Conceptual structures in LEADing and best enterprise practices

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Conceptual Structures in LEADing and Best Enterprise Practices

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Abstract. Conceptual Structures, namely Conceptual Graphs (CGs) and Formal Concept Analysis (FCA) are beginning to make an impact in Industry. This is evidenced in LEAD as it seeks to provide its 3100+ industry practitioners in many Fortune 500 and public organisations with capabilities that can handle ontology and semantics. The existing ontology and semantics work in LEAD, supported by the Global University Alliance, is described and how CGs, FCA and their tools (e.g. CoGui, CG-FCA) enhance this endeavour.

1. Introduction

Despite its long incubation period, Conceptual Graphs (CGs) and Formal Concept Analysis (FCA) are beginning to make an impact in Industry. Like the Semantic Web and the emerging use of Ontology tools such as Protégé in Enterprise tools such as Essential Project, Conceptual Structures (that CGs and FCA epitomise) reflect industry's need for enriched knowledge capture and reasoning tools that extend beyond the existing provision [1, 2, 3, 4, 5]. The LEADing Practice Community (LEAD) is one such recognition, as it seeks to provide its 3100+ industry practitioners in many Fortune 500 and public organisations with tools that can handle ontology and semantics. In LEAD, Conceptual Structures are becoming pivotal in the way of thinking, working and modelling around LEAD's enterprise and industry standards.

2. LEAD

Founded in 2004, LEAD was originally an acronym for *L*ayered *E*nterprise *A*rchitecture *D*evelopment but now simply refers to itself as the LEADing Practice Community that develops Enterprise Standards [6]. This is because it now includes Enterprise Modelling (including Business Process Management) and Enterprise

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Engineering as well as Enterprise Architecture. LEADing Practice's CEO (Chief Executive Officer) Henrik von Scheel describes it as:

"LEADing Practice represents a new breed of Enterprise Standards and is recognized as a paradigm shift by the global business and IT community to empower through its Reference Content, enabling organizations to innovate, transform and deliver value". [6]

LEAD is based on an open source community concept that is adopted by most of the Fortune 500 and public organizations, and is integrated into software solutions such as SAP (ASAP Methodology), IBM Rational, IBM System Architect, iGrafx and Software AG (ARIS). Today, LEADing Practice is the fastest growing open source standard development community, supported by the 2nd largest certified community of 3100+ industry practitioners. LEAD has developed 90 different Enterprise Standards with detailed reference content as well as over 51 different Industry User Group Committees that provides a global platform for industry executives, experts, academics, thought-leaders, practitioners and researchers to develop, use and apply [6]. The LEADing Practice reference content connects to all the major existing enterprise architecture and other frameworks, methods and approaches (such as TOGAF, Zachman, FEAF, ITIL, Prince2, COBIT, DNEAF, and others). This is tabulated by LEAD [7].

To mention some examples, the LEGO Group, famous for its Lego bricks, provides a detailed exposition of the use of LEADing Practices and how to combine business model, process model, performance management, and information aspects. This led to that the LEGO Group receiving the prestigious Gartner Group award of being the Best BPM organization [8]. There are many other success stories that also include non-commercial organisations, and government bodies such as the Government of Germany, US Government, the Government of Canada and many others [6].

To assist its industry practitioners and the development of the discipline as a whole, LEAD provides a multitude of reference content with meta-object, descriptions, templates and Hands-On Modelling rules and tools. In order to enable a repeatable and structured way, LEAD is structured as a "Way of Thinking, Way of Working, Way of Modelling, Way of Implementation and Way of Governance", with each way setting the context of the next one in this list. It reflects the architectural principle of capturing the very purpose of an enterprise (its vision and mission) right down to the individual assets (e.g. purchases, sales, employees, IT support systems) that fulfil that purpose.

LEADing Practice's Enterprise Standards are developed by a) Researching and analysing industry best practice & leading practices, b) Identifying common and repeatable patterns (the basis of LEAD's standards), c) Developing the Enterprise Standards that increase the level of re-usability and replication, and d) Build industry accelerators within the standards, enabling to adopt and reproduce the best & leading practices. LEAD is therefore practically oriented, but based on a strong theoretical base that it gathers from its research partner, the Global University Alliance.

Global University Alliance (GUA). Also founded in 2004 by one of us (von Rosing) and in support of developing Best and Leading Practices, the Global University Alliance (GUA) is stated as a non-profit organisation and international consortium of

university tutors and researchers whose aim it is to provide a collaborative platform for academic research, analysis and development and to explore leading practices, best practices as well as to identify missing gaps in those practices [9]. Academic research is therefore combined with industry practice, providing industry practitioners with a strong theoretical basis whilst providing academics with industry experiences (such as the companies referred to earlier) to test that base. Conceptual Structures has a natural fit with this approach, as enterprises need to draw on enriched models to capture their way of thinking in their way of modelling, and ensure they are optimising the intellectual and physical assets they have own to achieve to fulfil their vision and mission. Enterprises are creative knowledge-based endeavors whereas computers prefer simpler structures such as data that they can easily process. Conceptual Structures harmonise the creativity of humans with the productivity of computers. Put simply, Conceptual Structures recognise that organisations work with concepts; machines like structures. It connects the user's conceptual approach to problem solving with the formal structures that computer applications need to bring their productivity to bear. This will be discussed later, once the role of ontology and semantics in LEAD through the GUA is understood.

3. Ontology and Semantics in LEAD

To support LEAD and the various enterprise practitioners, the GUA provides a number of resources that encompass the study of Enterprise DNA, Enterprise Philosophy, Enterprise Ontology, Enterprise Semantics, Information Management, BPM, Enterprise Architecture, Sustainability, and Industry Standards [10]. Two of us (Laurier and Polovina) are responsible for Ontology and Semantics respectively in the GUA and can be seen in the foundation of the Figure on LEAD's home page [6]; accordingly these are described in more detail as follows.

The Enterprise Ontology Reference Framework. Ontology formally represents knowledge as a set of concepts within a domain, and the relationships between those concepts. It is the theory of being. It can be used to model a domain and support reasoning about concepts. The Global University Alliance (GUA) supports LEAD and other contemporary enterprise practices through its Enterprise Ontology Reference Framework (EORF) [11]. It describes ontology as a shared vocabulary and the definition of its objects or concepts, and their properties and relations within and across key business domains as illustrated by the Framework. Along the way, EORF's modelling and architecture principles have attracted software vendors. These include SAP AG, IBM, and iGrafx and have used or adapted the EORF's meta-model. The last mentioned, iGrafx, currently incorporates EORF's modelling aspects into their extended process methods and meta-models [12]. Another is Essential Project, which through its productive use of Protégé in its Essential Manager and its own Visualisation tool (Essential Viewer) requires ontology as its building blocks to help organisations analyse and manage the knowledge needed to make decisions that impact or are impacted by their own enterprise architecture [3, 2]. The GUA

describes EORF in further detail including its rapid adoption by industry, taking advantage of academic expertise [11].

The Enterprise Semantics Reference Framework. The GUA also provides the Enterprise Semantics Reference Framework (ESRF) [13]. The ESRF aligns with the EORF above. Together they underpin LEAD's Reference Content. The term Semantics arises from Ancient Greek: σημαντικός - sēmantikós - being the study of meaning. It denotes the relation between signifiers, symbols and objects. Semantics (or Semantic) is about making meaning from the objects using the best possible signifiers and symbols. It includes those signifiers and symbols used to describe the relationship between objects as this comparison further enhances their meaning. Enterprise Semantics is therefore the study of objects and symbols used to describe the enterprise, what they stand for, their underlying formal logics and their relationship and correlation. It supports Enterprise Pragmatics - the sharing of meanings gathered from Enterprise Semantics across its diverse interpretations in practice, leading towards a universal truth whilst maintaining these wide-ranging interpretations and beliefs in the real world. Through this way of thinking and working it sets the way of modelling – the impact of modelling and engineering as it most usefully aligns the relevant parts of the enterprise. The ESRF includes the objects, their properties and relations found throughout Enterprise Architecture, Modelling and Engineering. The ESRF at its core consists of a number of holistic meta-models and fully integrated templates (e.g. maps, matrices and models). The scope of the ESRF is detailed further by the GUA [13]. Like the EORF, the ESRF has attracted software vendors as already described above under the previous EORF heading.

4. Conceptual Structures in LEAD

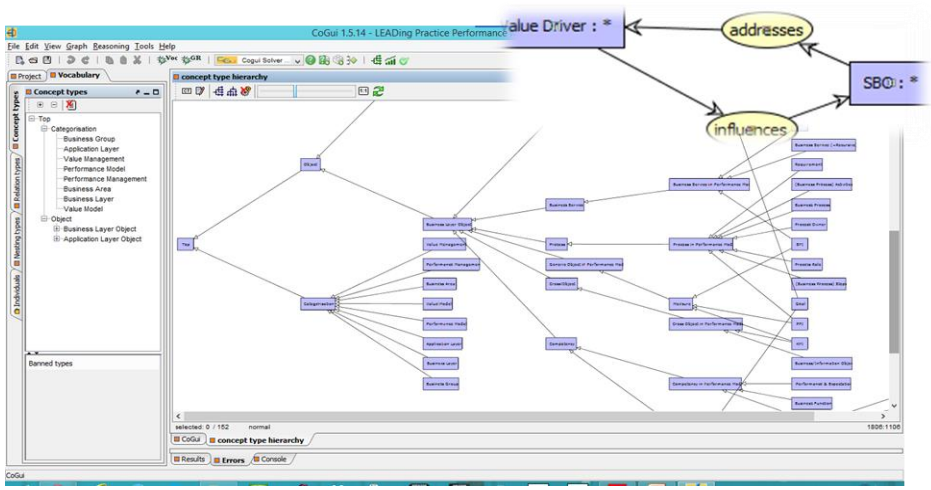

Figure 1: The LEAD Performance Meta-model in CGs, using CoGui

Conceptual Graphs. As indicated earlier, LEAD consists of a number of meta-models. Like other enterprise meta-models, The LEAD meta-models define a formal structure for the concepts or objects and their relations. These structures ensure self-consistency and to provide a computational basis for enterprise modelling tools (e.g. iGraphx), especially because simple drawing tools alone do not capture the ontology and semantics that enterprise tools require. That requirement enables the tool to assist an organisation in capturing its conceptual structure thus aligning its IT systems with its corporate vision and mission, as described earlier. The GUA therefore uses CGs as they characterise conceptual structures using the same concept-relation fundamental as the meta-models. This is illustrated by Figure 1 that shows the use of the CGs tool CoGui [14]. In CoGui the GUA are then able to explore the meta-models (in this case the Performance meta-model) to identify, for example, novel indirect relations that provide higher-level abstractions, or patterns, in that model or the actual organisation's population of the meta-model.

Formal Concept Analysis. Using CGs the cognitive-level models (drawn by hand from the minds of experts) can be taken further and explored at the logical level, where for example apply logical operators can be applied (e.g. CGs maximal join or projection operations) [4]. Using FCA the GUA has also been able to explore the concepts (objects) and relations (attributes) at the lower but even more rigorous mathematical level to discover e.g. hidden relations or un-named concepts (pointing possibly to a new object). In particular, CG-FCA is used that once visualised in the FCA tool Concept Explorer (ConExp) produces a lattice as illustrated by the extract shown in Figure 2 [15].

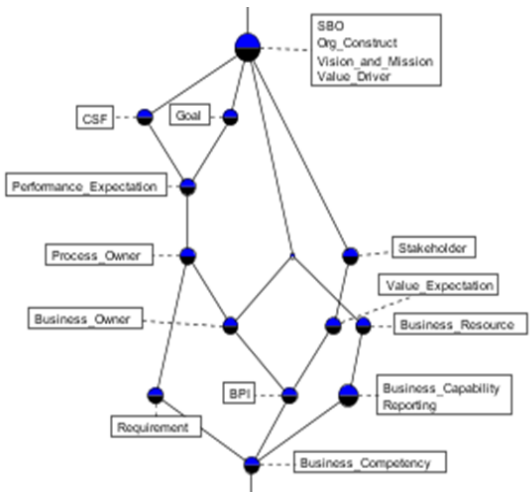

Figure 2: The LEAD Performance Meta-model in ConExp, after conversion by CG-FCA

5. Concluding Remarks

We have demonstrated how Conceptual Graphs (CGs) and Formal Concept Analysis (FCA) are making an impact in Industry through the GUA into LEAD. As stated, these Conceptual Structures reflect industry's need for enriched knowledge around meta-objects, their attributes, the relations and the rules that govern the nature of the

objects and the models. It reveals how tools that can handle ontology and semantics can be applied to industrial-strength enterprise architecture, modelling and engineering.

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