

# Notification Design in Collaborative and Social Networking Environments

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## **Theme:** Smart Interactions

Knowledge workers are living in an ever-connected world with information technology supporting many kinds of collaboration. This enables substantial flexibility – working with others is no longer restricted to taking place in offices, but happens in geographically distributed locations (such as Asia and North America) and in all sorts of locales from the home, to the coffee shop, to the commuter train, and even while on the go walking down the street. Collaboration not only happens across space (at a distance as well as locally), but also across time (both synchronously and asynchronously). With the power and flexibility comes a downside, however; namely, constant notifications, which often result in interruptions. One research study estimated that unnecessary interruptions consume 28 percent of a knowledge worker's day (Spira and Feintuch, 2005). Another study showed that interrupting users with many non-critical events lowers productivity and cause stress and frustration (Mark et al., 2008). Notifications come in many forms, including email messages, instant messages, phone calls (some of which can be delivered in multiple different ways across the personal computer), various forms of mobile devices and even simply a phone call on a traditional land line.

The goal of this workshop was to explore the effective design of notifications in various collaborative/social environments, including, but not limited to collaborative development environments. We covered a broad range of questions and issues, including the following:

- What is the design space for the presentation styles of notifications?
- How should notification content (the message) be best matched to a presentation style?
- To what extent does the effectiveness of notifications (presentation styles and notification content) depend on the particular kind of environment or application?
- What is the state of the art in commercial environments and applications?
- What is the state of knowledge on notifications from the research literature?

The organizers of this workshop have investigated notifications in the Jazz collaborative development environment for the past year. Users are exposed to many forms of notifications in Jazz. While the goal of these notifications is to increase awareness of team activities and thereby improve team productivity, the effect can often be the opposite. Currently, for example, every time there is a change to the code base, a programmer working on that code base receives a “toaster pop-up” notifying of the change. This can be extremely disruptive, as many of the notifications do not directly impact individual programmers. Further, the large volume of notifications can overwhelm programmers, leading them to largely ignore all notifications, and thus miss ones that are in fact relevant to their tasks. Thus, the current notification system can greatly reduce an individual user's productivity as well as the team's overall productivity. To facilitate better team collaboration, our team is investigating how to design notifications with a view to balancing users' awareness of team members' activities and protecting their work time/space so that they can perform their primary tasks efficiently and effectively. Dimensions under investigation include context-appropriate timing, information content, and presentation formats of notifications. The ultimate goal of the work is to improve individual productivity, as well as team productivity, and thereby improve business process outcome.

In recent years, there has been considerable attention paid to the topic of interruption management in the Human-Computer Interaction and related research communities. The two main components to interruption management that have been studied, albeit largely independently, are: (1) timing of interruption delivery

based on user context; (2) presentation format of the interruption based on user context. In a pure timing-based model, notifications are queued up until it is a “good time” to interrupt the user, and all of the queued notifications are delivered at once. In a pure presentation-format based model, notifications are always delivered right away, but the way that the notification is presented, in particular the degree of intrusiveness (which also has been referred to as the degree of attentional draw), is adjusted based on context. A user’s context generally refers to what the user is doing at a given moment, and at its highest level reflects whether the user is busy or not. There are two primary ways to determine context. The first is system determined, where the system attempts to detect when users are interruptible or not. There has been considerable research on computationally appraising appropriate times for interruption, based on things such as physiological sensors and mental workload. The second way of determining context is manually, or user determined. Here, users declare their preferences, generally through a clickable dialog, as to when they can be interrupted, and the system interrupts users accordingly. This is currently how Jazz works, as do many other interruption-based communication applications, such as Lotus Sametime.

The format of this half-day workshop was as follows. It included an expert panel, where the panel started with each panelist making a short presentation related to their expertise on notifications, and then the majority of the panel time was for discussion and questions. After a short break, small breakout groups tackled specific questions/issues related to notification designs, the outcomes of which were then reported back to the reconvened full group. The workshop concluded with an itemized list of next steps for academia and industry to tackle with respect to notification design.