ABSTRACT

We present a design and implementation of a Flexible Videoconference System, FVCS. FVCS aims to reduce the botheration of the users under operational environments with insufficient computational resources, such as the Internet environment with the small-scale computers at home and offices, by embedding flexibility into the conventional videoconference system. In this paper, we propose a design and implementation of FVCS with knowledge-based multiagent framework. We implement some kinds of prototype systems of FVCS with different types of knowledge embedded in the agent. We also perform some experiments using the prototype systems to evaluate the adaptability of the systems in response to the observed operational situations. From the results of the experiments, the adaptability is influenced by knowledge of agent, and we conclude that the knowledge-based design and implementation is reasonable for construction of FVCS.

Keywords: videoconference system; flexible system; multiagent, QoS control; knowledge base

Recently, with the rapid growth in networking technology like exponential increase of bandwidth of the access channel to the Internet, a videoconference system (VCS) with reasonable quality of service (QoS) is finding widespread application. Currently, research and development of practical and low-cost desktop VCSs, such as IVS, VIC, etc. (McCanne, 1995), are in progress. However, these force users to adjust to the video size, the quality, the frame rate, etc., by themselves, considering the resource status of computer platform and networks. Such systems require non-trivial tasks to be done by non-expert users. Thus, the intelligent characteristics of system that can tune appropriate function and performance both dynamically and autonomously according to the users’ requirements and the resource status would be most needed. We may call this property “flexibility” of the system.

This research aims at realizing Flexible Videoconference System, FVCS.
FVCS is a VCS with flexibility added to the conventional videoconference system, aiming at achieving the user-friendly and advanced services for non-expert users. So far we have been developing many types of prototype systems of FVCS based on the concept of flexible system and flexible networking (Suganuma, 1997, 1998).

In this paper, we first define three functional requirements for FVCS and describe the design and implementation of FVCS with a knowledge-based multi-agent framework. We implement some kinds of prototype systems of FVCS with different types of knowledge embedded in the agent. Then, we conduct experiments to observe the behavior of a conventional VCS and prototype FVCSs in the situation of platform resource degradation. We evaluate the flexibility of these prototype systems of FVCS with the operational situations observed in its experiments. From the result of the experiments, we evaluated it by verifying whether the functional requirements for FVCS are achieved with the proposed design and implementation, and we conclude that the multi-agent-based design and implementation is reasonable for construction of FVCS.

FUNCTIONAL REQUIREMENTS OF FVCS

Functional Requirements

This section summarizes the functional requirements of FVCS. FVCS has to be designed considering the following flexible properties:

(F1) Reliable provisioning of each multimedia communication service: The basic performance of multimedia communication services, such as video service and audio service, is good enough to satisfy user requirements, and the services can keep the communication stable continuously for a long time without terminating and breaking.

(F2) Adaptive handling of changes (Adaptability): On the basis of the results of monitoring user requirements and resource statuses, the system should activate adjustments and fine-tunings to the embedded system parameters automatically to keep the system situation desirable by absorbing the degradation of QoS.

(F3) Evolutional response to drastic changes: When any drastic change occurs in the user requirements and resource statuses, such as change of users, upgrade of access line of network, or replacement of computer hardware, the system should respond to the changes as much as possible.

Applying Agent-Based Computing

To fulfill the functional requirements described in section “Functional Requirements”, we construct FVCS as a knowledge-based multi-agent system that consists of multiple agents with rule type knowledge. An agent consists of a computational base process dedicated to a specific task and knowledge concerning the utilization of the base process (Fujita, 1998; Kinoshita, 1998). A multi-agent system potentially has following characteristics. These are:

(1) Adaptive behavior: The multiagent system has reactivity, autonomy and cooperativeness to change itself automatically and dynamically according to the changes of environment. These adaptive behaviors of the multi-agent
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