Cloud: The Next Disruption in HPC

Gabriel Broner, VP & GM of HPC, Rescale
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Agenda

- Evolution of High Performance Computing
- Disruptions and Challenges
- HPC in the Cloud
- Use Cases
- What is needed in the Cloud
- Intro to Rescale
- Incorporating Cloud in HPC
- The Future
High Performance Computing

Aerospace

Oil & Gas

Automotive

Life Sciences
Evolution of HPC

Cray 1
1976

Special Architecture
160 MegaFlops
Evolution of HPC

Cray T3E MPP
1995

Standard Processors
2048 nodes
1 TeraFlop
Evolution of HPC

SGI NASA Columbia
2004
60 Teraflops
Evolution of HPC

SGI NASA Pleiades 2018
7 Petaflops
Standard Intel Nodes
Evolution of HPC

Barcelona Mare Nostrum
2018
11 Petaflops
Supercomputing Performance (FLOPS)
High Performance Computing

A History of Disruptions

Cray 1
Proprietary
1970s

Cray MPP
Standard CPU, Memory
1990s

SGI Altix
Linux
2000s

SGI ICE
Intel 2-cpu nodes
Now
Processor Performance Reaching a Plateau

40 Years of Microprocessor Trend Data


- Transistors (thousands)
- Single-Thread Performance (SpecINT x 10^3)
- Frequency (MHz)
- Typical Power (Watts)
- Number of Logical Cores
Multiple Architectures

More difficult to select an on-premise system

“What architecture should I buy?”
HPC in the Cloud

- Instant access to unlimited resources
- Choice of architectures
- Applications available and tuned
- Application runs on best suited architecture
- Jobs run with no wait
- Engineers not constrained by the size of a system

- Faster innovation, shorter cycles, improved time to market
- Immediate provision, variable size, no capital investment
- System utilization, job queues, downtimes, are a thing of the past
Automotive Supplier Challenge

What size on-premise system should I buy?

- $4M for a system with high utilization, wait in queue
- $20M for a system sized for the peaks, no wait
Automotive Supplier

*With Cloud HPC*

With Rescale, match the workload needs at $50-100K per month
Automotive Supplier

With Cloud HPC

- Depreciation of a $4M system is $111K per month - Rescale costs less
- Users run with no wait, like if owning a $20M system sized for the peaks
Wing Design

*With Cloud HPC*

- Instant access to a large system
- 3 month development in 24 hours
- 787 wing lighter by 150 pounds
- Cost savings of $180M
Rocket Design

With Cloud HPC

- Instant access to 1000 cpus
- Development speedup of 24x
- Tens of thousands of simulations validate design before launch
Formula 1 Racing

With Cloud HPC

- Real world sensor data
- Trackside simulation
- 3000 simulations per lap
- F1 team adjusts race strategy
Designing and Flying a Supersonic Virtual Plane

With Cloud HPC

- Pilots fly in the simulator the model of the plane being designed
Challenge: Accessing Diverse Data Centers

USA
LATAM
Europe
Asia

- RESCALE PLATFORM
- NUMBER OF DATA CENTERS AT LOCATION
Challenge: Availability of Applications
Challenge: Run on the best suited architecture

**Abaqus/Standard**
- 10 GbE Network
- 31 GB SSD Storage
- 3.3 GB Memory
- 16 K80 GPU & 32 CPU

**LS-DYNA**
- Infiniband Network
- 50 GB Storage
- 8 GB Memory
- 256 CPU

**TensorFlow**
- 10 GbE Networking
- Storage
- Memory
- TPU

On demand cluster provisioning

Up to **5X speed up** over standard hardware

Up to **2X speed up** over standard hardware

Up to **30X speed up** over standard GPUs
Challenge: Reliability and Security

SOC 2 Type 2 Certified  ISO 27001 Certified  CSA Certified  ITAR Compliant
Challenge: Simple User Interface
Intro to Rescale
Founded in 2011, **San Francisco, USA HQ**
APAC office Singapore/Tokyo, EMEA office Munich

Cloud-based HPC and simulation platform
**100+ data centers, 250+ software solutions**

**100+ leading Global 2000 enterprise customers**

Aerospace  |  Oil & Gas  |  Automotive  |  Life Sciences  |  Industrials  |  Semiconductor  |  Financial Services

Jeff Bezos  |  Richard Branson  |  Peter Thiel
Rescale is the Leading Enterprise Simulation Platform

Software
- 250+ turnkey software solutions

Multi-cloud
- Hybrid, private, public & on-premise

Workflow
- Support team; ease of use; customized

Administration
- Manage usage, Costs & resources

Security
- Data and user security
Rescale - Cloud HPC Simulation Platform

- Library of 260+ simulation and deep learning software packages
- SaaS workflows for engineers, IT administrators, and ISV partners
- Zero IT footprint, turn-key cloud platform with best-in-class security
- Global HPC resources provided and supported in multiple IT environments
Rescale’s global multi-cloud HPC infrastructure network

Over 100 data centers worldwide
One Platform, All Codes

1. Licenses
On-demand licensing in the cloud or use your existing license.

2. Software
Wide package selection with new versions added regularly.

3. Workflow
Easy workflow for pre- & post-processing. View results online with the GUI app.

4. Support
Best-in-class support from experts through instant chat, email, phone.

*NOT EXHAUSTIVE
Performance Tuning
Automated tuning through proprietary software results in sustainable best performance
A seamless experience for Enterprise IT

Rescale delivers Best-in-class security layer across entire platform

Compliant with the strictest industry security standards

- Full administrative management and IT dashboard provide comprehensive controls and visibility
- Software defined security policy implementation tools to enforce proper IP handling
- Encryption in transfer with high-grade TLS and multi-layered encryption at rest with 256-bit AES

SOC 2 Type 2 Attested  CSA Registered  ITAR Compliant  HIPAA Certified

* Not available in all geographical regions.
Hybrid - Incorporating Cloud in HPC
Incorporating Cloud in HPC

1. Move selected jobs to the cloud

Select a few jobs to move to the cloud
Use the Rescale portal directly

Most jobs continue to run on premises unchanged

Rescale portal
GUI and API

In house HPC systems

Job Scheduler
Incorporating Cloud in HPC

**Iterate**

Learn from experience
Iterate
Move bigger jobs and more users to the cloud
Refine implementation

- **Rescale portal**
- **Rescale cloud**
- **In house HPC systems**
Incorporating Cloud in HPC

2. Access cloud and on premise from the Rescale portal

Rescale cloud

Rescale portal submits jobs to the cloud and on premises

Multiple in house HPC systems can be pooled behind the Rescale interface
Accounting and tracking

Continue to run on-premises unchanged

Job Scheduler

Rescale portal

In house HPC systems
Incorporating Cloud in HPC

Cloud and on-premise systems offered through the Rescale portal

Cloud

On Premise

Rescale cloud

Rescale portal

In house HPC systems

Job Scheduler
Incorporating Cloud in HPC

3. Offer in-house systems in the external cloud

- Offer in-house systems in the cloud
- Control access

- Get Rescale credit dollars

In house HPC systems

Job Scheduler

Rescale portal

Rescale cloud
Incorporating Cloud in HPC

Future State

Flexibly use on premise and cloud

Rescale portal
GUI and API

In house HPC systems
Big Compute

The Future

Deep Learning SaaS

Intelligent Algorithms

Link: Rescale Deep Learning

Real-Time IoT at F1

Video: Formula 1 Real-Time IoT Simulation

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Big Data & IoT

ScaleX Labs with Intel

Link: Intel ScaleX Labs

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Specialized Hardware

Digital Mfg with DMDII

Simulation at Boom Supersonic

Video: Rescale Night Boom Keynote

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Simulation & Digital Twin

Video: Rescale Night Boom Keynote

Gabriel Broner, Rescale – Cloud: The Next Disruption in HPC – March 2018
"Like the previous disruptions of clusters vs. monolithic systems or Linux vs. proprietary operating systems, cloud changes the status quo, takes us out of our comfort zone, and gives us a sense of lack of control. But the effect of price, the flexibility to dynamically change your system size and choose the best architecture for the job, the availability of applications, the ability to select system cost based on the needs of a particular workload, and the ability to provision and run immediately, will prove very attractive for HPC users."

Read the Full Story
Gracias      Thanks      Gràcies