

The Future of the Internet



Audio and music experience is made interactive by Virtual Music Reproduction. Combining virtual reality technologies and spatial acoustic simulation allows a new kind of music presentation and acoustic reproduction. Integration of network streaming components creates interesting applications on the internet, paving the way to virtual live concerts.

Virtual Music – Towards the Internet Concert Hall

Since the beginning of sound recording it has been the goal to reproduce an acoustic atmosphere as accurately as possible. Today's classical and live recordings approach this goal very closely. In many rock and pop recordings, the right atmosphere is created using artificial effects. Yet in both cases the listener remains passive, without being able to influence the acoustic events in a musical piece. The result of musical production fixes the atmosphere and the sound positions of the musical voices. Virtual Music Reproduction, however, makes the different parts of an audio production accessible: A user is enabled to actively control the positions of sound sources within the acoustic space, such as instruments and voices, or even change the acoustic scene itself. He navigates through a three-dimensional virtual environment which graphically makes the acoustic reproduction accessible and arranges the acoustic scene himself.

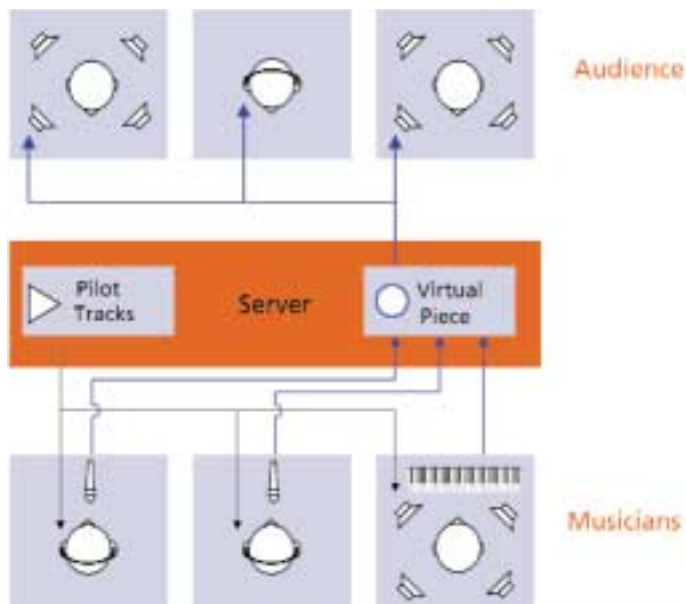


Fig. 2: Audio transmission for virtual concerts.

In this manner, a virtual concert can take place – for instance – in a simulated theatre. A user, being actor and listener in one person, can move herself through the audience area, the stage, and other rooms. She can influence the different audio sources by moving, muting or unmuting them during a musical piece. Everything the user sees or manipulates is reflected in the appropriate acoustics – »What you see is what you hear«. During reproduction, audio sources are added atmosphere for their respective positions, by interactive acoustic simulation that includes reverberation, attenuation etc. (For this purpose, all voices must have been recorded separately and with little room acoustics.) The complete acoustic scene is auralized either

Virtual Music – Towards the Internet Concert Hall

using a system of four to ten loudspeakers that are placed around the listener, or using headphones with binaural room simulation. Thus, the listener perceives audio sources and room acoustics around himself.

Audio sources can also be inserted in real-time. That way, musicians can position themselves within the virtual scene, making Virtual Music Reproduction interesting especially by allowing them to play their own instrument in place of one in the original recording («all minus one» mode). Moreover, voices can be studied separately by muting others (or placing them at distance).

The connection of several VMR applications over the Internet – which will be possible in the nearest future – creates a distributed Internet service: Virtual Music Remote (VMRemote). Musicians at different geographic locations can join themselves to virtual rehearsals or concerts and even let audience take part. Each participant runs a VMR application, a so-called client, at their terminal. Musician Clients send and receive audio data, whereas Audience Clients receive only. For additional communication between musicians or for presentation to the audience, video data can be transmitted. A central server controls the interaction between different clients.

A complex problem for musical interaction is raised by the latency inherent in today's Internet connections. While this delay is sufficiently low for speech communication purposes, such as Internet telephony, it is considered too long for acoustic coordination between musicians playing remotely. After all, musicians must be able to listen to each other in if they want to mutually



Fig. 1: Virtual concert hall: audio sources (played live as well as pre-recorded) are reproduced in the acoustic environment. Additionally, musicians can be watched via video transmission.

synchronize their play. Present Internet infrastructure, however, in most cases allows unidirectional synchronization only. Hence, VMR allows coordination between artists by way of a common timing reference, a number of so-called pilot tracks, which is received by all musicians at the same time and serves as a timing cue for their instrumental or vocal play. The entire musical piece is collected on a central server and can be listened to by the audience.

The distributed Internet service VMRemote paves the way to virtual, geographically distributed concerts, whereas the multimedia application VMR creates an interactive, spatial experience of music and audio. Yet by far are these not the only applications of VMR technologies. Beside possible VMR audio formats on DVD, imaginable scenarios include the areas of distributed learning and online education - not only in musical

teaching. Using VMRemote, course content could be enhanced with novel ideas for navigation and interaction. Furthermore, the acoustic room simulation used and the audio and video streaming technologies currently developed allow high quality teleconferencing but also good acoustic simulations on their own rights.

Contact

Gregor Heinrich

Phone: +49 (0) 6151/155 209

Email: Gregor.Heinrich@igd.fhg.de