Whitepaper

Semantic Management of Information Technology

Benefits and Added Value for Companies.
Contents

Introduction .............................................................................. 3
IT, Knowledge and Knowledge Processing ........................................ 3
Semantic Information Processing .................................................... 4
Importance of Knowledge Processing for the Industrialization of IT..... 5
Formalization and Process Maturity ................................................. 5
Semantic IT Management.................................................................. 6
Example: Building an Ontology .................................................... 8
Ontologies: Areas of Application ..................................................... 9
Business Value ........................................................................... 10
The Potential of Ontologies .......................................................... 10
Contact .................................................................................... 11
About Blue Elephant Systems ....................................................... 11
Copyright .................................................................................. 11
Introduction

As human beings, we process imprecise knowledge and inaccurate information without giving much thought to it. We, for example, communicate on the basis of a vocabulary, which is not accurately defined in many places and are still capable of understanding one another. We are able to make sensible decisions, even if we cannot assess a situation perfectly and the underlying circumstances and rules are barely known to us. The "efficiency" of such a process is, however, restricted with regard to the problem size. The more facts and background knowledge we have to consider, the worse the results of our work will be.

Given the increasing complexity of tasks, such problems can only be properly solved using machines. In addition to the increased efficiency due to automation, machine processing also offers the advantage of delivering deterministic results. The last point alone has proven very useful in actual practice. The analysis of complex and dynamic circumstances and correlations may serve as an example here. Machine processing of complex and dynamic circumstances and correlations is subject to certain requirements, which will be explained in the following.

IT, Knowledge and Knowledge Processing

It is considered a truism that knowledge in general and in particular regarding IT is the most important "fuel" for IT operations. Unfortunately, it is often ignored that the "efficiency" of this "fuel" directly depends on its degree of formalization. The better the formalization of the information constitutes the concerned knowledge, the higher the efficiency. The higher the quality of used information models, for example regarding the coherence, integration and consistency of the modeled information, the better is the knowledge available and useable.

Today, only a small part of the knowledge regarding IT is accessible in a form that ensures and allows a trans-sectoral availability and processing capability. It is also problematic that a large part of the facts and structural information that comprise the basis of IT knowledge is spread, or rather scattered, across many IT systems. In addition, a large part of this aforementioned knowledge (especially with regard to interrelationships and correlations) exists only in the minds of special experts.

Though this situation may not come as a surprise, it should still be alarming to every IT manager. The lack of availability regarding
sufficiently formalized knowledge not only hampers all conceptual IT processes from planning stage to audit, but also prevents the emergence of transparency regarding important information in many areas. It also hampers the automation or standardization of processes and, thus, presents a major risk factor and significant IT cost driver.

Semantic Information Processing

The field of Information Technology is characterized by abstract terms, concepts and constructs, possibly more than any other field of knowledge. Every IT employee deals with a multitude of terms on a daily basis, many of which are entirely "mental" or rather theoretical in nature: an "application" is as abstract a term as is a "service", an "architecture", a "business process", a "standard" or a "protocol".

Many of these terms are not accurately defined. Very often, the same things are named differently and different things receive the same names. This is in addition to all kinds of similarities regarding such terms. Many data integration problems are the direct consequences of the following four conflicts:

- **Technical Conflicts**
  Conflicts arise at the technical level, if information is distributed among different systems and can only be accessed using different technical means or interfaces. Using technologies developed for integration purposes, such as Enterprise Service Bus (ESB) systems, these technical conflicts can be resolved.

- **Syntactic Conflicts**
  Conflicts arise at the syntactic level, if different languages, data formats or data models are used. Syntactic conflicts can be resolved using standardized object models and languages, such as XML.

- **Structural Conflicts**
  Structural conflicts are the consequences of different structures and relations being used to represent the same data. There are different kinds of structural conflicts. In this regard, attributes of objects that describe the same property may, for example, have different names. Additionally, the same information can be represented in different informative sources by a multitude of data types, such as objects – resolved below.

- **Semantic Conflicts**
  Semantic conflicts result from using different terms or names for the same element of an application area. There are two
variants of semantic conflicts. Identical or semantically equivalent objects may have different names (synonyms). Moreover, different objects can be referred to with the same name or term (homonyms) – resolved below.

Examples for synonyms and homonyms in the IT sector:

- **Synonyms**
  - Program, application (word synonyms)
  - DBA and data base administrator (word synonyms)
  - PC, client and workstation (partial synonyms)
  - Database and repository (word synonyms)

- **Homonyms**
  - Server (as a powerful computer system) and server (as a program)
  - Interface (network interface / HW) and interface (programming interface / SW)
  - Service (in the sense of ITIL services) and service (as in services belonging to an operating system)

**Importance of Knowledge Processing for the Industrialization of IT**

Even without defining the terms "knowledge" and "information" in an exact manner, it becomes apparent that both terms are closely related. In order to grasp the meaning of a situation or circumstances and to extract "knowledge" from this "information", machines, just like human beings, need data regarding the context of the information provided. Without specifying a unit, for example, every measurement is practically meaningless. A significant difference between human beings and machines is the degree and quality of formalization that is required in order to grasp the "important core" of the information. The adequate formalization of information, enables machines to utilize contextual meanings for the purpose of making decisions and performing actions. This has the potential to significantly accelerate the IT industrialization process and the service orientation of the IT sector.

**Formalization and Process Maturity**

A significant aspect of the IT industrialization and the service orientation of the IT sector is the maturity of the processes. This maturity level is in turn directly related to the formalization of the underlying information. With regard to CMMI, it is possible to differentiate between the following levels of process maturity:
• **Level 0**
  Correlations and circumstances are largely unknown. The information is spread across many informative sources or employees. The structure of the information is largely undefined. The evaluation of the aforementioned circumstances and decisions is based on "gut feeling" and rough estimates.

• **Level 1**
  In some areas, documentation exists that - compiles and explains the essential contents and - defines the structure of the information. The documentation can be used by employees to evaluate situations and make decisions.

• **Level 2**
  In some areas, the information (and structural information) and meta-data are sufficiently formalized so that the information can - be automatically determined or acquired, - (semantically) consolidated and - properly enriched. The formalization of information and meta-data forms the basis for continuous improvement processes. In addition, critical situations, issues or circumstances can be evaluated automatically and analyses as well as decisions in this regard can be prepared.

**Semantic IT Management**

Blue Elephant Systems develops and implements innovative solutions for the purposes of Semantic IT Management. These solutions are based on Semantic Web technologies and use ontologies to represent formalized knowledge. An ontology is a formal description of terms (concepts) and their relations that apply to a certain organization or other group of people within a domain of knowledge. Ontologies are a powerful technology for the formalization of knowledge. Ontologies consist of formal depictions or rather models regarding certain sections of a knowledge domain. The formalization and modeling are not ends in themselves, but merely necessary prerequisites to enable an automated processing of knowledge or context information. In addition, ontologies are not limited by the requirements of a certain field of use or specific application, but allow the formalized knowledge to be used by different users and applications. They also improve the transparency of information by introducing a common language. Ontologies promote a better understanding of circumstances and correlations within a field.
of knowledge and support processes along the entire value chain. Therefore, ontologies play a key role regarding data integration when it comes to resolving structural and semantic conflicts.

Ontologies provide functional means of communication between people, processes, applications and systems. In this regard, ontologies usually consist of a defined basic vocabulary, as well as definitions and entities based on it and a description of the existing correlations and relationships between these. Thanks to a well-defined ontology, a common understanding of terms and relations of complex information structures is achieved; this includes, for example, CMDBs, product-specific repositories and databases of technical and operational systems as well as technical and operational systems employed as part of IT operations. Ontologies offer significant advantages:

- They enable semantic interoperability. Information from different areas and sources can be integrated with regard to meanings, contexts and circumstances.
- They improve the ability of developing a common understanding of an information structure.
- Data and information can be assigned / matched to clear meanings.
- Existing databases and systems can be reused.
- Facts and structures can be visually represented or the corresponding knowledge can be passed on for automatic processing.
- They allow a standardization and presentation of the used terminology. As a result of this, the used terms can be identified and documented.
- Conventional modeling approaches are not capable of representing different perspectives on a topic or subject area. Ontologies provide this exact possibility and are therefore capable of representing complex and polymorphic contexts and circumstances, for example at the corporate level.
- They offer the possibility of explicating assumptions and to delineate these in comparison to the determined information. Formalized concepts provide a much higher degree of objectivity. The value of such formalization can be substantial in fields of knowledge, where there is great controversy even with regard to the most basic concepts.
• They support an iterative modeling procedure. The source model can be gradually expanded by further aspects and requirements using iterations. This also makes the modeling of large corporate models possible.

• This modeling procedure eliminates minor properties of the viewed object or circumstance.

Of course, the field of modern computer science provides many powerful tools for managing, editing, searching as well as archiving of information without any semantic processing. However, it is often forgotten that without an adequate degree of formalization of the underlying circumstances, these "tools" merely provide "islands of information in an ocean of data". Without an adequate formalization of knowledge, the "map" is so to speak "missing", which allows a search for and a processing of system-wide circumstances and contexts. The usage of data sources from different areas and the processing of system-wide relations constitute an essential basis for an integrated and holistic approach to IT management.

**Example: Building an Ontology**

Consider one of the central questions regarding IT operations: "How can the allocation of overhead costs be improved and how can we lower IT costs by increasing transparency?" Answering this question using conventional technologies and procedures would have the following disadvantages:

• A comprehensive overview would be very difficult to achieve.

• It would be necessary to "partially reinvent the wheel", because integration with existing information standards would prove difficult.

• The usage of existing data sources and information would cause great difficulty.

A simple ontology may consist of the following elements:

• Concepts (with corresponding attributes)

• Instances (with corresponding attributes)

• Simple relations
As part of a demo ontology, we model the following concepts: Cost centers, technical services, IT resources, usage potentials, the involved organizations and business processes. We complement these concepts with the corresponding attributes, such as: technical performance parameters, direct costs and overhead costs. We then form instances, which we derive from the concepts. During this process, the attributes are passed on to the instances from the concepts and in turn supplemented by new attributes.

Finally, we model the relations between concepts, instances and attributes. Using the corresponding data sources (databases, APIs, CLIs, Web Services, Excel documents, etc.), it is possible to reference instance information.

The ontology obtained in this manner allows for an operationalization of a service-oriented cost allocation. The starting point is the identification of IT resource burdens presented by the respective services. The degree of IT resource load is subdivided into different usage potentials and corresponding potential classes in advance. The collection and processing of service-specific context information, such as time and place of the service rendering, the inquiring organization and the usage of potential classes to describe the actual usage or "load", the possibility of allocating costs according to performance is improved significantly.

The ontology constitutes the foundation for providing clear answers to our inquiries in collaboration with the structural model. In addition, visual representations provide the great advantage that dependencies and facts are much easier to identify and much better documented.

**Ontologies: Areas of Application**

Ontologies are already being used in many business areas, where they provide great benefits. The following tasks can, among others, be supported:

- Acceleration of development processes
- Improvement of planning transparency
- Support for analysis processes
- Optimization of support processes
- Support of budgeting processes
- Automation of information gathering / acquisition
Existing data stocks or databases, information models and systems can be upgraded and expanded using ontologies. There is thus more flexibility, quality and an improved processing of data derived from various sources and of different kinds.

Business Value

The fight for market shares and new customers is tough. Companies have to work efficiently in order to be capable of constantly adapting to the ever-changing market conditions and situations. In order for the companies to reach their goals and to remain competitive in the long run, a closed flow of information and knowledge has to be ensured along the entire value chain. New solutions based on process-oriented ontologies help to overcome these existing dynamics and to always keep the essential aspects in sight.

Thanks to the fact that ontologies function independent of specific platforms, it is possible to construct system-wide "networks of knowledge". These networks constitute a measurable degree of investment protection and optimize the way in which companies deal with complex information structures.

The Potential of Ontologies

Depending on the area, ontologies offer various potentials for possible improvement or optimization:

- Acceleration of planning processes: 20-30%
- Support for risk management processes: 40-50%
- Optimization of cost allocation: 40-50%
- Optimization of license management: 30-50%
- Support for budgeting processes: 40-60%
- Support for auditing processes: 30-45%
Contact

If you would like to know more about how to generate benefits and values for your company due to semantic IT management, visit www.blue-elephant-systems.com, send an e-mail to sales@blue-elephant-systems.com or call us at +49 711 400 425 25.

About Blue Elephant Systems

Blue Elephant Systems GmbH is an international operating company, developing and implementing software to improve the IT operational safety. Large IT infrastructures can be controlled and monitored, analyzed and evaluated. The company's goal is to optimize the use of IT and to achieve the maximum operational reliability. The MIDAS Product Family optimizes and expands the usage of HP Operations Manager (HPOM), MIDAS boom automatically monitors heterogeneous IT infrastructures, and MOSCITO is a management information system for a company's managerial staff. Blue Elephant Systems GmbH is located in Stuttgart, Germany, and joined by Blue Elephant Systems Inc., based in Tuscaloosa, AL, U.S.A.

Copyright

Author: Joachim Hoernle, April 2014.
Copyright 2014, Blue Elephant Systems GmbH. All rights reserved. No part of this document may be copied, reproduced, translated, transferred to an electronic medium or machine-readable language without Blue Elephant Systems GmbH's express prior agreement in written form. The information contained here is non-binding. All product and service names are the property of the respective trademark owner. BLUE ELEPHANT SYSTEMS and the BLUE ELEPHANT SYSTEMS logo are registered with the US Patent & Trademark Office. All other product or service names are the property of the respective owner. Should you have questions regarding these conditions, please contact us via email at info@blue-elephant-systems.com.
BLUE ELEPHANT SYSTEMS GmbH, Zettachring 2, 70567 Stuttgart, Germany.