Chapter 2
Supporting Synchronous Collaboration with Heterogeneous Devices¹

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ABSTRACT

The increasing availability of mobile devices in today’s business contexts raises the demand to shift the focus of groupware framework design. Instead of solely focusing on functional requirements of specific application domains or device characteristics, nonfunctional requirements need to be taken into account as well. Flexibility concerning the integration of devices and tailorability of the framework according to different usage contexts is essential for addressing device heterogeneity. Besides flexibility, in order to support the development of real-world applications involving heterogeneous devices, robustness and scalability concerns have to be addressed explicitly by the framework. This article presents Agilo, a groupware framework for synchronous collaboration. The framework incorporates approaches addressing flexibility, robustness, and scalability issues. The combination of these concerns makes it suitable for development of collaborative applications involving up to hundreds of users. As an example application, a commercial electronic meeting system is presented by illustrating typical usage scenarios, explaining application-specific requirements and describing the system design.
INTRODUCTION

During the last decade, the use of mobile devices in daily work scenarios has massively increased. Although mobile devices have found their way into business work settings, the application areas are still most often limited to individual services like synchronizing personal calendars, note-taking, and browsing the Web. The research on the integration and use of mobile devices in collaborative settings is constantly growing. It has been pointed out that the use of application frameworks is an adequate way to simplify the design and development of applications in general and groupware in particular (Fayad & Schmidt, 1997; Schuckmann, Kirchner, Schümmer, & Haake, 1996). Following the increasing trend of mobility in CSCW (Computer-Supported Collaborative Work) scenarios, new groupware application frameworks have been developed or existing groupware frameworks have been extended in order to support mobile devices.

While there exist several groupware frameworks addressing mobile devices of one particular type, others take into account the diversity of devices to be supported in the same runtime environment. The devices constituting such heterogeneous environments exhibit diverse characteristics (Raatikainen, Christensen, & Nakajima, 2002; Weiser, 1991). Most notably these are (a) limitations of processing and battery power, memory, and user interface (UI) capabilities, (b) diverse input/output techniques, (c) unreliable network conditions, and (d) a highly dynamic environment including specific context information, for example, changing user and device locations. While some of these characteristics are immanently present in any heterogeneous environment, others depend on the specific domain and usage scenario. For example, wireless devices nearly always exhibit unreliable network connectivity due to interferences and dead spots. However, specific context information like device locations might not be relevant for particular applications.

The increasing availability of different devices—mainly mobile devices—in everyday life puts new demands not only on addressing device characteristics and functional requirements of specific application domains but also on nonfunctional requirements. Nonfunctional requirements, as they exist for real-world or even commercial applications, usually encompass (among others) robustness and scalability/performance (Robinson, Pawlowski, & Volkov, 2003). These observations can be phrased as three requirements that a framework for real-world groupware applications in heterogeneous environments needs to fulfill:

First, the framework has to provide flexibility with respect to the integration of new and different devices. In order to implement and execute applications using different devices, the framework must put as few constraints as possible on device and network characteristics. In fact, it might well be necessary to tailor and extend the behavior of the framework itself. For example, depending on characteristics of particular devices, available framework services such as data distribution mechanisms or messaging protocols might need to be adapted or new ones have to be implemented. Second, the framework must provide robustness (reliability) with respect to network and device failures. For example, short-term interruptions of network connections should be handled (ideally) transparently by the framework while more severe failures, for example, device failures or long-term network interruptions, usually should trigger a notification to the end user. Third, the framework needs to provide scalability with respect to the number of devices in a single runtime environment. Although the number of collaborating users mainly depends on the application domain and usage scenario, the increasing availability of devices allows considering large-scale groupware environments with even hundreds of users and devices.

This article presents Agilo, a groupware framework for building applications for synchronous