Rich Internet Architectures for Browser-Based Multiplayer Real-Time Games – Design and Implementation Issues of virtual-kicker.com

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Abstract. With the ongoing evolvement of Rich Internet Application (RIA) technology, browser-based game development has reached a point where exciting real-time applications with remote players can be produced and distributed quickly and easily. However, as the browser is a very different operating environment and interactive experience from that of classical game software, browser-based real-time multiplayer games involve gaming architectures that are distinct from their classical counterparts. Elaborating on the case of an online tabletop soccer game with two remote players, this paper presents the design and implementation of two distinct architectural models that RIA developers can fall back on when implementing distributed, browser-based real-time applications.

1 Introduction

Due to advances in game design and the availability of broadband Internet access to the end-user, multiplayer online games with real-time interaction have come into wide use [1,2,3] and many researchers regard multiplayer online games as the future of the interactive entertainment industry [4,5,6]. The majority of these games are made up by classic software titles that need to be installed on the players' machines [6]. Browser-based multiplayer games, on the contrary, can be run instantly from a web site, but have, due to technical limitations, long been round-based, strategy-focused games. However, with the ongoing evolvement of Rich Internet Application (RIA) technology [7] such as Adobe Flash and Java, browser-based game development has reached a point where also *real-time* games can be produced and distributed to a large audience quickly and easily. Browser-based games can be integrated in e-business environments in a very simple way and hold a number of exciting possibilities for new online business models, new markets, and new growth [8,5]. However, the browser is a very different operating environment and interactive experience from that of classical game software [9]. Browser-based real-time multiplayer games therefore involve software architectures that are distinct from their classical counterparts. A major challenge when designing and implementing such architectures is that multiplayer games are highly vulnerable to propagation delays resulting from redundant communication, bottlenecks, single points of failure and poor reactivity to changing

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network conditions [10]. As latency from input of information to its output determines gameplay and fairness [4], architectures have to be designed in a way that it mitigates latency effects and meets the expectations of the players [3].

Elaborating on the case of *virtual-kicker.com*, an online tabletop soccer game with two remote players, this paper presents design and implementation issues for such Rich Internet architectures. More specifically, after giving a short background information on the abovementioned case and an overview on multiplayer gaming architectures in general, it introduces two architectural models that can be applied to implement browser-based multiplayer real-time games, gives practical implications for RIA developers that intend to create similar application concepts, and it points out future research work required in the area.

2 Background: Tabletop Soccer at virtual-kicker.com

As one of the first browser-based multiplayer real-time games that have become available in the German-speaking Web, virtual-kicker.com was launched in August 2006. In collaboration with the 18 clubs of the German Soccer League ('Bundesliga'), virtual-kicker.com was developed with the idea to create a portal website for German soccer fans that would allow them to register for their favourite club and compete against each other in an online tabletop soccer game. Paralleling the official schedule of the German Soccer League, virtual-kicker.com features virtual matches of the respective opponents.

More than 60,000 players had registered to the game until May 2007. Via the web-based hosting and matchmaking portal, they can communicate with each other and gain access to services such as player profiles, league tables and high scores. The player-side RIA is implemented in Adobe Flash. As the amount of players is likely to differ between the clubs, players competing for the team with the superior number of players have to queue until an opponent is available. This time can be bridged in a club-specific chatroom featuring a score ticker, allowing teammates to discuss current results and strategies.

3 Multiplayer Online Gaming Architectures

Online games that give the player the ability to compete against other players over a network emerged strongly in the mid of the last decade. Traditionally, multiplayer online games have been implemented using client-server architectures [11,12]. However, to address various problems associated with client-server architectures, many authors and game designers have developed fully distributed peer-to-peer (P2P) architectures [6,11].

3.1 Client-Server vs. Peer-to-Peer

In a client-server architecture, the player-side game software connects to a central authoritative server designed to handle game logic [6,3,13]. The server deals out information individually to each client as it is requested and keeps all the