A Scalable Distributed Peer-to-Peer MMOG Architecture

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Abstract

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I. Introduction

With the advent of broadband Internet, Massively Multiplayer Online Games (MMOGs) have gained significant popularity over the course of the past few years. Figure 1 shows the total number of active MMOG subscriptions over time for the period 1997 to 2008. From here, the accelerating growth of the MMOG market is evident.

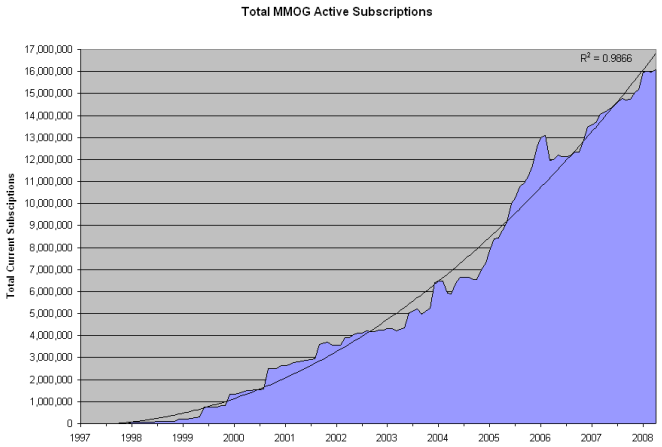

Fig. 1. Total number of active MMOG player subscriptions over time [1].

MMOGs are characterised by expansive worlds, where a large number of players interact online with each other and the virtual environment to achieve certain goals through collaboration and teamwork. Throughout the development of MMOGs, role play has been tightly coupled to this type of game. This is perhaps due to the exploration and player interaction aspects. Role play allows players to fully immerse themselves in the game world and might, therefore, provide for a more compelling experience. Because of this tight coupling, the terms Massively Multiplayer Online Role Playing Game (MMORPG) and MMOG have almost become synonymous. Throughout this work, a distinction will, however, be made between the two.

MMOGs hold great commercial as well as academic value. From a commercial perspective, the growing number of active subscriptions shown in Figure 1 translates to a growing MMOG market. Figure 2 shows the online games market forecast by DFC Intelligence, a company specialising in game market forecasts for various sectors.

From an academic perspective, MMOGs also hold great value. An MMOG is a complex networked application, with clients requiring reliable real-time feedback on actions taken. The design of an MMOG requires in-depth knowledge of server architectures and network design. The design of a server architecture determines how may players the game will be able to host and what the user experience will be in terms of quality of service. The server architecture must be able to handle thousands of requests, store large amounts of data, update the game state and send responses back to all clients in real time.

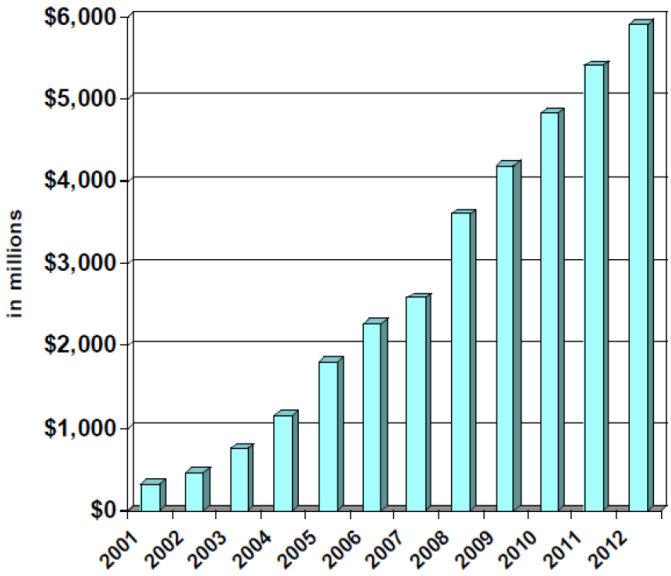

Fig. 2. DFC Intelligence MMOG market forecast '08 [2].

A. A brief history of MMORPGs

MMOGs have a history stretching from 1978 to the present. A complete history of MMOGs and the histories of the games and boardgames that they originate from can be found in [3] and Chapter 1 of [4]. The first games that could be called MMOGs were Multi-User Dungeons (MUDs) (1978) [5]. MUDs are entirely text-based, with players exploring areas by receiving descriptions of what they were "seeing" and typing commands to move and interact with objects or players. MUDs contain many of the elements that today are still central to the MMOG concept. These elements include exploration, large worlds, multiplayer, social interaction and progression.

After MUDs, there were many MMORPGs that acted as building blocks for what is recognised today as being an MMORPG. The first graphical MMORPG was Neverwinter Nights (1991) [6]. Neverwinter Nights was not an Internet based game, it was hosted on what today is the AOL network. Meridian 59 (1994) was the first MMOG to have featured a monthly subscription fee, receive wide media coverage and most importantly, the first MMOG to feature a 3D engine [7].

The first MMORPG to be commercially successful and largely credited with popularising the genre was Ultima Online (1997). Ultima Online used existing intellectual property from the Ultima universe as well as an aggressive marketing campaign by game publisher EA, to quickly gain 100,000 subscribers. NCsoft's Lineage (1998) looked similar to Ultima Online, but was more Player-versus-Player (PvP) oriented and with an added castle siege mechanism, became very popular in South Korea. Lineage had more than three million subscribers at one point, most of them from South Korea [8]. Everquest (1999) is credited for bringing MMORPGs into mainstream Western Culture. It featured a large persistent 3D environment that was capable of hosting up to 15000 players per server [9].

MMORPGs in the first millennium are considered to be of the first generation. These games provided blueprints for all MMORPGs to follow in the second generation. While there are many more games in the second generation, these games are characterised by little innovation in the genre and focus more on improving graphics and ease-of-use [3]. Notable games in this generation are: Final Fantasy XI (2000) (console based), Dark Age of Camelot (2001) (realm vs. realm combat) and Anarchy Online (2001) (instancing).

Eve Online (2003), developed by CCP Games in Iceland, brought many new innovations to the MMORPG. It was the first successful MMORPG to feature a science fiction theme. It was the first MMOG to have a single distributed server architecture. This meant that no sharding was required. Sharding is a method by which the game world is duplicated onto multiple servers to distribute load. Players cannot communicate between shards as these worlds are complectly isolated from each other. By employing a distributed server architecture, where different regions of the virtual world was hosted on different servers, players could have a seamless and more immersive experience. This was accomplished by hosting different star systems on different servers. Players have to use a warp gate to travel between star systems. This mechanic is used to mask the time it takes to move the player from one server to another. In 2006, CCP Games launched the largest supercomputer in the gaming industry to upgrade their existing infrastructure and enable Eve to support more than 50,000 concurrent users [10]. This number that was surpassed in 2009 with 54,181 concurrent users in game [11].

Another innovation of Eve was the in-game economy. CCP games appointed Dr. Eyjólfur Guõmundsson as chief economist of Eve online in 2006 [12]. His duties were to monitor and predict market trends in the game world and produce detailed quarterly economic reports [13]. The economy is based on a open market system ruled by supply and demand. No other game

has implemented an in-game economy in such a rigourous fashion.

Blizzards's World of Warcraft (WoW) (2004) is the most successful MMORPG to date. After six years it still has by far the most subscribers of any MMOG, totaling 11,5 million, each paying $15 per month subscription [14]. In 2008 it was estimated that WoW holds more than 60% of the MMORPG subscription market [15]. From the first generation of games, a steady growth has been seen in the MMOG space, but before the run away success of WoW, no one had estimated that the gaming market could be this large [16]. It should be noted, however, that the growth seen in the MMOG market, is mostly due to growth in the Asian markets and that the size of these markets are much larger than the size of the Western markets.

The success of WoW has largely been attributed to the overall quality and finish of the game [17]. It is interesting to note that WoW is not attributed with many innovations. Most games that came before it implemented most of the features in WoW. What WoW did do, is combine all previous innovations into a package that was accessible to a large number of people. Players also don't just play WoW to experience the game content, they also play the game to meet up with friends and socialise. Guilds are also an integral part of WoW. Guilds are collections of players that choose to play together to achieve some common goal.

II. Overview of MMOG network architectures

The previous section presented a brief history of the MMOG and more specifically, the MMORPG genre. This section explores the network architecture that is generally employed by this genre of games. The network architecture of a system specifies how the different entities in the network communicate. On a high level, there are two well-known general network architectures: The client/server model and the peer-to-peer model. Bear in mind that these models are not specific to MMOGS, what is specific to them is how the models are implemented to store and disseminate data. These models specify how data are distributed over the network and what the levels of control are that each entity in the network possesses.

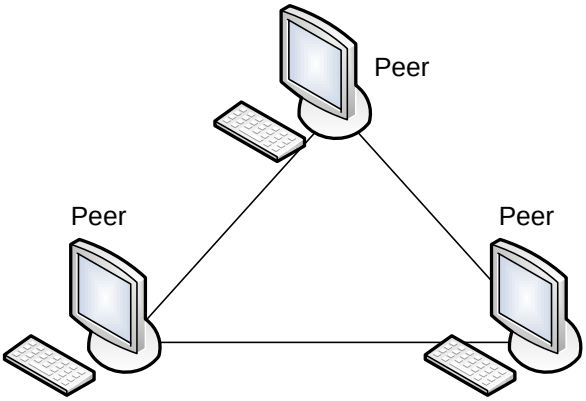

Fig. 3. Peer-to-Peer architecture

Figure 3 shows a peer-to-peer network architecture

III. Conclusion

The conclusion goes here.

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