FUJITSU

VIRTUAL reality

Make sure that virtualisation pays – and keeps on paying

Once a niche technology for test and development environments, virtualisation has moved into the mainstream as organisations embrace the benefits in efficiency and flexibility that it offers. It's our opinion that virtualisation in itself is neither a quick fix for complex IT environments nor a guaranteed source of bottom-line benefits. It all depends on how you manage the technology – and how you adapt the processes and culture of your organisation to new ways of working.
Mark Wilson

FROM THEORY TO REALITY

Virtualisation scores high on every CIO's must-do list. This is galvanising IT managers and architects across all kinds of large organisations: now that the technology has come of age and the concept is on decision makers' agendas, IT teams are getting to grips with the reality of implementation.

It's an attractive proposition: use virtualisation technologies to reduce your server count, save energy and boost flexibility – all in one fell swoop. Virtualisation is one of the shinier silver bullets to emerge from the IT industry in recent years, promising as it does to remove management headaches, streamline procurement and provision and contribute to cost and carbon savings.

The theory of virtualisation is indeed elegant and compelling. The reality – making virtualisation happen in a complex business environment – is a little more challenging. We believe, however, that if implementers stick to a set of key guidelines they'll be able to recognise and head off the challenges.

TOUCHING DOWN IN A VIRTUAL WORLD

Consolidating multiple servers into a smaller set certainly saves on power consumption, both directly and through less cooling. We reckon that, on average, consolidation through virtualisation reduces power usage by a factor of four in production systems and a factor of eight in test and development environments.

Those cuts add up to substantial, sustained savings and, with established data centres nearing the upper limits of their power supplies, these are strategically valuable effects. It's easy to imagine that by virtualising all their IT services, organisations will be able to accommodate growth without investing in new plant, while reducing their impact on the physical environment – a bit like zipping up their IT so that it takes up less room – and less thought.

VIRTUALISATION TECHNOLOGIES

Server virtualisation (eg, Microsoft Hyper-V, managed with Microsoft System Center Virtual Machine Manager)

Virtual desktop infrastructure (eg, Vista Enterprise Centralized Desktop)

Application virtualisation/isolation (eg, Microsoft Application Virtualization, formerly known as SoftGrid Application Virtualization)

Presentation virtualisation (eg, new Windows Server 2008 features such as Terminal Services RemoteApp)

But, back in the real world, it's not so simple. Around 6% of today's servers are running in virtual environments, and we can clearly expect that proportion to rise. But we'll never see 100% running virtually – and we shouldn't try to force that situation. There are natural breakpoints where virtualisation confers no benefits and even introduces degradation in service, manageability and risk containment. Take, for example, a Microsoft Exchange Server hosting five thousand users. This service demands its own dedicated server that is sized, optimised and secured to carry out its well-defined task with maximum efficiency.

There's no fat to be cut in this scenario, and nothing to be gained by sliding the service into a virtual environment – except risks of service failure and performance fall-off. Similarly, if you are running multiple instances of SQL Server then you will gain efficiencies by allocating them to a single server (or cluster), without using virtualisation. On the other hand, many application servers are prime candidates for consolidation onto a virtual infrastructure.

We can't replace the one-app-one-box rule with a similarly sweeping all-apps-no-box rule: you need to assess each function for its potential improvement under virtualisation. We find, for example, that services such as Active Directory and ISA Server are not well suited to running in a virtualised environment. Active Directory is a poor target because of the risk that instances will hibernate and then be awoken in out-of-date states. These instances will play catch-up when they awake, but the mismatch in availability may impact time-sensitive synchronisation operations. In the case of ISA Server, a firewall running in a virtual machine can't protect the operating system from an attack at the hypervisor layer (the so-called 'Blue Pill' attack), exposing the systems to risk. This threat is small, owing to the deliberately small footprint of the hypervisor, but it is a risk that needs to be appreciated and factored into the resource allocation process.

There are also potential risks of 'man-in-the-middle' attacks that target virtual machines as they are being transferred between host servers, for example in a failover situation. Such an attack could be prevented using encryption technologies such as IPSec in the network layer. More likely risks include moving a virtual machine into the wrong security domain (for example, into a DMZ), theft of entire virtual machines (copying a few files is a lot easier than removing a physical asset), or impersonation via the introduction of a rogue virtual machine. All of these potential threats illustrate the need to manage a virtual infrastructure effectively.

REMOVING WASTE

How did IT evolve to a situation where around 90% of servers run at less than 10% utilisation? One good engineering reason is the need to build in spare capacity to cover peak loads, but over-capacity also arises from the way in which systems are procured. System designers are asked to build systems with a defined level of performance, often using over-optimistic growth forecasts keyed to a business case. In an era of relatively low-cost commodity hardware, with budgets managed in silos, the natural tendency has been to over-specify IT components.

Procurement process efficiencies also contribute to over-specification; for example, it's cheaper to specify two CPUs in the initial build than to risk a subsequent upgrade from one to two. Customers also prefer to choose hardware from standardised configurations, since packages are always easier to assess and compare than bespoke requirements lists. However, once you're using a package-based procurement system you are tempted to opt for the 'next size up' if you're unsure of your operational requirements. In this way, rational margins for error accumulate into wasted resources that, in traditional environments, do not figure on any consolidated management radar.

UNLEASHING NEW DEMAND

Virtualisation promises a much closer match between the demands of applications and the resources that serve them. Customers and managers alike gain greater visibility of the relationship between delivery to a business process and the costs of that delivery. In addition, fulfilment of customer requirements becomes much faster in a virtualised world. With physical servers there is often a long lead time for ordering and configuration, with six weeks being not uncommon. With a well-managed virtualised environment, the time to provision a new virtual machine can be reduced to minutes.

This greater speed to delivery can create an unexpected effect: a surge in demand. Since customers can now provision more specific services, in smaller packages and with quicker delivery, they discover new needs for services. A pent-up 'long tail' of demands hits the IT department, and the fulfilment of those demands trains customers to expect future service provision at the same high level. In an instant, users switch from seeing IT as a scarce and difficult resource to regarding it as a free and limitless capability.

This means that the organisation which 'goes virtual' may well enjoy an initial period of server consolidation – but then see its server population growing again to meet the newly unleashed demand. The reduction in power consumption that looked like such a great (and green) benefit now looks like a short-term blip – and even the springboard to a newly elevated level of daily consumption. In addition, with many virtual machines running on one piece of physical hardware, high availability options such as failover clustering become vital. If the original servers were not clustered prior to being virtualised, some of the planned savings will be consumed by the provision of additional failover servers.

The scenario we've looked at up to this point is restricted to the impact of virtualisation on data centre operations. But what if the technology is applied to the desktop as well as the back-end infrastructure? The potential benefits for management of applications, accountability and security are clear, especially as organisations continue to become more mobile, more global and more porous. On average, large organisations own around ten PCs for every server. Extend virtualisation to the desktop using virtual desktop infrastructure technologies or software streaming and the demand for power at the data centre will grow even faster and higher. Network usage will also grow in orders of magnitude.

TAMING THE VIRTUAL WORLD

We're not advising organisations to avoid virtualisation, but to use it judiciously and with appropriate standards and governance. Think of virtualisation as a strategy rather than a technology. Adapt your existing management processes and develop new ones where necessary, both to enable and contain the great creative potential of virtualisation.

These are the key touchstones for ensuring success with your virtualisation strategy:
- Make a full and faithful inventory of what your servers do and how they relate to each other. This is ideally expressed as a structured model. Make sure you're clear on which servers carry the greatest business process value. This will allow you to rule on whether you host virtual machines with different SLAs on the same servers.
- Build a provisioning model with supporting workflow to allow the cost of a new virtual machine to be attributed to an individual or department. This cost can be real or indicative, but it should be meaningful. You can then create differentiated charges and levels of service so that customers pay less for a virtual machine that is rarely used.
- Design a lifecycle mechanism to ensure that your SANs are not filled with duplicate, unused virtual machine files. For virtual machines servicing those 'long tail' demand items, you may want to poll users every six months to check that they still need them.
- Continue to perform capacity planning and load placement in order to find workloads that complement each other; for example, applications that have peak loads at different times. By applying your business insight to the environment, you can add intelligence to the virtualisation regime.
- Record appropriate metadata for each virtual machine, including details of its owner, dependencies, and SLA level.

VIRTUALISING THE APPLICATION AND PRESENTATION LAYERS

Many organisations hope that application and presentation virtualisation will give them additional control over their business processes, improve accountability, compliance and security, and save money on licences and desktop maintenance. These benefits are attractive, not least in simplifying image management. But once again, virtualisation is no panacea.

In the first place, application virtualisation is unlikely to make an application run on any operating system on which it won't run natively. Applications that use COM+ or system-level drivers are key examples. It can help, though, with the management of standard application configurations or where otherwise incompatible applications are required to run side by side on the same computer. And when considering presentation, common sense suggests that there will always be applications that must be run locally; graphics-intensive applications in particular.

Lastly, laptops sales have now overtaken desktop sales in EMEA. Since not every mobile user is connected to a high speed network at all times, virtualisation may actually be chasing a shrinking market in this space.

CHANGING PROCESSES AND CULTURE

Our touchstones and guidelines (see box) strongly imply that you can't rely on technology alone to achieve the benefits of virtualisation. But they also beg questions of ownership and collaboration within the organisation. So, for example, if you have virtual desktops running on servers in the data centre, who manages them – the desktop support team or the server support team? Or do these teams merge? Similarly, who manages the network when it is no longer entirely made up of physical cables and switches but encompasses a virtual network infrastructure too?

By consolidating their physical assets in the data centre and removing servers from office environments, IT managers can create a dangerous illusion of control. The equipment may all be in one place but that doesn't mean it's being centrally managed. Management doesn't emerge by itself: it has to be applied. The organisation's virtual machines are still islands of capability, each of which requires active monitoring and management. And if those capabilities weren't managed in the physical world, virtualising them will not supply the remedy. There's no magic in the box.

Organisations will continue to need engaged and committed professionals who understand the services being delivered by the IT. If anything, managers will need to have greater business process insight and use more abstract problem-solving skills to fix issues and create improvements in service.

We see the virtualisation market changing rapidly, with hypervisors becoming a commodity. Just as you don't need to care too much about which BIOS your computers are running, so your choice of Microsoft Hyper-V, VMware ESX Server or Citrix XenSource hypervisors will become largely irrelevant. The key question for management isn't about which hypervisor to choose, but how a mixed physical and virtual environment should be managed. Whatever the exact split between physical and virtual, it is unlikely to be 100% either way. We can also guarantee that the split will change over time, both as the organisation discovers where its best options lie and as the business evolves. You therefore need management tools that not only understand the differences between physical and virtual servers, but which can also manage different virtualisation environments from a single console or toolset.

GO VIRTUAL – VIRTUOUSLY

If you start with a physical mess and virtualise it, then you'll create a virtual mess. However, virtualisation offers organisations great benefits, particularly in flexibility. Since any business's only certainty is that tomorrow will look very different from today, virtualisation's ability to reconfigure IT's delivery to match need and resources is a welcome contribution to the management task. But it's just that: a contribution, not a replacement.

Whose **OPINION**?

MARK WILSON

Mark is the technology lead for Microsoft Windows Server 2008 and Hyper-V technologies in our Microsoft practice. He has been designing, implementing and managing IT infrastructure in the UK, continental Europe and Australia for almost 15 years, operating both in-house and as a consultant. In addition to his knowledge of Microsoft technologies, his experience includes implementation of virtualisation using products from VMware and PlateSpin. Mark is married with two young sons and spends what little time is left at the end of the day writing about technology on his personal blog.

mark.a.wilson@uk.fujitsu.com