고에너지물리를 위한 협업환경 도구와 KISTI EVO 서버

Collaborative Tools in High Energy Physics and EVO Server at KISTI

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Abstract

We report on our experience on utilization of collaborative tools for KISTI high energy physics group. Our main subject will be the new EVO (Enabling Virtual Organization) server that we hosted recently at KISTI. The EVO is a next generation collaborative tool from CalTech high energy physics group with several improvements from its predecessor VRVS (Virtual Room Videoconferencing System). EVO has the same baseline structure as in VRVS. The network of servers lies at the heart of EVO structure and one server called Panda communicates with local clients called Koala.

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I. Introduction

As the networking infrastructure around the globe has seen a fast evolution in the recent years, the concept of multimedia multipoint conference has also become a very popular subject in many areas. New technologies, ideas and protocols have been introduced by academic fields such as high energy physics (HEP) community and research institutes. In this paper, we present our study to examine best solution for e-Science HEP discipline among EVO[1], Access Grid[2], H.323[3] and SIP (Session Initiation Protocol)[4]. We first try to understand motivations behind these various solutions by examining how fundamental aspects of multipoint videoconferencing system are implemented in terms of several practical factors by which we try to determine on optimized solution for e-Science HEP community in Korea.

II. Main Issues

1. Prerequisites to set up a conference session

Before actual exchanges of multimedia (audio and video) streams take place, the nature and the scope of a conference must be defined. This also includes how to expand a conference on the fly during the course of the session. In other words each participant should be able to know where to send its audio and video streams. For this kind of rendezvous mechanism, two options are available and they are described in the following sections.

1.1 A dedicated MCU or a network of MCU

In case of EVO and Access Grid (AG), a dedicated client is provided. Users only interface with the client and everything else is handled by the system. In case of SIP, we can have a dial-in conference which can be identified by a unique SIP URI. With H.323 applications, we can have a analogous configuration in which we have an MCU (Multipoint Control Unit) and its address can be distributed to participants via emails.

1.2 Extension of p2p communication

Suppose A and B are in conversation and they need to conference in the third person C. With SIP, this situation can be handled easily and there can be several possible solutions such as endsystem mixing, full mesh multipoints conference and ad-hoc central server instead of endsystem mixing. In all of these scenarios, all must know each other's URI.

▶▶ Figure 1. EVO system, client is shown

2. How to effectively exchange audio and video streams: Multipoint control and use of multicast

This includes the topology of a network and whether it is multicast or multiple unicasts. As stated in the previous section, there are two possible ways to achieve a multipoint conference between three or more endpoints. The first one is the centralized configuration in which a MCU supports a conference between three or more endpoints. All terminals send audio, video and control streams to the MCU in a point-to-point fashion and MCU then sends the resulting streams back to the participating terminals in either unicast or multicast fashion.

The second one is the decentralized configuration in which participating terminals can send audio and video to other participating terminals in either multicast or unicast, which is just a matter of efficiency. In case of Access Grid in which number of output streams (both video and audio) are relatively large, use of multicast becomes mandatory, otherwise a serious degradation in performance will be observed. The audio application such as RAT must handle the audio mixing in any case.

In summary, the presence of MCU affects both sending and receiving as follows,

2.1 In case a MCU is present

There can be two scenarios;

the relation between multiple senders and one receiver (MCU) is the following;

- Senders can send only one outward stream to MCU
- Use of multicast is totally meaningless the relation between one MCU and multiple receivers is the following;
- MCU must send the outward stream to all receivers
- Therefore use of multicast becomes important
- Receiver is free from the burden of audio mixing
- Use of multicast is meaningless to the receiver.

2.2 In case a MCU is absent

There can be one relation between multiple senders and multiple receivers;

- Senders must send one stream to each of participant
- Therefore use of multicast becomes important
- Especially so as number of sources is huge as in AG
- Receiver must handle audio mixing and video switching or multiple video displays
- Use of multicast is meaningless to the receiver.

3. Comparison in Structure and Procedure

We compare the possibilities in terms of structure and procedure for the two stages; one is before a session is formed and the other is after a session is formed.

3.1 H.323 and SIP

The H.323 prototocol suites and the SIP uses the standard unicast IP network.

3.1.1 Before a session is formed

The following protocols are needed for H.323 protocol stuites. H.225.0 handles call signaling by exchanging H.225 messages over the call-signaling channel. The call-signaling channel is opened between two H.323 endpoints or between an endpoint and the gatekeeper. H.245 handles control signaling by exchanging H.245 messages over the control-signaling channel.

3.1.2 After a session is formed

Each participant sends his audio and video in a point-to-point fashion to MCU. MCU mixes audio streams from all participants and switches the video streams and transmit audio and video streams to the

participants.

3.2 EVO

The system is composed of one main server and several reflectors. EVO builds its collaboration service on top of pure software reflector infrastructure which is a kind of software multicast. The reflectors communicate with each other via IP unicast or multicast. In effect, the reflector network acts as a sort of one big distributed MCU with unicast and multicast compatibility which can provide a sophisticated real time multipoint algorithm with low cost and maintenance.

3.2.1 Before a session is formed

Participants initiate a session via the central web server, which then coordinates their connections to an appropriate reflector. A simple click on a dynamic web-based interface on the main server, will transparently connects the user to the nearest reflector. A conference or a session is established when one of predefined virtual rooms is connected by participants. EVO provides a web based booking system where participants can organize meetings manually or through a booking wizard so that people will join from anywhere. Then the structure of a given session is maintained internally by the network of reflectors. Bookers can prevent abuse accesses from a meeting with an additional password. Limited number of virtual rooms sets the current limit on the total number of simultaneous sessions which can be supported.

3.2.2 After a session is formed

A java panel is given with which the user can decide on the type of the client applications to use among H.323 and mbone tools, in other words EVO can either be used in H.323 mode or mbone mode. Users in H.323 mode by default see a single voice-activated video in their H.323 video window, but users of H.323 may choose other options, such as multi-video mode display using VIC. This ability to simultaneously display all video streams coming from several H.323 clients is unique and provided only via the EVO infrastructure. Users in mbone mode use VIC and will see thumbnails of all participants who are transmitting video feeds and may select one or more for a multi-video display. The participants simply send their audio and video streams to the nearest reflector and the network handles audio mixing and transmits the resulting audio and video streams in either unicast or multicast.

3.3 Access Grid

Access Grid in its pure form utilizes IP multicast which makes Access Grid well suited for multi-point sessions. Multicasting provides a scalable solution for large-scale conferences over IP network.

3.3.1 Before a session is formed

A client application is given with which a participant connects to a local venue server and decides on the session.

3.3.2 After a session is formed

In Access Grid, the main real-time conference operates in a completely decentralized fashion. Since the Access Grid is based on the multicast as an absolute requirement, participants do not have to worry about network performance which enables them to transmit audio video streams from multiple video and audio sources and the receiving mbone tools have to mix incoming audio streams.

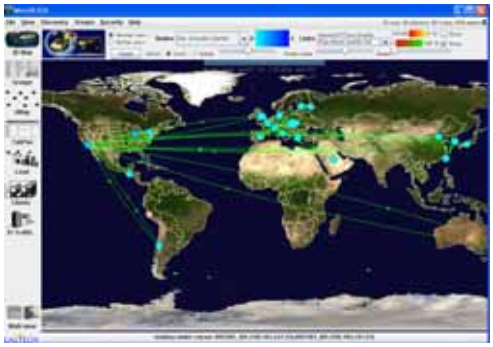
4. The use of EVO at KISTI and its domestic server

As shown in the Table 1, EVO seems to be the best choice for high energy physics community including KISTI high energy physics group. Thus we decided to host a local EVO server at KISTI for the first time in Korea. Figure 2 shows the network of EVO servers (called Panda).

4.1 Interoperability issues

We exploited some good features of EVO that include the interoperability with other commodity softwares based on SIP and H.323 protocol suites. We could make outbound calls to a SIP package such as Ekiga, the former GnomeMeeting as shown in Figure 3. We could receive incoming calls from Ekiga as well. For H.323

package, again such as Ekiga, EVO only provides outbound calls from EVO client as shown in Figure 4.



▶▶ Figure 2. A network of EVO servers

▶▶ Figure 3. A call from EVO to SIP package

III. Summary

We conclude that the EVO can be best solution for the use of high energy physics community in Korea including KISTI for multi-site videoconferencing. Any IP-based terminal with non-costly video and audio devices can serve as a decent EVO terminal which can provide good quality of video and audio transmissions whereas H.323 and Access Grid requires a dedicated terminal equipped with hardware.

▶▶ Figure 4. A call from EVO to H.323 package

[Table 1] A comparison of several videoconferencing possibilities

	Access Grid	H.323	EVO
Cost	$5,000	$5,000	$100
Display Quality	Good	Excellent H/W codec	Good
Audio Quality	Good	Good	Good
Network	multicast	unicast	Both
Interoperability	Good	Good	Excellent

▌References ▌

[1] http://evo.caltech.edu
[2] http://www.accessgrid.or.kr
[3] http://www.itu.int/rec/T-REC-H323/en
[4] http://www.iet.org/rfc/rfc3261.txt