Construction and Federation Techniques in Distributed and Virtualized Smart Computing Environments

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Smart computing environment (SCE) has been a hot topic of ubiquitous computing researches; however, construction of SCEs and federations among them are still difficult because it is hard to alter SCE hardware structure and software. There were no virtualization techniques that ensure adaptability of SCE software for SCE hardware structure, and also there were no network and service connection management techniques that work with not modified SCE hardware and software. In order to solve the issue, we implemented three systems: virtual smart environment system (VSCE system), PeerPool and SceCoM. The integration of these systems was confirmed to make it easier to establish SCE and federations among them.

VSCE system is a virtual machine federation system with a function to virtualize distributed devices. It enables users to construct SCEs by only downloading and running VSCE images without complete knowledge of SCE software. PeerPool enables node-to-network connectivity with easy dynamic configuration and management, using the DNS query interface. SceCoM enables service connection management with easy configuration, using the DNS query interface. DNS query interface ensures PeerPool and SceCoM of high compatibility with SCE hardware structure and software that cannot be altered easily.

Moreover, we proposed an operational guideline of the above three systems, and implemented a system to integrate them and evaluated it. According to our guideline, developers distribute their implementation of VSCE images via a repository on the Internet. At that time, they statically wrote service relationships in the VSCE images in the form that PeerPool and SceCoM understand. The guideline enables the system to automatically establish SCE federations when a user has constructed distributed SCEs with the help of the system.