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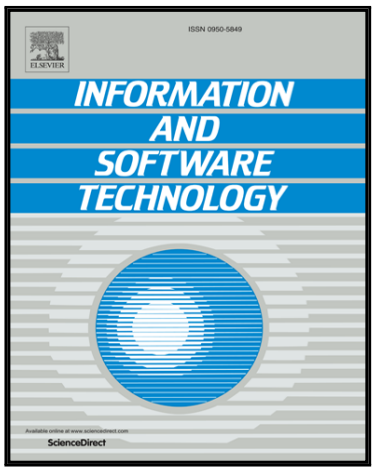

Building Reliable and Maintainable Dynamic Software Product Lines: an Investigation in the Body Sensor Network Domain

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Building Reliable and Maintainable Dynamic Software Product Lines: an Investigation in the Body Sensor Network Domain

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Abstract

Context: Dependability is a key requirement, especially in safety-critical applications. Many of these applications have changing context and configurations at runtime to achieve functional and quality goals and can be realized as Dynamic Software Product Lines (DSPLs). DSPL constitutes an emerging but promising research area. Nevertheless, ensuring dependability in DSPLs remains insufficiently explored, especially in terms of reliability and maintainability. This compromises quality assurance and applicability of DSPLs in safety-critical domains, such as Body Sensor Network (BSN).

Objective: To address this issue, we propose an approach to developing reliable and maintainable DSPLs in the context of the BSN domain.

Method: Adaptation plans are instances of a Domain Specific Language (DSL) describing reliability goals and adaptability at runtime. These instances are automatically checked for reliability goal satisfiability before being deployed and interpreted at runtime to provide more suitable adaptation goals complying with evolving needs perceived by a domain specialist.

Results: The approach is evaluated in the BSN domain. Results show that reliability and maintainability could be provided with execution and reconfiguration times of around 30 milliseconds, notification and adaptation plan update time over the network around 5 seconds, and space consumption around 5 MB.

Conclusion: The method is feasible at reasonable cost. The incurred benefits are reliable vital signal monitoring for the patient—thus providing early detection of serious health issues and the possibility of proactive treatment—and a maintainable infrastructure allowing medical DSL instance update to suit the needs of the domain specialist and ultimately of the patient.

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