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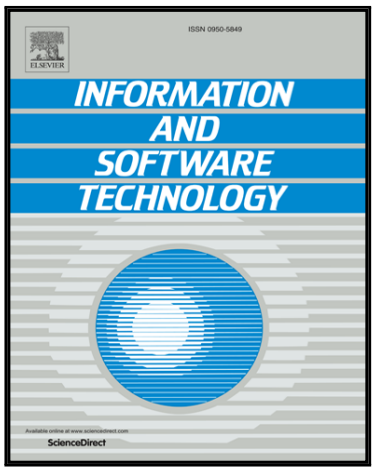

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A Software Reference Architecture for Semantic-Aware Big Data Systems

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Abstract

Context: Big Data systems are a class of software systems that ingest, store, process and serve massive amounts of heterogeneous data, from multiple sources. Despite their undisputed impact in current society, their engineering is still in its infancy and companies find it difficult to adopt them due to their inherent complexity. Existing attempts to provide architectural guidelines for their engineering fail to take into account important Big Data characteristics, such as the management, evolution and quality of the data.
Objective: In this paper, we follow software engineering principles to refine the λ-architecture, a reference model for Big Data systems, and use it as seed to create *Bolster*, a software reference architecture (SRA) for semantic-aware Big Data systems.
Method: By including a new layer into the λ-architecture, the Semantic Layer, *Bolster* is capable of handling the most representative Big Data characteristics (i.e., Volume, Velocity, Variety, Variability and Veracity).
Results: We present the successful implementation of *Bolster* in three industrial projects, involving five organizations. The validation results show high level of agreement among practitioners from all organizations with respect to standard quality factors.
Conclusion: As an SRA, *Bolster* allows organizations to design concrete architectures tailored to their specific needs. A distinguishing feature is that it provides *semantic-awareness* in Big Data Systems. These are Big Data system implementations that have components to simplify data definition and exploitation. In particular, they leverage metadata (i.e., data describing data) to enable (partial) automation of data exploitation and to aid the user in their

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