OVERLAY NETWORK BASED OPTIMIZATION OF DATA FLOWS IN LARGE SCALE CLIENT-SERVER-BASED GAME ARCHITECTURES FOR DEPLOYMENT ON CLOUD PLATFORMS

Peter Quax, Robin Marx, Wouter Vanmontfort, Wim Lamotte

Hasselt University / tUL / IBBT
Wetenschapspark 2
3590 Diepenbeek
Belgium

Keywords: Massive Multiplayer On-Line Games, Cloud Platforms, Application Architectures, Overlay Networks

Extended abstract:

The majority of modern massive multiplayer on-line games (MMOG) rely on a high performance network infrastructure being maintained by the game publisher. There is little flexibility built into the server setup, as there is a straight communication path between clients and servers, over which elementary protocols are used. In research, many suggestions have been offered to create a more scalable and flexible back-end for this purpose, however the take-up rate of technology has been very low. This is mainly caused by the focus of the research community on pure peer-to-peer solutions; which are inherently difficult to manage and moderate – the main rationale behind the choice for a client/server based system. In this work, we present novel solutions for the classic problems faced in the design and deployment of an MMOG back-end, namely:

- application-level optimization of the data flows between the clients and the back-end, based on semantic information available through the game environment.
- integration of the above protocols into a scalable back-end infrastructure, which is suitable for deployment on cloud platforms.
- the inclusion of a bandwidth shaping mechanism, based on an overlay network of adaptation servers; integrated with the above-described infrastructure.

As stated before, current MMOGs use relatively low-tech solutions for the communication flows between the client software and the back-end infrastructure. Examples of this include fixed update rates, constant size update packets, and little use of very elementary optimization techniques such as dead reckoning for avatar movements. By exploiting context information that is available through knowledge of the game semantics, a protocol can be designed that adapts to the actual needs of the player and the current conditions. It is shown that significant bandwidth and - more importantly - back-end processing power savings can be made by using this technique.

A novel architecture for MMOG deployment has previously been proposed in literature, called ALVIC-NG[1]. Like some commercial solutions (e.g. EVE Online), ALVIC-NG employs a multi-tier proxy-based
setup, which causes the direct link between the client and the back-end to be converted into a multi-hop communication channel. The latter allows for dynamic placement of components with different responsibilities. It has already been shown in literature that the possible drawbacks of the inclusion of a proxy layer are outweighed by the advantages it offers in terms of flexibility. The major advantage of this design is that parts of the back-end can be deployed on generic private or public cloud platforms, as server instances are created and removed at run-time. At the same time, the dynamic nature of the back-end aligns perfectly with the context-aware protocol in use between the clients and the server instances, which will be demonstrated in our work.

As clients typically are unaware of all events in a massive game world, some decisions can only be made on network nodes that have a broader view on the state of the virtual world. Therefore, our work proposes the design of a bandwidth shaping mechanism that can be integrated into an overlay network of adaptation servers. This overlay network is integrated with the back-end described above, in order to introduce as few additional hops as possible. The latter is a requirement for minimizing the end-to-end delay, particularly in case of deployment on global public cloud platforms. Decisions within the adaptation nodes will be made based on the contextual information available through knowledge of the game semantics.

Our work will demonstrate the feasibility of the approach, as well as a quantitative comparison of the novel setup versus the more traditional straight client-server communication path.

References:


Vitae:

Peter Quax is a post-doc researcher and guest professor at Hasselt University in Belgium. He is affiliated to the Expertise Center for Digital Media (http://www.edm.uhasselt.be) and the Interdisciplinary Institute for Broadband Technology (http://www.ibbt.be). Research interests include delivery of multimedia content over next-generation network architectures, scalability of networked virtual environments and multimedia data adaptation for efficient delivery mechanisms.

Robin Marx is a student in Computer Science at Hasselt University in Belgium. His master thesis topic is on the scalability of networked virtual environments. General research interests include (besides the topic of the paper) game development in general and multimedia.

Wouter Vanmontfort is a researcher at the Interdisciplinary Institute for Broadband Technology (http://www.ibbt.be) and affiliated to the Expertise Center for Digital Media (http://www.edm.uhasselt.be). His research interests include multi-platform development of multimedia applications and scalability of networked virtual environments.

Wim Lamotte is a full professor at Hasselt University in Belgium. He is affiliated to the Expertise Center for Digital Media (http://www.edm.uhasselt.be) and the Interdisciplinary Institute for Broadband Technology (http://www.ibbt.be). Research interests include computer networks, delivery of multimedia data and computer games.
Author contact details:

- Prof. dr. Peter Quax
- Expertise Center for Digital Media / Hasselt University
- Wetenschapspark 2
- 3590 Diepenbeek, Belgium
- Tel: +32 11 26 84 11
- Fax: +32 11 26 84 99
- e-mail: peter.quax@uhasselt.be