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FUJITSU

LOT 4 - HPC

Case Study University of East Anglia

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I. INTRODUCTION

In selecting our reference for Lot4 we have chosen University of East Anglia (UEA) in that it demonstrates the strength of relationship we have with our HPC partner, OCF and UEA. As well as evidencing the longevity of the relationship which started in 2015.

We have structured our response to cover the areas that you need information upon to clearly demonstrate to you that we have the skills and capabilities to deliver against Lot 4 HPC within the Framework.

In selecting partners to work with on the SSSNA Framework, Fujitsu ensure that their Design and Project Management methodologies are in line with ours, such that as an OEM we are assured that our partners can deliver to the same standards as if it was Fujitsu delivering the project.

Background and requirements

With its focus on environmental, biological, and computational science, UEA has an enduring demand for high-performance computing (HPC) platforms. In 2015, the university engaged IT partner OCF and Fujitsu to create the original HPC cluster, consisting of approximately 100 nodes. In the years since, demand has grown exponentially, leading UEA to explore ways of extending the existing solution. It needed to find an affordable way to extend HPC capability without compromising performance.

This reference covers

- In 2018 the doubling of the capacity of the original HPC cluster that was implemented in 2015
- In 2021 the installation of a separate PoC/Development/Testing cluster to meet the Cyber Essential requirements.

II. PROJECT DATA SYNOPSIS

1. ENTITIES INVOLVED AND RESPECTIVE ROLES IN THE PROJECT

This project was conducted by the partnership of Fujitsu Services Limited and its partner OCF (Prime contractor).

For a more detailed description of the role distribution between each of the parties in the project, please refer to the Section III further on.

2. PROJECT NAME AND GEOGRAPHICAL LOCATION

The Project Research HPC Project was contracted with the University of East Anglia for the delivery of infrastructure and services in Norwich.

3. PROJECT TIMEFRAME

The project was completed in August 2020 and the contract continues until August 2023.

III. DESCRIPTION OF THE SOLUTION PROVIDED, TECHNOLOGY DEPLOYED AND WARRANTY TERMS

The Solution and technology selected

- 2018 Doubling of the 2015 Capacity

In 2018 UEA undertook a serious evaluation of the market to ensure it could take advantage of the best price and performance. Again, Fujitsu led the pack with competitive pricing, best-in-class performance, and its deep knowledge of the HPC space.

"In 2015, we ran 4.4 million HPC jobs, which had risen to 11 million in 2018. At the same time, the number of HPC users among students and faculty has grown from 223 in 2015 to 550 in 2018. The original cluster simply could no longer support the demand," explains Leo Earl, Head of Research and Specialist Computing, University of East Anglia. "That's why we went back to the market for additional HPC capacity."

This was an additional installation of 68 FUJITSU Server PRIMERGY CX2550 M2, 17 FUJITSU Server PRIMERGY CX400 chassis, two FUJITSU Server PRIMERGY RX2530 M4 and two FUJITSU Server PRIMERGY RX2540 M4 units, all powered by Intel® Xeon® processors. Because UEA had an existing Fujitsu HPC cluster deployed, it was simple to add and integrate these new nodes.

"For the regular compute nodes, we kept the older Intel Broadwell architecture because it gives the best price/performance ratio, however, being able to integrate Intel Skylake gave us additional flexibility," says Earl. "At the same time, our enhanced graphics cards gave our users up to 70 per cent increases in things like objection detection experiments. Researchers have told us that having an additional 5GB of GPU RAM allows them to explore more complex problems."

"From start to finish, including delivery, installation, testing, benchmarking and finally production, it took just two weeks and required zero downtime of the original system," continues Earl. "That meant we could quickly ramp up our HPC capacity and meet the rising demand."

- Upgrading a critical HPC platform

"Fujitsu has a rich background in HPC and is familiar with us as an organisation. Moreover, the pricing was incredibly attractive, so it was a simple choice to continue with Fujitsu as our HPC partner," adds Earl. "We worked with partner OCF to design and configure the additional nodes. Our priority was to ensure we could handle the particular demands of key subjects, including AI, climate modelling, machine learning, and molecular dynamics."

A faster, more powerful HPC platform

The advanced HPC cluster puts UEA at the forefront of higher education research, enabling undergraduates and post-graduates to work within a bespoke HPC environment which supports their cutting-edge work. In a competitive educational landscape, this ability is critical.

"Having an HPC cluster with high performance, fast throughput and significant capacity is vital," remarks Earl. "It is not uncommon for prospective students and researchers to contact me to discuss HPC capacity and strategy prior to taking a position at UEA. This validates that we will meet their requirements and allows us to market our HPC service offering. Many researchers and students see HPC as their new 'wet lab' and see it as a critical service offering."

The extended HPC platform also boosts performance, enabling projects to be completed up to ten times faster. This means far more projects can be undertaken and students do not have to wait to access HPC resources. In total, the university expects to complete 30 million CPU hours in 2018 alone.

In the event of any issues both OCF and Fujitsu are on hand to provide round the clock support: "The systems are very stable, and the service is improving continuously, however, if an incident does arise, we perform first fix in-house and then escalate to OCF and finally Fujitsu. That ensures optimal uptime," adds Earl.

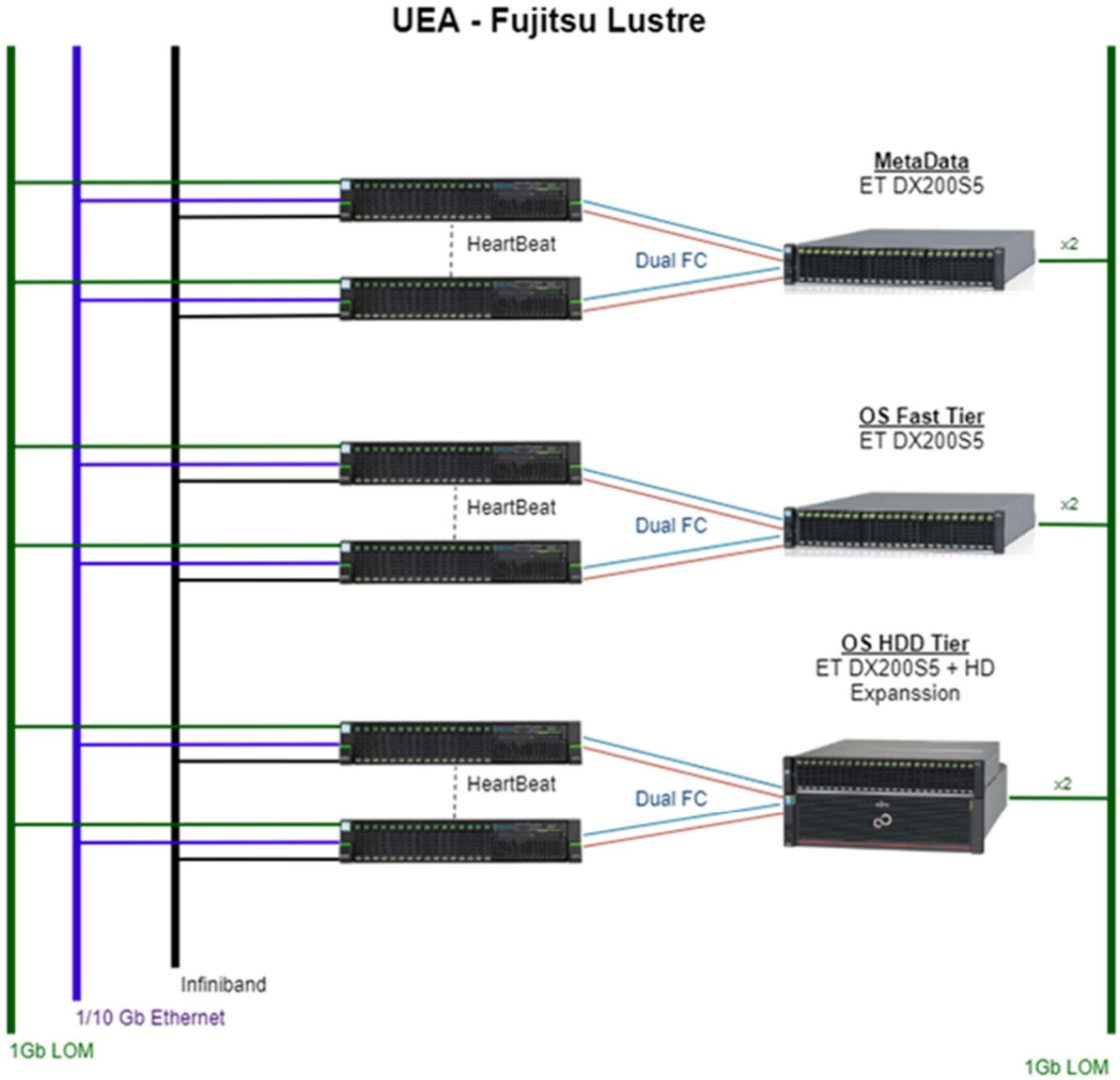
➢ 2021 Installation of Proof-of-Concept environment to mirror their existing production cluster

In 2021 University of East Anglia (UEA) purchased a Proof of Concept (PoC) environment to mirror their existing production cluster of more than 500 Fujitsu compute nodes. This environment is important as a Cyber Essentials environment as updates must be rolled out quickly and having a test environment will reduce risks to the user community on the production HPC cluster.

The PoC environment will allow UEA to test new applications and software in a secure environment before the applications and software will be allowed on the production cluster. This is expected to significantly reduce the risks to the production cluster from deploying new applications. The HPC PoC environment will also allow the University to test upgrades to the HPC software stack prior to the production release.

In addition, UEA want to evaluate new storage solutions that will potentially provide faster and cheaper shared storage to their user community. The PoC solution included hardware that will be initially tested with Open-Source Lustre. The same hardware can also be used for BeeGFS or other solutions.

This is depicted in the diagram below:



This is the software stack that was installed:

- CentOS 7.9 – The operating system provisioned throughout the cluster.
- xCAT – Used for bare metal node provisioning and management.
- Salt-Stack – Configuration management.
- Slurm – HPC Job Schedular.
- Grafana – Used to present cluster monitoring data/metrics.
- Icinga1 – Monitoring and alerting.
- InfluxDB – For storing metrics Data for Icinga1.
- VAS integration

The solution was delivered with support for 24x7, 4-hour onsite response for the server hardware and a 24x7, 4-hour remote response for the hypervisor software.

Fujitsu can extend both the term (up to maximum of 5 years) or uplift the Service Level as required (for example to '4hour Response').

When considering requests for extended warranty Fujitsu considers:

- The End of Support Life (EOSL) date, which is 5 years from the last sale i.e., End of Sales (EOS) date. Fujitsu can offer support up to the End of Support Life date and this is a standard process. When support is required beyond the EOSL date, Fujitsu has to consider the availability of spares, as when systems are no longer manufactured the availability of spares reduces as they are not replaced. If a customer is planning a tech refresh of the equipment, and requires Fujitsu to support the equipment being replaced, this will influence the decision to offer extended support. If the customer gives Fujitsu sufficient advanced warning of needing extended support beyond the EOSL date, Fujitsu can investigate whether it can do a 'last time buy' of spares for the particular configuration and ring fence it for the customer use only (at additional cost).
- Uplift to on-onsite response and improved time to fix depend mainly on location, in relation to where spares are located and the availability of suitably qualified engineers.

Design and Deployment Approach

In selecting partners to work with on the SSSNA Framework Fujitsu ensure that their Design and Project Management methodologies are in line with ours. In particular for HPC, OCF are our chosen partner as they have the HPC software experience and capability to complement the Fujitsu HPC hardware capability.

We will cover the following in greater detail as requested by you:

1. Project management
2. Design Method
3. Risk Management
4. Customer liaison
5. Cost management

1. PROJECT MANAGEMENT

Fujitsu's standard methodologies are based upon industry best practice guidelines. These in combination with our own extensive experience form the basis of our Manage Project, Manage Programme and Manage Risk processes. Together these form constituent elements of our overall ISO9001:2008 assured Business Management System (BMS).

The 'Manage Project' processes are defined for use by all Fujitsu projects, irrespective of project size and nature of deliverables, and incorporate a comprehensive set of PM tools including detailed procedures, templates, and tools.

Project Team Structure & Roles

The team is now very streamlined and consists of

- UEA HPC User
- OCF HPC software expert
- Fujitsu HPC hardware expert
- Minimal project management

Quality Management

A short Project Initiation Document (PID) is produced for each project to identify the stage and the roles and responsibilities to deliver the project on time. The PID also identifies the acceptance criteria for a successful project completion and are captured in the Acceptance Criteria table in the PID. The acceptance criteria are tested during the user acceptance test (UAT) tasks in the project plan.

At least one OCF and one UEA member of the project team must be present during UAT. Either party can identify a second or proxy team member to carry out the testing to satisfy project resourcing and ensure the smooth progression of the project.

2. DESIGN METHOD

The OCF HPC software Subject Matter Expert (SME) and the Fujitsu HPC hardware SME worked together to select the optimal server models and configuration to deliver the performance and capacity needed for the UEA HPC Cluster workloads. This was captured in a High-Level Design and a bill of material is produced and approved by UEA for ordering.

The design method is summarised as follows

- The design stage covers preparation for implementation, operational running, and testing
- The develop stage builds the defined solution in a controlled environmental and the development of any associated implementation guides.
- The deliver stage is where the solution is implemented and tested. This was a joint activity with staff from UEA who were going to be responsible for the ongoing support and operation of the solution. This ensured that validation of the solution is satisfactory and allowed for knowledge transfer of the solution.

Verification and validation are ongoing activities through the 'design and develop' and into the 'deliver' stages of the overall project of the designed Solution. Verification ensures that the final solution 'can be built right' whilst validation ensures that 'the right solution is built' and meets UEA's requirements. The output is captured in a User Acceptance Test (UAT) document that documents the testing that was agreed and the outcome of the tests.

The deliverables from the Design method are:

- The High-Level Design (HLD) document that details all the Functional and non-functional requirements and how they are to be addressed, the design decisions made, and any Risks, Assumption, Issues and Dependencies that exist, which were worked through and addressed as the project progresses
- The Low-Level Design (LLD) detailed the configuration of the solution and information needed to implement the solution
- Any operational handover training for administrative staff. This typically occurs inline through the deployment in a hands-on fashion.

3. RISK MANAGEMENT

The Fujitsu Manage Risk Process, which is mandatory throughout the lifecycle from the bid stage until closure of the contract, defines the steps (Initiate, Identify, Analyse, Plan and Manage) that every bid or contract is to progress through to ensure the appropriate management of risk. It is mandatory that a Risk Plan is produced and updated throughout the life of the project or service.

4. CLIENT LIAISON

At the start of each project, the communication plan is agreed between UEA, OCF and Fujitsu to ensure that all parties are informed of progress, any issues that need to be addressed and to assist with any action that is required by any party to keep the project on track.

As the project duration is short, the project manager liaises directly with the UEA team. General progress is distributed to the Project Team and the project manager records all decisions in the relevant documentation and provide feedback to the project team when necessary.

5. COST MANAGEMENT

The Project Manager (PM) is responsible for managing the cost for the project and is accountable to the UEA for this. The PM will flag any significant deviation of the project in terms of costs or time and will seek guidance and approval from the Board before undertaking the changes.

An agreed margin of change to the project cost base will be agreed at the start of the project with the Project Board to allow the PM to resolve issues and keep the project on track. If during delivery the project team identify risks or issues that mean the cost of the project will move outside the boundaries of the agreed margin the PM will escalate to the project board to assist in determining a resolution. This means that all parties are informed and consulted of any significant changes to costs.

Fujitsu together with OCF have an accumulation of experience and know-how to draw upon. Fujitsu and OCF work on the principle of continuous improvement and we have a lessons' learnt process that means we review what went well, what could have gone better and what would we do next time, consequently we are continually seeking ways to improve the way we deliver solutions and project to our customers.

UEA is not resting on its laurels – HPC usage is expected to continue its dramatic growth meaning the university is already eying the next stage in its evolution. Within nine months it will invest in additional HPC capacity.

"It is a simple equation: more computing resource means more demand is satisfied, which equals more research, more publications and more citations," concludes Earl. "It creates a virtuous circle which attracts more students who then produce more great research. And that means it creates a swift ROI which enables us to invest further in HPC for the future."