
Introduction

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Biographical notes: Gregor Schiele is a Senior Researcher and Lecturer at the University of Mannheim. He received his MSc and Doctoral Degree in Computer Science from the University of Stuttgart, Germany. His research interests include distributed virtual environments, peer-to-peer systems, and pervasive context-aware computing. Currently, he is the Lead Coordinator of the *peers@play* project (<http://www.peers-at-play.org>), involving the Universities of Mannheim, Duisburg-Essen, and Hannover. The goal of the *peers@play* project is the development of a peer-to-peer-based middleware system for massively multiuser and highly scalable virtual environments.

Arno Wacker is a Senior Researcher and Lecturer with the University of Duisburg-Essen. He received his Master's Degree (Diplom-Informatiker) and PhD in Computer Science from the University of Stuttgart, Germany. His current research focuses security requirements for P2P systems especially massively multiuser virtual environments (MMVEs). More precisely he is interested in algorithms for decentralised authentication, accounting and billing, and anti-cheating in MMVEs. Additionally he investigates the suitability of P2P systems for highly distributed computing, especially cryptanalysis.

Shun-Yun Hu received his MEng Degree in Computer Science and Information Engineering from Tamkang University, Taiwan in 2005, and his PhD in Computer Science and Information Engineering from National Central University, Taiwan in 2009. He initiated the open source projects VAST and ASCEND at SourceForge since 2005, and is currently a Postdoctoral Fellow at Academia Sinica, Taiwan. His research interests are networked virtual environments and peer-to-peer systems.

Wei Tsang Ooi received his BSc (Honors) Degree from the National University of Singapore (NUS) in 1996 and his PhD in Computer Science from Cornell University, Ithaca, New York in 2001. He then spent a year as post-doctoral at Berkeley Multimedia Research Center in University of California, Berkeley, before re-joining NUS in 2002. His research interest lies in the area of multimedia systems.

Massively Multiuser Virtual Environments (MMVEs) continue to spark much interest in industry as well as in academia. New systems have been published (e.g., Sony, 2009; zygna, 2009). New research venues have been established (e.g., P2PDVE, 2009; DISIO, 2010). With this special issue we want to give an overview on current work directions in the community. It consists of papers presented at the second international IEEE Workshop on Massively Multiuser Virtual Environments (MMVE09), held March 15th 2009 in Lafayette, Louisiana, USA in conjunction with the IEEE Virtual Reality (IEEE VR 2009) Conference. In the following we give a short overview on the papers included in the special issue.

Last year we identified a number of challenges that developers and scientists face when developing MMVEs (see Schiele et al., 2008), namely content delivery, content creation, interoperability between MMVEs, scalability in high-density situations, as well as the search for a killer application. This year Lu Fan, Phil Trinder and Hamish Taylor revisited this list of challenges and complement it with a list of design issues that are necessary in order to develop P2P-based MMVEs. In their paper ‘Design issues for Peer-to-Peer Massively Multiplayer Online Games’ they present their findings and analyse how current systems address the different design issues.

Delivering content updates, e.g., movements and actions of users and non-player characters, is one of the basic challenges of MMVEs. Although much work has been done, the problem of how to realise delivery efficiently is not solved. As a representative of the effort towards solving this problem, the second paper of the special issue – written by Helge Backhaus and Stephan Krause – presents ‘QuON: a quad-tree-based overlay protocol for distributed virtual worlds’. It combines direct delivery to neighbouring peers with a quad-tree approach to ensure that the network stays connected.

The next paper builds upon such basic message delivery and addresses how the simulated entities, i.e., the sources of the messages, are placed in the system. Clearly, a distributed entity placement is necessary in a P2P system to achieve scalability. Lu Fan, Phil Trinder and Hamish Taylor present an approach for ‘Deadline-Driven Auctions for NPC host allocation in P2P MMOGs’, which realises such a distributed placement dynamically.

With networking (i.e., update delivery) and distributed simulation (i.e., entity placement) handled, a third important issue in MMVEs is how to allow users to interact

with an MMVE. Classical systems assume homogeneous input devices. However, with the ascend of mobile devices like smart phones that may be used to access MMVEs, this assumption becomes increasingly restrictive. To overcome this situation, Mario Ciampi, Luigi Gallo, Antonio Coronato and Giuseppe De Pietro propose ‘Middleware mechanisms for interaction interoperability in Collaborative Virtual Environments’.

The papers presented so far in the special issue handle different techniques for MMVEs at runtime. The last paper addresses another important phase in the lifecycle of an MMVE, the development time. One major issue here is how to efficiently develop and test large scale MMVEs. Traditionally, early testing is done with few users. Real stress testing with thousands of users is delayed until near the end of the development cycle (e.g., in the beta phase). However, if severe problems are detected in this phase, fixing them may become very expensive and may delay the system launch considerably. To fix this, Jean Botev, Markus Esch, Hermann Schloss, Ingo Scholtes, and Peter Sturm propose to use a mixed simulation and testbed environment for testing in their paper: ‘HyperVerse: simulation and testbed reconciled’.

We hope that you find the papers included in this special issue interesting and helpful. More information on the MMVE workshop can be found at <http://www.peers-at-play.org/MMVE09/>.

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