SAASHA: a Self-Adaptable Agent System for Home Automation
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Home Automation Systems

Smart homes are equipped with networked domestic electronic devices that each provide several services and are remotely controlled by a home automation system.

State-of-the-art home automation systems often are capable of playing simple and mostly predefined scenarios that sequentially execute various devices’ services and are useful in recurrent situations.

They generally fail to:
- provide inexperienced users with the ability to define their own rich scenarios and have them automatically and dynamically implemented so they can instantly be played,
- perceive their environment, and changes in their environment, and adapt to them.

Requirements for SAASHA

Expected qualities of the proposed system thus are:
- configurability,
- context-awareness,
- autonomic reconfigurability,
- dynamic adaptability.

Sample scenario. Close all shutters, turn lights on in the living-room and turn radiators on as soon as night falls if house temperature is too low.

Architecture of SAASHA

SAASHA is agent-based.
- Graphical User Interface Agents mediate the interaction with users. Administrators can parameterize the system. End-users can define custom scenarios.
- Device Control Agents control devices’ service execution, and implement scenarios.

Rich scenarios are defined as ECA rules. As soon as some Event occurs, if Conditions all are satisfied, the associated sequence of Actions is executed.

They are automatically deployed into their destination agents’ architecture and control the devices their destination agents are responsible of.

- Coordination components are dynamically generated from scenario descriptions. They are automatically deployed depending on both control responsibility reparation and administrator-parameterized deployment strategy. Alone (in case of centralized scenario deployment) or in groups (in case of distributed scenario deployment), coordination components implement scenarios. They are responsible of event occurrence monitoring, condition checking and action triggering.

A Device Control Agent’s inner architecture:

Meta-level components (gray) are the agent’s predefined part. Turquoise blue components are device control components. They are added into the agent’s architecture to support a specific scenario that involves a shutter, a light, a radiator and a clock. The coordinator component (deep blue) is deployed to coordinate the behavior of all components involved in the scenario. This example scenario implementation is centralized.

SAASHA provides means to avoid scenario conflicts.

SAASHA reconfigures itself (finds alternate possibilities, re-generates components and re-deploys them) so as to try and maintain service continuity when agents or devices fail or become unavailable.

Implementation of SAASHA

SAASHA’s implementation combines the use of UPPM as a middleware for device and service discovery and control and of OSCI as a framework for component dynamic deployment. SAASHA agents are themselves coded as UPPM devices.

The Domus simulator demonstrates the effects of SAASHA scenario execution on virtual devices when real-world devices are not available.

Snapshots of the Domus smart home simulator.
Domus is a JavaFX GUI that provides a realistic view of a house and of installed UPPM virtual devices (here, the lamp, air con, washing machine and shutters) and enables to act on devices through their views.

Conclusion

SAASHA automatically and dynamically adapts itself to its surrounding physical environment without previous knowledge.

SAASHA detects, identifies and controls available devices. It provides inexperienced users with an adapted scenario definition GUI. It implements, deploys and executes user-defined scenarios.

Administrators can optionally parameterize the running mode of SAASHA.

These capabilities are enabled by the automatic generation and dynamic deployment of device control and coordination software components.

Euromicro SEAA 2010, Lille, France

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