Distributed Engineering of Ontologies (DILIGENT)

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Summary. Ontology engineering processes in truly distributed settings like the Semantic Web or global Peer-to-Peer systems may not be adequately supported by conventional, centralized ontology engineering methodologies. In this chapter, we present our work towards the DILIGENT methodology, which is intended to support domain experts in a distributed setting to engineer and evolve ontologies. We show partial results on how the DILIGENT process model has been applied in two case studies, in particular (1) in a computer science department where we investigated a fine-grained methodological approach for argumentation, and (2) in a virtual organizational setting in the tourism domain with the support of a Peer-to-Peer system.

15.1 Introduction and Motivation

It has been a widespread conviction in knowledge engineering that methodologies for building knowledge-based systems help knowledge engineering projects to successfully reach their goals in time (cf. [16] for one of the most widely deployed methodologies). With the arrival of ontologies in knowledge-based systems the same kind of methodological achievement for structuring the ontology-engineering process has been pursued by approaches like [4, 18, 21] and their application has been proposed in such areas as the Semantic Web, too. At this point, however, we have found some mismatches between these proposals (including our own) and the requirements we meet in the Semantic Web:

1. Classical development of knowledge-based systems and of corresponding ontologies is mostly centralized like the targeted knowledge-based system itself. In contrast, we consider the general tendency to support distributed information processing with ontologies, e.g. the Semantic Web, agents, web services or ontology-based Peer-to-Peer (P2P). Stakeholders in an ontology development process will hardly ever gather in one place. Yet they have an interest to fruitfully contribute toward the ongoing development of their ontologies.
2. Existing methodologies support knowledge engineering (KE) by using check lists that guide the engineering process. The check lists have been shaped by the
needs of *knowledge engineers* to comprehensively cope with nearly arbitrarily complex processes. In contrast, in the distributed cases we consider, the participation of a knowledge engineer is often restricted to a (possibly complex) core ontology. Beyond the core, these cases involve extensive participation and, comparatively simple, concept formation by *domain experts*.

3. KE has mostly focused on an *up-and-running system* with some moderate effort for maintenance. In contrast, ontologies for distributed information processing must permanently *evolve* in order to reflect the widely diverging needs of their users.

4. KE methodologies remain rather *coarse* and the gap between their description and concrete actions to be taken is filled by the KE. In contrast, for Semantic Web ontologies and comparable use cases, we ask the question whether we could provide the domain experts with *fine-grained* guidance in order to improve their effectiveness and efficiency in ontology engineering.

To account for some of the differences between classical knowledge engineering and ontology engineering methodologies derived from there, we have started to develop a methodology for DIstributed (cf. item 1 above), Loosely-controlled (cf. item 2) and evolvInG (cf. item 3) Engineering of oNTologies, the validity of which has been partially checked and is still being checked against experiences in two case studies (cf. [15]).

In this chapter, we focus on the last consideration (cf. item 4): Could ontology engineering benefit from a more fine-grained methodological support? To answer this question we have applied this process framework in two case studies. In the first case study, we specifically investigated whether some argumentation structures dominate the progress in the ontology engineering task and should therefore be accounted for in a fine-grained methodology. We tested the methodological hypothesis by an *in vivo* experiment of collaborative ontology engineering — once with and once without fine-grained methodological guidance. In the second case study, we have investigated how this kind of process framework can be realized in a virtual organizational setting in the tourism domain with the support of a P2P network.

In the remainder of this chapter, we start by explaining the methodological framework of DILIGENT (Sect. 15.2). Then, we present the experiences that helped finding a DILIGENT ontology engineering argumentation framework (Sect. 15.3). In Sect. 15.4 we show the technical solutions developed to support the realization of a DILIGENT process in an organizational setting.

Before concluding, we compare to some related work not contrasted in the introduction here.

### 15.2 DILIGENT Process

We here sketch the overall framework, in which it is embedded, i.e. the overall DILIGENT process (cf. [15]).