

## HELPING A TOP RANKED ENGINEERING SERVICES FIRM MEET COMPLEX BIOPHARMA DESIGN NEEDS

By Massimo Malagoli, Ph.D., Sr. Cloud Architect



### Overview

CRB, ranked #2 in 2017 by Engineering News-Record magazine as a leader in engineering, architecture and construction services, needed additional computing power very quickly to meet a client's needs for an innovative new engineering design. They had their own in-house compute capacity and didn't want to take on additional capital expense because of the cost and the time delay and because they didn't know how often they would be using this additional capacity, making its return on investment uncertain at best.

To complicate matters, CRB was working on a project for a biopharma client, designing a mixing tank for them, a piece of equipment that is the heart of biopharma research. Not only did they have to know how its components would interact together to generate the desired hydrodynamic properties for adequate mixing, their calculations had to ensure the survival of the microorganisms in the mix.



They chose a Penguin Computing® On-Demand™ (POD™) HPC cluster connected to a Scyld Cloud Workstation™, tuned to support an ANSYS® software stack. This combination enabled CRB to scale their processing capabilities and satisfy peak demand without having to increase their in-house resources. Access to scalable HPC resources enabled fast turnaround for time sensitive analysis with:

- 100% on-time project completion
- 100% client satisfaction
- 10% reduction in project execution time
- 20% cost avoidance and cost savings

### Problem

With gene therapy advances on one side and expiring patents on the other, the biopharmaceutical industry is experiencing increasing pressure to convert research into revenue more quickly than ever. High-performance computing (HPC) helps many biopharma companies conduct research, however, HPC also helps the engineering services firms they work with to build facilities and equipment.

Mixing tanks and bioreactors, for example, are common in many industries: chemical processing, consumer goods, and so on. The design of these mixing tanks is complex as the engineering services firms building them must ensure high efficiency, by minimizing blend time.

However, optimally designed mixing tanks are critical to biopharma. This is because, unlike other industries, biopharma faces the additional, even more complex challenge of identifying the optimum balance between high agitation and survival of the microorganisms that are the central focus of biopharma.



*"Having a cloud partner enables us to size our internal resources for our usual workload, instead of peak seasons, reducing yearly costs by over 20%."*

—Juan Pacio, CRB



Engineering services firms building mixing tanks typically use computational fluid dynamics (CFD) to perform blend times and exposure analysis. Due to the complexity of mixing tanks and bioreactors geometries (which include impellers, shafts, baffles, sparger, etc.) the calculations are complex and require highly specialized software and powerful but finely tuned hardware.

To model such mixers properly, a very fine mesh is required, resulting in models greater than 14 million cells and datasets that are over 8GB in size. With multiple simulations running at once, it can be challenging for engineer services firms to process them all at once, especially during peak seasons, even for a firm with the in-house computing power of CRB.

### Solution

According to CRB's Simulation/Process Engineer Juan Pacio, "as consultants, sometimes during the year we can get busier than usual, [but it is] difficult to estimate when or how much busier."

The issue facing CRB was a familiar one to the POD team. Basically, CRB needed a lot of power but only for a specific project and they couldn't wait for that access. Equally important, they needed this additional computing power to fit into their budget.

That's why Penguin Computing maintains 7 clusters on-site, set up with a variety of configurations. We have everything from the latest Intel® Skylake processors to NVIDIA® Tesla® GPU, as well as QDR InfiniBand or Intel Omni-Path high-speed interconnects and storage options that include Lustre or our own NAS. We offer as few as 12 cores per node with 48 GB of RAM per node to 40 cores per node with 384 GB of RAM per node. All our clusters have a transparent pricing model based on usage, so you can forecast costs with a high degree of accuracy.

After taking a look at options of bare metal HPC clusters available through the cloud (via secure browser or command line interface) and finding out about Penguin Computing's deep relationship with ANSYS (we're an ANSYS Advanced Solution Partner), CRB decided POD was the way to go for them.

The CRB team chose a public cloud cluster (though we also offer private cloud options) with Intel processors and Infiniband interconnects and was up and running 5 days after making the decision.

And, of course, POD comes with free support from HPC power users (including me)...

The Penguin Computing team worked with CRB to leverage their deep understanding of fluid mechanics and our extensive experience with ANSYS to help CRB set up the ANSYS environment on POD. This included configuring the elastic license server and installing the ANSYS suite of programs, including ANSYS Fluent and ANSYS CFD.

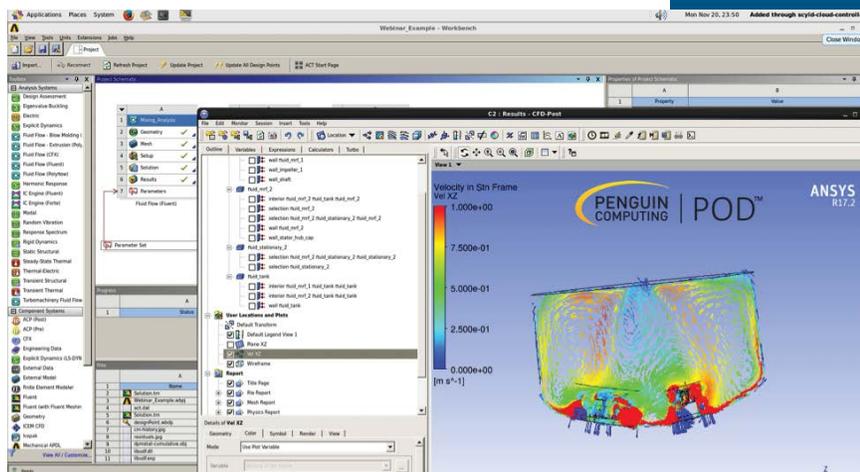
Then, we tuned the ANSYS solvers to take full advantage of the POD HPC environment, in particular, the low-latency Infiniband interconnects we use. After that, we integrated the ANSYS Remote Solve Manager (RSM) with the POD job scheduler. This allowed CRB to have seamless job submission from the ANSYS Workbench to the POD HPC cluster.

The CRB team built their model geometry on in-house workstations but then meshed models on POD clusters when they needed large models. The POD cluster also gave them the ability to update and re-run models, if required after sharing results, directly on the cloud.

In addition to using a POD to run the computing job, CRB used the engineering-grade Penguin Computing Scyld Cloud

Workstation (SCW) to remotely visualize their results. The Penguin Computing team even tuned SCW to ensure maximum graphic performance of the ANSYS applications.

The CRB team was able to access real-time, interactive 2D and 3D results with this virtual workstation via a standard browser without any plugins. The access sharing capabilities of the SCW enabled collaboration directly on the cloud, accelerating the sharing of results among the CRB team and ensuring rapid discussion and update of the models.



Screenshot from Penguin Computing Scyld Cloud Workstation desktop visualization of ANSYS CFD

*"We have found that using Fluent in the POD HPC cloud clusters is a winning combination to solve complex models quickly in a cost-effective manner."*

*—Juan Pacio, CRB*

## Results

The natural focus of HPC is on computational performance. Working with CRB enabled our Penguin Computing team to develop exciting new processes and techniques to facilitate every step of the production cycle: model preparation, solution, analysis and sharing of the results.

As a result, CRB self-reported that they had:

- 100% on-time project completion by solving models during peak seasons on POD
- 100% client satisfaction on delivery time and results provided
- 10% reduction in project execution time, allowing more design time for engineers
- Eliminated lost revenue due to computational resources limitations
- Complete flexibility and customization: allocated storage capacity, processor type and speed, number of cores
- 20% cost avoidance and cost savings compared to procuring or upgrading in-house equipment
- Real ease of use with quick adoption and minimal training needs
- Access to a dedicated support team to tailor settings according to specific needs

Our contact, CRB's Juan Pacio, said that, *"we have found that using Fluent in the POD HPC cloud clusters is a winning combination to solve complex models quickly in a cost-effective manner."*

From a business perspective, CRB believes "having a cloud partner enables us to size our internal resources for our usual workload instead of peak seasons, reducing yearly costs by over 20%. During peak seasons we can turn to our partner Penguin Computing to process simulation jobs faster, or to handle additional jobs in parallel by expanding our in-house capacity."

One of the most unexpected parts of this project was Pacio's comment that one of the benefits of this project was "improved employee morale during those "hard peak" seasons." We hear about business benefits to our work a lot but this statement, about helping morale, made this project even more satisfying!

### SOLUTION COMPONENTS

ANSYS Fluent

ANSYS CFD

Public cloud Penguin Computing On-Demand HPC cluster with Intel processors and Infiniband interconnects

Penguin Computing Scyld Cloud Workstation

Optimization and other assistance from the Penguin Computing On-Demand support team



## Learn More

See related solutions at [www.penguincomputing.com/POD](http://www.penguincomputing.com/POD)  
For pricing on your specific design needs, contact a representative by email at [podsales@penguincomputing.com](mailto:podsales@penguincomputing.com) or call **1-888-PENGUIN (736-4846)**.

## Purchase with Financing

Finance products, services, even soft costs with Penguin Computing Capital. Choose from options such as no money down, flexible billing choices, extended repayment timelines, and a variety of end-of-term alternatives.

## About Penguin Computing

Penguin Computing, Inc is a 20-year-old, U.S.-based global provider of high-performance computing (HPC) and data center solutions with more than 2,500 customers in 40 countries, across eight major vertical markets. Penguin Computing offers a comprehensive portfolio of Linux servers and software, integrated, turn-key clusters, enterprise-grade storage, and bare metal HPC on cloud, as well as expert HPC and AI services, financing, and top-rated support.

© 2018 Penguin Computing. All rights reserved. Penguin Computing, Scyld ClusterWare, Scyld Insight, Scyld Cloud Workstation, Scyld Cloud Manager, Relion, Altus, Penguin Computing On-Demand, Tundra, Arctica and FrostByte are trademarks or registered trademarks of Penguin Computing, Inc. Arista and the Arista logo are trademarks of Arista Networks, Inc. in the U.S. and/or other countries. Canonical and the Canonical logo are trademarks of Canonical Group, Ltd. in the U.S. and/or other countries. Mellanox and the Mellanox logo are trademarks of Mellanox Technologies, Inc. in the U.S. and/or other countries. NVIDIA and the NVIDIA logo are trademarks of NVIDIA Corporation in the U.S. and/or other countries. Pure Storage and the Pure Storage logo are trademarks of Pure Storage, Inc. in the U.S. and/or other countries. The Open Compute Project mark and logo, and the Marks and Logos referenced herein, are all marks of The Open Compute Project Foundation. TOP500 is a registered trademark of PROMETEUS Professor Meurer Technologieberatung und -Services GmbH.

```
----- OPERATOR CLASSES
Mirror Tool

class MirrorX(bpy.types.Operator):
    """This adds an X mirror to the se
    l_idname = "object.mirror_mirror_
    l_label = "Mirror X"

classmethod
```