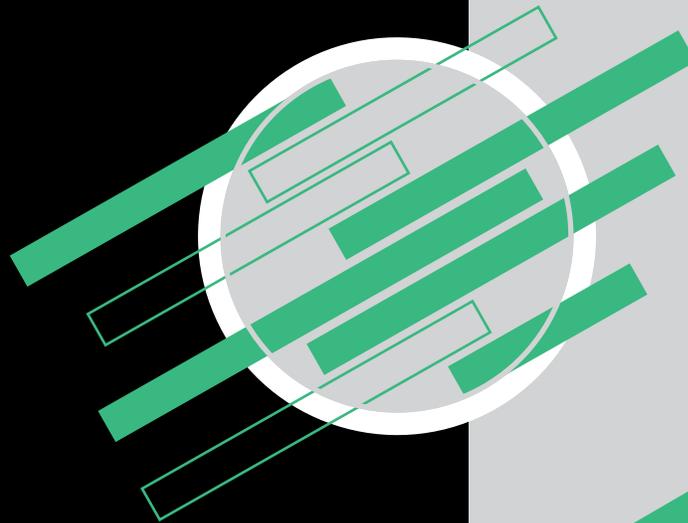


A Forrester Consulting
Thought Leadership Spotlight
Commissioned By Dell Technologies
and Intel

September 2020

HPC And AI In The Cloud: A Spotlight On Higher Education

Higher Education Results From The August 2020
Thought Leadership Paper, “Hybrid Cloud: A
Smart Choice For AI And HPC”



FORRESTER®



Higher education institutions are working to harness the power of cloud for HPC and AI workloads.



Running HPC and AI in a hybrid environment drives significant business benefits.

Introduction

Higher education institutions are no strangers to complex questions, large data sets, and advanced analyses. As such, these organizations have routinely needed high performance computing (HPC) platforms where large clusters of computational nodes conjoin with high volumes of storage and bandwidth to allow for faster computing and complex problem-solving. But as cloud computing increases in popularity, and the need for complex modeling expands from the world of academia into the world of business, the technological and infrastructure options for how to run HPC and other demanding workloads — such as advanced analytics, AI, and machine learning (ML) — expand.

Dell Technologies and Intel commissioned Forrester Consulting to evaluate this trend to understand how cloud is being used to run HPC and AI workloads within higher education institutions. To do so, Forrester conducted an online survey with 155 IT decision makers within higher education organizations across the globe.

KEY FINDINGS

- › **Cloud can be a transformational force for organizations.** Cloud computing is a powerful force with the capacity to truly transform campus administrative operations. However, today, most higher education institutions are either using cloud to improve existing infrastructure, processes, and applications or to add capabilities to on-premises environments, without fundamentally altering operational models. This modernization is a critical step towards advancing AI capabilities.
- › **HPC and AI workloads are starting to move to cloud for efficiency gains.** Though HPC and AI services are mostly run on-premises today, within the year there will be a shift towards more public and private cloud use. Driven by a desire to optimize infrastructure utilization and efficiency, most organizations — moving forward — will work with an environment that encompasses on-premises and cloud options.
- › **Teams struggle with high costs and other challenges.** It's not all smooth sailing. Respondents report issues with security, application architecture, and the work involved getting internal teams up to speed on key skill sets, all while trying to balance the costs and benefits of moving workloads to the cloud.
- › **Hybrid is the new reality for a reason.** It's not simply that teams are choosing to keep some applications on non-cloud infrastructure. IT teams are making infrastructure decisions based on a myriad of business and application requirements. And the fact remains that HPC and AI workloads running in hybrid environments will lead to a slew of business benefits that can help organizations overcome the challenges inherent in cloud migration, while also providing returns on initial investments.

HPC And AI Propel A Move To Cloud

The need to support massive amounts of data and run complex analysis has long necessitated the use of HPC in academia. Additionally, the use of AI and ML are on the rise: 86% of educational organizations will access AI capabilities in some way this year, and 64% either plan to or are already training employees on these technologies.¹

All of this computational work requires a modern IT infrastructure. Our study found that 90% of higher education respondents say their AI initiatives increase the need to modernize servers and HPC, while 79% say the same for hybrid cloud infrastructure. This begs the question of how and why cloud computing is being leveraged to run these workloads. Our study shows:

- › **Cloud is used to extend and improve capabilities.** Higher education IT teams use cloud in a variety of ways (see Figure 1). Though some are merely trying to make incremental improvements, and few lack a formal strategy entirely, the majority of organizations are using cloud as either a way to add capabilities to their on-premises environment or as a means of modernizing existing infrastructure in order to fundamentally change operations. Only 16% have successfully leveraged cloud to transform their business model and operations.
- › **The road to cloud solutions is paved with efficient intentions.** Currently only about a quarter of respondents utilize public and private cloud environments for either HPC or AI workloads. However, within 12 months, there will be a clear shift: 31% of respondents say their institutions plan to run HPC services in the public cloud in the coming year (an 8% increase over current levels), while 35% of respondents say their organization plans to run AI/ML on the private cloud (a 10% increase over current levels). This move is largely driven by a desire to improve overall infrastructure utilization and efficiency (64% HPC, 60% AI).
- › **Hybrid cloud is the new reality.** The move to cloud is not a move entirely away from other deployments. Most institutions today pursue a mix of public and private cloud environments based on application and business requirements. Our study also found that respondents' teams most often deploy their AI technologies in a hybrid environment during exploratory and development (32%), testing (30%), and production (30%) phases. Furthermore, just under one-fifth of respondents say their institutions deploy these workloads in multiple clouds.

"We pursue a hybrid cloud strategy because it has proved to be very effective for our business, especially in terms of optimizing cost and benefitting from research computing cloud strategies."

Director of IT, UK higher education institution

Figure 1

"Which of the following statements most closely describes your organization's use of cloud platforms today?"



Base: 155 global decision makers on IT infrastructure cloud strategies, high-performance computing strategies, or AI strategies at higher education institutions

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell & Intel, June 2020

Hybrid Cloud Helps Institutions Overcome Steep Challenges

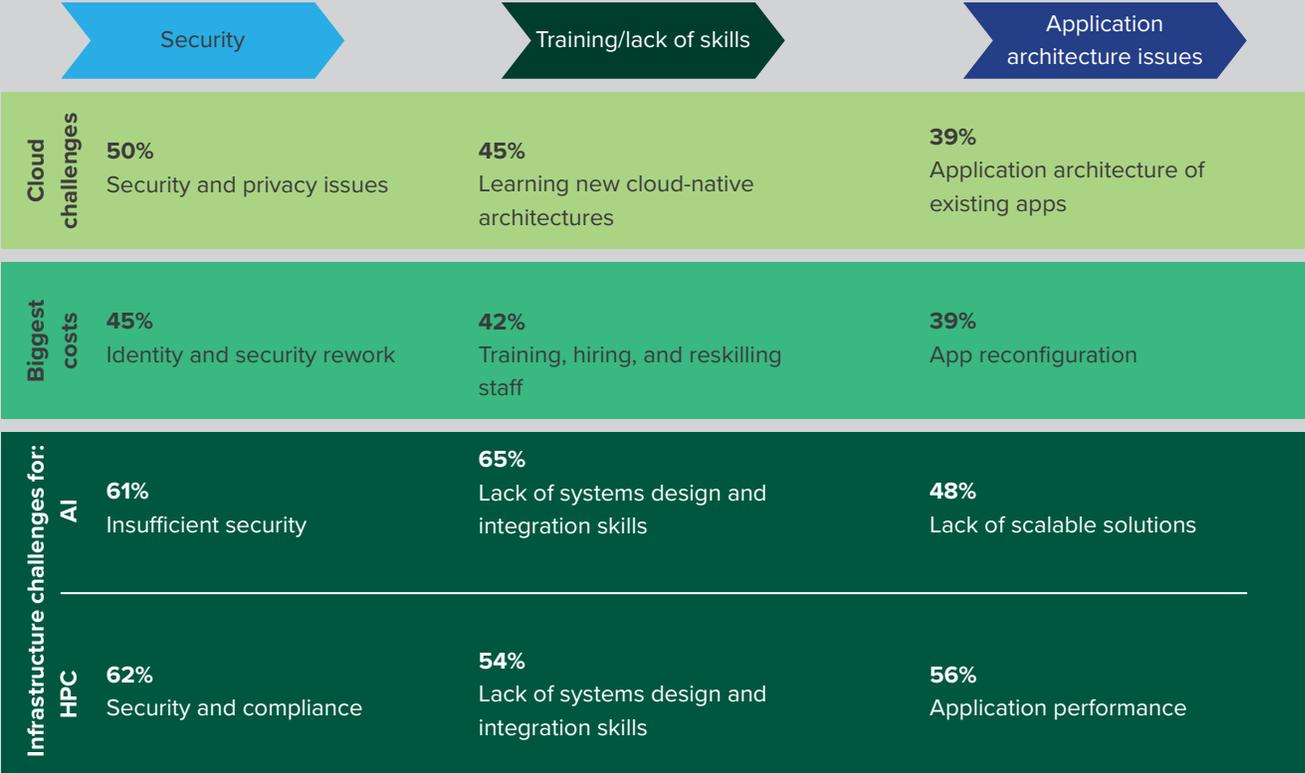
The move to cloud is not without issues. Cloud migration forces institutions to reassess and update existing processes and applications, and it requires ample foresight to plan ahead for application growth and scale.² Higher education decision makers are challenged by: 1) maintaining strict security and privacy protocols; 2) training, hiring, and reskilling staff on critical yet lacking skills; and 3) reworking applications to maintain peak performance and achieve desired scale (see Figure 2).

Costs are also a big issue. In addition to the costs that result from the above challenges, 61% of teams struggle with infrastructure costs and cost transparency when implementing HPC workloads on the cloud, and 52% find system costs challenging when implementing AI workloads. Teams are keenly aware of the issue: 60% of respondents note that cost optimization is a determining factor when selecting a primary cloud strategy for HPC workloads; the same is true for 49% of respondents when it comes to AI/ML.



Within three years, 47% of higher education organizations expect a positive boost of more than 5% to their bottom lines from cloud migration.

Figure 2
Key Challenges To Executing AI And HPC In The Cloud



Base: 155 global decision makers on IT infrastructure cloud strategies, high-performance computing strategies, or AI strategies at higher education institutions
Source: A commissioned study conducted by Forrester Consulting on behalf of Dell & Intel, June 2020

But despite the costs, organizations are starting to see returns from their time and effort. To date, 61% of higher education respondents report a positive financial impact on their organization's bottom line from migrating workloads to the cloud. And things are only expected to get more profitable: Within three years, 81% anticipate a positive return.

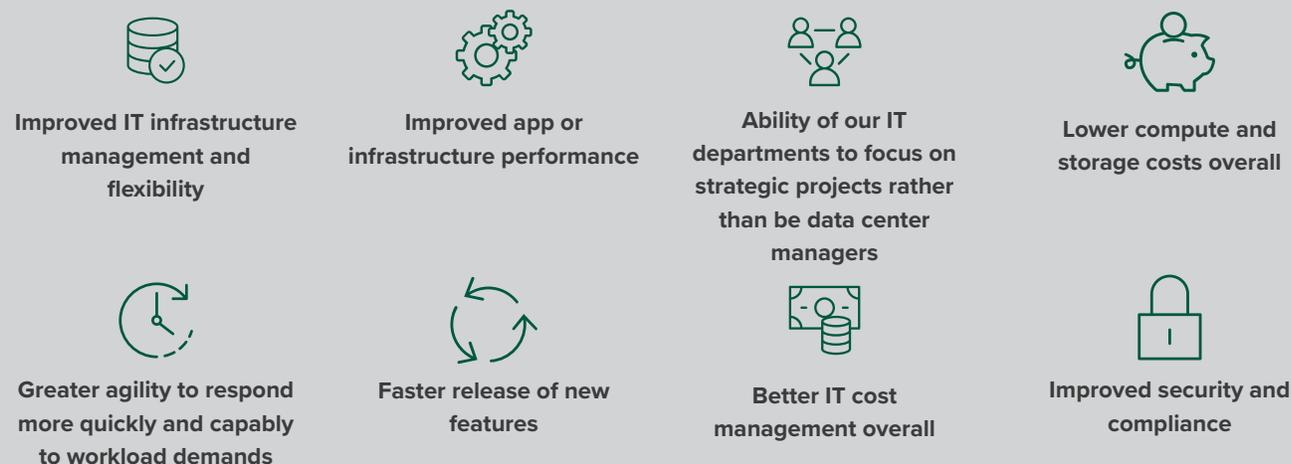
ACCELERATE BUSINESS BENEFITS FROM HPC AND AI USE WITH HYBRID CLOUD

Positive financial returns are a direct result of the benefits cloud can provide. Our study shows that higher education respondents experience business benefits from moving workloads to the public cloud. Not only do respondents enjoy lower compute (30%) and storage costs (28%), to help offset some of the cost concerns that migration can cause, but they also see greater agility to respond to workload demands (41%), improved infrastructure management and flexibility (35%), and improved security and compliance (39%).

There are also benefits from running AI and/or HPC workloads specifically in a hybrid cloud environment (see Figure 3). In fact, some of these benefits — like improved app and infrastructure performance (37%), improved security and compliance (30%), lower compute (32%) and storage costs (34%), and better overall IT cost management (32%) — alleviate some of respondents' top challenges. Also notable is the fact that 36% of respondents say that a hybrid environment allows IT teams to focus on strategic projects, since they are no longer forced to be the de facto data center managers. For universities and research facilities, this is invaluable as teams are free to innovate without worrying if their infrastructure can support the work. But the top benefit experienced — improved IT infrastructure management and flexibility (43%) — is the realization of teams' top goal of moving workloads to the cloud in the first place. If organizations want to make the most efficient use of the infrastructure options at their disposal, running AI and HPC workloads in a hybrid environment is a wise choice.

Figure 3

Top Benefits From Running AI And/Or HPC/Research Computing Workloads In A Hybrid Cloud Environment



Base: 155 global decision makers on IT infrastructure cloud strategies, high-performance computing strategies, or AI strategies at higher education institutions

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell & Intel, June 2020

Key Recommendations

Traditionally, setting up high performance and research computing infrastructure has been capital intensive. In recent years, with the value brought on by Moore's Law, as well as the advanced services that public cloud vendors now offer, HPC in the cloud is not only a viable option for organizations of any size but it can also offer significant advantages, including freeing up IT support resources to focus on innovation.³ However, the right method will require a systematic approach from planning to operations. With the advent of robust cloud options and services, universities and colleges may consider optimal solutions for AI and HPC workloads, running on-premises or in a variety of hybrid cloud scenarios.

Forrester's in-depth survey yielded the following important recommendations:



Consider cost, latency, and data gravity as the core deciding factors.

HPC and AI workloads are resource-intensive. They require specialized infrastructure including support from graphics processing units and high-speed storage as well as innovative software approaches. Whether you are experimenting with AI workloads, or you already have an HPC environment and are expanding it, establish a clear framework that is centered around data gravity and internal cloud readiness for assessing the right approach for cloud usage. Data gravity is defined as the ability of bodies of data to attract applications, services, and other data. The larger the amount of data, the more applications, services, and other data will be attracted to it. Unlike regular workloads, HPC and AI workloads quickly attract associated applications and large amounts of analytical data. This eventually makes further migration efforts cost prohibitive. Considering data gravity upfront will make AI and HPC workloads more successful and cost-effective in the long run.



Adapt your architecture to the hybrid cloud. Data from this survey emphasized that a hybrid cloud approach not only addresses the top concerns of organizations with regards to HPC on the cloud, but it also forces digital transformation through a cloud-first approach in application development. An all-cloud strategy for AI and HPC workloads can significantly skew the economic benefits in the long term, unless justified by a lack of scalability requirements or network access. With the advent of mature HPC virtual machine orchestration engines (which provide the functionality of a physical computer via software) and reliable data center interconnection networks, a hybrid approach offers the best of both worlds.

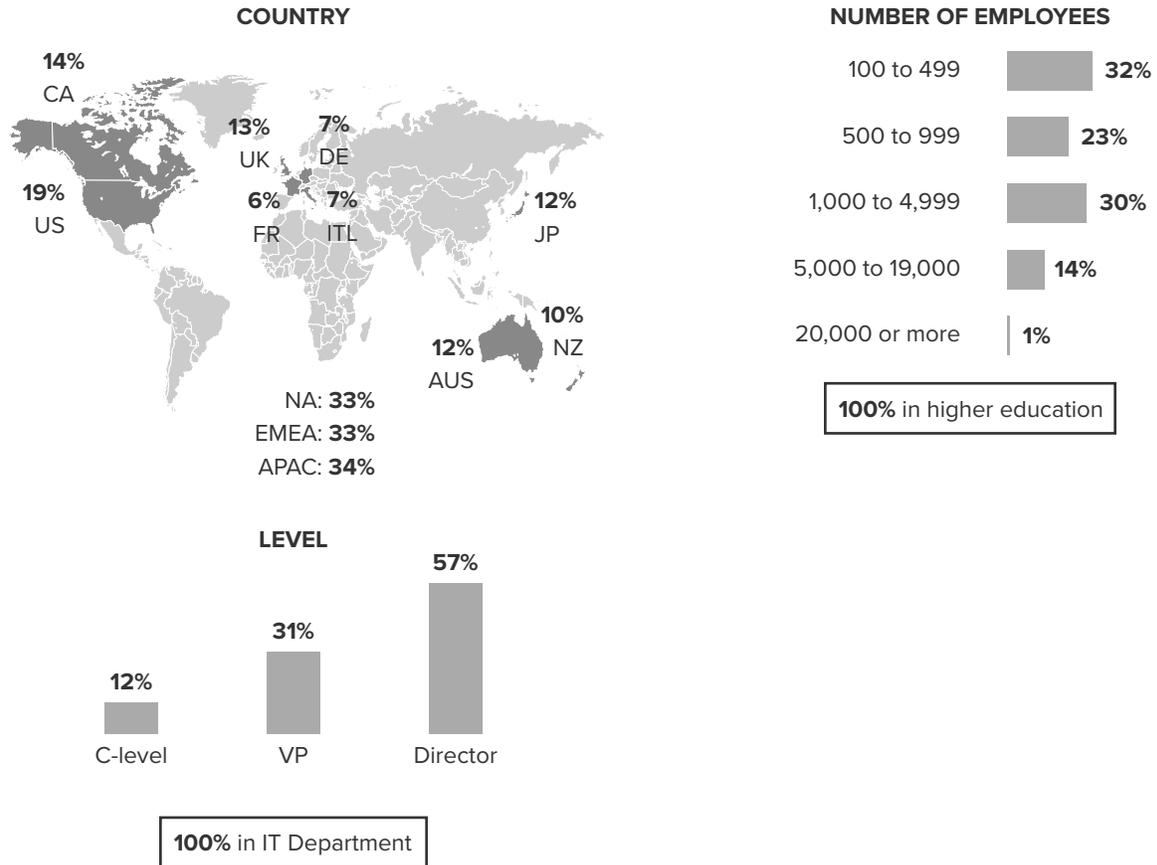


Empower HPC teams with the right tools and guidelines. Infrastructure and operations leaders must empower HPC teams with guidance on how to use cloud platforms safely, sustainably, and cost-effectively. To do this, develop governance/security guidelines and training that prepare IT staff and researchers to leverage the cloud responsibly and productively. Pay special attention to security needs of sensitive analytical workloads. Be prepared to supplement the cloud services that public cloud providers offer with cloud monitoring tools, orchestration tools, an efficient cloud release management process, and cloud access guidelines for your teams.

Appendix A: Methodology

In this study, Forrester conducted an online survey of 155 higher education decision makers in the US, Canada, the UK, Germany, France, Italy, Australia, New Zealand, and Japan with responsibility for IT infrastructure, high performance computing, or AI strategies. Respondents were offered an incentive as a thank you for time spent on the survey. The study began in May 2020 and was completed in June 2020.

Appendix B: Demographics/Data



Base: 155 global decision makers on IT infrastructure cloud strategies, high-performance computing strategies, or AI strategies at higher education institutions

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell & Intel, June 2020

Appendix C: Supplemental Material

RELATED FORRESTER RESEARCH

“Predictions 2020: Cloud Computing,” Forrester Research, Inc., November 4, 2019.

“The Forrester Tech Tide™: Compute Platforms, Q4 2019,” Forrester Research, Inc., October 19, 2019.

“Top 10 Ways To Master Performance For Your Cloud Migration,” Forrester Research, Inc., April 13, 2020.

Appendix D: Endnotes

¹ Source: Forrester Analytics Business Technographics® Data And Analytics Survey, 2020.

² Source: “Top 10 Facts Tech Leaders Should Know About Cloud Migration,” Forrester Research, Inc., March 14, 2019.

³ First observed by Intel cofounder Gordon E. Moore, Moore’s Law essentially states that the number of transistors in a given unit of space will roughly double every two years, thereby doubling computing power but halving cost.

To read the full results of this study, please refer to the Thought Leadership Paper commissioned by Adobe titled “Hybrid Cloud: A Smart Choice For AI And HPC.”

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