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"Can the Future Promises of Utility Computing Deliver Value Today?"

A Report by

iReach

Commissioned by Horizon Open Systems – Sun Microsystems' Country Partner

Sun microsystems

HORIZON Open Systems

Foreword

With IT Departments under greater pressure than ever to 'sweat' their assets, there has been a lot of talk about Utility Computing. But what exactly is Utility Computing and can it help meet today's demands?

Our view is that there is confusion in the market about the concept of Utility Computing and this is partly due to the IT industry itself which uses different terms to describe the concept.

To help erase some of the fog surrounding what is potentially the future of IT, Horizon Open Systems, Sun's country partner, commissioned the first Irish study into Utility Computing. We hope this report "Can the Future Promises of Utility Computing Deliver Value Today?" contributes to the Utility Computing debate in Ireland.

We would like to thank iReach and their research team for their work on this study.

Roland Noonan
Managing Director
Horizon Open Systems – Sun Microsystems' Country Partner

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Executive Summary

"Can the Future Promises of Utility Computing Deliver Value Today?"

In a recent survey of 100 Irish executives completed by iReach, the number one priority for respondents is for IT to help 'reduce operational costs' over the next two years.

Based on iReach estimates, hardware remains the largest element of IT spend and will exceed €1billion in Ireland this year against a total IT spend of €2.2billion. Due to the reducing cost of hardware, the solution to many performance or security issues is to deploy more servers. Research suggests that on average only 25% of server and storage capacity is utilised in Irish organisations. The maintenance costs and management overhead of these devices remain labour intensive leading to high Total Cost of Ownership (TCO).

Utility Computing is a growing trend which can help increase server and storage utilisation and in turn generate significant cost savings of 40%[1] on hardware purchases. The road to Utility Computing can begin today with a focus on virtualisation, a key building block in maximising IT investments.

In this Report, we look at an evolving trend in IT, the Utility Computing model and identify the stepping stones to deliver cost savings and business value today and in the future. This is an opportunity for organisations to cut IT costs and speed up business now.

Key Takeaways

- **Average server and storage utilisation is at only 25% of total capacity.**
- **Utility Computing can help organisations maximise existing server and storage capacity.**
- **66% of executives prefer to pay for computing resources on a pay-as-you-go basis**
- **Utility Computing can deliver significant cost savings in reducing hardware spend by 40%.**

iReach Analysis

Increasingly business executives see the need for IT to deliver competitive advantage in their chosen market in addition to reducing or controlling costs. IT teams now face increasing pressure to deliver real and measurable value to the business. The ability to maximise IT utilisation is a critical factor in helping to deliver value.

No business today builds and owns utilities such as electricity, gas, water and telecommunications. All of these services are sourced and consumed as required.

[1] Forrester Research

Could we be entering a phase where technology is also consumed in line with increases or decreases in demand and where available capacity is maximised? What are the benefits of this approach?

You pay for computing power and software only when you need it. No more money, time and resources wasted on computer servers or storage that are underused much of the time.

What is Utility Computing?

There is a lot of confusion surrounding Utility Computing – what it is (and isn't) and what it comprises. Often the term 'Utility Computing' is a generic phrase used to describe a particular approach to IT software and hardware architecture deployments. Fundamentally Utility Computing provides users with computing power on demand (similar to electricity). Sun, HP and IBM are generally recognised as the leading vendors in the Utility Computing arena. The term 'Utility Computing' has grown to comprise a number of definitions and brand names using the 'Utility Computing' umbrella term, including: Grid Computing; On-demand Computing; Clusters and Software as a Service.

Grid computing: A form of networking, Grid computing is the concept of connecting arrays of smaller computers into a single virtual supercomputer. Unlike conventional networks that focus on communication among devices, grid computing harnesses unused processing cycles of all computers in a network for solving problems too intensive for any stand-alone machine. Grid is largely used today as an inexpensive alternative to supercomputers for research and scientific projects.

Pay as you go/on-demand: The concept of paying for computing power on a metered basis rather than simply buying a piece of hardware and a software license. Because an enterprise's demand for computing resources can vary drastically from one time to another, the on-demand model was developed to overcome the challenge to an enterprise of being able to meet such fluctuations efficiently.

Clusters: Groups of computer systems tied together to act as a single computing unit. Clusters are often not geographically distributed, nor can machines be added or removed on an ad-hoc basis.

Software as a service: Rather than purchasing a software license for a number of users or CPUs and then "owning" that software for some predetermined time, software-as-service agreements allow users to pay for a piece of software on a per-user basis.

A lot of the confusion surrounding the term 'Utility Computing' stems from the fact that companies offering such computing services are trying to differentiate their services by branding them. For example, while Sun lead with Utility Computing, IBM use their On-Demand brand to describe essentially the same package of services: providing users with computing power on an ad-hoc basis.

Key Market Trends in Utility Computing

There are five major trends that will shape the Utility Computing infrastructure over the next three years.

Performance: Processor and system performance is growing faster than demand, slowing demand for new 64-bit Intel servers, dropping hardware prices, increasing the focus on manageability, and increasing viable PC and server lifetimes.

Utility: Management issues are driving centralisation of resource ownership and increasing variability of workload drives' demand for a Utility Computing model.

Grid: Grid computing technologies will enable cheap, utility-like supercomputing power and drive new massively parallel applications. Grid computing standards will also enable the acceleration of resource rental.

Storage: Real-time computing is driving the deployment of fabric-attached storage infrastructures and storage virtualisation. Automated storage area management (ASAM) will make storage more "real time."

Virtualisation: Technologies that enable pooling of resources (and partitioning/sharing of resources) are evolving rapidly and changing the server market.

Data storage and server virtualisation are key stepping stones to the Utility Computing model. Virtualisation of storage and processing capabilities will enable the break down of connectivity barriers between standalone servers and creating a unified single server available to users across the organisation. Addressing these technology issues today will enable organisations to extract maximum value from latent hardware resources, scale down on hardware outlay costs, and reduce management costs.

Utility Computing Market Size Estimates

The reason Utility Computing should be considered today by executives is due to a very clear shift in IT spend. iReach estimates the global Utility Computing market will be worth €20 billion by 2008. The Utility Computing model will mature over the next five years, first gaining popularity with hosted service offerings leading to the growth in composite applications from 2007 to 2010.

The chart over illustrates the expected growth of the global Utility Computing market. In 2005 the market is valued at €8 billion and expected to reach €20 billion by 2008, representing a 250% growth in three years.

Utility Computing Market Uptake

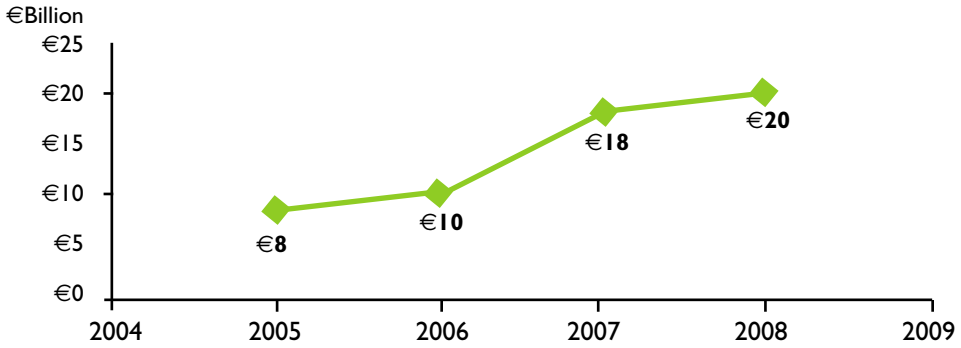

Figure 1: Expected Growth of the Utility Computing Market

iReach market intelligence shows that almost 65% of companies in Ireland are interested in leveraging some type of Utility Computing, however there is a lack of understanding of the business benefits and technology implications. Education and maturing market awareness will have a positive impact on uptake.

Some leading vendors estimate that the Utility Computing trend will take their hardware sales, as a percentage of total profits, down from 58% to 42% over the next three years. Software sales are expected to increase from 29% of profits to 41% in the same period.

Through efficient sharing of resources, hardware investments are likely to fall. Utility Computing allows customers make a smaller capital commitment, thus reducing risk.

Grid Computing Market Trends

In relation to the Grid Computing market trends, the chart opposite outlines a breakdown of Grid-related projects from a sample of European enterprises (Source: Forrester Research). Although it is predominantly confined to larger organisations, 37% of respondents are currently in the process of developing a Grid Utility solution, while a further 30% are considering whether or not to begin a Grid Utility project.

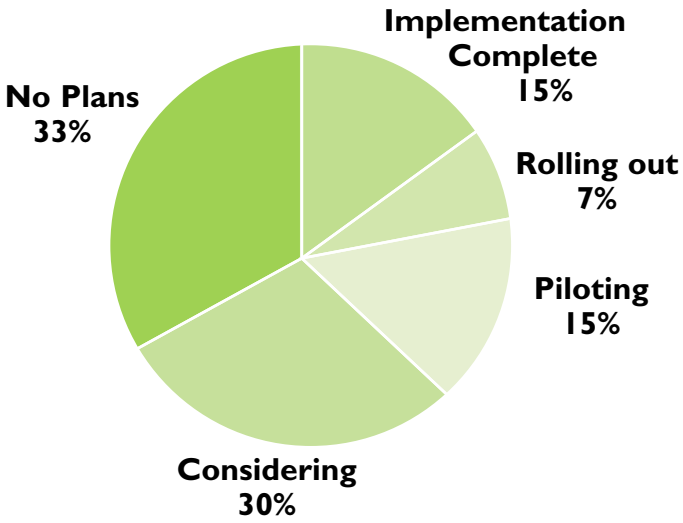

Figure 2: Implementation Levels of Grid Utility Computing

Utility Computing Evolution

Utility Computing is not a new concept. Indeed the idea of utility pricing has been around for quite some time. The concept of Utility Computing has its roots in facilities management, before outsourcing became popular in the 1980's. In the late 1990's ASPs became popular with many of these vendors charging customers on a pay-as-you-go basis. A combination of the principles of ASPs with outsourcing resulted in the emergence of Utility Computing, see figure below.

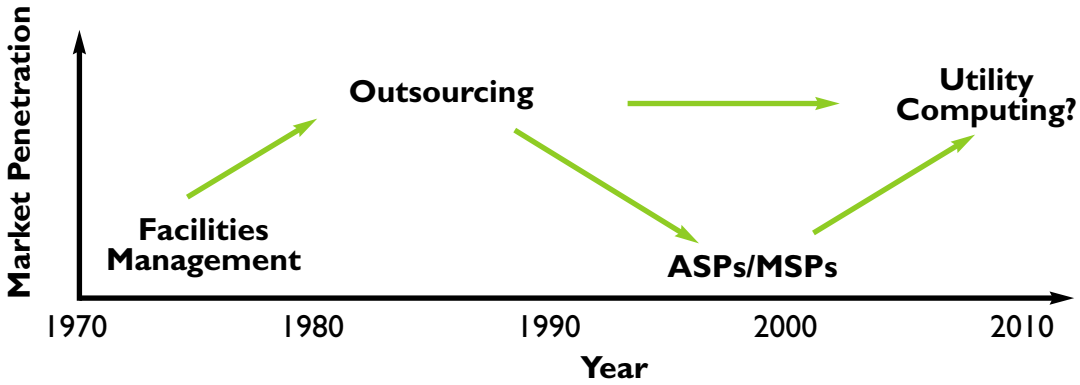

Figure 3: The Utility Computing Evolution

The Business Case for Utility Computing

Return on Investment

The bottom line, of course, is money. Once pricing models are in place, Utility Computing promises lower licensing costs by consolidating multiple instances of applications into fewer licenses, allowing companies to pay only for the active hours, transactions, megabytes or bits. It also promises reduced maintenance costs, with outsourced Utility Computing services handling some operations and internal IT groups freed from laborious and repetitive tasks. Smaller hardware budgets are possible, thanks to fewer servers and fewer people required to manage them. The ultimate goal will be to create an automated technology framework for a truly agile enterprise, allowing business processes to be rebuilt on the fly to meet new opportunities.

The diagram below outlines the biggest challenges faced by executives in relation to existing hardware pricing models. Issues such as hardware rigidity, complexity, high maintenance levels and misalignment with business goals reinforces the view that there will be increasing demand for Utility Computing services, since the goal of a Utility Computing model is to increase the efficiency of how hardware is deployed and utilised by end-users. Given that Utility Computing seeks to address the key cost issues surrounding traditional hardware pricing models, ultimately anticipated ROI will be the defining factor in ensuring that the Utility Computing model will succeed.

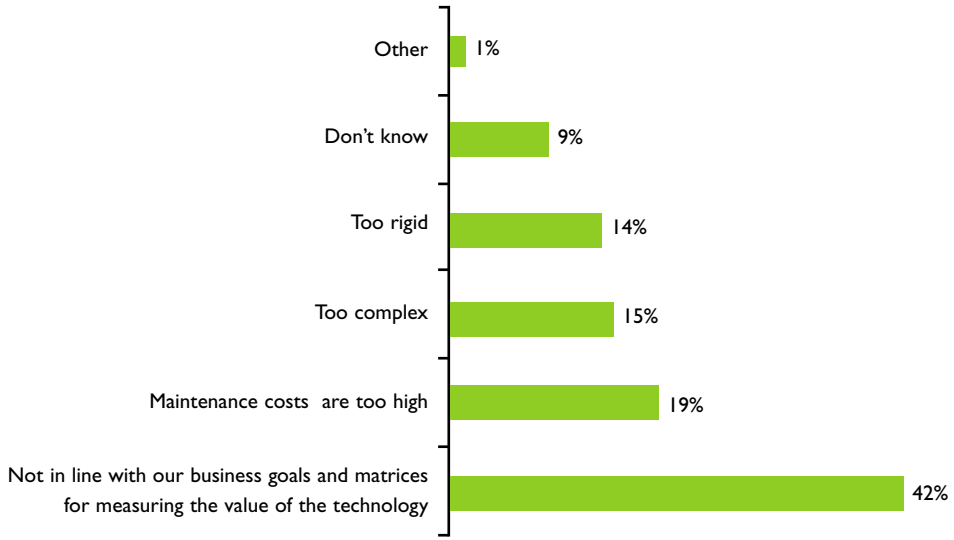

Figure 4: Drawbacks of Existing Hardware Pricing Models

Leaner, more flexible IT infrastructure

Utility Computing can lead to leaner, more flexible IT infrastructure because the Utility Computing revolution in data centre architecture addresses IT's three fundamental problems: wasteful technology, laborious processes, and rigid business capabilities.

Retrofitting and evolving existing technology: Utility Computing is not a rip and replace revolution that requires ignoring or discarding existing assets. The technologies are extensions of today's distributed systems and often can be retrofitted to leading products already in the data centre.

Utility Computing will offer immediate savings: with more to come over the rest of this decade. Global research firm, Forrester expects that most large firms will find that they can achieve significant savings within a year or two with emerging Utility Computing technologies. Some firms find the savings in software and servers, others in storage, networks, or systems management. These are real cash savings from avoiding new technology buys or staff hires, not intangible savings from faster results or productivity benefits.

Enabling firms to move to a leaner, faster business strategy: Utility Computing helps IT accelerate the response to new business needs because it makes it much easier to update software and reconfigure data centre assets. At first, this will result in faster company mergers and quicker responses to competitive threats.

Lower Total Cost of Ownership for IT

A recent iReach survey found that hardware will remain the largest element of IT spend at approximately €1billion in Ireland this year. However, independent research has found that on average, as little as 15% of Wintel server capacity is utilised with this figure rising to 25% in Irish organisations. Consequently, the maintenance costs and management overheads for these devices remains labour intensive leading to high Total Cost of Ownership (TCO).

Utility Computing allows companies to "save money and gain competitive advantage", with costs likely to fall further as resources can be efficiently shared. The approach allows enterprises benefit from reduced average operating costs while giving access to resources during peak usage.

As the perception of low server hardware cost diminishes, especially when compared to software, organisations are beginning to look to other solutions to combat high total cost of ownership. Many organisations have a low average utilisation level on their hardware infrastructure.

This is due to a variety of reasons, including individual applications requiring separate machines (web/firewall/caching/proxy/application servers). The sharing or resources between systems seems rational but remains minimal. In February 2005, Sun announced the ability for customers to access the computing power they need, when they need it, and at an affordable price of $1 per CPU per hour. This compares to the $9 - $12 Sun estimate it costs to run a Wintel box running at 15% CPU utilisation.

The diagram below illustrates user payment preferences in relation to IT infrastructure investments. The findings indicate that 66% of respondents find it preferable to make payments on a continuous basis rather than in an up-front lump payment. This reflects users growing preference for an on-demand payment approach for technology hardware resources. This trend was further supported by a recent iReach survey of business executives' attitudes towards IT, which found that cost is the number one inhibitor for new investment in information technologies.

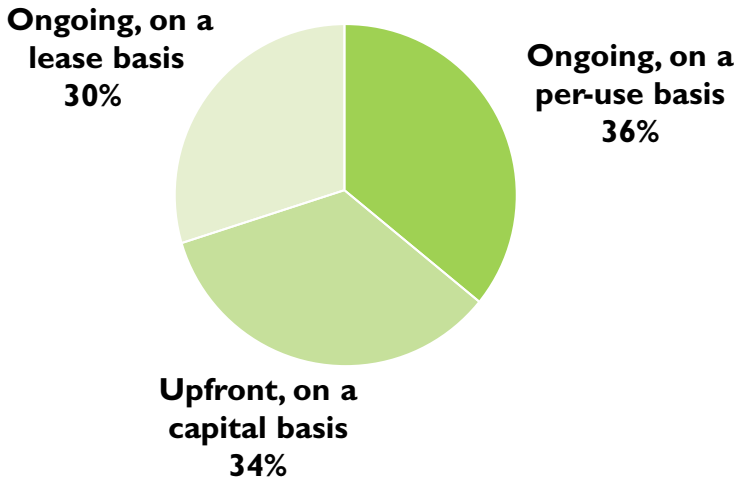

Figure 5: Favoured Payment Options for Hardware Purchase (Source: Forrester Research)

Organisations also need infrastructure, both hardware and software, which allows them to rapidly respond to a variety of scenarios in an efficient and cost effective manner. Utility Computing allows system administrators scale technology infrastructure to meet the needs of a dynamic business environment. Excess resources can be redeployed to business processes which require them, without negatively impacting on the overall business.

However, although in a true utility such as the telephone, services are priced as a base fee per month plus usage, most utility services offered today follow a subscription-based pricing model of "per user per month". This pricing model is set to change as the technology and usage uptake evolves.

Benefits of Utility Pricing include:

- **Usage is predictable:** By negotiating price upon purchase, buyers can control usage costs. Ceilings on price and usage can be included in the contract, thus avoiding spikes in cost caused by unexpected activity.

- **IT usage maps directly onto business value:** By directly mapping IT costs onto business drivers, usage becomes more of an asset. It also allows for IT costs to be directly related to overall business revenues.

- **An internal mechanism for chargeback already exists:** Utility Computing allows IT administrators charge business units for the IT usage, allowing for usage volumes and costs per department to be monitored.

Operational Cost Savings

As a result of these emerging hardware developments, such as faster individual processors, more powerful multi-core processor chips and servers with a large number of processor chips, server performance has grown so fast that it has outpaced the needs of most mainstream applications.

Reacting to these trends, enterprises that want to maximise their hardware investments will be forced to turn to virtualisation technology, workload management, virtual servers, and hardware partitions to crowbar additional operating system instances and/or additional applications into a single server, thereby driving server utilisation up.

As more enterprises build real-time business processes, workloads are becoming more variable and less predictable. This is driving the need for over-provisioning of computing resources to an extreme. Servers that are only 10% utilised are still 100% managed, so administrative costs are sky-rocketing.

Reacting to these advancements in hardware technologies:

- Many enterprises today are turning to consolidation methodologies to reduce costs.
- Server vendors such as Sun are now offering varying degrees of capacity on demand.
- As virtualisation, consolidation and distributed management tools improve, a real economy of scale is building for centralised resource management. Service providers are beginning to offer utility services.
- Leading-edge service providers and internal data centre managers will leverage virtualisation and automation technologies to create a real-time infrastructure.
- Data centres that do not leverage technologies to reduce cost, increase agility and improve service-level management will find themselves outsourced within a few years to a service provider that can offer them.

Implementing Utility Computing for your Organisation

There are a number of steps which executives can take towards becoming a Utility Computing focused enterprise. Given the state of current technology deployments in organisations, virtualisation techniques and changes in software operating systems will be key steps towards a full utility-based computing model. Virtualisation tackles existing cost and management issues and provides a useful testing ground for Utility Computing to demonstrate its effectiveness as well as identifying further areas where Utility Computing can deliver efficiencies. Additionally, organisations will need to deploy operating systems with the capacity to deliver intelligent exploitation of latent hardware resources following virtualisation techniques which remove the traditional boundaries of hardware technologies.

Virtualisation is not a new concept. But technologies and customer demand are coming together to rapidly broaden the use of virtualisation in servers and storage. Virtualisation is not just about consolidation to bigger resources. Virtualisation is the pooling of various IT resources in a way that masks the physical nature and boundaries of those resources from resource users. Virtualisation technologies will increase the ability to effectively consolidate to larger resources. However, virtualisation technologies will also make distributed resources easier to manage, redeploy, and use efficiently.

Storage and storage management are rapidly evolving technologies. Development is being driven by established enterprises fighting for market share, venture capitalists attempting to solve high-impact operational problems, and the market's demonstrated willingness to adopt new technologies that promise cost savings and staff productivity improvements. In less than a decade, redundant array of independent disks (RAID) storage arrays have relegated non-RAID systems to museums. These new technologies include Fibre Channel (FC), which has become the interconnect technology of choice, and storage area networks (SANs), which have been deployed at most customer sites.

Replication technologies have moved to near-commodity status, and storage growth has made backup/restore and provisioning central to any well-run IS organisation. On the software side, new technologies such as clustered file systems, file virtualisation and automated storage area management (ASAM) are being developed to improve the scalability and manageability of ever-growing storage infrastructures.

Virtualisation

Virtualisation can help organisations maximise latent hardware resources, particularly server processing and storage capacity. Several things are changing to make virtualisation critical to most enterprises in the next few years:

1) Processor capability has outpaced the performance requirements of many applications;
2) Performance is relatively inexpensive, and therefore the overhead of a virtualisation layer is a non-issue;
3) Even though processing power is inexpensive (and getting cheaper), space, power, installation, integration and administration are *not* inexpensive - and cost the same whether a resource is 10% utilised or 90% utilised;
4) Web access has changed workload levels from relatively predictable to spiky - forcing enterprises to over-provision.

For several decades, Intel and Unix-based servers have grown to take the dominant share of the server market. At the same time, the vast majority of Intel and Unix-based servers were deployed with a single OS copy and a single application.

The growth of virtualisation technology deployment could create a significant discontinuity in the server market. Smaller servers will be pooled and shared among applications that can leverage dynamically provisioned servers (rather than reserved for use by peak loads of a single application). Virtualisation technologies will enable higher utilisation rates for the processors, memory and input/output of servers. By 2008, server utilisation rates could improve from 25% on average today to more than 40% on average.

Based on these potential utilisation rates, enterprises could require as much as 40-percent-less server processing power, which would have dramatic ramifications for the server market and server vendors.

Virtualisation technology could dramatically reduce server hardware and administrative spending and increase enterprise server flexibility. Over time, the server market may need to absorb a decline because of improved processing efficiency. Enterprises will not be able to ignore this trend; the cost benefits will be too great. Successful enterprises will have a virtualisation strategy and will be mindful of evolving virtualisation solutions.

Virtualisation can also take place at various other points in a server architecture - between the application and operating system (for example, a Java Virtual Machine), between the operating system and hardware (for example, partitions), across multiple operating systems and hardware, and so on.

Virtualisation Building Blocks

Workload Management: Enabling diverse workloads to effectively run together in a single instance of an operating system by balancing workload resource consumption to achieve business goals and priorities. Examples: Aurema ARMTech, Planwise and Sun Solaris Containers.

Distributed-Workload Management: Enabling diverse workloads to effectively run together and across multiple operating system instances by balancing workload resource consumption to achieve business goals and priorities. Examples: IBM bWLM, various grid and clustering toolkits such as Sun N1 Grid Engine.

Resource Management: Enabling multiple operating system instances to share a specific server hardware resource by balancing operating system resource consumption. Examples: Sun Solaris Resource Manager or VMware ESX/GSX.

Distributed-Resource Management: Enabling multiple operating system instances to share distributed server hardware resources by balancing operating system resource consumption through re-provisioning or, possibly, runtime. Examples: HP UDC, Sun StorEdge Suite and SRM.

Most virtualisation technologies will improve between now and 2008. Users will have more than one method from which to choose. The most valuable from a cost and agility perspective will be distributed workload and resource managers.

Today, only resource managers (hardware and software partitions) are relatively mature. Resource management and distributed-resource management will mature, and workload management and distributed-workload management will be effective solutions for many enterprises within the next 12 months.

Impact of Operating Systems Trends on Utility Computing

In the days of the mainframe, hardware was the king of the enterprise, and enterprise infrastructures were hardware-centric. With the introduction of Unix and Windows, the operating system moved to centre stage. And then came Linux.

Linux is quite simply a basic operating system. Unlike Windows, Linux is focused on the most basic operating system functions - providing an intermediate interface between applications, administrators and hardware. But Linux also changes the operating system paradigm, commoditising the "real" operating system functions and

opening the door to the next wave of change - a shift from the operating system as the centre of the infrastructure world to distributed management tools and "meta-operating systems." In the world of the meta-operating system, the operating system is simply the driver of a piece of hardware.

The driver of the distributed infrastructure is something much broader that uses virtualisation and automation technologies to control where operating systems are loaded, what priorities workloads are given and how much resource to allocate. Where operating systems were responsible for driving a piece of hardware, meta-operating systems will be responsible for driving a distributed configuration of hardware. Linux has helped accelerate this change.

Operating systems will remain important - especially as enablers to various software infrastructures (.NET, J2EE, etc.). However, as virtualisation technologies improve, the physical boundary of a specific resource becomes less important (and less of a limitation). As automation technologies improve, the administrative driver's seat will be taken by service governors that operate across multiple server, storage and network devices, using operating systems for the most basic of commoditised functions. The operating system will be more important as an enabler to a distributed management system.

Stepping-stones towards Utility Computing

The greatest inhibitor to any form of server virtualisation is software pricing and licensing. Software vendors typically charge based on the size of the server or the number of processors. Most are not prepared to charge based on usage or percentage of system capability. As virtualisation technologies become more effective, utility offerings expand and Web services become more prevalent, the market will force software vendors to change. However, software pricing and licensing will be the last major issues to be solved to enable effective server virtualisation and will continue to be a general problem through the next 24 months.

Provisioning will evolve to include the related point-in-time copies, remote copies, backup copies and quality-of-service alternatives. Performance monitoring, analysis, optimisation and automated data movement will extend provisioning services to guarantee performance, even in the face of changing loads.

Finally, these modules must be linked and integrated with expert systems if the storage administrators, fundamental to developing a storage area management practice, are to be moved out of the critical knowledge/decision paths. Simple portals must be developed to provide the storage services consumer with status of service-level agreements (SLAs) and a means of requesting service.

Virtualisation technologies can improve IT resource utilisation and increase flexibility to adapt to changing requirements and workloads. However, by itself, virtualisation technologies are simply an enabler to broader improvements in infrastructure cost reduction, flexibility and resiliency. With the addition of automation technologies - with service-level, policy-based active management - resource efficiency can improve dramatically, flexibility can become automatic based on requirements, and services can be managed holistically, ensuring high-levels of resiliency.

While enterprises should investigate virtualisation technologies as they mature to maximise value from their cost, agility and service-level benefits, automation technology that leverages the virtualised resources should also be considered. Virtualisation should not be seen as an end goal, but as a stepping stone and enabler on which to build automation and a flexible software infrastructure within a Utility Computing model.

iReach Summary

iReach estimates the global Utility Computing market will be worth €20 billion, by 2008. Utility Computing will aim to address the issues of wasteful technology, laborious processes, and rigid business capabilities. Moreover, iReach findings suggest that by 2008, server utilisation rates could improve from 25% on average today to more than 40% on average on the back of virtualisation technology deployments. In real terms this means companies will spend less on hardware, software licenses and enable personnel to be redeployed into higher value roles.

Virtualisation is the pooling of various IT resources in a way that masks the physical nature and boundaries of those resources from resource users. However, virtualisation in a Utility Computing context is not just about consolidation to bigger resources. Companies such as Samsung Corporation and Telefonica - the Spanish telecom incumbent - are using virtualisation techniques to provide better resource usage and drive productivity increases with the results of lower operational costs, and simplified physical connectivity and management.

While Utility Computing will offer benefits such as: predictable usage levels, where IT usage can be mapped directly onto business value, as well as providing an internal mechanism for chargeback, several issues must first be overcome. Software pricing and licensing, the development of portals to provide the consumer with status of service-level agreements (SLA's) and a means of requesting service, and recognition that the operating system will be more important as an enabler to a distributed management system.

Utility Computing should not be viewed as a panacea for increasingly disillusioned and cost-conscious technology decision-makers. iReach market intelligence shows that although almost 65% of companies in Ireland are interested in leveraging some type of Utility Computing, there exists a lack of understanding of the business benefits and technology implications. Education on these issues and maturing market awareness will likely have a positive impact on uptake.