The Flexible Multimedia System with QoS Guarantee Functions

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1.Introduction

Distributed multimedia system which integrates various multimedia information distributed over computer networks must guarantee the user requested quality of services (QoS) even though the computer and network resources change dynamically or statically. This paper describes a flexible multimedia system with QoS guarantee functions, which is based on agent-oriented architecture and provides both real time and stored multimedia information services simultaneously to users even though the multimedia services environment and the resource utility of computers or networks has been dynamically changed.

2.Flexible Multimedia System

Figure 1 shows the teleconferencing system which is one of multimedia information services. In the system, users can hold conference on the computer networks interconnected by LANs and WANs. The users not only communicate using a number of realtime media such as TV Phone and White Board but make presentation using distributed multimedia information which consists of the stored media such as audio, video, text and graphics in the user station.

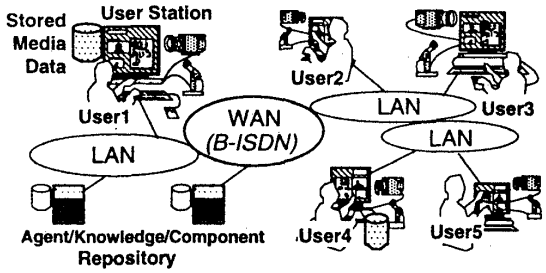

Figure 1: Mutlimedia Teleconferencing System

In order to provide these services in various user environments, we propose a flexible multimedia system (FMS) [1] shown as Figure 2. The system consists of *User stations* and *Repository*.

A user station is a working field of agents and components, which is consisted of CCIS and ACAS. CCIS consists of the permanent resident agents including UPA and RMA. UPA organizes and controls MSMAs and processes user's requests such as "service start", "service end" or "update QoS".

RMA monitors the status of resource utilization, reserves required resources and releases the allocated resources. ACAS consists of the dynamically organized agents and components including MSMAs, MAs and MCs. FMS dynamically organizes the required agents and components for multimedia services depending on multimedia service type, network and computing environments and user's QoS requirements.

MSMAs coordinate spatial and temporal synchronization between media data. MSMAs also organize MAs. MAs exist for each the media, organize required MCs. MCs are functional modules to process media data.

A repository consists of AKR, CR and BA AKR stores the agents and knowledge to provide multimedia service to user, CR stores required MCs. BA is an agent to provide dinamic agents, knowledge and components in the RF to CIF via networks.

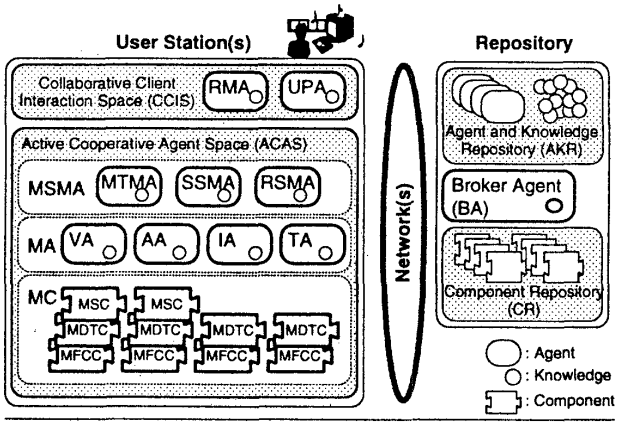

Figure 2: Flexible Multimedia System

The CIF in the figure 2 also shows the configuration for realization of the teleconferencing service.

In order to provide teleconference service including realtime and stored media services to users, UPA organizes three MSMAs. *MTMA* manages teleconferencing itself. *RSMA* and *SSMA* manage realtime or stored media services and organizes MAs each media.

QoS 機能を考慮したやわらかいマルチメディアシステム
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Furthermore, in order to process of various media data, the following three functions are performed by MC.

1) MSC: intra and intermedia synchronization.

2) MDTC: compression/decompression and data format conversion of media, such as JPEG, MPEG1/2 and H.261 for video.

3) MFCC: variable packet flow control and packet loss rate control

The agents use organization protocols [2] to organize required agents and components when organization or re-organization is executed.

3.QoS Functions

FMS determines how multimedia services are able to provide to users based on the knowledges from a priori experiment for FMS in various service conditions.

In order to provide multimedia services to users, FMS has *QoS Mapping*, *Admission Test* and *QoS Adaptation* functions. Forthermore, FMS should clear required computer and network resources to media data processing by each MCs. Here, the basic parameters used by FMS are shown in the followings.

Application QoS Parameters: quality of video/audio, delay, etc.

Environment Parameters: type of OS and CPU, amount of use memory, characteristics of devices, using network protocol, etc.

Media QoS Parameters: inter/intra-media synchronization interval time, Frame rate, frame size, color depth, packet loss rate, packet interval time, etc.

Resource Parameters: network traffic, cpu share, load average, the number of paging and swap per unit time, etc.

In the multimedia teleconferencing system, at the beginning of a conference, all participants may request each various QoS. Then each UPAs arrange suitable QoS using consensus protocols [3]. Next, each user stations perform resource reservation or adaptation to guarantee required QoS. Figure 3 shows QoS decision flow in a user station.

1. **QoS Mapping** : UPA converts user requested application QoS parameters into media QoS parameters. Next, in order to get necessary resource parameter values for mapped media QoS parameters, UPA sends a *Mapping Request* message to each MAs. Then, MAs convert received media QoS parameters into resource parameters, send a *Mapping Response* message to UPA. Next, in order to allocate or adapt necessary resources, UPA sends a *Resource Allocation Request* message to RMA.

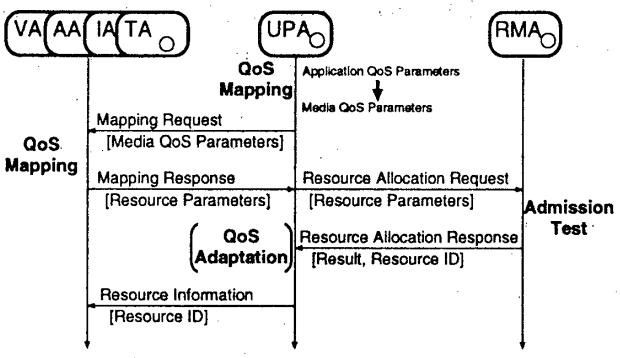

Figure 3: QoS Decision Flow

2. **Admission Test** : RMA performs admission test to confirm whether available resources are sufficiently to guarantee QoS or not. In the case of the resources are sufficiently, RMA allocates resources and sends a *Resource Allocation Response* with the resource ID to UPA. Then, UPA sends a *Resource Information* message to MAs, and MAs control MCs using allocated resources.
3. **QoS Adaptation** : In the case of the resources are not sufficiently as result of Admission Test, UPA performs *QoS Adaptation* accordance with each application QoS parameter's priority number. Then, UPA sends a *Mapping Request* message to each MAs again.

4.Conclusion

In this paper, we proposed FMS which provides suitable multimedia services to user in accordance with user's QoS requirements, user's multimedia environments and state of resource utilization. However, the required knowledges for QoS gurantee are still under consideration. This problem will be cleared through the functional and performance evaluation of the prototype. At present, we are developing multimedia telecomferencing sysmtem by multiple computers over ATM network.

References

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