



HADEAN



Case Study: CCP Games & Hadean

**Building the Future of Cloud-Based Massively
Multiplayer Online Games with EVE Aether Wars**





EVE AETHER WARS

Creating compelling multiplayer experiences is one of the toughest challenges game developers face today, especially at scale. The technical complexity in building and running an online multiplayer game, combined with the limited resources available to developers, often results in compromises being made to the original vision before the first line of code is even written.

CCP Games, creators of EVE Online, are familiar with the challenges of multiplayer development. Their sandbox gameplay has led to exciting and unpredictable in-game player behaviour such as the Siege Of 9-4, a player-organised skirmish that involved 6,142 players at its peak and set a new Guinness World Record. However, the player experience presented obvious opportunities for improvements. Time dilation, a mechanic that slows gameplay down to ease server load when thousands of players descend upon the same area, negatively impacted player experience as well as the performance and reliability of the game.

CCP Games' drive to find solutions for the technical challenges imposed by the long-standing architecture it uses for EVE Online led them to the Hadean platform, and Aether Engine, the world's first and only distributed cloud game engine for developers. Over the course of 2019, Hadean and CCP Games developed a partnership and R&D workstream towards the development of the next iteration of EVE Online.

Problem

CCP Games has achieved fantastic success with EVE Online since its release in 2003, including setting a Guinness World Record breaking skirmish involving 6,142 players in a single game. However, significant growth has led to the introduction of new mechanics causing less-than-ideal repercussions on the player experience, such as Time Dilation (or TiDi)

Solution

CCP Games started work with Hadean's Aether Engine in early 2019, allowing them to dynamically scale massive game worlds, upgrade pre-existing tools within their tech stack and develop EVE Aether Wars – a series of public, technical demonstrations showcasing the capabilities of this new technology and the cloud gaming experience it facilitates.

Benefit

Over the course of seven months and three phases, CCP Games and Hadean were able to fully realise the strength and capabilities of using cloud-based spatial simulation technology to build bigger game worlds with unprecedented gameplay possibilities faster and more cost-efficiently. The technology also demonstrated a viable business model that could be taken and utilised by CCP Games in the development of future projects and the next generation of EVE Online.



The Creation of EVE Aether Wars

CCP Games and Hadean collaborated on a development workstream called EVE Aether Wars, comprising a series of multiplayer technical demos built using Hadean's distributed compute simulation engine, Aether Engine, underpinned by the Hadean platform. Hadean's solutions allowed CCP Games to dynamically scale massively multiplayer game worlds, using existing tools like Unreal Engine 4 and enable faster, more powerful game development.

The first demo, EVE Aether Wars: Phase One, went live for an hour on stage at the Game Developers Conference [GDC] in March 2019, bringing thousands of players together for a simple deathmatch battle in space. The demonstration was a pure technology test with Aether Engine still an early-stage product. Despite this, the game supported more than 3,750 globally-distributed human players in the single-sharded game – an unprecedented feat, demonstrating scale that had never previously been achieved.

As well as testing the amount of real players who could join, EVE Aether Wars was also used to test the overall limits of the technology. AWS Lambdas was used to create over 10,000 non-human connected clients to further stress test the simulation. In total, 14,274 clients were set upon each other in a single battle. Microsoft Azure played a key role in supporting the dense technical strain with a global game-optimised network.

Under this significant amount of technical strain, the simulation remained stable, proving the power and potential of Aether Engine. The demo gained coverage in Business Insider, EDGE magazine and PC Gamer.



Building Phase Two in Eight Weeks

Following the success of EVE Aether Wars, the Aether Engine Software Development Kit [SDK] was put into the hands of CCP Games' developers, taking the software from internally-managed to externally-driven.

A team of seven people from CCP Games created EVE Aether Wars: Phase Two in just eight weeks: Stephen Northcott (Technical Director), Kári Gunnarsson (Art Director), Árni Berúlfur Jónsson (Senior Technical Artist), Ævar Örn Kvaran (Senior Software Engineer), Simon Rasmussen (Sound Designer), Nelle Stahl (Senior QA Analyst) and Jaimie Fryer (Senior Quality & Build Engineer).

Pullout: Using Aether Engine, seven people from CCP Games built EVE Aether Wars: Phase Two in just eight weeks, a cost-effective multiplayer technical demo that saw 4,369 players battle each other in real-time on a single-sharded, globally-distributed game world.

Phase Two set out to deliver;

- ▮ **Increased gameplay performance at large scale.** Hadean increased the simulation tick rate to 30Hz (doubling that of the 1 demo), matching the required rate for first-person shooter gameplay on platforms such as Xbox One, PlayStation 4, and PC. The simulation state in every CPU was synchronised to the state in every other CPU. This took place 30 times a second across hundreds of CPUs, demonstrating extreme performance and reliability in a distributed environment.
- ▮ **Reduced the cost of running a large-scale MMO game.** Egress charges make cloud gaming prohibitively expensive and often forces the cancellation of high-profile and ambitious large-scale multiplayer long before they are realised. To reduce operational costs and prove the viability of the business model, server and bandwidth efficiency was a key focus of Phase Two

The playtest went live for one hour on Sunday August 18th with 4,369 players on a single-shard. Player concurrency peaked at 3,047, with 1.2 million missiles fired and over 20,000 ships destroyed. At the simulation's peak, 832 cores were used across 13 virtual machines accessed by users from 88 countries. Crucially, the demo held at a stable 33ms tick rate running on hundreds of cores with thousands of geographically-distributed clients – something that had never achieved before.



As more players joined, extra resources were commissioned using Aether Engine's distributed Octree within 50ms, to supply the necessary bandwidth and ensure the gameplay experience remained smooth. Resources that were not needed were decommissioned to avoid unnecessary costs. This process took place dynamically without the requirement of any manual ops or engineering.

The cost of running the simulation from the original playtest was reduced by over 100x. The simulation processed an average 69mb/s of bandwidth, which included adding 'simulated' players to further stress test the technology, resulting in just under 250GB of data being processed over the hour. Using Aether Engine, CCP Games' development team was able to achieve true real-time, single shard, multi-region gameplay, unlocking new creative possibilities within the EVE Online universe.

"We have learned so much together in the last few weeks. I love this cross-studio team. We have a great engine and chassis that we've put through its paces and we have the data / learning to analyse and apply to our development."

– Stephen Northcott, Technical Director (CCP Games)

Delivering the Future of EVE Online Today

The third demo combined the lessons learnt from the prior stages to take EVE Aether Wars further than ever before.

To improve user journey to register, download, and play the game, a new partnership was formed with Steam and Microsoft Game Stack. Steam provided a platform for centralised comms and delivery of the game and Microsoft PlayFab handled all authentication requirements, client-side analytics and management of cloud infrastructure on Microsoft Azure.

Phase Three took place on Saturday, 23 November 2019 during the last stage of CCP Games' Invasion Tour, EVE London and drew in over 2,800 players from 80 countries around the world into a single-sharded game for sixty minutes, with a peak of 1,901 players all enjoying a smooth, real-time game experience.

Using a distributed network of 1,024 cores globally, players enjoyed a more fully-defined overall game experience, compared to previous phases. This was echoed by players on Hadean and CCP Games' community channels; I. "The gameplay was much smoother this time," said one player. "This was the first time I was able to make it – was very neat and I have high hopes for the tech," said another.

Over the course of several months and three phases, Hadean and CCP Games took EVE Aether Wars from a raw technology test to a fully-fledged gaming experience, equivalent to an early access MMO title.



The Next Step Forward

Our work with key partners, such as CCP Games, has enabled us to demonstrate the capability and strength of Aether Engine in delivering impressive scale and smooth gameplay experiences. Using our technology, it is possible to create a high-quality, globally distributed gaming experience for a massive number of players all within a viable business model that isn't heavily constrained by severe costs.

EVE Aether Wars has enabled CCP Games to explore the next frontier of MMOs and the opportunity to harness the full potential of the cloud. Using Aether Engine, CCP Games were able to supersede the constraints and costs of traditional development methods and develop a larger and richer experience, faster and at a significantly reduced cost.

CCP Games are now beginning to take full advantage of the new frontier that is cloud gaming. Aether Engine enables developers to focus on developing the games they want, rather than having to deal with the complexity of traditional ops and engineering. By taking full advantage of new technologies such as Aether Engine, developers will be able to deliver new games and genres that players have never experienced before.

Company Background

CCP Games

As the creators of EVE Online, CCP Games has been pushing technical and creative possibilities in MMO gaming since its release in May 2003. Based in Iceland and with offices in London and Shanghai, CCP Games was acquired by South Korean publisher Pearl Abyss in 2018 for \$425 million.

Key Games: EVE Online, Dust 514, EVE Valkyrie, EVE Gunjack

Location: Reykjavik, Iceland

Hadean

Hadean is a distributed hyper-compute platform for global organisations needing to apply the full force of cross-cloud capability to solve the world's most complex problems.

Hadean's patented technology is the only computation platform capable of instantly distributing applications to multiple cloud instances to exploit both immense scale and agility.

Hadean's platform removes the burden of multiple code changes and overcomes developer skill shortages, accelerating time to market.

Key Technologies: The Hadean platform, Aether Engine, Muxer, Mesh

Location: London, United Kingdom