



Powering Innovation That Drives Human Advancement

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# Key Findings of Surveys on Cloud Computing for Engineering Simulation

Wim Slagter, PhD

Director, Partner Programs

# Ansys – 50+ Years of Simulation Innovation and Leadership

**5,600+**  
GLOBAL EMPLOYEES

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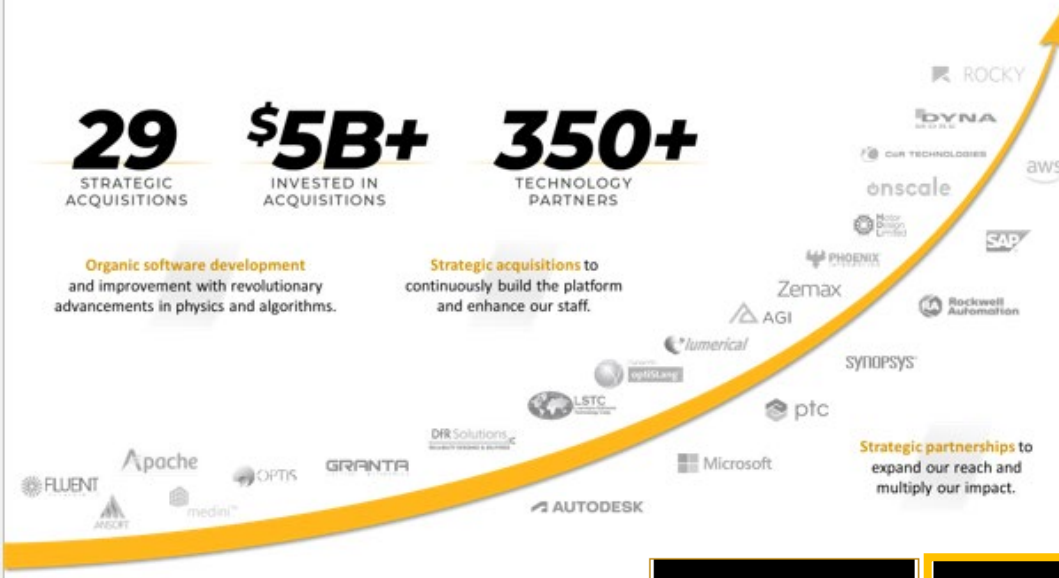
**\$2.3B**  
2023 TOTAL REVENUE

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**86**  
OFFICES WORLDWIDE

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**CADagnostic**

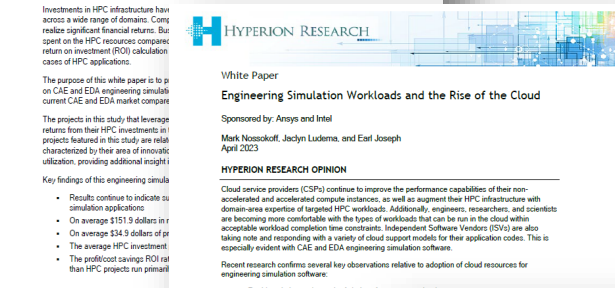


NUMERICAL METHODS	HIGH-PERFORMANCE COMPUTING	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	CLOUD AND EXPERIENCE	DIGITAL ENGINEERING
<ul style="list-style-type: none"> <li>• Solver methods</li> <li>• Geometry and meshing</li> <li>• Shape and topology optimization</li> <li>• Advanced analysis</li> <li>• Multi-physics</li> <li>• Multi-scale</li> </ul>	<ul style="list-style-type: none"> <li>• Shared-memory</li> <li>• Message-passing</li> <li>• Fine-grained GPUs</li> <li>• New architectures: FPGAs &amp; AI Hardware</li> <li>• Quantum computing</li> </ul>	<ul style="list-style-type: none"> <li>• Solver acceleration</li> <li>• Solver settings</li> <li>• Top-down methods</li> <li>• Bottom-up methods</li> <li>• Reduced order models</li> <li>• Generative AI</li> </ul>	<ul style="list-style-type: none"> <li>• Cloud Enabled</li> <li>• Cloud Native</li> <li>• Platform, Collaboration</li> <li>• Open APIs and developer ecosystem</li> <li>• Common user experience</li> </ul>	<ul style="list-style-type: none"> <li>• MBSE</li> <li>• Requirements &amp; architecture connections</li> <li>• Safety, security &amp; software</li> <li>• Digital twins</li> <li>• Simulation process &amp; data management</li> <li>• Mission Engineering</li> </ul>

# Cloud computing for engineering simulation – context of the surveys

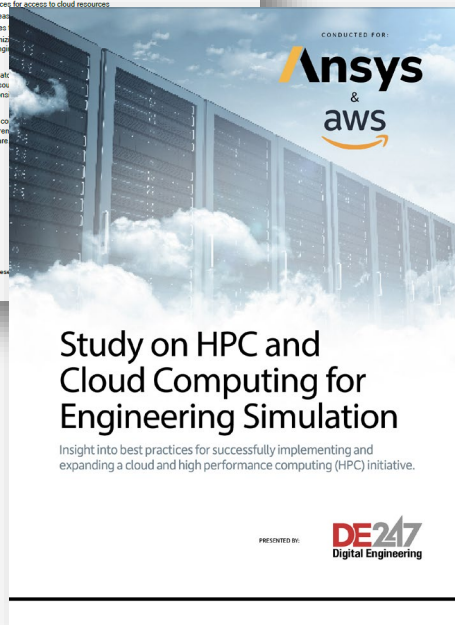


**Objective of surveys:** to better understand the usage, adoption and ROI of HPC and cloud-enabled engineering simulations.



**Focus of my presentation:** reveal insights in the following areas:

- Engineering challenges
- Driving factors for cloud-enabled simulations
- Methods for accessing cloud resources
- Best practices for implementing/expanding cloud-enabled simulations



**Surveys were conducted by Peerless Research Group and Hyperion Research** for Ansys and sponsored by Amazon Web Services (AWS) and Intel, resp. The total number of survey respondents was **more than 800 people**, including both Ansys and non-Ansys CAE customers.



# Customer Challenges

# Customer challenge: Reducing time to solution

**54 %**

Said their top business challenge in design activities is pressure to reduce design cycle times

**30 %**

Reported that most of their simulations run overnight and take 9 hours or more to complete

**38 %**

Limit the size and amount of detail in simulation models due to turnaround time limitations

Source: [Study on HPC and Cloud Computing for Engineering Simulation](#) conducted by PRG in 2023 for Ansys and AWS.

# Customer challenge: Lack of IT expertise, support and hardware

**44 %**

Do not have the expertise on its design teams and/or IT support group to expand the use of simulation tools\*

**48 %**

Does not have sufficient IT hardware and support infrastructure to use simulation tools\*

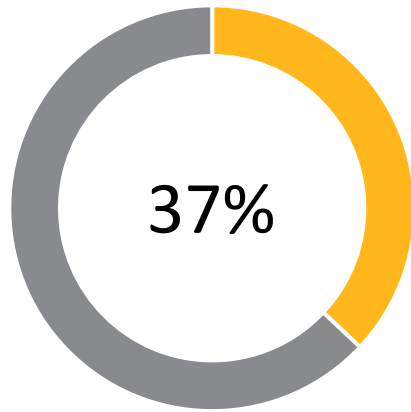
**#1**

Roadblock for HPC sites is the growing scarcity of HPC experts^

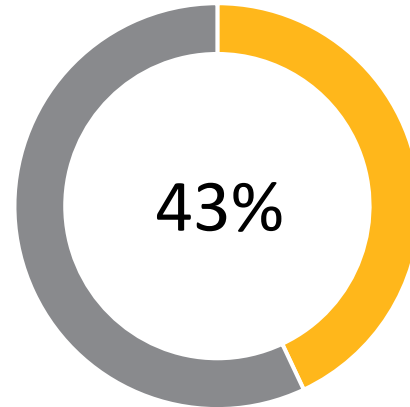
Source (\*): [Study on HPC and Cloud Computing for Engineering Simulation](#) conducted by PRG in 2023 for Ansys and AWS.

Source (^): [Hyperion Research HPC Market Update](#), March 2022.

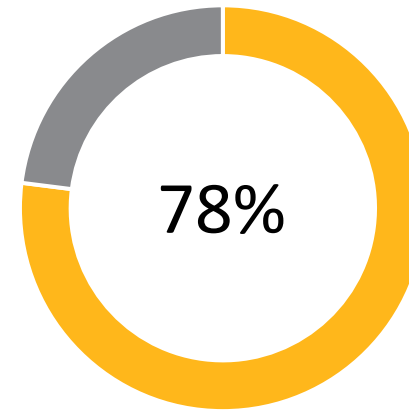
# Many engineers are compute bound



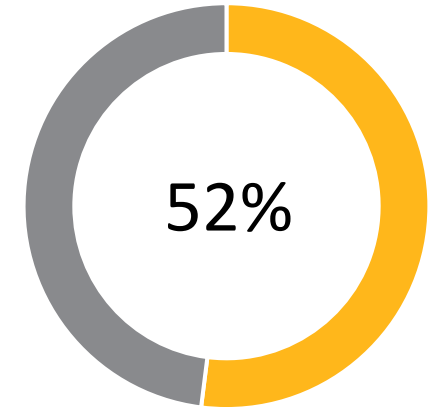
of users  
exclusively  
running on a  
desktop computer



of users running  
on 12 CPU cores  
or less



of users  
constrained due  
to turnaround  
time limitations



of users getting low  
fidelity results in  
more than half of  
the time

Source: [Study on HPC and Cloud Computing for Engineering Simulation](#) conducted by PRG in 2023 for Ansys and AWS.

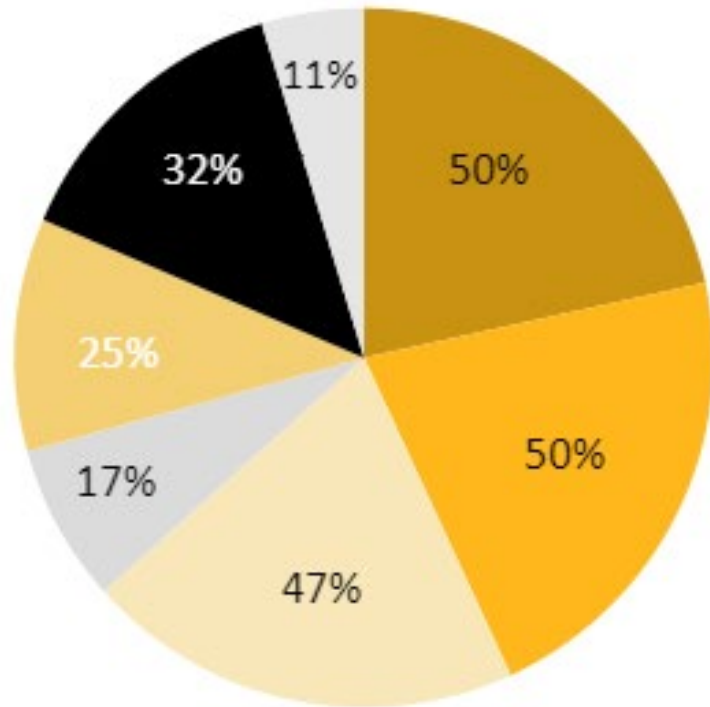


# Driving Factors for Cloud-Enabled Simulations



# Cloud has become important to reduce turnaround time limitations

## What strategies would best reduce turnaround time limitations on simulation?



- Replace current hardware by new, better performing hardware
- Upgrade existing hardware
- Add HPC software licenses
- Use of Partner Managed Cloud solutions
- Use of ISV-managed SaaS solution
- Use of public cloud solution
- Not sure, don't know

Note: Multiple answers accepted

Base: 344

Source: [Study on HPC and Cloud Computing for Engineering Simulation](#) conducted by PRG in 2023 for Ansys and AWS.

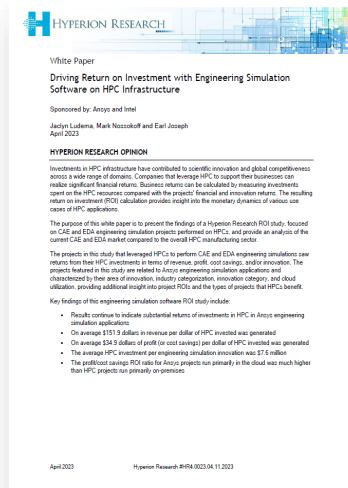
# HPC drives high financial ROI for customers

Analysis of 71 Ansys projects reveals **very substantial returns** for customers' HPC investments:

- **Revenue:** \$152 dollars per dollar of HPC invested, on average
- **Savings:** \$35 dollars per dollar of HPC invested, on average

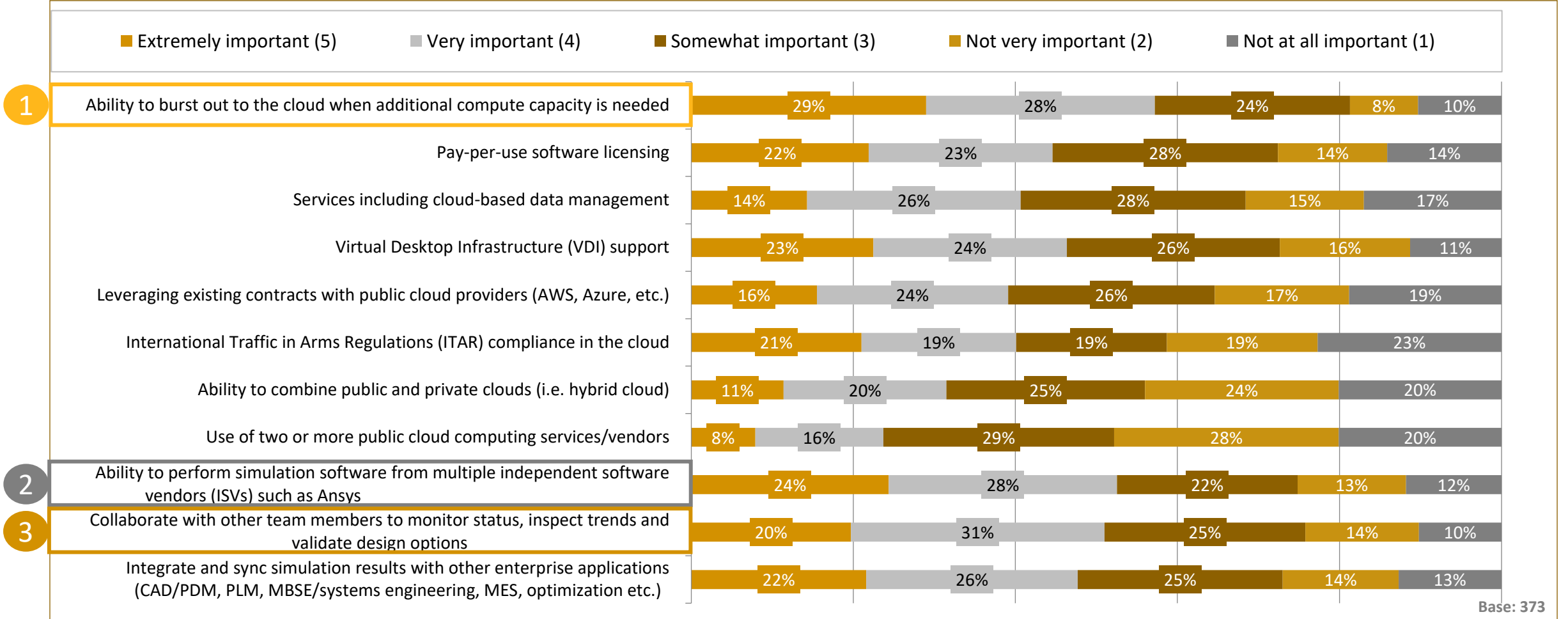
Ansys Deployment	Revenue per Dollar of HPC Invested	Savings per Dollar of HPC Invested
Primarily on-premises (> 90% of runtime)	\$225	\$30
Primarily in the cloud (> 90% of runtime)	\$70	\$56
Hybrid on-premises and in the cloud	\$46	\$26
<b>Average ROI</b>	<b>\$152</b>	<b>\$35</b>

Source: [Driving Return on Investment with Engineering Simulation Software on HPC Infrastructure](#) conducted by Hyperion Research in 2023 for Ansys and Intel.



# Burst capacity is the most important cloud capability

## What are the most important capabilities or attributes to your organization when seeking a cloud solution?



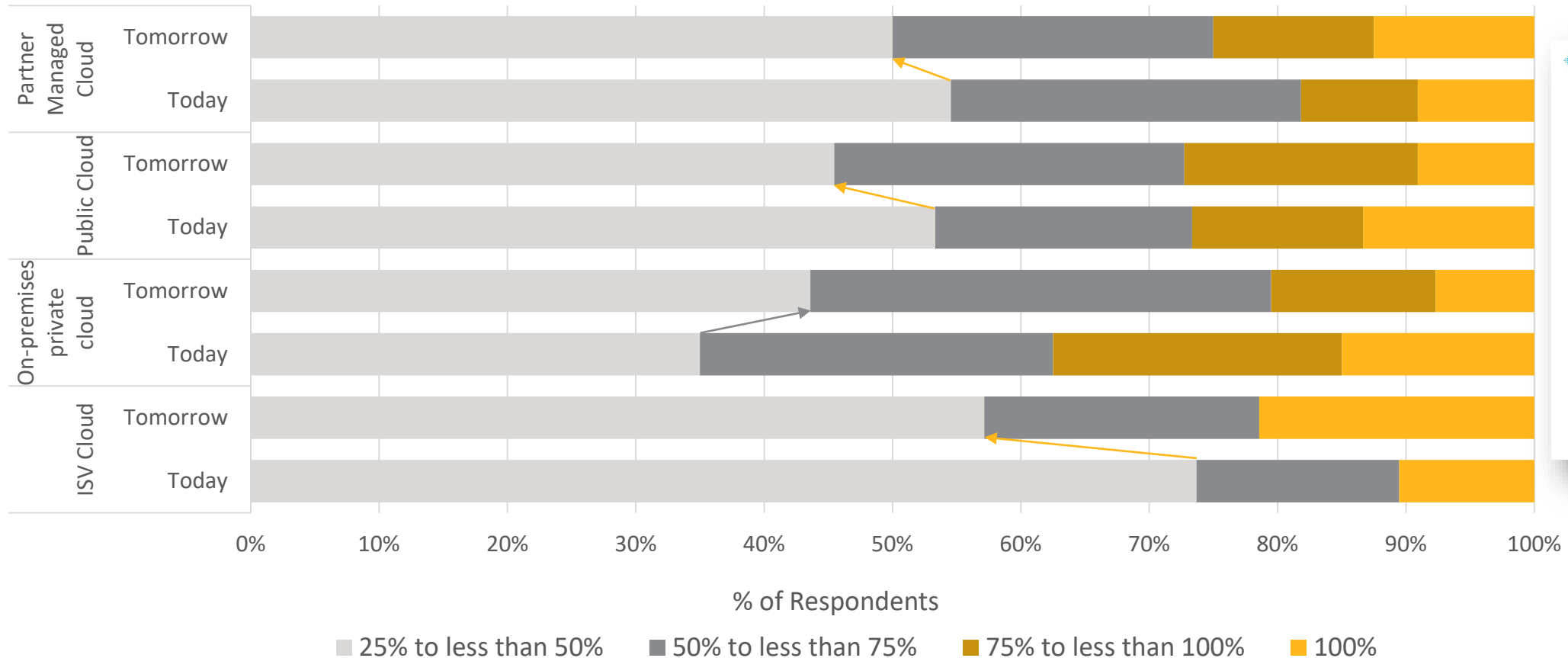
Source: [Study on HPC and Cloud Computing for Engineering Simulation](#) conducted by PRG in 2023 for Ansys and AWS.



# Methods for Accessing Cloud Resources

# Mix of platforms in use for simulations with expected cloud increase

## Cloud Access Method Adoption for Utilization Levels above 25%



Source: [Engineering Simulation Workloads and the Rise of the Cloud](#) conducted by Hyperion Research in 2023 for Ansys and Intel.

**HYPERION RESEARCH**

White Paper  
**Engineering Simulation Workloads and the Rise of the Cloud**  
 Sponsored by: Ansys and Intel  
 Mark Nicoskoff, Jaclyn Ludema, and Earl Joseph  
 April 2023

**HYPERION RESEARCH OPINION**

Cloud service providers (CSPs) continue to improve the performance capabilities of their non-accelerated and accelerated compute instances, as well as augment their HPC infrastructure with domain area expertise of targeted HPC workloads. Additionally, engineers, researchers, and scientists are becoming more comfortable with the types of workloads that can be run in the cloud within acceptable workload completion time constraints. Independent Software Vendors (ISVs) are also taking note and responding with a variety of cloud support models for their application codes. This is especially evident with CAE and EDA engineering simulation software.

Recent research confirms several key observations relative to adoption of cloud resources for engineering simulation software:

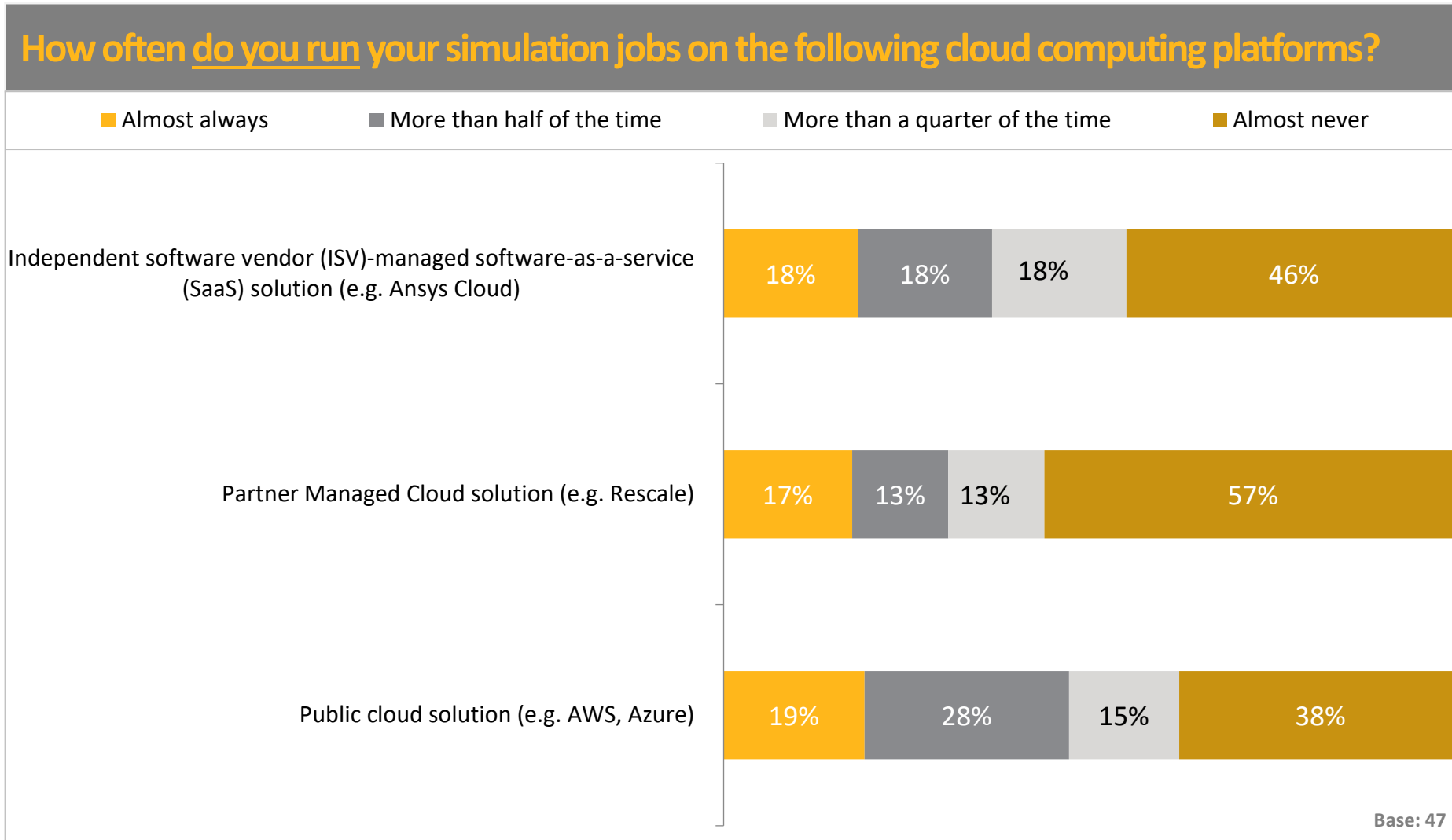
- Rapid evolution and growth of choices for access to cloud resources
- Divergent HPC application focus areas among the public CSPs
- Growing reliance on cloud resources for CAE and EDA engineering workloads
- Importance of integrating and optimizing engineering workflows to include on-premises resources, cloud resources, and engineering simulation software

Application software is a common denominator within this ecosystem. Software must run performantly within both on-premises and cloud HPC resources, work seamlessly between those operating environments, and provide a simple and consistent user experience for engineers, scientists, and researchers regardless of where it is run.

Within the engineering simulation software community, Ansys is an example for others to emulate in bridging the usage and capabilities of on-premises and cloud HPC resources for CAE and EDA engineers to employ their simulation software.

April 2023      Hyperion Research #R14-0024-04-24-2023

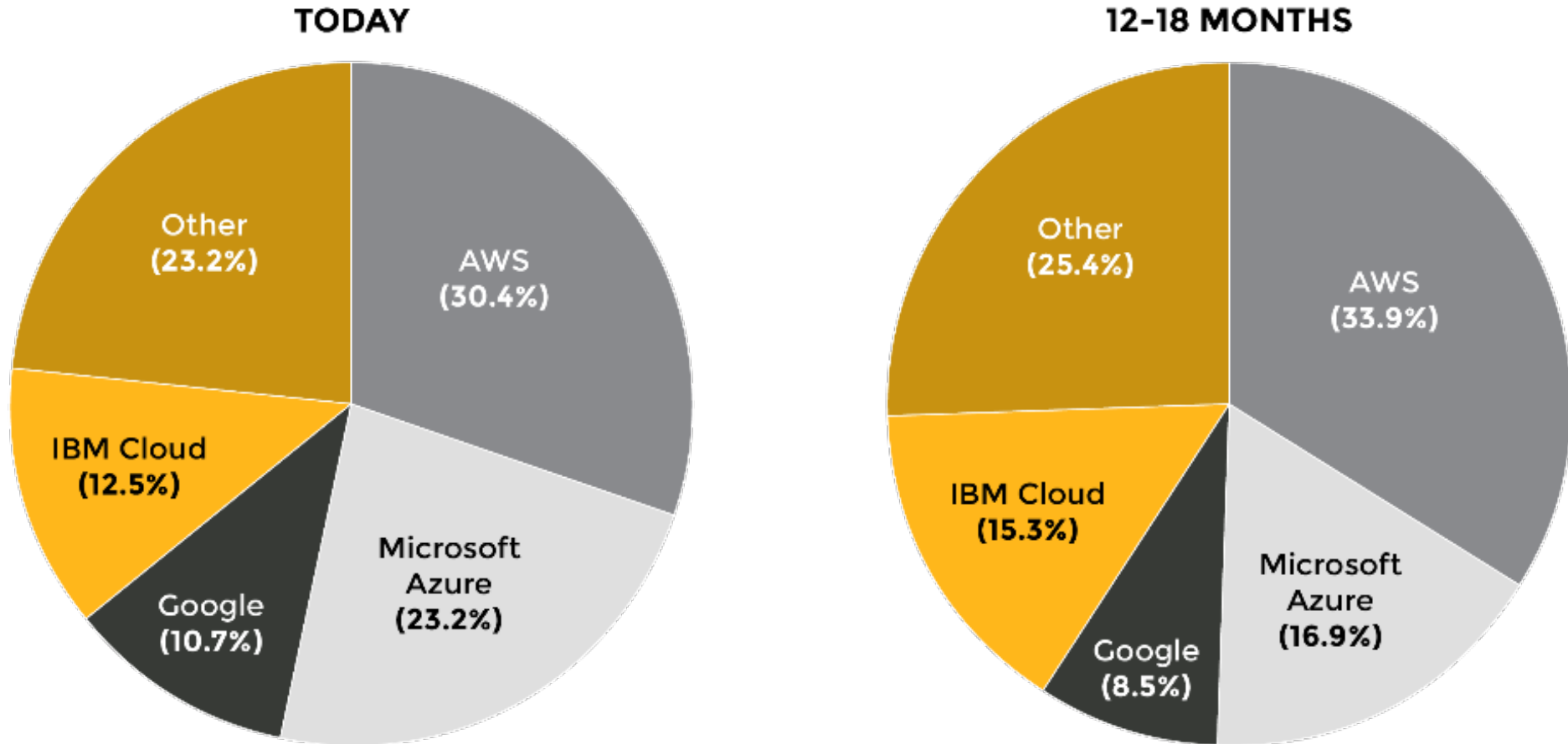
# Mixed usage of cloud platforms, public cloud most frequently used



Source: [Study on HPC and Cloud Computing for Engineering Simulation](#) conducted by PRG in 2023 for Ansys and AWS.

# Preference for major Cloud Service Providers

Who is your primary provider for 3rd party cloud-based engineering simulation resources today and in 12-18 months?



Base: 56

Source: [Engineering Simulation Workloads and the Rise of the Cloud](#) conducted by Hyperion Research in 2023 for Ansys and Intel.

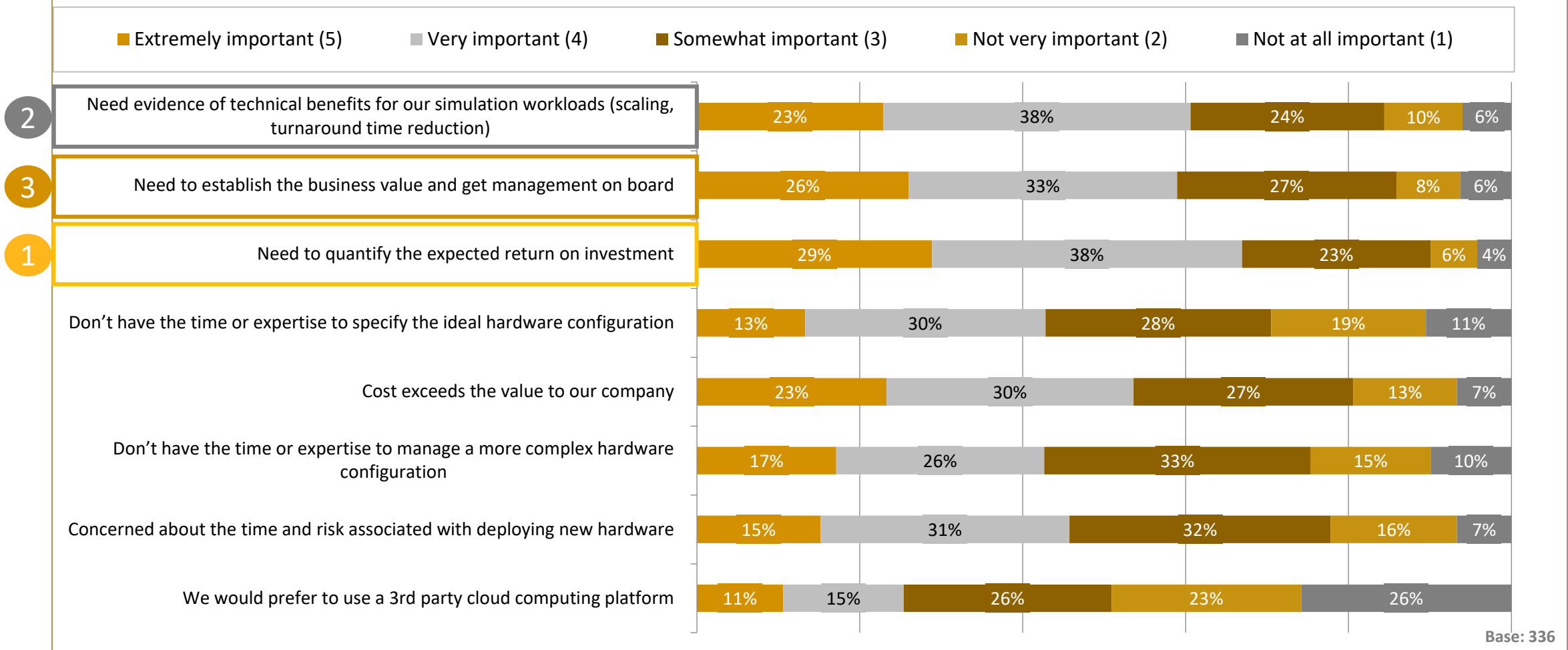


# Best Practices for Implementing/Expanding Cloud-Enabled Simulations



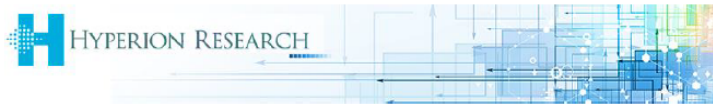
# Make the business case before acquiring HPC

## Rating of important needs to your company before acquiring new HPC hardware and infrastructure for simulation workloads



Source: [Study on HPC and Cloud Computing for Engineering Simulation](#) conducted by PRG in 2023 for Ansys and AWS.

# Get some proof points of financial ROI of HPC



White Paper

## Driving Return on Investment with Engineering Simulation Software on HPC Infrastructure

Sponsored by: Ansys and Intel

Jaclyn Ludema, Mark Nossokoff and Earl Joseph  
April 2023

### HYPERION RESEARCH OPINION

Investments in HPC infrastructure have contributed to scientific innovation and global competitiveness across a wide range of domains. Companies that leverage HPC to support their businesses can realize significant financial returns. Business returns can be calculated by measuring investments spent on the HPC resources compared with the projects' financial and innovation returns. The resulting return on investment (ROI) calculation provides insight into the monetary dynamics of various use cases of HPC applications.

The purpose of this white paper is to present the findings of a Hyperion Research ROI study, focused on CAE and EDA engineering simulation projects performed on HPCs, and provide an analysis of the current CAE and EDA market compared to the overall HPC manufacturing sector.

The projects in this study that leveraged HPCs to perform CAE and EDA engineering simulations saw returns from their HPC investments in terms of revenue, profit, cost savings, and/or innovation. The projects featured in this study are related to Ansys engineering simulation applications and characterized by their area of innovation, industry categorization, innovation category, and cloud utilization, providing additional insight into project ROIs and the types of projects that HPCs benefit.

Key findings of this engineering simulation software ROI study include:

- Results continue to indicate substantial returns of investments in HPC in Ansys engineering simulation applications
- On average \$151.9 dollars in revenue per dollar of HPC invested was generated
- On average \$34.9 dollars of profit (or cost savings) per dollar of HPC invested was generated
- The average HPC investment per engineering simulation innovation was \$7.6 million
- The profit/cost savings ROI ratio for Ansys projects run primarily in the cloud was much higher than HPC projects run primarily on-premises

April 2023

Hyperion Research #HR4.0023.04.11.2023

In this white paper conducted by **Hyperion Research for Ansys and Intel**, you'll discover that combining Ansys solutions with high-performance computing (either on premises or in the cloud) led to substantial financial returns on investment across industries.

[www.ansys.com/resource-center/white-paper/driving-return-on-investment-with-engineering-simulation-software-on-hpc-infrastructure](http://www.ansys.com/resource-center/white-paper/driving-return-on-investment-with-engineering-simulation-software-on-hpc-infrastructure)

# Ansys Cloud Solutions: *enabling location-independent and unconstrained computing*



GATEWAY



**Bring your own AWS cloud (BYOC)  
+  
Bring your own licenses (BYOL)**

Cost effective cloud compute with 50+ pre-configured  
Ansys apps. optimized on AWS

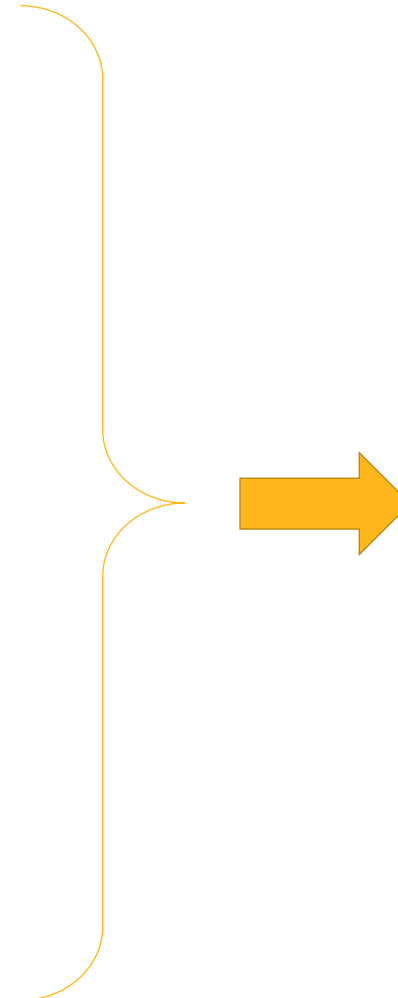
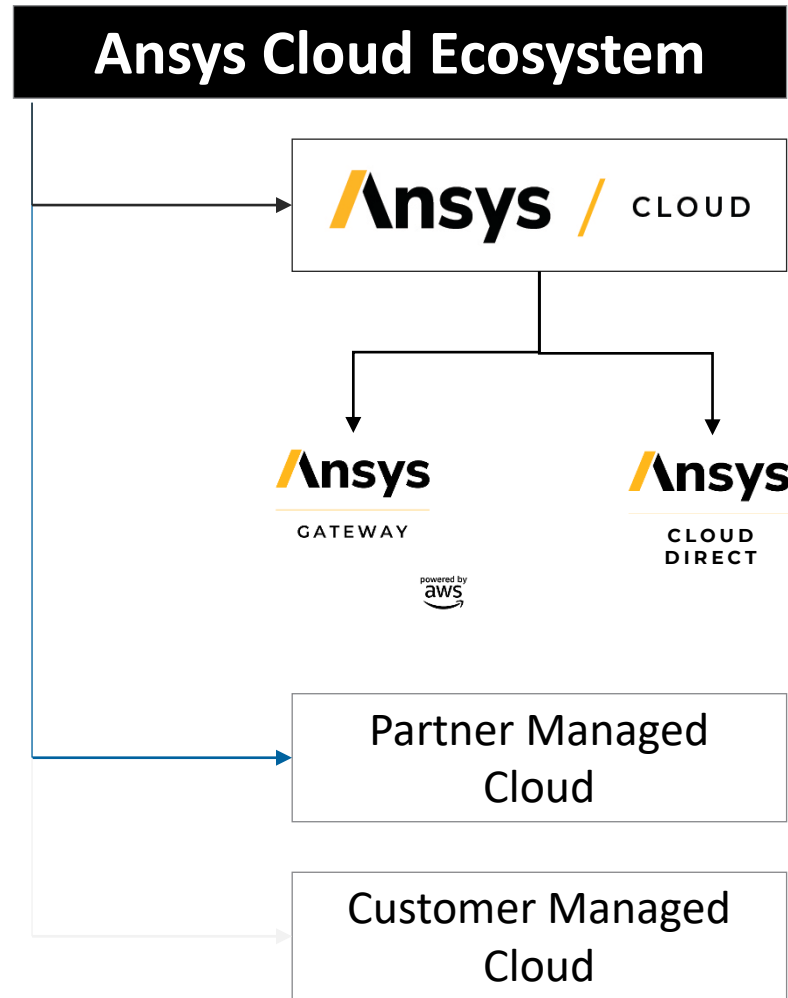


CLOUD DIRECT

**Ansys managed service for high-  
performance computing (HPC)**

HPC cloud simulation platform optimized for Ansys  
apps. on Microsoft Azure

# Ansys Cloud Ecosystem – *enabling customer choice and maximum flexibility*



**A team of Ansys Experts  
at your disposal to help  
you choose the right  
cloud solution!**

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The Ansys logo consists of a yellow slanted bar followed by the word "Ansys" in a bold, black, sans-serif font.

