The evolution so far

Douglas Aircraft develops Panel Methods to simulate ship hulls and aircraft fuselages.1

Commercial unstructured 3D flow solvers

The release of Fluent, STAR-CD and others start the rise of 3D unstructured commercial CFD codes.

First HPC cluster

NASA builds the first HPC cluster, Beowulf, to solve parallelizable problems faster with commodity grade computers

CFD in the cloud

Amazon Web Services introduces the C1 compute-optimized instance, making high performance computing (HPC) more accessible.

Cloud HPC is accelerated with up to 100 Gbps networking and the AWS Nitro System.

Large GPU clusters in the cloud

Amazon EC2 P4d UltraClusters combine 4,000+ NVIDIA® A100 tensor core GPUs and petabit-scale networking.

1967

1994

2008

2018

2020

How AWS is building the future of CFD

AWS ParallelCluster

Easily deploy and manage HPC clusters with an AWS-supported open source management tool. You can scale resources automatically and migrate existing workloads with little to no modification.

Amazon EC2 C5n Instances

Get high performance Intel-based Amazon EC2 C5n instances with Elastic Fabric Adapter, our custom high network bandwidth and low latency network adapter to help scale out your CFD simulations to tens of thousands of cores.

Amazon EC2 P4d Instances

Train ML models in the cloud with P4d instances powered by the latest NVIDIA® A100 Tensor Core GPUs. P4d instances are the only instances in the cloud to offer up to 400 Gbps networking with EFA. P4d instances provide up to 60% lower ML training costs and an average of 2.5x better performance compared to P3 and P3dn instances.

AWS Inferentia

Part of our vision to make DL an everyday tool for developers, AWS Inferentia is a high-performance ML inference chip, custom designed by AWS. It's designed to drive down the total cost of inference and make it easy to integrate machine learning into CFD.

Machine learning (ML) and deep learning (DL) are delivering the potential for a disruptive technology in CFD, making it possible to train models that then predict new geometries in seconds and at low cost. To leverage ML and DL organizations need:

- High-performance GPUs like the ML-focused AWS Trainium and AWS Inferentia
- Fast access to training data as provided by Amazon FSx for Lustre and Amazon S3
- Model building, training, and deployment tools such as Amazon SageMaker and AWS Batch

The Future of CFD

Computational fluid dynamics (CFD) is a key design tool for engineers today. But time-consuming, costly physical testing is still a regulatory requirement in many industries, including aviation and automotive. For digital certification to fully replace physical tests, CFD needs massive compute power and innovation to deliver accuracy equal to physical tests.

Computational fluid dynamics is the mainstay for engineers to improve product designs and rapidly develop viable prototypes. CFD simulations predict the interactions between fluids, solids and gases and provide a virtual equivalent to physical testing.

GPUs have the potential to rapidly accelerate CFD compared to CPUs. But many popular CFD codes are not yet GPU-optimized. As more workloads are adapted to GPUs, organizations need GPU clusters and HPC infrastructure that:

- Scales massively as CFD workloads grow
- Offers flexible access enabling you to use CPUs today and quickly switch to GPUs when you need them
- Removes the high upfront costs of traditional on-premises servers

Growing GPU power and demand

AWS offers the most advanced and comprehensive set of solutions available in the cloud today. The flexibility of AWS infrastructure means that you can adopt new CFD technologies, or grow and shrink your infrastructure, as your workloads demand.

ML/DL transforms CFD

2-3x GPU acceleration can deliver 2-3x speedup over CPU-based codes

Growing GPU power and demand

100+ GPUs are required for real-world CFD accuracy

33.6% GPU market growth rate forecast, 2020-2027

ML/DL transforms CFD

Use the latest CFD technologies now

AWS allows you to run your simulations faster and improve your digital certification meets and provide a virtual equivalent to physical testing.