

HPC

Debunking those Myths



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Introduction

While High-Performance Computing (HPC) has been around for decades it is now increasingly available to organisations of all shapes and sizes. Super-powerful computers capable of performing complex calculations and simulations, determining outcomes and solving major challenges by crunching huge data volumes at extremely high speed.

So, do you need HPC? How will you know? What are the advantages – and pitfalls of staying on-premises or moving to the Cloud?

Using our proven track-record and experience as independent HPC consultants, we thought a good place to start the conversation would be debunking a few of the most common HPC myths still out there...



MYTH #1

HPC and Supercomputers are one and the same thing”

They are similar in concept but not the same. Both concentrate the power of tens of thousands of processors (CPUs and GPUs) to process massive amounts of data to solve complex problems – often in real-time.

A key differentiator is that a Supercomputer is typically a very large piece of purpose-built standalone hardware while an HPC set up consists of a ‘cluster’ of high-speed computer servers (nodes) which are networked together. This allows them to work cooperatively using parallel processing for performing multiple tasks simultaneously.

MYTH #2

“HPC is just another name for a powerful computer”

HPC is radically different to standard computing and far more powerful due to the sheer quantity and redundancy of high-performance CPU cores deployed along with the vast memory and supersized storage space.

1 million
times faster than the fastest commodity
desktop, laptop or server systems¹

If you are still using a standard serial computer which separates the workload into a sequence of consecutive tasks on the same processor, chances are you will need to look at HPC – and sooner than planned if your research workloads are already becoming too large for your laptop and desktop systems to handle. An obvious sign is if they are taking longer to process which is often down to insufficient CPU, memory and storage capacity. Or perhaps you now need to run the same program repeatedly using varied input data. HPC's parallel processing can speed the process up significantly compared to a serial computer. Maybe you plan to do more complex simulations, or modelling applications involving AI-machine learning tasks. This will require access to HPC nodes with powerful graphics processing (GPU) capabilities.

¹ IBM | How fast is super computing?



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MYTH #3

“HPC isn’t meant for businesses like mine”

Because of its long association with Academia and pure scientific and engineering research, the idea of harnessing HPC as part of their day-to-day business operations may still appear a step too far for many commercial enterprises.

However, whether on- premises or Cloud, more and more organisations across various sectors are starting to harness the power of HPC solutions, driven by the need to increase competitive advantage when developing new products or services.

HPC can deliver unprecedented insights by turning large volumes of data (Big Data) into actionable information in real-time, enabling products to be developed more quickly and coming to market at precisely the right time.

The growing impact of the Internet of Things (IOT) and AI-based technologies such as machine learning and deep learning is another driver.

HPC solutions can handle the types of demanding and complex IT workloads typically required that conventional computing architectures can't. The urgent focus on finding new types of materials in the face of climate change and for discovering new drugs to combat new and resurgent diseases are further examples.



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MYTH #4

“Keeping HPC on-premises is a no brainer”

How best to approach HPC really needs to be carefully assessed on a case-by-case basis. Where you are on your HPC journey is a key factor.

For large R&D establishments at the leading edge of technology, on-prem is likely to be the most efficient and cost-effective approach. However, this assumes you already have a world class data centre at your disposal along with world class HPC engineering support people, and a very competitively priced energy provider with guarantees in place for supplying scalable forwards power.

For those without such luxuries in place, it's even more vital to consider the risks and costs involved – the Total Cost of Ownership (TCO). Like an iceberg there's an awful lot below the surface aside from what's in plain sight, namely the hardware purchase costs which will typically account for 20-25% of the overall TCO over five years.

But what about the ongoing costs of running and maintaining your own data centre? The support personnel required?

And the specialist cooling solutions, not to mention current and future power supply costs. In all cases, it's essential to have CFO involvement from the outset to keep control of what we at Red Oak Consulting call Absolute TCO where we itemise over 50 contributing factors – [see here](#). For those considering a colocation alternative to reduce data centre costs, this is certainly an option but colos capable of comprehensively supporting HPC environments remain few and far between.

The major public Cloud providers are making HPC increasingly user friendly and accessible to SMEs as well as larger enterprises. The advantages of running HPC in the Cloud are broadly the same as for other Cloud-based applications:

- **Removing the burden of running and maintaining your own data centre**
- **Access to the latest IT equipment and productivity tools**
- **Uptime guarantees and stringent security**
- **On demand scalability and the flexibility to optimise and accelerate workflows**



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MYTH #5

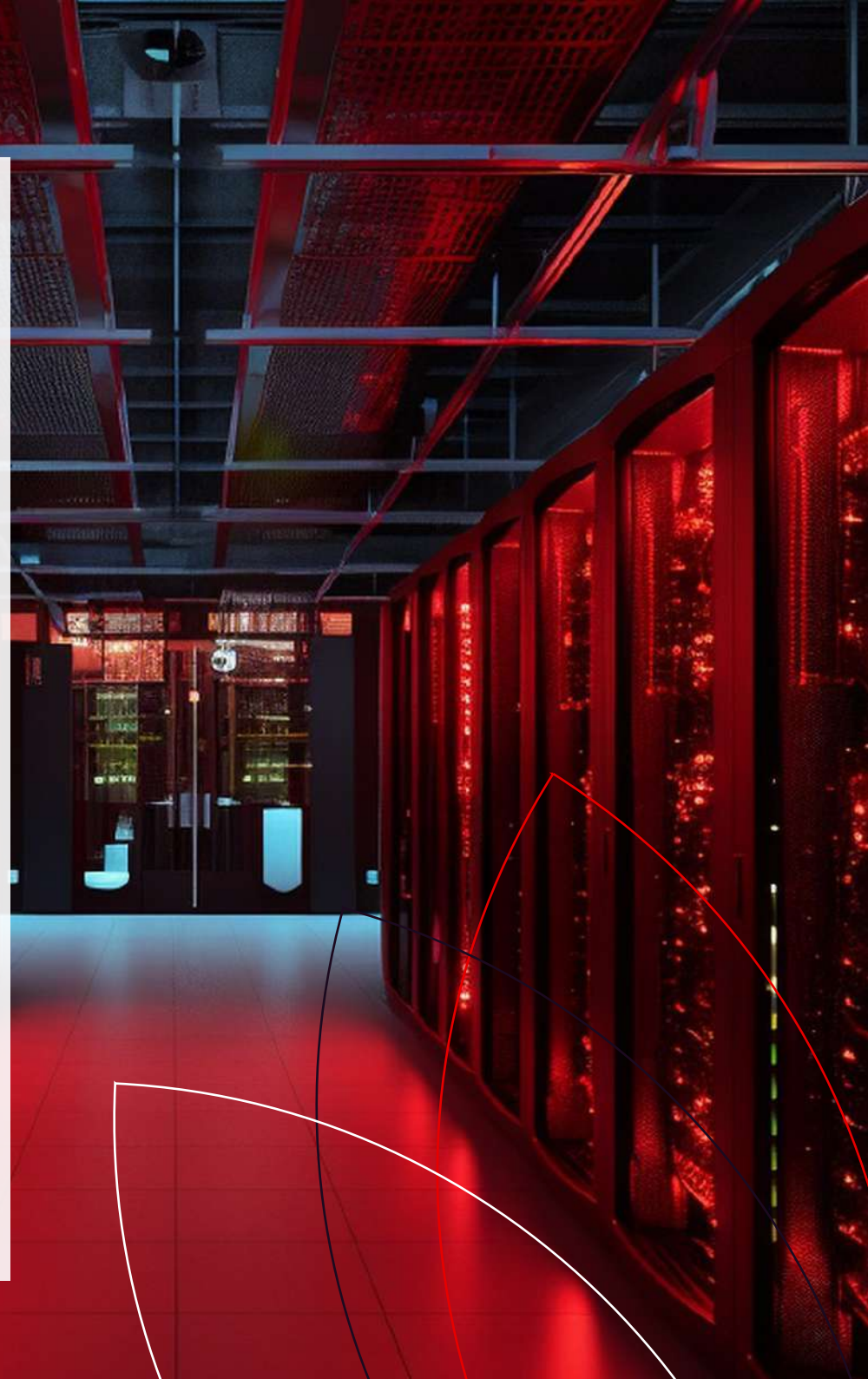
“Optimised HPC environments are ones that run at full load”

Doing so may well provide the ROI on the capital investment of the HPC system, but it will often cause workload backlogs, preventing new and more urgent tasks from being addressed at any moment in time. If an HPC environment isn't fully optimised, one of the major signs will be data access bottlenecks resulting in reduced performance and an inability to accelerate workflows.

This is key. First and foremost, HPC must enable human ideas to be translated into IP as quickly as possible. Routinely running your HPC clusters at or close to near maximum capacity stifles human creativity and productivity.

In our experience, load should be maintained at 50 - 65%.

This provides sufficient headroom to factor in the longer-term value creation/productivity that a project has been designed to deliver. Any higher and there's a risk of increased costs from missed deadlines and even lost market opportunities. This is especially important in industry sectors which operate on very slim margins such as engineering and construction.





MYTH #6

“Buyer beware - once you’re in the Cloud you can never leave”

There are good reasons to migrate many of your IT workloads to the public Cloud - including HPC. The major providers make it a relatively seamless experience, and in the case of HPC, allow even complex solutions to be built and deployed. Alternatively, you may just want to supplement existing on-premises HPC resources from time to time to ease capacity overloads, for which the on-demand nature of Cloud is ideally suited.

Moving your data back on-premises is possible but there will be data egress charges. These can be quite costly depending on the volume of data concerned. It would be prudent to plan for these well in advance if ever such a requirement was on the horizon. Moving your HPC between public Cloud providers is also a possibility. Both Cloud parties would ideally need to be based on open source platforms - most likely *OpenStack*.



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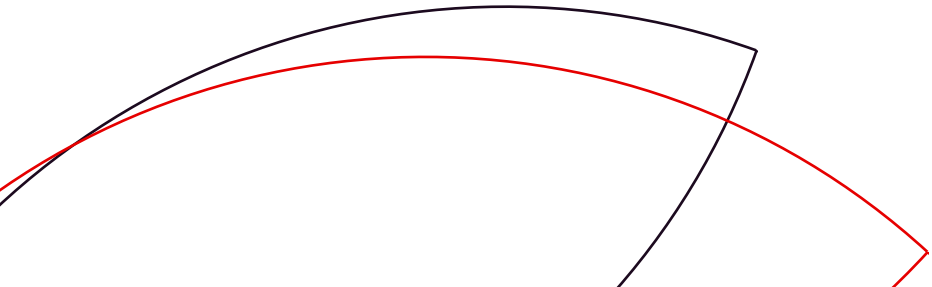
In our view



For many companies, whether considering HPC for the first time or migrating from on-premises, using the HPC services of one of the major public Cloud providers can mitigate many of the risks involved. It can offer a faster and more scalable solution compared to on-premises and removes the headache of finding and training personnel with the necessary IT skills.

We recommend a 10 – 15-year cadence when running HPC in the Cloud compared to the typical five years for on-premises.

This allows sufficient time to extract the maximum value from the procurement and for the impact of different workflows to have been fully evaluated. In some cases, however, the public Cloud just won't suit the HPC applications and workflows at stake.



Carbon emission is a further major factor. On-premises HPC users will find it an increasing challenge to drive CO2 savings beyond what they can control or manage directly (Scope 1 & 2). This is largely due to their technology manufacturers' poor record of addressing hardware embodied carbon which is incurred pre-purchase i.e. before and during manufacture. Migrating HPC into the public Cloud could therefore be beneficial to meeting your corporate Environmental Social and Governance (ESG) obligations. The major providers are making significant strides in minimising their carbon footprints.

As a vendor neutral firm of IT management consultants specialising in high-performance computing, Red Oak Consulting offers unbiased advice as well as managed services to ensure you take advantage of the optimum HPC solution for your organisation - whether in the Cloud, on-premises or hybrid.



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UNIVERSITY OF HULL

The customer and why?

As a highly esteemed academic institution in Britain, The University of Hull has built a strong reputation for its exceptional teaching and world-class research contributions. Recognising the need to further elevate its status as a leading research institution, the University made a strategic decision to implement a High Performance Computing (HPC) solution.

This initiative aimed to upscale its research capabilities, attract research investments, and elevate its position research prospects.

The challenge?

HPC uses computer clusters to solve advanced computation problems, saving a significant amount of time compared to running a single machine. In short: it solves problems faster. Understanding the potential of HPC, but lacking in-house expertise, The University of Hull started their search for a solution.

The University of Hull came to Red Oak in order to deliver a solution that would ensure reduced financial risk, and keep pace with a fast paced environment.

The solution?

Red Oak provided a complete HPC service to the University of Hull consisting, including:

- Procurement of hardware, software and other required HPC services.
- Supporting and advising on upscaling in-house expertise.
- Collaboratively developing operational procedures
- Advising on the specification of HPC acceptance testing

The results

Following the work completed by Red Oak and The University of Hull, the main specification was used to support a re-tender for a National Servers, Storage and Solutions Agreement tendered by Southern Universities Purchasing Consortium (SUPC) - a deal which is worth £600m over a four-year lifespan.

1.25 million hrs of research processed in the first month

Completion of user acceptance testing

"Hull's HPC solution is the top Tier 3 (University) machine for performance in the North of the UK and ranked in the top 10 nationally, and is now a beacon of success for others looking to implement this type of solution."

Graeme Murphy

Head of Research and Enterprise for ICT | University of Hull



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The customer and why?

King Abdullah University of Science & Technology (KAUST) is a world-leading graduate research university based in Saudi Arabia. During 2014, it undertook the Shaheen II project to purchase a new \$60m supercomputer – the most powerful HPC in the Middle East.

The challenge?

KAUST had worked with Numerical Algorithms Group (NAG) as the lead contractor providing HPC procurement services on this project, however, shortly after the contract with the hardware supplier was signed, KAUST's Head of HPC left the company, which raised concerns about derailing the project entirely, whilst under the amounting pressure of aggressive timescales.

The solution?

NAG was already provided with procurement support from Red Oak, in order to focus on the development of requirements and provide assurance and guidance to the acceptance testing.

The requirement for a highly experienced HPC project manager was quickly recognised in order to keep the project on track, so Red Oak's Senior Project Manager was appointed interim director at KAUST, taking responsibility for all aspects of the project, including:

- Benchmarking
- Acceptance testing
- Forming a team, consisting of: the hardware supplier, facilities, users, computational science, support and technical assurance

The results

Through Red Oak's work, KAUST delivered a highly successful project, which facilitated the establishment of a partnership between the supplier and the customer. This also resulted in Red Oak providing increased support and advice to the senior executives at the University.

**7th most powerful
supercomputer in the world**

"The procurement was highly successful. Red Oak were highly professional and highly knowledgeable, and really saved the day for us. Red Oak smoothly integrated into the KAUST team but more importantly, believed in our mission to deliver this computer in order to support the global ambitions of KAUST and the Kingdom of Saudi Arabia."

Dr Justin Mynar

Director of Core Labs & Major Facilities | KAUST



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The customer and why?

For nearly 40 years RES (Renewable Energy Systems) has been in the renewable energy market, pioneering new ways of generating power through their unique modelling and simulation technology. Active across wind, solar, energy storage, transmission and distribution, RES is now one of the largest independent renewable energy companies in the world. RES caters to clients such as utility companies, investors and energy buyers, offering services related to the complete life cycle of renewable projects.

The challenge?

RES originally had been using two compute clusters housed on-premises to support its simulation and modelling needs, but over time their maintenance costs grew along with increasing hardware failures. RES recognised they needed to act fast and saw migration to the cloud as a growing market opportunity.

They were already familiar with the concept of Microsoft Azure through their deployment of Microsoft products, so wished to build on its existing infrastructure to minimise cost. In order to uphold its differentiated place in the market, RES partnered with Microsoft to find a Cloud solution.

The solution?

After initial testing, RES pushed the button to move from a testing/evaluation deployment environment, to full commercial production. Microsoft elected Red Oak into the project, to advise and assist RES in achieving their objectives.

As the HPC consulting lead on the project, Red Oak delivered a cost effective solution through:

- Analysing RES's existing evaluation environment
- Collaborating with RES stakeholders from RES to scope requirements and functionality, ensuring the Azure cloud solution was fit for purpose.
- Optimising existing HPC workloads

The results?

Through the use of the Azure CycleCloud service, Red Oak Consulting mirrored the existing RES cluster configuration in Azure to deliver the speed and scalability required by RES.

Upscaled WRF computing environment

Maintained cost efficiency

"It's opened up a whole lot of opportunities for us which we hadn't had available before, and it's making us think about things in an entirely different way."

Jeremy Bass

Head of Specialised Services | RES



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The customer and why?

The ASTUTE 2020 (Advanced Sustainable Manufacturing Technologies) is an operation led by Swansea University in partnership with Cardiff University, Aberystwyth University & University of Wales Trinity Saint David was formed to support industrial Research, Development and Innovation (RD&I) through world-class academics and a team of highly qualified technical experts and project managers.

The five year operation had been part-funded by the European Regional Development Fund through the Welsh Government and the participating Higher Education Institutions. As part of this operation, the College of Engineering at Swansea University tendered for a £500,000 HPC system to enable the ASTUTE 2020 research team to achieve the best possible computational solutions.

The challenge?

Driven by aggressive timescales and budget, this was the first time the research team had purchased its own machine. Some members of the team had prior experience of HPC procurement, but there were some key team members had none. However, no one had experience of procuring and installing a large HPC solution.

The solution?

Red Oak's job was quite simply to do everything possible to help the supplier and the customer to achieve a high quality installation within the tight deadline.

This involved:

- Understanding the customer's expectations by working collaboratively
- Interfacing effectively with the supplier, factoring in aggressive timescales.
- Helping key personnel anticipate the process
- Evaluating documentation that would be helpful post-launch
- Liaising with University's technical personnel to achieve optimal value from technologies purchased.

"Red Oak made the whole project go smoothly and they understood our expectations. The team were very friendly and approachable and showed a high level of professionalism. They put a lot of effort into the commissioning and it was hugely appreciated."

Dr Sam Rolland

Senior Lecturer | College of Engineering



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To find out more about our services and how we help our clients harness the full potential of HPC, contact an expert today.

Speak to an expert

Visit our website: redoakconsulting.co.uk



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