Case study: Virtualising servers at Loughborough University Library

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In autumn 2009 the Systems Team at Loughborough University Library undertook a pilot project to virtualise some of its servers. This paper discusses what we did, why we did it and the results obtained.

Context

In the dim and distant past libraries only had to maintain a single application, their library management system. Now however there is an increasing range of applications and services that fit within the portfolio of a modern library. These include: federated search engines, link resolvers, resource/reading list management systems, institutional repositories, e-resource management systems, discovery services, etc.

To support this range of services (and other in-house systems) the Systems Team at Loughborough University Library maintain a small suite of eleven servers running the Red Hat Enterprise Linux (RHEL) operating system. As these severs have been introduced gradually over time we have a rolling cycle for their replacement.

Why virtualise?

Obviously the first question we asked ourselves was why virtualise our servers? Typically the reason given is to save space in the server room. However for us this wasn't a factor. Instead we identified the following six aims.

- **Better utilisation of hardware**. Some applications require little processing power, memory or disk space and therefore additional capacity is wasted.
- **Flexibility in allocating server resources**. To allow for the growth of services without having to add additional physical resources, such as more disks, and to support fine tuning of server to improve application performance.
- **Maintain separation of services**. From a security perspective it is always better to have one service per server but this can be a financial issue sometimes.
- **Faster commissioning of new servers**. After specifying server requirements traditionally you need to purchase new hardware, wait for it to arrive and then physically install it into available rack space.
- **Reduce hardware maintenance**. Obviously the fewer physical servers the less to maintain and hopefully the less to go wrong.
- **Costs savings**. One higher spec server is cheaper to purchase and operate than multiple smaller servers.

Of course virtualisation isn't without its drawbacks. Having to run both the host operating system and operating system of the virtual servers is going to have an effect on the overall performance of the server. Also with services running on fewer

servers there runs the risk that the failure of a single server has an increased impact on the overall service level.

And finally it's worth noting that not all applications are supported in a virtualised environment.

Pilot

In autumn 2009 a server was scheduled for replacement that housed a number of small library staff facing services. Due to the low risk around the loss of the services and the natural increase in power of the new server it was decided to use this as a pilot for virtualisation.

The first stage was to decide on which hypervisor to use. Our choice was between VMWare and XEN. Both were mature hypervisors, so the deciding factors were cost and support for/by RHEL5. Based upon these factors XEN was chosen.

To help mitigate the slightly higher consequences of hardware failure in a virtual server environment it was decided to use RAID6 for the server's disk configuration. This would allow the server to continue functioning even if two of its 6 hard disks failed.

The available disk space was split into two volumes, a small one to hold the host hypervisor operating system and a large volume to be divided up for the virtual machines via the host's logical volume management.

Having configured the server's disk space a 64bit instance of RHEL5 was installed on the smaller volume and configured to act as a XEN Hypervisor. A new virtual server was then created with a fresh install of RHEL5 and the services from the old server being replaced were migrated over to it. It was decided to do a migration of the services rather than use a Physical to Virtual process as this gave us an opportunity to upgrade to RHEL5.

Once the migration of the services was complete the IP addresses of the new server and the old server were swapped, making the virtual server the live server.

Moving into production

Three months after undertaking the virtualisation pilot another physical server was due for replacement. This server hosted two key Library services: the online reading lists system and resource booking system. The latter system was migrated from its physical server onto its own virtual server within the existing virtual host.

It was decided to use the replacement server to extend the virtual environment available. Again the new physical server was installed with a XEN hypervisor in RHEL5.

As well as migrating established services over to virtual servers a number of other virtual servers were created within a short period of our first virtual server going live.

The new virtual servers were used for developing and piloting new services. The development of the new version of the online reading list system took place in a complete virtual environment.

As we continue to replace physical servers over the coming two years we hope to eventually migrate all our services (except as noted below) to our virtual environment.

Virtualisation failures

A number of third party suppliers wouldn't support their systems running in a virtual environment. Unfortunately their restriction of requiring these systems to be migrated out of a virtual environment and back onto a physical server whenever we require support prevented us from including any of them in the pilot or production service.

Actualised benefits

XEN has proven to be a stable platform for us and the tools provided in RHEL5 are very effective in creating and managing virtual servers. We certainly wouldn't hesitate in recommending it to others undertaking similar virtualisation exercises.

Our virtualisation pilot has realised all of the expected aims of the project. We now host more services on less hardware. This means we can better utilise the capacity of each physical server whilst having the flexibility to change the processor/memory/disk allocation of each service independently.

Key findings

What was a pilot project has quickly established itself as a production service for us. The clear benefits of virtualising our servers has far outweighed any potential drawbacks. Beyond this we have come to recognise two additional points.

- **Virtualisation aids innovation**. With the ability to quickly "throw up" a new server we can rapidly test/trial a new application or local development. In particularly this supports Agile project management/programming methods.
- **It doesn't need to cost**. By implementing server virtualisation over a period of time, replacing hardware as and when required rather than attempting to do everything at once, then there is no need for additional budgets to support it and there can still be immediate ongoing cost savings.