Melton Borough Council

Business Case:
Consolidation of Servers using VMWare Virtualisation

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Contents

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2.Management Summary

This document constitutes the Business Case for the consolidation of servers using VMware virtualisation. This management summary is an overview of the benefits, costs and risks of implementing this project.

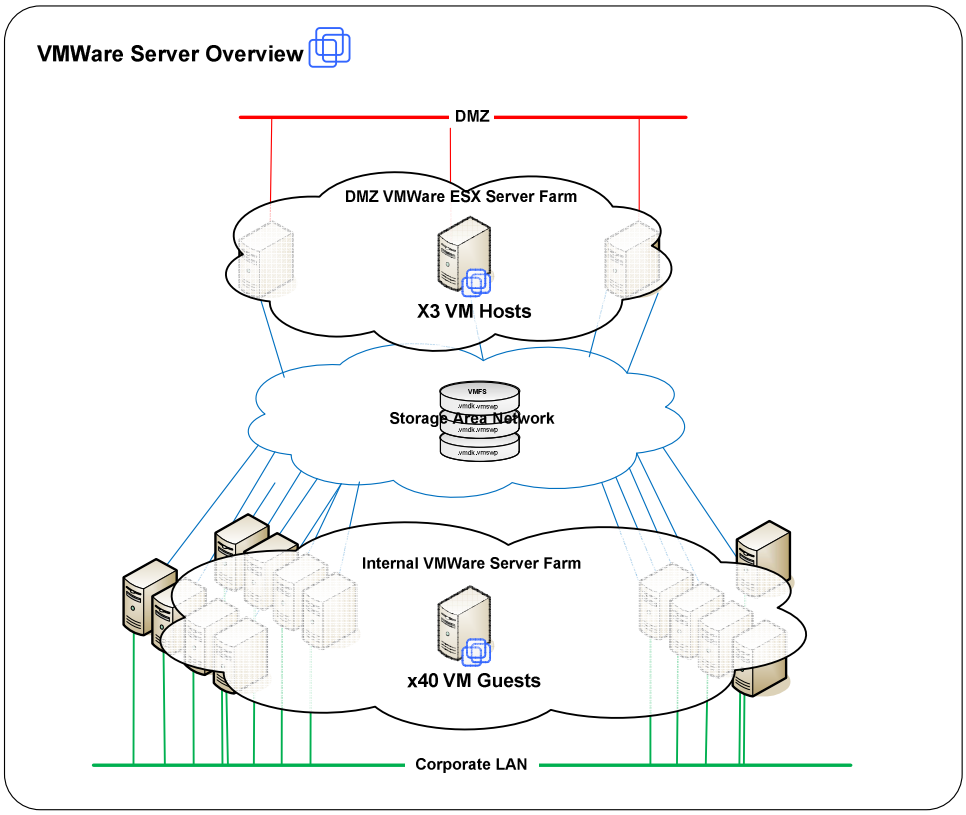
2.1 Introduction

Server consolidation using VMware is a method of converting physical servers into software, a process commonly known as server virtualisation. This approach allows the virtualised servers (VMware guest systems) to share hardware resources, making it possible to run multiple operating systems with multiple applications on the same physical server hardware at the same time, increasing the utilization of resources such as memory, CPU, network and shared storage.

Melton Borough Council already has a number of virtualised servers running as a proof of concept for VMware with 6 systems moved on to a VMware ESX server. This has proved very successful with minimal disruption during migration with no downtime experience during testing.

During this phase, any new test and production servers were first assessed for suitability of virtualisation using the existing VMware infrastructure before dedicated hardware procurement was considered.

The diagram below shows the proposed VMware infrastructure.



This element of the authority's adoption of virtualisation is aimed at reducing the number of physical servers in the Phoenix House Computer Room by moving the environment onto the VMware V-Sphere Virtualisation platform. After successful completion, there will still be a number of servers that are not suitable for virtualisation, in particular, systems with attached peripherals or lack of software support from the vendor.

2.2 Advantages

- Green IT benefits including, reduced power consumption, cooling and rack space
- Contributes towards other initiatives such as 'the low carbon building project'
- Reduced system hardware costs, including ongoing support and maintenance after 3 year warranty
- Rapid deployment of new systems
- Improved hardware resiliency
- Simplifies and enhances disaster recovery arrangements,
- DR recovery plan covers all VM guest systems, which simplifies individual systems' recovery arrangements.
- No downtime required for hardware replacement
- System resources can be increased without additional expenditure
- Savings on LAN infrastructure as fewer servers will be connected.
- Better use of server resources. Most Intel x86 based system servers typically use less than 10% CPU. We will be able to increase the resource utilisation significantly without affecting performance.
- Improved historical performance metrics.
- Each server's data is stored on the corporate SAN for easy maintenance
- Microsoft Windows Data Centre licensing allows for no cost operating system upgrades
- All new VMware guests systems benefit from Enterprise OS licensing
- Point in time 'snapshots' of VM guests allows for quick system roll-back in the event of a system upgrade failure.

2.3 Options

In considering this project, we have two main options as detailed below. These range from do nothing to investment in additional capacity which will build on our existing VMware infrastructure shown previously.

2.3.1 Option 1 – Do nothing

We could decide not to virtualise servers and continue using the traditional server hardware platform per system. This would keep the emphasis on server funding for particular projects plus corporate funding for authority wide initiatives.

2.3.2 Option 2 – Virtualise Servers

An analysis of the current physical systems has identified 40 systems which are suitable for migration to the virtualised environment. The project would upgrade existing servers, released by the virtualisation project, to create a VMware server farm to provide sufficient virtualisation capacity. The identified 40 systems for migration would require a total of 3 VMware ESX servers; this is based on a consolidation ratio of 13:1.

2.4 Costs

The costs below show the capital and revenue costs for all options, this includes the costs for all hardware and licensing and revenue costs include power consumption. A full breakdown of these costs can be found in section 6.

5 year revenue costs	Power	Equipment
Option 1 – Do Nothing	£36,135	£165,000
Option 2 – Upgrade existing servers Reducing count from 40 servers to 3	£3,350	£98,000

2.4.1 Savings

Depending on the option adopted, there are various levels of savings that can be achieved after the initial server outlay.

5 year cost saving	Power	Equipment
Option 1 - Do Nothing	£0	£0
Option 2 – Upgrade existing servers	**£32,785**	**£67,000**

Whilst significant savings can be achieved against the effort required to physically upgrade 40 servers, which is estimated at 120 days. These savings are lost against the effort required to virtualise these systems which is a total of 75, please see section 2.4.2 Resources Required.

2.4.2 Resources Required

We estimate the migration of 40 systems to VMware would require the following effort:

Dell consultancy	15 days
MBC teams	60 days

These figures are estimates based on each of the 40 systems requiring 0.75 days to migrate and half a day to test, including 25 additional days for VMware server infrastructure changes. These estimates will be re-evaluated once a more detailed analysis is carried out.

2.5 Project plan overview

Virtualisation pilot	Completed
Analysis of current infrastructure and specify new design	Completed
Purchase components, install and configure upgraded servers	Dec 2010
Virtualisation of 40 servers	Jan 2011

2.6 Key risks

- Lack of business resources made available for implementation, migration and testing.
- Security / technical issues prevent consolidation for some applications.

- Lack of support / response from 3rd party suppliers.
- Customers seeing 'no benefit' whilst having disruption and testing and thus not buying into the project.
- Arranging system downtime at convenient times.
- Current instabilities in the SAN infrastructure could cause data corruption if not addressed.

2.7 Opportunities and recommendations

The recommendation is to select 'Options 2 – Upgrade existing Servers' and purchase additional hardware for the existing servers. This option would realise considerable costs savings in terms of server renewal, maintenance and power consumption whilst still leaving capacity available for future projects that require the rapid provisioning of a virtual server. Option 2 also ensures systems are ready for business continuity / disaster recovery and allows system upgrades with minimal disruption.

3.Introduction

3.1 Purpose of this Document

This document constitutes the Business Case for the consolidation of Windows servers using VMware, the purpose of this Business Case is:

- To review the progress made so far.
- To document the justification for undertaking a further consolidation.
- Assess the costs for further consolidation.

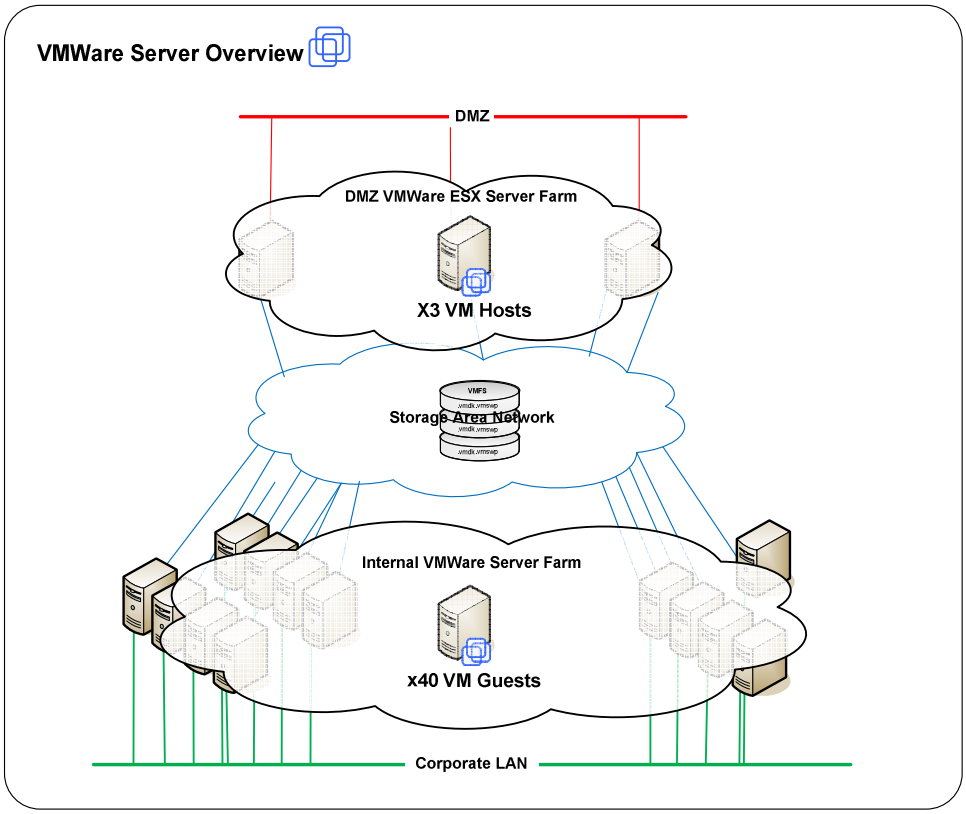
3.2 Background

Historically individual projects have specified their own servers according to their individual project and system requirements. This has resulted in large number of servers running within the Phoenix House computer suite, each with their own power, cooling and space requirements.

This proliferation of servers has resulted in approximately 45 systems within the computer suite, both attached to the corporate LAN and various security zones (DMZs). Whilst around 25% of these systems are heavily utilised, the other 75% sit on hardware that is under utilised, with processors running between 1-10%, these underutilised systems are ideal for virtualisation. VMware can achieve VM Guest to physical 'consolidation ratios' of between 10:1 and 20:1. For this paper all calculations are based on a physical to VMware server consolidation ratio of 13:1.

Melton Borough Council ICT has run a proof of concept for VMware with 6 systems moved on to a single VMware ESX server. This proved very successful with minimal disruption during migration with no downtime experienced during testing.

The aim of the project is to migrate the remaining 40 systems identified in the virtualisation survey onto the VMware platform.



After successful migration, there will be a number of servers that are not suitable for virtualisation, in particular, systems with attached peripherals, lack of software support from the vendor and remote servers located around the borough. It is expected that these system may become suitable in the future as higher bandwidth becomes available to the remote sites and as vendors build their software to be 'VM ready'.

3.2.1 Current context

Melton Borough Council will need to relocate the current server infrastructure from Phoenix House to the new shared office building in May 2011 and, in order to accommodate the ICT requirements of partner organisations, there will considerable pressure on both space and resources within the new server room. The council also has to make significant financial savings over the coming years and this project aims to address both of these issues by reducing the number of physical servers, and the power and cooling required to support the Councils ICT systems.

3.3 Project mandate

The project mandate comes from Melton Borough Council's ICT Strategy for 2007/10 which was agreed by the full Council in 2007, and the requirement to accommodate Melton Borough Council systems alongside partner systems within the server room specified in the new office building and additionally to release savings to the business to offset increases in costs elsewhere.

3.4 Assumptions

- ICT and business resources will be available to both migrate and test applications once they have been consolidated onto fewer machines. The project needs to be given a high enough priority so that it doesn't get superseded by other projects.
- 3rd party suppliers are willing to support their applications in a virtual environment and will be able to assist in a timely manner to support requests when migrated.
- Departmental staff will be able to assist with testing as and when required.

- Pressure will be put on 3rd party suppliers where necessary to ensure they will support their product on the virtualisation platform.
- All hardware required will be purchased and installed during Q4 2010.
- All costs for servers, maintenance etc will be based on the latest information and quotes available.
- Legacy systems will, where practical, either be migrated to the new hardware or decommissioned.
- The physical server to VMware server consolidation ratio will be 13:1.
- Projects will be required to pay for large system implementations requiring one or more physical servers.
- SAN stability issues are addressed through an updated version of disk array.

4.Options appraisal

This section describes the main options that are being considered by Melton Borough Council.

4.1 Option 1 – Do Nothing

4.1.1Summary / Description

We could decide not to virtualise servers and continue using the traditional server hardware platform per system. This would keep to the emphasis on server funding within the particular projects plus corporate funding for authority wide initiatives.

4.1.2Rationale for including this option

The do nothing option should always be considered as a baseline for comparison.

4.1.3Advantages

- No immediate resource requirements to implement new hardware and technologies.
- Systems will continue to run on their own discrete servers with hardware replacement based on available funding.
- Support arrangements easier as there will be no dependency between different systems.

4.1.4Disadvantages

- The current server density is too great to fit into that available space at the new building
- Expensive. Four year server replacement cycle for 40 systems would cost approximately £93,000.
- Each system requires its own power, cooling and rack space.
- Each system requires a maintenance contract if kept after the 3 year warranty period.
- Changes in departmental priorities may limit funding for hardware upgrades, requiring a greater support effort.
- Disaster recovery consideration increases the cost of each system, including increasing the environmental requirements.
- Downtime required for hardware replacement

4.2 Option 2 – Consolidate servers onto VMware

4.2.1Summary / Description

Following a detailed audit and analysis of the existing physical servers by Dell, ICT Services will need to purchase the necessary components to upgrade three of the existing servers (these servers will be released as part of the virtualisation exercise) and create a VMware server farm to provide sufficient virtualisation capacity. This approach would benefit from economies of scale in that each system would share the cost of hardware, power consumption, cooling and rack space. We would also need to update the existing SAN to provide sufficient fast access disk storage to allow the virtual servers to be moved between host systems for load balancing and system maintenance.

It is recognised that there are a small number of servers that are not good candidates for virtualisation, in particular, systems with attached peripherals or lack of support from the software vendor.

Once migration has taken place, old server hardware will be decommissioned with any local disk system destroyed to prevent data loss outside the organisation. The identified 40 systems for migration would require a total of 3 VMware ESX servers; this is based on a consolidation ratio of 13:1.

4.2.2Rationale for including these options

Virtualisation offers a cost effective way of reducing the number of physical servers required to service the organisation's business needs, and making systems 'DR ready' whilst reducing the reliance on, and maintenance of, dedicated hardware. The environmental impact of systems is also reduced, fitting in with the Council's environmental initiatives including Green IT.

4.2.2.1 Advantages

- Green IT benefits including, reduced power consumption, cooling and rack space
- Contributes towards other initiatives such as 'the low carbon building project'
- Reduced system hardware costs, including ongoing support and maintenance after 3 year warranty
- Rapid deployment of new systems
- Improved hardware resiliency
- Simplifies and enhances disaster recovery arrangements,
- DR recovery plan covers all VM guest systems; this simplifies individual systems' recovery arrangements.
- No downtime required for hardware replacement
- VM guest's resources can be increased without additional expenditure
- Savings on LAN infrastructure as fewer servers will be connected.
- Better use of server resources. Most Intel x86 based system servers typically use less than 10% CPU. We will be able to increase the resource utilisation significantly without affecting performance.
- Improved historical performance metrics.
- Each server's data is stored on the corporate SAN for easy maintenance
- Microsoft Windows Data Centre licensing allows for operating system upgrades at no additional cost
- All new VMware guests benefit from Enterprise OS licensing
- Point in time 'snapshots' of VM guests allows for quick system roll-back in the event of a system upgrade failure.

4.2.2.2 Disadvantages

- VMware server farms put greater emphasis on the Storage Area Network, increasing the impact of SAN downtime.
- Resources from within ICT will be required to migrate systems,
- Need 3rd party application suppliers to verify that their software will work and is supported in a virtual environment
- A more co-ordinated approach will need to be taken across ICT to make sure upgrades are well planned and the impact on other systems is considered.
- Additional SAN & LAN ports are required, although LAN ports would be freed up once old equipment is migrated.
- A VMware server failure impacts multiple VM Guest systems, but VM guest automatically reboot on an alternative server to minimise downtime

4.2.3Audit of systems

The detailed audit and analysis found in the appendix identified systems that can be considered as candidates for virtualisation, including system already migrated or not suitable for virtualisation.

System Type	*Number of Systems*
Candidates for migration	35
Already migrated	6
Remote site	2
High Utilisation	2
VM ESX	1
Total	**46**

*based on 13:1 consolidation ratio.

4.3 Preferred option

The recommendation is to select 'Option 2 – Upgrade existing Servers' and purchase additional hardware for the existing servers. This option would realise considerable costs savings in terms of server renewal, maintenance and power consumption whilst still leaving capacity available for future projects that require the rapid provisioning of a virtual server. Option 2 also ensures systems are ready for business continuity / disaster recovery and allows system upgrades with minimal disruption.

5.Benefits

5.1 Quantifiable benefits

Reduction in Hardware spend over 3 years

Baseline: Spending now would save on replacement hardware over three years.

Project: This project would negate the costs of buying new hardware for individual systems.

Measurable: Reduced hardware cost.

New server systems would benefit from Microsoft Licensing

Baseline: Each new system requires a Microsoft Server licence @ £350.

Project: Microsoft Data Centre License allows new systems to be commissioned at no additional Microsoft costs.

Measurable: Reduced software costs

VM Systems are ready for DR

Baseline: 40 physical servers require their own partner system at the Disaster Recovery site and recovery documentation

Project: Physical VM server farm will require 'partner' hardware at the DR site but each VM guest system benefits from the main VMware recovery plans.

Measurable: Reduced hardware costs

Less environmental impact of servers

Baseline: 40 physical servers require their own power, cooling and rack space.

Project: Reduce the number physical servers also reduces power consumption and cooling.

Measurable: Reduce power costs

5.2 Non-quantifiable benefits

Environmental impact of server

Baseline: Each system currently requires its own power, cooling and rack space

Project: Fewer servers will mean less power consumption and cooling. Supporting Melton Borough Council's Green/environmental initiatives, good PR!

Easy upgrade of Hardware:

Baseline: Currently, each server's hardware requires downtime to perform maintenance and upgrade tasks

Project: Once systems are virtualised, hardware maintenance can be performed without the need for system downtime by moving live guest systems

5.3 Threats/dis-benefits

The main threat is the fact that Microsoft has strict rules on licensing virtualised servers, in particular, VM servers can be moved to new hardware, but not moved again for 90 days. The cost projections in this report take this into account through the purchase of Microsoft Data Centre licenses, which avoid this restriction.

Storage Area Network backup and stability issues could cause VMware data corruption. This threat is expected to be removed by the upcoming upgrade of the SAN.

6.Project costs

6.1 Costs summary

Below are details of the of the capital and revenue costs associated with the two options discussed. At this stage some costs are estimates and could vary when final quotation for servers is produced.

5yr revenue spend	Power	Equipment
Option 1 – Do Nothing	£36,135	£165,000
Option 2 - Upgrade VMware servers	£3,350	£98,000

6.2 Option 1 – Do Nothing

During the next three years, all of the 90 proposed systems would require new hardware or an extended maintenance agreement. The costs below assume each system requires only entry to mid level range server within the next three years.

5yr revenue spend	Power	Equipment
40 x Intel based Dell servers		£165,000
40 x Power consumption @ £507	£36,135	
Total	**£36,135**	**£165,000**

6.3 Option 2 – Consolidate server onto VMware

6.3.1 Costs Models

6.3.1.1 Options 2a – New VMware servers

40 VM Guest would require a total of 3 ESX server based on a consolidation ratio of 13:1.

	Purchase
3 x Dell VM server upgrade	**£7,799**
1 x VMware V-Sphere Enterprise	**£2,471**
1 x EqualLogic PS4000XV SAS 15K SAN	**£20,924**
1 x Dell Backup Server upgrade	**£2,098**
3 x Backup Exec 2010 Agent	**£1,779**
2 x 24 Port managed Switch	**£3,902**
1 x ICS Consulting	**£8,703**
Total	**£47,676**

6.3.1.2 Savings

For a savings comparison, the 'Estimated' costs of 'Do nothing' against the 'Option 2' cost for upgrading the existing 3 servers to support 40 VM in a resilient configuration. This would leave our existing spare capacity in place.

5 year revenue saving	Power	Equipment
Option 1 - Do Nothing	**£0**	**£0**
Option 2 – Upgrade existing servers	**£32,785**	**£67,000**

**Power consumption savings detailed below*

Whilst significant savings can be achieved against the effort required to physically upgrade 40 servers, which is estimated at 120 days. These savings are lost against the effort required to virtualise these systems which is a total of 75, please see section 6.3.2 Resources Required.

6.3.1.3 Power Consumption Saving

Property department has advised that winter 2009 consumption costs for the Phoenix House are 10.75p per kilo watt hour (kwh). This has increased by 10 percent from an average of 9.40p per kwh for summer 2009. Industry experts predict energy costs will increase over the next 12 months, so the figures below can be considered conservative.

Summer 2009 figures = Day: 10.695p per kwh, Night: 6.258p per kwh , Avg (d/n) 9.400 p per kwh

Winter 2009 energy increased cost by 10% to an average of 10.75p per kwh

An analysis of the current servers by Dell shows power consumption figures shown below:

	Count	Annual Energy Usage (kWh)	Annual Energy Cost
Current Servers	37	65700	£7,227
Target Servers	5	6096	£670
Saving		**59,604**	£6,557

This shows that a migration to VMWare ESX servers will save £32,785 over 5 years.

6.3.2 ICT Staff Resources

6.3.2.1 ICT teams

Analysis of current infrastructure and specify new design	5 days
Confirm suppliers approval for application migration	5 days
Purchase components for upgrade, install and test servers	15 days
Preparatory work to release server systems for upgrade	10 days

6.3.2.2 Virtualisation Consultants

Install VMware and Configure servers against SAN	1 day
Plan migration to virtual environment	2 days

Migrate servers to virtual environment	13 days

6.3.2.3 Business teams

Application testing after migration	10 days
Total	**39 days**

All of the above resources are based on estimates and will be refined later, please allow for a tolerance of +/- 20% at this stage. It should also be noted that some of the migration work will be required regardless of the option selected, as aging hardware will need replacing at some point in the future.

6.4 Assumptions

This consolidation project assumes that all servers systems can be consolidated easily and that there are no issues. In reality there will be other issues to be resolved, such as vendor support – any system with an external support agreement will require the vendor to approve migration to a virtualised environment.

7.Risk Analysis

7.1 Risk assessment

ID	Risk	How to mitigate this risk	Likelihood / Impact
001	Insufficient resources to complete the project initiation document	Raise with project board at next meeting.	H/H
002	Lack of resources within ICT to implement and test	Make sure the work is given a high enough level of priority with ICT.	M/H
003	Technical reasons mean many systems cannot be migrated.	Talk to 3rd party suppliers early and give them time to check and validate our plans.	M/H
004	Security issues prevent consolidation of servers.	A recent risk assessment has been concluded that no additional security risks are posed.	M/H
005	SAN stability issues can cause VMWare server downtime and loss of reputation	Implement SAN upgrade as soon as possible.	M/H
006	Customers seeing 'no benefit' whilst having disruption and testing and thus not buying into the project.	Promote the benefits of virtualisation to system owners. E.g. costs saving, green benefits and DR capabilities	L/M
007	Arranging system downtime at convenient times.	Arrange downtime outside core hours when required	L/M

7.2 Financial sensitivity analysis

7.2.1Scenarios

The costs identified at this stage are estimates only and could vary when final/updated hardware quotations are produced. Thus it would seem reasonable to assume that the prices could change by +/- 20%.

7.2.2Sensitivity to failure

The project would become unviable when the total costs for increasing the use of virtualisation exceed the 'do nothing' option. ie: when the procurement costs exceeds £165,000. However we also need to take into account the savings realised due to reduced maintenance costs, lower power consumption and the projects contribution towards Borough Council 'Green' initiatives.

8. Timescales

8.1 Summary of project plan

Virtualisation pilot	Completed
Analysis of current infrastructure and specify new design	Completed
Purchase components, install and configure upgraded servers	Dec 2010
Virtualisation of 40 servers	Jan 2011

8.2 Dependencies

All virtualised servers require their operating system and data is stored on the Corporate Storage Area Network (SAN). An estimated 4TB of additional SAN storage will be required to complete the migration. If the recommended approach is taken, 24 LAN connections will be required.

9.Appenix

9.1 Full server list

Host	Make	Model	Type	Size (MB)	Speed (MHz)
BACH	Dell Inc.	PowerEdge 1950	Windows 2003	4096	1596
BIZET	Dell Inc.	PowerEdge 2950	Windows 2003	4096	1595
BRAHMS	Dell Inc.	PowerEdge 2950	Windows 2003	4096	1995
CHOPIN	Dell Inc.	PowerEdge 1950	Windows 2003	2048	1596
GLORFINDELL	Dell Inc.	PowerEdge 1850	Windows 2003	2048	2992
LISZT	Dell Inc.	PowerEdge 2950	Windows 2003	4096	1995
MAHLER	Dell Inc.	PowerEdge 2950	Windows 2003	4092	1995
MBCADS001	Dell Inc.	PowerEdge R200	Windows 2008	4096	3000
MBCADS002	Dell Inc.	PowerEdge R200	Windows 2008	4096	3000
MBCBIZ001	Dell Inc.	PowerEdge 2950	Windows 2003	4096	1995
MBCCCM001	Dell Inc.	PowerEdge R710	Windows 2008	4096	2128
MBC-CMS-001	Dell Inc.	PowerEdge 2950	Windows 2003	4092	2992
MBC-CRM-001	Dell Inc.	PowerEdge 2950	Windows 2003	4092	2992
MBCDMZ001	Dell Inc.	PowerEdge 2850	Windows 2008	2048	3192
MBCEER001	Dell Inc.	PowerEdge R300	Windows 2003	4092	3000
MBCERM001	Dell Inc.	PowerEdge R710	Windows 2003	4096	2527
MBCISA001	Dell Inc.	PowerEdge 2950	Windows 2003	4092	1595
MBCLOG001	Dell Inc.	PowerEdge 2850	Windows 2008	2048	3790
MBC-MOSS-001	Dell Inc.	PowerEdge 2950	Windows 2003	4092	2992
MBCMSC001	Dell Inc.	PowerEdge 2950	Windows 2003	4092	1595
MBCMSX001	Dell Inc.	PowerEdge 2970	Windows 2008 (64 bit)	8188	1995
MBCNET001	Dell Inc.	PowerEdge 1850	Windows 2008	4096	2793
MBCSDS001	Dell Inc.	PowerEdge R300	Windows 2003	4092	3000
MBCSEC001	Dell Inc.	PowerEdge R200	Windows 2003	4096	3000
MBC-SQL-001	Dell Inc.	PowerEdge 2950	Windows 2003	4092	2992

MBCSQL002	Dell Inc.	PowerEdge R710	Windows 2003	4096	2926
MBCTLC001	Dell Inc.	PowerEdge R610	Windows 2003	4088	1862
MBCTLC901	Dell Inc.	PowerEdge R610	Windows 2003	4088	1862
MBCVIR001	Dell Inc.	PowerEdge 2850	Windows 2008	3072	2992
mbcvmw001	Dell Inc.	PowerEdge R610	VMware ESX Server	12275.55	2526
MBCWTS001	Dell Inc.	PowerEdge 2950	Windows 2003	4092	2493
MBCWTS002	Dell Inc.	PowerEdge 2950	Windows 2003	4092	2493
RAVEL	Dell Inc.	PowerEdge 2950	Windows 2003	4096	1595
SAURON	Dell Inc.	PowerEdge 2650	Windows 2003	3840	2784
STRAUSS	Dell Inc.	PowerEdge 2950	Windows 2003	4096	1995
VERDI	Dell Inc.	PowerEdge 1950	Windows 2003	2044	1596
WAGNER	Dell Inc.	PowerEdge 2950	Windows 2003	4092	1596