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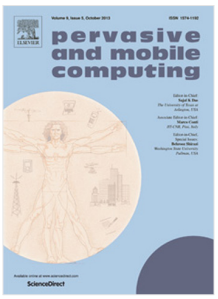


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# XWARE - A Customizable Interoperability Framework for Pervasive Computing Systems

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**Abstract**

Middleware support for Pervasive Computing has been extensively researched in the past. Different approaches for, e.g., discovery, communication, or interaction, have been explored and successfully tested in different lab environments. Although this works well in lab environments, where one middleware manages all resources, this will not suffice in real-world deployments, where more than one system software is present and services as well as other resources are only accessible by those.

In this paper, we present XWARE, an interoperability framework that allows to integrate discovery and interaction of different middleware platforms. The flexible design allows to configure and extend the interoperability framework in order to add new platforms and tailor it for the use in different domains. Furthermore, XWARE instances can communicate with each other enabling interoperability in smart environments as well as in smart peer groups. The feasibility of our approach is discussed and evaluated based on the integration of four different platforms.

*Keywords:* Pervasive Computing, Middleware, Interoperability

## 1. Introduction

In ubiquitous and pervasive computing [1] environments, (mobile) devices and everyday objects, enhanced with computational units, provide value-added services to users. We see a service as a loosely-coupled software component offering one or several functionalities [2], e.g., turn light on/off. Then, an application is composed of several services and is described by its required services. So, a light-follow-me application may require a presence service service and a light service. If all required services are present, the application can be executed. It may specify rules, such as: If someone is present and the light is off, then turn on the light.

To realize pervasive computing environments, an appropriate middleware is required. Nowadays, many different middleware platforms exist for this purpose, such as BASE [3], iPOJO [4], Limone [5], or UPnP [6]. However, they are not able to operate together due to heterogeneities within, e.g., data representation or service discovery (see Section 2). Therefore, researchers have been investigating interoperability solutions with respect to those heterogeneities. Most of those approaches do not address all of the heterogeneities ([7, 8]), or offer only domain-specific solutions ([8, 9, 10]). Furthermore, many existing approaches only work between services in the same smart environment, such as, e.g., [11] or [8].

In our earlier work, we investigated on different topics with respect to pervasive computing, such as, context management [12], proactive adaptation [13], and conflict management [14, 15]. Now, we aim at

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