Building a more convincing world in online games using AI and the cloud

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Introduction

Building a world that feels alive outside of the player vs player aspect of a multiplayer shooter is something that has rarely been attempted. Popular multiplayer shooters such as Call of Duty (Infinity Ward, 2016) or Battlefield (DICE, 2016) fail to include any kind of AI to aid in creating a convincing atmosphere. The whole experience is completely focused around pitting humans against each other in an arena. It can result in a world that feels rather empty with only 10-12 players moving around a large map leaving the player often feeling un-immersed in the game world. New players may find these games particularly frustrating, especially in multiplayer only games such as Overwatch (Blizzard Entertainment, 2016), where it becomes much more difficult to practice playing without fear of losing to more experienced enemy players.

From a technical perspective and development standpoint, it is a great challenge to use AI to create a convincing multiplayer world. To create a convincing battle, the game would require a number of AI controlled characters on the ground and a basic director for spawning enemies. For example, spawning reinforcements for the losing team to balance the game. The director is a non-entity AI in control of major aspects of the game. In Left 4 Dead, the AI director is used to determine the spawn of new enemies and weapon upgrades, health etc. (Thompson, 2014).

Leveraging Cloud Services

To create a convincing world filled with varied artificially controlled characters, a great deal of CPU power is required. Most multiplayer games, particularly on console are hosted on a single player's machine (Seppala, 2014). The large number of artificially controlled players in a match in Titanfall would be too demanding to run on a single console (Savill, 2015) and an average users' upload speed.

Respawn estimated over 200 entities regularly on screen, each entity allowed a maximum of 3.5 bytes on an average users' upload speeds assuming a 768kbit/s upload speed of the host shared between 11 other players (Shiring, 2015). On the other hand, hosting in a datacentre would allow more than

26 bytes per entity. This is a big reason why many games feel empty as the player hosted matches do not have the bandwidth to support the additional AI used in Titanfall (Shiring, 2015).

To resolve this, Respawn leveraged the power of Microsoft's Azure Cloud Platform in their 2014 release of Titanfall for Xbox 360, Xbox One and PC. Using a service like Azure gave the developers enough processing power to host matches alongside processing the artificial intelligence calculations

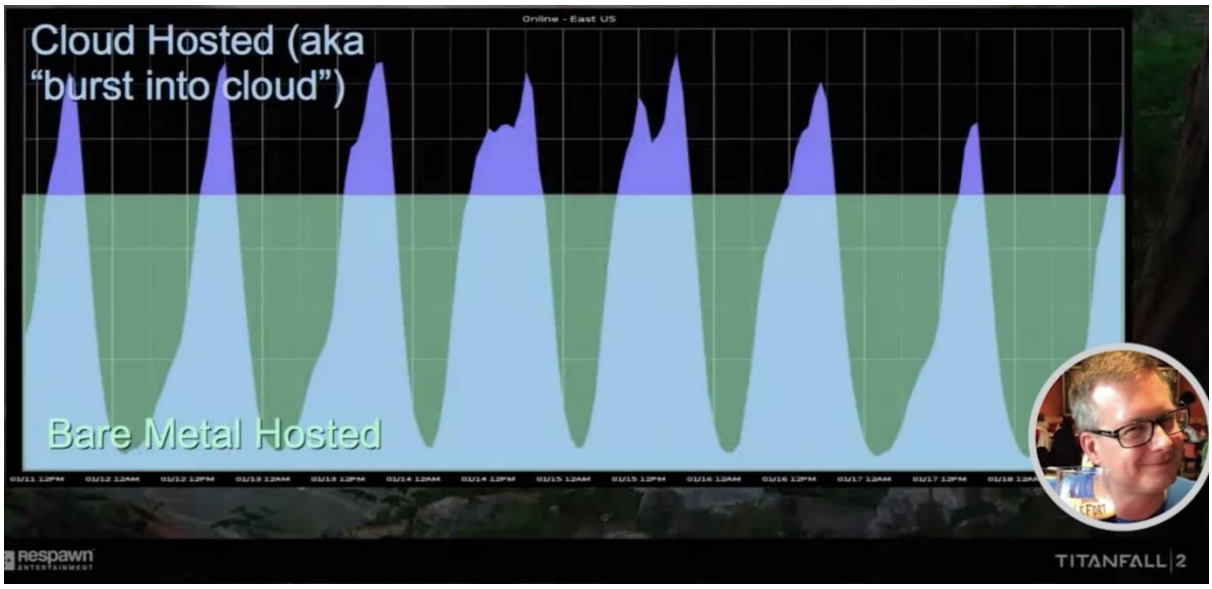

Figure 1 Titanfall 2 utilizing both bare metal and cloud servers (Multiplay, 2017)

in each match (Kar, 2014). John Shiring, an engineer for Respawn Entertainment felt that player hosted matches were holding back what could be achieved, and the additional CPU power opened the opportunity for a bigger world, with more advanced physics and AI (Chapple, 2013). With Azure also being a pay as you go service, paying only for the CPU cycles used, costs can be much better reduced compared to running bare metal servers at all times. Additional servers can be started quickly without additional hardware and stopped when the demand is low (Multiplay, 2017).

Using the cloud to provide more advanced processing away from the console has never really been attempted before and now other developers are following in Respawn Entertainment's footsteps. The Forza Motorsport and Forza Horizon series are now using cloud computing to create "Drivatar's". These are artificially controlled drivers that learn from the way you drive (Staff, 2014). Through machine learning, they attempt to emulate real player behaviour and allow the player to compete in multiplayer racing without playing. This means players can earn in-game money and progress through the game without having to play (Suszek, 2013).

Many of the issues that came with the release of Titanfall can be traced back to the Azure service. The servers were limited by Microsoft's server locations and so reliability and latency could often become an issue (Shiring, 2016). The game was not released in some locations such as South Africa, as good

performance could not be guaranteed for most users in the region on Azure (Pitcher, 2014). With the sequel Titanfall 2, the developers have taken the cloud processing idea a step further and expanded to more cloud providers including Amazon and Google to provide the best experience anywhere in the world, and provide servers with faster scaling (Titanfall 2 – Inside Development: Servers, 2016). This means that from one game to the next you could be connected to a completely different cloud provider for the duration of the match.

Cannon Fodder

To provide the feeling of a wider battle going on throughout the match, Titanfall has two different kinds of AI on the ground. The first are known as grunts, and the second are spectres, although both behave similarly in the game. These NPCs are not designed to be equal in skill to a player. Instead they are considerably weaker. Killing them will contribute to your team winning the match, but not as much as killing another player, or Pilot as they are known in-game (Respawn Entertainment, 2014).

These kinds of AI can open a completely different kind of gameplay. For new players, who feel they cannot compete with other more experienced players, Grunts and Spectres can provide a good way of practising since they are considerably weaker than the human players. For the more advanced, they can make for some interesting tactics and strategies. One example is following the AI to where they will come under attack by a Pilot, and then use the AI as cover to kill the enemy Pilot (Crecente, 2014). Grunts are also fully capable of keeping themselves busy. Often grunts will fight each other, even without the presence of any players (PREDX99, 2014).

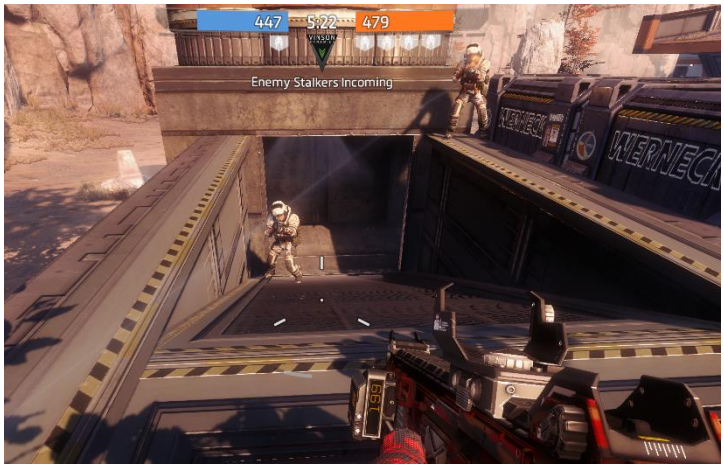

Figure 2 Enemy grunts engaging with the player, but far less powerful.

They will generally travel in groups, and can engage in battles with other enemy NPCs. They can also provide tactical information; often they may call out positions of enemy pilots and may be seen dragging away a friendly NPC who is injured. Spectres tend to act in a similar manner to grunts, but with some extra available actions based on their available skills. Spectres can also be 'hacked', changing their behaviour to fight against members of the same team (Unknown, 2014). While these things may seem insignificant and add little to the game, they help to enrich the world around you (Respawn Entertainment, 2014), which was one of the aims of the Titanfall developers.

Stand by for Titanfall

Figure 3 Auto-Titan in guard mode defending the player.

Despite all the impressive work that went into the NPCs mentioned previously and the server system to run it all, the main selling point of the Titanfall series is the Titans. These are giant mech-like warriors designed primarily to be controlled by a pilot, but they can control themselves in two distinct ways. Each Titan is designated to a single pilot, and when not being directly controlled by the pilot, the pilot can choose the Titan to engage follow mode or guard mode. A Titan in follow mode constitutes your own personal body guard, and he is effective at defending you when you are in Pilot mode. Guard mode will set the Titan to defend the area it is already in, such as a capture point for example. Both allow for more interesting strategies for advanced players that can take advantage of the AI around them (Respawn Entertainment, 2016).

Recommendations and Conclusion

Cloud computing has the potential to change the way we use our devices. It has already allowed smartphone users to offload more demanding tasks that the processor may struggle with. In games, we've already seen how almost the entire game can be offloaded to a machine in the cloud. Nvidia has already shown off the ability to render the entire game in the cloud and stream to the user's screen with Nvidia GRID (Nvidia, n.d.), only requiring input from the user. Meaning any game could be played on almost any modern device, supported by the GRID application.

Currently however, this comes at an exceptional cost and would not make sense for a developer to integrate cloud graphics processing into the game. But that's not to say cloud computing cannot be used effectively. With the Titanfall and Forza series, we've seen a heavy use of AI processing in the cloud to improve player experience and compared to similar games, the use of AI has improved these games significantly.

For those developers wanting to build a more convincing online world in almost any genre, then use of the cloud may be recommended. To push the limits of artificial intelligence, the current processing power of a console or individual PC is insufficient. So, having the far superior power of datacentres

could allow developers to concentrate more on having convincing artificial intelligence using more advanced and realistic algorithms than using less effective algorithms due to performance.

Ignoring performance, AI controlled entities play a huge role in making Titanfall a more convincing and enjoyable game. Very few other games create a variety of different AI entities like Titanfall does and they fall short because of it. Some games use AI for player equivalent bots, but these are rarely affective. They're designed to match the player, something that is even more difficult to achieve, since all players are at different skill levels. The varied kind of AI used in Titanfall however are designed to achieve different things and are usually designed to be weaker than a Pilot (the player).

If allowed, I believe the flexibility of the cloud to process AI and the idea of using AI to help build a convincing in-game world could create some interesting games in the future. No longer limited by the processing power of a small machine, more effort can go into creating better AI with more advanced path-finding and potentially thousands of actions to fit almost every situation where a simplified AI may struggle to convince the player.

Bibliography

Blizzard Entertainment, 2016. *Overwatch.* s.l.:Blizzard Entertainment.

Chapple, C., 2013. *Respawn: Xbox Live cloud more than just dedicated servers.* [Online]
Available at: http://www.develop-online.net/news/respawn-xbox-live-cloud-more-than-just-dedicated-servers/0115214
[Accessed 10 December 2017].

Crecente, B., 2014. *Titanfall maps can be packed with nearly 50 combatants including AI, players and Titans.* [Online]
Available at: https://www.polygon.com/2014/1/9/5292474/titanfall-maps-can-be-packed-with-nearly-50-combatants-including-ai
[Accessed 13 December 2017].

DICE, 2016. *Battlefield 1.* Unknown: Electronic Arts.

Infinity Ward, 2016. *Call of Duty: Infinite Warfare.* Unknown: Activision.

Kar, S., 2014. *Silicon ANGLE.* [Online]
Available at: https://siliconangle.com/blog/2014/02/25/windows-azure-the-power-behind-blockbuster-game-titanfall-for-the-xbox-one/
[Accessed 13 December 2017].

Multiplay, 2017. *Preparing for Titanfall 2 - a Tech Talk by Multiplay, Respawn and Google Cloud.* s.l.:s.n.

Nvidia, n.d. *Nvidia Grid.* [Online]
Available at: http://www.nvidia.co.uk/object/nvidia-grid-cloud-gaming-uk.html
[Accessed 13 December 2017].

Pitcher, J., 2014. *EA cancels Titanfall release in South Africa due to bad online performance.* [Online]
Available at: https://www.polygon.com/2014/3/7/5480654/ea-cancels-titanfall-release-in-south-africa
[Accessed 13 December 2017].

PREDX99, 2014. *Titanfall Grunt Fight.* Unknown: Unknown.

Respawn Entertainment, 2014. *Titanfall.* s.l.:Electronic Arts.

Respawn Entertainment, 2016. *Titanfall 2.* s.l.:Electronic Arts.

Savill, J., 2015. Understanding the Cloud (or Why Everyone Should Play Titanfall). In: M. Barsolo, et al. eds. *Mastering Microsoft Azure Infrastructure Services.* Indiana: Sybex, p. 1.

Seppala, T., 2014. *A closer look at Titanfall's not-so-secret weapon: Microsoft's cloud.* [Online]
Available at: https://www.engadget.com/2014/03/10/titanfall-cloud-explained/
[Accessed 10 December 2017].

Shiring, J., 2015. *The Online Tech of Respawn's Titanfall (also, consumer broadband is hopeless and game certification is counterproductive).* [Online]
Available at: http://www.slothy.com/Rackspace-talk-slides.pdf
[Accessed 13 December 2017].

Shiring, J., 2016. *Titanfall 2: Inside Development: Servers.* [Online]
Available at: https://www.ea.com/games/titanfall/titanfall-2/news/inside-development-servers?isLocalized=true
[Accessed 13 December 2017].

Staff, X. W., 2014. *Xbox Wire.* [Online]
Available at: https://news.xbox.com/en-us/2014/09/30/games-forza-horizon-2-drivatars/
[Accessed 13 December 2017].

Suszek, M., 2013. *Forza 5 to feature a 'Drivatar' that races while you're away.* [Online]
Available at: https://www.engadget.com/2013/06/10/forza-5-to-feature-drivatar-that-races-while-youre-away/
[Accessed 13 December 2017].

Thompson, T., 2014. *In the Directors Chair: Left 4 Dead.* [Online]
Available at: http://aiandgames.com/in-the-directors-chair-left-4-dead/
[Accessed 13 December 2017].

Titanfall 2 – Inside Development: Servers. 2016. [Film] Directed by Unknown. United States: Respawn Entertainment.

Unknown, 2014. *BRD-01 Spectre.* [Online]
Available at: http://titanfall.wikia.com/wiki/BRD-01_Spectre
[Accessed 13 December 2017].