

Reducing Operational Expense (OpEx) with Virtualization and Virtual Systems Management

An ENTERPRISE MANAGEMENT ASSOCIATES® (EMA™) White Paper
Prepared for VMware

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Executive Summary

Over 70% of organizations report that virtualization has delivered “real, measurable cost savings.” There is clear evidence of capital expense (“CapEx”) reduction. However, virtualization, especially with sophisticated management, also allows significant operational expense (“OpEx”) savings.

ENTERPRISE MANAGEMENT ASSOCIATES[®] (EMA[™]) research and the case studies in this paper document opportunities including:

- Reduction of Service Failures – fixing problems up to 24 times faster, eliminating up to 43 hours of downtime a year, improving uptime to as high as 99.999%, to reduce the impact, frequency, duration, and cost of service issues, troubleshooting, out-of-hours support, and productivity loss
- Improved Staff Efficiency – increasing administrator efficiency by an average of 10%, and as much as 270%, by allowing a single administrator to manage up to 1800 servers, reducing annual management costs by up to \$1000 per server
- Faster Service Deployment – allowing new systems to be deployed up to 240 times faster, and new applications up to 96 times faster, saving almost \$2000 in wage costs alone per deployment, while reducing downtime, and improving time-to-market for new products and services
- Reduced Facility Operation Costs – allowing around half of all organizations to reduce both floor space/rent costs, and power consumption, the latter by an average of 16%, or around \$700,000 per year for a 5 megawatt data center

EMA recommends organizations standardize virtualization technologies, improve management processes, and make the best use of people, to realize advanced and ongoing virtualization cost benefits.

Introduction

There are many different drivers and outcomes for virtualization, including clear evidence of overall cost reduction and ROI. In fact, EMA surveyed IT technicians, architects, and management from over 600 mid- to very large organizations (89% of which had already implemented virtualization; 59% for over 12 months) and found that virtualization has delivered “real, measurable cost savings” for over 70% of these organizations¹. These savings come from reducing both capital expenses (“CapEx”) – periodic costs of buying or upgrading assets such as servers, software licenses, or data center facilities – and operational expenses (“OpEx”) – day-to-day costs of running IT such as staff costs, rent, or power.

There is clear evidence that virtualization reduces CapEx. The same research showed 73% were able to consolidate servers, 69% reduced hardware costs, and 34% reduced software costs. However, CapEx reduction is just one way to save, and it is limited to one-off budget cuts. By contrast, there are many outcomes for OpEx reduction, that deliver ongoing results to reduce IT budgets year after year.

This EMA white paper will highlight OpEx reduction opportunities using EMA data and case studies, provide advice on how to standardize the environment, address process challenges, and make the best use of people, to take the next step in realizing advanced and ongoing virtualization cost benefits.

Over 70% of organizations
report that virtualization
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¹ EMA Research Report, *Virtualization and Management: Trends, Forecasts, and Recommendations*,
<http://www.enterprisemanagement.com/research/asset.php?id=721>

OpEx Reduction – Reality of Virtualization

Some areas of OpEx saving are well established. For example, when EMA surveyed IT technicians, architects, and management from over 150 mid- to very large organizations with virtualization deployments, we found that server provisioning on a virtual server is up to 240 times faster than a traditional or physical server, while new applications can be deployed up to 96 times faster to virtual systems than to physical systems². EMA has also found that virtualization alone saves an average 16% across the whole environment in power and cooling costs³ – or around \$700,000 per year for a 5 megawatt data center⁴.

Several other areas where organizations can achieve OpEx savings are highlighted in Figure 1 below.

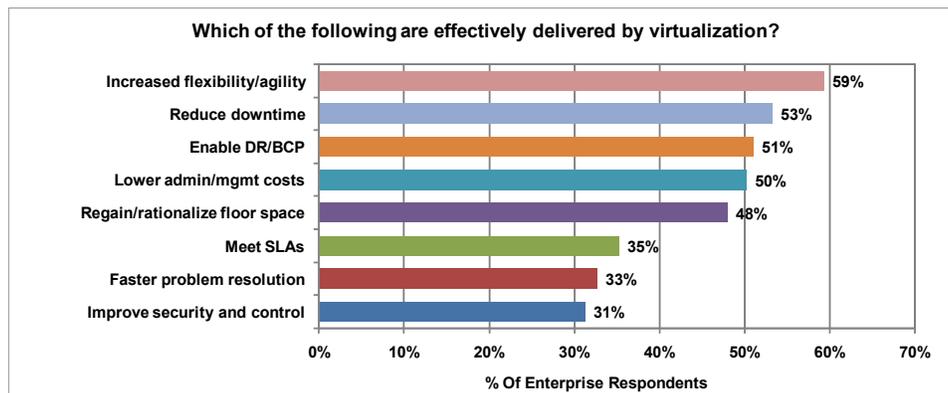


Figure 1 - OpEx Reduction outcomes reported by enterprises that have deployed virtualization⁵

It is quite clear then that organizations are achieving a wide range of outcomes that drive OpEx savings. They are increasing flexibility and agility, reducing downtime (and the costs of lost productivity), reducing administration and management costs, solving problems faster, achieving better disaster recovery and availability, and more – all areas that directly reduce operational costs. Moreover, most organizations are achieving several of these outcomes simultaneously, further increasing their opportunities for OpEx reduction.

In order to achieve the best possible OpEx reduction outcomes, EMA recommends an approach that starts with defining specific operational KPIs, measuring performance against these KPIs over time, and working toward making them better.

Key Virtualization KPIs to Measure OpEx Savings

EMA research has documented over 20 virtualization KPIs, average and best performance outcomes for these metrics, and the virtual systems management disciplines that correlate with the best practice outcomes⁶. Based on this research, Enterprise Management Associates' recommendation for key virtualization KPIs to measure OpEx savings include:

² EMA Research Report, *Best Practices in Virtual Systems Management (VSM)*,

<http://www.enterprisemanagement.com/research/asset.php?id=1104>

³ EMA Research Report, *The True Value of Green IT*

<http://www.enterprisemanagement.com/research/asset.php?id=945>

⁴ EMA White Paper, *Avoiding the Economic Cliff by Managing the Data Center Floor*

<http://www.enterprisemanagement.com/research/asset.php?id=1006>

⁵ EMA Research Report, *Virtualization and Management: Trends, Forecasts, and Recommendations*

⁶ Except where noted, figures in this section are from EMA Research Report, *Best Practices in Virtual Systems Management (VSM)*

Frequency of Service Failures

Service impact covers a number of metrics including application response time, unscheduled and scheduled downtime, and frequency of security breaches. These KPIs in turn directly relate to IT staff costs (including overtime and on-call costs for out-of-hours support), business unit staff costs (including time lost when systems are down), and lost revenue from downtime – which EMA research shows can be up to millions of dollars an hour⁷. It also affects the potentially high costs of post-facto system recovery, data assurance activities (e.g., providing free credit checks to compensate for lost Social Security or Credit Card numbers), and even the extended share-price impact that often follows a major security breach.

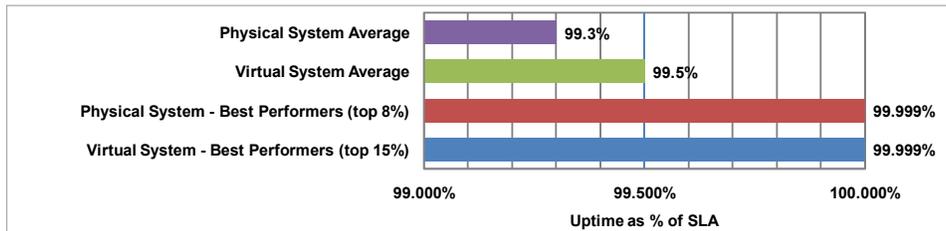


Figure 2 - Comparing Uptime (as a % of SLA) for Virtual and Physical Systems

EMA data shows that best performers definitely achieve higher availability from their virtual deployments. Average uptime for virtual environments is 99.5%, compared with average uptime for physical environments of 99.3%.

The best performers in both physical and virtual environments have an uptime of 99.999%. However, organizations with virtualization achieve the elite ‘5 nines’ availability at almost twice the rate as in physical deployments. These best performers achieve 43 hours less downtime per year than average physical systems, or more than 7 minutes every day, in a 24x7 environment. The best performers were more likely to use sophisticated management disciplines including remote consoles, capacity management, and lab automation.

Mean Time to Repair (MTTR)

Originally a measurement applied to hardware, MTTR is widely used to measure the time between a fault occurring, and the fault being fixed. As such, it is a very good measure of how quickly IT responds to problems occurring in managed systems. Faster MTTR results in less downtime, and reduces lost productivity from idle business unit staff. It also means fewer IT resources are being diverted from strategic project work (such as application implementation or optimization activity) to devote their valuable time to break-fix activity. For problems that occur or extend to out-of-hours, it also directly results in reduced overtime payments for extended recovery activity.

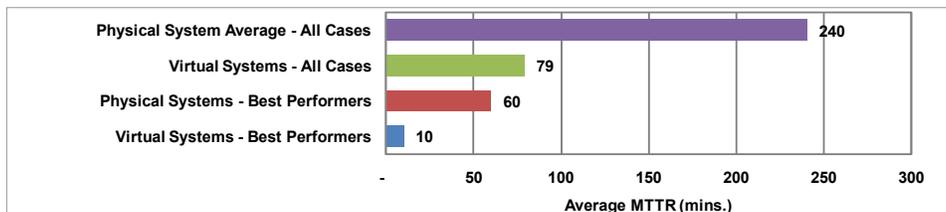


Figure 3 - Comparing MTTR (in mins.) for Virtual and Physical Systems

⁷ EMA White Paper, *Decreasing IT Operational Costs by Accelerating Problem Resolution*, <http://www.enterprisemanagement.com/research/asset.php?id=1191>

EMA research shows that virtualization fundamentally improves MTTR. Organizations with virtualization deployments can repair problems in an average of 79 minutes, compared to an average of around 240 minutes in a physical environment. Best performers in virtual environments (the top 10%) are able to do even better, reducing MTTR to less than 10 minutes, compared to between 15 and 60 minutes in a typical physical environment. These best performers are more likely to be using advanced virtual systems management tools in disciplines including remote consoles, automated backup and recovery, and automated disaster recovery.

Improved Staff Efficiency

The admin-to-server ratio (i.e., the number of administrators divided by the number of servers) is a key staff efficiency metric that directly reflects wage, training, and other staff costs. Virtualization technologies like reusable templates change the server management paradigm, reducing the number of separate images each administrator needs to manage, allowing them to manage an order of magnitude more systems. Remote VM consoles allow administrators to manage remote servers without travel costs.

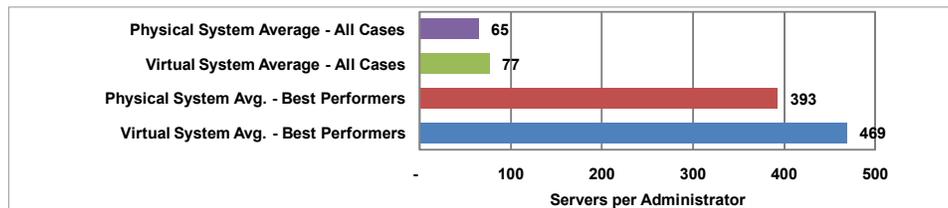


Figure 4 - Comparing Servers Managed per Administrator for Virtual and Physical Systems

EMA research shows that the average admin-to-VM ratio with virtualization and virtual systems management tools is 1:77 (i.e., each administrator is able to manage around 77 virtual machines), whereas the average admin-to-server ratio in a physical data center with automation tools is 1:65 – approximately a 10% staffing efficiency gain⁸. Using EMA data for an average Data Center administrator salary of \$67,860⁹, each additional VM adds an average \$881 in administrator staff costs, whereas each new physical server adds an average \$1044.

Comparing the best performers (the top 10%) in virtual and physical environments, administrators in a physical environment manage an average of 393 servers per administrator, whereas in a virtual environment each administrator manages an average of 469 VMs (and as many as 1800) – approximately a 20% staffing efficiency gain. For these best performers, each new VM adds just \$452 (almost 2½ times less than a physical system), and as little as \$37 (or 28 times less than a physical system), in administrator staff costs. These best performers are more likely to be using advanced management tools, including change and configuration management, capacity planning, and inventory management.

⁸ Previously unpublished data gathered for EMA Research Report, *Data Center Automation: Delivering Fast, Efficient, and Reliable IT Services*, <http://www.enterprisemanagement.com/research/asset.php?id=613>

⁹ A very conservative average of salary and wage payments only, this does not include any on-costs, paid benefits, regional allowances, overtime, etc.. For more details, see EMA Research Report, *Data Center Automation: Delivering Fast, Efficient, and Reliable IT Services*

Faster Service Deployment and Migration

Reducing the time to deploy or move an operating environment is one of the most widely-reported OpEx reduction outcomes from virtualization. EMA research shows that virtualization allows administrators to provision a new VM, from initial request to final handover, in less than 30 minutes (typically using VM templates, images, and management tools such as virtual machine management and automated provisioning). On average, this is 24 times faster than physical machines, and in the best case up to 240 times faster. Similarly, virtualization allows IT to provision new applications in less than 30 minutes, on average around half the time of a physical environment and as much as 96 times faster in a best case scenario.

Each new VM adds as little as \$37 in administrator staff costs – 28 times less than a physical system

Using Enterprise Management Associates' conservative salary numbers, this saves almost \$2000 in wage costs alone for every deployment. Zero-downtime migration (courtesy of live migration) also eliminates both application downtime costs for business users, and overtime payments for out-of-hours migrations. It also means a faster, cheaper software lifecycle, especially when testing requires a new build every day (or with every bug fix), which allows the business to bring new and better products and services to market faster and cheaper, as developers can build, test, and deploy new applications in half the time (or less).

Overall Ease of Management

A great deal of OpEx reduction comes from the overall ease of management and functionality that is unique to virtualization. Most enterprises report daily management tasks are easier, or at least the same, in a virtual environment as in a physical environment (seen in Figure 5 below).

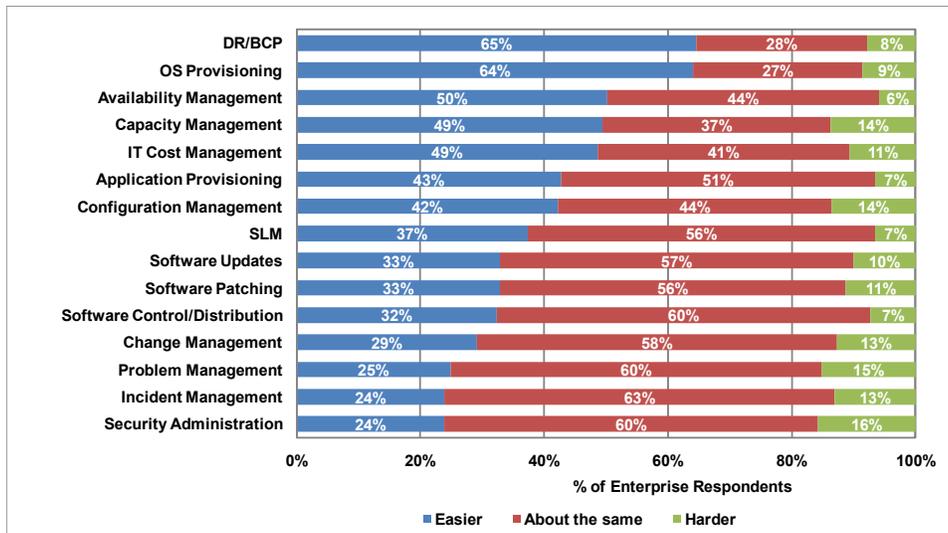


Figure 5 - Does virtualization makes the following management disciplines easier, about the same, or harder?

For example, whole system backups (for change back-out or DR) are simpler with snapshots than with traditional backups, OS and application provisioning is easier with templates than with traditional software installation, availability is easier to ensure with resource pooling, live migration, and automated failover/DR. While some management may get harder, most organizations report virtualization greatly reduces staff time and effort for performing a wide variety of day-to-day management activities.

Case Study – Regional Energy Services Provider

Chris is the Supervisor of IT Infrastructure Systems for a large regional energy services provider (at the company's request, the company will remain anonymous). He oversees 60 Intel-based physical servers, including 42 VMware ESX hosts, running a total of 380 Windows/Linux server instances, supporting roughly 1,900 employees and 630,000 customers across both entities.

Virtualization has allowed the company to grow significantly without increasing their sysadmin headcount. "We are growing at a net of 40 servers per year over the last 5 years [and] 100% storage growth year over year," Chris explained, yet "we have been able to accommodate that growth, to triple our

They have been able to avoid or repurpose around \$130,000 annually in staff costs due to virtualization

workload, without adding a single additional systems administrator in 5 years." With physical servers, said Chris, "we would have required another 2.5 FTEs," even after dedicating two resources to managing the virtualization deployment. For internal calculations, the company costs system administrators at \$65/hr (fully burdened), so they have been able to avoid or repurpose around \$130,000 in staff costs due to virtualization.

"The main hours you save from virtualization are on operational and DR tasks," said Chris. For example, he noted the ease of provisioning, saying, "We probably do about 60 Windows deployments a year," each taking "easily 6 hours on average with a traditional [physical] mechanism. Now with virtualization, we have master templates, and a server can be brought up within 5 minutes." This saves 355 hours (or \$23,000 in admin costs) per year on Windows deployments alone.

Similarly, he noted the backup and recovery benefits of VM snapshots – "Previously it would have taken easily 4-24 hours for a mailbox recovery; now it takes literally minutes – and we get 20-30 requests a year for mailbox recoveries." This saves up to 720 hours a year, or \$46,000 in staff costs, just on mailbox recoveries.

Power reduction is significant too (although for this company – supplier of its own energy – power is not a hard cost). Chris described how the company swapped 120 Dell and HP 'pizza boxes' for 36 larger Dell, HP, and Sun rack-mount servers, achieving a manufacturer-rated power saving of approximately 19kW¹⁰, which equates to a putative annual saving of around \$17,000¹¹.

Plus, virtualization features like VMware DRS and HA have resulted in fewer outages (scheduled or unscheduled), and both the number of performance-related tickets and scheduled downtime have halved.

¹⁰ Based on various device power ratings from Dell, HP, and Sun websites

¹¹ US EIA 2009 power cost of \$0.10/kWh http://www.eia.doe.gov/cneaf/electricity/epm/table5_3.html

Case Study – George Washington University

Raoul Gabiam, IT Operations and Engineering Manager for George Washington University, explained to EMA how virtualization with VMware has reduced or avoided operational costs which EMA estimates at around \$400,000 each year.

GW University supports approximately 5,000 staff and 25,000 students with 500 servers, about half of which are virtualized with VMware. Thirty administrators manage all their UNIX, Novell, and Windows server and storage environments.

One key OpEx benefit comes from reducing the hardware lifecycle management effort. “[Virtual] servers we deployed in 2004 are still running perfectly; if they were on physical boxes, we would have to lifecycle them. From the end of procurement deploying a new server would take 2-3 weeks – taking out the server, racking and stacking, cabling, building, migration. That doesn’t have to be done anymore.” Gabiam now cycles just 18 ESX hosts, instead of 250 physical servers. At 100 hours for each physical server, once every 3 years, EMA estimates that VMware is helping GW University to avoid over \$270,000 annually in staff costs “that would be devoted to lifecycleing, but can now be allocated to new projects.”

**VMware is helping GW
University avoid over \$270,000
annually in staff costs**

VMware has also enabled major growth, without any staff expansion. “Over the last year we have added around 80 new [virtual] servers,” yet only one engineer manages the entire virtual Infrastructure. “I could not have 200 servers dependent on just one person – I had to get more people involved. But even with the growth that we have had, we have had the same staff for the last couple of years.” Using EMA staff cost estimates, not hiring just 2 additional administrators, works out to over \$125,000 each year in OpEx avoidance on staff costs alone.

Gabiam also described how VMware saves around 24 hours of admin time every month with faster and better preparation for and roll-back after system changes and upgrades with the use of Snapshots, fewer hardware issues to resolve given the small number of physical hosts, and a more efficient management and monitoring through a centralized console for all VMs. However, he maintains that the biggest beneficiary is not IT, but its customers. “Yes, we’ve been able to do more with the same staff, and it has really increased productivity,” he said, “but it is not about us. It is about the customers, the university, their needs – we have been able to meet their needs, add programs before school starts, even in a window that might be unrealistic on physical hosts.”

Case Study – Attachmate Corporation

Yens Steller is a Project Manager & Senior Asset Manager for Attachmate Corporation, a Seattle-based software company that has been helping businesses extend, manage and secure their IT investments for more than 26 years. With more than 65,000 customers worldwide, Steller's team manages Attachmate's development labs, including 21 VMware ESX servers under VMware vCenter Lab Manager, and 4 standalone ESX servers, running an average of 450 VMs at any one time.

“We had 4 full-time administrators supporting 180 users. Now, we have 2 part-time administrators supporting over 250 users”

Virtualization has allowed Attachmate's lab environment to operate with fewer resources, while providing additional service to more customers. “Last year, we had 4 full-time lab administrators supporting around 180 lab users,” Steller explained. “Now, we have 2 part-time administrators supporting over 250 lab users worldwide. This enabled us to relocate our staff to expand our strategic goals in the department. We're busy, but this wouldn't have been possible before the VMware Lab Manager.”

VMware vCenter Lab Manager features such as image templates, automation, and self-service have driven much of this additional productivity. “My day has changed completely,” said Steller. “I used to do a lot of repetitive tasks, like building test environments on x86 hardware. Now, I don't do that at all. If someone wants a new machine, they simply go to VMware vCenter Lab Manager and select the template that they want, and they are done.” Troubleshooting is less time consuming and less frequent too. “Before, it took about 60 percent of my time. Now, I spend less than 5 percent of my time troubleshooting physical machines.” Virtualization has also reduced routine maintenance. “We have retired more than 200 machines. So, we now have fewer hardware and maintenance problems.”

This frees up time for strategic projects. “It used to be about survival – worrying about overheating, cooling, building test environments, fixing hard drives, etc. Now, I am responsible for strategic projects, including optimizing our lab environment to help our company to become more productive. I am no longer just a development lab administrator; I am a strategic project manager.”

Steller also mentions how business users are saving time – around 10 hours per week on average. For example, developers share real software images, rather than relying on scheduled Web-based demos, making UI reviews more efficient and more comprehensive. Support, Test, and Development teams share pre-built systems for problem analysis, rather than each team building multiple test environments. Sales engineers check out existing demo systems in seconds, instead of spending days to build new ones.

“VMware has allowed us to do things that we couldn't do before, for more users, with less staff,” said Steller. “It works better than we ever imagined.”

Core Recommendations

EMA recommends organizations take a number of progressive steps to standardize their virtualization environment and management technologies, address and improve their server management process challenges, and make the best use of their skills and people, in order to realize advanced and ongoing virtualization cost benefits. Organizations should, for example:

- Reduce the frequency, duration, and impact of outages – by proactively monitoring performance and availability, administrators can detect, predict, and even prevent service failures. Virtualization technologies like resource pooling and live migration allow for seamless scheduled maintenance; high availability and fault tolerance can recover automatically from failures, or even eliminate their impact entirely.
- Reduce *ad hoc* and routine use of senior staff – automation and sophisticated management embeds complex process knowledge into software as documented, reusable, repeatable processes. This allows junior staff to do more, by automating routine procedures such as performance monitoring, lab deployments, etc. This in turn frees up senior resources for more complex, strategic activities such as application design or infrastructure optimization.
- Reduce routine use of junior staff – expanding automated management to handle more complex activities such as dynamic workload balancing, template-based solution provisioning, or self-service provisioning via service desk integration, frees up even junior staff from routine activities, allowing for workload growth or project activity, without increasing staff costs.
- Expand virtualization deployments – as automated management tools accomplish more routine activities, such as capacity planning, physical migration, and workload management, even complex environments become easier to manage, and more scalable. This in turn allows virtualization deployments to expand, further multiplying OpEx savings.
- Automate power management – with advanced workload balancing, performance monitoring, live migration, and automated power management, it is possible to load up machines that have spare headroom, throttle power for machines that are only lightly used, and dynamically shut down machines that are not needed, further reducing operating costs.

The case studies above show a number of additional best practices to reduce the frequency and severity of service impacts, improve MTTR, increase administrator efficiency, speed up system deployments, and reduce facilities costs. These include swapping old hardware for cooler-running and more energy-efficient systems; providing hands-off self-service so end users can do more for themselves; sharing VMs between multiple user departments rather than building new systems every time; and assigning newly available resources to strategic projects that may not have been possible before. All of these measures, enabled by virtualization, will further reduce OpEx.

EMA Perspective

EMA research is very clear on the OpEx cost reductions that are possible through virtualization. Beyond inherent cost reductions from hardware efficiencies, ease of management for many day-to-day tasks removes a considerable amount of effort and costs from IT administration.

Of course, many factors contribute to the possible levels of OpEx savings. Smaller servers will not permit the highest possible consolidation ratios; some management tasks will be harder than they appear; some management tasks may even be harder than in a physical environment. Nevertheless, there is no doubt that virtualization drives clear opportunities for OpEx reduction, with proven savings in administrator time and effort.

Virtualization alone is just one side of the OpEx coin. As this paper shows, virtualization definitely drives a fundamental reduction in OpEx burdens, but it is not the only way to save. Better management of the virtualization environment, with good deployment of virtual systems management tools, is the other side of the coin, as better management tools and processes add even more to OpEx reduction than virtualization alone.

There is no doubt that
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OpEx reduction

Together, EMA believes that virtualization and virtual systems management promise to not only reduce capital outlays, but provide major reductions in operating costs, deliver ongoing benefits, and reduce IT budgets up front, and year after year.

About VMware

VMware (NYSE: VMW) delivers solutions for business infrastructure virtualization that enable IT organizations to energize businesses of all sizes. With an industry leading virtualization platform – VMware vSphere™ – customers rely on VMware to reduce capital and operating expenses, improve agility, ensure business continuity, strengthen security and go green. With 2008 revenues of \$1.9 billion, more than 150,000 customers and 22,000 partners, VMware is a leader in virtualization which consistently ranks as a top priority among CIOs. VMware is headquartered in Silicon Valley with offices throughout the world and can be found online at www.vmware.com.

About Enterprise Management Associates, Inc.

Founded in 1996, Enterprise Management Associates (EMA) is a leading industry analyst firm that specializes in going “beyond the surface” to provide deep insight across the full spectrum of IT management technologies. EMA analysts leverage a unique combination of practical experience, insight into industry best practices, and in-depth knowledge of current and planned vendor solutions to help its clients achieve their goals. Learn more about EMA research, analysis, and consulting services for enterprise IT professionals and IT vendors at www.enterprisemanagement.com or follow [EMA on Twitter](#).

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