Server Infrastructure Optimization

Best Practices to Reduce IT Operational Costs

Abstract

This paper shows technical decision makers and IT managers how organizations can reduce costs and improve their IT efficiency by optimizing their core infrastructure and adopting server-related best practices. This paper identifies which best practices are most effective in driving IT efficiency to reduce operating costs and free up human and financial IT resources to add more value to the business.

people ready

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Contents

Executive Summary

This paper summarizes results of a research study that shows how implementing up to 31 core infrastructure best practices on key server workloads can significantly reduce IT operational costs and increase workload availability.

Findings

- **Organizations can achieve big savings by adopting core infrastructure best practices for mission-critical server workloads.** In the email and collaboration workloads, organizations that adopted core infrastructure best practices reported IT labor costs of more than $10,000 per server per year less than those that did not. Companies are increasingly aware of these benefits and are rapidly adopting these best practices for their mission-critical messaging and collaboration workloads.
- **Organizations are not necessarily implementing best practices on all core server workloads.** There are significant unrealized cost savings to be made from adopting best practices for core workloads, such as print management. However, adoption of best practices in these workloads is limited.
- **Some best practices that deliver considerable benefits are not widely adopted.** Practices such as software imaging or cloning, automated restore, or automated deployment processes offer considerable benefits across multiple workloads. However, they are not as widely adopted as other, less beneficial practices.

Benefits

- **Best practices provide tangible benefits.** Although the benefits of best practice adoption vary widely across workloads, they are real, and the cost savings are quantifiable.
- **The more practices adopted, the greater the cost savings.** As organizations adopt more best practices, their infrastructure optimization (IO) level increases, their IT efficiency improves, and the value of the benefits achieved increases. For example, organizations operating at the rationalized IO level tended to realize higher-value benefits than those operating at lower IO levels.
- **Benefits are accessible to any organization.** Organizations at any IO level can drive cost savings now by adopting core infrastructure best practices. Study results show that best practice adoption has an increasingly positive effect on IT costs and server availability as organizations move through the continuum of basic, standardized, and rationalized IO levels.
- **Microsoft solutions support best practice implementation.** Microsoft infrastructure solutions provide core infrastructure capabilities that enable many best practices and help deliver the cost and availability benefits documented in this paper.

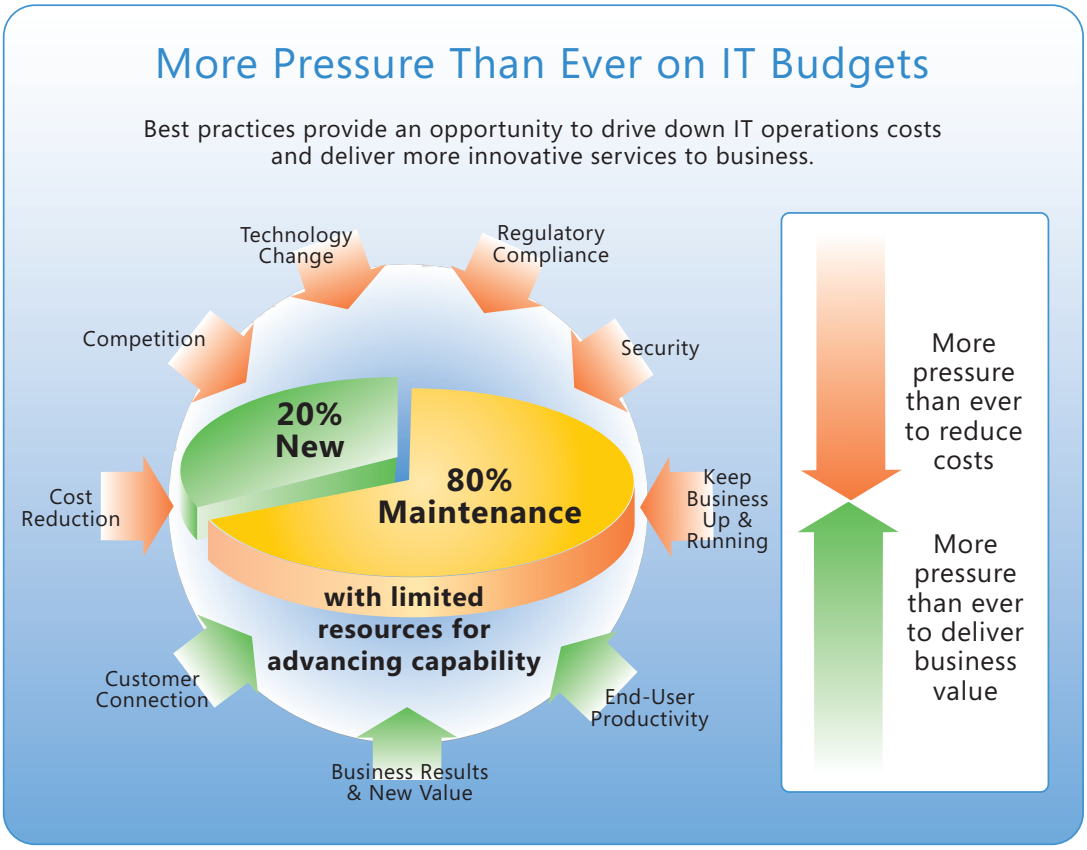
Recommendations

- **Begin the IO process by implementing the easiest-to-adopt best practices.** These would be the highest-value, most frequently adopted best practices, which appear at the upper right corner of the workload best practices graphs.
- **Assess organizational IO level.** Use the Microsoft Infrastructure Optimization Assessment to determine the current state of the IT infrastructure.
- **Learn more about Microsoft's free IO tools.** Find out more about optimization tools, guidance, and Microsoft Solution Accelerators.
- **Learn more about Microsoft solutions that support best practices.** Microsoft solutions are designed to support best practice adoption and to become part of a long-term IT investment road map, which can help organizations realize rapid cost benefits now and in the future. IT organizations should schedule a meeting with their Microsoft or partner representative to discuss Microsoft solutions that can help address IT operational costs.

Introduction

Even in the best of times, IT managers are faced with the challenge of providing high-quality services on a 24 x 7 basis with limited budgets. Research from many IT industry analysts indicate that roughly 80% of the typical enterprise IT budget is spent on operations and maintenance, leaving roughly 20% for IT innovation that contributes to greater business value. In uncertain economic times, with smaller budgets, this ratio can shift even more toward operations and maintenance, leaving less money available to enhance IT services that serve the business.

Microsoft solutions can help data center administrators improve the efficiency of their organization's core infrastructure, so more human and financial resources will be available for IT innovation.



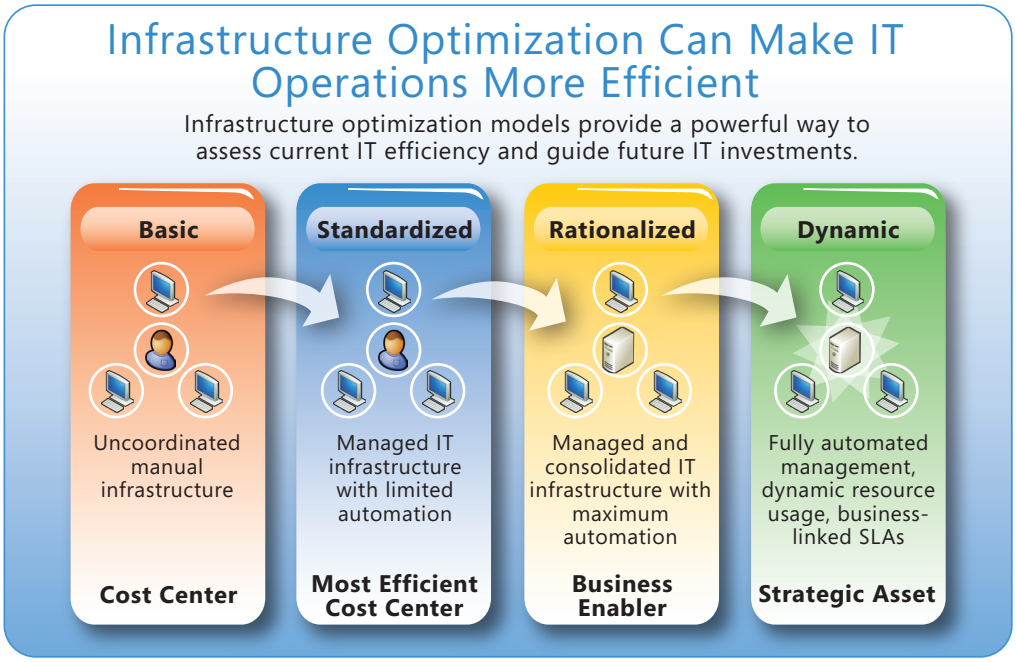
This paper, written for technical decision makers and IT managers, shows how organizations can improve IT efficiency and reduce operating costs by adopting core infrastructure best practices designed to optimize the server environment.

Infrastructure Optimization

Engaging with Microsoft and its partners helps organizations consider how best to plan and make IT investments, establish the appropriate IO level, and reduce IT operations costs. To support this effort, Microsoft has developed the Core IO Model. This model can help organizations understand where they are today in terms of IT efficiency, what they need to do to improve this efficiency, and optimize their IT infrastructure.

Core Infrastructure Optimization Model

Microsoft developed the Core IO Model to characterize levels of IT efficiency organizations can achieve by delivering core infrastructure services more efficiently. Four different levels of IT operations efficiency (IO levels) are assigned to specific technology capabilities that can advance IT efficiency and reduce IT operations and maintenance costs. These levels are: basic, standardized, rationalized, and dynamic. These IO levels indicate how efficiently IT services are delivered within specific workloads. The higher an organization's optimization status, the more efficient its IT organization, and generally, the lower the costs of IT services delivered.



To better assess an organization's current IO level and identify areas for improvement, the Core IO Model is divided into different capabilities. Core IO capability areas include identity and access management; desktop, device, and server management; security and networking; data protection and recovery; and IT and security management. This paper looks at best practices related to each of these capabilities to identify and quantify their impact on the availability and costs of operating core server workloads.

Core Infrastructure Best Practices

Identifying and adopting Core IO best practices is a powerful way for organizations to reduce IT operations costs, improve IT service levels, and increase the agility of their IT infrastructure. Previous studies have documented the strong connection between best practices adopted and benefits such as desktop support and PC user cost savings. This paper describes the less well known connection between the adoption of server-related best practices and associated benefits in terms of the availability and the cost of running core server workloads.

The Study

This paper summarizes the results of a multi-phase, Microsoft-sponsored study of core infrastructure best practices and their impact on key server workloads.

The study was designed and managed by a team of Microsoft specialists, who investigate costs in the IT environment and inform Microsoft product development teams about features and functionality that can help organizations reduce IT operations costs. The first, qualitative phase of the study analyzed a small group of companies to identify a set of practices used to manage core server workloads.

In 2007, the team engaged the research firm, Hansa/GCR, to perform Phase 2 quantitative research. This phase analyzed the practices identified in Phase 1 and quantified their impact on the availability and ongoing IT operations costs of core server workloads.

IT managers and data center administrators at 850 organizations responded to the survey, on which the Phase 2 study was based. Of these respondents, 162 organizations provided enough detail (cost, quality of service, and efficiency metrics) and insight into the workloads and related core infrastructure practices to validate study results.

The study investigated the connection between adoption of specific core infrastructure best practices and IT operations performance in six common server workloads. Each practice examined was mapped to an IO level in the Core IO Model to help determine each participating organization's IO level for specific workloads.

Server Infrastructure Workloads

The study focused on six server infrastructure workloads that are essential to keeping organizations up and running. These workloads include:

- **Collaboration**
- **Data management**
- **Identity and access**
- **Email**
- **Connectivity**
- **Print**

These server workloads were analyzed from a core IO perspective; practices analyzed in the study were related to managing and running each server workload rather than specific workload activities. Although the practices described in the summaries that follow were common across three or more workloads, they had different effects on IT labor costs and workload availability, depending on the workload.

Collaboration Workload

The collaboration workload includes practices undertaken in enterprise content management, Web content management, document storage and search, document workflows, social networking, and project tracking.

Collaboration Workload: Benefits of Core Infrastructure Optimization

IT organizations managing collaboration servers at the rational IO level achieved far greater benefits than those operating at basic and standardized levels. By being able to automate cluster server management and other routine management tasks, rationalized organizations experienced significantly lower per-server IT labor effort and costs.

Rules-based core infrastructure tools and standardized, pre-scheduled maintenance contributed to the greater availability that standardized IT organizations experienced. Rationalized IT organizations were able to reduce the impact of system downtime further through automated patch deployment and by leveraging the failover protection of server clustering and rollover capabilities.

Collaboration Workload: Higher Core IO Level Means Lower IT Costs, More Availability

Organizations adopting more core infrastructure best practices had more efficient server management and significantly lower IT labor costs than those that did not.

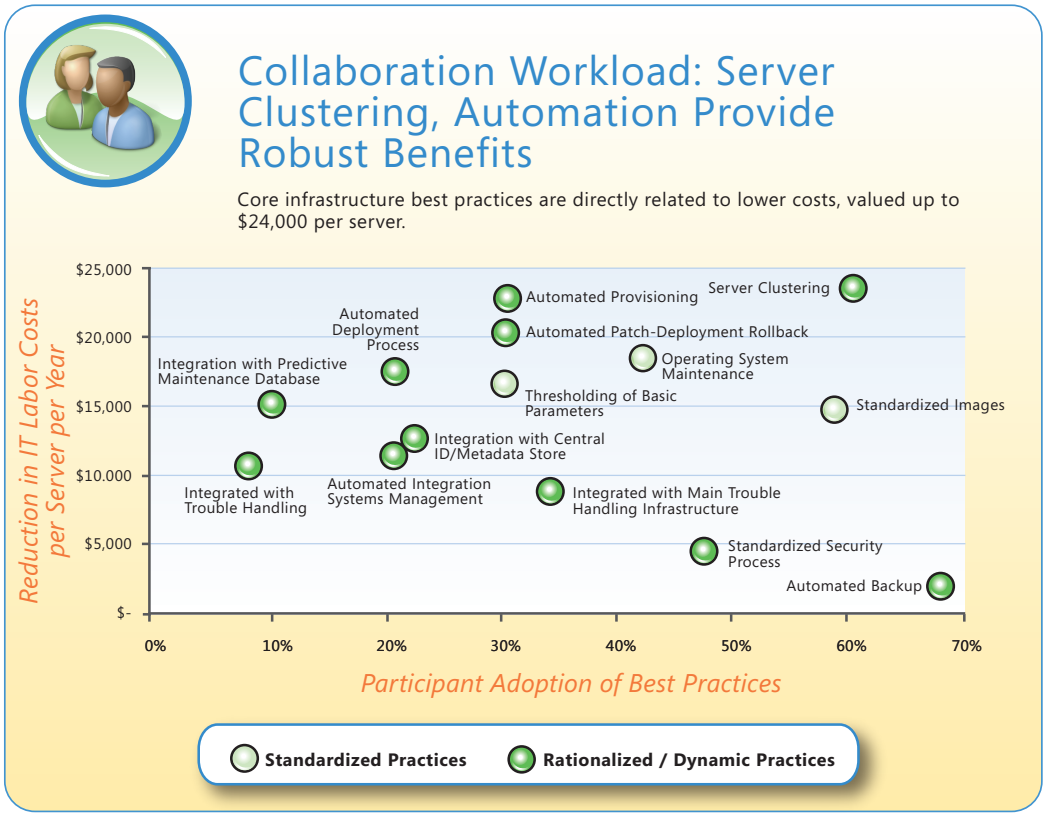
	Basic	Standardized	Rationalized
IT Labor Costs per User per Year	$89.68	$67.3	$1.24
Servers per IT FTE	4.6	10.8	91.8
IT Labor Costs per Server per Year	$23,807	$10,163	$1,201
Downtime per Server per Year (Hours)	3.02	0.81	0.31

Collaboration Workload: Core Infrastructure Best Practices

In this workload, core infrastructure practices had a significant impact on IT operations costs. Collaboration is one of the more recently implemented core server workloads. Nevertheless, organizations, that see clear value in adopting core infrastructure best practices are doing so rapidly.

- **High-impact practices:** The 47% of study participants who use server clusters spent $24,000 per server less in annual IT labor costs than those that did not adopt this best practice. Most of this difference is related to greater efficiency gained through managing collaboration databases in this deployment model. The best practice of automated provisioning, patching, and deployment also yielded significant IT labor cost savings.
- **Widely adopted practices.** The use of thresholding of basic performance parameters, regular operating system maintenance, and using standardized images had effects on IT labor costs ranging from $15,000 to $18,000 per server. These practices enable greater efficiencies through automation, rules-based monitoring, and standardized maintenance practices.

- **Practices with lower adoption rates.** Five practices (integration of automated trouble handling, integration with predictive maintenance database, automated integration with systems management, automated deployment, and integration with centralized identification and metadata store) are examples of collaboration practices that were seldom adopted. However, these practices were associated with lower IT labor costs valued at $11,000 to $17,000 per server. These best practices support automated system monitoring, deployment, and problem response capabilities that identify critical issues and root causes with a minimal IT staff intervention.



Note: Best Practice graphs show the difference in labor costs per server per year for participants who had implemented a best practice compared to those who had not. Values are not cumulative.

Data Management Workload

The data management workload includes practices undertaken in managing data management and file sharing servers in the IT organization.

Data Management Workload: Benefits of Core Infrastructure Optimization

IT organizations managing data management servers at the rational IO level incurred 63% lower per-server operations costs and managed approximately 3 times more servers per administrator than those operating at the basic level. Automated server virtualization, deployment, and security processes contribute to lower IT staff effort, which relates to lower costs and higher per-server FTE efficiency.

Data management availability at organizations with a standardized level of core IO availability was higher than that of organizations at the basic IO level. However, data management availability of rationalized organizations was slightly lower than that at standardized IT operations. This anomaly may be due to the fact that key rationalized practices are implemented for other benefits, such as cost efficiency or increased agility.

Data Management Workload: Core Infrastructure Best Practices Drive Down IT Costs Significantly

Efficient processes, integrated toolset help minimize administrator effort.

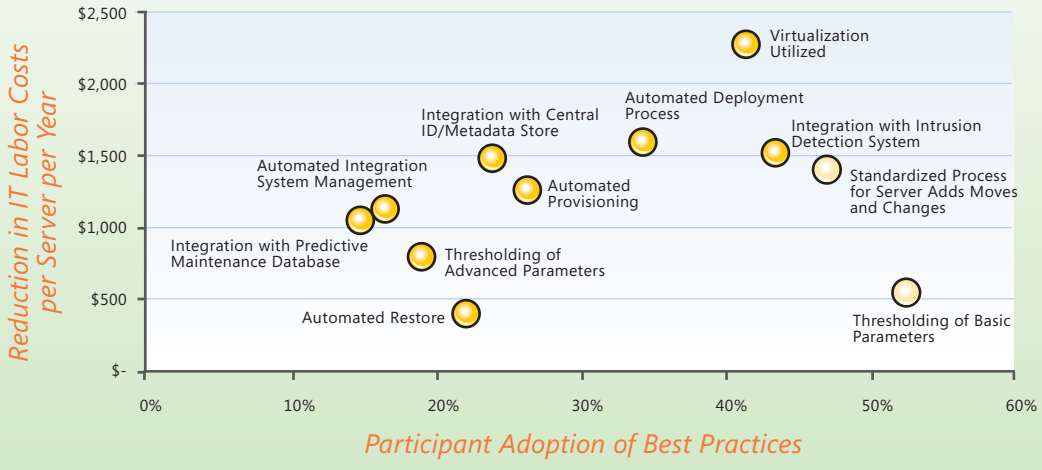
	Basic	Standardized	Rationalized
IT Labor Costs per User per Year	$58.7	$30.56	$3.81
Servers per IT FTE	35.6	46.3	96.5
IT Labor Costs per Server per Year	$3,094	$2,381	$1,143
Downtime per Server per Year (Hours)	1.20	0.63	0.96

Data Management Workload: Core Infrastructure Best Practices

In this workload, two trends were apparent: the clear benefit of virtualizing data management workloads and the low adoption rates of automated management practices, despite measurable benefits.

Data Management Workload: Automated Processes Are Beneficial But Underutilized

Automated processes reduce IT staff effort and contribute to three-fold increase servers managed per FTE.



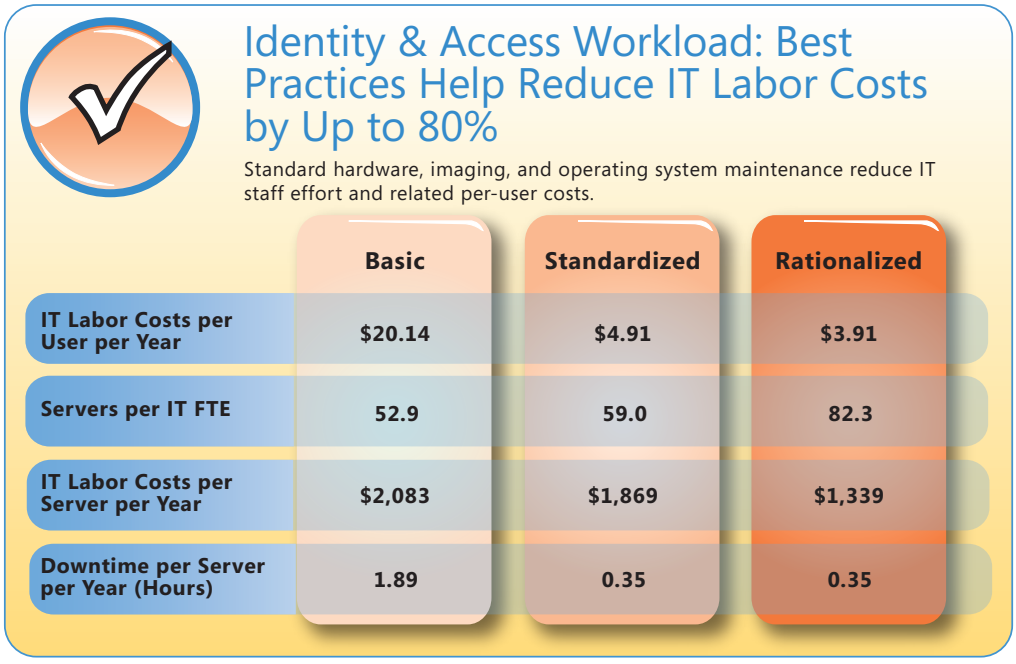
- **High-impact practices.** Server virtualization enables organizations to reduce their hardware footprint, save on utilities costs, and (where systems management is used) reduce IT labor costs. These savings are reflected in an annual $2,300 per-server difference in IT labor costs at organizations that adopt the practice compared to those who don't. Automation also factors in heavily; by automating the creation, conversion, and management of virtual servers, the IT staff can assign resources dynamically, improving server utilization rates and saving hardware, power consumption, and other IT costs.
- **Widely adopted practices:** Two widely adopted standardized best practices delivered value to study participants in this workload. Standardizing the process for adding, moving, or changing data management servers helps ensure that only proven, efficient procedures are used to perform these routine tasks. This practice, which helps IT organizations avoid rework or system downtime, had an annual $1,400 per server impact on IT labor costs. Thresholding of basic parameters, a rules-based monitoring practice, had a $700 per server impact on annual IT labor costs.
- **Practices with lower adoption rates.** Only 17% of study participants integrated automated systems management with a predictive maintenance database, but those that did experienced $1,100 per server less in IT labor costs than organizations that did not. These savings are based on having pre-defined rules and actions that are triggered by system events and by automated monitoring and management tools.

Identity and Access Workload

The identity and access (IDA) workload includes practices undertaken in managing identity and access servers in a corporate IT organization. Identity and access management includes supporting servers that provide Lightweight Directory Access Protocol (LDAP) or Microsoft Active Directory® services.

Identity and Access Workload: Benefits of Core Infrastructure Optimization

In this workload, organizations with rationalized operations showed significant differences in terms of per-user and per-server IT labor costs.

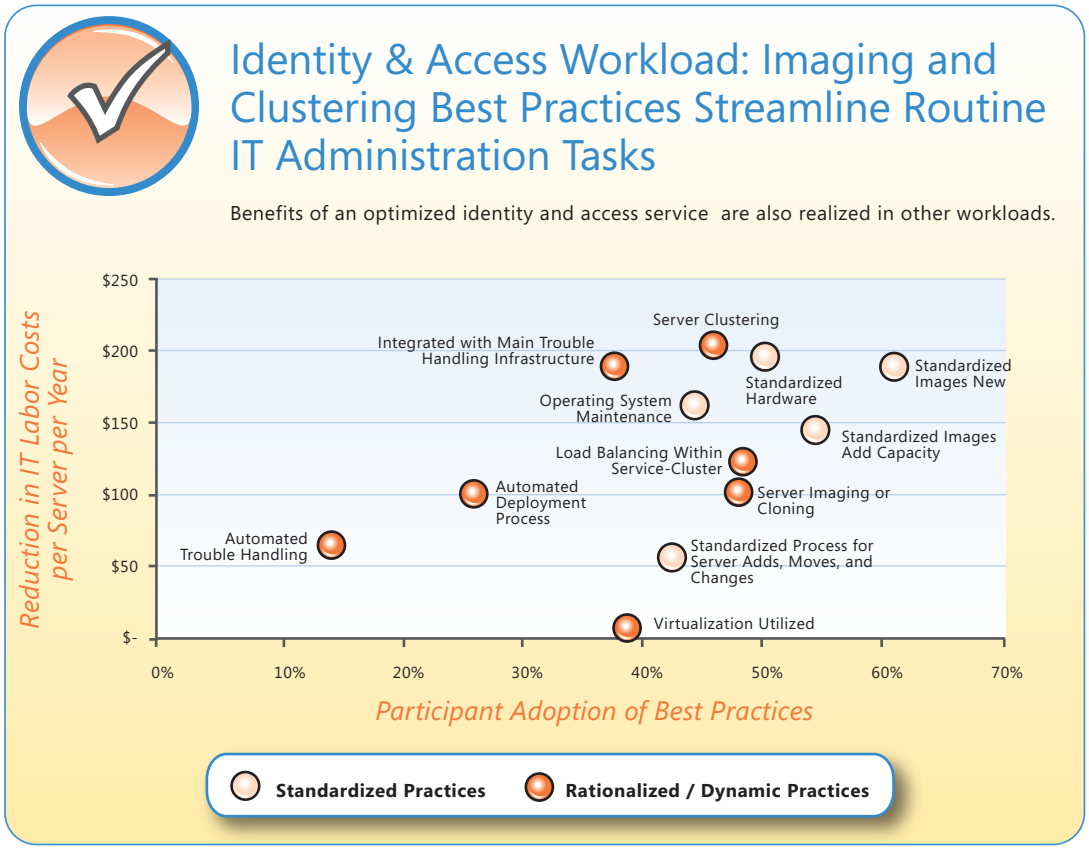


Server availability provided by standardized and rationalized operations was virtually the same. This is because, in the IDA workload, availability improvements are mostly associated with combining more efficient processes and an integrated toolset. Capabilities that these practices support minimize the time that servers are offline while data center administrators troubleshoot problems, change server hardware, and maintain the network.

Identity and Access Workload: Core Infrastructure Best Practices

Because the post-installation environment of IDA servers requires relatively little management and maintenance, operations costs are low, and the impact of best practice implementation on the workload is limited. However, IDA capabilities such as single sign-on, automated provisioning, or integration with a central identity (ID) metadata store are the foundation of other core infrastructure best practices. As a result, best practice adoption for this workload has a positive effect on other workloads.

- **High-impact practices.** Server clustering provides the redundancy and recovery capabilities that reduce the risk of interrupted IDA workloads. The automated provisioning functions of server clustering reduce response time and IT staff effort.
- **Widely adopted practices:** Four widely adopted standardized best practices (standardized hardware, new and additional standardized images, and operating system maintenance) streamline routine IT tasks. These practices decrease the number of core software configurations that the IT staff must deploy and support. These best practices had an impact on IT labor costs that ranged from $140 to $200 per server.
- **Practices with lower adoption rates.** Automated trouble handling and automated deployment practices contributed to IT cost savings, but both had low adoption rates (less than 30%). These practices minimize IT staff effort and costs by providing pre-defined process workflows that automate responses to trouble event triggers and by providing a fully defined, scripted, and tested deployment process.

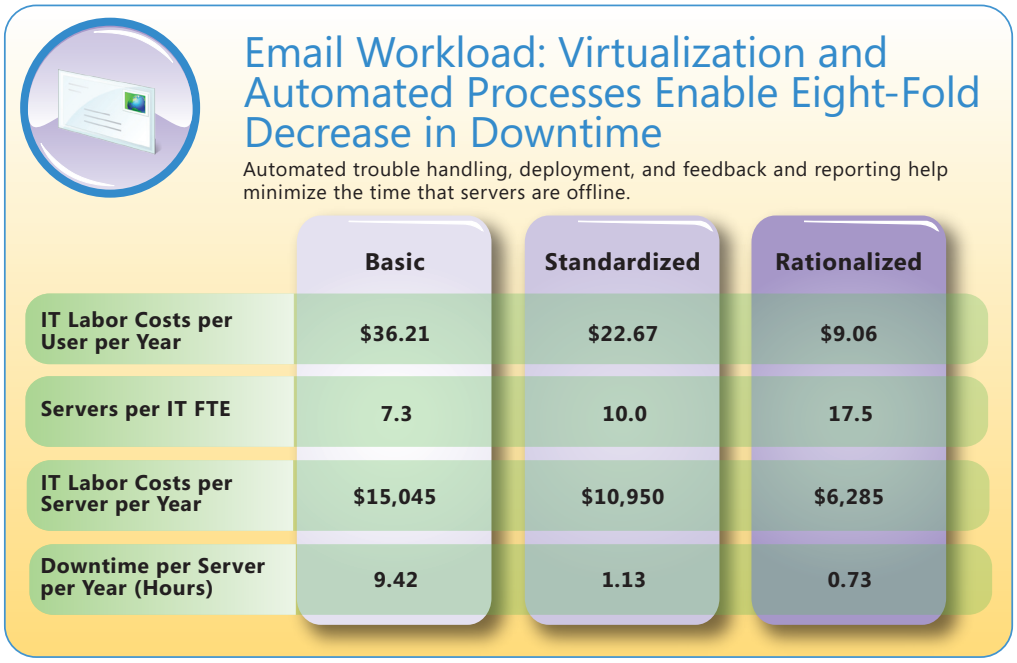


Email Workload

The email workload includes the practices required to manage email server software and ensure the quality and responsiveness of email messaging services.

Email Workload: Benefits of Core Infrastructure Optimization

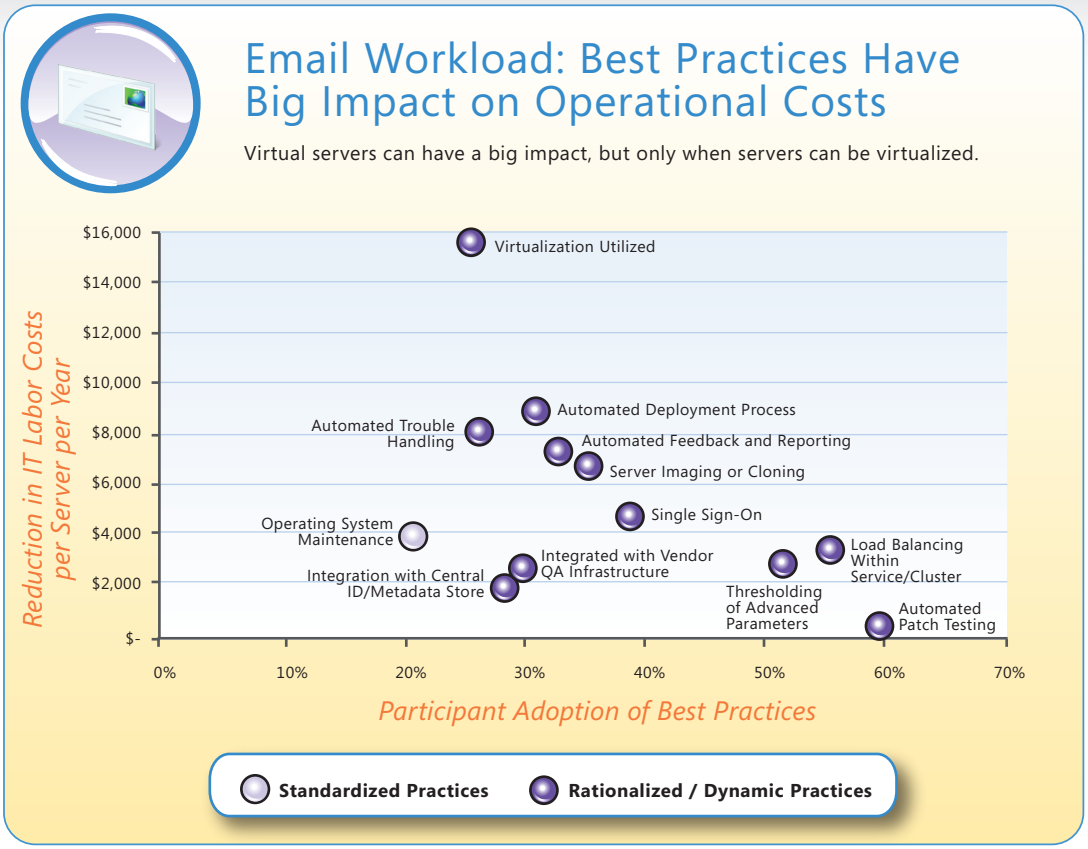
Server consolidation through virtualization and automated server deployment, feedback, and reporting made contributions to reduce the cost of IT operations for study participants at the rationalized IO level. Automated trouble handling, server operating system maintenance, and automated feedback and reporting capabilities contributed to improved availability at rationalized organizations:



Email Workload: Core Infrastructure Best Practices

Email is another mission-critical workload that is relatively complex from an IT operations point of view. As a result, email operations tend to be expensive, and best practice adoption can have a major impact on IT labor costs.

- **High-impact best practices.** Several automation-related best practices prove highly beneficial to email workload management. For example, automated server deployment uses a fully defined, scripted, and tested deployment process, which can be engaged whenever it is needed, with minimal customization. IT departments adopting this practice avoid $9,000 in IT labor costs per server by automating formerly manual setup and installation tasks.
- **Widely adopted best practices.** Several best practices such as load balancing with server clusters, thresholding of advanced parameters, and automated patch testing had relatively high adoption rates but relatively low impact on costs. These practices had IT labor cost impacts ranging from $1,000 to $3,500 per server annually.
- **Practices with lower adoption rates.** Automated trouble handling provides a pre-defined workflow that minimizes manual responses to network trouble alerts. The ability to reduce IT intervention to solve network problems helped organizations adopting this practice to spend $8,000 per server less in IT labor cost than those that did not.



Connectivity Workload

The connectivity workload provides connectivity-related services such as Dynamic Host Configuration Protocol (DHCP), Domain Name System (DNS), and Microsoft® Windows® Internet Name Service (WINS).

Connectivity Workload: Benefits of Core Infrastructure Optimization

In this workload, software imaging and cloning had a substantial effect on IT costs and availability. The time and cost savings of more efficient provisioning, patch testing, and storage management further reduced IT operations costs for organizations with a rationalized infrastructure.

Workload availability changed only a little across IO levels. Availability among rationalized organizations was slightly lower than that of standardized groups. This pattern, which is similar to that experienced for the data management workload, suggests that at this IO level, availability is not the key benefit driving best practice adoption. Presumably, the goal of increasing availability takes second place to driving down costs or better alignment of IT operations with business requirements.

Connectivity Workload: Best Practices Contribute to 12-fold Increase in Server Management Efficiency

More efficient provisioning, patch testing, and storage management enable IT staff to manage more servers per FTE.

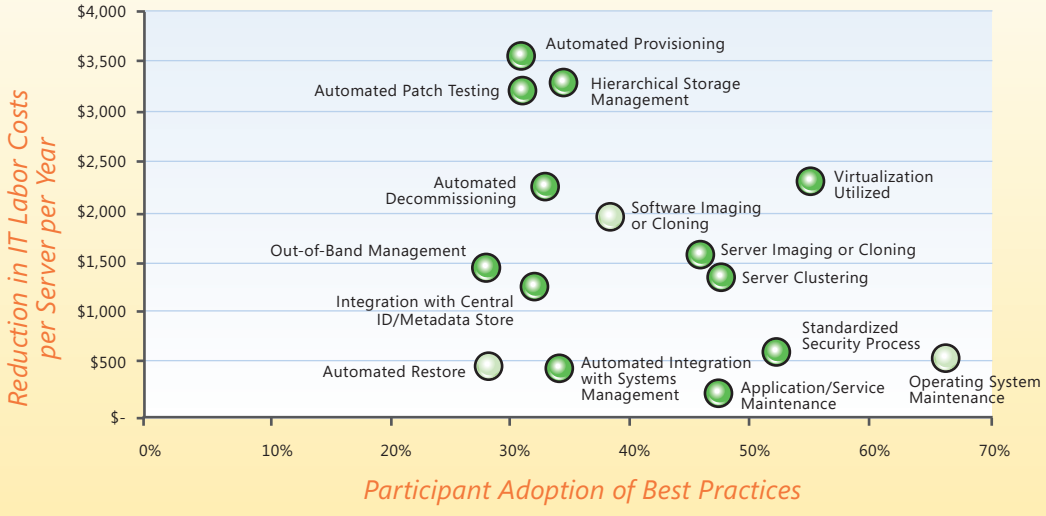
	Basic	Standardized	Rationalized
IT Labor Costs per User per Year	$23.07	$13.02	$0.96
Servers per IT FTE	29.4	118.2	366.8
IT Labor Costs per Server per Year	$3,753	$933	$301
Downtime per Server per Year (Hours)	1.10	0.96	1.04

Connectivity Workload: Core Infrastructure Best Practices

Connectivity is also another relatively mature workload. Best practices are generally well adopted and have less impact on IT operations costs than in collaboration and email workloads.

Connectivity Workload: Organizations Spend up to $3,500 Less per Server by Adopting Best Practices

Automating management tasks provides significant operational cost savings.



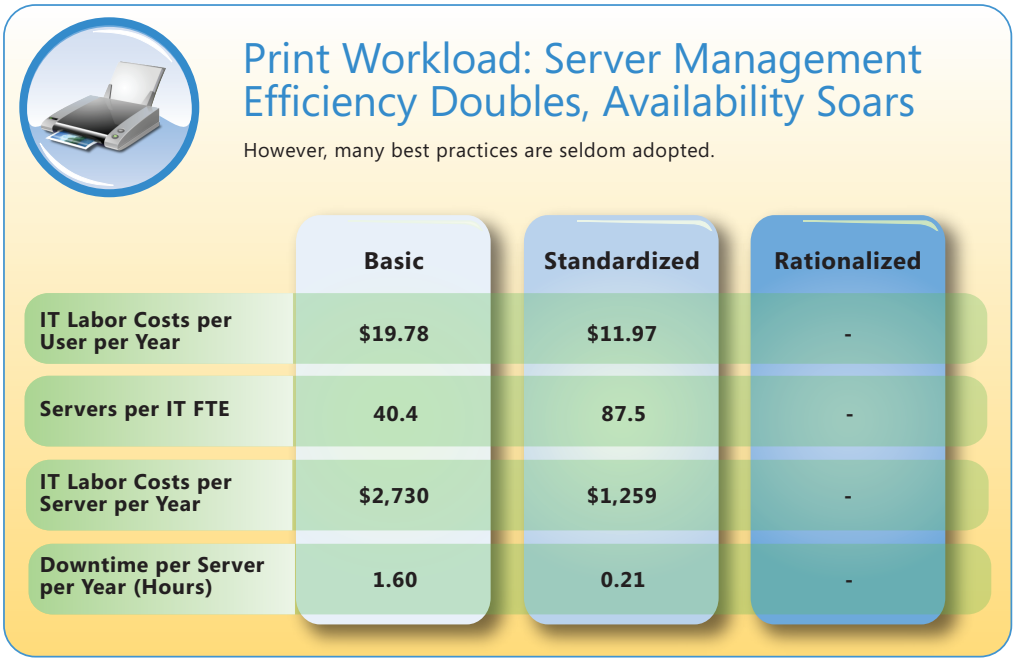
- **High-impact best practices.** Automated provisioning yields the highest IT labor cost savings in the connectivity workload. The 30% of organizations that had adopted this best practice spent $3,500 less in annual per-server IT labor costs than those that had not adopted it. Patch testing provides a standard, pre-defined process workflow that tests security updates before full-scale production deployment occurs. Automating this process eliminates formerly manual testing processes and reduces the IT staff effort (and related labor costs) of managing security updates. Organizations that had adopted this practice spent $3,200 per server less in IT labor costs than those that had not adopted it.
- **Widely adopted practices.** Operating system maintenance, server virtualization, server imaging or cloning, and server clustering, all widely adopted best practices, enable organizations to scale and adapt the workload on demand. In addition to their impact on costs, these practices also help improve workload availability.
- **Practices with lower adoption rates.** In this workload, a variety of best practices including out-of-band management and automated restore were under-utilized. The automated restore best practice reduces the business impact of data loss by ensuring that intellectual property and other vital data are always protected. This best practice enables IT organizations to consistently restore data according to established business and IT policies. Organizations implementing this practice paid roughly $500 less per server in annual IT labor costs than those that did not.

Print Management Workload

The print workload includes practices required for print server management in a corporate IT organization. Activities include management of printer server hardware and software and ensuring the quality and responsiveness of print services.

Print Management Workload: Benefits of Core Infrastructure Optimization

Efficiencies enabled by standardized images and practices enabled standardized IT organizations to manage twice the number of servers per administrator than those operating at the basic level. Standardized practices such as automated backup and standardized images enabled IT organizations in this workload to minimize the time that servers are offline for repairs.



Print Management Workload: Core Infrastructure Best Practices

Study results showed that in the print management workload, there are clear benefits to optimizing the management of print servers. But surprisingly few participating organizations sought to achieve these benefits by adopting best practices.

Although organizations adopted some rationalized best practices in this workload, none of the organizations ran their print operations at a rationalized level overall. This is reflected in the generally low adoption of print server management practices. Ten of the 13 best most frequently adopted practices in this workload (and all rationalized practices) have adoption rates less than 30%.

- **High-impact practices.** The standardized images practice streamlines server management by reducing the core software configurations that IT professionals must deploy and support. This practice has a $3,200 per server IT labor cost impact associated with updating and maintaining images.
- **Widely adopted practices.** Of the print server management practices with a higher-than-30% adoption rate, standardized imaging, standardized hardware, and automated backup practices have the biggest impact on IT labor costs. By streamlining routine, formerly manual IT tasks, these practices have an impact on IT costs valued from $1,000 to $3,200 per server.
- **Practices with lower adoption rates.** Many of the more typical management and automation best practices have lower adoption rates in the print workload. Of the 10 practices in this workload with adoption rates less than 30%, the standardized security process and application and service maintenance practices have the biggest impact on IT costs. These practices, which provide a formalized approach to security and ensure that IT core workloads meet defined service levels, are associated with IT labor costs valued at $3,200 and $2,700 respectively per server.

Delivering Best Practices with Microsoft Solutions

Microsoft solutions deliver unified management and security capabilities into its core infrastructure solutions. These solutions, which make best practice adoption and core infrastructure optimization possible, include:

- **Configuration management.** Provides comprehensive set of systems management tools that assess, deploy, and update servers across physical, virtual, distributed, and mobile environments.
- **End-to-end monitoring.** Enables operations and data center administrators to identify and resolve issues affecting health of distributed IT services.
- **Identity management.** Provides identity synchronization, certificate and password management, and user provisioning in a single solution that works across Microsoft Windows and other organizational systems.
- **Data protection and recovery.** Provides continuous data protection for Windows application and file servers.
- **Security and compliance.** Includes a comprehensive line of business security solutions that provide greater protection and control through integration with existing IT infrastructure.

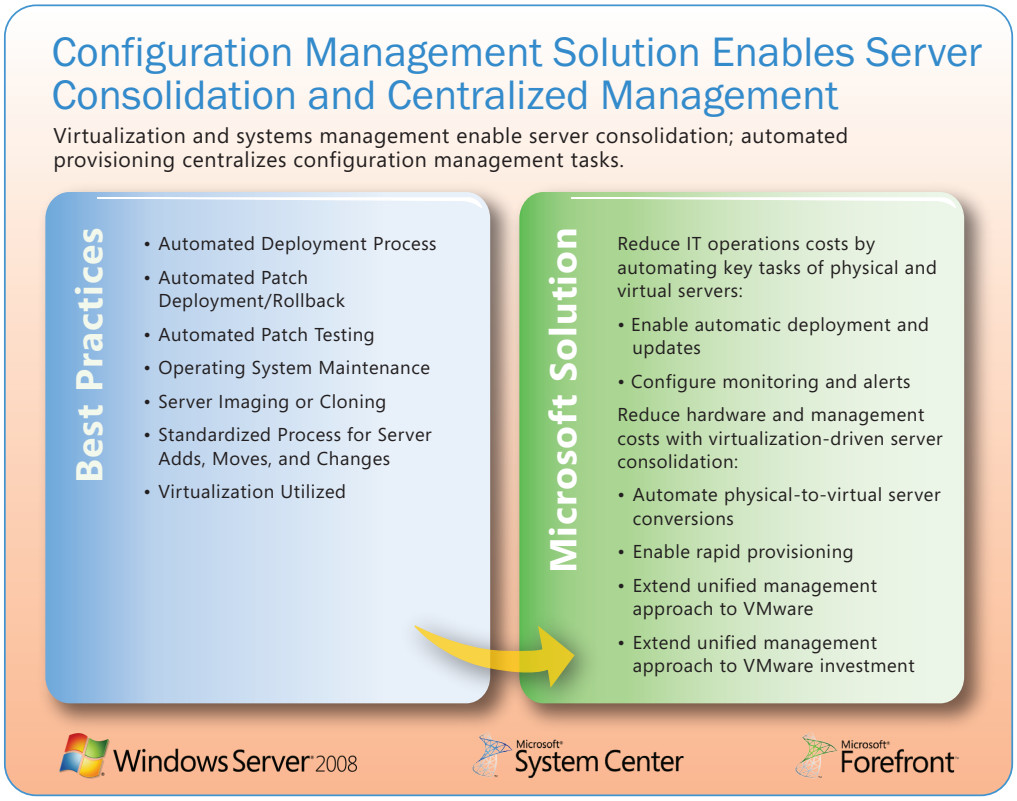
Data center administrators using Microsoft core infrastructure management solutions can leverage these capabilities and use their, familiar, consistent Microsoft systems management environment and skills set to reduce IT effort and related costs.

Configuration Management Solution

Microsoft provides a solution that helps data center managers support fewer physical machines and deal with the increasing number of servers and applications deployed in the data center. The Microsoft configuration management solution:

- **Automates server provisioning and updates** by centralizing the management of physical and virtual server software deployments in the data center.
- **Consolidates physical servers** by converting, provisioning, and managing virtual machines.

The solution helps to reduce IT operations costs by reducing power consumption, optimizing IT resources, improving IT staff efficiency, and by keeping operating systems, security software, and other applications updated.



Microsoft Configuration Management Products

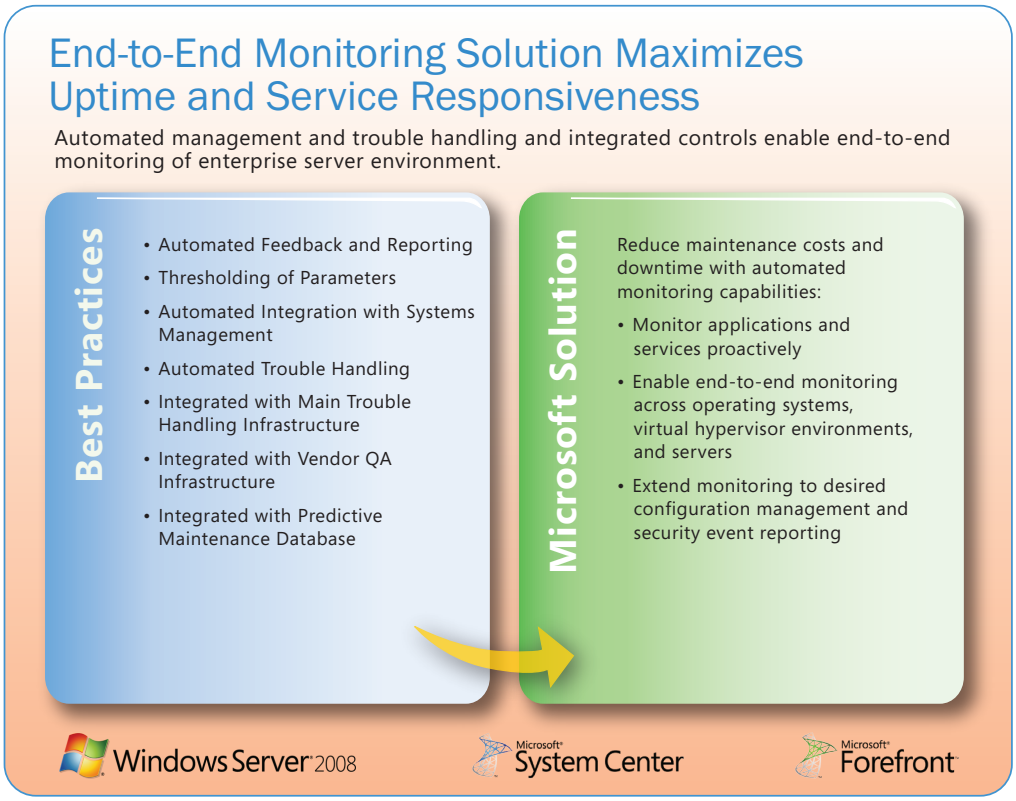
The Microsoft configuration management solution uses these products, which provide automated virtualization, provisioning, and update capabilities:

- **System Center Configuration Manager 2007 R2,** which comprehensively assesses, deploys, and updates servers, client computers, and devices.
- **System Center Virtual Machine Manager 2008,** which enables organizations to configure and deploy new virtual machines and centrally manage physical and virtual infrastructure from one console.
- **Windows Server® 2008 Solution Accelerators,** which include proven guidance and automated tools that enable organizations to assess hardware and deploy and securely operate Windows Server 2008.
- **Offline Virtual Machine Servicing Tool** which proactively patches virtual machines that are offline to make them compliant, protected and ready before they are started on the corporate network.

End-to-End Monitoring Solution

Microsoft's end-to-end monitoring solution enables data center administrators to monitor the entire enterprise application environment, regardless of its complexity, and identify potential problems that affect business process and workflow. The solution supports:

- **End-to-end service management** that is easy to customize and extend.
- **Best-of-breed solution for Windows** built on expertise from the Microsoft server, client, and application teams.
- **Increased efficiency and control capabilities,** which automate routine, redundant tasks and provide intelligent reporting and monitoring.



This solution uses an open and extensible platform that helps to ensure that IT services, applications, and servers run smoothly and meet service levels to maximize uptime and responsiveness.

Microsoft End-to-End Monitoring Products

The Microsoft end-to-end monitoring solution uses these products to provide automated alerts, trouble handling, and feedback and reporting capabilities across operating systems in virtual and physical server environments:

- **System Center Operations Manager,** which provides end-to-end service management that helps organizations increase IT efficiency and enables greater control of the IT infrastructure.
- **System Center Virtual Machine Manager 2008,** which enables organizations to configure and deploy new virtual machines and centrally manage physical and virtual infrastructure from one console.
- **Windows Server 2008 Solution Accelerators,** which include proven guidance and automated tools that enable organizations to assess hardware and deploy and securely operate Windows Server 2008.
- **Service Level Dashboard Solution Accelerator** which provides the user perceived performance by simulating user actions from different vantage points in the network and sending the resulting observations to System Center Operations Manager.

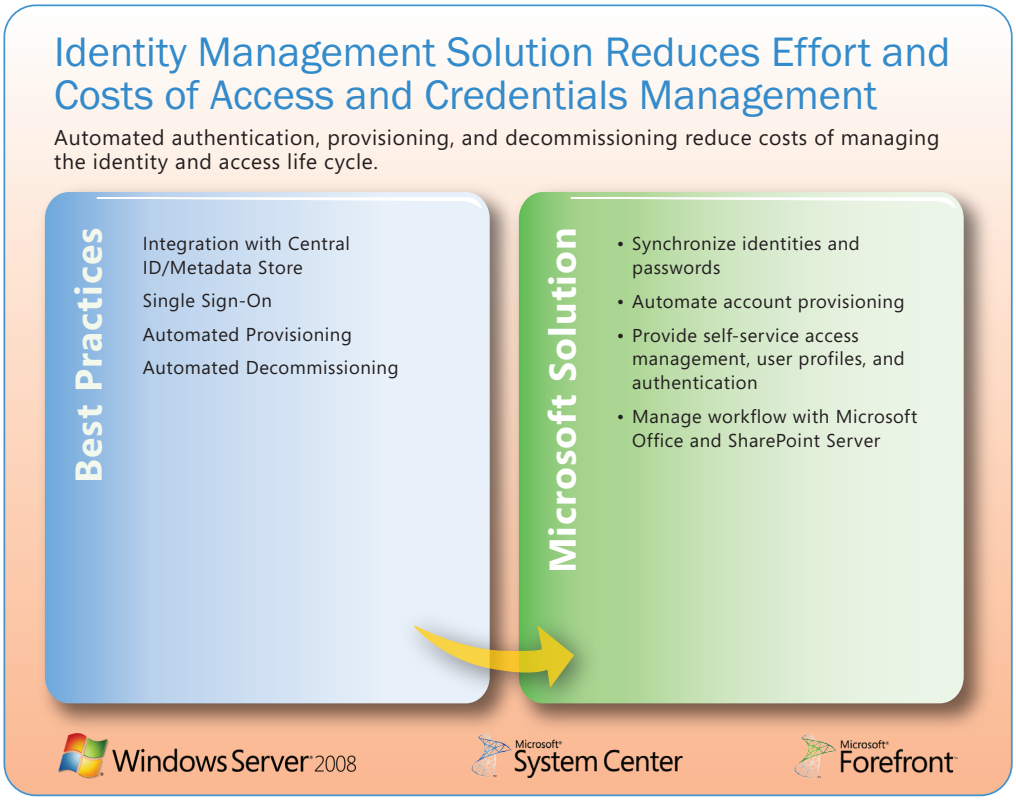
Identity Management Solution

Microsoft's identity management solution provides an integrated and comprehensive solution for managing the entire lifecycle of user identities and their associated credentials. It provides identity synchronization, certificate and password management, and user provisioning in a single solution that works across Windows and heterogeneous systems.

The next version of the solution enables comprehensive identity and access management in the enterprise, delivering an integrated identity management solution that serves IT professionals, end users, and developers. The new solution provides powerful self-service capabilities for Office end-users, rich administrative tools and enhanced automation for IT professionals, and extensibility for developers.

The solution includes:

- **A single view of digital identities** across multiple identity systems.
- **Automated user provisioning,** which synchronizes identities and passwords across a wide range of directories, databases, and proprietary identity systems.



Automating provisioning to these applications provides users with immediate access to intranet and extranet resources such as content, files, and workspaces.

Microsoft Identity Management Products

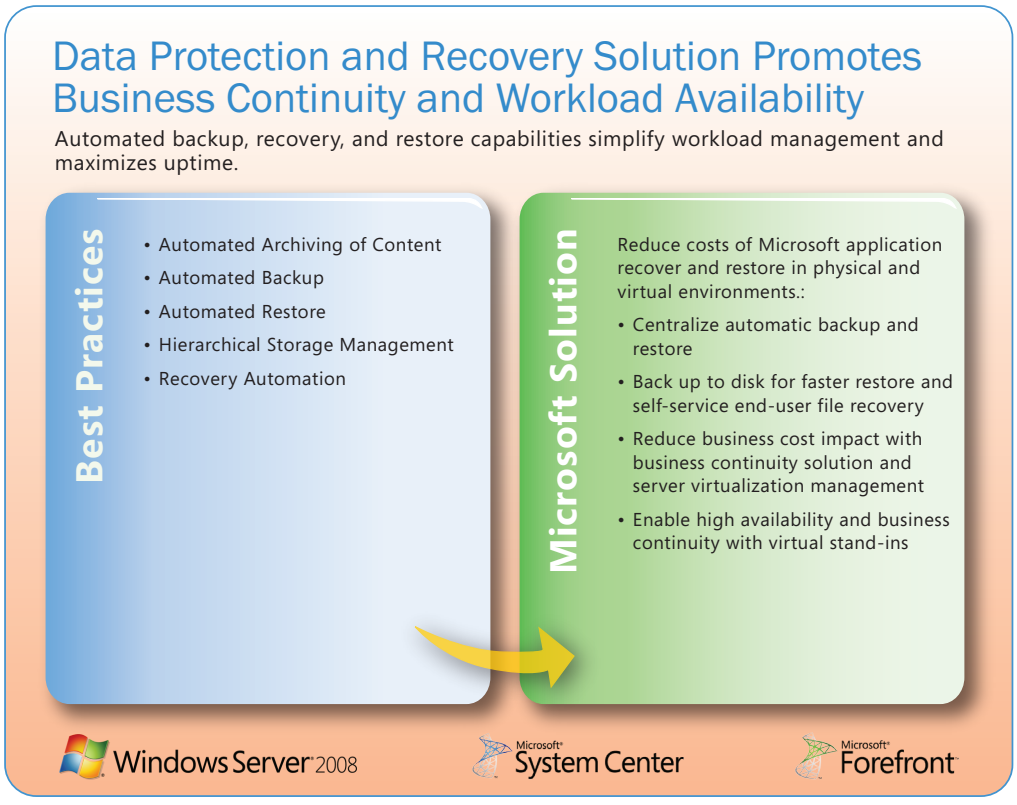
The Microsoft identity management solution includes these products, which provide automated provisioning, authentication, and de-commissioning capabilities:

- **Identity Lifecycle Manager 2007 Feature Pack 1,** which uses the automation of common tasks to reduce the cost of managing the identity and access life cycle by providing a single view of a user's identity across heterogeneous computing environments.
- **Windows Server 2008 Solution Accelerators,** which include proven guidance and automated tools that enable organizations to assess hardware and deploy and securely operate Windows Server 2008.

Data Protection and Recovery Solution

The Microsoft data protection and recovery solution delivers data protection, recovery, and reliability capabilities of physical and virtual servers and applications. This solution helps to ensure:

- **Business continuity through server virtualization,** which enables quick restoration of virtual machines in case of failure. Virtualization technology supports rapid recovery of virtual machines' operating system state.
- **Backup and restore capability** by recovering mission-critical enterprise data and data center physical and virtual environment after a power outage, data loss, or file corruption problem. This capability, which supports the backup of Windows Server machines and Windows applications, enables file recovery in minutes rather than hours.



Implementing the data protection and recovery solution simplifies storage management, improves system availability, and makes IT workloads more responsive.

Microsoft Data Protection and Recovery Products

The Microsoft data protection and recovery solution includes these products, which provide server virtualization, centralized backup, and restore capabilities:

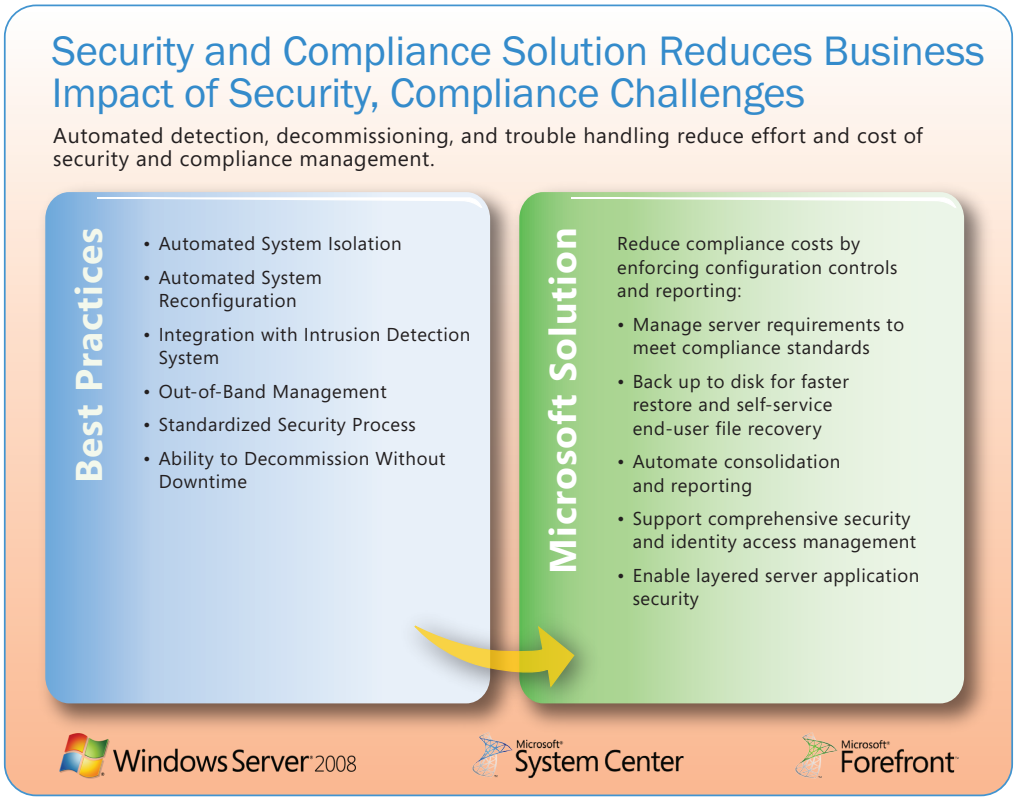
- **System Center Data Protection Manager 2007,** which delivers continuous data protection for Microsoft application and file servers by using seamlessly integrated disk and tape media.
- **System Center Virtual Machine Manager 2008,** which enables organizations to configure and deploy new virtual machines and centrally manage physical and virtual infrastructure from one console.
- **Windows Server 2008 Solution Accelerators,** which include proven guidance and automated tools that enable organizations to assess hardware and deploy and securely operate Windows Server 2008.

Security and Compliance Solution

Microsoft's security and compliance solution helps data center managers maintain internal and external standards by staying current with business policies and regulatory requirements.

The solution accomplishes this by providing:

- **Easy-to-use configuration controls and a comprehensive collection of security events.** A console dashboard and reporting tools in the solution help data center administrators understand and control the state of their server configuration against both regulations and best practices.
- **Integrated secure messaging and collaboration capabilities for mission-critical servers.** The solution provides comprehensive malware and SPAM protection that eliminates single points of failure with a multi-engine architecture.



This solution, which offers comprehensive, integrated, and easy-to-manage security for server and edge protection, can reduce the business impact of changing security challenges and the costs of security-related systems management.

Microsoft Security and Compliance Products

The Microsoft security and compliance solution uses these products to support security and compliance standards:

- **Microsoft Forefront™ Suite,** which helps provide protection for server operating systems, application servers, and the network edge.
- **System Center Configuration Manager 2007 R2**, which comprehensively assesses, deploys, and updates servers, client computers, and devices across physical, virtual, distributed, and mobile environments.
- **System Center Operations Manager,** which provides end-to-end service management that helps organizations increase IT efficiency and enables greater control of the IT infrastructure.
- **IT Governance and Compliance Solution Accelerators,** which provide free guidance and tools to manage compliance infrastructure and to institute sound principles of IT service governance.
- **Security Solution Accelerators,** which provide free, authoritative resources to help organizations proactively plan, integrate, and operate their security infrastructure.

Conclusions and Next Steps

The study findings suggest that, as the number of best practices adopted increases, IT organizations stand to gain exponentially, not just in terms of reducing ongoing costs or increasing server availability but by being able to reallocate the IT resources saved to new projects designed to deliver new capabilities to the business.

While the impact of each best practice varies according to workload, there are a number of broad conclusions that can be drawn from the study.

- **Best practices provide tangible benefits.** Although the benefits of best practice adoption vary widely across workloads, they are real and quantifiable.
- **The more practices adopted, the greater the value of benefits.** Organizations operating at the rationalized IO level tended to realize higher-value benefits than those operating at lower levels. As organizations adopt more and more best practices, their IO level advances, their IT efficiency increases, and the value of the benefits achieved increases.
- **Benefits are accessible to any organization.** Organizations operating at any IO level can drive cost savings now by adopting core infrastructure best practices. Study results show that best practice adoption has an increasingly positive effect on IT costs and server availability for organizations operating at basic, standardized, and rationalized IO levels.
- **Microsoft solutions support and enable best practice implementation and support.** Microsoft infrastructure solutions provide core infrastructure capabilities that enable and support many of the best practices that deliver the cost and availability benefits documented in this study.

Next Steps

- **Learn more about Microsoft server infrastructure management solutions,** which support best practice adoption and core IO.
- **Find out more about Microsoft Solution Accelerators.** Free tools and guidance that help organizations optimize their infrastructure are available at http://technet.microsoft.com/en-us/solutionaccelerators/default.aspx
- **Take an Infrastructure Optimization Assessment.** Organizations can find out more about the current state of their IT infrastructure by taking this assessment, which is available at www.microsoft.com/optimization/default.mspx.
- **Meet with your Microsoft or partner representative** to discuss IT operations costs and Microsoft solutions that can help core infrastructure optimization.

Appendix A: Study Methodology

The study documented in this white paper was commissioned by Microsoft as a blind study. The study was conducted by Hansa/GCR, an independent analyst firm, who collected the data used.

Premise and scope. Based on detailed analysis of six core server workloads, the study was designed to determine how server availability as well as per-server and per-user IT labor costs are affected by the adoption of core infrastructure best practices.

Participating organizations. Director-level or senior IT managers at 850 organizations were surveyed. Of these organizations, 162 organizations were selected for the study, based on their ability to provide rich data on best practice adoption and IT labor costs across multiple server workloads. Participating organizations were selected from a wide range of different industries with a range of between 1,000 to 300,000 PCs. Respondents were surveyed for information on IT staff size, budgetary responsibility, and technical knowledge of core server-related IT workloads to ensure that they qualified to participate in the study.

The study is not platform specific, and participants were selected regardless of the brands of products they deployed in their server environment.

Data assumptions. Value metrics for each server workload (per-user IT labor costs, per-server IT labor costs, IT staff efficiency, and server availability) were mapped to the core infrastructure practices implemented on each server workload to determine the most beneficial practices per workload.

Percentage of best practice adoption per workload was used to determine which organizations were operating at the basic, standardized or rationalized levels of the Core IO Model.

Cost savings indicated in best practices graphs compare the IT labor costs per server per year for organizations that had adopted a particular practice with the costs for those that had not.

(Note: The best practice graphs only include the practices associated with the highest cost savings for each server workload and a net improvement in server availability.)

The following hypotheses were proposed:

- Core infrastructure practices that have a positive impact on a given workload will reduce the per-user and per-server IT labor costs needed to manage and support the service provided by that workload.
- Core infrastructure practices that have a positive impact on a given workload will increase server availability by reducing the occurrence of downtime and reducing the number of hours required to recover from a downtime incident.

Appendix B: Core Infrastructure Optimization

The Core IO Model has been developed using industry best practices and Microsoft experience with enterprise customers. A key goal for Microsoft in creating the Core IO Model was to develop a flexible, easy-to-use framework that can be used as the benchmark to determine technical capabilities and business value.

The following table characterizes the Core IO Model by the IT and business capabilities of organizations operating at each of four levels.

IO Model Level	IO Model Level Descriptions
Basic	• Most IT resources are used to keep IT functioning with reactive management. • Systems are complex, incompatible, and expensive; they do not provide services throughout the organization. • Organizations use few IT policies and automated processes.
Standardized	• Organizations run somewhat effective, centralized IT departments. • IT systems, which remain complex, incompatible, and expensive, run as stand-alone operations. • Basic automation is provided by a centralized IT department. • Pockets of automated services exist in business units.
Rationalized	• Organizations run somewhat effective, centralized IT departments. • IT systems, which remain complex, incompatible, and expensive, run as stand-alone operations. • Basic automation is provided by a centralized IT department. • Pockets of automated services exist in business units.
Dynamic	• Cost savings are secondary to maximizing business agility, which is a source of competitive advantage. • Some decision making is decentralized to bring decisions closer to business processes. • IT systems are highly automated, flexible and responsive to changing business conditions. • Organizations might choose not to implement specific best practices because they reduce business agility.

More information about Microsoft IO models is available at www.microsoft.com/optimization.

Appendix C: The 31 Server-Related Best Practices

The study identified 31 core infrastructure practices that had positive effects on IT labor costs and availability across multiple workloads. These practices are grouped by levels of the Core IO Model.

Standardized Practices

Best Practice	Description
Automated backup	Ongoing, automated backup capabilities—with the ability to consistently back up data according to established business and IT policies—reduces business risk by ensuring that intellectual property and other vital data are always centrally protected. This practice also reduces the staff time needed to recover data on an ad hoc basis.
Automated restore	Ability to consistently restore data according to established business and IT policies reduces business risk by ensuring that intellectual property and other vital data are always centrally protected. This practice also reduces the staff time needed to recover data on an ad hoc basis.
Operating system maintenance	The activities undertaken within in pre-defined change windows to ensure core IT services meet defined service levels for the organization.
Software imaging or cloning	Use of fully prepared software environment sourced from a reference system to rapidly provide new images or clones of standard systems on demand.
Standardized process for server adds, moves, and changes	Standardized process for server adds, moves and changes.
Standardized hardware	Deploying a uniform set of hardware platforms that can be monitored and managed using a common set of management tools, consoles, and processes reduces IT labor costs by minimizing the amount of time and training needed to maintain the systems.
Standardized images add capacity	Enforcing use of a limited number of approved software images streamlines IT staff effort by reducing the core software configurations that staff members must deploy and support. Standardization also reduces resource costs associated with patching and maintaining images.
Thresholding of basic parameters	Use of core management tools capabilities to monitor the system state and performance. Uses core relationship state rules and capabilities.

Rationalized Practices

Best Practice	Description
Automated deployment process	Uses a fully defined, scripted, and tested deployment process that is enabled by request. Limited variable changes are required.
Automated integration with systems management	Embedded monitoring agents, state management tools, and capabilities within standard images that are pre-configured for immediate use. Practice is based on use of service model distilled into actionable components such as monitors and tasks.
Automated patch testing	Pre-defined process workflow that automates patch testing before a production release.
Automated patch deployment/ rollback	A systematic method of validating, targeting, and distributing security updates reduces business risk by ensuring that all systems remain in compliance with standard images and security update levels. Automation also reduces staff costs by eliminating the need for manual updates.
Automated system isolation	Pre-defined process that automates system quarantine in event of a security event or failure that violates pre-determined risk levels.
Automated trouble handling	Pre-defined process workflow that automates responses to production issue triggers.
Hierarchical storage management	Automatically shifting data to the most cost-effective storage instance reduces the cost of data storage and improves business continuity, helps to increase security and data protection, and enhances data recovery capabilities.

Rationalized Practices (continued)

Integrated with main trouble handling infrastructure	Formal event triggers that are mapped to system management software for generation of alerts in the event of a security event or failure. This practice supports a prescriptive maintenance workflow.
Integrated with vendor QA infrastructure	Pre-defined systems management processes integrated with vendor QA procedures.
Integration with intrusion detection system	Formal event triggers mapped to system management software for generation of alerts in the event of a security event or failure. This practice supports a prescriptive maintenance workflow.
Integration with predictive maintenance database	Automated system monitoring that alerts IT staff when predetermined criteria are met reduces the time needed to identify critical issues and isolate root causes. Automation also helps maintain service levels by initiating diagnostics and repairs before users are affected by the problem.
Server clustering	Clustering servers to provide system redundancy for crucial IT services reduces downtime, improves service levels, and simplifies day-to-day operations, scheduled maintenance, and system upgrades.
Server imaging or cloning	Uses a fully prepared software environment sourced from a reference system to rapidly provide new images or clones of standard systems on demand.
Standardized security process	A formalized approach to security reduces IT staff time devoted to creating, implementing, and enforcing security policies and helps to ensure company-wide compliance.
Thresholding of advanced parameters	Uses core and extended management tools capabilities to monitor system state and performance. This practice uses expanded relationship state rules and capabilities.
Virtualization utilized	By using virtualization technology to reduce the number of physical servers providing IT services, the IT staff can assign resources dynamically to improve utilization, which reduces physical hardware, power consumption, and data center space requirements.

Dynamic Practices

Best Practice	Description
Automated provisioning	The ability for users to trigger a process that automatically creates their own user accounts and privileges reduces their reliance on the IT staff to perform these tasks. IT staff is freed to manage infrastructure, not users, and users enjoy improved productivity by achieving faster access to the accounts and permissions they need to do their jobs.
Automated de-commissioning	The ability to trigger a process that automatically decommissions user accounts and privileges reduces reliance on the IT staff to perform these tasks. IT staff is freed to manage infrastructure, not users.
Integration with central ID/metadata store	Single source for identity propagated through all applications and platforms within current Service levels.
Out of band management	Problem or change management activities undertaken outside of planned maintenance window timeframes to ensure IT core services meet defined service levels for the organization.
Recovery automation	Pre-defined process that automates system recovery in the event of failure that requires intervention.
Single sign-on	Single source for identity propagated through all applications and platforms within current service levels.
Self healing	Pre-defined process that automates system recovery and returns to standard service levels in the event of failure that does not require intervention.

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