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Integrated Performance Simulation of Business Processes and Information Systems

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Abstract: Business processes (BPs) and information systems (ISs) mutually affect each other in non-trivial ways. Quality issues may arise from missing alignment. Although simulation is a powerful approach to predict the performance of BPs and ISs, current approaches lack their integration in simulation. We propose a holistic performance prediction approach to adequately reflect the mutual impact between BPs and ISs in simulation. Applying the approach and tooling in a real-life case study showed its feasibility and practicability.

Keywords: Business Process, Information System, Alignment, Performance

1 Mutual Quality Impact between Business Processes and Information Systems

Business process (BP) designs and enterprise information system (IS) designs are often not well aligned. Missing alignment may result in quality issues at run-time, such as large process execution time or overloaded IS resources. The complex interrelations between BPs and ISs are neither adequately researched so far nor sufficiently considered in development or operation. Especially interrelations between quality aspects (such as performance, reliability, security, or maintainability) concerned with BP designers and those concerned with IS developers are not well understood. Frequently, a direct mapping of metrics is difficult as the representation of a certain quality aspect may differ in the BP and IS domain.

Engineering methods for aligning one domain to the quality objectives of another are missing. One major reason for insufficient quality engineering is that current approaches lack an integrated consideration of quality aspects among several domains. Frequently, BPs and ISs are not well aligned, meaning that BPs are designed without taking IS impact into account and vice versa [He14]. Neglecting the mutual impact between BPs and ISs leads to serious issues, e.g. unsatisfied requirements, unreliable decisions, deceleration and rework.

Simulation is a promising approach to predict performance of both, BP and IS designs. Based on prediction results, design alternatives may be compared and verified against requirements. Thus, BP and IS designs can be aligned to improve performance. Yet, BP simulation and IS simulation are not adequately integrated in current simulation approaches. This results in limited prediction accuracy due to neglected interrelations between the BP and the IS in simulation.

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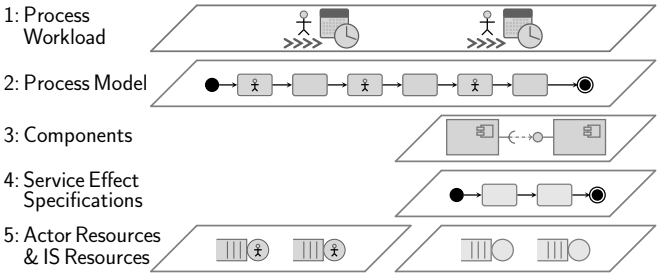

Abb. 1: Overview of the IntBIIS Simulation Layers [He15]

2 Integrated Business IT Impact Simulation (IntBIIS)

The holistic approach IntBIIS [He15] combines performance prediction on software architecture level and business process level to adequately reflect the mutual impact between BPs and ISs in simulation. Based on a quality reference model [He14] for BPs, IntBIIS models and analyzes the mutual performance impact between BPs and ISs building upon the Palladio approach [BKR09]. While Palladio provides adequate means for analyzing IS architectures, IntBIIS extends Palladio by modeling constructs and simulation behavior to analyze BPs and their organizational environment. In this way, the alignment of BP designs and IS designs can be supported by comparing the predicted performance impact of design alternatives and verifying them against requirements.

Fig. 1 illustrates IntBIIS where elements with a stickman symbol indicate layers and elements introduced as a result of our work. The remaining layers and elements are taken from the Palladio reference simulator. A run of the integrated simulation starts at the topmost layer with simulating time-variant workloads. The workloads trigger the traversing of an action chain of actor steps and system steps specified in the BP model (layer 2). For actor steps a suitable actor resource is requested (layer 5, left) to process the step according to a predefined scheduling policy. For system steps resource demands are not issued directly, but emerge as the system request propagates through software components (layer 3), their service effect specifications (layer 4), down to hardware resources (layer 5, right).

We evaluated the feasibility and practicability of our approach and tooling by modeling and simulating a BP and involved ISs in a real-life case study. Comparing our simulation output to reference values measured in reality and prediction results of another BP simulation tool indicated that IntBIIS yields accurate simulation results. In experiments we examined the scalability of IntBIIS and showed its ability to handle long and complex simulation runs.

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