

# CoreGRID Researcher Exchange Programme (REP)

## Activity Report

### 1. Title of the proposal

**Performance Issues in Managing Grid Resources for Massively Multiplayer Online Games**

### 2. Name of the REP beneficiary

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### 3. Name of the hosting institute or if applicable of the hosting Industrial Company

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### 4. REP Context

The integration work in REP-43/2008 focuses on the management of grid resources for an important and novel grid application: Massively Multiplayer Online Games (MMOGs). UIbk has recently proposed a grid environment for real-time multiplayer online games (e.g., MMOGs) within the CoreGRID IIRWM and the CoreGRID IRMS (TR-0133); in this environment the key offered services are resource allocation, monitoring, and capacity planning. At the same time, TU Delft has been collecting and analyzing traces of real MMOGs workloads. For this REP, our main goal was to investigate the performance of the capacity planning and of the resource allocation services offered by the grid environment, when the system is subject to real workloads.

### 5. Summary of Results

The objective of this REP proposal was to investigate the performance of the capacity planning and of the resource allocation services offered by the grid environment defined in our previous work, when the system is subject to real (realistic) workloads.

#### 5.1. Achievements

1. Formulated a model for the MMOG Ecosystem, to be used in this integrated work and throughout the continuation of this collaboration. The model comprises three entities, the game players, the game operators and the resource owners (hosters), and the interaction between them. The model also includes a novel analytical model for the load of MMOG servers based on the number of players in the system and on their interaction type.
2. Set up a simulation environment for the MMOG Ecosystem, based on previous work. Configured the environment for three simple grid resource allocation policies, and for using the MMOG workload data that we have previously collected. Using the simulation environment and as validation data the new MMOG traces, analyzed the impact on performance of the capacity planning accuracy and of simple grid resource allocation policies.
3. Establish directions for continuing this work. Identified three potential research directions and planned a common route for addressing them.

## 5.2. Publications

1. V. Nae, [A. Iosup](#), S. Podlipnig, R. Prodan, D.H.J.Epema, and T. Fahringer, Efficient Management of Data Center Resources for Massively Multiplayer Online Games, In the ACM/IEEE SuperComputing Conference on High Performance Networking and Computing (SC'08), Nov 10-16, 2008 (accepted). Note: The camera-ready version of this work was the direct result of this research visit, including additional results to address the comments of the reviewers.
2. R. Prodan, V. Nae, and [A. Iosup](#), Dynamic Resource Provisioning in Massively Multiplayer Online Games, Journal version of reference 1 (submitted). Note: For this work we have used the achievements 1 and 2.
3. V. Nae, [A. Iosup](#), and R. Prodan, On the Performance of Managing Grid Resources for Massively Multiplayer Online Games, CoreGRID Technical Report (draft). Note: The planned CoreGRID technical report will contain the formulation of the common model for the MMOG ecosystem, the analysis and modeling results for MMOG workloads based on the real data, the performance results obtained from the simulation environment, and a discussion of the directions for future work.

## 6. Conclusion

The work within the CoreGRID REP-43/2008 focuses on the problem of the performance of the capacity planning and of the resource allocation services offered by the grid environment for MMOGs. We have formulated a novel model for the MMOG Ecosystem, set up a simulation environment for it, and used trace-based simulation to analyze the impact on performance of the capacity planning accuracy and of simple grid resource allocation policies. This joint research has resulted in one top-tier conference article, and in the submission of one journal article.

We have also identified three avenues for future joint research; we plan to continue this work in these directions for at least three months after the research exchange has ended. We also plan to create a CoreGRID Technical Report with the main findings of this work.