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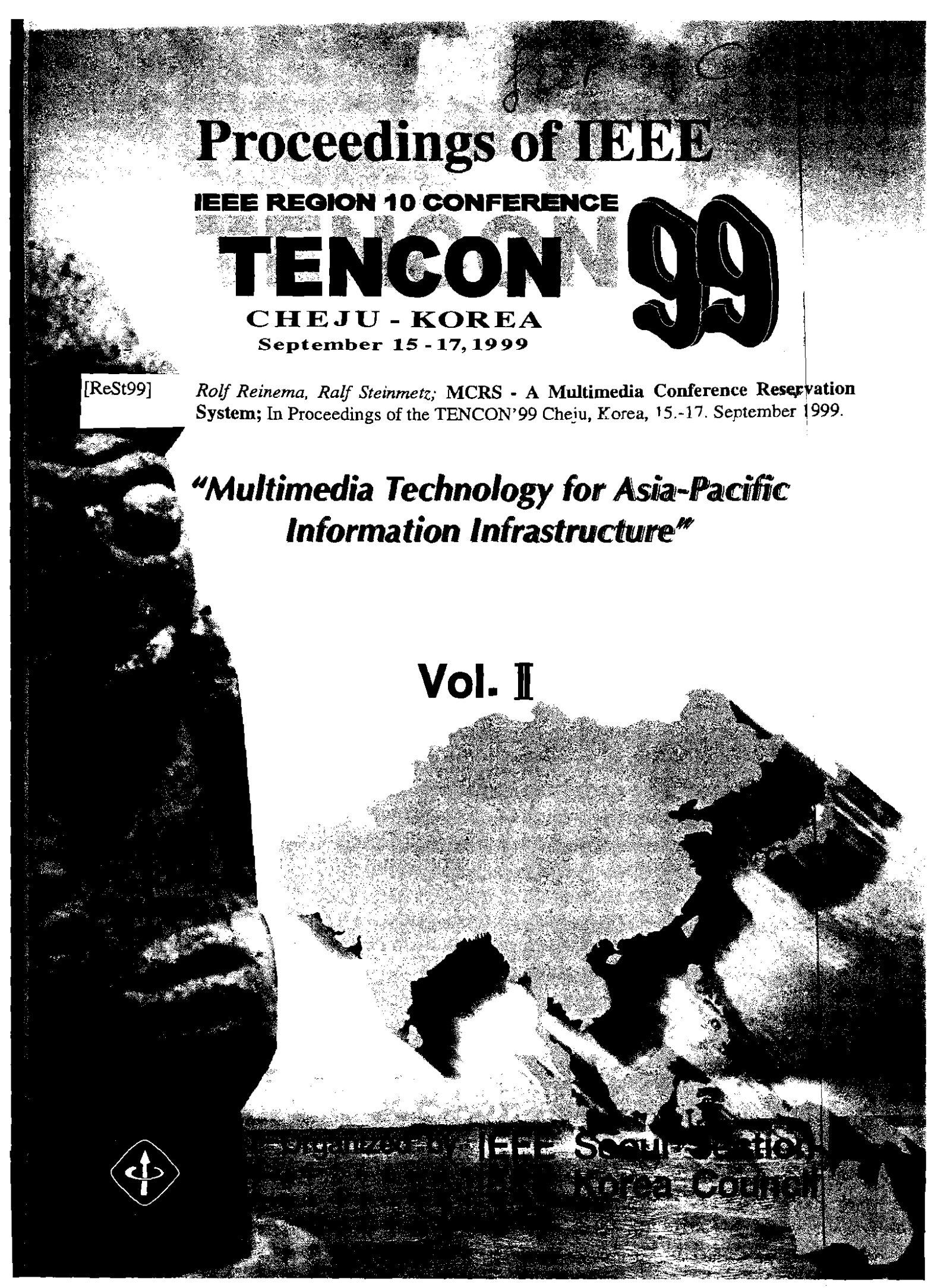

MCRS - A Multimedia Conference Reservation System

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Abstract

While modern multimedia communication technology provides many important features, easy usage and control of this technology by the end user is currently still a big problem. This paper presents a new approach to multimedia conference reservation, which integrates conference scheduling and the reservation of resources necessary to perform a multipoint multimedia conference.

I. INTRODUCTION

Multimedia conferencing is a powerful technology, which enables people to collaborate in ways never before possible. But administrating the necessary infrastructure, setting up and scheduling conferences as well as controlling them can be very difficult, time consuming, and costly [1].

This paper presents an enhanced approach to multimedia conference reservation, which integrates conference scheduling and the reservation of resources necessary to perform a multipoint multimedia conference. It provides a powerful extension in a way that allows even end-users to schedule, manage and control their multimedia conferences without any need for additional help (e. g. by an operator). This speeds up the scheduling process, allows spontaneous and ad-hoc collaboration and reduces the likelihood of scheduling errors. All the steps required to setup the necessary communication infrastructure are automated in a way that multimedia collaboration between distributed users and groups of users is just a mouse-click away.

II. REQUIREMENTS

The requirements for our system were partly gathered in a user community within the German government by interviews with the users and by analysis of the cooperative work processes found [2]. Within that user community bilateral communication (e. g. point-to-point multimedia conferencing, phone calls) as well as multilateral communication (e. g. face-to-face meetings, multipoint multimedia conferencing) takes place. Meetings include a certain amount of preparation (agreement of a certain date, time and location, distribution of the necessary documents, setting up the required multimedia conferencing infrastructure, i. e. reserving the necessary resources). Among others support needs to be provided for:

- Scheduled conferences and ad-hoc conferences
- Pre-defined conferences (i. e. all necessary resources and tools are known in advance) as well as spontaneous ones (i. e. resources and tools are added when required)
- Setup of point-to-point as well as multipoint conferences
- Setup of a conference repository for storage and retrieval of relevant documents of different type and media
- Reservation of the necessary resources to support high quality audio/visual communication
- Reservation of the necessary resources to support cooperative document processing
- Conference reservation, management, and control to be performed by end-users instead of highly skilled operators.

A more detailed consideration of the users' requirements can be found in [2]. As a general requirement, a multimedia conference reservation system should be characterized by adaptability, flexibility, scalability, and openness in order to be integrated into an application domain, organizational information systems and business processes. For this purpose, it is indispensable that it is based on widespread and open standards.

III. APPROACH

Multimedia conferencing as basic means for synchronous communication was provided to the user community on the basis of H.320/H.323 compliant systems. Multimedia conferencing systems based on the ITU-T H.320 standard [3] are the most widespread systems today. Due to the growth of bandwidth within Intranets as well as the Internet, multimedia conferencing systems based on the ITU-T H.323 standard [4] are also becoming more popular. In addition, in the given network infrastructure, only those systems could provide the audio and video quality the users asked for.

The compliance of the used multimedia conferencing systems with the international ITU-T standards H.320/H323 and T.120 ensured interoperability with multimedia conferencing systems from different vendors. This was an important design decision, allowing the developed system to be deployed in heterogeneous environments.

To provide multipoint communication, multimedia conferencing systems based on either the H.320 or the H.323 standard require the usage of so called MCUs (Multipoint Control Units). Additionally, conferences between H.320 and H.323 based systems require an H.320/H.323 conferencing gateway.

Within the user community an MCU has been installed, able to handle a large number (a maximum of 24) of simultaneous conferences, each between several sites (a maximum of 48 within a single conference), allowing users to view four, seven, 10, 13, or even 16 participants simultaneously on the same screen during a conference.

Early usage experiences indicated the end-users' difficulty to successfully use multimedia conferences

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within their daily work. Especially the lack of direct access to MCU scheduling and control severely restricted the usefulness of the system when faced with multi-party collaboration.

Today's MCUs as well as H.320/H.323 conferencing gateways lack a (standardized) API (Application Programmers Interface), but instead require a human operator for conference reservation, setup and control. Another problem is that it is almost impossible for users to setup ad-hoc conferences. When a user wants to have a multi-point conference with others he often has to ask an MCU operator to schedule it – often well in advance. This can be very time-consuming (it may take minutes to hours depending on the availability of the operator). Also, because of the way MCU-controlled conferences are typically set up, a multipoint multimedia conference cannot be resized dynamically in terms of time and number of participants, i.e. once a conference is running, further participants cannot attend unless their participation was anticipated at reservation time.

These experiences led to the decision to provide the users with an easy to use multimedia conference reservation system. The developed Multimedia Conference Reservation System (MCRS) provides the following functionality:

- Advanced conference reservation as well as on-demand reservation and set up
- Conference administration (add, remove, change and display conferences)
- Resource reservation, including:
  - Conference Repositories
  - Reservation of MCU resources (on H.320 as well as H.323 based MCUs)
  - Reservation of H.320/H.323 gateways (if required)
  - Reservation of multipoint application sharing servers (e.g. for joint viewing and editing of documents, if required)
- Detection of conflicts (e. g. unavailability of required resources)
- Confirmation for the convener and invitation of the selected participants

For spontaneous multimedia conferences, all the user typically needs to do, is to select the other user(s) with whom he wants to collaborate. The MCRS uses its knowledge of the users and their available infrastructure to initiate the (possibly multipoint) multimedia communication. Pre-planned conferences are set up in the MCRS by selecting a set of users (or user groups), entering a conference topic, selecting a conference time and date. Due to the interactive collaborative nature of the MCRS, the scheduled conference automatically shows up on all users' desktops in order to inform them about this conference. When the time of the conference has arrived, the users will be reminded of this in advance and will be asked to indicate when they are ready to enter the conference. Upon confirmation, MCRS can automatically start the necessary A/V conferencing tools and establish the connection to the other user (by using the provided MCUs, in the case of a multipoint conference, and/or conferencing gateways).

IV. SYSTEM ARCHITECTURE

The system architecture of MCRS consists of several components, which can be categorized in the following functional areas: a Web-based user interface client, a directory service, a reservation server, and MCU dependent servers (fig. 1). This modularization of MCRS facilitated a very flexible design, better scalability and reusability of the implementation.

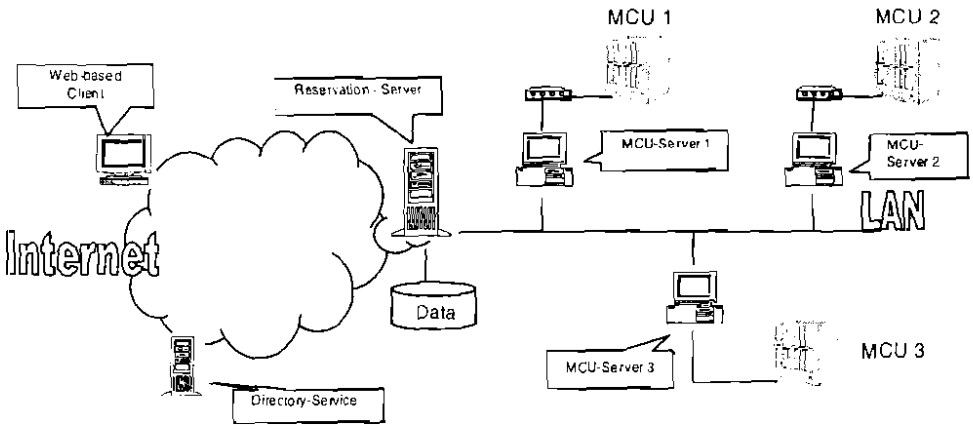

Fig. 1. Overall System Architecture

Web-based Client

A major user requirement was an easy to use user interface for setting up a conference with other partners. In order to make the functionality of MCRS easily accessible, a Web-based user interface was developed. Its usage can best be presented in the form of short usage scenarios.

Conference reservations conducted using MCRS can be roughly subdivided into:

- Spontaneous ad-hoc conferences (e.g. triggered by a user's need for direct communication with others) and
- Pre-planned scheduled conferences (e.g. a multi-party conference at a certain point in time and with a specific topic).

Both types of conferences can be initiated and administered by using the Web-based user interface client.

For spontaneous multimedia conferences, e. g. on a certain document, all the user typically needs to do is to indicate the document on which to collaborate and to select the other user(s) with whom the document is to be shared from the list of available users. The Reservation-Server then uses its knowledge about the users and their available infrastructure (by looking up a directory or a connected database) to initiate the (possibly multipoint) audio/video communication, start the document processing tools required and begin the collaborative editing/presentation session.

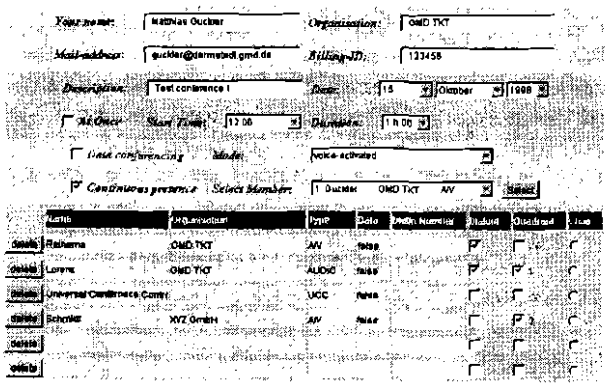

Fig.2. Web-based Client

Pre-planned conferences are characterized by a specific point in time at which the conference takes place, a conference topic and a set of documents which form the basis for the conference (e.g. the conference's agenda and documents which are to be presented in the conference). These conferences are set up by selecting a set of users (or user groups), entering a conference topic, selecting a conference time and date and creating a document repository, which will contain the conference's documents. Due to the interactive collaborative nature of MCRS, the scheduled conference automatically shows up on all users' Web-Browsers in order to inform them about this conference. When the time of the conference has arrived, the users will be reminded of this in advance and will be asked to indicate when they are ready to enter the conference. Upon confirmation, MCRS automatically starts the A/V conferencing module, establishes the connection to the other user(s) (or to the MCU, in the case of a multipoint conference) and opens the associated conference repository. The users can now conduct their conference, cooperatively present and edit documents found in the repository.

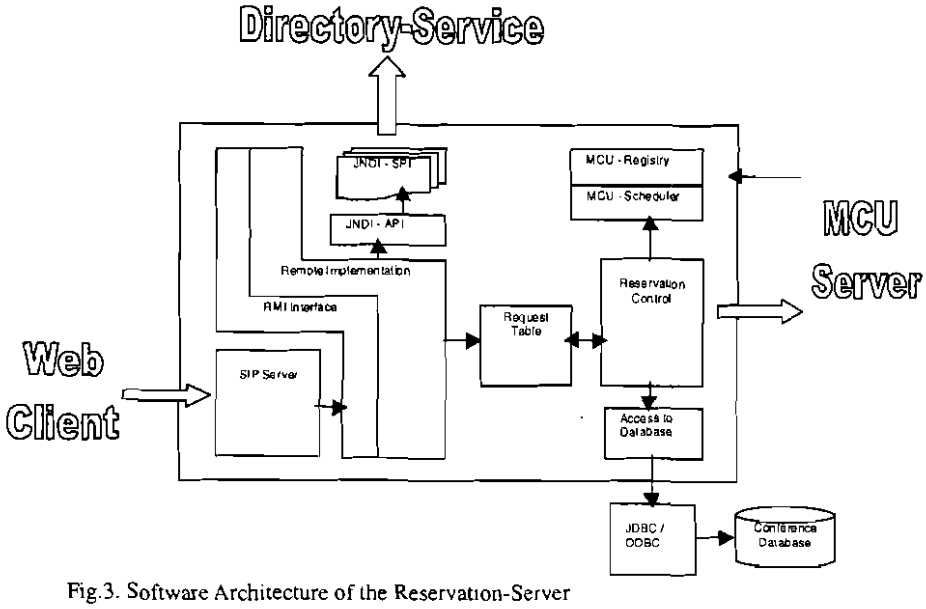

Fig.3. Software Architecture of the Reservation-Server

Reservation Server

The Reservation-Server forms the heart of our multimedia conference reservation system. It is the central process, which automates the reservation and administration of conferences without the need for an operator. It receives reservation requests from the Web-client and transmits them to one of the connected MCU's, depending on the type of a conference (e. g. audiographics, multimedia) and the required resources.

The software architecture of the Reservation-Server is shown in fig. 3. The chosen software architecture makes it possible that conferences can be reserved and administrated by several users at the same time. This assures a higher degree of availability of the reservation system and shorter response times.

As already mentioned above, our conference reservation system is based on the Session Initiation Protocol (SIP), a protocol which enables the invitation of users to participate in multipoint multimedia conferencing sessions [5]. This protocol has been designed initially for multipoint conferences over the Internet using IP-Multicast. Within our system it is also being enhanced for H.320/H323 based conferences.

But SIP is not suitable for all administrative purposes, which a multimedia conference reservation system should fulfill. For example, SIP does not offers direct support for listing conferences, which have already been reserved. Additionally changing existing conference reservations is also not supported by SIP. For this reason, we extended the SIP protocol correspondingly.

The *SIP-Server* provides the interface to the Web-client. After it has received a reservation request, it stores them in an internal database via the *RMI-Interface* of the Reservation-Server. In principle the SIP-Server would be able to carry out the reservation of the required resources by itself. However, the RMI interface offers the advantage, that a dedicated SIP-Server can be assigned to each connected Web-client, which provides a better de-coupling of the overall system and therefore shorter response times.

The *MCU-Registry* is used for the registration of the available MCU's. Such a registration of an MCU will automatically be performed whenever the corresponding MCU-Server is started. During this registration process, the Reservation-Server gets information about the capabilities as well as the available resources of the respective MCU.

The *MCU-Scheduler* performs the selection of a suitable MCU for a specific conference. For example, if the conference will be a pure H.320 conference, the MCU-Scheduler reserves the required resources on a corresponding H.320 MCU. In the case of a mixed H.320/H.323 conference it reserves the necessary resources both on a corresponding H.320 and an H.323 MCU as well as on the required gateway between them. Before a reservation request will be transmitted to the respective MCU-Server, the MCU scheduler checks,

whether the required resources are available on the corresponding MCU.

Directory services are integrated via the JNDI-API (JAVA Native Directory Interface – Applications Programmers Interface) and the JNDI-SPI (JAVA Native Directory Interface - Service Provider Interface). The JNDI-SPI transforms queries from the JNDI-API into protocol specific queries for the corresponding directory service. Such a service provider interface is used for each corresponding directory service. A widespread directory access protocol is the LDAP protocol (Lightweight Directory Access Protocol) [7].

Directory Service

At present most of the current available conference reservation systems provide only a static assignment between users and related conference sites. Nowadays it is getting more and more important to support people in a desk-sharing situation, mobile users and the usage of non predetermined rooms for team meetings. This means that whenever one user wants to call another user, he currently needs to know the corresponding site. Therefor we have integrated directory-based user location services. Within MCRS user data can either be stored and retrieved from so called directory servers (in our case we are using the Netscape Directory Server [8]) by using LDAP (Lightweight Directory Access Protocol) or stored and retrieved from conventional relational databases by using ODBC (Open Database Connectivity). This provides a greater flexibility and allows the integration of already existing user directories.

MCU-Server

The MCU-Server is a server process, which carries out a conference reservation on a particular MCU.

In order to be able to reserve conferences on a MCU the MCU server must register at start-up at the Reservation-Server. During this registration, the resources (e. g. number of the free slots, supported bandwidths, supported coding and compression techniques) available on the respective MCU are being transmitted to the Reservation-Server. The MCU Server maps the received conference reservation onto the MCU specific interfaces. The used MCU does provide an API, although it is not very convenient, which allows to control its operation. This API can be accessed by using asynchronous dialup connections, a native command set, and the so-called Operations Support Systems Interface (OSSI) protocol [6], running over a modem.

V. CONCLUSIONS

The developed conference reservation and management software provides an efficient way and simple means for end-users to schedule and setup their multimedia conferences. It automates the necessary steps required to configure an MCU for a certain multipoint conference. Users do not longer need the help of an operator to setup or modify their multipoint conferences. The conference reservation system can be characterized by its high degree of flexibility and its MCU independent architecture i. e. it can easily be setup on top of MCUs from different vendors.

An important aspect that will be examined in the further development of MCRS is the use of security methods.

Like any other distributed system operating over open networks, our conference reservation system has the following security requirements:

- access control to prevent unauthorized access to the reservation system
- authentication to confirm the identities of the reserving users
- data confidentiality to protect data against bugging and to provide traffic flow
- confidentiality
- data integrity to protect data against loss and manipulation
- non-repudiation to provide proof of origin (reservation requests) and delivery of data (reservations).

The basic building blocks meeting those requirements are encryption, authentication, certification and integrity.

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Subject: [Fwd: 8th Int'l. Conference on Telecommunication Systems, Modelling (fwd)
Date: Fri, 29 Oct 1999 09:58:28 +0200 (MET DST)
From: Ralf Steinmetz <Ralf.Steinmetz@KOM.tu-darmstadt.de>
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> X-Accept-Language: en,en-GB,en-US,de,de-DE,de-AT,de-CH,ja
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> zu Ihrer Information, ich habe eine erweiterte Fassung unseres Papers
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> Der Beitrag ist jetzt angenommen worden (s.u.).
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> Viele Grüße,
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> The Program Committee is pleased to accept your paper, "MCRS - A
> Multimedia Conference Reservation and management System," co-authored
> with
> Ralf Steinmetz, for presentation at the 8th International Conference on
> Telecommunication Systems, Modelling and Analysis, which is scheduled to
> be
> held March 9 through March 12, 2000.
>
> The Conference will be held at two sites. Thursday and
> Friday meetings will take place at the Tennessee Economic
> Development Center at the BellSouth Tower, 333 Commerce Street, and
> the Saturday and Sunday meetings will be held at the ClubHouse Inn
> & Conference Center, 920 Broadway, both located in downtown
> Nashville. Social and cultural activities will be included in the
> 2000 agenda. More details will be distributed closer to the