Mayor and Cabinet

Report title: Compute & Storage Infrastructure Replacement

Date: 15 June 2022

Key decision: Yes

Class: Part 1

Ward(s) affected: All

Contributors: Executive Director of Corporate Resources

Outline and recommendations

This report presents members of Mayor and Cabinet with a proposal for the procurement of a replacement for the Shared Technology Services (STS) server and disk storage infrastructure. Members are asked to approve the recommendations as set out in section 2 of this report:

1. approves Brent Council entering into a contract with Computacenter on behalf of the Council for a solution based on Nutanix HCI software using SuperMicro hardware for the physical server and disk storage components for a period of 5 years at a total cost of £1,465,000.00 across all 3 Councils. The Council's contribution to that would be £407,805 over the period; and
2. approves the Council's contribution to the contract value of £407,805 plus an additional £120,071 for additional backup storage, risk of inflation, training and contingency, meaning a total contribution of £527,876.

Timeline of engagement and decision-making

This proposal has been reviewed at the STS Joint Management Board (JMB) which meets bi-monthly. Each partner council is represented at JMB by an Appointed Director. The JMB is responsible for overseeing the activities and reviewing the performance of STS.

1. Summary

1.1 Shared Technology Services (STS) provides IT infrastructure management and support services to the three partner councils within the shared IT service (as well as to additional customers such as the Local Government Authority and Lewisham Homes). These services include managing the two STS datacentres in Brent Civic Centre and Croydon Civic Centre – Bernard Weatherill House. Additional supported services include networks, messaging and collaboration services, support for end-user devices such as laptops, tablets and mobile phones, as well as providing the service desk to resolve IT-related incidents and requests. The three partner councils that provide governance over STS are Brent, Lewisham and Southwark. Brent is the lead council in the respect that it is the employer for all officers within STS and also carries out procurements on behalf of STS. This report is to request approval for the replacement of the compute and storage elements of the IT infrastructure. The compute component provides the processing capability for the various IT workloads and is supplied by computers referred to as servers. The storage component stores the councils' data and is comprised of physical disks and solid state drives.

1.2 Two key elements of the IT hardware infrastructure provided by STS are the server and disk storage capabilities within the STS datacentres, which are in the Brent Civic Centre and Croydon Council – Bernard Weatherill House.

1.3 The storage component consists of disks that currently contain the council's data held primarily in shared folders/documents, personal folders/documents, email and databases. The compute component provides the processing capability for the various IT workloads and is provided by approximately 150 physical servers (high-specification computers).

1.4 A number of the key components of the existing infrastructure will reach the end of vendor support in January 2023. This means that the vendors will no longer provide hardware support, firmware upgrades or security patches. This will leave the service in an unsupported position with regards to hardware failures and security vulnerabilities.

1.5 It is vital to procure the replacement solution now in order to provide sufficient time to acquire the new hardware, install and configure it within both STS datacentres and then transfer all of the existing data and workloads onto the new solution, before vendor support for the existing kit expires.

1.6 In January of 2022, STS began the tender process for the replacement solution. Six bids were received and by the end of March, 2022, a winning bid from Nutanix/Computacenter had emerged.

2. Recommendations

2.1 It is recommended that Mayor and Cabinet:

(a) approves Brent Council entering into a contract with Computacenter on

behalf of the Council for a solution based on Nutanix HCI software using SuperMicro hardware for the physical server and disk storage components for a period of 5 years at a total cost of £1,465,000.00 across all 3 Councils. The Council's contribution to that would be £407,805 over the period; and

(b) approves the Council's contribution to the contract value of £407,805 plus an additional £120,071 for additional backup storage, risk of inflation, training and contingency, meaning a total contribution of £527,876.

3. Background

3.1 Shared Technology Services currently uses Dell/EMC disk arrays for the storage component, with Dell servers providing the compute/processing capability.

3.2 The disk arrays store the councils' data that consists mainly of:

- Users' personal shared folders and documents
- Council shared folders and documents
- Email
- Databases

3.3 The disk arrays use two types of disk:

- HDD – traditional hard disks that spin. These are relatively cheap and provide the bulk of the current storage capacity
- SSD – solid state disks (often known as flash drives). These are more expensive but provide far better performance in terms of how quickly data can be written to or retrieved from the disks.

3.4 The disk arrays have intelligent controllers that manage the movement of data between the different types of disks. Frequently accessed data typically resides on the SSD disks from where it can be retreived more quickly. Infrequently accessed data is typically held on the HDD disks which provide cheaper storage.

3.5 The raw capacity of the current disk arrays is approximately one petabyte per datacentre. However, data protection mechanisms, that ensure data integrity is maintained in the event of a disk (or multiple disk) failure, reduce the usable capacity. A typical example of one of the protection mechanisms used is disk mirroring, which is exactly as described: the contents of one disk are mirrored to another. This reduces capacity by 50% for those disks that are mirrored but does provide excellent data resilience as all disk input/output operations are redirected to the mirror. When the failed disk is replaced, the mirro relationship is automatically rebuilt.

3.6 The physical server estate uses an architecture known as Blade server. A server is a high-specification computer (very fast processors and lots of memory). In Blade format, the physical components of the servers are combined into very compact units that are then held within a Blade enclosure. An enclosure is like a big box that the Blade servers slot into (typically 16 servers are housed within a single enclosure). The benefit is that the enclosure can provide resources to all those servers it holds, so removing the need for each server to have certain individual components e.g. power supply and network connections.

3.7 The storage and server architectures used by the shared service have been in place (although upgraded over time) for more than ten years. When the technologies were first deployed, they were state-of-the-art solutions that were appropriate for the needs of the councils. As technology has moved on, these traditional architectures now have some significant disadvantages for our environment:

- Expensive to increase capacity
- Power hungry, so expensive to run and larger carbon footprint
- Significant technical expertise required to manage and maintain

3.8 With several of the existing storage and server components reaching end of vendor support in January 2023, the shared service has evaluated a number of different possible replacement architectures. The aims being to:

- Provide the best value for the partner councils
- Have a more energy-efficient solution so reducing power consumption and carbon emissions
- Give a secure, performant and scalable server and storage capability
- Bring a more flexible architecture that is easy to scale-up or scale-down as required
- Allow for a single administrative interface to all components so reducing the complexity of management
- Provide a path for future integration and migrations with cloud computing platforms such as Microsoft Azure and Amazon Web Services that the partner councils are already using to some degree

4. Technical Solution Architectures

4.1 To determine what solution would best meet the needs of the shared service both now and in the future, STS looked at various technical solution options.

4.2 Solutions Considered:

4.21 Stay with the existing disk storage and server solution. Extend hardware support contracts (through third parties where necessary) to sweat the assets.This would, however, still leave us without any security patches and

software updates, leaving us in a vulnerable position with regards to security.

4.22 Procure another traditional disk storage/server solution. The benefit of this is that it is a well-proven architecture and one that we are very familiar with. However, looking forward, the traditional approach does not easily give us the flexibility we need to scale up (or down) and can be very expensive to expand. It also lacks the integration with cloud platforms, so may hinder future migration paths and disaster recovery flexibility.

4.23 Look at more modern and flexible solutions such as:

- Hyperconverged Infrastructure (HCI). HCI combines the server and disk storage into a single appliance. Scalability is achieved by adding additional appliances as required. Multiple appliances work together within a cluster to provide optimum performance and resilience. Workloads can be moved (automatically if required) between appliances without any downtime to optimise the loads on the appliances. Data is replicated between the appliances – if an appliance crashes or fails, the workloads it was running are automatically relocated to, and balanced across, the remaining appliances in the cluster. But there is a lot more to it as well – H CI converges all of the components including server, disk storage, networking into a single management unit and interface so greatly reducing the administrative effort required ro maintain the environment.
- Disaggregated Hyperconverged Infrastructure (dHCI). This is similar to HCI but uses centralised disk storage rather than consolidating the server and disk storage into a single appliance.

5. Recommended Technical Architecture

5.1 STS has examined the possible technical solutions and recommends that a Hyperconverged Infrastructure (HCI) would be the best way forward to meet the needs of the shared service now and for the next 5-7 years. There are a number of benefits and advantages of HCI.

5.2 Scalable and agile. As more resource is required, additional nodes can be added, and the software-defined infrastructure makes it possible to automate and orchestrate workload deployments and other operations.

5.3 Simplified management. Management of the entire HCI environment is through a single interface.

5.4 Reliability. An HCI cluster contains multiple nodes that distribute functions across the cluster to provide resilience and high availability. Fault tolerance and disaster recovery are built into an HCI platform so if one node fails, the workloads that were running on that node will be automatically moved to another node in the same cluster. Additional nodes can be added or replaced without incurring downtime or workload disruptions.

5.5 Performance. Storage and compute are in the same unit so reducing latency (the time taken to access data held on the disk storage). Workloads can be moved between nodes to ensure optimal processing.

5.6 HCI uses significantly less space and power than the existing server and storage components used by the shared service. This will lead to lower energy costs, cooling requirements and carbon emissions.

5.7 Cloud computing compatible. HCI platforms have been designed with cloud compatibilty in mind. This provides support for hybrid environments that use both on-premise datacentres but also look to take advantage of benefits provided by clouds such as Microsoft Azure or Amazon Web Services. This also presents potential future migration paths to the cloud.

5.8 Cost savings. HCI consolidates hardware resources and maximizes their use, resulting in fewer servers, smaller datacentre footprint, lower power and cooling requirements leading to lower carbon emissions. Also, the platform can be built with commodity hardware, avoiding the high costs that come with deploying specialized server, storage or network components and because HCI uses direct-attached disk storage, the high costs that come with deploying and managing a traditional centralised disk storage architecture can be avoided.

6. Recommendations and Tender Result

6.1 The requirement for the compute/storage replacement was put out to tender via the Crown Commercial Services Technology Products and Associated Services (RM6068), Lot 1 hardware and Software Associated Services ("the Framework Agreement"). The tender process operated was in accordance with the requirements of the Framework Agreement.

6.2 The opportunity was published through the Crown Commercial Bravo Solution Portal on 21 December 2021.

6.3 In accordance with the requirements of the Framework Agreement, the Invitation to Tender stated that the selection of Suppliers to be awarded the contract would be made on the basis of the most economically advantageous combination, and that in evaluating tenders, the Council would have regard to the following:

- Quality (40%)
- Price (60%)

6.4 The tender evaluation was carried out by officers from Shared Technology Services.

6.5 All tenders had to be submitted electronically no later than 12pm on 28 January 2022. Six tenders were submitted. Of the 6 bids received Computacenter (UK) Limited submittied the most economically advantageous bid.

6.6 Brent will enter into the contract on behalf of both Southwark and Lewisham Council.

7. Financial Implications

7.1 The cost of the solution, including installation and support, is (currently) £1,465,000 as per the tender response. We run a risk where prices may increase, as the time taken for internal governance may pass the expiry of the quotations and the channel partner has identified the risk of inflation and currency fluctuations. Furthermore, we require resources to deliver the project, additional cloud backup storage, training and a contingency to give a total of £1,995,000 – detailed below:

Component	Cost	Capital	Revenue
Project Resources	£ 200,000	£ 200,000	-
Hardware (includes £25k for additional required network equipment), Support, Licensing, Installation + Professional Services	£ 1,490,000	£ 1,490,000	-
Additional Backup Storage	£ 150,000	£ 150,000	-
Risk of Inflation and Currency rate changes	£ 45,000	£ 45,000	-
Training	£ 10,000	£ 10,000	-
Contingency	£ 100,000	£ 100,000	-
Total	**£ 1,995,000**	**£ 1,995,000**	

7.2 In the case of the Server/Disk Storage replacement project, we based cost apportionment between the partner councils on existing usage within STS datacentres, as this would give a fairer representation of what would actually be using the new infrastructure.
To calculate usage, we looked at memory utilisation within the STS Server estate. Memory is the best indicator for usage of the current platform. With the recent on-boarding of Lewisham Homes into STS infrastructure support, Lewisham Homes memory assignment on their existing platform has also been

taken into consideration. The table below shows the memory assignment and apportioned cost.

MEMORY CALCULATIONS			Apportioned Cost
Proposed apportionments			
	Configured RAM	Proportion	
Brent	6,519,949	44.80%	893,760
Lewisham	3,850,393	26.46%	527,876
Southwark	2,377,049	16.33%	325,784
LH	1,805,668	12.41%	247,580
TOTALS	**14,553,059**		**1,995,000**

7.3 The cost to Lewisham is therefore estimated to be £527,876 and this cost will be met from specific corporate reserves held to fund IT transformation.

8. Legal Implications

8.1 The Council, Southwark and Brent entered into a Shared Service Agreement ("the Agreement") for the provision of IT services which includes hardware. The Agreement sets out how the service will be run, each Council's obligations under it and what decisions are reserved to each paricular Council. In the Agreement, decisions are reserved to members where a contract is being awarded on behalf of the Shared Service that has a total value of above £500k. Therefore only Mayor and Cabinet can approve the recommendations in this report.

8.2 The report sets out the rational for the technical architecture chosen, procuring the service and the process used. A Crown Commercial Services framework agreement was used which is a compliant route. The bidder that submitted the most economically advantageous bid is the chosen supplier.

8.3 The decision is a key decision as it is likely to result in expenditure of £500,000 or more.

8.4 In taking this decision, the Council's public sector equality duty must be taken into account. It covers the following protected characteristics: age, disability,

gender reassignment, marriage and civil partnership, pregnancy and maternity, race, religion or belief, sex and sexual orientation.

8.5 In summary, the Council must, in the exercise of its functions, have due regard to the need to:

- eliminate unlawful discrimination, harassment and victimisation and other conduct prohibited by the Act.
- advance equality of opportunity between people who share a protected characteristic and those who do not.
- foster good relations between people who share a protected characteristic and those who do not.

8.6 It is not an absolute requirement to eliminate unlawful discrimination, harassment, victimisation or other prohibited conduct, or to promote equality of opportunity or foster good relations between persons who share a protected characteristic and those who do not. It is a duty to have due regard to the need to achieve the goals listed above. The weight to be attached to the duty will be dependent on the nature of the decision and the circumstances in which it is made. This is a matter for Mayor and Cabinet, bearing in mind the issues of relevance and proportionality. Mayor and Cabinet must understand the impact or likely impact of the decision on those with protected characteristics who are potentially affected by the decision. The extent of the duty will necessarily vary from case to case and due regard is such regard as is appropriate in all the circumstances.

8.7 The Equality and Human Rights Commission (EHRC) has issued Technical Guidance on the Public Sector Equality Duty and statutory guidance. The Council must have regard to the statutory code in so far as it relates to the duty. The Technical Guidance also covers what public authorities should do to meet the duty. This includes steps that are legally required, as well as recommended actions. The guidance does not have statutory force but nonetheless regard should be had to it, as failure to do so without compelling reason would be of evidential value. The statutory code and the technical guidance can be found on the EHRC website.

8.8 The EHRC has issued five guides for public authorities in England giving advice on the equality duty. The 'Essential' guide provides an overview of the equality duty requirements including the general equality duty, the specific duties and who they apply to. It covers what public authorities should do to meet the duty including steps that are legally required, as well as recommended actions. The other four documents provide more detailed guidance on key areas and advice on good practice.

9. Equalities Implications

9.1 No specific equalities implications

10. Climate Change and Environmental Implications

10.1 There will be some significant environmental benefits of the chosen Nutanix solution, and these will also lead to energy cost savings.

10.2 The existing Dell Server solution would consume electricity costing approximately £83k for the 12 months beginning October of this year (2022) based on projected energy price rises (for the day rate expected to be around 28p per kWh and a night rate of 20p per kWh). The disk storage components will consume electricity costing around £41k during the same period, giving a total cost of approximately £124k.

10.3 The proposed Nutanix HCI solution will use electricity costing between £42.3k and £65k for the same twelve month period depending on the power draw (which will in turn depend upon the loading on each appliance). As can be seen there are significant electricity cost savings that will be between approximately £59k to £81k per annum.

10.4 There will also be additional cost savings from reduced cooling requirements. Again, depending on the load on the new solution, cooling savings are estimated to be between £36k and £50k per annum.

10.5 Overall power consumption costs and carbon emissions for the proposed Nutanix solution are likely to be around 50% of those of the current Dell server and disk storage infrastructure.

10.6 This project is likely to reduce the data centres' carbon footprint by around 50-60 tonnes of carbon per year.

11. Crime and Disorder Implications

11.1 No specific crime and disorder implications

12. Health and wellbeing implications

12.1 No specific health and wellbeing implications

13. Report author and contact

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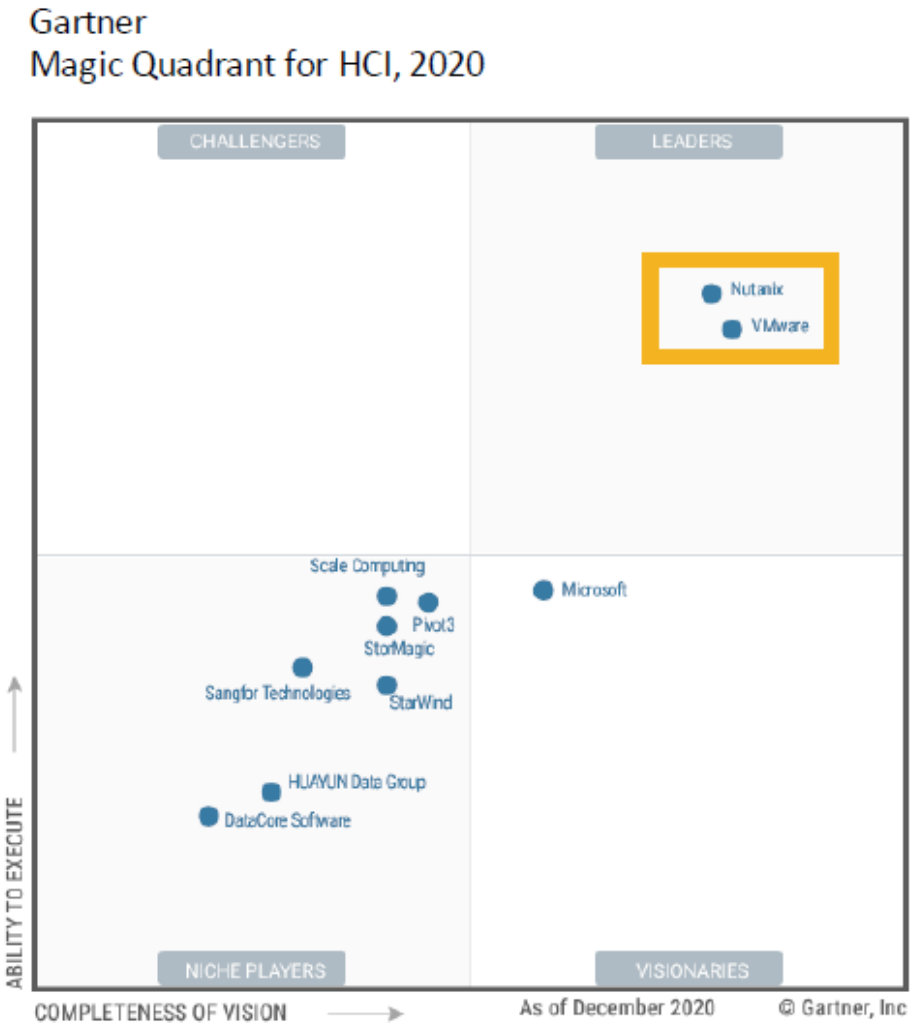
Appendix 1: Advisories

The shared service has a subscription with Gartner, part of which gives us access to a Gartner Technical Professional. This enabled us to participate with an expert in evaluating HCI solutions. In the engagement, we discussed our environment and what our needs were going forward. We also asked a pointed question “If you had this budget, what product would you buy” but there was no specific recommendation other than to say that all the options we were considering were valid choices and would all meet our requirements. This is largely borne out by the Gartner Magic Quadrant for HCI solutions (it should be noted that in this context, the Magic Quadrant focusses on software solutions, so turnkey solutions integrated with specific hardware (such as VxRail) are not considered). The solutions we have considered are Nutanix, VMWare vSAN implemented on a VxRail hardware platform and Microsoft Azure Stack HCI. Both Nutanix and VMWare are out on their own in the Leaders section of the Gartner Magic Quadrant. While Microsoft is a new player in this market, when this Magic Quadrant was published, they are listed in the Visionaries segment.



In addition, the Forrester Wave for HCI has the following analysis, which again shows that Nutanix and VMWare are leaders in both current offerings and strategy:

Appendix 2: Detailed Energy Consumption Requirements

APP 2.1 The existing Dell M1000e Blade enclosures used by STS are currently consuming an average of around 4kWh each. STS currently has 12 of these enclosures divided equally between the Brent and Croydon datacentres. The disk storage component of the Compellent solution comprises 10 Dell SC 220 enclosures, 6 Dell SC280 enclosures and 2 Dell SC420 enclosures (the total for both datacentres combined). The estimated cost of electricity beginning in October 2022 (for the STS Brent datacentre) is a day rate of 28p per kWh and a night rate of 20p per kWh. The day rate is for 19 hours a day and the night rate for 5 hours a day.

APP 2.2 The existing Dell Blade enclosures electricity cost for the upcoming year at the estimated rates will be approximately £83k (this is based on an average power consumption per enclosure of 3kWh). The Dell disk storage components will consume electricity costing approximately £41k over the same time period, so giving a total annual cost for the existing Compellent solution of around £124k per annum.

APP 2.3 The Nutanix solution that is recommended in this report requires 12 Nutanix nodes per datacentre (24 in total). The power consumption requirements are:

Brent
12 x NX-8155-G8 @ 0.82KWh (Typical Power Draw) - Typical Cluster power requirement = 9.8KWh.
12 x NX-8155-G8 @ 1.18KWh (Maximum Power Draw) - Max Cluster power requirement = 14.16KWh.

Croydon
12 x NX-8155-G8 @ 0.82KWh (Typical Power Draw) - Typical Cluster power requirement = 9.8KWh.
12 x NX-8155-G8 @ 1.18KWh (Maximum Power Draw) - Max Cluster power requirement = 14.16KWh."

APP 2.4 At a typical power draw, the annual cost for the Nutanix solution is approximately £42.3k and at the maximum power draw, £65k.

APP 2.5 As can be seen by comparing our existing Dell configuration with the proposed Nutanix configuration, there will be significant reductions in energy usage over the 5-year period, so complying with the councils' wishes to promote a cleaner environment and at the same time delivering energy cost savings.

APP 2.6 Using a conversion rate of 1kWh causes 233g of CO2 emissions (source Bulb - https://bulb.co.uk/carbon-tracker/#:~:text=The%20UK%20government%20report%20on,CO2e%20per%20kWh%20of%20gas.)

The following approximate CO2 emissions are:

- Existing Dell blade enclosure and Compellent storage infrastructure = 111,000 kg per annum
- Nutanix typical power usage = 37,474 kg per annum
- Nutanix maximum power usage = 57,803 kg per annum

APP 2.7 In addition, there will also be a cost-saving on cooling compared with the existing kit. The ratio of total power (power used by the compute/storage and network plus the power needed to provide cooling) used within the datacentre, against just the power used by the compute, storage and network is known as the PUE – Power Usage Effectiveness. Using a PUE of 1.6 for the STS datacentres, with the existing Dell Compellent Solution in place, the annual cooling power consumption cost is approximately £75k. With the Nutanix solution, using typical power usage, the approximate annual power consumption cooling cost is £25k. Using the maximum power usage figures, the approximate annual power consumption cooling cost is £39k.

APP 2.8 Overall power consumption costs and carbon emissions for the proposed Nutanix solution are likely to be around 50% of those of the current Dell server and disk storage infrastructure.

APP 2.9 There will also be some considerable space savings within the racks of our datacentres. Each blade enclosure requires 10U of rack space (so totalling 120U currently). The Compellent SAN adds around 30U to that. The Nutanix solution only requires 60U of rack space in total (less than one rack per datacenre).