

# MAINFRAME INDUSTRIES BUILDS MASSIVE ONLINE GAME WORLDS WITH AMD CPUS

Redefining the MMO genre for the next decade with the power of AMD processors

AMD  
THREADRIPPER

## CUSTOMER



## INDUSTRY

Game development

## CHALLENGES

Processing power to quickly compile Unreal Engine code and shaders for groundbreaking Pax Dei Massively Multiplayer Online game world

## SOLUTION

Deploy workstations powered by AMD Ryzen™ and Ryzen™ Threadripper™ CPUs, alongside Incredibuild network processing

## RESULTS

Up to 8 times faster shader processing and quicker iteration of Unreal Engine builds to enable the scale required for the Pax Dei MMO

## AMD TECHNOLOGY AT A GLANCE

AMD Ryzen™ CPUs

AMD Ryzen™ Threadripper™ CPUs

### Designing a groundbreaking computer game takes an enormous level of processing performance, especially when building a massive virtual world.

Mainframe Industries is pushing the limits of what's possible by creating a huge photorealistic fantasy online game world called Pax Dei, literally the game of a lifetime, where players can explore, build their home, forge a reputation, and craft their own stories. This is a project that requires exceptional workstation power, so the company turned to AMD Ryzen™ and Ryzen Threadripper™ processors to deliver everything they need to build their innovative Massively Multiplayer Online (MMO) game.

### Building massive game worlds

"We have 13 co-founders evenly distributed between Helsinki and Reykjavik," says Eetu Martola, co-founder and lead technical artist at Mainframe Industries. The co-founders come from illustrious backgrounds in the games industry – Martola worked at Remedy Entertainment, and Reynir Harðarson, game director at Mainframe Industries, was one of the co-founders of CCP Games. "My background is very much in the massively multiplayer genre and creating huge worlds," Harðarson says.

"With Pax Dei, we want to create a world you live in," continues Harðarson. "It's not just set dressing for quests. You interact with it and build your home. From that, you might group with others and build a small village, then a town, then a barony, then even a kingdom. It goes from the very small interaction where you are picking flowers or foraging for food or going on a solo adventure, up to massive kingdoms because the game is about human interaction."

"It's an extremely large world and we have a lot of assets," adds Harðarson. "We have an incredible number of trees, flora, and farmland." The huge scale of the Pax Dei world causes major challenges. "One of them is the building of the large worlds. Another thing is the shaders. We have literally thousands of different art assets. Because of the modularity we use, they all share the same shaders, so if you need to recompile a single material, you must recompile them all. This often requires tens of thousands of recompiles. A single recompile only takes a few seconds, but recompiling all really adds up. This can hold up your machine. If you are running the editor on just a quad-core workstation, you would spend half of your day just waiting for your shaders. We couldn't take on such a large project without serious horsepower."

"The scale and the complexity of the environment is unique," adds Kristján Valur Jónsson, senior software architect, Mainframe Industries, another former CCP employee. "We're trying to create something that's hyper realistic and a believable large world. We decided very early on to use Epic Unreal® Engine. Many of us have experience with that. With

Unreal Engine, the big plus is that you can modify the source code. It is well-written and easily extendable. To realize what we want to do in this large-world MMO, we must customize the way that the Unreal Engine works. There's a lot of number crunching involved." AMD processors were an excellent choice to carry this heavy workload.

*"The AMD processors have made our journey so much easier...allowing us to do things at scale that were otherwise impossible."*

*Reynir Harðarson,  
Game Director at  
Mainframe Industries*

## The road to AMD Ryzen processors

"Unreal Engine 5 has a lot of very interesting technologies to do massive worlds on an incredibly detailed scale," says Harðarson. "But Unreal is not yet built to distribute massive simulation to so many clients in real time, so we have to build that in ourselves. On top of that, we use SideFX Houdini™ quite a bit for creating the procedural part of the world. We use the QGIS® geographic information system. And then of course we use Autodesk® Maya®."

"This stuff is highly multi-threaded," says Harðarson. "It's also memory intensive, and requires fast disk speed because we're managing so much data." All these requirements played to the strengths of AMD Ryzen and Ryzen Threadripper processors. "We had been working with Unreal 4 on a previous project in 2016. We started experimenting with the first eight-core Ryzen and it boosted our productivity a lot. The larger on-processor cache was speeding up the shader compiling significantly. We had been using Intel Core i7s. The Ryzen was four to eight times faster. It was a game changer."

Because of this previous positive experience, Mainframe Industries initially deployed AMD Threadripper 2990WX processor-powered systems for building Pax Dei, but now the main workloads run on a combination of 16-core AMD Ryzen 9 3950X and 64-core AMD Ryzen Threadripper 3990X CPUs. Additional developer workstations are powered by eight-core AMD Ryzen 7 5800X processors. "The Threadrippers in the compilation farm chiefly do two kinds of jobs," says Jónsson. "They compile game engine code and shaders."

"We use all the Threadripper CPUs in an Incredibuild network, so now we have a few hundred cores compiling shaders," says Harðarson. "That is insanely fast." Mainframe Industries was a very early adopter

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*Reynir Harðarson,  
Game Director at  
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of the 64-core AMD Ryzen Threadripper 3990X processor. "It enabled us to do the first prototypes for the large world builds. Just going from the 32-core to the 64-core CPUs was more than double the speed for building the world."

## Enabling scale for a living world

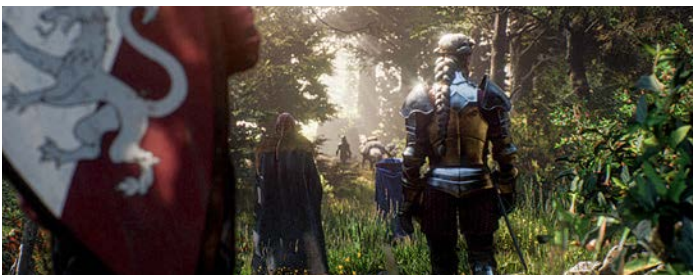
"The speed of iteration is king," says Martola. "Now we can do a couple of iterations in a day for jobs that used to be an overnight process. That's a huge productivity improvement." Harðarson adds: "The resolution we're working with is about 25 centimeters per pixel. Doing this for 100 square kilometers is very memory and CPU intensive."

The combination of Incredibuild and the Threadripper CPUs is the golden solution for us. Without them, it would not have been possible to work at this detail level or scale. All our development machines are running AMD processors. The performance for the money and pure performance at the top end are unquestionable."

"There are a lot of roadblocks when doing game development," continues Harðarson. "You're always waiting for the computer to process something."

Anything that removes these bottlenecks increases creativity and productivity massively. The Threadripper CPUs are a complete game changer. It makes all the difference, a no-brainer. There's a reason why we don't have anything else except AMD CPUs in our office. In our experience, they are just better. Especially for the heavy lifting, there is no question that Threadripper pays for itself very quickly."

"With Pax Dei, we're creating a living, breathing world full of mystery and wonder, and the story is hidden behind every rock," concludes Harðarson. "It's your home. The AMD processors have made our journey so much easier by increasing iteration speed massively and allowing us to do things at scale that were otherwise impossible."



## About Mainframe Industries

Mainframe Industries is an independent, venture-backed game developer. The company brings together veterans from CCP, Next Games, Blizzard Entertainment, Rovio, Ubisoft, and Remedy Entertainment. Mainframe is aiming to create a cloud-native Massively Multiplayer Online game that will be a social sandbox, accessible on any screen (PC, console or phone) and offering new ways of playing with friends. The company has studios in Finland and Iceland and has also opened an office in France. Mainframe Industries intends to reimagine the MMO for the next decade of gaming. For more information visit [themainframe.com](https://themainframe.com).

## About AMD

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