Web-supported Knowledge-based Decision-making for the Disposal of WEEE

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Abstract
In the complex field for finding the right strategy in the treatment of waste electric and electronic equipment (WEEE), decision makers need an efficient and flexible support for defining, structuring, assessing and analysing their specific disposal scenarios. Since October 2000 a team of different European companies and research institutions have been developing in a joint project (AEOLOS - An End Of Life OF product Systems) a method and a toolset, which shall ease the way of decision finding in this area.

1. Introduction
The AEOLOS project started in 2000 with the objective to develop a methodology and a software toolset that can help actors dealing with WEEE treatment. AEOLOS³ is an European initiative and project in the 5th framework programme "Competitive and Sustainable Growth" and has a consortium with core competence in electronic equipment manufacturing (INTRACOM, Greece; Q-FREE, Norway), resource recovery (MULTIS, Ireland; BIRD, Switzerland) and research (SINTEF, Norway; EPFL, Switzerland; ECOBILAN, France; CIMRU, Ireland; BIBA, Germany).

2. Technical Architecture of the AEOLOS Toolset

2.1 Overall description of architecture
The technical architecture of the integrated AEOLOS toolset is structured as a three-tier information system. The advantages of such architecture are described as follows:

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• Improved performance (by utilization of efficient server architecture);
• Flexibility (flexible module or tool connection and re-utilisation of existing applications);
• Portability by usage of web browser technology at end-users side (which allows applicability to mobile services, which use e.g. WAP and SMS);
• Better maintenance (updating of software resources only at the server side);
• Resource saving because the client only to provide visualisation capabilities;
• Consistent data through server-based architecture.

2.2 Description of front-tier (1)

2.2.1 Functionality

The front-tier (upper-tier), which represents the front-end of user interface, is a very thin client, such as a web browser. Web based graphical user interfaces were preferred for the development of the AEOLOS toolset due to their ubiquity and ease of deployment. The client is termed thin because it requires very little in the way of computing resources, support or maintenance.

The separation of the user interface and the corresponding domain model of the toolset together with the functionality provided by the system comes along with a further concept namely the Front Controller Architecture making the AEOLOS architecture very similar to the MVC (Model – View – Controller) architecture, which can be considered as the state of the art in software development.

2.2.2 Front Controller Architecture

The Front Controller Architecture has the following advantages:
• Maintainability & facilitated integration;
• Almost all views and functionality can be maintained by the design team (JSP is also supported);
• Security is handled by the controller and is transparent to (JSP) views;
• The controller handles error reporting transparently in a consistent manner;
• Detailed performance and usage of statistics.
2.3 Description of middle-tier (2)

2.3.1 Functionality

The middle-tier is the point of contact for the client: Here in principle a (front) controller instance handles requests from the client, launches relevant functionality provided by the server and passes its responses back to the client (in this context the middle-tier will often performs some validation to ensure that requests from the upper-tier are correct). The response delivered by the server are generated using its’ own program logic together with functionality provided by other server modules (e.g. DB Connector) and the resources provided by the lower-tier (see figure 1).

Due to this architecture (the separation of components for visualisation, controlling and the domain model) AEOLOS is open for existing resources or applications in order to adapt or extend the overall functionality as long as new components obey the interface, which has to be specified before. Afterwards system modules like the database connector allows a transparent access to the functionality newly offered.

2.4 Back-end-tier (3)

2.4.1 Functionality

The back-end-tier (lower-tier) reflects basic services, provided by web servers, data stores (database management systems like Microsoft SQL-Server) and existing applications (like TEAM4).

Figure 1 describes the whole architecture of the AEOLOS toolset, which contains the following additional elements to a current architecture:

- Displayer-Classes and Session Handler;
- Other supporting Classes comprises functionality, which is required from different sides within the server environment and a DB connector. Here the session handler takes the control over the working context for each user working with the system (that means for each session), the displayer classes are support the creation of html code for the visualisation within a web browser. Furthermore the DB connector allows a unified access to various data sources. The three-tier information system can work in a closed environment like a company intranet or in a more open environment (sheltered by a security system) in the World Wide Web.

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TEAM: Tool for Environmental Analysis and Management (Life Cycle Assessment software of the ECOBILAN Group)
3. Conclusion

The technical architecture of the AEOLOS toolset supports an open and flexible environment, which allows an easy user access nearly everywhere, a proper maintenance and a continually development process. Due to its openness the system can be easily integrated into the various IT-systems at end users side. Additionally the components used for the development are mostly free. Therefore the AEOLOS system is affordable not only for the large companies but also for SMEs. Furthermore there are new and innovative business models coming along with AEOLOS, which are currently evaluated by the AEOLOS consortium.

The combination of the AEOLOS methodology and a user-friendly, open and flexible toolset, which is available nearly everywhere, are key factors, which will support a successful introduction and application of the system in the end users business processes.