



# The Admin's Guide to Server Infrastructure Tools

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# The Admin's Guide to Server Infrastructure Tools

by Nelson King

So you've done your research and purchased your servers and possibly signed a service agreement. Now what? If you said, "walk away and let 'em run," think again.

Life around servers is rarely that simple. A sys admin in a large server room, or rooms, will most likely need tools to help him or her keep the servers running effectively. This is where software to manage, monitor, and configure the server infrastructure comes in. Thus, the question is not whether you need some of the tools, but which ones and from whom.

## Definition

When it comes to servers, what do we mean by infrastructure? Simply put, it's organized server support. Do all of your servers work in isolation as standalone units? Probably not. There are groups of them: different types, different functions, clusters for scalability, and so forth. You organize them to support them and enable them to work better together. Collectively, the way the servers are organized and the tools are provided to support them constitutes the infrastructure. To make the infrastructure work, you must set the servers up in the right way, monitor their operation, and manage

their services. Not a simple task by any means.

Start with a rule of thumb: The greater the number of servers, the greater the need for infrastructure tools. One server does not constitute an infrastructure. On the other hand, if you have a thousand servers, you certainly need infrastructure tools. With that many servers, you probably need infrastructure tools just to keep them running. Then, there's the no small matter of getting the most out of the servers, ultimately known as maximizing ROI. Infrastructure tools are necessary for that as well.



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## Tools to Consider

These "tools" are, of course, products. Sometimes they come in suites, such as IBM Tivoli or Computer Associates Unicenter. They are also sold in various combinations or as individual (even standalone)

products. Infrastructure tools cover a very large range, as this by no means inclusive list illustrates:

- Application Deployment and Management
- (IT) Asset and Inventory Management
- Backup and Archiving
- Batch Processing

To make the infrastructure work, you must set the servers up in the right way, monitor their operation, and manage their services. Not a simple task by any means.

- Configuration and Change Management
- Cluster Management
- Data Management
- Desktop Management
- Disaster Recovery
- Enterprise System Management
- File Transfer Management
- Job Automation and Scheduling
- License Management
- Network Management
- Performance (Load and Stress) Testing
- Patch and Update Management
- Print Management
- Security Management
- Storage Management
- User Management
- Web Systems Management

There are many ways to slice and dice the territory of server infrastructure. With hundreds of products that have considerable overlap, vendors, analysts, and journalists can (and do) see infrastructure tools through many perspectives.

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As numerous and confusing as the server infrastructure products can be, one needn't be a computer scientist to reach an understanding about what an organization must have to support its servers. Some basic information is required: Where servers are located, what they are doing (at least in general), and some details of their configuration (what hardware and software they are running). From there, consider other areas of server management (such as items on the above list) to determine strengths and weaknesses. If there are gaps or problems managing the server infrastructure, start looking at tools to cover them. Fundamentally, the process is the same for small and midsize businesses as it is for very large enterprises.

## Open Source Apps for the Server Room

By Aaron Weiss

To best determine whether some or your entire server infrastructure is a good candidate for open source solutions, consider several criteria.

Who is your audience? Does your server infrastructure serve highly platform-dependent users? For example, a Microsoft Exchange server handling groupware messaging for a shop full of Microsoft Outlook clients is serving a highly specific audience. Unless your plans include migrating clients to open source messaging solutions, such as Gnome Evolution, the MS Exchange server probably makes the most sense in this scenario.

On the other hand, many "generic" network services, such as file serving, POP3 or IMAP4 e-mail, Web serving, DNS, CUPS-based printing, and even some databases can be served neutrally by open source packages. In a neutral network, client connections may come in from any platform with support for these protocols. POP and IMAP e-mail is supported by virtually every e-mail client available, so running an open source e-mail server does not preclude which clients it can serve.

A third consideration is cost control and cost shifting. Traditionally, commercial server solutions require ongoing licensing fees be paid for the right to use the software. These fees may include a certain level of support, which can often be upgraded with additional payment. This may also introduce the need for in-house expertise to maintain the server infrastructure, thus raising costs.

Open source server solutions can offer more financial options. With money invested in in-house expertise, outside support costs can be low to none. This same expertise can customize open source software to a degree that may be costly or unavailable with commercial server applications. Third-party vendors, like Novell and Red Hat, offer subscription-based open source solutions that function similarly to commercial offerings, involving ongoing costs with support and maintenance contracts. In this scenario, the costs may not differ all that much from those of commercial applications. Enterprises, however, may continue to benefit from other flexible aspects of open source software.

People with experience will say, "It's not that easy." True. The process described in the previous paragraph leaves out some important complications, including budget limitations, existing infrastructure elements, personal preferences (e.g., those of executives), and resistance to change. Nor is comparing server infrastructure products necessarily easy. Products may have many common features, but their vendors may describe them differently. There are also overlaps in functionality. Finally, not all vendors are equally skilled in marketing, which means sometimes a good product (or feature) is not effectively represented. More often, though, it means some products (or features) are over-sold.

### Options and Trade-Offs

Any research undertaken on infrastructure tools will probably pay off regardless of the ultimate purchase and implementation. Whether a vendor sells it to you, you buy it yourself, or a hosting service provides it, you'll see many of the same products. Even if you're attracted to a particular vendor (or already have a horse in the barn), it is useful to see what the competition is doing. Later in this guide, we will provide feature checklists for infrastructure tools - those focused on server management, server monitoring, and server configuration - that you can use to evaluate products.

The category of server infrastructure tools is one of the fastest growing areas of software. Thanks to the proliferation of small servers used in large groups (e.g., blades) the need for software to manage them has grown exponentially. As a category of software, server infrastructure tools is extremely competitive. Products are available from the biggest names in the business as well as tiny, unknown start-ups. The good news is the resulting proliferation of options, alternatives, and comparative advantages. This is also, of course, the bad news.

On top of wading through the forest of products, there are large issues to consider: Own or lease? Operate in-house or outsource? Single vendor or multiple vendors? Given the wide functionality of server

tools, the many platforms, and the large number of products, the trade-offs that must be weighed are inevitable.

When it comes to server infrastructure tools, the default decision factor has long been the server hardware vendor. If a company has IBM, HP, or Dell servers, for example the tendency is to stick with the respective vendor's server tools. This is usually convenient and may mean the tools are optimized for the servers. Still, the functional coverage of vendor-supplied tools may not be complete, and they may be comparatively expensive. It's also true that organizations often use servers from different vendors (running different operating systems). A grab bag of vendor tools may not play together as well as third-party tools designed to run in a heterogeneous environment. In addition, third-party products are often selected because they are considered best-of-breed

or offer cost advantages - not because of inertia.

If third-party products are selected, the assumption is that each offering has best-in-class features; there is no guarantee they will work together

properly (or at all). On the other hand, if you select an all-in-one (or suite) product from a single vendor, the coordination problems may be gone, but cost and vendor lock-in may be a problem. In a different context, there are decisions to be made about whether a company wants to own and operate the infrastructure tools, or outsource that operation to others. Trade-offs apply: Owning and operating your own management tools provides greater security and control (usually), but using a host or another outsourcer can be less expensive and may provide better facilities or staff.

None of these trade-offs are a given, but it is important to be aware that in the category of server infrastructure tools, there are usually trade-offs. In general, the larger and more complex the infrastructure, the more it will exacerbate the trade-offs.

### Management Software

In the realm of infrastructure management, server management tools have a wide row to hoe. In most

**The category of server infrastructure tools is one of the fastest growing areas of software.**

cases, these tools are the center, or hub, of the server infrastructure. As a result, they provide unified administrative services for a large number of servers, which usually means combined or even comprehensive functionality covering major areas of server management.

In general, server management tools can be divided into two categories: suites and specialist products. The most conspicuous products are suites. These are generally the big one-stop shops for server administration. Some of these suites are so comprehensive that it's legitimate to wonder, do suites cover everything?

The question is relevant only after a definition of "everything" is provided. Certainly, some enterprise-level suites, such as IBM's Tivoli and HP's OpenView,

Microsoft System Management Server and the Big Four suites: IBM Tivoli, Computer Associates Unicenter, BMC Software PATROL, and Hewlett Packard OpenView. Although clear and convenient, this categorization is misleading because there are products that greatly enhance or even replace Microsoft products, and there are literally dozens of products constantly challenging at least part of the hegemony of the big four suites. Still, the orientation remains: Many products are divided into those that run only on servers running a Microsoft OS, and those for multiplatform servers running Linux, Unix, or Mac OS X. To a certain extent, this divide also reflects products developed using Java, the ones in Java being non-Microsoft, but again, there are many exceptions.

**All server management products consolidate, aggregate, or concentrate (pick the word) the operation of many servers into a single point of administration.**

attempt to cover the principal areas of server management - storage, networking, security, server performance, and software management. On the other hand, the scores of specialist products in these same areas demonstrate that suites don't include all (or even enough) of some important features and functionality, and there is indeed a market for other products.

Then there's the difference in "approach" to server management. Most suites attempt to establish a unified approach - a consistent user interface, multiplatform support, overarching policy controls, a unified framework in code and structure to hold all the pieces together, and of course, single-vendor support. Less comprehensive products may have some of these elements, but they often distinguish themselves by adhering to a particular kind of management philosophy (e.g., exception-based or business-process-oriented) or they may have unusual user interfaces (often more graphical) or a unique configuration of features (grouping features in unorthodox ways).

It should be no surprise that management products are divided primarily into single platform (for the most part Microsoft and partners) and multiplatform products. For convenience, this is often sliced and diced as

### When Shopping Around

So what should be expected from server management software? First and foremost, all server management products consolidate, aggregate, or concentrate (pick the word) the operation of many servers into a single point of administration. The principle benefits are obvious: It takes fewer people to manage a large number of servers, and the power of management software can be brought to bear on many servers in a uniform way. Of course, which servers, performing what functions, and how they are administered are crucial issues.

Server management software can be specific to certain hardware (e.g., IBM, Dell, and Apple), to certain operating systems (e.g., Windows, Linux, Unix, and Mac OS X), and certain types of servers (e.g., Web, database, and application). When researching products, this is a starting point because the information is readily available. Overall, most vendors are accurate in categorizing their software's functionality, but not always. Teasing features into categories can sometimes be arbitrary, and suite vendors will sometimes claim full functionality when only providing a subset of features. Some products will also ride the overlap between functionality, for example monitoring net-

work traffic and monitoring server security.

The most difficult choice is determining how the server will be managed - i.e., the approach. Some features, such as whether the software is GUI-oriented or Web-based, are easily determined. However, the more subtle aspects of management often fall into the realm of marketing-speak, making it necessary in most cases to run a trial or test the software to get a true feel for how it works.

Before selecting products to trial, it helps to develop a reasonably well-defined set of requirements concerning platforms, basic functionality, and desired approach. As is often the case in software, server management tools bring trade-offs to consider. For example, for one organization the convenience of having a single source of support for an all-in-one suite may trump a higher price tag and less-than-complete components, but for another, pieced-together best-of-breed software with support cobbled from

many vendors may be preferable.

To help with the evaluation of server management tools, we've crafted a functionality checklist ideal for comparing the coverage of suites and specialist tools. If an organization has identified the kind of server management it needs, the checklist can help determine whether a suite or a collection of specialist products is most appropriate.

Note that no one product (or even suite) will cover all of the areas listed. There will be many overlaps in functionality, and vendors will define what they do in often-contradictory ways. In other words: These categories are intended for use as guidelines and can be modified to best suit your needs.

We also have not weighted the importance of any of these areas, as only you can determine what is of primary importance for your organization.

## Management Tools Matrix

	Product 1	Product 2	Product 3
<b>Application Deployment and Management</b> (May include functions of an application server)			
<b>IT Asset Management</b> (e.g., catalog, valuation, and life cycle)			
<b>Availability, Error, and Problem Management</b> (Primarily monitoring system errors)			
<b>Backup and Archiving Services</b> (e.g., security, federal compliance, and data management)			
<b>Batch Processing</b> (e.g., scripting and large scale deployments)			
<b>Change Management</b> (Primarily for applications and program updates)			
<b>Configuration Management</b> (Initial software installation and configuration)			
<b>Cluster Management</b> (Server farms and other clustered configurations)			

**Management Tools Matrix** continued

	Product 1	Product 2	Product 3
<b>Data Center Management</b> (Coordination of data managers and other data operations)			
<b>Desktop Management</b> (e.g., user desktop software, licenses, and configuration)			
<b>Disaster Recovery</b> (On-site, off-site, and other recovery schemes)			
<b>Enterprise Systems Management</b> (Coordination of many or all facets of server management)			
<b>Event Automation</b> (e.g., Using server events to generate e-mail)			
<b>File Transfer Management</b> (FTP and other file transfer control)			
<b>Job Scheduling</b> (Local and remote server jobs management)			
<b>Load, Stress, and Performance Management</b> (Testing and monitoring of server activity)			
<b>License Management</b> (Software and hardware license record keeping)			
<b>Network Management</b> (Monitoring, analysis, and troubleshooting)			
<b>Patch and Update Management</b> (For commercial software and hardware changes)			
<b>Printing Management</b> (Control and monitoring of print-related services)			
<b>Security Management</b> (e.g., firewall, spam and spyware, and anti-virus)			
<b>Storage Management</b> (Management of many kinds of storage devices)			
<b>User Management</b> (User registration, policy management, and monitoring)			
<b>Web Systems Management</b> (Web server resources and other services)			

## Monitoring Software

Monitoring many servers - i.e., keeping an eye on their operation - is one step toward meeting two priorities: troubleshooting and optimizing.

Hardware may fail, and software may not perform well enough. Servers may fail entirely, or worse, appear to be operating while they are no longer performing vital functions. The more servers a company is managing, the greater the likelihood of problems and the more difficult it becomes to monitor them. Then there's the not-so-small matter of getting bang for the buck. Are the servers performing well enough? Can a group of servers be considered reliable?

These and similar considerations are behind the need for specialized software that falls under the category of server monitoring tools.

Getting the most from server monitoring tools is more than a numbers game of managing as many servers as possible with the fewest number of people. It's also a matter of what is monitored. In most cases, this means three areas:

1. Monitoring server operation (the running status)
2. Monitoring server traffic (both in and out)
3. Monitoring the results of server use (keeping logs, statistics, and analysis)

Within the three areas, the products that monitor servers also cover (albeit somewhat unevenly) a great deal of functionality, which can be broken down like this:

- **Physical:** Monitoring the physical hardware includes keeping an eye on the temperature, power supply, and the functioning of components, such as disk drives. Many of these are critical elements, and failure means a dead server. Software that monitors the hardware can be very specific, for example, it works on IBM servers but not Dell servers.
- **Server Performance:** Monitoring the performance of a server (e.g., CPU usage, available disk space, and mem-

ory availability), especially under a variety of conditions, helps with both troubleshooting and optimization.

- **Services:** All servers run a number of services (e.g., DNS, POP3, and TCP). Many of these are critical to server operation. Again, if they fail, the server fails. Most monitoring software covers a wide range of services.
- **Network:** An old and very large area of server monitoring is associated with operating a network. This is often considered a separate category of monitoring software, although such functionality is often built into general-purpose server monitoring tools.

In addition, many server-monitoring tools are designed for a particular type of server (e.g., Web or database servers). We've provided a Functions Checklist for server monitoring tools below. Although the matrix attempts to cover features generally available, it barely scratches the surface of the more-specialized features for monitoring Web servers or networks.

Getting the most from server monitoring tools is more than a numbers game of managing as many servers as possible with the fewest number of people. It's also a matter of what is monitored.

In all, server-monitoring software is very diverse, and literally hundreds of products are on the market. Most offer "real-time" monitoring that displays the current condition of

servers along with historical monitoring, which is the record of server performance over time. Server monitoring tools are also packaged in different ways: They are always included in the big server management suites, such as IBM Tivoli or Computer Associates Unicenter. There are a large number of general server monitoring products, such as GFI Software Network Server Monitor and BMC Software Server Monitoring and Management.

Specialized products provide features for specific operating systems (Microsoft Windows being an obvious example) and types of servers. To further complicate the choices, server monitoring tools can be purchased and operated by the user, hosted by a third-party company but operated by the user, or fully outsourced (i.e., hosted and operated by a third party). A cursory product search on the Internet will reveal scores of hosted and outsourced approaches.

The server monitoring tool selection process is often a

matter of matching several things: hardware, operating system, functionality (e.g., Web or database), and organizational priorities (e.g., preferring software that provides a strong reporting and analytical capability). Some enterprises may opt to match their hardware vendor with the monitoring software (e.g., an xSeries shop may choose Tivoli); others may look for specific features or best-of-breed characteristics in different kinds of servers (again, most commonly for Web and database servers).

And don't forget specific organizational needs. When comparing server monitoring products, it may be important to evaluate the options for alerting adminis-

trators, as support for specific methods, such as SMS and e-mail, can be crucial for some organizations. Alternatively, the ability to take remote corrective measures, such as server shutdown or script execution, can be of great practical value.

The matrix below is designed to help in the comparison of products by listing a range of features and placing the servers side by side. Keep in mind, however, that to create a usable matrix, we had to limit the details for several monitoring functions. Hence, the blank cells at the bottom of the table, which are there for you to fill in with any requirements unique to your organization.

### Server Monitoring Tools Matrix

			Product 1	Product 2	Product 3
Real-Time Monitoring	Physical Status	Temperature			
		Chassis Integrity			
		Power Supply			
		Fan Speed			
	Server Performance	Hard Disk Utilization			
		- Files Open/Owner			
		- File Existence Monitor			
		- File Size Monitor (e.g. Log files)			
		Memory Utilization			
		CPU Utilization			
		Processes (Count)			
	Services Monitoring	DNS			
		HTTP/HTTPS			
		FTP			
		Telnet			
		NNTP			
		SMTP, POP3, or IMAP			
	Server Types Supported	Web			
		Database			
		File			
		Communications			
	Network Monitoring	Network Throughput			
		Current Logons			
		Failover Monitoring			
		Other Network Monitoring Points			
	Web Site Monitoring	Hit Rate			
		Page Content Verification			
		Database Connection Verification			
		Cache Rate(s)			
	Security	Intrusion Monitoring			

**Server Monitoring Tools Matrix** *continued*

			Product 1	Product 2	Product 3
		Login Error Monitoring			
		Other Security Monitoring Points			
Administration	Dashboard (or Other Overview Display)				
	Remote or Internet Monitoring				
Administration	Monitor Views	Domain			
		Workgroup			
		User-Defined Group			
	Alert Modes	E-Mail			
		Phone (Land Line or Cell Phone)			
		Pager			
		Network Alert			
		SMS			
	Escalating Alert Levels Support				
	Alert Multiple People				
	Designate by Type of Alert				
	Monitoring Interval				
	User Configurable Monitoring Intervals				
	Corrective Action Support				
		Machine Shutdown or Reboot			
		Service Shutdown or Restart			
		Process Shutdown or Restart			
		Run Script, EXE, and Job			
	Testing Suite - Automatic Testing Support				
Historical Monitoring	Logs				
	Statistics				
	Reporting	Online			
		Printed			
		Charts or Graphs			
	Analysis				
Other					
Other					
Other					
Other					

## Configuration Software

In a perfect world, every server in the enterprise would run with optimum efficiency and could be reconfigured to accommodate moves, adds, and changes at the drop of hat. Needless to say, the world of servers doesn't work like that. Such efficiencies oftentimes are not possible or can be the least attractive option.

The job of loading servers (and server-based software) and of tuning servers to run properly is the task of remote server configuration software. This is a loose category, and products vary widely in functionality and feature set. They cover tasks as diverse as software change management, license management, inventory control, and performance monitoring. Moreover, this working definition does not include remote client configuration (desktop or mobile), although this is sometimes part of the feature package for this type of software.

The job of configuring a large number of servers can be daunting. There are three main steps:

1. Deployment and installation of software - be it new, an update, or a fix (occasionally, this step is not part of the process)
2. The actual configuration of the server - settings, rules, levels, and actions for events
3. Testing of changes to ensure they actually work

The obvious benefit of configuration management software derives from centralization and remote management. It rids an administrator (or small army of administrators) of the need to physically visit each server that requires configuration. It also makes it possible to synchronize at levels difficult to achieve manually. An important secondary benefit is the automatic logs that record what was done, when, by whom, and to what.

Deployment, configuration, and testing on remote equipment are rather tricky. Configuration processes have more places where things can go awry than other server management areas. For example, a server may be down or unplugged from the network, a piece of software that works on one server may not even start on another server, or a change that takes place on all servers from one manufacturer could fail to take place

on machines from another manufacturer. The conditions for failure in configuration management are greater because it is 1) an active form of management that is actually doing things to a server and its software, and 2) it usually involves making critical, simultaneous, and often sequential changes.

The moral of this story is that although configuration management promises substantial and immediate benefits, such products are among the most difficult to choose and implement. Perhaps because it is difficult to do everything well, products in this category are often very targeted. There are configuration managers for specific operating systems, specific types of applications (most commonly database), and for specific hardware.

As is always the case with server infrastructure software, suites (e.g., IBM Tivoli or Netopia netOctopus) often include server (and server-based software) configuration tools. Although the suites are usually more general in their approach, there is currently no such thing as a universal configuration manager. Thus, when choosing this kind of software, there is often a trade-off between the range of possible configurations and the software needed to fulfill the functionality.

To illustrate this, the Functionality Matrix for Configuration Tools provided below is one where rather

than checking and comparing two or three products that compete across many of the features, enterprises will more likely be selecting from a grid of products that complement each other on the features provided.

An often-overlooked aspect of configuration management is that it must work with and sometimes around system security measures. The presence of firewalls, port sniffers, spyware and antivirus software, and even things like unexpected password changes, can interrupt or derail a multiserver configuration process. Therefore, features in configuration management software that help with security issues should be paramount.

Once a change is deployed and configured, it should be part of the routine to ensure the changes are working and delivering the expected improvements. This usually involves analyzing logs, event reports, and per-

**An often-overlooked aspect of configuration management is that it must work with and sometimes around system security measures.**

## Server Configuration Tools Matrix

		Product 1	Product 2	Product 3
Server Architecture	Cluster Support			
	User-Defined Server Groups			
	Orchestration Features			
	Homogeneous Platform Deployment			
Configuration Types Supported	Multiplatform Deployment			
	Operating System			
	Applications			
	Application Servers (Middleware)			
Deployment	Networks			
	Storage			
	Other			
	Installation Scripting			
Configuration	- If Yes, Indicate Whether on All Servers or Specified Servers			
	Firewall Management			
	Links to Asset/Inventory Management			
	Mass Migration Support			
Server Configuration Testing	Deployment Logs			
	Synchronization			
	Policy Configuration			
	Enterprise Directory Support			
Change Management	Configuration Logs			
	Testing Suite			
	Links to Monitoring Software			
	Version Changes			
Administration	Patches			
	License Control			
	Console			
	Web (Browser)			
Other	Single Sign-On			
	Administrative Session Logs			
	Other 1			
	Other 2			
	Other 3			

formance tests. Some configuration management software includes testing capabilities, although the minimum should be support for third-party testing and performance monitoring.

When done, it's crucial to set standards for a "successful" configuration and measure the results against those standards.

Coincidentally, note that "rollback" is not a common feature in this type of software. These products assume that the organization unleashing a new configuration

on, for example, 1,000 servers, has tested those changes before doing so. To paraphrase an old adage, the chain of configuration is no stronger than its weakest link. ■

*This content was adapted from internet.com's ServerWatch Web site and written by Nelson King.*

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