	<p>Web users can contribute a large part to the reduction of network traffic and power consumption by configuring the caching capabilities of their web browsers in a way that far future expiry dates can take effect, or by installing web browsers that are fully compatible with GZIP based HTTP compression.</p> <ul style="list-style-type: none"> <li>- configure large caches in Web browsers</li> <li>- do not clear cache during browser shutdown</li> <li>- use advertisement blockers to block advertisement images and Flash</li> <li>- use browsers supporting GZIP compression</li> </ul>	
UserRoles	End User	
LifecyclePhases	Usage	
Categories	Cache, Browser	
Authors	firstName	John
	lastName	Doe
	org	Institute for Software Systems
	eMail	greensoft@umwelt-campus.de
	originator	yes
Keywords	Network Traffic, Browser, Advertisement Blocker, Cache	
References	King, A., 2008. Website Optimization 1st ed. Sebastopol: O'Reilly Media	


This article deals with the configuration of web browsers and is intended to be used by end users.




**ISS** Institute for Software Systems  
in Business, Environment and Administration

## Current Status

- Up to now, we finished the conception and development phase of the model
- We implemented a prototypical application



The screenshot shows a web browser displaying the 'S3C Knowledge Base' interface. The page features a search bar with the text 'Caching' and a 'SEARCH' button. Below the search bar, there are two search results. The first result is titled 'Configure HTTP's Caching Support' by 'Author: Fischer' with a rating of 3 and SKID:2. The second result is titled 'Support caching on the server side' by 'Author: Hasemann, et al' with a rating of 4 and SKID:3. The page also includes a pagination control showing 'Page 1 of 22' and a footer with the text 'S3C Knowledge Base - How Caching Works | Page 1 | 2013-08-27'.



16

A simple prototype was developed by 3 students.





## V. Summary and Outlook





## Summary


- Development of software in a resource-saving way is an important field of research
- It helps to reduce energy consumption and environmental impact
- The knowledge base is a good opportunity to use and to expand the potentials of Green IT





## Outlook

- Our next steps are to create screen flows for the user interface and to start the implementation
- The subsequent user acceptance test will follow
- For the future, we plan to evaluate the platform to find out, which articles are particularly efficient



**ISS** Institute for Software Systems  
in Business, Environment and Administration


**Thank you for your attention!**

Feel free to contact us:

Stefan Naumann    [s.naumann@umwelt-campus.de](mailto:s.naumann@umwelt-campus.de)

SPONSORED BY THE


Trier University of Applied Sciences  
Environmental Campus Birkenfeld  
Institute for Software Systems  
Germany



Federal Ministry  
of Education  
and Research

[greensoft@umwelt-campus.de](mailto:greensoft@umwelt-campus.de)  
<http://www.green-software-engineering.de/>

Ref.-No. 17N1209

 Umwelt-Campus Birkenfeld  
FACHHOCHSCHULE TRIER

20

The project “Green Software Engineering” (GREENSOFT) is sponsored by the German Federal Ministry of Education and Research under reference 17N1209.

The contents of this document are the sole responsibility of the authors and can under no circumstances be regarded as reflecting the position of the German Federal Ministry of Education and Research.