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Discovering the Gaps in Enterprise Systems via Conceptual Graphs & Formal Concept Analysis

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Abstract. Enterprise systems such as SAP are software applications that are intended to bring the productivity of computers to bear on the human endeavour of enterprise. An industrial-strength SAP enterprise information model was rendered as meta-object→relation→meta-object in Conceptual Graphs (CGs). Then Formal Concept Analysis (FCA)'s *CGtoFCA* algorithm was used to generate the meta-object⌒relation→meta-object binaries, revealing gaps in some of model's key performance indicators that human decision-makers need to realise the enterprise's vision.

1 Introduction

Enterprise systems are software applications that are intended to bring the productivity of computers to bear on the human endeavour of enterprise [3]. The SAP University Alliances program (http://uac.sap.com) includes a set of industrial-strength case studies to demonstrate SAP including an enterprise information model [1,5]. Conceptual Graphs (CGs) and Formal Concept Analysis (FCA) were used to abstract the conceptual structures from the business and systems layers in this model [2]. Our purpose was to illustrate how gaps in the alignment between the associated human-oriented business concepts and their counterpart computer-oriented structures could be discovered.

2 Outcomes

By expressing the model's underlying meta-object→relation→meta-object triples as Conceptual Graphs (CGs) we brought together into one simple, common conceptual structure the model's myriad business and systems modelling notations (e.g. Value chain diagrams, Organisation Charts, UML, BPMN, Data models). The simplification extended to rendering the model's i) Value, Competency, Service, Process, Application, and Data layers across ii) the four levels of detail for each of these layers. The rationale for the layers and levels are detailed

Fig. 1. Application, CGs

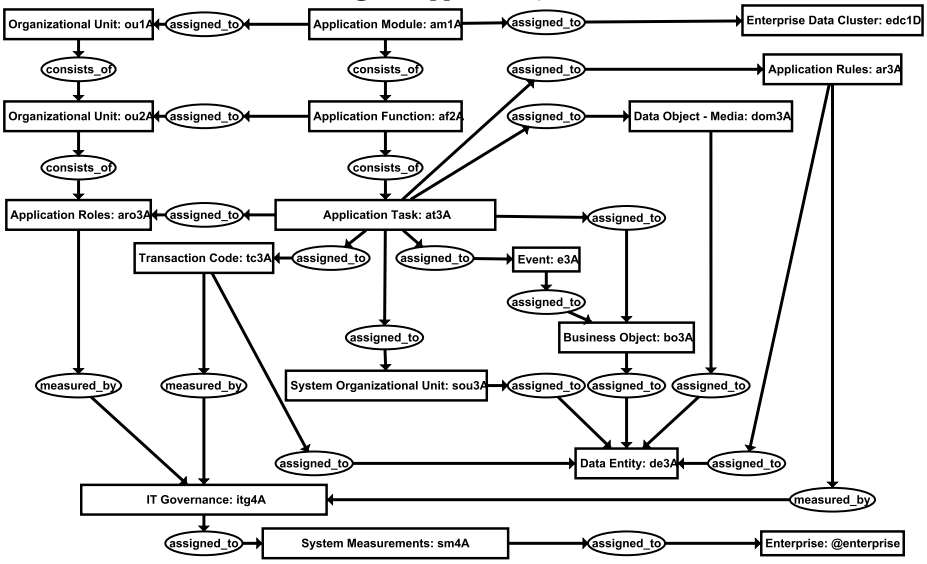


Fig. 2. Application, FCA

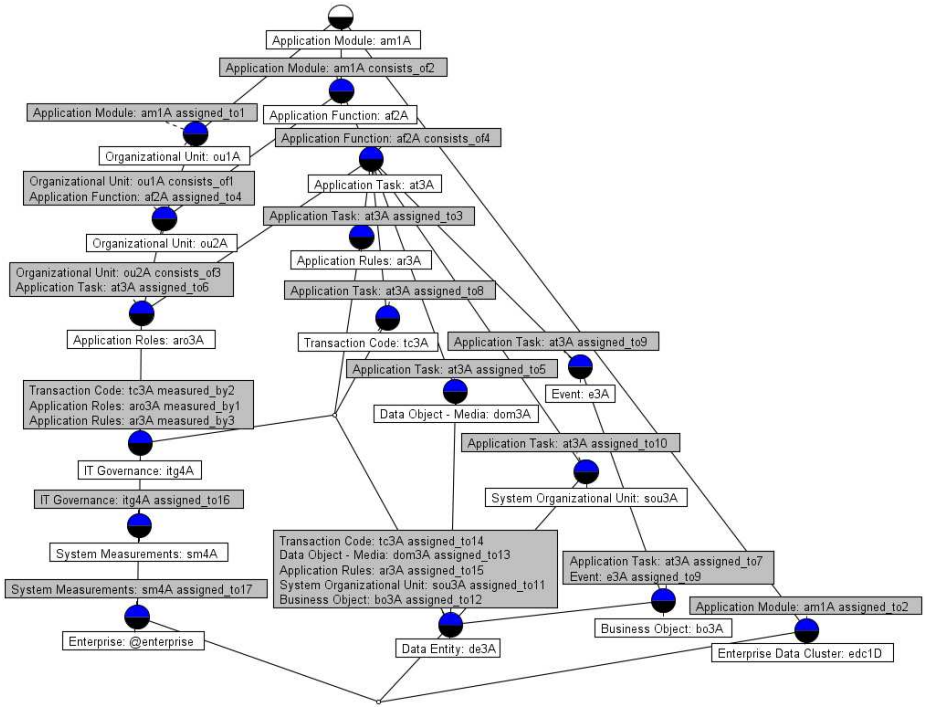


Fig. 3. Data, CGs

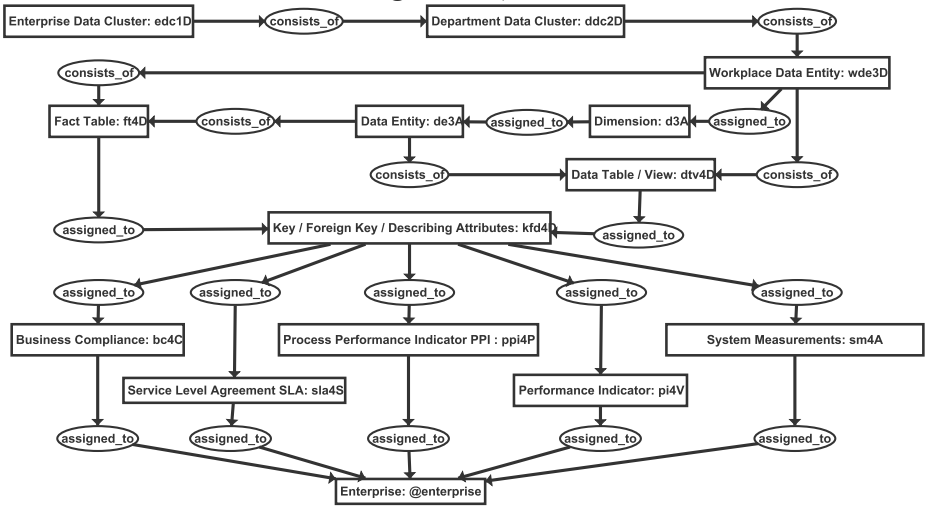
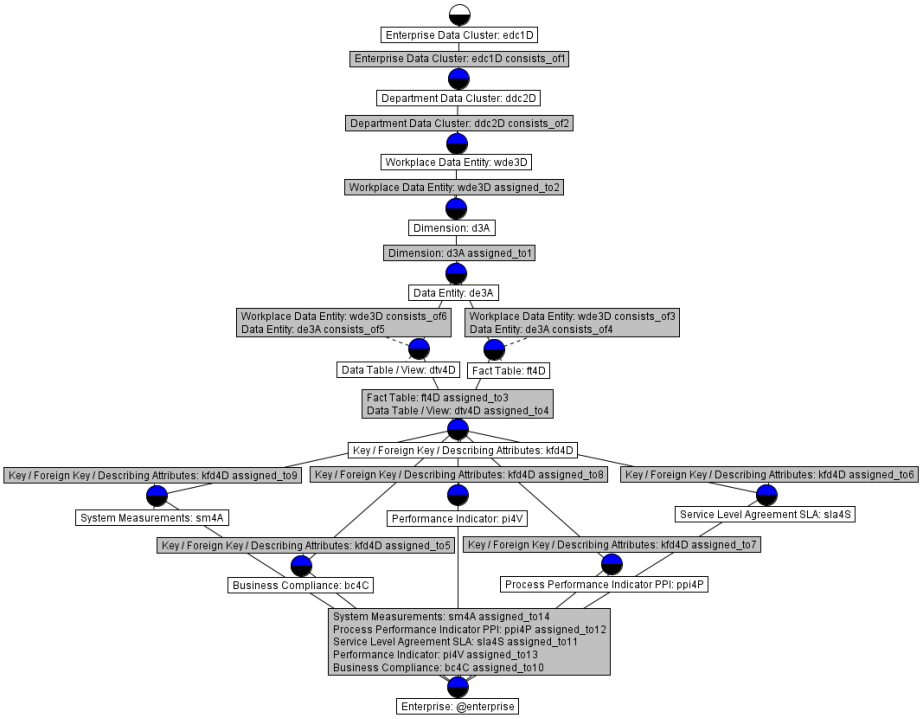


Fig. 4. Data, FCA



elsewhere [4]. Put simply, their intention is to align the human concepts and computer structures that realise an enterprise's vision i.e. its purpose for existing. Formal Concept Analysis (FCA)'s *CGtoFCA* algorithm then generated the meta-object⌒relation→meta-object binaries [2]. Figure 1 depicts the model's Application layer CG (Conceptual Graph). It portrays each meta-object as a CG concept made up of a CG type label of the meta-object name (e.g. Organisational Unit) and a unique identifier in the referent field e.g. `ou1A` denotes a meta-object that is Organisational Unit (ou), level 1 (1), and A (Application layer) from the model. The `[Enterprise: @enterprise]` concept has a CGs measure referent (`@enterprise`). For the model to be aligned as described earlier, each meta-object⌒relation (an attribute in FCA generated by *CGtoFCA*) should be in the intent of the bottommost formal concept at `[Enterprise: @enterprise]` [2].

On inspecting this CG the `[Application Module: am1A]` → `(assigned_to)` → `[Enterprise Data Cluster: edc1D]` CG triple therein does not point directly or indirectly to `[Enterprise: @enterprise]`. Likewise for the three meta-objects (`sou3a`, `bo3a`, and `dom3a`) that are `(assigned_to)` → `[Data Entity: de3A]`. Using index numbers to illustrate that the relations are distinct from each other (e.g. `assigned_to`N where $N \geq 1 \leq 17$), the *CGtoFCA* Formal Concept Lattice (FCL) figure 2 evidences that `[Enterprise: @enterprise]` is not bottommost. That is because of the meta-object⌒relation attributes that are outside the intent of the level 4 key performance indicator (KPI) meta-object `[System Measurements: sm4A]`, which evaluates the Application layer. These gaps however do not occur in the Data layer - see figures 3 and 4 respectively. Here the extent of all the attributes is `[Enterprise: @enterprise]` including from all the relevant KPIs (level 4 meta-objects) including `[System Measurements: sm4A]`. Gaps also occurred in other layers (Competency, Service, Process). Given that human decision-makers rely on these KPIs to realise the enterprise's vision, the gaps demonstrate how their misalignment with an enterprise system can be discovered, thus focussing any further investigation and the gaps resolved.

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