

HPC Experiment

Wolfgang Gentzsch

Burak Yenier

Paving the way to HPC as a Service

HPC User Forum - Tucson



What is the UberCloud HPC Experiment?

- + Started by **Wolfgang Gentsch** and **Burak Yenier** in mid-2012 as a voluntary effort
- + Demonstrate the potential of HPC in the Cloud
- + Uncover and overcome the obstacles

Wolfgang Gentsch

Chairman at ISC Cloud Conference for
HPC & Big Data in the Cloud
HPC Entrepreneur and Executive
Consultant at Industry and
Governments
Regensburg Area, Germany



Burak Yenier

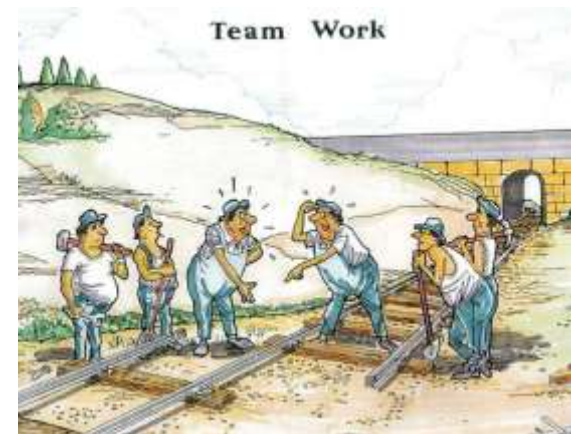
VP of Operations at Cashedge, now part
of Fiserv
San Francisco Bay Area





How does the Experiment work?

- + You register as **End-User, Software Provider, Resource Provider, or an Expert**, and provide your profile
- + **End-User** joins the experiment; we ask the **ISV** to join
- + We select a suitable **Team Expert** from our database
- + End-User and Expert analyze **resource requirements**
- + We suggest a computational **Resource Provider**
- + After all four team members agree, the team is **ready to go**





Where are we with the experiment

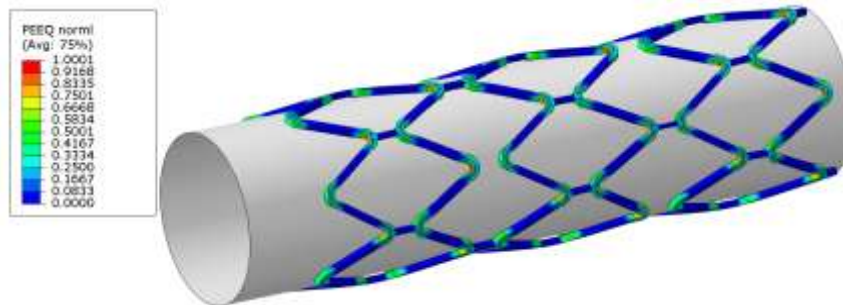
- + Started last August: Now Round 3: currently **450 participating** organizations and individuals
- + Participants are from **31 countries**
- + **Registration** at: www.hpccexperiment.com , www.cfdexperiment.com , www.compbioexperiment.com , www.bigdataexperiment.com
- + **60 teams** have been formed in Rounds 1 & 2
- + **Round 3** started April 1, 2013



HPC Experiment- Team 26

Simulating Stent Deployment using SIMULIA's Abaqus/Standard and Remote Viz Software from NICE to run Abaqus/CAE on SGI Cyclone™

The analysis associated with this project is directed at the assessment of a fictitious balloon expandable stent design from the standpoint of device response to loading onto a delivery system, deployment, physiological pulsatile loading and both axial and radial compression.

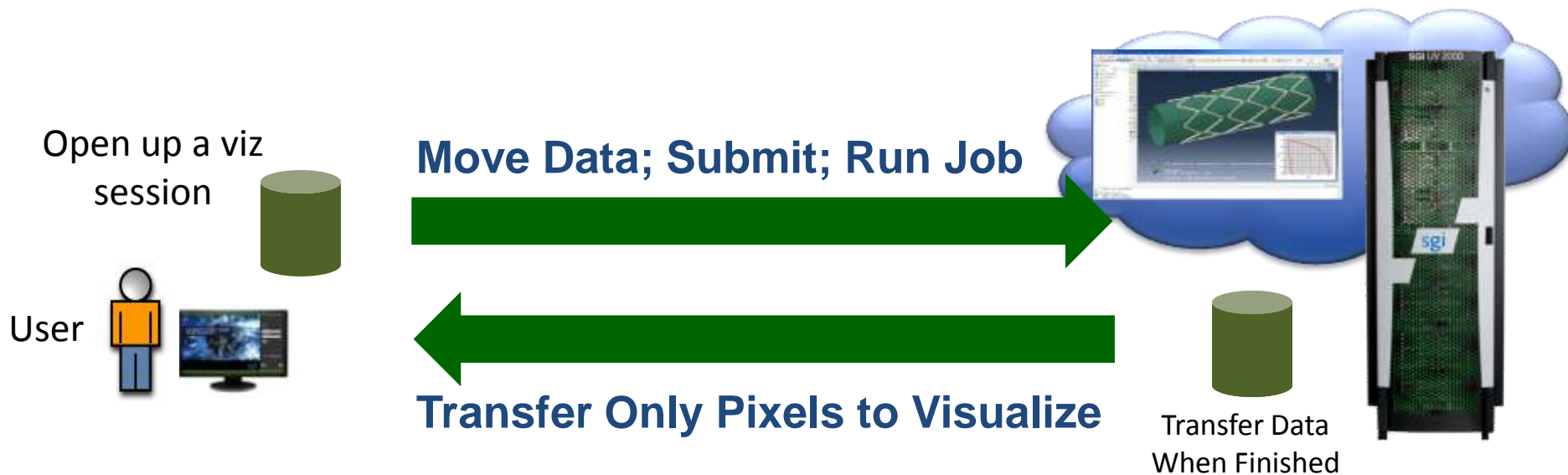


Team 26- Members

- + **End User:** Global Designer and Manufacturer of Sterile Medical Products
- + **CAE Software Provider:** Matt Dunbar, Chief Architect, SIMULIA
- + **Remote Viz Software:** NICE Desktop Cloud Visualization (DCV)
- + **HPC/CAE Expert:** Scott Shaw, Senior Applications Engineer, SGI.
- + **Resource Provider: SGI Cyclone.** Tony DeVarco, Senior Manager for Strategic Partners and Cloud Computing at SGI. Eugene Kremenetsky, Systems Engineering Technical Lead at SGI
- + **Team Mentor:** Gregory Shirin from the HPC Experiment team

What questions were being asked?

1. Is running Abaqus production jobs in a HPC cloud feasible?
2. How hard is it to set up “cloud bursting” capability when local resources are not available?
3. How well does remote visualization tools work?



So what was to be tested by the End User in SGI Cyclone?

What Was Offered

- + For the experiment it was agreed the Simulia and SGI would provide the end user with Abaqus licenses for up to 128 cores in order to see if running a job on more cores could reduce the time to finish the job.
- + Access to NICE DCV remote graphics software to view the results with Abaqus/CAE in Northern California before downloading them to the End User office on the US East Coast.

Remote Visualization Interface

The screenshot displays the enginframe web interface. At the top, the browser address bar shows the URL: `cy001.sgi.com:8080/enginframe/views/efviews_demo.sm?_url=/com.ef.views.services/efviews.lst.sessions`. The page header includes the enginframe logo and a navigation menu with items: Home, My Sessions, My Data, My Jobs, All Jobs, Cluster Load, and File Manager. A sidebar on the left lists Desktop, iTerm, and other applications. The main content area features a table of sessions with columns for Name, Status, Sharing, Started on, and Running on. A search bar and filters are also present.

Name	Status	Sharing	Started on	Running on
Abacus	Running	Not shared	Today 10:54:23	zy001-gfc
Abacus	Expired	Not shared	Today 10:47:08	

Below the table, a 3D visualization window is open, showing a cylindrical mesh structure. The visualization includes a color scale for PEEQ (normal) ranging from 0.0000 to 1.0001. The mesh is rendered in a blue and green color scheme, indicating stress distribution. The visualization window also displays a file explorer on the left and a status bar at the bottom.

Challenges, Barriers, Lessons Learned

- + Getting customer's IT to open up firewall ports
- + Data transfer via the network was found to be slow. Final results might be better transferred through an external USB hard drive via FedEx.
- + Data security and privacy – assurance of the best possible data stewardship is critical from the standpoint of protecting the customer's intellectual property.
- + For an Abaqus user using SGI Cyclone is a viable solution for both compute and visualization.
- + The remote visualization aspect of the solution was impressive

Top benefits for the End User

1. Gained increased understanding of using a cloud-based solution for doing Abaqus based FEA simulations.
2. Shifting computational work to the cloud during periods of full utilization of in-house compute resources is a viable approach to ensuring analysis throughput.
3. Participation in the experiment allowed direct assessment of speed and integrity of remote viz of computational models (both pre- and post-processing) for a variety of model and output database sizes.
4. SGI/Nice DCV provides robust solution permitting fast and accurate remote manipulation of the computational models used in the study.

Teams, it's all about teams

20 teams from Round 1:



- + Anchor Bolt
- + Resonance
- + Radiofrequency
- + Supersonic
- + Liquid-Gas
- + Wing-Flow
- + Ship-Hull
- + Cement Flow
- + Sprinkler
- + Space Capsule
- + Car Acoustics
- + Dosimetry
- + Weathermen
- + Wind Turbines
- + Combustion
- + Blood Flow
- + ChinaCFD
- + Gas Bubbles
- + Side impact
- + ColombiaBio





Teams in Round 2

- + Simulating **stent** deployment
- + Ventilation benchmark - Simulating free **convection** in a room
- + Two-phase **flow** simulation of a separation column
- + CFD simulations of vertical and horizontal **wind turbines**
- + Remote Visualization
- + Simulating **acoustic** field around a person's head (near-field HRTF)
- + **Drifting snow** in urban environments and on building rooftops
- + Simulation of flow around a hull of the **ship**
- + Simulating **steel** to concrete fastening capacity for an anchor bolt
- + Simulating water flow through an irrigation water **sprinkler**
- + Numerical EMC and **Dosimetry** with high-resolution models
- + Ensemble simulation of **weather** at 20km and higher resolution
- + Simulating radial and axial **fan** performance
- + Gas turbine **gas dilution** analysis
- + Simulating wind tunnel **flow around bicycle** and rider
- + Interactive **Genomic** Data Analysis in the Cloud

Do all teams succeed?

- + Certainly not!
- + We don't artificially push teams towards success. Teams work autonomously.
- + We prepare the environment for them to succeed. The rest is up to the members of the teams.

Why projects failed, especially early in the process

- + End-user's ISV is not ready for remote, on-demand, pay-per-use licensing
- + End-user's software is not yet installed on the remote computer, and the process of installing it on a system which is not ready is complex
- + Matching the requirements of the actual application software release with the version of the underlying system's middleware can be a roadblock
- + Fulfilling the registration, authentication and authorization requirements of a remote computing site can take several weeks
- + Finding the necessary HPC expertise required to implement and run the software on the remote resource can be a challenge
- + Team members are very busy with their day job, that it can take days or even weeks to jointly define and agree on the next step and thus delay a project dramatically

Our recipe for success

- + Find the best matches and form the team
- + Step by step process
- + Collaborative tools
- + Experienced mentors
- + Exhibit – list of services to pick from
- + Community – help available when needed

Step by Step process

Team 404: Simulating life beyond the Internet ☆

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[23 Discussions](#) [24 To-dos](#) [2 Files](#) [6 Text documents](#) [Dates](#)

Discussions



Burak Y. [Welcome to the HPC Experiment BaseCamp page](#) - Please start by reading the "How to get Started with BaseCamp" text document below.

To-do lists

Step 1. Define the end-user project by completing the following to-do's

- 1.1 Team Expert fills out "Project definition" text document with support from End User
- 1.2 Organizer assigns Software Provider based on "Project definition" text document
- 1.3 Organizer assigns Resource Provider based on "Project definition" text document
- 1.4 Team Expert calls for a kick-off meeting over Skype via Doodle event scheduler

Experienced Team Mentors

Gregory Shirin is highly diversified, educated, energetic and result oriented **Senior Program / Project manager** with over 40 years of experience from various functions in SW development in **Grid and Cloud Computing** including New Product Introduction, HW&SW Life Cycle, OEM. Partners and Business Development. He is currently consulting at Grid Dynamics



Dennis Nagy is a broad **expert in engineering simulation (CAE)**, with over 40 years of experience from R&D, university teaching, through commercial software development, support, sales, sales and marketing management, to executive management. He is the Principal at [BeyondCAE](#), a **strategy and business development** consulting activity.

Exhibit – list of services to pick from

UberCloud Exhibit



Participants – resource providers



Participants – resource providers



Participants – resource providers



Wrocławskie Centrum Sieciowo-Superkomputerowe



WCSS



UNIVERSIDAD
PONTIFICIA
DE SALAMANCA



UNIVERSIDADE DA CORUÑA



peer1
hosting

MEGWARE
SUPERCOMPUTING
TECHNOLOGY

 **GOMPUTE**
A GRIDCORE COMPANY

Participants – resource providers



Ohio Supercomputer Center

OCF

SABALCORE
[WHERE DATA BECOMES DISCOVERY]

Stanford
University



Oxalya

The Oxalya logo consists of a stylized, dark blue, three-dimensional ring or torus shape, resembling a Möbius strip, positioned above the word "Oxalya" in a bold, sans-serif font.

CoinLab

The CoinLab logo features the word "CoinLab" in a white, sans-serif font on a dark blue rectangular background. Above the letter 'i' in "Coin" are three small, white circles of varying sizes, arranged in a vertical line.

Participants – resource providers



Participants – software providers



CST



Open  FOAM

Participants – software providers



Participants – software providers



Participants – software providers



DATAADVANCE

Numerate



PhenoSystems®

Systemix Institute
Frontier in Bioinformatics

Participants – software providers



Participants – software providers



CloudBroker

Participants – expertise providers



Participants – expertise providers



MONASH University



National
College of
Ireland



HPC Links



UNIVERSIDAD COMPLUTENSE
MADRID

Participants – expertise providers



Participants – expertise providers



Participants – expertise providers



The University of Manchester



Innovation and Technology

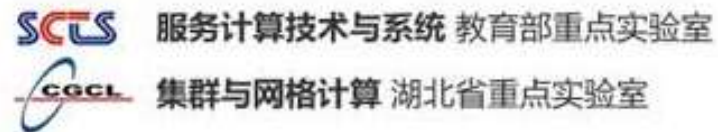


universidade de aveiro

Participants – expertise providers



Participants – end-users



Participants – end-users



Foldyne

Participants – end-users

BC BISCARRI
CONSULTORIA

LM WIND
POWER

ATKINS

 **Combustion**
Science & Engineering, Inc.

Participants – end-users



Université
de Liège

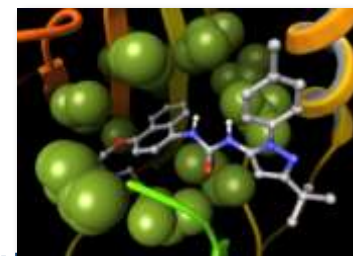


CFD Consultants



UberCloud Round 3

- + April – June 2013
- + Expecting **500** organizations, ready for **40** more teams
- + **Extending** applications: HPC, CAE, Life Sciences, Big Data
- + Better **guidance**: 25-steps end-to-end process
- + Better Basecamp 'team rooms' for **collaboration**
- + Growing the UberCloud **Exhibit** services directory
- + **3-level support**: front line (within a team), 2nd level (UberCloud Mentors), 3rd level (software & hardware providers)
- + Introducing the first commercial brokerage services, for a fee



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Thank You

<http://www.hpccexperiment.com>

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<http://www.bigdataexperiment.com>