HPC for 3D Electromagnetic Simulations From Workstation to Cluster & Cloud

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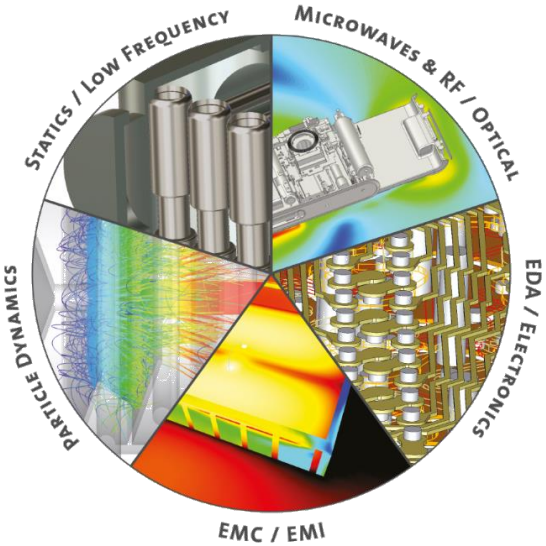
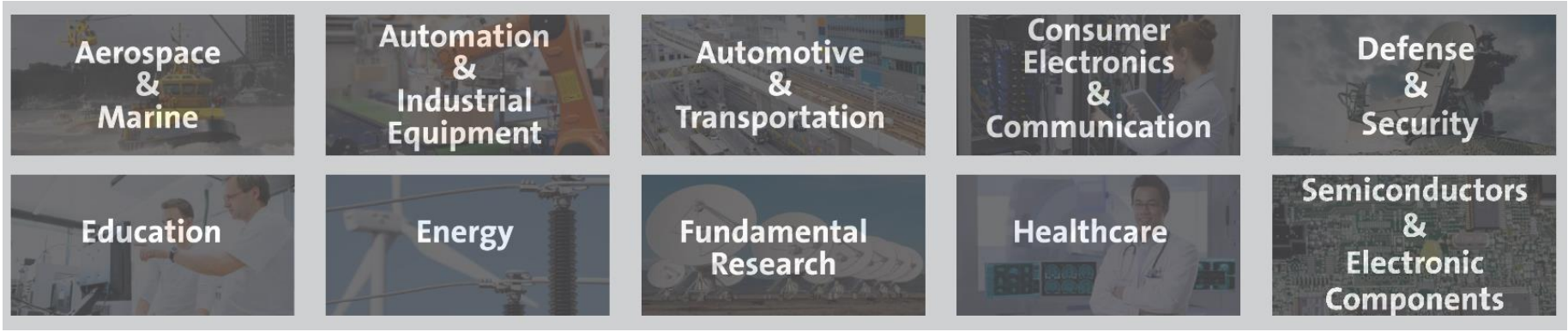
About CST AG

- Founded in 1992
- Complete Technology for 3D Electromagnetic Simulation
- 300 Employees
- Worldwide Support Network

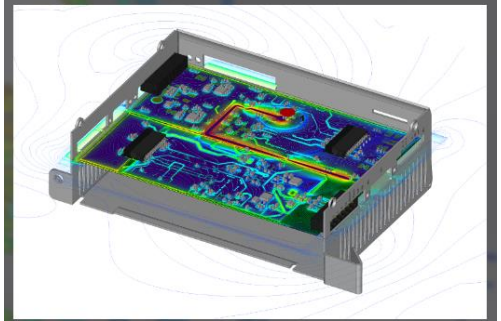


Main Product: CST STUDIO SUITE®

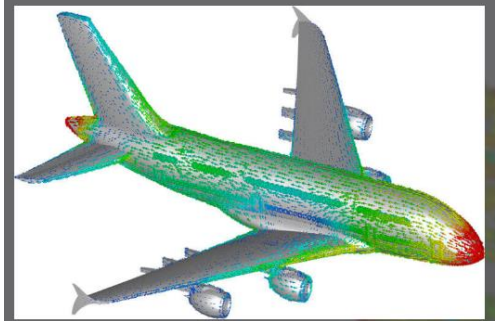
3D EM Simulation Examples



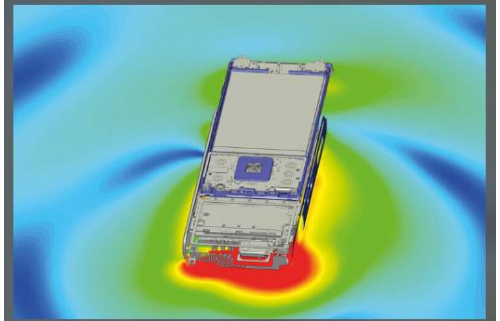
Emissions & Immunity



E3



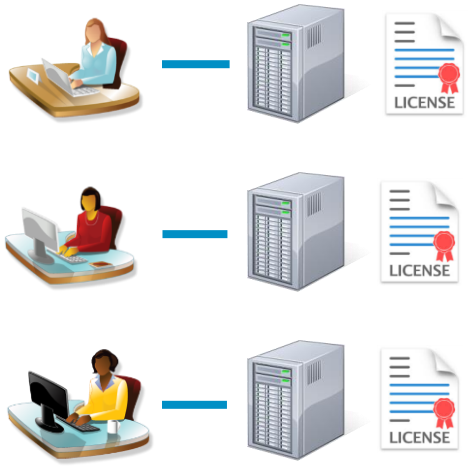
Antennas



Moving to “The Cloud”

Traditional Approach

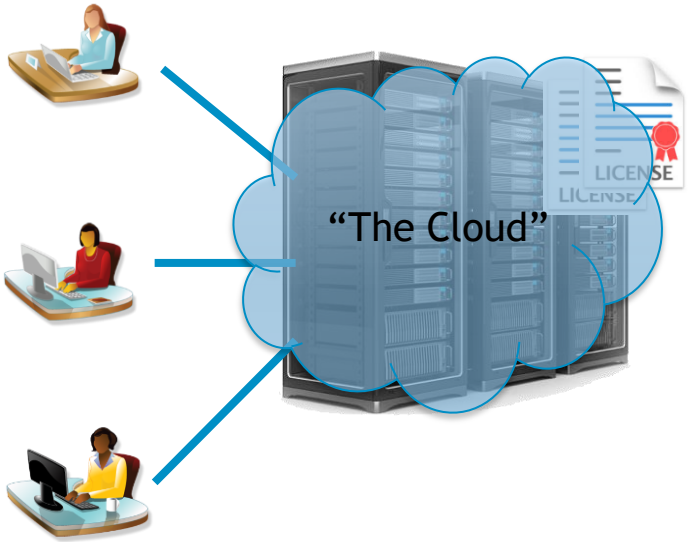
Each user “owns” his/her resources (workstation and license).



Still widely used in smaller companies and in very competitive environments.

Cloud Approach

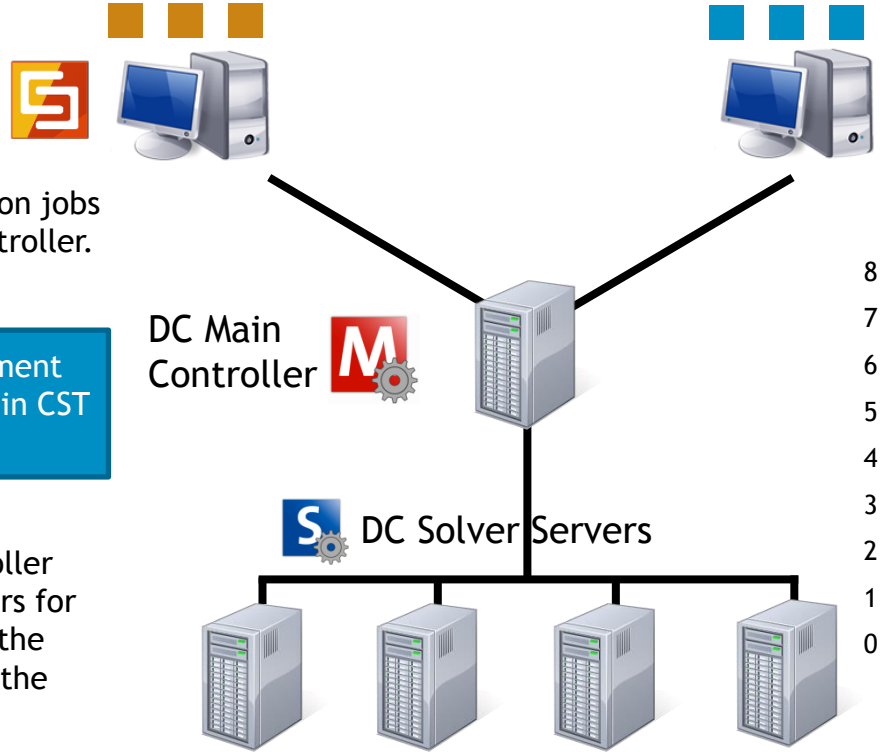
Users not in charge of the resources they use.
Resources are centralized and shared.



1. **Private cloud** used **exclusively** for CST software.
2. **Private cloud shared** with other software.
3. **Public cloud.**

Larger accounts tend to move in this direction.

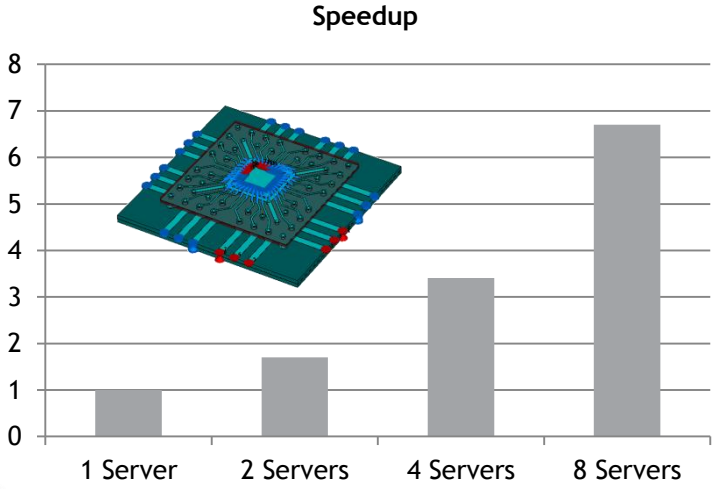
CST Distributed Computing



Users send simulation jobs to the DC Main Controller.

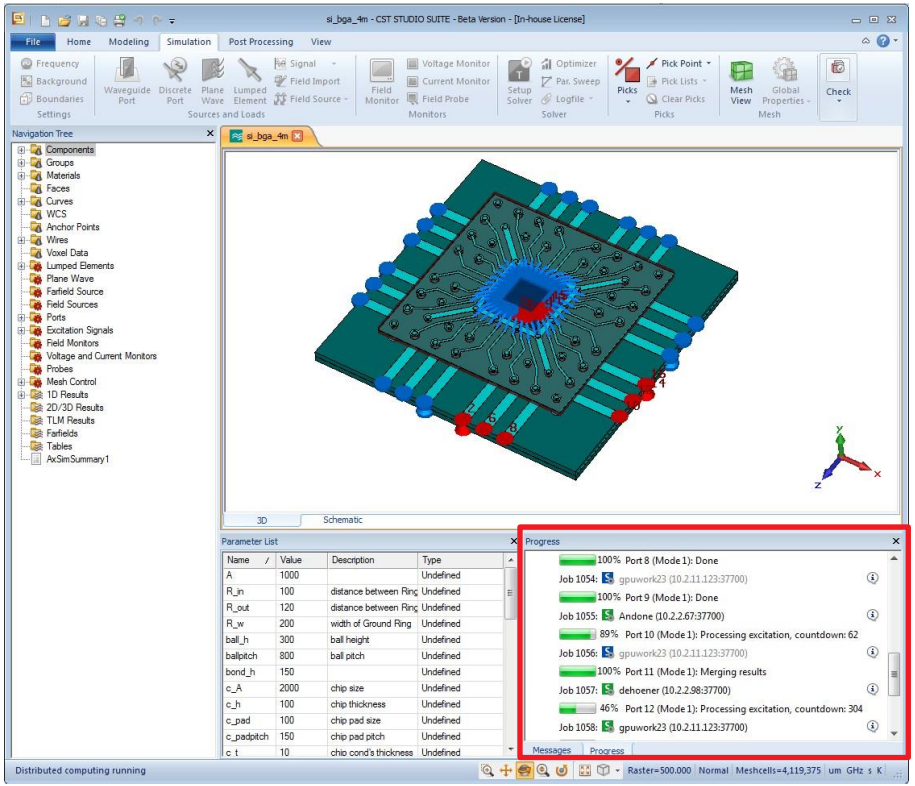
Workload management system integrated in CST STUDIO SUITE.

The DC Main Controller selects solver servers for the jobs and sends the simulation tasks to the selected machines.



Distributed excitations (transient solver) on a cluster with eight nodes (dual Xeon E5-2643 v3).

CST Distributed Computing



- Very **good utilization** of computational resources.
- Very **efficient parallelization** strategy for independent tasks.
- **Fully integrated with the CST STUDIO SUITE frontend.**
- Easy way to share computational resources in a **multi user environment.**

Simple “cloud” solution for private cloud when computational resources are used for CST exclusively.

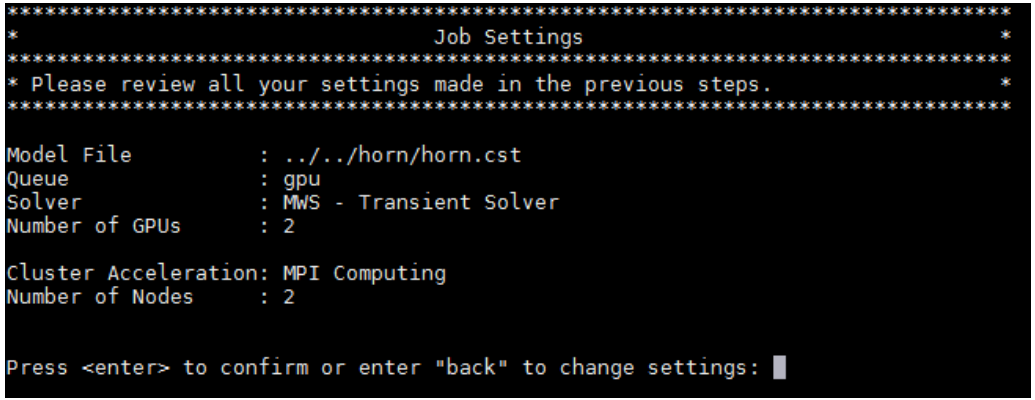
Private Cloud – Shared with Other Software

- Workload managed by any scheduling system (**no standard interface or configuration**).
- Accessed companywide, i.e., often **low network bandwidth** for users who access via internet.
- Often **complicated to use** for a CAE engineer (command line only).
- In most cases **Linux based**.

Private Cloud – Shared with Other Software

Support of centralized HPC environments is available on several levels of convenience for CST STUDIO SUITE:

1. Script collection for **convenient job submission and progress view on Linux systems** (supports all major scheduling systems). Flexible and open such that the user can make adjustments as required.



Private Cloud – Shared with Other Software

Support of centralized HPC environments is available on several levels of convenience for CST STUDIO SUITE:

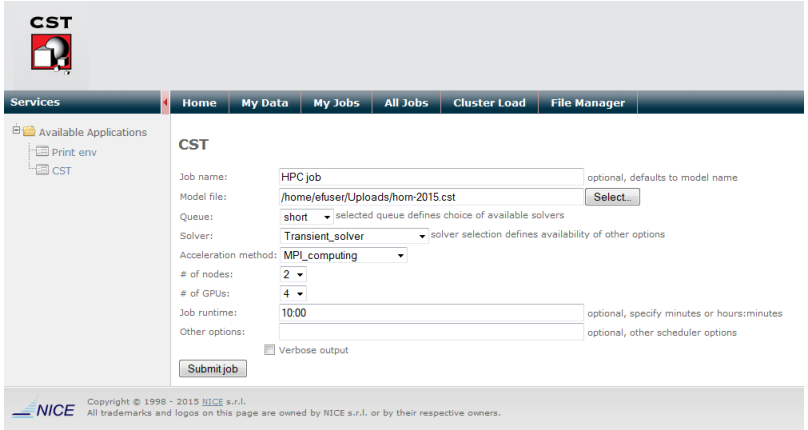
2. Integration of CST STUDIO SUITE in the **EnginFrame** web portal solution provided by NICE is available. This allows for **job submission**, **monitoring**, and **post-processing** with **accelerated remote rendering**.

NICE

enginframe

DCV
desktop cloud visualization

For more information on EnginFrame and DCV go to **booth #740**

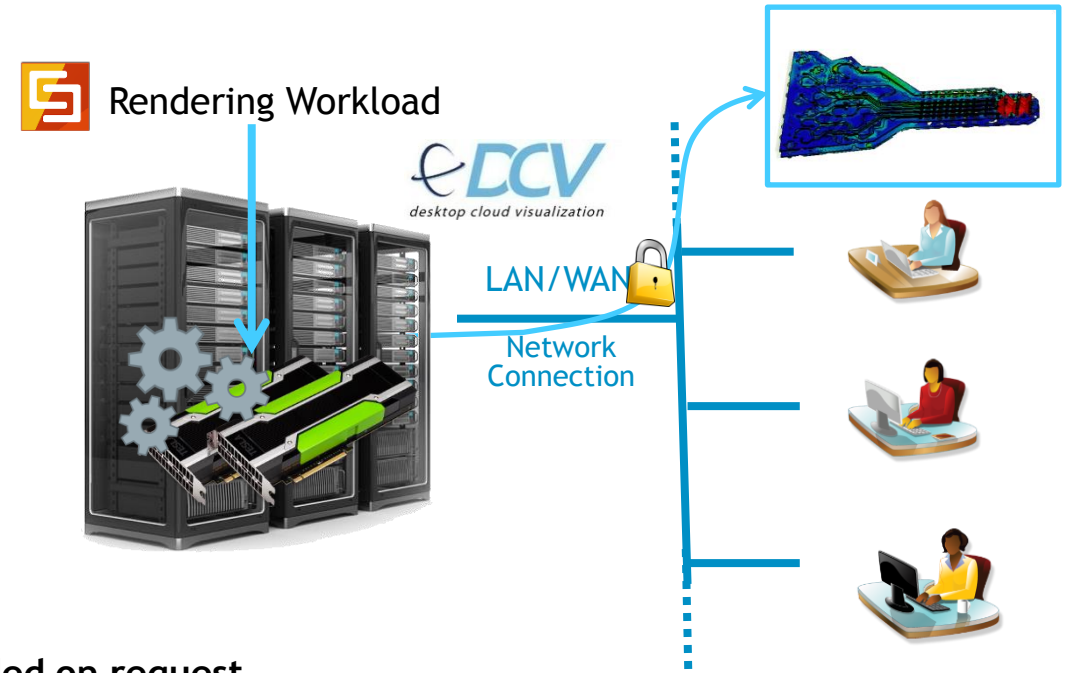


Private Cloud – Shared with Other Software

Complete simulation workflow can be easily and conveniently managed via the EnginFrame web portal using the CST plugin for job submission and visualization.

Key features:

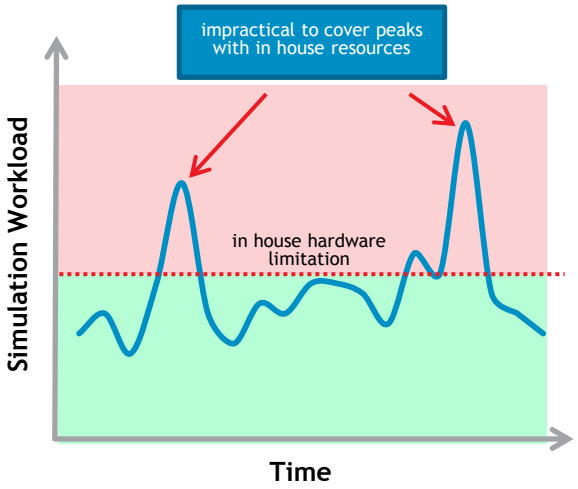
- Full GPU acceleration for Windows and Linux sessions on the cluster (remote visualization) using DCV.
- Dynamic quality adjustment to maximize frame rate in motion.
- Encryption using AES algorithm.

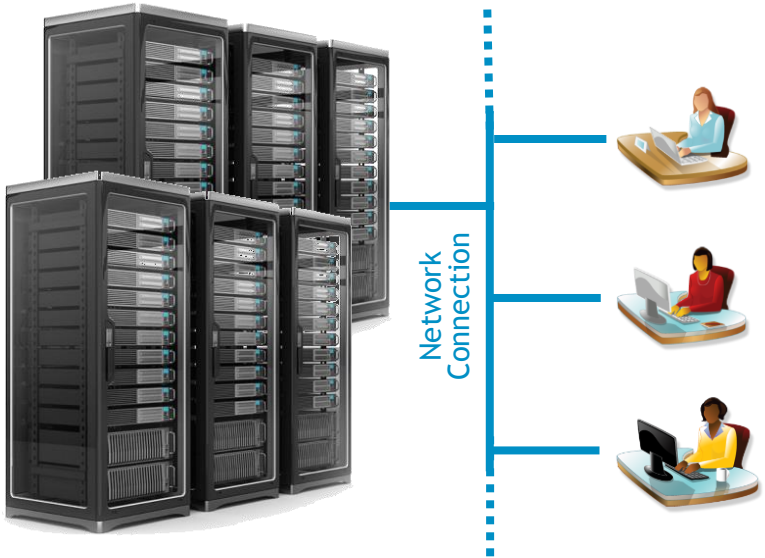


CST plugin for EnginFrame can be provided on request.

Public HPC Cloud

What makes "HPC in the Public Cloud" different from "normal" HPC?

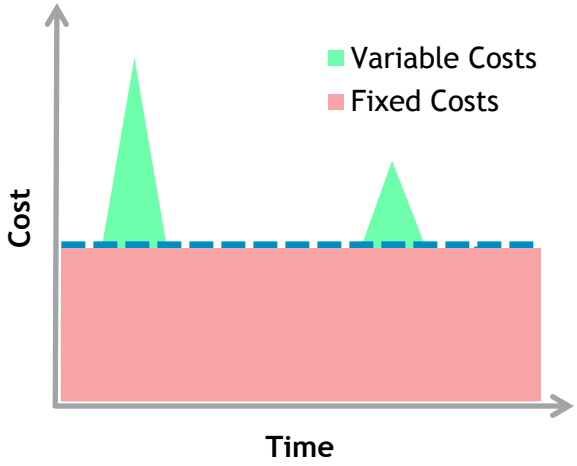


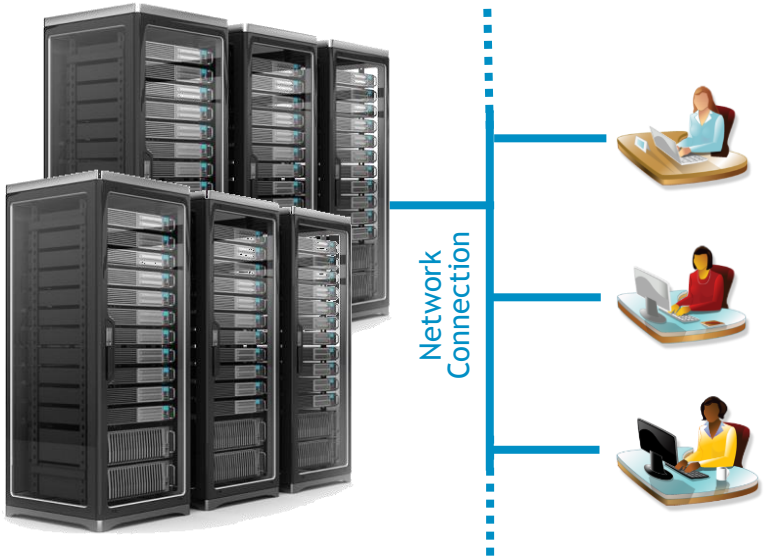


- **Scaling** infrastructure up and down when needed.

Public HPC Cloud

What makes "HPC in the Public Cloud" different from "normal" HPC?





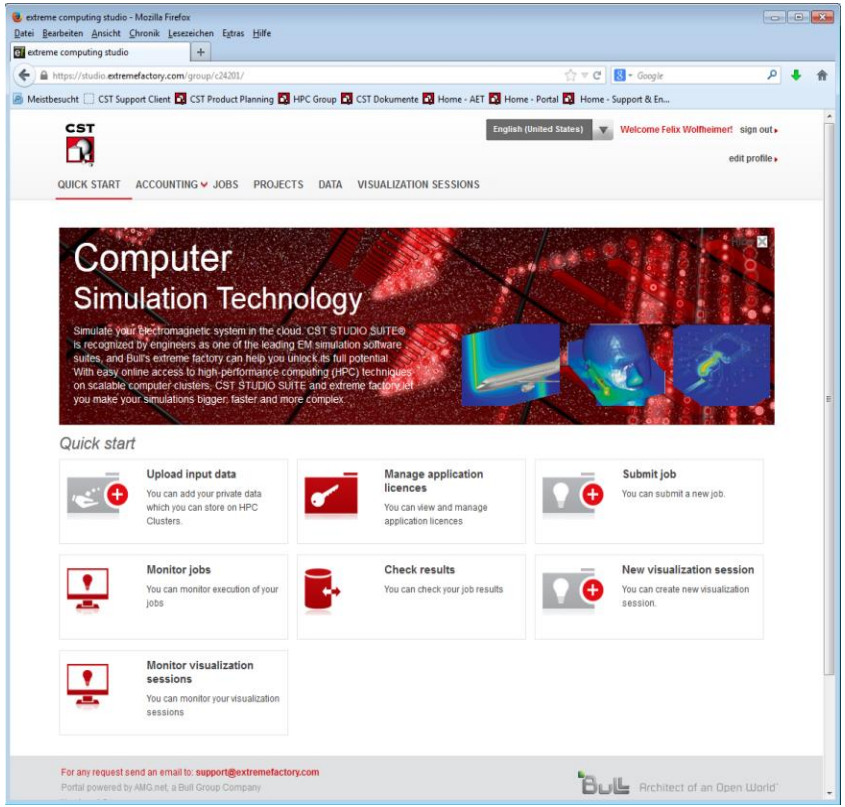
- **Scaling** infrastructure up and down when needed.
- **Reducing fixed cost** in favor of dynamic cost.

Public HPC Cloud

What makes "HPC in the Public Cloud" different from "normal" HPC?

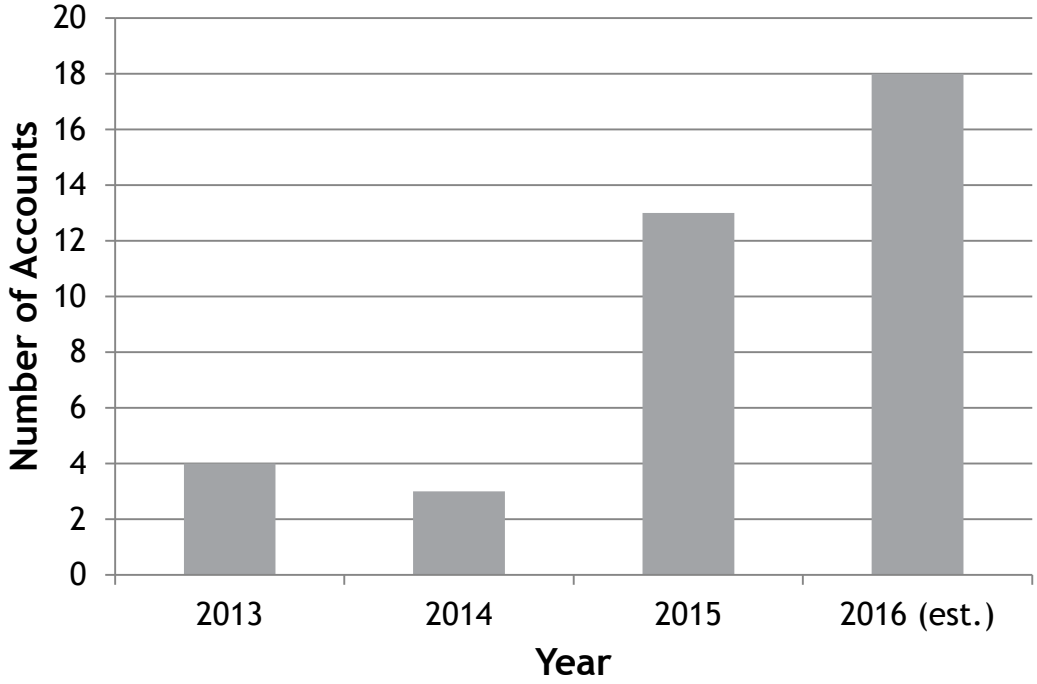
- **Scaling** infrastructure up and down when needed.
- **Reducing fixed cost** in favor of dynamic cost.
- **Covering high-end** simulation workloads.

Public HPC Cloud



- **Partnership with HPC resource providers** (Bull/Atos, Nimbix, Rescale).
- Special **cloud licensing model** available (credit based, pre-paid).
- **Focus on usability** (user friendly way of job submission, progress view and result view via remote visualization).
- **Available hardware and technology is important** (fast interconnect, hardware accelerators, amount of RAM).

Public HPC Cloud Customer Requests



First public cloud offering established in 2013.

So far not a large number of accounts show interest in the public HPC cloud.

Interest gradually growing over time though.