Bauhaus-Universität Weimar

CML:// Collaboration Bus

Personal and Collaborative Sensor-Actuator Control

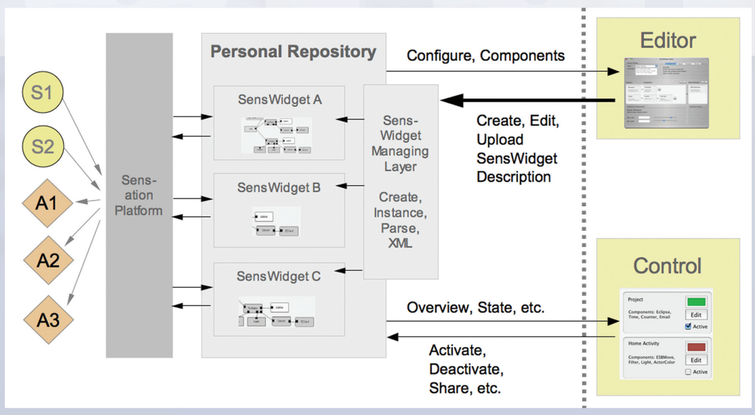

Figure 1. Collaboration Bus architecture.

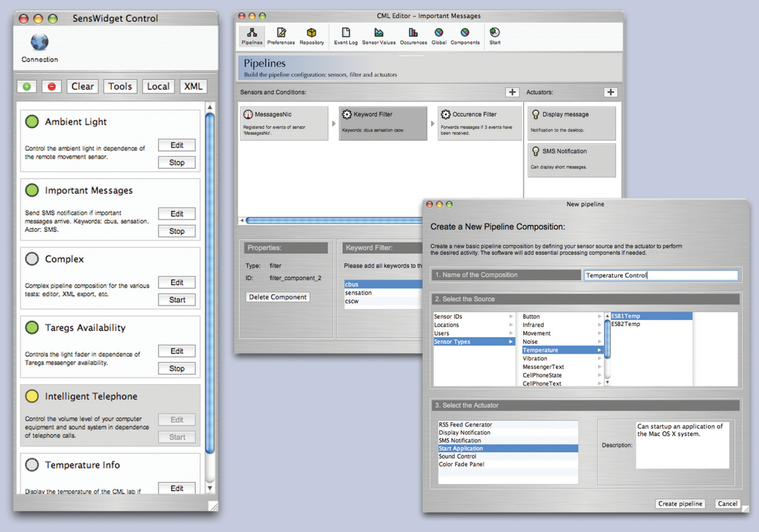

Figure 2. The Collaboration Bus GUI: the control interface for the personal repository of the user, the editor window and the select panel for sensor sources and actuators.

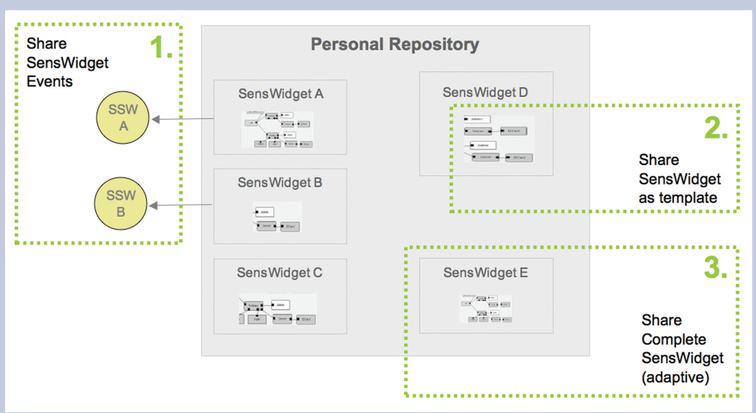

Figure 3. Sharing the pipeline compositions (SensWidgets) amongst users (template mechanism works in a similar manner)

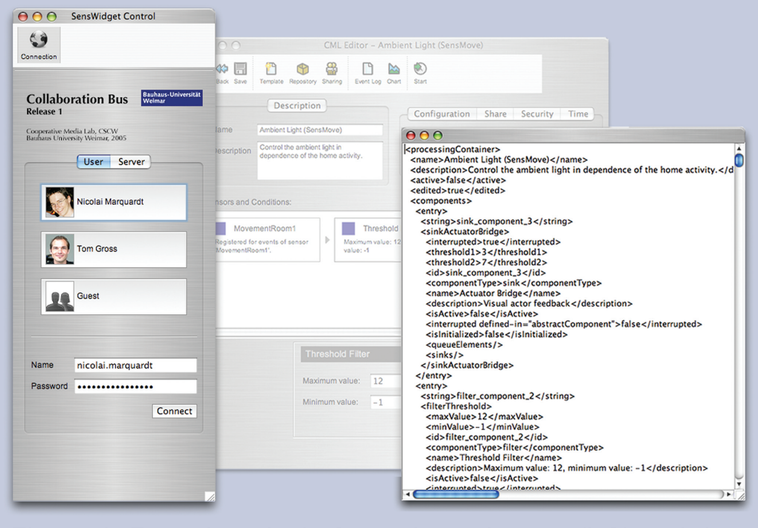

Figure 4. Repository login for registered users (left) and the serialized XML data of the current personal repository (right).

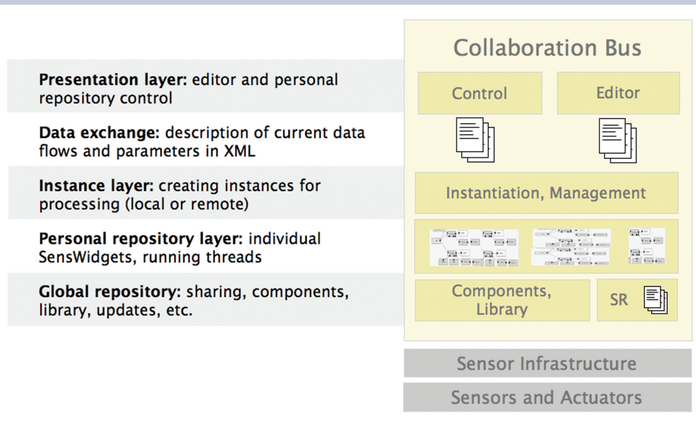

Figure 5. Layer structure of the Collaboration Bus application.

Sensor-based infrastructures provide base technology for sensing information, for processing the captured data, and for adapting the behaviour. In the Collaboration Bus project we developed a graphical editor that allows end-users to control system behaviour by specifying information flows from selected sensors, and sensor data to the envisioned system reactions.

Pipelines between Sensors, Operators and Actuators

Each connection between sensors, operators and actuators is implemented with pipeline compositions (SensWidget). Users can easily add new pipeline compositions using the integrated editor (cf. Figure 2): at first, they can discover the available sensors (e.g., movement, temperature, telephone, instant messaging) of the infrastructure and add them to the pipelines. Then they can specify rules and conditions by adding pipeline processing components of a set of filters and operators. For each of these processing components, the condition parameters can be selected (e.g., the event value threshold, occurred events counter, period of time, search strings). Finally, the actuators can be specified to execute actions at the users' computer systems or in the real environment. Here, the editor provides the option to specify the mapping between the pipeline output and the actuator commands (e.g., display message, activate light source, send email, mute the sound volume).

Personal Repository and Collaborative Sharing

All the pipeline compositions of the users are stored in the respective user's personal repository that can either be local or remote at the server (cf. Figure 1). We have implemented a central interface to let the users control each pipeline composition (e.g., create new, activate, deactivate, activity statistic of compositions) and start the editor (cf. Figure 2). Furthermore, users can use an integrated sharing mechanism to provide their own pipeline compositions to other users. Thereby they can decide to provide the complete pipeline composition, a general template of the composition, or only the final processing value. In an analogous manner they can add the composition to their own template repository, or to build new compositions based on this template (cf. Figure 3). Using this functionality, users can easily share their pipeline trajectories with each other, and can also benefit from the template mechanism.
The Collaboration Bus application uses XML serialisation (cf. Figure 4) to create descriptions of the pipeline composition as well as of the complete personal repository. This flexible mechanism enables the local and remote instantiation, and the storage of templates and the shared repository (cf. Figure 5).

Visualisation

Graph visualisations can help the users to overlook complex compositions of sensors, filters, and actuators while editing pipelines. They display relations between incoming and outgoing events of the pipeline in real-time, and let the user easily adjust the pipeline settings while seeing the consequences of his changes at the same time (cf. Figure 6).

Application Scenarios

The Collaboration Bus editor can be used for applications at the private home of the users as well as their business work. The software can easily connect sensors and actuators from remote locations and build a new envisioned application of the user in a only a few seconds. Application scenarios (cf. Figure 7) are the 'Intelligent Telephone' (e.g., controlling the sound volume of the computer and the audio system in dependence of using the office telephone) and the 'Informal Group Awareness' (e.g., finding team members in the instant messenger and their activity in the lab via movement and speech

For further information see:
http://cml.medien.uni-weimar.de

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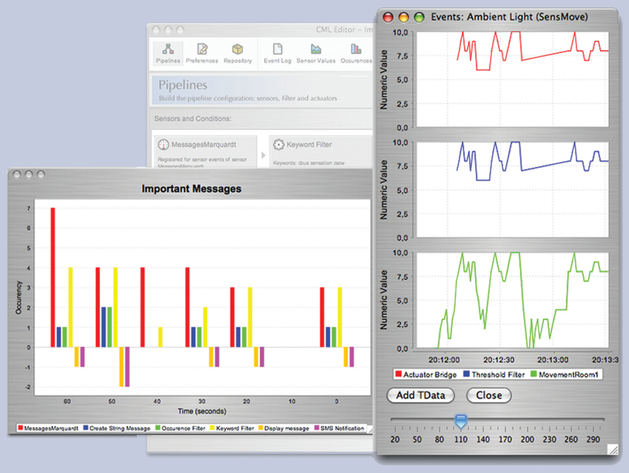

Figure 6. Event occurrence visualization (left) and the real-time value visualization (right) of the incoming sensor data and the outgoing actuator events.

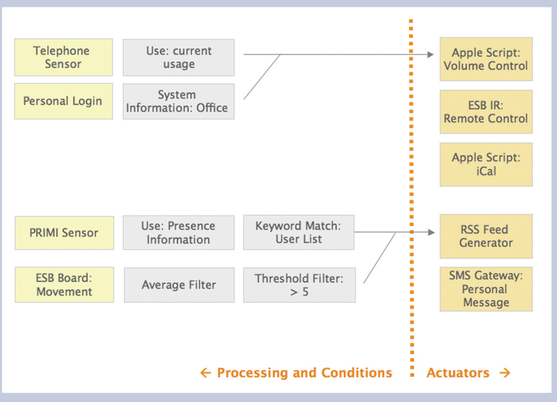

Figure 7. Two example applications for the pipeline compositions in the personal repository of the user: "Intelligent Telephone" and "Informal Group Awareness".